S8000 RS

High-Precision Chilled Mirror Hygrometer

A high-precision hygrometer offering a wide operating range and small form factor, coupled with very high sensitivity to changes in moisture content.

Highlights

- Accuracy of ±0.1°C
- Precision measurement to -90°C dew point (100 ppb) with no need for additional cooling
- Simple configuration and operation via touch screen interface
- Sensor head optimised for fast response to low moisture levels
- High measurement sensitivity
- Microscope for visual inspection of condensate on mirror
- Compact 19” x 4U package for flexibility of installation
- Lightweight at 22.4kg
- Ethernet or USB connections
- SD card datalogging

Applications

- Standards laboratory reference instrument
- Measurement standard for high purity gas manufacture
- Measurement standard for semiconductor dry gas supply
- Calibration facilities
- Research and development
- Clean/Dry room monitoring
- Metallurgical processes

S8000 RS
High-Precision Chilled Mirror Hygrometer

The New Workhorse for Your Lab

The S8000 RS chilled mirror sensor directly measures the formation of condensation, giving long-term and unmatched, drift-free readings of dew-point and relative humidity. It offers a wide measurement range from -90 to +20°C dew point. Fully automated control of the auxiliary cooling system means that no operator intervention is required even if the measured dew point changes from one end of the range to the other. The instrument provides three user-configurable analog outputs, and a range of modbus digital communications, allowing it to be monitored by a suitable computer or PLC system or via specific S8000 RS logging software. A pair of adjustable isolated alarm contacts allow the S8000 RS to be used for direct process control. A high-contrast touch screen LCD display provides entirely customizable local indication of the measured values, along with a trend graph and fault warnings.

Advanced Optical System for Increased Sensitivity

The S8000 RS utilises a unique advanced dual optics system to detect very small changes in moisture condensed on the mirror surface, resulting in very high sensitivity and fast response to changes in frost point, even at low levels of moisture. The rate of formation of frost on the mirror surface is slower at lower frost points. This is due to the very low quantity of water molecules which are present (100 ppb at -90°C dew point). So it takes time for enough molecules to pass the mirror to form a layer of frost. An accurate and reliable measurement with a non-fundamental hygrometer can be difficult to perform.

Use Your Preferred Communication Media

The S8000RS can be ordered with a wide range of communication protocols:

- Modbus RTU over:
  - USB
  - RS232
  - RS485
- Modbus TCP over Ethernet
- 3 user configurable 0/4–20mA
- Status and Process Alarm contacts
- Datalogging to SD Card

Uncompromising Accuracy

The new sensor design incorporates a high precision Pt100 to measure the mirror temperature. Combined with high integrity internal sampling, featuring welded stainless steel tubing and VCR fittings, this provides ±0.1°C accuracy of dew-point measurement and the fastest possible response time to very low dew points.

To further improve the accuracy of pressure-derived calculated values an optional pressure transducer can be installed, which provides a real-time pressure input for these parameters. This allows for continued measurement accuracy, even during sample pressure fluctuations.

Confidence Through Seeing What You Measure

It is possible for moisture to exist as a liquid at temperatures down to -40°C. The difference in condensation temperature between water and ice can be 10% of the reading.

The S8000 RS takes two approaches to ensure confidence in the phase of water condensate being measured (dew or frost):

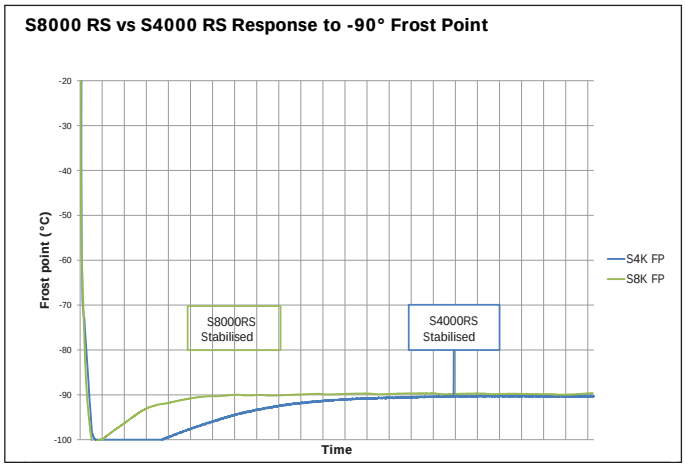
Frost Assurance (FAST)
Frost Assurance determines whether the dew-point of the sample is in the temperature region where super-cooled water can exist, and if so, will drive the mirror down to below -40°C to ensure that ice is present on the mirror surface.

Microscope
A viewing microscope is supplied as standard. This enables the user to inspect the mirror directly during the measurement process, and determine the state of condensation.

DCC for Increased Reliability

The S8000 RS utilizes a system called DCC (Dynamic Contamination Correction). The DCC system is intuitive and adapts the instrument control to the operating conditions to achieve optimum measurement performance at all times by periodically re-balancing the optics to compensate for any reduction in light intensity caused by contamination of the components in the optical path. Although the DCC system is fully automatic it can be configured by the user for individual applications.

Three Times Better Response Time Down to -90°C Frost Point



Technology: Chilled Mirror

RRS

Michell's chilled mirror dew-point hygrometers are precision instruments for critical measurement and control applications.

Chilled mirror sensors measure a primary characteristic of moisture – the temperature at which condensation forms on a surface.

This means that chilled mirror instruments:

- have no drift: the temperature at which condensation forms is measured directly so there are no calculated variables that could shift over time
- are inherently repeatable, giving reliable results every time.

The chilled mirror sensor consists of a temperature controlled mirror and an advanced optical detection system.

A beam of light from an LED (1) is focused on the mirror surface (2) with a fixed intensity. As the mirror is cooled less light is reflected due to the scattering effect of the condensate formed on the mirror surface. The levels of reflected and scattered light are measured by two photo-detectors (3 & 4) and compared against a third reference detector (5) measuring the intensity of light from the LED.

The signals from this optics system are used to precisely control the drive to a solid state thermoelectric cooler (TEC) (6), which heats or cools the mirror surface. The mirror surface is then controlled in an equilibrium state whereby evaporation and condensation are occurring at the same rate. In this condition the temperature of the mirror, measured by a platinum resistance thermometer (7), is equal to the dew-point temperature of the gas.

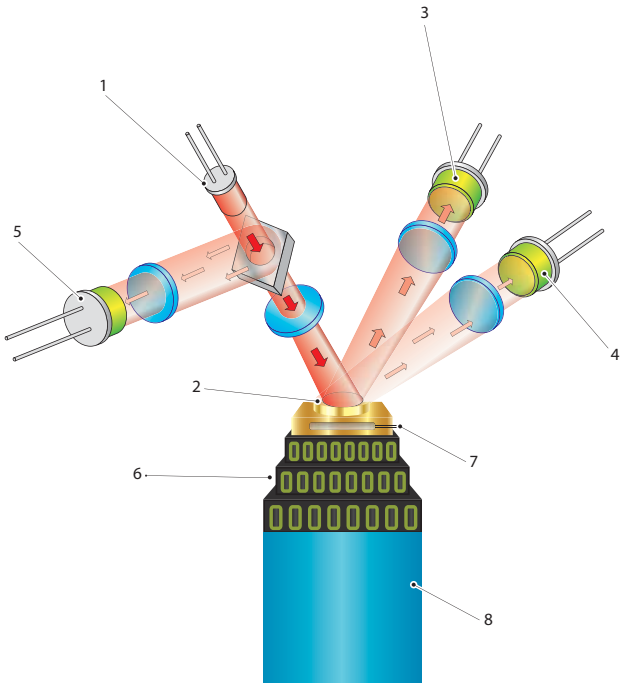
An auxiliary cooling system (8) is used to remove heat from the 'hot' side of the TEC. This supplements the depression capabilities of the heat pump, and enables measurement of very low dew points.

Our chilled mirror instruments prove their reliabilty on a daily basis in our production processes and service centres, as well as in our UKAS-accredited calibration laboratory.

The graph opposite compares response speed of the S8000 RS with its predecessor, the S4000 RS, to a sample of -90°C frost point.

As can be seen, the S8000 RS stablizes in one third of the time of the S4000 RS.

Experts in Chilled Mirror Technology



The S8000 RS is the result of 40 years' experience of developing chilled mirror technology.

As the world's largest producer of high-quality dew-point sensors, we use the S8000 RS, along with other instruments in the chilled mirror range, as the work-horses of our manufacturing and calibration operations.

Technical Specifications

Dew-Point Sensor Performance

Measurement Accuracy*	±0.1°C
Reproducibility	±0.05°C
Measurement Technology	Chilled Mirror
Measurement Range	RS80: -80 to +20°Cdp (-112 to +68°Fdp) RS90: -90 to +20°C dp (-130 to +68°Fdp)
Mirror	Gold plated copper
Temperature Measurement	4 wire Pt100, 1/10 DIN class B
Sample Flow Rate	500 to 1000 ml/min (1 to 2.1 scfh)
Sample Gas Pressure	1 MPa (10 barg) max

Remote PRT

Temperature Measurement	4 wire PT100, 1/10 DIN class B
Measurement Accuracy	±0.1°C
Cable Length	2 metres (250 metres max)

Flow Sensor

Measurement Range	0 to 1000ml/min

Optional Integrated Pressure Sensor

Measurement Range	0 to 1.6 MPa (0 to 16 bara)
Measurement Accuracy	0.25% Full Scale
Measurement Units	barg, psig, kPa, MPa

* Measurement accuracy means maximum deviation between instrument under test and corrected reference. To this must be added the uncertainties associated with the calibration system and the environmental conditions during testing or subsequent use.

Monitor

Resolution	User selectable to 0.001°C, depending on parameter
Measurement Units	**Moisture:** °C dp or °F dp, % RH, g/m^3, g/kg, ppm$_v$, ppm$_w$ (SF6) **Temperature:** °C or °F **Pressure:** barg, psig, kPa, MPa
Outputs	**Analog:** Three channels, user selectable 4-20 mA, 0-20 mA or 0-1 V **Digital:** Modbus RTU over USB and optionally Modbus RTU over RS232 or RS485, or Modbus TCP over ethernet. **Alarm:** Two volt-free changeover contacts, one process alarm, one fault alarm; 1 A @ 30 V DC
HMI	5.7" LCD with touchscreen
Data Logging	SD Card (512 Mb supplied) and USB interface. Supports SD Card (FAT-32) - 32 Gb max. that allows 24 million logs or 560 days, logging at 2 second intervals
Environmental Conditions	5 to 30°C, max 80% RH
Power Supply	85 to 264 V AC, 47/63 Hz
Power Consumption	250 VA

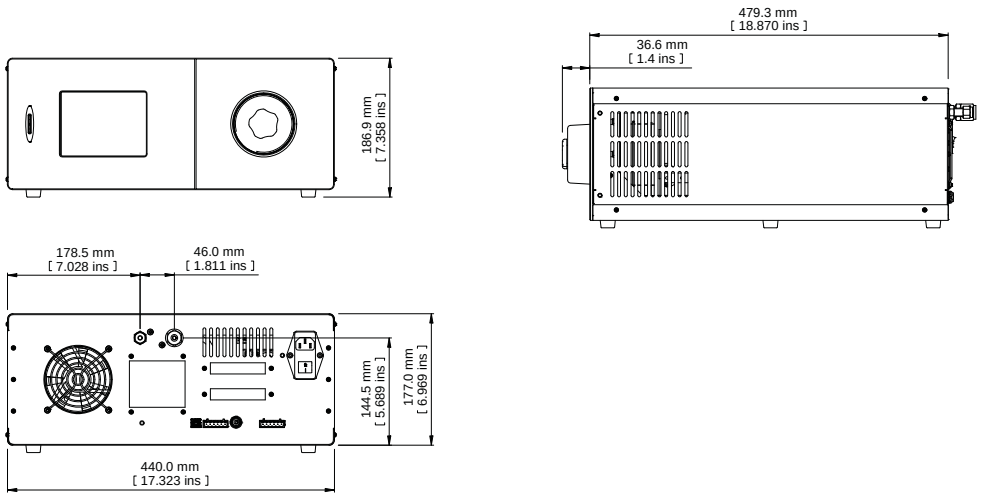
Mechanical Specification

Dimensions	190 x 445 x 550mm (7.48 x 17.51 x 21.65 in) (h x w x d)
Weight	22.4kg (49.38lbs)
Sample Gas Circuit	316 Stainless steel
Sample Gas Connections	**Inlet:** ¼" VCR (MALE) **Outlet:** ¼" Swagelok (MALE)
Optional Integrated Sample Pump	Flow rate: 1.4l/min maximum Sample gas connections: 1/4" Swagelok (MALE) with bypass loop

General

Calibration	5-point in-house calibration, national standards traceable as standard UKAS ISO17025 accredited calibrations optional – please consult factory

Dimensions



Michell Instruments 48 Lancaster Way Business Park, Ely, Cambridgeshire, CB6 3NW
Tel: +44 1353 658000, Fax: +44 1353 658199, Email: uk.info@michell.com, Web: www.michell.com/uk

Michell Instruments adopts a continuous development programme which sometimes necessitates specification changes without notice.
Issue no: S8000 RS_97316_V3.1_UK_0818