PERFORMANCE SPECIFICATION
PIEZORESISTIVE ACCELEROMETER
(71M10-XXX)

Document Number	Rev	Date	Entered by	Description of Change	Change Accountable Engineer	ECO
EDVPS71M10	E	6/26/23	NAD	Zero Measurand Output Updated	JKN	53965

1.0 DESCRIPTION

The ENDEVCO® Model 71M10 is a family of miniature, rugged, undamped, piezoresistive accelerometers designed for shock measurements. The Leadless Chip Carrier package is designed for surface mount attachment to circuit boards. The highly efficient sensing system of the Model 71M10 is sculpted from single crystal silicon, which includes the inertial mass and strain gages arranged in a four-active-arm Wheatstone bridge circuit (patent numbers 4,498,229, 4,605,919 and 4,689,600). The extremely small size and unique construction of the element provides exceptionally high resonant frequency. On-chip balance resistors provide low zero measure and output and low thermal zero drift. The light weight flat case is designed for adhesive mounting. The Model 71M10 features solder tinning of the electrical terminations and 10Vdc excitation.

2.0 PERFORMANCE

(See Note 1 for the relations between sensitivity, resonant frequency and range limitations)

	Sensitivity (microvolts/g)			**Resonant Frequency** (Kilohertz)	**Range** (g's)	**Overrange Limit** (g's)
MODEL	Min	Typ	Max	Typ		
71M10-60K	1.5	3	5	700	*60 000	120 000
71M10-20K	5	10	15	350	20 000	60 000
71M10-6K	15	30	50	180	6 000	18 000
71M10-2K	50	100	150	90	2 000	10 000

All specifications assume +75°F (+24°C) and 10 volts excitation.
*Refer to Note 3 for cautions and mounting procedures when operating at these acceleration levels.

2.1 AMPLITUDE LINEARITY [1] — ±2% of reading typical up to full scale acceleration.

2.2 ZERO SHIFT DUE TO HALF SINE ACCELERATION AT FULL RANGE. — 0.5 mV maximum

2.3 FREQUENCY RESPONSE [2]

MODEL	±5% Deviation at
-60 K	100kHz
-20 K	50kHz
-6 K	20 kHz
-2 K	10 kHz

2.4 ZERO MEASURAND OUTPUT — ±10 mV/V maximum at +75°F (+24°C)

2.5 TRANSVERSE SENSITIVITY [3] — 5% maximum

2.6 THERMAL ZERO SHIFT [9] — < 10 mV typical from 0°F to 150°F, reference 75°F

2.7 THERMAL SENSITIVITY SHIFT — Typical deviation is -.067% /°F (-.12% /°C)

3.0	**ELECTRICAL**	
3.1	EXCITATION [5] [7]	10.00 Vdc, 12 Vdc maximum
3.2	RESISTANCE INPUT OUTPUT	 650 ±300 ohms 650 ±300 ohms
3.3	WARM-UP TIME REQUIRED TO MEET THE ABOVE SPECIFICATIONS [3]	2 minutes maximum, 15 seconds typical
4.0	**PHYSICAL**	
4.1	CASE MATERIAL	Alumina substrate with plastic cover.
4.2	WEIGHT	0.06 grams
4.3	IDENTIFICATION	Model and serial number engraved into top of unit.
4.4	MOUNTING [3]	Recommended mounting is with structural epoxy acrossthe entire surface of the alumina substrate, with electrical connections made via solder to the metalized castellations.If electrical contact is made to the mounting surface, epoxy under fill is required to enable the unit to withstand high g shocks. Refer to instruction manual IM71 or IM71-60K for detailed mounting instructions.
5.0	**ENVIRONMENTAL**	
5.1	TEMPERATURE Operating: [5] [9] Non-operating:	 -65°F to +250°F (-54°C to +121°C) -65°F to +250°F (-54°C to +121°C)
5.2	SHOCK LIMITS (In any direction) [1]	Half sine pulse at full scale range. Pulse duration should be the greater of 20 microseconds or five periods of the resonant frequency.
5.3	HUMIDITY	Epoxy sealed
5.4	BASE STRAIN SENSITIVITY	Typically less than 0.5 mV for 250 microstrain when tested per ISA 37.2, para 6.5.
5.5	VIBRATION	No damage or degradation of performance was observed when subjected to random vibration in all 3 axes at .04 g^2/Hz from 80 to 350 Hz, with 30 dB/Octave roll offs down to 20 Hz and down to 2000 Hz.
5.6	ESD	This unit is susceptible to damage from ESD. The unit should be handled using the normal ESD precautions of wrist straps, etc.
6.0	**CALIBRATION DATA SUPPLIED**	(Taken at room temperature and 10.00 Vdc)
6.1	SENSITIVITY [4] [6] [7]	Sensitivity measured at recommended full scale range or 5000 g, whichever is smaller.
6.2	ZERO MEASURAND OUTPUT	Measured at 10.00 Vdc
6.3	INPUT RESISTANCE	
6.4	OUTPUT RESISTANCE	

7.0 ACCESSORIES

7.1 OPTIONAL

8.0 NOTES:

[1] The overrange limit is a design safety margin. Operating the unit above its rated range is not recommended.

IMPORTANT: Frequency content of shocks often contains significant amplitudes well above 100 kHz. Signal conditioning with insufficient bandwidth may attenuate the signal and indicate significantly lower peak accelerations than actually occur.

[2] Frequency response should deviate by less than ±5% from dc to indicated frequency, based on predicted response of single degree of freedom system. For conventional vibration sweeps using shakers, the signal to noise ratio is too low for accurate measurement of the frequency response for the 6K and higher ranges.

These frequency response estimates apply to the transducer mounted to an infinitely stiff surface. Mounting the unit to a structure such as a PCB will result in resonant outputs which are independent of the transducer.

NOTE: The sensor chip includes two masses, each with a separate resonant frequency. Both resonances satisfy the specified minimum resonant frequency. If these resonances are excited, the transducer output will exhibit a "beat" frequency which will not adversely affect results if the signal conditioning is linear at these frequencies.

[3] For best performance, the accelerometer should be attached parallel to a clean, flat surface. The adhesive should be chosen to match the strength and temperature requirements of the measurement environment. For best frequency response, keep the adhesive under the accelerometer as thin as possible. Tilt of the transducer relative to the mounting surface will result in increased sensitivity to transverse accelerations. Thermal conductivity of the adhesive and mounting surface may affect warm up characteristics.

[4] Prior to final calibration, each 2 Kg, 6 Kg, 20 Kg and 60Kg accelerometer is shocked in its sensitive axis approximately equal to its rated range.

[5]150°F is the maximum recommended operating temperature with 10 Vdc excitation and low thermal conductivity epoxy attachment to stainless steel. In applications requiring higher operating temperatures, lower excitation voltage and use of high thermal conductivity materials can increase the operating temperature to 250°F.

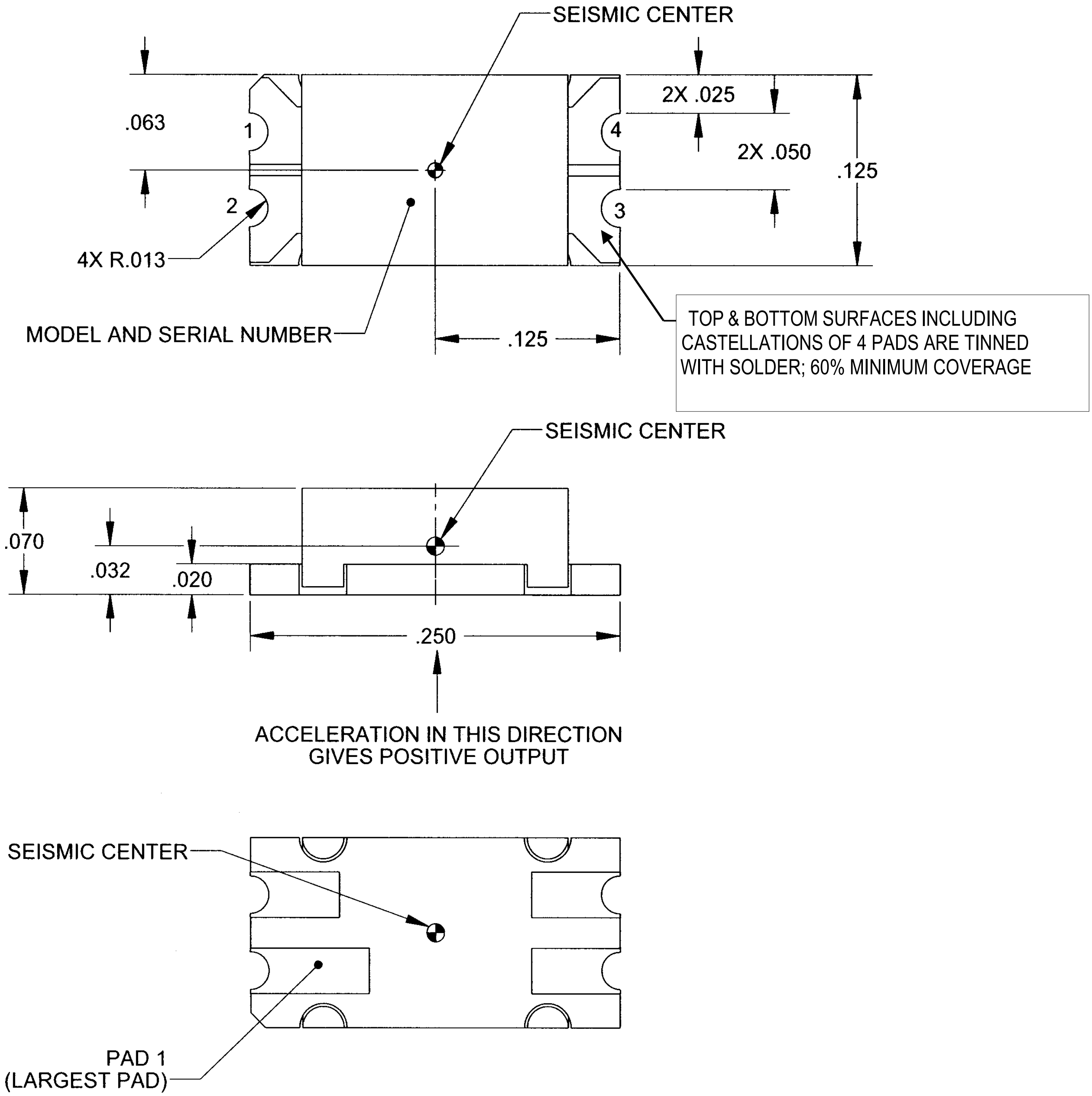
[6]Intentionally left blank.

[7] Although this circuit is a simple 4 active-arm wheatstone bridge, the sensitivity vs. excitation is not perfectly linear due to the self heating of the strain gages. For example, a typical -20K unit with sensitivity of 12.000 microvolts/g at 10.0 Vdc has a sensitivity of 6.09 microvolts/g at 5.0 Vdc. To obtain maximum accuracy from the calibration of the unit at Endevco, the excitation voltage to beused in the application should be the same as the calibration voltage. (For 5Vdc excitation use Model 71M5)

[8] Model Number Definition:

```
71      M10   -      XXX
|       |            |_________Range in g's
|       |                      -2K
|       |                      -6K
|       |                      -20K
|       |                      -60K
|       |
|       |_______________________Modifier
|
|_________________________________Basic Model Number
```

[9] Operating temperatures above 200°F results in highly variable and unpredictable thermal zero shift. TZS should be monitored and/or managed by auto-zeroing to ensure no loss in data due to signal saturation.



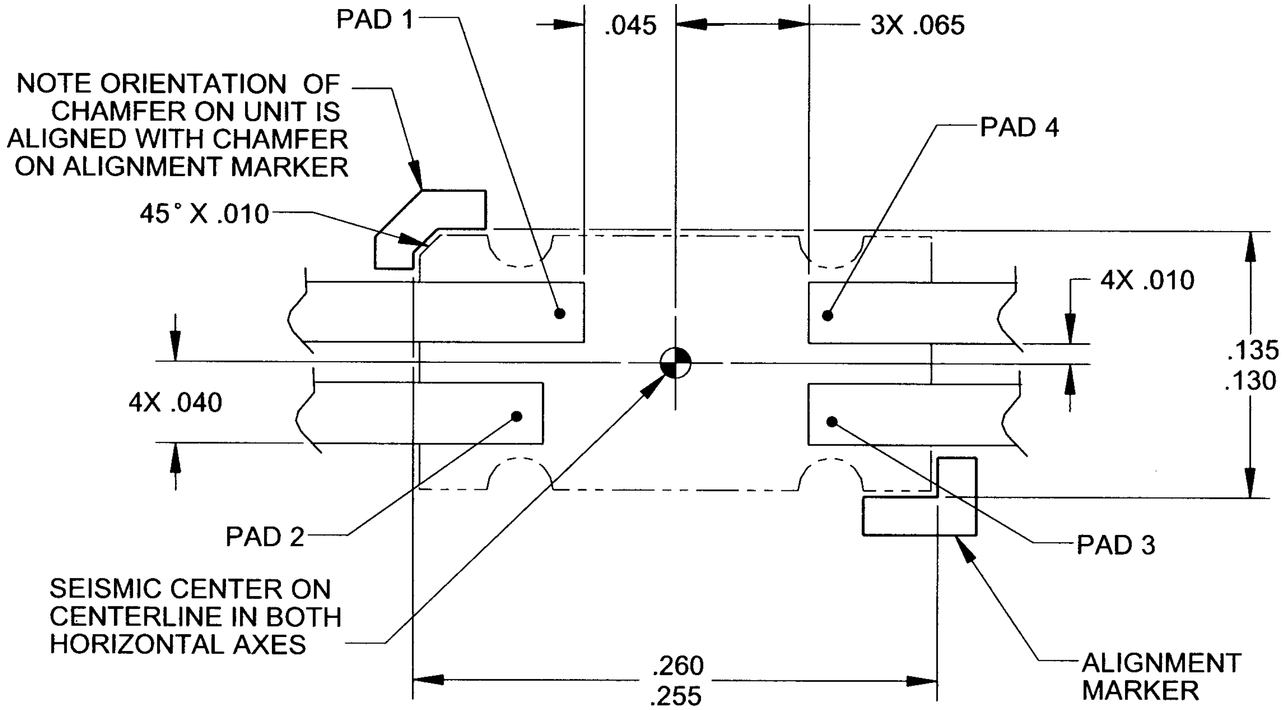
STANDARD TOLERANCE

INCHES [MILLIMETERS]

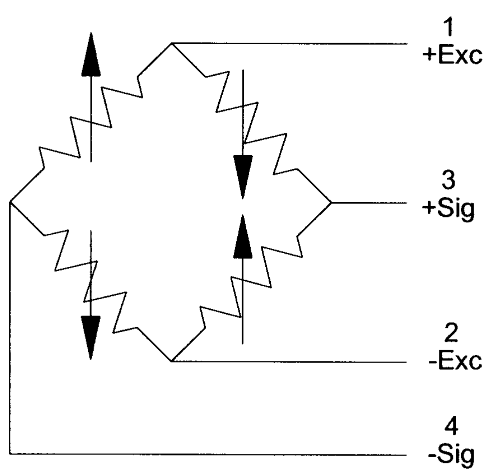
.XX = ± .02 [.X = ± .5]

XXX = ± .005 [.XX = ± .13]

FIGURE 1 - OUTLINE DRAWING



RECOMMENDED FOOTPRINT FOR MOUNTING



STANDARD TOLERANCE

INCHES	[MILLIMETERS]
.XX = ± .02	[.X = ± .5]
.XXX = ± .005	[.XX = ± .13]

FIGURE 2 - OUTLINE DRAWING