CMG-1T CALIBRATION SHEET

WORKS ORDER:	12801	DATE:	08-Mar-2013
SERIAL NUMBER:	T1076	TESTED BY:	S. Goddard

	Velocity Output V/m/s (Differential)	Mass Position Output (Acceleration output) V/m/s^2	Feedback Coil Constant Amp/m/s^2
VERTICAL	2 x 1468	2265	0.015
NORTH/SOUTH	2 x 1500	1435	0.01435
EAST/WEST	2 x 1495	1439	0.01439

Power Consumption: xmA @ +12V input
Calibration Resistor: 51000

NOTE: A factor of 2 x must be used when the sensor outputs are used differentially (also known as push-pull or balanced output). Under no conditions should the negative outputs be connected to the signal ground. A separate signal ground pin is provided.

POLES AND ZEROS TABLE

WORKS ORDER NUMBER: 12802

SENSOR SERIAL NO: T1076

Velocity response output, Vertical Sensor:

POLES (HZ)	ZEROS HZ
$-1.964 \times 10^{-3} \pm j1.964 \times 10^{-3}$	0
-30.0529±j31.1211	0
-41.2564±j114.535	

Normalizing factor at 1 Hz: A = 27.7×10^{6}

Sensor Sensitivity: See Calibration Sheet.

Velocity response output, Horizontal Sensors:

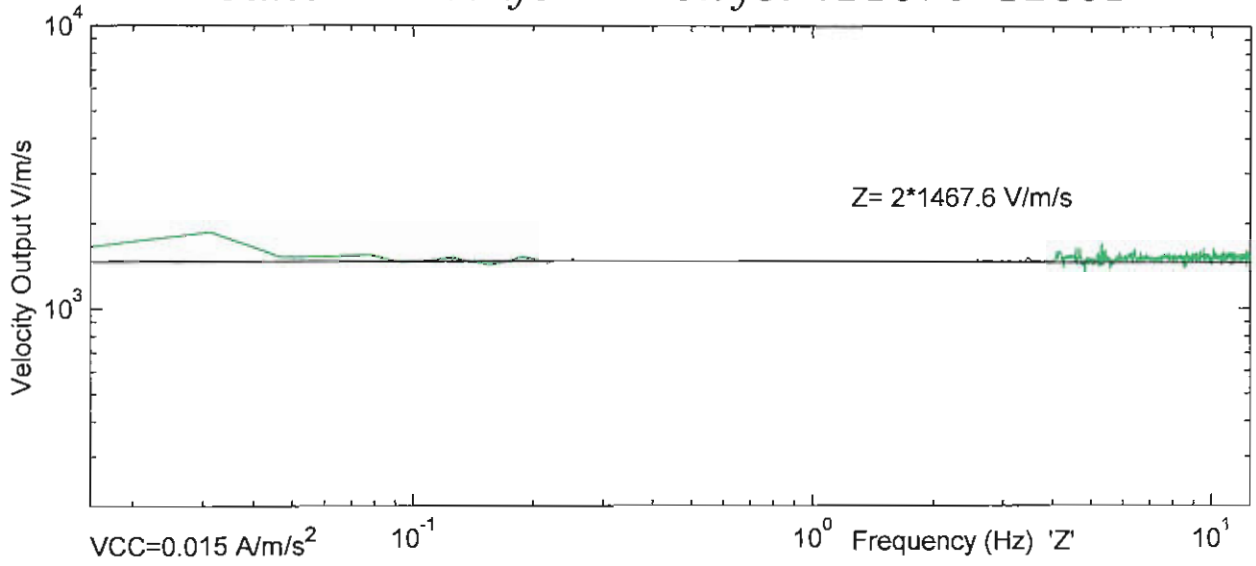
POLES (HZ)	ZEROS (HZ)
$-1.964 \times 10^{-3} \pm j1.964 \times 10^{-3}$	0
-30.0529±j31.1211	0
-41.2564±j114.535	

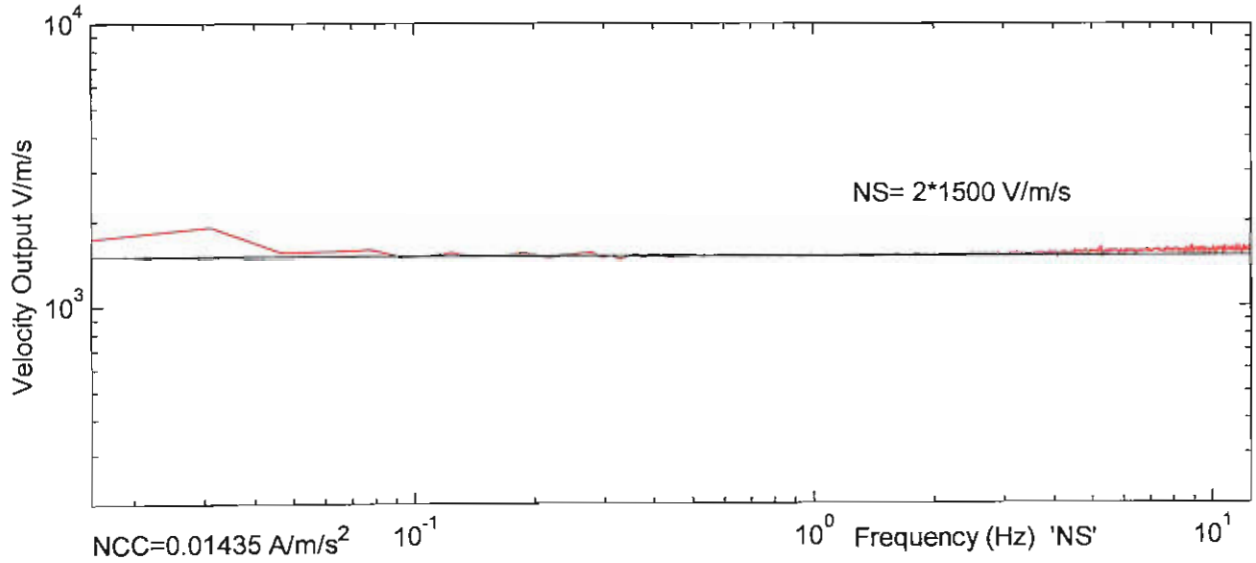
Normalizing factor at 1 Hz: A = 27.7×10^{6}

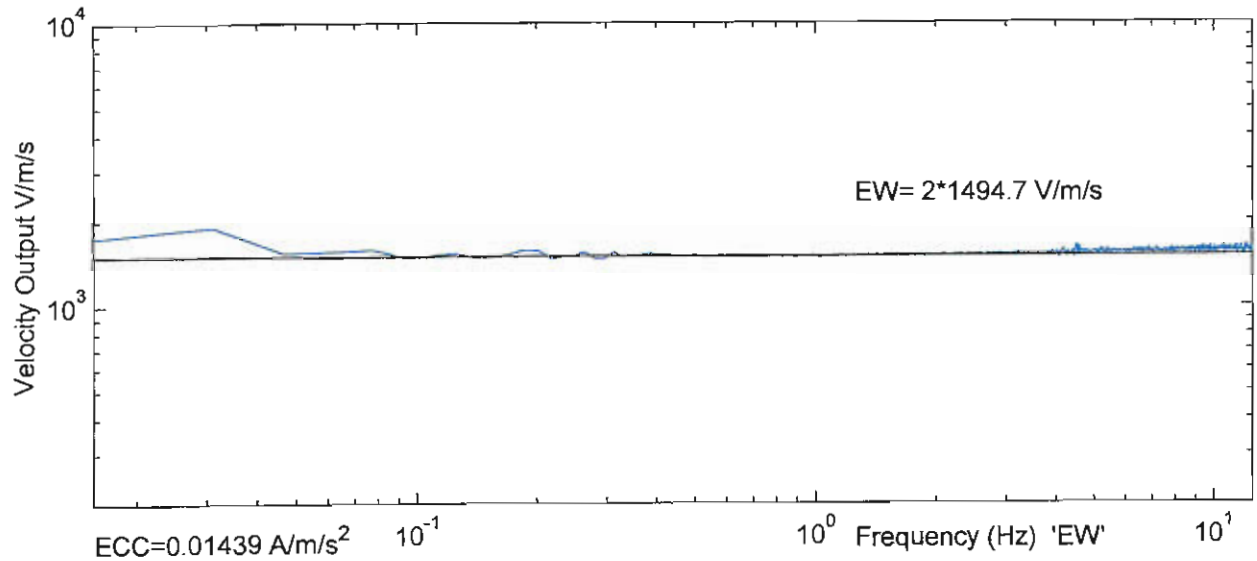
Sensor Sensitivity: See Calibration Sheet.

NOTE: The above poles and zeros apply to the vertical and the horizontal sensors and are given in units of Hz. To convert to Radian/sec multiply each pole or zero with 2π. The normalizing factor A should also be recalculated.

Calibration Information for :T1076 12801



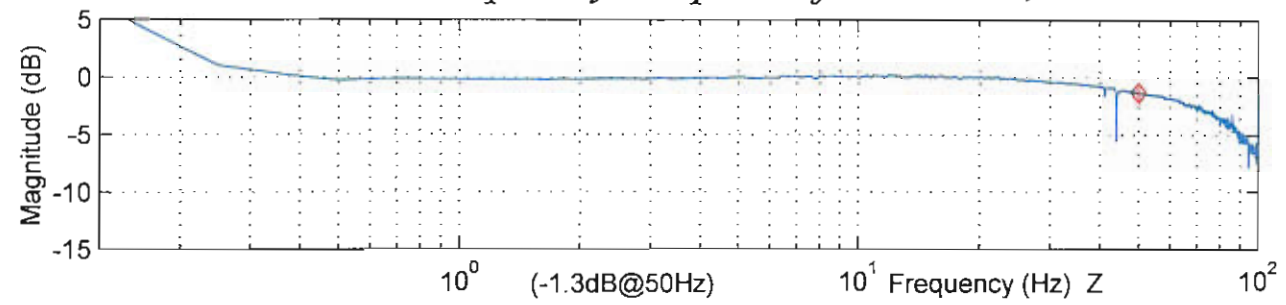


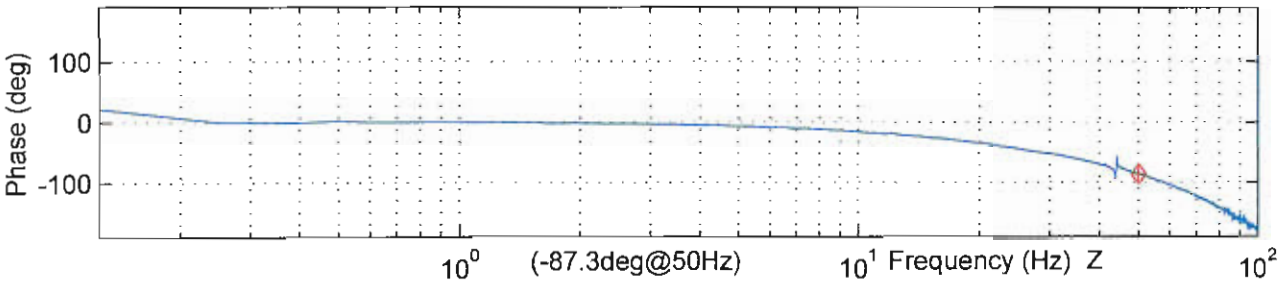


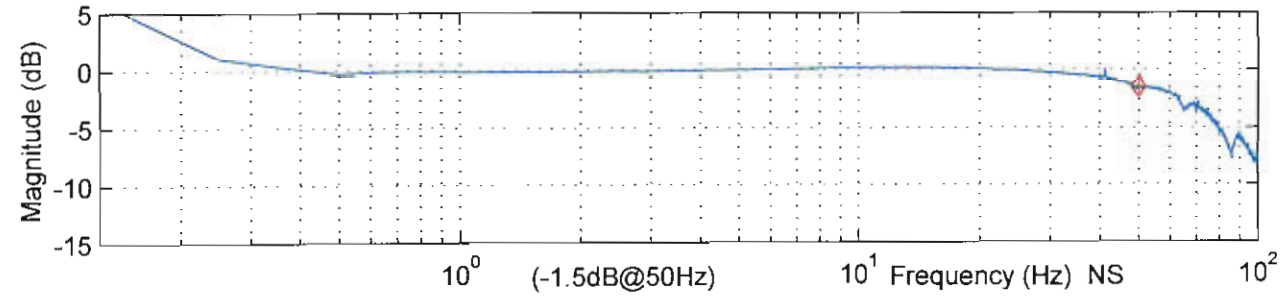
RCal =51000 Ohms

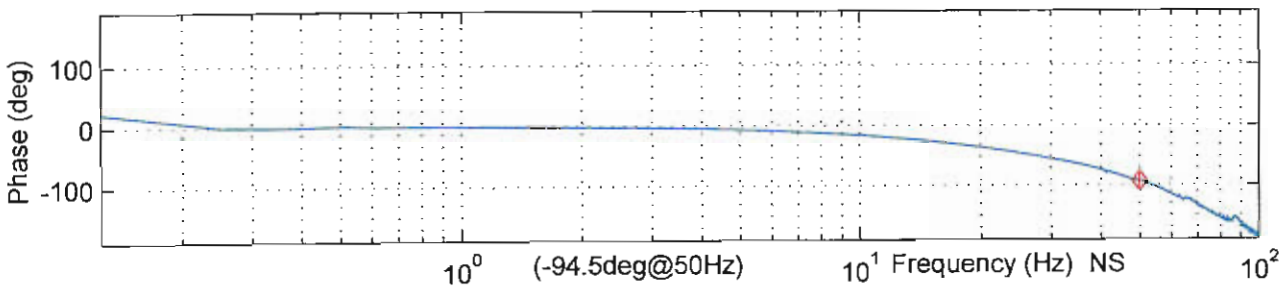
08-Mar-2013

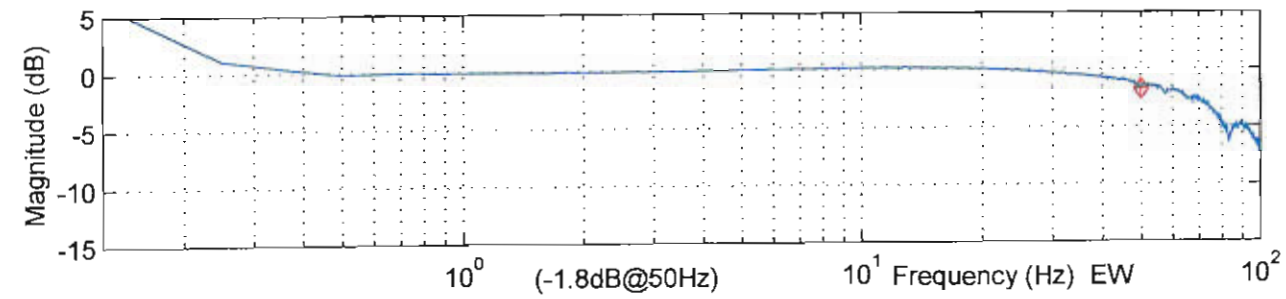
Normalized Frequency Response for :T1076, 12801

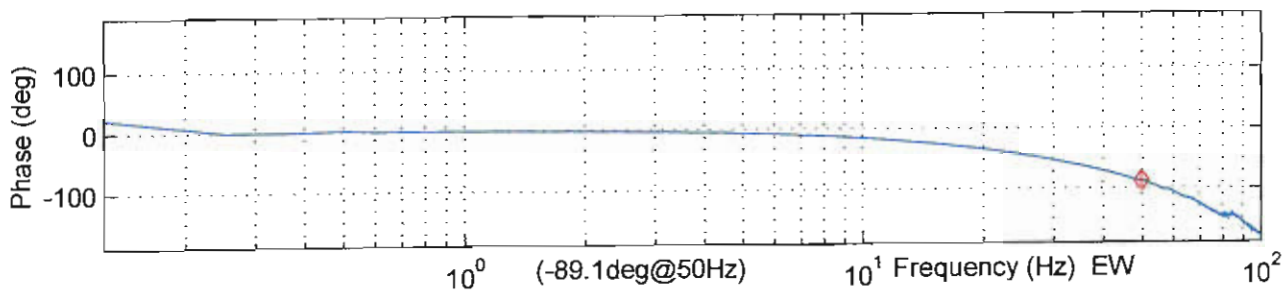






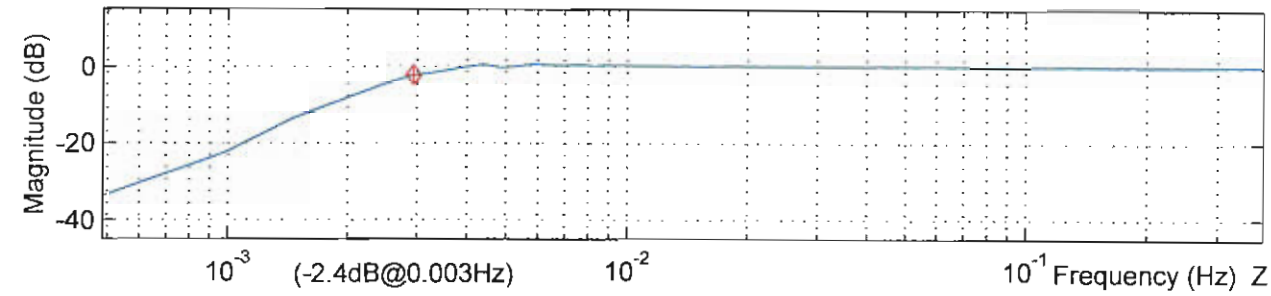


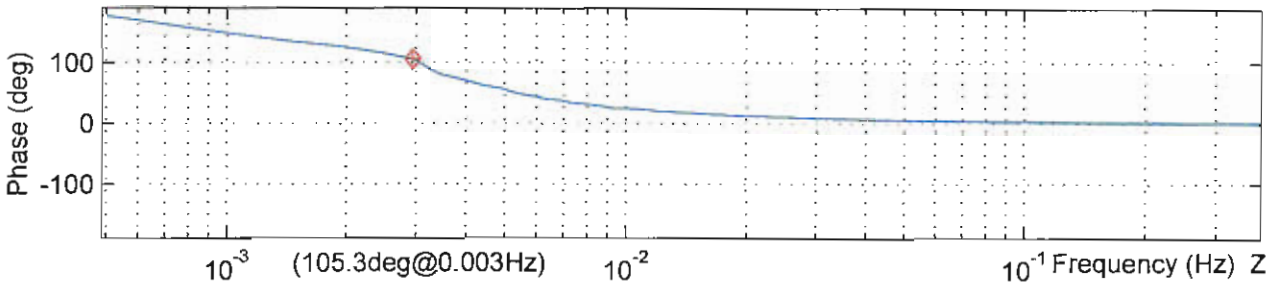


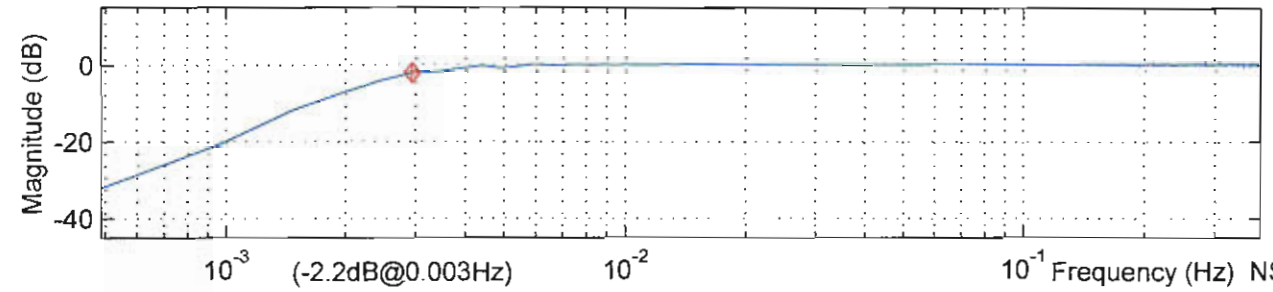


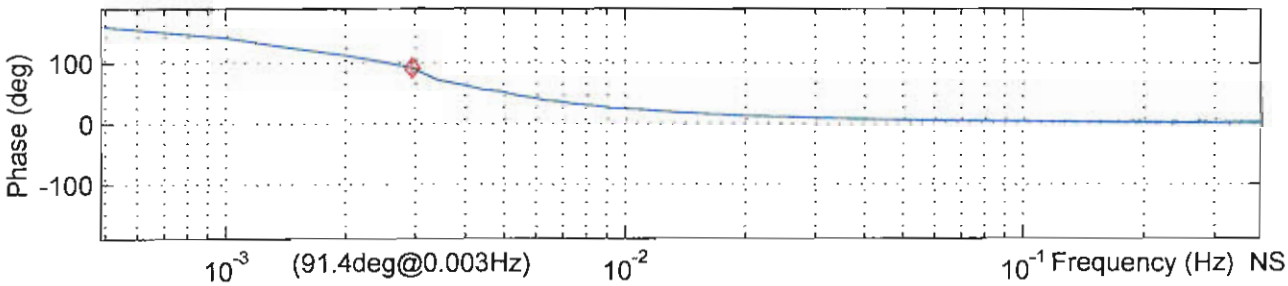
07-Mar-2013

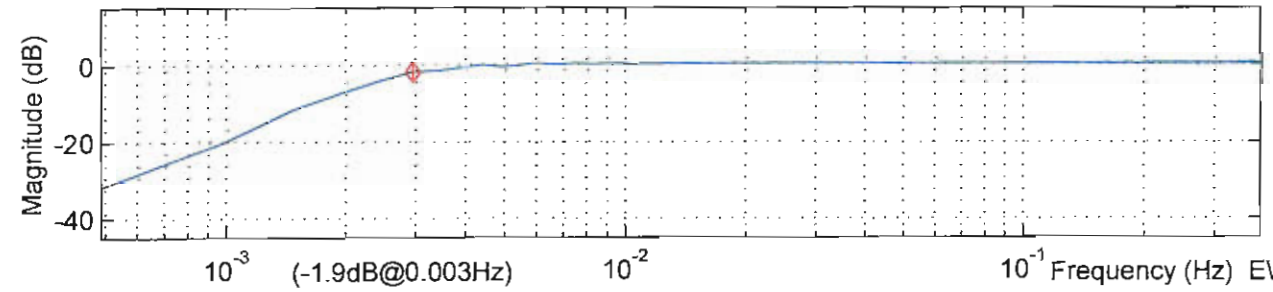
Normalized Frequency Response for :T1076, 12801

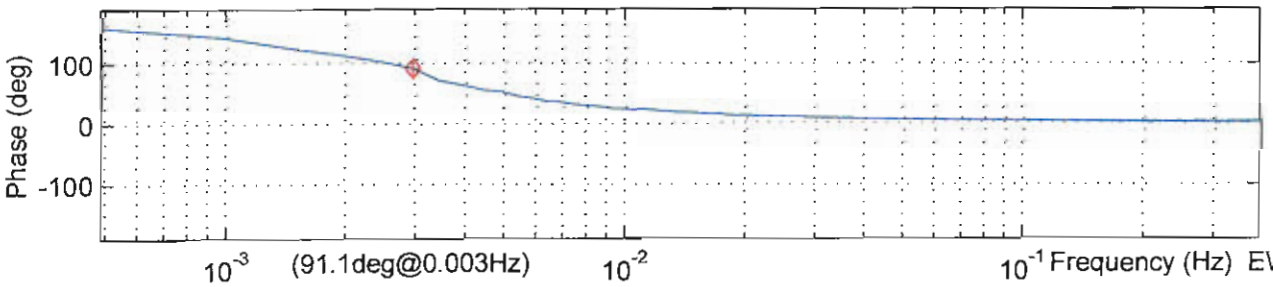












08-Mar-2013

GURALP SYSTEMS

GURALP SYSTEMS LIMITED, 3 MIDAS HOUSE, CALLEVA PARK,
ALDERMASTON, READING, RG7 8EA, UK.
TELEPHONE: +44 118 9819056 FAX: +44 118 9819943
sales@guralp.com

CMG-5T/TD/U Instrument Quality Certificate

This certificate identifies the tests and inspection carried out.

Sensor Serial Number.	T5C03
	Pass
Sensor Noise Coherence.	✓
Frequency response. Document attached.	✓
Calibration. Document attached.	✓
Cable Lengths & Ancillaries as per customer order?	n/a

Final Quality Approval. AD

On behalf of Guralp Systems. Date 31/12/13

GURALP SYSTEMS LIMITED, REGISTERED OFFICE, 3 MIDAS HOUSE, CALLEVA PARK, ALDERMASTON, READING, RG7 8EA
REGISTERED IN ENGLAND No. 2199239. VAT REGISTRATION No. 491 4657 20.

CMG-5T ABSOLUTE CALIBRATION
(ACCELERATION OUTPUTS)

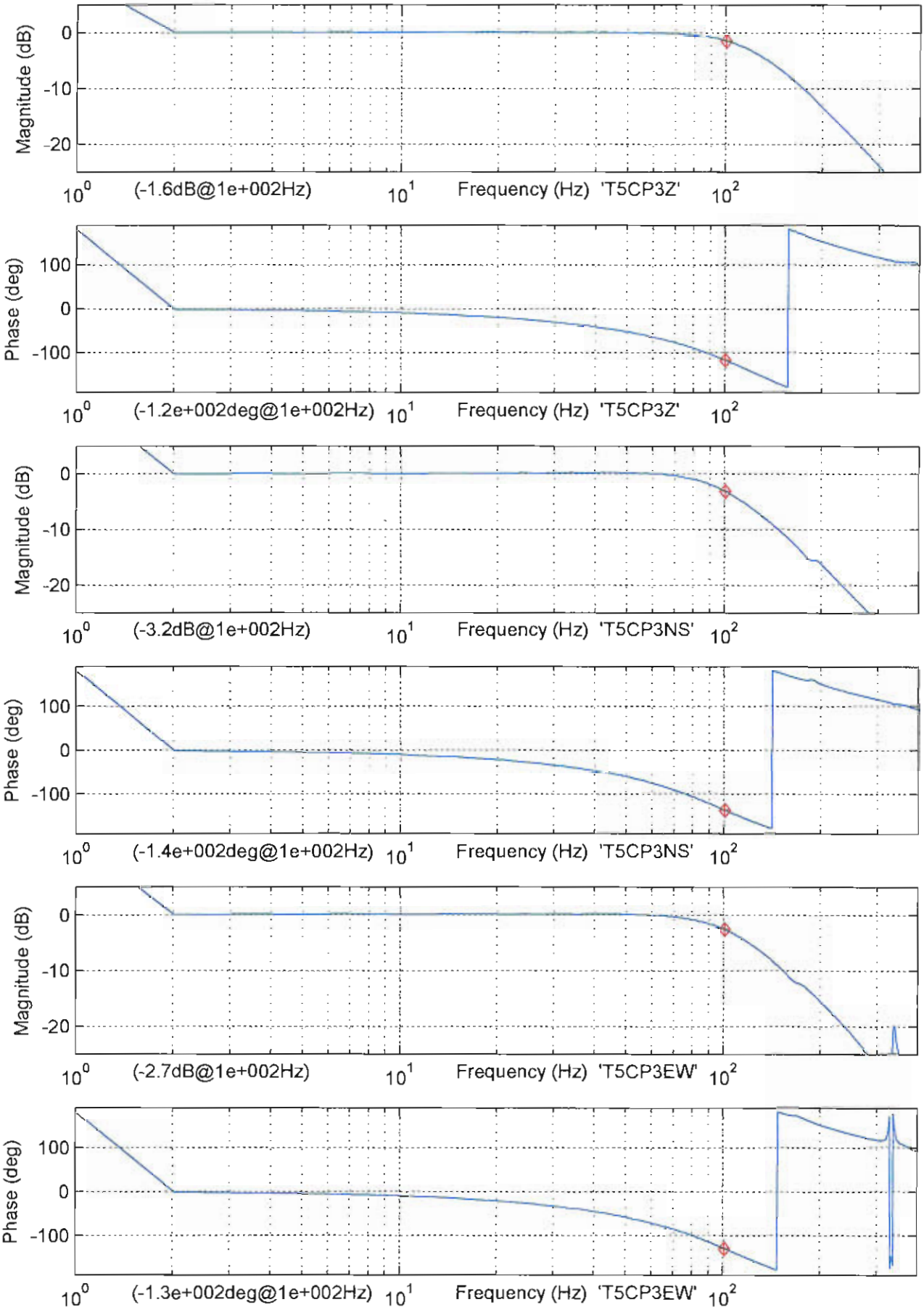
WORKS ORDER:	12801	DATE:	26/02/2013
SERIAL NUMBER:	T5CP3	TESTED BY:	SH
		OUTPUT at 1g	5 volts

	Acceleration Response $V/m/s^2$
VERTICAL	2 x 0.508
NORTH/SOUTH	2 x 0.508
EAST/WEST	2 x 0.509

Vertical component equivalent acceleration from calibration signal of:	1 Volt = $0.984 m/s^2$
North/South component equivalent acceleration from calibration signal of:	1 Volt = $0.984 m/s^2$
East/West component equivalent acceleration from calibration signal of:	1 Volt = $0.982 m/s^2$
Calibration enable signal polarity:	Active Low
Typical Current Consumption:	
This sensor operates from:	10 to 36 Volts

NOTE: A factor of 2 x must be used when the sensor outputs are used differentially (also known as push-pull or balanced output). Under no conditions should the negative outputs be connected to the signal ground. A separate signal ground pin is provided.

Frequency Response for :T5CP3 'WO12802'



HIGH TECH, INC.

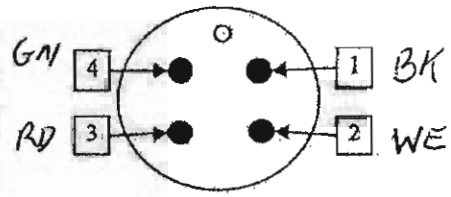
21120 Johnson Road
Long Beach, MS 39560

Tel. (228) 868-6632
Fax (228) 868-6645
hightechinc@att.net

299/1/57 Hydrophone Information 03/04/13
Model# HTI-90-U/Diff
Connector: Subconn IL-4-M & DLSA-M

Connector Pinout

Pin 1	+12VDC
Pin 2	12VDC Return / Signal Gnd
Pin 3	Signal + Output
Pin 4	Signal - Output



Test Data

Serial Number	Hydrophone Sensitivity dB re: 1V/uPa	Current mA
299463	-174.8	2.22
299464	-174.1	2.23
299465	-173.9	2.21
299466	-174.2	2.24
299467	-174.0	2.22
299468	-174.5	2.23
299469	-174.4	2.2
299470	-174.6	2.22
AVG	**-174.3**	**2.22**
VAR	**0.1**	**0.00**
STD	**0.3**	**0.01**
MAX	**-173.9**	**2.24**
MIN	**-174.8**	**2.20**
DIF	**0.9**	**0.04**

5m cable

Sensitivity was measured using the comparison method
Reference hydrophone = **999901**
Measurements traceable to USRD Newport, RI

Hydrophones listed on this page:
- Leaked less than 0.1uA @ 27VDC after 1hr @ 100PSI hydrostatic pressure
- Passed shield integrity test
- Have the same Polarity Response

BSS 2/28/13

Voltage	12VDC
Preamp Mode	Voltage
Source Capacitor	800pF
Termination Resistor	-

Expected Gain	12dB
Response High (-3dB)	20kHz
Response Low (-3dB)	2Hz

	Gain (dB)								
Preamp#	2Hz	5Hz	50Hz	100Hz	1KHz	5KHz	10KHz	20KHz	30KHz
1	9.62	11.83	12.42	12.42	12.42	12.42	12.43	12.44	12.47
2	9.60	11.83	12.43	12.44	12.44	12.44	12.44	12.46	12.49
3	9.55	11.81	12.42	12.42	12.42	12.42	12.43	12.44	12.47
4	9.57	11.80	12.42	12.43	12.43	12.43	12.43	12.45	12.48
5	9.56	11.83	12.42	12.42	12.42	12.42	12.43	12.44	12.47
6	9.54	11.84	12.41	12.42	12.42	12.42	12.42	12.44	12.47
7	9.57	11.83	12.43	12.43	12.43	12.43	12.44	12.45	12.48
8	9.68	11.84	12.41	12.42	12.42	12.42	12.42	12.44	12.47
AVG	9.59	11.82	12.42	12.43	12.43	12.43	12.43	12.45	12.47
VAR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STD	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
MAX	9.68	11.84	12.43	12.44	12.44	12.44	12.44	12.46	12.49
MIN	9.54	11.80	12.41	12.42	12.42	12.42	12.42	12.44	12.47
DIF	0.14	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.02

	Phase (deg)								
Preamp#	2Hz	5Hz	50Hz	100Hz	1KHz	5KHz	10KHz	20KHz	30KHz
1		-159.7	-177.9	-179.0	179.9	178.9	177.8	175.6	173.4
2		-159.5	-177.8	-179.0	179.9	178.9	177.8	175.6	173.4
3		-159.9	-177.9	-179.0	179.8	178.9	177.8	175.5	173.4
4		-159.7	-177.9	-179.0	179.9	178.9	177.8	175.6	173.4
5		-159.7	-177.9	-179.0	179.9	178.9	177.8	175.6	173.4
6		-159.6	-177.9	-179.0	179.9	178.9	177.8	175.6	173.4
7		-159.4	-177.8	-179.0	179.9	178.9	177.8	175.6	173.4
8		-159.9	-177.9	-179.0	179.9	178.9	177.8	175.5	173.4
AVG		-159.7	-177.9	-179.0	179.8	178.9	177.8	175.6	173.4
VAR		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STD		0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAX		-159.4	-177.8	-179.0	179.9	178.9	177.8	175.6	173.4
MIN		-159.9	-177.9	-179.0	179.8	178.9	177.8	175.5	173.4
DIF		0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DM24 CALIBRATION

WORKS ORDER:12801 **DIGITISER SERIAL NUMBER:**A4272

SYSTEM ID:4272 CPLD:A0.E1
UNIT ID:VEL0, ACC0 BOOTLOADER:MK3BOOT302.IMG
OUTPUT DATA FORMAT:GCF DSP SOFTWARE:DSP1090.BIN
BAUD RATE: 115200 SYSTEM: DMNET107b10.IMG

VELOCITY CHANNELS

Channel:	VEL0Z2	Vertical	3.234 µV/Count
	VEL0N2	North/South	3.226 µV/Count
	VEL0E2	East/West	3.226 µV/Count
	ACC0Z2	Vertical	3.219 µV/Count
	ACC0N2	North/South	3.234 µV/Count
	ACC0E2	East/West	3.231 µV/Count

MASS POSITION CHANNELS

Sample Rate: 4 samples/sec (Default)

Channel:	VEL0M8	Vertical	291.33 µV/Count
	VEL0M9	North/South	291.83 µV/Count
	VEL0MA	East/West	290.95 µV/Count

CAL SIGNAL MONITOR

VEL0X2/ VEL0C2 3.225 µV/Count

GPS RECEIVER

PWM: 8000 Counts
At Temperature Reading: 23°C

POWER CONSUMPTION

Digitiser Power Consumption	80mA @ 12v
GPS Power Consumption	28mA @ 12v

AUXILIARY CHANNELS

Sample Rate: 4 samples/sec (Default)

Channel:		
	VEL0MB	291.08 μV/Count
	VEL0MC	290.40 μV/Count
	VEL0MD	291.57 μV/Count
	VEL0ME	290.93 μV/Count
	VEL0MF	290.71 μV/Count

National
Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

National Oceanography Centre
University of Southampton Waterfront Campus
European Way, Southampton SO14 3ZH
United Kingdom

Pressure Test Lab +44 (0) 23 8059 6309
http://noc.ac.uk

Date: 30/10/13

Purchase Order; 29508

HYDROSTATIC TEST REPORT

Company: Guralp Systems Limited

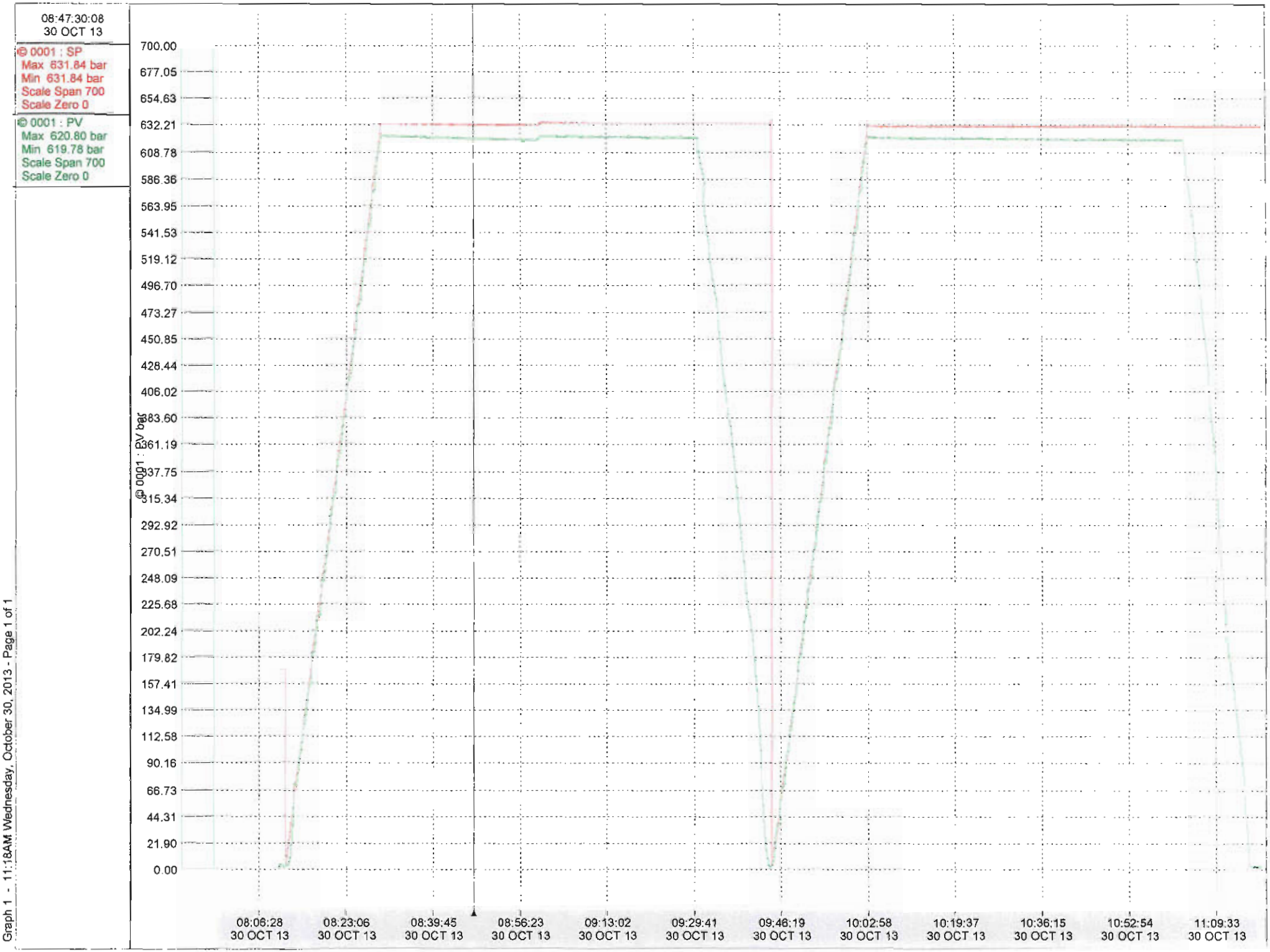
Address: 3 Midas House
Calleva Park
Aldermaston
Reading
RG7 8EA

Equipment: 1 x ITOBS Sphere
Serial No; 58328-00001

Schedule: 620 bar hold for 1 hour, 2 cycles

Comments: No visual signs of leaks or damage.

Andy Staszkiewicz
023 8059 6309


08:47:30:08
30 OCT 13
0001 : SP
Max 631.84 bar
Min 631.84 bar
Scale Span 700
Scale Zero 0
0001 : PV
Max 620.80 bar
Min 619.78 bar
Scale Span 700
Scale Zero 0
700.00
677.05
654.63
632.21
608.78
586.36
563.95
541.53
519.12
496.70
473.27
450.85
428.44
406.02
383.60
361.19
337.75
315.34
292.92
270.51
248.09
225.68
202.24
179.82
157.41
134.99
112.58
90.16
66.73
44.31
21.90
0.00
0001 : PV bar
08:06:28 30 OCT 13
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08:39:45 30 OCT 13
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10:52:54 30 OCT 13
11:09:33 30 OCT 13
Graph 1 - 11:18AM Wednesday, October 30, 2013 - Page 1 of 1