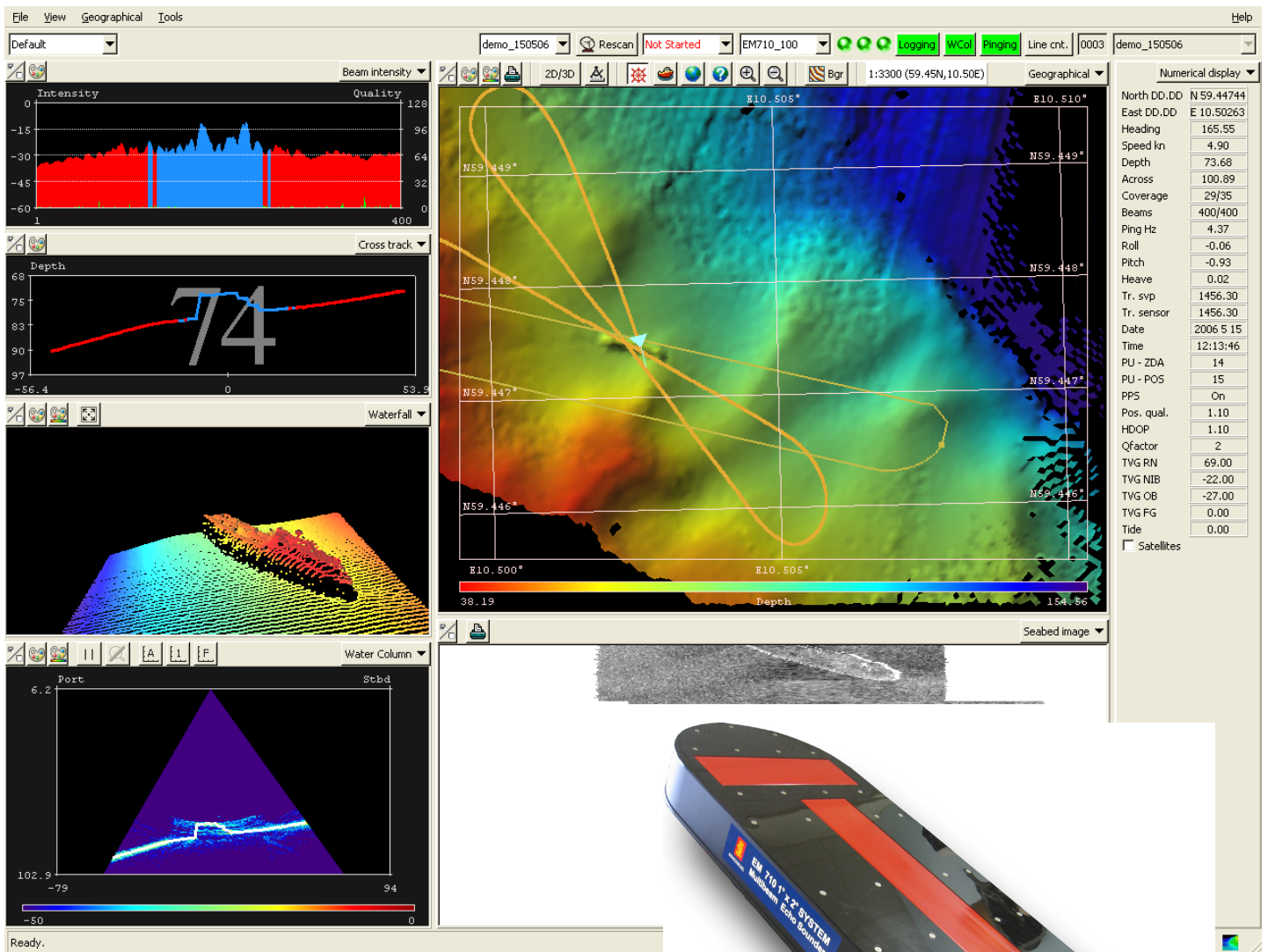




KONGSBERG

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.

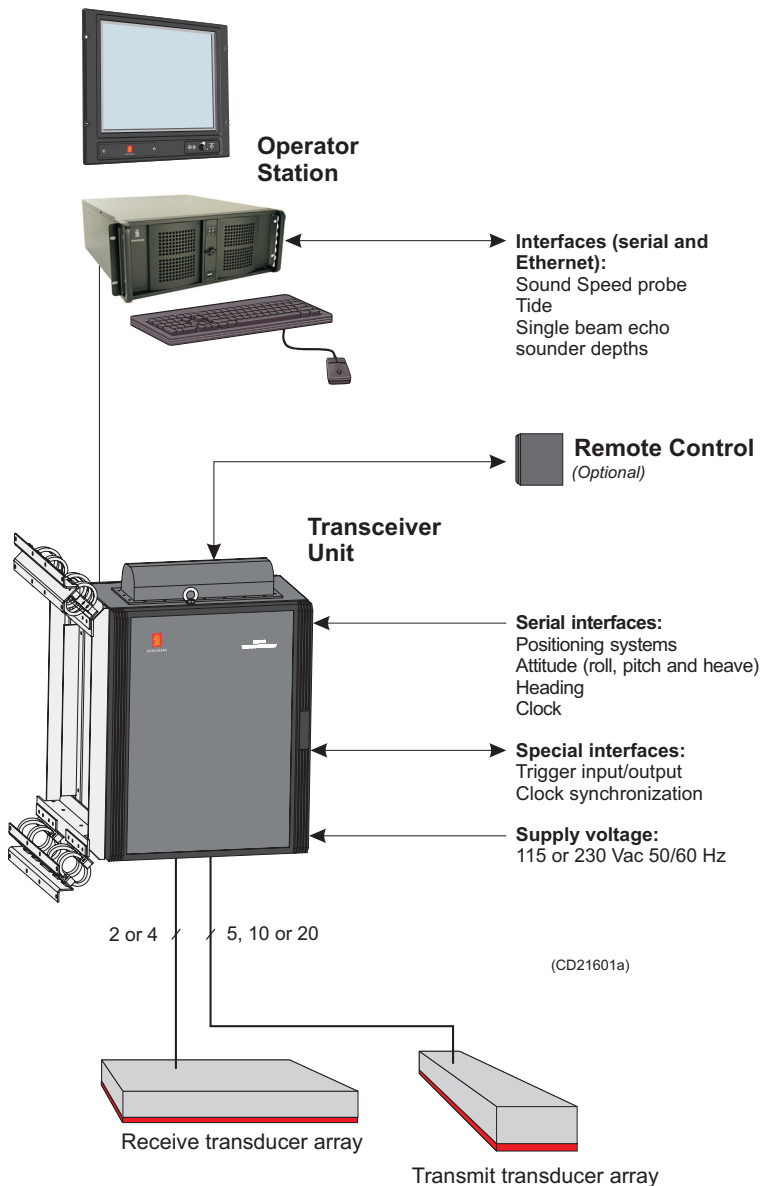
The non-saturating and low noise receivers and A/D converters are of floating point type, resulting in a dynamic range of more than 140 dB. The conventional TVG compensation is no longer needed.

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.

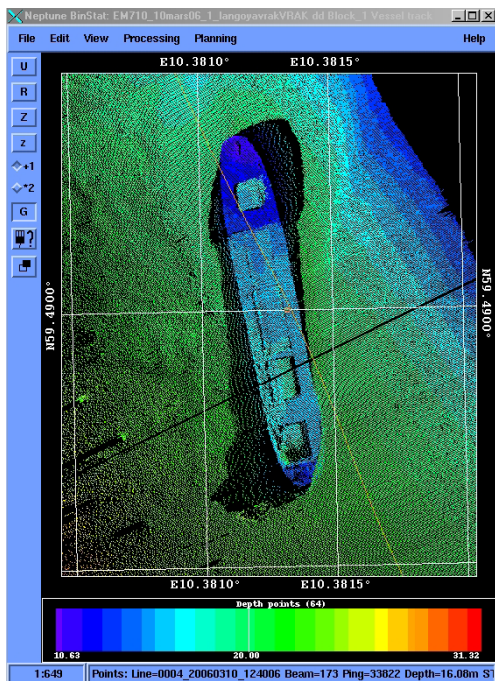
Operator Station

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 stage 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° transmit and 1° 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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