



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: - Latitude and longitude (°) - Pitch and roll (°) - Disk occupation (%)
Status (CSV format)	OK/WARNING/CRITICAL for: - 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 ($\text{m}^{-1}\cdot\text{sr}^{-1}$) Attenuated absolute beta ($\text{m}^{-1}\cdot\text{sr}^{-1}$)

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

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.

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, $\pm 22.5^\circ$ 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: - 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

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