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GE
Measurement & Control

M Series

Panametrics Aluminum Oxide Moisture Probe



Applications

This Panametrics aluminum oxide moisture sensor probe measures moisture concentration in gases and non-aqueous liquids from trace to ambient levels. It is designed to be used in conjunction with all Panametrics moisture analyzers for industries including:

- Petrochemical
- Natural gas
- Industrial gas
- Semiconductor
- Furnace gas/heat treating
- Power generation
- Air dryer
- Pharmaceutical
- Aerospace

Features

- Intrinsically safe when used in conjunction with certified electronics or zener barriers
- Superior sensitivity, response speed and calibration stability
- Optional temperature sensor
- Calibrations traceable to national standards
- Designed for in situ applications or in conjunction with sample conditioning systems
- True absolute humidity sensor
- Wide dynamic range

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Panametrics Hygrometer Systems and Moisture Probes

Panametrics aluminum oxide moisture probes have set the standard of performance and value in industrial moisture measurement for more than 40 years.

In use, M Series moisture probes are coupled to Panametrics hygrometer consoles by an interconnecting cable. Ease of use, wide measurement range and rigorous calibration standards make these systems the preferred choice for industrial moisture measurement worldwide.

Superior Performance

Film thickness of the oxide layer is critical to the performance of this type of sensor. GE manufactures sensors with an oxide film thickness that causes them to exhibit true absolute humidity, rather than relative humidity response. This critical film thickness also gives the M Series probe quick response and exceptional calibration stability.

Rigorous Calibration Standards Traceable to National Standards

Each Panametrics aluminum oxide sensor is individually calibrated in one of the world's most advanced moisture calibration facilities. Developed over several decades, this facility uses flow, temperature and pressure measuring devices, traceable to national standards, to generate precisely known moisture concentrations to which each probe is exposed during the calibration process.

All data is gathered and stored by a dedicated computer system. Calibrations are repeated over a period of months to determine the stability of each individual moisture probe. Only those probes that meet GE's demanding specifications for accuracy and stability are shipped to customers.

Theory of Operation in Gases and Liquids

The direct measurement of water vapor pressure is accomplished easily and effectively in both gases and liquids by the M Series aluminum oxide moisture sensor. The sensor consists of a porous oxide layer over which a very thin coating of gold is evaporated. The base and the gold layer form the two electrodes of what is essentially an aluminum oxide capacitor. Water vapor is rapidly transported through the gold layer and equilibrates on the pore walls of the oxide layer. The number of water molecules absorbed on the oxide structure determines the conductivity of the pore walls. Each value of pore wall resistance provides a distinct value of electrical impedance, which in turn is functionally related to the water vapor pressure. This functional relationship holds for measurements made in either gas phase or liquid phase.

Installation Flexibility

M Series probes are designed to be located at the process, exactly where the measurement is needed. Cable length between the probe and hygrometer may be 2000 ft (610 m) or more. Pressure range is from vacuum up to 5000 psig (345 bar) with no minimum flow requirements. Sample cells make M Series probes easy to install, and the cells are available in general purpose, Type 4 weatherproof, and Type 7 explosion-proof housings.

Remote installation of the probe and wide operating parameters minimize measurement lag time and the potential for sample contamination associated with long sample runs back to an analyzer. This feature is extremely important in the measurement of very low moisture content or where rapid changes occur.

When the integrity of the measurement is threatened by conductive or erosive particles, or adverse process conditions, sample conditioning will be required. GE manufactures turnkey sample-conditioning systems that maintain the integrity of the sample's moisture content while removing the contaminants. These designs have been field-tested and have proven to be reliable, while requiring little or no maintenance.

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M Series Specifications

Moisture Probe

Intrinsic Safety
Intrinsically safe when connected
to a Panametrics Moisture Series analyzer, PM880 portable hygrometer or intrinsically safe barriers in accordance with the user's manual.
M Series moisture probe:
BAS01ATEX1096X
Ⓔx II 1 G EEx ia IIC T4 (-20°C to +80°C), and
CSA C US Class I, Division 1, Groups A,B,C&D T4,
LR44204-23

European Compliance
Complies with EMC Directive 89/336/EEC and
PED 97/23/EC for DN<25

Type
Aluminum oxide moisture sensor

Calibration
Each probe is individually computer calibrated against known moisture concentrations, traceable to national standards.

Dew/Frost Point Calibration Ranges
- Overall capability: 140°F to -166°F (60°C to –110°C) by request
- Standard calibration range: 50°F to -112°F (10°C to –80°C) with data provided from 68°F to -166°F (20°C to -110°C)
- Ultralow calibration range: -58°F to -148°F (-50°C to –100°C) with data to -166°F (-110°C)

Accuracy
- ±3.6°F (±2°C) in range of 50°F to -85°F (10°C to –65°C)
- ±5.4°F (±3°C) in range of -86°F to -112°F (-66°C to -80°C)

Repeatability
- ±0.9°F (±0.5°C) in range of 50°F to -85°F (10°C to –65°C)
- ±1.8°F (±1.0°C) in range of -86°F to -112°F (-66°C to -80°C)

Temperature
- Operating: -166°F to 120°F (–110°C to 50°C)
- Storage: Maximum 158°F (70°C)

Operating Pressure (Dependent on Mount)
- Flange process connection (M1): 5 µHg to 75 psig (6 bar)
- Threaded process connection (M2): 5 µHg to 5000 psig (345 bar)

Flow Range
- Gases: Static to 10,000 cm/s linear velocity at 1 atm
- Liquids: Static to 10 cm/s linear velocity at density of 1 g/cc

Input Voltage
1 VAC, 77 Hz

Limited Warranty
- Calibration: Six months from delivery
- Materials and workmanship: One year from delivery

Optional Temperature Sensor

Type
Nonlinear negative temperature coefficient (NTC) thermistor (resultant temperature linearized by microprocessor)

Operating Range
–22°F to 158°F (–30°C to 70°C)

Accuracy
±0.9°F (±0.5°C) overall

Response Time (Maximum)
1 second in well-stirred oil or 10 seconds in still air for a 63% step change in increasing or decreasing temperature

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N4271 CE

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920-046E

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