

G3S GLIDER-FINAL PRODUCTION RECORD

Schematic Rev 1

SELECT ONE	X	1000M	350M	SPECIAL
CUSTOMER	OSU		CUST. ORDER NO.	R144265

NOTE: FILL IN ALL REQ'D DATA, NO EMPTY SPACES, NO DITTOS.

ASSY / PART DESCRIPTION		DWG #	REV	SERIAL #
GLIDER ASSY (FILL IN) PN "GLD-XXX-NFC"	GLD-0155-D-CSM1	NA	1	1138
SHALLOW FRONT PUMP (SELECT ONE)	N/A	NA	NA	NA
FWD SECTION ASSY (SELECT ONE)	ASSY 305685-1000	305685	C	788
ALTIMETER ASSY (SELECT ONE)	G-1414	G-1414	C	60871668
PAYLOAD BAY ASSY - Fill In	PLD-0122-CSM	NA	2	1667
STACK-ON BAY - Fill In	NA	NA	NA	NA
AFT SECTION	A311317-NFC	A311317-NFC	1	1148
AFT END CAP	ASSY 305654	305654	F	298
AFT TRAY	A311318-NFC	A311318-NFC	1	1152
PRESSURE TRANSDUCER	ASSY G-1312	3002	D	140052
RADOME FIN	ASSY 304376	304376	E	1597
THRUSTER ASSY	ASSY 302409	302409	F	457
Composite Hull, Fwd	ASSY G-1405-L	3135	K	3889
Composite Hull, Aft	ASSY G-1405-3	3135	K	3831
ASSY / PART DESCRIPTION		DWG #	VENDOR SERIAL #	
LITHIUM BATTERY, PITCH	Assy 305523	305523	C	232
LITHIUM BATTERY, AFT	Assy 305524	305524	C	184
ENERGY BAY BATTERY	NA	NA	NA	NA
BATTERY, EMERGENCY	306318-NFC	306318-NFC	A	NA
FREEWAVE	ASSY 301784	301784	D	713-0458
ASSY / PART DESCRIPTION		VENDOR SERIAL #		
IRIDIUM SIM CARD (CUSTOMER SUPPLIED)		8988169234003511326		
ARGOS ID# (CUSTOMER SUPPLIED)		Dec. 108719 Hex. 3F2D0F2		
ASSY / PART DESCRIPTION		VERSION #		
FIRMWARE, COTS TESTING		10.08		
HELIUM LEAK TEST				
☒ PASS ☐ FAIL Initial: <u>ARC</u> Date: <u>10/23/23</u>				
NOTES:				

Completion Date 10/23/23 Name (print) Adam Ritterbusch Initials ARC
 Inspection Date 10/23/27 Name (print) Riley Rutherford Initials RR
 Review Date 10/27/2023 Name (print) Thomas Lee Initials TL



This document and the information contained herein are proprietary to Teledyne Technologies, Inc. and may not be distributed outside of Teledyne Technologies, Inc., used, reproduced or disclosed without the prior, express, written consent of Teledyne Technologies, Inc.



Information included herein is controlled by the Export Administration Regulations (EAR) and may require an export license, license exception or other approval from the appropriate U.S. Government agency before being exported from the United States, reexported, transferred or retransferred to any non-U.S. person. Diversion contrary to U.S. law is prohibited.

GLIDER RELEASE RECORD

TO BE COMPLETED BEFORE FACTORY ACCEPTANCE TEST (FAT)
NOTE THESE STEPS ARE LISTED IN THEIR PREFERRED (NOT REQUIRED) ORDER

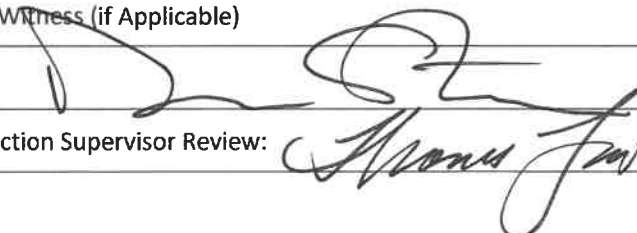
Step	Test description	Initials/Date	Pass/Fail
1	Glider Ballasting Procedure, Document 4095-GBP Spreadsheet Document 4095-GBPSH	DS 10/26/23	PASS
2	Confirm ballasting in tank (Only necessary if internal ballast was changed.)	DS 10/26/23	PASS
3	Document 4095-GVI Glider Visual Inspection		
4	Document 4095-FSI, 4095-FSI-L or 4095-FSI-L-G3S Glider Final Seal Inspection	DS 10/26/23	PASS
5	Document 301750-HLT Helium Leak Test	DS 10/26/23	PASS
6	Verify Flight Testing is Complete	DS 10/26/23	PASS

FACTORY ACCEPTANCE TEST (FAT) WITH CUSTOMER (IF REQUIRED)

1	Document 4095-FCP, 4095-FCP-L, 4095-FCP-L-G3S, or 4095-FCP-LBSG-G3s Functional Checkout Procedure	NA	—
2	(Optional, as requested by customer) Document 4095-CICT Customer Iridium Communications Test	NA	—
3	Gliders installed with Aanderaa optodes. Fill and install the rubber cover with fresh water (tap) and secure over the sensor.	NA	—

COMMENTS:

FINAL APPROVAL FOR PRODUCT SHIPPING

Customer Witness (if Applicable)	Date:
TWR : 	Date: 10/26/23
QA/ Production Supervisor Review: 	Date: 10/27/2023



Document #:	4095-GBPSH
Rev:	H
Date:	11/23/2022
ECO #:	14841

Glider Ballast Worksheet

Glider Name: Unit 1138
Ballasting Technician: Daniel Sciortino
Date: 10/23/2023
Glider Displacement (L): 62.4
H-Moment (mm): 5.82

TANK WATER:

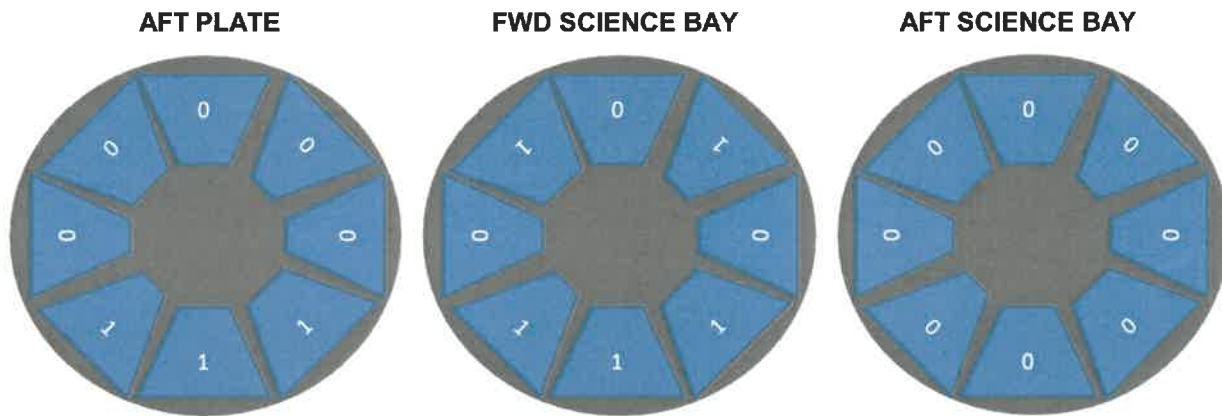
Temperature (°C):	19.60
Conductivity (S/m):	4.61
Salinity (psu):	33.80
Density (g/L°C):	1023.9503

TARGET WATER

Temperature (°C):	19.60
Conductivity (S/m):	4.61
Salinity (psu):	33.80
Density (g/L°C):	1023.9503

Pie Weight Locations

Pie weights can be removed or shifted around to indicate exact location. The quantity can also be changed to represent stacked pie weights.



Wing Rail Weight Locations

Shade in the location of wing rail weights.



Final Weight Configuration As Sent to Customer

Forward	Weight (g)	Payload	Weight (g)	Aft	Weight (g)
Port Bottle	143	Top FWD	400	Aft Bottle PORT	123
STBD Bottle	225	Bottom FWD	600	Aft Bottle STBD	163
Bottom Bottle		Top AFT		Aft Plate	600
		Bottom AFT			
Desiccant	118	Weight Bar			

Pond Wings:	Installed
Pinger Channel:	None

Ballasting The Slocum Glider (Spreadsheet)

Reference Ballasting Procedure 4095-GBP

- 1- Fill in all fields that are shaded in blue
- 2- Adjust weight by amount in yellow box to go from neutrally buoyant in tank to neutrally buoyant in target water
- 3- If you want to change anything, the password to unprotect the sheet is "glider"

Glider Name:	Unit 1138
Ballasted by:	Daniel Sciortino
Date:	10/23/2023
Glider Type:	G3 Deep (1000m)
FWD Hull	ASSY G-1405-L (Standard G3 - 20.25")
AFT Hull	ASSY G-1405-3 (21.75")
Primary Payload Bay	Standard MCBH PL Bay (10.8")
Secondary Payload Bay	
Mark III Aft End Cap	☐
Rockland Scientific Microrider	☐
SUNA Nitrate Sensor	☐
Sonar Dome Recovery System	☐
Pinger	None
Thruster	☒ Installed ☐ Dummy
Pick Point	☒
Insert Glider-Specific Volume Adjustment Here (L)	0.21
Base Glider Displacement:	10.40 Liters
Total Glider Displacement:	62.42 Liters

CTD, Optode

Perferred Volume Calculation Method (Please select from drop down menu)	Standard
	62.42

Tank Water		Target Water		Mass Change
Temperature and	19.6036 °C	19.6036 °C		0.0000 grams
(Density or				
Conductivity or	4.6054 s/m	4.6054 s/m		
Salinity)	pss	pss		
Calculated/given Salinity	33.7991 pss	33.7991 pss		
Calculated/given Density	1023.9503 g/L °C	1023.9503 g/L °C		0.0000 grams
		Total Mass Adjustment:		0.0000 grams
Drive Weight Material				
Configure 2 Drive Weights, Each Weighing (g)				
Battery Type:	Lithium	mass (kg)		
Pitch Configuration	Pitch	8.556		
Science/Energy Bay Configuration	N/A	NA		
Aft Configuration	Lithium Aft Pack	9.884		
Nose Configuration	1 pack nose	0.5944		

Note: This spreadsheet consists of 3 tabs. Complete "Ballast", "Worksheet", and the tab relevant to your particular glider.

Calculating H-moment (Roll Method)

- 1- Place well-ballasted glider in tank with wings.
- 2- Add a known amount of weight (~300 g) on one wing rail
- 3- Attach a spring scale to the glider on the opposite wing rail
- 4- Measure the weight change shown on the spring scale
- 5- Measure the angle of roll that the glider undergoes due to the addition of weight. For this step you can use an inclinometer (less accurate) or have the glider on and measure compass roll before and after weight addition and measure angle difference.
- 6- Remove the added weight, measure weight, and multiply by 0.912 if using Lead weight or by 0.875 if the weight used is stainless steel. This factor accounts for buoyancy provided by water on material.

Roll Start	0.0000	radians
Roll End	0.0000	radians
Weight on Spring	0.00	grams
Weight added on wing rail	0.00	grams
Angle of Rotation	0.00	degrees
Radius of Hull + Distance to Weight (radius of hull: 200m=107, 1000m=110)	107	mm
H-distance	#DIV/0!	mm
Mass of Pitch Battery	8.5560	kg
Total range of Pitch Battery (+/- in)	1.00	inches
Pitch Range	#DIV/0!	degrees

Calculating H-moment (Pitch Battery method)

- 1- Put battery position (c_batpos) at about .25, ensure front of glider is not touching bottom of tank- adjust as necessary
- 2- Record m_pitch and m_batpos
- 3- Put battery position at 0
- 4- Record m_pitch and m_batpos

Mass of Pitch Battery	8.5560	kg
Pitch_1	0.0122173	radians
Battery Position_1	-0.018565	inches
Pitch_2	-0.12566	radians
Battery Position_2	0.216374	inches
H-Distance	5.82	mm
Total range of Pitch Battery (+/- in)	1.00	inches
Pitch Range	74.43	degrees

Sign:

Date:

10/23/23

Certificate no: Oxygen Optode 4831_693_215561
FoillID: 1517

Product: Oxygen Optode 4831
Serial no: 693
Calibration date: 25.05.2023

2-POINT RECALIBRATION, OXYGEN OPTODE

This is to certify that this product has been calibrated and verified using the following reference equipment:

Reference Equipment	Serial
Calibration Bath Model Toho TM-005-P-A	12-K
Fluke 5615 PRT	Serial No. 802054 and Serial No. 849155
Fluke CHUB E-4	Serial No. A7C677
Reference sensor 4330	338

Specification

	O2 Concentration	Air Saturation	Temperature
Range	0-500 µM	0 - 120%	-5 to +40°C
Accuracy	< ±8µM or ±5% ¹⁾	±5% ²⁾	±0.03°C ³⁾
Resolution	< 1 µM	< 0.4%	0.01°C
Settling Time (63%)	< 25 seconds	< 25 seconds	< 2 seconds

1) Requires salinity compensation for salinity variations > 1mS/cm, and pressure compensation for pressure > 100meter

2) Within calibrated range 0 - 120% / 0 - 30°C

3) Within calibrated range 0 - 36°C for standard version and 0 - 30°C for multipoint version

Calibration points and readings:

	Air Saturated Water	Zero Solution (Na2SO3)
Phase reading (°)	32.06	63.39
Temperature reading (°C)	20.27	21.76
Air Pressure (hPa)	959.31	

Giving these coefficients

Index	0 (Offset)	1 (Slope)
ConcCoef	-5.517112E+00	1.068713E+00

With following settings

Index	0	1	2	3	4	5	6
SVUFoilCoef	3.57703E-03	1.51175E-04	2.80811E-06	2.33877E+02	-2.78781E-01	-5.76821E+01	4.53682E+00
PhaseCoef	-2.502000E+00	1.000000E+00	0.000000E+00	0.000000E+00			
TempCoef	2.535336E+01	-3.194119E-02	2.971491E-06	-4.334261E-09	0.000000E+00	0.000000E+00	
Salinity (mS/cm)	0.00						
Firmware Version	5.3.1						

Date:25.05.2023


Sr. Repair Technician



Sea-Bird Scientific
13431 NE 20th Street
Bellevue, WA 98005
USA

+1 425-643-9866
seabird@seabird.com
www.seabird.com

SENSOR SERIAL NUMBER: 0072
CALIBRATION DATE: 23-Jun-23

Slocum Payload CTD CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

g = -1.037743e+000
h = 1.677609e-001
i = -5.590358e-004
j = 7.045729e-005

CPcor = -9.5700e-008
CTcor = 3.2500e-006
WBOTC = 4.0092e-007

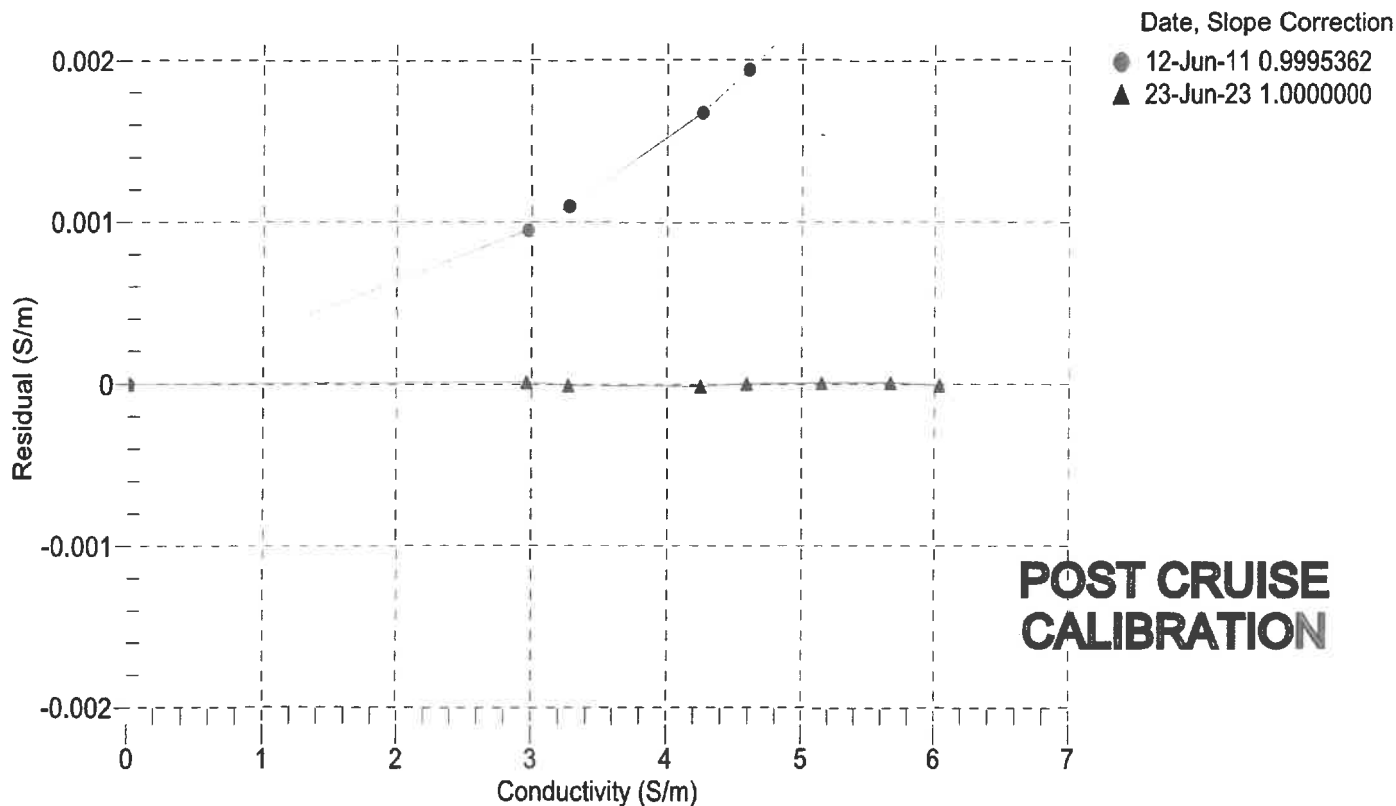
BATH TEMP (° C)	BATH SAL (PSU)	BATH COND (S/m)	INSTRUMENT OUTPUT (Hz)	INSTRUMENT COND (S/m)	RESIDUAL (S/m)
22.0000	0.0000	0.00000	2494.24	0.00000	0.00000
1.0000	34.6806	2.96547	4900.27	2.96548	0.00001
4.5000	34.6611	3.27152	5083.74	3.27151	-0.00001
15.0000	34.6198	4.25005	5629.70	4.25004	-0.00001
18.5000	34.6113	4.59410	5809.22	4.59410	0.00000
24.0000	34.6019	5.15025	6087.93	5.15026	0.00001
29.0000	34.5954	5.67020	6337.08	5.67020	0.00001
32.5000	34.5882	6.04070	6508.60	6.04069	-0.00001

$f = \text{Instrument Output(Hz)} * \sqrt{1.0 + \text{WBOTC} * t} / 1000.0$

t = temperature (°C); p = pressure (decibars); $\delta = \text{CTcor}$; $\epsilon = \text{CPcor}$;

Conductivity (S/m) = $(g + h * f^2 + i * f^3 + j * f^4) / (1 + \delta * t + \epsilon * p)$

Residual (Siemens/meter) = instrument conductivity - bath conductivity





Sea-Bird Scientific
13431 NE 20th Street
Bellevue, WA 98005
USA

+1 425-643-9866
seabird@seabird.com
www.seabird.com

SENSOR SERIAL NUMBER: 0072
CALIBRATION DATE: 15-Jun-23

Slocum Payload CTD PRESSURE CALIBRATION DATA
1450 psia S/N 3274632

COEFFICIENTS:

PA0 = 5.466727e-001
PA1 = 4.944059e-003
PA2 = -1.976850e-011
PTEMPA0 = -6.964140e+001
PTEMPA1 = 5.056916e-002
PTEMPA2 = -3.780204e-007

PTCA0 = 5.246615e+005
PTCA1 = 9.058771e+000
PTCA2 = -1.863133e-001
PTCB0 = 2.528963e+001
PTCB1 = -2.750000e-004
PTCB2 = 0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE (PSIA)	INSTRUMENT OUTPUT (counts)	THERMISTOR OUTPUT (volts)	COMPUTED PRESSURE (PSIA)	RESIDUAL (%FSR)	TEMP (°C)	THERMISTOR OUTPUT (volts)	INSTRUMENT OUTPUT (counts)
14.60	527621.8	1851.0	14.64	0.00	32.50	2051	527611.70
301.12	585582.8	1853.6	301.20	0.01	29.00	1980	527612.60
586.47	643444.0	1854.6	587.14	0.05	24.00	1878	527642.30
873.65	701448.6	1855.2	873.65	0.00	18.50	1766	527617.30
1159.99	759460.2	1856.0	1160.06	0.01	15.00	1695	527613.90
1443.87	816965.8	1857.0	1443.85	-0.00	4.50	1482	527523.10
1159.73	759380.2	1857.2	1159.67	-0.00	1.00	1412	527545.80
873.50	701421.2	1857.0	873.52	0.00			
587.81	643595.0	1857.2	587.89	0.01			
300.93	585477.4	1857.0	300.68	-0.02			
14.60	527617.2	1857.6	14.62	0.00			

TEMPERATURE (°C)	SPAN
-5.00	25.29
35.00	25.28

y = thermistor output (counts)

$$t = PTEMPA0 + PTEMPA1 * y + PTEMPA2 * y^2$$

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

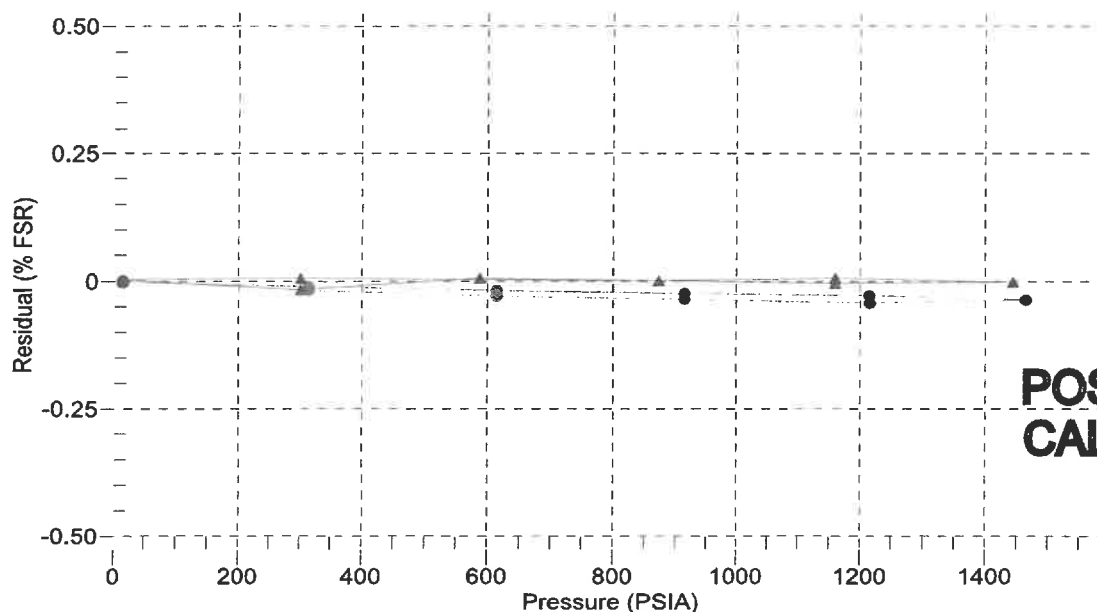
$$n = x * PTCB0 / (PTCB0 + PTCB1 * t + PTCB2 * t^2)$$

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

$$\text{Residual (\%FSR)} = (\text{computed pressure} - \text{true pressure}) * 100 / \text{Full Scale Range}$$

Date, Offset (%FSR)

● 09-Jun-11 -0.02
▲ 15-Jun-23 -0.00



**POST CRUISE
CALIBRATION**



Sea-Bird Scientific
13431 NE 20th Street
Bellevue, WA 98005
USA

+1 425-643-9866
seabird@seabird.com
www.seabird.com

SENSOR SERIAL NUMBER: 0072
CALIBRATION DATE: 23-Jun-23

Slocum Payload CTD TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

COEFFICIENTS:

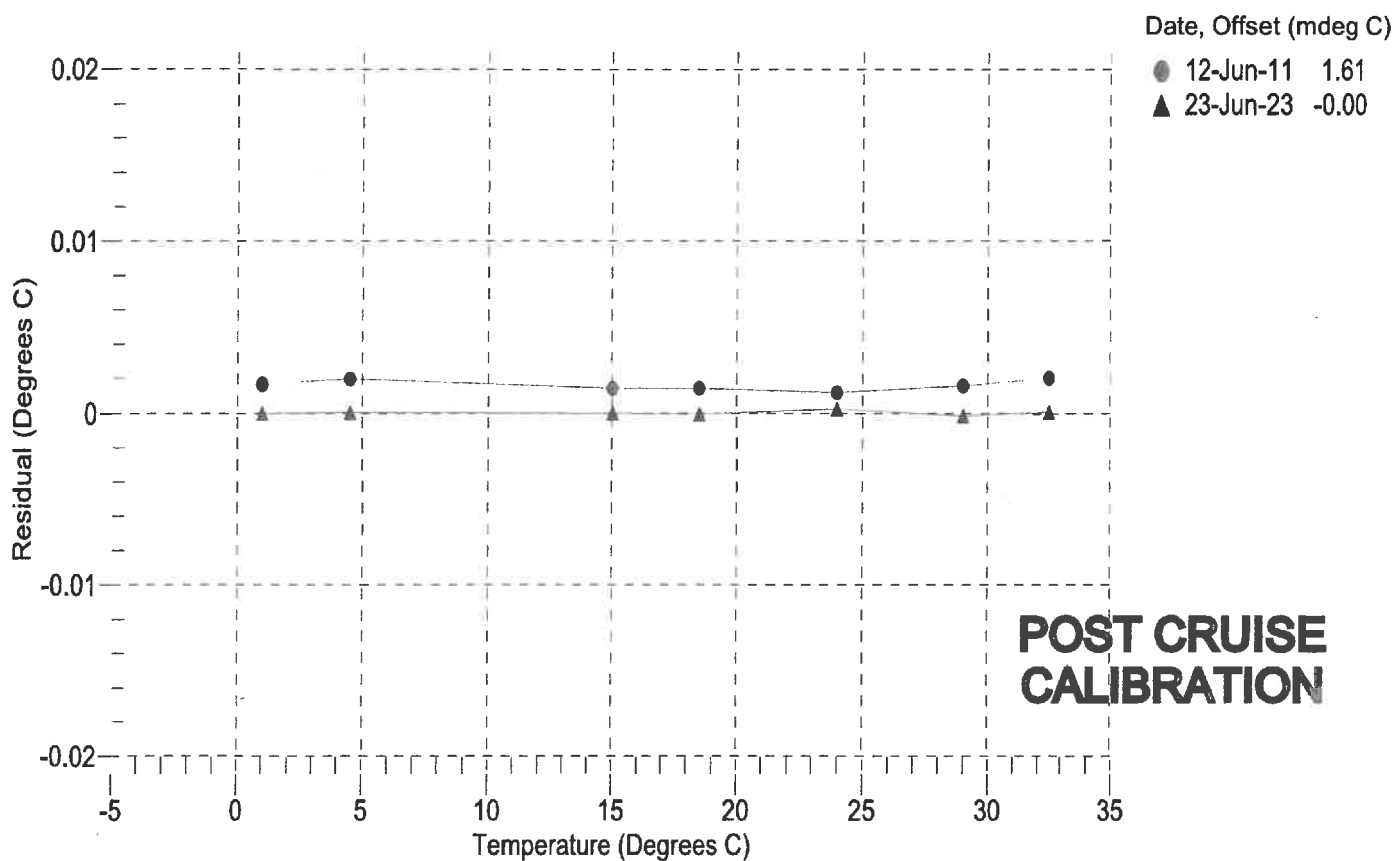
a0 = -1.481367e-004
a1 = 3.205445e-004
a2 = -5.660222e-006
a3 = 2.322090e-007

BATH TEMP (° C)	INSTRUMENT OUTPUT (counts)	INST TEMP (° C)	RESIDUAL (° C)
1.0000	572192.4	1.0000	-0.0000
4.5000	488914.8	4.5000	0.0000
15.0000	311083.3	15.0000	-0.0000
18.5000	269247.7	18.4999	-0.0001
24.0000	215871.0	24.0002	0.0002
29.0000	177683.6	28.9998	-0.0002
32.5000	155567.4	32.5001	0.0001

n = Instrument Output (counts)

Temperature ITS-90 (°C) = $1 / \{a_0 + a_1[\ln(n)] + a_2[\ln^2(n)] + a_3[\ln^3(n)]\} - 273.15$

Residual (°C) = instrument temperature - bath temperature



PO Box 518
620 Applegate St.
Philomath, OR 97370



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

ECO Chlorophyll Fluorometer Characterization Sheet

Date: 7/21/2023

S/N: FLBBCDSLC-8395

Chlorophyll concentration expressed in $\mu\text{g/l}$ can be derived using the equation:

$$\text{CHL } (\mu\text{g/l}) = \text{Scale Factor} * (\text{Output} - \text{Dark counts})$$

	Digital
Dark counts	46 counts
Scale Factor (SF)	0.0072 $\mu\text{g/l/count}$
Maximum Output	4130 counts
Resolution	1.0 counts
Ambient temperature during characterization	23.0 $^{\circ}\text{C}$

Dark Counts: Signal output of the meter in clean water with black tape over detector.

SF: Determined using the following equation: $\text{SF} = x \div (\text{output} - \text{dark counts})$, where x is the concentration of the solution used during instrument characterization. SF is used to derive instrument output concentration from the raw signal output of the fluorometer.

Maximum Output: Maximum signal output the fluorometer is capable of.

Resolution: Standard deviation of 1 minute of collected data.

The relationship between fluorescence and chlorophyll-a concentrations in-situ is highly variable. The scale factor listed on this document was determined using a mono-culture of phytoplankton (*Thalassiosira weissflogii*). The population was assumed to be reasonably healthy and the concentration was determined by using the absorption method. To accurately determine chlorophyll concentration using a fluorometer, you must perform secondary measurements on the populations of interest. This is typically done using extraction-based measurement techniques on discrete samples. For additional information on determining chlorophyll concentration see "Standard Methods for the Examination of Water and Wastewater" part 10200 H, published jointly by the American Public Health Association, American Water Works Association, and the Water Environment Federation.

PO Box 518
620 Applegate St.
Philomath, OR 97370



SEA-BIRD
SCIENTIFIC

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

Scattering Meter Calibration Sheet

1/0/1900

Wavelength: 700

S/N FLBBCDSLC-8395

Use the following equation to obtain either digital or analog "scaled" output values:

$$\beta(\theta_c) \text{ m}^{-1} \text{ sr}^{-1} = \text{Scale Factor} \times (\text{Output} - \text{Dark Counts})$$

• Scale Factor for 700 nm	=	1.830E-06 (m ⁻¹ sr ⁻¹)/counts
• Output	=	meter output counts
• Dark Counts	=	45 counts
Instrument Resolution	=	1.0 counts

Definitions:

- **Scale Factor:** Calibration scale factor, $\beta(\theta_c)/\text{counts}$. Refer to User's Guide for derivation.
 - **Output:** Measured signal output of the scattering meter.
 - **Dark Counts:** Signal obtained by covering detector with black tape and submersing sensor in water.
- Instrument Resolution: Standard deviation of 1 minute of collected data.

PO Box 518
620 Applegate St.
Philomath, OR 97370



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

ECO CDOM Fluorometer Characterization Sheet

Date: 7/21/2023

S/N: FLBBCDSLC-8395

CDOM concentration expressed in ppb can be derived using the equation:

$$\text{CDOM (ppb)} = \text{Scale Factor} * (\text{Output} - \text{Dark Counts})$$

Dark Counts	Digital 48 counts
Scale Factor (SF)	0.0908 ppb/count
Maximum Output	4130 counts
Resolution	1.3 counts
Ambient temperature during characterization	23.0 °C

Dark Counts: Signal output of the meter in clean water with black tape over detector.

SF: Determined using the following equation: $SF = x \div (\text{output} - \text{dark counts})$, where x is the concentration of the solution used during instrument characterization. SF is used to derive instrument output concentration from the raw signal output of the fluorometer.

Maximum Output: Maximum signal output the fluorometer is capable of.

Resolution: Standard deviation of 1 minute of collected data.



PRESSURE TRANSDUCER CALIBRATION DATA

<i>Customer</i>	<i>Date</i>
SIDUS SPACE, INC.	21 FEB 23
<i>Model Number</i>	<i>Serial Number</i>
141698A-2000A	140052

<i>Diaphragm Materials</i>	<i>Excitation</i>	<i>Pressure Range</i>	<i>Excitation Type</i>
TITANIUM	5 VDC	2000 PSIA	Constant Voltage

Pressure Calibration Data all readings are in mV DC						Date of Pressure Calibration
						14 FEB 23
Pressure	Increase	Decrease	Ideal	Linearity (%FS)	Hysteresis (%FS)	STATIC ERROR BAND ± .12% FS BFS
0 PSIA	1.16	1.15	1.16		.01%	
1000 PSIA	53.33	53.35	53.08	.25%	.02%	
2000 PSIA	104.99		104.99			
SENSITIVITY	103.83					

Thermal Calibration Data all readings are in mV DC						Date of Thermal Calibration
						14 FEB 23
	Low Temp.	Ambient	High Temp	Temperature Range	Thermal Balance Shift	Thermal Sensitivity Shift
Temperature	35 °F	75 °F	75 °F			
0 PSIA	1.13	1.14	1.25	35°F to 75°F	.01% FS	0.00% FS
2000 PSIA	104.97	104.98	105.24	75°F to 75°F	.11% FS	.14% FS
Sensitivity	103.84	103.84	103.99	AVERAGE	± .001% FS/°F	± .002% FS/°F

Notes

P.O. No.: 2022551
S.O. No.: 22-356

RR#2022551-1
3/2/23
JPM

DATE OF LAST
MEASUREMENT:

16 FEB 23

BALANCE OUTPUT:
-.01 mV DC

+SIGNAL
GREEN

+ EXCITATION
RED

-SIGNAL
WHITE

-EXCITATION
BLACK

INPUT RESISTANCE 989 Ohms
OUTPUT RESISTANCE 485 Ohms

Data Entered and Reviewed By
Bryan Pierce

Date Data Entered
16 February 2023

CERTIFICATE OF COMPLIANCE

Sales Order No. R144265

This is to certify that the materials & services used for:

Customer OREGON STATE UNIVERSITY

Purchase Order No. P0237391

conform to the drawings, specifications and conditions called for in the above Customer Purchase Order Number and Teledyne standards.

Country of Origin – Assembled in the United States of America with U.S. & foreign components.

[illegible]

Authorized By:

Thomas Loo
Name (print)

Mona Lisa
Signature

10/27/23
Date