The water content of soil significantly influences their chemical, physical and biological properties. In respect of Mars the thin layer of the upper millimetres of the Martian surface are of particular interest since this soil interacts directly with the diurnally varying atmospheric humidity (Möhlmann (2004)), which can reach saturation during night and early morning (Fig.: 1; 2). Adsorption/desorption of water in the soil and freezing of it can be a consequence. Therefore, near-surface measurements of the atmospheric content of water vapour will allow to investigate the interaction between the atmosphere and the adsorbed water, which is deposited in the upper soil layer (Bish et al. (2003), Möhlmann (2004)). This should be an important aspect for exobiology and the future exploration of Mars. The Institute of Planetary Research at the German Aerospace Center and the SMB Dr. Wernecke Feuchtemesstechnik GmbH are jointly developing a humidity sensor system in preparation for the ExoMars mission. Its objective is to obtain first-in-situ measurements of diurnal and seasonal variations of the near surface atmospheric water vapour content. Therefore MiniHUM will be able to measure as well as traces of humidity as saturation phenomena (Fig.: 2) on Mars. The instrument consists of two different units: HUM and ASS.

The atmospheric saturation sensor (ASS) consists of a highly sensitive resistant thermometer for independent determination of the frost point temperature. That will give an independent way to determine the absolute humidity specifically at that point of phase transition (cf. Ryan and Sharman (1981)). This information can also be used for calibration purposes of the humidity sensors.

The humidity sensor (HUM) is a combined unit of a coulometric sensor (QSE) and a capacitive sensor (CPS) with an integrated thermocouple. Under Martian conditions the capacitive and the coulometric principle are the most appropriate. The coulometric principle is based on the ability of Diphosphorpentoxid (P$_2$O$_5$) to adsorb environmental water vapour almost completely. In case of an applied DC voltage the resulting current is directly related to the amount of adsorbed water, as described by Faraday’s law (cf. Fig.: 3). The capacitive humidity sensor uses the humidity dependence of a polymeric dielectric to measure the relative humidity of environmental gas.