

**SEA-BIRD ELECTRONICS, INC.**  
 1808 136th Place N.E., Bellevue, Washington, 98005 USA  
 Phone: (425) 643 - 9866 Fax (425) 643 - 9954 Email: seabird@seabird.com

SENSOR SERIAL NUMBER: 0096  
 CALIBRATION DATE: 08-Dec-06

90340 TEMPERATURE CALIBRATION DATA  
 ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

a0 = 1.929639e-006  
 a1 = 2.629531e-004  
 a2 = -1.350624e-006  
 a3 = 1.276526e-007

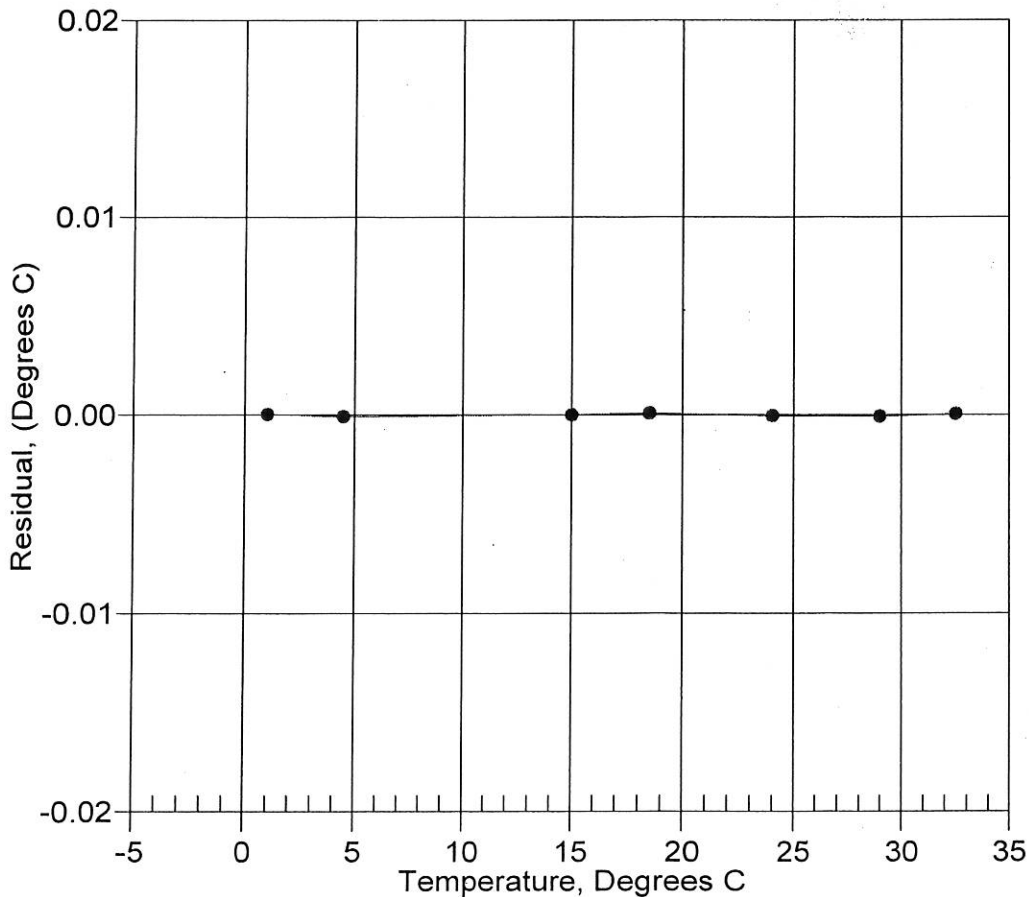
BATH TEMP (ITS-90)	INSTRUMENT OUTPUT	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	801403.0	1.0000	0.0000
4.5000	686248.5	4.4999	-0.0001
15.0000	439245.5	15.0000	0.0000
18.5000	380856.1	18.5001	0.0001
24.0000	306163.0	23.9999	-0.0001
28.9999	252548.7	28.9999	-0.0001
32.5000	221424.2	32.5000	0.0001

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

Residual = instrument temperature - bath temperature

Date, Delta T (mdeg C)

● 08-Dec-06 0.00



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SENSOR SERIAL NUMBER: 0096  
CALIBRATION DATE: 08-Dec-06

90340 CONDUCTIVITY CALIBRATION DATA  
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

g = -9.931518e-001  
h = 1.356387e-001  
i = -3.257858e-004  
j = 4.335553e-005

CPcor = -9.5700e-008  
CTcor = 3.2500e-006  
WBOTC = 9.2185e-008

BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (Hz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2711.57	0.00000	0.00000
1.0000	34.7321	2.96945	5414.88	2.96944	-0.00001
4.5000	34.7122	3.27587	5619.73	3.27587	0.00001
15.0000	34.6697	4.25552	6228.70	4.25552	-0.00001
18.5000	34.6606	4.59994	6428.79	4.59994	0.00000
24.0000	34.6504	5.15667	6739.32	5.15667	0.00000
28.9999	34.6443	5.67730	7016.90	5.67730	-0.00000
32.5000	34.6408	6.04884	7208.22	6.04884	0.00000

$$f = \text{INST FREQ} * \text{sqrt}(1.0 + \text{WBOTC} * t) / 1000.0$$

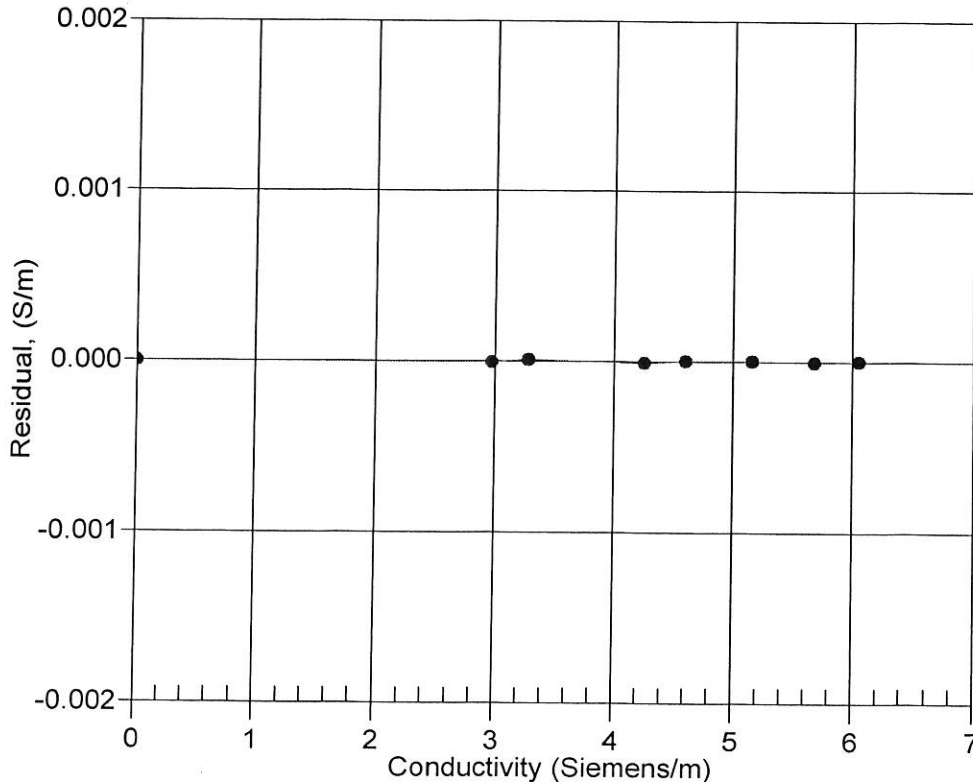
$$\text{Conductivity} = (g + hf^2 + if^3 + jf^4) / (1 + \delta t + \epsilon p) \text{ Siemens/meter}$$

t = temperature[°C]; p = pressure[decibars];  $\delta$  = CTcor;  $\epsilon$  = CPcor;

Residual = instrument conductivity - bath conductivity

Date, Slope Correction

● 08-Dec-06 1.0000000



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SENSOR SERIAL NUMBER: 0096  
 CALIBRATION DATE: 05-Dec-06

90340 PRESSURE CALIBRATION DATA  
 508 psia S/N 2328593

**COEFFICIENTS:**

PA0 =	1.329461e-001	PTCA0 =	5.469011e+001
PA1 =	2.419430e-002	PTCA1 =	2.779457e-001
PA2 =	2.906701e-009	PTCA2 =	-2.305397e-004
PTHA0 =	-6.793951e+001	PTCB0 =	2.512363e+001
PTHA1 =	4.950575e-002	PTCB1 =	-1.675000e-003
PTHA2 =	1.559153e-007	PTCB2 =	0.000000e+000

**PRESSURE SPAN CALIBRATION**

PRESSURE PSIA	INST OUTPUT	THERMISTOR OUTPUT	COMPUTED PRESSURE	ERROR %FSR
14.79	665.8	1768.0	14.81	0.00
105.04	4385.4	1770.0	104.97	-0.01
205.03	8508.1	1773.0	205.01	-0.00
305.02	12625.4	1771.0	305.01	-0.00
405.01	16738.0	1771.0	405.00	-0.00
504.98	20845.4	1773.0	504.96	-0.00
404.97	16738.5	1771.0	405.01	0.01
305.00	12626.3	1775.0	305.03	0.01
205.00	8509.1	1772.0	205.03	0.01
105.02	4387.0	1772.0	105.01	-0.00
14.79	666.1	1780.0	14.81	0.00

**THERMAL CORRECTION**

TEMP ITS90	PRESS TEMP	INST OUTPUT
32.50	2015.80	681.36
29.00	1946.60	680.55
24.00	1846.30	679.12
18.50	1736.80	677.75
15.00	1666.20	676.49
4.50	1456.80	674.19
1.00	1386.40	672.67
TEMP (ITS90)	SPAN (mV)	
-5.00	25.13	
35.00	25.07	

$$y = \text{thermistor output}; t = P\text{TEMPA}0 + P\text{TEMPA}1 * y + P\text{TEMPA}2 * y^2$$

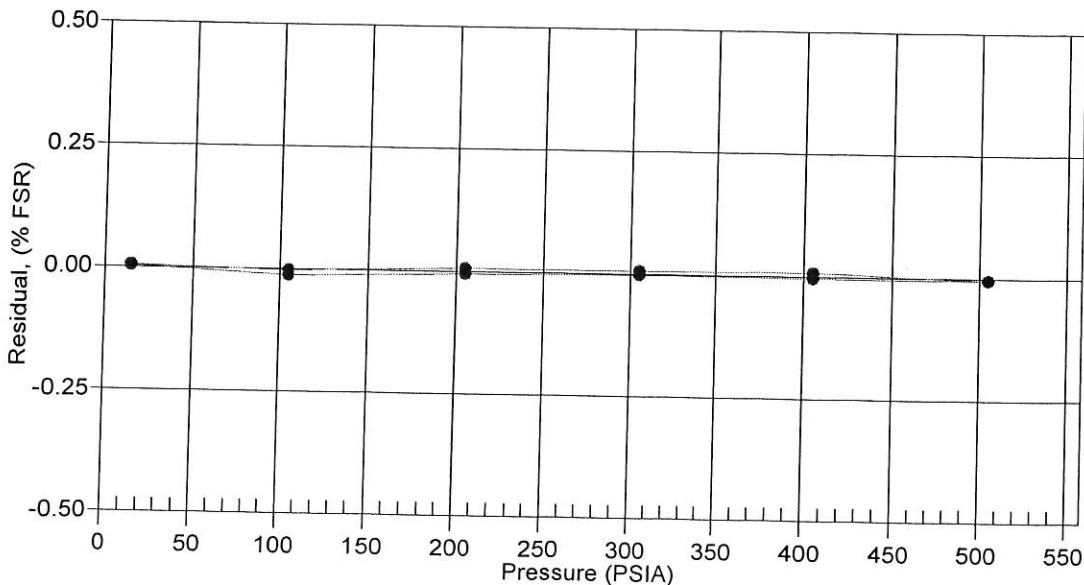
$$x = \text{pressure output} - PTCA0 - PTCA1 * t - PTCA2 * t^2$$

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

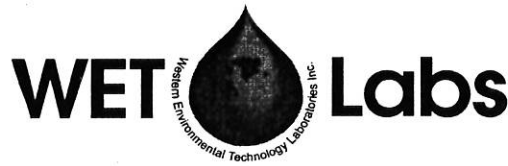
$$\text{pressure (psia)} = PA0 + PA1 * n + PA2 * n^2$$

Date, Avg Delta P %FS

05-Dec-06 0.00



PO Box 518  
620 Applegate St.  
Philomath, OR 97370



(541) 929-5650  
Fax (541) 929-5277  
[www.wetlabs.com](http://www.wetlabs.com)

## ECO CDOM Fluorometer Characterization Sheet

Date: 3/23/2007

Customer: Webb Research

Job #: 702026

SO #: 793

S/N:# BBFL2SLO-364

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

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

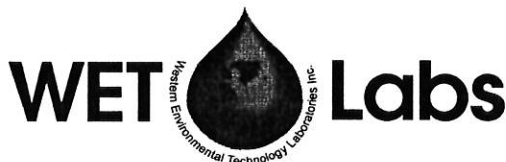
<b>Dark Counts</b>	<b>Digital</b>
<b>Scale Factor (SF)</b>	62 counts
<b>Maximum Output</b>	0.0943 ppb/count
<b>Resolution</b>	4118 counts
	1.2 counts
Ambient temperature during characterization	19.8 °C

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

**SF:** Determined using the following equation:  $SF = x + (\text{output} - \text{dark counts})$ , 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.



## ECO Chlorophyll Fluorometer Characterization Sheet

Date: 3/23/2007

Customer: Webb Research

Job #: 702026

SO #: 793

S/N:# BBFL2SLO-364

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

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

	<b>Digital</b>
<b>Dark counts</b>	42 counts
<b>Scale Factor (SF)</b>	0.0124 $\mu\text{g/l/count}$
<b>Maximum Output</b>	4118 counts
<b>Resolution</b>	1.2 counts
Ambient temperature during characterization	19.8 °C

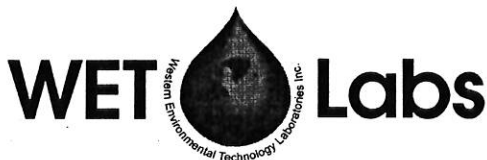
**Dark Counts:** Signal output of the meter in clean water with black tape over detector.

**SF:** Determined using the following equation:  $\text{SF} = x + (\text{output} - \text{dark counts})$ , 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.



## Scattering Meter Calibration Sheet

3/22/2007

Customer: Webb Research

SO #: 793

Wavelength: 660

S/N#: BBFL2SLO-364

Job #: 702026

Tech: cw

Use the following equation to obtain "scaled" output values:

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

- **Scale Factor for 660 nm** = 3.677E-06 (counts)
- **Output** = meter reading (counts)
- **Dark Counts** = 47 (counts)

Instrument Resolution = 1.1423 (counts) 4.20E-06 ( $\text{m}^{-1} \text{sr}^{-1}$ )

### 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.

Layout No: 1308E, 1299F  
Circuit Diagram No:  
Program Version: 3, Build: 7

Product: Oxygen Optode 3835  
Serial No: 474

## 1. Visual and Mechanical Checks:

- 1.1. O-ring surface
- 1.2. Soldering quality
- 1.3. Visual surface
- 1.4. Galvanic isolation between housing and electronics

## 2. Current Drain and Voltages:

- |  |             |
|--|-------------|
| 2.1. Average current drain at 0.5Hz sampling (Max: 38mA) | 31 mA       |
| 2.2. Current drain in sleep (Max: 300 $\mu$ A)           | 220 $\mu$ A |
| 2.3. Quiescent current drain from -9V (Max: 5 $\mu$ A)   | 0 $\mu$ A   |
| 2.4. DSP voltage, IC5.1 (3.3 $\pm$ 0.15V)                | 3.30 V      |
| 2.5. Excitation driver voltage, IC1.1 (3.3 $\pm$ 0.15V)  | 3.34 V      |
| 2.6. Flash/RS232 driver voltage, IC7.4 (5 $\pm$ 0.2V)    | 5.10 V      |

## 3. Receiver test:

- |  |         |
|--|---------|
| 3.1. Average of Receiver readings (0 $\pm$ 50mV)         | -12 mV  |
| 3.2. Standard Deviation of Receiver readings (Max: 10mV) | 2.19 mV |

## 4. Performance Test in Air, 0°C Temperature:

- |  |           |
|--|-----------|
| 4.1. Amplitude measurement (Blue: 220 – 470mV)             | 342.48 mV |
| 4.2. Phase measurement (Blue: 30 $\pm$ 5)                  | 31.4 °    |
| 4.3. Standard deviation of Phase measurement: (Max: 0.02°) | 0.002 °   |
| 4.4. Temperature measurement: (700 $\pm$ 300mV)            | 659.13 mV |
| 4.5. SR10 Output tested (Set_Output(-100))                 |           |

## 5. Performance Test in Air, 20°C Temperature:

- |  |           |
|--|-----------|
| 5.1. Amplitude measurement (Blue: 290 – 470mV)             | 379.55 mV |
| 5.2. Phase measurement (Blue: 25 $\pm$ 5°)                 | 27.5 °    |
| 5.3. Standard deviation of Phase measurement: (Max: 0.02°) | 0.008 °   |
| 5.4. Temperature measurement: (100 $\pm$ 300mV)            | 22.87 mV  |
| 5.5. SR10 Output tested (Set_Output(-100))                 |           |

## 6. Performance Test in Air, 40°C Temperature:

- |  |            |
|--|------------|
| 6.1. Amplitude measurement (Blue: 320 – 500mV)             | 383.57 mV  |
| 6.2. Phase measurement (Blue: 22 $\pm$ 5°)                 | 24.0 °     |
| 6.3. Standard deviation of Phase measurement: (Max: 0.02°) | 0.014 °    |
| 6.4. Temperature measurement: (-500 $\pm$ 300mV)           | -542.09 mV |
| 6.5. SR10 Output tested (Set_Output(-100))                 |            |

Date: 30 January 2007

Sign:



Vidar Selsvik, Production Engineer



# CALIBRATION CERTIFICATE

Form No. 622, Dec 2005  
Page 1 of 2

AANDERAA DATA INSTRUMENTS

Sensing Foil Batch No: 3606  
Certificate No: 3835 474 39111

Product: Oxygen Optode 3835  
Serial No: 474  
Calibration Date: 29 January 2007

This is to certify that this product has been calibrated using the following instruments:

ASL Digital Thermometer model F250  
Platinum Resistance Thermometer  
Calibration Bath model FNT 321-1-40

Serial No. 06792/06  
Serial No. 2H1072/1

### Parameter: Internal Temperature:

#### Calibration points and readings:

Temperature (°C)	1.14	12.09	24.09	36.06
Reading (mV)	690.39	338.83	-57.20	-420.94

#### Giving these coefficients

Index	0	1	2	3
TempCoef	2.23239E+01	-3.07008E-02	2.86004E-06	-4.10694E-09

### Parameter: Oxygen:

	O2 Concentration	Air Saturation
Range:	0-500 $\mu\text{M}$ <sup>1)</sup>	0 - 120%
Accuracy <sup>1)</sup> :	< $\pm 8\mu\text{M}$ or $\pm 5\%$ (whichever is greater)	$\pm 5\%$
Resolution:	< 1 $\mu\text{M}$	< 0.4%
Settling Time (63%):	< 25 seconds	

#### Calibration points and readings<sup>2)</sup>:

	Air Saturated Water	Zero Solution (Na <sub>2</sub> SO <sub>3</sub> )
Phase reading (°)	2.87355E+01	6.47070E+01
Temperature reading (°C)	1.98583E+01	2.04615E+01
Air Pressure (hPa)	1.00000E+03	

#### Giving these coefficients

Index	0	1	2	3
PhaseCoef	-1.12592E+00	1.12781E+00	0.00000E+00	0.00000E+00

<sup>1)</sup> Valid for 0 to 2000m (6562ft) depth, salinity 33 - 37ppt

<sup>2)</sup> The calibration is performed in fresh water and the salinity setting is set to 0

AANDERAA DATA INSTRUMENTS AS





# CALIBRATION CERTIFICATE

AANDERAA DATA INSTRUMENTS

Form No. 622, Dec 2005  
Page 2 of 2

Sensing Foil Batch No: 3606  
Certificate No: 3835 474 39111

Product: Oxygen Optode 3835  
Serial No: 474  
Calibration Date: 29 January 2007

## SR10 Scaling Coefficients:

At the SR10 output the Oxygen Optode 3830 can give either absolute oxygen concentration in  $\mu\text{M}$  or air saturation in %. The setting of the internal property "Output"<sup>3)</sup>, controls the selection of the unit. The coefficients for converting SR10 raw data to engineering units are fixed.

Output = -1	Output = -2
A = 0	A = 0
B = 4.883E-01	B = 1.465E-01
C = 0	C = 0
D = 0	D = 0
Oxygen ( $\mu\text{M}$ ) = A + BN + CN2 + DN3	Oxygen (%) = A + BN + CN2 + DN3

<sup>3)</sup> The default output setting is set to -1

Date: 29 January 2007

Sign:

Tor-Ove Kvalvaag, Calibration Engineer

AANDERAA DATA INSTRUMENTS AS



# CALIBRATION CERTIFICATE

Form No. 621, Dec 2005

AANDERAA DATA INSTRUMENTS

Certificate No: 3853\_3606\_39038  
Batch No: 3606

Product: O2 Sensing Foil PSt3 3853  
Calibration Date: 19 September 2006

### Calibration points and phase readings (degrees)

Temperature (°C)		3.04	10.78	20.35	30.00	39.56
Pressure (hPa)		972.00	972.00	972.00	972.00	972.00
O2 in % of O2+N2	0.00	72.89	72.27	71.36	70.47	69.51
	1.00	68.28	67.21	65.74	64.29	62.76
	2.00	64.58	63.19	61.34	59.57	57.76
	5.00	55.90	54.05	51.72	49.51	47.43
	10.00	46.52	44.50	42.07	39.84	37.85
	20.90	35.52	33.65	31.50	29.61	28.00
	30.00	30.42	28.73	26.82	25.16	23.79

Giving these coefficients <sup>1)</sup>

Index	0	1	2	3
C0 Coefficient	4.60262E+03	-1.56352E+02	3.11002E+00	-2.63289E-02
C1 Coefficient	-2.56549E+02	7.84126E+00	-1.55660E-01	1.32344E-03
C2 Coefficient	5.79714E+00	-1.58265E-01	3.17570E-03	-2.71486E-05
C3 Coefficient	-6.10916E-02	1.48660E-03	-3.05830E-05	2.62173E-07
C4 Coefficient	2.46453E-04	-5.32422E-06	1.13945E-07	-9.73074E-10

<sup>1)</sup> Ask for Form No 621S when this O2 Sensing Foil is used in Oxygen Sensor 3830 with Serial Numbers lower than 184.

Date: 6/25/2007

Sign:

Tor-Ove Kvalvaag, Calibration Engineer

AANDERAA DATA INSTRUMENTS AS



Persistor Instruments part number  
Serial Number

SSCF512MBI  
20684

This card has been tested and is certified by Persistor Instruments for use with Persistor products.  
The characteristics of this part are: SiliconDrive, CompactFlash, 512 MB, Industrial Temp (-40 to +85 C)

-----  
Card Check Program      CF21M SN 02271  
Software:1.42, Build:Apr 19 2006, Fixture:1.11  
-----

Cert #: 20684  
Tester: rwk  
Date: Thursday, March 22, 2007 07:37 AM  
Capacity: 521773056  
Model: SILICONSYSTEMS INC 512MB  
Firmware: "V2.23 "  
Config: 0000848AH

Card SN: 526CTP67SV604DC00452SILICONSYSTEMS INC 512MB  
Side code: 7505/3012  
File Path: C:\Mar2007\522M12MB.018  
CF2 SN: 02271  
BIA SN: 01058  
PicoDOS: 4.02r1  
BIOS: 4.02r1

--- READ ---

Repaired: 0  
Read bytes/sec: 867268  
Read Current Max (5V): 9.09 mA  
Read Current Avg (5V): 7.85 mA  
Idle Current (3V): 196 uA

--- FDISK/FORMAT ---

FDISKed: Yes  
FORMATed: Yes  
--- SPEED ---

MB5VWriteNoOpt (bytes/sec): 278765  
MB5VReadNoOpt (bytes/sec): 499584  
MB5VWriteZoom (bytes/sec): 524813  
MB5VReadZoom (bytes/sec): 518584  
MB3VWriteNoOpt (bytes/sec): 260807  
MB3VReadNoOpt (bytes/sec): 499584  
MB3VWriteZoom (bytes/sec): 524655  
MB3VReadZoom (bytes/sec): 518225  
P A S S E D



Persistor Instruments part number  
Serial Number

SSCF128MBI  
20616

This card has been tested and is certified by Persistor Instruments for use with Persistor products.  
The characteristics of this part are: SiliconDrive, CompactFlash, 128 MB, Industrial Temp (-40 to +85 C)

-----  
Card Check Program                   CF21M   SN 02271  
Software:1.42,   Build:Apr 19 2006,   Fixture:1.11  
-----

Cert #:       20616  
Tester:       rwk  
Date:        Thursday, March 01, 2007  11:45 AM  
Capacity:     130154496  
Model:        SILICONSYSTEMS INC 128MB  
Firmware:     "V2.23   "  
Config:       0000848AH

Card SN:     406VTK65SG602SC00247SILICONSYSTEMS INC 128MB  
Side code:   5497/3005  
File Path:   C:\Mar2007\130M28MB.001  
CF2 SN:      02271  
BIA SN:      01058  
PicoDOS:     4.02r1  
BIOS:        4.02r1

--- READ ---

Repaired:    0  
Read bytes/sec:       867272  
Read Current Max (5V):       7.67 mA  
Read Current Avg (5V):       6.54 mA  
Idle Current (3V):        181 uA

--- FDISK/FORMAT ---

FDISKed: Yes  
FORMATed: Yes  
--- SPEED ---

MB5VWriteNoOpt (bytes/sec):    104554  
MB5VReadNoOpt (bytes/sec):     463561  
MB5VWriteZoom (bytes/sec):     318891  
MB5VReadZoom (bytes/sec):      501855  
MB3VWriteNoOpt (bytes/sec):    102791  
MB3VReadNoOpt (bytes/sec):     463561  
MB3VWriteZoom (bytes/sec):     318542  
MB3VReadZoom (bytes/sec):      501471

P A S S E D



**PRESSURE TRANSDUCER  
CALIBRATION DATA**

<i>Customer</i> WEBB RESEARCH	<i>Date</i> 30 MAY 07
<i>Model Number</i> MP50A-300A	<i>Serial Number</i> 75550

<i>Diaphragm Materials</i> TITANIUM	<i>Excitation</i> 5 VDC	<i>Pressure Range</i> 300 PSIA	<i>Excitation Type</i> CONSTANT VOLTAGE
--	----------------------------	-----------------------------------	--

<b>Pressure Calibration Data</b> all readings are in mV DC	<i>Date of Pressure Calibration</i> 28 FEB 07
--	--

Pressure	Increase	Decrease	Ideal	Linearity (%FS)	Hysteresis (%FS)	<i>STATIC ERROR BAND</i> ± 0.19% FS BFSL
0 PSIA	0.01	-0.08	0.01		0.08%	
150 PSIA	53.57	53.48	53.17	0.38%	0.08%	
300 PSIA	106.32		106.32			
<b>SENSITIVITY</b>	106.31					

<b>Thermal Calibration Data</b> all readings are in mV DC	<i>Date of Thermal Calibration</i> 28 FEB 07
---	---

	Low Temp.	Ambient	High Temp	Temperature Range	Thermal Balance Shift	Thermal Sensitivity Shift
<b>Temperature</b>	30 °F	75 °F	130 °F			
0 PSIA	-0.48	-0.10	-0.31	30°F to 75°F	0.36%FS	1.38%FS
300 PSIA	104.46	106.31	107.00	75°F to 130°F	-0.20%FS	0.85%FS
<b>Sensitivity</b>	104.94	106.41	107.31	<b>AVERAGE</b>	± 0.002% FS/°F	± 0.011% FS/°F

**Notes**

DATE OF LAST MEASUREMENT:  
5 MAR 07

BALANCE OUTPUT:  
-2.26 mV DC

INPUT RESISTANCE      2079 Ohms  
OUTPUT RESISTANCE    808 Ohms

<i>Data Entered and Reviewed By</i> Dennis Adkinson	<i>Date Data Entered</i> 7 March 2007
--	--