

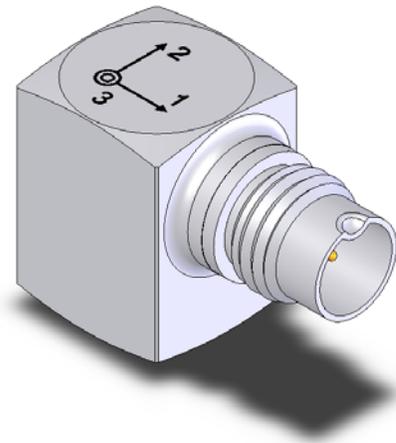


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OG3023A4  
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## OPERATING GUIDE

### MODEL 3023A4 MINIATURE TRIAXIAL LIVM<sup>™</sup> ACCELEROMETER WITH SINGLE 4-PIN CONNECTOR, STUD MOUNTED, CASE GROUNDED



Model 3023A4 is a miniature, **Low Impedance Voltage Mode (LIVM)<sup>™</sup>** triaxial accelerometer featuring a single, transverse mounted, 4-pin electrical connector. The 3023A4 features a 5-40 tapped hole in the bottom surface for mounting. Model 3023A4 is case grounded.

The sensitivity of each of the three orthogonal axes of Model 3023A4 is nominally 5 mV/g.

This Guide contains:

- 1) Specifications, Model 3023A4
- 2) Outline/Installation Drawing 127-3023A4
- 3) Paper, "Low Impedance Voltage Mode (LIVM) Theory and Operation"

**NOTE:** LIVM<sup>™</sup> is Dytran's trademark for its line of **Low Impedance Voltage Mode** sensors with built-in amplifiers operating from constant current sources over two wires. **LIVM** instruments are compatible with most other manufacturers' comparable systems.



## SPECIFICATIONS, MODEL 3023A4 TRIAXIAL ACCELEROMETER

| SPECIFICATIONS                                | VALUE   | UNITS  |
|---|---|--------|
| <b>PHYSICAL</b>                               |   |        |
| WEIGHT  | 4   | GRAMS  |
| SIZE (HEIGHT x WIDTH x DEPTH)                 | 0.49 x .36 x .36                                      | INCHES |
| MOUNTING                                      | 5-40 TAPPED HOLE IN BASE                              |        |
| CONNECTOR                                     | 4-PIN [1]   |        |
| MATERIAL, HOUSING/CONNECTOR                   | TITANIUM ALLOY  |        |
| <b>PERFORMANCE</b>                            |   |        |
| SENSITIVITY, -10 +15% [2]                     | 5.0   | mV/g   |
| RANGE, F.S. (each axis)                       | +/- 1000  | g      |
| FREQUENCY RESPONSE AXIS 1 & 2 (-10 / +15%)    | 1.5 to 5000   | Hz     |
| FREQUENCY RESPONSE AXIS 3 (-10 / +15%)        | 1.5 to 10000  | Hz     |
| ELEMENT NATURAL FREQUENCY, NOM.               | 40  | kHz    |
| EQUIVALENT ELECTRICAL NOISE                   | .0095   | g rms  |
| LINEARITY [3]                                 | 1   | %F.S.  |
| TRANSVERSE SENSITIVITY, MAX,                  | 5   | %      |
| SIGNAL POLARITY                               | POSITIVE FOR MOTION IN DIRECTION OF ARROWS ON HOUSING |        |
| <b>ENVIRONMENTAL</b>                          |   |        |
| MAXIMUM VIBRATION                             | +/- 1000  | g pk   |
| MAXIMUM SHOCK                                 | 5000  | g pk   |
| TEMPERATURE RANGE                             | -60 to +250   | °F     |
| ENVIRONMENTAL SEAL                            | HERMETIC  |        |
| COEFFICIENT OF THERMAL SENSITIVITY            | .03   | %/°F   |
| <b>ELECTRICAL</b>                             |   |        |
| SUPPLY CURRENT RANGE, (each axis) [4]         | 2-to 20   | mA     |
| COMPLIANCE (SUPPLY) VOLTAGE RANGE (each axis) | +18 to +30  | VDC    |
| OUTPUT IMPEDANCE, TYP.                        | 100   | OHMS   |
| OUTPUT BIAS VOLTAGE, NOM.                     | +10   | VDC    |
| DISCHARGE TIME CONSTANT, NOM.                 | 0.3   | SEC    |
| GROUND ISOLATION                              | CASE GROUNDED   |        |

[1] Connector mates with Dytran cable assy. Model 6811Axx. (xx = length in feet)

[2] Reference sensitivity measured at 100 Hz, 1 g rms per ISA RP 37.2

[3] Linearity is % of specified full scale (or any lesser full scale range), zero-based best fit straight line method.

[4] Power only with Dytran LIVM power unit or other Dytran-compatible constant current type power unit. If power is applied without current limiting protection, the internal amplifier will be immediately destroyed.

## OPERATING INSTRUCTIONS

### MODEL 3023A4 TRIAXIAL ACCELEROMETER

#### INTRODUCTION

Model 3023A4 is a miniature three-axis accelerometer, using the latest in quartz shear technology, coupled with 2-wire internal LIVM electronics.

This instrument contains three miniature quartz laminar shear mode accelerometer elements mounted to a single support and welded into a titanium housing. The three elements are mounted orthogonally to each other so that they can measure the complete motion of a point, i.e., in three orthogonal axes.

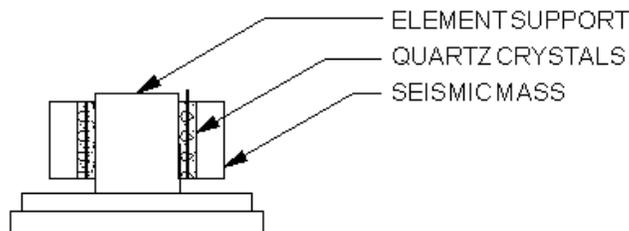
Model 3023A4 is designed to mount by means of a 5-40 tapped hole in the base. In order to precisely align the x and y axes, it is best to mount the 3023A4 to a mounting pad (such as the Dytran Model 6207 adhesive mounting base) which is then adhesive mounted to the test surface. Model 3023A4 may also be mounted with adhesives directly to the test surface without a mounting pad, but this is not the preferred method.

LIVM (Low Impedance Voltage Mode) design means that three miniature IC amplifiers are built into the instrument, one for each axis, to lower the impedance of the quartz seismic elements by many orders of magnitude. This technique allows the driving of long cables without affecting sensitivity and the use of very simple constant current type power units.

#### DESCRIPTION

Refer to the outline/installation drawing 127-3023A4 for the dimensions of Model 3023A4.

This novel accelerometer features three modular style quartz seismic elements mounted to a single vertical post. Each planar shear mode element is connected to a miniature LIVM amplifier. The assembly is mounted in a titanium housing.



**Figure 1** Representative cross section, 3023A4 element assembly

The electrical connections from each of the three elements amplifiers are brought out to the contacts of a four-pin connector mounted transversely to a vertical face of the housing. The three signal/power connections to the elements are connected to three pins while the three ground returns for the elements are tied together to one common pin of the four-pin connector. The case of this instrument is connected to electrical ground.

The performance specifications and criteria for Model 3023A4 are delineated on the specification sheet included with this operating guide.

#### INSTALLATION

Refer to the Outline/Installation drawing 127-3023A4 for this section.

This accelerometer is designed for mounting by use of an adhesive mounting base with integral 5-40 stud such as Dytran Model 6213. The mounting base is threaded to the 3023A4, then adhesive mounted to the test surface so the axes may be positioned as desired.

The bottom surface (the surface with the tapped hole) is the preferred mounting surface for Model 3023A4 and the one which is used at the factory for calibration. If the accelerometer is mounted on any other surface, its calibration cannot be guaranteed.

To install using the 6213 mounting base, first spread a light coat of silicone grease on the bottom surface of the 3023A4, then thread the stud of the

6213 into the 5-40 tapped hole in the bottom surface. Torque to 15 Lbs-inches.

On the test object, select a smooth surface approx. .75 in. in diameter and clean off all oil, debris and any contaminants or foreign matter which would preclude a good bond. Various adhesives may be used to mount Model 3023A4 but the adhesives of choice for ease of use are any of the cyanoacrylate "instant" adhesives. They are tough and they set almost instantly. They also do not need a thick bond line which is good for high frequency response.

The selected (or prepared) mounting area should be flat to within .001 in TIR for best high frequency response.

**NOTE:** Before mounting, be sure to clean the mounting surface thoroughly to avoid inclusion of machining chips and other debris between mating surfaces. Intimate contact between mating surfaces is important for best performance.

If a fair amount of motion is expected during the test, it is good practice to tie the cable down to a stationary point as close as possible to the accelerometer (but not closer than 1 inch) to avoid potentially damaging cable whip.

You are now ready to connect the 3023A4 to the power unit.

## **OPERATION**

The Dytran power unit designed to power the Model 3023A4 is the Model 4113B. This line-powered unit has a 4-pin connector jack similar to that on the 3023A4. Cable Model 6811AXX connects the 3023A4 to the power unit. ('XX' is the cable length in feet).

Connect the 6811XX cable to Model 3023A4 by first rotationally aligning the locating tab, then engaging the rotating threaded collar and threading the collar on, hand tight.

Connect the other end of the cable to the 4-pin connector on the power unit and tighten threaded collar hand tight. As previously noted, tie cable down within 1 inch or so of the instrument if excessive displacement of the accelerometer is expected.

Apply line power to the power unit and allow several seconds for coupling capacitors to fully

charge. Rotate the channel selector knob through the three axis positions to monitor the bias voltage of each of the three accelerometer element assemblies to check for normal operation. The bias voltage level appears on the front panel mounted voltmeter on the 4113B.

Consult the paper, "Low Impedance Voltage Mode (LIVM) Theory and Operation", included as part of this manual, for instructions in using the bias monitoring voltmeter on the power unit as a check for normal operation and as an effective trouble shooting aid.

Although only one axis of the 3023A4 may be monitored with the front panel meter on the 4113B at a given time, each axis is continuously outputting data at the respective output jack at all times irrespective of the position of the monitor switch. Selecting a channel for bias monitoring does not affect the signal from that channel.

Connect each of the three BNC 'Output' jacks of the power unit to the readout instrument or data collector and proceed with the measurement. The sensitivities of each of the three axes are directly in mV/G and are specified precisely in the calibration certificate supplied with each instrument.

Be sure to check the orientation of each axis with the markings on the instrument upper surface and/or the outline/installation drawing supplied with the Operating Guide. The polarity of each axis is also defined with arrows engraved in the top surface of the 3023A4 and again, on the outline/installation drawing 127-3023A4. The arrows indicate the direction and sense of motion of the accelerometer that will produce positive-going output signals. The vertical axis, axis 3, produces positive-going output voltage when the accelerometer is accelerated upward, i.e., away from the mounting surface.

Other mounting bases such as bases with high-pull magnets, are available from Dytran. Also, special bases to suit a specific need can be provided. Contact a Dytran sales engineer and discuss your needs to determine the best method custom for mounting to meet your specific need.

## REMOVAL (OR UNINSTALLATION)

It is very important when removing this instrument to remember that, although it is built to be very rugged, it **is** a sensitive measuring instrument and as such should be treated gently while being removed from its installation. **Never** strike the unit to break it free from its mounting surface. This kind of trauma will surely at best, change the calibration significantly and at worst, could damage the unit irreparably.

If the accelerometer is mounted with an adhesive mounting pad like the 6213, Simply grip two opposing flats of the 3023A4 with an adjustable or open end wrench and gently twist the instrument to separate it from the mounting base.

To remove the mounting base, grip two opposing hex flats with a wrench and slowly torque the base until the adhesive fails in shear.

## MAINTENANCE AND REPAIR

This instrument is not field repairable. No maintenance is required, or possible. If a problem occurs, contact the factory for help. You will be assigned a Returned Material Authorization (RMA) number should the instrument have to be returned to the factory for evaluation. A short note describing the problem will facilitate the repair procedure.

There is no charge for evaluation of the instrument and we will perform no repair work until you are notified of any charges.

It is good practice to return the instrument to the factory for recalibration from time to time with frequency of recalibration dependent on usage intensity and frequency.