

Moisture measurement as quality assurance in high purity gas manufacturing

High purity gases are used across an enormous range of applications, from carbon dioxide used as a refrigerant gas, to argon used in the production of silicon wafers for the electronics industry. Moisture is a common and undesirable contaminant in many high purity gases, and measuring moisture content provides assurance that drying and purification processes are effective. Meeting customers' quality expectations where gas has a certified purity level is vital to maintain reputation as a world class gas manufacturer.

The permitted moisture content will vary depending on the type of gas and certified purity. Moisture can be harmful to the end customer process for a variety of reasons. Excessive moisture content in gases can cause corrosion to pipework, and at low temperatures lead to the formation of ice, causing premature wear and failure of equipment. Moisture in liquid form can also react with other chemicals or gases in a process, forming corrosive compounds, contaminating products and contributing to inferior finishes.

High purity gas is supplied in different grades, with some typical examples of moisture content listed in the table below:

Gas Type	Purity	Maximum Moisture Content
R744 Refrigerant Grade CO ₂	99.9%	< 10ppm
Synthetic Air	99.99%	≤ 5ppm
High Purity Nitrogen	99.999%	≤ 3ppm
High Purity Argon	99.9999%	≤ 0.5ppm

It is important to establish a routine check of the moisture content of manufactured gas, so drying and purification processes are known to be effective. This provides assurance that the gas is being produced to the required purity and customers' expectations are being met. The gas can be measured at the point of production, or directly from a sample of freshly filled bottles. The sample gas will need to be regulated down to an appropriate pressure and flow rate that is suitable for the connected measuring instrument.

Michell Instruments offers a range of precision moisture analyzers, based on two different technologies:

- Quartz Crystal Microbalance, which measure the frequency change in a hygroscopic-coated quartz crystal as it adsorbs and desorbs moisture.
- Chilled mirror hygrometers, which measure a primary characteristic of moisture – the temperature at which condensation forms on a surface.

Each device has its own benefits, which are relevant to different aspects of high purity gas production.

Quartz crystal microbalance:

- Responds very quickly to changes in moisture content.
- Consumes a very small amount of gas to make a measurement (300ml/min without a bypass loop)
- Automatically self-adjusts, using a calibrated internal moisture source

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 QMA401 is an ideal analyzer for measuring an absolute quantity of water vapor using only a very small volume of gas. Its detection method is extremely sensitive to small changes in moisture content, and does not need to wait for measurement equilibrium to produce accurate results. This is the instrument of choice when response speed and minimal gas consumption are the important factors.

The S8000 RS utilizes a unique advanced dual optics system to detect very small changes in moisture condensed on the mirror surface, resulting in very high sensitivity and precision when making measurements at low levels of moisture content. This is the instrument of choice when accuracy and repeatability are the important factors.

QMA401

The QMA401 uses a Quartz Crystal Microbalance moisture measurement technique which is accurate, reliable and very fast to respond. The system incorporates an internal calibrated moisture source, which is used to perform calibration verification and adjustment of the analyzer automatically. The analyzer is equipped with a modern touch-screen UI, which is configurable for the displayed parameters and outputs the customer requires. On-board data logging, plus USB and Ethernet communications are provided as standard. The instrument is supplied with a traceable calibration certificate.



Key Features

Measurement Range	0.1 to 2000ppmv	HMI	7" Resistive Touch Screen
Measurement Units	ppmv, ppm _w , mg/Nm ³ , vapour pressure (Pa), Frost point (°C), lb/MMscf	Data Logging	Direct logging to SD card or PC via application software
Accuracy	±10% of reading from 1 to 2000 ppmv, 0.1 ppmv between 0.1 & 1 ppmv	Outputs	Analogue: 2 channels, user selectable 4–20 mA or 1 to 5 V Digital: USB or Ethernet (Modbus TCP) Alarms: 1 x System alarm, volt-free change-over (FORM C) 1 x Flow alarm, volt-free change-over (FORM C) settable high or low 2 x Level alarm, for ppmv or DP, settable to be active high or low
Repeatability	±5% of reading from 1 to 2000 ppmv ±0.1 ppmv between 0.1 & 1 ppmv	Additional Features	Automated flow control, automated self calibration at either 0.5, 5 or 50ppmv

S8000 RS

The S8000RS uses a fundamental cooled mirror measurement technique that is dependable, reliable and highly accurate. Measurements are repeatable, and drift free. The S8000 RS comes with a modern touch-screen UI, many user selectable measurement units and a generous number of outputs. Other features include data logging and Ethernet communications. The instrument is supplied with a traceable calibration as standard, but an optional UKAS accredited calibration is also available.





Key Features

Measurement Range	RS80: -80 to +20°C dew point RS90: -90 to +20°C dew point	HMI	5.7" Resistive Touch Screen
Measurement Units	Moisture: °C/°F dp, %RH, g/m ³ , ppmv, ppmw (SF6) Pressure: barg, psig, kPa, MPa	Data Logging	SD Card, 32GB Max 560 days at 2 second interval
Accuracy	±0.1°C	Outputs	Analogue: 3x User selectable, 0/4-20mA, or 0-1V Digital: USB or Ethernet (Modbus TCP) Alarms: 1x Process, 1x Fault
Repeatability	±0.05°C	Additional Features	Integrated flow sensor, remote temperature probe, optional integrated pressure sensor.



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



Q06284