Supplement of Atmos. Meas. Tech., 11, 1833–1849, 2018
https://doi.org/10.5194/amt-11-1833-2018-supplement

Atmospheric Measurement Techniques
Open Access

Supplement of

COCAP: a carbon dioxide analyser for small unmanned aircraft systems

Martin Kunz et al.

Correspondence to: Martin Kunz (mkunz@bgc-jena.mpg.de)

S1 Blueprints

Schematics and PCB layouts for the temperature and humidity sensor board, the pressure sensor board and the temperature control board are available from the corresponding author. Likewise, the firmware for the temperature controller is available upon request.

S2 Diagrams

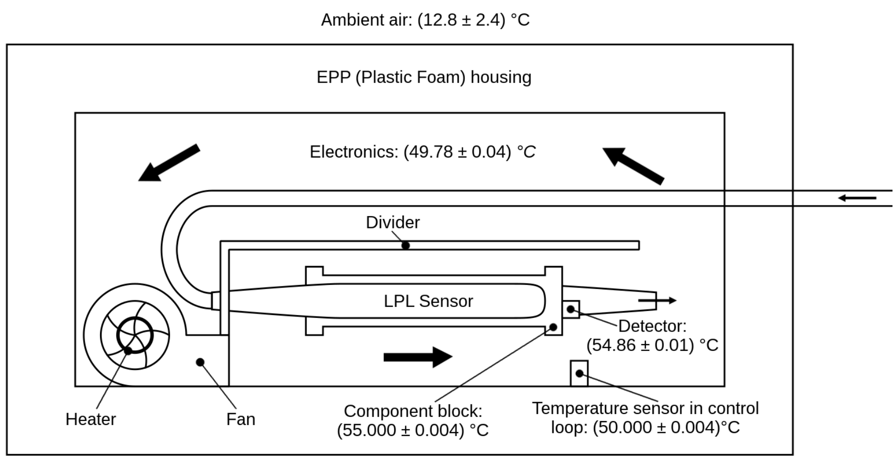

Figure S1: Temperature stabilisation of COCAP. A fan drives circulation of air inside the housing as indicated with the large arrows. The heater at the fan inlet is controlled to stabilise the temperature of the air stream to 50 °C. The values given are mean and standard deviation of temperature at the respective point during flight simulations in an environmental chamber (see Sect. 5.1.2). During the simulations the temperature of the ambient air varied between 6.7 and 15.5 °C. Temperatures outside this range may be encountered in field deployments, but the change in temperature between two calibrations is typically smaller.

S3 Photographs

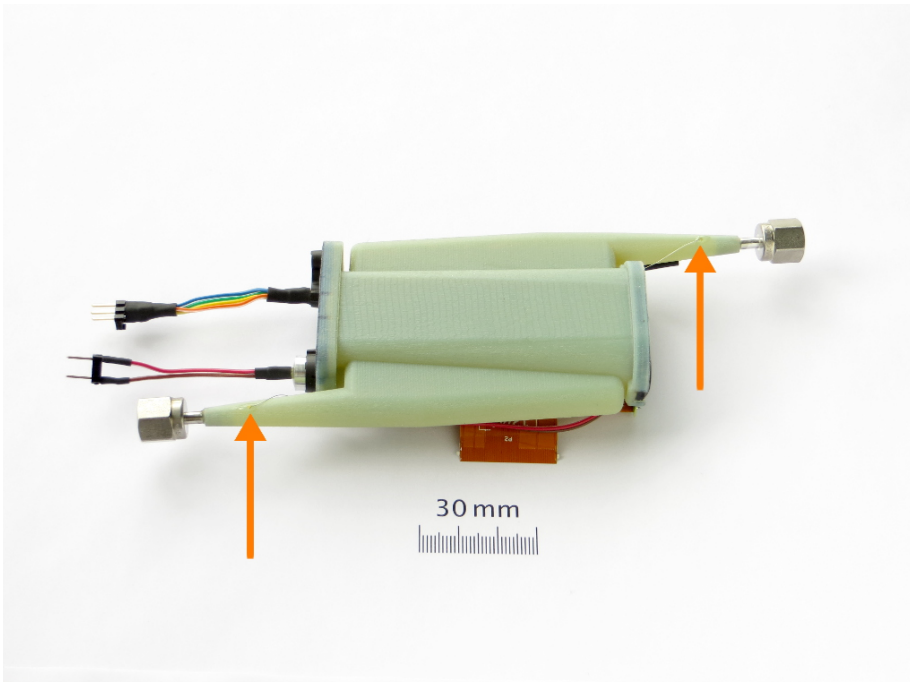

Figure S2: COCAP's carbon dioxide sensor. It is based on SenseAir AB's HPP family (High Performance Platform) of gas sensors. For deployment in COCAP it was built with a custom, 3D-printed measurement cell. The arrows indicate the location of temperature sensors inside inlet and outlet.

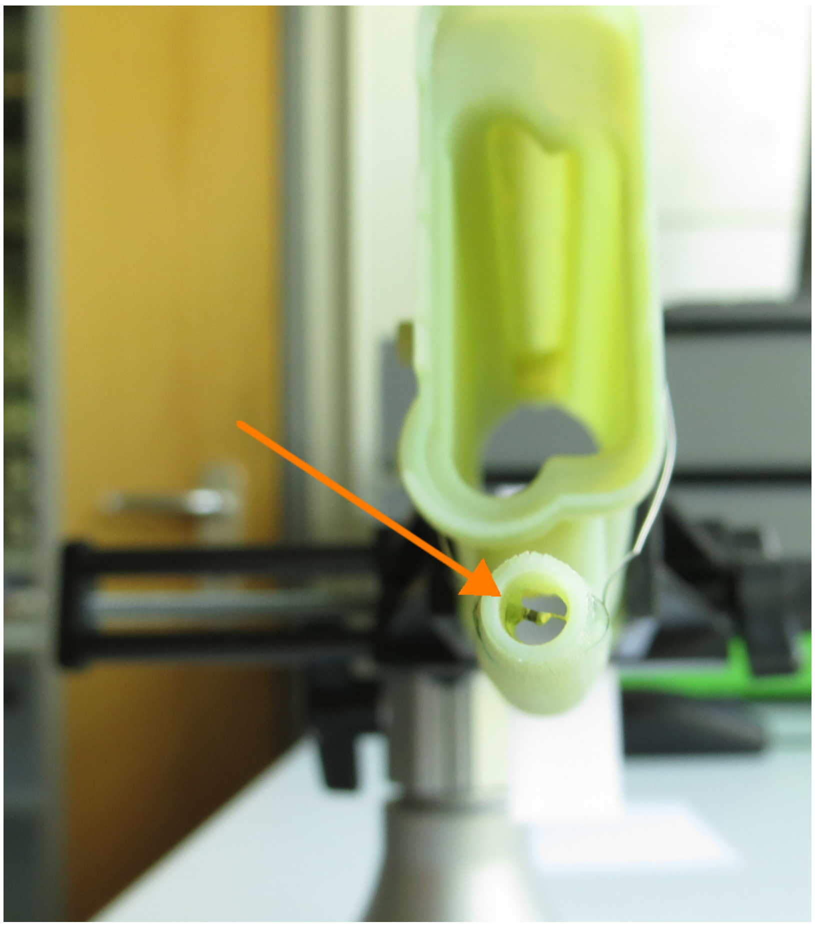

Figure S3: Detail of the outlet temperature sensor

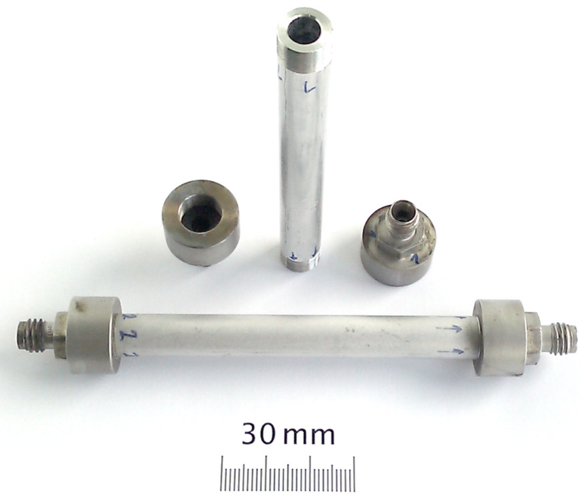

Figure S4: Cartridges for drying agent (magnesium perchlorate)

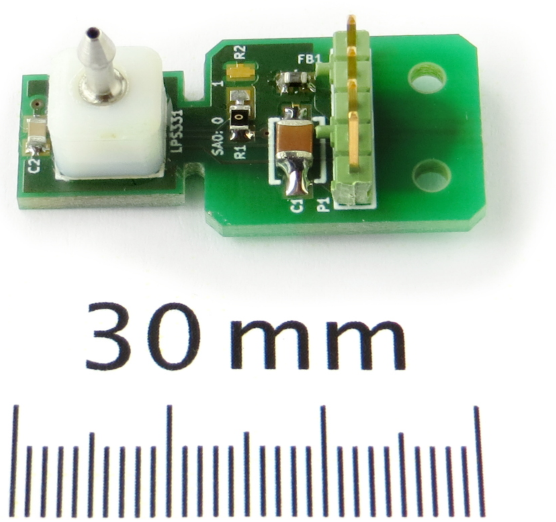

Figure S5: Sensor board for measurement of pressure in the gas line. The pressure sensor is located beneath the white cap ($7\times7\times6\,mm^3$). The shape of the PCB prevents bending of the sensor which would degrade the measurement.

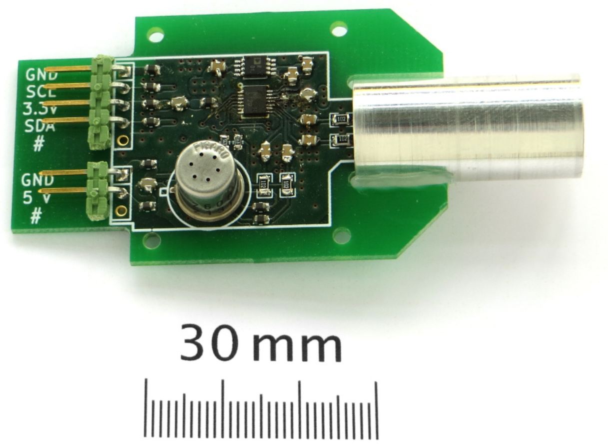

Figure S6: PCB for measuring temperature and relative humidity of ambient air. The sensors are protected by an aluminium tube (right hand side). A conformal coating covering all electronic components but the sensors prevents stray currents under humid conditions.

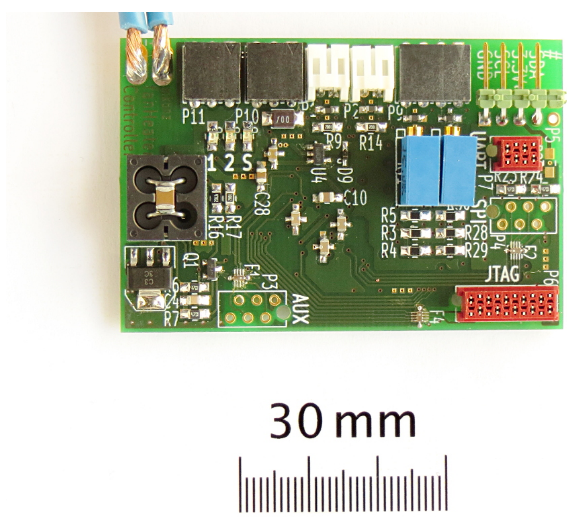

Figure S7: Front side of the temperature control board. Two control channels for temperature measurement and heater control are available, but only one is currently in use.

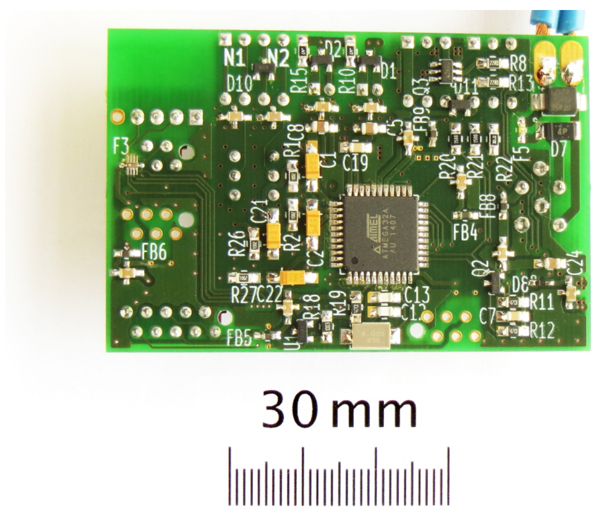

Figure S8: Back side of temperature control board with the Atmega32A (Atmel, USA) microcontroller that runs the PID controller

Figure S9: Field calibration device

Figure S10: COCAP mounted under a custom-built multicopter (Sensomotion UG, Germany and Ostwestfalen-Lippe University of Applied Sciences, Germany)