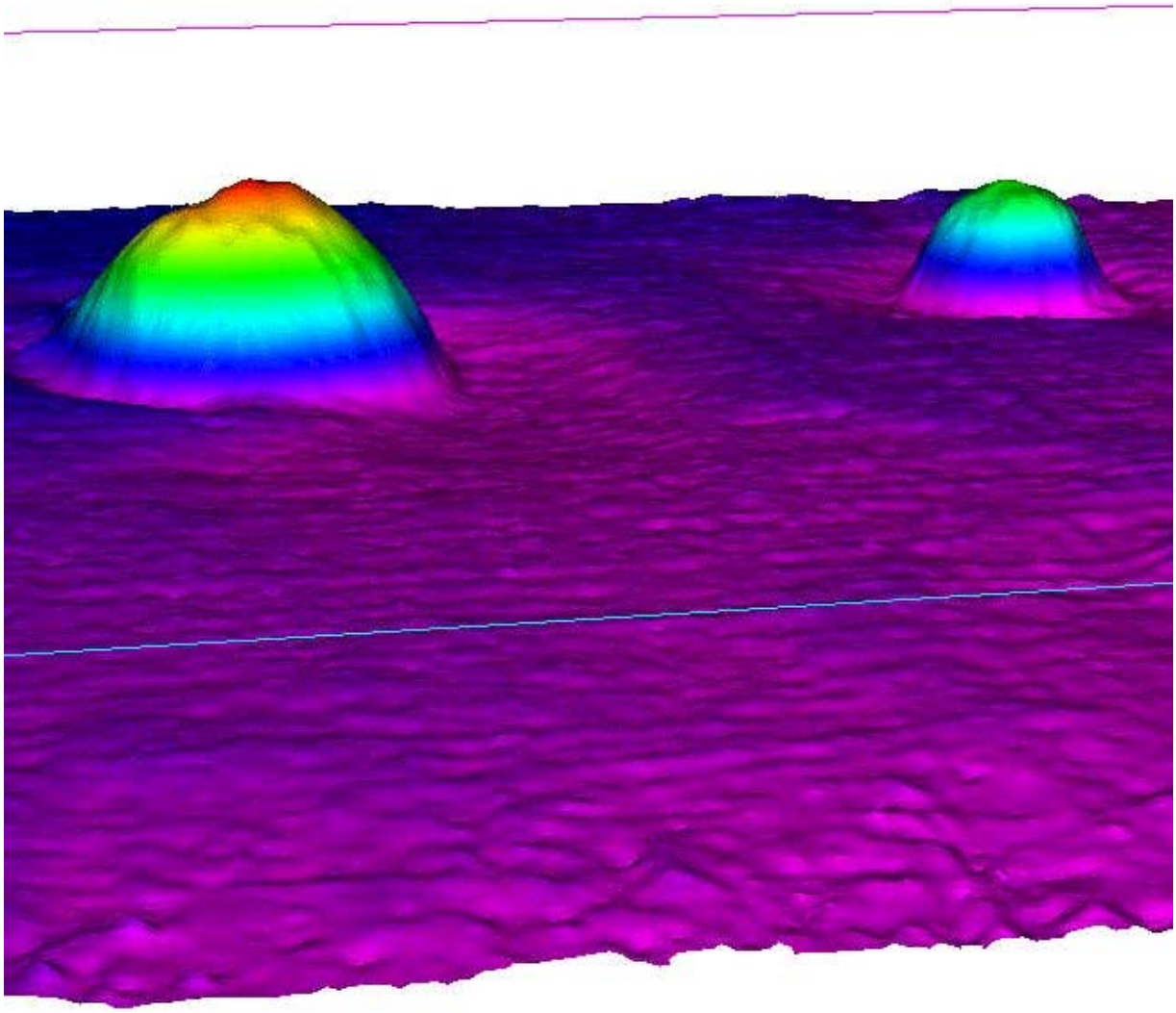
Product Description

KONGSBERG

EM 120

Multibeam echo sounder



855-160930

EM 120
Multibeam echo sounder

Product description

This document presents a brief technical description of the EM 120 multibeam echo sounder.

About this document

Rev	Date	Written by	Checked by	Approved by
A	20.05.98	RBr	EHa	MGj
	Original issue.			
B	29.05.98	RBr	EHa	MGj
	Minor changes to technical specifications. Mapping examples replaced. One accuracy curve replaced.			
C	27.04.99	RBr	EHa	EHa
	Minor changes to document and to technical specifications. System overview diagram replaced with new version. Preamplifier Unit added.			
D	19.11.99	RBr		EHa
	System overview drawing replaced. Layout in “Technical specifications” reformatted for HTML publishing. Outline dimensions on Tx Junction Box and Guarantee conditions added to “Technical specifications”.			
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	Several minor changes implemented. Updated outline dimension drawings added. Changes to “Technical specifications”. Small errors and misprints corrected throughout the document.			
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	Additional images added, several small corrections to the text.			
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	Minor corrections.			
H	18.03.05	EB	KEN	FP
	Implementation of SIS (Seafloor Information System software) and HWS 10 (Hydrographic Work Station). Other minor corrections.			

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SYSTEM OVERVIEW

Key facts

The EM 120 is designed to perform seabed mapping to full ocean depth with an unsurpassed resolution, coverage and accuracy. The system is cost effective, reliable, and easily operated on workstations with familiar operating systems.

The design of the EM 120 is based on more than 50 years of hydrographic experience with echo sounders, sonars and underwater positioning for civilian and military use. Kongsberg Maritime is today a part of the Kongsberg Group, a world wide organisation supplying advanced instrumentation for civilian, research and military maritime communities.

The EM 120 is a complete system. All necessary sensor interfaces, data displays for quality control and sensor calibration, seabed visualization, and data logging are a standard part of the system, as is integrated seabed acoustical imaging capability (sidescan).

Including a shallow water multibeam echo sounder with the EM 120 system will give a total system solution meeting IHO requirements for all depths.

Operating frequency and coverage sector

The nominal sonar frequency is 12 kHz with an angular coverage sector of up to 150 degrees and 191 beams per ping as narrow as 1 degree. Achievable swath width on a flat bottom will normally be up to 5.5 times the water depth. The angular coverage sector and beam pointing angles may be set to vary automatically with depth according to achievable coverage. This maximizes the number of usable beams. The beam spacing is normally equidistant with equiangle available.

Transmission

The transmit fan is split in several individual sectors with independent active steering according to vessel roll, pitch and yaw. This place all soundings on a “best fit” to a line perpendicular to the survey line, thus ensuring a uniform sampling of the bottom and 100% coverage.

The sectors are frequency coded (11.25 to 12.60 kHz), and they are transmitted sequentially at each ping. The sector steering is fully taken into account when the position and depth of each sounding is calculated, as is the refraction due to the sound speed profile, vessel attitude and installation angles. Pulse length and range sampling rate are variable with depth for best resolution, and in shallow waters due care is taken to the near field effects.

The ping rate is mainly limited by the round trip travel time in the water up to a ping rate of 5 Hz.

Transducer arrays

The EM 120 transducers are linear arrays in a Mills cross configuration with separate units for transmit and receive. The arrays are divided into modules, these may be replaced by a diver. The number of modules used (and hence the beamwidth) may be adjusted according to particular installation requirements. For both arrays 1 and 2 degrees beamwidths are standard options, and 4 degrees beamwidth is available for the receive array. The resulting array lengths are between 2 and 8 m.

A combination of phase and amplitude detection is used, resulting in an instrument measurement accuracy practically independent of beam pointing angle.

Post-processing

Postprocessing software is available from both Kongsberg Maritime and third-party suppliers. A world-wide marketing and service organization having many years of multibeam experience is in place for supporting the EM 120.

Optional sub-bottom profiling

The receive transducer is wideband. In conjunction with a separate low frequency transmit transducer, the EM 120 may optionally be able to deliver sub-bottom profiling capabilities with a very narrow beamwidth. This system is known as the **SBP 120 Sub-Bottom Profiler**. For more information, refer to the dedicated product information.

System drawing

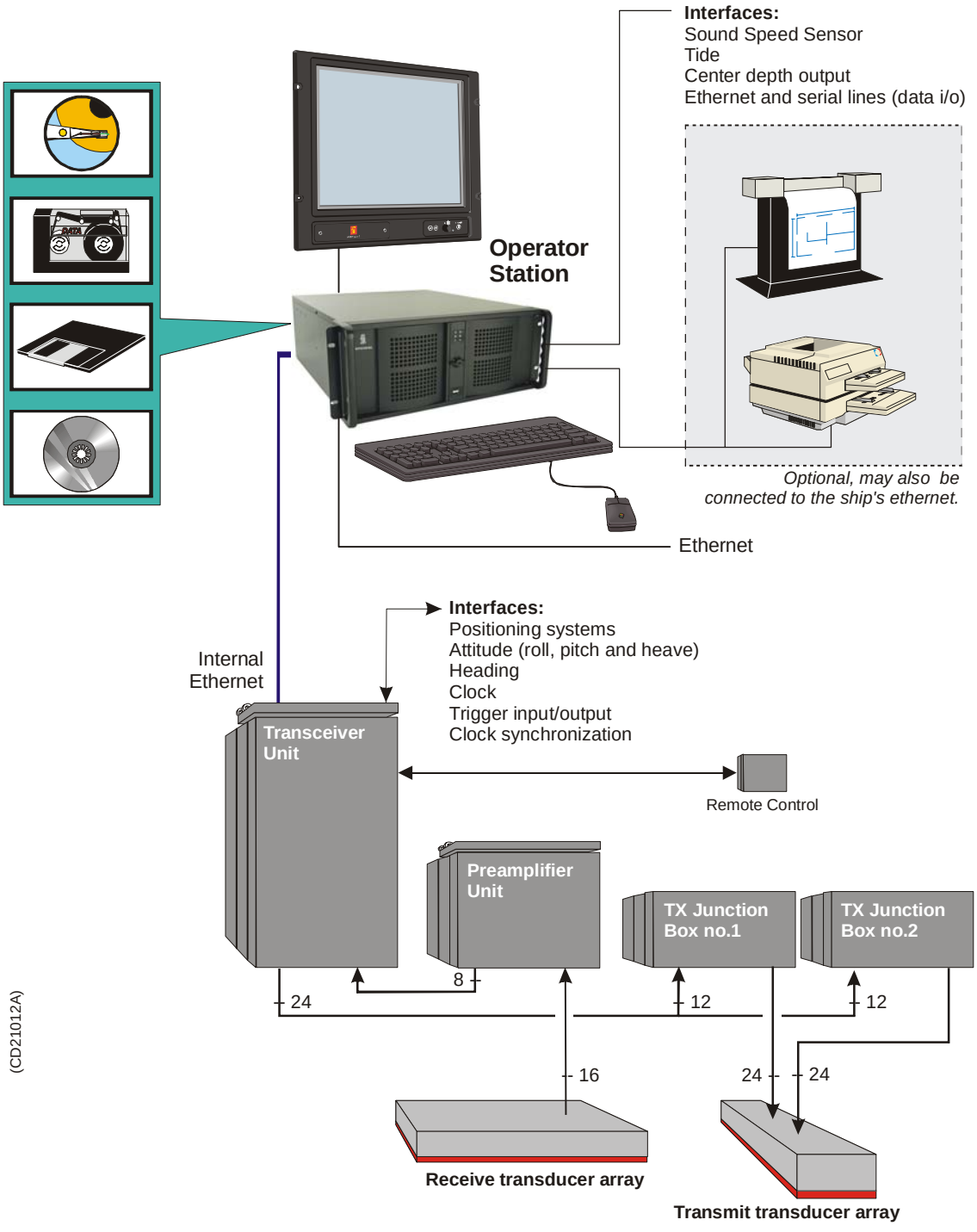


Figure 1 EM 120 system units and interfaces

System characteristics

Main units

The EM 120 multibeam echo sounder consists of the following units:

- Transmit transducer array (with TX Junction Box(es))
- Receive transducer array
- Transceiver Unit
- Preamplifier Unit
- Operator Station

Figure 2 The Transceiver Unit and TX Junction Boxes on "Bligh".

A complete mapping system will also include the following additional units:

- Vessel motion sensor(s)
- Positioning system(s)
- Sound speed sensor(s)
- Post-processing system

An extra low frequency transmit transducer and transceiver may be added for the optional high resolution sub-bottom profiling capability; the **SBP 120**.

Transducer arrays

The transmit transducer array contains up to 48 modules in accordance with the chosen beamwidth. Each module contains 18 elements arranged in rows of 6 elements. Each element is individually connected through the TX Junction Box to its corresponding transmitter in the Transceiver Unit. It can thus be driven with an unique amplitude level and phase to allow forming of the required transmit sectors with individual steering.

The receive transducer contains up to 16 modules in accordance with the chosen beamwidth. Each module contains 8 transducer staves, and these have individual electrical connections to their corresponding preamplifiers in the Preamplifier Unit. Each stave can thus be given unique amplitude and phase weighting to allow forming of the required receive beams.

The flat and horizontally mounted transducers of the EM 120 makes the accuracy almost independent of variations in sound speed at the transducer depth, unless the roll and pitch are not too excessive (exceeding 10 degrees with a 1 m/s sound speed error). Installation of a sensor to allow real-time measurement of sound speed variation can be made if this is expected, and recommended if a reduction in angular coverage is unacceptable during survey in heavy seas. The system will take into account the sensor measurements in its calculations of beam pointing angles and raybending. The system is prepared for using an AML Smart Probe directly. Due to possible marine growth, and to ease of cleaning or servicing of the sensor, it would be advisable to mount the sensor in a tank inside the hull, and pump water taken from the transducer depth through the tank.

Transceiver Unit

The EM 120 Transceiver Unit contains the transmit and receive electronics and processors for beamforming, bottom detection, and control of all parameters with respect to gain, ping rate and transmit angles. It has serial interfaces for all time-critical external sensors such as vessel attitude (roll, pitch, heading and heave), vessel position, and external clock. The Transceiver Unit is a wall mounted cabinet with integrated shock and vibration absorbers. The same cabinet is used for all combinations of beamwidths. An Ethernet cable connects the Transceiver Unit to the Operator Station.

Preamplifier Unit

The EM 120 Preamplifier Unit contains the preamplifiers for the receive signals. The unit also provides the frequency splitting circuitry to feed low frequency signals to the optional Sub-Bottom Profiler.

Tx Junction box(es)

The Tx Junction box serves as an interface routing box for easy transmit transducer cable installation. One or two units must be used depending on the chosen beamwidth.

Operator Station

The Operator Station of the EM 120 is the HWS 10 high performance dual-processor PC workstation. The operator software is the Seafloor Information System (SIS). The HWS 10 is dual bootable to either Linux® or Windows XP®.

SIS allows setting the EM 120 installation and runtime parameters, data logging and running self-test on the system without restrictions.

The SIS software also includes functionality for survey planning, 2D and 3D geographical display of the survey results, seabed image and water column displays, plus real-time data cleaning algorithms.

The HWS 10 is normally supplied with a 17.4” 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, but optionally a small IP 65 rated keyboard with integrated track stick can be delivered.

SPB 120 Sub-Bottom Profiler (optional)

The EM 120 system may be expanded to include an optional SBP 120 Sub-Bottom Profiler. The SBP 120 system capability includes the following items:

- An additional low frequency transmit transducer array, with the EM 120 hydrophone array being used for reception
- A sub-bottom profiler transceiver unit
- Operator Station(s)

For further information about the SBP 120 system, refer to the applicable product description.

PERFORMANCE

Basic specifications

The operating frequency of the EM 120 multibeam echo sounder is 12 kHz. This frequency is standard for deep ocean echo sounding, and gives a good balance between reasonably small dimensions, narrow beams, and good range capability.

The swath width in shallow waters is typically 6 times the water depth to about 2000 m depth. A swath width of about 20 km or more is generally achievable for deep waters, depending upon bottom conditions and chosen system beamwidths.

The system has 191 beams with pointing angles automatically adjusted according to achievable coverage or operator defined limits. The beam spacing is normally equidistant, corresponding to 1% of depth at 90 degrees angular coverage, 2% at 120 degrees and 3% at 140 degrees. Equiangle beam spacing is also available, as is an in-between spacing.

Pulse lengths

Deep waters

In deep waters a pulse length of 15 ms is normally used. The transmit fan is split into nine different sectors transmitted sequentially within the same ping. This method increases the system source level, and thus depth and coverage capability significantly. Using electronic steering, the sectors are individually tilted alongtrack to take into account the vessel's current roll, pitch and yaw with respect to the survey line heading. The swath can then be stabilized to fall on a line perpendicular to the survey line. Pitch and especially yaw steering in individual sectors is required to guarantee 100% bottom coverage in deep waters.

The EM 300 was the first multibeam echo sounder implementing such yaw steering, while the EM 120 now uses this technique to reach full ocean depth.

Intermediate depths

At intermediate depths a pulse length of 5 ms is used and the transmit fan is split in three sectors which are stabilized according to vessel roll, pitch and yaw. Note that yaw steering may be required even at a few hundred meters depth despite the higher ping rate the lesser depth allows.

Shallow waters

In shallow waters a pulse length of 2 ms is used, and special processing is used to handle the detrimental near field effects. An increased resolution is then possible, allowing a system performance meeting Order 2 IHO accuracy requirements even at 100 m depth.

Depth accuracy

The system depth accuracy is very high due to the narrow beams and high range sampling rate used (2 kHz), but most importantly through using the advanced bottom detection methods proven through many years of experience with the Kongsberg range of multibeam echo sounders. Near normal incidence a centre of gravity amplitude detection is employed, but for most of the beams the system uses interferometric phase detection.

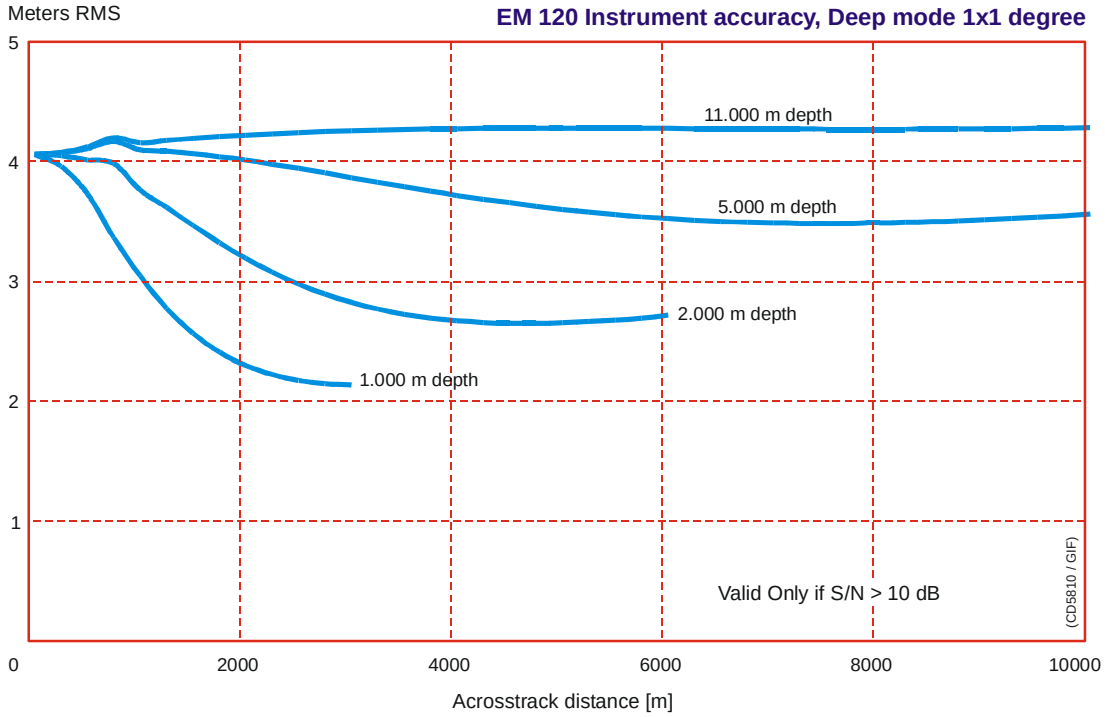


Figure 3 EM 120 Bottom detection

For every range sample an interferometric measurement of the angle of arrival of the returned bottom echo is done, and from all the bottom returns in a beam the exact range to the bottom in the beam centre is derived. The total system error will also depend upon the quality of the positioning, vessel motion and sound speed sensors.

The expected total system RMS accuracy (assuming good external sensor data) is then:

- 0.2% of depth (from vertical up to 45 degrees)
- 0.3% of the depth (up to 60 degrees)
- 0.5% of the depth (between 60 and 70 degrees)

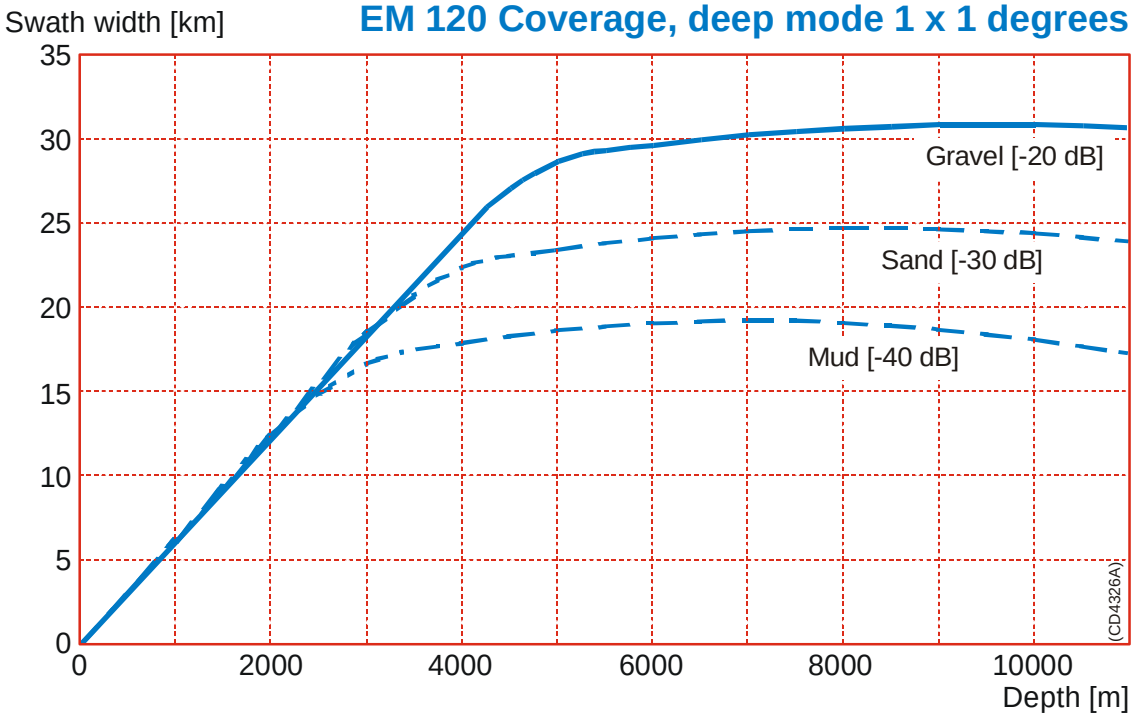
Note that the achievable accuracy may be limited by the selected pulse length (to 0.25 m for 1 ms pulse length, scaleable with pulse length).

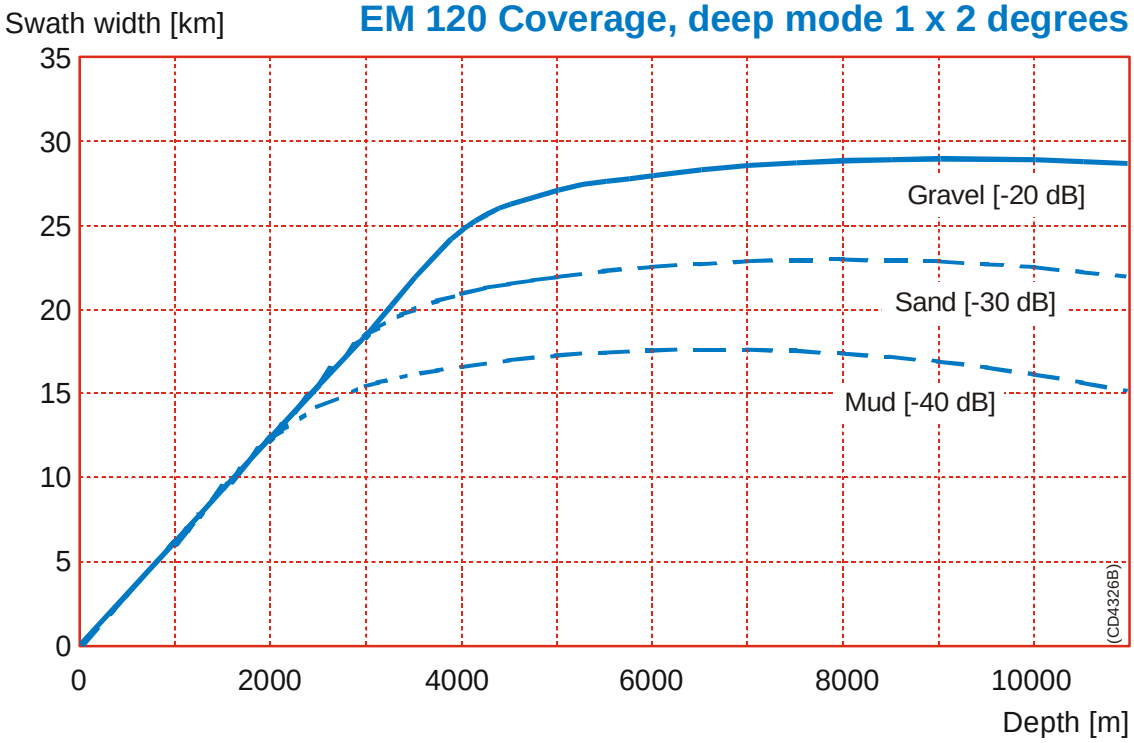
The signal-to-noise ratio must be better than 10 dB.

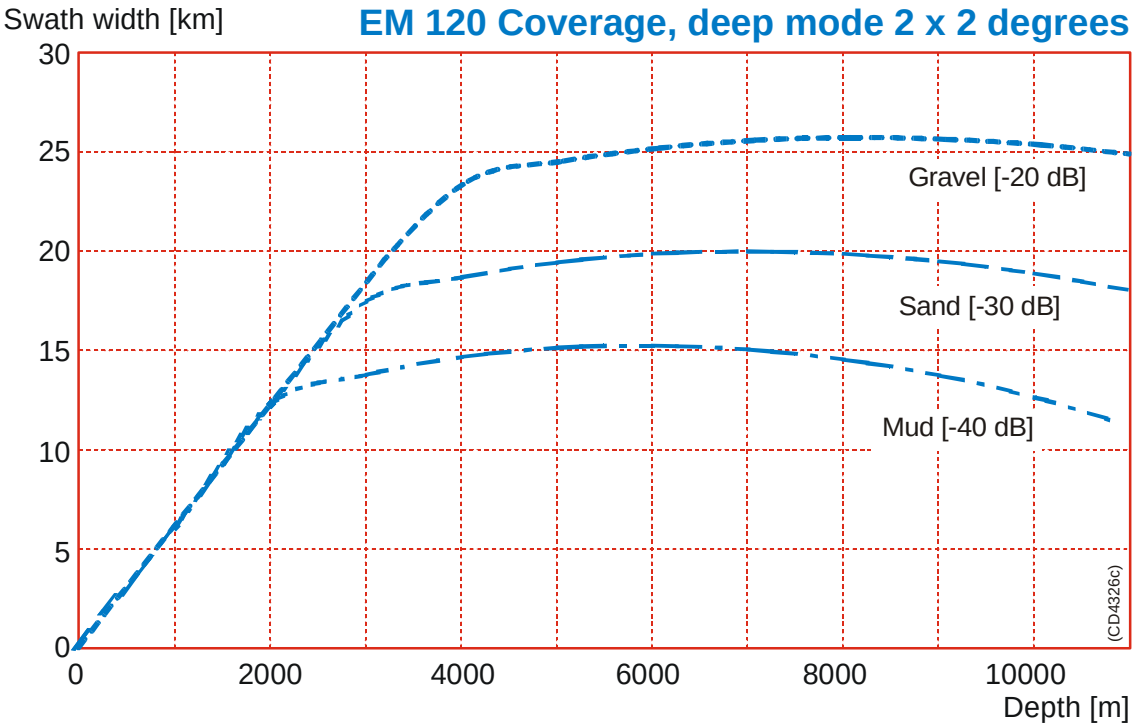
Transducer arrays for individual requirements

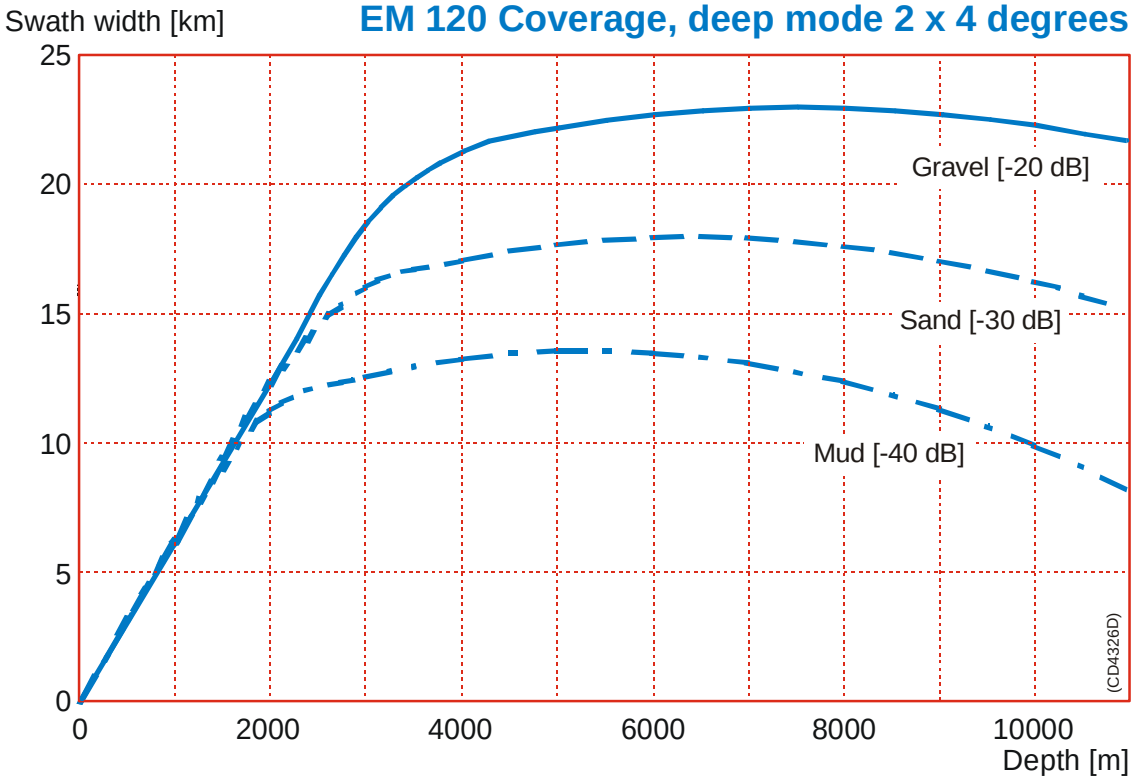
System accuracy, resolution and coverage capability improves with decreasing beamwidth, and a beamwidth of 1 x 1 degree with 8 m long transducer arrays is a standard option for the utmost performance. However, long arrays are expensive and may be difficult to install, especially with regard to the receive array which is long athwartship. The transducer array lengths may therefore be tailored to individual requirements. Transmit beamwidth is the most important performance factor, and 1 and 2 degrees transmit beamwidths are standard options. For the receive array 1, 2 and 4 degrees are standard options.

The beamwidth of the receive array is normally set to twice the transmit beamwidth.


EM 120 Coverage, deep mode 1 x 1 degrees
Swath width [km]
35
30
25
20
15
10
5
0
0
2000
4000
6000
8000
10000
Depth [m]
Gravel [-20 dB]
Sand [-30 dB]
Mud [-40 dB]
(CD4326A)


EM 120 Coverage, deep mode 1 x 2 degrees
Swath width [km]
35
30
25
20
15
10
5
0
0
2000
4000
6000
8000
10000
Depth [m]
Gravel [-20 dB]
Sand [-30 dB]
Mud [-40 dB]
(CD4326B)


Swath width [km]
EM 120 Coverage, deep mode 2 x 2 degrees
30
25
20
15
10
5
0
Gravel [-20 dB]
Sand [-30 dB]
Mud [-40 dB]
(CD4326c)
0
2000
4000
6000
8000
10000
Depth [m]


Swath width [km]
EM 120 Coverage, deep mode 2 x 4 degrees
25
20
15
10
5
0
Gravel [-20 dB]
Sand [-30 dB]
Mud [-40 dB]
(CD4326D)
0
2000
4000
6000
8000
10000
Depth [m]

INSTALLATION

Introduction

The compactness of the EM 120 multibeam echo sounder is a guarantee for a fast and easy installation.

Operator Station and electronic cabinets

The Operator Station is usually mounted on a desk in the operation room and suitably tied down. The TX Junction Box(es) and the Preamplifier Unit are intended to be mounted on a bulkhead in a room close to the transducers to reduce the amount of cabling. The Transceiver Unit is usually installed in the same room, but may be moved elsewhere to allow for easier access.

Transducer arrays

The transducer arrays should be mounted in the forward part of the vessel, taking into account hull shape, potential aeration problems and ease of cable installation.

The transducer modules are fixed to a frame with bolts from the front. The frames may either be mounted directly on or recessed into the hull, or within sea chests. The latter solution may be somewhat more expensive, but will ensure that the transducers are properly mounted within the tolerances required. A fairing will usually be added around the transducers to ensure a laminar water flow without any aeration problems. Ice protection windows may be added if required, but angular coverage may then be restricted.

A blister or gondola installation will usually help in avoiding air bubble blockage of the transducers and may contain additional transducers for other systems. The receive transducer array may be folded to fit the vessel’s hull.

EM 120 installation examples has been provided.

The cables from the modules have a standard length of 20 m, and are terminated with connectors which plug directly into the Preamplifier Unit cabinet. Normally the cables enter the hull through tubes which are fitted with standard ship type cable glands (Brattberg or equivalent) to provide water tightness. The cable glands should be of the type having a pressure rating of 4 bars or more. The glands should be installed above the vessel water-line if diver replacement of transducer modules is envisioned. If the tubes end below the water-line, classification requirements may require a double set of glands.

Figure 4 The blister for the EM 120 transducer arrays (2x2 degrees system) designed for "Commander Jack"

Figure 5 Transducer element installation on "Commander Jack"

Figure 6 The flush blister for the EM 120 transducer array designed for "James Clark Ross"

Figure 7 Forward view of the transducer blister on "Bligh". An EM 1002 transducer array is also mounted.

OPERATION

System features

The EM 120 multibeam echo sounder is controlled from the HWS 10 Operator Station using a standard click and point graphical user interface. The software, Seafloor Information System (SIS), may either be run under the Microsoft Windows XP or Linux operating systems which are both installed on the HWS 10. As standard, the system software includes the necessary features for system installation, testing and running the multibeam, ping related displays (including water column display) and the capability of logging the acquired bathymetry data.

The EM 120 system does not require operator intervention during normal operation, but tracks the bottom automatically while adjusting mode, gain and range dependent parameters as required. Before operation is started, the necessary external sensors, such as positioning and vessel motion sensors, are connected and calibration procedures followed in order to define the system and sensor installation parameters.

Parameters critical to data quality are password protected, and most of the parameters can be recalled from a disk file.

Seabed imagery data is available from the system as standard. The imagery data, representing the acoustic backscatter strength of the bottom in 0.5 dB resolution, is available in two forms, one with range resolution nominally corrected for the effect of incidence angle, the other given per beam as an absolute measure. The imagery data may be useful for object detection, but the most important application is probably geophysical for seabed characterization.

Quality control

Quality control of the acquired data is done through graphical displays. In addition a message window and alphanumeric displays are included to allow a quick overview of the system status, indicating any interface or hardware related problems. SIS provides the graphical displays required for real-time checking of the EM 120. These include:

- Cross-track depth profiles
- Beam intensities and quality measures
- Time series display of beam samples and sensor values
- 3D waterfall display
- Sound speed profile display and editor

Graphical user interface

Using the SIS software, the operator will normally be viewing gridded data in a geographically oriented 2D or 3D display as his primary means of quality control of the survey. The grid has six levels of detail, allowing rapid zoom in and out. Previous survey results can be imported to allow visualisation of any differences between the current and old surveys in overlapping areas.

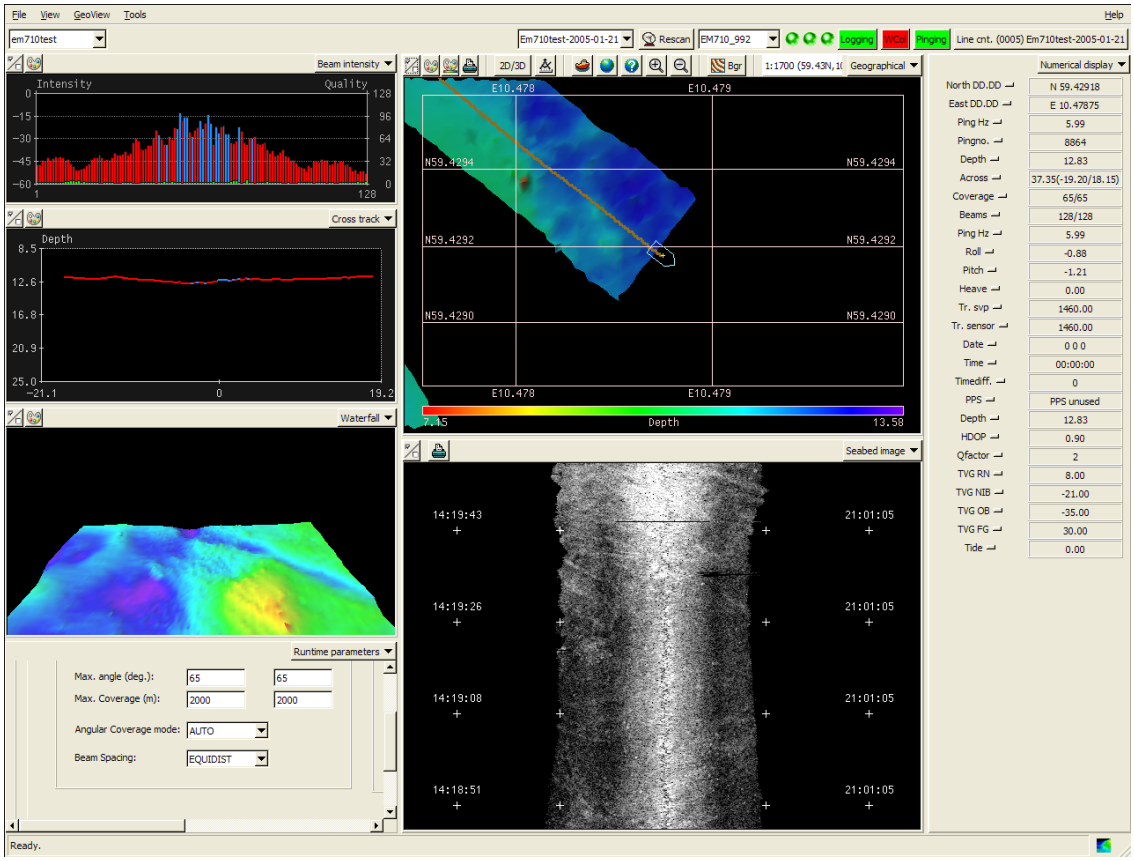


Figure 8 Example of SIS graphical user interface

The grid may also be utilized for real-time data cleaning. Based upon a set of user defined rules, outliers in a grid cell, whether from old or new survey lines, are flagged. The flags may be retained or updated through the processing. Optionally the CUBE data-cleaning package from the Center for Coastal and Ocean Mapping Center at the University of New Hampshire is also available in SIS.

Among other features included are:

- System (sensor) calibration
- Planning of surveys
- Real time cleaning of data, for separate survey lines or for the complete survey area
- Helmsman Display
- Full use of the chosen operating system for data export, plotting and printing

Electronic chart data can be displayed as a background in the geographical displays.

Data logging

It is of the utmost importance to ensure that all survey related data is logged in a safe way. The data is always stored on disk and the geographical displays take data only from disk. In this way, what the operator sees is what is safeguarded and already stored. As standard the HWS 10 runs two high performance SerialATA disks connected in a RAID1 array, i.e. one disk may fail without loss of data. The disks are mounted in mobile storage bays, thus they may be removed for security reasons or for transporting the acquired data The stored data may be written to DVD at any time. The Firewire, SCSI and USB interfaces may be used for transfer of data to external storage devices, such as disk or tape, according to user preferences. All data are also available on an external Ethernet.

The logged data sets include:

- Raw sensor data
- Beam ranges and beam pointing angles
- Depth datagrams
  - In each depth datagram range/angle data from one ping have been merged with motion sensor data and the current sound velocity profile to derive a rigorous solution for vessel motion and raybending, calculating sounding depth and position as Cartesian coordinates. The depth datagrams are suited for immediate presentation in the geographical display.
- Seabed image data
- System parameter settings

The gridded data (terrain model) is also available for logging. The data formats are public and published on the Kongsberg Maritime web site, ensuring that EM 120 is a truly open solution, allowing third party or own software to be developed for data processing.

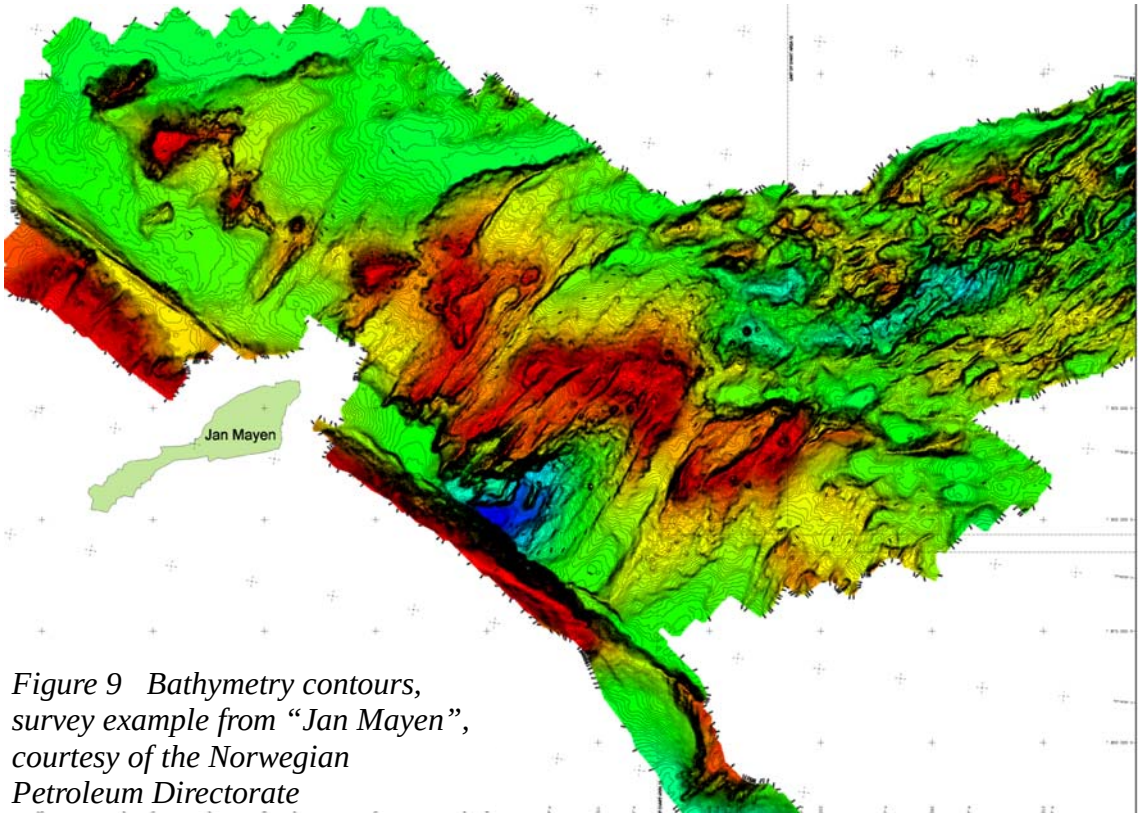


Figure 9 Bathymetry contours, survey example from "Jan Mayen", courtesy of the Norwegian Petroleum Directorate

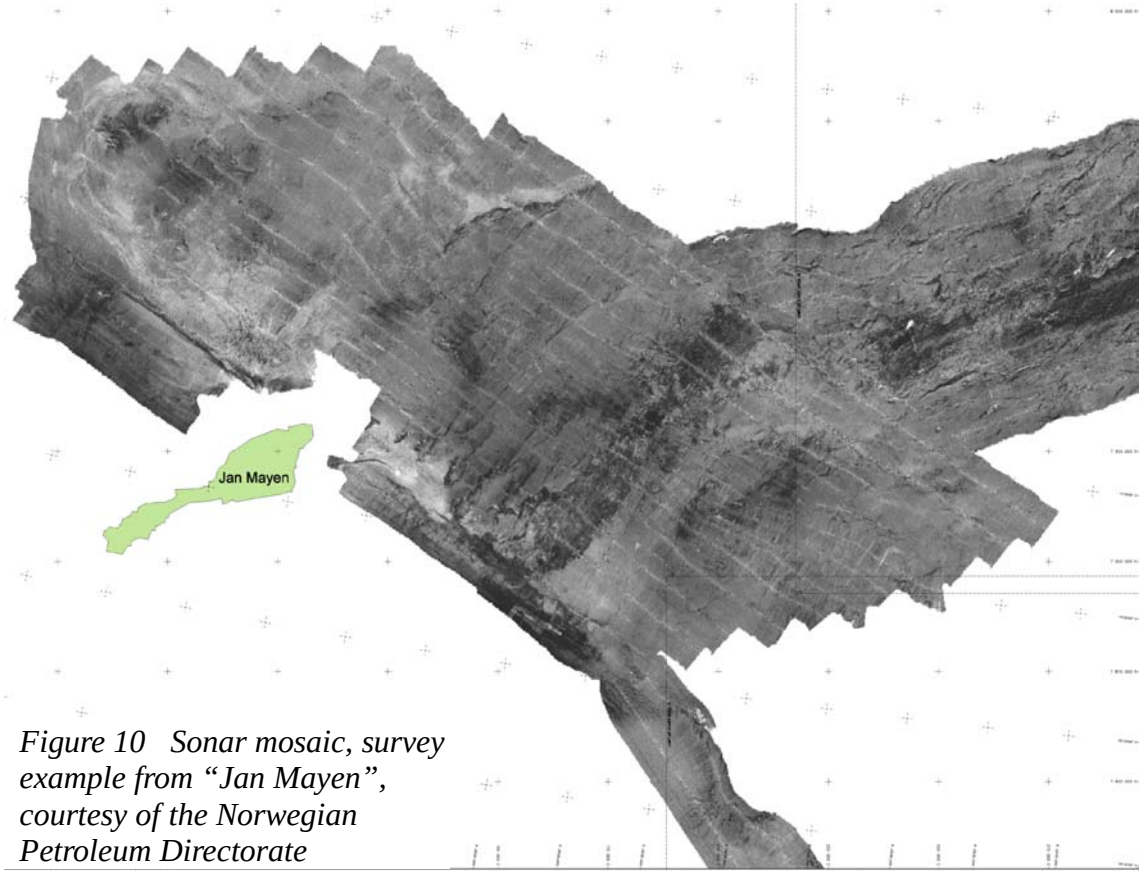


Figure 10 Sonar mosaic, survey example from "Jan Mayen", courtesy of the Norwegian Petroleum Directorate

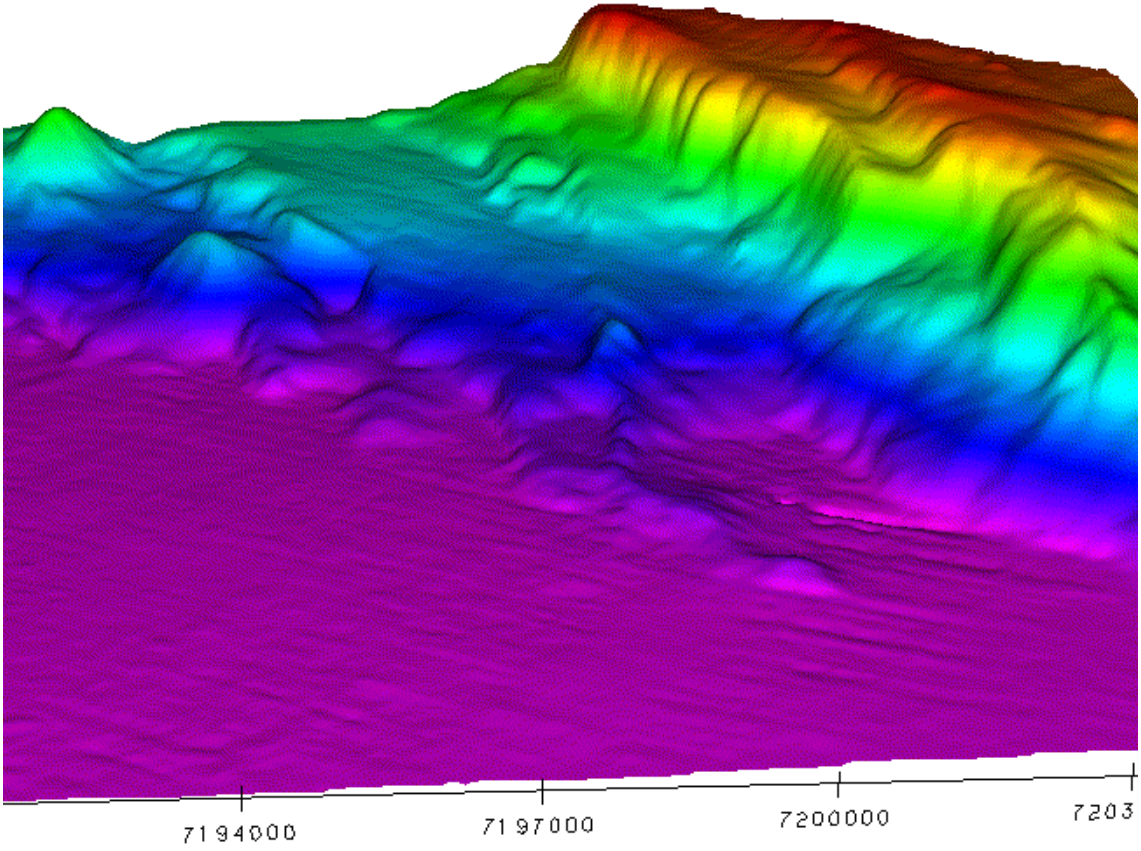


Figure 11 Survey example from "Roger Revelle"

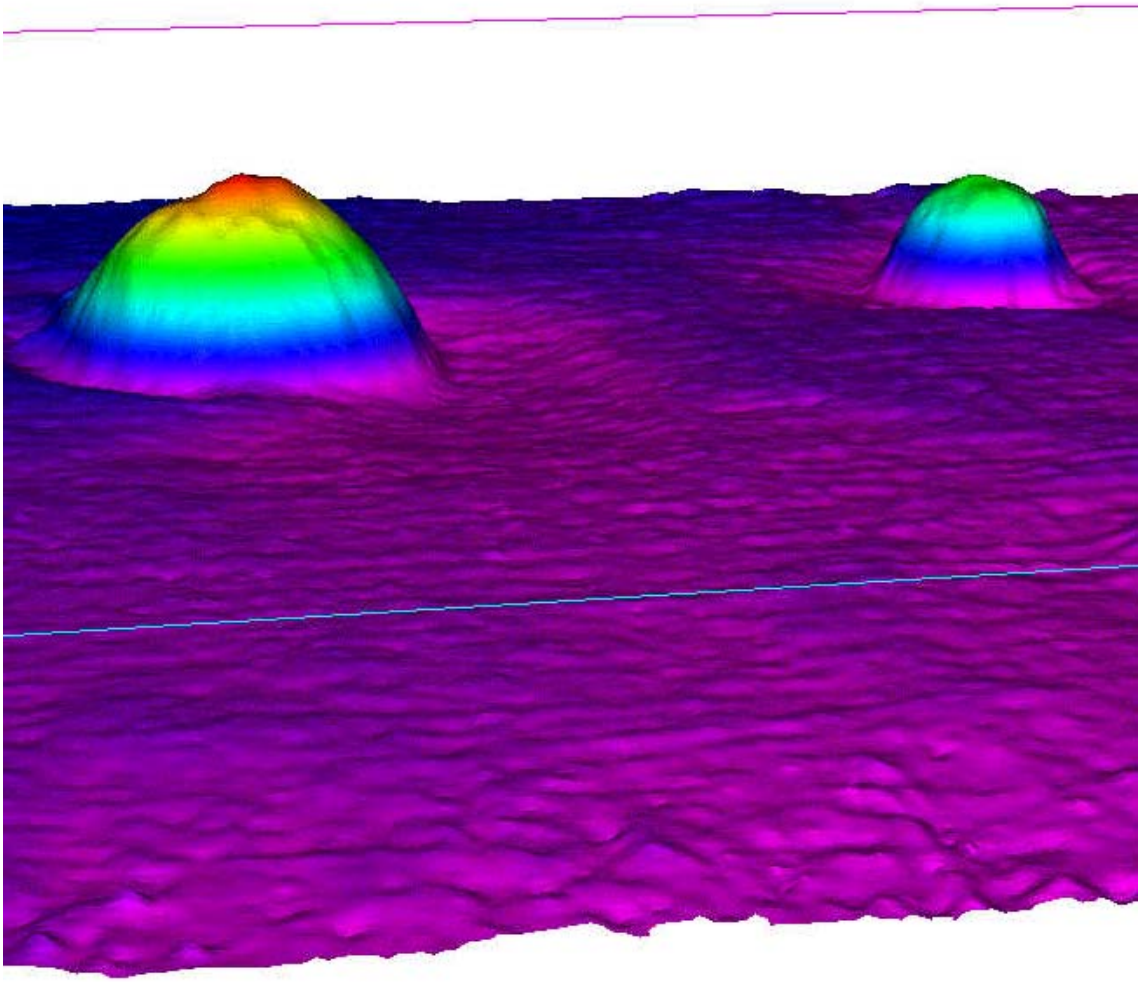


Figure 12 Survey example from "Roger Revelle". The "mountains" on the seabed are volcanos

POST-PROCESSING

Post-processing options

The high quality data produced by the EM 120 multibeam echo sounder is an excellent basis for producing a complete description of the seabed in the form of charts, 3D displays, combined bathymetry and acoustic imagery, seabed classification, etc. Kongsberg Maritime can deliver a complete set of products for post-processing EM 120 bathymetric data. Interfaces to other post-processing software is also available.

Brief descriptions

The **Neptune** software is used for post-processing of bathymetric data. Such post-processing involves cleaning and filtering of position data, analysis and corrections for depth data, tidal height adjustment, automated data cleaning based upon statistical rules, manual editing, controlled data thinning, and export of the final sounding data to further processing.

The **Poseidon** software is used for post-processing of seabed image data into seabed image mosaic map overlay. This involves merging of data from overlapping survey lines, applying systematic corrections which are required, filtering and interpolation.

The **Triton** software is used for seabed sediment classification. This process extracts signal features from the seabed image data, and applies this data to a statistical classification procedure in order to obtain the best estimate for seabed sediment type as a function of position in the form of a map overlay. The classifier can be trained and adapted to local conditions by use of a training module to correlate acoustical signature to ground truth information.

Software to be used for digital terrain modelling and plot generation can be delivered integrated with Neptune to derive a digital terrain model from an interpolation of the cleaned sounding data. From the terrain model contour maps, 3D plots, depth profiles along specified routes, fairsheets, volume calculations, etc, are easily produced. This additional third-party software is usually the **Cfloor** system.

CUSTOMER SUPPORT

Introduction

As a major supplier of multibeam echo sounders with many years of experience, Kongsberg Maritime has developed a marketing and service organization tuned to customer needs.

Installation

As part of the discussions with the client Kongsberg Maritime will - free of charge and without any obligations - give advice regarding the practical installation of the EM 120 system. We will also - upon request - prepare proposals for the supply of complete instrument packages and/or systems. A project manager will usually be appointed to supervise the delivery, installation and testing of larger instrumentation systems.

The installation and final testing of an EM 120 system should be done according to Kongsberg Maritime's documentation. If required, Kongsberg Maritime field engineers can be made available to:

- Supervise the installation.
- Perform the measurement of final location and attitude of the transducers and/or sensors.
- Perform system check-out and final testing.

Documentation and training

The EM 120 is delivered with complete documentation for installation, operation and maintenance. If required, the manuals are prepared to reflect the actual system on the client's vessel.

Kongsberg Maritime can conduct the training of operators and maintenance personnel to the extent required by the client. Such training courses can take place on the vessel, on any of Kongsberg Maritime's facilities, or any other location decided by the client.

Service

The Kongsberg Maritime service department has a 24 hour duty arrangement, and can thus be contacted by telephone at any time. The service department will assist in solving all problems that may be encountered during the operation of the system, whether the problem is caused by finger trouble, insufficient documentation, software bugs or equipment breakdown.

FEMME

A forum for users of Kongsberg Maritime's multibeam echo sounder systems (FEMME), with the aim of improving communication both between the users and Kongsberg Maritime, but also between the system users, is arranged at approximately 18 months intervals. Close to 100% user participation has been experienced at these meetings.

Warranty and maintenance contract

The normal warranty period of the EM 120 is 24 months after delivery.

A system maintenance contract tailored to fit the needs of the client is available. This contract can be defined so that it covers repair work only, or complete support for preventive maintenance, repair work, and system upgrading of both hardware and software as the system design is improved by Kongsberg Maritime.

The maintenance contract could also include a life-time warranty of transducers, upgrading of spare parts and documentation, and repeated or additional training courses.

SCOPE OF SUPPLY AND OPTIONS

Standard system

A basic EM 120 multibeam echo sounder delivery includes:

1 Operator Station HWS 10 with 17.4” LCD monitor.

2 Transducer modules.

These include necessary cables and mounting frames in accordance with chosen beamwidths.

3 Preamplifier Unit.

4 Transceiver Unit.

5 TX Junction Box(es).

6 Signal and control cables between cabinets. Standard length is 5 m.

7 All system software.

8 System manuals covering system installation, operation and maintenance.

Options

System options available include:

- Sea chests for transducers.
- Ice protection windows (may limit angular coverage).
- Raw data recorder.
- Non-standard cable lengths between the the TX Junction Box(es), Preamplifier Unit and Transceiver Unit. Maximum length is 25 m.
- Helmsman Display and/or additional monitors.
- Postscript colour graphic printer/plotter.
- High resolution grayscale recorder for continuous seabed image hardcopy.
- Spare parts.
- SPB 120 Sub-Bottom Profiler system.

System integration

Complimentary to the EM 120, the following software products may be delivered:

- **Neptune** for post-processing of bathymetric data.
- **Cfloor** integrated with Neptune for digital terrain modelling.

- **Triton** for seabed classification.
- **Poseidon** for seabed image mosaicing.

Additionally Kongsberg Maritime may deliver the EM 120 as part of a complete survey system. This may include integration with single beam echo sounders and/or other multibeam echo sounders for seamless coverage of any depth range.

An integrated system may share electronic chart display (ECDIS), dynamic positioning and vessel management systems, and third-party equipment such as sound speed sensors, vessel motion sensor and positioning systems.

TECHNICAL SPECIFICATIONS

Note

Kongsberg Maritime is engaged in continuous developments of its products and reserves the right to alter specifications without prior notice.

Interfaces

- Serial lines with operator adjustable baud rate, parity, data length and stop bit length for:
  - Motion sensor (roll, pitch, heave and optionally heading) in format supported by sensors from Applanix, iXSEA, Kongsberg Seatex and VT TSS
  - Heading (gyrocompass) in either NMEA 0183 HDT or SKR82/LR60 or Sperry Mk39 format
  - Positions in either Simrad 90, NMEA 0183 GGA or GGK format
  - External clock in NMEA 0183 ZDA format
  - Sound speed at transducer
  - Sea level height (tide)
  - Single beam echo sounder depths
  - Output of depth straight down in NMEA 0183 DPT format
- Interface for 1PPS (pulse per second) clock synchronisation signal
- SCSI interface intended for tape drive
- Firewire interface for external data storage device (tape or disk)
- USB 2.0 interfaces for data storage, printing or plotting
- Parallel interface for Postscript colour graphics printer/plotter
- Ethernet interface for input of sound speed profile, tide and echo sounder depths, and output of all data normally logged to disk

Physical specifications

Transmit transducer

- **Module:**
  - **Length:** 178.6 mm / 131.4 mm
  - **Width:** 760 mm (780 mm with frame)
  - **Height:** 197 mm (261.5 mm with 1 degree frame, 249.5 mm with 2 degrees frame)
  - **Weight:** 58 kg
- **Frame length:**
  - 4020 mm (2 degrees)
  - 7770 mm (1 degree)

Receive transducer

- **Module:**
  - **Length:** 447 mm
  - **Width:** 342 mm (420 mm with frame)
  - **Height:** 120 mm (177 mm with frame)
  - **Weight:** 24 kg
- **Frame length:**
  - 1808 mm (4 degrees)
  - 3600 mm (2 degrees)
  - 7200 mm (1 degree)

Transceiver Unit

- **Height:** 1760 mm
- **Width:** 600 mm
- **Depth:** 630 mm
- **Weight:** Approximately 197 kg

Preamplifier Unit

- **Height:** 920 mm
- **Width:** 600 mm
- **Depth:** 630 mm
- **Weight:** Approximately 96 kg

TX Junction Box

- **Height:** 440 mm
- **Width:** 500 mm
- **Depth:** 303 mm
- **Weight:** Approximately 15 kg

Operator Station

- **Height:** 127 mm
- **Width:** 427 mm (excluding rack fixing brackets)
- **Depth:** 480 mm (excluding handles and connectors)
- **Weight:** Approximately 20 kg

LCD monitor

- **Height:** 400 mm (excluding mounting brackets)
- **Width:** 460 mm (excluding mounting brackets)
- **Depth:** 71 mm (excluding mounting brackets)
- **Weight:** 9.2 kg

Power requirements

- **Fuse:** The single phase supply must be protected with 16A slow-blow fuses.
- **Operational voltage and frequency:**
  - **Transceiver Unit:** 115 or 230 Vac (±10%), < 1100 W, 47 to 63 Hz
  - **Operator Station:** 110 or 240 Vac (±10%), < 250 W, 47 to 63 Hz
  - **LCD monitor:** 110 or 240 Vac (±10%), < 60 W, 47 to 63 Hz
  - **Preamplifier Unit:** 110 or 240 Vac (±10%), < 300 W, 47 to 63 Hz
  - **TX Junction Box:** None

Note

For 110 Vac operation, please contact km.hydrographic.support@kongsberg.com

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- **Acceptable transients:**
  - **Short time (max 2 sec):** ±25%, 42 to 69 Hz
  - **Spikes (max 50 µS):** < 1000 V
- **Power interrupts:** Menu settings, all parameters and the sound speed profile are stored on the Operator Station's harddisk during operation, so operation can continue after power interruption. However, the file system may be damaged, so the use of an uninterruptable power supply (UPS) is higly recommended.

Restrictions for use - limitations

No specific restrictions apply.

Surface finish

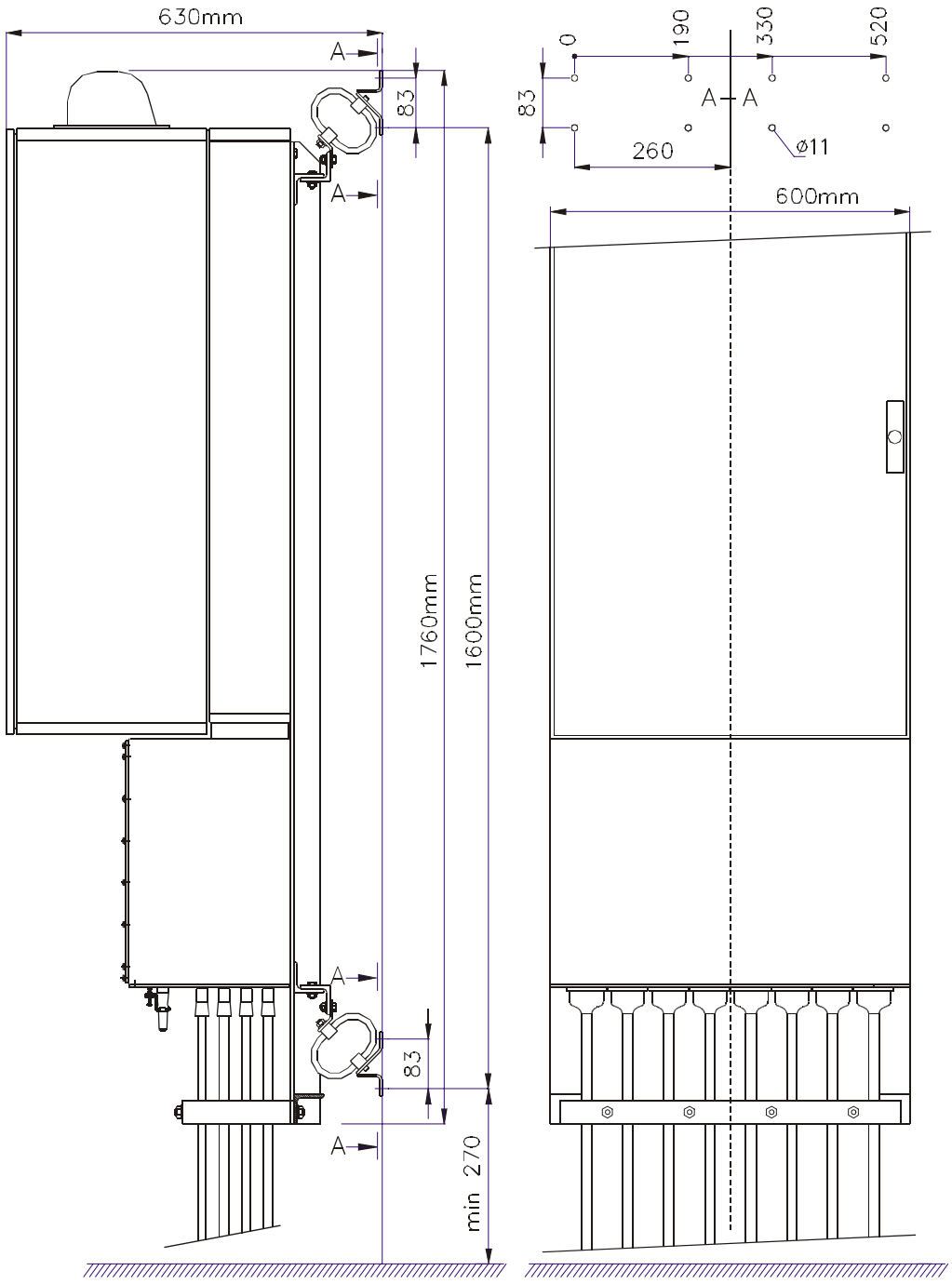
All cabinets are painted. System units exposed to salt water must be treated accordingly.

Environmental specifications

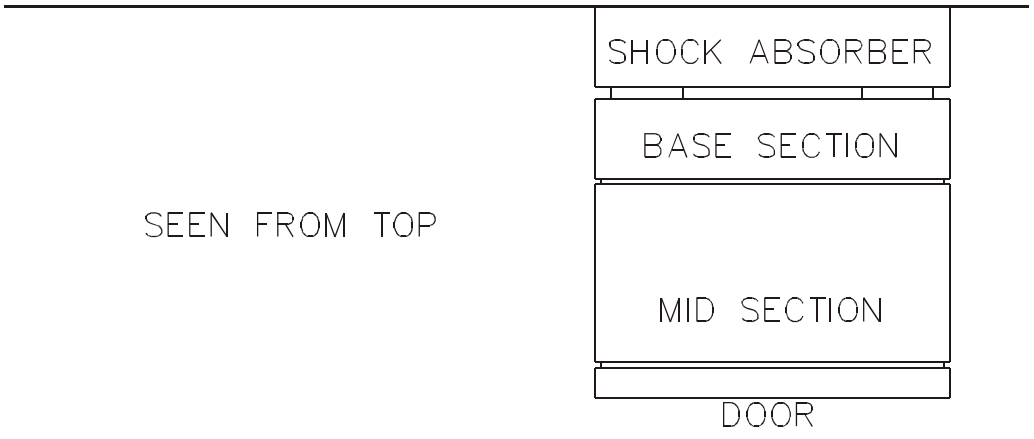
- **IP rating:**
  - **Transceiver Unit:** IP54
  - **Preamplifier Unit:** IP54
  - **Operator Station:** IP22
  - **LCD Monitor:** IP22
- **Operating temperatures:**
  - **Transceiver Unit:** 0 to +45°C
  - **Preamplifier Unit:** 0 to +40°C
  - **Operator Station:** 5 to +55°C
- **Storage temperatures:**
  - **Transceiver Unit:** -30 to +70°C
  - **Preamplifier Unit:** -30 to +70°C
  - **Operator Station:** -30 to +70°C

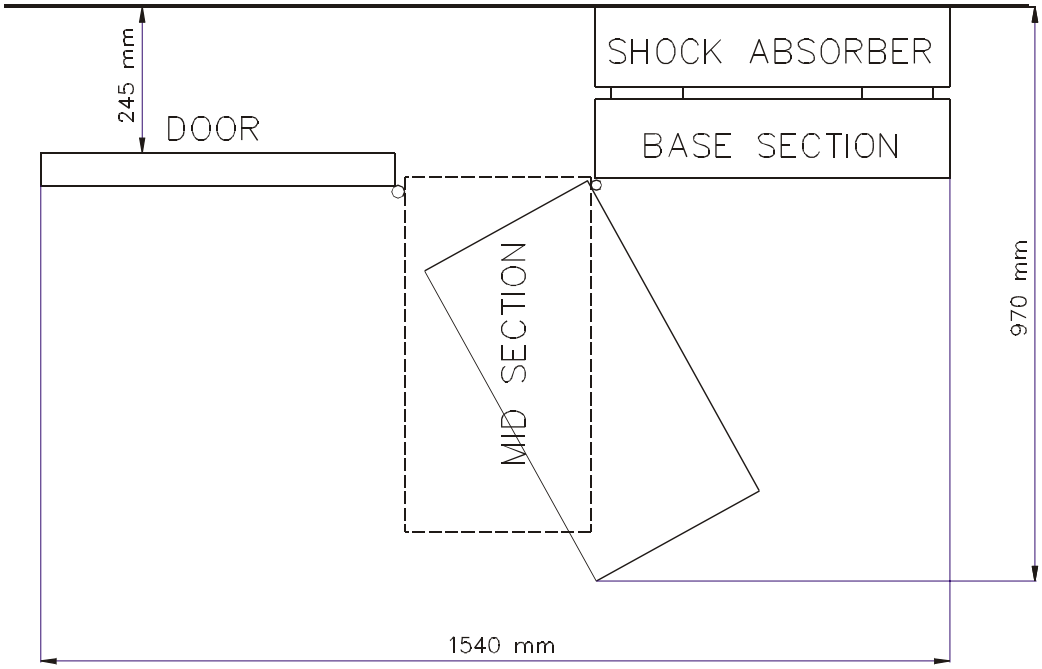
System performance data

- **Main operational frequency:** 12 kHz
  - Frequencies in the range of 11.25 to 12.60 kHz are employed to code the different transmit sectors.
- **Maximum ping rate:** 5 Hz
- **Number of beams for each ping:** 191
- **Beamwidths:** 1x1, 1x2, 2x2 or 2x4 degrees
  - Other beamwidth combinations are are possible in accordance with the number of transducer modules installed.
- **Beam spacing:** Equidistant or equiangle
- **Coverage sector:** Up to 150 degrees
- **Transmit beam steering:** Stabilized for roll, pitch and yaw
- **Receive beam steering:** Stabilized for roll
- **Depth range from transducers:** 20 to 11.000 metres
- **Depth resolution:** 10 to 40 cm
- **Pulse lengths:** 2, 5 and 15 ms
- **Range sampling rate:** 2 kHz (37 cm)

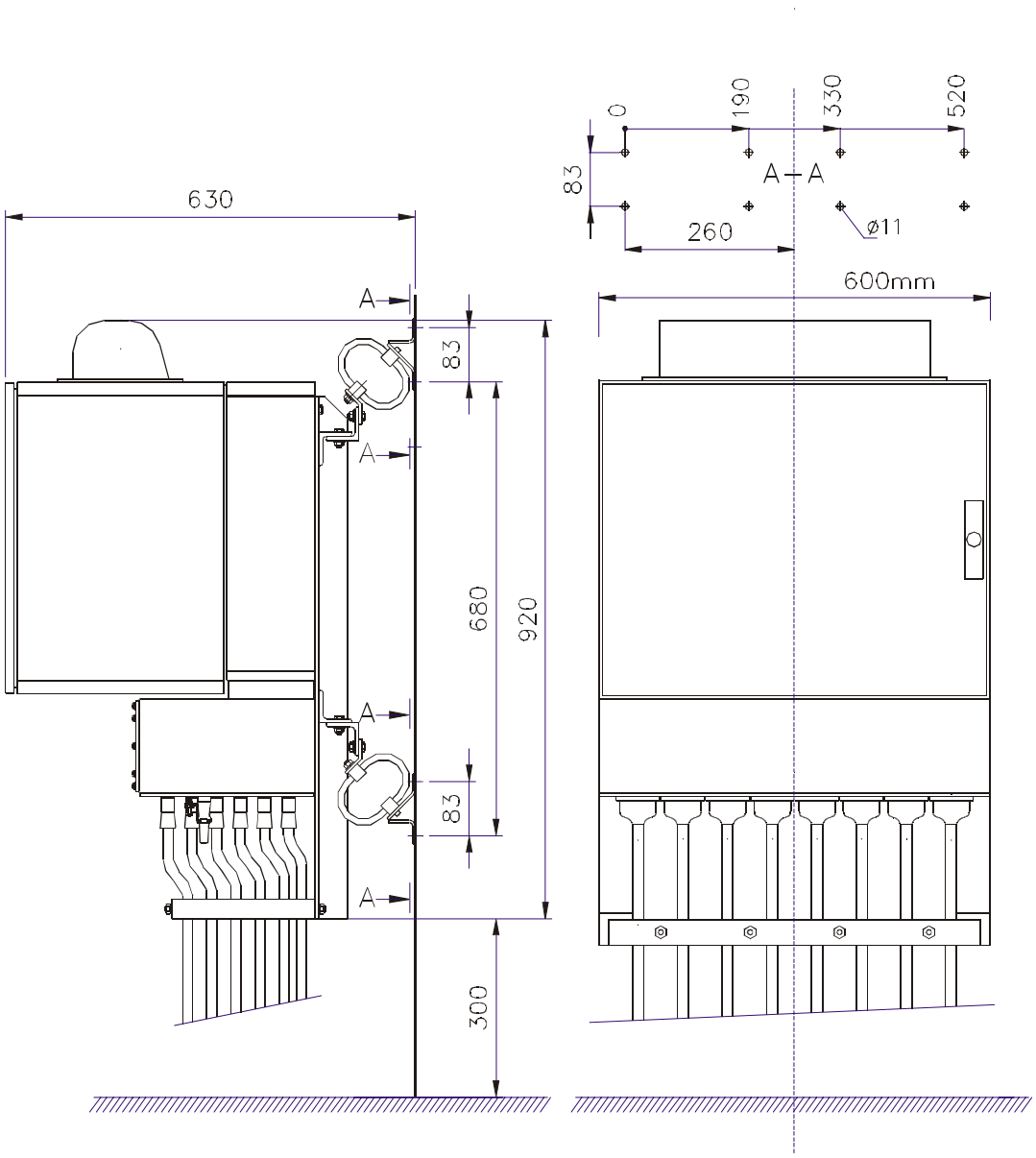


Page 1 of 2 (CD5646)	Transceiver Unit, outline dimensions	**830-211291** Rev.A



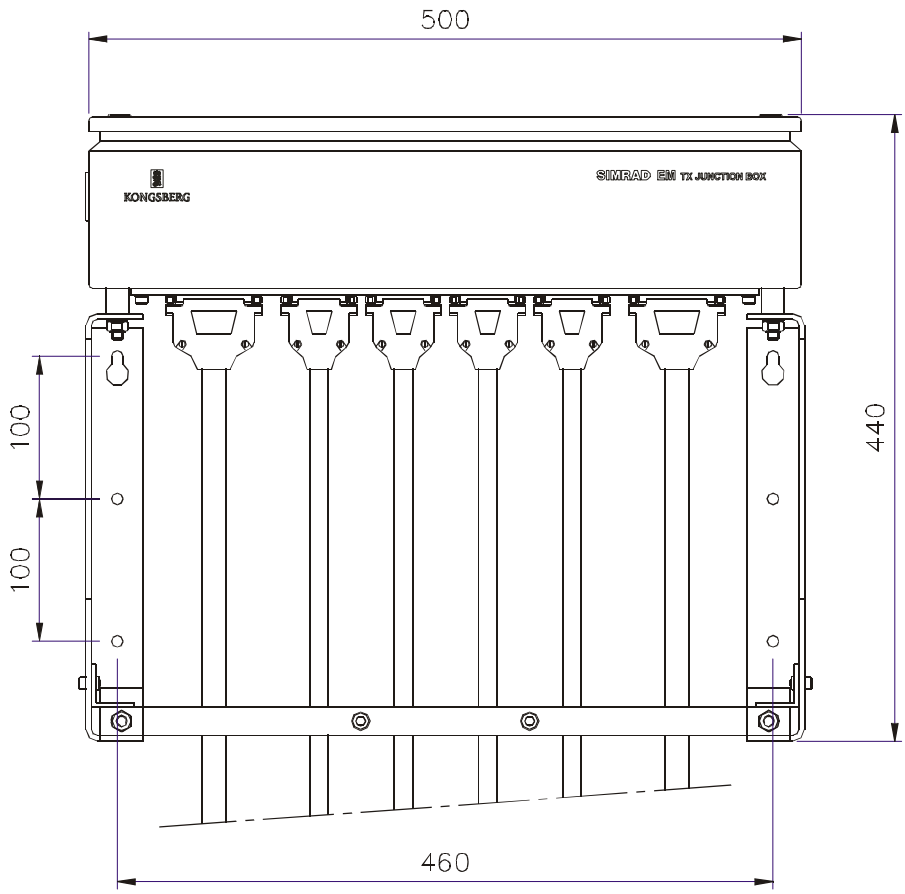


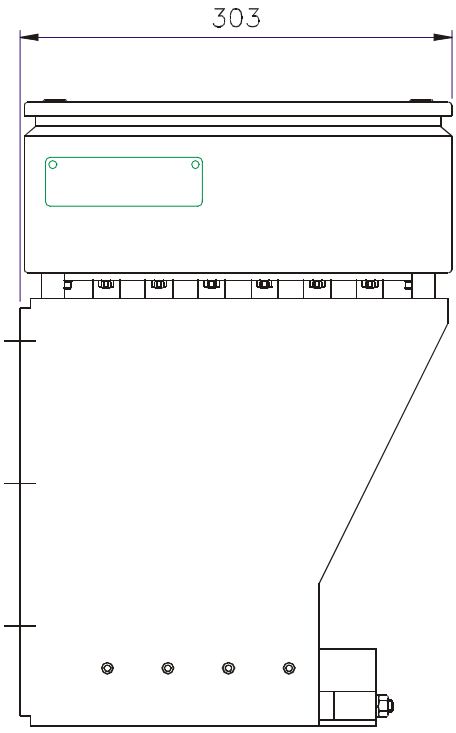
Page 2 of 2 (CD5646)	Transceiver Unit, outline dimensions	**830-211291** Rev.A



Weight: Approx. 96 kg
All measurements in mm.

Page 1 of 1 (CD5649)	Preamplifier Unit, outline dimensions	**830-213112** Rev.B





Weight: Approx 15.5 kg
All measurements in mm.

Page 1 of 1 (CD5648)	TX Junction Box, outline dimensions	**830-213111** Rev.B

COMPANY PROFILE

Kongsberg Maritime

Kongsberg Maritime is a leading supplier of advanced maritime automation and instrumentation systems. The company has approximately 2400 employees and an annual turnover of MNOK 3.700 (year 2004). Kongsberg Maritime owns subsidiaries in Canada, Italy, the Netherlands, Germany, Sweden, Singapore, China, Korea, the UK and the USA in addition to four locations in Norway. Decentralisation lets subsidiary company optimise customer relationships while providing maximum flexibility in relation to product design, production and marketing. Kongsberg Maritime currently exports its products to all of the world's major markets.

Figure 13 Kongsberg Maritime's facilities in Horten.

Kongsberg Maritime's main office is situated in Horten, Norway. The **Hydroacoustics** department responsible for the design and production of the EM 120 is also located in Horten, close to the Oslo fjord. Sharing premises with Simrad AS, producer of echo sounder and sonars for the world's fishing fleet, the companies also share more than 50 years of experience in single and multibeam echo sounding, sonar technology and underwater communication and instrumentation.

Kongsberg Maritime's location close to the waterfront provides excellent surroundings for the design, test and manufacturing of the advanced products. Two in-house test tanks, a sea based test station as well as two vessels are available for extensive testing and quality control.

Figure 14 The test and demonstration yacht "M/K Simrad Echo"

The product range provided by Kongsberg Maritime in Horten includes:

- Single and multibeam echo sounders for hydrographic use
- Underwater communication
- Underwater positioning reference systems (including the highly accurate HiPAP® system)
- Naval sonars and echo sounders (hull mounted and towed systems)
- Oil and gas simulator systems

Kongsberg Maritime is fully owned by the **Kongsberg Group**.

Kongsberg Group

Kongsberg Gruppen ASA (the Kongsberg Group) is one of Norway's leading high-technology companies. With an annual turnover of approximately MNOK 6.400 (in 2004), it is listed at the Oslo Stock Exchange. The largest shareholder is the Norwegian Ministry of Industry and Energy holding 51% of the shares. The rest is publicly owned.

The Kongsberg Group operates through two major business areas:

- Kongsberg Defence & Aerospace AS
- Kongsberg Maritime AS

These companies are fully owned by the Kongsberg Group. Kongsberg Defence & Aerospace is engaged in defence activities, while the commercial market activities are allocated within Kongsberg Maritime.

The Kongsberg Group is represented world wide.

For more information, visit www.kongsberg.com

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