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REV A 2-26-98  
REV B, ECN 11283, 09/16/14  
REV C, ECN 12932, 09/14/16

**SUPPLEMENTAL OPERATING GUIDE**

**MODEL 3030B4 & 3030B5**

**RUGGEDIZED MINIATURE IEPE ACCELEROMETERS,**

**HERMETICALLY SEALED**

**NOTE:**

MODEL 3030B4 IS A MINIATURE INTEGRATED ELECTRONICS PIEZOELECTRIC (IEPE) ACCELEROMETER. MODEL 3030B5 IS IDENTICAL TO 3030B4 EXCEPT THAT THE DISCHARGE TIME CONSTANT IS SHORTENED TO IMPROVE THERMAL STABILITY IN ESS CHAMBERS.

**THIS MANUAL INCLUDES:**

- 1) OPERATING GUIDE, MODEL 3030B
- 2) OUTLINE/INSTALLATION DWG, 127-3030B

**NOTE: IEPE** is an acronym for Integrated Electronics Piezoelectric types of low impedance voltage mode sensors with built-in amplifiers operating from constant current sources over two wires. **IEPE** instruments are compatible with other comparable systems labeled **LIVM™**.

## OPERATING INSTRUCTIONS

### MODEL SERIES 3030B ACCELEROMETER

#### INTRODUCTION

The model Series 3030B sensors are general-purpose quartz accelerometers with built in impedance converting amplifier. These versatile instruments utilize pure Alfa quartz crystals in compression mode to generate voltage signals exactly analogous to input acceleration including shock and vibration.

An internal MOSFET integrated circuit (IC) amplifier operating as a source follower, converts the very high impedance level signals from the quartz crystals to a low impedance voltage mode signal which is able to drive long cables and feed directly into many types of readout instruments. Output signals are directly in units of mV/g.

The miniature on-board amplifier requires 2 to 20 mA of constant current supplied by special IEPE power units with compliance voltages from +18 to +30 Volts DC. Sensor power and signal are conducted over a single pair of wires allowing the use of inexpensive coaxial cable for system interconnections. Even less expensive twin lead cable may also be used.

Voltage mode systems such as described here feature fixed sensitivity signals, unaffected by cable length. A calibration certificate, traceable to NIST is provided to define the exact sensitivity and frequency response of each instrument.

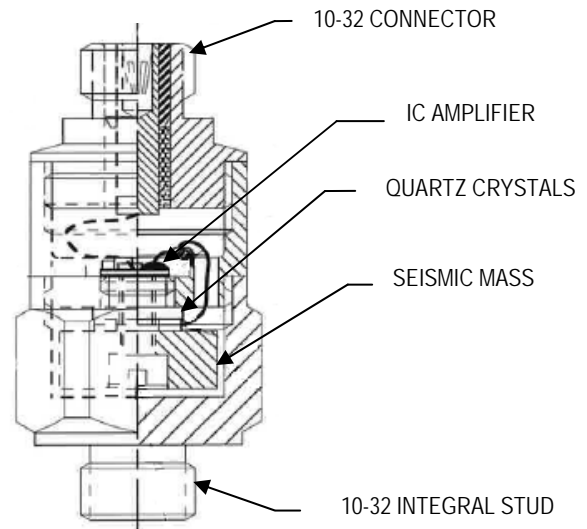
The sensitivity of Model 3030B is 10.0 mV/g,  $\pm 5\%$  @ 100 Hz and the frequency response is  $\pm 5\%$  from 5 Hz to 5 kHz. Other models in this series may have differing specifications. For example, the 3030B4 features longer discharge time constant (TC) for improved low frequency response for better shock pulse fidelity, while Model 3030B5 features shorter discharge time constant (TC) for a better thermal transient response.

Series 3030B4 are truly hermetically sealed. All joints are laser welded and the connector is a glass to metal hermetic sealed design.

#### DESCRIPTION

Refer to Fig. 1 and Outline/Installation drawing 127-3030B).

Model 3030B utilizes an inverted quartz element to minimize the unwanted effects of base strain on the accelerometer signal.

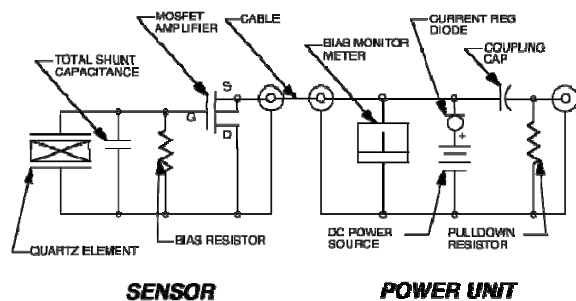


**Figure 1 Cross-section model 3030B**

The highly preloaded quartz crystals coupled to a dense tungsten seismic mass ensure excellent linearity over the entire dynamic range with minimal distortion.

The integral MOSFET IC amplifier has been proven dependable to 100,000 g's shock, providing high reliability.

The IC amplifier operates from constant current type power units (many types are available from Dytran) and may be supplied with from 2 to 20 mA of current, depending upon the length of cable being driven by the sensor. The current is supplied to the source terminal of the sensor amplifier (see Fig. 2) and this point is normally biased at approximately +10 Volts DC.



**Figure 2 System Schematic**

The DC bias voltage of the sensor amplifier is blocked by the 10 uF coupling capacitor in the power unit and only the dynamic signal from the sensor is allowed to pass to the readout instrument.

Referring to Fig. 2, the resistor from the gate of the MOSFET to ground serves to bias the amplifier at its proper operating point and it also establishes the low frequency response of the sensor by establishing the discharge time constant (TC) of the accelerometer. This resistor and the total shunt capacitance C across it (the crystal, gate and stray capacitance) set the TC, which, in turn, sets the low frequency response as follows:

$$f_{-3db} = \frac{.16}{RC} \quad (\text{Eq. 1})$$

where:

$f_{-3db}$  = The lower -3db frequency (Hz)

R = bias resistor value (Ohms)

C = total shunt capacitance across the bias resistor

The product RC is also known as discharge Time Constant or TC. Model 3030B4 has a TC of .5 seconds. Applying equation 1, the lower -3db frequency of Model 3030B is .32 Hz and the -5% frequency is 3 times the -3db frequency or .96 Hz.

Referring to Fig. 2, most Dytran power units feature a DC voltmeter that reads this bias voltage from the sensor and as such, serves as a very useful system trouble shooting tool.

Dytran offers many types of current source power units to operate IEPE sensors such as the Model 3030B. These include the single-channel battery-operated Models 4102 and 4105, which supply fixed 2 mA of constant current, the line

powered single channel model 4110, and the four channel model 4114, both of which feature adjustable drive current. Also included are many types of other multiple channel units with 6, 12 and 16 sensor channels.

## INSTALLATION

Refer to Outline/Installation drawing 127-3030B for this section.

To install Model 3030B, it is necessary to select or prepare a smooth, flat mounting area at least .50 in diameter. The surface should be flat to .001 TIR and may be prepared by various machining methods such as spot facing, grinding, turning, etc. if required.

It is important that the accelerometer base be in intimate contact with the mounting surface for best high frequency response and for faithful reproduction of the calibrated sensitivity over all frequencies.

At the center of the selected mounting area, drill and tap a 10-32, UNF-2B mounting hole with minimum thread depth of .150. (Be careful to ensure that the drilled hole is perpendicular to the mounting surface to within  $\pm 1^\circ$ .) After this operation, clean the area thoroughly to remove all traces of oil, machining chips and burrs that could preclude intimate contact between mounting surfaces.

Next, coat one of the mating surfaces with a thin layer of silicone grease. Thread the accelerometer with stud into the tapped hole by hand, until the base bottoms against the mounting surface. Inspect the mating surfaces to see that they contact squarely, inspecting for chips that may have become lodged between the mating surfaces. If the contact looks square, proceed to torque the sensor down with 20 to 25 lb-inches of torque, preferably using a torque wrench with a 1/2 in. deep socket gripping on the 1/2 in hex of the case.

Connect the accelerometer to the power unit using Model 6010AXX or 6011AXX coaxial cable. Model 6010A is used when the power unit has 10-32 input connectors and Model 6011A is used when the power unit has BNC jack input connectors. Carefully tighten the 10-32 knurled nut at the sensor, by hand to ensure a secure connection. Do not use pliers on this cable nut as this may damage the cable or sensor connector.

Under high shock or high vibration conditions, it may be discovered that the cable nut

has become loose and is causing erratic readings. Under these conditions, it may be advisable to use a mild thread locking agent such as Loctite® on the threads of the 10-32 connector when re-installing the cable.

Connect the "Output" jack of the power unit to the readout instrument (oscilloscope, recorder, meter, etc.) and proceed with the measurement.

## **MAINTENANCE AND REPAIR**

The sealed construction of the 3030B precludes most maintenance other than that necessary to maintain a smooth mounting surface at the accelerometer base mounting surface.

Periodically inspect the mounting base surface for nicks or deep scratches, gouges and other imperfections that could prevent intimate contact between mating surfaces. If surface imperfections are discovered, it is possible to redress the surface of the mounting base by wiping on a flat plate (surface plate preferred) with a fresh piece of 400 grit emery paper. Use a smooth figure 8 motion being careful not to round the surface. Press firmly down on the paper to ensure flat contact with no rocking motion.

The electrical connector may be cleaned if necessary, with a cloth or paper wipe dipped in Freon ® or alcohol. After this operation, it may be

beneficial to bake the sensor out in a drying oven at 200 to 250 °F for an hour or so.

Should a problem arise with the sensor, contact the factory for assistance. If the instrument must be returned for evaluation, you will be issued a Returned Material Authorization (RMA) number to help guide the instrument through the evaluation process. Please do not return any instrument or power unit to the factory without first obtaining an RMA number.

We will not proceed with repairs without first notifying you of charges (if any) and obtaining your approval. There is no charge for evaluation of the instrument.

## **CAUTIONS**

1) Do not store or use Model 3030B above +250°F.

2) For best frequency response, measure the mounting torque, don't guess.

3) Never connect the sensor to a power source (battery or power supply) which does not have current limiting, 20 mA MAX! This will immediately destroy the integral IC amplifier.

4) Do not attempt to measure the resistance at the sensor connector as many ohmmeters supply too much current for the internal IC and may destroy it.