SEA-BIRD

Sea-Bird Electronics, Inc.
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www.seabird.com

SERVICE REPORT

Service Request 1005505025
Date 01-AUG-2018
Sales Order 315146845

PRODUCT INFORMATION

Item: ECO.LEGACY
Item Description: (LEGACY) ECO (FLRTD-XXX, BBFL2-XXX, BB2FL-XXX..ETC)
Serial: FLNTURTD-4050

Special Notes
Services Requested:
Standard Service

Diagnosis:
Evaluated instrument FLNTURTD-4050 and found no problems.

Repairs and Modifications:
Standard service performed.

Comments:
New Device file and characterization sheets included.

ECO Standard Service:
The instrument bulkhead connector, pressure housing and window\optics are inspected for damage.
Instrument is checked to determine proper functionality. Incoming settings and memory are collected if incoming condition allows.
A pre-service characterization is performed, if applicable. Data is analyzed and Instrument is rescaled, if required.
The head is inspected for cracks in detector and motor bores. Case seals, shaft, shaft seal, faceplate, wiper, desiccant pack and batteries (if equipped) are replaced. Noise, stability, and live pressure test is performed.
Final calibration and characterization is completed. Including calibration of thermistor and pressure sensor, if equipped. A device file, repair sheet, and new characterization sheets are provided to customer via hard copy and CD.

Item	Item Description	Qty
WET_SRV_CHRG	Service Charges from WETLabs (FRRF)	1

Unbilled Items

Item	Item Description	Qty

PO Box 518
620 Applegate St.
Philomath, OR 97370

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

FLNTU Characterization Sheet

Date: July 24, 2018 S/N: FLNTURTD-4050

Chlorophyll Scale Factor

Chlorophyll concentration expressed in µg/l can be derived using the equation:

CHL (µg/l) = Scale Factor x (Output - Dark Counts)

		Analog		Digital	
Dark Counts		0.069	V	48	counts
Scale Factor (SF)		6	µg/l/V	0.0072	µg/l/count
Maximum Output		4.98	V	4130	counts
Resolution		1.0	mV	1.0	counts
Ambient temperature during calibration	22.0		°C		

Nephelometric Turbidity Unit (NTU) Scale Factor

Turbidity units expressed in NTU can be derived using the equation:

NTU = Scale Factor x (Output - Dark Counts)

		Analog		Digital	
Dark Counts		0.067	V	51	counts
NTU Solution Value		3.26	V	2660	counts
Scale Factor (SF)		2	NTU/V	0.0026	NTU/count
Maximum Output		4.98	V	4130	counts
Resolution		1.1	mV	1.0	counts
Ambient temperature during calibration	22.0		°C		

Definition of terms:

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

NTU Solution Value: Signal output of the turbidity sensor when measuring a sample of interest.

SF (CHL): Determined using the following equation: SF = x ÷ (output - 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.

SF (NTU): Scale factor is determined using the following equation: SF = xx ÷ (Output - Dark counts), where xx is the value of a Formazin concentration. For example: 12.2 ÷ (2011 - 50) = 0.0062.

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

Resolution: standard deviation of 1 minute of collected data.

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ECO Calibration and Repairs

Diagnosis: Evaluated instrument FLNTURTD-4050 and found no problems.

Repairs and Modifications: Standard service performed.

Comments: New Device file and characterization sheets included.

ECO Standard Service:

The instrument bulkhead connector, pressure housing and window\optics are inspected for damage. Instrument is checked to determine proper functionality. Incoming settings and memory are collected if incoming condition allows.

A pre-service characterization is performed, if applicable. Data is analyzed and Instrument is rescaled, if required.

The head is inspected for cracks in detector and motor bores. Case seals, shaft, shaft seal, faceplate, wiper, desiccant pack and batteries (if equipped) are replaced. Noise, stability, and live pressure test is performed.

Final calibration and characterization is completed. Including calibration of thermistor and pressure sensor, if equipped. A device file, repair sheet, and new characterization sheets are provided to customer via hard copy and CD.

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SERVICE REPORT

Service Request 1005505025
Date 01-AUG-2018
Sales Order 315146845

CUSTOMER INFORMATION

Name: WHOI - WOODS HOLE OCEANOGRAPHIC INSTITUTION
Account : 40296385
PHILIP ALATALO
palatalo@whoi.edu
5082892980

PO Number:

Bill To Address
266 WOODS HOLE RD, MS#1;
WOODS HOLE,MA,02543,US

Ship To Address
RECEIVING DEPARTMENT;266 WOODS HOLE ROAD;
WOODS HOLE,MA,02543,US

PRODUCT INFORMATION

Item: 43.2111
Item Description: SBE43, 1/2 MIL, 7000m, XSG, STD 43 PLENUM
Serial: 43-3011

Special Notes
Services Requested:
Evaluate/Repair Instrumentation.
Perform Routine Calibration Service.

Problems Found:
The membrane was found to be damaged.

Services Performed:
Perform initial diagnostic evaluation.
Replaced the lid and membrane assembly (0.5 mil).
Replaced the electrolyte with new fluid.
Replaced the O-rings.
Performed a hydrostatic pressure test.
Performed a "Final" Calibration.

Item	Item Description	Qty
CAL_43	SBE 43 dissolved oxygen sensor calibration	1

Unbilled Items

Item	Item Description	Qty
801576	SBE43 LID & MEMBRANE SUB-ASSY, 5MIL MEMBRANE	1

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SENSOR SERIAL NUMBER: 3011
CALIBRATION DATE: 04-Jul-18

SBE 43 OXYGEN CALIBRATION DATA

COEFFICIENTS:
Soc = 0.4425
Voffset = -0.5132
Tau20 = 1.05
A = -4.7309e-003
B = 2.1915e-004
C = -2.9784e-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

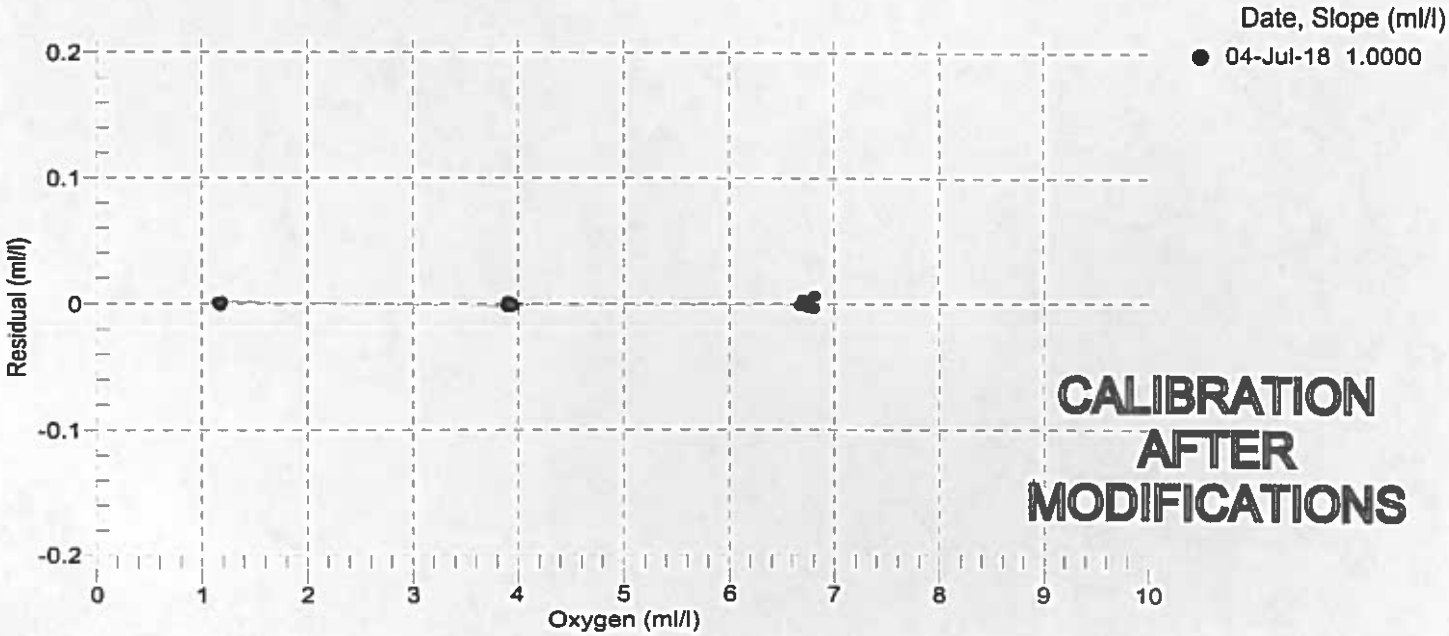
BATH OXYGEN (ml/l)	BATH TEMPERATURE (° C)	BATH SALINITY (PSU)	INSTRUMENT OUTPUT (volts)	INSTRUMENT OXYGEN (ml/l)	RESIDUAL (ml/l)
1.15	2.00	0.00	0.784	1.15	0.00
1.15	6.00	0.00	0.819	1.15	0.00
1.15	12.04	0.00	0.871	1.16	0.00
1.17	20.00	0.00	0.940	1.16	-0.00
1.17	26.00	0.00	0.994	1.17	0.00
1.18	30.00	0.00	1.031	1.18	0.00
3.89	2.00	0.00	1.430	3.89	-0.00
3.90	6.00	0.00	1.548	3.90	0.00
3.91	12.05	0.00	1.722	3.91	-0.00
3.93	20.00	0.00	1.951	3.92	-0.00
3.94	26.00	0.00	2.124	3.94	0.00
3.95	30.00	0.00	2.243	3.95	-0.00
6.67	2.00	0.00	2.085	6.67	-0.00
6.70	6.00	0.00	2.290	6.70	0.00
6.75	30.00	0.00	3.471	6.75	-0.00
6.75	12.05	0.00	2.603	6.75	-0.00
6.80	20.00	0.00	3.005	6.80	-0.00
6.81	26.01	0.00	3.304	6.82	0.01

V = instrument output (volts); T = temperature (°C); S = salinity (PSU); K = temperature (°K)

Oxsol(T,S) = oxygen saturation (ml/l); P = pressure (dbar)

$$\text{Oxygen (ml/l)} = Soc * (V + Voffset) * (1.0 + A * T + B * T^2 + C * T^3) * Oxsol(T,S) * \exp(E * P / K)$$

Residual (ml/l) = instrument oxygen - bath oxygen



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SERVICE REPORT

Service Request 1005505025
Date 01-AUG-2018
Sales Order 315146845

PRODUCT INFORMATION

Item: 49.LEGACY
Item Description: (LEGACY) SBE 49 FastCAT CTD
Serial: 4932457-0054

Special Notes
Services Requested:
Evaluate/Repair Instrumentation.
Perform Routine Calibration Service.

Services Performed:
Perform initial diagnostic evaluation.
Performed pressure calibration.
Performed "POST" cruise calibration.

Item	Item Description	Qty
CONCERT49A	Confirm and recertify SBE 49. Complete external inspection; test all functions. Cost of major repairs, modifications or calibration is not included.	1
CAL_49	SBE 49 FastCAT CTD sensor calibration; conductivity (C&P + recal if necessary), temperature, and pressure	1

Unbilled Items

Item	Item Description	Qty
233493	SBE41/49/52/WQM TC DUCT TOP, BLACK ACETAL	1

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SENSOR SERIAL NUMBER: 0054
CALIBRATION DATE: 29-Jun-18

SBE 49 TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

COEFFICIENTS:

a0 = 8.472817e-004
a1 = 2.764824e-004
a2 = -1.588455e-006
a3 = 1.900341e-007

BATH TEMP (° C)	INSTRUMENT OUTPUT (counts)	INST TEMP (° C)	RESIDUAL (° C)
1.0000	731833.898	1.0000	0.0000
4.5000	648435.797	4.5000	-0.0000
15.0000	436480.424	15.0001	0.0001
18.5000	378270.475	18.4998	-0.0002
24.0242	297945.017	24.0245	0.0003
29.0292	236261.085	29.0289	-0.0003
32.5312	198662.153	32.5313	0.0001

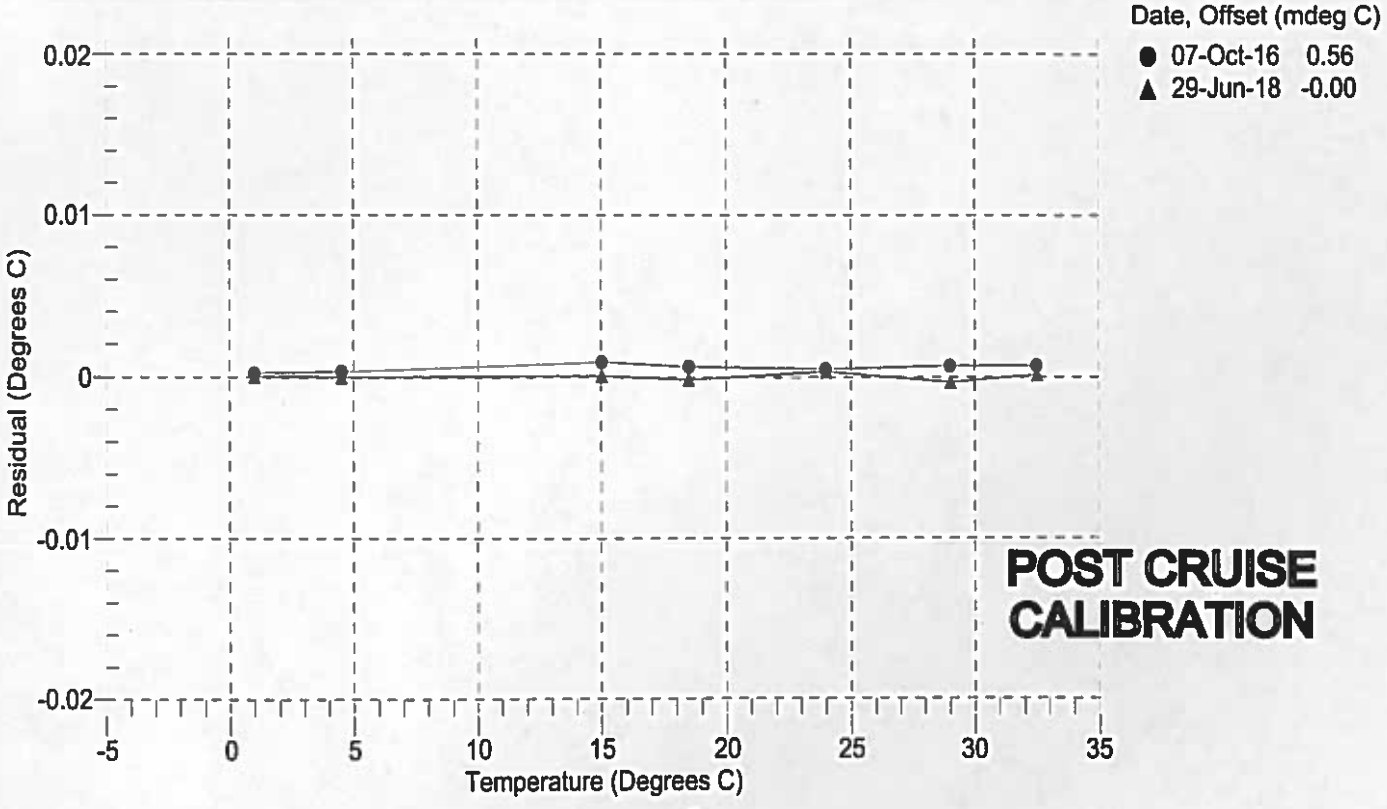
n = Instrument Output (counts)

MV = (n - 524288) / 1.6e+007

R = (MV * 2.295e+010 + 9.216e+008) / (6. 144e+004 - MV * 5.3e+005)

Temperature ITS-90 (°C) = $1/\{a0 + a1[ln(R)] + a2[ln^2(R)] + a3[ln^3(R)]\} - 273.15$

Residual (°C) = instrument temperature - bath temperature



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SENSOR SERIAL NUMBER: 0054
CALIBRATION DATE: 29-Jun-18

SBE 49 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g = -1.037321e+000
h =  1.513062e-001
i = -2.136025e-004
j =  4.136448e-005

CPcor = -9.5700e-008
CTcor =  3.2500e-006
```

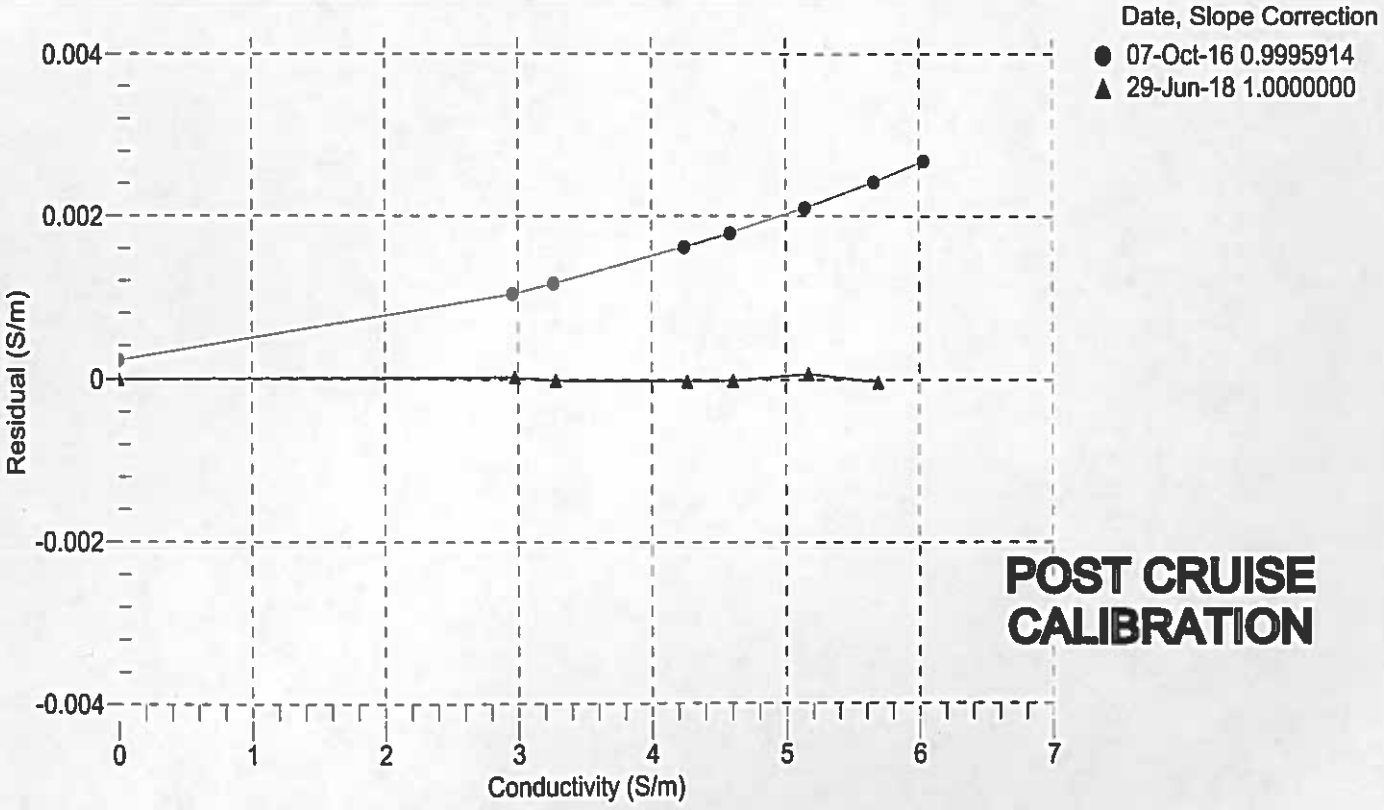
BATH TEMP (° C)	BATH SAL (PSU)	BATH COND (S/m)	INSTRUMENT OUTPUT (Hz)	INSTRUMENT COND (S/m)	RESIDUAL (S/m)
22.0000	0.0000	0.00000	2620.74	0.0000	0.00000
1.0000	34.8200	2.97625	5150.42	2.9763	0.00002
4.5000	34.7995	3.28330	5343.05	3.2833	-0.00001
15.0000	34.7549	4.26488	5916.20	4.2648	-0.00003
18.5000	34.7450	4.60993	6104.64	4.6099	-0.00001
24.0242	34.7352	5.17039	6398.61	5.1705	0.00007
29.0292	34.7303	5.69290	6660.58	5.6929	-0.00003
32.5312	34.7282	6.06571	6841.23	6.0657	0.00004

f = Instrument Output (Hz) / 1000.0

t = temperature (°C); p = pressure (decibars); δ = CTcor; ε = CPcor;

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

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



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SENSOR SERIAL NUMBER: 0054
CALIBRATION DATE: 27-Jun-18

SBE 49 PRESSURE CALIBRATION DATA
1450 psia S/N 2983

COEFFICIENTS:

PA0 =	-5.540088e-001	PTCA0 =	5.205330e+005
PA1 =	4.410332e-003	PTCA1 =	-1.397483e+001
PA2 =	-1.468072e-011	PTCA2 =	3.387698e-001
PTEMPA0 =	-6.038439e+001	PTCB0 =	2.486563e+001
PTEMPA1 =	5.419313e+001	PTCB1 =	-1.475000e-003
PTEMPA2 =	-9.410580e-001	PTCB2 =	0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE (PSIA)	INSTRUMENT OUTPUT (counts)	THERMISTOR OUTPUT (volts)	COMPUTED PRESSURE (PSIA)	RESIDUAL (%FSR)
14.64	523831.2	1.6	14.64	0.00
301.84	588868.6	1.6	301.80	-0.00
588.88	653899.8	1.6	588.81	-0.00
875.91	718970.2	1.6	875.87	-0.00
1162.97	784074.3	1.6	1162.96	-0.00
1450.08	849207.4	1.6	1450.05	-0.00
1163.21	784138.8	1.6	1163.25	0.00
876.19	719051.3	1.6	876.24	0.00
589.00	653946.4	1.6	589.03	0.00
301.84	588886.1	1.6	301.88	0.00
14.63	523832.0	1.6	14.64	0.00

THERMAL CORRECTION

TEMP (°C)	THERMISTOR OUTPUT (volts)	INSTRUMENT OUTPUT (counts)
32.53	1.77	524117.19
29.03	1.70	524105.59
24.02	1.60	524090.97
18.50	1.49	524079.63
15.00	1.43	524080.75
4.50	1.22	524155.25
1.00	1.16	524216.47

TEMPERATURE (°C)	SPAN
-5.00	24.87
35.00	24.81

y = thermistor output (counts)

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

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

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

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

Residual (%FSR) = (computed pressure - true pressure) * 100 / Full Scale Range