

# APPENDIX A

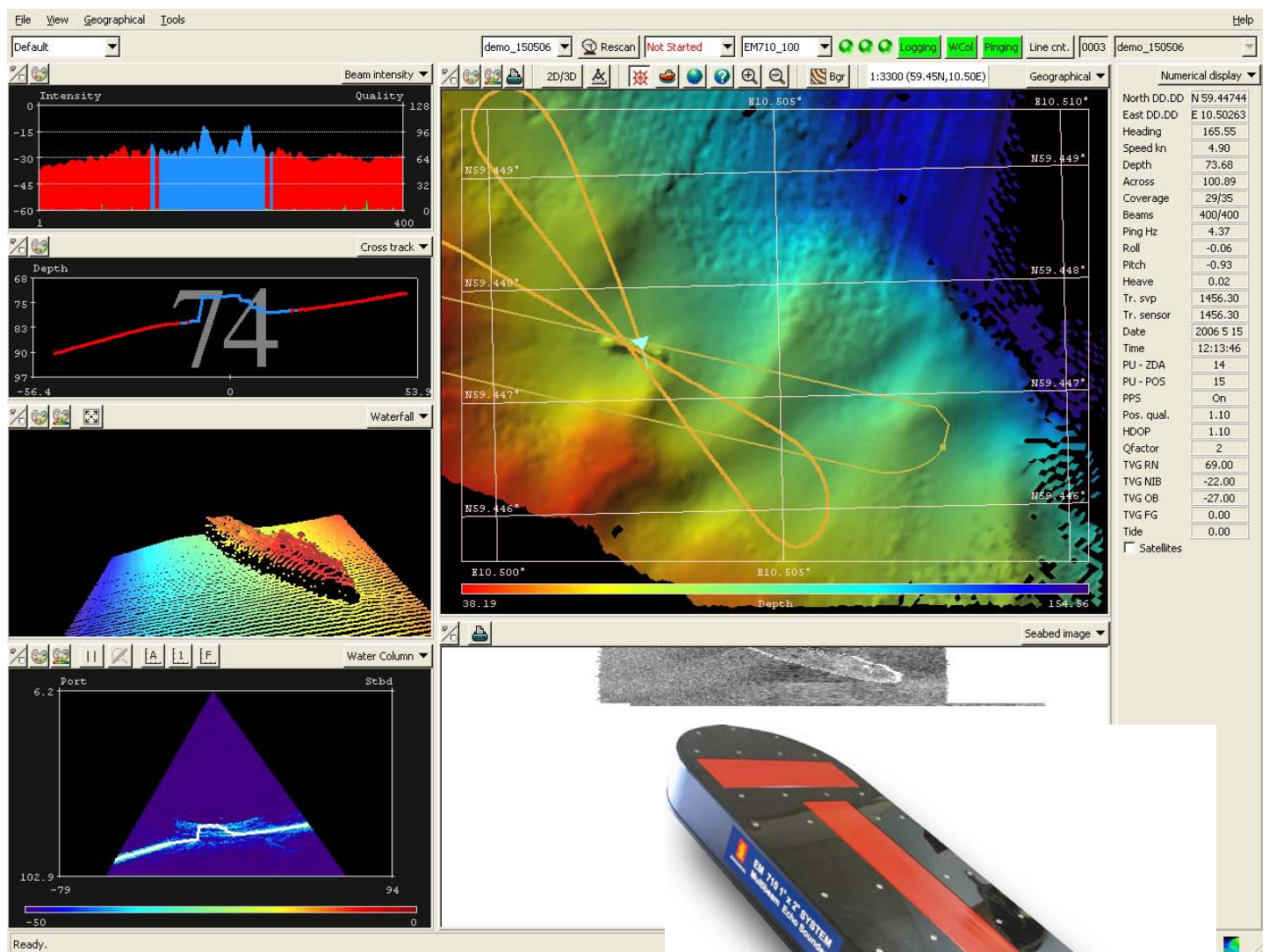
## Information on Typical Equipment and Shipping



KONGSBERG

# EM 710

## Multibeam echo sounder High resolution seabed mapping system



### System overview

The EM 710 multibeam echo sounder is a high to very high resolution seabed mapping system capable of meeting all relevant survey standards. The system configuration can be tailored to the user requirements, allowing for choice of beam widths as well as transmission modes.

The minimum acquisition depth is from less than 3 m below its transducers, and the maximum acquisition depth is approximately 2000 m, somewhat dependant upon array size. Across track coverage (swath width) is up to 5.5 times water depth, to a maximum of more than 2000 m.

### Echo sounder models

There are three basic versions of the EM 710 system, with different range performances:

- EM 710 - Full performance version.
- EM 710S - CW pulse forms only.
- EM 710RD - Short CW pulse only.

### Choice of beamwidths

The along track beamwidth depends upon the chosen transducer configuration with 0.5, 1 and 2° available as standard. The receive beam width is either 1 or 2° depending on the chosen receive transducer.

### Innovative acoustic principles

The EM 710 operates at sonar frequencies in the 70 to 100 kHz range. The transmit fan is divided into three sectors to maximize range capability, but also to suppress interference from multiples of strong bottom echoes. The sectors are transmitted sequentially within each ping, and uses distinct frequencies or waveforms. EM 710S and EM 710RD both use CW pulses of different lengths. The full performance version, EM 710, supports even longer, compressible waveforms (FM sweep).

### Fully stabilized and focused beams

The system applies beam focusing to both transmit and receive beams in order to obtain the maximum resolution also inside the acoustic near-field. During transmission, focusing is applied individually to each transmit sector with a focus point on the range defined by the previous ping, to retain the angular resolution in the near field. Dynamic focusing is applied to all receive beams. The transmit beams are electronically stabilized for roll, pitch and yaw, while the receive beams are stabilized for roll movements.

### Controlled, dense and accurate soundings

The beam spacing may be set to be either equiangular or equidistant. The maximum swath coverage may be limited by the operator either in angle or in swath width without reducing the number of beams. A combination of phase and amplitude bottom detection algorithm is used, in order to provide soundings with the best possible accuracy.

The number of beams varies with the beamwidth. The system generates 256 beams/400 soundings per ping for 0.5 and 1° systems, and 128beams/200 soundings for a 2° system.

### Transducers

The active elements of the EM 710 transducers are based upon composite ceramics, a design which has several advantages, in particular increased bandwidth and tighter performance tolerances. The transducers are fully watertight units which will give many years of trouble-free operation.

The 1x2° and 2x2° versions can be mounted on a pole for portable deployment, while the larger transducer versions are for permanent mounting; flush with the hull, in a blister or in a gondola construction.

### Transceiver Unit

The EM 710 electronics system is a true wideband design. The transmitter circuits are fully programmable to support any frequency or pulse form. The use of FM sweep as a pulse form allows for more energy per pulse and thus increased range performance, without any sacrifice of range resolution.

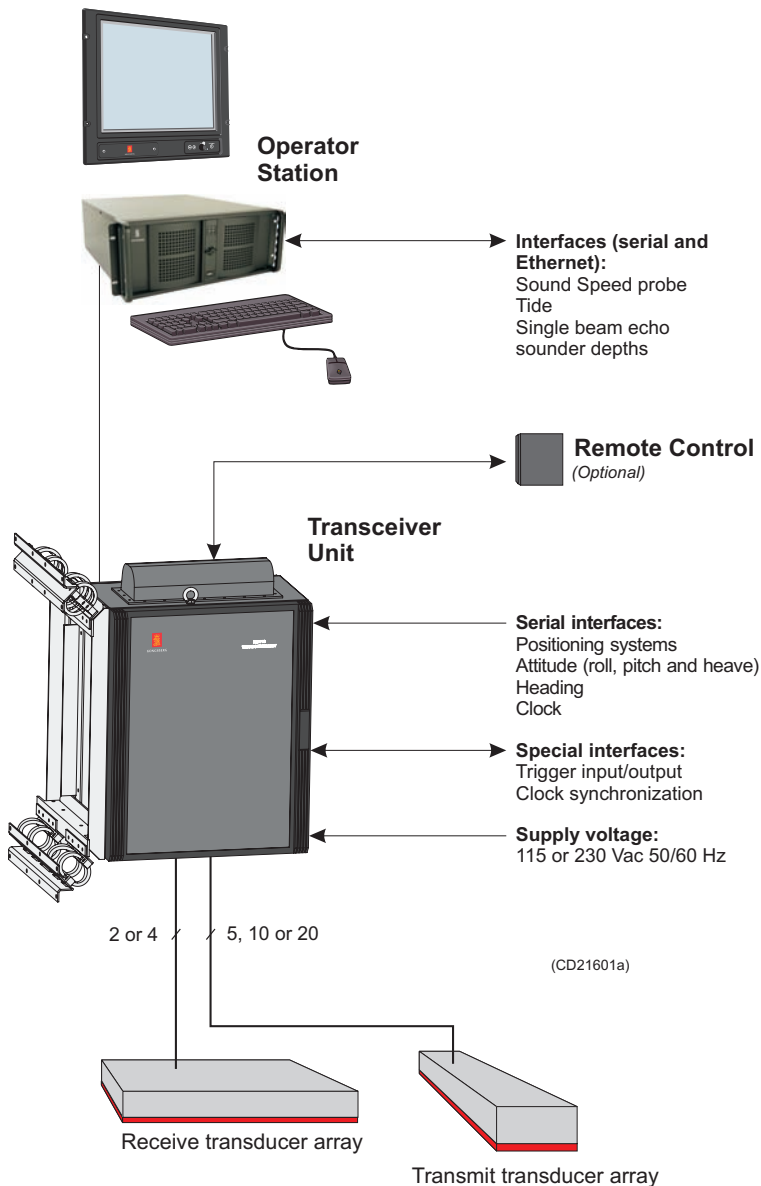
The non-saturating and low noise receivers and A/D converters are of floating point type, resulting in a dynamic range of more than 140 dB. The conventional TVG compensation is no longer needed.

Filters, correlators and beamformers are fully digital implementations, and the beam forming method is by time delays, to allow for the wide frequency band of the system.

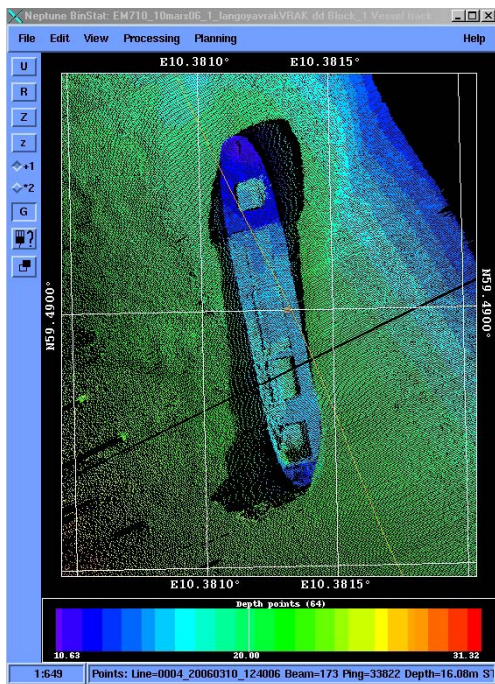
### Operator Station

The Operator Station is the HWS high performance dual-processor PC workstation is used as. It is dual bootable to either Linux® or Windows XP®.

The HWS is normally supplied with a 19" industrialized LCD monitor with a resolution of 1280x1024 pixels. Support for a second monitor is included. A spill-proof US keyboard and a standard optical mouse is normally supplied.



Typical system configuration with desktop Operator Station, Transceiver Unit and transducer arrays



The image of a sunken wreck at 20 m depth.

## Advanced functions

- Integrated seabed acoustical imaging capability is included as standard. Software to use this data for automatic seabed classification is available.
- A real time display window for water column backscatter is available. Logging of water column data and of raw stave data (before beamforming) is a system option.
- A high density beam processing mode provides up to 400 or 200 soundings per swath. In order to make the soundings independent, a limited range window is set inside each beam for each sounding. In practice this is equivalent to synthetically sharpening the beam width.
- With a  $0.5^\circ$  transmit and  $1^\circ$  receive transducer the system will be able to generate two separate alongtrack swaths per ping. The system produces up to 800 soundings per ping in this mode.
- The Operator Station includes the necessary operator controls for setting up and running the system, data logging and system testing.
- The Seafloor Information System (SIS) includes an extensive set of graphical displays for data quality control, as well as system calibration and other tools which are required. SIS supports on-line real-time data cleaning to improve the overall survey efficiency.
- Post-processing software for the EM 710 is available from both Kongsberg Maritime and third-party suppliers.



## Technical specifications

Frequency range	70 to 100 kHz
Max ping rate	30 Hz
Swath coverage sector	Up to 140 degrees
Depth resolution	1 cm
Min depth	3 m below transducer

Max depth (approximate values)	EM 710	EM 710S	EM 710RD
	2000 m	1000 m	600 m
CW transmit pulses	0.15 to 2 ms	0.15 to 2 ms	0.15 ms
FM sweep pulse	Max 200 ms	No	No

Roll stabilized beams	Yes, $\pm 15^\circ$
Pitch stabilized beams	Yes, $\pm 10^\circ$
Yaw stabilized beams	Yes, $\pm 10^\circ$
Sounding patterns	Equiangular
	Equidistant
	High Density

Transducer choices	0.5 x 1°	1 x 1°	1 x 2°	2 x 2°
Availability	Not EM 710RD	Not EM 710RD	All models	All models
TX dimensions (L x W x H)	1940 x 224 x 118 mm	970 x 224 x 118 mm	970 x 224 x 118 mm	490 x 224 x 118 mm
RX dimensions (L x W x H)	970 x 224 x 118 mm	970 x 224 x 118 mm	490 x 224 x 118 mm	490 x 224 x 118 mm
Max coverage (approximate values)	2500 m	2300 m	2200 m	2100 m
Max no. of soundings per ping	800 (2 profiles per ping)	400	200	200

Transceiver Unit dimensions (W x H x D)	540 x 841 x 750 mm (including shock absorbers)
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Kongsberg Maritime is engaged in continuous development of its products, and reserves the right to alter the specifications without further notice.

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**KONGSBERG**

# 4200-MP SIDE SCAN SONAR SYSTEM

*Technologically  
advanced digital  
Dual Mode high-  
resolution side scan  
sonar system*



The *EdgeTech 4200-MP Side Scan Sonar System* provides a unique advantage over conventional dual frequency side scan systems by combining EdgeTech's Full Spectrum and Multi-Pulse technologies into one unit. The 4200-MP comes available with a choice of three dual simultaneous frequency sets; either 100/400 kHz, 300/600 kHz or 300/900 kHz, and offers two software selectable modes of operation:

- **High Definition Mode (HDM)** - conventional dual simultaneous frequency operation with extra long array for superior resolution; excellent tool for Mine Countermeasures (MCM).
- **High Speed Mode (HSM)** - Multi-Pulse operation on either selected frequency for speeds up to 10 knots, while meeting NOAA and IHO-44 requirements for Hydrographic Survey for "hits on target" compared to conventional systems at 4 knots. This is an additional feature for high-speed navy patrol vessels.

## Features:

- Either 100/400, 300/600 or 300/900 kHz dual simultaneous frequencies
- Selectable dual mode of operation: High Definition Mode (HDM) or High Speed Mode (HSM)
- 2000 meter depth rating for stainless steel towfish
- 500 meter depth rating for lightweight aluminum towfish
- Data transmitted over long single coaxial cable lengths
- Integrated with other sensors
- Full Spectrum CHIRP processing
- Able to interface with customer supplied PC and 3<sup>rd</sup> party software

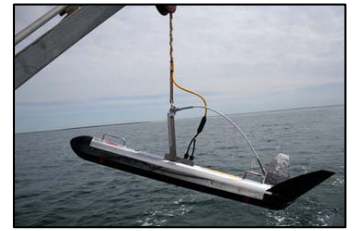
## Applications:

- Mine Countermeasures (MCM)
- Hydrographic surveys
- Geo-hazard surveys
- Geological/geophysical surveys
- Route surveys
- Archeological surveys
- Search and recovery
- AUV/ROV adaptable





# 4200-MP SIDE SCAN SONAR SYSTEM



## Configuration Options:

Model 4200 Rack Mount  
Topside Processor with  
EdgeTech's DISCOVER  
Software

Model 4200-P Portable Topside  
Processor with EdgeTech's  
DISCOVER Software

Model 701-DL to interface  
to 3<sup>rd</sup> Party Topside  
Processors



Or



Or

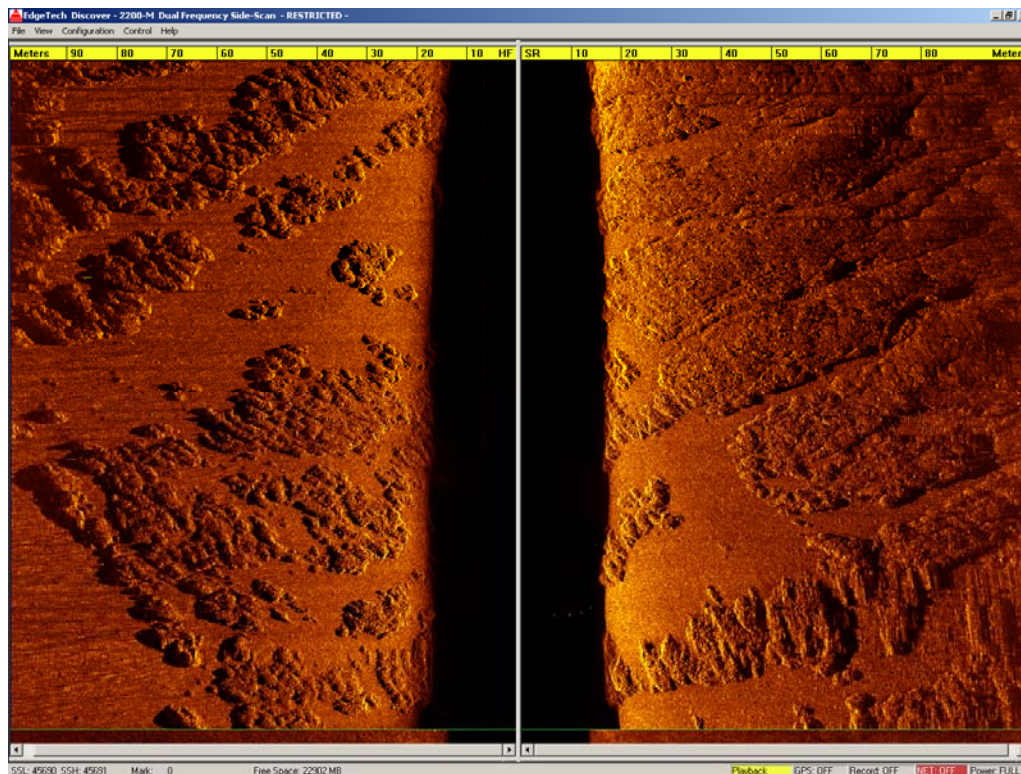


Or



EdgeTech stainless steel towfish with choice  
of either 100/400 kHz, 300/600 kHz or  
300/900 kHz dual simultaneous frequencies.

EdgeTech lightweight aluminum towfish with  
choice of either 100/400 kHz, 300/600 kHz or  
300/900 kHz dual simultaneous frequencies.



600 kHz data image of coral reef





# 4200-MP SIDE SCAN SONAR SYSTEM

## Key Specifications

Sonar Specifications	
Frequency	Choice of either 100/400, 300/600 or 300/900 kHz dual simultaneous
Modulation	Full Spectrum CHIRP frequency modulated pulse with amplitude and phase weighting
Operating Range (meters/side)	100 kHz: 500m, 300 kHz: 230m, 400 kHz: 150m, 600 kHz: 120m, 900 kHz: 75m
Towing Speed (max safe)	12 knots
Towing Speed *	4.8 knots in HDM, 9.6 knots in HSM while maintaining 100% coverage
Output Power	100 kHz: 4 j, 300 kHz: 3 j, 400 kHz: 2 j, 600 kHz: 1 j, 900 kHz: 1 j
Pulse Length	100 kHz: up to 20 ms, 300 kHz: up to 12 ms, 400 kHz: up to 10 ms, 600 kHz up to 5 ms, 900 kHz: up to 3 ms
Resolution Across Track	100 kHz: 8 cm, 300 kHz: 3 cm, 400 kHz: 2 cm, 600 kHz: 1.5 cm, 900 kHz: 1 cm
Resolution Along Track	100 kHz: 2.5m @ 200m, 300 kHz: 1.0m @ 200m, 400 kHz: 0.5m @ 100m, 600 kHz: 0.45m @ 100m, 900 kHz: 18 cm @ 50m
Horizontal Beam Width (HDM)	100 kHz: 0.64°, 300 kHz: 0.28°, 400 kHz: 0.3°, 600 kHz: 0.26°, 900 kHz: 0.2°
Horizontal Beam Width (HSM)	100 kHz: 1.26°, 300 kHz: 0.54°, 400 kHz: 0.4°, 600 kHz: 0.34°, 900 kHz: 0.3°
Optional CW Pulse Short Range	Yes
Digital Link	4 MBits/sec (typical), 4 channels of side scan data + sensor data
Dynamic Range	24 Bits
Depression Angle	Tilted down 20°
Vertical Beam Width	50°
Operating Temperature	0°C to 45°C
Power In (4200-P portable topside processor)	18-36 VDC or 110/240 VAC (auto-ranging); 300 Watts maximum
Power In (4200 rack mount topside processor)	80-140 VAC or 175-265 VAC (auto switching); 300 Watts maximum
Optional Sensor Port	(1) Serial - RS 232C, 9600 Baud, Bi-directional & 27 Vdc
Heading/Pitch/Roll	Heading Accuracy: < 1.5° RMS Heading Resolution: 0.1° Roll, Pitch Angle Accuracy: ± 0.4° Roll, Pitch Angle Repeatability: 0.2° Roll, Pitch Angle Resolution: 0.1°
Towfish Specifications	
Diameter	11.4 cm (4.5 inches)
Length	125.6 cm (49.5 inches)
Weight in Air/Saltwater	Stainless Steel: 48 / 36 kg (105 / 80 pounds) Aluminum: 30 / 18 kg ( 66 / 40 pounds)
Tow Cable Length	6,000 meters typical
Tow Cable Type	Co-axial
Operating Depth (maximum)	Stainless Steel Towfish: 2,000m, Aluminum Towfish: 500m
Options	Pressure, Temperature, Magnetometer, USBL Acoustic Tracking System, Depressor, Power Loss Pinger and Custom Sensors

\* Meets NOAA Shallow Water Survey Specification - Min 3 pings on a 1 meter target

## Other EdgeTech Products

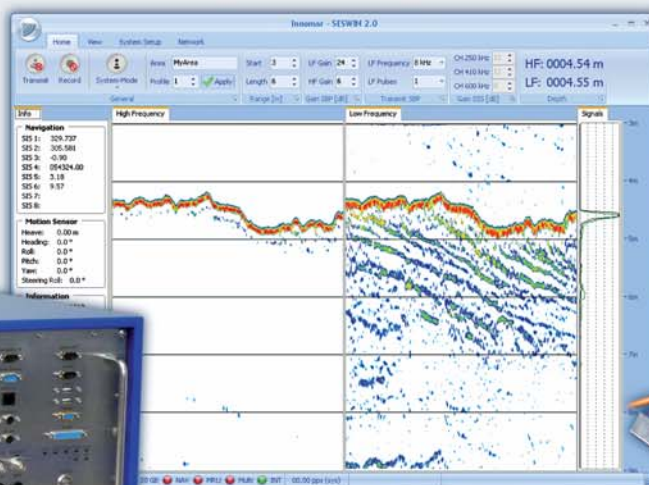
✓ Side Scan, Sub-bottom, Integrated and Modular Imaging Systems for Deep Towed, AUV, ROV and Other Applications utilizing Full Spectrum, MultiPing or Synthetic Aperture Acquisition and Processing Techniques.



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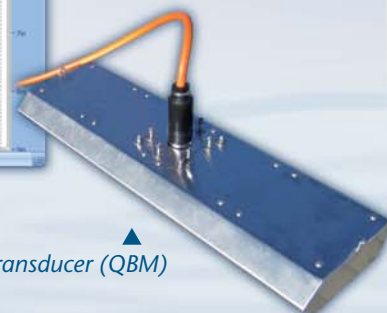
Top-side unit



Screenshot of the operating software

- single beam mode (SBM)
- dual beam mode (DBM)
- quattro beam mode (QBM)

Transducer (QBM)



### ► Performance

- water depth range:
  - SBM: 0.5 – 500 m
  - QBM: typically < 20 m (depends on array geometry)
- sediment penetration:
  - SBM: up to 50 m
  - QBM: up to 20 m
- layer resolution: up to 5 cm
- motion compensation: heave
- beam width @ 3 dB for all frequencies:
  - SBM:  $\pm 1.5^\circ$  / footprint < 5.5 % of water depth
  - QBM:  $\pm 2.5^\circ$  / footprint < 9.0 % of water depth

### ► Transmitter

- primary frequencies: approx. 100 kHz (band 85 – 115 kHz)
- secondary low frequencies: 4, 5, 6, 8, 10, 12, 15 kHz (band 2 – 22 kHz)
- primary source level:
  - SBM: > 242 dB// $\mu$ Pa re 1 m
  - QBM: > 236 dB// $\mu$ Pa re 1 m
- pulse width: 0.07 – 1 ms
- pulse rate:
  - SBM: up to 60/s
  - QBM: up to 15/s per transducer
- multi-ping mode (SBM)
- pulse type: CW, Ricker

### ► Acquisition

- primary frequency (echo sounder, bottom track)
- secondary low frequency (sub-bottom data, multi-frequency mode)
- sample rate 96 kHz @ 24 bit

## SES-2000 quattro Parametric Sub-bottom Profiler

### ► System Components

- transceiver unit 19 inch / 6 U (WHD: 0.52 m x 0.30 m x 0.40 m; 32 kg)
- transducer excl. 20 m cable (WHD: 4 x [0.21 m x 0.06 m x 0.21 m]; 4 x 5 kg)
- system control: internal PC

### ► Software

- SESWIN data acquisition software
- SES Convert SEG-Y/XTF data export
- SES NetView remote display
- ISE post-processing software
- 3D volume renderer

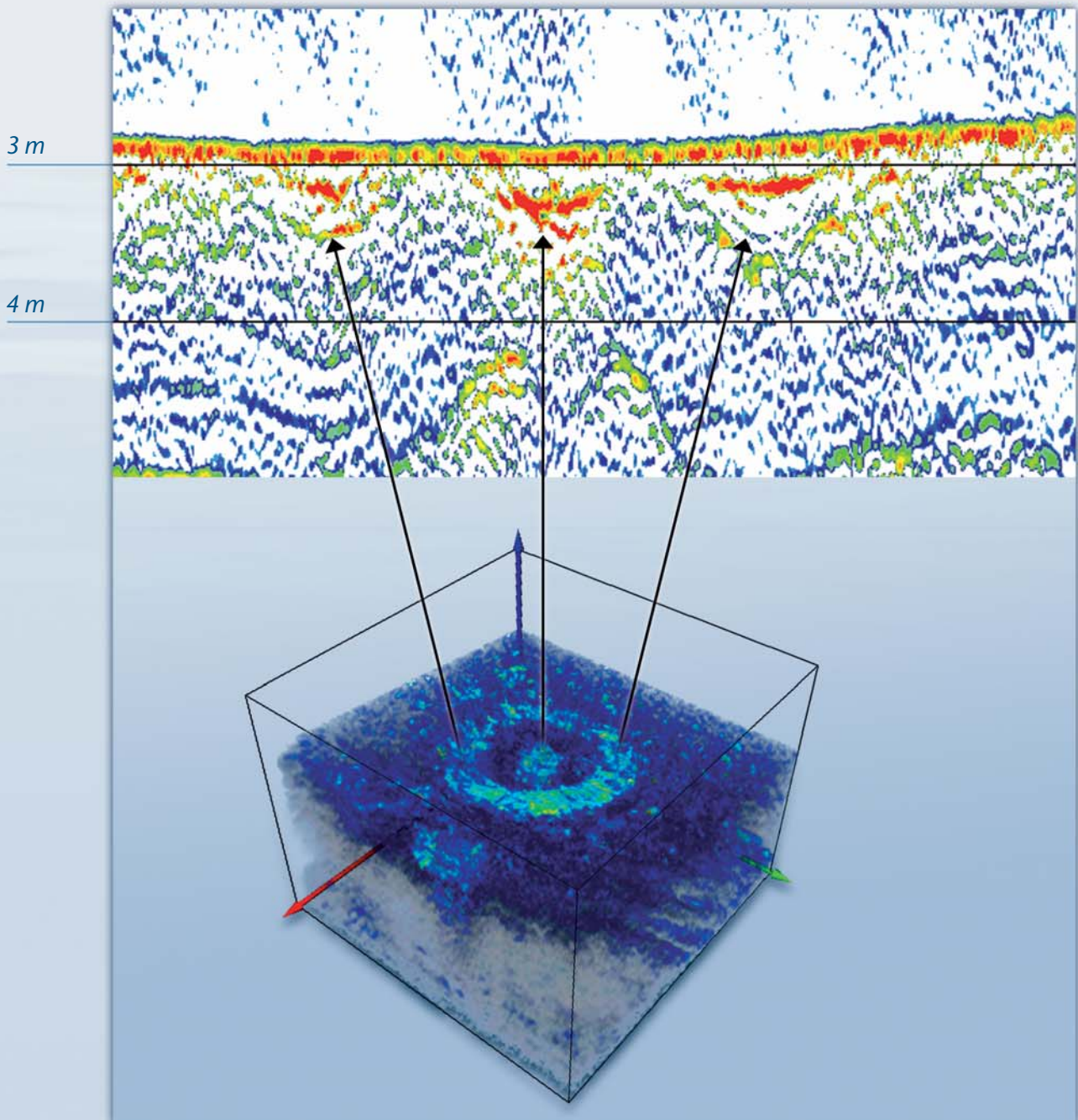
### ► Power Supply Requirements

- 100 – 240 V AC / 50 – 60 Hz
- power consumption: < 350 W



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## Survey example of SES-2000 quattro



*Wismar Bay echo plot example and 3D volume rendered area with embedded circular structure  
Frequency 10 kHz, pulse length 100  $\mu$ s, profile length 40 m (3D volume: 40 m x 40 m x 3 m)*

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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**

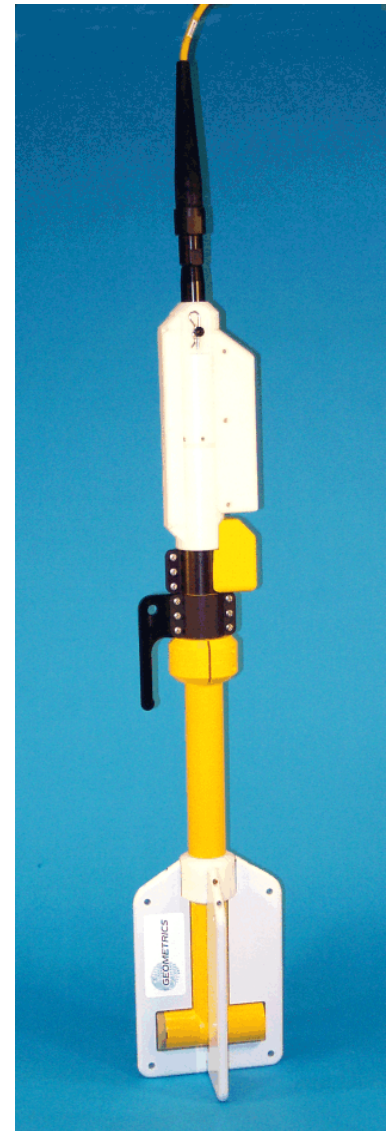
Very high resolution Cesium Vapor performance is now available in a low cost, small size system for professional surveys in shallow or deep water. High sensitivity and sample rates are maintained for all applications. The well proven Cesium sensor is combined with a unique and new CM-221 Larmor counter 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**

<b>OPERATING PRINCIPLE:</b>	Self-oscillating split-beam Cesium Vapor (non-radioactive)
<b>OPERATING RANGE:</b>	20,000 to 100,000 nT
<b>OPERATING ZONES:</b>	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.
<b>CM-221 COUNTER SENSITIVITY:</b>	<0.004 nT/√Hz rms. Up to 20 samples per second
<b>HEADING ERROR:</b>	±1 nT (over entire 360° spin )
<b>ABSOLUTE ACCURACY:</b>	<2 nT throughout range
<b>OUTPUT:</b>	RS-232 at 1,200 to 19,200 Baud
<b>MECHANICAL:</b>	
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.
<b>OPERATING TEMPERATURE:</b>	-30° F to +122° F (-35° C to +50° C)
<b>STORAGE TEMPERATURE:</b>	-48° F to +158° F (-45° C to +70° C)
<b>ALTITUDE:</b>	Up to 30,000 ft (9,000 m)
<b>WATER TIGHT:</b>	O-Ring sealed for up to 4,000 psi (9000 ft or 2750 m) depth operation
<b>POWER:</b>	24 to 32 VDC, 0.75 amp at turn-on and 0.5 amp thereafter
<b>ACCESSORIES:</b>	
Standard:	View201 Utility Software operation manual and ship kit
<b>Optional:</b>	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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## AA251, AA301 Boomer Seismic Sound Source



The **AA251** and **AA301** boomer plates are seismic sound sources that produce a sharp repeatable pulse from a floating position on the sea surface.

The AA251, deployed on either a robust CAT100 or CAT200 catamaran, is ideal for inshore surveys from small craft.

The AA301 is designed for higher power applications and can also be used as a variable frequency boomer when combined with the CSP-D range of energy sources.

### Key Features

- Stable pulse shape clarity with minimum reverberation
- Rugged mechanical design with weight kept to a minimum
- Supplied as individual product, or with a catamaran
- Supplied with RMK connectors and locking collars as standard.
- **AA251** forms part of the Inshore Boomer System, ideal for coastal surveys
- **AA301** ideal for nearshore and shallow water surveys (up to 120m) depending on geology

### Technical Specification

#### PHYSICAL

	Size	Weight air/water	Fixing centres	Connector
AA251 Boomer plate	380 x 380mm	18kg/10kg	315mm <sup>2</sup>	RMK 1/0
AA301 Boomer plate	620 x 520mm	25kg/14kg	485mm x 440mm	RMK 1/0

#### ELECTRICAL INPUT

Recommended energy	AA251	50 – 200J/shot
	AA301	100 – 300J/shot
Maximum energy	AA251	300J/shot
	AA301	350J/shot

## AA251, AA301 Technical Specification continued...

Average energy	AA251	600J/second
	AA301	1000J/second
Operating voltage	3600 to 4000Vdc	

### SOUND OUTPUT

Source level	AA251	Typically 212dB re 1 $\mu$ Pa at 1 metre with 200J
	AA301	Typically 215dB re 1 $\mu$ Pa at 1 metre with 300J
Pulse length	AA251	120/150/180 $\mu$ s at 50/100/200J
	AA301	200 $\mu$ s depending on energy setting of CSP
Reverberation	AA251	<10% of initial pulse
	AA301	<10% of initial pulse

### COMPATIBLE ENERGY SOURCES

AA251	CSP-L, CSP-P, CSP-D, CSP-N, CSP-S1250, CSP-S4000, CSP-S6000
AA301	CSP-P, CSP-D, CSP-N, CSP-S1250, CSP-S4000, CSP-S6000

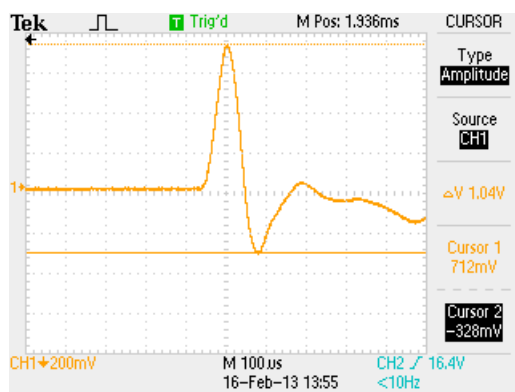
### COMPATIBLE CATAMARAN

AA251	CAT 100:	940 (L) x 740 (W) x 500 (H) mm
	CAT 200:	1280 (L) x 915 (W) x 525 (H) mm
AA301	CAT 200:	1280 (L) x 915 (W) x 525 (H) mm
	CAT 300:	1700 (L) x 660 (W) x 490 (H) mm

### COMPATIBLE HV CABLE

AA251 and AA301	HVC 2000
	Standard length 50m
	RMK 1/0 connectors complete with locking collars

### AA301 TYPICAL PULSE SIGNATURE AT 300J



Due to continual product improvement, specification information may be subject to change without notice.  
AA251, AA301 Boomers/Jan 2015  
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## Streamer Hydrophones



High quality streamer hydrophones available as 1, 8, 12 or 20 element MF designs and 24 element LF design. Each is supplied with a pre-amplifier and connectors for standard seismic acquisition systems.

### Key Features

- Filled with silicon oil for neutral buoyancy
- Supplied with robust 50m tow leader
- Complete with pre-amplifier
- Standard models and customised units with grouped elements available
- Medium frequency and low frequency versions

### Technical Specification

#### Streamer hydrophone, fluid filled with multi-elements

Model number	AH1	AH360/8
Tow leader	50m	50m
Array Tube type	Polyurethane	Polyurethane
Array tube length	4.5m	4.5m
Number of elements	1	8
Element spacing	n/a	360mm
Array sensitivity	-187dB ref 1V per $\mu$ Pa	-169dB ref 1V per $\mu$ Pa
Fluid type	Polydimethylsiloxane, PMX561	Polydimethylsiloxane, PMX561
Power	Battery, 9V alkaline, PP3/MN1604	Battery, 9V alkaline, PP3/MN1604
Frequency response	140Hz to 10kHz (-3dB)	140Hz to 10kHz (-3dB)
Signal output	Up to 8V peak to peak	Up to 8V peak to peak
Preamp	Single ended, fixed gain	Single ended, fixed gain
Connector type	BNC, 50/75 ohm cable can be used	BNC, 50/75 ohm cable can be used
<b>Elements</b>		
Dimensions	55 x 16 x 10 mm	55 x 16 x 10 mm
Sensitivity	-187dB ref 1V per $\mu$ Pa	-187dB ref 1V per $\mu$ Pa
Depth recoverable	30m max	30m max
Operating depth	Typical 10m	Typical 10m
Type	Non acceleration cancelling	Non acceleration cancelling
Resonance	@ 9 kHz	@ 9 kHz



## Streamer Hydrophones Continued...

Model number	AH250/12	AH150/20
Tow leader	50m	50m
Array Tube type	Polyurethane	Polyurethane
Array tube length	4.5m	4.5m
Number of elements	12	20
Element spacing	250mm	150mm
Array sensitivity	-165dB ref 1V per $\mu$ Pa	-161dB ref 1V per $\mu$ Pa
Fluid type	Polydimethylsiloxane, PMX561	Polydimethylsiloxane, PMX561
Power	Battery, 9V alkaline, PP3/MN1604	Battery, 9V alkaline, PP3/MN1604
Frequency response	140Hz to 10kHz (-3dB)	140Hz to 10kHz (-3dB)
Signal output	Up to 8V peak to peak	Up to 8V peak to peak
Preamp	Single ended, fixed gain	Single ended, fixed gain
Connector type	BNC, 50/75 ohm cable can be used	BNC, 50/75 ohm cable can be used
<b>Elements</b>		
Dimensions	55 x 16 x 10 mm	55 x 16 x 10 mm
Sensitivity	-187dB ref 1V per $\mu$ Pa	-187dB ref 1V per $\mu$ Pa
Depth recoverable	30m max	30m max
Operating depth	Typical 10m	Typical 10m
Type	Non acceleration cancelling	Non acceleration cancelling
Resonance	@ 9 kHz	@ 9 kHz

Model number	AH365/20	AH610/24LF (Low Frequency)
Tow leader	50m	50m
Array Tube type	Polyurethane	Polyurethane
Array tube length	10m	14
Number of elements	20	24
Element spacing	365mm	610mm
Array sensitivity	-161dB ref 1V per $\mu$ Pa	-162dB ref 1V per $\mu$ Pa
Fluid type	Polydimethylsiloxane, PMX561	Polydimethylsiloxane, PMX561
Power	Battery, 9V alkaline, PP3/MN1604	24Vdc
Frequency response	140Hz to 10kHz (-3dB)	115Hz to 7.2kHz (-3dB)
Signal output	Up to 8V peak to peak	Up to 8V peak to peak
Preamp	Single ended, fixed gain	Differential output, link adjustable gain
Connector type	BNC, 50/75 ohm cable can be used	BNC, 50/75 ohm cable can be used
<b>Elements</b>		
Dimensions	55 x 16 x 10 mm	53 x 20mm
Sensitivity	-187dB ref 1V per $\mu$ Pa	-192dB ref 1V per $\mu$ Pa
Depth recoverable	30m max	30m max
Operating depth	Typical 10m	Typical 10m
Type	Non acceleration cancelling	Acceleration cancelling
Resonance	@ 9 kHz	@ 9 kHz

Other element configurations are available to order



Due to continual product improvement, specification information may be subject to change without notice.  
 Streamer Hydrophones/July 2016  
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## CSP-L Seismic Energy Source



The **CSP-L** is a seismic energy source for high resolution boomer sub-bottom profiling, primarily intended for use as part of the Inshore Boomer System.

Available as a 50 Joule or 100 Joule unit, the CSP-L uses minimal generator current, and is ideal for use on small vessels undertaking coastal survey work .

### Key Features

- Operates from the smallest possible generator
- Proprietary pulse shaping circuitry for high resolution data
- Additional safety/protection features
- All settings externally selectable
- LED fault indicators
- High current and voltage solid state (semi-conductor) discharge method
- Meets EC emissions regulations enabling interference-free field use
- Supplied in robust transit case, with mains lead and HV connector plug

## Technical Specification

### PHYSICAL

Size                      Transit Case (4U) with cover in place and handles flat: 24cm(H) x 54cm(W) x 44.5cm(D)  
Weight                    CSP-L, case and cover: 18.5kg

### ELECTRICAL SPECIFICATION

Mains Input            110-240Vac (auto) 45-65Hz@1.0kVA (max) single phase. 3 pin connector

Voltage Output        3600 Vdc, 4 pin interlocked connector  
Solid state semi-conductor discharge method

Output Energy        CSP-L50, 50 Joules  
CSP-L100, 100 Joules

Charging Rate        500J/second for continuous operation at 0-45°C ambient

Capacitance            CSP-L50, 8µF at 10<sup>8</sup> shot life  
CSP-L100, 16µF at 10<sup>8</sup> shot life

## CSP-L Technical Specification continued...

Trigger	+ve key opto isolated or isolated closure set by front panel switch BNC connector on front panel
Repetition rate	Up to 8pps at 50 Joules, up to 4pps at 100J Limited by charge rate, energy level and sound source rating
Earth	M8 stainless steel stud on front panel

### SAFETY FEATURES

- Main electronic control circuits and secondary layer of safety circuitry
- Specially designed HV connector with interlock
- High speed dump resistors for high voltage components
- Capacitor bleed resistors
- Open circuit shutdown
- Timer shutdown
- Output current monitor
- Over temperature shut-down
- Cover and connector interlocks

*The unit's internal design has a modular construction for ease of servicing and capacitor replacement. However, for safety reasons, only Applied Acoustics trained engineers should attempt a repair.*

### COMPATIBLE SOUND SOURCES

CSP-L50	AA201, AA251 and AA301 Boomer plates
CSP-L100	AA201, AA251 and AA301 Boomer plates



Due to continual product improvement, specification information may be subject to change without notice.  
CSP-L Seismic Energy Source/June 2015  
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Teledyne RD Instruments

# Workhorse Quartermaster

150 kHz ADCP

## Versatile Precision

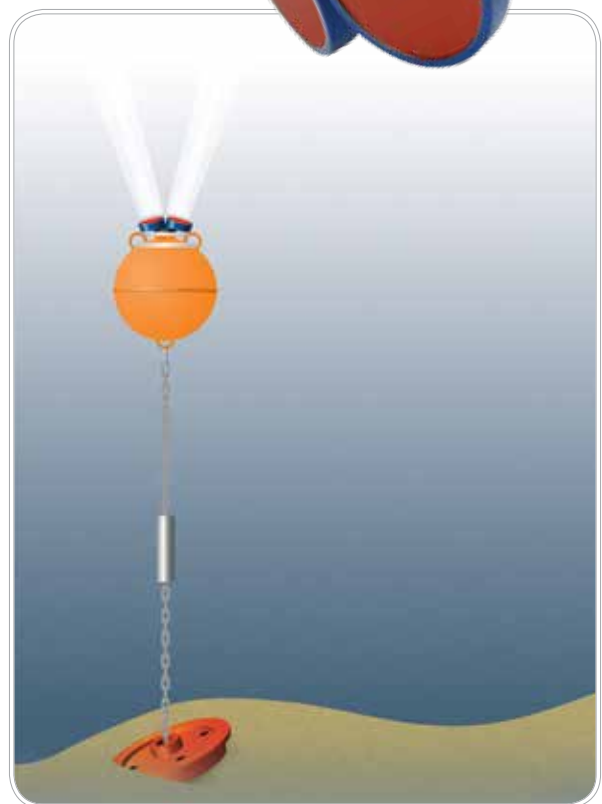
Teledyne RD Instruments' WORKHORSE QUARTERMASTER Acoustic Doppler Current Profiler (ADCP) has been designed to fill the gap between Teledyne RDI's higher frequency 300 kHz Workhorse units and the 75 kHz Long Ranger. The Quartermaster is ideally suited for current profile measurements that may require up to 300m range. The unit provides an unsurpassed combination of range, resolution, and versatility, thanks to Teledyne RDI's Broadband technology.

The highly flexible Workhorse Quartermaster is available in two product configurations: self-contained (Sentinel), and direct-reading (Monitor). The Quartermaster is ideally suited for:

- Ocean observatories
- Shelf-edge profiling
- Upper ocean dynamics

### Third-party solutions

Collect data at your desk: the Quartermaster can operate in real-time or stored-data mode. Third-party products are available for delivery of data via an acoustic modem and radio data transfer direct to your desktop.



## PRODUCT FEATURES

- **Versatility:** The highly versatile Quartermaster offers ranges of up to 300m, as well as self-contained and direct read configurations.
- **Precision data:** Teledyne RDI's Broadband signal processing produces high-resolution, precise measurements without compromising battery life.
- **Reliability:** Set it and forget it; the highly reliable and energy-efficient Quartermaster can be deployed for three, six, or even twelve months of worry-free operation.
- **4-beam solution:** Teledyne RDI's 4-beam design provides a redundant data source in case of a blocked or damaged beam, as well as an independent measure known as error velocity to ensure the quality of the data.





# Workhorse Quartermaster



150 kHz ADCP

## TECHNICAL SPECIFICATIONS

Mode	Depth Cell Size	Std. Dev. <sup>1</sup>	First Cell Range <sup>2</sup>	Maximum Range <sup>3,4,5</sup>
High Resolution	4	7.0cm/s	8.9m	210m
	8	3.5cm/s	12.8m	235m
	16	1.8cm/s	20.6m	255m
	24	1.2cm/s	28.4m	270m
Long Range	4	14.0cm/s	8.8m	275m
	8	7.0cm/s	12.7m	300m
	16	3.6cm/s	20.5m	325m
	24	2.5cm/s	28.7m	340m
Bottom Track	N/A	N/A	N/A	540m
<b>Profile Parameters</b>	Velocity accuracy	± 1% ± 5mm/s		
	Velocity resolution	1mm/s		
	Velocity range:	± 5m/s default, ± 10m/s max		
	Depth cell size	2–24m		
	Number of depth cells	1–255		
	Ping rate	1Hz (typical)		
<b>Echo Intensity Profile</b>	Vertical resolution	Depth cell size, user configurable		
	Dynamic range	80dB		
	Precision	±1.5dB (relative measure)		
<b>Transducer and Hardware</b>	Beam angle	20°		
	Beam width (1-way)	4°		
	Configuration	4-beam, convex		
	Internal memory	Two PCMCIA card slots; one memory card included		
	Communications	RS-232 or RS-422; ASCII or binary output at 1200-115,200 baud		
<b>Power</b>	DC input	20–50VDC.		
	Number of batteries	Select from 0, 2, or 4 battery pack configurations		
	Internal battery voltage	42VDC (new) 28VDC (depleted)		
	Battery capacity @ 0°C	450 watt hrs typical / 900 or 1800 watt hours total		
<b>Standard Sensors</b>	Pressure sensor	Maximum range 2000m		
	Pressure accuracy	0.25% of full scale		
	Temperature (mounted on transducer)	Range -5° to 45°C, Precision ±0.4°C, Resolution 0.01°		
	Tilt	Range ±15°, Accuracy ±0.5°, Precision ±0.5°, Resolution 0.01°		
	Compass (fluxgate type, includes built-in field calibration feature)	Accuracy ±2°, Precision ±0.5°, Resolution 0.01°, Maximum tilt ±15°		
<b>Environmental</b>	Depth rating	1500m (3000/6000m optional)		
	Operating temperature	-5° to 45°C		
	Storage temperature without batteries	-30° to 60°C		
	Weight in air	SC (2 BP) 56kg, SC (4 BP) 70kg, DR (0 BP) 41kg, ExtBC (4 BP) 39kg		
	Weight in water	SC (2 BP) 30kg, SC (4 BP) 38kg, DR (0 BP) 22kg, ExtBC (4 BP) 15.3kg		
<b>Software</b>	Use Teledyne RDI's Windows™-based software for the best results: <b>WinSC</b> —Data Acquisition; <b>WinADCP</b> —Data Display and Export; <b>Teledyne RDI Tools</b> —Utilities			
<b>Available Options</b>	<ul style="list-style-type: none"> <li>• 3000m and 6000m depth option</li> <li>• External battery case</li> <li>• Mooring accessories: in-line and bottom-mount accessories</li> <li>• Remote head configurations</li> <li>• Memory: 2 PCMCIA slots, total 4GB</li> <li>• <b>Velocity</b> for advanced post processing</li> </ul>			
<b>Dimensions</b>	488.14 mm wide x 473.91mm long (Monitor); 751.71mm long (2-battery Sentinel); 994.71mm long (4-battery Sentinel) (line drawings available upon request)			

1 Standard deviation is ADCP uncertainty given a single ping.  
 2 The first cell range is the distance from the transducer to the center of the first cell.  
 3 Maximum range is a nominal value based on 5°C, 35ppt, and typical ocean backscatter; actual range will vary depending on environmental conditions.  
 4 Assuming the ADCP is pointed vertically (0° tilt), the maximum range is limited to 94% of the distance to the surface.  
 5 Assumes a power supply of 32VDC (typical average battery voltage).  
 6 <±1.0° is commonly achieved after calibration.

Specifications subject to change without notice.

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# High Performance Corer - HPC™

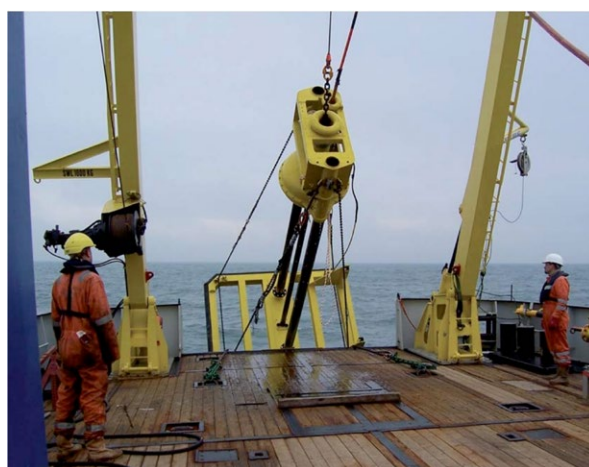


Fugro Alluvial has developed a High Performance Corer™ to cope with the demand for longer sample recovery in dense granular and stiff cohesive materials.

## Application

The HPC™ utilises innovative electric motor technology and sample barrel design. The new motor technology allows an optimisation of excitation frequency and vibration amplitude to suit any particular soil conditions. At its most powerful settings the HPC™ can apply more than twice the power and five times the vibration amplitude of a standard vibrocorer. All of this translates into much longer sample recovery.

The HPC™ may also be used with a newly developed low area ratio sample barrel which minimises the sampling disturbance in clay soils.



High Performance Corer - HPC™

## Optional Features

- Maximum working water depths of 350 m
- Umbilical spooler for deep water projects
- Easily transported by road, sea or air
- Real time penetration and base tilt registration

## Applications

- Pre-dredge surveys
- Cable Route surveys
- Environmental investigations
- Mineral/Aggregate prospecting
- Inshore civil engineering site investigations
- Offshore oil and gas pipeline geotechnical investigations

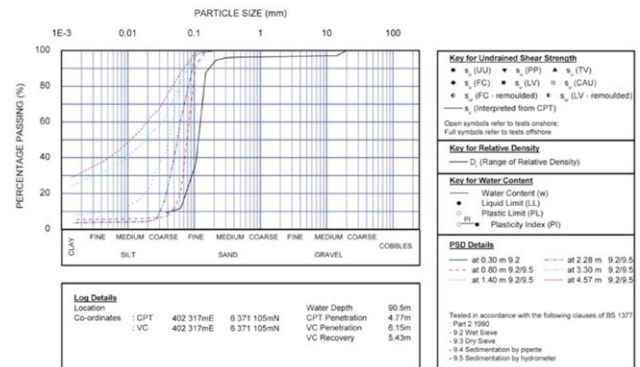
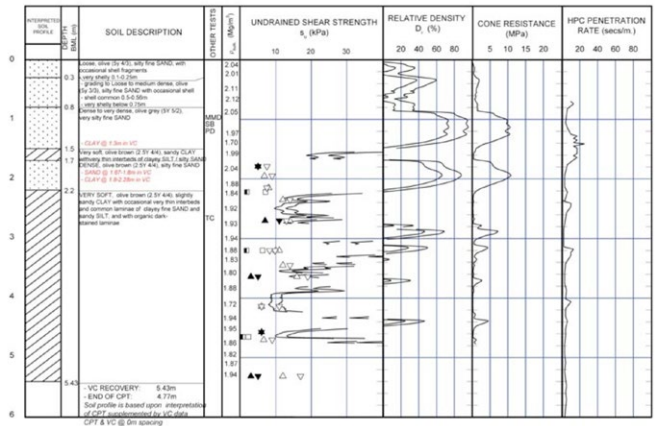
## Specification

- 415V, minimum 45 kVA power supply
- 3m to 6m core barrel (8m optional)
- Mild steel barrels 101.6 mm o.d. 93.6 mm i.d.
- PVC Liners Sample diameter 84mm

# High Performance Corer - HPC™

The HPC™ penetration and soils data may be used in combination with CPT data to further refine stratigraphic and soils parameter logging along pipelines or in discrete location seabed soil engineering projects.

Example of HPC™ data set:



VIBROCORE / CPT LOG

## Fugro Alluvial Offshore Limited

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 info@alluvial.co.uk

This document includes technical information. Reasonable effort has been made to verify its correctness at the time of compilation but details may change with the passage of time and without prior notice. Fugro does not accept any liability for loss or damage of any kind arising from use of the information.





## FUGRO SEACALF<sup>®</sup> SEABED CPT MODULAR SYSTEM

Our SEACALF<sup>®</sup> Seabed Cone Penetrometer Test (CPT) system is capable of undertaking a rapid evaluation of in situ soil properties in a large variety of soil types in water depths of up to 800 metres.

Test results are used to assess strength parameters, pore water pressure and relative soil density, as well as to provide a detailed stratigraphic profile.

### SPECIAL FEATURES

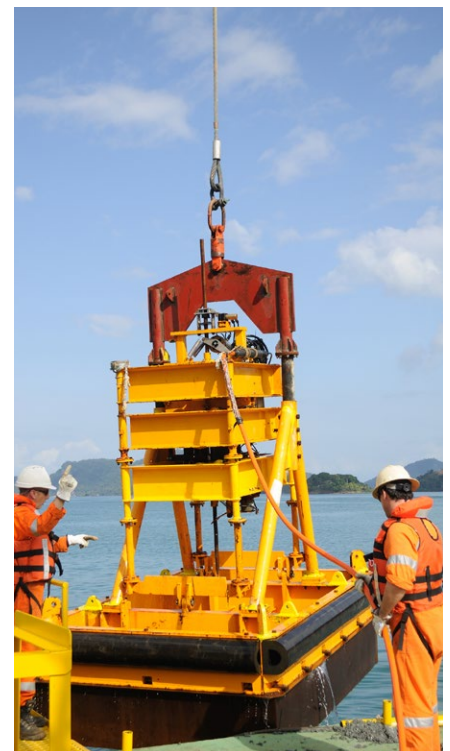
Continuous penetration into the seabed at the standard rate of 20 mm per second is achieved through a friction-wheel system clamped onto the CPT rods. Variable thrust nominal 3 - 12 tonnes. The required ballast is obtained from weights incorporated into the CPT frame.

### CONES AVAILABLE

- Piezocones
- Friction cones
- Electrical Conductivity Cones
- Low Capacity cones (for very soft cohesive soils)
- T-Bar
- In situ Vane
- Ball cone
- Thermal Conductivity Probes

### OPTIONAL FEATURES

- Penetration in excess of 15 metres is possible depending on the soil conditions and deployment arrangement



SEACALF<sup>®</sup> Seabed CPT system





## APPLICATIONS

The SEACALF® Seabed CPT system provides numerous advantages over conventional systems, with typical benefits including:

- Offshore pipeline route and subsea structure geotechnical surveys
- Pre-dredging geotechnical investigations
- Marine inshore geotechnics
- Site investigations for marine reclamation projects
- Marine aggregate surveys

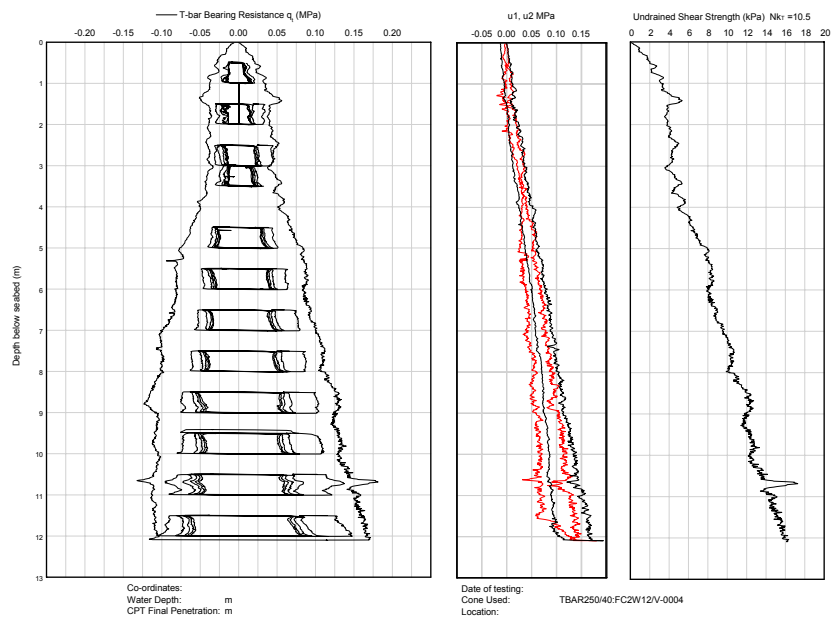
## TECHNICAL DATA/ DIMENSIONS

### Technical data/Dimensions Seacalf®

UNIT	BASE(m)	WEIGHT(tonnes)	MAX THRUST(kN)
2 modules	2.2 x 3.2	5 - 10	40 - 75
3 modules	2.2 x 3.2	12	100
4 modules	2.2 x 3.2	15	120



SEACALF® Seabed CPT system



CYCLIC T-BAR PENETRATION TEST RESULTS -

Example of T-bar and cyclic T-bar data set acquired using the SEACALF® Seabed CPT system.

The T-Bar test is taken to full depth and return to surface, so giving an undisturbed and remoulded strength, and then multiple cyclic tests are undertaken at discrete depth intervals. Cyclic T-Bar test can be used to refine the understanding of the residual remoulded shear strength and sensitivity of the soils.



# Submeter Guidance with NT300D

*All your navigation needs in a single package*

*Efficiency, precision and flexibility are three main features in the 5 Hz submeter surveyor and navigator.*

The NT300D™ targets professional mariners in need of submeter navigation and positioning during applications such as dredging, echo sounding, tug and workboat duties, precise navigation, research and much more.

The NT300D is a cost effective choice including everything needed for precise navigation in a single package. The rugged and water proof unit includes a high resolution LCD display, a 12-channel GPS receiver and a built in dual-channel radiobeacon receiver.

The NT300D is fully featured as a stand alone DGPS navigator. The display presents accurate navi-

gation guidance both graphically and numerically. Custom navigation screens can also be created for maximum flexibility.

The NT300D includes a large database where up to 500 waypoints and other important positions can be stored. An optional Trimble PC Card reader/writer, SCR, can also be installed with the receiver for extended data logging and uploads of routes and waypoints.

The ease in using the NT300D, its single key operations for quick access to important navigation functions and the ability to plan the missions ahead of time, all make the receiver a perfect time saver.

The NT300D can also be part of an integrated system. It provides a simple interface to a large variety of equipment onboard, such as radars, autopilots, computers and

gyros. Any one of its two serial ports can transmit submeter positions up to 5 times per second, with a maximum latency of 0.2 seconds. Other information such as configuration control messages, beacon receiver status and GPS status can also be transmitted.

The NT300D utilizes Trimble's latest technology to achieve submeter position accuracy. The built in dual-channel radiobeacon receiver allows for intelligent and seamless switching between radio beacons resulting in maximum performance and availability.

The unit also accepts externally received corrections and allows the user to prioritize between those corrections and the corrections received by the internal beacon receiver.



# Submeter Guidance with NT300D

All your navigation needs in a single package

## Features

- 12 channel DGPS receiver with an integrated beacon receiver
- Dual-channel beacon receiver with intelligent selection of reference station
  - Two automatic modes
  - One manual mode
- External RTCM SC-104 input
- Combined L1 GPS and beacon H-field loop antenna
- Sub-meter accuracy
- Positioning based on carrier-phase filtered L1 pseudoranges
- Two programmable RS-422 serial ports, 1200 - 38400 baud
  - NMEA-0183 input/output
  - RTCM SC-104 input/pass through
  - TSIP interface protocol input/output
- Speed output, 200 PPNM contact closure (150 mA max)<sup>†</sup>
- External alarm, contact closure (150 mA max)<sup>†</sup>
- High resolution LCD display
- Graphical and numerical presentation of navigation data
- Position resolution: 4 decimal places (lat/lon)
- 3 user configurable screens
- 500 waypoints
- 50 reversible routes
- 183 datums
- User defined 3 or 7 parameter datum
- Output local datums directly on the serial port
- Supports English, French, German, Spanish, Icelandic
- Beacon receiver control and monitoring
- Operation manual
- 35m (105 ft) antenna cable
- One year warranty

## Options

- 50m (160 ft) antenna cable
- Smart Card Reader, SCR, for data logging and waypoint storage only.
- Extended warranty (1 year)
- Firmware update service (1 year)
- TSIP development kit

## Physical Characteristics

### NT300D

Size:	26cm W x 18cm H x 5cm D (10" x 7" x 2")
	Water proof to IEC 529 IPX5 Meets IEC945
Display:	15cm (6") diagonal, high resolution, 320 x 240 pixels, backlit LCD
Operating Temperature:	0°C to +55°C (+32°F to +131°F)
Storage Temperature:	-20°C to +60°C (-4°F to +140°F)
Power:	12 and 24 Volt systems, 12 Watts max.

### Smart Card Reader

Size:	10cm W x 18cm H x 5cm D (4" x 7" x 2")
-------	---

### GPS/Beacon antenna

Size:	15cm H x 15cm D (6" x 6"), 35 m (105') cable
Operating Temperature:	-30°C to +85°C (-22°F to +185°F)
Storage Temperature:	-40 °C to +100 °C (-40 °F to +212 °F)

## Performance Characteristics

### GPS receiver

General:	12 channel, parallel tracking, L1 C/A code with carrier phase filtered measurements.
Update rate:	5 Hz position updates, latency <200 ms
Differential speed accuracy:	0.2 km/h (0.1 MPH, 0.1 knot, 5.6 cm/s) <sup>‡</sup>
Differential position accuracy:	Less than 1 meter RMS <sup>‡</sup> At least 5 satellites, PDOP <4 and RTCM SC-104 standard format broadcast from a Trimble 4000RS or equivalent reference station.
Time to first fix:	<30 seconds, typical
NMEA messages out:	ALM, DTM, GGA, GLL, GRS, GSA, GST, GSV, MSS, RMC/RMB, VTG, XTE, ZDA, ZLZ
NMEA messages in:	MSK, HDG, VHW

### Built in Dual Channel Beacon Receiver

Frequency range:	283.5 kHz to 325 kHz
Channel spacing:	500 Hz
MSK modulation:	50, 100 and 200 bits/second
Signal strength:	10 µV/meter minimum @ 100BPS
Dynamic range:	100 dB
Acquisition time:	2-5 seconds, typical <sup>‡</sup>

<sup>‡</sup> To achieve differential speed and position, the unit must be operating within the broadcast area of a reference station conforming to the International Association of Lighthouse Authorities Standards. All non-differential GPS receivers are subject to degradation of position and velocity accuracy under U.S. Department of Defence-imposed Selective Availability (S/A). Positions may be degraded up to 100 meters 2D RMS.

<sup>†</sup> The receiver may be configured to either a speed log output or an external alarm.

<sup>†</sup> Assumes beacon almanac stored in battery backed RAM.

Trimble follows a policy of continuous product improvement. Specifications are thus subject to change without notice.



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**S/V “SEVERN GUARDIAN”**

The S/V “SEVERN GUARDIAN” is meant to be utilized for nearshore bathy, geophysical and benthic survey activities.

She is a 18m l.o.a. catamaran-type coastal survey vessel with considerable track-record in nearshore survey operations and is deemed well suitable for the SOW (see attached specs).



*The S/V Severn Guardian*

**MAIN VESSEL DATA/INFO** (summary, for full specs see attached datasheet)

**MAIN FEATURES:**

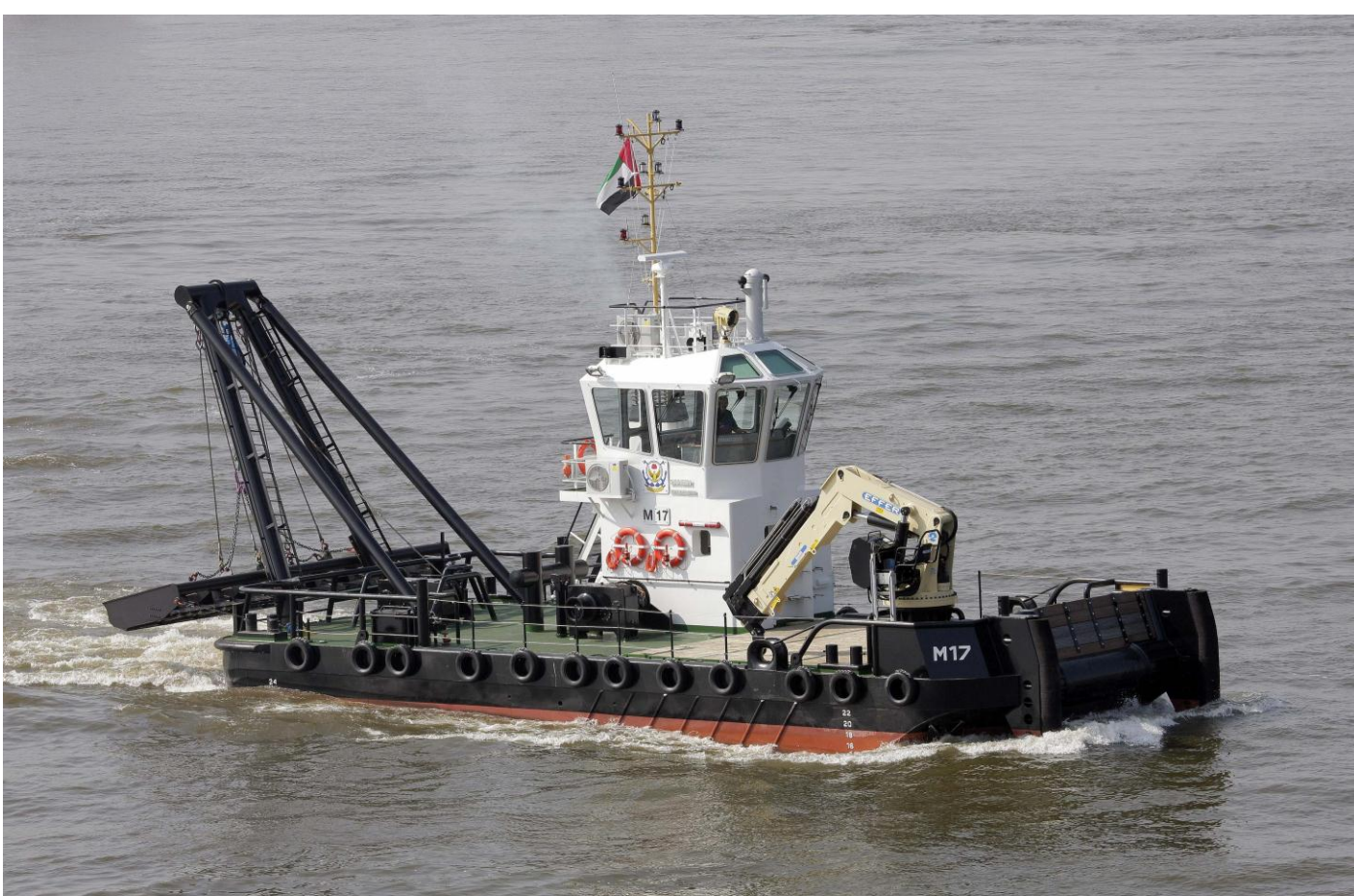
Name: ..... SEVERN GUARDIAN  
 Title of Specification: ..... 18m Survey Vessel, UK MCA certified Category 2  
 Port of Registry: ..... Leith, UK  
 Year built: ..... 2012

**MAIN PARTICULARS:**

LOA: ..... 18,3 m  
 Breadth: ..... 6,3 m  
 Draft (baseline): ..... 1,15 m  
 Draft (skegs): ..... 1,65 m  
 Service Speed: ..... 11-12 kn  
 Max Speed: ..... 16 kn  
 Gross Tonnage: ..... 34,60 t

*NOTE: All proposed Guardian vessels (4 in the sister vessel fleet) are identical in marine survey setup/ configuration and fully interoperable with survey mounts, poles, and deck rigging for towed equipment etc.*





## DAMEN MULTI CAT<sup>®</sup> 1908

"YN 518526-27-29-30"

### GENERAL

YARD NUMBER	518526-27-29-30
BASIC FUNCTIONS	Towing, pushing, anchor handling dredging support
CLASSIFICATION	Bureau Veritas 1 ✕ HULL • MACH Special Service/ Workboat Coastal Area
PAINTING	Epoxy paint system

### DIMENSIONS

LENGTH O.A.	19.05 m
BEAM O.A.	8.06 m
DEPTH AT SIDES	2.75 m
DRAUGHT AFT (APPROX.)	2.10 m
SCANTLINGS	hull plating 10 mm sheerstrake 30 mm deck plating 10 mm

### TANK CAPACITIES

FUEL OIL	7.5 m <sup>3</sup>
FRESH WATER	1.1 m <sup>3</sup>
LUBRICATION OIL	0.8 m <sup>3</sup>
DIRTY OIL	0.9 m <sup>3</sup>
BILGE WATER	0.8 m <sup>3</sup>
SEWAGE	0.9 m <sup>3</sup>
FRESH WATER BALLAST AFT	12.9 m <sup>3</sup>
FRESH WATER BALLAST FRONT	9.0 m <sup>3</sup>
Ø FUEL OIL	46.6 m <sup>3</sup>
Ø FRESH WATER	14.8 m <sup>3</sup>

### PERFORMANCES

BOLLARD PULL AHEAD	13.7 ton
SPEED	9.2 knots

### PROPULSION SYSTEM

MAIN ENGINES	2x Caterpillar C18 TA/B
TOTAL POWER	894 bkW (1200 bhp) at 1800 rpm
GEARBOXES	2x Reintjes WAF 264L, 4.5:1
PROPELLERS	2x Kaplan II fixed pitch propellers
NOZZLES	2x 1350 mm Van de Giessen "Optima" with st.st. innerring
STEERING GEAR	Powered hydraulic 2x 45° with rudder indicator

### AUXILIARY EQUIPMENT

GENERATOR SET	Caterpillar C4.4 NA, 47 kVA, 230/400 V, 50 Hz
HYDRAULIC SYSTEM	Main engine driven hydraulic pumps
ALARM SYSTEM	Engines, gearboxes + bilge alarm
BILGE PUMP/GS PUMP	2x Sterling VWSI 5013, 24 m <sup>3</sup> /hr at 10 m.w.g., electrically driven
FRESHWATER SYSTEM	Electrical pressure set and sewage pump
Ø F.W. TRANSFER PUMP	Sterling AKHK 5101, 20 m <sup>3</sup> /hr at 14 m.w.g.
Ø F.O. TRANSFER PUMP	Sterling AKHK 5101, 20 m <sup>3</sup> /hr at 14 m.w.g.

### DECK LAY-OUT

ANCHOR WITH CHAIN	Pool HHP type, 1x 105 kg and 1x 48 kg
DECK CRANE	Hydraulic Heila HLRM 80-2S
	Lifting capacity 6.7 ton at 10.07 m
	Ø Hydraulic winch, 5 ton hoisting capacity
	Mampaey SWL 150 kN
	Diameter 900 mm, width 2500 mm, SWL 30 ton
	15 ton at 5 m/min
Ø TOWING HOOK	
BOW ROLLER	
ANCHOR HANDLING WINCH	

### ACCOMMODATION

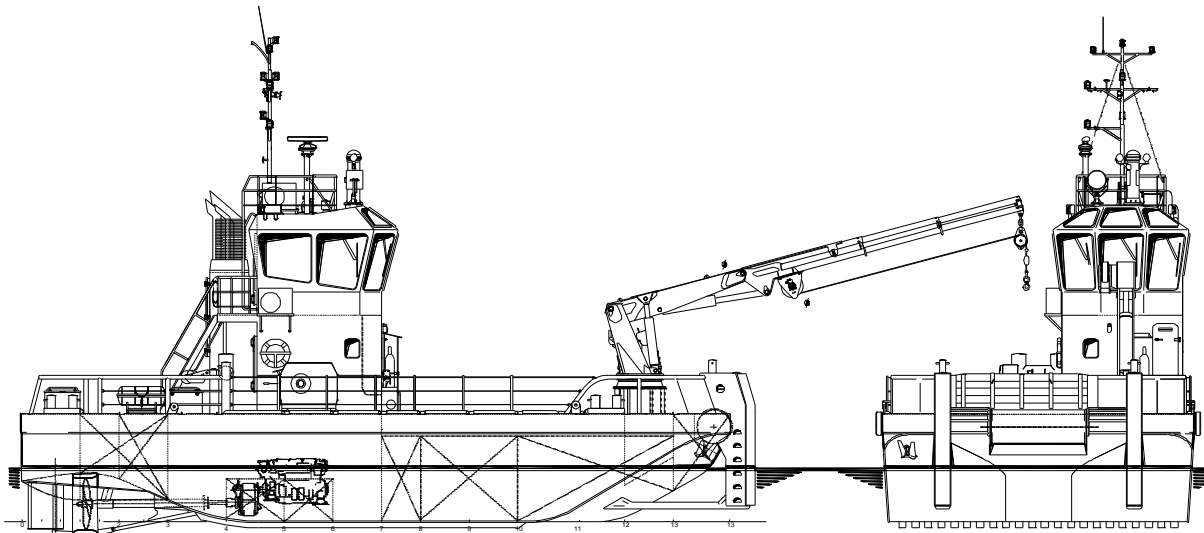
Wheelhouse, day-room / pantry and sanitary space. Below main deck at starboard a workshop/store. Port side Ø crew cabin with air-conditioning.

### NAUTICAL AND COMMUNICATION EQUIPMENT

SEARCHLIGHT	Pesch 500 W 24V
RADAR SYSTEM	Furuno FR 8062
COMPASS	Magnetic Kotter type
GPS	Furuno GP-32
ECHO SOUNDER	Furuno LS-6100
VHF	Sailor 6248 or Ø 2x Sailor 6222
Ø HAND HELD VHF	2x Furuno TR 20
Ø AUTOPILOT	Simrad AP50
INTERCOM	6 stations
Ø NAVTEX	Furuno NX-700
Ø EPIRB	Jotron, Tron-40S
Ø SART	Jotron, Tron Sart
Ø AIS	Furuno FA-150

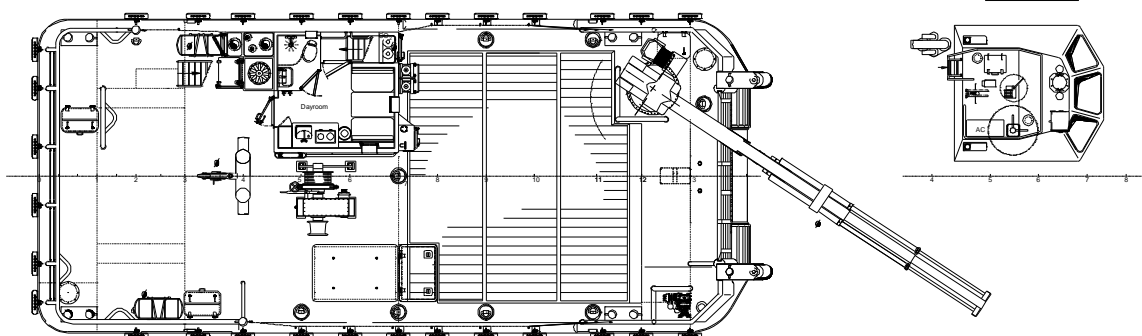
### COMPLETE VESSEL ON STOCK

\* PHOTOGRAPH SHOWS SIMILAR VESSEL / Ø = OPTIONAL EQUIPMENT



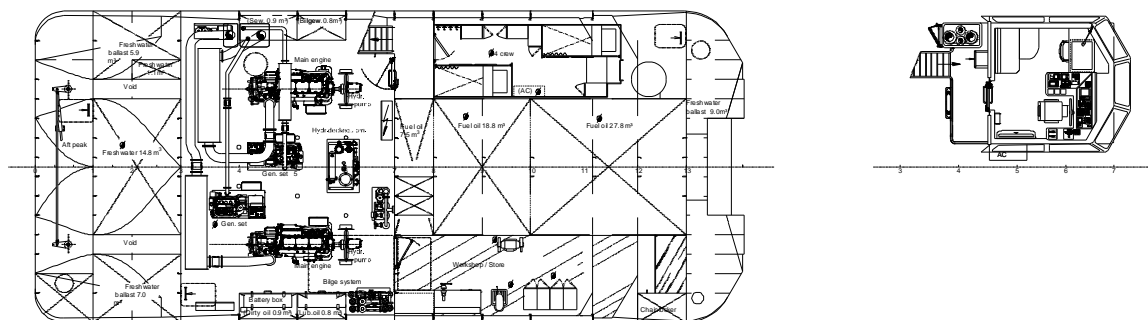
Maindeck

Topdeck



Below Maindeck

Bridgedeck



# DAMEN MULTI CAT<sup>®</sup> 1908

"YN 518526-27-29-30"

## DAMEN

DAMEN SHIPYARDS GORINCHEM

Member of the DAMEN SHIPYARDS GROUP



Industrieterrein Avelingen West 20  
4202 MS Gorinchem

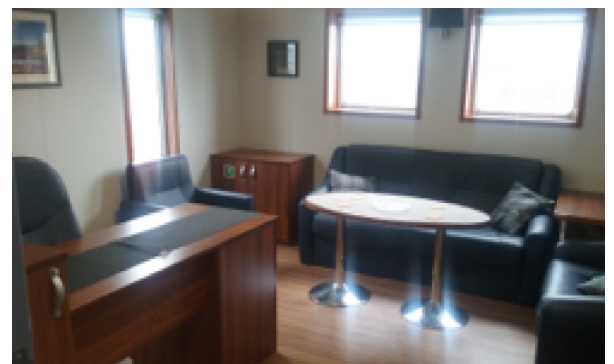
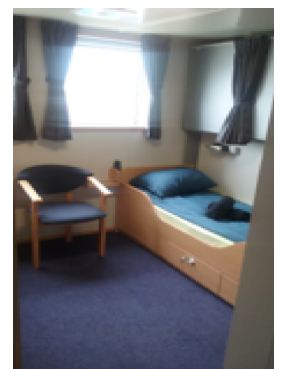
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## S/V “KOMMANDOR IONA”

The “Kommandor Iona” is a 76m LOA DP1 Survey Vessel that has just completed an intense refurbishment programme and is fitted with a number of survey-specific features that shall ensure more than sufficient working spaces onboard to cope with all equipment, LARS systems and online/offline spaces.



The S/V Kommandor Iona

**S/V KOMMANDOR IONA - VESSEL TECHNICAL SPECIFICATIONS (Summary)**

**DIMENSIONS**

Length Overall 76.0m

Length b.p. 66.0m

Beam Moulded 15.0m

Draft (Summer) 4.2m

**CLASSIFICATION**

Lloyds Register

**FLAG**

United Kingdom (SPS Code)

**DP SYSTEM**

Dual EMRI JS/DP (DP1 Compatible)

**LIFESAVING EQUIPMENT**

Vessel conforms to SOLAS requirements

**PROPULSION**

2 X 1490kw Ruston Diesels

4-blade controllable pitch propeller

**THRUSTERS**

1 Bow – Gill Jet - 700 kW

1 Stern Tunnel - 400 kW

**AUXILIARY POWER**

4 X 400 kW

440 V/ 60 HZ -

**ACCOMMODATION**

Fully air conditioned accommodation

5 Staterooms

16 Single cabins (client's all ensuite)

14 Double (Pullmans) ensuite cabins

**WORKING AREAS**

Geotechnical deck 150m<sup>2</sup>

Processing room 50m<sup>2</sup>

Aft. Decks 200m<sup>2</sup>

Wet Labs 50m<sup>2</sup>

**HANDLING EQUIPMENT**

A Frame Fwd 10t

Davits Aft

**BRIDGE/RADIO ROOM**

DGPS positioning system

2 x Gyro compass