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Specification and setup of Ocean Bottom Tiltmeter  
(OBT) – OBT2b

*Logatchev Hydrothermal Vent Field*

*Mid-Atlantic Ridge*

*20.12.2007-31.08.2008*

2008

## OBT2b

Time interval: 20/12/2007 – 31/08/2008 (255 days)  
Area: Logatchev Hydrothermal Vent Field, Mid-Atlantic Ridge  
Position: 14°45.194'N 44°58.773'W (determined during deployment by HF beacon)  
Depth: 3035m  
Orientation: not available

### Equipment/instrumentation:

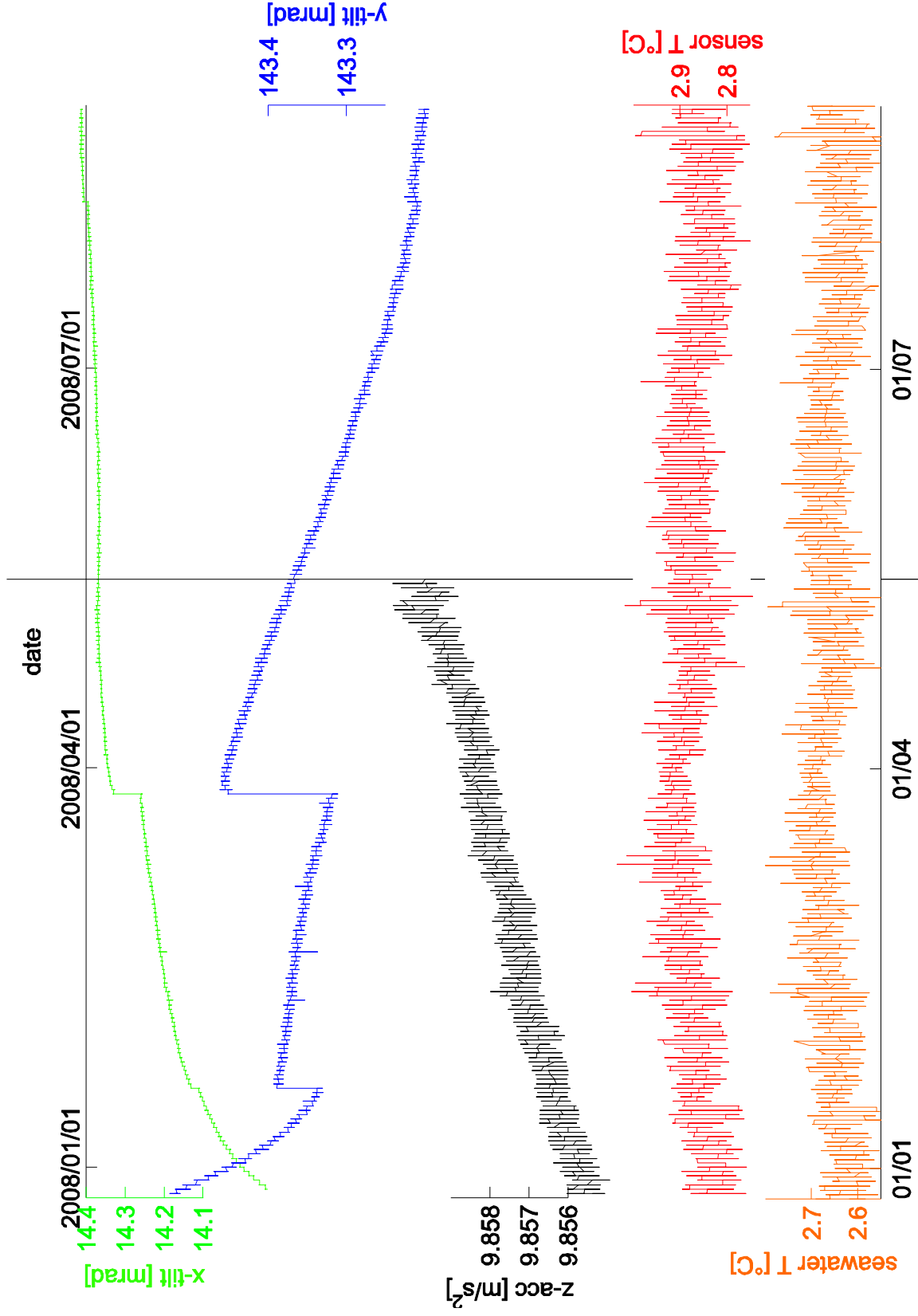
- Applied Geomechanics Inc. 756 biaxial bubble tilt sensor
- MEMS Kistler Servo K-Beam 8330 A2.5 single-axis accelerometer
- Persistor Instruments Inc. CF2 data logger
- Autonomous Miniaturised Temperature Logger (MTL) for external temperature

	Unit	Resolution	Precision	Sample rate [s]	Conversion factor	Channel	File name
x-tilt	mrad	1µrad	5 µrad (repeat ability)	1.229	[mrad]=f[6.1246*1.4177*17.453*x-tilt[V]]	3	OBT2b_Tilt_x_2008.dat
y-tilt	mrad	1µrad	5 µrad (repeat ability)	1.229	[mrad]=f[6.1191*1.4331*17.453*y-tilt[V]]	5	OBT2b_Tilt_y_2008.dat
sensor T	°C	0.1°C		1.229	[°C]=f[100*T-tilt[V]]	7	OBT2b_Tilt_T_2008.dat
accl (z)	m/s <sup>2</sup>	10 <sup>-5</sup> m/s <sup>2</sup>	±2 m/s <sup>2</sup> (0 m/s <sup>2</sup> bias)	1.229	[m/s <sup>2</sup> ]=f[(accl[V]-0.206)*8.513]	1	OBT2b_Accl_z_2008.dat
external T	°C	0.001°C	±0.1°C	600.0	1/T=T <sub>O</sub> +T <sub>L</sub> (ln(R))+T <sub>C</sub> (ln(R)) <sup>3</sup> , T <sub>O</sub> = 0.0010743547 T <sub>L</sub> = 0.0002113377 T <sub>C</sub> = 0.0000000922 R=resistivity[Ohm]	-	OBT2b_Mtl_T_2008.dat

### Remarks:

- Data are linearly interpolated to correct for time drift of 0.53s/day (except external T)
- Deployment by ROV "Kiel 6000" during cruise MSM06/2 with RV L'Atalante (December 17 2007, station ATA24ROV)
- Recovery by ROV "Kiel 6000" during cruise MSM10/3 with RV M.S. Merian
- Levelled horizontally with deep sea level |2°|

# OBT 2b



# ServoK-Beam Accelerometer

Type 8330A...

## Force Feedback Capacitive Accelerometer

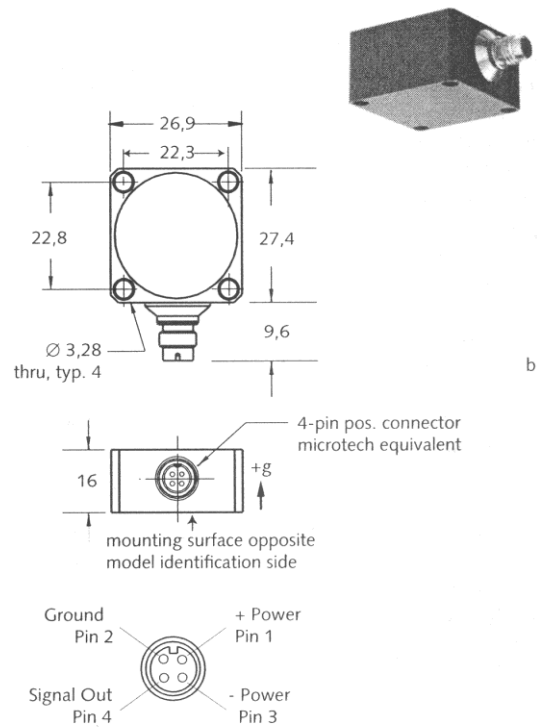
A single axis capacitive accelerometer for measuring static acceleration or low-level, low-frequency vibration. Featuring 1.3µg @ <10 Hz resolution, excellent frequency response and insensitivity to thermal transients and transverse acceleration.

- 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

8330A3\_000-542 e-07.06

## Technical Data

Type	Unit	8330A3
Acceleration Range	gpk	±3
Acceleration Limit	gpk	±3,5
Sensitivity, ±10%	mV/g	1200
0g Bias	mg	±200
Resolution (Threshold) typ. (0...10 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 Hz	degree	0
@ 100 Hz	degree	0,25
@1000 Hz	degree	1,6
Environmental:		
Random Vibration 20... 2000 Hz	grms	20
Shock (half sine, 0,5 µs)	gpk	1500
Temperature Coefficient of:		
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)		
Voltage	VDC	±6 ... ±15
Current nom.	mA	8,5
Construction:		
Sensing Element	type	MEMS
Housing/Base	material	Al. hard anodized
Sealing - housing/connector	type	Epoxy
Connector	type	4-pin pos.
Ground Isolation min.	MΩ	>10
Weight	grams	28,5

1 g = 9,80665 m/s<sup>2</sup>, 1 Inch = 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

	Type
• (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 equivalent to pigtails power and signal output cable; 4-pin neg.	1592M1
• Microtech equivalent to three power banana plugs and a BNC pos. signal connector. x = 2, 5, 10, meter	1788A...
• Triaxial mounting cube	8530

## Ordering Key

Measuring Range	8330A
±3g	3

## 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: $\pm 1$ arc degree; Series 756: $\pm 10$ arc degrees; Series 757: $\pm 60$ 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 $\pm 10$ arc minutes, within 0.5 arc minute at an angle of $\pm 20$ arc minutes; Series 756: within 0.03 degree at an angle of $\pm 3$ degrees, within 0.17 degree at an angle of $\pm 6$ degrees; Series 757: within 0.1 degree at an angle of $\pm 10$ degrees, within 1.0 degree at an angle of $\pm 45$ degrees, within 3.0 degrees at an angle of $\pm 60$ degrees
SCALE FACTOR @ 20°C	Series 755: 7.2 mV/arc minute/volt excitation $\pm 20\%$ ; 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 755: $-0.05\%$ per °C; Series 756: $-0.05\%$ per °C; Series 757: $-0.13\%$ per °C;
POWER REQUIREMENTS	AC excitation @ 3-5 volts peak-to-peak, 400 Hz to 10 kHz. Typically provided by Applied Geomechanics signal conditioning electronics
TEMPERATURE RANGE	$-30^{\circ}\text{C}$ to $+70^{\circ}\text{C}$ operational, $-30^{\circ}\text{C}$ to $+100^{\circ}\text{C}$ 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 available on request.