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TECHNICAL LITERATURE FOR DME PRESSURE TRANSDUCERS - Revision 1.2
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The following examples will show how to properly calculate pressure readings using DME slide sensors and DME button sensors. The product catalog numbers are SS-405C, SS-406C, BS-412C and the BS-413C.

STEP 1: What pressure transducer is the customer using?

If a BS-412C or a SS-405C is being used (Mold Pressure Transducer) then the Force Range is 500 Pounds. (lb.)

If a BS-413C or SS-406C is being used (Mold Pressure Transducer) then the Force Range is 2000 Pounds. (lb.)

If a HPS-420 is used (Hydraulic Pressure Transducer), then the Pressure Range is 3000 PSI.

Lets assume the customer has a BS-412C. The Force Range is 500 lbs.

STEP 2: Input voltage is 12 Volts maximum across pin A(+) to pin B(-). What is the actual voltage supplied?

Lets assume the customer says 10 Volts.

STEP 3: Now calculate the Full Scale Output Volts.

The Output is 2.0 mV/V Full Scale for the Mold Pressure Transducers and 2.3 mV/V for the Hydraulic Pressure Transducer from the catalog page. {i.e. - this is referred to as the transducer's sensitivity}

*** Mold Pressure Transducer ***

(2.0 mV / V Full Scale) x (10 Volts) = 20.0 mV / Full Scale

In other words, 20.0 milli-Volts = 500 lbs. Full Scale Force Range

If you would put a 500 lb. weight on the sensor with a 10 Volt input, then on pin A(+) to pin B(-) you would get 20.0 milli-volts out from pin C(+) to pin D(-).

*** Hydraulic Pressure Transducer ***

(2.3 mV / V Full Scale) x (10 Volts) = 23 mV / Full Scale

If you would put 3000 PSI of Hydraulic pressure on the sensor with a 10 Volt input on pin A(+) to pin B(-), you would get 23.0 milli-volts out from pin C(+) to pin D(-).

STEP 4: Now calculate the Full Scale Pressure Range output.

Lets assume the customer has an 1/8 inch pin.

The cross sectional area of the pin is equal to:

(square inches) = pi x {(diameter)^ 2} / 4

= {(0.125 inches) ^2} x 3.1416 / 4 = {0.015625} x 0.7854 = 0.01227 square inches (in^2).

Now take the Full Scale Force Range of the transducer and divide it by the cross sectional area of the pin to get the Full Scale Pressure Range.

500 lbs. / 0.01227 sq. in. = 40,750 PSI (pounds per square inch) Full Scale Pressure Range

also 40,750 PSI = 20.0 mV

*** NOTE ***

Remember that typical plastic injection molding machines develop from 0 to 20,000 PSI range. One should select a pin size and sensor Force Range such that the operating pressure is about 75% of the Full Scale Pressure Range for the best accuracy. The minimum percentage of Full Scale Pressure Range for operating pressure should be about 15% of Full Scale Pressure Range for accuracy purposes.

STEP 5: Now use this information to calculate operating pressure.

Set up a ratio of the operating pressure.

we know that 40,750 PSI = 20.0 mV

Measure the output voltage from pin C(+) to pin D(-).

Lets say the voltage is 2.5 milli-volts. (remember that input voltage is from pin A(+) to pin B(-) at 10 Volts)

$$\frac{\text{Operating Pressure}}{40{,}750\ \text{PSI}} = \frac{2.5\ \text{mV}}{20.0\ \text{mV}}$$

or

Operating Press. = 40,750 PSI x (2.5 mV) / (20 mV) = 5,093 PSI

CALIBRATION OF EQUIPMENT WITHOUT LOADING THE TRANSDUCER

The use of a shunt resistor will allow one to simulate a full load output on the transducer. In other words, it acts like putting a 500 lb. weights on a BS-412C transducer and generating the proper Full Scale Output Voltage. This can be used to calibrate instrumentation span without devising loading equipment.

The transducer is a 350 Ohm resistor bridge configuration. Measuring resistance between pin A and pin B when the transducer is not connected to power or an instrument should give a reading from 350 Ohms to 380 Ohms.

To simulate full scale, calculate the shunt resistor as follows:

Use the measured resistance from pin A to pin B. lets assume 350 Ohms and sensitivity of 2.0 mV / V

{350 / 4} / {0.002 V / V} = 43,750 Ohms shunt calibration resistor

Place the shunt calibration resistor between pin A(+ power) and pin C(+ signal). With input power of 10 Volts from pin A(+) to pin B(-), the output milli-volts should read from pin C(+ signal) to pin D(-signal), 20.0 millivolts.

Using the Full Scale Pressure Range calculated in STEP 4 above would be the pressure value to calibrate your full scale readout (for that example it was 40,750 PSI).

To obtain a percentage of Full Scale for calibration, lets say you wanted a calibration number of 21% full scale which is 0.21 x 40,750 PSI = 8,558 PSI, you would multiply the shunt calibration resistor by the ratio of {40,750 PSI / 8,558 PSI} x 43,750 Ohms = 208,321 Ohm resistor and use that resistance value in place of the shunt resistor to simulate a 21% scale output.

CHECKING A TRANSDUCER TO SEE IF IT IS GOOD

The measured resistance between the following pins should be as follows without anything hooked up to the transducer:

Pin A to Pin B ≅ 350 Ohms
Pin C to Pin D ≅ 350 Ohms
Pin A to Pin C ≅ 263 Ohms
Pin A to Pin D ≅ 263 Ohms
Pin B to Pin C ≅ 263 Ohms
Pin B to Pin D ≅ 263 Ohms

Typical failure readings would be 0 Ohms (wires shorted out) or infinite Ohms (999 flashing, etc. which signifies broken wires)

Damaged transducers will not give linear responses and is typically caused from exceeding full scale pressure of the transducer which causes physical damage to the diaphragm or top surface of the transducer. These are not repairable. Also, make sure that the transducer is fully supported from the back surface with no trapped debris between it and the mold. This could cause bad readings.

TABLE OF FULL SCALE PRESSURES VERSUS PIN DIAMETER

125 Pound Sensors

Pin Diameter Size in Inches 1/32 Inch Increment	**BS-411C 125 lb. Full Scale** PSI = 125/{PI*D^2/4}	Recommended Minimum Range 15% Full Scale	Recommended Operating Pressure 75% Full Scale
1/32	162,974.66 PSI F.S.	24,446.20 PSI	122,231.00 PSI
1/16	40,743.67 PSI F.S.	6,111.55 PSI	30,557.75 PSI
3/32	18,108.30 PSI F.S.	2,716.24 PSI	13,581.22 PSI
1/8	10,185.92 PSI F.S.	1,527.89 PSI	7,639.44 PSI
5/32	6,518.99 PSI F.S.	977.85 PSI	4,889.24 PSI
3/16	4,527.07 PSI F.S.	679.06 PSI	3,395.31 PSI
7/32	3,326.01 PSI F.S.	498.90 PSI	2,494.51 PSI
¼	2,546.48 PSI F.S.	381.97 PSI	1,909.86 PSI
9/32	2,012.03 PSI F.S.	301.80 PSI	1,509.02 PSI
5/16	1,629.75 PSI F.S.	244.46 PSI	1,222.31 PSI
11/32	1,346.90 PSI F.S.	202.03 PSI	1,010.17 PSI
3/8	1,131.77 PSI F.S.	169.77 PSI	848.83 PSI
13/32	964.35 PSI F.S.	144.65 PSI	723.26 PSI
7/16	831.50 PSI F.S.	124.73 PSI	623.63 PSI
15/32	724.33 PSI F.S.	108.65 PSI	543.25 PSI
½	636.62 PSI F.S.	95.49 PSI	477.46 PSI

500 Pound Sensors

Pin Diameter Size in Inches 1/32 Inch Increment	**BS-412C, SS-405C 500 lb. Full Scale** PSI = 500/{PI*D^2/4}	Recommended Minimum Range 15% Full Scale	Recommended Operating Pressure 75% Full Scale
1/32	651,898.65 PSI F.S.	97,784.80 PSI	488,923.99 PSI
1/16	162,974.66 PSI F.S.	24,446.20 PSI	122,231.00 PSI
3/32	72,433.18 PSI F.S.	10,864.98 PSI	54,324.89 PSI
1/8	40,743.67 PSI F.S.	6,111.55 PSI	30,557.75 PSI
5/32	26,075.95 PSI F.S.	3,911.39 PSI	19,556.96 PSI
3/16	18,108.30 PSI F.S.	2,716.24 PSI	13,581.22 PSI
7/32	13,304.05 PSI F.S.	1,995.61 PSI	9,978.04 PSI
¼	10,185.92 PSI F.S.	1,527.89 PSI	7,639.44 PSI
9/32	8,048.13 PSI F.S.	1,207.22 PSI	6,036.10 PSI
5/16	6,518.99 PSI F.S.	977.85 PSI	4,889.24 PSI
11/32	5,387.59 PSI F.S.	808.14 PSI	4,040.69 PSI
3/8	4,527.07 PSI F.S.	679.06 PSI	3,395.31 PSI
13/32	3,857.39 PSI F.S.	578.61 PSI	2,893.04 PSI
7/16	3,326.01 PSI F.S.	498.90 PSI	2,494.51 PSI
15/32	2,897.33 PSI F.S.	434.60 PSI	2,173.00 PSI
½	2,546.48 PSI F.S.	381.97 PSI	1,909.86 PSI

2,000 Pound Sensors

Pin Diameter Size in Inches 1/32 Inch Increment	**BS-413C, SS-406C 2000 lb. Full Scale** PSI = 2000/{PI*D^2/4}	Recommended Minimum Range 15% Full Scale	Recommended Operating Pressure 75% Full Scale
1/32	2,607,594.59 PSI F.S.	391,139.19 PSI	1,955,695.94 PSI
1/16	651,898.65 PSI F.S.	97,784.80 PSI	488,923.99 PSI
3/32	289,732.73 PSI F.S.	43,459.91 PSI	217,299.55 PSI
1/8	162,974.66 PSI F.S.	24,446.20 PSI	122,231.00 PSI
5/32	104,303.78 PSI F.S.	15,645.57 PSI	78,227.84 PSI
3/16	72,433.18 PSI F.S.	10,864.98 PSI	54,324.89 PSI
7/32	53,216.22 PSI F.S.	7,982.43 PSI	39,912.16 PSI
¼	40,743.67 PSI F.S.	6,111.55 PSI	30,557.75 PSI
9/32	32,192.53 PSI F.S.	4,828.88 PSI	24,144.39 PSI
5/16	26,075.95 PSI F.S.	3,911.39 PSI	19,556.96 PSI
11/32	21,550.37 PSI F.S.	3,232.56 PSI	16,162.78 PSI
3/8	18,108.30 PSI F.S.	2,716.24 PSI	13,581.22 PSI
13/32	15,429.55 PSI F.S.	2,314.43 PSI	11,572.17 PSI
7/16	13,304.05 PSI F.S.	1,995.61 PSI	9,978.04 PSI
15/32	11,589.31 PSI F.S.	1,738.40 PSI	8,691.98 PSI
½	10,185.92 PSI F.S.	1,527.89 PSI	7,639.44 PSI