



RH Generator Calibration

Application Overview

Relative Humidity (RH) generators are widely used for the calibration of RH instruments on-site and in laboratories. These generators have the advantage of being based on fundamental principles to generate a gas of known humidity. Used in combination with a dew point mirror as the transfer standard, state of the art calibration work can be performed.

These RH generator types also incorporate temperature control. This means that RH and temperature conditions may be generated to match the working conditions of the sensors under test. This is particularly useful in the validation of sensors used in a wide range of relative humidity and temperature.



APPLICATION NOTE

Calibration and Tracability

Any system used for the calibration of sensors must itself be calibrated according to ISO 17025 to provide traceability to recognised national standards.

Two pressure systems generate precise and stable RH values based on pressure/temperature measurement and control. As such they are less likely to suffer from drift. Typically, instruments need to be sent back to the manufacturer or to a laboratory for calibration. However, using a dew point mirror the generated RH value can be compared to the mirror transfer standard. This allows the user to determine the stability of the system and provide measurement traceability without having to send the generator away.

Uncertainty

The correct method to define the 'precision' of a measurement is to assign an uncertainty. Calibration laboratories, working according to the standards of ISO 17025, calculate the overall uncertainty from a mathematical combination of all possible uncertainty components. Industrial users are increasingly finding that this approach provides a useful, and more importantly, validated means of defining measurement performance. Thanks to its inherent precision and long term stability, the use of a chilled mirror dew point hygrometer provides the best measurement capability in RH generator monitoring and calibration. If needed, MBW/RH Systems are able to provide example uncertainty budgets for support.

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Measurement Options

The integration of chilled mirror measurements with RH generators depends very much on the type used. In all cases, since RH is highly temperature dependent, careful consideration of temperature measurement is essential. The temperature measured by the dew point mirror must be the same as the generator chamber and any instrument under test. The table below shows the effect of a $\pm 1\text{ }^\circ\text{C}$ temperature error at various RH/temperature conditions:

Relative Humidity	$\pm 1\text{ }^\circ\text{C}$ Temperature				
	10 $^\circ\text{C}$	20 $^\circ\text{C}$	30 $^\circ\text{C}$	50 $^\circ\text{C}$	70 $^\circ\text{C}$
10 %rh	$\pm 0.7\text{ %rh}$	$\pm 0.6\text{ %rh}$	$\pm 0.6\text{ %rh}$	$\pm 0.5\text{ %rh}$	$\pm 0.5\text{ %rh}$
50 %rh	$\pm 3.5\text{ %rh}$	$\pm 3.2\text{ %rh}$	$\pm 3.0\text{ %rh}$	$\pm 2.6\text{ %rh}$	$\pm 2.3\text{ %rh}$
90 %rh	$\pm 6.3\text{ %rh}$	$\pm 5.7\text{ %rh}$	$\pm 5.4\text{ %rh}$	$\pm 4.6\text{ %rh}$	$\pm 4.1\text{ %rh}$

External Sampling from Generator Chamber

A sample of the chamber gas is drawn through a heated sampling tube to the chilled mirror measuring head where the dew point is measured, while a separate probe is used for the measurement of temperature. The heated tube allows for dew point measurements above the ambient temperature without the risk of condensation. Since the measuring head will produce a small amount of waste heat during measurement, the measuring head is external to the humidity generator to preserve chamber temperature uniformity.

Products:

373H, 373HX for dew points up to $+95^\circ\text{C}$



Advantages of Chilled Mirrors in the Validation of Climatic Chambers

- Low drift measurement of dew/frost points and temperature
- Automated gas sampling at temperatures up to $100\text{ }^\circ\text{C}$
- Simultaneous measurement of temperature to permit calculation of relative humidity
- Integrated calibration verification function to allow on-site verification of instrument performance

MBW Calibration & RH Systems

MBW Calibration (CH) and RH Systems (USA) work closely together to develop and manufacture chilled mirror dew point hygrometers that are used by standards laboratories worldwide at national, accredited and industrial levels.

The available range of chilled mirrors cover frost/dew points over the range of -95 to $+95\text{ }^\circ\text{C}$ and incorporate the features necessary to provide reliable and accurate measurements in all conditions.

RH Systems

3416 Vista Alameda NE
Albuquerque NM 87113
USA

Phone +1 505-856-5766
Fax +1 866-891-3399

www.rhs.com
info@rhs.com

MBW Calibration Ltd.

Seminarstrasse 55/57
CH-5430 Wettingen
Switzerland

Phone +41 56 437 28 30
Fax +41 56 437 28 40

www.mbw.ch
sales@mbw.ch