

# S8000

## Precision Chilled Mirror Hygrometer

A high-precision hygrometer combining straightforward operation with very high sensitivity to changes in moisture content.



### Highlights

- $\pm 0.1^{\circ}\text{Cdp}$  ( $\pm 0.18^{\circ}\text{Fdp}$ ) accuracy
- Fundamental, accurate and drift-free measurement
- Simple configuration and operation via touch screen interface
- Precision measurements to  $-60^{\circ}\text{C}$  ( $-76^{\circ}\text{F}$ ) dew point
- FAST – guaranteed frost formation below  $0^{\circ}\text{C}$  ( $+32^{\circ}\text{F}$ )
- Measure at pressures up to 2 MPa (20 barg)
- USB, Ethernet, RS485 or RS232 connectivity
- Datalogging to SD card or via digital comms

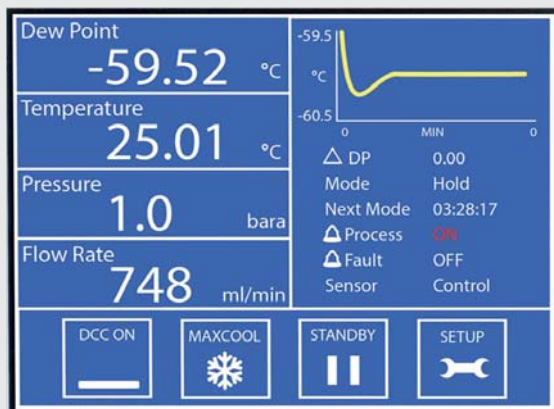
### Applications

- Standards laboratory reference instrument
- Transformer vacuum drying verification
- Clean/dry room environmental monitoring
- Metallurgical process monitoring
- Reference instrument for commercial calibration laboratory
- Compressed air dryer R&D
- $\text{SF}_6$  switchgear moisture testing
- Hydrogen fuel cell R&D

## S8000 Precision Chilled Mirror Hygrometer

The new S8000 Hygrometer provides a direct measurement of dew point, temperature and pressure. Dew-point measurement is based on the proven, fundamental optical chilled mirror measurement principle, giving long-term drift-free humidity measurement over the entire operating range. The S8000 uses this measurement to offer a range of available measurement units including ppm<sub>v</sub>, absolute humidity, relative humidity and ppm<sub>w</sub>.

To further improve the accuracy of pressure-derived calculated values (ppm<sub>v</sub>, ppm<sub>w</sub>, absolute humidity), an optional internal pressure transducer can be supplied, which provides real-time pressure. This allows for continued humidity measurement stability even during fluctuations in sample pressure.



A pair of adjustable isolated alarm contacts allow the S8000 Chilled Mirror Hygrometer 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.

### RRS Triple Optics for Increased Sensitivity

The rate of frost formation on the surface of a chilled mirror is slower at lower frost points. This is due to the very low quantity of water molecules which are present – 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.

The S8000 utilizes the RRS Optical System to detect very small changes in the quantity of 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.

### Confidence of Seeing your Measurement

In carefully controlled laboratory conditions, super-cooled water can exist in temperatures as low as -48°C (-54°F). However, when using a chilled mirror instrument it only occurs on the mirror at temperatures down to around -30°C (-22°F).

The difference in vapor pressure between condensed water and ice formed on a chilled mirror can introduce dew-point errors of up to 10% of reading. It is also possible for intermediate states to exist, where the formation is a mixture of ice and super-cooled water, making calculated conversions from one state to the other invalid.

### Frost Assurance Technology (FAST)

The S8000 features FAST, the frost assurance technology which guarantees all dew-point measurements below 0°C (+32°F) are made over ice. The FAST system works by detecting whether the mirror is at a temperature where super cooled water could form, and if so; rapidly cooling the mirror until a film of ice of predetermined thickness forms. Once ice has formed, control returns to the instrument and measurement can begin.

### Microscope

A viewing microscope can be supplied with the instrument. This enables the user to inspect the mirror directly during the measurement process, and determine whether the condensation on the surface is water or ice.

### Use your Preferred Communications Media

For greater flexibility:

- Modbus TCP over Ethernet
- Modbus RTU over: USB, RS232, RS485
- Datalogging to SD Card or via application software
- 3 user-configurable analog outputs
- Status and process alarms

### DCC for Increased Reliability

The S8000 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.

### Application Software

Flexible application software is provided with the S8000, allowing the operator to control all the functions of the instrument directly from a PC. A parameter display shows all measured and calculated parameters, and a customizable graph is provided to display any combination of parameters against a time base.

Data logging functionality is provided, allowing log files to be created and saved directly on the host PC.

## Technology: Chilled Mirror



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.

These parameters mean that chilled mirrors are widely accepted as the default choice for use as humidity calibration references.

The chilled mirror sensor consists of a temperature-controlled mirror and the advanced RRS optical detection system. A beam of light from an LED (4) 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 level of light reflected from the mirror surface is measured by photo-detector 5, whereas photo-detector 6 measures light which is scattered by the condensate. The third reference photo-detector (3) measures the intensity of light from the LED, and compensates for changes in temperature conditions.

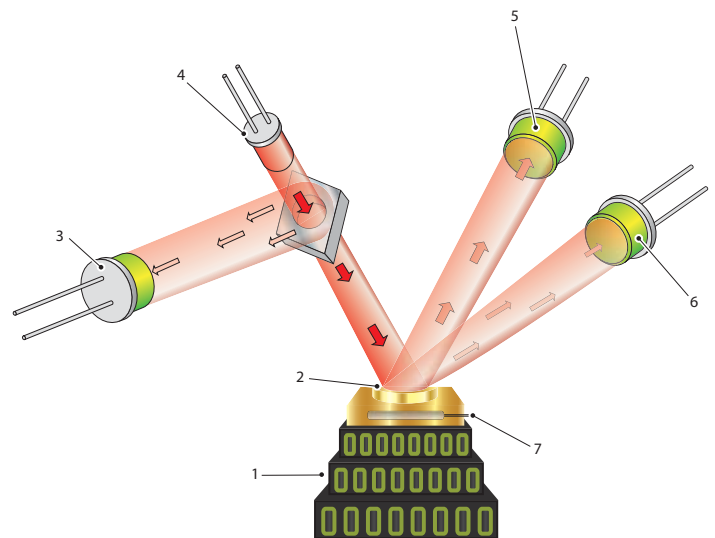
The signals from this optical system are used to precisely control the drive to a solid state thermoelectric cooler (TEC) (1), which heats or cools the mirror surface. The mirror surface is then controlled in an equilibrium state whereby evaporation and condensation are occurring at the same rate. In this condition the temperature of the mirror, measured by a platinum resistance thermometer (7), is equal to the dew point temperature of the gas.

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

## Experts in Chilled Mirror Technology

The S8000 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, along with other instruments in the chilled mirror range, as the secondary references and the working standards of our manufacturing and calibration operations.



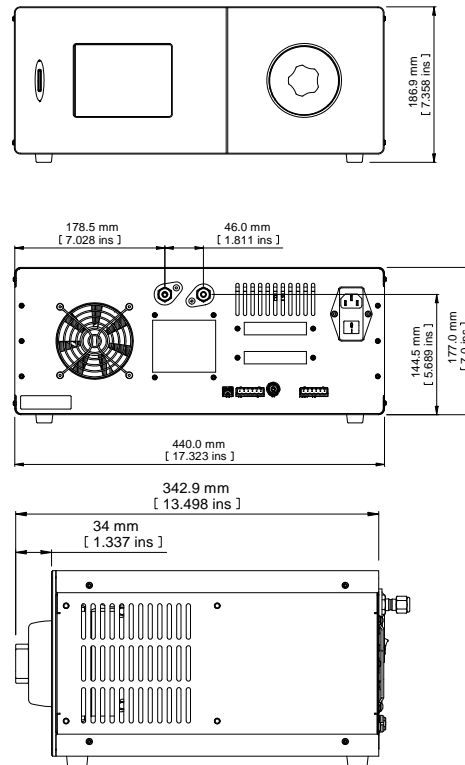
# Technical Specifications

Dew-Point Sensor Performance	
Measurement technology	Chilled Mirror
Accuracy*	±0.1°C (±0.18°F)
Reproducibility	±0.05°C (±0.09°F)
Measurement range	-60 to +40°Cdp (-76 to +104°Fdp)
Operating pressure	
Low pressure version	0 to 1 barg / 14.5 psig
High pressure version	0 to 20 barg / 290 psig
Sample flow rate	0.1 to 1 NI/min (0.2 to 2.1 scfh)
Detection system	RRS Triple Detection
Remote PRT Probe (Optional)	
Temperature measurement	4 wire Pt100, 1/10 DIN class B
Measurement accuracy	±0.1°C (±0.18°F)
Cable length	2m (6.6') (250m (820') max)
Flow Sensor	
Measurement accuracy	Typical ±5% uncalibrated
Measurement range	0 to 1000 ml/min
Integrated Pressure Sensor (Optional)	
Measurement range	0 to 25 bara (0 to 377 psia)
Measurement accuracy*	0.25% Full Scale
Measurement units	psia, bara, KPa or MPa
Monitor	
Resolution	User-selectable to 0.001 dependant on parameter
Measurement units	°C and °F for dew point and temperature %RH, g/m <sup>3</sup> , g/kg, ppm <sub>v</sub> , ppm <sub>w</sub> (SF <sub>6</sub> ), for calculated humidities
Outputs	
<b>Analog</b>	3 channels, user-selectable 4–20 mA, 0–20 mA or 0–1 V
<b>Digital</b>	Modbus RTU over USB, and optional Modbus RTU over RS232, RS485 or Modbus TCP over Ethernet
<b>Alarm</b>	Two volt-free changeover contacts, one process alarm, one fault alarm; 1 A @ 30 V DC
HMI	5.7" LCD with touchscreen, white on blue graphics
Data logging	SD Card (512Mb supplied) and USB interface SD Card (FAT-32) — 32Gb max. that allows 24 million logs or 560 days, logging at 2 second intervals
Environmental conditions	-20 to +40°C (-4 to +104°F)

Power supply	85 to 264 V AC, 47/63 Hz
Power consumption	100 V A
EMC - Class A Emissions	Complies with EN61236:1997 (+A1/A2/A3)
Industrial Location Immunity	
Mechanical Specifications	
Dimensions	187 x 440 x 343mm (7.36 x 17.32 x 13.5") h x w x d
Weight	11.4kg (25.1lb)
General	
Process connections	6mm Swagelok® (MALE) or 1/4" Swagelok® (MALE)
Storage temperature	-20 to +50°C (-40 to +122°F)
Calibration	3-point traceable in-house calibration as standard UKAS accredited calibrations optional — please consult Michell

\* 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.

## Dimensions



## Related Products



**S8000 RS**  
High Precision Hygrometer



**S8000 Remote**  
Remote High Precision Hygrometer



**Optidew 401**  
Precision Dew-Point Hygrometer



**S4000 TRS**  
Precision Dew-Point Hygrometer

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Michell Instruments adopts a continuous development programme which sometimes necessitates specification changes without notice.  
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