

XMTC

Panametrics Thermal Conductivity Binary Gas Transmitter

Applications

A thermal conductivity gas transmitter for use in the following industries and applications:

Metals Industry

- H_2 in N_2 ; atmosphere in metal heat-treating furnaces

Electric Power Industry

- H_2 in cooling systems for generators

Petroleum Industry

- H_2 in hydrocarbon streams

Chemical Industry

- H_2 in ammonia synthesis gas
- H_2 in methanol synthesis gas
- H_2 in chlorine plants

Methane Industry

- CO_2 in methane
- N_2 in methane

Landfill/Biogas Industry

- CO_2 in biogas
- CH_4 in biogas



Gas Production Industry

- Purity monitoring of argon, hydrogen, nitrogen and helium

Food Industry

- CO_2 in fermentation processes

Features

- Ultra-stable glass-coated thermistors
- Single or dual gas push-button calibration
- PC interface package for digital output
- Type 4X/7 construction; ATEX, FM and CSA certified for Class I, Division 1 hazardous areas



The microprocessor-based XMTC is a compact, rugged, online thermal conductivity transmitter that measures the concentration of binary gas mixtures containing hydrogen, carbon dioxide, methane or helium. The analyzer also combines computer enhanced signal measurement with fast-response software, real-time error detection and digital communication via an RS232 or RS485 interface.

Theory of Operation

Two ultrastable, precision glass-coated thermistors are used—one in contact with the sample gas and the other in contact with the reference gas (such as air in a sealed chamber). The thermistors are mounted so that they are in close proximity to the stainless steel (or Hastelloy®) walls of the sample chamber. The entire transmitter is temperature-controlled, and the thermistors are heated to an elevated temperature in a constant-current Wheatstone bridge. The thermistors lose heat to the walls of the sample chamber at a rate that is proportional to the thermal conductivity of the gas surrounding them. Thus, each thermistor will reach a different equilibrium temperature. The temperature difference between the two thermistors is detected in the Wheatstone bridge, and the resulting bridge voltage is amplified and converted to a linear 4 to 20 mA output proportional to the concentration of one of the constituents of the binary or pseudo binary gas mixture.

Minimal Calibration and Service

The XMTC is the most stable thermal conductivity analyzer on the market today. The rugged XMTC measuring cell resists contamination and remains insensitive to flow variations. Since the design uses no moving parts, the transmitter can easily withstand the shock, vibration and harsh environment found in many industrial applications. If the transmitter requires maintenance, its modular construction permits fast and easy servicing. Users can field-calibrate it quickly and replace the plug-in measuring cell with a precalibrated spare in minutes.

Sample System

A sample system is mandatory for use with the XMTC. The design of the sample system will depend on the conditions of the sample gas and the requirements of the application. In general, a sample system must deliver a clean, representative sample to the XMTC at a temperature, pressure and flow rate that are within acceptable limits. Standard XMTC sample conditions are: a temperature of less than 122°F (50°C) for a cell operating temperature of 131°F (55°C) with a flow rate of 0.5 SCFH (250 cc/min) at atmospheric pressure. Higher temperature and pressure options are available.

GE offers sample systems for a wide variety of applications. For assistance in designing your own sample system, please consult the factory.

Relative Thermal Conductivities of Common Gases



212°F (100°C) is relative thermal conductivity at 212°F (100°C)

Gas	Formula	Chemical	Gas	Formula	Chemical
Acetylene	0.90	C ₂ H ₂	Helium	5.53	He
Air	1.00	N ₂ /O ₂	n-Heptane	0.58	C ₇ H ₁₆
Argon	0.67	Ar	n-Hexane	0.66	C ₆ H ₁₄
n-Butane	0.74	C ₄ H ₁₀	Hydrogen	6.80	H ₂
Carbon Dioxide	0.70	CO ₂	Methane	1.45	CH ₄
Chlorine	0.34	Cl ₂	Methyl Chloride	0.53	CH ₃ Cl
Ethylene Alcohol	0.64	C ₂ H ₅ OH ₄	Neon	1.84	Ne
Ethylene	0.98	C ₂ H ₄	n-Pentane	0.70	C ₅ H ₁₂
Ethylene Oxide	0.62	C ₂ H ₄ O	Sulfur Dioxide	0.38	SO ₂
Freon-11	0.37	CCl ₃ F	Water Vapor	0.77	H ₂ O

Choosing the Reference Gas

The simple two-port version can be selected for measurement of zero-based gas mixtures using the sealed reference gas (air) or the four-port version (generally preferred for zero-suppressed gas mixtures) where higher accuracy is obtained using a specific flowing reference gas.

XMTC Specifications

Performance

Accuracy

±2% of span

Linearity

±1% of span

Repeatability

±0.5% of span

Zero Stability

±0.5% of span per week

Span Stability

±0.5% of span per week

Response Time

20 seconds for 90% of step change

Measurement Ranges

- 0% to 2%
- 0% to 100%
- 0% to 5%
- 50% to 100%
- 0% to 10%
- 80% to 100%
- 0% to 25%
- 90% to 100%
- 0% to 50%

Measurement Gases (Typical)

- H₂ in N₂, air or CO₂
- He in N₂ or air
- CO₂ in N₂ or air
- SO₂ in air
- Argon in N₂ or air
- H₂/CO₂/Air for hydrogen-cooled generators

Ambient Temperature Effect

±0.09% of span per °F

±0.05% of span per °C

Required Sample Flow Rate

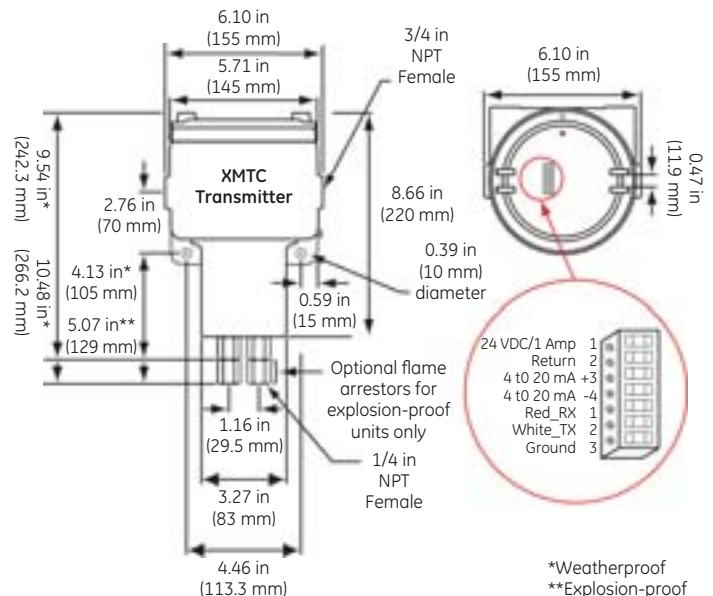
0.1 to 4.0 SCFH (10 to 2,000 cc/min);

0.5 SCFH (250 cc/min) nominal

Required Flow Rate for Optional Reference Gas

0.01 to 4.0 SCFH (5 to 2,000 cc/min);

0.5 SCFH (250 cc/min) nominal



Functional

Analog Output

4 to 20 mA isolated, 800 Ω maximum field-programmable

Power

24 VDC $\pm$ 2 VDC, 1.2 A maximum

Temperature

- Standard: 131°F (55°C)
- Optional: 149°F (65°C)

XMTC Specifications

Physical

Sensor Wetted Materials

- Standard:
316 stainless steel, glass and Viton® O-rings
- Optional:
Hastelloy C276, titanium and Chemraz® O-rings

Dimensions

- Weatherproof unit (h x diameter):
9.53 in x 5.71 in (242 mm x 145 mm)
- Explosion-proof unit (h x diameter):
10.47 in x 5.7 in (266 mm x 145 mm)

Weight

9.5 lb (4.3 kg)

Connections

- 3/4 in NPTF (electrical conduit)
- 1/4 in NPTF (sample inlet/outlet and optional reference inlet/outlet)

Environmental

- Weatherproof: Type 4X/IP66
- Explosion-proof: Class I, Division 1, Groups A,B,C&D
FM File No. J.I.2Z4A8.AE (3615) CSA LR44204-15
- Flameproof:  II 2 GD EEx d IIC T6 or T5
ISSeP02ATEX022

European Compliance

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

Order and Calibration Information

XMTC Thermal Conductivity Transmitter

Measuring Cell Package

- 3 Weatherproof, four-port, flowing reference gas, CPVC cell
- 4 Explosion-proof enclosure, four-port, flowing reference gas, CPVC cell
- 5 Weatherproof enclosure, two-port, sealed reference gas, FEP-coated aluminum cell
- 6 Explosion-proof, two-port, sealed reference gas, FEP-coated aluminum cell
- W No enclosure, two-port, sealed reference gas, FEP-coated aluminum cell (spare)
- Y No enclosure, two-port, flowing reference gas, CPVC cell (spare)

Output

- 2 4 to 20 mA

Maximum Ambient Temperature

- 1 131°F (55°C)
- 2 149°F (65°C)

Materials

- 1 316 stainless steel
- 2 Hastelloy C276

XMTC - 2 Use this number to order product

For explosion-proof/flameproof packages, select temperature as follows: 131°F (55°C) for EEx d IIC T6 or 149°F (65°C) for EEx d IIC T5. For weatherproof packages, select temperature as follows: 149°F (65°C).

XMTC Calibration Specifications

Cell Range

- | | | | |
|---|-----------|---|-------------|
| 2 | 0% to 2% | 8 | 0% to 100% |
| 3 | 0% to 5% | A | 90% to 100% |
| 4 | 0% to 10% | B | 80% to 100% |
| 6 | 0% to 25% | C | 50% to 100% |
| 7 | 0% to 50% | S | Special |

Calibration Gases

- 1 H₂ in N₂
- 2 CO₂ in N₂ (minimum range 0% to 20% CO₂)
- 3 CO₂ in air (minimum range 0% to 20% CO₂)
- 4 He in N₂
- 5 He in air
- 6 Calibration for hydrogen-cooled generators, H₂/CO₂/air
- S Other, please specify

Temperature Control Set Point

- 1 131°F (55°C), suitable for ambient temperatures up to 122°F (50°C)
- 2 158°F (70°C), suitable for ambient temperatures up to 149°F (65°C)
- S Special

XMTC-Cal 2 Use this number to order product

Binary or pseudobinary gas composition must total 100%



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