



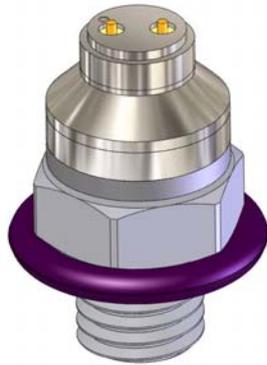
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OPERATING GUIDE

SERIES 3086A/AT

LIVM™ HIGH SHOCK ACCELEROMETER



NOTE:

Series 3086A/AT are miniature high shock accelerometers designed to measure the severe shocks generated by pyrotechnic and other severe events. Series 3086A have 1/4-28 integral mounting studs. Series 3086AT have 10-32 integral mounting studs.

These models features quartz compression mode crystals combined with proven LIVM (built-in electronics) technology.

All models feature ground isolation construction to minimize ground loops.

This guide includes:

- 1) Outline/Installation drawing 127-3086A.
- 2) 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 all comparable systems designated IEPE.

OPERATING GUIDE

MODEL SERIES 3086A/AT HIGH SHOCK ACCELEROMETERS

INTRODUCTION

Series 3086A/AT quartz shock accelerometers are designed to measure mechanical shock events of up to 70,000 g's amplitude. These rugged miniature instruments feature compression design quartz seismic elements for very high natural frequency and ruggedness. On-board miniature IC amplifiers convert the very high impedance voltage signals from the quartz crystals to a much lower impedance level which allows these instruments to drive long cables with negligible signal loss. The output signals are directly in units of mV/g.

These series of instruments are part of Dytran's line of LIVM instrumentation and as such, may be compatible with existing installations from other manufacturers which use similar principles.

DESCRIPTION

NOTE: Refer to Outline/Installation drawing (127-3086A) supplied with this manual for a physical outline of Series 3086A/AT.

The quartz element is mounted within the housing in an inverted position to minimize base strain effects. The quartz crystals are tightly preloaded in place between the base and the seismic mass, with a thin metallic electrode sandwiched between them to collect the voltage signal from the crystals. When the instrument senses acceleration into its base, the seismic mass is accelerated through the crystals accordingly. The inertial force from the seismic mass acting upon the crystals, produces a force equal to the mass times the acceleration. This force then squeezes or relaxes the preload on the crystals, depending upon its sense, producing a voltage analogous to the impinging acceleration input.

This signal is processed by the unity gain IC amplifier which drops the impedance level approximately 10 orders of magnitude to 100Ω. This allows the signal and constant current power to be carried over long cables with little or no loss.

The amplifier is connected to the Power/Signal pin of the top header where it can be connected to the LIVM power unit.

The inner body of the series 3086A/AT is electrically isolated from the mounting surface. This is to eliminate annoying "ground loops" which can cause spurious signals to interfere with the measurements.

INSTALLATION

Consult the Outline/Installation drawing (127-3086A), provided with this Operation Guide, for instructions as to mounting port preparation for your particular model.

When preparing the accelerometer mounting ports, it is important to first prepare a smooth, flat $\text{Ø}.375$ min. mounting surface, flat to at least .0005 TIR. At the center, drill and tap the mounting.

It is especially important that the mating surfaces of accelerometer and mounting surface be in intimate contact for best high frequency performance of the accelerometer. This is doubly important when measuring pyroshock and other fast rise time shock events which may excite lower frequency resonances in the accelerometer which may exist due to poor contact between surfaces.

What this translates to is making sure that there are no foreign particles clamped between these surfaces when the instrument is installed. Clean both surfaces well to remove any machining chips which may linger due to the drilling and tapping operations. Blow the port out with compressed air if available to ensure that all chips are gone. Check surfaces for other contaminants as well.

Before installing the accelerometer, coat the mounting surface with a thin layer of silicone grease. This will help to attain optimum mechanical coupling between mating surfaces.

Torque the accelerometer in place in accordance with instructions on Outline/Installation drawing (127-3086A). Torquing to the prescribed torque level will ensure that the calibration figures will be most accurate and that you are not overtorquing, (which could damage the unit) or undertorquing (which could cause the accel. to loosen while in use). Torquing is best accomplished with a torque wrench thru a 3/8" hex, deep socket.

POWERING AND ELECTRICAL CONNECTIONS

Dytran manufactures several LIVM (IEPE) current source power units suitable for powering Series 3086 accels. The battery powered 410C and the line powered 4110C are the least expensive, single channel power units available for this purpose. For multi-channel installations, the 4-channel 4114B1, the 6-channel 4120 and the 12 channel 4121 are all capable of powering these units.

Connections to Series 3086A/AT are made with 6869AXX (XX denotes length in feet) twisted pair cable soldered to the pins of the hermetic header. The 6869AXX cable is equipped with coaxial 10-32 connector. After installation of the accelerometer onto the mounting structure, it may be advantageous to use an O-ring (supplied) to anchor the wires against the accelerometer housing and mounting surface.

Connect the accelerometer to the "Sensor" jack of the power unit. Verify that the proper bias voltage is present at the unit by observing the bias monitoring voltmeter located on the front panel of most Dytran power units. A mid-scale reading of approx. +8.5 VDC is typical and indicates that the internal amplifier and cables are operating normally.

After powering the system, allow several seconds for the bias voltage to settle and for coupling capacitors to fully charge before taking measurements.

SENSOR DRIVE CURRENT

Many Dytran power units have adjustable constant current settings over the range from 2 to 20 mA. For high shock work, it is advisable to use the higher current ranges, i.e., from 10 to 20 mA. The higher sensor drive current increases the slew rate capabilities of the internal amplifier which is necessary for high fidelity reproduction of very short rise time pulses. We suggest using 10 mA for driving of short cables (3 to 10 ft.) and 20 mA for longer cables.

BACKGROUND INFORMATION

Many high g level mechanical shocks involve metal-to-metal impacts and as such, exhibit extremely short rise times and which contain large amounts of high frequency energy. Pyrotechnic shocks also fall into this category.

Model series 3086A/AT have a very high natural frequency (100 kHz) which makes it less susceptible to "ringing" or resonating. However, any accelerometer will resonate under certain conditions due to very short rise time, high g pulses. For this reason, for some applications, low pass filtering of the signal by signal conditioning amplifiers or other readout instruments may enhance the readability of the results. Experimentation is the best way to determine whether filtering is called for in your particular application.

SIGNAL POLARITY

Model 3086A/AT Series are designed to measure both positive and negative shocks, i.e., the shock pulse may stress the unit in either direction.

The unit is designed to give positive-going output voltage when the acceleration force acts from the base upward toward the top (connector end) of the instrument.

It is perfectly acceptable to reverse the direction of the acceleration and create a negative-going output pulse. The calibration factor is valid in both directions.

PRECAUTIONS

While this model series is necessarily our most rugged sensor, the weak link, as such, is the built-in IC amplifier. To maximize the useful life of this instrument, the following precautions should be observed:

Do not connect any source of power to these instruments which **does not** include current limiting protection. This would include batteries and other DC power supplies. Series 3086A/AT must be powered from constant current sources with current limiting ranges from 2 to 20 milliamps. If a DC power source without this limitation is connected to the input connector, the instrument will try to draw infinite current and will immediately self destruct.

Whenever possible, use a Dytran (or Dytran approved) LIVM or IEPE power unit to avoid such problems.

Do not subject the Model Series 3086A/AT to temperatures above +250°F (121°C). To do so may destroy the internal amplifier.

Always inspect the mounting surfaces for burrs and other inclusions which could preclude intimate contact between mounting surfaces. Damage to mounting surfaces can occur and further,

it is very important, for accurate transmissibility of high frequency information, that the mounting surfaces be in tight, intimate contact.

MAINTENANCE AND REPAIR

Because of the small size and sealed construction, very little maintenance is possible or required. The connector may be cleaned, if necessary, with a solvent such as alcohol. Inspect the mounting surface from time to time and if it sustains damage (nicks, gouges, etc.), it should be returned to the factory for refacing of the mounting surface along with recalibration.

If it is decided that the unit needs repair or recalibration, before returning the instrument to Dytran for service, please contact the factory to obtain a Returned Material Authorization (**RMA**) number. This will aid in moving the instrument through the repair and recalibration cycle.