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Vaisala Radiosonde RS41-SGP

RS41 PTU Sensors

The 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 the 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 a RS41 Radiosonde

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

The ground check device is conveniently operated with Vaisala MW41 software. A short-range wireless communication link is used for powering on the radiosonde and for data transfer during the ground check.

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, the 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.

Wind Data and GPS-Based Height and Pressure Measurements

Wind, as well as height and pressure readings are derived from velocity and location measurements of the RS41 GPS receiver. Wind is calculated independently based on satellite carrier frequency changes. With RS41-SGP height and pressure are also calculated from satellite ranging codes, combined with differential corrections from the MW41 ground station, as with RS41-SG.

Data Transmission

The 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.

Operational Benefits

The RS41's robust and compact design makes it easy to handle and there is no assembly needed prior to launch. The status LED indicates when the radiosonde is ready to launch, and if there is an error, it is clearly indicated prior to launch. With the unwinder the radiosonde sensor boom is automatically and consistently set in an ideal position for sounding.

Vaisala Radiosonde RS41-SGP – accuracy and reliability.

Benefits

- Superior PTU measurement performance with a pressure sensor
- Automated ground check
- Robust and easy-to-use
- 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

Add-On Sensor Connector

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

Technical Data

Measurements

Measurement cycle	1 s
TEMPERATURE SENSOR	TYPE: PLATINUM RESISTOR
Measurement range	+60 °C to -90 °C
Resolution	0.01 °C
Response time (63.2%, 6 m/s flow, 1000 hPa)[1]	0.5 s
Stability (0.5 year / 2 years)	< 0.05 °C / < 0.1 °C
Accuracy (Repeatability & 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 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 & 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 & 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[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

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	113 g
Dimensions[5]	Body (L x W x H): 145 x 63 x 46 mm
	Sensor boom bent (L x W x H): 272 x 63 x 104 mm

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	20 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.

1) Time lag correction applied, negligible residual errors
2) Standard deviation of differences in twin soundings, ascent rate above 3 m/s for temperature and humidity
3) In practice unlimited
4) Standard deviation of differences in twin soundings. Wind speed above 3 m/s for directional measurement uncertainty.
5) Without wire antenna

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