Woods Hole Oceanographic Institution
Upper Ocean Processes Group

Technical Note

Relative Humidity Sensor for VOS Modules

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The air-sea interface is a particularly harsh environment for relative humidity measurements on both ships and buoys. Making these measurements unattended for six to twelve months is especially difficult. Many relative humidity sensors were evaluated for the Improved METeorology (IMET) program based on World Ocean Circulation Experiment (WOCE) criteria for accuracy, reliability, and operational requirements. The Rotronic MP100 unit was selected for the IMET modules. This unit has provided excellent performance in the field over many years with many units. Of particular interest on the MP100 sensor is the permeable membrane used to protect the humidity and temperature sensor elements. At this time, no other manufacturer offers a membrane filter that works as well in the marine environment since any salt spray dries and fall off of the membrane. The sensor is also protected by an R. M. Young static radiation shield to minimize the effects of solar radiation. More accurate measurements can be made by using an aspirated shield but that requires more power, which is available in limited quantities on surface buoys. The selection of the Rotronic, Inc., sensor and the R. M. Young shield for use on Volunteer Observing Ships (VOS) modules was based on this significant previous experience. However, there were two problems that required design modification. A description of these problems and the resulting modifications follows.

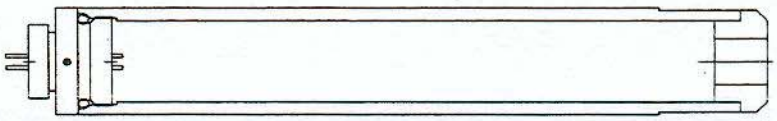

Figure 1: Sensor case with SAE port seal configuration

The first problem was that the MP100 sensor has been replaced by the MP101 sensor (by the manufacturer, Rotronic, Inc., of Huntington, N. Y.). The older MP100 case seal at the top of the unit had one o-ring seal and was fastened by three screws into the end cap above the o-ring. The new MP101 case seal has two smaller o-rings with the same three screws into the cap between the o-rings. The screws are capable of deforming the case and permitting water to enter past the o-ring. In addition, the electronics are very sensitive to any moisture. The new unit had some difficulties in the calibration process (when immersed in the water bath for temperature calibration) and in the field due to water leaks in the case. This became evident when the new units were being calibrated for temperature in a water bath and 80% failed. A VOS module installed on the RV *Pt. Sur* in April 1996 passed calibration but failed in a period of heavy fog. Many discussions were held with Rotronic about methods to protect the sensor in the air-sea interface environment. In recognition of the UOP severe environment requirement, it was agreed that a new sensor case was required. This new case has a Number 10 SAE port seal configuration which places the O-ring behind the thread, as shown in figure 1.

The new case is fabricated from PVC pipe and end caps with electrical conductors (pins) epoxied in place for feed through. Rotronic, Inc., has been very cooperative and is willing to install the electronics and sensors in the new case (at a nominal cost) as long as the new case is provided by the customer. The electronics were also conformal coated by Rotronic at the time of conversion. Packs of silica gel (4 x 0.75 gm) are sealed in the case as further protection of the electronics. A custom spanner wrench is recommended for opening the unit as shown below.

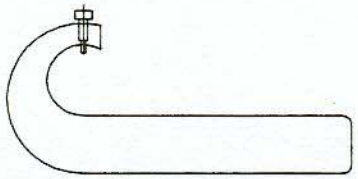

Figure 2: Spanner wrench

Units fabricated this way have proven very successful in both calibration and in the field.

The second problem is with the R. M. Young static shield. Researchers at JHU-APL (John Hopkins University - Applied Physics Lab) and at the Naval Postgraduate School have determined that the shield holds water due to adhesion and that the shield plates are too close together for normal air flow to remove the moisture. This humid "microclimate" created by the shield was reduced by increasing the plate spacing and coating the plates with a hydrophobic coating. The following figure shows the plate configuration.

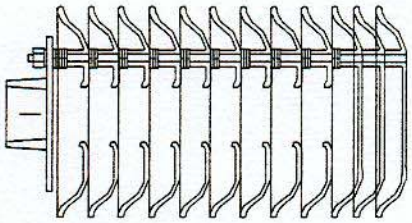

Figure 3: Static shield

R. M. Young Co. has been willing to provide the assembled shields with the proper spacers and with coated plates on special order. Comparison testing of standard and custom shields is ongoing at WHOI.

With these modifications, the relative humidity and air temperature sensor is capable of high reliability and improved measurement accuracy in the harsh environment of ships and surface buoys. These modifications are standard on the new VOS meteorological modules that have evolved from the IMET modules originally developed for use on ships and buoys.

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Note: Previous issues of the UOP Technical Note can be found on our homepage at http://uop.whoi.edu

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