HEAVY DUTY, MEDIA-ISOLATED PRESSURE TRANSDUCERS
MIP SERIES

WHITMAN™ CONTROLS

TABLE 1. APPLICATIONS

Industry	Media
Industrial: pumps compressors process	 water, hydraulic fluids compressed air food, beverage, oil, gas, steam
HVAC/R	refrigerants (butane, propane, ammonia, CO_2, R134A, R407C, R410A, R448A/Solstice® N40, R32 and R1234ze, R1234yf, glycol + water
Transportation	gasoline, diesel fuel, engine oil, brake fluid, coolants, CNG
Medical	O_2, N_2, CO_2, N_2O, air

TABLE 2. ELECTRICAL SPECIFICATIONS (AT 25°C [77°F] AND UNDER UNLESS OTHERWISE NOTED.)

Characteristic	Ratiometric Output (AA)	Current Output (CH)	Regulated Output (BC,BD,BE,BG)
Supply voltage (V_s)	5.0 Vdc ±0.25 Vdc	8 Vdc to 30 Vdc[1]	BC, BE & BG : 8 Vdc to 32Vdc[3] BD : 12 Vdc to 32 Vdc[3]
Output transfer function	10 % to 90 % of V_s	4 mA to 20 mA	BC : 1 Vdc to 6 Vdc BD : 0.25 Vdc to 10.25 Vdc BE : 0.5 Vdc to 4.5 Vdc BG : 1 Vdc to 5 Vdc
Output load (pull up or pull down)	≥ 2 kΩ	(V_s - 8) x 50Ω[2]	≥ 10 kΩ
Short circuit protection	yes	yes	yes
Current consumption	6.5 mA ±1 mA	—	5 mA ±1 mA
Over/reverse voltage	±40 Vdc	±35 Vdc	±36 Vdc

[1] **Supply voltage:** Must be de-rated to 8 Vdc to 25 Vdc for above 100°C to 125°C [212°F to 257°F].
[2] Applies at 25°C [77°F]. See Figure 4 for Current Output Supply Voltage.
[3] For Regulated cable variant with load dump requirement, the minimum supply voltage should be greater than output voltage by +4 V

TABLE 3. ENVIRONMENTAL AND MECHANICAL SPECIFICATIONS

Characteristic	Parameter
Shock	100 G per MIL-STD-202, Method 213, Cond. C (at 25°C [77°F])
Vibration	20 G sweep, 10 Hz to 2000 Hz (at 25°C [77°F])
Ingress protection: Metri-Pack 150 version cable harness version DIN version	 IP65, IP67 IP65, IP67, IP69K IP65
External freeze/thaw resistance	>6 cycles from -30°C to 50°C [-22°F to 122°F] (Metri-Pack 150 version only)
Wetted materials: port diaphragm external seal for ports	 stainless steel 304L stainless steel 316L nitrile (-30°C to 100°C [-22°F to 212°F]) (other materials available)
Electrical connector material	PBT 30 %GF (UL V-0)
Cable material (jacket and insulation)	TPE (Thermoplastic Elastomer) flame retardant-type cable is FT1 rated per CSA AWM-I-A/B-II-A/B specification, -40°C to 125°C [-40°F to 257°F], three 24 AWG wires.

TABLE 4. SENSOR PRESSURE TYPES

Pressure type	Description
Absolute	Output is calibrated to be proportional to the difference between applied pressure and a fixed reference to a perfect vacuum (absolute zero pressure).
Sealed gage[1]	Sensor construction is identical to the absolute version, with a built-in reference at zero pressure in order to minimize measurement error over temperature. The output is calibrated to be proportional to the difference between applied pressure and a reference of 1 standard atmosphere (1.012 barA | 14.7 psiA). Example: 100 psi sealed gage has a calibrated pressure range from 14.7 psi absolute to 114.7 psi absolute.

[1] Sealed gage option only available in pressure ranges at or above 8 bar | 100 psi.

TABLE 5. PERFORMANCE SPECIFICATIONS (AT 25°C [77°F] AND UNDER UNLESS OTHERWISE NOTED.)

Characteristic	Ratiometric Output (AA)	Current Output (CH)	Regulated Output (BC,BD,BE,BG)
Total Error Band[1]	>10 bar or >150 psi: ±0.75 %FSS (-40°C to 125°C) ≤10 bar or ≤150 psi: ±1.0 %FSS[2] (-40°C to 125°C)	±1.0 %FSS (-20°C to 85°C) ±2.0 %FSS (-40°C to 125°C)	±1.0 %FSS (-20°C to 85°C) ±2.0 %FSS (-40°C to 125°C)
Operating temperature range	-40°C to 125°C [-40°F to 257°F]		
Accuracy BFSL[3]	±0.15 %FSS	±0.25 %FSS	±0.25 %FSS
Long term stability (1000 hr, 25°C)	±0.25 %FSS		
Typical output resolution	0.05 % Full Scale Pressure		
Typical response time[4]	1 ms	2 ms	2 ms
Startup time[5]	7 ms		
EMC rating (CE Conformity): surge immunity (all leads) electrostatic discharge radiated immunity fast transient burst immunity to conducted disturbances radiated emissions	±1 kV line to ground per IEC 61000-4-5 ±4 kV contact, ±8 kV air per IEC 61000-4-2 10 V/m (80 MHz to 1000 MHz) per IEC 61000-4-3 ±1 kV per IEC 61000-4-4 3 V (150 kHz to 80 MHz) per IEC 61000-4-6 40 dBµV (30 MHz to 230 MHz), 47 dBµV (230 MHz to 1000 MHz) per CISPR 11		
Radiated immunity	100 V/m (200 MHz to 2.5 GHz) per ISO 11452-2	100 V/m (300 MHz to 2.7 GHz) per ISO 11452-2 100 V/m (100 kHz to 400 MHz) per ISO 11452-5	100 V/m (200 MHz to 2.7 GHz) per ISO 11452-2
Bulk current injection - common mode	–	–	60 mA, 1 MHz to 200 MHz for Industrial 100 mA, 1 MHz to 200 MHz for Transportation
Insulation resistance	>100 MΩ at 1k Vdc (60 s)		
Dielectric strength	<1 mA at 500 Vac (60 s)	<1 mA at 1000 Vac (60 s)	<1 mA at 1000 Vac (60 s)
Life	>10 million full scale pressure cycles		
UL Conformity	Compliant[6]	Compliant[6]	–

[1] **Total Error Band:** The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range.Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, pressure non-repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis (see Figure 5).

[2] **TEB:** Above 100°C [212°F] for pressure ratings less than 4 bar [58 psi], TEB is ±1.5 %FSS for ratiometric outputs and 2.0 % FSS for other outputs.

[3] **Accuracy:** The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and pressure non-repeatability.

[4] **Response time:** The time taken by the transducer to change output from 10 % to 90 % of full scale in response to a 0 % to 100 % full scale step input pressure.

[5] **Startup time:** The time needed to receive valid output after power up.

[6] UL marking currently not applicable for all transducers above 60 bar pressure range and for MIPS regulated transducers.

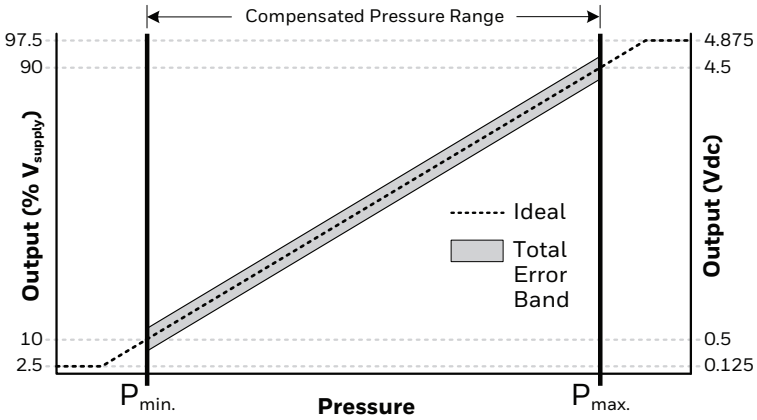
TABLE 6. PRESSURE RATINGS

BAR			PSI		
OPERATING PRESSURE	OVER-PRESSURE[1]	BURST PRESSURE[2]	OPERATING PRESSURE	OVER-PRESSURE[1]	BURST PRESSURE[2]
1 to 3	6	207	15 to 43.5	87	3000
>3 to 12	24		>43.5 to 174	348	
>12 to 70	120		>174 to 1000	1740	

[1] **Overpressure:** The maximum pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product.

[2] **Burst Pressure:** The maximum pressure which may be applied without causing escape of pressure media. The product should not be expected to function after exposure to the burst pressure.

Figure 2. Ratiometric Output Transfer Function
The transfer function shown here is applicable to a ratiometric output ranging between 10 % V_{supply} at null pressure to 90 % V_{supply} at full scale pressure.



$$\text{Output (V)} = \frac{0.8 \times V_{supply}}{P_{max.} - P_{min.}} \times (\text{Pressure}_{applied} - P_{min.}) + 0.10 \times V_{supply}$$

Figure 3. Absolute vs. Sealed Gage
Example shown is for 100 psi.

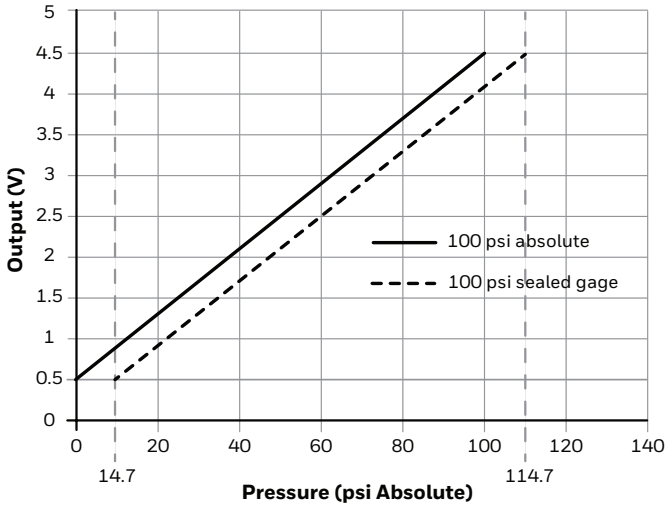
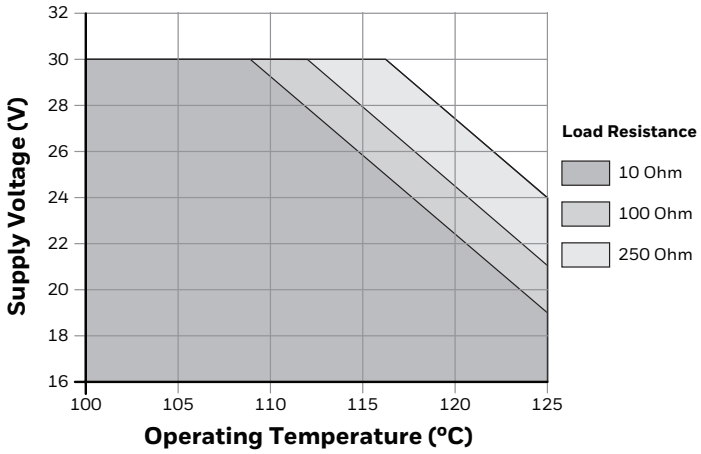


Figure 4. Current Output Supply Voltage vs. Temperature



Transfer Function for Regulated and Current Output Pressure Examples

$$\text{Pressure} = \frac{(\text{Output} - \text{Output}_{min.}) * (P_{max.} - P_{min.})}{\text{Output}_{max.} - \text{Output}_{min.}} + P_{min.}$$

Where:

$\text{Output}_{max.}$ = Ideal output at maximum pressure
$\text{Output}_{min.}$ = Ideal output at minimum pressure
$P_{max.}$ = maximum value of pressure range [bar/psi]
$P_{min.}$ = minimum value of pressure range [bar/psi]
Pressure = Transducer pressure reading [bar/psi]
Output = Transducer Voltage/current output

Example listing: MIPAN1XX010BSCHX -
10 bar sealed gage, 4 mA to 20 mA output
$\text{Output}_{max.}$ = 20 mA
$\text{Output}_{min.}$ = 4 mA
$P_{max.}$ = 11.012 bar
$P_{min.}$ = 1.012 bar
Output from the sensor = 12 mA
Calculated pressure = ((12-4)*(11.012-1.012)/(20-4)) + 1.013 = 6.013 bar

Example listing: MIPAN1XX010BABEX -
10 bar absolute, 0.5 Vdc to 4.5 Vdc output
$\text{Output}_{max.}$ = 4.5 Vdc
$\text{Output}_{min.}$ = 0.5 Vdc
$P_{max.}$ = 10 bar
$P_{min.}$ = 0 bar
Output from the sensor = 2.5 Vdc
Calculated pressure = ((2.5-0.5)*(10-0)/(4.5-0.5)) + 0 = 5 bar

TOTAL ERROR BAND

Total Error Band (TEB) is a single specification that includes the major sources of sensor error. TEB should not be confused with accuracy, which is actually a component of TEB. TEB is the maximum error that the sensor could experience.

Honeywell uses the TEB specification in its datasheet because it is the most comprehensive measurement of a sensor's true accuracy. Honeywell also provides the accuracy specification in order to provide a common comparison with competitors' literature that does not use the TEB specification.

Many competitors do not use TEB—they simply specify the accuracy of their device. Their accuracy specification, however, may exclude certain parameters. On their datasheet, the errors are listed individually. When combined, the total error (or what would be TEB) could be significant.

Figure 6. TEB Components for the MIP Series

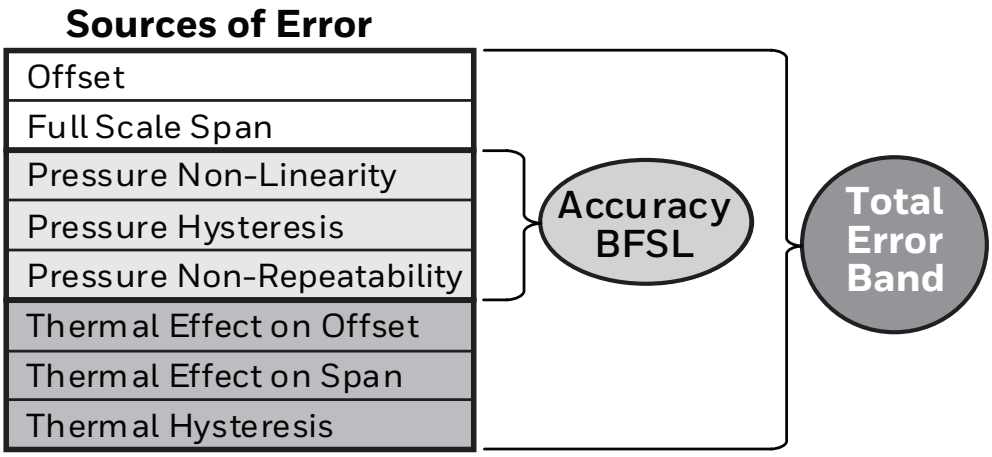
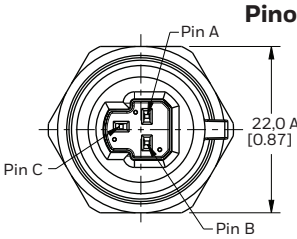


TABLE 7. OUTPUT DIAGNOSTIC CODE FOR RATIOMETRIC OUTPUT

FAULT CONDITION	ANALOG DIAGNOSTIC RAIL
Sensor internal failures	97.5 % of V_{supply} (See Figure 2.)
Over pressure	97.5 % of V_{supply} (See Figure 2.)
Under pressure (for sealed gage only)	2.5 % of V_{supply} (See Figure 2.)
Power or ground loss	high (external pull-up resistor)
Power or ground loss	low (external pull-down resistor)

Figure 7. Metri-Pack 150 Mounting Dimensions (for reference only. mm [in])

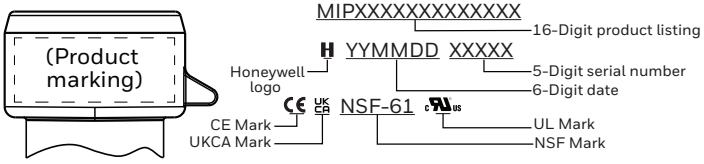
Pinout



Ratiometric & Regulated Voltage Output
Pin A = Ground
Pin B = V+
Pin C = V_{out}

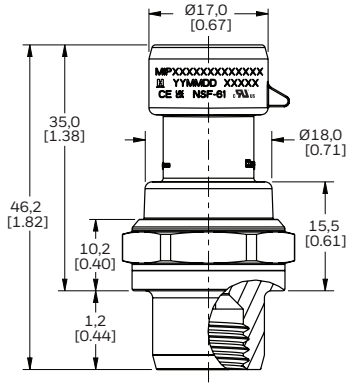
Current Output
Pin A = Return
Pin B = Supply
Pin C = Not connected

Product Marking



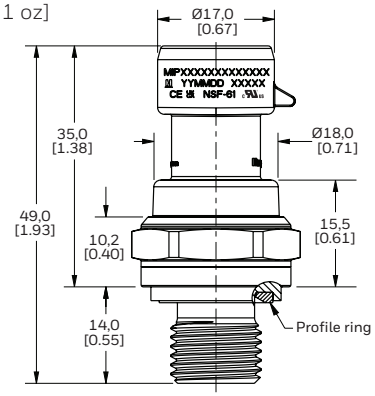
F1: 7/16-20 UNF 1/4 inch 45° Flare Female Schrader (SAE J512)

Seal: 45° cone
Mating geometry: SAE J512
Installation torque: 17 N m [12 ft-lb]
Weight: 36 g [1.3 oz]



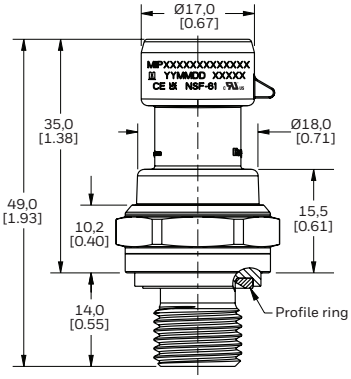
G1: G1/4 A-G (ISO 1179-3)

Seal: O-ring (included) and retaining ring ISO 1179-3-G1/4 (not included)
Mating geometry: ISO 1179-1
Installation torque: 20 N m [14.7 ft-lb]
Weight: 33 g [1.1 oz]



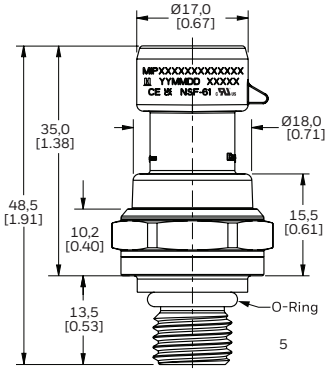
G2: G1/4 A-L (ISO 1179-2)

Seal: ISO 9974-2/DIN 3869 profile ring (included)
Mating geometry: ISO 1179-1
Installation torque: 20 N m [15 ft-lb]
Weight: 36 g [1.3 oz]



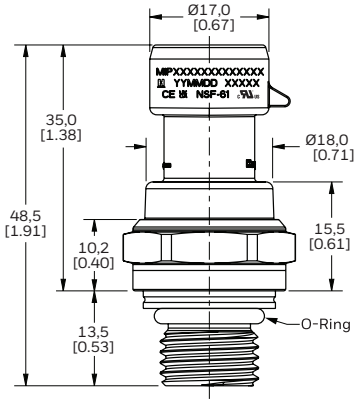
M1: M12 x 1.5 (ISO 6149-3)

Seal: O-ring (included)
Mating geometry: ISO 6149-1
Installation torque: 20 N m [15 ft-lb]
Weight: 34 g [1.2 oz]



M3: M14 x 1.5 (ISO 6149-2)

Seal: O-ring (included)
Mating geometry: ISO 6149-1
Installation torque: 30 N m [22.1 ft-lb]
Weight: 39 g [1.4 oz]



N1: 1/4-18 NPT

Seal: Pipe thread
Mating geometry: ANSI B1.20.1
Installation torque: Two to three turns from finger tight
Weight: 38 g [1.3 oz]

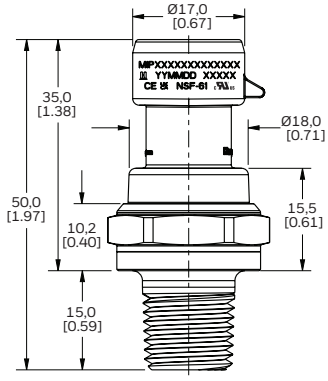
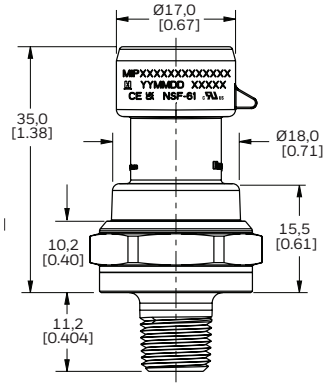
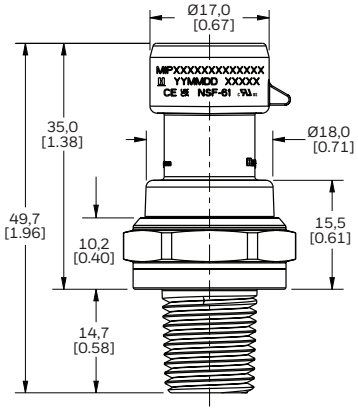


Figure 7. Metri-Pack 150 Mounting Dimensions (continued)

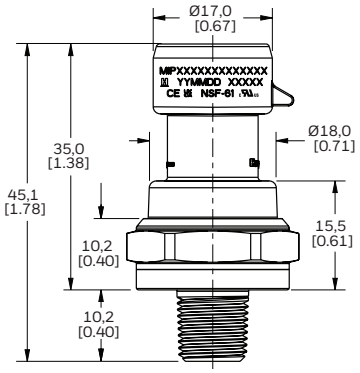
N2: 1/8-27 NPT
Seal: Pipe thread
Mating geometry: ANSI B1.20.1
Installation torque: Two to three turns from finger tight
Weight: 30 g [1.0 oz]



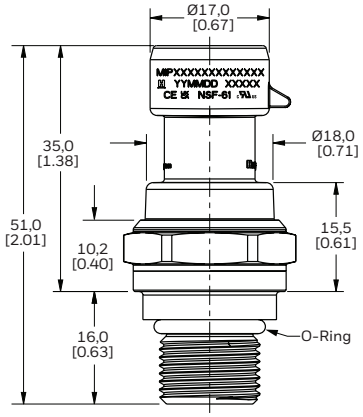
R1: R1/4-19 BSPT (ISO 7-1)
Seal: Pipe thread
Mating geometry: ISO 7-1
Installation torque: Two to three turns from finger tight
Weight: 36 g [1.3 oz]



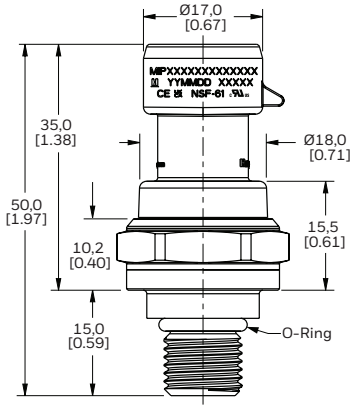
R2: R1/8-28 BSPT (ISO 7-1)
Seal: Pipe thread
Mating geometry: ISO 7-1
Installation torque: Two to three turns from finger tight
Weight: 29 g [1.0 oz]



S1: 9/16-18 UNF (SAE J1926-2)
Seal: O-ring (included)
Mating geometry: SAE J1926-1
Installation torque: 30 N m [22.1 ft-lb]
Weight: 44 g [1.6 oz]



S2: 7/16-20 UNF (SAE J1926-2)
Seal: O-ring (included)
Mating geometry: SAE J1926-1
Installation torque: 18 N m [13.3 ft-lb]
Weight: 36 g [1.3 oz]



S3: 3/8-24 UNF (SAE J1926-2)
Seal: O-ring (included)
Mating geometry: SAE J1926-1
Installation torque: 10 N m [7.4 ft-lb]
Weight: 32 g [1.1 oz]

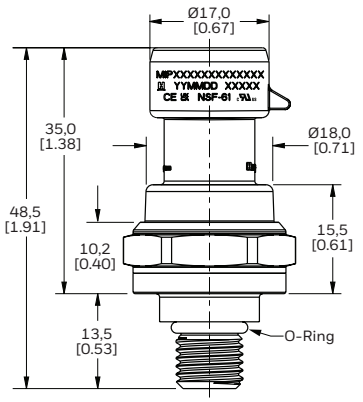
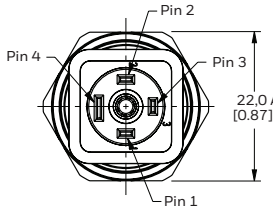


Figure 8. DIN-C Mounting Dimensions (for reference only. mm [in])

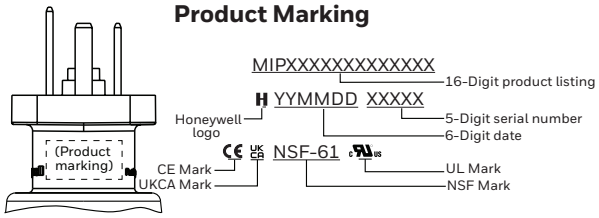
Pinout



Ratiometric and Regulated Voltage Output
Pin 1 = Ground
Pin 2 = V+
Pin 3 = V_{out}
Pin 4 = N/A

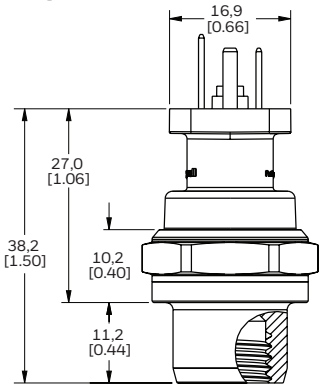
Current Output
Pin 1 = Return
Pin 2 = Supply
Pin 3 = N/A
Pin 4 = N/A

Product Marking



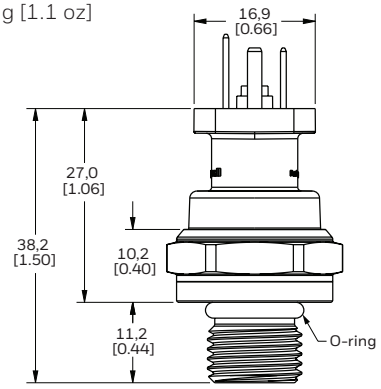
F1: 7/16-20 UNF 1/4 inch 45° Flare Female Schrader (SAE J512)

Seal: 45° cone
Mating geometry: SAE J512
Installation torque: 17 N m [12 ft-lb]
Weight: 36 g [1.3 oz]



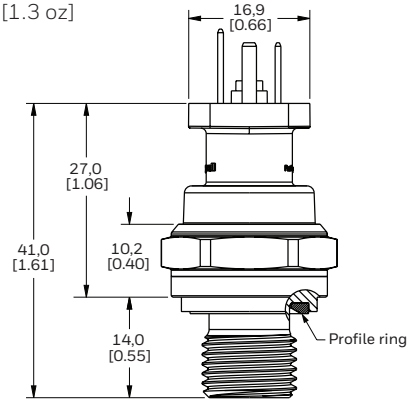
G1: G1/4 A-G (ISO 1179-3)

Seal: O-ring (included) and retaining ring ISO 1179-3-G1/4 (not included)
Mating geometry: ISO 1179-1
Installation torque: 20 N m [14.7 ft-lb]
Weight: 33 g [1.1 oz)



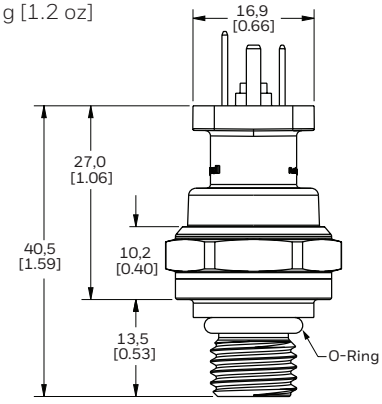
G2: G1/4 A-L (ISO 1179-2)

Seal: ISO 9974-2/DIN 3869 profile ring (included)
Mating geometry: ISO 1179-1
Installation torque: 20 N m [15 ft-lb]
Weight: 36 g [1.3 oz]



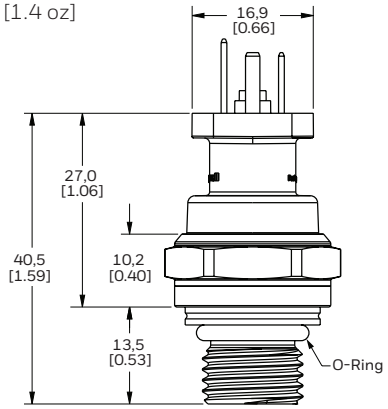
M1: M12 x 1.5 (ISO 6149-3)

Seal: O-ring (included)
Mating geometry: ISO 6149-1
Installation torque: 20 N m [15 ft-lb]
Weight: 34 g [1.2 oz]



M3: M14 x 1.5 (ISO 6149-2)

Seal: O-ring (included)
Mating geometry: ISO 6149-1
Installation torque: 30 N m [22.1 ft-lb]
Weight: 39 g [1.4 oz]



N1: 1/4-18 NPT

Seal: Pipe thread
Mating geometry: ANSI B1.20.1
Installation torque: Two to three turns from finger tight
Weight: 38 g [1.3 oz]

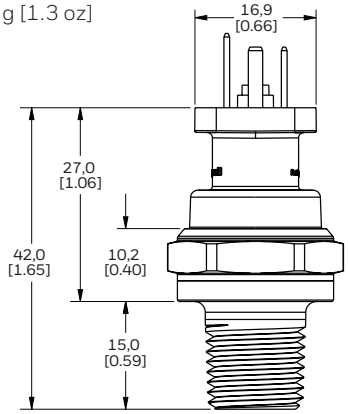
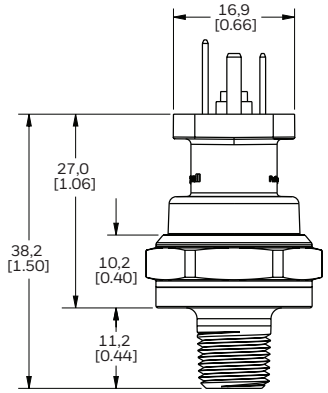
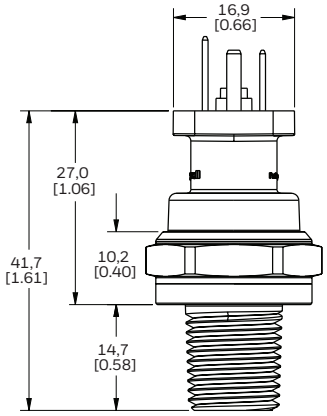


Figure 8. DIN-C Mounting Dimensions (continued)

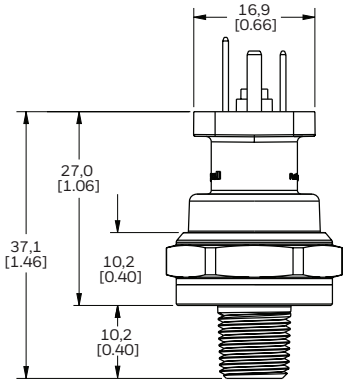
N2: 1/8-27 NPT
Seal: Pipe thread
Mating geometry: ANSI B1.20.1
Installation torque: Two to three turns from finger tight
Weight: 30 g [1.0 oz]



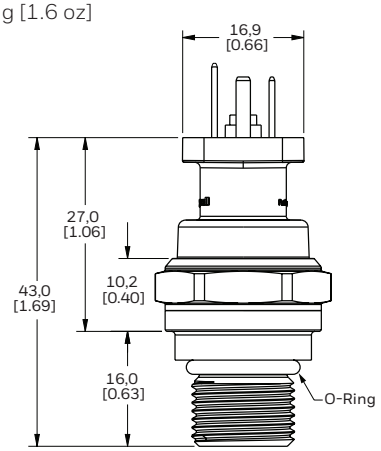
R1: R1/4-19 BSPT (ISO 7-1)
Seal: Pipe thread
Mating geometry: ISO 7-1
Installation torque: Two to three turns from finger tight
Weight: 36 g [1.3 oz]



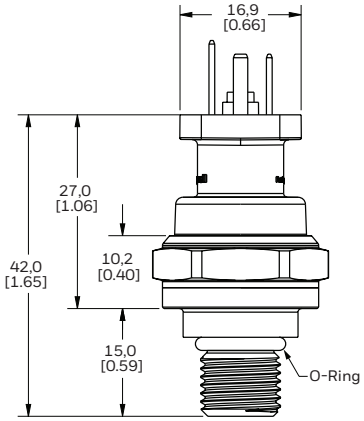
R2: R1/8-28 BSPT (ISO 7-1)
Seal: Pipe thread
Mating geometry: ISO 7-1
Installation torque: Two to three turns from finger tight
Weight: 29 g [1.0 oz]



S1: 9/16-18 UNF (SAE J1926-2)
Seal: O-ring (included)
Mating geometry: SAE J1926-1
Installation torque: 30 N m [22.1 ft-lb]
Weight: 44 g [1.6 oz)



S2: 7/16-20 UNF (SAE J1926-2)
Seal: O-ring (included)
Mating geometry: SAE J1926-1
Installation torque: 18 N m [13.3 ft-lb]
Weight: 36 g [1.3 oz]



S3: 3/8-24 UNF (SAE J1926-2)
Seal: O-ring (included)
Mating geometry: SAE J1926-1
Installation torque: 10 N m [7.4 ft-lb]
Weight: 32 g [1.1 oz]

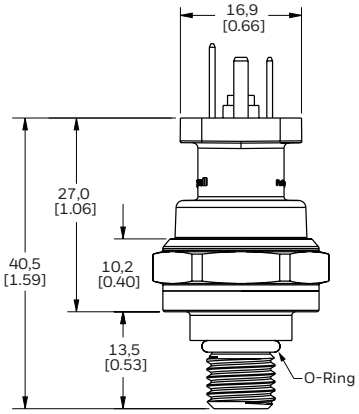
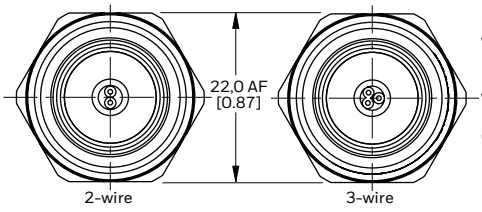


Figure 9. Cable Harness Mounting Dimensions (for reference only. mm [in])

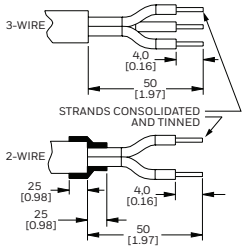
Wireout with Free Ends



Ratiometric and Regulated Voltage Output
Black = Ground
Red = V+
White = V_{out}

Current Output
Black = Return
Red = Supply

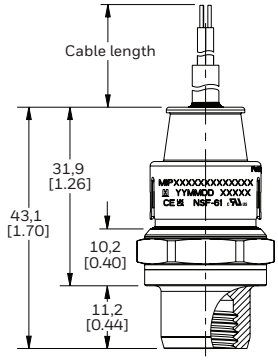
Wire Lead Dimensions



Product Marking

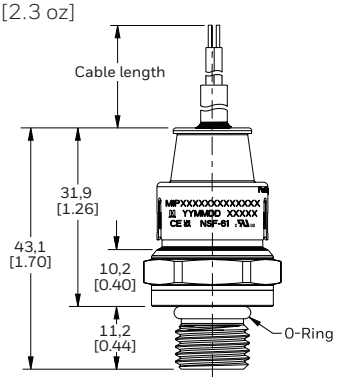
F1: 7/16-20 UNF 1/4 inch 45° Flare Female Schrader (SAE J512)

Seal: 45° cone
Mating geometry: SAE J512
Installation torque: 17 N m [12 ft-lb]
Weight: 68 g [2.4 oz]



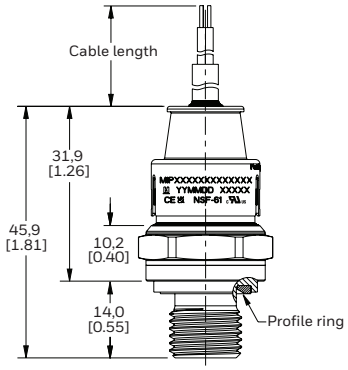
G1: G1/4 A-G (ISO 1179-3)

Seal: O-ring (included) and retaining ring ISO 1179-3-G1/4 (not included)
Mating geometry: ISO 1179-1
Installation torque: 20 N m [14.7 ft-lb]
Weight: 65 g [2.3 oz]



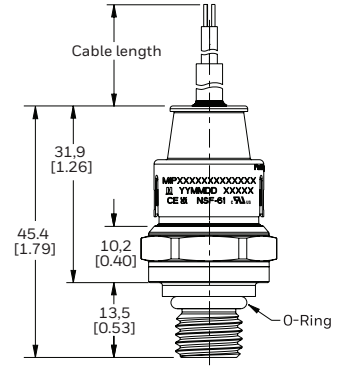
G2: G1/4 A-L (ISO 1179-2)

Seal: ISO 9974-2/DIN 3869 profile ring (included)
Mating geometry: ISO 1179-1
Installation torque: 20 N m [15 ft-lb]
Weight: 68 g [2.4 oz]



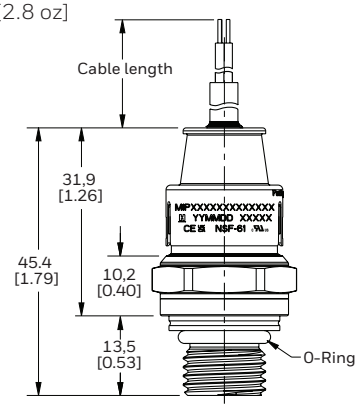
M1: M12 x 1.5 (ISO 6149-3)

Seal: O-ring (included)
Mating geometry: ISO 6149-1
Installation torque: 20 N m [15 ft-lb]
Weight: 66 g [2.3 oz]



M3: M14 x 1.5 (ISO 6149-2)

Seal: O-ring (included)
Mating geometry: ISO 6149-1
Installation torque: 30 N m [22.1 ft-lb]
Weight: 80 g [2.8 oz]



N1: 1/4-18 NPT

Seal: Pipe thread
Mating geometry: ANSI B1.20.1
Installation torque: Two to three turns from finger tight
Weight: 79 g [2.5 oz]

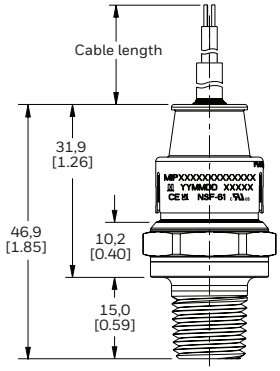
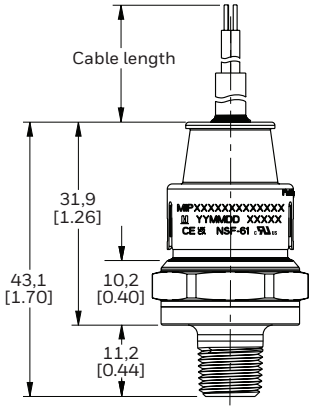
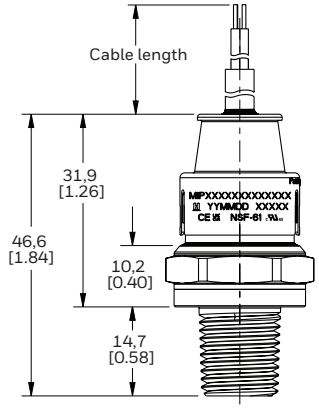


Figure 9. Cable Harness Mounting Dimensions (continued)

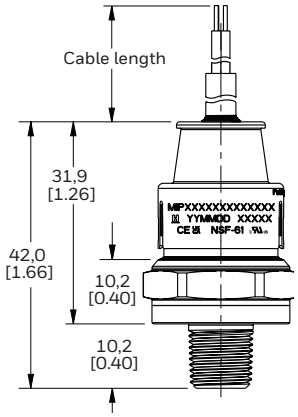
N2: 1/8-27 NPT
Seal: Pipe thread
Mating geometry: ANSI B1.20.1
Installation torque: Two to three turns from finger tight
Weight: 62 g [2.2 oz]



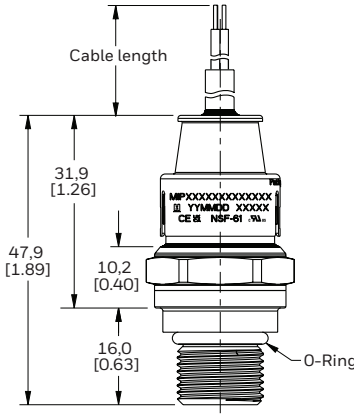
R1: R1/4-19 BSPT (ISO 7-1)
Seal: Pipe thread
Mating geometry: ISO 7-1
Installation torque: Two to three turns from finger tight
Weight: 77 g [2.7 oz]



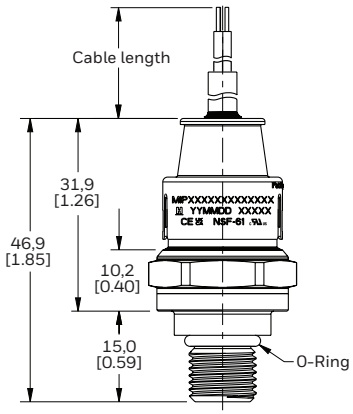
R2: R1/8-28 BSPT (ISO 7-1)
Seal: Pipe thread
Mating geometry: ISO 7-1
Installation torque: Two to three turns from finger tight
Weight: 70 g [2.5 oz]



S1: 9/16-18 UNF (SAE J1926-2)
Seal: O-ring (included)
Mating geometry: SAE J1926-1
Installation torque: 30 N m [22.1 ft-lb]
Weight: 85 g [3.0 oz]



S2: 7/16-20 UNF (SAE J1926-2)
Seal: O-ring (included)
Mating geometry: SAE J1926-1
Installation torque: 18 N m [13.3 ft-lb]
Weight: 77 g [2.7 oz]



S3: 3/8-24 UNF (SAE J1926-2)
Seal: O-ring (included)
Mating geometry: SAE J1926-1
Installation torque: 10 N m [7.4 ft-lb]
Weight: 73 g [2.6 oz]