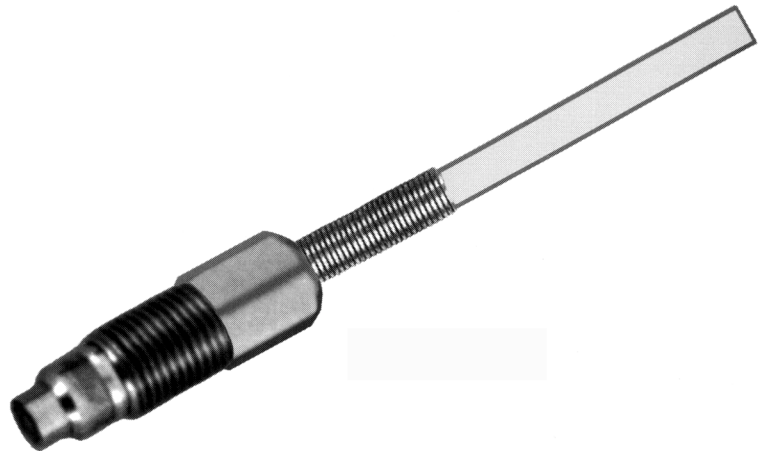
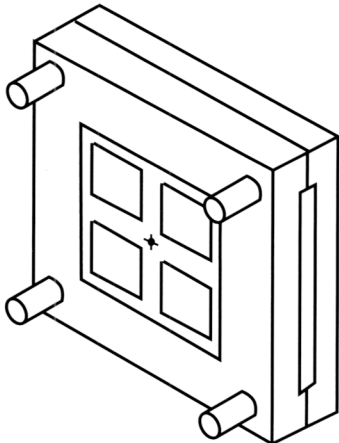
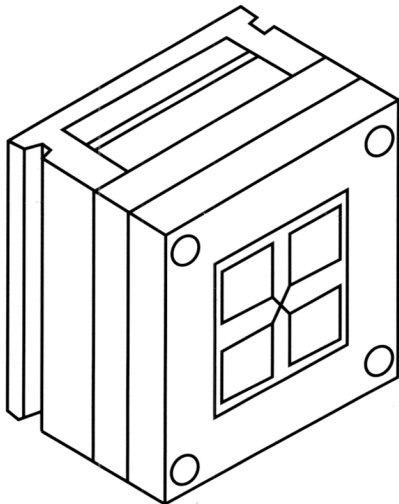
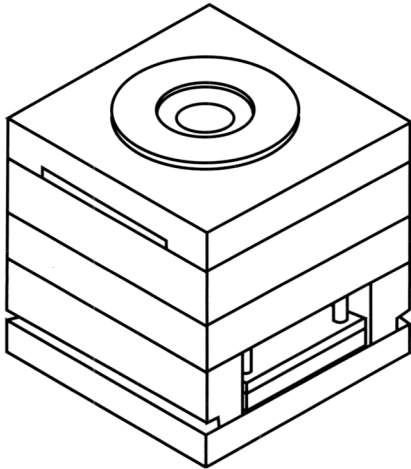




SENSONETICS

Sensing today...with tomorrow's technology

MOLD CAVITY PRESSURE AND TEMPERATURE TRANSDUCERS AND TRANSMITTERS



Measures both temperature and pressure

APPLICATIONS

- Blow molding
- Compression molding
- Chemical process industries
- Injection molding
- Insert molding
- RTM and SMC
- LIM and RIM
- Structural foam
- Pultrusion dies
- Transfer molding

FEATURES

- Sapphire Diaphragm
- Fast response time < 100 microseconds
- Infinite cycle life @ rated FSPR
- Abrasion-proof diaphragm
- No harmful mercury, NaK or Push Rods
- No signal decay
- No hysteresis
- Ideal for ISO-9000 and Six Sigma

MOLD CAVITY PRESSURE TEMPERATURE TRANSDUCERS

SENSONETICS offers direct cavity pressure temperature transducers for a broad range of pressures ranging from 0-150 PSI to 0-30,000 PSI for a wide variety of molding processes. Low pressure cavity transducers are used in RTM, LIM, RIM, and low pressure structural foam molding. Medium pressure cavity transducers are used in high pressure structural foam molding, SMC, and rubber compression molding. High pressure cavity transducers are used in the injection molding of the full range of thermosets, thermoplastics, and rubber.

Sensonetics's Cavity melt pressure transducer uses the same Silicon-on-Sapphire sensing diaphragm that has proven itself in melt extrusion applications. The sensing diaphragm is manufactured from sapphire, a single-crystal aluminum oxide that is the hardest of the metal oxide crystals and is chemically inert. Sapphire is ideally suited to the plastic melt transducer application. It has a modulus of elasticity 30% higher than stainless steel and is 5 times more abrasion resistant than tungsten carbide. In fact, the only material that can scratch it is diamond. The high modulus of elasticity combined with the high gage factor of the piezoresistive strain gages results in virtually infinite fatigue (cycle) life. Single-crystal piezoresistive strain gages are epitaxially grown on the sapphire force collection diaphragm, forming a homogeneous, single-crystal, radiation-hardened structure. It can be exposed directly to process media and can withstand continuous operating temperatures to 750°F. An optional silicon on-diaphragm RTD is available, providing excellent temperature measurement ($\pm 0.5^\circ\text{F}$) the melt isolated from the transducer mounting-well.

CAVITY MELT PRESSURE AND TEMPERATURE

PRESSURE and TEMPERATURE are the two IMPORTANT MEASURABLE PROCESS VARIABLES in molding processes. The use of mold cavity transducers assures complete mold fill-out when placed strategically in key mold cavity positions. Until now, good measurement tools were not available due to fatigue, lack of durability, and slow response time.

SENSONETICS' patented Silicon-on-Sapphire cavity pressure transducers provide direct pressure measurement with faster than 500 microsecond

response time. The sapphire diaphragm has infinite fatigue (cycle) life and will not wear out in abrasive melt applications. Its piezoresistive strain gage allows dynamic as well as steady-state pressures to be accurately measured without signal decay. The optional on-diaphragm temperature sensor provides cavity temperature information at the surface of the melt. Both of these parameters are especially important in thermoset molding applications, where maximum pressures and temperatures occur during the plastication process in the mold.

SENSONETICS cavity pressure transducers are characterized by the following:

1. Operating pressures from 150 to 30,000 PSI, temperature to 750°F.
2. Fast response time to better than 500 microseconds.
3. Infinite fatigue life, high gage factor and high modulus of elasticity of the sapphire diaphragm allow the transducer to operate at less than 10% of the proportional limit.
4. Piezoresistive strain gages - Virtually no hysteresis; dynamic as well as steady state pressures are measured.
5. Patented sapphire diaphragm, second in hardness to diamond, provides extreme resistance to wear and attack by abrasive fillers, blowing agents, or chemical and conductive additives.
6. Optional on-diaphragm Silicon RTD melt temperature sensor provides direct measurement of cavity melt temperature.
7. Compact design fits most mold configurations.
8. Environmentally safe; requires no hazardous chemical fills such as NaK and Mercury.
9. Available in millivolt, 0-10VDC, and 2-wire 4-20mA outputs. Compatible with industry standard for dataloggers, PLC's, PID controllers, and indicators.

MOLD CAVITY PRESSURE TEMPERATURE TRANSDUCERS

CAVITY PRESSURE VS. HYDRAULIC CLOSED LOOP PRESSURE CONTROL

The advantages of using SENSONETICS' cavity melt pressure transducers for closed-loop control instead of the hydraulic pressure transducers is as follows: measurement errors relating to variations in hydraulic oil viscosity, cylinder friction, screw shear variations, and plastic composition are eliminated. The cavity pressure measurement has 10 to 12 times better resolution, thus allowing much better control. Hydraulic transducers infer melt pressure while SENSONETICS cavity transducers measure it directly.

SENSONETICS' cavity pressure transducer's fast response ensures greater repeatability and accurate reproduction of injection peak, pack, and hold pressures. This is especially important for faster cycling machines. The results - fewer short shots, fewer flashed parts, faster setup times, fewer process control adjustments, and less scrap.

DIRECT CAVITY MOLD TRANSDUCERS VS EJECTOR PIN TRANSDUCERS

SENSONETICS direct pressure and temperature cavity mold transducers are superior to ejector-pin transducers in accuracy, response time, and repeatability. They also eliminate the problems associated with ejector pin hang-ups and the requirement for calculations for conversion to actual pressure. The optional on-diaphragm temperature sensor enables the measurement of melt temperatures and cooling rates. In the case of thermosets, the cavity transducer can measure temperature profiles of exotherms as well as curing.

SENSONETICS VS TIE-BAR STRETCH TRANSDUCERS

While tie-bar stretch is sometimes used to infer melt pressure, it is less repeatable than the direct cavity transducer. Depending upon cavity symmetry, tie-bar strain may not be identical in all four tie-bars. For best results using this method, all four tie-bars

should be measured. This increases cost and precludes any measurement of melt temperature which is possible with the Sensonetics' Cavity Pressure/Temperature transducers.

SENSONETICS VS OTHER DIRECT CAVITY PRESSURE TRANSDUCERS

SENSONETICS' patented Silicon-on-Sapphire diaphragm has superior chemical and abrasion resistance, infinite fatigue (Cycle) life, and faster dynamic signal response while capable of measuring steady-state pressure. The device does not require harmful liquid-metal fills that could contaminate molded parts.

SENSONETICS cavity pressure and temperature transducers are constructed to take the heat and keep up with the process dynamics. The results fewer failures and improved process reliability.

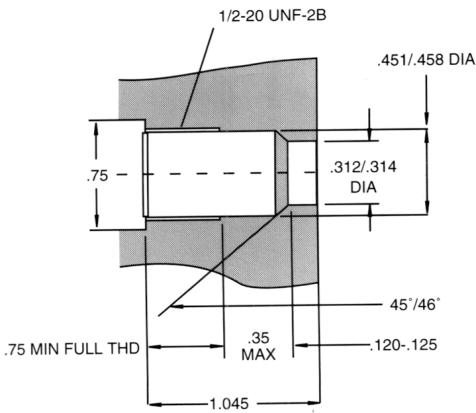
FIELD PROVEN IN PLASTIC EXTRUSION PROCESSES

SENSONETICS melt pressure and temperature transducers and transmitters are increasingly being used in extrusion applications and have been proven especially beneficial when tight control and quick response is required. In closed-loop pressure control such as critical catheter or film production, they allow users to achieve exceptional dimensional control. In highly filled polymer melt extrusion applications, the SENSONETICS melt pressure and temperature transducers have virtually unlimited wear life, thus eliminating costly downtime and replacement costs.

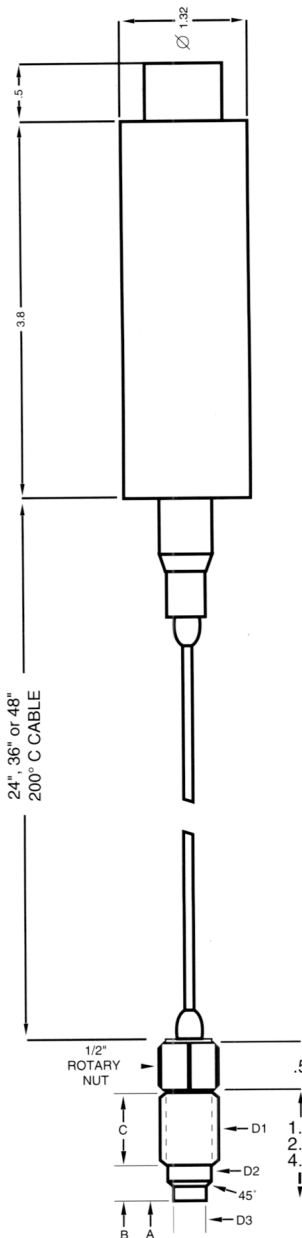
SYSTEM COMPATABILITY

SENSONETICS offers all of the standard outputs such as millivolts, 0-10VDC, or 2-wire 4-20mA, thus making them able to interface with all popular injection molding control systems. In many instances, provisions already exist for Cavity melt pressure control in modern solid-state controllers.

MOUNTING WELL



.312/.314 DIA & 1/2-20 UNF-2B THD are concentric to within .004 total indicator reading



C	.62
B	.45
A	.125
D4	.420
D3	.305
D2	.409
D1	1/2 X 20
OUTLINE DRAWING	No. 10 (inches)

PERFORMANCE CHARACTERISTICS

Pressure Ranges	0-150, 0-250, 0-500, 0-1000, 0-1500, 0-3000, 0-5000, 0-10000, 0-15000, 0-20000, 0-30000 PSI
Combined Error	Better than $\pm 0.5\%$ FSO
Repeatability	Better than $\pm 0.1\%$ FSO
Resolution	Infinite
Frequency Response	Better than 10 KHz
Maximum Pressure	2X full scale; 40,000 PSI Max

ELECTRICAL CHARACTERISTICS

	SEN-40X	SEN-41X	SEN-42X	SEN-43X
Output	0-33.3mV	0-5VDC	4-20mA	0-10VDC
Input Voltage	10VDC	16-32VDC	14-30VDC	16-32VDC
Load Resistance	as req	2000 OHMS MIN	800 OHMS MAX	2000 OHMS MIN
Zero Adjust	N/A	$\pm 10\%$ FS	$\pm 10\%$ FS	$\pm 10\%$ FS
Span Adjust	N/A	$\pm 10\%$ FS	$\pm 10\%$ FS	$\pm 10\%$ FS
Shunt Calibration	80% FSO $\pm 0.5\%$ for all models			

TEMPERATURE CHARACTERISTICS

Max Diaphragm Temp	800°F (425°C)
Temperature effects	
Zero	$\pm 0.01\%$ FSO/°F
Span	$\pm 0.005\%$ FSO/°F

CONNECTORS

C2=Pressure, 8 pin, PCIH-12-8P
 C4=Pressure & Temp., 8 pin, "
 CD=Conduit
 C6=P, 6-PIN-SEN421, PTIH-10-6P
 C8=P+T, 8-PIN-SEN422, PCIH-12-8P

TEMPERATURE SENSOR CHARACTERISTICS

	SEN-402	SEN-412	SEN-422	SEN-432
Output	mVDC	0-5VDC	4-20mA	0-10VDC
Input	.01mA	16-32VDC	14-30VDC	16-32VDC
Zero Adjust	N/A	$\pm 10\%$ FS	$\pm 10\%$ FS	$\pm 10\%$ FS
Span Adjust	N/A	$\pm 10\%$ FS	$\pm 10\%$ FS	$\pm 10\%$ FS

ORDERING INFORMATION

SEN -432 -20M-19R -1.0 -36 -C4
 SEN -422 -30M-19R -2.0 -48 -C8
 -MODEL
 -PRESSURE
 -BODY STYLE
 -STEM LENGTH, INCHES
 -FLEX, INCHES
 -CONNECTOR

RECOMMENDED ACCESSORIES

CAX-20 = 20 ft. CONNECTOR/CABLE ASSEMBLY
 X = SEE CONNECTOR NUMBER
 MB-1 = MOUNTING BRACKET