SBE 16plusV2 SEACAT, RS-232

Conductivity and Temperature Recorder (Pressure Optional)
with RS-232 Interface

Serial Number: 16P73164-7297

User Manual, Version 010

Sea-Bird Electronics, Inc.
13431 NE 20th Street
Bellevue, Washington 98005 USA
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SBE 16plus CTD OPERATING AND REPAIR MANUAL

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SEA-BIRD ELECTRONICS, INC.
13431 NE 20th St.
Bellevue, Washington 98005 USA
Phone: (425) 643 9866
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Email: seabird@seabird.com

Manual Generation Date: 11 April 2013

LIMITED LIABILITY STATEMENT

Extreme care should be exercised when using or servicing this equipment. It should be used or serviced only by personnel with knowledge of and training in the use and maintenance of oceanographic electronic equipment.

SEA-BIRD ELECTRONICS, INC. disclaims all product liability risks arising from the use or servicing of this system. SEA-BIRD ELECTRONICS, INC. has no way of controlling the use of this equipment or of choosing the personnel to operate it, and therefore cannot take steps to comply with laws pertaining to product liability, including laws which impose a duty to warn the user of any dangers involved in operating this equipment. Therefore, acceptance of this system by the customer shall be conclusively deemed to include a covenant by the customer to defend, indemnify, and hold SEA-BIRD ELECTRONICS, INC. harmless from all product liability claims arising from the use of servicing of this system.

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Sea-Bird Electronics, Inc.
13431 NE 20th Street, Bellevue, WA 98005 USA

DECLARATION OF CONFORMITY

Manufacturer's Name: **Sea-Bird Electronics**
Manufacturer's Address: 13431 NE 20th Street
Bellevue, WA 98005, USA

The Authorized Representative located within the Community is:
OTT MESSTECHNIK GmbH & Co.KG
P.O.Box: 2140 / 87411 Kempten / Germany
Ludwigstrasse 16 / 87437 Kempten
Internet: http://www.ott.com
Phone: +49 831 5617 – 100
Fax: +49 831 5617 - 209

Device Description: Various Data Acquisition Devices and Sensors

Model Numbers:

3S	3F	3plus	4C	4M	5T	5P	5M	7
8	9plus	11plus	14	16plus V2	16plus-IM V2		17plus V2	18
19plus V2	21	25plus	26plus	27	29	32	32C	32SC
33	35	35RT	36	37-IMP	37-IM	37-SMP	37-SM	37-SIP
37-SI	38	39	39-IM	41	41CP	43	43F	44
45	49	50	52-MP	53BPR	54	55	56	63
SIM	ICC	IMM	PDIM	AFM	90488	90204	90402	90504
Glider Payload CTD		NiMH Battery Charger and Battery Pack						

Applicable EU Directives: Machinery Directive 98 / 37 /EC
EMC Directive 2004 / 108 /EC
Low Voltage Directive (73 / 23 /EEC) as amended by (93 / 68 /EEC)

Applicable Harmonized Standards:
EN 61326-1:2006 Class A Electrical Equipment for Measurement, Control, and Laboratory Use, EMC Requirement – Part 1: General Requirements
(EN 55011:2007 Group 1, Class A)

EN 61010-1:2001, Safety Requirements for Electrical Equipments for Measurement, Control, and Laboratory Use – Part 1: General Requirements

Declaration based upon compliance to the Essential Requirements and Letter of Opinion from CKC Certification Services, LLC., Notified Body 0976

I, the undersigned, hereby declare that the equipment specified above conforms to the above European Union Directives and Standards.

Authorized Signature:

Name: Nordeen Larson

Title of Signatory: President

Date: 27 June 2012

Place: Bellevue, WA

WARNING !!

**Do not submerge this instrument (S/N 16P73164-7297)
beyond the depth rating of the lowest rated component listed below!**

Main Housing (Plastic)	**600 meters**
Pump (SBE 5M)	600 meters

SYSTEM CONFIGURATION 12 April 2013

Model SBE 16plus	**S/N 16P73164-7297**
Instrument Type	**SBE 16plusV2 SeaCaT**
Firmware Version	**2.5.2**
Communications	**9600 baud, 8 data bits, no parity, one stop bit**
Memory	**64MB**
Housing	**600 meter (Acetron plastic)**
0 Conductivity Raw Frequency	**2758.37 Hz**
Operating Mode	**Moored**
Pressure Sensor	**None**
Computer communications (Data I/O) connector	**located on the P/N 17797 Y-Cable**
Number of Voltages Sampled:	**0**
Serial RS-232C Sensor	**None**

Data Format:

Count	**Temperature**
Frequency	**Conductivity**
Count	**No Pressure Sensor**

Pump (SBE 5M)	**05-2794**

IMPORTANT SOFTWARE & HARDWARE CONFIGURATION INFORMATION

Sea-Bird supplies two versions of our software package for communication, real-time data acquisition, and data analysis and display:

- SEASOFT-Win32 - Windows software for PC running Win 95/98/NT/2000/XP
- SEASOFT-DOS - DOS software for IBM-PC/AT/386/486 or compatible computer with a hard drive

Detailed information on the use of the **Windows** software follows:

SEASOFT-Win32

SEASOFT-Win32 software was supplied on a CD-ROM with your CTD. This software package is designed to run on a PC running Win 95/98/NT/2000/XP. The CD-ROM also contains software manuals that describe the appropriate applications for the various programs, the procedure for installing the software, and instructions on using the programs. There are three primary programs used with the CTD for setup, data collection and retrieval, data display, and data processing:

- SEATERM - terminal program for setup of the CTD and uploading of data from the CTD memory (**Note**: If using the CTD with the 90208 Auto Fire Module or SBE 17*plus* V2 SEARAM, use SeatermAF instead of SEATERM)
- SEASAVE - real-time data acquisition program
- SBE Data Processing - data processing program

Instructions for using the software are found in their Help files.

To communicate with the CTD to set it up or to upload data from the CTD memory to the computer hard drive, **SEATERM** must have information about the CTD hardware configuration (communication parameters, internal firmware, etc.) and about the computer. To communicate with the CTD, double click on Seaterm.exe:

1) In the Configure menu, select the CTD. The Configuration Options dialog box appears.
   A) On the COM Settings tab, select the firmware version (if applicable), baud rate, data bits, and parity to match the CTD's configuration sheet. If necessary, change the com port to match the computer you are using.
   B) On the Upload Settings tab, enter upload type (all as a single file, etc.) as desired.
   For the SBE 17 and 25 only: enter the serial number for the SBE 3 (temperature) and SBE 4 (conductivity) modular sensors, exactly as they appear in the configuration (.con) file.
   C) On the Header Information tab, change the settings as desired.

Click OK when done. SEATERM saves the settings in a SEATERM.ini file.

1) On the Toolbar, click Connect to communicate with the CTD.
2) To set up the CTD prior to deployment:
   On the Toolbar, click Status. SEATERM sends the Status command and displays the response. Verify that the CTD setup matches your desired deployment. If not, send commands to modify the setup.
3) To upload data from the CTD:
4) On the Toolbar, click Upload to upload data from the CTD memory to the computer.

Sea-Bird CTDs store and/or transmit data from their primary and auxiliary sensors in the form of binary or hexadecimal number equivalents of the sensors' frequency or voltage outputs. This is referred to as the *raw* data. The calculations required to convert from *raw* data to *engineering* units of the measured parameters (temperature, conductivity, pressure, dissolved oxygen, pH, etc.) are performed using the software, either in real time, or after the data has been stored in a file. SEASAVE creates the file in real time. As noted above, SEATERM uploads the recorded data and creates the file on the computer hard drive.

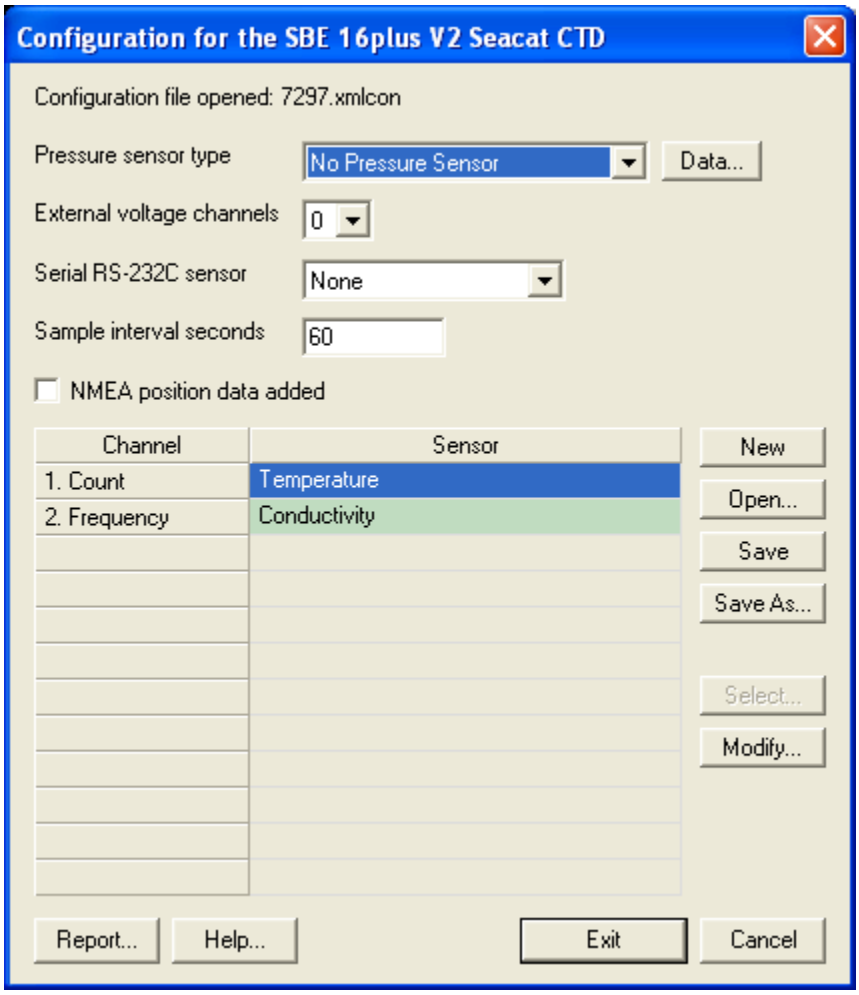
To successfully store data to a file on the computer and subsequently convert it to engineering units, the software must know the CTD type, CTD configuration, and calibration coefficients for the sensors installed on the CTD. This information is unique to each CTD, and is contained in a *configuration* file. The configuration file, which has a .con extension, was written onto a floppy disk and the CD-ROM shipped with the CTD. The .con file for a given CTD is named with the last four digits of the serial number for that CTD (e.g., 1234.con). The configuration file is created or modified (e.g., changing coefficients after recalibration, or adding another sensor) by using the Configure menu in **SEASAVE** or **SBE Data Processing**. The configuration file is used by SEASAVE to convert raw data to engineering units when it acquires, stores, and displays real-time data. The configuration file is also used by some modules in SBE Data Processing (Data Conversion and Derive) that convert raw data to engineering units during data processing.

The instrument type and instrument configuration settings of the .con file and the required setup for the SEATERM.ini file for the CTD *as delivered* are documented below. The calibration coefficients for the CTD's sensors are contained in the calibration coefficient section of the CTD manual.

NOTE:
SEATERM will not upload data correctly without a properly configured SEATERM.ini file. SEASAVE and SBE Data Processing will not interpret the data correctly without the correct .con file.

SEASOFT CONFIGURATION:

The correct instrument type for your instrument is SBE 16plus V2 SEACAT Profiler. The correct settings for the configuration of your instrument as delivered are documented below:



CALIBRATION SHEETS

Sea-Bird Electronics, Inc.

13431 NE 20th Street, Bellevue, WA 98005-2010 USA

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

SENSOR SERIAL NUMBER: 7297
CALIBRATION DATE: 22-Mar-13

SBE16plusV2 TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

a0 = 1.241662e-003
a1 = 2.773686e-004
a2 = -1.409910e-006
a3 = 1.922253e-007

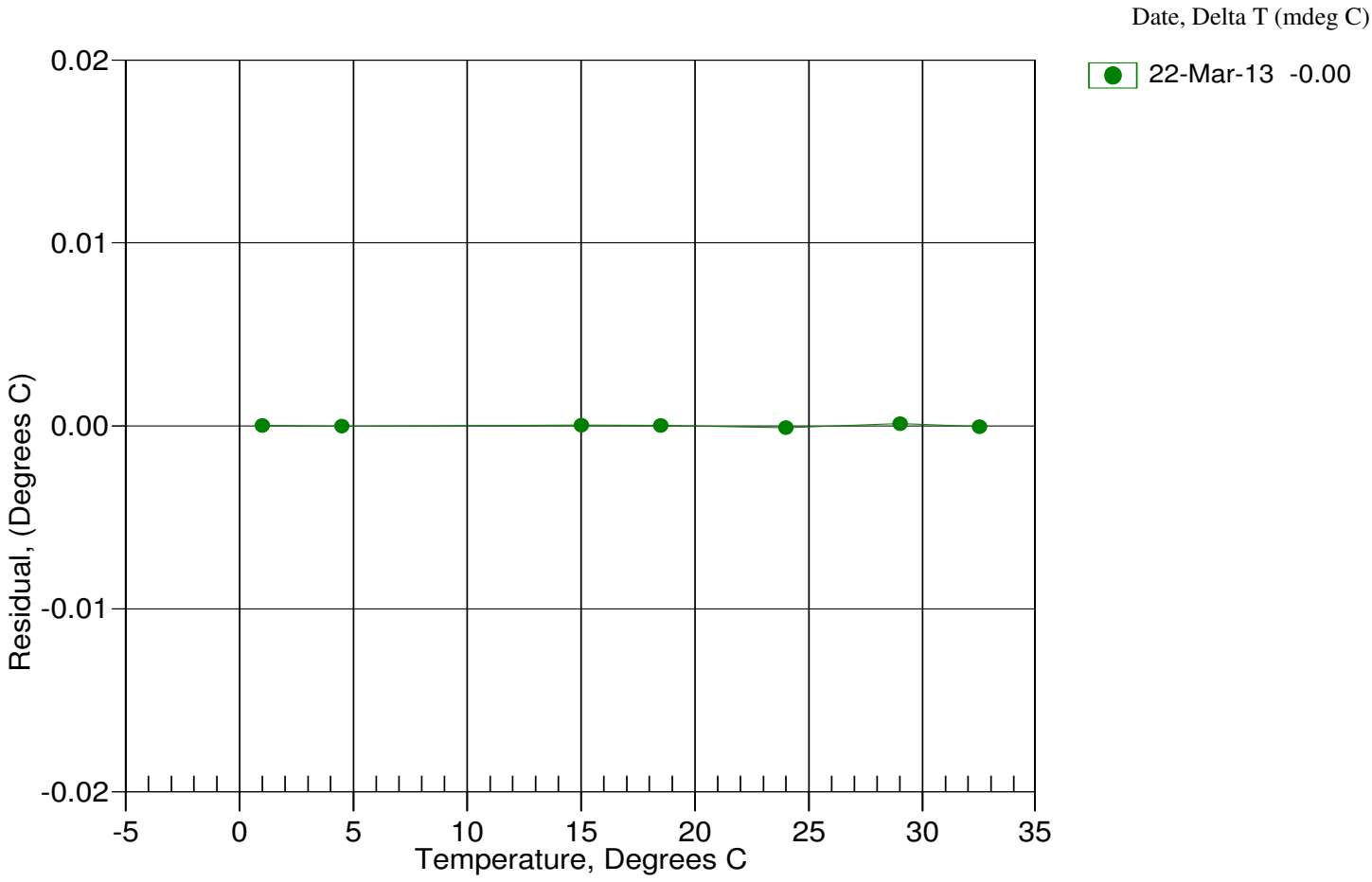
BATH TEMP (ITS-90)	INSTRUMENT OUTPUT(n)	INST TEMP (ITS-90)	RESIDUAL (ITS-90)
1.0000	563643.091	1.0000	0.0000
4.5000	497797.000	4.5000	-0.0000
15.0000	336785.636	15.0000	0.0000
18.5000	294141.300	18.5000	0.0000
24.0000	236647.600	23.9999	-0.0001
29.0000	193190.300	29.0001	0.0001
32.5001	167073.300	32.5001	-0.0000

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

R = (MV * 2.900e+009 + 1.024e+008) / (2.048e+004 - MV * 2.0e+005)

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

Residual = instrument temperature - bath temperature



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SENSOR SERIAL NUMBER: 7297
CALIBRATION DATE: 22-Mar-13

SBE16plusV2 CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

```
g = -9.796064e-001
h =  1.294055e-001
i = -3.495165e-004
j =  4.057576e-005

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

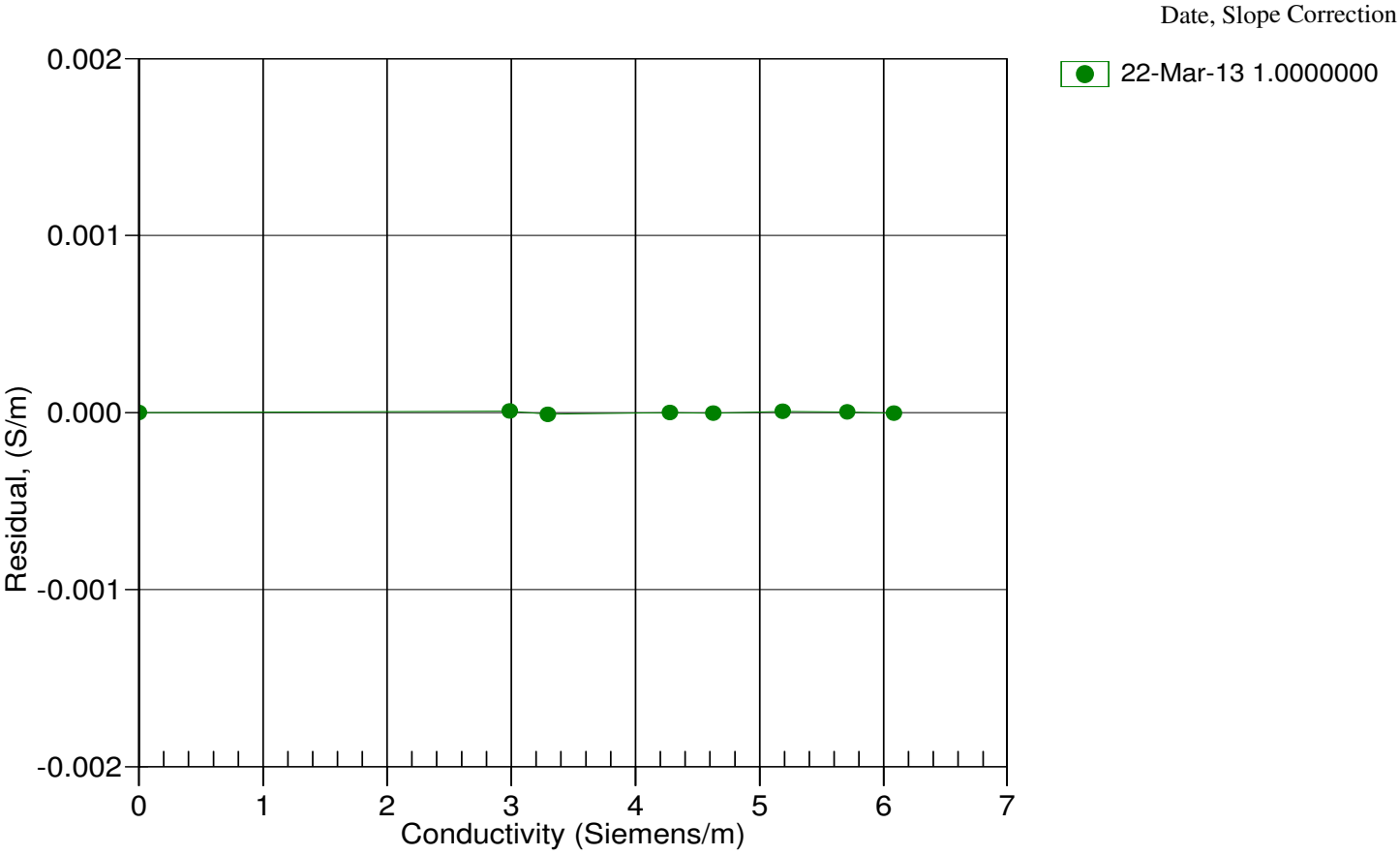
BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (Hz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2758.37	0.0000	0.00000
1.0000	34.9356	2.98519	5550.04	2.9852	0.00001
4.5000	34.9159	3.29319	5761.08	3.2932	-0.00001
15.0000	34.8734	4.27788	6388.39	4.2779	-0.00000
18.5000	34.8647	4.62410	6594.48	4.6241	-0.00000
24.0000	34.8551	5.18376	6914.31	5.1838	0.00001
29.0000	34.8502	5.70724	7200.23	5.7072	0.00000
32.5001	34.8467	6.08070	7397.22	6.0807	-0.00000

f = INST FREQ / 1000.0

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

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

Residual = instrument conductivity - bath conductivity



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SBE 5M MINI SUBMERSIBLE PUMP CONFIGURATION SHEET

Serial Number: **7074**

Job Number: **73164P**

Customer: **NOAA/PMEL**

Delivery Date: **4/12/2013**

Single Bulkhead Connector.

Pressure Case: 600 meters (Plastic)

Maxon Motor Type:

Motor PN 20199

~~P/N 801605, Motor PN 20130~~ **(Pulsed Duty 6 VDC, 2000 RPM MAX)** ☑

P/N 801606, Motor PN 20127 (Continuous Duty 9 VDC, 2000 RPM MAX) ☐

Vin 15V voltage across C2:	***6.2***	VDC	Current	***1.34***	mA
Vin 9V voltage across C2:	***6.2***	VDC	Current	***2.05***	mA
Vin 6V voltage across C2:	***6.02***	VDC	Current	***2.69***	mA

Pump submerged test, no load, Vin 12VDC Average current draw in water: ***31.2*** mA

PRESSURE TEST CERTIFICATES

Sea-Bird Electronics, Inc.
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SBE Pressure Test Certificate

Test Date: **3/18/2013** Description **SBE-16P SeaCat**

Job Number: **stock** Customer Name

SBE Sensor Information:

Model Number: **16P**
Serial Number: **7297**

Pressure Sensor Information:

Sensor Type: **None**
Sensor Serial Number: **None**
Sensor Rating: **0**

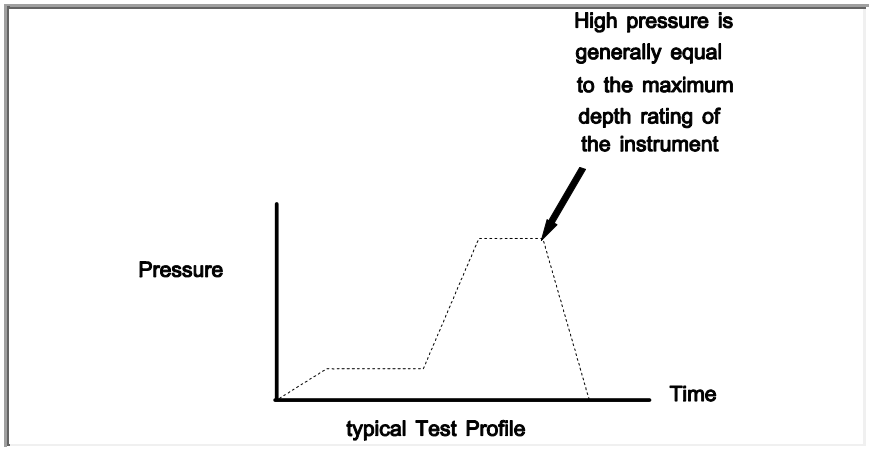
Pressure Test Protocol:

Low Pressure Test: **40** PSI Held For **15** Minutes

High Pressure Test: **800** PSI Held For **15** Minutes

Passed Test: ☑

Tested By: nd



typical Test Profile

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SBE Pressure Test Certificate

Test Date: **3/27/2013** Description **SBE-5M Submersible Pump**

Job Number: **stock** Customer Name

SBE Sensor Information:

Model Number: **5M**
Serial Number: **7074**

Pressure Sensor Information:

Sensor Type: **None**
Sensor Serial Number: **None**
Sensor Rating: **0**

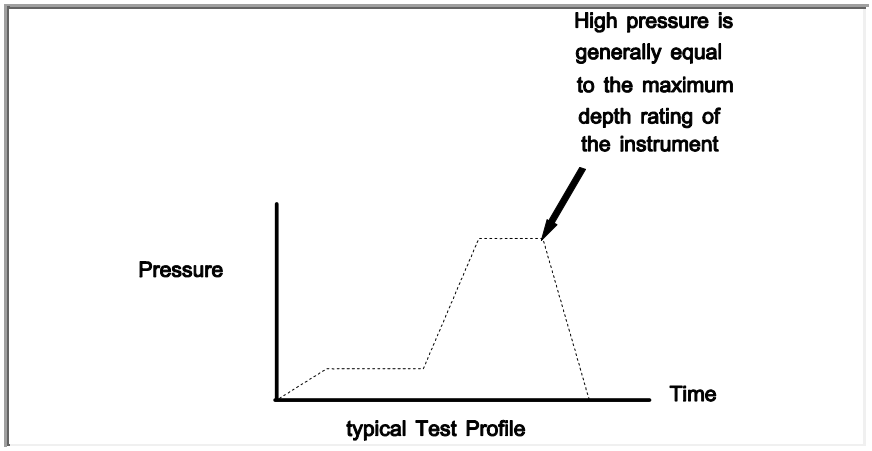
Pressure Test Protocol:

Low Pressure Test: **40** PSI Held For **15** Minutes

High Pressure Test: **800** PSI Held For **15** Minutes

Passed Test: ☑

Tested By: nd



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