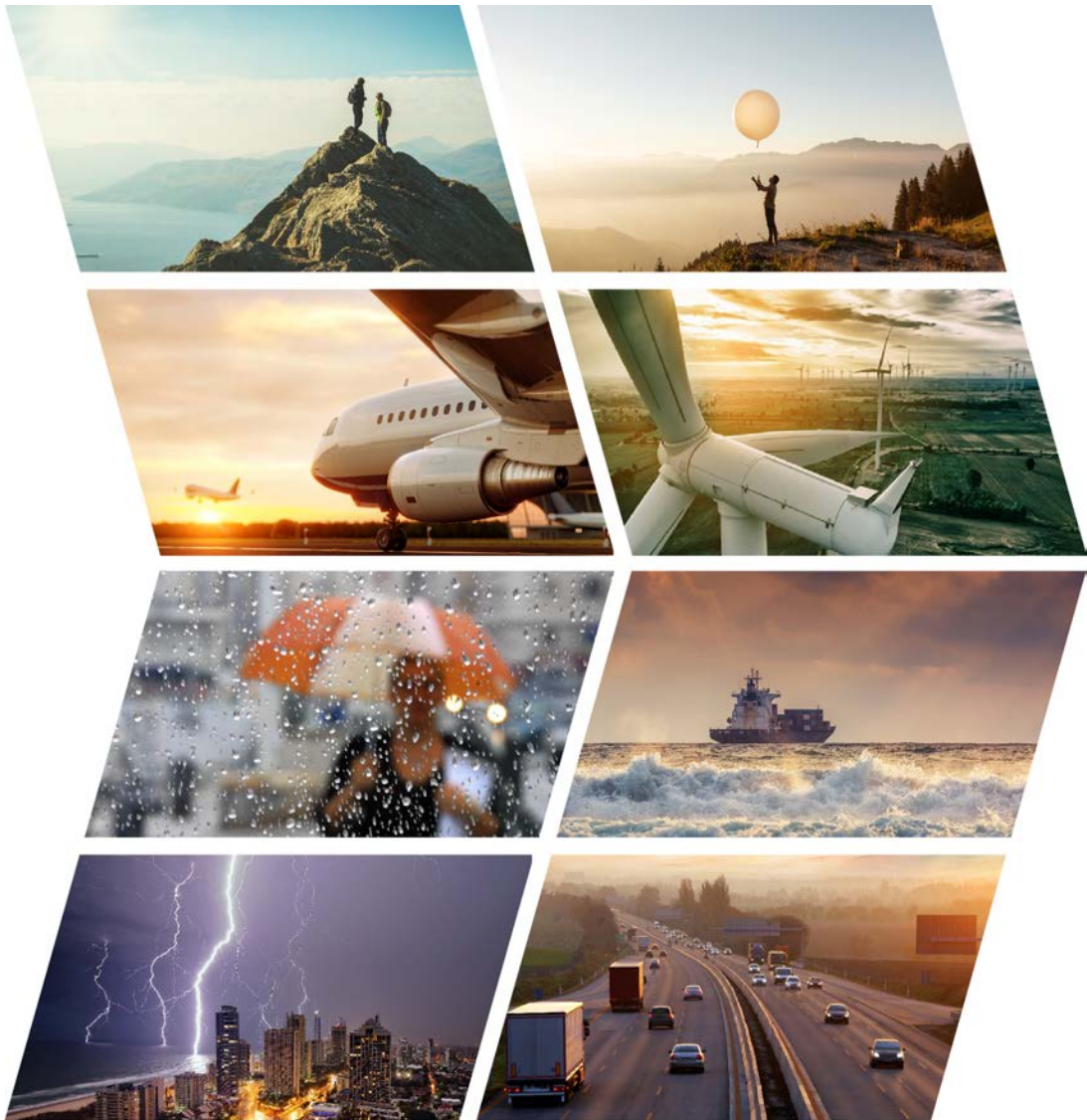


Product Catalog

Weather radars | Wind lidars | Software systems | Airport weather |
Lightning networks and sensors | Soundings |
Weather sensors | Weather stations | Professional
measurement devices | Road weather | SaaS solutions

Weather and Environmental Solutions



VAISALA

Observations for a better world

Weather and Environment serves weather-dependent markets where accurate, real-time, uninterrupted and reliable weather data is essential to run efficient operations. Our offerings enable customers to monitor the natural environment and support operational decision making under any weather conditions.

Meteorology

As the day-to-day impacts from climate change and extreme weather events continue to grow, Vaisala is innovating and equipping meteorology professionals to better understand, forecast, and explain the phenomena.

In the coming decades, meteorologists will play an increasingly important role in helping governments and industry make informed decisions across a range of sectors.

Aviation

Aviation weather and runway management solutions from Vaisala are comprehensive, automated, and scalable to keep airport operations running smoothly no matter what kind of weather or conditions you encounter.

We understand the critical need for accurate situational awareness, and we deliver superior and reliable real-time data so air traffic controllers, pilots, and airport personnel can make informed decisions to keep flights, airports, surrounding areas, and ground operations safe and efficient.

Our solutions adhere to FAA, ICAO, and WMO standards, regulations, and recommendations to help you meet compliance requirements.

Ground transportation

Road weather technology is critical for winter and summer road maintenance and the automotive industry and other industries affected by weather. Regardless of the application, accurate data regarding road surface and weather conditions, from snow and ice to wind, sand storms, or flooding, empowers your ground transportation decision making with crucial information.

Vaisala's road weather systems, sensors, and solutions monitor roadways for the specific parameters you need to know, so you can act effectively or warn travelers.

Defense meteorology

Observation applications for land, sea and air to enable better timing, troop safety and readiness, and system performance.

Maritime

Vaisala's complete offering of scalable maritime weather observation solutions keeps your personnel safe and your operations running smoothly. Easy access to accurate and reliable onshore and offshore weather and environmental observation data ensures maritime personnel and port authorities get the information they need to make critical decisions.

Having data on air quality, coastal weather, and waterways right when you need it reduces costly disruptions and delays in port operations. It allows you to plan ahead and react quickly to changing circumstances.



Renewable energy

Renewables relates to the use of wind, solar and weather sensors, remote sensors (incl. lidars, scanning and nacelle mounted), systems, stations, softwares, and data products connected or not to the energy infrastructure (excl.: SCADA), equipment (excl.: wind turbine, solar panel) or system for pre-project phases (excl.: wind or solar resource assessment), and Operations & Maintenance phases (excl.: power curve, weather and production forecast).

Urban and industrial systems

Weather and environmental solutions for environmental protection agencies, smart city projects including city departments and private sector customers and industries dependent on weather and environmental data, (e.g. power, mining and building automation).

Road Asset Management

Support maintenance decisions in your road network by automatically identifying and assessing assets such as pavement defects, signs, and lane markings condition.

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Features

- 250 kW magnetron transmitter with low-maintenance solid-state modulator
- Vaisala lightweight, semi-yoke style pedestal
- 1° beamwidth low side lobe antenna
- Modular single cabinet design containing transmitter, receiver, controller, processor, dehydrator, polarization waveguide assembly
- Built around RVP900™ and IRIS™ software
- Remote control and monitoring
- Image rejection > 80 dB (> 100 dB with Vaisala waveguide filters)
- Optional built-in automatic dual-channel calibration

Vaisala Weather Radar WRM200 is a dual-polarization C-band radar that uses a magnetron transmitter.

Dual-polarization

- Precision horizontal and vertical beam matching
- > 35 dB integrated cross-polarization isolation
- Enhanced reflectivity processing in STAR mode

Dual-polarization

Dual-polarization radars send vertically and horizontally polarized microwaves to measure the parameters needed for analyzing the target shape and improving data quality.

Targets are identified as, for example, rain, hail, or snow, using sophisticated data processing techniques.

HydroClass™

Vaisala Hydrometeor Classification (HydroClass) software makes optimal use of dual-channel measurements to detect the types of scatterers present in the atmosphere, such as rain, hail, snow, graupel, and even non-meteorological targets such as insects, chaff, and sea clutter.

The benefit is improved data quality and more accurate warnings for hazardous weather such as hail.

Enhanced reflectivity

Enhanced reflectivity is a signal processing technique that improves the detection capabilities of a dual-polarization radar.

The technique uses echo power estimation to improve the detectivity of weak signals over a long range.

Enhanced reflectivity is exclusive to Vaisala dual-polarization radars and RVP900™.

Attenuation Correction

Attenuation by intervening heavy precipitation has been a long-standing concern with weather radars, especially in tropical environments where heavy rain is common.

Dual-polarization radars meet this challenge by performing accurate, real-time attenuation corrections.

Technical Data

Transmitter specifications

Transmitter tube	Coaxial magnetron VMC-2033A
Modulator type	Solid-state, utilizing IGBT technology
Frequency range	5.5 ... 5.7 GHz
Peak power	250 kW
Pulse widths	0.5, 0.8, 1.0, or 2.0 μ s.
Duty cycle	0.12 %
Phase stability	< 0.5° rms
Pulse Repetition Frequency	50 ... 2400 Hz
Average Power	300 W, 0.0012 duty cycle
Modes	STAR or LDR
Dimensions (W × H × D)	483 × 622 × 920 mm
Weight	76 kg (typical configuration)

Antenna and pedestal mechanical specifications

Total weight (4.5 m antenna and pedestal)	1530 kg
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Antenna specifications

Type	Center-fed parabolic reflector
Reflector diameter	4.5 m
Gain (typical)	45 dB
Beam width	< 1.0°
Difference between H and V beam widths	< 0.1° (<0.2 dB difference in gain)
Peak sidelobes at main polarization planes	< -29 dB
Integrated cross-pol isolation	< -35 dB
Cross-pol isolation at main polarization planes	< -36 dB
H/V alignment (squint angle)	< 0.1°
Weight (reflector with counterweight plate)	620 kg

Pedestal specifications

Type	Semi-yoke elevation over azimuth
Angle span software limits	-2 ... 108°
Maximum scan rate (azimuth and elevation)	40 degrees/second (6.67 rpm)
Acceleration	20 degrees/second ²
Position accuracy	< 0.1°
Motors	Brushless AC servo
Weight	910 kg

Signal processing

Signal processor	Vaisala RVP900
Azimuth averaging	2 ... 1024 pulses
Clutter filters	IIR, fixed, and adaptive width GMAP 50 dB rejection
Data outputs (8 and 16 bit)	Ah/v, Azdr, CCOR, CSP, CSR, dBT, dBZ, dBZt, KDP, LDR, LOG, PHIH/V, PHIDP, PMI, R, RHOHV, SNR, SQI, T, V, VC, W, Z, ZC, ZDR, ZDRC, Zh, Zv, Zhv
Dual PRF velocity de-aliasing	2:3, 3:4, or 4:5 for 2X, 3X, or 4X de-aliasing
High sensitivity Zhv STAR	3 dB improvement detection gain
IF digitizing	16 bits, 100 MHz in 5 channels
Number of range bins	Up to 8168 per channel
Optional data outputs	HCLASS, I/Q
Processing modes	PPP, FFT/DFT, Random Phase 2nd trip filtering/recovery
Range resolution	N*22 m
Range de-aliasing by random phase	

System specifications

Input power	Voltage: 3-phase 230/400 VAC \pm 10 % 50-60 Hz \pm 5 % Site mains supply fuses: min 16 A
Pedestal	Max. 1050 W Typical 200 W
Radar cabinet ¹⁾	Max. 2500 W Typical 2000 W 2)
Phase stability	< 0.5° rms
Maximum RhoHV	> 0.99

- 1) Includes cabinet cooler power consumption.
2) Ambient temperature +22 °C, RH 50 %.

Options

Radome	Typical 6.7 m, foam core sandwich, random panel
Automatic calibration	
Forward and reverse transmitted power monitoring	
Wide dynamic range receiver	> 115 dB



Radar receiver specifications

Type	Dual-stage, dual-channel IF downconverter and digitizer
Noise figure	< 2 dB
Dynamic range	> 99 dB (2 μ s pulse) (option > 115 dB)
Image rejection	> 80 dB > 100 dB with waveguide filters
Tuning range	5.5 ... 5.7 GHz
1st intermediate frequency	442 MHz
2nd intermediate frequency	60 MHz

Radar controller specifications

Type	Vaisala RCP8 with IRIS Radar
Scan modes	PPI, RHI, Volume, Sector, Manual, Rapid Scan
Local display	Real time, Ascope, BITE, products

Radar cabinet specifications

Dimensions (W × H × D)	600 × 1800 × 1320 mm
Total height	1890 mm ¹⁾
Weight	380 kg
Cooling	Air-conditioned
Operating temperature	+10 ... + 40 °C
Recommended operating temperature	+15 ... + 25 °C
Operating humidity	0 ... 95 %RH, non-condensing
Storage temperature	-50 ... +50 °C
Operating altitude/ Ambient pressure	Up to 3000 m Up to 700 hPa

¹⁾ The total height includes the cabinet protection unit and cabinet legs.



Features

- 250 kW klystron transmitter with low-maintenance solid-state modulator
- Vaisala lightweight, semi-yoke style pedestal
- 1° beamwidth low side lobe antenna
- Feed forward control loop to allow extremely fast and precise antenna movement
- Built around RVP900™ and IRIS™ software
- Remote control and monitoring
- Image rejection > 80 dB (> 100 dB with Vaisala waveguide filters)
- Dynamic range > 99 dB (2 μs pulse)
- Optional built-in automatic dual-channel calibration

Vaisala Weather Radar WRK200 is a dual-polarization C-band radar that uses a coherent klystron transmitter.

Dual-polarization

- Precision horizontal and vertical beam matching
- > 35 dB integrated cross-polarization isolation
- Enhanced reflectivity processing in STAR mode

Dual-polarization radars send vertically and horizontally polarized microwaves to measure the parameters needed for analyzing the target shape and improving data quality.

Targets are identified as, for example, rain, hail, or snow, using sophisticated data processing techniques.

Enhanced reflectivity

Enhanced reflectivity is a signal processing technique that improves the detection capabilities of a dual-polarization radar.

The technique uses echo power estimation to improve the detectivity of weak signals over a long range.

Enhanced reflectivity is exclusive to Vaisala dual-polarization radars and RVP900™.

HydroClass™

Vaisala Hydrometeor Classification (HydroClass) software makes optimal use of dual-channel measurements to detect the types of scatterers present in

the atmosphere, such as rain, hail, snow, graupel, and even non-meteorological targets such as insects, chaff, and sea clutter.

The benefit is improved data quality and more accurate warnings for hazardous weather such as hail.

Attenuation Correction

Attenuation by intervening heavy precipitation has been a long-standing concern with weather radars, especially in tropical environments where heavy rain is common.

Dual-polarization radars meet this challenge by performing accurate, real-time attenuation corrections.

Technical Data

Klystron transmitter specifications

Transmitter tube	Klystron VKC8387
Frequency range	5.6 ... 5.65 GHz
Peak power	250 kW
Average power	max. 550 W
Duty cycle	0.0022
Pulse widths	Typical 0.5, 0.8, 1.0, 2.0, max. 5.0 μ s
Pulse repetition frequency	250 ... 2125 Hz
Modulator	Solid state
Phase stability	<0.1 degrms

Antenna and pedestal mechanical specifications

Total weight (4.5 m antenna and pedestal)	1530 kg
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Antenna specifications

Type	Center-fed parabolic reflector
Reflector diameter	4.5 m
Gain (typical)	45 dB
Beam width	< 1.0°
Difference between H and V beam widths	< 0.1° (<0.2 dB difference in gain)
Peak sidelobes at main polarization planes	< -29 dB
Integrated cross-pol isolation	< -35 dB
Cross-pol isolation at main polarization planes	< -36 dB
H/V alignment (squint angle)	< 0.1°
Weight (reflector with counterweight plate)	620 kg

Pedestal specifications

Type	Semi-yoke elevation over azimuth
Angle span software limits	-2 ... 108°
Maximum scan rate (azimuth and elevation)	40 degrees/second (6.67 rpm)
Acceleration	20 degrees/second ²
Position accuracy	< 0.1°
Motors	Brushless AC servo
Weight	910 kg



Signal processing

Signal processor	Vaisala RVP900
Azimuth averaging	2 ... 1024 pulses
Clutter filters	IIR, fixed, and adaptive width GMAP 50 dB rejection
Data outputs (8 and 16 bit)	Ah/v, Azdr, CCOR, CSP, CSR, dBT, dBZ, dBZt, KDP, LDR, LOG, PHIH/V, PHIDP, PMI, R, RHOHV, SNR, SQI, T, V, VC, W, Z, ZC, ZDR, ZDRC, Zh, Zv, Zhv
Dual PRF velocity de-aliasing	2:3, 3:4, or 4:5 for 2X, 3X, or 4X de-aliasing
High sensitivity Zhv STAR mode processing	> 3 dB improvement detection gain
IF digitizing	16 bits, 100 MHz in 5 channels
Number of range bins	Up to 8168 per channel
Optional data outputs	HCLASS, I/Q
Processing modes	PPP, FFT/DFT, Random Phase 2nd trip filtering/recovery
Range resolution	N*22 m
Range de-aliasing by random phase	

System specifications

Input power	Voltage: 3-phase 230/400 VAC \pm 10 % 50- 60 Hz \pm 5 % Site mains supply fuses: min 25 A
Pedestal	1050 W (max.) / 200 W (typical)
Radar cabinet	Max. 8720 W with UPS Max. 7850 without UPS
Phase stability	< 0.1° rms
Maximum RhoHV	> 0.99

Options

Radome	Typical 6.7 m, foam core sandwich, random panel
Automatic calibration	
Forward and reverse transmitted power monitoring	
Wide dynamic range receiver	> 115 dB

Radars receiver specifications

Type	Dual-stage, dual-channel IF downconverter and digitizer
Noise figure	< 2 dB
Dynamic range	> 99 dB (2 µs pulse) (option > 115 dB)
Image rejection	> 80 dB > 100 dB with waveguide filters
Tuning range	5.5 ... 5.7 GHz
1st intermediate frequency	442 MHz
2nd intermediate frequency	60 MHz

Radars controller specifications

Type	Vaisala RCP8 with IRIS Radar
Scan modes	PPI, RHI, Volume, Sector, Manual, Rapid Scan
Local display	Real time, Ascope, BITE, products

Radars cabinet specifications

Dimensions (w × h × d)	1400 × 1800 × 1300 mm
Total height	1890 mm ¹⁾
Weight	977 kg
Cooling	Equipment rack: air-conditioned Transmitter: forced air
Operating temperature	+5 ... +40 °C +15 ... +25 °C recommended
Operating humidity	0 ... 95 %RH, non-condensing
Storage temperature	-50...+50 °C without oil -10 ... +50 °C with oil
Operating altitude/ Ambient pressure	Up to 3000 m Up to 700 hPA

¹⁾ The total height includes the cabinet protection unit and cabinet legs.



Features

- Fully solid-state transmitters
- Compact, modular design
- High resolution, accuracy, and sensitivity
- Fast installation and easy maintenance
- Low life-cycle costs
- Built-in automatic calibration
- Graceful degradation
- Light-weight pedestal
- Built around RVP900™ and IRIS™ software

Vaisala Weather Radar WRS400 is a dual-polarization X-band radar that uses solid-state transmitters.

Solid-state transmitters

Solid-state power amplifier (SSPA) transmitters provide increased observation accuracy, sensitivity, and tracking quality. The ultra-wideband performance virtually removes the risk of frequency interference.

The life-cycle costs of the SSPA transmitters are low because they do not require replacement of expensive consumable parts, in contrast to tube-based transmitters.

Thanks to continuous calibration, there is no calibration downtime.

SSPA transmitter is also smaller in size compared to traditional tube-based models.

Improved coverage with high quality

X-band frequency provides measurement data with high resolution and excellent precision for short-range meteorological surveillance.

By filling gaps in radar networks, the X-band weather radar improves radar network coverage, for example, in mountainous areas, rain catchment areas, and around wind parks.

Compact design

The compact weather radar is designed for fast installation and easy maintenance.

The transceiver is located at the back of the antenna, so only a short waveguide structure is needed. The simplified signal path provides improved sensitivity.

The simplified structure requires no RF rotary joints, waveguide switches, or site-specific parts. This enables increased data quality, reliability, and lower costs.

Because there is no need for a large equipment room, the site construction work is less extensive, and maintenance costs lower.

The transceiver has an internal heating/cooling system. The other units can be installed inside radar cabinet, or in other preferred location.

Graceful degradation

WRS400 has an independent SSPA transmitter for H channel and V channel. The radar design is based on reliable and redundant modules; even if one of the key components fails, the system will still maintain limited functionality. The failing component can be replaced fast and easily without an extensive break in operation.

Technical data

Operating environment for units in the radome

Operating temperature	-40 ... +55 °C
Operating humidity	0 ... 100 %RH, condensing
Operating altitude/Ambient pressure	Up to 3000 m Up to 700 hPA
IP class for pedestal and transceiver	IP54

Antenna specifications

Reflector diameter	1.4 m or 2.4 m
Type	Center-fed parabolic reflector
Gain (minimum)	For 1.4 m antenna: >40 dBi For 2.4 m antenna: 45 dBi
Beam width	For 1.4 m antenna: <1.8° For 2.4 m antenna: <1°
Peak sidelobes at main polarization planes	<-25 dB
Cross-pol isolation at main polarization planes	<-30 dB
H/V alignment (squint angle)	<0.1°

Pedestal specifications

Type	Semi-yoke elevation over azimuth
Acceleration	20°/s ²
Position accuracy	±0.05° accuracy
Azimuth steering	360°
Vertical steering	-2 ... +92° or better
Scanning rates	Up to 40°/s
Weight	250 kg

Transmitter specifications

Type	Fully solid-state, SSPA-based transmitters. Transmitters for H and V channels are separate and independently-modulated.
Frequency range	9300 ... 9700 MHz Selectable in 100 MHz bands and tunable within the range.
Peak power	SSPA 200 W (H) + 200 W (V) SSPA 400 W (H) + 400 W (V)
Pulse width	1...90 µs
Duty cycle	Max. 10%
Max pulse repetition frequency	3 kHz
Polarization	Simultaneous Transmit and Receive (= STAR) Horizontal-only Vertical-only

Radar controller

Type	Vaisala RCP8 with IRIS Radar
Scan modes	PPI, RHI, Volume, Sector, Manual, Rapid Scan
Local display	Real time, Ascope, BITE, products

Receiver specifications

Type	RF front-end, dual-channel digital receiver for horizontal and vertical polarization
Noise figure	≤3 dB
Linear dynamic range	95 dB or better
Image rejection	80 dB or better (with WG filters)
Recovery time after Tx pulse	≤5 µs

System specifications

Typical operating range	100 km
Input power	Voltage: 230 ±10 %, 50 ... 60 Hz ± 3 Hz (single-phase)
Power consumption	Typical: 1200 W
Phase stability	0.5° or better
Total weight of radar (antenna, pedestal, transceiver)	With 1.4 m antenna: approx. 340 kg With 2.4 m antenna: approx. 370 kg
Storage temperature	-50...+60 °C
Noise emissions	55 dB ¹⁾

¹⁾ Measured in a situation representing a typical radar maintenance situation, where the fans are on but the antenna is not rotating.

Signal processing

Azimuth averaging	2 ... 1024 pulses
Clutter filters	IIR, fixed, and adaptive width GMAP
Dual PRF velocity de-aliasing	2:3, 3:4, or 4:5 for 2X, 3X, or 4X de-aliasing
High sensitivity mode processing	> 3 dB improvement detection gain
IF digitizing	16 bits, 100 MHz in 5 channels
Number of range bins	Up to 8168 per channel
Optional data outputs	I/Q
Processing modes	PPP, FFT/DFT, Random phase 2nd trip filtering/recovery
Range resolution	N*22 m
Range de-aliasing by random phase	

Radome specifications

Property	Value
Type	Quasi-random (dual-polarization)
Typical outside diameter	For 1.4 m antenna: 2400 mm For 2.4 m antenna: 3660 mm

WindCube Scan Lidar

The WindCube® Scan series provides accurate wind and atmospheric measurements reliably and affordably even in extreme environments.



The WindCube Scan series of wind and aerosol lidars perform 24/7 real-time measurements and high-level data processing. They are versatile tools for recovering accurate real-time wind and aerosol backscatter measurements in any scanning geometry up to more than 10 km. They are among the most flexible and accurate wind measurement technologies available, complementing met masts and accurate vertical profiling lidars in wind energy applications, for example.

State of the art structure detection algorithm offers the capability to detect, locate, and classify clouds and aerosol layers in the troposphere, as well as to monitor the height of the atmospheric boundary layer (ABL). They can be deployed either as standalone units for wind hazards detection, or in combination with other weather sensors as part of comprehensive systems like windshear alert systems at airports.

Features

- 24/7 real-time measurements
- Fully configurable for monitoring, cross-sectioning, wind profiling, and more
- A wind reconstruction tool proven by international third parties is also available
- Dedicated reprocessing and display software

Versatility and robustness

WindCube Scan units feature rugged, industrial design and can be placed in extreme environments. Each system is fully configurable for several uses including monitoring, atmospheric cross-sectioning, wind profiling, and more.

Technical data

Operating environment

Operating temperature	-30 ... +45 °C (-22 ... +113 °F)
Maximum operating altitude	3048 m (10 000 ft)
IP rating	IP65

Mechanical specifications

Dimensions (L × W × H)

System	830 × 1012 × 1370 mm (32.68 × 39.84 × 53.94 in)
Shipping case closed	948 × 1204 × 1507 mm (37.32 × 47.40 × 59.33 in)
Shipping case opened	948 × 2736 × 1905 mm (37.32 × 107.72 × 75.00 in)

Weight

System only	232 kg (511 lb)
Shipping case only	100 kg (220 lb)
Total with accessories	370 kg (816 lb)

Laser

Laser source	Pulsed at 1.54 μm
Lidar eye safety	Class 1M according to IEC 60825-1:2014

Inputs and outputs

Power supply	100 ... 240 VAC, 18 ... 9 A RMS, 47 ... 60 Hz With mains supply voltage fluctuations up to ±10 % of the nominal voltage
Power consumption	500 ... 1600 W (range includes the use of coolers and heaters)

Compliance

Compliance marks	CE-marking
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Lidar parameters

Property	WINDCUBE 100S/200S	WINDCUBE 400S	WINDCUBE 200S-AT
Accumulation time	0.1 ... 10 s		Down to 50 ms in vortex mode
Range resolution	25 m, 50 m, 75 m, or 100 m	75 m, 100 m, 150 m, or 200 m	34 m in vortex mode
Display range resolution	Down to 1 m (with gate overlapping)		5 m in vortex mode
Number of range gates	Up to 320 (depending on range gate length used)		
First range of measurement	More than twice the range gate length		68 m in vortex mode

Scanner parameters

Scanner rotation speed	Up to 30°/s
Azimuth angle	0° ... 360° (with 0.01° increment)
Elevation angle	-19° ... 199° (with 0.01° increment)

System requirements for Windforge software

Processor	Core i3 or better
Operating system	Windows 7
Memory	4 GB RAM
Hard disk space	500 GB
Resolution	1366 × 768
Data format	Stored in an embedded SQL database. Export in auto documented NetCDF files by graphical user interface, API, or to an FTP server. The Leosphere NetCDF file format is built on NetCDF-4 (which is in turn built on HDF5) and its architecture is based on CfRadial2 and Cf convention.
Storage capacity	1 TB* hard drive. Database storage autonomy depends on scenario. Typically 1 year (without saving raw signal averaged spectra, and with 1-second accumulation time).
Data transfer	Ethernet/LAN Radial Wind Speed file, 70 gates, 1s accumulation = 25 MB* /h Size proportional to the number of gates and the accumulation time.
Synchronization	UTC clock via NTP server and GPS
Main functionalities	- Instrument control and configuration - Management of a library of scans - Programming in a loop or a scheduler - Real-time data acquisition and measurement display - System diagnostics and alarms

1) *: TB = Tera Byte
2) *: MB = Mega Byte

Windforge scanning scenarios

Scanning modes	PPI: constant elevation angle scenario RHI: constant azimuthal angle scenario DBS: vertical wind profile wind scenario Fixed: fixed line of sight scenario
Scanning type	Endless full hemispherical scanning Continuous scanning (scanner measures while rotating)

Technical data

System behavior data

Environmental data (CSV format)	30-minute average, minimum, maximum, and number of samples for: <ul style="list-style-type: none"> • Latitude and longitude (°) • Pitch and roll (°) • Disk occupation (%)
Status (CSV format)	OK/WARNING/CRITICAL for: <ul style="list-style-type: none"> • Overall view (lidar status) • Precise view (components status) • Measurement thresholds (for example temperature, disc space)
Activity (CSV format)	Time stamp Actions (LOG IN/OUT, START/STOP Acquiring, START/STOP Operating) User information

Wind data exports

Radial wind	Radial wind speed (m/s) Radial wind speed dispersion (m/s) Carrier to noise ratio (dB) Confidence index
Vertical profile wind (in DBS mode)	Horizontal wind speed (m/s) Wind direction (m/s) Vertical wind speed (m/s) Carrier to noise ratio (dB) Confidence index
Spectra (activate upon request)	Spectral density

Particles data exports (optional)

Structure	Residual planetary boundary layer Mixing planetary boundary layer Aerosols Clouds
Radial backscatter coefficient	Attenuated relative beta (m ⁻¹ .sr ⁻¹) Attenuated absolute beta (m ⁻¹ .sr ⁻¹)

Range

Property	WINDCUBE 100S	WINDCUBE 200S(-AT)	WINDCUBE 400S(-AT)
Maximum typical operational range ¹⁾	3000 m	6000 m	10 000 m
Maximum acquisition range ¹⁾	14 700 m	14 700 m	>15 000m

¹⁾ As defined in ISO 28902-2:2017, the maximum acquisition range is the maximum distance to which the lidar signal is recorded and processed. It depends on the chosen range resolution. The maximum acquisition range is 14,7 km in 100 m mode for a 100S or 200S(-AT) and >15 km in 200 m mode for a 400S(-AT).
The maximum operational range is the distance to which a confident wind speed can be derived from the lidar signal. It depends on various parameters such as the accumulation time, physical range resolution, visibility, type of aerosols, and variations of refractive index in the atmosphere.

API

API type	REST Web API
Functionalities	Lidar configuration and programming Status/Activities/Logs monitoring Data download (JSON stream or NetCDF files)
Possible uses	Change the programming automatically according to wind direction Program several Windcubes simultaneously Integrate WindCube data easily in a third-party software Create a custom-made file format using JSON data stream
Performances	When several Windcubes are programmed simultaneously, they can keep synchronized in time up to 0.5 s after running 1 h

Lidar performance

Radial wind speed range ¹⁾	-30 ... 30 m/s
Reconstructed wind speed range (DBS scan)	0 ... 60 m/s for 60° elevation angle 0 ... 115 m/s for 75° elevation angle
Radial wind speed accuracy ²⁾	< 0.1 m/s

¹⁾ Close to extremal values, wind speed can be less accurate, according to the resolution used.
²⁾ Accuracy must be understood as absolute mean error of the radial wind speed, after filtering by the status and in a regular lidar measurement situation: diffuse particles, no hard target in the direct line of sight, no ambiguities.

Scanner performance

Scanner pointing accuracy ¹⁾	0.1°
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¹⁾ The Windcube scan pointing accuracy specification is 0.1°. This value has to be understood after alignment on distant hard targets, on a limited area, ±22.5° in elevation or azimuth, around a reference hard target and without considering possible backlash, that is, using always the same scanning direction.

System requirements for post-processing software

Processor	Core i5 or i7 and 3.4 GHz or better
Operating System	Windows 7 and 10 or Windows server 2012R2 (64-bit)
Memory	8 GB RAM
Storage	Capacity: 1 TB (depending on campaign duration) Interface: SATA III 6.0 GB/s Single track seek time: <ul style="list-style-type: none"> • Read: 0.6 ms • Write: 0.8 ms
Resolution	1366 × 768
Rights	Local admin rights
Basic display and export	Animated data visualization
Vortex (optional)	Vortex measurement and aircraft vortex characterization

WindCube Ground-based Vertical Profiler Lidar



Features

- Measurement from 40 meters to over 300 meters
- Pulsed lidar technology
- 4 inclined beams and 1 vertical beam
- 45 W nominal power
- Remote monitoring through WindCube Insights
- Multiple communication channels (wired, cellular, satellite)
- Optional autonomous power kit

WindCube® is a ground-based vertical profiler Lidar that measures accurate wind data up to over 300 meters. It is equivalent to a very tall met mast, collecting wind speed, direction, vertical wind speed, and turbulence intensity data at 20 different heights with limited installation constraints and high operational safety.

Based on pulsed Doppler heterodyne laser principle, the WindCube sends a light pulse at a high frequency into the atmosphere and observes the signal backscattered by aerosols naturally present in the air. The time between the pulse and the detection of the backscattered signal is processed by the system thanks to the Doppler effect, and provides an accurate measure of the wind speed and direction.

Pulsed laser technology

Pulsed Lidars send laser pulses at a very high frequency. To avoid confusing time delays and distance, the Doppler shift is analyzed before the next laser pulse is emitted. Therefore, the probe distance, or height, only depends on the time it takes for a pulse to be received after it has been emitted.

Multiple heights are measured simultaneously, and spatial resolution is constant throughout the entire wind profile. Also, measurement is not affected by clouds, fog, high density of dust, or obstacles.

Thanks to a vertical beam, the lidar allows a direct measurement of the vertical wind speed, and improves the turbulence intensity (TI) assessment.

Remote monitoring

The web-based WindCube Insights platform enables remote monitoring and control of the WindCube vertical profiler. Wind speed data and carrier-to-noise ratio (CNR) are displayed live, and the platform also provides the possibility to configure measurement heights and communication with the Lidar.

Ease of installation and operations

The Lidar is easy to handle and install. A couple of hours is enough to fully set up the lidar and start measuring. It is compatible with autonomous power solutions (power pack, solar panels), and its robustness supports operations continuity.

Technical data

Measurement parameters

Measurement range (1)	40 ... > 300 m
Data sampling rate	1 Hz
Measuring distances	20 user-defined distances simultaneously
Radial Wind Speed range	-23m/s to +23m/s
Reconstructed Wind Speed range	0m/s to 49m/s
Reconstructed Wind Direction range	0 - 360°
Speed accuracy (2)	0.1 m/s
Wind speed	0 ... > 60 m/s
Speed uncertainty (2)	40 - 80m: 1.4% to 2.6% 80 - 120m: 0.6% to 1.4% 120 - 135m: 0.6% to 0.8%
Direction accuracy (2)	2°
Beam geometry	4 inclined beams at 28° and 1 vertical beam

1) Height from WindCube feet. Data availability depends on environmental factors such as visibility, type of aerosols and variation of refractive index in the atmosphere

2) For 10-min averages, as assessed by several 3rd parties on multiple WindCube devices or in 2020 according to IEC 61400-12-1 Ed.2. Uncertainty figures are Final Accuracy Class divided by $\sqrt{3}$

Operating environment

Warranty	3 years standard
Preventive maintenance	3 years cycle (factory or onsite maintenance)
Temperature range (1)	-30°C to +45°C / -22°F to 113°F (chamber conditions)
Maximum altitude	3000m (when equipped with DC-DC convertor)
Operating humidity	0 to 95% RH (non-condensing)
Environmental Protection	Designed for installation in many kinds of weather and environmental conditions IP66 and IP67 (Inner sub-assemblies) IP54 (Lidar Casing) Radiation +1000W/m ² at +45°C
Rain protection	Wiper
Marine atmosphere (Salt Atmosphere Compliance)	IEC 60068-2-52 (2017) - 120 hours
Shocks and vibration	ISTA/FEDEX 6B

1) Starting the system at low temperature (lower than -20°C) will require to have the WindCube equipped with an adapted protection

Electrical and optical

Power consumption (1)	45 W between -5°C and 30°C / 23°F and 86°F 110W below - 5°C / 23°F 55W over 30°C / 86°F
LASER Safety Compliance	1M Class / EN 60825-1:2014

1) Nominal power consumption taken from an initial state of the WindCube at 15°C.

Data output

Output data	1 s / 1-, 2-, 5-, 10-minute averaged (user-defined) horizontal and vertical wind speed Standard deviation Direction CNR (carrier-to-noise ratio) GPS coordinates Data availability
Complex terrain measurements	FCR unlimited license
Data storage	120 GB industrial disk (over 5 years storage of all data) WindCube Insights secured cloud-based server
Data file format	RTD and STA (file), UTF-8 encoding
Communication	LAN, USB, 3G, or 4G router (router availability depends on the region/country), Modbus RTU (gateways available), Wi-Fi
Time synchronization	GPS, NTP

Mechanical specifications

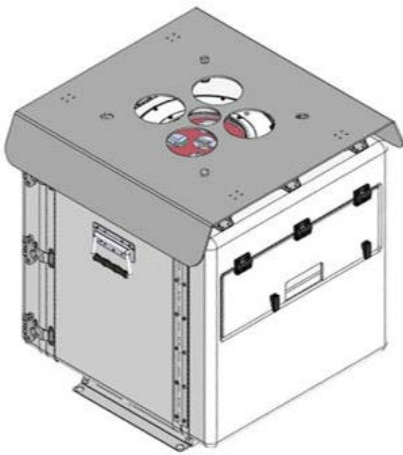
Cube dimensions (L × W × H)	554 × 566 × 554 mm (21.81 × 22.28 × 21.81 in)
With feet and wiper	608 × 566 × 661 mm (23.94 × 22.28 × 26.02 in)
Weight	59kg (system only) 28kg (shipping case only) 91kg (total with accessories)

Compliance

Compliance marks (1)	CE, FCC, IC
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1) As verified on WindCube without Geofencing option

WindCube Offshore Vertical Profiler Lidar



Features

- Measurement from 40 meters to over 300 meters
- 20 range gates
- Pulsed lidar technology
- 4 inclined beams and 1 vertical beam
- 45 W nominal power
- Remote monitoring through WindCube Insights
- Multiple communication channels (wired, cellular, satellite)
- IP67 Casing + IP67 Internals
- Classified

WindCube Offshore is a vertical profiler Lidar that measures accurate wind data up to over 300 meters. It is equivalent to a very tall met mast, collecting wind speed, direction, vertical wind speed, and turbulence intensity data at 20 different heights with limited installation constraints and high operational safety. For Offshore uses, on buoy or fix platform installation, Leosphere designed a maritized version of the WindCube Vertical Profiler Lidar. Both Casing plus internals are IP67 and specifically tested to resist harsh environment for years of sea operation.

Based on pulsed Doppler heterodyne laser principle, the WindCube sends a light pulse at a high frequency into the atmosphere and observes the signal backscattered by aerosols naturally present in the air. The time between the pulse and the detection of the backscattered signal is processed by the system thanks to the Doppler effect, and provides an accurate measure of the wind speed and direction.

Pulsed laser technology

Pulsed lidars send laser pulses at a very high frequency. To avoid confusing time delays and distance, the Doppler shift is analyzed before the next laser pulse is emitted. Therefore, the probe distance, or height, only depends on the time it takes for a pulse to be received after it has been emitted.

Multiple heights are measured simultaneously, and spatial resolution is constant throughout the entire wind profile. Also, measurement is not affected by clouds, fog, high density of dust, or obstacles.

Thanks to a vertical beam, the lidar allows a direct measurement of the vertical wind speed, and improves the turbulence intensity (TI) assessment.

Remote monitoring

The web-based WindCube Insights platform enables remote monitoring and control of the WindCube vertical profiler. Wind speed data and carrier-to-noise ratio (CNR) are displayed live, and the platform also provides the possibility to configure measurement heights and communication with the lidar.

Ease of installation and operations

The lidar is easy to handle and install. A couple of hours is enough to fully set up the lidar and start measuring. It is compatible with autonomous power solutions (power pack, solar panels), and its robustness supports operations continuity.

WindCube Offshore

The WindCube Offshore can be used offshore and onshore, according to your needs. A customized version of the WindCube has been designed for harsh offshore locations like floating buoys, substations and vessels. For Offshore wind farms located further away, the WindCube Offshore allows measuring accurately the wind on stable platforms located several kilometers from the shore, even in harsh offshore environments. In case of absence of platform, the measurement with a Lidar installed on a buoy/vessel, is the most effective way of performing a cost-effective wind resource assessment. The WindCube Offshore is based on the same technology than the standard WindCube Lidar with a maritized robust casing and base in order to stand harsh marine conditions, it has been reinforced to operate for extended periods in harsh sea conditions (saltwater, humidity and bird presence).

WindCube Offshore technical data

Operating environment

Warranty	3 years standard, extendable once after maintenance
Preventive maintenance	3 years cycle at factory or service center or onsite onshore
Temperature range*	-30°C to +45°C / -22°F to 113°F (chamber conditions)
Operating humidity	0 to 95% RH (non-condensing)
Solar radiation protection	Sunshade
Environmental Protection	Designed for installation in many kinds of weather and environmental conditions IP66 and IP67 (Inner sub-assemblies) IP54 (Lidar Casing) Radiation +1000W/m ² at +45°C
Rain protection	Wiper
Marine atmosphere	IEC 60068-2-11, 4 to 5 years sea operation equivalence
Shocks and vibration	ISTA/FEDEX 6B

(*) Starting the system at low temperature (lower than -20°C) will require to have the WindCube equipped with an adapted protection.

(**) As verified on WindCube without Geofencing option

Mechanical specifications

Cube dimensions (H × W × D)	677 mm × 585 mm × 592 mm
Weight	52 kg

Electrical and optical

Power consumption	45 W nominal
Temperature range	-20 ... +40 °C (-4° +104°F)
Laser safety	1M Class / EN 60825-1:2014

Compliance

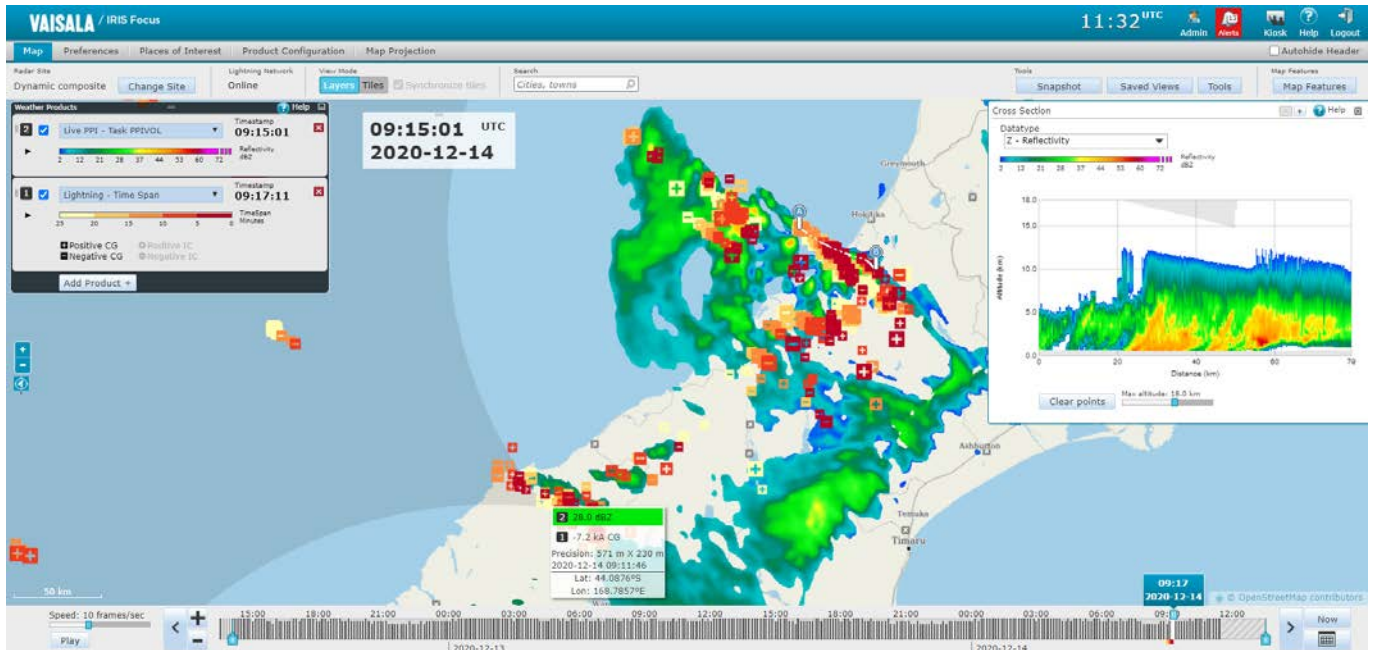
Compliance marks	CECE, FCC, ICES
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Measurement parameters

Measurement range	40 ... > 300 m
Data sampling rate	1 Hz
Measuring distances	20 user-defined distances simultaneously
Wind speed measurement	0.1 m/s
Wind speed	0 ... > 60 m/s
Wind speed uncertainty	2 ... 3 % (following IEC 61400-12-1 Ed. 2)
Wind direction accuracy	2°
Beam geometry	4 inclined beams at 28° and 1 vertical beam

Data output

Output data	1 s / 1-, 2-, 5-, 10-minute averaged (user-defined) horizontal and vertical wind speed Standard deviation Direction CNR (carrier-to-noise ratio) GPS coordinates Data availability
Complex terrain measurements	FCR unlimited license, option only available for fixed installation
Motion compensation software	External reprocess software, option available for buoy installation, unlimited license
Geofencing	3 years license, option only available for fixed installation
Data storage	120 GB industrial disk (over 10 years storage of all data) WindCube Insights secured cloud-based server
Data format	RTD and STA (file), UTF-8 encoding
Communication	LAN, USB, 3G, or 4G router (router availability depends on the region/country), Modbus RTU (gateways available), Wi-Fi, Satellite
Time synchronization	GPS, NTP



Weather radar data: courtesy of Meteorological Service of New Zealand Ltd. Lightning data: courtesy of Transpower New Zealand Ltd.

Features

- Web-based application
- Easy-to-configure events and alerts
- On-demand data regeneration at high resolution
- Tested and audited with the latest security standards

IRIS Focus weather products

Weather products are graphical representations of the data captured by the remote sensing devices, such as weather radars, lightning networks, and lidars.

On-demand products are based on raw data from the IRIS back-end systems (IRIS - Interactive Radar Information System and/or TLP - the Total Lightning Processor). IRIS Focus processes this data and generates on-demand products in real time. On-demand products provide control over the presentation of this data.

You can combine data from several remote sensing devices into composites to provide an expanded area of coverage.

IRIS Focus Remote Sensing Software provides a rich set of unique tools for viewing and analyzing your weather data from various sources: weather radars, lidars, and lightning networks. IRIS Focus helps you better understand storms for quicker decisions and more accurate precipitation classification.

Integrated weather data visualization

Integrated data from various sources enables you to better understand storms and other weather phenomena for more accurate forecasts and earlier alerts.

Radar-based nowcasting

Nowcasting performs advection calculations on motion data from radar products to predict weather movement and severity up to 2 hours in the future.

Lightning Network Health

With the Network Health product, you can visualize the performance of the lightning sensor network.

Events and alerts

IRIS Focus can provide alerts for weather events, such as the approach of a severe storm, turbulence, or flood potential for user-defined areas of interest.

Customizable map view

The map view can be customized by adding WMS layers from external sources, such as satellite images or radar data from external radar networks.

Technical data

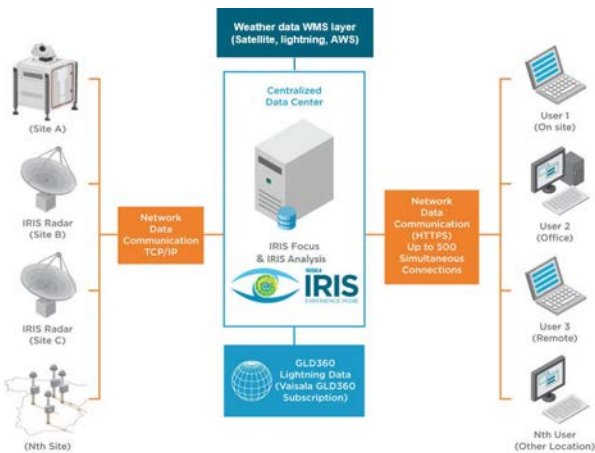
Network requirements

Communication from IRIS Analysis and the TLP to IRIS Focus

Network data transfer >100 Mbit/s (1000 Mbit/s recommended)

Communication from IRIS Focus to IRIS Analysis and the TLP

Single user (1 seat)	Network data transfer	> 650 kbit/s
	Latency	< 150 ms
Multiple simultaneous users	5 seats	> 3.5 Mbit/s
	10 seats	> 7 Mbit/s
	20 seats	> 14 Mbit/s



IRIS Focus in Remote Sensing Networks

Hardware requirements

Minimum	Recommended ¹⁾
<ul style="list-style-type: none"> Modern 4-core CPU (Intel Xeon E5 series or similar) 24 GB RAM ²⁾ 1 TB HDD 1400 x 1050 minimum screen resolution 	<ul style="list-style-type: none"> Modern 8-core CPU (Intel Xeon E5 series or similar) 32 GB RAM 2x 1 SAS TB HDD in RAID 1 configuration 1920 x 1200 screen resolution

1) The pre-installed IRIS Focus system delivery option uses the Dell PowerEdge R440 rack server unit, which meets the recommended hardware setup.

2) For a small installation with only a few users, 16 GB of RAM is sufficient.

Software requirements

Browser	IRIS Focus supports current Microsoft Edge®, Mozilla Firefox®, and Google Chrome™ browsers.
Operating system	AlmaLinux 8
IRIS Analysis	IRIS 8.13.6 or later. IRIS Analysis provides radar products through a proprietary socket server connection.
TLP	TLP 1.2.7

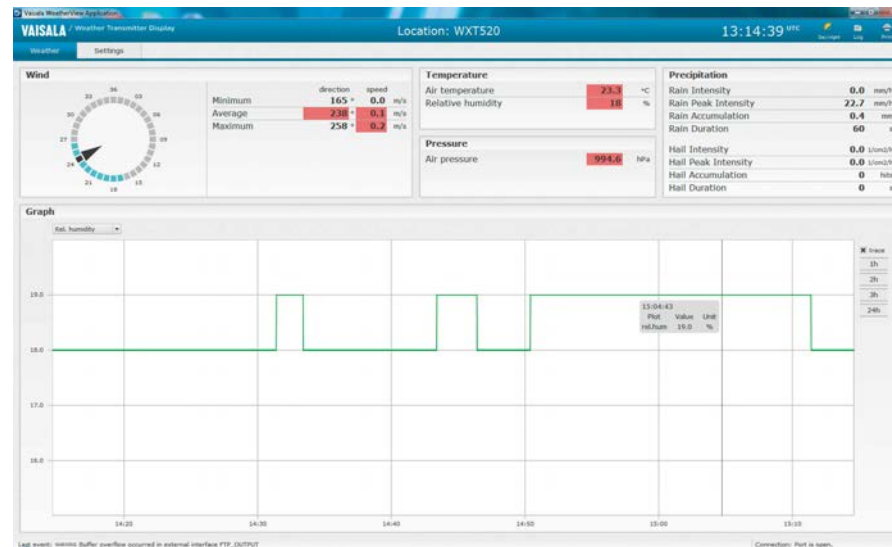
Weather products

On-demand product	Weather product
✓	BASE Echo Base
	BEAM Antenna Beam Pattern
✓	CAPPI Constant Altitude PPI
	HMAX Height of Maximum Intensity Product
	LAYER
✓	MAX Maximum Data
	MLHGT Melting Level Height
	MVF Motion Vector Field
	Network Health Lightning network performance
✓	PPI Plan Position Indicator
	RAINI Hourly Rain Accumulation
	RAIN-N N-Hour Rain Accumulation
	RHI Range Height Indicator
	RTI Range Time Indicator
	SRI Surface Rainfall Intensity
	SHEAR Wind Shear
	SLINE Shear Line (frontal boundary)
✓	THICK Echo Thickness
✓	TimeSpan Lightning event evolution
✓	TOPS Echo Tops Map
	VAD Velocity Azimuth Display
	VIL Vertically Integrated Liquid
	VVP Velocity Volume Processing
	WARN Warning/Centroid
	WIND Wind Speed and Direction



MCC201 night-time color scheme

Vaisala Weather Transmitter Display MCC201 is PC software designed for use with Vaisala Weather Transmitter WXT520. It is used for displaying and storing the meteorological measurement data needed for planning weather critical operations and examining longer-term weather phenomena or climatological trends.



MCC201 day-time color scheme

Real-Time Display

Vaisala Weather Transmitter Display presents meteorological data in numerical and graphical formats. Users can choose from a range of engineering units when displaying the latest

measurement values on the easy-to-use default screen layout. The default weather parameters monitored include wind speed and direction, air temperature, relative humidity, atmospheric pressure and precipitation.

Features

- Displays and logs data from Vaisala Weather Transmitter WXT520
- Easy to install and operate
- Provides data for various weather applications
- High contrast day-time and night-time color schemes
- Visual and audible alarms
- Remote client PC display option and FTP client support

Observation data can also be displayed as a real-time graph. Visual and audible alarms provide warnings of critical weather conditions or other important issues such as sensor or system failure.

Data Archiving and Viewing

The application automatically stores data chronologically as ASCII log files, and continues to run in the background so that data collection can continue even when the user interface is closed. The ASCII log files can be exported to external applications so that collected data can be viewed in tabular or graphical formats.

Data Distribution

The data distribution feature allows several client PCs to gather weather data from the master PC. The file transfer feature allows the latest data files to be transferred to another server using FTP protocol.

Technical Data

Connecting with WXT520

Vaisala Weather Transmitter Display MCC201 can connect with WXT520 via LAN, wireless GPRS, or USB/serial connections with ports RS-232 or RS-485.

Communication options between WXT520 and PC

Serial connection via RS-232 port

Serial connection via RS-485 (requires converter)

USB connection via RS-232/RS-485 (requires converter)

TCP/IP via Ethernet (requires converter)



Minimum Hardware Requirements

Personal Computer	Desktop/Laptop
Processor	2.0+ GHz
RAM	2048 MB
Hard Disk Space	Software: 100 MB
Data storage	1 GB/Year
Ports	Ethernet/LAN Serial/USB port (may require an adapter)
Monitor resolution	1024 x 768 pixels (or higher)
Drives	DVD required for installation
Operating system	

Operating systems

Windows 10, Windows 7, Windows XP, Windows 2008 Server, Windows 2003 Server

Features

Monitored default weather parameters	Wind speed and direction
	Air temperature and relative humidity
	Atmospheric pressure
	Precipitation
Data collection	Automatic background data collection
	Data validation
Real-time display	Text boxes, graphs, and labels
	Alarms
	Wind Rose
Data logging and viewing	Full-screen mode
	Received data log
	Observation parameter log
	Event log
Data distribution	Tabular view
	Support for client PCs
	FTP client support
Precipitation accumulation reset	



Benefits

- Operational cost savings with more efficient operation and maintenance
- Fast remote problem solving
- Automatic continuous data availability and validity analysis and reporting
- Secure 24/7 monitoring of observation sites
- Web interface for sharing real-time surface weather and other information

Vaisala Observation Network Manager NM10 enables remote monitoring, management and control of your weather observation networks on one central, secure, and automated platform. Easy access to all essential event, alert, observation, device status, metadata and maintenance information helps to identify and solve problems quickly ensuring continuous high-quality observations and shorter site visits with correct actions. From implementation to long-term maintenance, a network management solution optimized for your needs improves operational efficiency and reduces the lifetime cost of managing and maintaining all your observation sites.

Cost-effective, configurable off-the-shelf platform

Implementing a scalable, flexible management solution with autonomous systems and intelligent field devices of different brands and types which provide interfaces for efficient integration with other products and systems will allow you to optimize your network operations, improve safety and facilitate operation in remote locations.

Vaisala Observation Network Manager NM10 enables remote monitoring and control of your weather observation networks on one central, secure and automated platform. An off-the-shelf solution with extensive support and

proven performance and functionality significantly reduces the implementation time and total lifetime costs, helping you stretch your budget further.

Real-time monitoring with alerts and remote diagnostics

NM10 provides the ability to monitor individual site status via secure web technologies and collect data 24/7 from one central network in real time. It allows your team to remotely access and control individual sites to fix the problems faster and optimize your network operation. With centralized event, alert, notification, device metadata and maintenance information quicker reaction to network and sensor failures, and faster problem identification and solution deployment can be achieved for improved network uptime

and data availability. In addition, configure the layout and displayed data to clearly visualize and understand precisely real-time weather conditions throughout your country or region affecting your operations and observation site performance.

High data security, availability and validity

Perform automatic real-time data quality control and analytics services to feel confident that you will get the high-quality observation data you need. Advanced data security and user management capabilities are utilized to avoid network vulnerability and to mitigate the risks of intrusion and cyber threats.

Surface Weather Display Views



Precisely understand current and past surface weather and environmental conditions affecting your operations on a single or a group of sites.

Default desktop view customizable by system administrator to include new pages and layouts for different users.

Surface weather alarm information optionally visualized on GIS map and list views.

Text view to list observations in numeric and string format.

Chart view to inform about current and past surface weather and environmental conditions.

Wind rose view with optional road or runway direction indication to inform about current wind conditions.

Observation Network Management Views

Remotely monitor, access and control the sites connected to avoid unnecessary site visits.

Monitoring overall status of the observation network using GIS map, list and detailed site views.

Manage device metadata and maintenance activities.

Verify the quality of observation data.



Access to administrator view for user management and system settings.

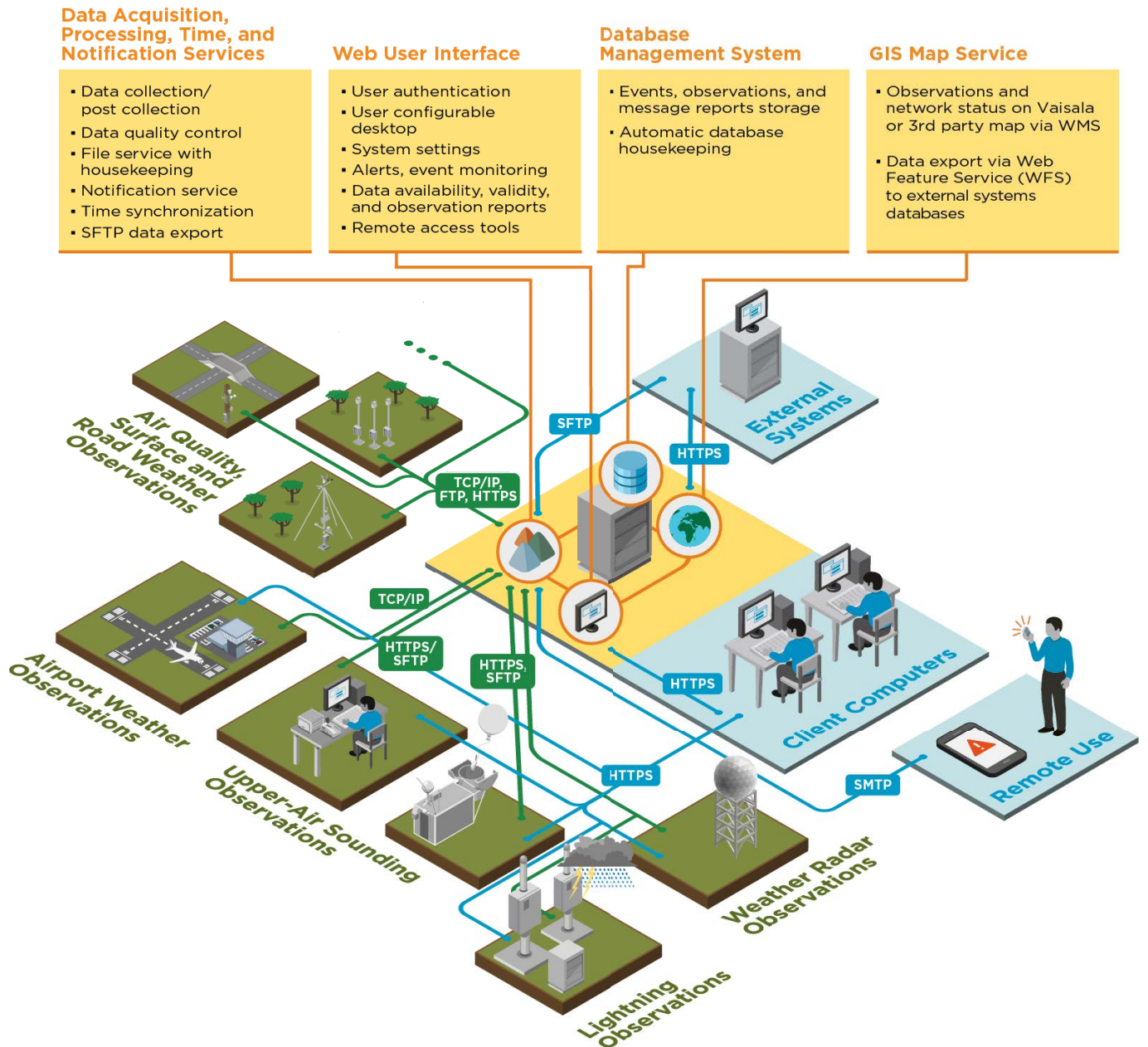
Context sensitive help to use the application.

Remotely control observation sites directly from the application desktop.

Receive notifications when problems occur.

Remotely access observation sites to further diagnose issues.

Vaisala Observation Network Manager



NM10 is a stand-alone system installed in customer premises on Windows or Linux operating systems. The system is configured individually for each customer use. The figure shows the available main components and interfaces of the system.

Data acquisition, processing, time, and notification services component provides the capabilities to receive air quality, surface, road and airport weather observations as well as events and alerts information from airport weather, upper-air sounding, weather radar and lightning detection observation systems. Variety

of different communication protocols and message formats can be used. The component is also able to synchronize time, manage the post-collection of the observations from the Vaisala automatic surface weather stations and provide central data quality control service. Email, visual and sound alarms and notifications are available.

System events, state changes, observations and message reports received from the observation sites are persisted to a scalable database management system.

A browser-based user interface via HTTPS restricted by username and password is provided for viewing the observation data and for monitoring the

data quality and the status of the network and its components. Geographic information system (GIS) map, list, site details, wind rose, chart, text and report widgets are available to view real-time and history observations, site statuses and their exact locations. Depending on the site and its configuration, links are included for remote access to view and diagnose the connected devices and systems without the need to use any additional software on client PCs.

Technical data

Features

Data acquisition	<ul style="list-style-type: none"> Vaisala weather transmitters Vaisala air quality transmitters Vaisala surface weather stations Vaisala ceilometers Vaisala AviMet® airport systems Vaisala AUTOSONDE® systems Vaisala DigiCORA® sounding systems Vaisala RWS200 road weather stations Vaisala weather radars Vaisala lightning detection systems ASCII string message parsing from third-party surface weather sensors and systems (when applicable) OGC SensorThings RESTful HTTP service
Data post collection	Vaisala surface weather stations
Data processing	<ul style="list-style-type: none"> Range, step, and persistence checks for surface and road weather transmitter and station observations Generic statistics, wind, sun radiation and solar specific central calculations Gain and offset correction for air quality measurements MGRS (NATO UTM) coordinate support
Data storage	<ul style="list-style-type: none"> PostgreSQL database Observation and event log text files Configurable database management system
Time services	<ul style="list-style-type: none"> Time synchronization for Vaisala surface weather stations NTP system time synchronization
Notification services	Configurable SMTP email alerts
Remote site access	<ul style="list-style-type: none"> Terminal connection for weather transmitters and stations, RDP over HTTPS for airport, AUTOSONDE® and DigiCORA® sounding systems Web browser connection via HTTPS to AUTOSONDE® and DigiCORA® sounding systems, RWS200, and lightning detection systems
Metadata management	Manual maintenance and device metadata management
Web user interface	<ul style="list-style-type: none"> Client connection via HTTPS User authentication and administration User configurable desktop and widgets Map, list, graph, wind rose, text and IFRAME widgets System settings Sound alerts, events monitoring Alarm acknowledgement: grant or deny balloon release Observation data reports Data availability and validity reports Maintenance and device metadata management views Translation for local language(s) Context sensitive help
GIS map service	<ul style="list-style-type: none"> GeoServer with OpenStreetMap world map Standard map max. zoom level: 1:433K Enhanced map max. zoom level: 1:6759 WMS interface for third-party map data
Data export	<ul style="list-style-type: none"> FTP/SFTP, WFS via HTTPS Automatic WMO FM 94 BUFR Ed 4 v. 29.0.0 (Fixed land station synoptic reports, ref. 3 07 080)

Minimum system requirements

Processor	2.0+ GHz, 4-core CPU or higher
RAM	<ul style="list-style-type: none"> 8 GB or higher (with standard GIS map) 16 GB or higher (with enhanced GIS map)
Hard disk space	300 GB or higher (with standard GIS map) 1 TB or higher (with enhanced GIS map)
Operating system	<ul style="list-style-type: none"> Microsoft Windows Server 2012 R2 Microsoft Windows Server 2016 Microsoft Windows 10 Professional (64bit) Microsoft Windows 10 Enterprise Embedded (64bit) Linux CentOS 7.2 Linux CentOS 7.3 Linux Ubuntu 16.04 LTS (64-bit)
Installation environment	On-premise computer hardware or virtual environment instance
Ethernet	10/100/1000 MB
Other peripherals	USB drive, UPS
Web browsers	Microsoft Edge latest versions Microsoft Internet Explorer 11 Mozilla Firefox latest versions Google Chrome latest versions
Monitor resolution	1366 x 768 or higher

Exact system requirements for computer hardware are dependent on the number and type of observation sites connected, amount of data collected, data acquisition interval(s), data storage time, maximum number of concurrent web clients connected, and features selected by the customer. For further information and more detailed specifications, please contact Vaisala.



Features

- Standard DIN rail for mounting devices
- Room for 16 DXL421 fixed-line modem units and 12 1-port port servers
- Installation on 19-inch standard device rack
- Dual power supply

Vaisala Device Mounting and Powering Frame MDF101 is designed for mounting and powering DIN-rail mountable devices to system device racks in Vaisala Central Data Unit (CDU) rack applications. MDF101 can be installed on standard 19-inch device racks.

Device Mounting Capacity

MDF101 includes a standard DIN-rail, which enables the mounting of practically any DIN-mountable devices to the frame. The maximum number of devices that can be installed in MDF101 is limited by the width of the DIN rail (420 mm (16.54 in)) and the number of power outputs in dual power supplies (16).

Common Device Mounting Examples

MDF101 is commonly used for installing DXL421 modem units and 1-port port servers in Vaisala Central Data Unit rack applications. For example, a total number of 16 DXL421 modem units can be installed on the frame.

Serial data cables from DXL421 modems can be connected either to a single 16-port port server, or to multiple 1-port port servers to achieve additional redundancy in sensor data communication. Both serial-to-LAN conversion options are supported by Vaisala Central Data Unit rack applications. The 16-port port server is installed directly to the 19-inch device rack, and multiple 1-port port servers are installed to MDF101.

A total number of 12 1-port port servers can be installed to MDF101. In a setup where both DXL421 modem units and 1-port port servers are installed to the same MDF101 unit, a total number of 6 DXL421 modem units and 6 1-port port servers can be installed side by side.

Device Entity as Legacy MCU111 Replacement

The MDF101, DXL421 modem, and port server entity is a modular system for replacing legacy product Midas Communication Unit MCU111 in Vaisala Central Data Unit rack applications. The modular design of the entity provides higher system redundancy and faster Mean Time To Repair (MTTR).

Dual Power Supply

MDF101 comes with dual power supplies, each providing power to half of the mounted devices. In addition, for 1-port port servers their dual power input makes it possible to wire the dual power supplies as dual redundant power supplies.

Technical Data

Operating Environment

Operating temperature	-40 ... +55 °C (-40 ... +131 °F)
Storage temperature	-40 ... +60 °C (-40 ... +140 °F)
Operating humidity	2 ... 85 %RH, non-condensing
Storage humidity	2 ... 85 %RH, non-condensing

Inputs and Outputs

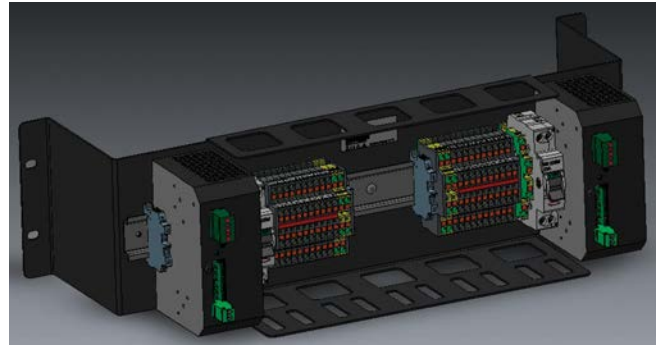
Input voltage	100-240 VAC (90 ... 264 VAC)
Input frequency	50/60 Hz (45 ... 65 Hz)
Input connection	3-pole pluggable screw terminal (R7.62 mm)
Output voltage	15 VDC
Output current (at 15 VDC)	4.0 A
Max. output power	60 W (× 2)
Output connection	8-pole pluggable screw terminal (R5.08 mm)

Mechanical Specifications

Dimensions (H × W × D)	132 × 483 × 212 mm (5.20 × 19.02 × 8.35 in)
Weight (as empty)	1700 g (3.75 lb)
Mounting options	19-inch rack
Frame material	S235JR steel, RAL7024 powder painted
DIN-rail design	Standard DIN-rail
DIN-rail width	420 mm (16.54 in)

Compliance

Safety	EN60950-1
EMC compliance	CISPR 22, Class B (EN55022)
Approvals	CE marking
Vibration and shocks	ETS 300 019-2-4, class 4M5 (for Power Supplies)



MDF101 back panel and dual power supplies



CDU401 Central Data Unit Rack

Vaisala Central Data Unit Rack CDU401 is the main computer for the weather monitoring system.

For Collecting, Processing, Visualizing, Distributing, and Storing System Data at Central Sites

The system's application software is installed in CDU401's servers. The rack includes high reliability, rackmountable servers and additional communication unit hardware to connect the servers to field sensors, workstations, and other external interfaces included in the system. CDU401's display options include professional KVM (Keyboard-Video-Mouse) rack console displays and simpler desktop displays on the rack shelf. For added reliability, CDU401 can also be powered by an optional UPS mounted in the same rack.

Rack Server Computers

CDU401 utilizes standard commercial off-the-shelf enterprise-class rack servers with high reliability. The server specifications are designed to meet and exceed the needs of Vaisala's weather system application software products. This means that smooth operation and sufficient storage space for the application in question can be ensured by using standard Vaisala-selected rack servers.

Vaisala-selected rack servers are a cost-effective solution, eliminating the need to overspecify computing power or storage space. Server reliability is further improved with internal redundancy, in the form of duplicated, and mirrored hot-swap hard drives, as well as duplicated hot-swap power supplies.

The number of rack servers can be adjusted in line with the needs of the application and according to your wishes. The servers can also be duplicated for additional reliability.

Communication Unit Options

CDU401 includes several communication unit options. Communication units are selected according to your application and needs. Options include enterprise-class network switches, routers, VPN

routers, device port servers, leased-line modems, and SFP modules. Units can also be duplicated for additional reliability.

Built-In Safety Features

CDU401 includes separate surge protection for input power, input serial (RS485/RS232), and input modem lines. Surge arrestors protect the equipment from potential damage caused by lightning and poor or variable power quality.

It is recommended to include optional backup power (UPS) in CDU401. The UPS protects against system downtime, data loss, and process interruption by providing continuous, clean power during short power outages. The optional UPS for the CDU401 includes an extra battery module that provides sufficient backup power for at least two hours of operation.

Easy Maintenance and Access

CDU401 has lockable doors on the front and back for easy and controllable maintenance access. Both doors are perforated for optimal airflow and cooling. Servers are installed onto sliding rails for easy maintenance, and all cables are clearly marked. The rack display provides easy access for system maintenance.

CDU401 and AviMet® AWOS

In airport weather observation systems, reliability and high availability are essential. For increased system reliability, duplicated rack servers are recommended for AviMet AWOS, RVR, and LLWAS systems. Vaisala AviMet software includes dual hot-swap and fail-over functionalities: if the active server fails, the backup server immediately takes over operations. The AviMet software is divided into numerous modules, and if one of these fails on the active server, the backup server assumes operation of the failed module.



Features

- Highly configurable to meet any application and customer need
- Sturdy steel housing protects sensitive equipment
- Lockable perforated doors on front and back for optimal airflow and easy, controllable access
- Separate surge protection for input electricity, input serial, and input modem lines
- Optional UPS for continuous operation during short power outages
- Optional server and communication duplication for increased reliability

Technical Data

Operating Environment

Operating temperature	+5 ... +40 °C (+41 ... +104 °F)
Operating humidity	5 ... 90 %RH, non-condensing

Inputs and Outputs

Input voltage	120/230 VAC (120 V : 90 ... 138 VAC 230 V : 160 ... 276 VAC)
Input frequency	(45 ... 65 Hz)
Optional backup power (UPS)	2000 VA/1800 W UPS and extra battery module (provides at least 2 hours of backup power)
Surge protection	Input electricity, input serial (RS485/RS232), input modem

Communication Interfaces

Copper Ethernet (LAN)	RJ45 connectors, CAT5e
Fiber Optic with SFP modules	LC Duplex, SM/MM, 100/1000
Fiber Optic with converters	RS485 (2-wire)
Serial (RS485 / RS232)	Krone terminal (LSA-Plus)
Leased-line modem	Krone terminal (LSA-Plus)

Mechanical Specifications

Installation location	Indoors in clean, dry room on flat, stable floor
Installation height for components	42 U
Installation width for components	19" standard rack
Rack material	Sheet steel, dipcoatprimed/ powder-coated (light gray) RAL 7035
Doors	Lockable perforated doors on front and back
Dimensions	2030 x 600 x 1080 mm (H x W x D)
Weight	120-350 kg (varies according to included equipment)

Compliance

Safety	IEC/EN 60950-1
EMC	IEC/EN 55022, IEC/EN 55024
Approvals	CE marking



CDU401 housed with two rack servers, UPS with extra battery module, KVM rack display, two network switches, and two MDF101 units with 1-port servers



RME111 Radio Modem Enclosure for Central Site



Features

- Room for 8 radio modem units and 2 combiners as standard
- Robust and tight (IP66) stainless steel housing protecting sensitive equipment
- Separate surge protection for each antenna cable, data output cable, and power input
- Recharging backup battery for continuous operations through short power outages

Vaisala Radio Modem Enclosure for Central Site RME111 is used for enabling and combining weather sensor data radio communication between field sensor sites and central site.

RME111 is a connection box that provides enclosure, mounting, powering, backup battery, surge protection, and needed internal cabling for radio modem units, and also for radio antenna combiners, when needed.

Radio Modem Housing Capacity

RME111 can contain up to 8 radio modem units and 2 radio antenna combiners, as standard. The number of radio modem interfaces can be flexibly selected between 1 and 8 to meet the needs in a cost effective way. Vaisala has designed the RME111 unit for certain selected and field proven radio modem models. Compatibility with other radio modem models should be verified separately. RME111 can house also up to 2 radio antenna combiners. One radio antenna combiner can be used to combine 2-4 radio modem units to use only single receiving end radio antenna instead of multiple antennas. By using combiners the amount of radio antennas installed at central site can be decreased, and excess antennas in the radio mast can be avoided. RME111 can also be used without combiners, but this is recommended only, when only few radio modem units are needed. RME111 includes also 10m antenna signal cables, as standard, for the needed radio antennas.

Installation Options

RME111 can be installed indoors or outdoors, and to wall or mast. Indoor wall installation is the most commonly needed option and there only the IP66 stainless steel enclosure is needed. In outdoor wall or mast installations also mounting frame, radiation shield, and cable cover are needed. Mounting frame enables different mast installation

options, radiation shield protects the enclosure from excessive solar radiation, and cable cover protects cable throughputs in outdoor environment.

Mast options include mounting support for 63mm, 75mm, 102mm, 106mm pole masts, and mounting support for DKP11 and DKE200 lattice masts. DKP711 frangible 1.2m fiberglass mast and DKP721 frangible 2.0m fiberglass mast can also be bought with RME111.

Safety Features Included

RME111 includes separate surge protection for input electricity, input antenna cable, and output serial data cable (RS485 / RS232). These surge arrestors are protecting the radio modem units and power supply from damages caused by lightning activity and bad or varying electricity quality. RME111 includes also recharging backup battery for continuous operations through short power outages. The battery provides backup power for at least 6 hours for 2 radios and for at least 2 hours for 8 radios.

Radios, Combiners, and Antennas

RME111 itself does not include fixed radio modem units, radio antenna combiners, or radio antennas, because these components are frequency dependent. This choice has been made to increase flexibility of RME111, because these frequency dependent components can vary between different customer, country, or project specific needs. Needed frequency dependent components are included in the Vaisala Radio, Combiner, and Antenna Set RCA111, or as separately selected items. The radio modems, combiners, and antennas will be fully installed and integrated to RME111, so the end result is fully working and tested radio communication system for central site.

Technical Data

Operating Environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-50 ... +70 °C (-58 ... +158 °F)
Operating humidity	0 ... 100 %RH, non-condensing
Storage humidity	0 ... 100 %RH, non-condensing

Compliance

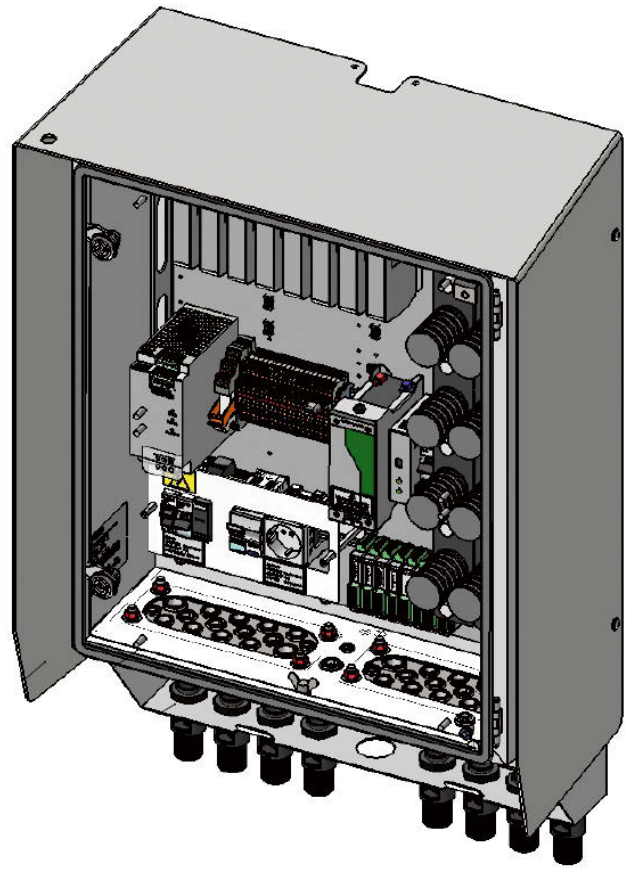
EMC compliance	IEC/EN 61326-1
Electrical safety	IEC/EN 60950-1
Vibration	IEC 60068-2-64, 5-500Hz 2G-RMS 30 min, 3 axes
Shock	IEC 60068-2-27, 25G-peak 11 ms 6 pulses
IP rating	IP66
Approvals	CE marking

Inputs and Outputs

Input voltage	100 ... 240 VAC (90 ... 264 VAC)
Input frequency	50 ... 60 Hz (45 ... 65 Hz)
Input connection	3-pole pluggable screw terminal (R7.62 mm)
Surge protection	For input electricity, input antenna cable, output serial (RS-485/RS-232)
Rated current	10 A
Input Current on Full Load	
115 VAC	Approx. 2.3 A
230 VAC	Approx. 1.15 A
Socket outlet inside the enclosure	100 ... 240 VAC, 10 A
AC/DC power supply inside the enclosure	24 VDC, 10 A, efficiency > 93 %
Backup battery	2.6 Ah / 12 V (provides backup power for 6 h for 2 radios and 2 h for 8 radios)

Mechanical Specifications

Dimensions (H × W × L), including radiation shield and cabling box	787 × 581 × 270 mm (30.98 × 22.87 × 10.63 in)
Dimensions (H × W × L)	600 × 500 × 211 mm (23.62 × 19.69 × 8.31 in)
Weight with radiation shield and cabling box	Approx. 40 kg (88 lb)
Weight	20 kg (44 lb)
Color	White (RAL9003)
Frame material	Acid-proof stainless steel AISI316, Powder coat (white) RAL9003



RME111 housed with 8 radios and 2 combiners





Features

- Connect up to 4 separate sensor sites to the fiber optic network with RS-485
- Multiple fiber communication options
- Multiple mast-mounting options
- Durable, weatherproof (IP66) stainless steel housing to protect sensitive equipment
- Separate surge protection for data and power input cables
- Rechargeable backup battery ensures continuous operation during power cuts

Vaisala Field Communication Box FOC201 is a connection box that converts sensor data in the field for use by the rest of the weather system. It enables, for example, sensor data to be connected in copper line serial format (RS-485) to the customer's existing fiber network in AviMet® systems.

FOC201 provides enclosure, mounting, power, a backup battery, and surge protection for device port servers and the managed network switch. It also includes an RS-485 serial input for data from field sensors, fiber connection boxes for terminating the customer's fiber cable, and the associated internal cabling.

Communication equipment housing capacity

FOC201 can contain up to 4 device port servers, 1 managed network switch, and 2 fiber connection boxes as standard. The device configuration can be adjusted in order to meet individual customers' needs in a cost-effective manner. FOC201 is compatible with selected field-proven device port servers and managed network switch models. Compatibility with other models should be verified separately.

Installation options

FOC201 can be installed indoors or outdoors, either wall or mast mounted. Outdoor mast installation is the most common choice, and for this reason the connection box includes an IP66 stainless steel enclosure, mounting frame, radiation shield, and cable cover. The mounting frame makes different mast installation options possible. The radiation shield protects the enclosure from excessive solar radiation. The cable cover protects the cable throughputs in outdoor environments. Mast-mounting options include support for 63-, 75-, 102-, and 106-millimeter pole masts, and DKP11 and DKE200 lattice masts.

The 1.2-meter frangible composite mast DKP711 and 2-meter frangible composite mast DKP721 can be purchased in conjunction with FOC201. These masts are strongly recommended for FOC201 installations at airports. Frangible structures are mandatory in areas adjacent to runways.

Vaisala frangible pole and lattice masts are impact tested and comply with both ICAO and FAA frangibility standards. These masts comply with the frangibility requirements set out in part 6 of the Aerodrome Design Manual, First Edition, 2006, and the FAA AC 150/5345-45C – Low Impact Resistant Structures, 2007.

Safety features

FOC201 includes separate surge protection for the input power and input serial data cable (RS-485). These surge protectors protect the device port server units and power supply from potential damage caused by lightning activity and poor or variable-quality electricity.

The box also includes recharging backup battery to enable continuous operation during short power cuts. The battery provides sufficient backup power for approximately one hour of operation.

Multiple fiber communication options

FOC201 supports several fiber optic communication network options: both single-mode and multi-mode, and single-fiber ring, dual-fiber ring, and point-to-point network topologies. Suitable SFP modules for different kinds of fiber optic networks can also be included.

Technical data

Operating environment

Operating environment	Outdoor use
Use in wet location	Yes
Operating temperature ¹⁾	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-50 ... +70 °C (-58 ... +158 °F)
Operating humidity	0 ... 100 %RH, non-condensing
Storage humidity	0 ... 100 %RH, non-condensing
Pollution degree	2
Maximum operating altitude	3000 m (approx. 9800 ft)
IP rating	IP66

¹⁾ For backup battery operating and storage temperature, see manufacturer documentation.

Mounting options

DKP202W, DKP203W	Ø 63 mm (2.48 in) pole mast
DKP204W	Ø 75 mm (2.95 in) pole mast
DKP206W, DKP206AV, DKP210W, DKP210AV	Ø 102 mm (4.02 in) pole mast
DKP711, DKP721, DKE100 (DKE110F)	Ø 106 mm (4.17 in) pole mast
DKE200	Lattice mast
Wall-mounting screws included.	

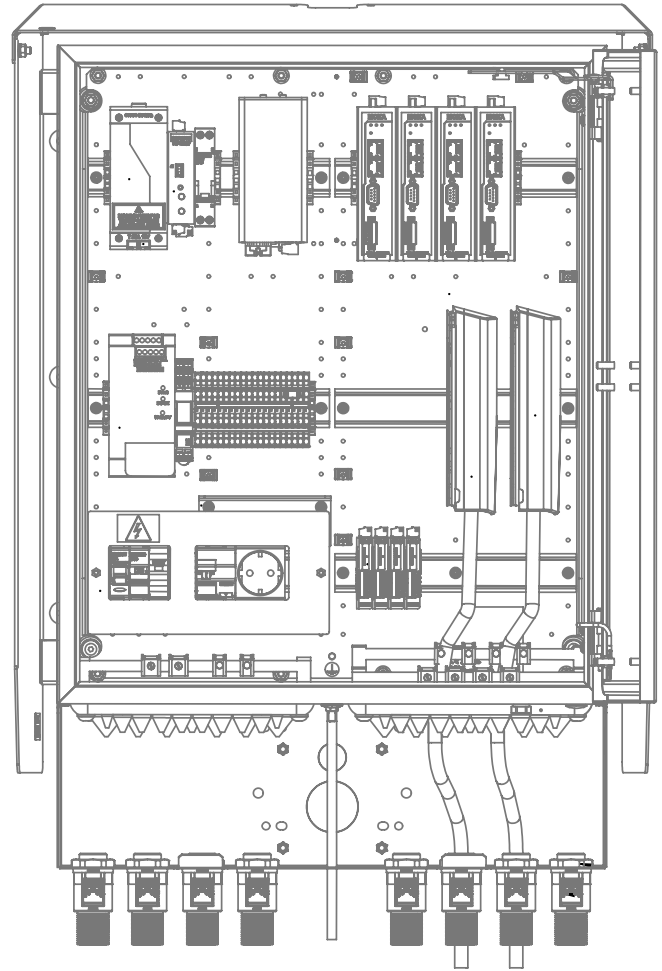
Inputs and outputs

Input voltage	100 ... 240 V AC, ±10 %
Input frequency	50 ... 60 Hz
Input connection	3-pole pluggable screw terminal (R7.62 mm)
Input current	10 A maximum
Surge protection	For AC (mains) input, serial input (RS-485)
Overvoltage category	II
Socket outlet inside the enclosure	100 ... 240 V AC, 6 A
AC/DC power supply inside the enclosure	24 V DC, 10 A, efficiency > 93 %
Backup battery	2.6 Ah / 12 V (provides backup power for 1 hour)

Fiber optic network options

Fiber mode	Single-mode / Multi-mode
Network topology	Single-ring / Dual-ring / Point-to-point
Device port servers	0 ... 4 units ¹⁾
Managed network switch	0 ... 1 units ¹⁾
SFP modules	0 ... 4 modules ¹⁾
Fiber connection boxes	0 ... 2 units ¹⁾

¹⁾ All are needed for functioning serial-to-fiber entity. Choosing 0 units means project-specific solution.



FOC201 with 1 managed network switch, 4 port servers, and 2 fiber connection boxes

Compliance

EU directives and regulations	Low Voltage Directive (2014/35/EU) EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC compatibility	EN 61326-1, industrial environment
Electrical safety	EN 61010-1
Vibration (random)	IEC 60068-2-64 (5 ... 500 Hz 2G-RMS 30 min, 3 axes)
Shock	IEC 60068-2-27 (25 G-peak, 11 ms, 6 pulses)
Frangibility, pole and lattice masts	ICAO Aerodrome Design Manual, First Edition, 2006, Part 6 – Frangibility FAA AC 150/5345-45C – Low-Impact Resistant Structures, 2007
Compliance marks	CE, RCM



Features

- Designed and tested for Vaisala AviMet® systems
- Robust, tightly sealed polycarbonate housing protects electronics
- Surge protection for input power, input closing contacts, and output serial data
- 8 closing contacts for runway lighting system switch or relay

The Vaisala Runway Light Setting Interface Unit RSI51 is a sensor that provides data on the current light intensity setting on the runway lighting system as well as on the current runway-in-use settings.

The runway light intensity data is integrated into Vaisala AviMet RVR calculations, AviMet systems can also use runway-in-use data to indicate the current runway in use.

Operating principle

RSI51 provides runway light intensity setting information to the airport's AviMet system. Runway light intensity setting information is collected from a runway lighting system switch or relays, normally located on the air traffic control tower.

RSI51 converts the data from the switches or relays into a message for the AviMet system. Each of the maximum 6 light setting values corresponds to a 0 to 100 mA input that is converted into a corresponding number in the AviMet message. Only one active input at a time is possible. The AviMet system converts the number into the corresponding runway light intensity setting value defined in the AviMet configuration file.

Installation options

RSI51 can be installed indoors, either mounted on a wall with screws or on a DIN rail with an mounting kit. DIN-rail mounting kits are supplied as standard.

Standard safety features

RSI51 includes surge protection for input-power, input closing contacts, and output serial data (RS-485/RS-232). The surge protectors protect the unit from potential damage caused by poor or variable power quality or other possible surges.

Technical data

Operating environment

Operating environment	Indoor use
Use in wet location	No
Operating temperature	-20 ... +55 °C (-4 ... +131 °F)
Storage temperature	-40 ... +65 °C (-40 ... +149 °F)
Operating humidity	0 ... 100 %RH, non-condensing
Storage humidity	0 ... 100 %RH, non-condensing
Pollution degree	2
Maximum operating altitude	3000 m (approx. 9800 ft)

Inputs and outputs

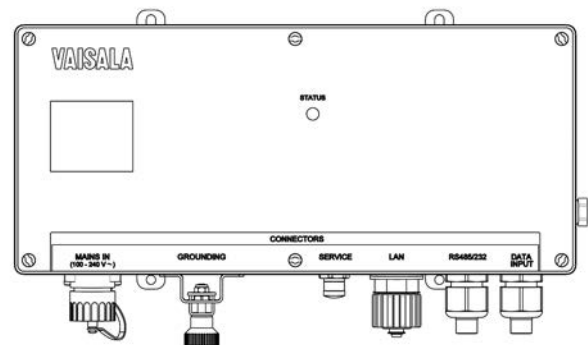
Input voltage	100 ... 240 V AC, ±10 %
Input frequency	50 ... 60 Hz
Input current	100 mA
Surge protection	Input electricity, input closing contacts, output serial (RS-485/RS-232)
Overvoltage category	II
Data input options	8 × closing contact from manual switch or relay 12 ... 48 DC voltage message
Data output options	Serial (RS-485/RS-232), Ethernet/LAN
Service connection	Serial RS-232

Mechanical specifications

Dimensions (H × W × D)	216 × 360 × 111 mm (8.50 × 14.17 × 4.37 in)
Weight	3.5 kg (7.72 lb)
Enclosure material	Polycarbonate (PC), light gray RAL7035
Mounting options	DIN-rail mounting kit included in the delivery Wall-mounting screws not included

Compliance

EU directives and regulations	Low Voltage Directive (2014/35/EU) EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC compatibility	EN 61326-1, industrial environment
Electrical safety	EN 61010-1
Cold	IEC 60068-2-1
Dry heat	IEC 60068-2-2
Damp heat, cyclic	IEC 60068-2-30
Vibration	ETSI EN 300 019-2-2
Compliance marks	CE, RCM





Features

- Stand-alone high-performance wind panel display, compliant with latest ICAO standards and recommendations
- Easy-to-use touch screen with intuitive graphical user interface
- High contrast day-time and night-time color schemes with display brightness control
- Coherent calculations, look and feel with Vaisala AviMet® systems
- Visual and audible alarms
- Desktop, panel, and wall mounting options
- Short installation times and virtually maintenance free
- Robust electrical and mechanical design

Vaisala AviMet® Wind Panel Display WID511 is designed for viewing real-time measurements from Vaisala wind sensors in aviation applications, in accordance with the latest ICAO standards and recommendations.

WID511 uses a compact 5.7-inch LCD screen suitable for aviation-related operating environments such as air traffic control towers, where excellent readability in both bright and dim light is required. The display is controlled using an easy-to-use resistive touch screen, with a clear, uncluttered user interface for simple operation.

Robust display with high performance

WID511 is robust, designed and tested for demanding industrial electromagnetic and environmental specifications. It is equipped with a resistive touch screen that can be controlled with either bare or gloved hands, or any other suitable object.

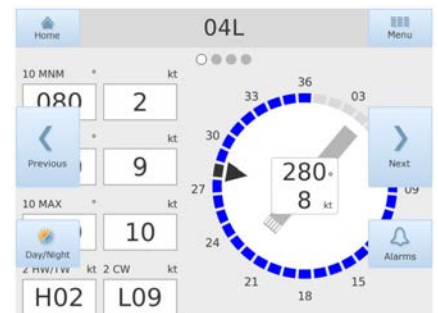
The display can be mounted in different ways depending on where it is installed. It can be easily mounted on a standard IEC panel, desktop, or wall.

Integrated touch screen for efficient operations

WID511 has a full-size intuitive touch screen with a graphical user interface for easy navigation between separate wind data views – such as sensor pages – as well as simple display setting changes with straightforward item selection. Each wind sensor view is in wind rose and alphanumeric formats as default, suitable for operational use at airports in accordance with ICAO wind data display standards and recommendations.

WID511 can collect data from multiple wind sensors with a four-times-per-second interval as recommended by ICAO and WMO. To receive data from a Vaisala wind sensor, such as Vaisala WINDCAP® Ultrasonic Wind Sensor WMT700, Ethernet and RS-485 connections are standard.

There are visual and audible alarms in all views to warn of serious events, such as message or system failures. To prevent unauthorized changes to the display settings, a PIN code is required to access advanced settings in the maintenance mode.



Technical data

Operating environment

Operating temperature	0 ... +40 °C (+32 ... +104 °F)
Storage temperature	-20 ... +80 °C (-4 ... +176 °F)
Operating humidity	2 ... 95 %RH, non-condensing
IP rating	IP20
Flammability class	UL94 V-0

Inputs and outputs

Supply voltage	12 ... 28 V DC
Maximum power consumption at +20 °C (+68 °F)	15 W
Typical power consumption at +20 °C (+68 °F)	4 W
Data interfaces	Ethernet (10/100 MBit/s), RS-422, RS-485, RS-232

Display specifications

Display	5.7-inch TFT LCD, 640 × 480 VGA resolution, > 500 cd/m ² luminance
Brightness control	Manual
User input interface	Touch screen
Audible alarm	> 80 dB(A) at 1 m (3 ft 3 in), 2 kHz

User interface

Observation mode	Wind data pages
Navigation mode	<ul style="list-style-type: none"> • Switch between data pages • Alarm log • Day-time and night-time views • Access to maintenance mode
Maintenance mode	<ul style="list-style-type: none"> • Display cleaning (wipe) mode • Touch screen calibration • Volume setting • Brightness setting • Product information view • Advanced settings (PIN login) • Configuration settings • Configuration file import/export • Software update

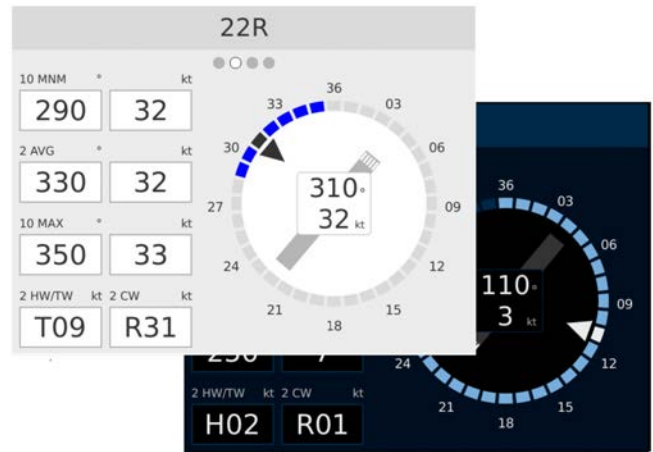
Displayed values	
Wind speed and direction	According to ICAO standards and recommendations: <ul style="list-style-type: none"> • 3-second and 2-minute average • 10-minute minimum, maximum, and variation • Headwind, tailwind, crosswind

Compliance

EU directives and regulations	Low Voltage Directive (2014/35/EU) EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC immunity	EN 61326-1, industrial environment
EMC emissions	CISPR 32 / EN 55032, Class B
Drop test compatibility	MIL-STD-810G 516.6 Procedure IV, Free Fall (Rough Handling)
Vibration compatibility	MIL-STD-810G 514.6C-3 Procedure I, Cargo Vibration Test
Compliance marks	CE, RCM, UKCA

Mechanical specifications

Housing material	PC/ABS
Mounting options	Panel, desktop, wall
Panel installation standard compatibility	IEC 61554
Panel mounting aperture dimensions	138 × 138 mm (5.43 × 5.43 in)
Panel mounting frame dimensions	144 × 144 mm (5.67 × 5.67 in)



WID511 day-time and night-time color schemes



Features

- Generic data panel display for aviation purposes
- Easy-to-use touch screen with intuitive graphical user interface
- High contrast day-time and night-time color schemes with display brightness control
- Coherent look and feel with Vaisala AviMet® systems
- Visual and audible alarms
- Desktop, panel, and wall mounting options
- Short installation times and virtually maintenance free
- Robust electrical and mechanical design

Vaisala AviMet® Data Panel Display WID512 is designed for viewing important information in aviation applications in a simple way.

WID512 uses a compact 5.7-inch LCD screen suitable for aviation-related operating environments such as air traffic control towers, where excellent readability in both bright and dim light is required. The display is controlled using an easy-to-use resistive touch screen, with a clear, uncluttered user interface for simple operation.

Robust display with high performance

WID512 is robust, designed and tested for demanding industrial electromagnetic and environmental specifications. It is equipped with a resistive touch screen that can be controlled with either bare or gloved hands, or any other suitable object. The display can be mounted in different ways depending on where it is installed. It can be easily mounted on a standard IEC panel, desktop, or wall.

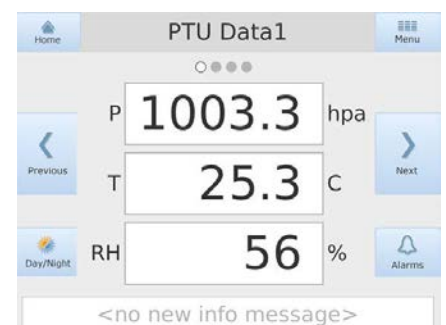
Integrated touch screen for efficient operations

WID512 has a full-size intuitive touch screen with a graphical user interface for easy navigation between separate data pages – as well as simple display setting changes with straightforward item selection. Each data page contains 3 data rows with 3 columns. Typically one data label, one value, and one unit are shown on each row.

The display supports up to 16 pages of information. Data shown on it is controlled by the host computer with a message format defining the content of each displayed page.

WID512 can be used for different data viewing purposes, most commonly it is used as a back-up display for the AWOS system main user displays. The display is connected to the data sending unit, like the AWOS, via Ethernet or RS-485 connection.

There are visual and audible alarms in all views to warn of serious events, such as message or system failures. To prevent unauthorized changes to the display settings, a PIN code is required to access advanced settings in the maintenance mode.



Technical data

Operating environment

Operating temperature	0 ... +40 °C (+32 ... +104 °F)
Storage temperature	-20 ... +80 °C (-4 ... +176 °F)
Operating humidity	2 ... 95 %RH, non-condensing
IP rating	IP20
Flammability class	UL94 V-0

Inputs and outputs

Supply voltage	12 ... 28 V DC
Maximum power consumption at +20 °C (+68 °F)	15 W
Typical power consumption at +20 °C (+68 °F)	4 W
Data interfaces	Ethernet (10/100 MBit/s), RS-422, RS-485, RS-232

Display specifications

Display	5.7-inch TFT LCD, 640 × 480 VGA resolution, > 500 cd/m ² luminance
Brightness control	Manual
User input interface	Touch screen
Audible alarm	> 80 dB(A) at 1 m (3 ft 3 in), 2 kHz

User interface

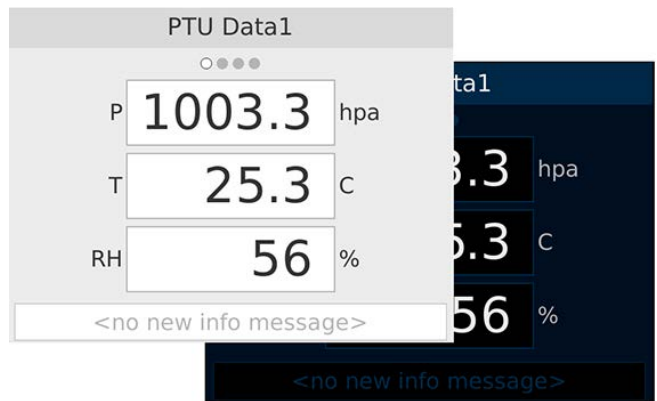
Observation mode	Up to 16 data pages with a header text box and 9 alphanumeric text boxes
Navigation mode	<ul style="list-style-type: none"> • Switch between data pages • Alarm log • Day-time and night-time views • Access to maintenance mode
Maintenance mode	<ul style="list-style-type: none"> • Display cleaning (wipe) mode • Touch screen calibration • Volume setting • Brightness setting • Product information view • Advanced settings (PIN login) • Configuration settings • Configuration file import/export • Software update

Compliance

EU directives and regulations	Low Voltage Directive (2014/35/EU) EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC immunity	EN 61326-1, industrial environment
EMC emissions	CISPR 32 / EN 55032, Class B
Drop test compatibility	MIL-STD-810G 516.6 Procedure IV, Free Fall (Rough Handling)
Vibration compatibility	MIL-STD-810G 514.6C-3 Procedure I, Cargo Vibration Test
Compliance marks	CE, RCM, UKCA

Mechanical specifications

Housing material	PC/ABS
Mounting options	Panel, desktop, wall
Panel installation standard compatibility	IEC 61554
Panel mounting aperture dimensions	138 × 138 mm (5.43 × 5.43 in)
Panel mounting frame dimensions	144 × 144 mm (5.67 × 5.67 in)



WID512 day-time and night-time color schemes



Features

- Stand-alone high-performance panel display for wind, pressure, and temperature data
- Easy-to-use touch screen with intuitive graphical user interface
- High contrast day-time and night-time color schemes with display brightness control
- Coherent calculations, look and feel with Vaisala AviMet® systems
- Visual and audible alarms
- Desktop, panel, and wall mounting options
- Short installation times and virtually maintenance free
- Robust electrical and mechanical design

Vaisala AviMet® Weather Panel Display WID513 is designed for viewing real-time weather information in accordance with ICAO standards and recommendations.

WID513 uses a compact 5.7-inch LCD screen suitable for aviation-related operating environments such as air traffic control towers, where excellent readability in both bright and dim light is required. The display is controlled using an easy-to-use resistive touch screen, with a clear, uncluttered user interface for simple operation.

Robust display with high performance

WID513 is robust, designed and tested for demanding industrial electromagnetic and environmental specifications. It is equipped with a resistive touch screen that can be controlled with either bare or gloved hands, or any other suitable object.

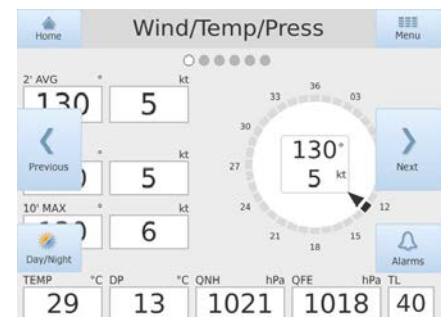
The display can be mounted in different ways depending on where it is installed. It can be easily mounted on a standard IEC panel, desktop, or wall.

Integrated touch screen for efficient operations

WID513 has a full-size intuitive touch screen with a graphical user interface for easy navigation between separate data pages – as well as simple display setting changes with straightforward item selection. There are multiple predefined data pages that can be set to be displayed.

There are visual and audible alarms in all views to warn of serious events, such as message or system failures. To prevent unauthorized changes to the display

settings, a PIN code is required to access advanced settings in the maintenance mode. From these settings pages the authorized user can enter station specific parameters, such as declination and airport elevation.



WID513 weather panel display close-up of a clear, uncluttered user interface for simple operation

Technical data

Operating environment

Operating temperature	0 ... +40 °C (+32 ... +104 °F)
Storage temperature	-20 ... +80 °C (-4 ... +176 °F)
Operating humidity	2 ... 95 %RH, non-condensing
IP rating	IP20
Flammability class	UL94 V-0

Inputs and outputs

Supply voltage	12 ... 28 V DC
Maximum power consumption at +20 °C (+68 °F)	15 W
Typical power consumption at +20 °C (+68 °F)	4 W
Data interfaces	Ethernet (10/100 MBit/s), RS-422, RS-485, RS-232

Display specifications

Display	5.7-inch TFT LCD, 640 × 480 VGA resolution, > 500 cd/m ² luminance
Brightness control	Manual
User input interface	Touch screen
Audible alarm	> 80 dB(A) at 1 m (3 ft 3 in), 2 kHz

User interface

Observation mode	Multiple user selectable data pages
Navigation mode	<ul style="list-style-type: none"> • Switch between data pages • Alarm log • Day-time and night-time views • Access to maintenance mode
Maintenance mode	<ul style="list-style-type: none"> • Display cleaning (wipe) mode • Touch screen calibration • Volume setting • Brightness setting • Product information view • Advanced settings (PIN login) • Configuration settings • Configuration file import/export • Software update

Displayed values

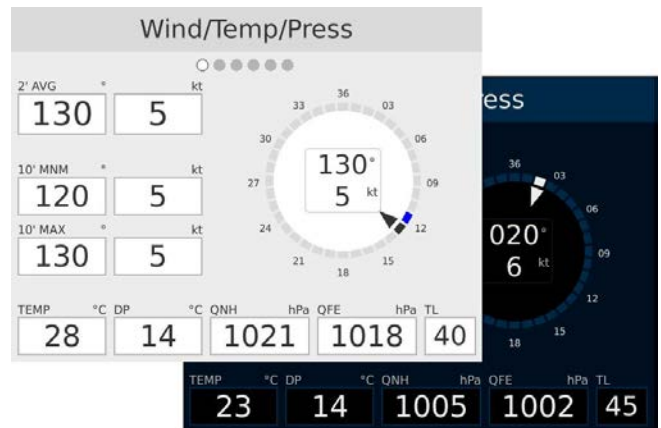
Wind speed and direction	<ul style="list-style-type: none"> • 3-second and 2-minute average • 10-minute average, minimum, and maximum
Temperature and humidity	<ul style="list-style-type: none"> • Air temperature • Dew point • Relative humidity
Pressure	<ul style="list-style-type: none"> • Air pressure • QNH • QFE • Transition level • QFF • 3-hour tendency • 3-hour trend

Compliance

EU directives and regulations	Low Voltage Directive (2014/35/EU) EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC immunity	EN 61326-1, industrial environment
EMC emissions	CISPR 32 / EN 55032, Class B
Drop test compatibility	MIL-STD-810G 516.6 Procedure IV, Free Fall (Rough Handling)
Vibration compatibility	MIL-STD-810G 514.6C-3 Procedure I, Cargo Vibration Test
Compliance marks	CE, RCM, UKCA

Mechanical specifications

Housing material	PC/ABS
Mounting options	Panel, desktop, wall
Panel installation standard compatibility	IEC 61554
Panel mounting aperture dimensions	138 × 138 mm (5.43 × 5.43 in)
Panel mounting frame dimensions	144 × 144 mm (5.67 × 5.67 in)





Features

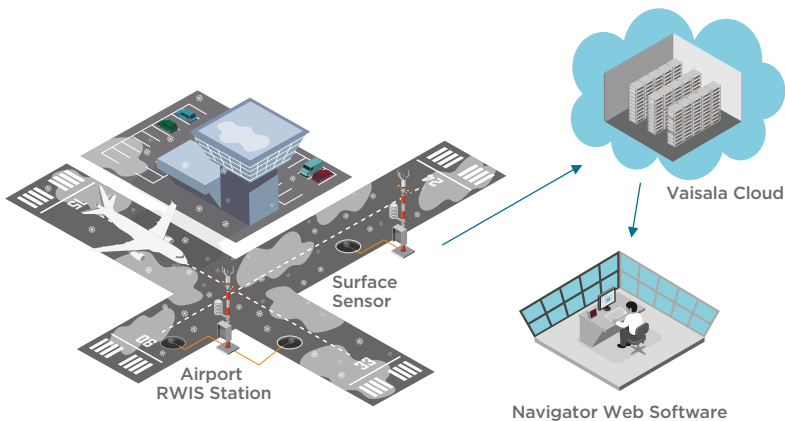
- Reduces runway maintenance costs
- Reduces chemical application based on reported conditions
- Improves decision making and makes critical decisions easier
- Ease of use lowers amount of training time required

Winter weather impacts our runways and taxiways very differently than it impacts the atmosphere, so measuring specific runway conditions is critical. Accurate, real-time weather monitoring of the runways and taxiways is one of the most cost-effective ways to ensure safe, continuous airport operations. Vaisala Runway Weather Information System (RWIS) is designed to provide airport staff with critical information to make informed decisions about treating, clearing, and maintaining the airport surface.

RWIS system consists of in-pavement sensors, sub-surface temperature probes, and a full suite of atmospheric sensors. Data from all sensors are collected and processed in an on-field

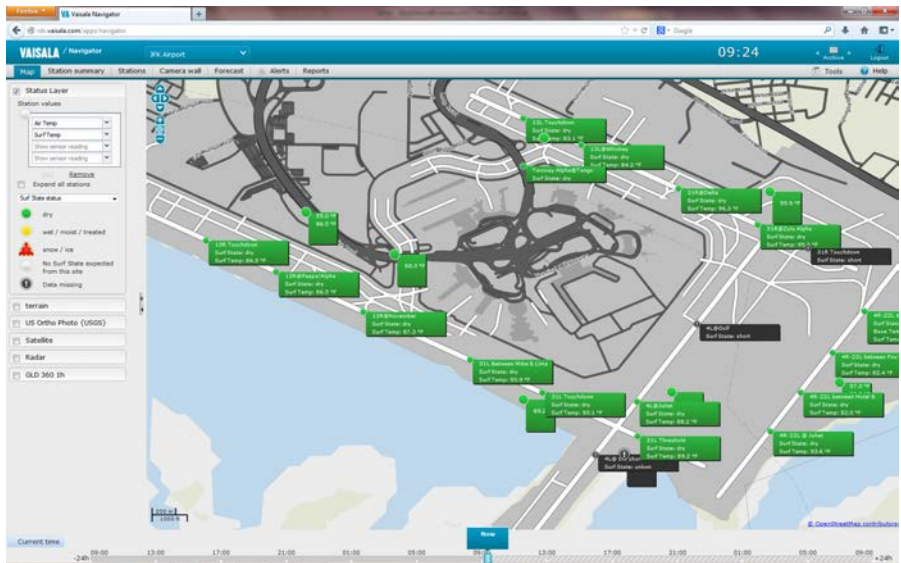
remote processing unit (RPU). The data from RWIS system provides accurate and reliable information to improve the timing of airport maintenance deicing

applications. Deicing chemical's effectiveness is determined by the surface temperature and not the air temperature.



Airport RWIS Diagram

Remote Services



Vaisala Navigator User Software

Navigator Cloud Software

Vaisala's unique cloud option enhances the RWIS user display by adding our proprietary IceBreak pavement forecasting model. Using the secure Vaisala Cloud also provides worry-free operations to the airport, decreasing downtime and eliminating the need for an on-site server.

Vaisala becomes the airport's weather partner by collecting RWIS reports, remotely monitoring the system and sensors, and archiving all data in our sophisticated redundant data centers. The Cloud allows you to feel safe that your data is protected, and available from anywhere you have internet, not just inside the airport network at the airport.

Forecasting

In addition to the IceBreak forecast model, Vaisala offers full forecasting services. Custom forecasts are generated for each airport customer and are

delivered daily, including a daily outlook, 24-hour forecast, and 2-5 day forecast. Meteorological Consultants are available 24/7/365 for telephone and email consultations, and provide email, telephone, or text message alerts in case of weather events. Vaisala's forecasting services are flexible and customizable to the airport's particular needs.

Maintenance

Vaisala offers a comprehensive maintenance program that includes: remote monitoring, 24-hour telephone support, onsite support for outages, and replacement of failed components.



RWIS installed on an airfield - weather station with sensor suite (atmospherics)



www.vaisala.com



Total Lightning™ Sensor network detects cloud and cloud-to-ground lightning with high detection efficiency and excellent location accuracy. It uses combined technology and provides large area coverage with fewer sensors, which leads to lower lifetime network ownership costs than any other technology.

The latest in precision lightning geolocation technology

LS7002 is a Total Lightning Sensor. It detects low frequency (LF) electromagnetic signals generated by lightning in order to provide extremely accurate geolocation capability with industry leading measurement of lightning strength and lightning type classification. LS7002 is the most cost-effective network-based lightning detection solution for customers demanding high accuracy, reliability, ease of installation, and ease of maintenance.

LS7002 network uses a combination of magnetic direction finding and time-of-arrival techniques to deliver superior detection efficiency, optimal location accuracy, and system redundancy with fewer sensors than any other method for detecting cloud lightning pulses and cloud-to-ground lightning strokes. It provides large area coverage with fewer sensors, which leads to lower lifetime network ownership costs than any other technology.

Lightning data for a wide range of applications

LS7002 provides real-time data that is recommended for operations that focus on tracking cloud and cloud-to-ground lightning threats to ground-based and airborne assets, including applications in:

- Aviation
- Defense
- Forestry
- Meteorology/Climatology
- Power utilities
- Telecommunications

Features

- The most precise cloud-to-ground lightning detection, geolocation, and calibrated lightning parameters
- Detects a high percentage of cloud lightning for early thunderstorm identification
- Detects lightning events at long ranges (> 1500 km)
- Independently validated 150 m median location accuracy for cloud-to-ground lightning strokes
- Up to 95 % network detection efficiency for cloud-to-ground lightning and better than 50 % network detection efficiency for cloud lightning

Benefits

- Calibrated parameters for lightning events including time, location, amplitude, polarity, and waveform features
- Data buffering capability at the sensor in case of communication failure between sensor and Total Lightning Processor™
- Lightning magnetic field waveform storage capability at the sensor
- Capability to generate and save raw sensor data locally for offline reprocessing and archiving
- Efficient lightweight electronics module allows for ease of installation and maintenance with stand-alone, rooftop and indoor electronic mounting options
- Sensor electronics can be installed separately from the antenna, for example tower-mounted with custom cable sets or indoors to reduce potential physical damage from severe weather environments
- Compatible with previous generation Vaisala sensors: LS7000 and LS7001

Support services

Training, technical support, and spare parts are available for maintaining optimal network and sensor performance. Contact your Vaisala Sales Representative for service agreement information.

Standard warranty

Vaisala warrants all products manufactured by Vaisala to be free from defects in workmanship or material for one year from the date of delivery. Contact your Vaisala Sales Representative for specific product service warranty details.

Technical data

Measurement performance

Lightning type	Cloud (IC) and Cloud-to-ground (CG) lighting events and flashes
Network flash detection efficiency ^{1) 2)}	CG: 95 % IC: 50 %
Network median location accuracy ²⁾³⁾	150 m (492 ft)
Recommended baseline distances between sensors	15 ... 350 km (9 ... 217 mi)
Min. number of sensors per network	4
LF band	1 ... 350 kHz
Performance monitoring	Complete automatic system calibration and self-test with manual capability
Remote configuration	Operational parameters are remotely configurable

- 1) IC flash detection efficiency higher than 50 % can be achieved with network baseline distances shorter than 150 km.
- 2) Performance specifications are applicable to LS7002 networks that use the latest version of Vaisala Total Lightning Processor™.
- 3) Median network location accuracy can be better than 150 m in the interior of the network.

Operating environment

Operating temperature	-40 ... +55 °C (-40 ... +131 °F)
Operating humidity	0 ... 100 %RH, condensing
Maximum wind speed	240 km/h (149 mph)
Maximum operating altitude	5500 m (approx. 18000 ft)
Hail	Ø 2.0 cm (0.79 in)
Ice	8.0 cm (3.15 in)
Rain	8.0 cm/h (3.15 in/h) at wind speed 65 km/h (40 mph)
IP rating	IPX4

Inputs and outputs

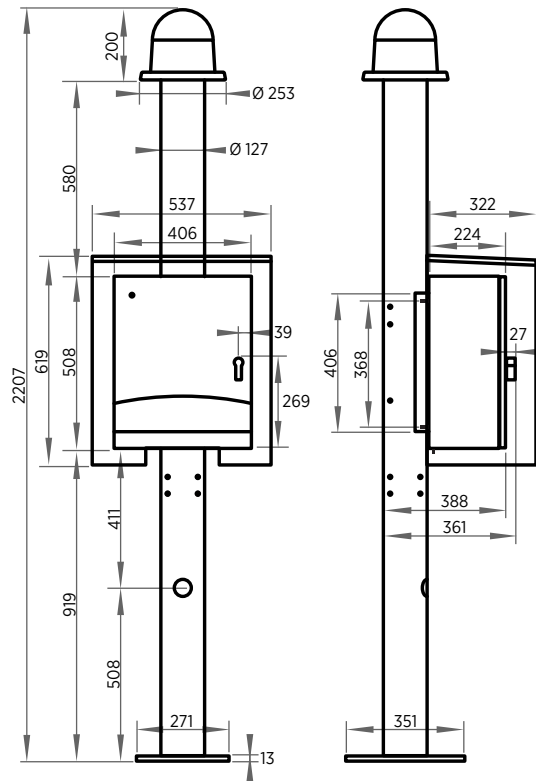
Time synchronization	Source: GPS receiver Accuracy: 50 ns to UTC
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Communication interfaces	
TCP/IP	Max. 64 kbps per data stream depending on network geometry and gain settings
RS-232 serial	Maintenance port for optional on-site connection

AC input to 48 V DC output power supply options	
Indoor AC/DC power supply	90 to 264V AC at 50/60 Hz input
Outdoor AC/DC power supply	100 to 130 V AC at 50/60 Hz input
Outdoor AC/DC power supply	200 to 240 V AC at 50/60 Hz input

Mechanical specifications

Dimensions (H × W × D)	220 × 54 × 50 cm (86.61 × 21.26 × 19.69 in)
Weight	50.1 kg (110 lb)
Mounting	Concrete ground pad Non-ground mounting options available



Dimensions in mm

Compliance

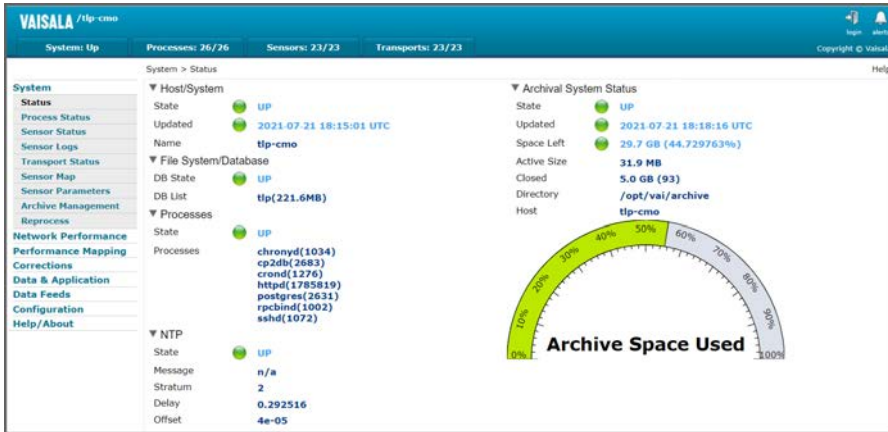
UL standard	UL 61010-1
CAN/CSA certification	C22.2 NO. 61010-1



This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operations.

VAISALA

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Features

- Continuous monitoring of remote sensor performance and communication status
- Location propagation correction service for improved location accuracy
- Dynamic monitoring of network location accuracy and detection efficiency
- User-friendly, web-based interface
- Geolocating of multiple pulses in lightning generated pulse-bursts

Total Lightning Processor™ processes data from both Vaisala’s low frequency (LF) and very high frequency (VHF) sensors providing lightning location solutions for greater than 90 % of Cloud-to-Ground (CG) and 50 % of Cloud (IC) lightning flashes for LF and greater than 90 % of both CG and IC lightning flashes for VHF.

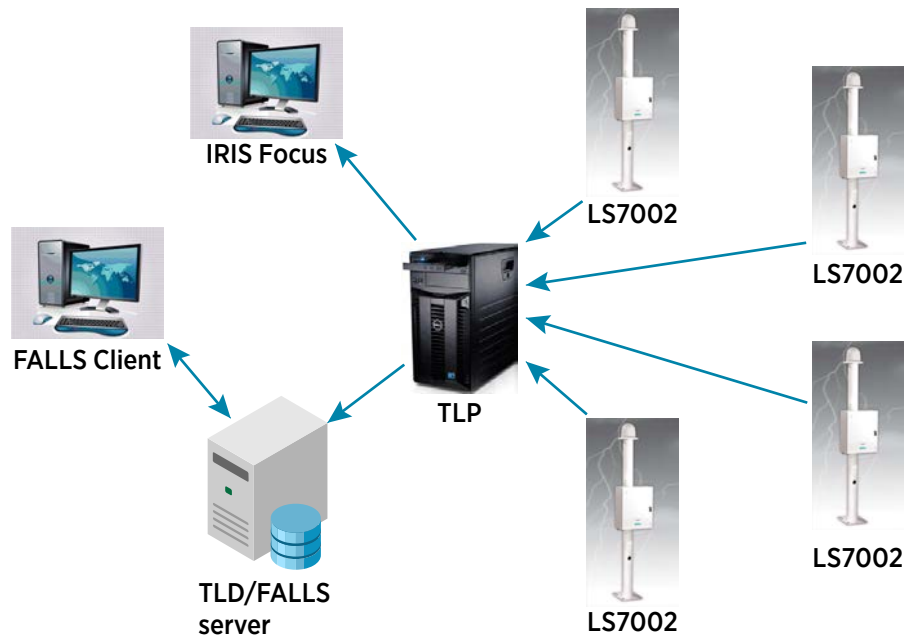
Lightning detection network

With an improved licensing schematic, all Vaisala precision lightning detection network configurations will come with a TLP200 configuration, enabling the capability to use both LF and VHF technology.

Each network consists of 4 or more sensors (depending upon desired coverage area). Each sensor sends back data from detected lightning-generated electromagnetic signals to the TLP in real-time.

TLP uses this data from multiple sensors along with a geolocation algorithm to find the optimum location solution for each lightning event.

In addition, a variety of parameters and associated characteristics are reported for each solution. Lightning data from the TLP can be sent to different applications for display, storage, and analysis.



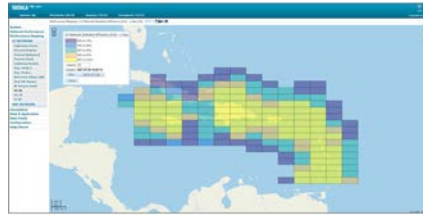
Benefits

- Enhanced lightning classification using multiple waveform parameters
- Improved archive management tools
- Better location accuracy for cloud lightning pulses

Advanced lightning geolocation with flexible features

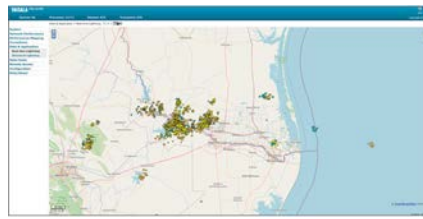
The revolutionary technology in Vaisala Total Lightning Processor is designed with multiple performance levels to meet the needs of a wide range of applications. Users are no longer required to determine which features are most important to their operation as Vaisala has decided to centralize the offering into one license level, which includes all available features. This license includes the following features:

- System and sensor performance monitoring
- Network performance mapping
- Dynamic detection efficiency (DE) and location accuracy (LA) projections
- Advanced lightning type classification, “burst” processing, and waveform parameters



These features provide more efficient network operations, stabilized performance, and deliver advanced information about the geolocated lightning events.

TLP combines Vaisala’s latest patented location algorithm with terrain and propagation correction services, significantly improving the network median location accuracy to 250 meters or better in the interior of the network. With Vaisala’s newest sensor technology, a location accuracy approaching 150 meters can be achieved.



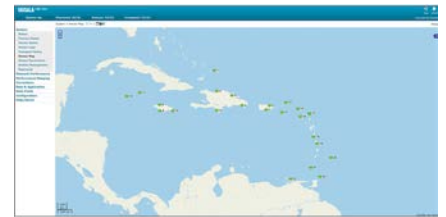
Continuous monitoring

Vaisala Total Lightning Processor continuously monitors remote sensor performance and communication status. This allows sensor owners to validate that the sensor is operational and functioning to specifications.



User-friendly, web-based operation

Vaisala Total Lightning Processor is available on a Linux® operating system for added flexibility and lower ownership costs. TLP employs a web-based interface with excellent network monitoring tools.



Technical data

Operating environment

Operating temperature	+10 ... +35 °C (+50 ... +95 °F)
Storage temperature	-40 ... +65 °C (-40 ... +149 °F)
Operating humidity	20 ... 80 %RH, non-condensing (non-condensing twmax = +29 °C / +84 °F)
Storage humidity	5 ... 95 %RH, non-condensing (non-condensing twmax = +38 °C / +100 °F)
Operating altitude	-16 ... 3048 m (-50 ... 10 000 ft)
Storage altitude	-16 ... 10 600 m (-50 ... 35 000 ft)

Supported lightning sensors

Fully supported	LS7002
Compatible with limited support	LS7000, LS7001, and TLS200

Capacity

LF data only	512 sensors
LF and VHF data	256 sensors

Communication interfaces

Supported interfaces	TCP/IP
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Certified web browsers

Operating system	Web browser	Version
Microsoft Windows® 10	Internet Explorer®	20H2
Microsoft Windows® 10	Mozilla Firefox®	78
Microsoft Windows® 10	Google Chrome®	92
Linux® CentOS 8	Mozilla Firefox®	68

Graphical tools

Network performance	Problems panel, region status, sensor QA / network QA (95 th percentile time and angle deviation)
Data and application	Real-time and historical lightning viewer

Performance mapping tools

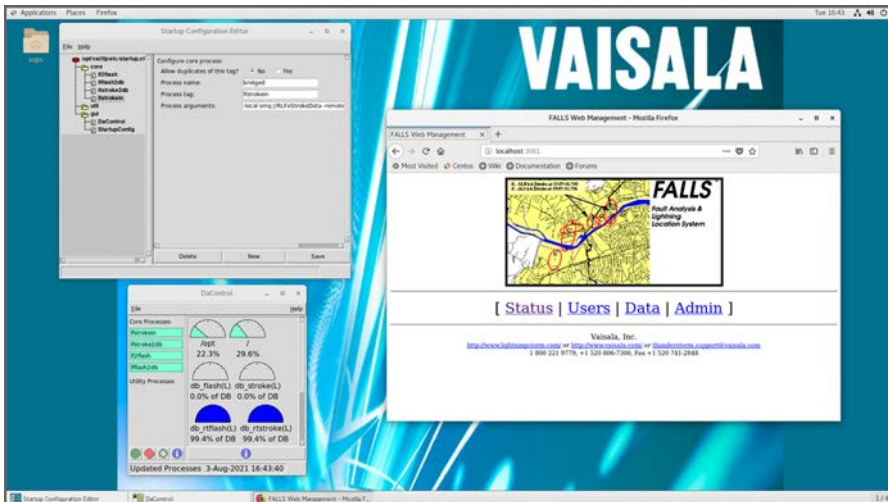
- Sensor Map
- % Positive
- % Optimized
- % Cloud
- CG Detection Efficiency
- CG Location Accuracy
- IC Detection Efficiency
- Lightning Counts
- Lightning Density
- Avg. Positive Signal
- Avg. Negative Signal
- Avg. Error Ellipse SMA
- Avg. CHI Square Value
- Avg. Sensor Count

Minimum system requirements

Option of tower or rack mount server	
Processor	Intel® Xeon® Silver 4208 or better CPU
Operating system	CentOS 8, 64-bit edition
Memory	64 GB of RAM
Hard disk space	4 × (960 GB) SSD SATA disk, RAID 5
RAID controller	Hardware RAID controller that supports RAID 5
NIC ports	Intel® i350 Quad Port 1 GbE Base-T, rNDC
USB ports	Min. 2 × USB 2.0 FP, 2 × USB 2.0 BP
Graphics card	With hardware accelerated drivers compatible with CentOS 8 (16 GB RAM, PCI Express Interface) Lenovo Nvidia Tesla T4 GPU recommended
Optical disc drive	DVD +/-RW, SATA, internal
Monitor	VGA, dual port, integrated
Modem	CentOS 8 compatible modem

Lightning parameters

Date and time to 100 nanosecond resolution
Latitude and longitude
Number of sensors used in location solution
Position confidence (chi-square)
Degrees of freedom when optimizing the solution
Semi-major axis of the 50 % positional confidence ellipse (km)
Semi-minor axis of the 50 % positional confidence ellipse (km)
Eccentricity of the positional confidence ellipse
Enable threshold crossing-to-peak risetime (microseconds)
Peak-to-zero time (microseconds)
Maximum rate-of-rise (kA/microsecond)
Polarity
CG flash multiplicity (number of CG strokes per flash)
10-to-90 risetime
50-to-90 % risetime
Maximum rate-of-rise of current
Bipolarity
Peak-to-peak times
Associated events before/after
Waveform time before/after
Estimated peak current in kiloamps (kA)
Cloud pulse count for the lightning record
Eccentricity and angle of the positional confidence ellipse
Flash ID, a unique integer value identifying the flash grouping where a stroke belongs



Features

- Provides long-term storage of stroke and flash data in a relational database for post-storm and multi-year statistical analyses
- Distributes archived data to Vaisala FALLS® Fault Analysis and Lightning Location System
- Supports multiple workstations and simultaneous queries
- Manages multiple user connections

Total Lightning Database™ TLD100™ and TLD200™ is a Vaisala processing module that specializes in archiving cloud and cloud-to-ground lightning data for forensic analysis.

Easy, secured access to real-time and archived lightning information

TLD100 and TLD200 is a lightning data management processor module that receives and stores real-time lightning data from the Vaisala Total Lightning Processor™. Users have easy and secured access to their archived data via a relational database for use in their lightning display software and lightning analysis software. The module also provides secured access to reprocessed lightning data.

Flexibility for users

Multiple users can simultaneously access lightning information for use in their Vaisala FALLS Fault Analysis and Lightning Location System, or custom lightning application software.

TLD100 and TLD200 allows flexible and efficient manipulation of lightning data through a published set of industry standard queries within Structured Query Language (SQL).

Summary

TLD100 and TLD200 resides on a single or multiprocessor server and includes the Vaisala lightning database software license. TLD100 and TLD200 utilizes a powerful, open source, object relational database system by PostgreSQL. PostgreSQL has proven architecture that has earned a strong reputation for reliability, data integrity, and correctness.

Support services

Training and after-sales support services are available for maintaining optimal network and processor performance. Contact your Vaisala Sales Representative for service agreement information.

Technical data

Operating environment

Operating temperature	+10 ... +35 °C (+50 ... +95 °F)
Storage temperature	-40 ... +65 °C (-40 ... +149 °F)
Operating humidity	20 ... 80 %RH, non-condensing (non-condensing twmax = +29 °C / +84 °F)
Storage humidity	5 ... 95 %RH, non-condensing (non-condensing twmax = +38 °C / +100 °F)
Operating altitude	-16 ... 3048 m (-50 ... 10 000 ft)
Storage altitude	-16 ... 10 600 m (-50 ... 35 000 ft)

Minimum system requirements

Computer hardware is subject to change. In case of evolution of an item, an equivalent or better item will be provided.

TLD100 and TLD200 module includes a reliable server with the following minimum specifications:

Processor	Intel® Xeon® Silver 4208 or better CPU
Operating system	CentOS 8, 64-bit edition
Memory	64 GB of RAM
Hard disk space	4 × (960 GB) SSD SATA disk, RAID 5
RAID controller	Hardware RAID controller that supports RAID 5
NIC ports	Intel® i350 Quad Port 1 GbE Base-T, rNDC
USB ports	Min. 2 × USB 2.0 FP, 2 × USB 2.0 BP
Optical disc drive	DVD +/-RW, SATA, internal
Monitor	VGA, dual port, integrated
Modem	CentOS 8 compatible modem

Inputs and outputs

Power requirements	100 ... 240 V AC 47 ... 63 Hz 0.4 kVA
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Data access/Output

Scalable number of simultaneous users

Supports simultaneous real-time and archived data access

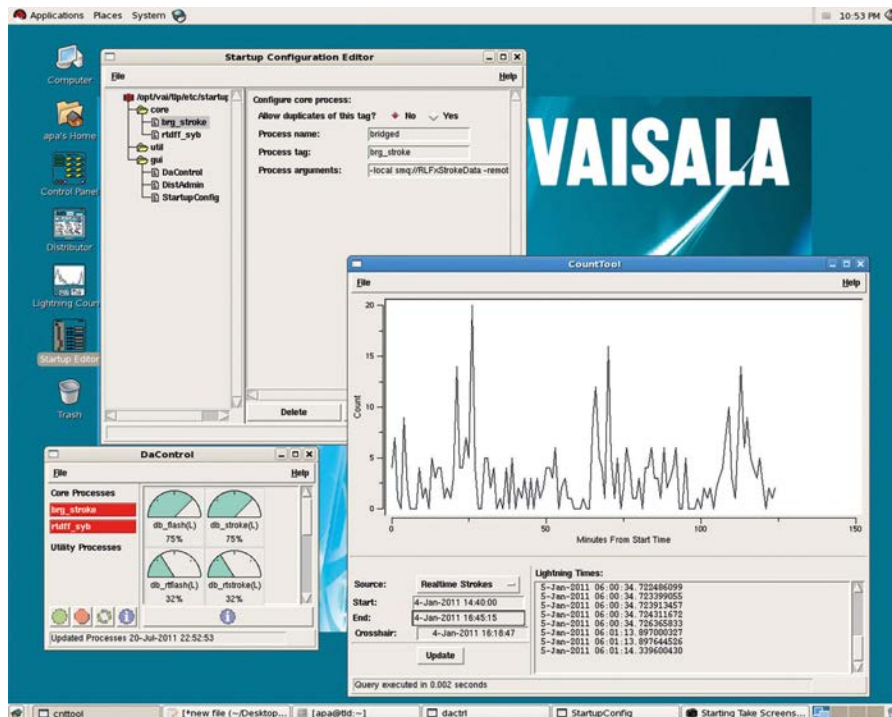
Access to archived data based on date/time, latitude/longitude, and range/azimuth queries

Base configuration supports on-line storage for 1 billion strokes or flashes

Simultaneous flash or total lightning and stroke data access support

System compatibility

Communication interfaces	TCP/IP (recommended)
TLD100 and TLD200 support	Archive lightning location data to Vaisala FALLS (TLD200 only) ODBC-compliant applications and other Vaisala FALLS server software (may require additional hardware)



Features

- Provides long-term storage of stroke and flash data in a relational database for post-storm and multi-year statistical analyses
- Supports multiple workstations and simultaneous queries
- Manages multiple user connections, including accounting and security control functions with the capability to add users
- Provides standard and customized lightning data format outputs that can be integrated with weather display software configured to ingest external data
- Provides a connection to Vaisala FALLS® client software decision support system to analyze and display lightning activity

FALLS® Server is a processing module in the Vaisala Thunderstorm Information System. It specializes in archiving cloud and cloud-to-ground lightning data for forensic applications, and connecting with FALLS® Client application to display decision support information.

Easy, Secured Access to Real-time and Archived Lightning Information

FALLS Server is a lightning data management processor module that receives and stores real-time lightning data from Vaisala Thunderstorm central processor. Vaisala Thunderstorm Information System operators use the server to archive their lightning data into a relational database. Users have

easy and secured access to the archived data for use in their lightning display software and lightning analysis software. The server also provides secured access to real-time lightning data.

Flexibility for Users

Multiple users can simultaneously access lightning information for use in their FALLS Fault Analysis and Lightning Location System, or custom lightning

application software. The standard data format allows users to import lightning data into their weather display software that is configured to accept external data.

FALLS Server allows flexible and efficient manipulation of lightning data through a published set of industry standard Structured Query Language (SQL) function calls and procedures.

Technical Data

Summary

FALLS® Server resides on a single or multiprocessor server. It includes the Vaisala lightning database software license. FALLS® Server utilizes a powerful, open-source, object-relational database system by PostgreSQL. PostgreSQL has proven architecture that has earned a strong reputation for reliability, data integrity and correctness.

Minimum System Requirements

Computer hardware is subject to change. In case of evolution of an item, an equivalent or better item will be provided.

Internet connectivity is required for installation. Recommended speed: T1.

Optical disc drive	DVD+RW burner
Modem	RHEL6 or CentOS 6 compatible
Form factor	Tower or rack mount
Processor	2 or more physical CPUs x86_64 compatible 2 GHz or faster Dual-core or better
Operating system	Linux CentOS 6.x
Memory	Min. 64 GB RAM
Hard disk space	4 or more internal hard drives, each 1 TB or larger
RAID	Min. 3 disks configured as RAID 5 1 disk as a hot spare to the RAID set
Ports	2 or more USB 2.0 ports 2 NIC ethernet ports (100/1000 Mbps)

Data Access and Output

Scalable number of simultaneous users

Supports simultaneous real-time and archived data access

Access to archived data based on date/time, latitude/longitude, and range/azimuth queries

Base configuration supports on-line storage for 1 billion strokes or flashes

Simultaneous flash or total lightning and stroke data access support

System Compatibility

Communication interfaces	Asynchronous RS-232 TCP/IP (recommended) FALLS® Server supports: <ul style="list-style-type: none">• Archive lightning location data to Vaisala FALLS® and Vaisala DAM analysis software• Real-time data to other third-party software• ASCII-based, user-defined formats• Stored procedures and triggers• ODBC-compliant applications
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Operating Environment

The operating environment specifications are equal to the hardware specifications by default. The following specifications are subject to change without notice based on hardware availability.

Operating temperature	+10 ... +35 °C (+50 ... +95 °F)
Storage temperature	-40 ... +65 °C (-40 ... +149 °F)
Operating humidity	20 ... 80 %RH, non-condensing Non-condensing twmax: +29 °C (+84.2 °F)
Storage humidity	5 ... 95 %RH, non-condensing Non-condensing twmax: +38 °C (+100.4 °F)
Operating altitude	-16 ... 3048 m (-52 ft 6 in ... 10 000 ft)
Storage altitude	-16 ... 10 600 m (-52 ft 6 in ... 35 000 ft)

Inputs and Outputs

Power requirements	100 ... 240 VAC 47 ... 63 Hz 0.4 kVA
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Support Services

Training and after-sales support services are available for maintaining optimal network and processor performance. Contact your Vaisala Sales Representative for service agreement information.

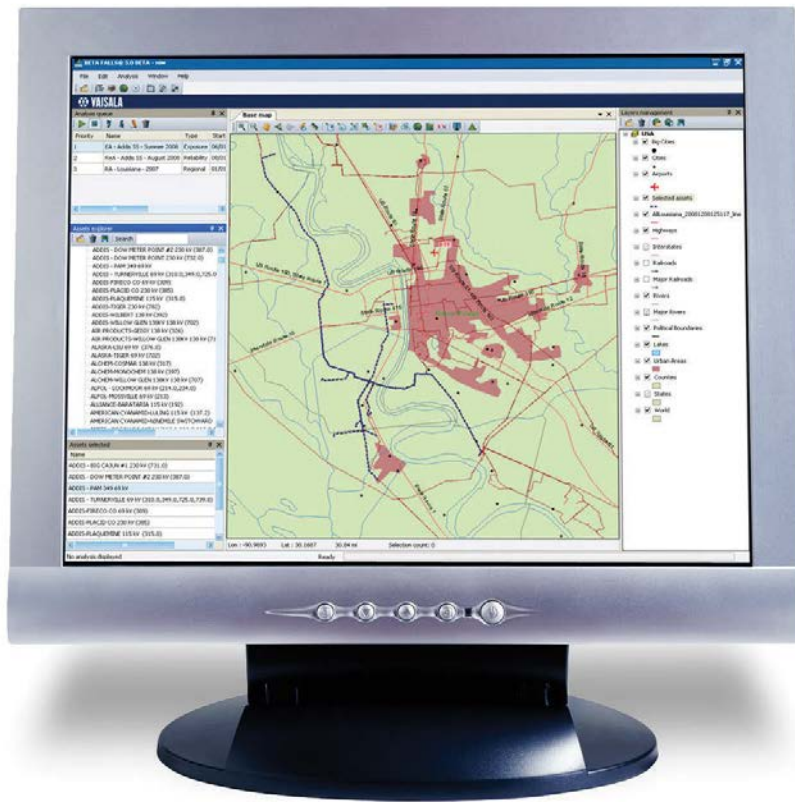


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FALLS Client Fault Analysis and Lightning Location System



Features

- Easy-to-use interface
- GIS (geographic information systems) functionality
- Automatically generated maps save time
- Automated processing of prioritized and queued analyses
- Execute other tasks while analyses run in the background
- Easy interpretation of lightning data, using color, time, polarity and amplitude codes
- Filter out unwanted lightning data
- The user can automate analyses by setting the start and end dates and by inserting other criteria

Prioritize your analyses on the fly using FALLS® Analysis queue. The ability to explore one analysis while others run in the background will improve your productivity.

Vaisala FALLS® Client is innovative software used by electric utilities to query previously recorded lightning information in a GIS (Geographic Information Systems) environment.

FALLS Client generates lightning information into maps, graphs, and statistical tables, and is used to analyze the impact of lightning on assets and systems. Whether you are investigating suspected lightning-caused faults or are studying the climate of your service territory, Vaisala FALLS® provides an easy-to-use platform to quantify and prioritize recommended protection investments

Electric Utility Power Package

Vaisala has now made it easier than ever for U.S. and Canadian customers, or international customers with access to a Vaisala precision lightning detection network, to gain access to the FALLS

services you depend on to minimize the risk lightning poses to your operations. Partner with Vaisala for your historic and near real-time lightning data access, automated lightning fault correlation, and continuing education to keep your organization ahead of the storm.

Vaisala offers customers access to the following options:

- Subscription to Vaisala FALLS Lightning Data for your service territory (US and Canadian customers)
- FALLS Client and FALLS Server software support and upgrades
- Priority access to the FALLS Users Group and Vaisala Webinars on special topics of interest

- Preferred discounts for real-time lightning data access with Vaisala's partners

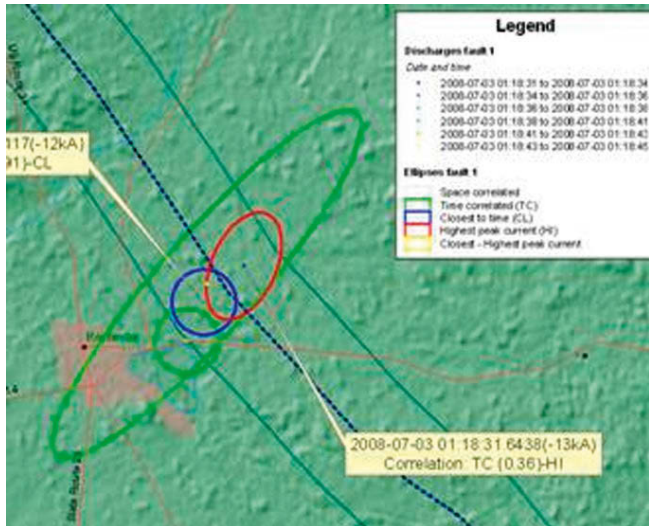
Lightning Data Source

North American customers have access to Vaisala U.S. National Lightning Detection Network® and the Canadian Lightning Detection Network, which together create the most comprehensive historic lightning database in the world. With a FALLS Server add-on, international customers and private Vaisala lightning detection network owners can access data from any Vaisala or archive processor.

FALLS® Client Analyses

Reliability Analysis

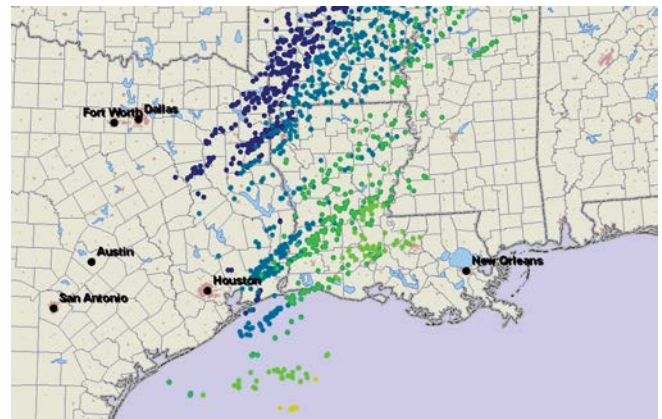
A Reliability Analysis maps event-specific lightning analysis in near real-time. It locates poorly performing line segments or system weaknesses, validates your lightning protection design and correlates your line faults to lightning activity or a lack of lightning activity.



This FALLS® Reliability Analysis reveals four cloud-to-ground lightning discharges which correlated to a suspected fault. The blue ellipse represents the stroke that best matches the fault recorder timestamp, and the red ellipse shows the highest peak current event. Field crews could be dispatched to the location to restore service.

Regional Analysis

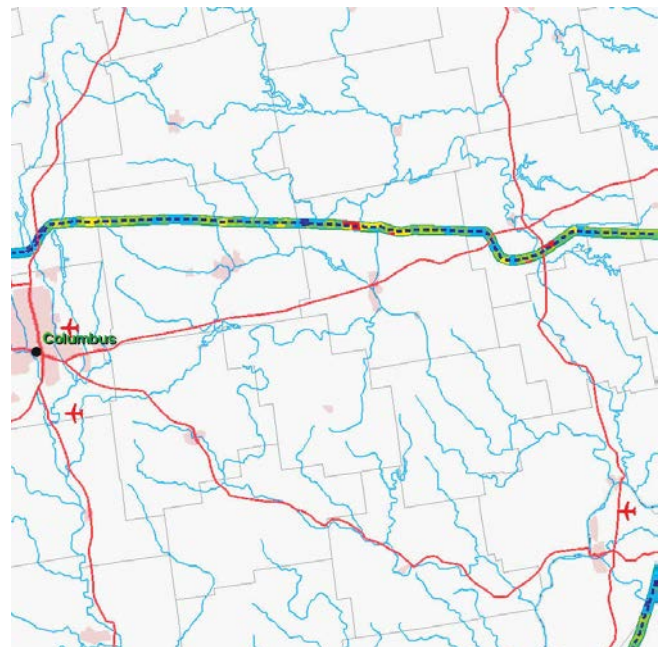
A Regional Analysis generates regional and local lightning strike occurrences and/or densities for user-specified time periods. With a map of lightning density variations and percent positive discharges, it is used to identify hot spots for lightning activity, compare variations in lightning occurrence, amplitude, and polarity across days, weeks, months or years and statistically verify the expected amounts of lightning activity in your service territory.



FALLS® allows the user to display and discriminate lightning discharges by their time of occurrence. The map displayed here for December 3rd and 4th, 2008 shows a line of thunderstorms in the U.S. gulf coast that tracked to the northeast.

Exposure Analysis

An Exposure Analysis offers point-by-point and/or gridded analysis resolving the amount and type of lightning activity within user-defined asset buffer regions. It plots time trends of lightning over your service territory and/or assets, ranks assets by the amount and intensity of lightning exposure and discriminates by polarity and amplitude around user-defined asset buffers.



An example of FALLS® Exposure Analysis for a transmission circuit in eastern Ohio. Areas of higher lightning activity are revealed. This information can help an electric utility to prioritize protection or maintenance.

Technical Data

Minimum System Requirements



Processor	2.1+ GHz Intel Pentium 4, Intel Xeon, Intel Core Duo, or AMD Athlon equivalent
Operating system	Windows® 7 Pro Windows® 10
Memory	Recommended: 2 GB RAM or higher
Hard disk space	5 GB of available space: <ul style="list-style-type: none">• 850 MB for install• Up to 50 MB of disk space may be needed in the Windows System directory• 3 GB of available space to be allocated for swap, temporary files, and saved analyses
Display card	24-bit capable graphics accelerator card
Screen resolution	Recommended: 1280 × 1024, 32-bit Minimum: 1024 × 768, 32-bit
Browser	Recommended: Microsoft® Internet Explorer® 8.0 or higher
Other	DVD-ROM drive DVD is required to install FALLS, but not to run it



Features

- Meets ASOS requirements for lightning range and bearing
- Detects and reports range and bearing of cloud-to-ground lightning
- Detects and counts cloud lightning
- Data format supports direct interface with common communication systems
- Self-diagnostics features for checking sensor function status
- Sustained performance in extreme weather conditions
- Modular design allows easier field service and on-site maintenance

Vaisala TSS928™ is a local-area lightning detection sensor that can be integrated with automated surface weather observations.

Superior performance in local-area lightning tracking

Lightning-sensitive operations rely on Vaisala TSS928 sensors to provide critical local lightning information, both for meteorological applications as well as threat data, to facilitate advance warnings, initiate safety procedures, and isolate equipment with full confidence. The patented lightning algorithms of TSS928 provide the most precise ranging of any standalone lightning sensor available in the world today.

The optical coincident requirement eliminates reporting of non-lightning events.

TSS928 detects:

- Optical, magnetic, and electrostatic pulses from lightning events with zero false alarms

- Cloud and cloud-to-ground lightning within 30 nautical miles (56 km)
- Cloud-to-ground lightning classified into three range intervals:
 - 0 ... 5 nmi (0 ... 9 km)
 - 5 ... 10 nmi (9 ... 19 km)
 - 10 ... 30 nmi (19 ... 56 km)
- Cloud-to-ground lightning classified into directions: N, NE, E, SE, S, SW, W, and NW

TSS928 can be used to integrate lightning reports with automated weather observation programs such as METAR.



Vaisala TSS928™ accurately reports the range and direction of cloud-to-ground lightning and provides cloud lightning counts.

Technical data

Measurement performance

Detection range	30 nmi (56 km) radius from sensor location
Range resolution	Three range groups: <ul style="list-style-type: none"> • 0 ... 5 nmi (0 ... 9 km) • 5 ... 10 nmi (9 ... 19 km) • 10 ... 30 nmi (19 ... 56 km)
Range resolution uncertainty	0 ... 10 nmi (0 ... 19 km): less than 3 nmi (5.6 km) 10 ... 30 nmi (19 ... 56 km): less than 6 nmi (11.1 km)
Bearing resolution	One of eight compass octants (N, NE, E, SE, S, SW, W, NW)
Detection efficiency	
Thunderstorm detection	98 % for thunderstorms within 10 nautical miles (12 mi, 19 km) with 3 or more cloud-to-ground discharges
Cloud-to-ground flashes	Approximately 70 % for flashes within 10 nautical miles

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-40 ... +60 °C (-40 ... +140 °F)
Sustained wind speed, maximum	85 kn (157 km/h) (standard mast mount)
Wind gust, maximum	125 kn (231 km/h)
Relative humidity, operating	0 ... 100 %RH
Siting requirements	Flexible installation requirements. Questions should be referred to your distributor or your Vaisala sales representative.

Inputs and outputs

DC power	11 ... 32 V DC
Power consumption	Nominal 6 W
Communications	
Serial ASCII format	RS-232 and RS-422 serial at 9600 bps
The default TSS928 sensor messaging configuration is polled at user defined periods by external data acquisition equipment. The sensor may be configured to send present weather format messages at one minute intervals or immediately send flash format messages.	

Compliance

EU directives and regulations	Low Voltage Directive (2006/95/EC) - 230 V model EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC immunity	EN 61326-1, basic immunity test requirements
EMC emissions	CISPR 22 / EN 55022, Class B FCC part 15, class A ICES-3 (A)
Electrical safety	EN 61010-1
Compliance marks	CE, China RoHS, FCC, RCM

Mechanical specifications

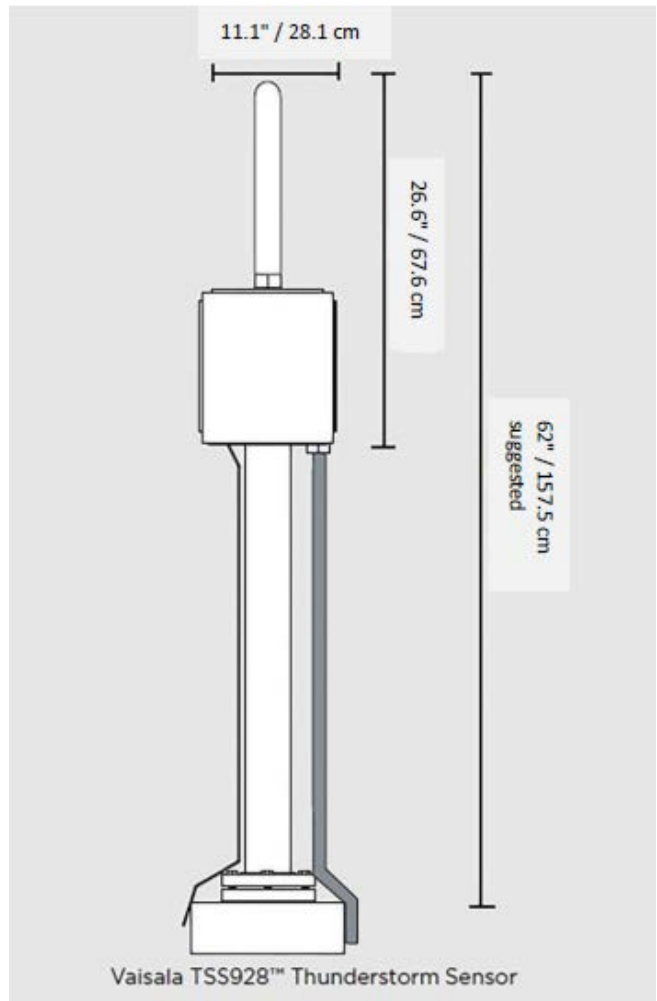
Mounting options	<ul style="list-style-type: none"> • Ground mount option • Roof mount option with tripod • Frame mount for either roof or ground options
Height	Max. 3 m (9 ft 10 in) recommended
Weight (sensor only)	9.9 kg (22 lb)

Support services

Vaisala TSS928™ is fully supported by our Customer Support Center, Technical Service Group, and Field Service Engineering Team. Maintain optimal performance by purchasing a service agreement customized to your unique system requirements.

Standard warranty

Vaisala warrants all products manufactured by Vaisala to be free from defects in workmanship or material for 1 year from the date of delivery. Contact your Vaisala Sales Representative for specific product warranty and service warranty details.



Dimensions

AS41 Automatic Sounding Station



Vaisala AUTOSONDE AS41 is an upper-air observation system for synoptic and adaptive use. With a loading capacity of 60 radiosondes, it provides the longest autonomous sounding capacity on the market.

Features

- Upper-air observation system for synoptic and adaptive use
- All benefits of Vaisala Radiosonde RS41 and Vaisala MW41 Sounding System
- Reloading needed only once every four weeks
- Safe working environment, gas lines located outside the container
- Balloon filling with either hydrogen or helium
- Remote control and configuration
- Easy loading and stocking
- Controlled access for improved operational safety
- User interface design supports easier system diagnostics

High-quality Data

Complemented by Vaisala DigiCORA® Sounding System MW41 and the RS41 radiosonde, Vaisala AUTOSONDE AS41 provides world-class sounding data. Its automated and manual operations are based on proven algorithms and procedures, such as the automatic ground check.

As a reliable start reference for sounding data, AS41 uses either Vaisala Automatic Weather Station AWS310 installed on a 10-meter mast according to WMO requirements or Vaisala Weather Transmitter WXT536 installed on a short mast on the container roof.

High Data Availability

Each individual detail in AS41 has been carefully designed and tested to achieve high target rates of successful soundings.

AS41 is designed to endure extreme weather conditions around the world. Thoroughly tested automation control and carefully selected components and materials guarantee continuous operation with minimum downtime.

Cost Efficient Solution

AS41 offers the longest autonomous sounding capacity on the market. Site visits are significantly reduced as reloading is only required once every four weeks.

As AS41 complies with tight international standards for explosive atmospheres, cost-efficient hydrogen can be used as an optional balloon filling gas in place of helium.

Easy Remote Control and Monitoring

Vaisala Observation Network Manager NM10 is used for remote control and monitoring. Connecting to AS41 through a secure communication protocol, operators can efficiently control sounding schedules, initiate on-demand soundings, and perform remote diagnostics.



Green for Operational: AS41 Diagnostics is Supported by Visual Cues

Technical data

Automatic Sounding Station Vaisala AUTOSONDE® AS41

Loading capacity	60 radiosondes
Storage capacity for consumables	4 months (2 soundings a day)
Radiosonde	RS41-SG, RS41-SGP
Sounding workstation	<ul style="list-style-type: none"> Sounding system software preinstalled Operating system Windows 10 preinstalled AUTOSONDE Control software preinstalled System recovery tools, including USB drive with recovery image
Vaisala Sounding Processing Subsystem	SPS311G, SPS341AG
Antennas	Telemetry antenna (directional UHF) GPS antenna
Automatic ground check device	RI41-AS41
Uninterrupted Power Supply	Options for 1 hour and 3 hours
Surface observation options	<ul style="list-style-type: none"> AWS310, sensors on separate 10-meter mast, complies with WMO CIMO guide 8 WXT536, sensors on short mast attached to the container

Remote server

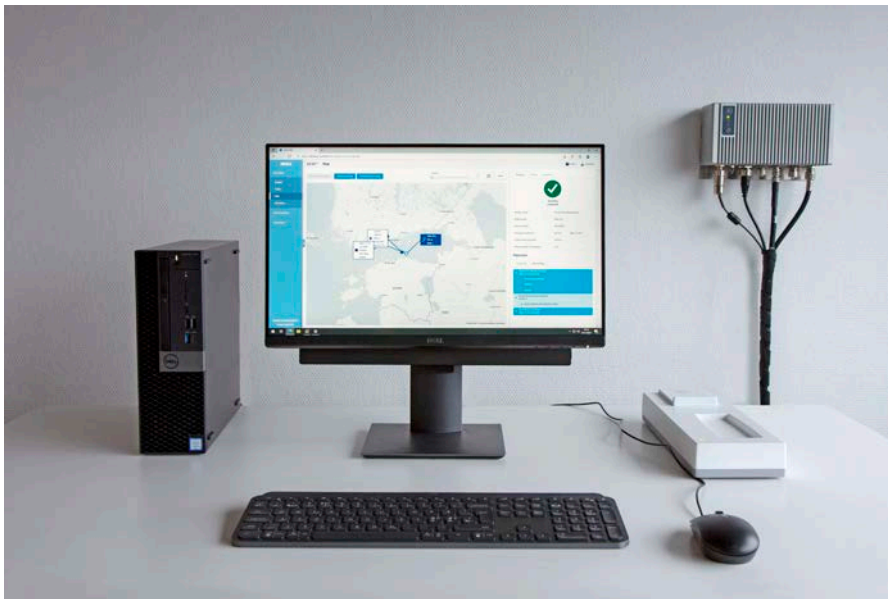
Vaisala Observation Network Manager software NM10	Preinstalled
Operating system	Windows 10 preinstalled
System recovery tools	Including USB drive with recovery image

Electrical specifications

Main electric cabinet	Located inside the container Includes surge arresters, circuit breakers, residual current devices, mechanics controller, safety controller, servo drives, and frequency controllers.
Mechanics controller	Industry standard programmable logic controller with analog and digital I/O and electric motor controls.
Input power	400 VAC 50 Hz 20 A, 3-phase 230 VAC 50 Hz 25 A, 1-phase
Max. power consumption	5500 W
Average power consumption	Under 1000 W
Cabling	Halogen-free
Wall sockets	Integrated in the operator desk
Lights	Ceiling light with presence detector Remotely controlled robotics room lights
Heater	1000 W with thermostat
Air conditioner with heating functionality	2000 W
UPS	Capacity for completing one ongoing sounding

Mechanical specifications

Container	
Dimensions during transportation (L × W × H)	6058 × 2438 × 2896 mm Transports as CSC-approved 20-foot HC sea container
Dimensions during operational use (L × W × H)	7800 × 3300 × 5100 mm
Dimensions of access door with window (L × H)	900 × 2100 mm
Total weight with launcher vessel	7.5 t
Launcher vessel	
Vessel tube dimensions	Ø 2 m
Vessel frame material	Acid-proof steel frame Separate from the container
Covers	2 pieces, operated by electric gearmotors
Cover dimensions	Ø 2 m, inside
Cover material	Laminated fiberglass
Gas flow measurement	
Gas flow measurement unit	<ul style="list-style-type: none"> Installed on the container roof 2 flexible input gas hoses controlled by magnetic gas valves Connection to gas regulator Output hose to nozzle controlled by magnetic valves
Gas flow meter	With electrical current output Maintenance-free, no moving parts Automatic measurement of gas amount
Balloon	
Balloon size	200 ... 1200 g
Balloon filling gas	Hydrogen or helium
Nozzle	Connected to the balloon during loading Gas-proof connection
Container outdoor painting color codes	
White	RAL9003
Gray (for the container access door)	RAL7035
Container painting color types for outdoors	
First coating	Interzinc 52
Second coating	Intergard 475HS Interseal 1052
Third coating	Interthane 990SG
Operating environment	
Operating temperature	-40 °C ... +53 °C
Operating humidity	0 ... 100 %RH, condensing
Max. operating wind speed	25 m/s
Surviving wind speed	60 m/s
Storage temperature	-40 °C ... +53 °C
Storage humidity	0 ... 100 %RH, condensing
Compliance	
Explosive atmospheres Part 14: Electrical installations design, selection and erection	IEC 60079-14 (2013), IEC 60079-10-1 (2015)
Machine safety	Machinery Directive 2006/42/EC



Features

- Consistent, high-quality data
- Easy to operate
- Good tolerance to near-band interference
- Long telemetry range
- Inbuilt IT security with regular updates
- Compact design supports portable applications

Vaisala Cirrus® Sounding System MW51 is the foundation of modern meteorological upper-air observations.

Vaisala Cirrus Sounding System MW51 processes, analyses, archives, and relays sounding data. While keeping the best qualities of its predecessor MW41, it introduces significant improvements to radio design, usability, and reliability.

The MW51 system consists of a computer that runs DigiCORA® Software, the Sounding Processing Subsystem SPS511, the RI41 / RI41-B Ground Check Devices for preparing RS41 radiosondes, and the UHF and GPS antennas used to receive the radiosonde signal and provide local positioning data. Together with RS41, the MW51 system brings upper-air measurements into a new era. To ensure the system meets the needs of a wide range of Vaisala Radiosonde RS41 customers, various radiosonde ground check device and antenna options are available. If desired, the DigiCORA user interface can be accessed from anywhere within the connected network using a standard web browser.

Excellent radio characteristics

The new built-for-purpose Vaisala Cirrus® Sounding Processing Subsystem SPS511 is sensitive to radiosonde signals, while also being resistant to interference near the meteorological frequency band. This allows for a steady data flow from the radiosonde to the MW51 system, resulting in an accurate atmospheric profile even in demanding radio environments.

Sustainable IT security

The system is designed with security in mind. User access is controlled, while data transfer and remote control use secure communication.

Regular security updates are available for both the DigiCORA application software as well as the embedded SPS511 firmware. This provides the user with additional peace of mind against IT security threats.

New, intuitive and visual DigiCORA Software

During a sounding, data can be visualized in a variety of views like graphs, tables and a map. With DigiCORA as a guide, preparing a radiosonde continues to require minimal effort from the user.

Configuring DigiCORA to create a wide range of meteorological messages is easy. Triggers and messages set for the sounding are displayed in a brand-new flight plan layout, which shows the main sounding events relative to the current sounding status.

Compact and portable

Variable field conditions and locations for research campaigns pose demands on the sounding system, which needs to be portable as well as efficiently built for transport. MW51 continues to support the portable antenna set CG31 with both UHF and GPS antennas, and SPS511 is notably smaller and lighter than its predecessor.

With an IP rating of IP54, SPS511 tolerates dust and moisture well. SPS511 uses conductive cooling and has no moving parts. The electronics are designed on one signal board to minimize points of failure.

Technical data

Performance

Range with Directional antenna RB31	Up to 350 km (217.5 mi)
Range with Omnidirectional antenna RM32	200 km (124 mi)
Range with Omnidirectional antennas CG31 and RM31N	150 km (93mi)

System components and compatible radiosondes

Radiosondes	<ul style="list-style-type: none">• RS41-SG• RS41-SGP
Sounding processing subsystems	Vaisala Cirrus Sounding Processing Subsystem SPS511
Application software	DigiCORA® Software
Ground check devices	<ul style="list-style-type: none">• RI41• RI41-B with barometer module
Antennas	<ul style="list-style-type: none">• Vaisala Directional UHF Antenna RB31• Omnidirectional UHF antennas RM32 and RM31N• Vaisala GPS Antenna GA31/N• Vaisala portable (UHF + GPS) antenna set CG31

Minimum system requirements for sounding workstation

Operating system	Windows 10 Pro 64-bit (English)
Web browser	<ul style="list-style-type: none">• Microsoft Edge® latest version• Mozilla Firefox® latest version• Google Chrome™ latest version
Processor	Intel Pentium Dual Core or equivalent (Quad Core recommended)
Memory	8 GB RAM (16 GB RAM recommended)
Hard disk space	160 GB
Display resolution	1366 × 768 (Full HD, 1920 × 1080 recommended)
USB port	For connecting the ground check device
Serial port	For optional future connection of Automatic Weather Station. Either integrated serial port or via USB / RS-232 converter
Network adapter	For connecting the sounding processing subsystem
Speakers	For audio notification (optional)

Operating environment

Computer and accessories

Operating temperature	+10 ... +40 °C (+50 ... +104 °F) +10 ... +45 °C (+50 ... +113 °F) with rugged laptop
Storage temperature	-40 ... +65 °C (-40 ... +149 °F)
Operating humidity	10 ... 90 %RH
Storage humidity	5 ... 95 %RH

Sounding Processing Subsystem SPS511

Operating temperature	0 ... +45 °C (+32 ... +113 °F)
Storage temperature	-40 ... +65 °C (-40 ... +149 °F)
Operating humidity	5 ... 100 %RH (condensing)

IP rating	IP54
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Ground check devices

RI41 and RI41-B. See separate datasheets for details.

Antennas

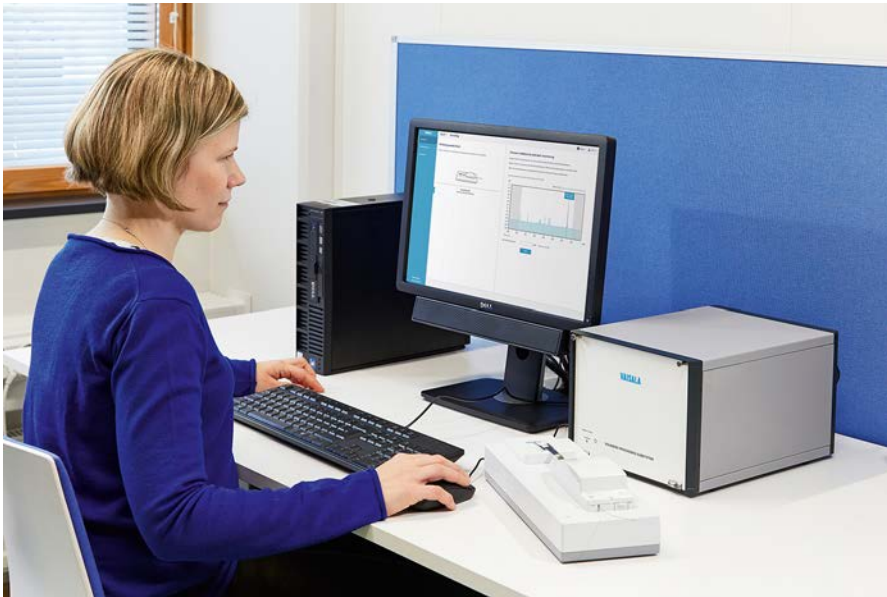
RB31, RM32, RM31N, CG31 and GA31 or GA31N. See separate datasheets for details.

Meteorological messages

BUFR messages	BUFR 3'09'050 and BUFR 3'09'051 (for PILOT data) BUFR 3'09'052 and BUFR 3'09'057 (for TEMP data) BUFR 3'09'053 and BUFR 3'09'056 (for descending sounding after balloon burst) All BUFR messages are also available as high resolution variants.
TEMP messages	TEMP FM35-XI



Future DigiCORA releases will have enhanced compatibility with other Vaisala products, as well as more available features and meteorological messages.



Features

- Modern look and feel
- Consistent, high-quality data
- Easy integration to existing soundings network
- Increased flexibility through advanced networking options
- Easy and intuitive operation
- Quick configuration and modification of station parameters, also remotely

Vaisala Sounding System MW41 is now available with the new DigiCORA Software application that supports the world-class performance of the Vaisala RS41 radiosonde family. This makes MW41 an excellent choice for both synoptical and research applications.

Vaisala Sounding System MW41 processes, analyses, archives, and relays sounding data. The system consists of a computer that runs DigiCORA, and is connected to a sounding processing subsystem using a network adapter.

DigiCORA consists of the user interface running on a web browser and the sounding processing software running as services on a computer.

Flexible to use

As the DigiCORA user interface runs on a web browser, it can be operated from anywhere. This allows, for example, managing sounding operations remotely, away from the sounding station. Additionally, all network users can access sounding data remotely.

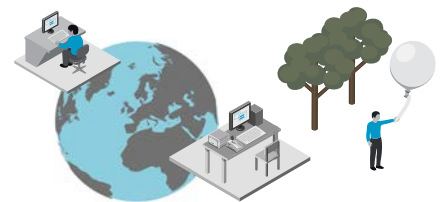
Intuitive to operate

DigiCORA guides you through the radiosonde preparation process with a minimal need for user input and interaction. Clear status indicators and animations tell you whenever action is needed. As operating the system is highly intuitive, training users is faster. Access to specific functionalities can be defined with user groups and their related privileges.

Quick to configure

Configuring DigiCORA for operation is easy. The user interface supports quick configuration of station parameters, message creation, and parameter sending. The system can also be configured remotely.

DigiCORA validates sounding data to ensure it is of high quality. The system can create various WMO messages.



Technical data

Radiosonde compatibility

Radiosonde	RS41-SG RS41-SGP
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Minimum system requirements for sounding workstation

Operating system	Windows 10 Pro 64-bit (English)
Web browser	<ul style="list-style-type: none">• Microsoft Edge® latest version• Mozilla Firefox® latest version• Google Chrome™ latest version
Processor	Intel Pentium Dual Core or equivalent (Quad Core recommended)
Memory	8 GB RAM (16 GB RAM recommended)
Hard disk space	160 GB
Display resolution	1366 × 768 (Full HD, 1920 × 1080 recommended)
USB port	For connecting the ground check device
Serial port	For optional future connection of Automatic Weather Station. Either integrated serial port or using USB / RS-232 converter
Network adapter	For connecting the sounding processing subsystem
Speakers	For audio notification (optional)

Vaisala Sounding Processing Subsystem

Software-defined radio technology
Code-correlating GPS

Operating environment

Computer and accessories

Operating temperature	+10 ... +40 °C (+50 ... +104 °F) +10 ... +45 °C (+50 ... +113 °F) with rugged laptop
Storage temperature	-40 ... +65 °C (-40 ... +149 °F)
Operating humidity	10 ... 90 %RH
Storage humidity	5 ... 95 %RH

Sounding Processing Subsystem SPS311G / SPS341AG

Operating temperature	0 ... +45 °C (+32 ... +113 °F)
Storage temperature	-55 ... +70 °C (-67 ... +158 °F)
Operating humidity	10 ... 90 %RH (non-condensing)
Storage humidity	5 ... 95 %RH
Altitude	Up to 2 000 m (6 562 ft)

Ground check devices

RI41 and RI41-B. See separate datasheets for details.

Antennas

RB31, RM32, RM31N, CG31 and GA31 or GA31N. See separate datasheets for details.



The operating environment requirements may vary depending on different product models.

Telemetry

Frequency band	400.15 ... 405.99 MHz
Tuning step (user-adjustable)	10 kHz
Error detection and correction	Reed-Solomon
Telemetry range (using directional antenna)	Up to 350 km (217.5 mi)
Recommended frequency difference between sondes used simultaneously	150 kHz

Meteorological messages

BUFR messages	BUFR 3'09'050 and BUFR 3'09'051 (for PILOT data) BUFR 3'09'052 and BUFR 3'09'057 (for TEMP data) BUFR 3'09'053 and BUFR 3'09'056 (for descending sounding after balloon burst) All BUFR messages are also available as high resolution variants.
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Antennas

Directional UHF antenna (automatic direction control)	RB31
Omnidirectional UHF antenna	RM32 RM31N
Portable antenna for UHF and GPS	CG31
GPS antenna	GA31 GA31N

Ground check devices

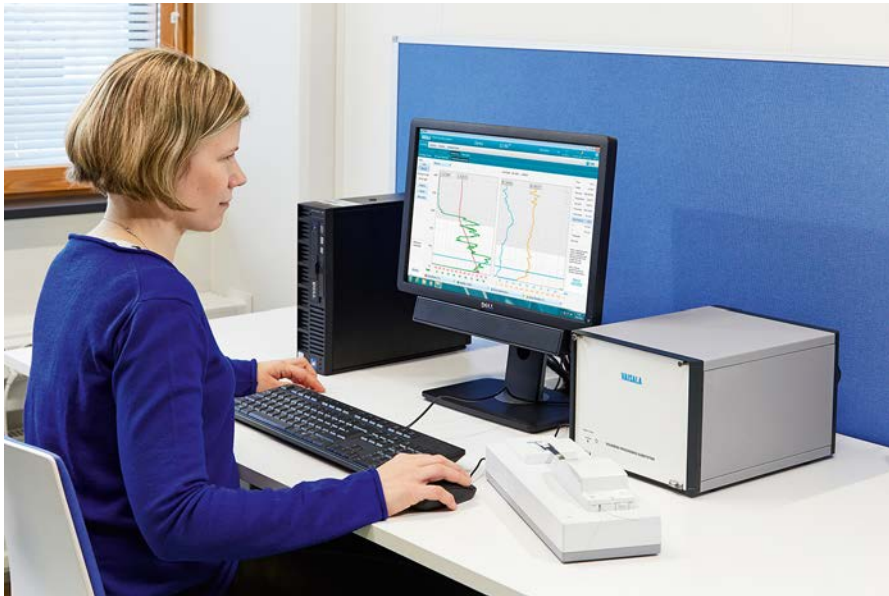
RI41 and RI41-B. See separate datasheets for details.



Future DigiCORA releases will have enhanced compatibility with other Vaisala products, as well as more available features and meteorological messages.

VAISALA

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Features

- Consistent, high-quality data
- Easy integration to existing soundings network
- Increased flexibility through advanced networking options
- Easy and simple operation
- Quick configuration and modification of station parameters, also remotely

Vaisala Sounding System MW41 supports the world-class performance of Vaisala RS41 radiosonde family. This makes MW41 an excellent choice for both synoptical and research applications.

Vaisala Sounding System MW41 processes, analyses, archives, and relays sounding data. The system consists of a computer that runs MW41 sounding software and is connected to a sounding processing subsystem via a network adapter. MW41 sounding software includes the sounding processing software running as services on a computer and an optional remote client for remote access/use.

Easy to integrate

Upgrading to MW41 from earlier Vaisala sounding systems is smooth and cost-effective. The software is compatible with commonly used Windows operating systems and hardware, making it easy to integrate to most IT bases and helping to minimize maintenance costs. Connectivity with Vaisala Automatic Weather Stations allows using highly accurate surface weather information as reference, which makes operation simpler and less sensitive to human error.

Flexible to use

As MW41 user interface is separated from other software functionalities, it can be operated from anywhere within your network. This allows, for example, managing sounding operations remotely, away from the sounding station. Additionally, all network users can access sounding data, remotely.

The standard MW41 software package includes all features needed to perform synoptic soundings. For more advanced sounding needs, like ozone sounding capability or extended graphics, optional modules are available. The system can be tailored for specific needs of a sounding station.

Intuitive to operate

MW41 follows the radiosonde preparation process, minimizing the need for user input and interaction. When the user needs to act, using the system is made easier with clear status indicators and animations, and a software help is available for additional

assistance. As operating the system is highly intuitive, training users is faster. Access to specific functionalities can be defined by utilizing user groups and their related privileges.

Quick to configure

Configuring MW41 for operation is easy. The user interface supports quick configuration of station parameters, message creation, and parameter sending. The system can also be configured remotely.

MW41 validates sounding data to make sure it is of high quality. The system can create WMO messages and special text reports using the validated data, and the data is also available in XML format.



Technical data

Compatibility

Radiosonde	<ul style="list-style-type: none"> • RS41-SG • RS41-SGP • RS41-SGM • RS41-D
Special sensor	Ozone sensors: <ul style="list-style-type: none"> • ECC-6A ECC • Z ECC

Minimum system requirements for sounding workstation

Computer	PC delivered by Vaisala includes: <ul style="list-style-type: none"> • Pre-installed MW41 sounding software • System recovery tools, including USB drive with recovery image • Optional Edgeport serial extension Optionally, any PC that fulfills the requirements below can be used.
Operating system	<ul style="list-style-type: none"> • Windows® 11 Pro • Windows®10 Pro 64-bit
Web browser	<ul style="list-style-type: none"> • Microsoft Edge latest version (English) • Mozilla Firefox latest version (English) • Google Chrome latest version (English)
Processor	Intel Pentium Dual Core or equivalent (Quad Core recommended)
Memory	8 GB RAM
Hard disk space	160 GB
Display resolution	1366 × 768 (minimum)
DVD-ROM drive	For the installation media
Optional serial ports	Either integrated or using USB/RS-232 converter. 1 for possible Automatic Weather Station
USB port	For connecting the ground check device
Ethernet adapter	For isolating the sounding system from the internal network
Speakers	Integrated either into computer or display
Remote client PC	Using devices that fulfill the same requirements as for Sounding Workstations is recommended. ¹⁾

¹⁾ It is likely that devices with lower hardware specifications, other operating systems, or other browsers can be used.

Vaisala Sounding Processing Subsystem

Software-defined radio technology
Code-correlating GPS

Operating environment

Indoor equipment	
Operating temperature	+10 ... +40 °C (+50 ... +104 °F) +10 ... +45 °C (+50 ... +113 °F) with rugged laptop
Storage temperature	-40 ... +65 °C (-40 ... +149 °F)
Operating humidity	10 ... 90 %RH
Storage humidity	5 ... 95 %RH
Outdoor equipment	
Operating temperature	-40 ... +55 °C (-40 ... +131 °F)
Storage temperature	-50 ... +71 °C (-58 ... +160 °F)
Operating humidity	0 ... 100 %RH
Storage humidity	0 ... 100 %RH
Operating wind speed	0 ... 65 m/s (0 ... 145 mph)
Operating precipitation	Unlimited

Telemetry

Frequency band	400.15 ... 406 MHz
Tuning step (user-adjustable)	10 kHz
Error detection and correction	Reed-Solomon
Telemetry range (using directional antenna)	Up to 350 km (217.5 mi)

Meteorological messages

TEMP messages	TEMP FM35-XI, TEMP SHIP FM36-XI, TEMP MOBIL FM38-XI
PILOT messages	PILOT FM32-XI, PILOT SHIP FM33-XI, PILOT MOBIL FM34-XI
BUFR messages	BUFR 3'09'050 and BUFR 3'09'051 (for PILOT and High resolution data) BUFR 3'09'052 and BUFR 3'09'057 (for TEMP and High resolution data) BUFR 3'09'056 (for descending sounding after balloon burst)
Advanced option	CLIMAT TEMP FM 75-X BUFR 3'09'053 (DROP BUFR)
Special sensor option	NILU, WOUDC
Defense messages option	METCM STANAG 4082, METB2/METB3 STANAG 4061, METFM STANAG 2103, METSR/METSRX, METTA STANAG 4140, METEO 11

Antennas

Directional UHF antenna (automatic direction control)
Omnidirectional UHF antenna
Portable antenna for UHF and GPS
GPS antenna
Advanced Multipath Rejection GPS antenna

Ground check set

RI41 and RI41-B. See separate datasheets for details.



Features

- Meteorological profile data for artillery ballistic preparation, naval applications, fire weather, and numerical weather prediction models
- Rugged design to stand harsh environment and transport
- With Vaisala Radiosonde RS41-SGM, improved security thanks to radio silence (patent EP2689279, Method for launching and a radiosonde) and encryption
- Straight-forward, menu-driven operation through integrated display and keyboard
- Extensive data quality assurance processes guarantee error free messages in relevant STANAG and WMO formats

Vaisala MARWIN® Sounding System MW32 is a fully rugged sounding system designed and specified for tough military use. Different configurations include a portable system, vehicle installation, and naval installation.

Vaisala MARWIN® Sounding System MW32 provides an atmospheric profile of wind, pressure, temperature, and humidity from the surface up to the altitudes to be used in the ballistic weather computation. The data can be used as input into numerical weather models to provide updated observation for more precise predictions. The atmospheric profile is useful e.g. for fire weather, aviation, CBRN, and naval applications.

With Vaisala Radiosonde RS41-SGM, encryption and radio silence (patent EP2689279, Method for launching and a radiosonde) improve security of defense operations. Radiosonde transmission does not reveal the balloon launch location because the radiosonde transmitter is not switched on until a specified height or time from launch has been reached. Data is recorded also during the radio silence and, when the radio silence ends, transmitted to MW32.

Compact system design

The MW32 system consists of a receiver/processor and antennas to track the radiosonde attached to a freeflying balloon. The integrated display and keyboard unit supports menu driven operation. Side panel connectors enable rack mount installation. The display unit and connector panel have been designed using MIL-STD-1472F as a guideline. The system can be operated, assembled, and disassembled wearing gloves or arctic mittens.

Easy operation

The MW32 system is straightforward to operate using the self-guiding menu. After powering-up, the radiosonde is connected to the system for setting-up using a ground check device. When done, the system indicates its readiness for launch.

Rugged design for tough military use

The MW32 system has been designed from conception for demanding use in harsh environments, and rough transportation. A special feature is the conductive cooling. MW32 complies with MIL-STD-810G for vibration, functional shock and transit drop, low and high temperature, temperature shock, sand and dust, wind driven rain, humidity, salt fog, and altitude.

Versatile interfaces

The MW32 system provides one integral LAN port, two USB ports and four serial ports. It also supports the PCSERV protocol of the Vaisala MARWIN® Sounding System MW12 legacy so the MW32 can replace the MW12.

Technical Data

Hardware and software

Processor type	COM Express PC, 1.5 GHz
DRAM	SO-DIMM, 2 GB
Flash disk	8 GB
TFT LCD display	8.4 in, SVGA, transfective, daylight viewable
Integral console	5 hardkeys, 5 softkeys, alphanumeric keypad
Operating system	Windows Embedded Standard 2009
I/O ports	
Asynchronous serial	RS-232C, 4 lines
LAN connection	10/100 Mbps Ethernet, 1 line
USB	USB1.1 / USB2.0, 2 lines
Other	
Cooling system	Conductive cooling, no cooling fans
Case	Cast aluminum
Connector types	MIL-C-26482, MIL-C-38999, MIL-C-5015
Protection class	IP65
Environmental tests	MIL-STD-810G, see separate list
Electromagnetic compliance	MIL-STD-461F, see separate list
Dimensions (H × W × D)	280 × 430 × 380 mm (11.02 × 16.93 × 14.96 in)
Weight	22 kg (48.50 lb)
Overvoltage category	II
Pollution degree	2
Maximum operating altitude	3000 m (approx. 9800 ft)

Power supply

Internal AC power unit	Input: 90-132 / 180-264 VAC autoranging, 47-63 Hz, 180 W max
Internal DC power unit	Input: 18-33 VDC, 144 W max., MIL-STD-1275B DC out for external device: 12 V / 0.5 A, 28 V / 1 A
Internal battery	2 pcs, Ultralife UBBL02-01 Li-Ion Internal back-up power time: 240 minutes. Battery pack capacity: 2 × 250 Wh Automatic switch-over from AC to external DC to internal battery

Operating environment

Operating temperature	-20 ... +50 °C (-4 ... +122 °F)
Operating humidity	0 ... 100 %RH
Storage temperature (without batteries)	-40 ... +71 °C (-40 ... +159.8 °F)
Storage humidity	5 ... 95 %RH
Antennas	
Operating temperature	-40 ... +55 °C (-40 ... +131 °F)
Operating humidity	0 ... 100 %
Operating wind speed	0 ... 65 m/s (0 ... 145 mph)
Operating precipitation	Unlimited
Storage temperature	-50 ... +71 °C (-58 ... +159.8 °F)
Storage humidity	0 ... 100 %RH

Radiosondes and windfinding options

Supported Vaisala radiosondes	RS41-SGM, RS41-SGP, RS41-SG, RS41-D, RS92-AM, RS92-SGP, and RS92-D
Windfinding options	C/A code GPS Radio-direction finding (with Vaisala Radiotheodolite RT20A) ¹⁾

¹⁾ Required configuration if 1680 MHz band RS41-D or RS92-D is used

Antennas

CG31 Portable antenna (UHF and GPS)
CG32 Vehicle antenna (UHF and GPS)
RM32 and RM31N, Omnidirectional UHF antennas
GA31 and GA31N, GPS antennas
RB31 Directional UHF antenna for fixed installation
Vaisala Radiotheodolite RT20A ¹⁾

¹⁾ Required configuration if 1680 MHz band RS41-D or RS92-D is used

Telemetry

Frequency range	400.15 ... 406 MHz, EN 302 054 v1.1.1 1668.4 ¹⁾ ... 1690 MHz EN 302 454 v1.1.1
Tuning step	10 kHz, user adjustable
Error detection and correction	Reed-Solomon
Telemetry range (400 MHz)	150 km (93.2 mi) with portable/ vehicle antennas and up to 350 km (217.5 mi) with directional antenna

¹⁾ Required configuration if 1680 MHz band RS41-D or RS92-D is used

Meteorological messages (military)

METCM, STANAG 4082	Standard Artillery Computer Meteorological Message
METB2/METB3, STANAG 4061	Standard Ballistic Meteorological Message
METFM, STANAG 2103	Standard Fallout Meteorological Message
METSR/METSRX	Sound Ranging Meteorological Message
METTA, STANAG 4140	Standard Target Acquisition Meteorological Message
METEO 11	

Meteorological messages (WMO)

TEMP FM35-XI, TEMP SHIP FM36-XI, TEMP MOBIL FM38-XI PILOT FM32-XI, PILOT SHIP FM33-XI, PILOT MOBIL FM34-XI
BUFR 3'09'050, BUFR 3'09'051 for PILOT data, BUFR 3'09'052 for TEMP data, and BUFR 3'09'053 for a descending sounding with RS41 series GPS radiosondes

Vaisala Radiosonde RS41-D – accuracy and reliability with Vaisala Radiotheodolite RT20 systems.



Features

- Independent and passive windfinding with Vaisala Radiotheodolite RT20 systems
- Superior PTU measurement performance
- Automated ground check
- Robust and easy-to-use design with informative LEDs
- Stable narrow-band transmission complies with ETSI standard EN 302 454
- Unwinder for consistent sensor boom positioning

Independent and Passive Windfinding

Vaisala Radiosonde RS41-D is the RS41 radiosonde model for Vaisala Radiotheodolite RT20 systems. RS41-D measures pressure, temperature and humidity, and RT20 provides a passive and independent windfinding solution.

RS41-D PTU Sensors

Vaisala Radiosonde RS41 temperature sensor utilizes linear resistive platinum technology known for its high stability. The small size of the sensor results in low solar radiation error and guarantees fast response. It also incorporates effective protection against evaporating cooling, a phenomenon occasionally encountered when a radiosonde emerges from a cloud top.

The humidity sensor integrates humidity and temperature sensing elements. Preflight automatic reconditioning of the humidity sensor effectively removes chemical contaminants and ensures excellent humidity measurement accuracy. The integrated temperature sensor is used to compensate the effects of solar radiation in real time. The sensor heating function enables an active and effective de-icing method at freezing conditions during the flight. The humidity sensor also responds quickly to detect fine structures of the atmosphere. The pressure sensor is the same high-quality, shock-resistant capacitive silicon sensor as the one in the Vaisala Radiosonde RS92 with revised

electronics and calibration. All RS41 sensors are calibrated against references that are traceable to international standards (SI units) and measurement uncertainties are estimated according to recommendations of the Joint Committee for Guides in Metrology, 100:2008.

Carrying out Ground Checks on RS41 Radiosonde

RS41 ground check includes several functional checks: temperature check, humidity sensor recondition, humidity check and setting radiosonde parameters. Ground check is performed prior to flight for a radiosonde placed on the Ground Check Device MWH322/RI41 conveniently operated with MW32/MW41 software.

Short range wireless communication link is used in ground check devices for turning radiosonde power on and for data transfer during the ground check. The communication link is based on the RF technique within the range around 4 cm.

For the pressure measurement ground check, the sounding software compares pressure sensor reading difference against an optional barometer module installed inside the ground check device, and adjusts the measurement accordingly. Alternatively an external precision barometer can be used as the reference value and the readings entered manually.

Technical data

Measurements

Measurement cycle	1 s
Temperature sensor	Type: Platinum resistor
Measurement range	+60 °C to -95 °C
Resolution	0.01 °C
Response time (63.2%, 6 m/s flow, 1000 hPa) ¹⁾	0.5 s
Stability 1 year / 3 years	< 0.05 °C / < 0.1 °C
Accuracy:	
Repeatability in calibration	0.1 °C
Combined uncertainty after ground preparation	0.2 °C
Combined uncertainty in sounding < 16 km	0.3 °C
Combined uncertainty in sounding > 16 km	0.5 °C
Reproducibility in sounding ²⁾	
> 100 hPa	0.15 °C
< 100 hPa	0.30 °C
Humidity sensor	Type: Thin-film capacitor
Measurement range	0 to 100 %RH
Resolution	0.1 %RH
Response time	
6 m/s, 1000 hPa, +20 °C	< 0.3 s
6 m/s, 1000 hPa, -40 °C	< 10 s
Accuracy:	
Repeatability in calibration	2 %RH
Combined uncertainty after ground preparation	3 %RH
Combined uncertainty in sounding	4 %RH
Reproducibility in sounding ²⁾	2 %RH
Pressure	Type: Silicon capacitor
Measurement range	from surface pressure to 3 hPa
Resolution	0.01 hPa
Accuracy:	
Repeatability in calibration	
> 100 hPa	0.4 hPa
100 - 3 hPa	0.3 hPa
Combined uncertainty in sounding	
> 100 hPa	1.0 hPa
100 - 3 hPa	0.6 hPa
Reproducibility in sounding ²⁾	
> 100 hPa	0.5 hPa
100 - 3 hPa	0.3 hPa

1) After applying time-lag correction, the effect to measurement uncertainty is negligible.

2) Standard deviation of differences in twin soundings, ascent rate above 3 m/s for temperature and humidity

Telemetry

Compatibility	With Vaisala Radiotheodolite RT20 systems
Transmitter type	Synthesized
Frequency band	1668.4 MHz - 1690 MHz
Tuning range	1668.6 - 1689.8 MHz
Maximum transmitting range	up to 160 km
Emission bandwidth	According to EN 302 454
Output power (high-power mode)	200 mW, typical
Sideband radiation	According to EN 302 454
Modulation	GFSK
Frequency setting	Wireless with ground check device

Operational data

Power-up	Wireless with ground check device or with switch
Factory calibration	Stored on Flash memory
Battery	2 pcs AA-size Lithium cells
Operating time	> 135 min
Weight	84 g
Dimensions ¹⁾	Body (L × W × H): 155 × 63 × 46 mm Sensor boom bent (L × W × H): 282 × 63 × 104 mm
Environmental tests (transit drop, vibration)	MIL-STD-810G

1) For cover, without wire antenna

Unwinder

Material of the string	Non-UV treated polypropylene
Tenacity	< 115 N
Length of the string	55 m
Unwinding speed	0.35 m/s
Weight	25 g

Measurement performance data is expressed with 2-sigma confidence level (k=2), unless otherwise explicitly specified.
For humidity, the performance data is valid T > -60 °C



Vaisala Radiosonde RS41-SG – accuracy and reliability.

Temperature and Humidity Sensors

Vaisala Radiosonde RS41 temperature sensor is very stable, utilizing linear resistive platinum technology. The small size of the sensor results in low solar radiation error and guarantees fast response. The RS41 temperature sensor also incorporates effective protection against evaporating cooling, the phenomenon occasionally encountered when a radiosonde emerges from a cloud top.

RS41 humidity sensor integrates humidity and temperature sensing elements to provide unique features. Prior to flight, automatic recondition of the humidity sensor effectively removes chemical contaminants and ensures excellent humidity measurement accuracy. Integrated temperature sensor is used to compensate the effects of solar radiation in real time resulting in very precise measurement. The sensor heating function enables an active and effective de-icing method when a radiosonde is flying through layers with freezing conditions. The humidity sensor is very accurate throughout the whole measurement range and has fast response to detect fine structures of the atmosphere.

RS41 Ground Check

RS41 ground check includes several functional checks: temperature check, humidity sensor recondition, humidity check and setting radiosonde parameters. Ground check is performed prior to flight on a radiosonde placed on the Ground Check Device RI41 conveniently operated with MW41 software.

Wind Data, Height and Pressure

Wind, height and pressure are derived from velocity and location measurements of the RS41 GPS receiver. Height and pressure are calculated from

satellite ranging codes, combined with differential corrections from the MW41 ground station. Pressure calculation also uses temperature and humidity from the radiosonde. Wind is calculated independently based on satellite carrier frequency changes.

Data Transmission

RS41-SG has proven data transmission from radiosonde to receiver up to 350 km. This is sufficient for any sounding operations. Data availability during a sounding is guaranteed with digital error correction code transmission and telemetry errors are always detected. Due to narrow band transmission, more channels are available in the meteorological frequency band.

RS41 Calibration

RS41 temperature and humidity sensors are calibrated against the references that are traceable to SI standards and measurement uncertainties are estimated according to recommendations of Joint Committee for Guides in Metrology, 100:2008.

Unwinder

With the unwinder the radiosonde sensor boom is automatically set in an ideal position for sounding. As the unwinder is separated from the radiosonde, the balloon and unwinder can be prepared in advance to streamline launch preparations.

Add-on Sensor Connector

RS41 has a serial interface for additional sensors, primarily to connect ozone interface OIF411 to RS41. Also other sensors with Xdata protocol can be connected. The data is transferred either directly or via OIF411 to a RS41 radiosonde and further to Vaisala DigiCORA® Sounding System MW41.

Features

- Superior PTU measurement performance
- Automated ground check
- Robust and easy to use design with informative LEDs
- GPS for continuous wind data availability as well as height and pressure calculation
- Stable narrow band transmission complies with ETSI standard EN 302 054

Technical Data

Measurements

Measurement cycle	1 s
Temperature Sensor	Type: Platinum Resistor
Measurement range	+60 °C to -95 °C
Resolution	0.01 °C
Response time (63.2%, 6 m/s flow, 1000 hPa) ¹⁾	0.5 s
Stability (1 year / 3 years)	< 0.05 °C / < 0.1 °C
Accuracy:	
Repeatability in calibration	0.1 °C
Combined uncertainty after ground preparation	0.2 °C
Combined uncertainty in sounding < 16 km	0.3 °C
Combined uncertainty in sounding > 16 km	0.4 °C
Reproducibility in sounding ²⁾	
> 100 hPa	0.15 °C
< 100 hPa	0.30 °C
Humidity Sensor	Type: Thin-Film Capacitor
Measurement range	0 to 100 %RH
Resolution	0.1 %RH
Response time:	
6 m/s, 1000 hPa, +20 °C	< 0.3 s
6 m/s, 1000 hPa, -40 °C	< 10 s
Accuracy:	
Repeatability in calibration	2 %RH
Combined uncertainty after ground preparation	3 %RH
Combined uncertainty in sounding	4 %RH
Reproducibility in sounding ²⁾	2 %RH
Pressure	Type: Calculated from GPS
Measurement range	From surface pressure to 3 hPa
Resolution	0.01 hPa
Accuracy:	
Combined uncertainty / Reproducibility in sounding ²⁾	
> 100 hPa	1.0 hPa / 0.5 hPa
100 - 10 hPa	0.3 hPa / 0.2 hPa
< 10 hPa	0.04 hPa / 0.04 hPa
Geopotential Height	Type: Calculated from GPS
Measurement range ³⁾	From surface to 40 000 m
Resolution	0.1 gpm
Accuracy:	
Combined uncertainty in sounding	10.0 gpm
Reproducibility in sounding ²⁾	6.0 gpm
Wind Speed	
Velocity measurement uncertainty ⁴⁾	0.15 m/s
Resolution	0.1 m/s
Maximum reported wind speed ³⁾	180 m/s
Wind Direction	
Directional measurement uncertainty ⁴⁾	2 deg
Resolution	0.1 deg
Wind direction range	0 to 360 deg

1) After applying time-lag correction, the effect to measurement uncertainty is negligible.

2) Standard deviation of differences in twin soundings, ascent rate above 3 m/s

3) In practice unlimited

4) Standard deviation of differences in twin soundings. Wind speed above 3 m/s for directional measurement uncertainty.

Telemetry

Transmitter type	Synthesized
Frequency band	400.15 – 406 MHz
Tuning range	400.16 – 405.99 MHz
Maximum transmitting range	Up to 350 km
Frequency stability, 90 % probability	±2 kHz
Deviation, peak-to-peak	4.8 kHz
Emission bandwidth	According to EN 302 054
Output power (high-power mode)	Min. 60 mW
Sideband radiation	According to EN 302 054
Modulation	GFSK
Data downlink	4800 bit/s
Frequency setting	Wireless with ground check device

GPS Receiver (SA Off, PDOP<4)

Number of channels	≥ 48
Frequency	1575.42 MHz, L1 C/A code
Cold start Acquisition Time	35 s (nominal)
Reacquisition Time	1 s (nominal)
Correction	Differential
Reporting resolution of lat, lon position values	1e-8°

Operational Data

Power-up	Wireless with ground check device or with switch
Factory calibration	Stored on Flash memory
Battery	2 pcs AA-size Lithium cells
Operating time	> 240 min
Weight	80 g
Dimensions ¹⁾	Body (L × W × H): 155 × 63 × 46 mm Sensor boom bent (L × W × H): 282 × 63 × 104 mm

1) For cover, without wire antenna

Add-On Sensor Support

Protocol support	Xdata to connect several sensors in the same chain, data transferred either directly or via OIF411 to RS41
Transfer rate	Max. 200 bytes/s

Unwinder

Material of the string	Non-UV treated polypropylene
Tenacity	<115 N
Length of the string	55 m
Unwinding speed	0.35 m/s
Weight	25 g

The performance data is expressed with 2-sigma confidence level (k=2), unless otherwise explicitly specified.

For humidity, the performance data is valid T > -60 °C.

RS41-SGM Radiosonde

Vaisala Radiosonde RS41-SGM – security, accuracy and reliability.



Improved Security

Vaisala Radiosonde RS41-SGM features radio silence (patent EP2689279 and US 9,972,198, Method for launching and a radiosonde), which improves security of defense operations. Radiosonde transmission does not reveal the balloon launch location because the radiosonde transmitter is not switched on until a specified height or time from launch has been reached. Data is recorded also during the radio silence and, when the radio silence ends, transmitted to the ground equipment. Transmitted data is also encrypted.

Temperature and Humidity Sensors

Vaisala Radiosonde RS41 temperature sensor is very stable, utilizing linear resistive platinum technology. The small size of the sensor results in low solar radiation error and guarantees fast response. The RS41 temperature sensor also incorporates effective protection against evaporating cooling, the phenomenon occasionally encountered when a radiosonde emerges from a cloud top.

Vaisala Radiosonde RS41 humidity sensor integrates humidity and temperature sensing elements to provide unique features. Prior to flight, automatic recondition of the humidity sensor effectively removes chemical contaminants and ensures excellent humidity measurement accuracy. Integrated temperature sensor is used to compensate the effects of solar radiation in real time resulting in very precise

measurement. The sensor heating function enables an active and effective de-icing method when a radiosonde is flying through layers with freezing conditions.

RS41 Ground Check

RS41 ground check includes several functional checks: temperature check, humidity sensor recondition, humidity check and setting radiosonde parameters. Ground check is performed prior to flight for a radiosonde placed on Ground Check Device MWH322/RI41 conveniently operated with MW32/MW41 software.

Short range wireless communication link is used in ground check devices for turning radiosonde power on and for data transfer during the ground check. The communication link is based on the RF technique within the range around 4 cm.

RS41 Calibration

Vaisala Radiosonde RS41 temperature and humidity sensors are calibrated against references that are traceable to SI standards, and measurement uncertainties are estimated according to recommendations of Joint Committee for Guides in Metrology, 100:2008.

Operational Benefits

RS41-SGM has been designed for mobile use in the field. In its transport package, it has been tested to comply with MIL-STD-810G for transit drop, vibration, low and high temperature and low pressure.

Features

- Improved security thanks to radio silence and encryption
- Superior PTU measurement performance
- Automated ground check
- Robust and easy to use design
- GPS for continuous wind data availability as well as height and pressure calculation
- Stable narrow band transmission complies with ETSI standard EN 302 054
- Unwinder for consistent sensor boom positioning

Technical data

Measurements

Measurement cycle	1 s
Temperature Sensor	Type: Platinum Resistor
Measurement range	+60 °C to -95 °C
Resolution	0.01 °C
Response time (63.2%, 6 m/s flow, 1000 hPa) ¹⁾	0.5 s
Stability (1 year / 3 years)	< 0.05 °C / < 0.1 °C
Accuracy:	
Repeatability in calibration	0.1 °C
Combined uncertainty after ground preparation	0.2 °C
Combined uncertainty in sounding < 16 km	0.3 °C
Combined uncertainty in sounding > 16 km	0.4 °C
Reproducibility in sounding ²⁾	
> 100 hPa	0.15 °C
< 100 hPa	0.30 °C
Humidity Sensor	Type: Thin-Film Capacitor
Measurement range	0 to 100 %RH
Resolution	0.1 %RH
Response time:	
6 m/s, 1000 hPa, +20 °C	< 0.3 s
6 m/s, 1000 hPa, -40 °C	< 10 s
Accuracy:	
Repeatability in calibration	2 %RH
Combined uncertainty after ground preparation	3 %RH
Combined uncertainty in sounding	4 %RH
Reproducibility in sounding ²⁾	2 %RH
Pressure	Type: Calculated from GPS
Measurement range	From surface pressure to 3 hPa
Resolution	0.01 hPa
Accuracy:	
Combined uncertainty / Reproducibility in sounding ²⁾	
> 100 hPa	1.0 hPa / 0.5 hPa
100 - 10 hPa	0.3 hPa / 0.2 hPa
< 10 hPa	0.04 hPa / 0.04 hPa
Geopotential Height	Type: Calculated from GPS
Measurement range ³⁾	From surface to 40 000 m
Resolution	0.1 gpm
Accuracy:	
Combined uncertainty in sounding	10.0 gpm
Reproducibility in sounding ²⁾	6.0 gpm
Wind Speed	
Velocity measurement uncertainty ⁴⁾	0.15 m/s
Resolution	0.1 m/s
Maximum reported wind speed ³⁾	180 m/s
Wind Direction	
Directional measurement uncertainty ⁴⁾	2 deg
Resolution	0.1 deg
Wind direction range	0 to 360 deg

Telemetry

Transmitter type	Synthesized
Tuning range	400.16- 405.99 MHz
Frequency band	400.15 - 406 MHz
Frequency stability, 90 % probability	± 2 kHz
Deviation, peak-to-peak	4.8 kHz
Emission bandwidth	According to EN 302 054
Output power (high-power mode)	min. 60 mW
Sideband radiation	According to EN 302 054
Modulation	GFSK
Data downlink	4800 bit/s
Frequency setting	Wireless with MWH322/RI41
Radio silence	Up to 5 km or 20 min
Data encryption (stream cipher)	128-bit key
Transmitter termination	User-selectable based on timer or height

GPS Receiver (SA Off, PDOP<4)

Number of channels	≥ 48
Frequency	1575.42 MHz, L1 C/A code
Cold start Acquisition Time	35 s (nominal)
Reacquisition Time	1 s (nominal)
Correction	Differential
Reporting resolution of lat, lon position values	1e-8°

Operational Data

Power-up	Wireless with ground check device or with switch
Factory calibration	Stored on Flash memory
Battery	2 pcs AA-size Lithium cells
Operating time	> 240 min
Weight	80 g
Dimensions ¹⁾	Body (L x W x H): 155 x 63 x 46 mm Sensor boom bent (L x W x H): 282 x 63 x 104 mm
Environmental tests (transit drop, vibration, low and high temperature and low pressure)	MIL-STD-810G

¹⁾ For cover, without wire antenna

Unwinder

Material of the string	Non-UV treated polypropylene
Tenacity	<115 N
Length of the string	55 m
Unwinding speed	0.35 m/s
Weight	25 g

The performance data is expressed with 2-sigma confidence level (k=2), unless otherwise explicitly specified.

For humidity, the performance data is valid T > -60 °C.

Vaisala Radiosonde RS41-SGP – accuracy and reliability.



Features

- Superior PTU measurement performance with a pressure sensor
- Automated ground check
- Robust and easy-to-use with informative LEDs
- GPS for continuous wind data availability as well as additional height and pressure calculation
- Stable narrow-band transmission complies with ETSI standard EN 302 054
- Unwinder for consistent sensor boom positioning

RS41 PTU Sensors

Vaisala Radiosonde RS41 temperature sensor utilizes linear resistive platinum technology and is very stable. The small size of the sensor results in low solar radiation error and guarantees fast response. It also incorporates effective protection against evaporating cooling, a phenomenon occasionally encountered when a radiosonde emerges from a cloud top.

The humidity sensor integrates humidity and temperature sensing elements. Pre-flight automatic reconditioning of the humidity sensor effectively removes chemical contaminants and ensures excellent humidity measurement accuracy. The integrated temperature sensor is used to compensate the effects of solar radiation in real time. The sensor heating function enables an active and effective de-icing method at freezing conditions during the flight. The humidity sensor also responds quickly to detect fine structures of the atmosphere.

The pressure sensor is the same high-quality, shock-resistant capacitive silicon sensor as the one in the Vaisala Radiosonde RS92 with revised electronics and calibration.

All RS41 sensors are calibrated against references that are traceable to international standards (SI units), and measurement uncertainties are estimated according to recommendations of the Joint Committee for Guides in Metrology, 100:2008.

RS41 Ground Checks

The in-built temperature sensor check includes a comparison of readings from the temperature element of the humidity sensor and the actual temperature sensor, although no correction to radiosonde measurement is applied. With the new humidity sensor design, the radiosonde is able to generate physical zero humidity reference more consistently than is possible with

desiccants. The sensor can measure the deviation of humidity measurement at physical zero (0 %RH) and fine-tune the humidity measurement accordingly.

For the pressure measurement ground check, sounding software MW41 displays the RS41 pressure sensor reading difference against an optional barometer module installed inside the ground check device, and adjusts the measurement accordingly. Alternatively an external precision barometer can be used as the reference value and the readings entered manually.

Sensor-based Height and Pressure and GPS-based Wind Data

For meteorological messages, height and pressure measurements utilize the integrated silicon capacitive pressure sensor. Wind is calculated independently based on GPS satellite carrier frequency changes. GPS-based height and pressure measurements are also available for research purposes.

Data Transmission

Vaisala Radiosonde RS41 has a proven data transmission range from radiosonde to receiver of up to 350 km. Data availability during a sounding is guaranteed with digital error-correction code transmission, and telemetry errors are always detected. Due to narrower band transmission, more channels are available in the meteorological frequency band.

Add-on Sensor Connector

RS41 has an interface for additional sensors, primarily to connect it to ozone interface OIF411. Other sensors with Xdata protocol can also be connected. The data is transferred either directly or via a OIF411 interface to the radiosonde and onward to Vaisala DigiCORA® Sounding System MW41.

Technical data

Measurements

Measurement cycle	1 s
Temperature sensor	Type: Platinum resistor
Measurement range	+60 ... -95 °C
Resolution	0.01 °C
Response time (63.2%, 6 m/s flow, 1000 hPa) ¹⁾	0.5 s
Stability (1 year / 3 years)	< 0.05 °C / < 0.1 °C
Accuracy (Repeatability and combined uncertainty with k=2)	
Repeatability in calibration	0.1 °C
Combined uncertainty after ground preparation	0.2 °C
Combined uncertainty in sounding < 16 km	0.3 °C
Combined uncertainty in sounding > 16 km	0.4 °C
Reproducibility in sounding	
> 100 hPa ²⁾	0.15 °C
< 100 hPa ²⁾	0.30 °C
Humidity sensor	Type: Thin-film capacitor
Measurement range	0 ... 100 %RH
Resolution	0.1 %RH
Response time	
6 m/s, 1000 hPa, +20 °C	< 0.3 s
6 m/s, 1000 hPa, -40 °C	< 10 s
Accuracy (Repeatability and combined uncertainty with k=2)	
Repeatability in calibration	2 %RH
Combined uncertainty after ground preparation	3 %RH
Combined uncertainty in sounding	4 %RH
Reproducibility in sounding ²⁾	2 %RH
Pressure	Type: Silicon capacitor
Measurement range	from surface pressure to 3 hPa
Resolution	0.01 hPa
Accuracy (Repeatability and combined uncertainty with k=2)	
Repeatability in calibration	
> 100 hPa	0.4 hPa
100 - 3 hPa	0.3 hPa
Combined uncertainty in sounding	
> 100 hPa	1.0 hPa
100 - 3 hPa	0.6 hPa
Reproducibility in sounding ²⁾	
> 100 hPa	0.5 hPa
100 - 3 hPa	0.3 hPa
Wind speed	
Velocity measurement uncertainty ³⁾	0.15 m/s
Resolution	0.1 m/s
Maximum reported wind speed ⁴⁾	180 m/s
Wind direction	
Directional measurement uncertainty ³⁾	2 deg
Resolution	0.1 deg
Wind direction range	0 to 360 deg

- 1) After applying time-lag correction, the effect to measurement uncertainty is negligible.
 2) Standard deviation of differences in twin soundings, ascent rate above 3 m/s for temperature and humidity
 3) Standard deviation of differences in twin soundings. Wind speed above 3 m/s for directional measurement uncertainty.
 4) In practice unlimited

Telemetry

Transmitter type	Synthesized
Frequency band	400.15 – 406 MHz
Tuning range	400.16 – 405.99 MHz
Maximum transmitting range	up to 350 km
Frequency stability, 90 % probability	± 2 kHz
Deviation, peak-to-peak	4.8 kHz
Emission bandwidth	According to EN 302 054
Output power (high-power mode)	min. 60 mW
Sideband radiation	According to EN 302 054
Modulation	GFSK
Data downlink	4800 bit/s
Frequency setting	Wireless with ground check device

GPS receiver (SA Off, PDOP<4)

Number of channels	≥ 48
Frequency	1575.42 MHz, L1 C/A code
Cold start acquisition time	35 s (nominal)
Reacquisition time	1 s (nominal)
Correction	Differential
Reporting resolution of lat, lon position values	1e-8°

Operational data

Power-up	Wireless with ground check device or with switch
Factory calibration	Stored on Flash memory
Battery	2 pcs AA-size Lithium cells
Operating time	> 240 min
Weight	84 g
Dimensions ¹⁾	Body (L × W × H): 155 × 63 × 46 mm Sensor boom bent (L × W × H): 282 × 63 × 104 mm

1) For cover, without wire antenna

Add-on sensor support

Protocol support	Xdata to connect several sensors in the same chain, data transferred either directly or via OIF411 to RS41
Transfer rate	max. 200 bytes/s

Unwinder

Material of the string	Non-UV treated polypropylene
Tenacity	< 115 N
Length of the string	55 m
Unwinding speed	0.35 m/s
Weight	25 g

The performance data is expressed with 2-sigma confidence level (k=2), unless otherwise explicitly specified.

For humidity, the performance data is valid T > -60 °C.



Features

- Designed for atmospheric profilings from aircraft flight level to surface
- Used for tropical cyclone reconnaissance and research, data acquisition over oceans as input for Numerical Weather Prediction (NWP) models, and in various field campaigns to acquire data for meteorological research and for validation of other airborne instrumentation
- Measures pressure, temperature, and humidity values, and reads wind direction and speed data from the point of launch to the surface
- Airborne Vertical Atmospheric Profiling System (AVAPS®) onboard the aircraft receives, displays, stores, and distributes dropsonde data for further use

Dropsonde RD41 is a meteorological measurement device for use in atmospheric profilings from aircraft flight level to surface. Descending through the atmosphere by a parachute, it measures the profiles of pressure (P), temperature (T), and relative humidity (U), and reads wind direction and speed data from the point of launch to the surface.

Dropsonde RD41 is used for tropical cyclone reconnaissance and research, data acquisition over oceans as input for Numerical Weather Prediction (NWP) models, and in various field campaigns to acquire data for meteorological research and for validation of other airborne instruments. RD41 transmits data to the Airborne Vertical Atmospheric Profiling System (AVAPS®) onboard the aircraft using narrow bandwidth Frequency Shift Key (FSK) modulation in the 403 MHz meteorological band.

Proven Measurement Performance

RD41 is based on the same Vaisala-made sensors and unique measurement technology as the RS41 radiosonde family. The temperature sensor utilizes linear resistive platinum technology and is very stable. The humidity sensor integrates humidity and temperature sensing elements. The pressure sensor is the same high-quality, shock-resistant capacitive silicon sensor as the one in Vaisala Radiosonde RS92 and Dropsonde RD94, but with revised electronics and calibration. All sensors are calibrated against references that are traceable to international standards. The sensors are effectively protected from freezing, wet bulb, and solar radiation errors. Winds are measured using a commercial GPS receiver. Wind profiles from multiple simultaneous dropsondings show good consistency.

Designed for Aircraft Use

RD41 is designed for aircraft use, and it is launched through the body of an aircraft. Specially designed launchers are used for both pressurized and unpressurized cabin aircrafts. The delayed deployment

mechanism ensures proper clearance from the aircraft and allows the parachute to open safely. The specially designed parachute stabilizes RD41 by aligning it properly for measurements, and its small gliding factor ensures proper measurement of wind speed and direction. The descent speed of the RD41 is approximately 11 m/s at the sea level and about 21 m/s in 12-km altitude. In strong convective circumstances, the descent rate can vary, and even negative (descent) rates are measured.

RD41 measures PTU values twice, and wind speed and direction readings four times a second. This means that the last measured pressure level is about 5-6 meters above the surface at maximum. The robust design of RD41 ensures safe use of the legacy launchers and high speed deployment of the parachute.

Dropsonde Receiving System

Onboard the aircraft, the AVAPS® system receives, displays, stores, and distributes dropsonde data for further use. AVAPS® is compatible with dropsondes, not with the conventional Vaisala radiosondes, and vice versa. AVAPS® can be configured to track up to eight dropsondes at the same time. This is an essential ability in operations carried out with a high-speed, high-altitude aircraft when dense horizontal resolution of data is required. AVAPS® can be set to provide the data automatically for the aircraft data system for further use. Dropsonde technology developer NCAR/EOL provides ASPEN data post-descent processing software for dropsonde users.

Technical Data

Dropsonde RD41

Weight	350 g
Size	Diameter 70 mm, length 410 mm
Maximum deployment airspeed	325 KIAS (indicated airspeed)
Shelf life	1 year from delivery

Transmitter - EN302054

Tuning range	400.16 ... 405.99 MHz
Frequency stability	< ±10 kHz
RF power output	< 200 mW
Channel spacing	200 kHz
Modulation	FSK
Harmonic and spurious output	According to EN302054
Telemetry range with recommended receiving antenna	325 km

Battery

Type	Two lithium 123 cells in series
Voltage	6 V nominal
Life	2 hours (operating), 3 years (shelf)

Pressure Sensor (P)

Type	Silicon capacitor
Range	From surface pressure to 3 hPa
Resolution	0.01 hPa
Repeatability ¹⁾	0.4 hPa

¹⁾ Standard deviation of differences between two successive repeated calibrations, k = 2 confidence level

Temperature Sensor (T)

Type	Platinum resistor
Range	-90 ... +60 °C
Resolution	0.01 °C
Repeatability ¹⁾	0.1 °C
Response time (when used and measured in Vaisala Radiosonde RS41):	
6 m/s, 1000 hPa	0.5 s

¹⁾ Standard deviation of differences between two successive repeated calibrations, k = 2 confidence level

Relative Humidity Sensors (U)

Type	Thin-film capacitor
Range	0 ... 100 %RH
Resolution	0.1 %RH
Repeatability ¹⁾	2 %RH
Response time (when used and measured in Vaisala Radiosonde RS41):	
6 m/s, 1000 hPa, +20 °C	< 0.3 s
6 m/s, 1000 hPa, -40 °C	< 10 s

¹⁾ Standard deviation of differences between two successive repeated calibrations, k = 2 confidence level

Wind (Horizontal)

Commercial GPS receiver

Data Rates

PTU update rate	2 Hz
Wind update rate	4 Hz

Descent

Descent speed	Approx. 11 m/s at sea level
Descent Time	
From 14 km	Approx. 15 mins
From 7.5 km	Approx. 8 mins



Intellectual Property Rights and Development

Vaisala Inc., USA, manufactures and markets the Dropsonde RD41 and AVAPS® Dropsonde Receiving System under license to University Corporation for Atmospheric Research (UCAR). The dropsonde and receiving system hardware and software have been developed at the Earth Observing Laboratory (EOL) of the National Center of Atmospheric Research (NCAR), in Boulder, Colorado, USA. AVAPS® is a registered trademark of the University Corporation for Atmospheric Research.





Features

- Interface for wireless short range communication between Vaisala Radiosonde RS41 family and Vaisala sounding software
- Interface is active – no short range transmitter in radiosonde
- Detects and powers up RS41 automatically
- Fully compliant with ETSI EN 302 291-1 and ETSI EN 302 291-2
- RI41-B is equipped with precise barometer module

Vaisala Ground Check Device RI41 – reliability with RS41 radiosonde.

RI41 is an essential tool for carrying out ground preparation of Vaisala Radiosonde RS41. RI41-B is similar to RI41 but is equipped with a barometer module to provide an alternative to the ground check of the radiosonde's pressure measurement or surface pressure observation. Both RI41 and RI41-B are configured and operated with Vaisala sounding systems.

RS41 ground check with RI41 and RI41-B

Vaisala sounding system detects and automatically powers up RS41 radiosonde when it is placed onto the ground check device.

Radiosonde preparation includes sensor functionality checks and setting the options for in-flight operational parameters, like timer to power off the radiosonde at the desired time, pressure, or altitude. During the preparation, the operator can also set the transmitter frequency of the radiosonde or apply the station default frequency.

Temperature checks

A ground check of RS41 temperature sensor includes several advanced electrical checks and a comparison against the temperature element of the

humidity sensor. For RS41 temperature sensor only comparison is made, meaning no corrections to radiosonde measurement are applied. Due to the lack of environmental control, the acceptance limits for the comparison are set accordingly.

Humidity checks

The unique design of the sensors in RS41 enables automatic reconditioning and physical zero humidity check of the humidity sensor during ground preparations. Prior to flight, reconditioning effectively removes chemical contaminants that could affect the humidity measurement. The physical zero humidity check is based on generating dry conditions by heating the humidity sensor. This results in dry reference corrections that are more reliable than those made using drying desiccants with limited drying capacity.

Pressure checks and surface pressure

For the pressure measurement ground check, Vaisala sounding software compares the pressure sensor reading of RS41 with that of the RI41-B's highly accurate, built-in barometer module and adjusts the measurement accordingly.

Alternatively, an external precision barometer can be used for the comparison and the pressure value can be manually entered in Vaisala sounding software.

The pressure measurement from the RI41-B barometer module can also be used as a surface pressure value, when sounding station parameters are set accordingly.

Wireless short-range communication link

RI41/RI41-B uses a wireless short-range data link for communication between RS41 and the sounding system. The link uses RF technology and has a range of 4 cm (1.57 in). During ground preparations, only RI41/RI41-B device is active, and there is no short-range transmitter on the radiosonde. The communication link operates at 13.56 MHz and is fully compliant with the ETSI EN 302 291-1 and ETSI EN 302 291-2 standards.

Technical data

Operating environment

Operating temperature	+10 ... +45 °C (+50 ... +113 °F)
Storage temperature	-40 ... +65 °C (-40 ... +149 °F)
Operating humidity	10 ... 90 %RH
Storage humidity	5 ... 95 %RH
Operating frequency (carrier)	13.56 MHz
Short range wireless communication	RF technique
Transmitting power	Max. 200 mW
Communication link range	0.04 m (1.57 in)
Electrical interface	USB 1.1/2.0
Cable with connector	USB

Inputs and outputs

Power supply

Input	Via USB interface
Voltage	5 VDC
Typical current	300 mA

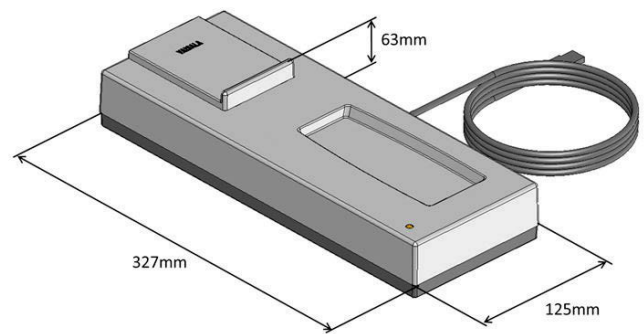
Mechanical specifications

Dimensions (H × W × L)	63 × 125 × 327 mm (2.48 × 4.92 × 12.87 in)
Weight	1.1 kg (2.43 lb)
Material	Polyurethane
Cable length	1.8 m (5 ft 11 in)

Reference sensors

Pressure	Only in the RI41-B model
Calibration of the module	Class A, NIST traceable
Uncertainty ¹⁾	0.15 hPa
Long term stability	0.1 hPa/year

¹⁾ The recommended in-field calibration interval for barometer module is one year





Features

- Rugged radiosonde interface for Vaisala Sounding Systems MW32 and MW41
- Utilizes wireless short range data link to communicate with Vaisala Radiosonde RS41
- Radiosonde can be prepared inside its protective cardboard package and with gloves or arctic mittens on
- Military grade switch activates the interface when radiosonde is placed onto MWH322 – no short range transmitter in radiosonde
- Detects automatically the RS41 radiosonde and powers it up
- Fully compliant with ETSI EN 302 291-1 and -2
- Equipped with precise barometer modules

Vaisala Radiosonde Ground Check Device MWH322 has been designed for the ground preparation of Vaisala Radiosonde RS41 in field conditions.

Versatile and Convenient

MWH322 can be conveniently operated with both Vaisala MARWIN® Sounding System MW32 and Vaisala DigiCORA® Sounding System MW41. MWH322 version for MW32 is equipped with a serial cable and it connects to MW32's serial radiosonde connector. The version for MW41 is equipped with a USB cable and it connects to a USB connector of the sounding PC.

MWH322 can be operated on a desk, or attached to MW32's handle. In case of a vehicle or shipboard installation, optional Vehicle Installation Kit can be used to mount it e.g. on a table or a wall. The kit has been tested to meet Crash Hazard Shock specification according to MIL-STD 810G, and it also allows quick removal of MWH322 if needed.

As RS41 radiosonde is placed onto the MWH322 the sounding system MW32/MW41 detects the radiosonde and automatically powers it up. The radiosonde can be secured in place with a rubber strap.

The version with serial cable has been tested to fulfill all relevant environmental specifications according to MIL-STD 810G, and electromagnetic emission and immunity specifications according to MIL-STD 461F.

Ease of Use

Thanks to the wireless connection, the radiosonde can be prepared inside its cardboard package, which protects sensors until balloon launch site. MWH322 can easily be operated with gloves or arctic mittens on.

RS41 Ground Check at MWH322

The Vaisala Radiosonde RS41 temperature sensor is very stable utilizing linear resistive platinum technology. The humidity sensor integrates humidity and temperature sensing elements providing consistent results in all sounding conditions.

The Vaisala Radiosonde RS41 sensors are all calibrated against references that are traceable to international standards (SI units).

During the radiosonde preparation procedure several steps are carried out including functionality checks for sensors and setting the radiosonde frequency and the optional in-flight operational parameters, like radio silence (with Vaisala Radiosonde RS41-SGM), and timer for turning the radiosonde power off either after desired time or altitude.

For the ground check of the RS41 temperature sensor, several intelligent electrical checks and a comparison against the temperature element of the humidity sensor is conducted. For the RS41 temperature sensor only comparisons are made, thus no corrections to radiosonde measurement are applied.

Reliable Measurements

The unique sensor designs of Vaisala Radiosonde RS41 enable automatic reconditioning and physical zero humidity check of the humidity sensor during the ground preparations. Prior to flight, reconditioning effectively removes chemical contaminants that could affect humidity measurement. The physical zero humidity check is based on generating dry conditions by heating the humidity sensor. This enables long radiosonde storage time. This results in dry reference corrections that are more reliable than those made utilizing drying desiccants with limited drying capacity.

The pressure measured with the precise barometer modules inside MWH322 can be used as a surface pressure in MW32 and MW41 sounding systems.

The Short Range Communication Link of MWH322

MWH322 utilizes wireless short range data link to communicate with Vaisala Radiosonde RS41. The communication link is based on the RF technology

having a range of 4 cm. During ground preparations only the MWH322 device is active, while there is no short range transmitter on the radiosonde.

The communication link is completely switched off when there is no radiosonde. A military grade switch activates the interface when radiosonde is placed onto MWH322.

The short range communication link of Vaisala Ground Check Device MWH322 operates at 13.56 MHz and is tested to be fully compliant with the standard ETSI EN 302 291-1 and -2.

Technical data

Operating environment

Operating temperature	-20 ... +50 °C
Storage temperature	-40 ... +71 °C
Operating humidity	0 ... 100 %RH
Storage humidity	5 ... +95 %RH

Inputs and outputs

Input	From MW32 or PC
Voltage, MW32	9 VDC
Typical current, MW32	150 mA
Voltage, PC	5 VDC
Typical current, PC	200 mA

Mechanical specifications

Short range wireless communication	RF technique
Frequency (carrier)	13.56 MHz
Transmitting power	Max. 200 mW
Communication link range	0.04 m
Electrical interface	MW32 or USB 1.1/2.0
Cable with connector	MIL-C-26482 (MW32) or USB
Cable length	1 m (MW32) or 1.5 m (USB)
Weight	1.43 kg without handle locking mechanism 1.79 kg with handle locking mechanism
Dimensions (H × W × L)	72 × 150 × 223 mm without handle locking mechanism 72 × 220 × 223 mm with handle locking mechanism

Compliance

IP rating	IP65
Environmental tests	MIL-STD-810G, see separate list
Electromagnetic compliance	MIL-STD-461F, see separate list



Vaisala MARWIN Sounding System MW32 and Vaisala Ground Check Device MWH322 with Vaisala Radiosonde RS41-SGM in its cardboard package.



Features

- Software Defined Radio technology for outstanding telemetry link performance and bandwidth efficiency
- Optimum performance when used with the Vaisala RS41-SG, RS41-SGP, or RS41-SGM radiosonde.

Vaisala Sounding Processing Subsystem SPS311G is the latest generation of the SPS-series for the Vaisala DigiCORA® Sounding System MW41.

Software Defined Radio Technology in Use

SPS311G makes extensive use of Software Defined Radio (SDR) technology for receiving radiosonde signals. SDR technology is mature and commonly used today in a wide range of products including cellular base stations, military communication systems and public safety radios.

Radio Technology Programmed in Software

In SPS311G, most of the radio technology is programmed in software to work with a powerful Digital Signal Processor (DSP). This greatly improves flexibility and the future upgradability of both the hardware and software. SPS311G's SDR receiver works with the Vaisala RS41

radiosonde family. When used with the Vaisala RS41 Radiosondes, SPS311G offers excellent telemetry link performance and bandwidth efficiency. As a sounding progresses, SPS311G receives the radiosonde and GPS signals by means of the SDR receiver and local antennas. SPS311G decodes the data and relays it to the sounding workstation for processing and archiving.

Technical data

Operating environment

Indoor use. Altitude up to 2000 meters.

Operating temperature range	0 ... + 45 °C
Operating humidity	10 ... 90 %RH (non-condensing)
Storage temperature	-55 ... + 70 °C
Storage humidity	5 ... 95 %RH

Mechanical specifications

Dimensions	235 × 335 × 184 mm
Weight	7.5 kg max.
Cooling system	Forced air convection, three fans

Inputs and outputs

Power consumption	70 W max.
Mains voltage nominal	100 ... 240 VAC
Mains frequency	50 / 60 Hz
DC power connection	19 ... 36 VDC, 60 W max.
UHF Connector	Coaxial N-type female
GPS Connector	Coaxial TNC-type female
VLF Connector	Coaxial C-type female
Antenna power	Antenna amplifiers are powered through antenna cables

Radio receiver system

Modulation	GFSK, GMSK, FM, FSK
Frequency range	400.15 ... 406 MHz
Sensitivity with RS41 and RS92 radiosondes	-120 dBm
Noise figure	< 2.5 dB
Image rejection	70 dB
Spurious Free Dynamic Range with RS41 and RS92 radiosondes	90 dB
Third Order Intercept Point (IIP3)	0 dBm
Input impedance	50 Ω

(specifications valid with Vaisala telemetry antennas)

Features

- Easy set up with captive parts
- Long telemetry range - 150 km (93.2 mi) using the RS41 series GPS radiosondes



Vaisala Portable Antenna Set CG31 is a portable antenna designed to be used with GPS wind-finding systems.

The antenna set consists of a Helix UHF antenna with antenna amplifier and GPS antenna on a tripod. The antenna set is painted green as standard. One person can handle and assemble the antenna set. CG31 receives radiosonde signals in 400 MHz meteorological UHF band.

Technical data

GPS antenna

Primary power	+5 VDC (±10 %)
Power consumption	22 mA, 0.11 W (nominal)
Output impedance	50 Ω
Frequency	L1 (1575 MHz)
Polarization	Right-Hand Circular Polarization (RHCP)
VSWR	2 : 1
Axial ratio	2 dB at zenith, 10 dB above 10° elevation
Gain	35 dB (nominal)
Noise	2.75 dB (nominal)
Pass-band width	50 MHz
Azimuth coverage	360° (omni-directional)
Elevation coverage	0° to 90° elevation (hemispherical)

Mechanical specifications

Diameter	Footprint 1133 mm (44.61 in)
Total height assembled	1695 mm (66.73 in)
Transportation case dimensions	1380 × 355 × 385 mm (54.33 × 13.98 × 15.16 mm)
Standard cable length	20 m (65 ft)
Connector	
UHF Antenna	Coaxial N-type female
GPS Antenna	Coaxial TNC-type female
Weight	
With cables	10.5 kg (23.15 lb)
With accessories and transport case	23 kg (50.71 lb)

Operating environment

Operating temperature range	-40 ... +55 °C (-40 ... +131 °F)
Operating humidity range	0 ... 100 %RH
Operating precipitation	Unlimited
Maximum wind speed	65 m/s (145 mph)
Storage temperature	-50 ... +71 °C (-58 ... +159.8 °F)
Storage humidity	0 ... 100 %RH

CG32 Vehicle Antenna Set

Vaisala Vehicle Antenna Set CG32 is an antenna configuration designed to be used for operation in vehicles. The antenna set can be used with GPS wind finding systems out in the field.

Designed for Field Operation Conditions

The antenna set consists of a UHF antenna, a spring base with a GPS antenna, and Antenna Amplifier and Switch RAA111 at the base of the antenna. The antenna can be attached to a vehicle wall with a mounting plate, or it can be mounted on a mast. The color of the antenna parts is adjusted for field operation conditions and the metal parts are made from stainless steel, brass and aluminum. One person can transport and assemble the antenna set.

Vaisala Vehicle Antenna Set CG32 receives radiosonde signals in 400 MHz meteorological band. The antenna set can be used in conjunction with the Vaisala MARWIN® Sounding System MW32.

Easy to Assemble

CG32 can be mounted on a vehicle-wall or mast. The antenna set is delivered with Antenna Amplifier and Switch RAA111 and the antenna cables connected.



Features

- Fixed to the vehicle - no need to erect and dismantle a tripod
- Rugged and durable
- Long telemetry range - 150 km (93.2 mi) using the RS41 series GPS radiosondes

Technical data

UHF Antenna

Type	Centered dipole
Frequency range	400 ... 406 MHz
Gain	2 dBi
Polarization	Vertical
Horizontal pattern	Omni-directional

Telemetry range

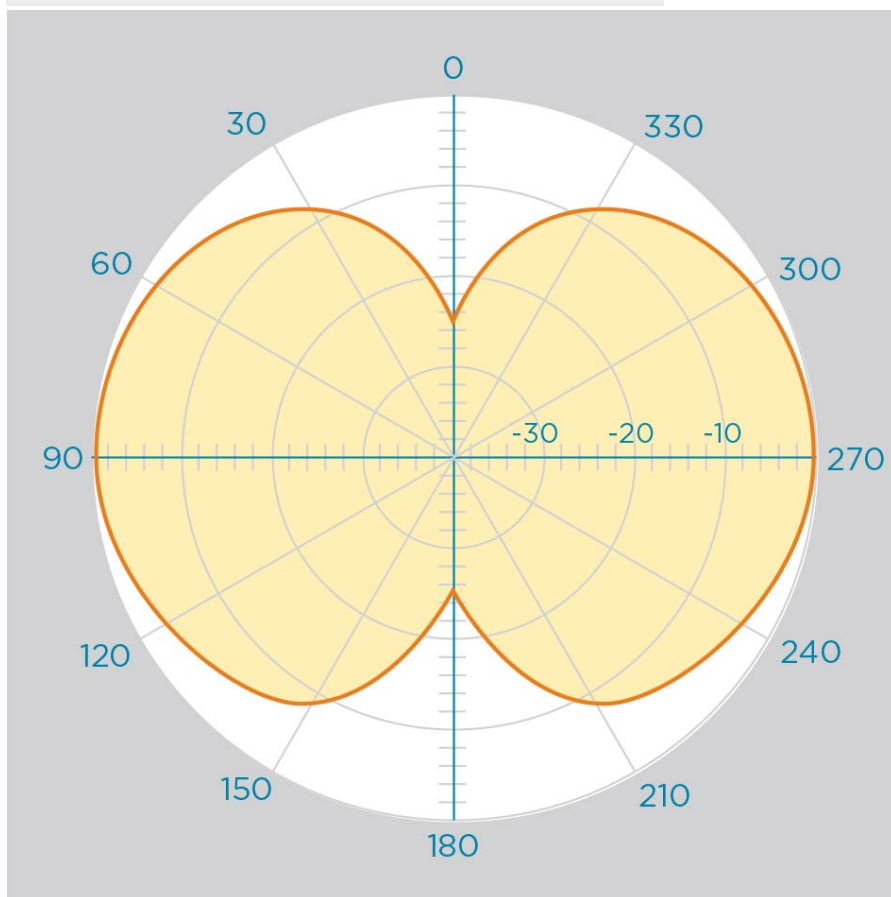
With RS41 series GPS radiosondes 150 km (93.2 mi)

Amplifier

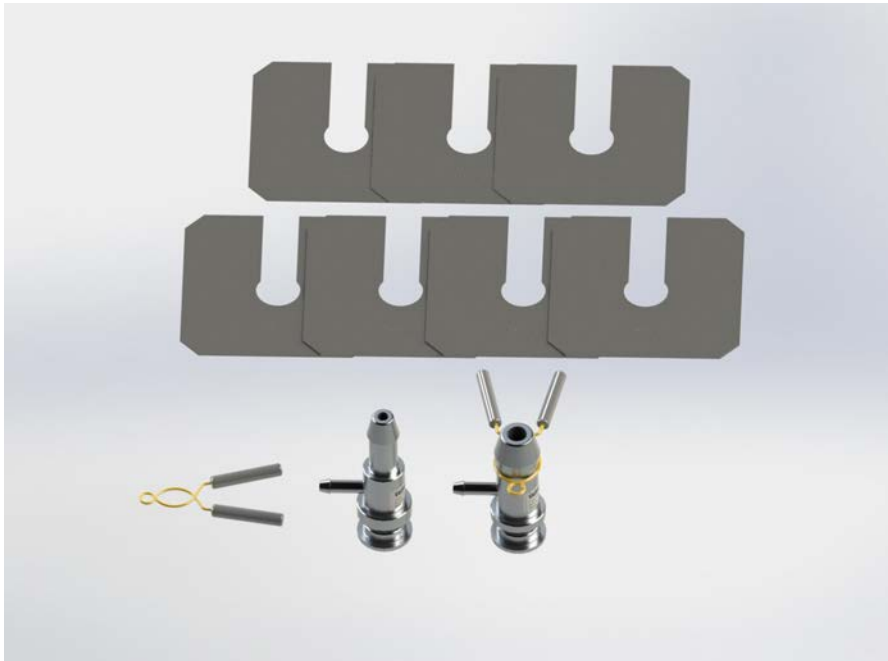
Gain	20 dB typical
Noise figure	< 2 dB
Power input	+10 ... 12 VDC, typically 130 mA through RF cable
Output impedance	50 Ω , VSWR < 1.5



CG32 internal and external cables



UHF antenna radiation pattern - elevation



Features

- Two nozzles for balloons with different sized necks
- Grounded to remove static electricity

Vaisala Filling Balance FB13 is used as ballast when filling radiosonde balloons in order to obtain the correct lift (free lift + payload) for the sounding balloon.

Ballast for Optimizing Nozzle Lift

Vaisala Filling Balance FB13 facilitates the use of radiosondes. It is used as ballast for obtaining the correct nozzle lift (free lift plus payload) for the sounding balloon. Nozzle lift refers to the weight a balloon is capable of lifting when filled. In addition, the balance also acts as a gas inflation pipe.

Two Nozzle Sizes for Convenient Filling

FB13 contains two different nozzles for convenient attachment of balloons with small and large neck diameters.

The balloon neck is secured on the nozzle with a spring clamp. Each nozzle has a clamp of its own, and the nozzles are easily interchangeable.

The small nozzle is 130 mm high with a diameter of 20 mm. The large nozzle is 150 mm high with a diameter of 42 mm.

Grounding Removes Static Electricity

During balloon filling, the required nozzle lift is obtained by loading the nozzle with additional weight. The FB13 nozzles are made of aluminum, and are grounded to remove possible static electricity formed during the balloon inflation. The weights are made of stainless steel.

Nozzle lifts from 0.4 kg to 2.8 kg for the big nozzle, and from 0.3 kg to 2.7 kg for the small nozzle can be obtained by loading weights in intervals of 0.1, 0.2, and 0.4 kg onto the nozzle.

Vaisala GPS Antenna GA31 is used with the Vaisala Sounding Systems for the local reception of GPS signals when performing GPS soundings. GA31 is suitable for stations equipped with the GPS wind finding system.

Data Directly from GPS Satellites

Vaisala GPS Antenna GA31 allows Vaisala Sounding Systems to gather orbital and other navigational data directly from the GPS satellites. The local reception is also used to get differential corrections for positioning.

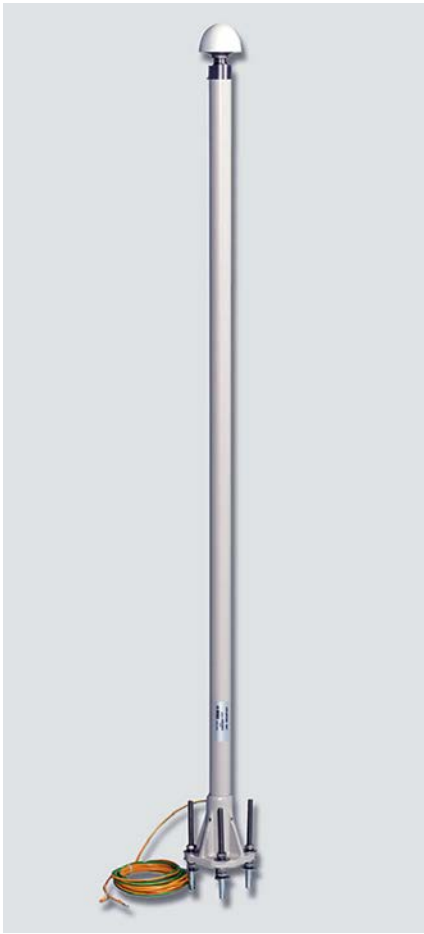
Achieving Optimal Reception

GPS signal reception requires an unobscured line-of-sight to the GPS satellites. Seen from the zenith, an open sky angle of at least 75 degrees is necessary. The best reception is achieved with a location that has a clear view of

the sky down to the horizon in every direction. The Vaisala GPS Antenna GA31 is equipped with a 35 dB pre-amplifier. A band pass filter renders the GA31 immune e.g., to Inmarsat and radar interference.

Protected against Weather Conditions

The Vaisala GPS Antenna GA31 is sealed with epoxy for protection against ambient conditions. It is shipped with a 1.5-meter aluminum pole with a cast-aluminum flange and pole mounting clips and 33 meters of cable.



Features

- Receives data from GPS satellites
- 35 dB pre-amplifier
- Epoxy seal for protection against ambient conditions
- 33 meter long N-to-TNC cable for connecting to sounding instruments.

Technical data

Operating Environment

Operating temperature	-40 ... +85 °C
Storage temperature	-55 ... +100 °C
Operating humidity	0 ... 100 %RH
Storage humidity	0 ... 100 %RH
Operating precipitation	Unlimited
Maximum wind speed	65 m/s

Inputs and Outputs

Primary power	+5 VDC (±10 %)
Power consumption	22 mA, 0.11 W (nominal)
Output impedance	50 Ω
Operating frequency	L1 (1575 MHz)
Polarization	Right-hand circular polarization (RHCP)

Mechanical Specifications

Weight (without cables)	2.6 kg
Height	1.6 m
Mounting	Pedestal flange or pole clamps

General

VSWR	2:1
Axial ratio	2 dB at zenith, 10 dB above 10° elevation
Gain	35 dB (nominal)
Noise figure	2.75 dB (nominal)
Pass-band width	50 MHz
Cable attenuation	17 dB > A > 7 dB at 1.5 GHz
Azimuth coverage	360° (omni-directional)
Elevation coverage	0 ... 90° (hemispherical)

RM32 Telemetry Antenna

Vaisala Telemetry Antenna RM32 is an omnidirectional UHF antenna used with the Vaisala DigiCORA[®] Sounding System to receive radiosonde signals in the 400 MHz meteorological band. It includes 2 antenna elements and a switch for selecting the antenna element with the best reception.

Optimal Performance in All Elevation Angles

RM32 has 2 antenna elements which have been selected to optimize the performance in all elevation angles, both near the horizon and at the zenith. The vertical antenna has a maximum gain of 5 dBi just below zero elevation, and the helix antenna has approximately hemispheric coverage and a maximum gain of 3 dBiC at the zenith.

Selects the Antenna with the Best Reception

RM32 includes an antenna amplifier with a two-position antenna switch, through which the sounding system selects the antenna with the best reception. All the

amplifier parts are housed in a waterproof box at the base of the antenna mast. The amplifier runs on DC voltage supplied by the UHF receiver.

For Fixed and Portable Systems

RM32 is well suited for fixed installations, but it can also be used in portable systems, when feasible. The mounting sleeve at the bottom of the tubular stand makes it easy to install the whole antenna assembly on top of an external mast.



Features

- Radiation pattern optimized for radiosonde reception
- Long telemetry range, up to 200 km
- For use with RS41-SG, RS41-SGP, or RS41-SGM radiosonde
- Includes vertical and helix antennas

Technical data

Antennas

Frequency range 400.15 ... 406 MHz

Vertical Antenna

Directivity 5.1 dBi

Polarization Vertical

Horizontal pattern Omnidirectional

Helix Antenna

Gain 3 dBiC

Polarization Right-hand circular

Horizontal pattern Omnidirectional with hemispheric coverage

Telemetry Range

With RS41-SG, RS41-SGP, and RS41-SGM radiosonde 200 km

Amplifier

Gain 20 dB typical

Noise figure < 2 dB

Operating voltage +10 ... 12 VDC

Typical power consumption 130 mA through antenna cable

Output impedance 50 Ω

VSWR < 1.5:1

Mechanical Specifications

Height with tubular mast 1912 mm

Weight (with antenna cable) 11.4 kg

Weight (without antenna cable) 6.3 kg

Distance between the antennas 300 mm

Antenna cable

Connector Coaxial N-type male

Standard length 33 m

Mounting sleeve for mounting to external mast

Inner diameter 61.5 mm

Depth 90 mm

Operating Environment

Operating temperature -40 ... +55 °C

Operating humidity 0 ... 100 %RH

Operating precipitation Unlimited

Maximum wind speed 65 m/s

Storage temperature -50 ... +100 °C

Storage humidity 0 ... 100 %RH



Features

- Meteorological profile data for artillery ballistic preparation and numerical weather prediction models
- Independent and passive windfinding

The Vaisala Radiotheodolite RT20A is the independent and passive windfinding solution available as an option for Vaisala sounding systems.

The Vaisala Radiotheodolite RT20A is easy to assemble, dismantle and transport by truck, trailer or helicopter. The RT20A accurately locates radiosondes during soundings using a modern interferometric technique and light tracking motors. Advanced signal processing ensures data accuracy and reliability. The RT20A meets all the operational needs of defense forces while fulfilling stringent environmental and EMC/EMI requirements.

Accurate Wind Data Even at Low Elevation Angles

The windfinding accuracy of the Vaisala Radiotheodolite RT20A is maintained even at low elevation angles, where ground reflections can cause some theodolite problems. The typical wind vector error (standard deviation) is less than 1 m/s at elevation angles above 17 degrees and less than 1.5 m/s above elevation angles of 15 degrees up to an altitude of 20 kilometres. Good accuracy is achieved even at an elevation angle of 12 degrees. This accuracy is a result of the RT20A's excellent

attenuation of ground reflection, its sophisticated data processing capabilities, and its unique antenna array design.

Automatic Tilt Compensation for Dependable Data

Soft ground or snow can cause the mechanical attitude of a radiotheodolite to shift during a sounding, leading to erroneous elevation angle and wind data. The Vaisala Radiotheodolite RT20A compensates for this by means of a tilt sensor that automatically adjusts the RT20A's mechanical attitude. This feature ensures that correct wind data is collected even in difficult terrain and sounding conditions.

Ready for Sounding in under 15 Minutes

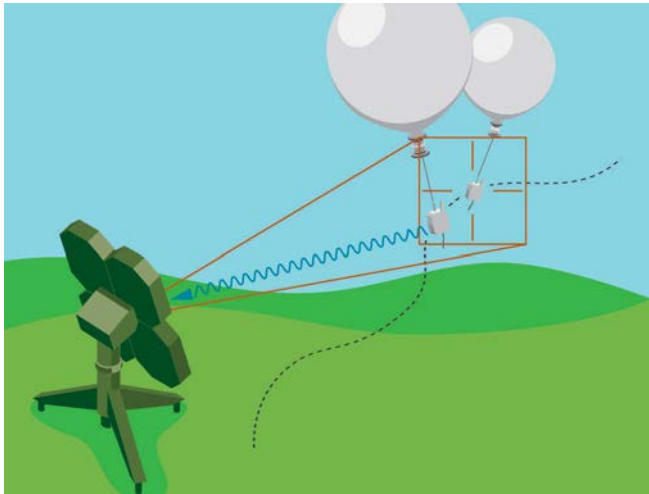
When disassembled in its rugged carrying cases, the Vaisala Radiotheodolite RT20A can be transported with light vehicles. After arriving onsite, it is quick to assemble.

The four interchangeable antenna elements have quick-lock mechanisms - two experienced operators will have the RT20A ready for sounding in under 15 minutes. Alternatively, the RT20A can be installed and operated on a trailer.

Accurate Calculation of Azimuth and Elevation Angles

The angle at which the radiosonde signal arrives at the RT20A is calculated by means of phase comparison. This method uses mathematical formulas that are applicable regardless of signal strength or variations in radio frequency. Off-axis tracking ensures high accuracy without using conventional servomotors. Zero-backlash synchronized encoders measure the mechanical attitude of the RT20A with great accuracy. The mechanical and electronic measurements are combined, and the true azimuth and elevation angles are calculated accurately. This combination of electronic and mechanical measurement ensures reliable operation and uses small servomotors that consume little power.

Technical data



General

Average wind vector accuracy (calculated from METCM messages)	Better than 1 m/s with EL angle > 17°
Distance from antenna to Sounding Processor	Max. 30 + 30 m
Primary power	115/230 VAC or 24 VDC (vehicle battery)
Operating temperature	-30 ... +55 °C (Radiotheodolite)

Antenna

Tracking principle	Phase comparison
Antenna type	Four 24-element arrays
Polarization	Vertical
Gain	Min. 16 dBi
Side lobe attenuations	> 20 dB to the direction of specular ground reflection on flat terrain when EL angle > 14°

AZ-EL Platform

Rotation	Continuous azimuth -5° to 95° elevation
Drives	DC motors with low backlash reducing gears
Slewing speed	25°/s, AZ and EL.
Angular position reading	Synchro decoders, no backlash, 0.02 w° resolution (14 bits)

Receiver

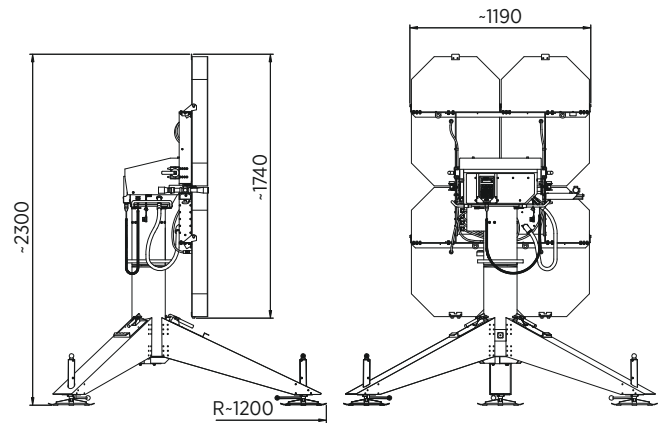
Tuning frequency range	1660 ... 1700 MHz
Tuning	Manual with automatic frequency control Automatic search and lock on
Sensitivity	-110 dBm RF input and 12 dB S+N/N
IF bandwidth	300 kHz
Automatic gain control dynamic range	-110 dBm ... 0 dBm

Dimensions

Height	2300 mm
Foot span diameter	2400 mm

Antenna Arrays

Height	1740 mm
Width	1190 mm
Weight	172 kg



Dimensions in mm



Features

- Upper-air observation station for marine conditions.
- Radiosonde data collection and transmission in standard WMO message format, TEMP SHIP and BUFR.
- Radiosonde launcher: ALS211

Vaisala ASAP Sounding Station is a semi-automatic upper-air observation station for use on-board ships. ASAP receives the radiosonde signals and converts them into meteorological messages.

The Vaisala ASAP Sounding Station converts radiosonde signals into meteorological messages, which are forwarded in standard WMO message format, TEMP SHIP and BUFR through satellite system to land station. Vaisala automatic weather stations can be integrated in order to bring data into the system for surface weather observation and SYNOP SHIP message.

Accurate Meteorological Measurements

The Vaisala ASAP Sounding Station uses Vaisala RS41 family radiosondes that measure air pressure, temperature, relative humidity and wind direction/speed. Wind-finding methods are based on the GPS.

Robust Design for Extreme Conditions

The Vaisala ASAP Station is housed in a 10-foot container. It meets the international requirements for mechanical construction (ISO), with a design that applies to the original

specifications set by the ASAP Coordinating Committee (ACC) including certain carefully considered modifications. Vaisala Balloon Launcher ALS211 protects the meteorological balloon during the filling and launches the radiosonde. It has been designed for marine applications thus the functionality of the balloon launcher is reliable even in most extreme weather conditions at sea.

User Friendly Operation

The Vaisala ASAP Sounding Station includes the DigiCORA® Sounding System that requires the minimum amount of time from the operator prior to balloon release. Sounding preparation phase can be easily followed with the sounding system user interface. The ASAP container offers comfortable and air-conditioned room for the operator during the sounding preparation phase, protecting at the same time from the current conditions at the sea. Balloon filling and release actions are performed

by simply operating two separate control levers. After the balloon and radiosonde are released all actions are automatically fulfilled including message transmission.

The Vaisala ASAP Station consists of:

- Vaisala DigiCORA® Sounding System MW41 with a no-break power supply and the necessary software and hardware options.
- Vaisala RS41 radiosondes
- Optionally Vaisala Automatic Weather Station for making the surface PTU and wind observations.
- Vaisala ALS211 semiautomatic radiosonde launcher which includes electrical heaters and air-conditioner.

Benefits

- Very compact structure
- Easy to install, operate and transfer
- Reliable data collection and transmission.

Technical Data

Vaisala DigiCORA® Sounding System MW41

Sounding Workstation

Ruggedized laptop delivered by Vaisala, including pre-installed DigiCORA Sounding Software, system recovery tools including USB drive with recovery image, and optional Edgeport serial extension.

Operating system Windows, pre-installed

Ground check device

Uninterruptible Power Supply (UPS)

Vaisala Sounding Processing Subsystem SPS311

Windprofiling options Code correlating GPS

Antenna

Antenna options Directional UHF antenna
Omnidirectional UHF antenna
GPS antenna

Antenna stand Acid proof (AISI316), fitting for container roof installation

Options

Vaisala Automatic Surface Weather Observing System



ASAP Launcher ALS211

Mechanical Specifications

Dimensions 2991 x 2438 x 2591 mm (l x w x h)

Gross weight without gas bottles 2400 kg

Interior is insulated with fireproof mineral wool and paneled with fibre cement flat sheets

Rack for electrical equipments AISI304

Electricity

Power consumption 4.2 kW without transformer option
6 kVA (1-phase with transformer option)
6 kVA (3-phase with transformer option)

Nominal input voltages 230/400 VAC, 3-phase; or 230 VAC 1-phase

Optional input voltages (with transformer option): 220/380/400/440 VAC, 3-phase or 1-phase

Supply frequency 50/60 Hz for 60 Hz supply; air conditioner should be selected correspondingly

Lights 2 x 9 W ceiling lights

Heating 2 x 750 W radiators

Air conditioner

Launcher Vessel

Material Fiberglass

Balloon size 350 - 500 g

Control Controlled by pneumatic actuators

Launch door Stainless steel

Options

Compressor and pressurized air tank

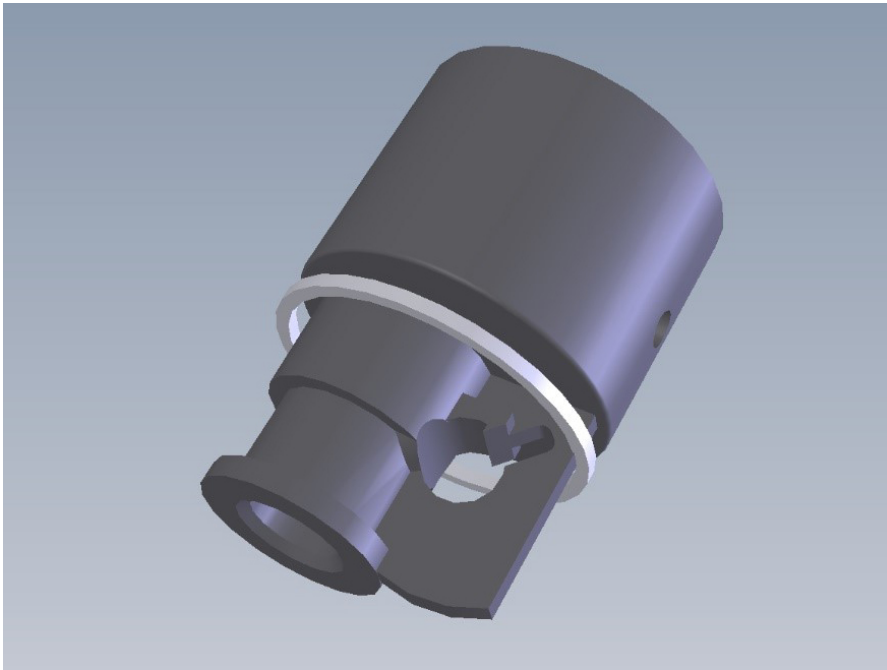
Main transformer with volt meter 3-phase 6 kVA or 1-phase 6 kVA

Storage cabinet 1030 x 500 x 2000 mm

OR gas bottle rack 8 gas bottles

Filling gas regulator

Ladder steps 6 pcs



Features

- Enables automated filling and releasing of the balloon
- Connects the balloon to the radiosonde tray
- Connects the unwinder to the balloon

Vaisala Balloon Nozzle 16817 is used in Vaisala Automatic Sounding Stations to enable automated filling and release of the balloon.

Enables automatic filling and release

Vaisala Balloon Nozzle 16817 is a special gas-tight valve that is inserted inside each balloon during balloon preparation. It connects the balloon to the radiosonde tray and allows safe automated filling and release of the balloon. The flow path of the balloon nozzle opens during balloon filling, and is automatically closed after filling by an internal spring.

Compatible with Vaisala AUTOSONDES

The nozzle is designed to be used with Vaisala AUTOSONDE® AS15 and Vaisala AUTOSONDE® AS41.

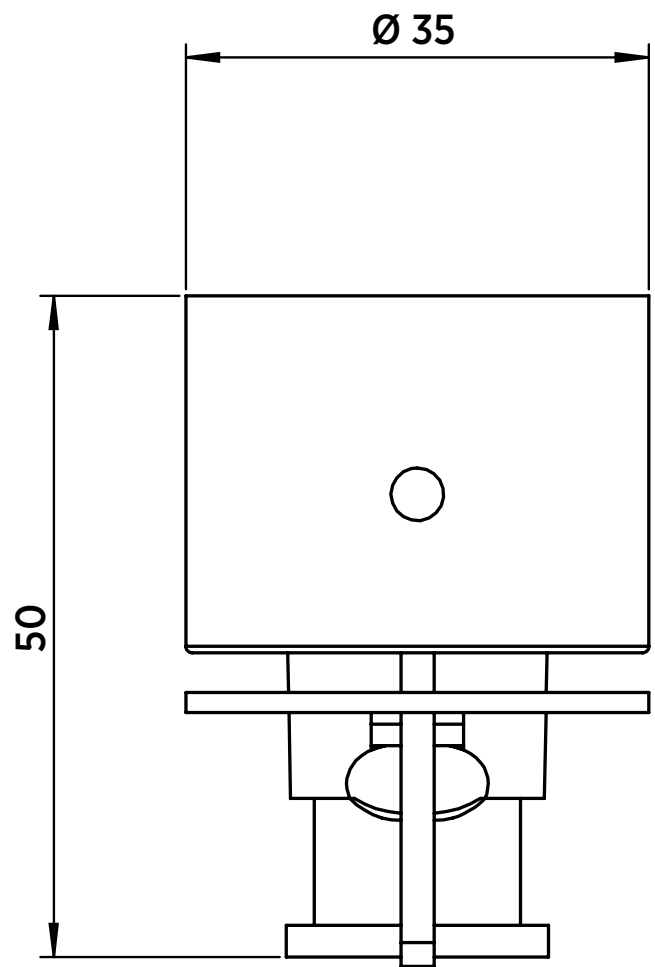
Connecting balloon, nozzle, and unwinder

The nozzle body is made of conductive plastic and it is attached to the balloon neck. The balloon neck is fitted tightly around the nozzle body by using a plastic ring. Vaisala Radiosonde RS41 unwinder is then connected to the nozzle body.

Technical data

Mechanical specifications

Dimensions (H × Ø)	50 × 35 mm
Weight	16 g
Parts	Nozzle body Plastic ring for folding the balloon neck



Nozzle dimensions in millimeters



Features

- Visibility up to 100 km (62 mi)
- Precipitation type identification, intensity, and accumulation
- Droplet size distribution and reflectivity
- Exceptional precipitation detection sensitivity
- Superior liquid/frozen differentiation
- Look-down geometry to minimize measurement disturbances
- Enhanced visibility measurement in sand dust conditions

Vaisala Forward Scatter Sensor FD70 combines forward scatter and optical disdrometer technologies. FD70 sets the standard in precipitation identification and quantification, providing best-in-class visibility determination.

Innovative technology

Novel use of a single thin light sheet instead of the conventional light cone results in high detection sensitivity, enabling scatter-property analysis of each single particle and allowing detection of even the smallest drizzle droplets. Particle size and fall speed distributions provide additional information, enhancing precipitation type identification.

The receiver measures forward scattered light at an angle of 42° with a very high sampling rate and powerful signal processing. Measurement arrangement and method is patented.

Visibility measurement

FD70 forward scatter technology provides the most representative extinction coefficient (EXCO) determination possible. Scatter-property analysis reliably calculates the visibility-reducing effect of precipitation, allowing meteorological optical range (MOR) reporting in the most challenging conditions. FD70 covers all application needs, including measurement performance and capability requirements for runway visual range (RVR).

Precipitation measurement

Due to its innovative technology, FD70 reliably detects and identifies precipitation types that have been challenging for conventional technologies.

Present weather identification ^{1) 2)}

- Drizzle
- Rain
- Snow
- Snow grains
- Ice crystals
- Ice pellets
- Freezing drizzle
- Freezing rain
- Snow pellets
- Hail
- Fog
- Freezing fog
- Mist
- Haze
- Dust

1) *Optional*

2) *In addition to listed types, reports a variety of mixed precipitation types*

Reliable in all weather

FD70 has multiple features to ensure reliable operation even in extreme weather conditions. Effective hood heating and proven look-down geometry protect the sensor windows against external disturbances. These are complemented with independent optical path monitoring and window contamination compensation.

Self-diagnostics and modular design enable short service times. Redundancy of data communication is available for critical cases such as airport use.

FD70 complies with ICAO, FAA, and WMO requirements and uses WMO and NWS weather codes in reporting.

Calibration traceability

To ensure specific visibility and rain performance, Vaisala continuously compares calibrated FD70 units against reference sensors in the Vaisala outdoor test field. Every delivered unit can be traced back to this set of calibrated reference sensors.

Technical data

Visibility (MOR) measurement

Reporting range	1 m ... 100 km (3 ft ... 62 mi)
Reporting resolution	1 m (3 ft)
Reporting uncertainty in operational conditions	±10 % or ±1 m at 1 m ... 10 km (±3 ft at 3 ft ... 6.2 mi) ¹⁾ ±20 % at 10 ... 100 km (6.2 ... 62 mi)
Measurement error	±0.7 %

¹⁾ Fulfills ICAO Annex 3: ±50 m (164 ft) up to 600 m (1968 ft).

Present weather reporting (optional)

Present weather identification	Drizzle, rain, snow, snow grains, ice crystals, ice pellets, freezing rain / drizzle, snow pellets, hail, fog / freezing fog, mist, haze
Weather codes	SYNOP: WMO table 4680 METAR: WMO table 4678 NWS codes Light, moderate, and heavy intensities

Precipitation measurement (optional)

Precipitation Intensity

Sensitivity	Single droplet $\varnothing \geq 0.1$ mm (0.004 in)
Reporting range	0.01 ... 999.99 mm/h (0.0004 ... 40 in/h) liquid water equivalent (LWE)
Reporting resolution	0.01 mm/h (0.0004 in/h)
Minimum intensity	0.01 mm/h (0.0004 in/h)

Precipitation accumulation

Reporting range	0 ... 999.99 mm (0 ... 40 in) liquid water accumulation (LWA)
Reporting resolution and uncertainty ¹⁾	0.01 mm (0.0004 in), ±2.2 %
Reporting range, snow height	0 ... 9999 mm (0 ... 32 ft 9 in)
Reporting resolution, snow height	1 mm (0.04 in)

Additional precipitation reporting

Droplet size / fall speed distribution	41 size classes, 26 speed classes
Size / speed measuring range	\varnothing 0.1 ... 35 mm (0.004 ... 1.38 in) 0 ... 10+ m/s (0 ... 32.8+ ft/s)
Radar reflectivity	-9.9 ... 99.9 dBZ
Kinetic energy	0.000 ... 999.999 J/m ² × h

¹⁾ Proven under laboratory conditions.

Compatibility

System compatibility	Vaisala AviMet®
Backwards compatibility	Vaisala FD12(P), FS11(P), PWD Series

Measurement specifications

Operating principle	Look-down forward scatter
Scattering angle (main receiver)	42° ±0.25°
Scattering angle (side receiver)	90° ±0.25°
Light source	Near-infrared
Sampling frequency	5 MHz
Measurement cycle	5 s

Mechanical specifications

Material, measurement unit	Aluminum
Material, interface unit	Maritime-grade aluminum (EN AW-5754)
Coating	Multi-layer coating to prevent environmental corrosion
Dimensions, measurement unit	354 × 551 × 883 mm (13.94 × 21.69 × 34.76 in)
Weight, measurement unit	Max. 7.5 kg (16.5 lb)
Dimensions, interface unit with radiation shield	885 × 380 × 320 mm (34.84 × 14.96 × 12.60 in)
Weight, interface unit with electronics	Max. 25 kg (55.1 lb)

Inputs and outputs

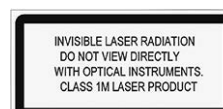
Operating voltage	Measurement unit with interface unit: 115/230 V AC ±10 %, 50 ... 60 Hz Measurement unit only: 10 ... 50 V DC
Heating voltage	24 V AC or V DC ±10 %
Power consumption, typical	Measurement unit with interface unit, all options: 245 W Measurement unit: 10.0 W / 24 V Measurement unit, heating: 180 W (at 60 W per hood)
Backup battery (optional)	12 V 2.6 Ah
External inputs	Vaisala HUMICAP® Humidity and Temperature Probe HMP155 Vaisala Background Luminance Sensor LM21
Data communication options	10/100 Mbps Ethernet RS-232, RS-485 Leased-line modem DXL421 UHF/VHF radio modem

Operating environment

IP rating	IP66
Operating temperature	-40 ... +65 °C (-40 ... +149 °F)
Operating temperature, extended (optional)	-55 ... +65 °C (-67 ... +149 °F)
Storage temperature	-55 ... +65 °C (-67 ... +149 °F), non-condensing environment
Operating humidity	0 ... 100 %RH
Wind speed	Up to 60 m/s (134 mph)

Compliance

EU directives and regulations	EMC, LVD, RoHS
Environmental	IEC 60068-2-1, 2, 6, 14, 30, 31, 52, 78 IEC 60529, VDA 621-415 IEC/EN 63000
Eye safety	Class 1M IEC / EN 60825-1:2014
Electrical safety	IEC/EN/UL/CSA 61010-1
EMC compliance	EN 61326-1, industrial environment CISPR 32 / EN 55032, Class B



FS11 Visibility Sensor



Visibility Sensor FS11 is intended for the most demanding weather applications, such as runway visual range (RVR), aeronautical and synoptical visibility. It provides the optimal combination of the best accuracy, the highest reliability, broad measurement range, and low maintenance need.

Features

- Unique window contamination correction
- Accurate and traceable forward scattering measurement
- Technical design and high-power heating according to FAA guidelines
- Frangible composite fiber mast
- Can be upgraded for sensing present weather

Benefits

- The most widely proven forward scatter RVR sensor
- Visibility sensor selected and used by FAA
- Meets FAA and ICAO specifications
- Accurate and traceable measurement
- Can be used for both aeronautical and synoptical applications
- Minimal maintenance needs
- Meets ICAO frangibility standards

The main applications of FS11 are runway visual range (RVR) and synoptical and aeronautical visibility measurements. FS11 is also well suited for other demanding applications, such as visibility measurement at ports and harbors.

Scientifically valid chain of calibration

FS11 is calibrated through a scientifically valid chain of reference. The scattering response of the calibration device can be clearly traced to a reference FS11 visibility sensor, which is in continuous operation at Vaisala outdoor test field along with reference transmissometers and other instrumentation. The visibility measurement of FS11 is also traceable to FAA reference sensors.

Low maintenance need

FS11 incorporates a technique that measures and compensates for window contamination. It ensures unparalleled measurement accuracy between window

cleanings. It also enables much longer window cleaning intervals than compared to conventional visibility sensors.

The unique system works by monitoring the total reflectance of the window surface. It automatically compensates for visibility measurement errors caused by window contamination.

The sophisticated self-diagnostics and modular design allow for very short service times. The measurement fork and optional background luminance sensor LM21 are independent instruments that can be replaced quickly as pre-calibrated spare parts.

Reliable operation in the harshest weather

Four main design features are combined in FS11 to ensure reliable operation in the harshest weather. The first is the window contamination compensation technique. The second is the "head-down" design of the optical heads, which protects them against virtually all windblown particles (even those flying horizontally).

High-power heaters are the third feature. Each heater has its own temperature monitoring and control mechanism to prevent snow accumulation during the heaviest snowstorm.

As a final measure, there is an optical path clearance monitoring circuitry to verify that measurement is not affected by obstructions.

Technical data

Measurement performance

Measurement range of MOR	5 ... 75 000 m (16 ft ... 46.6 mi) with 1, 3, and 10 min averaging
Reporting uncertainty	±10 % range 5 ... 10 000 m (16 ft ... 6.2 mi) ±20 % range 10 000 ... 75 000 m (6.2 ... 46.6 mi)
Scatter measurement accuracy	±3 %

Inputs and outputs

AC (mains) power supply	100/115/230 VAC ±10 %, 50 ... 60 Hz
Power consumption	Max. 300 VA (60 VA + 240 VA defrosting heaters)
Battery backup option	Battery 2 Ah, typical backup time 30 min at 25 °C (77 °F) and 5 min at -40 °C (-40 °F)
Outputs	Serial data line RS-232 or opto-isolated RS-485 (2-wire) or optional data modem Separate maintenance line RS-232 +12 VDC max. 800 mA output for option powering
Overvoltage category	CATII
Output data	Automatic or polled visibility and sensor status data message with selectable message interval

Operating environment

Operating temperature	-40 ... +65 °C (-40 ... +149 °F) -55 ... +65 °C (-67 ... +149 °F) (optional)
Operating humidity	0 ... 100 %RH
Wind speed	Up to 60 m/s (134 mph)
Maximum operating altitude	3000 m (approx. 9800 ft)
Pollution degree	2
IP rating	IP66

Mechanical specifications

Dimensions (H × W × D)	2.8 × 0.9 × 1.0 m (9.19 × 2.95 × 3.28 ft)
Weight without mast	37 kg (81.57 lb)
Weight, including Frangible Mast F5FM250	52 kg (115 lb)
Mast	Frangible and hinged glass fiber mast

Optical specifications

Operating principle	Forward scatter measurement
Scattering angle	42°
Light source	Near-infrared LED

Compliance

EMC compliance	
Electrical safety	IEC/EN 61010-1
EMC immunity	EN 61326-1, industrial environment
EMC emissions	EN 55032:2012, Class B EN 61000-3-2 EN 61000-3-2

Directives	
EU directives and regulations	RoHS Directive (2011/65/EU) amended by 2015/863 EMC Directive (2014/30/EU) Low Voltage Directive (2014/35/EU)

Compliance marks	CE, RCM, UKCA
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Spare parts and accessories

Calibration set	FSA11
Background luminance sensor	LM21
Battery backup	FSB101
Modem for long distance communication (> 1 km / 0.6 mi)	DMX501
Obstruction light	FS11OBS
Transformer	FS45002SP
Calibration set	PWA12
Maintenance cable	QMZ101





Features

- Unique window contamination correction
- Uses the same principles as the renowned FD12P weather sensor
- Accurate and traceable forward scattering measurement
- Technical design and high-power heating according to FAA guidelines
- Frangible composite fiber mast

Vaisala Present Weather Sensor FS11P is intended for the most demanding weather applications such as runway visual range (RVR), aeronautical and synoptical visibility, and present weather observation. It provides the optimal combination of the best accuracy, the highest reliability, broad measurement range, and low maintenance need.

Benefits

- Excellent value: RVR, visibility, and present weather all-in-one
- The most widely proven forward scatter RVR sensor
- Visibility sensor selected and used by FAA
- Meets FAA and ICAO specifications
- Can be used for both aeronautical and synoptical applications
- Minimal maintenance needs
- Compatible with FD12P
- Meets ICAO frangibility standards

Scientifically valid chain of calibration

FS11P is calibrated through a scientifically valid chain of reference. The scattering response of the calibration device can be clearly traced to a reference FS11P visibility sensor, which is in continuous operation at Vaisala outdoor test field along with reference transmissometers and other instrumentation. The visibility measurement of FS11P is also traceable to FAA reference sensors.

Low maintenance need

FS11P incorporates a technique that measures and compensates for window contamination. It ensures unparalleled measurement accuracy between window cleanings. It also enables much longer window cleaning intervals than compared to conventional visibility sensors.

The unique system works by monitoring the total reflectance of the window surface. It automatically compensates for visibility measurement errors caused by window contamination.

The sophisticated self-diagnostics and modular design allow for very short service times. The visibility measurement fork, present weather detector, and optional background luminance meter are independent instruments that can be replaced quickly as pre-calibrated spare parts.

Reliable operation in the harshest weather

Four main design features are combined in FS11P to ensure reliable operation in the harshest weather. The first is the window contamination compensation technique. The second is the "head-down" design of the optical heads, which protects them against virtually all windblown particles (even those flying horizontally).

High-power heaters are the third feature. Each heater has its own temperature monitoring and control mechanism to prevent snow accumulation during the heaviest snowstorm.

As a final measure, there is an optical path clearance monitoring circuitry to verify that measurement is not affected by obstructions.

Technical compatibility

In addition to the technological similarity, FS11P is compatible with and can be used to replace FD12P. They both provide the same mechanical, electrical and communication interfaces, and they transmit similar message formats widely used in aviation and meteorology.

Technical data

Measurement performance

Measurement range of MOR	5 ... 75 000 m (16 ft ... 46.6 mi) with 1, 3, and 10 min averaging
Reporting uncertainty	±10 % range 5 ... 10 000 m (16 ft ... 6.2 mi) ±20 % range 10 000 ... 75 000 m (6.2 ... 46.6 mi)
Scatter measurement accuracy	±3 %

Weather measurement performance

Weather type identification	7 different types of precipitation (rain, freezing rain, drizzle, freezing drizzle, mixed rain/snow, snow, ice pellets) Precipitation (unknown type) Fog (mist), haze (smoke, sand) or clear
Weather type reporting	WMO 4680 (SYNOP), 4678 (METAR), and NWS code tables; 49 different codes supported from the WMO 4680 code table
Precipitation detection sensitivity	0.05 mm/h (0.0020 in/h) or less, within 10 minutes
Precipitation intensity measurement	0.00 ... 999.99 mm/h (0.00 ... 39.37 in/h)
Precipitation amount measurement	0.00 ... 99.99 mm (0.00 ... 3.94 in)
Amount of new snow	0.00 ... 999 mm (0.00 ... 39.33 in)

Operating environment

Operating temperature	-40 ... +65 °C (-40 ... +149 °F) -55 ... +65 °C (-67 ... +149 °F) (optional)
Operating humidity	0 ... 100 %RH
Wind speed	Up to 60 m/s (134 mph)
Maximum operating altitude	3000 m (approx. 9800 ft)
Pollution degree	2
IP rating	IP66

Inputs and outputs

AC (mains) power supply	100/115/230 VAC ±10 %, 50 ... 60 Hz
Power consumption	Max. 300 VA (60 VA + 240 VA defrosting heaters)
Battery backup option	Battery 2 Ah, typical backup time 30 min at 25 °C (77 °F) and 5 min at -40 °C (-40 °F)
Outputs	Serial data line RS-232 or opto-isolated RS-485 (2-wire) or optional data modem Separate maintenance line RS-232 +12 VDC max. 800 mA output for option powering
Overvoltage category	CATII
Output data	Automatic or polled visibility and sensor status data message with selectable message interval

Mechanical specifications

Dimensions (H × W × D)	2.8 × 0.9 × 1.0 m (9.19 × 2.95 × 3.28 ft)
Weight without mast	37 kg (81.57 lb)
Weight, including Frangible Mast FFSM250	52 kg (115 lb)
Mast	Frangible and hinged glass fiber mast

Optical specifications

Operating principle	Forward scatter measurement
Scattering angle	42°
Light source	Near-infrared LED

Spare parts and accessories

Calibration set	FSA11
Background luminance sensor	LM21
Battery backup	FSB101
Modem for long distance communication (> 1 km / 0.6 mi)	DMX501
Obstruction light	FS11OBS
Transformer	FS45002SP
Calibration set	PWA12
Maintenance cable	QMZ101
Calibration set	PWA12
Maintenance cable	QMZ101

Compliance

EMC compliance	
Electrical safety	IEC/EN 61010-1
EMC immunity	EN 61326-1, industrial environment
EMC emissions	EN 55032:2012, Class B EN 61000-3-2 EN 61000-3-2
Directives	
EU directives and regulations	RoHS Directive (2011/65/EU) amended by 2015/863 EMC Directive (2014/30/EU) Low Voltage Directive (2014/35/EU)
Compliance marks	CE, RCM, UKCA



Features

- Single baseline for the MOR measurement range
10 ... 10 000 m (33 ... 32 800 ft)
- State-of-the-art white light source
- Automatic alignment with quality control
- Automatic calibration
- Internal back-up battery
- Compatible with Vaisala Transmissometer MITRAS and SKOPOGRAPH II Flamingo
- Window contamination compensation
- Meets the ICAO and WMO requirements for RVR and visibility
- Based on decades of field experience
- Sophisticated self-diagnostics

Vaisala Transmissometer LT31 enables accurate and reliable single baseline measurement for CATIIIb category airports.

Accurate and reliable determination of runway visual range (RVR) reduces airport downtime and improves safety of operations. LT31 is the qualified observer of RVR providing correct visibility data without interruptions and with minimal maintenance.

Measurement Range from 10 to 10 000 m (33 to 32 800 ft)

LT31 provides the most accurate and reliable solution for the automatic measurement of RVR.

The meteorological optical range (MOR

measurement range is 10 ... 10 000 m (33 ... 32 808 ft), which covers the full required RVR range (CATI ... CATIIIb), as well as the range required for aeronautical visibility (the ICAO-defined visibility). LT31 accuracy meets the ICAO and WMO requirements.

This full measurement range is achieved with a single baseline system, which makes measuring easier and more economical.

White LED Provides Wide Spectrum Light Source

LT31 incorporates a white LED as a light source. White light is needed for the best accuracy in transmittance measurement. The WMO recommends the use of a wide spectrum (white) light sources for transmissometers as narrow spectrum light source (for example, lasers or colored LEDs) will cause measurement error with some weather phenomena.

Automatic Systems



The automatic fine alignment also provides easy handling of LT31 during installation. The alignment quality during harsh weather conditions is ensured by a double mast construction. The outer tube works as wind and solar radiation shield. The inner support structure is separated from thermal and mechanical stress caused by solar radiation and wind load.

Contamination Reduction

In general, precipitation leads to an increased amount of window contamination. LT31 has long and narrow weather protection hoods that reduce the amount of window contamination caused by precipitation.

For wind-driven precipitation or dust, the instrument is equipped with a powerful blower. The blower creates an air curtain in front of the instrument window. The air curtain is specifically designed not to disturb the measurement path and cause the measurement errors that have been a problem with conventional blower designs.

Automatic Calibration with Integrated Forward Scatter Sensor

Calibration of a transmissometer is traditionally based on human observations. A reliable and accurate calibration has required very high visibility, stable conditions, and skilled and well trained personnel.

The Vaisala-patented automatic calibration method for transmissometers is based on an integrated forward scatter sensor/present weather sensor. The system automatically detects drift

and adjusts the sensor settings accordingly. Weather conditions do not need to be as good as for manual calibration; LT31 automatically recognizes suitable conditions.

Automatic Fine Alignment

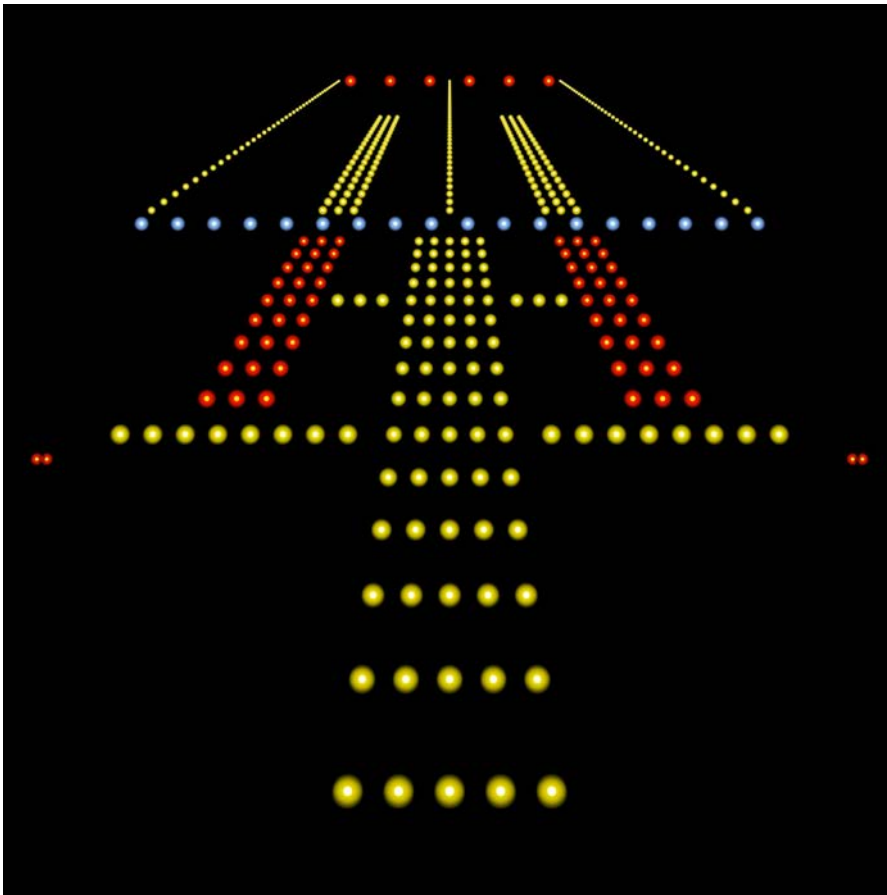
One of the major error sources in transmittance measurement is alignment drift. Checking and adjusting the alignment has also required skilled and trained personnel.

To maintain the measurement accuracy, LT31 performs an automatic optimization of the alignment. The alignment quality is also continuously evaluated without any human intervention.



The integrated forward scatter sensor

Up-to-date Data



Airport runway lights at night



True window contamination compensation based on V-shaped windows

Automatic Window Contamination Compensation

Window contamination is a significant source of error in transmissometers. Maintaining high accuracy has required frequent cleaning. However, the effects of contamination can be automatically compensated if the window transmittance can be measured accurately.

In LT31, window contamination is also compensated for by the most accurate method: by measuring the transmittance directly through the window glass.

Extensive Self-diagnostics

LT31 has a sophisticated self-diagnostics that provides detailed status information for all functional units. In addition, this feature helps to locate possible technical failures. It records a history of significant operational situations, warnings, and alarms from the instrument.

Internal Backup Battery

LT31 can be equipped with an internal backup battery. It provides steady data availability during short power breaks, for example while backup generators are started.

Present Weather Reporting

The optional present weather reporting from RVR sites gives a full picture of the prevailing weather conditions within the entire airport area. The arrival of weather fronts and the presence of local showers can easily be monitored due to the multiple present weather observation points. The integrated present weather sensor provides the type and intensity of precipitation for METAR and local weather reporting purposes.

Background Luminance Sensor LM21

The optional LM21 sensor offers the means for measuring the ambient light level or background luminance in RVR applications. The background luminance sensor is used for measuring the background against which the runway lights or runway markings are seen.

Technical Data

Measurement performance

Transmittance measurement resolution	20 bit
Recommended baseline lengths	
30 m (98 ft) baseline length (optimal)	MOR: 10 ... 10 000 m (33 ... 32 808 ft) Transmittance range: < 0.01 % ... 100 %
50 m (164 ft) baseline length	MOR: 25 ... 10 000 m (82 ... 32 808 ft) Transmittance range: < 0.02 % ... 100 %
75 m (246 ft) baseline length	MOR: 37.5 ... 10 000 m (123 ... 32 808 ft) Transmittance range: < 0.02 % ... 100 %
Purchased option	
25 m (82 ft) baseline length	1/3 × baseline length to 10 000 m (32 808 ft)
Accuracy (RVR range)	Exceeds the ICAO (Annex 3) recommendations
Output data	<ul style="list-style-type: none"> Automatic or polled data messages Standard message including MOR, LT31 status and BGL data (option) Message including present weather data (option) MITRAS transmissometer compatible message SKOPOGRAPH II Flamingo transmissometer compatible message FD12 Visibility Meter compatible message
Present weather reporting option	Identifies 7 different types of precipitation (rain, freezing rain, drizzle, freezing drizzle, mixed rain/snow, snow, ice pellets)
Reports	49 different codes from WMO 4680 code table

Transmitter optical specifications

Light source	White light-emitting diode (LED) - Certified class 1 product according to EN 60 825-1
Optical monitoring	<ul style="list-style-type: none"> Light source stability control Window contamination measurement and compensation circuitry

Operating environment

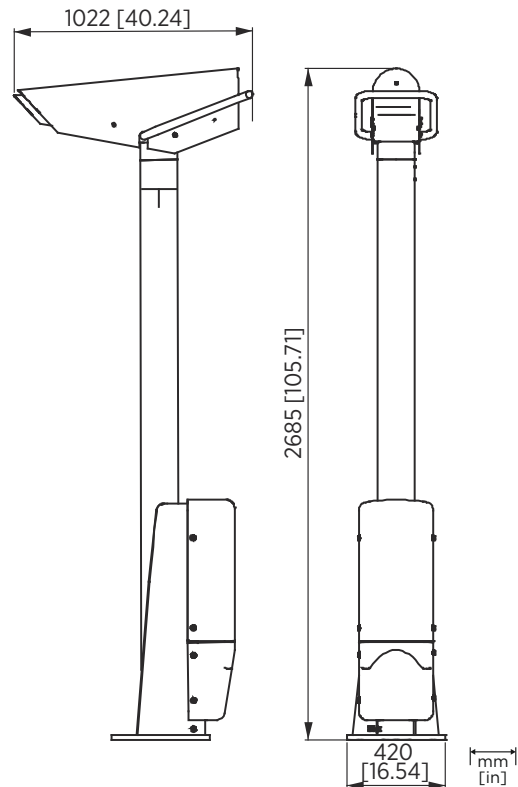
Operating temperature	-40 ... +60 °C (-40 ... +140 °F) standard -55 ... +60 °C (-67 ... +140 °F) hood heater option
Operating humidity	0 ... 100 %RH
Wind speed	Up to 60 m/s (134 mph)
Electrical safety	IEC 60950-22 / EN 60950-22/A11 / IEC 60950-1 / EN 60950-1 / UL 60950-1
Maximum operating altitude	3000 m (9800 ft) Surge protectors 2000 m (6562 ft)
Pollution degree	PD2

Inputs and outputs

AC (mains) supply	115/230 V ~ ±10 %, 50 ... 60 Hz
Power consumption	Max. 800 VA (for complete LT31 system) with all options
Battery backup option	Battery 2.3 Ah, backup time 60 min at +20 °C (+68 °F) when a proper and fully charged battery is used
Obstruction light	Optional
Outputs	Serial data line RS-232 or opto-isolated RS-485 (2-wire) or optional data modem Separate maintenance line RS-232
Overvoltage category	CAT II With Termbox CAT III

Mechanical specifications

Dimensions (H × W × D)	2685 × 420 × 1022 mm (105.71 × 16.54 × 40.24 in)
Weight	
Transmitter unit LTT111	85 kg (187.39 lb)
Receiver unit LTR111	82 kg (180.78 lb)
IP rating	IP66



Compliance

EU directives and regulations	<ul style="list-style-type: none">• Low Voltage Directive (2014/35/EU)• EMC Directive (2014/30/EU)• RoHS Directive (2011/65/EU)
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Compliance marks	CE, RCM
Electrical safety	IEC 61010-1
Electromagnetic compatibility	IEC/EN 61326-1, industrial environment EN 55032 Class B, FCC 15B





Features

- Intelligent, standalone sensor
- Verified accuracy and photopic response
- Extensive self-diagnostics
- Window contamination measurement and compensation
- Optical path blockage detection
- High power heaters to prevent snow accumulation
- Calibration traceable to measurement standards
- Field calibration device available

Vaisala Background Luminance Sensor LM21 is an intelligent, standalone precision photometer.

Vaisala Background Luminance Sensor LM21 is a state-of-the-art luminance sensor for runway visual range (RVR) assessment. The background luminance has an effect on the distance from which the pilot can see the runway lights.

Resembles Human Eye

LM21 is a precision photometer with a verified photopic spectral response. It measures the total amount of light coming in from an angle of 6 degrees, and converts the measured data to cd/m^2 . The sensor sends the measurement data to the interface unit of a Vaisala transmissometer or forward scatter visibility sensor. The interface unit combines both the visibility and background luminance data into the same message and sends it to the main RVR computer.

LM21 can be connected to Vaisala Transmitter LT31 and Vaisala Forward Scatter Sensor FS11. LT31 and FS11 are connected using a RS-485 serial line.

Comprehensive Self-Diagnostics

LM21 is an intelligent, standalone sensor. To ensure reliable and uninterrupted operation, it has extensive self-monitoring functions with high power heating features. The sensor measures and compensates for the attenuation effect of window contamination. It ensures that measurement accuracy is maintained between window cleanings, and also extends the cleaning interval. The optical path clearance monitoring circuitry verifies that measurement is not affected by obstructions.

Easy to Calibrate

The calibration of LM21 is traceable to international measurement standards for luminous intensity. Vaisala Field Calibrator LMA21 is a unique field calibration device that is available for quick field calibration. It provides a stabilized and diffused white light beam for LM21 calibration.

The calibration coefficients for light intensity have been defined during factory calibration and stored in the LMA21 memory. Calibration starts automatically when LMA21 is connected to LM21. LM21 reads the calibration

coefficients from the LMA21 memory and performs the calibration. The status and result of the calibration is displayed with 5 LED indicators on the cover of LMA21.



LM21 measures the ambient light level or background luminance in RVR applications. In the picture, LM21 is installed on Vaisala Transmissometer LT31.

Technical Data

Measurement performance

Measurement range	2 ... 40 000 cd/m ²
Accuracy	±10 %

Optical specifications

Spectral response	400 ... 700 nm, photopic according to CIE standards
Peak wavelength	553 nm ± 5 nm
Field of view	6° (94 % of measured luminance)
Effective diameter of reception lens	24 mm (0.94 in)

Operating environment

Operating temperature	-55 ... +65 °C (-67 ... +149 °F)
Operating humidity	0 ... 100 %RH

Inputs and outputs

Connection	Power/signal cable provided
Power supply	10 ... 38 VDC, or alternatively 8 ... 28 VAC, 6 W
Heater power supply	28 VAC, 50 W
Output signal	RS-485 (RS-232), frequency output
Overvoltage protection	Power supply lines and output lines are protected by current limiting series resistors and transient suppressors

Mechanical specifications

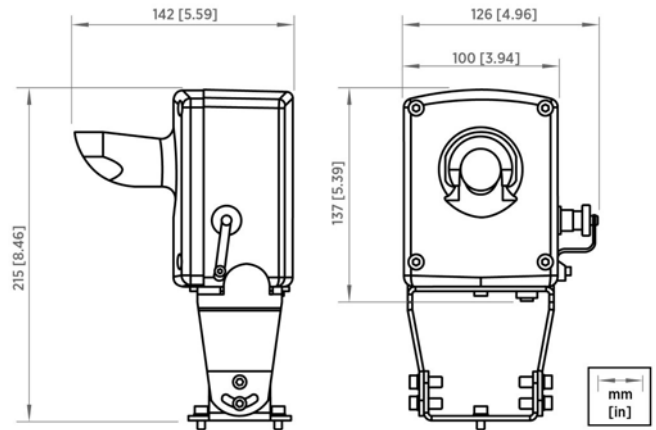
Weight	1230 g (2.71 lb)
Cable length	2.3 m (7 ft 7 in)
Color	White
Housing	Aluminum, weatherproof
Mounting	With a mounting clamp onto LM21 Support Arm of LT31 or Optional Support Arm of FS11

compliance

LM21 sensor is CE compliant. The compliance has been verified according to the following EMC product family standards:

Electrical equipment for measurement, control and laboratory use - EMC Requirements IEC 61326-1: 2012-07 (Edition 2.0), Environment class: Industrial

Electrical equipment for measurement, control and laboratory use - EMC Requirements EN 61326-1: 2013-01 (Edition 2.0), Environment class: Industrial



LM21 dimensions





PWD10, PWD12, PWD20, and PWD22 Present Weather and Visibility Sensors



Features

All models:

- Accurate and traceable measurement of prevailing visibility
- Compact and lightweight
- Easy to install

Additionally PWD12 and PWD22 models:

- Indicate the cause of reduced visibility
- Identify precipitation type
- Measure the intensity and accumulation of precipitation
- Estimate snow accumulation

Vaisala PWD series of present weather detectors and visibility sensors provide you off-the-shelf accuracy and reliability. They are a sensor family that grows with your needs.

Thousands of Vaisala present weather and visibility sensors are installed around the world, working reliably and accurately in diverse applications and climates. In Vaisala PWD series, you find the mix you require of visibility measurement range (MOR), characterization of reduced visibility, precipitation type identification, precipitation accumulation/intensity measurement, and report formats (WMO, NWS code tables).

Proven Measurement Principles for Present Weather

PWD12 and PWD22 identify precipitation type by accurately estimating the water content of precipitation with a capacitive device (Vaisala RAINCAP® sensor

element) and combining this information with optical forward scatter and temperature measurements. These three independent measurements are processed through sophisticated algorithms in order to produce an accurate evaluation of the weather type according to the WMO and NWS code tables.

Accurate Visibility Measurement

Calibrated with reference to a highly accurate transmissometer, Vaisala PWD series sensors use the proven forward-scatter measurement principle to measure meteorological optical range (MOR). The visibility sensor is well-protected against contamination:

the optical components point downwards and hoods protect the lenses against precipitation, spray, and dust. This weather-proof design of PWD sensors provides accurate measurement results and reduces the need for maintenance. The optional hood heaters are recommended for wintry conditions to prevent ice and snow accumulation.

Easy Installation

PWD sensors are less than one meter long. All are compact, light-weight, come with a cable and connector for easy installation, and can be mounted in many ways on any existing mast.

PWD Sensor Applications



Vaisala Present Weather Detector PWD22

Economical Visibility Measurement for Road Weather Applications

With a measurement range of 10 ... 2000 meters, PWD10 offers economical and reliable visibility measurement for road weather applications. PWD10 is recommended for road weather systems that alert drivers to e.g. reduced visibility.



PWD12 is ideal for road weather applications.

For Sophisticated Road Weather Applications

PWD12 provides accurate visibility and present weather measurement in the road environment, where low visibility is a serious safety hazard and significantly reduces traffic flow rates. With a visibility

measurement range of 10 ... 2000 meters, Vaisala Present Weather Detector PWD12 is ideal for road weather applications. PWD12 also indicates the cause of reduced visibility to give you a full picture of weather conditions. Its ability to detect precipitation and identify precipitation type gives the road authority valuable information for the short-range planning of road maintenance operations.

Wherever Visibility Measurement Is Needed

With a measurement range of 10 ... 20 000 meters, PWD20 offers long-range visibility measurement for diverse applications covering harbors, coastal areas, heliports, windmill parks – indeed, any locations or areas where visibility measurement is necessary.



PWD sensors can be used in planning road maintenance.

For Meteorological and Aviation Applications

With a visibility measurement range of 10 ... 20 000 meters, PWD22 is a two-in-one forward scatter visibility and present weather sensor. PWD22 is recommended for automatic weather stations, especially low-power ones that are used for general meteorological and aviation applications.

PWD22's ability to detect freezing precipitation makes it possible to issue warnings when the weather presents safety hazards for road and air traffic.

PWD22 is equipped with two Vaisala RAINCAP® sensor elements to improve detection sensitivity during light precipitation events – even light drizzle is detected. PWD22 also reports present weather in WMO METAR code format so it is easily integrated with AWOS systems.



PWD22 is recommended for automatic weather observation systems (AWOS).

Technical data

PWD10 measurement performance

Operating principle	Forward scatter measurement with 45° scattering angle
Observation range of MOR	10 ... 2000 m (32 ... 6500 ft)
Accuracy	±10 % at 10 ... 2000 m (32 ... 6500 ft)

PWD12 measurement performance

Operating principle	Forward scatter measurement with 45° scattering angle
Observation range of MOR	10 ... 2000 m (32 ... 6500 ft)
Accuracy	±10 % at 10 ... 2000 m (32 ... 6500 ft)
Weather type identification	4 different types of precipitation (rain, drizzle, mixed rain/snow, snow) Precipitation (unknown type) Fog (mist), haze (smoke, sand) or clear
Weather type reporting	WMO 4680 (SYNOP) and NWS code tables; 39 different codes supported from WMO 4680 code table
Precipitation detection sensitivity	0.05 mm/h (0.0020 in/h) or less, within 10 minutes
Precipitation intensity measurement	0.00 ... 999.99 mm/h (0.00 ... 39.37 in/h)
Precipitation amount measurement	0.00 ... 99.99 mm (0.00 ... 3.94 in)
Amount of new snow	0.00 ... 999 mm (0.00 ... 39.33 in)

PWD20 measurement performance

Operating principle	Forward scatter measurement with 45° scattering angle
Observation range of MOR	10 ... 20 000 m (32 ... 65 600 ft)
Accuracy	±10 % at 10 ... 10 000 m (32 ... 32 800 ft) ±15 % at 10 ... 20 km (2.6 ... 12 mi)

PWD22 measurement performance

Operating principle	Forward scatter measurement with 45° scattering angle
Observation range of MOR	10 ... 20 000 m (32 ... 65 600 ft)
Accuracy	±10 % at 10 ... 10 000 m (32 ... 32 800 ft) ±15 % at 10 ... 20 km (2.6 ... 12 mi)
Weather type identification	7 different types of precipitation (rain, freezing rain, drizzle, freezing drizzle, mixed rain/snow, snow, ice pellets) Precipitation (unknown type) Fog (mist), haze (smoke, sand) or clear
Weather type reporting	WMO 4680 (SYNOP), 4678 (METAR) and NWS code tables; 49 different codes supported from WMO 4680 code table
Precipitation detection sensitivity	0.05 mm/h (0.0020 in/h) or less, within 10 minutes
Precipitation intensity measurement	0.00 ... 999.99 mm/h (0.00 ... 39.37 in/h)
Precipitation amount measurement	0.00 ... 99.99 mm (0.00 ... 3.94 in)
Amount of new snow	0.00 ... 999 mm (0.00 ... 39.33 in)

Inputs and outputs

Power supply	12 ... 50 V DC (electronics) 24 V AC or 24 V DC for heater option
Average power consumption	3 W (peak 10 W) With optional luminance sensor: 5 W With optional hood heaters: 65 W
Outputs	Serial data line may be used either as RS-232 or RS-485 (2-wire) level signals 3 relay controls (open collector) Analog output current: 0 ... 1 mA or 4 ... 20 mA 8-m power/data cable standard. The PWD end is equipped with connector.
Auxiliary data	Low visibility alarms in the data messages. 3 adjustable alarm limits to set the 3 relay controls. Hardware status (fail/warning) in the data messages. Third relay control output can also be driven by hardware status.

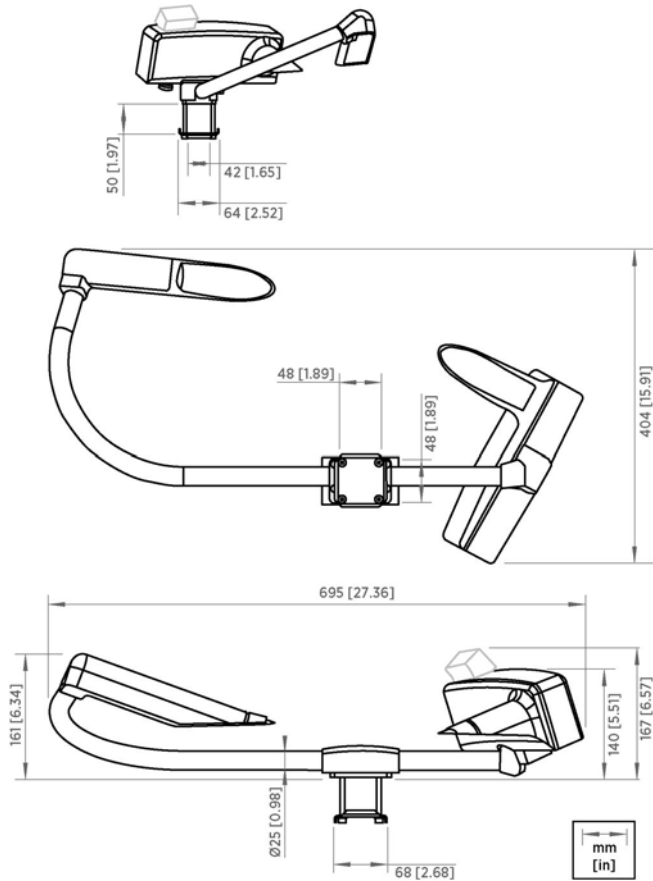
Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-40 ... +60 °C (-40 ... +140 °F)
Operating humidity	0 ... 100 %RH
Maximum operating wind speed	60 m/s (134 mph)
Sun orientation	Sunlight into the light receiver must be avoided
IP rating	IP66

Technical Data

Mechanical specifications

Weight	3 kg (6.61 lb)
Material	Aluminum
Dimensions (H × W × L)	



Dimensions

Compliance

EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
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Corrosion and salt mist	VDA 621-415
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EMC compatibility	
EMC emissions	CISPR 32 / EN 55032, Class B
Radiated susceptibility	IEC 61000-4-3, 10 V/m
Conducted susceptibility	IEC 61000-4-6
EFT immunity	IEC 61000-4-4
ESD immunity	IEC 61000-4-2
Surge	IEC 61000-4-5

Spare parts and accessories

Item	Code
Pole mast	-
Interface unit with power supplies: 115/230 V AC	-
Luminance sensor	PWL111
Hood heaters for harsh winter conditions	-
Support arm for mast installations	-
Pole clamp kit for mast top installations	-
Calibration set	PWA12
Maintenance cable	16385ZZ
Maritime insulator	-



Features

- Certified by Deutscher Wetterdienst
- Accurate and traceable measurement of prevailing visibility
- Hood heaters prevent ice accumulation
- Robust and versatile
- Unique algorithm ensures no flicker interference
- Mean time between failures (MTBF) in excess of 20 years
- Easy installation

PWD20W is a visibility sensor with a special algorithm designed for wind turbine installations.

Limit Your Light Emissions

Flashing lights can be disturbing so it is smart to dim them to the optimal level. With the help of PWD20W you can be in conformity with the regulations, such as the German General Administrative Regulation for the Marking and Lightning of Obstacles to Air Navigation. At the same time you can create a comfortable living environment for the surrounding community.

The conditions on top of a wind turbine require a robust device, like PWD20W. Its performance and reliability have proven to be top-class. The hood heaters prevent ice accumulation on the device. A special firmware ensures that flashing lights near the visibility sensor are not mixed with light pulses from the sensor. Thousands of PWD sensors are installed worldwide in demanding applications in all kinds of climates. They are installed on wind turbines both onshore and offshore. With PWD series sensors you get the best-in-class measurement performance and unparalleled reliability. Our failure rate statistics indicate a mean time between failures (MTBF) clearly in excess of 20 years. You will also benefit from our fast delivery.

The FAA and other leading aviation authorities have placed their confidence in us. Our visibility sensor is also certified by Deutscher Wetterdienst.

Especially for Wind Turbines

Wind turbines are usually equipped with two red obstruction lights each. These obstruction lights flash at set intervals by day and night. Residents in the vicinity of a wind turbine complain of the brightness of the obstruction lights at night. Visibility data is used to control the intensity of these obstruction lights, thereby reducing the disturbance to the neighbours, yet not undermining aviation safety.

PWD20W software has been specially designed for the wind turbine application. The infrared light emitted by obstruction lights may significantly disturb conventional visibility sensors. However, PWD20W filters out the interference to eliminate the effect of obstruction lights on the visibility measurement. Red LED lights interfere with neither the visibility measurement nor the control of the lights.

Wherever Visibility Measurement Is Needed

With a measurement range of 10 to 20 000 meters (32 to 65 600 feet), PWD20W offers long-range visibility measurement for onshore and offshore obstruction lights, offshore obstruction lights for vessels, met mast equipment. The standard model PWD20 can be used in diverse applications covering harbors, coastal areas, heliports, wind parks – indeed, any locations or areas where visibility measurement is necessary.



Technical Data

PWD20 measurement performance

Operating principle	Forward scatter measurement with 45° scattering angle
Observation range of MOR	10 ... 20 000 m (32 ... 65 600 ft)
Accuracy	±10 % at 10 ... 10 000 m (32 ... 32 800 ft) ±15 % at 10 ... 20 km (2.6 ... 12 mi)

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-40 ... +60 °C (-40 ... +140 °F)
Operating humidity	0 ... 100 %RH
Maximum operating wind speed	60 m/s (134 mph)
Sun orientation	Sunlight into the light receiver must be avoided
IP rating	IP66

Inputs and outputs

Power supply	12 ... 50 V DC (electronics) 24 V AC or 24 V DC for heater option
Average power consumption	3 W (peak 10 W) With optional luminance sensor: 5 W With optional hood heaters: 65 W
Outputs	Serial data line may be used either as RS-232 or RS-485 (2-wire) level signals 3 relay controls (open collector) Analog output current: 0 ... 1 mA or 4 ... 20 mA 8-m power/data cable standard. The PWD end is equipped with connector.
Auxiliary data	Low visibility alarms in the data messages. 3 adjustable alarm limits to set the 3 relay controls. Hardware status (fail/warning) in the data messages. Third relay control output can also be driven by hardware status.

Mechanical specifications

Weight	3 kg (6.61 lb)
Material	Aluminum
Dimensions (H × W × L)	140 × 404 × 695 mm (5.51 × 15.91 × 27.36 in)

Compliance

EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
Corrosion and salt mist	VDA 621-415
EMC compatibility	
EMC emissions	CISPR 32 / EN 55032, Class B
Radiated susceptibility	IEC 61000-4-3, 10 V/m
Conducted susceptibility	IEC 61000-4-6
EFT immunity	IEC 61000-4-4
ESD immunity	IEC 61000-4-2
Surge	IEC 61000-4-5

Spare parts and accessories

Item	Code
Pole mast	-
Interface unit with power supplies: 115/230 V AC	-
Interface unit with power supplies, transient protection and relays: 230 V AC	-
Luminance sensor	PWL111
Hood heaters for harsh winter conditions	-
Support arm for mast installations	-
Pole clamp kit for mast top installations	-
Calibration set	PWA12
Maintenance cable	PWDRSCABLE
Maritime insulator	-



Features

- Accurate, traceable measurement of prevailing visibility
- Versatile and easy to install
- Easy to integrate
- Robust and dependable
- Weather-proof design reduces need for maintenance

Dependable operation of automated observation networks is a must today. Maritime observing systems need to work in inhospitable environments and also meteorological institutes face tough productivity and performance prerequisites. Vaisala Visibility Sensor PWD50 answers these needs with a mixture of robustness, dependability, versatility, and reliability. PWD50 measures visibility from 10 m to 50 km (from 32 ft to 31 mi).

Accurate Visibility Measurement

Calibrated with reference to a highly accurate transmissometer, PWD50 uses the proven forward-scatter measurement principle to measure meteorological optical range (MOR). The sensor optics are well-protected against contamination: the optical components point downwards, and hoods protect the lenses against precipitation, spray, and dust. This weather-proof design helps to sustain accurate measurement results.

Versatility

PWD50 architecture allows for easy integration to existing or newly designed systems in a cost-efficient manner. The sensor can be mounted on existing masts in many ways. The electrical

interfaces are in a single cable. Versatility is further enhanced with various options, such as pole masts, a selection of mounting adapters, power supply cabinets, and a modem for long distance communication.

Robust and Dependable

The downward-facing sensor hoods protect the optical surfaces from contamination, resulting in low maintenance needs and costs. The optional hood heaters prevent the build-up of ice and/or snow in the optical path.

Solid Track Record

Thousands of PWD series sensors have been installed all around the world. They have undergone rigorous test programs. In the field, the sensors have

demonstrated very low failure rates. They have proved their robustness in the harshest climates and most demanding conditions, ranging from offshore to desert and from airport to roadside.



PWD50 reports meteorological visibility reliably from 10 meters to 50 kilometers (from 32 feet to 31 miles).

Technical data

PWD50 measurement performance

Operating principle	Forward scatter measurement with 45° scattering angle
Observation range of MOR	10 ... 50 000 m (32 ... 164 000 ft)
Accuracy	±10 % at 10 ... 10 000 m (32 ... 32 800 ft) ±20 % at 10 ... 50 km (6.2 ... 31 mi)

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-40 ... +60 °C (-40 ... +140 °F)
Operating humidity	0 ... 100 %RH
Maximum operating wind speed	60 m/s (134 mph)
Sun orientation	Sunlight into the light receiver must be avoided
IP rating	IP66

Inputs and outputs

Power supply	12 ... 50 V DC (electronics) 24 V AC or 24 V DC for heater option
Average power consumption	3 W (peak 10 W) With optional luminance sensor: 5 W With optional hood heaters: 65 W
Outputs	Serial data line may be used either as RS-232 or RS-485 (2-wire) level signals 3 relay controls (open collector) Analog output current: 0 ... 1 mA or 4 ... 20 mA 8-m power/data cable standard. The PWD end is equipped with connector.
Auxiliary data	Low visibility alarms in the data messages. 3 adjustable alarm limits to set the 3 relay controls. Hardware status (fail/warning) in the data messages. Third relay control output can also be driven by hardware status.

Compliance

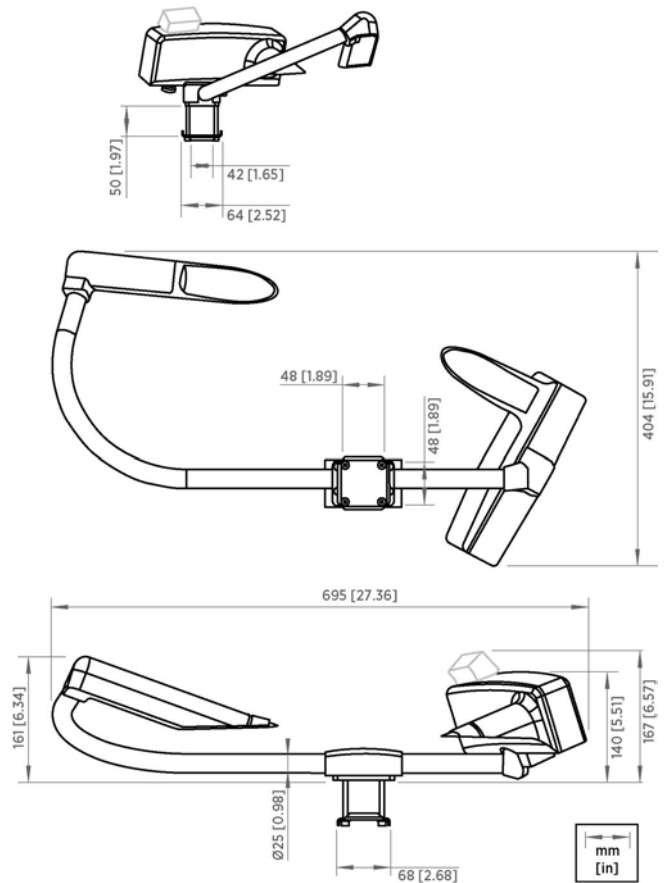
EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
Corrosion and salt mist	VDA 621-415
EMC compatibility	
EMC emissions	CISPR 32 / EN 55032, Class B
Radiated susceptibility	IEC 61000-4-3, 10 V/m
Conducted susceptibility	IEC 61000-4-6
EFT immunity	IEC 61000-4-4
ESD immunity	IEC 61000-4-2
Surge	IEC 61000-4-5

Mechanical specifications

Weight	3 kg (6.61 lb)
Material	Aluminum
Dimensions (H × W × L)	140 × 404 × 695 mm (5.51 × 15.91 × 27.36 in)

Spare parts and accessories

Item	Code
Pole mast	-
Interface unit with power supplies: 115/230 V AC	-
Luminance sensor	PWL111
Hood heaters for harsh winter conditions	-
Support arm for mast installations	-
Pole clamp kit for mast top installations	-
Calibration set	PWA12
Maintenance cable	16385ZZ
Maritime insulator	-



Dimensions



In addition to meteorological observation networks, PWD50 is also well-suited for use in offshore operations.



Features

- Accurate, traceable measurement of prevailing visibility
- Detects precipitation type
- Measures the intensity and accumulation of precipitation
- Estimates snow accumulation
- Robust and dependable
- Weather-proof design reduces need for maintenance
- Easy to install, easy to integrate

PWD52 provides a wide visibility measurement range and accurate present weather reporting.

Automated observation networks need to operate with maximum reliability. Maritime and aviation observing systems need to operate in extremely harsh conditions. Meteorological institutes face challenging productivity and performance requirements. Vaisala Present Weather Detector PWD52 answers these needs with a mixture of robustness, dependability, versatility, and reliability.

Accurate Visibility Measurement

Calibrated with reference to a highly accurate transmissometer, PWD52 uses the proven forward scatter measurement principle to measure meteorological optical range (MOR). The sensor optics are well-protected against contamination: the optical components point downwards and hoods protect the lenses against precipitation, spray, and dust. This weather-proof design helps sustain accurate measurement results.

Proven Measurement Principles

PWD52 identifies precipitation type by accurately estimating the water content of precipitation using Vaisala RAINCAP® sensor element, and combines this information with optical forward scatter and temperature measurement. These three independent measurements are processed through sophisticated algorithms to produce an accurate evaluation of the precipitation type according to the WMO and NWS code tables.

Robust and Dependable

Three measurement methods are used in PWD52 continuously, independently, and simultaneously, which reduces false alarm rates to a minimum. The identification of precipitation type is reliable due to sophisticated algorithmic processing of complementary data from multiple sources. These factors together produce exceptionally dependable data.

The downward-facing sensor hoods protect the optical surfaces from contamination, resulting in low maintenance needs and costs. The optional hood heaters prevent the build-up of ice and/or snow in the optical path.

Solid Track Record

Thousands of PWD series sensors have been installed all around the world. They have undergone rigorous test programs. In the field, PWD sensors have demonstrated very low failure rates. They have proved their robustness in the harshest climates and most demanding conditions, ranging from offshore to desert and from airport to roadside.

Technical data

PWD52 measurement performance

Operating principle	Forward scatter measurement with 45° scattering angle
Observation range of MOR	10 ... 50 000 m (32 ... 164 000 ft)
Accuracy	±10 % at 10 ... 10 000 m (32 ... 32 800 ft) ±20 % at 10 ... 50 km (2.6 ... 31 mi)
Weather type identification	7 different types of precipitation (rain, freezing rain, drizzle, freezing drizzle, mixed rain/snow, snow, ice pellets) Precipitation (unknown type) Fog (mist), haze (smoke, sand) or clear
Weather type reporting	WMO 4680 (SYNOP), 4678 (METAR), and NWS code tables; 49 different codes supported from the WMO 4680 code table
Precipitation detection sensitivity	0.05 mm/h (0.0020 in/h) or less, within 10 minutes
Precipitation intensity measurement	0.00 ... 999.99 mm/h (0.00 ... 39.37 in/h)
Precipitation amount measurement	0.00 ... 99.99 mm (0.00 ... 3.94 in)
Amount of new snow	0.00 ... 999 mm (0.00 ... 39.33 in)

Inputs and outputs

Power supply	12 ... 50 V DC (electronics) 24 V AC or 24 V DC for heater option
Average power consumption	3 W (peak 10 W) With optional luminance sensor: 5 W With optional hood heaters: 65 W
Outputs	Serial data line may be used either as RS-232 or RS-485 (2-wire) level signals 3 relay controls (open collector) Analog output current: 0 ... 1 mA or 4 ... 20 mA 8-m power/data cable standard. The PWD end is equipped with connector.
Auxiliary data	Low visibility alarms in the data messages. 3 adjustable alarm limits to set the 3 relay controls. Hardware status (fail/warning) in the data messages. Third relay control output can also be driven by hardware status.

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-40 ... +60 °C (-40 ... +140 °F)
Operating humidity	0 ... 100 %RH
Maximum operating wind speed	60 m/s (134 mph)
Sun orientation	Sunlight into the light receiver must be avoided
IP rating	IP66

Mechanical specifications

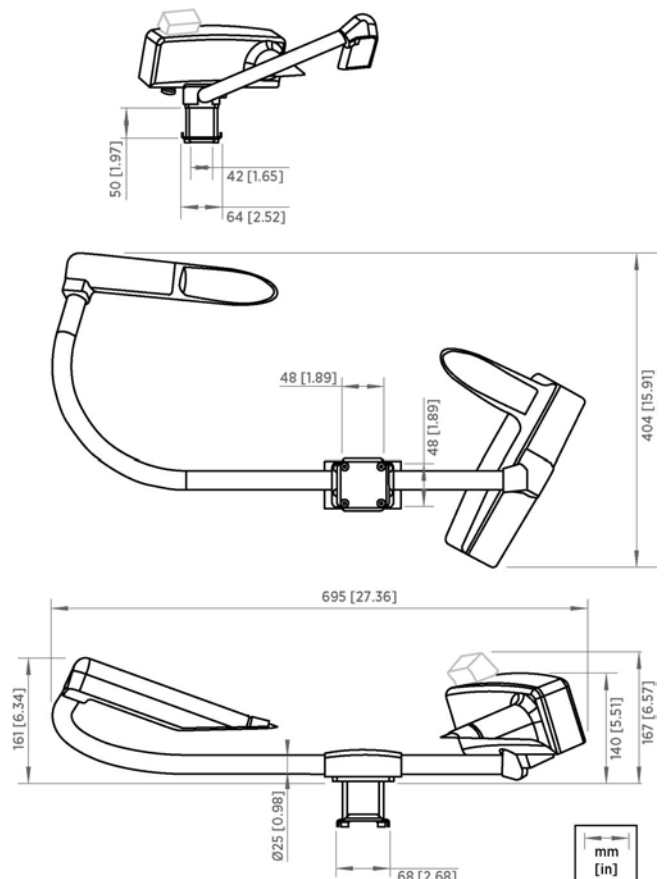
Weight	3 kg (6.61 lb)
Material	Aluminum
Dimensions (H × W × L)	167 × 404 × 695 mm (6.57 × 15.91 × 27.36 in)

Compliance

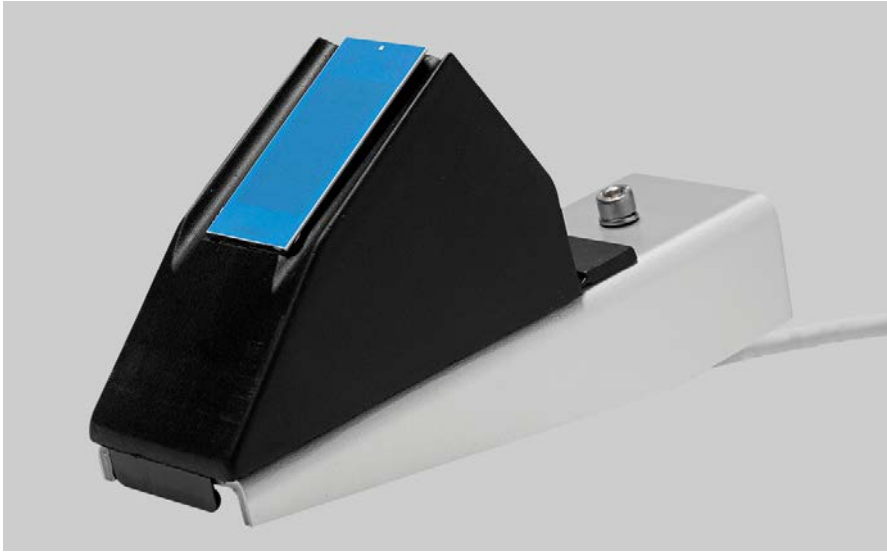
EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
Corrosion and salt mist	VDA 621-415
EMC compatibility	
EMC emissions	CISPR 32 / EN 55032, Class B
Radiated susceptibility	IEC 61000-4-3, 10 V/m
Conducted susceptibility	IEC 61000-4-6
EFT immunity	IEC 61000-4-4
ESD immunity	IEC 61000-4-2
Surge	IEC 61000-4-5

Spare parts and accessories

Item	Code
Pole mast	-
Interface unit with power supplies: 115/230 V AC	-
Luminance sensor	PWL111
Hood heaters for harsh winter conditions	-
Support arm for mast installations	-
Pole clamp kit for mast top installations	-
Calibration set	PWA12
Maintenance cable	16385ZZ
Enhanced weather detection option	-
Maritime insulator	-



Dimensions



Features

- Fast and accurate precipitation detection (ON/OFF)
- Rain intensity measurement with processing unit
- Heating element for keeping sensor free of snow and condensed moisture, and for quick drying
- Maintenance free

Vaisala DRD11A Rain Detector detects rain and snow quickly and accurately. It uses droplet detection instead of signal level threshold.

A delay circuitry allows a two-minute interval between raindrops before assuming the OFF position (no rain). This enables the sensor to accurately distinguish between rain cessation and light rain.

DRD11A also features an analog rain signal for estimating rain intensity. Since this signal is proportional to the percentage of moist or wet area on the sensor plate, rain intensity has a direct impact on the amplitude and variation of this analog signal.

The DRD11A sensor is positioned at a 30° angle. The design together with the internal heating element ensure that the surface dries quickly. This is an essential factor for calculating intensity. The same heating element also protects the surface from fog and condensed moisture. It activates at low temperatures to melt snow and allow snow detection. Sensor performance is not affected by reasonable amounts of dirt and dust due to droplet detection.

The low heating power model DRD11L is designed for areas with only rain or wet and moist snow precipitation.

Technical Data

Measurement performance

Sensor	Capacitive principle, thick layer sensor RAINCAP®, with a thin glass shield Integrated heater element
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Rain detection sensitivity

Minimum wet area	0.05 cm ² (0.008 in ²)
Detection delay	< 0.1 ms
OFF delay (active)	< 5 min

Sensor plate

Sensing area	7.2 cm ² (1.12 in ²)
Angle	30°

Inputs and outputs

Operating voltage	12 V DC, ±10 %
Average power consumption	0.30 W at 12 V
Maximum power consumption with sensor plate heating on	3.12 W at 12 V ¹⁾
Rain on/off output	Open collector, active low signal corresponds to rain Maximum voltage 15 V Maximum current 50 mA
Analog output	1 ... 3 V (wet ... dry)
Frequency output	1500 ... 6000 Hz, non-calibrated
Supply current	Typical less than 150 mA Maximum 260 mA Heater off 25 mA
Heating power, sensor plate	0.5 ... 2.3 W

Control for heater OFF

OFF	Connect to GND
Contact rating	Minimum 15 V, 2 mA

¹⁾ The actual power consumption depends on the temperature and rain intensity.

Mechanical specifications

Weight	0.5 kg (1.1 lb)
Cable length	4 m (13 ft 1 in)
Ground wiring	Separate ground wires for signal and heater
Mounting	By one screw (M5×20 mm) to sensor support arm

Dimensions (H × W × L)

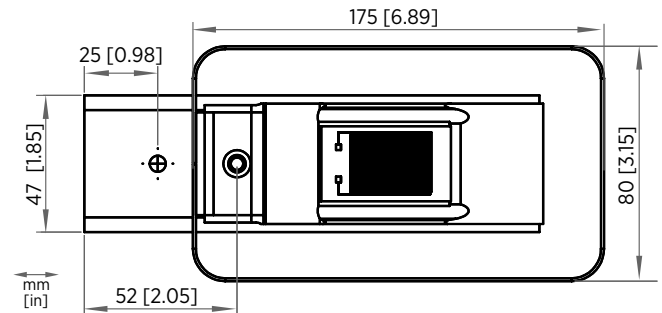
With wind shield	110 × 80 × 175 mm (4.33 × 3.15 × 6.89 in)
Without wind shield	90 × 46 × 157 mm (3.54 × 1.81 × 6.18 in)

Materials

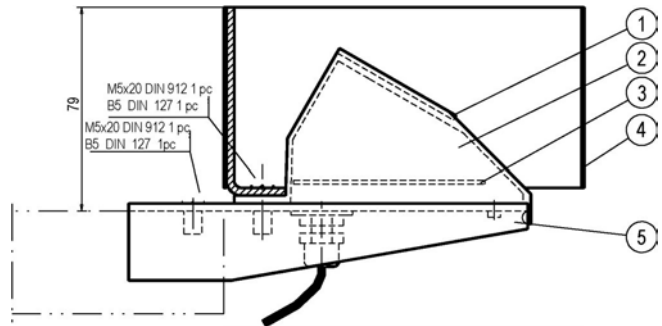
Housing	Polypropylene
Windshield and support bracket	Aluminum
Moisture shield	Polyurethane

Operating environment

Operating temperature	-15 ... +55 °C (+5 ... +131 °F)
Storage temperature	-40 ... +65 °C (-40 ... +149 °F)



Dimensions



- 1 Sensor, RAINCAP®
- 2 Polyurethane moisture shield
- 3 Component assembly
- 4 Wind shield
- 5 Mounting plate



CL31 Ceilometer



Vaisala Ceilometer CL31 is a compact and lightweight instrument for cloud base height and vertical visibility measurements. It detects 3 cloud layers simultaneously. CL31 uses a pulsed diode laser LIDAR (light detection and ranging) technology. CL31 is ideal for aviation and meteorological applications.

Measurement starts from ground level

The enhanced single-lens technology applied in CL31 ensures excellent performance starting at a height of virtually zero. This is due to the strong and stable signal over the whole measurement range. The single-lens technology provides unsurpassed reliability during precipitation, low clouds and ground based obscurations, which are the most critical phenomena in aviation safety.

Fast measurement

Fast measurement helps to detect thin cloud patches below a solid cloud base. CL31 provides a full backscatter profile for data visualization and research purpose.

The CL31 beam can be directed either vertically or tilted. The tilting option together with the novel optics design provides enhanced performance during precipitation by improving the protection given by the shield. In the measurement unit, a tilt angle sensor automatically corrects the measured cloud distance reading to vertical cloud base height.

Extensive self-diagnostics

CL31 is fully automatic. In addition to cloud height data, the messages contain instrument status information based on comprehensive self-diagnostic routines.

In case of malfunction, the diagnostics help users to identify the failed module. CL31 features practical modularity and its easy-access door ensures fast servicing and high data availability.

Easy installation and maintenance

CL31 is easy to install. It has a radiation shield that protects the unit during precipitation and against excessive heat or cooling in extreme temperatures. The automatic window blower with heater improves performance by keeping the window clean and dry. In cold conditions heating prevents frost generation on the window.

Features

- Measurement range from 0 to 7.6 km (from 0 to 25 000 feet)
- Modular design for easy installation and maintenance
- Second-generation, advanced single-lens optics provides excellent performance also at low altitudes
- Fast measurement enables detection of thin cloud layers below a solid cloud base
- Reliable operation in all weather; unsurpassed performance in vertical visibility and cloud detection during precipitation
- Latest technology from the world-leading manufacturer - based on the experience from more than 5000 installed Vaisala ceilometers worldwide
- Extensive self-diagnostics with fault analysis

Data messages

- Cloud hits (up to 3 layers) and status information
- Cloud hits, status, and backscatter profile
- Emulation of CT12K, CT25K, LD-25/40
- Sky condition (optional)

Technical data

Operating environment

Operating temperature	-55 ... +55 °C (-67 ... +131 °F), excluding battery
Operating humidity	0 ... 100 %RH
Wind tolerance	Up to 55 m/s (123 mph)
Vibration	Lloyds Register / IEC 60068-2-6 5 ... 13.2 Hz, ±1.0 mm 13.2 ... 100 Hz, ±0.79 g 9.1 ... 150 Hz, ±0.5 g
Pollution degree	2
Maximum operating altitude	3000 m (approx. 9800 ft)
IP rating	IP65 (measurement unit) IPX6 (with radiation shield)

Inputs and outputs

Operating voltage	115/230 V AC 100 – 127 V AC, 207 – 253 V AC
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Power consumption	
Power consumption (maximum)	310 W
Measurement unit	15 W
Internal heater	100 W
Window conditioner heater	175 W
Window blower	20 W
Frequency (min/max)	50/60 Hz
No-break power supply	12 V sealed lead-acid battery, 2 Ah
Backup battery	12 V internal, 2 Ah
Overvoltage protection	Low-pass filter, VDR
Overvoltage category	II

Interfaces	
Data	<ul style="list-style-type: none"> RS-232 RS-485, multidrop, 2-wire DXL421 modem module LAN (Ethernet) interface option
Maintenance	RS-232

Baud rate	
RS-232 / RS-485	300 ... 57 600 bps
Modem V.21, V.22	300 ... 1200 bps

Mechanical specifications

Tilt positions	Vertical or 12° tilted
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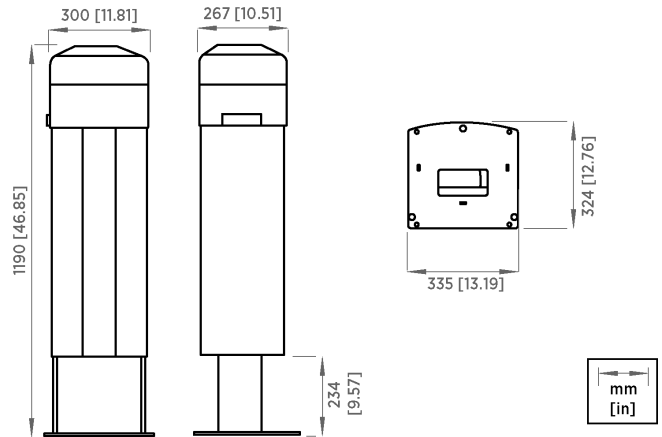
Dimensions	
Measurement unit	620 × 235 × 200 mm (24.41 × 9.25 × 7.87 in)
Height with radiation shield	1190 mm (47 in)
Total	1190 × 335 × 324 mm (46.85 × 13.19 × 12.76 in)

Weight	
Measurement unit	12 kg (26.5 lb)
Radiation shield and blower	19 kg (41.8 lb)
Total	31 kg (68 lb)

Plywood transport container	
Container size	1400 × 490 × 450 mm (55 × 19.30 × 17.72 in)
Container weight	47 kg (103.6 lb)

Measurement performance

Measurement range	0 ... 7.6 km (0 ... 25 000 ft)
Measurement resolution	10 m (33 ft) or 5 m (16 ft), selectable
Reporting interval	Programmable 2 ... 120 s, or polling
Measurement interval	2 s default
Distance measurement accuracy against a hard target	±5 m (16 ft)

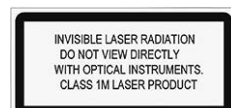


Spare parts and accessories

Cable termination box with extra transient protection	Termbox-1200
PC maintenance cable	QMZ101
Shock absorbing mounting pad for ship installations	CT35022
Modem	DXL421
Attachment mechanics for radio modem antenna	CLRADIOKIT
Graphical User Interface for Ceilometers	CL-VIEW
Boundary Layer View Software for Ceilometers	BL-VIEW
Bird deterrent	CL31BIRDKIT
Air Quality Plug and Play Package for Ceilometer with laptop and pre-installed BL-View	CLAQPACKAGE

Compliance

EU directives and regulations	LVD, EMC, RoHS
EMC immunity	IEC/EN 61326-1, industrial environment
EMC emissions	CISPR 32 / EN 55032, Class B EN 61000-3-2 EN 61000-3-3
Electrical safety	IEC/EN/UL/CSA 61010-1
Environmental	IEC/EN 63000
Eye safety	IEC/EN 60825-1:2014
Compliance marks	CE, RCM, China RoHS, UKCA



CL51 Ceilometer



Vaisala Ceilometer CL51 is designed to measure high-range cirrus cloud heights without surpassing the low and middle layer clouds, or vertical visibility in harsh conditions.

CL51 employs a pulsed diode laser LIDAR (light detection and ranging) technology, where short, powerful laser pulses are sent out in a vertical or near-vertical direction. The reflection of light (backscatter) caused by clouds, precipitation or other obscuration is analyzed and used to determine the cloud base height.

Measurement from ground level

The enhanced single lens technology applied in CL51 ensures excellent performance starting at a height of virtually zero. The signal is strong and stable over the whole measurement range.

CL51 is able to detect 3 cloud layers simultaneously. If the cloud base is obscured due to precipitation or ground-based fog, CL51 reports vertical visibility. CL51 is able to provide the backscatter profile over the full measurement range. This information provides a possibility for an advanced boundary layer and atmospheric analysis.

Designed for harsh weather

CL51 has a shield with a blower and heater, which allows steady operation in precipitation and under extreme temperatures. Reliable solar protection is ensured by optical filters. A tiltable shield further protects the instrument from precipitation and specular reflection from ice crystals. The tilt angle measurement and correction is automatic.

Self-diagnostics

In addition to cloud height data, the fully automatic CL51 outputs messages with information on the instrument status. The information is based on comprehensive self-diagnostic routines. In case of a malfunction the diagnostics help the user to identify the failed module.

Maintenance

Periodic maintenance of CL51 is normally limited to window cleaning. There is no need for adjustments in the field. The automatic window blower with heater improves performance by keeping the window clean and dry. In cold conditions heating prevents frost generation on the window. Any malfunction is automatically reported in the data and status messages.

Features

- Cloud reporting range up to 13 km (43 000 ft)
- Backscatter profiling over full range up to 15 km (49 200 feet)
- Second-generation, advanced single-lens optics with excellent performance also at low altitudes
- Field-proven, fully automatic 24/7 operation in all weather conditions
- Modular design for easy installation and maintenance
- Extensive self-diagnostics with fault analysis
- Reliable operation in all weather: unsurpassed performance in precipitation
- Based on robust and affordable laser diode technology
- Detection of cirrus clouds
- Latest technology from the world leading manufacturer - over 5000 ceilometer installations worldwide

Data messages

- Cloud hits and internal monitoring data
- Cloud hits, status, and backscatter profile
- Emulation of CL31 and LD-40
- Sky condition (optional)

Technical data

Measurement performance

Measurement range	0 ... 13 km (0 ... 43 000 ft)
Backscatter profiling range	0 ... 15 km (0 ... 49 200 ft)
Reporting resolution	10 m (30 ft), units selectable
Reporting cycle	6 ... 120 s, or polling
Distance measurement accuracy against a hard target	±5 m (16 ft)

Inputs and outputs

Operating voltage	115/230 V AC 100 – 127 V AC, 207 – 253 V AC
Power consumption (typical)	310 W
Backup battery	12 V internal, 2 Ah
Overvoltage category	II

Interfaces

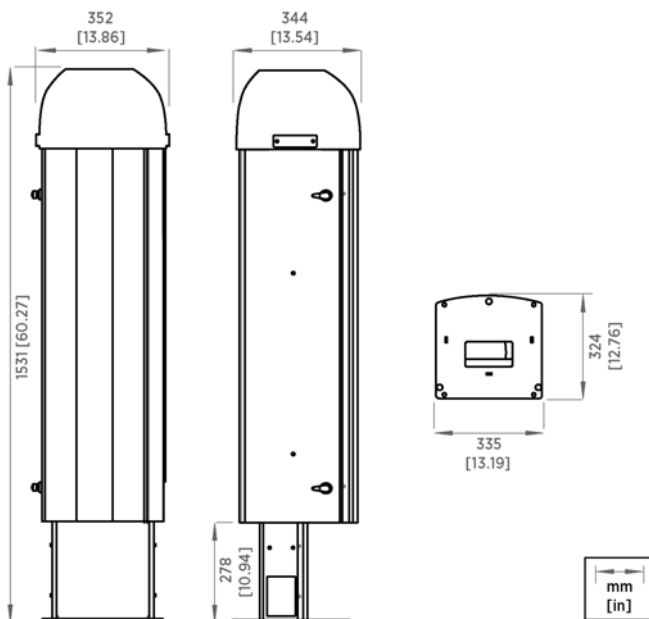
Data	<ul style="list-style-type: none"> RS-232 RS-485, multidrop, 2-wire DXL421 modem module LAN (Ethernet) interface option
Maintenance	RS-232

Baud rate

RS-232 / RS-485	300 ... 115 200 bps
Modem V.21, V.22	300 ... 1200 bps

Operating environment

Operating temperature	-55 ... +55 °C (-67 ... +131 °F) excluding battery
Operating humidity	0 ... 100 %RH
Wind tolerance	Up to 55 m/s (123 mph)
Vibration	Lloyds Register / IEC 60068-2-6 5 ... 13.2 Hz, ±1.0 mm 13.2 ... 100 Hz, ±0.7 g 9.1 ... 150 Hz, ±0.5 g
Pollution degree	2
Maximum operating altitude	3000 m (approx. 9800 ft)
IP rating	IP65 (measurement unit)



Mechanical specifications

Dimensions

Measurement unit	834 × 266 × 264 mm (32.83 × 10.47 × 10.40 in)
Height with radiation shield	1531 mm (60.28 in)
Total	1531 × 335 × 324 mm (60.28 × 13.19 × 12.76 in)

Weight

Measurement unit	18.6 kg (41 lb)
Radiation shield and blower	27.4 kg (60.4 lb)
Total	46 kg (101.41 lb)

Plywood transport container

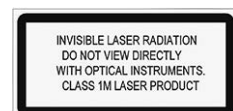
Container size	1650 × 540 × 480 mm (65 × 21.26 × 18.90 in)
Shipping weight	Typically 75 kg (165.3 lb)

Spare parts and accessories

Cable termination box with extra transient protection	Termbox-1200
PC maintenance cable	QMZ101
Shock absorbing mounting pad for ship installations	CT35022
Modem	DXL421
Attachment mechanics for radio modem antenna	CL51RADIOKIT
Graphical User Interface for Ceilometers	CL-VIEW
Boundary Layer View Software for Ceilometers	BL-VIEW
Bird deterrent	CL51BIRDKIT
Air Quality Plug and Play Package for Ceilometer with laptop and pre-installed BL-View	CLAQPACKAGE

Compliance

EU directives and regulations	LVD, EMC, RoHS
EMC immunity	IEC/EN 61326-1, industrial environment
EMC emissions	CISPR 32 / EN 55032, Class B EN 61000-3-2 EN 61000-3-3
Electrical safety	IEC/EN/UL/CSA 61010-1
Environmental	IEC/EN 63000
Eye safety	IEC/EN 60825-1:2014
Compliance marks	CE, RCM, China RoHS, UKCA



CL61 Lidar Ceilometer



Vaisala Lidar Ceilometer CL61 is a high-performance light detection and ranging (LiDAR) instrument with depolarization measurement capable of unattended operation 24/7 in all conditions. The depolarization measurement enables differentiation between solid, liquid, or mixed-phase clouds and precipitation, providing ready-to-use information for atmospheric characterization.

Improved decision-making with more detailed view of atmospheric conditions

CL61 uses attenuated backscatter profiles measured in 2 polarization directions to calculate the depolarization ratio. The depolarization measurement not only enables the liquid/solid differentiation, but also makes it possible to detect dust and volcanic ash.

To further enhance atmospheric structure reporting, CL61 has an improved signal-to-noise ratio (SNR). The improved high-resolution attenuated backscatter profiling is available for the full range, up to 15.4 km (9.6 mi).

With these enhanced features and BL-View software, you also get a detailed view of atmospheric conditions within the planetary boundary layer, for example, for air quality forecasting.

Leading technology

CL61 contains the latest technology from the world-leading manufacturer with strong experience in lidar technology since the 1980s. There is an installed base of thousands of Vaisala ceilometers worldwide.

Vaisala's unique and proven single-lens technology guarantees reliable measurements in low altitudes.

The new patented transmitter technology in CL61 minimizes the effect of water vapor absorption.

Single-receiver depolarization measurement does not require field calibration.

Portable and versatile data

Measurement data is available in the universal and accessible netCDF format, making data sharing easy with colleagues and other users.

The system is able to internally buffer data to smooth out brief communication inconsistencies. Data is labeled with time, based on a clock synced using Network Time Protocol.

Easy installation and maintenance

CL61 is a compact and eye-safe lidar ceilometer with modern communication and network capabilities. The modular structure enables safe and easy installation by 1 person.

The product has low maintenance requirements, with extensive self-diagnostics and embedded fault analysis minimizing downtime. Remote Ethernet access reduces the need for site visits and interruption of measurement data flow. These benefits contribute to overall low cost of ownership.

Integrated security software keeps your instrument and data safe.

Features

- Depolarization measurement to support liquid/solid differentiation, as well as detection of potential dust and volcanic ash
- Attenuated backscatter profiling for the full range of up to 15.4 km (9.6 mi)
- Improved signal-to-noise ratio (SNR) for enhanced atmospheric structure reporting
- Unique single-lens optics with excellent performance also at low altitudes
- Patented technology to minimize the effect of water vapor absorption
- Measurement data available in netCDF format
- Traceable factory calibration

Technical data

Measurement performance

Measurement range, cloud and backscatter	0 ... 15 400 m (0 ... 50 500 ft)
Reporting resolution	4.8 m (15.7 ft)
Measurement interval	5 s
Measurement accuracy against hard target	±5 m (16.4 ft)
Laser	InGaAs diode
Laser wavelength	910.55 nm

Data reporting

Atmospheric parameters	Cloud base heights (up to 5 layers) Cloud depth and penetration ¹⁾ Precipitation/fog detection ¹⁾ Sky condition
Atmospheric profiles	Attenuated backscatter profile Parallel and cross-polarized profiles Depolarization ratio profile
Status information	Internal monitoring data

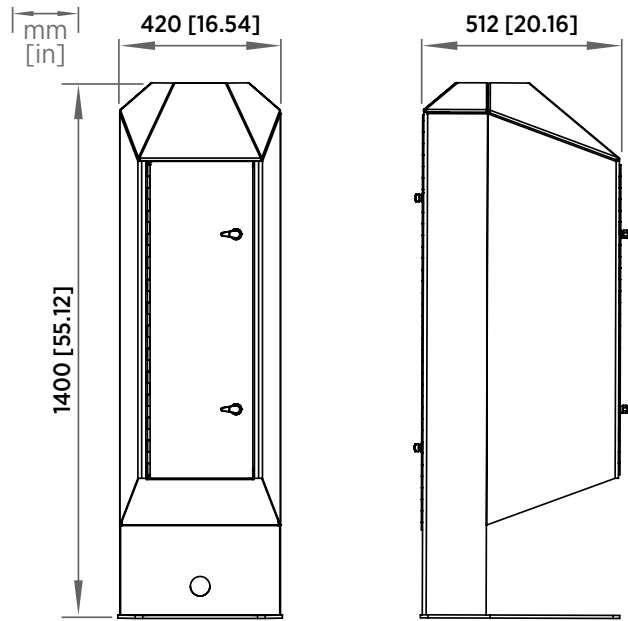
¹⁾ Available later.

Inputs and outputs

Nominal voltage	120 / 230 V AC 3.1 / 1.6 A
Operating voltage	90 - 130 / 200 - 250 V AC
Oversvoltage category	CAT III
Operating frequency	50 ... 60 Hz
Data interface	Ethernet (> 10 Mbit/s)
Maintenance interface	Ethernet
Message format	NetCDF
Power consumption	
With heating	Max. 370 W
Without heating	Max. 100 W

Mechanical specifications

Dimensions (H × W × L)	1400 × 420 × 512 mm (55.12 × 16.54 × 20.16 in)
Weight, total	55 kg (121 lb)
Weight, radiation shield	23 kg (51 lb)
Weight, interface unit	12 kg (26 lb)
Weight, measurement unit	20 kg (44 lb)
Material	Aluminum
Color	White (RAL9003)
Coating	Multi-layer coating to prevent environmental corrosion
Tilt angle	Default: 3°



CL61 dimensions

Operating environment

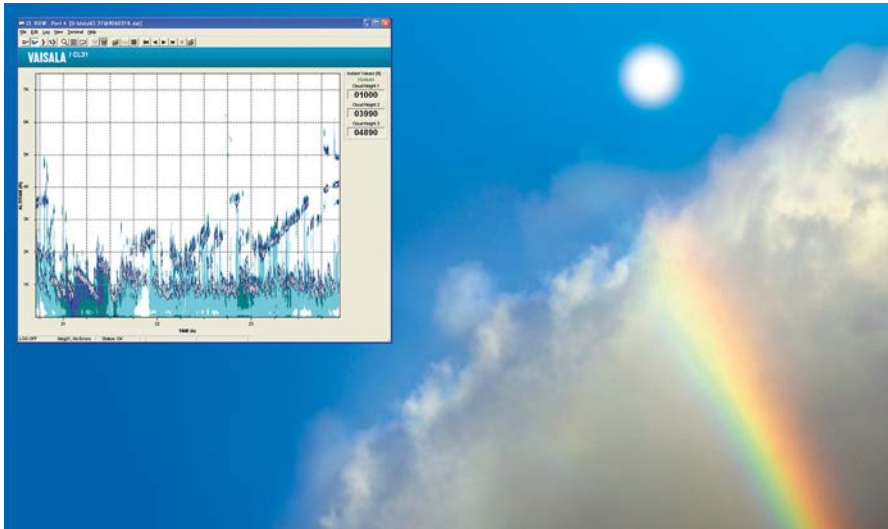
IP rating (when inside radiation shield, excluding window blower)	IP66
Operating temperature	-55 ... +55 °C (-67 ... +131 °F)
Storage temperature	-55 ... +60 °C (-67 ... +140 °F)
Operating humidity	0 ... 100 %RH
Wind	Up to 60 m/s (134 mph)

Compliance

EMC immunity	EN 61326-1, industrial environment
EMC emissions	CISPR 32 / EN 55032, Class B
Electrical safety	IEC / EN 61010-1 ¹⁾
Eye safety	Class 1M IEC / EN 60825-1:2014
Compliance marks	CE, China RoHS, RCM, UKCA
Complies with ICAO fragility requirements.	

¹⁾ IEC / EN / UL / CSA 61010-1 available later.





Features

- Displays and logs data from one or more ceilometers while running other Windows applications
- Viewing of previously logged data is possible while logging and displaying real-time data
- Cloud base data and backscatter profiles in clear graphical form
- A large variety of user selections
- Maintenance access through internal terminal program
- Sky condition window

Vaisala CL-VIEW offers an improved graphical interface for ceilometer users.

Vaisala Graphical User Interface for Ceilometers CL-VIEW is an independent data collection, storage, and presentation software designed for Vaisala CL51, CL31, CT25K, and CT75K Laser Ceilometers. Ceilometer models CT12K and LD40 are also partially supported.

CL-VIEW runs on a computer with Microsoft® Windows® 10, providing all conveniences of a graphical user interface. Menus, option screens, icons, and help texts make the program easy and fast to use. Communication between

the ceilometer and the computer is arranged through a direct RS-232 serial line or through a modem in longer distances.

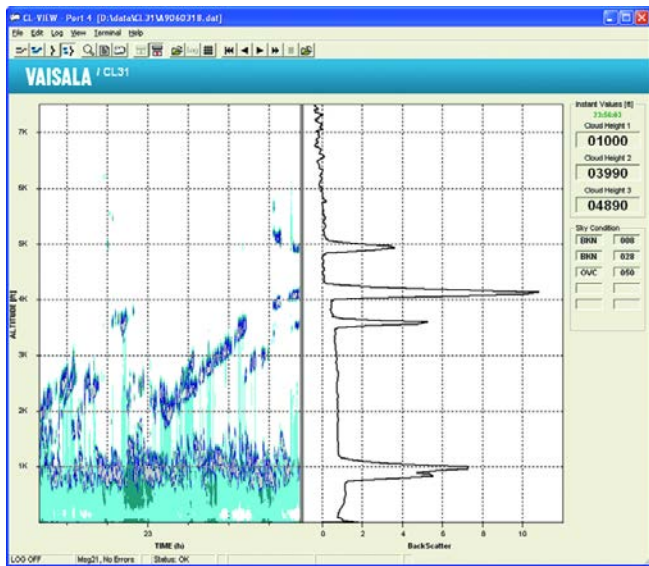
CL-VIEW is designed to be optimal for receiving, storing, visualizing, and analyzing data. The software is very flexible, and it can be tailored to suit operators' needs.

The graphical presentations include cloud detection, cloud intensity, and backscatter profile graphs. Numerical cloud height information, ceilometer status, and log status along with time and date are also displayed in all three graphs.

If the ceilometer is equipped with the sky condition option, this message content can be viewed in the main window or a separate window. It provides cloud layer height and information in textual or symbolic format.

CL-VIEW has an internal terminal program that can be used to check the ceilometer status and change the internal parameters of the ceilometer.

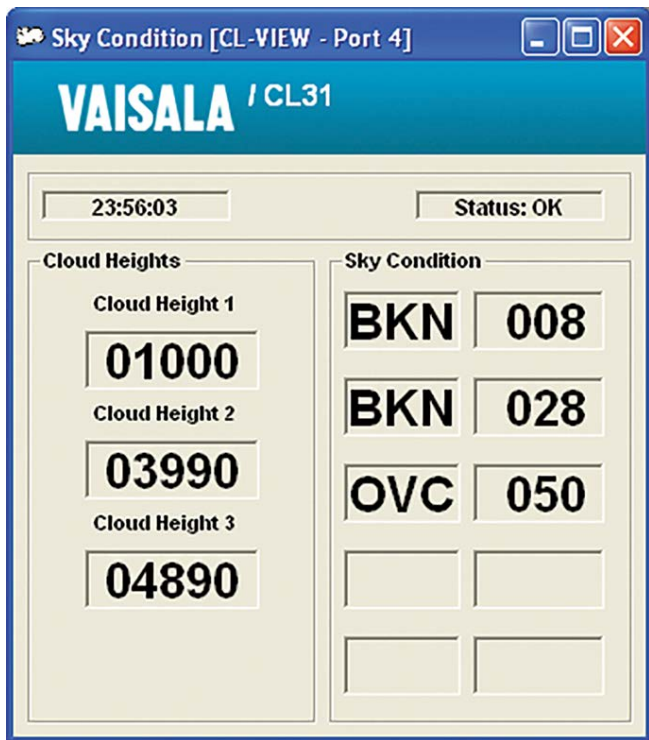
Technical data



The cloud intensity is shown as a point graph where the color is proportional to the strength of the return signal from the altitude in question. The backscatter profile is presented as a line graph in instant and average modes. Both modes can be displayed simultaneously.

Minimum system requirements

Operating system	Microsoft® Windows® 10
Memory	32 MB RAM
Hard disk space	50 MB



The sky condition window presents cloud layer height information and the corresponding sky condition in textual, numerical, or graphics format.



Features

- 24/7 visualization of mixing layer height (MLH) evolution and additional layers
- Hourly average MLH
- Centralized view to data from up to 10 ceilometers
- Complete view of MLH, clouds, and full-range backscatter profile
- Easy sharing, viewing, and analysis of data between independent BL-View users
- Seamless integration of data for external applications, forecasting, and numerical model verification

Vaisala BL-View is an application software for the data collection, analysis, and visualization of the planetary boundary layer. It provides an understanding of the current conditions to support faster and more reliable decision-making.

Improved decision-making with accurate boundary layer visualization

BL-View generates an online visual representation of the mixing layer height (MLH), which provides you with an immediate understanding of the local conditions. You can view and analyze logged data while continuing to display online data. BL-View helps to improve your air quality monitoring and forecasting.

Reliable data in all weather

Vaisala ceilometer measures the backscatter profile of the atmosphere and provides it for analysis in BL-View. The analysis uses an automatic algorithm for the online reporting of the boundary layer depth and additional residual structures. BL-View calculation is based on the combined gradient and idealized backscatter methods and enables reliable automatic reporting of the convective MLH.

To ensure reliable reporting in all weather conditions, BL-View uses an all-weather algorithm that takes into account precipitation and cloud events. The algorithm also uses the time of day and the location to improve automatic reporting in all conditions.

Manage your ceilometer network

BL-View provides a centralized view of the ceilometer data in the network, facilitating concentrated data analysis. The status information of the network is available in one place.

For a network with more than 10 ceilometers, Vaisala recommends using BL-View with Vaisala Observation Network Manager NM10.

Fast data analysis

The ceilometer messages are stored in the netCDF format on the computer hard drive for fast data analysis and easy sharing. The automatically analyzed boundary layer data can be easily transferred to other applications, for example, as inputs to numerical weather prediction models.

File Viewer enables a simple and convenient way to analyze any netCDF files logged with BL-View.

Flexible user interface

You can run simultaneous operator-specific analyses with user-set algorithm parameters for both logged and online data without disturbing online data analysis.

The ceilometer and communication status is displayed on the main screen enabling easy investigation of possible operational alerts. The warnings and alarms are stored automatically to log files for easy retrieval.

Technical data

Measurements and observations

Measured parameters	Cloud height data Backscatter intensity
Calculated parameters	Mixing layer height 1-hour average mixing layer height 2 ... 4 additional elevated layers Negative gradient profile Quality index
Cloud base height	3 height values
Update interval	1 minute
Measurement range	
MLH data, CL31, CL51 and CL61	Up to 4000 m (13 120 ft)
Profile data, CL31	Up to 7700 m (25 260 ft)
Profile data, CL51 and CL61	Up to 15 400 m (50 520 ft)

Inputs and outputs

Supported devices	CL31 CL51 CL61
Connection capacity	1 ... 10 Vaisala ceilometers
Connection options, ceilometer/ BL-View	Serial UDP TCP client TCP server
Input file format	netCDF DAT (Vaisala proprietary)
Output file format	netCDF HIS (Vaisala proprietary) PNG

Minimum system requirements

Computer connection options	Ethernet port Serial port USB serial converter
Operating system	Microsoft® Windows® 10
Memory	2 GB RAM
Hard disk space ¹⁾	
For BL-View installation	600 MB
For BL-View data files	40 GB / year / ceilometer (typically)

¹⁾ Required total hard disk space depends on the number of ceilometers.

User interface features

File viewer for shared netCDF files
Zooming of plots
Scheduled snapshot
Selectable algorithm (gradient, profile fit, merged gradient and profile fit)
User-selectable algorithm parameters
Import (DAT files)
Alerts view
Device-specific configuration
Management of your ceilometer network
User-selectable units (meters/feet)
User interface languages:
• English
• Chinese



Algorithm performance verified by radiosondes



WMT700 Series WINDCAP Ultrasonic Wind Sensor



WMT700 Series has been designed for professional use in meteorology, aviation, maritime, wind energy, and many other applications.

Vaisala WINDCAP® Ultrasonic Wind Sensor WMT700 Series is a robust and reliable ultrasonic anemometer. It measures surface wind, which is one of the key parameters for meteorology and aviation.

WMT700 series meets WMO CIMO Guide (WMO-No.8) and ICAO requirements.

Accurate and maintenance-free

WMT700 series has a durable full steel structure with welded arms, clear North indication, and one-point, quick bayonet-style mounting. It has no moving parts, and it is resistant to contamination and corrosion.

It measures accurately and produces reliable data in demanding wind conditions and climates without periodic or on-demand maintenance. Self-diagnostics and measurement validation are standard features. The 60-minute average is available for polar coordinates and vectors.

Measurement based on ultrasound

WMT700 series uses ultrasound to determine the horizontal wind speed and direction. The measurement is based on transit time, the time it takes for the ultrasound to travel from one transducer to another, depending on the wind speed.

The transit time is measured in both directions for a pair of transducer heads. Using 2 measurements for each of the 3 ultrasonic paths at 60° angles to each other, WMT700 computes the wind speed and direction.

The wind measurement is calculated in a way that completely eliminates the effects of altitude, temperature, and humidity.

Standard and heated models

WMT700 series operates with a power supply of 9 ... 36 V DC. For the heated model, an additional heating power supply of 24 ... 36 V DC is required.

Thermostatically controlled heaters in the transducer heads and arms of the heated model prevent build-up of freezing rain and snow. A model with a heated transducer, arms, and body is available for operation in the harshest and coldest environments.

In addition, accessories are available for mounting and connecting WMT700. To minimize interference from birds, a bird prevention kit is available.

Features

- WMO and ICAO compliant
- Data output rate 4 Hz and 8 Hz
- Stainless steel structure
- Maintenance-free
- 3-transducer layout provides accurate data
- Data format outputs: polar coordinates and vectors
- Fully compensates effects of temperature, humidity, and pressure
- Measurement range up to 90 m/s (201 mph)
- Heating up to 250 W
- IP66 and IP67
- Large transducers provide high ultrasound power
- Optional bird prevention kit
- Wind gust calculated according to WMO guidelines
- US National Weather Service and the FAA rely on Vaisala WINDCAP® technology



DNV GL TYPE EXAMINATION
CERTIFICATE No. TAA00000U5



Technical data

Wind speed measurement performance

Observation range	WMT701: 0 ... 40 m/s (89 mph) WMT702: 0 ... 65 m/s (145 mph) WMT703: 0 ... 75 m/s (168 mph) WMT704: 0 ... 90 m/s (201 mph)
Starting threshold	0.01 m/s (0.0223 mph)
Resolution	0.01 m/s (0.0223 mph)
Response time	250 ms
Accuracy	0 ... 75 m/s (168 mph): ±0.1 m/s (0.2 mph) or 2 % of reading, whichever is greater 75 ... 90 m/s (201 mph): ±5 % of reading

Wind direction measurement performance

Observation range	0 ... 360°
Starting threshold	0.1 m/s (0.2 mph)
Resolution	0.01°
Response time	250 ms
Accuracy	±2°

Powering specifications

Operating voltage	9 ... 36 V DC (absolute max. 40 V DC) ¹⁾
Heating voltage	24 ... 36 V DC (absolute max. 40 V DC) ¹⁾
Heating power supply requirement ²⁾	
Heated transducers	Average 32 W Peak 40 W
Heated transducers and arms	Average 152 W Peak 200 W
Heated transducers, arms, and body	Average 252 W Peak 350 W at 24 V DC

¹⁾ In maritime environments, the normal input voltage ranges are: operating voltage 10 ... 30 V DC (-10 ... +30 %) and heating voltage 24 ... 30 V DC (-10 ... +30 %), as defined in the maritime standard IEC 60945.

²⁾ The actual power consumption depends on the temperature.

Messaging specifications

Readout update interval	4 Hz (default) and 8 Hz (optional)
Units available	m/s, knots, mph, km/h, V, mA, Hz
Operating mode	Automatic message or poll mode
Virtual temperature	Celsius degrees

Mechanical specifications

Dimensions (H × W × Ø ¹⁾)	348 × 250 × 285 mm (13.70 × 9.84 × 11.22 in)
Weight	1.8 kg (4.0 lb)
Materials	
Body and arms, mounting kit	Stainless steel AISI 316
Transducers	Silicone
Connector housing surface	Nickel-plated brass

¹⁾ Diameter of area covered by transducers.

Analog outputs

Wind speed	Voltage, current, frequency
Wind direction	Voltage, current, potentiometer

Operating environment

Heating ¹⁾	0 W, 30 W, 150 W, or 250 W
Operating temperature ¹⁾	-10 ... +60 °C (+14 ... +140 °F) -40 ... +60 °C (-40 ... +140 °F) -55 ... +70 °C (-67 ... +158 °F)
Storage temperature	-60 ... +80 °C (-76 ... +176 °F)
IP rating	IP66 and IP67

¹⁾ For freezing conditions, select appropriate combination of heating and temperature ranges.

Digital outputs

Communication interfaces	COM1: RS-485 COM2: RS-485, RS-422, RS-232, SDI-12
Communication profiles	WMT700, WS425 ASCII, NMEA Standard and Extended (version 0183), SDI-12 (version 1.3), WS425 ASOS, ROSA MES 12, customized
Bit rate	300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200
Available averages	Max. 3600 s

Compliance

EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863 REACH Regulation (EC 1907/2006)
EMC immunity	IEC 61326-1, IEC 60945
EMC emissions	CISPR 32 / EN 55032, Class B
Environmental	IEC 60068-2-1, 2, 6/34, 30, 31, 67, 78, IEC 60529 VDA 621-415
Maritime	IEC 60945, DNVGL-CG-0339
Electrical safety	UL 61010-1 CAN/CSA C22.2 No. 61010-1-12
Compliance marks	CE, China RoHS, RCM, UKCA
Listing marks	SGS (USA and Canada)

PJB480 Power Junction Box



PJB480 with WMT700 on a pole mast

Features

- Provides operational and heating power for WMT700
- Allows heating WMT700 sensor transducers, arms, and body
- Designed for demanding conditions, such as maritime use and cold climates
- IP66 waterproof enclosure
- Robust enclosure of stainless steel

Vaisala Power Junction Box PJB480 provides operational and heating power to Vaisala WINDCAP Ultrasonic Wind Sensor WMT700. PJB480 is designed for demanding conditions, such as maritime use and cold climates.

Prevents Build-up of Ice and Snow

PJB480 is equipped with two 24 VDC power supplies and has the maximum output power of 480 W. It provides power for keeping the WMT700 sensor operational and heated, thus preventing build-up of ice and snow. With PJB480, WMT700 can be fully heated (including sensor transducers, arms, and body) to keep the sensor functional in the harshest and coldest environments. PJB480 supports one WMT700.

bulkhead installation is included in the delivery. PJB480 can also be mounted to a mast using an optional APPK-SET mounting kit.

Meets Maritime Standards

PJB480 is a durable solution for cold climates and demanding maritime conditions; it is compliant with IEC 60945 standards. PJB480 can be used with a standalone WMT700 or with a WMT700 that is part of a Vaisala Automatic Weather Station.

Withstands Harsh Weather

PJB480 withstands low temperatures, down to $-55\text{ }^{\circ}\text{C}$ ($-67\text{ }^{\circ}\text{F}$). Its housing is waterproof (IP66) and made of stainless steel. A mounting plate for wall or

Technical Data

Operating Environment

Operating temperature	-55 ... +55 °C (-67 ... +131 °F) ¹⁾
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH, non-condensing
Maximum operating altitude	2000 m (6 500 ft)

1) Cold start -40 °C (-40 °F)

Inputs and Outputs

Input voltage	100 ... 240 VAC
Input current	10 A
Operating frequency	50/60 Hz
Output voltage	24 VDC
Output current	16 A
Maximum output power	480 W
Nominal output power	300 W

Spare Parts and Accessories

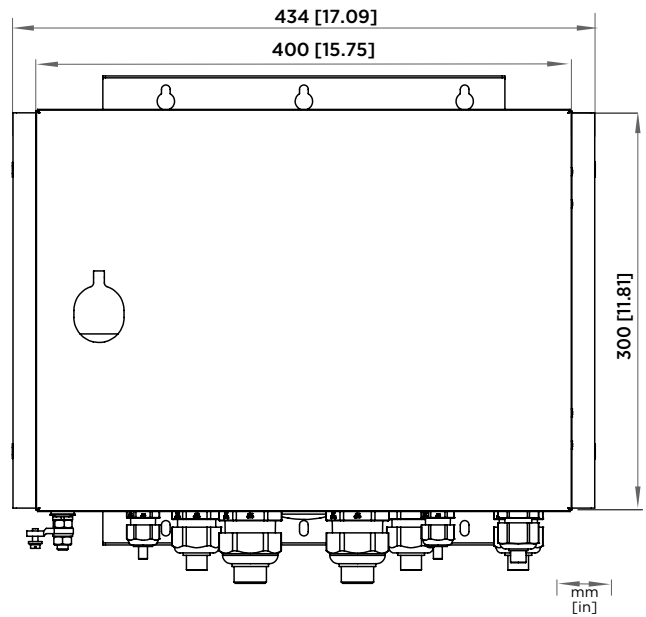
Fuse, 2 A, glass tube 5 × 20 mm (0.79 in)	3595
Surge protector	254404SP
Mounting kit for pole mast, Ø 60 mm (2.36 in)	APPK-SET60
Mounting kit for pole mast, Ø 75 mm (2.95 in)	APPK-SET75
Mounting kit for pole mast, Ø 100 mm (3.94 in)	APPK-SET100
Mounting kit for pole mast, Ø 106 mm (4.17 in)	APPK-SET106
AC (mains) cable	To be purchased separately. Min. 3 × 1.5 mm ² (15 AWG)

Mechanical Specifications

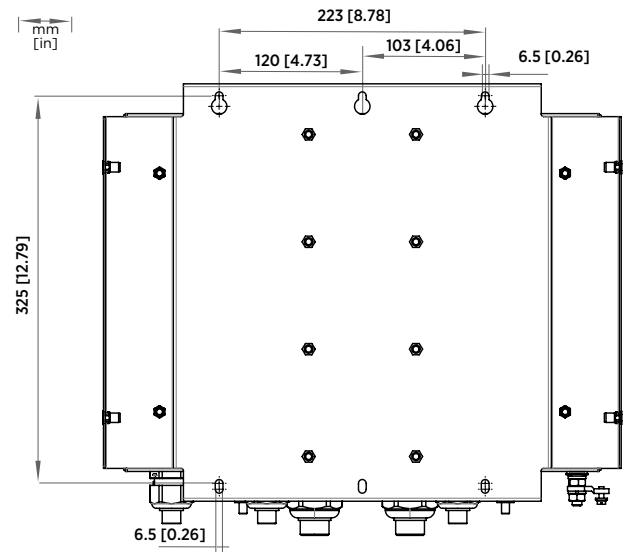
Enclosure dimensions (H × W × D)	300 × 400 × 200 mm (11.81 × 15.75 × 7.87 in)
Weight	14 kg (30 lb)
Materials (enclosure and mounting plate)	Stainless steel AISI 316 / EN 1.4404
Coating (enclosure and mounting plate)	Painted white, polyester powder coating RAL9003

Environmental Compliance

Maritime	IEC 60945
Electrical safety	EN/UL/IEC 61010-1
IP rating	IP66
Vibration	IEC 60068-2-6/IEC 60945
Dry heat	IEC 60068-2-2
Damp heat	Cyclic IEC 60068-2-30
Low temperature	IEC 60068-2-1
Corrosion and salt mist	IEC60068-2-52, VDA 621-415



PJB480 Dimensions, Front View



PJB480 Dimensions, Back View

EMC Compliance

Immunity	EN/IEC 61326-1 (Industrial Environment) / IEC 60945
Insulation	IEC 60092-504
Emissions	EN55032 / CISPR 32 (Class B) / IEC 60945





Features

- High-performance wind measurement set
- Long and successful track record in meteorological applications
- Accurate wind speed and direction measurement
- Low measurement starting threshold
- Conical anemometer cups provide excellent linearity
- Heated shaft prevents bearings from freezing

WA15 is based on accurate sensors installed on a crossarm. It is designed for demanding wind measurement applications.

With a proven track record of successful installations, Vaisala Wind Set WA15 has earned its reputation as the industry standard in the wind sensor market.

WA15 consists of Vaisala Anemometer WAA151, Vaisala Wind Vane WAV151, an optional crossarm, a power supply, and cabling.

Anemometer with excellent linearity

WAA151 is a fast-response, low-threshold anemometer. Three lightweight, conical cups mounted on the cup wheel provide excellent linearity over the entire operating range, up to 75 m/s (168 mph).

A wind-rotated chopper disc attached to the shaft of the cup wheel cuts an infrared light beam 14 times per revolution. This generates a pulse output from the phototransistor.

The output pulse rate is directly proportional to wind speed, for example, 246 Hz = 24.6 m/s (55 mph). However, for the highest accuracy, the characteristic transfer function must be used to compensate for starting inertia.

Sensitive wind vane

WAV151 is a counter-balanced, low-threshold, optoelectronic wind vane. Infrared LEDs and phototransistors are mounted on 6 orbits on each side of a 6-bit GRAY-coded disc. Turned by the vane, the disc creates changes in the code received by the phototransistors. The output code resolution is $\pm 2.8^\circ$.

Heated bearings withstand cold weather

Heating elements in the shaft tunnels of both the anemometer and vane keep the bearings above freezing temperatures in cold climates.

Complete package available

The anemometer and vane are designed to be mounted on Vaisala crossarms.

Technical Data

WAA151 measurement performance

Sensor/Transducer type	Cup anemometer/opto-chopper
Observation range	0.4 ... 75 m/s (0.9 ... 168 mph)
Starting threshold ¹⁾	< 0.5 m/s (1.1 mph)
Distance constant	2.0 m (6 ft 7 in)

Transducer output

0 ... 75 m/s (0 ... 168 mph)	0 ... 750 Hz square wave
Characteristic transfer function	U_f (wind speed) = $0.328 + 0.101 \times R$ (output pulse rate)

Transducer output level

($I_{out} < +5$ mA)	High state > $U_{in} -1.5$ V
($I_{out} > -5$ mA)	Low state < 2.0 V

Accuracy within 0.4 ... 60 m/s (0.9 ... 134 mph)

With characteristic transfer function (standard deviation)	± 0.17 m/s (0.38 mph)
With simple transfer function $U_f = 0.1 \times R$	± 0.5 m/s (1.12 mph) ²⁾

- ¹⁾ Measured with the cup wheel in position least favored by flow direction. The optimum position yields $a < 0.35$ m/s (0.8 mph) starting threshold.
²⁾ Typical error vs. speed with the simple transfer function used.

RANGE (m/s)	0-3	3-10	10-17	17-24	24-31	31-37	37-44	44-51	51-58	58-65
ERROR (m/s)	-0.4	-0.3	-0.2	-0.1	0.0	+0.1	+0.2	+0.3	+0.4	+0.5

WAA151 inputs and outputs

Electrical connections	MIL-C-26482 type, 6-wire cable
Cabling	6-wire cable through cross arm
Recommended connector at cable end	Souriau UTS6JC10E6P
Operating power supply	$U_{in} = 9.5 \dots 15.5$ V DC, 20 mA, typical
Heating power supply	AC or DC 20 V, 500 mA, nominal
Settling time after power-up	< 30 μ s

WAA151 operating environment

Operating temperature ¹⁾	-50 ... +55 °C (-58 ... +131 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH
IP rating	IP65

- ¹⁾ With shaft heating.

WAA151 mechanical specifications

Dimensions (H \times \emptyset)	240 \times 90 mm (9.45 \times 3.54 in)
Swept radius of cup wheel	91 mm (3.58 in)
Weight	570 g (1.26 lb)
Materials	
Housing	AlMgSi, gray anodized
Cup	PA, reinforced with carbon fiber

WAV151 measurement performance

Sensor/Transducer type	Optical code disc
Observation range at wind speed 0.4 ... 75 m/s (0.9 ... 168 mph)	0 ... 360°
Starting threshold	< 0.4 m/s (0.9 mph)
Resolution	$\pm 2.8^\circ$
Damping ratio	0.19
Overshoot ratio	0.55
Delay distance	0.4 m (1 ft 4 in)
Accuracy	Better than $\pm 3^\circ$
Output	6-bit parallel GRAY code

Transducer output level	
($I_{out} < +5$ mA)	High state > $U_{in} -1.5$ V
($I_{out} > -5$ mA)	Low state < 1.5 V

WAV151 inputs and outputs

Electrical connections	MIL-C-26482 type, 10-wire cable
Cabling	10-wire cable through cross arm
Recommended connector at cable end	Souriau UTS6JC12E10P
Operating power supply	$U_{in} = 9.5 \dots 15.5$ V DC, 20 mA typical
Heating power supply	20 V AC or DC, 500 mA nominal
Settling time after power turn-on	< 100 μ s

WAV151 operating environment

Operating temperature ¹⁾	-50 ... +55 °C (-58 ... +131 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH
IP rating	IP65

- ¹⁾ With shaft heating.

WAV151 mechanical specifications

Dimensions (H \times \emptyset)	300 \times 90 mm (11.81 \times 3.54 in)
Swept radius of vane	172 mm (6.77 in)
Weight	660 g (1.46 lb)
Materials	
Housing	AlMgSi, gray anodized
Vane	AlSi 12, anodized

WA15 mechanical specifications

Junction box	125 \times 80 \times 57 mm (4.92 \times 3.15 \times 2.24 in)
Crossarm length	800 mm (31.50 in)
Mounting to a pole mast with a nominal outside diameter	60 mm (2.36 in)

WA15 compliance

Compliance marks	CE
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WA15 spare parts and accessories

Service kit for one WA15/25 sensor (a set of bearings and gasket) 16644WA

Cup assembly WAA151	7150WA
Tail assembly WAV151	6389WA
Sensor board WAA151	1433WA
Sensor board WAV151	1434WA
Attachment hardware for WAA151/252 and WAV151/252	16546WA
Crossarm and serial RS-485 transmitter	WAC155
Component board for WAC155	WAC155CB
Crossarm and termination box	WAC151
16-lead signal cable 10 m for WA15/25, open leads on both ends	ZZ45048
6-lead heating power cable 10 m for WA15/25, open leads on both ends	ZZ45049
Special length 16-lead signal cable for WA15/25, open leads on both ends	ZZ45048SPEC
Special length 6-lead heating power cable for WA15/25, open leads on both ends	ZZ45049SPEC
Sensor cable for WAA151/252 0.8 m (31.5 in) , open lead on one end (6 wires), connector 230118 on another end	ZZ45036
Sensor cable for WAV151/252 0.8 m (31.5 in), open lead on one end (10 wires), connector 230119 on another end	ZZ45037
Special length sensor cable for WAA151/252, open lead in one end (6 wires), connector 230118 on another end	ZZ45036SPEC
Special length sensor cable for WAV151/252, open lead in one end (10 wires), connector 230119 on another end	ZZ45037SPEC
Connector WAA151, WAA252	230118
Connector WAV151, WAV252	230119
Crossarm and analog transmitter	WAT12
Component board for WAT12	16637WA
Power supply for WA15	WHP151
Power board for WHP151 power supply	WA35120



Features

- Non-freezing, high-performance wind set
- Cups and vane, sensor bodies and bearings are heated to prevent snow build-up and ice formation
- Accurate wind speed and direction measurement
- Low measurement starting threshold
- Conical anemometer cups provide excellent linearity

Vaisala Wind Set WA25 is a high-quality cup and vane wind measurement station designed for arctic conditions. WA25 consists of Vaisala Anemometer WAA252, Vaisala Wind Vane WAV252, an optional crossarm, a power supply, and cabling.

Heating Provides Resistance to Snow and Ice

Most of the heating power is consumed where it is needed most – in the cups and vane. Foil heaters, integrated into the cups and vane, prevent snow build-up and ice formation.

Heating power is also supplied to the sensor shafts, bearings, and bodies. This keeps the sensor bodies free of ice, which is important for maintaining the aerodynamic performance.

Anemometer with Excellent Linearity

WAA252 is a fast-response, low-threshold anemometer. Three lightweight, conical cups mounted on the cup wheel provide excellent linearity over the entire operating range, up to 75 m/s (168 mph).

A wind-rotated chopper disc attached to the shaft of the cup wheel cuts an infrared light beam 14 times per revolution. This generates a pulse output from a phototransistor.

The output pulse rate is directly proportional to wind speed (for example, 246 Hz = 24.6 m/s). However, for the highest accuracy, the characteristic transfer function must be used to compensate for starting inertia.

Sensitive Wind Vane

WAV252 is a counterbalanced, low-threshold, optoelectronic wind vane providing a 6-bit GRAY-coded message. Turned by the vane, the disc creates changes in the code received by the phototransistors. The code is changed in steps of 5.6°.

Complete Package Available

The anemometer and vane are designed to be mounted on Vaisala crossarms.

Technical Data

WAA252 Measurement Performance

Measurement range	0.4 ... 75 m/s (0.9 ... 168 mph)
Starting threshold	< 0.5 m/s (1.1 mph) ¹⁾
Distance constant	2.7 m (8 ft 10 in)
Characteristic transfer function	U_f (wind speed) = $0.328 + 0.101 \times R$ (output pulse rate)

Transducer Output Level

($I_{out} < +5$ mA)	High state > 11 V
($I_{out} > -5$ mA)	Low state < 1.5 V

Accuracy Within 0.4 ... 60 m/s (0.9 ... 134 mph)

With characteristic transfer function (standard deviation)	± 0.17 m/s (0.38 mph)
With simple transfer function $U_f = 0.1 \times R$	± 0.5 m/s (1.12 mph) ²⁾

- 1) Measured with cup wheel in position least favoured by flow direction. Optimum position gives approx. 0.35 m/s (0.78 mph) threshold.
2) Typical error vs. speed with the simple transfer function used.

WAA252 Operating Environment

Operating temperature	-55 ... +55 °C (-67 ... +131 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Wind tunnel tests	ASTM standard method D5366-90
Exploratory vibration test	MIL-STD-167-1
Humidity test	MIL-STD-810E, Method 507.3
Salt fog test	MIL-STD-810E, Method 509.3
EMC compliance	EN/IEC 61326-1:1997 + Aml:1998; Generic Environment

WAA252 Mechanical Specifications

IP rating	IP65
Dimensions (H × Ø)	264 × 90 mm (10.39 × 3.54 in)
Swept radius of cup wheel	91 mm (3.58 in)
Weight	0.8 kg (1.76 lb)
Materials	Housing: AlMgSi, gray and black anodized Cup: PC, reinforced with glass fiber

WAA252 Inputs and Outputs

Operating power supply	$U_{in} = 24$ VDC $\pm 10\%$, max. 3.2 A
Typical Power Consumption ($U_{in} = 24$ VDC)	
Below +2 °C (+36 °F) (heating on)	72 W
Above +6 °C (+43 °F) (heating off)	1 W
Output	0 ... 750 Hz square wave
Recommended connector at cable end	SOURIAU MS3116F10-6P
Plug 6-PIN	MIL-C-26482 type

WAV252 Measurement Performance

Measurement range	0 ... 360°
Starting threshold	< 0.4 m/s (0.9 mph)
Resolution	$\pm 2.8^\circ$
Damping ratio	0.3
Overshoot ratio	0.4
Delay distance	< 0.5 m (1 ft 8 in)
Accuracy	Better than $\pm 3^\circ$
Output	6-bit parallel GRAY code

Transducer Output Level

($I_{out} < +3$ mA)	High state > 11 V
($I_{out} > -3$ mA)	Low state < 1.5 V

WAV252 Operating Environment

Operating temperature	-55 ... +55 °C (-67 ... +131 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Wind tunnel tests	ASTM standard method D5366-93
Exploratory vibration test	MIL-STD-167-1
Humidity test	MIL-STD-810E, Method 507.3
Salt fog test	MIL-STD-810E, Method 509.3
EMC compliance	EN/IEC 61326-1:1997 + Aml:1998; Generic Environment

WAV252 Mechanical Specifications

IP rating	IP65
Dimensions (H × Ø)	355 × 90 mm (13.98 × 3.54 in)
Swept radius of vane	218 mm (8.58 in)
Weight	0.85 kg (1.87 lb)
Materials	Housing: AlMgSi, gray and black anodized Vane: Carbon fiber and glass fiber

WAV252 Inputs and Outputs

Operating power supply	$U_{in} = 24$ VDC $\pm 10\%$, max. 3.2 A
Typical Power Consumption ($U_{in} = 24$ VDC)	
Below +2 °C (+36 °F) (heating on)	50 W
Above +6 °C (+43 °F) (heating off)	1 W
Output code	6-bit parallel GRAY
Recommended connector at cable end	SOURIAU MS3116F12-10P
Plug 6-PIN	MIL-C-26482 type

WA25 Spare Parts and Accessories

Service kit for one WA15/25 sensor (set of bearings and gasket) 16644WA

Crossarm and serial RS-485 transmitter WAC155

Component board for WAC155 WAC155CB

Heated cup assembly WAA252 WA35066

Heated tail assembly WAV252 WA35336

Connector WAA151, WAA252 230118

Connector WAV151, WAV252 230119

Crossarm and termination box WAC151

16-lead signal cable (10 m) for WA15/25, open leads on both ends ZZ45048

6-lead heating power cable (10 m) for WA15/25, open leads on both ends ZZ45049

Special length 16-lead signal cable for WA15/25, open leads on both ends ZZ45048SPEC

Special length 6-lead heating power cable for WA15/25, open leads on both ends ZZ45049SPEC

Sensor cable for WAA151/252 0.8 m (31.5 in), open lead on one end (6 wires), connector 230118 on other end ZZ45036

Sensor cable for WAV151/252 0.8 m (31.5 in), open lead on one end (10 wires), connector 230119 on other end ZZ45037

Special length sensor cable for WAA151/252, open lead on one end (6 wires), connector 230118 on other end ZZ45036SPEC

Special length sensor cable for WAV151/252, open lead in one side (10 wires) and connector 230119 in another side ZZ45037SPEC

Crossarm and analog transmitter WAT12

Component board for WAT12 16637WA

Attachment hardware for WAA151/252 and WAV151/252 16546WA

Power supply for WA25 WHP25

Power board for WHP25 power supply WA35078



Features

- Measures the wind data at configurable interval and computes wind average values over adjustable period
- Communicates over 2-wire RS-485 line with NMEA 0183 protocol (MWV, MWV query)
- Input voltage range of 9 ... 31.5 V enables use in both 12 V and 24 V systems
- Average power need 0.2 W, including the sensors
- Superior protection against lightning surges allows for installation to high towers
- Marine use can be enabled, with over 500 VAC isolation from system to frame
- Sensor heating control with adjustable temperature limits
- Auto-detection of sensor failure and system error

WAC155 converts the wind speed and direction data for use in the RS-485 bus.

Vaisala Serial Wind Transmitter WAC155 converts the digital data supplied by Vaisala WA15 and WA25 series wind sensors into standard data messages for use in the RS-485 bus. WAC155 consists of a component board in a junction box and a crossarm for mounting the wind sensors.

WAC155 communicates with the host system over 2-wire RS-485 line. The standard sensor connections are for WA15 or WA25 series anemometers and wind vanes.

Long Distance Operation

Only a 4-wire cable is required for the line between WAC155 and the host. One wire pair provides the operating power. The other pair is for the serial line. For long distances, the RS-485 line terminator can be activated with the onboard jumper plug.

WAC155 accepts 9 ... 31.5 VDC as input power, from which it also generates operating power for the sensors. The total average current consumed in power-save mode is less than 10 mA. This, along with the good line transient protection, allows for remote supply of the operating power.

A 20 ... 30 V supply is recommended for remote power. This is to minimize the current and the voltage drop in the cable. The allowable transmitter distance depends on the wire gauge of the cable, and is typically several hundreds of meters. It should be noted that the peak operating current can reach 30 mA even in power-save mode.

Flexible Communications

Wind data is provided in standard NMEA messages. In addition, a service connection is available for configuration and status information.

In the same RS-485 bus, there may be one or more transmitters. When WAC155 is alone in the bus, it can work in auto-transmit mode, sending data in pre-configured intervals. When more devices are involved, the host must control the data transit by polling one device at a time with an NMEA query. Each transmitter has a configurable ID for device addressing.

Self-Diagnostics

When the service connection is open or the system has been started recently, the onboard indicator LED flashes red when any error condition is active.

During an error condition NMEA messages also carry a flag for invalid data. The error flag can result from an incorrect system voltage level, absence or failure of a wind sensor, or system memory error. The cause of error is shown in a special error message.

Optional Heating Power

WAC155 also provides the sensors for throughput and control of heating power. The heating power connection, if required, calls for an extra pair of wires. Since a sensor typically requires 0.5 A current for heating, the power is most conveniently supplied from a local power source. By default WAC155 switches heating on in temperatures below +4 °C (+39 °F) (user-adjustable).

Technical Data

WAC155 measurement performance

Averaging interval	3 s (selectable range 0.25 ... 5 s)
Updating interval	0.25 s
Wind speed	
Observation range	0 ... 75 m/s (0 ... 168 mph)
Observation frequency	4 Hz
Resolution	0.1 m/s
Wind direction	
Observation range	0 ... 360°
Observation frequency	32 Hz
Resolution ¹⁾	2.0°

¹⁾ Gained by averaging the eight samples in each 0.25-second period.

WAC155 inputs and outputs

Input operating voltage	9 ... 31.5 V
Input operating current (incl. both sensors)	Power-save enabled: 7 mA typically at 24 V Power save disabled: 37 mA typically at 24 V
Heating control, WA15	On at 3 °C (37 °F) / Off at 5 °C (41 °F), adjustable
Input heating voltage, WA15	16 ... 24 V DC or V AC _{rms} with 1 or 2 sensors in parallel 32 ... 48 V DC or 32 ... 43 V AC _{rms} with 2 sensors in series
Input heating current	1.0 A typically at 20 V with 1 or 2 sensors in parallel 0.5 A typically at 40 V with 2 sensors in series
Heating for WA25	Passed by with expansion connector
Signal input	6-bit parallel GRAY code (0.5/10.5 V typical) from wind vane 0 ... 750 Hz square wave (0.5/10.5 V typical) from anemometer
Data output	2-wire half-duplex RS-485, 9600 8N1 ¹⁾
Service interface	RS-232 or RS-485
Message protocol	NMEA 0183, MWV, and MWV Query

¹⁾ Adjustable rate: 300 ... 19200, 7/8, 0/E/N, 1/2.

WAC155 operating environment

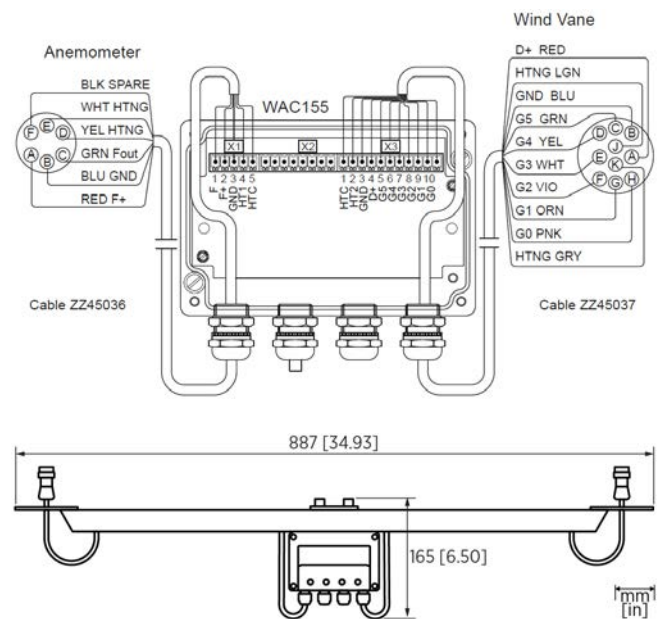
Operating temperature	-55 ... +60 °C (-67 ... +140 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH
IP rating	IP65

WAC155 mechanical specifications

Weight	1.5 kg (3.3 lb)
Material	Aluminum
Mounting	To Ø 60 mm (2.36 in) pole mast
Dimensions	
Crossarm and junction box (W × H × D)	887 × 165 × 157 mm (34.92 × 6.50 × 6.18 in)
Junction box (W × H × D)	Without cable glands: 127 × 82 × 58 mm (5.00 × 3.23 × 2.28 in) With cable glands: 127 × 110 × 58 mm (5.00 × 4.33 × 2.28 in)

WAC155 spare parts

Spare part	Order code
Component board for WAC155	WAC155CB
Crossarm and serial RS-485 transmitter	WAC155
Sensor cable for WAA151/252 0.8 m (31.5 in), open lead on one end (6 wires), connector 230118 on other end	ZZ45036
Sensor cable for WAV151/252 0.8 m (31.5 in), open lead on one end (10 wires), connector 230119 on other end	ZZ45037
Special length sensor cable for WAA151/252, open lead on one end (6 wires), connector 230118 on other end	ZZ45036SPEC
Special length sensor cable for WAV151/252, open lead in one side (10 wires) and connector 230119 in another side	ZZ45037SPEC
Connector WAA151, WAA252	230118
Connector WAV151, WAV252	230119





Features

- Converts the digital data supplied by Vaisala Wind Set WA15 and Vaisala Wind Set WA25 into two industry standard analog current loops: one for speed, the other for direction
- Selectable loop current
- Suitable for nearly any input type
- Wide range of input power
- Provides the sensors with a throughput for optional heating power

WAT12 is designed to convert the wind speed and direction data measured by WA15 or WA25 into two analog current loop signals.

Vaisala Analog Wind Transmitter WAT12 is an economic solution to a standard interface between Vaisala wind sensors and analog panel meters, chart recorders, digital LCD or LED displays, data loggers, computers with analog inputs, or other instruments with an analog input interface. The transmitter converts the wind speed and direction data measured by either Vaisala Wind Set WA15 or Vaisala Wind Set WA25 into two analog current loop signals, respectively. The power to the sensors is also supplied through the WAT12 unit.

WAT12 consists of a PC board unit in a junction box and a cross arm for mounting the wind sensors. A 4-wire cable for the wind speed and direction signals and power supply is needed between the transmitter and the receiving end.

User-selectable Loop Current

Several loop current ranges are available, such as 4 ... 20 mA, 0 ... 10 mA, and 1 ... 5 mA. The loops are supplied by high-side drivers with a return to the signal and power ground. Nearly any input type can be driven.

The transmitter accepts a wide range of input power, from 12 to 28 VDC. With 5 mA loop current selected, the total current consumed is less than 40 mA (including the sensors and the loop current). This makes it possible to remotely supply the operating power from a distance of several kilometers, even through private or leased telephone lines.

Optional Heating Power

WAT12 also provides the sensors for throughput of optional heating power. The heating power connection, if required, needs an extra pair of wires. Since the heating elements typically consume about 500 mA, the heating power is most conveniently supplied from a local power source. An optional thermostat switch is available for automatic connection of heating power in temperatures below +4 °C (+39.2 °F).

Technical Data

Operating environment

Operating temperature	-55 ... +55 °C (-67 ... +131 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH

Inputs and outputs

Input operating power	12 ... 28 VDC, 30 mA
Output sensor power	On-board regulated to 10.7 VDC typically

Signal input from sensors

Wind direction	6-bit parallel GRAY code (optionally 7 bits)
Wind speed	Pulse frequency 0 ... 750 Hz

Output signals

2 analog current loops	1 for direction, 1 for speed
Highside drivers; the loops return to the common signal and power ground	
Typical loop driving voltage	10 V
Output accuracy	> 1 % of full scale
Loop current options (jumper selectable)	0 ... 5 mA 1 ... 5 mA 0 ... 10 mA 2 ... 10 mA 0 ... 20 mA 4 ... 20 mA

Max. loop resistance (including cable resistance and receiver's input resistance)	5 mA loop: 1800 Ω
	10 mA loop: 900 Ω
	20 mA loop: 450 Ω

Full-scale options (jumper selectable)	For direction: 0 ... 360° / 0 ... 540°
	For speed: 0 ... 51.2 m/s (0 ... 115 mph) / 0 ... 76.8 m/s (0 ... 172 mph)

Signal cable	Min. 4 wires (Vin+, Vin-, DOP, SOP)
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Mechanical specifications

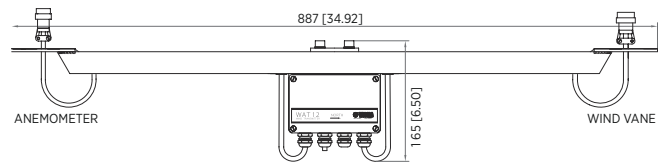
EMC compliance	EN 61326-1, Basic electromagnetic environment
Mounting	To Ø 60 mm (2.36 in) pole mast
Weight	1.5 kg (3.31 lb)

Dimensions

PC board	114 × 69 mm (4.49 × 2.72 mm)
Junction box (H × W × D)	80 × 125 × 57 mm (3.15 × 4.92 × 2.24 in)
Cross arm length	800 mm (31.50 in)

Materials

Cross arm	Anodized aluminum
Junction box	Aluminum, painted grey



Dimensions in mm (inches)





Features

- Combined wind speed and direction sensor with affordable price
- Compact and light design is optimal for mobile applications
- Low power consumption
- Fast and linear response to wind
- Choice of one-wiper or two-wiper potentiometer models

Vaisala Wind Sensor WM30 provides accurate wind measurement in a compact and economical package.

Vaisala Wind Sensor WM30 is a compact and economical wind speed and direction sensor. The rotating cup anemometer at the top of the unit provides a linear response to wind speed. The vane, which is attached to the body of the unit, provides a fast response to wind direction.

Accurate wind measurement

The shape, dimensions, and material of the cups contribute to accurate measurement. The cups are carefully tested to give linear response between the wind speed and the angular velocity of the cup wheel.

The wind vane is located directly beneath the cup assembly and is made of a durable, lightweight material that ensures fast response and low inertia.

Flexible outputs

A relay contact output is provided for wind speed. The wind speed can be recorded either by counting the number of pulses within a fixed time period, or by measuring the time between successive pulses.

A potentiometer detects the position of the vane. The potentiometer features low starting and running torque, linear resistance, and a long operation life. It has a single wiper with an open gap of less than 5 degrees. With constant voltage supplied to the potentiometer, the output voltage is directly proportional to the azimuth angle.

Optimal for low-power applications

The electronics are designed specifically for applications where low power consumption is essential.

Built for harsh conditions

The cups and vane are made of reinforced polyamide (PA) plastic which guarantees a rigid structure even at the highest wind speeds.

The electronics are located inside an anodized aluminum core which creates not only a firm body, but a watertight enclosure for the electronics as well. This provides full protection against water, dust, pollutants, and electromagnetic interference.

Easy installation

A mast adapter for a 30 mm tube is supplied with the sensor. An installation kit for larger tube diameters, from 50 to 110 mm, is available as an option.

Technical data

Measurement performance

Wind speed

Measurement range	0.5 ... 60 m/s (1.1 ... 134 mph)
Starting threshold	< 0.4 m/s (0.9 mph)
Distance constant	2 m (6 ft 7 in)
Transducer output	1 Hz at approximately 0.7 m/s (1.6 mph)
Characteristic transfer function	$U = -0.24 + 0.699 \times F^{1)}$
Accuracy (within range 0.4 ... 60 m/s (0.9 ... 134 mph)):	Wind speed < 10 m/s (22 mph): ± 0.3 m/s Wind speed > 10 m/s (22 mph): $\pm 2\%$

Wind direction

Measurement range	WMS301 with 1-wiper potentiometer: 0 ... 355° WMS302 with 2-wiper potentiometer: 0 ... 360°
Starting threshold	< 1.0 m/s (2.2 mph)
Damping ratio	0.3
Overshoot ratio	0.4
Delay distance	0.6 m (1 ft 12 in)
Accuracy	Better than $\pm 3^\circ$

1) U = wind speed [m/s], F = output frequency [Hz]

Operating environment

Operating temperature	-40 ... +55 °C (-40 ... +131 °F)
Storage temperature	-60 ... +65 °C (-76 ... +149 °F)

Inputs and outputs

Supply voltage	3 ... 15 VDC
Connector	5-pin male with 12 mm threads
Recommended connector at cable end	BINDER 99 1436 814 05

Mechanical specifications

Dimensions (H × Ø)	265 × 360 mm (10.43 × 14.17 in)
Weight	360 g (12.70 oz)
Materials	
Housing	AlMgSi, gray anodized
Cups	PA, reinforced with carbon fibre, black
Vane	PA, reinforced with fiberglass, white

Spare parts and accessories

Mounting adapter	WMS30KIT
Sensor connector	19370
Sensor connector and cable, 10 m (32 ft 10 in)	19904

Compliance

Wind tunnel tests	ASTM standard method D5366-93 ASTM standard method D5096-90
EMC compliance	EN 61326-1, Basic electromagnetic environment





Features

- Superior 3-stage, transient surge protection
- Tolerates up to 10 kA surge currents
- Provides additional filtering for blocking the HF-conducted interference
- Robust structure, IP66 housing
- Both differential and common mode protection on each channel
- 2 power and 2 data channels
- Can be used for example with WXT530, WA15, WMT700 (non-heated), WM30, DSC211, and DST111
- Applications: most installations of weather measurement networks, meteorological stations in wind parks

Vaisala Surge Protector WSP150 is a compact transient overvoltage suppressor designed for outdoor use. It can provide overvoltage protection for 2 power supply lines and RS-422, RS-485, RS-232 serial communication, or 2 mA loop lines.

Vaisala Surge Protector WSP150 is a compact transient overvoltage suppressor designed for outdoor use. It can provide overvoltage protection for 2 power supply lines and RS-422, RS-485, RS-232 serial communication or 2 mA loop lines. It can be used with WXT530 series, WMT700 (non-heated) WA15 wind set, WM30 wind set, DSC211, and DST111. Also other instruments can be protected if the current consumption is less than 1.5 A.

Superior protection

A lightning strike nearby may induce a high voltage surge, which the integral transient suppressor of the instrument may not tolerate. Additional protection is

needed, especially where frequent and severe thunderstorms are common and where cables longer than 30 m (98 ft 5 in) are used. Also use WSP150 if you have unshielded, open-wire lines.

WSP150 offers 3-stage protection against surge currents up to 10 kA entering through the power and signal cables.

Powerful technology

WSP150 has 4 channels, 2 of which are dedicated to power lines and 2 for data lines. Each channel uses a 3-stage protection scheme: first there are discharge tubes, then voltage dependent resistors (VDR), and finally transient zener diodes. Between each stage, there are either series inductors or resistors.

Both differential and common mode protection is provided for each channel: across the wire pairs, against the operating voltage ground, and against the earth.

WSP150 also provides an additional filter for blocking the HF-conducted interference.

Applications

Vaisala recommends using WSP150 when wind and weather instruments are installed on top of high buildings or masts and in open grounds, that is, anywhere with an elevated risk of lightning.

WSP150 technical data

Operating environment

Operating temperature	-52 ... +70 °C (-60 ... +158 °F)
Storage temperature	-52 ... +70 °C (-60 ... +158 °F)
Installation temperature	-40 ... +70 °C (-40 ... +158 °F)
Maintenance work temperature	-40 ... +70 °C (-40 ... +158 °F)

Inputs and outputs

Input voltage ¹⁾	Power channels: max. ±43 V Data channels: max. ±13 V
Input common mode voltage	Any line to earth: max. ±72 V
Throughput current	Power lines: max. 1.5 A Data lines: max. 0.16 A
Throughput resistance (per line)	Power lines: max. 0.3 Ω Data lines: max. 15 Ω
Turn-on voltage	Power channels: max. ±60 V Data channels: max. ±16 V
Surge current	To earth: max. 10 kA Differential: max. 5 kA

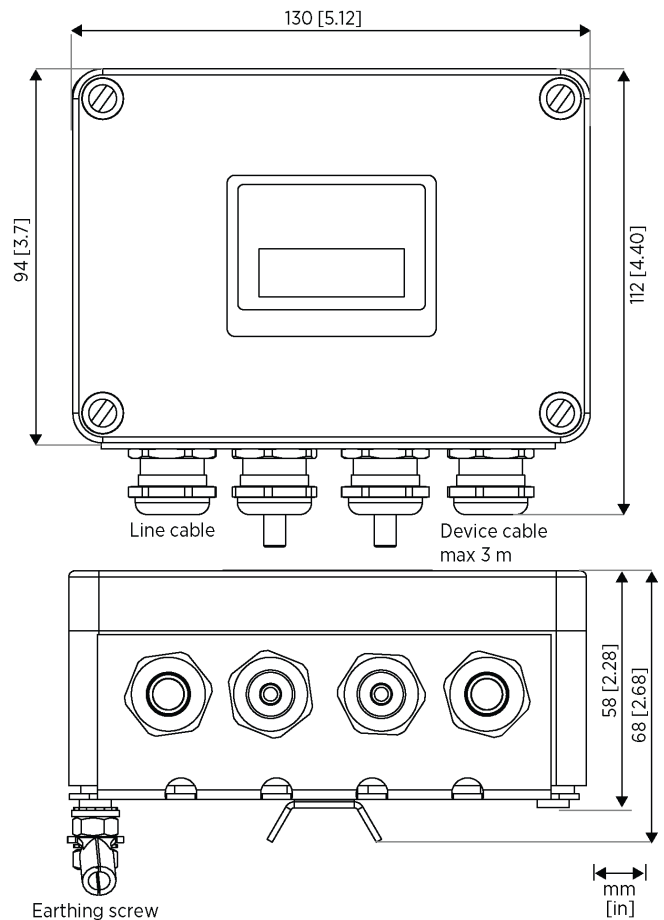
¹⁾ Across channel line pair and from line to GND, terminals #3

Mechanical specifications

Weight	0.65 kg (1.43 lb)
Housing material	Polycarbonate, stainless steel
Housing dimensions (H × W × D)	94 × 130 × 58 mm (3.70 × 5.12 × 2.28 in)
Dimensions with cable glands and mounting assembly (H × W × D)	112 × 130 × 69 mm (4.41 × 5.12 × 2.72 in)
Cables (Ø)	5 ... 10 mm (0.20 ... 0.39 in)
Wires (Ø)	0.4 ... 1.7 mm (0.016 ... 0.067 in) (AWG 26 ... 14)

Compliance

EMC surge tolerance	EN 61000-4-5 (4 kV, 2 kA) IEEE C62.45 (6 kV, 3 kA)
IP rating	IP66 (NEMA 4X)



WSP150 dimensions in mm [in]



Features

- Excellent three-stage, transient surge protection
- Tolerates up to 10 kA surge currents
- Provides additional filtering for blocking the HF-conducted interference
- Both differential and common mode protection on each channel
- 2 power and 2 data channels
- Protects the USB connection of a PC connected to Vaisala Weather Transmitter WXT530 Series

Vaisala Surge Protector WSP152 is a compact transient overvoltage suppressor designed for the protection of the USB connection of a computer connected to Vaisala WXT530.

Excellent protection

WSP152 is designed to protect the host PC against surges entering through the USB port. For example, a nearby lightning strike may induce a high-voltage surge, which is not tolerated by the protection of the USB cable or the port itself. Therefore, additional protection is needed, especially where frequent and severe thunderstorms are common and where cables longer than 30 m (98 ft 5 in) are used. Note that the USB connection of a PC is for indoor use only.

WSP152 offers three-stage protection against surge currents of up to 10 kA that may enter through the USB cable or the port.

How does WSP152 work?

WSP152 has 4 channels, 2 dedicated to power lines and 2 for data lines. Each channel uses a three-stage protection scheme: first there are discharge tubes, then voltage dependent resistors (VDR), and finally transient zener diodes. Between each stage, there are either series inductors or resistors.

Both differential and common mode protection is provided for each channel: across the wire pairs, against the operating voltage ground, and against earth.

WSP152 also includes noise filtering against HF and RF interference.

Applications

Vaisala recommends using WSP152 when USB cables are used for permanent connections. The surge protector is always recommended when there is an elevated risk of a lightning strike.

WSP152 technical data

Operating environment

Operating temperature	-52 ... +70 °C (-60 ... +158 °F)
Storage temperature	-52 ... +70 °C (-60 ... +158 °F)
Installation temperature	-40 ... +70 °C (-40 ... +158 °F)
Maintenance work temperature	-40 ... +70 °C (-40 ... +158 °F)

Inputs and outputs

Input voltage ¹⁾	Power channels: max. ±43 V Data channels: max. ±13 V
Input common mode voltage	Any line to earth: max. ±72 V
Throughput current	Power lines: max. 1.5 A Data lines: max. 0.16 A
Throughput resistance (per line)	Power lines: max. 0.3 Ω Data lines: max. 15 Ω
Turn-on voltage	Power channels: max. ±60 V Data channels: max. ±16 V
Surge current	To earth: max. 10 kA Differential: max. 5 kA

Mechanical specifications

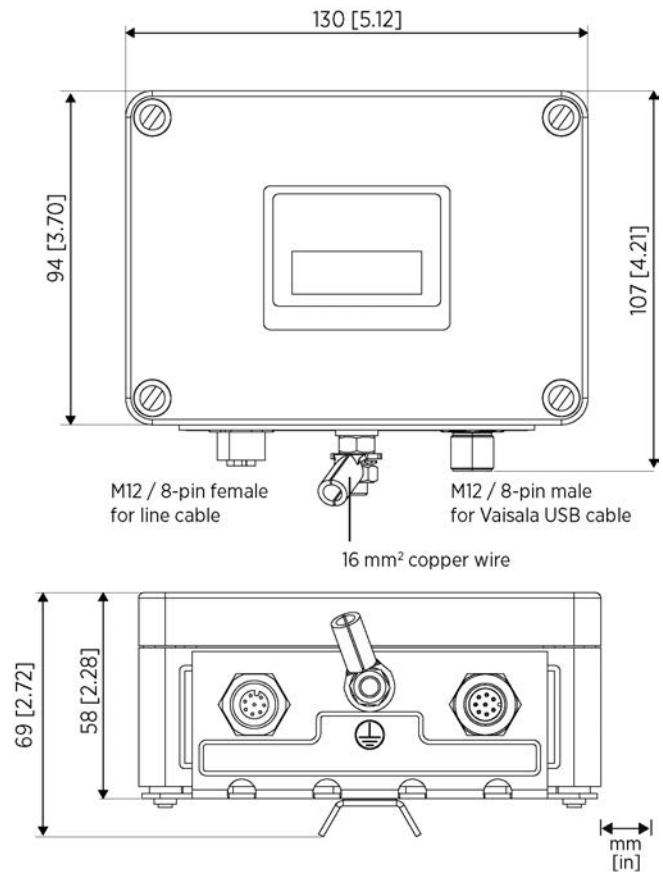
Weight	0.65 kg (1.43 lb)
Housing material	Polycarbonate, stainless steel
Housing dimensions (H × W × D)	94 × 130 × 58 mm (3.70 × 5.12 × 2.28 in)
Dimensions with cable glands and mounting assembly (H × W × D)	112 × 130 × 69 mm (4.41 × 5.12 × 2.72 in)
Cables (Ø)	4 ... 8 mm (0.16 ... 0.31 in)
Wires (Ø)	0.4 ... 1.7 mm (0.016 ... 0.067 in) (AWG 26 ... 14)

Compliance

EMC surge tolerance	EN 61000-4-5 (4 kV, 2 kA) IEEE C62.45 (6 kV, 3 kA)
IP rating	IP66 (NEMA 4X)

Accessories

Description	Order code
WXT530 cable 10 m, connectors on both ends	215952
Vaisala USB cable 1.4 m	220782



WSP152 dimensions in mm [in]

HMP155 HUMICAP Humidity and Temperature Probe



HMP155 with an additional temperature probe and optional Stevenson screen installation kit.

Features

- Vaisala HUMICAP®180R sensor: superior long-term stability
- Optional warmed humidity probe and chemical purge
- Plug-and-play
- USB connection for service use
- Use with DTR13 and DTR503 radiation shields and a Stevenson screen
- Weather-proof housing IP66
- Optional, fast temperature probe
- Different output possibilities: voltage, RS-485, resistive Pt100
- Applications: meteorology, aviation and road weather, instrumentation

Vaisala HUMICAP® Humidity and Temperature Probe HMP155 provides reliable humidity and temperature measurement. It is designed especially for demanding outdoor applications.

Long-term stability

HMP155 uses the proven Vaisala HUMICAP®180R sensor that has excellent stability and withstands well harsh environments. The probe structure is solid and the sensor is protected by default with a sintered teflon filter, which gives maximum protection against water, dust, and dirt.

Warmed probe and high-humidity environment

Measuring humidity reliably is challenging in environments where humidity is near saturation. Measurements may be corrupted by fog, mist, rain, and heavy dew. A wet probe may not give an accurate measurement in the ambient air.

This is an environment to which Vaisala has designed this patented, warmed probe for reliable measurements. As the sensor head is warmed continuously, the humidity level inside it stays below the ambient level. Thus, it also reduces the risk of condensation forming on the probe.

Fast measurements

With its fast response time, the additional temperature probe for HMP155 is ideal for measuring in environments with changing temperatures. The membrane filter speeds up the relative humidity measurement.

Long lifetime

Protecting the sensor from precipitation, and scattered and direct solar radiation increases its lifetime. Thus, Vaisala recommends installing HMP155 in one of the following radiation shields: DTR503, DTR13, or Stevenson screen. For the additional temperature probe, an installation kit is available for Vaisala DTR502 Radiation Shield.

Calibration

The probe can be calibrated using a computer with a USB cable, with the push buttons, or with the MI70 indicator.

Technical Data

Humidity measurement performance

Sensor	HUMICAP®R2, 180R and INTERCAP for typical applications HUMICAP®R2C, 180RC and INTERCAPC for applications with chemical purge and/or warmed probe
Observation range	0 ... 100 %RH
Response time at +20 °C (+68 °F) in still air with sintered Teflon filter	63 %: 20 s 90 %: 60 s
Factory calibration uncertainty at +20 °C (+68 °F) ¹⁾	±0.6 %RH (0 ... 40 %RH) ±1.0 %RH (40 ... 95 %RH)

Accuracy (including non-linearity, hysteresis, and repeatability)

At +15 ... +25 °C (+59 ... +77 °F)	±1 %RH (0 ... 90 %RH) ±1.7 %RH (90 ... 100 %RH)
At -20 ... +40 °C (-4 ... +104 °F)	±(1.0 + 0.008 × reading) %RH
At -40 ... -20 °C (-40 ... -4 °F)	±(1.2 + 0.012 × reading) %RH
At +40 ... +60 °C (+104 ... +140 °F)	±(1.2 + 0.012 × reading) %RH
At -60 ... -40 °C (-76 ... -40 °F)	±(1.4 + 0.032 × reading) %RH

¹⁾ Defined as ±2 standard deviation limits. Small variations possible (see also the calibration certificate).

Temperature measurement performance

Sensor	Pt100 RTD element, Class F 0.1 IEC 60751
Observation range	-80 ... +60 °C (-112 ... +140 °F)
Response time for additional temperature probe in 3 m/s (7 mph) air flow	63 %: < 20 s 90 %: < 35 s
Other measured variables	Dew point / frost point temperature, wet bulb temperature, mixing ratio

Accuracy with voltage output

At -80 ... +20 °C (-112 ... +68 °F)	±(0.226 - 0.0028 × temperature) °C
At +20 ... +60 °C (+68 ... +140 °F)	±(0.055 + 0.0057 × temperature) °C

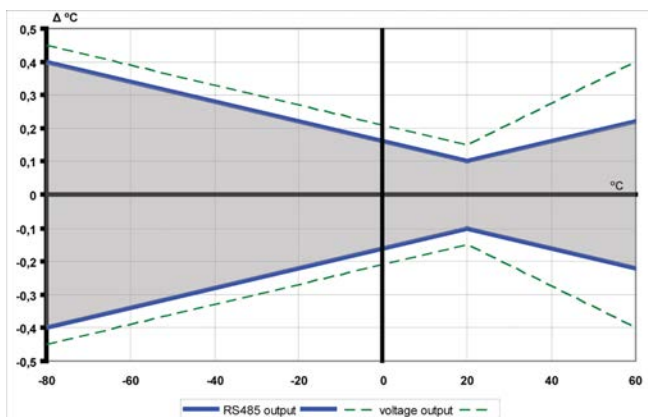
Accuracy with passive (resistive) output

According to Tolerance Class AA IEC 60751 ¹⁾	±(0.1 + 0.0017 × temperature) °C
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Accuracy with RS-485 output

At -80 ... +20 °C (-112 ... +68 °F)	±(0.176 - 0.0028 × temperature) °C
At +20 ... +60 °C (+68 ... +140 °F)	±(0.07 + 0.0025 × temperature) °C

¹⁾ Tolerance Class AA IEC 60751 corresponds to IEC 751 1/3 Class B



HMP155 accuracy over temperature range: voltage and RS-485

Operating environment

Operating temperature for humidity measurement	-80 ... +60 °C (-112 ... +140 °F)
Storage temperature	-80 ... +60 °C (-112 ... +140 °F)
Operating humidity	0 ... 100 %RH
IP rating	IP66

Inputs and outputs

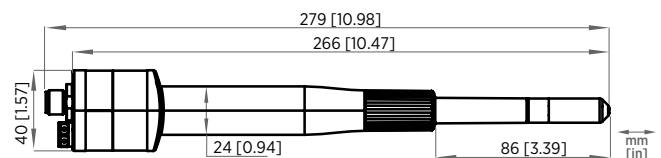
Operating voltage	7 ... 28 V DC
Minimum operating voltage	0 ... 1 V output or RS-485: 7 V 0 ... 5 V output, or warmed probe: 12 V 0 ... 10 V output, chemical purge, or XHEAT: 16 V
Outputs	Voltage output: 0 ... 1 V, 0 ... 5 V, 0 ... 10 V Resistive Pt100 4-wire connection RS-485
Average power consumption (+15 V DC, load 100 kΩ)	0 ... 1 V output: < 3 mA 0 ... 10 V output: +0.5 mA RS-485: < 4 mA During chemical purge: Maximum 110 mA With warmed probe: Maximum 150 mA
Settling time at startup	Voltage output: 2 s RS-485: 3 s

Mechanical specifications

Dimensions (H × W)	279 × 40 mm (10.9 × 1.6 in)
Weight	93 g (3.25 oz)
Length of additional T-probe cable	2 m (6 ft 7 in)
Connection	8-pin male M12 connector
Connection cables	3.5 m (11 ft 6 in), 10 m (32 ft 10 in), 30 m (98 ft 5 in)
Maximum wire size	0.129 mm ² (26 AWG)
Service cables	USB connection cable MI70 connection cable

Materials

Filter	Sintered Teflon or membrane
Housing	Polycarbonate (PC)
Additional temperature probe	Stainless steel AISI 316L
Cable	PUR



Dimensions in mm (inches)



DTR13 Radiation Shield

Features

- Fiberglass-filled polyester
- UV-proof
- Excellent ventilation
- Water-repellent

Vaisala DTR13 and DTR15 radiation shields are designed for protecting probes and sensors against solar radiation and rain.

DTR13 Radiation Shield

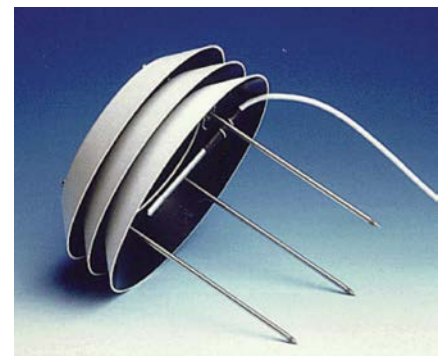
The naturally ventilated, maintenance-free DTR13 provides protection from scattered as well as direct solar radiation and rain. The material is fiberglass-filled polyester designed to offer excellent thermal characteristics and a durable UV-proof construction. The outer surface is painted white to reflect radiation while the inside is black to absorb accumulated heat.

The design of DTR13 enables easy installation and mounting. DTR13 can be used with Vaisala HMP155 Temperature and Humidity Probe,

DTS12A Air Temperature Probe, and also environmental sensors by other manufacturers. The radiation shield is tested to withstand vibration according to IEC 6-2 (Fc, sinusoidal vibration).

DTR15 Ground Radiation Shield

DTR15 is designed to reflect direct solar radiation by means of its highly reflective white surface. It is used to protect the DTS12G Ground/Soil Temperature Probe from solar radiation and rain. The shield is fastened to its location by inserting its 3 stainless steel spikes into the ground.



DTR15 Ground Radiation Shield

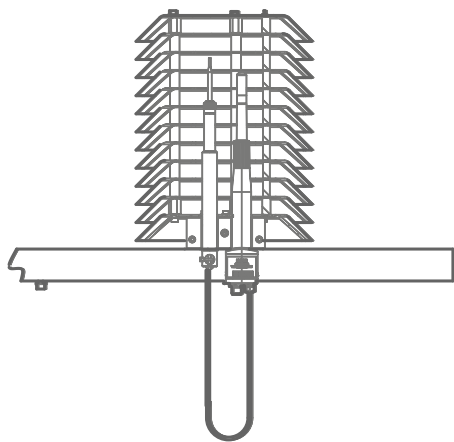
DTR13 and DTR15 Technical Data

DTR13 radiation shield dimensions

Outer diameter	220 mm (8.66 in)
Outer height	300 mm (11.81 in)
Inner diameter	110 mm (4.33 in)
Inner height	223 mm (8.78 in)
Weight	1.9 kg (4.19 lb)

DTR13 installation

- DKP060SUP1 sensor support arm, square tube, for 60-mm (2.36 in) pole mast
- DKP12SUP1 sensor support arm, square tube, for 100-mm (3.94 in) pole mast
- DKPFXP44H mounting arm for 60, 75 and 100-mm (2.36, 2.95, and 3.94 in) pole mast or wall mounting



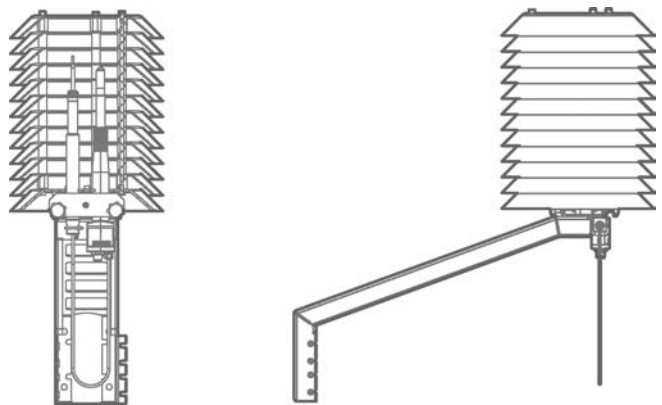
HMP155 inside DTR13 on Sensor Support

DTR15 radiation shield dimensions

Outer diameter	220 mm (8.66 in)
Outer height	110 mm + 180 mm spikes (4.33 in + 7.09 in)
Inner diameter	110 mm (4.33 in)
Inner height	50 mm (1.97 in)
Weight	1.4 kg (3.09 lb)

DTR15 installation

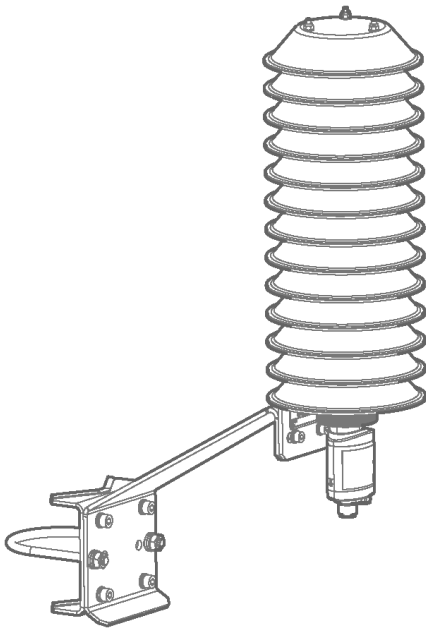
Spikes inserted into ground



HMP155 inside DTR13 on DKPFXP44H

DTR500 Solar Radiation and Precipitation Shields

Vaisala Radiation Shield Series DTR500 are solar radiation and precipitation shields supporting humidity probe installations in outdoor applications.



Sensor protection

The maintenance-free DTR500 series shields protect the humidity and temperature sensors from solar radiation and precipitation. They provide excellent ventilation while blocking both direct and reflected solar radiation.

The special plastic used in the plates has excellent thermal characteristics: the white outer surface reflects radiation, and the black inside absorbs accumulated heat. The shields can be easily installed on a vertical pole, horizontal beam, or flat surface.

The DTR shields can be used with the following Vaisala products:

Features

- Protection for temperature and humidity probes from scattered and direct solar radiation and rain
- Maintenance-free
- Naturally ventilated
- Easy to install on a vertical pole, horizontal beam, or flat surface
- Suitable for a wide selection of applications
- Choice of shields and mounting accessories

DTR503(A)

Vaisala HUMICAP® Humidity and Temperature Probe HMP155

DTR504(A)

Vaisala HUMICAP® Humidity and Temperature Transmitters HMT120/130

Vaisala HUMICAP® Humidity and Temperature Probe HMP110

Vaisala INTERCAP® Humidity and Temperature Probe HMP60

DTR502(A) with adapter 221072

Vaisala HUMICAP® Humidity and Temperature Probe HMP155's additional temperature sensor

DTR502B

Vaisala HUMICAP® Humidity and Temperature Transmitters HMT333, HMT337, HMT373, and HMT377

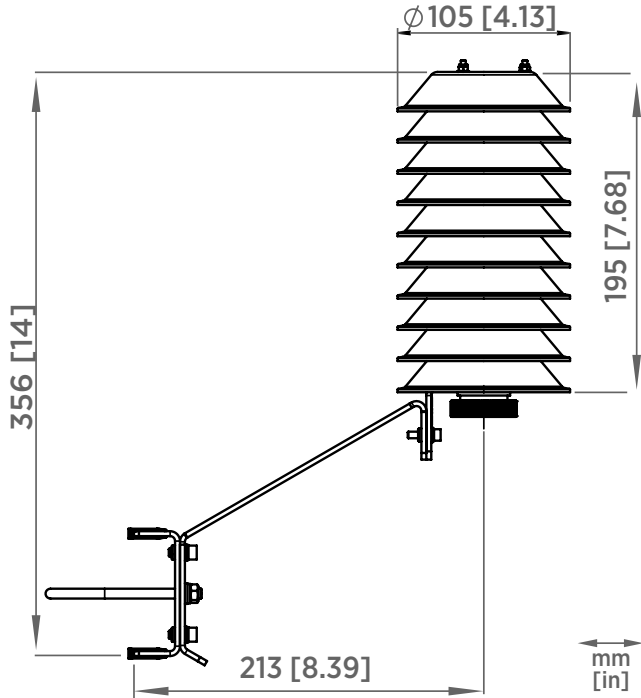
Vaisala HUMICAP® Humidity and Temperature Probes HMP3 and HMP7

Vaisala Combined Pressure, Humidity and Temperature Transmitters PTU303 and PTU307

Technical data

DTR502B for HMT333, HMT337, HMT373, HMT377, HMP3, HMP7, PTU303, and PTU307

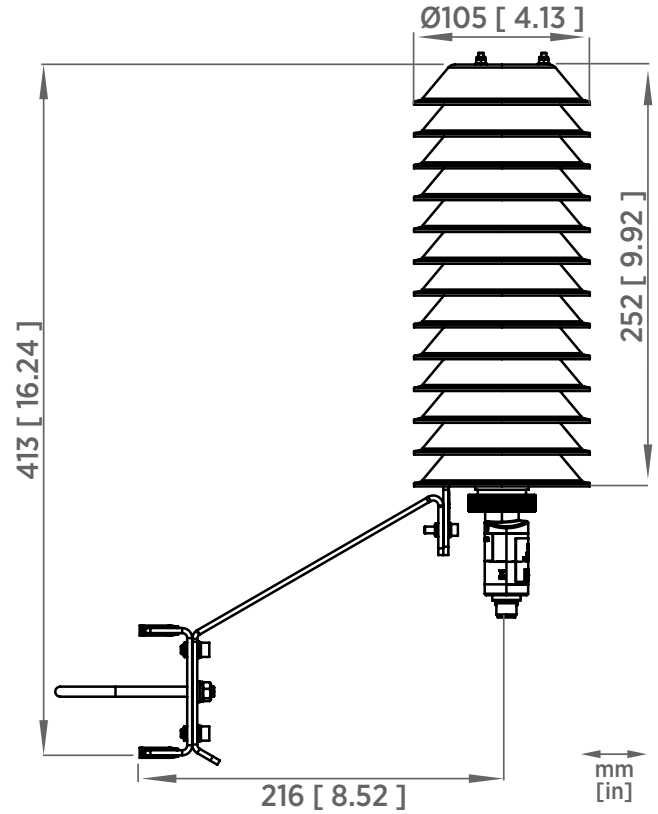
Dimensions (H × W)	195 × 105 mm (7.68 × 4.13 in)
Accessories	Product specific adapter



DTR502B dimensions

DTR503A for HMP155

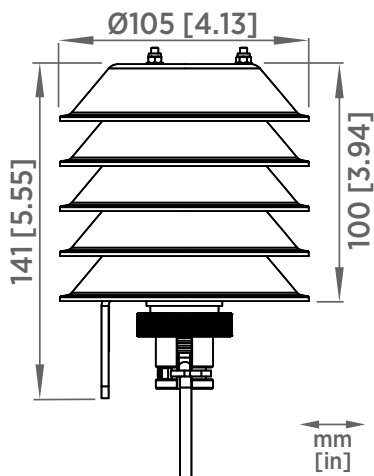
Dimensions (H × W)	252 × 105 mm (9.92 × 4.13 in)
Accessories	Horizontal beam assembly Pole mast installation kit



DTR503A dimensions

DTR504 for HMT120/130 remote probes, HMP110, and HMP60

Dimensions (H × W)	141 × 105 mm (5.55 × 4.13 in)
Accessories	Horizontal beam assembly Pole mast installation kit



DTR504 dimensions



Features

- Vaisala BAROCAP® sensor
- Several pressure ranges
- Accuracy ± 0.3 hPa at $+20$ °C
- Long-term stability
- On/Off control with external trigger
- Output voltage 0 ... 2.5 or 0 ... 5 VDC
- Current consumption less than 4 mA
- Mountable on 35 mm wide DIN rail
- Traceable calibration (certificate included)

Vaisala BAROCAP® Barometer PTB110 is designed both for accurate barometric pressure measurements at room temperature and for general environmental pressure monitoring over a wide temperature range.

Vaisala BAROCAP Technology

PTB110 uses the Vaisala BAROCAP sensor, a silicon capacitive absolute pressure sensor developed by Vaisala for barometric pressure measurement applications. The sensor combines the outstanding elasticity characteristics and mechanical stability of single-crystal silicon with the proven capacitive detection principle.

Applications

PTB110 is suitable for a variety of applications, such as environmental pressure monitoring, data buoys, laser interferometers, and agriculture and hydrology. The compact PTB110 is ideal for data logger applications as it has low power consumption. The external On/Off control is practical when electricity supply is limited.

Accuracy and Stability

The excellent long-term stability of the barometer minimizes or even removes the need for field adjustment in many applications.

Technical Data

Measurement performance

Pressure range (1 hPa= 1 mbar)	500 ... 1100 hPa 600 ... 1100 hPa 800 ... 1100 hPa 800 ... 1060 hPa 600 ... 1060 hPa
Resolution	0.1 hPa
Load resistance	10 000 Ω minimum
Load capacitance	47 nF maximum
Settling time to full accuracy after startup	1 s
Response time to full accuracy after a pressure step	500 ms
Acceleration sensitivity	Negligible
Accuracy	
Linearity ¹⁾	±0.25 hPa
Hysteresis ¹⁾	±0.03 hPa
Repeatability ¹⁾	±0.03 hPa
Pressure calibration uncertainty ²⁾	±0.15 hPa
Voltage calibration uncertainty	±0.7 mV
Frequency calibration uncertainty	±0.3 Hz
Accuracy at +20 °C (+68 °F) ³⁾	±0.3 hPa
Total accuracy at	
+15 ... +25 °C (+59 ... +77 °F)	±0.3 hPa
0 ... +40 °C (+32 ... +104 °F)	±0.6 hPa
-20 ... +45 °C (-4 ... +113 °F)	±1.0 hPa
-40 ... +60 °C (-40 ... +140 °F)	±1.5 hPa
Long-term stability	±0.1 hPa / year

- 1) Defined as ±2 standard deviation limits of end-point non-linearity, hysteresis error, or repeatability error.
- 2) Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to international standards.
- 3) Defined as the root sum of the squares (RSS) of end-point non-linearity, hysteresis error, repeatability error, and calibration uncertainty at room temperature.

Operating environment

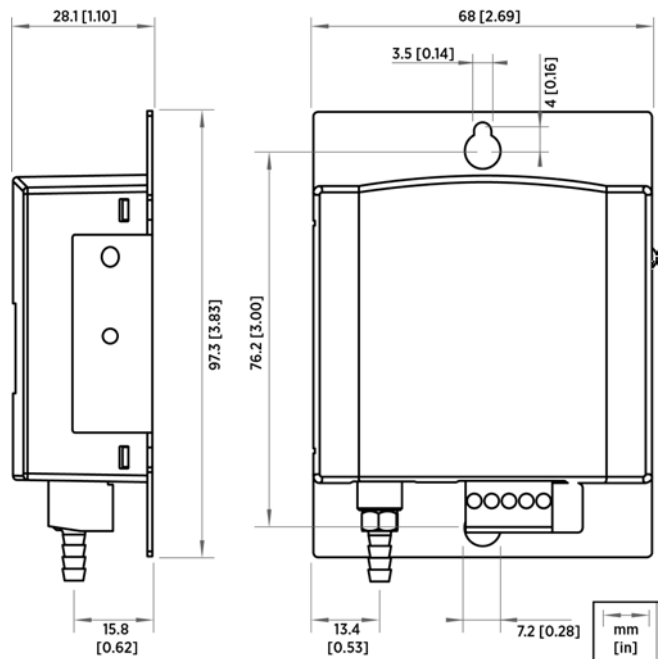
Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-40 ... +60 °C (-40 ... +140 °F)
Operating humidity	Non-condensing
IP rating	IP32
EMC compatibility	EN 61326-1, industrial environment

Mechanical specifications

Dimensions (H × W × D)	97.3 × 68.4 × 28.1 mm (3.83 × 2.69 × 1.10 in)
Weight	90 g (3.2 oz)
Materials	
Housing cover	Plastic ABS/PC blend
Mounting plate	Aluminum

Inputs and outputs

Supply voltage	10 ... 30 V DC
Supply voltage control	With TTL-level (Transistor-Transistor-Logic) trigger
Supply voltage sensitivity	Negligible
Average power consumption	0.10 W at 12 V
Output voltage	0 ... 2.5 V DC 0 ... 5 V DC
Output frequency	500 ... 1100 Hz
Pressure connector	M5 (10 ... 32) internal thread
Pressure fitting	Barbed fitting for 1/8 in
Minimum pressure limit	0 hPa abs
Maximum pressure limit	2000 hPa abs
Electrical connector	A removable connector for 5 wires (AWG 28 ... 16)
Terminals	Pin 1: External triggering Pin 2: Signal ground Pin 3: Supply ground Pin 4: Supply voltage Pin 5: Voltage/Frequency output



Dimensions





Features

- 500 ... 1100 hPa or 50 ... 1100 hPa pressure ranges with serial output
- Different scalings between 500 ... 1100 hPa with analog output
- Electronics housing IP65 protected against sprayed water
- Accurate and stable measurement
- Traceable calibration (certificate included)

Vaisala BAROCAP® Digital Barometer PTB210 is a reliable outdoor barometer for harsh conditions.

For harsh environments

PTB210 is ideal for outdoor installations and harsh environments. PTB210 is designed to operate in a wide temperature range, and the electronics housing provides IP65 (NEMA 4) standardized protection against sprayed water.

PTB210 is ideal for use in applications such as weather stations, data buoys, ships, airports, and agrology. It is also an excellent solution for monitoring barometric pressure in industrial equipment such as laser interferometers and engine test benches.

Several pressure ranges

PTB210 is designed for various pressure ranges. It is available in 2 pressure ranges in 3 configurations:

- Serial output for 500 ... 1100 hPa
- Serial output for 50 ... 1100 hPa
- Analog output with different scalings between 500 ... 1100 hPa

Accurate and stable measurement

PTB210 is digitally adjusted and calibrated by using electronic working standards. A higher accuracy barometer, which is fine-tuned and calibrated against a high-precision pressure calibrator, is available for the 500 ... 1100 hPa pressure range.

In addition, PTB210 integrates directly with Vaisala Static Pressure Head Series SPH10/20. This pairing offers accurate measurement in all wind conditions.

Vaisala BAROCAP technology

PTB210 uses the Vaisala BAROCAP sensor, a silicon capacitive absolute pressure sensor developed by Vaisala for barometric pressure applications. The Vaisala BAROCAP sensor provides excellent hysteresis and repeatability

characteristics and outstanding temperature and long-term stability. PTB210 is delivered with a traceable factory calibration certificate.



PTB210 paired with SPH10 static pressure head

Technical Data

Measurement performance

Pressure range

Serial output	500 ... 1100 hPa
	50 ... 1100 hPa
Analog output	500 ... 1100 hPa
	600 ... 1060 hPa
	800 ... 1060 hPa
	900 ... 1100 hPa

Serial output, accuracy (hPa)

Pressure range	500 ... 1100		50 ... 1100
	Class A	Class B	
Non-linearity ¹⁾	± 0.10	± 0.15	± 0.20
Hysteresis ¹⁾	± 0.05	± 0.05	± 0.10
Repeatability ¹⁾	± 0.05	± 0.05	± 0.10
Calibration uncertainty ²⁾	± 0.07	± 0.15	± 0.20
Accuracy at +20 °C (+68 °F) ³⁾	± 0.15	± 0.20	± 0.35
Temperature dependency ⁴⁾	± 0.20	± 0.20	± 0.40
Total accuracy -40 ... +60 °C (-40 ... +140 °F) ³⁾	± 0.25	± 0.30	± 0.50
Long-term stability (hPa/year)	± 0.10	± 0.10	± 0.20

Analog output, accuracy

Non-linearity ¹⁾	± 0.20 hPa
Hysteresis ¹⁾	± 0.05 hPa
Repeatability ¹⁾	± 0.05 hPa
Calibration uncertainty ²⁾	± 0.15 hPa
Accuracy at +20 °C (+68 °F) ³⁾	± 0.30 hPa
Temperature dependency ⁴⁾	± 0.50 hPa
Total accuracy -40 ... +60 °C (-40 ... +140 °F) ³⁾	± 0.60 hPa
Long-term stability	± 0.10 hPa/year

- 1) Defined as the ±2 standard deviation limits of end point non-linearity, hysteresis error, or repeatability error.
- 2) Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to international standards.
- 3) Defined as the root sum of the squares (RSS) of end point non-linearity, hysteresis error, repeatability error, and calibration uncertainty at room temperature.
- 4) Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Operating humidity	0 ... 100 %RH, non-condensing

Compliance

Directives	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU)
EMC compatibility	EN / IEC 61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirement; Basic environment CISPR 32 / EN 55032, Class B
Compliance	CE, FCC, UKCA

Mechanical specifications

Housing material	PC plastic
IP rating, electronics	IP65 (NEMA 4)
IP rating, sensor	IP53
Weight, sensor	110 g (3.9 oz)
Cable weight	28 g/m (1.0 oz)

Inputs and outputs

Serial output

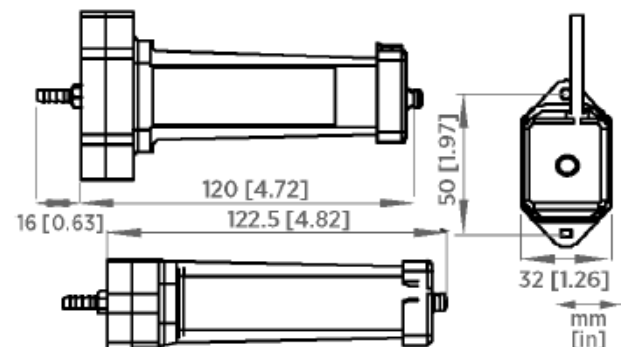
Shutdown	ON/OFF
Settling time at startup	2 s
Serial I/O	RS-232C RS-232C / TTL (optional) RS-485, non-isolated (optional)
Parity	None, even, odd
Data bits	7, 8
Stop bits	1, 2
Baud rate	1200, 2400, 4800, 9600, 19200
Response time	1 s
Resolution	0.01 hPa (1 measurement/s) 0.03 hPa (10 measurements/s)
Current consumption, normal mode	< 15 mA (factory setting)
Current consumption, shutdown mode	0.2 mA

Analog output

Outputs	0 ... 5 V DC, 0 ... 2.5 V DC (order specified)
Shutdown	ON/OFF
Response time	500 ms
Resolution	300 µV
Measurement rate	3 measurements/s
Current consumption, normal mode	< 8 mA
Current consumption, shutdown mode	0.2 mA

All models

Max. pressure	5 000 hPa absolute
Pressure connector	M5 (10-32) internal thread
Pressure fitting	Barbed fitting for 1/8 in I.D. tubing
Supply voltage (reverse polarity protected), with RS-232/TTL output	5 ... 28 V DC
Supply voltage (reverse polarity protected), with RS-485 or analog output	8 ... 18 V DC





Features

- Vaisala BAROCAP® sensor
- Accurate measurement
- Excellent long-term stability
- Added reliability through redundancy
- Graphical trend display with 1-year history data
- Height and altitude corrected pressure (QFE, QNH)
- For professional meteorology and aviation, laboratories, demanding industrial applications

Vaisala BAROCAP® Digital Barometer PTB330 is a new-generation barometer, designed for a wide range of high-end atmospheric pressure measurement. The pressure measurement of PTB330 is based on the Vaisala silicon capacitive, absolute pressure sensor - the Vaisala BAROCAP sensor. It provides high measurement accuracy and excellent long-term stability.

Highly Accurate

The PTB330 series is highly accurate. Class A barometers for the most demanding applications are fine-tuned and calibrated against a high-precision pressure calibrator. Class B barometers are adjusted and calibrated using an electronic working standard. All PTB330 barometers come with a traceable factory calibration certificate.

Reliability through Redundancy

According to your choice, PTB330 can incorporate 1, 2, or 3 BAROCAP sensors. When 2 or 3 sensors are used, the barometer continuously compares the readings of the pressure sensors against one another and reports if they are within the set internal difference criteria. This unique feature provides redundancy in pressure measurement.

Users also get a stable and reliable pressure reading at all times as well as a pre-indication of when to service or recalibrate the barometer.

QNH and QFE

PTB330 can be set to compensate for QNH and QFE pressure used especially in aviation. The QNH represents the pressure reduced to sea level, based on the altitude and temperature of the observation site. The QFE represents the height-corrected pressure of small differences in altitude, for example, the air pressure at the airfield elevation.

Graphical Display

PTB330 features a multilingual, graphical display allowing users to monitor measurement trends. PTB330 updates the graph automatically during measurement and it provides a one-year

measurement history. In addition to instant pressure, PTB330 provides the WMO pressure trend and tendency codes.

Applications

PTB330 can be used successfully for aviation, professional meteorology, and for demanding industrial pressure measurement applications such as accurate laser interferometric measurement and exhaust gas analysis in engine test benches.

Technical Data

Measurement performance

Property	Class A	Class B
Barometric pressure range 500 ... 1100 hPa		
Linearity ¹⁾	±0.05 hPa	±0.10 hPa
Hysteresis ¹⁾	±0.03 hPa	±0.03 hPa
Repeatability ¹⁾	±0.03 hPa	±0.03 hPa
Calibration uncertainty ²⁾	±0.07 hPa	±0.15 hPa
Accuracy at +20 °C (+68 °F) ³⁾	±0.10 hPa	±0.20 hPa
Barometric pressure range 50 ... 1100 hPa		
Linearity ¹⁾	–	±0.20 hPa
Hysteresis ¹⁾	–	±0.08 hPa
Repeatability ¹⁾	–	±0.08 hPa
Calibration uncertainty ²⁾	–	±0.15 hPa
Accuracy at +20 °C (+68 °F) ³⁾	–	±0.20 hPa
Temperature dependence ⁴⁾		
500 ... 1100 hPa	–	±0.1 hPa
50 ... 1100 hPa	–	±0.3 hPa
Total accuracy –40 ... +60 °C (–40 ... +140 °F)		
500 ... 1100 hPa	±0.15 hPa	±0.25 hPa
50 ... 1100 hPa	–	±0.45 hPa
Long-term stability		
500 ... 1100 hPa	–	±0.1 hPa/year
50 ... 1100 hPa	–	±0.1 hPa/year
Miscellaneous		
Pressure units	hPa, mbar, kPa, Pa inHg, mmH2O, mmHg, torr, psia	hPa, mbar, kPa, Pa inHg, mmH2O, mmHg, torr, psia
Resolution	0.01 hPa	0.1 hPa
Settling time at startup (one sensor)	4 s	3 s
Response time (one sensor)	2 s	1 s
Acceleration sensitivity	–	Negligible
Maximum pressure limit	–	5000 hPa absolute

- 1) Defined as ±2 standard deviation limits of endpoint non-linearity, hysteresis, or repeatability error.
 2) Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to international standards.
 3) Defined as the root sum of the squares (RSS) of endpoint non-linearity, hysteresis error, repeatability error, and calibration uncertainty at room temperature.
 4) Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

Operating environment

Pressure range	500 ... 1100 hPa, 50 ... 1100 hPa
Operating temperature	–40 ... +60 °C (–40 ... +140 °F)
Operating temperature with local display	0 ... +60 °C (+32 ... +140 °F)
IP rating	IP66 IP65 (NEMA4) with local display
EMC compatibility	EN 61326-1, industrial environment

Data transfer software

MI70 Link Interface software requirements	Microsoft® Windows OS Microsoft® Excel
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Mechanical specifications

Pressure fitting	Barbed fitting for 1/8-inch I.D. tubing or quick connector with shutoff valve for 1/8-inch hose
Pressure connector	M5 (10-32) internal thread
Housing material	G AISi10 Mg (DIN 1725)
Weight	1 ... 1.5 kg (2.2 ... 3.3 lb)

Inputs and outputs

Supply voltage	10 ... 35 V DC
Supply voltage sensitivity	Negligible
Typical power consumption at +20 °C (+68 °F) (U _{in} 24 V DC, one pressure sensor)	RS-232: 25 mA RS-485: 40 mA U _{out} : 25 mA I _{out} : 40 mA Display and backlight: +20 mA
Serial I/O	RS-232C, RS-485, RS-422

Analog output (optional)

Current output	0 ... 20 mA, 4 ... 20 mA
Voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Accuracy at pressure range	500 ... 1100 hPa 50 ... 1100 hPa
At +20 °C (68 °F)	±0.30 hPa ±0.40 hPa
At –40 ... +60 °C (–40 ... 140 °F)	±0.60 hPa ±0.75 hPa

Accessories

Serial interface cable	19446ZZ
USB-RJ45 serial connection cable	219685
Software interface kit	215005
Wall mounting kit	214829
Outdoor installation kit (weather shield)	215109
Installation kit for pole or pipeline	215108
Power supply module	POWER-1
Temperature compensated analog output module	AOUT-1T
Isolated RS-485 module	RS485-1
DIN rail kit	215094



VAISALA

www.vaisala.com



Features

- PTB330 digital barometer for accurate pressure measurement
- Handheld MI70 indicator with a user-friendly, multilingual display
- Service port for MI70 Link software or computer
- Vaisala HUMICAP® humidity and temperature probe HMP155
- Weatherproof transport case

Barometric Pressure Transfer Standard PTB330TS combines a PTB330 digital barometer with a handheld MI70 indicator into a portable unit that can be used as a transfer standard.

Barometer for Portable Use

PTB330TS uses a PTB330 series digital barometer that is housed in a tabletop casing. PTB330TS is designed to be operated using the handheld MI70 indicator. The MI70 indicator also provides the operation power for the barometer. Optional HMP155 probe is available for accurate humidity and temperature measurement.

For Measurements in Industrial and Meteorological Areas

PTB330TS is suitable for reference measurements in industrial and meteorological areas. PTB330TS is housed in a durable and weatherproof

transport case that can be easily carried and shipped. The components of the PTB330TS are placed in a foam interior with accessories and User Guide in the lid organizer. The case includes a shoulder strap.

Available Options

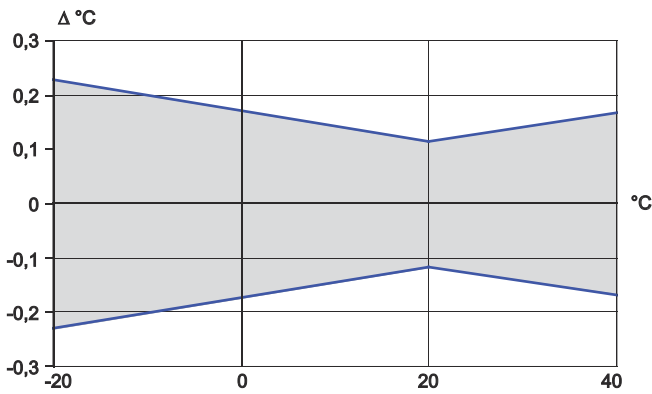
- ISO/IEC 17025 Accredited calibration for PTB330
- HMP155 options: additional temperature probe, manually controlled chemical purge feature
- MI70 Link software and USB or RS-232 cable for downloading measurement data to a computer
- USB service cable for connecting to PTB330 service port

Technical Data

These specifications apply when MI70, PTB330, and HMP155 are used together in PTB330TS. For PTB330 and HMP155 specifications, see the product documentation.

General

Operating temperature	
MI70	-10 ... +40 °C (+14 ... +104 °F)
PTB330	-40 ... +60 °C (-40 ... +140 °F)
HMP155	-80 ... +60 °C (-112 ... +140 °F)
Operating humidity	Non-condensing
Maximum pressure limit	5000 hPa abs.
Power supply	Rechargeable NiMH battery pack with AC-adaptor or 4xAA-size alkalines, type IEC LR6
Menu languages	English, Chinese, French, Spanish, German, Russian, Japanese, Swedish, Finnish
Display	LCD with backlight, graphic trend display of any parameter, character height up to 16 mm
Data logging capacity	2700 points
Alarm	Audible alarm function
Compliance	<ul style="list-style-type: none"> EMC Directive (2004/108/EC) Complies with the EMC product family standard EN61326-1 Electrical equipment for measurement control and laboratory use Basic immunity test requirements Low Voltage Directive (2006/95/EC) ROHS Directive (2002/95/EC)
Operation Time (Using Rechargeable Battery Pack)	
Continuous use with PTB330	11 h typical at +20 °C (+68 °F)
Datalogging use	Up to 30 days



Accuracy of HMP155 temperature measurement over temperature range

Measurement Performance

Barometric Pressure (PTB330)

Measurement range	500 ... 1100 hPa
Linearity ¹⁾	±0.05 hPa
Hysteresis ¹⁾	±0.03 hPa
Repeatability ¹⁾	±0.03 hPa
Calibration uncertainty ²⁾	±0.07 hPa
Accuracy at +20 °C (+68 °F) ³⁾	±0.10 hPa
Temperature dependence ⁴⁾	±0.1 hPa
Total accuracy -40 ... +60 °C (-40 ... +140 °F)	±0.15 hPa
Long-term stability	±0.1 hPa/year
Settling time at startup (one sensor)	4 s
Response time (one sensor)	2 s
Acceleration sensitivity	Negligible

Relative Humidity (HMP155)

Measurement range	0 ... 100 %RH
Accuracy (incl. non-linearity, hysteresis and repeatability)	
at +15 ... +25 °C (+59 ... +77 °F)	±1 %RH (0 ... 90 %RH) ±1.7 %RH (90 ... 100 %RH)
at -10 ... +40 °C (-4 ... 104 °F)	±(1.0 + 0.008 reading) %RH
Factory calibration uncertainty at +20 °C (+68 °F)	±0.6 %RH (0 ... 40 %RH) ⁵⁾ ±1.0 %RH (40 ... 97 %RH) ⁵⁾
Humidity sensor	HUMICAP180R HUMICAP180RC
Response time at +20 °C (+68 °F) in still air with a sintered PTFE filter	
63%	20 s
90%	60 s

Temperature (HMP155)

Measurement range	-10 ... +40 °C (+14 ... +104 °F)
Accuracy	
-10 ... +20 °C (+14 ... +68 °F)	±(0.176 - 0.0028 x temperature) °C
+20 ... +40 °C (+68 ... +104 °F)	±(0.07 + 0.0025 x temperature) °C
Temperature sensor	Pt100 RTD Class F0.1 IEC 60751
Response time with additional temperature probe in 3 m/s air flow	
63%	< 20 s
90%	< 35 s

- ¹⁾ Defined as ±2 standard deviation limits of endpoint non-linearity, hysteresis, or repeatability error.
- ²⁾ Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.
- ³⁾ Defined as the root sum of the squares (RSS) of endpoint non-linearity, hysteresis error, repeatability error, and calibration uncertainty at room temperature.
- ⁴⁾ Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.
- ⁵⁾ Defined as ±2 standard deviation limits. Small variations possible, see also calibration certificate.

Available Parameters

Pressure parameters	P, P3h, HCP, QFE, QNH
Humidity and temperature parameters	RH, T, Tdf, Td, x, Tw

Inputs and Outputs

MI70 probe ports	2
MI70 data interface	RS-232 (accessible only with MI70 Link software)
PTB330 supply voltage	10 ... 35 VDC (if not powered by MI70)
PTB330 data interface	RS-232C
PTB330 serial I/O connectors	RJ45 (service port) Male 8-pin M12 (user port)
HMP155 data interface	RS-485
HMP155 serial I/O connector	Male 8-pin M12

Mechanical Specifications

PTB330

Housing material	G-AISI 10 Mg (DIN 1725)
IP rating	IP65
Pressure connector	M5 (10-32) internal thread
Pressure fitting	Barbed fitting for 1/8 inch I.D. tubing or quick connector with shutoff valve for 1/8 inch hose

HMP155

Housing material	PC
IP rating	IP66
Additional T-probe cable length	2 m (6 ft 6 in)
Cable material	PUR
Sensor protection	Sintered PTFE

MI70 Measurement Indicator

IP rating	IP54
Housing material	ABS/PC blend

Transport Case

IP rating (when closed)	IP67
Plastic parts	TTX01®, PP+SEBS, POM
Metal parts	Stainless steel AISI303
Interior foam material	Polyethylene and polyether
Weight with all instruments and typical accessories	5.9 kg (13 lb)
Exterior dimensions (L × W × H)	405 × 330 × 165 mm (15.94 × 12.99 × 6.50 in)



Spare Parts and Accessories

PTB330

MI70 – PTB330 spiral cable	223235SP
USB-RJ45 serial connection cable	219685
Serial connection cable	19446ZZ
Barbed fitting 1/8 in	19498SP
Quick connector 1/8 in	220186
Transport case with interior foams and tabletop casing for PTB330	224068SP

MI70

USB cable for MI70, includes MI70 Link software	219687
MI70 Link software	MI70LINK
MI70 connection cable to HMT330, MMT330, DMT340, HMT100, PTB330	211339
MI70 battery pack variety of AC adapters available	26755

HMP155

HMP155 - MI70 connection cable	221801
Protection set for HMP155 calibration buttons: protective cover, 2 O-rings and protective plug	221318
USB cable for HMP155	221040
Sintered teflon filter + O-ring	219452SP
Humidity sensor	HUMICAP180R
Humidity calibrator	HMK15



VAISALA

www.vaisala.com

SPH10 and SPH20 Static Pressure Head Series



SPH10/20 is easy to install and connect. In the picture, SPH10 is connected to PTB210.

Features

- Minimizes wind induced error
- Reliable barometric pressure measurement in all weather
- Wind tunnel tested structure
- Easy to clean
- Easy to install

SPH10/20 Static Pressure Heads minimize the effects of wind on barometric pressure readings.

Wind induced effects are one of the main sources of error when measuring barometric pressure. Variations due to strong and gusty wind can be overcome by using a static pressure head to reduce the effect of dynamic pressure.

Vaisala Static Pressure Head Series SPH10/20 are designed to minimize the errors caused by wind. Their wind tunnel tested structure is both horizontally and vertically symmetrical. This design ensures reliable barometric pressure measurements in all weather.

Ideal for Outdoor Installations

Vaisala static pressure heads are available in two models: Vaisala Static Pressure Head SPH10 is a basic version, and Vaisala Static Pressure Head SPH20 is a heated version for reliable operation in snowy and icy conditions. The heated SPH20 contains a thermostat that switches on the warming power at temperatures where the risk of icing may occur.

Composed of ultraviolet stabilized PC plastics and offshore aluminum, SPH10/20 static pressure heads are durable and weather resistant.

SPH10/20 protects against rain and condensed water. This prevents capillary condensation of a water column in the pressure channel resulting in a pressure error. The drain holes in the lower plate allow rain and water to flow out. The static pressure heads have internal netting that prevents insects and debris from blocking the pressure channel.

Carefree Maintenance

SPH10/20 static pressure heads are easy to install and disassemble, service, and clean – even at the installation site. Vaisala BAROCAP® Digital Barometer PTB210 can be installed directly on top of SPH10/20 static pressure heads. Other barometers can be connected to the heads with pressure tubing.

SPH10 and SPH20 are a perfect pair for all Vaisala barometers. They ensure an accurate and reliable measurement in all weather conditions.

Technical Data

Operating Environment

Operating temperature -60 ... +80 °C (-76... +176 °F)

Mechanical Specifications

Weight	SPH10: 800 g (1.76 lb) SPH20: 1360 g (3.0 lb)
Materials	PC plastic, offshore aluminium
Mounting	With 2 bolts (M6 × 20 mm min.)
Hose connection	Barbed fitting for 4 mm I.D. hose or Rp1/4 thread (parallel)

SPH20 Inputs and Outputs

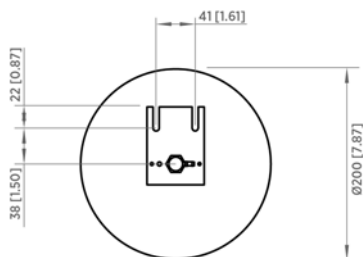
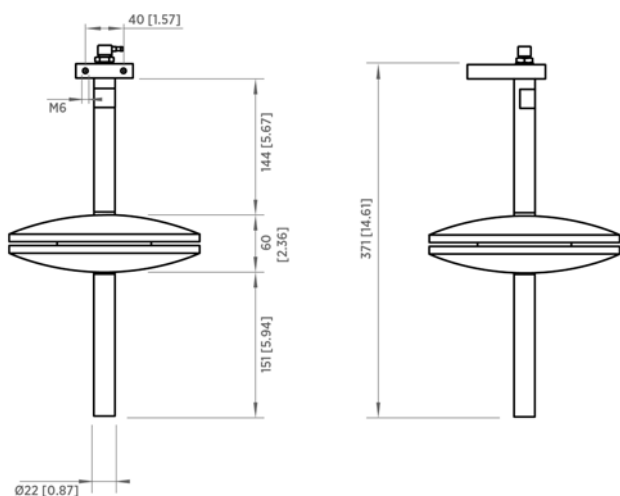
Electrical connections	M12 connector
Power supply	Factory setting: 12 V Changed connection: 24 V

Power consumption during heating 70 W

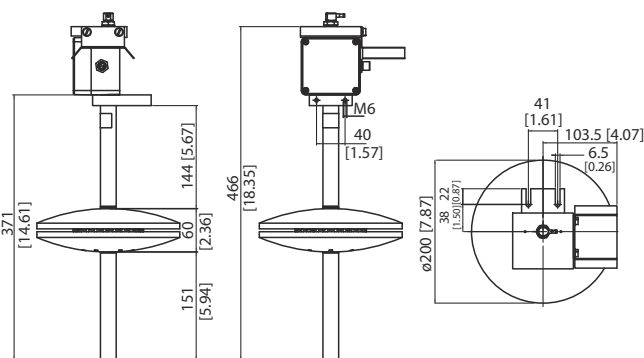
Thermostat Switching Temperature

On	+4 °C (±3 °C) +39.2 °F (±4.4 °F)
Off	+13 °C (±3 °C) +55.4 °F (±4.4 °F)

Dimensions in mm (inches)



SPH10



SPH20





Features

- Designed to measure rainfall / liquid precipitation
- Tipping bucket principle
- Suitable for remote and unattended locations
- Provides accurate measurements
- Economical and proven in operation
- Robust system component

Vaisala Rain Gauge RG13 and Vaisala Rain Gauge RG13H with heating option are designed for measuring liquid precipitation.

RG13(H) uses a pulse-based tipping-bucket mechanism to produce a contact closure every time it receives a predetermined quantity of rainfall: 0.1 mm (0.004 in) or 0.2 mm (0.008 in).

The body and funnel of the gauge are aluminum alloy. The septum ring at the top gives an aperture of exactly 400 cm² (62 in²).

The tipping-bucket mechanism is mounted inside the body on a cast aluminum-alloy base that has fixing slots, 3 leveling screws, and a spirit level.

The mechanism consists of a divided bucket pivoted at its center. Rain collects in the upper half. When this is full, the mechanism tilts and discharges the collected water, so that the other half of the bucket can start filling.

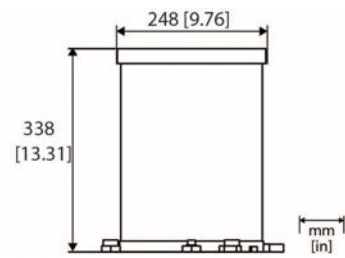
A siphon device is fitted to the base of the funnel to control the rate of flow into the buckets. By ensuring a constant flow rate into the tipping bucket, calibration is made easier and accuracy improved.

The gauge is available with or without the heating function. The heating turns on when the temperature drops below +4 °C (+39 °F).

Technical Data

Measurement performance

Precipitation	Liquid
Accuracy	2 % at 1 l/h (0.26 gal/h)
Diameter of aperture	225 mm (8.86 in)
Area of aperture	400 cm ² (62 in ²)
Rainfall capacity	Unlimited
Resolution	0.2 mm (0.008 in) 0.1 mm (0.004 in)



Operating environment

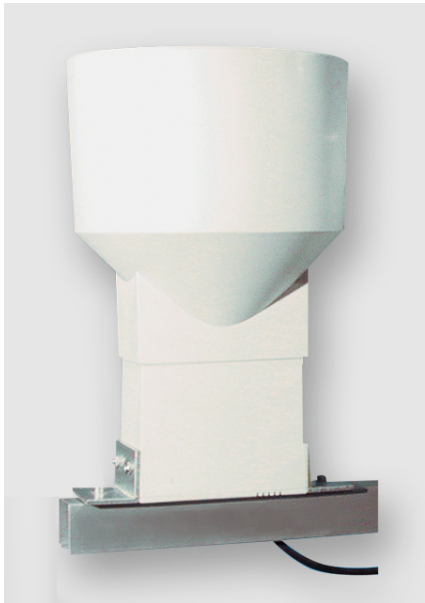
Operating temperature	RG13H: -20 ... +85 °C (-4 ... +185 °F)
Storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Heating (RG13H)	
Heating connection/disconnection at	+4 °C (+39 °F)
Heating power	RG13H: 33W / 48 V DC



Mechanical specifications

Dimensions (H × Ø)	338 × 248 mm (13.31 × 9.76 in)
Weight	2.6 kg (5.73 lb)
Material	
Base, septum ring	Aluminum alloy LM25
Outer ring, funnel	Aluminum alloy sheet
Inlet/Outlet ports, pins	Stainless steel
Tipping mechanism	Injection-moulded plastic
Transducer	Reed switch
Output	
Circuit	Contact closure
Connection	Screw terminal

QMR101 and QMR101M Rain Gauge



Rain Gauge QMR101 for MAWS201

Vaisala Rain Gauge QMR101 and QMR101M are durable solutions for gathering accurate precipitation data. QMR101 is part of Vaisala HydroMet™ Automatic Weather Station MAWS201 while QMR101M is for Vaisala TacMet™ Tactical Meteorological Observation System MAWS201M.

Portable rain gauge

Due to its small size, weight, and rugged design, QMR101(M) is especially suitable for portable applications and temporary installations. It is economical as well as accurate.

The rain gauge uses the self-emptying tipping spoon mechanism to measure the collected rain at 0.2-millimeter (0.008-inch) accuracy level.

For harsh conditions

Manufactured from UV-resistant plastic, QMR101(M) is a very rugged instrument that can withstand frost and icy conditions.

The rain gauge is installed on a sensor support arm and it is delivered with a ready-made 1-meter (3-foot 4-inch) connector cable.

Features

- Provides accurate precipitation data
- Weatherproof
- Enclosure from corrosion and UV-resistant plastic
- Suitable for temporary installations



Rain Gauge QMR101M for MAWS201M

Technical data

Measurement performance

Sensor/Transducer type	Self-emptying tipping spoon/magnet
Sensitivity	0.2 mm (0.008 in)
Capacity	144 mm/h (5.67 in/h)
Accuracy	±2 %

Compliance

EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC compatibility	EN 61326-1, industrial environment
Electrical safety	EN 61010-1
Compliance marks	CE

Mechanical specifications

Funnel diameter	159.6 mm (6.28 in)
Orifice area	200 cm ² (31 in ²)
Material	UV-stabilized plastic
Connector	QMR101: M12/5F QMR101M: Alden Pulse-Lok® V1, V114, 4P
Cable	1 m (3 ft 4 in)
Weight	0.380 kg (0.84 lb)



Features

- The Pt100 sensor element type, specified accuracy level of 1/4 IEC 60751 Class B
- Excellent accuracy, repeatability, and long-term stability
- Wide operating temperature range
- Watertight (IP68)
- Stable, highly accurate temperature sensor ideally suited for measuring soil, air, leaf and water temperatures
- Calibration traceable to international standards

Vaisala Soil/Water Temperature Probes QMT102, QMT103, and QMT110 are particularly well suited for the precision measurement of ground and soil temperatures.

Carefully selected materials

All the materials used in the probe's manufacture have been carefully selected to withstand various types of environmental stress and a wide range of temperatures.

Highly accurate measurements

The measurement accuracy and stability of QMT102, QMT103, and QMT110 are based on a Pt100 type sensor element, which is specified to a level of precision

of 1/4 IEC 60751 Class B. The probe includes a cable with a black, weather-resistant polyurethane (PUR) sheath that withstands both abrasive wear and extreme temperatures. A 5-pin watertight connector is molded to the other end of the cable for quick installation and replacement in Vaisala weather stations.

Probe variants

The offering has the following probe variants with different cable lengths:

- QMT102: 2 m (6 ft 7 in)
- QMT103: 5 m (16 ft 5 in)
- QMT110: 10 m (32 ft 10 in)

Technical data

Measurement performance

Sensor type	Pt100-type resistance temperature detector element
Accuracy	1/4 IEC 60751 Class B > 0.08 °C at 0 °C (+32 °F)
Sensitivity	0.385 Ω/°C (IEC 60751)

Operating environment

Operating temperature (fixed installation)	-40 ... +80 °C (-40 ... +176 °F)
Operating temperature (flexible installation)	-25 ... +80 °C (-13 ... +176 °F)
IP rating	IP68

Compliance

EU directives and regulations	RoHS Directive (2011/65/EU) amended by 2015/863
Compliance marks	CE

Mechanical specifications

Dimensions (L × Ø)	150 × 6 mm (5.91 × 0.24 in)
Material	Stainless steel AISI 316

Cable

Material	Black polyurethane (PUR), 5 × 0.34 mm ² Cu
Length	<ul style="list-style-type: none">• QMT102: 2 m (6 ft 7 in)• QMT103: 5 m (16 ft 5 in)• QMT110: 10 m (32 ft 10 in)



Features

- Complete solution for weather data collection
- Excellent expandability and flexibility
- Modern security architecture
- WMO-compliant sensors and data validation
- Includes the next generation Vaisala Data Management Unit DMU801
- Enhanced remote maintenance and configuration management
- Easy remote monitoring of network status using optional NM10 software
- Powers modern surface weather networks

Vaisala Automatic Weather Station AWS810 has everything that you need for taking accurate and reliable weather measurements. It is a complete communication and data monitoring solution including sensors, electronics, mast, and power supply.

An all-in-one solution with many applications

Vaisala Automatic Weather Station AWS810 is a weather data collection system that automatically measures, processes, and stores meteorological data for professional use. AWS810 can be operated as a standalone unit, or it can be connected with other compatible Vaisala weather stations to form weather observation networks.

AWS810 stations can be used for several applications, such as synoptic, aviation, and agricultural meteorology, hydrology, and climatology. Using the same standard hardware and software for many purposes lowers the cost of training, spare parts, and logistics support.

Validated data from reliable sensors

Vaisala weather stations and instruments are fully compliant with World Meteorological Organization guidelines. The design quality of Vaisala weather stations has been proven with extensive tests in the development phase and on the field.

To ensure continuous accuracy of measurements and calculations, AWS810 includes built-in data quality controls that test sensor data against minimum and maximum limits and changes between successive measurements. The weather station's DMU801 data management unit continuously monitors the status of the sensors to ensure measurement reliability, notifying the user if the status of any sensor becomes invalid. All the sensors operate

independently from each other, meaning that an individual sensor failure does not affect the performance of the other sensors.

Data security prioritized

AWS810 provides first-class data security mechanisms to protect your data from security threats and unauthorized access. DMU801 data management unit brings along a number of data security features, such as secure network protocols, secure communication interfaces with industry standard encryption protocols, and dynamic firewall protection. Security development and maintenance, including regular firmware updates, is provided for continuous improvements.

Maintenance made easier

For AWS810 networks, the Vaisala Observation Network Manager NM10 software provides a powerful browser-based interface for 24/7 monitoring, access, and control of all your observation sites. Continuous, reliable observations improve the performance of your weather services and weather-critical operations, while shorter site visits and correct maintenance actions save time and money.

Even without the optional NM10 software, it is possible to adjust settings and fix problems remotely. The AWS810 Web user interface allows the user to view basic station information, sensor status, and readings, to set site-specific parameters, and to perform many other functions using a graphical user interface.

Technical data

Operating environment

Operating environment	Outdoor use
Use in wet location	Yes
Operating temperature ¹⁾	-40 ... +60 °C (-40 ... +140 °F)
Extended operating temperature (with insulated enclosure and heating)	-60 ... +50 °C (-76 ... +122 °F), cold start at -40 °C (-40 °F)
Storage temperature ²⁾	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH
Pollution degree	2
Maximum operating altitude	3000 m (approx. 9800 ft)

- ¹⁾ Excluding backup battery, QST102-3, cellular modem, QMN101, RG13(H), SR50A, and PAA-36 X W. See the manufacturer documentation.
²⁾ Excluding cellular modem, HMP155, and HMP110. See the manufacturer documentation.

Powering specifications

AC (mains) power	100 ... 240 V AC ±10 % 50 ... 60 Hz ±10 % 5.6 A maximum (120 V AC)
Mains fuse (nominal)	10 A
External DC	16 ... 28 V DC 10.6 A maximum Heated option: 24 V DC ±2 10.6 A maximum for system, 12 A maximum for heating
Solar panel	70 W, typical 15 ... 28 V DC 6 A maximum (each), 10.6 A combined (both inputs)
Internal backup battery	12 V / 26 Ah or 12 V / 52 Ah
Backup battery fuse	10 A
Overvoltage category	II

ENC652 specifications

Approvals	UL 50 / UL 50E-listing
IP rating	IP66
NEMA rating	NEMA 4X
Maximum operating wind speed	75 m/s (168 mph)
Door opening angle	100°
Material	Stainless steel AISI 316, painted white
Size (enclosure only)	600 × 500 × 207 mm (23.62 × 19.68 × 8.15 in)
Weight (excluding backup battery)	< 30 kg (66 lb) ¹⁾

- ¹⁾ Depends on the selected options.

Compliance

EU directives and regulations	EMC, LVD, RoHS
EMC compatibility	EN 61326-1, industrial environment ¹⁾
Electrical safety	EN 61010-1

- ¹⁾ Modem Carrier Module DMX801 complies with EN 61326-1 basic level. Ethernet connection requires external surge protection to comply with EN 61326-1 industrial environment level.

Environmental compliance

Test	Applied standard or test procedure	Specification
Operation		
Cold	IEC 60068-2-1	-40 °C (-40 °F)
Dry heat	IEC 60068-2-2	+60 °C (+140 °F)
Damp heat	IEC 60068-2-78	+40 °C (+104 °F) / 85 ... 95 %RH
Vibration (sinusoidal)	IEC 60068-2-6 IEC 60945	5 ... 13.2 Hz, 1 mm (0.04 in) amplitude 13.2 ... 200 Hz, 0.7 g
Shock	IEC 60068-2-27 MIL-STD-202G, 213B	6.0 g, 11 ms, functional shock 30 g, 11 ms
Storage		
Cold ¹⁾	IEC 60068-2-1	-60 °C (-76 °F)
Dry heat ¹⁾	IEC 60068-2-2	+70 °C (+158 °F)
Damp heat	IEC 60068-2-78	+40 °C (+104 °F) / 85 ... 95 %RH
Transport		
Vibration (random)	IEC 60068-2-64	10 ... 500 Hz, a (rms) = 18.7 m/s ²
Shock	IEC 60068-2-27	18 g, pulse duration 6 ms, with 100 pulses in each direction
Rough handling	IEC 60068-2-31	Drop height 50 cm (19.69 in)

- ¹⁾ Excluding backup battery.

EMC compliance

Test	Applied standard or test procedure	Specification
Emissions radiated	CISPR 32 Class B (EN 55032)	30 MHz ... 2 GHz
Emissions conducted to mains (AC)	CISPR 32 Class B (EN 55032)	150 kHz ... 30 MHz
Emissions conducted to telecommunication lines	CISPR 32 Class B (EN 55032)	150 kHz ... 30 MHz
Emissions, harmonic current	EN 61000-3-2	0 ... 40 th harmonic
Immunity to RF field (80 MHz ... 6 GHz)	EN 61000-4-3	10 V/m (80 MHz ... 1 GHz) 3 V/m (1 ... 6 GHz)
Immunity to electric fast transient	EN 61000-4-4	4 kV AC, 1 kV I/O
Immunity to surge	EN 61000-4-5	2 kV / 1 kV AC, 1 kV I/O
Immunity to conducted RF	EN 61000-4-6	10 V e.m.f. (150 kHz ... 80 MHz)
Immunity to voltage dips and short interrupts	IEC 61000-4-11	0 % 1 cycle 40 % 10 cycles 70 % 25 cycles 0 % 250 cycles

Measurements

Wind speed and direction
Athmospheric pressure, air temperature, relative humidity, dew point
Rain/Precipitation, visibility and present weather
Global solar radiation, net radiation, UV radiation
Ground temperature, snow depth, water level
Cloud height and sky condition

Standard communications options

Wireless communication	LTE Cat 4 cellular modem (with UMTS/HSPA+ and GSM/GPRS/EDGE support)
Landline communication	RS-232, RS-485, LAN
Data collection software	Vaisala Observation Network Manager NM10
Maintenance	USB host device with Web UI

For other data validation, calculation, report, mast, powering, sensor, communication data collection software options, and measurement unit conversions, contact Vaisala.



Features

- Collects and processes sensor measurement data using advanced algorithms
- Stores observations, device information, and maintenance history
- Highly scalable and customizable
- Open design provides excellent sensor connectivity
- Low power consumption
- Latest hardware, firmware, and network security features
- Visual configuration tool for configuration creation and modification
- Robust design with long operating life
- Reliable also in extreme environmental conditions
- Built-in surge protection
- Easy to install, economical to maintain and upgrade both locally and remotely
- Self-diagnostics include monitoring of internal voltages, operating current and temperature
- Can also be used as a gateway between less secure subsystems and internet

Vaisala Data Management Unit DMU801 is designed for acquiring and managing data flow from sensors in automatic weather stations. Its open design allows flexibility in sensor selection and data interfaces. DMU801 can be configured to send observation data for analysis and visualization to Vaisala Observation Network Manager NM10 or any desired customer system.

Reliability as design principle

DMU801 hardware has been designed and tested for extreme environmental conditions. Only industry-proven components are used.

A local database ensures that the collected data is secured also in case of external communication network downtime.

High quality data

DMU801 performs advanced algorithm calculations to process observation data from sensors. In addition, DMU801 validates sensor data accuracy using preconfigured criteria before sending the data forward.

Secure by design

DMU801 has a number of data security features to protect the data. The features include, for example, secure network protocols, secure communication interfaces with industry standard encryption protocols, and dynamic firewall protection. Systematic user management is implemented to prevent unauthorized access, and regular firmware updates are provided for continuous improvements.

Energy efficient

The low power consumption of DMU801 makes it an ideal solution also for remote locations. DMU801 can be powered by solar panels.

Scales to your needs

DMU801 is available in 3 sizes. It has a processor board and room for either 2, 4, or 8 optional plug-in modules. You can select the size of the base unit according to your expansion needs and complement it with additional plug-in modules.

Plug-in modules include an analog module, serial modules, an Ethernet switch module, a modem carrier module, and a barometer module.

DMU801 is suitable for any sensor and telemetry.

Easy configuration creation

You can create your own configuration files or modify existing ones with Vaisala DMU801 Configuration Tool. The tool is designed to be intuitive and visual, which makes it easy to use.

Remotely managed

For maintenance, configuration, and troubleshooting tasks, DMU801 includes a built-in web user interface that allows controlling the system remotely as well as locally. Most new features can be taken into use over a remote connection.

Technical data

Operating environment

Operating temperature ¹⁾	-40 ... +80 °C (-40 ... +176 °F)
Extended operating temperature (available on request)	-60 ... +80 °C (-76 ... +176 °F)
Storage temperature	-60 ... +85 °C (-76 ... +185 °F)
Operating humidity	0 ... 100 %RH, non-condensing

¹⁾ Operating temperature of some of the DMU801 plug-in modules may be different. See the plug-in module datasheets.

Powering specifications

Operating voltage	8 ... 32 V DC (maximum 10 A)
Power consumption, typical	500 mW
Heating voltage	24 V DC nominal
Maximum input current for heating	12 A
Mating connectors (power/heating input)	2 × Phoenix Contact FKCN 2,5/2-ST-5,08 (included)

Inputs and outputs

Ethernet

Ports	eth0 on CPU, additional ports with plug-in modules
Supported standard	IEEE 802.3u
Physical layer	Base-T
Data rate	10/100 Mbps
Connectors	RJ45 with link LEDs
Data transmission	Full/Half-duplex with auto-negotiation

USB

Ports	1
Supported standard	USB 2.0
Signaling	High speed
Connectors	USB-C

Serial

Ports	<ul style="list-style-type: none">1 × RS-232 / RS-485 / SDI-12 port2 × RS-485 portsAdditional ports with plug-in modules
Supported bit rate	1200 ... 115 200 bps
Power output	5 × software controllable power output pins
Signals	<ul style="list-style-type: none">RS-232: RXD, TXDRS-485: D+/D-
Digital I/O	4 × 3.3 V logic level GPIO pins, pulse count/frequency capable
Mating connectors	<ul style="list-style-type: none">2 × Phoenix Contact DFMC 1,5/4-ST-3,5-LR (included)1 × M8 4-pin male

TCP/IP

Supported protocols	DHCP, DNS, NTP, ARP, ICMP Echo, TCP/IP, SSH, UDP, DTLS, HTTPS ¹⁾
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¹⁾ The list is subject to change.

Processing system

Processor	ARM Cortex A9, 800 MHz
Memory	1 GB DDR3L RAM, 8 GB eMMC Flash
External memory	SD card up to 32 GB ¹⁾
Operating system	Linux
Communications protocol	IPv4 and IPv6

Real-time clock (standard)

Accuracy	Better than 20 s/month
Backup battery	CR1225/BR1225
Backup time	Minimum 5 years

¹⁾ SD card available as accessory.

Mechanical specifications

Weight	2 slot unit: 0.35 kg (0.77 lb) 4 slot unit: 0.48 kg (1.06 lb) 8 slot unit: 0.71 kg (1.57 lb)
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Mounting	DIN rail 35 mm (1.4 in)
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Dimensions (H × W × D) ¹⁾

2 slots	120 × 77 × 84 mm (4.72 × 3.03 × 3.31 in)
4 slots	120 × 113 × 84 mm (4.72 × 4.45 × 3.31 in)
8 slots	120 × 185 × 84 mm (4.72 × 7.28 × 3.31 in)

Materials

Screws, washers, DIN rail locking piece	Stainless steel AISI 316
Frame profile	Aluminum EN AW-6060 T6
End covers	Plastic PC/ABS

¹⁾ Reserve some extra space for connectors and cables. For example, sensor connectors require a minimum of 20 mm (0.8 in) additional space from the DMU801 frame.

Compliance

EU directives and regulations	EMC, RoHS
EMC immunity	EN 61326-1, industrial environment ¹⁾
EMC emissions	CISPR 32 / EN 55032, Class B
Maritime	IEC 60945
Vibration (sinusoidal)	IEC 60068-2-6 5 ... 13.2 Hz, 1 mm (0.04 in) amplitude 13.2 ... 200 Hz, 0.7 g
Rough handling	IEC 60068-2-31 MIL-STD-810G, 516.6 Drop height 122 cm (48.03 in)
Shock	IEC 60068-2-27 15 g, 11 ms, saw-tooth MIL-STD-202G, 213B 30 g, 11 ms, half-sine
Dry heat	IEC 60068-2-2 +85 °C (+185 °F)
Damp heat	IEC 60068-2-78 +40 °C (+104 °F), 95 %RH
Cold	IEC 60068-2-1 -60 °C (-76 °F)
Compliance marks	CE, RCM, UKCA

¹⁾ Modem Carrier Module DMX801 complies with EN 61326-1 basic level. Ethernet connection requires external surge protection to comply with EN 61326-1 industrial environment level.

Plug-in modules

Analog Measurement Module DMA801	<ul style="list-style-type: none"> • 4 × differential analog inputs with protection • 2 × 0 ... 30 V single-ended measurement channels • Sensor excitation power
Serial Module DMS801	<ul style="list-style-type: none"> • 4 × serial ports with power control and protection: <ul style="list-style-type: none"> • 3 × isolated RS-485 ports • 1 × multipurpose RS-485 / RS-232 / SDI-12 port
Serial Module DMS802	<ul style="list-style-type: none"> • 4 × serial ports with power control and protection: <ul style="list-style-type: none"> • 2 × standard RS-232 serial ports • 1 × multipurpose RS-485 / RS-232 port • 1 × multipurpose RS-485 / RS-232 / SDI-12 port
Ethernet Switch Module DME801	<ul style="list-style-type: none"> • 3 × Gigabit copper ports • 2 × SFP fiber optic ports
Modem Carrier Module DMX801	<ul style="list-style-type: none"> • Support for standard mPCIe card modems • SIM card holder or embedded SIM • Support for low-power LTE Cat 1 modem modules
Barometer Module DMB801	Class A calibrated barometer

Note: For more detailed information on the plug-in modules, see the separate plug-in module datasheets.

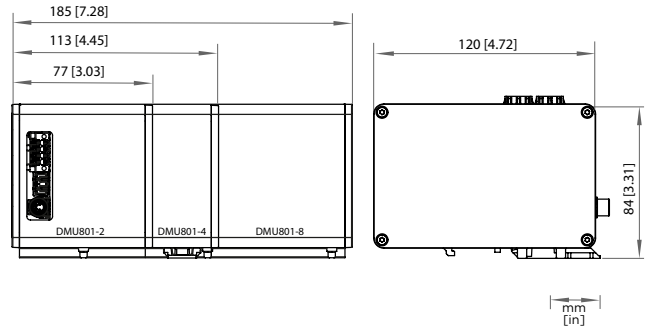
Self-diagnostics features

Internal temperature monitoring

Voltage monitoring

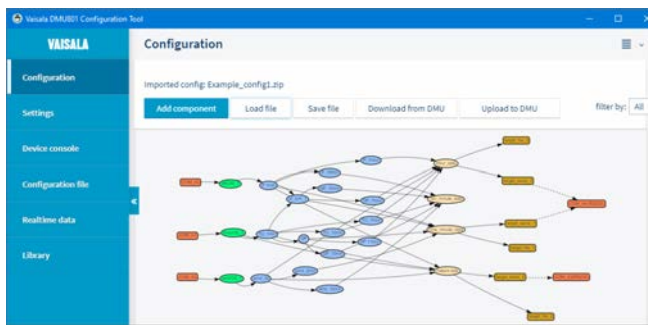
Current monitoring

Enclosure door monitoring (to detect if the door is open or closed)



DMU801 dimensions (all sizes)

Software tools

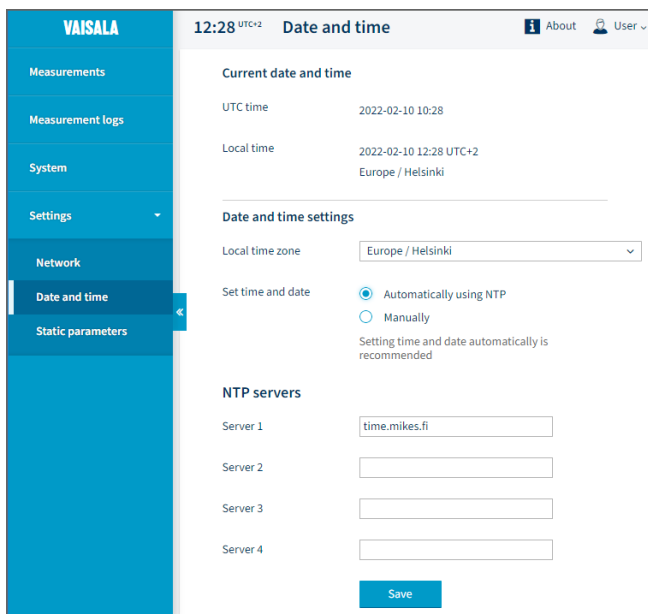


Vaisala DMU801 Configuration Tool

The configuration tool allows creating and modifying configuration files which define how a specific weather station works. Basic meteorological calculations are included, and they are easily extendable with existing Python modules as well as custom Python calculations. The configuration is visualized as colored nodes in the tool.

Features:

- For creating and modifying configuration files
- Configuration files consist of scripts and libraries based on Python 3
- Includes basic meteorological calculations
- Easily extendable with existing Python modules and custom Python calculations



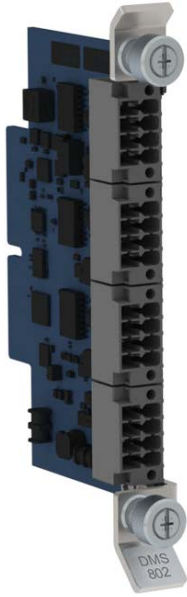
Web User Interface

The web user interface allows setting station-specific parameters such as date and time. No separate installation is needed, but a browser connection is automatically established when the user connects to the station. The tool helps perform typical maintenance tasks, for example, enabling and disabling individual sensors and viewing or downloading log files.

Features:

- For maintenance tasks
- No dedicated software required
- Viewing station events, downloading log files
- Setting and modifying station parameters
- Viewing station metadata like power consumption details
- Updating firmware remotely

DMS802 Serial Module



Vaisala Serial Module DMS802 extends the number of serial ports in Vaisala Data Management Unit DMU801. Each DMS802 provides interfaces for 4 serial connections.

For serial sensor interfaces

Vaisala Serial Module DMS802 provides interfaces for serial sensors. With 2 standard RS-232 ports and 2 different multipurpose ports, each DMS802 allows connecting 4 additional sensors to Vaisala Data Management Unit DMU801. Depending on the size of your DMU801 base unit, you can connect up to 8 DMS802 serial modules to the system.

Easy expansion when needed

DMS802 is easy to install during initial system setup and can also be plugged in later to expand the selection of sensors. DMS802 can be configured with the intuitive, node-based Vaisala DMU801 Configuration Tool.

Rugged solution with internal protection

DMS802 operates in a wide temperature range and withstands fast temperature changes. Because of its internal rugged surge protection (up to 3 kA), external surge protection is not required.

Features

- Allows connecting additional sensors to Vaisala Data Management Unit DMU801
- Sophisticated, software controllable sensor power control
- Heating power connection with overcurrent and surge protection (surge protectors on baseboard)
- 2 standard 3-wire RS-232 ports
- 1 multipurpose port that supports 2-wire RS-485 and RS-232
- 1 multipurpose port that supports 2-wire RS-485, RS-232, and SDI-12
- Rugged lightning surge protection for all sensor connections

Technical data

Operating environment

Operating temperature	-40 ... +85 °C (-40 ... +185 °F)
Extended operating temperature (available on request)	-60 ... +85 °C (-76 ... +185 °F)
Storage temperature	-60 ... +85 °C (-76 ... +185 °F)
Operating humidity	0 ... 100 %RH, non-condensing

Inputs and outputs

Ports	<ul style="list-style-type: none">• 2 × standard RS-232 serial ports• 1 × multipurpose serial port supporting 2-wire RS-485 and RS-232• 1 × multipurpose serial port supporting 2-wire RS-485, RS-232, and SDI-12
Mating connectors	4 × Phoenix Contact DFMC 1,5/4-ST-3,5-LR (included)
Supported bit rate	1200 ... 115 200 bps
Power output	Each serial port has a separate, software controllable power output pin
Heating output	Each serial port has separate heating power supply pins
Signals, RS-232	RXD, TXD, GND
Signals, RS-485 serial	D+/D-

Powering specifications

Sensor supply voltage	3 ... 26 V, software controllable
Current limit	1.4 A -25 %/+20 % per port

Mechanical specifications

Dimensions (H x D)	123 × 79 mm (4.84 × 3.11 in)
Distance between 2 plug-in module slots in DMU801 frame	18 mm (0.71 in)
Weight	65 g (2.3 oz)
Material	UL-rated fire-resistive FR4 material
Handles	Stainless steel
Coating	Conformally coated against humidity

Compliance

EU directives and regulations	EMC, RoHS	
EMC immunity	EN 61326-1, industrial environment ¹⁾	
EMC emissions	CISPR 32 / EN 55032, Class B	
Maritime	IEC 60945	
Vibration (sinusoidal)	IEC 60068-2-6	5 ... 13.2 Hz, 1 mm (0.04 in) amplitude 13.2 ... 200 Hz, 0.7 g
Rough handling	IEC 60068-2-31 MIL-STD-810G, 516.6	Drop height 122 cm (48.03 in)
Shock	IEC 60068-2-27 MIL-STD-202G, 213B	15 g, 11 ms, saw-tooth 30 g, 11 ms, half-sine
Dry heat	IEC 60068-2-2	+85 °C (+185 °F)
Damp heat	IEC 60068-2-78	+40 °C (+104 °F), 95 %RH
Cold	IEC 60068-2-1	-60 °C (-76 °F)
Compliance marks	CE, RCM, UKCA	

¹⁾ Modem Carrier Module DMX801 complies with EN 61326-1 basic level. Ethernet connection requires external surge protection to comply with EN 61326-1 industrial environment level.

DMS801 Serial Module



Vaisala Serial Module DMS801 extends the number of serial ports in Vaisala Data Management Unit DMU801. Each DMS801 provides interfaces for 4 serial connections.

For serial sensor interfaces

Vaisala Serial Module DMS801 provides interfaces for serial sensors. With 3 isolated RS-485 ports and 1 multipurpose port, each DMS801 allows connecting 4 additional sensors to Vaisala Data Management Unit DMU801. Depending on the size of your DMU801 base unit, you can connect up to 8 DMS801 serial modules to the system.

Easy expansion when needed

DMS801 is easy to install during initial system setup and can also be plugged in later to expand the selection of sensors. DMS801 can be configured with the intuitive, node-based Vaisala DMU801 Configuration Tool.

Rugged solution with internal protection

DMS801 operates in a wide temperature range and withstands fast temperature changes. Because of its internal rugged surge protection (up to 3 kA), external surge protection is not required.

Features

- Allows connecting additional sensors to Vaisala Data Management Unit DMU801
- Sophisticated, software controllable sensor power control
- Heating power connection with overcurrent and surge protection (surge protectors on baseboard)
- 3 isolated RS-485 ports
- 1 multipurpose port that supports 2-wire RS-485, RS-232, and SDI-12
- Rugged lightning surge protection for all sensor connections

Technical data

Operating environment

Operating temperature	-40 ... +85 °C (-40 ... +185 °F)
Extended operating temperature (available on request)	-60 ... +85 °C (-76 ... +185 °F)
Storage temperature	-60 ... +85 °C (-76 ... +185 °F)
Operating humidity	0 ... 100 %RH, non-condensing

Inputs and outputs

Ports	<ul style="list-style-type: none">• 3 × serial ports for isolated RS-485• 1 × multipurpose serial port supporting 2-wire RS-485, RS-232, and SDI-12
Mating connectors	4 × Phoenix Contact DFMC 1,5/4-ST-3,5-LR (included)
Supported bit rate	1200 ... 115 200 bps
Power output	Each serial port has a separate, software controllable power output pin
Heating output	Each serial port has separate heating power supply pins
Signals, RS-232	RXD, TXD, GND
Signals, RS-485 serial	D+/D-
Signals, RS-485 serial, isolated	D+/D-

Powering specifications

Sensor supply voltage	3 ... 26 V, software controllable
Current limit	1.4 A -25 %/+20 % per port

Mechanical specifications

Dimensions (H x D)	123 × 79 mm (4.84 × 3.11 in)
Distance between 2 plug-in module slots in DMU801 frame	18 mm (0.71 in)
Weight	68 g (2.4 oz)
Material	UL-rated fire-resistive FR4 material
Handles	Stainless steel
Coating	Conformally coated against humidity

Compliance

EU directives and regulations	EMC, RoHS	
EMC immunity	EN 61326-1, industrial environment ¹⁾	
EMC emissions	CISPR 32 / EN 55032, Class B	
Maritime	IEC 60945	
Vibration (sinusoidal)	IEC 60068-2-6	5 ... 13.2 Hz, 1 mm (0.04 in) amplitude 13.2 ... 200 Hz, 0.7 g
Rough handling	IEC 60068-2-31 MIL-STD-810G, 516.6	Drop height 122 cm (48.03 in)
Shock	IEC 60068-2-27 MIL-STD-202G, 213B	15 g, 11 ms, saw-tooth 30 g, 11 ms, half-sine
Dry heat	IEC 60068-2-2	+85 °C (+185 °F)
Damp heat	IEC 60068-2-78	+40 °C (+104 °F), 95 %RH
Cold	IEC 60068-2-1	-60 °C (-76 °F)
Compliance marks	CE, RCM, UKCA	

DMA801 Analog Measurement Module



Vaisala Analog Measurement Module DMA801 provides analog channels to Vaisala Data Management Unit DMU801. Each DMA801 includes 4 differential analog channels and 2 additional single-ended high voltage channels. Depending on the size of DMU801, it is possible to add up to 8 DMA801 modules to DMU801.

Features

- Allows connecting analog sensors to Vaisala Data Management Unit DMU801
- One plug-in module adds 4 differential analog inputs to the system
- Converts analog signals into digital format with 24-bit resolution
- Rejection filter for 50/60 Hz frequencies
- 2 × 0 ... 30 V single-ended measurement channel
- Sophisticated, software controllable sensor power control
- Heating power connection with overcurrent and surge protection (surge protectors on baseboard)
- Rugged lightning surge protection for all sensor connections

For analog sensor interfaces

Many sensors for measuring temperature, pressure, and solar radiation have analog interfaces. DMA801 provides analog channels and converts the analog data into digital format for DMU801.

Analog inputs of DMA801 support Pt100, Pt1000, NTC thermistor, and voltage-out sensors such as pyranometers.

4 ... 20 mA current loop measurement can be supported with an additional DCA420 adapter module or with external shunt resistor.

Highly accurate

DMA801 has unmatched accuracy and is thus well suited for various analog measurement applications.

Rugged solution with internal surge protection

DMA801 operates in a wide temperature range and withstands fast temperature changes. Because of its internal rugged surge protection (up to 3 kA), external surge protection is not required.

Easy expansion when needed

DMA801 is easy to install during initial system setup and can also be plugged in later to expand the selection of sensors. Several DMA801 modules can be plugged into the same DMU801 base unit, if needed. DMA801 can be configured with the intuitive, node-based Vaisala DMU801 Configuration Tool.

Technical data

Accuracy specifications

Temperature measurement (Pt100 sensor) ¹⁾

Measurement range -60 ... +85 °C (-76 ... +185 °F)

Maximum error over -40 ... +70 °C (-40 ... +158 °F) < ±0.03 °C

Maximum error over -60 ... +85 °C (-76 ... +185 °F) < ±0.04 °C

Maximum error at 0 °C (+32 °F) ²⁾ < ±0.01 °C

Voltage measurement

Uncertainty over temperature range -40 ... +70 °C (-40 ... +158 °F):

±2.5 V range < 0.05 % of reading ±1.85 µV

±1.25 V range < 0.04 % of reading ±2.3 µV

±620 mV range < 0.04 % of reading ±0.9 µV

±310 mV range < 0.04 % of reading ±0.75 µV

±156 mV range < 0.04 % of reading ±0.8 µV

±78 mV range < 0.04 % of reading ±1.25 µV

±39 mV range < 0.04 % of reading ±0.8 µV

Uncertainty over temperature range -60 ... +85 °C (-76 ... +185 °F):

±2.5 V range < 0.05 % of reading ±1.85 µV

±1.25 V range < 0.04 % of reading ±2.3 µV

±620 mV range < 0.04 % of reading ±0.9 µV

±310 mV range < 0.04 % of reading ±0.85 µV

±156 mV range < 0.04 % of reading ±1.2 µV

±78 mV range < 0.05 % of reading ±1.25 µV

±39 mV range < 0.06 % of reading ±0.95 µV

Common mode range +2.5 V / -0.9 V

Voltage measurement 0 ... 30 V

Uncertainty over temperature range -40 ... +70 °C (-40 ... +158 °F):

To be defined

Uncertainty over temperature range -60 ... +85 °C (-76 ... +185 °F):

To be defined

¹⁾ Verified by measuring ± 20 °C from ambient temperature, while ambient temperature spreads across the entire range.

²⁾ Verified with DMU801 at 0 °C (+32 °F).

Operating environment

Operating temperature -40 ... +85 °C (-40 ... +185 °F)

Extended operating temperature (available on request) -60 ... +85 °C (-76 ... +185 °F)

Storage temperature -60 ... +85 °C (-76 ... +185 °F)

Operating humidity 0 ... 100 %RH, non-condensing

Powering specifications

Sensor supply voltage 3 ... 26 V, software controllable

Current limit 0.7 A -25 %/+20 % per port

Inputs and outputs

Inputs

- 4 × differential analog inputs
- 2 × 0 ... 30 V single-ended measurement channels

Mating connectors

4 × Phoenix Contact DFMC 1,5/4-ST-3,5-LR (included)

Power output

Each port has a separate, software controllable power output pin and a separate excitation pin

Heating output

Each port has separate heating power supply pins

A/D conversion

Low noise 24-bit A/D converter with internal diagnostics

Mechanical specifications

Dimensions (H x D)

123 × 79 mm (4.84 × 3.11 in)

Distance between 2 plug-in module slots in DMU801 frame

18 mm (0.71 in)

Weight

64 g (2.26 oz)

Material

UL-rated fire-resistive FR4 material

Handles

Stainless steel

Coating

Conformally coated against humidity

Compliance

EU directives and regulations EMC, RoHS

EMC immunity EN 61326-1, industrial environment ¹⁾

EMC emissions CISPR 32 / EN 55032, Class B

Maritime IEC 60945

Vibration IEC 60068-2-6 5 ... 13.2 Hz, 1 mm (0.04 in) amplitude (sinusoidal) 13.2 ... 200 Hz, 0.7 g

Rough handling IEC 60068-2-31 MIL-STD-810G, 516.6 Drop height 122 cm (48.03 in)

Shock IEC 60068-2-27 MIL-STD-202G, 213B 15 g, 11 ms, saw-tooth 30 g, 11 ms, half-sine

Dry heat IEC 60068-2-2 +85 °C (+185 °F)

Damp heat IEC 60068-2-78 +40 °C (+104 °F), 95 %RH

Cold IEC 60068-2-1 -60 °C (-76 °F)

Compliance marks CE, RCM, UKCA

¹⁾ Modem Carrier Module DMX801 complies with EN 61326-1 basic level. Ethernet connection requires external surge protection to comply with EN 61326-1 industrial environment level.

DMX801 Modem Carrier Module



Vaisala Modem Carrier Module DMX801 is an interface module for connecting a mPCIe card modem or external modem through USB to Vaisala Data Management Unit DMU801.

Support for modems

DMX801 modem carrier module provides an interface for connecting a cellular modem to DMU801 data management unit. DMX801 supports standard mini Peripheral Component Interconnect express (mPCIe) card modems and low-power LTE Cat 4 modem modules. DMX801 can be used as a SIM card carrier for any compatible 2FF (mini) card. It can also act as an interface for external modem using USB connection.

Ordering options

You can order DMX801 with an integrated modem module or connect an external modem to it with USB. It is also possible to order DMX801 without

integrated or external modem and provide your own integrated modem module instead, if that serves your purpose. Integrated modem modules provided with DMX801 by Vaisala have the required approvals in place and they are also tested to be compatible with DMU801 specifications. For your own integrated modem module, verify the compatibility before use.

Easy expansion when needed

DMX801 is easy to install during initial system setup but it can also be plugged in later. DMX801 can be configured with the intuitive, node-based Vaisala DMU801 Configuration Tool.

Features

- Supports standard mPCIe card modems
- Provides interface for external modem through USB connection
- Supports low-power LTE Cat 4 modem modules
- Can be used for connecting any 2FF (mini) card to DMU801
- Modem included as an option

Technical data

Operating environment

Operating temperature ¹⁾	-40 ... +80 °C (-40 ... +176 °F)
Storage temperature	-60 ... +85 °C (-76 ... +185 °F)
Operating humidity	0 ... 100 %RH, non-condensing

¹⁾ According to modem module specifications.

Inputs and outputs

Main antenna	SMA female connector
Antenna diversity	SMA female connector
GPS antenna	SMA female connector

USB connection

Supported standard	2.0
Connector	USB-A

mPCIe card specifications

Type	Full-Mini Card
Dimensions (L × D × W)	56 × 30 × 5 mm (2.20 × 1.18 × 0.20 in)
Max. (peak) current consumption	2.75 A
Supported voltage	+ 3.3 V

Supported modem modules

Model	Quectel EG25-G LTE Cat4 Mini PCIe ¹⁾
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¹⁾ For more information, see the manufacturer documentation.

Supported external modems

Model	Cinterion PLS62T-W-USB ¹⁾
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¹⁾ For more information, see the manufacturer documentation.

Mechanical specifications

Dimensions (H × D)	123 × 79 mm (4.84 × 3.11 in)
Distance between 2 plug-in module slots in DMU801 frame	18 mm (0.71 in)
Weight, no modem included	64 g (2.26 oz)
Weight with EG25-G mPCIe modem, 3 × antenna connectors, and SIM card	86 g (3.03 oz)
Materials	UL-rated fire-resistant FR4 material
Handles	Stainless steel
Coating	Conformally coated against humidity

Compliance

EU directives and regulations	EMC, RoHS
EMC immunity	EN 61326-1
EMC emissions	CISPR 32 / EN 55032, Class B
Maritime	IEC 60945
Vibration (sinusoidal)	IEC 60068-2-6 5 ... 13.2 Hz, 1 mm (0.04 in) amplitude 13.2 ... 200 Hz, 0.7 g
Rough handling	IEC 60068-2-31 MIL-STD-810G, 516.6 Drop height 122 cm (48.03 in)
Shock	IEC 60068-2-27 15 g, 11 ms, saw-tooth MIL-STD-202G, 213B 30 g, 11 ms, half-sine
Dry heat	IEC 60068-2-2 +85 °C (+185 °F)
Damp heat	IEC 60068-2-78 +40 °C (+104 °F), 95 %RH
Cold	IEC 60068-2-1 -60 °C (-76 °F)
Compliance marks	CE, RCM, UKCA

DME801 Ethernet Switch Module



Vaisala Ethernet Switch Module DME801 adds 5 Ethernet connections to Vaisala Data Management Unit DMU801. Its 1 Gb Ethernet connectors include 3 copper ports and 2 SFP ports for fiber optic traffic.

Adding Ethernet connectivity to DMU801

While the DMU801 base unit already includes a 100 MB Ethernet port for basic activities and a USB port for setup and maintenance tasks, DME801 adds 5 ports with 1 GB connections and expands the selection of supported Ethernet protocols.

Easy expansion when needed

DME801 is easy to install during initial system setup and can also be plugged in later to expand the selection of sensors. DME801 can be configured with the intuitive, node-based Vaisala DMU801 Configuration Tool.

Features

- 5 Gigabit Ethernet connectors including:
 - 3 copper port connectors
 - 2 small form-factor pluggable (SFP) module slots for fiber optic traffic

Technical data

Operating environment

Operating temperature	-40 ... +85 °C (-40 ... +185 °F)
Extended operating temperature (available on request)	-60 ... +85 °C (-76 ... +185 °F)
Storage temperature	-60 ... +85 °C (-76 ... +185 °F)
Operating humidity	0 ... 100 %RH, non-condensing

Inputs and outputs

Ports	<ul style="list-style-type: none">• 3 × copper ports, RJ45 connectors• 2 × SFP module slots
Supported standard	IEEE 802.3
Physical layer, copper ports	Base-T
Data rate	10/100/1000 Mbps
Data transmission	Full/Half duplex with auto-negotiation

Mechanical specifications

Dimensions (H × D)	123 × 79 mm (4.84 × 3.11 in)
Distance between 2 plug-in module slots in DMU801 frame	18 mm (0.71 in)
Weight	65 g (2.3 oz)
Material	UL-rated fire-resistive FR4 material
Handles	Stainless steel
Coating	Conformally coated against humidity

Compliance

EU directives and regulations	EMC, RoHS	
EMC immunity	EN 61326-1, industrial environment ¹⁾	
EMC emissions	CISPR 32 / EN 55032, Class B	
Maritime	IEC 60945	
Vibration (sinusoidal)	IEC 60068-2-6	5 ... 13.2 Hz, 1 mm (0.04 in) amplitude 13.2 ... 200 Hz, 0.7 g
Rough handling	IEC 60068-2-31 MIL-STD-810G, 516.6	Drop height 122 cm (48.03 in)
Shock	IEC 60068-2-27 MIL-STD-202G, 213B	15 g, 11 ms, saw-tooth 30 g, 11 ms, half-sine
Dry heat	IEC 60068-2-2	+85 °C (+185 °F)
Damp heat	IEC 60068-2-78	+40 °C (+104 °F), 95 %RH
Cold	IEC 60068-2-1	-60 °C (-76 °F)
Compliance marks	CE, RCM, UKCA	

¹⁾ Ethernet connection requires external surge protection to meet EN 61326-1 industrial environment level.

DMB801 Barometer Module



Vaisala Barometer Module DMB801 includes a Class A calibrated barometer. It is designed to be used with Vaisala Data Management Unit DMU801.

Class A barometer

DMB801 uses the capacitive Vaisala BAROCAP sensor and features barometric pressure measurement for DMU801 calculation and additional pressure calculations (HCP, QFE, and QNH). The module includes a self-diagnostics feature.

Accuracy with BAROCAP

The Vaisala BAROCAP Pressure Module (BARO-1) has excellent accuracy, repeatability and long-term stability over a wide range of operating temperatures. The pressure module is available with Class A factory calibration. The total accuracy with factory calibration is ± 0.15 hPa. The pressure module is well suited

for demanding synoptic applications. The fine adjustment and calibration of the sensor are handled using the electronic working standards, which are traceable to international standards (NIST). The pressure module can be calibrated independently of DMB801 module.

The observation range of DMB801 module is 500 ... 1100 hPa and its accuracy is ± 0.05 hPa.

Easy expansion when needed

DMB801 is easy to install during initial system setup and can also be plugged in later. DMB801 can be configured with the intuitive, node-based Vaisala DMU801 Configuration Tool.

Features

- Includes a Class A calibrated barometer
- Uses the proven Vaisala BAROCAP® sensor
- Excellent accuracy, repeatability, and long-term stability
- Wide operating temperature range
- Calibration traceable to international standards (NIST)
- Accuracy ± 0.05 hPa

Technical data

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Extended operating temperature (available on request) ¹⁾	-60 ... +85 °C (-76 ... +185 °F)
Storage temperature	-60 ... +85 °C (-76 ... +185 °F)
Operating humidity	0 ... 100 %RH, non-condensing

¹⁾ Measurement performance specifications not valid outside normal operating temperature range.

Measurement performance

Pressure range	500 ... 1100 hPa
Accuracy	Class A
Linearity ¹⁾	±0.05 hPa
Hysteresis ¹⁾	±0.03 hPa
Repeatability ¹⁾	±0.03 hPa
Calibration uncertainty ²⁾	±0.07 hPa
Accuracy at +20 °C (+68 °F) ³⁾	±0.10 hPa
Total accuracy at -40 ... +60 °C (-40 ... +140 °F)	±0.15 hPa
Temperature dependence ⁴⁾	± 0.10 hPa
Long-term stability	± 0.10 hPa/year

- ¹⁾ Defined as ±2 standard deviation limits of endpoint non-linearity, hysteresis error, or repeatability error.
²⁾ Defined as ± 2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.
³⁾ Defined as the root sum of the squares (RSS) of endpoint non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature.
⁴⁾ Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

BARO-1 specifications

Sensor type	Vaisala BAROCAP [®] (silicon capacitive)
Observation range	500 ... 1100 hPa
Resolution	0.01 hPa
Operating temperature	-40 ... +60 °C (-40 ... +140 °F)

Mechanical specifications

Dimensions (H × D)	123 × 79 mm (4.84 × 3.11 in)
Distance between 2 plug-in module slots in DMU801 frame	18 mm (0.71 in)
Weight	88 g (3.1 oz)
Material	UL-rated fire-resistive FR4 material
Handles	Stainless steel
Coating	Conformally coated against humidity

Compliance

EU directives and regulations	EMC, RoHS
EMC immunity	EN 61326-1, industrial environment ¹⁾
EMC emissions	CISPR 32 / EN 55032, Class B
Maritime	IEC 60945
Vibration (sinusoidal)	IEC 60068-2-6 5 ... 13.2 Hz, 1 mm (0.04 in) amplitude 13.2 ... 200 Hz, 0.7 g
Rough handling	IEC 60068-2-31 MIL-STD-810G, 516.6 Drop height 122 cm (48.03 in)
Shock	IEC 60068-2-27 15 g, 11 ms, saw-tooth MIL-STD-202G, 213B 30 g, 11 ms, half-sine
Dry heat	IEC 60068-2-2 +85 °C (+185 °F)
Damp heat	IEC 60068-2-78 +40 °C (+104 °F), 95 %RH
Cold	IEC 60068-2-1 -60 °C (-76 °F)
Compliance marks	CE, RCM, UKCA

¹⁾ Modem Carrier Module DMX801 complies with EN 61326-1 basic level. Ethernet connection requires external surge protection to comply with EN 61326-1 industrial environment level.



Vaisala Automatic Weather Station AWS310 has everything that you need for taking accurate and reliable weather measurements. It is a complete communication and data monitoring solution including sensors, electronics, mast, and power supply.

An all-in-one solution with many applications

Vaisala Automatic Weather Station AWS310 is a weather data collection system that automatically measures, processes, and stores meteorological data for professional use. AWS310 can be operated as a standalone unit, or it can be connected with other compatible Vaisala weather stations to form weather observation networks.

AWS310 stations can be used for several applications, such as synoptic, aviation, and agricultural meteorology, hydrology, and climatology. Using the same standard hardware and software for many purposes lowers the cost of training, spare parts, and logistics support.

Validated data from reliable sensors

Vaisala weather stations and instruments are fully compliant with World Meteorological Organization guidelines. The design quality of Vaisala weather stations has been proven with extensive tests in the development phase and on the field.

To ensure continuous accuracy of measurements and calculations, AWS310 includes built-in data quality controls that test sensor data against minimum and maximum limits and changes between successive measurements. The weather station's QML data logger continuously monitors the status of the

sensors to ensure measurement reliability, notifying the user if the status of any sensor becomes invalid. All the sensors operate independently from each other, meaning that an individual sensor failure does not affect the performance of the other sensors.

Maintenance made easier

For AWS310 networks, the Vaisala Observation Network Manager NM10 software provides a powerful browser-based interface for 24/7 monitoring, access, and control of all your observation sites. Continuous, reliable observations improve the performance of your weather services and weather-critical operations, while shorter site visits and correct maintenance actions save time and money.

Even without the optional NM10 software, it is possible to adjust settings and fix problems remotely. The Vaisala AWS Client software, that is included in each AWS310 delivery, supports setup, diagnostics, and data retrieval. The AWS310 StationView GUI allows the user to view basic station information, sensor status, and readings, to set site-specific parameters, and to perform many other functions using a graphical user interface.

AWS310 can also automatically download a new configuration file from a network server, making maintenance even easier.

Features

- Complete solution for weather data collection
- Common options preconfigured, fully customizable for special needs
- WMO-compliant sensors for validated data
- Remote configuration management
- Easy remote monitoring of network status using the optional NM10
- Long calibration intervals
- Fast delivery for preconfigured systems

Technical data

Operating environment

Operating environment	Outdoor use
Use in wet location	Yes
Operating temperature ¹⁾	-40 ... +60 °C (-40 ... +140 °F)
Extended operating temperature (project delivery)	-60 ... +50 °C (-76 ... +122 °F), cold start at -40 °C (-40 °F)
Storage temperature ²⁾	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH
Pollution degree	2
Maximum operating altitude	3000 m (approx. 9800 ft)

1) Excluding backup battery, QMD202, GST102-3, cellular modem, QMNI01, RG13(H), SR50A, and PAA-36 X W. See the manufacturer documentation.

2) Excluding cellular modem, HMP155, and HMP110. See the manufacturer documentation.

Compliance

EU directives and regulations	Low Voltage Directive (2014/35/EU) EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC compatibility	EN 61326-1, industrial environment FCC part 15, class B ICES-3 (B)
Electrical safety	EN 61010-1
Compliance marks	CE, FCC, ICES, RCM

Environmental compliance

Test	Applied standard or test procedure	Specification
Operation		
Cold	IEC 60068-2-1	-40 °C (-40 °F)
Dry heat	IEC 60068-2-2	+60 °C (+140 °F)
Vibration (sinusoidal)	IEC 60068-2-6	Frequency range 5 ... 200 Hz 1.2 mm/s velocity, 5 ... 12 Hz 0.7 g, 12 ... 200 Hz
Shock	IEC 60068-2-27	5.0 g, pulse duration 11 ms with 100 pulses in each direction
Damp heat, cyclic	IEC 60068-2-30	+40 °C (+104 °F) / 85 ... 95 %RH
Vibration (random)	IEC 60068-2-64	5 ... 100 Hz
Storage		
Cold	IEC 60068-2-1	-60 °C (-76 °F)
Dry heat	IEC 60068-2-2	+70 °C (+158 °F)
Damp heat, cyclic	IEC 60068-2-30	+40 °C (+104 °F) / 85 ... 95 %RH
Transport		
Shock	IEC 60068-2-27	18 g, pulse duration 6 ms, with 100 pulses in each direction
Rough handling	IEC 60068-2-31	Drop height 60 cm (23.62 in)
Vibration (random)	IEC 60068-2-64	5 ... 200 Hz

EMC compliance

Test	Applied standard or test procedure	Specification
Emissions radiated	CISPR 32 / EN 55032, Class B	30 MHz ... 2 GHz
Emissions conducted to mains (AC)	CISPR 32 / EN 55032, Class B	150 kHz ... 30 MHz
Emissions conducted to telecommunication lines	CISPR 32 / EN 55032, Class B	150 kHz ... 30 MHz
Emissions, harmonic current	EN 61000-3-2	0 ... 40th harmonic
Immunity to RF field (80 MHz ... 6 GHz)	EN 61000-4-3	11 V/m (80 MHz ... 1 GHz) 4 V/m (1 GHz ... 6 GHz)
Immunity to electrical fast transient	EN 61000-4-4	2 kV AC, 1 kV I/O
Immunity to surge	EN 61000-4-5	2 kV / 1 kV AC, 1 kV I/O
Immunity to conducted RF	EN 61000-4-6	4 V e.m.f. (150 kHz ... 80 MHz)
Immunity to voltage dips and short interrupts	IEC 61000-4-11	0 % 1 cycle 40 % 10 cycles 70 % 25 cycles 0 % 250 cycles

Powering specifications

AC (mains) power	100 ... 240 V AC, ±10 % 50 ... 60 Hz 5.6 A maximum (120 V AC)
Mains fuse (nominal)	10 A
External DC	16.8 ... 26.4 V DC 10 A maximum
Solar panel	70 W 15.5 ... 30 V DC 2.5 A maximum
Internal backup battery	12 V / 26 Ah or 12 V / 52 Ah
Backup battery fuse	10 A
Overvoltage category	II

ENC652 specifications

Approvals	UL 50 / UL 50E-listing
IP rating	IP66
NEMA rating	NEMA 4X
Maximum operating wind speed	75 m/s (168 mph)
Door opening angle	100°
Material	Stainless steel AISI 316, painted white
Size (enclosure only)	600 × 500 × 207 mm (23.62 × 19.68 × 8.15 in)
Weight (excluding backup battery)	< 30 kg (66 lb) ¹⁾

Standard sensor options

Wind speed and direction	WMT700, WA15 (dual sensors available)
Weather transmitter	WXT531, WXT532, WXT535, WXT536
Athmospheric pressure	BARO-1 (Class A accuracy), PTB330 (Class A accuracy, with 3 transducers)
Air temperature, relative humidity, and dew point	HMP110, HMP155
Rain/Precipitation	RG13(H), OTT Pluvio ² L
Global solar radiation	SMP3, SMP6, SMP10, SMP21, SMP22, SP Lite2
Net radiation	QMN101
UV radiation	SUV5
Visibility and present weather	PWD22
Cloud height and sky condition	CL31
Ground temperature	QMT110
Snow depth	SR50A
Water level	VEGAPULS 61, PAA-36 X W

Standard communication options

Wireless communication	4G LTE cellular modem with seamless fallback to 2G and 3G networks Five-band 3G cellular modem (with quad-band GSM GPRS support)
Landline communication	RS-232, RS-485, LAN
Data collection software	Vaisala Observation Network Manager NM10
Satellite communication	Vaisala GOES DCP Transmitter QST102-3
Maintenance terminal software	Vaisala AWS Client with StationView GUI

For other data validation, calculation, report, mast, powering, sensor, communication data collection software options, and measurement unit conversions, contact Vaisala.

Standard accessories

USB maintenance cable
Removable 2 GB CF memory card

AWS310-SITE Automatic Weather Station



Vaisala Automatic Weather Station AWS310-SITE is an automatic weather station that is optimized for airport weather observations. Based on the proven Vaisala AWS310 weather station, AWS310-SITE provides reliable and accurate weather measurements for aviation applications using ICAO and WMO-compliant sensors.

Optimized for airport weather observation needs

AWS310-SITE is specially designed and tested for Vaisala AviMet Automated Weather Observing System (AWOS) and Low-level Windshear Alert System (LLWAS), ensuring complete end-to-end system integration. With Vaisala AviMet, users are able to collect and view weather data remotely, as well as monitor and control the AWS310-SITE observation stations.

A complete solution

The AWS310-SITE solution includes everything required for accurate and reliable weather measurements: the enclosure, a wide variety of sensor options, installation kits, power supply, and communication devices.

The solution has a robust, tightly sealed IP66 stainless steel (AISI 316) enclosure to protect the electronics. AWS310-SITE is available with different installation and powering options according to customer needs and site requirements, including a solar-powered option for remote locations.

The AWS Client software is included for maintenance purposes to support setup, diagnostics, and data retrieval.

Data collection

Meteorological data is sent to the airport weather observation system in real time. There are several standard communication options available, including landline communication through RS-232, RS-485, or leased-line modem, or wireless communication through a UHF/VHF radio interface.

To provide redundancy in safety-critical airport applications, data can be sent simultaneously via 2 parallel communication ports. The data is also saved on the weather station's external memory card. The stored log files can be exported to external applications.

Excellent long-term stability

Sensor calibration is vital to accurate and reliable observations. The sensors of AWS310-SITE ensure excellent long-term stability with a low risk of drift or sudden changes in calibration. This results in longer calibration intervals, lower maintenance costs, and reduced downtime.

Installation options

There are several standard masts and mast installation kits available for AWS310-SITE. Frangible options include pole masts DKE110F, DKP721, and DKP711 and lattice mast DKE200. Vaisala frangible masts are impact-tested, and they comply with the frangibility requirements set in the following specifications:

- *ICAO Doc 9157 Aerodrome Design Manual, Part 6 Frangibility, First Edition, 2006*
- *FAA AC 150/5345-45C - Low Impact Resistant Structures, 2007*

Standard safety features

AWS310-SITE includes surge protection for the power input, sensor connections, and output data connections. Surge protectors protect the AWS310-SITE unit from potential damage caused by poor or variable power quality, or other possible surges.

Features

- Designed and tested for aviation applications with Vaisala AviMet® systems
- Complete solution for weather data collection
- Wide range of installation, power supply, and communication options
- ICAO- and WMO-compliant sensors with long calibration intervals
- Surge protection for power input, sensor connections, and output data connections

Technical Data

Operating environment

Operating environment	Outdoor use
Use in wet location	Yes
Operating temperature ¹⁾	-40 ... +60 °C (-40 ... +140 °F)
Extended operating temperature (with insulated enclosure and heating)	-60 ... +50 °C (-76 ... +122 °F), cold start at -40 °C (-40 °F)
Storage temperature ²⁾	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH
Pollution degree	2
Maximum operating altitude	3000 m (approx. 9800 ft)

1) Excluding backup battery, QMD202, DXL421, and RG13(H). See the manufacturer documentation.
2) Excluding HMP155. See the manufacturer documentation.

Environmental compliance

Test	Applied standard or test procedure	Specification
Operation		
Cold	IEC 60068-2-1	-40 °C (-40 °F)
Dry heat	IEC 60068-2-2	+60 °C (+140 °F)
Vibration (sinusoidal)	IEC 60068-2-6	Frequency range 5 ... 200 Hz 1.2 mm/s velocity, 5 ... 12 Hz 0.7 g, 12 ... 200 Hz
Shock	IEC 60068-2-27	5.0 g, pulse duration 11 ms with 100 pulses in each direction
Damp heat, cyclic	IEC 60068-2-30	+40 °C (+104 °F) / 85 ... 95 %RH
Vibration (random)	IEC 60068-2-64	5 ... 100 Hz
Storage		
Cold	IEC 60068-2-1	-60 °C (-76 °F)
Dry heat	IEC 60068-2-2	+70 °C (+158 °F)
Damp heat, cyclic	IEC 60068-2-30	+40 °C (+104 °F) / 85 ... 95 %RH
Transport		
Shock	IEC 60068-2-27	18 g, pulse duration 6 ms, with 100 pulses in each direction
Rough handling	IEC 60068-2-31	Drop height 60 cm (23.62 in)
Vibration (random)	IEC 60068-2-64	5 ... 200 Hz

EMC compliance

Test	Applied standard or test procedure	Specification
Emissions radiated	CISPR 32 / EN 55032, Class B	30 MHz ... 2 GHz
Emissions conducted to mains (AC)	CISPR 32 / EN 55032, Class B	150 kHz ... 30 MHz
Emissions conducted to telecommunication lines	CISPR 32 / EN 55032, Class B	150 kHz ... 30 MHz
Emissions, harmonic current	EN 61000-3-2	0 ... 40th harmonic
Immunity to RF field (80 MHz ... 6 GHz)	EN 61000-4-3	11 V/m (80 MHz ... 1 GHz) 4 V/m (1 GHz ... 6 GHz)
Immunity to electrical fast transient	EN 61000-4-4	2 kV AC, 1 kV I/O
Immunity to surge	EN 61000-4-5	2 kV / 1 kV AC, 1 kV I/O
Immunity to conducted RF	EN 61000-4-6	4 V e.m.f. (150 kHz ... 80 MHz)
Immunity to voltage dips and short interrupts	IEC 61000-4-11	0 % 1 cycle 40 % 10 cycles 70 % 25 cycles 0 % 250 cycles

Powering specifications

AC (mains) power	100 ... 240 V AC, ±10 % 50 ... 60 Hz 5.6 A maximum (120 V AC)
Mains fuse (nominal)	10 A
External DC	16.8 ... 26.4 V DC 10 A maximum
Solar panel	70 W 15.5 ... 30 V DC 2.5 A maximum
Internal backup battery	12 V / 26 Ah or 12 V / 52 Ah
Backup battery fuse	10 A
Overvoltage category	II

ENC652 specifications

Approvals	UL 50 / UL 50E-listing
IP rating	IP66
NEMA rating	NEMA 4X
Maximum operating wind speed	75 m/s (168 mph)
Door opening angle	100°
Material	Stainless steel AISI 316, painted white
Size (enclosure only)	600 × 500 × 207 mm (23.62 × 19.68 × 8.15 in)
Weight (excluding backup battery)	< 30 kg (66 lb) ¹⁾

Standard sensor options

Wind speed and direction	WMT700, WA15 (dual sensors available)
Air temperature and relative humidity	HMP155
Barometric pressure	PTB330 (Class A accuracy, with 3 transducers)
Global solar radiation	SMP3, SMP6, SMP10
Sunshine duration	CSD3
Rain/Precipitation	RG13(H), OTT Pluvio ² L
Runway temperature	DRS511
Runway temperature and surface state	RWCC
Ground temperature	QMT107
Soil temperature	QMT110
Standard interface	CL31, LT31, FS11, FS11P, PWD22, TSS928

Standard communication options

Landline communication	RS-232, RS-485, or leased-line modem
Wireless communication	UHF/VHF radio interface
Fiber optic communication	With Vaisala Field Communication Box FOC201 or customer-provided solution
Dual communication	Any combination of 2 standard communication options

Standard accessories

2 enclosure locks
USB maintenance cable
2 removable 2 GB CF memory cards



Features

- Easy to install, economical to maintain and upgrade
- Field-proven reliability and accuracy in harsh environments
- Low power consumption
- Extensive calculation and data logging capability
- Good expandability and high level of customization through open and modular design
- Built-in TCP/IP connectivity
- Compact design

Vaisala Data Logger QML201C is built using proven sensor technology by Vaisala. A 32-bit central processing unit (CPU), 24-bit A/D conversion (ADC), autocalibration of the ADC, and measurement electronics, coupled with advanced data quality control and validation software, ensure the accuracy of data measurement.

Easy to use

Sensor measurements, statistical calculations, data logging, and data transmissions are performed according to configuration done with the Vaisala Lizard Setup Software. The software has many setup options and advanced features.

Easy to upgrade

The system architecture enables QML201C to be easily upgraded with new sensors, calculations, output formats, and logging schedules at any time to accommodate the changing requirements of the users.

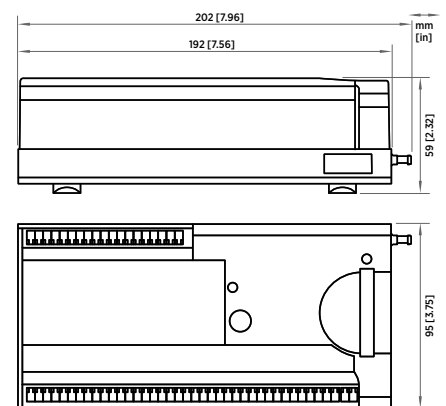
The basic system provides RS-232, RS-485, and SDI-12 ports for interfacing with almost any type of telemetry, terminal, display, and smart sensor. With

optional plug-in modules, the number of serial ports can be extended from 2 to up to 8 ports, enabling multiple RS-232, RS-485, SDI-12, and Ethernet connections.

Easy to expand

QML201C can also be expanded with another QML201C unit that offers 10 additional differential analog channels and serial lines.

A digital I/O unit adds 8 digital outputs and 8 digital inputs for sensors, power optimizing, and unmanned control functions based on user-defined requirements.



QML data logger dimensions

Technical data

Operating environment

Operating temperature	-50 ... +60 °C (-58 ... +140 °F)
Extended operating temperature	-60 ... +70 °C (-76 ... +158 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH

Inputs and outputs

Processor	33 MHz, 32-bit Motorola
A/D conversion	24-bit
Memory	2 MB RAM and 4 MB program
Data logging memory	3.3 MB internal Flash memory
External memory card capacity	2 GB on CompactFlash card
Sensor inputs	10 analog inputs (20 single-ended inputs) 2 counter/frequency inputs Internal channel for pressure sensor BARO-1
External powering	8 ... 30 V DC
Power consumption	< 10 mA / 12 V (typically with basic 5 sensors)

Communication specifications

Serial

Standard	RS-232 2-wire RS-485 SDI-12
Optional	2 optional plug-in slots for communication modules to increase the number of the serial I/O channels up to 8 pcs Fast serial expansion bus for connecting digital I/O module, for example
Speed	300 ... 38 400 bps
Configurable parameters	Speed, start bits, data bits, stop bits, parity, XON/XOFF, and checksum

Ethernet

Standard	IEEE 802.3 2 plug-in slots for Ethernet modules DSE101
Speed	10 Mbps (10BASE-T) Can also be connected to 100/1000 Mbps (100/1000BASE-T) networks with 10 Mbps
Parameters	Full/Half duplex with auto-negotiation

TCP/IP

Supported protocols	ARP, UDP/IP, TCP/IP, FTP, SMTP, PPP (with PAP or CHAP authentication), HTTP (GET), Telnet, ICMP Echo, DHCP, NTP, DNS, serial port tunneling over TCP/IP
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Accuracy specifications

All data for ambient temperature range -50 ... +60 °C (-58 ... +140 °F) unless otherwise specified.

Temperature measurement (Pt100 sensor)

Measurement range	-60 ... +70 °C (-76 ... +158 °F)
Uncertainty over -60 ... +70 °C (-76 ... +158 °F)	< ±0.02 °C, typically
Maximum error over -50 ... +60 °C (-58 ... +140 °F)	< ±0.04 °C
Maximum error over -60 ... +70 °C (-76 ... +158 °F)	< ±0.08 °C
Maximum error at 0 °C (+32 °F) ¹⁾	< ±0.02 °C

Voltage measurement

Uncertainty over temperature range -5 ... +30 °C (14 ... +86 °F):	
±5 V range	< 0.06 % of reading ±100 µV
±2.5 V range	< 0.04 % of reading ±50 µV
±250 mV range	< 0.06 % of reading ±6 µV
±25 mV range	< 0.06 % of reading ±5 µV
Uncertainty over temperature range -40 ... +60 °C (-40 ... +140 °F):	
±5 V range	< 0.06 % of reading ±100 µV
±2.5 V range	< 0.04 % of reading ±50 µV
±250 mV range	< 0.15 % of reading ±15 µV
±25 mV range	< 0.15 % of reading ±10 µV
Uncertainty over temperature range -50 ... +60 °C (-58 ... +140 °F):	
±5 V range	< 0.08 % of reading ±100 µV
±2.5 V range	< 0.08 % of reading ±50 µV
±250 mV range	< 0.15 % of reading ±15 µV
±25 mV range	< 0.15 % of reading ±10 µV
Uncertainty over temperature range -60 ... +70 °C (-76 ... +158 °F):	
±5 V range	< 0.12 % of reading ±150 µV
±2.5 V range	< 0.12 % of reading ±80 µV
±250 mV range	< 0.20 % of reading ±20 µV
±25 mV range	< 0.20 % of reading ±10 µV
Common mode range	+7 V / -3 V

Frequency measurement

Uncertainty over temperature range -60 ... +70 °C (-76 ... +158 °F):	
20 Hz ... 8000 Hz	< 0.04 % of reading
8000 Hz ... 20000 Hz	< 0.40 % of reading

Real-time clock (standard)

Accuracy	Better than 20 s/month
Backup time	5 years minimum with CR1220 battery

¹⁾ Verified with QML data logger at 0 °C (+32 °F).

Compliance

EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC immunity	EN 61326-1, industrial environment FCC part 15, class B ICES-3 (B)
EMC emissions	CISPR 32 / EN 55032, Class B
Compliance marks	CE, FCC, ICES, RCM

VAISALA

www.vaisala.com



Features

- LCD display with backlighting
- Stand-alone design allows installations up to 1000 meters (3280 ft) from the weather station
- Easy way to viewing measurement values
- Freely configurable with Vaisala configuration software
- Easily accessible keypad with user-friendly menu
- Data and system parameters can be entered using the keypad
- Communication through SPI, RS-232, or RS-485 line
- DIN-rail mounting

Vaisala Fixed Display QMD202 provides the local user interface for viewing the values measured and calculated by the QML data logger, and for adding observations or reference data into the system.

Local user interface for weather station

The weather station can be equipped with the QMD202 display and keyboard unit at the installation site. The operator can use the display to view the measurement values locally and insert observations or reference data into the system.

The operator can use the Vaisala configuration software to configure up to 24 pages to the display. In addition, it is possible to create configuration views for adjusting station-specific settings and changing the offset and gain values of the sensors connected to the system.

Installation inside enclosure

The QMD202 unit can be mounted on a DIN rail inside the weather station enclosure. The display can then be accessed only by opening the enclosure door, which can be firmly locked.

Installation outside enclosure

The QMD202 unit can also be installed outside the weather station enclosure using the RS-232 or the full-duplex RS-485 connection. The RS-485 connection together with a DS1485 module in the QML data logger allows installations up to 1000 meters (3280 feet) from the weather station.

LCD display

The QMD202 display includes a programmable LCD display with backlighting. Several lines of alphanumeric data can be shown. The full display size expressed in characters is 20 × 6 (width × height).

The displayed data is sent as reports to the display. The contents, format, and updating intervals of these reports are user-configurable. The update interval can be anything between 1 second and 24 hours.

Technical data

Operating environment

Operating temperature ¹⁾	-20 ... +60 °C (-4 ... +140 °F)
Survival temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-60 ... +60 °C (-76 ... +140 °F)

1) The LCD display does not show any characters in temperatures below -20 °C (-13 °F).

Inputs and outputs

Input voltage

RS-232, RS-485	8 ... 18 V DC
SPI	3.3 and 5.0 V DC powered from QML data logger

Power consumption

RS-485 mode, backlight off	96 mW at 12 V
RS-485 mode, backlight on	252 mW at 12 V
RS-232 mode, backlight off	132 mW at 12 V
RS-232 mode, backlight on	276 mW at 12 V
SPI, backlight off	20 mW
SPI, backlight on	85 mW

Interface

Connector for RS-232, RS-485, and power supply	8-pin M12
RS-485	Full duplex, non-isolated, 1200, 2400, 4800, 9600 bps (default 9600 bps)
RS-232	1200, 2400, 4800, 9600 bps (default 9600 bps)
SPI	Connected to and powered by QML data logger through 10-wire flat cable

Maximum communication distance

RS-485	1000 m (3280 ft)
RS-232	30 m (98 ft 5 in)
SPI	Inside the weather station enclosure

Compliance

EMC compatibility	EN 61326-1, industrial environment
Vibration	IEC 60068-2-6, level 2 g

Mechanical specifications

Dimensions (H × W × D)	135 × 95 × 28 mm (5.31 × 3.74 × 1.11 in)
Weight	0.23 kg (0.5 lb)
Mounting	DIN rail
Enclosure material	Aluminum
LCD display size (W × H)	20 × 6 characters



Example of QMD202 display

QSP431 Surge Protection Unit



The Vaisala Surge Protection Unit QSP431 is a compact device which provides heavy-duty protection for serial interface sensors.

All this comes in a 14-mm (0.55-in) wide package equipped with industry standard EN 60715 rail mount: 35-mm (1.38-in) DIN rail.

Surge Protector and Connector

QSP431 provides effective protection for all lines connected to a serial sensor: both operating and heating voltage supplies and either RS-485 or RS-232 serial interface line.

In addition to protective functionality, QSP431 acts also as a connector unit between the weather station and the sensor cabling, eliminating no need for separate screw terminals.

Suitable for Maritime Use

QSP431 is suitable to be used in maritime applications with requirements for 500 V chassis isolation ¹⁾. Isolation is user-selectable by removing a single chassis connection screw.

Features

- All in one: protection for serial line and power lines in one unit
- Heavy-duty protection for serial interface sensors
- Industry standard EN 60715 rail mount

1) In compliance with Lloyd's Register (LR) Type Approval System, Test Specification Number 1; 2002, Performance and Environmental Test Specification for the Environmentally Tested Products used in Marine and Offshore Applications, and Det Norske Veritas Standard for Certification No. 2.4; Environmental Test Specification for instrumentation and Automation Equipment, April 2006

Technical data

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH

Inputs and outputs

Signal line	2 lines (with common ground pin)
Maximum data rate	57 600 bps
Maximum voltage	±12 V DC
Maximum current	750 mA
Signal line series resistance	15 Ω

Power line	2 lines (with common ground pin)
Maximum voltage	±32 V DC
Maximum current	3 A
Maximum surge current (IEC 61000-4-5 8/20 μs pulse), common and differential modes	3 kA

Mechanical specifications

Dimensions (H × W × L)	74 × 14 × 62 mm (2.91 × 0.55 × 2.44 in)
Screw terminal connectors	6 pins with detachable plugs (2 pcs), pitch 3.81 mm (0.15 in)

Conductor cross-sections

Plain wire	0.14 ... 1.5 mm ² (26 ... 16 AWG)
Wire with plastic collar, with ferrules	0.25 ... 0.5 mm ² (24 ... 21 AWG)
Wire without collar, with ferrules	0.25 ... 1.5 mm ² (24 ... 16 AWG)

Frame isolation (applicable only when chassis screw is removed)

Nominal isolation voltage	500 V
Insulation resistance	> 10 MΩ
Protection breakdown voltage	700 V

Compliance

EU directives and regulations	RoHS Directive (2011/65/EU) amended by 2015/863
Compliance marks	CE



Features

- Specifically designed for critical maritime weather applications
- High-quality anti-corrosive design
- Complies with Lloyd's Register and IEC 60945 requirements for applicable parts
- High data availability
- Built-in test procedures and data validation
- Accurate true wind calculation even from multiple sensors
- Meets NMEA 0183 and IEC 1162-1 requirements for data communication
- Complies with CAP 437, HCA, NORSOK, and BSL D5-1 requirements for offshore helicopter landing areas

Automatic Weather Station AWS430 provides reliable meteorological and oceanographic data in maritime environments. It is designed for maritime environments such as ports, ships, and offshore platforms.

AWS430 contains either a waterproof outdoor enclosure with various mounting options or a 19" equipment rack unit. The outdoor enclosure is designed to withstand the corrosive conditions that prevail aboard ships and platforms as well as the freezing conditions experienced in extreme-weather environments. It is also able to endure vibration and shock.

Wide range of high quality measurements

AWS430 measures the following basic weather parameters: wind speed and direction (relative wind, true wind, upwind), atmospheric pressure, air temperature, and humidity. Additional sensors can be installed for measuring other parameters, including water temperature, duration of rain and sunshine, global and long wave radiation, amount of precipitation, cloud height, visibility, tide, wave height and direction, water level, ocean current speed and direction, and ship motion. AWS430 has

built-in calculation for many meteorological and statistical parameters such as dew point temperature.

Flexible integration

To obtain the most accurate true wind calculation, the ship's own gyrocompass and navigation system can be used to provide the required heading and ship speed, direction, and position information. However, an optional GPS compass can also be integrated into the system.

The system fully supports all the requirements for data communication as specified in NMEA 0183 and IEC 1162-1. When the system is equipped with several wind sensors, the built-in algorithm selects the most accurate wind data from these sensors.

AWS430 supports LAN connection with XML and Modbus[®] TCP/IP protocols and remote maintenance functionality. Satellite communication options are also available.

Self-diagnostics and constant data availability

To ensure data quality, the built-in algorithms continuously monitor the sensor data, providing an immediate alert in case of a fault. For every parameter, the minimum and maximum readings as well as step limits are tested. Various parameters are also cross-checked.

Designed for demanding maritime applications

All the materials of AWS430 have been selected for their ability to withstand the harsh, corrosive conditions experienced in maritime environments. The station has successfully passed a wide variety of environmental, electrical, vibration, and shock tests. Test specifications comply with both the Lloyds' Register approval system and the IEC 60945 international maritime standard for applicable parts.

Technical data

Outdoor Enclosure Specifications

Operating temperature	-50 ... +60 °C (-58 ... +140 °F) ¹⁾
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH, non-condensing
IP rating	IP66
Dimensions (H × W × D)	600 × 500 × 200 mm (23.62 × 19.69 × 7.87 in)
Material	Stainless steel (AISI316), painted white
Weight	Max. 40 kg (88.18 lb)
Backup battery	12 V, 2.6 Ah

¹⁾ Power cold start -40 °C (-40 °F)

19" Rack Specifications

Operating temperature	-25 ... +60 °C (-13 ... +140 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH, non-condensing
IP rating	IP21
Dimensions (H × W × D)	177 × 433 × 555 mm (6.97 × 17.05 × 21.85 in)
Material	Aluminum
Weight	Max. 15 kg (33.07 lbs)
Backup battery	12 V, 2.6 Ah

Powering Specifications

Powering	100 ... 240 VAC, 50 ... 60 Hz 24 VDC (18 VDC ... 30 VDC) ¹⁾
Internal battery	2.6 Ah / 12 V Battery regulator charge/recharge control Temperature compensation Deep discharge protection

¹⁾ DC powering available only with the outdoor enclosure

Data Validation, Calculations, and Reports

Data quality control	Upper/Lower climatological limits Step change validation
Statistical calculations	Averaging over user-set periods True and relative wind, wind selection (upwind)
Message inputs	NMEA 0183 HDT/RMC/VTG/GLL
Message outputs	NMEA 0183 MVW/XDR/MTW Vaisala SMSAWS XML format Modbus® TCP/IP and serial

Sensor Options

Typical Options

Wind speed and direction	WMT700
Atmospheric pressure	BARO-1, PTB330
Air temperature, relative humidity, and dew point	HMP155
Rain/Precipitation	RM Young 50202, RG13(H), DRD11A
Water temperature	DTS12W
GPS satellite compass	Vector G2
Visibility and present weather	PWD series
Ceiliometer	CL31
Wave height, direction, period, and tide	Radac WG5 series
Current speed and direction	Aanderaa 4830R, Nortek Aquadopp, Nortek AWAC

Water salinity	Aanderaa 4419R
Water level	Keller PAA-36 X W, VEGAPULS 61 and 62
Ship motion	SMC IMU-108
Solar radiation / Sun duration	Kipp & Zonen solar instruments

Options for Hazardous Areas

Wind speed and direction	Gill IS WindObserver
Atmospheric pressure	Keller PAA-33 X Ei
Air temperature, relative humidity, and dew point	HMT360
Wave height, direction, period, and tide	Radac WG5 Ex

Additional Options

RS-485/RS-232 sensors	
SDI-12 sensors	
Ethernet devices	
Analog sensors, with differential measurement up to 10 sensors	
Digital sensors, 2 counter/frequency inputs	
Software-controlled power outputs	

Communication Options

Satellite communication	Customer VSAT / Inmarsat-C through AWS430 LAN or serial port
Wireless communication	UHF, VHF, GSM, GPRS
Landline communication	RS-232, RS-485 bus, LAN, ModBus, TCP/IP, and serial
Data displays	Vaisala PC display software Vaisala Panel Displays

Compliance

For applicable parts, AWS430 main unit is in compliance with the following:

- Lloyd's Register (LR) Type Approval System, Test Specification Number 1: 2002, Performance and Environmental Test Specification for the Environmentally Tested Products used in Marine and Offshore Applications
- IEC 60945 International Standard, 4th edition, 2002-08, Maritime Navigation and Radio communication Equipment and Systems - General Requirements Methods of Testing and Required Test Results

Vibration	IEC 60068-2-6/IEC 60945
Shock	MIL-STD-202G, Method 213B, cond. J
Dry heat	IEC 60068-2-2/IEC 60068-2-48
Damp heat	Cyclic IEC 60068-2-30
Extreme conditions, outdoor enclosure	IEC 60068-2-3
Low temperature, outdoor enclosure	IEC 60068-2-1
Wind driven rain, outdoor enclosure	MIL-STD-810G, method 506.5
Corrosion and salt mist, outdoor enclosure	IEC60068-2-52, VDA 621-415
Conducted LF immunity	IEC 61000-4-16
Conducted RF immunity	IEC 61000-4-6
EFT immunity	IEC 61000-4-4
Surge immunity	IEC 61000-4-5
ESD immunity	IEC 61000-4-2
Dielectric tests	IEC 60947-2
Emissions, outdoor enclosure	CISPR22 Class B (EN 55022)
Emissions, rack enclosure	CISPR32 Class B (EN 55032)
RF field immunity	IEC 61000-4-3
Insulation resistance	IEC 60092-504
Power supply short term variation immunity	IEC 61000-4-11
Power supply failure immunity	IEC 61000-4-11/IEC 60092-504
Electrical safety	IEC/EN/UL/CSA 60950-1
EMC immunity	IEC 61326-1 Industrial environment (EN 61326-1)



Environmental and electrical specifications are valid only for the AWS430 main unit. For environmental and electrical specifications of the sensors, see the sensor specifications.

MAWS201 HydroMet Automatic Weather Station



Features

- Cost-effective, quickly deployable, and portable automatic weather station
- For a variety of applications: meteorological research, environmental impact studies, emergency response, waste management
- Compact, robust, and lightweight
- Low power consumption
- Field-proven reliability and accuracy
- Wide selection of sensors and options
- Extensive calculation and data logging capacity

MAWS201 is a portable automatic weather station designed to be used in various environments and in any weather.

Easy to Set Up and Configure

MAWS201 is easy to set up. Every sensor is supplied with a cable and connectors for easy installation. All components fit together easily and no special tools are required.

Vaisala Lizard Setup Software simplifies the configuration of sensor measurements, calculations, data logging schedules, and data transmissions. There are templates to guide you through the initial setup, and a large number of further options if you want to customize the settings further.

Accurate Sensors

The basic sensor suite measures wind speed and direction, atmospheric pressure, air temperature, relative humidity, and precipitation. Optional sensors can be added to measure, for example, soil/water temperature, global and net solar radiation, soil moisture, and water level. The performance of the sensors has been proven in the field in a wide range of environments.

Reliable in All Weather

MAWS201 operates reliably in all weather: its corrosion-resistant, anodized aluminum construction is rugged and weatherproof. The cables are made of high-quality polyurethane with moulded, watertight connectors that fulfill the requirements of the IP68 standard. All the inputs are surge-protected.

The quality control software checks the sensor data against the user-set climatological limits, as well as the step changes between successive measurements. Each statistical calculation has its own, user-configurable validation routine.

Statistical Calculations

The statistical calculations include minimum, maximum, average, standard deviation, and cumulative values. All are calculated over user-defined intervals. All extreme values can be timestamped.

In addition, a library of calculations is available. These include, for example, unit conversions, dew point, frost point, QNH, QFF, QFE, evapotranspiration, sunshine duration, forest fire index, wind chill, and heat stress.

Versatile Data Outputs

The user can freely configure the data output formats. Several ready-made templates make configuration easy.

The alarm module notifies the user when a measured or calculated value exceeds the set threshold values. The alarm module can be configured, for example, to send an alarm message, to change timing intervals, to log data, and to set an excitation voltage for controlling an external device.

Technical Data

Operating Environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-50 ... +70 °C (-58 ... +158 °C)
Operating humidity	0 ... 100 %RH

Mechanical Specifications

Weight Example

Portable system with 3 m (9 ft 10 in) tripod (pressure, temperature/humidity, and wind sensors)	15 kg (33.07 lb)
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Basic Enclosure

Dimensions (H × Ø)	420 × 120 mm (16.54 × 4.72 in)
Weight	3 kg (6.61 lb)
Materials	Anodized aluminum
IP rating	NEMA 4X, IP66

Sensors

Wind	QMW102/WMS302, WXT530
Pressure	BARO-IQML
Air temperature, relative humidity	HMP155
Solar radiation	QMS101/SP Lite2, QMS102/CMP3, QMN101/NR Lite2
Precipitation	QMR101, QMR102
Soil/Water temperature	QMT103, QMT107, QMT110
Soil moisture	ML2x

Options and Accessories

Communication modules	DSU232, DSI486
Mains power supply	QMP213
Solar/Mains power supply	QMP201C
Carrying cases for MAWS201	QMM110, QMM120
UHF radio modem set	SATEL3ASET-M2

QML201C Powering Specifications

Mains power QMP213	85 ... 264 VAC
Mains power QMP201C ¹⁾	85 ... 264 VAC

¹⁾ With 12 W solar panel and 7 Ah backup battery.

Compliance

EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC immunity	EN 61326-1, industrial environment FCC part 15, class B ICES-3 (B)
EMC emissions	CISPR 32 / EN 55032, Class B
Compliance marks	CE, FCC, ICES, RCM

Inputs and outputs

Processor	33 MHz, 32-bit Motorola
A/D conversion	24-bit
Memory	2 MB RAM and 4 MB program
Data logging memory	3.3 MB internal Flash memory
External memory card capacity	2 GB on CompactFlash card
Sensor inputs	10 analog inputs (20 single-ended inputs) 2 counter/frequency inputs Internal channel for pressure sensor BARO-1
External powering	8 ... 30 V DC
Power consumption	< 10 mA / 12 V (typically with basic 5 sensors)

Communication specifications

Serial

Standard	RS-232 2-wire RS-485 SDI-12
Optional	2 optional plug-in slots for communication modules to increase the number of the serial I/O channels up to 8 pcs Fast serial expansion bus for connecting digital I/O module, for example
Speed	300 ... 38 400 bps
Configurable parameters	Speed, start bits, data bits, stop bits, parity, XON/XOFF, and checksum

Ethernet

Standard	IEEE 802.3 2 plug-in slots for Ethernet modules DSE101
Speed	10 Mbps (10BASE-T) Can also be connected to 100/1000 Mbps (100/1000BASE-T) networks with 10 Mbps
Parameters	Full/Half duplex with auto-negotiation

TCP/IP

Supported protocols	ARP, UDP/IP, TCP/IP, FTP, SMTP, PPP (with PAP or CHAP authentication), HTTP (GET), Telnet, ICMP Echo, DHCP, NTP, DNS, serial port tunneling over TCP/IP
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Features

- Wide mains input range
- Extended operating temperature range
- Easy to install and connect

Vaisala Mains Power Supply QMP213 is a small outdoor power supply with a weatherproof enclosure for installations supplied with AC power.

Wide Mains Input range

QMP213 is an outdoor power supply for installations where AC power is available. The input may vary from 100 to 240 VAC with a frequency of 50 or 60 Hz. The output provides a maximum of 12 VDC, 2.5 A.

Protected against Overvoltage and Short Circuits

QMP213 is equipped with protection circuits for transient overvoltage at both the input and the output ends, as well as replaceable fuses for both input lines. The output is fully protected against short circuits.

Weatherproof Enclosure

QMP213 has a weatherproof enclosure made of durable, UV-resistant polycarbonate reinforced with glass fiber. IP rating of the enclosure is IP66. QMP213 can be mounted on a 60 mm (2.36 in) or 100 mm (3.94 in) pole mast as well as on one of the tripod legs of MAWS201.

Technical Data

Inputs and Outputs

Input range	100 ... 240 VAC, maximum 0.8 A, 50-60 Hz
Input fuses	T3.15 A / 250 A, 250 V internal fuse fitted in line and neutral
Input surge protection	EN61000-4-5, installation class 3
Input wiring	Standard delivery does not include mains cable. Recommended input wiring: <ul style="list-style-type: none">• With a 3-wire cable (L, N, PE)• Lead dimension: 0.75 ... 1.5 mm² (19 ... 16 AWG)• Maximum cable Ø 8 mm (0.31 in)
Output voltage	12 VDC ±5%
Output current	Maximum 2.5 A
Output protection	Short circuit proof: continuous trip and restart (hiccup)
Output wiring	Cable with black polyurethane sheath and a female 4-pole plug (12M standard) included.

Enclosure Specifications

Enclosure dimensions (W × H × D)	160 × 80 × 65 mm (6.30 × 3.15 × 2.56 in)
Enclosure dimensions including mounting fixture (W × H × D)	160 × 104 × 95 mm (6.30 × 4.09 × 3.74 in)
Weight	0.5 kg (1 lb)
Material	Polycarbonate reinforced with glass fiber
Color	Gray
IP rating	IP66
Mounting	To a Ø 60 (2.36 in) or Ø 100 mm (3.94 in) pole mast or to the tripod leg

Operating Environment

Operating temperature	-40 ... +60 °C (-40 ... +140 F°)
Storage temperature	-50 ... +70 °C (-58 ... +158 F°)
Operating humidity	0 ... 100% RH

Compliance

Electrical safety	EN/UL/IEC 61010-1 Low voltage directive (LVD)
EMC compliance, immunity	EN/IEC 61326-1, Industrial Environment



MAWS201M TacMet Tactical Meteorological Observation System

Vaisala TacMet MAWS201M is a portable weather station that offers high performance in a compact package. MAWS201M is designed to be used in various environments and in any weather.

Compact and lightweight basic system

MAWS201M measures, processes, and reports data from wind speed and direction, air temperature, relative humidity (dew point), pressure, and precipitation. The system is powered either by AC (mains) power or by an integrated solar panel. Backup batteries are available, providing a minimum of 7 days of operation without recharging.

Full aviation support with enhanced systems

MAWS201M is easily enhanced with the needed support for aviation. An additional optical sensor set enhances the basic system with sensors for cloud height and coverage, visibility, present weather, and lightning detection. Furthermore, it is possible to add a remote wind site and digital displays to the system. A freezing rain sensor option is also available.

MAWS201M includes a handheld display for setting station-specific parameters and for viewing measured and calculated parameters and system alarms.

Maximum portability and ease of use

Mechanical parts of the system are lightweight but robust, and all cables are fitted with quick-release color-coded connectors. The carrying cases are light, yet they provide excellent cushioning during transport.

Versatile reports automatically

Optionally, MAWS201M can be delivered with advanced AviMet® software that displays numerical and graphical data and codes automatically. It also issues automatic METAR and SPECI reports based on user-defined weather events. Remarks can easily be included with reports.

The software also does the archiving and transmitting for further processing.

Reliability and highest precision

MAWS201M processes statistical calculations, performs data quality control, and formats data for output. Built-in quality control software validates sensor data against user-set limits and step changes between successive measurements.

In case of unlikely malfunction, MAWS201M automatically detects failures, and the sensor can be replaced quickly on site.



Features

- Cost-effective, quickly deployable, and portable automatic weather station
- For defense operations that use small landing strips, drop zones, test ranges, UAV systems, and uncategorized airports
- The most compact lightweight system with full aviation support
- Reliability and precision gained through built-in diagnostics and high-quality sensor technology
- Robust design for harsh environments
- Enhanced freezing rain detection
- Accurate second wind measurement site to assist approach
- Preconfigured digital displays to distribute data to the command center

Technical data

Operating environment

Operating environment	Outdoor use
Use in wet location	Yes
Operating temperature ^{1) 2)}	-50 ... +60 °C (-58 ... +140 °F), cold start at -40 °C (-40 °F)
Storage temperature	-50 ... +70 °C (-58 ... +158 °F)
Operating humidity	0 ... 100 %RH, non-condensing
Maximum wind speed	35 m/s (70 kts)
Pollution degree	2
Maximum operating altitude	3000 m (approx. 9800 ft)
IP rating	IP66

¹⁾ For further extended range, please contact Vaisala.

²⁾ For internal battery storage and operating temperature range, see manufacturer documentation.

Setup time

Basic system	< 15 min
With optical sensors	30 min
With remote wind site	30 min ¹⁾

¹⁾ Total setup time depends on location and distance of additional wind sites and displays.

Inputs and outputs

AC (mains) power	100 ... 240 V AC, ±10 % 50 ... 60 Hz
Solar panel	13 W
Overvoltage category	II
Internal battery	
Basic system (continuous operation without AC power)	7 Ah / 12 V
With optical sensors (min. 24 h operation without AC power)	48 Ah / 12 V
With remote wind site (min. 24 h operation without AC power)	24 Ah / 12 V
Battery regulator for enhanced systems	Charge/Recharge control Temperature compensation Deep discharge protection Simultaneous inputs from solar and AC power allowed

Mechanical specifications

Tripod mast	Adjustable from 1.8 to 3.6 m (6 to 12 ft)
Optional telescopic mast	10 m (30 ft)
Weight	
Basic system	2 × carry case, 44 kg (97 lb)
Basic system and optical sensors (Enhancement 2)	4 × carry case, 115 kg (253.53 lb)
Basic system, optical sensors, and remote wind site (Enhancement 2 and Enhancement 1)	6 × carry case, 176 kg (388.01 lb)
Optional freezing rain sensor (Enhancement 3)	1 × carry case, 12 kg (26.46 lb)

Standard communication options

Wireless communication	UHF, VHF
Landline communication	RS-232

For other communication options, please contact Vaisala.

Data validation, calculations, and reports

Data collection platform	Vaisala Data Logger QML201C
MTBF	> 12 500 h (MIL-HNDB217F)
Data quality control	Upper/Lower climatological limits Step change validation Sensor status indication
Statistical calculations	Averaging over user-configurable periods Minimum/Maximum values Standard deviation Cumulative values
Other calculations	Dew point QNH, QFE, QFF, PA, DA, pressure tendency, pressure trend Gust, peak, squall Modified discomfort index
Weather data reports	METAR, SPECI

Sensor options

Sensor	Basic	Enhancement
Wind speed and direction (WMS302M)	✓	-
Atmospheric pressure (BARO-1)	✓	-
Temperature and relative humidity (HMP155)	✓	-
Rain/Precipitation (QMR101M)	✓	-
Cloud height and coverage (CL31M)	-	✓
Visibility and present weather (PWD22M)	-	✓
Wind speed and direction (WMT700)	-	✓
Freezing rain (LID-330IP)	-	✓

Compliance

EU directives and regulations	Low Voltage Directive (2014/35/EU) EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
Electrical safety	EN 60950
EMC compatibility	EN 61326-1, industrial environment
EMC emissions	CISPR 32 / EN 55032, Class B
Compliance marks	CE, FCC, ICES, RCM

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AUD111, AUD211, and AUD211M Audio Unit



Vaisala Audio Units AUD111/AUD211/AUD211M are used for generating spoken weather messages over radio, PSTN modem line, handset, and speaker.

Vaisala Audio Unit AUD111

AUD111 is a USB soundcard that generates audible voice messages and receives speech data, such as Notices to Airmen (NOTAMs), as an input. The voice is transferred between the central data unit (CDU) and AUD111 as WAV files (8.0 kHz, 8-bit, mono).

The voice message is voiced to the following audio output channels: radio, handset, and speaker. The handset is a local phone that can be used for listening weather reports and recording NOTAMs. The handset channel has a dual tone multi-frequency signaling (DTMF) receiver.

Vaisala Audio Unit AUD211

AUD211 provides voice generation over radio. It communicates with QML data logger through an RS-232 port. AUD211 uses the onboard CompactFlash card as

a voice data memory. The logger communicates with AUD211 through an RS-232 line and controls in symbolic format which words and phrases the AUD211 is voicing out. The voice message is voiced to radio, handset, and speaker audio channels.

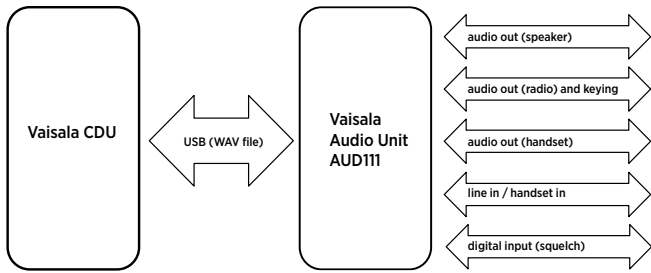
Vaisala Audio Unit AUD211M

AUD211M provides voice generation over PSTN modem line with an RS-232 interface to QML data logger. It includes an integrated 25.4 × 63.5 mm (1 × 2.5 in) PSTN modem module. AUD211M is used when QML data logger is speaking weather reports over a PSTN modem line. AUD211M can also speak to radio, handset, and speaker channels.

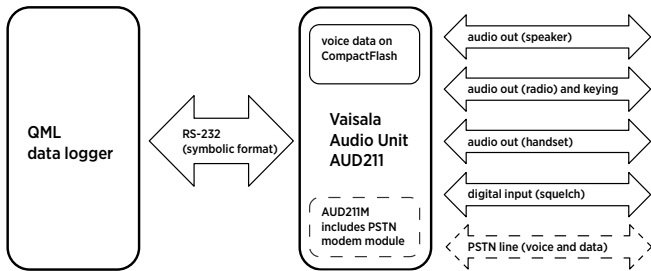
Features

- Supports and generates spoken weather messages over radio, PSTN modem line, handset, and speaker
- Supports voice recording, for example recording NOTAMs
- Supports the following communication options: voice over USB or CompactFlash
- Wide operating temperature range and industrial level EMI tolerance

Technical Data



AUD111 interfaces



AUD211/AUD211M interfaces

Audio input

Source	Handset or line in
Maximum signal	1.25 V _{pp}
Volume control	i2c potentiometer with 64 steps
Bandwidth	10 ... 3400 Hz
ADC	8 kHz, 8-bit, mono, 3400 Hz elliptic anti-aliasing filter
DTMF detection	In handset line
Line-in connector	2-position screw terminal
Handset connector	RJ45 (pins 4 and 5 : audio)
Isolation in handset line	3880 Vrms, 600 Ω transformer coupling

Compliance

EMC emissions	CISPR 22 / EN 55022, Class B
EMC susceptibility, test level industrial	
ESD	EN 61000 4 2
RF field	EN 61000 4 3
Fast transient bursts	EN 61000 4 4
Transient surges	EN 61000 4 5
Conducted RF	EN 61000 4 6

Mechanical specifications

Dimensions (W × H × D)	45 × 99 × 113 mm (1.77 × 3.90 × 4.45 in)
Weight (without modem and CompactFlash card)	220 g (7.76 oz)
Case material	Polyamid PA 6.6
Mounting	35-mm (1.38-in) DIN rail

Audio outputs

Speaker output

Maximum power	1.4 W to 4 Ω 1.0 W to 8 Ω
Connector	2-position screw terminal

Radio output

Maximum signal	9 V _{pp} at R _{load} = 10 kΩ
Connector	RJ45 (pins 5 and 6 : audio, pins 4 and 7 : keying, pin 3 : +12 V)
Isolation	3880 Vrms, 600 Ω transformer coupling
Connector	RJ45

Handset output

Maximum signal	0.5 V _{pp}
Supply for handset	19 V at 0 mA, 15 V at 55 mA
Connector	RJ45 (pins 4 and 5 : audio)
Isolation	3880 Vrms, 600 Ω transformer coupling

Common characteristics for each channel

Volume control	i2c potentiometer with 64 steps
Bandwidth	10 ... 3400 Hz
DAC	8 kHz, 8-bit, mono

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Operating humidity	0 ... 100 %RH, non-condensing

Other interfaces

Power input

Supply voltage	9 ... 30 V DC
Power consumption	Maximum 5 W, 0.5 W in power shutdown
Connector	2-position screw terminal
Fuse	1.1 A PTC
Transient protection	33 V, 1.5 kW / 1 ms transient diode
Reverse connect protection	Yes

EIA/TIA-232 (RS-232)

Serial port speed	1200 ... 57 600 bps
Handset connector	RJ45 (pin 6 : GND, pin 4 : Rx/D, pin 5 : Tx/D)
Connector	RJ45

USB

Speed	USB 1.1, 12 Mbit/s
Connector	Type B

SQ and radio in digital inputs

V _{in} low	-0.5 ... +0.8 V
V _{in} high	+2.0 ... +15.0 V
Connector	2-position screw terminal Phoenix Contact MC 1,5/2 ST 3,81

PSTN (AUD211M only)

Modem	Multitech MT9234SMI-L-92.R1
Ring detection	Separate ring detection circuit that can wake up the audio unit from low power mode
Connector	2-position screw terminal



Features

- Bright display visible even in direct sunlight
- Easy to use
- Robust design
- Tested against MIL-STD-810G and IEC6100
- Compatible with all generations of MAWS201M

Vaisala Handheld Terminal QMD102M is a new-generation terminal for Vaisala TacMet® Tactical Meteorological Observation System MAWS201M.

QMD102M is specifically designed for demanding military use in all weather conditions without any additional protection. It has a bright 4.3-inch color LCD display that is visible in direct sunlight. A night mode is also available. The user-friendly brightness control allows the display to be optimized for all light conditions.

Usability

The simple user interface enables easy operation without any additional documentation or training. The mechanical design enables operation with protective gloves. The navigation buttons allow basic operations to be done one-handed, and the removable silicon cover provides perfect grip.

Modern Display Design

The QMD102M display is easy to use and navigate. The layout includes a graphical wind display, a multi-parameter display that shows all parameters in the same

page, and dedicated displays for enhancement options. A specific alarm display gives clear instructions to solve any problems with the system. QMD102M has an advanced maintenance terminal window with pre-configured function keys for the most common commands.

Compatibility

QMD102M can be used in all MAWS201M systems from the very first units up to the newest generation with all the latest enhancement options. Based on the parameters provided by MAWS201M, the terminal adapts automatically to the system in case. All parameters are stored in the MAWS201M unit itself.

Testing

The environmental characteristics of QMD102M are designed and tested according to MILSTD-810G. EMC compliance has been tested according to

IEC 61000 and CISPR 22 standards. Additional water tightness tests have been done to prove the design of the terminal.



Technical Data



Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH, non-condensing
IP rating	IP66

Inputs and outputs

Supply voltage	9 ... 30 V DC
Average power consumption	< 0.9 W
Max. power consumption	1.5 W

Mechanical specifications

Dimensions (H × W × L) ¹⁾	200 × 95 × 30 mm (7.87 × 3.74 × 1.18 in)
Weight	0.6 kg (1.32 lb)
Cable length	2 m (6 ft 7 in)
Display	4.3" 480 × 800 color TFT

¹⁾ Without mounting bracket and cable.

Compliance

Environmental

Low pressure	MIL-STD-810G 500.5, procedure I and II
High temperature	MIL-STD-810G 501.5, procedure I and II
Low temperature	MIL-STD-810G 502.5, procedure I and II
Temperature shock	MIL-STD-810G 503.5, procedure I CI
Solar radiation	MIL-STD-810G 505.5, procedure I and II
Rain	MIL-STD-810G 506.5, procedure I, II and III
Humidity	MIL-STD-810G 507.5, procedure II non-hazardous
Salt fog	MIL-STD-810G 509.5, General
Sand and dust	MIL-STD-810G 510.5, procedure I
Vibration	MIL-STD-810G 514.6, procedure I and II
Shock	MIL-STD-810G 516.6, procedure I and IV
Icing/Freezing rain	MIL-STD-810G 521.3
Freeze/Thaw	MIL-STD-810G 524, procedure I, II, and III

EMC

Conducted RF immunity	EN 61000-4-6
Surge	EN 61000-4-5
Electric fast transient	EN 61000-4-4
RF field immunity	EN 61000-4-3
Electrostatic discharge	EN 61000-4-2
Emissions	CISPR 22 / EN 55022, Class B

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Features

- Support for standard DIN-rail mounting
- Compact housing
- Suitable for both sensor sites and central sites
- Suitable for 2-wire or 4-wire point-to-point or multi-point applications

Vaisala Leased Line Modem DXL421 is designed for leased-line modem connections between central site and sensor sites.

For Use in Leased-line Modem Connections

DXL421 is a leased-line modem for weather stations and other systems and sensors. For example, modem unit in the transmitting end can be inside the weather station enclosure and the modem unit in the receiving end can be inside the central data unit rack.

Device Mounting

The DXL421 unit is compact: 80 x 76 x 25 mm (3.15 x 2.99 x 0.98 in). It can be mounting on a standard DIN-rail connected into various enclosures.

DXL421 can be mounted, for example, to Vaisala Device Mounting and Powering Frame MDF101, or inside the weather station enclosure, or inside a large enough field sensor enclosure.

Connections and Standards

DXL421 can be used to connect the weather station to the leased-line 2-wire or 4-wire point-to-point or multipoint application. DXL421 has face connectors where the power supply, RS-232, and leased line can be connected.

DXL421 supports standards such as:

- V.21 300/300 bps frequency shift keying (FSK)
- V.22 1200/1200 bps differential phase shift keying (DPSK)
- V.23 1200/1200 bps FSK

The operation mode and settings are selectable with the DIL switch and jumpers.

Technical Data

DXL421 operating environment

Operating temperature	-40 +55 °C (-40 ... +131 °F)
Storage temperature	-60 ... +75 °C (-76 ... +167 °F)
Operating humidity	0 ... 100 %RH, non-condensing
IP rating	IP30
NEMA rating	NEMA 1

DXL421 inputs

Supply voltage	+5 ... +30 V DC
Power consumption	0.09 W
Fuse	0.5 A PTC
Transient protection	Yes, transil diode
Reverse connect protection	Yes
Connector	2-position screw terminal
Indicator	Green power LED

DXL421 serial RS-232 interface

Topology	EIA/TIA-232-F (RS-232C) interface
Serial port speed	300 ... 57 600 bps
Connector	6-position screw terminal
Indicators	3 orange LEDs: CD , TxD , and RxD

DXL421 PSTN interface

Modem compatibility	<ul style="list-style-type: none">• V.21 300/300 bps FSK• V.22 1200/1200 bps DPSK• V.23 1200/1200 bps FSK• 2-wire or 4-wire, point-to-point or multi-point
Transient protection	Yes, 350 V surge protector, PTC fuses, SIDACTor®
Isolation	1500 V
Connector	4-position screw terminal

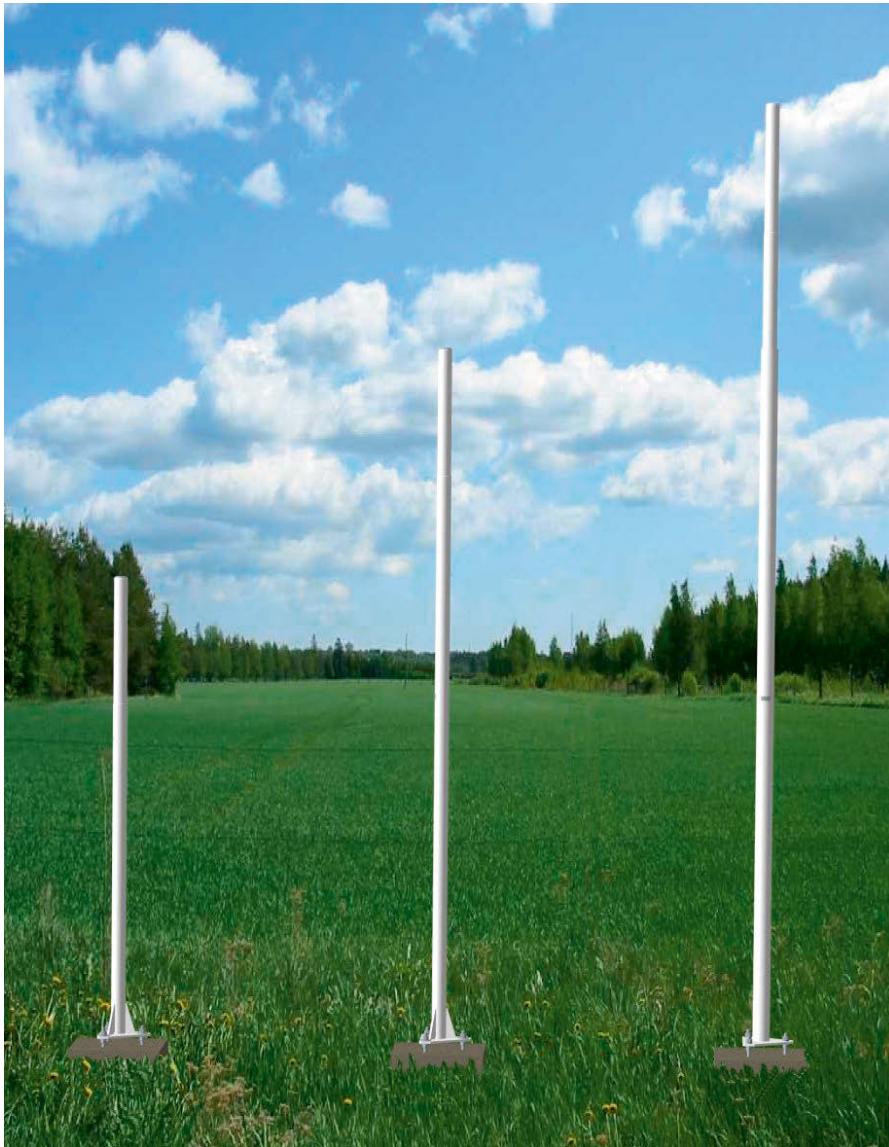
DXL421 mechanical specifications

Housing material	EN AW-1050A aluminum, gray anodized
Dimensions (H × W × L)	80 × 76 × 25 mm (3.15 × 2.99 × 0.98 in)
Weight	94 g (3.31 oz)

DXL421 compliance

Vibration	IEC 68-2-64 Fh, 10 ... 500 Hz, up to 2.0 G
Free fall	IEC 68-2-32 Ed, fall height 1000 mm (39 in)
Cold	IEC 68-2-1, -40 °C (-40 °F) 16 hours
Heat	IEC 68-2-2, +55 °C (+131 °F) 16 hours
Slow change of temperature, 1 °C/min	IEC 68-2-14, -40 ... +55 °C (-40 ... +131 °F), 2 cycles
Immunity	
ESD	EN 61000-4-2, contact dis. 4 kV, air dis. 8 kV
RF field	EN 61000-4-3
Fast transient bursts (EFT)	EN 61000-4-4
Transient surges	EN 61000-4-5
Conducted RF	EN 61000-4-6





Features

- Easily tilted down for equipment installation and maintenance when equipped with the optional tilt division flange
- An optional insulated guy wire (for DKP204W) and air terminal provide maximum lightning safety
- Foundation set includes all the necessary parts for quick and easy installation
- Maintenance free aluminum/ stainless steel construction
- Packages are suitable for air freight
- Suitable for a wide range of automatic weather station applications

Vaisala Short Pole Masts DKP204W (4 m high), DKP203W (3 m high), and DKP202W (2 m high) are suitable for a wide range of surface weather and climatological applications.

The mast tubes of Vaisala Short Pole Masts DKP204W, DKP203W, and DKP202W are made of anodized aluminum. In DKP204W, the remaining parts of the main assembly are made of stainless steel to resist weathering. The masts are painted white.

The optional, highly efficient air terminal protects the sensors and other equipment against lightning strikes. The air terminal with the non-conductive

holders is grounded through the support guy wire, which is completely isolated from the mast. The equipment is always grounded to a separate grounding point.

The foundation set includes all the parts needed to construct a steady and correctly orientated base for the mast. The only additional item needed is concrete or an existing concrete pad. With the optional leveling/welding plate, the mast can be installed also to metal surfaces.

To maintain the sensors and other equipment installed on the upper mast assembly, one maintenance person can effortlessly tilt the mast when it is equipped with the optional tilt division flange. This significantly reduces the maintenance costs of weather stations. The basic mast delivery includes the mast pole and the foundation set. All the components are packed in a durable cardboard box that is suitable for air freight.

Technical data

Operating environment

Maximum wind speed with typical weather station components ¹⁾	30 m/s (67 mph) from all directions DKP204 with guy wires: 50 m/s (112 mph)
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¹⁾ Enclosure ENC652, support arm, solar panel, radiation shield DTR13 with humidity and temperature probe HMP155, visibility and present weather sensor PWD22, and wind sensor WMT700.

Main mast assembly

Height	DKP204: 4 m (13 ft 1 in) DKP203: 3 m (9 ft 10 in) DKP202: 2 m (6 ft 7 in)
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Diameter	Lowest section: 75 mm (2.95 in) Mid-section: 63 mm (2.48 in) Top section: 60 mm (2.36 in)
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Weight	DKP204: 21.5 kg (47.40 lb) DKP203: 17.3 kg (38.14 lb) DKP202: 13.0 kg (28.66 lb)
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Materials

Base	Stainless steel
Tube	Aluminum alloy
Other parts, such as bolts	Stainless steel

DKP204 guy wires

Material	Stainless steel
Breaking strength	28 kN
Marking	Black and yellow cable shrouds to the height of 2 m (6 ft 7 in) above ground

Foundation set

Material	Galvanized steel
Thread of foundation bolts	M16
Length of foundation bolts	220 mm (8.66 in)
Wedge bolts	Cast or drilled into concrete using the template provided

Mast concrete base

Soil bearing capacity	Must exceed 45 kPa
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Coating/Painting

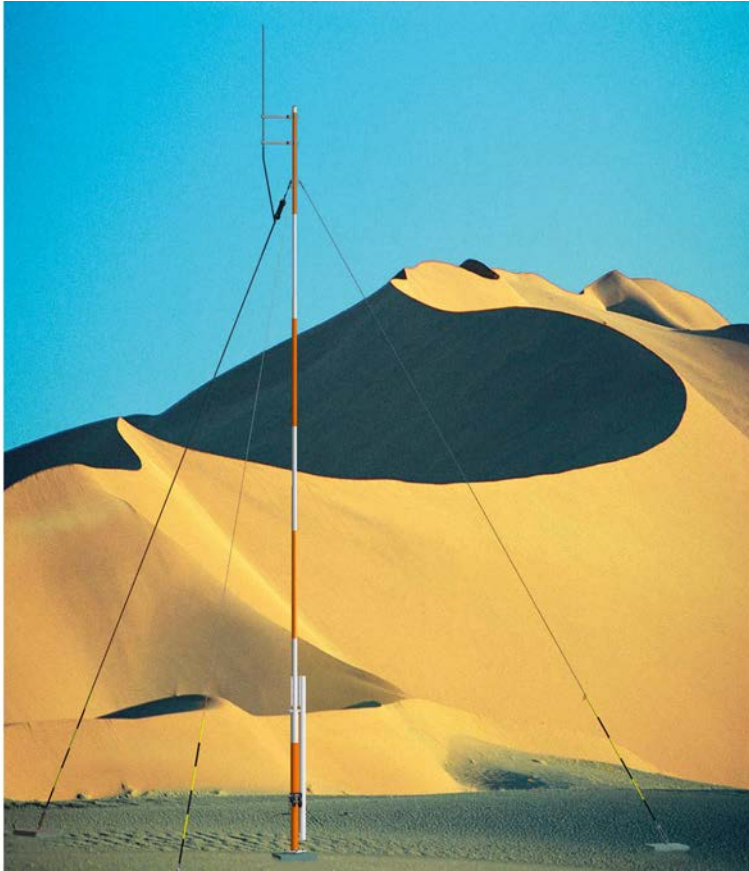
Aluminum parts	Anodized and painted
Steel parts	Galvanized
Stainless steel parts	Base: Painted Other parts: Uncoated

Package

Material	Cardboard
Maximum length	< 3.1 m (10 ft 2 in), suitable for air freight

Spare parts and accessories

Item	Order code
4 m (13 ft 1 in) white mast with foundation set	DKP204W
3 m (9 ft 10 in) white mast with foundation set	DKP203W
2 m (6 ft 7 ft) white mast with foundation set	DKP202W
Foundation set	DKF200-2
Options	
Screw foundation set, length 130 cm (51.18 in)	DKF200-2S13
Screw foundation set, length 200 cm (78.74 in)	DKF200-2S20
Leveling/Welding plate	DKP200LP-2
Tilt division flange	DKP200DF-2
Support stand	ASM211887SP
Lightning protection kit	DKL201



Features

- Easily tilted down by one person for equipment installation and maintenance
- Insulated guy wire and air terminal provide maximum lightning safety
- Can withstand winds of up to 50 m/s (112 mph); up to 75 m/s (157 mph) with 2 sets of guy wires
- With orange and white paint (DKP206AV and DKP210AV), suitable for aviation applications
- Foundation set includes all the necessary parts for quick and easy installation

Vaisala Tiltable Masts, the 6-meter DKP206 and 10-meter DKP210, are suitable for a wide range of surface weather and climatological applications. The masts are available in two colors, white (DKP206W and DKP210W) or orange and white for aviation purposes (DKP206AV and DKP210AV).

DKP206 and DKP210 mast tubes are made of anodized aluminum. The remaining parts of the main assembly are made of stainless steel to resist weathering.

Tilting for maintenance tasks

One maintenance person can effortlessly tilt the mast with the optional and easily detachable tilting set. Note that the number of persons needed depends on local safety regulations.

The sensors and other equipment installed on the upper mast assembly do not need to be removed when performing maintenance tasks. This significantly reduces the automatic weather station maintenance costs.

Mast delivery contents

The basic mast delivery includes the air terminal with grounding cable, one set of guy wires, and the lifting rod. All the components are packed in durable cardboard boxes that are suitable for air freight.

Lightning safety

The air terminal protects the sensors and other equipment. From the air terminal a down conductor runs to the grounding connector at the base of the mast. The equipment is always grounded to a separate grounding point.

Proven wind resistance

With one standard set of guy wires, the mast can withstand winds of up to 50 m/s (112 mph) when the weather station enclosure, solar panel, and sensors are installed on it. DKP210 includes an optional second guy wire set, which enables it to withstand winds of up to 75 m/s (157 mph).

Quick and easy installation

The optional foundation set includes all the parts needed for constructing a steady and correctly oriented base for the mast. The only additional item needed at the installation site is a concrete block of the correct size.

Technical data

Main mast assembly

Height	DKP206: 6 m (19 ft 8 in) DKP210: 10 m (32 ft 10 in)
Maximum wind speed	With 1 set of guy wires: 50 m/s (112 mph) With 2 sets of guy wires DKP210 only): 75 m/s (168 mph)
Diameter	
Lowest section (0.0 ... 1.9 m / 0 ft ... 6 ft 3in)	100 mm (3.94 in)
Second section (1.9 ... 4.9 m / 6 ft 3in ... 16 ft 1 in)	75 mm (2.95 in)
Third section	63 mm (2.48 in)
Highest section	50/60 mm (1.97/2.36 in)
Top of the mast	60 mm (2.36 in)
Material	
Tube and lifting rod	Aluminum alloy
Base and hinge, bolts, and similar	Stainless steel

Guy wires

Material	Stainless steel
Breaking strength	28 kN (6295 lbf)
Marking	Black and yellow cable shrouds to a height of 2 meters (6 ft 7 in) above the ground

Foundation set

Material	Galvanized steel
Thread of foundation bolts	M20
Length of foundation bolts	300 mm (11.81 in)
Wedge bolts	Cast or drilled into concrete using the provided orientation template

Mast concrete base

Soil bearing capacity	Must exceed 45 kPa
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Coating/Painting

Aluminum parts	Anodized and painted
Steel parts	Galvanized
Pedestal tube	Corrosion-resistant powder coating
Stainless steel parts	
Base and hinge	Painted
Other parts	Uncoated

Packages

Material	Cardboard
Maximum length	< 3.1 m (10 ft 2 in), suitable for air freight
Weight (packaged with DKF200, DKL200, and DKP200)	DKP206: 105 kg (232 lb) DKP210: 125 kg (276 lb)

Spare parts and accessories

Item	Order code
Tiltable mast with basic accessories, 10 m (32 ft 10 in), aviation orange	DKP210AV
Tiltable mast with basic accessories, 10 m (32 ft 10 in), white	DKP210W
Tiltable mast with basic accessories, 6 m (19 ft 8 in), aviation orange	DKP206AV
Tiltable mast with basic accessories, 6 m (19 ft 8 in), white	DKP206W
Basic accessories	
Lifting rod	DKP200LR
Guy wire set	DKP210GW-1
Lightning protection kit	DKL201
Options	
Foundation set	DKF200-1
Winch and tilting support	DKP200IS
Winch	DKW200
Tilting support	DKP200TS
Additional guy wire set for DKP210	DKP210GW-2

DKE110F Guyed Frangible Mast



Vaisala Guyed Frangible Mast DKE110F is 10 meters (33 feet) high and suitable for a wide range of surface weather and climatological applications, including locations at the airports.

DKE110F mast tubes are made of glass-fiber reinforced plastic (GRP) which has very good weathering properties. The same material is also used for the guying sets. Though the mast is light weight, even with one set of guy wires it is rigid enough to resist wind speeds up to 60 m/s (134 mph) with the weather station enclosure, solar panel, and sensors installed. With the optional second guy wire set, DKE110F withstands winds of up to 75 m/s (168 mph).

Excellent Weather Resistance

DKE110F has excellent corrosion and environmental resistance verified with salt spray and solar radiation tests. The metal parts are made of anodized aluminum alloy and maritime-grade stainless steel to achieve excellent weather resistance.

Tilting for Easy Maintenance

The hinged base allows the mast to be manually tilted down for easy maintenance of the sensors and other equipment installed on the upper assembly. Optionally, the mast can be fitted with a separate lifting rod device to allow tilting the mast with a winch.

The Choice for Airport Locations

DKE110F is an excellent choice for airport locations. The mast is frangible according to ICAO Annex 14 and ICAO Doc 9157, Aerodrome Design Manual, Part 6 – Frangibility.

Mast Delivery Contents

The mast delivery consists of the basic round tube mast complemented with the appropriate accessories, such as foundation, air terminal, and top guying set. An optional middle guying set kit is available for even increased maximum wind load tolerance. The mast components are packed in durable containers suitable for air freight.

Features

- Low mass and frangible according to ICAO Annex 14 and ICAO Doc 9157, Aerodrome Design Manual, Part 6 – Frangibility
- Hinged base with options to tilt manually or with a winch
- Withstands winds up to 60 m/s (134 mph); up to 75 m/s (168 mph) with two sets of guy wires
- Glass-fiber reinforced plastic material is UV-stabilized and RF-transparent to electromagnetic signals, such as instrument landing system (ILS) and microwave landing system (MLS)
- Suitable for a wide range of meteorological automatic weather station applications

Environmental Impact

- Manufacturing process consumes far less energy than with aluminum or steel mast
- GRP material is recyclable
- Recycling according to EU directive 2008/98/EC

Technical Data

Mechanical specifications

Height, assembled	Total: 10 m (32 ft 10 in) Mast tube 1: 0 ... 3 m (0 ... 9 ft 10 in) Mast tube 2: 3 ... 6 m (9 ft 10 in ... 19 ft 8 in) Mast tube 3: 6 ... 9 m (19 ft 8 in ... 29 ft 6 in) Top section: 9 ... 10 m (29 ft 6 in ... 32 ft 10 in)
Length	Mast tubes 1, 2, and 3: 3 m (9 ft 10 in) each Top section: 1 m (3 ft 4 in)
Diameter	Mast tubes 1, 2, and 3: 106 mm (4.17 in) Top section: 60 mm (2.36 in)
Weight (mast only)	35 kg (77 lb)
Material	
Mast tubes 1, 2, and 3	Glass-fiber reinforced plastic (GRP)
Top section	Aluminum alloy
Base and hinge	Aluminum alloy
Other parts	Aluminum alloy or maritime-grade stainless steel
Fasteners	Maritime-grade stainless steel

Guy wires and optional rods

Number of guy wire rods	18 pcs (top guying) or 30 pcs (top and middle guying)
Breaking strength	15 kN
Material	
Rod	GRP
Fasteners	Maritime-grade stainless steel
Lifting rod (optional)	Aluminum alloy
Tilt rod (optional)	Aluminum alloy

Foundation set

Material	Galvanized steel
Thread of foundation bolts	M20
Length of foundation bolts	350 mm (13.78 in), cast in or drilled to concrete

Coating/Painting

GRP	Painting, red and white in 7 sections (ICAO compliant, others available on request)
Aluminum parts	Anodizing and painting
Steel parts	Galvanized
Stainless steel	Painted

Packaging

Material	Plywood
Mast package	
Dimensions (L × W × H)	3100 × 500 × 390 mm (122.05 × 19.69 × 15.35 in)
Weight	48 kg (106 lb)
Foundation set package	
Dimensions (L × W × H)	385 × 275 × 110 mm (15.16 × 10.83 × 4.33 in)
Weight	12 kg (26.5 lb)

Operating environment

Maximum wind speed (top guying)	60 m/s (134 mph)
Maximum wind speed (top and middle guying)	75 m/s (168 mph)

Compliance

Frangibility certification	
ICAO	Aerodrome Design Manual Part 6: Frangibility Doc 9157 AN/901 1st edition, 2006
FAA	Advisory Circular (AC) 150/5345-45C
Material certifications	
Salt spray test	STD-810F, Method 509.4, Paragraph 4.5.2., Procedure I
Solar radiation test	STD-810F, Method 505.4, Paragraph 4.4.3., Procedure II



Vaisala Composite Pole Mast DKE110 is a 10-meter (33-foot) mast that is available with white (DKE110W) and with red/orange and white (DKE110AV) painting. The mast is suitable for a wide range of surface weather and climatological applications.

Lightweight but Rigid

DKE110W/AV mast is lightweight, but rigid enough to withstand wind speeds of up to 60 m/s (134 mph) with 1 set of guy wires. With 2 sets of guy wires, the mast can withstand wind speeds of up to 75 m/s (168 mph).

To achieve excellent weather resistance, the metal parts of the mast are made of anodized aluminum alloy and maritime-grade stainless steel.

Weather Resistant

The mast tubes of DKE110W/AV are made of glass-fiber reinforced plastic (GRP) which has very good weathering properties.

Features

- Painted white (DKE110W) or red/orange and white (DKE110AV)
- Suited for surface weather and climatological applications
- Withstands wind speeds of up to 60 m/s (134 mph)
- With 2 sets of guy wires, withstands wind speeds up to 75 m/s (168 mph)

Technical data

Operating environment

Maximum wind speed (top guying)	60 m/s (134 mph)
Maximum wind speed (top and middle guying)	75 m/s (168 mph)

Mechanical specifications

Height, assembled	Total: 10 m (32 ft 10 in) Mast tube 1: 0 ... 3 m (0 ... 9 ft 10 in) Mast tube 2: 3 ... 6 m (9 ft 10 in ... 19 ft 8 in) Mast tube 3: 6 ... 9 m (19 ft 8 in ... 29 ft 6 in) Top section: 9 ... 10 m (29 ft 6 in ... 32 ft 10 in)
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Length	Mast tubes 1, 2, and 3: 3 m (9 ft 10 in) each Top section: 1 m (3 ft 4 in)
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Diameter	Mast tubes 1, 2, and 3: 106 mm (4.17 in) Top section: 60 mm (2.36 in)
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Weight (mast only)	35 kg (77 lb)
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Material

Mast tubes 1, 2, and 3	Glass-fiber reinforced plastic (GRP)
Top section	Aluminum alloy
Base and hinge	Aluminum alloy
Other parts	Aluminum alloy, glass-fiber reinforced plastic (GRP), or maritime-grade stainless steel
Fasteners	Maritime-grade stainless steel

Guy wires

Material	Maritime-grade stainless steel
Fasteners	Maritime-grade stainless steel
Guy wires, top guy wire set	3 pcs
Guy wires, middle guy wire set (optional)	3 pcs
Length	11 m (36 ft)

Foundation set

Material	Galvanized steel
Thread of foundation bolts	M20
Length of foundation bolts	350 mm (13.78 in), cast in or drilled to concrete

Coating/Painting

Glass-fiber reinforced plastic (GRP) parts	Painted, white (DKE110W) Painted, red/orange and white (DKE110AV)
Aluminum parts	Anodized and painted
Steel parts	Galvanized
Stainless steel parts	Painted

Packaging

Plywood mast package

Dimensions (L × W × H)	311 × 52 × 43 cm (122.44 × 20.47 × 16.93 in)
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Weight	52 kg (115 lb)
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Cardboard mast package with plywood reinforcements

Dimensions (L × W × H)	318 × 51 × 42 (125.20 × 20.08 × 16.54 in)
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Weight	11 kg (24.5 lb)
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Foundation set package

Dimensions (L × W × H)	385 × 275 × 110 mm (15.16 × 10.83 × 4.33 in)
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Weight	12 kg (26.5 lb)
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Features

- Meets ICAO and FAA standards
- Built-in frangibility
- Fully impact tested
- Transparent to electromagnetic radiation – no interference with airport communication equipment
- Optional passive air terminal protects sensors and other equipment
- Composite structure provides superior air terminal insulation

Vaisala Frangible Lattice Mast DKE200 is a lightweight and rigid mast especially suited for aviation use. The mast complies with ICAO and FAA standards and is compatible with all Vaisala weather stations.

Fully compliant with safety specifications

The DKE200 mast materials comply with aviation safety specifications and the mast is impact tested according to the ICAO Aerodrome Design Manual Part 6, chapter 5 and FAA AC 150/5345-45C, section 4.

The DKE200 mast is rigid and strong but lightweight, and its composite structure makes it brittle in case of sudden impact. In collision, the mast breaks at the point of impact without causing hazard to the aircraft.

Robust and corrosion-resistant build

The DKE200 mast withstands wind speeds of up to 60 m/s (134 mph). The composite materials resist fatigue, corrosion, and other effects of weather and temperature, making the masts also suitable for marine and other corroding environments.

As composite materials do not distort electromagnetic signals of the airport communications equipment, the need to calibrate instrument landing system (ILS) antennas is reduced.

The DKE200 mast is maintenance free.

Custom options for all kinds of airports

The mast is supplied with a bottom hinge, allowing maintenance from a crane truck without lowering the mast. A center-hinged version is also available, allowing the mast to be lowered by a single maintenance worker for easy maintenance of the sensors and other equipment. Note that the number of persons needed depends on local safety regulations.

An optional passive air terminal is available for protecting sensors and other equipment. The composite materials of the mast provide superior air terminal insulation.

Technical data

Operating environment

Maximum wind load 60 m/s (134 mph)

Mechanical specifications

Height, assembled 10 m (32 ft 10 in)

Dimensions

Upper mast module (H × W × L)	400 × 400 × 3750 mm (15.75 × 15.75 × 147.64 in)
Lower mast module (H × W × L)	500 × 500 × 5550 mm (19.69 × 19.69 × 218.50 in)
Top frame with spigot (Ø × L)	60 × 1000 mm (2.36 × 39.37 in)

Materials

Main mast assembly	Glass reinforced plastic (GRP)
Top frame and spigot	Aluminum
Base frame and foundation kit	Galvanized steel
Crossbar, sensor support tubes, and joining element	Glass-reinforced plastic (GRP)
Sensor support arm at 2-meter (3-foot) height	Aluminum
Painting	Orange (RAL2004) and white (RAL9016) in 7 sections according to ICAO Annex 14 and FAA AC 150/5345-45C Red (RAL3020) and white (RAL9016) in 7 sections according to ICAO Annex 14
Packaging	Plywood, suitable for air freight

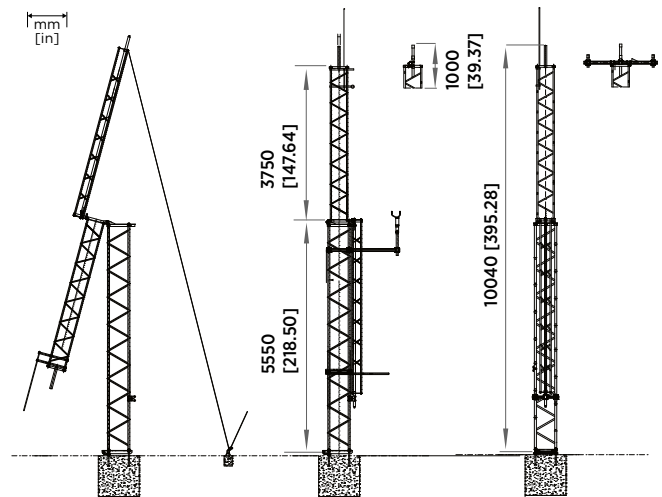
Frangibility certification

ICAO

Aerodrome Design Manual Part 6:
Frangibility Doc 9157 AN/901
1st edition, 2006

FAA

Advisory Circular (AC) 150/5345-45C



Dimensions



Vaisala Air Quality Transmitter AQT530 measures the pollution content of ambient air. AQT530 is available in different models for measuring gases, particles, or both.

Applications

- Air quality networks supplementing existing regulatory stations
- Air quality measurements in smart city and urban applications
- Roadside monitoring
- Building automation
- Air quality research

New value in air quality measurements

The supplementary air quality measurement of AQT530 modernizes the way air quality can be monitored. It offers totally new value for money by measuring the most important pollutants in one compact package.

AQT530 is available in different models, and configurations can be selected based on the needs.

State-of-the-art technology

For gas measurements AQT530 utilizes industry standard electrochemical gas sensor technology. By using proprietary advanced algorithms, individual factory calibration, and improved humidity robustness, parts per billion (ppb) concentrations at different environmental conditions can be measured reliably in one compact package. Algorithms compensate for the impact of ambient conditions and aging of the sensor elements, removing the need for costly gas sampling and equipment.

Particles are measured with a state-of-the-art proprietary laser particle counter (LPC). Single particles scatter light and based on the scattered intensity and number of pulses detected, the particle sizes and mass concentrations are calculated.

Easy to deploy in networks

AQT530 is specifically designed for air quality monitoring networks in areas with traffic, road networks, or around transportation hubs.

Thanks to its small weight, compact size, and good precision it is ideally suited for deployment especially in large air quality networks. The measurement data can be sent wirelessly to a web-based database with a gateway solution and it is also available locally through a serial interface.

AQT530 can be paired with Vaisala Beacon Station to provide a professional-grade complete network solution with best-in-class accuracy and reliability.

Features

- Measures important urban pollutant gases (NO₂, NO, O₃, and CO) and particles (PM₁₀, PM_{2.5}, PM₁)
- Proven laser particle counter (LPC) technology with pulse height analyzer for measuring particulate matter
- Intelligent humidity management for gas sensor elements
- Robust temperature and humidity sensor using Vaisala HUMICAP® technology
- Compact design and easy to deploy in the field
- Factory calibrated
- Field performance derived from global long-term multi-site and multi-continent field tests ¹⁾

¹⁾ Test locations include Beijing, China; Helsinki, Finland; Jakarta, Indonesia; Lapland, Finland; London, UK; New Mexico, Arizona, US; Paris, France; São Paulo, Brazil.

Product model	NO ₂	NO	O ₃	CO	PM ¹⁾
Gases	✓	✓	✓	✓	
Particles					✓
Gas and particles	✓				✓
Gases and particles	✓	✓	✓	✓	✓

¹⁾ Includes PM₁₀, PM_{2.5}, PM₁.

Technical Data

Measurement performance - gases

Property	NO ₂	NO	O ₃	CO
Concentration range	2000 ppb	2000 ppb	2000 ppb	10 000 ppb
Detection limit	5 ppb	5 ppb	5 ppb	10 ppb

Field performance - gases

Property ¹⁾	NO ₂ ²⁾	NO	O ₃ ²⁾	CO
Correlation with reference ³⁾	R ² : 0.70	R ² : 0.75	R ² : 0.50	R ² : 0.85
Accuracy ⁴⁾	7 ppb	15 ppb	11 ppb	183 ppb
Unit-to-unit correlation ⁵⁾	R ² : 0.93	R ² : 0.96	R ² : 0.84	R ² : 0.97
Precision ⁵⁾	3 ppb	3 ppb	4 ppb	25 ppb

- 1) All values are based on 1-hour averages with factory calibration, no linear correction applied. Values are obtained from global field testing in major climate zones against reference instruments. The values represent typical values and may be different based on the location.
- 2) At 10 V/m RF field test, the presence of electromagnetic interference in the range of 800 ... 900 MHz may cause additional deviation for NO₂ and O₃.
- 3) Typical R² against a reference grade instrument derived from field tests globally.
- 4) Mean absolute error against reference.
- 5) Mean absolute difference of AQT530 reading from average reading of AQT530s.

Measurement performance - environmental parameters

Humidity

Accuracy for sensor element	0 ... 90 %RH: ±3 %RH 90 ... 100 %RH: ±5 %RH
Resolution	0.1 %RH

Temperature

Accuracy for sensor element	0.3 °C (0.17 °F) at +20 °C (+68 °F)
Resolution	0.1 °C

Pressure (indicative)

Accuracy	15 hPa
Resolution	1 hPa

Operating environment

Operating temperature	-30 ... +40 °C (-22 ... +104 °F) ¹⁾
Storage temperature	+20 ... +25 °C (+68 ... +77 °F)
Operating humidity	15 ... 100 %RH, non-condensing ²⁾ ³⁾
Storage humidity	20 ... 75 %RH
Operating pressure	800 ... 1150 hPa
IP rating	IP65 ⁴⁾

- 1) Optimal performance at -10 ... +30 °C (-14 ... +86 °F).
- 2) Optimal performance at 15 ... 90 %RH. Operation in low-humidity environments may weaken the gas measurement performance. Operation in high-humidity environments may weaken the particle measurement performance.
- 3) Water uptake of particles may result in PM overestimation. In most cases this is indicated by the sensor.
- 4) Specified for gas measurement device only.

Powering

Operating voltage	10 - 25 V DC Max. 1 A at 10 V DC ¹⁾
Power consumption, max. peak ¹⁾	10 W
Power consumption (average with default settings)	
Gas and particle measurement	1.8 ... 4.4 W ²⁾
Gas measurement	1.4 ... 3.8 W ³⁾
Particle measurement	1.7 ... 2.0 W ⁴⁾

- 1) Humidity management active, particle measurement active, temperature < 0 °C (32 °F).
- 2) Maximum consumption when humidity > 85 %RH, temperature < 0 °C (32 °F), default particle measurement cycle.
- 3) Maximum consumption when humidity > 85 %RH.
- 4) Maximum consumption when temperature < 0 °C (32 °F), default particle measurement cycle.

Measurement performance - particles

Property	PM _{2.5}	PM ₁₀
Size range ¹⁾	0.6 ... 2.5 µm	0.6 ... 10 µm
Concentration range ²⁾	0 ... 1000 µg/m ³	0 ... 2500 µg/m ³
Detection limit	0.1 µg/m ³	0.1 µg/m ³
Accuracy ³⁾	5 %	6 %
Precision ^{3) 4)}	2 %	2 %

- 1) Spherical equivalent size of DEHS particles. Lower detection limit of 0.6 µm defined as 50 % detection efficiency for DEHS particles.
- 2) Specified with ISO12103-1, A1 ultrafine test dust.
- 3) Measured against a certified reference grade instrument at room temperature using Arizona dust equivalent (ISO12103-1, A1 Ultrafine test dust). PM_{2.5} measured at 150 µg/m³ and PM₁₀ at 1300 µg/m³. Accuracy and precision are defined with 2 standard deviations.
- 4) Unit-to-unit variation. Defined as difference of AQT530 reading from average reading of AQT530s.

Field performance - particles

Property ¹⁾	PM _{2.5}	PM ₁₀
Correlation with reference ²⁾	R ² : 0.65	R ² : 0.75
Accuracy ³⁾	9 µg/m ³	13 µg/m ³
Unit-to-unit correlation ⁴⁾	R ² : 0.97	R ² : 0.97
Precision ⁴⁾	2 µg/m ³	3 µg/m ³

- 1) All values are based on 1-hour averages with factory calibration, no linear correction applied. Values are obtained from global field testing in major climate zones against different reference equivalent methods. The values represent typical values and may be different based on the location and reference instrument. Majority of particle mass within size range.
- 2) Typical R² against a reference grade instrument derived from field tests globally.
- 3) Mean absolute error against reference.
- 4) Mean absolute difference of AQT530 reading from average reading of AQT530s.

Data connection specifications

Data output	Modbus® ASCII, Modbus® RTU, ASCII CSV
Serial data interface	RS-485
Maintenance interface ¹⁾	RS-232

- 1) Recommended Vaisala USB maintenance cable kit (253163SET).

Mechanical specifications

Dimensions (H × Ø)	335 × 133 mm (13.19 × 5.24 in)
Weight, with mounting kit	2.4 kg (5.29 lb)
Color, radiation shield	White (RAL9003)
Material, base module	Anodized aluminum
Material, radiation shield	Polycarbonate (PC)
Power and data connector	Standard 8-pin M12 male

Compliance

EU directives and regulations	EMC Directive (2014/30/EU) REACH Regulation (EC 1907/2006) RoHS Directive (2011/65/EU) amended by 2015/863
EMC immunity ¹⁾	EN 61326-1, industrial environment
EMC emissions	CISPR 32 / EN 55032, Class B
Cold	IEC 60068-2-1
Dry heat	IEC 60068-2-2
Damp heat	IEC 60068-2-78
Eye safety	IEC 60825-1:2014 Class 1 laser product
Compliance marks	CE, China RoHS, FCC, RCM, UKCA

- 1) At 10 V/m RF field test, the presence of electromagnetic interference in the range of 800 ... 900 MHz may cause additional deviation for NO₂ and O₃.

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Features

- Right parameter combination
- Easy to use and integrate
- Weather parameter hub
- Analog sensors can be added
- Compact, lightweight
- Low power consumption
- mA output suitable for industrial applications
- Cost-effective
- DNV GL Type Examination

Vaisala Weather Transmitter WXT530 is a unique series of sensors with parameter combinations that allow you to choose what is right for your application. WXT530 is a flexible, integrated building block for weather applications. WXT530 series improves your grip on weather.

Flexibility

WXT530 is a series of weather instruments that provides 6 of the most important weather parameters: air pressure, temperature, humidity, rainfall, wind speed and direction through various combinations. You can select the transmitter with the needed parameter(s) into your weather application, with a large variety of digital communication modes and wide range of voltages. A heated option is available. Low power consumption enables solar panel applications. WXT530 Series focuses on maintenance-free operations in a cost-effective manner.

Integration

The series offers analog input options for additional third-party analog sensors. With the help of the built-in analog-to-digital converters, you can turn WXT530 into a small, cost-effective weather parameter hub.

Additional parameters include solar radiation and external temperature sensor. Further, the analog mA output for wind speed and wind direction enables a wide variety of industrial applications. WXT530 exceeds IEC60945 maritime standard.

Solid performance

WXT530 Series has a unique Vaisala solid-state sensor technology. To measure wind, Vaisala WINDCAP® ultrasonic wind sensors are applied to determine horizontal wind speed and direction. Barometric pressure, temperature, and humidity measurements are combined in the PTU module using capacitive measurement for each parameter. This module is easy to change without any contact with the sensors. The precipitation measurement is based on the unique acoustic Vaisala RAINCAP® Sensor without flooding, clogging, wetting, and evaporation losses.

Option	Rain	Wind	PTU ¹⁾
WXT531	✓		
WXT532		✓	
WXT533	✓	✓	
WXT534			✓
WXT535	✓		✓
WXT536	✓	✓	✓

¹⁾ PTU is a compact changeable module. Vaisala recommends changing it every 2 years.



DNV GL TYPE EXAMINATION
CERTIFICATE No. TAA00000VF

Technical data

Barometric pressure measurement performance

Observation range	500 ... 1100 hPa
Accuracy (for sensor element) at 600 ... 1100 hPa	±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 / 0.001 bar / 0.1 mmHg / 0.01 inHg

Air temperature measurement performance

Observation range	-52 ... +60 °C (-60 ... +140 °F)
Accuracy (for sensor element) at +20 °C (+68 °F)	±0.3 °C (±0.54 °F)
Output resolution	0.1 °C (0.1 °F)

Relative humidity measurement performance

Observation range	0 ... 100 %RH
Accuracy (for sensor element)	±3 %RH at 0 ... 90 %RH ±5 %RH at 90 ... 100 %RH
Output resolution	0.1 %RH

Wind measurement performance

Wind speed

Observation range	0 ... 60 m/s (134 mph)
Reporting range	0 ... 75 m/s (168 mph)
Response time	0.25 s
Available variables	Average, maximum, and minimum
Accuracy	±3 % at 10 m/s (22 mph)
Output resolution	0.1 m/s (km/h, mph, knots)

Wind direction

Azimuth	0 ... 360°
Response time	0.25 s
Available variables	Average, maximum, and minimum
Accuracy	±3.0° at 10 m/s (22 mph)
Output resolution	1°
Averaging time	1 ... 3600 s, sample rate 1, 2, or 4 Hz (configurable)

Mechanical specifications

Weight

WXT534, WXT535, WXT536	0.7 kg (1.54 lb)
WXT531, WXT532, WXT533	0.5 kg (1.1 lb)

Operating environment

Operating environment	Outdoor use
Operating temperature	-52 ... +60 °C (-60 ... +140 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH
Operating pressure	500 ... 1100 hPa
Wind ¹⁾	0 ... 60 m/s (0 ... 134 mph)
IP rating	Without mounting kit: IP65 With mounting kit: IP66

¹⁾ Due to the measurement frequency used in the sonic transducers, RF interference in the 200 ... 400 kHz range can disturb wind measurement.

Precipitation measurement performance

Collecting area	60 cm ² (9.3 in ²)
Rainfall ¹⁾	
Output resolution	0.01 mm (0.001 in)
Field accuracy for daily accumulation	Better than 5 %, weather-dependent
Duration	Counting each 10-second increment whenever droplet detected
Duration output resolution	10 s
Intensity	Running 1-minute average, 10 s steps
Intensity observation range	0 ... 200 mm/h (0 ... 7.87 in/h) (broader with reduced accuracy)
Intensity output resolution	0.1 mm/h (0.01 in/h)
Hail ²⁾	
Output resolution	0.1 hits/cm ² (1 hits/in ²), 1 hit
Intensity output resolution	0.1 hits/cm ² h (1 hits/in ² h), 1 hit/h

¹⁾ Cumulative accumulation after the latest automatic or manual reset.
²⁾ Cumulative number of hits against collecting surface.

Inputs and outputs

Operating voltage	6 ... 24 V DC (-10 ... +30 %)
Average power consumption	Minimum: 0.1 mA at 12 V DC (SDI-12 standby) Typical: 3.5 mA at 12 V DC (typical measuring intervals) Maximum: 15 mA at 6 V DC (constant measurement of all parameters)
Heating voltage	DC, AC, or full-wave rectified AC 12 ... 24 V DC (-10 ... +30 %) 12 ... 17 V AC _{rms} (-10 ... +30 %)
Typical heating current	12 V DC: 800 mA, 24 V DC: 400 mA
Digital outputs	SDI-12, RS-232, RS-485, RS-422
Communication protocols	SDI-12 v1.3, Modbus RTU, ASCII automatic and polled, NMEA 0183 v3.0 with query option

WXT536 analog input options

Solar radiation	0 ... 25 mV
Voltage input	0 ... 2.5 V, 0 ... 5 V, 0 ... 10 V
Tipping bucket rain gauge	0 ... 100 Hz
Temperature (Pt1000)	800 ... 1330 Ω

WXT532 analog mA output options

When the analog output option is applied, digital communication is not available.

Wind speed	0 ... 20 mA or 4 ... 20 mA
Wind direction	0 ... 20 mA or 4 ... 20 mA

Compliance

EU directives and regulations	EMC, RoHS
EMC compatibility	EN 61326-1, industrial environment CISPR 32 / EN 55032, Class B
Environmental	IEC 60068-2-1, 2, 6, 14, 30, 31, 78 IEC 60529, VDA 621-415
Maritime	IEC 60945 (Exposed) DNV GL Type Examination Certificate No. TAA00000VF
Compliance marks	CE, RCM, RoHS, China RoHS, UKCA



Features

- Triangular design ensures excellent data availability
- Maintenance-free with no moving parts
- Optional heating available
- Compact, durable, and robust
- Low power consumption
- IP66 housing with mounting kit
- mA output suitable for industrial applications
- Cost-effective
- Optional accredited wind calibration (MEASNET) available

Vaisala WINDCAP® Ultrasonic Wind Sensor WXT532 is designed for demanding applications where stable and inexpensive wind measurements are required.

Proven Vaisala performance

WXT532 incorporates decades of Vaisala experience in wind measurement using ultrasound to determine horizontal wind speed and direction. With no moving parts, the sensor has high sensitivity as the measurement time constant and starting threshold are virtually zero. This makes it superior to conventional mechanical wind sensors.

WXT532 is designed to operate without periodic field calibration and maintenance.

Applications

WXT532 is ideal for use in marine applications as the housing with the mounting kit is water resistant. The sensor is also suitable for environmental monitoring, for example, for measuring wind speed and direction in automatic weather stations.

Easy to install

WXT532 is delivered fully assembled and configured from the factory. With Vaisala configuration software tool you can change the settings, such as averaging times, output mode, update intervals, measured variables, and message contents.

The sensor can be mounted either on top of a pole mast or on a cross arm. When using the optional mounting kit, the north alignment needs to be performed only once.

Heating

The optional heating available in WXT532 assists measurements in freezing or snowy weather conditions and in humid environments.

Since the heating circuit is independent of the operation power, separate power supplies can be used. Heating is switched on automatically at low temperatures, well before the freezing point.

Low power consumption

WXT532 has very low power consumption: in idle mode the device typically consumes about 2 ... 3 mW.



DNV GL TYPE EXAMINATION
CERTIFICATE No. TAA00000VF

Technical data

Wind measurement performance

Wind speed

Observation range	0 ... 60 m/s (134 mph)
Reporting range	0 ... 75 m/s (168 mph)
Response time	0.25 s
Available variables	Average, maximum, and minimum
Accuracy	±3 % at 10 m/s (22 mph)
Output resolution	0.1 m/s (km/h, mph, knots)

Wind direction

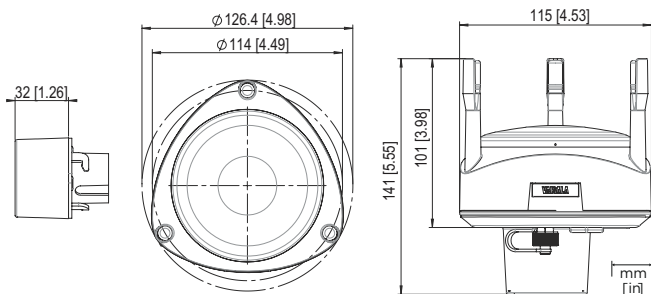
Azimuth	0 ... 360°
Response time	0.25 s
Available variables	Average, maximum, and minimum
Accuracy	±3.0° at 10 m/s (22 mph)
Output resolution	1°

Wind measurement frame

Averaging time	1 ... 3600 s, sample rate 1, 2, or 4 Hz (configurable)
Update interval	1 ... 3600 s (= 60 min), at 1 s steps

Inputs and outputs

Operating voltage	6 ... 24 V DC (-10 ... +30 %)
Average power consumption	Minimum: 0.1 mA at 12 V DC (SDI-12 standby) Typical: 3.5 mA at 12 V DC (typical measuring intervals) Maximum: 15 mA at 6 V DC (constant measurement of all parameters)
Heating voltage	DC, AC, or full-wave rectified AC 12 ... 24 V DC (-10 ... +30 %) 12 ... 17 V AC _{rms} (-10 ... +30 %)
Typical heating current	12 V DC: 800 mA, 24 V DC: 400 mA
Digital outputs	SDI-12, RS-232, RS-485, RS-422
Communication protocols	SDI-12 v1.3, Modbus RTU, ASCII automatic and polled, NMEA 0183 v3.0 with query option



WXT532 analog mA output options

When the analog output option is applied, digital communication is not available.

Wind speed	0 ... 20 mA or 4 ... 20 mA
Wind direction	0 ... 20 mA or 4 ... 20 mA

Options and accessories

Vaisala configuration tool and USB service cable SP	220614
Cable USB RS-232/RS-485 1.4 m USB M12 SP	220782
Cable 2 m shielded 8-pin M12 SP	222287
Cable 10 m shielded 8-pin M12 SP	222288
Cable 40 m shielded 12-pin, open end wires SP	217020
Cable USB with power supply RS-232 / 485 USB/ M12SP / 100-240 VAC	263193SP
Cable 10 meter shielded 8-pin M12	CBL210679
Cable 50 m shielded 8-pin M12, open end wires	245931
Bushing and grounding accessory kit	222109
Mounting kit	212792
Mounting accessory between mounting kit and 60 mm tube	WMSFIX60
Bird kit	212793

Operating environment

Operating environment	Outdoor use
Operating temperature	-52 ... +60 °C (-60 ... +140 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating humidity	0 ... 100 %RH
Operating pressure	500 ... 1100 hPa
Wind ¹⁾	0 ... 60 m/s (0 ... 134 mph)
IP rating	Without mounting kit: IP65 With mounting kit: IP66

Mechanical specifications

Dimensions (H × Ø)	141 × 114 mm (5.48 × 4.49 in)
Weight	510 g (1.12 lb)
Materials	
Radiation shield, top, and bottom parts	Polycarbonate +20 % fiberglass
Precipitation sensor plate	Stainless steel (AISI 316)

Compliance

EU directives and regulations	LVD, EMC, RoHS
EMC compatibility	EN 61326-1, industrial environment CISPR 32 / EN 55032, Class B
Environmental	IEC 60068-2-1, 2, 6, 14, 30, 31, 78 IEC 60529, VDA 621-415
Maritime	IEC 60945 (Exposed) DNV GL Type Examination Certificate No. TAA00000VF
Compliance marks	CE, RCM, RoHS, China RoHS, UKCA

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BWS500 Beacon Station



Vaisala Beacon® Station BWS500 is a compact weather station for environmental monitoring. The complete solution provides measurements, data collection, and data visualization in one package. BWS500 includes Vaisala Beacon Edge Gateway EGW501, a selected set of sensors, powering equipment, and mounting accessories. To maximize ease-of-use, the station comes with a data plan and a variety of service packages to choose from.

Features

- Compact end-to-end solution for various weather observation applications
- Accurate, high-quality weather data with Vaisala WXT530 Series Weather Transmitters and air quality data with Vaisala Air Quality Transmitter AQT530 and Vaisala CARBOCAP® Carbon Dioxide Probe GMP252
- Solar panel powering for installations at remote locations
- Secure software platform and data communications
- Remote monitoring service for carefree operation
- Data visualization with Wx Beacon and open API for third-party integrations

Complete solution

BWS500, when combined with data management and visualization software, includes the required hardware and software for managing your weather data. You can select to use Vaisala Wx Beacon for measurement data visualization.

BWS500 is suitable for a variety of applications and can be scaled to support both small and large-scale weather observation networks – from harbor and port weather to complementing national weather forecast networks.

Sensors for various measurement needs

The sensor selection of BWS500 includes the proven Vaisala WXT530 Series Weather Transmitters, Vaisala Air Quality Transmitter AQT530, and Vaisala CARBOCAP Carbon Dioxide Probe GMP252. WXT530 series sensors measure air pressure, temperature, humidity, rainfall, wind speed, and wind direction. AQT530 provides measurement data of the most important urban pollutant gases (NO₂, NO, O₃, CO) and particles (PM₁₀, PM_{2.5}, PM₁). GMP252 measures carbon dioxide concentration up to 10 000 ppm CO₂.

Secure data connectivity

BWS500 takes care of the measurements, as well as data storage and transfer with Vaisala Beacon Edge Gateway EGW501. EGW501 provides secure data transfer between the sensors and Wx Beacon. The integrated SIM card and cellular data plan make the station ready for use as soon as it is installed.

Flexible powering solution

Power Supply Unit PSU501 is the powering solution for BWS500, designed to ensure uninterrupted power supply (UPS) to the station. PSU501 can be used in sites where AC (mains) power is available, and in cases where AC (mains) is not available PSU501 can work together with an environmentally friendly solar panel or other DC power source.

PSU501 is suitable for both portable and fixed installations.

The solar panel in conjunction with low power consumption make BWS500 an ideal choice for data applications in remote locations.

To ensure sufficient power supply, solar power can be used only when a non-heated version of WXT530 series sensor is selected for BWS500 configuration.

Plug and play

A range of options for mast, tripod, and wall mounting are available for the station hardware, enabling optimal installation regardless of the location.

BWS500 is easy to install and requires minimal configuration. Simply install and connect the devices, and start gathering data.

Data sharing and management

The Vaisala Wx Beacon software collects and visualizes measurement data from the station. Once you have an account in Vaisala Wx Beacon, you can share the data to third-party services and systems through an open API.

Technical data

Operating environment

Operating environment	Outdoor use
Use in wet location	Yes
Operating temperature	-40 ... +55 °C (-40 ... +131 °F) ¹⁾
Storage temperature	-40 ... +70 °C (-40 ... +158 °F) ¹⁾
Operating humidity	0 ... 100 %RH ¹⁾
Pollution degree	2
Maximum operating altitude	2000 m (approx. 6500 ft)
IP rating	
WXT530 series	IP65, with mounting kit IP66
AQT530	IP65 ²⁾
GMP252 (probe body)	IP65
EGW501	IP67
PSU501	IP65

¹⁾ Excluding AQT530. See AQT530 specifications.

²⁾ Specified for gas measurement device only.

Powering

Powering options	<ul style="list-style-type: none"> Power supply unit PSU501 for AC (mains) power and solar panel/ external DC power use DC input without power supply unit
AC (mains) power	100 ... 240 V AC, ±10 % 50 ... 60 Hz 800 mA
AC (mains) fuse, internal (non-replaceable)	Type 3, 1.5 kV / 3kA
AC (mains) cable connection	<ul style="list-style-type: none"> Conductor cross-section (flexible): 0.75 ... 2.5 mm² (20 ... 14 AWG) Cable lead-through: for 6 ... 12.5 mm (0.24 ... 0.49 in) cable
External DC / Solar panel input	15 ... 32 V DC Max. 2 A
Solar panel ¹⁾	20 W for Vaisala-provided solar panel
Battery	Lead-acid battery
Battery capacity	12 V DC, 7 Ah
Overvoltage category	II
Power output (PSU501)	30 W
Power consumption ²⁾	
EGW501	< 0.75 W, typical

¹⁾ Solar panel feasibility and operation depends on the installation location and the amount of sunshine.

²⁾ For power consumption of sensors, see the relevant sensor documentation.

Communication options

Wireless communication	4G LTE / 3G / 2G
Maintenance communication	USB 3.0 Web UI (locally)
Data collection and visualization	Vaisala Wx Beacon
Data interfaces	<ul style="list-style-type: none"> Vaisala Wx Beacon open API Lightweight machine-to-machine (LwM2M) interface
Sensor interfaces	RS-485 Modbus

Compliance

EU directives and regulations	EMC, LVD, RED, RoHS
EMC compatibility	EN 61326-1, industrial environment CISPR 32 / EN 55032, Class B EN 301489-1 FCC part 15, class B ICES-3 (B)
Electrical safety	EN 61010-1
Cold	IEC 60068-2-1
Dry heat	IEC 60068-2-2
Vibration	IEC 60068-2-6 IEC 60068-2-64
Change of temperature	IEC 60068-2-14
Damp heat, cyclic	IEC 60068-2-30
Rough handling	IEC 60068-2-31
Damp heat	IEC 60068-2-78
Freezing rain	NWS 8.0
Compliance marks	CE, EAC/CE, FCC, IC, RCM, UKCA

Radio module

Acceptance	CE (Europe), EAC/CE (Ukraine), FCC (USA), IC (Canada), RCM (Australia and New Zealand), Giteki (Japan) ¹⁾
SIM card type	Mini-SIM
Frequency bands	
LTE-FDD	B1/ B2/ B3/ B4/ B5/ B7/ B8/ B12/ B13/ B18/ B19/ B20/ B25/ B26/ B28
LTE-TDD	B38/ B39/ B40/ B41
WCDMA	B1/ B2/ B4/ B5/ B6/ B8/ B19
GSM	B2/ B3/ B5/ B8

¹⁾ For a full list of global availability, see www.vaisala.com/en/bws500-support.

Sensor options

Vaisala WXT530 Series Weather Transmitter (heated or non-heated)
Vaisala Air Quality Transmitter AQT530
Vaisala Carbon Dioxide Probe GMP252

Mounting options

Mast 4 m (13 ft 1 in) ¹⁾	DKP204
Mast 3 m (9 ft 10 in) ¹⁾	DKP203
Mast 2 m (6 ft 7 in) ¹⁾	DKP202
Tripod 3 m (9 ft 10 in) ²⁾	DKT504
Wall mounting kit for gateway	ASM213843
Wall mounting kit for power supply units	ASM213949
Mast mounting kit for gateway	ASM213841
Mast mounting kit for power supply units	ASM213841

¹⁾ Installation to concrete foundation. Optional accessories: leveling/welding plate, tilt division flange, support guy wire set (DKP204 only), and lightning protection kit.

²⁾ Tripod comes with a toolkit, including tools bag, hammer, and ground pegs.

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Features

- Allows extensibility with 3 sensor connectors
- Buffers data from sensors for transfer to cloud in case of connection loss
- Enables remote sensor and gateway management and monitoring
- Remote update of sensor and gateway software to maximize up-to-date secure operation
- Integrated SIM card and ready-made data plan
- Tested to endure extreme weather conditions
- LED indication for status and connection

Vaisala Beacon® Edge Gateway EGW501 is a data collection and transfer solution that provides platform-level security for Vaisala Beacon Station BWS500. The integrated radio module and SIM card, together with the compact design, allow for speedy installation and commissioning.

Connection point for sensors

EGW501 has 3 dedicated connectors for sensor-to-gateway communication, a power connector, and a connector for local maintenance connection. EGW501 supports a selected set of Vaisala sensors and, in the future, also third-party sensors.

Data buffering and transfer

EGW501 handles data transfer between the sensors and a Vaisala cloud. Additionally, it provides data collection and storage. EGW501 buffers the observation data for transmission at regular intervals. The local buffering capacity ensures that no data is lost and there are no communication breaks.

Remote update and diagnostics

Because of the Internet connectivity, the gateway firmware can be updated remotely. With the remote device management and monitoring service, there is less need for site visits.

Remote operations are supported with diagnostics to ensure speedy recovery from error situations.

Local management

In normal use, site visits are rare. When you need to visit the site to, for example, establish a direct connection to EGW501, a local connection is simple to establish. Simply connect your laptop to EGW501 using a USB-C cable and access the browser-based Web UI tool.

Cellular data service subscription

EGW501 operates as a secure gateway between the weather station and the outside world.

It is plug and play out of the box. Using the integrated radio and SIM card, the data is transferred over a cellular connection. The cellular data plan is available as a service for a range of countries.

Technical data

Operating environment

Operating environment	Outdoor use
Use in wet location	Yes
Operating temperature	-40 ... +55 °C (-40 ... +131 °F)
Storage temperature	-40 ... +70 °C (-40 ... +158 °F)
Operating humidity	0 ... 100 %RH
Pollution degree	2
Maximum operating altitude	2000 m (approx. 6500 ft)
IP rating	IP67

Powering

Operating voltage	9 ... 32 V DC
Current consumption, maximum	2 A
Mating connector (power input)	M12 A-coded 4-pin female

Processing system

Processor	ARM Cortex A9, 800 MHz
Memory	1 GB DDR3L RAM, 8 GB eMMC Flash
Operating system	Linux
Communications protocol	IPv4

Radio module

Acceptance	CE (Europe), EAC/CE (Ukraine), FCC (USA), IC (Canada), RCM (Australia and New Zealand), Giteki (Japan) ¹⁾ <ul style="list-style-type: none"> FCC ID: 2A039-EGW501 ICED ID: 23830-EGW501
SIM card type	Mini-SIM
Frequency bands	
LTE-FDD	B1/ B2/ B3/ B4/ B5/ B7/ B8/ B12/ B13/ B18/ B19/ B20/ B25/ B26/ B28
LTE-TDD	B38/ B39/ B40/ B41
WCDMA	B1/ B2/ B4/ B5/ B6/ B8/ B19
GSM	B2/ B3/ B5/ B8

¹⁾ For a full list of global availability, see www.vaisala.com/en/bws500-support.

Mechanical specifications

Weight	1 kg (2.2 lb)
Package dimensions (L × W × H)	306 × 184 × 156 mm (12.05 × 7.24 × 6.14 in)
Mating connectors (sensor input)	<ul style="list-style-type: none"> 1 × M12 8-pin male 2 × M12 5-pin male
Material, enclosure	Polycarbonate (PC)
Material, connectors	Nickel-plated brass

Mounting options and accessories

Mast mounting kit for pole masts Ø 60 ... 200 mm (2.36 ... 7.87 in), includes mounting brackets, steel band, accessories, and 5-mm Allen key	ASM213841
Tripod mounting kit, includes mounting brackets and accessories	ASM213954
Wall mounting kit, includes mounting plate, screws, and wall plugs	ASM213843
USB-C maintenance cable ¹⁾	-

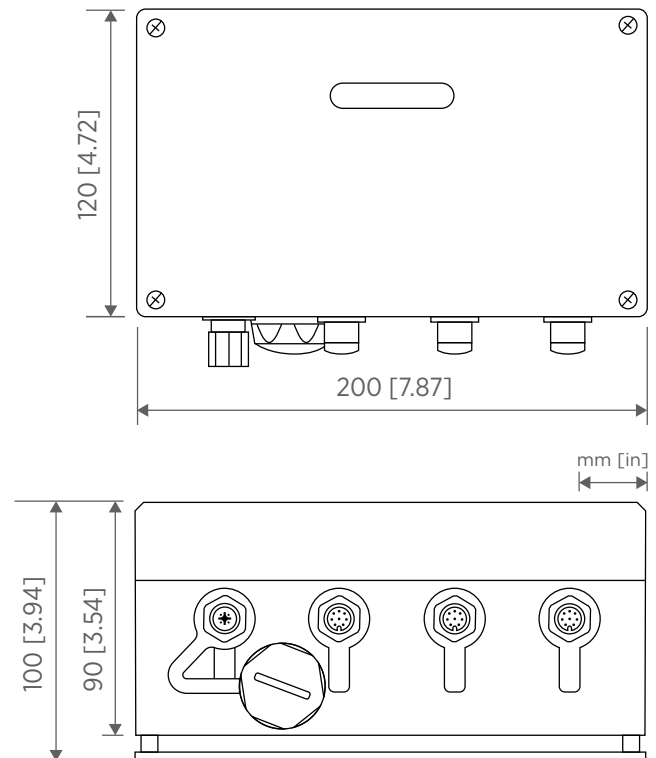
¹⁾ Delivered with each gateway.

Communication options

Wireless communication	4G LTE / 3G / 2G
Maintenance communication	USB 3.0 Web UI (locally)
Data interfaces	Lightweight machine-to-machine (LwM2M) interface
Sensor interfaces	RS-485 Modbus

Compliance

EU directives and regulations	EMC, LVD, RED, RoHS
EMC compatibility	EN 61326-1, industrial environment CISPR 32 / EN 55032, Class B EN 301489-1 FCC part 15, class B ICES-3 (B)
Radio compatibility	EN 301 908-1 EN 301 511 FCC part 22, 24, 27, 90
Electrical safety	EN 61010-1
Cold	IEC 60068-2-1
Dry heat	IEC 60068-2-2
Vibration	IEC 60068-2-6 IEC 60068-2-64
Change of temperature	IEC 60068-2-14
Damp heat, cyclic	IEC 60068-2-30
Rough handling	IEC 60068-2-31
Damp heat	IEC 60068-2-78
Corrosion and salt mist	VDA 621-415
Freezing rain	NWS 8.0
Compliance marks	CE, EAC/CE, FCC, IC, RCM, UKCA



EGW501 dimensions and connectors

DKT504 Tripod Mast

Vaisala Tripod Mast DKT504 is designed to enable the use of Vaisala BWS500 as portable weather station. Fast and easy to assemble, the tripod is suitable for temporary installations as well as for long term installations with no need for civil works.



Used in many applications

DKT504 is suitable for a wide range of applications, such as meteorological and environmental research, construction, agromet, and recreational weather. It supports the attachment of BWS500 components: sensors, solar panels, and gateway and power supply unit enclosures.

Portable solution

DKT504 is a portable, lightweight mast that it easy to set up in a variety of locations. Its individually-adjustable legs allow installation even on an uneven terrain. Pegs are used to secure the tripod in place.

The tripod comes in a carry case and it can be easily collapsed for transportation when needed. The carry case has fastening straps inside to secure the tripod during the transportation.

Delivery contents

DKT504 mast tube and legs are made of anodized aluminum and it includes a toolkit, which makes it suitable for remote locations and demanding environments.

Features

- Can be used in temporary and long term installations with no need for civil works
- Suitable for various applications
- Easy to set up and dismantle by one person
- Portable, comes in a carry case
- Individually-adjustable legs allow installation on uneven ground

DKT504 technical data

Operating environment

Maximum wind load	25 m/s ¹⁾
Maximum slope angle	30° (one leg oriented downhill)

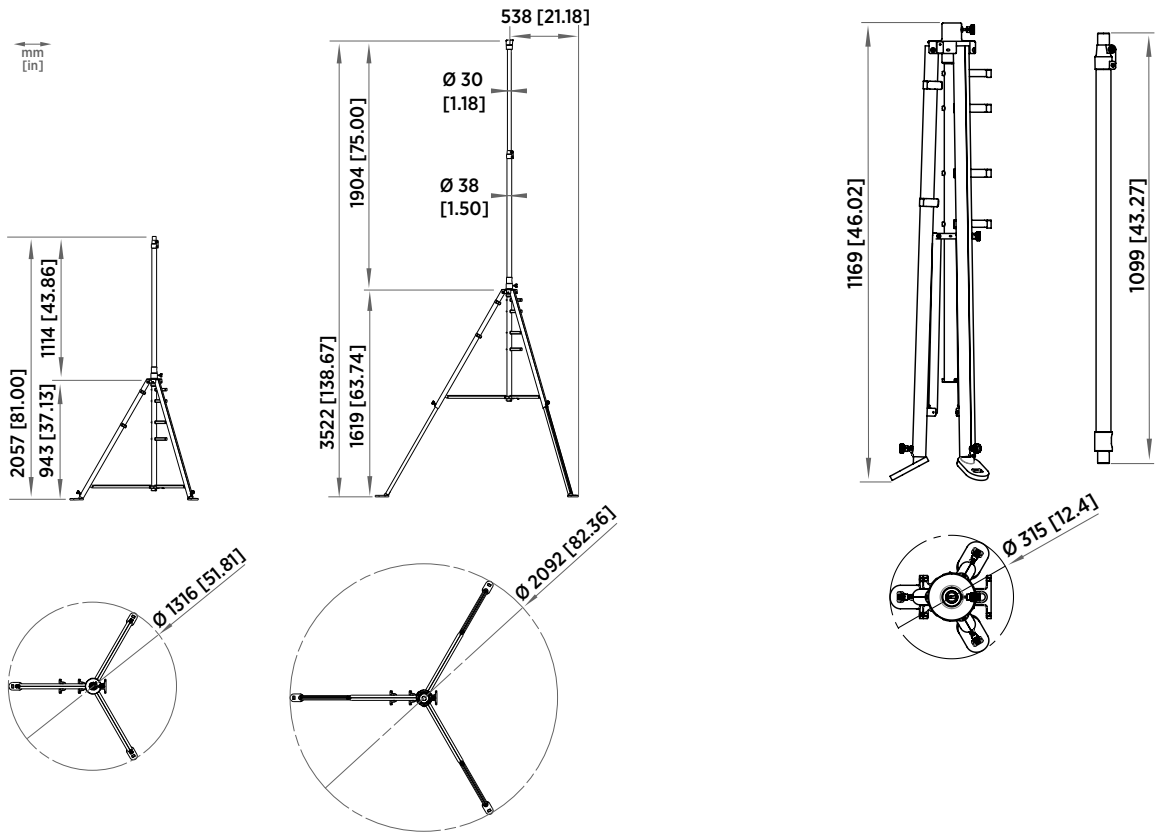
¹⁾ When installed on firm soil and anchored to the ground with pegs.

Mechanical specifications

Tripod and telescopic mast	Adjustable legs and mast
Height	2057 ... 3522 mm (81.00 ... 138.67 in)
Mast length	1114 mm (43.86 in)
Mast length with extension	1904 mm (75.00 in)
Base diameter	1316 ... 2092 mm (51.81 ... 82.36 in)
Mast outer diameter	Ø 38 mm (1.50 in)
Mast extension outer diameter	Ø 30 mm (1.18 in)
Tripod weight (legs and mast)	8.7 kg (19.2 lb)
Total weight (tripod, toolkit, and bag)	13.6 kg (30 lb)
Maximum weight for equipment	10 kg on the mast + 10 kg on the tripod legs
Color	Natural grey
Materials	
Mast tube and legs	Anodized aluminum
Screws and washers	Stainless steel
Locking part in telescope mast	Composite

Package

Type	Soft shoulder bag
Material	Canvas
Length	1350 mm (53.15 in)
Diameter	Ø 400 mm (15.75 in)
Empty weight	2.6 kg (5.7 lb)
Example weight (including tripod, toolkit, bag, and solar panel SOL501)	16.5 kg (36.4 lb)



Dimensions



Features

- Power supply unit
 - Weather resistant with durable polycarbonate enclosure
 - Includes battery backup
 - Autodiagnostic data available when used with Vaisala Beacon® Station BWS500
- Installation
 - Easy to install
 - Mast, tripod, and wall mounting options for power supply unit
 - Mast or tripod mounting options for solar panel

Versatile powering solution with AC (mains) powering and DC powering with an optional solar panel is available for Vaisala Beacon Station BWS500. The mounting options are similarly versatile: you can choose from mast, tripod, and wall mounting.

Versatile powering solution

Power Supply Unit PSU501 is the powering solution for Vaisala Beacon Station BWS500, designed to ensure uninterrupted power supply (UPS) to the station. PSU501 can be used in sites where AC (mains) power is available, and in cases where AC (mains) is not available PSU501 can work together with an environmentally friendly solar panel SOL501/SOL502 or other DC power source.

PSU501 is suitable for both portable and fixed installations.

The solar panel in conjunction with low power consumption make BWS500 an ideal choice for data applications in remote locations.

PSU501 for AC (mains) and DC power

PSU501, when used with AC (mains) power, requires a licensed expert such as an electrician for installation. The PSU501 enclosure contains a backup battery to ensure operation during power failure or outage.

When used with BWS500, PSU501 provides autodiagnostic data, such as the battery level.

Solar Panel 20 W

Vaisala Solar Panel comes in 2 variants to allow mounting on a mast (SOL502) or tripod (SOL501).

The use of the solar panel can be considered in locations with sufficient amount of sunlight.

To ensure sufficient power supply, the solar panel can be used only when a non-heated version of Vaisala WXT530 Series Weather Transmitter is selected for BWS500 configuration.

Technical data

Powering options

Vaisala power supply unit for AC (mains) and DC power	PSU501
Vaisala Solar Panel 20 W ¹⁾	SOL501/SOL502

¹⁾ Power supply unit not included.

PSU501 operating environment

Operating environment	Outdoor use
Use in wet location	Yes
Operating temperature	-40 ... +55 °C (-40 ... +131 °F) ¹⁾
Operating humidity	0 ... 100 %RH
Pollution degree	2
Maximum operating altitude	2000 m (approx. 6500 ft)
IP rating	IP65

¹⁾ The capacity of the backup battery degrades in cold temperatures.

PSU501 powering

Input power (AC)	100 ... 240 V AC, ±10 % 50 ... 60 Hz 800 mA
Input power (DC) ¹⁾²⁾	15 ... 32 V DC Max. 2 A
Nominal output voltage, AC input connected	24 V In backup (battery) mode: 12 V
Nominal output voltage, AC input not connected	12 V ³⁾
DC output current	Max. 1.2 A
AC (mains) fuse, internal (non-replaceable)	Type 3, 1.5 kV / 3kA
AC (mains) cable connection	<ul style="list-style-type: none"> Conductor cross-section (flexible): 0.75 ... 2.5 mm² (20 ... 14 AWG) Cable lead-through: for 6 ... 12.5 mm (0.24 ... 0.49 in) cable
Overvoltage category	II
Battery type ⁴⁾	Valve-regulated lead-acid (VRLA) battery
Nominal battery capacity	12 V DC, 7 Ah
Expected battery lifetime	3 ... 5 years
Battery dimensions (H × W × L)	Approx. 97.5 × 65 × 151 mm (3.84 × 2.56 × 5.94 in)

¹⁾ In PSU501, solar panel or other external DC power supply is connected to **DC in**. EGW501 of Beacon Station is connected to **DC out**.

²⁾ DC power supply must have reinforced insulation between AC (mains) and output.

³⁾ The actual output voltage equals the DC input voltage (max. 32 V).

⁴⁾ Vaisala recommends, for example, YUASA NP7-12.

PSU501 mechanical specifications

Dimensions (H × W × L)	244.5 × 164.2 × 101.0 mm (9.63 × 6.46 × 3.98 in)
Weight	4 kg (8.8 lb)
Material, enclosure	Polycarbonate
Mating connectors	<ul style="list-style-type: none"> DC in: M12 A-coded 4-pin female DC out: M12 A-coded 4-pin male AC in: 4-pin female circular connector

PSU501 compliance

EU directives and regulations	EMC, LVD, RoHS
EMC compatibility	EN 61326-1, industrial environment CISPR 32 / EN 55032, Class B FCC part 15, class B
Electrical safety	EN 61010-1
Cold	IEC 60068-2-1
Dry heat	IEC 60068-2-2
Vibration	IEC 60068-2-6 IEC 60068-2-64
Change of temperature	IEC 60068-2-14
Damp heat, cyclic	IEC 60068-2-30
Rough handling	IEC 60068-2-31
Damp heat	IEC 60068-2-78
Corrosion and salt mist	VDA 621-415
Freezing rain	NWS 8.0
Compliance marks	CE, FCC, RCM, UKCA

PSU501 mounting options and accessories

Mast mounting kit for pole masts Ø 60 ... 200 mm (2.36 ... 7.87 in), includes mounting brackets, steel band, accessories, and 5-mm Allen key	ASM213841
Tripod mounting kit, includes mounting brackets and accessories	ASM213954
Wall mounting kit, includes mounting plate, screws, and wall plugs	ASM213949
Cable, PSU501 to gateway ¹⁾	-
AC (mains) power connector ¹⁾	-

¹⁾ Delivered with each power supply unit.

Solar panel options

Solar panel for tripod mounting, includes mounting brackets, cable, and accessories	SOL501
Solar panel for pole masts Ø 60 ... 200 mm (2.36 ... 7.87 in), includes solar panel holder, mounting brackets, steel band, cable, and accessories	SOL502

SOL501/SOL502 specifications

Operating environment	Outdoor use
Use in wet location	Yes
Nominal voltage	12 V DC
Maximum power	20 W
Voltage at maximum power (V _{mpp}), typical	18.5 V
Current at maximum power (I _{mpp}), typical	1.09 A
Open-circuit voltage	22.6 V
Short-circuit current (I _{sc}), typical	1.19 A
Dimensions (H × W × D), without mounting frame	440 × 350 × 49.6 mm (17.32 × 13.78 × 1.95 in)
Dimensions (H × W × D), including mounting frame	377.5 × 350 × 319.7 mm (14.86 × 13.78 × 12.59 in)
Weight, including mounting frame	4.3 kg (9.5 lb)
Weight, including mounting frame and power supply unit	7.7 kg (17 lb)

VAISALA

www.vaisala.com



Features

- Chemical Supply Management
- Complete transportation forecast services (atmospheric, road surface and friction, consultative)
- Live and archived road weather data
- Radar and satellite overlay (where available)
- Operations management
- Reporting capabilities
- View multiple stations or single sites
- Data import/export capabilities
- Internal and External Communication

Vaisala RoadDSS Manager is a road weather software system that provides the decision maker with a complete set of tools to make operational decisions.

Benefits

- Treatment proposals based on your agency's guidelines
- User personalization
- Customer designed interface with customizable views
- Proposals can be automated or manual
- Combines fixed, mobile, and other weather data in one platform
- Hosted solution so no need to manage server(s)
- Street level mapping provides improved detail
- Provide road weather data - past, present, and future

RoadDSS Manager allows decision makers to access all relevant weather data, such as fixed road weather stations, mobile road weather data, vehicle traffic, satellite and radar information, in one location.

The system provides a complete view of road weather data through time, by providing historical views of past information, conditions in near real-time, and predictions of conditions in the

future with road weather forecasts that allow for proper planning. Using all of this information, RoadDSS Manager integrates the road authority's own operational guidelines and policies to provide treatment proposals, delivering a consistent guide for decisions makers.

A True Decision Tool

The growing trend in decision management tools is to not only provide quality information to make a decision, but to also provide a proposed action. RoadDSS Manager takes in current conditions, past maintenance activities, and road weather forecasts, and provides a treatment or maintenance strategy.

The proposals do not replace an actual human decision maker, but give guidance as to what they could be doing based on best practices and approved policies. The tool is perfect for inexperienced supervisors, or agencies wanting to deliver efficiency and consistency in decision making.

RoadDSS Manager enables the implementation plan to be tracked through to completion in the operations screen. This ensures the agency has a full audit trail of operational activity.

A final critical piece of decision making is communicating information out to the stakeholders in a efficient and uniform way. RoadDSS Manager takes care of this for you, improving your speed of decisions.

Data Across Time

With RoadDSS Manager, the decision makers get a total view of the data throughout time. Historical data is easily accessible and the displays can be viewed exactly as they appeared during an event. The data provides a learning tool for analysis of past performance with a real understanding of the outcome.

RoadDSS Manager also provides a wealth of current road weather information in several views and displays. Other weather data, such as radar and satellite images (if available) can be viewed with the road weather data, providing a complete weather picture.

The most critical weather information for decision making is knowing the future state of the road. RoadDSS Manager allows viewing the forecast surface state with intended treatment before confirming the plan.

Technical Data

Map Displays

- Street level resolution map displaying station information, including air and surface temperature, surface state, wind, camera images, precipitation, humidity, traffic data and much more, depending on the sensors installed.
- Color coded status parameters including surface temperatures, surface state, wind speed, level of grip, and visibility.
- Optional displays such as radar, lightning, and terrain maps.
- Zooming in an out capability and the ability to go back or forward 24hrs to see observed and forecast values of all station parameters.

Stations

- Display camera image, if available, along with surface state and select weather parameters, in addition to a wind rose indicating wind speed and direction.
- Configurable Graph Tabs
- Surface state bars showing road conditions and road state, past current and forecasted.
- Wind speed and direction on a timeline that can be adjusted to see more or less past conditions and forecast.
- Forecast text describing conditions for the next hours or days.
- Alert Management capability to provide weather alerts on wind speed, visibility, and slippery conditions, and choice of e-mail and/or SMS messages.
- Camera Wall showing current image displays from weather stations equipped with cameras.
- Wind Rose Wall displaying wind data and threshold breach alerts from all weather stations equipped with appropriate instrumentation on the network.

Weather Forecast

Text and chart displays of multiple forecasts including Morning Summary, 24 hour forecasts, 2-5 day forecast, or other type, based on forecast supplier data.

Planning

- Ability to set up an unlimited number of routes, with the flexibility to group them according to the operational workflow.

- Auto-propose capabilities that takes the current and forecasted conditions and proposes treatment as a starting point, based on previously set up road authority guidelines.
- Ability to manually propose treatments or edit auto-propose actions.
- Surface state displays of road conditions before and after proposed treatment, in the forecasted side of the timeline.
- Display of the Stations graphs with the added benefit of seeing the forecast surface state after one or more treatments.
- Selection of Cause, Action, Start Time, and Comments for each of the treatment proposals (manual or automatic).
- Continuous tracking of events and treatment proposals.

Operations

- Software can be used to efficiently communicate current maintenance strategies to crews and other stakeholders.
- Continuous tracking of operations
- Ability to adjust start and end times of the operation.
- Ability to add comments for justifying each operation or indicating changes to the standard procedure.
- Track start and end times, treatment cause, and comments for each phase of the operation.
- Electronic date time and user stamp associated with each logged activity enabling comprehensive audit trail.

Miscellaneous

- Archiving capabilities to review past performance and decisions made. Screens display the same information that was displayed at the time.
- User hierarchy to manage access rights and enable tailoring in accordance with job role.
- Data Reports and Online Help
- Multiple logins per customer, with user personalized displays
- Comprehensive audit trail



Map view of Vaisala RoadDSS Navigator

Features

- Easy-to-use interface with customizable views
- Works with latest versions of Microsoft Internet Explorer and Mozilla Firefox browsers
- Easy to implement and maintain
- Shows real-time data on a map, table or graph
- Alerting and Alarming Feature
- Easy access to service from anywhere with an Internet connection
- GIS maps optimized for displaying road weather data

Vaisala RoadDSS Navigator is a hosted web user interface for viewing past, present and future road weather data. The application displays data collected by the Vaisala Global Data Management Center, which handles data collection from the road weather networks around the world.

More Features

- Historical data available
- Compare and contrast road weather observations with other road information all in the same application
- Configurable e-mail and SMS alerts
- Supports animation of radar, satellite and other map based information where available
- Generate reports quickly and in a printer friendly format
- Station data export for easy data analysis offline

The application consists of a set of dynamic web pages that can be viewed with a simple Internet connection. The Vaisala RoadDSS Navigator also features GIS maps which are optimized to clearly display road weather data, including Thermal Mapping and mobile weather observations, where available.

The Navigator user interface is part of the Vaisala RoadDSS Software Suite and provides the added functionality of providing detailed reporting. The reports save you time in compiling information from the system making your job easier. Navigator also includes detailed alerting functionality that continuously monitors specific parameters you make decisions on, and then provides you with notification as soon as those thresholds are reached. Vaisala RoadDSS Navigator was designed by Vaisala customers, which means it fits into your operations more naturally.

Customizable Views

Vaisala RoadDSS Navigator has been designed with user convenience in mind. You can easily customize the application to suit your needs. This will allow you to view only the important and relevant information, which will help you focus quickly and easily on the job at hand.

Browse Observations and Forecasts with Ease

The application has many features that make browsing the data very easy. For instance, with the powerful Time Slider feature you can quickly see on the map page all the observations and any forecasts that are available for 24 hours on either side of the actual time. This gives an unparalleled overview of past, present and future conditions at a glance. It also takes less time to train staff on how to use the program, which results in a quicker return on investment.



Single station graph

System Requirements

- Internet connection
- Web browser – supported browsers are Microsoft Internet Explorer v. 7 or later and the latest Mozilla Firefox
- Cookies must be enabled
- Adobe Flash Player v. 10 or later
- To view PDF reports, Adobe Reader v. 9 or later
- To view data exports, Microsoft Excel v. 2003 or later

All the Relevant Data in the Same Application

One of the key features in the Vaisala RoadDSS Navigator is it has the ability to compare and contrast road weather information with other relevant data. Where available this could include weather radar, satellite and traffic counting data, automatic vehicle location (AVL) data, all in the same application. With all this data in the same place you can easily see how the weather affects traffic flow, and plan your actions accordingly. In addition, some features

can be conveniently animated for easy representation of moving weather events and developing situations that need monitoring.



Features

- Incorporates data from the Runway Weather Information System (RWIS) and your airport surface condition information into forecasts.
- Provides a 72-hour prediction of conditions at your airport.
- IceBreak runway surface model for generating runway and taxiway surface forecasts

Vaisala RoadDSS Navigator Runway Weather Forecast is a tool to help plan your operations, providing you with a traditional atmospheric weather forecast, and a prediction of runway and taxiway surface conditions. Vaisala Runway Weather Forecast is an optional component of the RoadDSS Navigator Software Suite, and provides you with a 72-hour prediction of conditions at your airport.

In airport maintenance knowing what is currently going on is critical to a successful maintenance operation; however, this does not provide the whole picture or tell us what is going to happen. Recognizing when to prepare for an icing event or a winter storm can save money, resources, and most importantly, lower your stress level.

Today, with so many new maintenance practices, it just as important to know what you do as when you will do it. Vaisala RoadDSS Navigator Runway Weather Forecast is a tool to help plan your operations, providing you with a traditional atmospheric weather forecast, and a prediction of runway and taxiway surface conditions. Vaisala Runway Weather Forecast is an optional component of the RoadDSS Navigator Software Suite, and provides you with a 72-hour prediction of conditions at your airport.

The value that Vaisala Runway Weather Forecasts provide you is the perfect combination of current observations and predicted weather conditions. To create any weather forecast, current local conditions are important, and Vaisala incorporates data from the Runway Weather Information System (RWIS) to provide a baseline for the forecast.

Intelligent Weather

A key concern when building an airport maintenance weather program is making sure you have a fully integrated system that provides you the value you need. Vaisala Runway Weather Forecast is part of RoadDSS Navigator Software Suite, which means you receive both your current RWIS information within the

same user interface as your airport surface condition forecasts. Combining both provides quick, easy access, and allows for integrated features, such as current and predicted values in a single graph. This means you can quickly determine how well a forecast is performing, and whether any short-term adjustments are needed.

Reliable Decisions

At the heart of the airport surface forecast is the model used to predict runway conditions. Vaisala incorporates a cutting-edge proprietary runway surface model called IceBreak to generate runway and taxiway surface forecasts. A key to a runway surface model accuracy is the years of operation. Just like a person on the job, a model is tweaked and improved over the years to ensure it remains the industry leading model and provides you key decision information.

Benefits

- Be able to make confident decisions about weather
- Tool to help choose maintenance actions
- Less stress during decision making times
- Save money through better use of resources
- Keep airport as safe as possible and operational
- Less impact on the environment

Technical Data

Roadway Forecast Parameters Available

- Roadway Forecast Parameters Available
- Runway/taxiway Surface Temperature
- Runway/taxiway Surface State
- Runway/taxiway Sub-Surface Temperature
- Runway/taxiway surface Grip Estimate
- Base (Sub-Surface) Temperature

Atmospheric Forecast Parameters Available

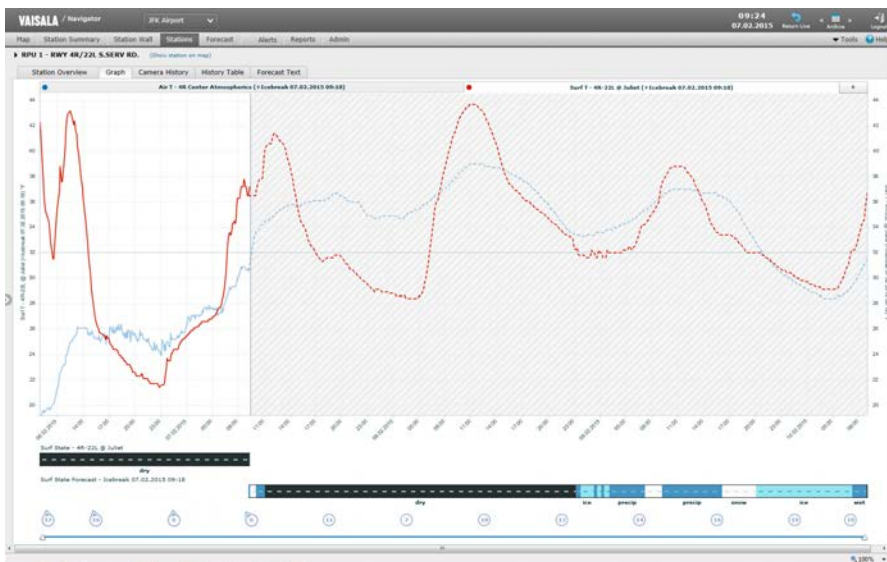
- Air Temperature
- Dew Point Temperature
- Cloud Cover
- Wind Speed
- Wind Direction
- Precipitation

Optional Forecast Consultancy Services (Not available in all regions)

- 24/7 access to a certified meteorologist, year-round
- Service targeted to your applications with access to meteorologists that understand your operations
- Tailored to client operations and impacts
- Targeted daily textual forecast products
- Proactive notifications of impending storms and weather impacts to customer operations
- Dedicated daily weather conference call for your staff

Other Information

- Standard forecast length is 72 hours
- High frequency forecast updates – hourly and 3-hourly options available
- Optional graphical atmospheric forecast outlook products - 24- hour forecast and 5-day outlook are available



Runway Weather Forecast appears within RoadDSS Navigator Software Suite

Flexible Sources

The RoadDSS Navigator Runway Weather Forecast can work with your current provider, ingesting their atmospheric weather forecast, while also providing you even more information through the Vaisala forecast.

If you do not already have a preferred forecast provider, Vaisala works with leading services around the globe to ensure you receive the best possible prediction.



Features

- Compact, multi-parameter mobile sensor
- Designed for snow plow trucks, suitable for any vehicle
- Proven DSC technology optimized for mobile measurements
- Simultaneous water, ice, and snow layer reporting
- Molded design to withstand heavy vibration and water ingress
- Patent pending double-hood for window protection
- Hand-removable hood for easy window cleaning

Vaisala Mobile Detector MD30 is a mobile road and runway condition sensor for winter maintenance operations. The compact MD30 measures all key surface weather parameters and is suitable for snow plow trucks and other vehicles. MD30 data is targeted to enable more accurate maintenance decision-making and salt usage optimization.

Measurements

- Grip
- Surface state
- Surface layer thickness
- Surface temperature
- Air temperature
- Dew point and frost point
- Relative humidity

Reliable in any weather

To provide quick response time and high sensitivity in road and runway condition reporting, MD30 utilizes an improved, fast-measuring version of the proven DSC laser technology. In cases where external heat sources could disturb the temperature measurements, the surface and air temperature sensors can be separated from the MD30 body and placed in desired locations.

Robust for any vehicle

The rugged design allows MD30 to operate in snow plow trucks and other vehicles. The core is molded to withstand continuous vibration and to prevent water ingress. Further, the hood has a special vented double structure that directs air flow to protect the window from dirt and splashes.

Easy to use and maintain

MD30 provides simplicity for both use and maintenance. It starts to measure automatically when the vehicle starts, and constantly monitors the sensor status, such as the window contamination. The window is heated to avoid dew and frost formation. The sensor automatically indicates the need to clean the window. When cleaning is needed, the window can be accessed by simply removing the hood by hand, without any tools.

Compact and cost-effective

MD30 provides grip, as well as other key measurements in one package. The cost-effective product allows you to use the full potential of your vehicle fleet as a data collection platform.

Output and visualization

MD30 outputs a binary data message over an RS-232 interface, which can also be turned wireless with an external Bluetooth module.

MD30 data can be collected and locally visualized with Vaisala RoadAI Android mobile application. The app can also be set to record video or take photos.

The powerful combination of sensor data, images and video can be visualized in Vaisala Wx Horizon or Vaisala RoadAI online maps.

In Wx Horizon, MD30 data can be used to improve road and runway weather forecasts and it can be combined with fixed weather station data in the same map.

Technical Data

Measurement specifications

Grip and surface state	
Reported level of grip	0.09 ... 0.82
Reported surface states	Dry, moist, wet, snowy, icy, slushy
Surface layer thickness	
Water	0 ... 5 mm (0 ... 0.20 in)
Ice	0 ... 2 mm (0 ... 0.08 in)
Snow (water equivalent) ¹⁾	0 ... 1 mm (0 ... 0.04 in)
Accuracy, water and ice ²⁾	±10 % at 0 ... 2 mm (0 ... 0.08 in)
Surface temperature	
Measurement range	-40 ... +60 °C (-40 ... +140 °F)
Air temperature and relative humidity	
Humidity range	0 ... 100 %RH
Temperature range	-40 ... +60 °C (-40 ... +140 °F)
Dew point range	-40 ... +60 °C (-40 ... +140 °F)

1) 1 mm (0.04 in) snow water equivalent corresponds to snow depth of approx. 10 mm (0.39 in).
 2) According to laboratory measurement method as described in latest draft (2020) of EN 15518-4.

Measurement details

Measurement interval	40 times/s
Light source	Laser
Layer thickness reporting	3 layers simultaneously (water, ice, snow)
Window dew/frost protection	Heated window
Window contamination reporting	Clean, contaminated, heavily contaminated
Window cleaning access	Hand-removable hood

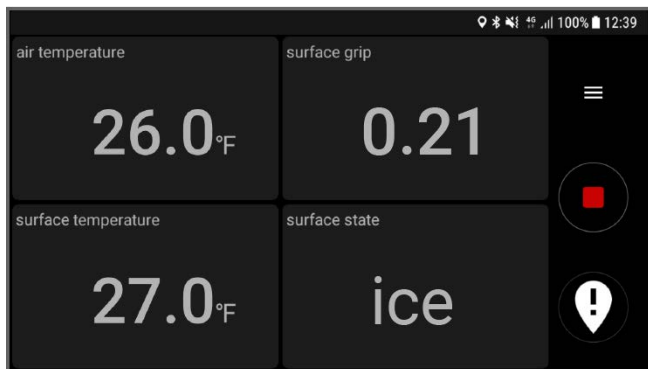
Operating environment

Operating temperature ¹⁾	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-40 ... +60 °C (-40 ... +140 °F)
Operating humidity	0 ... 100 %RH

1) In +35 ... 60 °C (+95 ... 140 °F), surface layer thickness measurement performance may be degraded.

Inputs and outputs

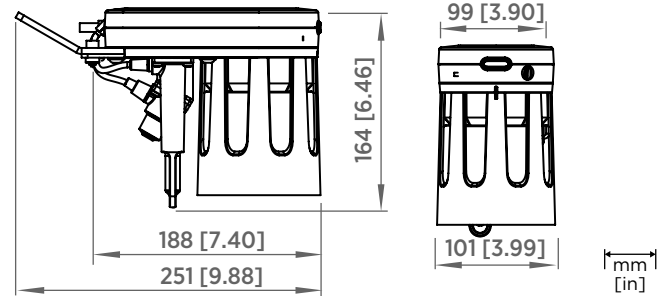
Powering	12 ... 32 V DC
Power consumption, maximum	15 W
Protocol	RS-232
Protocol, with optional Bluetooth module	RS-232-to-Bluetooth
Data output	Binary



Data visualization on Vaisala RoadAI mobile app

Mechanical specifications

Sensor structure	Encapsulated and molded
IP rating	IP68
Installation height, mobile sensor	20 ... 110 cm (7.87 ... 43.31 in)
Weight, mobile sensor with bracket	1.8 kg (4.0 lb)



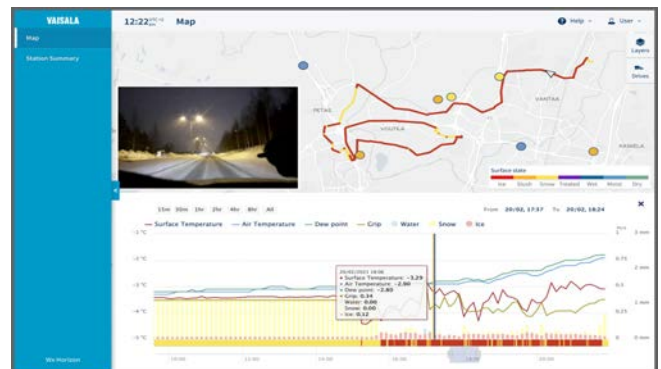
Mounting options

Standard mounting bracket for front, side, rear, bottom mounting	MDBRACKET ¹⁾
Front towing hook mounting	MD30FRONTMOUNT
Rear trailer hook mounting	MD30REARMOUNT ²⁾ MD30REARKIT ³⁾
Mounting kit for temperature sensors	MD30EXTSET

1) Delivered with each MD30 sensor.
 2) MD30 mounting kit for vehicle rear trailer hook.
 3) MD30 sensor with mounting kit for vehicle rear trailer hook and Bluetooth module enclosure.

Compliance

EU directives and regulations	EMC Directive (2014/30/EU)
EMC compatibility	EN 61326-1, industrial environment CISPR 32 / EN 55032, Class B FCC part 15, class B ICES-3 (B)
Cold	IEC 60068-2-1
Dry heat	IEC 60068-2-2
Change of temperature	IEC 60068-2-14
Shock	IEC 60068-2-27
Damp heat, cyclic	IEC 60068-2-30
Vibration	IEC 60068-2-64
Corrosion and salt mist	VDA 621-415
Eye safety	IEC 60825-1 Class 1 laser product
Compliance marks	CE, China RoHS



Data visualization on Vaisala Wx Horizon online map

Ground Cast Sensor



Vaisala Ground Cast Sensor provides an easy and affordable way to get key road weather measurements from critical locations that have not been covered before. It measures road temperature and the amount of treatment materials with the same performance as Vaisala's industry leading road weather stations.

Improve situational awareness and quality of pavement forecasts

Because efficient winter maintenance decision-making requires understanding of current and future road conditions, Ground Cast Sensor not only reports high-quality local observations, but also enhanced point forecasts.

Pavement forecast quality can be enhanced specifically by using Ground Cast Sensor's reference-grade surface temperature and base temperature (-30 cm or -11.8 in) measurements.

Measure from locations not possible before

Infrastructure-free installation and wireless design of Ground Cast Sensor allow rapid deployment to virtually any location in your road network. It works as a stand-alone unit and does not require external powering or coupling with a road weather station. Ground Cast Sensor offers a cost-effective way to complement your current weather observation network with additional measurement locations.

3+ year lifetime without any maintenance needs

Ground Cast Sensor includes a patent-pending wear-with-road mechanism that ensures the sensor stays always leveled with the road surface. As a result, the

sensor does not need maintenance during its lifetime, unlike conventional embedded sensors that may need annual grinding in roads where studded winter tires are used. The completely sealed construction makes the sensor incredibly robust and helps to minimize the risk of water leakage.

All wireless, yet reference grade

Ground Cast Sensor provides the same reference-grade measurement quality as Vaisala road weather stations and sensors. This ensures all data from your road network is comparable and reliable.

Easy access to data

The information provided by Ground Cast Sensor is automatically available in Vaisala Wx Horizon or alternatively as an API for integration into other systems. In Wx Horizon, the data can be visualized in the same way as other Vaisala road weather station data. The system provides a map view to understand the overall road conditions, location-specific graphs, and forecasts to provide insight into future road conditions. Configurable alerting can be set up for situations when, for example, the surface temperature drops below freezing and conditions are becoming hazardous.

Features

- Reports observations with enhanced point forecasts
- Wireless and self-powered
- 3+ year battery lifetime
- Measures:
 - Temperature at 3 levels: surface, -6 cm, -30 cm (-2.4 in, -11.8 in)
 - Treatment material amount
 - Surface state (dry / not dry)
- Drilled to road, installation takes less than 30 minutes
- Can be installed to various lane locations, including wheel track
- Maintenance-free due to self-leveling cushion mechanism (patent-pending)
- Low power NB-IoT communication
- Data available through Vaisala Wx Horizon® or API

Technical data

Measurement performance

Surface temperature

Measurements	0, -6, and -30 cm (0, -2.4, and -11.8 in) (below surface)
Measurement range	-40 ... +70 °C (-40 ... +158 °F)
Measurement accuracy	±0.2 °C (±0.4 °F) at -40 ... +70 °C (-40 ... +158 °F)

Chemical amount

Supported de-icing chemicals	Sodium chloride (NaCl) Calcium chloride (CaCl ₂) Sodium acetate (NaOOC ₂ H ₃) Potassium formate (KOOCH) Magnesium chloride (MgCl)
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Reporting unit g/m²

Surface dryness

Reported surface states Dry, not dry ¹⁾

¹⁾ Sensor measures if there are any contaminants on top of it, but it does not differentiate between water, ice, and snow, for example. Situations other than dry are reported as "not dry".

Operating environment

Operating temperature ¹⁾	-40 ... +70 °C (-40 ... +158 °F)
Storage temperature ²⁾	Recommended max. +30 °C (+86 °F)
Operating humidity	0 ... 100 %RH
IP rating	IPX8: Water immersion tested under the following conditions: <ul style="list-style-type: none"> • Immersion depth: 20 m (65 ft) • Immersion time: 140 hours

¹⁾ In extreme cold conditions where road temperature stays continuously below -20 °C (-4 °F) for multiple days, sensor battery operation might temporarily degrade.

²⁾ Recommendation from the battery manufacturer.

Mechanical specifications

Sensor

Dimensions (H × Ø)	353 × 56 mm (13.90 × 2.20 in)
Weight	640 g (1.4 lb)
Materials	Polyurethane (PUR)

Battery

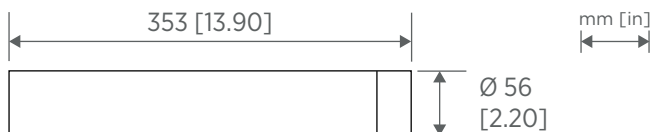
Type	Lithium-thionyl chloride
Lithium metal content	9 g per sensor, sensor includes 2 built-in, non-removable batteries (4.5 g / 0.010 lb each)

Installation

Recommended installation hole size	Ø 60 mm Depth: min. 360 mm (14.17 in)
Requirements for surface material ¹⁾	Paved (asphalt, concrete)
Recommended installation sealants ²⁾	Fabick® MP-55

¹⁾ Sensor is not designed to be installed in sand or gravel roads, as it will not stay on the surface level, and the sensor performance is optimized for paved surfaces.

²⁾ Vaisala recommends the use of Fabick® sealant, but it is not available in all countries. For using locally available sealants, please check the suitability with Vaisala.



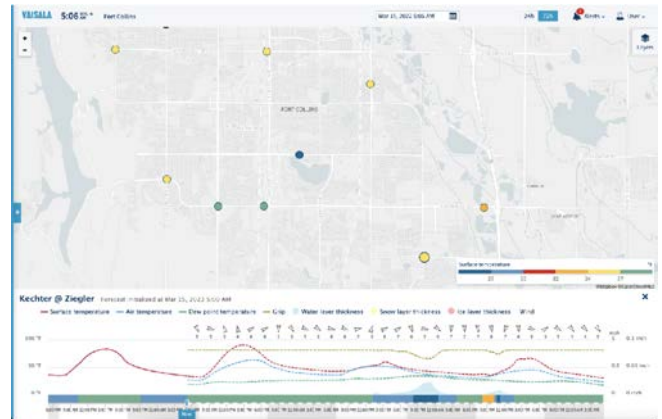
Dimensions



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Communication and data collection

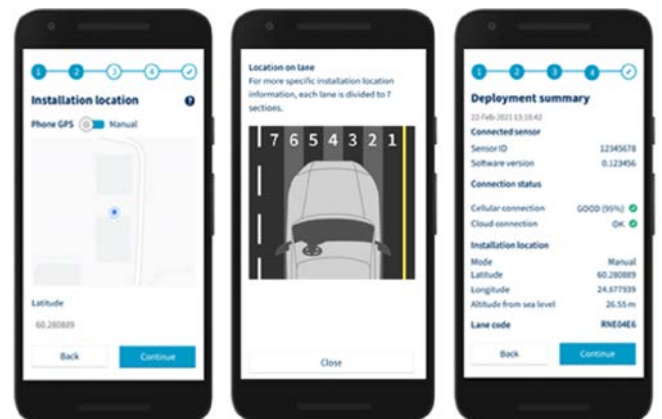
Communication standard	Narrowband IoT (NB-IoT)
SIM card type	Micro-SIM (3ff), provided by Vaisala
Local connection for sensor setup	NFC, disabled after installation
Software for sensor setup	Vaisala Android application
Data message interval	Every 10 minutes
Data storage location	Vaisala cloud
Data access options	Vaisala Wx Horizon® user interface Vaisala Wx Horizon® API Vaisala RoadDSS® user interface



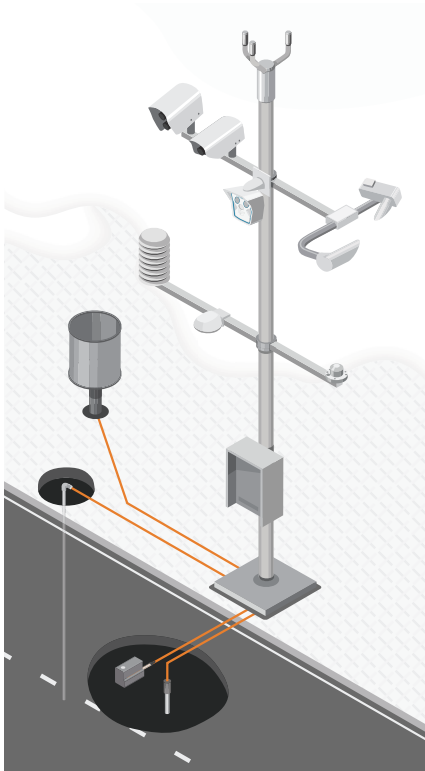
Sensor data visualization in Vaisala Wx Horizon®

Compliance

EU directives and regulations	EMC Directive (2014/30/EU)
EMC compatibility	EN 61326-1, industrial environment CISPR 32 / EN 55032, Class B FCC part 15, class B ICES-3 (B)
Electrical safety	IEC 62368-1
Cold	IEC 60068-2-1
Dry heat	IEC 60068-2-2
Change of temperature	IEC 60068-2-14
Damp heat, cyclic	IEC 60068-2-30
Damp heat	IEC 60068-2-78
Compliance marks	CE



Sensor Deployment application (Android)



Features

- Reliable and quality data for educated decision making
- Increased system reliability through centralized power management
- Local database for data storage
- Battery backup
- Fast return of investment through operational savings
- Built-in web user interface
- On-site wireless network access to ease annual maintenance
- Easy upgrade and sensor retrofit from previous versions

Vaisala Road Weather Station RWS200 is designed for the future of road weather systems and Intelligent Transportation Systems (ITS). RWS200 provides a complete road weather solution to improve road, rail, or runway winter maintenance activities in your organization.

Reliable data

The primary requirement of a road weather station is that data is reliable and it flows from the station continuously. Road maintenance decision makers must be able to trust the information every time they make a critical decision.

RWS200 contains a local database which greatly improves data reliability by storing observation data. The data is not lost even if the external communication network is down for a long period of time.

Advanced communication options, such as Ethernet and 3G/4G, add reliability to the entire system and ensure continuous data flow to external systems. These options also allow remote access to the weather station for monitoring and maintenance.

Advanced algorithms

In addition to road weather sensors, the standard sensor options for RWS200 include a number of atmospheric sensors. Atmospheric observations greatly increase the accuracy of road weather observations, especially for embedded road sensors.

Data Management Unit DMU703 contains the algorithms that further calculate the observations, such as the road surface state. DMU703 also handles the storage, analysis, and reporting of observation data.

Power and charging control

Power Management Unit PMU701 makes sure that the sensors receive continuous and steady power. PMU701 also protects the sensors from power surges and switches on sensor heating power when needed.

To extend station operating time, PMU701 switches off sensor heating power if mains power is lost and the station is running on backup battery power. The intelligent battery management detects if the battery is faulty and stops charging it.

Cost-effective maintenance

Timely and routine maintenance is important to the health of your road weather network and to the safety of the road users.

Some maintenance tasks, such as sensor cleaning, you cannot perform without visiting the site. For other tasks that can be performed remotely, RWS200 offers a web user interface. In addition to maintenance tasks, such as software updates, you can use the web user interface to view the observation data and the station setup.

Looking ahead

The flexible, modular design of RWS200 means that a unit purchased today can be updated either remotely or in the field to support new features and functions as they are designed by Vaisala. Vaisala continuously develops RWS200 based on customer feedback.

Integration to Vaisala-hosted information services expands the possibilities to profit from the current data view of your road weather network, the winter index, and forecast services, among others.

Technical data

Operating environment

Operating environment	Outdoor use
Use in wet location	Yes
Operating temperature ¹⁾	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature ²⁾	-60 ... +80 °C (-76 ... +176 °F)
Operating humidity ³⁾	5 ... 100 %RH
Pollution degree	2
Maximum operating altitude	3000 m (approx. 9800 ft)

1) Excluding cellular router, DRD11A, RG13H, AQT530, Mobotix, and AXIS PTZ camera. See the manufacturer documentation.

2) Excluding backup battery. See the manufacturer documentation.

3) Excluding cellular router and AQT530. See the manufacturer documentation.

Powering specifications

AC (mains) power	100 ... 240 V AC, ±10 % 50 ... 60 Hz 5.6 A maximum (120 V AC)
Mains fuse (nominal)	10 A
AC (mains) surge protection	Type 3, 1.5 kV / 3 kA Max. continuous voltage: 264 V AC
Overvoltage category	II
External power	10 ... 32 V DC 15 A maximum

Internal backup battery

Standard backplate (ENC652, BOXALU-US, BOXSS-US)	26 Ah / 12 V
Slim backplate (ENC722)	2.6 Ah / 12 V

Average operating power consumption ¹⁾

Without sensor heating	18 W
At -10 °C (+14 °F) with sensor heating on ²⁾	102 W

1) With the following configuration: cellular router (4.7 W), DSC211, DST111, WMT700, PWD22, two DR5511 sensors, and HMP155E.

2) DSC211 lens heating (5 W), WMT700 transducer heating (22 W), and PWD22 lens heating and hood heating (57 W).

Data reporting

Polled interfaces	Vaisala DTO XML DATEX II NTCIP (1201 v03.15r, 1204 v03.08r2, 1204 v04.22d) Vaisala MES 14 Vaisala MES 16
Pushed interfaces	Vaisala DTO XML Images Vaisala MES 14 Vaisala MES 16
Station reports	Station summary report Event log
Road surface state	Vaisala classes EN 15518-3 classes

Communication options

Standard communication options	2.5G/3G/4G cellular, WLAN, and Ethernet
Customer-provided communication options	Cellular, Ethernet, and serial
User interface	Browser-based Web UI



Compliance

EU directives and regulations	EMC Directive (2014/30/EU) Low Voltage Directive (2014/35/EU) Radio Equipment Directive, RED (2014/53/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC immunity	EN 61326-1, industrial environment FCC part 15, class B ICES-3 (B)
EMC emissions	CISPR 32 / EN 55032, Class B ¹⁾
Electrical safety	EN 61010-1
Cold	IEC 60068-2-1
Dry heat	IEC 60068-2-2
Vibration	IEC 60068-2-6
Shock	IEC 60068-2-27
Rough handling	IEC 60068-2-31
Damp heat	IEC 60068-2-78
Corrosion and salt mist	VDA 621-415
Compliance marks	CE, FCC, ICES, RCM

1) AXIS PTZ camera and Wavetronix traffic sensor emissions: Class A

Standard sensor options

Road state, remote	DSC211
Road temperature, remote	DST111
Road state and temperature, embedded	DRS511
Subsurface temperature	DTS12G
Subsurface temperature multidepth	TPS10
Humidity and temperature	HMP155E
Visibility and present weather	PWD12/PWD22
Rain	DRD11A
Tipping bucket	RG13H
Wind speed and direction (ultrasonic)	WMT700
Wind speed and direction (mechanical)	WA15 (WAC155)
Wind speed and direction (combined/mechanical)	R.M. Young Wind
Pressure	PTB110
Multiparameter	WXT536
Water level	SR50A
Snow depth	SR50A
Global radiation	SP Lite2
Air quality	AQT530
Fixed camera	Mobotix M16
Pan-tilt-zoom (PTZ) camera	Axis Q6154-E

Other supported sensors

Air quality	AQT420
Road state and temperature, embedded	FP2000
Subsurface temperature	DTS210
Multiparameter	WXT520
Fixed camera	Mobotix M12, M15
PTZ camera	Axis Q6032-E, Q6042-E, Q6052-E, Q6124-E
Traffic sensor	Wavetronix SmartSensor HD ¹⁾

¹⁾ Project item.

Enclosure options

ENC652

IP rating / NEMA rating	IP66 / NEMA 4X
Approvals	UL 50 / UL 50E-listing
Vibration	IEC 60068-2-6
Shock	IEC 60068-2-27
Size (H × W × D), incl. mounting frame, radiation shield, and cabling box	787 × 581 × 270 mm (30.98 × 22.87 × 10.62 in)
Weight after installation	Approx. 46 kg (101 lb)

ENC722

IP rating	IP66
Vibration	IEC 60068-2-6
Shock	IEC 60068-2-27
Size (H × W × D), incl. mounting frame, radiation shield, and cabling box	887 × 322 × 270 mm (34.92 × 12.67 × 10.62 in)
Weight after installation	Approx. 29 kg (64 lb)

BOXALU-US, BOXSS-US (North America only)

NEMA rating	NEMA 4X
Size (H × W × D), enclosure only	838 × 610 × 330 mm (33.00 × 24.00 × 13.00 in)
Weight after installation	BOXALU-US: Approx. 35.3 kg (77.8 lb) BOXSS-US: Approx. 55.5 kg (122.3 lb)

Backplate only

Vibration	IEC 60068-2-6
Shock	IEC 60068-2-27
Size (H × W × D)	555 × 455 × 42 mm (21.85 × 17.91 × 1.65 in)
Weight after installation	Approx. 12.8 kg (28.2 lb)



Features

- Protects weather station electronics
- Acid-proof against de-icing chemicals (stainless steel AISI 316)
- Mounting kits for lattice towers and different size of pole masts

ENC652 and ENC722 with radiation shield and cabling box

Vaisala high-quality weather station enclosures protect weather station electronics from the weather and other damaging elements. Enclosure materials are selected to withstand harsh roadside conditions, where de-icing chemicals constantly try to contaminate the enclosure.

Robust design

The enclosures are made of stainless steel and the seams are continuously welded for maximum strength and solidity.

Rubber flanges provide cabling access through the bottom of the enclosure.

The door sealing is water proof.

The backplate to which all electronics are attached is made of stainless steel.

Additional shielding

Optional shielding is available for the enclosures. The set contains a cabling box that protects the cabling from vandalism and a radiation shield that protects the enclosure from excessive sunshine and falling material such as ice and tree branches.

Like the enclosure itself, the shielding elements are finished with powder coating.

Easy installation

To ease the installation, the enclosures are delivered with a mounting frame. The mounting frame can be used to install the enclosure on a wall or on the backplate of another enclosure.

Mounting accessories are also available for mounting the enclosure on a thin pole mast, a thick pole mast, or a lattice mast.

The enclosure door has two hinges and a wind lock to keep it open in heavy winds. All installation and maintenance work can be done without the door banging on your shoulder.

Standard and slim models

With the standard ENC652 enclosure, you have a wider selection of components that fit inside the enclosure. On the other hand, the slim ENC722 can be used in places where space is limited.

The following components are only available with ENC652:

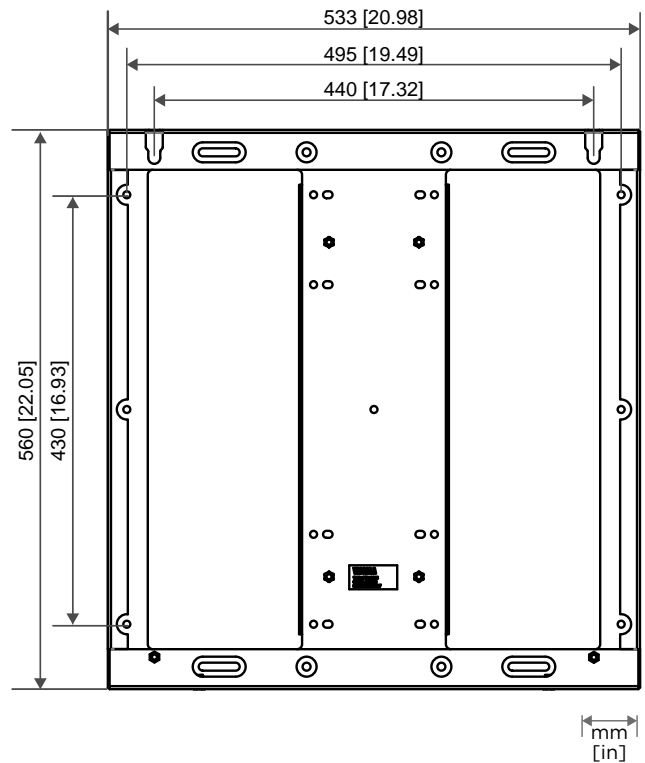
- Additional power supply unit for the WMT700 sensor that has heated transducers and array arms
- Output socket for on-site tools or laptop
- Residual-current circuit breaker (GFCI)
- Mains terminal strip for easier power supply connection

ENC652 also has room for a larger, 26 Ah / 12 V backup battery, while ENC722 can only accommodate a 12 Ah / 12 V backup battery.

ENC652 technical data

ENC652 specifications

Approvals	UL 50 / UL 50E-listing
IP rating	IP66
NEMA rating	NEMA 4X
Maximum operating wind speed	75 m/s (168 mph)
Maximum door opening angle	100°
Materials	
Enclosure	Stainless steel AISI 316, painted white (RAL9003)
Backplate	Fe/Zn
Flanges	Rubber (TPE)
Radiation shield	Aluminum EN AW-5754
Dimensions (H × W × L)	
Enclosure only	600 × 500 × 207 mm (23.62 × 19.68 × 8.15 in)
With radiation shield, mounting frame, and cabling box	787 × 581 × 270 mm (30.98 × 22.87 × 10.62 in)
Backplate only	555 × 455 × 42 mm (21.85 × 17.91 × 1.65 in)
Weight	
Enclosure only	14.2 kg (31.3 lb)
Lifting weight (enclosure with back plate)	Approx. 27 kg (59.5 lb)
RWS200 shipping package	
Dimensions	Approx. 91 × 72 × 44 cm (36 × 28 × 17 in)
Weight	Approx. 60 kg (132 lb)



ENC652 mounting frame dimensions

ENC652 spare parts and accessories

Spare part or accessory	Order code
Enclosure ENC652 with mounting plate, locks and flanges, mounting frame, radiation shield, and cabling box	ENC652KIT
Pressure port	1694IDM
Cabling box	ASM210466SP
Radiation shield	ASM210463SP
Rubber flange set (2 pcs)	DRFLANGE10SP
Enclosure lock set (2 pcs)	ASM213869SP
Backplate assembly	ASM211817SP
Enclosure accessories:	BOX652ACC1SP
• Cable ties 2.5×100 mm (20 pcs)	
• Cable tie holders FTH-13R-01 (5 pcs)	
• DIN rail end brackets (10 pcs)	
• Washers with EPDM gasket 6.8/16×1.5/A2/EPDM (4 pcs)	
• Hex screws M6×16 ISO7380 A4 (2 pcs)	
• Hex nuts M6 Wulock Fe/Zn (2 pcs)	
• Torx screws M4×8 ISO14583 TX A4 (10 pcs)	
• Flat washers A6.4 DIN125 A4 (4 pcs)	
Accessory set, screws and washers	262928

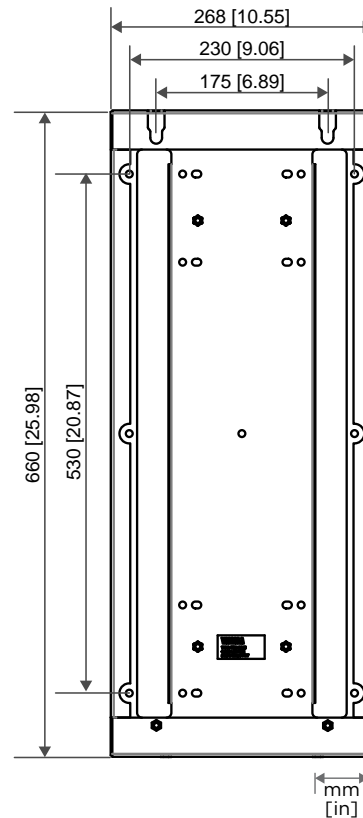
ENC722 technical data

Specifications

IP rating	IP66
Materials	
Enclosure, mounting frame base, cabling box, nuts, washers	Stainless steel AISI 316
Backplate	Steel
Radiation shield	Aluminum EN AW-5754
Flange, gaskets, plugs	Rubber (TPE)
Dimensions (H × W × D)	
Enclosure only	700 × 200 × 207 mm (27.55 × 7.87 × 8.14 in)
With radiation shield, mounting frame, and cabling box	887 × 322 × 270 mm (34.92 × 12.67 × 10.62 in)
Weight	
Enclosure only	9.5 kg (20.9 lb)
Enclosure with backplate	19.3 kg (42.6 lb)
RWS200 shipping package	
Dimensions	Approx. 86 × 40 × 34 cm (34 × 16 × 13 in)
Weight	Approx. 50 kg (110 lb)

ENC722 spare parts and accessories

Spare part or accessory	Order code
Enclosure ENC722 with mounting plate, locks and flanges, mounting frame, radiation shield, and cabling box	ENC722KIT
Cabling box	ASM211127SP
Radiation shield	ASM211081SP
Rubber flange set (2 pcs)	DRFLANGE10SP
Enclosure lock set (2 pcs)	ASM213869SP
Enclosure accessories:	BOX652ACC1SP
<ul style="list-style-type: none"> • Cable ties 2.5×100 mm (20 pcs) • Cable tie holders FTH-13R-01 (5 pcs) • DIN rail end brackets (10 pcs) • Washers with EPDM gasket 6.8/16×1.5/A2/EPDM (4 pcs) • Hex screws M6×16 ISO7380 A4 (2 pcs) • Hex nuts M6 Wulock Fe/Zn (2 pcs) • Torx screws M4×8 ISO14583 TX A4 (10 pcs) • Flat washers A6.4 DIN125 A4 (4 pcs) 	
Accessory set, screws and washers	262928



Mounting frame dimensions

ENC652 and ENC722 mounting kit options

Mounting kit	Order code
Mounting kit for lattice mast ¹⁾	ASM210998
Mounting kit for 60 mm (2.36 in) pole mast ²⁾	APPK-SET60
Mounting kit for 75 mm (2.95 in) pole mast ²⁾	APPK-SET75
Mounting kit for 100 mm (3.94 in) pole mast ²⁾	APPK-SET100
Mounting kit for 80 ... 600 mm (3.15 ... 23.62 in) pole mast, excluding stainless steel band and locks ^{2) 3)}	DRUNIV-US
Mounting kit for 80 ... 600 mm (3.15 ... 23.62 in) pole mast, including stainless steel band and locks ²⁾	DRUNIV

1) Installation requires 1 pc of the mounting kit.
 2) Installation requires 2 pcs of the mounting kit.
 3) You can use any suitable stainless steel band and locks for attaching the mounting support to the pole mast, for example, Band-It 19.1 mm (0.75 in) with Ear-Lokt buckles. If you only need the band for a few installations, use the DRUNIV mounting kit instead.

DMU703 Data Management Unit



Vaisala Data Management Unit DMU703 is specifically designed and built to be the brains of Vaisala Road Weather Station RWS200. DMU703 handles the storage, analysis, and reporting of observation data.

Effective data management

DMU703 manages data flow, performs algorithm calculations, stores observation data, and provides a web-based user interface for viewing data remotely and for controlling the system.

In addition to managing realtime data flow, DMU703 also handles sensor calibration data, maintenance activities, and configurations, including serial numbers and software versions. To have this information available both locally and remotely helps in troubleshooting and maintaining the weather station.

DMU703 contains a local database which greatly improves data reliability by storing observation data. The data is not lost even if the external communication network is down for a long period of time.

Advanced algorithms

DMU703 contains the algorithms that make RWS200 more than a collection of road weather sensors. The algorithms process the observation data from the atmospheric and road weather sensors and provide accurate data to support decision making.

Web user interface

A web user interface provides direct access to the weather station. The user interface is available locally and remotely and it is used for station setup and maintenance, as well as for viewing observation data and reports.

Looking ahead

A DMU703 unit purchased today can be updated either remotely or in the field to support new features and functions as they are designed by Vaisala.

Features

- Performs advanced algorithms based on sensor measurements
- Storage for all observations, configurations, serial numbers, and maintenance history
- Reliable in harsh environments
- Industry-proven components that guarantee reliability and extend the life span
- Built-in web user interface
- GPS receiver for accurate time synchronization
- Reliable internal communications from Ethernet architecture

Technical data


Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-60 ... +80 °C (-76 ... +176 °F)
Operating humidity	5 ... 95 %RH, non-condensing

Powering specifications

Operating voltage	9 ... 32 V DC
Maximum power consumption	3 W

Computer specifications

Processor	ARM Cortex A8
Memory	512 MB DDR3 RAM, 2 GB flash
Operating system	Linux
RTC backup battery	CR2032
Web services	HTTPS
Graphical user interface	

Mechanical specifications

Dimensions (H × W × L)	126 × 55 × 127 mm (4.96 × 2.17 × 5.00 in)
Weight	0.4 kg (0.8 lb)
Mounting	DIN rail 35 mm (1.4 in)

Materials

Screws, washers, DIN rail locking piece	Stainless steel AISI 316
Frame profile	Aluminum EN AW-6060 T6
Side plates	Plastic PC/ABS

Compliance

EU directives and regulations	Low Voltage Directive (2014/35/EU) EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC immunity	EN 61326-1, industrial environment FCC part 15, class B ICES-3 (B)
EMC emissions	CISPR 32 / EN 55032, Class B
Electrical safety	EN 61010-1
Compliance marks	CE, FCC, ICES, RCM

Test compliance

Dry heat	IEC 60068-2-2	+60 °C (+140 °F)
Vibration	IEC 60068-2-6	0.2 g (0.007 oz), 62 ... 200 Hz 5 ... 62 Hz, 1.5 mm (0.06 in) displacement
Shock	IEC 60068-2-27	3.0 g (0.106 oz) Pulse duration 11 ms with 3 pulses in each direction.
Rough handling	IEC 60068-2-31	Drop height 50 cm (19.69 in)
Damp heat	IEC 60068-2-78	+40 °C (+104 °F), 93 %RH

Inputs and outputs

Ethernet

Ports	ETH 0, ETH 1
Supported standard	IEEE 802.3
Physical layer	Base-T
Data rate	10/100 Mbps
Connectors	RJ45 with link LEDs

USB

Ports	4 (reserved)
Supported standard	USB 2.0
Signaling	High speed
Connectors	Standard-A

RS-232 serial

Ports	COM 1, COM 5 (configurable)
Signals	COM 1: RXD, TXD, CTS, RTS, DTR, DSR, DCD, and RI COM 5: RXD, TXD, CTS, and RTS
Connectors	Phoenix Contact DFMC 1,5/3-ST-3,5-LR

RS-485 serial

Ports	COM 5 (configurable), COM 6, COM 7
Signals	D+/D- for all ports COM 5 also has R+/R-
Connectors	1 × Phoenix Contact DFMC 1,5/3-ST-3,5-LR 1 × RJ45 (expansion bus)

RS-485 serial, isolated

Ports	COM 2, COM 3
Signals	R+/R-/T+/T-
Connectors	Phoenix Contact DFMC 1,5/3-ST-3,5-LR

Other serial ports

1 × CAN (reserved)	Connector: RJ45
1 × SDI-12 (reserved)	Connector: Phoenix Contact DFMC 1,5/3-ST-3,5-LR

Analog

Lines	CH A, CH B
Frequency input signal	1 Hz ... 20 kHz, 2.5 ... 14 V DC, or 10 mV ... 15 V DC
Excitation voltage signal	0 ... 12 V DC at 20 mA
Fast input high signal	0 ... 1.8 V DC, 12-bit ADC
Fast input low signal	0 ... 1.8 V DC, 12-bit ADC
Single-ended/Differential measurement mode	Ground
Connectors	Phoenix Contact DFMC 1,5/3-ST-3,5-LR

I/O digital

Ports	4 × input, 4 × output
Input signal	0 ... 30 V DC
Output signal	Open collector, maximum load 30 V DC at 1 A
Connectors	Phoenix Contact DFMC 1,5/3-ST-3,5-LR

Technical data

Data reporting

Polled interfaces	Vaisala DTO XML DATEX II NTCIP (1201 v03.15r, 1204 v03.08r2, 1204 v04.22d) Vaisala MES 14 Vaisala MES 16
Pushed interfaces	Vaisala DTO XML Images Vaisala MES 14 Vaisala MES 16
Station reports	Station summary report Event log
Road surface state	Vaisala classes EN 15518-3 classes

GPS receiver specifications

Receiver type	72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F BeiDou B1I, Galileo E1B/C SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN
Time-to-first-fix	Cold/Warm start 26 s
Horizontal position accuracy ¹⁾	2.5 m (8.2 ft)
Antenna connector	SMA (female)

¹⁾ LEP, 50 % 24-hour static, -130dBm

WLAN transmitter specifications

Supported standards	IEEE 802.11 b/g/n (single stream n)
Transmit power	+17.5 dBm, 11 Mbps, CCK (b) +14.0 dBm, 54 Mbps, OFDM (g) +12.5 dBm, HT20 MCS7 (n)
Acceptance	FCC, IC, ETSI, Giteki, RCM Contains FCC ID: TFB-1003 Contains IC: 5969A-1003
Antenna connector	RP-SMA (female)

Spare parts and accessories

Spare part or accessory	Order code
DMU703-RWS unit including: <ul style="list-style-type: none">Ethernet cable 40 cm (15.75 in)Phoenix Contact DFMC 1,5/3-ST-3,5-LR 6-pin cable connector (2 pc)Phoenix Contact DFMC 1,5/5-ST-3,5-LR 10-pin cable connector (5 pc)	DMU703-RWSSP
Phoenix Contact DFMC 6-pin cable connector set (10 pcs)	262926
Phoenix Contact DFMC 10-pin cable connector set (10 pcs)	262924
Insulated ferrules 0.5 mm ² , length 10 mm, white (100 pcs)	237754SP



Features

- Surge protection increases reliability
- Handles analog, serial, and Ethernet sensors
- Easy to configure and wire sensors
- Able to cycle power for individual sensors
- Optimizes charging voltage according to temperature
- Detects faulty battery

Vaisala Power Management Unit PMU701 manages power and sensor communication within Vaisala Road Weather Station RWS200.

Centralized power management

PMU701 handles the specific power requirements of the sensors, making sure that each sensor receives steady and suitable power at all times.

PMU701 is also responsible for charging the internal backup battery inside the RWS200 enclosure. If an external DC power supply is used with the road weather station, the power is routed through PMU701.

In total, PMU701 provides 1 external DC input, 2 solar panel inputs, 4 inputs for analog sensor communications, and 14 inputs for serial communication, 8 of which can be Ethernet-based communication.

Surge protection

All sensor communication lines and DC power lines route through PMU701 to provide surge protection between the station, the DC power supply, and the individual sensors attached to the weather station.

As the RWS200 weather station enclosure is typically mounted to a pole or a metal lattice mast, lightning strikes are a real danger for the weather station. Proper power protection ensures that power disruptions are kept to a minimum, which increases the overall reliability of the system.

Power control

Continuous and steady power is a luxury for a roadside station. Power Management Unit PMU701 meets the challenges posed by power interruptions and surges caused by, for example, lightning. PMU701 provides surge protection and power to the sensors, including heating power when needed.

Intelligent battery management

PMU701 automatically detects if the backup battery is faulty, missing, or disconnected and reports it. PMU701 stops charging when the battery is faulty,

the ambient temperature inside the enclosure exceeds the battery operating temperature, or PMU701 self-diagnostics detect an internal failure.

Simplified configuration

PMU701 is designed for simplified configuration and wiring during initial setup or when adding new sensors. Grounding each sensor cable shield is simple and easy, and a quick reference card is provided to ensure that each sensor is connected correctly; once again, to add system reliability.

Simplified maintenance

PMU701 has the ability to control and cycle the power of each sensor remotely, making it possible to perform some technical services remotely, such as powering down and restarting individual sensors.

Technical data

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-60 ... +80 °C (-76 ... +176 °F)
Operating humidity	5 ... 95 %RH, non-condensing

Inputs and outputs

Operating voltage	24 V DC (10 ... 32 V DC)
Solar panel input (requires PMP701)	10 ... 32 V DC
External DC power (requires PMP701)	12 ... 28 V DC (max. range 10 ... 32 V DC)
Output power	12 V at 3 A and 24 V at 7 A
Maximum charging current	3,8 A (total) for 26 Ah battery 1,9 A (total) for 2,6 Ah battery
Nominal charging voltage	13,5 V at +25 °C (+77 °F)

Connectors

DC INPUT	23 ... 32 V at 10 A Phoenix Contact MVSTBR 2,5HC/ 2-ST-5.08
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BATTERY 1, BATTERY 2	2 separately controlled 12 V lead-acid batteries Temperature compensation Deep discharge protection Charging within battery operating temperature only Phoenix Contact MVSTBR 2,5HC/ 2-ST-5.08
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SERVICE PORT	RS-232 Phoenix Contact DFMC 1,5/5-ST-3,5-LR
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POWER OUT C	12 V out at 1.4 A, 24 V out at 2.8 A Phoenix Contact DFMC 1,5/5-ST-3,5-LR
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ETH 1, ETH 2	10/100 Mbps 2 × RJ45
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DMU	Serial and I/O Molex 90130-3250
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TELECOM	RS-232/RS-485, DC output Phoenix Contact DFMC 1,5/10-ST-3,5-LR
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Mechanical specifications

Dimensions (H × W × D)	126 × 224 × 142 mm (4.96 × 8.82 × 5.59 in)
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Weight	1.4 kg (3.1 lb)
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Materials

Screws, washers, DIN rail locking piece	Stainless steel AISI 316
Grounding rail clamps	Stainless steel AISI 630
Frame profile	Aluminum EN AW-6060 T6
Cooling plate	Aluminum EN AW-6082 T6
Side plates	Plastic PC/ABS
Grounding rail	Copper (Cu)

Available plug-in module slots	10 pcs
PMP701	Maximum 1 pcs
PMA701	Maximum 2 pcs
PMS701	Maximum 7 pcs ¹⁾
PME701	Maximum 4 pcs ¹⁾

¹⁾ SERIAL/ETHERNET slots can house either PME701 or PMS701 plug-in modules.

Compliance

EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
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EMC immunity	EN 61326-1, industrial environment FCC part 15, class B ICES-3 (B)
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EMC emissions	CISPR 32 / EN 55032, Class B
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Electrical safety	EN 61010-1
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Dry heat	IEC 60068-2-2
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Vibration	IEC 60068-2-6
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Shock	IEC 60068-2-27
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Rough handling	IEC 60068-2-31
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Damp heat	IEC 60068-2-78
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Compliance marks	CE, FCC, ICES, RCM
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Spare parts and accessories

Spare part or accessory	Order code
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PMU701 unit including:	PMU701SP
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- Sensor data cable
- Phoenix Contact DFMC 1,5/10-ST-3,5-LR 20-pin cable connector (1 pc)

PMU701 accessories including:	PMU701ACC1SP
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- Torx screws M4×8 ISO14583 TX A4 (4 pcs)
- Torx screws M3×6 ISO14583 A4-60 (6 pcs)
- Cable shield grounding clamps SK 8 (10 pcs) (217844)
- Cable shield grounding clamps SK 14 (10 pcs) (237528)
- Hex-tapped spacers M4×55 FeZn Female/Male (2 pcs)
- Enclosure grounding rail for sensor cables (DRW240852)
- PMU701 grounding rail for sensor cables (DRW240399)

PMU701 accessories including:	PMU701ACC2SP
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- Cable shield grounding clamps SK 8 (10 pcs)
- Cable shield grounding clamps SK 14 (10 pcs)

PMU701 accessories including:	PMU701ACC3SP
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- Set of quick reference cards
- Cable ferrules 0.5 mm² / 10 mm (100 pcs) (237754)
- Phoenix Contact DFMC 1,5/1-ST-3,5-LR 2-pin cable connectors (4 pcs)
- Phoenix Contact DFMC 1,5/3-ST-3,5-LR 6-pin cable connectors (10 pcs)
- Phoenix Contact DFMC 1,5/4-ST-3,5-LR 8-pin cable connectors (10 pcs)
- Phoenix Contact DFMC 1,5/5-ST-3,5-LR 10-pin cable connectors (30 pcs)
- Phoenix Contact DFMC 1,5/8-ST-3,5-LR 16-pin cable connectors (10 pcs)
- Phoenix Contact DFMC 1,5/10-ST-3,5-LR 20-pin cable connectors (5 pcs)
- Phoenix Contact MVSTBR 2,5HC/2-ST-5.08 cable connectors (4 pcs)
- Narrow cover plates for empty slots (7 pcs)
- Wide cover plates for empty slots (3 pcs)

Phoenix Contact DFMC 6-pin cable connector set (10 pcs)	262926
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Phoenix Contact DFMC 8-pin cable connector set (10 pcs)	262923
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Phoenix Contact DFMC 10-pin cable connector set (10 pcs)	262924
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Phoenix Contact DFMC 16-pin cable connector set (10 pcs)	262925
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Phoenix Contact DFMC 20-pin cable connector set (10 pc)	262927
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Accessory set, screws and washers	262928
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Insulated ferrules 0.5 mm ² , length 10 mm, white (100 pcs)	237754SP
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External DC / solar panel input module PMP701 specifications

Surge protection	IEC 61000-4-5: external DC input up to 6 kV (line to GND) / 6 kV (line to line)
Reverse voltage protection	Yes
Solar panel input	2 pcs Maximum 10 ... 32 V DC at 4 A/port
External DC input	1 pc Maximum 10 ... 32 V DC at 15 A
Status LED	Green for each input

Analog input/output module PMA701 specifications

Surge protection	IEC 61000-4-5
Sensor power	12 V at maximum 2 A/port
Sensor power	24 V at maximum 3 A/port
Status LED	Green/Red
Mechanical	Has red circuit board
Digital I/O and differential	
Lines	2
Frequency input signal	1 Hz ... 20 kHz, 2.5 ... 14 V DC, or 10 mV ... 15 V DC
Excitation voltage signal	0 ... 12 V DC at 20 mA
Fast input high signal	0 ... 1.8 V DC, 12-bit ADC
Fast input low signal	0 ... 1.8 V DC, 12-bit ADC
Single-ended/Differential measurement mode	Ground
Connectors	Phoenix Contact DFMC 1,5/3-ST-3,5-LR

Serial input/output module PMS701 specifications

Surge protection	IEC 61000-4-5
Sensor power	12 V at maximum 2 A/port
Sensor power	24 V at maximum 3 A/port
Heat output	24 V at maximum 5 A/port
Supports	RS-232 2-wire and 4-wire RS-485 Isolated 2-wire and 4-wire RS-485
Status LED	Green/Orange

Ethernet / Power over Ethernet module PME701 specifications

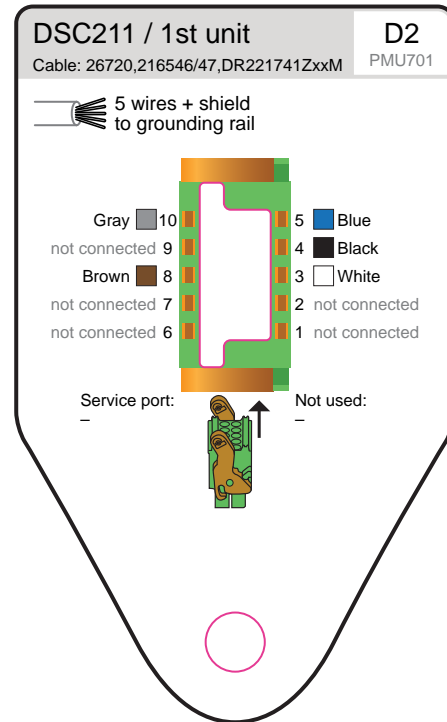
Surge protection	IEC 61000-4-5
Supported IEEE 802.3af PoE classes / module	1 × PoE class 0 (0.44 ... 12.94 W) device 1 × PoE class 3 (6.49 ... 12.95 W) device 2 × PoE class 1 (0.44 ... 3.84 W) device 2 × PoE class 2 (3.84 ... 6.49 W) device
Status LED	Ethernet link and speed built into connectors

PMU701 plug-in module spare parts

Spare part	Order code
External DC / Solar panel input module	PMP701SP
Analog input/output module with 10-pin cable connectors (2 pcs)	PMA701SP
Serial input/output module with 10-pin cable connectors (2 pcs)	PMS701SP
Ethernet / power over Ethernet module	PME701SP

The following shows an example of a quick reference card used for sensor wiring to PMU701 port.

Example of quick reference card for sensor wiring



DRI701 Digital Road Interface



Vaisala Digital Road Interface DRI701 is an optional component of Vaisala Road Weather Station RWS200. DRI701 is also required whenever an analog sensor, such as DRS511, is integrated to the RWS200 system.

Sensor interfaces

Each DRI701 provides an interface for two Vaisala Embedded Road Sensors DRS511 and two Vaisala Subsurface Temperature Sensors DTS12G. One of the subsurface temperature sensors can be replaced with a global radiation sensor. If the application requires more sensors, another DRI701 card can be added to the road weather station. Each station can house a maximum of two DRI701 cards.

Functionality

DRI701 provides power to the sensors, and converts analog and frequency signals from these sensors to a message for internal system communication.

Features

- Provides connection for analog road sensors
- Provides connection for analog subsurface temperature sensors
- Provides connection for an analog global radiation sensor

Technical data

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-60 ... +80 °C (-76 ... +176 °F)
Operating humidity	5 ... 95 %RH, non-condensing

Inputs and outputs

Operating voltage	9 ... 32 V DC
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Average power consumption

With two DRS511 sensors	0.76 W
With two FP2000 sensors	1.06 W

Compliance

EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC immunity	EN 61326-1, industrial environment FCC part 15, class B ICES-3 (B)
EMC emissions	CISPR 32 / EN 55032, Class B
Electrical safety	EN 61010-1
Dry heat	IEC 60068-2-2
Vibration	IEC 60068-2-6
Shock	IEC 60068-2-27
Rough handling	IEC 60068-2-31
Damp heat	IEC 60068-2-78
Compliance marks	CE, FCC, ICES, RCM

Mechanical specifications

Dimensions (H × W × D)	126 × 37 × 127 mm (5.0 × 1.5 × 5.0 in)
Weight	0.3 kg (0.7 lb)

Materials

Screws, washers	Stainless steel AISI 316
DIN rail locking piece	Stainless steel AISI 630
Frame profile	Aluminum EN AW-6060 T6
Side plates	Plastic PC/ABS

Spare parts and accessories

Spare part or accessory	Order code
DRI701 with: <ul style="list-style-type: none">Power cable 30 cm (11.81 in)Ethernet cable 30 cm (11.81 in)	DRI701SP
Phoenix Contact DFMC 8-pin cable connector set (10 pcs)	262923
Phoenix Contact DFMC 16-pin cable connector set (10 pcs)	262925
Insulated ferrules 0.5 mm ² , length 10 mm, white (100 pcs)	237754SP

Supported sensors

Road state sensors, embedded	2 × DRS511 / 2 × FP2000 ¹⁾
Subsurface temperature sensors	2 × DTS12G / 2 × DTS210 ²⁾
Global radiation sensor	For example, SP Lite2 ³⁾

¹⁾ For FP2000 availability, contact Vaisala.

²⁾ DTS210 only in retrofit installations.

³⁾ The first DRI701 supports one global radiation sensor and one subsurface temperature sensor or two subsurface temperature sensors.

DRS511 Embedded Road and Runway Sensor



Features

- Amount of de-icing chemical measurement
- Identifies road condition
- Water amount measurement
- Surface temperature measurement
- Subsurface temperature measurement –6 cm (–2.36 in)
- Freezing point
- Hoar frost detection

Vaisala DRS511 is an embedded road and runway sensor that takes a variety of measurements and observations of the road or runway surface. It is used in a road weather station to provide accurate and reliable information on the surface state.

DRS511 is embedded directly in the pavement. It gathers its readings by being installed flush with the surface. The sensor design features open-end carbon fiber electrodes and optical fiber technology. These are molded into a solid sensor block consisting of an epoxy compound with properties matching the surface for thermal conductivity and emissivity.

Surface temperature

The sensor contains 2 Pt100 elements to measure the temperature of the road or runway surface. Temperature is a key decision factor for the formation of ice and snow on the pavement, and is used before an event to determine if snow or ice will stick to the surface.

The surface temperature is also key to determining how effective winter maintenance chemicals will work at the desired temperature, as air temperature can be many degrees different and is not a good decision point for determining chemical effectiveness.

Lastly, the surface temperature, when used with dew point, can accurately indicate when hoar frost formation is possible.

Surface state

DRS511 not only provides the temperature of the pavement, but it also detects the presence of moisture on the pavement. Using these readings, the Vaisala road weather station algorithm produces the road state such as dry, wet, ice, and snow to give you an estimate of surface conditions on the roadway or runway.

When used in Vaisala Road Weather Station RWS200, DRS511 also shows the sky condition: is it raining or not, are there clouds or not.

Without the weather stations' algorithm to process the readings, DRS511 provides only the surface temperature of the road or runway.

Chemical knowledge

A characteristic that is unique to DRS511 compared to all other embedded road and runway sensors is its ability to provide a calculation of the amount of chemical on the sensor's surface. The value is provided in the form of g/m^2 and lb/mi^2 , which is a very effective way to determine how chemicals will perform if additional moisture is introduced. The greater the quantity of chemical present, the better the chance of the surface remaining unfrozen with the introduction of more ice or snow.

In addition to providing the amount of chemical present, DRS511 also calculates the freezing point of the current solution as another decision point used by many winter maintenance decision makers.

Tried and true

DRS511 offers many advantages as a surface sensor system, with the biggest being its location. It is placed directly where the tires of vehicles and aircraft interact with the surface of the road or runway. This means it is directly measuring its environment, which ensures accuracy.

DRS511 is a passive sensor, which means that it does not change or alter the environment that it resides in. This type of road and runway technology has been around for decades, so when using DRS511 the risk of failure or ineffectiveness in your operations is minimal. The passive technology found in the sensor has been tested by institutions and authorities for years, so you know exactly how the sensor can aid you in your operational decision making.

Technical data

Measurement performance

Surface temperature and temperature at 6 cm (2.36 in) below the surface ¹⁾

Observation range	-40 ... +60 °C (-40 ... +140 °F)
Pt100 accuracy	±(0.1 + 0.00167 × temperature) °C

Water layer thickness ¹⁾

Observation range	0 ... 7 mm (0 ... 0.28 in)
Accuracy	0.1 mm in the range of 0 ... 1.0 mm ²⁾

Reported surface states ¹⁾

Vaisala classes	Dry, Moist, Wet, Snowy, Icy, Frosty ³⁾ , Moist and chemical, Wet and chemical
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EN 15518-3 classes	Dry, Moist, Wet, Streaming water, Slippery
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Sky condition	No rain, Rain, Cloudy, Clear
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Chemicals

Supported de-icing chemicals	Sodium chloride (NaCl), calcium chloride (CaCl ₂), sodium acetate (NaOOC ₂ H ₃), potassium formate (KOOCH), magnesium chloride (MgCl)
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- ¹⁾ Temperature at -6 cm (-2.36 in), water layer thickness, and surface state are only available when DRS511 is used with a Vaisala road weather station.
²⁾ Applies to an even layer of water on the sensor. The detection accuracy of the average water layer thickness on the road depends on sensor installation, pavement material, and water impurities.
³⁾ Requires dew point information.

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
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EU directives and regulations	EMC Directive (2014/30/EU) ¹⁾ RoHS Directive (2011/65/EU) amended by 2015/863 ¹⁾
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EMC immunity	EN 61326-1, industrial environment ¹⁾
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EMC emissions	CISPR 22 / EN 55022, Class B ¹⁾
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¹⁾ When connected to a Vaisala weather station.

Mechanical specifications

Temperature sensors	2 Pt100 elements at 0 cm (0 in) and -6 cm (-2.36 in) from the surface 1/3 IEC 751 Class B
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Dimensions (H × W × D) ¹⁾	DRS511AB: 75 × 84 × 30 mm, bottom 38 mm (2.95 × 3.31 × 1.18 in, bottom 1.50 in) DRS511BB for bridge applications: 50 × 84 × 30 mm, bottom 38 mm (1.97 × 3.31 × 1.18 in, bottom 1.50 in)
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Cable length options	20 m (65 ft 7 in) 30 m (98 ft 5 in) 50 m (164 ft 1 in) 100 m (328 ft 1 in) 150 m (492 ft 2 in) 200 m (656 ft 2 in) 250 m (656 ft 2 in) 300 m (984 ft 3 in)
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Type V extension cable option	Maximum 1524 m (5000 ft)
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Weight including 50 m (165 ft 1 in) cable	3.1 kg (6.8 lb)
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Materials

Epoxy compound	Araldite D, HY 956, lamp black for color
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Cable tubing	Stainless steel AISI 316L
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Cable	4 × (2 × 0.22 mm ² / 24 AWG and shield) PUR, high density polyethylene lead isolation
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Sensing electrodes	Carbon fiber in epoxy
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Optical sensor	Acrylic optical fibers
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¹⁾ To make sure that the sensor remains even with the road surface, the sensor can wear up to 35 mm (1.38 in).

DSC211 Remote Road State Sensor

DSC211 is the latest member of the DSC family with more sensitive measurement of the amount of water, ice, or snow on the road. Also, the improved autocalibration provides long-term stability by better adapting to the wear and tear of the road surface.



Features

- Measures the amount of water, ice, or snow on the road or runway surface
- Provides road state and grip based on the amount of water, ice, or snow
- Accurate and reliable measurements even with intense traffic
- Easy and low-cost installation and maintenance since there is no need for traffic control
- Can operate standalone, as a standalone solution with DST111, or as a sensor in a road weather station

Compared to its predecessor DSC111, DSC211 offers the following:

- Improved accuracy and sensitivity of the measurement of the amount of water, ice, or snow
- Enhanced autocalibration

No traffic disruption for installation or maintenance

The remote sensor DSC211 eliminates the traffic disruption caused by installation and maintenance. Remote installation means that there is no need to cut the road surface or to close the road. The sensor can be installed in a remote location to a pole adjacent to the road, or as an addition to Vaisala Road Weather Station RWS200.

Improved sensitivity for earlier warnings

The spectroscopic measuring principle enables accurate measurement of the amount of water, ice, or snow on the road surface. In addition, DSC211 provides road state and grip, which is a calculated estimate of friction.

DSC211 has a clearly improved sensitivity and accuracy compared to DSC111. It provides an accurate measurement of the presence of ice crystals well before they make the road slippery. The earlier warnings enable the winter maintenance engineer to react before the road becomes hazardous for drivers.

Frost detection and enhanced autocalibration

DSC211 requires air temperature, relative humidity, and road temperature observations from another sensor or system for frost detection and enhanced autocalibration. DSC211 can be connected to Vaisala Remote Road Temperature Sensor DST111, which provides these observations to DSC211.

For the most accurate and reliable observations, Vaisala recommends using DSC211 as a sensor in the Vaisala RWS200 or RWCC road weather station. RWS200 and RWCC automatically reports observation values from the most reliable sensor in the system, for example, air temperature and relative humidity from Vaisala HUMICAP® Humidity and Temperature Probe HMP155.

With certain limitations, DSC211 can be connected to Vaisala legacy road weather stations LX-RPU and ROSA.

Optional visibility measurement

The optional visibility measurement offers a useful, compact, and extremely cost-effective way to measure the meteorological optical range (MOR). The visibility measurement extends the capabilities of DSC211 to detect low visibility conditions – without any external hardware.

Upgrade from DSC111 to DSC211

Because DSC111 and DSC211 share the same hardware, you can usually upgrade your DSC111 to DSC211 just by purchasing the software. To make sure that your system configuration is compatible with DSC211, please contact Vaisala.

DSC211 technical data

Measurement performance

Measuring distance with visibility observation disabled	2 ... 15 m (6 ft 7 in ... 49 ft 3 in)
Measuring distance with visibility observation enabled	8 ... 15 m (26 ft 3 in ... 49 ft 3 in)
Installation angle from the horizontal line	30 ... 80° (35 ... 65° recommended)
Diameter of measuring area at 10 m (33 ft)	20 cm (7.87 in)
Surface layer thickness	
Water	0.00 ... 2 mm (0.00 ... 0.06 in)
Ice	0.00 ... 2 mm (0.00 ... 0.06 in)
Snow	0.00 ... 10 mm (0.00 ... 0.40 in)
Snow (water equivalent)	0.00 ... 1 mm (0.00 ... 0.04 in)
Accuracy, water and ice	±0.1 mm in the range of 0 ... 1 mm (0 ... 0.04 in)
Grip	
Reported level of grip	0.09 ... 0.82
Reported surface states	
Vaisala classes	Dry, moist, wet, frosty ¹⁾ , snowy, icy, slushy
EN 15518-3 classes	Dry, moist, wet, streaming water, slippery
Visibility (optional)	
Observation range (meteorological optical range, MOR)	10 ... 2000 m (33 ... 6572 ft)
Resolution	1 m (3 ft 3 in)
Accuracy (fog and snowfall)	±20 % (average)
Response time	60 s

¹⁾ Frost is only reported when dew point and road temperature information is available.

Inputs and outputs

Connectors	3 × M12 (5 pins) RS-485 and power out for DST111, female RS-485 and power in, male RS-232, male
Communication interface	RS-485 isolated, RS-232
Sensor support	DST111
Input voltage	9 ... 30 V DC
Maximum input current	0.25 A at 24 V
Date and time	Real-time clock with battery backup
Settling time before dry calibration	5 min
Typical power consumption	
At above -10 °C (+14 °F)	1.13 W at 24 V
At below -10 °C (+14 °F)	1.90 W at 24 V
With lens heating on	5.25 W at 24 V

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-55 ... +60 °C (-67 ... +140 °F)
Operating humidity	0 ... 100 %RH
IP rating	IP65

Compliance

EU directives and regulations	Low Voltage Directive (2014/35/EU) EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC immunity	EN 61326-1, industrial environment FCC part 15, class B ICES-3 (B)
EMC emissions	CISPR 32 / EN 55032, Class B
Eye safety	IEC 60825-1:2014 Class 1 laser product
Vibration	IEC 60068-2-6

Mechanical specifications

Dimensions (H × W × D)	210 × 133 × 448 mm (8.27 × 5.24 × 17.64 in)
Weight	Sensor: 2.69 kg (5.93 lb) Mounting bracket: 0.71 kg (1.57 lb)
Mounting	Fits on a sensor support arm with cross-section of 40 × 40 mm (1.57 × 1.57 in)
Cables	3 ... 150 m (9 ft 10 in ... 492 ft) One end without connector 0.6 m (1 ft 12 in) extension cable to DST111
Materials	
Weather shield	ABS plastic
Transmitter body	POM plastic
Bolts, screws, and washers	Stainless steel
Fixture plate of the weather shield	
Lenses and windows	Glass
Other parts	Aluminum



Vaisala Remote Road Temperature Sensor DST111 presented with Vaisala Remote Road State Sensor DSC211

DSC111 Remote Road Surface State Sensor

DSC111 has proven its capabilities during intensive field testing in collaboration with Vaisala customers. The sensor is operational at hundreds of sites throughout the world.



Features

- Remote surface state sensing
- Spectroscopic measuring principle individually identifies the presence of water, ice, snow, and frost
- Provides road state and grip
- Accurate and reliable measurements even with intense traffic
- Easy and low-cost installation and maintenance since there is no need for traffic control
- Cost-effective visibility measurement
- Weather-proof, durable design

No traffic disruption for installation or maintenance

The remote sensor DSC111 eliminates the service disruption caused by installation and maintenance. Remote installation means that there is no need to cut the road surface or to close the road. The sensor can be installed in a remote location to a pole adjacent to the road, or as an addition to a Vaisala Road Weather Station.

Compatibility

DSC111 can be used as a standalone sensor or as a sensor in LX-RPU or ROSA, but it is not compatible with RWS200. In RWS200, you can use DSC211 which has improved accuracy and sensitivity compared to DSC111. For more information on the DSC211 features, see the DSC211 datasheet.

Accurate measurements

The spectroscopic measuring principle enables accurate measurement of the amount of water, ice, or snow on the road or runway surface. In addition, DSC111 provides road state and grip, which is a calculated estimate of friction.

DSC111 provides an accurate measurement of the presence of ice crystals well before they make the road slippery. The early warnings enable the winter maintenance engineer to react before the road becomes hazardous for drivers.

Additional sensors can be directly connected to DSC111 to provide, for example, road and air temperature, relative humidity, and present weather.

Optional visibility measurement

The optional visibility measurement offers a useful, compact, and extremely cost-effective way to measure the meteorological optical range (MOR). The visibility measurement extends the capabilities of DSC111 to detect low visibility conditions – without any external hardware.

Technical data

Measurement performance

Measuring distance with visibility observation disabled	2 ... 15 m (6 ft 7 in ... 49 ft 3 in)
Measuring distance with visibility observation enabled	8 ... 15 m (26 ft 3 in ... 49 ft 3 in)
Installation angle from the horizontal line	30 ... 80° (35 ... 65° recommended)
Diameter of measuring area at 10 m (33 ft)	20 cm (7.87 in)
Surface layer thickness	
Water	0.00 ... 2 mm (0.00 ... 0.06 in)
Ice	0.00 ... 2 mm (0.00 ... 0.06 in)
Snow	0.00 ... 10 mm (0.00 ... 0.40 in)
Snow (water equivalent)	0.00 ... 1 mm (0.00 ... 0.04 in)
Grip	
Reported level of grip	0.09 ... 0.82
Reported surface states	
Vaisala classes	Dry, moist, wet, frosty, snowy, icy, slushy
Visibility (optional)	
Observation range (meteorological optical range, MOR)	10 ... 2000 m (33 ... 6572 ft)
Resolution	1 m (3 ft 3 in)
Accuracy (fog and snowfall)	±20 % (average)
Response time	60 s

1) Frost is only reported when dew point and road temperature information is available.

Inputs and outputs

Connectors	3 × M12 (5 pins) RS-485 and power out for DST111, female RS-485 and power in, male RS-232, male
Communication interface	RS-485 isolated, RS-232
Sensor support	DST111, PWD10/PWD12/PWD20/ PWD22, WXT530, HMP155
Input voltage	9 ... 30 V DC
Maximum input current	0.25 A at 24 V
Date and time	Real-time clock with battery backup
Settling time before dry calibration	5 min
Typical power consumption	
At above -10 °C (+14 °F)	1.13 W at 24 V
At below -10 °C (+14 °F)	1.90 W at 24 V
With lens heating on	5.25 W at 24 V

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-55 ... +60 °C (-67 ... +140 °F)
Operating humidity	0 ... 100 %RH
IP rating	IP65

Optics and radiation

Optical specification	
Light source	Near-infrared laser diodes
Detection of window contamination	Contamination level of the receiver window is measured
Radiation properties	
Beam divergence	0.022 radians
Pulse duration	0.55 ms
Maximum output	0.0077 W
Radiation properties of incorporated laser diodes	
Beam divergence	0.022 radians
Pulse duration	0.55 ms
Maximum output	0.0077 W

Compliance

EU directives and regulations	Low Voltage Directive (2014/35/EU) EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC immunity	EN 61326-1, industrial environment FCC part 15, class B ICES-3 (B)
EMC emissions	CISPR 32 / EN 55032, Class B
Eye safety	IEC 60825-1:2014 Class 1 laser product
Vibration	IEC 60068-2-6

Mechanical specifications

Dimensions (H × W × D)	210 × 133 × 448 mm (8.27 × 5.24 × 17.64 in)
Weight	Sensor: 2.69 kg (5.93 lb) Mounting bracket: 0.71 kg (1.57 lb)
Mounting	Fits on a sensor support arm with cross-section of 40 × 40 mm (1.57 × 1.57 in)
Cables	3 ... 150 m (9 ft 10 in ... 492 ft) One end without connector 0.6 m (1 ft 12 in) extension cable to DST111
Materials	
Weather shield	ABS plastic
Transmitter body	POM plastic
Bolts, screws, and washers	Stainless steel
Fixture plate of the weather shield	
Lenses and windows	Glass
Other parts	Aluminum



Remote Road Surface Temperature DST111 presented with Remote Road Surface State Sensor DSC111

DST111 Remote Surface Temperature Sensor



Features

- Remote temperature measurement
- Eliminates the traditional nighttime problem of too cold road temperature readings when the sky is clear
- No need for road specific emissivity adjustment
- Easy and low-cost installation and maintenance
- No internal moving parts
- Stable measurement results even with intense traffic
- Weather-proof, durable design
- Reports air temperature and humidity
- Easy integration with Vaisala Road Weather Station RWS200

DST111 provides a unique remote alternative to measuring road surface temperature. By measuring the infrared radiation emitted by the surface and applying intelligent signal processing, the sensor provides a reliable remote surface temperature measurement.

Reliable infrared measurements

DST111 provides reliable results in conditions where most of the commercially available infrared sensors fail. At nighttime, when the road surface is cooling under a clear sky, conventional infrared sensors provide an error of up to -3°C due to emissivity conditions of the road surface. DST111 compensates for this error by using wavelengths where mirrored radiation is not visible. This also eliminates the need for road specific emissivity adjustment.

No traffic disruption for installation or maintenance

Installation of DST111 is easy, requiring no slot cutting or road closure. Supplied with solar/GSM options, the sensor is ideal for standalone operation in remote

or in-fill locations and on bridge decks. The sensor is simply installed on a mast or an existing structure beside the road. DST111 can also be installed alongside an existing Vaisala RWS200 or the earlier ROSA or LX-RPU Road Weather Stations.

Great combination with DSC111 or DSC211

DST111 can be combined with Vaisala Remote Road State Sensor DSC111 or DSC211. This combination provides all key parameters for road weather, such as road temperature, road state, and grip. The DST111 data also enables DSC111 and DSC211 to report frost, and it improves their autocalibration, impacting long-term stability.

Technical data

Measurement performance

Measuring distance	2 ... 15 m (6 ft 7 in ... 49 ft)
Installation angle from the horizontal line	30 ... 85° (35 ... 65° recommended)
Measuring area	Ø 150 cm at 10 m (59.1 in at 32 ft)
Road temperature	
Observation range	-40 ... +60 °C (-40 ... +140 °F)
Resolution	0.1 °C
Accuracy (RMS error ¹⁾)	0.3 °C (0.5 °F)
Time constant	1 min
Data refresh time	30 s

¹⁾ The RMS (root mean square) error of the surface temperature reading is 0.3 °C in typical freezing conditions when compared to a reference thermometer installed on the road surface. This accuracy is valid when the difference between the device temperature and the surface temperature is less than 10 °C and the device temperature is in the range of -40 ... +40 °C. (In the range of +40 ... +60 °C the error may be increased by an offset of ±1.5 °C.)

HMP60 measurement performance

Relative humidity ¹⁾

Measurement range	0 ... 100 %RH
Resolution	0.1 %RH
Typical accuracy at +20 °C (+68 °F)	±3 %RH (0 ... 90 %RH) ±5 %RH (90 ... 100 %RH)

Air temperature ¹⁾

Measurement range	-40 ... +60 °C (-40 ... +140 °F)
Resolution	0.1 °C
Typical accuracy at +20 °C (+68 °F)	±0.6 °C (±1.1 °F)

Dew point temperature ¹⁾

Measurement range	-40 ... +60 °C (-40 ... +140 °F)
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¹⁾ The relative humidity, air temperature, and dew point readings of HMP60 are mainly intended for internal compensation of DST111. The accuracy is not as high as that of the HMP155 sensor with a proper solar radiation shield.

Compliance

EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) amended by 2015/863
EMC compatibility	EN 61326-1, industrial environment FCC part 15, class B ICES-3 (B)
Vibration	IEC 60068-2-6, Level 2 g

Inputs and outputs

Input voltage	9 ... 30 V DC
Average input current	1.4 mA at 24 V
Average power consumption	0.05 W at 24 V
Communication interface	Isolated RS-485
Connectors	Male M12 (5 pins) including RS-485 and power in Cable connector Ø 15 mm (0.59 in)
Cables	3 ... 150 m (9 ft 10 in ... 492 ft) ¹⁾ One end without connector 0.6 m (1 ft 12 in) extension cable to DSC111 or DSC211

¹⁾ Cables longer than 50 m (164 ft) require a minimum of 24 V input.

Operating environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-55 ... +60 °C (-67 ... +140 °F)
Operating humidity	0 ... 100 %RH
IP rating	IP65

Mechanical specifications

Dimensions (H × W × D)	125 × 100 × 320 mm (4.92 × 3.94 × 12.60 in)
Weight	1.9 kg (4.19 lb)
Mounting	Fits on a support arm with cross-section of 40 × 40 mm (1.57 × 1.57 in)
Materials	
Cover	ABS plastic
Mounting bracket	POM-C
Other parts	Aluminum



Remote Road Temperature Sensor DST111 with Remote Road State Sensor DSC211



Air Temperature Sensor DTS12A for meteorological temperature measurement

Features

- Platinum resistance element
- Accuracy: 1/4 EN 60751 Class B
- Weather-resistant design
- EMI shielding

DTS12 Series temperature sensors are specially designed for outdoor use, for example with weather stations. The watertight, weather-resistant design ensures reliable temperature measurements in extreme conditions.

DTS12 sensors can be used with equipment operating either with the resistor bridge principle (3-wire connection) or constant current principle (4-wire connection).

The housing of the platinum resistance (Pt100 sensor) sensing element is made of stainless steel, and it is located in the tip part of the assembly. The cable screen attached to the sensor housing provides a good shield against electromagnetic interference (EMI).

Air Temperature Sensor DTS12A

DTS12A is meant to be used in meteorological temperature measurement. Vaisala recommends using a radiation shield to ensure correct results.

Subsurface Temperature Sensor DTS12G

DTS12G is specially designed for automatic weather stations. It can be used to measure the temperature at a certain level beneath the surface.

In roads applications, DTS12G is typically used to measure road depth temperature information at 30 cm (11.81 in) below the surface. This information is used to produce a 24-hour road surface temperature forecast.



DTS12G for subsurface temperature measurement

Water Temperature Sensor DTS12W

DTS12W is dedicated for measuring water temperature in tanks. It is equipped with the standard M20 thread for fastening.



DTS12W for water temperature measurement

Technical data

Specifications

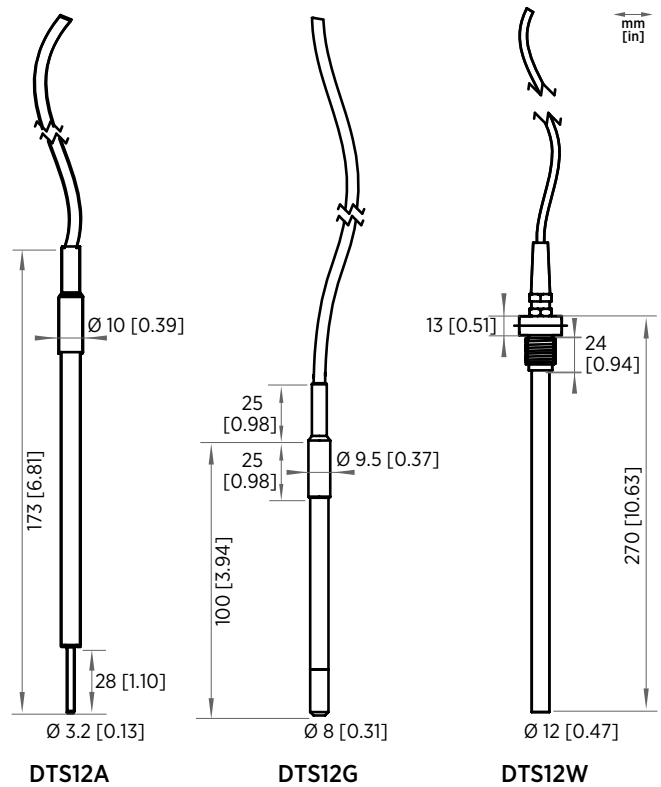
Sensor	Platinum resistance element (Pt100)
Accuracy	1/4 EN 60751 Class B ±0.08 °C at 0 °C (+32 °F)
Sensitivity	0.385 Ω/°C
Measurement range	-60 ... +80 °C (-76 ... +176 °F)
Housing material	Stainless steel AISI 316, PVC
Probe	Max. diameter: 10 mm (0.39 in) Length: 173 mm (6.81 in)
Cable	Screened multicore 4 × 0.22 mm and shield Length: 3.5 m (11 ft 6 in) Diameter: 5 mm (0.20 in)

Specifications

Sensor	Platinum resistance element (Pt100)
Accuracy	1/4 EN 60751 Class B ±0.08 °C at 0 °C (+32 °F)
Sensitivity	0.385 Ω/°C
Measurement range	-80 ... +80 °C (-112 ... +176 °F)
Housing material	Stainless steel AISI 316
Probe	Max. diameter: 9.5 mm (0.37 in) Length: 100 mm (3.94 in)
Cable	Screened multicore 4 × 0.22 mm (24 AWG) and shield Diameter: 5 mm (0.20 in)
Cable length options	10 m (32 ft 10 in) 20 m (65 ft 7 in) 30 m (98 ft 5 in) 50 m (164 ft 1 in) 100 m (328 ft 1 in) 120 m (393 ft 8 in) 150 m (492 ft 2 in) 200 m (656 ft 2 in)
Type V extension cable option	Maximum 1524 m (5000 ft)

Specifications

Sensing element	Platinum resistance element (Pt100)
Accuracy	1/4 EN 60751 Class B ±0.08 °C at 0 °C (+32 °F)
Sensitivity	0.385 Ω/°C
Measurement range	-80 ... +80 °C (-112 ... +176 °F)
Housing material	Stainless steel AISI 316
Probe	Max. diameter: 33 mm (1.30 in) Length: 270 mm (10.63 in) Tube: 12 mm (0.47 in) Thread: M20
Cable	Screened multicore 4 × 0.22 mm ² and shield Length: 5 m (16 ft 5 in) Diameter: 5 mm (0.20 in)



Dimensions



Features

- Measures both air and pavement temperatures
- Easy-to-read, dash-mounted digital display
- Patented cone design to protect sensor lens
- Separate air sensor for improved accuracy
- Quick and easy to install
- Field calibration with no need to return unit to manufacturer
- Integrates with other vehicle equipment such as spreaders
- Optional RS-232 output to connect to a computer or analog output for other applications

Vaisala Surface Patrol Pavement Temperature Sensor DSP100 Series is a mobile temperature sensor for detecting possible freezing temperatures on the pavement. DSP100 features a non-contact infrared sensor for measuring pavement temperature, and it also measures air temperature. The easy-to-use DSP100 is valuable for large agencies, such as Departments of Transportation, airport operations, as well as smaller companies with only a few trucks.

Benefits

- Mobile sensor provides pavement data for your entire route
- Real-time pavement and air temperature readings
- Inexpensive compared to other pavement monitoring methods
- Knowledge of surface pavement temperature makes winter decision making easier

Accurate Real-Time Data

DSP100 is mounted outside your vehicle and continuously monitors road surface temperatures, providing instant feedback on road surface conditions. DSP100 has a separate air temperature sensor and cabling so that it can be placed away from direct sunlight for accurate readings.

The data retrieved from DSP100 is accurate and real-time, making it a reliable method for collecting pavement information.

Ease of Use

DSP100 can be calibrated in the field, ensuring you are always getting the most accurate readings. In addition, the pavement probe features a cone design to protect the sensor from spray and winter elements that can decrease the accuracy of the readings.

DSP100 Series Technical Data

Measurement Performance

Accuracy of surface temperature ^{1) 2)}	±0.28 °C at 0 °C (±0.5 °F at +32 °F)
Field calibration	Adjustable ±2.8 °C at 0 °C (±5.0 °F at +32 °F)
Measurement units	°C or °F (user selectable)

- 1) For DSP111:
EN 61000-4-6 Conducted RF immunity test specification within EN 61326-1:2013 is 3 Vemf. Within frequency range 15 ... 30 MHz, DSP111 may invalidate RS-232 output message with levels above 2 Vemf.
- 2) For DSP113:
EN 61000-4-3 Electromagnetic RF immunity test specification within EN 61326-1:2013 is 3 V/m. Within frequency ranges 80 ... 200 MHz, 750 MHz, and 1600 MHz, DSP113 may show ± 1.2 C deviation in surface temperature readings with levels above 1 V/m.
EN 61000-4-6 Conducted RF immunity test specification within EN 61326-1:2013 is 3 Vemf. Within frequency ranges 2.4 ... 60 MHz, DSP113 may show invalid ambient temperature readings with levels above 1 Vemf.

Operating Environment

Operating temperature	-40 ... +71 °C (-40 ... +160 °F)
Storage temperature	-40 ... +71 °C (-40 ... +160 °F)

Inputs and Outputs

Input voltage	12 or 24 VDC unregulated
Digital output (optional)	RS-232; ASCII output
Analog output (optional)	4 ... 20 mA; 1 ... 5 V
Connections	Compression terminals for input voltage and signals quick disconnect connector for sensor head

Mechanical Specifications

Cable length, both sensors	5.5 m (18 ft) standard
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Infrared Surface Temperature Sensor

Weight	57 g (2.01 oz)
Weight, with cables and connectors	284 g (10.02 oz)
Housing/Optical assembly	Injected molded housing with lens protecting cone
Optics	Precision crystal (germanium lens)

Display Unit

Dimensions (H × W × L)	50.8 × 88.9 × 139.7 mm (2.00 × 3.50 × 5.50 in)
Temperature indicators	User selectable audio and visual temperature indicators

Dual digital meter	High-brightness red LED, showing both ambient air and pavement temperature
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Spreader Control

Dimensions (H × W × L)	36.0 × 117.6 × 133.0 mm (1.42 × 4.63 × 5.24 in)
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Compliance

CE compliance (product models DSP110, DSP111, DSP113)	Directive 2014/30/EU EMC standard EN61326-1, immunity test requirements for equipment intended to be used in a basic electromagnetic environment
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Shock	50 Gs
Vibration	10 Gs in any axis



Applications

- Winter maintenance operations (snow plows, supervisor vehicles, and so on)
- Other fleet vehicles to increase your AVL network
- Runway temperature monitoring for airport operations

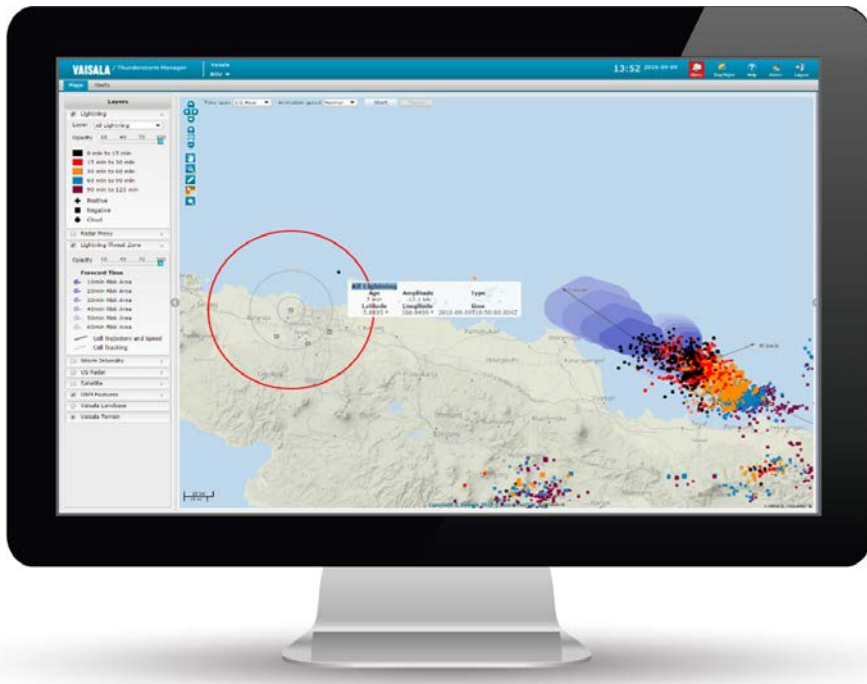
DSP100 Series Products

DSP110	Surface Patrol with display
DSP111	Surface Patrol with display and digital output
DSP112	Surface Patrol with display and analog output
DSP113	Surface Patrol with spreader interface and DB9 connector
DSP114	Surface Patrol with spreader interface and FA connector



VAISALA

www.vaisala.com



Features

- Lightning Threat Zone – a one-hour forecast of the potential for lightning and severe weather (in 10-minute increments). Includes a storm trajectory display, and a storm cell velocity vector with speed and direction.
- Storm track – showing history of the storm route
- Storm Intensity – displays current lightning threat region, and the storm intensity level

Vaisala Thunderstorm Manager 1.2 is a professional thunderstorm tracking and alert management application and indicates the possibility of severe weather.

Vaisala Thunderstorm Manager is a web-based application to assist you in tracking approaching storms. It supports a broad range of applications from synoptic or national scale lightning surveillance, to keeping local ground and maintenance crews safe, and operational stoppages at a minimum.

Benefits

- Easy access using any modern web browser
- Access data for anywhere
- Available to you now
- Proven best quality data
- Global oceanic and continental coverage

Storm tracking

Vaisala Thunderstorm Manager enables you to track approaching storms in real-time. You can use a desktop or mobile device browser to access the displays.

One or multiple sites with alerting rings, defining an alert region, will serve to notify you about lightning taking place in the area.

Quality lightning data

Thunderstorm Manager is powered by lightning from the Vaisala global lightning detection network, GLD360, and lightning from the Vaisala US National Lightning Detection Network, NLDN. Both networks are proven industry leaders, delivering excellent detection efficiency, location accuracy, and distinction between cloud and cloud-to-ground lightning.

Alerts

Independent of the display, alerts are working in the background and are server-based.

Multiple alert areas per site have different types of notifications (for example, Information, Warning, and Alarm) depending on the distance to the site.

Alert notifications can be received via email and SMS, including all-clear notices.

Additional features

General features

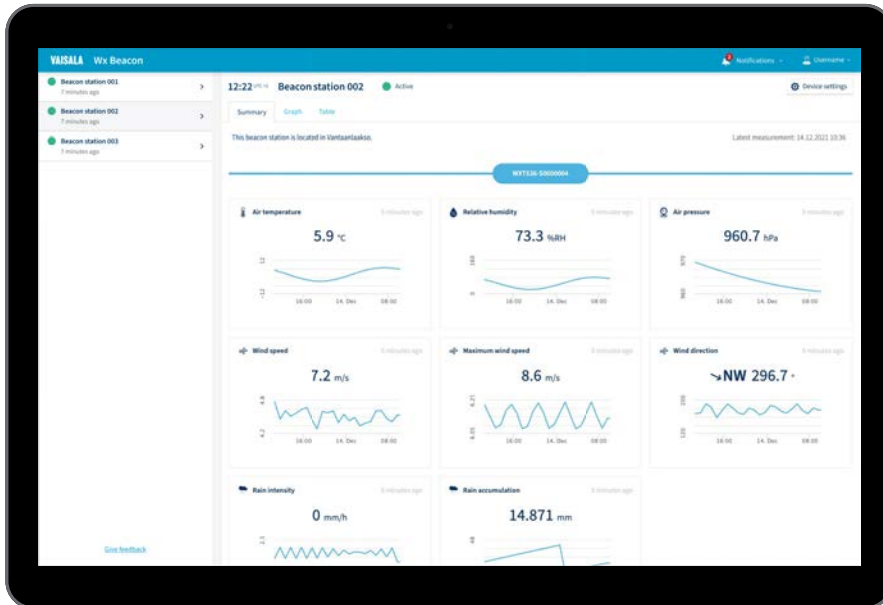
- Map display for both cloud-to-ground and cloud-to-cloud lightning updates every 30 seconds
- Display of lightning polarity and graphical representation of the magnitude of each strike
- Time discrimination of lightning to determine the storm path through color-coded symbols
- Display of coordinates that follow the cursor
- Zoom and pan with dedicated zoom area selection
- Hover over lightning events for display of more detailed information
- Measure distance between 2 points (for example, between strike location and asset)
- Toggle day and night modes

Alert features

- One alert site standard, but more sites can be added for extra charge
- Add up to 3 levels of alert per alert site
- Standard alert regions are circles, but customers can define polygons for an extra charge
- Choice of alert-triggering criteria (for example, one or more lightning events, cloud and/or cloud-to-ground lightning)
- 7-day alert history
- Alert notifications to email and SMS
- Alerts to multiple email addresses or cell phone numbers
- All-clear alert notifications when no lightning has occurred after a predetermined amount of time.

Animation features

- Choose from multiple time periods (from ½ hour up to 24 hours), from present time to 7-day history
- Choose various replay speeds



Features

- Online service for monitoring measurement parameters
- Up-to-date real-time measurement data
- Available 24/7
- Access with web browser on computer, tablet, or mobile phone
- Dashboard-like measurement summary
- History data as graphs or in tables
- Data export to CSV format
- Device management
- Open API for data integration
- Data from Vaisala Beacon Station BWS500 through Vaisala Edge Gateway EGW501

Vaisala Wx Beacon is cloud software for accessing measurement data from Vaisala sensors. With Wx Beacon, you can easily manage your devices and their settings and monitor observations in real time. Measurement data can be downloaded to other applications for further analysis.

Real-time measurement data

Wx Beacon has a dashboard-like summary view, showing the different measurements coming from the sensors. The summary shows data from the most recent 24-hour time period.

The measurement data in Vaisala Wx Beacon is updated once a minute. The data is available 24/7.

Data visualization and export

In addition to real-time data, Wx Beacon shows the history data. There are different views available with various filtering options. You can look at each device and measurement parameter separately or combine several devices, measurement parameters, and measurements to one view.

In the graph view, you can compare two measurement parameters of a device and limit the timeframe from one day to up to one year.

The table view shows all measurement parameters of one of more devices for the selected timeframe, and you can filter the data to be shown from one minute to up to one day. From the table view, you can export the data in CSV format, for example, for viewing in Excel.

Centralized device management

Wx Beacon helps you manage your devices. You can show and hide devices and modify their settings, such as the device name. The system raises alerts and notifications in case a sensor needs maintenance or there is some other significant event.

There are settings for the unit conversion so you can select, for example, whether to display the wind speed measurements in m/s, mph, or knots.

Data integration to systems

Vaisala Beacon Edge Gateway EGW501 of a Vaisala Beacon Station BWS500 handles the data transfer between the sensors and Vaisala Wx Beacon.

Vaisala sensors that you can connect to Wx Beacon currently include Vaisala Air Quality Transmitter AQT530 and Vaisala Weather Transmitter WXT530.

No device pairing is needed because the devices are associated with a specific cloud account when they are purchased.

Wx Beacon not only provides a UI, but in addition you can transfer the data to your own data collection system through the Vaisala Wx Beacon open API.

Wx Beacon includes settings for managing your API integrations.

Technical data

Measurements and observations

Measurement parameters ¹⁾

- Air temperature, relative humidity, air pressure, wind speed, maximum wind speed, wind direction, rain accumulation, rain intensity
- NO₂, NO, O₃, CO, PM₁, PM_{2.5}, PM₁₀
- CO₂

Units available

- Air pressure: hPa, mbar, inHg
- Air temperature: °C, °F
- Relative humidity: %RH
- Rain accumulation: mm, in
- Rain intensity: mm/h, in/h
- Wind direction: °
- Wind speed: m/s, mph, knots
- Maximum wind speed: m/s, mph, knots
- Gas concentration: ppb, ppm, µg/m³

Reported values

Instant or average, depending on the measurement parameter

Measurement interval

1 minute

Reporting interval

1 minute

¹⁾ Depend on the selected sensors.

Connection specifications

Web address

wxbeacon.vaisala.com

Security protocol

TLS/SSL

Supported browsers

Any modern browser, such as Microsoft® Edge®, Google Chrome™, Apple® Safari™, Mozilla Firefox®

Supported environments

PC/Mac, tablet, mobile phone

Supported sensors

- Vaisala Air Quality Transmitter AQT530
- Vaisala Weather Transmitter WXT530

Supported devices

EGW501 ¹⁾

Connection capacity

No limit

Data interface

Vaisala Wx Beacon XML API

API

wxbeacon.vaisala.com/api/xml ²⁾

API description

See docs.vaisala.com/access/sources/dita/map?aton_code=M212639EN

¹⁾ For transfer of data from sensor to Wx Beacon.

²⁾ Wx Beacon login credentials required.

User interface

Measurement views

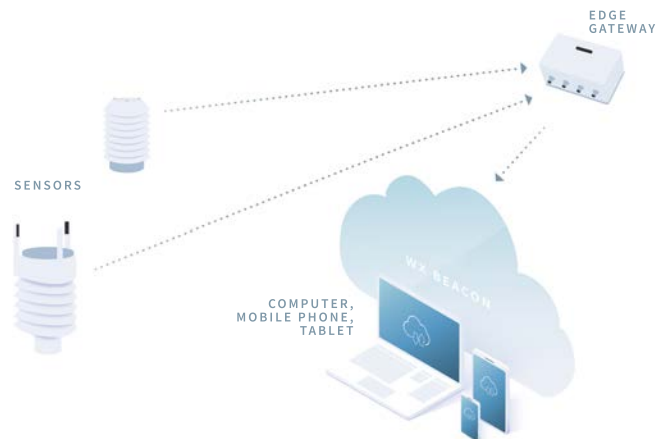
Summary, graph, table

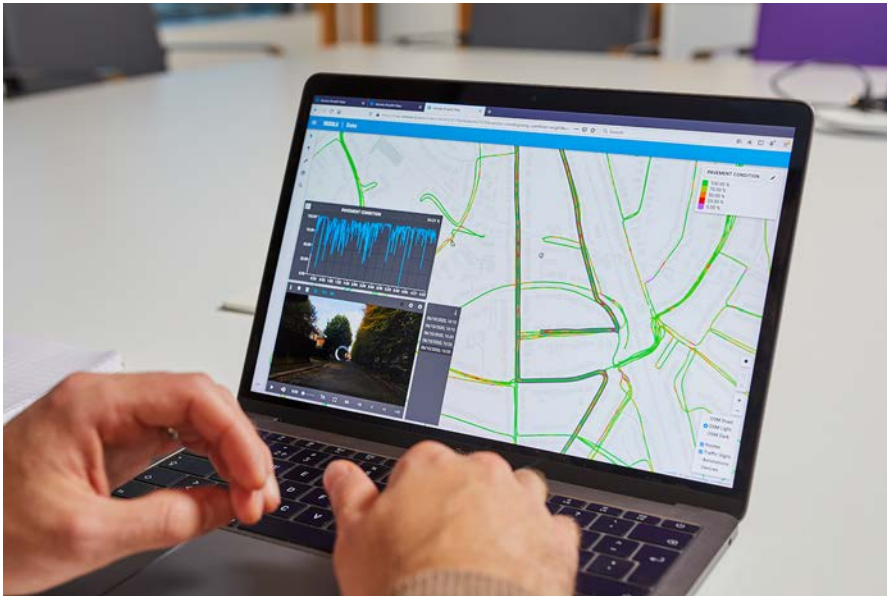
Download file format

CSV
Max. latest 1-month data or 60.000 measurements

User interface languages

English, Finnish





Features

- Online service supporting you with traffic sign inventory management, road marking condition assessment, and road surface condition scoring
- Combines live road video, AI for advanced analysis of the video data, and analytics
- Easy-to-use smartphone application for video data collection with automatic uploads to RoadAI cloud
- Exports data to an asset management system or Geographic Information System (GIS) for further analysis
- Assists in prioritizing and optimizing road maintenance projects and budgets

Vaisala RoadAI is a SaaS solution that helps you assess and monitor your road network. RoadAI combines an artificial intelligence (AI) tool with video data and analysis methodology to identify pavement defects and the condition of traffic signs and lane markings, and enables data-driven decision making and efficient deployment of the maintenance patrolling fleet.

Objective visibility of network condition

RoadAI combines geospatial videos, driver-made annotations, and computer vision analysis to support road maintenance and management. Videos, and therefore road condition and surface data, are constantly being updated, enabling engineering teams to make decisions based on the current condition of the network. Data and videos can be shared between teams for a variety of purposes, saving time spent on unnecessary site visits.

Increased efficiency and safety

With RoadAI, the patrolling teams can record a variety of on-site issues with the integrated steering wheel button, while video collection happens in the

background. This means that unnecessary stops can be avoided, bringing higher efficiency but also increasing safety, with the road inspector not having to step out of the vehicle. Same-day delivery of videos enables teams to respond to public surface condition reports from within the office without visiting a site.

Pavement preservation

RoadAI quickly and accurately assesses pavement conditions up to four times faster than in a manual road survey. It distinguishes between all defect types and provides information and analysis of pavement defects and patches across more than 20 different categories, reporting on every 10-meter segment. Road repair and resurfacing schemes can

be planned in reduced time with up-to-date road surface condition and defect data available whenever it is needed. Linking data collection to existing road inspection schedules unlocks a variety of cost-effective pavement preservation strategies.

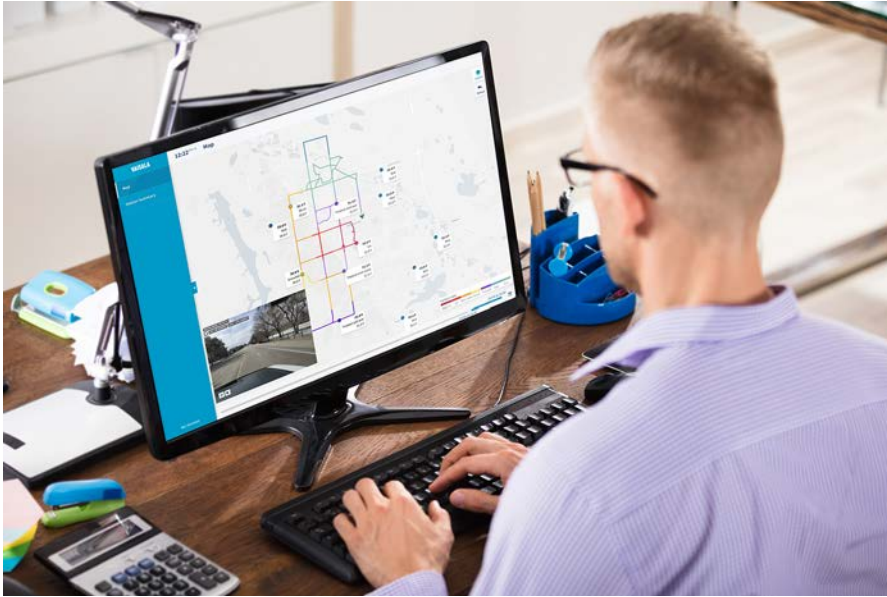
Road assets

RoadAI's computer vision technology goes beyond pavement defects. With traffic sign detection and management tools and lane marking condition assessment, it provides improved management of kerb-to-kerb assets.

Technical data

Web application

Web address	www.vaisala.com/en/products/road-ai
Supported environments	PC/Mac, tablet, smartphone
Recommended web browsers	Any modern and up-to-date browser, such as: <ul style="list-style-type: none">• Google Chrome™• Google Chromium™• Opera™• Mozilla Firefox®
User interface	Vaisala RoadAI is a SaaS solution, and new features and user interface languages are added continuously - visit our website for the latest feature and language set.



Features

- Online service providing real-time data for making data-driven decisions about transportation safety, maintenance, and mobility during winter storm events
- Leverages Vaisala industry-leading sensors and world-class forecasting capabilities
- Combines data from fixed and mobile Vaisala sensors and other suppliers
- Uses a secure, cloud-hosted environment that is available 24/7
- Provides road weather condition forecasts using our proprietary road weather model

Wx Horizon helps you prioritize treatments, plan equipment resources efficiently, and optimize salt and liquid usage to minimize impact to the environment. The data that you can see helps you optimize winter maintenance resources.

Maintain safer roads

Wx Horizon provides you information on the current conditions and precipitation levels and shows near-term forecast data to help you decide when and where to deploy your fleet. The combination of accurate measurements and powerful modeling provides the best situational awareness of current conditions plus a forecast of how the weather will impact road network mobility—giving you the ability to make timely, targeted decisions more easily.

Improve sustainable operations and treatment practices

Wx Horizon helps you prioritize treatments, optimize salt and liquid usage, and plan equipment resources efficiently to minimize the use of

resources that can negatively impact the environment. The data that you can see helps you optimize winter maintenance resources.

Observation-driven data for better accuracy

Wx Horizon combines the best of Vaisala's accurate, dependable technology with world-class forecasting. It aggregates real-time road data from several sources—including mobile sensors, IoT sensors, RWIS and ESS—then analyzes and visualizes the information. This information provides cities, counties and state and national transportation departments with a clear picture of the current situation so they can take immediate steps to ensure road safety.

Designed with mobile sensing in mind

Wx Horizon aims to produce the strongest, most efficient solution for helping you keep your roads safer. Beyond research and community input and close collaboration with the public works community, feedback has also been collected from users of the Vaisala Mobile Detector MD30. The result of this research is a solution that has the needs of winter maintenance experts as a fundamental building block to its design.

Technical data

Web application

Web address	www.vaisala.com/en/road-maintenance/wx-horizon
Supported environments	PC/Mac and tablet
Recommended web browsers	Any modern and up-to-date browser, such as: <ul style="list-style-type: none">• Google Chrome™• Apple Safari™• Microsoft Edge®• Mozilla Firefox®
User interface	Vaisala Wx Horizon is a SaaS solution and new features and user interface languages are added continuously - visit our website for the latest feature and language set.



Project Services



Calibration Services



Extended Warranty



Training Services



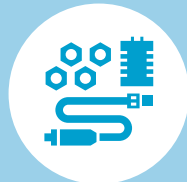
Maintenance and repair



Instrument modernization



Technical Support



Spare Parts



Remote Services

Project services

Vaisala offers turn-key project delivery which ensures a smooth and efficient project completion with high reliability. With several decades of experience, Vaisala successfully delivered a wide range of projects in different market segments, and continue to serve many customers throughout the world. Using this knowledge Vaisala has created a suite of project services that ensure the successful planning, delivery and implementation of your system of equipment.

Project service options include:

- Site Survey and Feasibility study
- Engineering
- Installation
- Acceptance testing
- Project management
- Training
- Consulting



Calibration services

Using our calibration services is the most convenient way to ensure that your device will meet the original accuracy specifications. Our calibration options are available for you 24/7 from our Online store throughout the life cycle of your instrument.



Original factory calibration performed on new instruments

In compliance with
ISO 9001 requirements

Predefined calibration points



Calibration for regulated industries and reference instruments

In compliance with
ISO/IEC 17025 requirements

Predefined/selectable calibration points



Configurable calibration for customer-specific needs

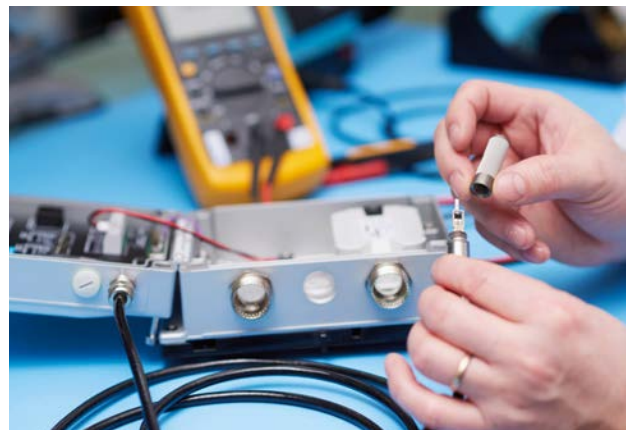
In compliance with
ISO 9001 requirements

Selectable calibration points

Much more than a calibration

All of our calibration options include:

- Functional testing
- Traceable calibration
- Accuracy adjustment as needed
- Filter replacement as needed
- Calibration certificate with as-found and as-left results
- Service report
- Calibration due-date update



Learn more at www.vaisala.com/calibration

Calibration Care agreement

Our Care agreement includes planned calibrations for multiple years. It is the most convenient and economical way to maintain the accuracy of your Vaisala measurement instrument year after year.



Benefit	Care Agreement
Planned calibrations for multiple years	✓
Fixed pricing	✓
Free shipping to and from Vaisala	✓
Priority order handling at the Service Center	✓
Easy return process from the online portal	✓

Personalize your agreement by choosing

- 1 Calibration**
 - Standard ISO 9001
 - Accredited ISO/IEC 17025
- 2 Number of calibrations**
 - Three or more
- 3 Duration of the agreement**
 - Three or more years
- 4 Payment options**
 - Advance payment
 - Annual invoicing

How the Care return process works

-  **1.** Use the Online return portal or form to get the pre-filled waybill.
-  **2.** Send your instrument to Vaisala Service Center by using our free shipping.
-  **3.** Calibration is performed at a Service Center with a priority status.
-  **4.** Your instrument is returned with a calibration certificate and service report.

Frequently asked questions about calibration

Why is calibration important?

- All electronics and sensors drift over time.
- It is important to verify accuracy and make adjustments if needed.
- A calibration certificate is often required by internal or external quality standards.

Calibration versus adjustment?

- Calibration refers to comparing the output of a measurement instrument against a reference instrument and only reporting the result.
- Adjustment refers to changing the output to correspond the output of a reference instrument.

How often should I calibrate?

- The most common calibration interval is 12 months but the interval depends on your accuracy requirements, operating environment, and your system's quality requirements.

Extended warranty

Provides additional years of coverage beyond the factory warranty:

- Up to the year five of additional warranty over the standard warranty period
- Allows for fast and easy use of the warranty process



Spare parts

A well-managed spare parts inventory ensures the continuity of the operations and maximizes uptime. To place an order, please

- Contact us through MyVaisala Portal reach out to the Sales
- Order through Vaisala Online Store for selected items

To minimise waiting time, we also offer express delivery service for critical spare parts on selected products.



Training services

Our training services are based on customers' needs to ensure efficient and accurate measuring operations.

Contact us for training services related to product and system operations, measuring procedures, and maintenance.

Maintenance and repair

When your instrument requires repair or component changes, select maintenance and repair services that include:

- Fixed pricing
- Performed by professionals using original parts
- Completed with a calibration to meet the original specifications



Modernization

Modernization services ensure your equipment and systems meet the latest technical standards. We offer modernization packages that can cover from research to the full upgrades of your instruments, software and system.



Remote services

Vaisala Network Operation Centre provides remote hosting, monitoring and diagnostics services for a wide range of Weather equipment and systems.

- Ensure high-quality data is continuously available
 - 24/7 monitoring and troubleshooting
 - Vaisala end-to-end knowledge
 - Proactive and efficient lifecycle support
- Option to have on-demand remote diagnostics without monitoring



Technical support

We are dedicated to providing global technical support to all our customers during the lifetime of their Vaisala products.

- Remote support
- Vaisala experts to help you
- Fast response
- Multiple channels to contact us 24/7
- On-site support on request

How to order our services?

Contact your local Sales or reach out via MyVaisala

- Our experts are available to answer all your questions
- Quick and easy quoting according to your specific needs
- Contact us at www.vaisala.com/support

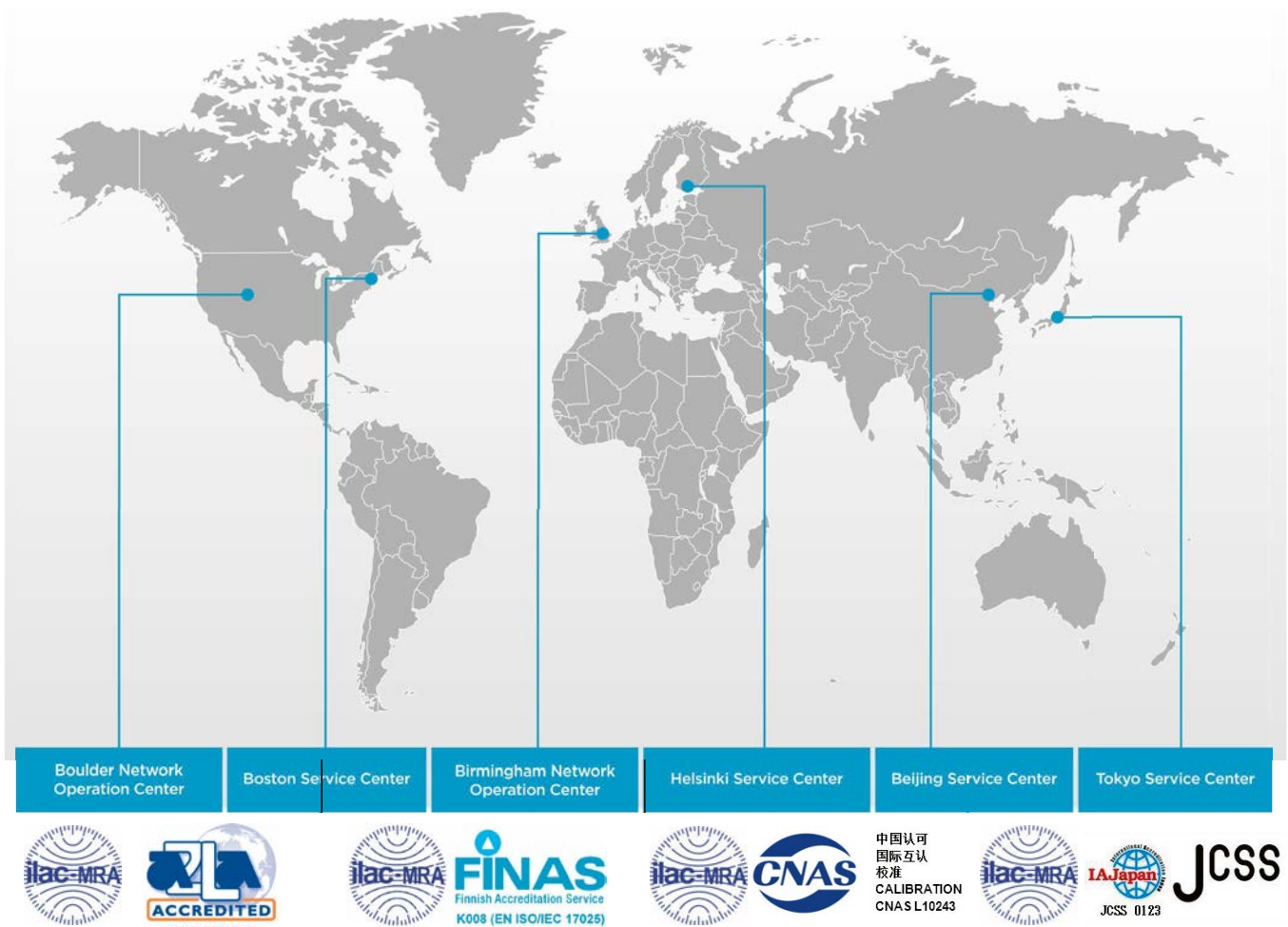
View and order 24/7 via Vaisala Online Store for services such as Calibration

- Open 24/7/365
- Easily find and purchase services
- Visit us at Vaisala online store store.vaisala.com

At your service worldwide

- Global technical support
- Network Operation Center
- Service Centers
- Field service

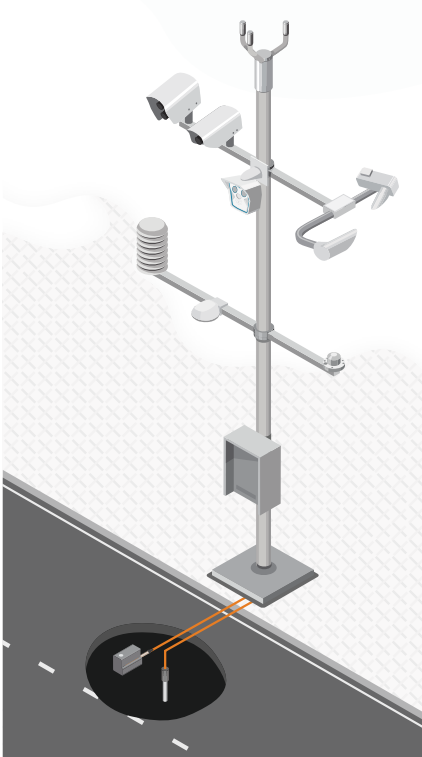
Our service centers are accredited according to world's leading authorities.



VAISALA

www.vaisala.com

Remote Monitoring and Diagnostics for Road Weather Stations



Features

- Ensure reliable and continuous mission-critical data
- 24/7 remote monitoring and diagnostics of Vaisala full-stack solutions: no need to dedicate other resources to monitoring
- Vaisala NOC has end-to-end knowledge backed up by the Vaisala global technical expert network

The Vaisala Network Operation Centre (NOC) provides remote monitoring and diagnostics service for Vaisala Road Weather Stations to make sure that the high-quality data is continuously available. The service includes 24/7 monitoring backed up by trained technical experts. Any issues are identified and investigated, and appropriate corrective actions are taken as agreed.

Ensure mission-critical data

The primary requirement of a road weather station is reliable and continuous data, flowing as scheduled for road maintenance teams. Road maintenance decision makers must be able to access and trust the information every time that they make a critical decision.

Sometimes issues may arise, for example, around mobile network status, station or sensor operation, or power supply failures. When problems occur, Vaisala can help provide timely and appropriate actions to return the stations back to the required operating state.

Vaisala roads solution support

In most cases, Vaisala is responsible for the sensor measurement technology at the roadside as well as for the data flow to the hosted system, plus winter maintenance decision-making tools such as Vaisala RoadDSS and Vaisala Wx Horizon. This allows Vaisala to investigate complete data flow chains. Building up and hosting a monitoring center can be time-consuming, complicated, and expensive. Instead, Vaisala 24/7 Sensor Monitoring and Diagnostics can provide a full solution for RWS lifecycle support in an ongoing, proactive, and efficient manner. The

trained technical staff in the NOC consider potential issues, analyze each case, and implement corrective actions or provide guidance to resolve the issue.

Vaisala end-to-end knowledge

It can be challenging to have a well-trained team on road weather stations. Vaisala has in-depth knowledge of the whole system, and monitoring is not limited to basic station data availability. The NOC team can analyze individual data values, inspect sensor performance history, and remotely restart stations. Getting corrective actions right from the start helps to get the system back to normal state as quickly as possible.

The NOC team is fully trained on the full road solution and has direct access to Vaisala's global technical expert network for escalations when needed.

Customized service

Depending on your needs and system architecture or regional location, Vaisala can offer remote network monitoring and diagnostics, escalations to pre-defined contacts, or even roadside repair services. Please contact Vaisala sales or a partner representative for more information to create a service that meets your organization's needs.

Remote monitoring and diagnostics

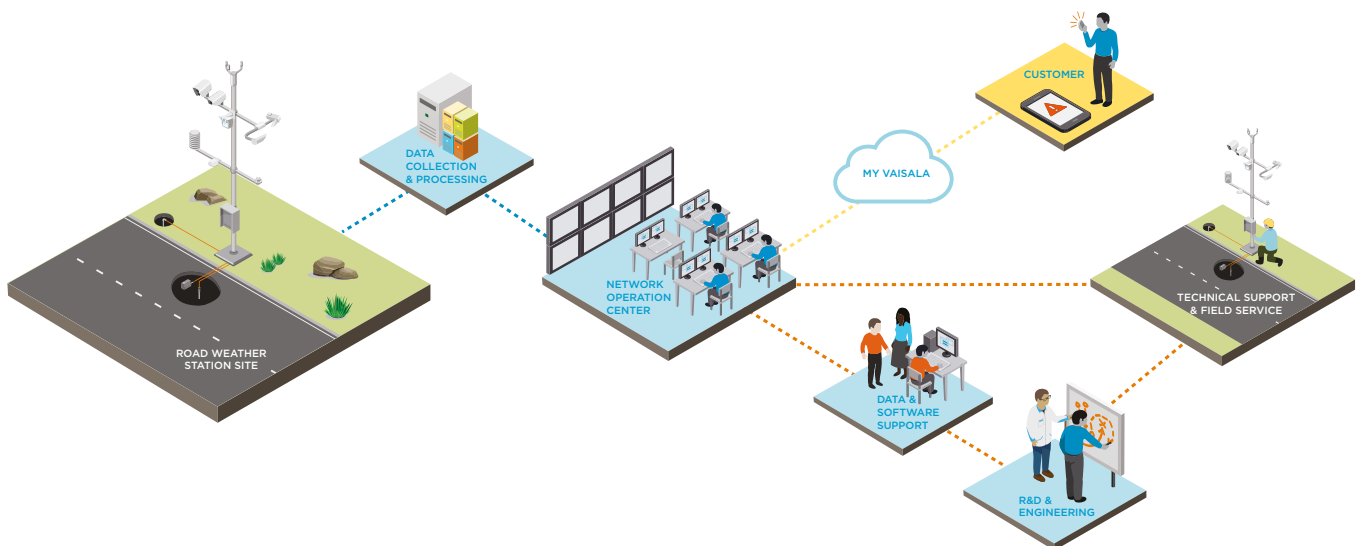
Service description

24/7 sensor monitoring ¹⁾	Periodic reporting ²⁾	Escalation for resolution
<p>Monitoring the quality and availability of road weather stations and sensor data, including the availability of camera images.</p> <p>Systems that can be continuously monitored with diagnosis:</p> <ul style="list-style-type: none"> Vaisala road weather stations: RWS200, RWCC, LX-RPU and ROSA Vaisala road and weather sensors: DSC211, DST111, WXT530 Series Third-party weather stations ³⁾ 	<p>Daily Corrective Action Report: Summary of current and recent faults of weather station and sensor data, and who is investigating them.</p>	<p>Escalation to end-to-end Vaisala experts in second-tier technical support, field service, and engineering teams, or your specified contacts.</p>
<p>Frontline diagnosis, initial troubleshooting, and remote restarts if required.</p>	<p>Monthly Network Performance review: Summary of the network performance of your data.</p>	<p>Customer notification of faults and updates as the case progresses to resolution.</p>

- 1) *The following are not included in this service: SIM communication, cloud storage or digital application services, spare and wear parts, onsite execution or step-by-step executional support. These services can be provided as service extensions. Please contact sales for query and availability of service globally.*
- 2) *Weekly reports, which provide detailed data break outage records, can be made available for specific customers (this is not a default feature).*
- 3) *Third-party sensor integration and monitoring require separate discussion and customized agreement.*

Service escalation procedure

- Data from road weather stations are sent to the Vaisala hosted service, where measurements are entered into internal roads monitoring software.
- If the readings from the road weather station or the associated sensors go outside of a threshold for a certain amount of time, the system automatically detects the reading as a suspected fault and suppresses it from being displayed to end users.
- The NOC team investigates the fault, diagnoses the issue, and attempts to resolve the issue remotely. NOC can also manually suppress incorrect data to make sure that end users are viewing accurate data in the Vaisala or third-party decision-making application.
- If NOC is unable to resolve the issue, they create a ticket in the Salesforce system to inform you of the relevant details and escalate accordingly. Depending on the type of issue, this escalation could go to second-tier technical support, field services, engineering, or specified customer contacts.
- All information and communication regarding the issue is recorded in the Salesforce ticket to make sure that you have a single point of contact, and that the Vaisala expert has all the details related to the case to help resolve it.
- In case of any questions or concerns, end users may contact NOC via email, phone, or the MyVaisala portal 24/7.



System description and requirements for customer system

[Preferred] Vaisala-supplied secure cellular connectivity

Secure bi-directional mobile network cellular service using Vaisala suppliers. The system supports a private static IP address or a secured public IP address for RWS data collection and remote access for configuration or troubleshooting.

Observation data can be received through system polling or RWS pushing. This solution is typically the easiest option as Vaisala is responsible for the whole communication chain. Availability of this service depends on customer location. Please contact Vaisala sales for more details.

[Optional] Customer-provided secure connectivity

Either white-listed bi-directional access from Vaisala IP addresses or a dedicated VPN to tunnel through to customer network, for data collection and remote configuration or troubleshooting.

Observation data can be received through system polling or RWS pushing. White-listing incoming IP addresses provides secure access for the customer and/or local integrator/service provider to log in to the system. A secure VPN is recommended for this solution.

Remote Monitoring and Diagnostics for Weather Radar



Features

- Ensure reliable and continuous mission-critical data
- 24/7 remote monitoring and diagnostics of Vaisala full-stack solutions: no need to dedicate other resources to monitoring
- Vaisala NOC has end-to-end knowledge backed up by the Vaisala global technical expert network

The Vaisala Network Operation Centre (NOC) provides remote monitoring and diagnostics service for Vaisala weather radars to ensure the high-quality data is continuously available. The service includes 24/7 monitoring backed up by trained technical experts, so that any issues are identified and investigated, and appropriate corrective actions agreed.

Ensure mission-critical data

The primary requirement for a weather radar is reliable and continuous data, flowing as scheduled for meteorological organizations and other authorities, such as airports, responsible of mission-critical operations. It gives operators the accurate weather information they need for early and correct operational decisions.

When problems related to radar system operations occur, Vaisala can provide timely and appropriate actions to return radar operation back to the required operating state.

We do not collect observation data, so your data security is maintained.

Vaisala solution support

In most cases, Vaisala collaborates with customers in the delivery and life-cycle service support phases of radar systems. This remote monitoring solution allows Vaisala to provide prompt diagnostic support and solutions for possible issues in system performance, often reducing the need for on-site intervention, and thus can significantly increase the uptime of the system.

Building up and hosting a monitoring center can be time-consuming, complicated, and expensive. Instead, the NOC 24/7 monitoring and diagnostics can provide life-cycle support in an ongoing, proactive, and efficient manner. Potential issues are considered by NOC trained technical staff, who analyze each case and can implement corrective actions or provide guidance to resolve the issue.

Vaisala end-to-end knowledge

It can be challenging to have a well-trained team on weather radar network maintenance.

With Vaisala's deep knowledge across the whole system, monitoring is not limited to the detection of possible issues when they occur. The NOC team is fully trained on the radar monitoring and has direct access to the Vaisala global technical expert network for escalations when needed. NOC also ensures timely communication with customers in case of detected issue.

Weather radar experts can further analyze, troubleshoot, and possibly make some corrective actions through remote connection. If on-site intervention is needed, this service supports the preparation of correct spares and instructions for field teams. It can significantly speed up the process of getting the system back to normal.

Customized service

Depending on your needs and system architecture or regional location, Vaisala can offer remote network monitoring and diagnostics, reactive remote diagnostics, escalations to pre-defined contacts, or on-site repair services. Please contact Vaisala sales or a partner representative for more information to create a service that meets your organization's needs.

Remote monitoring and diagnostics

Service description

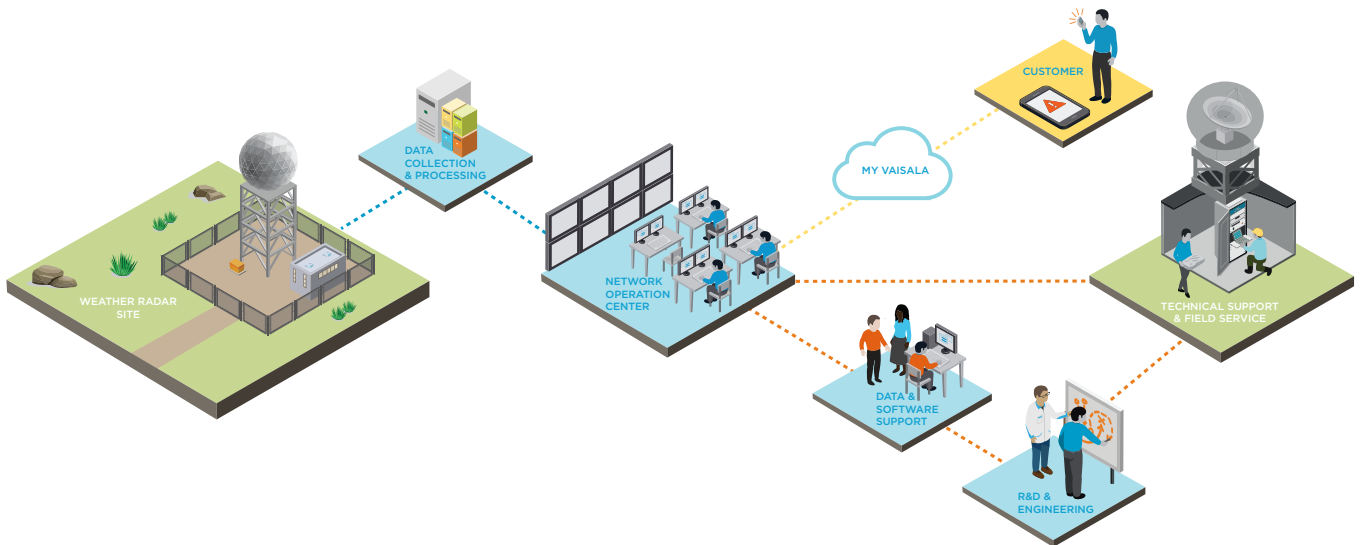
24/7 monitoring ¹⁾	Periodic reporting	Escalation for resolution
<p>Continuous monitoring of the system critical alarms and events status and automated alarming of the following systems:</p> <ul style="list-style-type: none"> Vaisala weather radars Site infrastructure monitoring (e.g. radar cabinet, shelter, radome humidity and temperature) ²⁾ Initial troubleshooting and frontline diagnosis when required. 	<ul style="list-style-type: none"> Customer notification on faults and updates Case creation, status updates, and resolution summaries 	<p>Escalation to Vaisala product experts in second-tier technical support, field service and engineering teams, or your specified contacts.</p> <p>Technical experts can remotely access the system and perform deep diagnosis and corrective actions.</p>

1) The following are not included in this service: "SIM communication", cloud storage or digital application services, spare and consumable parts, on-site execution or step-by-step executional support. These services can be provided as service extensions; please contact sales for query and availability of service globally.

2) Site infrastructure monitoring requires separate hardware solutions, such as dataloggers and temperature and humidity sensors, and requires a separate discussion and customized agreement.

Service escalation procedure

- Status and event data from the system are sent to the NOC through a secure VPN tunnel, where measurements are fed into Vaisala monitoring system.
- If the status and events from the system or the associated sensors go outside of a threshold for a certain amount of time, the system automatically detects the reading as a suspected fault, and displays an alarm to the NOC team.
- The NOC team investigates the fault, diagnoses the issue, and attempts to resolve the issue remotely.
- If NOC is unable to resolve the issue, they create a ticket to inform you of the relevant details and to escalate the issue accordingly. Depending on the type of issue, this escalation could go to second-tier technical support, field services, engineering, or customer-specified contacts.
- All information and communication regarding the issue is recorded in the ticket to make sure that you have a single point of contact, and that the Vaisala expert has all the details related to the case to help resolve it.
- In case of any questions or concerns, end users may contact NOC via MyVaisala portal 24/7.



System description and requirements for customer system

This service is available for the compatible IRIS versions. Radars with older versions will need an update first.

[Preferred] Vaisala-supplied secure VPN connectivity

All the network traffic to/from the customer observation system and Vaisala remote services is protected with a network security VPN product supporting state-of-the-art security features. The network traffic protection is based on client – server architecture where the client side is installed in the customer's remotely monitored observation system and the server side is installed in the NOC. The mutual authentication between the client and the server is based on public key certificates (X.509), and state-of-the-art cryptographic settings and protocols are applied for the encryption of the network traffic.

Being an always-on service in the endpoints, the firewall and traffic encryption policy is enforced for all relevant network traffic, all the time. Nothing sensitive escapes, and nothing unintended enters the customer's remotely monitored observation systems, and only Vaisala authorized personnel can access the systems.

This solution is typically the easiest option, as Vaisala can perform the installation, and the customer only needs to open specific ports in the intermediate firewall to allow secure traffic from the customer system to NOC. Please contact Vaisala sales for more details.

[Optional] Customer-provided secure connectivity

A dedicated VPN tunnel through to customer network, for status and event information and remote configuration or troubleshooting. A secure VPN is recommended for this solution.



Vaisala contact information

EUROPE

FINLAND

Vaisala Oyj
P.O. Box 26
FI-00421
Helsinki
FINLAND
weathersales.europe@vaisala.com
www.vaisala.com

FRANCE

Vaisala SAS
Paris Office
Tech Park
6A, Rue René Razel
F-91400 Saclay
FRANCE
weathersales.europe@vaisala.com
www.vaisala.com/fr

GERMANY

Vaisala GmbH
Notkestraße 11
D-22607 Hamburg
GERMANY
weathersales.germany@vaisala.com
www.vaisala.com/de

UNITED KINGDOM

Vaisala Ltd
Birmingham Office
6230 Bishops Court
Birmingham Business Park
Birmingham B37 7YB
UNITED KINGDOM
uksales@vaisala.com
www.vaisala.com

AMERICAS

U.S.A.

Vaisala Inc.
Boulder Office
194 South Taylor Avenue
Louisville, Colorado 80027
USA
WEA-
NorthAmericaInsideSales@vaisala.com
www.vaisala.com

Vaisala Inc.
Boston Office
10-D Gill Street
Woburn, Massachusetts 01801
USA
WEA-
NorthAmericaInsideSales@vaisala.com
www.vaisala.com

MEXICO

Vaisala México Limited
México Office
Sócrates 140
Col. Polanco Sección II
Del. Miguel Hidalgo
CP 11540, CDMX
MÉXICO
weathersales.latinamerica@vaisala.com
www.vaisala.com/es

BRAZIL

Vaisala Serviços de Marketing Ltda
Ladeira da Gloria 26
Bloco 3 - Studio 206
Glória, Rio de Janeiro
RJ 22211-120
BRAZIL
weathersales.latinamerica@vaisala.com
www.vaisala.com/pt

ASIA AND PACIFIC

AUSTRALIA

Vaisala Pty Ltd
Melbourne Office
3 Guest Street
Hawthorn, VIC 3122
AUSTRALIA
sales.melbourne@vaisala.com
www.vaisala.com

CHINA

Vaisala China Ltd
Beijing Office
Floor 2, EAS Building
No. 21, Xiao Yun Road, Dongsanhuan Beilu
Chaoyang District
100027 Beijing
P.R. CHINA
www.vaisala.com/zh

MALAYSIA

Vaisala Sdn Bhd
Regional Office Malaysia
W11-A0, Level 11, West Block
Wisma Golden Eagle Realty
142-C Jalan Ampang
50450 Kuala Lumpur
MALAYSIA
weathersales.malaysia@vaisala.com
www.vaisala.com

JAPAN

Vaisala KK
Tokyo Office
Jimbocho Mitsui Building 16F
1-105 Kanda-Jimbocho
Chiyoda-ku
Tokyo 101-0051
JAPAN
weathersales.japan@vaisala.com
www.vaisala.com/ja

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