MIP SERIES HEAVY DUTY, MEDIA-ISOLATED PRESSURE TRANSDUCERS

3012-0317
Issue A

Digital Output, 1 bar to 60 bar | 15 psi to 870 psi

DESCRIPTION

Media-Isolated Pressure Transducers with Digital Output use piezoresistive sensing technology with ASIC (Application Specific Integrated Circuit) signal conditioning in a stainless-steel housing and cable harness electrical connections. The MIPS Series Digital Output transducers are fully calibrated, and temperature compensated from -40°C to 125°C [-40°F to 257°F]. MIPS Series Digital Output Series transducers are developed for pressure applications that involve measurement of hostile media in harsh environments. MIP Series Digital Output comes with clock speed of up to 1 MHz for the SPI output option, and 400 kHz for the I^2C option, respectively.

VALUE TO CUSTOMERS

- **Cost-effective:** Small size helps engineers reduce design and manufacturing costs while maintaining the performance and reliability of the systems they design.
- **Accurate:** Total Error Band (TEB) as low as ±1.0 % and wide pressure range enable engineers to enhance system performance by improving resolution and system accuracy.
- Supply voltage range, variety of pressure units, types and ranges, output options, and wide operating temperature range simplify use in the application.
- **Versatile:** Wet-media compatibility, low power, and temperature output options make the sensor a versatile choice for Internet of Things applications.
- High insulation resistance and dielectric strength.
- **Digital output:** Allows the sensor to be directly plugged into the customer's circuitry without requiring major design changes. This plug and play feature enable ease of implementation and system level connectivity.
- **Reduced current consumption:** Helps to reduce energy costs and enhances product life if used in battery driven systems. Sleep mode for ultra-low current consumption.
- **Hermetically welded design:** Supports almost all media without the use of an internal seal. The sensors are designed to be used in harsh environments that see aggressive media.

DIFFERENTIATION

- **Great customer value:** Multiple configuration possibilities provide flexibility of use in the application with no upfront NRE or tooling charges.
- **Durable:** Provides the tough environmental specifications needed, including insulation resistance and dielectric strength, and EMC performance.

TABLE 1. POTENTIAL APPLICATIONS

Industry	Application
Industrial	Refrigerant pressure monitoring in HVAC/R systems, air compressor system pressure, water meter, water pumps, Industrial automation and flow control
Transportation	Air system monitoring, hydraulic oil pressure monitoring, agriculture/marine/railway machinery and equipment
Medical	Heavy duty hospital and outpatient equipment such as hospital beds and massage machines
Consumer	General appliances, sports equipment

FEATURES

- Pressure range: 1 bar to 60 bar | 15 psi to 870 psi absolute; 8 bar to 60 bar | 100 psi to 870 psi sealed gage
- SPI output: 50 kHz to 1000 kHz , I^2C output: 100 kHz to 400 kHz with 24 bits resolution in pressure and temperature output
- Fully calibrated and temperature compensated
- Total Error Band: ±1.0 %FSS from -20°C to 85°C [-4°F to 185°F], ±2.0 %FSS from -40°C to 125°C [-40°F to 257°F]
- Insulation resistance: >100 MΩ, 1000 Vdc (in dry, non-ionized air)
- Current consumption: 3 mA max.
- Suitable for both 3.3 Vdc and 5 Vdc applications
- Ingress protection: IP67
- CE, UKCA, RoHS, REACH compliant
- Twelve industry-standard pressure port types provide greater flexibility and configurable options for hermetically sealed process connection

PORTFOLIO

Honeywell offers a variety of heavy duty pressure transducers for potential use in industrial and transportation applications. To view the entire product portfolio, click here.

Honeywell

DIGITAL OUTPUT, HEAVY DUTY, MEDIA-ISOLATED PRESSURE TRANSDUCERS
MIP SERIES

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FIGURE 1. TEB COMPONENTS FOR THE MIP SERIES

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 worst 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.

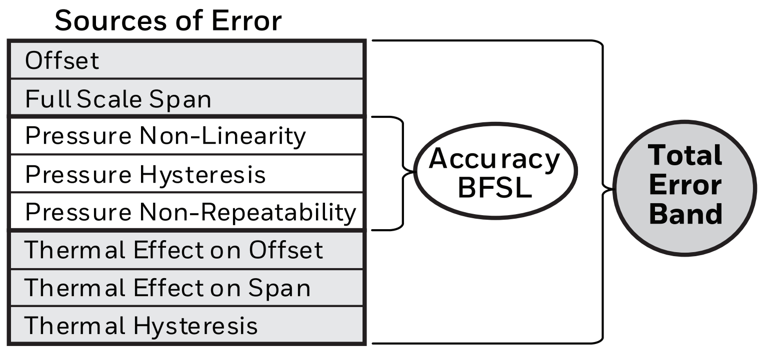


TABLE 2. ELECTRICAL SPECIFICATIONS (AT 25°C [77°F] AND UNDER UNLESS OTHERWISE NOTED.)

Characteristic	Parameter
Supply voltage (V_{DD})	2.7 V to 5.5 V
Supply current: **Active operating mode** **Sleep/Standby mode:** **25°C [77°F]** **85°C [185°F]** **125°C [257°F]**	 2.7 mA typical (min 2.4 mA, max 3.0 mA) 2 µA typical (min 1.6 µA, max 2.5 µA) 6 µA 22 µA
I^{2}C/SPI voltage level: **low** **high**	 <20% supply voltage >80% supply voltage
Clock interface frequency: **I^{2}C** **SPI**	 50 kHz to 1 MHz 100 kHz to 400 kHz
Pullup resistor on I^{2}C SDA/SCL	>1.8 kOhm at 5.5 V_{DD}

TABLE 3. ENVIRONMENTAL AND MECHANICAL SPECIFICATIONS

Characteristic	Parameter
Shock	100 G per MIL-STD-202, Method 213, Cond. C (at 25°C [77°F]), 100 G per MIL-STD-202F, Method 213B, and Condition C
Ingress protection	IP67
Wetted materials: **threaded ports** **diaphragm ring** **metal diaphragm** **external seal for ports**	 stainless steel 304L stainless steel 316L stainless steel 316L nitrile (-30°C to 100°C [-22°F to 212°F]) (other materials available)

TABLE 4. PERFORMANCE SPECIFICATIONS (AT 25°C [77°F] AND UNDER UNLESS OTHERWISE NOTED.)

Characteristic	Parameter
Temperature ranges: **Operating** **Storage** **Compensated**	 -40°C to 125°C [-40°F to 257°F] -40°C to 125°C [-40°F to 257°F] -40°C to 125°C [-40°F to 257°F]
Total Error Band[1] **-20°C to 85°C** **-40°C to 125°C**	 ±1.0 %FSS ±2.0 %FSS
Accuracy BFSL[2]	±0.25 %FSS
Configuration features	I^2C 00Hex address or SPI Mode 0 default[3]
Startup time[4]	<2.5 ms
Response time[5]	<1 ms
Output transfer function	10% to 90% of 2^{24} counts
Output resolution	24 bits, (14 bits minimum)
Temperature accuracy	±3°C
EMC rating: **electrostatic discharge** **radiated immunity** **radiated emissions**	 ±4 kV contact, ±8 kV air per IEC 61000-4-2 3 V/m (80 MHz to 1000 MHz) per IEC 61000-4-3 Class A (30 MHz to 1 GHz) as per CISPR 11
Insulation resistance	>100 MΩ at 1000 Vdc (60 s)
Dielectric strength	<1 mA at 1000 Vac (60 s)
Life	>10 million full scale pressure cycles over the calibrated pressure range

[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 1).

[2] **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.

[3] Refer to Section 2.0 (I^2C) and Section 3.0 (SPI) for more details.

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

[5] **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.

TABLE 5. PRESSURE RATINGS

Bar			PSI		
Operating Pressure	**Overpressure[1]**	**Burst Pressure[2]**	**Operating Pressure**	**Overpressure[1]**	**Burst Pressure[1]**
1 to 3	6	207	**15 to 43.5**	87	3000
>3 to 12	24		**>43.5 to 174**	348	
>12 to 60	120		**>174 to 870**	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.

TABLE 6. 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.

FIGURE 2. NOMENCLATURE AND ORDER GUIDE

For example, **MIPDN1XX010BSDAX** defines a MIP Series, Heavy Duty, Media-Isolated pressure transducer with digital output, with cable electrical connector type, 1/4-18 NPT pressure port type, 10 bar pressure range, sealed gage pressure reference, and digital I²C output.

MIP D N1 X X 010B S DA X[1]

Series
- **MIP** Media Isolated Pressure

Electrical Connector Type
- **D** Digital output with cable (100 mm [3.94 in] length)[2]

Pressure Port Type

F1	7/16-20 UNF 1/4 inch 45° Flare Female Schrader (SAE J512)	N2	1/8-27 NPT (ANSI/ASME B1.20.1)
G1	G1/4 A-G[3] (ISO 1179-3)	R1	R1/4-19 BSPT BSPT (ISO 7-1)
G2	G1/4 A-L[3] (ISO 1179-2)	R2	R1/8-28 BSPT BSPT (ISO 7-1)
M1	M12 x 1.5[3] (ISO 6149-3)	S1	9/16-18 UNF[3] (SAE J1926-2)
M3	M14 x 1.5[3] (ISO 6149-2)	S2	7/16-20 UNF[3] (SAE J1926-2)
N1	1/4-18 NPT (ANSI/ASME B1.20.1)	S3	3/8-24 UNF[3] (SAE J1926-2)

Special
- **X**

Special
- **X**

Pressure Range

bar				psi			
001B	1 bar	020B	20 bar	015P	15 psi	500P	500 psi
002B	2 bar	025B	25 bar	030P	30 psi	600P	600 psi
004B	4 bar	035B	35 bar	050P	50 psi	667P	667 psi
006B	6 bar	040B	40 bar	060P	60 psi	700P	700 psi
008B	8 bar	046B	46 bar	100P	100 psi	750P	750 psi
010B	10 bar	050B	50 bar	150P	150 psi	800P	800 psi
012B	12 bar	055B	55 bar	200P	200 psi	850P	850 psi
016B	16 bar	060B	60 bar	250P	250 psi	870P	870 psi
				300P	300 psi		

Pressure Reference
- **A** Absolute
- **S** Sealed gage[4]

Output Transfer Function
- **DA** I²C Digital output
- **DB** SPI Digital output

Special
- **X**

[1] Contact Honeywell Sales for custom configurations.
[2] Digital output with cable. Manufacturer part number is S1SST-06-28-GF-04.50-D-NDS.
[3] Other external seal materials are available for G1, G2, M1, M3, S1, S2, and S3 Pressure Port Types.
[4] Sealed gage option only available in pressure ranges at or above 8 bar | 100 psi.

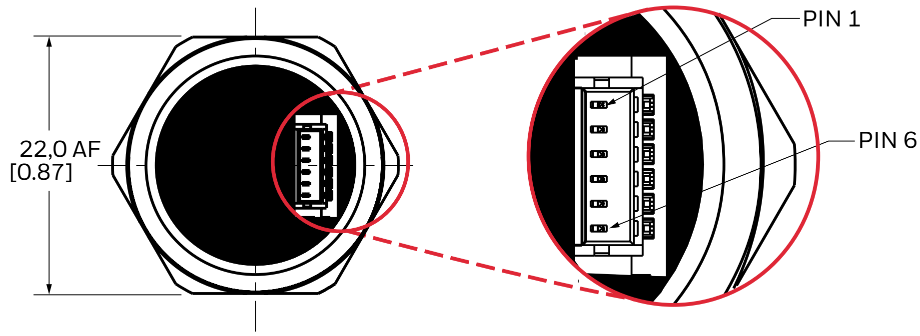
CAUTION
PRODUCT DAMAGE DUE TO MISUSE

- Ensure torque specifications are determined for the specific application. Values provided are for reference only. (Mating materials and thread sealants can result in significantly different torque values from one application to the next.)
- Use appropriate tools (such as an open-ended wrench or deep well socket) to install transducers.
- Ensure that the proper mating electrical connector with a seal is used to connect the transducer. Improper or damaged seals can compromise ingress protection, leading to short circuits.
- Ensure that filters are used upstream of the transducers to keep media flow free of particulates. MIP Series transducers are dead-end devices. Particulate accumulation may clog the port or damage the diaphragm.
- Ensure that the transducer is mounted in a vertical position with the process connection (pressure port) downward to avoid particular deposits.
- Ensure that the media does not create a residue when dried. Build-up of residue inside the transducer may affect its output.
- Ensure that the transducer housing is properly grounded.
- For cable harness versions, ensure that the cable bend radius is maintained at a minimum of 38 mm [1.50 in] in the end application assembly.

Failure to comply with these instructions may result in product damage.

1.0 PINOUT AND FUNCTIONALITY (SEE TABLE 7.)

TABLE 7. PINOUT AND FUNCTIONALITY



Pin Number	I²C		SPI	
	Name	Description	Name	Description
1	V_{DD}	Positive supply voltage	V_{DD}	Positive supply voltage
2	SDA	Data in/out	MOSI	Master Out/Sensor In
3	SCL	Clock input	SCK	Clock input
4	GND	Ground reference voltage signal	GND	Ground reference voltage signal
5	NC	No connection	MISO	Master In/Sensor Out
6	NC	No connection	SS	Sensor Select, Chip Select

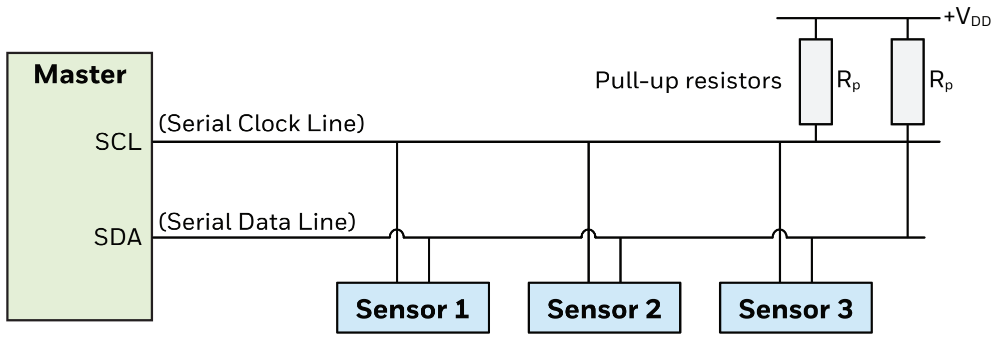
NOTICE

- Ensure proper connection to avoid permanent damage.
- Connect appropriate damping resistor at master side to avoid signal ringing/overshoot.

2.0 I²C COMMUNICATIONS

2.1 I²C BUS CONFIGURATION (SEE FIGURE 3)

FIGURE 3. I²C BUS CONFIGURATION



2.2 I²C DATA TRANSFER

The MIP Series I²C will only respond to requests from a Master device. Following the address and read bit from the Master, these sensors are designed to output up to seven bytes of data. The first data byte is the Status Byte (8-bit) , the second to fourth bytes are the Compensated Pressure Output (24-bit), and the fifth to seventh bytes are the compensated temperature output (24 bit).

2.3 I²C SENSOR ADDRESS

Each MIP Series I²C is referenced on the bus by a 7-bit sensor address. The default address is 00Hex. Custom addresses are available. (Please contact Honeywell Customer Service with questions regarding custom sensor addresses.)

2.4 I²C PRESSURE AND TEMPERATURE READING

To begin communication, the Master generates a START condition and sends the sensor address followed by a read bit (1). After the sensor generates an acknowledge, it will transmit up to 4 bytes of data. The first data byte is the Status Byte (8-bit), the second to fourth bytes are the Compensated Pressure Output (24-bit), and the fifth to seventh bytes are the compensated temperature output (24 bit).

The Master must acknowledge the receipt of each byte and can terminate the communication by sending a Not Acknowledge (NACK) bit followed by a Stop bit after receiving the required bytes of data.

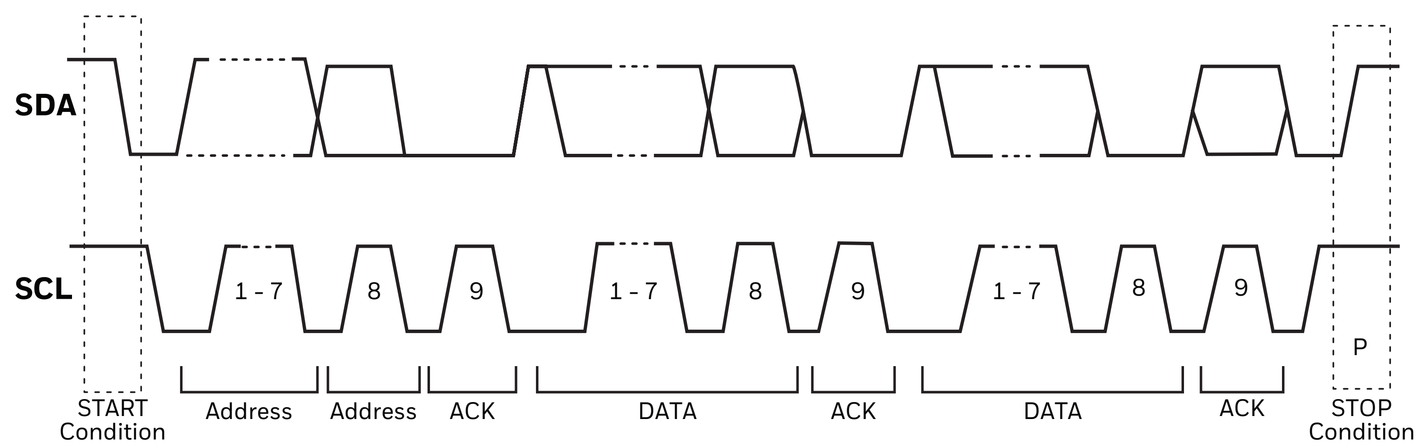
2.5 I²C OUTPUT MEASUREMENT COMMAND (SEE TABLE 8)

To communicate with the MIP Series I²C using an Output Measurement Command of “0xAA”, followed by “0x00” “0x00”, follow the steps shown in Table 8. This command causes the device to exit Standby/Sleep Mode and enter Operating/Active Mode. The time required for the sensor from exiting Standby/Sleep Mode and to initiate communication is 10 µs max. At the conclusion of the measurement cycle, the device will automatically re-enter Standby/Sleep Mode.

TABLE 8. I²C COMMAND REQUEST

Step	Action	
1	S | SensorAddr | 0 | A | Command | A | P ↑ Write bit S | SensorAddr | 0 | A | Command | A | CmdData <15:8> | A | CmdData <7:0> | A | P ↑ Write bit	
2	**Option 1:** Wait until the busy flag in the Status Byte clears. S | SensorAddr | 1 | A | Status | N | P ↑ Read bit	**Option 2:** Wait for at least 5 ms for the data conversion to occur.
3	S | SensorAddr | 1 | A | Status | A | SensorData <23:16> | A | SensorData <15:8> | A | SensorData <7:0> | A | TempData <23:16> | A | TempData <15:8> | A | TempData <7:0> | N | P ↑ Read bit	

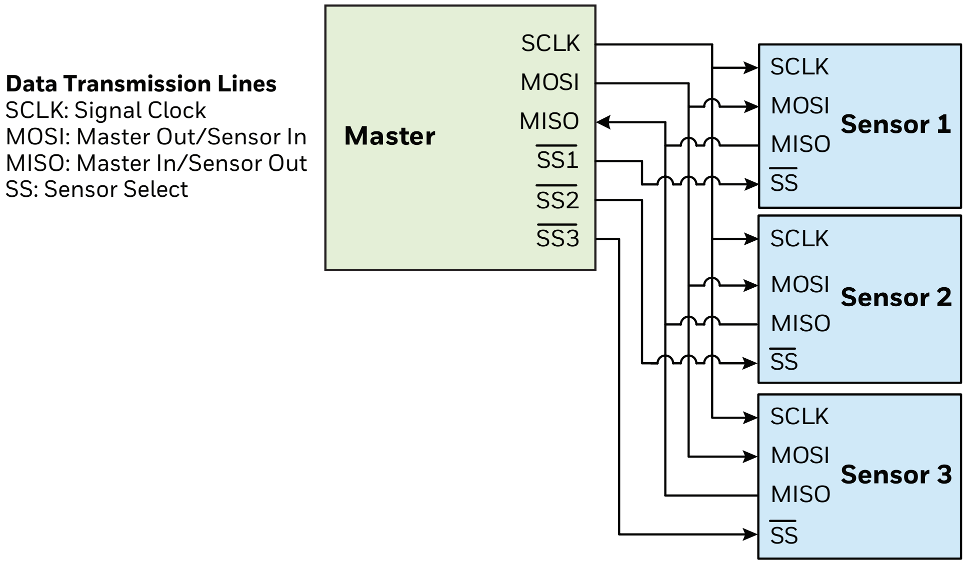
FIGURE 4. I²C TIMING CONFIGURATION



3.0 SPI COMMUNICATIONS

3.1. SPI BUS CONFIGURATION (SEE FIGURE 5)

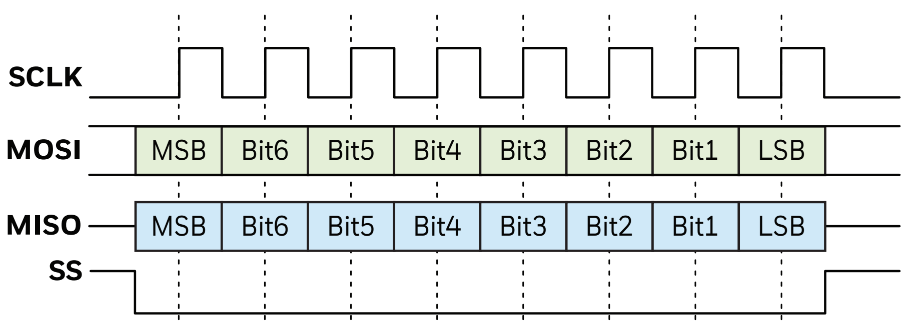
FIGURE 5. SPI BUS CONFIGURATION



3.2 SPI DATA TRANSFER (SEE FIGURE 6)

Communicate with the MIP Series SPI sensors by de-asserting the Sensor Select (SS) line. At this point, the sensor is no longer idle, and will begin sending data once a clock is received. MIP Series SPI sensors are configured for SPI operation in mode 0 (clock polarity is 0 and clock phase is 0). SPI operation in mode 1 (clock polarity is 0 and clock phase is 1), mode 2 (clock polarity is 1 and clock phase is 0), and mode 3 (clock polarity is 1 and clock phase is 1) is also available. (Contact Honeywell Sales for custom configurations.)

FIGURE 6. EXAMPLE OF 1 BYTE SPI DATA TRANSFER



3.3 SPI PRESSURE AND TEMPERATURE READING

To read out the compensated pressure and temperature reading, the Master generates the necessary clock signal after activating the sensor with the Sensor Select (SS) line. The sensor will transmit up to 7 bytes of data. The first data byte is the Status Byte (8-bit), the second to fourth bytes are the compensated pressure output (24-bit) and the fifth to seventh bytes are the Compensated Temperature Output (24-bit). The Master can terminate the communication by stopping the clock and deactivating the SS line.

3.4 SPI COMMUNICATION (SEE TABLE 9)

TABLE 9. SPI OUTPUT MEASUREMENT COMMAND

Step	Action	Notes
1	The data on MISO depend on the preceding command. Discard the data on the MISO line. 0xAA | 0x00 | 0x00 **MOSI**: Command other than NOP | CmdData <15:8> | CmdData <7:0> **MISO**: Status | Data | Data	• NOP Command is "0xF0".
2	**Option 1:** Wait until the busy flag in the Status Byte clears. **MOSI**: Command = NOP **MISO**: Status **Option 2:** Wait for at least 5 ms for the data conversion to occur.	
3	**MOSI**: Command = NOP | 00_{Hex} | 00_{Hex} | 00_{Hex} | 00_{Hex} | 00_{Hex} | 00_{Hex} **MISO**: Status | SensorData <23:16> | SensorData <15:8> | SensorData <7:0> | TempData <23:16> | TempData <15:8> | TempData <7:0>	

TABLE 10. SPI INTERFACE PARAMETERS

Characteristic	Description
Input rising and falling edge slew rate	1 V/ns
Delay time[1] between SS-activation edge and first edge of SLCK, MOSI or MISO	50 ns
Delay time[1] between SS-deactivation edge and last edge of SLCK, MOSI or MISO	50 ns
Delay between SS-deactivation edge of last command and of SS-activation edge for next command	10 µs

[1] Typical for conditions with no clocks prior to and after the command and data bytes.

TABLE 11. I²C AND SPI MODES STATUS

Bit (Meaning)	Status	Comment
7	Always 0	—
6 (Power indication)	1 = Device is powered 0 = Device is not powered	—
5 (Busy flag)	1 = Device is busy	Indicates that the data from the last command is not yet available. No new commands are processed if the device is busy.
4	0 = CMD/Debug mode 1 = Sleep mode	Mode StatusCMD/Debug mode is reserved for Honeywell.
3	Always 0	Mode Status
2 (Memory integrity/error flag)	0 = Integrity test passed 1 = Integrity test failed	Indicates whether check sum-based integrity test passed or failed. The memory error status bit is calculated only during power up sequence.
1	Always 0	—
0 (Math Saturation)	1 = Internal math saturation has occurred	—

4.0 PRESSURE AND TEMPERATURE CALCULATIONS

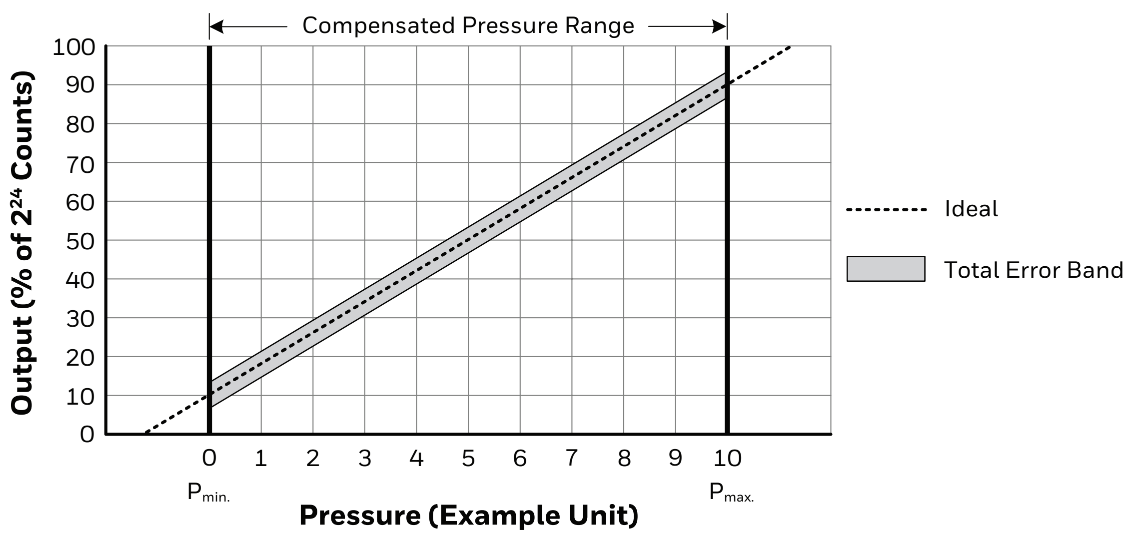
4.1 SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES (SEE TABLE 12)

TABLE 12. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES

Output (%)	Digital Counts		Output (°C)	Digital Counts	
	Decimal	Hex		Decimal	Hex
0	1677722	19999A	-40	0	0
25	5033165	4CCCCD	0	4067203	3E0F83
50	8388608	800000	25	6609205	64D935
75	11744051	B33333	85	12710011	C1F07B
100	15099494	E66666	125	16777215	FFFFFF

4.2 OUTPUT TRANSFER FUNCTION (SEE FIGURE 7)

FIGURE 7. OUTPUT TRANSFER FUNCTION



4.3 PRESSURE EXAMPLES

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

Where:

$\text{Output}_{max.}$ = output at maximum pressure [counts]

$\text{Output}_{min.}$ = output at minimum pressure [counts]

$P_{max.}$ = maximum value of pressure range [bar/psi]

$P_{min.}$ = minimum value of pressure range [bar/psi

Pressure = pressure reading [bar/psi]

Output = digital pressure reading [counts]

Example 1: Calculate the pressure for a 10 bar absolute sensor with a pressure output of 8388608 (decimal) counts.

$$5\text{ bar} = \frac{(8388608 - 1677722) * (10 - 0)}{15099494 - 1677722} + 0$$

Example 2: Calculate the pressure for a 25 bar sealed gage sensor with a pressure output of 8388608 (decimal) counts.

$$13.5135\text{ bar} = \frac{(8388608 - 1677722) * (26.0135 - 1.0135)}{15099494 - 1677722} + 1.0135$$

4.4 TEMPERATURE EXAMPLE

$$\text{Temperature} = \frac{T_{out} * (T_{max.} - T_{min.})}{2^{24}} + T_{min.}$$

Example: Calculate the temperature for a temperature output of 6291456 (decimal) counts. Where:

Temperature = calculated temperature output in °C

T_{out} = digital temperature output in counts (decimal)

$T_{max.}$ = 125°C

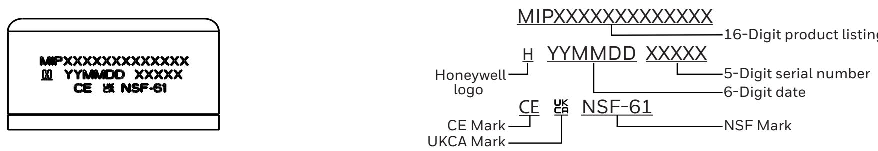
$T_{min.}$ = -40°C

$$21.875^{\circ}\text{C} = \frac{6291456 * (125 - (-40))}{2^{24}} + (-40)$$

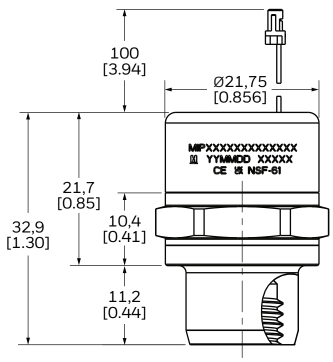
DIGITAL OUTPUT, HEAVY DUTY, MEDIA-ISOLATED PRESSURE TRANSDUCERS
MIP SERIES

FIGURE 8. MOUNTING DIMENSIONS (FOR REFERENCE ONLY. MM/[IN])

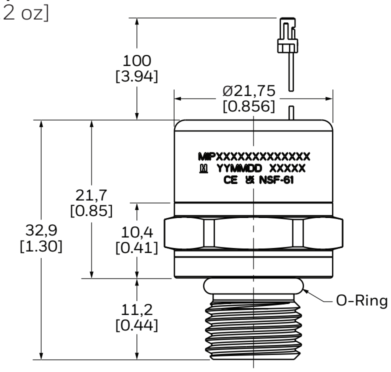
Product Marking



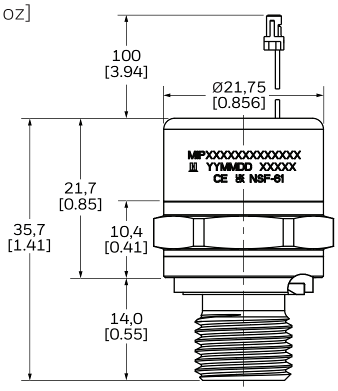
F1: 7/16-20 UNF 1/4 inch 45° Flare Female Schrader (SAE J512)
Seal: 45° cone
Mating geometry: SAE J512
Installation torque: 17 N m [12 ft-lb]
Weight: 37 g [1.3 oz]



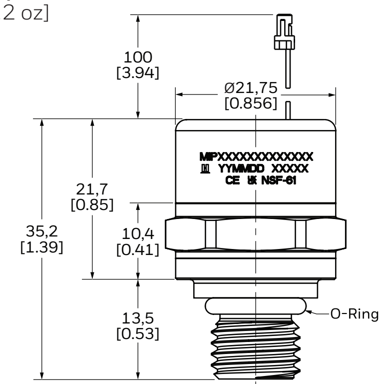
G1: G1/4 A-G (ISO 1179-3)
Seal: O-ring (included) and retaining ring ISO 1179-3-G1/4 (not included)
Mating geometry: ISO 1179-1
Installation torque: 20 N m [14.7 ft-lb]
Weight: 34 g [1.2 oz]



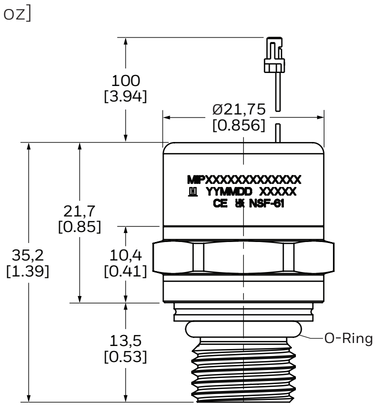
G2: G1/4 A-L (ISO 1179-2)
Seal: ISO 9974-2/DIN 3869 profile ring (included)
Mating geometry: ISO 1179-1
Installation torque: 20 N m [15 ft-lb]
Weight: 37 g [1.3 oz]



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: 35 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: 40 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: 39 g [1.4 oz]

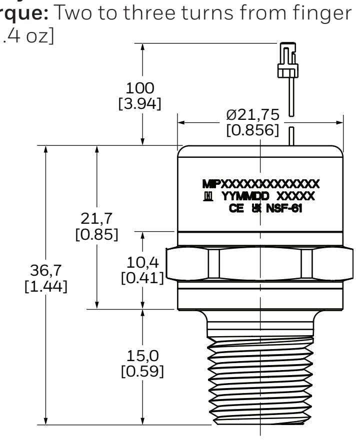
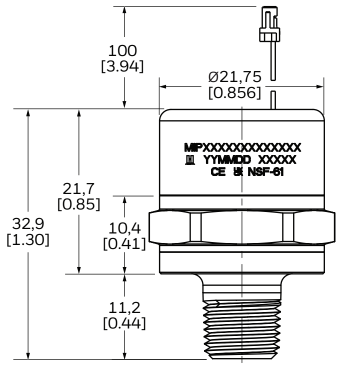
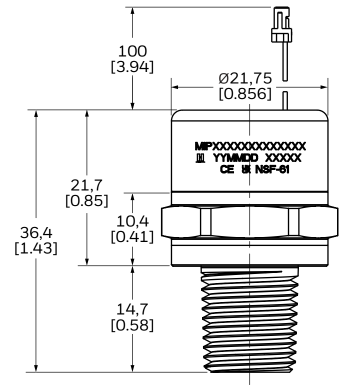


FIGURE 8. MOUNTING DIMENSIONS (FOR REFERENCE ONLY. MM/[IN]) (CONTINUED)

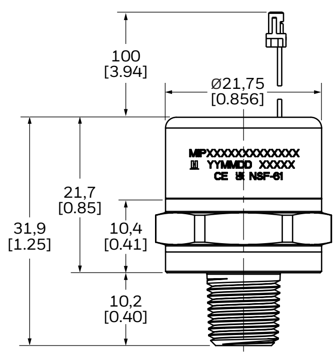
N2: 1/8-27 NPT
Seal: Pipe thread
Mating geometry: ANSI B1.20.1
Installation torque: Two to three turns from finger tight
Weight: 31 g [1.1 oz]



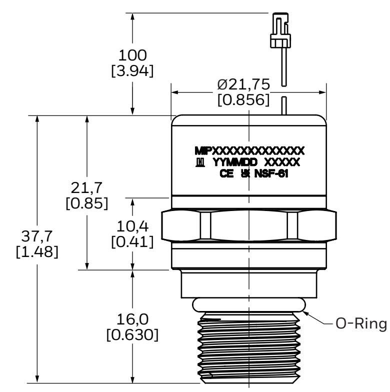
R1: R1/4-19 BSPT (ISO 7-1)
Seal: Pipe thread
Mating geometry: ISO 7-1
Installation torque: Two to three turns from finger tight
Weight: 37 g [1.3 oz]



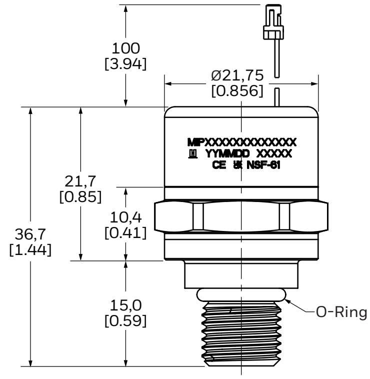
R2: R1/8-28 BSPT (ISO 7-1)
Seal: Pipe thread
Mating geometry: ISO 7-1
Installation torque: Two to three turns from finger tight
Weight: 30 g [1.1 oz]



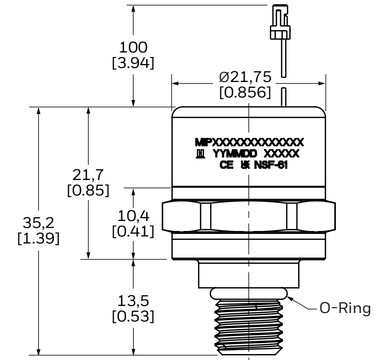
S1: 9/16-18 UNF (SAE J1926-2)
Seal: O-ring (included)
Mating geometry: SAE J1926-1
Installation torque: 30 N m [22.1 ft-lb]
Weight: 45 g [1.6 oz]



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: 37 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: 33 g [1.2 oz]



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