GE Infrastructure
Sensing

Calibration Report 060915A0813

Digital Pressure Indicator

for

Fugro Consultants LP

6100 Hillcroft
Houston, TX 77081

Date of Issue: September 15, 2006

Full Scale: 500 psi gauge

As Found / As Left Calibration Data

Calibration Date: September 15, 2006

Calibration Standard: PC-89, and ,WS-12

Medium: nitrogen

Applied psi	Uncertainty psi	Displayed psi
0.0	0.0E+00	0.0
124.6700	1.4E-03	124.7
249.580	2.7E-03	249.6
374.330	4.1E-03	374.4
499.070	5.5E-03	499.2
249.580	2.7E-03	249.6
0.0	0.0E+00	0.1

Notes: The instrument was not adjusted.

General Electric Company
10311 Westpark Drive
Houston, TX 77042
USA

T 713 975 0547
F 713 975 6338

GE Infrastructure
Sensing

Calibration Report 060915A0813

Digital Pressure Indicator

for

Fugro Consultants LP

6100 Hillcroft
Houston, TX 77081

Date of Issue: September 15, 2006

Full Scale: 250 psi gauge

As Left Calibration Data

Calibration Date: September 15, 2006

Calibration Standard: PC-89, WS-12, and WS-27

Medium: nitrogen

Applied psi	Uncertainty psi	Displayed psi
0.00	0.0E+00	0.00
61.7960	6.8E-04	61.80
124.6680	1.4E-03	124.65
186.5430	2.1E-03	186.55
249.579	2.7E-03	249.60
124.6680	1.4E-03	124.65
0.00	0.0E+00	0.00

Notes: The instrument was adjusted prior to recording the above data.

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GE Infrastructure
Sensing

Calibration Report 060915A0813

Digital Pressure Indicator

for

Fugro Consultants LP

6100 Hillcroft
Houston, TX 77081

Date of Issue: September 15, 2006

Full Scale: 100 psi gauge

As Left Calibration Data

Calibration Date: September 15, 2006

Calibration Standard: PC-67, WS-12, and WS-27

Medium: nitrogen

Applied psi	Uncertainty psi	Displayed psi
0.00	0.0E+00	0.00
24.86100	2.5E-04	24.84
49.8390	5.0E-04	49.84
74.9860	7.5E-04	74.98
99.9310	1.0E-03	99.96
49.8390	5.0E-04	49.82
0.00	0.0E+00	0.00

Notes: The instrument was adjusted prior to recording the above data.

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Houston, TX 77042
USA

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F 713 975 6338

NVLAP® National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:1999

GE Infrastructure Sensing
10311 Westpark Drive
Houston, TX 77042-5312
Mr. Kenneth A. Kolb
Phone: 713-975-0547 Fax: 713-975-6338
E-mail: kenneth.kolb@ge.com
URL: http://www.gesening.com

CALIBRATION LABORATORIES **NVLAP LAB CODE 200491-0**

NVLAP Code: 20/A01 ANSI/NCSL Z540-1-1994; Part 1 Compliant

MECHANICAL

NVLAP Code: 20/M08
Mass

Calibration of Primary Piston Gauge Masses

Range	*Best Uncertainty (±) Relative to Indicated Value* [note 1]	*Remarks*
1 mg to 17 kg	5.0×10^{-6} but not less than 0.5 mg	Substitution – Mechanical
1 mg to 1.2 kg	5.0×10^{-6} but not less than 0.5 mg	Substitution – Electronic

Calibration of Secondary Piston Gauge Masses

1 mg to 8.0 kg	2.0×10^{-5} but not less than 0.5 mg	Substitution – Electronic
1 mg to 1.2 kg	2.0×10^{-5} but not less than 0.5 mg	Direct Reading - Electronic
1.2 kg to 8 kg	2.0×10^{-5} but not less than 43 mg	Direct Reading – Electronic

2006-01-01 through 2006-12-31
Effective dates

For the National Institute of Standards and Technology

NVLAP-01S (REV. 2004-10-31)

NVLAP® National Voluntary Laboratory Accreditation Program

CALIBRATION LABORATORIES **NVLAP LAB CODE 200491-0**

THERMODYNAMICS

NVLAP Code: 20/T05
Pressure

Pneumatic Pressure using Primary Piston Gauge note 2

Range	*Best Uncertainty (±) of Reading* note 1	*Remarks*
-100 kPa to -1.38 kPa	1.0×10^{-5} but not less than 0.07 Pa	Negative Gauge Mode
-16 kPa to 16 kPa	1.1×10^{-5} but not less than 0.034 Pa	Differential Mode
1.38 kPa to 1.4 MPa	1.0×10^{-5} but not less than 0.07 Pa	Gauge Mode note 4
1.4 MPa to 7 MPa	1.1×10^{-5} but not less than 2.8 Pa	Gauge Mode note 4
7 MPa to 21 MPa	$1.1 \times 10^{-5} + 1.9 \times 10^{-7}$ per MPa	Gauge Mode
21 MPa to 104 MPa	3.5×10^{-5}	Gauge Mode

Pneumatic Effective Area Determination using Primary Piston Gauge note 2

Range	*Best Uncertainty (±) of Reading* notes 1, 7	*Remarks*
1.38 kPa to 345 kPa	8.8×10^{-6}	
11.72 kPa to 1.4 MPa	8.3×10^{-6}	
14 kPa to 7 MPa	$1.0 \times 10^{-5} + 2.4 \times 10^{-7}$ per MPa note 3	
700 kPa to 21 MPa	$1.0 \times 10^{-5} + 4.8 \times 10^{-7}$ per MPa note 3	
1.17 MPa to 104 MPa	3.37×10^{-5}	

Pneumatic Pressure using Precision Transducer note 2

Range	*Best Uncertainty (±) of Reading* note 1	*Remarks*
0 Pa to 133 Pa	0.133 Pa	Absolute Mode
-16 kPa to 16 kPa	5.0×10^{-5} but not less than 0.035 Pa	Differential Mode
-100 kPa to 17 MPa	6.5×10^{-5} but not less than 0.22 Pa	Gauge Mode note 5

2006-01-01 through 2006-12-31

Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200491-0**

Pneumatic Effective Area Determination using Precision Transducer [note 2]

20 Pa to 17 MPa	7.2×10^{-5} but not less than 0.05 Pa

Pneumatic Deadweight Tester Output Pressure Conformance using Precision Transducer [note 2]

Range	*Best Uncertainty (±) of Reading* [notes 1, 8]	*Remarks*
20 Pa to 17 MPa	7.5×10^{-5} but not less than 0.053 Pa	

Hydraulic Pressure using Primary Piston Gauge [note 2]

Range	*Best Uncertainty (±) of Reading* [notes 1, 6]	*Remarks*
50 kPa to 7 MPa	2.5×10^{-5} but not less than 10 Pa	Gauge Mode
7 MPa to 140 MPa	3.5×10^{-5}	Gauge Mode
14 MPa to 280 MPa	7.5×10^{-5}	Gauge Mode
280 MPa to 500 MPa	1.0×10^{-4}	Gauge Mode

Hydraulic Effective Area Determination using Primary Piston Gauge [note 2]

Range	*Best Uncertainty (±) of Reading* [note 1]	*Remarks*
50 kPa to 7 MPa	2.31×10^{-5}	
7 MPa to 140 MPa	3.34×10^{-5}	
140 MPa to 280 MPa	7.29×10^{-5}	
280 MPa to 500 MPa	9.80×10^{-5}	

Hydraulic Effective Area Determination using Secondary Piston Gauge [note 2]

70 kPa to 140 MPa	7.2×10^{-5}

2006-01-01 through 2006-12-31

Effective dates

For the National Institute of Standards and Technology

NVLAP® National Voluntary Laboratory Accreditation Program

CALIBRATION LABORATORIES **NVLAP LAB CODE 200491-0**

Hydraulic Deadweight Tester Output Pressure Conformance using Secondary Piston Gauge [note 2]

70 kPa to 140 MPa	7.5×10^{-5} but not less than 50 Pa

1. Represents an expanded uncertainty using a coverage factor, k = 2, at an approximate level of confidence of 95 %.
2. This capability includes on-site calibration service, as limited by influences of operating environment.
3. Component uncertainties are combined in quadrature.
4. For absolute mode, uncertainties increase by 1.33E + 00 Pa, combined in quadrature with stated level.
5. For absolute mode, uncertainties increase by 1.88E + 00 Pa, combined in quadrature with stated level.
6. For absolute mode, uncertainties increase by 1.31E + 01 Pa, combined in quadrature with stated level.
7. Calibration process may include the use of transducers to measure small differential pressures.
8. Conformance evaluation of Deadweight Tester output pressure compared to indicated pressure.

2006-01-01 through 2006-12-31

Effective dates

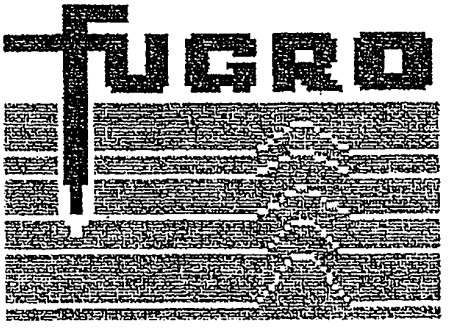
For the National Institute of Standards and Technology

NVLAP-01S (REV. 2004-10-31)

QUALITY SYSTEM MANUAL

FOR

HOUSTON GEOTECHNICAL LABORATORY



CONTROL #: GEO-1

Fugro Consultants, Inc.
6100 Hillcroft
Houston, Texas 77081
Phone: (713) 369-5400
Fax: (713) 369-5545

Document Revised: July 07, 2007

CALIBRATION EQUIPMENT OR REFERENCE STANDARDS			
Equipment Name	Calibration Interval	Check Interval	Procedure Used
Digital Micrometer & Mechanical Micrometers	2 years		Outside Source
Force Transducers	1 year		Outside Source
Metal Specimens	Verify Before Use or After Repair		HGL 2655
Pressure Gages	2 years		Outside Source
Set of Gage Blocks	5 years		Outside Source
Thermometers	1 year		Outside Source
Torque Transducers	2 years		Outside Source
Voltmeters/Multimeters (6.5 digit)	3 years		Outside Source

***The term "calibration" is used to maintain consistency with ASTM D 3740. It is taken to mean "verification."**

PRE JOB
CALIBRATION
VERIFICATION

CALIBRATION CERTIFICATE

APPLICANT	FGI HOUSTON	Certificate number	FC070040	Page 1 of 1
SUBMITTED	A Piezo Cone Penetrometer	Manufacturer	Fugro Engineers B.V.	
Device type	CONE, A15F2.5CKE3SW2/ B, 50 bar		Serial number	1701-1788

The device contains an electronic data sheet which contains, amongst others, the characteristics of all the sensors inside the device. The data acquisition system calculates the measured value from these known characteristics. All calibration results are conform the values specified below.

Force calibration

Calibration reference : 548 FRE.001
Procedure : FEBV.CAL.PRO.003 KALIBRATIE KRACHT
Title of channel(s) : Cone and Cone+Fric.
Max. load 150 kN

Range	Calibration range From	to	Sensitivity Deviation	Zero load output
1	0	25 kN	< 0.5 %	< 0.75 kN
Calibration uncertainty			0.3 %	0.008 kN

Pressure test :

Deviation from specified Alpha factor at 2.5 MPa	< 5 %

Cone quality control values :

Max. deviation from reference	< 1 %
Max. Tip to Sleeve friction Crosstalk	< 1 %

Pressure calibration

Calibration reference : 3257-0001
Procedure : FEBV.CAL.PRO.004 KALIBRATIE DRUK
Title of channel : Pore 2
Max. load 30 Mpa

Range	Calibration range From		Sensitivity Deviation	Zero load output
1	0	2.5 MPa	< 1.0 %	< 0.002 MPa
Calibration uncertainty			0.6 %	0.003 MPa
Pore 2 transducer : Kistler 4043A50 SN : 1233109				

Calibration of the slope sensor

Calibration reference :
Procedure:FEBV.CAL.PRO.006 KALIBRATIE HELLING
Title of channel : Slope x

Range	Calibration range From		Sensitivity Deviation	Zero load output
1	0	15 deg	< 10 %	< 1.5 deg
Calibration uncertainty			1 %	0.5 deg

Typical values for this type of device

Cone diameter (mm)	43.7	Pore 2 position	2	Alpha factor	0.58
Cone area (square cm)	15	Sleeve length (mm)	144.7	Cone - Sleeve distance (mm)	14.4
Sleeve diameter (mm)	43.9	Sleeve area (square cm)	200	Cone - Pore 2 distance (mm)	6.0

TRACEABILITY. The measurements have been executed using standards for which the traceability to primary and/or (inter)national standards has been demonstrated .

Calibrated by: Hoogendoorn, Raymond

Approved by : Sinjorgo, Gerry

Calibration date: 16-1-2007

Approval date: 16-1-2007

Calibrate before: 16-1-2008

FUGRO ENGINEERS B.V. * Veurse

Calibration Verification Certificate

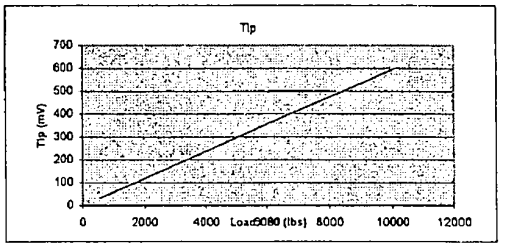
Device Type: Piezo Cone Penetrometer

Device Number: **F7.5CKESW2/V 1701-1788**

TIP CALIBRATION

Tip area = 15 cm2 = 0.0161 ft2
Tip readings in mV

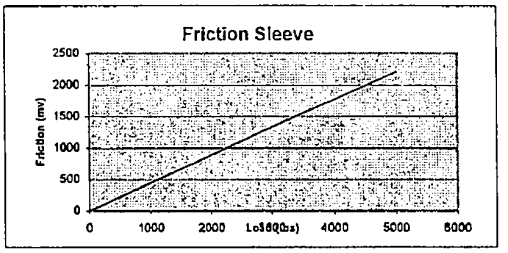
Load lb	Load Tons	load/area tsf	Tip mV	TIP Cal Factor Mpa
0	0	0	0	0
540	0.27	16.77019	32.1	50.0287963
5110	2.555	158.6957	303.4	50.0883413
7580	3.79	235.4037	449.8	50.1165401
10020	5.01	311.1801	596.3	49.9728639
15020	7.51	466.4596	892.5	50.0487269
20005	10.0025	621.2733	1183.2	50.2819048



FRICTION CALIBRATION

Sleeve area = 200 cm2 = 0.2153 ft2
Friction readings in mV

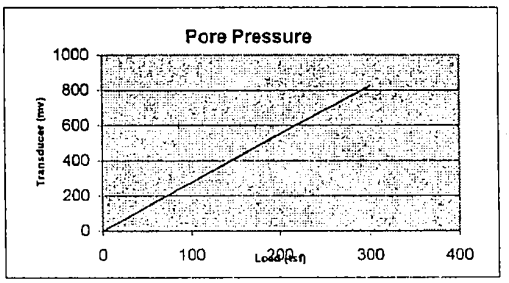
Load lb	Load Tons	load/area tsf	Friction mV	Friction Cal Factor Mpa
0	0	0	0	0
620	0.31	1.439851	279.8	0.49278463
1990	0.995	4.621458	884.6	0.50028711
3520	1.76	8.17464	1562.3	0.50106193
5010	2.505	11.63493	2212.2	0.5036473
7510	3.755	17.44078	3308.9	0.50474203



PORE PRESSURE TRANSDUCER CALIBRATION

Serial : 1233109
Pore Pressure readings in mV

Pressure psi	Pressure tsf	Transducer readings mV	P.Pres. Cal Factor Mpa
0	0	0	0
75	5.4	206.7	2.50173026
150	10.8	413.6	2.50052053
300	21.6	824.2	2.50962215



Temperature Calibration (30 - 115 degrees F)

Temp (deg	TIP (mV)	FRIC (mV)	PIEZO (mV)
30	-0.017	-0.198	-0.109
50	-0.008	-0.336	-0.067
75	0.011	-0.456	-0.054
100	0.132	2.307	-2.192
115	0.257	2.987	-2.647

Deviation	mV	Mpa	% Full Scale
Tip	0.274	0.0137	0.0274
Friction	3.185	0.001593	0.3185
Piezo	2.593	0.006483	0.2593

TIP CALIBRATED BY GEOTAC (A2LA APPROVED) LOAD CELL:
Model 560K, Serial No. 129739
FRICTION CALIBRATED BY INTERFACE (A2LA APPROVED) LOAD CELL :
Model: 1211EX-10K-B, Serial : 113655
PORE PRESSURE TRANSDUCER CALIBRATED BY GE SENSING (AANSI/NCSL APPROVED)
Pressure Indicator Model: UPS3000CC, Serial : A0813
TEMPERATURE CALIBRATED BY HOUSTON PRECISION TYPE K THERMOCOUPLE (A2LA APPROVED)
Model # 8528-40, Serial # C95005824, ID # TD-001

Calibration Verified by: Dennis Stauffer Date: 11/5/2007

Checked By : Recep Yilmaz Date: 11/5/2007

HGL Instrument Verification

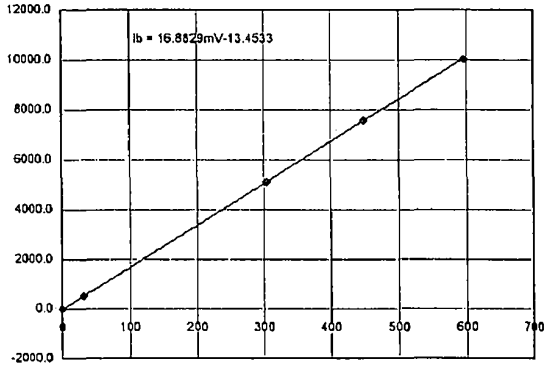
DATE: 11/5/2007 Instrument No.: ft Location: Houston LVDT?: [ ] Yes; [X] No

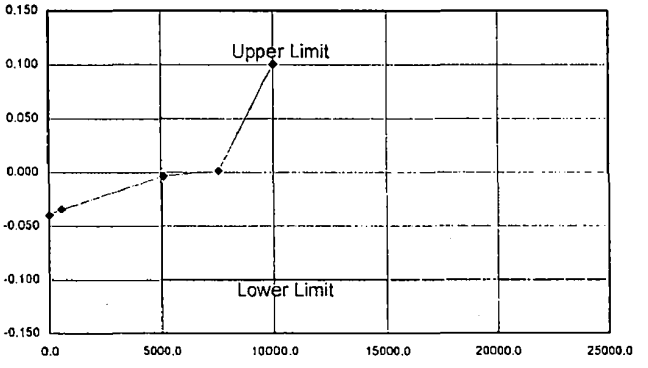
Type Analysis: [X] BF; [ ] NonBF; [X] FS; [ ] Abs. Reading Resolution of Instrument: 0.000001

Instrument Identification/Data	
Type	Cone Penetrometer_TIP
Manufacturer	Fugro
Model Number	F7.5CKESW2/B1
Serial Number	1701-1788 (Tip)
HGL Instrument Number	ft
Excitation (V)	
Gain/Span Setting	NA
Full Range Output (V)	
Full Range/Capacity (lb)	33716
Date Verified	11/5/2007
Date Due	11/4/2008
Service Status	In Service
Accept. Abs. or FS Error (%)	0.1 [X] FS; [ ] Abs.
Verification/Standard Equipment	
Type	Load Cell (A2AL APPROVED)
Manufacturer	Geotac
Model Number	560K
Serial Number	129739
HGL Instrument Number	
Date Verified	
Temperature	°C = °F
Linear Regression, Uncertainty, & Error Summary	
Correlation Coeff. (R^2)	0.999986252
Intercept (lb)	-13.45326099
Slope (lb/mV)	16.88287763
Verification (Calib.) Factor	16.88287763
Verification Factor Units	lb/mV
Absolute Zero (V)	
Floating Zero (V)	
Combined Uncertainty (lb)	6.479058372
Coverage Factor	2
Expanded Uncertainty (lb)	12.95811674
Max. Abs. or FS Error (%)	-0.13 [X] FS; [ ] Abs.

Instrument mV	Standard lb	Prediction lb	Abs. Error lb	Full Scale Error (%)
0.000000	0.0	-13.5	13.5	-0.04
32.100000	540.0	528.5	11.5	-0.03
303.400000	5110.0	5108.8	1.2	0.00
449.800000	7580.0	7580.5	0.5	0.00
596.300000	10020.0	10053.8	33.8	0.10
892.500000	15020.0	15054.5	34.5	0.10
1183.200000	20005.0	19962.4	42.6	-0.13

MTS [ ] Yes; [X] No





Uncertainity Budget Analysis For ft							
Source of Uncertainty	Value in lb	Distribution	Divisor	Type	Uncertainty (u_i)	u_i^2	Comments
Standard's Uncertainty		N	2.0000	B			
Abs. Error-STDEV[1]	6.4791	N	1.0000	A	6.4791	41.9782	
Resolution of Instrument	0.0000	R	3.4641	B	0.0000	0.0000	
Repeatability[2]		N	1.0000	A			
Resolution of Standard	#N/A	R	3.4641	B			
Combined Uncertainty	6.4791	Coverage Factor		2		for 95% confidence level.	
Expanded Uncertainty (Best Measurement Capability)[3]		12.958		lb			

(1) This equation follows the approach presented by A2LA, not that typically used in uncertainty calculations; i.e., STDEV of the Mean.

(2) This value is unique for type (model) of equipment.

(3) This uncertainty represents an expanded uncertainty expressed as approximately the 95% confidence level using a coverage factor of k=2.

Verified By: _____ Input By: _____ Reviewed By: _____ Checked By: _____

File: _____

Remarks: _____

HGL Instrument Verification

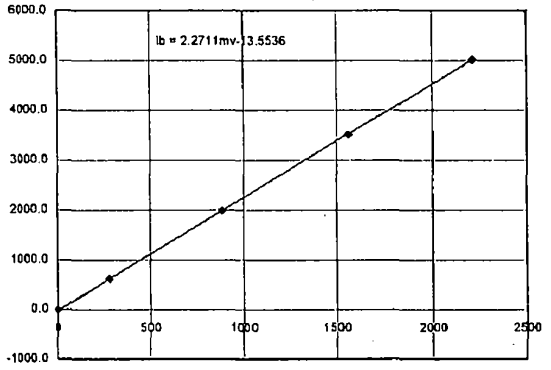
DATE: 11/5/2007 Instrument No.: ft100 Location: LVDT?: [ ] Yes; [X] No

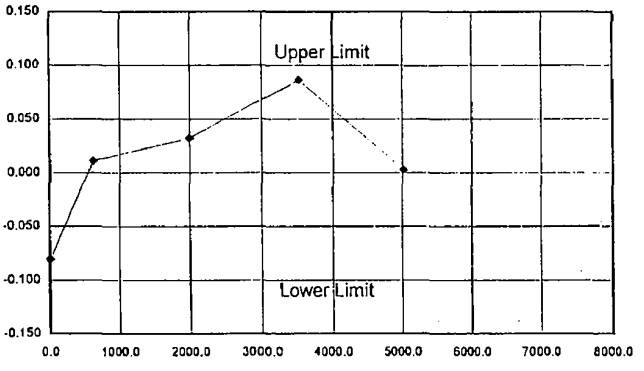
Type Analysis: [X] BF; [ ] NonBF; [X] FS; [ ] Abs. Reading Resolution of Instrument: 0.000001

Instrument Identification/Data	
Type	Cone Penetrometer
Manufacturer	Fugro
Model Number	F7.5CKESW2/B1
Serial Number	1701-1788 (Friction)
HGL Instrument Number	ft100
Excitation (V)	
Gain/Span Setting	NA
Full Range Output (V)	
Full Range/Capacity (lb)	16858
Date Verified	11/5/2007
Date Due	11/4/2008
Service Status	In Service
Accept. Abs. or FS Error (%)	0.1 [X] FS; [ ] Abs.
Verification/Standard Equipment	
Type	Load Cell (A2AL APPROVED)
Manufacturer	INTERFACE
Model Number	1211EX-10K-B
Serial Number	113655
HGL Instrument Number	
Date Verified	
Temperature	°C = °F
Linear Regression, Uncertainty, & Error Summary	
Correlation Coeff. (R^2)	0.999987431
Intercept (lb)	-13.55356528
Slope (lb/mv)	2.271068817
Verification (Calib.) Factor	2.27106882
Verification Factor Units	lb/mv
Absolute Zero (V)	
Floating Zero (V)	
Combined Uncertainty (lb)	2.398188297
Coverage Factor	2
Expanded Uncertainty (lb)	4.796376595
Max. Abs. or FS Error (%)	0.09 [X] FS; [ ] Abs.

Instrument mv	Standard lb	Prediction lb	Abs. Error lb	Full Scale Error (%)
0.000000	0.0	-13.6	13.6	-0.08
279.800000	620.0	621.9	1.9	0.01
884.600000	1990.0	1995.4	5.4	0.03
1562.300000	3520.0	3534.5	14.5	0.09
2212.200000	5010.0	5010.5	0.5	0.00
3308.900000	7510.0	7501.2	8.8	-0.05

MTS [ ] Yes; [X] No





Uncertainity Budget Analysis For ft100							
Source of Uncertainty	Value in lb	Distribution	Divisor	Type	Uncertainty (u_i)	u_i^2	Comments
Standard's Uncertainty		N	2.0000	B			
Abs. Error-STDEV[1]	2.3982	N	1.0000	A	2.3982	5.7513	
Resolution of Instrument	0.0000	R	3.4641	B	0.0000	0.0000	
Repeatability[2]		N	1.0000	A			
Resolution of Standard	#N/A	R	3.4641	B			
Combined Uncertainty	2.3982	Coverage Factor		2		for 95% confidence level.	
Expanded Uncertainty (Best Measurement Capability)[3]		4.796		lb			

(1) This equation follows the approach presented by A2LA, not that typically used in uncertainty calculations; i.e., STDEV of the Mean. (2) This value is unique for type (model) of equipment.

(3) This uncertainty represents an expanded uncertainty expressed as approximately the 95% confidence level using a coverage factor of k=2.

Verified By: Input By: Reviewed By: Checked By:

File:

Remarks:

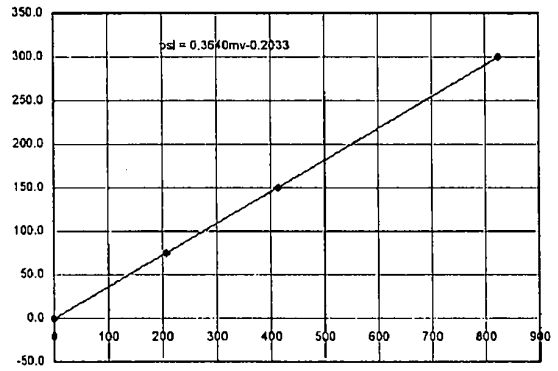
HGL Instrument Verification

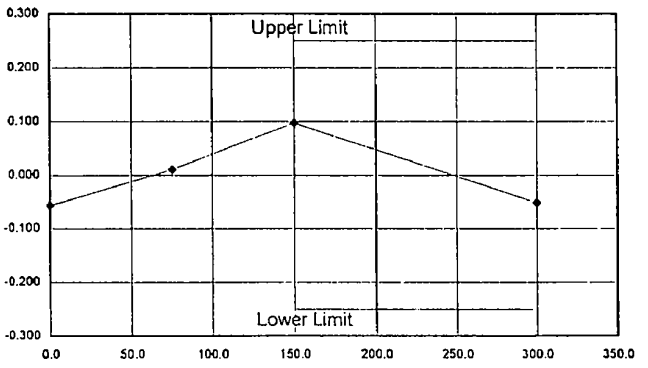
DATE: 11/5/2007 Instrument No.: pt Location: Houston LVDT?: [ ] Yes; [X] No

Type Analysis: [X] BF; [ ] NonBF; [X] FS; [ ] Abs. Reading Resolution of Instrument: 0.000001

Instrument Identification/Data		Instrument	Standard	Prediction	Abs. Error	Full Scale
Type	Cone Penetrometer	mv	psi	psi	psi	Error (%)
Manufacturer	Fugro	0.000000	0.0	-0.2	0.2	-0.06
Model Number	F7.5CKESW2/B1	206.700000	75.0	75.0	0.0	0.01
Serial Number	1701-1788-1233109 (Piezo)	413.600000	150.0	150.4	0.4	0.10
HGL Instrument Number	pt	824.200000	300.0	299.8	0.2	-0.05
Excitation (V)						
Gain/Span Setting	NA					
Full Range Output (V)						
Full Range/Capacity (psi)	360					
Date Verified	11/5/2007					
Date Due	11/4/2008					
Service Status	In Service					
Accept. Abs. or FS Error (%)	0.25 [X] FS; [ ] Abs.					
Verification/Standard Equipment						
Type	PT(ANSI/NCSL APPROVED)					
Manufacturer	Eaton					
Model Number	UPS3000CC					
Serial Number	A0813					
HGL Instrument Number						
Date Verified						
Temperature	^{o}C = ^{o}F					
Linear Regression, Uncertainty, & Error Summary						
Correlation Coeff. (R^2)	0.99999592					
Intercept (psi)	-0.20331044					
Slope (psi/mv)	0.364010552					
Verification (Calib.) Factor	0.36401055					
Verification Factor Units	psi/mv					
Absolute Zero (V)						
Floating Zero (V)						
Combined Uncertainty (psi)	0.064150208					
Coverage Factor	2					
Expanded Uncertainty (psi)	0.128300415					
Max. Abs. or FS Error (%)	0.10 [X] FS; [ ] Abs.					

MTS [ ] Yes; [X] No





Uncertainity Budget Analysis For pt							
Source of Uncertainty	Value in psi	Distribution	Divisor	Type	Uncertainty (u_i)	u_i^2	Comments
Standard's Uncertainty		N	2.0000	B			
Abs. Error-STDEV[1]	0.0642	N	1.0000	A	0.0642	0.0041	
Resolution of Instrument	0.0000	R	3.4641	B	0.0000	0.0000	
Repeatability[2]		N	1.0000	A			
Resolution of Standard	#N/A	R	3.4641	B			
Combined Uncertainty	0.0642	Coverage Factor		2	for 95% confidence level.		
Expanded Uncertainty (Best Measurement Capability)[3]		0.128	psi				

(1) This equation follows the approach presented by A2LA, not that typically used in uncertainty calculations; i.e., STDEV of the Mean.

(2) This value is unique for type (model) of equipment.

(3) This uncertainty represents an expanded uncertainty expressed as approximately the 95% confidence level using a coverage factor of k=2.

Verified By: Input By: Reviewed By: Checked By: RY

File:

Remarks:

Calibration Verification Certificate

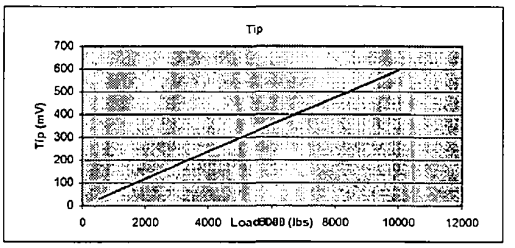
Device Type: Piezo Cone Penetrometer

Device Number: **F7.5CKE3SW2/B 1701-0750**

TIP CALIBRATION

Tip area = 15 cm2 = 0.0161 ft2
Tip readings in mV

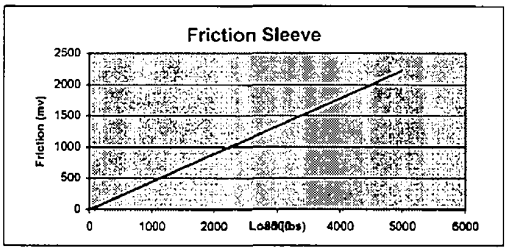
Load lb	Load Tons	load/area tsf	Tip mV	TIP Cal Factor Mpa
0	0	0	0	0
530	0.265	16.45963	31.5	50.0376197
5010	2.505	155.5901	298.1	49.9812458
7490	3.745	232.6087	445.2	50.0331664
10020	5.01	311.1801	595.9	50.0064083
15050	7.525	467.3913	895.2	49.9974383
19910	9.955	618.323	1184.3	49.9966444



FRICTION CALIBRATION

Sleeve area = 200 cm2 = 0.2153 ft2
Friction readings in mV

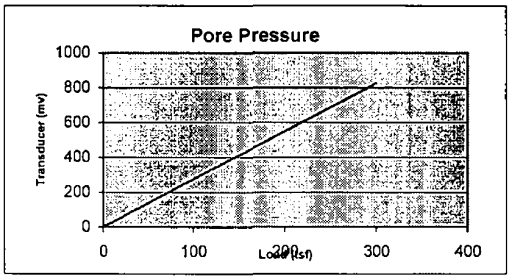
Load lb	Load Tons	load/area tsf	Friction mV	Friction Cal Factor Mpa
0	0	0	0	0
520	0.26	1.207617	231.3	0.49996647
2490	1.245	5.782629	1107.3	0.50008891
3750	1.875	8.708778	1665.6	0.50069555
5010	2.505	11.63493	2228.3	0.50000833
7510	3.755	17.44078	3340.2	0.50001224



PORE PRESSURE TRANSDUCER CALIBRATION

Serial : 8091223
Pore Pressure readings in mV

Pressure psi	Pressure tsf	Transducer readings mV	P.Pres. Cal Factor Mpa
0	0	0	0
75	5.4	206.8	2.50052053
150	10.8	413.5	2.50112525
300	21.6	825.7	2.50506307



Temperature Calibration (30 - 115 degrees F)

Temp (deg	TIP (mV)	FRIC (mV)	PIEZO (mV)
30	0.946	0.783	-0.132
50	0.983	0.974	-0.077
75	1.012	1.114	0.264
100	1.297	1.267	0.357
115	1.324	1.771	0.992

Deviation	mV	Mpa	% Full Scale
Tip	0.378	0.0189	0.0378
Friction	0.988	0.000494	0.0988
Piezo	1.124	0.00281	0.1124

TIP CALIBRATED BY GEOTAC (A2LA APPROVED) LOAD CELL:
Model 560K, Serial No. 129739
FRICTION CALIBRATED BY INTERFACE (A2LA APPROVED) LOAD CELL :
Model: 1211EX-10K-B, Serial : 113655
PORE PRESSURE TRANSDUCER CALIBRATED BY GE SENSING (AANSI/NCSL APPROVED)
Pressure Indicator Model: UPS3000CC, Serial : A0813
TEMPERATURE CALIBRATED BY HOUSTON PRECISION TYPE K THERMOCOUPLE (A2LA APPROVED)
Model # 8528-40, Serial # C95005824, ID # TD-001

Calibration Verified by: Dennis Stauffer Date: 4/23/2008

Checked By : Recep Yilmaz Date: 4/23/2008

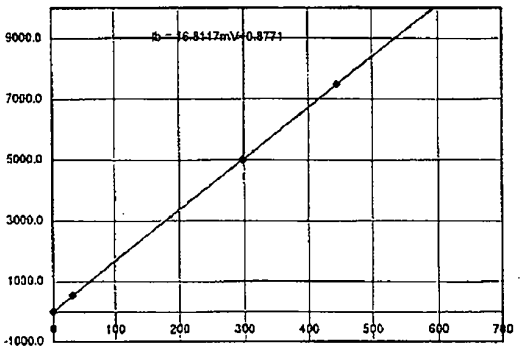
HGL Instrument Verification

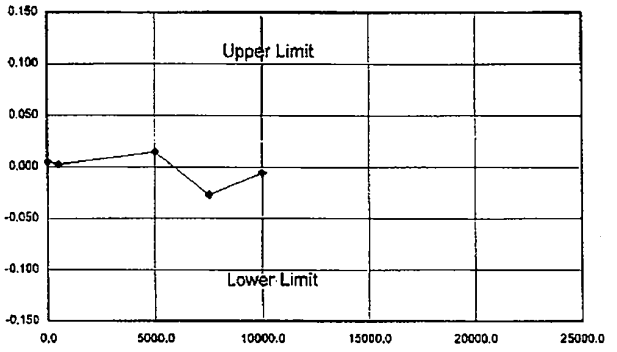
DATE: 4/23/2008 Instrument No.: ft100 Location: Houston LVDT?: [ ] Yes; [X] No

Type Analysis: [X] BF; [ ] NonBF; [X] FS; [ ] Abs. Reading Resolution of Instrument: 0.000001

Instrument Identification/Data		Instrument	Standard	Prediction	Abs. Error	Full Scale
Type	Cone Penetrometer-TIP	mV	lb	lb	lb	Error (%)
Manufacturer	Fugro	0.000000	0.0	0.9	0.9	0.01
Model Number	F7.5CKEW2/B	31.500000	530.0	530.4	0.4	0.00
Serial Number	1701-0750	298.100000	5010.0	5012.5	2.5	0.01
HGL Instrument Number	ft100	445.200000	7490.0	7485.5	4.5	-0.03
Excitation (V)		595.900000	10020.0	10019.0	1.0	-0.01
Gain/Span Setting	NA	895.200000	15050.0	15050.7	0.7	0.00
Full Range Output (V)		1184.300000	19910.0	19911.0	1.0	0.01
Full Range/Capacity (lb)	16858					
Date Verified	4/23/2008					
Date Due	4/23/2009					
Service Status	In Service					
Accept. Abs. or FS Error (%)	0.1 [X] FS; [ ] Abs.					
Verification/Standard Equipment						
Type	Load cell (A2LA APPROVED)					
Manufacturer	GEOTAC					
Model Number	560K					
Serial Number	129739					
HGL Instrument Number						
Date Verified						
Temperature	°C = °F					
Linear Regression, Uncertainty, & Error Summary						
Correlation Coeff. (R^2)	0.999999907					
Intercept (lb)	0.877122495					
Slope (lb/mV)	16.81173849					
Verification (Calib.) Factor	16.81173849					
Verification Factor Units	lb/mV					
Absolute Zero (V)						
Floating Zero (V)						
Combined Uncertainty (lb)	0.54832333					
Coverage Factor	2					
Expanded Uncertainty (lb)	1.09664666					
Max. Abs. or FS Error (%)	-0.03 [X] FS; [ ] Abs.					

MTS [ ] Yes; [X] No





Uncertainty Budget Analysis For ft100							
Source of Uncertainty	Value in lb	Distribution	Divisor	Type	Uncertainty (u_i)	u_i^2	Comments
Standard's Uncertainty		N	2.0000	B			
Abs. Error-STDEV[1]	0.5483	N	1.0000	A	0.5483	0.3007	
Resolution of Instrument	0.0000	R	3.4641	B	0.0000	0.0000	
Repeatability[2]		N	1.0000	A			
Resolution of Standard	#N/A	R	3.4641	B			
Combined Uncertainty	0.5483	Coverage Factor		2		for 95% confidence level.	
Expanded Uncertainty (Best Measurement Capability)[3]		1.097	lb				

(1) This equation follows the approach presented by A2LA, not that typically used in uncertainty calculations; i.e., STDEV of the Mean. (2) This value is unique for type (model) of equipment.

(3) This uncertainty represents an expanded uncertainty expressed as approximately the 95% confidence level using a coverage factor of k=2.

Verified By: Input By: Reviewed By: Checked By:

File:

Remarks:

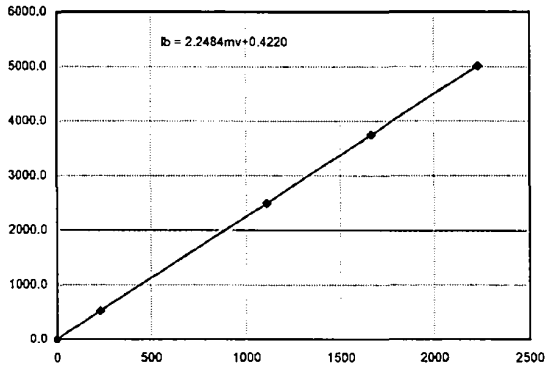
HGL Instrument Verification

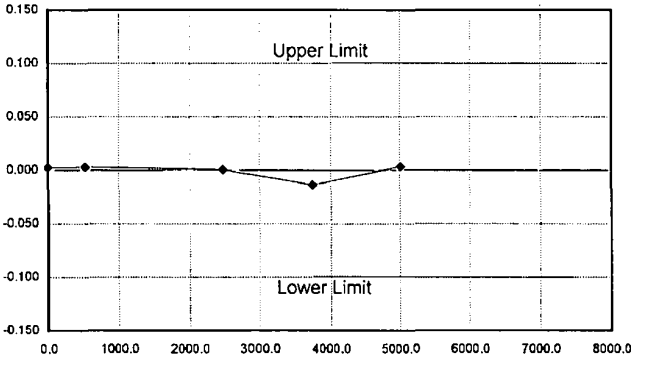
DATE: 4/23/2008 Instrument No.: ft100 Location: LVDT?: [ ] Yes; [X] No

Type Analysis: [X] BF; [ ] NonBF; [X] FS; [ ] Abs. Reading Resolution of Instrument: 0.000001

Instrument Identification/Data		Instrument	Standard	Prediction	Abs. Error	Full Scale
Type	Cone Penetrometer	mv	lb	lb	lb	Error (%)
Manufacturer	Fugro	0.000000	0.0	0.4	0.4	0.00
Model Number	F7.5CKE3SW2/B	231.300000	520.0	520.5	0.5	0.00
Serial Number	1701-0750	1107.300000	2490.0	2490.1	0.1	0.00
HGL Instrument Number	ft100	1666.600000	3750.0	3747.7	2.3	-0.01
Excitation (V)		2228.300000	5010.0	5010.6	0.6	0.00
Gain/Span Setting	NA	3340.200000	7510.0	7510.7	0.7	0.00
Full Range Output (V)						
Full Range/Capacity (lb)	16858					
Date Verified	4/23/2008					
Date Due	4/23/2009					
Service Status	In Service					
Accept. Abs. or FS Error (%)	0.1 [X] FS; [ ] Abs.					
Verification/Standard Equipment						
Type	Load Cell (A2AL APPROVED)					
Manufacturer	INTERFACE					
Model Number	1211EX-10K-B					
Serial Number	113655					
HGL Instrument Number						
Date Verified						
Temperature	°C = °F					
Linear Regression, Uncertainty, & Error Summary						
Correlation Coeff. (R^2)	0.999999834					
Intercept (lb)	0.421964823					
Slope (lb/mv)	2.248442121					
Verification (Calib.) Factor	2.24844212					
Verification Factor Units	lb/mv					
Absolute Zero (V)						
Floating Zero (V)						
Combined Uncertainty (lb)	0.319825144					
Coverage Factor	2					
Expanded Uncertainty (lb)	0.639650288					
Max. Abs. or FS Error (%)	-0.01 [X] FS; [ ] Abs.					

MTS [ ] Yes; [X] No





Uncertainty Budget Analysis For ft100							
Source of Uncertainty	Value in lb	Distribution	Divisor	Type	Uncertainty (u_i)	u_i^2	Comments
Standard's Uncertainty		N	2.0000	B			
Abs. Error-STDEV[1]	0.3198	N	1.0000	A	0.3198	0.1023	
Resolution of Instrument	0.0000	R	3.4641	B	0.0000	0.0000	
Repeatability[2]		N	1.0000	A			
Resolution of Standard	#N/A	R	3.4641	B			
Combined Uncertainty	0.3198	Coverage Factor		2		for 95% confidence level.	
Expanded Uncertainty (Best Measurement Capability)[3]		0.640	lb				

(1) This equation follows the approach presented by A2LA, not that typically used in uncertainty calculations; i.e., STDEV of the Mean.

(2) This value is unique for type (model) of equipment.

(3) This uncertainty represents an expanded uncertainty expressed as approximately the 95% confidence level using a coverage factor of k=2.

Verified By: Input By: Reviewed By: Checked By:

File:

Remarks:

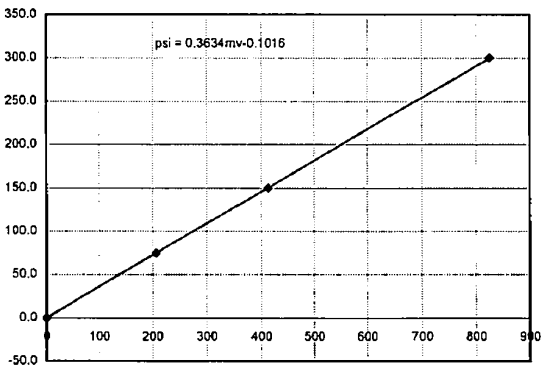
HGL Instrument Verification

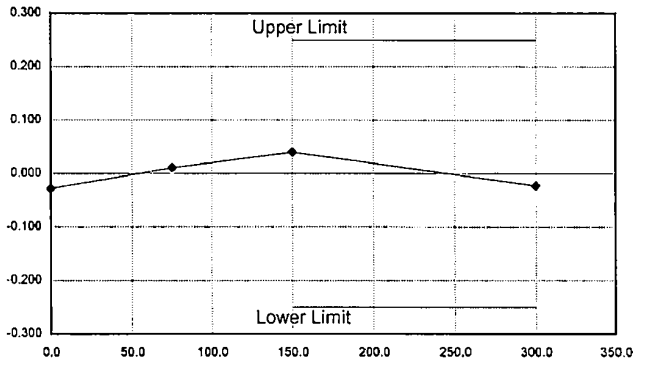
DATE: 4/23/2008 Instrument No.: pt Location: Houston LVDT?: [ ] Yes; [X] No

Type Analysis: [X] BF; [ ] NonBF; [X] FS; [ ] Abs. Reading Resolution of Instrument: 0.000001

Instrument Identification/Data		Instrument mv	Standard psi	Prediction psi	Abs. Error psi	Full Scale Error (%)
Type	Cone Penetrometer	0.000000	0.0	-0.1	0.1	-0.03
Manufacturer	Fugro	206.800000	75.0	75.0	0.0	0.01
Model Number	F7.5CKEW2/B	413.500000	150.0	150.1	0.1	0.04
Serial Number	1701-0750-8091223	825.700000	300.0	299.9	0.1	-0.02
HGL Instrument Number	pt					
Excitation (V)						
Gain/Span Setting	NA					
Full Range Output (V)						
Full Range/Capacity (psi)	360					
Date Verified	4/23/2008					
Date Due	4/23/2009					
Service Status	In Service					
Accept. Abs. or FS Error (%)	0.25 [X] FS; [ ] Abs.					
Verification/Standard Equipment						
Type	PT(ANSI/NCSL APPROVED)					
Manufacturer	Eaton					
Model Number	UPS3000CC					
Serial Number	A0813					
HGL Instrument Number						
Date Verified						
Temperature	°C = °F					
Linear Regression, Uncertainty, & Error Summary						
Correlation Coeff. (R^2)	0.999999198					
Intercept (psi)	-0.101633254					
Slope (psi/mv)	0.363351683					
Verification (Calib.) Factor	0.36335168					
Verification Factor Units	psi/mv					
Absolute Zero (V)						
Floating Zero (V)						
Combined Uncertainty (psi)	0.021757343					
Coverage Factor	2					
Expanded Uncertainty (psi)	0.043514685					
Max. Abs. or FS Error (%)	0.04 [X] FS; [ ] Abs.					

MTS [ ] Yes; [X] No





Uncertainty Budget Analysis For pt							
Source of Uncertainty	Value in psi	Distribution	Divisor	Type	Uncertainty (u_i)	u_i^2	Comments
Standard's Uncertainty		N	2.0000	B			
Abs. Error-STDEV[1]	0.0218	N	1.0000	A	0.0218	0.0005	
Resolution of Instrument	0.0000	R	3.4641	B	0.0000	0.0000	
Repeatability[2]		N	1.0000	A			
Resolution of Standard	#N/A	R	3.4641	B			
Combined Uncertainty	0.0218	Coverage Factor		2		for 95% confidence level.	
Expanded Uncertainty (Best Measurement Capability)[3]		0.044	psi				

(1) This equation follows the approach presented by A2LA, not that typically used in uncertainty calculations; i.e., STDEV of the Mean.

(2) This value is unique for type (model) of equipment.

(3) This uncertainty represents an expanded uncertainty expressed as approximately the 95% confidence level using a coverage factor of k=2.

Verified By: Input By: Reviewed By: Checked By: Ry

File:

Remarks:

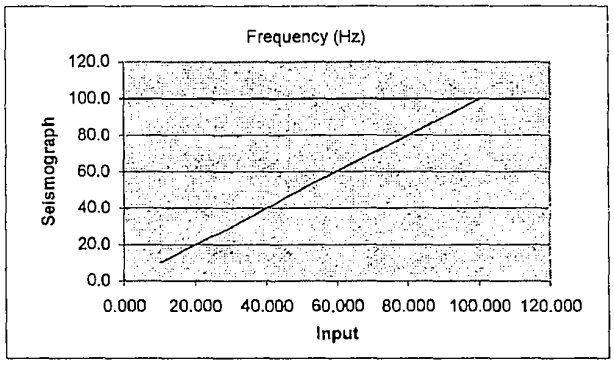
Calibration Verification Certificate

Device Type: **Seismograph**

Device Manufacturer **Geometrics, Inc.**
Model Number: **ES-3000**
Serial Number: **5138**

Frequency (Hz)

Input	Seismograph
10.055	9.9
20.037	19.9
30.071	29.3
40.040	40.1
50.061	50.6
60.048	60.3
70.005	70.2
80.011	79.9
90.090	90.1
100.014	99.8

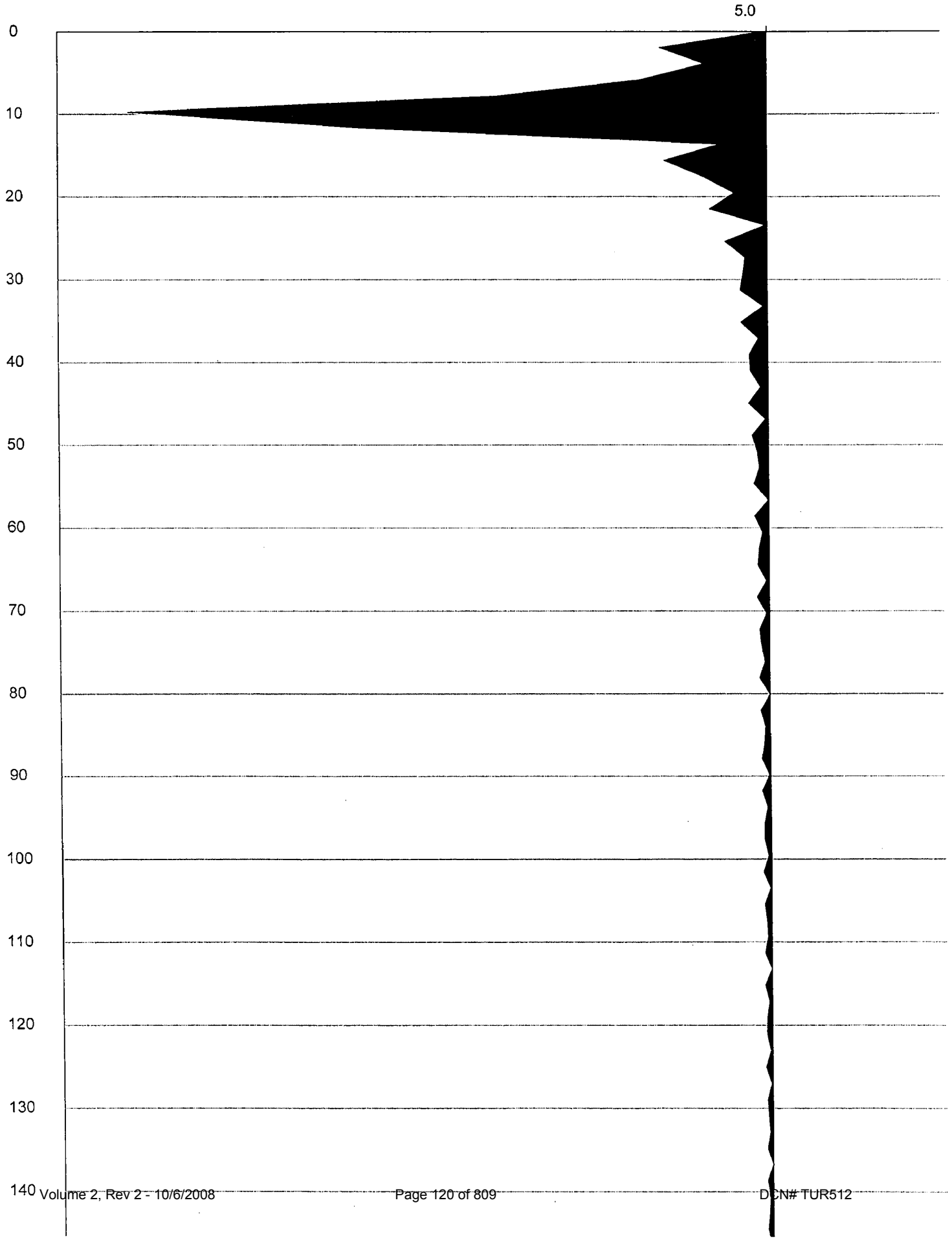


FREQUENCY CALIBRATED BY INSTEK GOOD WILL INSTRUMENTS (A2LA APPROVED) FREQUENCY COUNTER :
Model: GFC-80101H, Serial No. CF871549
FREQUENCY GENERATED BY EZ DIGITAL, INC (A2LA APPROVED) OSCILLISCOPE WITH BUILT IN FUNCTION GENERATOR
Model: OS-5020G, Serial No.: 3080209

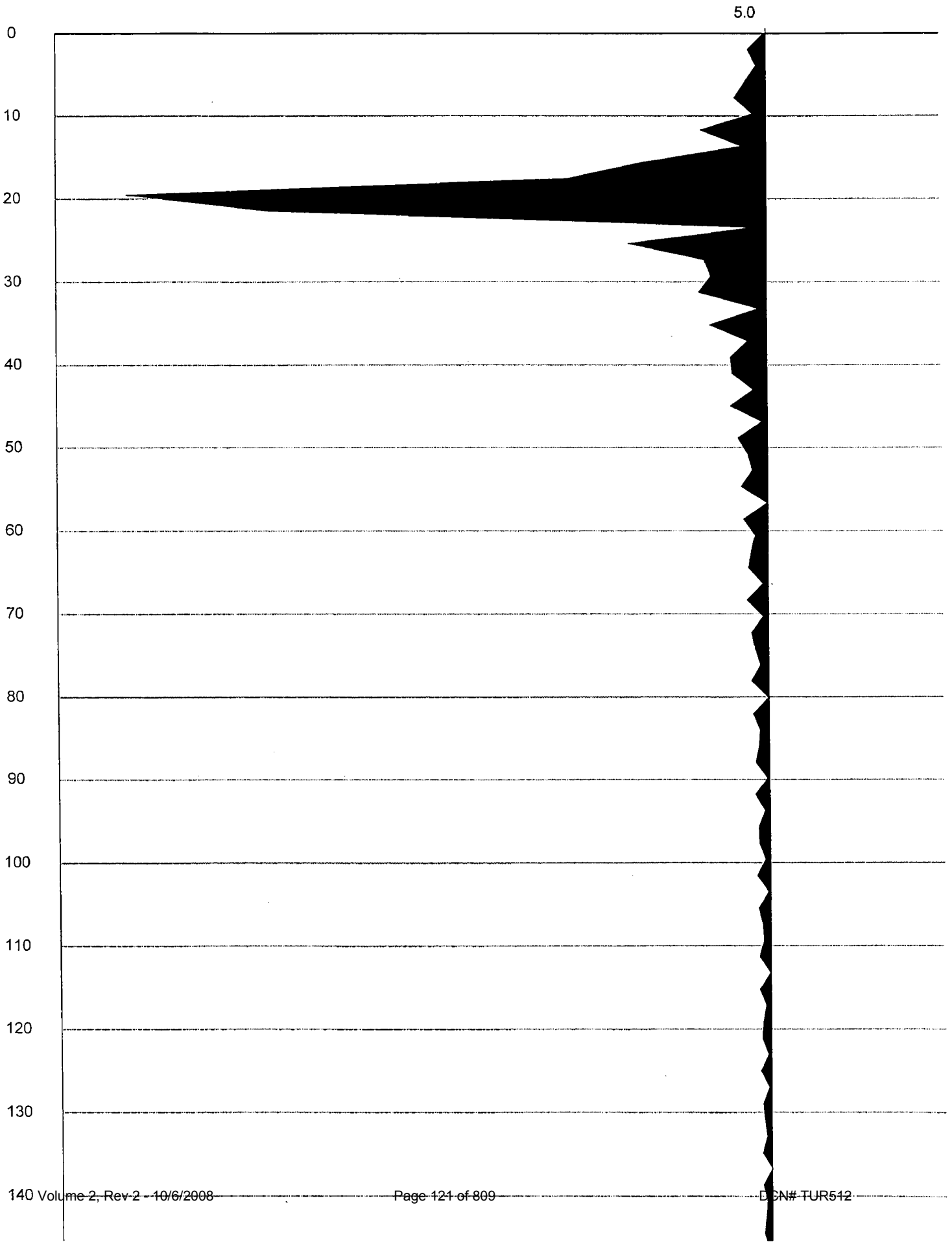
Calibration Verified by: Dennis Stauffer Date: 1/22/2008

Checked By : Recep Yilmaz Date: 1/22/2008

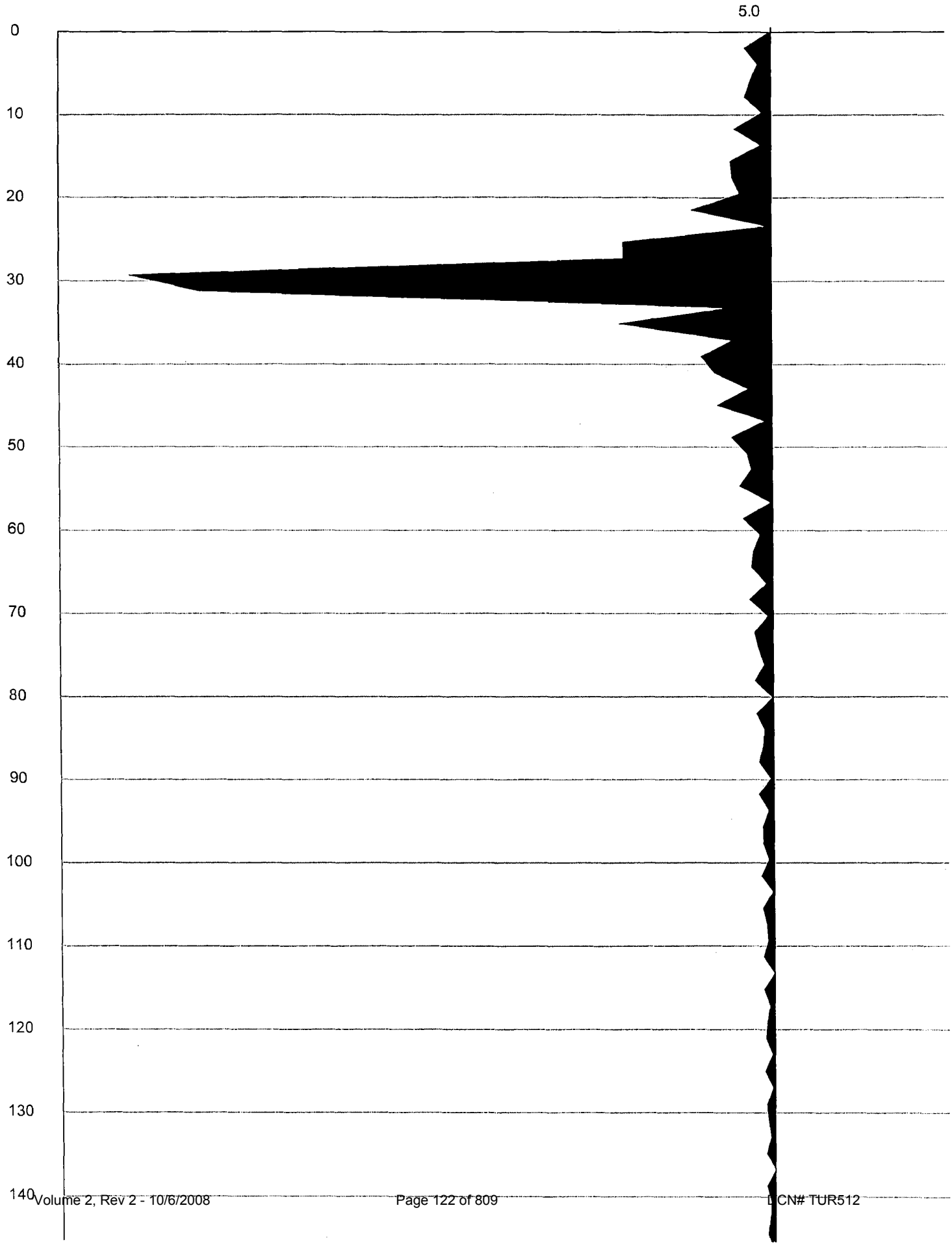
Geometrics ES-3000 S/N 5138
Frequency (HZ) In: 10.055 Seismograph: 9.9
Date: 1/22/2008



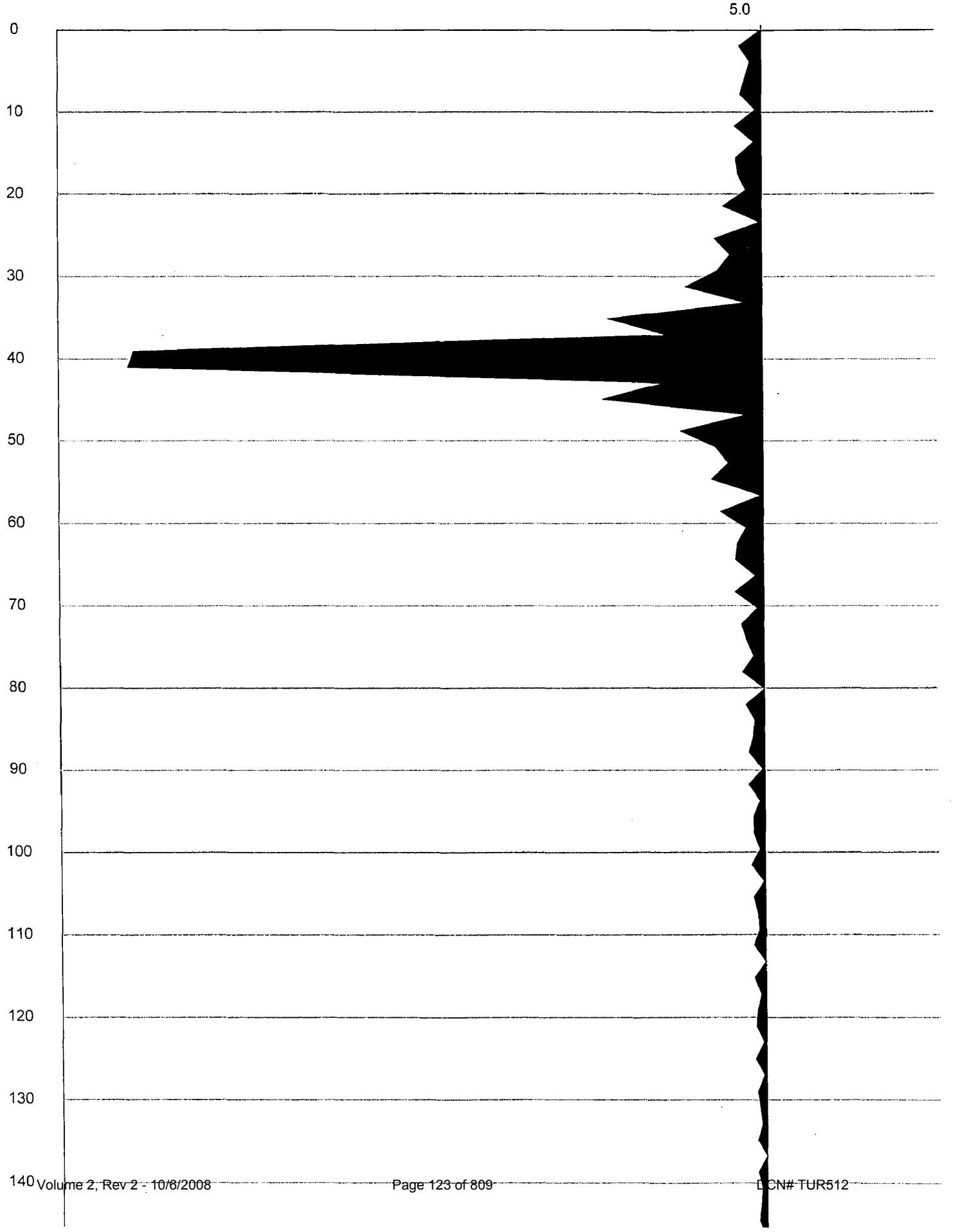
Geometrics ES-3000 S/N 5138
Frequency (HZ) In: 20.037 Seismograph: 19.9
Date: 1/22/2008



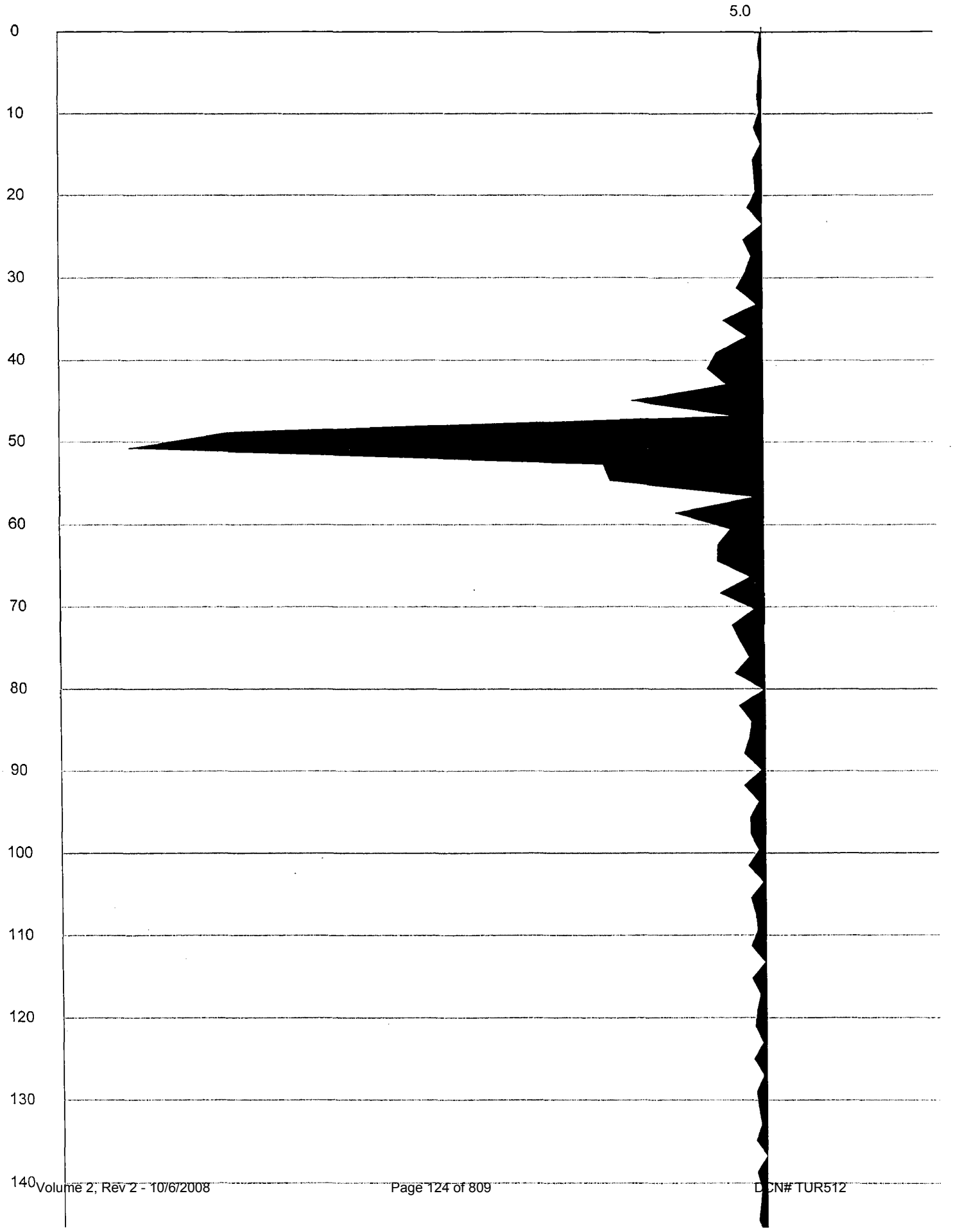
Geometrics ES-3000 S/N 5138
Frequency (HZ) In: 30.071 Seismograph: 29.3
Date: 1/22/2008



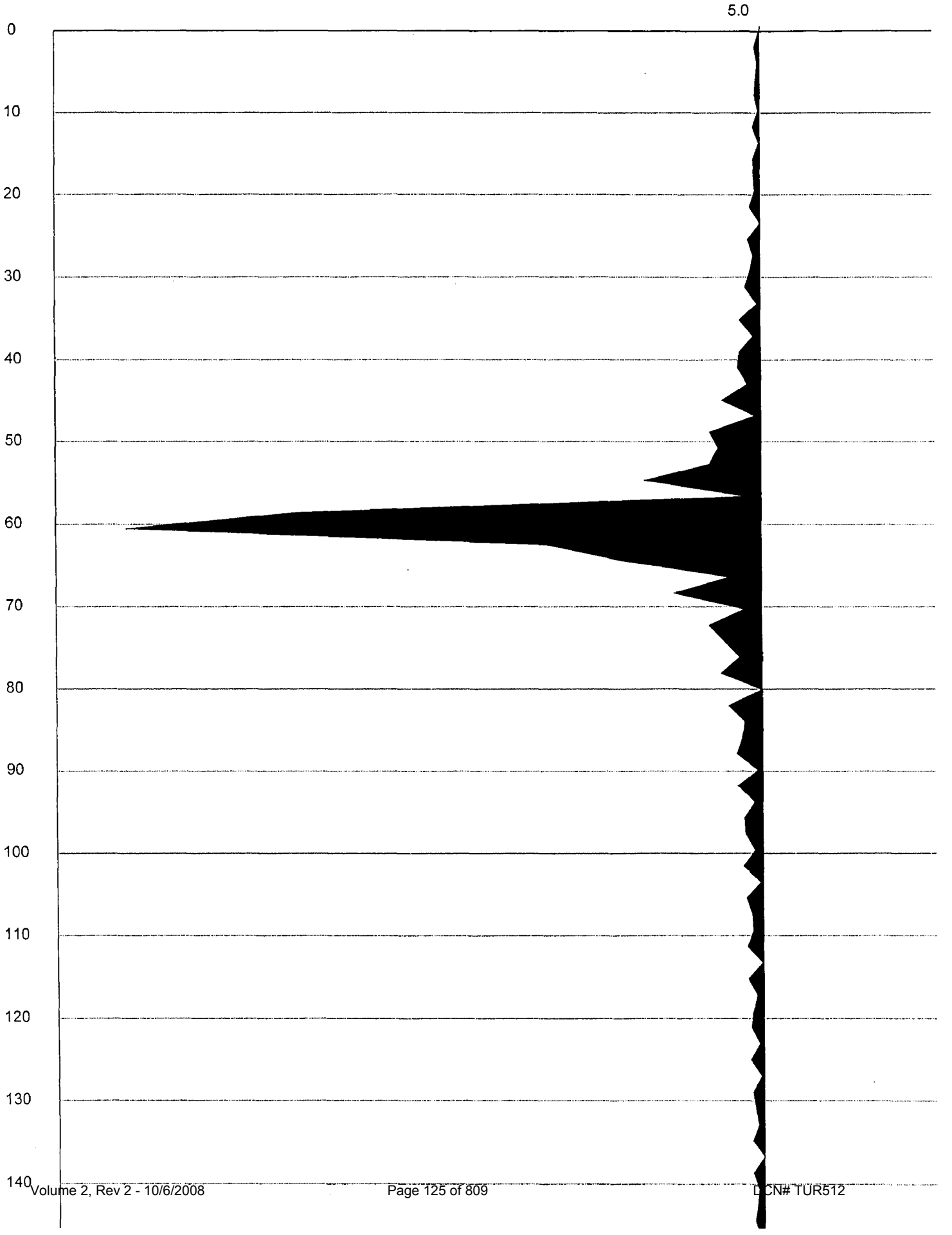
Geometrics ES-3000 S/N 5138
Frequency (HZ) In: 40.040 Seismograph: 40.1
Date: 1/22/2008



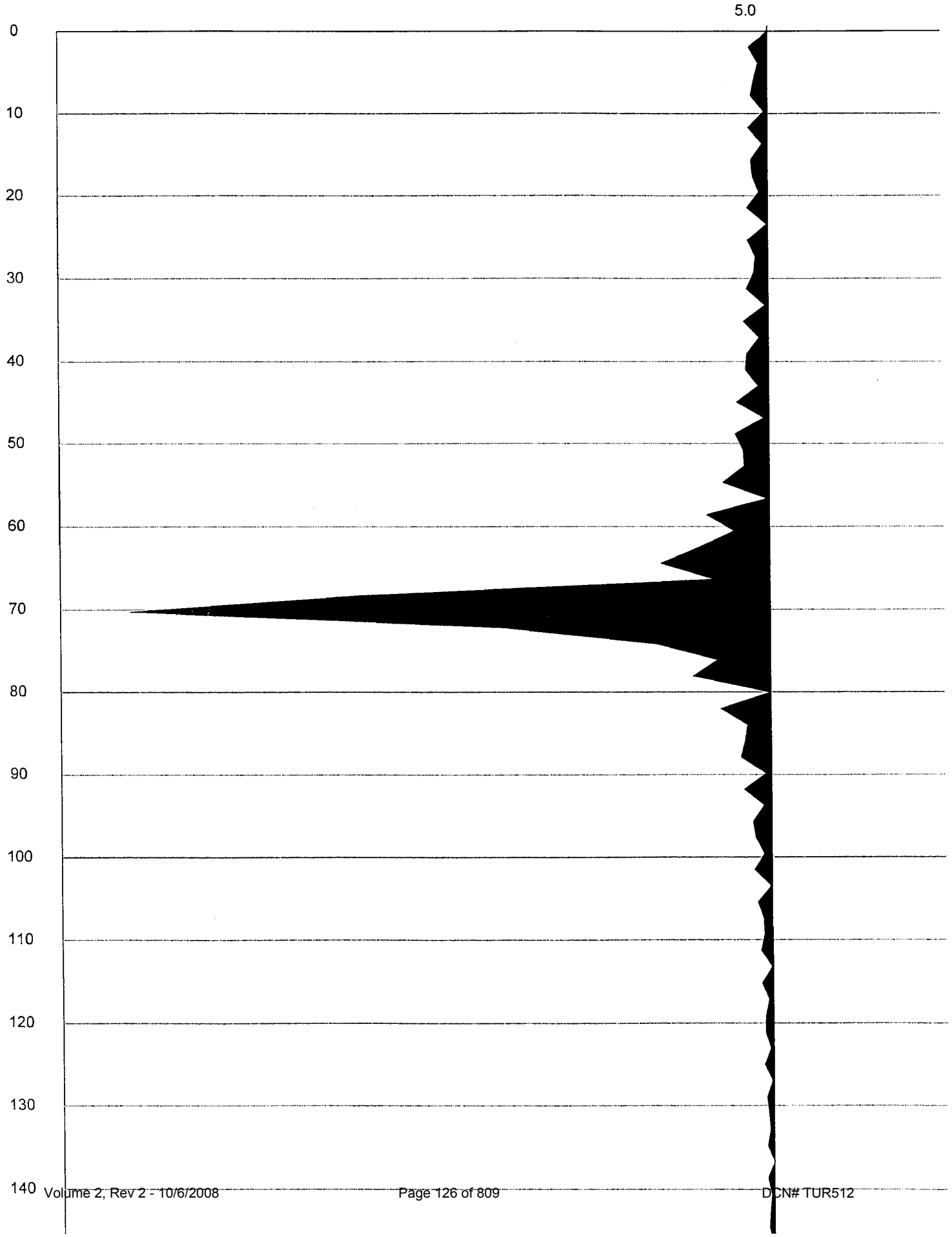
Geometrics ES-3000 S/N 5138
Frequency (HZ) In: 50.061 Seismograph: 50.6
Date: 1/22/2008



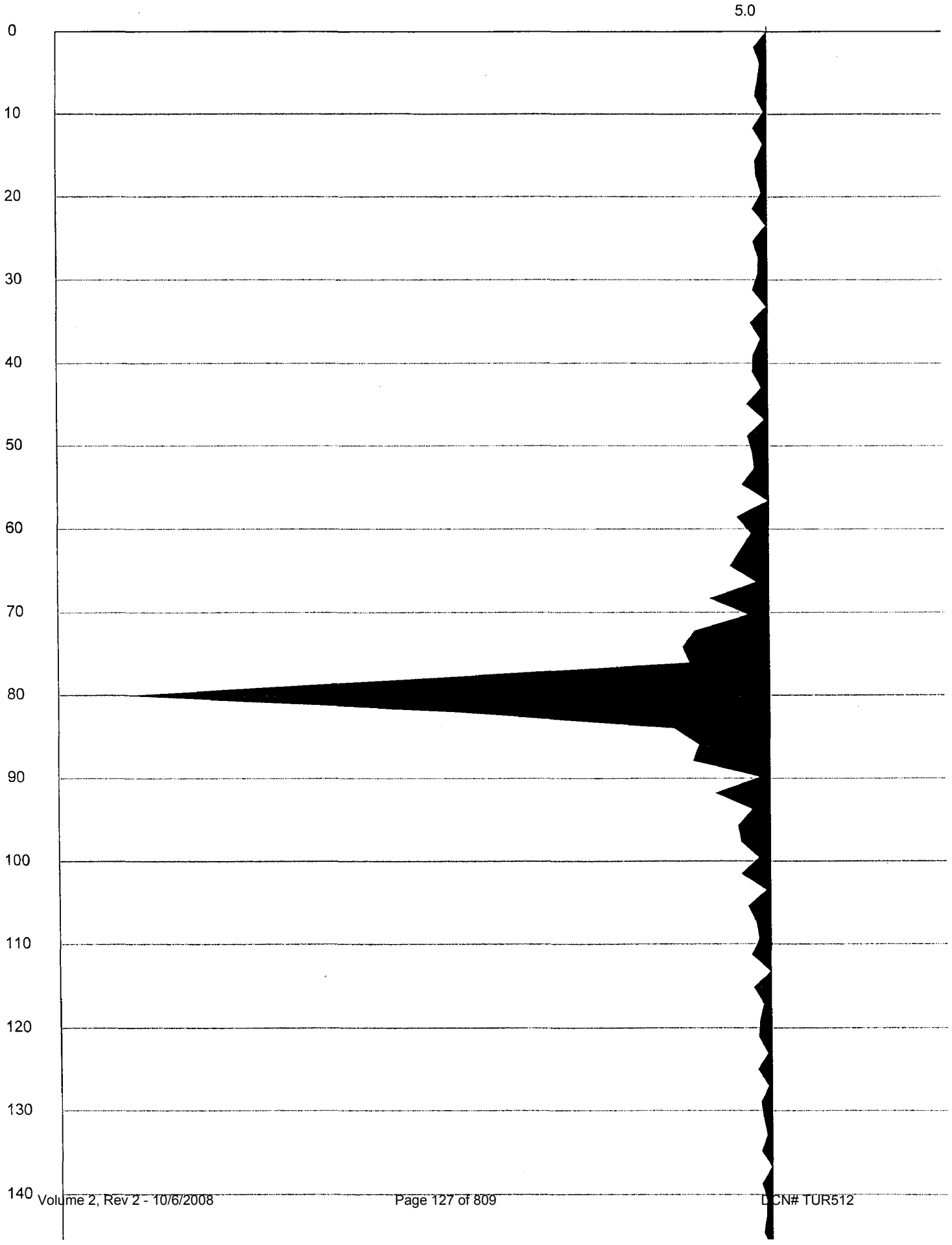
Geometrics ES-3000 S/N 5138
Frequency (HZ) In: 60.048 Seismograph: 60.3
Date: 1/22/2008



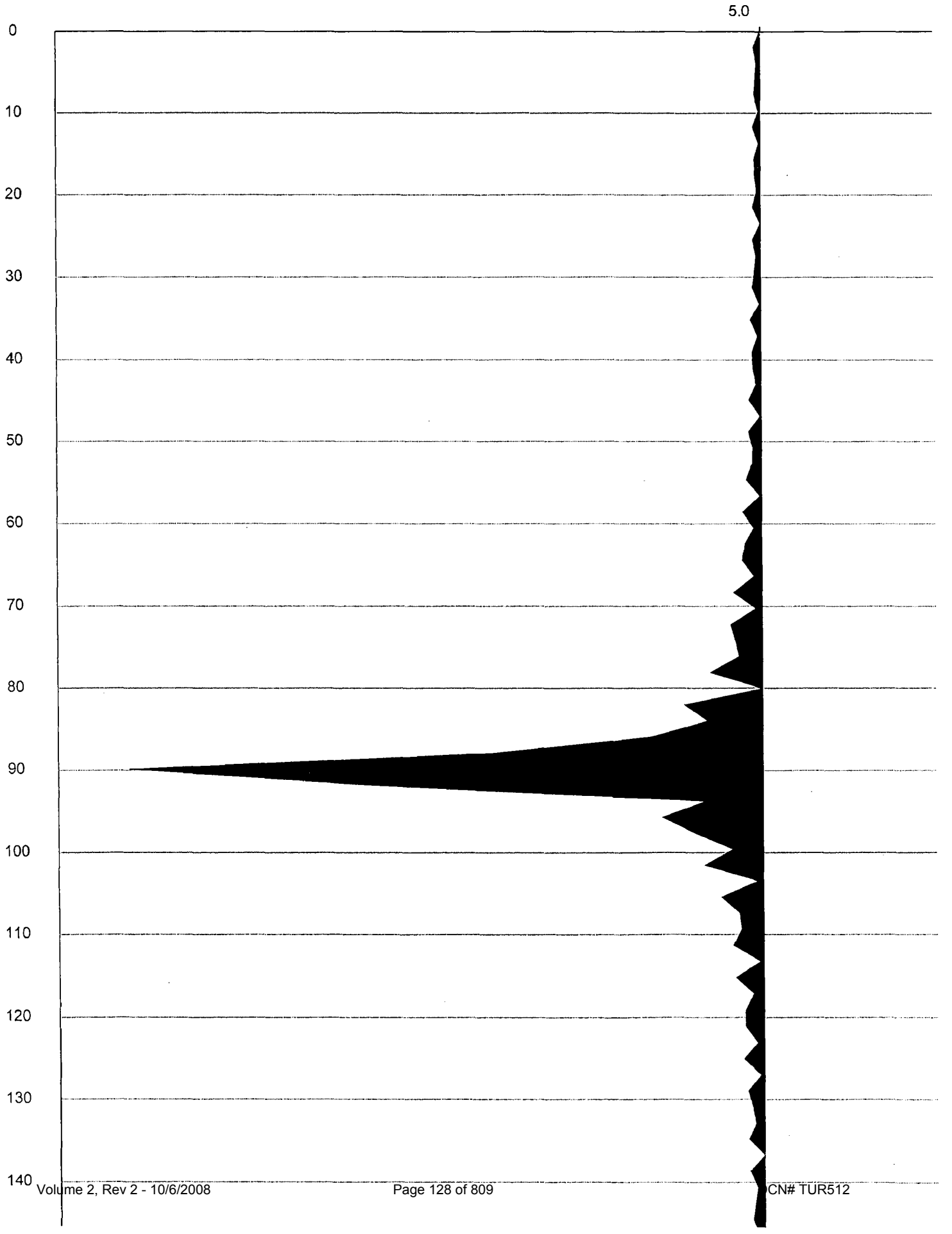
Geometrics ES-3000 S/N 5138
Frequency (HZ) In: 70.005 Seismograph: 70.2
Date: 1/22/2008



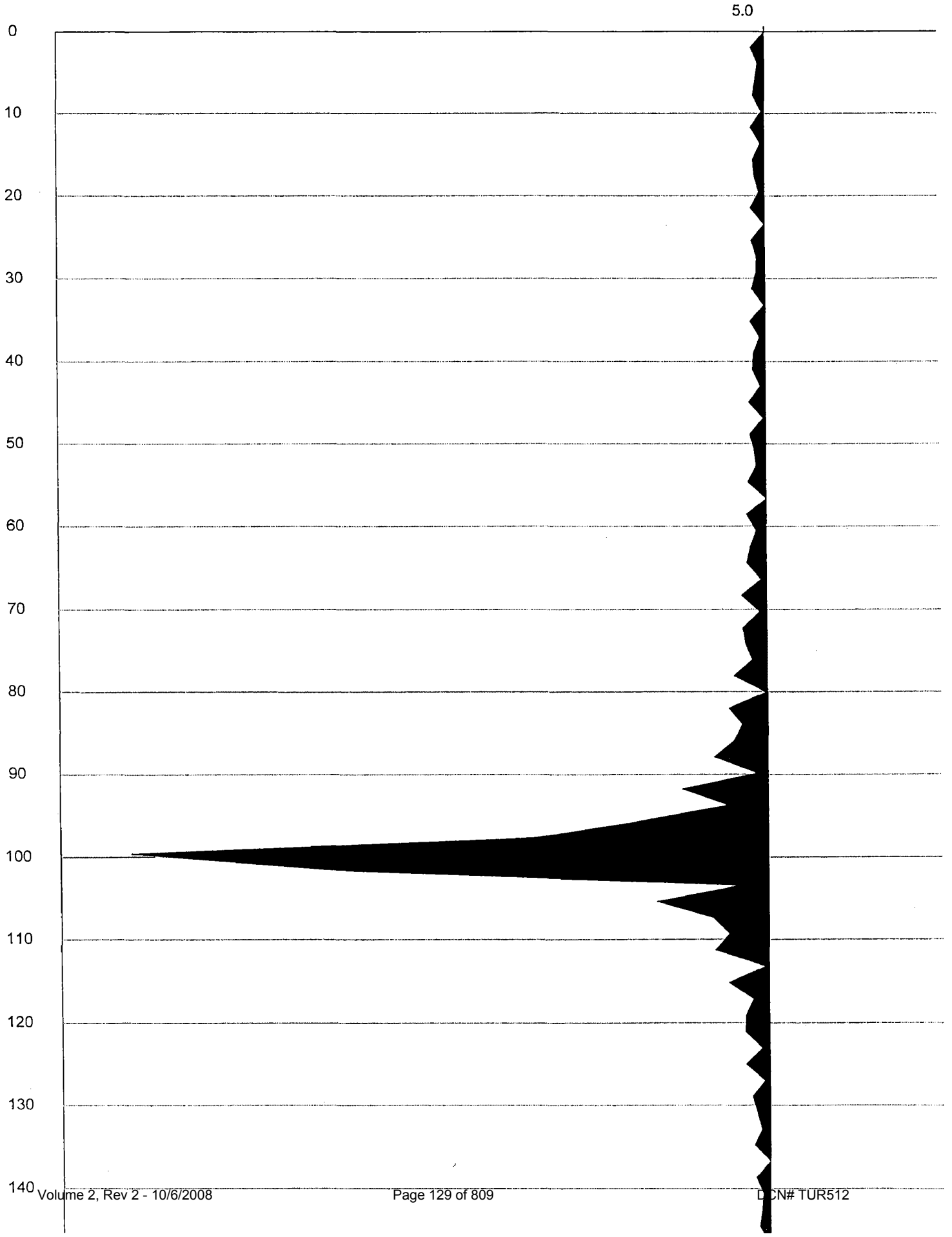
Geometrics ES-3000 S/N 5138
Frequency (HZ) In: 80.011 Seismograph: 79.9
Date: 1/22/2008



Geometrics ES-3000 S/N 5138
Frequency (HZ) In: 90.090 Seismograph: 90.1
Date: 1/22/2008



Geometrics ES-3000 S/N 5138
Frequency (HZ) In: 100.014 Seismograph: 99.8
Date: 1/22/2008



POST JOB CALIBRATION VERIFICATION

Calibration Verification Certificate

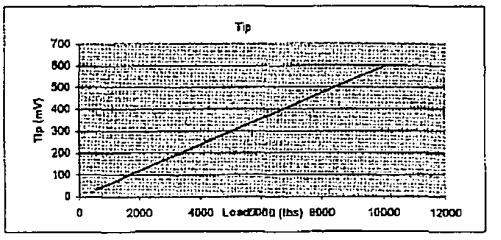
Device Type: Piezo Cone Penetrometer

Device Number: **F7.5CKE3SW2/B 1701-0750**

TIP CALIBRATION

Tip area = 15 cm2 = 0.0161 ft2
Tip readings in mV

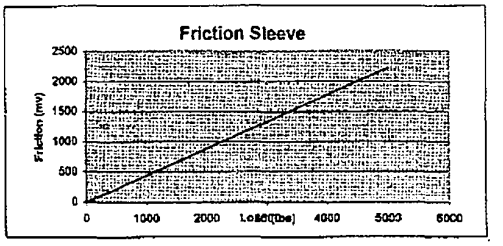
Load lb	Load Tons	load/area tsf	Tip mV	TIP Cal Factor Mpa
0	0	0	0	0
540	0.27	16.77019	32.1	50.0287963
5015	2.5075	155.7453	298.3	49.9975831
7510	3.755	233.2298	446.2	50.0543352
10005	5.0025	310.7143	594.3	50.0659763
15010	7.505	466.1491	892.6	50.0098021
19980	9.99	620.4969	1186.6	50.0751739



FRICTION CALIBRATION

Sleeve area = 200 cm2 = 0.2153 ft2
Friction readings in mV

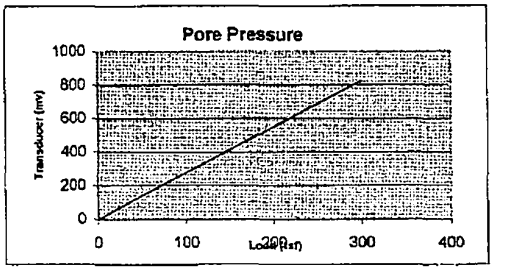
Load lb	Load Tons	load/area tsf	Friction mV	Friction Cal Factor Mpa
0	0	0	0	0
500	0.25	1.16117	220.3	0.50474111
2520	1.26	5.852299	1110.6	0.50461022
3755	1.8775	8.72039	1666.2	0.5011826
4990	2.495	11.58848	2215.9	0.50079912
7505	3.7525	17.42917	3335.8	0.50033843



PORE PRESSURE TRANSDUCER CALIBRATION

Serial : 8091223
Pore Pressure readings in mV

Pressure psi	Pressure tsf	Transducer readings mV	P.Pres. Cal Factor Mpa
0	0	0	0
75	5.4	206.6	2.50294116
150	10.8	413.3	2.50233557
300	21.6	823.4	2.51206045



Temperature Calibration (30 - 115 degrees F)

Temp (deg	TIP (mV)	FRIC (mV)	PIEZO (mV)
30	0.957	0.788	-0.124
50	0.994	0.957	-0.065
75	1.054	1.037	0.258
100	1.284	1.236	0.369
115	1.352	1.752	1.013

Deviation	mV	Mpa	% Full Scale
Tip	0.395	0.01975	0.0395
Friction	0.964	0.000482	0.0964
Piezo	1.137	0.002843	0.1137

TIP CALIBRATED BY GEOTAC (A2LA APPROVED) LOAD CELL:
Model 560K, Serial No. 129739
FRICTION CALIBRATED BY INTERFACE (A2LA APPROVED) LOAD CELL :
Model 560K, Serial No. 129739
PORE PRESSURE TRANSDUCER CALIBRATED BY GE SENSING (AANSI/NCSL APPROVED)
Pressure Indicator Model: UPS3000CC, Serial : A0813
TEMPERATURE CALIBRATED BY HOUSTON PRECISION TYPE K THERMOCOUPLE (A2LA APPROVED)
Model # 8528-40, Serial # C95005824, ID # TD-001

Calibration Verified by: Dennis Stauffer Date: 6/2/2008

Checked By : Recep Yilmaz Date: 6/2/2008

HGL Instrument Verification

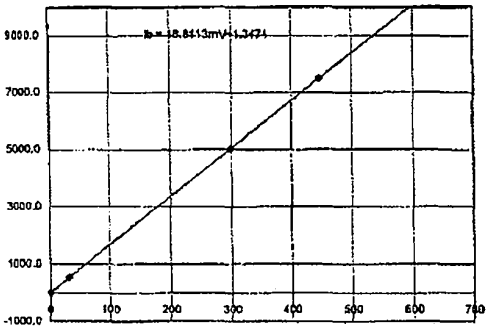
DATE: 6/2/2008 Instrument No.: ft100 Location: Houston LVDT?: [ ] Yes; [X] No

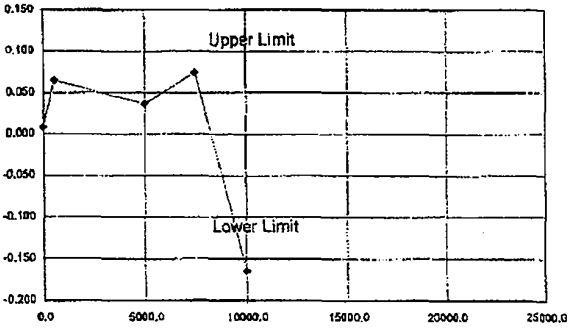
Type Analysis: [X] BF; [ ] NonBF; [X] FS; [ ] Abs. Reading Resolution of Instrument: 0.000001

Instrument Identification/Data	
Type	Cone Penetrometer-TIP
Manufacturer	Fugro
Model Number	F7.5CKEW2/B
Serial Number	1701-0750
HGL Instrument Number	ft100
Excitation (V)	
Gain/Span Setting	NA
Full Range Output (V)	
Full Range/Capacity (lb)	16858
Date Verified	6/2/2008
Date Due	6/2/2009
Service Status	In Service
Accept. Abs. or FS Error (%)	0.1 [X] FS; [ ] Abs.
Verification/Standard Equipment	
Type	Load cell (A2LA APPROVED)
Manufacturer	Geotac
Model Number	560K
Serial Number	129739
HGL Instrument Number	
Date Verified	
Temperature	°C = °F
Linear Regression, Uncertainty, & Error Summary	
Correlation Coeff. (R^2)	0.999986128
Intercept (lb)	1.347403615
Slope (lb/mV)	16.81127161
Verification (Calib.) Factor	16.81127161
Verification Factor Units	lb/mV
Absolute Zero (V)	
Floating Zero (V)	
Combined Uncertainty (lb)	6.258542548
Coverage Factor	2
Expanded Uncertainty (lb)	12.5170851
Max. Abs. or FS Error (%)	-0.25 [X] FS; [ ] Abs.

Instrument mV	Standard lb	Prediction lb	Abs. Error lb	Full Scale Error (%)
0.000000	0.0	1.3	1.3	0.01
32.100000	530.0	541.0	11.0	0.07
298.300000	5010.0	5016.1	6.1	0.04
446.200000	7490.0	7502.5	12.5	0.07
594.300000	10020.0	9992.3	27.7	-0.16
892.600000	15050.0	15007.1	42.9	-0.25
1186.600000	19910.0	19949.6	39.6	0.23

MTS [ ] Yes; [X] No





Uncertainity Budget Analysis For ft100							
Source of Uncertainty	Value in lb	Distribution	Divisor	Type	Uncertainty (u_i)	u_i^2	Comments
Standard's Uncertainty		N	2.0000	B			
Abs. Error-STDEV[1]	6.2585	N	1.0000	A	6.2585	39.1694	
Resolution of Instrument	0.0000	R	3.4641	B	0.0000	0.0000	
Repeatability[2]		N	1.0000	A			
Resolution of Standard	#N/A	R	3.4641	B			
Combined Uncertainty	6.2585	Coverage Factor			2	for 95% confidence level.	
Expanded Uncertainty (Best Measurement Capability)[3]		12.517			lb		

(1) This equation follows the approach presented by A2LA, not that typically used in uncertainty calculations; i.e., STDEV of the Mean.

(2) This value is unique for type (model) of equipment.

(3) This uncertainty represents an expanded uncertainty expressed as approximately the 95% confidence level using a coverage factor of k=2.

Verified By: Input By: Reviewed By: Checked By:

File:

Remarks:

2000.2 (06/14/07) Tip0750.xls, 6-2-2008 6/26/2008 FUGRO CONSULTANTS INC

HGL Instrument Verification

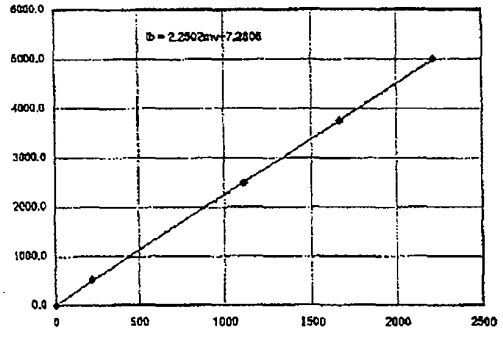
DATE: 6/2/2008 Instrument No.: ft100 Location: LVDT?: [ ] Yes; [X] No

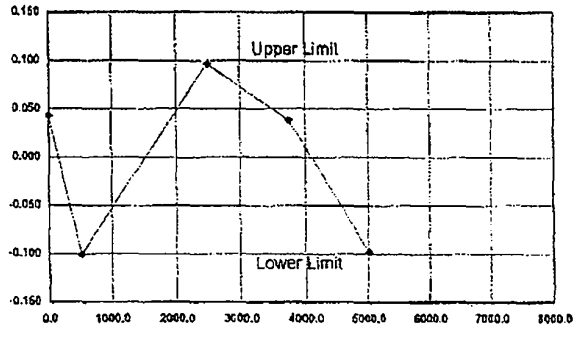
Type Analysis: [X] BF; [ ] NonBF; [X] FS; [ ] Abs. Reading Resolution of Instrument: 0.000001

Instrument Identification/Data	
Type	Cone Penetrometer
Manufacturer	Fugro
Model Number	F7.5CKE3SW2/B
Serial Number	1701-0750
HGL Instrument Number	ft100
Excitation (V)	
Gain/Span Setting	NA
Full Range Output (V)	
Full Range/Capacity (lb)	16858
Date Verified	6/2/2008
Date Due	6/2/2009
Service Status	In Service
Accept. Abs. or FS Error (%)	0.1 [X] FS; [ ] Abs.
Verification/Standard Equipment	
Type	Load Cell (A2AL APPROVED)
Manufacturer	Geotac
Model Number	560K
Serial Number	129739
HGL Instrument Number	
Date Verified	
Temperature	°C = °F
Linear Regression, Uncertainty, & Error Summary	
Correlation Coeff. (R^2)	0.999976621
Intercept (lb)	7.280791244
Slope (lb/mv)	2.250177247
Verification (Calib.) Factor	2.25017725
Verification Factor Units	lb/mv
Absolute Zero (V)	
Floating Zero (V)	
Combined Uncertainty (lb)	2.492195376
Coverage Factor	2
Expanded Uncertainty (lb)	4.984390751
Max. Abs. or FS Error (%)	-0.10 [X] FS; [ ] Abs.

Instrument mv	Standard lb	Prediction lb	Abs. Error lb	Full Scale Error (%)
0.000000	0.0	7.3	7.3	0.04
220.300000	520.0	503.0	17.0	-0.10
1110.600000	2490.0	2506.3	16.3	0.10
1666.200000	3750.0	3756.5	6.5	0.04
2215.900000	5010.0	4993.4	16.6	-0.10
3335.800000	7510.0	7513.4	3.4	0.02

MTS [ ] Yes; [X] No





Uncertainty Budget Analysis For ft100							
Source of Uncertainty	Value in lb	Distribution	Divisor	Type	Uncertainty (u_i)	u_i^2	Comments
Standard's Uncertainty		N	2.0000	B			
Abs. Error-STDEV[1]	2.4922	N	1.0000	A	2.4922	6.2110	
Resolution of Instrument	0.0000	R	3.4641	B	0.0000	0.0000	
Repeatability[2]		N	1.0000	A			
Resolution of Standard	#N/A	R	3.4641	B			
Combined Uncertainty	2.4922	Coverage Factor		2		for 95% confidence level	
Expanded Uncertainty (Best Measurement Capability)[3]		4.984		lb			

(1) This equation follows the approach presented by A2LA, not that typically used in uncertainty calculations; i.e., STDEV of the Mean. (2) This value is unique for type (model) of equipment.

(3) This uncertainty represents an expanded uncertainty expressed as approximately the 95% confidence level using a coverage factor of k=2.

Verified By: Input By: Reviewed By: Checked By:

File:

Remarks:

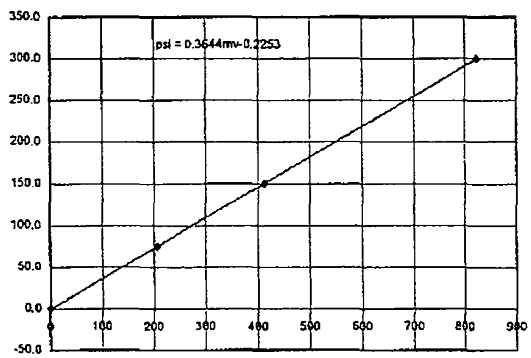
HGL Instrument Verification

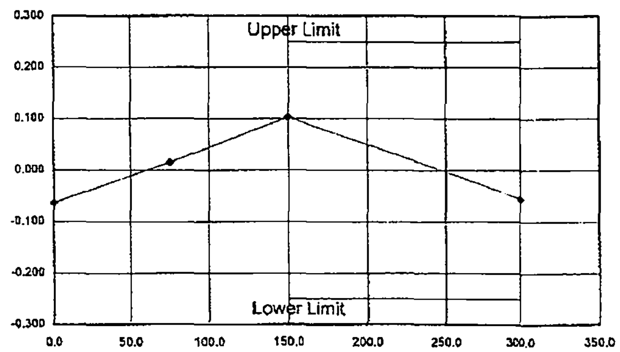
DATE: 6/2/2008 Instrument No.: pt Location: Houston LVDT?: [ ] Yes; [X] No

Type Analysis: [X] BF; [ ] NonBF; [X] FS; [ ] Abs. Reading Resolution of Instrument: 0.000001

Instrument Identification/Data		Instrument mv	Standard psi	Prediction psi	Abs. Error psi	Full Scale Error (%)
Type	Cone Penetrometer - Piezo					
Manufacturer	Fugro	0.000000	0.0	-0.2	0.2	-0.06
Model Number	F7.5CKEW2/B	206.600000	75.0	75.1	0.1	0.02
Serial Number	1701-0750-8091223	413.300000	150.0	150.4	0.4	0.10
HGL Instrument Number	pt	823.400000	300.0	299.8	0.2	-0.06
Excitation (V)						
Gain/Span Setting	NA					
Full Range Output (V)						
Full Range/Capacity (psi)	360					
Date Verified	6/2/2008					
Date Due	6/2/2009					
Service Status	In Service					
Accept. Abs. or FS Error (%)	0.25 [X] FS; [ ] Abs.					
Verification/Standard Equipment						
Type	PT(ANSI/NCSL APPROVED)					
Manufacturer	Eaton					
Model Number	UPS3000CC					
Serial Number	A0813					
HGL Instrument Number						
Date Verified						
Temperature	°C = °F					
Linear Regression, Uncertainty, & Error Summary						
Correlation Coeff. (R^2)	0.999995309					
Intercept (psi)	-0.225296318					
Slope (psi/mv)	0.364374132					
Verification (Calib.) Factor	0.36437413					
Verification Factor Units	psi/mv					
Absolute Zero (V)						
Floating Zero (V)						
Combined Uncertainty (psi)	0.064742646					
Coverage Factor	2					
Expanded Uncertainty (psi)	0.129485291					
Max. Abs. or FS Error (%)	0.10 [X] FS; [ ] Abs.					

MTS [ ] Yes; [X] No





Uncertainity Budget Analysis For pt							
Source of Uncertainty	Value in psi	Distribution	Divisor	Type	Uncertainty (u_i)	u_i^2	Comments
Standard's Uncertainty		N	2.0000	B			
Abs. Error-STDEV[1]	0.0647	N	1.0000	A	0.0647	0.0042	
Resolution of Instrument	0.0000	R	3.4641	B	0.0000	0.0000	
Repeatability[2]		N	1.0000	A			
Resolution of Standard	#N/A	R	3.4641	B			
Combined Uncertainty	0.0647	Coverage Factor			2	for 95% confidence level.	
Expanded Uncertainty (Best Measurement Capability)[3]		0.129		psi			

(1) This equation follows the approach presented by A2LA, not that typically used in uncertainty calculations; i.e., STDEV of the Mean. (2) This value is unique for type (model) of equipment.

(3) This uncertainty represents an expanded uncertainty expressed as approximately the 95% confidence level using a coverage factor of k=2.

Verified By: TS Input By: ______ Reviewed By: ______ Checked By: RJ

File:

Remarks:

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FINAL DATA REPORT Rev. 2
GEOTECHNICAL EXPLORATION AND TESTING

TURKEY POINT COL PROJECT
FLORIDA CITY, FLORIDA

October 6, 2008

VOLUME 2
Appendix D – Geovision Downhole and P-S Logging Report

Prepared By:

MACTEC Engineering and Consulting, Inc.
Raleigh, North Carolina

MACTEC Project No. 6468-07-1950

Prepared For:

Bechtel Power Corporation
Subcontract No. 25409-102-HC4-CY00-00001

MACTEC

DOCUMENTATION OF TECHNICAL REVIEW
SUBCONTRACTOR WORK PRODUCT

Project Name: Turkey Point COL

Project Number: 6468-07-1950

Project Manager: Scott Auger

Project Principals: Al Tice and Tom McDaniel

The report described below has been prepared by the named subcontractor retained in accordance with the MACTEC QAPD. The work and report have been reviewed by a MACTEC technically qualified person. Comments on the work or report, if any, have been satisfactorily addressed by the subcontractor. The attached report is approved in accordance with section QS-7 of MACTEC's QAPD

The information and date contained in the attached report are hereby released by MACTEC for project use.

REPORT : Report Boring Geophysical Logging. Report 8083-03 rev 0, July 24, 2008_

SUBCONTRACTOR: GeoVision

DATE OF ACCEPTANCE :_ 7-25-08

TECHNICAL REVIEWER: _____

PROJECT PRINCIPAL _____ 7-25-08

DCN TUR - 483

MACTEC
3301 Atlantic Avenue, Raleigh, NC 27604

GEOVision
geophysical services

BORING GEOPHYSICAL LOGGING
BORINGS B-601 (DH), B-604 (DH), B-608 (DH), B-610 (DH), B-620 (DH), B-640 (DHT), B-701 (DH), B-704 G (DH), B-708 (DH), B-710 G (DH), B-720 G (DH) AND B-740 (DHT)

FPL TURKEY POINT COL

Report 8083-03 rev 0

July 24, 2008

DCN TUR 482

BORING GEOPHYSICAL LOGGING
BORINGS B-601 (DH), B-604 (DH), B-608 (DH), B-610 (DH), B-620 (DH), B-640 (DHT), B-701 (DH), B-704 G (DH), B-708 (DH), B-710 G (DH), B-720 G (DH) AND B-740 (DHT)

FPL TURKEY POINT COL

Report 8083-03 rev 0

July 24, 2008

Prepared for:

MACTEC Engineering and Consulting, Inc.
3301 Atlantic Avenue
Raleigh, N. C. 27604
919-831-8000
MACTEC Job number 6468-07-1950

Prepared by

GEOVision Geophysical Services
1124 Olympic Drive
Corona, California 92881
(951) 549-1234

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APPENDICES

INTRODUCTION

Boring geophysical measurements were collected in ten uncased and two cased borings located at the Florida Power and Light (FPL) Turkey Point Combined Operating License (COL) Application Project, located near Florida City, Florida. Geophysical data acquisition was performed between March 8 and June 26, 2008 by Robert Steller, Charles Carter, Anthony Martin and Nathan Baldwin of **GEO***Vision*. Data analysis was performed by Robert Steller and Anthony Martin, and reviewed by John Diehl of GEOVision. Report preparation was performed by Robert Steller and reviewed by John Diehl of GEOVision. The work was performed under subcontract with MACTEC Engineering and Consulting, Inc., (MACTEC) with Stephen Criscenzo serving as the point of contact for MACTEC.

This report describes the field measurements, data analysis, and results of this work.

SCOPE OF WORK

This report presents the results of boring geophysical measurements collected between March 8 and June 26, in twelve borings, as detailed in Table 1. The purpose of these studies was to supplement stratigraphic information obtained during MACTEC's soil and rock sampling program and to acquire shear wave velocities and compressional wave velocities as a function of depth, as a component of the FPL Turkey Point COL Project.

The OYO/Robertson Suspension PS Logging System (Suspension System) was used to obtain in-situ horizontal shear (S_H) and compressional (P) wave velocity measurements in ten borings at 1.6 foot intervals. Measurements followed **GEO***Vision* Procedure for P-S Suspension Seismic Velocity Logging, revision 1.31. The acquired data was analyzed and a profile of velocity versus depth was produced for both compressional and horizontally polarized shear waves.

The Robertson ELGX and 3ACS probes were used to collect long and short normal resistivity, single point resistance (SPR) Spontaneous Potential (SP), natural gamma and 3 arm mechanical caliper data at 0.05 foot intervals in the ten uncased borings to aid in identification of stratagraphic transitions. Measurement procedures followed these ASTM standards:

- ASTM D5753, "Planning and Conducting Borehole Geophysical Surveys
- ASTM D6167 "Conducting Borehole Geophysical Logging – Mechanical Caliper"
- ASTM D6274, "Conducting Borehole Geophysical Logging – Gamma"

The acquired data was combined and a profile of these parameters versus depth was produced.

The Robertson High Resolution Acoustic Televiewer (HiRAT) was used to collect deviation data at 0.04 foot intervals and acoustic televiewer images of the rock section of each boring at 0.008 foot intervals in the ten uncased borings. Measurements followed the **GEO***Vision* HiRAT Field Procedure, revision 1.0. The acquired data was analyzed and a profile of boring deviation versus depth was produced for each boring, and an image of the rock portions of the uncased borings, with 4 arm caliper dimensions superimposed, was produced.

The Downhole Seismic velocity logging system was used in the two PVC cased borings as a validation of the suspension velocity data collected at this site. In this method, the source remains stationary at the surface, while a single receiver travels down the cased boring at 5 foot intervals. Source energy is transmitted down the soil column from the surface and velocity is calculated from first arrival travel time and receiver depth. Measurements followed **GEO***Vision* Procedure for Downhole Seismic Velocity Logging, revision 1.1. The acquired data was analyzed and a profile of velocity versus depth was produced for both P- and S_H –waves.

A detailed reference for the suspension PS velocity measurement techniques used in this study is:

> Guidelines for Determining Design Basis Ground Motions, Report TR-102293, Electric Power Research Institute, Palo Alto, California, November 1993, Sections 7 and 8.

INSTRUMENTATION

Suspension Velocity Instrumentation

Suspension velocity measurements were performed in ten uncased nominal 3.88 – 5.0 inch diameter borings using the suspension PS logging system, manufactured by OYO Corporation, and their subsidiary, Robertson Geologging. Components used for these measurements are listed in Table 2. This system directly determines the average velocity of a 3.3 foot high segment of the soil column surrounding the boring of interest by measuring the elapsed time between arrivals of a wave propagating upward through the soil column. The receivers that detect the wave, and the source that generates the wave, are moved as a unit in the boring producing relatively constant amplitude signals at all depths.

The suspension system probe consists of a combined reversible polarity solenoid horizontal shear-wave source (S_H) and compressional-wave source (P), joined to two biaxial receivers by a flexible isolation cylinder, as shown in Figure 2. The separation of the two receivers is 3.3 feet, allowing average wave velocity in the region between the receivers to be determined by inversion of the wave travel time between the two receivers. The total length of the probe as used in these surveys is 19 feet, with the center point of the receiver pair 12.1 feet above the bottom end of the probe.

The probe receives control signals from, and sends the digitized receiver signals to, instrumentation on the surface via an armored 4 conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth data, using a 3.28 foot circumference sheave fitted with a digital rotary encoder.

The entire probe is suspended in the boring by the cable, therefore, source motion is not coupled directly to the boring walls; rather, the source motion creates a horizontally propagating impulsive pressure wave in the fluid filling the boring and surrounding the source. This pressure wave is converted to P and S_H-waves in the surrounding soil and rock as it passes through the

casing and grout annulus and impinges upon the wall of the boring. These waves propagate through the soil and rock surrounding the boring, in turn causing a pressure wave to be generated in the fluid surrounding the receivers as the soil waves pass their location. Separation of the P and S_H-waves at the receivers is performed using the following steps:

1. Orientation of the horizontal receivers is maintained parallel to the axis of the source, maximizing the amplitude of the recorded S_H -wave signals.
2. At each depth, S_H-wave signals are recorded with the source actuated in opposite directions, producing S_H-wave signals of opposite polarity, providing a characteristic S_H-wave signature distinct from the P-wave signal.
3. The 6.3 foot separation of source and receiver 1 permits the P-wave signal to pass and damp significantly before the slower S_H-wave signal arrives at the receiver. In faster soils or rock, the isolation cylinder is extended to allow greater separation of the P- and S_H-wave signals.
4. In saturated soils, the received P-wave signal is typically of much higher frequency than the received S_H-wave signal, permitting additional separation of the two signals by low pass filtering.
5. Direct arrival of the original pressure pulse in the fluid is not detected at the receivers because the wavelength of the pressure pulse in fluid is significantly greater than the dimension of the fluid annulus surrounding the probe (meter versus centimeter scale), preventing significant energy transmission through the fluid medium.

In operation, a distinct, repeatable pattern of impulses is generated at each depth as follows:

1. The source is fired in one direction producing dominantly horizontal shear with some vertical compression, and the signals from the horizontal receivers situated parallel to the axis of motion of the source are recorded.
2. The source is fired again in the opposite direction and the horizontal receiver signals are recorded.
3. The source is fired again and the vertical receiver signals are recorded. The repeated source pattern facilitates the picking of the P and S_H-wave arrivals; reversal of the source changes the polarity of the S_H-wave pattern but not the P-wave pattern.

The data from each receiver during each source activation is recorded as a different channel on the recording system. The Suspension PS system has six channels (two simultaneous recording channels), each with a 1024 sample record. The recorded data are displayed as six channels with a common time scale. Data are stored on disk for further processing. Up to 8 sampling sequences can be summed to improve the signal to noise ratio of the signals.

Review of the displayed data on the recorder or computer screen allows the operator to set the gains, filters, delay time, pulse length (energy), sample rate, and summing number to optimize the quality of the data before recording. Verification of the calibration of the Suspension PS digital recorder is performed every twelve months using a NIST traceable frequency source and counter, as outlined in Appendix E.

Downhole Velocity Instrumentation

Downhole velocity measurements were performed in two 2 inch PVC cased borings using a Geostuff BHG-3, 3-component borehole geophone, serial number B-3079. This system orients the downhole geophones parallel to the axis of excitation at the surface, insuring that signals received at the downhole geophones are of maximum amplitude, and are not subject to errors in travel time caused by incorrect phase of first arrival picks, as found with non-orientable downhole probes. The downhole probe consists of horizontal and vertical geophones mounted on a rotatable structure with a fluxgate magnetometer compass sensor. The structure can be pre-set on the surface to match the azimuth of the horizontal geophone axis with the azimuth of the surface shear wave source whenever power is applied to the compass sensor and orientation servo mechanism. The probe receives control signals from, and sends the geophone signals to, instrumentation on the surface via cable. Cable travel is measured to provide probe depth data. The probe is locked into the boring using a motor driven clamp mechanism. The BHGC-4 controller directs the voltages to control the clamping mechanism and orientation mechanism. A meter monitors motor current to indicate the clamping action and force.

A triaxial geophone is placed on the surface adjacent to the boring collar, to record reference waveforms to validate the function of the hammer switch, as well as to monitor shifts in timing due to changes in source coupling to the soil.

The S_H -wave energy source consists of an 88-pound elastic band accelerated hammer striking horizontally against the ends of a steel capped traction plank. The traction plank is weighted by placing it beneath the rear end of a truck supported on an air suspension, as shown in Figure 2. The P-wave energy source utilizes the same energy source operating in a vertical orientation, striking an aluminum plate, as shown in Figure 3. A hammer switch mounted on the steel plank caps or aluminum plate is used to provide consistent triggering from each hammer blow. During logging operations, a repeatable pattern of impulses, similar to that produced by the suspension source, is generated at each measurement depth as follows:

1. The plank is struck with the hammer laterally in one direction, producing dominantly horizontal shear with some vertical compression, and the signals generated by the horizontal receivers are recorded. The signals are checked, and repeated (stacked) as needed.
2. The plank is struck in the opposite direction and the horizontal signals are recorded, and stacked as needed.
3. The plate is struck on top, and the signals generated by the vertical receivers are recorded. The repeated source pattern facilitates the picking of the P- and S_H-wave arrivals, since the reversal of the source direction changes the polarity of the S_H-wave pattern but not that of the P-wave pattern.

The signals from the BHG-3 geophone were recorded on a Geometrics Geode seismograph, controlled by a laptop computer. Geode S/N 3458 was used on both borings. The Geode is a 24-bit exploration seismograph with 113dB dynamic range. Triggered by the hammer switch (see procedure, Appendix G) the seismograph recorded the responses of the borehole and surface sensors. Data was reviewed on the computer screen, and stored internally on hard disk. Multiple hammer blows can be summed to improve the signal-to-noise ratio of the signals. Review of the displayed data on the screen allows the operator to set the gains, filters, sample rate, and summing number in order to optimize the quality of the data before recording to disk for later processing.

Caliper / Natural Gamma Instrumentation

Caliper and natural gamma data were collected using a Model 3ACS 3-leg caliper probe, serial number 5368, manufactured by Robertson Geologging, Ltd. With the short arm configuration used in these surveys, the probe permitted measurement of boring diameters between 1.6 and 16 inches. With this tool, caliper measurements were collected concurrent with measurement of natural gamma emission from the boring walls. The probe was 6.82 feet long, and 1.5 inches in diameter.

This probe is useful in the following studies:

- Measurement of boring diameter and volume
- Location of hard and soft formations
- Location of fissures, caving, pinching and casing damage
- Bed boundary identification
- Strata correlation between borings

The probe receives control signals from, and sends the digitized measurement values to, a Robertson Micrologger II on the surface via an armored 4 conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth data, using a 3.28 foot circumference sheave fitted with a digital rotary encoder. The probe and depth data are transmitted by USB link from the Micrologger unit to a laptop computer where it is displayed and stored on hard disk.

The caliper consists of three arms, each with a toothed quadrant at their base, pivoted in the lower probe body. A toothed rack engages with each quadrant, thus constraining the arms to move together. Linear movement of the rack is converted to opening and closing of the arms. Springs hold the arms open in the operating position. A motor drive is provided to retract the arms, allowing the probe to be lowered into the boring. The rack is coupled to a potentiometer which converts movement into a voltage sensed by the probe's microprocessor.