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Helicopter

Helicopter Sensors

A helicopter is a rotary winged aircraft. Unlike fixed-wing aircraft, the rotor provides lift and forward propulsion to the helicopter. The fuselage of the helicopter is essentially balanced underneath the rotor. The helicopter presents a unique vibration scenario for the rotor. It must not only have proper blade balance to minimize unbalance vibration from the blades, but they also provide the lift to the vehicle. The blades themselves are very complex as they must pitch and tilt as well as providing flight attitude control. Any vibration of the rotor assembly will translate itself into vibration of the helicopter fuselage suspended below. The fuselage will also be affected by the pressure waves produced by the passage of the blades and set up vibration simply due to wave effects.

Wilcoxon has been manufacturing vibration accelerometers for many years that are being used in helicopter Health and Usage Monitoring System (HUMS) applications. Wilcoxon vibration sensors are at work in the CH-53/MH-53. These sensors are used in the rotor track and bearing monitoring. Specially designed sensors are fitted to the swashplate for vibration monitoring at the rotor. Additional sensors are mounted throughout the drive path to the tail rotor for monitoring vibration at critical points. Other vibration sensors are used within the U.S. military in the Vibration Analysis and Diagnostic System (VADS).

Wilcoxon Helicopter Sensors:

Model	Style	Sensitivity	Low Freq	High Freq	Accel / Veloc Range
991D	shear	40 mV/g	0.5 Hz	12 kHz	40 g peak
991V	shear	20 mV/ips	2.5 Hz	7 kHz	400 in/sec peak
992-1	shear	10 mV/g	2.0 Hz @ 1.5dB	20 kHz @ 1.5dB	N/A

Note: Frequency @ ±3dB.

Model 991D

Internally Amplified, Helicopter Accelerometer

FEATURES:

- Low noise
- Safety wire hole on case
- Compatible with helicopter systems

DYNAMIC

Sensitivity[1], ±5%, 25°C	40 mV/g
Acceleration Range	40 g peak
Amplitude Nonlinearity	1%
Frequency Response:	
±5%	2.0 - 4,000 Hz
±10%	1.0 - 6,000 Hz
±3 dB	0.5 - 12,000 Hz
Resonance Frequency, mounted, nominal	20 kHz
Transverse Sensitivity, max.	7% of axial
Temperature Response	–35°C +2% +100°C –10%

ELECTRICAL

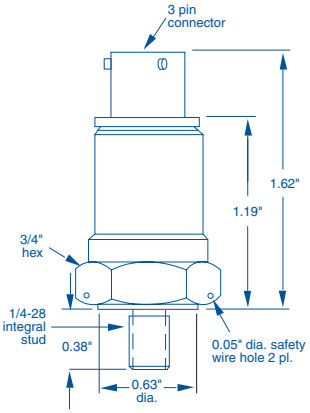
Power Requirement, voltage source		9 VDC
Electrical Noise, equiv. g, nominal:		
Broadband,	2.5 Hz to 25 kHz	75 µg
Spectral	10 Hz	7.0 µg/√Hz
	100 Hz	1.3 µg/√Hz
	1000 Hz	0.9 µg/√Hz
Output Impedance, max.		2,400 Ω
Bias Output Voltage		3.5, ±0.5 VDC
Grounding		base isolated

ENVIRONMENTAL

Temperature Range	–50 to 120°C
Vibration Limit	250 g peak
Shock Limit	1,000 g peak
Electromagnetic Sensitivity, equiv. g.	40 µg/gauss
Base Strain Sensitivity	0.002 g/µstrain

PHYSICAL

Weight		54 grams
Case Material		stainless steel
Mounting		1/4-28 x 0.38 integral stud
Output Connector		3 pin, MIL-C-26482 style
Pin A	9 VDC	
Pin B	Signal out	
Pin C	Common	
Cabling: Mating Connector		Bendix PT06A-8-3S
Cable		2 conductor shielded



NOTES: [1] As measured across a 4.7 kΩ load (see calibration powering diagram). Sensitivity is 60 mV/g as measured in operating system.

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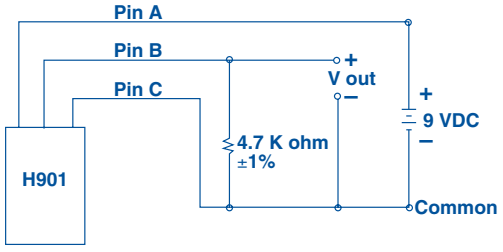
Calibration Powering Diagram



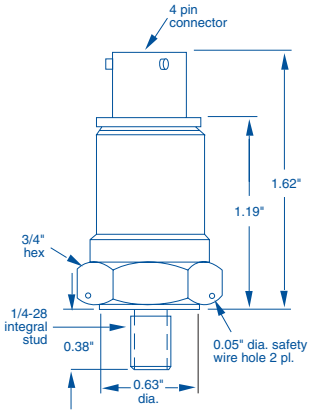
NOTE: This powering method is used for calibration purposes ONLY.

Model 991V

Internally Amplified, Velocity Helicopter Sensor

FEATURES:

- Internally integrated to velocity
- Compatible with helicopter monitoring systems
- Mechanical & thermal isolation
- Low noise



DYNAMIC		
Sensitivity, ±10%, 25°C		20 mV/in/sec
Velocity Range		400 in/sec peak
Amplitude Nonlinearity		1%
Frequency Response:		
±10%		5.0 - 4,000 Hz
±3 dB		2.5 - 7,000 Hz
Resonance Frequency, mounted, nominal		20 kHz
Transverse Sensitivity, max.		5% of axial
Temperature Response		–50°C +2% +120°C –10%
ELECTRICAL		
Power Requirement:		
current draw		see connections <0.5 mA
Electrical Noise, equiv. in/sec, nominal:		
Broadband	2.5 Hz to 25 kHz	1,500 µin/sec
Spectral	10 Hz	100 µin/sec/√Hz
	100 Hz	9 µin/sec/√Hz
	1000 Hz	3 µin/sec/√Hz
Output Impedance, max.		100 Ω
Grounding		base isolated
ENVIRONMENTAL		
Temperature Range		–50 to 120°C
Vibration Limit		250 g peak
Shock Limit		1,000 g peak
Electromagnetic Sensitivity, equiv. in/sec.		300 µin/sec/gauss
Base Strain Sensitivity		0.004 in/sec/µstrain
PHYSICAL		
Weight		55 grams
Case Material		stainless steel
Mounting		¼-28 x 0.38 integral stud
Output Connector		MIL-C-26482
Connections:	Pin A	–9 VDC
	Pin B	common
	Pin C	+9 VDC
	Pin D	signal
Cabling:	Mating Connector	Wilcoxon R4V (Bendix SP06A-8-4S)
	Recommended Cable	4 conductor shielded

ACCESSORIES AVAILABLE: Mating connector.

CE

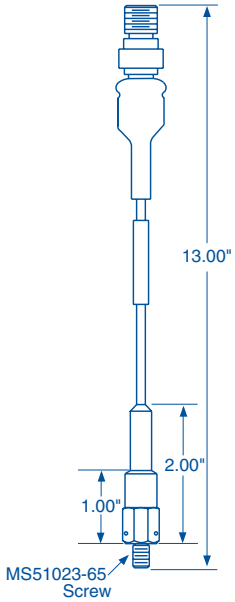
Model 992-1

Single Axis Accelerometer with Connector

FEATURES:

- Low noise
- Safety wire hole on case
- Compatible with helicopter systems

DYNAMIC	
Sensitivity, ±10% @ 100 Hz	10 mV/g
Amplitude Linearity:	
±1.0%	to 100 g
±1.5%	to 300 g
Frequency Range:	
±1 dB	2 Hz - 15 kHz
±1.5 dB	2 Hz - 20 kHz
Resonance Frequency, nominal	35 kHz
Transverse Sensitivity, max.	5%
Temperature Response	–35°C +2% +100°C –10%
ELECTRICAL	
Power Requirement	2 mA ±5% at reference of 18-30VDC
Electrical Noise:	
Broadband	<0.002 g rms equivalent (2-25,000Hz)
Spectral Noise, nominal:	
2.5 Hz	160 µg/√Hz
10 Hz	40 µg/√Hz
100 Hz	20 µg/√Hz
1000 Hz	8 µg/√Hz
Output Impedance	600 Ω
Bias Output Voltage	8 VDC, ±1.5 VDC
Phase Shift, absolute	<6° @ 2.5 Hz
Phase Shift, relative	±2° max. @ 2.5 Hz
ENVIRONMENTAL	
Temperature Range[1]	-35 °C to 100 °C
Vibration Limit	500 g peak
Shock Limit	10,000 g peak
Electromagnetic Sensitivity	<300 µg/gauss
Base Strain Sensitivity	<0.005 g/µstrain
Acoustic Sensitivity	<0.004 g/100 dB SPL
PHYSICAL	
Sensing Design Element	PZT ceramic / shear
Weight	45 grams
Case Material	stainless steel
Electrical Isolation	case isolated
Mounting	1/4 - 28 UNF
Cable	two conductors, with 100% overall shield
Connector Pinout:	
A	signal / power
B	no connection
C	no connection
D	common
Shell	shield
Connector	PC01A-8-4P



NOTES: [1] *±15% max change in sensitivity over temperature range.*

ACCESSORIES SUPPLIED: MS 51023-65 mounting screw epoxied in place.

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