



AANDERAA DATA INSTRUMENTS

# TEST & SPECIFICATIONS

Form No. 727, Oct 2007

Layout No:  
Circuit Diagram No:

Product: Seaguard RCM  
Serial No: 169

Component	Serial No.	Remarks
Main Assembly Seaguard 9340	307	
DCS 4520	149	
Oxygen Optode 4330	102	
Pressure Sensor 4117D	164	
Temperature Sensor 4060	123	

## 1. Visual and Mechanical Checks

- 1.1. Sensors fixed in correct position
- 1.2. Watertight receptacle and plugs connected
- 1.3. HUB connectors connected to main board
- 1.4. Pressure sensor filled with oil
- 1.5. Epoxy coating intact
- 1.6. Zinc anode installed
- 1.7. O-ring groove inspected, cleaned and greased

## 2. Pre-performance Setup

- 2.1. Hardware and sensors configured
- 2.2. Sensors detected and displayed in configuration wizard
- 2.3. Analog channels configured if used
- 2.4. Touch screen calibrated
- 2.5. Battery indicator calibrated
- 2.6. SD card operation
- 2.7. S-Flash operation
- 2.8. USB Connection to PC(only if installed)
- 2.9. Clock adjusted to correct UTC
- 2.10. Analog switch in correct position

## 3. Performance test

- 3.1. Clock adjusted to UTC
- 3.2. Current drain after power up (max 130 mA) 74 mA
- 3.3. Current drain with display off (max 30 mA) 14 mA
- 3.4. Current drain in Power Down Mode (max 1.0 mA) 0.77 mA
- 3.5. Pressure test
- 3.6. Field test and data analysis
- 3.7. Operation of display at 0°C
- 3.8. Operation with test probes on transducers, -5°C to +35°C (all sensors, 16 hours, data on SD)

Windows CE Licens-Key : 00039-230-230-985

Date: 12 February 2009

Sign:

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# TEST & SPECIFICATIONS

Form No. 728, Oct 2007

**Product: Seaguard RCM**

**Serial No: 169**

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**1. Final Check prior to Shipment: (point 1.1 – 1.9 only if sensors installed)**

- 1.1. Doppler Current Sensor is tested with Test Unit 3731
- 1.2. Temperature readings correspond to room temperature
- 1.3. Conductivity Sensor reads correct with seawater loop
- 1.4. Check that the pressure sensor is oil filled
- 1.5. Pressure Sensor gives correct reading at air pressure
- 1.6. Turbidity reading increases when a reflector is placed 20cm in front of it
- 1.7. The oxygen sensor reads maximum in air
- 1.8. Inspect O-ring groove and clean and grease O-ring
- 1.9. Battery in lower slot,
  - a) Type:
  - b) Open loop voltage: V
  - c) Voltage with 100 ohms load: V
- 1.10. Battery in upper slot,
  - d) Type:
  - e) Open loop voltage: V
  - f) Voltage with 100 ohms load: V

Date: 12 February 2009

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# TEST & SPECIFICATIONS

Form No. 727, Oct 2007

License:

4654-4831-3090-2111	Analog Sensors	2009,2,3
3059-3749-0953-1699	AADI Real-Time	2011,5,20

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# TEST & SPECIFICATIONS

Form No. 776, Jul 2008

AANDERAA DATA INSTRUMENTS

Product Name: Main Assembly Seaguard 9340

Serial No: 307

Main Board Seaguard 9341  
Main Board tested according to form 773

Serial No: 307

## 1. Visual component check prior to assembly in covers

## 2. Initial hardware test after bootloader and image loaded and display added

- |  |         |
|--|---------|
| 2.1 Current drain after bootloader start-up (max 70mA).....                      | 23.40mA |
| 2.2 Current drain with image loaded (max 130mA) .....                            | 3.30mA  |
| 2.3 Voltage 3.3V ( $3.3V \pm 0.1V$ ).....  | 1.27V   |
| 2.4 Voltage 1.25V ( $1.25V \pm 0.13V$ ).....                                     | 3.30V   |
| 2.5 Check that the SD card is detected and found in application in Control Panel |         |
| 2.6 Check that the touch panel responds when the Start button is clicked         |         |
| 2.7 Check that the S-Flash is present in application in Control Panel            |         |

## 3. Hardware test with covers

- |  |    |
|--|----|
| 3.1 Current drain with image loaded (max 130mA).....                             | mA |
| 3.2 Voltage 3.3V ( $3.3V \pm 0.1V$ ).....  | V  |
| 3.3 Check that the SD card is detected and found in application in Control Panel |    |
| 3.4 Check that the touch panel responds when the Start button is clicked         |    |
| 3.5 Check that the S-Flash is present in application in Control Panel            |    |
| 3.6 Check that the USB port is working   |    |

Display Board Seaguard 9342  
Display Board tested according to form 772

Serial No: 84

## 1. Visual component check prior to assembly in covers

## 2. Hardware tests

- |  |                |
|--|----------------|
| 2.1 Current drain with display on (max 230mA).....                             | 71.00mA        |
| 2.2 Current drain with display off (max 30mA).....                             | 12.00mA        |
| 2.3 Current drain in sleep mode (max 350 $\mu$ A) .....                        | 224.00 $\mu$ A |
| 2.4 Check the display colors, miscoloration is best seen on a white background |                |
| 2.5 Check the touch screen operation   |                |

## Main assembly with Main Board and Display Board

Main assembly tested according to form 774

## 4. Seaguard Main assembly test

- |  |               |
|--|---------------|
| 4.1 Current drain with display connected (max 130mA) .....           | 72.0mA        |
| 4.2 Visual display check   |               |
| 4.3 Current drain in Sleep Mode (max 350 $\mu$ A).....               | 231.0 $\mu$ A |
| 4.4 Clock setting (check new clock setting after switching power on) |               |
| 4.5 Battery setting (check battery setting after power off)          |               |
| 4.6 Compact flash storage  |               |
| 4.7 SD card storage  |               |
| 4.8 USB connection to PC   |               |
| 4.9 RS485 connection to PC   |               |
| 4.10 Power spec test   |               |
| 4.11 Temperature test  |               |
| 4.12 Sensor setup test   |               |
| 4.13 Data collection test  |               |

Date: 11 February 2009

Sign:

William Benevoli,  
Calibration & Production Engineer

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# TEST & SPECIFICATIONS

Form No. 769, Jun 2008

Layout No:  
Circuit Diagram No:

Product: DCS 4520  
Serial No: 149

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## Digital Board

1. Tested according to Test Procedure Form 754.

## Analog Board

2. Tested according to Test Procedure Form 757.

## Complete Sensor

3. Tested according to Test Procedure Form 759.

## Performance test and results from Test Procedure Form 759

### 4. Visual Check

- 4.1. Inspection of o-ring groove.
- 4.2. Pressure tested.
- 4.3. Electrical isolation to flange after pressure test (only 4520).
- 4.4. Communication tested (AiCaP, Rs-232/Rs-422).

### 5. Current Consumption

- |  |                |
|--|----------------|
| 5.1. Quiescent, no ping (maximum 220 $\mu$ A)          | 193.00 $\mu$ A |
| 5.2. Total with one ping each second (maximum 14.5 mA) | 10.60mA        |

### 6. Compass and Tilt sensor

- 6.1. Compass calibrated and verified to be within  $\pm 2.0^\circ$  at  $0^\circ$  tilt and  $\pm 3.5^\circ$  at  $30^\circ$  tilt.

### 7. Tilt Compensation

- 7.1. Tilt sensor calibrated and verified to be within  $\pm 1.0^\circ$  in the range from  $+35^\circ$  to  $-35^\circ$  on both axes.

### 8. Performance test

- 8.1. The sensor is tested with Test Unit 3731 during climatic tests to control sensor performance over the whole temperature range.
- 8.2. The direction data is also controlled by changing the direction of the Test Unit 3731.

Date: 16 October 2008

Sign:

Halvard Skurve, Production Engineer

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# TEST & SPECIFICATIONS

Form No. 712, July 2008

Layout No: 1372A, 1374A, 1376

Circuit Diagram No: : V-3979A, V3977A, V-3980

Program Version: V1.20.1

Product: Oxygen Optode 4330

Serial No: 102

## Visual and Mechanical Checks:

- 1.1 Soldering quality
- 1.2 Visual surface
- 1.3 Galvanic isolation between housing and electronics

## Current Drain and Voltages:

2.1	Average current drain at 0.5 Hz sampling (Max.: 33 mA)	29.2	mA
2.2	CANBus Current drain at 0.5 Hz sampling (Max.: 33 mA)	23.2	mA
2.3	Current drain in sleep (Max.: 180 $\mu$ A)	152	$\mu$ A
2.4	CANBus Current drain in sleep (Max.: 180 $\mu$ A)	106	$\mu$ A
2.5	DSP IO voltage, J4.18 (3.3 $\pm$ 0.15V)	3.30	V
2.6	DSP Core voltage, J4.17(1.8 $\pm$ 0.05 V)	1.83	V
2.7	Excitation driver voltage, C4 Analog Board (4.5 $\pm$ 0.15 V)	4.62	V

## Performance test:

Performance test:		Channel:	BLUE		RED	
3.1	Average of Receiver readings (0±150mV)		-16.8	mV	-9.7	mV
3.2	Standard Deviation of Receiver readings (Max.: 45mV/10mV)		28.73	mV	2.27	mV
3.3	Amplitude measurement with non- fluorescence foil (<60mV/650-1200mV)		23.9	mV	1197	mV
3.4	Amplitude measurement with fluorescence foil (700-1200mV)		951	mV	931.6	mV
3.5	CANBus Output test					

## Function test at 0°C Temperature (in air with reference foil):

Action test at 0°C Temperature (in air with reference foil):		Channel:	BLUE		RED	
4.1	Amplitude measurement (Blue: 150 – 500mV,Red 650-1800mV)		223.9	mv	1745.2	mv
4.2	Phase measurement (Blue: 4 ±2°,Red: 4 ±2°)		3.9	°	3.7	°
4.3	Standard deviation of Phase measurement: (Max: 0.02°)		0.008	°	0.004	°
4.4	Raw data temperature measurement: (600 ±200mV)				774.3	mv

## Function test at 20°C Temperature (in air with reference foil):

Function test at 20°C Temperature (in air with reference foil):		Channel:	BLUE		RED	
5.1	Amplitude measurement (Blue: 100 – 300mV,Red 650-1800mV)		209	mv	1372	mv
5.2	Phase measurement (Blue: 5 ±2°,Red: 5 ±2°)		4.2	°	4.0	°
5.3	Standard deviation of Phase measurement: (Max: 0.02°)		0.009	°	0.004	°
5.4	Raw data Temperature measurement: (0 ±200mV)				87.4	mv

## Function test at 40°C Temperature (in air with reference foil):

Function test at 40°C Temperature (in air with reference foil):		Channel:	BLUE		RED	
6.1	Amplitude measurement (Blue: 150 – 500mV,Red 650-1800mV)		203.8	mv	1155.4	mv
6.2	Phase measurement (Blue: 5 ±2°,Red: 5 ±2°)		4.3	°	4.3	°
6.3	Standard deviation of Phase measurement: (Max: 0.02°)		0.013	°	0.008	°
6.4	Raw data Temperature measurement: (-400 ±200mV)				-370.6	mv

## Pressure test :

7.1	Pressure (IW version: 20MPa, DW version 60MPa)	60MPa
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Date: 5 December 2008

Sign:

Vidar Selsvik, Production Engineer

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# CALIBRATION CERTIFICATE

Form No. 710, Dec 2005

AANDERAA DATA INSTRUMENTS

Sensing Foil Batch No: 4807E  
Certificate No:

Product: Oxygen Optode 4330  
Serial No: 102  
Calibration Date: 4 December 2008

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

**Parameter: Internal Temperature:**

**Calibration points and readings:**

Temperature (°C)	0.98	11.95	23.98	35.96	
Reading (mV)	817.73	481.04	83.91	-294.56	

**Giving these coefficients**

Index	0	1	2	3	4	5
TempCoef	2.65420E01	-3.07350E-02	2.90236E-06	-4.33935E-09	0.00000E00	0.00000E00

**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 (°)	3.11482E+01	6.15863E+01
Temperature reading (°C)	9.92734E+00	2.01867E+01
Air Pressure (hPa)	9.87530E+02	

**Giving these coefficients**

Index	0	1	2	3
PhaseCoef	-4.92291E-01	1.00565E00	0.00000E00	0.00000E00

<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

Date: 5 December 2008

Sign:

  
Rita Ramberg, Production Engineer

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# CALIBRATION CERTIFICATE

Form No 770. , Jun 2008

AANDERAA DATA INSTRUMENTS

Certificate No: 3853\_4807E\_39743  
Batch No: 4807E

Product: O2 Sensing Foil PST3  
Calibration Date: 22 October 2008

Serial No: 4807

## Calibration points and phase readings

Index	Temperature (°C)	Phase Reading (°)	Oxygen reference (µM)	Index	Temperature (°C)	Phase Reading (°)	Oxygen reference (µM)
0	3.349	62.633	0.00	32	39.772	34.429	84.86
1	3.345	59.290	18.86	33	39.775	26.156	177.36
2	3.343	56.399	37.72	34	39.774	22.545	254.59
3	3.346	49.426	94.30	35	6.810	62.418	0.00
4	3.345	41.679	188.61	36	6.808	58.923	17.32
5	3.344	32.529	394.21	37	6.808	55.893	34.65
6	3.342	28.265	565.88	38	6.809	48.702	86.61
7	10.271	62.204	0.00	39	6.809	40.893	173.23
8	10.271	58.557	15.78	40	6.808	31.809	362.06
9	10.272	55.387	31.57	41	6.807	27.608	519.71
10	10.272	47.979	78.92	42	15.099	61.832	0.00
11	10.272	40.106	157.85	43	15.212	57.967	14.19
12	10.272	31.089	329.90	44	15.215	54.643	28.39
13	10.272	26.951	473.54	45	15.215	47.009	70.97
14	19.928	61.461	0.00	46	15.215	39.077	141.94
15	20.153	57.377	12.60	47	15.215	30.163	296.64
16	20.157	53.899	25.21	48	15.214	26.115	425.81
17	20.158	46.040	63.01	49	24.977	61.062	0.00
18	20.158	38.048	126.03	50	25.090	56.759	11.45
19	20.158	29.237	263.39	51	25.093	53.137	22.89
20	20.157	25.278	378.08	52	25.094	45.096	57.23
21	30.026	60.662	0.00	53	25.094	37.092	114.46
22	30.027	56.140	10.29	54	25.095	28.409	239.22
23	30.030	52.375	20.58	55	25.095	24.539	343.38
24	30.030	44.152	51.45	56	34.895	60.171	0.00
25	30.031	36.135	102.90	57	34.899	55.470	9.39
26	30.032	27.580	215.05	58	34.899	51.588	18.78
27	30.034	23.799	308.67	59	34.900	43.265	46.94
28	39.765	59.680	0.00	60	34.902	35.282	93.88
29	39.771	54.799	8.49	61	34.904	26.868	196.20
30	39.769	50.801	16.97	62	34.904	23.172	281.63
31	39.771	42.377	42.43	63			

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## Giving these coefficients

Index	FoilCoefA	FoilCoefB
0	-3.685854E-06	4.017659E-07
1	-7.653380E-06	3.831877E+03
2	1.989782E-03	-4.008088E+01
3	-2.091438E-01	1.416987E-01
4	7.936103E-04	-5.775240E-04
5	-5.982573E-07	2.583929E-05
6	1.123019E+01	-4.553939E-07
7	-6.568948E-02	0.000000E+00
8	1.065603E-04	0.000000E+00
9	-1.340582E-07	0.000000E+00
10	-3.152081E+02	0.000000E+00
11	2.539086E+00	0.000000E+00
12	-5.973739E-03	0.000000E+00
13	-1.586347E-05	0.000000E+00

## Using the following monomial degrees

Index	FoilPolyDegT	FoilPolyDegO
0	1	4
1	0	5
2	0	4
3	0	3
4	1	3
5	2	3
6	0	2
7	1	2
8	2	2
9	3	2
10	0	1
11	1	1
12	2	1
13	3	1
14	4	1
15	0	0
16	1	0
17	2	0
18	3	0
19	4	0
20	5	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0

Date: 22 October 2008

Sign:



John Arne Lillestøl,  
Automation Engineer

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# TEST & SPECIFICATIONS

Form No. 725, Dec 2005

Layout No: 1349, 1350, 1351  
Circuit Diagram No: V-3964C, V-3965C  
Program Version: 6.2.1

Product: Pressure Sensor 4117D  
Serial No: 164

---

## 1. Visual and Mechanical Checks:

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

## 2. Current Drain and Voltages:

2.1. DSP IO voltage, J4.7 ( $3.3 \pm 0.07$ V)	3.31 V
2.2. DSP Core voltage, J4.6 ( $1.8 \pm 0.04$ V)	1.80 V
2.3. Analog voltage, TP2 ( $3.3 \pm 0.15$ V)	3.33 V
2.4. Average current drain at 0.5 Hz sampling (Max.: 7 mA)	2.9 mA
2.5. Current drain in sleep (Max.: 220 $\mu$ A)	129 $\mu$ A
2.6. RS232 peak current drain at 0.5 Hz sampling	25.2 mA
2.7. CANBus average current drain at 0.5 Hz sampling (Max.: 7 mA)	2.6 mA
2.8. CANBus current drain in sleep (Max.: 220 $\mu$ A)	124.0 $\mu$ A
2.9. CANBus peak current drain at 0.5 Hz sampling	31 mA

## 3. Electronic performance test:

3.1. Raw data pressure reading at air pressure (-500000 to +1000000 LSB)	-9348 LSB
3.2. Raw data temperature reading in room temp (4000000 to 13000000 LSB)	7805491 LSB
3.3. Noise on raw data pressure readings (max.: 230 LSB)	16 LSB
3.4. Noise on temperature reading (max.: 5000 LSB)	1109 LSB

Date: 24 September 2008

Sign:

Helge Soltveit, Production Engineer

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# CALIBRATION CERTIFICATE

AANDERAA DATA INSTRUMENTS

Form No. 724, June 2007  
Page 1 of 1

**Certificate No:** 4117D\_164\_39734  
**Range:** 0 - 20000 kPa

**Product:** Pressure Sensor 4117D  
**Serial No:** 164  
**Calibration Date:** 13 October 2008

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

ASL Digital Thermometer model F25  
Platinum Resistance Thermometer  
Calibration Bath model FNT 321-1-40  
Budenberg Dead-Weight Tester 280 D

Serial No. 1103-14  
Serial No. SV1915/D  
Serial No. Serial No. 11570

## Parameter: Temperature

### Calibration points and readings:

Temperature (°C)	1.020	13.944	26.920	39.852
Reading (LSB)	11866324	9706528	7514988	5584137

### Giving these coefficients

Index	0	1	2	3
TempCoef	2.16347E+01	-4.97213E+01	7.89382E+00	-1.90609E+01

## Parameter: Pressure

### Giving these coefficients

Index	0	1	2	3
R1Coef0	1.30683E+02	-7.39763E+00	-3.87724E+00	-3.94247E+00
R1Coef1	2.75472E+04	-3.05749E+03	4.91089E+02	-1.08887E+03
R1Coef2	-9.02657E+01	1.51527E+02	7.85559E+01	-8.08853E+02
R1Coef3	6.76099E+02	-2.82714E+02	-1.35773E+02	1.83604E+03
R1Coef4	-1.82437E+02	1.55688E+02	7.97183E+01	-1.27491E+03

Date: 13 October 2008

Sign:

  
Rita Ramberg, Production Engineer

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# TEST & SPECIFICATIONS

Form No. 689, Dec 2005

Layout No: 1349C, 1350C, 1351A  
Circuit Diagram No: V-3964C, V-3965C  
Program Version: 4.3.1

Product: Temperature Sensor 4060  
Serial No: 123

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**1. Visual and Mechanical Checks:**

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

**2. Current Drain and Voltages:**

2.1. DSP IO voltage, J4.7 ( $3.3 \pm 0.07$ V)	3.30 V
2.2. DSP Core voltage, J4.6 ( $1.8 \pm 0.04$ V)	1.80 V
2.3. Analog voltage, TP2 ( $3.3 \pm 0.15$ V)	3.33 V
2.4. RS232 average current drain at 0.5 Hz sampling (Max.: 7 mA)	1.5 mA
2.5. RS232 peak current drain at 0.5Hz sampling	27.8 mA
2.6. RS232 current drain in sleep (Max.: 220 $\mu$ A)	137 $\mu$ A
2.7. CANBus average current drain at 0.5Hz sampling (max: 25mA)	1.8 mA
2.8. CANBus peak current drain at 0.5Hz sampling	33.1 mA
2.9. CANBus current drain in sleep (max: 180 $\mu$ A)	125 $\mu$ A

**3. Electronic performance test:**

- 3.1. Raw data temperature reading in room temp (4000000 to 13000000 LSB) 7730765 LSB
- 3.2. Noise on temperature reading (max.: 5000 LSB) 909 LSB

Date: 17 November 2008

Sign:

Helge Soltveit, Production Engineer

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# CALIBRATION CERTIFICATE

Form No. 726, June 2007

AANDERAA DATA INSTRUMENTS

**Product: Temperature Sensor 4060**

**Serial No: 123**

**Calibration Date: 15 January 2009**

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

Calibration Bath model FNT  
ASL Digital Thermometer model F250

321-1-40  
Serial: 6792/06

## Calibration points and readings:

**Parameter:** Temperature

Calibration points and readings

Temperature (°C)	-4.125	3.977	11.950	19.922	27.966	35.960
Reading (LSB)	12999590	11815415	10533538	9200113	7876534	6640828

Giving these coefficients

Index	0	1	2	3	4	5
TempCoef	2.48118E01	-5.11302E01	7.71064E00	-1.71961E01	9.81987E-01	-7.87452E00

Date: 15 January 2009

Sign:

Tor-Ove Kvalvaag, Calibration Engineer

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