



deep offshore

GEOPHYSICAL SOIL INVESTIGATIONS Wind Farm Zone Borssele Wind Farm Sites I and II EQUIPMENT SPECIFICATIONS



Rijksdienst voor Ondernemend
Nederland

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ABBREVIATIONS

CD	Chart Datum
COG	Centre Of Gravity
DGPS	Differential GPS
DPR	Daily Progress Report
ETRS	European Terrestrial Reference System
GPS	Global Positioning System
IHO	International Hydrographic Organization
LAT	Lowest Astronomical Tide
MBE	Multibeam Echosounder
MRU	Motion Reference Unit
PPS	Pulse Per Second
QA	Quality Assurance
QC	Quality Control
RTK	Real Time Kinematic
SBP	Sub Bottom Profiler
SNR	Signal to Noise Ratio
SSS	Side Scan Sonar
USBL	Ultra Short Base Line
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance

1 INTRODUCTION

This document contains the equipment specifications of the hydrographical and geophysical survey equipment that Deep BV anticipates to use for the performance of Geophysical surveys at the Borssele wind farm site.

Deep BV can guarantee the availability of the proposed geophysical equipment as Deep BV is the owner of the equipment and the spare equipment. This will secure the availability and the flexibility for any opportunities which may arise within the frame work agreement.

Sufficient spares will be on board to ensure continuous operations in case of breakdown.

All equipment components and their combination are to industry standard and capable of providing data to the quality requirements. Equipment specifications can be found in the appendices.

2 EQUIPMENT

For this project the following suitable equipment (or equivalent) will be made available:

Positioning equipment

- Trimble SP855 GNSS receiver using 06-GPS or Fugro Marinestar correction signals (1 spare);
- IXblue Octans III motion and heading sensor;
- Kongsberg HiPAP350P USBL;
- Kongsberg MST319 USBL beacons;
- Applied Acoustics mini USBL beacons;
- Survey computer with QPS QINSy v8.1 acquisition and QC software installed.

Bathymetric equipment

- R2Sonic 2024 multibeam sonar;
- Valeport MiniSVS sound velocity probe;
- Valeport MiniSVP velocity profiler;
- Reson SVP-15 sound velocity profiler;
- Minos SVP on OSIL Minibat FC60.

Side scan sonar equipment

- Edgetech 4200 side scan sonar system;
- Edgetech 4125 side scan sonar system (spare);
- QPS QINSy v8.1 digital data recording software;

Magnetometer equipment

- Geometrics G-882 marine Cesium Vapor magnetometer (1 spare)
- QPS QINSy v8.1 digital data recording;
- Oasis Montaj v5.0 processing software

Sub-bottom profiler equipment

- Innomar SES-2000 standard Parametric sub-bottom profiler;
- Geo-Source 200 LW sparker with 48 channel Ultra hi-res streamer system

Data processing and mapping software

- QPS QINSy v8.1
- QPS Qloud v2.3
- QPS Fledermaus Geocoder
- Trimble Terramodel v10.3
- Chesapeake SonarWIZ MAP
- Oasis Montaj v5.0

2.1 GPS surface positioning

All measurements will be absolutely geo-referenced by means of the Trimble SP855 RTK GNSS receiver in combination with RTK data corrections from a shore based RTK GNSS station (06-GPS). The 06-GPS correction signal will be received through a VSAT internet connection.

Despite the large distance to the shore based reference station, accuracy is expected to be better than 10cm in X, Y and Z.

As a secondary positioning system a Trimble SP855 RTK GNSS receiver in combination with Fugro Marinestar DGPS corrections will be used. Accuracies of 10cm horizontal and 15cm vertical can be achieved.

2.2 Heading and motion sensor

To compensate the measurements for vessel heading, roll, pitch and heave motion, Deep will install an IXBlue Octans III motion sensor. The Octans III is an IMO grade fibre-optic gyro compass with an integrated motion sensor.

Factory specified accuracies are:

Heading:	0.10 deg. secant latitude
Roll / Pitch:	0.01 deg.
Heave:	5 cm or 5% (whichever is highest)

2.3 USBL sub-surface positioning

Subsurface positioning of the side scan sonar and magnetometer fish' will be realized by means of a Kongsberg 350P USBL system. The USBL system contains of a transceiver and a minimum of one transponder. The transceiver will be mounted in a moonpool on the survey platform. The transponder will be mounted on the tow cable just above the fish.

Factory specified accuracy is 0.5% of slant range (using external VRU and Gyro).

2.4 Multibeam bathymetry

The bathymetric survey will be conducted using an R2Sonic 2024 broadband multibeam echosounder with the option to record backscatter data.

For highest resolution and accuracy, the R2sonic will be operated on a frequency of 400 KHz at a maximum opening angle of 140°. The across track beamwidths (at 400 kHz) are 0.5°.

At an average water depth of 20 meters, these settings result in a swath coverage of 110 meters and a maximum footprint size (for the outer beams) of 1.46m. This facilitates the detection of objects greater than 2.0m x 2.0 m dimensions.

At greater water depths the opening angle will be reduced in order to improve resolution.

2.4.1 MBE a-priori analysis

An a-priori analysis of the entire multibeam system (all components) showed that the system is fully capable of complying with the IHO S-44 Order 1 standard. This analysis was done using the 'AMUST' tool which is published by Rijkswaterstaat.

2.5 Sound Velocity Profiler

The Sound velocity will be continuously measured in an undulating pattern by means of the Osil Minos SVP, mounted on a MiniBAT FC60, alternatively, a sound velocity profile can be taken using a regular sound velocity probe. In the latter case, a profile will be taken at the beginning and end of each survey period, or when changing of survey area. A sound velocity profile will be recorded at half metre intervals. The water column will be sampled to the maximum depth practically possible. The recorded profile will be entered in the survey software to correct depth measurements.

2.6 Side scan sonar

For the side scan sonar survey an Edgetech 4200 side scan sonar system will be used. This system operates on two frequencies, 300 kHz and 600 kHz respectively.

Both channels will be digitally recorded in online survey software Qinsy.

Utilizing a dedicated winch, the side scan sonar fish will be towed behind the vessel. The system will be towed at a height above the bottom of 8-15% of the range. Using a range of 125 m this will result in a tow height between 10-19 m above the seabed. The internal altimeter of the fish will be applied for bottom tracking of the SSS records.

The side scan sonar survey will be conducted at a line spacing of 100 meters and a scanning range of 125 meters. The resulting data coverage will be close to 200%.

The horizontal position of the side scan sonar fish will be determined by means of the USBL system. Used in a dynamic towed set-up the accuracy of the measured fish position varies between 1.0m to 2.0m. The error on the position of the final interpreted side scan sonar contacts can exceed 2 meters due to inaccuracies inherent to the operation of the side scan sonar and interpretation of the side scan sonar imagery.

2.7 Magnetometer

The magnetometer survey will be conducted using a Geometrics G-882 marine Cesium Vapor magnetometer, which will be deployed in a 'piggy-back' arrangement behind the side scan sonar fish. This allows careful control of the fish in relation to the seabed.

The system will be towed behind the side scan sonar at a distance of approximately 20m to reduce noise. The magnetometer data shall be monitored constantly for any noise caused by the side scan sonar towfish.

A 5 nT threshold will be used for picking purposes.

The accuracy of the magnetometer depends on the distance to the magnetic object. A small object directly below the magnetometer might be detected, while a similar object several meters away might not be. As the purpose of this survey is to detect large objects (wrecks, pipelines, cables) this poses no problems.

2.8 Parametric sub-bottom profiler

To define upper soil layers and relatively shallow buried channel features an Innomar SES-2000 parametric sub-bottom profiler mounted in the vessels moonpool will be used.

The low frequencies of the Innomar range from 4 kHz to 15 kHz.

The penetration could be up to 50m below seabed depending on sediments and frequency.

The range resolution is up to 5 cm, depending on pulse settings.

Since the optimum operating parameters of the innomar SES 2000 parametric echosounder are related to the local shallow geology in the survey area, these settings have to be selected upon arrival in the survey area. The operator will start with common central parameters to begin the test and fine tune the settings in order to achieve the best possible image/data.

Parameters which have to be selected are:

Low frequency: 4, 5, 6, 8, 10, 12 or 15kHz

Pulse width: 0.07 – 1.3ms

Pulse rate: 60pulses/s max.

Gain: 0 – 90dB.

Optional the operator may select multi frequency mode, used to transmit consecutive pings with different centre frequencies and/or pulse lengths

the operator may select multi frequency mode, used to transmit consecutive pings with different centre frequencies and/or pulse lengths

2.9 Multichannel sparker

For deep penetrations, up to a depth of approximately 80m below seabed, a Geo Marine Systems multichannel sparker system will be used.

The systems consist of following components:

- 2000 X Geo-Spark HV power supply
- Geo-Source 200 LW sparker
- 48 channel Ultra hi-res streamer system

The Geo-Spark Power supply uses an innovative “negative discharge” technology. In combination with the Geo-Source sparker an extremely stable signature with a broad spectrum in the 500 - 3500 Hz frequency range is generated. The signature of the Geo-Source sparker consists typically of a very short, initial HF pulse (explosive phase), which provides the ultra-high resolution in the upper strata, followed by a longer, LF pulse (implosive phase) which achieves substantial penetration in the deeper subsoil. The sparker source does not emit explosive pulses.

The 48 channel UHR Geo-Sense streamer consists of 24 channels of 1 m (1-24) plus 24 channels of 2 m (25-48). This configuration is specially designed for a subsoil with fast sediments like in the North Sea and allows to make very precise velocity analysis of the upper layers, which is essential for advanced UHR processing.

By tuning on the HF pulse with the electrodes at 30 cm below sea surface and limiting the energy to < 10 J per electrode, a penetration of 200 – 400 ms in “ordinary” marine sediments with a resolution of around 10 cm in the shallow layers and 20 -25 cm in the deeper layers can be achieved.

A group spacing of 1&2 m will be used, resulting in a horizontal resolution of 0.5 m or better.

To monitor the feather angles of the streamer, a beacon will be placed at the end of the streamer array. Data will be transmitted to the online survey computer(s).

In case the feather angles will exceed 12°, a rerun will be carried out if needed.

3 APPENDICES

Appendix A	Trimble SPS855 GNSS receiver
Appendix B	IXblue Octans III heading and motion sensor
Appendix C	Kongsberg HiPAP350P USBL USBL
Appendix D	R2Sonic 2024 multibeam echosounder
Appendix E	Valeport mini SVS
Appendix F	OSIL Minos SVP
Appendix G	OSIL MiniBAT FC60
Appendix H	Valeport MiniSVP
Appendix I	Edgetech 4200 Side scan sonar
Appendix J	Edgetech 4125 Side scan sonar
Appendix K	Geometrics GM-882 Marine Magnetometer
Appendix L	Innomar 2000 Standard sub-bottom profiler
AppendixM	Geo-source 200 LW Sparker
Appendix N	Geosense multichannel streamer
Appendix O	Reson SVP14 soundvelocity profiler

Specifications

Trimble SPS855 GNSS Modular Receiver



Receiver Name

SPS855 GNSS Modular Receiver

Configuration Option

Base and Rover interchangeability
Rover position update rate
Rover maximum range from base radio
Rover operation within a VRS™ network
Heading and Moving Base operation
Factory options

Yes, upgradeable to Rover, Base or Rover / Base
1 Hz, 2 Hz, 5 Hz, 10 Hz, 20 Hz
Unrestricted, typical range 2–5 km (1.2–3 miles) without radio repeater
Yes
Yes - option⁷
See Receiver Upgrades below

General

Keyboard and display

Vacuum Fluorescent display 16 characters by 2 rows. Invertable
On/Off key for one-button startup
Escape and Enter keys for menu navigation
4 arrow keys (up, down, left, right) for option scrolls and data entry
24 cm × 12 cm × 5 cm (9.4 in × 4.7 in × 1.9 in) including connectors
1.65 kg (3.64 lb) receiver with internal battery and radio
1.55 kg (3.42 lb) receiver with internal battery and no radio

Dimensions (L × W × D)
Weight

Antenna Options

GA510
GA530
GA810

L1/Beacon, DSM 232
Zephyr™ Model 2
Zephyr Geodetic™ Model 2
Zephyr Model 2 Rugged
Zephyr, Zephyr Geodetic, Z-Plus, Micro-Centered™

L1/L2/L2C GPS, SBAS, and OmniSTAR
L1/L2/L2C GPS, SBAS, and OmniSTAR
GPS, Glonass, Galileo, Compass, OmniSTAR, SBAS (optimized for OmniSTAR)
Not Supported
L1/L2/L2C/L5 GPS, Glonass, Galileo, Compass, OmniSTAR, SBAS
L1/L2/L2C/L5 GPS, Glonass, Galileo, Compass, OmniSTAR, SBAS
L1/L2/L2C/L5 GPS, Glonass, Galileo, Compass, OmniSTAR, SBAS
Refer to Antenna specification

Temperature

Operating¹
Storage
Humidity
Waterproof

-40 °C to +65 °C (-40 °F to +149 °F)
-40 °C to +80 °C (-40 °F to +176 °F)
MIL-STD 810F, Method 507.4
IP67 for submersion to depth of 1 m (3.3 ft), dustproof

Shock and Vibration

Pole drop
Shock – Non-operating
Shock – Operating
Vibration

Designed to survive a 1 m (3.3 ft) pole drop onto a hard surface
To 75 g, 6 ms
To 40 g, 10 ms, saw-tooth
Tested to Trimble ATV profile (4.5 g RMS): 10 Hz to 300 Hz: 0.04 g/Hz²
300 Hz to 1,000 Hz; -6 dB/octave

Specifications

Trimble SPS855 GNSS Modular Receiver

Measurements

Advanced Trimble Maxwell™ 6 Custom GPS Chips
 High-precision multiple correlator for GNSS pseudorange measurements
 Unfiltered, unsmoothed pseudo-range measurements data for low noise, low multipath error, low-time domain correlation, and high-dynamic response
 Very low noise carrier phase measurements with <1 mm precision in a 1 Hz bandwidth
 Trimble EVEREST™ multipath signal rejection
 L-Band: OmniSTAR VBS, HP and XP by subscription
 GPS L1 C/A, L2C, L2E (Trimble method for tracking unencrypted L2P) upgradable to L5. 440 channels
 Upgradeable to GLONASS L1/L2C/A, L1/L2P Full Cycle Carrier
 Upgradeable to Galileo: L1 CBOC, E5A, E5B & E5AltBOC⁸
 Upgradeable to Compass: B1, B2, B3
 4-channel SBAS L1 C/A, L5 (WAAS/EGNOS/MSAS)
 QZSS: L1 C/A, L1C, L1 SAIF, L2C, L5

SBAS (WAAS/EGNOS/MSAS) Positioning³

Accuracy

Better than 5 m 3DRMS (16 ft)

Code Differential GPS Positioning²

Horizontal accuracy

0.25 m + 1 ppm RMS (0.8 ft + 1 ppm RMS)

Vertical accuracy

0.50 m + 1 ppm RMS (1.6 ft + 1 ppm RMS)

OmniSTAR Positioning

VBS service accuracy

Horizontal <1 m (3.3 ft)

XP service accuracy

Horizontal 0.2 m (0.66 ft), Vertical 0.3 m (1.0 ft)

HP service accuracy

Horizontal 0.1 m (0.33 ft), Vertical 0.15 m (0.5 ft)

Location RTK Positioning

Horizontal accuracy

Location RTK (10/10) or (10/2) 10 cm + 1 ppm RMS (0.32 ft + 1 ppm)

Vertical accuracy

Location RTK (10/10) 10 cm + 1 ppm RMS (0.32 ft + 1 ppm)

Location RTK (10/2) 2 cm + 1 ppm RMS (0.065 ft + 1 ppm)

Real-Time Kinematic (RTK up to 30 km) Positioning²

Horizontal accuracy

8 mm + 1 ppm RMS (0.026 ft + 1 ppm RMS)

Vertical accuracy

15 mm + 1 ppm RMS (0.05 ft + 1 ppm RMS)

Trimble VRS⁹

Horizontal accuracy

8 mm + 0.5 ppm RMS (0.026 ft + 0.5 ppm)

Vertical accuracy

15 mm + 0.5 ppm RMS (0.05 ft + 0.5 ppm)

Precise Heading

Heading accuracy

When combined with SPS555H⁷

2 m antenna separation

0.09° RMS

10 m antenna separation

0.05° RMS

Initialization Time

Regular RTK operation with base station

Single/Multi-base

Initialization reliability⁴

typically less than 8 seconds

>99.9%

Power

Internal

Integrated internal battery 7.2 V, 7800 mA-hr, Lithium-ion

Internal battery operates as a UPS in the event of external power source failure

Internal battery will charge from external power source as long as source can support the power drain

Integrated charging circuitry

Specifications

Trimble SPS855 GNSS Modular Receiver

Power

External

Power input on 7-pin 0-shell Lemo connector is optimized for lead acid batteries with a cut-off threshold of 11.5 V

Power input on the 26-pin D-sub connector is optimized for Trimble lithium-ion battery input with a cut-off threshold of 10.5 V

Power source supply (Internal/External) is hot-swap capable in the event of power source removal or cut off

DC external power input with over-voltage protection

Receiver automatically turns on when connected to external power
N/A

Power over Ethernet (PoE)

Power consumption

6.0 W in rover mode with internal receive radio

8.0 W in base mode with internal transmit radio

Operation Time on Internal Battery

Rover

13 hours; varies with temperature

Base station

450 MHz systems

Approximately 11 hours; varies with temperature⁵

900 MHz systems

Approximately 9 hours; varies with temperature

Regulatory Approvals

FCC: Part 15 Subpart B (Class B Device) and Subpart C, Part 90

Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Canadian RSS-310, RSS-210, and RSS-119.

Cet appareil est conforme à la norme CNR-310, CNR-210, et CNR-119 du Canada.

R&TTE Directive: EN 301 489-1/-5/-17, EN 300 440, EN 300 328, EN 300 113, EN 60950, EN 50371

ACMA: AS/NZS 4295 approval

CE mark compliance

C-tick mark compliance

UN ST/SG/AC.10.11/Rev. 3, Amend. 1 (Lithium-ion Battery)

UN ST/SG/AC. 10/27/Add. 2 (Lithium-ion Battery)

RoHS compliant

WEEE compliant

Communications

Lemo (Serial)

7-pin 0S Lemo, Serial 1, 3-wire RS-232

Modem 1 (Serial)

26-pin D-sub, Serial 2, Full 9-wire RS232, using adaptor cable

Modem 2 (Serial)

26-pin D-sub, Serial 3, 3 wire RS-232, using adaptor cable

1PPS (1 Pulse-per-second)

Available on Marine versions

Ethernet

Through a multi-port adaptor

WiFi

N/A

Bluetooth wireless technology

Fully-integrated, fully-sealed 2.4 GHz Bluetooth module⁶

Integrated radios (optional)

Fully-integrated, fully-sealed internal 410-470 MHz Tx/Rx; Internal 900 MHz Tx/Rx

Channel spacing (450 MHz)

12.5 kHz or 25 kHz spacing available

Sensitivity (450 MHz)

-114 dBm (12 dB SINAD)

450 MHz output power

0.5 W, 2.0 W (2.0 W available only in certain countries)

900 MHz output power

1.0 W

Frequency approvals (902-928 MHz)

USA/Canada

External GSM/GPRS, cell phone support

Supported for direct-dial and Internet-based correction streams – directly using the external SNM940 or using the SCS900 software

Cell phone or GSM/GPRS modem inside controller or external SNM940

Specifications

Trimble SPS855 GNSS Modular Receiver

Internal MSK Beacon receiver

N/A

Receiver position update rate

1 Hz, 2 Hz, 5 Hz, 10 Hz, and 20 Hz positioning

Correction data input

CMR™, CMR+™, CMRx™, RTCM 2.x, RTCM 3 (require Rover upgrade)

Correction data output

CMR, CMR+, CMRx, RTCM 2.x, RTCM 3 (require Base upgrade)

Data outputs

NMEA, GSOFF, 1PPS Time Tags (Marine version)

Receiver Upgrades

Location RTK (10/10) or (10/2)

Precision RTK Base, Rover or Base/Rover

L5, GLONASS, GALILEO, COMPASS¹⁰

28 MB Internal Data Logging option. Moving Base and Heading

2 Watt upgrade for 450 MHz radio

Notes

1 Receiver will operate normally to those temperature limits. Internal batteries will operate from -20 °C to +48 °C

2 Accuracy and reliability may be subject to anomalies such as multipath, obstructions, satellite geometry, and atmospheric conditions. Always follow recommended survey practices.

3 Depends on SBAS system performance.

4 May be affected by atmospheric conditions, signal multipath, and satellite geometry. Initialization reliability is continuously monitored to ensure highest quality.

5 If your receiver has the 2.0 W upgrade, you will experience reduced battery performance compared to the 0.5 W solution.

6 Bluetooth type approvals are country specific. For more information, contact your local Trimble office or representative.

7 When receiver is combined with an SPS555H or other suitable SPS receivers.

8 Galileo Commercial Authorization

Developed under a Licence of the European Union and the European Space Agency.

9 Networked RTK PPM values are referenced to the closest physical base station

10 This Trimble SPS Receiver is capable of supporting existing and planned GNSS satellite signals, including GPS, GLONASS, GALILEO, Compass and QZZ, and existing and planned augmentations to these GNSS systems.

Specifications

Trimble SPS855 GNSS Modular Receiver

Specifications subject to change without notice.

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technical specifications

Gyrocompass & motion sensor



Heading

Accuracy	0.1 deg secant latitude ^{(1) (2)}
Resolution	0.01 deg
Settling time (static conditions)	< 1 minute
Full accuracy settling time (all conditions)	< 5 minutes

Heave / Surge / Sway

Accuracy	5 cm or 5% (whichever is highest) Set-up free (SAFE-HEAVE™)
----------	--

Roll / Pitch

Dynamic accuracy	0.01 deg (for ±90 deg amplitude) ⁽²⁾
Range	No limitation (-180 deg to 180 deg)
Resolution	0.001 deg

Environment

Vibrations	1 g sine (5 to 50 Hz)
Follow-up speed	Up to 750 deg/s
Shocks Operating / Survival	30 g 6 ms / 50 g 11 ms
MTBF	30,000 hours
Operating / Storage Temperature	-40 °C to +60 °C / +80 °C
No warm-up effects, insensitive to thermal shocks	
No latitude or speed limitation	

OCTANS III surface unit

Housing (L x W x H)	280 x 136 x 150 mm
Weight in air	4.8 Kg
Water proof	IP66
Material	Aluminium
Mounting / Connectors	3 off M6 Holes / Souriau military
Inputs	3 serial / 2 pulses
Outputs	3 serial / 4 analogue / 2 pulses
Power supply / consumption	24 V DC / 11 W

OCTANS III subsea unit

	OCTANS 100	OCTANS 3000	OCTANS 6000
Material	Duplex Steel	Titanium or Duplex Steel	Titanium
Depth rating	100 m	3,000 m	6,000 m
Weight in air / water (kg)	9 / 2	12 / 5 or 25 / 17	18 / 9
Housing (dia. x H mm)	179 x 318	179 x 318	179 x 318
Base plate (dia. x H mm)	209 x 10	209 x 10	NA
Mounting	6 off M6 Holes	6 off M6 Holes	Cradle
Connector	16-Pin MCBH16 M Subconn (Burton in option)		
Inputs	2 serial		
Outputs	2 serial / 4 analogue (3 serial in option)		
Power supply / consumption	24 V DC / 11 W		

Interface

Output protocols
Serial I/O
Baud rates
Output frequency

Industry standards: NMEA 0183, binary
RS232 or RS422 (user-definable)
600 bauds to 115 kbauds
0.001 Hz to 100 Hz



(1) Secant latitude = 1 / cosine latitude

(2) RMS value

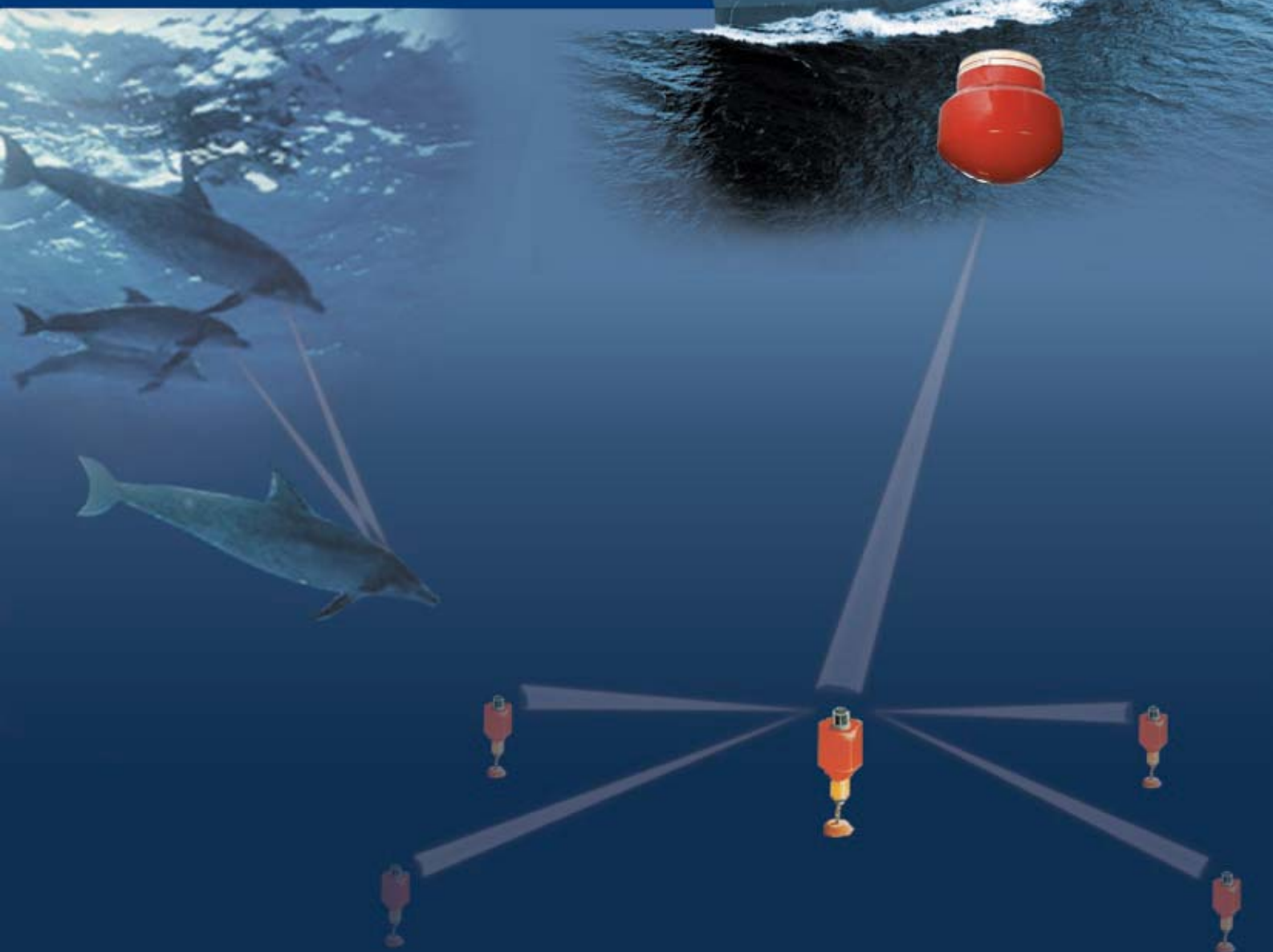
Specifications subject to change without notice



KONGSBERG

HiPAP[®] 350

High Precision Acoustic
Positioning System



WORLD CLASS - *through people, technology and dedication*

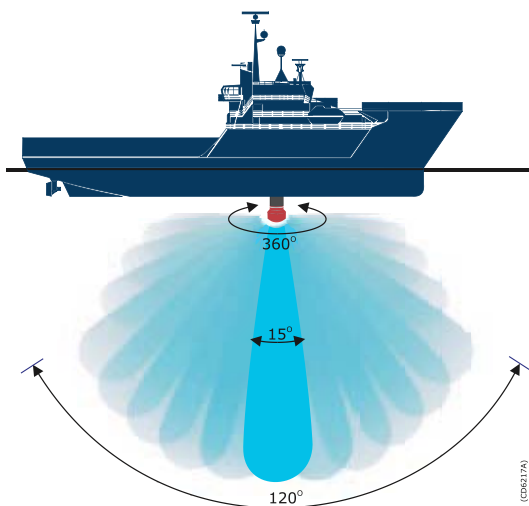
The right system for your application

The HiPAP family of underwater positioning systems lets you choose the right system level for your application. HiPAP 350 has been developed to provide the market's best accuracy where HiPAP 500 extreme accuracy and long-range capabilities are not required.

With this unique transducer array, measuring only 320 mm in diameter (and thus smaller than HiPAP 500), the HiPAP 350 can be used with all existing HPR gate valves.

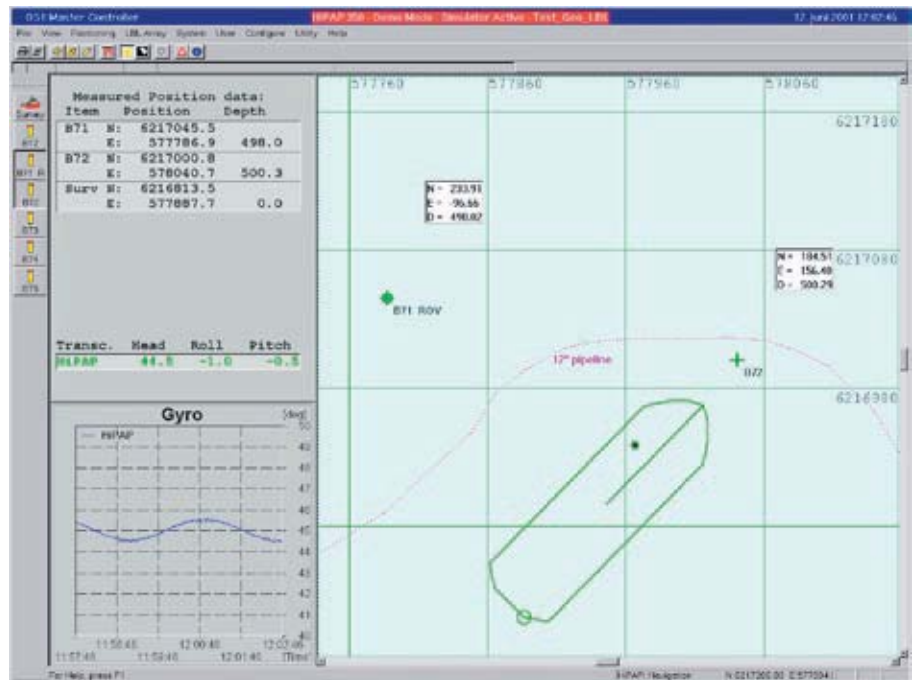
Acoustic beam pointing control

The HiPAP 350 uses the unique technology of *narrow pointing beams*. This minimizes the effect of noise from propellers and thrusters. This technology gives the system maximum Signal-to-Noise ratio, and this is the major key to successful acoustic performance. The curved transducer creates a narrow beam pointed towards the transponder(s) within a large sector below the vessel. Outside this sector, the pointing beam will increase in width. Data from roll, pitch and heading sensors are used to compensate for vessel movements.



Super-Short Base Line functionality

The Super-Short Base Line (SSBL) principle has the obvious advantage that it only requires installation of one hull-mounted transducer and one subsea transponder to establish a three-dimensional position of the transponder. To provide this position, the SSBL system measures both the horizontal and vertical angles, as well as the range to the transponder.



Long Base Line functionality

At some point of range, depending on the application, the SSBL principle will have accuracy limitation. Long Base Line (LBL) accuracy is independent of range. An LBL system can position more accurately, but only within an array of seabed transponders.

The HiPAP with the optional LBL features is a very flexible system combining the advantages of both the SSBL and LBL principles.

The HiPAP has better long range performance than traditional wider beam systems. This is because the Signal-to-Noise ratio of the detected seabed transponders' replies are higher than when using one wide beam that needs to cover the seabed footprint of a transponder array.

Multi vessel positioning

The Multi-User LBL (MULBL) function enables several individual vessels and ROV units to position themselves using the same seabed transponder array.

LBL for subsea construction

Kongsberg Simrad introduced the LBL system in 1992, and has since become the market leader in supplying LBL and combined LBL / SSBL systems for vessel positioning.

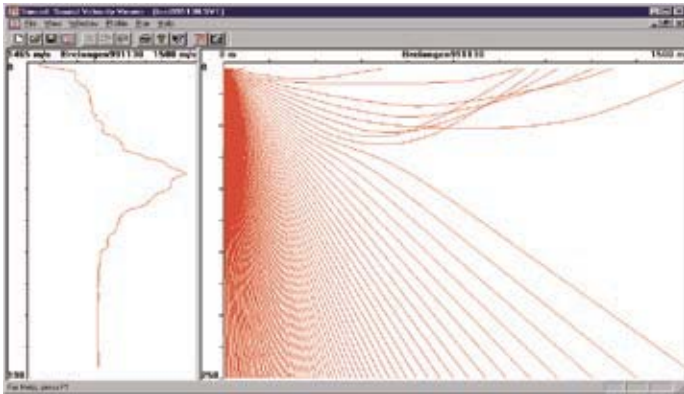
The current LBL systems use intelligent, instrumented transponders and deep water transceivers and transducers. These are all rated for 3000 m water depth, and fulfil any requirements within subsea construction, survey and metrology.

Accuracy a function of transducer size

Accuracy is always dependent on the beam width and the “active surface” of any transducer. The HiPAP 350 will therefore have some reduced performance compared to the more accurate HiPAP 500 which has several more transducer elements.

Automatic compensation for ray bending and sound velocity errors

The HiPAP takes input of the local sound velocity profile, calculates, error compensates and displays the effect of the physical phenomena of sound velocity differences in the water column.



“World Record” in transponder channels

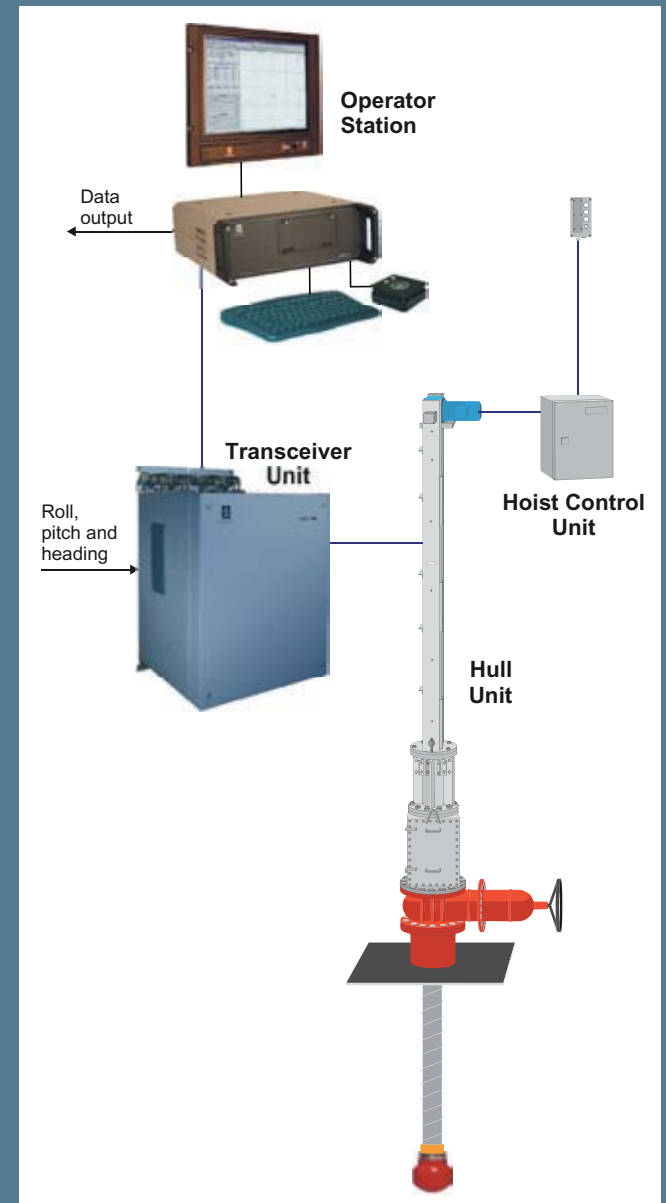
The HiPAP systems can operate with up to 56 transponder channels, and feature transponder telemetry communication for use with transponder release, sensor readings and all LBL functionalities.

Typical applications

The HiPAP 350 has been developed for use in situations where positioning is within a sector of ± 60 degrees below the vessel, but will also perform outside this sector at some reduced accuracy and range capability. This level of functionality makes the HiPAP 350 ideal for drill-rigs, ROV tracking and dynamic positioning reference. It is also ideal for other operations where the underwater positioning is relatively directly below, and where extreme accuracy, shallow water horizontal positioning and ultra deep performance are not required.

HiPAP 350 - ideal for HPR upgrades

The HiPAP 350 system is without question the ideal solution for upgrade of older HPR systems. With its small diameter, the HiPAP 350 transducer can be used with all HPR system gate valves, and may also be installed on the existing hull units to replace the HPR transducer. The upgrade is limited to a minimum of cabling and work.



Typical HiPAP® 350 configuration

The HiPAP® 350 system operates with the transducer mounted on a hull unit. Several hull unit models are available, these enable the transducer to be lowered approximately 1.5 to 5.5 m below the keel. A Transceiver Unit containing the transmitter, preamplifier and beamforming electronics is mounted close to the hull unit. The system can be configured with one or two hull mounted transducers. The use of two transducers will increase accuracy and redundancy.

The system operation is performed on a Windows XP® based operator station.

HiPAP 350 basic specifications

Gate valve size required:	350 mm (14 inches)
Transducer diameter:	320 mm
Acoustic operating area:	+/- 80° (Recommended)
Number of active elements:	46
Angle accuracy: ¹⁾	0 dB S/N: 0.40° 10 dB S/N: 0.23° 20 dB S/N: 0.18°
Range detection accuracy: ¹⁾	< 20 cm
Typical operating range: ¹⁾	1 to 3000 m
Narrow pointing receiver beam:	+/- 7.5°

Note that the technical specifications are subject to change without prior notice.

¹⁾ The specifications are based on; Line of sight from transducer to transponder, no influence from ray bending, Signal to Noise ratio as specified in water in the 250 Hz receiver band, no error from heading / roll / pitch sensors, and use of correct sound velocity. Operating ranges are typical and conservative, and are assumed by using sufficient transponder source level (up to 206 dB dependant on range).

HiPAP 350 standard features

- 56 transponder channels
- Hull unit for transducer deployment
- Windows XP® based operating system
- Receive frequency band: 27,0 – 30,5 kHz
- Telemetry frequency band: 24,5 – 27,0 kHz
- Transmit frequency band: 21,0 – 24,5 kHz
- Comprehensive on-line help
- Automatic transducer alignment calibration
- Compensation for ray-bending
- Display of ray-bending
- External Depth sensor interface
- Position and angle alarm limits
- Responder mode
- Telegram output to dynamic positioning system
- Telegram output to survey system
- Transponder Telemetry for full utilization
- DGPS Interface

HiPAP 350 optional features

- Beacon Mode
- Compass Transponder Mode
- Depth Sensor Transponder Mode
- Inclinometer Transponder Mode
- Long Base Line (LBL) functionality
- Geographical LBL Calibration
- Multi-User LBL functionality (MULBL)
- Operator Station Master / Slave function
- Blow Out Preventer (BOP) telemetry function
- Offshore Loading Telemetry function
- Submerged Turret Loading function
- Fast LBL Transponder Positioning mode *
- LBL Accurate Metrology mode*

(* standard in LBL function)

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KONGSBERG

SONIC 2024

Multibeam Echo Sounder

Features:

- 60kHz wideband signal processing
- Selectable frequencies 200-400kHz
- Selectable swath sector 10° to 160°
- Focused 0.5° x 1° beam widths
- 1-500m range
- Embedded processor/controller
- Low weight, volume and power
- Easy installation and operation

Applications:

- Hydrographic Survey
- Offshore Site Survey
- Pre & Post Dredge Survey
- Defense & Security
- Marine Research

System Description:

The Sonic 2024 is the world's first proven wideband high resolution shallow water multibeam echo sounder. With unmatched performance, the Sonic 2024 produces reliable and remarkably clean data with maximum user flexibility through all range settings to 500m.

The unprecedented 60 kHz signal bandwidth offers twice the resolution of any other commercial sonar in both data accuracy and image, over the entire frequency band.

With over 20x selectable operating frequencies to choose from 200 to 400 kHz, the user has unparalleled flexibility in trading off resolution and range and controlling interference from other active acoustic systems. In addition to selectable operating frequencies, the Sonic 2024 provides variable swath coverage selections from 10° to 160°. Both the frequency and swath coverage may be selected 'on the fly', in real-time during survey operations.

The Sonar consists of the outboard projector and receiver modules, and the inboard Sonar Interface Module (SIM). Third party auxiliary sensors are connected to the SIM. The sonar data is tagged with GPS time.



The sonar operation is controlled from a graphical user interface on a PC or laptop which is typically equipped with navigation, data collection and storage applications software.

The operator sets the sonar parameters in the sonar control window, while depth, imagery and other sensor data are captured and displayed by the applications software.

Commands are transmitted through an Ethernet interface to the Sonar Interface Module. The Sonar Interface Module supplies power to the sonar heads, synchronizes multiple heads, time tags sensor data, and relays data to the applications workstation and commands to the sonar head. The receiver head decodes the sonar commands, triggers the transmit pulse, receives, amplifies, beamforms, bottom detects, packages and transmits the data through the Sonar Interface Module via Ethernet to the control PC.

The compact size, low weight, low power consumption <50W and elimination of separate topside processors make Sonic 2024 *very well* suited for small survey vessel or ROV/AUV operations. For AUV integration, apart from the transmit and receive transducer, the only hardware to be housed on the AUV is an interface board the size of a PC/104, Ethernet ports, and the provision of isolated 48V DC power.

The standard data output format is compatible with SeaBat™ 81xx for ease of interface to existing systems. An expanded format will be released as part of a planned firmware update, to incorporate additional features.

Sonic 2024 Multi Beam Echo Sounder

Systems Specification:

Frequency	200kHz-400kHz
Beamwidth, across track	0.5°
Beam width, along track	1.0°
Number of beams	256
Swath sector	Up to 160°
Max Range setting	500m
Pulse Length	15µs-500µs
Pulse Type	Shaped CW
Depth rating	100m
Operating Temperature	0°C to 50°C
Storage Temperature	-30°C to 55°C

Electrical Interface

Mains	90-260 VAC, 45-65Hz
Power consumption	<50W
Uplink/Downlink:	10/100/1000Base-T Ethernet
Data interface	10/100/1000Base-T Ethernet
Sync In, Sync out	TTL
GPS	1PPS, RS-232
Auxiliary Sensors	RS-232
Deck cable length	15m

Mechanical:

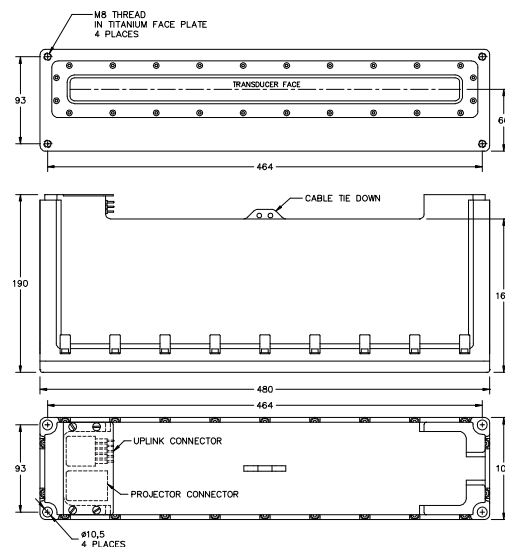
Receiver Dim (LWD)	480 x 109 x 190 mm
Receiver Mass	12.9 kg
Projector Dim (LWD)	273 x 108 x 86 mm
Projector Mass	3.3 kg
Sonar Interface	
Module Dim (LWH)	280 x 170 x 60 mm
Sonar Interface	2.4 kg
Module Mass	

Sonar Options:

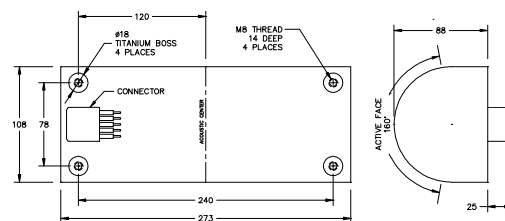
Snippets Imagery Output
Switchable Forward Looking Sonar Output
Steerable Transmit Projector w/Multi-ping
Mounting Frame & Hardware
Over-the-side Pole Mount
Sound Velocity Probe & Profiler
Extended Sonar Deck Cable, 25m or 50m
3000m Depth Immersion Depth



Sonar Interface Module



Sonic 2024 Receiver



Sonic 2024 Projector

High Resolution
Multibeam
Systems
for:

Hydrography

Offshore

Dredging

Defense

Research

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the next generation, literally

miniSVS



Our unique digital time of flight technology gives unmatched performance figures, with signal noise an order of magnitude better than any other sensor. The miniSVS is available in a selection of configurations and with optional pressure or temperature sensors. There are a variety of sizes to suit many applications.

miniSVS - still the most accurate sound velocity sensor in the world. Nothing else comes close.

Sound Velocity Measurement

Each sound velocity measurement is made using a single pulse of sound travelling over a known distance, so is independent of the inherent calculation errors present in all CTDs. Our unique digital signal processing technique virtually eliminates signal noise, and gives almost instantaneous response; the digital measurement is also entirely linear, giving predictable performance under all conditions.

Range:	1375 - 1900m/s	
Resolution:	0.001m/s	
Accuracy:	Dependent on sensor size	
100mm	Random noise (point to point)	±0.002m/s
	Max systematic calibration error	±0.013m/s
	Max systematic clock error	±0.002m/s
	Total max theoretical error	±0.017m/s
50mm	Total max theoretical error	±0.019m/s
25mm	Total max theoretical error	±0.020m/s

Acoustic Frequency: 2.5MHz

Sample Rate: Selectable, dependent on configuration

Rate	SV	SV+P	SV+T
Single Sample	•	•	•
1Hz	•	•	•
2Hz	•	•	•
4Hz	•	•	•
8Hz	•	•	•
16Hz	•	•	•
32Hz	•	•	•
60Hz	•	•	•

Optional Sensors

The miniSVS may be optionally supplied with either a pressure or temperature sensor (but not both). Data is sampled at the rates shown above

Sensor	Pressure	Temperature
Type	Strain Gauge	PRT
Range	5, 10, 50, 100 or 600 Bar	-5°C to +35°C
Resolution	0.001% range	0.001°C
Accuracy	±0.05% range	±0.01°C

Data Output

Unit has RS232 & RS485 output, selected by command code. RS232 data may be taken directly into a PC over cables up to 200m long, whereas RS485 is suitable for longer cables (up to 1000m) and allows for multiple addressed units on a single cable.

Baud Rate: 2400 - 115200 (NB. Low baud rates may limit data rate)
Protocol: 8 data bits, 1 stop bit, No parity, No flow control



Electrical

Voltage: 8 - 30VDC
Power: 0.25W (SV only), 0.35W (SV + Pressure)
Connector: Subconn MCBH6F (alternatives on request)

Data Format

Examples of data formats are:
`<space>{sound_velocity}<cr><lf>`
`<space>{pressure}<space>{sound_velocity}<cr><lf>`
`<space>{temperature}<space>{sound_velocity}<cr><lf>`

SV: Choose from mm/s (1510123), m/s to 3 decimal places (1510.123), or m/s to 2 decimal places (1510.12)

Pressure: If fitted, pressure is always output in dBar with 5 digits, with a decimal point, including leading zeroes if necessary. Position of the point is dependent on sensor range, e.g.

50dBar	47.123
100dBar	047.12
1000dBar	0047.1

Temperature: If fitted, temperature is output as a 5 digit number with 3 decimal places and leading zeroes, signed if negative, e.g.

21.456
02.298
-03.174

Physical

Please refer to drawing on reverse for detailed dimensions.

Depth Rating: 6000m (Titanium), 500m (acetal)
Weight: 1kg (housed type)
Housing & Bulkhead: Titanium or acetal, as selected
Transducer Window: Polycarbonate
Sensor Legs: Carbon Composite
Reflector Plate: Titanium.

Ordering

All systems supplied with operating manual and carry case. OEM units come with a test lead, housed units with a 0.5m pigtail.

Configuration	100mm	50mm	25mm
Titanium Housed	0652004	0652005	0652006
Acetal Housed	0652045	0652046	0652047
Bulkhead OEM	0652001	0652002	0652003
Remote OEM	0652007	0652008	0652009

0652010 Spare 50cm Pigtail
 0652013 Pressure sensor option (specify range)
 0652028 Temperature sensor option

Datasheet Reference: miniSVS version 2A, Feb 2011

Minos SVP

Ideal for Sound Velocity Profiles by Hand or Small Winch

A logger, the Minos SVP was specifically designed for vertical profiles from small launches or boats. ½ the size of a SV Plus v2, the instrument is much easier to handle in small spaces. The instrument also has an LED light which provides a visual status indicator to the end-user.

Like all AML sound velocimeters, the Minos SVP directly measures the time-of-flight of an acoustic ping. Time-of-flight measurement technology is between 5 and 10x more accurate than traditional CTD based sound velocity equations such as Chen & Millero or Del Grosso. The Minos SVP also has 25 Hz sampling, guaranteeing high resolution data.

Standard Features:

- Sound Velocity: Time-of-Flight, +/-0.05 m/s accuracy
- Pressure: Temperature Compensated Strain Gauge, +/-0.05%FS accuracy
- Small Size: half the size of the SV Plus v2
- Rechargeable Lithium-Ion battery pack provides approximately 30 hours of continuous sampling
- Designed for Profiling: with integrated shackle point and stainless steel protective sensor cage
- LED light indicates ready, logging, and low battery
- High speed sampling: user configurable, up to 25Hz



X•Series: Sensor-Xchangeable Instruments

Available as an upgrade, X•Series instruments allow the user to change instrument sensor-load on demand. With the X•Series, your CTD can be an SVTP, shallow pressure sensors can be swapped for deep, and temperature range can be adjusted as needed. The X•Series uses Xchange™ sensor-heads, which are both field-swappable and shareable with all other models of X•Series instruments.

For more information, request an X•Series brochure.

Electrical:

- LED light indicates if the battery is low and when instrument is operating
- Gigabyte non-volatile memory (expandable)
- Up to 25 scans per second
- Real time clock
- 7.5 to 26 VDC (external)
- Auto detect RS232 or RS485
- Optional additional channels (2 analog or 1 digital)
- Auto shut-down in low battery conditions

Sampling Modes:

- User configurable
- By time, up to 25 Hz
- By pressure, .01 dBar and greater
- By sound speed, 0.1 ms and greater

Power:

- Rechargeable Lithium-Ion battery pack

Mechanical:

- Housing & Endcap: Delrin to 1000 m or Titanium to 6000 m
- Stainless steel shackle point and sensor protection cage
- Size: 75.7 mm (2.98") diameter x 566 mm (22.3") OAL
- Connector: Subconn Micro 8, Female
- Storage Temperature: -20°C to 60°C
- Operating Temperature: -20°C to 45°C

Accessories:

- Instrument suspension bar
- Instrument protection frame
- Field spares kit

Parameter	Range	Precision	Accuracy	Resolution	Response
STANDARD					
Sound Velocity (Composite)	1400 to 1600m/s	+/-0.03m/s	+/-0.05m/s	0.015m/s	47 microseconds
Pressure (Strain Gauge)	Up to 6000m	+/-0.03 %FS	+/-0.05%FS	0.005%FS	10 milliseconds
OPTIONAL					
Temperature	-2 to 32°C	+/-0.003°C	+/-0.005°C	0.001°C	100 milliseconds
Salinity (Calculated)	Up to 40ppt		+/-0.035ppt		
Density (Calculated)	990 to 1200kg/m ³		+/- 0.051kg/m ³	+/- 0.001kg/m ³	

Xchange™

Field-swappable Xchange™ sensors (Conductivity, Sound Velocity, Temperature and Pressure) are only available on X-Series instruments, including the Minos•X. For more information, please request a copy of the Minos•X brochure.

*specifications subject to change without notice



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OSIL
Environmental Instruments
and Systems

OSIL MINIBAT FC60

The Complete Solution for Coastal and Freshwater Research Applications

The OSIL MiniBAT FC60 is an extremely lightweight, remotely controlled towed instrumentation platform designed for use with a wide variety of data collection instruments. It provides an extremely flexible profiling system for use in estuaries, lakes, rivers, and coastal areas. The MiniBAT FC60 is easily deployed by one person from virtually any size of vessel and performs at a user set depth below the surface, above the seabed or in an undulating pattern between 2 depths down to 60 metres. Suggested towing speeds are in the range of 1 to 10 knots and the typical speeds for the average field survey are 4 to 6 knots.



The basic system consists of:

- MiniBAT FC60 tow body
- Onboard control electronics
- On board pressure sensor
- Adjustable wings
- Graphical interface software control box
- 7-conductor Y-cable

One branch of the Y-cable controls the MiniBAT, leaving four conductors for user instrumentation.

Features:

• Flexible mounting of existing instrumentation	• Remote undulation control by computer
• Easy towing with a 5 to 10 meter power boat	• Profiling at speeds up to 10 Kts
• Power - 12VDC battery or 120/240V line	• Direct depth measurement
• Operational depth - surface to 60 meters	• Auto bottom following and avoidance
• GPS data recorded (Optional)	• Basic depth stability: < 1 meter graphical display of flight path

FOR FURTHER INFORMATION PLEASE CONTACT:

OSIL, Culkin House, C7/8 Endeavour Business Park, Penner Road, Havant, Hampshire PO9 1QN
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OSIL
Environmental Instruments
and Systems

OSIL MINIBAT FC60

MiniBAT FC60 Control Software

The control software allows the user to have the MiniBAT FC60 undulate over a desired depth range, maintain a constant depth, or maintain a given elevation above the bottom. It presents a graphical display of the MiniBAT's position with respect to the bottom and logs this information along with latitude, longitude, boat speed, wing angle, time, and date. There is an additional line in facility to integrate the GPS data (NMEA0183) into the display and logs.

The software provided is independent of any software which may be needed to control and recover data from the instrumentation onboard the MiniBAT.

Systems

Complete systems including the MiniBAT FC60, instrumentation, sea cable, winch, control box, software and systems integration can be supplied on request.

Please note we are also able to integrate existing instrumentation into the MiniBAT FC60 on request.

SPECIFICATIONS

Tow Body

Overall Length..... 75 cm
Overall Width70 cm
Body Width.....13 cm
Air Weight (unloaded).....13 kg

Construction Materials

Stainless Steel, PVC, Delrin

Power

MiniBAT Power Module.....30 watts
Requirements for MiniBAT Power
Module: 120/240 VAC supplied either directly, or
via a 12 VDC battery and DC to AC converter.
Operating Voltage: +/-12 VDC floating
Consumption.....6.5 watts

MiniBAT Control Data

Transmission
Conductor Cable: 8 mm diameter, 7-conductor
(Kevlar suggested)
Data Format: NMEA 0183
I/O RS-232, 4800 baud

On-Board Depth Sensor

Safe Working Range0 to 100 m
Resolution 0.4 m
Operational Depth60 m

Typical instrumentation which can be supplied with the MiniBAT FC60 in an Integrated System includes:

CTD's	Dye Tracers
Chlorophyll	Sound Velocity Sensors
Turbidity	Optical Plankton Counters
DO	Acoustic Instruments
pH	PAR



FOR FURTHER INFORMATION PLEASE CONTACT:

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miniSVP



The miniSVP has been developed to provide a cost effective tool for the collection of Sound Velocity Profiles, without compromising the quality of the data. Ideally suited to ROV, coastal, or small boat applications, the miniSVP will appeal to survey companies, the military and academia alike, being simple to use, easy to handle, and featuring the most accurate SV sensor in the world.

Sensors

The miniSVP is fitted with Valeport's digital time of flight sound velocity sensor, a PRT temperature sensor, and strain gauge pressure transducer.

Sound Velocity

Range: 1375 - 1900m/s
Resolution: 0.001m/s
Accuracy: ± 0.02 m/s

Temperature

Range: -5°C to $+35^{\circ}\text{C}$
Resolution: 0.001 $^{\circ}\text{C}$
Accuracy: $\pm 0.01^{\circ}\text{C}$

Pressure

Range: 10, 50, 100, 300 or 600 Bar
Resolution: 0.001% range
Accuracy: ± 0.05 % range

Data Acquisition

The miniSVP features a selection of pre-programmed sampling regimes, covering many standard applications. Data may be sampled from 1 to 16Hz, making it suitable for rapid profiling or for continuous measurement at a fixed point

Sampling Modes

Continuous: Regular output from all sensors at 1, 2, 4, 8, 16Hz.
Profile: Logs data as the device falls (or rises) by a defined amount through the water column.

Communications

The instrument will operate autonomously, with setup and data extraction performed by direct communications with PC before and after deployment. It also operates in real time, with a choice of communication protocols fitted as standard and selected by pin choice on the output connector:

RS232: Up to 200m cable, direct to serial port
RS485: Up to 1000m cable, addressable half duplex comms
Baud Rate: 4800 - 460800
Protocol: 8 data bits, 1 stop bit, No parity, No flow control
Bluetooth: Optional Bluetooth adapter available for cable free data recovery (adapter not designed for immersion)

Memory

The miniSVP is fitted with a solid state non-volatile Flash memory, capable of storing over 10 million lines of data (equivalent to 10,000 profiles to 500m, at 1m profile resolution).



Electrical

Internal: 1 x C cell, 1.5v alkaline or 3.6v lithium
External: 9 - 28vDC
Power: <250mW
Battery Life: approx 30 hours operation (alkaline)
approx 90 hours operation (lithium)
Connector: Subconn MCBH10F

Physical

Materials: Acetal or titanium housing (as ordered), polycarbonate & composite sensor components
Depth Rating: 500m (acetal)
6000m (titanium)
NB: Maximum deployment depth may be limited by transducer range
Instrument Size: Main Housing 48mm \varnothing
Sensor Body 54mm \varnothing
Length 435mm (including connector)
Weight: 0.8kg (acetal)
1.6kg (titanium)
Shipping: 51 x 42 x 27cm, 10kg

Software

System is supplied with DataLog Express Windows based PC software, for instrument setup, data extraction and display. DataLog Express is licence free.

Ordering

0660001 miniSVP Sound Velocity Profiler in acetal housing, switch plug, deployment cage, 3m communications lead, DataLog Express software, manual and transit case. *Specify required pressure range*
0660002 miniSVP Sound Velocity Profiler in titanium housing, switch plug, deployment cage, 3m communications lead, DataLog Express software, manual and transit case. *Specify required pressure range*
04000536 Optional Bluetooth adapter

Datasheet Reference: miniSVP version 2A, Feb 2011

As part of our policy of continuing development, we reserve the right to alter at any time, without notice, all specifications, designs, prices and conditions of supply of all equipment

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4200 SERIES

SIDE SCAN SONAR SYSTEM

FEATURES

- Optional Multi-Pulse (MP) technology for high speed surveys
- Crisp, high resolution CHIRP images
- Multiple dual simultaneous frequency sets to choose from
- Stainless steel towfish
- Easily integrates to other 3rd party sensors
- Meets IHO & NOAA Survey Specifications

APPLICATIONS

- Cable & Pipeline Surveys
- Geological/Geophysical Surveys
- Mine Countermeasures (MCM)
- Geohazard Surveys
- Channel Clearance
- Search and Recovery
- Archeological Surveys



The 4200 Series is a versatile side scan sonar system that can be configured for almost any survey application from shallow to deep water operations. The 4200 utilizes EdgeTech's Full Spectrum® CHIRP technology to provide crisp, high resolution imagery at ranges up to 50% greater than non-CHIRP systems; thus allowing customers to cover larger areas and save money spent on costly surveys.

One of the unique features of the 4200 is the optional Multi-Pulse (MP) technology, which places two sound pulses in the water rather than one pulse like conventional side scan sonar systems. This allows the 4200 to be towed at speeds of up to 10 knots while still maintaining 100% bottom coverage. In addition, the MP technology will provide twice the resolution when operating at normal tow speeds, thus allowing for better target detection and classification ability. The addition of the optional MP technology provides the operator with two modes of operation; either High Definition Mode (HDM) or High Speed Mode (HSM). This software-selectable mode of operation provides the operator the ability to select the best configuration for the specific job type.

All EdgeTech 4200 systems are comprised of a topside system and a reliable stainless steel towfish. A choice of dual simultaneous frequency sets are available to the user and topside processors come in a choice of configurations from portable to rack mounted units. In addition, an easy-to-use GUI software is supplied with every unit.



4200 SERIES

SIDE SCAN SONAR SYSTEM

KEY SPECIFICATIONS

SONAR SPECIFICATIONS	STANDARD	WITH OPTIONAL MP TECHNOLOGY
Frequency	Choice of either 100/400, 300/600 or 300/900 kHz dual simultaneous	
Operating Range (meters/side)	100 kHz: 500m, 300 kHz: 230m, 400 kHz: 150m, 600 kHz: 120m, 900 kHz: 75m	
Horizontal Beam Width:	100 kHz: 1.5°, 300 kHz: 0.5°, 400 kHz: 0.4°, 600 kHz: 0.26°, 900 kHz: 0.2°	<p>In High Speed Mode: 100 kHz: 1.26°, 300 kHz: 0.54°, 400 kHz: 0.4°, 600 kHz: 0.34°, 900 kHz: 0.3°</p> <p>In High Definition Mode: 100 kHz: 0.64°, 300 kHz: 0.28°, 400 kHz: 0.3°, 600 kHz: 0.26°, 900 kHz: 0.2°</p>
Resolution Along Track	<p>100 kHz: 5 m @ 200 m</p> <p>300 kHz: 1.3 m @ 150 m</p> <p>400 kHz: 0.6 m @ 100 m</p> <p>600 kHz: 0.45 m @ 100 m</p> <p>900 kHz: 18 cm @ 50 m</p>	<p>High Definition Mode:</p> <p>100 kHz: 2.5m @ 200m</p> <p>300 kHz: 1.0m @ 200m</p> <p>400 kHz: 0.5m @ 100m</p> <p>600 kHz: 0.45m @ 100m</p> <p>900 kHz: 18 cm @ 50m</p> <p>High Speed Mode:</p> <p>100 kHz: 4.4m @ 200m</p> <p>300 kHz: 1.9m @ 200m</p> <p>400 kHz: 0.7m @ 100m</p> <p>600 kHz: 0.6m @ 100m</p> <p>900 kHz: 26 cm @ 50m</p>
Resolution Across Track	100 kHz: 8 cm, 300 kHz: 3 cm, 400 kHz: 2 cm, 600 kHz: 1.5 cm, 900 kHz: 1 cm	
Vertical Beam Width	50°	
Depression Angle	Tilted down 20°	
TOWFISH	STAINLESS STEEL	
Diameter	11.4 cm (4.5 inches)	
Length	125.6 cm (49.5 inches)	
Weight in Air/Saltwater	48 / 36 kg (105 / 80 pounds)	
Depth Rating (Max)	2,000m	
Standard Sensors	Heading, pitch & roll	
Optional Sensor Port	(1) Serial – RS 232C, 9600 Baud, Bi-directional & 27 VDC	
Options	Pressure Sensor, Magnetometer, Integrated USBL Acoustic Tracking System, Built-in Responder Nose, Depressor, Power Loss Pinger and Custom Sensors	
TOPSIDE PROCESSOR	4200-P	4200 701-DL INTERFACE
Hardware	Portable splash-proof case	19" rack mount computer 19" rack mount interface
Display & Interface	Splash-proof laptop	21" flat panel monitor, keyboard & trackball Customer-supplied
Power Input	20-36 VDC or 115/230 VAC	115/230 VAC 115/230 VAC
Operating System	Windows® 7	
File Format	Native JSF or XTF	
Output	Ethernet	
TOW CABLE	Coaxial Kevlar or double-armored up to 6,000m, winches available	

For more information please visit EdgeTech.com

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4125

SIDE SCAN SONAR SYSTEM

FEATURES

- Ultra high resolution images
- Lightweight for one person deployment
- Standard heading, pitch, roll & pressure sensors
- Choice of dual simultaneous frequencies
- Runs on AC or DC
- Pole mount option for shallow water use

APPLICATIONS

- Hydrographic Surveys
- Geological Surveys
- Search & Recovery
- Channel/Clearance Surveys
- Bridge/Pier/Harbor Wall Inspection
- Hull Inspections



EdgeTech's 4125 Side Scan Sonar System was designed with both the Search & Recovery (SAR) and shallow water survey communities in mind. The 4125 utilizes EdgeTech's Full Spectrum® CHIRP technology, which provides higher resolution imagery at ranges up to 50% greater than non-CHIRP systems operating at the same frequency. This translates into more accurate results and faster surveys, thus cutting down on costs.

Two dual simultaneous frequency sets are available for the 4125 depending on the application. The 400/900 kHz set is the perfect tool for shallow water survey applications, providing an ideal combination of range and resolution. The 600/1600 kHz set is ideally suited for customers that require ultra high resolution imagery in order to detect very small targets (SAR).

There are two towfish options for the system; one with telemetry and one without. The towfish with added telemetry provides the ability to operate over longer tow cable lengths for operation in deeper waters. Both frequency sets are available for either towfish.

The 4125 system can be powered by both AC and DC for added versatility and is delivered in portable rugged cases for ease of transport from site-to-site. As is standard with all of EdgeTech's towed side scan systems, the 4125 comes with a safety recovery system which will prevent the loss of a towfish if it becomes snagged on an obstacle during a survey.

A standard 4125 System comes with a choice of towfish and a portable water resistant topside processor with a splash-proof, drop & shock resistant laptop computer including EdgeTech's easy-to-use Discover acquisition software. A 50m Kevlar tow cable is included as standard with customer-specified lengths also available. Multiple options are available such as a v-fin depressor, keel weight, pole mount and hull scan bracket for added versatility.



For more information please visit EdgeTech.com

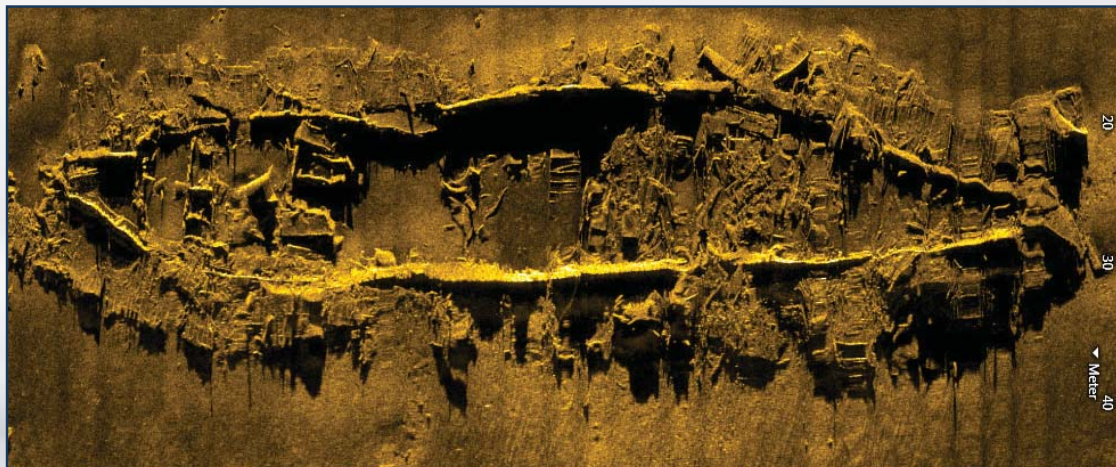
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4125

SIDE SCAN SONAR SYSTEM

KEY SPECIFICATIONS

SONAR		
Frequencies (Dual Simultaneous)	Choice of either a 400/900 kHz or 600/1600 kHz towfish	
Pulse Type	EdgeTech's Full Spectrum® CHIRP (user-selectable CW pulses also included)	
Operating Range	150m @ 400 kHz, 75m @ 900 kHz; 120m @ 600 kHz, 35m @ 1600 kHz	
Horizontal Beam Width	0.46° @ 400 kHz, 0.28° @ 900 kHz; 0.33° @ 600 kHz, 0.20° @ 1600 kHz	
Vertical Beam Width	50°	
Resolution Across Track	400 kHz: 2.3 cm, 900 kHz: 1.5 cm, 600 kHz: 1.5 cm, 1600 kHz: 0.6 cm	
TOWFISH	4125 Towfish	4125 Towfish with added telemetry*
Diameter	9.5 cm (3.75 inches)	9.5 cm (3.75 inches)
Length	97 cm (38 inches)	112 cm (44 inches)
Weight in Air	15 kg (34 pounds)	20 kg (44 pounds)
Tow Cable Type	Multi-conductor up to 150m max length (will provide a typical operational depth down to 50m)	Coaxial up to 600m max length (will provide a typical operational depth down to 200m)
Max Depth Rating of Towfish	200m	
Material	Stainless Steel	
Standard Sensors	Heading, Pitch, Roll, Pressure (Depth)	
* The 4125 Towfish with added telemetry is slightly larger to incorporate the electronics necessary to run over longer coaxial tow cables		
SPLASH-PROOF TOPSIDE PROCESSOR		
Power Input	12-24 VDC or 115/230 VAC, 50/60 Hz	
Connections	AC, DC, Ethernet (to laptop), Towfish	
Hardware	Ruggedized splash-proof, drop & shock resistant laptop	
Operating System	Windows® XP	
Acquisition Software	EdgeTech DISCOVER	
SYSTEM OPTIONS	Keel weight, v-fin depressor wing, pole mount, quick change hull scan bracket	



For more information please visit EdgeTech.com

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G-882 MARINE MAGNETOMETER

- **CESIUM VAPOR HIGH PERFORMANCE** – Highest detection range and probability of detecting all sized ferrous targets
- **NEW STREAMLINED DESIGN FOR TOW SAFETY** – Low probability of fouling in lines or rocks
- **NEW QUICK CONVERSION FROM NOSE TOW TO CG TOW** – Simply remove an aluminum locking pin, move tow point and reinsert. New built in easy carry handle!
- **NEW INTERNAL CM-221 COUNTER MODULE** – Provides Flash Memory for storage of default parameters set by user
- **NEW ECHOSOUNDER / ALTIMETER OPTION**
- **NEW DEPTH RATING** – 4,000 psi !
- **HIGHEST SENSITIVITY IN THE INDUSTRY** – 0.004 nT/√Hz RMS with the internal CM-221 Mini-Counter
- **EASY PORTABILITY & HANDLING** – no winch required, single man operation, only 44 lbs with 200 ft cable (without weights)
- **COMBINE TWO SYSTEMS FOR INCREASED COVERAGE** – Internal CM-221 Mini-Counter provides multi-sensor data concatenation allowing side by side coverage which maximizes detection of small targets and reduces noise

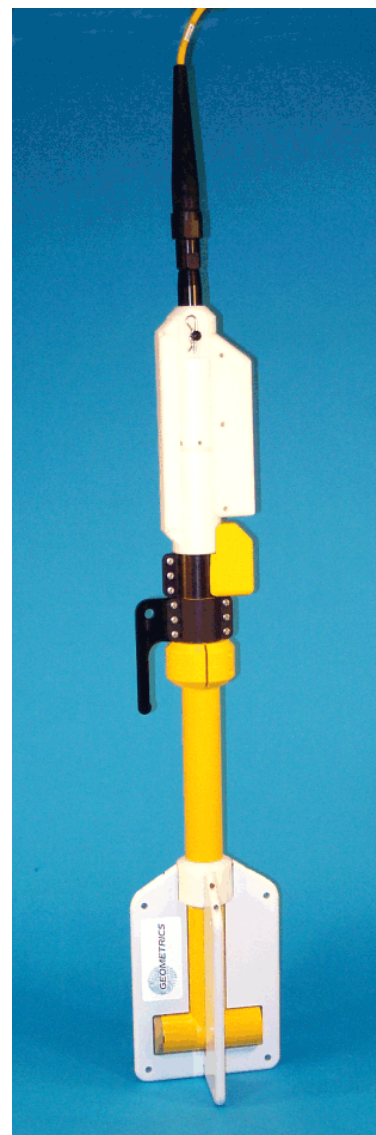
Very high resolution Cesium Vapor performance is now available in a low cost, small size system for professional surveys in shallow or deep water. High sensitivity and sample rates are maintained for all applications. The well proven Cesium sensor is combined with a unique and new CM-221 Larmor counter and ruggedly packaged for small or large boat operation. Use your computer and standard printer with our MagLogLite™ software to log, display and print GPS position and magnetic field data. The G-882 is the lowest priced high performance full range marine magnetometer system ever offered.

The G-882 offers flexibility for operation from small boat, shallow water surveys as well as deep tow applications (4,000 psi rating, telemetry over steel coax available to 10Km). The G-882 also directly interfaces to all major Side Scan manufacturers for tandem tow configurations. Being small and lightweight (44 lbs net, without weights) it is easily deployed and operated by one person. But add several streamlined weight collars and the system can quickly weigh more than 100 lbs. for deep tow applications. Power may be supplied from a 24 to 30 VDC battery power or the included 110/220 VAC power supply. The tow cable employs high strength Kevlar

strain member with a standard length of 200 ft (61 m) and optional cable length up to 500m with no telemetry required.

A rugged fiber-wound fiberglass housing is designed for operation in all parts of the world allowing sensor rotation for work in equatorial regions. The shipboard end of the tow cable is attached to an included junction box or optional on-board cable for quick and simple hookup to power and output of data into any Windows 98, ME, NT, 2000 or XP computer equipped with RS-232 serial ports.

The G-882 Cesium magnetometer provides the same operating sensitivity and sample rates as the larger deep tow model G-880. MagLogLite™ Logging Software is offered with each magnetometer and allows recording and display of data and position with Automatic Anomaly Detection and automatic anomaly printing on Windows™ printer! Additional options include: MagMap2000 plotting and contouring software and post acquisition processing software MagPick™ (free from our website.)



**G-882 with Weight Collar
Depth Option & Altimeter**

The G-882 system is particularly well suited for the detection and mapping of all sizes of ferrous objects. This includes anchors, chains, cables, pipelines, ballast stone and other scattered shipwreck debris, munitions of all sizes (UXO), aircraft, engines and any other object with magnetic expression. Objects as small as a 5 inch screwdriver are readily detected provided that the sensor is close to the seafloor and within practical detection range. (Refer to table at right).

The design of this high sensitivity G-882 marine unit is directed toward the largest number of user needs. It is intended to meet all marine requirements such as shallow survey, deep tow through long cables, integration with Side Scan Sonar systems and monitoring of fish depth and altitude.

Typical Detection Range For Common Objects

Ship 1000 tons	0.5 to 1 nT at 800 ft (244 m)
Anchor 20 tons	0.8 to 1.25 nT at 400 ft (120 m)
<u>Automobile</u>	<u>1 to 2 nT at 100 ft (30 m)</u>
Light Aircraft	0.5 to 2 nT at 40 ft (12 m)
Pipeline (12 inch)	1 to 2 nT at 200 ft (60 m)
<u>Pipeline (6 inch)</u>	<u>1 to 2 nT at 100 ft (30 m)</u>
100 KG of iron	1 to 2 nT at 50 ft (15 m)
100 lbs of iron	0.5 to 1 nT at 30 ft (9 m)
10 lbs of iron	0.5 to 1 nT at 20 ft (6 m)
1 lb of iron	0.5 to 1 nT at 10 ft (3 m)
Screwdriver 5 inch	0.5 to 2 nT at 12 ft (4 m)
<u>1000 lb bomb</u>	<u>1 to 5 nT at 100 ft (30 m)</u>
500 lb bomb	0.5 to 5 nT at 50 ft (16 m)
Grenade	0.5 to 2 nT at 10 ft (3 m)
20 mm shell	0.5 to 2 nT at 5 ft (1.8 m)

MODEL G-882 CESIUM MARINE MAGNETOMETER SYSTEM SPECIFICATIONS

OPERATING PRINCIPLE:	Self-oscillating split-beam Cesium Vapor (non-radioactive)
OPERATING RANGE:	20,000 to 100,000 nT
OPERATING ZONES:	The earth's field vector should be at an angle greater than 6° from the sensor's equator and greater than 6° away from the sensor's long axis. Automatic hemisphere switching.
CM-221 COUNTER SENSITIVITY:	<0.004 nT/√Hz rms. Up to 20 samples per second
HEADING ERROR:	±1 nT (over entire 360° spin)
ABSOLUTE ACCURACY:	<2 nT throughout range
OUTPUT:	RS-232 at 1,200 to 19,200 Baud
MECHANICAL:	
Sensor Fish:	Body 2.75 in. (7 cm) dia., 4.5 ft (1.37 m) long with fin assembly (11 in. cross width), 40 lbs. (18 kg) Includes Sensor and Electronics and 1 main weight. Additional collar weights are 14lbs (6.4kg) each, total of 5 capable
Tow Cable:	Kevlar Reinforced multiconductor tow cable. Breaking strength 3,600 lbs, 0.48 in OD, 200 ft maximum. Weighs 17 lbs (7.7 kg) with terminations.
OPERATING TEMPERATURE:	-30° F to +122° F (-35° C to +50° C)
STORAGE TEMPERATURE:	-48° F to +158° F (-45° C to +70° C)
ALTITUDE:	Up to 30,000 ft (9,000 m)
WATER TIGHT:	O-Ring sealed for up to 4,000 psi (9000 ft or 2750 m) depth operation
POWER:	24 to 32 VDC, 0.75 amp at turn-on and 0.5 amp thereafter
ACCESSORIES:	
Standard:	View201 Utility Software operation manual and ship kit
Optional:	Telemetry to 10Km coax, gradiometer (longitudinal or transverse), reusable shipping case
MagLog Lite™ Software:	Logs, displays and prints Mag and GPS data at 10 Hz sample rate. Automatic anomaly detection and single sheet Windows printer support

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

12/06

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GEOMETRICS CHINA

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Geo-Source 200 Light Weight Marine Multi-Tip Sparker System



Applications

- Small vessel surveys
- Site & route surveys
- Offshore engineering
- Mineral exploration
- Sand searches
- Oceanographic research



Examples of Records

To see examples of our sparker records, please visit the 'Downloads' page on our website:
www.geo-spark.com

Efficient & Cost Effective

With the Geo-Spark HV power supplies you will save a lot of time and money, since the electrodes do NOT burn off like in all other systems.

You don't need to trim tips during the survey. There is no need to have any stock of consumables.

Operational Features

- Specially designed for small vessel surveys,
- Can be handled by one person
- Water depths from 2 to 500 m
- Penetration to 200 - 300 ms below seabed depending on geology
- Vertical resolution up to 10- 30 cm
- Overall performance depending on acoustic characteristics of vessel, geology and acquisition conditions

INNOVATIVE Preserving Electrode Mode

The Geo-Source 200 light weight is designed for operation with the Geo-Spark 1000 Pulsed Power Supply using the "Preserving Electrode Mode". This patented concept consists of using a NEGATIVE electric discharge pulse, instead of a positive electric discharge pulse.

Note that working with a negative pulse is NOT the same thing as reversing the polarity of an antique power supply, which is generating a positive pulse.

Maintenance free Electrodes

5 year guarantee

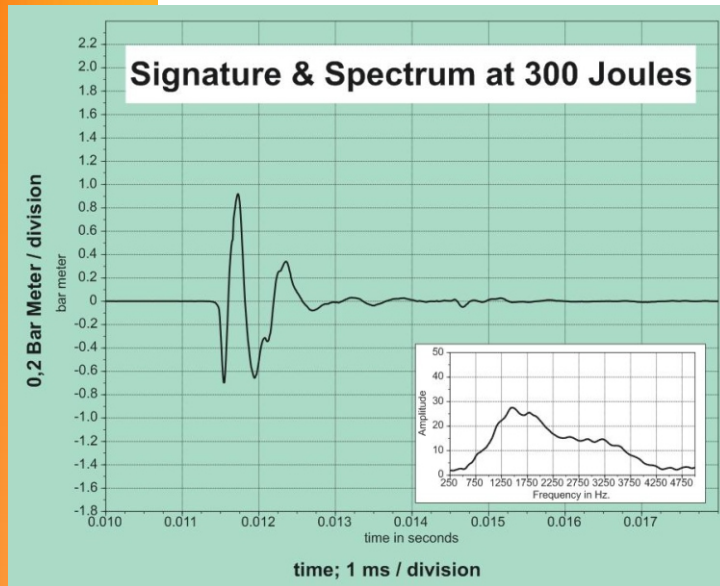
The Preserving Electrode Mode reduces the tip wear to practically **zero**. You can shoot day after day, week after week, month after month with practically **NO tip maintenance**.

Optimum Acoustic Repeatability

Zero tip wear is essential for the repeatability of the acoustic pulse, which depends largely on a constant, unaltered electrode surface.



Electrode tip after three years of operation



Control of All Sparker Parameters

The advanced Geo-Source 200 L design gives you full control of:

- Source depth and geometry
- Joules per tip
- Number of tips actively in use

- The effective source depth is set to 15 - 20 cm below the surface. A constant source depth at 1/4 of the wavelength is essential in order to optimize the constructive interference between the primary pulse and surface ghost.
- The electrode modules are evenly spaced in a planar array of 0.50 m x 1.00 m. This geometry not only enhances the downward projection of the acoustic energy, it also reduces the primary pulse length, since all tips are perfectly in phase.
- Two electrode modules of 100 tips each allow the distribution of energy from the Geo-Spark 1000 PPS over 100 or 200 tips.
- Each tip has an exposed surface of 1.4 mm², suitable for maximum 10 Joules per tip.
- The standard electrode configuration with the Geo-Spark 1000 consists of 2 electrode modules of 100 tips each. This configuration gives an excellent pulse over the 100 - 1000 Joule power range.
- For the highest resolution it is recommended to set the energy output < 400 Joule. This power is usually sufficient in water depths to 300 m

Flexible & floating HV tow cable

A flexible, floating power/tow cable with a standard length of 25 m plus 6 m jumpers to the PS is available for small vessel operations.

This dedicated coaxial HV cable contains 4 leads of 6 mm² plus outer braiding of 24 mm²

It is designed to have a low self-inductance in order to preserve the high dI/dt pulse output of the Geo-Spark 1000.

The wet side of the cable is terminated with two special HV connectors to the electrode modules and a ground connector to the frame. Connecting or disconnecting the cable to the Geo-Source 200 L takes not more than ten minutes. The cable weights only 35 kg and is easy to handle by one person.



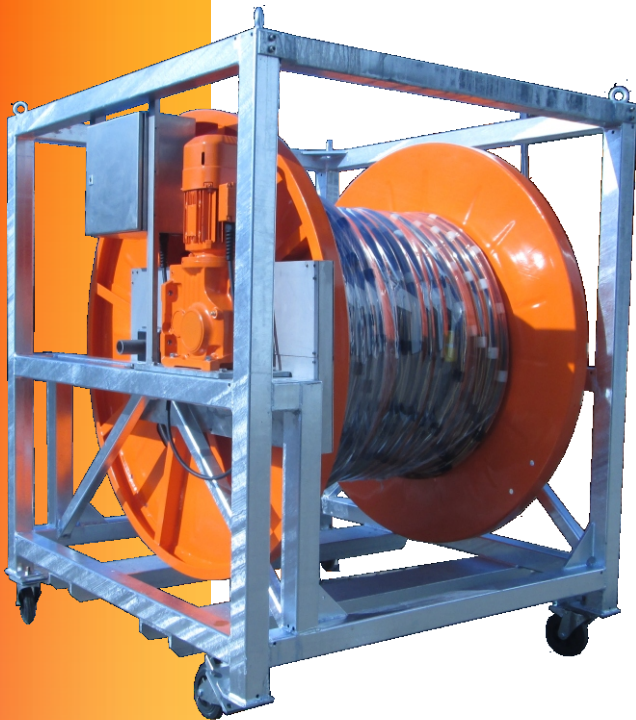
Compatible with standard 50 m floating HV Power cable on reel with axial contacts

The Geo-Source 200 L is compatible with the standard cable for the Geo-Source 800 and 200, and can also be towed by the (4 x 10 mm²) power cable on the dedicated cable reel with axial rotating contacts.

Cable Reel with axial contacts



Geo-Sense Classic HR & UHR 24-48 Channel Streamers



Electric streamer winch
in Box frame



Electric streamer winch
in A - frame

Classic Versatile Design

- The classic multi-channel Geo-Sense streamer is using a large diameter PU skin with an outer diameter of 51 mm
- The harness consists of 45 mm Delrin spacers and two 8 mm Kevlar ropes with a total pulling strength of > 9 ton !!
- Under normal towing condition the Kevlar harness has practically no elongation.
- The maximum total array length is rather limited by the maximum number of channels (48 x 12.5 m = 600 m) than by the physical limitations of the harness
- The 45 mm diameter of the harness allows obviously to use small HF hydrophones such as the AQ 2000 but also the larger size LF hydrophones such as the Geopoint
- Consequently, the customer can choose the specific hydrophone for his application
- For instance the streamer can be specifically designed to capture the HF spectrum emitted by the Geo-Source Sparkers
- Alternatively, the streamer can be designed for a low frequency source such as an Air gun or Water gun
- Ultra short custom connectors ensure a small bending radius < 40 cm and small cable reel / winch
- Standard interfacing to Multi-Trace 24-48 via one or two ITT 62 pin D connectors
- It is possible to accommodate com. coils for depth controllers
- The classic analogue design is repairable in any cable shop, which gives the user a lot of freedom
- We also build high quality streamer winches in various models, see picture
- All winches feature the integrated Multi-Trace recording module (see Multi-Trace Data sheet)

Information sheet to be completed for quotation

STREAMER GEOMETRY

<i>Group Length, # of Hydrophones,</i>	depending on spectrum source
<i>Group Spacing:</i>	3.125 m , 6.25 m or 12.5 m, or custom
<i>Deck Lead:</i>	25 m or 50 m armoured LAN
<i>Tow lead:</i>	100 m - 75 m
<i>Front-Stretch:</i>	12.5 - 25.0 m - 50.0 m
<i># of active sections</i>	to be defined
<i>Active section length:</i>	100 m maximum
<i>Tail-Stretch:</i>	12.5 - 25.0 m - 50.0 m
<i>Total length streamer c/w tow lead</i>	to be defined

STREAMER STRUCTURE

<i>Jacket size ID & OD:</i>	45 mm & 51,3 mm
<i>Jacket material:</i>	Unreinforced polyurethane, wall thickness 3.14 mm
<i>Connectors</i>	depending on # sections
<i>Spacing of spacers</i>	24 cm
<i>Stress members</i>	2 x 8mm Kevlar rope, breaking strength >4500 kg
<i>Ballast fluid:</i>	Shell Sol T (standard)
<i>Buoyancy:</i>	Slightly positive, must be zero balanced using lead
<i>Wiring:</i>	32 twisted pair, super flexible, conductor diam 0,38mm
<i>Shielding</i>	100 % ground shielding all along

HYDROPHONE

<i>type;</i>	AQ 2000, Geopoint or Sensor
<i>No of hydrophones per group:</i>	to be defined

PRE-AMP (option)

<i>Type</i>	GEO, High imp, low noise, differential pre-amplifier
<i>Gain:</i>	26 dB
<i>Size:</i>	60 x 16 mm
<i>Gain:</i>	26 dB
<i>Ground reference:</i>	Single-ended
<i>Power :</i>	9 -12 V DC (polarity protected)
<i>High-pass:</i>	-3 dB : 3 Hz
<i>Low-pass:</i>	-3 dB :13 kHz
<i>ESD handling</i>	conform IEC 61000-4 norm

TOW -CABLE

<i>Length:</i>	Standard 75 m or 100 m
<i>Diameter:</i>	18 - 22 mm
<i>Type:</i>	31 or 62 screened twisted pair extra flex 26 AWG
<i>Insulation:</i>	Polyurethane
<i>Strain member:</i>	Double reverse spiral Kevlar, 2.5 ton breaking strength
<i>Termination</i>	62 pin ITT D connector compatible with Multi-Trace 24

ELECTRIC WINCH for 48 channel

foot print 160 x 170 cm, height 180 cm, weight 300 kg
Multi-Trace integrated in winch
LAN deck lead to acquisition PC

Depth Control & Positioning

Lead-in depth controller, AIS-GPS option
Tail depth controller with sea anchor AIS-GPS option
Optional Communication coils for depth controles

SVP 14/ SVP 15

SOUND VELOCITY PROBES 40 m / 200 m

SVP 14/15 sound velocity probes are designed to measure the sound velocity profile in the water column.

SVP 14/15 measures the sound velocity and depth information directly whilst underway.

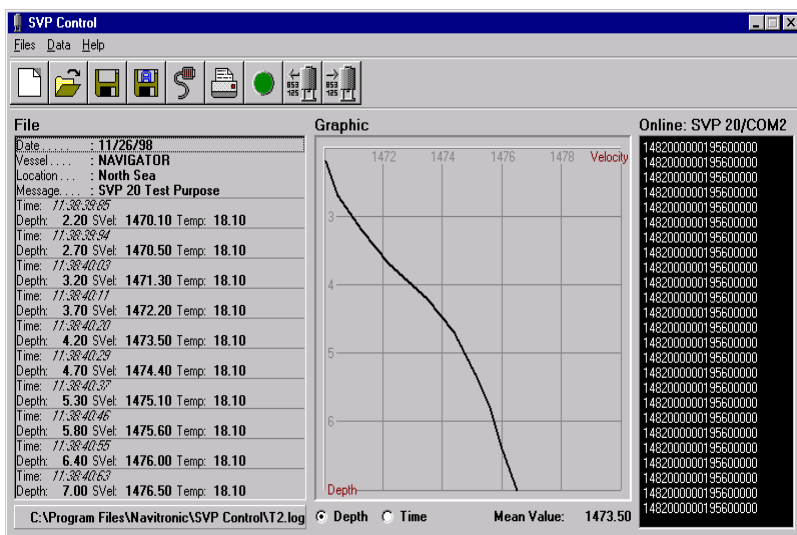
SVP 14/15 operates by measuring the sound velocity using sounding technology.

SVP 14/15 either sends the sound velocity data directly via cable to an external device, or operates autonomously - storing information inside the internal memory.

SVP 14/15 includes an integrated battery.

SVP 14/15 controlling, logging and presentation software is included.

SVP 14/15 is constructed as a compact module.



Features:

- Self recording and/or direct reading.
- High precision absolute sound velocity measurement.
- Handy and portable, easy to use.
- Integrated battery, giving long operation
- Based on well-proven and reliable design.
- Integrated verification procedures.
- Long life-time, very low maintenance cost.
- PC software included
- External battery charger with external power supply and data read out.



NAVITRONIC

TECHNICAL DETAILS

SVP 14/ SVP 15		SPECIFICATIONS
Sound velocity:	Range: Resolution: Accuracy:	1350 to 1600 m/s. 0.1 m/s. ± 0.25 m/s.
Depth:	Range: Measurement: Accuracy:	SVP 14: 40m in 0.5m steps. SVP 15: 200m in 0.5m steps Pressure sensor. ± 0.10m + 0.2% of measured depth.
Barometric adjustment:		Self adjusting zero point
Ultrasonic transmitter:	Power: Output rate: Frequency:	1 Watt. 10 Hz 2 MHz (nominal).
Data transmission:		RS-232 at 9600 Baud, 7 Stop Bit, Odd parity, 2 Stop Bit
Memory capacity:		SVP 14: 80 measurements SVP 15: 400 measurements
Operating temperature:		0 - 45° C.
Power consumption: Power source:	Operating:	100 mA. Internal sealed rechargeable batteries, providing a minimum of 20 hours continuous operation.
Reflector housing: Housing: Connector: Weight: Dimensions:	Tube diameter: Max. diameter: Length:	Marine grade stainless steel. Black polycarbonate. 6 pin Subcon. 5.0 kg. 90 mm. 100 mm. 550 mm (including reflector).
Control:		SVP 14/15 PC software package, including logging and presentation features.
External unit:		Power supply / Interface Box. 2m cable for SVP 14/15 and 9 pin female D-SUB connector for PC interfacing.

Ruggedized transport case included.

Options:

- **SVPD 10** Unit for manual data read out.
- Electrical wire winch, with 3.0mm steel wire at selectable length.

NOTE: Specify main voltage for Power Supply/Interface Box. Available: 220V AC, 110V AC, 24V DC (Standard is 220V AC)

Subject to change without notice - May. 2000/MAC\$VP14-15_02.DOC)



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