

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⁾	160 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
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 EPS / plastic covers	80 g / 109 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 EPS 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.



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