

# **RD41 and NRD41 dropsonde Procedures**

## **Relative Humidity Sensor Reconditioning**

DOC248776

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## Summary

The RD41 and NRD41 dropsonde models allow a reconditioning of the humidity sensor to restore the factory calibration. To avoid a dry bias in dropsonde profiles of relative humidity and a bias in all derived parameters, reconditioning of the relative humidity sensor is mandatory. This document describes the operating procedure to recondition the humidity sensor. The total time expected to recondition a group of 30 sondes is estimated to take about 10 minutes in total.

## Background

All modern dropsondes and radiosondes use thin film polymer relative humidity sensors. The RD41 and NRD41 dropsondes use a sensor module based on that of the Vaisala RS41 radiosonde. Its humidity sensor is one of the most advanced thin film humidity sensors currently on the market.

A thin film polymer sensor is built as small capacitive element with a humidity sensitive material, typically a thin film polymer, acting as the dielectric. The sensor detects water vapor through a change in its capacitance when atmospheric humidity changes. The sensing element may also absorb other gaseous contaminants, which slightly changes its sensitivity to humidity and thereby alters its calibration. The reconditioning cycle removes these contaminants and restores the original factory calibration.

How much of these contaminants are absorbed by the sensor is impossible to quantify and depends on the duration and environmental conditions of storage and possibly other factors not well understood. Accordingly, it is impossible to predict the level of bias caused by contamination. A dry bias of up to 6% has been observed, but larger biases cannot be ruled out. Therefore, it is essential to follow the recommendations for humidity sensor reconditioning described here.

## Sensor reconditioning

The procedures described here apply to the larger RD41 and smaller NRD41 dropsonde, not to earlier dropsonde models.

To recondition the humidity sensor of a sonde, follow these steps:

- 1) Navigate to the reconditioning tool page in AVAPS (see next section)
- 2) Connect the dropsonde to the umbilical cord
- 3) Unplug the power pin of the dropsonde. The sensor cap remains in place and is not removed during reconditioning.
- 4) Start the reconditioning process
- 5) Once the green LED on the dropsonde starts blinking, disconnect the dropsonde from the umbilical cord, but keep the sonde powered. The LED will continue to blink for the duration of the reconditioning process.
- 6) The LED stops blinking after about 3 to 5 minutes indicating that the reconditioning has been completed and that the sonde has entered a sleep mode. The larger RD41 sondes must now be powered down by inserting the power pin and stored for later use.

As soon as the reconditioning of the humidity sensor has started (blinking green LED), the sonde can be disconnected from the umbilical cord and another sonde can be connected to start the reconditioning of its humidity sensor. This allows parallel reconditioning of multiple sondes. In practice, the work time to recondition 30 sondes may be as little as 10 min total.

### Notes:

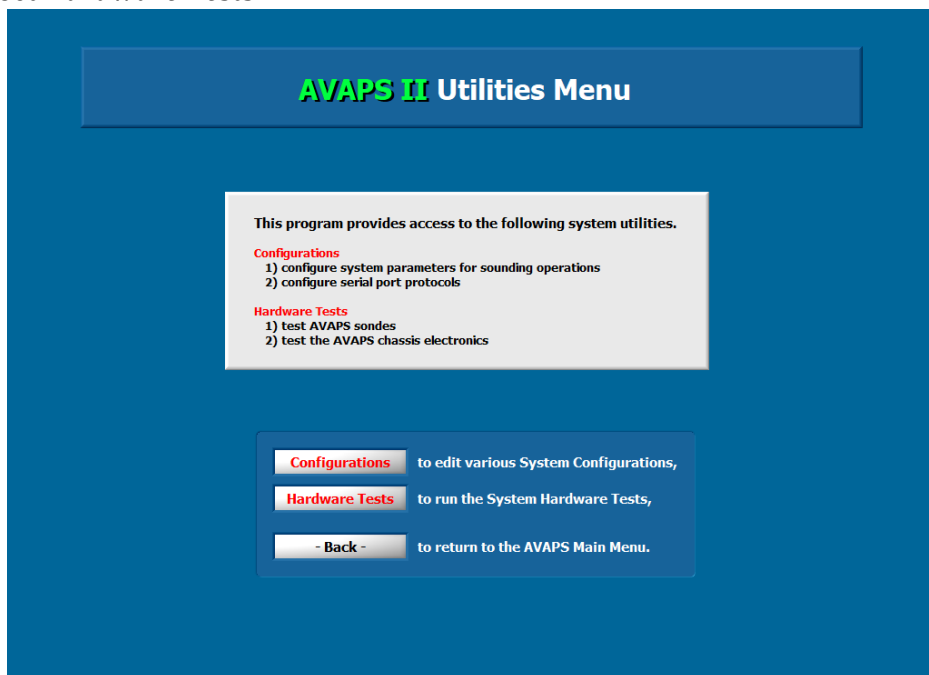
- a) A humidity sensor should be reconditioned within 24 hours prior to use. In operations, all dropsondes for a research flight can be reconditioned the day before takeoff with minimal concern for contaminated humidity measurements.
- b) For manual launchers, the smaller NRD41 is treated exactly as the RD41. For use in the automated launcher, the NRD41 is left in its sleep mode at the end of the reconditioning and then loaded into the automated launcher.
- c) This AVAPS utility cannot be used during active data collection. All sondes to be used during a research flight should be reconditioned prior to the first launch of a sonde at the latest.
- d) A humidity sensor can be reconditioned multiple times. We have not determined any threshold for the number of reconditioning operations; however, in operations, reconditioning is expected to happen only once or twice.
- e) The sonde stores whether the reconditioning of the humidity sensor has been performed, and whether it was successful. This allows analyzing any possible biases that may be observed later. If the sensor reconditioning was interrupted, e.g. the power pin was re-inserted prior to the completion of the reconditioning cycle, the sonde will store that the sensor reconditioning was unsuccessful.
- f) To ensure the dropsonde does not start high power telemetry transmission on the aircraft, the umbilical cord is always connected before pulling the power pin.

## Humidity sensor reconditioning in AVAPS Utilities

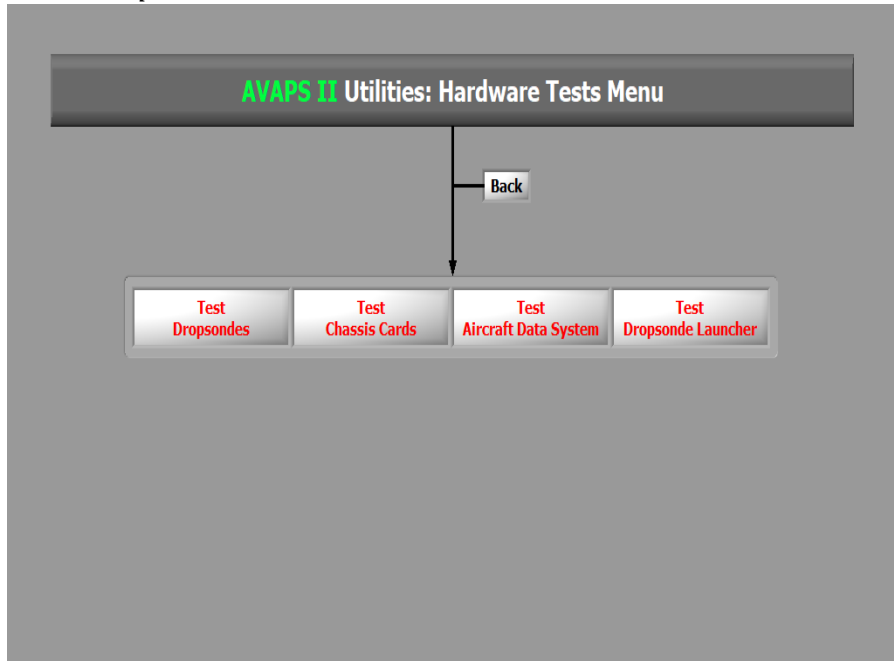
Step 1: Open AVAPS and select *Utilities*



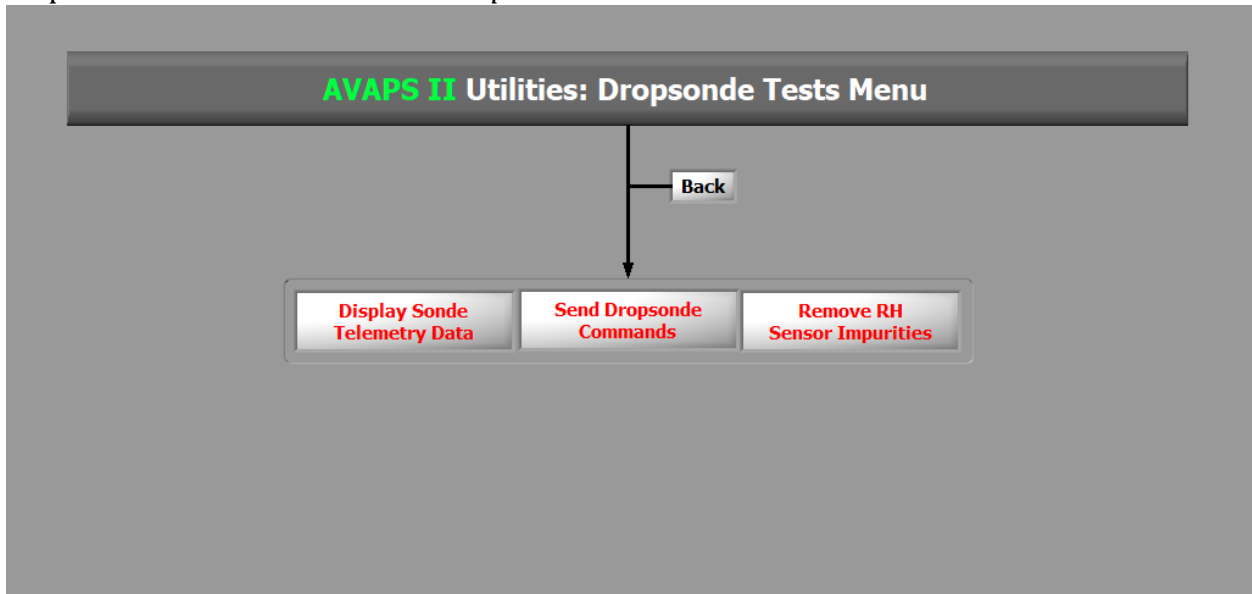
Step 2: Select *Hardware Tests*



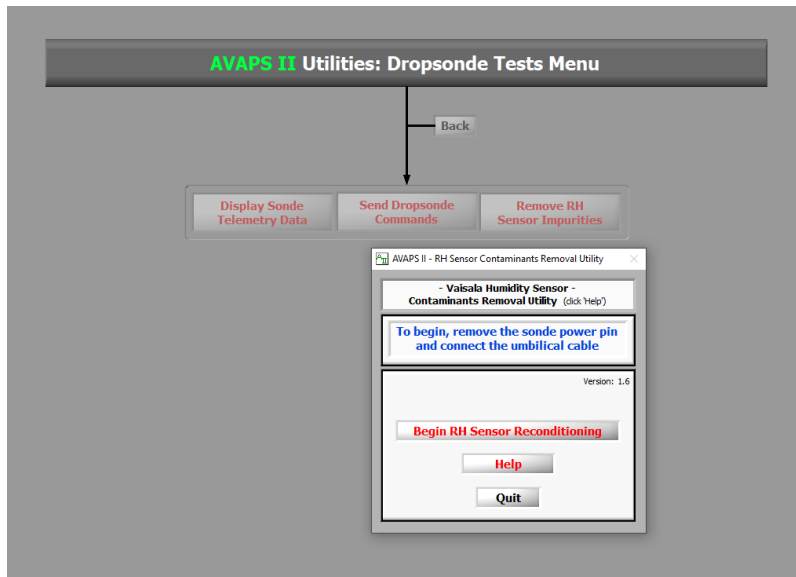
Step 3: Select *Test Dropsondes*:



Step 4: Select *Remove RH Sensor Impurities*

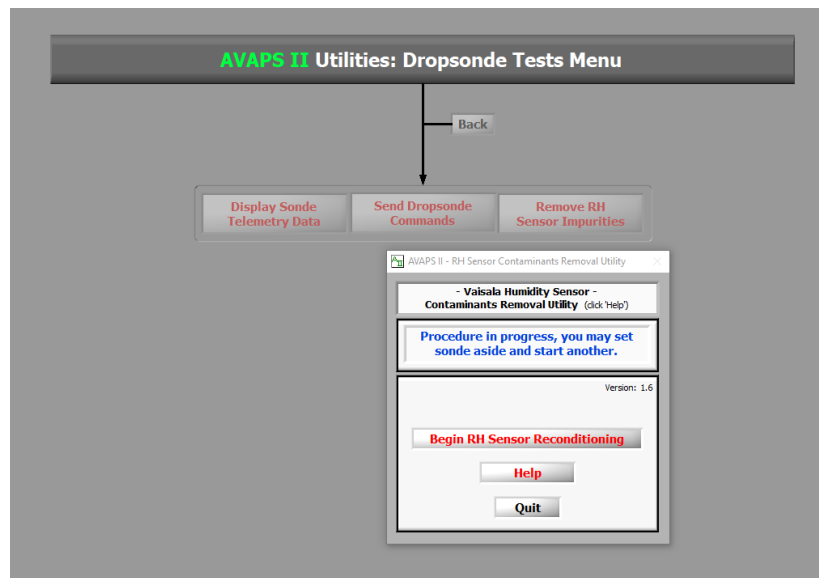


Step 5: Connect the sonde to the telemetry chassis umbilical cord first, then pull out the power pin, but leave the sensor cap on, and select *Begin RH Sensor Reconditioning*



The green LED in the sonde will begin to blink and remain blinking for the duration of the reconditioning process.

Step 6: Remove the sonde from the umbilical cord and plug in the next sonde. Repeat this process for all sondes preflight.



Step 7: Once the LED in the sonde stops blinking, re-insert the power pin and store the sonde.

## Release History

<i>Version</i>	<i>Date</i>	<i>Author</i>	<i>Changes</i>
1.0	28 April 2021	Tudor/Vömel	Initial document