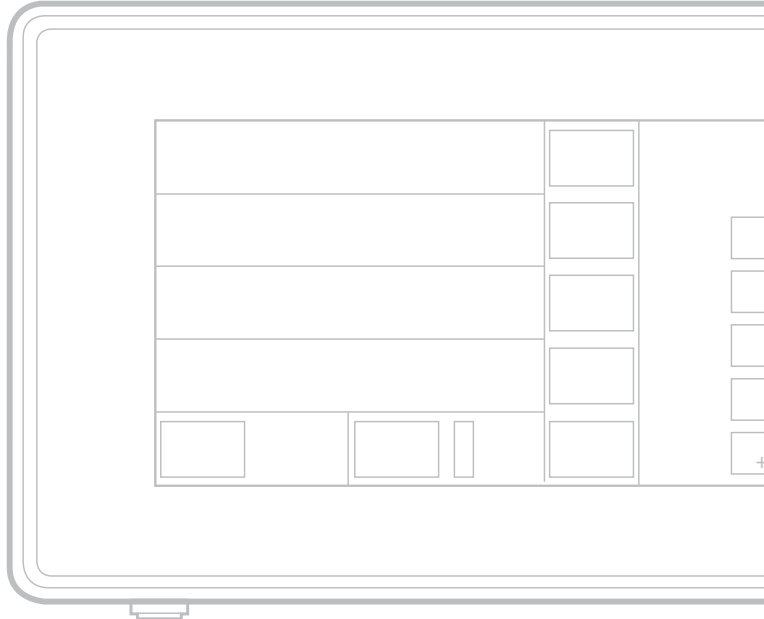
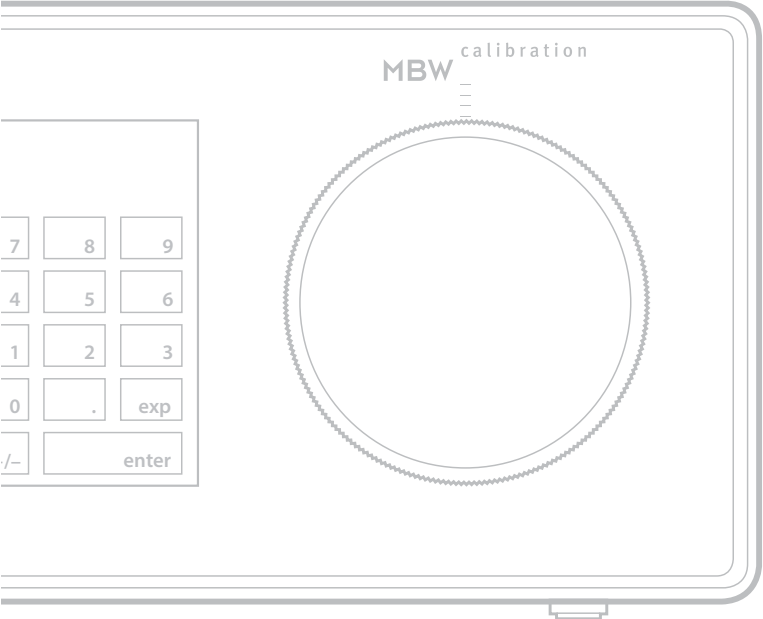


Company Overview





MBW Calibration AG is a Swiss family owned company. Since 1962 it has been at the forefront of the development and production of chilled mirror dew point hygrometers, SF₆ gas analyzers and temperature measurement instruments. MBW also supplies humidity generators for calibration and production systems.

Collaboration with the US Company, RH Systems, started in 1997. The combination of MBW mechanical experience and application knowledge with RH Systems fundamental humidity expertise and programming capabilities led to the development of a series of products that remain at the leading edge of humidity technology.

The first instrument, the 373, was introduced in 1999 and thanks to continual development it remains the state-of-the-art in terms of measurement performance, long term stability and ease of use. Almost every National Measurement Institute world-wide uses the 373 as a transfer standard, and all International dew-point inter-comparisons in the past 15 years have used the 373 thanks to its accuracy, repeatability and excellent long term stability.

Based on the core technology integrated within the 373, an expanded range of instruments has been developed to meet the technical and budgetary requirements of almost any humidity measurement application requiring the best possible measurement capability. These include low frost points to -95 °C, high dew points up to 95 °C, SF₆ gas analysis, fuel cell research, heat treatment and climatic chamber validation.

In 2011, MBW Calibration was accredited by the Swiss Accreditation Service to perform humidity and temperature calibration with uncertainties of ±0.05 to 0.52 °C dew/frost point and ±0.01 °C. This means that instruments can be supplied pre-calibrated to meet the requirements of ISO17025 for calibration laboratories and users requiring documented traceability. Through its long-term association with Thunder Scientific, MBW is also able to provide complete humidity/temperature generation and measurement systems for calibration laboratories and production systems.

In 2014 MBW was appointed by METAS, the national metrology institute of Switzerland, as Designated Institute (DI) in the field of humidity and joined the European regional metrology organization, EURAMET as an associate member (A-DI). In 2015 the MBW quality system was granted confidence by the EURAMET technical committee TC-Quality. As the Designated Institute, it is MBW's responsibility to maintain and disseminate the Swiss national humidity standards. Our role is to support Swiss and European industry with technical expertise and continual improvement of calibration standards that are traceable to the SI units.

MBW Calibration and RH Systems continue to develop innovative, high quality, precise and stable products to satisfy the most challenging applications and provide the best humidity measurement and generation capability available. This Company Overview provides an introduction to our products, services and expertise. Further information is available at www.mbw.ch.



Daniel Mutter
Chairman



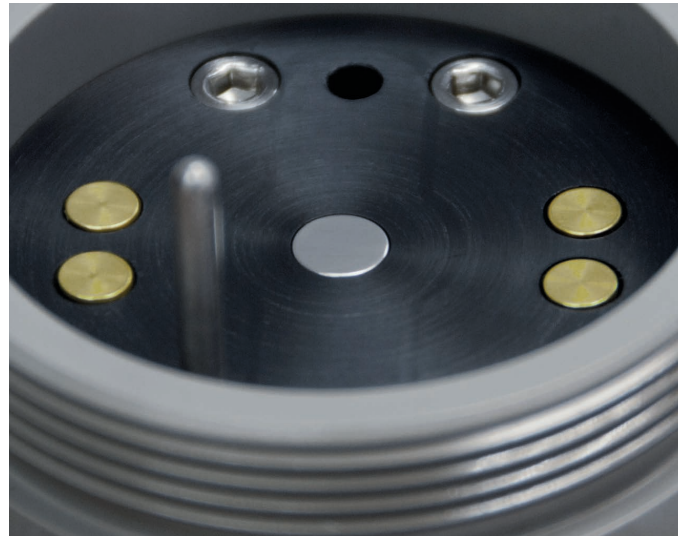
Contents

Dew Point Mirrors	4
Key Features	5
Key Applications	6
373 Dew Point Hygrometer	8
473 Dew Point Hygrometer	9
T12 Thermometer	10
973 Dew Point Hygrometer	11
573 Dew Point Hygrometer	12
973-SF6 Analyzer	13
Humidity Generators	14
Services - Calibration, Service and Repair Capabilities, Consultancy, Customized Solutions, Training	15
Contact Details	Back Cover



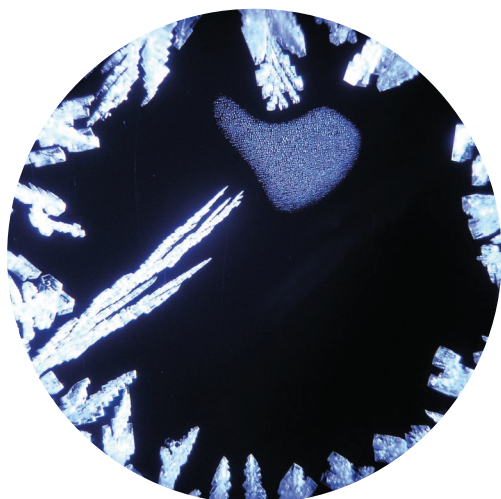
Dew Point Mirrors

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 and controlled with advanced optical electronics. Dew point is not temperature dependent, so measurement performance is consistent across the calibrated range of the instrument.



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 is stable can be up to 3 °C. It is important to know the condensate phase for correct calibration comparison or determination of parameters such as relative humidity. As shown on the microscope image, it is also possible that dew and frost can exist concurrently on the mirror during certain conditions. This results in a non-stable value somewhere between the dew and frost point, and measurement precision is compromised.



ForceFrost Function

Below a user defined temperature, the ForceFrost function over-cools the mirror to rapidly force condensate to the solid phase. This eliminates the uncertainty of whether dew or frost is present on the mirror. Once formed, the thickness of the ice film is controlled and can even be adjusted to suit specific application conditions.

User Calibration & Ice Test

Users can easily check the MBW system's stability at any time using the integrated 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 verify the stability of the mirror temperature measurement. This is not a replacement for recalibration, but does allow the user to run interim checks whenever is needed and without external resources.

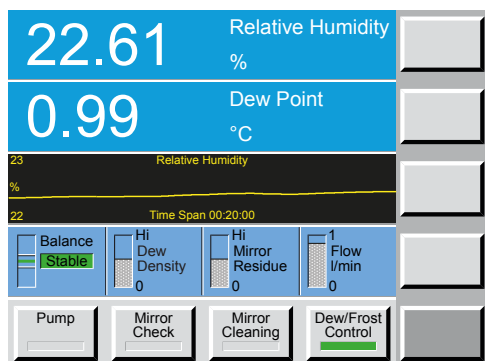
Key Features

Many of the key features on MBW products are unique within dew point mirror hygrometers. Their inclusion is a result of user demands from over 5 decades, and we continue to innovate to improve the usability and performance of our products. Detailed below are some of the most important features.



Touch Screen Interface

Instruments feature an LCD touch screen with a high contrast ratio and wide viewing angle for clear and easy readability. Using the on screen buttons and menus, you can easily configure each line of the instrument display for a variety of humidity, temperature and pressure parameters that may be viewed in units of your choice. A touch of a button changes any parameter between large font numeric and graph format with configurable axes, so that the user can easily view measurement trends and stability without the need for external data acquisition.



ORIS

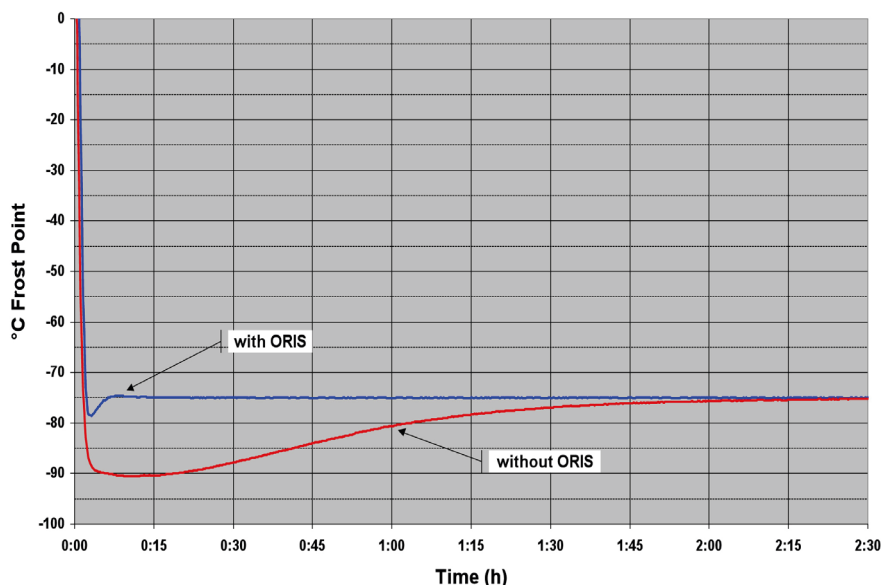
The Optimum Response Injection System (ORIS) is unique to MBW dew point instruments. At low frost/dew point conditions, the time to stabilize a condensate layer can be significant, sometimes as long as two hours for correct equilibrium. ORIS reduces the stabilization time using a carefully programmed 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 at equilibrium and the result precise.

Heated Measuring Heads and Sample Tubes

When measuring dew points even slightly above ambient temperature, there is a risk of condensation and therefore measurement error. By heating the dew point measuring head and sample tubes, condensation is avoided. MBW instruments are available for the measurement of up to 95 °C dew point thanks to the application of this technology.

Integrated Sample Pumps

For measurement applications where a sample gas needs to be extracted, MBW dew point mirrors are available with integrated sample pumps, including with heated sample paths. Electronic and mechanical flow meters are also integrated so the user can set consistent sampling rates by varying the pump duty via the instrument front panel.



Key Applications

Humidity measurement and control is integral to the development of more efficient systems and better product quality. The applications summarized below are examples of where MBW provides the very best measurement capability.

Calibration Laboratory Transfer Standard

Precise, easy to use and reliable reference hygrometers that provide measurement traceability with low drift for many years are an essential part of any calibration system. The long term stability of MBW mirrors means they are the choice of most National Measurement Institutes and accredited calibration laboratories, and have been for almost fifty years.



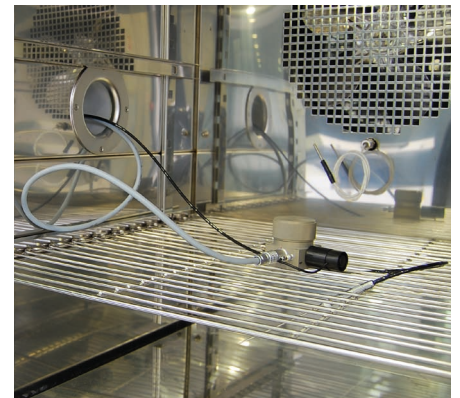
Energy Gases

Natural gas must be dried before distribution to prevent corrosion of pipelines, formation of hydrates and condensation. Measurement and control of humidity is a major challenge and costly, so the energy industry continually investigates improved measurement techniques and control systems, including specifically measurements at high pressure where MBW has developed reference instruments for use at pressures up to 200 bar.



Climatic Chamber Validation

Most of the products we depend upon in day to day life are at some time tested in climatic chambers. In many industries, such tests are so important that the chambers themselves must be routinely calibrated or validated to prove that they reach the correct conditions. Dew point mirrors provide a standard of measurement higher than the chamber control systems own measurement, so they are widely used as a maintenance and test tool by chamber manufacturers, maintainers and users.





Dryer Validation

Drying systems use humidity/moisture measurement to control the process. Many types of technology are used. Dew point mirrors are used to validate measurement performance at the working condition. This makes sure that energy use and product quality are optimal.

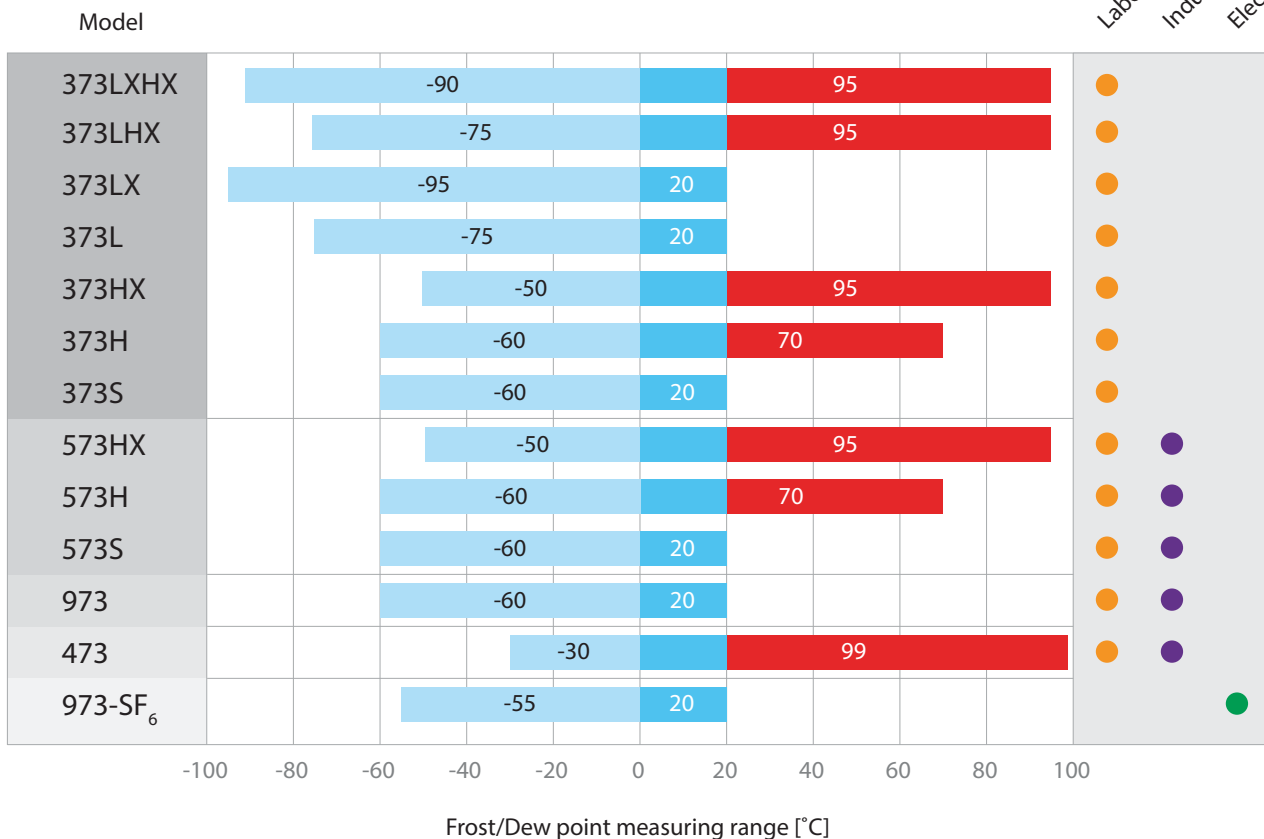
Heat Treatment

Heat treatment processes for metals achieve better quality with control of water vapor. Dew point mirrors are used because of their precision and long term stability. It is typical for MBW instruments to work for more than 20 years in these harsh environments.

SF₆ Gas Analysis

Chilled mirror dew point instruments provide the most precise results in this application where the control of humidity and moisture is fundamental to long term reliable operation of high voltage equipment. Instrument longevity and simple user-maintenance mean that dew point mirrors are a cost effective choice.

Hygrometer Comparison Chart



For full specifications please visit our website or request the specific product datasheet.

373 Dew Point Hygrometer



High Performance Reference Chilled Mirror Hygrometer

Features

- Wide measuring range -95 to +95 °C frost/dew point
- Dual mirror temperature sensors
- Removable mirror module for calibration in liquid
- Heated measuring heads and sampling systems
- High pressures up to 20000 kPa
- Temperature controlled sampling system
- Fast response
- Touch screen full color LCD user interface

Overview

The 373 is a de-facto standard in humidity measurement for over 15 years. Incremental development based on operational experience and customer feedback means that the 373 continues to meet the expectations of hundreds of users in some of the most challenging applications.

Despite its high specification, the 373 is easy to use and simple to maintain. Even early instruments remain serviceable thanks to the use of industry standard component architecture and careful control of software build records.

Recent 373 developments include improved materials of construction to further reduce sorption effects, higher pressure capability based on new mechanical designs, data acquisition software with external generator control, and multichannel thermometer data integration.

Typical Applications

- Calibration transfer standard
- Meteorology reference
- Fundamental research projects
- Trace humidity measurement
- Critical process monitoring
- Fuel cell research

Key Specifications

- Frost/dew point range: -95 to +95 °C
- Gas pressure range: 50 to 20000 kPa
- Temperature: -50 to +100 °C
- Temperature with T12: -200 to +250 °C

473 Dew Point Hygrometer

High Performance Chilled Mirror Hygrometer With Cable Mounted Measuring Heads



Features

- Highly precise chilled mirror dew point technology
- Cable mounted dew point and temperature measurement
- Aspirated and direct insertion measuring heads
- Barometric pressure measurement options
- High temperatures up to 125° C
- Intuitive color touch screen user interface
- User verifiable calibration

Key Specifications

- Frost/dew point range: -30 to +99 °C
- Temperature: -50 to +100 °C
- Temperature with T12: -200 to +250 °C

Overview

The 473 is the lowest cost MBW dew point instrument, yet it has high performance and the same user interface as its more expensive siblings. It features cable mounted dew point measuring heads that allow the user to measure directly within the application environment, and includes a temperature probe as standard. Using both measured variables, the 473 is able to calculate, display and output relative humidity. As an option, the 473 can be specified with a barometric pressure sensor.

Various types of measuring heads with connecting cables are available:

The SH2 measuring head is supplied with a small sample fan with variable speed to

generate a steady gas flow over the dew point mirror. It can also be connected to systems with sampling points using standard 6 mm or ¼" gas fittings. It is very well suited as a transfer standard in humidity chambers and calibration systems.

The SHX measuring head has been designed to operate at temperatures up to 125 °C. Its MBW developed sample flow module also has high temperature capability so that measurement performance is maintained across the working range.

The RP2 probe is designed to be placed directly into environments with existing gas flow. An example would be a RH calibration chamber where a circulation fan is used to mix the air so that its temperature and humidity are uniform.

In combination with the T12 multichannel thermometer, the 473 is particularly well suited to climatic chamber validation projects.

Typical Applications

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

T12 Thermometer



Precision Multichannel Thermometer System

Features

- Twelve channel temperature measurement
- High precision, stability and repeatability
- Internal reference resistors
- PC software for system control and data acquisition
- Simple to configure and use

Overview

The T12 is a highly precise and stable platinum resistance thermometer (PRT) based multichannel temperature measurement system. It is suitable for use in laboratories for temperature calibration, and when combined with a dew point mirror, for multichannel RH profiling.

The T12 is supplied complete with our easy to use Gecko software for configuration, data acquisition and control of humidity generators.

Typical Applications

- Climatic chamber validation and calibration
- Temperature calibration
- Calibration systems

Key Specifications

- Temperature range: -200 to +250 °C (PRT Pt-100)
- Resistance range: 1 to 200 Ω
- Resolution 0.1 mK
- Accuracy: $\leq \pm 2$ mK @ 23 °C

973 Dew Point Hygrometer

Portable Industrial Chilled Mirror Hygrometer



Features

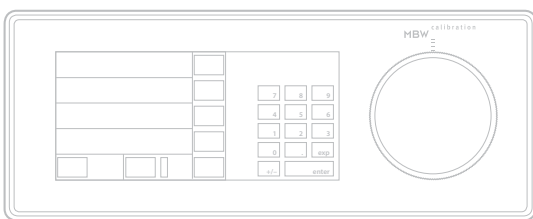
- Fundamental drift free humidity measurement
- Integral frost/dew point measuring head
- Internal sample pump
- Optimal Response Injection System
- Pressures up to 20 bar
- Intuitive, easy to use LCD touch screen user interface

Overview

The 973 is the workhorse of the MBW instrument range. Its wide -60 to +20 °C operating capability makes it suitable for the most typical dew point measurement applications. The instrument is easily transportable and is supplied as standard with a tough transport case so it can be moved or shipped securely. A number of variants are available, including a version specifically configured for on-site compressed gas measurements.

Typical Applications

- On-site calibration of dew point sensors
- Checking of breathing gas quality
- Battery manufacturing
- Compressed air systems
- Dryer performance tests



573 Dew Point Hygrometer



Industrial Chilled Mirror Hygrometer

Features

- Heated measuring head and sampling
- Internal sample pump
- Optimal Response Injection System
- ForceFrost function
- Ice-Test user calibration verification
- User configurable sampling circuit
- Dew points up to +95 °C

Overview

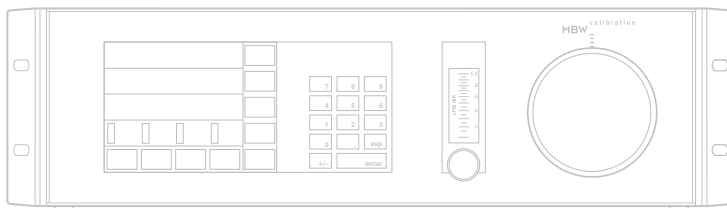
The 573 is a rack mounting dew point mirror that is very well suited to fixed industrial installations. Similar in specification to the 973, the 573 adds the capability to measure dew points above the ambient temperature thanks to versions with heated measuring heads and sampling tubes. A special option on the 573H and 573HX variants is an automated steam trap that provides user controlled draining of condensation collected during operation at dew points up to 95 °C.

Typical Applications

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

Key Specifications

- Frost/dew point range: -60 to +95 °C
- Temperature range: -50 to +100 °C
- Temperature range with T12: -200 to +250 °C



973-SF₆ Analyzer

Precise and Stable SF₆ Gas Analyzer



Features

- Simultaneous measurement of humidity, SF₆ purity and SO₂ concentration
- Integrated gas recovery system with automatic pump back
- Fully automated SF₆ gas testing
- Fundamental drift-free measuring principle
- Measurement results at SF₆ compartment or standard pressure
- Intuitive color touch screen user interface
- User verifiable calibration
- Robust case for easy transportation

Optimum SF₆ Gas Analysis Solution

The 973-SF₆ is an advanced analyzer for the measurement of humidity, SF₆ purity and SO₂ concentration in SF₆ gas insulated switchgears (GIS) and other high voltage equipment. With its internal gas containment and recovery system, the 973-SF₆ provides a high quality and environmentally safe measurement solution within a single, self-contained unit. Pure SF₆ is the standard filling within GIS, but over time gas compartments become contaminated with water vapor (H₂O) through permeation and by desorption from internal components.

Whilst water vapor and SF₆ do not normally react with each other, in the presence of a high-energy discharge, hydrogen and oxygen disassociated from water vapor will react with the sulfur and fluorine from SF₆

to form decomposition by-products. These include sulfur dioxide (SO₂) and hydrofluoric acid (HF) that are corrosive to the internal components of gas compartments.

SF₆ with low water vapor content (low humidity) significantly reduces the potential for formation of these corrosive compounds, which is why accurate and repeatable measurement data is an invaluable part of any GIS preventative maintenance program.

Put simply, careful maintenance of the quantity of water vapor within SF₆ gas insulated equipment is key to equipment reliability and minimized costs. The 973-SF₆ gives the user the best possible measurement capability with low operating costs and no release of SF₆ gas.

Humidity Generators

Humidity calibration systems need to vary the humidity conditions to test instruments over the required range. A number of different techniques are used, but almost without exception, a transfer standard is used to confirm the generated value and to provide measurement traceability. MBW Calibration dew point mirrors have been used as transfer standards for almost to 50 years.

One exception is the Thunder range of humidity generators. These fundamental two pressure based systems are able to provide humidity calibration traceability based on the calibration of the pressure and temperature sensors used. However, if the user does not maintain sensor calibration, then the generated value will be less certain, so in most cases, a transfer standard is applied.

The best case scenario is when generated and measured humidity values agree. For over 25 years, MBW has partnered within Thunder Scientific to provide hundreds of reliable, stable and precise humidity calibration systems worldwide.

MBW Calibration is the European Distributor of the Thunder Scientific range of humidity generators. From our Swiss headquarters, we have supplied, and continue to support more than 150 installations throughout Europe and the Middle East.



Thunder 2500

The 2500 is the de-facto standard for relative humidity (RH) calibration. Based on the two pressure principle, it allows calibration laboratories to generate stable RH conditions over a wide temperature range. Humidity set points can be manually changed by the user, or automatically using profiles configured within Thunder or MBW software.

The 2500 is typically used in combination with MBW 373, 573 or 473 dew point mirrors to provide continuous calibration traceability.

Key Specifications

- **Relative humidity range: 10 to 95 %rh**
- **Typical RH uncertainty: 0.5 %rh**
- **Chamber temp range: -10 to +70 °C**



Thunder 3900

The 3900 is a generator for precise and stable frost/dew point conditions for humidity calibration. Working on the two pressure and two temperature principles, it supplies a constant humidity controlled gas supply with flow rates up to 5 l/min for days or weeks automatically.

The 3900 is typically used in combination with the 373 dew point mirror

Key Specifications

- **Frost/dew point range: -95 to +10 °C**
- **Typical sat temp uncertainty: ± 0.08 °C**
- **Flow rate: 0.1 to 5 l/min**

MBW Services

SCS Accredited Humidity and Temperature Calibration Laboratory

The heart of MBW, our SCS accredited calibration laboratory has the capability to generate and test over a dew point range of -95 to +95 °C and -100 to +100 °C temperature. Our calibration and measurement capabilities compare favorably with the very best laboratories in the world. MBW can calibrate and test almost any type of hygrometer or thermometer with fast turnaround times of 2-4 weeks.



ISO/IEC 17025
ACCREDITED
SCS 0125



Designated Institute

As the Designated Institute, it is MBW's responsibility to maintain the primary humidity standard in Switzerland. Our role is to support Swiss and European industry with technical expertise and continual improvement of calibration standards that are traceable to the SI units. Ongoing intercomparison with National Metrology Institutes and other Designated Institutes around the world ensures that calibrations are continually assessed for equivalence.

Factory Calibration

During production, all MBW instruments are compared to in-house calibration standards, all of which are traceable to international standards. Factory calibration is also available as a service to any customer, and we add the capability to test pressure, SF₆ Vol% and SO₂ sensors.

Consultancy, Customized Solutions and Training

Humidity is a complex field, and at MBW we continue to learn, so we know users also need to continue learning. Combined with the purchase of instruments and generators we offer free advice and training. If an instrument purchase is not necessary, we can also supply experienced humidity specialists for training, problem solving, project development and system integration tasks. Training courses are also available, examples include humidity fundamentals, humidity calibration and SF₆ gas analysis.

MBW Service

We continue to support instruments for as long as the customer requires. There are many examples of instruments that remain in operation for more than 30 years. Our service engineers also build instruments, so they have vast experience of our entire range.

Our apprentice engineers are selected to be of the highest calibre to maintain the MBW tradition of quality and reliability.

Extended Warranty

MBW products are supplied as standard with a two year warranty. Customers are able to extend this to five years for a small additional cost.

When an instrument reaches more than five years old, we can combine a further warranty extension when combined with annual or bi-annual calibration.

RH Systems
1225 W Houston Ave
Gilbert, AZ 85233
USA

Phone +1 480-926-1955
Fax +1 866-891-3399

www.rhs.com
sales@rhs.com

MBW Calibration Ltd.
Seminarstrasse 55/57
CH-5430 Wettingen
Switzerland

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

www.mbw.ch
sales@mbw.ch



ISO/IEC 17025
ACCREDITED
SCS 0125

