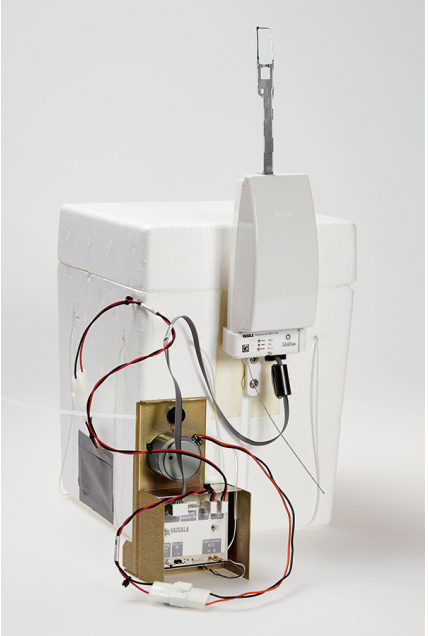
Ozone Sounding with Radiosonde RS41



The ozone sounding set-up comprises an ozone sensor connected via an ozone interface to a Vaisala Radiosonde RS41-SG or RS41-SGP. With the Vaisala Ozone Interface OIF411, an ECC-type ozone sensor, and a digital RS41 radiosonde it is possible to measure pressure, temperature, humidity, and geopotential height, as well as the vertical distribution of atmospheric ozone up to 3 hPa. Winds are measured using GPS navigation signals.

Features

- Reliable and accurate ozone measurement for synoptic sounding and atmospheric research
- Sharp vertical resolution and a fast sampling rate
- An ozone interface kit is available for combining a RS41 radiosonde and ozone sensor
- Easy start for ozone sounding; automatic retrieval for many set-up parameters
- Prevention of ozone box freezing by heating with an additional battery

Ozone Sensors

Two ECC-type ozone sensors, the Science Pump Corporation model ECC-6AB and the Droplet Measurement Technologies model Z, can be connected to the Vaisala Radiosonde RS41. The Science Pump Corporation ozone sensor is available via Vaisala. It measures ozone using the principle of iodide redox reaction to release electrons and is the most commonly used ozone sensor in the world today.

Ozone Interface Kit RSA411

The Vaisala Ozone Interface Kit RSA411 is used for ozone sounding with the Vaisala Radiosonde RS41 and an ECC-type ozone sensor. The kit is built around the Vaisala Ozone Interface OIF411. The other peripherals in the kit include a radiosonde holder, cables for connecting the devices, detainer for the radiosonde unwinder, and a stabilizer for use with certain parachute models.

Ozone Interface OIF411

The Vaisala Ozone Interface OIF411 has five measurement channels and is powered by the radiosonde battery. Two channels are dedicated to the ozone sensor current and ozone pump temperature measurement, providing the data for ozone partial pressure calculation. OIF411 provides two diagnostic tools for the ozone pump: battery performance can be monitored with the pump voltage measurement, and pump performance with the pump motor current. These measurements are useful in verifying that the ozone sensor is functioning properly and that ozone measurements are valid.

In addition, there is one channel for external voltage measurement that can be used freely for voltages from 0 to 12 V.

In very low ambient temperatures the liquid in the ECC cells may freeze during the flight, ending the ozone sounding before the radiosonde reaches important ozone layers in the stratosphere. To avoid this, the OIF411 is able to control the heating of the ozone sensor box based on the temperature measured from the pump base. The heating is powered by an additional battery with a voltage range from 9 to 19 V. The recommended battery is a 9 V square battery that can easily be fitted onto the ozone sensor frame inside the ozone box.

The OIF411 also has a serial interface for additional sensors, which can be chained and the data transferred via OIF411 to a RS41 radiosonde and further to the Vaisala DigiCORA® Sounding System MW41.

Ground Equipment

RS41-based ozone sounding is performed with the Vaisala DigiCORA® Sounding System MW41. The sounding system calculates the ozone partial pressure profile and integrated total ozone using raw ozone data and other radiosonde measurements. In addition, the sounding system offers many useful features for ozone sounding preparation, data processing, and data messaging. The ozone data is automatically stored to enable post-ascent processing, while performing simulations is easy with the DigiCORA® MW41 Sounding Software. System maintenance can be performed by Vaisala under the terms of a Vaisala Service Contract.

Technical Data

The performance data is expressed with 2-sigma (k=2) confidence level (95.5%), if not otherwise specified.

Ozone Interface Board OIF411

For use with	Science Pump Corporation ECC-6A ozone sensor and Droplet Measurement Technologies Model Z ozone sensor
Synchronization	All channels are measured in synchronization with the meteorological measurements (pressure, temperature, humidity, wind)
Compatibility	Vaisala Radiosonde RS41-SG, RS41-SGP

Ozone Current Channel

Ozone current measurement range	0 ... 14 µA
Combined uncertainty	0.2 % of the reading, minimum 3 nA
Resolution	0.1 nA
A/D conversion resolution	16 bit

Ozone Temperature Channel

Ozone temperature measurement range (specification fulfilment)	-5 ... +60 °C
Temperature measurement uncertainty [1)]	0.2 °C
Temperature measurement resolution	0.01 °C

1) Based on sensor specifications

Other Functions

Pump voltage measurement range	Pump voltage measurement range
Pump voltage measurement uncertainty [1)]	1.5 % of the reading, minimum 0.1 V
Pump current measurement range	0 ... 300 mA
Pump current measurement uncertainty [1)]	2.5 %, of the reading, minimum 3 mA
External voltage measurement range	0 ... 12.0 V
Resolution	0.1 V
Input resistance	111 kΩ
Heating of the ozone box	Controlled by software
Heating battery voltage range	9 ... 19 V
Heating start temperature (at the pump)	+5 °C
Heating stop temperature (at the pump)	+7 °C
Operating temperature range in ozone sounding	+60 °C down to -90 °C
Dimensions (L × W)	Max. 100 × 70 mm
Cable length	380 mm
Weight with cable	Max. 50 g
Power consumption	< 50 mA (from radiosonde battery)

1) 2-sigma (k=2) confidence level (95.5%) including uncertainties of the electrical components.

Add-on Sensor Support

Protocol support	Xdata to connect several sensors in the same chain, data transferred via OIF411 to RS41
Transfer rate	Max. 200 bytes/s

Technical Information on Ozone Sensors

The technical specifications for the ozone sensors available through Vaisala are given by the respective manufacturers. They have been used up to an altitude of 40 km or 3 hPa. The measurement time is limited to 2–3 hours due to evaporation of the sensor liquids. The temperature inside the ozone sounding (flight) box must be above 0 °C. For more information on the accuracy of a particular ozone sensor, please contact Vaisala or the ozone sensor manufacturer directly.

Science Pump Corporation Model ECC6AB Ozone Sensor

Dimensions	191 × 191 × 254 mm including weatherproof ozone sounding flight box
Weight	600 g including battery
Operating temperature range	0 ... +40 °C (inside ozone sounding flight box)
Operating pressure range	Ground level to 3 hPa
Storage, self-life, warranty	Two-year warranty from the day of delivery

Accessories and Consumable Items

Vaisala offers all the accessories and spare parts needed for ozone sounding. A start-up kit is available which contains everything you need to introduce ozone sounding to your upper-air sounding program. Please refer to the ozone sounding accessories brochure for more information.

Ozone Sounding Training

Vaisala offers training in ozone sounding. Please contact your Vaisala representative for more information.

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