OPERATION AND MAINTENANCE MANUAL
TRIAXIAL ACCELEROMETER
MODEL PA-23

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ILLUSTRATIONS

1. GENERAL DESCRIPTION

1.1 PURPOSE OF EQUIPMENT

The Short-Period Triaxial Accelerometer, Model PA-23 is a small portable three-component accelerometer suitable for use in the DC to 100 Hz frequency range with a full scale output of 4.0 g.

1.2 DESCRIPTION OF INSTRUMENT

The Triaxial Accelerometer consists of three, Model 60714 Force Balance Accelerometers, two horizontal, and one vertical. The sensors are securely mounted on a plate inside the case. Power and Input/Output for all three sensors is provided by one connector.

The PA-23 Triaxial Accelerometer is a rugged instrument that does not require a mass lock, but reasonable care should be exercised to prevent damage or change in calibration. Calibrations to verify proper operation should be run if accelerations of over 20 g are encountered.

1.3 SPECIFICATIONS

1.3.1 Sensitivity And Full Scale

The PA-23 can be factory configured to output either: (1) a single-sided voltage signal where SIGNAL (-)[1] is always grounded, or (2) a differential voltage signal where SIGNAL (+) is approximately the negative of SIGNAL (-).

For single sided output, the sensitivity is nominally 2.5 V / g. Full scale ± 10V corresponding to ± 4.0g. For differential output, the sensitivity may be varied to meet customer digitizing requirements.

1.3.2 Offset

Mechanically adjustable to less than ±25mV.

1.3.3 Absolute Accuracy

± 3% of full scale (with output offset mechanically nulled to less than ± 25mV). Absolute accuracy is defined as a maximum deviation from the expected ideal output voltage of the sensor expressed as a percentage of the full scale range. Calibrated sensitivity data is provided with each unit.

[1] Refer to Figure 2.1.

1.3.4 Linearity

± 0.2% of full scale. Linearity is defined as the maximum deviation of the sensor's transfer function from a straight line through the end points (± full scale) expressed as a percentage of the full scale range.

1.3.5 Cross Axis Sensitivity

± 0.01 g/g maximum.

1.3.6 Frequency Response

Flat (± 3 dB) from DC to 100 Hz.

1.3.7 Noise

Less than 4 μV RMS (non-coherent).

1.3.8 Dynamic Range

142 dB (145 dB between 0.1 – 5 Hz)

1.3.9 Calibration Input Sensitivity

Nominally 0.4 g/volt. Calibrated sensitivity data is provided with each unit.

1.3.10 Power Requirements

Voltage	+12 V (9 V – 36 V)
Current	57 mA
Power	1.1 Watts nominal

1.3.11 Environmental

Operating temperature of -20 to +70° C.
Storage temperature of -50 to +125° C.

1.3.12 Physical

Size:	Diameter	152 mm (6.0 in.)
	Height	107 mm (4.2 in., with feet)
	Weight	2.1 kg (4.6 lbs.)
	Construction	Weather resistant, IP67 rated
	Mating Connector	Souoriau 851-06JC18-32S50

2. CONFIGURATION AND INSTALLATION

2.1 UNPACKING

Remove instrument from shipping box and check items against the packing list. Contact Geotech Instruments, LLC if any discrepancies are found. Inspect unit for any obvious signs of external damage that may have occurred during shipping. Notify the carrier immediately if any damage is observed.

2.2 SETUP AND INSTALLATION

The sensors are calibrated as either horizontal or vertical units. Once calibrated, a sensor should only be used in the position it was set up for.

The PA-23 Triaxial Accelerometer should be installed in a sheltered environment, securely mounted to a flat surface via one center hole designed for a bolting screw 0.5 inch in diameter and 5 inch tall.

The installation should be made to insulate the PA-23 from low-frequency noise sources such as wind, temperature and precipitation. The installation should also provide good seismic coupling over the range of interest. The cost of the PA-23 has been minimized to facilitate permanent installation. Optimal coupling would be achieved by cementing the unit into a competent formation. The installation ideally would approximate uniform density, covering and contouring the surface to minimize wind-induced noise. Permanent installations, in particular should be provided with lightning protection for the PA-23, although all its inputs and power connections are transient protected.

The PA-23 should be orientated so that the NORTH marking on the top points in that direction. This is the required direction to orient the unit for positive data. Displacement in the up direction on the vertical channel; in the NORTH direction on the NORTH channel: and in the EAST direction on the EAST channel, will cause positive acceleration signals to be generated.

The PA-23 should be mounted on a level surface. A bubble level can be used but a more accurate method is to measure the output of the horizontal sensors with a DC meter while leveling the unit. At the factory, the PA-23 is tested on a calibrated level surface and the output of each accelerometer is adjusted to less than $\pm$ 50 mV.

The interconnecting cable should be wired using the schematic in Figure 2.1.

A general view of the PA-23 accelerometer surface package is shown in Figure 2.2.

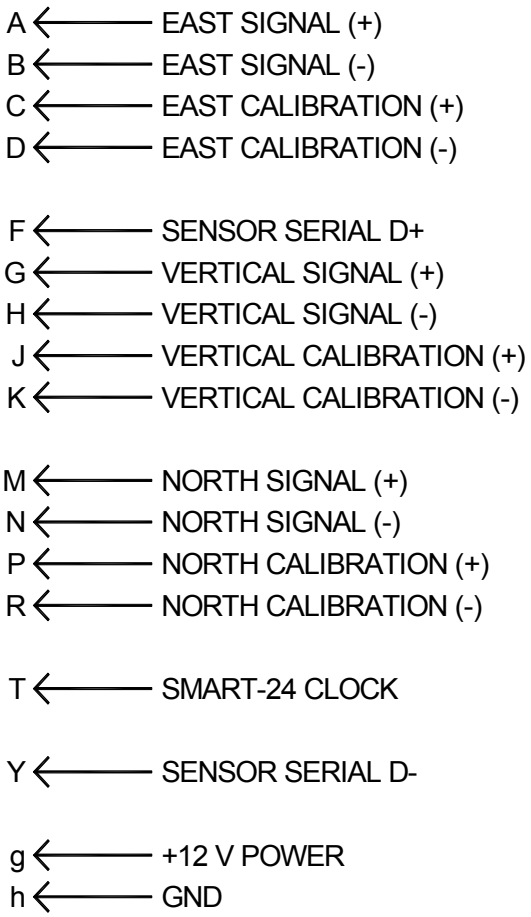


Figure 2.1 Circular Output Connector Pin Definition of Triaxial Accelerometer

Figure 2.2 Triaxial Accelerometer, Model PA-23

3. **OPERATION**

3.1 PRINCIPLE OF OPERATION

The Model 60714 FBA is a classic pendulous type force balance accelerometer (refer to Figure 3.1). The proof mass consists of a flat plate suspended by two metallic cantilever beams. The force torquer coil and counter balance are attached to the plate to complete the proof mass.

The flat plate of the proof mass is also the center plate of a differential capacitive pickoff transducer. The two fixed plates of the capacitor transducer are fastened to the frame of the accelerometer.

The proof mass assembly is attached to the frame so that the torquer coil is suspended in the magnetic field of a permanent magnet assembly.

An acceleration causes a movement between the proof mass and the frame that is detected by the capacitive pickoff transducer. This signal is amplified by the internal electronic circuit of the accelerometer and is fed back as a current through the torquer coil. This current interacts with the magnetic field of the permanent magnet assembly of the accelerometer to produce a force that is equal but opposite in direction to the acceleration force applied to the proof mass.

The output of the accelerometer is a voltage that is proportional to the feedback current, and thus, the acceleration applied to the accelerometer.

The DC offset of the accelerometer is determined by the position of the plate of the proof mass between the fixed plates of the capacitive pickoff sensor. A mechanical adjustment of this position is provided to allow setting of the DC offset.

3.2 MAINTENANCE & OFFSET ADJUST

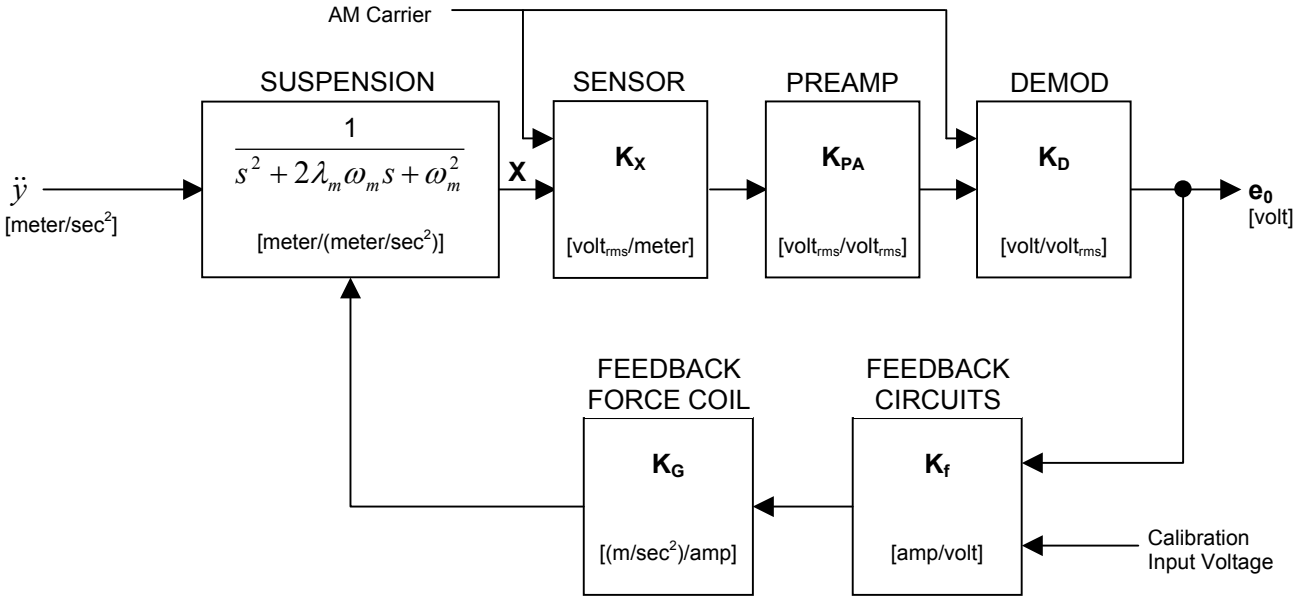
The Triaxial Accelerometer PA-23 does not require any routine maintenance.

There is a DC offset adjustment in each accelerometer that is accessible without removing the accelerometer cover. It is necessary to remove one of the covering screws (one on the upper panel to adjust the vertical sensor, and two on the lateral surface to adjust the horizontal sensors).

To adjust the DC offset, use a Philips screw driver to unscrew the covering screw and place the accelerometer on a level surface in its normal operating position, preferably on the final installation place. Use a flat blade screw driver to make the adjustment (the adjustment screw slot is about 0.020 inches (0.05 cm) wide. Carefully insert the screw driver straight into the accelerometer, and turn it slightly until you feel the screw driver fit into the slot of the adjustment screw. For the North and East accelerometers, the screw driver must be inserted about 1.7 inches (4.3 cm) to engage the adjusting screw; for the vertical accelerometer, the screw driver must be inserted about 1.3 inches (3.3 cm) to engage the

adjusting screw. Turn the screw slightly and observe the instrument that is monitoring the DC offset. The accelerometer can easily be set to zero ±0.003 volts.

When the adjustment is complete, cover the access holes with the covering screws using the Philips screw driver. The accelerometer is ready for operation.



$\ddot{y}$ - Input Acceleration
X - Motion between Mass and Frame
K_x - Capacitive Bridge Sensitivity
K_{PA} - Preamp Gain
K_D - Demodulator Gain
e_0 - Output Voltage
K_f - Feedback Gain
K_G - Feedback Force/Accel Constant

Figure 3.1 FBA Block Diagram