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

Logatchev Hydrothermal Vent Filed

Mid-Atlantic Ridge

11.05.2005-17.06.2006

2008

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:

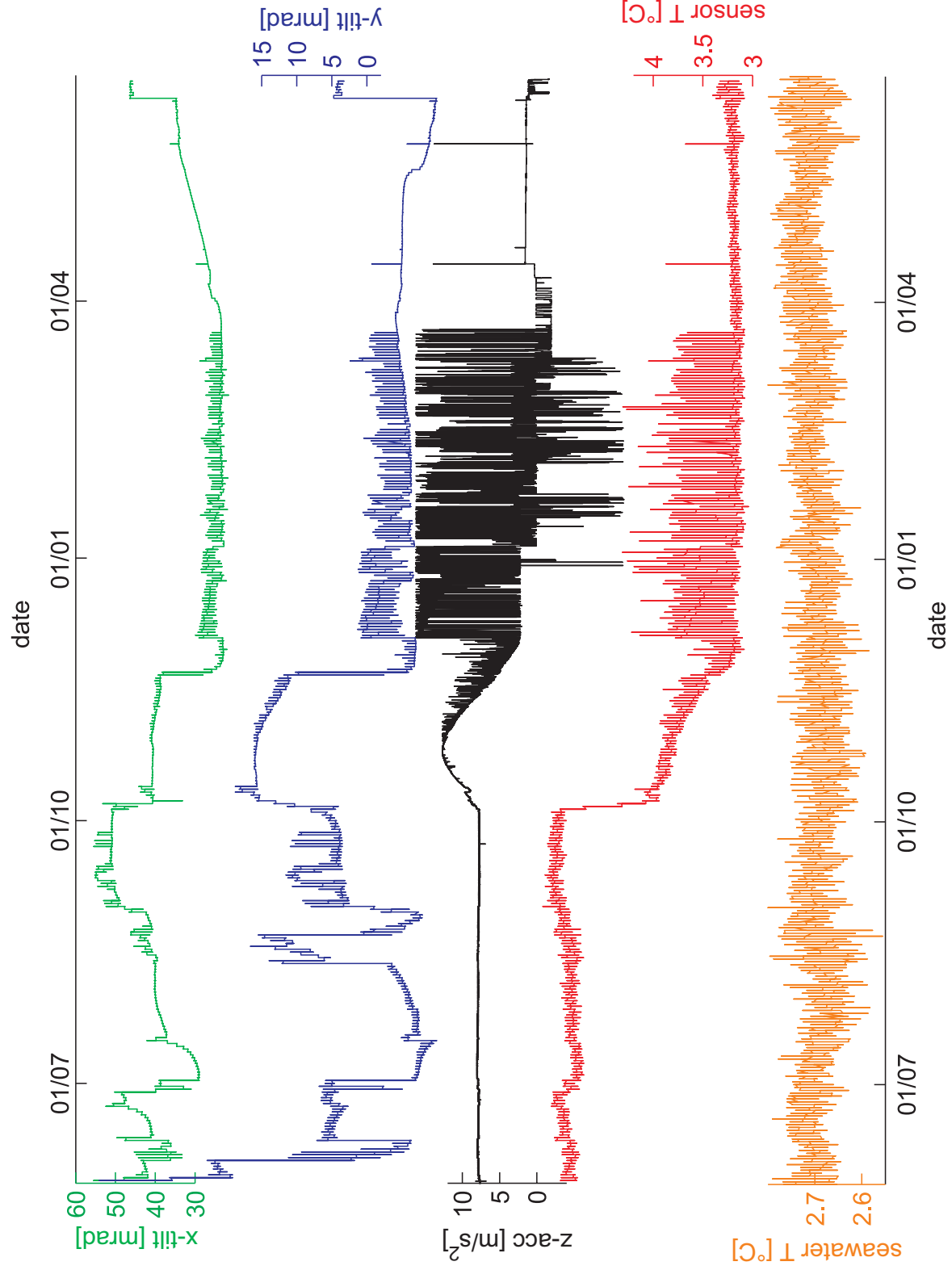
- Applied Geomechanics Inc. 756 biaxial bubble tilt sensor
- MEMS Kistler Servo K-Beam 8330 A2.5 single-axis accelerometer
- Persistor Instruments Inc. CF2 data logger
- Autonomous Miniaturised Temperature Logger (MTL) for external temperature

	Unit	Resolution	Precision	Sample rate [s]	Conversion factor	Channel	File name
x-tilt	mrad	1µrad	5 µrad (repeat ability)	6.000	[mrad]=f[6.1333*8.8395*x-tilt[V]]	5	OBT1a_Tilt_x_2005.dat
y-tilt	mrad	1µrad	5 µrad (repeat ability)	6.000	[mrad]=f[6.1340*8.9445*y-tilt[V]]	6	OBT1a_Tilt_y_2005.dat
sensor T	°C	0.1°C		6.000	[°C]=f[100*T-tilt[V]]	7	OBT1a_Tilt_T_2005.dat
accl (z)	m/s ²	10 ⁻⁵ m/s ²	±2 m/s ² (0 m/s ² bias)	0.750	[m/s ²]=f[6.4859*accl[V]]	1	OBT1a_Accl_z_2005.dat
external T	°C	0.001°C	±0.1°C	600.0	1/T=T _O +T _L (ln(R))+T _C (ln(R)) ³ , T _O = 0.0010743547 T _L = 0.0002113377 T _C = 0.0000000922 R=resistivity[Ohm]	-	OBT1a_Mtl_T_2005.dat

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)
- Levelled horizontally with deep sea level |2°|

OBT 1a



ServoK-Beam Accelerometer

Type 8330A...

Force Feedback Capacitive Accelerometer

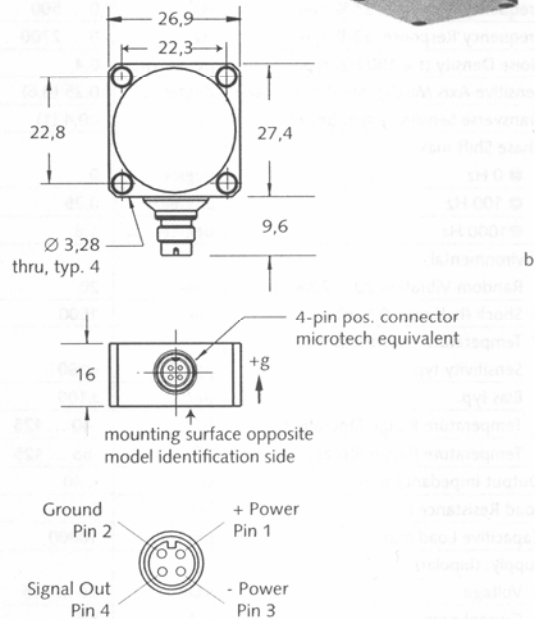
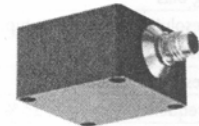
A single axis capacitive accelerometer for measuring static acceleration or low-level, low-frequency vibration. Featuring $1.3\mu\text{g}$ @ <10 Hz resolution, excellent frequency response and insensitivity to thermal transients and transverse acceleration.

- Static Response
- 1200 mV/g sensitivity
- 1,3 μg 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

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 minutes, 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 degrees at an angle of ± 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°C to $+70^{\circ}\text{C}$ operational, -30°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.