

Product Catalogue



RH systems
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Humidity Measurement
Humidity Generation
SF₆ Measurement
Thermometers



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Humidity Measurement



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Dew Point Mirror 373



High Precision

Fast Response

Wide Measuring Range

Laboratory Reference

Touch Screen

Full Color High Resolution LCD

Chilled Mirror Hygrometry

Chilled mirror hygrometry, a process used to measure the dew or frost point of a gas, works in the following manner. Light shines onto a polished mirror surface, the temperature of which is controlled by a thermoelectric heatpump known as a Peltier element. A light-sensitive receiver measures the intensity of the direct reflection. When the mirror is clean and dry, the intensity of the reflected light is at its maximum. Conversely, a cold mirror with water vapor condensed on its surface scatters the light, resulting in less light directly reflected and in reduced signal intensity. Using this received light signal as feedback in a closed loop control system, the mirror may be cooled to the temperature at which the

thickness of the condensed layer, detected through the intensity of the received light, remains constant. A condensate layer of constant thickness, with no further net increase or decrease in condensation, is in dynamic equilibrium with the gas surrounding the mirror. In this equilibrium condition, the dew or frost point temperature of the gas is determined by measuring the temperature of the mirror. If the condensate is known to be in liquid form, even for temperatures below freezing, then the measured mirror temperature is taken as the dew point. If the condensate is known to be in a solid form as ice or frost, then the measured mirror temperature is taken as the frost point.



Graphic Display



Full Color High Resolution LCD
Touch Screen
Selectable Display Parameters
Selectable Units
Numeric or Graph Format

The system uses a full color active matrix liquid crystal display with an integral touch panel. It has a high contrast ratio and a wide viewing angle for easy readability. Data is displayed in large easy to read fonts. Using the on screen buttons and menus, you can easily configure each line of the display for a variety of humidity, temperature, and pressure parameters that may be viewed in either SI or non-SI units. A simple touch of a button toggles any parameter between numeric or graph format.

Set It and Forget It. Once the screen is set up the way you like it (parameters, units, numerics, graphics), the system remembers this configuration, powering up each time with your customized configuration.

Easy Mirror Cleaning Access



The mirror is mounted right on the front panel making it easily accessible for cleaning. Simply twist and remove the cover to gain complete access to the removable optical assembly and the flush mounted mirror surface.

Dew/Frost Determination



Automatically Distinguishes between Dew and Frost –

For mirror temperatures above 0°C, water vapor condenses on the mirror as liquid water (dew). A condensation layer resulting from a mirror temperature above 0°C is considered a dew point.

For mirror temperatures far below 0°C, water vapor condenses on the mirror as solid ice (frost). A condensation layer resulting from a mirror temperature far below 0°C is considered a frost point.

However, for mirror temperatures between 0 and approximately -20°C, the state of the condensed layer is indeterminate, and may be either water or ice, or some combination of the two. In this temperature range it is difficult to know, without visual observation, whether the system is controlling at the dew point, at the frost point, or somewhere in between. Since these states occur at different mirror temperatures for gas of the same water vapor content, it is important to determine which it is; errors resulting from this problem can be in excess of 2°C.



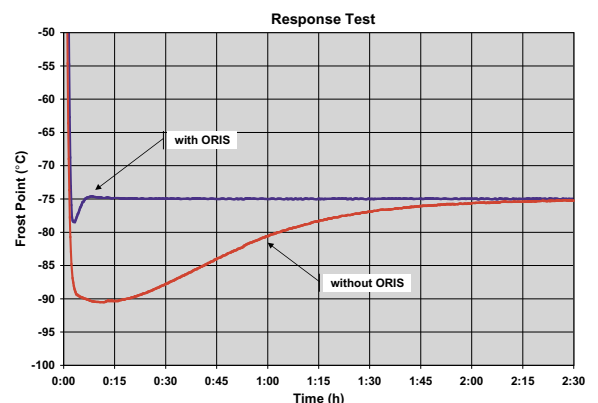
The 373 can automatically force all sub-zero condensation to a known state of frost, and thus eliminate the problem. Frost is ensured by rapidly cooling the mirror to below -40°C forcing the condensate to solidify, then quickly returning it to the previously predicted frost point temperature. It is then allowed to stabilize while ensuring the mirror temperature remains below 0°C. Once forced to

freeze in this manner, the condensation will remain in frost for all subsequent mirror temperatures that continue to remain below 0°C.

Once the mirror temperature has risen above 0°C, subsequent attempts to stabilize in the indeterminate range between 0 and -20°C cause the system to cycle through forced frost formation once again. A forced frost cycle may also occur at the completion of any automatic or manual mirror check.

By ensuring that sub-zero mirror temperatures are always forced to frost, the mirror temperature can be taken as the frost point temperature. Dew point temperature and other humidity parameters can be mathematically computed from the measured frost point temperature.

ORIS



Optimal Response Injection System –

ORIS allows faster measurements at mirror temperatures below -60°C. At these low frost point conditions a chilled mirror hygrometer must cool the mirror to a value well below the actual frost point temperature in order to start the condensation process on the mirror. Due to the low water vapor content of the gas, building even a thin layer of frost on the mirror often requires several hours; the lower the frost point of the gas, the longer it takes.

ORIS reduces hours of delay into just minutes. When measuring low frost points, ORIS momentarily injects a small amount of water vapor into the gas stream. This water vapor expedites the initial formation of frost on the mirror, significantly reducing the amount of time required for a stable measurement. Measurements that once took several hours or more, are now performed in a matter of minutes.

Low Frost Point Measurement

The 373 is equipped with a dual mode (air, water) heat exchanger for bulk heat removal from the Peltier element. For dew point and frost point temperatures above approximately -40°C , air-cooling is generally sufficient. For lower values, externally supplied cooling water is often recommended. Cooling water connections are located on the instrument's back panel. The temperature of the mirror, below which water cooling begins, can be selected from the touch screen. With the water valve on, the temperature of the recirculating water will control the temperature of the heat exchanger.

For measurement of very low frost point temperatures, a Dew Point Mirror 373L(X) must be used. Rather than using an air-water heat exchanger, the 373L(X) is equipped with an integral precooling using a closed-circuit direct refrigerant injection system for bulk heat removal of the Peltier element. The precooling allows the mirror to reach temperatures as low as -100°C without the need for any auxiliary equipment. The precooling may be operated in either a fixed temperature mode or at some delta above the currently measured frost point temperature. Both the mode and precooling temperature can be selected on the touch screen.



VCR couplings are used for the gas inlet and outlet connections on all low-range units.



Electropolished tubing and orbitally welded connections minimize dead volume and water vapor entrapment in the gas path.

High Dew Point Measurement

In general, making measurements of high dew point temperatures, i.e. those above room temperature, can pose difficulties due to possible condensation within the sampling tubes. Preventing such condensation often requires the use of external heaters and controllers to maintain the temperature of all tubing above the dew point temperature of the gas. The 373 offers a simpler solution. In addition to automatic control of the internal tubing and measurement head temperatures, it controls an externally connected heated hose. Simply connect the hose and plug in the electrical connection. The hose may be controlled at either a fixed temperature, or at some delta above the currently measured dew point temperature. The mode and temperature can be selected on the touch screen.

Mirror Check

The automated Mirror Check procedure dries the mirror, compensates for the presence of contamination (residue) on the mirror, then returns the system to its previous operational status.

To dry the mirror, it is first heated to a pre-selected temperature, burning off any dew or frost. The reflected optical signal is then measured and evaluated for the presence of mirror surface contamination. The resulting contamination level is depicted on the Mirror Residue indicator. Based on the value entered for Heating Time, the system will be held at the selected temperature. Upon completion of the hold time, the optical signal is re-aligned to compensate for the effects of any remaining contamination. The system is then restored to its previous mode of operation. If it was in Dew/Frost Control prior to Mirror Check, then a new dew or frost layer will be established and measurement resumes.

Mirror Check may be triggered manually at any time by pressing the Mirror Check button. Alternatively, it may be placed in a timed automatic mode with an interval set by the Cycle Time. The cycle time for automatic mirror check can be set from as little as a few minutes to as long as 48 hours.

373 Dew Point Hygrometer

Specifications:	373S	373H	373HX	373L	373LX	373LXHX
Measuring Ranges						
Frost/Dew Point:						
Min./max. expected range of use	-60...20 °C	-60...70 °C	-50...95 °C	-75...20 °C	-95...20 °C	-80...95 °C
Calibrated range	-50...20 °C	-40...70 °C	-40...95 °C	-70...20 °C	-90...20 °C	-75...95 °C
Temperature	-50...100 °C					
Sample pressure	500...2'000 hPa abs.					
Accuracy						
Frost/Dew point (for calibrated range)	≤ ± 0.1 °C					
Temperature	≤ ± 0.07 °C					
Reproducibility						
Frost/Dew point	≤ ± 0.05 °C					
Temperature	≤ ± 0.04 °C					
Standard Features						
Digital I/O	RS-232					
Display	8.4" LCD with color touch screen					
Mirror cooling	3-stage Peltier thermoelectric					
Mirror temperature sensors	Dual Platinum Resistance Thermometer PRT (Pt-100)					
External temperature probe	Platinum Resistance Thermometer PRT (Pt-100), Ø2 x 100 mm					
Analog outputs	Two analog outputs, user programmable, -10...+10 V and 4...20 mA					
Gas connections	6mm or ¼" Swagelok, VCR Cajon ¼" for L and LX only					
Sample gas flow rate	0...1 l/min (for 373 L and LX: 0...2 l/min)					
Sample gas circuit	Stainless steel, 316 / 316L, electro polished					
Transport case	Robust custom fit, foam lined, hard-shell case					
Power cable	2.5 m					
Operating instructions	English					
Calibration certificate	Factory calibration: 5 points FP/DP, 3 points temperature					
Cooling	Air/Water	Air/Water	Air/Water	Refrigeration	Refrigeration	Refrigeration
ORIS	Yes	No	No	Yes	Yes	No
Heated sample gas path	No	80 °C	105 °C	40 °C	40 °C	105 °C
Internal pump	Yes	Yes	Yes	Optional	Optional	Yes
Optional						
Pressure upgrades	Pressure upgrades to 1 MPa abs. or 2 MPa abs.					
Calibration upgrade	Upgrade to SCS accredited ISO 17025 calibration available					
Endoscope	Measuring head mount endoscopes					
Vacuum measurement capability	Down to 500 hPa					
Additional Information						
Compliance	CE Compliance					
Operating condition	15...35 °C, 90 %rh non-condensing					
Storage conditions	-10...50 °C, 90 %rh non-condensing					
Power supply	100...120 VAC / 200...240 VAC, 50/60 (auto-switching)			100...120 VAC, 50/60 Hz or 200...240 VAC, 50/60 Hz		
Power consumption	200 W	300 W	300 W	300 W	500 W	500 W
Weight & Dimensions						
Width	449 mm	449 mm	449 mm	449 mm	520 mm	449 mm
Height	236 mm	236 mm	236 mm	236 mm	255 mm	236 mm
Depth	461 mm	461 mm	461 mm	511 mm	500 mm	511 mm
Weight	20 kg	25 kg	25 kg	35 kg	45 kg	38 kg

373 V2.1 10.2015 We reserve the right to change design or technical data without notice.

Dew Point Mirror 973



Reliable Measurement

The Model 973 Dew Point Mirror is a portable instrument equipped with an integral measuring head for both spot and continuous measurement of Dew/Frost point and temperature in air and gas mixtures. Based on the chilled mirror principle, the 973 ensures direct and accurate humidity measurement.

Full Color Touch Screen

The system uses a full-color active matrix liquid crystal display with an integral touch panel. It has a high contrast ratio and a wide viewing angle for easy readability. Data is displayed in large easy to read fonts. Using the on screen buttons and menus, you can easily configure each line of the display for a variety of humidity, temperature, and pressure parameters that may be viewed in either SI or non-SI units. A simple touch of a button toggles any parameter between numeric or graph format.

Dew/Frost Determination

User configurable via the full color active matrix LCD touch screen, the 973 may be configured for measurement of dew point, frost point, relative humidity, and other parameters. The ForceFrost™ feature ensures reliable differentiation between super-cooled dew and frost.

Verifiable Calibration

Easily check the calibration at any time using the built-in Ice Test function, providing instant proof of system accuracy and integrity.

Connect and Go

The system is supplied ready for immediate use complete with built-in pump, flowmeter, pressure sensor, and external temperature probe. PC connectivity for remote data collection is easy with the simple yet robust protocol of the bi-directional RS-232 port.

Model:	973
Measuring range:	
Frost/Dew Point	-50...+20°C
% RH	5...100%
Temperature	-50...+150°C
Accuracy:	
Frost/Dew point	±0.1°C
Temperature	±0.1°C
Reproducibility:	
Frost/Dew Point	± 0.05°C
Temperature	± 0.05°C
Thermoelectric Mirror cooling:	3-stage, 80°C depression
Cooling:	Air
Display:	Active Matrix Color Graphic LCD
Digital I/O:	RS-232
Gas couplings:	1/4" Swagelok
Mirror temperature sensor:	PRT-100
Sample gas flow rate:	0.2...1.0 l/min
Sample gas circuit:	PTFE (Teflon)
Sample gas max pressure:	2 bar (10 bar option available)
Operation temperature:	-10...+40°C
Storage temperature:	-10...+40°C
Ambient humidity: Instrument	90% RH max., non condensing
Voltage:	100...240 VAC, 50/60 Hz
Power consumption:	200 Watt
Width:	440 mm
Height:	155 mm
Depth:	410 mm
Weight:	12 kg

We reserve the right to change design or technical data without notice.

473 Dew Point Hygrometer



High Performance Chilled Mirror Hygrometer With Cable Mounted Measuring Heads

- Highly precise chilled mirror dew point technology
- Cable mounted dew point and temperature measurement
- Aspirated and direct insertion measuring heads
- Barometric pressure measurement options
- Intuitive color touch screen user interface
- User verifiable calibration

Typical applications:

- Climatic chamber validation to IEC60068
- Weather station calibration
- RH generator transfer standard
- Engine test cells

REFLECTING YOUR STANDARDS

473 Dew Point Hygrometer

Highly Precise Chilled Mirror Dew Point Technology



Chilled mirror condensation technology provides highly precise, stable and repeatable results. Water vapor condenses onto a temperature controlled mirror surface and this 'dew point' is detected with advanced optical electronics. Since dew point is specific to water vapor concentration and not temperature dependent, measurement precision is consistent across the full application range including high temperature and humidity conditions in climatic test chambers.

MBW chilled mirror hygrometers have a typical service life of more than 15 years thanks to the use of high quality materials and Swiss precision engineering. The high quality platinum resistance thermometer (PRT) element embedded within the mirror ensures excellent long term measurement stability. Thanks

to the precise dew point and temperature measurements as well as the stability and long service life, MBW chilled mirrors are used by national standards and accredited laboratories worldwide. The 473 transfers reference standard performance into applications such as climatic chamber validation, relative humidity calibrators and a wide range of industrial processes.

Dew or Frost?

Below 0 °C, water can condense in either the liquid or solid phase (dew or frost). The difference in the temperature at which the condensate layer stabilizes can be up to 3 °C, therefore the condensate phase must be known for correct calculation or validation of parameters such as relative humidity. As shown on the picture to the right, it is also possible that dew and frost can exist concurrently on the mirror; this results in a non-stable value somewhere between the dew and frost point.

ForceFrost™ Function

Below a user defined temperature, the 473's ForceFrost function over-cools the mirror to force the condensed layer to the solid phase. This eliminates the uncertainty of whether dew or frost point is measured.



Intuitive User Interface

The 473 features a 5.7" color touch screen with a high contrast ratio and wide viewing angle for clear and easy readability. Using the on-screen buttons and menus, each line of the instrument display can be configured for a variety of humidity, temperature and pressure parameters that may be viewed in the units of choice. These parameters can be displayed either numerically or graphically with user-configurable axes enabling measurement trends and stability to be confirmed without the need for external data acquisition or display hardware.



Easy To Use and Minimal Maintenance

The 473 does not require either calibration adjustment or sensor replacement. Maintenance is limited to periodic mirror cleaning. The automatic mirror check feature can be user programmed to regularly check for surface contaminants.

Convenient Calibration Check

Users can easily check the 473 system's stability at any time using the built-in Ice-Test function. This automated test procedure allows the user to confirm that ice on the mirror melts at 0 °C to verify the accuracy and stability of the mirror temperature measurement system.

473 Dew Point Hygrometer

Flexible Measurement Options

The 473 is available with different measuring heads together with temperature and pressure sensor options to meet the requirements of a wide range of applications.

RP2 Measuring Head

The RP2 dew point measuring head has a two-stage Peltier element in a compact probe format and includes a connection for temperature measurement. It is supplied with a calibrated head mounted temperature probe and an extension cable to enable optimum placement in working volumes.

RP2 is suitable for direct insertion into applications with moving air such as relative humidity generators, climatic chambers, manufacturing processes and air ducts.

SH2 Measuring Head

The SH2 is a flow-through dew point measuring head with a two-stage Peltier element for mirror temperature control. It includes a variable speed fan that pulls a consistent airflow across the mirror. Alternatively, with the fan removed, the SH2 head can also connect to applications using tubing and standard 6 mm or ¼" fittings. It is also supplied with a calibrated temperature probe with 0.5 m and 3 m cables for connection to either the measuring head or the 473 back panel.

Typical SH2 applications include climatic chamber validation, humidity generators, engine test cells and on-site calibration projects.

Precise Temperature Measurement

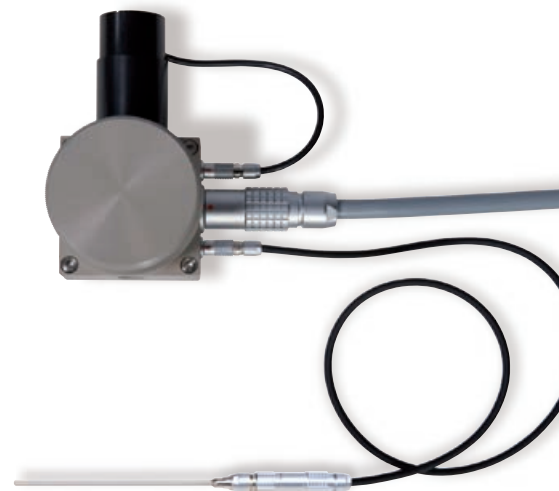
The 473 is supplied with a 4-wire PT100 platinum resistance thermometer (PRT) for precise temperature measurement and to enable calculation of relative humidity. The temperature probe supplied can be connected directly to the measuring head, or by cable to the 473 back panel. Wider temperature measurement ranges and alternative probe configurations are available on request.

Integrated Pressure Measurement

The internal pressure measurement option enables the 473 to compensate for pressure variations at the point of measurement resulting in the lowest possible uncertainties. A pressure measurement accuracy of 0.1 or 0.01% can be specified. The combination of precise dew point, temperature and pressure measurement makes the 473 suitable for use as a transfer standard for all three parameters. The pressure sensor is fitted inside the 473 housing with a 3 mm gas connection on the back panel.

Transportable

The 473 is supplied complete with a robust IP65 case to ensure that the instrument can be transported safely to site for validation projects or shipped for calibration without risk of damage. The custom foam insert provides storage space for additional measuring heads, cables, manuals and calibration certificates.



473 Dew Point Hygrometer

Specifications:	473-RP2 *	473-SH2
Measuring Ranges		
Frost/Dew Point	-20...70 °C	-20...70 °C
Relative humidity	5...100 %rh	2...100 %rh
Temperature (head mount PRT)	-20...80 °C	-20...80 °C
Temperature (cable mount PRT)	-50...100 °C	-50...100 °C
Accuracy		
Frost/Dew point	≤ ± 0.15 °C	≤ ± 0.1 °C
Temperature	≤ ± 0.07 °C	≤ ± 0.07 °C
Reproducibility		
Frost/Dew point	≤ ± 0.07 °C	≤ ± 0.07 °C
Temperature	≤ ± 0.05 °C	≤ ± 0.05 °C
Standard Features	RP2: Ø3 x 30 mm PRT, 0.5 m cable SH2: Ø2 x 100 mm PRT, 0.5 and 3 m cables Digital I/O Display Mirror temperature sensor Gas connections Transport case Power cable Operating instructions Calibration certificate	
Optional	Internal barometric pressure sensor Analog outputs Calibration upgrade	
Additional Information	Power supply Operating conditions: Instrument Measuring head Storage conditions	
Weight & Dimensions	Instrument W310 x H155 x D265 mm 5 kg IP20	In Transport Case W510 x H220 x D450 mm 12 kg IP65

473 V2.1 2.2013 We reserve the right to change design or technical data without notice.

* The RP2 measuring head is only suitable for use in applications with moving air.

473 Dew Point Hygrometer

Ordering Information

Description:	Order code
473, -30...70 °C FP/DP with SH2 measuring head on 2 m cable (including Ø2.1 x 100 mm PRT with 0.5 and 3 m cables and transport case)	105003
473, -20...70 °C FP/DP with RP2 measuring head on 2 m cable, (including Ø3 x 30 mm PRT with 0.5 m cable and transport case)	105004
Options:	
473-Upgrade to SCS accredited calibration (ISO 17025)	103846
Two analog outputs, user programmable, -10...+10 V and 4...20 mA	102662
0.1% accuracy internal barometric pressure sensor	100282
0.01% accuracy internal barometric pressure sensor	103954
Additional 1 year warranty upgrade (maximum 3 years)	103632
For a complete range of options and accessories, please contact us and request our pricelist.	



1800 128 000 (AUS)

0800 485 990 (NZ)

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573 Dew Point Mirror



Industrial Chilled Mirror Hygrometer

- Integral frost/dew point measuring head
- Internal sample pump
- Optimal Response Injection System
- ForceFrost™ function
- Ice-Test user calibration verification
- User configurable sampling circuit
- Drop-in replacement for DP3, DP8 and DP30
- Dew points up to +95 °C

Typical applications:

- | | |
|-----------------------------|------------------------------------|
| – Heat treatment, annealing | – Humidity generators |
| – Fuel cell research | – Calibration of dew point sensors |
| – Climatic test chambers | – Meteorology, climate research |

573 Dew Point Mirror



Accurate and Flexible Humidity Measurement

Chilled mirror condensation technology provides highly precise, stable and repeatable humidity measurements. Water vapor condenses onto a temperature controlled mirror surface and this 'dew point' is detected with advanced optical electronics. Since dew point is specific to water vapor concentration and not temperature dependent, measurement precision is consistent across the full instrument range.

The 573 Dew Point Mirror is a high performance 19" rack format instrument with an integral measurement head, pressure sensor, sample pump and flow meter for continuous precision monitoring of frost/dew point and absolute humidity values across a wide range of applications.

Dew or Frost?

Below 0 °C, water can condense in either the liquid or solid phase (dew or frost). The difference in the temperature at which the condensate layer stabilizes can be up to 3 °C, therefore the condensate phase must be known for correct calculation or validation of parameters such as relative humidity. As shown on the picture to the right, it is also possible that dew and frost can exist concurrently on the mirror; this results in a non-stable value somewhere between the dew and frost point.

ForceFrost™ Function

Below a user defined temperature, the 573's ForceFrost function over-cools the mirror to force the condensed layer to the solid phase. This eliminates the uncertainty of whether dew or frost point is measured.



Connect and Go

The system is supplied ready for immediate use complete with internal sample pump, mechanical flow meter and pressure sensor, plus an external temperature probe. PC connectivity for remote data collection is easy with the simple yet robust protocol of the RS-232 interface. As an option, two user configurable analog outputs provide for connection to existing data acquisition systems.

Convenient Calibration Check

Users can easily check the 573 system's stability at any time using the built-in Ice-Test function. This is an automated test procedure that allows the user to check that ice on the mirror melts at 0 °C and therefore verify the stability of the mirror temperature measurement.

573 Dew Point Mirror

Designed for Backwards Compatibility

The 573 is designed to be a drop-in replacement for the highly successful DP3, DP8 and DP30 instruments. The mechanical dimensions, flow meter, sampling features and output options

allow for an easy upgrade for users of these classic instruments giving access to the advanced user interface and improved performance offered by the latest RH Systems instruments.

Configurable Sampling Circuit

The 573 sampling circuit can be adapted by the user to suit any application.

The measuring head, flow meter and sampling pump use separate internal tubing that is connected using the 573 back panel fittings. The user can therefore bypass the flow meter and sample pump when needed.

Expanded Range

The 573H and HX versions can measure precisely at dew points up to +95 °C without risk of condensation in the sampling circuit, with the inclusion of a heated measuring head and temperature controlled inlet and outlet sample tubes. A condensate trap with automatic drain can be connected between the measuring head and the flow system to prevent condensate formation in the flow meter and sample pump.



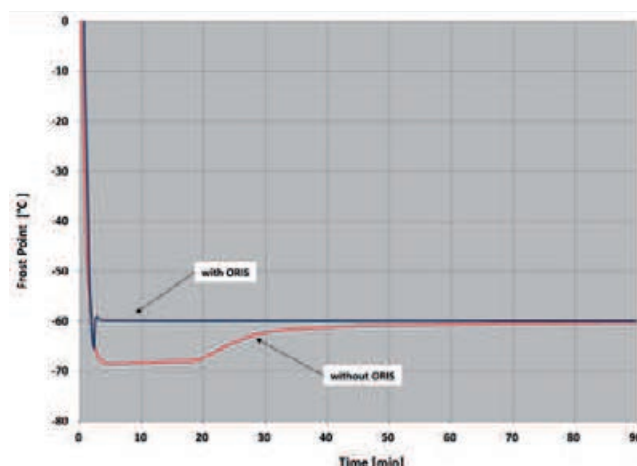
Mechanical Flow Meter

The 573 can be used in applications where the carrier gas is not air. A mechanical flow meter provides the user with indication and control of the gas flow to achieve consistent results irrespective of the make-up of the carrier gas.

Optimum Response Injection System: Accelerated Results

The Optimum Response Injection System (ORIS) is unique to RH Systems dew point instruments. At low frost/dew point conditions, the time to stabilize a condensate layer can be significant, sometimes as long as two hours for correct equilibrium.

ORIS reduces the stabilization time using a carefully programmed vapor injection procedure that accelerates the formation of a frost layer and then interfaces with the mirror control system to maintain stability. When the rate of sublimation and condensation is equal, the measurement system is truly in equilibrium, and the result precise.



573 Dew Point Mirror

Specifications:	573S	573H	573HX
Measuring Range			
Frost/Dew Point	-55...+40 °C *	-30...+70 °C	-30...+95 °C
	-65...+40 °C * (w/ water cooling)		
Temperature	-50...+100 °C	-50...+100 °C	-50...+100 °C
Pressure	0...2500 mbar	0...2500 mbar	0...2500 mbar
Instrument Features			
Optimum Response Injection System	Yes	No	No
Heated measuring head and internal inlet/outlet tubes	No	Yes	Yes
Accuracy			
Frost/Dew point	≤ ± 0.1 °C		
Temperature	≤ ± 0.1 °C		
Reproducibility			
Frost/Dew point	≤ ± 0.05 °C		
Temperature	≤ ± 0.05 °C		
Standard Features			
Digital I/O	RS-232		
Mirror cooling	3-stage Peltier thermoelectric, additional water cooling optional		
Display	5.7" LCD with touch screen		
Temperature measurement	External PRT on 3 m cable		
Internal gas tubes	Stainless Steel / FEP		
Gas inlet connections	6 mm or 1/4" Swagelok fittings		
Sample connections	Flow meter and internal sample pump bypass loops		
Mechanical flow meter	0...1 l/min with adjustment valve		
Power cable	2.5 m		
Operating instructions	English		
Calibration certificate	Factory calibration: 5 points FP/DP, 3 points temperature Upgrade to SCS accredited ISO17025 calibration available		
Optional			
High pressure	10 or 20 bar internal pressure sensor (no sample pump fitted)		
Analog outputs	User programmable, 2 x 4...20 mA or 0...10 V		
Additional water cooling	Extends frost/dew point range to -70 °C (water temp. 5 °C, ambient 20 °C)		
High flow meter	0...2 l/min		
Additional Information			
Supply voltage	100-120 VAC / 200-240 VAC, 50/60 Hz (auto switching)		
Power consumption	200 Watt		
Cooling	Air, additional water cooling optional		
Operational conditions	-10 °C...+40 °C, Maximum 98 %rh, non-condensing		
Storage temperature	-20 °C...+50 °C		
Weights & Dimensions			
Width	Instrument		
Height	485 mm		
Depth	147 mm		
Weight	370 mm		
	10 kg		

* Measured dew points may not exceed the ambient temperature.

573 V2.0 6.2012 We reserve the right to change design or technical data without notice.

573 Dew Point Mirror

Ordering Information

573S, -55 (-65 w/ water cooling)... +40 ° FP/DP*	Order Code
573H, -40...70 °C FP/DP***	102455
573HX, -40...95 °C FP/DP***	103114**
	103897**
Options:	
573 upgrade factory calibration to ISO17025	103848
10 bar pressure upgrade	103635
Analog outputs, user programmable, 2 x 4...20 mA or 0...10 V	102662
Electronic flow meter 0...1 l/min	103636
Additional 1 year warranty upgrade (max. 3 years)	103632

* Measured dew points may not exceed the ambient temperature.

** These items will be available with the launch of the 573H and 573HX in Q4 2012.

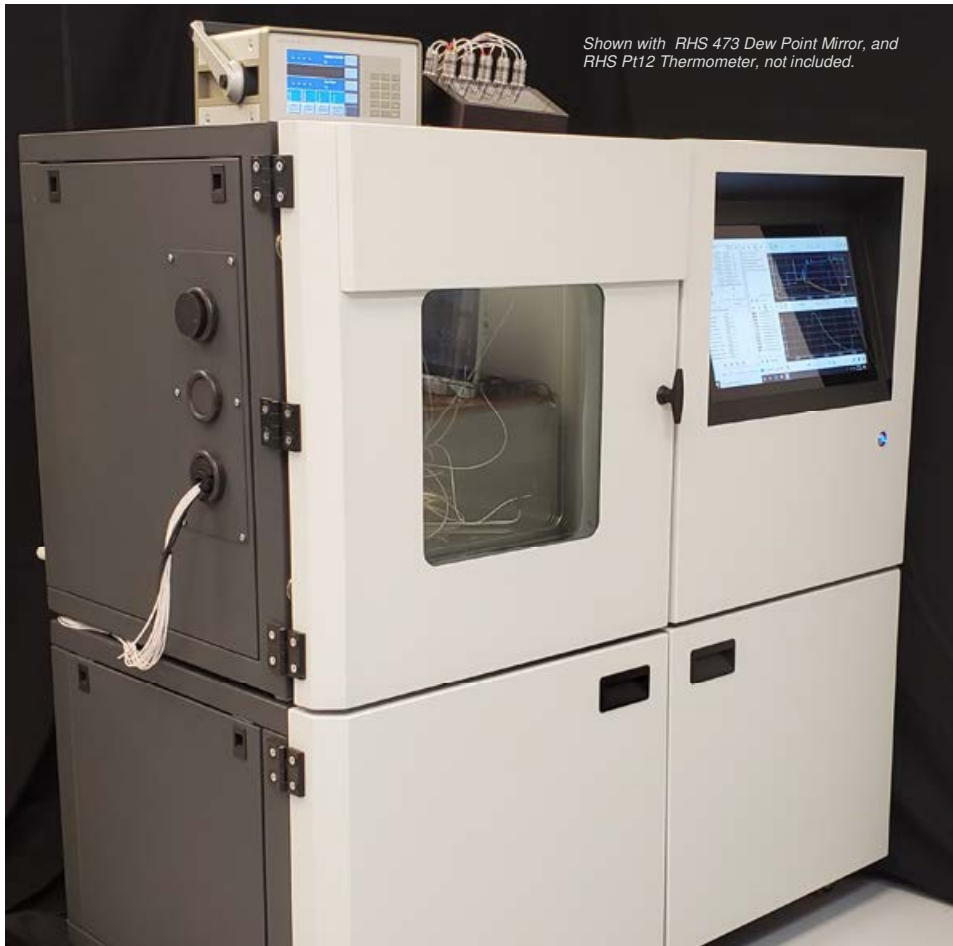
*** 573H and 573HX require a heated hose, external controller and steam trap for operation.

Humidity Generation



- **CGS-240 Humidity Generator**
 - G2 Humidity Generator
 - G3 Frost Point Generator
 - G9 Humidity Generator

CGS-240 Humidity Generator



Fully Automated *Two-Pressure Two-Temperature* Humidity Generator

The RH Systems CGS-240 Humidity Generator is a system capable of continuous, high-accuracy humidity generation over a wide range of humidity, temperature, and flow rates. The CGS-240 design is an RHS hybrid two-pressure two-temperature design based on fundamental NIST developed principles.

- ✚ RH uncertainty $\pm 0.5\%$ of Indicated Value
- ✚ Embedded full color touch-screen with pinch/zoom capability
- ✚ Large test chamber w/ multiple shelving options
- ✚ Full-size, thermally controlled window
- ✚ Integrated chamber light
- ✚ Three temperature controlled access ports

Large, Thermally Uniform Chamber

The chamber utilizes a robust design, with a cable management system for the chamber temperature probe, sample gas injection to the center of an air circulation fan, local pressure measurement, and a multi-position shelving system. It is equipped with high performance thermal insulation surrounding the door and all sides of the test chamber, and features a soft



silicone profile seal for perfect tightness. An integrated chamber fan provides internal air circulation which ensures uniformity and stability throughout the working volume.

Thermal Control and Stability

The liquid jacketed chamber door uses heavy duty hinges, a recessed latching mechanism, a built-in light, and integrated heating for the door frame and window. The window inner pane is liquid jacketed and thermally controlled at the same temperature as the chamber to aid significantly in chamber stability and temperature uniformity. The chamber is also liquid jacketed meaning all 6 walls of the chamber are thermally controlled. An air-jacket is then encased within the liquid jacket to ensure unparalleled stability and uniformity.

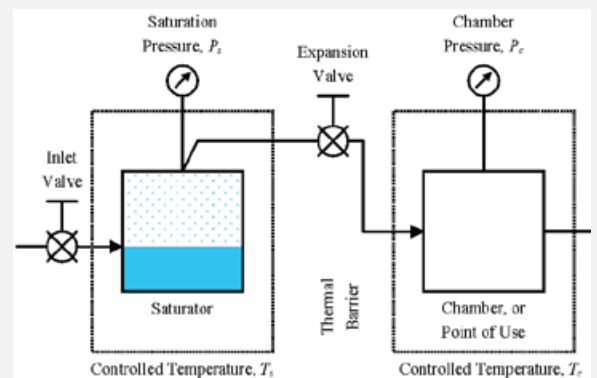
More than just an RH Generator

While %RH is a typical control parameter, the CGS-240 easily controls Dew Point and Frost Point, while automatically distinguishing between the two. When entering a dew or frost point setting, associated functions such as saturation and chamber temperatures are internally adjusted to suitable conditions thereby ensuring that the desired dew or frost point value can be achieved within an uncertainty better than 0.10 °C.

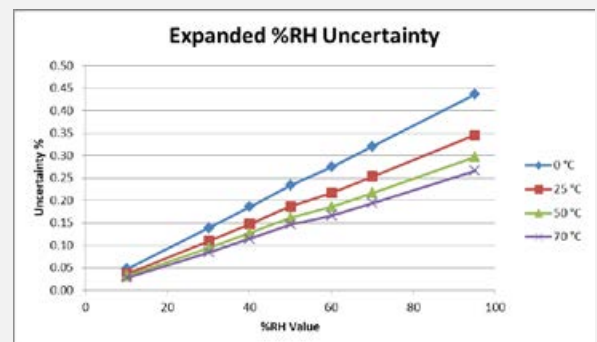
Hybrid Two-Pressure Two-Temperature Design

In competitor's two-pressure designs, the saturator and chamber share a common temperature. While simpler in mechanical implementation, a distinct disadvantage of those basic two-pressure methods is that low humidity generation requires excessively high saturation pressure. This high pressure requirement constrains system design while adding greater burden on air compressor systems.

In contrast, the CGS-240 hybrid design exploits combined capabilities of both the *two-pressure* and *two-temperature* principles where the saturator and chamber temperatures are controlled independently of each other. Operating at a lower saturation temperature results in diminished pressure requirements as compared to basic two-pressure systems. This CGS-240 hybrid design allows for a larger humidity generation range with only modest pressure requirements.

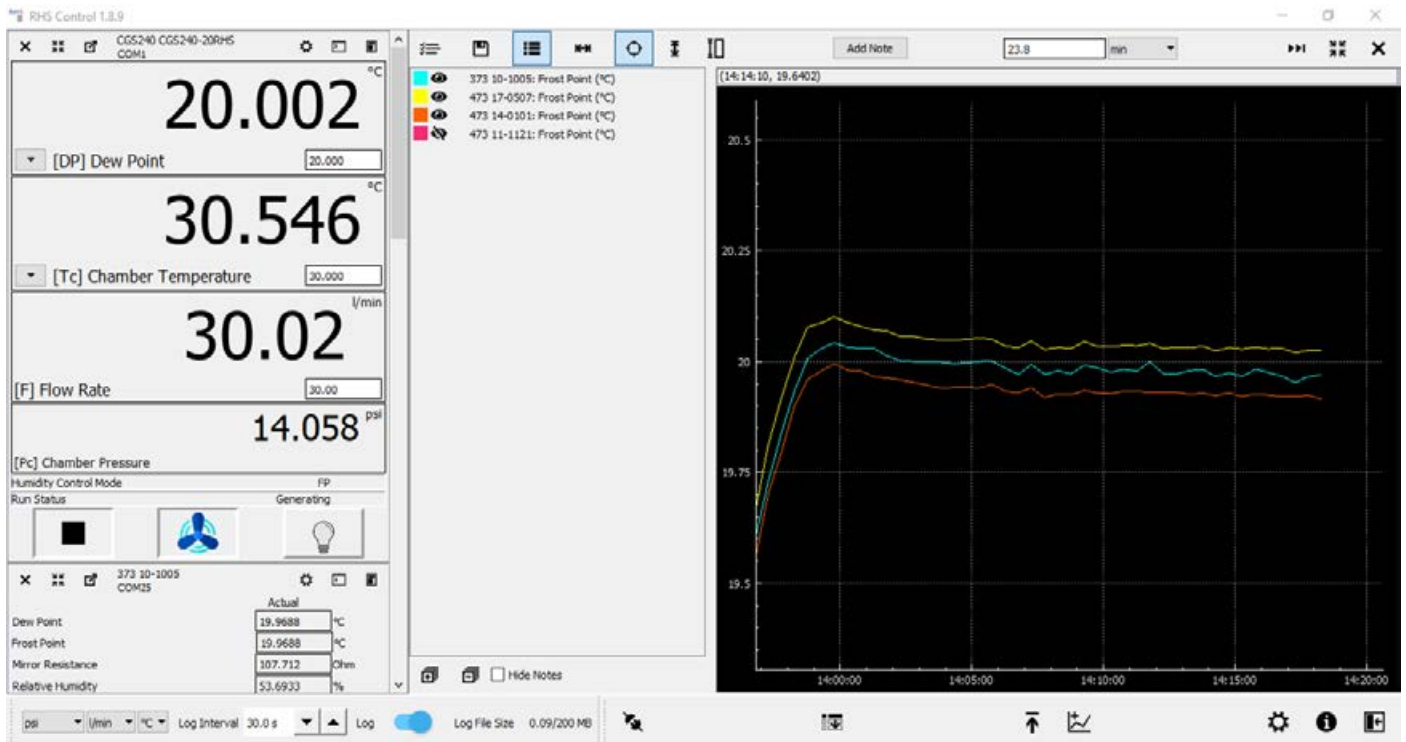


Regardless of whether the saturator and chamber are operated at a common temperature using only the two-pressure method, or independently from each other using our hybrid method, humidity calculations such as %RH, Dew Point and others rely on only four measured parameters; two absolute pressures ($P_{\text{saturation}}$, P_{chamber}) and two temperatures ($T_{\text{saturation}}$, T_{chamber}). Uncertainty in humidity is determined from the uncertainty in these four measured parameters.



RHS Control

RHS Control is our custom program allowing the user to operate the humidity generator system from the integrated touch screen monitor. The system may be operated manually through direct entry of desired setpoints, or automatically through a user defined profile. Profiles are a sequence of preprogrammed, user selectable setpoints and dwell times which allow for fully automatic operation and data collection, free of further user intervention.



Continuous Run Time

The CGS-240 may run continuously without the need to shut-down; the only requirement being that sufficient water level is maintained in the 20 liter (5 gallon) distilled water reservoir. The reservoir may be filled at any time without the need to stop the system, thereby allowing uninterrupted generation of humidity for days, weeks, or months. The only expected limit to operational run time is when chamber or saturation temperatures operate below 0°C (32 °F) where water freezing within the saturator will temporarily limit gas flow due to eventual ice blockage. In the event of blockage, the simple remedy is to warm the system above freezing for a short period to allow the blockage to melt away. While a saturator bypass circuit is utilized to extend run-time under these expected icing conditions, a limit of approximately 8-12 hours of continuous sub-zero run time is typical before warming is needed.

Data Collection

RHS Control allows for connection of various instruments via digital communication for continuous monitoring, control, and associated data collection. Many instruments with RS-232 or RS-485 communication capability require only an RHS or user-written description file (.json file) to enable data monitoring and collection. Collected data is viewable both numerically and graphically. All data from the CGS-240 and any connected instruments may be viewed together on a common graph. Data is automatically stored to files during collection for later import to Excel and other post process analysis and graphing programs.

Model: CGS-240	
Generating Range:	
Relative Humidity	10...95 %RH (5 %RH optional)
Dew/Frost Point	-25...70 °C DP, -23...0 °C FP
Chamber Temperature	-0...72 °C (-10 & +85 °C extended ranges optional)
Chamber Pressure	Ambient
Flow Rate	5...20 SLPM (5...50 SLPM optional)
Accuracy (0 to 70 °C, 10 to 40 l/min):	
Relative Humidity	The larger of ±0.1 %RH or ±0.5% of indicated RH value
Dew/Frost Point	±0.10 °C
Temperature (T _s , T _c)	±0.030 °C
Pressure (P _s , P _c)	±0.02% of full scale
Chamber Temp Uniformity ¹	<0.035 °C
Flow Rate	±1 SLPM
Integrated Sensors:	Cal Range: Cal Uncertainty:
Low Range Pressure (P _L)	Ambient...25 psia ±0.005 psia
High Range Pressure (P _H)	Ambient...150 psia ±0.030 psia
Saturator Temperature (T _s)	-15...72 °C ±0.03 °C
Chamber Temperature (T _c)	0...72 °C ±0.03 °C
Chamber Liquid Temp ² (T _{CL})	0...72 °C ±0.10 °C
Presaturator Temp ² (T _P)	0...75 °C ±0.10 °C
Flowmeter ²	0...50 SLPM ±1 SLPM
Chamber:	
Dimensions	15"H x 12"W x 12"D (380 x 300 x 300 mm)
Type	Circulating air-jacket encased within liquid jacket
Adjustable Shelf	Three shelf positions, one shelf supplied
Access Ports Window size	Three 50 mm diameter thermally controlled access ports 14"H x 12"W x 12"D (370 x 300 x 300 mm)
Window thermal control	Liquid jacketed, multi-pane, thermally controlled
Chamber light	Integrated light with on/off touchscreen control
Integrated control interface:	
Operation Software	RHS Control Software
Calibration Software	RHS Plateau Software
Display	18.5" Multi Touch Monitor with pinch/zoom/drag
Gas inlet pressure:	
Using external pressure source ³	175 psig max
Using supplied air compressor ⁴	60...90 psig @ 20 l/min typical
Environmental conditions:	
Operating environment	15...30 °C, 20...60 %RH
Storage environment	0...50 °C, <95 %RH non-condensing
Power requirements:	
Voltage	208...240 VAC, 50/60 Hz, single phase
Current ^{5,6}	20 Amps

- Notes: 1 Between any two points 1" or more from inner chamber perimeter (walls, door) while chamber fan is operating
2 Calibration not required since data is not used in humidity calculations
3 When using external pressure source, set regulator to a value below lowest source pressure
4 Supplied air compressor cycles within the range 60~90 psig. Set internal regulator to approx. 50~55 psig
5 Upper cabinet fused at 15 amps through circuit breaker power switch. Typical load <12 amps
6 Lower cabinet fused at 10 amps through circuit breaker power switch. Typical load <8 amps

We reserve the right to change design or technical data without notice.

G2 Humidity Generator



Precision Humidity Generation

- Precise generation of humidity controlled gas flow
- High accuracy two-pressure / two-temperature principle
- Flow rates up to 100 liters per minute
- Controls %RH, Dew Point, or other humidity parameters
- Simultaneous measurement of up to 3 external temperature probes
- Measurement of pressure and temperature at point of gas use
- PC software for system control and data acquisition
- Optional touch panel for control and status indication

Typical Applications:

- High volume production calibration systems
- Humidity control in semiconductor manufacturing and lithography processes
- Add humidity control to existing temperature chambers

REFLECTING YOUR STANDARDS

G2 Humidity Generator

Precision Humidity Generation

The G2 produces highly accurate humidity values based on RH Systems' unique hybrid combination of the NIST proven "two-pressure" and "two-temperature" humidity generation techniques. It delivers a humidified gas stream, accurately controlled to a variety of user selectable humidity parameters such as %RH, dew point, frost point, ppm, or vapor pressure. By accurately measuring the temperature and pressure at the point where the humidified gas is utilized, the G2 automatically adjusts for changes in dynamic conditions such as heat load or ambient pressure variation.

High Flow Capability

With flow rate capacity up to 100 standard liters per minute, the G2 ensures your external volume or test chamber rapidly achieves a stable, homogeneous humidity condition based on your defined RH or dew point setting.

Multiple External Temperatures

Three separate external temperature connections allow for determination of %RH at three completely independent temperatures. By splitting the high-flow gas stream and feeding into three separate chambers, with each chamber controlled at a different temperature, three unique %RH values will be produced. The G2 computes the resulting %RH at each of these three chambers based on the three external temperature measurements.

Alternatively, install up to three temperature probes in one chamber to measure uniformity of temperature and its result on %RH.

Embedded System for Control and Communication

All operations of the G2 are automated by its real-time embedded control system. Its setpoints are commanded and data is retrieved via robust serial communications. There are three fully capable, yet fully independent RS-232 serial ports, allowing for a variety of communication options. For example, up to three PCs could be connected to three temperature chambers and to a single G2 which feeds humidified gas to them all. The three PCs communicate independently with the G2 to retrieve their specific temperature and humidity data.

Simple Application Integration

The G1 is supplied in a 19" rack mountable format for integration within commercially available rack systems. A 19" rack enclosure is available as an option. All electrical, fluid, and pneumatic connections are made at the back panel of the instrument. All fluid and pneumatic connections are via industry standard Swagelok fittings.

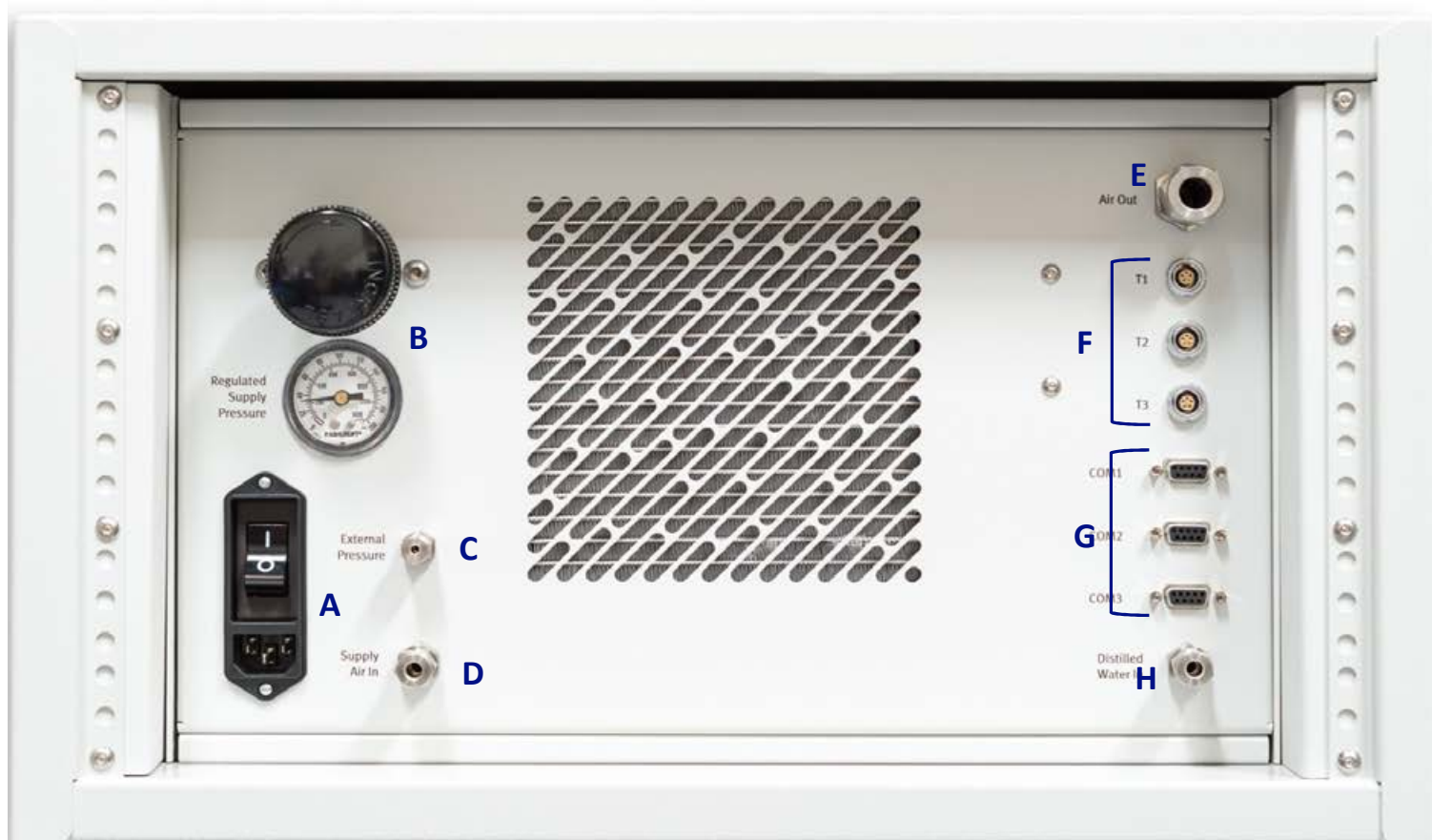
Two-Pressure Two-Temperature Hybrid Humidity Generation Technique

Utilizing the uniquely combined benefits of the two-pressure and two-temperature techniques, humidity is generated by fully saturating gas at a known temperature and pressure, then reducing the pressure to a lower value (typically ambient) and cooling or warming to an alternate temperature.

Humidity produced by this hybrid technique is determined from measurements of the temperatures and pressures alone, and does not rely on measurement of the water vapor content of the gas.

With RH Systems' hybrid humidity generation technique, the G2 is a true humidity reference instrument suitable for high accuracy calibration, product conditioning, and test applications.

G2 Humidity Generator



Connection panel side of instrument showing:

- | | |
|---|--|
| A. AC power receptacle and power switch | E. Humidity controlled air output, 1/2" Swagelok |
| B. Inlet pressure regulator and indicator | F. External temperature sensor connections (3) |
| C. External pressure sampling port, 1/8" Swagelok | G. RS-232 serial communication ports (3) |
| D. Compressed air supply input, 1/4" Swagelok | H. Distilled water inlet, 1/4" Swagelok |

G2 Humidity Generator

Specifications:	G2 Humidity Generator	
Generator Ranges		
Frost/dew point*	-25...20 °C	
Relative humidity	10...95 %RH	
Flow rate	5...100 l/min	
Saturation Pressure	Ambient...12 bar (Ambient...175 psia)	
Measurement Ranges		
External temperature sensor	-50...100 °C	
External pressure sensor	700...1,200 mbar (10.2...17.4 psia)	
Performance		
Dew point stability	≤ ±0.02 °C	
RH Stability	≤ ±0.1 %RH	
Pressure Stability	≤ ±1 mbar (0.015 psia)	
Saturator temperature stability	≤ ±0.01 °C	
Flow control	≤ ±0.5% of full scale	
Response time	10...90 %RH < 5 min	
Standard Features		
External temperature sensor(s)	Up to 3 simultaneous sensors, 100 ohm PRT	
Pressure sensor	Internal with 1/8" Swagelok connection	
Saturator water level	Automatic level control, 1/4" Swagelok water inlet	
Gas Connection, inlet	1/4" Swagelok, internally pressure regulated	
Gas connection, outlet	1/2" Swagelok, internally flow regulated	
Control and data acquisition	Optional touch screen controller and/or PC software	
Size	6U, 19" rack mountable module	
Digital I/O	3, simultaneous, independent RS-232 connections	
Additional Information		
Power requirements	208-240 VAC, 50-60 Hz, 1500 W	
Input pressure	Max. 16 bar, oil free	
Operation temperature*	-10...40 °C (must be higher than generated dew point)	
Storage temperature	-20...50 °C	
Humidity	Max. 98 %RH, non-condensing	
Weight and Dimensions	6U 19" Module	With enclosure
Height	267 mm (10.5")	318 mm (12.5")
Width	483 mm (19")	533 mm (21")
Depth	559 mm (22")	616 mm (24.25")
Weight	53 kg (117 lbs)	70 kg (154 lbs)

G2 V2014.04.01 We reserve the right to change design or specifications without notice

*Highest generated dew point is limited by ambient room temperature



G3 Frost Point Generator



Low Frost Point Humidity Generator

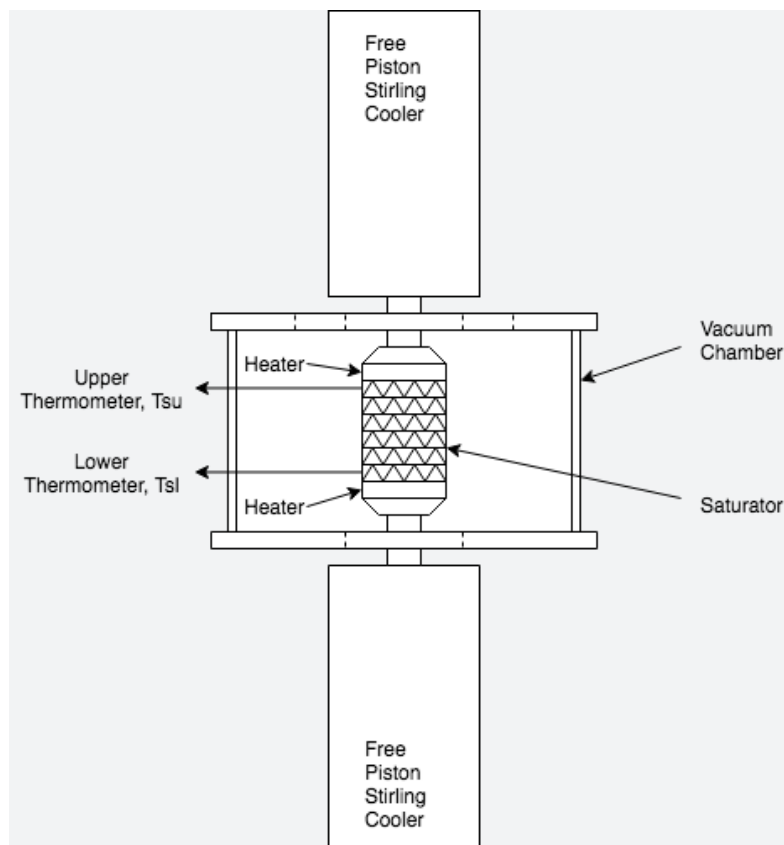
- Ultra-low -120°C FP to $+10^{\circ}\text{C}$ DP
- Vacuum insulated/isolated saturator and control valves
- Universal power input, 100-240 VAC, 5-60 Hz
- Hybrid two-temperature, two-pressure principle
- Dual CFC-free Cryocoolers
- 1 to 3 independent flow controlled outputs

REFLECTING YOUR STANDARDS

G3 Frost Point Generator

The RHS hybrid two-pressure, two-temperature principle

A hybrid humidity generator combines the features of the NIST-proven two-pressure and two-temperature humidity generation principles. Utilizing these principles, a stream of gas at an elevated pressure is saturated with respect to the liquid or solid phase of water at a given saturation temperature. Here, saturation temperature is the major determining factor for the quantity of water vapor admixed with the carrier gas. Pressure within the saturator is the major determining factor for the carrier gas quantity of the mixture. Upon leaving the saturator, the humidified gas stream (consisting of the water vapor admixed with the carrier gas) is then expanded to a lower pressure and warmed to an alternate temperature at the point of use, such as a Device Under Test (DUT). Measurements of the pressure and temperature within the saturator, and the pressure and temperature following expansion (generally at the DUT), are then used to determine the resulting humidity content of the gas stream. Humidity is then accurately controlled by regulation of the temperature and pressure within the saturator.



What is the G3 Frost Point Generator?

The G3 is a low humidity generator that encapsulates essential tubing, pressure regulator, flow regulator, and saturator within a sealed vacuum chamber. Use of the vacuum chamber eliminates atmospheric water vapor permeation and the need for thermal insulation materials in and around thermally controlled components. Additionally, Stirling cryo-coolers (more accurately Free-Piston Stirling Coolers) are used to cool the saturator.

With these improvements over conventional designs, the G3 has better accuracy and performance at low humidity due to reduced permeation effects, improved thermal insulation and control, faster cool down characteristics, and better maintenance access.

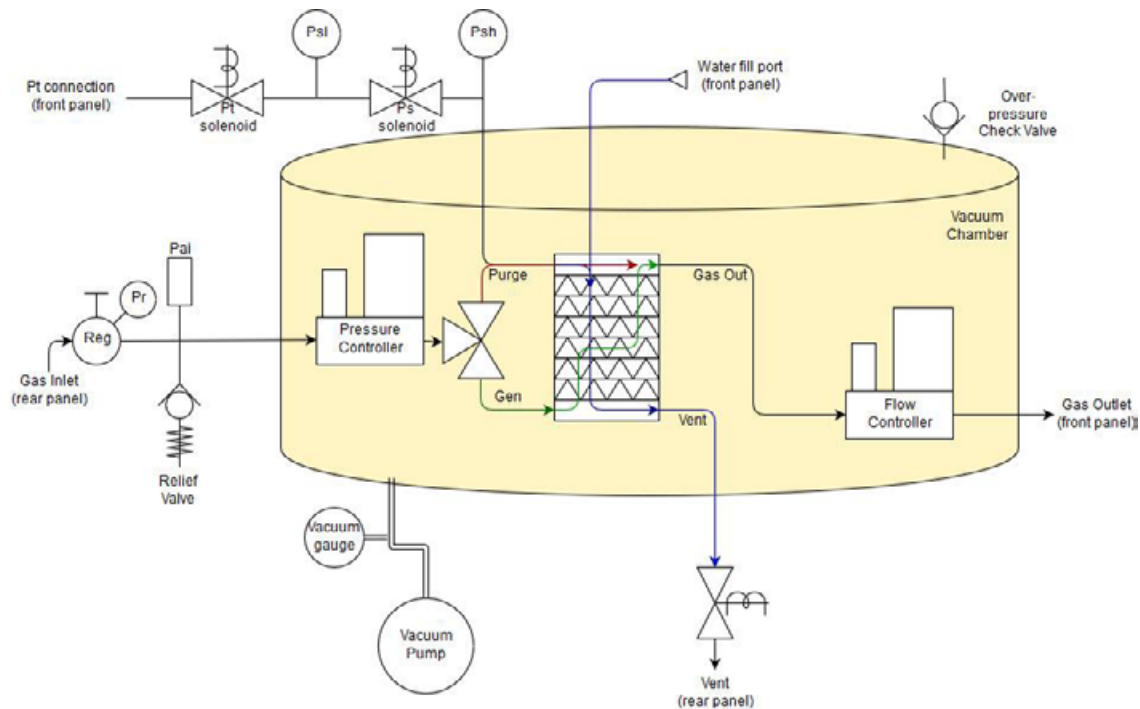
Multiple flow controlled outputs

The G3 offers up to 3 independent flow controlled outputs. Each output can flow up to 5 liters/min, with a total combined flow up to 10 liters/min.

Ultra-low range capability

Based on the highly efficient dual cryo-cooling mechanism, the G3 is capable of generating ultra-low humidity, achieving humidity concentration below 1 PPB (Part Per Billion).

G3 Frost Point Generator



Vacuum prevents Water Vapor Permeation

Water vapor permeates many things, especially elastomers and other sealing materials typically found within valves, regulators, and other gas path components. In the G3, permeation susceptible valves and components are housed within the vacuum chamber. As the vacuum intensifies due to removal of gas molecules from within the chamber, water vapor within the vacuum chamber is significantly reduced as well. This removal of water vapor from the exterior surfaces of normally susceptible components thereby prevents water vapor from permeating into these components and affecting the internal gas path humidity.

Vacuum provides Thermal Insulation

Rather than using standard insulation techniques such as fiberglass, urethane foams, or other thermal barrier materials, the saturator sits at the center of a high-vacuum chamber. Devoid of molecules which could otherwise transfer thermal energy, the vacuum chamber offers excellent thermal insulation. So rather than adding thermal barrier materials, we utilize vacuum to prevent thermal transfer by limiting molecular interaction.

G3 Frost Point Generator

Specifications	G3 Frost Point Generator
Generated Humidity Output Water Vapor Concentration Range Frost/Dew Point Temperature Range Frost/Dew Point Temperature Stability Frost/Dew Point Temperature Accuracy	<1 PPB ... 12000 PPM -120 °C FP ... +10 °C DP ±0.05 °C ±0.1 °C (FP > -70 °C) ±0.3 °C (-70 °C > FP > -100 °C) ±0.6 °C (-100 °C > FP)
Generated Flow Rate Output Gas Flow Rate Range, per output Gas Flow Rate Range, total Gas Flow Rate Accuracy Gas Flow Rate Stability	1 to 3 outputs at 0 ... 5 slpm each 0 ... 10 slpm ±0.2 slpm ±0.1 slpm
Temperature Saturation Temperature Control Range Saturation Temperature Control Accuracy Saturation Temperature Control Stability Test Temperature Connections Measurement Accuracy Probe type	-120 °C ... +20 °C * ±0.05 °C ±0.03 °C 2 external temperature connections ±0.05 °C Pt100, 4-wire
Pressure Saturation Pressure Control Range Saturation Pressure Accuracy Test Pressure Measurement Range Test Pressure Accuracy	Near ambient to 1 MPa (150 psia) ±0.05% FS ** 0.07 ... 0.12 MPa (11 ... 17 psia) ±0.05% FS**
Utility Requirements Gas Supply Gas Type Supply Voltage Power Consumption	0.3 ... 1MPa @ 10 slpm. Max pressure 3 MPa Dry air or nitrogen 100-240 VAC, 50/60 Hz, Single phase 1.5 kW
Environmental Operating Temperature Storage Temperature Humidity	15 °C ... 40 °C 0 °C ... 50 °C 10-95% RH, non-condensing
Weight & Dimensions Height Width Depth Shipping Weight	1.2 m 0.8 m 0.8 m 318 kg

G3 7/2019 We reserve the right to change design or technical data without notice.

G9 Humidity Generator

- Two-Pressure Principle
- ± 0.3 %RH Uncertainty
- High Temperature
- High Flow Rate
- Air or Water Cooled
- NIST Traceable



Precision Humidity Generation

The Model G9 produces highly accurate humidity values based on the NIST proven “two-pressure” humidity generation technique. This system will generate a variety of humidity values such as %RH, dew point, frost point, ppm, or vapor pressure. The system is computer controlled, allowing it to run at fixed points, or multi-point profiles, completely unattended.

Principle of Operation

Using the two-pressure technique, humidity is generated by fully saturating gas at a known temperature and pressure, then reducing the pressure to a lower value (typically ambient) at the same temperature. The humidity produced by this technique is determined solely from measurements of temperature and pressure, and does not rely on measurement of the water vapour content.

High Temperature, High Flow Capability

With chamber temperatures up to 85°C and flow rates to 150 standard liters per minute, the G9 boasts the highest temperature, highest flow rate capability of any commercially available two-pressure humidity generator.

Accurate Formulations

All equations programmed into the computer control system are high accuracy, internationally accepted formulations for vapor pressure, enhancement factor, relative humidity, dew point, frost point, ppm and others. Accuracy of the system relies completely on the accuracy of the temperature and pressure measurements.

Air or Water Cooled Refrigeration

Unlike other two-pressure systems, use of cooling water with the G9 is optional. If available, it can be connected and will work to provide cooling of the refrigeration system. If not available, the system reverts automatically to an air-cooled refrigeration mode.

Specifications

Relative Humidity Range (from 5 to 75°C):	10 to 99%RH
Relative Humidity Resolution:	0.01%RH
Relative Humidity Accuracy:	±0.3%RH
Frost Point Temperature Range:	-21 to 0°C
Dew Point Temperature Range:	-23 to 75°C
Bath Temperature Range:	5 to 85°C
Bath Temperature Measurement Resolution:	0.005°C
Bath Temperature Control Stability:	±0.02°C
Bath Temperature Uniformity:	0.04°C
Bath Temperature Measurement Accuracy:	±0.02°C
Bath Temperature Heating/Cooling Rate:	~2 minutes per °C
Gas Type:	Air or Nitrogen
Gas Pressure Rating (MAWP):	200 psig
Gas Flow Rate Range:	25 to 150 slpm
Gas Flow Rate Resolution:	0.1 slpm
Gas Flow Rate Accuracy:	±4 slpm
Saturation Pressure – Low Range:	Ambient to 23 psia (1500 hPa)
Saturation Pressure Accuracy – Low Range:	±0.0023 psia (0.15 hPa)
Saturation Pressure Display Resolution – Low Range	0.001 psia (0.1 hPa)
Saturation Pressure – High Range:	23 to 175 psia (1500 to 12000 hPa)
Saturation Pressure Accuracy – High Range:	±0.02 psia (1.4 hPa)
Saturation Pressure Display Resolution – High Range:	0.01 psia (1 hPa)
Test Chamber Pressure Range:	Ambient
Test Chamber Pressure Accuracy:	±0.0023 psia (0.15 hPa)
Test Chamber Pressure Resolution:	0.001 psia (0.1 hPa)
Test Chamber Dimensions:	300 mm x 300 mm x 300 mm
Physical Dimensions:	0.8 m x 1.2 m x 0.9 m

Utilities

Electrical Power:	200-240 VAC, 30 A, 1-phase, 50-60 Hz
Gas Supply:	250 psig @ 7 scfm (1.7 MPa @ 200 slpm)
Cooling Water (optional):	3 gpm (12 L/min) maximum @ 20-25°C

Environmental

Operating Temperature:	15 to 30°C
Storage Temperature:	0 to 50°C
Humidity:	5 to 95% non-condensing

SF6 Measurement



- 973-SF₆ Analyser

973-SF₆ Analyzer

Laboratory Precision - Field Ready



- SF₆ gas specific analyzer
- Measurement of humidity: Dew/Frost Point, ppm_v and ppm_w
- SF₆ purity: %Vol. SF₆
- Optional SO₂ measurement: ppm_v concentration
- Gas containment system with automatic pump back; No gas loss
- Fundamental measuring principle
- Dew/Frost Point results at SF₆ compartment or standard pressure
- Full color touch screen user interface
- User verifiable calibration
- Simple to set up, use and maintain
- Easily transportable
- Supplied complete with robust transport case

Protect Your SF₆ Equipment

Prevent costly repairs

Sulfur-hexafluoride (SF₆) is used as a dielectric in high power Gas Insulated Equipment (GIE) such as breakers, switches, transformers and transmission lines. SF₆ is normally a highly stable, non-reactive gas, even in the presence of high energy discharge such as the make or break of a switch. While SF₆ alone is the preferred gas within the GIE, water vapor (H₂O) always finds its way in through permeation and by desorption from the GIE's internal components. While water vapor and SF₆ are normally non-reactive with each other, in the presence of a high energy discharge, hydrogen and oxygen of the water vapor may react with the sulfur and fluorine of the SF₆ to create hydrofluoric acid (HF), sulfuric acid (H₂SO₄) and sulfur dioxide (SO₂), compounds corrosive to the internal workings of the GIE. Since SF₆ with low water vapor content (low humidity) significantly reduces the potential for creation of these corrosive compounds, the RH Systems 973-SF₆ gas analyzer is a critical component to any GIE preventative maintenance program.

Total Solution for SF₆ Measurement

One instrument for all your SF₆ measurements

The 973-SF₆ is an advanced analyzer for measurement of humidity, purity, compartment pressure and SO₂ concentration (optional) in SF₆ gas insulated equipment. With its internal gas containment/recovery system, the 973-SF₆ provides the best measurement solution available within a single instrument.



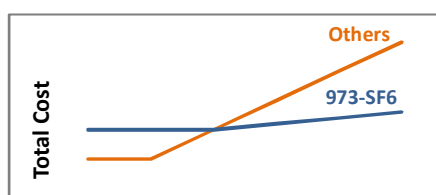
Chilled Mirror Technology

Based on physics for reliable measurement

A polished mirror surface is cooled to the point at which condensation forms on the mirror surface. The temperature is then measured. Since this condensation temperature is specific to water vapor concentration, highly precise results are achieved without the use of humidity sensors. Chilled mirror technology makes the 973-SF₆ the most accurate and reliable humidity measuring instrument in the industry.

Lower Cost of Ownership

No drift means less frequent calibration



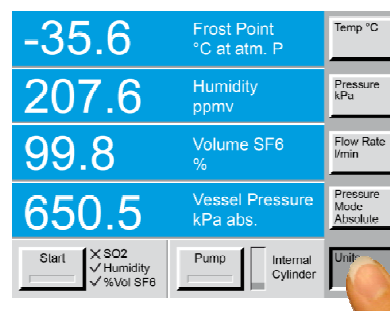
Unlike capacitive sensor-based systems that

rapidly and continually drift far out of specification, the 973-SF₆ chilled mirror technology relies on the drift-free physical principles of condensation. While sensor-based systems may have a lower initial acquisition cost, their ongoing costs for humidity sensor replacement, recalibration, and the lower reliability of their measurements, make the 973-SF₆ the most cost effective option.

Intuitive User Interface

Easy to use in the field

With the intuitive, interactive display, measurement results are clearly presented on the full color

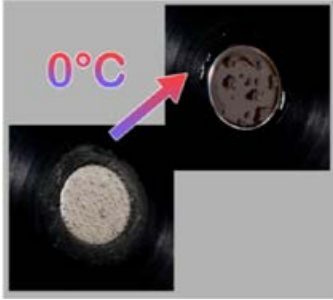


touch screen in the units of choice and held on the display for user notation. Results can easily be transferred directly to Microsoft Excel using the supplied software and cable. The 973-SF₆ data is compatible with all standard procedures issued by manufacturers and standards organizations including CIGRE and IEC.

User Verifiable Calibration

Be confident in your measurement

Field check the 973-SF₆ calibration at any time using the built-in Ice Test function. For this automatic test, the mirror cools to below 0°C, causing water vapor from the air to condense and freeze on the mirror surface. The mirror then begins to warm just above 0°C. While observing the mirror, simply press the on-screen button to



indicate the precise moment at which the ice melts. The 973-SF₆ measures the actual mirror temperature at that very moment and provides a pass/fail indication.

Easy to Maintain

Minimal training, field serviceable

Maintenance is limited to only occasional mirror cleaning and physical inspection of gas hoses. Automated tests for measurement integrity, pumping capability, and leaks allow the system to be easily verified in the field.



Containment System with Pump Back

Environmentally friendly, zero-loss system

The 973-SF₆ includes an integrated gas collection cylinder, allowing all measurements to be made with zero loss of SF₆ gas.

During measurement, the 973-SF₆ pumps the sample gas from the GIE, through the measuring head and into the internal storage cylinder. When finished, the gas is automatically pumped back into the original gas compartment. Optionally, it may be held within the 973-SF₆ for later pump back into a waste cylinder.

The 973-SF₆ incorporates a completely sealed, high-pressure pump and gas path for precise, zero-emission measurements.

SO₂ Concentration

An additional health check for your GIE



As an option, the 973-SF₆ is now available with integrated, industry standard chemical-based SO₂ measurement – another indicator of potential problems within gas-insulated equipment. The measurement cell is conveniently located on the rear panel for easy user replacement when needed (about every two years). Low cost, pre-calibrated, interchangeable modules make this swap-out a simple, two minute field operation.

Robust and Transportable

Made especially for field use

Highly compact, the 973-SF₆ is supplied complete with a robust, shock-resistant case for use on site and for transportation.



Sample lines and the most common DN8 and DN20 fittings are included. Alternative fittings are available to suit almost any SF₆ installation.

Laboratory Precision! Field Ready!

The 973-SF₆ is the gas analyzer of choice for all the major switch-gear manufacturers thanks to its precision, repeatability and long term stability.

Specifications

973-SF₆ Analyzer

Measuring range:		
Frost/Dew Point	-50...+20°C (-58...+68°F)	
Humidity content by volume	20...20,000 ppm _v	
Humidity content by weight	2.5...2,500 ppm _w	
Volume SF ₆	80...100%	
Inlet pressure	125...3,000 kPa abs usable range (18...435 PSIA usable range) 125...1,000 kPa abs calibrated range (18...145 PSIA calibrated range) (125...1,200 kPa abs calibrated range upgrade available) (18...174 PSIA)	
Accuracy:		
Frost/Dew Point	± 0.5 °C (± 0.9 °F)	
ppm _v / ppm _w	± 1 ppm +6% of reading	
Volume SF ₆	± 0.5%	
Pressure	± 3 kPa (± 0.4 PSIA)	
Reproducibility	± 0.1 °C Frost/Dew Point	
Standard Features:		
Digital I/O	RS-232	
Thermoelectric mirror cooling	3-stage	
Mirror temperature sensor	RTD (Pt-100)	
LCD display with touch screen	5.7"	
Internal gas tubes	Stainless Steel 316L / FEP	
Gas connections	Quick connect fitting (Swagelok® QM Series)	
Couplings	Dilo DN8 (VK/F-02/8) and DN20 (VK/F-02/20)	
External sample gas tube	6 m stainless steel armored PTFE tubing	
ORIS	Optimum Response Injection System	
Transport Case	Custom fit foam lined Peli 1620	
Power Cable	2.5 m (8Ft.)	
Operating instructions	English, French, Big5 Traditional Chinese, or German	
Calibration certificate	Pressure calibration, 2-point dew/frost point, 3-point volume %SF ₆	
Optional:		
Internal SO ₂ -Module	Range:	0...100 ppm _v or 0...500 ppm _v
	Accuracy:	<2% of range <2% of range
	Drift:	≤5%/ year ≤5%/ year
Additional Information:		
Supply voltage	100-120 VAC / 200-240 VAC, 50/60 Hz (auto switching)	
Supply voltage fluctuations	up to ± 10% of nominal voltage / Overvoltage category II Rated pollution degree 2	
Power consumption	200 Watt	
Pump back pressure max.	900 kPa (130 PSIA) (1,200 kPa abs upgrade available) (174 PSIA)	
Cooling	Air	
Operation Temperature	-10 °C...+40 °C (14 °F...104 °F)	
Storage Temperature	-20 °C...+50 °C (-4 °F...122 °F)	
Humidity	Maximum relative humidity 98% RH, non-condensing	
Outdoor use	Permissible, instrument must be protected against exposure to water.	
Altitude	Up to 2,000 m (6,500Ft.)	
Weights & Dimensions:		
	Instrument	with Transport Case
Width	420 mm (17in.)	650 mm (26in.)
Height	155 mm (6in.)	370 mm (15in.)
Depth	390 mm (15in.)	510 mm (20in.)
Weight	16.5 kg (37lbs.)	32 kg (71lbs.)

We reserve the right to change design or technical data without notice.

Multi-Channel Thermometer Pt12



Pt12 High Precision Multi-Channel Thermometer System

Features:

- Twelve channel temperature measurement
- High precision, stability and repeatability
- Internal temperature compensated high stability reference resistors
- PC software for easy GUI or command line system control and data acquisition
- Simple to setup, configure and use
- Touchscreen user interface with graphing
- Supports THERMOtelligent™ 100 Ω and 25.5 Ω Smart 4-wire PRTs

Typical Applications:

- Climate chamber validation
- Calibration Systems
- Temperature Calibration
- Temperature Control

Multi-Channel Thermometer Pt12

Multi-Channel Reference Thermometer

The Pt12 is a highly precise and stable platinum resistance thermometer (PRT) based multi-channel temperature measurement system. Using a custom designed high-quality measurement circuit with full current reversal and multiplexed sampling, the Pt12 provides 12 channels of low uncertainty temperature data for validation and calibration engineers.

Using one of three automatic or user selectable currents, the Pt12 repeatedly scans all 12 channels. Employing a full reversal current source, the Pt12 eliminates polarity sensitive errors normally inherent to DC measuring techniques. Accuracy is further enhanced by referencing all measurements to high stability, temperature compensated internal reference resistors.

The supplied software allows each channel to be individually programmed with ITS-90 or Callendar-Van Dusen coefficients for direct conversion of resistance measurements to temperature. The Pt12 connects to a PC over the RS-232 interface.

Data Logging

Data may be logged automatically to a USB flash drive. If no drive is detected, data is logged to internal memory and may be copied to a USB drive when inserted at a later time.

Internal Reference Resistors

Measurements are compensated against drift using four high precision, high stability internal reference resistors. During each sampling sequence, the Pt12 measures each reference resistor to define the measuring range and accurately determine the unknown values of each of the 12 channels. The result of this specific reference resistor measurement technique is a significant reduction in overall uncertainty.

Supports THERMOtelligent™ Smart 4-wire PRTs

THERMOtelligent™ Smart-Platinum Resistance Thermometers save you valuable time and decrease the possibility of measurement errors by eliminating the need to change calibration coefficients in the thermometer readout when temperature probes are changed.

An integrated microchip installed in the probe stores calibration coefficients and other information about the PRT. When the PRT is connected to the Pt12, it automatically identifies itself and updates the Pt12 with the calibration coefficients and other permanent information that is stored in the chip. Since the calibration coefficients are always kept in the THERMOtelligent™ PRT, the PRTs can be moved from channel to channel, or from one THERMOtelligent™-supported readout to another without requiring any reconfiguration.

The Pt12 also works with any standard 4-wire 100 Ω or 25.5 Ω PRT. In the case of non-intelligent probes, coefficients may be easily entered by the operator through the touch screen. In addition, any 4-wire PRT can be converted to a THERMOtelligent™ Smart-PRT by RH Systems.

Touch Screen Interface

The Pt12 is equipped with a full color touch screen capable of data display in both numeric and graph formats. Graph positioning and scaling uses intuitive pinch/zoom gesturing.



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