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Controller for in-situ pressure and humidity measurements on board ExoMars 2020 Surface Platform

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Finnish Meteorological Institute (FMI) has developed a compact instrument pair for the ExoMars 2020 mission, consisting of the METEO-P pressure and METEO-H humidity measurement devices. The devices are part of the METEO meteorological instrument package on board the Surface Platform (SP) element of the mission. The SP is a stationary lander hosting a set of science investigations and delivering the European Space Agency rover element to the surface of Mars. The METEO-P and METEO-H devices use capacitive Humicap and Barocap sensors built by Vaisala Inc. and have extensive heritage in FMI's past Mars pressure and humidity instrument designs including e.g. NASA Curiosity rover and Phoenix lander. The METEO-P pressure device is installed inside the SP warm compartment, sensing the atmosphere through a pressure inlet pipe, while the METEO-H humidity device is in more direct contact with the atmosphere on the meteorological mast of the lander. The METEO-P/H pair is operated through a semi-autonomous instrument controller integrated on the METEO-P circuit board. Traditionally, such instrument controllers for space and Mars environment have been realized using only space grade components, which means guaranteed reliability, but often also high cost, difficult procurement and lower performance compared to commercial-off-the-shelf (COTS) components. In order to address these issues, FMI decided to qualify an automotive COTS microcontroller for the pressure and humidity devices on the ExoMars 2016 Schiaparelli mission. This design resulted in low power consumption and the possibility to flexibly modify the controller software. The METEO-P/H controller design uses the Schiaparelli design as its basis, increasing its degree of autonomy and adding new advanced features for the humidity device control and measurement.