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Vibration • Acoustique • Systèmes

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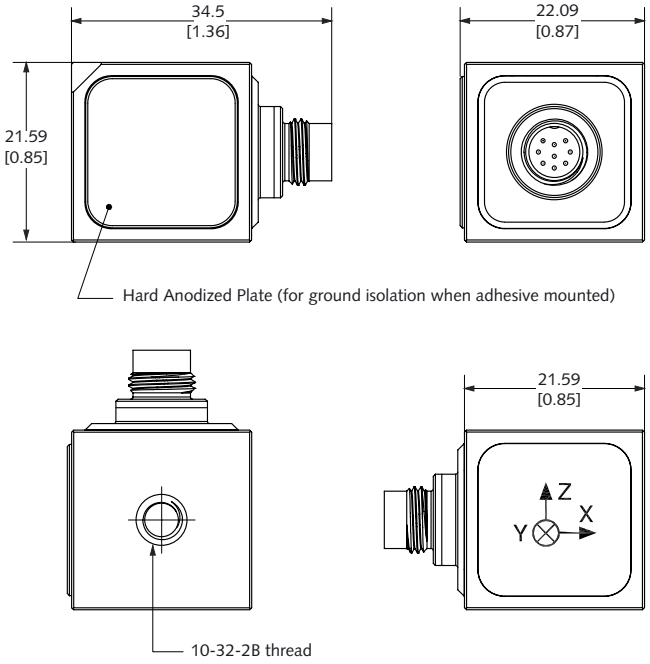
K-Beam Accelerometer

Type 8396A...

Capacitive MEMS, Triaxial Accelerometer

Type 8396A… is a high-sensitivity, low noise triaxial accelerometer which simultaneously measures acceleration and/or low-frequency vibration in three mutually perpendicular axes (x, y, z). The accelerometer features include:

- Measuring ranges: ±2 g, ±10 g, ±30 g, ±50 g, ±100 g, ±200 g
- Frequency response: 0 ... 2,000 Hz (5 %) (except ±2 g)
- Output Options: 0±4V or 2.5±2V single ended, 0±4V or 0±8V differential
- Operating temperature: –55 ... 125 °C [–65 … 260 °F]
- Low noise
- Excellent thermal stability
- Small cube, 30 grams mass
- Wide supply voltage range, 6 … 50 VDC
- 6,000 g_{pk} shock rated
- Conforming to CE



Description

Type 8396A… triaxial capacitive accelerometer family utilizes a silicon Micro-Electro-Mechanical System (MEMS) variable capacitance sensing element. The sensing element of each axis consists of a very small inertial mass and a flexure element cantilever positioned between two plates. As the mass deflects under acceleration, the capacitance between these plates changes. AC excitation and synchronous amplitude demodulation circuitry contained in the accelerometer's internal signal conditioner provides an analog output signal proportional to the applied acceleration. This output signal is scaled as a voltage which is proportional to the applied acceleration.

The output signal format is available as bipolar 0±4 V, single-ended 2.5±2 V and 0±4 V or 0±8 V differential. The accelerometer is powered by a single regulated supply between 6 and 50 VDC. Temperature output is provided if external compensation of the output signal is desired. The sensing element and electronics are contained in a lightweight, welded titanium housing with either a circular 9 pin connector or an integral cable* terminated by pigtails or 9 pin D-Sub connector. Ground isolation is obtained by mounting the sensor using one of the off-ground accessories or by adhesively mounting the sensor to the test object using the side of the sensor with the integral hard anodized plate.

* braided shield protection option also available upon request

8396A_003-325a-7.18

Technical data

Type	Unit	8396A2D0	8396A010	8396A030	8396A050	8396A100	8396A200
Acceleration range	g	±2	±10	±30	±50	±100	±200
Frequency response, ±5 %, min.	Hz	0 … 250	0... 1,000	0... 1,500	0... 1,500	0... 1,500	0... 1,500
±5%, typ.	Hz	0 ... 900	0 ... 2 000	0 ... 2 300	0 ... 2 700	0 ... 3 000	0 ... 3 500
±10 %, typ.	Hz	0 ... 1,000	0... 2,400	0... 3,000	0... 3,000	0... 3,500	0... 4,500
±3 dB, typ.	Hz	0 ... 1,150	0... 3,200	0... 4,000	0... 4,500	0... 5,000	0... 7,000
Damping ratio, nom.		0.7					
Sensitivity, ±5 % (ref 100 Hz),							
Output Type A, 0±4 V FSO output	mV/g	2,000	400	133.3	80	40	20
Output Type B, 2.5±2 V FSO output	mV/g	1,000	200	66.6	40	20	10
Output Type C, 0±4 V FSO differential	mV/g	2,000	400	133.3	80	40	20
Output Type D, 0±8 V FSO differential	mV/g	4,000	800	266.6	160	80	40
Resonant frequency, nom.	kHz	1.2	3.2	5.2	6.5	8.5	11
Transverse sensitivity, typ. (max.)	%	1.0 (3.0)					
Sensitive axis misalignment, typ. (max.)	mrad	10 (30)					
Amplitude linearity, max.	% FSO	±0.3					
Amplitude linearity, typ.	% FSO	±0.1					
Phase shift (max.) @ 0 Hz	degrees	0					
@ 10 Hz	degrees	2					
@ 100 Hz	degrees	10					
Noise density, 0 ... 100 Hz, typ. (max)	$mg_{rms}/\sqrt{Hz}$	0.007 (0.0085)	0.035 (0.042)	0.105 (0.125)	0.175 (0.210)	0.350 (0.420)	0.700 (0.840)
Noise 0 ... 100 Hz, typ.	mg_{rms}	0.070	0.350	1.050	1.750	3.500	7.000
Resolution (threshold), typ.	mg_{rms}	0.100	0.500	1.470	2.450	4.900	9.800

Electrical

0 g output, output Type (A; B; C; D)	mV	0 ±60 (A); 2,500±30 (B); 0±60 (C); 0 ±120 (D)
Capacitive load, max.	µF	0.5
Load resistance, min.	kΩ	30
Output impedance, typ.	ohm	300
Supply current, nom.	mA	12
Supply voltage, temperature	VDC	6 … 50 (≤ 100 °C [210 °F]); 6 … 35 (≤ 110 °C [230 °F]); 6 … 20 (≤ 120 °C [250 °F]); 6 … 12.5 (125 °C [260 °F])
Reverse polarity protection	yes/no	yes

Environmental

Shock, (half sine, 200 µs)	g	6,000
Random, (20 ... 2,000 Hz)	g_{rms}	20
Storage temperature range	°C [°F]	–55 ... 125 [–65 ... 260]
Operating temperature range	°C [°F]	–55 ... 125 [–65 ... 260]
Temp. coeff. sensitivity, typ. (max.)	ppm/°C [ppm/°F]	±100 (±300) [±55 (±165)]
Temp. coeff. sensitivity, typ. (max.)	%/°C [%/°F]	±0.01 (±0.030) [±0.006 (±0.017)]
Temp. coeff. bias, typ. (max.)	mg/°C [mg/°F]	±0.1 (±0.8) [±0.06 (±0.4)] / ±0.5 (±4) [±0.3 (±2.2)] / ±1.5 (±12) [±0.8 (±6.6)] / ±2.5 (±20) [±2.5 (±11)] / ±5 (±40) [±2.8 (±22)] / ±10 (±80) [±5.5 (±44)]

NOTE: Operation of the sensor with supply voltage exceeding stated values at indicated temperatures will cause permanent damage to the sensor.
1 g = 9.80665 m/s^2, 1 in = 25.4 mm, 1 gram = 0.03527 oz, 1 lbf-in = 0.1129 N·m

Technical data (continued...)

Type	Unit	8396A2D0	8396A010	8396A030	8396A050	8396A100	8396A200
Temperature sensor							
Output @ 20 °C [68 °F]	V (E.U.) [V (U.S.)]	1.23 [1.23]					
Sensitivity	mV/°C [mV/°F]	–4 [–2.2]					
Accuracy	°C [°F]	±5 [±9]					
Physical							
Case	type	Titanium					
Mounting	type	10-32 stud/adhesive					
Sealing	type	Hermetically sealed					
Ground isolation	yes/no	yes					
Weight (excluding cable), output type (A, B, C, D)	grams	31 (A, B); 33 (C, D)					
Cable length tolerance	m	±0.1					

Operation of the sensor with supply voltage exceeding stated values at indicated temperatures will cause permanent damage to the sensor.
1 g = 9.80665 m/s^2, 1 in = 25.4 mm, 1 gram = 0.03527 oz, 1 lbf-in = 0.1129 N·m

Application

Type 8396A… is an instrument grade triaxial accelerometer. As such, Type 8396A… is well-suited for a wide variety of R&D and OEM applications requiring precision measurements and packaging for demanding application and handling needs.

In particular, the sensor design is optimized for low frequency applications common to Aviation/Aerospace, Automotive, Civil Engineering Structures, Seismic, Railway and other R&D studies. In particular, Aviation/Aerospace ground and flight testing often evaluates dynamics and structural vibration to assess performance parameters, reliability and integrity. Automotive laboratory and road testing often evaluates system parameters such as vehicle ride, dynamics and structural analysis to assess performance parameters, reliability and durability. Civil engineering structures, such as bridges, often are evaluated for structural response to assess the integrity of the bridge to ensure safety. Seismic ground and structural testing is often performed to measure the effect of earthquakes and other natural phenomena. The differential versions are being used for railway comfort or conditional maintenance monitoring applications where halogen free cables are requested as well. Other R&D studies include human motion, robotics and platform motion control systems for example.

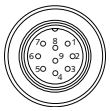
Mounting

Reliable and accurate measurements require that the mounting surface be clean and flat. The accelerometer can be directly attached to the test structure with the supplied stud. Alternately, a ground isolated adhesive mount is obtained by mounting the hard anodized aluminum side of the sensor to the test object. Several optional accessories are offered to mount Type 8396A… Type 8466K01 has an integral 10-32 stud and screws into threaded hole on the sensor to provide a ground isolated adhesive mount. Type 8466K02 is similar to Type 8466K01 except it has a threaded 10-32 hole to provide a ground isolated stud mount. Type 8466K03 has an integral 10-32 stud and screws into threaded hole on the sensor and provides a magnetic mount for the sensor. The instruction manual for Type 8396A… provides detailed information regarding mounting surface preparation.

Wiring - mating cable

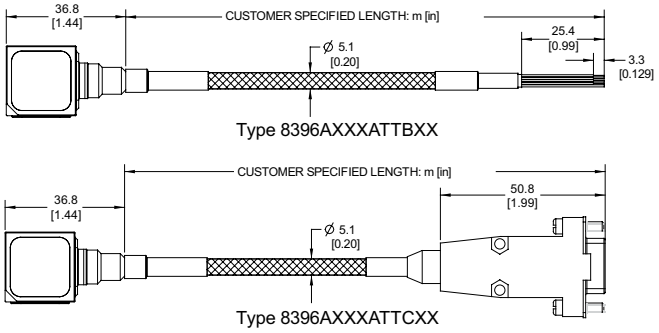
Sensor connector	**Function output**		**Integral cable TB vrs. or cable Type 1792A… K00/KB00**	**Integral cable TC vrs. or cable Type 1792A… K01/KB01**
Mini 9 pin female	AT, BT version	CT, DT versions	pigtail (color)	9 pin D-Sub
1	Power	Power	Red	1
2*	Ground	Ground	Black	2
3	X DC output	X DC output +	White	3
4	Y DC output	Y DC output +	Yellow	4
5	Z DC output	Z DC output +	Blue	5
6	Temp. output	Temp. output	Orange	9
7	N/C	X DC output –	Brown	6
8	N/C	Y DC output –	Green	7
9	N/C	Z DC output –	Violet	8
-	Case	Case	Shield	Shield

* not connected to cable shield



9 pin circular male connector sensor view

Integral cable solution

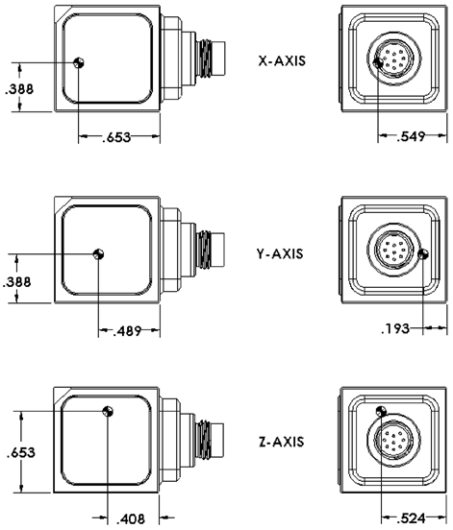


Dimensions specified in mm [in]

Measuring chain

Measure	Connect	Connect		Analyze
 Type 8396A… MEMS	 Type 1792A…K01 9 pin neg. circular 9 pin pos. D-Sub	 Type 1794, 9 pin neg. D-Sub (3) BNC pos. I (2) banana jacks for output AT and BT only		 not supplied
 Type 8396A… MEMS	 Type 1792A…K00 9 pin neg. circular pigtail	customer supplied		 not supplied
 Type 8396A… 15 up to 5	 Type 1792A…K01 9 pin neg. circular 9 pin pos. D-Sub	 Type 5146A15 15 channels power supply	 Type 1511 BNC pos. BNC pos. customer supplied	 Read-out

Center of sensing elements



Dimensions specified in mm [in]

Included accessories

	Type/Art. No.
• 10-32 mounting stud	8402
• Mounting wax	8432

Optional accessories

	Type/Art. No.
• Adhesive mounting base (off-ground) with 10-32 male sensor side	8466K01
• Mounting base (off-ground) with 10-32 male sensor side to 10-32 female mounting side	8466K02
• Magnetic mounting base	8466K03
• Interface plate for compatibility with legacy Type 8393 mounting hole pattern	8466K04
• Cable – mini 9 pin circular connector female, silicone jacket to pigtail (xx = length: 2, 5, or 10 meters – For other special length requests use 1792AK00sp)	1792AxxK00
• Cable – mini 9 pin circular connector female, silicone jacket to 9 pin D-Sub (xx = length: 2, 5, or 10 meters – For other special length requests use 1792AK01sp)	1792AxxK01
• 9 pin neg. D-Sub, (3) BNC pos. I (2) banana jacks (x = length: 2 meters – For other special length requests use 1794Asp)	1794Ax
• Halogen-free cable – mini 9 pin circular connector female to pigtail (Length to be specified upon order)	1792AK10sp
• Braided cable – mini 9 pin circular connector female, silicone jacket to pigtail (xx = length: 2, 5 or 10 meters – For other special length requests use 1792AKB00sp)	1792AxxKB00
• Braided cable – mini 9 pin circular connector female, silicone jacket to 9 pin D-Sub (xx = length: 2, 5, or 10 meters – For other special length requests use 1792AKB01sp)	1792AxxKB01

Ordering key

Type 8396A... □ □ □ □

Measuring range

±2 g	**2D0**
±10 g	**010**
±30 g	**030**
±50 g	**050**
±100 g	**100**
±200 g	**200**

Output Type

0±4 V FSO, with temperature output	**AT**
2.5±2 V FSO with temperature output	**BT**
0±4 V FSO, differential, w/ temp. output	**CT**
0±8 V FSO differential, w/ temp. output	**DT**

Housing

Hermetic titanium housing	**T**

Electrical interface/cable length (m)

Integral 9 pin connector	**A00**
Integral PET cable, braided shield protection, pigtail (specify length up to 20 m)	**Bxx**
Integral PET cable, braided shield protection, 9 pin D-Sub connector termination (specify length up to 20 m)	**Cxx**
Integral silicone cable, pigtail termination (specify length up to 20 m)	**Dxx**
Integral silicone cable, 9 pin male D-Sub connector termination (specify length up to 20 m)	**Exx**

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