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### **OPERATING GUIDE**

#### **MODEL 3053B1 MINIATURE TRIAXIAL LIVM™ ACCELEROMETER**

#### **WITH SINGLE 4-PIN CONNECTOR,**

#### **INTERNALLY CASE GROUND ISOLATED**

Model 3053B1 is a miniature, Low Impedance Voltage Mode (LIVM)™ triaxial accelerometer featuring a single, transverse mounted, 4-pin electrical connector. This feature allows the 3053B1 to be used in situations where vertical space is limited. Model 3053B1 is internally case ground isolated.

The sensitivity of each of the three orthogonal axes of Model 3053B is nominally 5 mV/G.

This Guide contains:

- 1) Specifications, Model 3053B1
- 2) Outline/Installation Drawing 127-30531B
- 3) Paper, "Low Impedance Voltage Mode (LIVM) Theory and Operation"

**NOTE:** LIVM™ 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 3053B1 TRIAXIAL ACCELEROMETER

SPECIFICATIONS	VALUE	UNITS
PHYSICAL		
WEIGHT	5.5	GRAMS
SIZE (HEIGHT x WIDTH x DEPTH)	0.35 x .50 x .50	INCHES
MOUNTING [1]	ADHESIVE MOUNT	
CONNECTOR	4-PIN [2]	
MATERIAL, HOUSING/CONNECTOR	TITANIUM ALLOY	
PERFORMANCE		
SENSITIVITY, -10 +15% [3]	5.6	mV/G
RANGE, F.S. (each axis)	+/- 1000	G
FREQUENCY RESPONSE, +/- 10%	2 to 5000	Hz
ELEMENT NATURAL FREQUENCY, NOM.	30	kHz
EQUIVALENT ELECTRICAL NOISE	.014	G, RMS
LINEARITY [4]	1	%F.S.
TRANSVERSE SENSITIVITY, MAX.,	5	%
SIGNAL POLARITY	POSITIVE FOR MOTION IN DIRECTION OF ARROWS ETCHED ON HOUSING	
ENVIRONMENTAL		
MAXIMUM VIBRATION	+/- 600	G
MAXIMUM SHOCK	5000	G
TEMPERATURE RANGE	-60 to +250	°F
ENVIRONMENTAL SEAL	HERMETIC	
COEFFICIENT OF THERMAL SENSITIVITY	.03	%/°F
ENVIRONMENTAL		
SUPPLY CURRENT RANGE, (each axis) [5]	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.	0.5	SEC
GROUND ISOLATION	10	MEGOHMS (MIN.)

[1] Case ground isolation is achieved by internal means.

[2] Connector mates with Dytran cable assy. Model 6430AXX. (XX = length in feet)

[3] Reference sensitivity measured at 100 Hz, 1 G RMS per ISA RP 37.2

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

[5] 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 3053B1 TRIAXIAL ACCELEROMETER

#### INTRODUCTION

Model 3053B1 is a miniature three-axis accelerometer using 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 central support and welded into a titanium housing. The three elements are mounted with axes orthogonal to each other so that they measure the complete motion of a point.

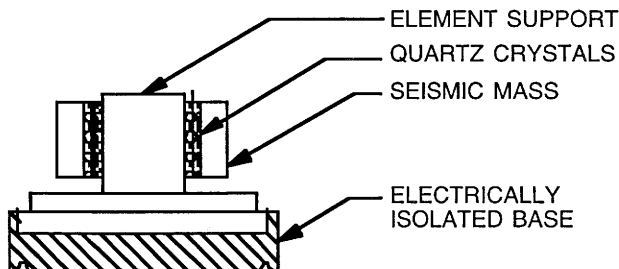
Model 3053B1 mounts with adhesives into very small spaces since its vertical dimension is .350 in. It weighs only 6.0 grams.

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.

All elements are internally isolated from the outer case and are enclosed by a Faraday shield for electromagnetic noise immunity.

#### DESCRIPTION

Refer to the outline/installation drawing 127-3053B1 for outline dimensions of Model 3053B1.



**Figure 1** Representative cross section, 3053B1 element assembly

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

The electrical connections from the elements are brought out to the contacts of a four-pin connector mounted transversely to one of the vertical faces of the housing. The three signal/power connections to the elements are connected to three separate 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 internally electrically isolated from electrical ground return.

The performance specifications and criteria for Model 3053B1 are delineated on the specification sheet included with this operating guide.

#### INSTALLATION

Select a smooth surface approx. .50 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 3053B1 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.

Spread a light layer of adhesive on the mounting surface and apply the 3053B1 to the mounting area in the desired orientation and press and hold firmly for several seconds.

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 3053B1 to the power unit.

## OPERATION

The recommended power unit for Model 3053B1 is the four channel 4114B1. This power unit has four channels so it can power each of the three channels of the 3053B1 with one channel left over for powering another LIVM sensor. Model 4114B1 has a switch selected front panel voltmeter to aid in system troubleshooting. More on this topic in subsequent paragraphs.

The recommended cable for Model 3053B1 is the Model 6430AXX (XX = length in feet). This cable has a four-pin connector at one end that mates with the connector of the 3053B1. The other end terminates in 3 BNC plugs labeled, Axis 1, Axis 2 and Axis 3.

Connect the 4-pin connector of the cable to the connector of the 3053B1, taking care to align the connectors properly using the alignment groove on the cable connector to engage the matching tab on the 3053B connector. Press the connectors together to engage the screw threads and rotate the cable nut until the connectors mate fully. Hand tighten the cable nut. Don't use pliers to tighten.

Connect the BNC cable connectors to three of the BNC connectors on the Model 4114B1. We suggest the you connect axis (1) of the 3053B1 to channel (1) of the power unit, and so forth. This will make it easier to remember which axis you are monitoring with the front panel voltmeter.

Apply power to the power unit and allow several seconds for coupling capacitors to fully charge. Rotate the channel selector knob through each of 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 4114B1.

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 3053B1 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. 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 define with arrows engraved in the top surface of the 3053B1 and again, on the outline/installation drawing 127-3053B1. 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 fro the mounting surface.

## 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 when being removed from its installation. Never strike the unit to break it free from its mounting surface. Simply grip two opposing flats with an adjustable or open end wrench and gently twist the instrument until the adhesive bond fails in shear. This method avoids any trauma to the instrument and will help ensure a long life for the accelerometer.

## 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.