

Instrument Test Report ITR 641

Performance Tests on a Rotronic MP101A Humidity/Temperature Probe

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Authorisation

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STCC, SRDS, SRCA, N Plummer, R Hutchinson
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5 Pages

Introduction:

The MP101A is a replacement unit for the discontinued MP100 unit made by Rotronic of Switzerland. The tests carried out on this probe were to determine if the probe meets the Bureau specification [1].

Experimental Procedure:

The MP101A was placed in the Physics Laboratory’s climate chamber and its output measured by a Fluke 8842A Digital Multimeter (S/N 4609294) which has an accuracy of ±0.002% of reading (95% confidence). Reference Humidity and Temperature were measured by a General Eastern Model 1500 Hygrocomputer (GE1500) which has an uncertainty of 2.07% of RH% reading and an uncertainty of ±0.2°C in the temperature reading (95% confidence). The tests were conducted from 25/5/95 to 26/5/95, 29/5/95 and 14/6/95.

There were four tests performed:

1. Constant Temperature (25 ± 1 °C), Variable Humidity (14% to 85% RH).
2. Constant Temperature (15 ± 1 °C), Variable Humidity (30% to 85% RH).
3. Constant Humidity (50 ± 3%), Variable Temperature (15 to 40°C).
4. Three Points were measured at high temperature and low humidity (Two at 30°C & 12% RH) and (40°C & 8% RH).

Results:

The difference between the MP101 and reference humidity was calculated for each point. The results were plotted in figures 1 and 2; the solid line in figure 1 indicates the Bureau’s accuracy specification [1].

From this data the mean difference, standard deviation, uncertainty in the data and uncertainty in the mean were calculated. (See Table 1.)

Test	Percent Relative Humidity				Number of Points	Figure #
	Mean Difference	Standard Deviation	Uncertainty in mean (95%) ¹	Uncertainty in Data (95%) ²		
All	-0.13	0.65	0.17	1.3	59	1
1	0.08	0.47	0.14	0.94	42	2
2	-1.13	0.233	0.15	0.466	9	2

Table 1.

¹ Uncertainty in mean is defined as: $\frac{2 \times \sigma}{\sqrt{n}}$

where : σ = Population Standard Deviation
: n = Number of samples

² Uncertainty in data is defined as: $2 \times \sigma$

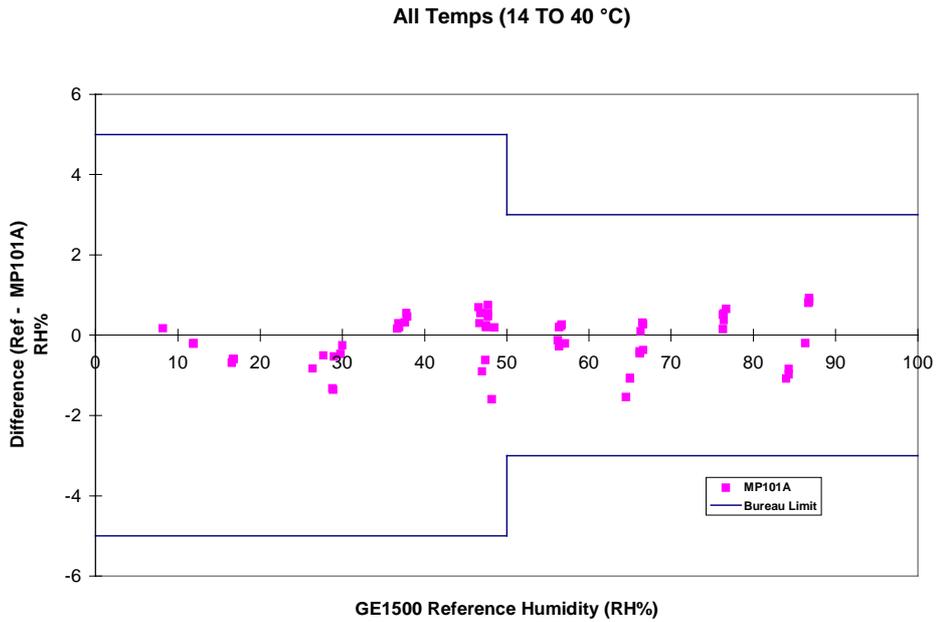


Figure 1:- All Data

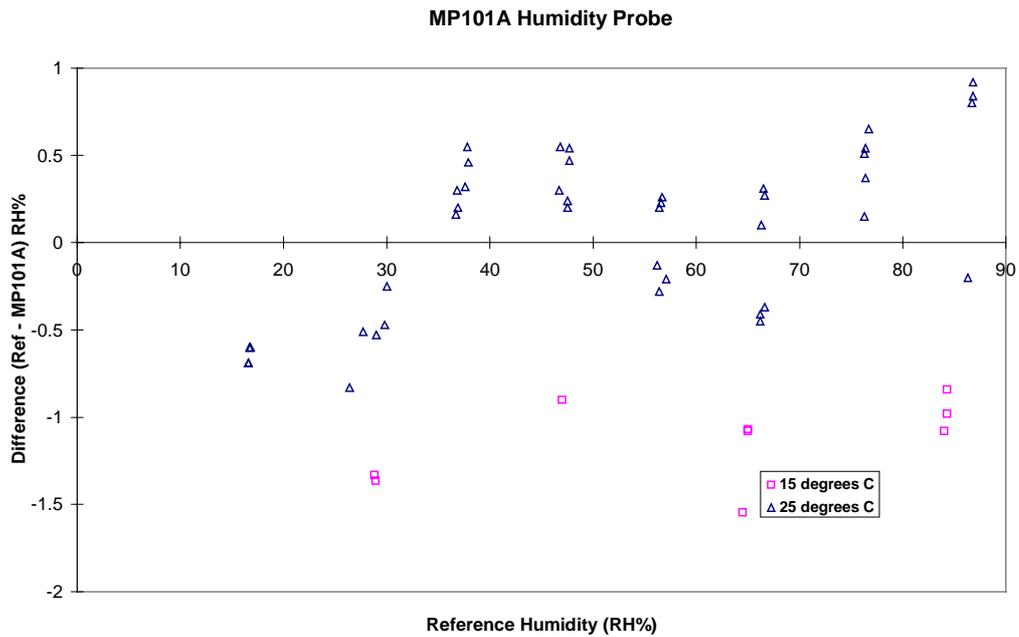


Figure 2:- Tests 1 & 2

From the data obtained during Test 3 (constant humidity) the difference between the reference and the humidity probe was calculated for each point and was plotted against reference humidity (see figure 3).

To determine the reason for the slope in the response of the humidity probe, (as shown in figure 3), the difference between the reference temperature and probe temperature was calculated and plotted (see Fig. 4).

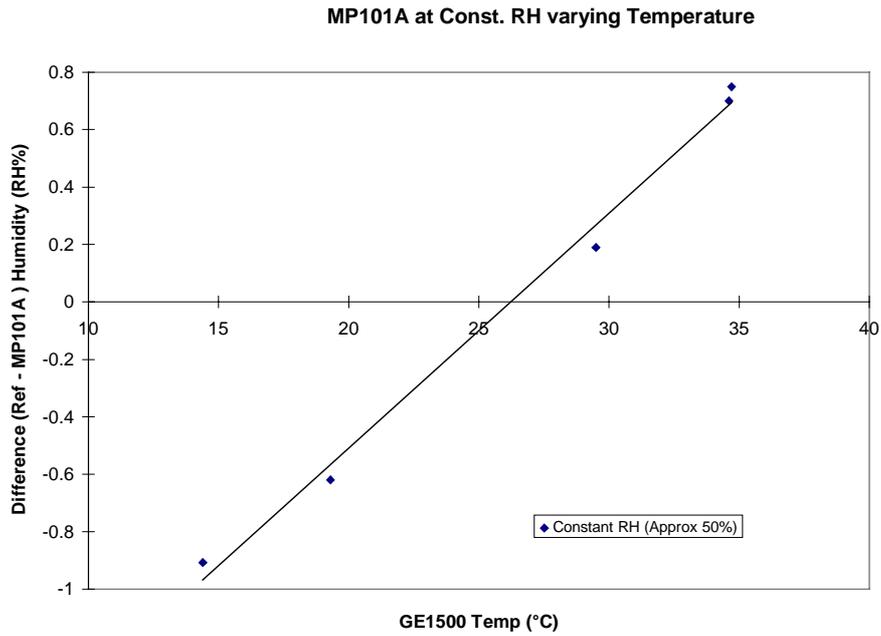


Figure 3:- Test 3.

Some statistics were calculated for the temperature sensor and are shown in table 2.

Degrees C				Number of Points	Figure #
Mean Difference	Standard Deviation	Uncertainty in mean (95%)	Uncertainty in Data (95%)		
0.01	0.18	0.09	0.35	17	4

Table 2 - Temperature Sensor Data.

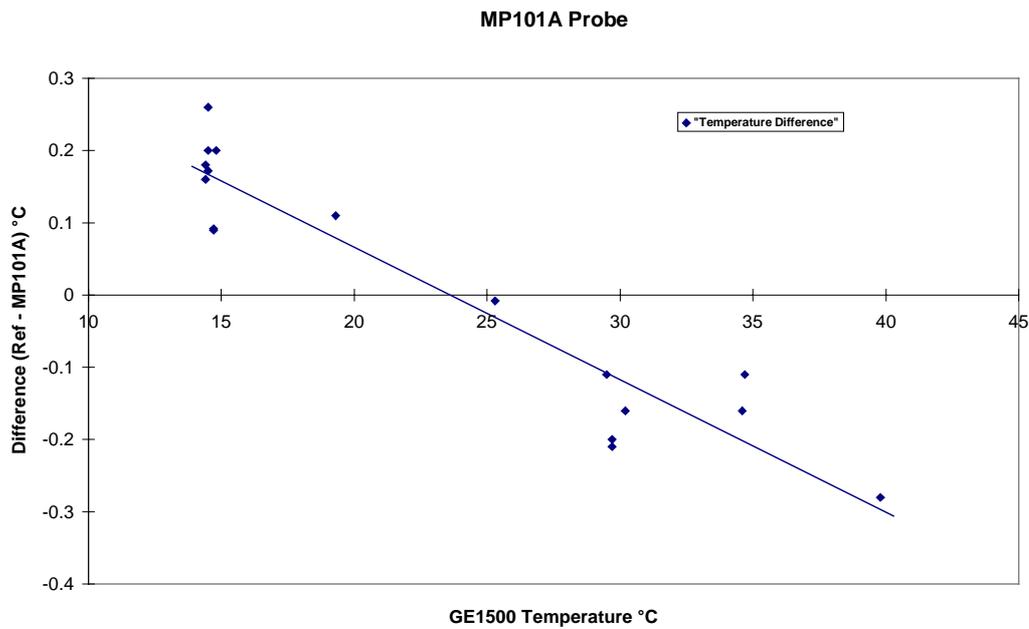


Figure 4:- Temperature sensor

Discussion:

The results from all the tests (refer to Fig 1) show that the MP101 humidity probe meets the Bureau specification [1] for humidity accuracy ($\pm 5\%$ for RH up to 50% and $\pm 3\%$ for RH over 50%).

The temperature test shown in figure 4, shows a slope opposite in sign to the humidity correction graph (Fig 3.) At low temperatures the probe temperature reads lower, this will make the humidity appear higher, and vice-versa at high temperatures. This may explain the slope in the response of the device observed in tests 1,2 & 3.

A line of best fit was fitted to the temperature sensor data (see figure 4), this line was used to estimate the maximum error expected in the temperature reading. Using typical values at either end of the temperature scale (for the Australian climate) yielded an error in the temperature of $+0.53^{\circ}\text{C}$ at -5°C and an error of -0.40°C at 40°C , which are outside the tolerances allowable for AWS temperature sensors [2].

Conclusion:

The MP101A probe tested was found to be a suitable replacement for the MP100 Relative Humidity probe for AWS applications. However the probe tested was found to be unsuitable for use as an AWS temperature sensor.

References:

1. Equipment Specification A2659, *Guidance Specification (functional) for a general purpose Automatic Weather Station (AWS)*, E.E.Jesson, June 1989.
2. Equipment Specification A2671, *Provision of an Automatic Weather Station Type I, Para. 2.2.1*, P.Cheng, March 1991.