

## 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 Moisture Image® Series 1, Moisture Image Series 2, and Moisture Monitor™ Series 3 moisture analyzers and PM880 portable hygrometer for industries including:

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

## Features

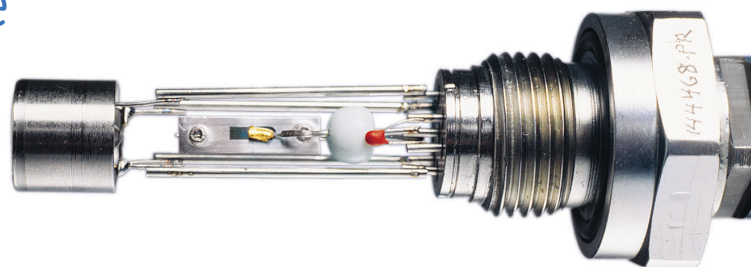
- Intrinsically safe
- Ambient to ppb moisture measurement
- Built-in temperature and pressure sensors
- Calibrations traceable to National Institute of Standards and Technology (NIST) or National Physical Lab U.K. (NPL)

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# TF Series

## Panametrics Aluminum Oxide Moisture Probe

TF Series probe is a Panametrics product. Panametrics has joined other GE high-technology sensing businesses under a new name—GE Industrial, Sensing.



# GE Sensing

## 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, TF Series 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.

## Built-In Pressure and Temperature Measurement

The three-function TF Series probe measures pressure and temperature, in addition to moisture content. This is because accurate determination of many moisture measurement parameters requires knowledge of the process temperature and pressure. GE eliminated the inconvenience and limitations associated with installing and using separate temperature and pressure sensors by building that capability directly into the TF Series probe. A nonlinear negative temperature coefficient (NTC) thermistor to measure temperature from  $-22^{\circ}\text{F}$  to  $158^{\circ}\text{F}$  ( $-30^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ ) and a choice of five solid-state piezoresistive transducers are available to measure pressures up to 5000 psig (345 bar).

Temperature and pressure input data are used by Moisture Image Series 1 and 2 analyzers, Moisture Monitor Series 3 analyzer and PM880 portable hygrometer to determine parameters such as parts per million (ppm)  $\text{H}_2\text{O}$  and relative humidity.

## True Absolute Humidity Sensors

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 TF Series probe quick response and exceptional calibration stability.

## Rigorous Calibration Standards Traceable to NIST/NPL

The aluminum oxide sensor of each TF Series probe is individually calibrated in one of the world's most advanced moisture calibration facilities. Developed over several decades, this facility generates precisely known moisture concentrations, traceable to NIST/NPL, to which each sensor is exposed during the calibration process.

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

## Installation Flexibility

TF Series probes are designed to be located at the process, exactly where the measurement is needed. Operating temperature is  $-166^{\circ}$  to  $158^{\circ}\text{F}$  ( $-110^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ ). The probe can withstand pressures up to 5000 psig (345 bar). No minimum flow rate is required.

In some cases, TF Series probes can be installed directly in the process line. More often, to ensure the integrity of the moisture measurement, a sample conditioning system is recommended.

GE designs and manufactures a line of reliable, field-proven conditioning systems to meet the demands of most applications. If required, a special system will be designed to meet unique application needs.

# TF Series Specifications

## Moisture Sensor

### 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.

TF Series moisture probe:

BAS01ATEX1096X

Ⓢ 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

### European Compliance

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

### Type

Aluminum oxide moisture sensor probe

### Calibration

Each sensor is individually computer calibrated against known moisture concentrations, traceable to NIST or NPL.

### Dew/Frost Point Calibration Ranges

- Overall: 140°F to -166°F (60°C to -110°C)
- Standard: 68°F to -112°F (20°C to -80°C) with data to -166°F (-110°C)
- Ultralow: -58°F to -166°F (-50°C to -110°C)
- Extended high: 140°F to -112°F (60° to -80°C) with data to -166°F (-110°C)

### Accuracy

- ±3.6°F (±2°C) from 140°F to -85°F (60°C to -65°C)
- ±5.4°F (±3°C) from -86°F to -166°F (-66°C to -110°C)

### Repeatability

- ±0.9°F (±0.5°C) from (60°C to -65°C)
- ±1.8°F (±1.0°C) from (-66°C to -110°C)

### Temperature

- Operating: -166°F to 158°F (-110°C to 70°C)
- Storage: 158°F (70°C) maximum

### Operating Pressure

5 in. of Hg to 5000 psig (345 bar), limited by optional pressure sensor—see pressure sensor ranges

### 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

### Response Time

Less than five seconds for 63% step change of moisture content in either wet-up or dry-down cycle

### Probe/Analyzer Separation

- Up to 2000 ft (609 m) for moisture and temperature
- Up to 500 ft (150 m) for pressure

### Probe/Analyzer Compatibility

- Moisture Image Series 1 analyzer
- Moisture Image Series 2 analyzer
- Moisture Monitor Series 3 analyzer
- PM880 portable hygrometer

### Probe/Analyzer Cable

8-conductor shielded

### Input Voltage

1 VAC

### Impedance Range

50 kΩ to 2 MΩ at 77 Hz, depending on vapor pressure

### Limited Warranty

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

## Built-In Temperature Sensor

### Type

Nonlinear 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

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

# TF Series Specifications

## Built-In Pressure Sensor

### Type

Solid-state/piezoresistive

### Available Ranges

- 30 to 300 psig (3 to 21 bar)
- 50 to 500 psig (4 to 35 bar)
- 100 to 1000 psig (7 to 69 bar)
- 300 to 3000 psig (21 to 207 bar)
- 500 to 5000 psig (35 to 345 bar)

### Accuracy

±1% of full scale

### Pressure Rating

3 times the span of the available range to a maximum of 7500 psig (518 bar)



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