

## Certificate of Conformance

(CF03)

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KONGSBERG

## Certificate of Conformance

Date: 24.01.2017

S/N: CO2-0212-001

Part #: 9847666

Description: Carbon dioxide sensor

Kongsberg Maritime Contros GmbH certifies that the system described above was manufactured, tested and inspected in accordance with Kongsberg Maritime Contros GmbH factory specifications and quality assurance standards.

*Tim Callsen*  
\_\_\_\_\_  
Responsible for Quality Assurance

*T. Callsen*  
\_\_\_\_\_  
Signature

# Calibration Sheet

Instrument: CONTROS HydroC CO<sub>2</sub>

Date of calibration: 19.01.2017

Serial number: CO2-0212-001

Date of delivery: 24.01.2016

Customer: CNR ISMAR

PO number: RMA47879



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## Sensor characteristics

Note! *For proper handling please check our manual, esp. chapter "Important Notices"!*

### Energy consumption

(CONTROS HydroC® CO<sub>2</sub> II standard, general values measured without pump):

Water temperature	8 °C	14.0 °C	20 °C	During warm-up**	During sleep mode
Current @ 12 V in mA	410	320*	300	630	< 1

\* measured during calibration

\*\* warm-up time decreases with increasing voltage

[consumption during zeroing: +300 mA @ 12 V]

### Warm-up time

(T\_control, general values of standard CONTROS HydroC® with 5T-pump):

Warm-up time	12 V	24 V
4 °C	approx. 35 min	approx. 12 min
17 °C	approx. 25 min	approx. 8 min
30 °C	approx. 10 min	approx. 3 min

### Response time

(standard CONTROS HydroC® CO<sub>2</sub> II with 5T-pump at calibration conditions, general values with new silicone composite membrane, ± 10 s)

Water temperature	5 °C	15 °C	25 °C
t <sub>63</sub>	70 s	65 s	60 s

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## Sensor specifications

Operating depth:	2000 m
Gas tension (abs.):	800 mbar to 1100 mbar (defined through measuring range of the internal pressure sensors p_NDIR and p_in)
Measuring range:	200 µatm to 1000 µatm
Resolution – digital signal:	<1 µatm
Accuracy:	± 1 % reading (as total sum of all error)
Water temperature range:	-2 °C to 30 °C
Calibration optimised for:	-2 °C to 30 °C ( <i>as requested by customer</i> )
Dimensions:	ø 89 x 380 without connector; ø 89 x 414 with connector
Weight:	4.5 kg (2.2 kg in water)
Output connector:	Standard SubConn® MCBH8M-Titanium
Voltage:	11 to 30 VDC
RS232/ EIA-232 output signal:	See “CONTROS HydroC® On-line data”
RS485/ EIA-485 output signal:	See “CONTROS HydroC® On-line data”
Baud rate (preset):	115200 Bd
Interval settings ( <i>customer's values</i> ):	Warm-up: 15 min; Zero: 2 min; Flush: 10 min; Measure: 20 min
Data logger ( <i>customer's values</i> ):	Yes; 5 s average every 10 s during Zero 5 s average every 30 s during Flush 10 s average every 30 s during Measure
Storage space:	2 GB
Analog output (voltage, current):	<i>None</i>

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## Calibration details

### Setup and parameters

Calibration unit:	KM Contros CO <sub>2</sub> calibration tank #1
RS232 protocol unit:	DETECT-2 software package on CO-CALIB2
Voltage:	12.0 VDC
Temperature:	14.0 °C
Water:	Deionised water with carbonate additives
Salinity:	0 ‰
Reference gases:	100.74 ppm, 445.57 ppm, 800.01 ppm CO <sub>2</sub> in natural air
Reference system:	SPRINK underway instrument with LiCOR LI7000
Calibration steps:	(200, 400, 600, 800) µatm
Pump:	Seabird SBE 5T

### Sensor

Sensor configuration:	BD-00Membrane: Silicone composite membrane / 32-011-2162-060117-009
Control temperature (NDIR detector):	39 °C
PWM of internal pump:	During Zero: 50 During Flush: 70 During Measure: 70

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## Pump Specifications

Manufacturer:	Seabird
Website:	<a href="http://www.seabird.com">http://www.seabird.com</a>
Model:	Submersible pump SBE 5T (Titanium)
Serial number:	056286
Input voltage:	10 to 18 VDC
Supply power:	8.3 W
Flow rate:	approx. 100 mL/s
Output connector:	Standard connector, XSG-2BCL-HP-SS

### Antifouling flow head:

Drawing number: 20141206\_101  
Version: 00\_01

### Antifouling clamping ring:

Drawing number: 20150323\_101  
Version: 00\_01

### Pump mount:

Drawing number: 05082011\_101  
Version: 0003

### Pump cap:

Drawing number: 18082011\_001  
Version: 0003

### Strainer:

Article number: TD 12 V4A 25 1"K

### Antifouling cap:

Drawing number: 30092011\_002  
Version: 0002





**Sea-Bird GmbH**  
Postfach 1167, 87401 Kempten, Germany  
Phone: +49 831 9 60994 701 Fax: +49 831 960994 709  
Email: seabird.eu@seabird.com

**Service**

**RMA Number**

E01560

**Report**

**Customer Information:**

**Date**

5/10/2017

**Company** Communications Technology SRL

**Contact** Chiara Benini

**PO Number** SBE-EU-04/17-025

**Serial Number** 37-10886

**Model Number** SBE 37SMP

**Services Requested:**

1. Return to manufacturer for service and calibration.
2. Replace Antifoulant Device(s).

**Problems Found:**

**Services Performed:**

1. This Instrument or Sensor was Repaired, Upgraded or Calibrated at SBE\_USA\*
2. AF24173 Anti-foulant, V2, pr w/ Bag/Label

**Special Notes:**

\*see service report #1005501717



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Postfach 1167, 87401 Kempten, Germany  
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**Service**

**Report**

**RMA Number**

E01560

**Date**

5/10/2017

**Customer Information:**

**Company** Communications Technology SRL

**Contact** Chiara Benini

**PO Number** SBE-EU-04/17-025

**Serial Number** 630477

**Model Number** SBE 63

**Services Requested:**

1. Return to manufacturer for service and calibration.

**Problems Found:**

**Services Performed:**

1. This Instrument or Sensor was Repaired, Upgraded or Calibrated at SBE\_USA\*

**Special Notes:**

\*see service report #1005501717



**SEA-BIRD ELECTRONICS, INC.**  
13431 NE 20<sup>th</sup> Street  
Bellevue, Washington 98005 USA

Phone +1-425-643-9866  
Fax +1-425-643-9954  
www.seabird.com

## SERVICE REPORT

**Service Request Date** 1005501717  
05-MAY-2017

### CUSTOMER INFORMATION

Name: SEA-BIRD GMBH  
Account : 40280182  
NATHALIE GAST  
SEABIRD.EU@SEABIRD.COM  
+49 831 960994 705

PO Number:  
4300957

**Bill To Address**  
POSTFACH 1167;  
KEMPTEN,87401,DE

**Ship To Address**  
LUDWIGSTRASSE 16;  
KEMPTEN,87437,DE

### PRODUCT INFORMATION

**Item:** 37SMP.12102  
**Item Description:** SBE37SMP-ODO, PLASTIC, 100M, XSG, 600M ODO  
**Serial:** 37-10886

#### Special Notes

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

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

Item	Item Description	Qty
SERVICE37	COMPLETE EXTERNAL INSPECTION. TEST ALL FUNCTIONS. CALIBRATE C & T, C&P AND RECAL IF NECESSARY. REPLACE END CAP O-RINGS A (FRRF)	1

#### Unbilled Items

Item	Item Description	Qty



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[www.seabird.com](http://www.seabird.com)

## SERVICE REPORT

**Service Request**  
**Date**

**1005501717**  
05-MAY-2017

## PRODUCT INFORMATION

**Item:** 63.LEGACY  
**Item Description:** (LEGACY) SBE 63 Optical Oxygen Sensor  
**Serial:** 630477

### Special Notes

Services Requested:  
No services requested.



# Sea-Bird Electronics, Inc.

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Phone: (+1) 425-643-9866 Fax (+1) 425-643-9954 Email: seabird@seabird.com

SENSOR SERIAL NUMBER: 10886  
 CALIBRATION DATE: 28-Apr-17

SBE 37 V2 CONDUCTIVITY CALIBRATION DATA  
 PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

## COEFFICIENTS:

$g$ = -9.914884e-001	$\text{CPcor}$ = -9.5700e-008
$h$ = 1.402304e-001	$\text{CTcor}$ = 3.2500e-006
$i$ = -2.111888e-004	$\text{WBOTC}$ = 4.0694e-007
$j$ = 3.490048e-005	

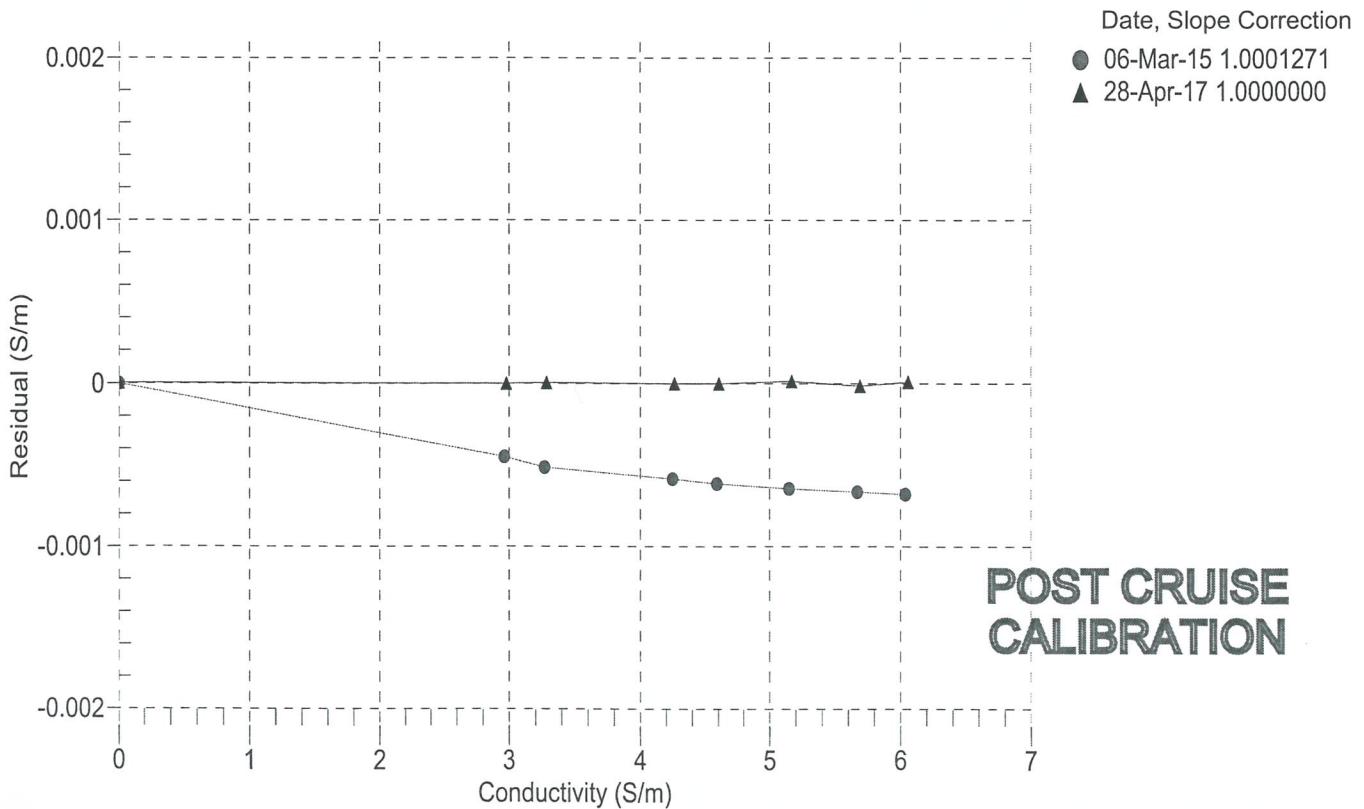
BATH TEMP (° C)	BATH SAL (PSU)	BATH COND (S/m)	INSTRUMENT OUTPUT (Hz)	INSTRUMENT COND (S/m)	RESIDUAL (S/m)
22.0000	0.0000	0.00000	2662.01	0.00000	0.00000
1.0000	34.8069	2.97524	5321.15	2.97523	-0.00000
4.5000	34.7872	3.28225	5522.59	3.28225	0.00000
15.0000	34.7452	4.26381	6121.55	4.26381	-0.00000
18.5000	34.7363	4.60890	6318.38	4.60890	-0.00000
24.0000	34.7263	5.16672	6623.90	5.16673	0.00001
29.0000	34.7210	5.68846	6897.07	5.68845	-0.00002
32.5000	34.7175	6.06071	7085.37	6.06071	0.00001

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

t = temperature (°C); p = pressure (decibars);  $\delta$  = CTcor;  $\varepsilon$  = 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: 10886  
 CALIBRATION DATE: 28-Apr-17

SBE 37 V2 TEMPERATURE CALIBRATION DATA  
 ITS-90 TEMPERATURE SCALE

COEFFICIENTS:

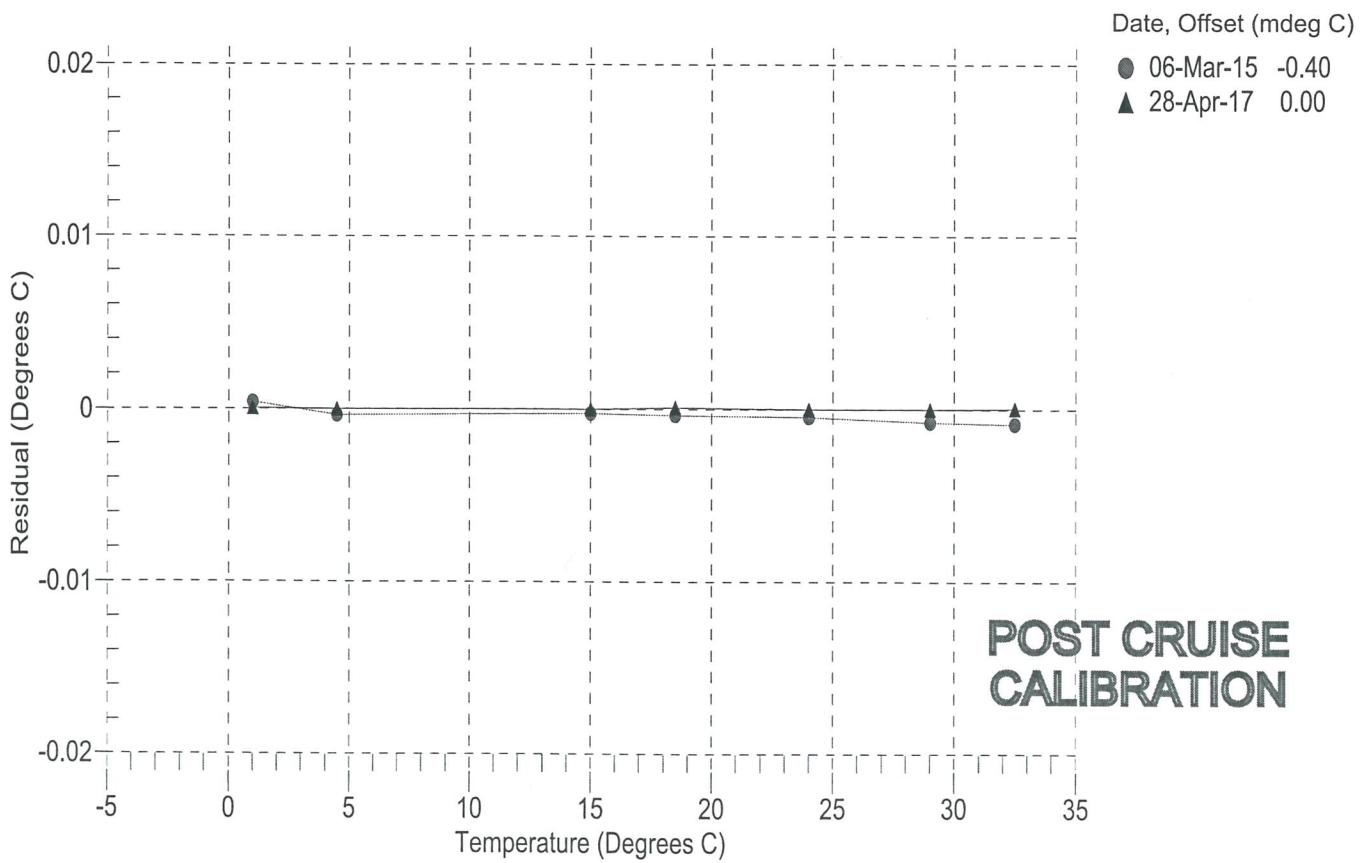
a0 = -6.274350e-005  
 a1 = 3.023153e-004  
 a2 = -4.272011e-006  
 a3 = 1.946714e-007

BATH TEMP (° C)	INSTRUMENT OUTPUT (counts)	INST TEMP (° C)	RESIDUAL (° C)
1.0000	571710.9	1.0000	0.0000
4.5000	488186.8	4.5000	-0.0000
15.0000	310053.2	15.0000	-0.0000
18.5000	268199.5	18.5001	0.0001
24.0000	214844.3	24.0000	-0.0000
29.0000	176697.2	29.0000	-0.0000
32.5000	154621.0	32.5000	0.0000

n = Instrument Output (counts)

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

Residual (°C) = instrument temperature - bath temperature



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SENSOR SERIAL NUMBER: 10886  
CALIBRATION DATE: 13-Feb-15

SBE 37 V2 PRESSURE CALIBRATION DATA  
160 psia S/N 3843098

## COEFFICIENTS:

PA0 = -8.313050e-003	PTCA0 = 5.239211e+005
PA1 = 4.965071e-004	PTCA1 = -1.571762e+000
PA2 = -6.767465e-012	PTCA2 = 3.668984e-002
PTEMPA0 = -6.987835e+001	PTCB0 = 2.504600e+001
PTEMPA1 = 5.152344e-002	PTCB1 = -0.000000e+000
PTEMPA2 = -5.868599e-007	PTCB2 = 0.000000e+000

## PRESSURE SPAN CALIBRATION

## THERMAL CORRECTION

PRESSURE (PSIA)	INSTRUMENT OUTPUT (counts)	THERMISTOR OUTPUT (volts)	COMPUTED PRESSURE (PSIA)	RESIDUAL (%FSR)	TEMP (°C)	THERMISTOR OUTPUT (volts)	INSTRUMENT OUTPUT (counts)
14.69	553547.0	1841.0	14.70	0.01	32.50	2034	554648.35
29.97	584311.0	1841.0	29.96	-0.01	29.00	1963	554641.15
59.97	644889.0	1841.0	59.96	-0.00	24.00	1862	554642.74
94.97	715697.0	1840.0	94.97	0.00	18.50	1750	554638.75
124.97	776491.0	1839.0	124.97	0.00	15.00	1680	554644.46
159.97	847532.0	1839.0	159.97	-0.00	4.50	1468	554657.60
124.97	776504.0	1839.0	124.98	0.00	1.00	1398	554652.78
94.97	715717.0	1841.0	94.98	0.01			
59.97	644930.0	1841.0	59.98	0.01			
29.98	584323.0	1842.0	29.97	-0.01		-5.00	25.05
14.68	553522.0	1842.0	14.69	0.01		35.00	25.05

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)

● 13-Feb-15 -0.00

