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OPERATING GUIDE MODEL 3032A

MINIATURE LIVM tm QUARTZ SHEAR

ADHESIVE MOUNT ACCELEROMETER

This manual contains:
1) Specifications, model 3032A
2) Outline/Installation drawing 127-3032A,
3) Paper, "Low Impedance Voltage Mode (LIVM) Theory and Operation".

NOTE: LIVM™ is Dytran's trademark for its line of **L**ow **I**mpedance **V**oltage **M**ode sensors with built-in amplifiers operating from constant current sources over two wires. **LIVM** instruments are compatible with all comparable systems designated **IEPE**.

OPERATING INSTRUCTIONS MODEL 3032A
MINIATURE QUARTZ SHEAR LIVM ACCELEROMETER

INTRODUCTION

Model 3032A is a miniature piezoelectric accelerometer which utilizes four quartz crystals in a shear mode configuration to generate a voltage exactly analogous to input acceleration. An exclusive Dytran integrated circuit (IC) amplifier serves to increase the amplitude of the output signal.

As with all standard LIVM instruments, signal and power are conducted over the same pair of leads with the signal superimposed upon the DC bias of the IC amplifier. Constant current power is supplied to Model 3032A by inexpensive constant current type power units. Model 3032A is compatible with standard **L**ow **I**mpedance **V**oltage **M**ode (**LIVM**)^{tm} power units.

LIVM sensors have fixed sensitivity and are supplied with calibration certificates traceable to NIST. The nominal sensitivity of Model 3032A is 10 mV/g. Frequency response is to 10 kHz.

DESCRIPTION

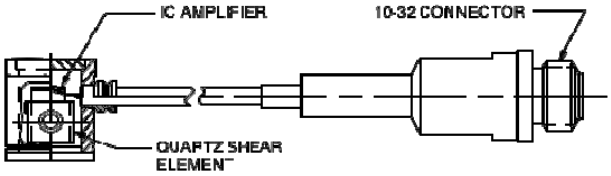

Figure 1. Representative cross section of Model 3032A

The sensing element is of a four-plate shear design utilizing four flat quartz plates. Two equal seismic masses are preloaded to the quartz crystals and produces a shearing force on the crystals which is analogous to input acceleration (shock and vibration) at the bas

An integral IC gain amplifier, located within the body of the 3032A, amplifies this signal by approximately 3 to 1 and lowers the output impedance of the quartz crystals by many orders of magnitude, allowing the accelerometer to drive very long cables at high frequencies with almost no attenuation.

A coaxial cable, permanently attached, exits radially from the housing as shown in figure 1. This cable, which is 18 inches long on the standard Model 3032A, terminates in a 10-32 jack. This is so a standard Dytran 10-32 coaxial cable (such as our model series 6010Axx) will mate directly with Model 3032A when used as an extender cable.

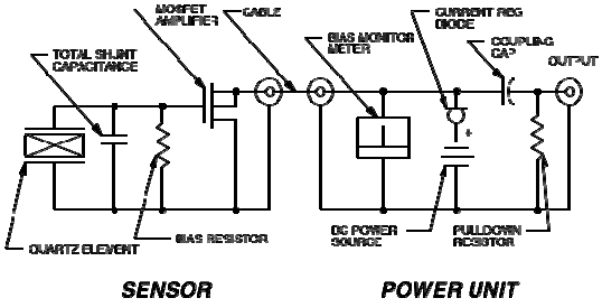

Figure 2-Simplified system schematic.

Figure 2 is a simplified schematic diagram of the accelerometer/power unit combination. Within the 3032A, the voltage generated by the quartz element is fed to the input of a MOSFET input, IC amplifier operating as a source follower with gain. The source terminal of the amplifier is connected, (via the integral cable and an extension cable) to a constant current source in the LIVM power unit. The instrument biases itself on at 10 VDC, measured at the center conductor of the cable.

The dynamic signal from the amplifier rides atop the 10 VDC bias and is separated from the bias voltage in the power unit. The signal, now at zero volts DC level, is fed to the output jack on the power unit and at this point, may be read out by almost any type of readout or data collecting instrument except for high current galvanometers.

INSTALLATION

Model 3032A is designed to be adhesively mounted in place to the test surface. Select or prepare a flat surface of at least .30 in. diameter and clean this surface carefully to remove all traces of oil, water and other contaminants which could preclude a secure adhesive mount.

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NOTE: THE MOUNTING SURFACE FOR MODEL 3032A IS THE CIRCULAR SURFACE AND NOT THE HEX SURFACE END. MOUNTING THE INSTRUMENT ON THE WRONG SURFACE WILL CHANGE THE HIGH FREQUENCY CHARACTERISTICS AND WILL INVERT THE SIGNAL POLARITY.

3032A may be held in place with a variety of adhesives but the type we recommend, for its ease of use and removability is the cyanoacrylate type of adhesive of the “instant bond” family. These adhesives, if used as recommended, set almost instantly and are readily removable.

An important point, with any adhesive, is that it must be used sparingly. This is so the adhesive bond line is very thin. Since the glue has a much lower modulus of elasticity than the steel body of the accelerometer, if it is too thick, it can create a spring-mass system (the glue is the spring and the accelerometer is the mass) with a resonant frequency which lies within the passband of the accelerometer. This could result in poor frequency response at the higher frequencies.

To install Model 3032A, use a single drop of cynoacrylate adhesive applied to the bottom surface of the 3032A, press the instrument down firmly, pressing on the top cap by hand, hold for several seconds and the bond is complete.

REMOVAL

It is very important, to avoid damaging the 3032A. It has been designed to facilitate removal. To remove, torque gently on the .250 hex surface at the top of the until. **Do not** pry or strike the accelerometer to remove. These actions can damage the instrument. Simply place a wrench on the hex and gently torque the instrument until the adhesive shears.

SECURING THE CABLE

Any miniature accelerometer will be somewhat sensitive to noise generation due to excessive cable bending at the exit point at the accelerometer. If the cable is allowed to hang loosely, there will probably be at least one point in the frequency spectrum where this will cause a frequency anomaly.

Aside from the possibility of noise generation, cable life may be shortened drastically by excessive mechanical stress at the exit point.

To minimize or preclude these problems, it is strongly recommended that the cable be secured by fastening it to the same surface to which the accelerometer is mounted, at a point within .25 to .50 in. away from the accelerometer.

This may be accomplished in a variety of ways such as by the use of a cable clamp, tie wrap, tape, etc.

OPERATION

Connect the 3032A to “Sensor” jack of the power unit using a Model 6011Axx cable (10-32 plug to BNC plug) to make the connection from the 10-32 connector of the 3032A to the BNC connector at the power unit. (xx represents the cable length in feet). This will be the proper cable for most Dytran power units which utilize a BNC “Sensor” jack. If you are using a Model 4114 power unit, which has 4 10-32 “Sensor” jacks, you will need a Model 6010Axx cable (10-32 plug, both ends) to connect the 10-32 jack on the 3032A to the 10-32 jack on the power unit.

Remember, cable length does not affect sensitivity in LIVM systems. Cables up to hundreds of feet long may be driven with these systems with the proper precautions.

A bias monitoring voltmeter is used on most Dytran units for the purpose of indicating normal or abnormal system operation. Please refer to the paper “Low Impedance Voltage Mode (LIVM) Theory and Operation” for a detailed treatise on the operation of this very useful resource. This is invaluable when trouble shooting measurement systems and for giving the user confidence in the system.

The fault monitor meter is especially useful in tracking down bad cables and faulty sensors and/or power units.

When you have installed the sensors and checked out the DC bias of each sensor and they all fall within the acceptable range, connect the power unit “Output” jacks to the readout and/or data collector and you are ready to take data.

CABLE REPAIR

Because of its miniature size, the cable of Model 3032A is the weakest link in its reliability profile. Because of this, we recommend caution when handling and mounting this instrument to avoid stressing the cable, especially at the point where the cable exits the body of the accel. The previous section, “Securing the Cable” deals with this potential problem

Should the cable of the 3032A break without negligence on the part of the user and within the warranty period, the instrument will be repaired at no cost, save shipping charges. The cable is designed to facilitate repair at the factory.

Should the breakage occur outside the warranty period, contact the factory for a quotation on the repair and recalibration charge.

In either case, always contact the factory before returning any instrument for repair or recalibration. **See the next section, Maintenance and Repair**

MAINTENANCE AND REPAIR

The sealed construction and miniature size of the Model 3032A precludes field repair.

Should the electrical connector become contaminated with moisture, oil, grease, etc., the cable end may be immersed in degreasing solvents (no acetone) to remove the contaminants. After degreasing, place the instrument in a 200 to 250 degree F oven for one hour to remove all traces of the solvent.

Should a problem be encountered with the operation of the instrument, contact the factory for trouble shooting advice. Often our service engineers may point out something which may have been overlooked and which may save the expense and time of returning the 3032A to the factory.

If the instrument must be returned, the service department will issue you a **R**eturned **M**aterials **A**uthorization (**RMA**) number to aid in tracking the repair through the system. Do not send the instrument back without first obtaining an RMA number. At this time you will be advised of the preferred shipping method.

A short note describing the problem, if it is not obvious, included with the returned instrument, will aid in trouble shooting at the factory and will be appreciated.

We will not proceed with a non-warranty repair without first calling to notify you of the expected charges. There is no charge for evaluation of the unit.