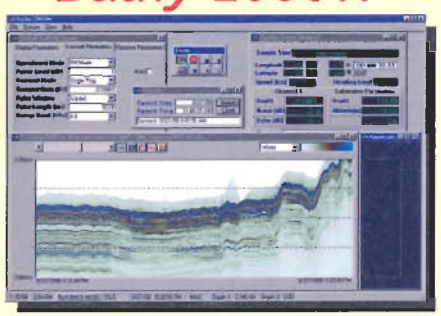
SPECIFICATIONS

CESP IV PDDD-2000

Receiver Input Signal Characteristics-
Type -Linear 16 Bit Analog
Input Impedance Center -
10 k ohms
Frequency -
3.5, 7, 12,16, 18, 33, 34 kHz (selected at time of purchase)
Bandwidth Dynamic Range Receiver Protection
144 dB
600 VRMS
Transmit Output Signal Characteristics
Output Impedance Signal Level Pulse Lengths
Linear 16 Bit Analog -600 Ohms
5 Volts RMS -Linear FM Mode -CW Pulse
Sweep Bandwidth Pulse Amplitude Shaping
25m, 50m, 100m & 200ms 200micro, 500micro, 1 m, 2m, 5m 1 Om, 20m, 50m, 100m, & 200ms
Linear FM Mode 1 kHz, 2 kHz, 5 kHz
Rectangular, Cosine, Blackman, Hamming
Transmit Synchronization
POWER
115VAC +/ 15%,47 to 63 HZ @175W
ENVIRONMENTAL
Temperature Humidity Vibration Shock
0 to 50 degrees C
0 to 95" non condensing -MIL-STD 167 Type 1 -50 g, 11 ms
CONSTRUCTION
Mounting
-Standard 19" rack (30" Deep) Processor Display
Height 225 mm (8.75 inches) 400 mm (15.75 inches)
Depth 635 mm (25 inches) 535 mm (21 inches)
Weight 25 kg (55 lbs) 17 kg (38 Lbs)

Display
1024 x 768 pixels, 16 Color, 15" Table or Rack mount
Hardcopy
Grey Shade, 8.5",12" or 20" Table or rack mount Parallel Interface
Depth Range
Maximum Depth
10 to 12,000 meters
Minimum
(Depends on Frequency & Transducer) -Less than 1.5 meters
Units
Meters, Feet
Tx Power
0 to -42 dB
Serial Interface
Serial channels, RS-232C,4800 -9600 Baud
Navigation / Position
Data Storage
10/100 Ethernet Interface
RS-232C or 4800 to 9600 Baud
POWER
115VAC +/ 15%,47 to 63 HZ @175W
ENVIRONMENTAL
Temperature Humidity Vibration Shock
0 to 50 degrees C
0 to 95" non condensing -MIL-STD 167 Type 1 -50 g, 11 ms
CONSTRUCTION
Mounting
Standard 19" rack (30" Deep) Processor Display
Height 225 mm (8.75 inches) 400 mm (15.75 inches)
Depth 635 mm (25 inches) 535 mm (21 inches)
Weight 25 kg (55 lbs) 17 kg (38 Lbs)

Bathy-2000W



OPTIONS
-Ethernet Network Interface
-Table Mount Display
-Thermal Grey Scale Recorder
Models TDU-1200F TDU-2000F Flathed, TDU-850 (8.5" rack mount) or (8.5" table mount)

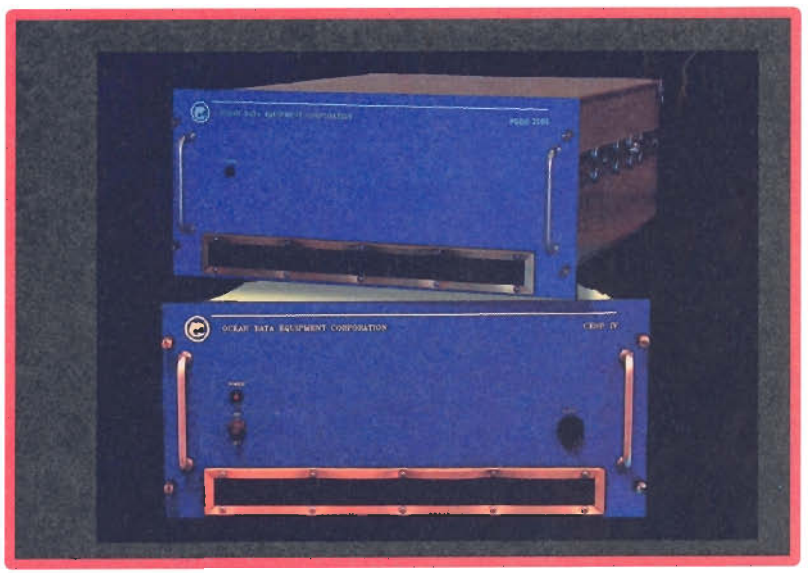
Users can readily interface the PC systems running Bathy-2000W to external storage devices and networks to allow archived data to be transported to and from other computing platforms. Features include: enhanced processing, thermal printing, and direct system control from a remote PC.

OCEAN DATA EQUIPMENT CORPORATION
88 Royal Little Drive Providence RI 02904 USA
Tel: (401) 454-1810 Fax: (401) 454-1806
E-mail: sales@oceandata.com Web Site: http://www.oceandata.com

Bathy-2000 Bathymetric and Sub-bottom survey system

PDDD-2000

CESP IV



OCEAN DATA EQUIPMENT CORPORATION

CESP IV
Correlation Echo Signal Processor

The CESP IV has applications in bottom contour mapping, sub-bottom profiling or similar acoustic processing functions. The unit produces enhanced output data by using correlation/Barker code detection techniques to match return echoes with transmitted signals. Unwanted acoustic interferences are filter out. The effect is up to a 26 dB increase in signal to noise ration performance

The design utilizes an extremely flexible reprogrammable DSP architecture. This benefits the user by allowing him the ability to alter many of the ***CESP***'s transmit/receive signal processing characteristics. For example, the user may select between linear FM, or CW pulse modes of operation. In linear FM mode operation the user may select sweep bandwidths of 1 kHz, 2 kHz and 5 kHz. The user may also select between sweep durations of 25, 50, 100 and 200 ms. CW pulse mode of operation allow for various pulse durations with matching receiver bandwidths and waveform shapes.

Transmit signal synthesis also provides modulation and pulse shaping capability as well as pre-distortion of replica waveform to equalize transducer effects. The analog front end provides AGC which expands the usable dynamic range of the unit to 144 dB.

The signal processing hardware utilizes the latest technology including an Intel 486 and two Motorola 56001 microprocessors to provide a peak performance capability which exceeds 55 MIPS.

This means that the CESP IV is capable of interfacing to virtually all types of computers and hardcopy devices. The extremely flexible architecture allows the system design to be easily modified to accommodate custom user requirements. With the CESP IV as part of a bathymetric system, clear bottom and sub-bottom profiling records can be obtained under poor acoustic conditions. This capability allows vessels to continue survey operations while maintaining reasonable speed in severe weather conditions.

CESP IV- FEATURES

- 16 BIT CORRELATION USING STATE OF THE ART DSP TECHNOLOGY.
- ENHANCED SLOPE TRACKING AND SUB-BOTTOM PROFILING PERFORMANCE.
- TRANSMIT SIGNAL PULSE SHAPING AND MODULATION CAPABILITY.
- LINEAR FM OR CW PULSE MODES OF OPERATION.
- EXTREMELY FLEXIBLE PROGRAMMABLE USER INTERFACE.
- ANALOG AND DIGITAL OUTPUT INTERFACES
- 19 INCH RACK MOUNT PACKAGE

PDDD-2000- FEATURES

- HIGH RESOLUTION COLOR VIDEO GRAPHICS
- COMPLETE REAL TIME ECHO SOUNDER CONTROL
- DEPTH DIGITIZING AND ENHANCED BOTTOM TRACKING
- THERMAL GREY SHADE HARDCOPY INTERFACE
- ETHERNET STORAGE INTERFACE
- NAVIGATION / POSITION DATA CHANNELS
- REMOTE DEPTH DISPLAY OUTPUT
- 19 INCH RACK MOUNT PACKAGE
- COMPREHENSIVE SELF TEST

PDDD-2000
Precision Depth Digitizing Display

The PDDD-2000 provides the main control, display and storage function for the BATHY-2000 system. The operator main interface is a large high resolution (1024 x 768) sixteen color monitor and keyboard. The monitor provides integrated sounding data and system programming menu.

The PDDD-2000 is capable of fully automatic as well as manual operation. The PDDD-2000 provides a hardcopy interface via a parallel port to gray-shade thermal recorders. The system is capable of real time display of sounding information as well as simultaneous depth digitizing, hardcopy and digital storage. An Ethernet interface (CAT5 /100mbit) is available to interface with the optional Bathy-2000W (please refer to the Bathy-2000W informational package). It also has eight serial communication links for navigation/position data, ships data, data-logging output, etc. It provides a completely integrated electronic environment with all other survey electronic equipment.

The ***PDDD-2000***, like the ***CESP IV***, is also packaged within a ruggedized/sealed 19 inch rack mount enclosure. The main processing elements are Intel microprocessors. It has a solid state disk emulation function which also provides non-volatile memory storage for control parameters. With the ***PDDD-2000*** as the control element for your Echo Sounding system, a complete highly integrated electronic system can be achieved.

OPERATION FEATURES-

DATA DISPLAYED

A high resolution 16 color display provides an ergonomic operator interface with important data highlighted and color coded for easy dissemination by the user. The following are examples of data types presented to the user.

Position (Latitude and Longitude from multiple navigational sensors), Ship's speed, time/date, system error status, roll, pitch and heave data, Acoustic noise level, Echo depth and signal strength.

MAIN MENU SELECTIONS-

Split Screen -Splits the sounding data display area in half. The top half presents the complete water column while the bottom half presents a user selectable 20% segment of the water column. This feature allows the user to view selected segments of the sounding data with greater visual resolution, while still presenting the complete water column.

Depth Range- Selects one of ten water column ranges: 10,20,50, 100,200,500,1000,2000, 5000,10,000. (Units of feet, meters or fathoms). Autoor manual.

Phase- Used with depth range to calculate top and bottom of sounding data display. Automatic or manual.

Power Level- Selects transmit power levels in 10 linear 6db steps from 0 to -42 db and off. This allows the user to select low power transmissions for shallow water where ever receiver saturation effects are a consideration or to increase transmit power levels to improve signal to noise in deep water.

Display Gain- Sounding display data gain values applied to the data in three db steps (from 3 to 48db).

Time Varied Gain (TVG)- 0.0 to 4.0db per meter (.2db per meter steps)

PULL DOWN MENU-

Operating Mode- Selects transmit waveform and detection processing mode of operation. Selectable modes are: CW (parametric and non-parametric transmissions) as well as FM sweep (parametric or non-parametric transmissions).

Transmit Mode- Active or Pinger echo sounder. In active mode the system provides the transmit waveform while in pinger echo sounder mode, the system automatically synchronizes to and passively processes a periodic active acoustic pinger source.

Transmit Rate- Allows the user to vary transmit pulse repetition rate as a function of depth range and pulse length. Varies from .1hz to 4hz dependent on depth range and selected pulse length.

Pulse Length -Allows the user to select pulse lengths most suitable to the operating mission and environment. Selectable pulse lengths are: - auto or Manual (.2ms, .5ms, 1 ms, 2ms, 5ms, 10ms, 25ms, 50ms).

Pulse Window -Transmit waveform shaping is provided to allow for maximum average power or a reduction in range sidelobes, resulting in higher resolution sub-bottom profiles and slope tracking. Selectable windows are: Rectangular, Cosine, Hamming, or Blackman

Primary Frequency -Center frequency for CW or FM sweep transmissions. Applicable to both parametric and non-parametric transmit waveforms, available frequencies are: 3.5, 12,16,or 18 kHz

Secondary Frequency -Center frequency for echo return in parametric transmission mode only. Available frequencies are: 12,16,18,33 or 34 kHz

Sweep Bandwith -FM sweep frequency bandwith. User selectable bandwidths are: 1 k, 2k and 4k Hz

Quantizing -Digital sounding data display quantizing to 16 levels.

Detector Mode -Allows user to set bottom detection for first, last or peak signal detection above the user selected digitizer threshold.

Digitzer Threshold -Sixteen linear settings for bottom detection threshold.

Alarm Count -Lost bottom audio alarm activated after N consecutive lost bottom returns. User selectable ; N=1 to 10 lost returns or off.

Hardcopy -Turns hardcopy on/off as well as controls hardcopy grid format/spacing.

Speed of Sound -Allows the user to obtain accurate and completely processed digitized sounding data by setting speed of sound for data processing. User entered value accurate to tenth's of a unit.

Draft -Allows the user to compensate all sounding data for transducer location and ship's draft. User entered value.

Shallow Water Limit -Set by user to allow the digitizer to begin a bottom search after an offset into the water column. Provides a bottom digitizer blanking period to allow for reverberation effects and compensation for pulse length effects. Also used as a shallow water alarm.

SEA BEAM® 2112 (12 kHz)

Multibeam Bathymetric Survey System

Full Ocean Depths with Optional Swept Beam Mode for Real-Time Pitch and Yaw Correction

- Swath Coverage to 150°
- Depth Range 50m to 11,000m
- Co-Located and Co-Registered Bathymetry, Sidescan Imagery
- 12 kHz Frequency; Accepts Multiple Frequencies, including 4 kHz for Sub-Bottom Profiling
- Single Electronics Rack; Real-Time Data Monitoring Software
- Compact, Windowless Underhull; Diver-Replaceable Transducers
- 2° x 2° or 1° x 1° Configurations; Ice-Hardened Array Option
- For Bathymetric Surveying; Seismic, Geophysics, and Cable and Pipeline Missions

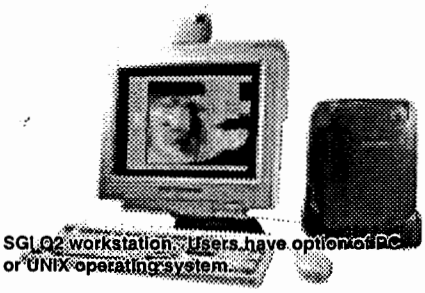
This compact, versatile 12 kHz system delivers bathymetry co-located and co-registered with sidescan imagery. Swath coverages range from 150-degrees in waters of 50 to 300 meters, to 90-degree coverage at full ocean depths.

The ***SEA BEAM 2112 (12 kHz)*** array length is variable, dependant upon the application, and the system is easily outfitted with a second frequency for extended operational capabilities.

SeaBeam's own advanced data processing package, called the ***SeaView® Survey Mapping System***, is system-integrated for powerful, real-time data acquisition, display, and quality control.

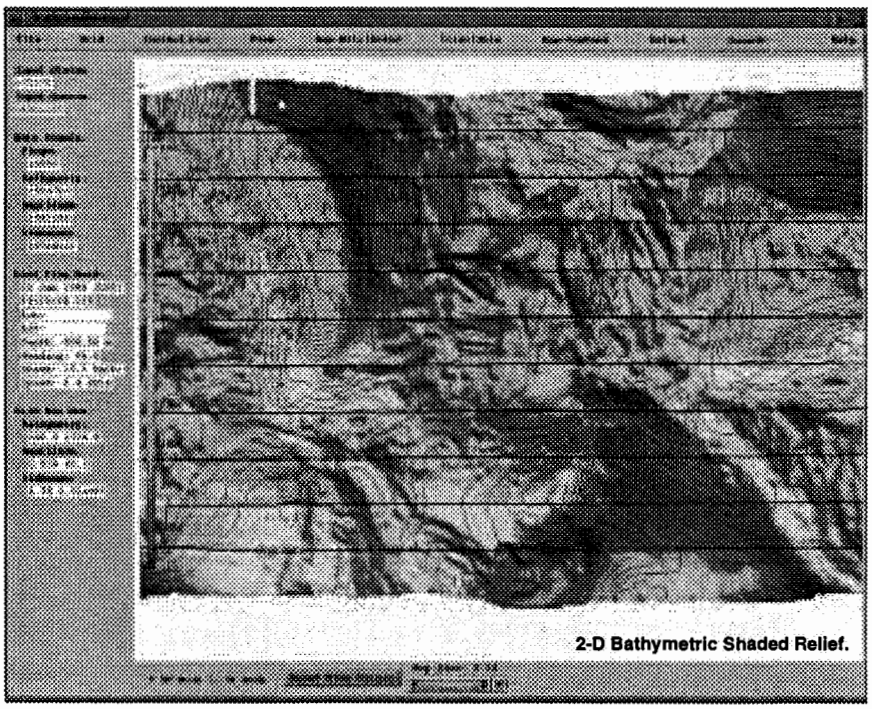
Systems are available with hardened arrays for ice operation, and with 1-degree by 1-degree resolution for heightened data requirements. The system conducts sub-bottom profiling with the addition of a 4 kHz projector array and a small electronics cabinet.

More than twenty ***SEA BEAM 2112*** systems have been sold to customers throughout the world.



SGI O2 workstation. Users have option of PC or UNIX operating system.

Sidescan draped on 3-D Bathymetry.



2-D Bathymetric Shaded Relief.

L3 communications
ELAC Nautik

One World-Class Company

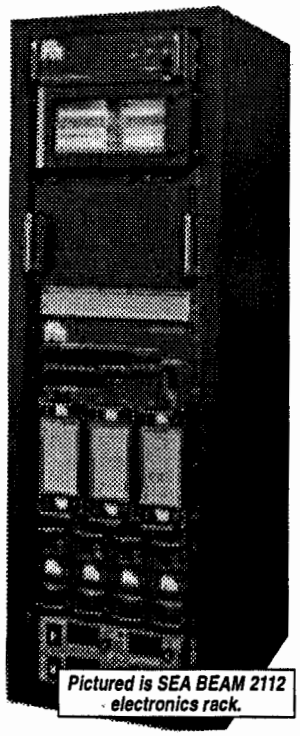
L3 communications
SeaBeam Instruments

SEA BEAM 2112 Leading Deep Water Multibeam

Commercial survey companies, research institutes, and others in need of bathymetric data continue to rely on the ***SEA BEAM 2112*** multibeam sonar to accurately and economically map the seafloor. This system delivers ultra-wide swath coverage with superior resolution in a compact, turn-key package.

The system's multi-frequency architecture produces co-located bathymetry and sidescan for detailed seafloor analysis. Monitoring mapping operations is simple with integrated ***SeaSurvey***® software for real-time multibeam data display and quality control of survey operations. Systems simultaneously gather sub-bottom information, with the addition of an integrated, optional 4 kHz array.

SeaBeam Instruments has a full range of multibeam survey systems — the ***SEA BEAM 1000 Series***, for very shallow to intermediate depth waters — and the ***SEA BEAM 2100 Series***, for intermediate to full ocean depth waters. The ***SEA BEAM 2112*** is the *baseline* system for the deep water series.



Pictured is SEA BEAM 2112 electronics rack.

SEA BEAM 2112 Specifications	
Operating Frequency:	12 kHz
Number of Beams:	149
Accuracy:	> 0.6% of Water Depth (Average Across Swath)
Sidescan:	16-Bit resolution to maximum 2000 pixels
Average Footprint Resolution:	1 Degree x 1 Degree or 2 Degree x 2 Degree
Swath vs Depth Coverage (1° x 1°)	1000m Depth – 150° 3500m Depth – 130° 6000m Depth – 120° 10000m Depth – 100° 11000m Depth – 95°
Transmit Array:	28 Projectors (Standard Configuration)
Receive Array:	80 Hydrophones (Standard Configuration)
Workstations:	Choice of PC (standard) or UNIX (HP or SGI) as online operator workstation
Sensor Interfaces	
HRP:	DMS-2, DMS-05, MRU-5, HydroStar DMS, POS M/V
SVP:	GMI, AML, FSI
Gyro:	Anschutz, KVH
Output Interfaces Raw Data Output to:	SeaBeam ***SeaView***® / ***SeaMapper***® System ELAC HDP 4061 Processing System TEI, CARIS, SAIC, HYPACK
Options:	• Integrated 4 kHz Sub-Bottom Profiler • Integrated 180 kHz Shallow Water Capability

communications
SeaBeam Instruments

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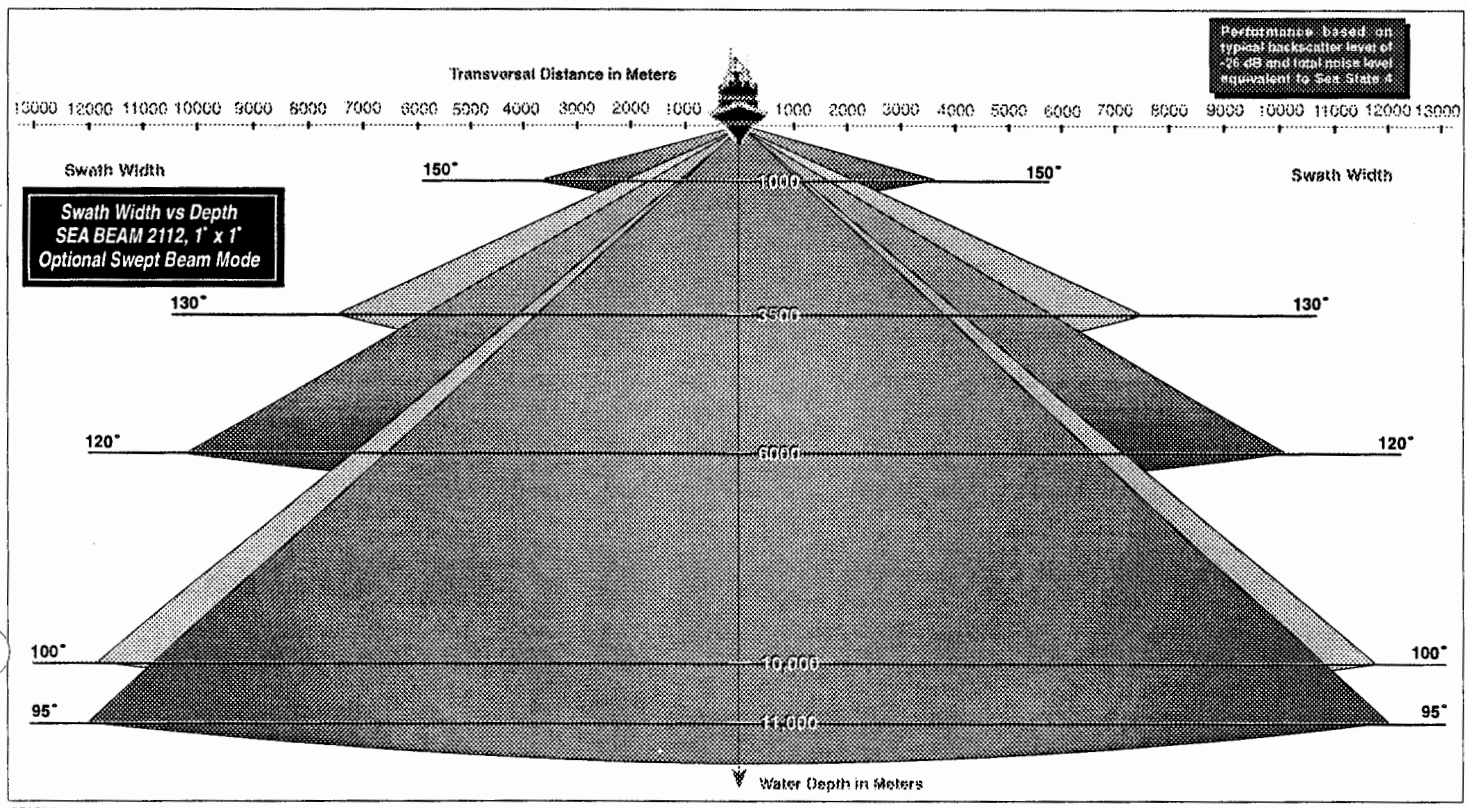
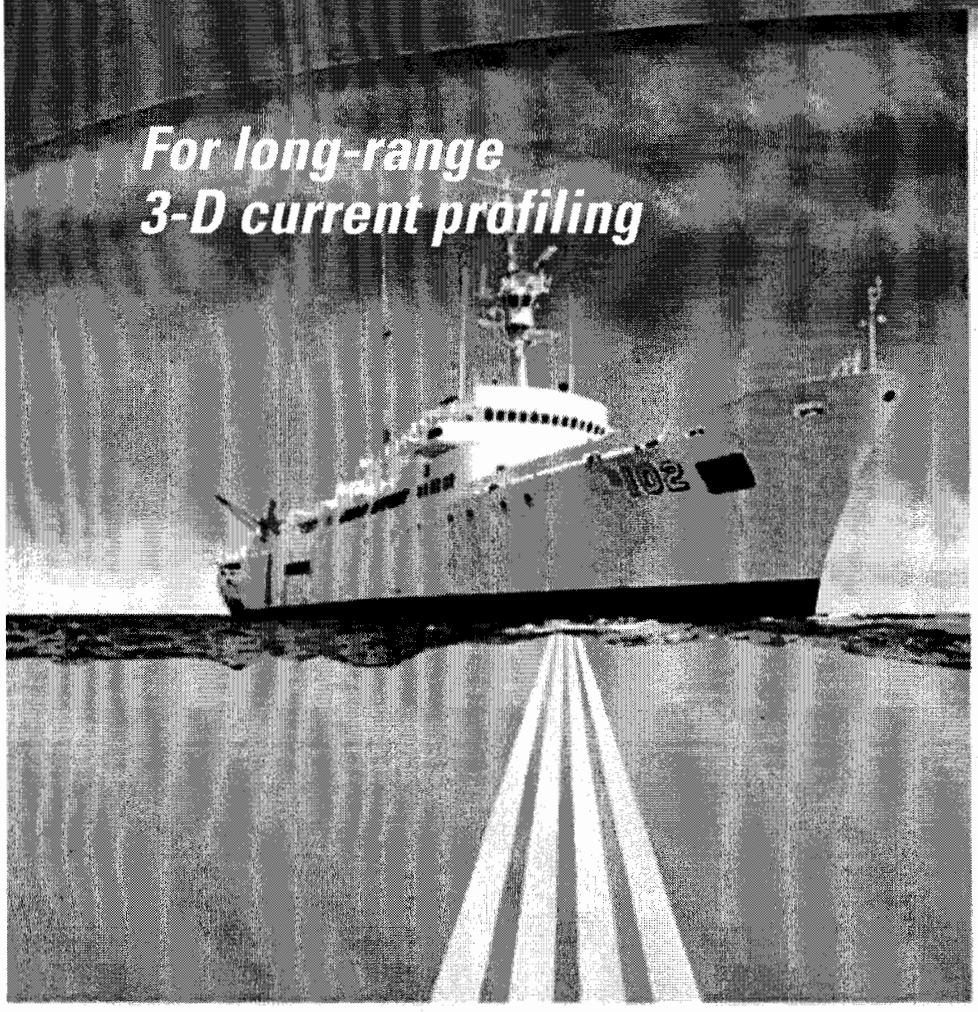


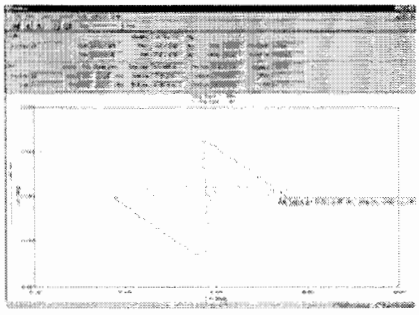
071399

Ocean Surveyor *Vessel-Mount ADCP*



The Ocean Surveyor

family of ADCPs adds a new chapter to RDI's unique contribution to the worldwide open-ocean research fleet. More than 350 vessel-mounted ADCPs have been installed around the world. These ADCPs provide



detailed maps of the distribution of water currents and suspended materials through the water column and along the ship's path. In real time, the ADCP is also used to aid in-situ decision making, to adapt field operations, and to understand current regime characteristics. Vessel-mounted ADCPs have contributed to a large range of ocean projects, as diverse as the following:

- Gulf Stream climate studies
- Mid-ocean frontal mapping
- Fisheries research
- Deep-water cable-laying jobs

The #1 proven choice in ADCPs for vessels

The only vessel-mounted ADCP incorporating:

- Patented BroadBand signal processing with: standard NarrowBand processing; patented phased array transducers which significantly reduce size/frequency ratio; current profiler, backscatter profiler, and Doppler velocity log; 4-beam design for measurement reliability.

The complete tool for the ocean community produced by the acoustic Doppler experts:

- 20 years of industry experience
- Thousands of units in operation
- Service second to none

Frequency	Range	Cell Size
38 kHz	800-1000m	24m
75 kHz	560-700m	16m
150 kHz	375-400m	8m

RD Instruments

Acoustic Doppler Solutions

www.rdinstruments.com telephone: 858-693-1178 sales@rdinstruments.com

Ocean Surveyor *Vessel-Mount ADCP* *38, 75 or 150 kHz*

Water Profiling

Long Range

Mode	38kHz		75 khz		150kHz	
Vertical Resolution Cell size[3]	Max Range[1] (m)	Precision[2] (cm/s)	Max Range[1] (m)	Precision[2] (cm/s)	Max Range[1] (m)	Precision[2] (cm/s)
4m					325-350	30
8m			520-650	30	375-400	19
16m	800-1000	30	560-700	17		
24m	800-1000	23				

High Precision

Mode	38kHz		75 khz		150kHz	
Vertical Resolution Cell size[3]	Max Range[1] (m)	Precision[2] (cm/s)	Max Range[1] (m)	Precision[2] (cm/s)	Max Range[1] (m)	Precision[2] (cm/s)
4m					200-250	12
8m			310-430	12	220-275	9
16m	520-730	12	350-450	9		
24m	730-780	9				

(1) Ranges at 1 to 5 knots ship speed are typical and vary with situation; (2) single-ping standard deviation; (3) user's choice of depth cell size is not limited to the typical values specified.

Profile Parameters

Velocity long term accuracy (typical): ±1.0% ±0.5cm/s
Velocity range: -5 to 9m/s
Number of depth cells: 1-128

Maximum Ping rate:

38kHz	75kHz	150kHz
0.4	0.7	1.5

Bottom Track

Maximum Altitude:

38kHz	75kHz	150kHz
1700m	950m	600m

Precision: <2cm/s

Echo Intensity Profile

Dynamic range: 80dB
Precision: ±1.5dB

Transducer and Hardware

Beam angle: 30°
Configuration: 4 beam, phased array
Communications: RS-232 or RS-422
Hex-ASCII or binary output at 1200-115,200 baud.
Output power: 1000W

Standard Sensors

Temperature (mounted on transducer)
- Range: -5° to 45°C
- Precision: ±0.1°C
- Resolution: 0.03°

System Power

AC input: 90-250V AC, 47-63 Hz
Power: 1600W

Environmental

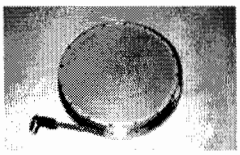
Operating temperature: -5° to 40°C
Storage temperature: -30° to 50°C

Software

Use RDI's Windows™-based software for the best results:
- VMDAS — Vessel Mount Data Acquisition System
- WinADCP — Data Display and Export

Included in a Complete System

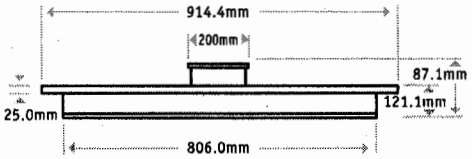
User to supply compass input, or GPS navigation data and NMEA tilt information.



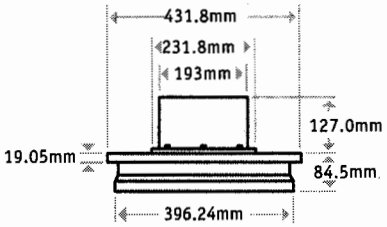
38, 75 or 150 kHz transducer

19" rack mount electronic chassis
- All purpose deck box
- Gyrocompass interface board
- LCD gyro offset control display

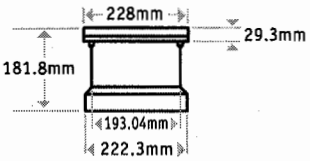
Dimensions



[38 kHz. round transducer]



[75 kHz]



[150 kHz]

For More Information

Call, e-mail or visit our web page.
Ask for our Primer about ADCPs.

Internet: www.rdinstruments.com

RD Instruments
9855 Businesspark Avenue
San Diego, CA 92131 USA
Tel: (858) 693-1178 Fax: (858) 695-1459
E-mail: sales@rdinstruments.com

Specifications subject to change
Rev 02.5

```
EVENT HEADER FILE = D:/DataLog/EventData/Hudson_Canyon_2002/Hudson_Canyon_2002_0DREVENT STARTED
START HEADER INFORMATION::
SHIP = RONALD H. BROWN
CAPTAIN = DON DREVES
CRUISE = RB-02-07
CHIEF SCIENTIST = PETER RONA
END HEADER INFORMATION::
START OUTPUT INFORMATION::
File Name = POSITION, Log Rate = 00:00:30
002 - PCODE_TIME (HHMMSS)
003 - PCODE_LAT (DEGMIN)
004 - PCODE_LON (DEGMIN)
009 - PCODE_COG (Degrees)
010 - PCODE_SOG (Knots)
011 - PCODE-SOG-MSecs (M/Secs)
033 - GYRO (Degrees)
File Name = WIND, Log Rate = 00:00:30
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003 - PCODE_LAT (DEGMIN)
004 - PCODE_LON (DEGMIN)
033 - GYRO (Degrees)
039 - Mast-Twind-DIR (Degrees)
040 - Mast-Twind-Spd-Knts (Knots)
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003 - PCODE_LAT (DEGMIN)
004 - PCODE_LON (DEGMIN)
033 - GYRO (Degrees)
080 - TSG-Unit-Temp (Degrees_C)
081 - TSG-Conductivity (Mega_Mhos)
082 - TSG-Salinity (PPT)
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004 - PCODE_LON (DEGMIN)
123 - Baro-CorrectedSeaLevel (MB)
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003 - PCODE_LAT (DEGMIN)
004 - PCODE_LON (DEGMIN)
009 - PCODE_COG (Degrees)
010 - PCODE_SOG (Knots)
033 - GYRO (Degrees)
088 - BATHY-Depth (Meters)
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004 - PCODE_LON (DEGMIN)
009 - PCODE_COG (Degrees)
010 - PCODE_SOG (Knots)
126 - Seapath_pitch (deg)
127 - Seapath_roll (deg.)
128 - Seapath_heading (deg)
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003 - PCODE_LAT (DEGMIN)
004 - PCODE_LON (DEGMIN)
009 - PCODE_COG (Degrees)
010 - PCODE_SOG (Knots)
011 - PCODE-SOG-MSecs (M/Secs)
033 - GYRO (Degrees)
131 - SSV (m/s)
132 - Seabeam-SSV (M*10/sec)
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08/28/2002,14:22:12,142210.0000,3057.7261,-7919.4189,14.9000,14.6000,14.9000,713.9000,
08/28/2002,14:22:12,142210.0000,3057.7261,-7919.4189,14.9000,14.6000,-0.0900,-0.8700,12.6200,
08/28/2002,14:22:12,142210.0000,3057.7261,-7919.4189,14.9000,14.6000,7.5700,14.9000,,0.0000,
EventStopTime: 08/28/2002,14:22:48
StopEventSnapShot
```

RB0207 - Rawdata from Science Computer on Boat

* Sea-Bird SBE 9 Data File:
* FileName = C:\HC02\HC021.HDR
* Software Version Seasave Win32 V 5.25
* Temperature SN = 1713
* Conductivity SN = 529
* Number of Bytes Per Scan = 27
* Number of Voltage Words = 3
* Number of Scans Averaged by the Deck Unit = 24
* System UpLoad Time = Aug 30 2002 12:14:56
** Ship: Ronald H. Brown
** Cruise: HC02
** Station: HC021
** Latitude: 37 41.41 N
** Longitude: 70 57.36 W

5.6M 1544.4
922.9 1486.2
3797.2 1523.4

* Sea-Bird SBE 9 Data File:
* FileName = C:\HC02\HC022.HDR
* Software Version Seasave Win32 V 5.25
* Temperature SN = 1713
* Conductivity SN = 529
* Number of Bytes Per Scan = 27
* Number of Voltage Words = 3
* Number of Scans Averaged by the Deck Unit = 24
* System UpLoad Time = Aug 31 2002 19:12:16
** Ship: Ronald H. Brown
** Cruise: HC02
** Station: HC022
** Latitude: 38 20.51 N
** Longitude: 70 34.62 W

5.6 1536.5
539.6 1479.42
3150.1 1511.79

* Sea-Bird SBE 9 Data File:
* FileName = C:\HC02\HCO23.HDR
* Software Version Seasave Win32 V 5.25
* Temperature SN = 1713
* Conductivity SN = 529
* Number of Bytes Per Scan = 27
* Number of Voltage Words = 3
* Number of Scans Averaged by the Deck Unit = 24
* System UpLoad Time = Sep 03 2002 16:30:09
** Ship: Ronald H. Brown
** Cruise: HC02
** Station: HC023
** Latitude: 38 33.94 N
** Longitude: 71 00.76 W

5.6 1534.14
532.812 1480.29
2944.824 1509.06

* Sea-Bird SBE 9 Data File:
* FileName = C:\HC02\HC024.HDR
* Software Version Seasave Win32 V 5.25
* Temperature SN = 1713
* Conductivity SN = 529
* Number of Bytes Per Scan = 27
* Number of Voltage Words = 3
* Number of Scans Averaged by the Deck Unit = 24
* System UpLoad Time = Sep 05 2002 17:39:20
** Ship: Ronald H. Brown
** Cruise: HC02
** Station: HC024
** Latitude: 39 10.00 N
** Longitude: 71 00.00 W

5.6 1532.75
662.263 1480.09
2710.408 1505.15
3500.00 1505.15

* Sea-Bird SBE 9 Data File:
* FileName = C:\HC02\HC025.HDR
* Software Version Seasave Win32 V 5.25
* Temperature SN = 1713
* Conductivity SN = 529
* Number of Bytes Per Scan = 27
* Number of Voltage Words = 3
* Number of Scans Averaged by the Deck Unit = 24
* System UpLoad Time = Sep 06 2002 09:32:24
** Ship: Ronald H. Brown
** Cruise: HC02
** Station: HC025
** Latitude: 39 02.26 N
** Longitude: 71 21.94 W

5.6 1532.32
574.771 1481.3
2841.038 1507.84
3500.00 1507.84

* Sea-Bird SBE 9 Data File:
* FileName = C:\HC02\HC025.HDR
* Software Version Seasave Win32 V 5.25
* Temperature SN = 1713
* Conductivity SN = 529
* Number of Bytes Per Scan = 27
* Number of Voltage Words = 3
* Number of Scans Averaged by the Deck Unit = 24
* System UpLoad Time = Sep 06 2002 09:32:24
** Ship: Ronald H. Brown
** Cruise: HC02
** Station: HC025
** Latitude: 39 02.26 N
** Longitude: 71 21.94 W

5.6 1532.42
600.755 1480.78
2650.823 1504.47
3500.00 1504.47

* Sea-Bird SBE 9 Data File:
* FileName = C:\HC02\HC027.HDR
* Software Version Seasave Win32 V 5.25
* Temperature SN = 1713
* Conductivity SN = 529
* Number of Bytes Per Scan = 27
* Number of Voltage Words = 3
* Number of Scans Averaged by the Deck Unit = 24
* System UpLoad Time = Sep 09 2002 01:53:20
** Ship: Ronald H. Brown
** Cruise: HC02
** Station: HC027
** Latitude: 39 18.95 N
** Longitude: 72 01.61 W

5.6 1530.73
510.501 1480.94
1912.654 1495.93
2500.00 1495.93

Pressure Calibration Check 05 December 2000

pressure sensor model: Digiquartz 410K-105
sensor serial number: 58955
installed in: CTD 09P9852-0382

This pressure calibration is a check of the 'test' sensor against a stable reference pressure sensor. The reference pressure sensor is itself checked several times per year against a NIST-traceable pressure standard maintained at Paroscientific, Inc.. The circumstances of this pressure check introduce no more than 1.5 psia total error in 10,000 psi (0.015 %) in addition to the error resident in the Paroscientific site standard. The check offers a very high level certification of the health and proper operation of the 'test' sensor.

Input Pressure* [psia]	Sensor Output [hz]	Sensor Temperature [deg C]	Pressure Factory Coef [psia]	Pressure Corrected [psia]	Error [psia]
14.700	33361.26	17.7	15.588	15.048	0.348
2014.722	34056.45	17.8	2015.431	2014.818	0.096
4014.181	34735.39	17.9	4015.058	4014.374	0.193
6013.379	35398.99	18.0	6014.280	6013.523	0.144
8012.846	36048.32	18.1	8013.796	8012.967	0.121
10012.248	36683.97	18.2	10012.945	10012.043	-0.205
8012.675	36048.35	18.3	8013.682	8012.853	0.178
6013.391	35398.99	18.4	6013.901	6013.144	-0.247
4013.964	34735.41	18.4	4014.556	4013.872	-0.092
2014.489	34056.54	18.5	2014.941	2014.328	-0.161
14.601	33361.28	18.6	14.766	14.226	-0.375

Input pressure is generated with a Ruska model 5201 dead-weight tester, serial number 23330/380, and is determined by measurement with reference pressure sensor model Digiquartz 410K-000, serial number 73292.

Sensor Temperature: pressure sensor internal temperature.

Pressure Corrected: pressure computed with original factory coefficients and then corrected with a slope and offset to give the best linear agreement with the 'reference' Input pressure.

Error: Corrected pressure - Input pressure

A linear fit of this calibration data, between sensor pressure computed with factory coefficients and the Input pressure, yields correction coefficients:

Corrected pressure = psi_slope * Factory pressure + psi_offset [psia]

psi_slope = 0.99996 and psi_offset = -0.54 [psia]

These are converted to Slope and Offset in decibars for use in the SEASOFT programs by: Slope = psi_slope = 0.99996
Offset = C * (psi_offset - 14.7 * (1 - psi_slope)) = -0.3725 [dbars]
C = 0.689476 [dbar/psi]

Slope and Offset coefficients are entered into the pressure sensor calibration coefficient section of the <>.CON file using the program SEACON.

Digiquartz Coefficients:

C1 = -4.738911e+04
C2 = -6.108813e-01
C3 = 1.360420e-02
D1 = 4.015100e-02
D2 = 0.000000e+00
T1 = 2.998639e+01
T2 = -4.351572e-04
T3 = 3.518940e-06
T4 = 3.294400e-09

AD590 Pressure Temperature Coefficients:

AD590M = 0.01137
AD590B = -8.62888

Calibration Correction:

Slope = 0.99996
Offset = -0.3725

SEA-BIRD ELECTRONICS, INC.

1808 136th Place N.E., Bellevue, Washington 98005 USA
Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 1713
CALIBRATION DATE: 09-Apr-02s

TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.83935985e-03
h = 6.82522840e-04
i = 2.68537700e-05
j = 2.05353379e-06
f_0 = 1000.000

IPTS-68 COEFFICIENTS

a = 3.68121004e-03
b = 6.05715182e-04
c = 1.57452129e-05
d = 2.05503932e-06
f_0 = 6096.206

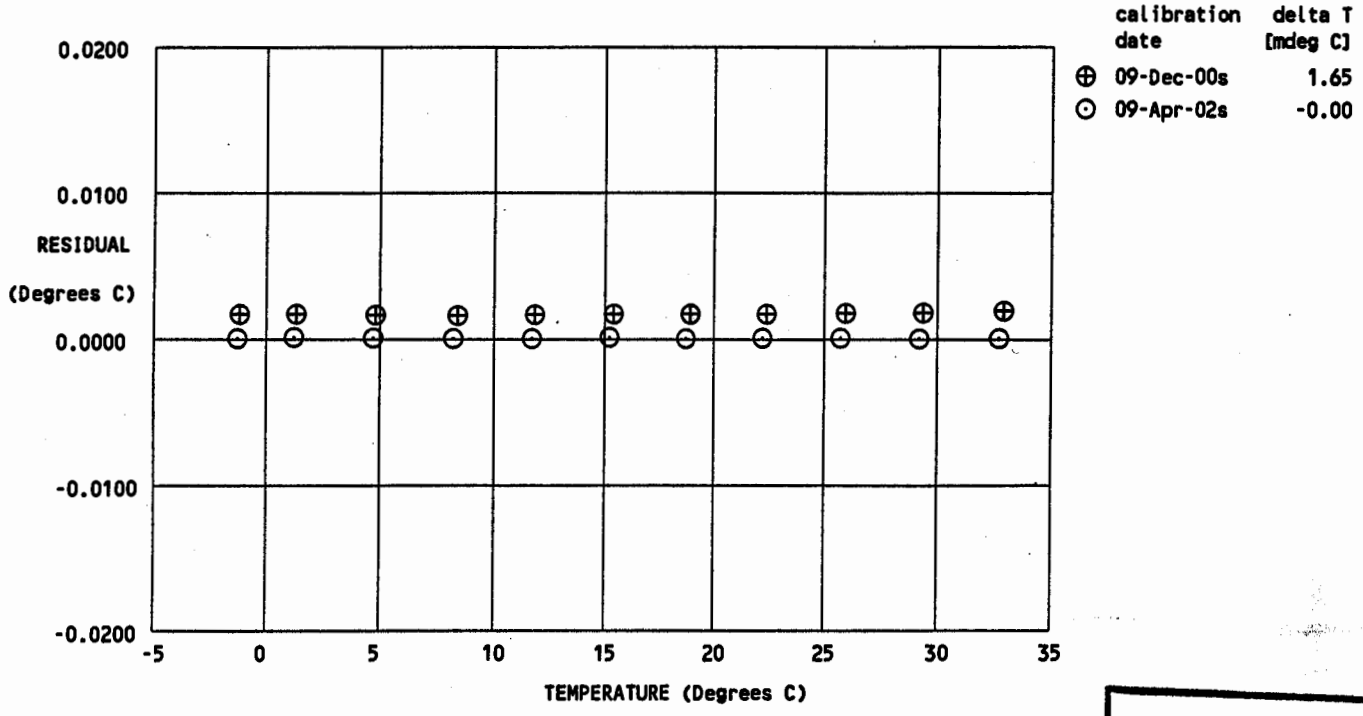
BATH TEMP (ITS-90 °C)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90 °C)	RESIDUAL (ITS-90 °C)
-1.4998	6096.206	-1.4998	-0.00003
1.0002	6444.210	1.0002	0.00005
4.5002	6955.106	4.5002	0.00002
8.0002	7494.346	8.0002	-0.00003
11.5002	8062.681	11.5002	-0.00005
15.0002	8660.844	15.0003	0.00005
18.5002	9289.480	18.5002	-0.00003
22.0002	9949.316	22.0002	0.00002
25.5002	10640.965	25.5002	0.00001
29.0002	11365.057	29.0002	-0.00002
32.5002	12122.200	32.5002	0.00000

Temperature ITS-90 $= 1/\{g + h[\ell n(f_0/f)] + i[\ell n^2(f_0/f)] + j[\ell n^3(f_0/f)]\} - 273.15$ (°C)

Temperature IPTS-68 $= 1/\{a + b[\ell n(f_0/f)] + c[\ell n^2(f_0/f)] + d[\ell n^3(f_0/f)]\} - 273.15$ (°C)

Following the recommendation of JPOTS: T_{68} is assumed to be 1.00024 * T_{90} (-2 to 35 °C).

Residual = instrument temperature - bath temperature



POST CRUISE CALIBRATION

SEA-BIRD ELECTRONICS, INC.

1808 136th Place N.E., Bellevue, Washington 98005 USA
Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 529
CALIBRATION DATE: 10-Apr-02s

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

GHIJ COEFFICIENTS

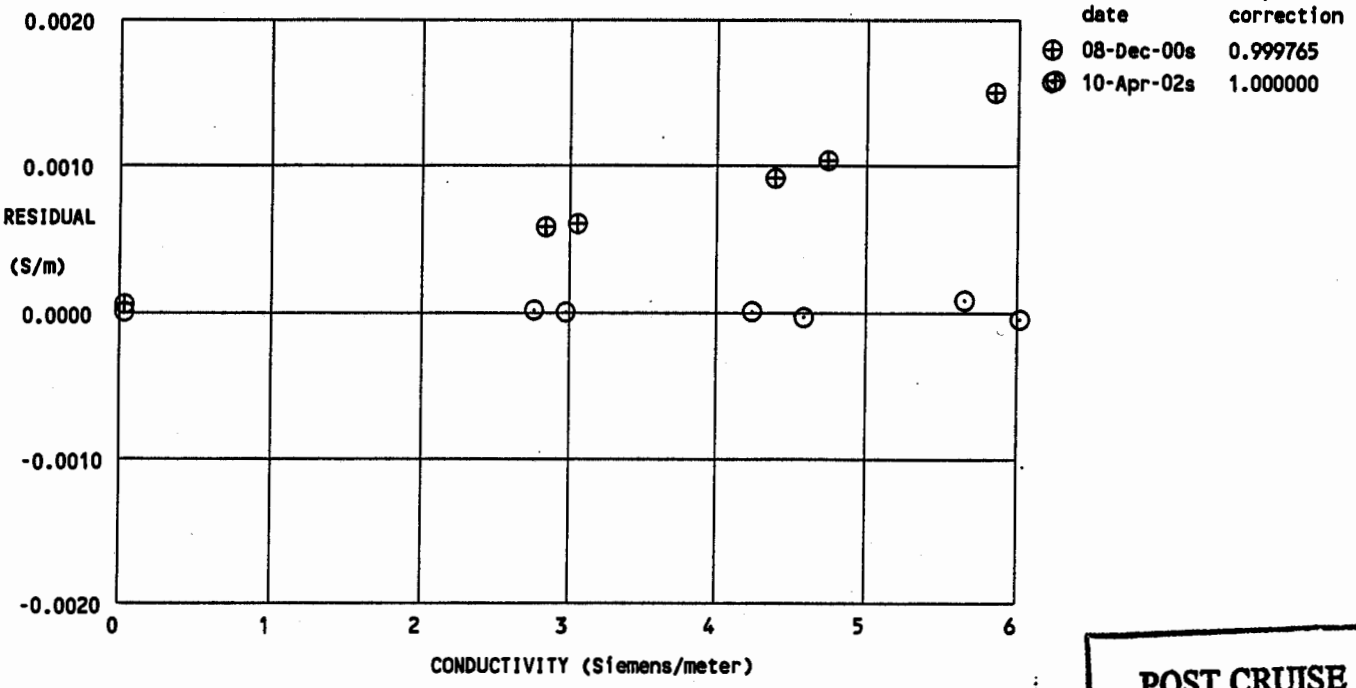
g = -4.37331535e+00
h = 4.68560704e-01
i = 2.48910301e-04
j = 9.87243996e-06
CPcor = -9.57e-08 (nominal)
CTcor = 3.25e-06 (nominal)

ABCDM COEFFICIENTS

a = 1.24242210e-04
b = 4.68916322e-01
c = -4.37425538e+00
d = -8.38236447e-05
m = 3.4
CPcor = -9.57e-08 (nominal)

BATH TEMP (ITS-90 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
0.0000	0.0000	0.00000	3.05230	-0.00000	-0.00000
-1.3861	34.2672	2.73223	8.20099	2.73224	0.00001
1.1371	34.2675	2.94520	8.47104	2.94520	-0.00000
14.9993	34.2688	4.21142	9.92442	4.21142	0.00000
18.4993	34.2694	4.55350	10.28136	4.55346	-0.00004
28.9993	34.2677	5.62241	11.32351	5.62249	0.00008
32.4993	34.2630	5.99024	11.66009	5.99019	-0.00005

Conductivity = $(g + hf^2 + if^3 + jf^4) / [10(1 + \delta t + \epsilon p)]$ Siemens/meter
Conductivity = $(af^m + bf^2 + c + dt) / [10(1 + \epsilon p)]$ Siemens/meter
t = temperaure [deg C]; p = pressure [decibars]; δ = CTcor; ϵ = CPcor;
Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients



POST CRUISE CALIBRATION

SEA-BIRD ELECTRONICS, INC.

1808 136th Place N.E., Bellevue, Washington 98005 USA
Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 2866
CALIBRATION DATE: 09-Apr-02s

TEMPERATURE CALIBRATION DATA
ITS-90 TEMPERATURE SCALE

ITS-90 COEFFICIENTS

g = 4.40795794e-03
h = 6.51439860e-04
i = 2.45015783e-05
j = 2.32418764e-06
f_0 = 1000.000

IPTS-68 COEFFICIENTS

a = 3.68120999e-03
b = 6.04101965e-04
c = 1.64362914e-05
d = 2.32577894e-06
f_0 = 3192.174

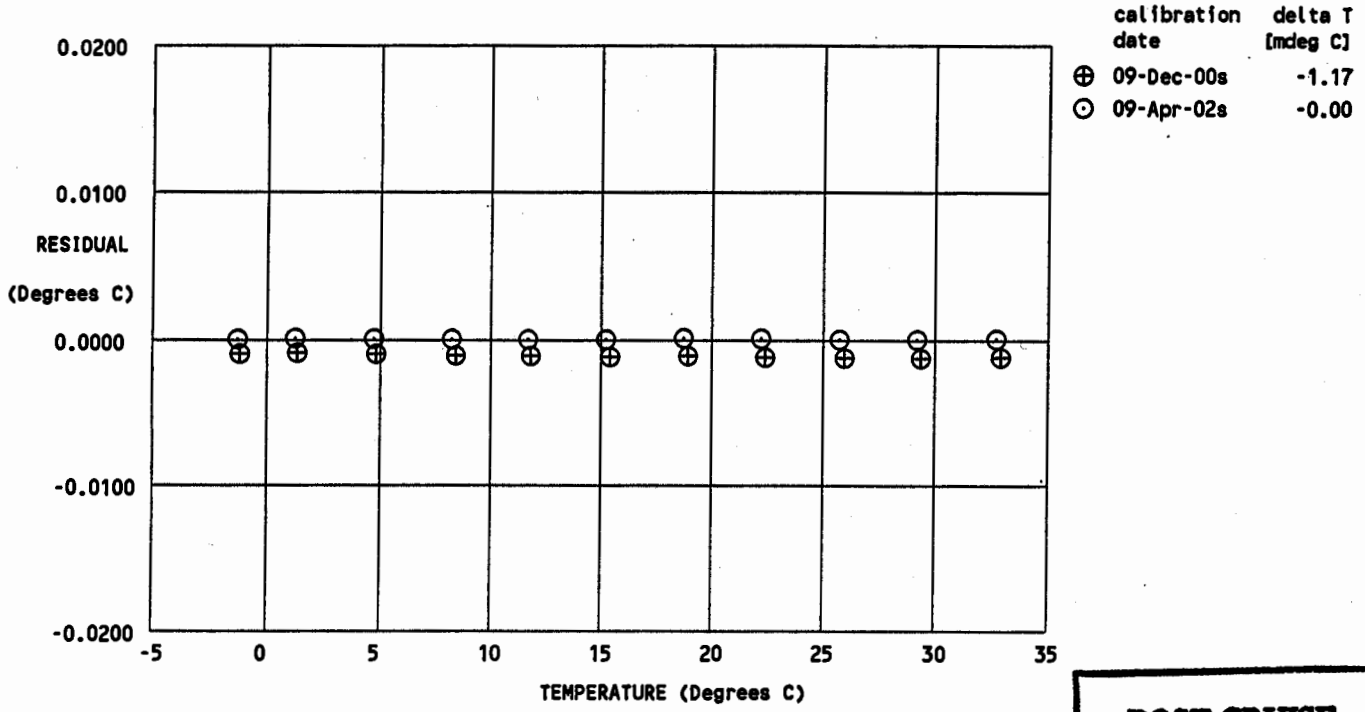
BATH TEMP (ITS-90 °C)	INSTRUMENT FREQ (Hz)	INST TEMP (ITS-90 °C)	RESIDUAL (ITS-90 °C)
-1.4998	3192.174	-1.4998	-0.00003
1.0002	3374.913	1.0002	0.00004
4.5002	3643.282	4.5002	0.00002
8.0002	3926.654	8.0002	-0.00001
11.5002	4225.425	11.5002	-0.00005
15.0002	4539.988	15.0002	-0.00003
18.5002	4870.720	18.5003	0.00006
22.0002	5217.962	22.0002	0.00003
25.5002	5582.070	25.5002	-0.00002
29.0002	5963.385	29.0002	-0.00003
32.5002	6362.227	32.5002	0.00002

Temperature ITS-90 $= 1/\{g + h[\ell n(f_0/f)] + i[\ell n^2(f_0/f)] + j[\ell n^3(f_0/f)]\} - 273.15$ (°C)

Temperature IPTS-68 $= 1/\{a + b[\ell n(f_0/f)] + c[\ell n^2(f_0/f)] + d[\ell n^3(f_0/f)]\} - 273.15$ (°C)

Following the recommendation of JPOTS: T_{68} is assumed to be 1.00024 * T_{90} (-2 to 35 °C).

Residual = instrument temperature - bath temperature



POST CRUISE CALIBRATION

SEA-BIRD ELECTRONICS, INC.

1808 136th Place N.E., Bellevue, Washington 98005 USA
Phone: (425) 643 - 9866 Fax: (425) 643 - 9954 Internet: seabird@seabird.com

SENSOR SERIAL NUMBER = 1473
CALIBRATION DATE: 19-Apr-02s

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

GHIJ COEFFICIENTS

g = -4.17553842e+00
h = 5.63109724e-01
i = -3.25734087e-04
j = 4.70317557e-05
CPcor = -9.57e-08 (nominal)
CTcor = 3.25e-06 (nominal)

ABCDM COEFFICIENTS

a = 5.88765108e-06
b = 5.62163290e-01
c = -4.17313005e+00
d = -8.52593252e-05
m = 4.6
CPcor = -9.57e-08 (nominal)

BATH TEMP (ITS-90 °C)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREQ (kHz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
0.0000	0.0000	0.00000	2.72438	-0.00000	-0.00000
-1.4007	33.1203	2.64786	7.37715	2.64788	0.00002
0.9993	33.1206	2.84434	7.60928	2.84432	-0.00002
14.9993	33.1218	4.08499	8.93544	4.08498	-0.00001
18.4992	33.1219	4.41702	9.25769	4.41701	-0.00001
28.9993	33.1201	5.45473	10.19821	5.45479	0.00006
32.4993	33.1154	5.81182	10.50185	5.81178	-0.00004

Conductivity = $(g + hf^2 + if^3 + jf^4) / [10(1 + \delta t + \epsilon p)]$ Siemens/meter
Conductivity = $(af^m + bf^2 + c + dt) / [10(1 + \epsilon p)]$ Siemens/meter
t = temperaure [deg C]; p = pressure [decibars]; δ = CTcor; ϵ = CPcor;
Residual = (instrument conductivity - bath conductivity) using g, h, i, j coefficients