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T3000 & T4000

PC-Programmable Temperature Transmitters

Long Term Stability

September 2001 **Data Sheet 3.95**

Description

Thermometrics PC-Programmable Temperature Transmitters—the T3000 (non-isolated) & T4000 (isolated)—combine smart digital technology with advanced analog operation to deliver superior reliability, accuracy, and ease of use.

Now with even more flexible capabilities, these 2-wire (loop-powered) analog/digital hybrid transmitters program in a minute or less to accept direct inputs from:

- **23 RTD Types**
(2-, 3-, and 4-wire; Pt, Cu and Ni; 10 to 1000Ω.

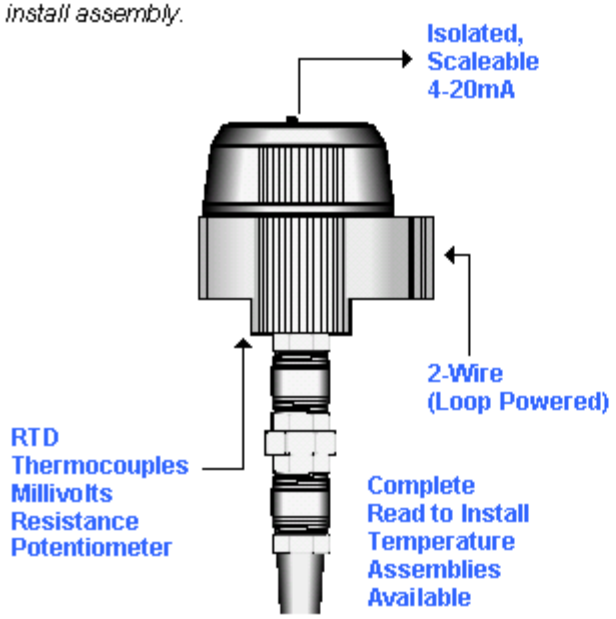
- **9 Thermocouple Types**
(J, K, E, T, R, S, B, N, and C).

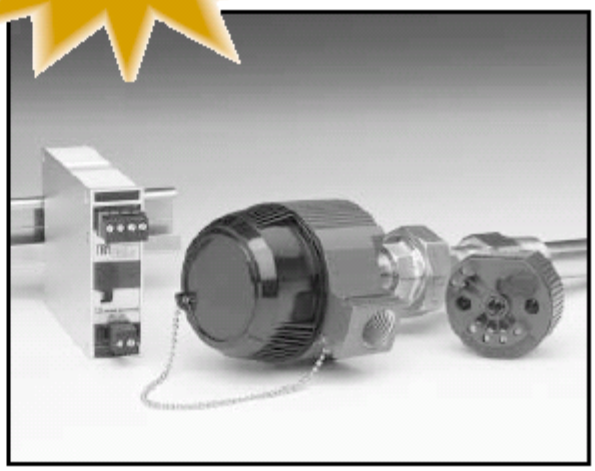
- **Direct Millivolt Sources**
(–50 to 1000mV).

- **Resistance & Potentiometer Devices**
(0 to 4000Ω).

They convert the input to a highly accurate 4-20mA output that is both linear and scaleable with respect to the input—ready for direct interface with readout instruments, recorders, DCSs, and other computer based SCADA systems.

Figure 1. *Compact yet powerful, the 2-wire* T3000 *and* T4000 *transmitters afford full programmability in a rugged, ready-to install assembly.*





Available in a variety of housing styles, *the T3000 & T4000 are ready to install in the control room, in existing hardware, or in their own, complete temperature assembly.*

Features

- **Universal plant standard.** No need to specify and stock fixed range transmitters as spares. The T3000 and T4000 provide programmable input type and output scaling.

- **PC-programmable with Windows® software.** From a single screen, you can choose, and then view to confirm, all of your application specific operating parameters from a personal computer.

- **Fast measurement cycle.** Delivering an output update up to 8 times per second, these transmitters are twice as fast as comparable microprocessor-based instruments.

- **Enhanced configuration software.** Now trim input sensor readings, and customize input linearization curves for even greater accuracy. Program output damping to compensate for erratic sensor readings. Use the Configuration Program to calibrate other loop instruments with its innovative Loop Test function.

Certifications

FM APPROVED SAA CE

*** All product names are trademarks of their respective companies.**

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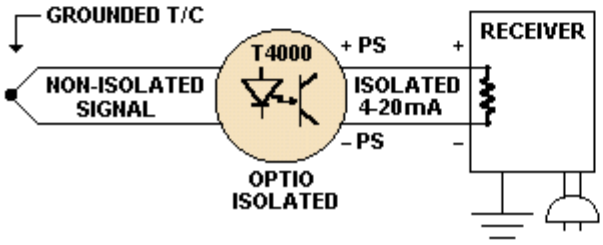
Universal Solution

With the T3000 & T4000, there's no need to specify and stock an array of single-function instruments. They are the perfect solution:

- 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.
- Easily customize linearization to process inputs in non-linear, millivolt input applications.
- Trim input readings directly from sensors to achieve maximum relative accuracy. Match performance characteristics with your already installed hardware.
- Avoid inaccuracies that result from transmitting "weak", low-level sensor signals through a noisy plant by converting them to stable, high level signals that can withstand long-distance transmission.
- Use true, 4-wire RTD inputs to eliminate signal inaccuracies that result 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 & fragile sensor wire runs and costly DCS input cards.
- Compensate for erratic input signals with programmable damping values.

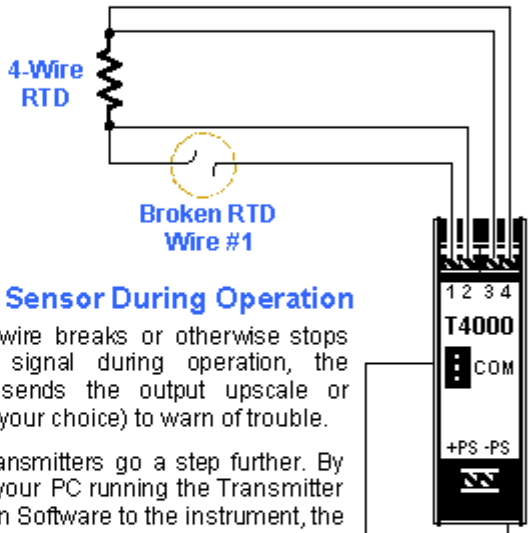
Figure 2. *The T4000 delivers complete isolation to stop ground loops from affecting signal accuracy.*



Total Sensor Diagnostics

Our programmable transmitters perform continuous sensor diagnoses. This industry-first, and patented, feature may save you thousands in production costs, and hours of troubleshooting time, by letting you know when a problem occurs, and its type and location.

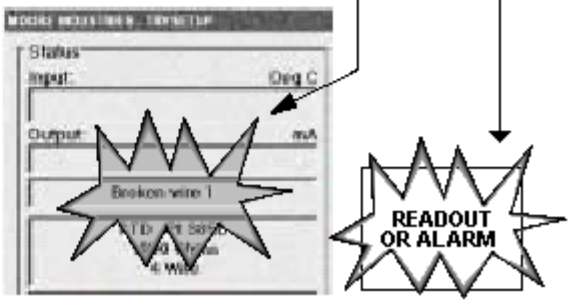
Figure 1. *Total Sensor Diagnostics saves troubleshooting time.*



Monitors Sensor During Operation

If an 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.

Then our transmitters go a step further. By connecting your PC running the Transmitter Configuration Software to the instrument, the RTD wire (s) causing the problem are identified via a plain-English error message on the software window. Specific error messages eliminate the work of removing the sensor or checking all lead wires to diagnose a problem. This advantage is especially valuable during startup.



T3000, T4000
Configuration Software
(partial window shown)

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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:
Error is in % of conformance range.

Stability	Input to Output		
	1yr	3yrs	5ys
T/C, mV	0.11	0.18	0.24
RTD OHM Pot	0.13	0.22	0.28

Isolation:
For T4000 in HPP housing, 1500 Vrms input to output; For T4000 in DIN housing, 500 Vrms input to output case.
Measurement Cycle:
Output updates 8 times per second.
Output Response:
256 msec, max, for output to reach full scale in response to a 10-90% step change on input.
Linearity:
0.1% of span, within rated ranges.

Ripple: 10 mV peak to peak, max.
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.
Load Capability:
500 Ω @ 24V, typical:
TRYΩ = (Supply Voltage -10V) ÷ 0.024A:
TRXΩ = (Supply Voltage - 8V) ÷ 0.024A:
Burnout Protection:
Total Sensor Diagnostics user selected via Windows configuration software; Upscale to 24mA or Downscale to 3.3mA.
Output Current Limiting:
21.4 mA for Input Over-Range; 23.6 mA for sensor failure or broken wire.
T/C Input Impedance:
40M Ω, nominal.
RTD Excitation:
250µA, ± 10%.
RTD Lead Wire Resistance Maximum:
RTD resistance + 2 times the lead wire resistance must be less than 4000 Ω; Recommend <35 Ω per wire for 3-wire RTD inputs; <5 Ω per wire for 10 Ω Cu inputs.

Operating and Storage Range:
-40°C to + 85°C (-40°F to + 185°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:
± 0.015% °C / °C change.
RFI / EMI Immunity:
20V/m @ 20-1000MHz, when tested according to SAMA standard 33.1 (10V/m @ 80-1000MHz, 1K AM, when tested according to IEC 1000-4-3-1995).
Common Mode Rejection:
100dB, min, @ 50/60Hz.
Normal Mode Rejection:
100dB, typical, @ 1V peak-to-peak, 50/60Hz.
Adjustments:
All settings made using Windows-based configuration program, then stored in non-volatile memory.
Weight:
Hpp-style housing: 65g (2.3 oz).
DIN-style housing: 184g (6.5 oz).
LH housing styles: 549g (19.4 oz).

FM APPROVED

Factory Mutual Research Corporation (FMRC)
Intrinsically Safe – HPP:
Class I, II, III, Division 1, Groups A, B, C, D, E, F, G.
Non-Incendive – HPP:
Class I, Division 2, Groups A, B, C, D.
Suitable for:
Class II, Division 2, Groups F and G.
Class III, Division 2
Explosion-Proof‡ – LH2:
Class I, Division 1, Groups A*, B, C, D.
T6; NEMA 4X; IP66
Dust Ignition-Proof‡ – LH2:
Class II and III, Division 1, Groups E, F, G.

Canadian Standards Association (CSA)
Intrinsically Safe – HPP:
Class I, Divison 1, Groups A, B, C, D.
Non-Incendive – HPP:
Class I, Division 2, Groups A, B, C, D.
General (Ordinary) Location – DIN/HPP

Ex

European Approvals by:
EECS/BASEEFA – LH:
Type N: Ex N IIC; T6 @ 40°C ambient.

Ex

KEMA/CENELEC Approved Intrinsically Safe – HPP:
EEx ia IIC; T4@60°C ambient/T5 @40°C ambient.

ISSeP/ATEX Approved Flameproof Apparatus – HPP:
LH2 II 2GD EEx d IIC T6, IP66.

SAA

Standards Association of Australia (SAA) Intrinsically Safe
HPP: EEx ia IIC; T4@60°C ambient / T5@40°C ambient.

Ex NEPSI

NEPSI-China Intrinsically Safe – HPP:
Ex ia IIC; T4@ 60°C ambient/T5@ 40°C ambient.

CE

CE Conformant – EMC Directive 89/336/EEC
EN 50081-2, 1993 and EN 50082-2, 1995.

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T3000 & T4000

PC-Programmable Temperature Transmitters

September 2001 **Data Sheet 3.95**

Ordering Information

Unit	Input	Output	Power	Options	Housing
T4000 Isolated, PC-Programmable Temperature Transmitter.	**PRG** Programmable with supplied Configuration Software (see Table 1 for descriptions of available input types; Factory Configuration available).	**4-20MA** User scaleable with supplied software.	**10-42DC** **10-30DC** Required for -ISA, ISC, ISCN, ISE, ISF, and NE options.	**-ISA** SAA approved intrinsically safe(IS) (HPP) -ISC CSA approved IS (HPP) -ISCN NEPSI approved IS (HPP) -ISE CENELEC approved IS (HPP) **-ISF** FM approved IS (HPP) **-NE** BASEEFA approved Type N with L100 (HPP)	**DIN** DIN-style aluminum housing mounts on 32mm G-type (EN50035) and 35mm Top Hat (EN50022) rails. **HPP** Hockey-puck housing for mounting in standard connection heads. **L100NS*** Connection head (FM approved, NEMA 4X, IP66) with two entry ports: ½-inch NPT cable and process – black PBT polyester cover. **L100MS*** Connection head (FM approved, NEMA 4X, IP66) with two entry ports: M20 cable and ½-inch NPT process - black PBT polyester cover. **L100CS*** Connection head with two entry ports: M20 cable and G ½ (BSP) process - black PBT polyester cover. **L100NX** Connection head with ½ NPT entry and mounting plate for customer's air duct opening – black PBT polyester cover. **L100-2 NS*‡** Explosion-proof connection head (FM approved, Class I, Div 1, Groups A**,B,C,D; Class II, Groups E, F,G; Class III) with two entry ports: ½ inch NPT cable and process—black metal cover. **L100-2 MS*‡** Explosion-proof connection head (FM approved, Class I, Div 1, Groups A**,B,C,D; Class II, Groups E,F,G; Class III) with two entry ports: M20 cable and ½ inch NPT process – black metal cover. **CH6** Plastic connection head. **CH17** CSA & UL approved explosion-proof housing for use in Class I, Div 1, Groups A,B,C,D; Class II, Groups E,F,G; Class III
T3000 Non-Isolated, PC-Programmable Temperature Transmitter	**PRG** Programmable with supplied Configuration Software (see Table 1 for descriptions of available input tvpes; Factory Configuration available).	**4-20MA** User scaleable with supplied software.	**8-42DC** **8-30DC** Required for -ISA, -ISC, -ISCN, -ISE, -ISF, -NE options		

When Ordering, specify:
Unit / Input / Output / Power / Option(s) [Housing]

Model number example:
T3000 / PRG / 4-20MA / 10-30DC / -ISF [L100-2MSP]

NOTE:

Factory Mutual (FM) certifications apply to the transmitter (T3000 or T4000) & the L100-2 NS & L100-2 MS connection head combination ONLY.

Sensor, thermowell or fixed immersion sensor components are not included in the certifications.

NOTE:

Add "P" suffix to any L100 housing for 2-inch pipe mounting hardware. (e.g., L100NSP).

** For Group A (only) all conduits must be sealed within 18 inches.

‡ L100-2 Explosion-proof certification carries 60°C (140°F) max ambient temperature restriction.

Other connection heads, cabinets, and enclosures also available.

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T3000 & T4000

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Table 1. *Input Types, Ranges, Minimum Span & Maximum Range Specifications, & Accuracy of the T3000 & T4000*

Input	Type	α*	Ω	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	10°C (18°F)	±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		±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		±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	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. *Use the HPP style Hockey Puck Housing for Installation in Field Enclosures.*

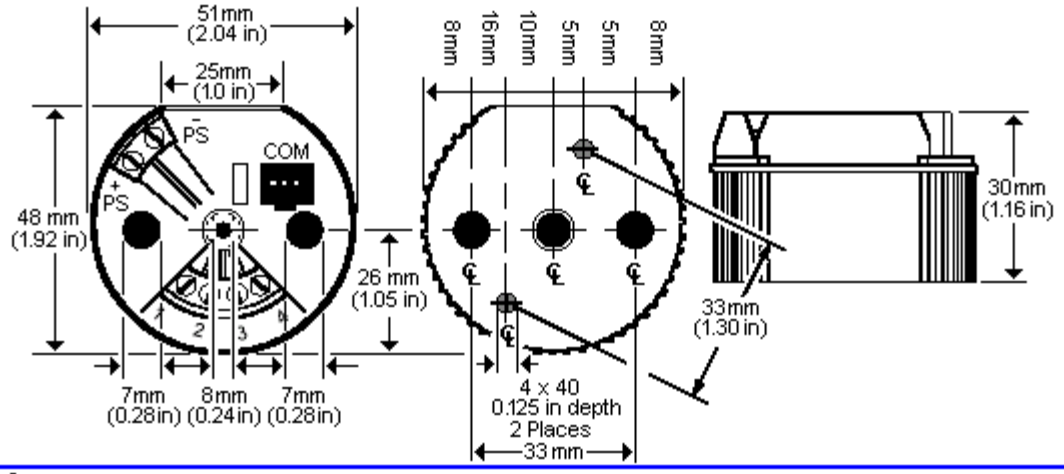

Figure 6. *The Din Style T4000 is Ideal for Control Room or Cabinet Installations.*

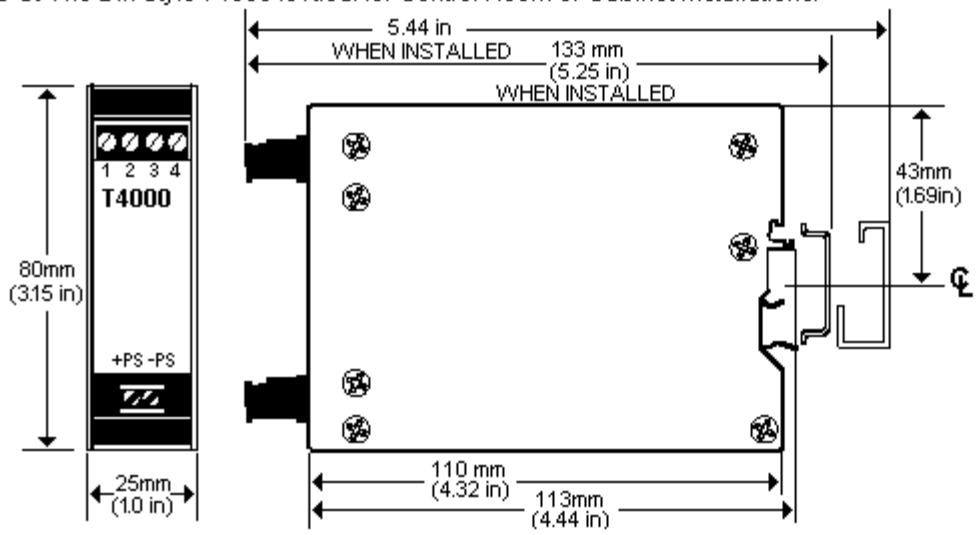

Figure 7. *Connecting the T3000 & T4000 to Input.*

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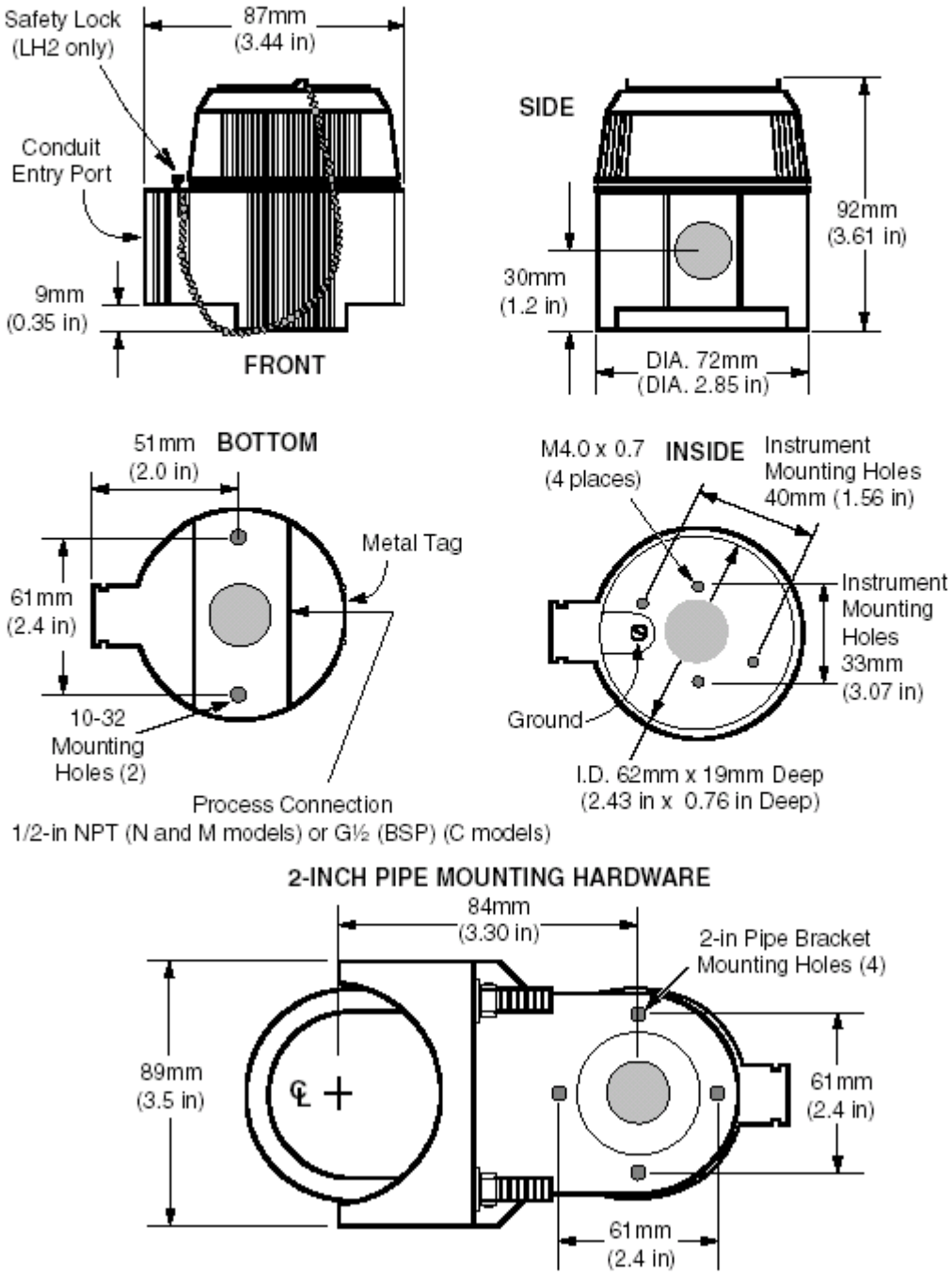
Figure 8. *The T3000 & T4000 Featured Rugged, Fully Certified, Ready to Install Housing Styles*



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