

PPT89TH Subminiature High-Temperature Pressure Transducer

Ø0.59" stainless body — ratiometric analog or I²C, 15 to 300 PSI



FEATURES

- Subminiature Ø0.59" all-stainless (SS316L) package
- Ratiometric 0.5–4.5 V analog or I²C (0x28) digital output
- Pressure ranges from 15 PSI to 300 PSI
- Gauge or Absolute pressure reference
- Accuracy 2.5% FS standard, 1% FS high-accuracy option
- Operating temperature -40 to 150 °C
- 2× FS proof, 4× FS burst pressure · IP65
- Six process connections including M6×1 and 1/8 NPT

DESCRIPTION

The PPT89TH is a subminiature pressure transducer built for OEM designs where space and media compatibility both matter. A Ø0.59" welded SS316L housing and port carry a media-isolated silicon sensing element, factory calibrated and temperature compensated, with 26 AWG tinned flying leads exiting through a sealed grommet.

Configure the output as a ratiometric 0.5–4.5 V analog signal or an I²C digital interface at address 0x28, across ranges from 15 to 300 PSI in gauge or absolute reference. Six mechanical connections and specified cable lengths make the same sensor drop into widely different assemblies.

APPLICATIONS

- Compact OEM equipment & instruments
- Pumps, compressors & hydraulic circuits
- HVAC/R and refrigerant pressure monitoring
- Water treatment & fluid handling systems
- Medical and laboratory devices
- Mobile, agriculture & construction equipment
- Embedded I²C control & monitoring nodes

MAXIMUM ENVIRONMENTAL RATINGS

Operating Temperature	-40 to 150 °C · -40-302 °F	Proof Pressure	2× full scale
Storage Temperature	-55 to 150 °C · -67-302 °F	Burst Pressure	4× full scale
Ingress Protection	IP65	Pressure Range	15 to 300 PSI

Electrical & performance specifications

PARAMETER	MIN	TYP	MAX	UNITS
Operating Temperature	-40	—	150	°C
Compensated Temperature	-15	—	125	°C
Storage Temperature	-55	—	150	°C
Supply Voltage	4.5	5.0	5.5	VDC
Supply Current	—	7	—	mA
Response Time	—	1	—	kHz
Analog Output (ratiometric)	0.5	—	4.5	V
Digital Output	—	I ² C (0x28)	—	—
Accuracy — Standard (opt. 1)	-2.5	—	+2.5	%FS
Accuracy — High (opt. 2)	-1.0	—	+1.0	%FS
Pressure Range	15	—	300	PSI
Proof Pressure	—	—	2× FS	—
Burst Pressure	—	—	4× FS	—

WIRING

Electrical connections

WIRE	ANALOG (OUTPUT 0)	DIGITAL (OUTPUT 1)
Red	V+	V+
White	Vout	SDA
Yellow	—	SCL
Black	GND	GND

CABLE ASSEMBLY

Lead construction

FEATURE	DETAIL
Conductors	26 AWG, 300 V, 105 °C
Bundle diameter	≤ .13 [3.3 mm]
Lead termination	Tinned, .25 strip length
Strain relief	Heat shrink, .75 length
Housing seal	TPE grommet
Cable length	Per part number, ±0.5"

Notes: 1) Analog output is ratiometric to the supply. 2) Analog builds ship 3 conductors, digital builds 4. 3) See the outline drawing on page 9 for cable and lead dimensions.

Package, media & installation

Package

A Ø0.59" welded assembly: an SS316L port laser-welded to an SS316L housing, with the sensing element and signal-conditioning circuit sealed inside. Overall length is 1.26" [32 mm] with the M6×1 port, excluding leads, making the PPT89TH suitable for tightly packaged OEM assemblies.

Pressure port

Six standard connections: 1/4" NPT, 1/8" NPT, 7/16-20 UNF-2A, 9/16-18 UNF-3A AN, 1/4" BSPP, and M6×1. Port length varies by connection — see the table at right. Custom fittings are available for OEM programs.

Wetted parts

Wetted components are SS316L throughout. The 7/16-20 UNF, 1/4" BSPP, and M6×1 connections seal with a silicone (VMQ) 70-durometer O-ring; NPT connections seal on thread.

PORT LENGTH (L)

MECHANICAL CONNECTION	L (IN)	L (MM)
1/4 NPT	.49	12.4
1/8 NPT	.38	9.7
7/16-20 UNF-2A	.36	9.1
9/16-18 UNF-3A AN	.80	20.3
1/4 BSPP	.51	13.0
M6×1	.37	9.4

Stability

The media-isolated silicon sensing element is factory calibrated and temperature compensated over the -15 to 125 °C compensated band. Welded stainless construction keeps mechanical stress off the element, supporting long-term stability through pressure and thermal cycling.

Media

Compatible with air, gas, water, oil, and industrial fluids that are compatible with SS316L and, where fitted, a silicone O-ring. Verify compatibility with aggressive or specialty media against the wetted materials before specifying.

Pressure ranges

Standard ranges span 15 PSI to 300 PSI in gauge or absolute reference. Intermediate and custom ranges within that span are available — specify the range code in the part number.

MARKING

Laser marking

Phoenix Sensors logo Configured part number Month, year, serial number

Marking is applied to the housing flat. Custom marking is available for OEM volumes.

Ø0.59"

Housing diameter

300

Max range PSI

150 °C

Max operating temp

6

Process connections

I²C interface

Output code 1 replaces the analog signal with an addressable I²C interface at 0x28. An internal DSP corrects the converted bridge signal and computes the temperature value for digital output. Two normal-operation modes are available — Update Rate Mode (continuous conversion at a selectable rate) and Sleep Mode (low power) — selected at the factory. The on-board EEPROM holds calibration coefficients and configuration bits and is **locked at the factory**.

PARAMETER	ANALOG (0)	I ² C (1)
Signal	0.5–4.5 V	Digital, 0x28
Conductors	3	4
Supply	4.5–5.5 VDC	4.5–5.5 VDC
Supply current (typ)	7 mA	7 mA
Response time	1 kHz	1 kHz
Ratiometric to supply	Yes	n/a

OPERATING MODES

MODE	BEHAVIOUR
Update Rate Mode	Continuous conversion at a factory-set rate. Default Update_Rate 00 (0.5 ms); slower rates cut power.
Sleep Mode	Low power — waits for a master command before measuring. See page 5.

ANALOG TRANSFER FUNCTION

$$V_{out} = 0.5 \text{ V} + 4.0 \text{ V} \times (P / FS) \times (V_{supply} / 5.0 \text{ V})$$

0.5 V = zero pressure · 4.5 V = full scale

BUS INTEGRATION

Slave address: 0x28 (7-bit) · read / write

Bus lines: SDA (white) · SCL (yellow)

Core clock 4 MHz (factory set) — 400 or 100 kHz bit rate

External pull-up resistors required on SDA and SCL

ANALOG DESIGN NOTES

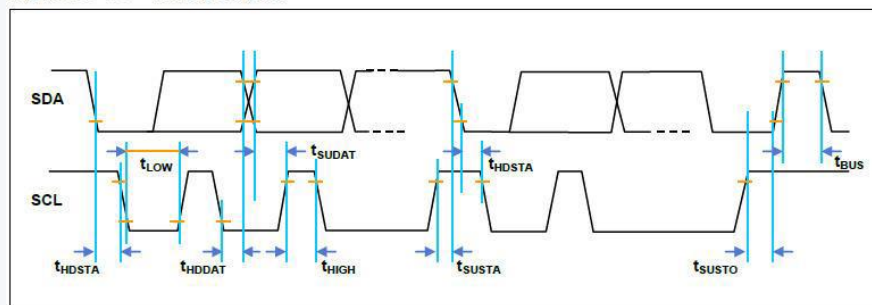
The 0.5–4.5 V output is ratiometric — measure it against the same 5 V rail that supplies the sensor, or supply error appears directly as pressure error. Keep leads short or shielded in noisy installations.

DIGITAL DESIGN NOTES

Fit external pull-ups on SDA and SCL sized for your bus capacitance and speed. Allow 10 ms after power-up before issuing any command, and never exceed 5.5 VDC on V+.

FIG. 2 · I²C TIMING DIAGRAM

Figure 2.6 I²C™ Timing Diagram



(See section 3.1 for data transmission details.)

Read & write command reference

The sensor begins A/D conversions 10 ms after power-up — **do not issue any command during start-up**. With a 4 MHz clock and the EEPROM locked, the first corrected data reaches the digital interface within 6 ms of power-on. Operation afterward depends on the factory-programmed mode — see page 4.

COMMAND	MODE	ACTION & RETURNED DATA
Read_MR	Sleep	Wakes the part and runs a full measurement cycle — temperature, auto-zero, bridge — then DSP correction. Slave address + READ bit, then master issues stop.
Write_MR	Sleep	Wakes the part and measures the bridge only, correcting with previously measured temperature and auto-zero values. Slave address + WRITE bit (0). A Read_DF is then required to fetch the result.
Read_DF2	Both	Two bytes of bridge data (2 status MSBs). Used when corrected temperature is not required.
Read_DF3	Both	Two bytes of bridge data plus one byte of temperature (8-bit accuracy). Master sends NACK + stop to terminate.
Read_DF4	Both	Four bytes: high/low bridge data plus the full corrected 11-bit temperature T[10:0]. The last 5 bits of the final byte are undetermined and must be masked in the application.
I ² C WRITE	Command	32-bit packet: address + WRITE, command byte, then a 16-bit data field. Command Mode only; supply all zeros when the command needs no data.

TABLE 2.8 • I²C PARAMETERS

PARAMETER	SYMBOL	MIN	MAX	UNITS
SCL clock frequency	f_{SCL}	100	400	kHz
Hold time, start condition	t_{HDSTA}	0.1	—	μs
Minimum SCL low / high width	t_{LOW} / t_{HIGH}	0.6	—	μs
Set-up time, start condition	t_{SUSTA}	0.1	—	μs
Hold time, data	t_{HDDAT}	0	—	μs
Set-up time, data	t_{SUDAT}	0.1	—	μs
Set-up time, stop condition	t_{SUSTO}	0.1	—	μs
Bus free time between transfers	t_{BUS}	2	—	μs

STATUS BITS & POLLING

After a valid output is read, the status bits are set to "stale," so the application can read at any time and be assured the data is no older than the selected update period. Poll no faster than 20% above the update-rate period; the four-lead I²C build has no interrupt conductor, so new data is detected by reading the status bits.

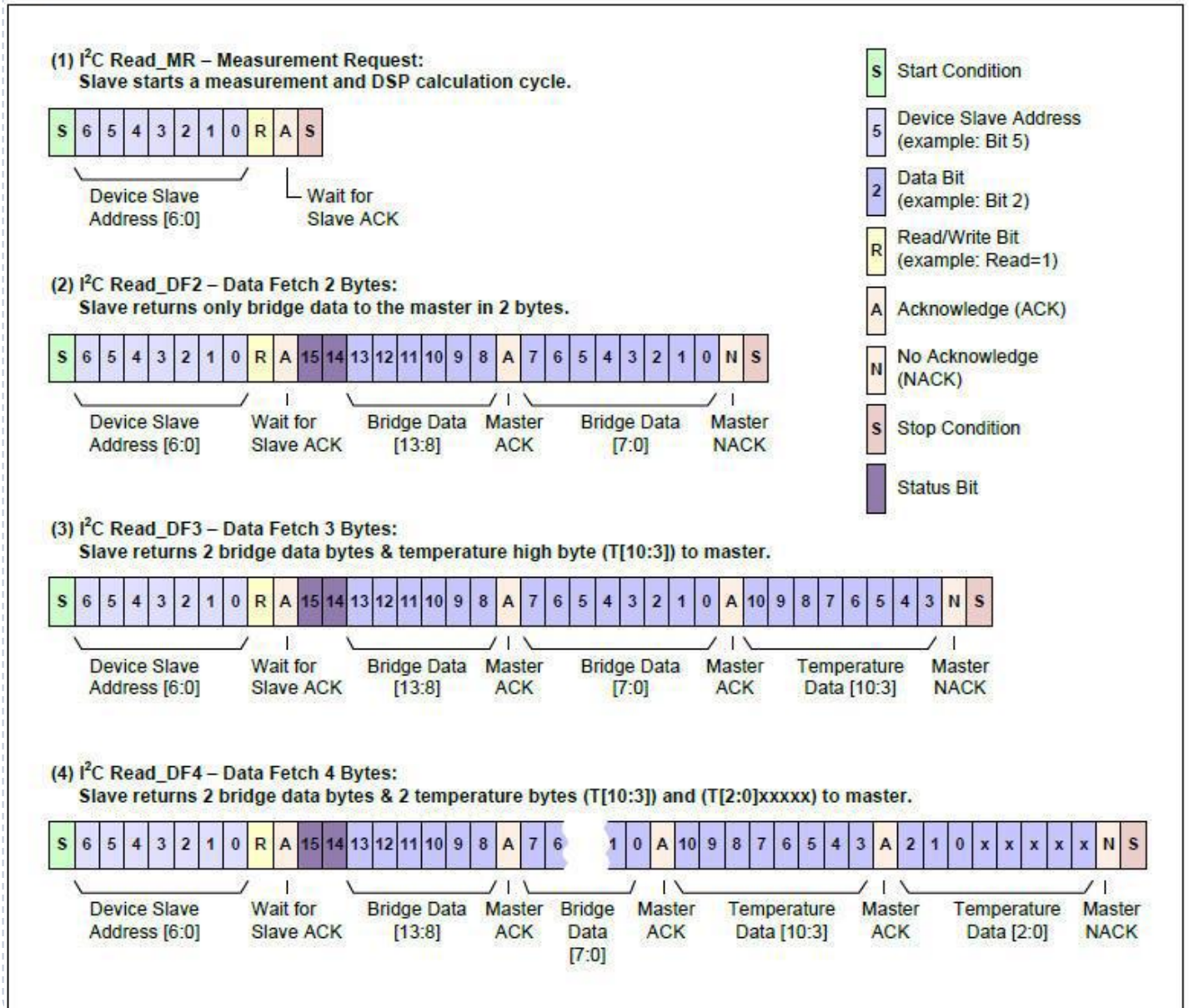
DATA VALIDITY AT POWER-ON

Data is invalid from power-on reset until the first measured value is written to the digital register. A Write_MR issued as the first command after power-on returns invalid data even though the status bits report "valid," because the correction uses uninitialised temperature and auto-zero values.

I²C read packet formats

FIG. 3 — READ OPERATIONS

Figure 3.6 I²C™ Measurement Packet Reads



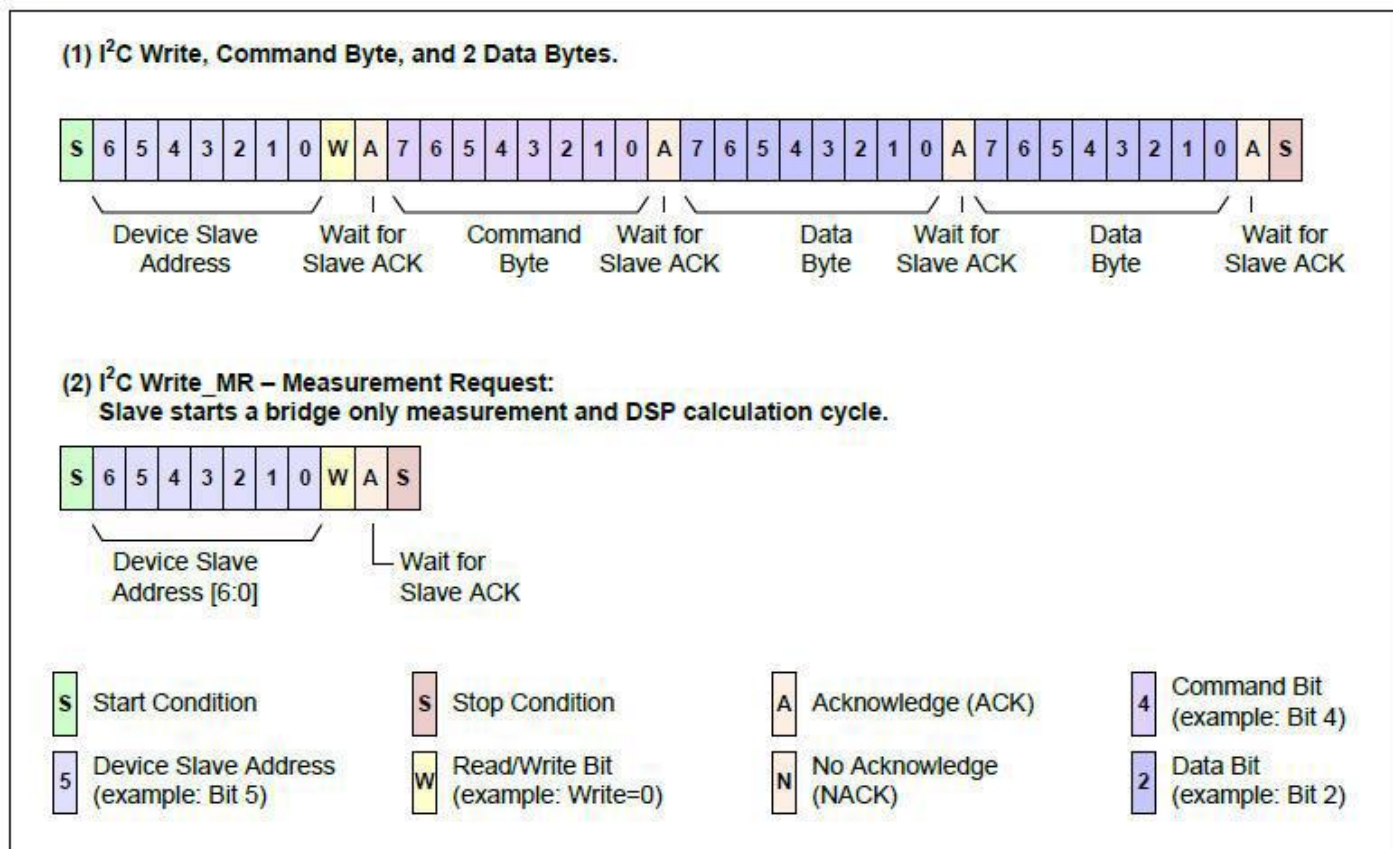
PROTOCOL DIFFERENCES VS. STANDARD I²C

1) A start-stop condition with no CLK transitions in between causes a communication error on the next transfer; send an additional start condition to restore it. 2) A restart condition — a falling SDA edge during transmission while CLK is still high — has the same effect. 3) A falling SDA edge is not allowed between the start condition and the first rising SCL edge; with an address whose first bit is 0, hold SDA low through the first bit.

I²C write packets & data format

FIG. 4 — WRITE OPERATIONS

Figure 3.9 I²C™ Measurement Packet Writes



CLOCK GENERATOR / POWER-ON RESET

An internal 4 MHz temperature-compensated oscillator provides the time base for all operations, feeding a 4:1 post-scalar. Factory default is the 4 MHz core clock; 1 MHz can be factory-selected for better resolution where fast response is not required. Factory update rate is Update_Rate 00 (0.5 ms), adjustable by request — slower rates reduce power consumption.

DATA PACKET

The full output packet is 4 bytes: high bridge byte, low bridge byte, then 11 bits of corrected temperature T[10:0] — the T[10:3] byte followed by the {T[2:0], xxxx} byte. The last 5 bits are undetermined and must be masked. Terminate after byte 2 for bridge value only, or after byte 3 for 8-bit temperature resolution.

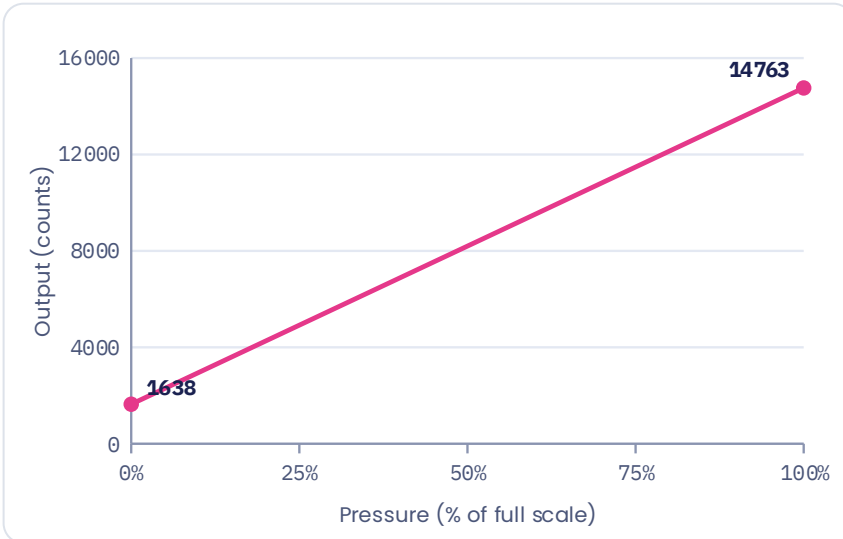
Converting raw counts to pressure and temperature — transfer functions and charts — is on page 8.

DIGITAL COMMUNICATION

Data conversion — counts to pressure & temperature

Bridge data is a 14-bit count; temperature is an 11-bit count returned by Read_DF3 / Read_DF4. Use the transfer functions below to convert raw output to engineering units. Y is the integer output value in counts.

Fig. 5 — Pressure output



PRESSURE FORMULA

$$Y = 131.25 \cdot X + 1638$$

X = pressure as % of full scale

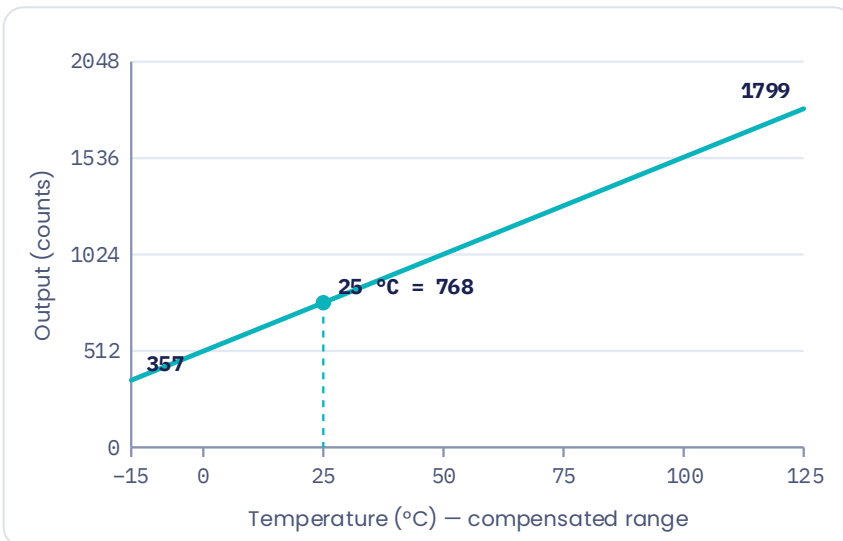
Y = 14-bit output (counts)

$$X = (Y - 1638) / 131.25$$

0% FS ≈ 1638 counts 100% FS ≈ 14763 counts

Offset tolerance ±125 counts

Fig. 6 — Temperature output



TEMPERATURE FORMULA

$$Y = 10.3 \cdot X + 511$$

X = temperature in °C

Y = 11-bit output (counts)

$$X = (Y - 511) / 10.3$$

25 °C = 768 counts

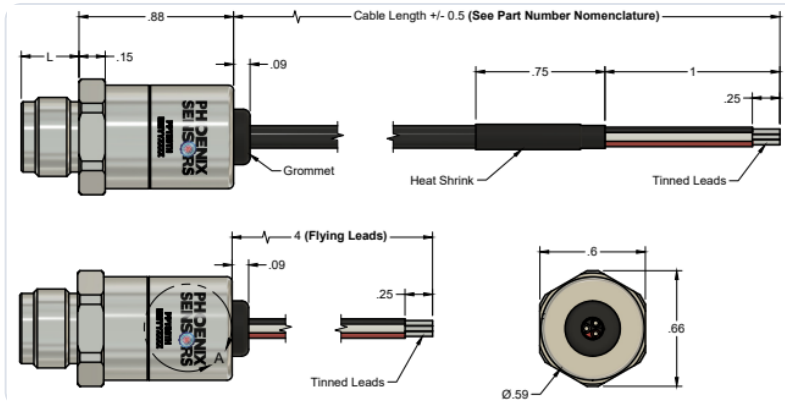
Read_DF4 returns T[10:0] — mask the last 5 bits

Confirm transfer-function coefficients for your configured build with the factory before writing production firmware.

MECHANICAL DIMENSIONS

Outline drawings – inches [mm]

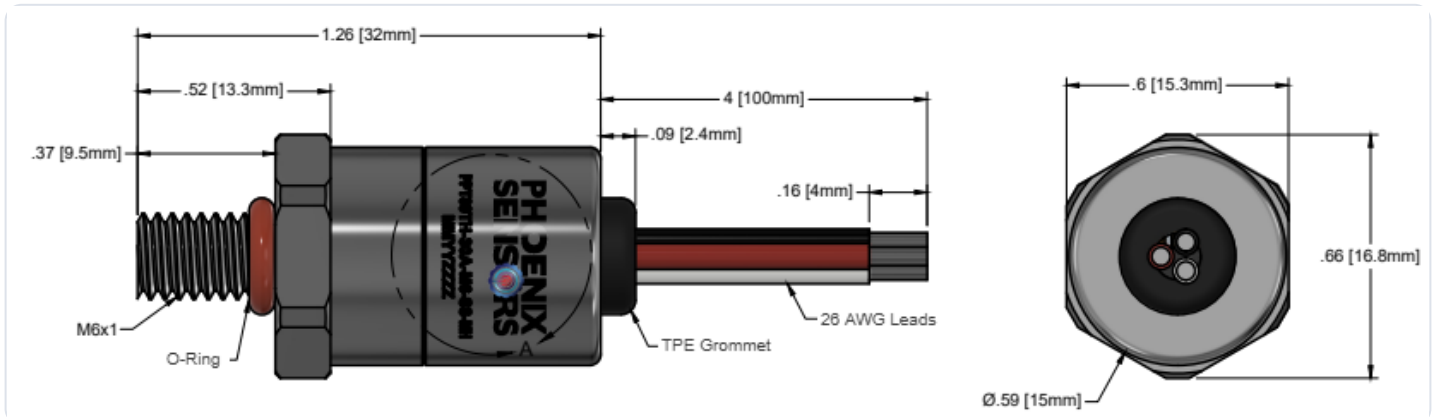
STANDARD – CABLE / FLYING LEADS



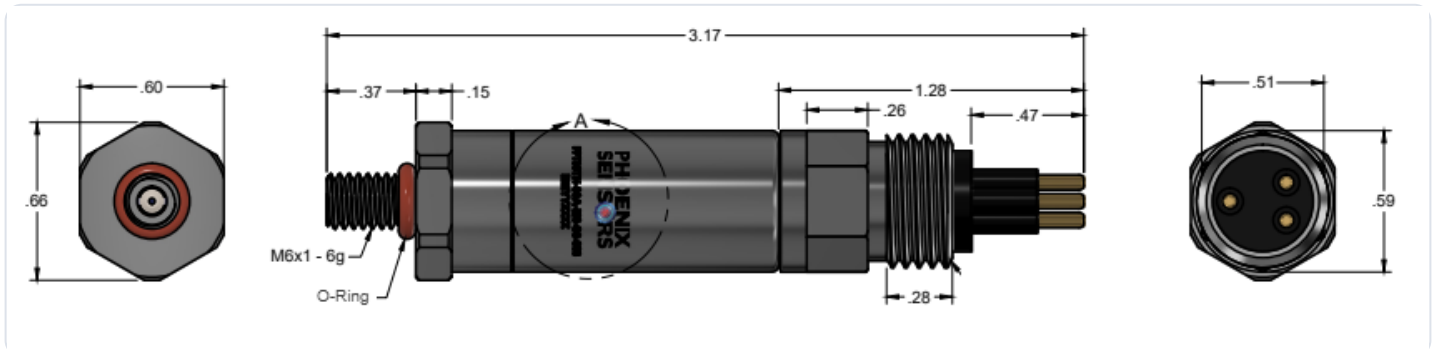
NOTES

- 1) Dimensions in inches; bracketed values are mm.
- 2) Tolerances: X ± 0.5 · X.X ± 0.15 · X.XX ± 0.010 · X.XXX ± 0.005 .
- 3) Cable length per part number, ± 0.5 ".
- 4) Port length (L) varies by connection – see page 3.

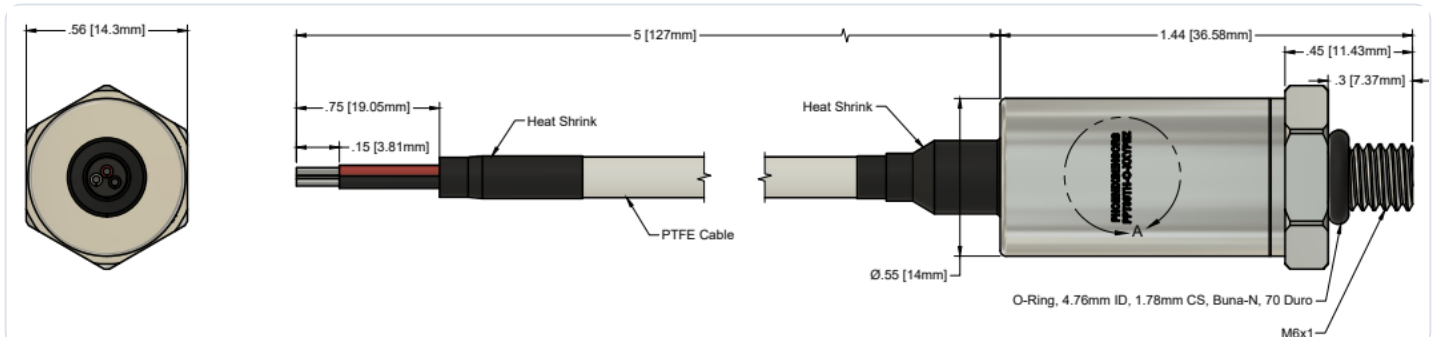
M6x1 · TPE GROMMET · 4" LEADS



M6x1 · 3-PIN CONNECTOR



M6x1 · Ø.55 BODY · PTFE CABLE



Part-number configuration



Model	Output	Pressure Range	Pressure Type	Mechanical Connection	Accuracy	Cable Length
PPT89TH	0 = 0.5–4.5V 1 = I ² C (0x28)	15 = 15 PSI ... 300 = 300 PSI	A = Absolute G = Gauge	1 = 1/4 NPT 2 = 1/8 NPT 3 = 7/16-20 UNF-2A 4 = 9/16-18 UNF-3A AN 5 = 1/4 BSPP 6 = M6×1	1 = 2.5% FS (standard) 2 = 1% FS (high accuracy)	1 = 1FT ... 10 = 10FT FL = Flying leads

EXAMPLE PART NUMBERS

PPT89TH-0-15G22-5FT → 0.5–4.5V · 15 PSI gauge · 1/8 NPT · 1% FS · 5FT cable

PPT89TH-1-100A51-2FT → I²C · 100 PSI absolute · 1/4 BSPP · 2.5% FS · 2FT cable

Configure your PPT89TH

REQUEST A QUOTE

Custom pressure ranges, fittings, cable lengths, and connector terminations available for OEM volumes. Talk to an engineer to spec your part.

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