REF TEK

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Related Sub-systems:

Third Generation Broadband Seismic Recorders, 130-01 & 130B-01
Strong Motion Accelerographs, 130-SM & 130-SMA
Miniature Seismic Recorder, 125A-01 "Texan"
Advanced Seismic Networks

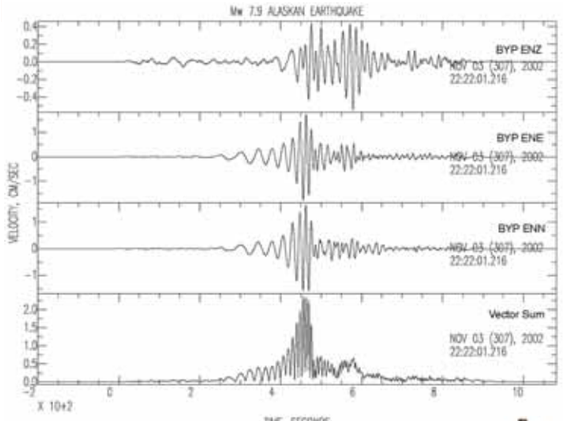
MEMS Force-Balance Accelerometers
131 SERIES

131A-02/BH Borehole Accelerometer

The REF TEK 131A-02/BH is a triaxial Borehole Accelerometer that offers a powerful combination of low noise and excellent stability for subsurface monitoring of ground motion. 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 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. Also, by using the wedge system, the sensor is retrievable for your reinstallation needs.

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.



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

131A-02/BH Accelerometer

Close up view of wedging cleet.

Borehole Clamp

Borehole package with clamp assembled

Configuration

Triaxial

Electrical

Full-scale Operation Range:	> ± 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 ± 1%
Linearity:	± 1% of full scale
Noise Floor:	200 ng^2/Hz
Cross-axis Sensitivity:	< 1% g/g
Temperature Effects:	< 0.5% from -40°C to +80°C
Orientation:	Monitored by internal digital compass
Compass Resolution:	± 0.1°
Compass Sensitivity:	± 0.5°
Self Test:	Logic level input will produce 0.5g positive output
Zero Offset:	< 25 µV
Case:	Electrically isolated

Power

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

Mechanical

Size:	3" diameter x 12" long
Direction of Acceleration:	Marked on the case
Watertight Integrity:	1000 psi
Material:	Stainless steel type 316
Connector Type:	Impulse
Interconnection:	2300 feet max.

Ordering Information

Part No.	Description
131A-02/3	Accelerometer, Force-balance, Triaxial 3g
131B-01/3	Accelerometer, Force-balance, Triaxial 4g
131A-BH	Accelerometer, Force-balance, Triaxial 3g Borehole
131A-BH/C	Accelerometer, Force-balance, Triaxial 3g Borehole, Internal Digital Compass
131A-BH/CLAMP	Borehole Clamp
131B-01/1	Accelerometer, Force-balance, Uniaxial 4g

Applications:

Free Field Reference
Building Arrays
Structural Monitoring
Site Response
Aftershock Studies

Features:

State-of-the-Art MEMS Force-Balance Accelerometer
Low Noise
Sensitivity and offset stable over wide temperature range
Available in triaxial, uniaxial, and borehole models

131A-02/3 & 131B-01/3 Triaxial Accelerometers

The REF TEK 131A-02/3 Low Noise model and 131B-01/3 are Triaxial Accelerometers which provide excellent dynamic range useful when used with 24-bit digitizers like the REF TEK 130 Series. These accelerometers use 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 131A-02/3 model shown here is greater than ±3g full scale with a low 200 ng^2/Hz noise level. This model is best suited for free field applications, such as microzonation, site response, earthquake monitoring, etc.

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

The 131A-02/3 and 131B-01/3 housings are 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

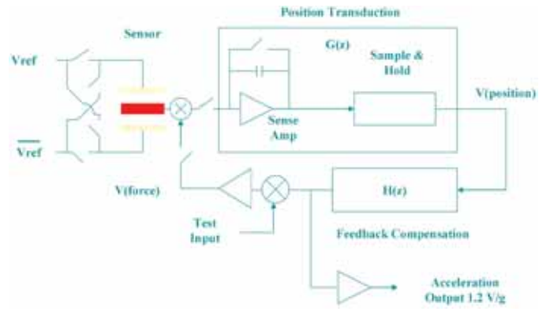
Full-scale Range:	> ±3g (131A) ±4g (131B)
Full-scale Output:	±10V
Type:	Force-balance accelerometer
Self Noise:	200 ng^2/Hz (131A) 2 μg^2/Hz (131B)
Linearity:	±1% of full scale
Hysteresis:	< 0.005% of full scale
Cross Axis Sensitivity:	< 0.005 g/g
Frequency Response:	DC - >500 Hz
Damping:	0.6-0.7
Output 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

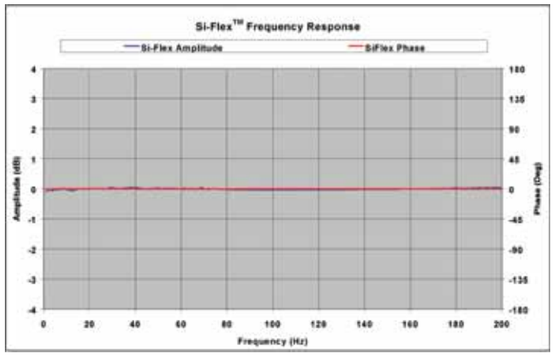
Environment

Operating Temp:	-25 to 60°C
Storage Temp:	-40 to 85°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
Weight:	2 lbs (~1 kg)
Mounting:	Single bolt attachment, 3 leveling screws





131B-01/1 Uniaxial Accelerometer

The REF TEK 131B-01/1 is a single channel Accelerometer which provides excellent dynamic range useful when used with 24-bit digitizers like the REF TEK 130 series. This 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 131B-01/1 shown here is ±4g full scale with 2 μg^2/Hz noise level.

The 131B-01/1 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.

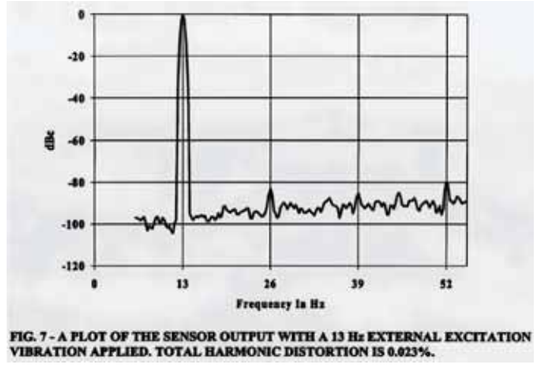
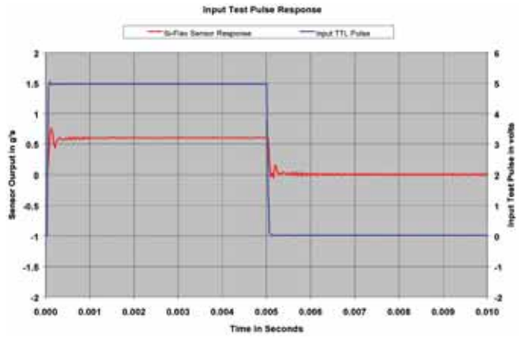


FIG. 7 - A PLOT OF THE SENSOR OUTPUT WITH A 13 Hz EXTERNAL EXCITATION VIBRATION APPLIED. TOTAL HARMONIC DISTORTION IS 0.023%.



Configuration Uniaxial

Electrical

Full-scale Range:	±4 g Full Scale
Full-scale Output:	±10V
Type:	Force-balance accelerometer
Self Noise:	2 μg^2/Hz
Linearity:	±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°C
Storage Temp:	-40 to 85°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
Weight:	1 lbs (~0.5 kg)
Mounting:	Two bolts on one of two axes