



Borehole Accelerometer



Borehole Clamp



Borehole and Clamp Assembled

Ordering Information	
Part No.	Description
97120-00	131A-02/BH: Accelerometer, Force-balance, Triaxial 3g Borehole
97121-00	131A-02/BH/C: Accelerometer, Force-balance, Triaxial 3g Borehole Internal Digital Compass
97191-00	131A-02/BH/CLAMP: Borehole Clamp
97122-00	131B-01/1: Accelerometer, Force-balance, Uniaxial 4g
97243-00	131B-01/3: Accelerometer, Force-balance, Triaxial 4g
97126-00	131C-01/3: Accelerometer, Force-balance, Triaxial 4g, low profile

KEY FEATURES:

State-of-the-Art MEMS Accelerometer

Low Noise

Sensitivity and Offset Stable

Available in Triaxial, Uniaxial, and Borehole Models

APPLICATIONS:

Free Field Reference

Building Arrays

Structural Monitoring

Site Response

Aftershock Studies

REF TEK MEMS FORCE-BALANCE ACCELEROMETERS



REF TEK 131B-01/3 Low Noise Triaxial Accelerometer



REF TEK 131A-02/BH Triaxial Borehole Accelerometer

REF TEK 131B-01/1 Single Channel Accelerometer



The 131A-02/BH Triaxial Borehole Accelerometer offers a powerful combination of low noise and excellent stability for subsurface monitoring of ground motion.

The 131B Accelerometer is available in either a single channel model 131B-01/1 or a low noise triaxial model 131B-01/3. Both models provide excellent dynamic range, useful when used with 24-bit digitizers like the REF TEK 130 Series.

The 131A-02/BH Accelerometer is housed in a 3-inch diameter stainless steel cylindrical case with a sealed connector, which can be deployed at depths up to 2300 feet (700 meters).

The 131B Accelerometer uses a Micro-Electro-Mechanical System (MEMS) variable capacitance displacement sensor. Because no coils or magnets are used, the accelerometer is inherently stable over temperature, with excellent reliability, linearity, hysteresis, and noise levels. More than 15,000 of the MEMS elements are in use for oil and gas exploration.

The case design allows for a wedging system to be attached for installation instead of using conventional back-filling methods for securing orientation of the accelerometer. The orientation can be monitored by an optional internal digital compass. Additionally, by using the wedge system, the sensor is retrievable for your reinstallation needs.



Model 131 Series

Related Sub-systems:

Strong Motion Accelerographs, 130-SMHR & 130-SMA
 Accelerometers, 147-01 & 131B
 Broadband Seismometers, 151B-120, 151B-60, 151B-30

131B-01/3 Triaxial Accelerometer Specifications



The 131B-01/3 model is a $\pm 4g$ full scale accelerometer with $2\mu g^2/Hz$ noise level and is best suited for structural applications (building, bridge, dam monitoring) when the project requires accelerometers in triaxial configuration.

The 131B-01/3 housing is anodized machined aluminum. Mounting is accomplished with a single bolt and 3 point leveling screws. The case is sealed to meet IP67 standards for watertight integrity.

Configuration:Triaxial

Electrical:

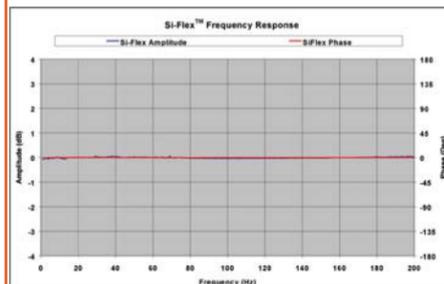
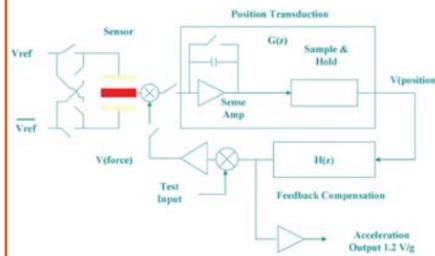
Full-scale Range: $\pm 4g$
 Dynamic Range: > 112 dB @ 1 Hz
 Full-scale Output: $\pm 10V$; 20 VPP
 Type:Force-balance
 Self Noise: $2\mu g^2/Hz$
 Linearity: $\pm 1\%$ of full scale
 Hysteresis: $< 0.005\%$ of full scale
 Cross Axis Sensitivity: < 0.005 g/g
 Frequency Response:DC - > 500 Hz
 Damping:0.6-0.7
 Output Impedance: ~ 100 ohms
 Shock:500g, 5 msec
 Self-test Response:Logic level input will produce 0.6g positive output
 Lightning Protection: ..Built-in surge protection
 Supply Voltage:10-16 VDC
 Supply Current:60 mA typical

Environment:

Operating Temp: -25 to $60^\circ C$
 Storage Temp: -40 to $85^\circ C$
 Humidity:0-100% non-condensing

Mechanical:

Type:Anodized aluminum, o-ring sealed access cover
 Size:4.1" h x 4.0" w x 4.0" d (10.4cm x 10.2cm x 10.2cm)
 Weight:2 lbs (~1 kg)



131B-01/1 Uniaxial Accelerometer Specifications



The 131B-01/1 shown here is $\pm 4g$ full scale with $2\mu g^2/Hz$ noise level and is best suited for structural applications (building, bridge, dam monitoring) when the project requires accelerometers to be deployed in uniaxial configuration.

The 131B-01/1 housing is a powdercoat paint over gold alodine aluminum. Mounting is accomplished with two bolts on one of two axes, thus the sensor may be oriented in any direction. This feature is an ideal application for structure monitoring, allowing for flexibility of installation. The case is sealed to meet IP67 standards for watertight integrity.

Configuration:Uniaxial

Electrical:

Full-scale Range: ± 4 g
 Full-scale Output: $\pm 10V$
 Type:Force-balance
 Self Noise: $2\mu g^2/Hz$
 Linearity: $\pm 1\%$ of full scale
 Hysteresis: $< 0.005\%$ of full scale
 Cross Axis Sensitivity:0.005 g/g
 Frequency Response:DC - > 500 Hz
 Damping:0.6 - 0.7
 Output Impedance: ~ 100 ohms
 Shock:500g, 5 msec
 Self-test Response:Logic level input will produce 1g positive output
 Lightning Protection: ..Built-in surge protection
 Supply Voltage:10 - 16 VDC
 Supply Current:20 mA typical

Environment:

Operating Temp: -25 to $60^\circ C$
 Storage Temp: -40 to $85^\circ C$
 Humidity:0-100% non-condensing

Mechanical:

Case:Powdercoat paint over gold alodine aluminum, gasket sealed access cover
 Size:3" h x 3.3" w x 3.2" d (7.6cm x 8.4cm x 8.1cm)
 Weight:1 lbs (~0.5 kg)
 Mounting:Two bolts on one of two axes

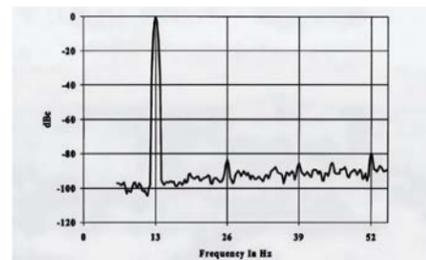
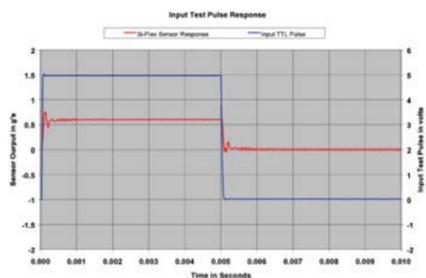


FIG. 7 - A PLOT OF THE SENSOR OUTPUT WITH A 13 Hz EXTERNAL EXCITATION VIBRATION APPLIED. TOTAL HARMONIC DISTORTION IS 0.023%.



131A-02/BH Borehole Accelerometer Specifications



The 131A-02/BH Accelerometer provides the industry standard analog output of $-10V$ to $10V$ full scale. The performance of the accelerometer includes exceptional linearity over a broad dynamic range, excellent bias stability, and little hysteresis errors or offset drift problems that are usually associated with other accelerometer designs.

The 131A-02/BH electronics employ three sensors mounted orthogonally in a rigid internal frame and anchored to the case. Provisions are built-in for mounting the internal digital compass. The modular electronics design consumes low power, only 60mA @ 12 VDC.

Configuration:Triaxial

Electrical:

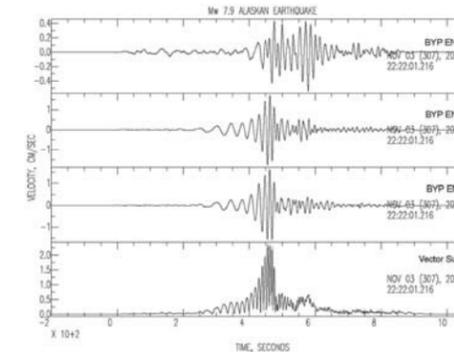
Full-scale Range: $> \pm 3g$
 Full-scale Output: ± 10 VDC
 Type:Force-balance
 Frequency Response:DC to > 500 Hz
 Natural Frequency: $> 2,000$ Hz
 Damping:0.6-0.7 of critical
 Amplitude Response:Flat $\pm 1\%$
 Linearity: $\pm 1\%$ of full scale
 Noise Floor:200 ng^2/Hz
 Cross-axis Sensitivity: $< 1\%$ g/g
 Temperature Effect: $< 0.5\%$ from $-40^\circ C$ to $+80^\circ C$
 Orientation:Monitored by internal digital compass
 Compass Resolution: $\pm 0.1^\circ$
 Compass Sensitivity: $\pm 0.5^\circ$
 Self Test:Logic level input will produce 0.5g positive output
 Zero Offset: $< 25\mu V$
 Case:Electrically isolated

Power:

Voltage:10 - 15 VDC
 Current:60mA @ 12 VDC (100mA with compass installed)

Mechanical:

Size:3" (7.6cm) dia. x 12" (30.5cm) long
 Weight:9.4 lbs (4.3 kg)
 Weight with Clamp:20 lbs (9.1 kg)
 Direction of Acceleration:Marked on the case
 Watertight Integrity:1000 psi
 Material:Stainless steel type 316
 Connector Type:Impulse
 Interconnection:2300 feet max. (701m)



Recorded with a 130-ANSS/02 using 131A-02/3