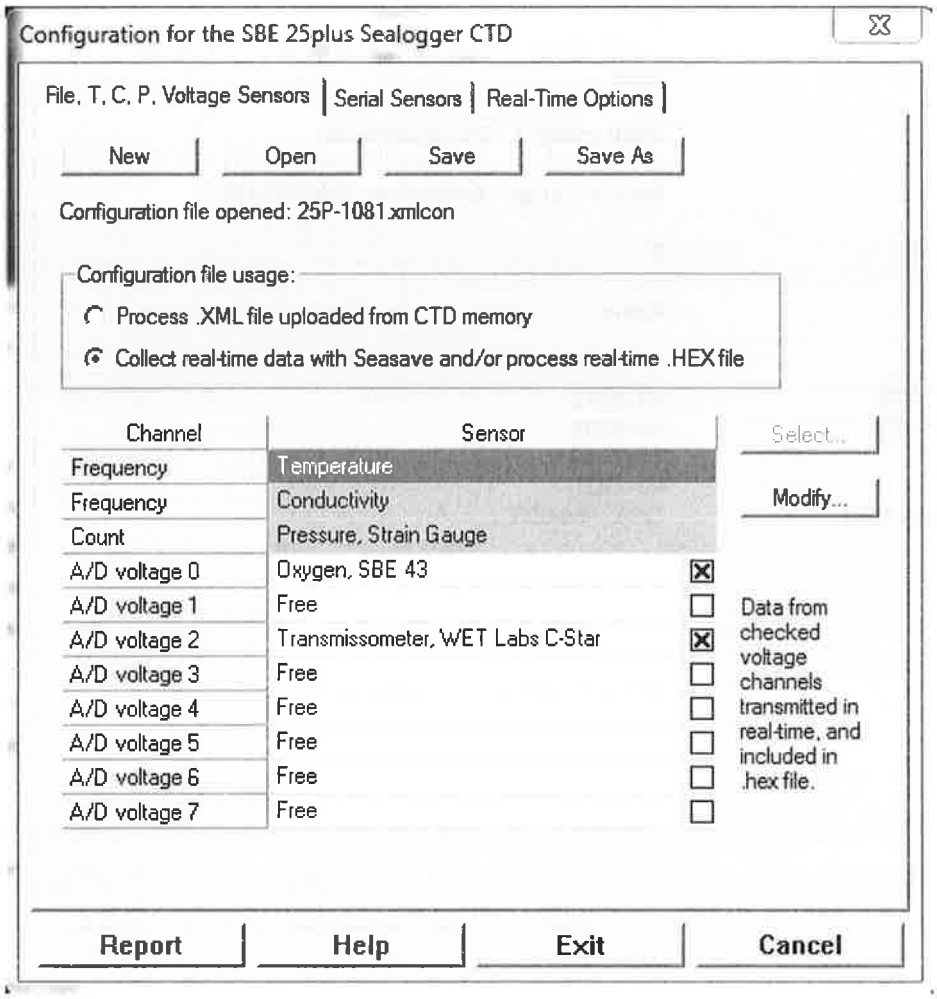
SYSTEM CONFIGURATION

Model SBE 25plus	**S/N 25-1081**
Instrument Type	**SBE 25plus Sealogger**
Firmware Version	**1.0**
Console Baud Rate	**9600 baud, 8 data bits, 1 stop bit, and no parity.**
Memory	**2GB**
Housing	**6800 meter (7075 Aluminum)**
Pressure Sensor	**Strain Gauge: 2000 dbar, S/N 3613101**
Number of Voltages Sampled:	**2**
Serial RS-232C Sensor	**None**
Temperature Sensor (SBE 3F)	**03-5843**
Conductivity Sensor (SBE 4C)	**04-4394**
Pump (SBE 5)	**05-7920**
Oxygen (SBE43)	**43-2935**
Transmissometer (Wet Labs CST)	**CST-1694DR**

SEASOFT CONFIGURATION:

The settings for the configuration of your instrument as delivered are documented below:



Sea-Bird Electronics, Inc.

13431 NE 20th Street, Bellevue, WA 98005-2010 USA

Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com

SENSOR SERIAL NUMBER: 1081
CALIBRATION DATE: 19-Nov-14

SBE 25plus PRESSURE CALIBRATION DATA
FSR: 2900 psia S/N 3613101

COEFFICIENTS:

PA0 =	3.858592e+000	PTCA0 =	8.409078e+006
PA1 =	5.549117e-004	PTCA1 =	5.389669e+002
PA2 =	-6.304879e-013	PTCA2 =	-9.456861e+000
PTEMPA0 =	-6.313844e+001	PTCB0 =	2.525163e+001
PTEMPA1 =	5.355101e+001	PTCB1 =	2.125000e-003
PTEMPA2 =	-5.212054e-001	PTCB2 =	0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE PSIA	INST OUTPUT	THERMISTOR OUTPUT	COMPUTED PRESSURE	ERROR %FS
14.60	8435768.0	1.6	14.64	0.00
614.42	9519909.0	1.6	614.37	-0.00
1214.40	10607441.0	1.6	1214.49	0.00
1714.39	11515516.0	1.6	1714.43	0.00
2314.37	12607745.0	1.6	2314.38	0.00
2914.33	13702625.0	1.6	2914.26	-0.00
2314.28	12607773.0	1.6	2314.35	0.00
1714.38	11515531.0	1.6	1714.38	-0.00
1214.39	10607318.0	1.6	1214.35	-0.00
614.46	9519883.0	1.6	614.29	-0.01
14.59	8435885.0	1.6	14.66	0.00

THERMAL CORRECTION

TEMP ITS90	THERMISTOR OUTPUT	INST OUTPUT
32.50	1.82	8437180.69
29.00	1.75	8437177.78
24.00	1.65	8436943.40
18.50	1.55	8436296.75
15.00	1.48	8435603.19
4.50	1.28	8431869.01
1.00	1.21	8430019.14

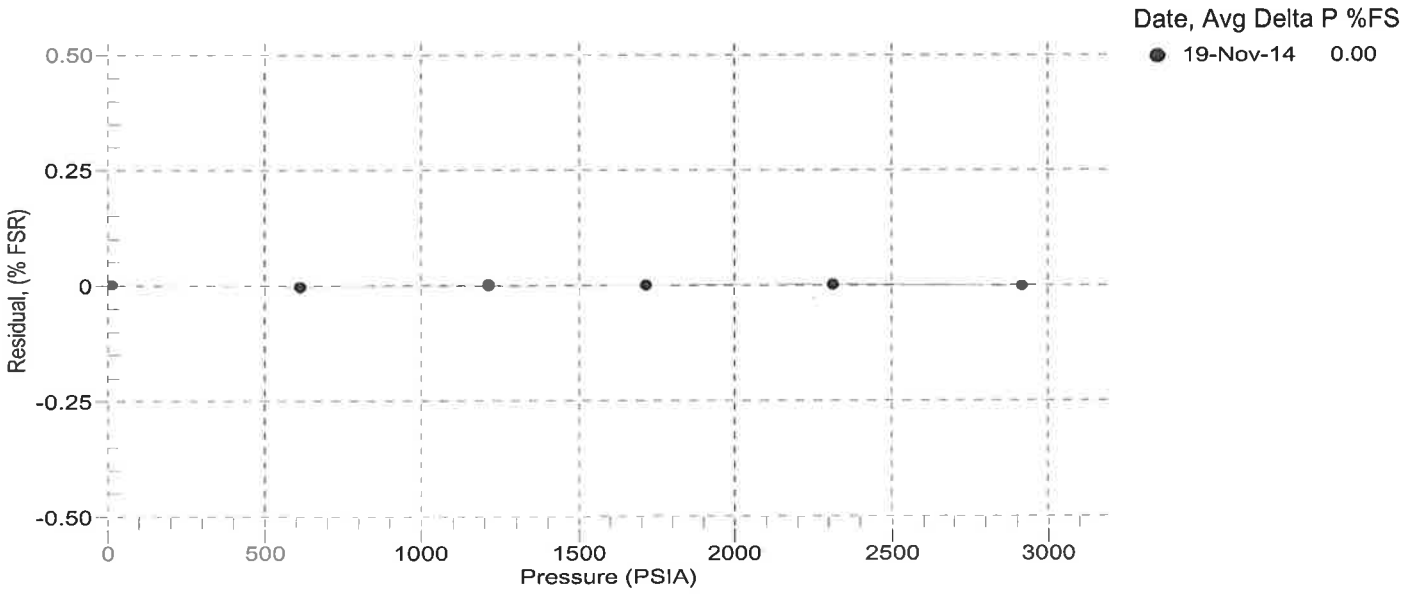
TEMP(ITS90)	SPAN(mV)
-5.00	25.24
35.00	25.33

y = thermistor output; $t = PTEMPA0 + PTEMPA1 * y + PTEMPA2 * y^2$

$x = \text{pressure output} - PTCA0 - PTCA1 * t - PTCA2 * t^2$

$n = x * PTCB0 / (PTCB0 + PTCB1 * t + PTCB2 * t^2)$

$\text{pressure (psia)} = PA0 + PA1 * n + PA2 * n^2$



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Email: seabird@seabird.com

Pressure Test Certificate

Test Date: **11/18/14**

Description: **SBE-25Plus SeaLogger CTD**

Sensor Information:

Model Number: **25P**

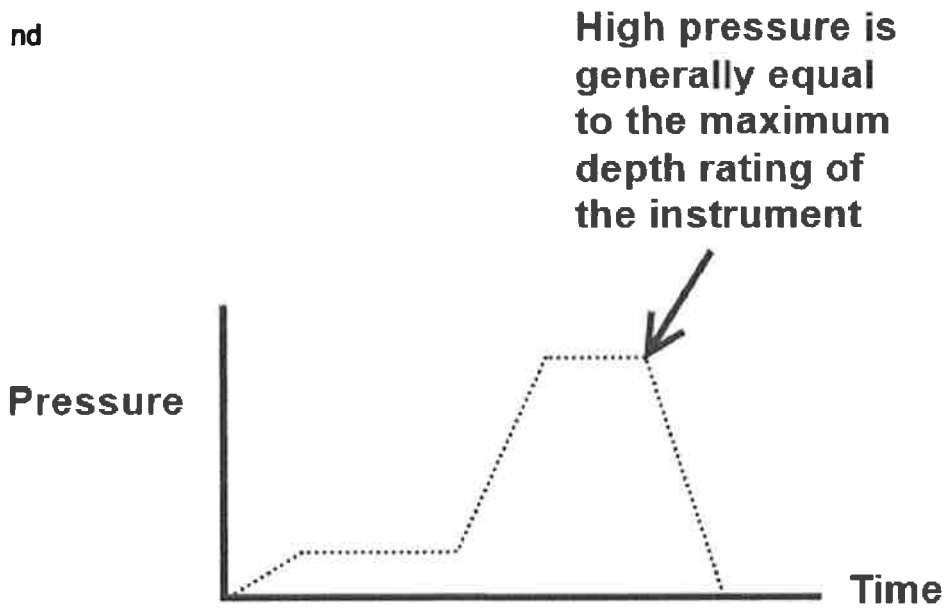
Serial Number: **1081**

Pressure Test Protocol:

Low Pressure Test:	**40**	PSI	Held For:	**15**	Minutes
High Pressure Test:	**2900**	PSI	Held For:	**15**	Minutes

Passed Test: **Yes**

Tested By: **nd**



Typical Test Profile

Sea-Bird Electronics, Inc.

13431 NE 20th Street, Bellevue, WA 98005-2010 USA

Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com

SENSOR SERIAL NUMBER: 5843
CALIBRATION DATE: 20-Nov-14

SBE 3 TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

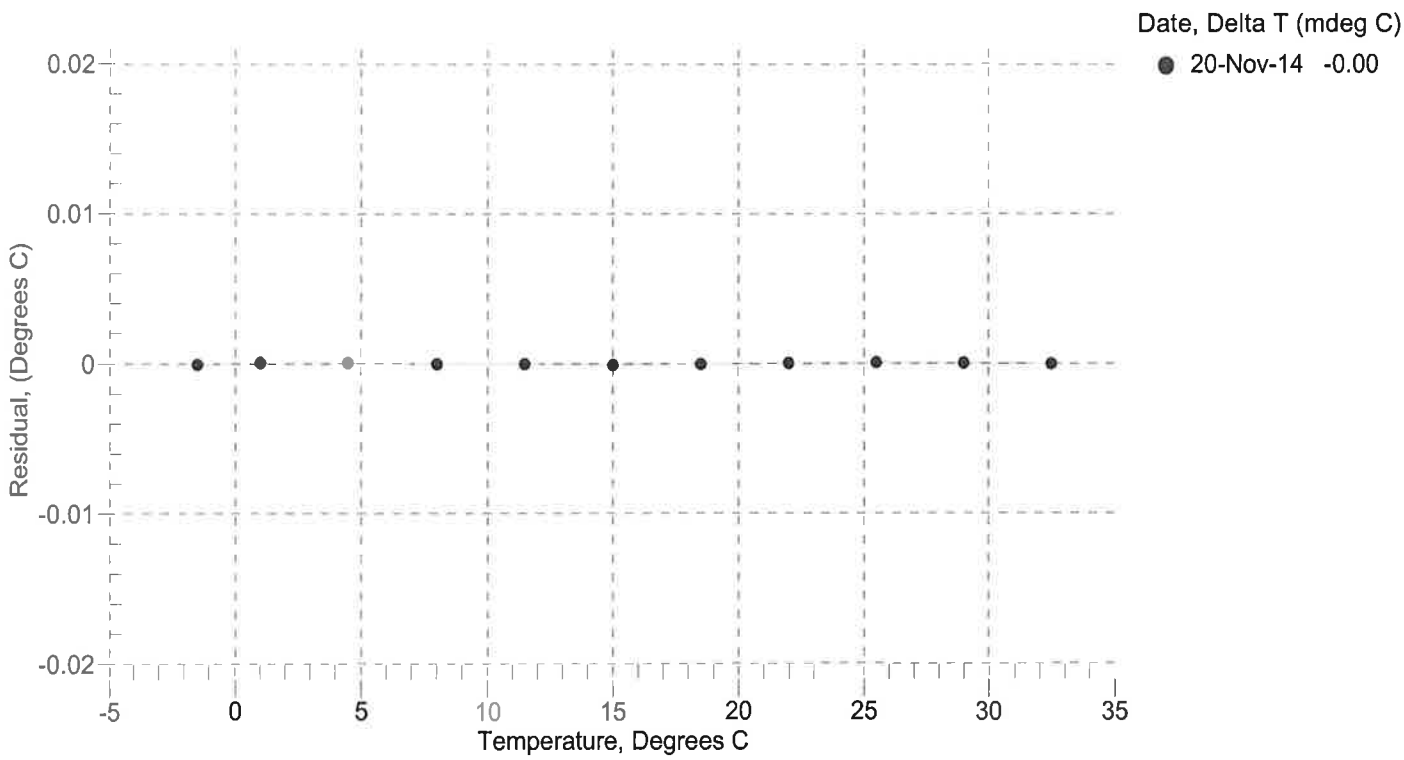
ITS-90 COEFFICIENTS:

```
g =  4.30846337e-003
h =  6.27537193e-004
i =  1.86810579e-005
j =  1.19438114e-006
f0 =  1000.0
```

BATH TEMP (ITS-90)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
-1.5000	2798.258	-1.5001	-0.00006
1.0000	2961.516	1.0001	0.00008
4.5000	3201.528	4.5000	0.00004
8.0000	3455.281	8.0000	-0.00002
11.4999	3723.172	11.4999	-0.00001
15.0000	4005.607	14.9999	-0.00006
18.4999	4302.948	18.4999	-0.00002
22.0000	4615.599	22.0000	0.00003
25.5000	4943.895	25.5001	0.00005
29.0000	5288.198	29.0000	0.00001
32.4999	5648.851	32.4999	-0.00003

Temperature ITS-90 = $1/\{ g + h[ln(f_0/f)] + i[ln^2(f_0/f)] + j[ln^3(f_0/f)]\} - 273.15$ (°C)

Residual = instrument temperature - bath temperature



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Email: seabird@seabird.com

SBE Pressure Test Certificate

Test Date: **8/21/2012** Description **SBE-3 Temperature Sensor**

SBE Sensor Information:

Model Number: **03**
Serial Number: **5843**

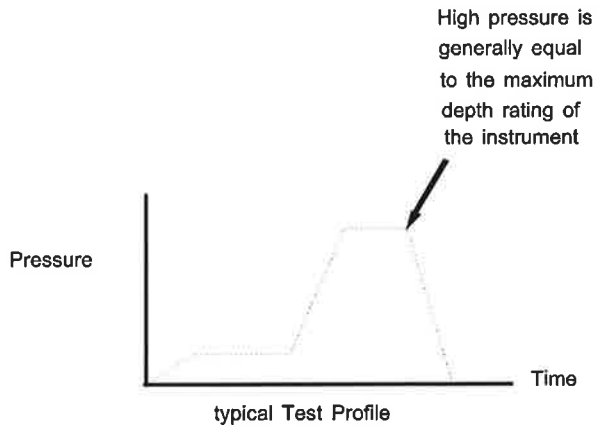
Pressure Test Protocol:

Low Pressure Test: **40** PSI Held For **15** Minutes

High Pressure Test: **10000** PSI Held For **15** Minutes

Passed Test: ☑

Tested By: nd



typical Test Profile

Sea-Bird Electronics, Inc.

13431 NE 20th Street, Bellevue, WA 98005-2010 USA

Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com

SENSOR SERIAL NUMBER: 4394
CALIBRATION DATE: 05-Nov-14

SBE 4 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g =  -9.93595143e+000
h =   1.35024429e+000
i =  -2.94175690e-003
j =   2.72103781e-004
```

```
CPcor = -9.5700e-008 (nominal)
CTcor =  3.2500e-006 (nominal)
```

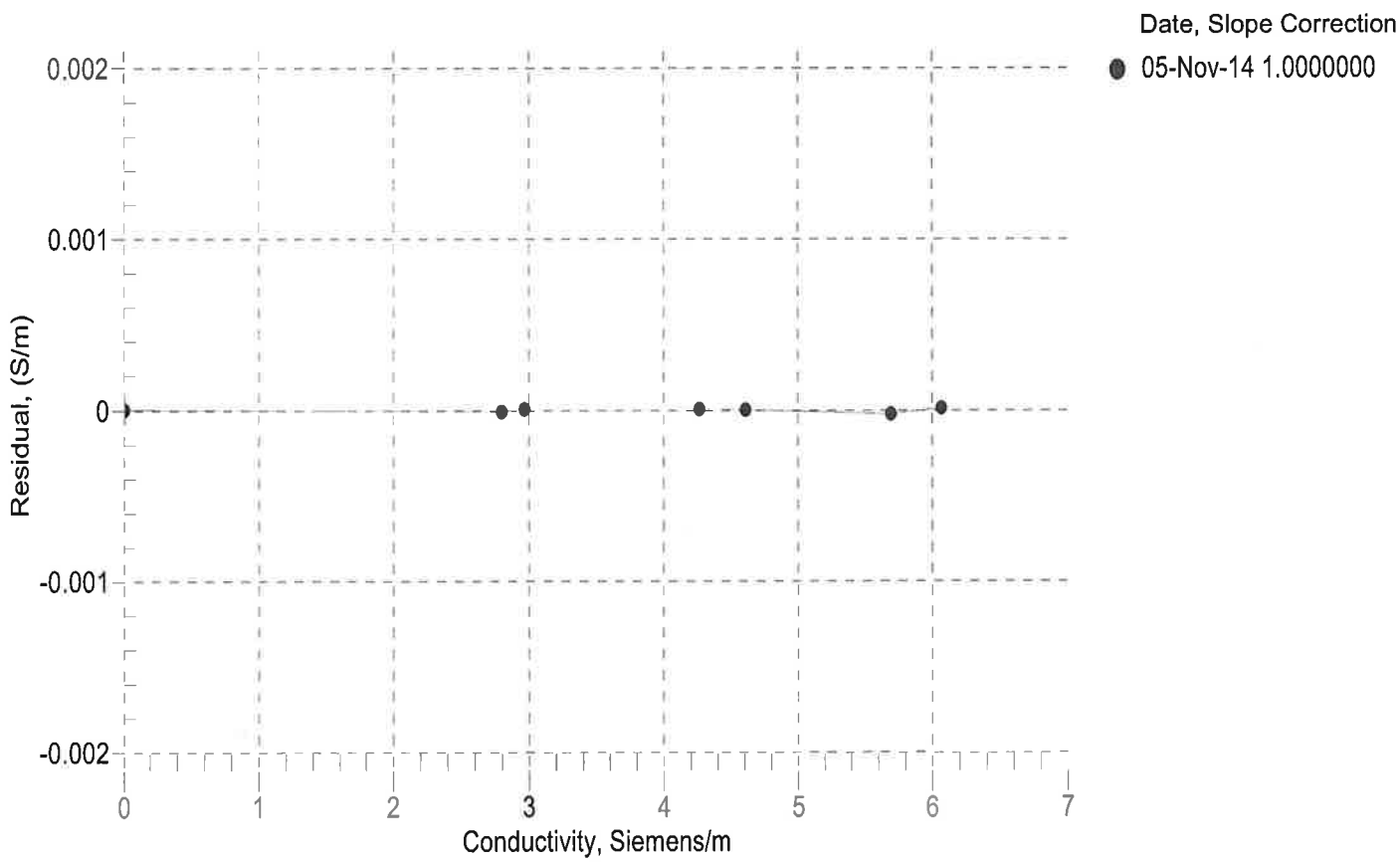
BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
0.0000	0.0000	0.00000	2.71871	0.00000	0.00000
-1.0000	34.7384	2.79889	5.31541	2.79888	-0.00001
0.9999	34.7425	2.97025	5.43420	2.97026	0.00001
14.9999	34.7515	4.26449	6.25845	4.26450	0.00001
18.4999	34.7558	4.61120	6.46127	4.61120	0.00000
28.9999	34.7606	5.69421	7.05691	5.69419	-0.00002
32.4999	34.7592	6.06715	7.25056	6.06716	0.00001

f = INST FREQ / 1000.0

Conductivity = $(g + h * f^2 + i * f^3 + j * f^4) / (1 + \delta * t + \varepsilon * p)$ Siemens / meter

t = temperatur e[°C)]; p = pressure[decibars]; δ = CTcor; ε = CPcor;

Residual = instrument conductivity - bath conductivity



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www.seabird.com

Phone: (425) 643-9866
Fax: (425) 643-9954
Email: seabird@seabird.com

Pressure Test Certificate

Test Date: **05/15/14**

Description: **SBE-4 Conductivity Sensor**

Sensor Information:

Model Number: **04**

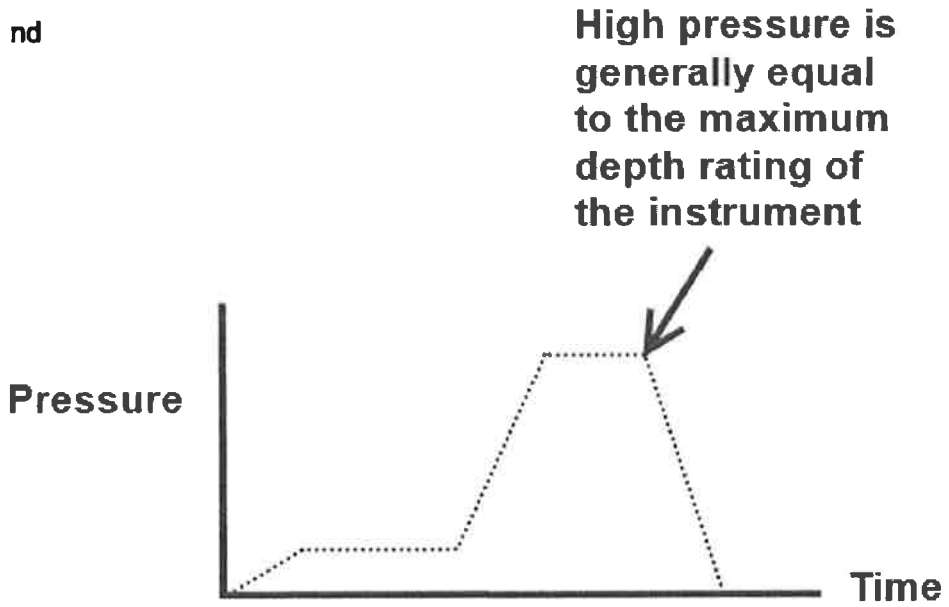
Serial Number: **4394**

Pressure Test Protocol:

Low Pressure Test: **40**	PSI	Held For:	**15**	Minutes
High Pressure Test: **10000**	PSI	Held For:	**15**	Minutes

Passed Test: **Yes**

Tested By: **nd**



Typical Test Profile

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Email: seabird@seabird.com

Pressure Test Certificate

Test Date: **05/29/14**

Description: **SBE-43 DO Sensor**

Sensor Information:

Model Number: **43**

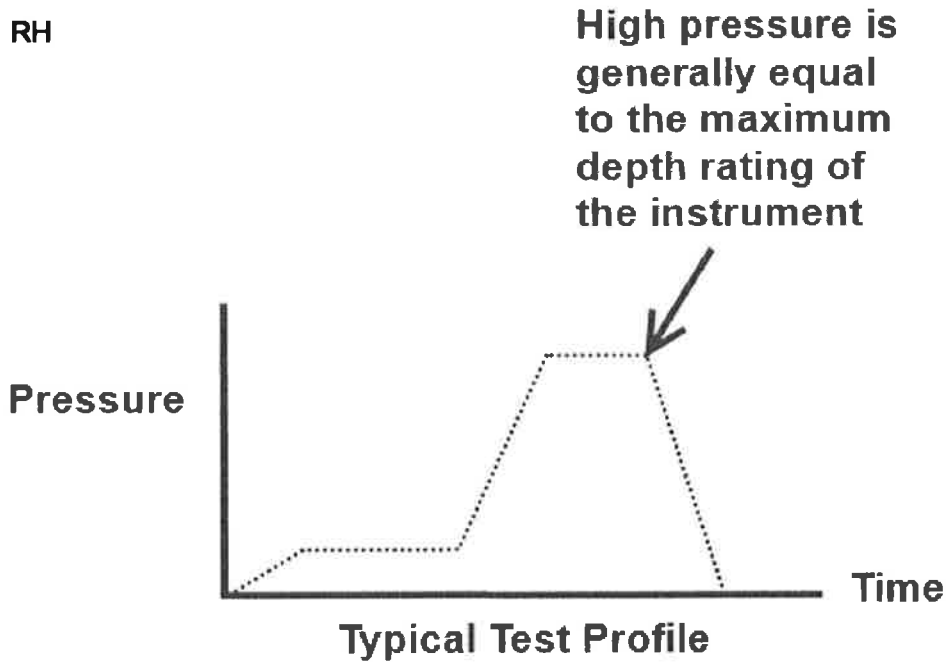
Serial Number: **2935**

Pressure Test Protocol:

Low Pressure Test:	**40**	PSI	Held For:	**15**	Minutes
High Pressure Test:	**10000**	PSI	Held For:	**15**	Minutes

Passed Test: **Yes**

Tested By: **RH**



Typical Test Profile

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13431 NE 20th Street, Bellevue, WA 98005-2010 USA

Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com

SENSOR SERIAL NUMBER: 2935
CALIBRATION DATE: 18-Nov-14

SBE 43 OXYGEN CALIBRATION DATA

COEFFICIENTS:
Soc = 0.3937
Voffset = -0.5300
Tau20 = 1.42

A = -3.5664e-003
B = 2.0518e-004
C = -3.0061e-006
E nominal = 0.036

NOMINAL DYNAMIC COEFFICIENTS
D1 = 1.92634e-4
D2 = -4.64803e-2
H1 = -3.300000e-2
H2 = 5.00000e+3
H3 = 1.45000e+3

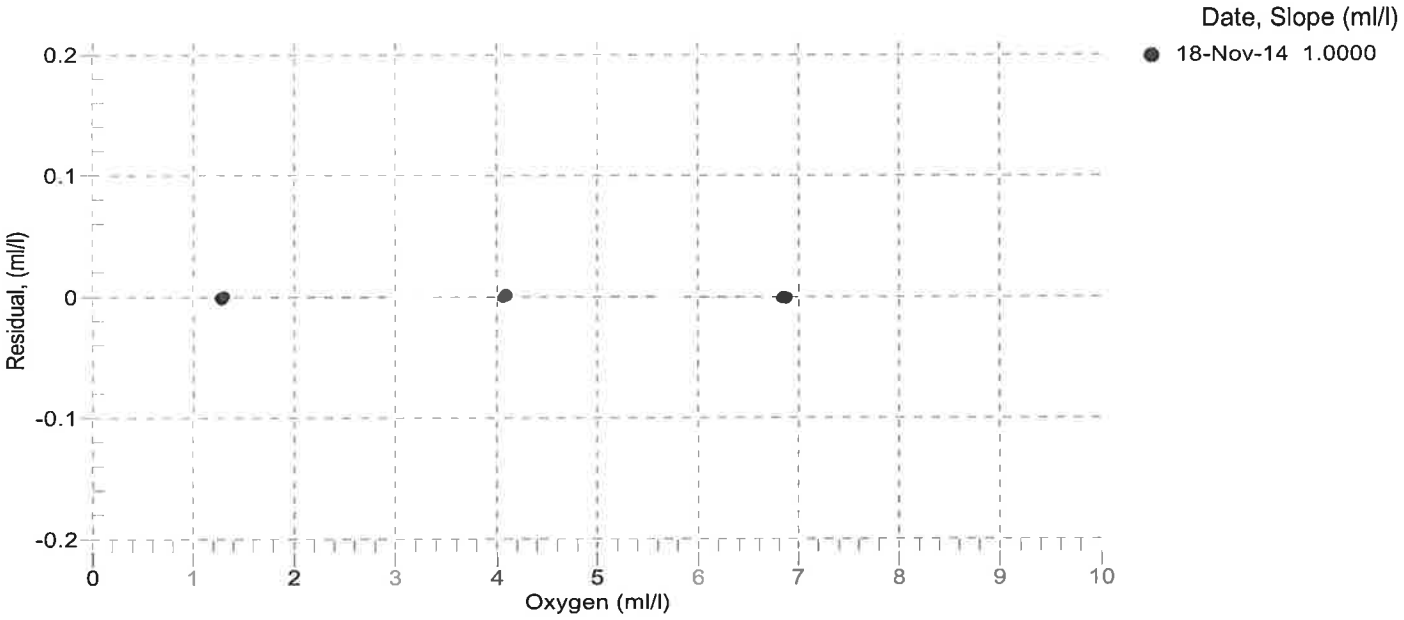
BATH OX (ml/l)	BATH TEMP (ITS-90)	BATH SAL (PSU)	INSTRUMENT OUTPUT (VOLTS)	INSTRUMENT OXYGEN (ml/l)	RESIDUAL (ml/l)
1.28	5.96	0.00	0.907	1.27	-0.00
1.28	2.00	0.00	0.868	1.28	-0.00
1.29	12.00	0.00	0.970	1.28	-0.00
1.30	20.00	0.00	1.055	1.30	-0.00
1.31	26.00	0.00	1.118	1.31	0.00
1.31	30.00	0.00	1.161	1.31	0.00
4.06	2.00	0.00	1.602	4.06	-0.00
4.07	5.99	0.00	1.734	4.07	0.00
4.08	12.00	0.00	1.932	4.09	0.00
4.09	20.00	0.00	2.184	4.09	0.00
4.09	26.00	0.00	2.373	4.09	0.00
4.09	30.00	0.00	2.502	4.09	0.00
6.83	30.00	0.00	3.819	6.82	-0.00
6.84	2.00	0.00	2.338	6.84	0.00
6.85	26.00	0.00	3.618	6.85	-0.00
6.86	6.00	0.00	2.560	6.86	0.00
6.87	12.00	0.00	2.887	6.87	-0.00
6.88	20.00	0.00	3.314	6.88	-0.00

Oxygen (ml/l) = Soc * (V + Voffset) * (1.0 + A * T + B * T^2+ C * T^3) * OxSol(T,S) * exp(E * P / K)

V = voltage output from SBE43, T = temperature [deg C], S = salinity [PSU], K = temperature [deg K]

OxSol(T,S) = oxygen saturation [ml/l], P = pressure [dbar]

Residual = instrument oxygen - bath oxygen



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SBE 5T SUBMERISIBLE PUMP CONFIGURATION SHEET

Serial Number:	**05-7920**	MRP PN:	**05T.22120**
Pressure Rating:	**10,500m**	Test Date:	**11/04/2014**
Housing Type:	**Titanium**		

Pittman Motor Type

P/N 3711B112-R2, 3.55 ohms nominal (For applications up to 4500 RPM MAX)
3 Winding, standard voltage input (jump P5 to P6)

Pump Specifications:

Motor speed with V_{IN} at 12.0V, no load:	**2003.85**	RPM	TP1=	**66.73**	Hz
Motor speed with V_{IN} at 12.0V, 300mA load:	**2001.97**	RPM	TP1=	**66.80**	Hz
Motor Dropout Voltage:	**9.10**	VDC	Speed=	**2000**	RPM
Pump submerged, no load, V_{IN} 12VDC:	**100.00**	mA			

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Pressure Test Certificate

Test Date: **11/05/14**

Description: **SBE-5T Submersible Pump**

Sensor Information:

Model Number: **5T**

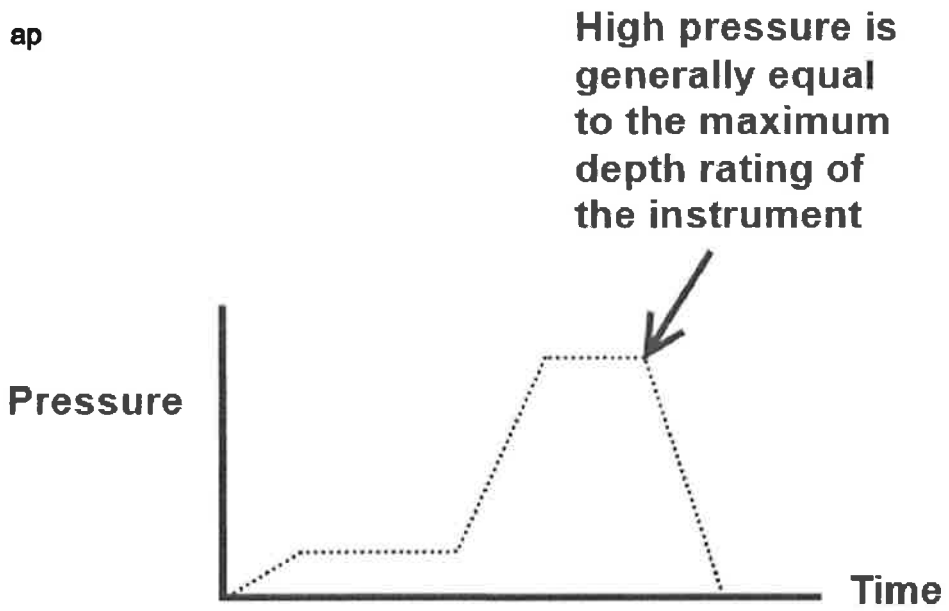
Serial Number: **7920**

Pressure Test Protocol:

Low Pressure Test:	**40**	PSI	Held For:	**15**	Minutes
High Pressure Test:	**10000**	PSI	Held For:	**15**	Minutes

Passed Test: **Yes**

Tested By: **ap**



Typical Test Profile

PO Box 518
620 Applegate St.
Philomath, OR 97370

WET Labs

(541) 929-5650
Fax (541) 929-5277
www.wetlabs.com

C-Star Calibration

Date 11.25.14 S/N# CST-1694DR Pathlength 25 cm

	Analog output	Digital output
V_d	0.006 V	0 counts
V_{air}	4.830 V	15867 counts
V_{ref}	4.701 V	15443 counts

Temperature of calibration water	20.4 ℃
Ambient temperature during calibration	22.0 ℃

Relationship of transmittance (Tr) to beam attenuation coefficient (c), and pathlength (x, in meters): $\mathbf{Tr = e^{-cx}}$

To determine beam transmittance: $\mathbf{Tr = (V_{sig} - V_{dark}) / (V_{ref} - V_{dark})}$

To determine beam attenuation coefficient: $\mathbf{c = -1/x * \ln (Tr)}$

V_d Meter output with the beam blocked. This is the offset.
V_{air} Meter output in air with a clear beam path.
V_{ref} Meter output with clean water in the path.
Temperature of calibration water: temperature of clean water used to obtain V_{ref}.
Ambient temperature: meter temperature in air during the calibration.
V_{sig} Measured signal output of meter.

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CTD S/N 25-1081

TRANSMISSOMETER CALIBRATIONS S/N: CST-1694DR Date: 2-Dec-14

z	=	0.250	meters (transmissometer path length)
A0	=	4.830	(air calibration voltage from instrument manufacturer)
Y0	=	0.006	(blocked path voltage from instrument manufacturer)
W0	=	4.701	(voltage output in pure water from instrument manufacturer)
A1	=	4.807	(current [most recent] air voltage)
Y1	=	0.006	(current [most recent] blocked path voltage)
Tw	=	100%	(% transmission in pure water, **relative to water** – see application note 7)

M = (Tw / [W0 – Y0]) * (A0 - Y0) / (A1 - Y1)
= (100 / [4.701 - 0.006]) * (4.830 - 0.006) / (4.807 - 0.006)
M = 21.401

B = -M * Y1
B = -0.128

M and B are based on the factory calibrations in water and in air performed by the instrument manufacturer, as well as calibrations performed in air at Sea-Bird Electronics. The calibrations at Sea-Bird (A1 and Y1) are done to account for any drift in the instrument response from when it was calibrated at Wet Labs to when it was integrated with a CTD at Sea-Bird.

Enter these values of z, M, and B in the transmissometer calibration section of the configuration (.con) file using the Configure menu in SEASAVE or SBE Data Processing (in the SEASOFT-Win32 suite of programs) or using SEACON (in the SEASOFT-DOS suite of programs).

Note on Transmissometer Measurements Relative to Air:

Many optical oceanographers prefer reporting transmissometer measurements relative to water, because they are not based on (the currently accepted) values of Tw, which are subject to interpretation and may change in the future. Consequently, as of April 2004, Sea-Bird is calculating M and B relative to water, and indicating those values on the Calibration Sheet and in the configuration (.con) file. However, if desired, you can recalculate M and B relative to air, using the following value of Tw with the equations above, and input those values in the .con file.

Tw = 90.2% (% transmission in pure water for this transmissometer, relative to air)

Transmissometer wave length and color = 660 nm, red

Refer to the instrument manufacturer's users manual and Sea-Bird Electronics Application Note 7 for further information