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OG5334
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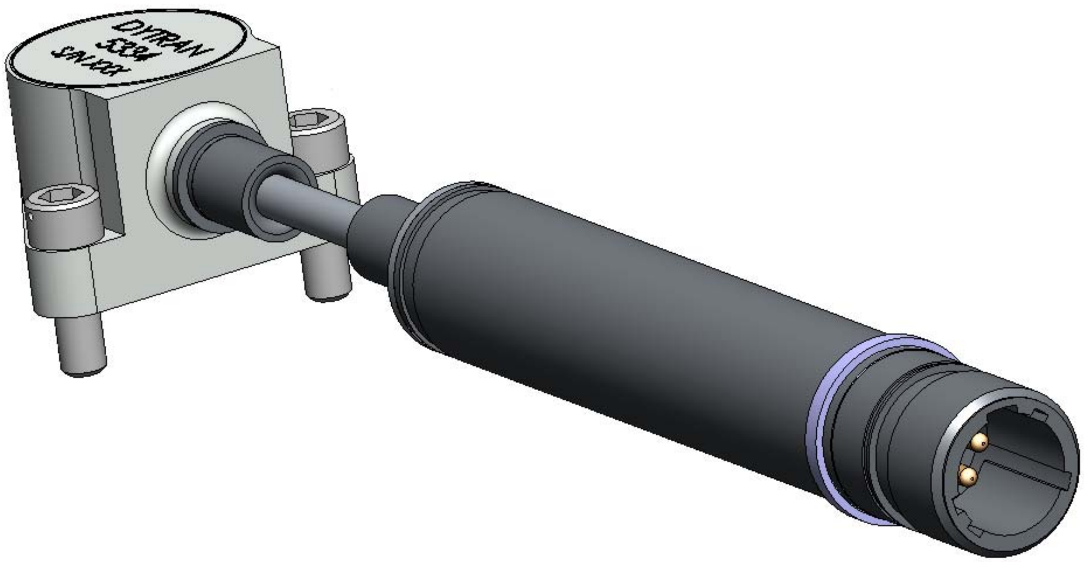
OPERATING GUIDE

SYSTEM MODEL 5334

HIGH TEMPERATURE VIBRATION MEASUREMENT SYSTEM



NOTE:
Model 5334 measurement system consists of a high temperature accelerometer coupled to an in-line 2-wire IEPE charge amplifier. The accelerometer, a 3-hole flange mount charge mode unit with internal ground isolation, features hermetically sealed construction. It is connected to the charge amplifier via triaxial hardline cable. An attached 2-wire shielded cable connects the charge amplifier to the IEPE power unit. System sensitivity is

This guide contains:
1) Operating instructions, Model 5334.
2) Outline/installation drawing, Model 5334
3) Specifications, System Model 5334
4) Paper, "Low Impedance Voltage Mode (IEPE) Theory and Operation.

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 most other manufacturers' comparable systems. It is equivalent to the Dytran LIVM system.

SPECIFICATIONS

MODEL 5334 HIGH TEMPERATURE VIBRATION MEASUREMENT SYSTEM

SPECIFICATION	VALUE	UNITS
PHYSICAL		
WEIGHT, including cables, accel and amplifier	150	grams
MOUNTING PROVISION	Three-hole flange for #8 SCREWS	
CABLE FROM ACCEL. TO CHG. AMP., (18 in LENGTH)	2-conductor shielded hardline cable	
CONNECTOR FROM CHARGE AMPLIFIER	D38999/25YA98PA	
MATERIAL, ACCELEROMETER	304L CRES	
PERFORMANCE (SYSTEM)		
SENSITIVITY, ±5% [1]	10	mV/g
RANGE F.S. FOR ± 5 VOLTS OUTPUT	± 500	g
FREQUENCY RANGE, ± 5%	4.8 to 660	Hz
FREQUENCY RANGE, -3db	1.6 to 2000	Hz
RESONANT FREQUENCY, NOM.	35	kHz
EQUIVALENT ELECTRICAL NOISE FLOOR	.01	grms
LINEARITY [2]	± 2%	% F.S.
TRANSVERSE SENSITIVITY, MAX.	5	%
STRAIN SENSITIVITY @ 250 $\mu\varepsilon$	.012	g/$\mu\varepsilon$
ENVIRONMENTAL		
MAXIMUM VIBRATION	±600	gpk
MAXIMUM SHOCK	±2000	gpk
TEMPERATURE RANGE (ACCELEROMETER)	-65 to +900	°F
TEMPERATURE RANGE (CHARGE AMPLIFIER)	-50 TO +185	°F
SEAL, (ACCELEROMETER & CHG. AMP) HERMETIC	Ceramic-to-metal and laser welded	
COEFFICIENT OF THERMAL SENSITIVITY	.02	%/°C
ELECTRICAL		
SUPPLY CURRENT RANGE [3]	4 to 20	mA
COMPLIANCE VOLTAGE RANGE	15 to 30	Volts
OUTPUT IMPEDANCE, TYP.	100	Ohms
BIAS VOLTAGE, +8 VOLTS NOM.	+7 to +9	VDC
DISCHARGE TIME CONSTANT, NOM.	0.1	Sec
OUTPUT SIGNAL POLARITY FOR ACCELERATION TOWARD TOP		Positive
ELECTRICAL ISOLATION, GROUND WIRE TO CASE	10 Megohms, min.	

Supplied accessories:
Mounting screw, model 6535 (8-32 UNC-2A, quantity of 3(three))

[1] Measured at 100 Hz, 1 g rms per ISA RP 37.2.
[2] Measured using zero-based best straight line method, % of F.S. or any lesser range.
[3] Do not apply power to this system without current limiting, 20 mA MAX. To do so will destroy the IC charge amplifier.

OPERATING INSTRUCTIONS MODEL 5334

HYBRID HIGH TEMPERATURE VIBRATION MEASUREMENT SYSTEM

INTRODUCTION

The Dytran Model 5334 high temperature vibration monitoring system consists of a high temperature charge mode accelerometer and an in-line miniature charge amplifier which operates from a constant current 2-wire (IEPE) power unit. This system is known as a hybrid system since it combines a charge mode accelerometer with the Low Impedance Voltage Mode technology.

The accelerometer/charge amplifier system is permanently joined together as a single unit with all necessary cables permanently connected. The accelerometer utilizes ultra-high temperature piezoelectric crystals in compression mode. A three hole flanged housing provides 3 equally spaced clearance holes for mounting to the test surface with three #8 mounting screws.

The accelerometer is connected to the input of the charge amplifier thru the use of a 18 inch long hardline cable which is impervious to the high temperature at the measurement point. This allows the in-line charge amplifier to be located in a lower temperature location

Power and signal are conducted over the same two-wire cable. Simple constant current type power units supply power to operate the charge amplifier and separate the signal from the DC bias of the amplifier.

Model 5334 features signal ground isolation from the mounting surface of the accelerometer to avoid annoying ground loops.

DESCRIPTION

Refer to the Outline/Installation drawing for Model 5334 vibration measurement system. This drawing is all included in this Operating Guide.

DESCRIPTION, ACCELEROMETER

Model 5334 is packaged in an hermetically sealed housing.

This high temperature accelerometer is a compression design, i.e., the seismic mass is located atop the thin piezoceramic discs and is preloaded against these discs with hundreds of pounds of preload force. Vibratory motion acting upward at the mounting base is transferred to the seismic mass through the crystals, placing them in, alternately, compression and tension. This movement and the opposing inertial forces generated by the mass produce a charge mode signal exactly analogous to the input acceleration.

Model 5334 is internally case ground isolated, i.e., the outer case is electrically isolated from an inner accelerometer. Power ground is thus isolated from case ground. This feature precludes ground loops resulting from mounting surfaces which may be at different electrical potentials from power (and signal) ground.

The unit is installed by use of three 8-32 x 1/2 inch long socket head cap screws, (supplied). The mounting screws thread into 3 matching threaded holes which must be provided in the mounting surface.

DESCRIPTION, CHARGE AMPLIFIER

The job of the charge amplifier is to convert the high impedance charge mode signal generated by the accelerometer to a low impedance voltage mode signal of the proper sensitivity and with the ability to drive long cables and feed directly into voltage reading data collection systems.

Model 5334 is a Low Impedance Voltage Mode device operating from 2-wire constant current power units. The output signal appears at the “Signal/Power” terminal superimposed on DC bias voltage.

When constant current from the IEPE power unit is applied to the charge amplifier Sig/Pwr terminal, the amplifier "turns on" at approx. +8 Volts DC quiescent bias level. When the accelerometer senses acceleration and sends the resultant charge signal to the input of the charge amplifier, the resultant voltage signal is superimposed upon this bias voltage. In the power unit, in its simplest form, a capacitor blocks the DC bias and allows the dynamic signal voltage to be separated and brought out to an "output" jack on the power unit. At this point the signal may be connected directly to almost any type of readout instrument such as DVM's, oscilloscopes, data collectors, spectrum analyzers, etc. The approximate 100 Ohm output impedance of the signal allows the driving of long cables without adverse effects on sensitivity or frequency response.

A charge amplifier is an inverting high gain amplifier with capacitive feedback. The feedback capacitor determines the charge to voltage sensitivity and a feedback resistor, along with the capacitor sets the discharge time constant which in turn determines the low frequency response of the system.

The discharge time constant is the product of the feedback resistor and capacitor

$$TC = R_f C_f \qquad \text{(Seconds)} \qquad \text{Eq 1}$$

where: R = Ohms
C = Farads

The -3db frequency is related to discharge time constant as follows:

$$f_{-3db} = \frac{0.16}{RC} \quad \text{(Hz)} \qquad \text{Eq 2}$$

Equation 2 above, defines the frequency at which the accelerometer sensitivity will be 3db down when compared to the reference sensitivity measured at 100 Hz.

The discharge time constant for System 5334 is 0.1 Sec. yielding a lower -3db frequency of 1.6. Hz, from equation 2.

As rule of thumb, the lower -5% frequency is three times the -3db frequency or 3 x 1.6 = 4.8 Hz.

INSTALLATION

Refer to Outline/Installation drawing 127-5334 for this section. See last page for bending instructions.

To mount Model 5334, it is necessary to drill and tap 3 equally spaced 8-32 mounting ports on a 1.188 dia. bolt circle. For best high frequency response, the contact area of the accelerometer must be selected or prepared to be flat to .001 TIR. The holes must be drilled perpendicular to the mounting surface to within 2 degrees of angular error.

After drilling and tapping, clean the area to remove all traces of cutting oil and machining chips. Spread a thin layer of silicone grease on the three contact surfaces of the 5334. Locate the accel. over the tapped holes and engage the three mounting screws through the holes in the flange and into the tapped holes. Thread the mounting screws into the tapped holes and torque to 15 pound inches. The cap screws have drilled heads for lockwire. Lockwire the cap screws in place per standard aircraft convention.

Support the cables against excessive motion in accordance with accepted helicopter convention.

CAUTIONS

1) Do not subject the in-line charge amplifier to temperatures above 185°F. To do so can damage this IC amplifier.

2) Do not allow cables to vibrate unrestrained. This will eventually destroy the cable and could lead to system inaccuracies.

3) Avoid dropping or striking the accelerometer, especially against rigid materials such as concrete and metals. While the accelerometer is designed to be very rugged, and the amplifier is intrinsically protected against shock induced overloads, the very high overloads induced by dropping can do permanent damage to the input amplifier or to the mechanical structure of the accelerometer. This type of damage is not covered by the warranty.

MAINTENANCE AND REPAIR

The welded and sealed construction of the System, Model 5334 precludes field repair.

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 5334 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, 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.

Bending Hardline Cable Accelerometers During Installation

To form the hard line cable it is recommended to use a small tube bender. Small tube benders are available on line, McMaster Carr and others, and local home improvement stores. It is recommended to use a bender with a built in tube support, see Figure 1. Figure 2 shows an alternative tube bender without the tube support. During the bending operations be sure not to stress the cable attachments by bending or torquing. If bending close to the accelerometer it is recommended to have a minimum 2 inches from the collar to the bend radius. If using a tool similar to figure 2, do not press on the accelerometer during bending.

Figure 1

Figure 2

Place tube into bender per tool instructions. Figure 3 shows the tool set at the recommended minimum bend distance of 2 inches from the unit collar to bend radius.

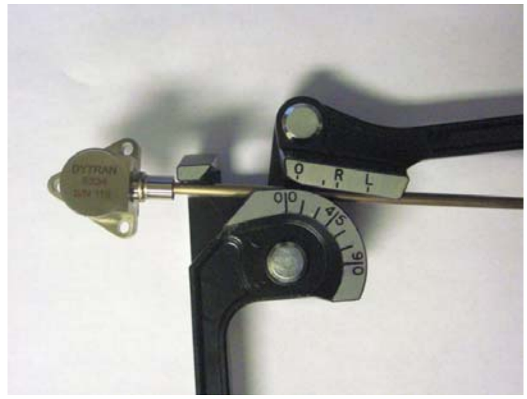
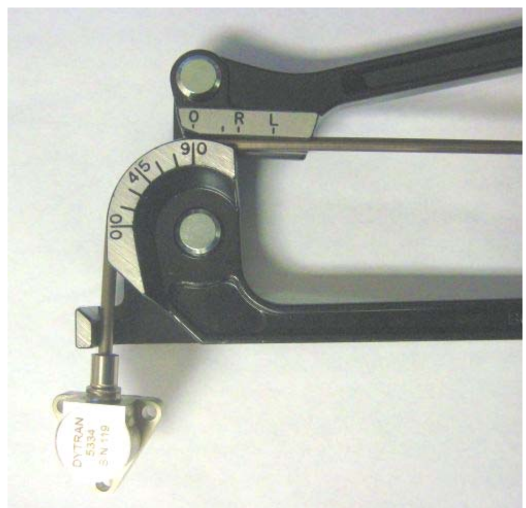


Figure 3

Bend tube to desired angle



Continue to bend as needed for installation.