

Status of MEDA PS and MEDA HS Pressure and Relative Humidity Devices for Mars 2020 Rover

Maria Hieta (1,2), Maria Genzer (1), Timo Nikkanen (1,2,3), Harri Haukka (1), Jouni Polkko (1), Matias Meskanen (1), Ari-Matti Harri (1) and Jose A. Rodriguez-Manfredi (4)

(1) Finnish Meteorological Institute, Helsinki, Finland, (maria.hieta@fmi.fi), (2) Aalto University, Finland, (3) Reaktor Space Lab, Helsinki, Finland, (4) Centro de Astrobiología (INTA-CSIC), Madrid, Spain

Abstract

Finnish Meteorological Institute (FMI) provides a pressure measurement device (MEDA PS) and a relative humidity measurement device (MEDA HS) for MEDA. MEDA is one of the scientific payloads on-board the NASA Mars 2020 rover mission: Mars Environmental Dynamic Analyzer, a set of environmental sensors for Mars surface weather measurements. This paper presents the current status of the devices. Calibration results will be presented in EPSC conference.

1. Introduction

Mars Environmental Dynamic Analyzer (MEDA) is a set of environmental sensors on board NASA's Mars 2020 rover provided by Spain's Centro de Astrobiología. MEDA's principal goals are to provide continuous measurements that characterize the diurnal to seasonal cycles of local environmental dust properties and near-surface environment. MEDA sensor package is designed to record dust optical properties and multiple atmospheric parameters: wind speed and direction, pressure, relative humidity, air temperature, ground temperature, and radiation in discrete bands of the UV, visible, and IR ranges of the spectrum.

Finnish Meteorological Institute (FMI) provides a pressure measurement device (MEDA PS) and relative humidity measurement device (MEDA HS) for MEDA. Both devices are designed, built and calibrated by FMI.

MEDA PS is a pressure measurement device based on silicon micro-machined capacitive Barocap® pressure sensors developed by Vaisala Inc. The technology of the Barocap® is well known and it has been used before in 6 missions, including Mars Science Laboratory mission (REMS-P) and Exomars 2016 Schiaparelli lander (DREAMS-P).

MEDA HS is a miniature relative humidity device based on polymeric capacitive Humicap® humidity

sensors developed by Vaisala Inc. The same technology has previously been used in MSL (REMS-H) and Exomars 2016 Schiaparelli lander (DREAMS-H).

Main scientific goal of both devices is to measure the meteorological phenomena (pressure and humidity) of the Martian atmosphere and complement the previous Mars mission atmospheric measurements for better understanding of the Martian atmospheric conditions.

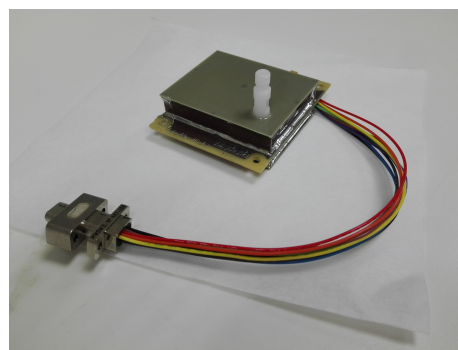


Figure 1: MEDA PS Flight model

2. Status of the devices

MEDA PS flight model (FM) and flight spare (FS) have been delivered to CRISA for higher level integration. Calibration tests in FMI are completed and initial calibration results are under work. The results will be presented in the EPSC conference.

MEDA HS flight model (FS) and flight spare (FS) will be delivered to CRISA in summer 2018. Calibration tests in FMI are completed and results will be presented in the EPSC conference.



Figure 2: MEDA HS Flight model

3. Calibration

Both MEDA PS and MEDA HS have been calibrated by FMI in FMI facilities.

For MEDA the calibration of relative humidity requires in minimum two humidity points - dry (0%RH) and (near)saturation (95-100%RH) - over the expected operational temperature and pressure range of the device. Custom-made, small, relatively low-cost calibration chamber has been developed in FMI for this purpose. Both dry points and saturation points were measured in Martian range pressure CO₂, in temperatures down to -70 °C.

MEDA PS has been calibrated in different constant temperature and pressure points in vacuum and in Martian pressure, in changing temperature and in rapidly changing pressure. Calibrations were performed inside a small vacuum chamber placed inside a temperature test station. Pressure was controlled with a commercial pressure controller and calibrations are calculated against Mars-range pressure references traceable to national standards.

References

- [1] NASA website, "Mars 2020 Rover", <https://mars.nasa.gov/mars2020>
- [2] Jose A. Rodriguez-Manfredi et.al.: MEDA, the environmental dynamics analyzer for Mars 2020, 3rd International Workshop on Instrumentation for Planetary Missions (2016)
- [3] Maria Hieta (1,2), Maria Genzer (1), Timo Nikkanen (1,2,3), Harri Haukka (1), Ari-Matti Harri (1), Jouni Polkko (1) and Jose A. Rodriguez-Manfredi: MEDA PS and MEDA HS: Pressure and Relative Humidity sensors for Mars 2020 Rover, EGU General Assembly 2018, Geophysical Research Abstracts Vol. 20, EGU2018-7681.