

# T5000

## PC-Programmable Temperature Transmitter with Display

September 2000

Data Sheet 3.75

### Description

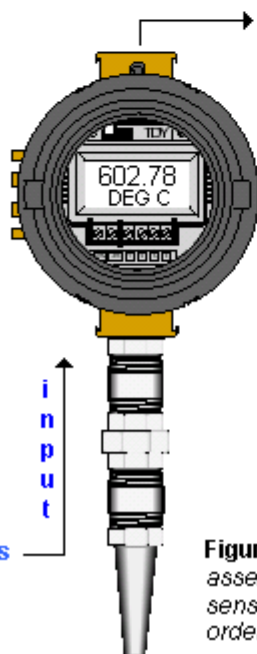
Thermometrics universal T5000 PC-Programmable Temperature Transmitter features a large integral display that shows real-time process status and valuable loop diagnostic information. Combining smart digital technology with advanced analog operation, the T5000 delivers superior reliability, accuracy, and ease of use.

The 2-wire (loop-powered) T5000 programs in a minute or less to accept direct inputs from:

- **22 RTD Types**  
(2-, 3-, and 4-wire; Pt, Cu and Ni; 10 to 1000Ω.)
- **9 Thermocouple Types**  
(J, K, E, T, R, S, B, N, and C)
- **Direct Millivolt Sources**  
(-50 to 1000mV).
- **Resistance & Potentiometer Devices**  
(0 to 4000Ω).

The T5000 converts the input to an accurate 4-20mA output that is both linear and input scaleable—ready to interface to readout instruments, recorders, DCS's, and other computer-based SCADA systems.

Complete  
Read to Install  
Temperature  
Assemblies  
Available



Isolated, Scaleable  
4-20mA Output

RTD  
Thermocouples  
Millivolts  
Resistance  
Potentiometer

**Figure 1.** Our ready-to-install T5000 temperature assemblies include your choice of enclosure, sensor, thermowell, and fittings in one easy-to-order package.



Available in a variety of mounting styles, the T5000 installs quickly and easily on a pipe or surface in the field, or on DIN rail and relay track in an multi-unit enclosure or cabinet.

- **Exceptional accuracy.** The T5000 provides the highest accuracy (up to  $\pm 0.05^{\circ}\text{C}$ ) for your critical process applications.
- **Easy-to-read, customizable display.** The T5000 large display features alphanumeric characters that can be read easily in the field. It can be customized to display the input, output, or toggle between both.
- **Auto decimal point.** The T5000 makes the most of its display area by automatically adjusting the decimal point in response to the number of digits required to represent the process variable being measured.
- **Sets up in a minute or less.** The ideal universal plant standard, our T5000 offers dozens of input, output, and operation choices, and still configures fast from a single software window.
- **Fast measurement cycle.** Delivering output updates at least 8 times per second, these transmitters are twice as fast as comparable microprocessor-based instruments.

Certifications



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### Universal Solution

With the T5000, there's no need to specify and stock an array of single-function instruments. It's the perfect solution:

- Simplify gathering information in the field or control room with its large, easy-to-read display.
- Convert RTD, T/C, mV, and Ohm signals to the linear 4-20mA needed by an indicator, recorder, PC, PLC, DCS, or similar SCADA system.
- Customize linearization to easily process inputs in non-linear, millivolt input applications.
- Trim input readings directly from sensors to achieve maximum relative accuracy and match performance characteristics with your already installed hardware.
- Convert signals from weak, low-level signals that allow inaccuracies from plant noise to stable, high-level signals that can withstand long-distance transmission through a noisy plant.
- Use true 4-wire RTD inputs to eliminate signal inaccuracies resulting from inevitable lead wire resistance imbalances.
- Increase DCS accuracy by using transmitters calibrated to a specific temperature range in place of direct DCS inputs that are only capable of measuring readings over the entire range of a sensor.
- Reduce installation costs by replacing expensive and fragile sensor wire runs and costly DCS input cards.
- Compensate for erratic input signals with programmable damping values.

### Total Sensor Diagnostics

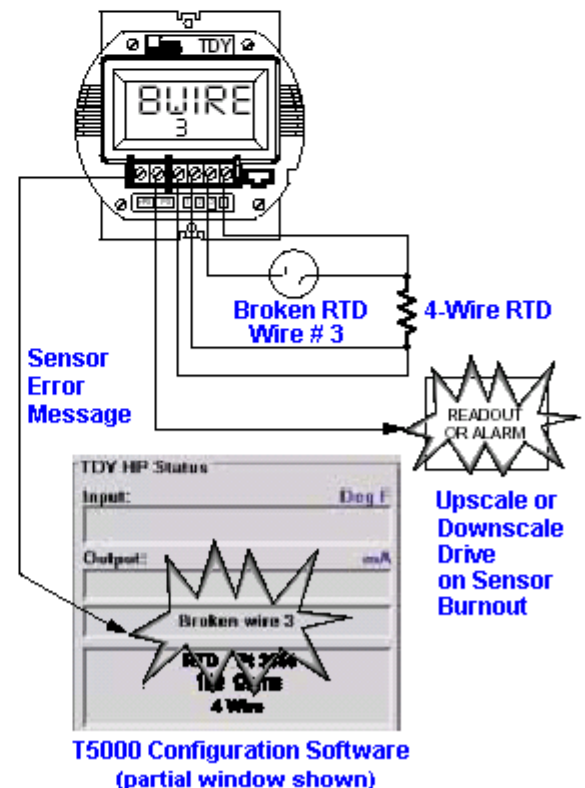
Our programmable transmitters perform continuous sensor diagnosis. This feature can save you from the costly problems of lost production time and hours of troubleshooting by identifying the type and location of the problem.

### Monitors Sensor During Operation

If a RTD wire breaks or otherwise stops sending a signal during operation, the transmitter sends the output upscale or downscale (your choice) to warn of trouble.

The T5000 instantly displays the type and location of the error. This helps you quickly diagnose the problem. If you do need additional help, our transmitters go even further! When the PC is connected to the T5000 loop and an error occurs, the configuration software will display a detailed, plain-English error message.

Figure 2. Total Sensor Diagnostics saves troubleshooting time.





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September 2000

Data Sheet 3.75

**Intelligent Configuration Software**

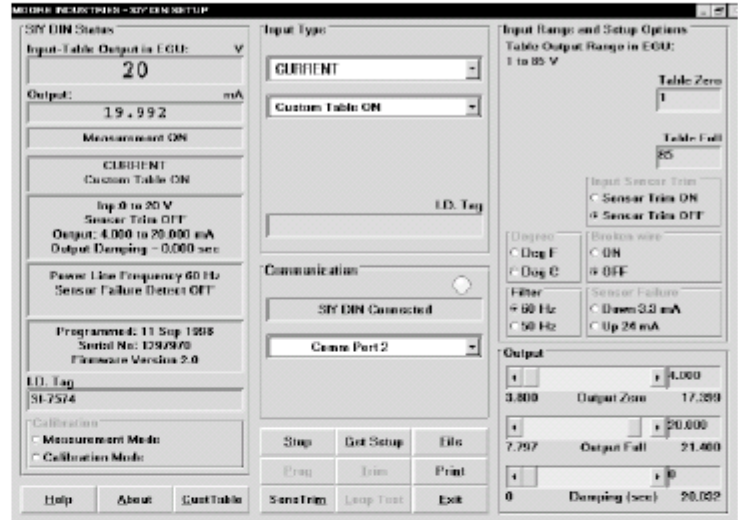
Configuring the TRY & TRX is as simple as point-and-click. Improved linearization and trimming capabilities make it an even more valuable tool.

All you need is a PC running Windows (v3.1 or '95), our TRY/TRX Configuration Software, and a Configuration Cable (software and cable supplied with each order).

In minutes, you can begin configuring your transmitter:

- Input type and range (zero and full scale).
- 4-20mA output range (zero and full scale).
- Reference junction compensation or no reference junction compensation for T/C inputs.
- Linearization or no linearization.
- Temperature readout in °F or °C.
- 50Hz or 60Hz noise rejection.
- Broken wire detection ON or OFF for calibration.
- Upscale or downscale on sensor burnout.
- Custom instrument tag (up to 40 characters) and instrument serial number.
- Custom Input Linearization,(up to 85 points).
- Custom Input Trimming to Actual Sensors.
- Loop Test Fixed Output for Easy Calibration of other instruments in the Loop.
- Damping Time for Erratic Signal Compensation (0-5 seconds).

Figure 3. All operating parameters can be set, and then viewed, on a single software screen.



**Digital Trimming Enhances Accuracy**

A single click of the mouse "captures" the actual sensor input zero or full scale. Scaling values can be entered directly from the PC. Using the on-screen adjustments for output, Zero Scale can be set between 3.800 and 17.400 milliamps. Full Scale can go from 7.800 to 21.400 milliamps.

**Precise Input Capturing**

The TDY Configuration Software will capture the upper and lower range of the sensor with just a click of a mouse. With this advanced technology, greater measurement accuracy is less than a minute away!

**Custom Tables Ease Linearization Problems**

Unusual inputs are no problem for the TDY. Not when it is so easy to use the Configuration Program's straight-forward interface to build a custom, 85-point linearization table.

**Output Damping Ensures Stable Output**

If your sensor is prone to step increments and decrements, use the TDY to lessen the impact on your process. Program a damping value from 0 to 5 seconds, averaging out sensor fluctuations over time and lessening the impact of step changes.



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September 2000

Data Sheet 3.75

### Specifications

**Input Accuracy:**

Refer to Table 1.

**Output Accuracy:**

± 0.03% of input span setting + Input Accuracy.

**Reference Junction Compensation Accuracy:**

± 0.45°C.

**Stability:**

T/C inputs 0.13% of max. span for 2

years; RTD inputs 0.14% of max. span

for 2 years.

**Isolation:**

500VAC/1000VDC input to output to case.

**Measurement Cycle:**

Output updates at least 8 times per

second.

**Output Response:**

256msec, typical, 300msec, max. for

output to change from 10% to 90% of

its scale for an input step change of

0% to 100%.

**Ripple:**

≤10mV peak to peak, maximum.

**Power Supply and Load Effect:**

Negligible within power and load limits.

**Over-Voltage Protection:**

4V max., on Input;

48V max., on Output;

48V Reverse Polarity protection on output.

**Output Current Limiting:**

24mA for Input Over range.

**Load Capability:**

583Ω @ 24V, typical;

$$\Omega = \frac{(\text{Supply Voltage} - 10V)}{0.024A}$$

0.024A

**Burnout Protection:**

Total Sensor Diagnostics user-selected

via Windows configuration software;

Upscale to 24mA or Downscale to 3.3

mA.

**T/C Input Impedance:**

40MΩ, nominal.

**RTD Excitation:**

250μA, ±10%.

**RTD Lead Wire**

**Resistance Maximum:**

RTD resistance + 2 times the lead wire

resistance must be less than 4000Ω;

Recommended < 35Ω per wire for 3-

wire inputs; < 5Ω per wire for 10Ω Cu

inputs.

**Display Type:**

LCD; Top Row, 10.16mm (0.4 inch)

high black digits on a reflective

background; Bottom Row, 5.72mm

(0.225 inch) high black digits on a

reflective background.

**Format:**

Two rows of five alphanumeric characters

**Decimal Points:**

Automatically adjusting decimal point

with a two decimal place maximum

(Analog output display is always two

decimal places) Range: -99999 to 99999.

**Minimum Display Span:**

1.00

**Operating and Storage Range:**

Transmitter, -40°C to 85°C (-40°F to 185°F)

Display, -20°C to 65°C (-4°F to 149°F).

**Relative Humidity:**

0-95%, non-condensing.

**Effect of Ambient Temperature on Accuracy:**

±0.015% of span per °C change, max

(+0.001% of Ω reading for RTD inputs).

**Effect of Ambient Temperature on Reference Junction Compensation:**

Ambient Conditions:

±0.015°C/°C change.

**RFI/EMI Immunity:**

20V/m @ 20-1000MHz, 1K AM @ 80%

when tested according to IEC 1000-4-3-

1995 with less than 0.5% error of

maximum span.

**Common Mode Rejection:**

100dB, min., @ 50/60Hz

**Normal Mode Rejection:**

70dB, typical, @ 0.2V

peak-to-peak, 50/60Hz

**Adjustments:**

All settings made using Windows-based

configuration program, then stored in

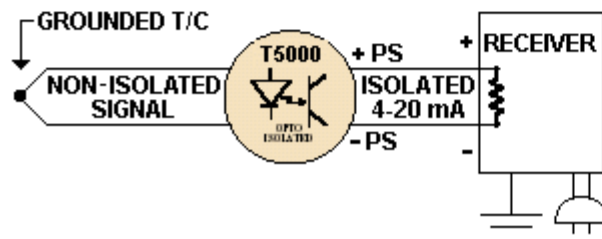
non-volatile memory.

**Weight:**

HP-style housing: 178g (6.3 oz)

BH housing: 1.5 kg (3.3 lbs)

D2LC housing: 688g (1 lb, 8.3 oz)





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## Ordering Information

Unit	Input	Output	Power	Options	Housing
<b>T5000</b> PC-Program- mable Isolator / Converter with Display.	<b>PRG</b> Programmable with supplied Configuration Software.	<b>4-20mA</b> User scaleable with supplied software.	<b>10-42DC</b> <b>10-30DC</b> for - ISF, - ISE, and - NE options.	- ISF FM approved IS - ISE ATEX IS approved  - NE ATEX Type N approved with BH.	<b>BH2NG</b> 2-Hub, explosion-proof enclosure with two, 1/2 inch NPT entry ports and a glass cover. <b>BH3NG</b> 3-Hub, explosion-proof enclosure with three, 1/2 inch NPT entry ports and a glass cover. <b>D1LC</b> 1-Hub, low base, clear cover, NEMA 4X (IP66) <b>D2LC</b> 2-Hub, low base, clear cover, NEMA 4X (IP66) enclosure <b>HP</b> Hockey puck housing and spring clips. <b>DN</b> Snap-in mounting for HP case on TS-32 DIN rail. <b>FL</b> Mounting flanges on HP suitable for relay track or screw Mounting. <b>FLD</b> Mounting flanges on HP suitable for 3/4" relay track or screw mounting.

To order, specify: Unit / Input / Output / Power [Housing]  
 Model Number Example: T5000 / PRG / 4-20 mA / 10-42DC [BH2NG]

### Certifications



**Factory Mutual Research (FMR) - FM Global  
 HP in BH Housing [BH2NGP]  
 Explosion Proof\***

Class I, Division 1, Groups A\*, B, C, D.

**Dust Ignition-Proof**

Class II & III, Division 1, Groups E, F, G.

**NEMA 4X; IP66; T6 @ 60°C Max. Op. Amb.**

**TDY HP Unit**

**Intrinsically Safe**

Class I, II, III, Division 1, Groups A, B, C, D.

**Non-Incendive -**

Class I, Division 2, Groups A, B, C, D.

Suitable For: Class II, Division 2, Groups F & G.

Class III, Division 2

T4A @ 60°C Max. Amb. T5A @ 40°C Max. Amb.

**Canadian Standards Association (CSA)**

**General (Ordinary) Locations**

**Intrinsically Safe - [HP]**

Class I, Division 1 & 2, Groups A, B, C, D.

T4A @ 60°C Max. Amb. T5A @ 40°C Max. Amb.

**European Approvals by HSE-EECS / BASEEFA:**

**CENELEC / ATEX Directive 94/9/EC**

**Intrinsically Safe** Ⓢ II IG EEx ia IIC T4

**Type N** [BH2MSP] - Ⓢ II 3G EEx nA II T4

T4 @ T<sub>amb</sub> Range: -40°C ≤ T<sub>amb</sub> ≤ + 60°C

**Flame-Proof** [BH2MGE] Ⓢ II 2GD EEx d IIB+H2

T6 @ T<sub>amb</sub> Range: -40°C ≤ T<sub>amb</sub> ≤ + 60°C

**CE Conformant** - EMC Directive 89/336/EEC

EN 50081-2, 1993 and EN 50082-2, 1995.



\* Group "A" only: seal all conduits within 18".





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**Table 1. Input Types, Ranges, Minimum Span and Maximum Range Specifications, and Accuracy of the T5000**

Input	Type	$\alpha^*$	$\Omega$	Conformance Range	Minimum Span	Input Accuracy	Maximum Range
RTD 2, 3, 4 Wire	Platinum	0.00375	1000	- 50 to 500°C - 58 to 932°F	15°C (27°F) for 100Ω inputs	± 0.11°C (± 0.20°F)	-100 to 560°C -148 to 1040°F
		0.003850	100, 200, 300 400, 500, 1000	-200 to 850°C -328 to 1562°F		± 0.21°C (± 0.38°F)	-240 to 960°C -400 to 1760°F
		0.003902	100, 200, 400 500, 1000	-100 to 650°C -148 to 1202°F		± 0.15°C (± 0.27°F)	-150 to 720°C -238 to 1328°F
		0.003911	100, 500	-200 to 630°C -328 to 1166°F	10°C (18°F) for 200Ω inputs	± 0.17°C (± 0.31°F)	-235 to 710°C -391 to 1310°F
		0.003916	100	-200 to 510°C -328 to 950°F		± 0.14°C (± 0.25°F)	-240 to 580°C -400 to 1076°F
		0.003923	98.129	-200 to 600°C -328 to 1112°F	7.5°C (13.5°F) for 500Ω & 1000Ω inputs	± 0.16°C (± 0.29°F)	-235 to 680°C -391 to 1256°F
		0.003926	100, 470, 500	-200 to 630°C -328 to 1166°F		± 0.17°C (± 0.31°F)	-235 to 710°C -391 to 1310°F
		0.003828	100	-200 to 850°C -328 to 1562°F		± 0.21°C (± 0.38°F)	-260 to 962°C -436 to 1763°F
	Nickel	0.006720	120	- 80 to 320°C -112 to 608°F	10°C (18°F)	± 0.16°C (± 0.29°F)	-100 to 360°C -148 to 680°F
Copper	0.004720	9.035	- 50 to 250°C - 58 to 482°F	100°C (180°F)	± 1.20°C (± 2.16°F)	- 65 to 280°C - 85 to 536°F	
Ω	Direct Resistance or Potentiometer	n/a	n/a	0-4000Ω	30Ω	± 0.4Ω	n/a
T/C	J	n/a	n/a	-180 to 770°C -292 to 1418°F	35°C (63°F)	± 0.28°C (± 0.50°F)	-210 to 770°C -346 to 1418°F
	K	n/a	n/a	-150 to 1372°C -238 to 2501°F	40°C (72°F)	± 0.30°C (± 0.54°F)	-270 to 1390°C -454 to 2534°F
	E	n/a	n/a	-170 to 1000°C -274 to 1832°F	35°C (63°F)	± 0.26°C (± 0.47°F)	-270 to 1013°C -454 to 1855°F
	T	n/a	n/a	-200 to 400°C -328 to 752°F	20°C (36°F)	± 0.24°C (± 0.43°F)	-270 to 407°C -454 to 764°F
	R	n/a	n/a	0 to 1768°C 32 to 3214°F	50°C (90°F)	± 0.71°C (± 1.28°F)	- 50 to 1786°C - 58 to 3246°F
	S	n/a	n/a	400 to 1820°C 752 to 3308°F	50°C (90°F)	± 0.71°C (± 1.28°F)	- 50 to 1786°C - 58 to 3246°F
	B	n/a	n/a	-130 to 1300°C -202 to 2372°F	75°C (135°F)	± 0.43°C (± 0.77°F)	-200 to 1836°C -392 to 3336°F
	N	n/a	n/a	0 to 1768°C 32 to 3214°F	45°C (81°F)	± 1.33°C (± 2.39°F)	-270 to 1316°C -454 to 2400°F
	C	n/a	n/a	0 to 2315°C 32 to 4199°F	100°C (180°F)	± 1.16°C (± 2.09°F)	- 0 to 2338°C - 32 to 4240°F
mV	DC	n/a	n/a	-50 to 1000mV	4mV	± 0.04mV	-50 to 1000mV



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Figure 5. Dimensions of the T5000 HP housing with mounting flanges.

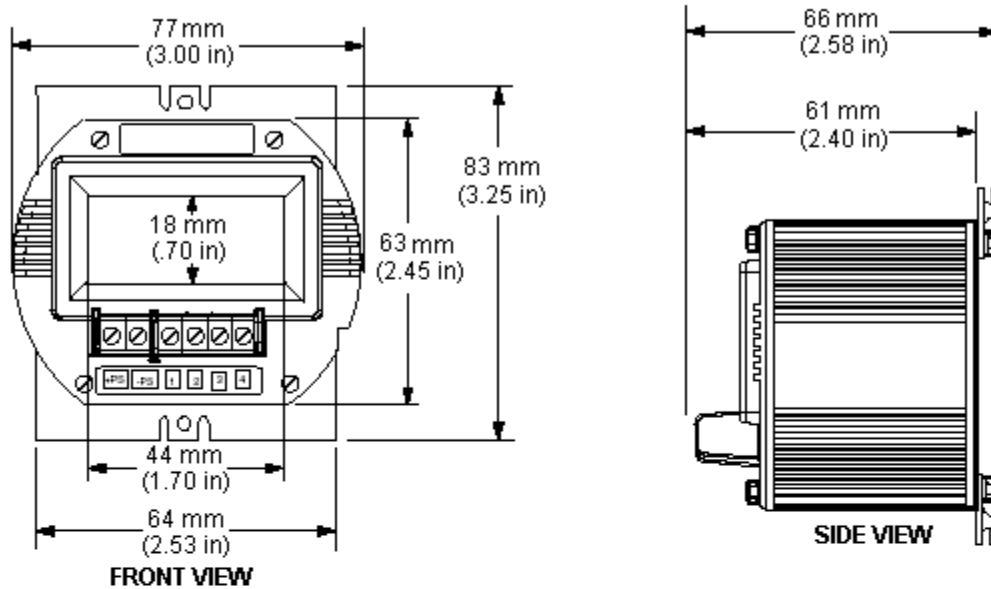
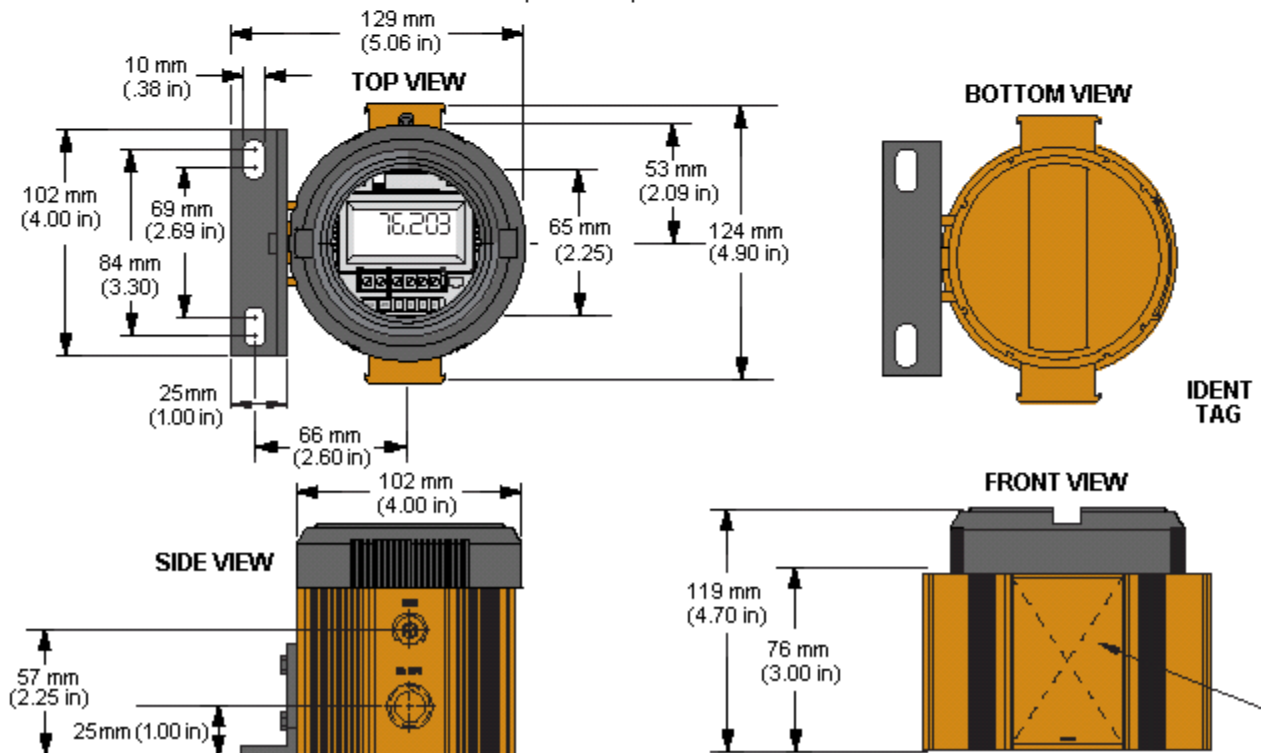


Figure 6. Dimensions of the T5000 with the BH explosion-proof enclosure.



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Figure 7. Dimensions of the T5000 in D-Box housing.

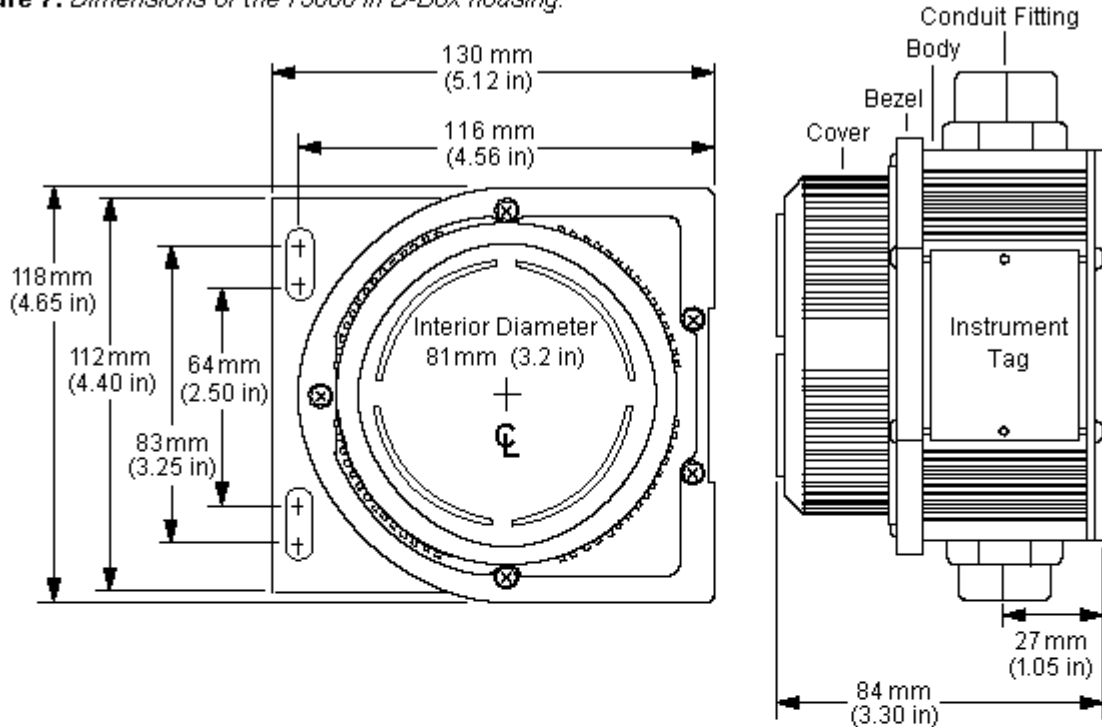


Figure 8. Sensor connections for the T5000

