

Vaisala Dropsonde RD94



The Vaisala Dropsonde RD94 is a meteorological measurement device to be used 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), relative humidity (U) and wind direction and speed from the point of launch to the ground. It has been used from low, 1500 ft, to high, 66 kft, altitude drops. The RD94 transmits data using a narrow bandwidth FSK (Frequency Shift Key) modulation in the 403 MHz meteorological band to the AVAPS (Airborne Vertical Atmospheric Profiling System) onboard the aircraft.

Proven Measurement Performance

The Vaisala Dropsonde RD94 sensors are calibrated using similar methods as with the Vaisala Dropsonde RD93

and the Vaisala RS92 radiosonde family. Calibrations are traceable to the international standards. Accuracies have been validated e.g. in the WMO comparisons.

The winds are measured using a commercial GPS receiver, which has a custom made firmware to ensure proper wind measurement. The wind profiles from multiple simultaneous dropsondings show a good consistency.

Designed for Aircraft Use

The Vaisala Dropsonde RD94 is designed for aircraft use, and is launched through the body of an aircraft. Specially designed launchers are used for both pressurized and un-pressurized cabin aircrafts. The delayed deployment mechanism ensures proper clearance from the aircraft, and allows the parachute to open safely. The specially designed parachute stabilizes the RD94 aligning it properly for measurements, and its small gliding factor ensures proper measurement of the wind speed and direction.

The descent speed of the RD94 is approximately 11 m/s at the sea level, and about 21 m/s at a 12 km altitude. In strong convective situations the descent rate can vary a lot, and even negative (descent) rates are measured. The RD94 measures the PTU twice and wind speed and direction four times a second. This means that e.g. the last measured pressure level is at maximum about 5 - 6 meters above the surface.

The robust design of the RD94 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 by the application in question. The AVAPS is not compatible with Vaisala radiosondes and vice versa.

AVAPS can be configured to track up to four dropsondes at the same time. This is an essential ability in operations that are carried out with high-speed, high-altitude aircraft when dense horizontal resolution of data is required.

The AVAPS can be set to provide data automatically for the aircraft data system for further use. The dropsonde technology developer NCAR/EOL provides ASPEN data post descent processing software for dropsonde users.

Intellectual Property Rights and Development

Vaisala Inc., USA, manufactures and markets the Dropsonde RD94 and AVAPS Dropsonde Receiving System under license to University Corporation for Atmospheric Research Foundation (UCARF). 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.

Vaisala Dropsonde References

Since 1996, about 50,000 earlier versions of the Vaisala Dropsonde RD93, have been used in eight countries by various operators. The main uses have been hurricane research, and data acquisition over oceans as input for Numerical Weather Prediction (NWP) models. In addition, a large number of Vaisala Dropsonde RD93s, have been annually used in various field campaigns to acquire data for meteorological research and for validation of other airborne instrumentation.

Technical data

Vaisala Dropsonde RD94

| | |
|-----------------------------|-----------------------------------|
| Weight | 350 g |
| Size | 7 cm in diameter, 41 cm in length |
| Maximum deployment airspeed | 250 kt IAS (= 125 m/s IAS) |
| Shelf life | 1 year from delivery |

Transmitter - EN302054

| | |
|--|--------------------------------|
| Frequency range | 400 MHz to 406 MHz |
| Frequency stability | ±1 kHz |
| RF power output | 100 mW |
| Channel spacing | |
| Modulation | FSK |
| Harmonic & spurious output | >50 dB below the carrier level |
| Total modulation | |
| Telemetry range with recommended receiving antenna | 325 km |

Battery

| | |
|---------|--------------------------------------|
| Type | Three lithium CR-2 cells in series |
| Voltage | 9V nominal |
| Current | Max. 235 mA, 200 mA average |
| Life | 2 hours (operating), 3 years (shelf) |

Pressure sensor (P)

| | |
|---------------------------------|-------------------|
| Vaisala BAROCAP® silicon sensor | |
| Range | 1080 hPa to 3 hPa |
| Resolution | 0.1 hPa |
| Accuracy | |
| Repeatability* | 0.4 hPa |

Temperature sensor (T)

| | |
|---|------------------|
| Vaisala THERMOCAP® capacitive bead | |
| Range | -90 °C to +60 °C |
| Resolution | 0.1 °C |
| Accuracy | |
| Repeatability * | 0.2 °C |
| Response time | |
| (when used and measured in Vaisala Radiosonde RS80) | |
| 6 m/s, 1000 hPa | < 2 s |



Relative humidity sensors (U)

| | |
|--|----------------|
| Vaisala H-HUMICAP® thin film capacitor, twin-sensor design | |
| Range | 0 % to 100 %RH |
| Resolution | 1 %RH |
| Accuracy | |
| repeatability * | 2 %RH |
| Response time | |
| (when used and measured in Vaisala Radiosonde RS92) | |
| 6 m/s, 1000 hPa, +20 °C | < 0.5 s |
| 6 m/s, 1000 hPa, -40 °C | < 20 s |

Wind (horizontal)

Commercial GPS receiver

Data rates

| | |
|------------------|------|
| PTU update rate | 2 Hz |
| Wind update rate | 4 Hz |

Descent

| | |
|---------------|----------------------|
| Descent speed | ~11 m/s at sea level |
| Descent time | |
| From 14 km | ~15 mins |
| From 7.5 km | ~8 mins |

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

VAISALA

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