

PPT93TH Subminiature Differential Pressure Transducer

Compact SS316L differential transducer with dual M6 ports, 0.5–4.5 V or I²C output



DIFFERENTIAL

SS316L

IP65

MIL-STD-810G

FEATURES

- Differential pressure ranges from 1 PSI to 300 PSI
- Output options: 0.5–4.5 V ratiometric or I²C (0x28)
- Total error band $\pm 0.2\%$ FS over -40 to 85 °C
- Linearity $\pm 0.15\%$ FS
- 1 kHz response
- Proof pressure $2 \times$ FS · burst pressure $4 \times$ FS
- SS316L housing with dual M6x1 male ports, marked H and L
- Silicone (VMQ) O-ring port seals
- Vibration/shock to MIL-STD-810G · EMI/EMC to MIL-STD-461G
- 26 AWG tinned flying leads, 1 in to 12 in

DESCRIPTION

The PPT93TH is a fully compensated differential pressure transducer in a compact SS316L body just 0.93 in [23.5 mm] in diameter. Two M6x1 male ports, laser-marked H (high) and L (low), let it mount directly into a manifold or a pair of fittings.

Each unit is factory calibrated and temperature compensated from -40 to 85 °C. Choose a 0.5–4.5 V ratiometric analog output or a 14-bit I²C digital output. The housing is welded and epoxy potted, rated IP65, and qualified to MIL-STD-810G for vibration and shock and MIL-STD-461G for EMI/EMC.

APPLICATIONS

- Filter and clog monitoring
- Orifice and venturi flow measurement
- Liquid level in pressurized tanks
- Hydraulic and pneumatic systems
- Defense and aerospace ground equipment
- HVAC and process control
- OEM embedded systems

MAXIMUM ENVIRONMENTAL RATINGS

Operating Temperature	-40 to 85 °C · -40–185 °F
Storage Temperature	-55 to 85 °C · -67–185 °F
Ingress Protection	IP65

Pressure Range	1 to 300 PSI differential
Proof / Burst	$2 \times$ FS / $4 \times$ FS
Vibration / Shock	MIL-STD-810G

Electrical & performance specifications

PARAMETER	MIN	TYP	MAX	UNITS
ELECTRICAL				
Excitation	4.9975	5.0	5.0025	VDC
Excitation current	3	5	7	mA
Output — option 0 (ratiometric)	0.5	—	4.5	V
Output — option 1	I ² C, address 0x28			—
I ² C pressure / temperature resolution	14-bit / 11-bit			bits
PERFORMANCE				
Accuracy (total error band)	−0.2	—	0.2	%FS
Linearity	−0.15	—	0.15	%FS
Response	—	1	—	kHz
Pressure range	1	—	300	PSID
Pressure type	Differential			—
Proof pressure	2× FS			—
Burst pressure	4× FS			—
ENVIRONMENTAL				
Operating & compensated temperature	−40	—	85	°C
Storage temperature	−55	—	85	°C
Environmental rating	IP65			—
Vibration / shock	MIL-STD-810G			—
EMI / EMC	MIL-STD-461G			—
Housing material	SS316L			—

PINOUT – ELECTRICAL CONNECTIONS

Digital – I²C (output 1)

WIRE COLOR	FUNCTION	DESCRIPTION
● Red	V+	Supply, 5.0 VDC
○ White	SDA	I ² C serial data
● Yellow	SCL	I ² C serial clock
● Black	GND	Supply / signal ground

Analog – 0.5–4.5 V (output 0)

WIRE COLOR	FUNCTION	DESCRIPTION
● Red	V+	Supply, 5.0 VDC
○ White	Vout	Ratiometric output
● Black	GND	Supply / signal ground

TEST CONDITIONS

Specifications at 5.0 VDC excitation unless noted. Accuracy is total error band over the compensated temperature range. %FS refers to full-scale differential span. Leads are 26 AWG, rated 300 V and 105 °C, with tinned ends.

Package, media & installation

Package

A cylindrical SS316L body, Ø0.93 in [23.5 mm] by 1.3 in [33 mm] long, with both pressure ports on one end and the leads exiting the other through a TPE grommet. The cap is welded to the housing and the electronics are epoxy potted.

Sealing

Each port carries a silicone (VMQ) O-ring, 4.47 mm ID × 1.78 mm CS, 70 durometer, that seals against the face of the mating port. Design the gland for no more than 30% compression.

Electrical

Three (analog) or four (I²C) 26 AWG wires, rated 300 V and 105 °C, with tinned ends. Bundle diameter is 0.13 in [3.3 mm] or less. Standard lengths run from 1 in to 12 in.

Rugged construction

Qualified to MIL-STD-810G for vibration and shock and to MIL-STD-461G for EMI/EMC, so it suits mobile, defense and heavy-equipment platforms.

Pressure ports

Two M6x1-6g male threaded ports, 0.37 in [9.5 mm] long. The high side is laser-marked “H” and the low side “L”. Output rises as H-port pressure rises above L-port pressure. Other port styles are available on request.

Media

For liquids and gases compatible with SS316L and silicone (VMQ). Verify compatibility for aggressive or corrosive media, or contact Phoenix Sensors about alternative seal materials.

Marking

Each housing is laser marked with the Phoenix Sensors logo, the full part number, the month, year and serial number, and the H and L port identifiers.

Installation

Thread each port into its mating fitting by hand until the O-ring seats, then tighten. Avoid over-compressing the O-rings. Keep the high and low connections consistent with the H and L markings.



Port identification

The laser marking identifies each port: **H** (high) and **L** (low) are marked on the body directly above their ports. Connect the higher of the two pressures to H. The full part number and serial number (month, year, sequence) are marked on every unit for traceability.

Fig. 1: PPT93TH-0-M6-1-30-MH showing laser marking, M6x1 ports and silicone O-ring.

±0.2%

Total error band FS

1–300

PSI differential

Ø0.93 in

Body diameter

1 kHz

Response

Analog output — 0.5–4.5 V ratiometric (option 0)

The analog version outputs a conditioned, temperature-compensated voltage on the white lead. Zero differential pressure reads 0.5 V and full-scale differential pressure reads 4.5 V. The output is ratiometric: it scales in proportion to the excitation voltage, so read it with an ADC that uses the same 5 V supply as its reference.

Transfer function

$$V_{out} = V_{exc} \times [0.1 + 0.8 \times (\Delta P / FS)]$$

At $V_{exc} = 5.0\text{ V}$ this gives $V_{out} = 0.5\text{ V} + 4.0\text{ V} \times (\Delta P / FS)$. ΔP is the H-port pressure minus the L-port pressure.

ΔP	OUTPUT (5.0 V EXC.)	% OF SUPPLY
0% FS	0.5 V	10%
25% FS	1.5 V	30%
50% FS	2.5 V	50%
75% FS	3.5 V	70%
100% FS	4.5 V	90%

Hookup

WIRE	CONNECT TO
Red · V+	5.0 VDC regulated supply
White · Vout	ADC / controller analog input
Black · GND	Supply and signal ground

FAULT DETECTION

Under normal operation the output stays within 0.5–4.5 V. A reading near 0 V or near the supply rail can mean an open lead, a short, or an over-range condition. Use these bands for host-side diagnostics.

SUPPLY

Excitation is specified at 5.0 VDC $\pm 0.0025\text{ V}$ and draws 3–7 mA. Because the output is ratiometric, supply variation shows up directly in V_{out} unless the ADC uses the same reference.

Bidirectional ranges

Custom bidirectional or offset ranges are available, for example –3 to +30 PSID. On these parts 0.5 V corresponds to the negative end of the range and 4.5 V to the positive end. Contact Phoenix Sensors to specify a custom range.

Digital output — I²C (option 1)

An internal digital signal processor converts the bridge signal, applies gain, offset and temperature correction, and writes corrected pressure and temperature to the output register. No compensation is needed on the host side. Calibration and configuration are stored in EEPROM, which is **locked at the factory**.

I²C interface

The device communicates over an addressable two-wire interface at slave address 0x28. Other addresses are available on request. SDA and SCL need external pull-up resistors sized for the bus capacitance and bit rate.

CORE CLOCK	SUPPORTED I ² C BIT RATES
4 MHz (factory default)	400 kHz or 100 kHz
1 MHz	100 kHz

Commands

COMMAND	RETURNS / ACTION
Read_MR	Starts a full measurement cycle (Sleep Mode)
Read_DF2	2 bytes: status bits and 14-bit pressure
Read_DF3	3 bytes: adds 8-bit temperature
Read_DF4	4 bytes: adds 11-bit temperature

Status bits (2 MSBs of the output packet)

BITS	DEFINITION
00	Normal operation, good data packet
01	Device in Command Mode
10	Stale data, already fetched since the last measurement
11	Diagnostic condition exists

Diagnostics cover invalid EEPROM signature, bridge input short, and loss of bridge connections. Status bits clear only after the fault is corrected and power is cycled.

Power-up

Wait 10 ms after power-up before issuing any command. With a 4 MHz clock and locked EEPROM, the first corrected value is ready within 6 ms of power-on.

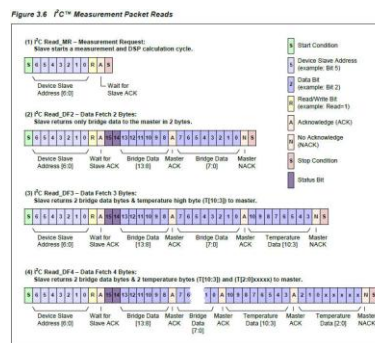


Fig. 2: I²C measurement packet reads. The master sends the 7-bit slave address with the 8th bit set to 1. The device ACKs and returns 2, 3 or 4 bytes, depending on when the master sends NACK and stop.

THREE DEVIATIONS FROM STANDARD I²C

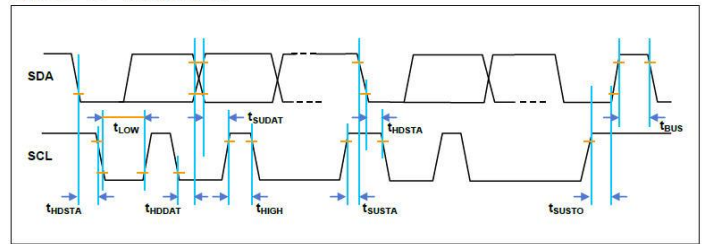
- 1) A start followed by a stop with no CLK transitions between them makes the next communication fail. Send an extra start condition to recover.
- 2) A restart (falling SDA edge during data transmission while CLK is high) causes the same failure and fix.
- 3) A falling SDA edge is not allowed between the start condition and the first rising SCL edge. If the address starts with a 0 bit, hold SDA low through the first bit.

Full command set and EEPROM map: Phoenix Sensors Digital Communication Manual, on request.

I²C timing & data conversion

I ² C PARAMETER	SYM	MIN	MAX	UNIT
SCL clock frequency	f_{SCL}	100	400	kHz
Start condition hold time to SCL edge	t_{HDSTA}	0.1	—	μs
Minimum SCL low width	t_{LOW}	0.6	—	μs
Minimum SCL high width	t_{HIGH}	0.6	—	μs
Start condition setup to SCL edge	t_{SUSTA}	0.1	—	μs
Data hold time on SDA	t_{HDDAT}	0	—	μs
Data setup time on SDA	t_{SUDAT}	0.1	—	μs
Stop condition setup time on SCL	t_{SUSTO}	0.1	—	μs
Bus free time, stop to start	t_{BUS}	2	—	μs

Figure 2.6 I²C™ Timing Diagram

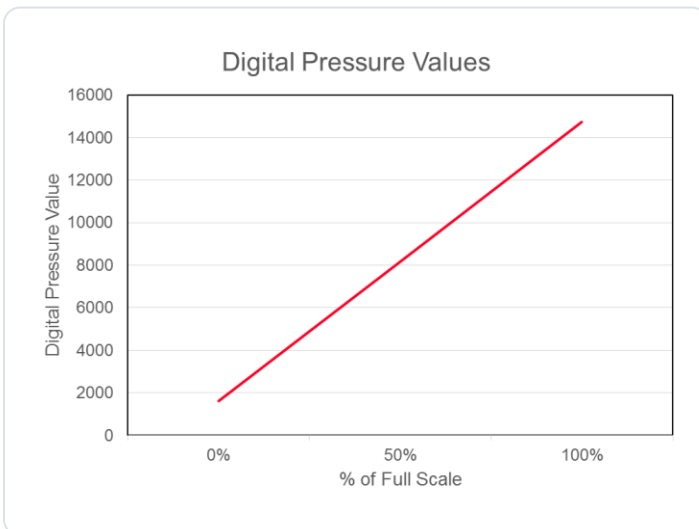


(See section 3.1 for data transmission details.)

Fig. 3: I²C timing diagram. The SCL low and high widths combined must equal or exceed the minimum SCL period.

DATA CONVERSION

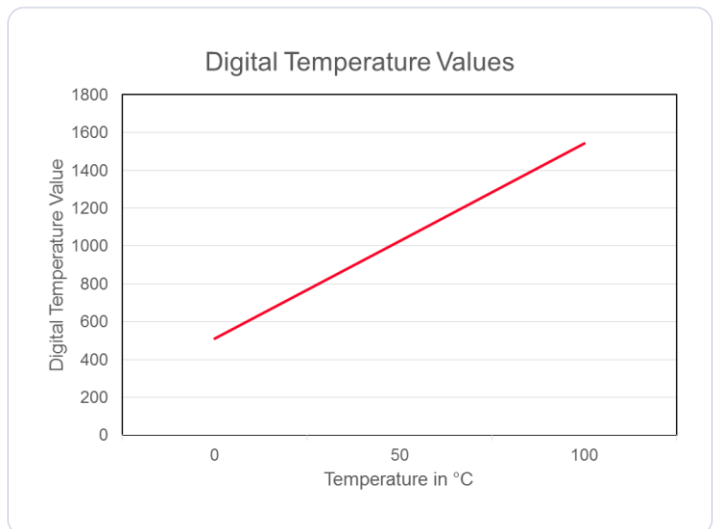
Pressure output



PRESSURE FORMULA

$Y = 131.25 \cdot X + 1638$ (offset ± 125 counts)
 X = differential pressure as %FS · Y = output counts
 0% FS $\approx$ 1638 counts · 100% FS $\approx$ 14763 counts

Temperature output



TEMPERATURE FORMULA

$Y = 10.3 \cdot X + 511$ (25 °C = 768 counts)
 X = temperature in °C · Y = 11-bit output counts
 Read_DF4 returns 11-bit temperature (mask last 5 bits)

Fig. 4: Digital output transfer functions. Y is the integer output value in counts.

Mechanical dimensions – inches [mm]

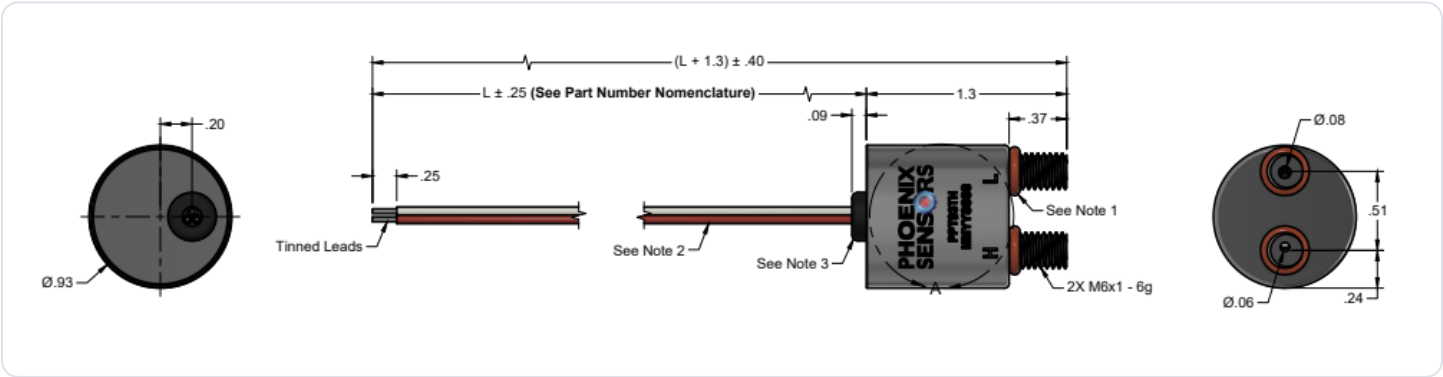


Fig. 5: Outline drawing, lead end (left), side (center) and port end (right). Overall length $(L + 1.3) \pm 0.40$, where L is the wire length from the part number. Ports on 0.51 centers.

FEATURE	DETAIL
Body diameter	Ø0.93 [23.5]
Body length	1.3 [33]
Pressure ports	2× M6x1-6g male, 0.37 [9.5] long
Port bore	Ø0.06 [1.52]
Wire length (L)	1–12 in ± 0.25, tinned 0.16 [4] typ.
Housing	SS316L, welded cap
O-rings	4.47 mm ID × 1.78 mm CS, VMQ, 70 duro
Grommet	TPE
Weight	1.9 oz [54 g] typ. (4 in leads)

TOLERANCES (INCHES)

X ± 0.5 · X.X ± 0.15
X.XX ± 0.010 · X.XXX ± 0.005

NOTES

- 1) O-ring compression 30% max.
- 2) Wires: 3× (analog) or 4× (I²C), 26 AWG, 300 V, 105 °C, bundle Ø ≤ 0.13 [3.3].
- 3) Laser marking: logo, part number, month, year, serial no., H and L.

Ordering information — part-number configuration



Model	Output	Port	Range (PSI)	Type	Wire length (L)
PPT93TH	0 = 0.5–4.5V 1 = I ² C (0x28)	M6 = 2× M6x1-6g male Others on request	1 to 300 e.g. 15, 30, 50, 300	D = Differential	1IN to 12IN 1 in steps

EXAMPLE PART NUMBERS

PPT93TH-0-M6-30D-4IN → 0.5–4.5 V · M6 ports · 0–30 PSI differential · 4 in wires

PPT93TH-1-M6-50D-6IN → I²C · M6 ports · 0–50 PSI differential · 6 in wires

CUSTOM CONFIGURATIONS

Bidirectional ranges (e.g. –3 to +30 PSID), other I²C addresses, alternative ports, seal materials and lead lengths are available for OEM volumes. Customer-specific builds carry a suffix on the part number.

Configure your PPT93TH

Custom ranges, ports, outputs and lead lengths for OEM volumes. Talk to an engineer to spec your part.

REQUEST A QUOTE

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