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

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 IP66/4X construction
- ATEX, IECEx, FM and CSA certified for Zone I and Division 1 hazardous areas

The microprocessor-based XMTC is a compact, rugged, online thermal conductivity transmitter that measures the concentration of binary gas mixtures including hydrogen, carbon dioxide, methane, helium and many others. 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.

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Minimal calibration and service

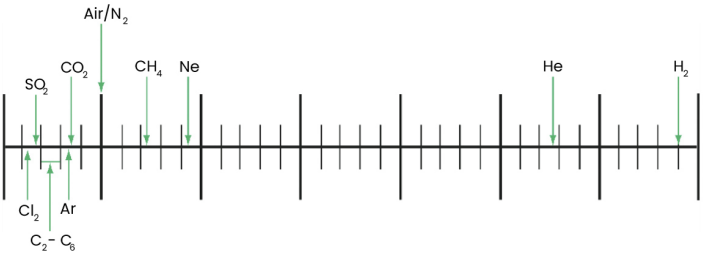
The XMTC is the most stable thermal conductivity analyzer on the market today. The rugged XMTC measuring cell resists contamination and remains insensitive to flow variations. Since the design uses no moving parts, the transmitter can easily withstand the shock, vibration and harsh environment found 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. A higher temperature option is available.

Panametrics offers sample systems for a wide variety of applications. For assistance in designing your own sample system, please consult our application engineering team.

Relative thermal conductivities of common cases



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

Gas	Formula	Chemical	Gas	Formula	Chemical
Acetylene	0.90	C_2H_2	Helium	5.53	He
Air	1.00	N_2/O_2	n-Heptane	0.58	C_7H_{16}
Argon	0.67	Ar	n-Hexane	0.66	C_6H_{14}
n-Butane	0.74	C_4H_{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_3Cl
Ethylene Alcohol	0.64	$C_2H_5OH_4$	Neon	1.84	Ne
Ethylene	0.98	C_2H_4	n-Pentane	0.70	C_5H_{12}
Ethylene Oxide	0.62	C_2H_40	Sulfur Dioxide	0.38	SO_2
Freon-11	0.37	CCl_3F	Water Vapor	0.77	H_20

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). There is a four-port version for improved performance 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% step change

Measurement Ranges

- 0% to 2%
- 0% to 5%
- 0% to 10%
- 0% to 25%
- 0% to 50%
- 0% to 100%
- 50% to 100%
- 80% to 100%
- 90% to 100%
- 95% to 100%
- 98% to 100%

Measurement Gases (Typical)

- H_2 in N_2, air, O_2 or CO_2
- He in N_2 or air
- CO_2 in N_2 or air
- SO_2 in air
- Argon in N_2 or air
- H_2/CO_2/air for hydrogen-cooled generators

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

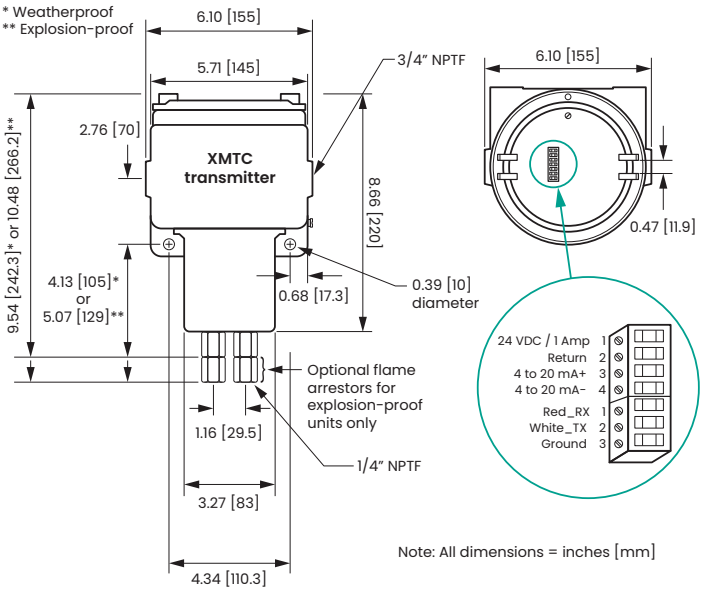
4 to 20 mA isolated, 800 Ω maximum load, field-programmable

Power

24 VDC ±2 VDC, 1.2 A maximum

Temperature

- Standard: 131°F (55°C)
- Optional: 158°F (70°C)



Note: All dimensions = inches [mm]

XMTC specifications

Physical

Sensor wetted materials

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

Dimensions

- Weatherproof unit (h x diameter): 9.53 x 5.71 in. (242 x 145 mm)
- Explosion-proof unit (h x diameter): 10.47 x 5.7 in. (266 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: Class I Div. 1 Groups A, B, C & D
  Class II, III Div. 1 Groups E, F & G
  Tamb 65°C T5 Type 4X
- Flameproof:
  IECEX/ATEX
  II 2 G Ex d IIC T6 Gb
  IP66 -20°C < Tamb < +65°C
  All conduit entries 3/4" NPT
- CE: EMC 2004/108/EC

European compliance

Complies with EMC Directive 2004/108/EEC

NEC/CSA

- Class I, Div I, Groups A, B, C and D;
- Class II, Div I, Groups E, F and G;
- Class III; Enclosure Type 4X
- FM

Order and calibration information

XMTC Thermal Conductivity Transmitter

Measuring Cell Package

1	Weatherproof two port sealed reference CPVC cell
2	Explosion-proof two port sealed reference CPVC cell
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)
X	No enclosure, two-port, sealed reference CPVC cell (spare)
Y	No Enclosure, four port , sealed reference CPVC cell (spare)

CE Compliance

2	4 to 20 mA
C	CE Compliant

Calibration Label for Explosion-proof Options

1	T6 Rating for Ambient Temperatures Up to 65°C

Materials

1	316 stainless steel
2	Hastelloy/C276 /Chemraz O Rings
3	316 Stainless Steel / Chemraz O Rings

XMTC – __ __ __ __ *[Use this number to order product]*

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%	D	98% to 100%
		E	95% to 100%
		S	Special

Calibration Gases

1	H_2 in N_2
2	CO_2 in N_2 (minimum range 0% to 20% CO_2)
3	CO_2 in air (minimum range 0% to 20% CO_2)
4	He in N_2
5	He in air
6	Calibration for hydrogen-cooled generators, H_2/CO_2/air
7	CH_4 in CO_2 (min range 0% to 10% CH_4)
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

Calibration Special

0	none
1	Ambient temperature compensation
2	Special

XMTC-Cal __ __ __ __ __ *[Use this number to order product]*

Note: Binary or pseudobinary gas composition must total 100%.

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