Micromachined Servo Accelerometer

ENDEVCO MODEL MSA100

Model MSA100

- **3 mg Bias Composite Error**
- **Rugged, Low Vibration Rectification**
- **High Resolution**
- **Range Adjustable**
- **Self Test**

Actual size

DESCRIPTION

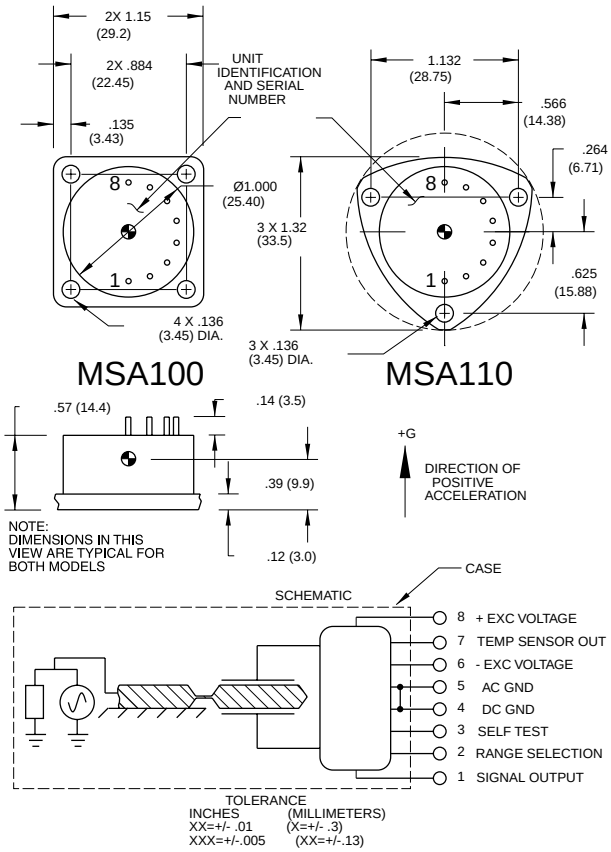
The ENDEVCO® Model MSA100 Servo Accelerometer utilizes a force rebalanced sensor that offers exceptional ruggedness, high resolution, and low vibration rectification. Temperature output and calibration coefficients are standard features allowing for modeling to 3 mg accuracies.

The Model MSA100 is designed for inertial motion studies in vehicles, tactical grade missile IMU's, flight tests, and tilt/angle measurements.

At the heart of the MSA100 is a three-layer micromachined silicon sensor. The middle layer includes the proof mass which, with applied acceleration, is electrostatically rebalanced to a null position between the upper and lower electrodes. This force rebalancing offers a wide bandwidth, minimal non-linearity and excellent performance in high shock and vibration environments. External resistors are used to adjust full scale range from the standard ±50 g's to lower g levels without affecting the accelerometer's electronics. The MSA100 also has self-test capability which moves the proof mass and outputs a proportional signal.

The micromachined silicon sensor and hybrid electronics are hermetically sealed for environmental protection in a stainless steel case with an industry standard mounting pattern. The Servo Accelerometer is also available with a triangular mounting plate as a Model MSA110.

U.S. Patent 5,205,171



SPECIFICATIONS

PERFORMANCE CHARACTERISTICS: All values are typical at +75°F (+24°C) and ±15 Vdc excitation and with ±50 g range unless otherwise stated. Calibration data, traceable to the National Institute of Standards, (NIST), is supplied. Reference Note [6] for definitions.

	Units	MSA100/MSA110
RANGE[1]	g	±50, Adjustable to ±0.5 [7]
BIAS	g Max	±1.5
BIAS COMPOSITE ERROR [2]	mg rms Typ	3
	mg rms Max	5
BIAS TEMPERATURE SENSITIVITY	µg/ °F Typ	330
	µg/ °C Typ	600

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SPECIFICATIONS—continued

PERFORMANCE CHARACTERISTICS—continued

	Units	MSA100/MSA110
SCALE FACTOR	mV/g	200 ±40
SCALE FACTOR COMPOSITE ERROR [2]	ppm Max	1000
SCALE FACTOR TEMPERATURE SENSITIVITY	ppm/°F Typ	-50
	ppm/°C Typ	-90
NON-LINEARITY	% FSO Typ	±0.1
FREQUENCY RESPONSE (±5% max, ref 100 Hz)	Hz	0 to 500
RESONANCE FREQUENCY	Hz Typ	2000
PHASE RESPONSE (0 to 500 Hz)	degree, Typ	-10
	degree, Max	-15
AXIS MISALIGNMENT	mrad Max	±10
VIBRATION RECTIFICATION COEFFICIENT [3] (0 to 2000 Hz)	$\mu g/g^2$ Max	30
VIBROPENDULOSITY	$\mu g/g^2$ Max	10
SELF-TEST	g/volt Typ	2.5
TEMPERATURE SENSOR OUTPUT@ +75°F (+24°C) [4]	V Typ	0.630
TEMPERATURE SENSOR SENSITIVITY	mV/°F Typ	1.2
	mV/°C Typ	2.1
ACTIVATION TIME	sec Max	0.5

ELECTRICAL

EXCITATION	±13 Vdc to ±18 Vdc	
Bias Voltage Sensitivity	< 1 µg/Vdc	
Scale Factor Voltage Sensitivity	<200 ppm/Vdc	
INPUT CURRENT	25 mA max per supply	
OUTPUT RESISTANCE	1000 ohms maximum	
INSULATION RESISTANCE	>20 Mohm at 50 Vdc	
OUTPUT NOISE [5] TYPICAL	0.5 to 10 Hz	0.4 µVrms/√Hz
	0.5 to 500 Hz	4 µVrms/√Hz
	0.5 to 10 kHz	40 µVrms/√Hz

PHYSICAL

CASE, MATERIAL	304L Stainless Steel
ELECTRICAL CONNECTIONS	Eight solder pins
IDENTIFICATION	Manufacturer's logo, model number and serial number
MOUNTING TORQUE	Holes for 4-40 or M3 mounting screws/ 6 lbf-in (0.7 Nm)
WEIGHT	40 grams maximum

ENVIRONMENTAL

TEMPERATURE RANGE, OPERATING	-65 to +221°F (-55 to +105°C)
VIBRATION	30 grms, 20 to 2000 Hz
SHOCK (half-sine pulse)	5000 g min, 200 µsecond or longer
HUMIDITY	Unaffected. Hermetically sealed
ALTITUDE	Unaffected
MAGNETIC SENSITIVITY ON BIAS	30 µg/ Gauss at 15 Gauss field

CALIBRATION DATA SUPPLIED

BIAS	mV
SCALE FACTOR	mV/g
AXIS MISALIGNMENT	mrad
TEMPERATURE MODELING	Coefficients for third order fit of Bias and Scale Factor
FREQUENCY RESPONSE	20 to 10 khz

ACCESSORIES

EHW265	(4) Size 4, Flat Washers
EH409	(4) 4-40 X 3/8 inch Cap Screws
EHM464	(1) Hex Wrench

NOTES

1. For best results unit should be calibrated to required lower acceleration ranges when rescaling.
2. RSS of temperature modeling residual and repeatability.
3. Optional 10 $\mu g/g^2$ available on special order.
4. Temperature modeling provides third order coefficients for bias and scale factor.
5. With 50 g full scale.
6. IEEE Std 337-1972. Standard Specification Format Guide and Test Procedure for linear, single axis, pendulous, analog and torque balance accelerometer.
7. Range selection external resistor (R_s) connected from pin 2 to pin 4.

$$R_s = \frac{10{,}000 \text{ ohms}}{\left(\frac{S_d}{S_u} - 1\right)}$$

S_d = desired scale factor, V/g.
S_u = unadjusted scale factor, V/g.

Continued product improvement necessitates that Endevco reserve the right to modify these specifications without notice. Endevco maintains a program of constant surveillance over all products to ensure a high level of reliability. This program includes attention to reliability factors during product design, the support of stringent Quality Control requirements, and compulsory corrective action procedures. These measures, together with conservative specifications have made the name Endevco synonymous with reliability.

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