Product Description

KONGSBERG

EM 3002

Multibeam echo sounder

Kongsberg EM 3002

Multibeam echo sounder

Product description

855-164929 / Rev.A

Note

Kongsberg Maritime AS makes every effort to ensure that the information contained within this document is correct. However, our equipment is continuously being improved and updated, so we cannot assume liability for any errors which may occur.

Warning

The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment or injury to personnel. The user must be familiar with the contents of the appropriate manuals before attempting to install, operate or maintain the equipment.

Kongsberg Maritime AS disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.

Copyright

Contact information

Support: hydrographic.support@kongsberg.com

Sales: subsea@kongsberg.com

24 hrs support telephone: +47 99 20 38 01

Kongsberg Maritime AS

Strandpromenaden 50
P.O.Box 111
N-3191 Horten,
Norway

Telephone: +47 33 02 38 00
Telefax: +47 33 04 47 53
www.kongsberg.com
E-mail: subsea@kongsberg.com

KONGSBERG

Table of contents

Document logistics

Rev	Date	Written	Checked	Approved
A	11.03.04	EHa	FP	KN
B				
C				
D				
E				
F				
G				

(The original signatures are recorded in the company's logistic database.)

Rev	Comments
A	Original issue.
B	
C	
D	

1 SYSTEM OVERVIEW

Key facts

The Kongsberg EM 3002 multibeam echo sounder is a very high resolution seabed mapping and inspection system meeting the most demanding standards for survey accuracy. The minimum operating depth is from less than 1 m below its transducers, and in typical sea water conditions the system operates to more than 150 m depth (less in warm water and more in fresh water). Small dimensions and low weight makes the system portable and easy to install. This allows use on survey launches and subsea vehicles to 1500 m water depth.

The EM 3002 system has a very high ping rate of up to 40 Hz, a large number of measurements per ping (up to 254 per sonar head), 1.5° beamwidth, and electronic pitch and roll stabilization. 100% coverage of the bottom is achievable at vessel speeds of about 10 knots in shallow waters with acrosstrack coverage of up to four times depth with a basic system. At larger depths the achievable coverage may be up to 200 m, and then 100% coverage is achievable with vessel speeds up to 20 knots.

The EM 3002 may be configured to use two sets of transducers (Sonar Heads). This increases the shallow water coverage to up to ten times the depth, and the number of measurements per ping up to 508. With an angular coverage sector of nominally 200° (with the heads tilted 40° to each side) the dual system also allows surveying to the water surface along shorelines, river banks and man-made structures.

The EM 3002 beamspacing may be set to equiangular or equidistant. The beams are electronically roll stabilized. The coverage may be limited by the operator either in angle or in swath width without reducing the number of beams. In the near field dynamic focussing is employed. A combination of phase and amplitude bottom detection algorithm is used, resulting in a measurement accuracy of 5 cm RMS being achievable.

The system sonar frequency is nominally 300 kHz allowing small dimensions, good range capability and high tolerance to turbid waters. The transmit fan may be widened as an aid to target detection. Integrated seabed acoustical imaging capability is included as standard. Options include display and logging of beamformed water column data and of raw stave data (before beamforming).

The EM 3002 can be delivered either as a basic multibeam echo sounder instrument for system integration, or as a complete stand-alone seabed mapping system. The Operator Station, a high-performance PC workstation, will always include the necessary operator controls for setting and running the system, data logging, and system testing. Normally the Operator Station also includes an extensive set of graphical displays for data quality control, but third-party software may instead be installed for this purpose.

Postprocessing software for the EM 3002 is available from both Kongsberg and third-party suppliers. A world-wide marketing and service organization having many years of multibeam experience is available for supporting the EM 3002.

→ *A system overview is shown in figure 1.*

→ *Data example is shown in figure 9 on page 18.*

System characteristics

Main units

The basic Kongsberg EM 3002 multibeam echo sounder consists of three (or four) units:

- Sonar Head(s)
- Processing Unit
- Operator Station

The system may be delivered either with one sonar head (EM 3002S) or with two sonar heads (EM 3002D).The dual sonar heads can be arranged in different ways. The most common configuration is to mount the two sonar heads tilted about 40 degrees to port and starboard in order to obtain a wider swath coverage.

A complete mapping system will in addition include a vessel motion sensor, heading sensor, sound speed sensor and a positioning system. For ROV applications a telemetry system is required for data communication between subsea units and surface electronics.

Sonar Head

The EM 3002 Sonar Head contains the transducers and all transmitter and receiver electronics. The diameter of the Sonar Head is 332 mm and it’s height 119 mm. The sonar head material is titanium, making the unit robust, durable and 100% non-corrosive. The transducers are replaceable in the event of damage for example due to grounding.

The maximum deployment depth for the standard sonar head is 500 m. A sonar head is available for maximum 1500 m water depth.

A single cable with an underwater plug connects the Sonar Head to the EM 3002 Processing Unit. The cable is normally 15 m long, optionally up to 45 m.

Existing EM 3000 sonar heads may be used in an EM 3002, but a factory check-up is recommended.

Processing Unit

The EM 3002 Processing Unit performs the beamforming and bottom detection. It further controls the sonar head with respect to gain, ping rate, pitch compensation of the transmit fan and roll compensation of the receive beams. It contains all interfaces for time-critical external sensors such as vessel attitude (roll, pitch, heading and heave), vessel position and external clock.

The Processing Unit is contained in an instrument case prepared for mounting in a 19” rack (height 4U). All circuit boards are plugable into a cPCI bus backplane giving a very robust solution. Ethernet is used for data communication with the Operator Station.

Operator Station

The Operator Station of the EM 3002 is the HWS 10 high performance PC workstation with Kongsberg SIS software. Additional third-party sw may be installed. The HWS 10 is dual bootable to either Linux® or Microsoft Windows XP®. Software for controlling the EM 3002 installation and runtime parameters, data logging and running selftest on the system is always included as standard.

The HWS 10 is normally supplied with a 17.4” industrial LCD monitor with a resolution of 1240x1024 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.

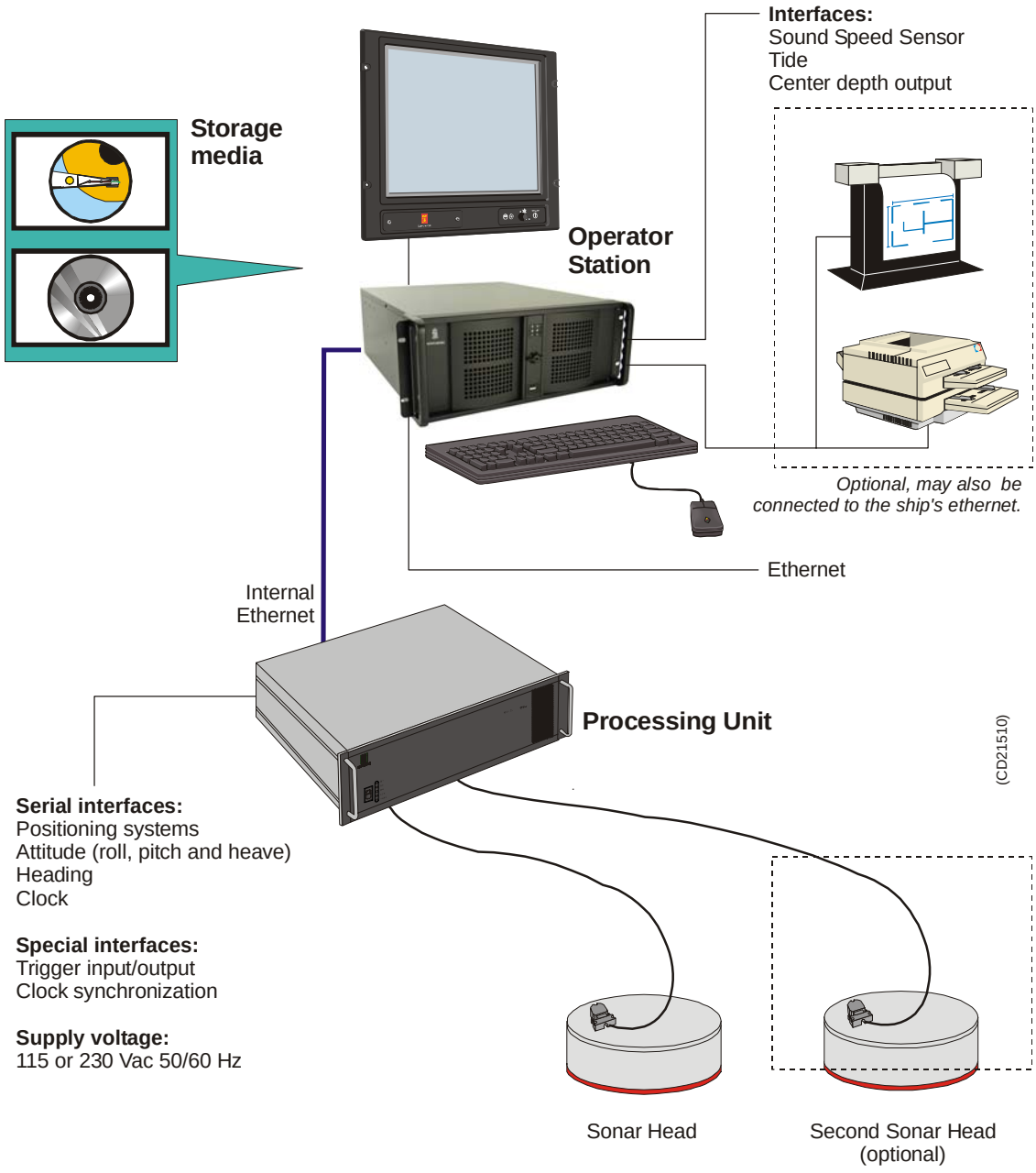


Figure 1 EM 3002 System overview

2 PERFORMANCE

The operating frequency of the Kongsberg EM 3002 multibeam echo sounder is 300 kHz. This frequency has been chosen carefully to achieve an optimum balance between small dimensions, narrow beams, and good range capability even in turbid waters. Acoustical interference between the two sonar heads of EM 3002D is eliminated by using two different operating frequencies (293 and 307 kHz).

The beamwidth is 1.5° both on transmit and receive. The transmit fan may be electronically stabilized for pitch to always point vertically. The receive beams are electronically stabilized for roll. Roll, pitch, heading, heave and the applied stabilization are fully taken into account when calculating sounding depths and positions. In the near field the receive beams are dynamically focused to maintain angular resolution even at very short ranges. All beamforming is rigorously done with a time delay algorithm.

There are 160 simultaneous receive beams for each Sonar Head. They are either spaced in an equiangular or equidistant pattern within the coverage specified by the operator. There is also a high density mode where 254 soundings are acquired per head and ping. The additional soundings are derived by using smaller sections of the range window than what the beamwidth provides, thus reducing the effective receive beamwidth to minimize the interdependency of the extra soundings.

Each Sonar Head has an angular coverage of 130 degrees corresponding to a swath width of 4 times water depth. For an EM 3002D system with two tilted Sonar Heads a total effective swath coverage of up to 10 times water depth with up to the water’s edge is obtainable even if the vessel is rolling. A dual head system may also be used for profiling of say a trench or a pipeline from two sides simultaneously. The number of simultaneous receive beams is then doubled to a maximum of 508 with the high density mode.

The dense beam pattern together with the high ping rate of up to 40 pings per second gives a very dense sounding spacing. A vessel speed of 10 knots in shallow waters and even more in deeper waters is thus possible while maintaining 100% bottom coverage.

The EM 3002 system depth accuracy is very good due to the narrow beams and high range sampling rate used (14 kHz), but most importantly through using the advanced bottom detection methods which have been developed through long experience in this field. Near normal incidence a centre of gravity amplitude detection principle is employed, but for most of the beams the system uses phase detection. This principle is based upon splitting the receiving aperture for each beam in two sections, and obtaining the angle of arrival of the incoming return signal from the bottom by processing of the phase angles of the two signals obtained. For every range sample a measurement of the angle of arrival of the returned bottom echo is done, and from all the bottom returns inside a receive beam the exact range to the bottom in the beam's geometrical centre is derived. The combination of beamforming and phase processing is robust and generates high quality sounding data.

The receive beamwidth of the EM 3002 varies inversely with the cosine of the beam pointing angle referred to the Sonar Head face. The resulting beam broadening for large beam pointing angles does not have any effect on accuracy due to the phase detection algorithm used in the EM 3002. Resolution is neither affected, as it is dependent upon the alongtrack beamwidth and the range sampling rate which do not vary.

The following figures show the expected instrumental accuracy of the EM 3002. Note that the total system error will always be higher than the instrumental error of the multibeam echo sounder, because errors in the sensors measuring the vessel's motion, heading, and position, water level and water column sound speed will contribute, as well as natural variations of the sound speed both in time and space.

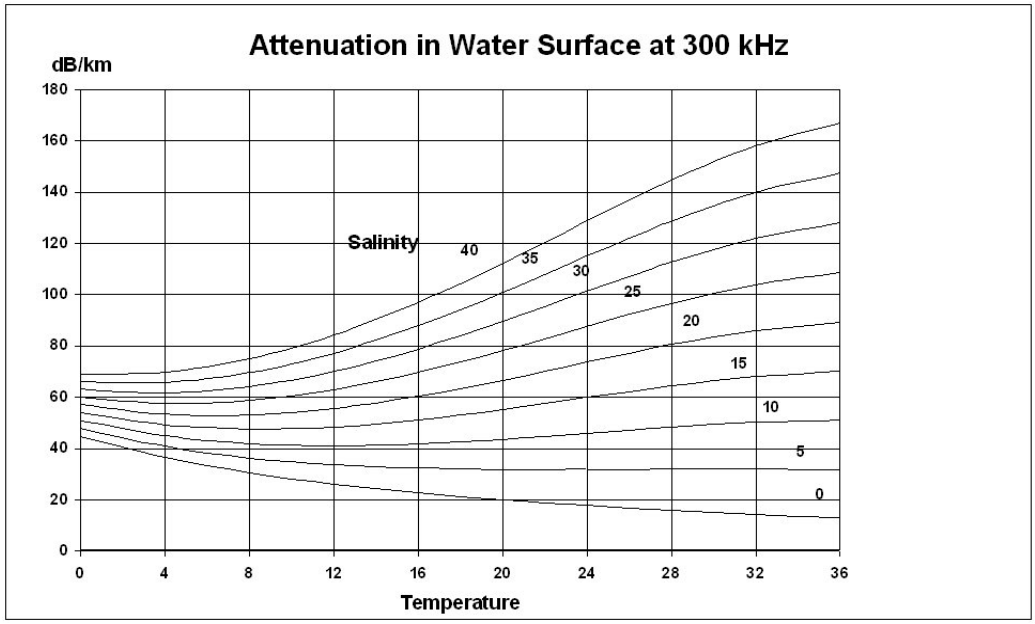
→ *Refer to figure 3 on page 9.*

With high quality external sensors it has been demonstrated that a mean system accuracy approaching 5 cm RMS is achievable in shallow waters with the EM 3002. This accuracy is well within the requirements of the IHO S-44 standard (4th edition) for special order surveys. It has also been demonstrated that the EM 3002 will meet the same standard's object detection requirements, although for deeper waters some limitations in vessel speed or coverage may be necessary.

The acrosstrack sounding density will limit the usability of the outer beams in a multibeam echo sounder, unless the beam spacing is equidistant and the beam pointing angles are roll compensated, which is the case for the EM 3002. It is common practice to run a survey with overlap between the neighbouring lines for quality control purposes. For a high resolution survey it is recommended that the spacing between neighbouring survey lines for EM 3002 is limited to about 3 times water depth and at least twice that with the EM 3002D. These line spacing recommendations will give an excellent sounding density and also a good swath overlap between neighbouring lines.

At high frequencies the range performance of any sonar system is strongly dependent upon water temperature and salinity in addition to bottom reflectivity.

→ *Refer to figure 2.*



(CD3209)

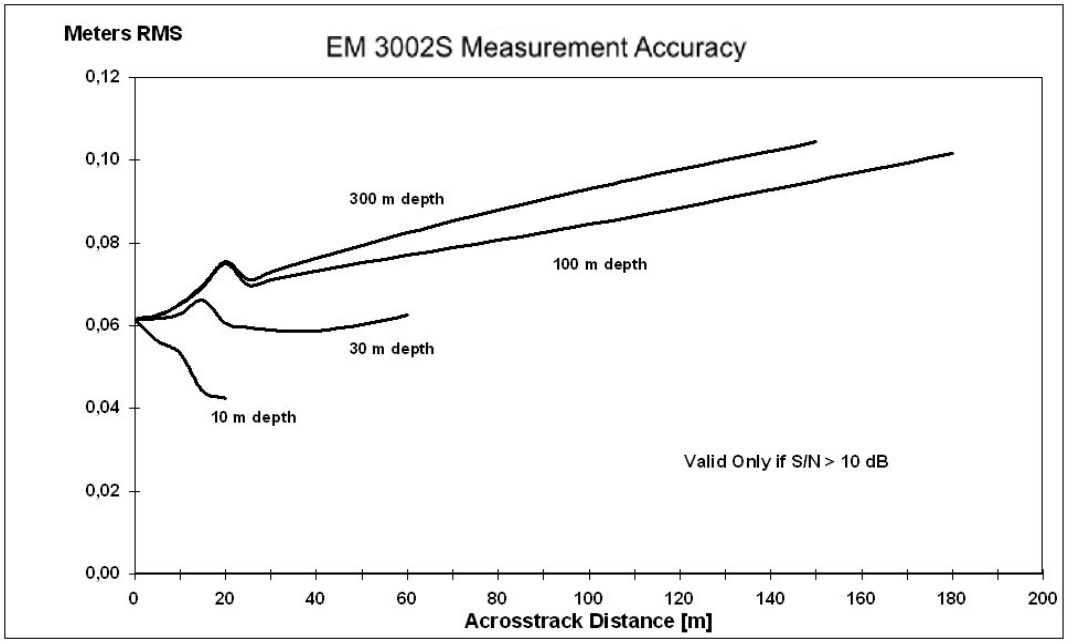
Figure 2 Attenuation in water surface. The depth dependence is negligible except for the temperature reduction with increasing depth.

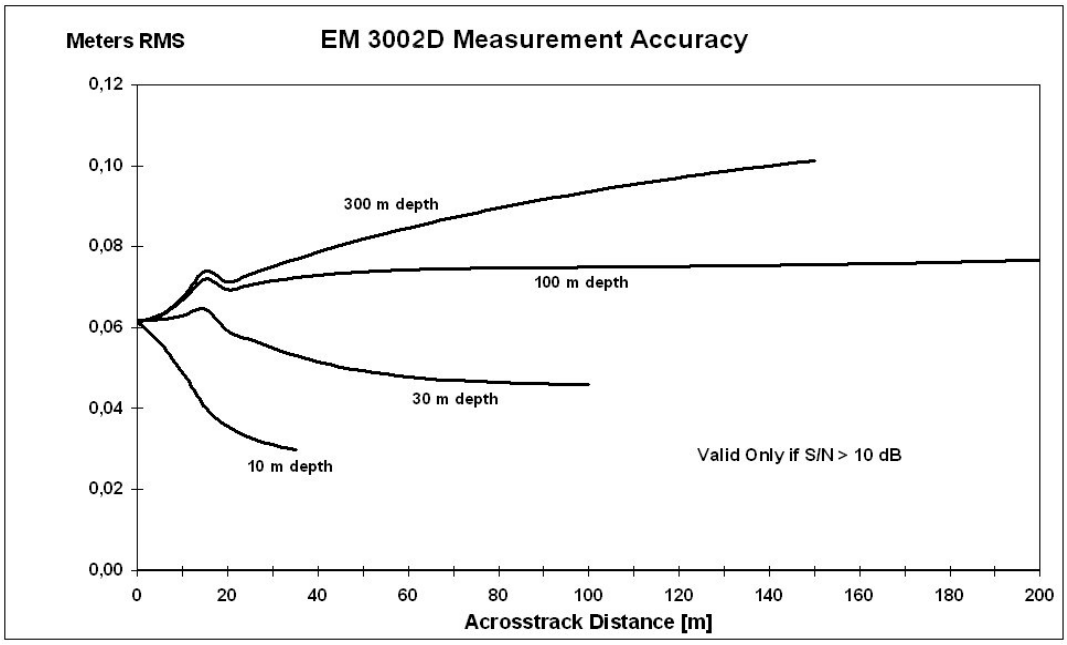
The next three figures show the achievable swath width for different absorption coefficients and bottom types as a function of depth beneath the transducers for both single and dual head versions.

For deeper waters these curves may be used to decide coverage capability and hence the line spacing to be used in a particular survey.

→ *Refer to figures 4 (page 10), 5 and 6*

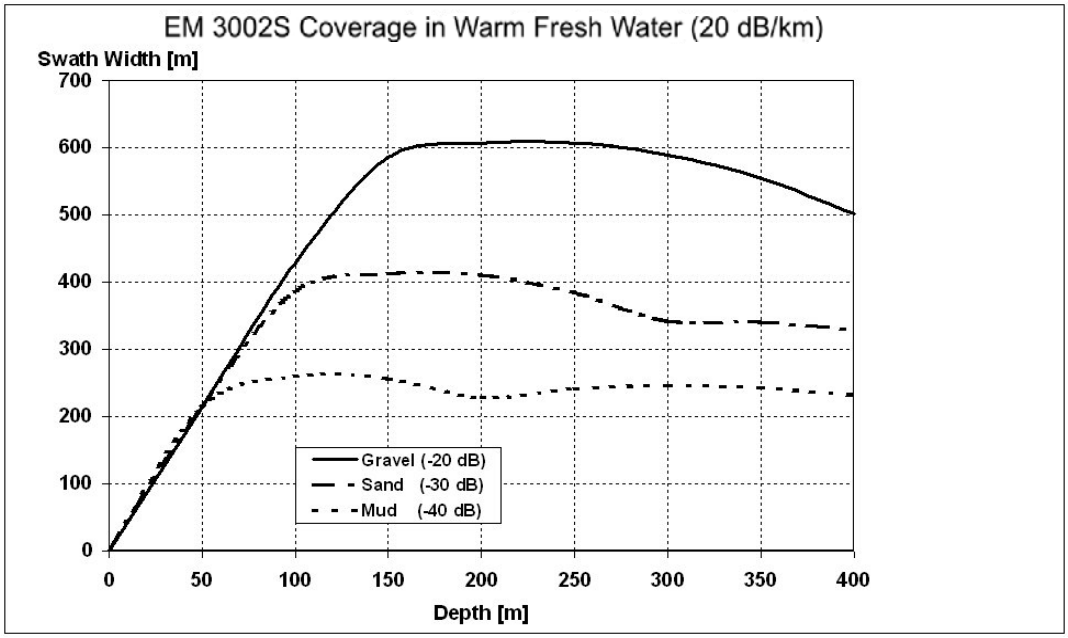
The performance of the EM 3002 will usually not be affected by suspended particles in the water column (turbidness), which would have been the case if its sonar frequency had been much higher. Only heavy concentrations of large particles such as sand (>50 mg/l for particle diameters of about 100 μm) or of very fine particles (>100 mg/l for particle diameters of about 3 μm) will lead to less achievable range in the outer beams than predicted by the enclosed coverage diagrams.

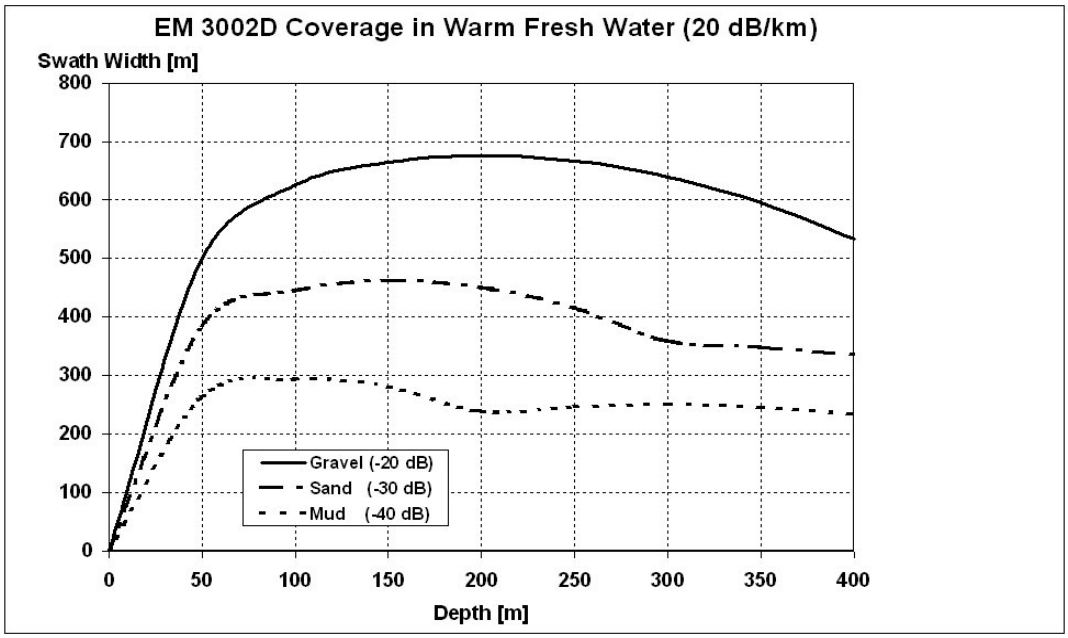




(Cd21512)

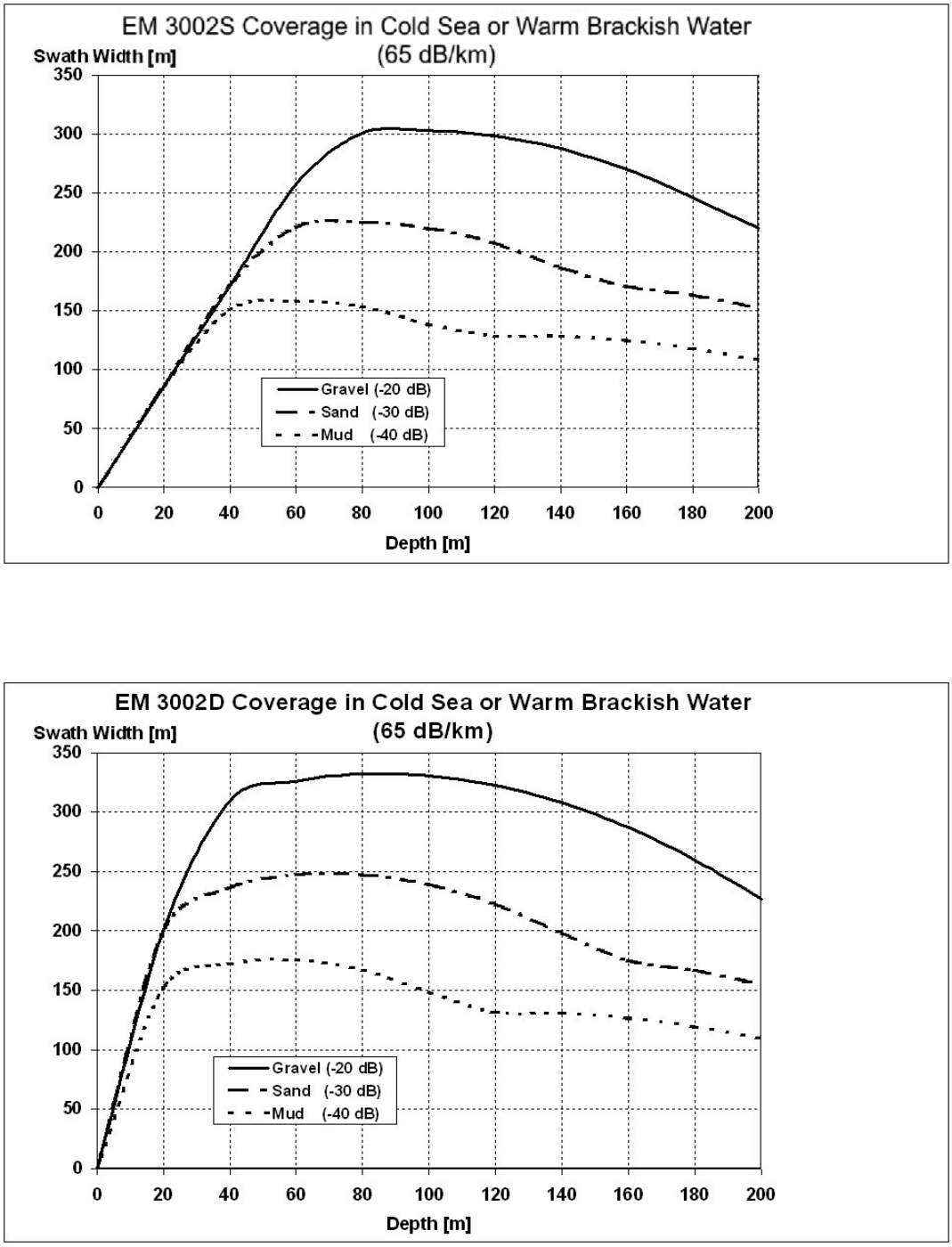
Figure 3 EM 3002 theoretically calculated accuracy





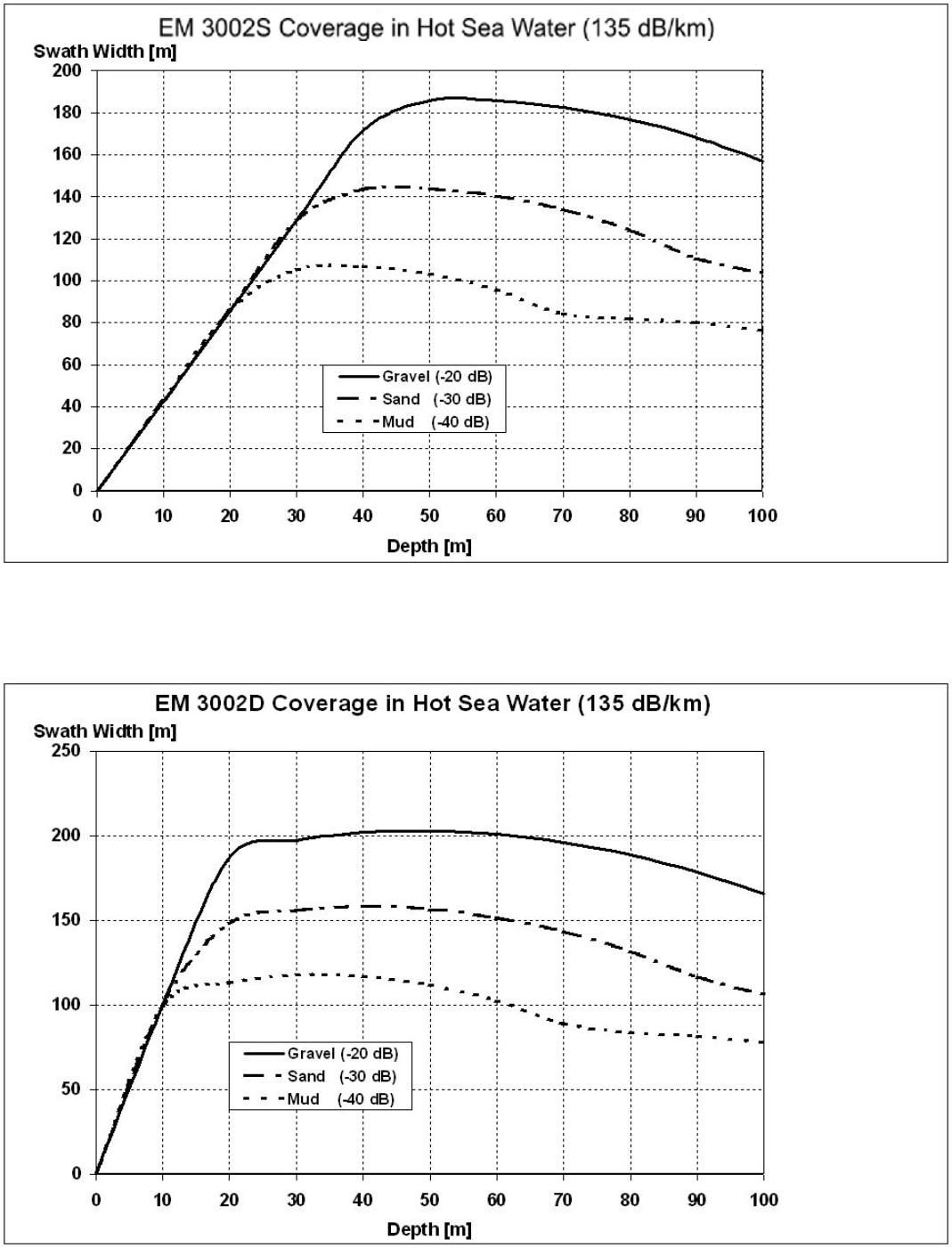
(Cd21513)

Figure 4 Calculated EM 3002 Coverage at 20 dB/km



(Cd21514)

Figure 5 Calculated EM 3002 Coverage at 65 dB/km



(Cd21515)

Figure 6 Calculated EM 3002 Coverage at 135 dB/km

3 INSTALLATION

Introduction

The compactness of the Kongsberg EM 3002 multibeam echo sounder is a guarantee for a fast and easy installation. For a surface vessel, the Operator Station and Processing Unit are placed inside the vessel while the Sonar Head is mounted so that it is always submerged in water with a mounting angle in accordance to the system mission.

Operator Station

The Operator Station is a ruggedized PC workstation, prepared for mounting in a standard 19” rack (requires 4 rack height units). It is supplied with a rackable 17.4” industrial LCD monitor, a keyboard and an optical mouse. A bracket for the monitor is included for table top, bulkhead and roof mounting.

Processing Unit

The Processing Unit may be mounted in a standard 19” rack (requires 4 rack height units).

On large vessels the Processing Unit may have to be mounted in a different location closer to the Sonar Head due to the restricted length of the cable connecting the two units (15 m standard length extendable to a maximum of 45 m) or a fibre optic link may be used.

Solutions for mounting the Processing Unit in an underwater vehicle may be discussed.

Sonar Head

The EM 3002 Sonar Head must be mounted so that it has a clear view of the bottom, i.e. no obstructions are permitted within a sector of minimum ±75° acrosstrack and ± 30° along track with respect to the face of the Sonar Head as seen from the transducers.

For standard mapping purposes the Sonar Head should be aligned with the keel line, and not be tilted more than about 10° forwards or 40° to the side.

It is important that the Sonar Head is mounted so that the water in front of the head is not aereated. On most vessels a suitable location would be near the keel in the forward part of the vessel. An arrangement for streamlining or mechanically protecting the head may be added, but would normally not be required. Flush mounting in a well may be used for a permanent installation.

To lessen risk of damage to the Sonar Head in case of grounding, it may be mounted on the side of the vessel above the keel line. If the keel obstructs the view to one side, the head may be tilted to the opposite side. ”Ice knives” may also be mounted in front of the head for protection against floating debris.

In a dual head installation the two sonar heads may be placed on each side of the keel and tilted about 30-40° above the horizontal, thus increasing the swath width to both sides. 40° tilt would be best for shallow waters and surveying to the water’s edge while 30° would increase maximum depth capability somewhat.

Figure 7 Sonar Head installation example: Retractable dual head

The flat face transducers of the EM 3002 makes the system accuracy less dependent of variations in sound speed at the transducer depth if the Sonar Head is mounted horizontally, and if roll and pitch are not excessive. If the sound speed in the survey area is subject to frequent changes, it is recommended to install a sensor to allow real-time measurement of the sound speed at the transducer. The system will then take into account the sensor measurements in its calculations of beam pointing angles as well as corrections for raybending. The system is prepared for using an AML Smart Probe directly.

→ *Further installation examples are shown on figure 10 on page 27.*

4 OPERATION

System control

The control of the Kongsberg EM 3002 is done from the HWS 10 Operator Station using a standard click and point graphical user interface. The software, Seafloor Information System for Real Time Multibeam or SIS-RTM, may either be run under the Microsoft Windows XP or Linux operating systems which are both installed on the HWS 10. As a minimum the system software includes the necessary features for system installation, testing and running the multibeam. Ping related displays are also included as standard, as is the capability of logging the acquired bathymetry data. The user has the option of replacing most parts of the advanced features of SIS with other software of his choice.

The 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 system and sensor installation parameters must be defined, and the necessary external sensors such as positioning system and vessel motion sensor connected. Parameters critical to data quality are password protected, and most parameters can be recalled from a disk file.

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 system status. The basic system includes the graphical displays required for real-time quality control of the EM 3002, such as:

- 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

Unless other software is installed the operator will normally be viewing gridded data in a geographically oriented 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. The 3D graphics allows the seabed to be viewed from any direction, and thus to for example highlight any differences between the current and old surveys in overlapping areas.

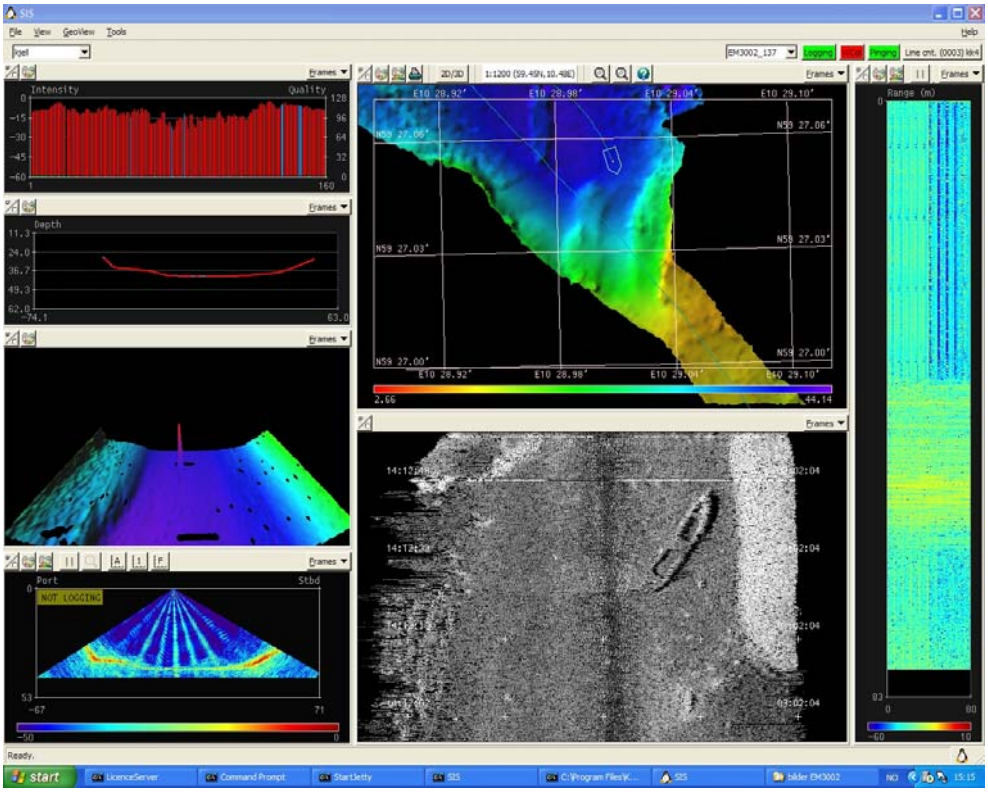


Figure 8 SIS operator software

The grid may also be utilized for real-time data cleaning. Based on 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 may also be employed in real time.

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 5 cm 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.

Among other features normally included are system (sensor) calibration, survey planning, helmsman display and the full use of the chosen operating system for data export, plotting and printing. Support is provided for displaying electronic map data as a background in the geographical displays. Optionally the raw beamformed data may be logged or shown as a water column sonar display. Also optionally the raw hydrophone data (before beamforming) may be logged.

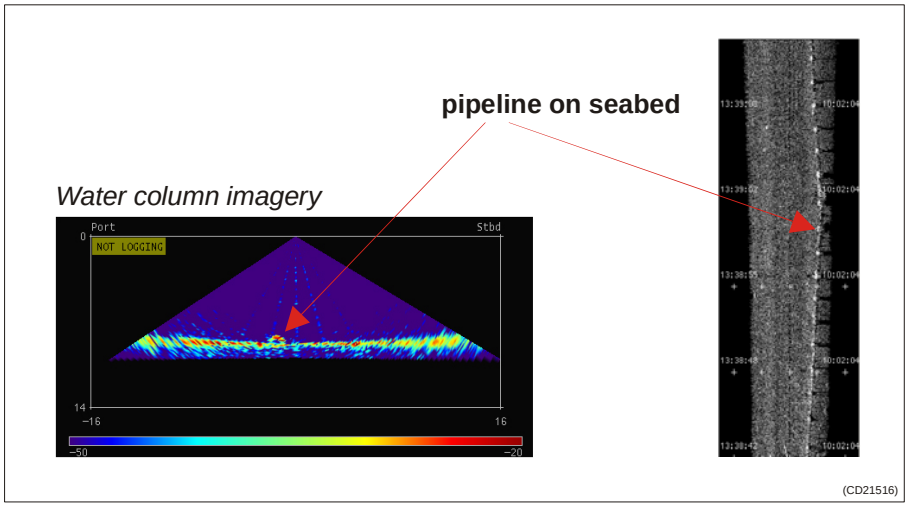


Figure 9 EM 3002 seabed water column and imagery display

Data logging

Ensuring logging of all data is of the utmost importance in the system. The data is always stored on disk and the geographical displays take data only from disk so that that what the operator sees is what is safeguarded. As standard there are 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 to transport the acquired data directly. The system disk has plenty of space to back up data or the data may be written to DVD at any time. The Firewire, SCSI and USB interfaces may be utilized 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.

Logged data include raw sensor data, beam ranges and beam pointing angles. In a depth datagram these data have been combined to derive a rigorous solution for vessel motion and raybending giving sounding depth and position as Cartesian coordinates. Also available for logging is the gridded data. The data formats are public ensuring that data may be used with other software.

5 POST-PROCESSING

Post-processing options

The high quality data produced by the Kongsberg EM 3002 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 AS can deliver a complete set of products for post-processing EM 3002 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 Kongsberg 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.

6 CUSTOMER SUPPORT

Introduction

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

Installation

As part of the discussions with the client Kongsberg Maritime AS will - free of charge and without any obligations - give advice regarding the practical installation of the EM 3002 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 3002 system should be done according to Kongsberg Maritime AS's documentation. If required, Kongsberg Maritime AS 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 Kongsberg EM 3002 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 AS 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 AS's facilities, or any other location decided by the client.

Service

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

Terms and conditions

Kongsberg Maritime AS' Conditions of Sale shall apply, unless otherwise specifically stated in the quotation and in the below terms and conditions.

The warranty period, for hydrograhic echo sounders and sonars as well as software for these intstruments, is 24 months from date when the equipment is sent from the factory. For all other equipment and systems which are delivered, the respective manufacturers warranty terms are applied.

Kongsberg Maritime offers MAINTENANCE CONTRACTS that may extend the warranty period for a period as defined in the contract.

Kongsberg Maritime will take full system responsibility for the system as delivered by Kongsberg Maritime. The equipment is to be delivered FCA, Horten, Norway. Incoterms 2000.

7 SCOPE OF SUPPLY AND OPTIONS

Standard system

A basic EM 3002 multibeam echo sounder delivery includes:

1 EM 3002 Sonar Head pressure rated to 500 m depth

2 EM 3002 Processing Unit

3 EM 3002 Operator Station - HWS 10

4 Signal and control cables between the units.

5 Software for all units

6 System manuals covering system installation, operation and maintenance.

Options

System options available include:

- Extra sonar head including additional electronics in the EM 3002 Processing Unit.
- Longer cable between the EM 3002 Sonar Head and the Processing Unit (maximum 45 m).
- Sonar Head pressure rating increased to 1500 m depth.
- Helmsman display and/or additional monitors.
- IP 65 integrated keyboard and pointing device.
- Spare parts.
- Additional functionality in the Operator Station software.

System integration

The EM 3002 system as described in this product description is a subsystem which is prepared for integration with other sensors to form a complete seabed mapping and inspection system. Kongsberg can supply the EM 3002 either as a subsystem for integration by the user or other parties, or we can offer complete system solutions tailored to the user’s need.

Dual frequency system solutions can be formed by combining the EM 3002 with a lower frequency multibeam echo sounder such as the EM 300.

The EM 3002 can be used as part of integrated instrumentation systems for large or small vessels, surface mounted, on ROV, on towed instrument platforms, or on UUV/AUV’s.

Complimentary to the acoustic instrument system, the following software products may be delivered:

- **Neptune** for post-processing of bathymetric data.
- **Cfloor** integrated with Neptune for digital terrain modelling.
- **Triton** for classifying the seabed sediment types by processing the acoustic response data from the seabed, in combiniation with some local ground-truth information.
- **Poseidon** for processing seabed image data into georeferenced high resolution images of the seabed.

8 TECHNICAL SPECIFICATIONS

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

Overall specifications per Sonar Head

Frequency: 293, 300 or 307 kHz

Maximum ping rate: 40 Hz

Number of beams per ping and sonar head: 160

Number of soundings per ping and sonar head: Up to 254

Beamwidth: 1.5 x 1.5 degrees

Beam spacing: Equidistant or equiangular

Coverage sector: 130 degrees per sonar head

Transmit beam steering: ±15 degrees in 0.5 degrees steps alongtrack

Depth resolution: 1 cm

Pulse length: 150 μs

Range sampling rate: 14, 14.3 or 14.6 kHz (5 cm)

Beamforming method: Time delay with dynamic focusing in near-field.

Data storage rate: 50 to 400 MB/h (max at about 5-10 m depth)

Frequencies of 293 and 307 kHz are normally used in dual Sonar Head systems.

Receive beamwidth is inversely proportional with the cosine of the beam pointing angle with respect to the Sonar Head (i.e. beamwidth is 2.1° at ±45° beam pointing angle and 3.0° at ±60°).

Interfaces

- Serial lines with operator selectable baud rate, parity, data and stop bit length for:
  - Motion sensor (roll, pitch, heave and optionally heading) in format supported by sensors from Applied Analytics, Seatex, TSS and IXSEA
  - Gyrocompass in either NMEA 0183 HDT or SKR82/LR60 format
  - Positions in either Simrad 90, NMEA 0183 GGA or GGK format
  - Sonar head depth in Digiquartz compatible format
  - External clock in NMEA 0183 ZDA format
  - Sound speed sensor in AML Smartprobe format

- Interface for a 1 PPS (pulse per second) clock sync signal
- Ethernet and serial line interface for input of tide and sound speed data and output of all data normally logged to disk.

Physical specifications

Sonar Head

Diameter: 332 mm

Height: 119 mm (+27 mm for connector)

Weight: 25 kg (15 kg in water)

Pressure rating: 500 m water depth

Diameter of cable to Sonar Head: 17 mm

Connector: Subconn LPBH9F

Material: Titanium

Power: 24 Vdc, 1 A (available from the Processing Unit)

A Sonar Head with pressure rating of 1500 m water depth is available with the same specifications except for height (121 mm) and a restriction in maximum swath width to 3.5 times depth (120° angular coverage sector).

Processing Unit

Height: 177 mm

Width: 427 mm (excluding rack fixing brackets)

Depth: 392 mm (excluding handles and connectors)

Weight: 14.5 kg

Power: 115 Vac (60 Hz) and 230 Vac (50 Hz), < 250 W

Operator Station

Height: 127 mm

Width: 427 mm (excluding rack fixing brackets)

Depth: 480 mm (excluding handles and connectors)

Weight: 20 kg

Power: 115 Vac (60 Hz) and 230 Vac (50 Hz), < 300 W

LCD monitor

Height: 400 mm (excluding mounting bracket)

Width: 460 mm (excluding mounting bracket)

Depth: 71 mm (excluding mounting bracket)

Weight: 9.2 kg

Power: 115 Vac (60 Hz) and 230 Vac (50 Hz), < 60 W

Environmental and EMC specifications

The system meets all requirements of the IACS E10 specification.

The Operator Station, LCD monitor and Processing Unit are all IP22 rated.

Sonar Head
mounted on a
high speed vessel

Bow mounted
Sonar Head
on a small vessel

(Cd21517)

Figure 10 EM 3002 installation examples