M. Fabian and H. Villinger

Specification and setup of Ocean Bottom Tiltmeter (OBT) - OBT1a

Logatchev Hydrothermal Vent Filed
Mid-Atlantic Ridge
11.05.2005-17.06.2006

OBT1a

Time interval: 11/05/2005 - 17/06/2006 (402 days)

Area: Logatchev Hydrothermal Vent Field, Mid-Atlantic Ridge

Position: 14°45.201'N 44°58.784'W (determined during deployment by HF beacon)

Depth: 3053m

Orientation: +Y-axis 295°±3° N

Equipment/instrumentation:

- Applied Geomechanics Inc. 756 biaxial bubble tilt sensor

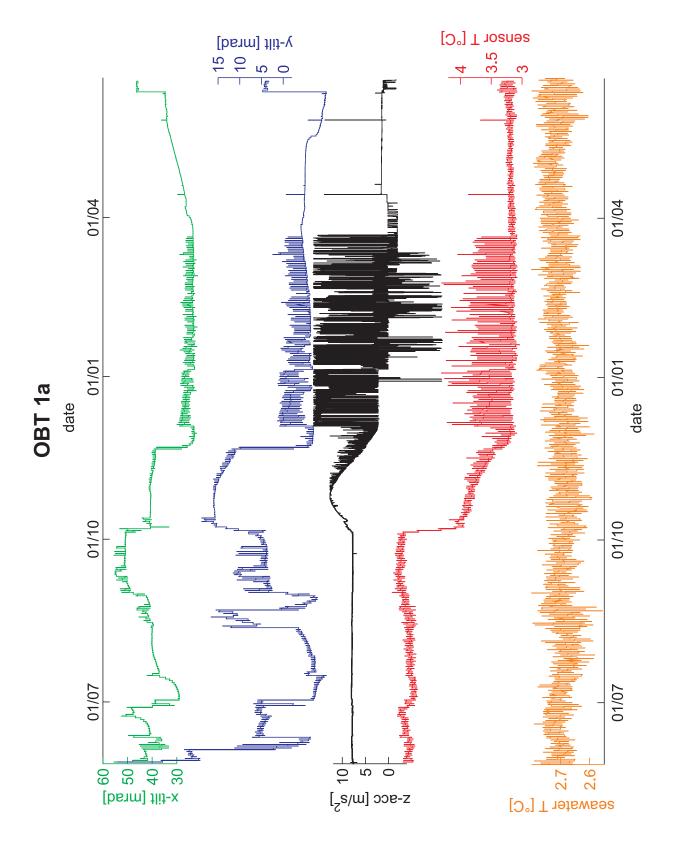
- MEMS Kistler Servo K-Beam 8330 A2.5 single-axis accelerometer
- Persistor Instruments Inc. CF2 data logger

- Autonomous Miniaturised Temperature Logger (MTL) for external temperature

	Unit	Reso-	Preci-	Sample	Conversion factor	Chan-	File name
		lution	sion	rate [s]		nel	
x-tilt	mrad	1µrad	5 µrad	6.000	[mrad]=f[6.1333*8.	5	OBT1a_Tilt_x
			(repeat		8395*x-tilt[V]]		_2005.dat
			ability)				
y-tilt	mrad	1µrad	5 µrad	6.000	[mrad]=f[6.1340*8.	6	OBT1a_Tilt_y
			(repeat		9445*y-tilt[V]]		_2005.dat
			ability)				
sensor T	°C	0.1°C		6.000	[°C]=f[100*T-	7	OBT1a_Tilt_T
					tilt[V]]		_2005.dat
accl (z)	m/s ²	10 ⁻	$\pm 2 \text{ m/s}^2$	0.750	$[m/s^2]=f[6.4859*ac]$	1	OBT1a_Accl_z
		5 m/s ²	(0 m/s^2)		cl[V]]		_2005.dat
			bias)				
external	°C	0.001°	±0.1°C	600.0	$1/T=T_O+T_L(ln(R))+$	-	OBT1a_Mtl_T
T		C			$T_{\rm C}(\ln({\rm R}))^3$,		_2005.dat
					$T_{O} = 0.0010743547$		
					$T_L = 0.0002113377$		
					$T_{\rm C} = 0.0000000922$		
					R=resistivity[Ohm]		

Remarks:

- Spikes in acceleration data due to crosstalk in data logger
- Data are linearly interpolated to correct for time drift of 1.0s/day (except external T)
- Deployment by ROV "QUEST" during cruise M64/2 with RV Meteor (May 12 2005, dive 244ROV)
- Recovery by ROV "Jason 2" during cruise MSM04/3 with RV M.S. Merian (January 28 2007, dive J2-254)
- Leveled horizontally with deep sea level |2°|



ServoK-Beam Accelerometer

Force Feedback Capacitive Accelerometer

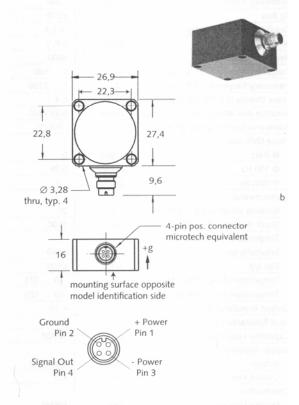
A single axis capacitive accelerometer for measuring static acceleration or low-level, low-frequency vibration. Featuring 1.3µg @ <10 Hz resolution, excellent frequency response and insensitivity to thermal transients and transverse acceleration.

- Static Response
- 1200 mV/g sensitivity
- 1,3µg resolution @ <10 Hz
- · High immunity to thermal transients
- · Low transverse acceleration
- 28,5 gram weight
- · 1500gpk shock rating
- Conforming to CE

Description

The 8330A3 ServoK-Beam Accelerometer is an analog force feedback sensor incorporating a silicon micro-machined variable capacitance sensing element that provides excellent bandwidth, dynamic range, stability, and robustness. The ServoK-Beam is a three terminal variable capacitance sensor made by a bulk MEMS process. The silicon proof mass is supported by silicon springs between the upper and lower fixed electrodes. A custom switched capacitor integrated circuit (ASIC) measures the mass position and provides the feedback force to restore the mass to the center position. The sensing circuit determines the position of the proof mass by measuring the charge difference between the upper and lower electrodes. A compensation circuit generates an electrostatic feedback voltage which when applied to the proof mass electrode restores the mass to the center position where the capacitance of both sides are equal.

The sensing element and conditioning electronics are integrated into a single lightweight, epoxy sealed aluminum housing. A hard anodized housing provides ground isolation. The unit is powered by a bipolar supply between ±6 and ±15 V DC.



Application

The characteristics of the ServoK-Beam makes it an ideal candidate in applications requiring the measurement of low level acceleration in steady-state or low frequency environment.

Specific areas of applications:

- Large structural modal testing (such as bridges)
- active vibration control during optical or precision manufacturing processes
- platform leveling; pitch and roll measurements
- high speed trains; tilt and lateral vibration measurements
- measuring seismic events on structures during quakes
- in-vehicle ride comfort and general vibration for automotive/truck vehicle dynamics

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Туре	Unit	8330A3
Acceleration Range	gpk	±3
Acceleration Limit	gpk	±3,5
Sensitivity, ±10%	mV/g	1200
Og Bias	mg	±200
Resolution (Threshold) typ. (010 Hz)	µgrms	< 1,3
Amplitude Non-linearity	%FSO	± 0,1
Resonant Frequency typ.	Hz	6600
Frequency Response, ±5% min.	Hz	0 500
Frequency Response, ±3dB typ.	Hz	0 2700
Noise Density (f = 100 Hz) typ.	µgrms/√Hz	0,4
Sensitive Axis Misalignment typ. (max.)	degree	0,25 (0,6)
Transverse Sensitivity typ. (max.)	%	<0,4 (1)
Phase Shift max.		0.55
@ 0 Hz	degree	0
@ 100 Hz	degree	0,25
@1000 Hz	degree	1,6
Environmental:	LEJ T	A roys und
Random Vibration 20 2000 Hz	grms	20
Shock (half sine, 0,5 µs)	gpk	1500
Temperature Coefficient of:		1
Sensitivity typ.	ppm/°C	±100
Bias typ.	μg/°C	±100
Temperature Range Operating	°C	-40 125
Temperature Range Storage	°C	-55 125
Output Impedance nom.	Ω	< 40
Load Resistance min.	kΩ	5
Capacitive Load max.	pF	10000
Supply: (bipolar)	16.00	
Voltage	VDC	±6 ±15
Current nom.	mA	8,5
Construction:		
Sensing Element	type	MEMS
Housing/Base	material	Al. hard anodized
Sealing - housing/connector	type	Ероху
Connector	type	4-pin pos.
Ground Isolation min.	MΩ	>10
Weight	grams	28,5

1 g = 9,80665 m/s 2 , 1 lnch = 25.4 mm, 1 gram = 0,03527 oz, 1 lbf-in = 0,113 Nm

Mounting

Reliable and accurate measurements require that the mounting surface be clean and flat. The accelerometer can be attached to the test structure with adhesive or with the supplied screws. The Operating Instruction Manual for the 8330A... provides detailed information regarding mounting surface preparation.

Accessories Included	Туре
• (4) mounting screws, 4-40 UNC-2A x 7/8" long	431-0491-003
• (4) mounting screws, M3 x 20 mm long	431-0492-002
Mounting wax	8432

Optional Accessories	Type
• 2 meter output cable, 4-pin neg. Microtech	1592M1
equivalent to pigtails power and signal output	
cable: 4-nin neg	

•	Microtech equivalent to three power banana	1788A
	plugs and a BNC pos. signal connector. $x = 2$,	
	5, 10, meter	

 Triaxial mounting cube 853 	0
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Ordering Key

Measuring Range	8330A 🗌	
±3g	3 1 1	ofings between

4 General Specifications

Typical physical and performance specifications for Miniature Tilt Sensors are listed below. Resolution (sensitivity), repeatability and linearity specifications were measured using Applied Geomechanics signal conditioning electronics.

TOTAL RANGE Series 755: ±1 arc degree;

Series 756: ±10 arc degrees;

Series 757: ±60 degrees

RESOLUTION Series 755: 0.1 microradian (0.02 arc second) or better;

Series 756: 1 microradian (0.2 arc second) or better; Series 757: approx. 5 microradians (1 arc second)

REPEATABILITY Series 755: 1 microradian (0.2 arc second);

Series 756: 5 microradians (1 arc second); Series 757: 5 microradians (1 arc second)

LINEARITY Series 755: within 0.1 arc minute at an angle of ± 10 arc min-

utes, within 0.5 arc minute at an angle of ± 20 arc minutes; Series 756: within 0.03 degree at an angle of ± 3 degrees,

within 0.17 degree at an angle of ± 6 degrees;

Series 757: within 0.1 degree at an angle of ±10 degrees, within 1.0 degree at an angle of ±45 degrees, within 3.0 de-

grees at an angle of ±60 degrees

SCALE FACTOR @ 20°C Series 755: 7.2 mV/arc minute/volt excitation ±20%;

Series 756: 34 mV/arc degree/volt excitation $\pm 20\%$; Series 757: 7.2 mV/arc degree/volt excitation $\pm 20\%$;

CHANGE IN SCALE FACTOR

WITH TEMPERATURE CHANGE Series 756: -0.05% per °C;

Series 757: -0.13% per °C;

Series 755: -0.05% per °C;

POWER REQUIREMENTS AC excitation @ 3-5 volts peak-to-peak, 400 Hz to 10 kHz.

Typically provided by Applied Geomechanics signal condition-

ing electronics

TEMPERATURE RANGE -30°C to +70°C operational, -30°C to +100°C storage

HUMIDITY RANGE 0 to 100%. Standard sensors are not submersible

SIZE AND WEIGHT See Tables 1, 2 and 3

MATERIALS Standard housings: Anodized 6061-T6 aluminum; stainless

steel, invar, brass, ceramic and fiberglass housings are avail-

able on request.