ROTRONIC HYGROGEN2 WITH MBW473

WORKING TOGETHER TO DRIVE DOWN MEASUREMENT UNCERTAINTY

Measurement Uncertainty

The correct method to define the ‘precision’ of any measurement is to assign an uncertainty. Humidity calibration laboratories, working to the requirements of ISO 17025, calculate the overall uncertainty from a mathematical combination of all possible uncertainty components as part of an uncertainty 'budget'. Industrial users are increasingly finding that this approach provides a useful, and more importantly, validated means of defining measurement performance.

Example uncertainty in HygroGen at 23°C and 50% rh using a chilled mirror reference instrument

Overall uncertainty of temperature measurement

Uncertainty source	Value	Units	Sensitivity	Distribution	divisor	One SD		squared
PRT calibration	0.020	°C	1.00	normal	2.00	0.010		0.000
PRT repeatability	0.010	°C	1.00	normal	1.00	0.010		0.000
PRT drift	0.040	°C	1.00	rectangular	1.73	0.023		0.001
PRT linearity	0.007	°C	1.00	rectangular	1.73	0.004		0.000
PRT resolution	0.001	°C	1.00	rectangular	1.73	0.001		0.000
PRT repeatability	0.010	°C	1.00	rectangular	1.73	0.006		0.000
Temperature gradients in HygroGen2 chamber	0.050	°C	1.00	rectangular	1.73	0.029		0.001
Temperature fluctuations in HygroGen2 chamber	0.010	°C	1.00	normal	1.00	0.010		0.000
	Standard uncertainty					0.041		0.00
				Expanded uncertainty		0.08	°C	95% confidence

Overall uncertainty of humidity measurement	RH Condition %rh	Sensisitivity coefficient %rh/°C	Sensitivity = RH * coefficient
	50	6.5	3.25

Uncertainty source	Value	Units	Sensitivity	Distribution	divisor	One SD		squared
Mirror uncertainty	0.06	°C dp	3.25	normal	2.00	0.098		0.010
Mirror repeatability	0.05	°C dp	3.25	normal	1.00	0.163		0.026
Mirror drift	0.10	°C dp	3.25	rectangular	1.73	0.188		0.035
Mirror linearity	0.02	°C dp	3.25	rectangular	1.73	0.038		0.001
Mirror resolution	0.01	°C dp	3.25	rectangular	1.73	0.019		0.000
Mirror repeatability	0.05	°C dp	3.25	rectangular	1.73	0.094		0.009
Temperature uncertainty in HygroGen2 chamber	0.08	°C	3.25	rectangular	1.73	0.155		0.024
Stabilisation criterion for reference probe	0.01	°C dp	3.25	rectangular	1.73	0.019		0.000
Stabilisation criterion for probe under test	0.10	% rh	1.00	rectangular	1.73	0.058		0.003
	Standard uncertainty					0.331		0.11
				Expanded uncertainty		0.66	%rh	95% confidence

Chilled mirror reference hygrometers

The lowest uncertainty in humidity measurement is achieved using chilled mirror dew point hygrometers. Chilled mirror condensation technology provides highly precise, stable and repeatable results. Water vapour condenses onto a temperature controlled mirror surface and this ‘dew point’ is detected with advanced optical electronics. Since dew point is directly related to water vapour concentration and is not temperature dependent, measurement precision is consistent across the full range, including high temperature and humidity conditions.

Integration with MBW

Rotronic has worked with MBW, the world’s leading chilled mirror manufacturer to integrate their products into the HygroGen2 portable temperature and humidity calibration system. Particularly well suited is the MBW473 Dew Point Mirror, whose RP2 measuring head is designed to be directly inserted into the working volume of the HygroGen2, and works across its full range. Temperature and humidity probes from all manufacturers can be calibrated with typical expanded uncertainty at ambient conditions of less than 0.7 %rh. Other models can be connected via the heated Swagelok sample ports on the rear of the instrument.

MBW calibration

Visit www.rotronic.co.uk for more details.

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MEASUREMENT SOLUTIONS

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A platform for low uncertainty: Stable Temperature and Humidity with Minimal Gradients

With the temperature stability of the HygroGen2 - even at its range extremes - better than 0.05°C, (typically less than 0.01°C) and temperature gradients better than 0.15°C (typically less than 0.1°C) - the HygroGen2 in combination with the MBW 473 provides even lower expanded uncertainties of measurement.

Summary of typical expanded uncertainties, with 95% confidence

Reference/condition	0°C 10%rh	0°C 95%rh	23°C 50%rh	60°C 10%rh	60°C 95%rh
RH probe					
Temp °C	0.24	0.24	0.14	0.20	0.20
Humidity %rh	1.13	3.10	1.38	1.13	2.50
Chilled mirror					
Temp °C	0.18	0.18	0.08	0.16	0.16
Humidity %rh	0.22	1.74	0.66	0.21	1.63

These values are typical values that can be achieved. Any real world system must be individually evaluated.

AutoCal+

Rotronic leads the temperature and humidity calibration industry with **AutoCal** - a unique automated system for calibrating and adjusting RH probes which is integrated into the HygroGen2.

The AutoCal function allows the user to pre-define a profile of temperature and RH calibration points to be performed automatically. Reference and test instrument values are automatically recorded and a certificate produced in pdf format. AutoCal can be configured to adjust the test instrument to the reference value, with pre and post adjustment values recorded on the calibration certificate.

rotronic HYGROGEN

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HygroClip 2 60851098 AutoCal Certificate

Date (YYYY-MM-DD): 2013-01-16
Time (HH:MM:SS): 21:04:40

Probe Under Test: HygroClip 2
Serial No.: 60851098

Reference: HygroClip2
Serial No.: 60851173
Reference Calibration Standard:
UKAS calibration cert number: 12345678
Reference Last Calibration Date: 2012-12-31
Reference Next Calibration Date: 2114-12-30
Comment on Reference:
Sample
HygroGen2 ID: 912542.65

AutoCal Program Number: 1
Descriptor: ACal Profile 1
Autocal Program Structure:

Step:	Temperature SP (°C):	Humidity SP (%):	Step Duration (HH:MM):	Adjust Temperature:	Adjust Humidity:
1	23.0	35.0	01:00	Yes	Yes
2	23.0	50.0	01:00	No	Yes
3	23.0	80.0	01:00	No	Yes
4	23.0	35.0	01:00	No	No

Tolerance to Set Point at which step duration timing will occur (zero = no tolerance applied).
SP Temperature Tolerance (°C): 0.1
SP Relative Humidity Tolerance (%): 0.1

Probe Actions Recorded:

With **AutoCal+** the HygroGen2 now offers the option of using an MBW chilled mirror hygrometer as the calibration reference. This means that the lowest achievable calibration uncertainty is available in combination with the automated functionality, making AutoCal the most efficient, precise and versatile temperature and humidity calibration system currently available.

MBW calibration

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