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Vaisala Radiosonde RS41-SG

Temperature and Humidity Sensors

The 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.

The Vaisala Radiosonde RS41 humidity sensor integrates humidity and temperature sensing elements to provide unique features. Prior 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 or a radiosonde placed on the Ground Check Device RI41 conveniently operated with 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.

In-built temperature sensor check includes comparison of readings from the temperature element of the humidity sensor and the actual temperature sensor giving additional confidence for the functionality check.

Utilizing the new humidity sensor design, the radiosonde is able to generate physical dry humidity reference more consistently than is possible with desiccants. The sensor can measure the deviation of humidity measurement at 0 %RH (physical zero) and fine tune the humidity measurement accordingly.

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

The Vaisala Radiosonde 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

The Vaisala Radiosonde RS41's 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.

Operational Benefits

The RS41's robust and compact design makes it easy to handle during launch preparations.

The status LED indicates when the RS41 is ready to launch, and if there is an error, it is clearly indicated prior to launch.

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.

Vaisala Radiosonde RS41-SG – accuracy and reliability.

Benefits

- 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

Add-On Sensor Connector

The 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 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 (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 > 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 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[2] in sounding	
> 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 40000 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

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 EPS / plastic covers	80 g / 109 g
Dimensions[5]	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

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.

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.
5) For EPS cover; without wire antenna

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