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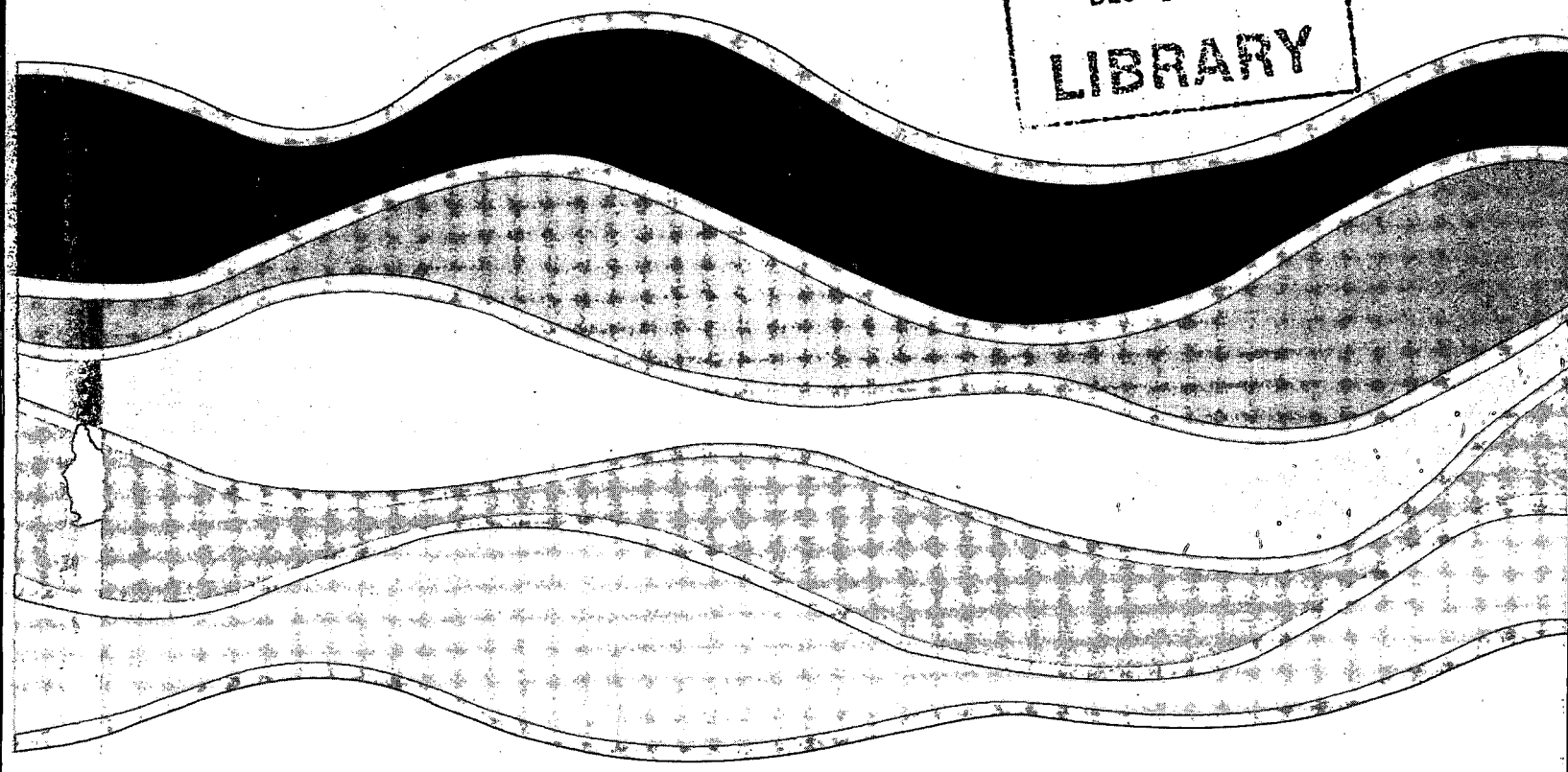

CRITERIA FOR ECHO-SOUNDER SELECTION FOR HIGH-RESOLUTION SUB-BOTTOM PROFILING

J.S. Ford and N.A. Rukavina

NWRI Technical Note No. 90-TN-05

LAKES RESEARCH BRANCH

TECHNICAL NOTE

DATE: June 1990

TITLE: Criteria for echo-sounder selection for high-resolution sub-bottom profiling

AUTHORS: J.S. Ford and N.A. Rukavina

REASONS FOR REPORT: For Centre Saint-Laurent

STUDY FILE NO: Study 82021

NWRI TN # 90-05

1.0 INTRODUCTION

NWRI and the Centre Saint-Laurent are cooperating on an assessment of commercially-available echo-sounders for mapping the thickness of modern contaminated sediments. NWRI is contributing the engineering and scientific expertise and CSL is providing the survey equipment, the field support and the test site- Lac St-Louis. This note describes the echo-sounders considered by NWRI and the criteria used to select the sounders recommended for testing. It also discusses some new types of equipment which have some potential for future use.

2.0 BACKGROUND

NWRI has an on-going study on acoustic applications to sediment studies, part of which is concerned with mapping sediment thickness and volume. Coring data from Lake St. Clair, Hamilton Harbour and the St. Lawrence lakes St-François, St-Louis and St-Pierre indicate that the modern cover of contaminated sediments over stiff glacial-clay substrate is generally less than 1 metre thick. Neither conventional hydrographic sounders nor sub-bottom acoustic profilers are suitable for measuring this layer. The sounders are not designed for penetration below the sediment-water interface; the profilers use frequencies too low to resolve layers less than a metre thick.

NWRI's research has been concerned with identifying the sounder specifications required to measure the surface-sediment layer and ultimately with the construction or adaptation of a sounder to be used for contaminated-sediment surveys. At this stage of the study, commercially-available sounders are being assessed to determine what they can contribute in terms of confirming the necessary specifications and producing useful data on sediment thickness. Because the Centre Saint-Laurent has an immediate need for a sounder for use in its upcoming surveys of river-bed sediments, a joint study has been planned. The study will evaluate a small number of sounders along a test course in Lac St-Louis to determine whether one or more are suitable for survey use.

3. GENERAL REQUIREMENTS

The requirement is for a sounder which can be operated with a side-mounted transducer from a small launch (8-12 m in length). Water depth for the survey will range from keel depth (1-2 m) to about 20 m. Transducer frequencies should be suitable for detecting the sediment-water interface and the interface between soft, watery surface muds and a substrate of stiff glacial sediment with lower water content. Sounder resolution, the thinnest layer capable of being resolved by the sounder, should be less than 0.5 m and preferably as low as 0.1 m.

4. SPECIFIC REQUIREMENTS FOR HIGH RESOLUTION

All the components of an acoustics system can have an effect on its ability to do high-resolution sounding. The discussion below considers the effect of each acoustic parameter in turn.

Burst Duration: For high resolution, the sound burst must be as brief as possible because the duration produces a depth interval that is insonified at one time. Reflecting layers, occurring within half that interval, are indistinguishable. The function for distinguishable depth interval, I in metres, versus burst duration, T in seconds, and sound speed C, in metres per second, is:

$$I = 0.5 * C * T$$

The largest acceptable duration is 100 µs.

Beamwidth: A narrow sound beam is a prime requirement. The wave front of the conical sound beam is spherical. Where the cone penetrates two closely spaced layers, the spherical front can intersect both layers simultaneously and the echoes are combined. The situation worsens with increasing range to the bottom. The function for minimum layer separation, S in metres, versus beam angle (full included) A in degrees and range, R in metres is:

$$S = R * (1-\cos(A / 2))$$

The largest acceptable beamwidth is 20 degrees.

Sidelobes: Sound travelling through the sidelobes of a transducer can mix with the echoes from subbottom features. Sound is emitted by the sidelobes at an oblique angle. Soon after the sound from the main lobe arrives at the bottom surface, the sound from the sidelobes strikes the bottom surface in the shape of an annular ring. The backscattered sound from the ring is received by the sidelobes and can mask the echoes from deeper layers arriving in the main lobe. Even though the sidelobe produces about one hundredth the sound intensity of the main lobe, its total cross-sectional area can project and receive significant sound. As well, the sidelobes increase the total noise received by the system. Because the geometry is complex and the data on the transducers are not readily available, no rule of thumb is offered here.

Receiver Bandwidth: The receiver's bandwidth also effects the minimum distance between layers that can be distinguished. The echoes from a pair of layers appear as two bursts of sound. These contain energy in a broad frequency spectrum. The transmitted burst also has frequency components about the dominant one. These are required to shape the burst envelope. If the receiver is too narrow-band, the received envelopes are distorted. When two layers are close together, the envelopes of their echoes combine at the output of the receiver and may be missed on the recorder. The minimum layer separation, L in metres as a function of receiver bandwidth, B in Hz, and sound speed C, in metres per second, is:

$$L = 0.5 * C / B$$

The smallest acceptable bandwidth is 7 kHz.

Damping: High resolution is also limited by the ringing (undamped) behaviour of the transducer and receiver. Electromechanical energy stored in the transducer or electrical energy stored in tuned filters

must be dissipated quickly or it extends the duration of the source burst and echoes beyond the ideal. Echo sounders must be tested for these characteristics because the data do not appear on specification sheets.

Grey Scale or Colour Scale: The recorder must be carefully chosen to present a good dynamic range on the paper. Interpretation of the record relies on textures, intensities and contrasts in subbottom features. It is important that these are not lost in the final process. Some recorders produce only black on white while others produce shading according to echo intensity. Some recorders use colours to display intensity. Regardless of preference, the recorder must be able to produce many shades or colours. Otherwise the dynamic range of the sounder's sensitivity is wasted and the controls have to be adjusted repeatedly to stay at the optimum recording level. A minimum of 4 levels is required.

Frequencies: The operating frequencies are determined by the need to detect both the sediment-water interface and the sub-bottom contact of modern and older sediments. A frequency of at least 200 kHz is required to record the sediment surface. Even higher frequencies may be essential if the sediment-water interface is gradational and needs to be resolved by scattering off very fine structures or individual particles. The second frequency should be around 30 to 50 kHz to permit penetration to the sub-bottom contact.

Both frequencies are high relative to those generally used for sub-bottom profiling. As such they have the advantages of using smaller transducers to produce a narrow beam, are less likely to cause cavitation at high powers and are amenable to short duration bursts. Their penetration depths are adequate and they form a good compromise for high resolution profiling.

Power: Pulse power of a kilowatt is adequate because of the short depth of penetration. Higher power in transducers and transmitters can be a problem when it extends the burst duration beyond what is intended.

Special Features: Some of the microprocessor controls in acoustic gear can produce negative effects and should be avoided in high-resolution profiling. For example, burst duration is often changed automatically by the microprocessor according to the operating depth. Some systems also employ automatic gain controls in the receiver to hold the record at a useful contrast, but the attack and decay of the gain circuit can affect the ability to see layers. This reduces the resolution of the record. A desirable microprocessor feature is the ability to print the system settings, time, and position data on the chart.

A useful feature in some systems is bottom loss compensation where the receiver detects the bottom and begins increasing the gain rapidly to compensate for the absorption and scattering losses of sound in the bottom material.

5. SURVEY OF SYSTEMS

A brief survey was done of the better-known echo sounders that might serve as high-resolution, sub-bottom profilers. The following sounders were considered: BioSonics Model 102, Datasonics SBP-5000, ELAC Honeywell LAZ 4721, InterOcean Model 3000, Krupp Deso 25, Ocean Data Equipment (Raytheon) DSF 6000, ORE GeoPulse, and Simrad EY200. Appendix 1 contains the available brochures and specification sheets. Table 1 summarizes the results of the survey in terms of the parameters discussed above and Table 2 compares their combined effect on ability to resolve sediment layers. The sum of burst-length, beam-width, and band-width resolutions has been used as an estimate of total resolution. Resolution and appropriate frequencies were the primary criteria used in the recommendations below.

The ORE was eliminated because it operated at only a single low frequency. The InterOcean, Simrad and ODEC were rejected because of inadequate resolution (0.68-1.14 m). The ELAC has suitable specifications but attempts to borrow or lease test equipment were unsuccessful and it has been eliminated for that reason. Availability and some of the specifications of the Atlas Deso 25 are still in question. Two potential problems are the low burst power (0.5 KW) and a transducer designed for through-the-hull mounting.

The Biosonics 102 and Datasonics DFT2100 have the best specifications of the sounders available for trial. The Biosonics should resolve 0.3m at its lower frequency if its full bandwidth can be used, and its 402 kHz high-frequency should be useful for detecting the sediment-water interface. The Datasonics has a potential resolution of 0.5 m, a suitable upper frequency of 300 kHz, and the best recorder dynamic range- 16 shades of grey as compared to 4 for the Biosonics. Its largest drawback is a transducer weight of 90 kg which will require a sturdy side-mount frame.

The recommendations above are based on specifications communicated by the manufacturers or suppliers and have not been confirmed by independent laboratory testing. Although the specifications have been useful in rating sounder potential for high-resolution profiling, only the field trials can determine their actual performance. Note that the recommendations herein are not to be construed as endorsement by Environment Canada of the products discussed.

6. FUTURE SYSTEMS

Parametrics: The steady development of nonlinear acoustics (parametrics) has resulted in a superior low-frequency sound source. It produces beamwidths from small transducers that are similar to high frequency beams (less than 5 degrees at 5 kHz). At least three companies are offering units: Ulvertech (U.K.), Simrad Mesotech and Krupp. Unfortunately, operating frequencies around 30 kHz are not yet commercially available. The 5-kHz types have good penetration qualities but one wave length insonifies a 0.3 metre interval (0.15 metre layer pair). NWRI is currently working with the acoustics laboratory at C-CORE, Newfoundland, which is developing parameric sources operating with a dominant frequency as high as 100 kHz. This

appears to be capable of fine discrimination of sediment layers from a fixed system but has not been tested in a survey mode.

Digital Processing: The advances in digital-power control and signal processing have opened the way to the next generation of sounders (Knudsen Engineering) or conversion kits (Oceanprobe Systems). Their use of encoded sound bursts which can then be extracted from the noise and clutter of return echoes may resolve some of the resolution problems of conventional sounders.

Radar: Subsurface interface radar equipment is now available (Geophysical Survey Systems) and has been used for profiling ice and sediments. It has been evaluated by the U.S. Geological Survey for profiling river beds near bridge footings and did well in supplementing data from more conventional sounders. If the conductivity contrast between modern contaminated sediment and older sediment is strong enough, this procedure may be useful as a mapping tool in shallow water (<20 m).

TABLE 1: Sounder Specifications

MODEL	BURST TIME us	BEAM WIDTH deg.	BAND WIDTH kHz	PULSE POWER kW	XDUCER MASS kg	GREY SCALE ratio	OPER FREQ kHz	NOTES
BioSonics Model 102	100	10	5	1.0	12	4	38/420	1
Datasonics SBP-5000	100	20	10	4.0	90	16	30/300	1
ELAC Honeywell LAZ 4721	300	12	7	1.0	10	N.A.	50/200	
InterOcean Model 3000	150	35	2	N.A.	N.A.	N.A.	6.5	3
KRUPP DISO 25	120	10	3.3	0.5	45	4	33/210	1,2
O.D.E.C. DSF 6000	100	20	2.2	2.0	25	8	40/200	
ORE Geopulse	150	30	15	10.0	120	16	10	3
Simrad EY 200	300	7x11	3.5	1.0	N.A.	N.A.	49/200	4

Notes: N.A. signifies not available or not pursued.
1. Bottom loss compensation available.
2. Microprocessor intervention must be disabled.
3. Designed for deep-penetration profiling.
4. Designed for fisheries surveying.

TABLE 2: Effective Layer Resolution

MAKER MODEL	BURST LENGTH RESOL.	BEAM WIDTH RESOL.	BAND WIDTH RESOL.	TOTAL OF RESOL.
BioSonics Model 102	0.08	0.08	0.15	0.31
Datasonics SBP 5000	0.08	0.3	0.08	0.46
ELAC Honeywell LAZ 4721	0.22	0.11	0.11	0.44
InterOcean Model 3000	0.11	0.68	0.35	1.14
KRUPP DISO 25	0.09	0.1	0.23	0.42
O.D.E.C. DSF 6000	0.08	0.3	0.3	0.68
ORE Geopulse	0.11	0.6	0.05	0.76
Simrad EY 200	0.22	0.5	0.21	0.93

Appendix 1 Sounder Brochures

BioSonics®

THE BIOSONICS MODEL 101 AND 105 ECHO SOUNDERS

ALAN WIRTZ

In:
Acoustic Systems for Assessment
of Fisheries.
UN/FAO FISH. Circ. 778
1984

distributed by:
BIOSONICS INC.,
4520 Union Bay Place NE
Seattle, WA 98105 USA

Hydroacoustic Publication #1
9/87

TABLE OF SPECIFICATIONS

	Model 101	Model 105
TRANSMITTER		
Frequency	30 to 150 kHz or 200 to 500 kHz	50 to 500 kHz
Frequency Change	Replace 3 filter modules and two crystals (field changeable)	Either of two frequencies via panel switch
Peak Power Output	1000 watts (30 to 150 kHz) 400 watts (200 to 500 kHz)	100 watts
Average Power Output	25 watts	10 watts
Power Levels	0, -3, -6, -10 and -13 dB (relative)	one level only
Load Impedance	50 Ω real	50 Ω real
Stability	±.5 dB	±.5 dB
Pulse Width	.1 to 9.9 ms in .1 ms steps	.2, .4, .8 and 1.6 ms
RECEIVER		
Noise Figure	3 dB	3 dB
TVG		
40 log R	80 dB range total (two decades of distance)	80 dB range total (two decades of distance)
20 log R	40 dB range total (two decades of distance)	40 dB range total (two decades of distance)
Starting TVG Distances	1.25, 2.5, 3.75, 5, 6.25... up to 12.5 meters	.5, 1, 2 and 4 meters
Accuracy	±.5 dB (including 2αR compensation)	±.5 dB (including 2αR compensation)
Stability	±.5 dB	±.5 dB
Equivalent Dynamic Range (1 kHz Bandwidth)	146 dB	146 dB
Bandwidth	1, 2, 5 and 10 kHz	2.5 and 10 kHz (automatically selected with pulse width)
Gain	-18 dB to +24 dB (relative) in 6 dB steps	-18 to +24 dB (relative) in 6 dB steps
Absorption Coefficient Selection	Eight different values, plus 2αR = 0 may be selected by the user	Fresh water (2αR = 0) and salt water (user selected value)
Outputs	RF, 8 kHz and Detected/ Filtered, Bottom Detect	10 kHz and Detected/ Filtered, Bottom Detect
TRIGGER		
External	positive-going trigger signal, 2 V to 100 V	positive-going trigger signal 2 V to 100 V
Internal	ping interval .1 sec to 99.9 sec in .1 sec steps	8 ping rates from 30/sec to .2/sec
Sync Output	Sync output at end of transmit pulse	sync output at end or beginning of transmit pulse
CONTROL		
Blanking Distance	0.1 to 999.9 meters in 0.1 meter steps	Internally configurable 0 to 50 meters
Range Distance	0.1 to 999.9 meters in 0.1 meter steps	Internally configurable 0 to 400 meters
Blank at Range/Normal	Panel Switch	Internally configurable

TABLE OF SPECIFICATIONS (cont.)

	Model 101	Model 105
CALIBRATOR		
Level	-40, -20, 0 and +20 dB (relative)	-40, -20, 0 and +20 dB (relative)
Pulse/CW	panel swith selectable	panel switch selectable
Separation between pulses	0.1 to 99.9 meters in 0.1 meter steps	1.25, 2.5, 5, 10, 20, 40, 80, or 160 meters (internally configurable)
Stability	±.2 dB	±.2 dB
POWER		
A.C.	115 VAC or 220 - 240 VAC 50 or 60 Hz, 30 watts (typical)	115 VAC or 220 - 240 VAC 50 or 60 Hz, 20 watts (typical)
D.C.	optional	12 V, 17 watts (typical)
SIZE		
Outside Dimensions	23 x 43 x 40.5 cm deep (not including rack mount handles) (9 x 17 x 16 in deep)	13.3 x 43 x 33 cm deep (not including rack mount handles) (5¼ x 17 x 13 in deep)
Weight	12.7 Kg (28 lb)	7 Kg (15.5 lb)
MISC.		
Price (international)	approximately $25,200 US (at Factory, no taxes included)	approximately $13,000 US (at Factory, no taxes included)
Delivery	within 3 months ARO	within 3 months ARO
OPTIONS		
Additional Frequencies	as many as desired	one additional frequency
Simultaneous 20 log R	yes	yes
2nd Receiver (dual-receivers)	yes	yes
Spare Circuit Cards	yes	yes
Higher Power Transmitter	yes	yes

NOTES: 1) A variety of custom modifications, additions or configurations are possible for both the Model 101 and 105. Contact BioSonics for a quote on your exact needs.

2) These specifications are believed to be accurate. However, all specifications are subject to change without notice. Contact BioSonics for the most current specifications or prices.

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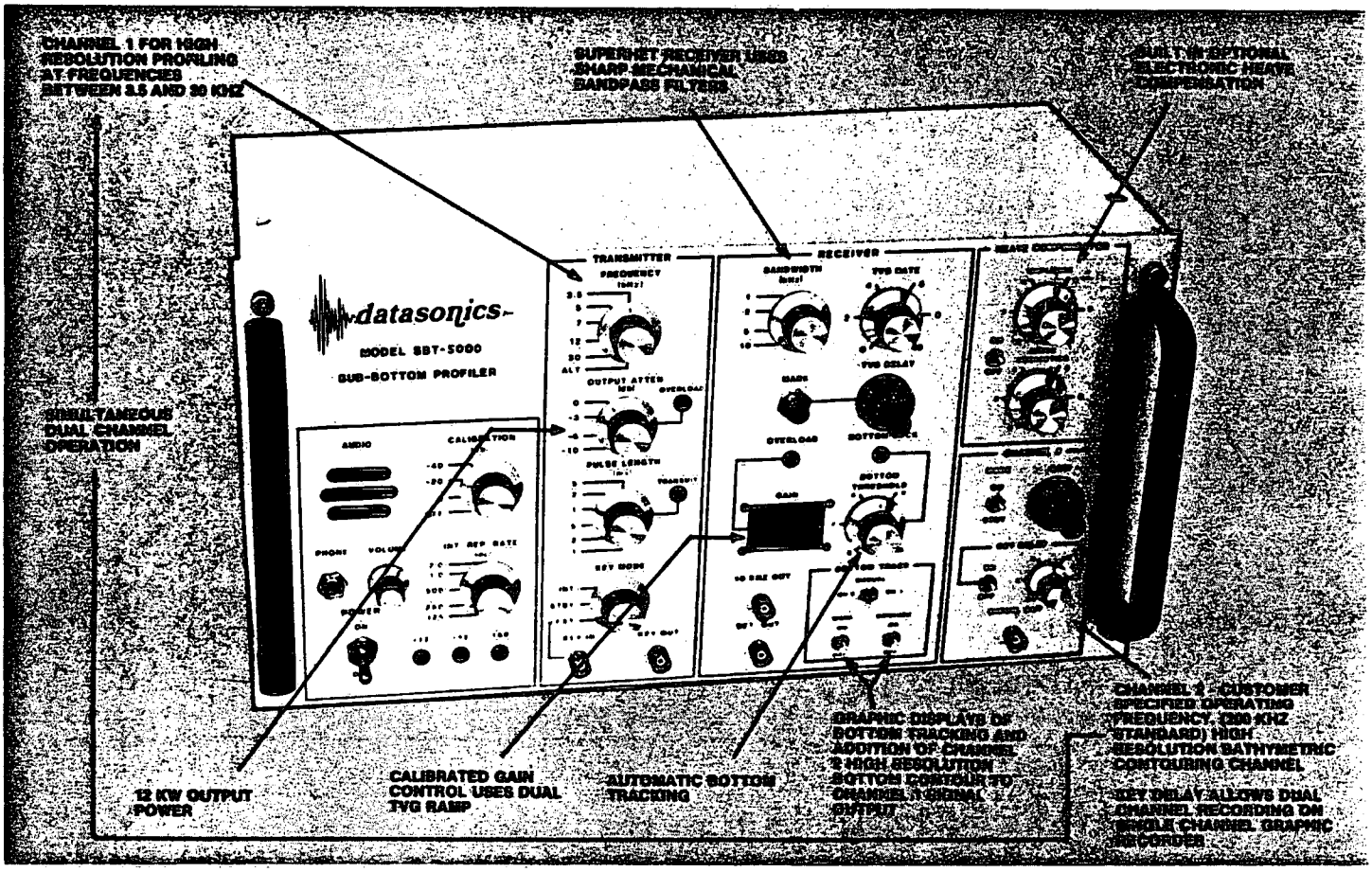
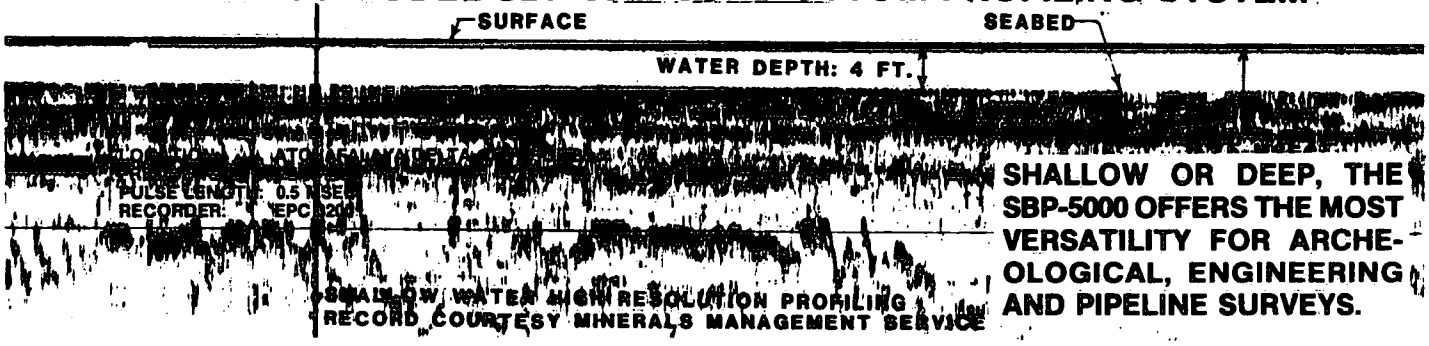


DATASONICS MODEL SBP-5000 SUB BOTTOM PROFILING SYSTEM



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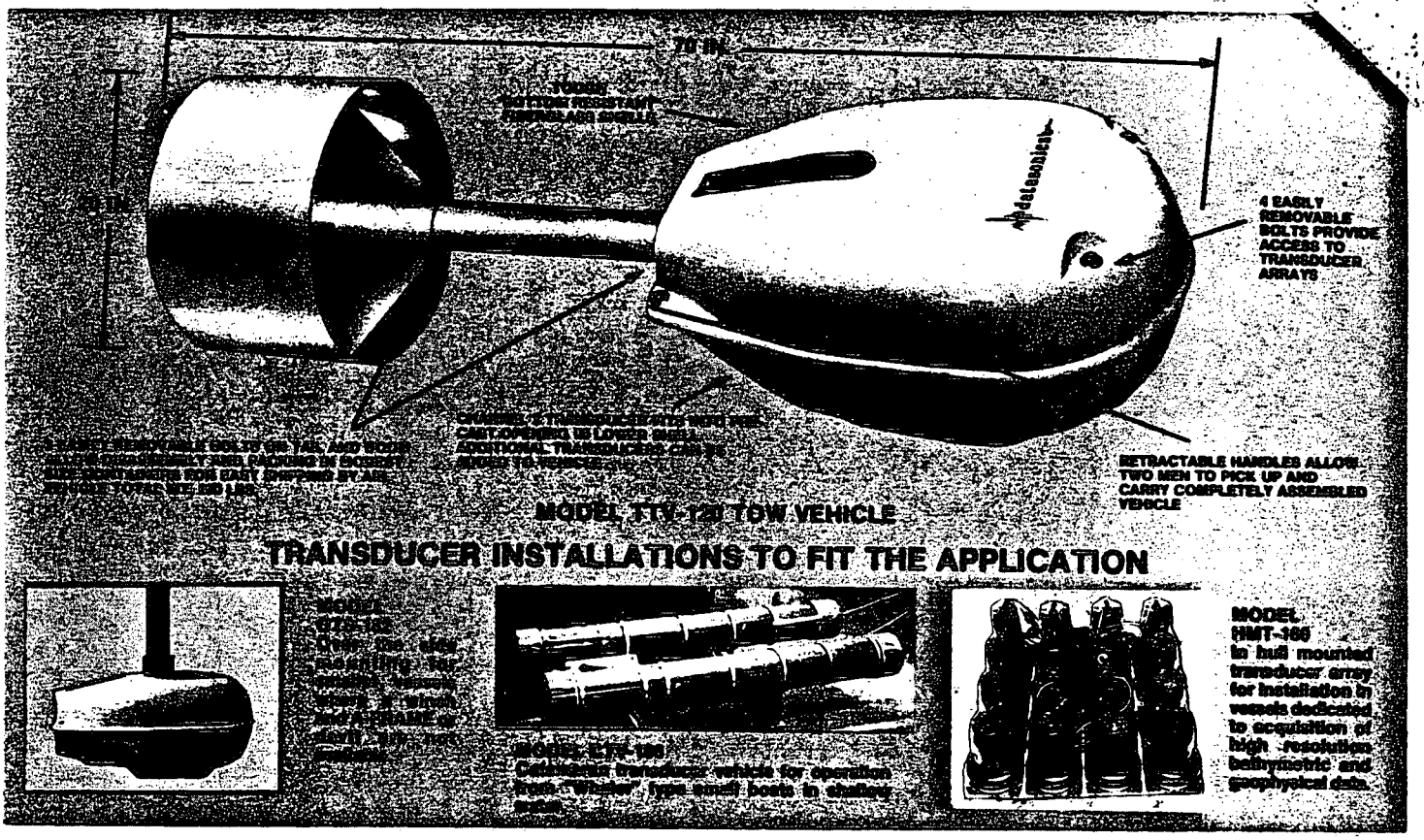
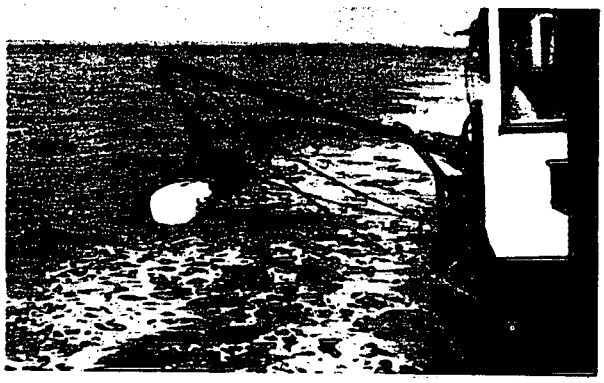
MODEL TTV-120 TOWED TRANSDUCER VEHICLE





Deep Water Survey aboard Texas A&M R/V Gyre.

Reservoir Survey for Monmouth, N.J. Consolidated Water Co. in water depths as shallow as 2 to 3 feet.

MODEL SBP-5000 SUB-BOTTOM PROFILING SYSTEM
SPECIFICATIONS

Model SBT-220 Transceiver

Operating Frequency:	Selectable: 3.5, 5.0, 7.0, 12.0 30.0, Alternate
Power Output:	Calibrated: 12 KW Maximum −3 db, −6 db, −10 db
Pulse Length:	Selectable: .1, .2, .5, 1.0, 2.0, 5.0 msec
Transmit Overload Protection:	Open/Short Circuit Protected
Key Mode Selection:	External, Internal or Standby
Internal Repetition Rate:	1/8, 1/4, 1/2, 1.0, 2.0 Seconds
Receiver Overload Protection:	LED indicates Receiver Overload
Receiver Bandwidth:	Selectable: 1, 2, 5, 10 kHz
Gain Control:	Calibrated in 3 db Increments to 100 db Maximum Gain
Time Varying Gain (TVG):	Calibrated 20 Log R Spreading Loss Compensation Plus Adjustable Bottom Loss Compensation
TVG Control:	Adjustable Delay and Rate Control
Automatic Bottom Track:	Initiates Start Of Adjustable Bottom Loss TVG. Automatic Bottom Track From Either Channel 1 or Channel 2 Bottom Echo. Threashold Control and LED Indicator To Set and Monitor Bottom Tracking.
Bottom Track Display:	Mark Control Allows Continuous Display of Electronic Bottom Track Position.
Calibration:	Self Test Cal Signal
Channel 2 Operating Frequency:	200 kHz Standard (other available)
Channel 2 Gain Control:	Adjustable to 100 db Maximum
Channel 2 Key Control:	Simultaneous With Channel 1 and Adjustable Delay For Single Channel Recorder Presentation Of Both Channel 1 and Channel 2
Bottom Enhancement:	Provides High Resolution Channel 2 Bottom Contour To Be Summed With Channel 1 and Written On Recorder
Signal Outputs:	Front and Rear Panel Outputs; 10 kHz Heterodyne and Detected Outputs 0 to 10 Vrms
Optional Heave Compensation:	Provides Key Delay In Accordance With Transducer Vertical Heave Motion

Specifications for over the side, catamaran, or in hull transducer installation available on request.

Tape Recorder Interface:	Key Burst and Signal Outputs For Analog Magnetic Tape Recording or Input To Digital Data Acquisition System
Construction:	19 inch Rack Mount or Free Standing In a Rugged Portable Case
Dimensions:	19 inch Wide x 8¾ inch High x 18 inch Deep
Weight:	60 lb.

Model TTV-120 Towed Transducer Vehicle With Transducer Array*

Vehicle Type:	Hydrodynamically Faired with Fiberglass Shells
Transducer Type:	4 Transducer Array (4 each Model AT-471 Elements) - Channel 1 Single Element Array (Model AT-405) - Channel 2
Maximum Power Input:	Channel 1 - 12 KW Channel 2 - 1 KW
Transducer Beamwidth:	Channel 1: 3.5 kHz - 55° 5.0 kHz - 45° 7.0 kHz - 35° Channel 2: 2W kHz - 5°
Vehicle Dimensions:	21 inch Wide x 20 inch High x 70 inch Long
Construction:	Galvanized Steel Transducer Plate, Boom, Tail Assembly, Molded Fiberglass Shells
Vehicle Weight:	In Air: 200 lb. In Water: 120 lb. Adjustable Ballast Available

Model TWC-601 Tow Cable

Cable Type:	Kevlar Reinforced, Polyurethane Jacket, or Double Armored
Diameter:	0.5 Inch
Core Construction:	3 each No. 22 Coaxial Conductors 3 each No. 22 Single Conductors
Breaking Strength:	Armored Cable - 16,000 lbs., Kevlar Reinforced Cable - 6,000 lbs.

EPC MODEL 8700 SERIES THERMAL RECORDER DATA SHEE

FEATURES

- Uses Thermal Film
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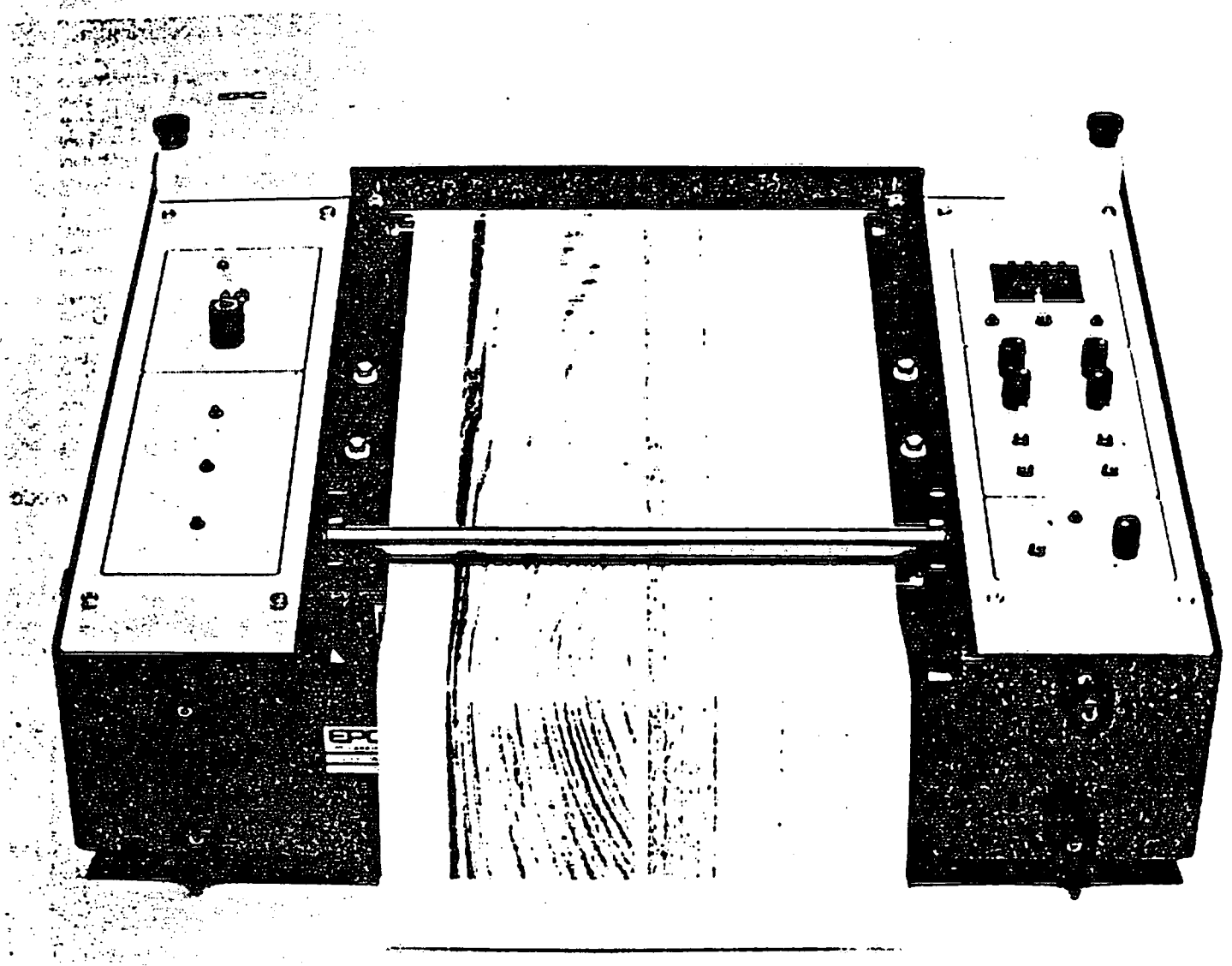

Model 8700 displaying Scientific Atlanta GPD Acoustic Data

EPC's new generation of Thermal Recorders uses the most innovative of concepts available today. The use of heat-sensitive film eliminates odor, carbon dust, and record smearing experienced with the use of electro-sensitive paper. The EPC 8700 series incorporates state-of-the-art technology to produce high-quality records for such applications as: LOFAR gram displays and spectrum analysis output for communications surveillance; and is compatible with side-scan sonar and sub-bottom profiling. Years of experience in the design and manufacture of hard-copy recorders are reflected in the development of this entirely new concept in recording technology—at an affordable price.

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INDIA - SOUTH AFRICA

SPECIFICATIONS

PAPER TYPE:	Thermal Film
PAPER WIDTH:	9.0 inches
ROLL LENGTH:	160 feet
PIXEL RESOLUTION:	240 dots/inch = 2048 points
SHADES OF GRAY:	16 dynamic range 23 DB
CHART SPEEDS:	Switch selectable 120-240 LPI, including Rapid Chart
FIRST LINE VIEWING:	Virtually instantaneous
CHART TAKE-UP:	On/Off
INTERNAL SWEEP SPEEDS: (Model 8700)	Selectable via front-panel switches from 10msec to 9.999 sec. in 1.0msec steps
REMOTE:	Digital I/O
SWEEP SPEEDS:	Up to 9 speeds may be selected: 64, 32, 16, 8, 4, 2, 1, .5, .25 scans/second and STANDBY.
REMOTE: (Model 8701)	Selectable via digital I/O connector 25 pin D. A 3-bit binary code will be utilized to select.
DIGITAL CLOCK OUT:	Provide a 2048PPS clock output for synchronization. Internal dip switch selectable 8,192 PPS/2,048 PPS.
ZERO PULSE:	Provide a 1.0μsec. 5V TTL pulse to indicate start of sweep.
DIGITAL DATA IN:	Provide 4 bits parallel. 0000 for white, 1111 for black, 16 shades.
EXTERNAL TRIGGER IN:	Provide input for external trigger. 50μsec minimum pulse width.

All digital I/O inputs and outputs to utilize line drivers and receivers.

Unit 19", rack mountable — Width: 17.625", Height: 19.21", Depth: 4.16", Weight: 35 pounds.

IEEE — 488 — RS232 INTERFACES AVAILABLE

ANALOG INTERFACE

SIGNAL ANALOG BNC:	.1 - 10V (input impedance 10K ohn All inputs frequency response flat f DC - 100KHZ E in 0.1V)
ZERO PULSE OUT BNC:	1.0μsec pulse 5V TTL
EXT. TRIGGER INPUT BNC:	.5V - 15V pulse; 50 μsec minimum pulse width
REMOTE SPEED DUAL BNC: (Model 8702)	Provide for selection of 9 sweep speeds and remote: 64, 32, 16, 8, 4 2, 1, .5, .25. scans/second and REMOTE. Internal dip switches are vided for manual selection.

CONTROLS

SWEEP SPEEDS:	**Model 8700:** 4 push-button BCD switches, .001 to 9.999 seconds. **Model 8701:** 64, 32, 16, 8, 4, 2, 1, and .25 scans/second.
CHART SPEEDS:	Switch selectable 120-240 lines/inch
RAPID:	Switch selectable - momentary rapid
INT/EXT TRIGGER CONTROL:	Internal trigger mode and level control for incoming trigger signal
STANDBY/ PUSH TO PRINT:	Switch selectable for momentary data printing at selected sweep speed/chart rate
SWEEP DIRECTION:	Switch selectable for data display lef right, right-to-left — internal dip type
CONTRAST:	Control of signal to maximum black
THRESHOLD:	Control small components of incoming
GAIN:	Control incoming signal
PRE-HEAT:	Controls intensity - shades of gray
LINE VOLTAGE:	Switch selectable front panel ON/OF

Power: 90-120VAC or 205-240VAC. 48-400 Hz. 200 W. Line f at front-panel fuseholder. Line cord is located on rear of case

Note 1: These specifications apply to all three models except where noted. Other minor differences existing are outlined in technical manual.

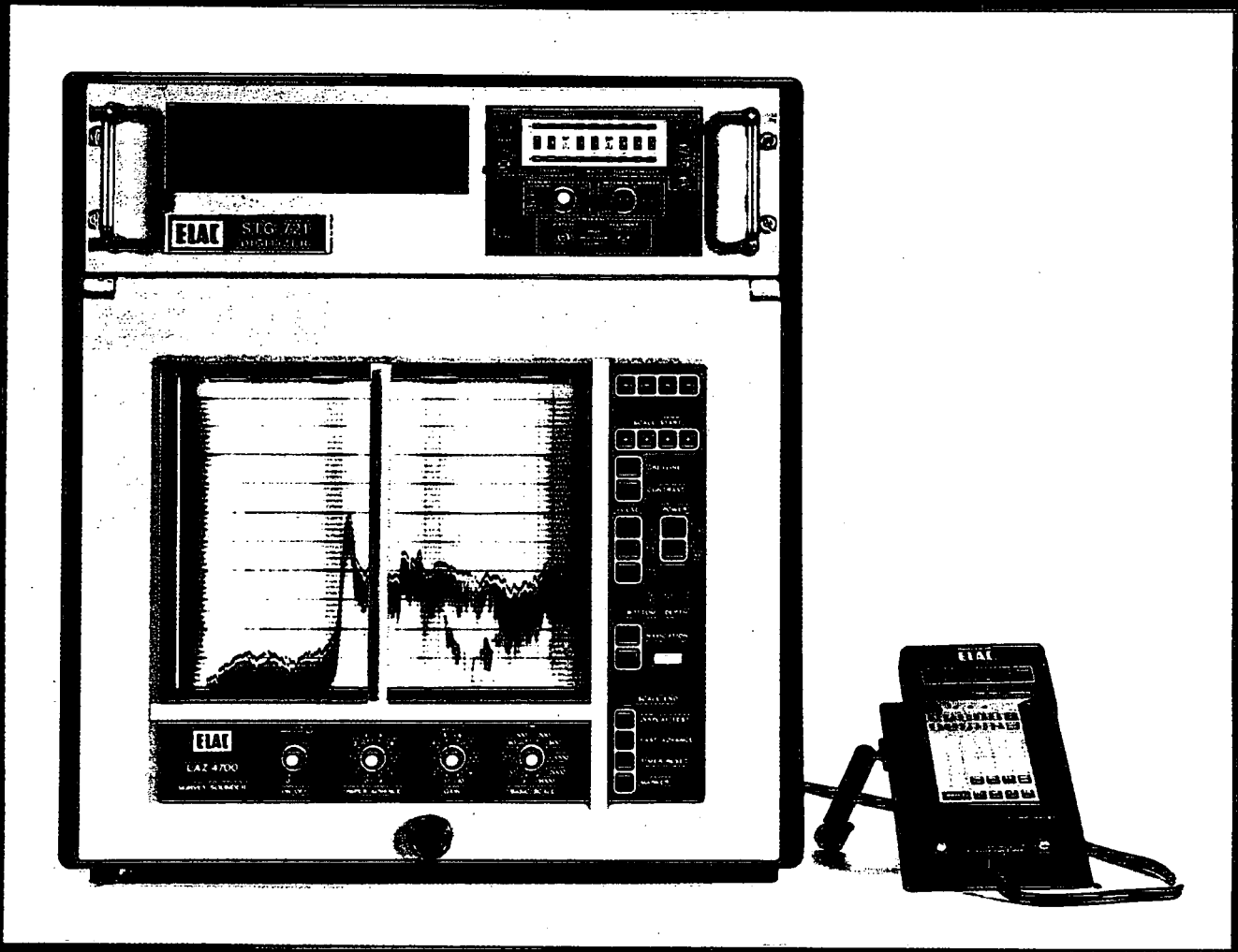
Note 2: For detailed specifications regarding digital interface, consult factory.

EPC LABORATORIES, INC.
5 Electronics Avenue
Danvers, MA 01923

EPC INTERNATIONAL LTD.
Beaumont Business Centre
Unit 10, Beaumont Close Banbury
Oxon OX 16 7TN United Kingdom

Honeywell ELAC

Dual-frequency Bathymetric System LAZ 4721



Dual-frequency bathymetric system LAZ 4721

APPLICATIONS

The integrated dual-frequency bathymetric system LAZ 4721 is designed for hydrographic surveying of inland waterways, harbours, pipelaying operations, deep-sea survey etc. By means of two transducers operating on low respectively high frequency, depth data are digitally indicated in the upper part while the echograph displays high and low frequency recordings on the paper. The equipment can thus be used equally for shallow water or extremely deep water echosounding.
With its wide selection of 10 basic range scales from 0 – 5 m to 0 – 5000 m, phasing in 1 m increments from 0 to 9999 m (to a maximum depth of 14.999 m) combined with a wide choice of frequencies, transducers, transmitters and optional equipment, its capabilities cover the entire range from shallow water surveys of harbours and inland waterways to bathymetry in maximum ocean depths. The compact, rugged construction and its precise recording make the equipment well suited both for stand/alone use and for use in an integrated computer-based survey system.

FEATURES

● Dependable performance against all types of bottoms	The bottom recognition technique utilizes "echopulse stacking" – non-coherent pulse integration for fail-safe indication of true bottom. Undesired echoes from temperature layers, plankton, fish, etc. are blocked by means of a gate. The gate start can be set at any depth down to 9900 meters, the gate width is continuously adjustable from 1 to 9900 meters. Within the limits of the selected gate width the bottom contour is tracked automatically. A "true bottom marker generator" in the digitizer provides markings on the recording paper which follow the bottom indication. This verifies to the operator that the digital data indicated on the STG 721 correspond with the true bottom contour on the recorder. Should the true bottom echo not be present within the preset gate for a period of 10 seconds plus 10 soundings an automatic failure indication "FFFF" will be displayed. Two digitized depth data outputs are available in BCD code (bit parallel and bit serial). The LAZ 4721 features 2 unique alarm modes: "vessel approaching a preset depth" – decreasing depth or "vessel moving away from a preset depth" – increasing depth. If the alarm is activated both visual and audible alarms are given. Contacts to activate remote alarms are available.
● Full-feature precision graphic recorder	Wide 9-inch dry paper recording with electronically ruled depth lines and electronic printing of range scale and velocity; time marks in 1 min, 10 min and 1 hour intervals; 4 selectable modes for manual/automatic speed control (including off).
● Full complement of auxiliary inputs and interfaces	Calibrated heave compensator input, sound velocity input, draft adjustment with differential for high/low frequency transducers.
● Rugged, compact construction	Aluminium housing, splashproof to IP 22, sliding window.
● Comprehensive two-way computer interface for control/readout (RS 232)	All important operating parameters can be remotely controlled and read out individually or in preformated groups – either over a computer or an optional hand-held terminal. Fully synchronized operation with any other echosounder including automatic range scale control.
● Easy-to-use integrated annotator	Over a computer or hand-held terminal operating parameters and arbitrary alphanumeric text can be printed out in highly legible characters on the chart records. Major operating parameters can be printed out as a set or individually selected.
● DHI-approved as navigation sounder	Useable as ship's navigation sounder (in selectable mode) meeting IMO/SOLAS requirements and recommendations.
● Unequaled range of frequencies, transducers, transmitters, power supplies and optional equipment	Transducers from 12 to 200 kHz including stabilized units, power levels from 250 W to 10 kW, 10 to 38 V DC or 110/220 V AC operation provide a comprehensive capability for all types of applications.
● Bottom characteristic determination and buried object location with EMG 2 Bottom Analyzer	With the optional EMG 2 the LAZ 4721 becomes a powerful system for remote classification of bottom characteristics, sediment types and unambiguous location of buried objects such as pipelines.

Recorder Performance Data:

Basic Range Scales (m)	Phased Range Scales (m)	Paper advance (mm/min)
0 – 5	Each basic range scale	0 – 100
0 – 10	can be shifted to any	0 – 50 or 0 – 100
0 – 20	depth interval in 1 m	0 – 25 or 0 – 100
0 – 50	increments, up to	0 – 10 or 0 – 50
0 – 100	9999 m	0 – 5 or 0 – 20
0 – 200	Max. range scale:	0 – 2.0
0 – 500	14999 m	0 – 1 or 0 – 5
0 – 1000		0 – 0.5 or 0 – 2
0 – 2000		0 – 0.2 or 0 – 1
0 – 5000		0 – 0.1 or 0 – 0.5

Paper advance can be controlled in 10 steps. 3 different types of paper advance:
1. range scale dependent
2. constant
3. speed-log controlled advance (proportional to travelling distance or velocity)

Pulse repetition rate:	450/min ... 3.5/min (range scale dependent)
Scale ratio:	40 mm/m at 0 – 5 m range scale
Recording accuracy:	Better than ± 0.25 % of range selected or ± 5 cm at + 20° C ambient temperature
Minimum sounding depth:	0.3 m with 50 kHz; 0.1 m with 200 kHz (below transducer)
Recording paper:	Electrosensitive dry paper, paperwidth 228 mm (9 in.); length per roll approx. 25 m (82 ft) or 16 m (52 ft); blank or ruled paper available
Approx. recording time:	At 0 – 5 m range scale/max. paper advance: 4 hrs/roll (25 m) at 0 – 500 m range scale/medium paper advance: 416 hrs/roll (25 m) at 0 – 5000 m range scale/min. paper advance: 4200 hrs/roll (25 m)
Electronic printout:	Printout of depth lines can be switched on and off. Depth lines are automatically adjusted to range scales. Digital depth values are printed out accordingly. At the lower edge time marks are printed out. The electronic printout increases the precision of recordings.
Window size:	295 × 235 mm (approx. 12 in. × 9 in.)
Sliding window:	Standard; aperture 215 × 130 mm
Heave or tide compensation:	Incorporated for connection to ELAC, Datawell, Anschütz, or Atlas Heco Heave sensors (1 V/m; max + 8 V corresponding to ± 8 m)
Sound velocity adjustment:	Quartz-precise adjustment, 1400 ... 1599 m/s in 1 m/s steps
Draft adjustment:	0.01 ... 29.9 m in cm steps
Zero line adjustment:	Continuously variable: 3 mm upwards, 13.5 mm downwards; zero line adjustable to different types of ruled paper
Receiver gain control:	10 steps, 6 dB each
TVG:	Switchable: 20 log R/40 log R/manual adjustment
Admissible ambient temperatures:	0° C ... + 55° C (operation) at max. 95 % relative humidity – 25° C ... + 70° C (storage) at max. 50 % relative humidity
Admissible vibration:	2.0 ... 13.2 Hz ± 1.0 mm amplitude 13.2 ... 8.0 Hz at 0.7 g
Radio interference protection:	Code K
Housing:	Seawater resistant aluminium alloy, protection code IP 22 (with closed sliding window)
Approval:	Equipment is approved as navigationsounder No. 05371 of the German Hydrographic Institute
Power supply:	10 – 38 VDC or 110/220 VAC ± 10 % (specify when ordering)
Power consumption:	Approx. 90 W (for equipment with built-in PGN 36)

Digitizer Data

Operating mode:	Unit processes and displays simultaneously information from low frequency recorder and high frequency built-in transceiver as dual frequency digitizer. Low and high frequency display can be selected separately.
Display type:	Large 6 digits, planar gas discharge technology, brightness adjustable (dimmer), very high light intensity.
Range scales (indications):	0.00 9.99 99.99 999.9 9999
Calibration:	Selectable in meters, feet or fathoms
Resolution:	1 cm for meter calibration, 1 ft resp. 1 fm for ft/fm calibration
Accuracy:	± 1 digit
Failure indication:	"FFFF" is shown if true bottom echo is not present within gate
Display test:	Proper function of all six digits is tested with a button
Gate settings:	Gate start: 0 – 9900, gate width: 0 – 9900 (steps of 1 between 0 and 99, all other × 10, × 100). Quick set-up by bi-directional push wheel switches
Bottom recognition:	True bottom recognition through "echopulse stacking"
Outputs:	BCD – bit parallel and/or bit serial (6 digits) TTL compatible (+ 5 V). Baud-rate adjustable. RS-232C on request.
Alarms:	Selection of 2 alarm modes: "decreasing depth" or "increasing depth" (both 0 ... 999 m/fms/ft). Set-up of alarm depth by bi-directional push wheel switches.
Alarm indication:	Visual and audible plus activated contacts for remote alarms
Power supply:	25.2 V ± 20 %, 32 V ± 20 %, 110, 220 VAC ± 10 % (to be specified when ordering)
Power consumption:	18 W
Interference protection:	Code K
Ambient temperatures:	0° ... + 55° C
Water protection	Code IP 20 (waterproof housing at option)

HIGH FREQUENCY TRANSCEIVER DATA

Pulse power:	150 W
AV/TV control:	Incorporated (20 log r)

Technical Data

Standard transducer and transmitters

Application depth up to	Frequency, kHz	Model, LSE –	Transducers Available installations	No. of elements	Beamwidth deg.	Used with transmitter: PGN 36 250 W	PGN 36 450 W	PGN 36 1000 W	STG-721 150
12,000 m	12	179	E, I-02	37	14 × 15				
3,800 m	12	185	E, IX-20	7	33	(Pinger Reception only)			
3,800 m	12	185	E, H	7	33				
8,000 m	15	179	E, I-02	37	12				
5,000 m	20	179	E, I-02	37	9				
3,000 m	30	138	E, H, IR-19	7/	15 × 16				
				14	10 × 13				
2,500 m	30	131	E, H, A	7	15 × 16				
2,200 m	30	131	IR-11, IR-29	7	15 × 16				
2,000 m	30	132	E, H, A	3	24				
2,000 /	30/	175	A	3	24				
200 m	200			2	10				
1,800 m	50	134	E, H, A, IW-29	7	11 × 12				
1,000 m	50	133	E, H, A	3	17				
1,000 /	50/	176	A	3	17				
200 m	200			2	10				
500 m	100	148	E, H	1	14				
300 m	150	151	E, H	10	4.3 × 6.5				
200 m	150	157	E, H	3	9 × 10				
200 m	200	135	E, H, A	10	10				
200 m	200	140	E, ER, H, A	2 × 1	each 10				

Transducer installation notes:
E = For steel hull installations, with housing approved by German Lloyd.
ER = For steel hull, with 25 mm reinforced housing. **H** = For wood and GRP hull installations. **A** = Outboard/portable transducers. **I** = Inboard installations –
IX-20, IX-02: with 75 mm GRP acoustic window; **IR-11:** with steel diaphragm;
IR-19, IR-29: plug-in models with 75 mm GRP acoustic window.

Transmitter notes:
PGN-36: Internal transmitter, output matched to transducer selected pulse lengths 0.3, 1, 3 millisec. **LGN-8:** Optional external transmitter (instead of PGN 36), requires AC supply, pulse lengths 0.3, 1, 3, 10 millisec. **STG-721:** High-frequency transceiver in precision digitizer, pulse length 0.05, 0.3 millisec.

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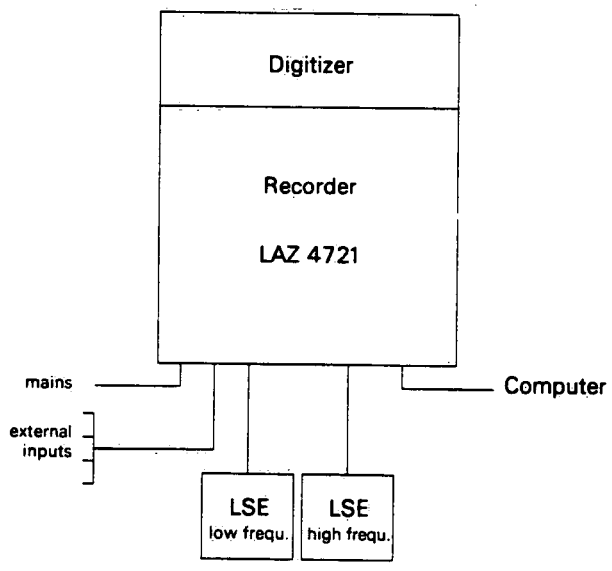
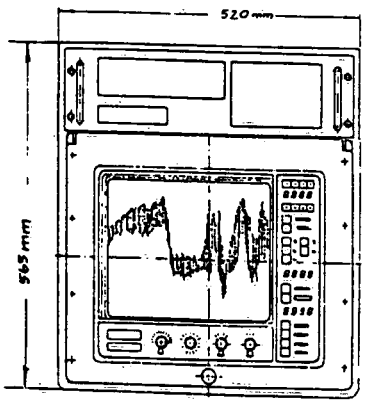
System configuration



Dimensions:
Height: 565 mm
Width: 520 mm
Depth: 435 mm

Weight: 41 kg



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MODEL 3000

SUBBOTTOM PROFILER

- BATTERY OPERATED
- SMALL SIZE
- LIGHT WEIGHT

The **Model 3000A Subbottom Profiler** is a portable, battery operated system which has been designed to be operated from small vessels. The system function is to present, in analog form, continuous, repetitive measurements of the acoustic reflectivity (density) of the materials comprising the water bottom and subbottom.

The system consists of the following subassemblies:

Model 3010/3020A Recorder/Transceiver
Model 3035 Transducer Assy. and cables

The system uses a drypaper recorder with high contrast characteristics. The system is battery operated. The Recorder-Transceiver is housed in a weatherproof case with window cover which will permit the operator to observe the recording.

The Model 3000 is designed for operation in coastal waters, harbors, estuaries, rivers, and lakes. It is configured to be easily transported to remote areas.

The Model 3000, which operates at a frequency of 6.5 KHz, has an advanced design one kilowatt transmitter. The high gain receiver is equipped with time variable gain, which is operator-adjustable, in time delay and slope (rate of change of gain). A three position switch provides the operator with two added gain steps to extend the dynamic range of the recording equipment.

A control, external to the transmitter, permits the operator to reduce the output acoustic power when operating in shallow waters.

SUBBOTTOM PROFILER SPECIFICATIONS

Recorder Model 3010

Input Power:	21-29 Vdc
Electronics:	Solid State
Chart Paper:	Electro Sensitive (dry type) 15.2 4 Cm (6 in.)W
Sounding Rate:	140 times/min & 53 times/min
Range Scales:	Eight overlapping scales 0 to 45 fathoms (0 to 82.3M) 30 to 75 fathoms (54.9 to 137.2M) 60 to 105 fathoms (109.7 to 192M) 90 to 135 fathoms (164.6 to 246.9M) 0 to 120 fathoms (0 to 219.5M) 90 to 200 fathoms (164.6 to 365.8M) 160 to 280 fathoms (292.6 to 512M)

Transceiver Model 3020A

Input Power:	21-29 Vdc
Operating Frequency:	6.5 KHz
Output Power:	Adjustable to 1 KW
Pulse Width:	1, 2, 4, 8, 16 cycles of 6.5 KHz carrier

Receiver

Bandwidth:	Adjustable 200 Hz to 2 KHz
Gain-Minimum:	Adjustable from 20 dB to 80 dB
Time Variable Gain (TVG):	Adjustable Delay & Slope
Delay:	Adjustable from 10 ms to 1 sec
Slope:	Adjustable from 1 to 3X Range Squared
External Dimensions:	367 mm (14-7/16 in.)H × 375 mm (14-3/4 in.)D × 206 mm (8-1/8 in.)W
Weight:	40/lb, 18 kg

Transducer Model 3035

Transducer:	Housed in an aluminum case. Oil filled.
Beam Width:	35 degrees
Source Level:	105 dB re 1 ubar at 1 yd
Frequency:	6.5 kHz
Size:	19 in. diam × 7¼ in. high Tuning inductor housing: 6 in. diam × 3 in. high

The Universal High-Precision Research Echosounder

ATLAS DESO 25, with two separate, active or passive sounding channels, offers many different possibilities of use in oceanographic research and in exploration technology. By means of a new type of high-resolution thermal comb recorder, extremely high recording accuracy is achieved, and all important parameters such as date, time, measuring range, the set sound velocity for the water and any additional measured values are documented on the paper.

- In research, the ATLAS DESO 25, with available hydroacoustic transducers, can be used in all occurring depths of water.
  Phasable measuring ranges and an automatic range switch-over facility permit expanded recording without the risk of losing the bottom echo.
- If a navigation system or computer system is connected, data transmission and external control take place simultaneously by means of a bidirectional serial interface.

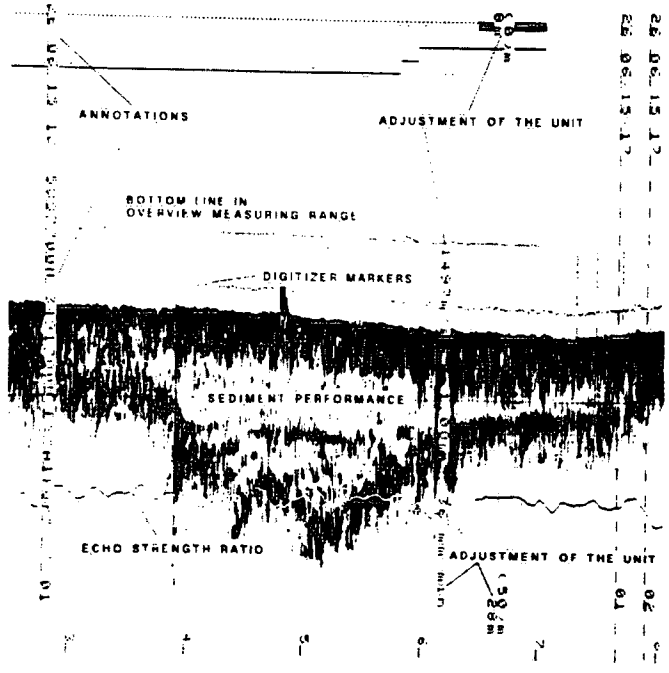
The ATLAS DESO 25, with the appropriate special transducers, is suitable both for sediment and mud recordings, and for deep sea use. A new measurement-amplifier permits automatic or sensitive manual gain control; a built-in echo contrast amplifier function makes a significant contribution to differentiated recording of layers.

Deep Sea Use
With an external high-powered transmitter (2 or 4 kW), in conjunction with special transducers (12, 15 or 33 kHz) for deep sea measurements, the attainable measurement depth can be increased to a maximum of 10,000 m.

Trigger Synchronisation
If the ATLAS DESO 25 is operated in conjunction with several other echosounders, the unit's own trigger pulse can be replaced by externally controlled triggering in order to prevent mutual interference.

Slave Operation
Via a sounding signal interface, the ATLAS DESO 25 can be connected to a second DESO 25 which acts as a master unit, for example. On the slave unit, it is then still possible to individually select the display range, markers and additional annotations. It is even possible to operate one channel in the slave mode and the other channel in the normal active echosounding mode.
For the transfer of digital information (digitised depths, signal strength etc.), the slave unit can additionally be connected to the master echosounder via the serial RS 232 interface.
For special use with the parametric measurement system ATLAS PARASOUND*), the high-precision echosounder ATLAS DESO 25 is used for analog recording of the primary frequency in channel 1 (18 ... 23.5 kHz) and of the parametric signal in channel 2 (2.5 ... 5.5 kHz).

Pinger Operation
For special tasks in oceanographic research and offshore technology, the ATLAS DESO 25, in conjunction with a 12 kHz pinger transmitter, can also be used as a pinger echosounder to determine the submersion depth of special equipment.

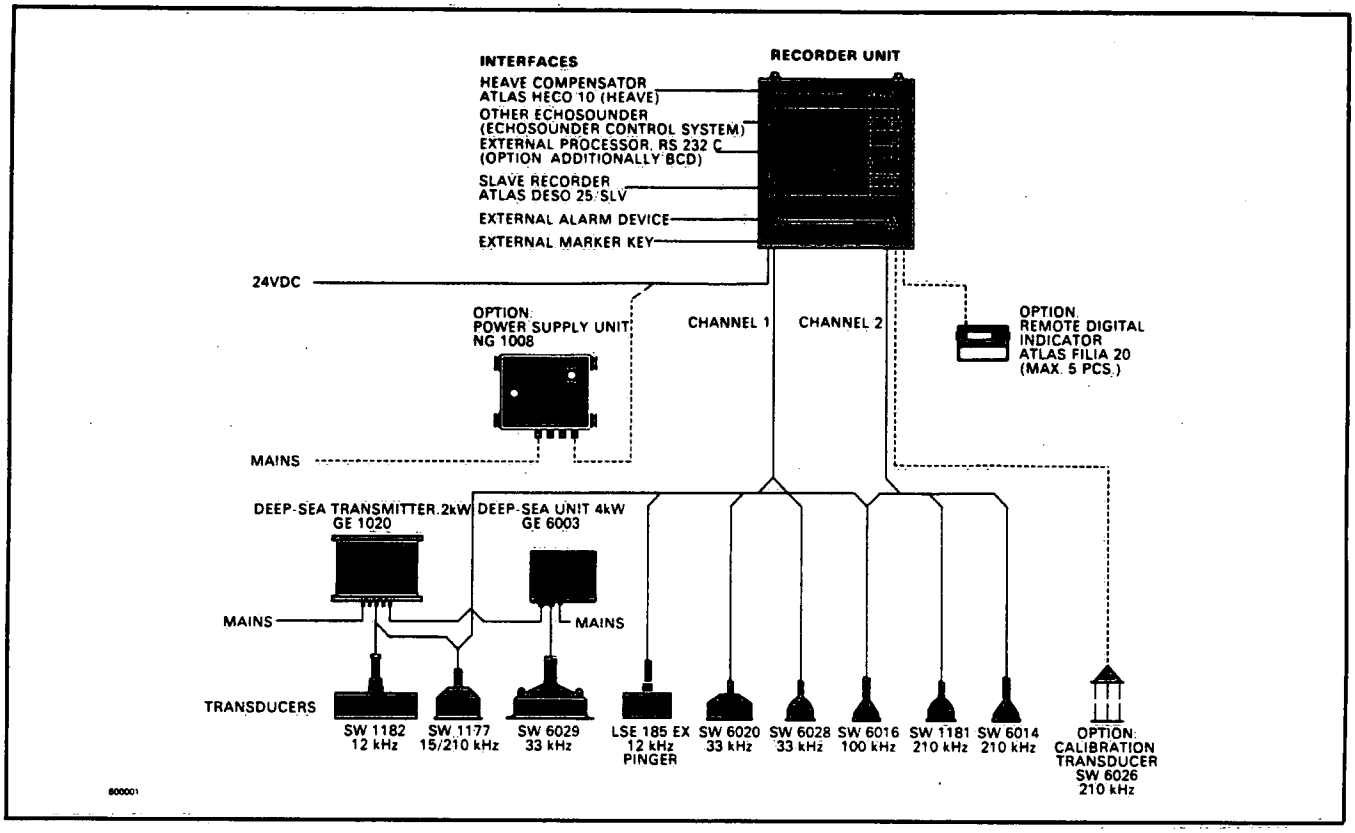


ATLAS DESO 25

- Modern thermal comb recording technique
- Annotation of measurement-related parameters
- Standardised interfaces for system integration
- Deep-sea range with special transmitters and transducers
- External triggering is possible when several units are in use
- Individual recording in the slave mode
- Can be used as a pinger echosounder

*) see separate data sheet

Specification and Performance Data



Measuring ranges:
From 0 ... 5 m up to 0 ... 15,000 m selectable in 10 steps.

Image scale:
Vertical (SCALE): Selectable in 10 steps from 5 m up to 15,000 m, corresponding to 1:25 up to 1:75,000.

PHASING:
Per measuring range in steps of 20% of the range selected (SCALE). Manually or automatically shifting over the total depth range (RANGE).

Horizontal (PAPERSPEED):
internal: 720 mm/min up to 0.9 mm/min selectable in 10 steps
external: proportional to ship's speed at a scale of 1:250 up to 1:200,000, but 720 mm/min maximum.

Digital displays:
Numerical indication of beginning (upper) and end of range (lower) after selection of image scale (SCALE) and PHASING. Actual depth in the centre.

Frequencies:
Standard frequencies for
Channel 1: 12, 15, 33 kHz
Channel 2: 100, 210 kHz
Calibration transducer: 210 kHz

Measurement accuracies:
12 kHz: 1 digit ± 300 mm ± 0.1% of depth value
210 kHz: 1 digit ± 10 mm ± 0.1% of depth value
(Sound velocity set exactly; GAIN:AUTO, flat bottom)

Recording paper:
Thermosensitive paper without marginal perforation
Overall width: ..... 230 mm
Recording width: ..... 200 mm
Length: ..... 32 m

Required voltage/ power consumption:
Rated voltage:
24 VDC, +30%/–20%
Short-time overvoltage:
60 VDC, 1 msec
Starting current: ..... 10 A, 1 sec at 24 VDC and room temperature
Current consumption: ..... 2.7 A (min.)
8 A (max.)
(with strong blackening of paper)
Average power consumption: 65 W

Installation:
Bulkhead, desk mounting, 19" rack with 12 panel units

Environmental conditions:
Operating temperature:
–10°C up to +55°C at ≤ 90% rel. humidity, no condensation
Storage temperature:
–25°C up to +70°C
Vibration: 3 Hz up to 12.5 Hz: ± 1.6 mm amplitude
12.5 Hz up to 50 Hz: 1 g acceleration
Shock: 30 g/11 msec
Type of enclosure: IP 21 (drip-proofed, fixed front glass)
(IEC 144 / DIN 40050)
Radio interference suppression grade: Limiting values class B as per VDE 0871
Noise level at distance of 1 m:
(air-borne sound): < 60 dB

Interfaces:
INPUTS:
- From other echosounders or echosounder control system (e.g. ATLAS ECHOCONTROL): Synchronizing and blanking pulses, analogue sounding signal
- From external computer or position measuring device (e.g. ATLAS DOLOG*, ATLAS POLARFIX*) digital signals for remote control and/or annotation (e.g. position data or text)
- From heave compensator ATLAS HECO 10*: heave signal
- External marker

OUTPUTS:
- To other echosounders or echosounder control system: Synchronizing and blanking pulses, analogue sounding signal
- To slave recorder or echosounder control system: Sounding signals
- To external computer or echosounder control system: water depth via RS 232 C / 20 mA or BCD parallel interface and status signals (via RS 232 C interface)
- Digital slave display ATLAS FILIA 20* (via BCD-interface)
- External alarm device

Options:
Power supply NG 1008:
Input: 115/120 V / 220/240 V } +10%/–20%
45 – 440 Hz
Output: 24 VDC, 15 A max.
Deep-sea transmitter GE 1020:
110/220/240 V, ± 10%
50 – 60 Hz
250 VA
Deep-sea unit GE 6003:
110/220/240 V, ± 10%
50 – 60 Hz
280 VA

Heave compensation: To compensate bad measuring results due to vertical movement of the vessel the heave compensator ATLAS HECO 10* can be connected. Alternatively the draught correction can be controlled from extern via the same interface.
Range: ± 5 m

Dimensions/weights:

		DESO 25	NG 1008	Deep-sea transmitter GE 1020	Deep-sea unit GE 6003	FILIA 20
Heigth	(mm)	488	300	502	400	224
Width	(mm)	440	380	600	483	300
Front-to-back	(mm)	270	155	520	285	200
Weight	(kg)	26	11	60	app. 28	app. 2

* see separate data sheet

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PINGER ECHOSOUNDER

ATLAS DESO 25

AN 1062 A 003

EQUIPMENT SPECIFICATION

Tagebuch-Nr. Day Book No.	Ausfertigung Nr. Copy No.										
		Equipment Specification									
		ATLAS DESO 25									
		KRUPP ATLAS ELEKTRONIK GMBH BREMEN	AN 1062 A 003 SN								Blatt/Sheet 1/13
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2.1.2 Performance Data (Channel 1)

- Frequency: 12 kHz
- Input sensivity: + 40 dB (re 1 µPa, Hz)
- Amplifier bandwidth: 1000 Hz
- Detection threshold: + 10 dB
- Transducer directivity: + 18 dB (re 1)
- Beamwidth: ± 33°, 2theta, - 3dB
- Side-lobe attenuation: - 20dB at ± 50°
- Range:

sound pressure level of pinger	receiving direction (relative to the ship's vertical)	range,* direct signal	range,* signal via bottom**
+ 193 dB(re 1 µPa)	0°	14 000 m	7 000 m
+ 185 dB(re 1 µPa)	0°	11 000 m	3 500 m
+ 185 dB(re 1 µPa)	± 50°	5 000 m	800 m
+ 185 dB(re 1 µPa)	± 70° to ± 90°	3 000 m	300 m

Boundary conditions for range:

*

- Isotropic noise level smaller than + 55 dB(re 1 µPa, $H^{-1/2}$)
- Absence of the temperature layers
- Absence of aeration under the transducer
- Pulse length: 10 msec

**

- Bottom reflection coefficient: - 25 dB
- Inclination of bottom smalller than 5°
- Distance between pinger and bottom is negligible compared to distance between pinger and ship

Requirements to the pinger:

- Frequency: 12 kHz ± 10 Hz
- Repetition rate: 1 sec ± 50 µsec
- Pulse length: 1.5 msec minimum

Remark (without obligation):
The pinger data stated in this paragraph are complied with by the pinger Benthos model 2216.

2.4 Power Supply

- Voltage	24 VDC - 20 %, + 30 %
- Ripple:	1 Vpp maximum
- Spikes:	+ 60 V, 1 ms maximum
- Power consumption:	65 W (at 24 VDC)
- Starting current:	8 A, 1 sec (at 24 VDC)
- Peak current during intensive blackening of the paper:	5 A (at 24 VDC)
- Fuse in main switch board:	16 A slow blow

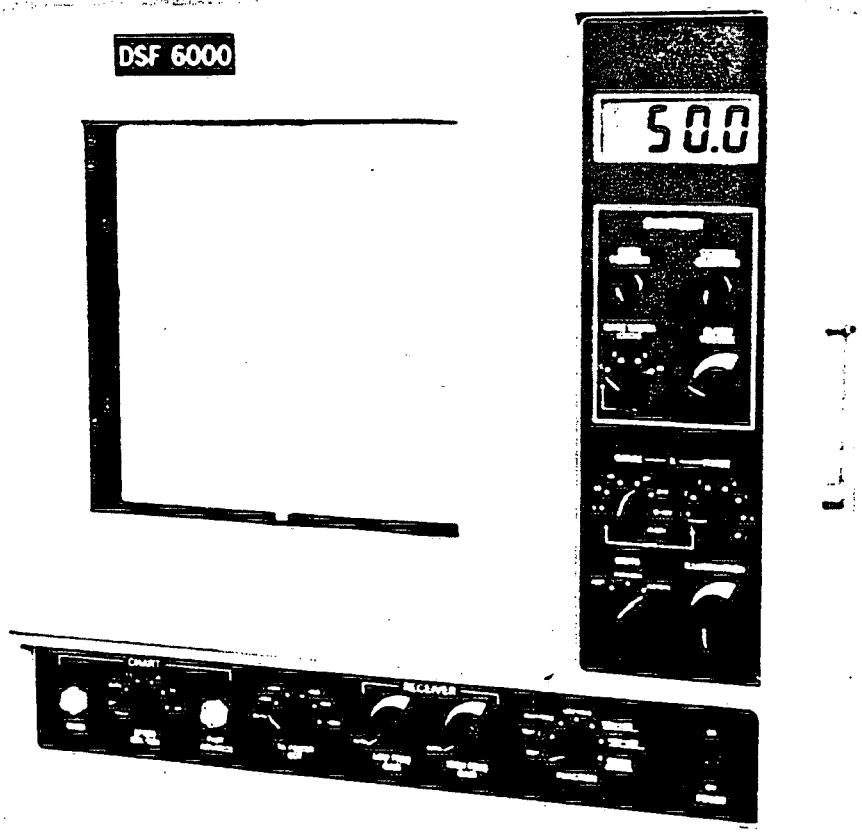
2.5 Mechanical Data/Installation/Cables

Dimensions, weights and spares required for maintenance are stated in the outline drawings (BZ) and installation drawings (EZ) respectively (see appendix).

Planning and installation advice for units and cables and - where necessary - the installation procedure are specified in a generally valid way in the Installation Instructions as per appendix of this document.

Additionally, cable types and special instructions are definded in the cabling diagrams as per appendix of this document.

DSF-6000



Specifications

Displays

This system has two displays. A chart display provides a permanent rec
A digital display is liquid crystal and visible in full sunlight. A remote digit
play is also available.

Chart Display

Accuracy	±0.1% of nominal range (clock accuracy better than 0.01%), or 0.1 foo
Selectable scale	Feet, fathoms or meters.

Nominal range*	Phase multiples* (full paper width)	Maximum range**	Grid interval*
8	10	58	0.1 m
20	25	145	0.5 m
40	50	290	0.5 m
80	100	580	1 m
200	250	1450	5 m
400	500	2900	5 m
800	1000	5800	10 m

*Maximum depth is broken into 7 'phases'; 'nominal range' indicates dep
vals at which system automatically shifts from one phase to the next.

**Top, bottom and four intermediate grid lines annotated for depth value a
change of range or phase and at least every 100 mm of paper advance.
tation will not blank first return of high frequency if digitizer is tracking.)

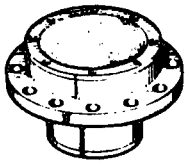
Chart paper speed	Switch selectable: 6 positions—OFF, AUTO, 7.5, 15, 30, 60 mm/min.
Chart paper	235 mm (9.4 in.) W × 20 m (65 ft) L. Type NDK 18 dB dynamic range.
Presentation	High frequency—2 levels of shading. Low frequency—8 levels of shading.
Resolution	0.025% of selected range scale.
Event mark	Contact closure via front panel, external connector, or serial input.
External annotation	6 digits (or blanks), input via one of the digital I/O ports: printed in upper gin of graphic recording.

105.0

Digital Display

Accuracy	Same as chart display. Limited by digital resolution.
Panel display	4 digits, 25 mm (1 in.) high LCD, decimal displayed when appropriate.
Resolution	0.1 to 999.9—1 beyond 1000. 0.1 units at depths up to 999.9 units, 1 unit at depth over 999.9 units.
Lost track alarm	Audible alarm, blank display, 9999 to digital outputs.
Computer I/O circuits	Parallel (BCD)—TTL compatible depth output. 4 BCD encoded digits with decimal and status bits.
	Serial ASCII (RS232C)—Input/output, with selectable baud rate. Outputs: Digitized depth, control settings, and status information. Inputs: Users annotation, event marks, and remote control functions.

Specifications

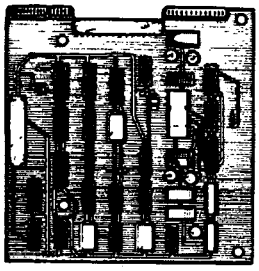


Transducers

The system has the capability for operating at dual frequencies simulta

Model	Frequency	Beamwidth	Depth range	Cable length
7510	40 kHz	20°	≈2000 m	30'
2572S	40 kHz	43°	≈1000 m	30'
7245A	200 kHz	3°	≈500 m	30'
200T5H	200 kHz	10°	≈400 m	30'
7511	100 kHz	9°	≈1000 m	30'
7426C	24 kHz	17°	≈3000 m	30'
7191C (incl xdcr matching unit)	24 kHz	19° x 35°	≈2000 m	25'
TC-12/34 (incl connector)	12 kHz	30°	≈6000 m	*

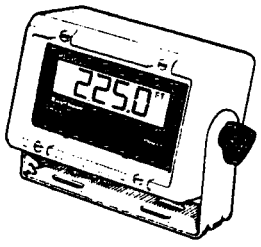
*Cable purchased separately



Electronic Design

Microprocessor	Z80A operating at 4 MHz.
Receivers	Minimum detectable signal: 10μvolts at 10 dB or better SNR.
	Bandwidth = 0.5 kHz @ 12 kHz, 1 kHz @ 24 kHz, 2.2 kHz @ 40 kHz, 2 kHz @ 100 kHz, 6 kHz @ 200 kHz.
Transmitters	2 kW peak power at 12 kHz, 24 kHz and 40 kHz. 1 kW peak power at 100 kHz; 500 W peak power at 200 kHz.
Gain adjustment	TIG circuit (10 dB threshold); manual gain control or 30 dB maximum A (fast attack, slow decay).
Circuit cards	Unique connector mating; sockets on all DIPs.
Connectors	MS circular type designed to MIC-C-5015; unique connector mating; a of unit.
Digitizer (discriminating)	Provides velocity tracking and automatic gate width selection algorithm maintain bottom tracking of slope in adverse signal-to-noise conditions.
Power input	80-130 W.
Voltage	Primary—24 V or 12 VDC ±20%. Optional—110/220 V with converter.
Safety	Interlock and circuit breaker protection.
	Reverse polarity protection.
	Voltages in excess of 30 V labeled.
	Chassis ground stud.

Specifications



Construction

Dimensions	500 mm (20 in.) W x 475 mm (19 in.) H x 225 mm (9 in.) D.
Weight	25 kg (nominal) 55 lbs.
Mounting	Stand-alone, bulkhead or table mount.
Environmental parameters	Temperature: 0° to 50°C (32°to 122°F).
	Humidity: 20 to 95% (non-condensing).
	Vibration: MIL-STD-167 type I (modified).
Enclosure	Cast aluminum.

Options

Heave compensation input (patented) (input patented)	Compensation controls both transmit & receive.
Remote display	4 digits plus decimal point via separate serial ASCII (RS232C) port.
AC converter	110 or 220 VAC.
Remote event marker switch	

All specifications subject to change without notice.

OCEAN DATA EQUIPMENT CORP.
473 Pleasant Street
P.O. Box 2557
Fall River, MA 02721
Telex 200537 ODEUR
(508) 679-5284 Fax (508) 672-9780

LSR-1807M SPECIFICATIONS

CHART DISPLAY

Paper: Dry electrosensitive paper (Timefax NDK).

Roll Size: 18.25 in. x 200 ft. (46.36 cm x 61m).

Active Scan Width: 17.28 in. (43.89 cm).

Viewing Area: 18.25 in. wide (46.36 cm) x 12 in. long (30.48 cm) including first printed line.
Past record review without recording interruption.
Automatic paper takeup and end of paper indicator.

Dynamic Range: 16 discernible levels of gray.
Grid Lines: Switch selectable, OFF, 10 or 20/scan.
Event Mark: 20 dashed lines/sweep, switch or remotely enabled.
Resolution: 150 data elements per inch nominal.
Line Densities: Switch selectable: 200, 150, 120, 100, 75, 50 lines/in. (79, 59, 47, 39, 30 and 20 lines/cm). Position for remote selection.
Rapid Advance: 24 in. (61 cm)/minute, switch or remotely enabled.

MECHANICAL SCANNING SYSTEM

Sweep Drive: Phase-locked servomotor driven belt supporting three equi-spaced styli:

Jitter: ± 2.5 mils (± 90μ) nominal.

Scan Speeds: Switch selectable: ⅛, ¼, ½, 1, 2, 4 and 8 sec/scan. Position for remote selection.

ELECTRONIC SCANNING SWEEP (MEMORY SWEEP)

Sweep Generation: 10 msec to 20 sec/scan. Crystal controlled, selectable in 10 msec increments, thumbwheel selected.

For depth sounding applications: The depth scale can be obtained by converting the electronic sweep rates (in msec) to feet, fathoms or meters by using the following formulas:

FT = TIME (ms) x 2.4
FMS = TIME (ms) x 0.4
M = TIME (ms) x .75

NOTE: FT/FMS based on 4800 ft/sec.
Meters based on 1500 meters/sec.

External Clock: Switch selectable: permits remote sweep generation for synchronous sampling and complete slaving capability when used in conjunction with an external sync pulse. If the external clock is not continuous (strobed) or if for other reasons full memory capacity is not used, an 'End of Data' control signal (externally provided) allows the remaining memory location to be jumped, minimizing data loss. To maintain chart efficiency with less than a full line of data, expansion of data is made possible by the substitution of the variable sweep clock for the read clock.

Data Format (scan direction): Switch selectable forward or reverse memory access allows data to be printed from left to right or right to left.

Depth Check: Increases Memory Sweep rate by exactly 5%, so that absolute depth can be observed directly from the resulting offset of the printed bottom return. This control also serves as the manual phase control when the Facsimile option is supplied. Switch or remotely enabled.

OUTPUT SIGNALS

Key: 1.0 msec pulse

Delayed Key: 1.0 msec pulse

T 'o': 1.0 msec pulse

Digital Data: 4 bit: Representative of either analog or digital input signal data, depending on which is actively being used.

Paper Advance control: DC level

Memory Ready control: DC level

Write Clock: Sampling clock, internal or external, depending on which is actively being used.

Read Clock: Print data clock.

Note: All outputs TTL compatible.

INPUT POWER

103.5 to 126.5 VAC, 47 - 63 Hz, single phase
Power consumption: 230 watts nominal.

SYNCHRONIZATION

Internal Sync: Switch selectable. An internal key pulse is generated (one/memory sweep) to initiate a write-into-memory cycle; key output is a 1 msec, TTL-compatible, positive-going pulse generated at the beginning of the chart. A normal/offset control allows data to be shifted one-half the chart width. Data loss is minimized by the use of a dual memory format and by adjusting the print rate for compatibility with the key rate.

External Sync: Switch selectable to provide synchronous operation with external equipment. Use of the memory ready control output as an external sync enable will provide zero-data-loss capability.

Delay Sync: Switch selectable. The external/internal key is time-delayed as it initiates the write cycle; this permits positioning and expansion of data. Delay period is thumbwheel selectable with a range of 0 - 9.999 sec in 1 msec increments.

Trigger Level: Control provided for adjusting the minimum level required for external keying. Input: 2 to 20 volts.

For Depth Sounding Applications: External sync sources, such as air guns, sparkers or other seismic sources can be used. Use of the external sync in conjunction with the delay function permits elimination of the water column from recordings.

INPUT SIGNALS AND RELATED FUNCTIONS

Analog Input: Switch selectable.
Frequency response: DC-200 kHz (Filter: Out).
Input impedance: 10,000 ohms, unbalanced.
Black reference level: 1.0 volt
Threshold: Variable setting provides for a choice of signal levels at which printing begins.

Contrast: Variable setting provides signal compression for capturing and displaying a greater signal dynamic range -20 dB min., -40 dB max, Ref. 1 volt.

Gain: Variable signal attenuation.

Level: Indication used to adjust for maximum signal input without clipping.

Filter In-Out: Switch selectable. When in the Filter In position, a low pass filter will automatically track =4 times below the sampling clock, thereby eliminating any printed artifacts which would result when the input frequency approaches the sampling clock frequency.

Digital Input: Switch selectable, 4-Bit.
Data rate: DC-500 kHz
Input high threshold: 2V, 20V max.
Threshold: Same as analog function described above.

External Sync: Switch selectable.
Input high threshold: 2V, 20V max.

External Clock: Same as External Sync.

End of Data: Same as External Sync.

External Paper Feed Clock: Switch selectable. 240 Hz max clock rate, TTL compatible.

DURABILITY

Shock: 50g Maximum for 11 ms.

Vibration: MIL-STD-167 Type 1 to 33 Hz.

Temperature: Operating: 0°C to +50°C
Nonoperating: -30° to +75°C

Humidity: 95% non-condensing (excluding paper).

Altitude: 0 to 40,000 ft. (0 to 12.2 km) operating.

PHYSICAL CHARACTERISTICS

Dimensions: 7⅝ in. (19.37 cm) x 30 in. (76.2 cm) x 20 in. (50.8 cm) (HXWXD).

Weight: 85 lbs. (38 kg) (approx).

Mounting: Bulkhead or table top.

For specific information on price and delivery, or for applications assistance, contact: Raytheon Ocean Systems Company, Westminster Park, Risho

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Telex: 710-324-6500. Cable: Raytheonex.

GeoPulse Transmitter
Model 5430A

Description

The GeoPulse Model 5430A Transmitter is designed to operate with the GeoPulse Model 5210A Receiver[1] to function as a transceiver in a GeoPulse "pinger" profiling system[2].

The Model 5430A provides a powerful transmit pulse at an operator selected frequency to a transducer array, which then converts the electrical pulse to an outgoing acoustic signal. This acoustic signal is reflected off the seabed and also penetrates below the seabed where it is reflected off subbottom layers. The returning echos are converted by the transducer(s) to an electrical signal which is in turn passed on to the GeoPulse Model 5210A Receiver for further processing. A range of transducer arrays is available from Ferranti O.R.E. to operate with the Model 5430A. For detailed information please refer to our "Transducer Array" data sheet.

The Model 5430A allows the operator to control the output power, frequency, and the number of full cycles included in the outgoing signal in order to achieve the desired combination of penetration and resolution. The complete system is compact enough to be operated from a craft of opportunity as small as an inflatable boat and versatile enough to be operated from large ocean going vessels in deep water.

Applications

Marine construction and inspection
The O.R.E. system, when used in conjunction with widely spaced corings, can provide accurate profiles of large areas rapidly and at low cost. This correlation method dramatically reduces the total number of cores required by tying the core sites together with the results of the profiler record. The system also provides an historical view of scour activity around structures that are founded in tidal areas and rivers to show maximum scour depths and resultant deposition of sediment.

Drilling rig site survey
When used to supplement the usual high energy sources, the transmitter provides high resolution records of the area containing information critical to anchor holding capacity, platform leg support and pile driving.

Pre-dredging survey
The O.R.E. profiler provides an efficient, economical tool for accurate determination of dredging materials, problems, and cost.

Pre and post pipeline survey
Used both during the planning of the best route for ease of burial and afterward to measure the depth of cover. The O.R.E. Profiler is one of the most extensively used acoustic systems in the North Sea and the Gulf of Mexico.

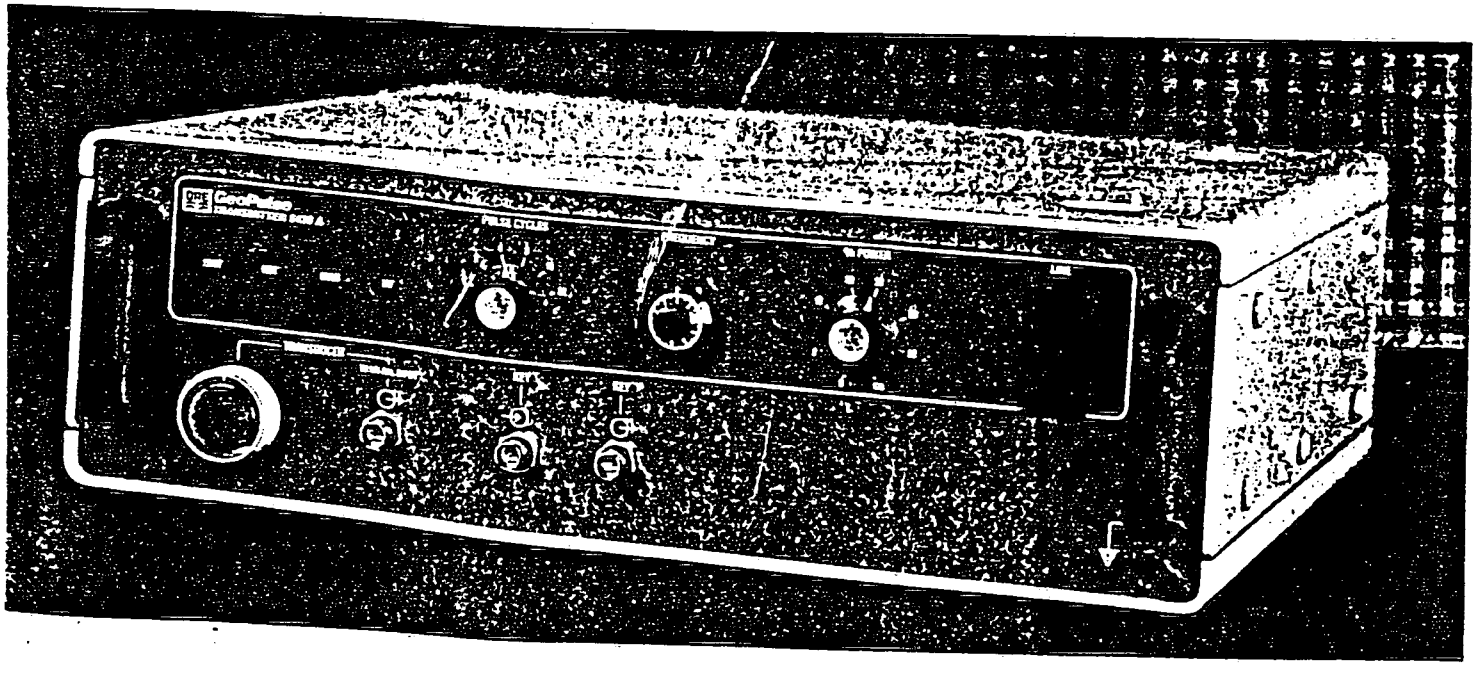
Military
The GeoPulse System is used to determine areas where "objects" might be buried in the soft sea-floor and to indicate seabed reflectivity, stability, and load bearing capacity.

Features

- Output power continuously adjustable to 10 kW.
- 2-15 kHz frequency range, operator selectable with front panel dial.
- Pulse length selected by number of cycles to improve efficiency of transducers and reduce "ringing".
- Transmit repetition rate controlled externally or internally, operator selectable.
- Special operator controllable TVG circuits to allow operation in very shallow water.
- Internal switch for 115/230 VAC operation. Unit is protected against damage caused by improper line voltage.
- Impedance matching switch allows operation with single or multiple transducer arrays. Transmitter can operate OEM transducers as well as those provided by FERRANTI O.R.E.
- Separate/Combined Switch to transmit on portion of transducer array and receive on remaining portion or to modify beam pattern of transducer array.
- Indicators to easily monitor all system parameters.

[1] See data sheet on O.R.E. Model 5210A GeoPulse Receiver.

[2] See "GeoPulse Subbottom Profiling Systems, A Guide to the selection of the most suitable O.R.E. systems for your requirements."



Controls

ine On/Off: Two position switch with indicator. (line is fused, filtered and surge protected)

ulse Cycles: 1, 2, 4, 8, 16, or 32 cycles of the frequency selected.

requency: Read in kilohertz from the main dial division with the vernier indicating fractions of kilohertz. Continuously adjustable between 2 and 15 kilohertz.

ercent Power: Adjusts output power to transducer array.

npedance Match: Located inside the instrument and used to match the transducer's impedance or to limit power for transducers that are not rated for operation up to 10 kW.

eparate/Combined: Also located inside the instrument and used to divide a transducer array in order to transmit on one half (or smaller percentage) of the array and receive on the remaining transducers. This feature is useful when operating in very shallow water or when the operator wishes to alter the beam pattern of the array.

dicators

HIT: Red LED indicates excessive load detected on the transmitter. No damage occurs, as transmitter output is terminated at the moment of detection. Normal operation resumes after overload condition is corrected.

)T: Red LED indicates high temperature on high voltage regulator heat sink. Power is automatically reduced until high temperature situation is rectified.

'LD: Amber "Overload" LED indicates excessive duty cycle for the output power level set on the front panel. No damage is done to the transmitter, as output power is automatically reduced. Continues to flash until duty cycle is reduced.

: Amber LED indicates, for safety reasons, that transmitter circuits contain voltage levels greater than 15 VDC.

Y: Two amber LEDs are convenient means of monitoring the nput and output key pulses.

nnections

' In: 2 to 12 volts (+ or -), 50 milliseconds width, leading edge riggered.

' Out: 5 volt, 1 millisecond width, TTL compatible. Transformer solated.

Connections

To Un-bal Input: Signal to Model 5210A Receiver. 100 ohm output, diode protected. Maximum signal + or - 10 volts peak.

Transducer: Standard 5 pin Amphenol to interconnect the transmitter with the transducer array.

Specifications

Output
10 kW with .75% duty cycle, continuously adjustable. 2 to 15 kHz, continuously adjustable. Short circuit proof. Impedance matched.

Pulse Cycles
1, 2, 4, 8, 16, or 32 cycles of the frequency selected. The transmitted output pulse will be phase coherent within 22.5 degrees.

Key
External - 2 to 12 volt pulse, either + or - edge triggered. Triggers on leading edge. Maximum width 50 milliseconds to eliminate double triggering. Transformer isolated.

Internal: Set by internal potentiometer, 1 to 10PPS, uncalibrated.

Output to Receiver
Transformer isolated. Frequency response flat between approximately 1 kHz and 20 kHz. Two modes of operation:
A. Flat gain - 0 dB gain.
B. Short range TVG - -20 dB (10:1) of attenuation during transmit pulse and a -20 dB to 0 dB ramp within 15 ms after end of transmit signal.

Power
115/230 VAC plus or minus 10%

47 to 63 Hz

220 Watts maximum

Auxiliary Power
IEC connector, unfused, 6 amp maximum.

Environmental
-5 to 50 degrees C, operational.

-15 to 85 degrees C, storage.

Dimensions
46 cm (L) x 43 cm (W) x 13 cm (H)

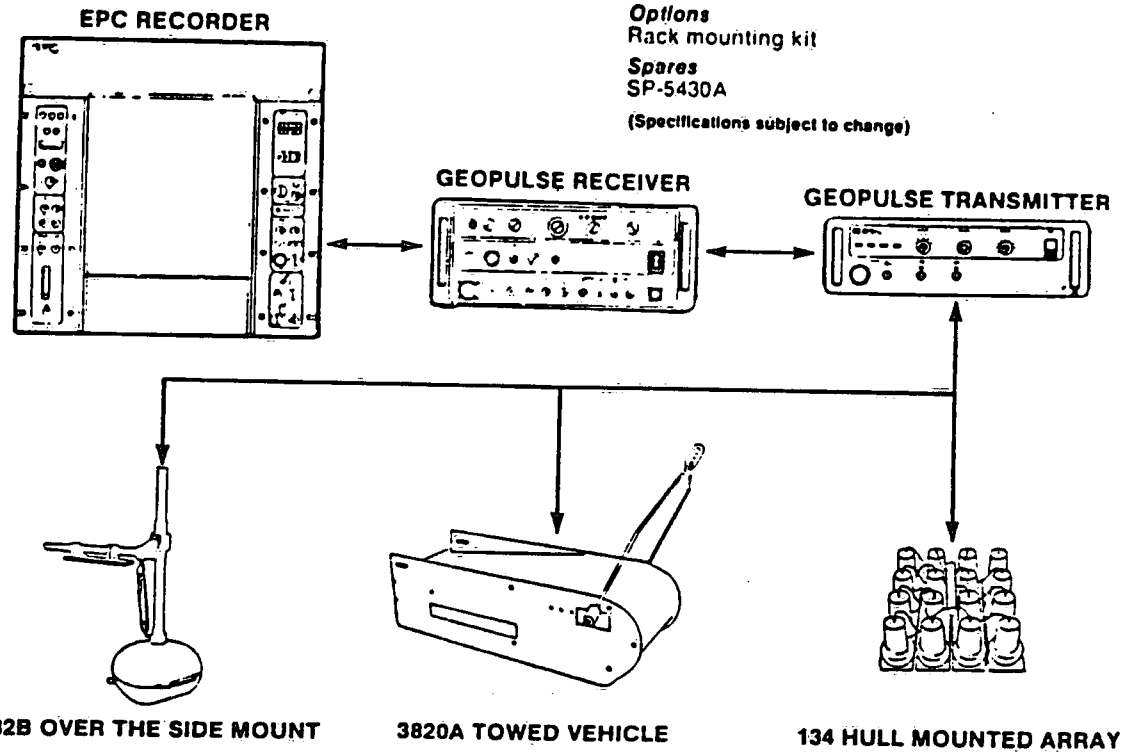
(18 in. x 17 in. x 5.25 in.)

35 lbs. (15.9 kg)

Options
Rack mounting kit

Spares
SP-5430A

(Specifications subject to change)



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U.K.: Ferranti O.R.E., Ltd. Tel 493-600666 Tlx 97208 FOREGY **Netherlands:** ORETECH B.V Tel 23-358284 Tlx 41907 ORTEC

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ade in U.S.A

Specifications subject to change without notice

Printed in U.S.A 10/87 AM

GeoPulse™ Receiver
model 5210A

Description

The GeoPulse Model 5210A receiver is a key component of the GeoPulse High Resolution subbottom profiling system. It combines in one compact, easily operated unit virtually all of the signal amplification, processing and control functions necessary to enhance the quality of analog seismic data. The versatile GeoPulse 5210A receiver may also be employed to improve the performance of other acoustic sources, including water and air guns, sparkers and boomers. Its features include:

Trouble-free Construction:
"Mother-boards" for backplane and front panel with ribbon cable connectors ensure minimal chance of hardware problems.

Event marks:
Both manual and remote automatic event marks can be put on record and tape. Width of mark is operator adjustable.

Hydrophone Flexibility:
Will accept a variety of hydrophone types, either passive or active.

Gain Bandwidth:
Wide filter range for use with source types with frequencies from 20Hz to 15kHz.

High Gain:
Combined TVG and operator controllable gain provide up to 100dB of active gain for low amplitude signal processing.

Bottom Tracking TVG:
Automatic tracking provides constant TVG adjustment to record regardless of bottom variation or degree of slope. (Manual TVG is also a standard feature.)

AGC:
AGC provides operator with the ability to manipulate receiver sensitivity for a given reflector intensity.

Key Program:
Multiply and divide-by functions for source triggering flexibility in deep water or extremely shallow water.

Tape Interface:
Allows for taping of either raw or processed data. Eliminates costly interface devices and provides calibration signal for proper recorder adjustment.

Fiber Optic Isolation:
Optic isolation between receiver and source power supply prevents ground loop interference on acoustic record.

TVG Record Annotation:
Upon switch closure by operator or by Nav interface, places a mark at every 6dB point throughout TVG ramp on record. This allows interpreter to keep track of changes in TVG and its impact on record quality.

Water Column TVG:
Compensates for spreading and attenuation losses through the water column in deep water.

Calibrated Gain:
All gain controls, manual or TVG, are in fixed increments enabling relative reflectivity of different areas to be compared.

Signal Level Indicators:
Signal output to tape recorder is displayed by LED's signifying maximum possible dynamic range or presence of "clipping."

Swell Filter Option:

Front panel control allows for compensation of swell and wave action on source and receiver.
(Please refer to 5212A data sheet)

Hydrophone Power Supply Option:
Provides (4) selectable voltages for preamplifiers in active hydrophone arrays.

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Ocean Research Equipment

Front Panel Controls

Line On/off: Two position switch with indicator, line fused with 1 amp, filtered and surge protected.

Input Gain: Two position switch selects either 0dB gain, or -20dB gain.

Coarse Gain: Two position switch selects 0dB, 20dB, 40dB, or water column TVG (a rate equal to water column attenuation).

Fine Gain: 0 to 30dB in 3dB increments.

Tape Select: 3 position switch; two positions select data format to be taped, raw data with gain adjustments, filtered data with gain adjustments. Third position is for playback which allows manipulation of all parameters in previously recorded data.

Key Program: Multiplies or divides incoming key by maximum of nine for applications requiring synchronous control of source.

Mark: Push button switch for manual event mark.

TVG Rate: Variable control with off position, controls the rate at which the TVG increases; maximum TVG range +30dB in 14 milliseconds.

TVG Delay Multiplier: Three position toggle switch controls TVG delay by factors of 1, 10 or 100. Internal switch is provided for maximum delay x1000.

TVG Delay Vernier: Vernier control of TVG delay in conjunction with multiplier provides continuous manual TVG delay of 1 millisecond to 14 seconds.

Delay Mark: Three position toggle switch with center off. Position A provides mark on record at point which TVG ramp begins. Position B mark point at which TVG bottom detect initiates time varied gain. Internal switch allows mark to appear on record at each 6dB increment of TVG gain increase, actuated by delay mark or event mark.

Bottom Track: Variable control adjusts sensitivity of the automatic TVG delay circuit. Holds TVG to minimum until first return is received.

AGC On/off: 2 position switch enables AGC functions which are set internally.

Attack: Adjustable from 330 microseconds to 330 milliseconds.

Decay: Adjustable from 330 microseconds to 330 milliseconds.

Range: AGC control voltage gain: 20dB.

Connections

Key In: 2 to 15v (+ or -) 50 milliseconds width leading edge triggered.

Key Out: Pulse width 1 millisecond, TTL compatible.

Key Out Isolated: Pulse width 1 millisecond, transformer coupled, 50 OHM minimum load.

Key Out Optic: Infrared emitting diode, λ = 940nm.

Event Mark In: Optically isolated, requires positive input pulse of 5 to 15 vdc, minimum pulse width required is 100 microseconds.

Tape In: Plus or Minus 10v peak-to-peak maximum from tape.

Tape Out: Signal out to tape recorder. Tape output calibrated to tape indicator for a 1 volt peak-to-peak signal. Maximum output plus or minus 9v peak-to-peak into 2000 ohms load.

Signal Out: Signal out to graphic recorder. Maximum output plus or minus 10v peak-to-peak into 2000 ohms load.

Hydrophone Input: Will accept a balanced or unbalanced signal into an 11 pin bulkhead connector from a hydrophone array or an unbalanced signal into a BNC.

Specifications

Amplifier

Differential common mode rejection: 100 dB at 60 Hz

Sensitivity: 30 microvolt RMS in produces 1 volt RMS out at 100dB total gain with TVG.

Signal to Noise: 20dB at 100dB gain, 1kHz center frequency and 1kHz bandwidth.

Coarse Gain: 40dB maximum.

Fine Gain: 0 to 30dB in 3dB increments.

Filter

Low Pass and High Pass: Active type, maximally flat, 24dB/octave minimum roll-off, 0 gain, 0.02kHz to 15kHz adjustable in ⅓ octave increments. Knobs interlock to prevent overlap.

TVG

Dynamic Range: 30dB

Rate: Approximately flat to 30dB in 14 milliseconds.

Manual Delay: Vernier adjust from 1 to 14 milliseconds with multiplier of X1, X10, X100 and internal select of X1000.

AGC

Attack: Adjustable from 330 microseconds to 330 milliseconds.

Decay: Adjustable from 330 microseconds to 330 milliseconds.

Range: 20dB

Power

115/230 vac plus or minus 10% (internal switch selectable)

47 to 63Hz

45 watts maximum

Environmental

-5 to 50 C operational

-15 to 85 C storage

Dimensions

48cm (L) x 43cm (W) x 19cm (H) (19in x 17in x 7½in)

30lbs, 13.6kg

Options

-01 The preamp Power Supply is a plug-in option to the 5210A. The u also contains an output current sensing circuit so that, if an overlo occurs, it can drive external L.E.D.'s to show supply status.

Output: Voltage: 0 (Off), 6, 12, 18, or 24VDC ±.5VDC, switch selectal

Current: 30ma max. overload protected

-02 The Model 5212A Swell Filter is a field installable option for the Mod 5210A. It can be used either "in situ" or with tape recorded records fo post processing of data to remove the effects of vessel or hydrophon vertical motion on subbottom data.

Maximum Frequency: 7.5 or 15.0 kHz (switch selectable)

Bottom Averaging Time: 2 - 40 seconds

Operation Modes: 1) Manual Signal Gate
2) Automatic Tracking Signal Gate — Return to "Manual" with bottom signal loss

Maximum Heave: Approximately ± 5.5 meters (18 ft.)

Maximum Memory Period/Trace: 960 ms at 7.5 kHz
480 ms at 15.0 kHz

Depth Resolution: Approximately 8cm (.25 ft.)

Maximum Depth: (without key delay) Approx. 720 meters at 7.5 kHz
Approx. 360 meters at 15.0 kHz

Spares

O.R.E. Model SP-5210A

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U.K.: Ferranti O.R.E., Ltd. Tel 493-600666 Tlx 97208 FOREGY **Netherlands:** ORETECH B.V. Tel 23-358284 Tlx 41907 ORTEC

O.R.E. Pacific: Australia Tel 09 361 4849 Tlx BTWSUR AA95733 New Zealand Tel 67 80122 Tlx BTW NZ31598 Singapore Tel 565-5211 Tlx RS 21696 GEO

GeoPulse Transducer Arrays

Models 132B / 3820A / 134

The key to any properly executed and successful survey is getting the transducers into the water!

Ferranti O.R.E. is able to supply a wide variety of transducer arrays to till your specific requirements. From our over-the-side mounted arrays for rapid installation on various craft of opportunity on up to large hull mounted arrays for dedicated survey and research vessels, we have what you are looking for.

Ferranti O.R.E. also offers one of the most versatile towed vehicles on the market today. The 3820A multi-purpose towed vehicle can take your survey from inshore on out to continental shelf depths and beyond.

Over-the-Side Transducer Mount MODEL 132B

The 132B transducer array is specifically designed for small boat operation at lower speeds. The transducers are mounted on a plate at the end of a vertical, gimballed staff. The staff, in turn, is supported by a mounting pad which can be fastened to either the deck of the boat, or to an athwart-ships timber. The gimballed unit relieves excess strain on the mounting pad and provides freedom of motion fore, aft, and athwart-ships to ensure the transducer beam remains directed at the sea floor despite motion of the vessel.

Features

- Installation by one man, with no lifting gear, in one to two hours, on boats ranging in size from 3 meter inflatables to 50 meter survey ships.
- Hydrodynamically faired cowling allows surveying at up to 5 knots.
- Hard coat anodized components allow for years of maintenance-free operation.

Towed Transducer Vehicle MODEL 3820A

The 3820A tow vehicle acknowledges the ever increasing payload requirement of multiple sensor sonar surveys as well as the variety of packages which need a work platform. Design of the tow body and tow bundle arrangement provides a stable tow platform with minimum pitch, roll or yaw despite varying payloads at a wide range of tow speeds. Its payload can include, either alone or in combination:

- Four transducer array of "Pinger" transducers (3 to 7 kHz)
- Two side scan transducers and multiplexer bottles
- Array of special "Pipeliner" transducers (3 to 7, and 14 kHz)
- GeoPulse "Boomer" Acoustic Source and hydrophone array
- Navigation responder and Pressure/Depth sensor

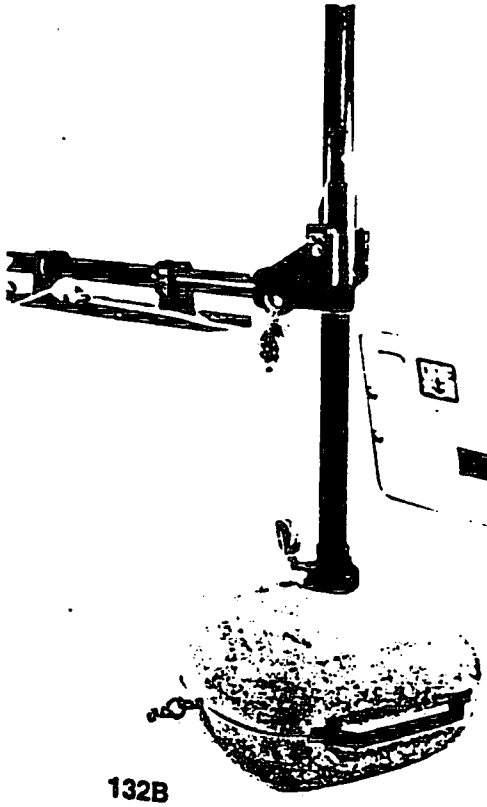
Construction is hot dipped galvanized steel frame and high impact polyethylene fairing with stainless hardware throughout for long life in the ocean environment. Design takes into account unplanned "contacts" with the seabed and allows simple, safe deployment, recovery and storage on deck.

Hull Mounted Transducer Array MODEL 134

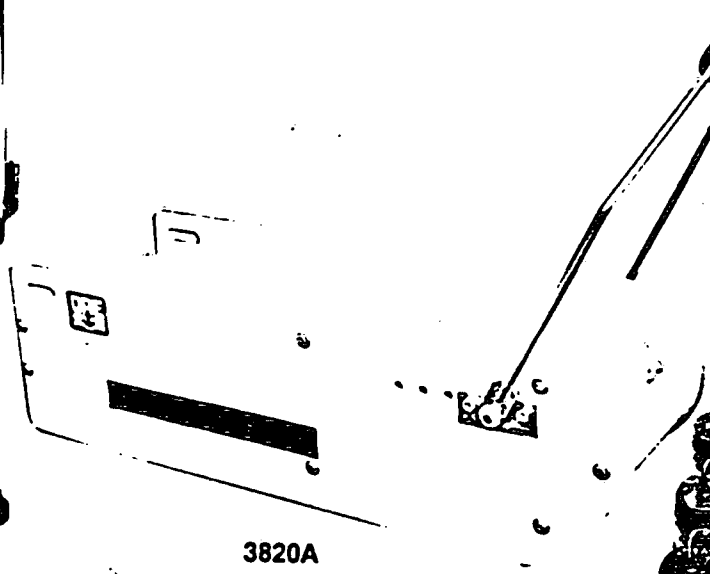
By mounting standard O.R.E. transducers in a sea chest and "pinging" right through the hull, the 134 offers its users a convenient and flexible profiling system. A hull-mounted array is ideal for a dedicated survey ship and deep water, yet is often used for short jobs in all water depths. A few of these system advantages are:

- Construction of a sea chest and installation of transducers is simple and rapid, eliminating the need for dry-docking or building a "window" in the hull.
- Collect data at sea with the flick of a switch. No winches, cables, or cold, wet deck hands.
- Large number of available transducers (up to 16) and a switching connector allow for very high source levels and varying beam patterns to optimize operation for water depth and ship motion.

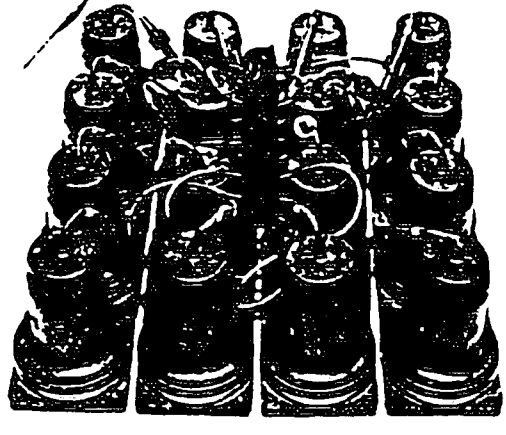
The O.R.E. Model 134 has been installed by survey companies, government agencies, research institutes, and many others. It has been proven through years of operation to be the most versatile, simple to operate, and cost effective profiler available.



132B



3820A



134

Specifications

Models 132B and 3820A
(fitted with Model 137D transducers for general subbottom pro'iling)

Frequency: 3 to 7 kHz (for maximum efficiency)

Power: 10 kW at .75% duty cycle

Beam Width: 55 degrees at 3.5 kHz
40 degrees at 5.0 kHz
30 degrees at 7.0 kHz

Source Level: 214 dB re: 1 μPa/1 meter

Dimensions:

132B
70 cm (L) x 48 cm (W) x 40 cm (H)
(27.5 in. x 18.9 in. x 15.75 in.)
120 kg (265 lbs.)

3820A
140 cm (L) x 46 cm (W) x 39 cm (H)
(55 in. x 18.25 in. x 15.375 in.)
66 kg (147 lbs.)

Mounting Staff:
One section, 226 cm (89 in.)
Two sections, 409 cm (161 in.)

Model 134

Frequency: 3 to 7 kHz (for maximum efficiency)

Power: 10 kW at .75% duty cycle, typical.

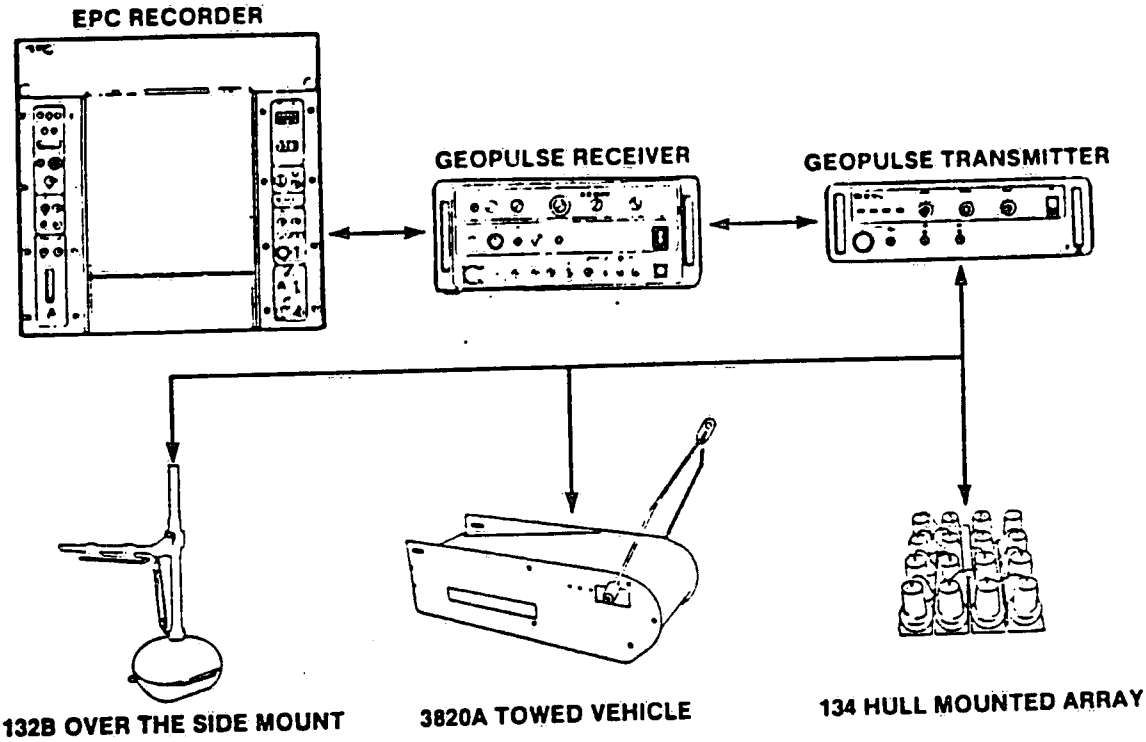
Approximate Transmitting Beams

Size	Freq. kHz	Combined	Separate FWD/AFT	Separate Port/Stbd
16	3.5	30	30	55
	5.0	20	20	45
	7.0	15	15	40
9	3.5	40	40	55
	5.0	30	30	45
	7.0	20	20	40
8	3.5	30 x 55	30	80
	5.0	20 x 45	20	60
	7.0	15 x 40	15	50
4	3.5	55	120	55
	5.0	45	100	55
	7.0	35	80	35

Source Level: (for 10 kW input)
16 transducer array - 225 dB re 1 μPa/1 meter
8 or 9 transducer array - 220 dB re 1 μPa/1 meter
4 transducer array - 214 dB re 1 μPa/1 meter

Dimensions:
82 cm (L) x 82 cm (W) x 34 cm (H)
(32.3 in. x 32.3 in. x 13.45 in.)

(Specifications subject to change without notice)



FERRANTI ORE
Ocean Research Equipment

Ferranti O.R.E., Inc.: P.O. Box 709, Falmouth, MA 02541 Tel 617 548-5800 Tlx 6817399 OREFAL UW Houston: Tel 713 240-3153 Tlx 774248 TFSI HOU

U.K.: Ferranti O.R.E., Ltd Tel 493-600666 Tlx 97208 FOREGY Netherlands: ORETECH B.V. Tel 23-358284 Tlx 41907 ORTEC

O.R.E. Pacific: Australia Tel 09 361 4849 Tlx BTWSUR AA95733 New Zealand Tel 67 80122 Tlx BTW NZ31383 Singapore Tel 265-1356 Tlx RS 39112 OCEANC

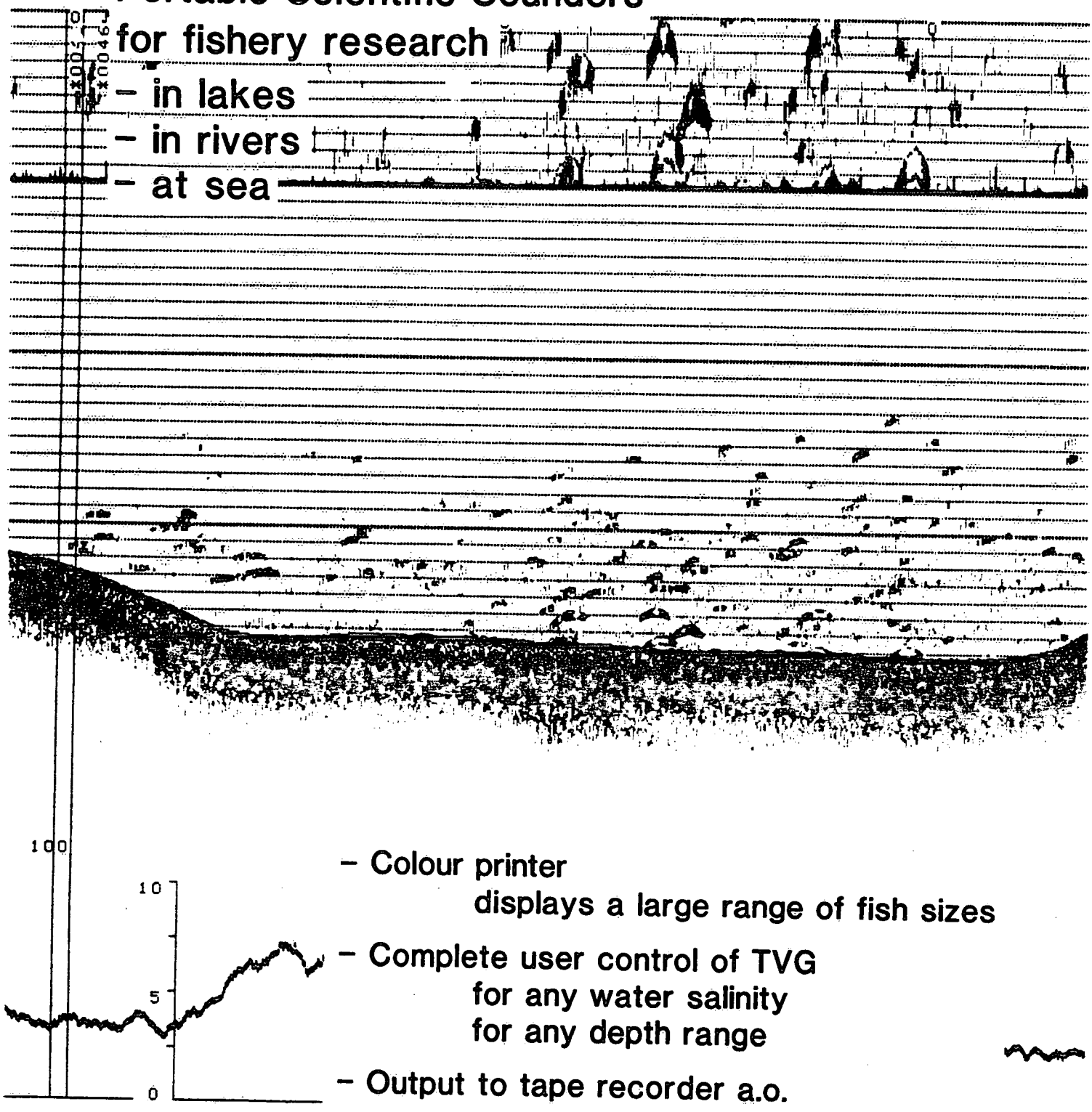
Printed in U.S.A.

Products made in U.S.A.

Specifications subject to change without notice

Product Information

SIMRAD EY200
Portable Scientific Sounders
for fishery research
- in lakes
- in rivers
- at sea



- Colour printer
  displays a large range of fish sizes
- Complete user control of TVG
  for any water salinity
  for any depth range
- Output to tape recorder a.o.

SIMRAD Subsea A/S
Strandpromenaden 50
P.O.Box 111
N-3191 Horten. Norway

Telephone: + 47 33 44 250
Telefax: + 47 33 44 424
Telexes: 70391 simh n
70279 subse n

SIMRAD

TECHNICAL SPECIFICATIONS

TRANSMITTER AND RECEIVER

Frequency:	**27-38-49-70-120-200 kHz**
Output power:	**freq. ≤70 kHz: 1000 W**
	freq. ≥120 kHz: 500 W
Pulse duration:	**0.3-1.0 ms**
Bandwidth:	**freq. ≤70 kHz: 3.5 kHz**
	freq. ≥120 kHz: 10 kHz
Dual receiver:	**fish and bottom channel**
TVG dynamic range:	**60 dB**
Calibrated output with	**85 dB gain from transducer**
Designed for 60-ohm transducer impedance	

COLOUR PRINTER

Echogram with 7 colours.
Expanded range printed on top of the paper.
Bottom echo strength printed on the lower 1/5 of the paper.
Recording paper: plain paper, width 216 mm

DATA OUTPUTS

Trigger (grounding from +15 V)
Echo signal, calibrated output
Echo signal, 12 kHz for tape recorder
Bottom pulse (grounding from + 5V)
Bottom depth, serial line NMEA 0183
Echo signal, 12-bit parallel every 10 cm

DATA INPUTS

External trigger (grounding, TTL level)
Serial line NMEA 0183 for alphanumeric data printout on LCD and paper.
Serial line RS232 for trawl markers.
External joystick

POWER SUPPLY AND MECHANICAL DATA

Supply voltage:	**110/220 V, ±15%, 50/60 Hz or 20-55 V DC**
Power consumption incl. printer:	**50-125 W**
Dimensions:	**EY 200 : 30x40x22 cm**
	colour printer: 40x30x10 cm
	EY 200P: 42x56x46 cm
Weight:	**EY 200 : 10 kg**
	colour printer: 7 kg
	EY 200P: 36 kg
Ambient temperature:	**EY200: 0 to 55 deg C**
	colour printer 10 to 35 deg C
	option: EY200P:
	-10 to 55 deg C

Revision February 1989.

COLOUR MONITOR (optional)

14-inch RGB monitor with push buttons for up, down and enter.

Supply voltage:	**110/220 V, 50/60 Hz**
Power consumption:	**70 W**
Weight:	**20 kg**
Dimensions:	**30x42x42 cm**

MENU

Range:	**10-25-50-100-250-500-1000 m**
Phasing:	**manual or automatic Max 3 x range with 20% increments. Max recorded depth is 1500m**
Pingrate:	**fast-medium-slow-off**
Expanded range:	**2.5-5-10 m, bottom locked**
Pulse duration:	**short-long**
Gain:	**1 to 19 in 3 dB steps**
Attenuator:	**0 and -15 dB**
TVG:	**The user can select:**
	- function: x log r (10 < x < 40)
	- alpha: seawater, freshwater or user specified
	- TVG start: 1 to 999 m. The sounder calculates and displays TVG stop range
Transmitter power:	**1/1 - 1/10 - 1/25 - off**
Sound velocity:	**1400 to 1560 m/s**
LCD mode:	**menu-echogram-echoscope-data**
Min.depth in bottom detector:	**1 to 999 m**
Bottom presentation:	**normal-bottom channel. The bottom channel TVG ensures correct bottom echo strength**
Depth alarm:	**1 to 999 m. Alarm sounds when depth is deeper/shallower than selected depth**
Bottom window:	**±50 ±25 ±12 ±6 % of current depth**
Event marker:	**start number (1 to 999) may be entered. Automatically incremented for each line on the echogram paper**
Colour threshold:	**1 to 10, removes weak echoes**
Trawl:	**enter start depth for headrope and footrope**
Printer:	**on-off, paper speed 1/1 - 1/3 - 1/5 - 1/10**
Test:	**on-off**
Standard:	**yes-no, to choose between Simrad standard setting or user's own**
Install:	**draft, language, ext.sync., unit (metre-foot- fathom), serial line output and input, ping filter on-off**

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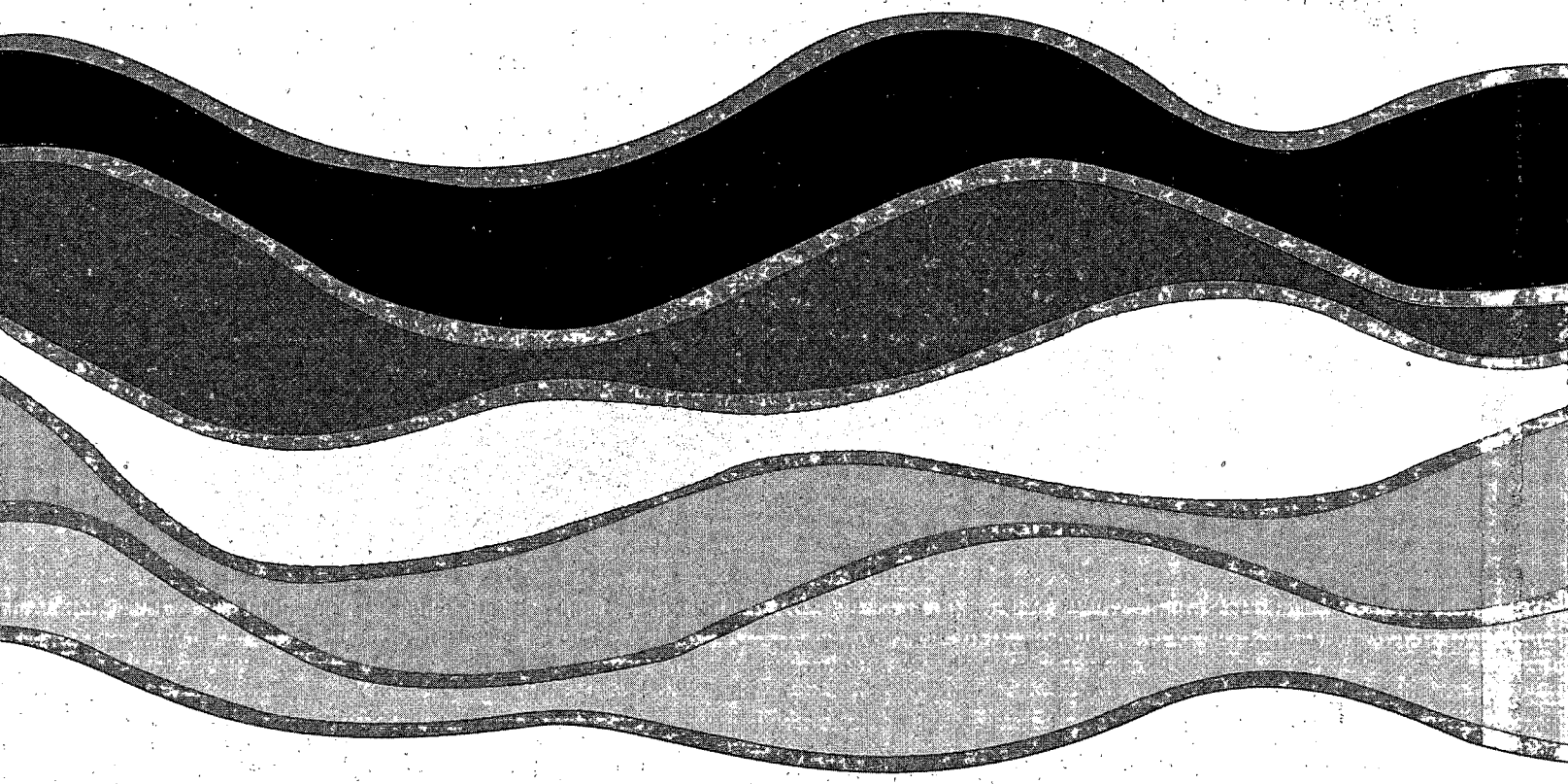
SIMRAD



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Environment Canada Environnement Canada

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