SEA-BIRD SCIENTIFIC

SBE Sea-Bird Electronics

Sea-Bird Electronics
13431 NE 20th Street
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98005 USA

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SBE41-CP ALACE

Instrument Configuration

Instrument Serial Number:	41-8717
Instrument Firmware Version:	V 7.2.5
Zero Conductivity Frequency:	2643.13
Communications Format:	RS232
Communications Settings:	9600 baud, 8 Data Bits, No Parity

Installed Devices/Sensors

Data Format	*Measurement*	*Sensor Type*	*Serial Number*	*Rating*
Count	Temperature	Internal	N/A	N/A
Frequency	Conductivity	Internal	N/A	N/A
Count	Pressure	Druck	10300791	2000m(2000 dBar)
RS232	Oxygen	SBE 63	63-1322	7000m

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SENSOR SERIAL NUMBER: 8717
CALIBRATION DATE: 16-Aug-16

SBE 41 TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

COEFFICIENTS:

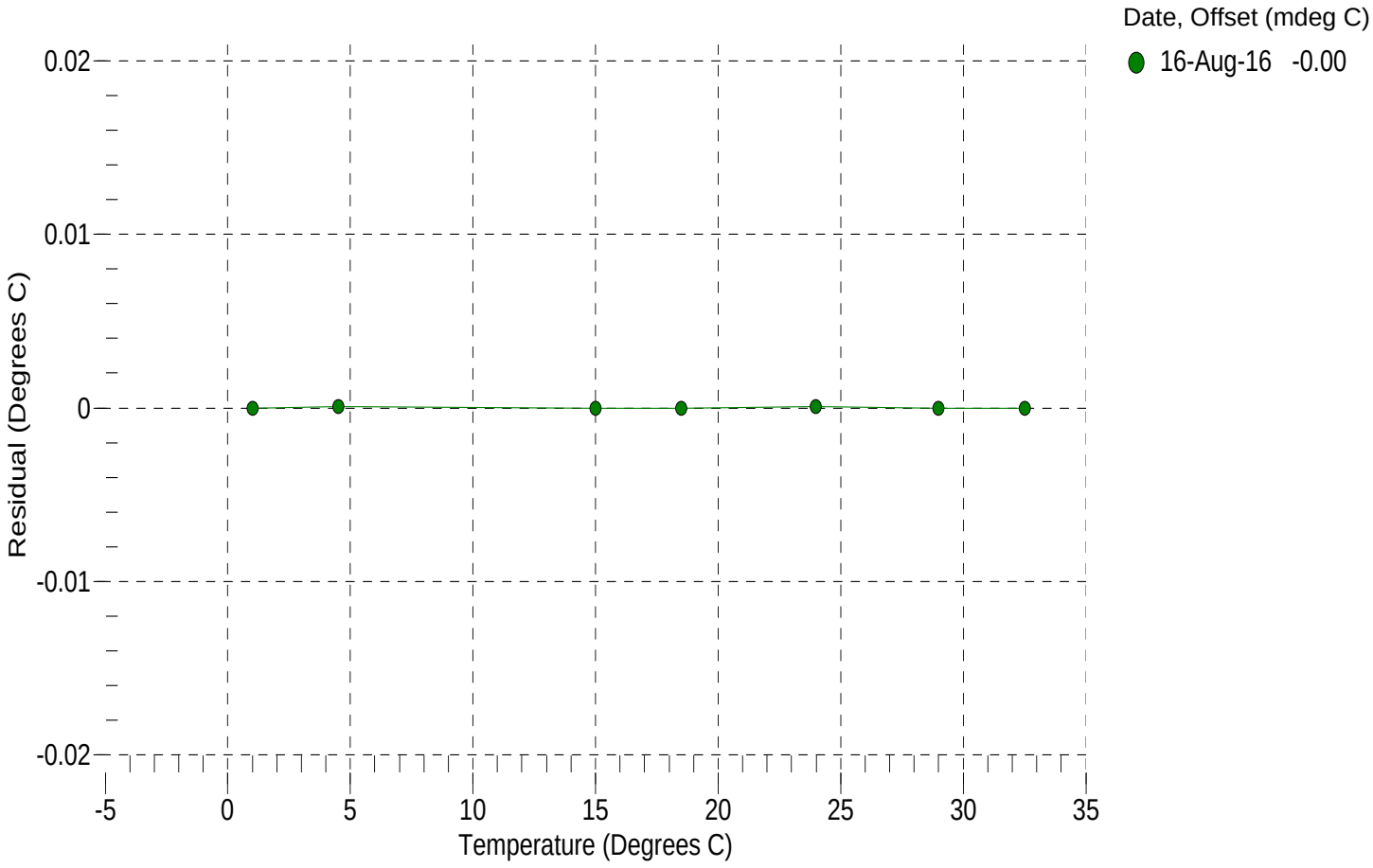
```
a0 = -8.753087e-004
a1 =  2.947427e-004
a2 = -3.939197e-006
a3 =  1.509754e-007
```

BATH TEMP (° C)	INSTRUMENT OUTPUT (counts)	INST TEMP (° C)	RESIDUAL (° C)
1.0001	17659947.0	1.0001	-0.0000
4.5000	15060828.1	4.5001	0.0001
15.0000	9528357.2	15.0000	-0.0000
18.5000	8231297.7	18.5000	-0.0000
23.9940	6581418.7	23.9941	0.0001
29.0001	5400971.2	29.0001	-0.0000
32.5001	4719626.3	32.5001	-0.0000

n = Instrument Output (counts)

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

Residual (°C) = instrument temperature - bath temperature



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SENSOR SERIAL NUMBER: 8717
CALIBRATION DATE: 16-Aug-16

SBE 41 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g = -9.724972e-001
h =  1.398799e-001
i = -3.817012e-004
j =  4.783715e-005

CPcor = -9.5700e-008
CTcor =  3.2500e-006
WBOTC = -3.7829e-007
```

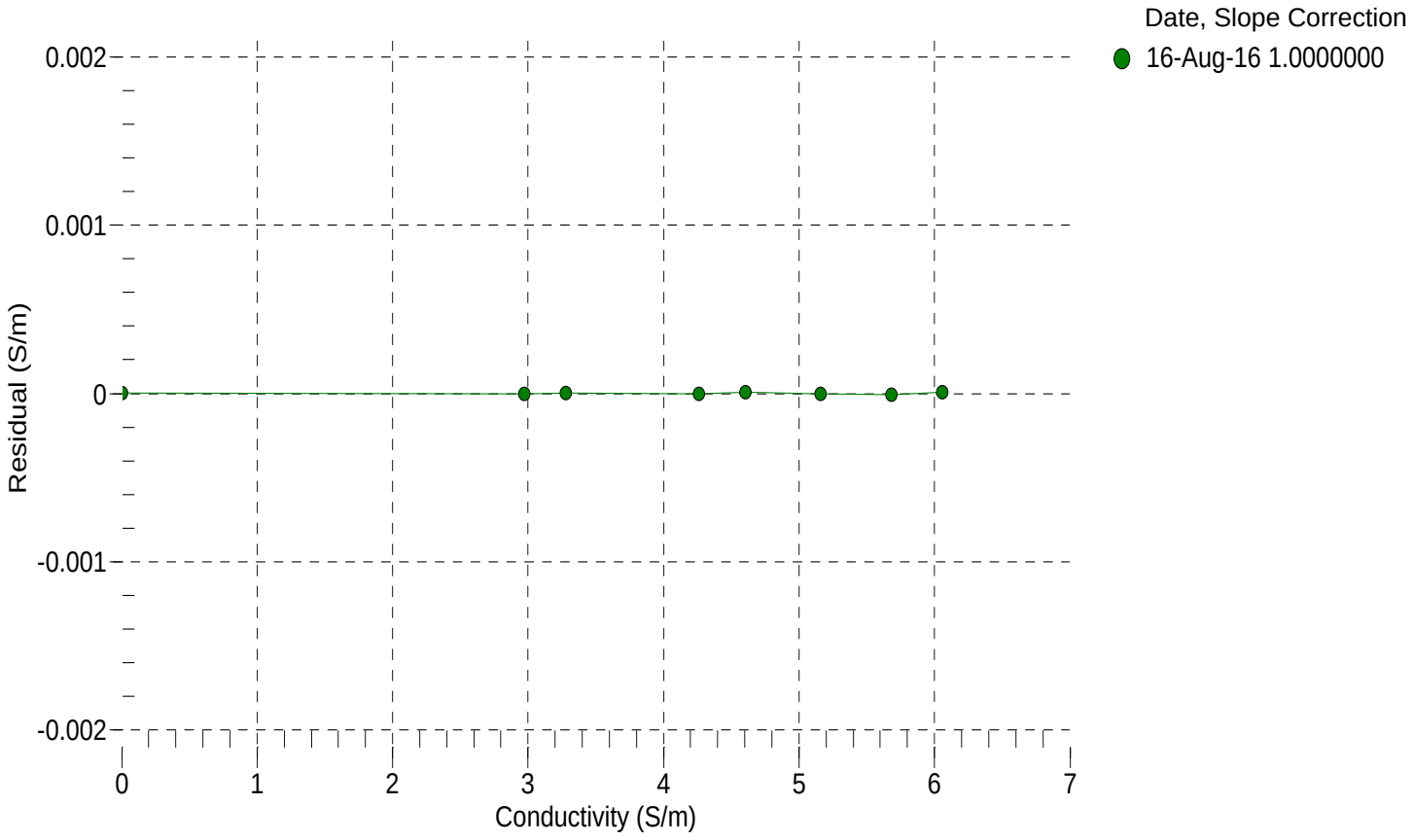
BATH TEMP (° C)	BATH SAL (PSU)	BATH COND (S/m)	INSTRUMENT OUTPUT (Hz)	INSTRUMENT COND (S/m)	RESIDUAL (S/m)
22.0000	0.0000	0.00000	2643.13	0.00000	0.00000
1.0001	34.7674	2.97219	5323.31	2.97219	-0.00000
4.5000	34.7477	3.27889	5525.86	3.27889	0.00000
15.0000	34.7054	4.25945	6127.84	4.25944	-0.00000
18.5000	34.6965	4.60419	6325.59	4.60420	0.00001
23.9940	34.6870	5.16090	6632.13	5.16089	-0.00000
29.0001	34.6820	5.68280	6906.79	5.68279	-0.00001
32.5001	34.6789	6.05475	7095.83	6.05475	0.00001

f = Instrument Output(Hz) * sqrt(1.0 + WBOTC * t) / 1000.0

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

Conductivity (S/m) = $(g + h * f^2 + i * f^3 + j * f^4) / 10 (1 + \delta * t + \varepsilon * p)$

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



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SENSOR SERIAL NUMBER: 8717
CALIBRATION DATE: 11-Aug-16

SBE 41 PRESSURE CALIBRATION DATA
2900 psia S/N 10300791

COEFFICIENTS:

PA0 =	-6.163175e-001	PTCA0 =	1.064160e+003
PA1 =	3.935895e-004	PTCA1 =	-6.417249e+001
PA2 =	-2.816853e-013	PTCA2 =	-2.757079e-001
PTHA0 =	2.831818e+002	PTCB0 =	2.507613e+001
PTHA1 =	-6.131714e-005	PTCB1 =	1.025000e-003
PTHA2 =	-7.661939e-013	PTCB2 =	0.000000e+000

PRESSURE SPAN CALIBRATION

PRESSURE (PSIA)	INSTRUMENT OUTPUT (counts)	THERMISTOR OUTPUT (counts)	COMPUTED PRESSURE (PSIA)	RESIDUAL (%FSR)
14.67	38396.2	4049866.4	14.68	0.00
591.27	1506569.8	4046123.4	591.37	0.00
1167.93	2977563.0	4044773.2	1167.95	0.00
1744.47	4451665.2	4043589.8	1744.52	0.00
2320.96	5928980.6	4042288.2	2321.12	0.01
2897.47	7408494.7	4041283.2	2897.35	-0.00
2320.93	5928597.3	4041436.0	2320.97	0.00
1744.40	4451392.2	4041383.2	1744.41	0.00
1167.86	2976777.8	4041410.8	1167.64	-0.01
591.06	1505447.6	4041537.8	590.94	-0.00
14.67	38454.1	4041663.4	14.72	0.00

THERMAL CORRECTION

TEMP (°C)	THERMISTOR OUTPUT (counts)	INSTRUMENT OUTPUT (counts)
32.50	3898380.40	39087.60
29.00	3950353.20	39451.25
23.99	4024622.80	39933.21
18.50	4105944.60	40241.75
15.00	4157679.60	40415.25
4.50	4312512.60	41195.45
1.00	4364043.40	41501.60

TEMPERATURE (°C)	SPAN (mV)
-5.00	25.07
35.00	25.11

y = thermistor output (counts)

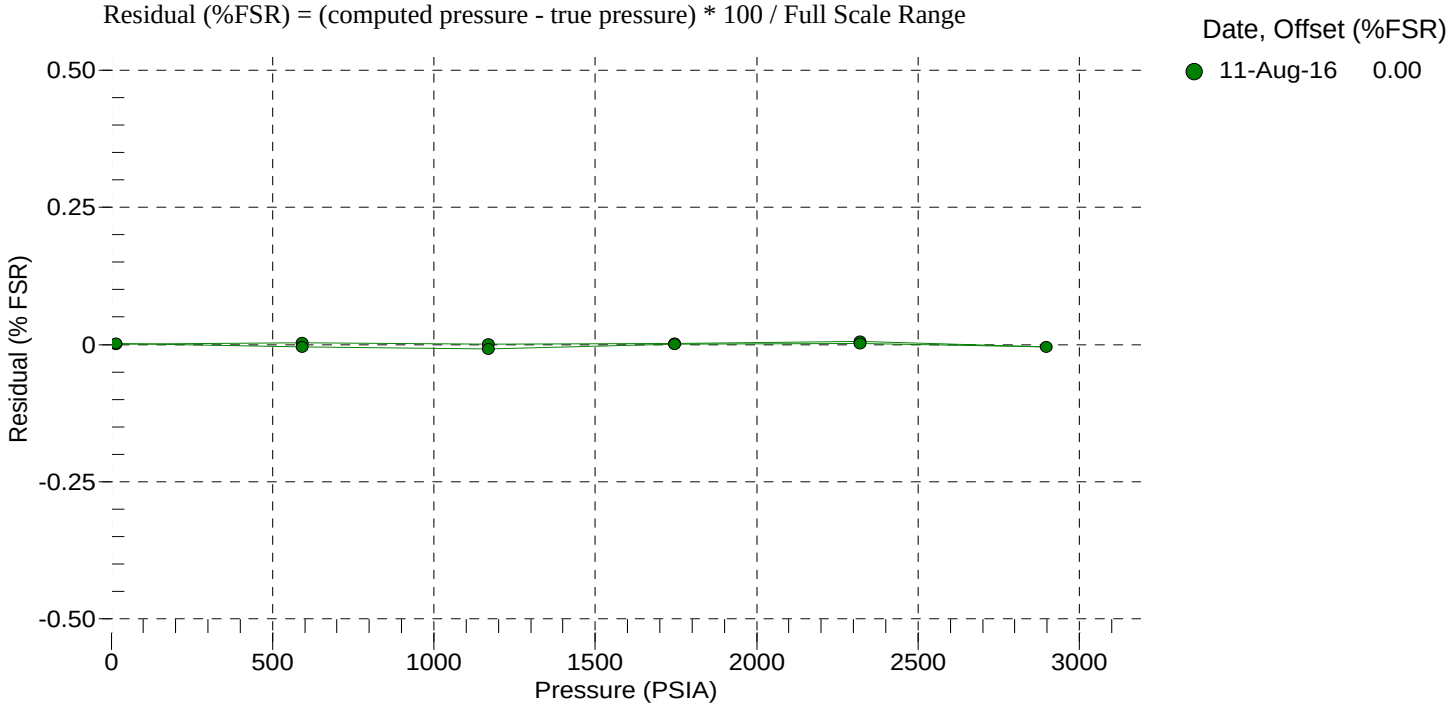
$t = PTHA0 + PTHA1 * y + PTHA2 * y^2$

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

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

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

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



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SENSOR SERIAL NUMBER: 1322
CALIBRATION DATE: 15-Jul-16

SBE 63 OXYGEN TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

COEFFICIENTS:

TA0 = 7.030878e-004 TA2 = 7.165771e-007
TA1 = 2.505938e-004 TA3 = 1.004467e-007

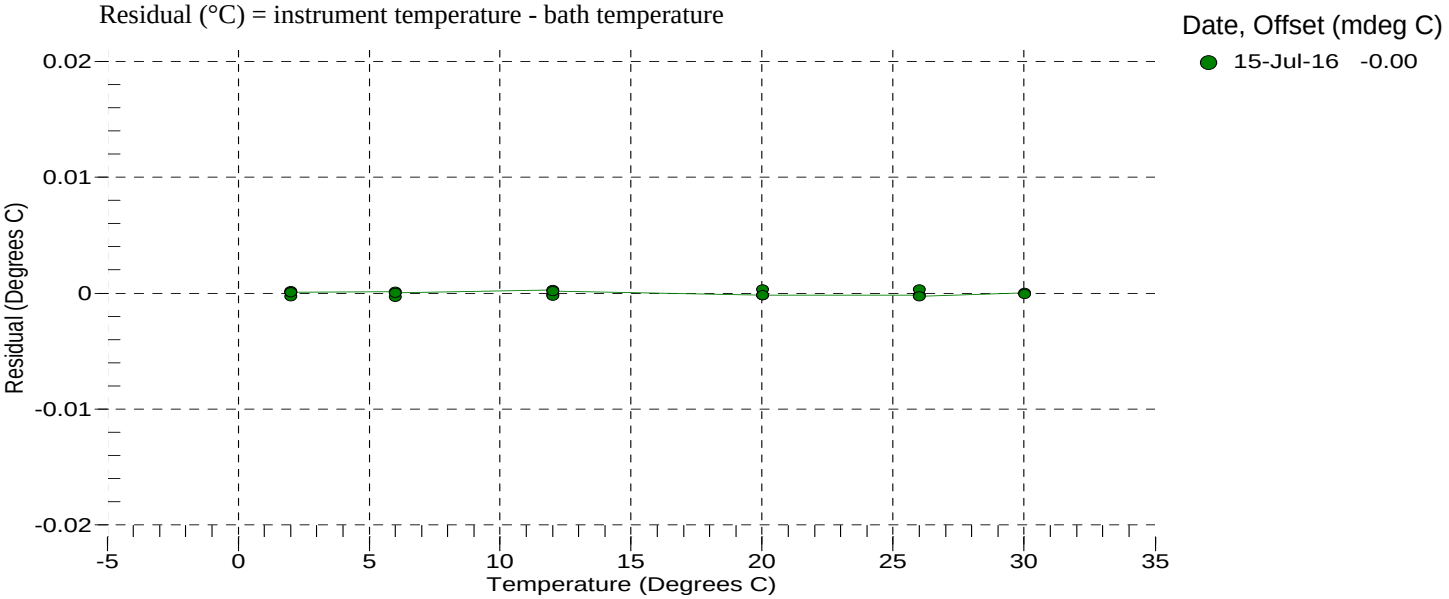
BATH TEMP (° C)	INSTRUMENT OUTPUT(V)	INST TEMP (° C)	RESIDUAL (° C)
1.9999	1.12152	2.0001	0.00015
2.0000	1.12152	2.0001	0.00005
2.0000	1.12153	1.9997	-0.00026
2.0000	1.12152	2.0001	0.00005
5.9999	0.99715	6.0000	0.00013
5.9999	0.99715	6.0000	0.00013
6.0000	0.99716	5.9997	-0.00031
6.0000	0.99715	6.0000	0.00003
11.9999	0.83103	12.0002	0.00027
11.9999	0.83104	11.9998	-0.00012
12.0000	0.83104	11.9998	-0.00022
12.0000	0.83103	12.0002	0.00017
20.0000	0.64702	19.9998	-0.00017
20.0000	0.64701	20.0003	0.00031
20.0000	0.64702	19.9998	-0.00017
20.0000	0.64702	19.9998	-0.00017
25.9999	0.53478	25.9997	-0.00016
26.0000	0.53477	26.0003	0.00033
26.0000	0.53477	26.0003	0.00033
26.0000	0.53478	25.9997	-0.00026
30.0000	0.47081	30.0000	0.00003
30.0000	0.47081	30.0000	0.00003
30.0001	0.47081	30.0000	-0.00007
30.0001	0.47081	30.0000	-0.00007

V = Instrument Output (Volts)

L = *ln* (100000 * V / (3.3 - V))

Temperature ITS-90 (°C) = $1 / (TA0 + (TA1 * L) + (TA2 * L^2) + (TA3 * L^3)) - 273.15$

Residual (°C) = instrument temperature - bath temperature



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SENSOR SERIAL NUMBER: 1322 SBE 63 OXYGEN CALIBRATION DATA

CALIBRATION DATE: 15-Jul-16

COEFFICIENTS:

A0 = 1.0513e+000	B0 = -2.2825e-001	C0 = 9.9378e-002	E = 1.1000e-002
A1 = -1.5000e-003	B1 = 1.6217e+000	C1 = 4.2220e-003	
A2 = 4.0180e-001		C2 = 5.8586e-005	

BATH OXYGEN (ml/l)	BATH TEMPERATURE (° C)	BATH SALINITY (PSU)	INSTRUMENT OUTPUT (µsec)	INSTRUMENT OXYGEN (ml/l)	RESIDUAL (ml/l)
0.717	30.00	0.00	30.92	0.724	0.007
0.750	26.00	0.00	31.54	0.756	0.006
0.807	20.00	0.00	32.51	0.810	0.004
0.895	12.00	0.00	33.88	0.896	0.001
0.992	6.00	0.00	34.88	0.988	-0.004
1.095	2.00	0.00	35.42	1.089	-0.005
2.205	30.00	0.00	22.71	2.208	0.003
2.317	26.00	0.00	23.33	2.324	0.006
2.487	20.00	0.00	24.41	2.491	0.003
2.994	12.00	0.00	25.33	2.996	0.002
3.416	6.00	0.00	26.27	3.417	0.002
3.653	30.00	0.00	18.79	3.647	-0.006
3.759	2.00	0.00	26.94	3.756	-0.003
3.907	26.00	0.00	19.21	3.910	0.003
4.318	20.00	0.00	19.99	4.316	-0.002
5.074	12.00	0.00	21.03	5.073	-0.001
5.168	30.00	0.00	16.28	5.158	-0.011
5.667	26.00	0.00	16.47	5.676	0.010
5.844	6.00	0.00	21.84	5.844	-0.001
6.300	20.00	0.00	17.13	6.300	-0.000
6.440	2.00	0.00	22.46	6.440	-0.000
7.260	12.00	0.00	18.22	7.254	-0.006
8.395	6.00	0.00	18.92	8.397	0.002
8.825	2.00	0.00	19.88	8.827	0.002

T = temperature (°C) , P = pressure (dbar), U = Instrument output (µsec)

S_{corr} (salinity correction function) = 1.0 for calibration in DI water

See the user manual for more information on S_{corr} calculation

V = U / 39.457071

Oxygen (ml/l) = $\{((A0 + A1*T + A2 * V^2)/(B0 + B1 * V) - 1.0)/(C0 + C1 * T + C2 * T^2)\} * S_{corr} * \exp(E * P / T + 273.15)$

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