4.3 Runtime Menu

Overview

The **Runtime Menu** is available by default.

*Figure 38 - The **Runtime menu** dialogue box*

The dialogue box gives you access to the following parameter groups:

- Sounder Main
- Sector Coverage
- Sound Speed
- Filtering
- Absorption coefficient
- Seabed Imaging

All these parameter groups are visible simultaneously.

Sounder Main

Overview

These parameters allow you to:

- define the ping mode, the desired swath coverage and the beam spacing
- define maximum port and starboard coverage.
- define the maximum and minimum depth for the echo sounder
- force a desired depth

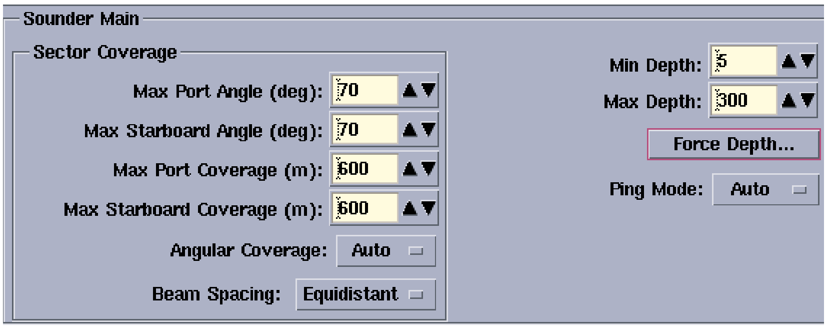


*Figure 39 - The EM 1002 **Sounder Main** field*

Ping mode

This parameter defines the operational mode of the EM 1002 multibeam echo sounder. You can select any of the following settings:

- Auto
- Shallow

- Medium
- Deep

During normal operating conditions, you are advised to set the ping mode to **Auto**. The system will then automatically use the most appropriate mode, and - if necessary - switch between the modes to obtain maximum coverage.

Sector Coverage

This parameter specifies the level of filtering of the heading.

Max port / starboard angle

These parameters allow you to define the maximum swath width by setting the maximum port and starboard angles. The values are entered in degrees.

Max coverage port / starboard

This parameter allows you to define the maximum swath width to each side by selecting values in meters. The port and starboard angles (as defined above) will then be adjusted accordingly by the system. To make use of these settings, you must set **Angular Coverage** to **Auto**.

Angular coverage

Manual - If Angular Coverage is set to manual, the values defined as **Max port** and **starboard angle** above (in degrees) are used directly. The **Max coverage port** and **starboard** settings (in meters) are not used in this case. Be aware that the outermost beams may be lost if the angular coverage set is larger than the coverage capability at the current depth.

Auto - If Angular Coverage is set to Auto, the maximum coverages (in meters) and the maximum angles will set the swath width limit. The actual angular coverage will always be set so that almost all the beams have valid detections. You may observe this in the Launchpad's echo sounder status display, as the numbers of beams accepted should almost equal to the number of beams available.

Beam spacing

Depending on the purpose of the survey, you may define the distribution of the beams on the seafloor.

Equidistant - This setting gives a uniform distribution of soundings on the seafloor, and it is the normal mode for a bathymetric survey.

Equiangle - The beams are distributed with an equal angular spacing based on the angular coverage used. This gives many soundings close to the centre of the survey line, and few on the edge of the swath.

In-between - Earlier the equiangle beam spacing was recommended for seabed imaginery. However, the very few soundings on the edge of the swath reduced the accuray of the imaginery positioning, and makes them not so good for bathymetry. Thus this in-between mode is introduced, giving a higher density in the central part of the swath (near-equiangle) and a acceptable density in the outermost parts (near-equidistant).

Minimum and Maximum Depth

These parameters allow you to define the operational depth range. This range should normally be wide enough to cover all depths encountered during the survey, as only depths within this range will be accepted by the system.

A narrow range will help the system in bottom tracking under difficult conditions. Exceptionally, it may be necessary to temporarily narrow the range to assist the system in bottom tracking. However, you must then monitor the actual depth closely, and adjust the depth window as often as required.

Note: *It is very important that valid depths are entered here when the echo sounder starts 'pinging'. If the bottom depth exceeds the limits with more than 10%, the sounder will not lock. It may therefore be useful to enter larger values in the beginning to accept a more dynamic depth, even though this may slow down the initial bottom detection when the system is started.*

If the bottom depth exceeds the limits given here it will simply loose track. The true depth should therefore be monitored closely, and compared with the settings here during the survey.

Minimum Depth (m)

Set the minimum limit of the depth range.

Maximum Depth (m)

Set the maximum limit of the depth range.

Force Depth

When the echo sounder is switched on and starts transmitting, or if it looses the bottom track, you may sometimes find that it has problems in finding or recovering the bottom. This happens typically at extreme depths, and especially if there is a lot of acoustic interference or if the water is very aerated. In order to help it, you can then enter the correct depth. This depth may be taken from your navigational charts, or from a navigation sounder elsewhere on the vessel. Forcing the depth will cause the system to set its gain and range windows accordingly, and ignore its own findings about where the bottom is.

Sound Speed

Overview

This parameter group has two subgroups:

- Sound Speed Profile
- Sound Speed at Transducer
- Sea Temp at Transducer

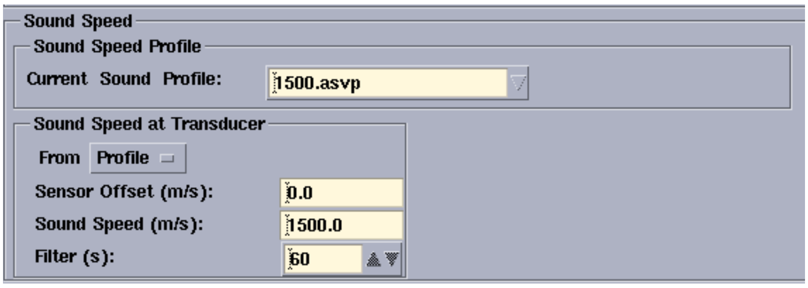


*Figure 40 - The **Sound Speed** field*

Sound Speed Profile

The Sound Speed Profile parameter allows you to select the sound speed profile to be used in the EM 1002's depth calculations. These calculations are based upon ray bending theory, and the importance of a correct sound speed profile can not be underrated.

The accuracy of the depth data obtained from the system is usually critically dependent upon the use of a correct sound speed profile. You must ascertain that the applied profile always corresponds to the real conditions. On the average errors in the sound speed profile should not be larger than about 0.5 m/s.

Sound speed profiles are organized as separate files. These may be edited with the **Sound Speed Profile (SSP) Editor**. New profiles may be created with the editor or imported into the system from another computer or sound speed probe.

→ *The SSP Editor is described on page 321.*

Current Sound Profile

This button is pressed to select and make active a new sound speed profile.

When this button is pressed, a standard file selection box appears. This box is used to select a file and make the sound speed profile active.

→ *How to use the File selection dialogue box is described on page 41.*

To select a new sound profile, click on the arrow on the right side of the name field and then click on the appropriate sound speed profile file name.

A warning will be given if the profile is more than 24 hours old, or if there exists a newer profile.

Sound Speed at Transducer

Note: *When the surface sound speed varies much with time, position and especially with tilted sonar head(s), it is recommended to install a sound speed sensor close to the transducer face!*

This is especially important for a curved transducer as used with the EM 1002..

→ *Sound speed errors are described on page 350.*

The sound speed value from the sensor will automatically be used as first value in the sound speed profile for depth/raybending calculations and for beam steering.

Note: *This can be disabled by the **Use Transducer Dept.** parameter in the **Show->Test-> Manual Control** window, but this is not recommended.*

The sound speed sensor at the transducer may also be used as a tool to give a warning when the sound speed profile is varying too much from the real-time value from the transducer sensor, provided this is set in the option menu. If the deviation is too large, a new profile should be taken.

To select the source for the Sound Speed at Transducer depths, select any of these three options:

From Profile

The system will use the active sound speed profile to derive the sound speed near the EM 1002 Sonar Head. If no matching depth is found in the profile, an interpolated value is used.

From Sensor

The readout from the specific sensor is used.

Manual

The EM 1002 system will use the sound speed you define.

Caution: *The manual setting is intended only for experienced operators !*

Sensor Offset (m/s)

This control is used to set a correction offset if the **From sensor** source is chosen. The offset will be added to the sound speed values received from the sound speed sensor.

Note: *When a new profile is taken into use, always set the offset so that the sensor value is the same as that in the profile at the transducer depth. This is most easily done by switching between deriving the sound speed at the transducer depth from the profile and from the sensor as the offset is changed.*

Sound Speed (m/s)

To set the sound speed at transducer directly to a fixed value. This function is only used if **Manual** is selected.

Filter(s)

If **From Sensor** is selected, the length of the filtering of the sensor data can be selected (1-60 seconds). This also sets the update rate.

Sea Temp. at Transducer

The transducer has a coating with a sound speed which differs significantly from water sound speed. As electronic beam steering is used for all beam angles larger than 50°, outer beam pointing angle accuracy is dependent on the coating sound speed being known to the system. As this sound speed is temperature dependent, the coating temperature must be known to the system. To give the system the coating temperature, a sound speed probe at the transducer depth may be equipped with an additional temperature sensor. The temperature sensor may otherwise be manually set or alternatively be derived from the sound speed if the salinity is known. The latter is recommended in open water where salinity does not vary, otherwise the use of a combined sound speed/temperature probe is recommended.

From Sensor

The readout from the temperature sensor is used.

From Salinity

When From is set to “Salinity”, the salinity value you enter here will be used together with sound speed at transducer depth to calculate temperature.

From Manual

The sea temperature you enter will be used.

Filtering

Overview

There is always a small risk of false detections in a multibeam echo sounder. This is due to external factors such as fish shoals, acoustical interference from other systems, passing over vessel wakes, etc. According to bottom conditions, you can apply the included filters to assist the system in discriminating against erroneous measurements. It is recommended to try different filter settings than the standards only if the occurrence of false detections is too high to be acceptable.

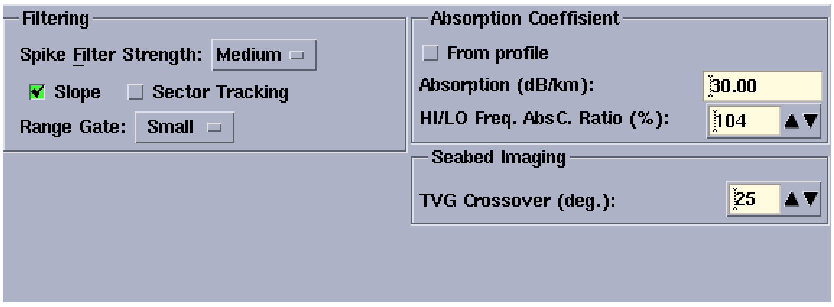


Figure 41 - Filtering, Absorption Coeffisient and Seabed Imaging fields

The recommended settings are:

- Spike Filter Strength: Medium
- Slope: On
- Sector Tracking: On
- Range gate: Normal

The bottom detection is performed in two passes in each ping. Filtering is performed after every pass.

- The first pass is done on all beams individually.
- The second pass is done only on beams which lack valid detection. However, the system then uses relaxed acceptance criteria within range windows derived from neighbouring beams with accepted detection.

It is always beneficial to eliminate erroneous measurements before postprocessing. In addition, if a false detection in a beam is eliminated in the first pass, a valid detection may be acquired in the second pass.

Spike Filter Strength

This selector button is used to define to what degree a non-smooth bottom is to be accepted. The filter remove beams with depths that deviate too much from a smoothed bottom profile as derived from the detected beams. The stronger filtering, the less deviation is accepted.

If you select **Off**, no filtering will takes place. Recommended setting is **Medium**.

To detect an object (for example a wreck) on a flat seabed, it may be necessary to switch this filter off to detect the object properly.

Slope

With this filter enabled, the EM 1002 system checks for bottom slopes that tilt inwards. These slant towards the vessel, and they are removed because the filter requires that the athwartships distance increases for every beam from the centre. Such detections are normally false, and after removal a new bottom detection is performed searching for a value with increased range.

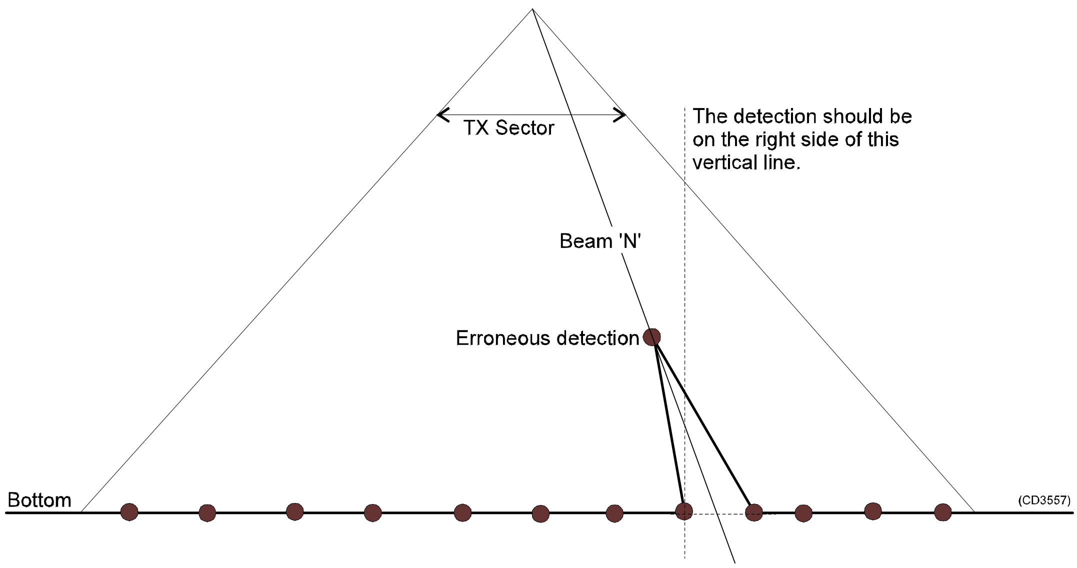


Figure 42 - Slope filter principles

This **Slope** filter should normally be enabled.

→ *The **Slope** filter is described visually in figure 42.*

Sector tracking

This setting does not affect the depth measurements, only the backscatter strengths.

Range gate

When the system detects the bottom, it will perform the search within a predefined depth window, where the depth limits are based on the information from the previous pings. The range gate setting is used to determine the size of this window, and you may choose between theese settings;

- small
- normal
- large

If the depth varies considerably (more than 10%) it may be useful to select a large range gate, but this may also increase the chance for false echoes from side lobes, interference or other noise sources.

Selecting a large range gate may reduce the ping rate slightly when operating in shallow waters.

The EM 1002 transmitter operates with three pulses within each ping when the coverage exceeds 100 degrees. This setting will turn on an automatic gain compensation to avoid gain steps between these sectors. During normal operations, the Sector Tracking should be on. However, if the survey specifications demand a fully calibrated system for seabed image data, this function should be turned off.

Absorption Coefficient

The setting in this field is used to define a value for the average absorption coefficient through the water column at 95 kHz.

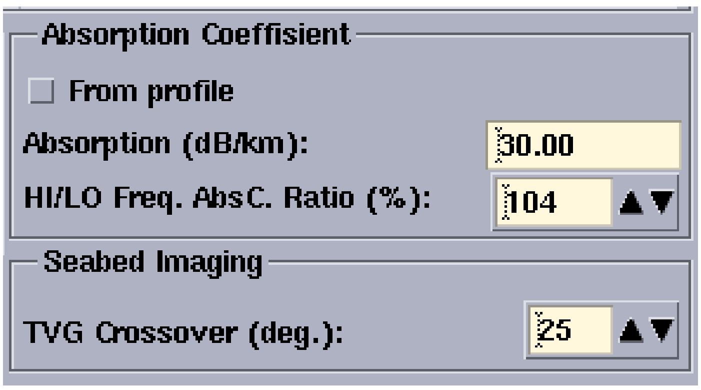


Figure 43 - Absorption Coefficient and Seabed Imaging.

The absorption coefficient depends upon depth, water temperature, salinity and frequency. A correct value is important with respect to the validity of the bottom backscatter data measured by the system.

→ *Absorption coefficients are described in more detail on page 365.*

The Absorption Coefficient can be entered manually or can be calculated from an Absorption Coefficient profile.

The Absorption Coefficient values can be calculated from a sound speed profile that includes information necessary to calculate an Absorption Profile. Use the **Auto** command to activate use of such a profile, which will increase the accuracy of the bottom reflectivity data. If **Auto** is selected, the absorption coefficient value displayed will change continuously depending upon the depth.

The system contains a default absorption coefficient profile. If you have not measured your own profile, Kongsberg Simrad recommends that you **DO NOT** use the default profile by selecting **Auto**.

HI / LO frequency ratio

Because the EM 1002 uses two different frequencies (93 and 98 kHz), the absorption coeffisient will vary slightly (for example 30 db/km for 93 kHz, 31.2 db/km for 98 kHz). The ratio of the HI/LO frequencies is to be set in this field.

Seabed Imaging

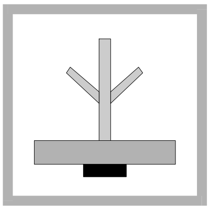
TVG Crossover

This value is used to define the angle at which the bottom backscatter can be assumed to not be affected by the strong increase at normal incidence. The optimum crossover angle will vary with the bottom type.

For seabed imaging, it is important to adjust this angle so that a minimum of angle-dependent amplitude variation is seen in the Seabed Image data display. This is to give best use of its dynamic range. The bottom backscatter strengths in the ping display are not affected by this setting.

4.4 Installation Menu

Overview



The Installation Menu is accessed from the **Runtime Menu** dialogue box by selecting **Installation Parameters** from the **Show** menu. The **Runtime Menu** is started automatically when the echo sounder is started, but you can also open it from the Launchpad.

You may use the **Installation Menu** dialogue box at any time if it is required to adjust certain parameters, but under normal operating conditions these settings should not be tampered with. The parameters are controlled with a password.

Once activated, a large window opens to view all the settings simultanously. This window gives you access to the following parameters:

- TRU Input Interfaces
- Active Systems
- Motion Sensor
- Height Sensor
- Stand-Alone Heading Sensor
- Clock
- Misc. External Trigging
- Sensor Location
- Installation Angles
- System Parameters

The top of the **Installation Menu** dialogue box contains the following options in the main menu bar:

- File
- Edit
- Help

Main menu

File

When you select **File** on the main menu, the following menu appears:

- Read

- Open...
- Save
- Save as...
- Close window

Read

Select **Read** to open the current set of previously defined parameters saved on the hard disk. Before you can read this setup file, you need to enable the EM 1002 to accept changes. To do this, select **Edit** on the menu bar and choose **Edit enable**. See below for further information.

Open...

Select **Open...** to retrieve a chosen set of previously defined parameters saved on the hard disk. Before you can open a parameter setup file, you need to enable the EM 1002 to accept changes. To do this, select **Edit** on the menu bar and choose **Edit enable**. See below for further information. Once the system is enabled to accept changes to the installation parameters, you are prompted with a small window to select a setup file.

Save...

Use this option to save all the current installation parameters on the system's default user setup file. Note that the file will be updated permanently. No warnings are given before you replace the existing file with the new set of parameters.

Save as...

Use this option to save all the current installation parameters as a new parameter setup file you can define for your own use or for a specific installation.

Close window

Use this option to close the **Installation Menu** dialogue box. You can reopen it by selectiong **Installation Parameters** from the **Show** menu.

Edit

The Edit option on the main menu bar contains one option: **Edit enable**.

Edit enable

Before you can change anything in the Installation Setup window, you need to enable the EM 1002 to accept changes to the installation parameters. To do this, you must select **Edit enable**, and then enter the password.

If a password does not exist, you are prompted to enter one. Note that this password is common for all EM 1002 operators.

Further information about this password is found in the *System Administration* chapter in *the* EM 1002 *Maintenance Manual.*

Help

This option provides on-line documentation.

TRU Input Interfaces

Overview

The EM 1002 Transceiver Unit is equipped with four serial ports to interface external time critical sensors. These parameter settings allow you to select which sensors are connected to the various ports. The dialogue is also used to set the communication parameters for each selected interface port.

- A separate heading sensor is not required if the heading is available from the motion sensor.
- Up to three positioning system may be connected to the EM 1002 Processing Unit and logged, but only one of these can be active at any one time.
- Two heading sensors may be used (one with the motion sensor data), but only one can be active at any one time.
- A third positioning system may be used on the Ethernet.
- Two motion sensors may be used, but only one can be active at any given time.
- Only one clock input is allowed.
- On one port several sensors may be connected provided their datagram formulas have clearly defined start and stop characters (such as NMEA datagrams). However, not more than one sensor of a specific type, such as a positioning system, is allowed per port.

Several input types are available, and the list presented will depend on the serial port you selected and the settings made for positioning system and heading system input.

Port 1 : is initially available for general purpose, such as a positioning system, external clock or heading sensor. It is normally allocated for a positioning system. It will not accept inputs from motion sensors.

Port 2 : is reserved for the motion sensor. No other sensor type may be connected to this port.

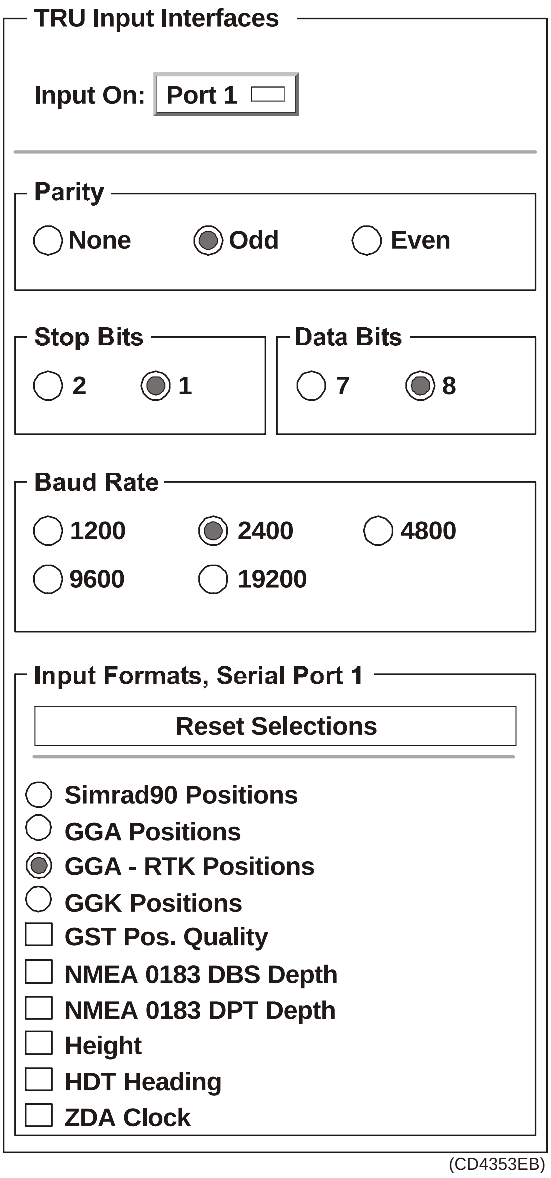


Figure 44 - TRU Input Interfaces

Port 3 : is initially available for general purpose, such as a positioning system, external clock or heading sensor. However, if the heading is retrieved from an SKR 80/82 (or an LR 40/60) gyrocompass (repeater), it can only be connected to this port. Also a second motion sensor can only be connected to this port.

Port 4 : is initially available for general purpose, such as a positioning system, external clock or heading sensor. It is often connected to an external clock.

The external clock is usually not required, unless the timing of the position data relative to the depth data demands one, or if it is wanted as the source for the setting of the system clock.

→ *See the description of the **Position delay** on page 130.*

Input On

This selector button is used to select which of the four interfaces to display in the dialogue box shall apply to.

Serial line specifications

Parity - Use these buttons to select the parity for the currently selected serial port.

Stop Bits - Use these buttons to select the number of stop bits for the currently selected serial port.

Data Bits - Use these buttons to select the number of data bits for the currently selected serial port.

Baud Rate - Use this selector to define the baud rate for the currently selected serial port.

Input formats, Serial Port 1/2/3/4/Ethernet

This area allows you to define what type of external sensor is connected to the serial interface port you selected with the **Input On** button.

Inputs in the following formats are available:

- Simrad90 Positions
- GGA Positions
- GGA - RTK Positions
- GGK Positions
- GST Pos. Quality
- NMEA 0183 DBS Depth
- NMEA 1083 DPT Depth
- Height
- HDT Heading
- ZDA Clock
- Attitude (on port 2 or 3)
- MK39 (only on Port 3)
- Motion sensor 2 (only on Port 3)
- SKR Gyrocompass (only on port 3)

Refer to EM 1002 in chapter Datagram Formats in the EM 1002 Maintenance manual for a description of these formats.

Positioning Systems

Overview

You can connect three positioning systems to the EM 1002 multibeam echo sounder, but only one of them can be active at any one time. One positioning system may be connected on Ethernet instead of serial line. For each of these positioning systems, you need to define certain basic parameters.

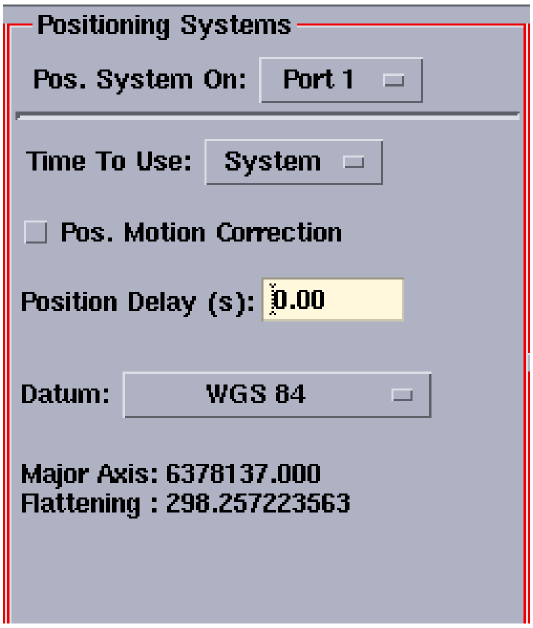


Figure 45 - Positioning Systems

Positioning System On

Up to three positioning systems may be defined. Data from all of them are logged, and may be used in post-processing. However, only the positioning system you have selected as “active” will be used by the EM 1002 system in its real-time displays.

→ *Refer to page 131 for a description of the Active Positioning System parameters where the selection is made.*

Use this selector to choose which positioning system you wish to alter the parameters for. The positioning system is thus not identified by its name, but by the serial line it is connected to.

The following ports are available:

- Port 1
- Port 3
- Port 4

- Ethernet

Time To Use

Usually the system's internal time should be used during logging, since the clock reference then will be identical for both positions and depths. Any time delay in the positioning system and the data transmission from the sensor must be taken into account. This is done by defining a fixed average position delay.

If this delay is not sufficiently constant - and provided that the time stamp in the position datagram is the time when the position was valid - the input datagram's time stamp may be used. However, it must then be assumed that the EM 1002 and the positioning system clock are both synchronized with the 1PPS signal, and that any time difference between the two clocks are entered as a position delay.

→ *For more information on timing, refer to page 360.*

System The EM 1002 will use its own internal time stamp when applying positions to the realtime display.

Datagram This choice allows the use of the time stamp in the input datagram when applying positions to the realtime display.

Note: *Both time stamps are stored, so the choices made can be redone in post processing!*

Pos. Motion Correction

When the vessel moves due to roll, pitch and heave the antenna on the positioning system moves as well. This parameter allows the system to compensate for this movement by adjusting the values from the positioning system based on the current information from the motion sensor(s).

Correct timing of the positions is very important if motion correction is to improve position accuracy.

Position Delay

This parameter is used to define the "age" of the position in the position datagrams.

The relative timing of vessel position data and system depth data is critical to the total achievable accuracy. The best solution is if it can be assured that the position datagrams are always received by the system with a fixed and sufficiently constant age with respect to the time of validity of the enclosed positions. This age is the position delay to be entered. Such a solution will make the use of any clock synchronization of the system with the positioning system unnecessary.

Datum

This parameter enables you to select which datum the positioning system uses. The datum specific parameters are also shown in the window. These describe the ellipsoid that defines the datum.

- Major Axis
- Flattening

Active Systems

Active Positioning System On

This selector button is used to choose which positioning system you wish to use as the **active** positioning system. The positioning system is thus not identified by its name, but by the serial line it is connected to.

- Port 1
- Port 3
- Port 4
- Ethernet

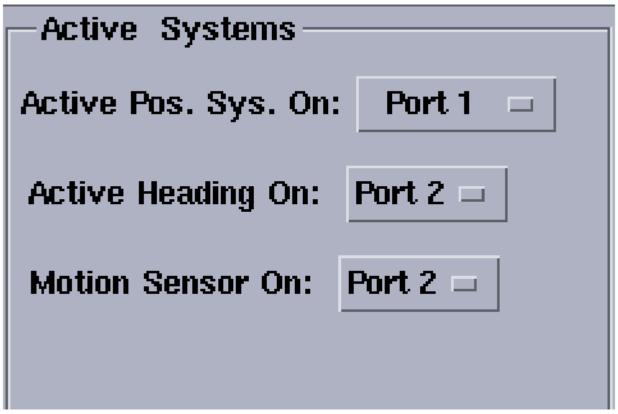


Figure 46 - Active Positioning System

Active Pos Filtering

The **Active Pos Filtering** makes it possible to filter the position data. This is done in real-time.

Pos Filtering

Selecting this button makes it possible to remove spikes from positioning data.

Ships Max Speed (kn)

To remove the spikes from the positioning data, you need to set the limit in knots for the spikes to be removed.

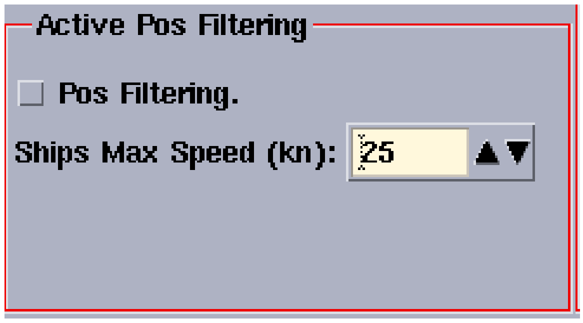


Figure 47 - Active Pos. Filtering

Motion Sensor

Overview

The motion sensor is presumed to measure the vessel attitude of some specified point on the vessel. The sensor must thus be aligned with the vessel, not the system's transducer(s). Any angular transformations required due to the transducer(s) not being aligned parallel with the vessel's forward axis will be done by the system.

If the motion sensor is programmed to calculate attitude at a different location than where it actually is mounted, this must be taken into account when describing the motion/attitude sensor location. The "virtual" site must then be entered, not the real one.

The roll reference plane convention used by the sensor may be defined in two ways, both are handled by the system.

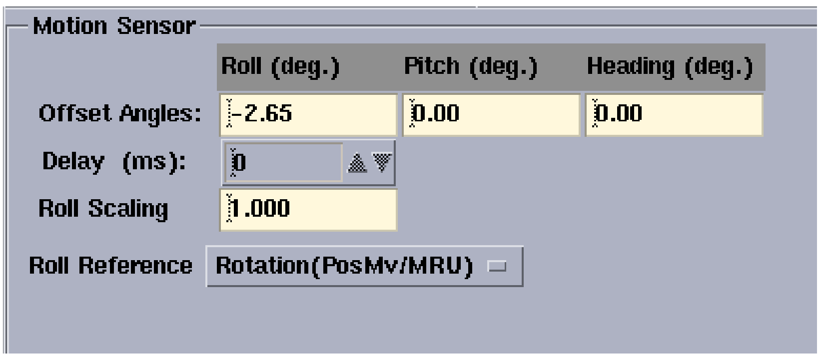


Figure 48 - The Motion Sensor

Offset Angles

Roll Offset (deg)

This setting is used to set a correction offset for roll values received from the Motion Sensor.

The offset will be added to the roll values received from the Motion Sensor. If the roll offset is found using the system's built-in calibration utility it should be applied without any change of sign.

Pitch Offset (deg)

This setting is used to set a correction offset for pitch values received from the Motion Sensor.

The offset will be added to the pitch values received from the Motion Sensor. If the pitch offset is found using the system's built-in calibration utility it should be applied without any change of sign.

Heading Offset (deg)

This setting is used to set a correction offset for any heading values received from the Motion Sensor.

The offset will be added to the heading values received from the Motion Sensor. If the heading offset is found using the system's built-in calibration utility it should be applied without any change of sign. If the heading offset is found by other methods, for example by a calibration with the vessel tied to a quay:

- a positive offset must be entered if the sensor reading is too "small" with respect to the true heading.
- a negative offset must be entered if the sensor reading is too "large" with respect to the true heading.

Delay

This parameter is used to define the expected time delay of the motion data.

If the data from the attitude sensor are delayed with respect to when they were valid, this may be corrected by the system provided the delay is known. This delay may be due to filtering and/or processing time in the sensor, and should be provided by its manufacturer. Some sensors are able to compensate for such delays by a prediction, but it is not advisable to use such a feature.

Roll Scaling

It has been found that at extreme and rapid roll some motion sensors can give a slight overshoot. A small change in scaling may improve the results.

Roll Reference

This selector button is used to define the reference plane against which the angle for roll is measured.

Horizontal (Hippy) - Select this alternative if roll is measured against the horizontal plane, i.e. against the plane normal to the gravity vector. This is the convention used by the Hippy 120, often emulated by other sensors.

Pitch Roll axis plane - Select this alternative if roll is measured against a plane defined as horizontal in the acrosstrack direction, but following the vessel pitch in the alongtrack direction, i.e. as a rotation around the forward axis of the vessel coordinate system. This is the convention usually used by inertial systems such as the POS/MV (the Tate-Bryant convention).

Stand-Alone Heading Sensor

Overview

The EM 1002 system must have access to the vessel's current heading. The data may be received from the motion sensor, or from another sensor (for example a gyrocompass or a dual GPS reciever system).

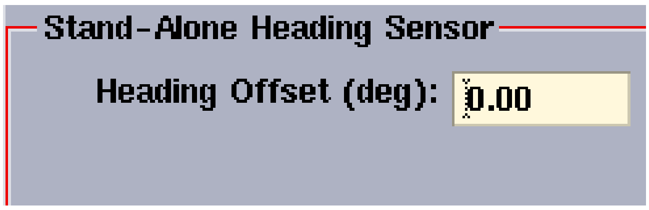


Figure 49 - Stand-alone heading sensor

Heading Offset

This selector is used to set a correction offset for the heading values received from the Heading Sensor.

The offset will be added to the values received from the heading sensor. If the heading offset is found using the system's built-in calibration utility it should be applied without any change of sign. If the heading offset is found by other methods, for example by a calibration with the vessel tied to a quay:

- a positive offset must be entered if the sensor reading is too "small" with respect to the true heading.
- a negative offset must be entered if the sensor reading is too "large" with respect to the true heading.

Clock

Overview

The EM 1002 system has an internal clock with 1 millisecond resolution. This clock is used to time stamp all logged data. The drift of the internal clock can be several seconds per day. The clock may be synchronized to an external 1 pulse per second (1PPS) signal. This signal will then determine the clock's drift rate, and in practice reduce it to zero using a GPS receiver as source.

You may set the internal clock's date and time to the values found in the datagrams sent to the system, either from a connected external clock or from the positioning system, or to that of the clock in the Operator Station.

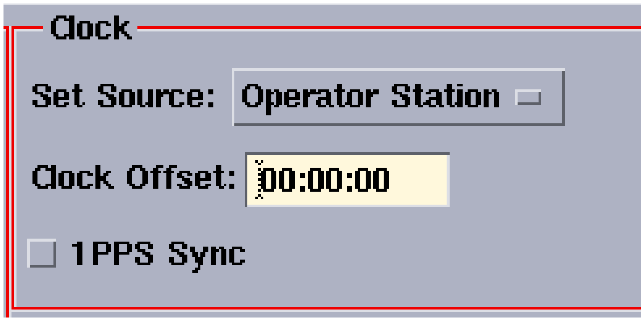


Figure 50 - The Clock

Such setting is only allowed while defining a new survey. The relative time stamp values will then be constant (without any "jumps") throughout each survey.

At power on the system will also set it's clock in accordance with the option chosen here.

For more information about timing, please refer to the *Clock* in the *Datagram formats* chapter in the EM 1002 *Maintenance manual*.

Set Source

This selector is used to define the source for the synchronization of date and time. The following options are available:

- External clock (UTC time received in ZDA format)
- Operator Station
- Active Positioning System

Clock Offset

This offset value is applied to the source time. Use it to offset the source time to the local time or whatever time zone you require.

1PPS Sync

Click to turn on the 1 pulse per second external clock synchronization.

Misc. External trigging

This option enables external trigging of the EM 1002 echo sounder system.

Figure 51 - External triggering

More about the External Triggering can be found in the EM 1002 *Maintenance Manual.*

Sensor Location

Overview

In order to make accurate measurements, the EM 1002 must know the physical location of all the sensors and its own transducers.

These locations must be related to the vessel's reference point. The position of each system must therefore be given as a forward (X), downward (Z) and starboard (Y) position relative to the reference point. The coordinate system assumes that the X-axis follows the vessel's keel, and that the X-Y plane is horizontal while the vessel is in normal trim.

→ *The vessel's coordinate system and reference point is described in the EM 1002 Installation manual.*

Positioning systems

These settings are used to define the physical location of the selected positioning system's antenna. The downward positions are required if RTK is to be used to position the bottom with respect to a datum vertically.

Note: *The downward position will also be used if the positions are to be corrected for vessel attitude. This requires that the actual physical antenna position is entered and that the given position is at the antenna.*

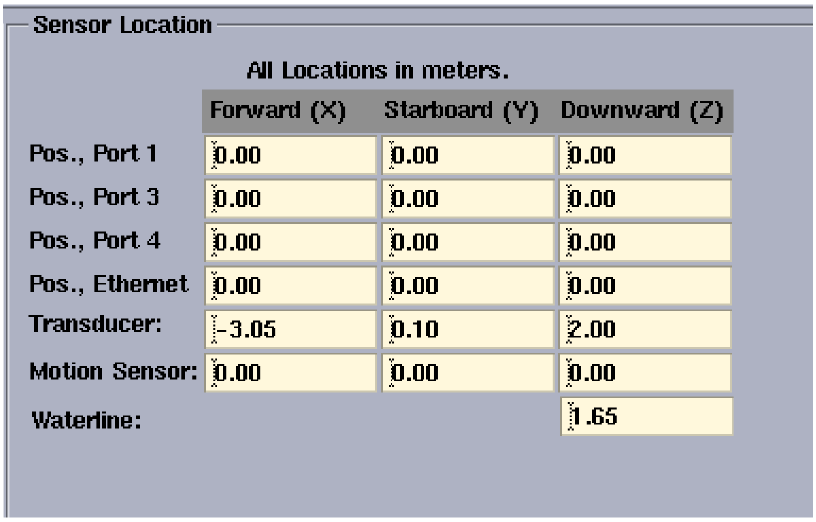


Figure 52 - Sensor Location

The position data you define here may however not necessarily always be the physical location of the antenna. This is because settings in the positioning system's own software can redefine the location of the antenna. The XY values of the soundings are referred to the location of the active positioning system, and it is this "virtual" position that you must enter.

Transducer

Use these settings to define the physical location of the lowest point of the transducer array.

Motion sensor

The Motion Sensor parameters allow you to define where the sensor is physically located, or where its data are valid.

Waterline

Enter the vessel's waterline (in normal trim) related to the vessel's reference point. The value should be an average of two measurements; one on each side of the vessel. The measurement must be made at the same alongship location as the physical location of the motion sensor.

Note: *If the vessel's deplacement or trim changes during a survey, this value must be updated accordingly.*

Installation Angles

Overview

After the installation of a transducer array, it must be measured accurately to find the angles between the transducer and the vessel coordinate system.

Transducer

Use this setting to enter the installation angles. These settings are normally entered once and for all, but if the vessel undergoes major repair or maintenance and the array is moved, all the installation checks must be repeated and new angles defined.

System Parameters

Overview

These are general system parameters. These settings are normally entered once and for all.

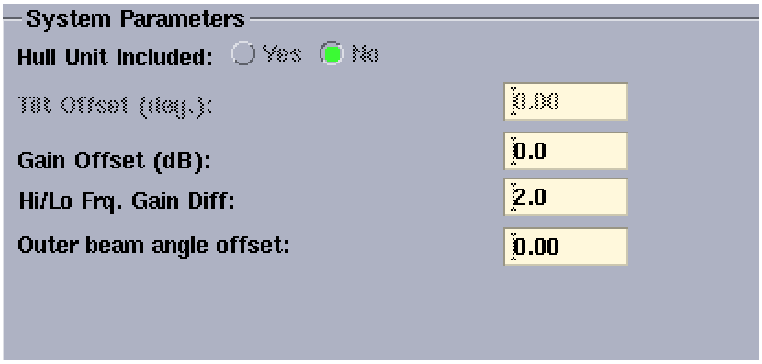


Figure 53 - System Parameters

Hull Unit included

The EM 1002 may be supplied with or without a hull unit with mechanical pitch compensation. Set **Yes** or **No** here as applicable with your system.

Tilt Offset (deg)

This setting is used to compensate for a fixed tilt setting of the hull unit.

Gain Offset (dB)

This setting allows you to compensate for a gain offset between the system and any difference in its backscatter measurement and any other systems you wnat to use as a reference. The gain offset may need changing with the aging of the system transducer(s).

HI / LO Frequency Gain Difference

The system uses three sectors with a higher frequency (98 kHz) in the middle and a lower in the outer two (93 kHz). Depending on the actual transducer, this may result in a gain difference in the backscatter measurements. The **HI / LO Frequency Gain Difference** parameter will allow you to compensate for this difference.

Outer beam angle offset

The pointing angles of the outer beams of the EM 1002 depend on the sound speed of the transducer coating material. This parameter will allow you to add a correction for this effect. The value may need changing with transducer aging and sea temperature (a compensation for temperature is built into the system software, but it may not be 100% effective). The actual parameter value must be found by estimating the beam pointing angle error in degrees by comparing the depths measured in th eouter beams to those of the beams. This is most easily done by running two lines perpendicularly and using the roll calibration applications to find the beam pointing angle offset.

4.5 Manual Control

Overview

The **Manual Control** options are available on the **Test, Simulator and Manual Control** dialogue window.

Using the Manual Control options, you can overrun several of the parameters set automatically by the echo sounder. We strongly advice you not to do this unless you are very familiar with the system, and well aware of the consequences these changes may have on your survey.

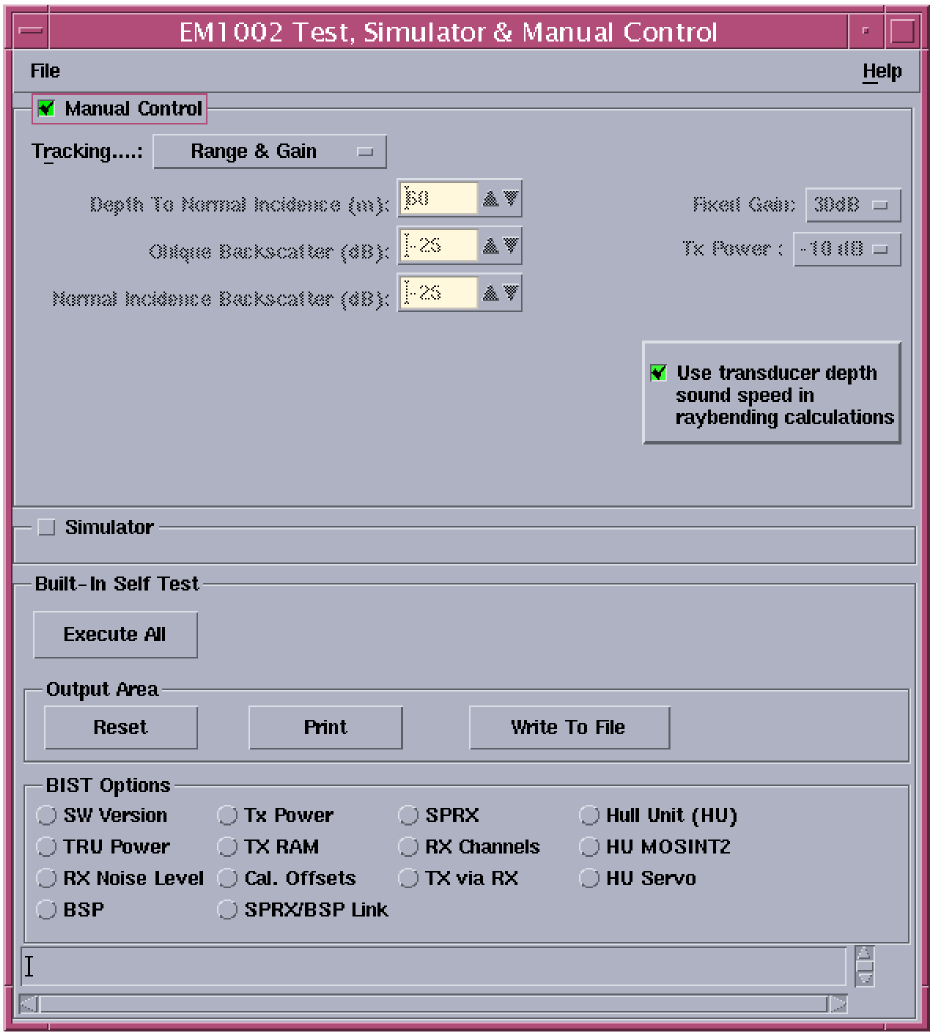


*Figure 54 - The **Manual Control** field*

Manual Control

Tracking

This setting is used to control the bottom tracking method used by the EM 1002 system.

The available options represent different degrees of automatic control. Bottom tracking requires good estimates of the ranges to the bottom and bottom backscattering strength which again are used to set the system gain. These values may either be set by you, or automatically estimated by the system.

<u>Manual</u>

The automatic control of the Fixed Gain, Oblique Backscatter, Normal Incidence Backscatter level and the TX power level, is disabled. The values entered by you will be used instead.

No bottom tracking will be performed, the range gates will be set assuming a horizontal bottom at the depth specified by the Depth To Normal Incidence parameter.

<u>Range Only</u>

The system will perform normal bottom tracking.

As in manual, the automatic control of the Fixed Gain, Oblique Backscatter, Normal Incidence Backscatter level and the TX power level, is disabled. The values entered by you will be used instead.

<u>Range & Gain</u>

With this setting the system will do bottom tracking and control the gain fully automatic. This is the normal setting.

Note: *The selected option should normally be **Range & Gain**. Other alternatives should only be selected for test purposes, or under exceptional conditions if the automatic bottom tracking is not working properly.*

Depth to Normal Incidence

The strongest echo from the bottom is usually the first echo which arrives from where the sound pulse hits the bottom perpendicularly. The model uses two parameters to describe this echo:

- Depth (equal to range on flat bottom) to normal incidence
- Normal incidence backscatter strength

The Depth to normal incidence parameter is used only if tracking is set to **Manual**. This parameter will be used as the depth to set the range gates, and for the TVG calculations.

Oblique Backscatter

This parameter is used to set a value for the oblique backscatter strength.

As the incidence angle decreases, the echo strength falls rapidly. From about 10 to 25 degrees (depending on bottom type) it may be modelled by the geometry and a single parameter: the oblique backscatter strength. The model used in the system assumes the bottom backscatter strength to vary linearly with incidence angle up to 25 degrees, and to decrease in accordance with Lambert's law for larger angles. In addition the model assumes the bottom to be flat, and that the signal is attenuated by spherical spreading and absorption loss in the water column. The value is used only if the tracking mode is set to **Manual** or **Range only**.

Normal Incidence Backscatter

This parameter is used to define a value for the backscatter strength at normal incidence. The value is used only if the tracking mode is set to **Manual** or **Range only**.

Fixed Gain

The preamplifier system has two independent gain controls; a fixed gain consistent during each ping, and the TVG (Time Variable Gain) setting implemented in the system software. Use this selector to set the value of the fixed gain. The value is used only if the tracking mode is set to **Manual** or **Range only**.

TX Power

You can set this parameter if you need to reduce the output power from the EM 1002 system. The normal setting is **Full**, you can reduce it to -10dB or -20dB. This value is used only if **Tracking** is set to **Manual** or **Range only**.

Use transducer depth sound speed in raybending calculations

If this function is activated, the sound speed measured at the transducer depth is used as the start point for the raybending calculations. It is strongly recommended to have this option activated.

4.6 Simulator

Overview

The **Simulator** options are available on the **Test, Simulator and Manual Control** dialogue window.

The built-in simulator allows you to practise your skills on the echo sounder system even without leaving port. You can also use it to train new operators, or to perform troubleshooting on an external logging and display system. The artificial bottom generated by the simulator is not advanced, but it allows you to define a few basic parameters.

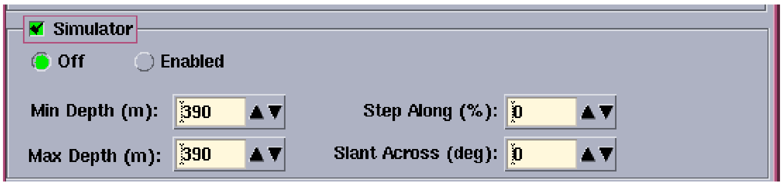


Figure 55 - Simulator

How it works

The **Simulator** simply creates a flat, artificial bottom. You can manipulate the bottom depth properties by setting the parameters described below.

The simulator is located in the Sonar Head, and when runnning, it will test most of the EM 1002. Only the transmit and recieve part will not be tested. If the sound speed profile is different from the transducer depth sound speed, the bottom will be curved.

Note: *Please be aware that the Simulator does not work in real time, it will have a reduced ping rate.*

Simulator

Off - Click to switch the simulator off.

Enabled - Click to switch the simulator on. To start the **Simulator** you must start it from the **Launchpad**.

Minimum depth - Change this parameter to modify the minimum depth of the simulated bottom.

Maximum depth - Change this parameter to modify the maximum depth of the simulated bottom.

Step Along - This setting determines how much the depth shall change from ping to ping. The depth will automatically change from the minimum to the maximum setting, and then be reduced again.

Slant Across - Change this parameter to modify the across slant angle of the simulated bottom.

4.7 Built-In Self Test

Overview

The **Built-In Self Test** options are available on the **Test, Simulator and Manual Control** dialogue box. To access this box, select it on the **Show** menu in the **Runtime Menu** menu bar.

The **Built-In Self Test** options provide a number of automatic tests that may be started to check the operation of the echo sounder system.

You can also enable a test to be performed every time you start the system. Test results are displayed in the dialogue box's text box.

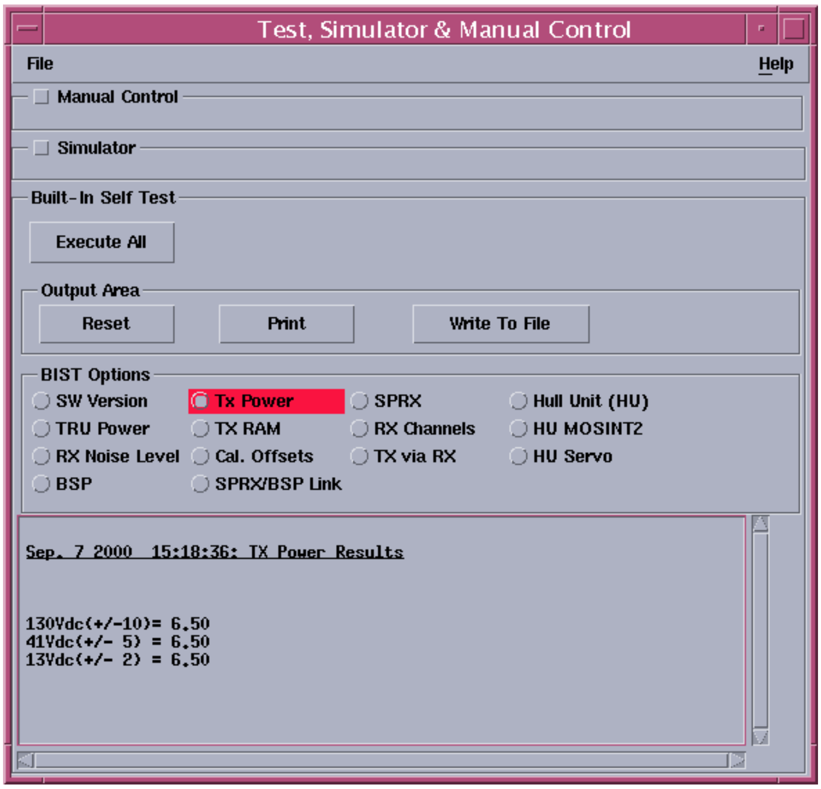


Figure 56 - The ***Built-In Self Test*** *options*

Note: *To operate the BIST system, the echo sounder must be in standby mode (not pinging), and logging must be off.*

Execute All

This button allows you to run all the built-in test programs automatically. The tests are rune one by one, and the results are shown in the message field at the bottom of the window. Note that this is a rather time consuming task, especially the Tx channel.

BIST At Startup

When this function is enabled, the system runs most of the built-in test programs automatically when the system is switched on. The tests are run one by one, and the results are shown in the message field at the bottom of the window.

Independent of this setting, the Operator Station software issues a “power up” BIST request to the Transceiver Unit when the Operator Station starts the EM 1002 operator interface. This verifies the operation of the Transceiver Unit and the software. This power-up test must be successfully completed in order to operate the system.

Reset

Press this button to erase all the current information in the message field.

Print

Press this button to print all the current information in the message field. The output is automatically sent to the default printer connected to the system.

Write To File

Press this button to print all the current information in the message field to a text file. A small dialogue box opens to let you select file name and location. The file format is normal ASCII.

→ *For more information about the file system, please refer to the System Administration chapter in the EM 1002 Maintenance manual.*

BIST Options

Overview

When you run the built-in test programs, you can either run all the test automatically (by pushing the **Execute All** button described above), or you can select which parts of the EM 1002 system you wish to test. The options available here allows you to test individual functions and hardware items. Note that efficient use of these parameters are only possible if you have a general knowledge of the EM 1002 design. The descriptions here are are only for general information.

→ *For more detailed descriptions, refer to the EM 1002 Maintenance manual.*

SW Version

Presents the software versions of the processors in the system.

TRU Power

This test checks the low voltage power supply in the EM 1002 Transceiver Unit. All the output levels are tested.

RX Noise Level

The level is normally higher at shallow waters due to reflections of the ship's noice from the bottom. This noise, the flow noice, normally increases with the ship's speed.

This test measures the noise level on all the receiver channels.

- The average equivalent isotropic noise level for all channels. (Typical value is 45-50 dB ref 1 V per μPascal).
- The equivalent isotropic noise level for each receiver channel (ref 1 V per μPascal)

BSP

This test check the Beamformer and Signal Processing circuit boards in the EM 1002 Transciever Unit.

TX Power

This test checks the high voltage power supply in the EM 1002 Transceiver Unit. All the output levels are tested.

Note: *This test may take several minutes!*

TX RAM

This test checks the memory on the transmitter boards in the Tranciever Unit.

Cal. Offsets

Factory calibration values for the transducer are stored in the transducer unit. This test displays these values.

SPRX / BSP Link

This test checks the communication between the Signal Processing Receiver and the Beamformer and Signal Processing circuit boards.

SPRX

This test checks the SPRX processor board. The SPRX is controlling the data aquisition and the transmitter.

Rx Channels

A test signal is injected individually to all 128 reciever channels. The amplitude and phase response is checked.

TX via RX

This test checks all the transmitter channels through the water to a neighbouring reciever. One pulse is transmitted at a time using one transmitter element only. Note that this test can last for several minutes.

Hull Unit (HU)

This is a test of the processor board (SPS) in the Hull Unit.

HU MOSINT2

Test of the driver circuit to the Hull Unit step motors.

HU Servo

This drives the Hull Unit to vertical then to +/- 5 degrees off and back.

Message field

The reports issued by the built-in test programs are shown here.

5 I/O INTERFACES

5.1 Overview

Various data may be imported to or exported from the EM 1002 Operator Station on serial lines. The imported data may come from another computer (in which case specific formats must be used) or directly from sensors.

The **I/O Interfaces** dialogue box functions are used to set up the serial lines. The dialogue box is accessed directly from the icon on the EM 1002 Launchpad.

In this chapter you will find

- I/O functions and main window
- Menu commands
- Operational procedures

5.2 I/O functions

The I/O functions are enabled by selecting the corresponding option button beside the function name. A green button indicates that the function is currently active. The different I/O functions are listed by group as follows:

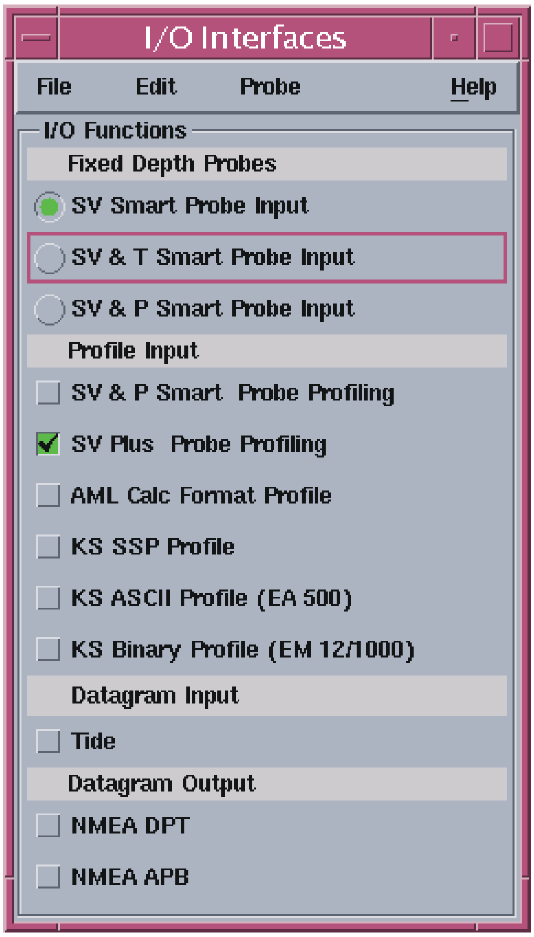


Figure 57 - I/O Interfaces dialogue box

Fixed Depth Probes:

- SV Smart Probe Input - sound speed probe
- SV & T Smart Probe Input - sound speed and temperature probe
- SV & P Smart Probe Input - sound speed and pressure probe

Profile Input:

- SV & P Smart Probe Profiling - sample a profile using AML SV & P probe
- SV Plus Probe Profiling - generate a profile using data collected with the AML SV Plus probe
- AML Calc Format Profile
- KS SSP Profile Datagram
- Kongsberg Simrad ASCII Profile Datagram
- Kongsberg Simrad Binary Profile Datagram

Datagram Input:

- Tide

Datagram Output:

- NMEA DPT - depth of most vertical beam
- NMEA APB - position with respect to the active survey line

Only one Fixed Depth Probe may be chosen at a time. All other functions can be combined as desired, depending on available I/O interfaces.

5.3 Menu commands

The menu includes the following commands:

File

- **Save** - saves current settings
- **Read** - allows you retrieve previous values
- **Exit** - closes the I/O Interfaces dialogue box

Edit

- **Device Setup...**

Choose **Edit->Device Setup...** from the menu to control the parameters of each I/O function. The Device Setup dialogue box allows you to associate each of the available functions with an input device. For most functions, this is a serial port, but the **AML Calc Format Profile,** the **KSI SSP Profile Datagram** and **SIMRAD ASCII and Binary Profile Datagrams** input functions may in addition be set up to the Ethernet.

→ *See description below.*

Probe

- **Probe Controls...**

→ *See description below.*

Edit menu

Device Setup

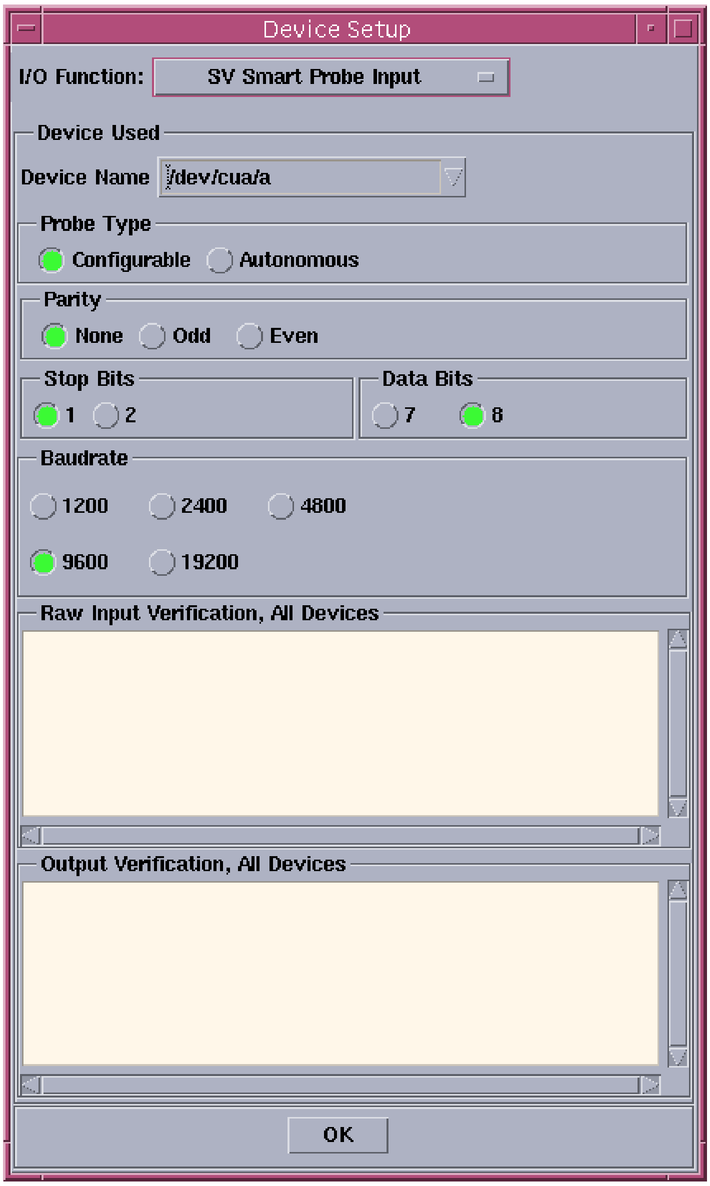


Figure 58 - The ***Device Setup*** *dialogue box*

To modify the device setup for any given function, select the function from the **I/O Functions** button at the top of the dialogue box. The various fields and items available for selection in **Device Used** are then updated according to the I/O Function chosen.

Options for controlling the associated device are:

- **Probe Type**: Use this selector to define whether the probe is Autonomous or Configurable. An Autonomous probe sends out data automatically when power is applied, a Configurable probe requires commands from the system to provide data.
- **Parity**: Use these option buttons to select the parity for the currently selected device.
- **Stop Bits**: Use these option buttons to select the number of stop bits for the currently selected device.
- **Data Bits**: Use these option buttons to select the number of data bits for the currently selected device.
- **Baudrate**: Use this selector to define the baudrate for the currently selected device.

All input is verified for the appropriate read & write access as given by the currently selected I/O Function and appropriate warnings are issued if necessary.

It is possible to verify device input in the **Raw Input Verification, All Devices** field and to verify the device output in the **Output Verification, All Devices** window.

5.4 Probe

Probe Controls

Sound Speed Profile Input

The EM 1002 may receive the sound speed profiles from either a combined sound velocity and depth/pressure sensor, or from an external computer. The only separate sensors currently accepted by the EM 1002 software are the Applied Microsystem's Smart SV&P Probe and the SV Plus Probe. Profiles loaded from an external computer are only accepted if they conform to the CALC format defined in the Applied Microsystem's Total System Software, or to proprietary formats defined by Kongsberg Simrad. They are the SSP format, the SIMRAD ASCII format originally defined for the EA500, and the SIMRAD Binary format originally defied for the EM12 and also used by the EM 950/1000. These formats are more useful than the other formats, as they also support sound speed input, absorption coefficient, temperature and salinity as a function of the depth. From these data, both sound speed and absorption coefficient profiles may be generated.

SV & P Smart Probe Profile Input

When **SV & P Smart Probe Profiling** is enabled under **Profiling Input**, the **SV & P Smart Probe Profile Input** controls at the bottom of the I/O Interfaces dialogue box become active for selection.

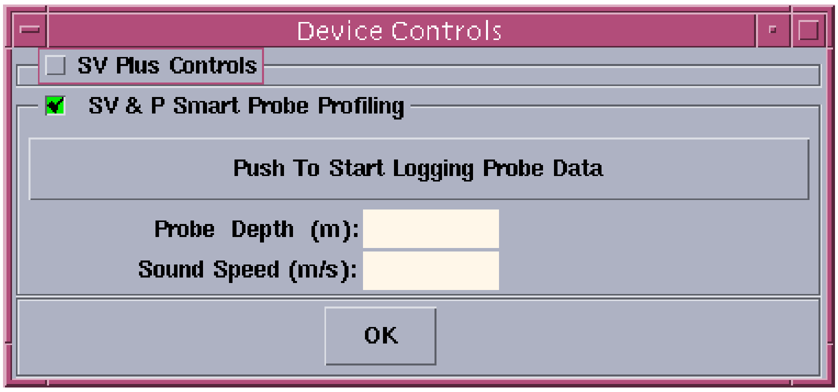


Figure 59 - The ***Device controls*** *dialogue box, SV & P Smart Probe Profiling*

Push to start Logging Probe Data

This button is used to start the collection of probe data in order to established a complete sound speed profile. The sampling process runs until you press the button again.

Note: *Please note that the probe starts sampling data as soon as it is enabeled in the main window!*

Probe depth

This field displays the current probe depth as a function of the pressure read by the sensor. The information is continuously updated once the sensor is activated.

Sound speed

This field displays the current sound speed as read by the sensor. The information is continuously updated once the sensor is activated.

5.5 Operational Procedures

The following procedure allows you to collect the sound speed profile using the Applied Microsystem’s Smart SV&P Probe connected to the EM 1002 Operator Station. The procedure assumes that you have defined a serial line input for the probe.

1 Open the **I/O Interfaces** on the EM 1002 Launchpad.

2 Click the **SV&P Smart Probe Profiling** option button.

3 Lower the probe to a stable position beneath the water surface.

4 Apply power to the probe and wait for the displayed values to stabilize.

5 Click **Push to Start Logging Probe Data** to activate the data logging. The button then turns green indicating logging is active, and the label changes to **Push to Stop.**

6 Lower the probe to the required depth.

- The sinking speed should not exceed 1 m/s. Allow the probe to sink freely, but try to keep an even movement.

7 Click **Logging Probe Data - Push to Stop** when the probe has reached the required depth to terminate data acquisition. The green colour is then switched off, and the label changes to **Push to Start Logging Probe Data.**

Note: *There may be systematic differences in the measurement values according to the up/down direction. This is due to the water flow around the sensor. If this is the case, only data from one direction should be measured!*

Note: *Also note that if logging of data is active in both directions, all data will be used!*

- Once the computer has collected all the data, it will automatically start the **SSP Editor**. The profile you have just collected will there be displayed for a visual check.

  → *The SSP Editor is described on page 321.*

- You may also collect data when the probe is hoisted. You must then press **Use Sampled Values** again (re-select) to start a new data acquisition before hoisting. Click again (deselect) just before the probe breaks the surface to terminate the second data acquisition.

8 If required, modify the sound speed profile to remove obvious erroneous measurements, or to correct for known offsets.

- The procedure for this is given in the **SSP Editor** instructions.

  → *The SSP Editor is described on page 321.*

9 Close the window by selecting the **OK** button.

- The sound speed profile is automatically saved on the hard disk. The file name is generated from the current date and time.

SV Plus Probe Input

The SV Plus Probe is configured, monitored and managed from the SV Plus Probe Profiling section of the **Probe Controls** window. The section may be expanded or collapsed using the section title button. The default state is collapsed.

The section contains several subsections whose titles are used as section titles below.

The SV Plus probe comes with a number of configuration options, most of which can be accessed from this window. For a complete description of the SV Plus probe configuration, operation and maintenance, please refer to the manufacturers documentation that comes with the probe.

During normal operation, available sensor data is logged to data files local to the probe. The data may be collected when the probe is retrieved and connected to the workstation.

Note: *Please note that the probe must be connected to the workstation with a special cable supplied with the probe in order to communicate with the probe!*

All commands issued to the probe is echoed in the **Raw SV Plus Input Verification** area of this section, along with any probe response or feedback to the issued command(s).

You may at any time select the **Push To Monitor Probe** button at the top of the window to monitor the probe sampling. Sampling will be performed according to the current probe configuration.

Show

The text field **Show** contains the following probe command options:

Pressure

Displays one sample of pressure sensor data.

Temperature

Displays one sample of temperature data.

Date & Time

Displays probe’s current date and time.

Battery Status

Displays sensor battery data.

Sound Speed

Displays one sample of sound speed sensor data.

Current Logfile

Displays name of file local to the probe containing probe sampling data.

Current Sample Rate

Displays current probe sample rate.

One Scan

Displays one scan of data using the current setup.

Data Management

Fetch & convert Probe Data

Lists all files local to the probe available for retrieval. The files are echoed in the input verification area and in a popup selection window. One file at a time may be selected in this window. Each file contains at least one cast (sampling session) of data. When the **OK** button is activated, the selected file of logged data is transferred to the Operator Workstation, and converted to one or more sound speed profiles.

The files are named according to the date and time found for each cast of data. The files are stored in the directory designated for sound speed profiles used by the system. Whenever a new profile is downloaded through esoIO, it will be copied to current raw data directory in addition to SHAREDHOME. The sound speed profiles may at any time be renamed, provided that the file extension '**.asvp**' is kept.

Fetch Probe Data

Lists all files local to the probe available for retrieval. Same as above except files are not converted but stay in the original format.

Set Logfile

Pops up a window for input of a file name to be used for storing data locally in the probe. The naming syntax follows that of the DOS operating system. The file name is sent to the probe when selecting the **OK** button. All subsequent data acquisition uses this file for data storage.

List Logfiles

Lists all data logfiles currently present in the probe. The file list is displayed in the **Raw SV Plus Input Verification** area.

Initialize Probe

Resets probe settings to factory defaults, and clears the probe memory. Since this operation destroys any data that you have collected, a verification box is diplayed and the initialize command is only issued if the **Yes** button is selected.

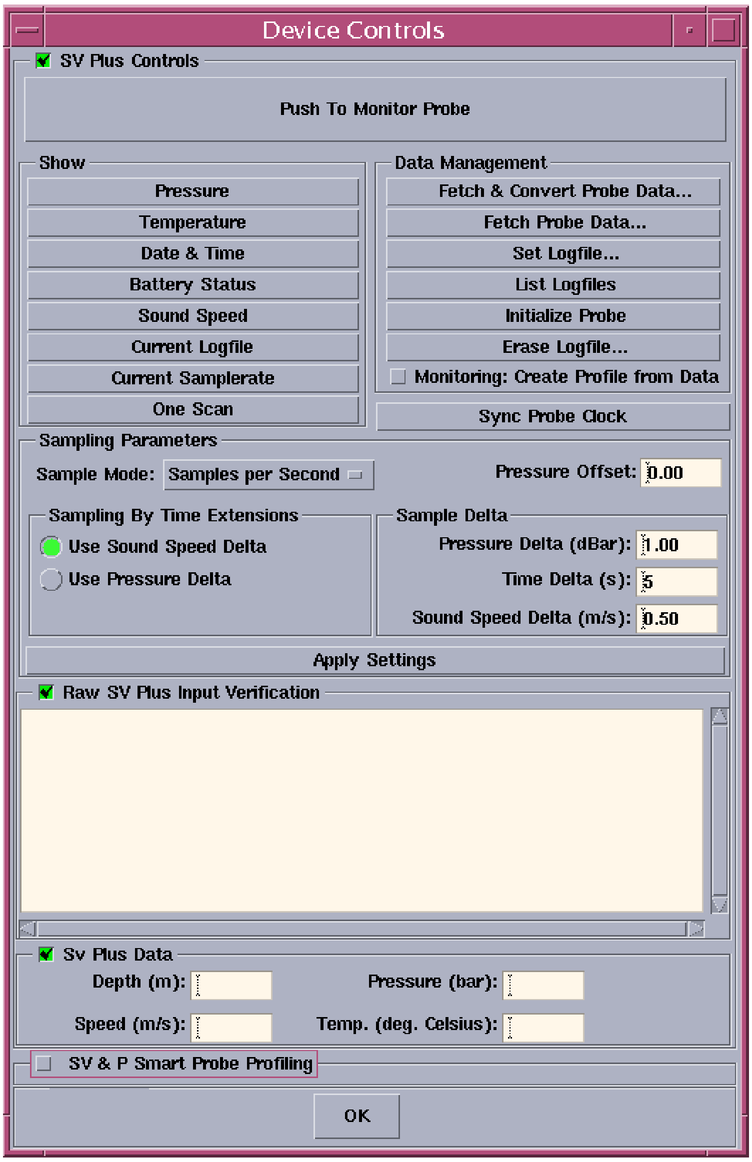


*Figure 60 - The **Device controls** dialogue box, SV Plus Probe Profiling.*

Erase Logfile

Lists all files local to the probe available for erasure. The files are echoed in the input verification area and in a popup selection window. Several files at a time may be selected in this window. When the **OK** button is activated, a verification box listing the selected files is presented. The erase command is only issued if the **Yes** -button is selected.

Monitoring: Create Profile from Data

This option is used to switch On / Off logging of realtime data. Realtime data is only available when the probe is deployed with a communication cable attached. In addition, monitoring of probe data must be activated. This is achieved by selecting the **Push To Monitor Probe** button at the top of the SV Plus section. Sampled data is converted to s sound speed profile when monitoring is switched off by reselecting the same button - now titled **Monitoring Probe - Push To Stop**.

Sync Probe Clock

In order to ensure correct timestamping of data, the probe clock should be synchronized with the operators workstation clock once for every recharge of the batteries. Use the **Sync Probe Clock** button to perform this operation. The synchronization command is echoed in the input verification window.

Sampling Parameters

The frame titled **Sampling Parameters** contains the available options which determines how the data acquisition is configured. All options, including the interval option input fields, updates the probe automatically. Please note, that the input fields need a ’Return’ from the keyboard to trigger the parameter download. Alternatively, you may select the **Apply Settings** to do the same. Only relevant options may be selected at any time during the probe configuration and setup.

The probe may basically perform logging of data in four different modes:

- Time based
- Sound speed based
- Pressure based.
- Time Based combined with either a sound speed or pressure trigger limit.

Time based

Use the Sample Mode option menu to select one of the following:

- Interval In Seconds and Samples per Second
- Interval In Minutes and Samples per Minute
- Interval In Hours and Samples per Hour

For all of the above, you have to supply a time argument in the **Time Delta** input field which controls how often a sampling and logging is performed. The sound speed and pressure increments are set to zero.

The Use **Sound Speed Delta** and the **Pressure Delta** options in the Sampling By Time Extensions frame should both be deselected.

Sound Speed based

Use the **Sample Mode** option menu to select the **By Sound Speed** option. This option configures the probe to sample continuously and to log a data scan only when the sound speed has changed with a value specified in the **Sound Speed Delta** input field.

Pressure based

Use the **Sample Mode** option menu to select the **By Pressure** option. This option configures the probe to sample continuously and to log a data scan only when the pressure has changed with a value specified in the **Pressure Delta** input field.

Time and sound speed / pressure based

Use the **Sample Mode** option menu to select one of the time based sample options. Supply the time argument in the **Time Delta** input field. Then select either the **Use Sound Speed Interval** or the **Use Pressure Interval** option in the **Sampling By Time Extensions** frame. Supply the relevant trigger limit in the **Sound Speed Delta** or the **Pressure Delta** input field.

Probe will start sampling according to the time sample mode, and will log data only when the change in sound speed or pressure is as specified.

Pressure Offset

As the surface pressure may vary, it is quite important to supply the probe with a pressure offset calibration value that will correct the probe's readings of the pressure (and thereby the speed). Use the input field titled **Pressure Offset** (in dBar) to supply the correct value, and press the enter button. Alternatively, select the **Apply Settings** button to download the current configuration to the probe.

Raw SV Plus Input Verification

As long as the probe is connected to the operator workstation with a communication cable, it is possible to monitor the probe sampling by selecting the **Push To Monitor Probe** button at the top of the window. The data is displayed in Real Mode. Please refer to manufacturer's documentation for information of the format.

SV Plus Data

The frame titled **SV Plus Data** displays data from the probe when it's connected to the workstation using a communication cable. The available data types are depths, sound speed, pressure and temperature. Decoded samples are displayed in the **SV Plus Data frame** at the bottom of the SV Plus section of the window.

6 PING DISPLAY

6.1 Purpose

The Ping Display presents a real-time view of the system performance. The display shows the raw data from the system after corrections have been applied for vessel attitude and sound speed. Note that the data are de-sampled, which means that data are not shown for every ping. You must define the actual update rate.

The following three default displays are shown initially

- Crosstrack display
- Beam Intensity display
- Waterfall display

In addition, the following optional displays may be shown:

- Scope display
- CCD Display (Colour Coded Depth)
- Time Based Displays
  - Backscatter data versus time
  - Across data versus time
  - Motion data and/or beam depth data versus time

The Crosstrack and CCD displays can present data in a per beam mode, or in across per beam mode.

6.2 Overview

Main menu

When you start the Survey Display, the main Ping Display window appears with all the individual information displays present. The following elements are shown

- Menu bar
- Graphic presentation of the three default information displays

The menu along the top side of the Ping Display window controls the display presentation. The Ping Display's main window has a menu bar with the following options

- File

→ *Refer to page 180.*

- Options

→ *Refer to page 180.*

- Displays

→ *Refer to page 187.*

- Help

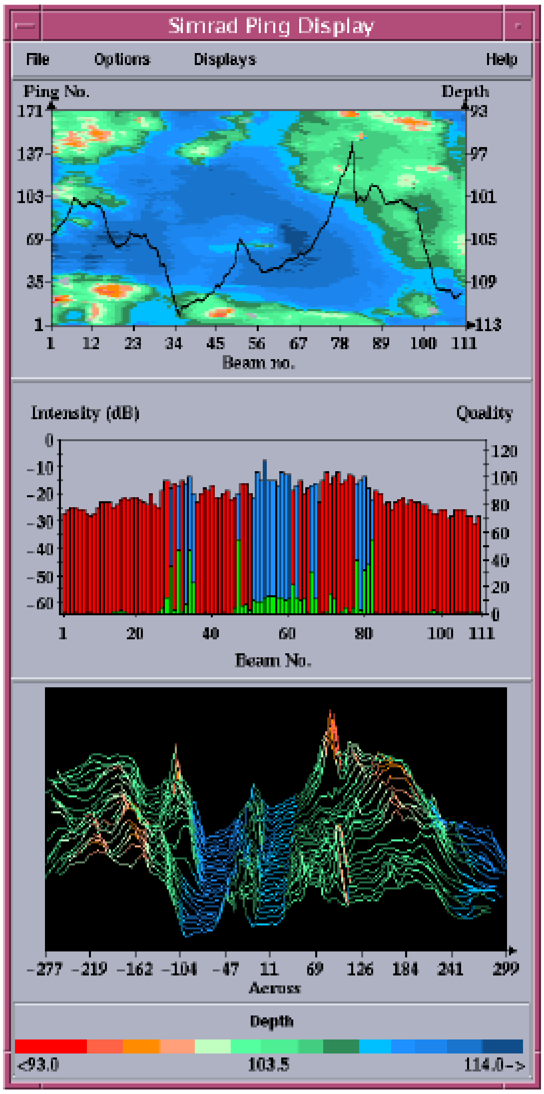


Figure 61 - The Ping Display main window

Crosstrack Display

This display shows the measured depths in all beams from the last ping. Different colours are used to show if a beam has a valid bottom detection, and if so what type of detection has been used:

- Red to show beams with phase detection
- Blue to show beams with amplitude detection
- Beams without any detection are not shown

Legends describing these colour codes may be shown along the bottom of the display.

The display contains a depth scale along the righthand (vertical) axis and beam numbers along the horizontal axis. These scales may also be turned on or off using a popup parameter menu. Turning legends and scales off will expand the display area containing the depth curve.

The automatic scaling may be adjusted using the **Depth delta** from the **Crosstrack & Depth displays** section in the Parameter Window.

→ *Please refer to page 170 for the Common display controls, and page 172 for the popup parameters available for this display.*

You may at any time switch Crosstrack presentation mode by using the rightmost mouse-button and select wanted mode from the display mode selection popup-menu. The display may also be switched off using the same menu.

Default mode for the Crosstrack display is depth per beam.

Beam Intensity

This display presents a bar for each individual beam. The beam numbers are shown along the horizontal axis.

The bar shows the backscattering strength of the bottom in dB. The values are corrected for system parameters, but not for any dependence upon angle of incidence. Normally the backscattering strength will be highest straight down, typically -15 dB, and lowest in the outer beams, typically -35 dB. These figures will vary dependent upon bottom material type and roughness (±15 dB or more).

This display also shows a data quality measure for each beam. This is the green bars shown along the bottom of the display. Small values (on a scale from 0 to 128) conveys good data quality.

The display contains scales along the left and right vertical axes, giving dB values (left side) for the intensity bars, and a quality measure (right side) for the data quality bars. The scales may be turned on or off using the parameter form available from the **Options -> Parameters** menu command.

The same colour codes as applied for the crosstrack display regarding bottom detection type are used, as are legends shown along the bottom of the display.

Turning legends and scales off will expand the display area containing the bars.

Parameters controlling these displays may be found in the **Parameter Window** or as menu items in a popup menu.

→ *Please refer to page 170 for the Common display controls, and page 172 for the popup parameters available for this display.*

Waterfall

The depth profiles from a number of pings as a function of acrosstrack horizontal distance are displayed with a small vertical offset between each profile. This gives a crude 3D representation of the most recently measured bottom area.

The colour coding applied to the profiles shows different depth levels, not bottom detection type as in the other displays. The deepest areas will be given a deep blue colour, shifting to lighter blue as the depth decreases. In ranges of middle depths, different shadings of green are used. The shallow areas are represented as different shadings of red.

A colour map (legends) showing the colours for each depth range may be shown along the bottom of the display.

The legends may also be toggled On/Off by selecting the **Legends parameter** menu option in a popup menu.

As the depth will usually change with position, the colour codes used initially may only be adequate for a limited time period. Therefore, an automatic adjustment of the depth ranges allocated to each colour code will take place.

Please note, that when both the Waterfall Display and the CCD Display are running at the same time, they will synchronise the colour coding. Since the CCD Display usually contains a bigger history buffer, the colour coding of this display will override the coding used by the Waterfall.

Parameters controlling these displays may be found in the **Parameter Window** or as menu items in a popup menu.

→ *Please refer to page 170 for the Common display controls, and page 172 for the popup parameters available for this display.*

Note: *Increasing the size of this display will result in decreased performance!*

Scope display

The display can be used to investigate the the receiver echo data, and is used mainly for test purposes.

Parameters controlling this display may be found in the Parameter Window or as menu items in a popup menu.

The data is shown as on an oscilloscope, with time on the horizontal X axis and level on the vertical Y axis.

A red colour is used to display the electrical phase difference between two so called half beams. This is also called interferrometric, or split beam phase signal.

The beam to investigate can be selected in the Scope section of the Parameter Window.

Beams close to the normal incidence will have a short echo and a noisy split beam phase signal. The outer beams will normally have a long echo and a well-defined phase curve.

The range for the bottom detection is indicated by a vertical dotted line. A dark blue line indicates an amplitude detection, and a red line indicates a phase detection. If the received echo is not accepted, no dotted line will be shown.

It is possible to switch on an information field that shows the beam number, the echo length and the phase variance (if phase detected beam).

→ *Use the controls located in the Scope section of the Parameter Window on page 171 to select which parts of the graph to display.*

→ *Please refer to page 170 for the Common display controls, and page 172 for the popup parameters available for this display.*

Stave data

On EM 120 and EM 300 it is possible to display amplitude data for a selected receiver channel (stave). This can be used to check that every receiver transducer element (stave) is working, and to check the level of the received echoes. The level shall normally be 10 to 20 dB below saturation (saturation level is at the top of window).

→ *Please refer to page 171 for the Scope display controls, and page 172 for the popup parameters available for this display.*

CDD Display - Colour Coded Depth Display

The CCD Display shows the colour coded depth per beam using a history buffer of varying size. The size of the history buffer depends on the size of the display. One vertical screen unit (pixel) is used per ping. Increasing the vertical size of the display area increases the number of vertical screen units, thus increasing the history buffer size.

Note: *Increasing the history buffer increases the processing time of this display function, resulting in reduced update rate!*

You may at any time switch CCD presentation mode by using the rightmost mouse-button and select wanted mode from the display mode selection popup-menu. The display may also be switched off using the same menu.

Default mode for the CCD Display is depth per beam.

Please note, that when both the Waterfall Display and the CCD Display are running at the same time, they will synchronise the colour coding. Since the CCD Display usually contains a bigger history buffer, the colour coding of this display will override the coding used by the Waterfall. This may produce situations where the Waterfall may seem overdue for refreshing the colour coding.

→ *Please refer to page 170 for the Common display controls, and page 172 for the popup parameters available for this display.*

Time Based Displays

The Time Based displays uses one or two vertical Y-axis' for display of data using a time-based X-axis.

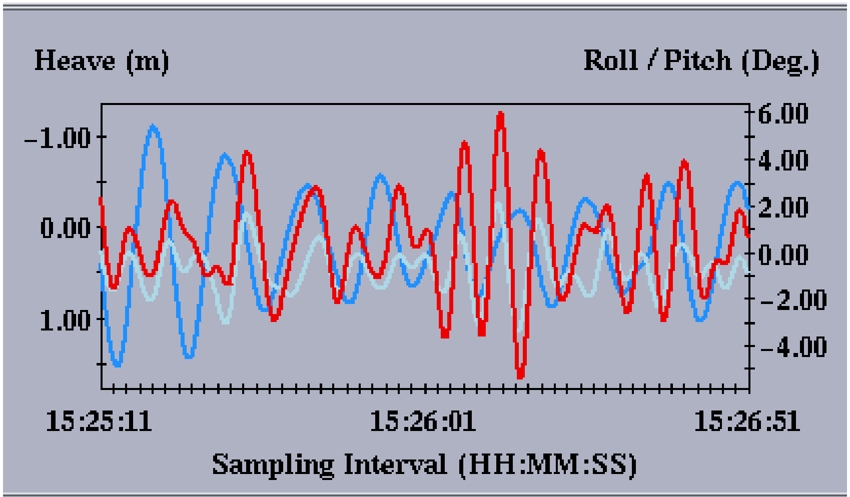


Figure 62 - The Time Based Display

The possible display types include:

Y2 Axis (Righthand Axis):

- Height, using data from Height Sensor
- Roll/Pitch, using data from Active Motion Sensor
- Roll/Pitch, using data from Inactive Motion Sensor
- Backscatter - Centerbeam

- Backscatter - 4 Beams, user-selectable
- Across - 4 Beams, user-selectable

Y1 Axis (Lefthand Axis):

- Heave, Active Motion Sensor
- Heave, Inactive Motion Sensor
- EM & EA Depth (in a multi sounder configuration)
- Depth Below Keel
- Depth - Centerbeam
- Depth - 4 Beams, user-selectable

The **Active Sensor** used for the Roll/Pitch/Heave display is given by the current setup of the installation parameters.

Depth Below Keel and **Depth From Centerbeam** are not the same. The first is computed using sensor data, and the latter is depth from a fixed beam.

The **Backscatter** option displays the same type of data as the Beam Intensity display on a per ping basis.

Note: *Any combination of the types of data associated with the two Y axis is possible!*

Parameters controlling these displays may be found in the **Parameter Window** or as menu items in a popup menu.

→ *Please refer to page 170 for the Common display controls, and page 172 for the popup parameters available for this display.*

The filtered amplitude is displayed with a dark blue color. The light blue color is used to show bottom candidates.

6.3 Operational procedures

Windows

- Crosstrack display
- Beam Intensity display
- Waterfall display

In addition, the following optional display may be shown:

- Scope display
- CCD Display (Colour Coded Depth Display)
- Time Based Displays
  - Backscatter data versus time
  - Across data versus time
  - Motion data and/or beam depth data versus time

A menu along the top side of the window is used to control the display presentation.

Start and exit

To start the Ping Display

When the Ping Display is used with a mulitbeam echo sounder, it automatically starts displaying data when the EM 1002 is activated. The program is then designed to be active throughout the operation of the EM 1002 operation. The procedures supplied here are only submitted in case the Ping Display is stopped by accident.

To start the Ping Display from the EM 1002 Launchpad

Press the Ping Display icon.

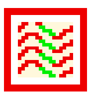


*Figure 63 - The **Ping Display** icon*

To exit the Ping Display

Follow these steps to exit the Ping Display:

1 Select **File** on the Ping Display's main menu bar.

2 Select **Exit** on the drop-down menu.

Common display controls

To change the display parameters

Several parameter settings are available to control the display of information in the displays. Some of the parameters are available in a Parameter Window, some in a display-dependent popup menu.

1 Select **Options** on the main menu bar.

2 Select **Parameters** on the drop-down menu.

To change display update rate

1 Select **Options** on the main menu bar.

2 Select **Parameters** on the drop-down menu.

3 Change **Sampling Rate** to change how often the Beam Display fetches a new datagram for update

or:

4 Change the **General Update Frequency** to set the frequency at which the displays are updated.

To change window orientation

You can decide if the three displays shall be presented in "landscape" or "portrait" format.

1 Select **Options** on the main menu bar.

2 Select **Parameters** on the drop-down menu.

3 Set **Window orientation** to Vertical or Horizontal.

To change the text fonts

1 Select **Options** on the main menu bar.

2 Select **Parameters** on the drop-down menu.

3 Set **Fonts in Graphs** to desired size.

If the system is configured with a single beam sounder like the EA500, it is possible to display depth data from this sounder along with depth data from the EM echo sounder installed. This display option is controlled using the EM & EA Depth menu item in the display-dependent popup menu.

The program selects the EM beam falling inside the EA footprint, and displays both beams.

Special display controls

Special Single Beam controls

<u>To modify the beam width</u>

1 Select **Options** on the main menu bar.

2 Select **Parameters** on the drop-down menu.

In the Single Beam section enter the EA500 beam width used for the EA sounder.

Special Crosstrack & Depth control

<u>To modify the depth scale</u>

All the displays using depth data in one form or another uses auto scaling. But occasionally it is convenient to control the amount of scaling. As an example, bottom conditions may yield spiky dept data, giving a jagged depth display. Using this parameter enables smoothing of the displayed data.

1 Select Options on the main menu bar.

2 Select Parameters on the drop-down menu.

3 In the Crosstrack & Depth Displays section, move the **Depth delta glider** to modify the value.

The specified value is added to the scaling computations based on the minimum - maximum depth values. A greater depth delta value has the effect of smoothing the displayed data, and vice versa.

The default depth delta value is dependent on the type of echo sounder.

→ *The Waterfall Display by default is unaffected by this parameter. It may be switched on using the display-dependent popup parameter menu. Please refer to 174 for details.*

Note: *Scaling may be switched off altogether, using the same display-dependent popup parameter menu.*

→ *Please refer to 173 for details.*

Special Height and Heave controls

<u>To modify the Height & Heave scale</u>

The scaling in these two displays may be modified in the same way as the depth displays. The procedure is exactly the same, except that the slider is located in the Height and Heave section.

Special Scope controls

The Scope display has a set of parameters in a special section of the **Parameter Window**.

1 Select Options on the main menu bar.

2 Select Parameters on the drop-down menu.

<u>To modify type of data displayed</u>

The section contais one button for each type of data

- Amplitude
- Phase
- Filtered Amplitude
- Stave
- Detection Information

When the data type is activated, the indicator to the left on the button turns green. When selected once more, the green indicator disappears.

<u>To select stave to display</u>

Use the slider to select the **Stave selection** to select the stave to display.

<u>To select beam to display</u>

Use the slider labelled **Beam selection** to select the beam to display.

Special Beam Selection controls

The Backscatter, Across and Depth displays may display data from 4 beams at the same time. The beam selection is performed in a special section of the **Parameter Window**.

1 Select Options on the main menu bar.

2 Select Parameters on the drop-down menu.

<u>To modify beams to be displayed</u>

1 Select Options on the main menu bar.

2 Select Parameters on the drop-down menu.

3 In the Beam Selection section move the Beam To Display sliders to set the wanted selection of 4 beams.

The displays are updated immediately using the new set of beams.

Popup Parameter Selection

To modify parameters affecting displayed data

All displays may modify several display parameters affecting how the current type of data is being presented. In addition to the parameters in the Parameter Window, several parameters are available in a popup menu.

1 Point the mouse cursor in the window that you want to change displayed type of data.

2 Press SHIFT + Mouse Button 3 in the selected window and a popup menu appears.

3 Active parameters in that window have a green indicator to the left.

4 Parameters not applicable to the currently displayed type(s) of data are grayed out.

5 Keep the button depressed, and move the cursor onto the selected parameter.

6 When the mouse button is released, the current state of the menu item is toggled. Active items are switched off, and inactive items are switched on.

Any change of parameters is reflected immediately in the affected display.

The popup menu contains the following items:

Common Parameters

Graph Parameters

Auto Scaling

- Off: Locks the display to the current scaling factor
- On: Enables automatic scaling and positioning of data

Axis Labels

- Off: Data displayed without showing the axis. Increases data area size.
- On: Shows the relevant axis numbering and labelling

Legends

- Off: Removes legends. Increases data area size.
- On: Shows explanation of graph content.

Active

- Off: Stops updating display. Yellow Inactive label placed across the graph area.
- On: Updates display with latest data. Removes any visible Inactive labels.

Grid

- Off: No gridlines are displayed.

- On: Horizontal gridlines are displayed. Waterfall Display does not have any grid lines.

Time Based Graphs

Sync. Time Axis

- Off: All data from all buffers are displayed disregarding any difference in buffer start- and end-time.
- On: Shows only data falling within common time interval.

CCD - Waterfall

Line Width = 1

- On: Uses only one screen unit (pixel) per line drawn. This is the optimum option in terms of performance. When selected, Line Width=2 button is switched off.

Line Width = 2

- On: Uses two screen units (pixels) per line drawn. May give a nicer, more readable display, especially if CCD is active in a tear-off window. When selected, Line Width=1 button is switched off.

Waterfall

Black Background

- Off: Draws data on a black background. When selected, the White Background button is switched off.

White Background

- Off: Draws data on a white background. When selected, the Black Background button is switched off.

Centreline

- On: Draws a white, vertical line through the centre of the displayed across profiles.
- Off: No vertical centreline is drawn.

Remove Hidden Lines

- Off: All ping sections are drawn.
- On: If a ping section crosses behind an already drawn ping, the section is not drawn. Has the effect of making a cleaner data presentation.

Use Depth Delta Smoothing

- Off: The data is scaled (if scaling is activated) independent of the Depth Delta parameter found in the Parameter Window.

- On: The data is scaled (if scaling is activated) using the Depth Delta parameter found in the Parameter Window. Has the effect of smoothing spiky data.

Display Selection

To modify displayed data type

All displays except the Waterfall diplays may change the type of data being presented.

1 Point the mouse cursor in the window that you want to change displayed type of data.

2 Press Mouse Button 1 in the selected window and a popup menu appears. Data being displayed in that window have a green indicator to the left.

3 Keep the button depressed, and move the cursor onto the selected data type.

4 When the mouse button is released, the current state of the menu item is toggled. Active items are switched off, and inactive items are switched on.

The popup menu contains the following items:

X-Axis, Meters

Crosstrack

- Off: No acrosstrack depth profile is displayed.
- On: Displays acrosstrack depth profile, using the rightmost Y axis. The graph uses the across distance on the X axis.

CCD

- Off: No CCD data is displayed.
- On: CCD data is displayed, using the leftmost Y axis. In the main window, one horizontal line is drawn per ping. The line uses one pixel line width. The graph uses the across distance on the X axis.

X-Axis, Beams

Crostrack

As above, except that data is displayed on a per beam basis.

CCD

As above, except that data is displayed on a per beam basis.

Y2-Axis (X=Time)

Height

- Off: No height sensor data is displayed

- On: Height data is displayed, using the rightmost Y axis. The data buffer contains 100 samples.

Roll / Pitch, Active Sensor

- Off: No roll / pitch sensor data is displayed
- On: Roll / pitch data from the active sensor is displayed, using the rightmost Y axis. The data buffer contains 100 samples.

Roll / Pitch, Inactive Sensor

- Off: No roll / pitch sensor data is displayed
- On: Roll / pitch data from the inactive sensor is displayed, using the rightmost Y axis. The data buffer contains 100 samples.

Backscatter - Centerbeam

- Off: No backscatter data is displayed.
- On: Backscatter data from the centerbeam is displayed, using the rightmost Y axis. The data buffer contains 100 samples.

Backscatter - 4 Beams

- Off: No backscatter data is displayed
- On: Backscatter data for the currently selected beams are displayed using the rightmost Y axis. The data buffer contains 100 samples.

Across - 4 Beams

- Off: No across track data is displayed
- On: Across-track data for the currently selected beams are displayed using the rightmost Y axis. The data buffer contains 100 samples.

Y1-Axis (X=Time)

All following options display data as a function of time (X axis).

Heave, Active Sensor

- Off: No heave sensor data is displayed
- On: Heave data from the active sensor is displayed, using the leftmost Y axis. The data buffer contains 100 samples.

Heave, Inactive Sensor

- Off: No heave sensor data is displayed
- On: Heave data from the active sensor is displayed, using the leftmost Y axis. The data buffer contains 100 samples.

EM & EA Depth

- Off: No EM & EA data displayed

- On: EM & EA Depth data is displayed. The EM beam within the footprint of the EA beam is displayed. The data buffer contains 100 samples.

Depth Below Keel

- Off: No depth data displayed
- On: The computed depth-below-keel data displayed. The data buffer contains 100 samples.

Depth - Centerbeam

- Off: No depth data displayed
- On: The centerbeam depth data is displayed. The data buffer contains 100 samples.

Depth - 4 Beams

- Off: No depth data is displayed
- On: Depth data for the currently selected beams are displayed using the leftmost Y axis. The data buffer contains 100 samples.

Other Graphs

Beam Intensity

- Off: No beam intensity data is displayed
- On: Beam intensity data for the last ping is displayed using both axis. The quality factor uses the rightmost Y axis, the backscatter strength (beam intensity) uses the leftmost Y axis.

Scope

- Off: No scope data is displayed
- On: Scope data for the currently selected beam from the last ping is displayed using both axis. Amplitude and filtered amplitude uses the rightmost Y axis, phase detection data uses the leftmost Y axis.

Display controls

To select playback or real time mode

You can select real time or playback operational modes. To use real time, logging must be active.

1 Select **Options** on the main menu bar.

2 Select **Display Control** on the drop-down menu.

3 Select desired mode with the Display Mode control button. If you select Playback, the File Selection dialogue box appears automatically. The files are either Survey Format files or Raw Data files, depending on the current file type. The file type is selected in the top rightmost corner in the Display Control window.

→ *Refer to page 184 for an in-depth description of Display Controls.*

→ *Refer to page 41 for a description of the* ***File Selection*** *dialogue box.*

To retrieve a depth file for playback

1 Select **Options** on the main menu bar.

2 Select **Display Control** on the drop-down menu.

3 Select Survey Format in the top righthand corner in the Control Window.

4 Select **Line menu**.

- The **File Selection** dialogue box appears. Select a file, and press **OK** to retrieve it.

→ *Refer to page 41 for a description of the* ***File Selection*** *dialogue box.*

To retrieve a raw data file for playback

1 Select **Options** on the main menu bar.

2 Select **Display Control** on the drop-down menu.

3 Select Survey Format in the top righthand corner in the Control Window.

4 Select Raw Data in the top righthand corner in the Control Window.

To control the playback

1 Select **Options** on the main menu bar.

2 Select **Display Control** on the drop-down menu.

3 Use the **Replay control** buttons to “play”, “rewind” or “fast forward” the depth file.

→ *Refer to page 186 the description of the Replay control buttons.*

6.4 Command references

Introduction

This chapter describes the various commands and dialogue boxes used throughout the Ping Display application.

The following options are available on the main menu:

- File
- Options
- Display
- Help

Each of these options have a menu with further commands.

In addition, you access the **Graph Mode Selection** popup menu when you click the right mouse button when the mouse pointer is placed within one of the top two graphs. This popup menu presents you with the following choices:

- **X-axis, Meters**
- Crosstrack
- CCD
- **X-axis, Beam No.**
- Crosstrack
- CCD
- **Y2-Axis (x=Time)**
- Height
- Roll/Pitch Active Sensor
- Roll/Pitch Inactive Sensor
- Backscatter - Centerbeam
- Backscatter - 4-Beams
- Across - 4-Beams
- **Y1-Axis**
- Heave, Active Sensor
- Heave, Inactive Sensor
- EM & EA Depth
- Depth Below Keel
- Depth - Centerbeam
- Depth - 4 - Beams

- **Other Graphs**
- Beam intensity
- Scope

File

This selection brings up a menu which only contains one alternative: **Exit.** This command closes the Ping Display. No warning is given before the Ping Display closes.

Options

Overview

This selection brings up the following choices:

- Parameters
- Display Control

Parameters - When you select this option the Ping Display opens the **Parameters** dialogue box. The options in this box are used to define the parameters and options for the display presentations.

Display Control - This command opens a dialogue box where you can select the source for the data to be displayed. Two alternatives are available:

- **Real time** for normal operation
- **Playback** for verification

Note: *Sensor data is not available in Playback mode!*

During playback, a file with recorded data is used in a simulation run. Several extra controls for replay operation are then available.

→ *The **Display Control** dialogue box is described on page 184.*

Parameters

Overview

The **Parameters** dialogue box for the Ping Display is activated through the **Options -> Parameters** command. The dialogue box has seven separate sections:

- Single Beam
- Common
- Crosstrack & Depth Displays
- Heave
- Height

- Scope
- Beam Selection

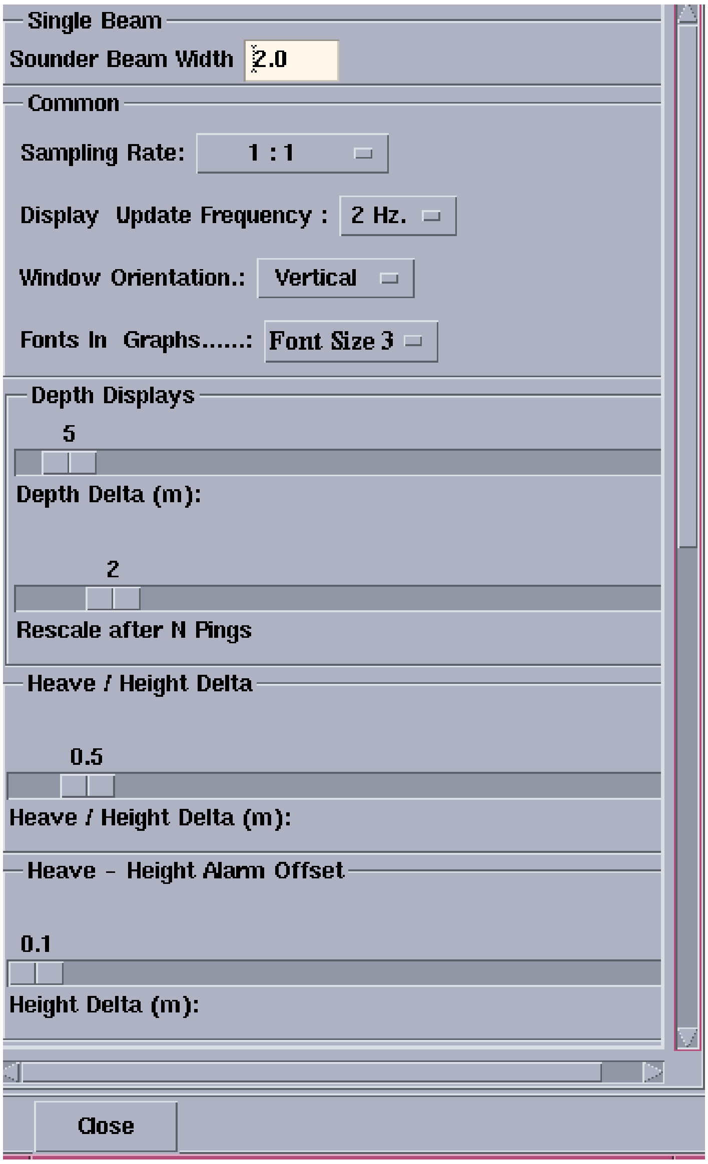


Figure 64 - The Parameter dialogue box, part 1

Single Beam

Used when running a singlebeam- multibeam configuration, to input key information on EA setup. The Single Beam Field includes the **Sounder Beam Width** parameter.

The **Sounder Beam Width** parameter value depends on the type of transducer used for the EA500. It varies with the frequency, and is a fixed value that may be found in the product specification of the installed EA500 echo sounder.

Common

In this field, you can select options associated with the whole Ping Display.

Sampling rate - Use this control to define how often the Ping Display fetches a datagram to update the displays.

Display Update Frequency - Use this control to set the frequency at which the displays are updated on the screen.

Window Orientation - This selector controls the overall organization of the Ping Display.

- Vertical: The three charts will be stacked on top of each other.
- Horizontal: The three charts will be placed side by side horizontally.

Fonts in Graphs - Use this control to define the character size used in the displays.

Depth Displays

This is used to change the automatic scaling when spiky data gives a noisy display. The **Depth Displays** field contains the **Depth Delta Parameter** as a slider. To change the **Depth Delta** slider, drag it to the wanted value and release. The new value will be used immediately for all subsequent pings. The **Depth Displays** field also contains **Rescale after N Pings** as a slider. This slider lets you rescale after a certain number of pings.

Heave / Height Delta

This is used to change the automatic scaling when spiky data gives a noisy display. The **Heave / Height Delta** field contains the **Heave / Height Delta Parameter** as a slider. To change the **Heave / Height Delta** slider, drag it to the wanted value and release. The new value will be used immediately for all sensor buffer contents.

Heave - Height Alarm Offset

In this field you can set the value **Height Delta (m)** with the slider. The **Height Delta** is the difference in meters between heave and height. You will then be notified when the difference between heave and height is greater than your chosen value.

Scope

This field allows you to control the presentation of the **Scope Display**. The following options are available:

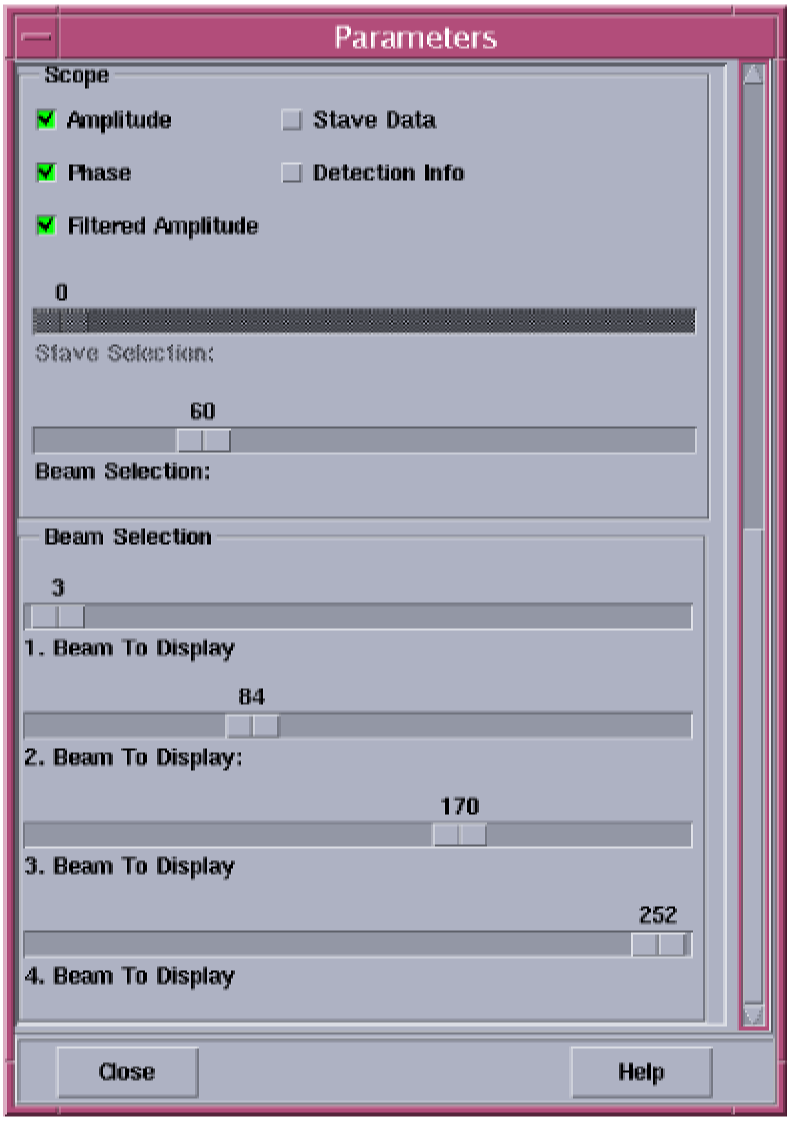


Figure 65 - The Parameter dialogue box -part 2

Amplitude - This button is used to select whether the amplitude curve should be displayed or not.

Phase - This button is used to select whether the phase curve should be displayed or not.

Filtered Amplitude - This button is used to select whether the filtered (sliding mean) amplitude curve should be displayed or not.

When **Off**, the filtered amplitude is again available, and the stave selection slider is made unavailable (insenstive).

Detection Info - This button is used to turn the detection information on or off.

Stave Selection - This slider is used to select which stave is to be displayed.

Beam Selection - This button is used to select which beam is to be displayed.

Beam Selection

This dialogue box allows you to control which beams to display in the displays enabled for this feature.

There are 4 sliders available. All sliders have the same functionality.

x Beam to display - This slider is used to set the beam number of beam x to display. x varies from 1 to 4.

Display Control

Overview

This dialogue box allows you to select the source of the data to be presented by the Ping Display. These data may either come directly from the EM 1002 echo sounder, or they may be read from a disk file containing previously collected data. In the latter case, the **Display Control** dialogue box gives you several options on how to replay the stored data.

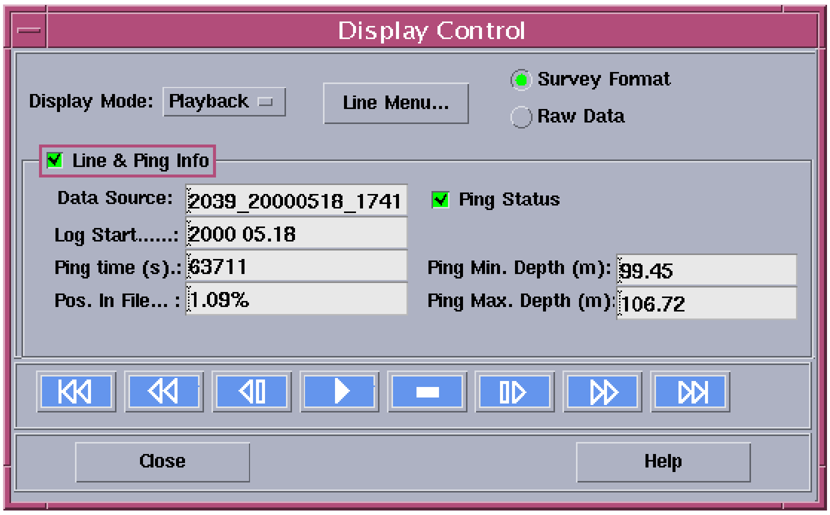


Figure 66 - The Display Control dialogue box

Display Mode

This button is used to select between real-time data presentation or playback of stored data.

Real time - Logging must be active if you select this alternative. The other options in the Display Mode dialogue box can not be applied as they are only relevant for playback mode.

Playback - If you choose this alternative, you must select a file for playback. The **File Selection** dialogue box appears automatically. Other controls in the **Display Mode** dialogue box are available to control the playback process. These are similar to the controls found on audio or video cassette recorders, and they allow you to position the playback operation to anywhere on the file. The files selected in the **File Selection** dialogue box are of the currently selected file type.

Line Menu

This button activates the **Depth File Selection** dialogue box which automatically appears when the **Playback** option is selected. This button allows you to switch to a new playback file while another file is already active.

File type

To select the type of file to be used in the playback process.

Survey format - The playback file must be in the Simrad Survey format.

Raw Data - The playback file must be a raw data file.

Line & Ping Info

This status field contains various information, some of which are only relevant for playback data. The field is initially presented in collapsed mode, which may be changed to expanded mode by clicking on the field label or the adjacent box. When expanded the following options appear:

Data source - This is the name of the playback file.

Log Start - Time when logging was started.

Ping time - Time in seconds since the start of a line.

Pos in file - Position in the file given as a percentage.

Ping status - Green when ping is valid, red when invalid.

Ping Min Depth - The minimum value in the current crosstrack depth curve.

Ping Max Depth - The maximum value in the current crosstrack depth curve.

Replay Control

These buttons acts like the similar physical buttons found on audio or video cassette recorders. They are used for starting and stopping the playback of the file, and for changing the playback position of the file.

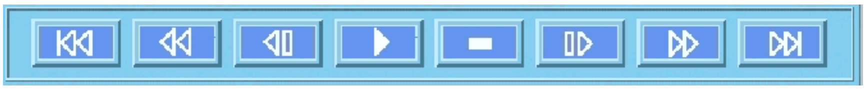


Figure 67 - Replay control buttons

The following buttons are available (from left on the illustration):

- Rewind
- Backwards one hundred pings
- Backwards one ping
- Start
- Stop
- Forwards one ping
- Forwards one hundred pings
- Move to end of file

Depth file selection

The **File Selection** dialogue box, described in the *Operational procedures* chapter, is used to select a playback file.

→ *Refer to page 41 for a description of the* ***File Selection*** *dialoge box.*

Note: *The filtered amplitude is displayed with a dark blue color. The light blue color is used to show bottom candidates.*

Displays

This menu item brings up the following pull-down menu:

- Tear-off Waterfall
- Tear-off Crosstrack
- Tear-off Beam Intensity

These menu commands all act in a similar way. A copy of one of the displays is put into a new window. This window obeys all the usual window controls, and may be resized, moved, etc.

Help

This option on the main menu will provide on-line help.

7 SURVEY DISPLAY

7.1 Introduction

Purpose

The purpose of this chapter is to provide detailed information about the commands and parameter settings in the Survey Display main window. Some commands and parameters are used in other display modules, and have the same meaning as they have here, they are only described here.

The purpose of the Survey Display application is to provide real time quality control of position and depth data. These are merged and presented on a geographical display. This information is a valuable tool for inspection and quality control of the data acquisition. The Survey Display windows thus provide both depth and position control.

Note: *Use of the Survey Display requires that you have enabled logging of Survey data to disk.*

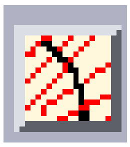


Figure 68 - The Survey Display icon

Main window and menu bar

Overview

→ *The main window in the Survey Display application is shown on page 189.*

The purpose of this window is two-fold:

1 The window itself constitutes a geographical utility for survey planning, survey overview and real time display of logged beam data in the nearest vicinity behind the vessel.

2 The window is also used to start the other graphical tools and displays hosted by the Survey Display.

Basic window elements

Geographical area - This is the main display area where the survey information is displayed.

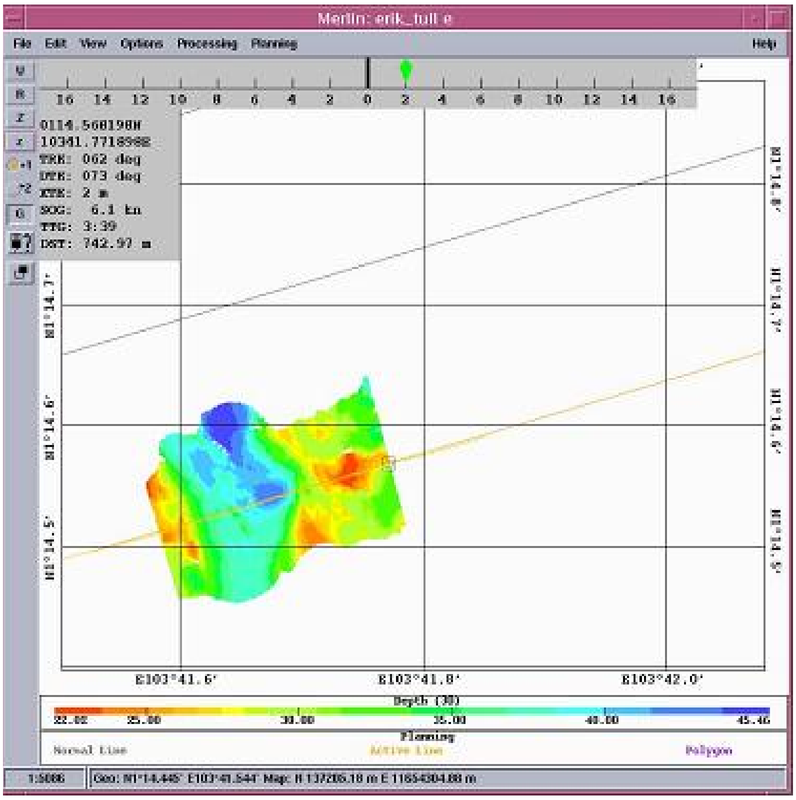


Figure 69 - The survey display main window

Menu bar - This the top line containing the the **Main menu commands** listed below.

Information bar - This is the area below the geographical area, where scaling factor and other information is displayed.

Tool bar - Buttons for easy access to common view functions.

→ *The tool bar is described on page 48.*

Main menu commands

The commands are described on the following pages:

→ ***File** - refer to page 190.*

→ ***Edit** - refer to page 193.*

→ ***View** - refer to page 199*

→ ***Options** - refer to page 215*

→ ***Processing** - refer to page 216*

→ ***Planning** - refer to page 285*

7.2 File

Overview

The **File** menu contains general commands for printing and closing the Survey Display utility. When the **File** menu item is activated a pull-down menu with the following alternatives appears:

- Plot
- Import DAF contours
- Exit

Plot

This choice allows you to print out the current information in the graphic window. This command is equivalent to the command **Print**.

→ *This is a common function, and it is described with the operational procedures. Refer to Print on page 43.*

Import DAF contours

This menu command activates a dialogue box to import depth contours from a .daf-file.

→ *Refer to the dialogue box description on page 191.*

Exit

When this menu command is selected, the Survey Display will terminate.

This includes all the utilities launched from the main geographical window. A warning will be issued if any unsaved changes have been made.

Import DAF contours

Choose this option to import depth contour lines from a .daf-format file containing depth curves and display them in the Grid Display. If there already are .daf-format depth contour objects in the application, the old ones will de deleted before new objects are inserted. A popup warning will be given before the old objects are deleted.

Choose **Import contours** from the **File** menu and the **Select DAF file to read** dialogue box opens.

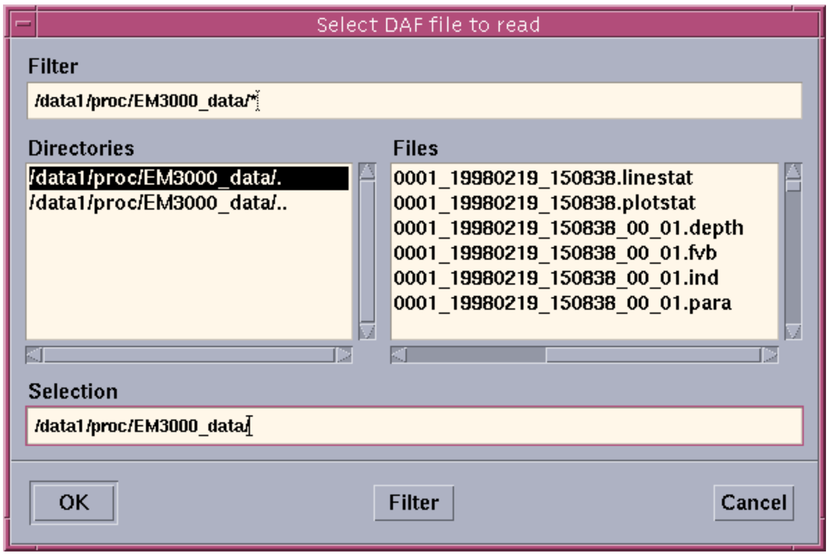


*Figure 70 - **Select DAF file to read** dialogue box*

1 In the **Filter** field, enter the pathname of the desired directory and file(s) to choose from, and hit return on your keyboard or click the Filter button. The contents of the directory specified in the Filter field will now be displayed in the list of **Files**.

- If the pathname entered in the **Filter** field ends with **/*** , all files in the directory will be displayed under **Files**.
- You can filter the list of **Files** by specifying filetype extensions in the Filter field. If the pathname ends with *.daf , only .daf-files in the given directory will be displayed for selection under **Files**.

2 Use the Directory navigation bar to the left to select the desired directory to choose from.

3 Choose the .daf-file to import by selecting it from the list of **Files** or by typing the filename into the **Selection** field.

4 Click the **OK** button to import the selected file. A list of all depth curves in the selected file will then appear.

5 You may select only one or all of the depth curves. The selected depth will then be displayed on top of all other data in the Graphic Display. If you select only one depth contour from the DAF-file, that depth contour will be automatically be given top priority, and only that depth contour will be available in the list.

Note: *The depth contours graphic objects are limited by the amount of **Maximum MB RAM** defined in the **Show/Hide** menu. If the user-defined limit is reached a warning is displayed.*

→ *See Show/Hide menu described on page 202.*

You can control the appearance (colour) of the imported contour files by setting the desired colour for **Imported depth contours** in the **Colour Mapping** dialogue box.

→ *See Colour Mapping described on page 204.*

7.3 Edit

Overview

The drop-down menu activated by this menu item contains operations for measuring distances and positions, selecting lines, and defining the display regions for the **Grid display** utility.

The right mouse button is used as an edit button when the pointer is inside the geographical area of the window. Select a menu command with the left mouse button, and then use the right mouse button inside the geographical area to execute the command.

The following command options are available:

- Reset Selection
- Keep Function
- Position
- Distance
- New Display Area
- Resize Display Area

These command options are explained on the following pages.

7.4 Reset selection

Reset selection

This command deselects all previous selections made.

Keep function

This option is just a function, and not a dialogue box. It is accessed from the **Edit** menu in the Survey Control window. The function allows the same operation to be performed over and over again, until an other command is selected on the menu.

Example: Press **Keep function** and then **Distance**. You can then try out different cursor positions until you press another function.

The “repeated” function is kept until the next function is selected. To switch off the **Keep function** mode, just press it again. It works as a toggle button (on/off).

Position

The **Position** function displays the geographical position of the points. It is available from the **Edit** menu in the Survey Control window.

To execute, select this command and press the right mouse button in the geographical area. A position is then written in the information text field at the bottom of the window. If the right mouse button is kept down and dragged around, the current positions are continuously updated in the information text field.

The following type of text appears (example):

Geo: N59° 21.550’ E10° 29.575’ Map:N1342,46 m E716,13 m

The format is defined by your setting in the **Lat/Long format** dialogue box. Unless **Keep function** is selected first, the **Position** mode ends as the mouse button is released.

→ *Keep Function is described on page 195.*

→ *The Lat/Long Format dialogue box is described on page 209.*

Distance

This function enables you to measure distances in the geographical window. It is accessed from the **Edit** menu in the **Survey Control** window.

To execute;

1 Press the right mouse button down.

2 Drag the cursor to another position while you hold the mouse button depressed.

The distance between the two positions is shown in the text information field at the bottom of the window. A guideline is visible as long as the mouse button is depressed. This line indicates the distance that is being measured.

The following type of text appears (example):

```
Delta S 661 m E 457 m Dist: 803 m Angle: 145
```

The resolution of the distance is 1 meter and the resolution of angles is 1 degree.

Unless **Keep function** is selected first, the **Distance** mode ends as the mouse button is released.

→ *Keep Function is described on page 195.*

New Display Area

This command is used to define a new geographical area to be used by the **Grid Display** utility.

Create an rectangular area with the right mouse button.

Note: *The display area must have been made visible by the settings in the Show/Hide window.*

Note: *The area must be selected (by clicking on it with the left mouse button) before the **Grid Display** utility can be started.*

Resize Display Area

If the area generated by **New Display Area** does not have the required size, this menu command can be used to resize it.

Use the right mouse button to drag one of the corners to a new position.

Note: *This operation has to be applied before the **Grid Display** utility using the area is started. Changing the area after the Grid Display has been started will not affect that process, but only new ones started after the resize operation.*

7.5 View

Overview

The pull-down menu activated by this menu item has menu commands for controlling how the information in the geographical area is presented.

The following menu commands are available:

- Annotation colours
- Show/Hide
- Colour mapping
- Lat/Long format
- Data choice
- Update View Area
- Redraw
- Vessel in centre
- Update Interval

The commands and dialogue boxes are explained on the following pages:

→ ***Annotation colours** - refer to page 200*

→ ***Show/Hide** - refer to page 202*

→ ***Colour mapping** - refer to page 204*

→ ***Lat/long format** - refer to page 209*

→ ***Data choice** - refer to page 210*

→ ***Update view area** - refer to page 212*

→ ***Redraw** - refer to page 212*

→ ***Vessel in centre** - refer to page 213.*

→ ***Update interval** - refer to page 214*

Annotation Colours

The background colour and the colours for the different attributes and objects displayed in a geographical window can be changed to suit your preferences. The **Annotation Colours** dialogue box is then used.

In this dialogue box, the colour for each attribute type can be chosen from a set of 18 different colours. A list of items (attributes and objects), which will vary according to which application the dialogue box belongs, is included.

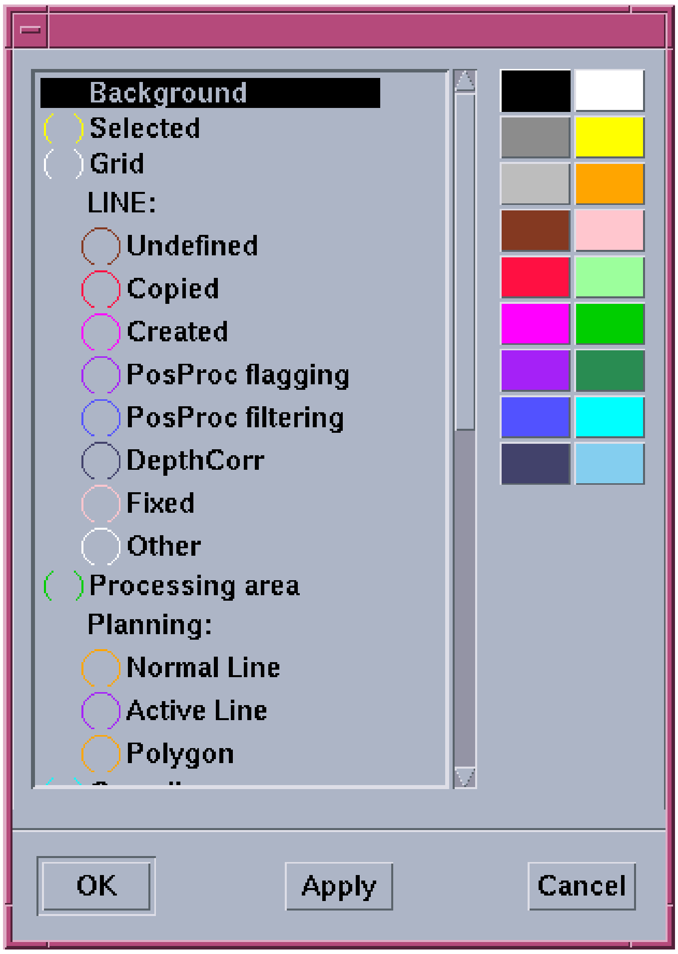


Figure 71 - The Annotation Colour dialogue box (example)

The 18 colours selectable are constant and identical for all the modules.

All modules have a common set of items: **Background**, **Selected** and **Grid**, in addition to the specific items for each module. Current settings for each module are saved as a part of the parameter settings for each survey.

To select a new colour for an item;

1 Click on the item

2 Click on the appropriate colour

Press the **OK** button to implement and save the new colour settings. The dialogue box is automatically closed.

The **Apply** button allows you to implement the new colour settings on a trial basis. The new colours can be seen in the geographical window immediately, but are not saved. The dialogue box remains open.

Finally, press **Cancel** if you wish to cancel any changes to the colours that have been done while the dialogue box was open. Even if the **Apply** button has been used, the colours will be reset to the setting that existed before the dialogue box was opened. The dialogue box is closed.

Show/Hide

The **Show/Hide** dialogue box contains a list of items that may exist in the client area of the geographical window. These items can either be displayed or hidden. A check button for each item indicates the current display status for the item.

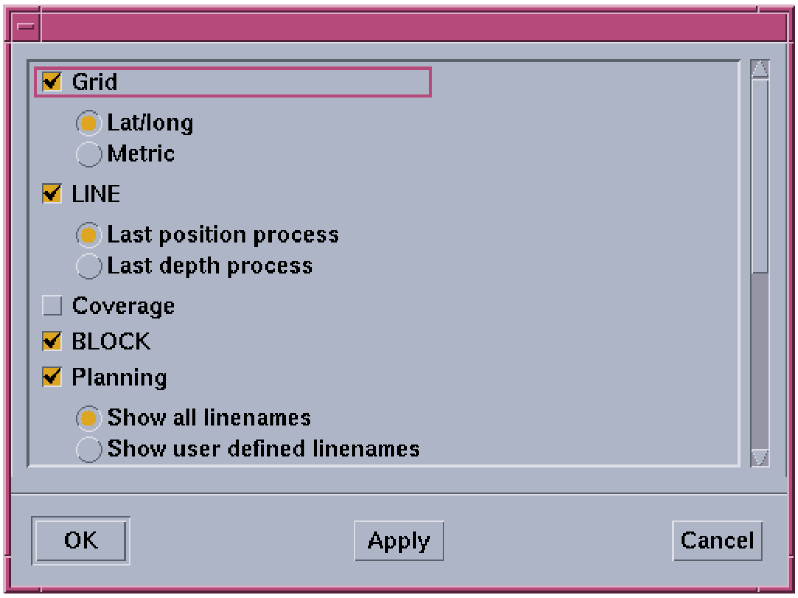


Figure 72 - One example of a Show/Hide dialogue box

Some items have two or more sub-items. Among these sub-items only one can be selected. The buttons show the status for the sub-items.

The current setting for each module is saved as a part of the parameter settings for each survey.

Common items

Some items are found in all **Show/Hide** dialogue boxes. These are:

- Grid lines
- Coast lines
- Legends

Grid

Grid lines showing the geographical locations may be toggled on or off by this button. The grid net can be set to metric scale. This is useful for estimation of distances.

The projection method may be changed.

For more detailed information about projections, please see the *Survey format conversion tools* in the *System Administration* chapter in the *maintenance manual.*

Coast

The coast lines are toggled on or off by this button.

Legend

The colour legend of the different objects in the display is toggled on/off by this button.

Other items

The **Show/Hide** dialogue box may present several other options depending on the actual display being used.

Acceptance

Press **OK** to implement and save the new settings for later use. The dialogue box is closed.

Press **Apply** to implement the new settings on a trial basis. The consequences can be seen in the geographical window immediately, but the new settings are not saved. The dialogue box remains open.

Press **Cancel** to cancel any changes that have been done while the dialogue box was open. Even if the **Apply** button has been used, the settings will be changed to that which existed before the dialogue box was opened. The dialogue box is closed.

Colour mapping

Modules where the survey data is displayed as a continuous data set, require a definition of the colours to be used. The **Colour Mapping** dialogue box uses an **HLS** (Hue, Light, Saturation) model for this purpose.

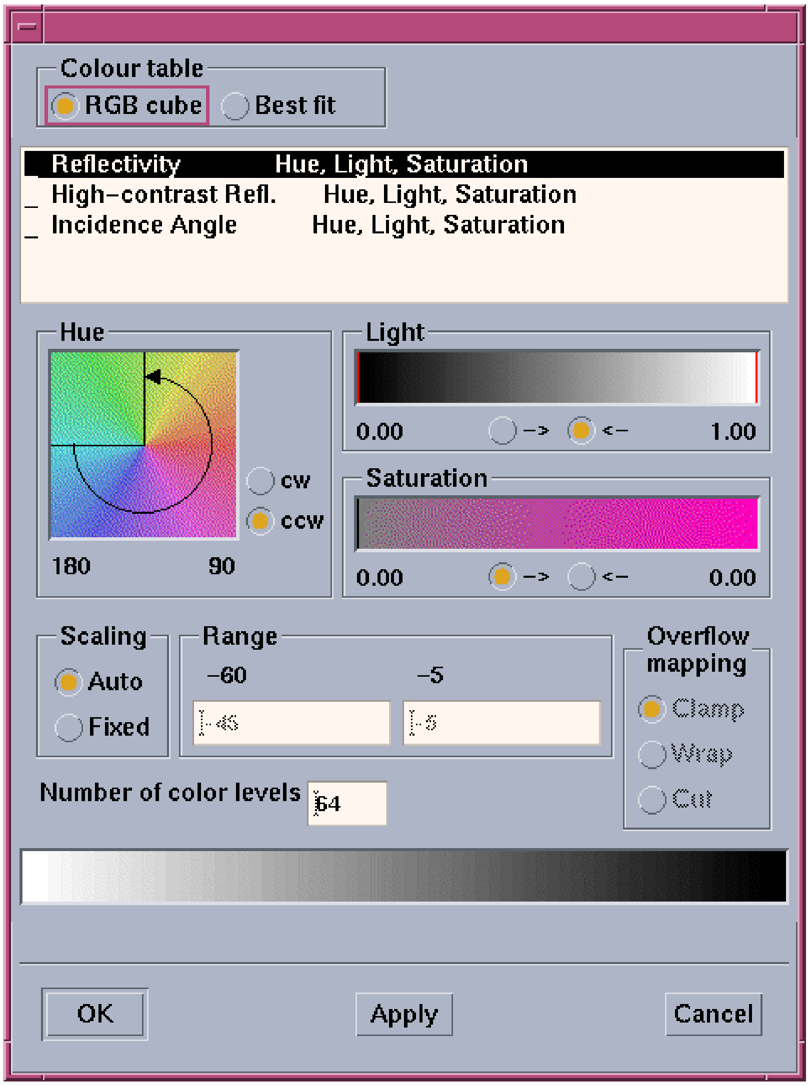


Figure 73 - The Colour Mapping dialogue box

Colour table

This setting is used to select the colour table to use for the application window.

When **RGB cube (Red/Green/Blue)** is selected, the colour table will be a standard RGB cube colour table defined commonly for all windows on the computer. The colour table of the screen do not change even if you change the HLS settings in the **Colour Mapping** dialogue box. A **Best fit** colour table will be re-initiated when any HLS setting is modified.

This **Best fit** choice is the slowest, but gives the best results inside one window. However the colours of other windows might not match the colours in the window containing the pointer. This can cause flickering between the windows. If the computer uses 24-bit colour planes, the flickering will disappear and a **Best-fit** colour table can be used all the time.

List of items

This list of items is used to define the data type for which the other selections are applied.

The list of items is a list box containing different data types displayed by the application module, and may vary depending on the module. The left column is the data type name, and the right column defines which of the HLS components is to be used for the data type. Select an item from this list by pressing the left mouse button on the item name.

The remaining controls in the dialogue box (positioned below the list box) all pertain to the settings for the selected item.

Hue, Light, Saturation

To each of the components in the HLS model (Hue, Light and Saturation), the dialogue box contains a graphic control used to define a value range for the corresponding component.

For the **Hue** component, this control is formed as a rainbow laid out in a circular manner. A sector is defined, giving the applied range. The sector may be changed by dragging either of the two edges around.

For the **Light** and **Saturation** components, controls similar to a slide bar are applied. Two vertical lines define the lower and upper limits of the range. They may be dragged as the slider in a slide bar.

Among these three graphic controls, only those corresponding to the components used for the currently active data type will be enabled.

The minimum and maximum values for each component are shown below the corresponding graphic control. The displayed values are updated during modification.

The two radio buttons attached to each of the three graphic controls defines the direction for the mapping of data to an HLS component.

- If **CCW** (Counter-Clock-Wise) is selected, then the lower data value will be displayed using the minimum value defined for the corresponding HLS component, and the upper data value will be displayed using the maximum HLS value defined.
- If **CW** (Clock-Wise) is chosen, the opposite direction will be applied.

To obtain a grey scale on the display, do as follows:

1 Move the saturation limits to the left of its scale.

2 Widen out the light area of the light scale.

The resulting colour scale for the current data type is displayed near the bottom of the dialogue box.

Scaling

This setting is used to choose how the value range used to display the data should be defined.

If the **Auto** scaling radio button is selected, the data range given by the actual minimum and maximum values in the data set is applied.

If **Fixed** scaling is selected, you need to set a range using the **Range** input fields.

Range

These values show the actual minimum and maximum values in the data set. Below these are text input fields where the lower and upper limits of the value range used to display the data are entered. These fields are only applied if the fixed scaling radio button is selected.

Number of colour levels

This is a text input field where the number of colour levels used for the display of the data is entered. A low number (3-10) gives very distinct colours. A high number (50-100) makes a more continuous impression.

Overflow mapping

These settings select how off-range values should be displayed.

When **Fixed** scaling is selected there may exist data values which are lower or higher than the defined range. These data values can be displayed by the same value as the nearest values inside the range (**Clamp**), or they can be made invisible (**Cut**). The third alternative is to apply the same colours again, to each of the intervals of the same size as the defined range, below and above the defined range (**Wrap**).

Acceptance

OK - This button is used to implement and save the new colour settings for later use. The dialogue box is closed.

Apply - This button allows you to implement the new settings on a trial basis. The new colours can be seen in the geographical window immediately, but are not saved. The dialogue box remains open.

Cancel - This button allows you to cancel any changes that have been done while the dialogue box was open. Even if the **Apply** button has been used, the colours and the other parameter values will be reset to the setting that existed before the dialogue box was opened. The dialogue box is closed.

Contour priority...

Contour priority is accessed from the view menu in the main window. Select this option to specify if you want to highlight one of the imported contour lines in the Grid Display.

Note: *The Contour priority is for highlighting one of the imported .daf contours only!*

Note that the contour curve may be visible or hidden depending upon settings you have selected in the **Show/Hide** dialogue box. The colour may be changed in the **Annotation Colours** dialogue box.

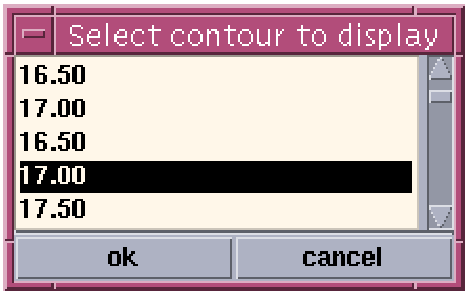


Figure 74 - Contour priority

The .daf format must be choosen in the **Import** dialogue box on the **File** menu in order to be able to use Contour priority. If not, you will get a warning message.

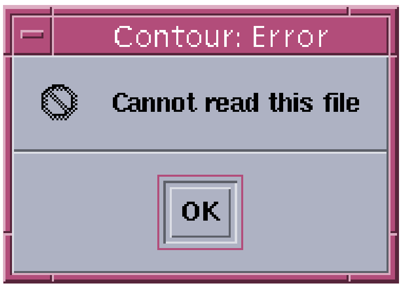


Figure 75 - Contour warning message

Lat/Long Format

The scales along each of the axes in a geographical window represents geographical latitude and longitude respectively. The latitude and longitude coordinates will be displayed in one of three different formats:

- Decimal degrees
- Degrees and decimal minutes
- Degrees, minutes and decimal seconds

The preferred format can be selected in this dialogue box.

This dialogue box is opened by selecting the **Lat/Long Format** command from the **View** menu in the survey display.

The selected setting for each module is saved as a part of the parameter settings for each survey.

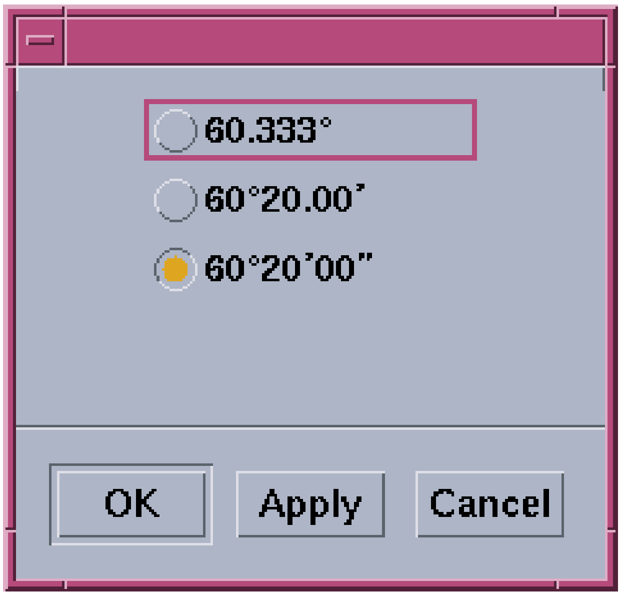


Figure 76 - The Lat/Long Format dialogue box

You can also choose to use metric scaling. This is made in the **Show/Hide**.. dialogue box. If metric scaling is selected, the settings described here have no effect.

→ *The Show/Hide dialogue box is described on page 202.*

Data choice

Overview

The purpose of this command is to select the type of beam data to be displayed in the nearest vicinity behind the vessel.

In realtime mode, the main geographic window will display data as they are received from the logging process. Only a limited amount of beam data or points behind the vessel will be displayed, and when the number of displayed points has reached its maximum, the oldest points are removed as new points are received.

To see all data of an area in real time, the **Grid Display** utility must be used.

The type of information to be plotted is selected using the sub-menu activated by the following **Data choice** menu commands:

- Depth
- Range
- Depth gradients
- Sun illumination
- Backscatter
- Phase / Amplitude
- Quality factor
- Ping mode
- Beam number
- Ping number

Depth - The depth value for all beams.

Range - The slant range (in metres) for all beams.

Depth gradients - Displays the Abs(dz/dy) ratio between two neighbouring beams.

- **dz** is the depth difference between the two depths.
- **dy** is the horizontal distance between the two adjacent beam positions in the same ping.

Sun illumination - Simulates what the seabed would look like if illuminated by a light source. This function is useful to emphasise steep changes in depth, and to highlight any artifacts in the data.

Backscatter - The backscatter for all beams.

Phase/Amplitude - Shows whether phase or amplitude detection was used.

Quality factor - A data quality measure for each beam. Small values (on a scale from 0 to 128) conveys good data quality. Only the lower 6 bits are used.

Ping mode - Which mode the echo sounder was using.

Beam number - A number from 1 to 111 identifying each beam.

Ping number - The number for each ping.

Presentation

The data is displayed using the colour codes set in the **Colour mapping** dialogue box activated by the **View->Colour mapping** menu command.

→ *Refer to page 204 for further information about the color mapping..*

The data may be shown as a raster plot, using either pixels or small rectangles as the basic unit, or the data values may be displayed directly, as numbers. In the latter case, Over Plot Removal (OPR) technology is applied to avoid a screen crowded with numbers. Select one of these alternatives using the **View->Show/Hide** menu command.

→ *Refer to page 202 for further information about the Show/Hide feature.*

Update view area

The **View Area** is defined as the rectangle covering the current survey.

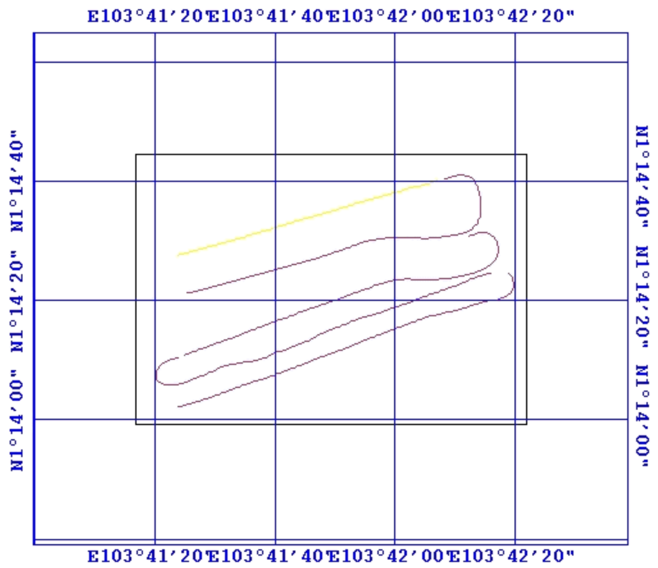


Figure 77 - The View Area

This command redraws the view area.

Redraw

This command updates the current display image with new data received since the image was last generated.

Vessel in centre

This command acts like an on/off switch. When the function is activated, a small rectangle appears next to the **Vessel in centre** command on the menu.

By enabling the **Vessel in Centre** command, the vessels relative position on the screen will be constant. The position of the vessel on the display may be moved with the mouse.

If the choice is disabled the geographical display will freeze and the vessel will move relative to the geographical display. In this case there is a possibility for the vessel to move outside the visible geographical area.

Update Interval

Update **Interval** is available from the View menu in the main window. The purpose of this command is to define an automatic display redraw.

During normal operations, you may find that the ping rate is very high, or the new positions come very often. If the computer is not fast enough to plot this continuously, the interval for screen updates can be manually set.

You can select between the following values or a small submenu:

- 5 seconds
- 10 seconds
- 60 seconds
- No update

If you select **No update**, the display image will never be redrawn. This may be useful if you want to freeze the display that you want to analyze further, or if you want to show the display to others on the vessel.

Note: *This function was useful with older computers, with present-day equipment it is no longer required.*

7.6 Options

Overview

The pull-down menu activated by this menu item contains only one menu command:

- Display

Display

This command is used to select another workstation as primary or secondary display unit for utilities launched from the main geographical window. It is usually used when the Bridge Display is operated from a monitor or an X-terminal on the bridge.

This menu command brings up a list of display units available on the external Ethernet. This may be other Unix workstations, X-terminals or computers operating with X-terminal software connected to the local area network. Select one of the units listed, and the **Bridge Display** utility subsequently launched from the **Processing** pull-down menu will use the defined display for visual presentation and user interface.

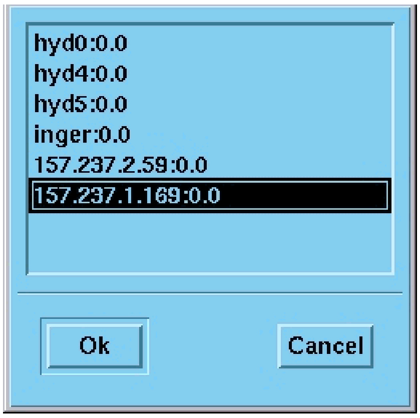


Figure 78 - Display select dialogue box

To add or remove computers to your operator station, edit the file

$NEPTUNEHOME/defaults/NeptuneDisplay

7.7 Processing

Overview

All utilities except the main geographical window in the Survey Display software application, are started from the **Processing** pull-down menu. The utilities that work on specific lines or areas will use lines or areas that are currently selected in the main geographical window.

The **Processing** pull-down menu contains menu commands for launching the utilities, as well as auxiliary commands related to how the utilities work.

The following commands are available from the **Processing** menu:

- Bridge and Helmsman display
- Sonar Image
- Create Grid
- Grid Display
- Grid Display Realtime
- Calibrate
- Sonar Image Replay

Some of these commands are explained in this chapter, but others - due to the fact that they are also used in other applications - are described in their own chapters.

Bridge and Helmsman display

The **Bridge and Helmsman Display** is a window very similar to the main geographical window, but it is only intended for viewing the steering route relative to the planned lines. This window is usually allocated to another monitor or X-terminal available on the vessels network. This is possible by using the **Options -> Display** menu command in the *Survey Display* window. In earlier versions the Bridge and Helmsman display were two separate programs. The former Helmsman Display is now removed and this function is now included in the Bridge and Helmsman display.

To start the Helmsman, use the options **View -> Show/Hide -> Helmsman.** This application is also accessed from the Launchpad.

Note: *Some of the functions in the Helmsman are only available when an active planned line is defined!*

→ *The description of the Bridge and Helmsman Display is on page 244.*

Sonar Image

This utility gives you a reflectivity or backscatter image of the seabed.

The **Sonar Image** application is also accessed from the Launchpad, and it is used during online operations.

→ *The Sonar Image can be found on page 304.*

Create Grid

This command is used to define the cell size for the reference grid The **Grid Display** utility displays the data using this grid.

→ *The Create Grid function is described in the Grid Display on page 229.*

Grid Display

This display is a geographical window dedicated to display depths and related values for a specific area. The area to be displayed is defined in the main geographical window using the **Edit -> New Display Area** menu command. When an area has been defined, it must be selected, and the **Grid Display** can be started to display the values inside the selected region. If no area is selected, the whole geographical area is used as display area.

Grid Display Realtime

The **Grid Display Realtime** is also accessed from the Launchpad, and it is used during online operations. It is intended to be used while logging is active. To avoid disturbing the logging process by computationally intensive activities, some options are not available (the **As grid** and **As grid and OVR text** in the **Show/Hide** dialogue box).

→ *The Grid Display is described on page 226.*

Calibrate

The Calibration (Calibrate) utility is a geographical window intended for analysis of data from a calibration survey. Depths from different survey lines may be compared, and it is possible to apply different roll, pitch and time offsets to see the consequences on the computed depth values.

This utility is used during online and offline operations.

→ *Calibration is described on page 254.*

Sonar Image Replay

This utility gives you a reflectivity or backscatter image of the seabed.

The **Sonar Image Replay** is accessed from the **Processing** menu, and used during offline operations.

→ *The Sonar Image can be found on page 304.*

→ *The Seabed Viewer can be found on page 313.*

Import/Export

Export lines

General

The purpose of the **Import/Export** utility is to transfer survey lines from one survey directory to another. All the survey format files representing a survey line, or alternatively only specified file types, are copied. The utility will either copy all survey lines, or only some selected lines. Survey lines may also be transferred to or from magnetic tape. The utility may also be used to delete survey lines from a survey.

Note: *You should not try to achieve similar functionality by using ordinary copy file/delete file tools available in the operating system. This will not be successful since internal references also have to be changed when the files are moved to another location, or deleted.*

The Import/Export utility is launched by selecting **Export Lines** on the **File** menu. This brings up the **Export Lines** dialogue box.

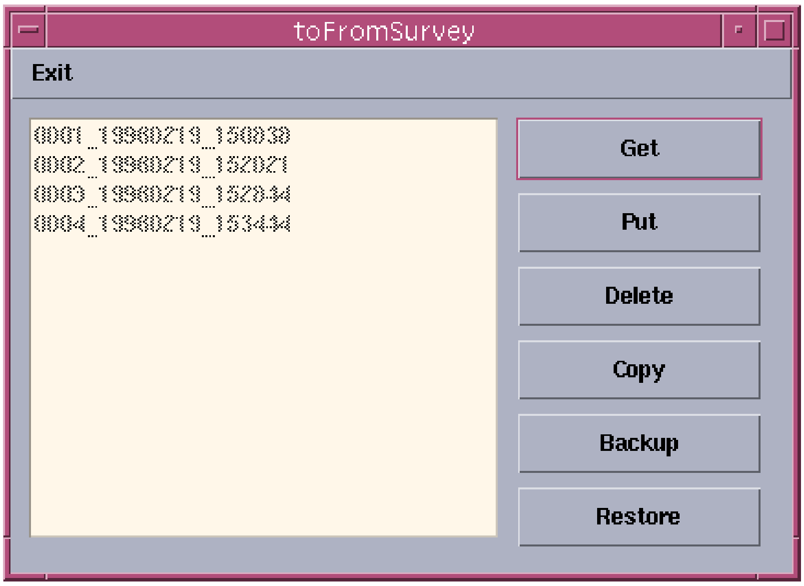


*Figure 79 - The **Import/Export** utility*

Note: *If only some of the lines in the current survey are to be transferred or deleted, they have to be selected in the Main geographical window before the Import/Export utility is started. No means are provided in the utility itself to include or exclude individual lines. If no lines are selected in advance, all lines in the survey will be transferred or deleted.*

Some of the buttons encountered in the dialogue boxes described below activate a restricted version of the Kongsberg Simrad **SurveyControl** utility. Use the **File** -> **Exit** menu command, and push the **OK** button in the resulting confirmation dialogue box to exit from this utility.

Commands

Overview

Six push buttons are available on the right hand side of the **Export lines** dialogue box. They represent the commands described below. After pushing one of these buttons, various dialogue boxes, described in the following paragraphs, appear.

While copying operations are active, a dialogue box informing you about this will sometimes appear. Although this dialogue box has an **OK** button, no interaction from you is required.

Get

To copy some or all lines in a survey (or lines previously copied to tape) to the current survey.

The lines in the source survey (or on the tape), but only version 01 of the Survey Format files, and only files adhering to the included file types (see the **Selecting file types** paragraph below) are copied.

Any selection of specific lines in the current survey, done before the Import/Export utility was started, will be ignored.

The following dialogue boxes appear:

- **File type** selection box
- **Source** selection box
- **SurveyControl** dialogue box. This dialogue box displays all the lines in the source survey. You may select some of these lines to be transferred. If no lines are selected, all lines will be transferred.
- **Confirmation** box

Note: *To get access to the added lines, you must exit from the main geographical window and restart Survey Display.*

Put

This option is used to **move** the selected (or all) survey lines from the current survey to another survey.

Only version 01 of the Survey Format files, and only files in file types described in the **Selecting file types** paragraph below, can be taken.

The following dialogue boxes will appear:

- **File type** selection box
- **Destination** selection box

Note: *The affected survey lines will be deleted from the current survey.*

Note: *To see the changes to the current survey, you must exit from the main geographical window and restart Survey Display.*

Delete

This option is used to delete the selected (or all) survey lines from the current survey.

All versions of the Survey Format files are deleted, but only files adhering to the included file types (see the *Selecting file types* paragraph below).

The following dialogue boxes will appear:

- **File type** selection box
- **Delete file** confirmation box.

Note: *To see the changes to the current survey,you must exit from the Main geographical window and restart the Survey Display.*

Copy

This option is used to copy the selected (or all) survey lines from the current survey to another survey or to magnetic tape.

Only version 01 of the Survey Format files, and only files adhering to the included file types (see the *Selecting file types* paragraph below), are copied.

The following dialogue boxes will appear:

- **File type** selection box
- **Destination** selection box

Backup

This option is used to copy the whole current survey to magnetic tape.

All files on the survey directory, including all versions of the survey line files, are copied. Any selection of specific lines before the Import/Export utility was started, will be ignored.

The following dialogue box will appear:

- A dialogue box informing you about the Backup operation.

Press **OK** to continue or **Cancel** to abandon the operation.

Restore

This option is used to restore a tape Backup previously taken with the **Backup** command, to the current survey directory.

All files are restored.

The following dialogue box will appear:

- A dialogue box informing you about the tape read operation. This box has several buttons, not all of them relevant for the current task. Push the **Start** button to continue with the transaction, or the **Cancel** button if you want to abandon the operation.

Note: *Any existing files on the survey directory will be deleted.*

Note: *To get access to the restored survey, you must exit from the main geographical window and restart Survey Display.*

Selecting file types

The first dialogue box appearing after one of the **Get**, **Put**, **Delete** or **Copy** commands has been initiated is the following dialogue box:

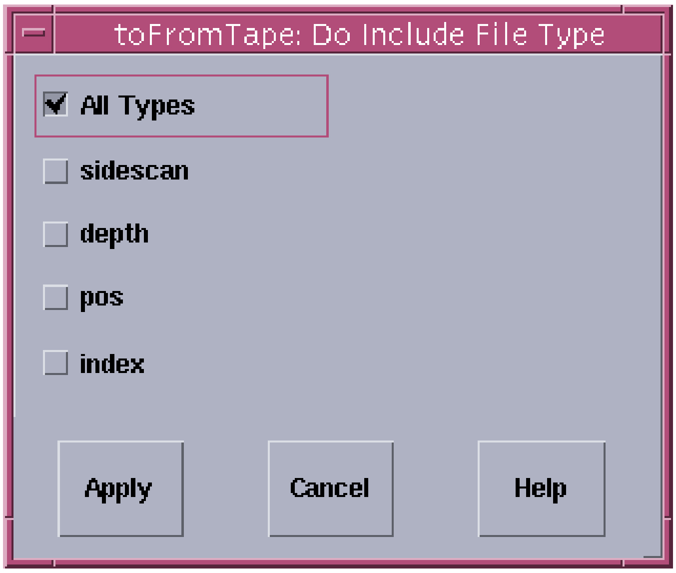


Figure 80 - Dialogue box for selecting file types

File type buttons

This option is used to specify which file types should be included in the transactions.

The five check buttons on the left hand side are used. Select either the *All types* button, or any combination of the four others.

All types - All file types will be included, disregarding the status of the other check buttons.

Sidescan - Sonar image data (*.sidescan files) will be included.

Depth - Depth data will be included (*.depth files).

Pos - Position data will be included (*.pos files).

Index - Index data will be included (*.ind files).

Acceptance

Apply - Use the current file type combination and go on with the transaction.

Cancel - Abandon the transaction.

Help - On-line help.

Selecting the source

Overview

Using the **Get** command, the source for the data to be transferred has to be specified. This is done by the following dialogue box, appearing after the File type inclusion box.

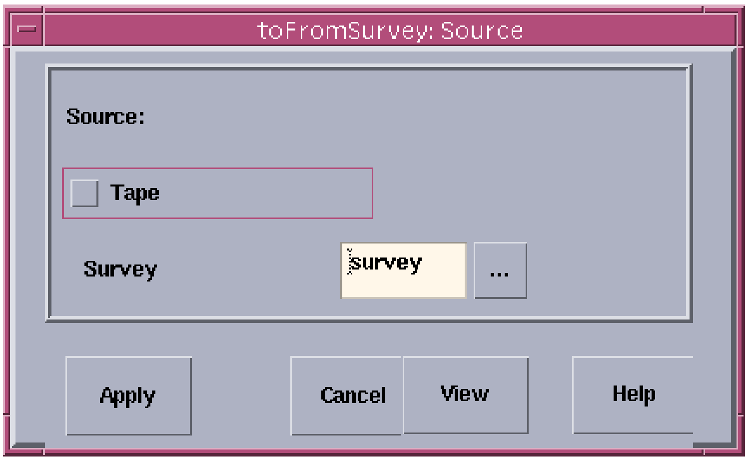


Figure 81 - The **Source** *dialogue box*

Tape

If this check button is checked, the survey lines to be imported will be transferred from magnetic tape.

Survey

This option is used to select a survey directory on the hard disk from where the lines will be transferred.

Two alternatives are available for the specification of a source survey. One alternative is a text input field where you can enter the name of a survey directly.

The other is a push button to the right of this text input field. Pushing this button, a survey selection dialogue box appears. Click on the survey you want. Use eventually the scroll bar on the right hand side to get more surveys into view. Click on the **OK** button to confirm the selection.

Acceptance

Apply - This option is used to accept the selected source and continue with the transaction.

Cancel - This option is used to abandon the transaction.

View - This option is used to view the lines to be copied using a restricted version of the Simrad SurveyControl utility.

Help - On-line help

Selecting the destination

Using the **Put** or **Copy** command, the destination for the data to be transferred has to be specified. This is done by the following dialogue box, which will appear after the File types inclusion box.

This dialogue box will also act as a confirmation box for these commands. After pushing the **Apply** button in this dialogue box, the transaction will be executed without any further opportunity to abandon the transaction.

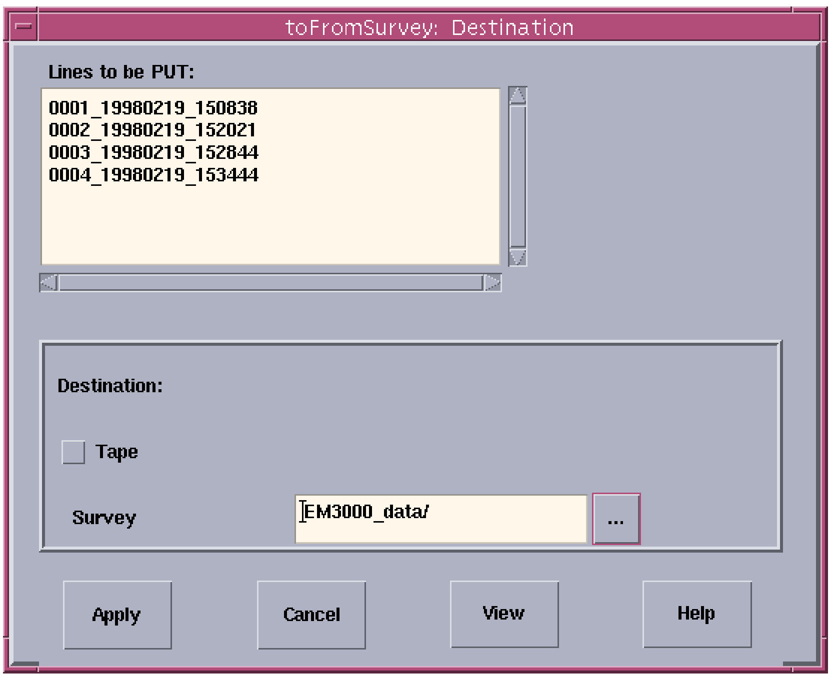


*Figure 82 - The **Destination** selection box*

Lines to be COPIED

This option is used to show which survey lines are included in the transaction. Use the scroll bars to get more of the list into view. This box is not used for further line selections.

Tape

If this check button is checked, the survey lines to be exported will be transferred to magnetic tape.

Survey

This option is used to enter a destination survey directory on the hard disk.

Two alternatives are available for the specification of a destination survey. One alternative is a text input field where you can enter the name of a survey directly.

The other is a push button to the right of this text input field. Pushing this button, a survey selection dialogue box appears. Click on the survey you want. Use eventually the scroll bar on the right hand side to get more surveys into view. Click on the **OK** button to confirm the selection.

If no survey of the given name exists, a new survey directory will be created.

Acceptance

Apply - This option is used to accept the selected destination and complete the transaction.

Cancel - This option is used to abandon the transaction.

View - This option is used to view the affected lines.

Help - Online help.

8 GRID DISPLAY

8.1 Purpose

The purpose of the Grid Display is to display a gridded image of large areas of the survey. This image can be used for a visual inspection of the quality and distribution of the logged data and related data for a specified geographical area. The logged data for this area is then displayed in a dedicated window.

The program contains different type of representations, such as backscatter, shaded depth and number of datapoints in each grid cell. Depth contouring is also included in the Grid Display.

The area to be displayed is defined in the main geographical window using the Survey Display's **Edit->New Display Area** command.

Two versions of the Grid Display application may be used:

- Online version
- Offline version

The online version of the Grid Display is intended to be used while logging is active. The **As grid** and **As grid and OVR text** options in the **Show/Hide** dialogue box are then not available to avoid disturbing the logging process by computational intensive activities.

8.2 Main window

Overview

The Grid Display main window is shown below. It is designed with the following elements:

- Menu bar
- Graphic presentation of the currently selected area
- Mean depth colour coding
- Tool bar

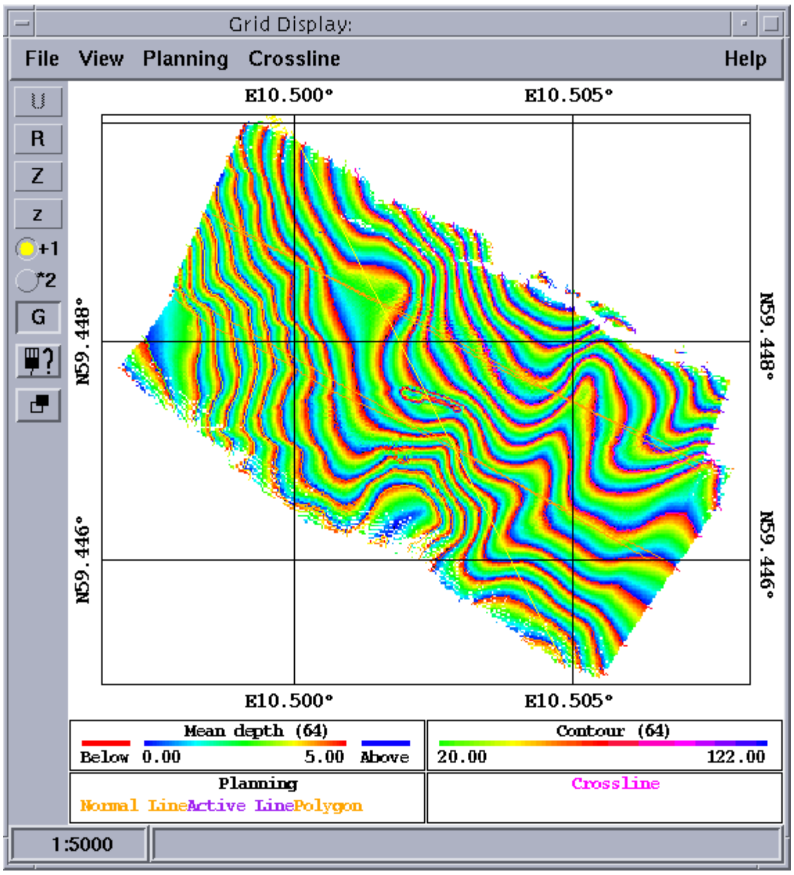


Figure 83 - The Grid Display main window

Main menu

The Grid Display's main menu bar provides the following choices:

- File
- View
- Planning
- Crossline
- Help

The **Planning** and **Crossline** modules are explained separately.

→ *The **Planning** utility is described on page 285.*

→ *The **Crossline** utility is described on page 276.*

Graphic presentation

The **graphic presentation** area displays the current geographical area. A grid positions the area, and colour codes are used to visualize the depths.

The bottom part of the graphic display presents the **current colour coding** used to visualize the various depths. The scale (in meters) is shown under the colour bar.

Information bar

The **information bar** at the bottow of the window contains information about the scale (for example 1:25000).

Tool bar

The buttons on the **tool bar** provides general tools for scaling, mouse operations and panning.

→ *Refer to the description on page 48.*

8.3 Operational procedures

Purpose

The purpose of the Grid Display is to display all depths and related data for a specified geographical area. The logged data for this area is then displayed in a dedicated window.

The area to be displayed is defined in the main geographical window using the Survey Display's **Edit->New Display Block** command.

Start and exit

Before you start the Grid Display

You must define a data set and a display area before you start the Grid Display. The following procedure applies:

1 Select **Processing** on the Survey Display's main menu.

2 Select **Create grid** on the menu. This opens the **Grid Definition** dialogue box.

- If logged data is available, the system will present you with a suggestion about the grid cell size.

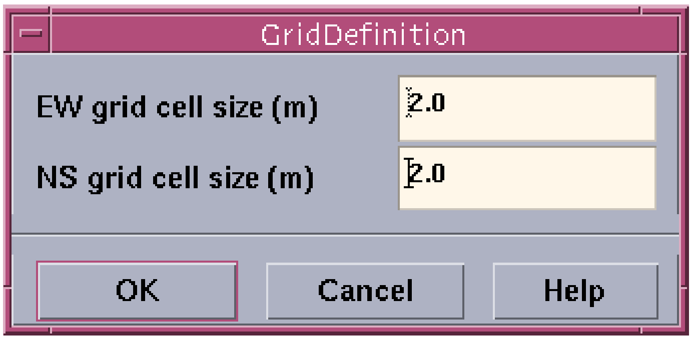


Figure 84 - Create grid/Grid definition dialogue box

Note: *If you attempt to perform **Create Grid** with no survey data, an error message is presented.*

Note: *If you attempt to perform **Create Grid** for the second time on the same survey data, a warning message is presented. You can then either cancel the process, or continue.*

- A subsequent re-definition of the reference grid will force the system to compute depths values for the new cells, which will take some time if the amount of data is large.

3 Select **New Display Area** on the **Edit** menu.

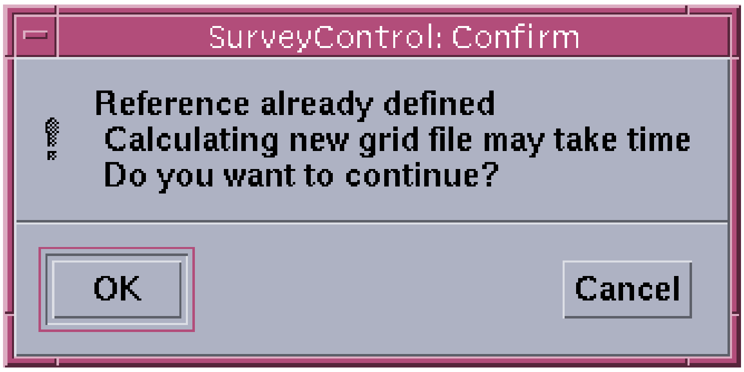


Figure 85 - Create grid warning message

4 Press the <u>right</u> mouse button to select an area.

5 Click once on the area border to select it.

6 Select **Edit** on the Survey Display's main menu bar.

7 Select **New Display Area** on the **Edit** menu.

8 Press the <u>right</u> mouse button to select an area.

9 Click once on the area border to select it.

You can now start the Grid Display, and only the selected lines will be displayed. If no lines were selected, all lines will be displayed.

To start the Grid Display

The Grid Display is started from the Survey Display application as follows:

1 Select **Processing** on the Survey Display's main menu bar.

2 Select Grid Display on the menu.

3 Change to Workspace three too see the Grid Display.

You can also start the Grid Display from the Launchpad by clicking on the dedicated icon.

If you try to start the Grid Display without first defining a display area, an error message will appear to guide you.

To start the Grid Display realtime

Before you start the Grid Display Realtime you need to log one survey line, or parts of one. You then need to create a grid for that line, the procedure for create grid is described above.

1 Select Edit on the Survey Display's main menu bar.

2 Select New Display Area on the Edit menu.

3 Press the right mouse button to select an area.

4 Click once on the area border to select it.

5 Select Processing on the Survey Display's main menu bar.

6 Select Grid Display Realtime on the menu.
   - The grid is updated continously.

Note: *When the vessel leaves the area defined by the realtime grid, the gridding stops.*

Note: *If you define an area for the realtimegridding that is too large, the Grid Display Message dialogue box will appear with a warning.*

To start the Grid Display realtime

Before you start the Grid Display Realtime you need to log one survey line, or parts of one. You then need to create a grid for that line, the procedure for create grid is described above.

1 Select **Edit** on the Survey Display's main menu bar.

2 Select **New Display Area** on the **Edit** menu.

3 Press the right mouse button to select an area.

4 Click once on the area border to select it.

5 Select **Processing** on the Survey Display's main menu bar.

6 Select Grid Display **Realtime** on the menu.
   - The grid is updated continously.

Note: *When the vessel leaves the area defined by the realtime grid, the gridding stops.*

Note: *If you define an area for the realtimegridding that is too large, the Grid Display Message dialogue box will appear with a warning.*

You can also start the Grid Display from the Launchpad by clicking on the dedicated icon.

If you try to start the Grid Display without first defining a display area, an error message will appear to guide you.

To start the Grid Display realtime

Before you start the Grid Display Realtime you need to log one survey line, or parts of one. You then need to create a grid for that line, the procedure for create grid is described above.

1 Select **Edit** on the Survey Display's main menu bar.

2 Select **New Display Area** on the **Edit** menu.

3 Press the right mouse button to select an area.

4 Click once on the area border to select it.

5 Select **Processing** on the Survey Display's main menu bar.

6 Select Grid Display **Realtime** on the menu.

- The grid is updated continously.

Note: *When the vessel leaves the area defined by the realtime grid, the gridding stops.*

Note: *If you define an area for the realtimegridding that is too large, the Grid Display Message dialogue box will appear with a warning.*

To exit the Grid Display

The Grid Display is closed as follows:

1 Select **File** on the main menu bar.

2 Select **Exit** on the **File** menu.

The common view procedures are presented in the Grid Display *Command Reference*.

You can view and modify the distance between the chart contours.

1 Select **View** on the main menu.

2 Select **Make Contour...** on the submenu.

3 Enter the desired contour interval.

4 Press **Ok**.

Once the contour lines are established, you can place depth labels on them.

1 Select **View** on the main menu.

2 Select **Contour labels at** on the submenu.

3 Select the desired level.

Make sure that **Contour** is enabled in the the Show/Hide dialogue box. If Grid cell is also enabled in the Show/Hide dialogue box, and your current Annotation Colours settings have defined Grid cell and Contour to be displayed in the same colour, you will not be able to see the contour labels. This can be fixed by either changing the color definitions in Annotation Colours or by disabling Grid cells in Show/Hide.

→ *Refer to page 202 for further information about the Show/Hide dialogue box.*

→ *Refer to page 200 for further information about the Annotation Colour dialogue box.*

To create Sun illumination charts

You can add shading to the displayed image, and thus make an artificial 3D effect.

1 Select **View** on the main menu.

2 Select **Grid/Cell** on the submenu.

3 Select **Sun illumination**.

4 Select **Shading parameters** on **View** submenu.

5 Select desired value.

You can select what kind of data to be displayed.

1 Select **View** on the main menu.

2 Select **Grid/Cell** on the submenu.

3 Select desired value.

8.4 Command references

Introduction

This chapter describes the various commands used throughout the Grid Display.

The following options are available on the main menu:

- File
- View
- Planning
- Crosslines
- Help

Each of these options have a number of commands available on drop-down menus.

The **File** menu allows you to print the contents of the geographical display, and to exit the Grid Display.

→ *Refer to the description on page 235.*

The **View** menu provides a number of commands and dialogue boxes to control the geographical display.

→ *Refer to the description on page 237.*

The **Planning** menu provides a utility to plan your surveys.

→ *Refer to the description on page 285.*

The **Crosslines** application makes it possible to evaluate the data quality of the multibeam echo sounder inside a corridor generated in any direction in the survey area.

→ *Refer to the description on page 276.*

The **Help** menu provides on-line help. It is not described here.

8.5 File

Overview

The **File** option on the Grid Display's main menu bar activates a drop-down menu where the following commands appear:

- Plot
- Export depth contours...
- Import...
- Exit

Plot

This menu command activates the **Plot** dialogue box.

→ *Refer to the dialogue box description on page 43.*

This menu command activates the **Export depth contours** dialogue box.

→ *Refer to the dialogue box description on page 236.*

This menu command activates a dialogue box to import depth contours from a .daf-file.

→ *Refer to the dialogue box description on page 191.*

Exit

When this menu command is selected, the Grid Display utility will terminate.

Export depth contours

This option exports contour lines to an output file.

You can select from the following options:

- plotmtv
- DAF

You can also select the output file name.

Plotmtv is a general purpose graphics utility available on the Internet. The utility is supplied with the Neptune, and may be started in a terminal window. When you press **Ok**, this application is started automatically.

DAF is a graphical format for use with the **dKart** software from **HydroService**. The dKart program also reads and generates the S57 ECDIS format.

A separate program named **HydroService** is supplied to read DAF format for conversion to Neptune's internal coast line format.

→ *Refer to page 191 for a more detailed description of the DAF format.*

8.6 View

Overview

The drop-down menu activated by this option contains commands for information presentation.

- Annotation colours
- Show/Hide
- Lat/Long format
- Colour Mapping
- Contour Priority
- Selections
- Vessel in center
- Make contour
- Contour Labels at
- Display Interval
- Shading Parameters
- Grid/Cell
- Keep Function
- Position
- Distance

The **Annotation Colours** command presents the **Annotation Colours** dialogue box, where you can modify the various colours used in your graphical window presentations.

→ *Refer to the description on page 200.*

The **Show/Hide** command presents the **Show/Hide** dialogue box, which contains a list of items that may exist in the client area of the geographical window. These items can either be displayed or hidden.

→ *Refer to the description on page 202.*

The **Lat/Long Format** command allows you to choose the scales along each of the axes in a geographical window. These represent geographical latitude and longitude respectively.

→ *Refer to the description on page 209.*

The **Colour Mapping** command allows you to manipulate with the colours in the graphical window.

→ *Refer to the description on page 204.*

The **Contour Priority** command is used to specify priority of imported contour lines to be displayed in the Grid Display.

Note that the contour curves may be visible or hidden depending on settings you have selected in the **Show/Hide** dialogue box.

The **Selections** command provides a small submenu with two choices: **Reset selection** and **Lines**. The first option deselects the currently selected line in the main window, and empties the edit buffers. Lines opens a small window to make the line selection.

The **Vessel in center** command places the vessel in center of the geographical window.

The **Make Contour** command enables the necessary computations to display the contour curves connecting all the points with equal depth.

→ *Refer to the description on page 239.*

The **Contour Labels At** command enables you to choose at which levels the contour curves should have labels displaying the depth.

→ *Refer to the description on page 240.*

The **Display Interval** command enables you to set up an automatic redraw period for the display.

→ *Refer to the description on page 214*

The **Shading Parameters** command controls the “amount” of shading you can apply to the image, as well as the angle of the light source.

→ *Refer to the description on page 241.*

The **Grid/Cell** command enables you to control which data types you wish to see.

→ *Refer to the description on page 241.*

The **Keep Function** command enables you to do the same operation over and over again, until an other function is selected.

→ *Refer to the description on page 195.*

The **Position** command allows you to identify positions on the geographical display.

→ *Refer to the description on page 196.*

The **Distance** command allows you to measure distances on the geographical display.

→ *Refer to the description on page 197.*

Make Contour

Make contour is available from the View menu. This dialogue box enables the necessary computations to display the contour curves connecting all the points with equal depth.

The dialogue box (shown below) asks for the current contour interval in meters. This is the depth difference between each contour curve.

Figure 86 - The Make Contour dialogue box

Enter the desired value, and press **OK**. **Cancel** will close the dialogue box without any changes. **Help** starts the context sensitive help.

The computer now performs the contour calculations, and the result is displayed in the main geographical window.

Note that the contour curves may be visible or hidden if you use the **Show/Hide** dialogue box.

Contour Labels At

Once contour lines are enabled, you can choose at which levels the contour curves should have labels displaying the depth.

The following options are available:

- Every level
- Every second level
- Every fifth level
- Every tenth level

Shading parameters

This menu option allows you to choose the “amount of shading” to be applied when the **Sun illumination** alternative is selected on the **Grid/Cell** sub-menu.

Options are:

- Normal
- 2 * Normal
- 4 * Normal
- 8 * Normal
- Light from <geographic direction>

Grid/Cell

This option defines the data type to be displayed. Select any of the following:

Mean depths - This is the mean value of the cell.

Min.depth - This is the minimum value of the cell.

Max. depth - This is the maximum value of the cell.

Diff.depth - This is the depth range (maximum value minus minimum) of the cell.

No.points - This is the number of data points in the cell.

Backscatter - This is the mean backscatter value of the cell.

Sun illumination - This is the mean depth of the cells with shading based on an artificial light source placed in the geographical direction described in **Shading Parameters** above.

Mean height - Mean distance from vertical reference to sea floor.

Max.height - Maximum distance from vertical reference to sea floor.

Min.height - Minimum distance from vertical reference to sea floor.

Create Grid

This command is used to define the grid's cell size for the **Grid Display** utility. The option brings up a dialogue box to define the size of the grid cells.

Note: *The generation of the cells takes much of the system resources, and should only be used while logging is not active!*

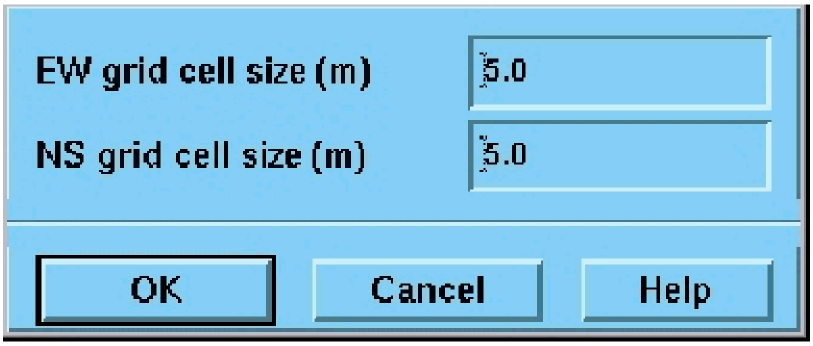


Figure 87 - Create Grid dialogue box

Grid cell size

To start the Grid cell size

To start the **Grid cell size** you need to do the following

1 Start **Merlin**

2 Change workspace to the **SI**.

3 Choose **Processing** on the main menu.

4 Choose **Create Grid.**

Introduction

If logged data is available, the system will present you with a suggestion about the grid cell size. For this purpose, some logged data is required.

- If you attempt to perform **Create Grid** with no survey data, an error message is presented.
- If you attempt to perform **Create Grid** for the second time on the same survey data, a warning message is presented. You can then either cancel the process, or continue.

To start EM 1002 on a survey, run the system for a few minutes without any grid defined, and then stop the logging. Use the **Create Grid** command to define a reference grid. The system will then have some data from which a reasonable suggestion about the grid cell size can be made.

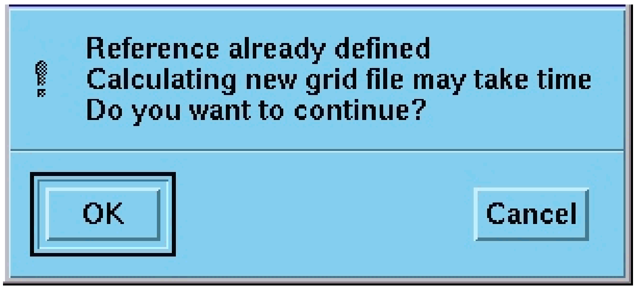


Figure 88 - Create Grid warning

A subsequent re-definition of the reference grid will force the system to compute depths values for the new cells, which will take some time if the amount of data is large.

Try to select the right cell size early in the survey. A good rule is to define the reference grid when the first line has been finished, and before the start-up of the next.

9 BRIDGE AND HELMSMAN DISPLAY

9.1 Purpose

The **Bridge and Helmsman Display** is designed to view track and coverage data. It presents a geographical view of the current survey area with vessel position, survey lines and swath coverage. On the Bridge and Helmsman Display various steering information with regard to the current survey line may be displayed.

- No depth or other beam data are shown.
- Only the track of the currently active line and optionally coverage is shown.

The Bridge and Helmsman Display window is usually allocated to another display unit. Therefore, use the **Options -> Display** menu command from the survey display menu before the Bridge and Helmsman Display program is started.

→ *Refer to page 246 for a start-up procedure.*

9.2 Main window

The Bridge and Helmsman Display window contains the following main elements:

- Menu bar
- Graphic presentation of the current survey area
- Information bar at the bottom of the display
- Tool bar

The following commands and options are available from the the Bridge and Helmsman Display main menu bar:

- File
- Edit
- View

These menu options and the respective commands are the same as used elsewhere in the Survey Display application.

The Bridge and Helmsman Display window is shown in figure 89. This window contains the same geographical information as the Survey Display main window, but the options on the main menu bar have been reduced.

The **information bar** at the bottom of the display contains information about the scale (for example 1:25000).

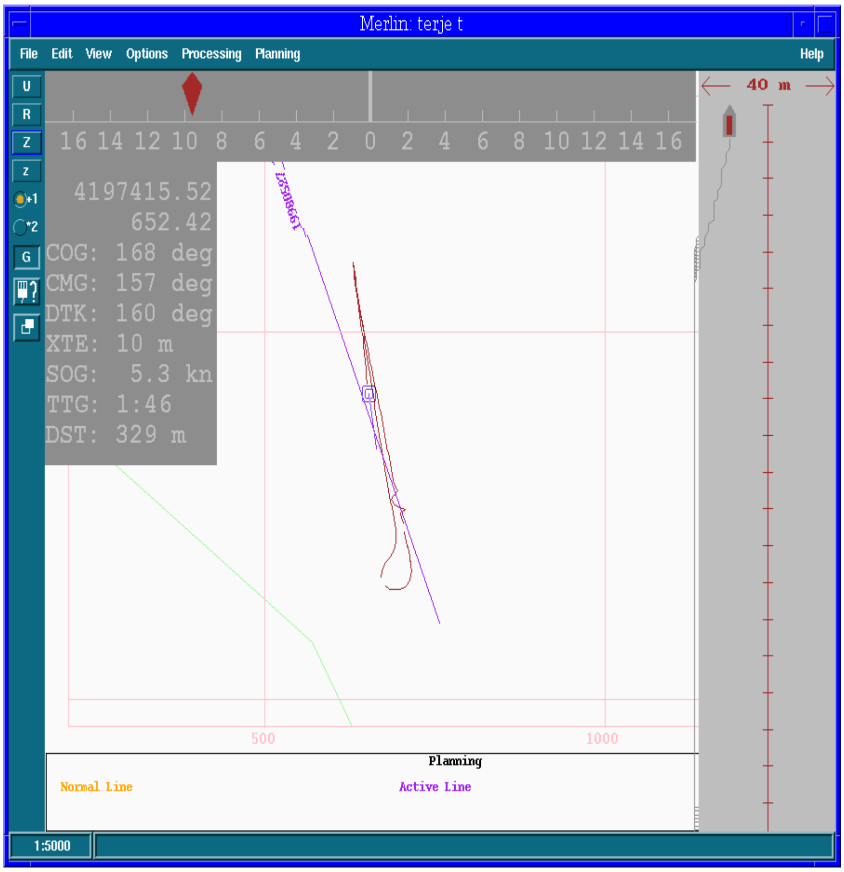


Figure 89 - Bridge and Helmsman Display. The Helmsman information is in the grey areas of the window.

The **Tool bar** provides easy access to a number of view functions.

→ *The Tool bar is explained on page 48.*

9.3 Operational procedures

Windows

The Bridge and Helmsman Display operates in a single window. In this window you can view the survey lines.

Start and exit

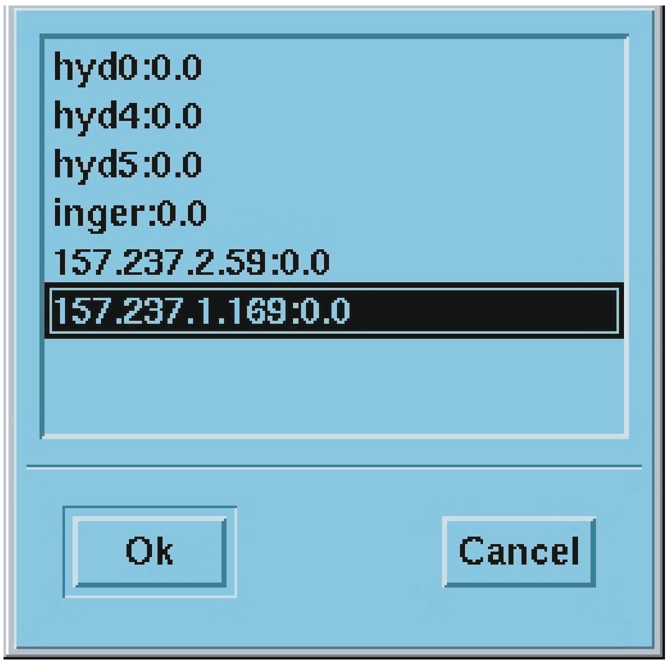
Before you start the Bridge and Helmsman Display

The Bridge and Helmsman Display is designed to run on a local workstation/x-terminal/remote display on the vessel's bridge, and to aid the crew during the survey.

In order to make the application appear on the remote display, the following procedure must be performed in the Survey Display main menu:

1 Select **Options -> Display.**

- A display select dialogue box appears. This box contains the logical addresses of the possible displays on your network. Each workstation is identified by its "alias" or IP address.



(Cd4392)

*Figure 90 - The **Display Select** dialogue box*

2 Select the workstation/x-terminal/remote display alias or adress to receive the Bridge and Helmsman Display window.

3 Clock **OK** to apply.

Note: *Usually, only the **Bridge Display** is sent to the display you select here.*

To start the Bridge and Helmsman Display

The Bridge and Helmsman Display is started from the Survey Display's main menu as follows:

1 Select **Processing** on the main menu bar.

2 Select **Bridge Display** on the pull-down menu.

You can also start the Bridge and Helmsman Display from the launchpad using the icon.

To exit the Bridge and Helmsman Display

The Bridge and Helmsman Display is closed as follows:

1 Select **File** on the main menu bar.

2 Select **Exit** on the pull-down menu.

Common view procedures

The common view procedures are presented in the *Operational procedures* chapter.

→ *Refer to page 50.*

Show/Hide settings

You can start the Helmsman display by activating the **Helmsman** button. What to display in the Helmsman can also be defined in the Survey Display. This setup is saved when the Survey Display exits, and it is restored when the Bridge and Helmsman Display is started. You can choose to display this:

DTK - Desired Track. This is the heading of the current line segment.

DPT - Depth. The water depth in meters.

COG - Course over ground.

CMG - Course Made Good. The heading from the first point in the planned line to the current position.

XTE - Crosstrack Error. The shortest distance to the current line segment.

SOG - Speed Over Ground. Current Speed.

TTG - Time to Go. Estimated time of arrival at the next waypoint.

DST - Distance to Waypoint. Distance in meters to the next waypoint.

XTE deviation indicator - XTE bar displayed at the top of the screen.

Use small fonts - Toggle between small and large fonts.

Output to Autopilot - Output of NMEA APB datagrams.

Automatic line direction - Automatically sets the active lines direction.

The XTE deviation indicator displays the distance from the ship to the active line. A line may have several waypoints and the DTK, XTE, TTG, DST and XTE deviation indicators all show their values to the next waypoint or to the current line segment. The scale of the XTE deviation indicator is either 16 meters (minimum) or 160 meters (maximum). When the ship is more than 16 meters away from the line, the scale changes automatically. If the ship is more than 160 meters away form the line, red and green arrows indicate that the helmsman should steer port or starboard to relocate. Before the ship reaches the start of the line, the indicator will form an arrow pointing downwards.

Automatic line direction will try to change the active lines direction according to the ships heading. This is done when the ship is close to the line, and it is done only once. The line stays the same if the ship turns.

If **Helmsman coordinates** are activated, the current position of the ship is also displayed in a user selectable format: decimal degrees, decimal minutes, decimal seconds or projection coordinates. If **Helmsman course offset** is activated, DTK is corrected with the value taken from the input field value. If the radio button ”Add (degrees * 10)” is enabled, the input field value is divided by 10 (which means that if you want to correct the heading with 1 degree, you must set 10 in the input field). If the radio button ”Automatic true north” is enabled, the Helmsman will display DTK to the true north.

If ”HUD” is activated the ship’s position relative to the active line is displayed to the right as shown in figure 89. The active line is always drawn in the centre and the ship’s position to starboard or port of the line is then displayed. The scale along the active line is time, and it is 10 seconds between the tic-marks. The across scale will change automatically between 40 and 400 meters (20 to 200 meters to either side of the active line).

The Bridge and Helmsman Display has the same colour- and show/hide settings as Survey Display, except that coverage is on, legend off, grid (metric) on, planning module on, displaying user defined line names and helmsman on.

For the Helmsman display the operator can set the colours of the background, the letters and the indicator in the XTE deviation indicator. Remember that these settings are stored to file only when Survey Display exits so it is really the operator of Survey Display who decides what the colours should be.

The active line is always displayed in the Bridge and Helmsman Display even if the operator changes the planned job in Survey Display. This line is given the name ”ACTIVE” when it is displayed. If the Helmsman functionality is turned on it will be displayed whenever a line is active (and turned off automatically when the line is deactivated).

If the button ”Output to autopilot” is enabled the system will output NMEA APB datagrams. You must then input what device the serial line is attached to. This is done from the ”Edit”-menu in Survey Display where the you select ”Autopilot setup...” and an interface pops up. If the you input something that is not a serial line device, it is assumed that it is an ordinary file name and the NMEA APB datagrams are written to this file (the file must already exist).

Note: *NMEA APB datagrams contain information regarding the vessel’s position with regard to the active survey line. The correctness of this information is critically dependent on positioning system input, correct setup of the system and user definition of the survey. Using the APB datagrams as autopilot input is possible as a help in steering the vessel during the survey, but it cannot in any way relieve the vessel crew from the responsibility in safe handling of the vessel.*

Some final notes

If the planning module is off in the Bridge and Helmsman Display, the helmsman will not see the activated line from Survey Display in the Bridge and Helmsman Display, but the Helmsman functionality will be active. This is an option if you want to display for example SOG even if you are not logging: simply activate a line and select DTK etc. in the Helmsman display.

You need to set the colours and select the planned job in Survey Display and then exit Survey Display to set the default colours for the Bridge and Helmsman Display.

When you reach the end of the line (or before you come to the line) the Helmsman will continue to display the ship’s position relative to the continuation of the last line segment of the planned line.

The more you display in the Helmsman, the more work for the computer and the bigger it gets. Try to choose only those values the helmsman really needs.

If you change the planned job in Survey Display, you need to restart the Helmsman display in order to view the changes.

Automatically setting the lines' direction may fail in some circumstances, like if the ship is close to the middle of the line when it is activated, or if you try to activate the current active line. Also note that the update of the display may be slow so you may not see the changes immediately and that the change will not take place until the ship is close to the line.

9.4 Command references

Introduction

This chapter describes the various commands used throughout the Bridge and Helmsman Display application.

The following options are available on the main menu:

- File
- Edit
- View

Each of these menu options have a number of commands available on pull-down menus.

File

Overview

The **File** option on the main menu bar contains two commands:

- Print
- Exit

Print

This menu command activates the **Print** dialogue box, and makes it possible for you to create a hardcopy of the current information shown on your display.

→ *The **Print** dialogue box is explained on page 43.*

Exit

When this menu command is selected, the Bridge and Helmsman Display program will close.

Edit

The **Edit** option on the main menu bar contains these commands:

- Reset selection
- Keep function
- Position
- Distance
- New Display Area
- Resize Display Area

→ ***Reset selection*** *is described on page 194.*

→ ***Keep function*** *is described on page 195.*

→ ***Position*** *is described on page 196.*

→ ***Distance*** *is described on page 197.*

→ ***New Display Area*** *is described on page 198.*

→ ***Resize Display Area*** *is described on page 198.*

→ *These commands are all used in the Survey Display application, and they are described on page 193.*

View

The **View** option on the main menu bar contains the following commands:

Several of these menu options are identical to the options on the Survey Display main menu. These have been described previously in this document as follows:

→ ***Annotation colours;*** *described on page 200.*

→ ***Show/Hide;****described on page 202.*

→ ***Colour mapping;*** *described on page 204.*

→ ***Lat/Long format;*** *described on page 209.*

→ ***Vessel in centre;*** *described on page 213.*

→ ***Update interval;*** *described on page 214.*

10 CALIBRATION

10.1 Introduction

Purpose

The purpose of the Calibration utility is to analyse survey data to discover any systematic error in the roll, pitch or heading received from the attitude sensor and the time delay of the positioning systems.

It is also used to find the outer beam angle offset of the EM 1002 transducer.

The Calibration utility will also assist in judging the quality of a sound speed profile.

The Calibration utility works on any survey data. To obtain valid results, we recommend that survey lines planned specifically for calibration purposes are used. These are lines where the same areas are covered in two or more different ways.

The Calibration utility will only work with two or more selected lines in a survey. These lines has to be selected in the survey display before the Calibration utility is started.

You must define one or more calibration lines along which the data will be analysed. For each line, the system will use data within a corridor, which represents all points within a specified distance from the line. The data will be displayed using a two-dimensional diagram (the calibration profile window) with the horizontal axis representing the distance along the line, and depth along the vertical axis. Data from two different survey lines will be shown in the same diagram, each with its own colour.

In the Calibration Profile window you can change the relevant sensor offset and see its effect on the depths shown. The offset value that gives the best fit betwenn the depths on the two calibration lines is to be entered in the corresponding sensor field in the system's installation menu. The actual value should be a mean of the values determined in several calibration corridors placed at difference positions along the calibration lines.

The Calibration utility is designed for determination of sensor offsets. It is NOT intended for determining the angular orientation of the system transducers, these must be determined through measurements as described in the installation manual. The reason for this is that it is not possible to do a linear addition of sensor offsets and transducer orientation angles. The only exception to this is if the transducers are oriented such that they have zero heading and pitch installation angles, i.e. that they lie horizontal when the pitch is zero and are mounted parallel to the keel, in which case receive transducer roll installation angle and sensor roll offset act as a linear sum. This may be exploited in temporary installations where it may be very difficult to measure roll installation angles with sufficient accuracy.

Main window and menu bar

When you start the Calibration utility the main window appears with the following elements shown:

- Menu bar
- Graphic presentation of the survey charts
- Geographical data
- Tool bar

The menu bar contains the following options:

- File
- Edit
- View
- Help

The bottom frames in the window present the geographical data:

- Current scale (1:5335 in the example above)
- Location of the lines

→ *The graphic presentation is shown in figure 91.*

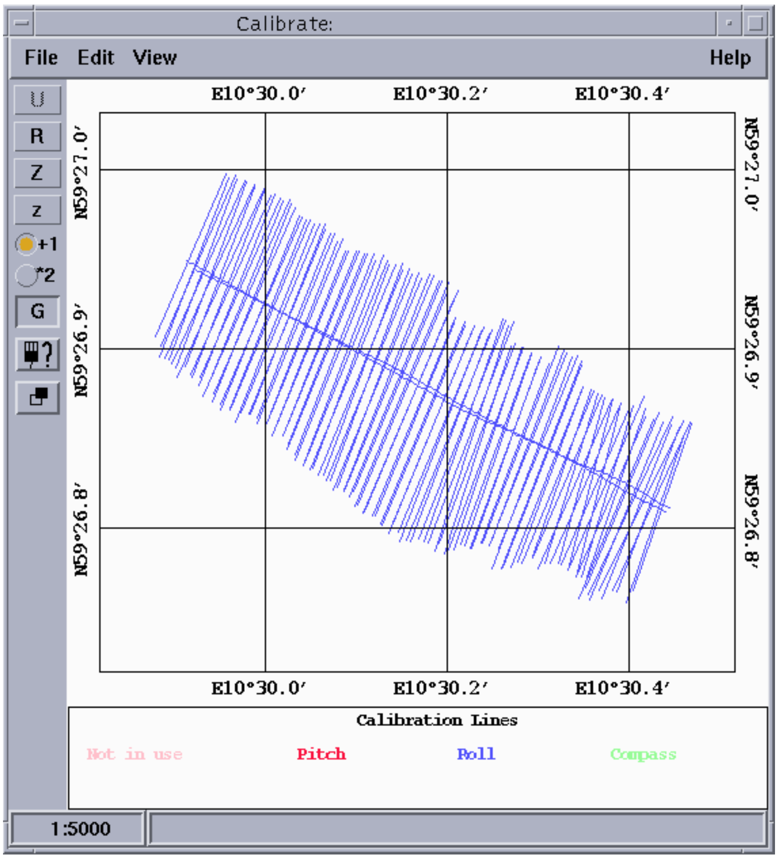


Figure 91 - Calibration main window

10.2 Calibration survey

Introduction

The correct calibration of the vessel attitude sensors and the time delay of the positioning system is vital to the quality of the data collected by the multibeam echo sounder. While modern motions sensors have little or no drift with time, they may fail. The time delay of the positioning system may vary according to system set-up. It is therefore important that the calibration values are checked at regular intervals, say once every month, or at the start of a new survey.

The built-in Calibration utility is used to process data from a calibration survey, usually consisting of one or more sets of overlapping lines as described below. The data should be processed by the Calibration utility, and a depth profile displayed with data from only a narrow corridor you define. This allows a comparison of the data collected on the two lines. Offsets may be found entering corrections into the system and reprocessing the lines to observe the effect of the correction.

Determining a suitable calibration area

On a flat area only roll error will cause significant depth errors. (Sound speed and echo sounder errors are not considered in this discussion.) Thus if the survey is to be run in a reasonably flat area, it may be sufficient to perform roll calibration only. Usually, however, a full calibration is required, and the calibration should then be done so that different sensor errors have no influence on the echo sounder data, except for the one which is to be determined. Note that the positioning accuracy is vital for good calibration results, except for the roll error calibration on a flat bottom. It should also be noted that although heading calibration is in principle possible from echo sounder data, it is recommended to calibrate the heading sensor with the vessel lying along a quay using standard land surveying methods.

The ideal calibration area is partly flat and partly a fairly steep slope with little change in depth acrosstrack, and with a distinct feature such as a peak or hollow in the flat area. If the heading and positioning errors are negligible, the flat area is not required if the slope has a reasonably constant depth acrosstrack.

The slope used for pitch and time delay calibration should have an appreciable relative change in depth from top to bottom, say 30%, if pitch offset and time delay are to be resolved accurately. Note that the slope should not be too steep, say not more than 20°, otherwise the echo sounder could have problems in maintaining good data quality.

Roll offset in the acrosstrack direction

Choose a horizontally flat area (at least acrosstrack). Survey a sufficiently long line twice in opposite directions. Ensure that a sufficient lead-in time to the line is used for the roll sensor to stabilize.

→ *Refer to figure 92 on page 259.*

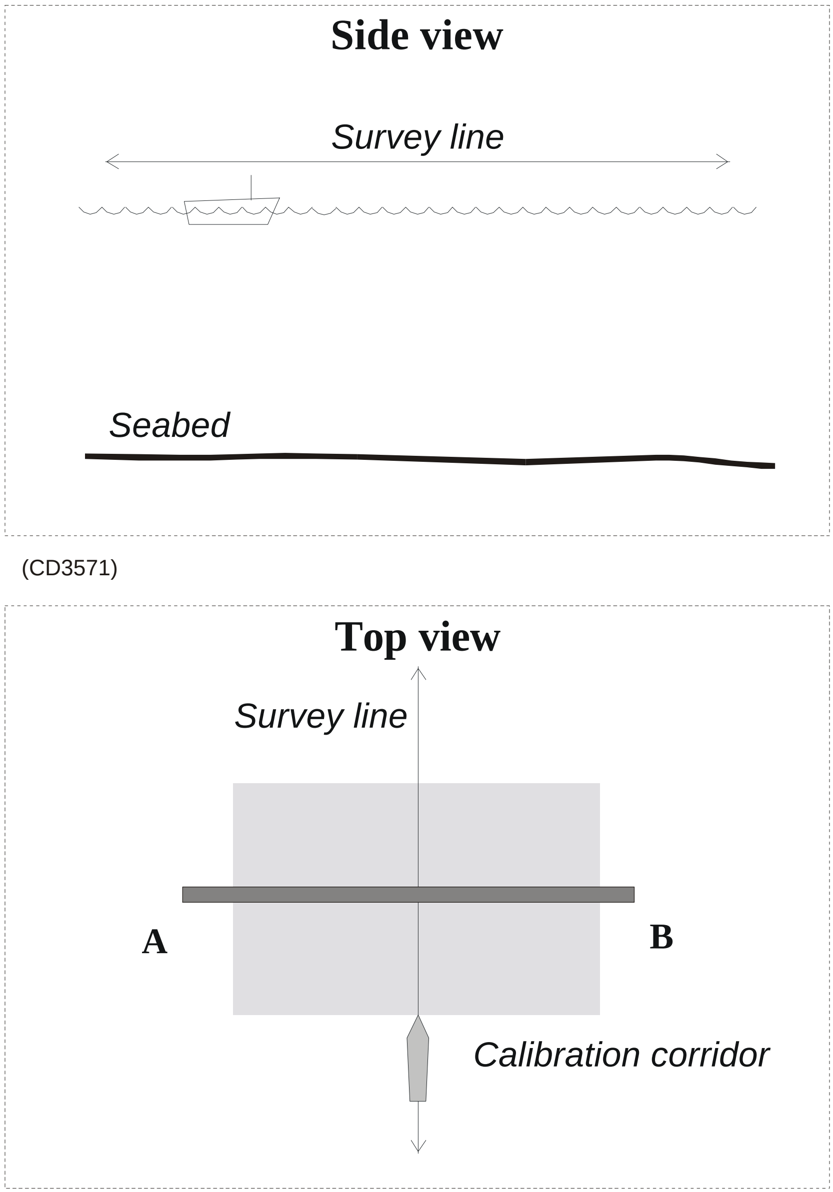


Figure 92 - Roll offset calibration procedure

The corridor used to compare data from the two survey data sets should be placed orthogonally to the survey lines.

If there is a roll offset, there will be a depth difference between the two data sets, linearly increasing with acrosstrack distance from the centre.

Pitch offset and time delay

Choose an area with a continuous but not too steep slope alongtrack. Survey a sufficiently long line twice in opposite directions with the same vessel speed, and once with a significantly lower speed. The direction is not important in the last survey. Ensure that a sufficient lead-in time to the line is used for the pitch sensor to stabilize.

→ *Refer to figure 93 on page 261.*

The corridor used to compare data from the survey data sets should be placed parallel to the survey line on the vessel track.

Any alongtrack depth difference between the runs may be due to four different factors:

- Pitch offset
- Time delay between actual position and position when position datagram supposed to be valid
- Position distance offset (either due to an error in the positioning system or an error in entered locations
- Tide difference

Note that a depth error on a constant gradient slope due to pitch offset, increases with increasing depths, while that due to position time delay increases with vessel speed, and that due to distance offset is independent of depth and speed but varies with slope angle.

Using a profile on the two lines in the same direction, but with different vessel speed, will thus allow the time delay to be found. After the correction has been applied to the data, you can determine the pitch offset from the two lines run in opposite directions. Any distance offset must of course first be removed.

Heading offset

Note: *The best check of the gyro is done with theodolite in the harbour.*

Alternative 1

Run two parallel lines up or down a slope in the same direction, separated, but with overlap in-between. The corridor used for comparison should be placed alongtrack in-between the lines. Any heading offset will give a depth difference between the two lines.

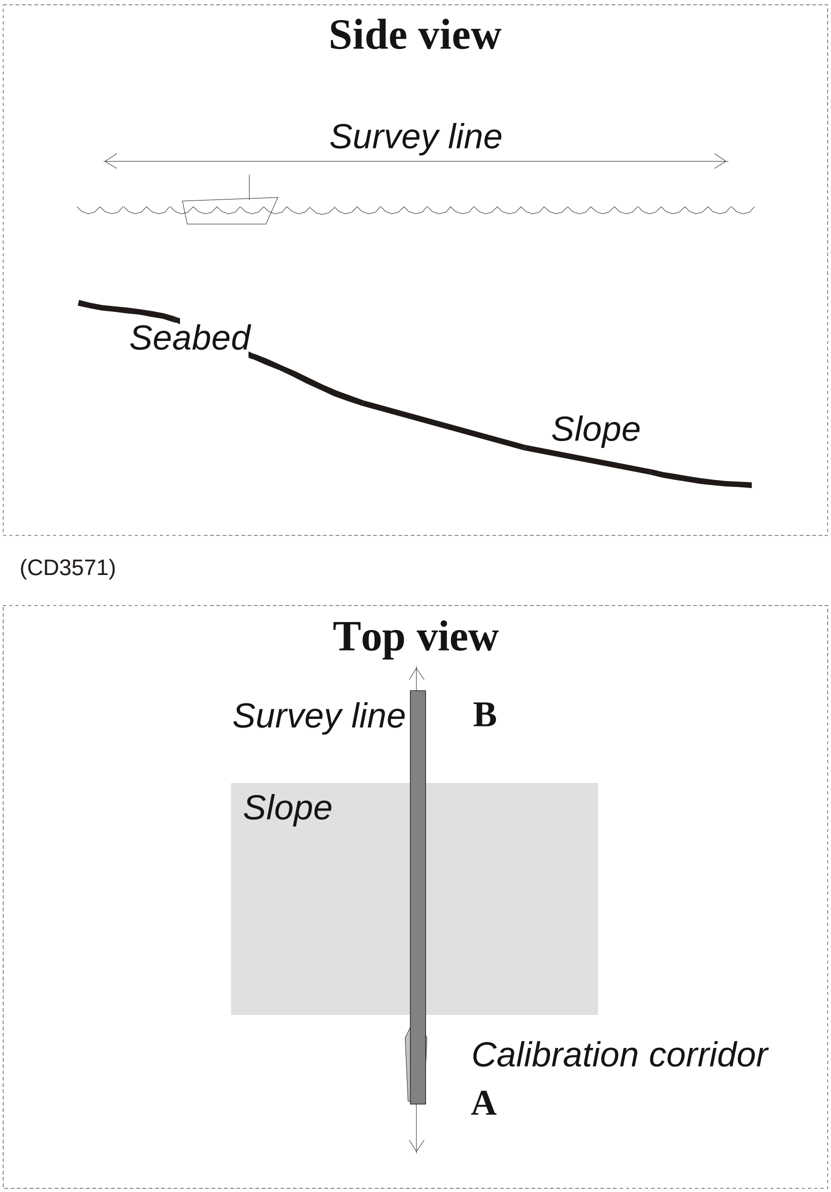


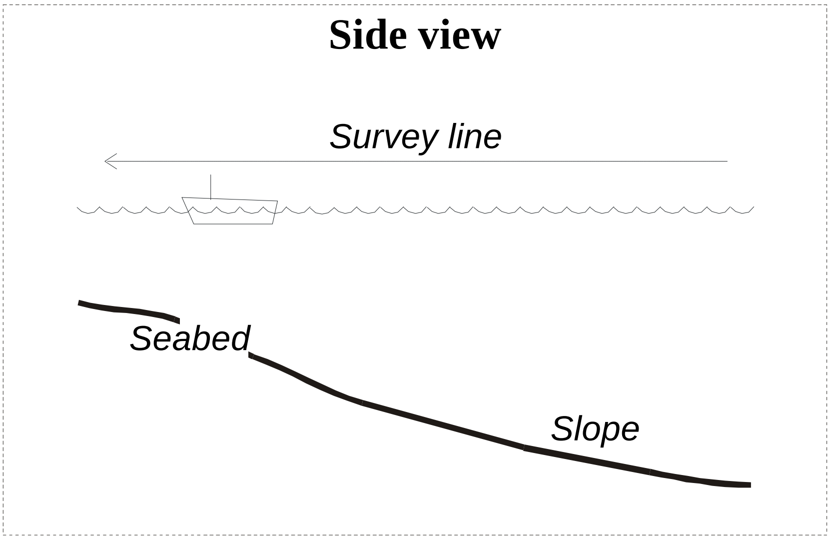
Figure 93 - Pitch offset and time delay calibration procedure

→ *Refer to figure 94 on page 262.*

Alternative 2

Find an easy recognizable point or feature on the bottom such as a peak or a depression. This may be difficult !

Set up **two** survey lines well to opposite sides of this feature so that the point will be in the outer part of the echo sounder swath. Survey these two lines in same direction.



(CD3571)

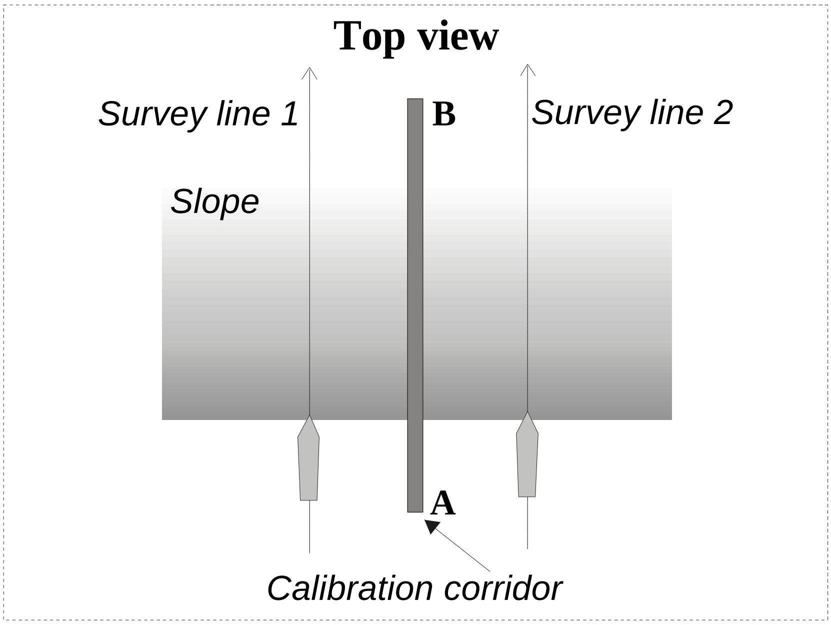
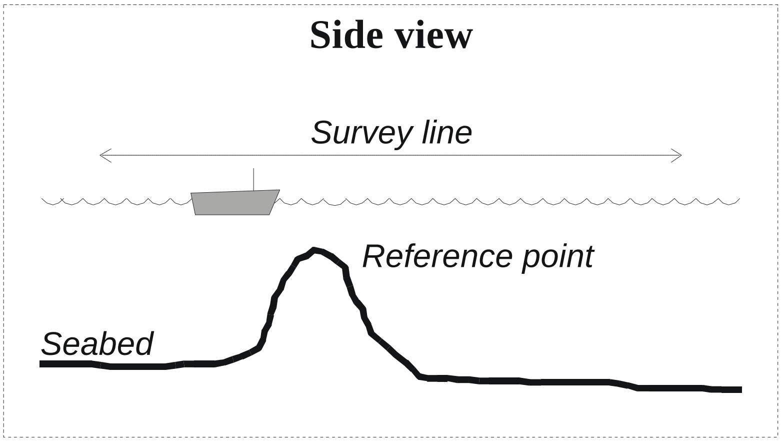


Figure 94 - Heading offset calibration procedure (Alternative 1)

The corridor used to compare data from the two survey data sets should be placed so that it intersects the feature, and is parallel to the survey lines. If there is a heading offset, you will have a different location alongtrack in the two data sets. Note that accurate positions and position time delays are required.

→ *Refer to figure 95 on page 263.*



(CD3572)

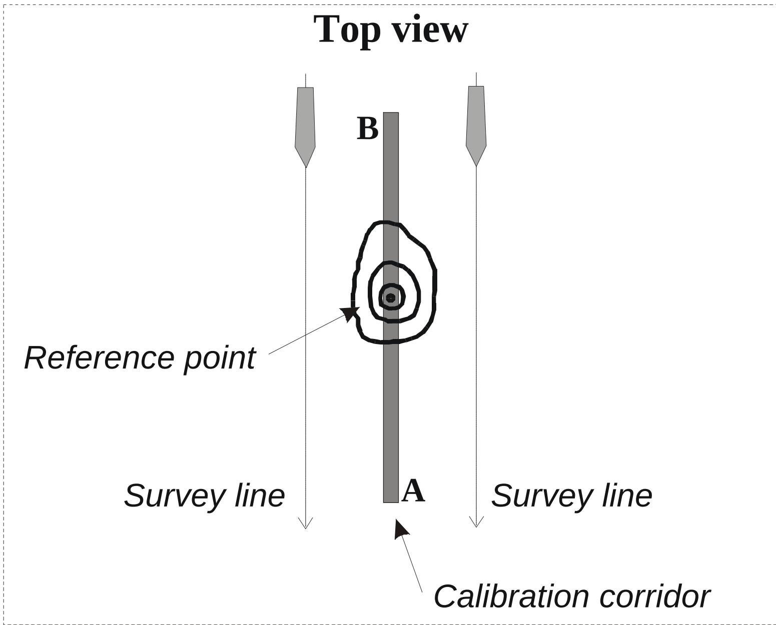


Figure 95 - Heading offset calibration procedure (Alternative 2)

Verification

After the calibration has been completed, we strongly advise you to repeat the procedure for verification. This is especially necessary if you initially had large errors (exceeding 1 - 2 degrees).

Outer beam angle offset calibration

Run two perpendicular survey lines on a relatively flat bottom. The depth should be approximately 50 to 100 meters, and 150 degrees coverage should be used. In the crossover area of the two lines, use the roll calibration utility. Set a calibration corridor along each of the tracklines in figure 96. Any angular error at the points 2, 4, 6 or 8 may be due to errors in

- outer beam angle offset
- sound speed
- roll offset

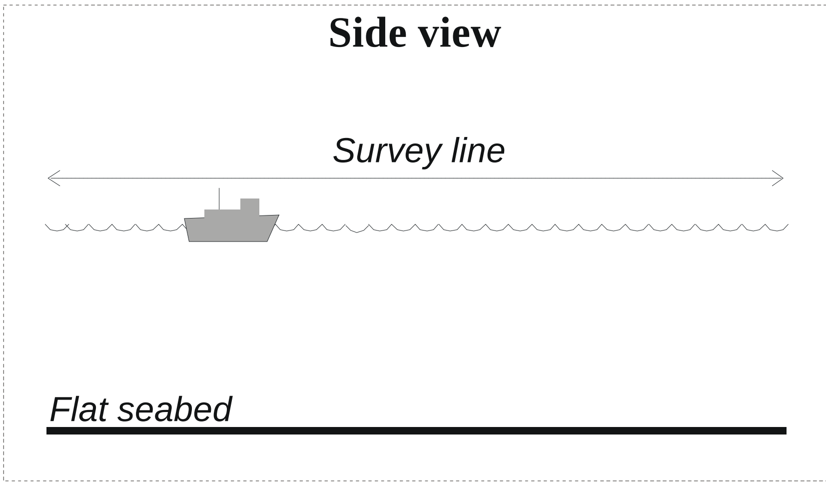
If sound speed and roll offset are correct, determine angular errors by changing the roll offset angle to make the outer beam depths equal at 2, 4, 6 and 8, and take the average of these. If the outer beams are **too shallow** compared to the centre beams, the outer beam angle offset is **positive**, if they are **too deep** the outer beam angle offset is **negative.** Add the outer beam angle offset **with sign** to the outer beam angle offset already used in the installation menu.

Note: *The diagonal through 1 and 9 may be used to check roll offset. Thus a crossline calibration is a good check to see if the system is well calibrated. The outer beam angle offset is critically dependent upon correct roll calibration and correct sound speed calibration. Ensuring that these are correct before doing an outer beam angle offset, is a sound principle.*

→ *Refer to figure 96 for the principles.*

Sound speed control

The same procedure as used for the outer beam angle offset calibration may be used as a check for sound speed corrections. Provided that the roll offset and outer beam angle offsets are correct, any depth deviation between the two lines in the two calibration corridors are due to sound speed errors, either in the used profile, and/or in the sound speed at transducer depth.



(CD 1065)

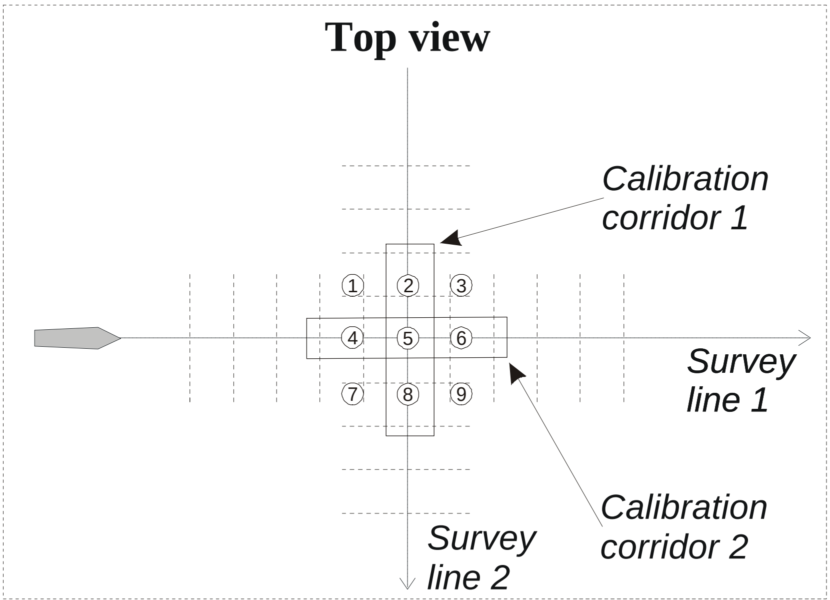


Figure 96 - Offset beam angle calibration

10.3 Command references

Overview

This chapter describes the various commands used throughout the Calibration utility.

The next pages describes the various commands used throughout the Calibration utility, and refers to other descriptions as required.

The following options are available on the main menu:

- File
- Edit
- View
- Help

Each of these menu options have a number of commands available on pull-down menus.

The **Help** option provides on-line help, and is not described.

File

Overview

The **File** option on the main menu bar contains two commands:

- Plot
- Exit

Plot

This menu command activates the **Print** dialogue box, and makes it possible for you to create a hardcopy of the current information shown on your display.

→ *Refer to the description on page 43.*

Exit

When this menu command is selected, the Calibration utility will terminate.

Edit

Overview

The **Edit** option on the main menu bar contains these commands:

- Reset selection
- Keep function
- Position
- Distance
- New line
- Move point
- Move region
- Delete region
- Pitch calibration
- Roll calibration
- Compass calibration

The drop-down **Edit** menu contains the same commands for measuring distances and positions, as the survey display. In addition, there are commands for calibration line definition and manipulation, and commands for initiating a calibration analysis of data along the calibration lines.

The right mouse button is used as an edit button when the pointer is inside the geographical area of the window. Select a menu command with the left mouse button, and then use the right mouse button inside the geographical area to execute the command.

Note: *To work with the calibration lines, they must be visible on the screen. Make sure the **Calibration lines** entry in the **Show/Hide** dialogue box (available from the **View** menu) is checked.*

→ *See **Reset selection** described on page 194.*

→ *See **Keep function** described on page 195.*

→ *See **Position** described on page 196.*

→ *See **Distance** described on page 197.*

New Line

This command is used to create a new calibration corridor. Depth profiles will be made along this corridor.

After this menu command has been selected, a new line is made by placing the pointer at an initial point, pressing the right mouse button and dragging the pointer to where the line should end. The profile will be from where the first point was set and to the point where the mouse button was released.

Move Point

This command is used to drag the initial point or end point of a calibration corridor to a new position.

Use the right mouse button to drag the point. This is useful for changing the direction or length of calibration corridors generated by **New Line**.

Move Region

This command is used to move a calibration corridor and corresponding region to a new position.

This is done by selecting the **Move Region** menu command, and then using the right mouse button to drag the region to another place.

Delete Region

This command is used to remove a calibration corridor and corresponding region.

This is done by selecting the **Delete Region** menu command, and then click on the region using the right mouse button. The region must not be in use.

Pitch Calibration

This command is used to analyze data in the region around a calibration line in order to do pitch and/or position delay calibration.

Use the following procedure:

1 Select two separate lines to use for pitch calibration. These lines should cover the same track, but be in opposite direction.

2 Generate a calibration corridor in the same direction as the two selected lines, and located on the top of the same lines.

3 Select the **Pitch calibration** menu command.

4 Click on the calibration corridor of interest with the right mouse button. This calibration corridor should be parallel to the vessel track, and include a steep slope.

A calibration profile window will appear. This window is explained below.

Roll Calibration

This command is used to analyze data in the region around a calibration line in order to do roll calibration.

Use the following procedure:

1 Select two separate lines to use for roll calibration. These lines should cover the same track over a flat sea floor, but be in opposite direction.

2 Generate a calibration corridor perpendicular to the two selected calibration lines.

3 Select the **Roll calibration** menu command.

4 Click on the calibration corridor of interest with the right mouse button.

- This calibration corridor must be normal to the vessel track.

A calibration profile window appears. This window is explained below.

Compass Calibration

This command is used to analyze data in the region around a calibration line in order to do heading (compass) calibration.

Use the following procedure:

1 Select two separate and parallel lines to use for this calibration.

- When you run your multibeam echo sounder according to these two lines, the covered area must overlap between the lines. In the commonly covered area, you must also make sure that you have an easily identified obstacle, such as a large rock or a wreck on the seabed.

2 Generate a calibration corridor in the same direction as the two selected lines, covering the overlapped area between them.

3 Select the **Compass calibration** command.

4 Click in the calibration corridor with the right mouse button.

A calibration profile window will appear. This window is explained below.

Calibration profile windows

Both **Roll, Pitch** and **Compass calibration** use the same type of window for calibration data analysis. The window appears when one of these commands are used.

The purpose of the window is to display the depth data as found inside the calibration corridor. Data from the two survey lines are displayed simultaneously using different colour for each line. The X-axis represents the distance along the calibration corridor, and goes from the initial point to the end point of the calibration corridor.

→ *The windows are shown in figures 97 and 98 below; one for roll calibration and one for pitch/time calibration. The compass calibration window is similar to the roll calibration window.*

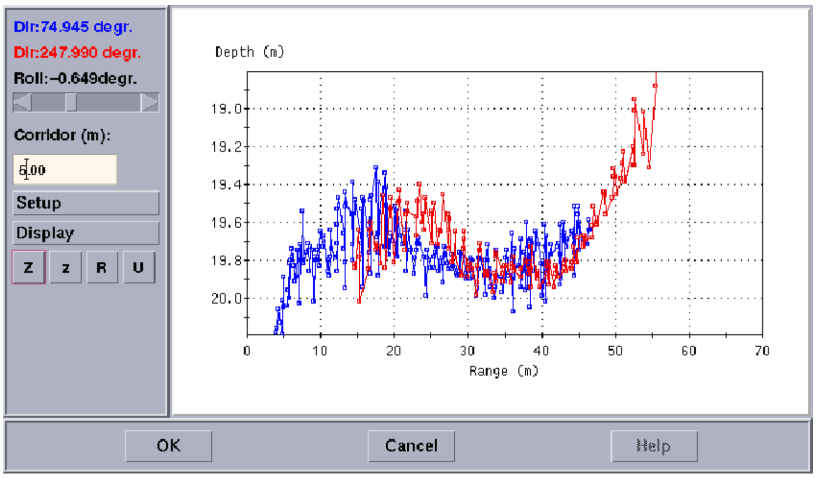


*Figure 97 - Calibration profile window for **roll** calibration*

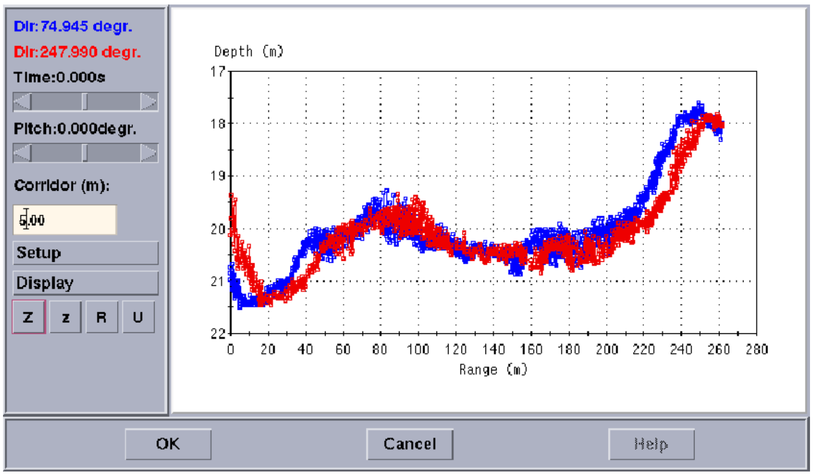


*Figure 98 - Calibration profile window for **pitch/time** calibration*

Window elements

Each window contains the following elements:

- Information and tool bar
- Graphic area
- Control area

On the left hand side of the graphic area the profile window contains the following controls:

Information and tool bar

Dir

This information shows the heading of the two lines. The same colours as applied for the depth profiles, are used to distinguish the two lines.

Slide bars

The two slide bars are used to change the sensor offset values used in the calibration computations.

- The calibration profile window for roll contains one slide bar. This is used to change the offset value for roll sensor data.
- The calibration profile window for pitch/time contains two slide bars. One is used for the time offset of the positions, and the other for the pitch offset.

The current offset values are displayed above each slide bar.

The slide bars are used to change the offset values by dragging the slider, clicking on the arrows (the values change in minor steps) or clicking to either side of the slider (the values change in major steps). The size of the minor and major steps can be set using the **Setup** button described below.

The offset values are added to the recorded data as the profiles are plotted in the graphic part of the window. The recorded data are not changed.

Any offset values set in the installation parameter form are added to the data as they are logged. The calibration module has no knowledge about these offset values. New offset values found using the calibration module on data from this survey may be used to generate new installation offset values by adding them to those already defined in the installation parameter form.

Corridor

The corridor field is a text input field where the distance from the calibration line to the border of the region on both sides can be set.

A corridor value of 10 meters generate a rectangle of width 2*10 meters and length as the calibration line.

Note: *The corridor field already has a value when the Pitch calibration or Roll calibration menu commands is selected from the **Edit** menu. This value may be too high, resulting in too much data to be displayed (which takes time). In order to limit the amount of data, a very short calibration line may be used first, just to bring up the calibration profile window. Then, the corridor value can be adjusted. Close the profile window and start over again, this time using the calibration line length you really wanted to use.*

Setup

This button brings up a new window where the range covered by the slide bars, and minor and major steps used when the arrows or slide bar is clicked, can be defined.

The following values can be set:

- *Min* (minimum of range)
- *Max* (maximum of range)
- *Step*
- *SubStep*

Step is the change made to the value when the mouse pointer is clicked on either side of the slider, and **SubStep** is the change made to the value when clicking on the arrows.

Cancel will close the window without any changes, while **OK** will use the new values.

Redraw

This button is used to force a redraw of the data in the graphical part of the window.

Z Zoom in
z zoom out
R Reset the view to the initial setting
U Undo last zoom

Acceptance

The acceptance area at the bottom of the window holds three buttons.

OK - This button saves the data to the ASCII file *CalibValues* on the processing directory.

Cancel - This button just closes the window without any changes taking place

Help - This button brings up help information about the profile window.

10.4 View

Overview

The **View** option on the menu bar contains these commands:

- Annotation colour
- Show/Hide
- Lat/long format
- Colour mapping

The **Annotation Colours** command presents the Annotation Colours dialogue box, where you can modify the various colours used in your graphical window presentations.

→ *Refer to the description on page 200*

The **Show/Hide** command presents the **Show/Hide** dialogue box, which contains a list of items that may exist in the client area of the geographical window. These items can either be displayed or hidden.

→ *Refer to the description on page 202.*

The **Lat/long format** command allows you to choose the scales along each of the axes in a geographical window. These represent geographical latitude and longitude respectively.

→ *Refer to the description on page 209.*

The **Colour mapping** command allows you to manipulate with the colours in the graphical window.

→ *Refer to the description on page 204.*

Help

The **Help** option provides on-line help.

11 CROSSLINES

11.1 Introduction

The Crosslines application makes it possible to evaluate the data quality of the multibeam echo sounder inside a corridor generated in any direction in the survey area.

An arbitrary number of survey lines can be selected, and the depths in these lines will be visualized inside the corridor as a cross profile. The depth data can be recalculated for new roll and pitch offsets and time delay and the depth changes are visualized directly. The module also recalculates the depth with new sound speed profiles selected by the user. This module is powerful tool for analysing the depth errors generated by inaccuracies or incorrect calibration of the external sensors.

The Crosslines application has in many respects the same functionality as **Calibration**. The main differences are that Crosslines allows re-processing using new sound speed profiles, and allows simultaneous viewing of data in many corridors. In addition, Crosslines is much faster because it only processes the data in and in the near vicinity of the corridors, and it can thus allow many more survey lines than Calibration.

Crosslines is available from several of the geographical displays in the Kongsberg Simrad multibeam echo sounders and postprocessing systems. Crosslines may then be defined and viewed. The survey lines from which data is to be analyzed are selected in the survey display and a crossline is also selected.

11.2 Operational Procedures

To start a new crossline

1. Start the **Survey Display.**
2. Select **Displays.**
3. Select **Create Grid.**
4. Select **Displays.**
5. Select **Grid Display.**
6. Select **Crosslines.**

To save a crossline

1. Select **Save Crosslines** on the Crosslines menu.

To delete a crossline

1. Position the mouse cursor on top of the line you wish to delete, and click once.
2. Select **Delete Crossline** on the Crosslines menu.

To move a crossline

1. Select **Move line** on the Crosslines menu.
2. Position the mouse cursor on top of the line you wish to move, click and hold the right mouse button.
3. Move the mouse cursor to where you wish the crossline to move, and release the mouse button.

To move a point

1. Select **Move Point** on the Crosslines menu.
2. Position the mouse cursor on top of the point you wish to move.
3. Click on the selected point, and hold the right mouse button depressed.
4. Move the mouse cursor to where you wish the point to move, and release the mouse button.

To change the crossline corridor width

1. Use the mouse and click once on the crossline you wish to modify.

2 Select **Change Width of Selected Crossline** on the Crosslines menu.

3 Enter the new width value in the dialogue box.
- The width value is entered in meters.

4 Press **Ok** to apply and close, or **Cancel** to close the dialogue box without changing the width.

To assign a sound velocity profile to a crossline

1 Select **Crosslines** -> **Start displayCrosslines** to open the Crosslines window.

2 In the Crosslines window, select **Assign sound velocity profile to file** from the **Edit** menu.
- The **Set SVP correction** dialogue box appears.

3 Select a survey line in the left list in the **Set SVP correction** dialogue box, and a sound velocity profile in the middle list.

4 Click the **Make pairs** button.
- The chosen pair of the selected survey line and the sound speed profile will be displayed in the right list.

5 Click **Ok** to exit.

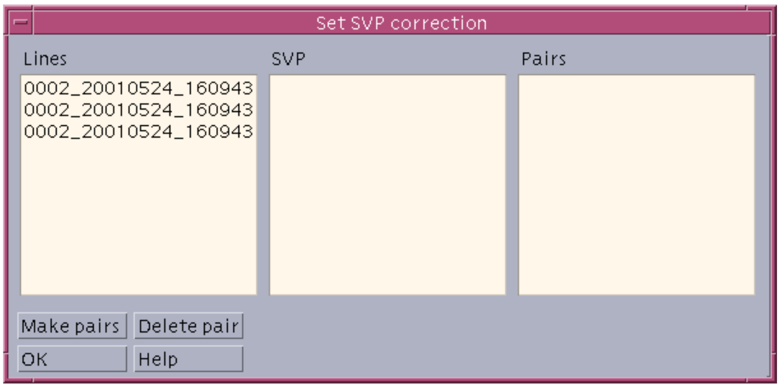


*Figure 99 - The **Set SVP correction** dialogue box*

To delete a pair

To delete a pair, select that pair in the right list and click the **Delete pair** button.

The **Ok** button commits these pairs to be reprocessed.

11.3 Crosslines menu

Overview

The Crosslines utility is accessed as a command, and controlled from a sub-menu. You may find it convenient to “tear off” this sub-menu to place the Crosslines menu in a separate window.

The menu provides the following options:

- New crossline
- Delete crossline
- Move line
- Move point
- Change width of selected crossline
- Save crosslines
- Start display Crosslines

The majority of these commands are uncomplicated, and they are briefly explained below. The **Start display Crosslines** provides a geographical display.

New Crossline

This command is used to create a new crossline.

→ *Refer to page 277 for the procedure.*

Delete Crossline

This command is used to delete a selected crossline.

→ *Refer to page 277 for the procedure.*

Move Line

This command is sued to move a crossline.

→ *Refer to page 277 for the procedure.*

Move point

This command is used to move one of the end points of a crossline.

→ *Refer to page 277 for the procedure.*

Change width of selected crosslines

This command is used to change the width of the corridor along one or more crosslines. Selecting the command presents the **Change Crossline Width** dialogue box, where you can enter the new width.

→ *Refer to page 277 for the procedure.*

Save crosslines

Use this command to save the crossline definitions and the selection of survey lines to a file for later use in the current or other geographical displays. This is not required if the crossline display is entered immediately as the file will then be generated automatically when exiting that display.

→ *Refer to page 277 for the procedure.*

Start display Crosslines

You need to select both at least one survey line and a crossline. Then you must save the crossline selected before you can start the **display Crosslines**.

The Crossline display will run faster with fewer survey lines. You can load maximum 15 crosslines into Crosslines at one time. However, maximum four -4- crosslines can be displayed simultaneously.

11.4 Crosslines window

Overview

In the main geographical window, the crossline number is always displayed in the beginning of the line. In the Crosslines display, the selected line(s) are shown with the names and the corresponding line depths identified using the same colour.

→ *Refer to figure 100 for a Crosslines window example.*

Note: *Note that Crosslines and **Planning** must never be operated simultaneously as the system does not then know which module should receive results from mouse operation in the geographical windows.*

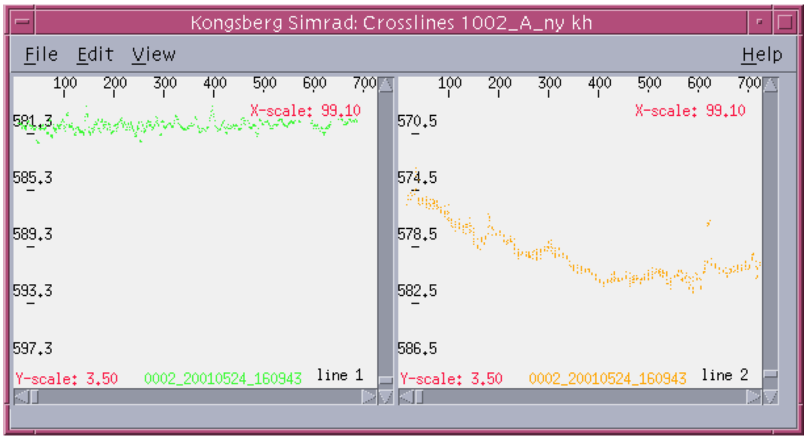


Figure 100 - The Crosslines window

The length of the corridor is shown along the x-axis, and the depth is shown along the y-axis.

The scrollbars can be used to scroll up and down the y-axis and along the x-axis (along the crossline). The maximum alongtrack resolution is 10 centimeters. If the resolution is such that there is more than one depth value with in a range corresponding to a pixel, a vertical line between the minimum and the maximum depth is shown in that pixel.

The Crosslines display provides the following options on the main menu:

- File
- Edit
- View
- Help

File

The only command on the **File** menu is **Exit**. Use this command to close the window.

Edit

You can reprocess the data in the crosslines with new offsets in time, roll and pitch, and he can reprocess the data with new sound speed profiles. The setup for this processing is controlled in the edit menu. Offsets affect all lines in all crosslines.

Set time, roll and pitch offset

You can change the time, roll and pitch offsets. Clicking the **Apply** button processes the data in the crosslines with the new offsets immediately. Otherwise the reprocessing is done after clicking **Apply current values**.

Assign sound velocity profile to file

Each selected survey line can be reprocessed with a different sound speed profile than the one used during the survey. Different profiles may be used for every survey line.

In the left a list all the survey lines selected for this crossline are shown, and in the middle a list of all available sound speed profile files is shown. The profiles must be stored in ASCII format **(*.asvp)**.

→ *A procedure is given on page 278.*

Sound velocity profile editor

This buttons starts the S**ound Speed Profile Edito**r.

→ *This application is described on page 321.*

Save values to file

The current offset values for time, roll, pitch and SVP are written to the file

`$PROCHOME/<survey>/crossSettings.dat`

This is a readable ASCII file.

Apply current values

This reprocesses the crosslines with the current settings for offsets and sound speed profiles.

Show current values

Shows the current values.

View

The view menu is used to control the display.

Assign crosslines to windows

There are four windows defined in displayCrosslines. There can be 15 crosslines at one time. In this interface you can decide which crossline should be displayed in what window. Each crossline is listed with four buttons behind it. These buttons are labeled 1 through 4. Clicking the button 1 in the line for Crossline 1 will display Crossline 1 in window one, and so on. The color of the button will change from blue to green for the window in use.

Windows

You can choose how many windows he wants to see at one time, 1, 2 or 4. With two windows the screen can be split horizontally or vertically.

Display crossline number

This toggles on and off the display of the crossline number.

Data about the crosslines

Some information about the crosslines and the survey lines in the crosslines are available. You are first presented with the interface above. For each crossline information about the crossline itself or about the survey lines inside that crossline can be shown. If you click the **Crossline values** button the following popup window is shown with the crossline number, the length, width and the direction of the crossline. Also the coordinates for the crossline is shown both in projection coordinates and geographic coordinates (decimal minutes):

If you click the **Crossline values** button, a window is shown with the line name, average direction and average speed. Clicking on the **Lines** button displays line name, heading and speed.

Draw lines between depths

This toggles on and off the drawing of lines between depths.

Background black / white

Toggles the background color between white and black.

Noise reduction

Toggles on and off noise reduction. The noise reduction is a low pass filter on the depths along the corridor.

Set scales

You can set the desired scale in the x- and y-direction. The x-direction is centimeters along the crossline and the y-direction is centimeters depth. The y-scale defines how many centimeters depth there is per centimeter on the screen. The x-direction defines how many centimeters along the crosslines there is per centimeter on the screen.

The length of a crossline may vary very much. Therefore the maximum value of the scrollbar can be set to 1000, 10000 of 100000 centimeters. This means that displayCrosslines can display a maximum of 1 kilometer per centimeter on the screen in the x-direction. Setting the correct maximum value for the x-scale makes it easier to operate the scrollbar.

Clicking the button ”Factory defaults” will cause displayCrosslines to calculate a best fit scale in x- and y-direction, based on the current size of the screen, the minimum and maximum depth and the maximum crossline length. Note that it is the longest crossline that defines the scale in the x-direction.

Draw grid

Toggles on and off the drawing of a grid in displayCrosslines.

Line legend

Toggles on and off the drawing of the line name in displayCrosslines.ping

12 PLANNING

12.1 Introduction

A survey is seldom performed without any planning being done beforehand. A comprehensive plan would normally define the following:

- the area to be surveyed
- the survey lines which the vessel must follow
- the direction and order in which the lines are to be run
- the lines required for system calibration
- the location and timing for sound speed profiles

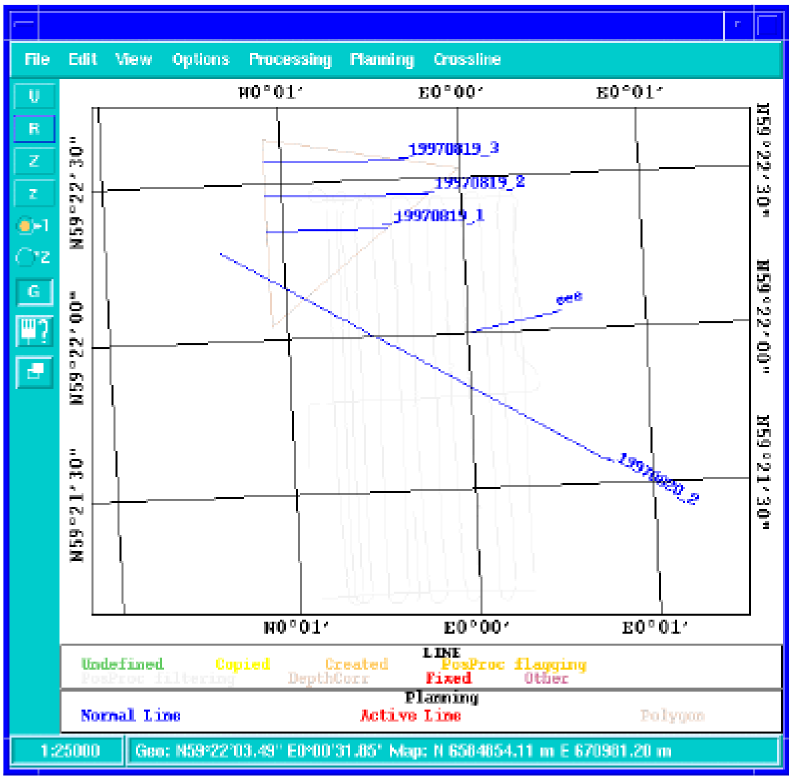


Figure 101 - Survey Display example with survey lines, planned lines and a polygon

The planned lines must take into account islands, coastlines, shoals or other obstacles within the survey area which may limit a safe and efficient survey. The achieveable coverage of the multibeam echo sounder and the overlap required between the neighboring lines is usually used to determine the line spacing.

A fully comprehensive survey plan is most useful in areas of deep waters or where the depth and hence coverage is fairly constant. In shallow waters where the depth changes rapidly and may not even be known well enough aforehand, a comprehensive plan may not be as useful, especially if the survey is to be run with a small and agile vessel. A defined survey area boundary plus a few pre-planned lines for calibration could then be enough, actual coverage as obtained on the spot being instead used to determine where the vessel is to run.

The Planning module allows a survey to be split into sub-surveys or jobs. The survey area boundary may be defined as a polygon with any number of corners, as may areas which are not to be entered. Automatic line clipping at the polygon boundaries and automatic generation of parallel lines is supported. If the area has previously been surveyed, it is possible to import shoal depths from Neptune (BinStat) into the plan.

When the survey is run, planned lines may be activated to generate steering information on the bridge and helmsman displays.

The purpose of the **Planning** utility is thus to provide help before and during the survey.

12.2 Operational procedures

Introduction

These operational procedures cover the main functions available in the **Planning** utility.

To open a job

1 Select **Jobs** -> **Open**.

- A small dialogue box appears. It lists the current jobs available, and allows you to select on.

2 Press **OK**

3 Select the type of coordinates to use.

To save a job

1 Press **Jobs** -> **Save** to save the job.

- The job is automatically saved with the name you defined when you created it.

To create planning lines

The **Planning** utility is started from the main menu on the Survey Grid Display. You may find in convenient to “tear off” the menu, this allows you much easier access to the commands.

1 Select **Jobs** -> **New**.

- A small dialogue box appears to accept your plan name.

2 Type in the job name and the press **OK**

- A second dialogue box appears to accept the format of the coordinates, and a short plan description.

3 Select the correct **Save coordinates as**, enter descriptive text (if desired) and press **OK**.

4 Start line creation by selecting **Lines** -> **New**.

5 Draw the line holding the right hand mouse button depressed.

6 Select the line and select **Lines** -> **Parallels**.

7 Fill in the values and press **OK**.

- You can here create any number of parallel lines for your survey. Enter the the number of lines to port and starboard, and the distance (in meters) between them.

8 Save the job.

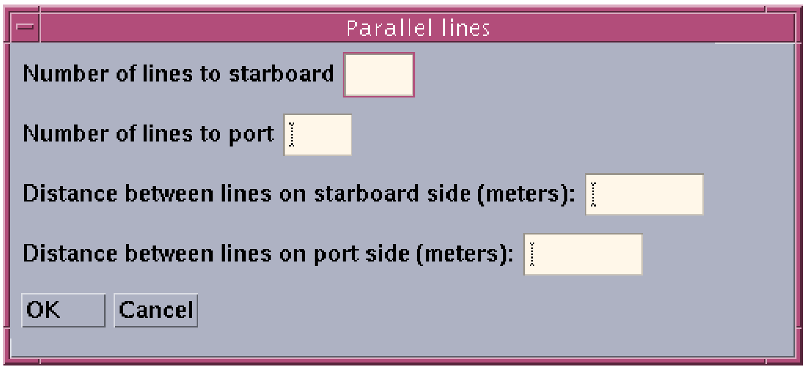


Figure 102 - Creating parallel lines

To create a polygon

1 Select **Planning** -> **Polygons**.

- A submenu appears. Click on the tear-off line to place the menu in a separate window.

2 Select **New** on the submenu.

3 Create the polygon by holding down the right hand mouse button.

- Establish the lines by pressing the middle mouse button at the desired points. When the last point is reached release the mouse button and the program automatically closes the polygon.

4 Save the job.

→ *See page 287 to save the job.*

To draw a line through a polygon

1 Select **Lines** -> **New**.

- Use the right hand mouse button to draw the line.

2 Save the job once more to keep the changes.

To fill a polygon

1 Select both the line and the poygon.

2 Select **Polygon** -> **Fill**.

- Fill in the proper values and press OK. The lines are now inside the polygon borders.

3 Now save the job once more to keep the changes.

12.3 Command references

Introduction

The following commands are available from the **Planning** menu:

- Jobs
- Print
- Lines
- Polygons
- Activate line
- Deactivate line
- Select all lines
- Export selected lines
- Import planned shoals from BinStat

Jobs

Overview

A “job” is a collection of planned lines and possibly one or more polygons. Each job is given a unique name. A job must first be selected as the current job before any other operations can be performed. The selected job can either be new, or you can continue to work on an existing job.

Once you select this option, you are prompted with a submenu:

- New...
- Open...
- Delete
- Options...
- Save

During your work, you may find it convenient to “tear off” this sub-menu to place it in a separate window.

New

Use this command to create a new job. The name of the new job must be written in the text field in the first dialogue box, the **New job** dialogue box. The second dialogue box (**Options**) is used to select how to save the coordinates, and to enter additional job information.

Note: *If you create a new job with the same name as an existing job, the existing job will be deleted and replaced with the new. No warning will be given.*

*Figure 103 - The **New** job first dialogue box*

→ *A procedure explaining how to define a new job (and to create planning lines) is given on page 287.*

Open

Use this command to open a previously defined job. Select a job from lists within the current survey, and click **Ok** to retrieve it.

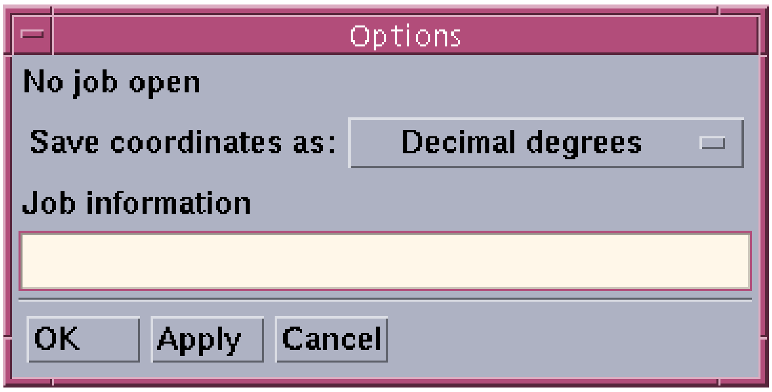


*Figure 104 - The **Options** dialogue box*

→ *Refer to figure 105*

*Figure 105 - The **Open Job** window*

Delete

Use this command to delete a current job. You are given a warning before the system allows you to delete the job.

Options

The **Options** choice on the **Jobs** submenu allows you to define the coordinate format, i.e. the decimal degrees, decimal minutes, decimal seconds or grid (projection) coordinates. The active settings are displayed in the label on top (”Current job is:...”). Additional text information may also be attached to the job. It can be entered and read in the text field labelled **Job information**. Click **Apply** or **OK** to make the selections active.

→ *Refer to figure 104!*

Save

Save writes the planned lines and polygons in the current job to disk. The current job is always saved when you exit the application or changes the current job.

The planning module is available in the **Survey** and the **Grid Display**. A plan made in one module will be available in all the other modules of a system. In case a job is saved in one module while it is being edited in another module, a warning will be given if save or exit is chosen in the other module, to allow you to choose which version is actually to be saved.

Print

This choice allows you to print out the current information in the graphic window.

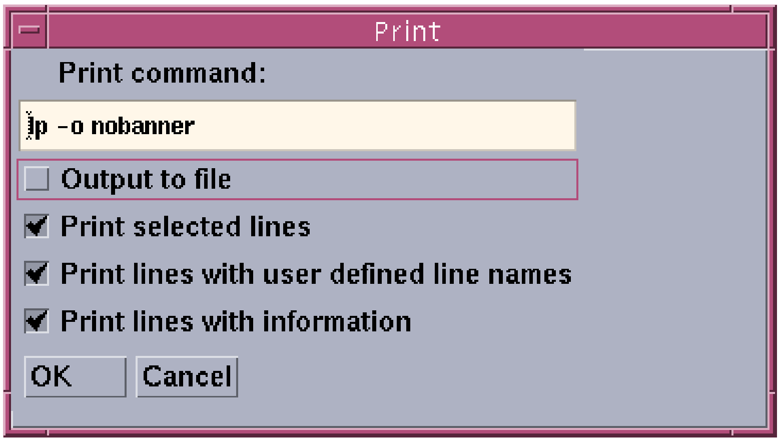


*Figure 106 - The **Print** dialogue box*

→ *This is a common function, and it is described with the operational procedures. Refer to page 43.*

Lines

Overview

The **Lines** submenu is used for all line manipulations such as creation, editing, deletion or selection. The following options are available on the submenu:

- New
- Edit... ->
- Move
- Reverse direction
- Delete
- Parallels...
- Select...
- Cancel selections
- Keep function

New

A new planned line is created by pressing the right mouse button down where the line is to start and releasing it where the line is to end. To create a waypoint in the line, click the middle mouse button where the waypoint is to be, before releasing the right button at the endpoint.

The new line is always given a default linename by the system:

`_YYYYMMDD_nnn`

DD is the day of the month, MM is the month, YYYY is the year, and nnn is a linenumber which makes the linename unique. Note that all system generated line names begin with underscore The name is printed at the end of the line.

Edit...

The **Edit** command presents a sub-menu with the following choices:

- Position editor
- Rename...
- Move point
- Extend

Position editor

Selected lines and polygons (at most 10 lines or polygons at a time) may be edited using the keyboard. The **Edit lines** dialogue box is used for this.

→ *Refer to figure 107*

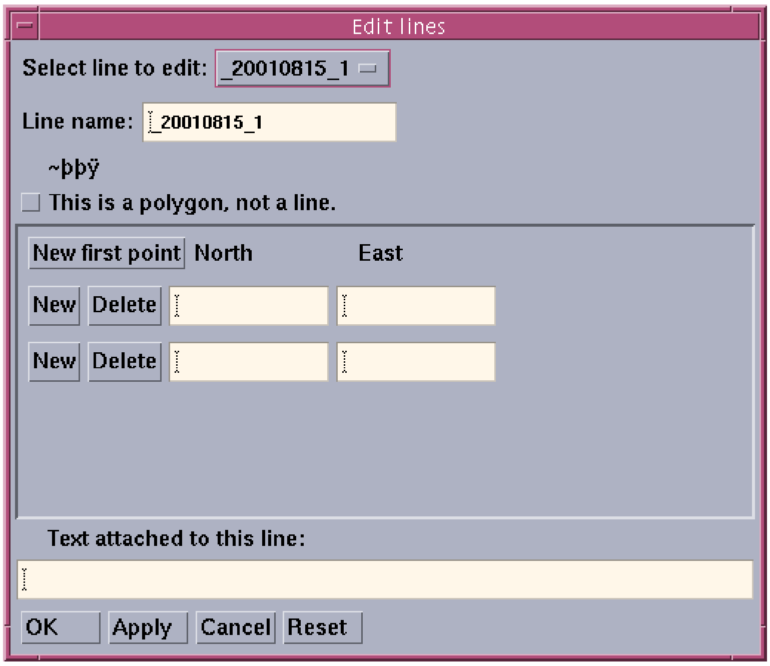


*Figure 107 - The **Edit lines** dialogue box*

The line or polygon to be edited is selected from list containing all selected lines and polygons. A new line is also available in the list, and it may be turned into a new polygon by clicking the toggle button **This is a polygon, not a line**. Line names, point coordinates, and information (text) attached to the line are all editable in their respective fields.

The coordinate format for the points is as defined for the job, and the coordinate format is also written right below the text field containing the line name. When coordinates are entered they should be terminated by clicking the **Enter** button on the keyboard to see that the program interprets the entered value correctly.

Note that decimal minutes usually requires four (or five) digits. i.e. 5903.0 will be read as 59 degrees, 3 minutes (593.0 is 5 degrees, 93 minutes which again is 6 degrees, 33 minutes).

Clicking the **New** button for a point will add a new waypoint after that point or new end point if the point is the last. A new start point in the line may be added by clicking the **New first point** button. Points between the first and last point in the list will be waypoints and may be deleted by clicking **Delete**.

Any changes will not take effect until one of the buttons **Ok** or **Apply** is clicked. All changes are discarded by clicking one of the buttons **Cancel** or **Reset**.

Note: *A line must have at least two coordinates and a line name. A polygon must have at least three coordinates. Any changes are only committed after clicking the button **Ok** or **Apply**.*

<u>Rename...</u>

This command can be used to rename any of the planned lines. You can only rename one line at the time.

<u>Move point</u>

Any point on a line may be moved with the mouse by selecting **Move point**, and then dragging the point to the desired position holding down the right mouse button.

<u>Extend</u>

Extend works like <u>Move point,</u> but a new end point is added from one of the previously selected end points. Any line can be extended by using this command. The end of this line will become a waypoint, and a new endpoint is generated.

Move

Any line may be moved with the mouse by selecting **Move line**, and then dragging the line to the desired position holding down the right mouse button.

Reverse direction

Every line has a defined direction. The line name is shown at the end of the line. You can select any number of lines and change the direction of these lines.

Delete

The selected lines are deleted. Any selected polygons are not deleted.

Parallels...

A user defined number of lines parallel to a selected line may be created by selecting this option. The above popup window is used to define the number of lines to be created on each side of the selected line, and their spacing.

→ *The **Parallel lines** dialogue box is shown in figure 102 on page 288.*

Select...

Lines can be selected by four different criteria through clicking the respective toggle buttons in the dialogue box.

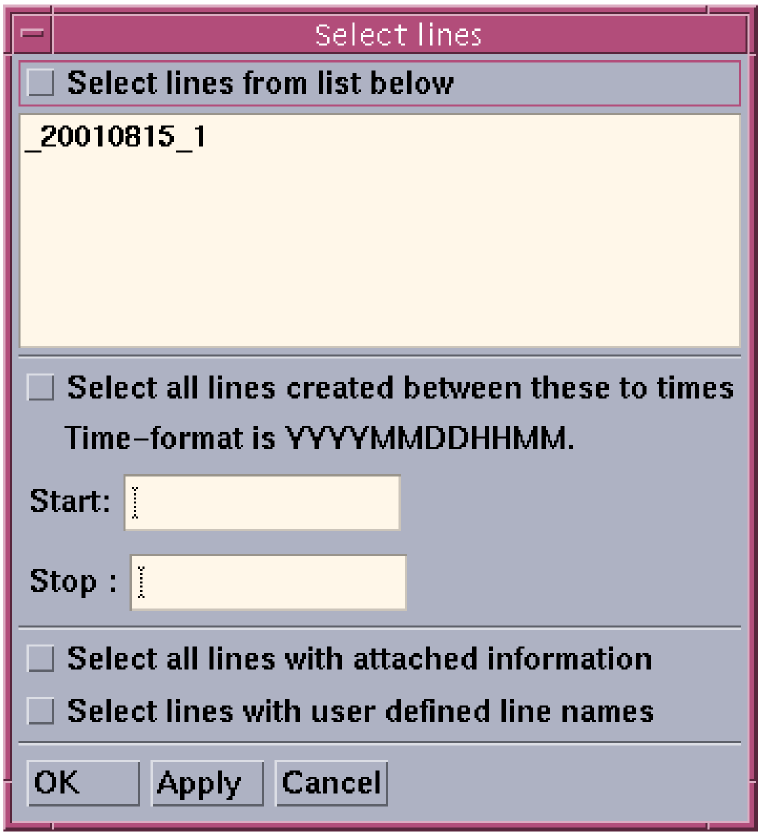


Figure 108 - ***Select Lines*** *dialogue box*

- **Select lines from list below**: lines are selected by clicking on their names.
- **Select all lines created between these two times**: lines are selected through the date and time the lines were created and the entered time limits (the time of creation is stored allthough it is not visible).
- **Select all lines with some information attached**: all lines that have attached information are selected.
- **Select all lines with non-system defined line names**: all lines with user defined names, i.e. names not starting with underscore (_), are selected.

You can choose to use some or all of these options. Click the **Ok** or **Apply** button to select the chosen lines. The sensible number of lines selected at any one time will depend on what is to be done with them.

Note: *Lines can also be selected by standard mouse operations.*

Cancel selections

Use this option to deselect previously selected lines (not polygons).

Keep function

Selecting **Keep function** will allow repetition of the chosen function many times without clicking in the menu. Selecting **Keep function** again allows a new item from the menu to be chosen.

→ *The command is also described in general terms on page 195.*

Polygons

Overview

The following options are available from this submenu:

- New
- Edit
- Delete
- Fill
- Clip selected lines
- Keep function

New

Use this command to create a polygon.

Note: *A polygon must have at least three points. A line from the last point to the first point is generated automatically.*

The name of a polygon is always ”polygon”. A specific polygon can thus only be selected by a standard mouse operation, and only one polygon can be selected at any time.

→ *Refer to page 289 for a procedure.*

Edit

This command presents two choices:

- Position editor
- Move point

Both of these function as for the Lines->Edit command.

→ *Refer to the description on page 294.*

Delete

Deletes the selected polygon. Selected lines are not deleted.

Fill

Use this command to fill a polygon.

→ *Refer to page 289 for a procedure.*

→ *Refer to figure 109 for the Fill polygon dialogue box.*

The selected polygon will be filled with lines parallel to the selected line, and all the lines will be clipped so that the start- and end-point of each line is exactly on the boundary of the selected polygon.

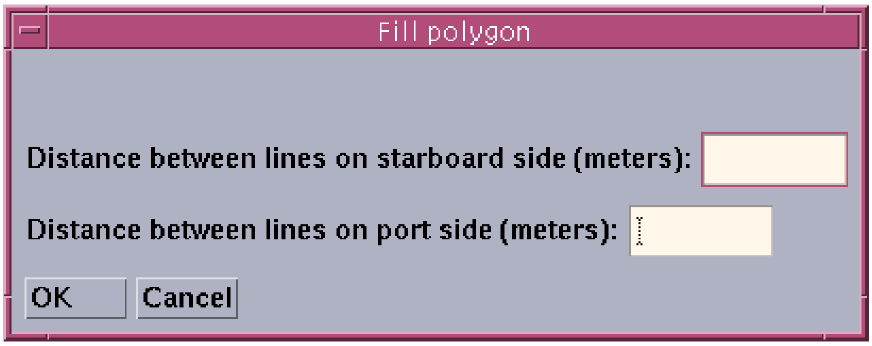


*Figure 109 - The **Fill polygon** dialogue box*

All the lines which are created in this way are given new linenames by the system. There is no point in editing this line (changing the linename or adding information to the line) prior to using it in this operation sincxe they are also given new linenames by the system.

Note: *There is no check on the possibility of creating more than the maximum of 1000 lines allowed in the planning module.*

Clip selected lines

This command presents two choices:

- Keep inside
- Keep outside

Keep inside

The parts of lines which extend outside a polygon's boundary may be deleted by this command. Note that the command will not extend lines to the boundary if they are within the polygon.

All the lines which are changed in this way are given new linenames by the system. So there is no point in editing these lines (changing the linename or adding information to the line) prior to using them in this operation.

Keep outside

The parts of lines which extend inside a polygon's boundary may be deleted by this command. Note that the command will not extend lines to the boundary if they are outside the polygon.

All the lines which are changed in this way are given new linenames by the system. There is therefore no point in editing these lines (changing the linename or adding information to the line) prior to using them in this operation.

Keep function

This command works the same way as the **Lines** -> **Keep function**.

→ *The command is also described in general terms on page 195.*

Activate line

After a line has been selected it can be made active. The active line is usually the current line to survey. The information on the bridge and helmsman's displays will depend on which line is active.

Deactivate line

Deactivates the active line.

Select all lines

Selects all the lines (no polygons are selected).

Export selected lines

You can select any number of lines and polygons and copy these objects to another job by selecting **Export selected lines**. The above popup window is used to select the target job. After the lines have been copied, they are still selected so they can thus for example easily be deleted from the current job.

Note: *Note that this operation may cause the limit of 1000 lines in a job to be exceeded.*

If there are possible duplicate linenames in a job due to the export operation, the exported lines are renamed by adding the extension '_1' or '_2' and so on if the extension already exists(however too many extensions may finally cause an error).

Import planned points from BinStat

In the Neptune BinStat module it is possible to select individual depths and put a flag on them. One of these flag types available is the Manually Planned Shoal. The depth points flagged in this way can be imported to the Planning module by selecting **Import planned points from BinStat.** The dialogue box is used to choose which survey the depth points are to be imported from (this must be done on a workstation running Neptune). Clicking the **Ok** button causes All Manually Planned Shoals created in Neptune BinStat for the chosen survey to be read into the current job.

Each planned shoal will be given a planned line in the planning module. These lines will be approximately 3 meters long and be oriented North-South. The exact location of the planned shoal in BinStat is the middle point of these planned lines. There will be some information attached to each of these lines: the shoal depth, the text 'BinStat', and the survey name.

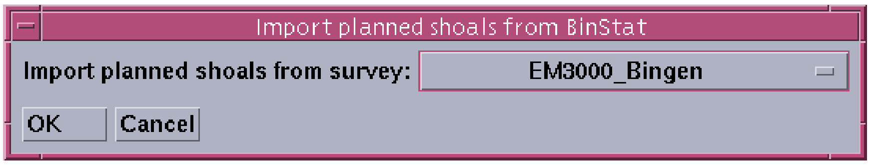


Figure 110 - The ***Import form BinStat*** *dialogue box*

Importing planned shoals from BinStat from the same survey several times will only retain the last imported set, but several sets may be imported from different surveys.

Note: *Note that this operation may cause the limit of 1000 lines in a job to be exceeded.*

13 SONAR IMAGE

13.1 Purpose

The Sonar Image utility displays the seabed image data. For each ping a straight line is plotted, this covers the swath width. The darkness of the display at any point represents the reflectivity of the bottom. The resulting plot (shown below) may be sent to a printer or shown on the screen.

The sonar image display may be set up for correct scaling in both directions. The presentation may also be chose to take into account actual footprint size alongtrack and small heading changes.

This utility may be run in two operational modes:

- Real time mode (on-line while logging of Seabed Image Data is active)

Note: *Data are only drawn in the display while the chosen workspace for this display is active.*

- Replay mode (off-line where data is taken from a previously logged line). A line selection box is then available.

(JPG017)

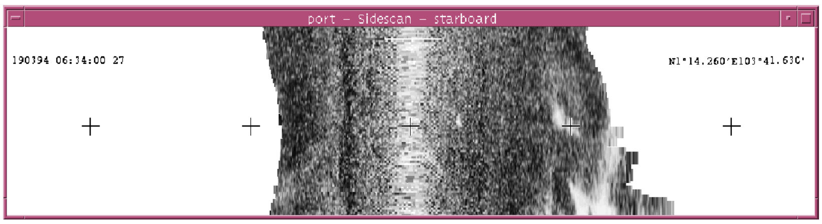


Figure 111 - The Sonar Image window

The Sonar Image is shown in the figure above. Black represents high reflectivity, and white low reflectivity. Time and position is printed out as annotations at given intervals. The depth of the centre beam is also printed.

When activated, the Sonar Image utility presents an opening dialogue box to collect the required parameters. After the parameters are defined, you press the **Continue** button to see the images.

13.2 Sonar Image windows

The parameter window

The **Parameter** window contains a wide range of settings.

→ *These are described on page 307.*

The sidescan window

The **Seabed** window presents the graphical result of the processing.

13.3 Operational procedures

To start the Sonar Image

Select the following command sequence in the Survey Display:

1 Select **Processing** on the main menu.

2 Select **Sonar Image** on the drop-down menu.

This opens the Sonar Image dialogue box.

There is one small difference in this dialogue box between the two operational modes: In replay mode, a push-button to select the line to be replayed is added to the top of the dialogue box.

The current settings of the dialogue box are used as defaults when the utility is restarted later on the same survey.

To exit Sonar Image

The dialogue box stays open as long as the Sonar Image utility is active. To exit from the Sonar Image utility:

1 Press the **Exit** button at the bottom of the dialogue box.

To select a line in Replay mode

Refer to the Sonar Image utility dialogue box.

1 Identify the **Line Name**, label and button at the top of the dialogue box.

2 Press the push- button and a selection box appears.

3 Select the line to be replayed by pointing at it in the list, and press the left mouse button.

4 Press **Ok** at the bottom of the box, and the selection box is closed.

or:

Press **Cancel** to close the selection box without any changes.

The name of the selected line is written on the line selection push-button. In this way you will see which line is being replayed. To select another line, just press the push-button again and the selection box will appear again.

13.4 Command references

Overview

As previously described, the Sonar Image opens with the **Ss real-Time** dialogue box, while the sidescan window only presents the graphic result.

The settings to be made in the **Ss real-Time** dialogue box are described on the following pages.

Parameter settings

Introduction

The Sonar Image dialogue box contains a number of buttons and selectors used to generate the image.

(JPG016)

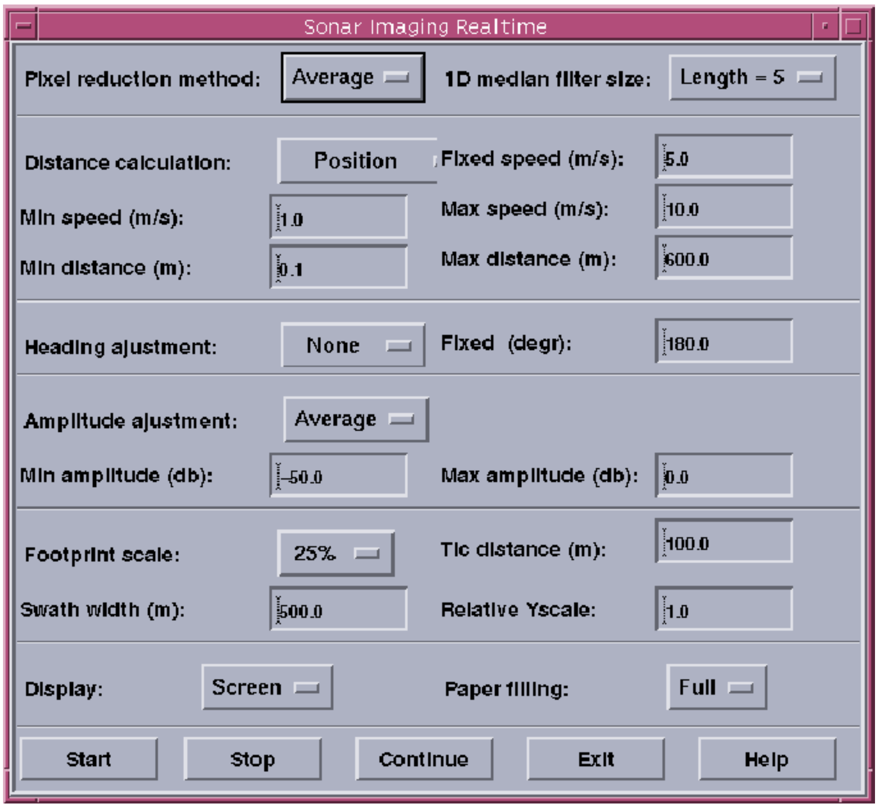


Figure 112 - The Sonar Image parameters

Line selection

This button is used to select a survey line in Replay mode.

Note: *This button only appears in **Replay** mode. It is not shown on the illustration above.*

The line to be replayed is selected in a similar way as a file is selected from a file selection box. A procedure is presented in the previous chapter.

Pixel reduction method

This setting is used to select which method to use for representing multiple data values by one pixel. Each pixel may cover multiple data values and the following alternatives exist for deriving the pixel value:

Average - The average of all samples.

Last - The last sample is displayed.

Max - The maximum sample is displayed.

Min - The minimum sample is displayed.

1D median filter size

This option allows you to set the window size of a filter to replace the central data value in the window with the median of all values falling into the window.

You can set up this median filter to filter the samples of a single ping. The filter moves from port to starboard side, and the filter length (the number of values in the filter at the same time) can be selected among the given values.

Distance calculation

This button gives you four ways to calculate the alongtrack scaling, and you can select one of the options below:

- Pixel steps
- Fixed speed
- Vessel speed
- Position

Pixel steps

The alongtrack movement consists of moving one pixel line forward in the display buffer. This means that no real geographical scaling takes place in the alongtrack direction, but just a pixel by pixel forward movement for each ping. No further scaling is thus possible, it is only a relative visualisation.

Fixed speed

You can use fixed speed to calculate the position of the pings, and thus the placement of the pixels in the display. If this option is selected, you will have to define the fixed speed to be used. The value should be in meters/second, and it must be entered in the text input field to the right of the **Fixed speed (m/s):** label.

Vessel speed

The vessel speed, as found in the position datagram, is used for calculation of the alongtrack position (recommended).

Position

The positions, as found in the position datagram, are used for calculation of the alongtrack scaling.

Jump limits

These settings are used to define the limits which the system will accept as "jumps" in position and speed. You can set these values in the text fields to the right of the following labels:

- Min speed (m/s):
- Max speed (m/s):
- Min distance (m):
- Max distance (m):

Heading adjustment

This setting allows you to select how the vessel's current heading is obtained.

The vessel's heading is used to calculate where the Sonar Image samples are placed on the display as the vessel change its course and thereby rotates the swath around the line direction. The following options are available:

- None
- Fixed
- Line
- Average

None

No rotation due to heading changes are used. The swaths are positioned 90 degrees to the line forward direction.

Fixed

A fixed heading direction is used, and you will have to fill in the heading direction in decimal degrees in the text field to the right of the label **Fixed (degr.):**. The line direction is then given, and the vessel heading is used to find the rotation of the swaths relative to this fixed line direction.

Line

The line direction in the multibeam data is used.

This option is not usable in the EM1002.

Average

The average of the last measured heading values are used as the line course. The value of the current ping is used to find the rotation of the swath relative to the average line direction found from the last measured heading values.

Amplitude adjustment

This setting is used to select how the amplitude strength is presented in the display.

The displayed data represents the amplitude strength of the Sonar Image samples. The way to scale the amplitude on the display can be set by the following methods:

- Fixed
- Average

Fixed

A fixed amplitude scale is used, and you can define the minimum and maximum of the scale. The scale is in dB.

The Min and Max values are set to the right of the labels **Min amplitude (db):** and **Max amplitude (db):** respectively.

Average

The average of the received amplitude over the latest pings are used to scale the display automatically. The dynamics of the data are then kept, but the amplitude level is not possible to read from the display. This gives a relative picture of the reflectivity.

Footprint scale

This setting is used to define the fraction of the actual alongtrack footprint of the echo sounder used for the display. You can select **None** or a percentage.

The footprint is the area on the bottom covered by the sound pulse. Since the footprint is larger alongtrack at the outer beams than at the centre of the swath, the same area may be measured with the outer beams for several pings. This may blur the display presentation at the outer part of the swath.

This variation along the swath will also be reflected on the display. The outer samples will fall into several pixel cells, while at the centre of the swath some pixel cells may have no data. These missing data will be shown on the display as white lines between the swath lines covering the centre area.

You may wish to fill the pixels in between the swath lines to make the output more homogeneous. It is then possible to increase the displayed footprint fraction to broaden the fore-and-aft display of the swath.

The footprint fraction can be set to be any of the above values. 100% represents the same size as the real alongtrack transmit beamwidth.

Swath width

The width across the entire display (plot) can be set here. This is done by entering the desired width in meters to the right of the label **Swath width (m):**.

Tic distance

This setting allows you to so set the distance (in meters) between distance annotations.

The display and the plot has tic marks to indicate distances. The tic marks shows the distance along as well as across the track, and the distance between the marks is the same in both directions.

The tic distance is entered as a number to the right of the label **Tic distance (m):**.

Relative Y-scale

This option is used to set a factor to compress or stretch the alongtrack scale.

If the number is 2, the scale in the fore-and-aft direction is 2 times the scale in the acrosstrack direction. This means that the image is compressed in the fore-and-aft direction compared with the acrosstrack direction.

The value 1 is used for 1:1 scaling between along and across directions.

The scale factor is written in the text field to the right of the label **Relative Yscale:**.

Display

This option is used to select the output medium for the Sonar Image; screen and/or printer.

The Sonar Image will be sent to the screen and optionally to the printer. Select the screen option if only the screen is wanted. To use the printer option, a printer and a printer interface must exist. With this option, both output media will be used.

Paper filling

The paper on the Raytheon grayscale recorder can be used in full scale, or just in half scale. This means that the pixels are doubled in size when full scale is used.

Acceptance

Start - Press this button to start the display or plot. A new window will be created (if it is not already on the screen) where the Sonar Image is displayed. If the printer option has been selected, the image is also sent to the printer.

Stop - Push this button to stop the display or plot.

Continue - Push this button to continue processing after a stop command. The display continues from the stop position, but new settings of the dialogue box are applied, if they have been changed.

Exit - Use this button to exit from the Sonar Image utility. This button closes down the display and the dialogue box.

Help: This button provides on-line help.

14 SEABED VIEWER

14.1 Purpose and description

The Seabed Viewer is designed to display seabed image data in a scrolling window. It displays one line per ping, and does not perform geographical corrections with regard to the vessel's heading and speed. The display can be used as a simple quality check of the data, or it can be used for object detection.

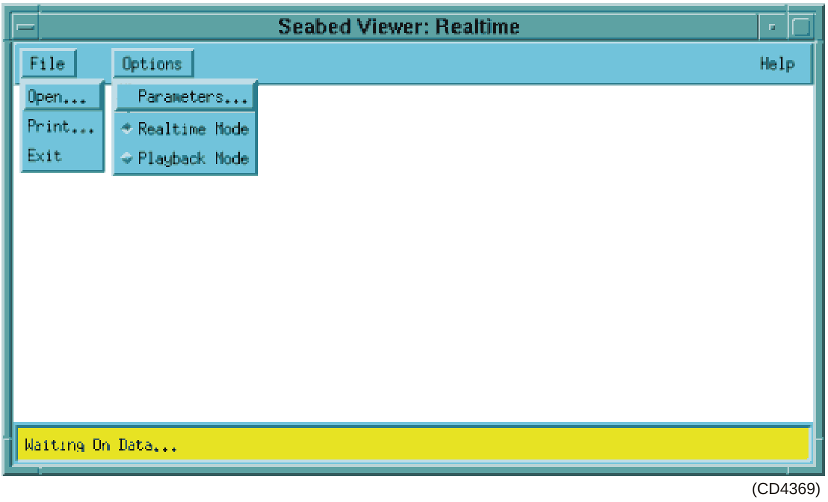


Figure 113 - Seabed Viewer - main window

The Seabed viewer does not require data logging of seabed image data to disk to be enabled. It draws data even if the workspace it is in, is not active. It cannot however be scaled correctly alongtrack, or take into account footprint size or loading changes. In comparison to the Sonar Image Display, it is thus better for online use, esecially to check and set gain effects, and for immediate views of interesting activity, and object detection in shallow waters.

14.2 Main window

The Seabed Viewer window contains the following main elements:

- Menu bar
- Graphic presentation of the seabed image data
- Information bar at the bottom of the display

The following commands and options are available from the the Seabed Viewer main menu bar:

- File
- Options
- Help

The menu options and the respective commands attached to them are explained in the *Command References* chapter on page 317.

The Seabed Viewer window is shown in figure 113.

14.3 Operational procedures

To start the Seabed Viewer

The Seabed Viewer is started from the EM 1002 Launchpad with the dedicated icon.

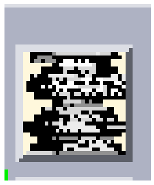


Figure 114 - The Seabed Viewer icon

To exit the Seabed Viewer

The Seabed Viewer is closed as follows:

1 Select **File** on the main menu bar.

2 Select **Exit** on the pull-down menu.

To open a file for replay

When you have chosen to operate the Seabed Viewer in playback mode, you can open a file to view.

→ *Refer to description of how to select Playback mode on page 318.*

1 Select **File** on the main menu bar.

2 Select **Open** on the pull-down menu.

3 Select any ***.all** file on your system.

Playback control

Once a file has been loaded for replay, you can play, stop or fast forward through the data.

1 Select **Options** on the main menu bar.
2 Select **Parameters** on the pull-down menu.
3 Use the three buttons "tape recorder" buttons in the lower section of the dialogue box for play, stop and fast forward.

Replay speed

You can control how fast the data are replayed.

1 Select **Options** on the main menu bar.
2 Select **Parameters** on the pull-down menu.
3 Use the **Update frequency** slider to choose the preferred speed.

Amplitude control

You can control the amplitude both in playback and realtime mode, or you can set it to control itself automatically.

1 Select **Options** on the main menu bar.
2 Select **Parameters** on the pull-down menu.
3 Set **Amplitude** to **Manual**.
4 Use the **Minimum amplitude** and **Maximum amplitude** sliders to choose the preferred minimum and maximum values.

   or

5 Set **Amplitude** to **Automatic**.

Swath width control

You can control the swath width both in playback and realtime mode, or you can set it to control itself automatically.

1 Select **Options** on the main menu bar.
2 Select **Parameters** on the pull-down menu.
3 Set **Swath Scaling** to **Manual**.
4 Use the **Swath Width** slider to choose the preferred values.

   or

5 Set **Swath Scaling** to **Automatic**.

Colour control

You can control the colours used both during playback and realtime mode.

1. Select **Options** on the main menu bar.
2. Select **Parameters** on the pull-down menu.
3. Set **Palette** to any of the four options available.

14.4 Command references

Introduction

This chapter describes the various commands used throughout the Seabed Viewer application.

The following options are available on the main menu:

- File
- Options
- Help

Each of these menu options have a number of commands available on pull-down menus.

The **Help** option provides on-line help, and is not described.

File

Overview

The **File** option on the main menu bar contains these options:

- Open
- Print
- Exit

Open

Use this to select a file to replay data from. This can only be used in playback mode. The file selected must be a raw data file (with extension **.all**).

→ *Refer to page 41 for a description of the* ***File Selection*** *dialogue box used to open files.*

Print

This menu item is used to select which printing device to use. The choices are:

- Alden 975
- HP DeskJet
- No Hardcopy

A hardcopy is generated while the survey data is displayed on the screen.

→ *Refer to page 43 for a description of the print process.*

Exit

When this menu command is selected, the Seabed Viewerprogram will close.

14.5 Options

Overview

The **Options** menu on the main menu bar in the Survey Display contains these commands:

- Parameters
- Realtime Mode
- Playback Mode

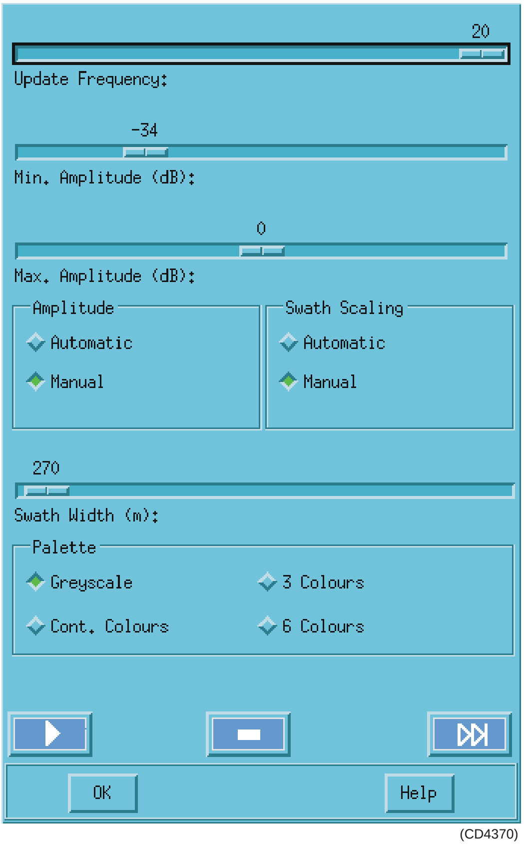


*Figure 115 - The **Parameter** options*

Parameters

When you select **Parameters...** on the **Options** menu, a dedicated window opens to present you the choices. You can control the following functions:

- Playback speed (Update frequency)
- Amplitude
- Swath width

- Screen colours

In addition, you have access to the three control buttons for playback mode:

- Play
- Stop
- Fast forward

Playback speed

Update frequency - This option is only available during playback mode. It specifies how fast data will be replayed. A higher number means faster replay of data.

Amplitude

Minimum Amplitude(dB) - Use this slider manually to select the minimum amplitude to be displayed. This option will not be available if Automatic Amplitude has been selected.

Maximum Amplitude(dB) - Use this slider to select the maximum amplitude to be displayed. This option will not be available if Automatic Amplitude has been selected.

Amplitude - Select Automatic if you want the program to change the minimum and maximum amplitude levels according to the current data. Changing this to Manual allows you to use the slider bars described above to change the mininimum and maximum levels.

Swath width

Swath scaling - Select **Automatic** if you prefer automatic scaling of the swath width. Selecting **Manual** allows you to use the slider bar to select the width.

Swath Width (m) - Use this slider to select the swath width. This is only possible when **Swath Scaling** has been set to **Manual**.

Screen colours

Palette - Use this to select which colour coding to use for the seabed image data.

- **Greyscale** - Display data with different shades of grey according to amplitude.
- **Continuous Colours** - Use a continous palette going from blue to green to red. Blue is low amplitude and red is highest amplitude. Only the colour is changed, not the intensity.
- **3 Colours** - Split the amplitude range into three regions: blue, green and red. The colour intensity is changed in each region, going from light to dark before transition into next region.

- **6 Colours -** Same as **3 Colours**, except that six colours are used: blue, cyan, green, yellow, magenta and red.

Playback control

[PLAY] - Start display of data. This option is only available in Playback Mode.

[STOP] - Pause display of data. This option is only available in Playback Mode.

[FF] - Fast forward. Jump forward through the data. This option is only available in Playback Mode.

Acceptance

OK - Saves the chosen parameters and closes the window.

Help - Provides on-line help.

Realtime Mode

Select this when you want to display realtime data. The data are then retrieved from the Survey Display application.

Playback Mode

Select this to display raw data from files. In order to achieve this, you must also select a file with the command **File** ->**Open**.

15 SOUND SPEED PROFILE EDITOR

15.1 Purpose and overview

The purpose of the SSP Editor is to:

- Edit or inspect existing sound speed profiles
- Create new sound speed profiles

The following commands and options are available on the main menu bar:

- File
- Edit
- Options
- Help

15.2 Main window

Basic window elements

The SSP Editor main window contains the following elements:

- Menu bar
- Edit area (the large area on the right hand side)
- Command area (on the left hand side)
- Information bar at the bottom of the display

The middle mouse button can be used to modify the view in the Edit area.

The menu bar

The menu bar contains the following options:

- File
- Edit
- Options
- Help

These menu options and the respective commands attached to them are explained in the *Command References* chapter.

→ *Refer to page 329.*

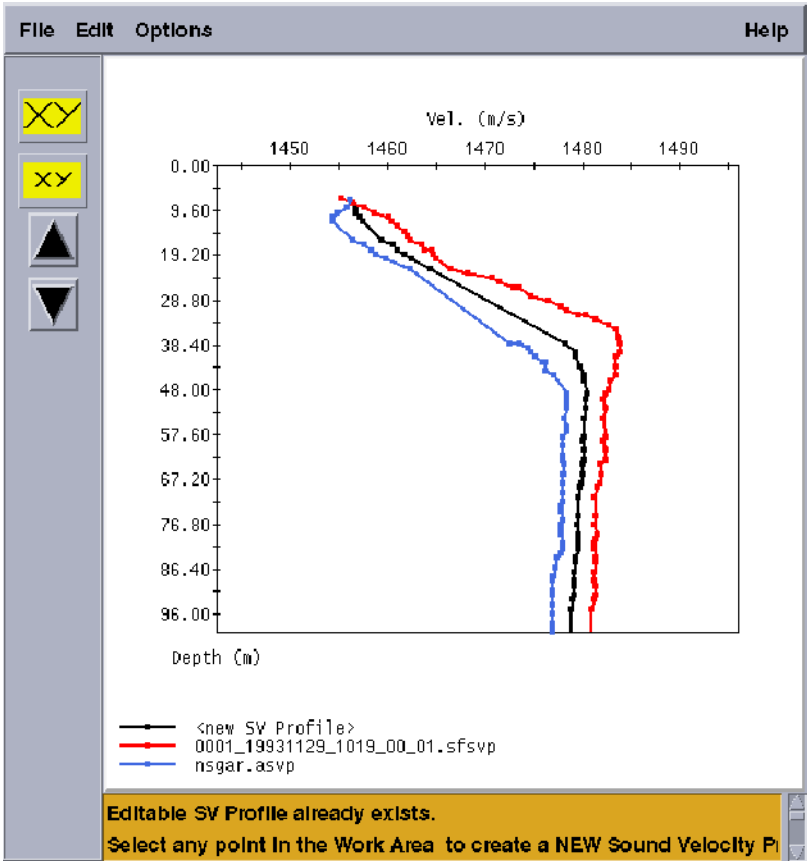


Figure 116 - The SSP Editor main window

The Edit area

The **Edit** area is the large area on the right hand side of the window. It has two axes:

- One horizontal axis along the upper edge of the area with a sound velocity scale.
- One vertical axis on the left hand side with a depth scale.

The sound velocity profiles are displayed as curves in this coordinate system.

Each profile is a sequence of points. These have coordinates with increasing depth values. Straight lines connect the points. The points are emphasised as small bullets on the curve.

The SSP Editor can operate with a maximum of three sound velocity profiles at one time:

- One **Editable profile**
- Two **Static profiles**

Only the editable profile can be saved to disk. The two static profiles are only auxiliary profiles used to create new editable profiles. They are read in from the hard disk, may be changed locally in the edit buffers, but can not be saved to disk.

The profiles are identified by their colour. The editable profile is black. The two static profiles are red and blue respectively. The profile names (file name if a profile is loaded from the hard disk, or the text <New SV Profile> if the profile is just created in the editable buffer) are shown at the bottom of the edit area, using the same colour codes as for the profile curves.

→ *Please remember to save your original sound velocity profile file! You need this original file if you later want to recalculate the sound velocity. The SVP Editor uses this original file when doing the recalculation.*

The Command area

Overview

This area on the left hand side contains push buttons for zooming and for panning up and down in the edit area.

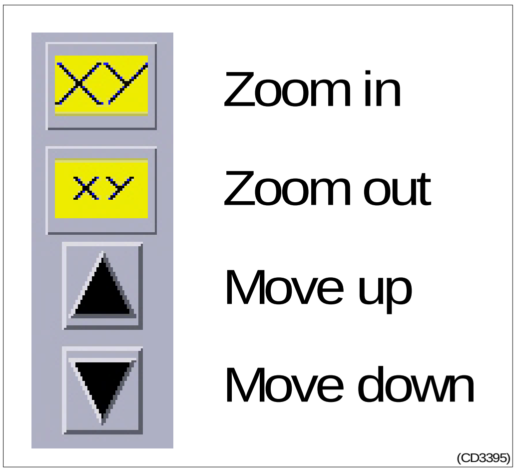


Figure 117 - The Command buttons in the SSP Editor window

Zoom in

This button is used to zoom in on the Edit area, i.e. to bring the diagram "closer to" you. The parts of the diagram which are close to the edges disappear from view. Pushing this button repeatedly (up to a maximum of 20 times) will each time bring the diagram closer.

Zoom out

This button is used to zoom out of the Edit area, i.e. to bring the diagram “further from” you. This gives the opposite effect as the **Zoom in** button.

Move up

This button is used to move the Edit area window upwards relative to the depth scale. The profiles will correspondingly be adjusted downwards on the screen.

Move down

This button is used to move the Edit area window downwards relative to the depth scale. The profiles will correspondingly be adjusted upwards on the screen.

Communication area

This area at the bottom of the window (yellow background) presents communication and acknowledge messages from the system.

Mouse operation

The middle mouse button may be used to pan the edit area in any direction. Place the mouse pointer anywhere in the edit area and drag in the wanted direction. The profiles will move in the opposite direction; the idea being that the edit area is a window limiting the view on the profiles “below”. This window is “dragged” to a new position. The shift middle mouse button zooms into an area.

15.3 File formats

The SSP Editor operates on files, and accepts two different file formats:

1. The Kongsberg Simrad Survey format, identified by the **sfsvp** file name extension, is a binary format used for files generated during logging. These files contain the profiles actually applied in the real-time computations giving each sounding depth and position values. These files may only be loaded into the static buffers, and are consequently protected against being changed by the editor.
2. The ASCII format, identified by the **asvp** file name extension, contains a file header and a sequence of depth/velocity value pairs in plain ASCII text. These files may be loaded into both types of buffer.

15.4 Operational procedures

Windows

The SSP Editor operates with a single window:

- SSP Editor

This window is referred to as the *main window* in this document. In this window, you can view the sound speed profiles.

Start and exit

To start the SSP Editor

The SSP Editor is started from EM 1002 as follows:

To exit the SSP Editor

The SSP Editor is closed as follows:

3 Select **File** on the main menu bar.

4 Select **Exit** on the roll-down menu.

- The application will close. If you have forgotten to save the profile in the editable buffer, the editor will present a warning.

Open, create and save

To open existing sound speed profiles

1 Select **File** on the main menu bar.

2 Select **Open Editable** if you wish to open an existing sound speed profile and put it in the editable buffer.

or:

3 Select **Open Static** if you wish to open an existing sound speed profile and put it in one of the static buffers.

4 Select the appropriate profile in the dialogue box.

5 Press **OK** to retrieve the file.

- The profile is loaded into the buffer, and presented in the Edit area. The profile in the editable buffer is black, while the profiles in the static buffers are red and blue.

Note: *Profiles in the static buffers can not be saved on disk. Do not perform any changes in these profiles unless you can copy the profile to the editable buffer for saving.*

To create new a sound speed profile

1 Select **File** on the main menu bar.

2 Select **New profile** if you wish to create a brand new profile from scratch.

3 Place the mouse pointer in the edit area.

- It will get a cross hair shape. The depth and speed co-ordinates will be shown as continually updated numbers following the mouse pointer.

4 Click the left mouse button to create a new point in the sound speed profile.

- The point is created at the current pointer position.

5 Repeat until a new sound speed profile is created.

To save a sound speed profile

Note: *You can only save a profile from the editable buffer. This profile is identified by its black colour.*

1 Select **File** on the main menu bar.

2 Select **Save as** on the roll-down menu.

3 Navigate up and down the file structure to select the desired catalogue.

4 Click **OK** to save.

Modify and delete

To empty a profile buffer

1 Select **File** on the main menu bar.

2 Select **Quit editable profile** to emty the editable buffer

or:

To delete a profile from disk

1 Select **File** on the main menu bar.

2 Select **Delete**.

3 Select the appropriate profile in the dialogue box.

4 Press OK to delete the profile.

To modify a profile

To move a point

1 Select **Edit -> Move point** on the menu bar.

2 Place the circular mouse pointer on the point you want to move. Press the left mouse button and keep it pressed.

3 Drag the point to a new position.

4 Release the left mouse button when the new location is reached.

While the left mouse button is pressed, the mouse pointer will be shaped as a cross-hair, and the depth and speed co-ordinates will be shown as continually updated numbers. Rubber lines connect the point to the neighbouring points on the curve. When the mouse button is released, the point will get a new position equal to the current pointer position.

After the move has been finished, the pointer reverts to its circular shape, and another point may be moved in the same way.

To add a point

1 Select **Edit -> Add point** on the menu bar.

- The mouse pointer gets a circular shape.

2 Click the left mouse button to select the profile.

- The mouse pointer now takes the shape of a cross-hair, and the depth and speed co-ordinates will be shown as continually updated numbers following the mouse pointer.

3 Click on the position you want for the new point.

- The profile is redrawn to include the new point.

After the point has been added, the mouse again reverts to its circular shape, and another point may be created in the same way.

To remove a point

1 Select **Edit -> Remove point** on the menu bar.

- The mouse pointer gets a circular shape.

2 Click the left mouse button on the point you want to delete.

- The point is immediately deleted, and the profile will be redrawn without it.

After the point has been deleted, the mouse pointer keeps its circular shape, and other points may be removed in the same way.

3 Reselect **Edit -> Remove point** on the menu bar to switch off the function.

To adjust the speed

1 Select **Options -> Parameters** on the menu bar.

2 Fill in the applicable data in the **Parameters** dialogue box. Close the box when all the parameters have been defined.

→ *The **Parameters** dialogue box is described on page 334.*

3 Select **Edit -> Adjust velocity** on the menu bar.

- The mouse pointer gets a circular shape.

4 Click the left mouse button on the point or profile you want to adjust.

- The profile is redrawn using the adjusted speed value(s).

The mouse pointer keeps its circular shape, and other points may be adjusted in the same way, or the adjustment repeated for the same point or profile.

5 Reselect **Edit -> Adjust velocity** on the menu bar to switch off the function.

<u>To combine two profiles</u>

1 Select **File -> Quit Editable Profile** on the menu bar to delete the profile in the editable buffer.

2 Make sure that your two static buffers contain the two profiles to be combined.

3 Click the left mouse button anywhere in the edit area.

- The new editable profile will then be drawn.

<u>To copy a profile</u>

1 Select **File -> Quit editable profile** on the menu bar to delete the profile in the editable buffer.

2 Click the left mouse button on the profile you wish to copy.

- The new editable profile will then be drawn.

→ *Refer page 333 for further information.*

15.5 Command references

Introduction

This chapter describes the various commands used throughout the SSP Editor application.

The following options are available on the main menu:

- File
- Edit
- Options
- Help

Each of these menu options have a number of commands available on pull-down menus.

The **Help** option provides on-line help, and is not described in detail

File

Overview

The **File** option on the main menu bar contains the following options:

- Open Editable
- Open Static
- New Profile
- Save
- Save As
- Quit Editable Profile
- Quit Static Profile 1
- Quit Static Profile 2
- Delete
- Exit

Open Editable

This option is used to open a Sound Velocity profile file in order to make changes to it in the edit buffer.

The **Read SV Profile** file selection box appears. This box provides a list of all the available Sound Velocity profile files in the profiles directory. Select a profile and click the **OK** button.

The selected profile is loaded into the edit buffer, and presented in the edit area. Black colour is used both for the line graphics and annotation values (if turned on). This profile may later be saved to the hard disk.

Open Static

This option is used to open a Sound Speed profile and load it into one of the static edit buffers. It brings up a file selection box listing all the available Sound Speed profile files in the profiles directory.

The File Selection window is explained on page 41. Select a profile and click the **Ok** button.

The selected profile is loaded into one of the static edit buffers and presented in the edit area. Red or blue colour is used both for the line graphics, and annotation values (if turned on). The colour depends on which of the two static buffers that contain a profile.

Static profiles can not be saved to the hard disk. An attempt to open more than two static profiles will automatically result in a warning message.

New profile

This option allows you to draw a new sound Speed profile in the Editable buffer.

This menu command allows you to create a completely new sound Speed profile. After this command has been selected, place the mouse pointer in the edit area where it will get a cross hair shape. The depth and Speed co-ordinates will be shown as continually updated numbers following the mouse pointer.

Each time you click the mouse with the left mouse button, a new point in the sound Speed profile will be created at the current pointer position.

Save

This option allows you to save the content of the editable buffer using the original file name.

Save As

This option allows you to save the content of the editable buffer to another (new) file.

This menu command brings up the **Save As** window which is basically an ordinary file selection box. Click in the **Sound Speed Profile** text input field, and enter the file name from the keyboard. The **asvp** file name extension will be appended automatically, unless entered manually. Select the **OK** button or push the **Enter** button on the keyboard to save. Select **Cancel** to exit without saving.

Quit Editable Profile

This option is used to empty the editable profile buffer (identified by a black colour) without saving it. This must be done before a new profile can be created or loaded into this buffer.

Quit Static Profile 1

This option is used to empty the first static profile buffer (identified by a red colour). This must be done before a new profile can be created or loaded into this buffer.

Quit Static Profile 2

This option is used to empty the second static profile buffer (identified by a blue colour). This must be done before a new profile can be created or loaded into this buffer.

Delete

This option allows you to remove a sound Speed profile file from the hard disk.

This menu command brings up the **Delete SV Profile** window which is an ordinary file selection box. Select the file you want to delete from the **Sound Speed Profiles** list box, or enter the file name directly into the **Sound Speed Profile** text input field. Click **OK** to delete the file. This brings up a confirmation dialogue box where you have to confirm the deletion before it is effectuated. **Cancel** closes the **Delete SV Profile** box without any file being deleted.

Note: *Only profile files in ASCII format may be deleted.*

Exit

This option closes the SSP Editor.

A warning is issued if the content of the editable buffer has been changed, without subsequently having been saved to the hard disk.

Edit

Overview

The **Edit** option on the main menu bar contains two commands:

- Move point
- Add point
- Remove point
- Adjust velocity
- Combine SV profiles
- Copy SV profile

These menu commands allow you to make changes to the profiles currently existing in one of the three edit buffers. The first four commands operate on any of the buffers, while the last two commands creates a new profile in the editable buffer from one or both of the static buffers. Changes made to the static buffers can not be saved to the hard disk, and has thus only meaning as a preparatory step for one of the last two edit commands.

The selection of one of the **Edit** menu commands makes this command the current edit command. The current command can be applied repeatedly until another edit command is selected.

Move point

This option is used to change the position of a point on one of the three profiles.

→ *The procedure is presented on page 326.*

Add Point

This option allows you to add a new point to one of the three profiles.

→ *The procedure is presented on page 327.*

Remove Point

This option allows you to delete a point from one of the three profiles.

→ *The procedure is presented on page 327.*

Adjust Velocity

This option is used to add a preset adjustment value to the velocity coordinate of a point on one of the profiles, or to the velocity coordinate of all points in a profile.

The preset adjustment value is set in the **Parameters** dialogue box available through the **Options -> Parameters** menu command. You must here decide if the adjustment should be applied to a single point or to all points in a profile.

→ *The **Parameters** dialogue box and it's options are described on page 334.*

→ *The procedure is presented on page 327.*

Combine Sound Velocity Profiles

This option is used to create a new profile in the editable profile buffer. In order to combine profiles, two static profiles must be present and the editable buffer must be empty.

If the two static profiles have different sound velocity values at common depths, the mean sound velocity values will be used in the new profile. Otherwise, all points in the two static profiles will move to the new profile unaltered.

→ *The procedure is presented on page 328.*

Copy Sound Velocity Profiles

This option is used to create a new profile in the editable profile buffer. This new profile is identical to one of the static profiles, possibly adjusted by a constant pre-set velocity value for all depths.

The editable buffer must be empty.

The mouse pointer gets a circular shape. Click, using the left mouse button, on the static profile you want to copy. The new profile will then be created in the editable buffer.

If you want this profile to be adjusted by a constant value for all depths, the **Velocity Adjustment** option in the **Parameters** dialogue box (available through the **Options->Parameters** menu command) should be set to **All Points**.

If this option is set to **None**, or the adjustment value is zero, the new profile will be situated on top of the original. To let the system know which profile is meant when you select one of them, a lock mechanism may be used which will disallow the selection of specific profiles. If one of the profiles is locked, the other will be selected. Profiles are locked using the **Parameters** dialogue box.

Options

Overview

Options on the main menu bar contains the choices:

- Parameters
- Reset Windows
- Show Profile

Parameters

Overview

This dialogue box, shown below, is brought up by selecting the **Options->Parameters** menu command.

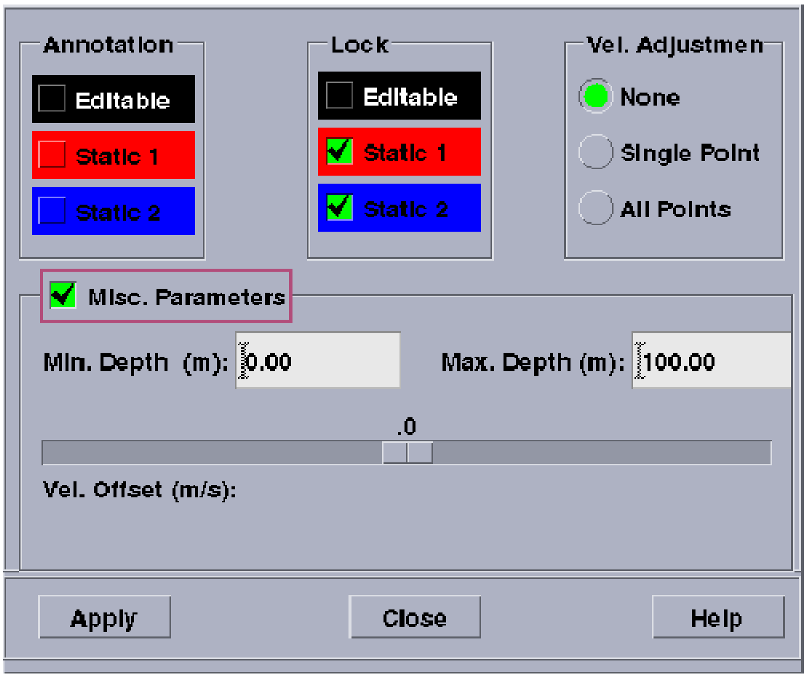


*Figure 118 - The **Parameters** dialogue box*

The dialogue box contains the following controls:

Annotation

These settings are used to turn the display annotations for each profile ON or OFF.

A check button is provided for each profile buffer. If the annotations for a profile is turned ON, a check-mark with green background is displayed. Click on the check button to change its state.

Lock

These settings make it possible to prevent the selection of profile points or whole profiles by edit commands.

A lock may be set on any of the three profile buffers. A check button is provided for each edit buffer. A check-mark with green background indicates a locked buffer. Click on the check button to change its state.

A lock may be set on an edit buffer if profiles have overlapping (or nearly overlapping) points. Set a lock on the profile which you don’t want to select to ensure that the other profile is selected when clicking on the overlapping points.

Vel.Adjustment

These buttons are used to control how the speed adjustment is applied when you use one of the **Adjust Velocity** or **Copy SV Profile** commands.

These radio buttons are used together with the **Vel. Offset** slide bar contained in the **Misc. Parameters** part of the dialogue box.

- When the **Adjust Profile** command is applied, and the **Single Point** radio button is ON, the speed for the selected point is adjusted by the **Offset** parameter value.
- If the **All Points** radio button is ON, the adjustment takes place for all the points on the profile.
- Selecting the **None** radio button disables the **Adjust Velocity** command.
- If speed adjustment is required when the **Copy SV Profile** command is applied, the **All Points** radio button must be selected.

The selected radio button is emphasised by a green colour.

Misc.Parameters

This setting is used to open or close the lower part of the dialogue box. This part contains fields for setting the depth range of the edit area, and a slide bar for the **Offset** parameter.

Min Depth (m)

Set the lower limit (most shallow) of the depth range for the edit area.

Max Depth (m)

Set the upper limit (deepest) of the depth range for the edit area.

Vel. Offset (m/s)

Set the speed adjustment value used by the **Adjust Velocity** and **Copy SV Profile** edit commands.

Apply

Press this button to implement the new parameter settings.

The edit area is redrawn to reflect any changes in the options or parameter values. The minimum and maximum depths parameters are checked, and a warning will be issued if they are not accepted. The dialogue box remains open.

Close

Press this button to close the ***Parameters*** dialogue box without implementing any changes to the options or parameter values made since last time the **Apply** was pushed.

Note: *If changes are made without using the **Apply** button before closing the dialogue box, the changes will not be implemented. However, the changed settings will remain in memory, and be displayed in the **Parameters** dialogue box when it is opened again. The displayed settings may thus not allways correspond to the actual situation.*

Help

This button is provided to give help on how to use the *Parameters* dialogue box.

Reset windows

This option is used to reset the scales along the axes to the original setting. Any panning and zoom operation since the SSP Editor was launched is undone.

Show Profile

This option is used to display the whole profile. This will normally cover all depths from the surface and down to 12000m. The profile is normally extended down to 12000m by the echo sounders operator station.

Help

This opens the online-help system.

16 REPLAY

16.1 Introduction

Replay is an application used to replay raw data from multibeam echo sounders and generate new survey data used by Kongsberg Simrad hydrographic programs.

Replay can convert echo sounder data from both old echo sounders and new echo sounders. If you want to convert new echo sounder data, choose the option EMX. EMX is a common term for all new echo sounders including EM3000, EM2000, EM1002, EM300 and EM120. It is also possible to select replay from older multibeam echo sounders, if you so wish, then choose the option EM1000/EM12/EM950.

The converted data will be placed in a survey of your choice, either a new or an existing one. If you place the data in a new survey, you are advised to initiate the survey with a projection of your choice. If you select an existing survey, you may change the projection already used in the survey, and will therefore be warned if this is unwanted.

16.2 Why use replay?

You can specify the name of the raw data directory, and select the replay speed.You have two modes when using replay. This can either be slowly, as if the data are arriving in real time from the echo sounder, or quickly to convert raw data to survey format.

16.3 Operational procedures

How to start Replay

This program is started from the EM 1002 by the following procedure;

1 Place the cursor in the background part of the display image in the **Common Desktop Environment.**

2 Press the middle mouse button.

- A small menu is displayed on the screen.

3 Choose **Check/Replay data.**

→ *The Replay dialogue box can be seen in figure 119 on page 339!*

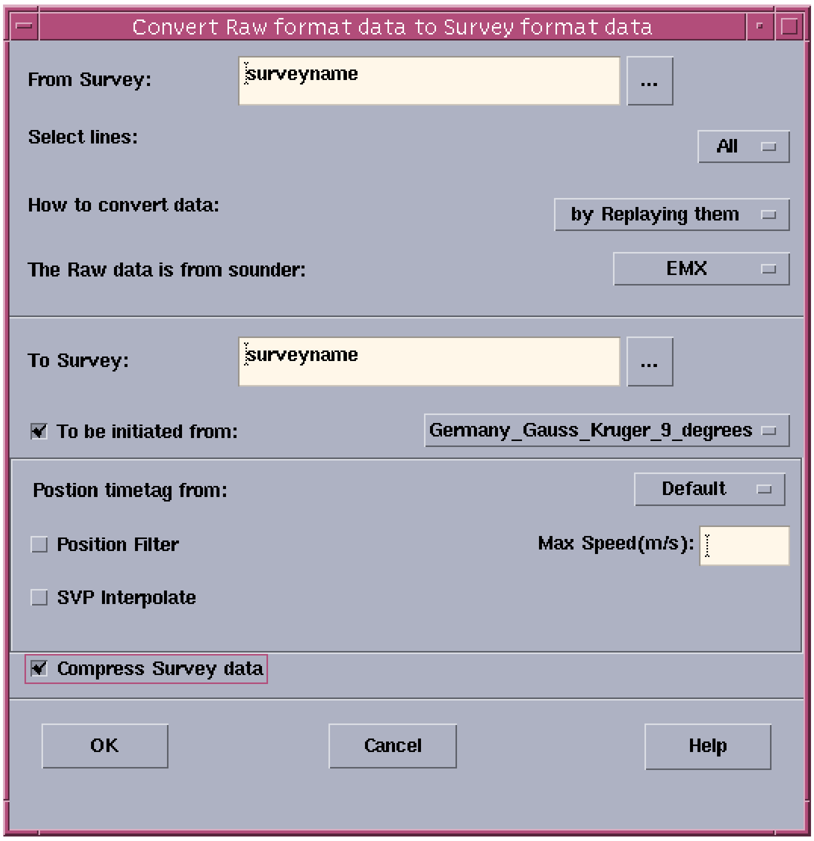


Figure 119 - The Replay dialogue box

The Replay dialogue box options

From Survey - This option lists all surveys found in your workstation. You may also enter the survey name directly in the text field.

Select lines - This option lets you select all or some lines. When you press the **'...'** button, a list of already existing lines will be shown. When you select your lines, a file selection dialogue box then opens. You may then choose lines in these files.

→ *The File Selection dialogue box can be found on page 41.*

How to convert data - This will let you choose how to convert your data;

- **by Replaying them -** This option will put all your raw data onto the network, as if comming from an echo sounder.
- **Directly -** This option will convert all raw data files directly and fast to survey format.

- **Extract Attitude -** If an attitude datagram is logged with the rawdata, this option will extract attitude and heading information to survey format attitude and heading files.
- **Extract EA 500 depths -** This option extracts single beam echo sounder depths from raw data. This will create survey format data containing only depths from the single beam echo sounder.
- **Print Installation -** This option prints out the installation parameters.
- **Print Content -** This option writes a start identifier for each datagram. Print content will also let you know from which echo sounder the depth datagrams are.
- **Print Pos -** Outputs date and time of position datagram plus the complete position input datagrams.
- **Print Clock -** Outputs content of clock datagram, if logged.
- **Print Heave -** If raw range datagrams are available the output is: Type, time, model, txheave(head2, if available), txroll, Rolldepth. If no roll range the output is: type, time, model, head1_depth (head2_depth)
- **Print Height -** If height datagram is logged, date, time, height and source are output.
- **Print ROV Depth -** Reads raw range datagram and depth datagram and gives time and calculated depth of ROV.
- **Print Runtime -** Converts and outputs runtime datagram contents to ASCII. Checks datagram description to decode each field.
- **Replay Realtimetape -** If you have logged data to tape in realtime, you are able to read data from the tape using this button.

The Raw data is from sounder - This button lets you specify the echo sounder. This is because there are different programs for old and new sounders. You must choose either EMX (new sounders) or EM1000/EM12/EM950 (old sounders).

New sounders include EM3000, EM2000, EM1002, EM952, EM300, and EM120

Old sounders include EM1000, EM950 and EM12.

To Survey - This field lets you specify the survey name into which you want to put your data. A list of already existing surveys will be shown by pressing the **'...'** -button. When writing the survey name, OK and Cancel buttons will appear. Press OK or enter to confirm. If the name you selected is already existing, a warning will appear.

Note: *A warning will be given if you select an existing survey!*

To be initiated from - Any new survey must be initiated with a projection. Select your correct projection.

The following choices/options appear while converting data;

1 **Position timetag from** This option lets you choose which timetag to use;
   - **Default -** uses original timetag
   - **PU Internal -** forces timetag to be from Processing Unit system time.
   - **Pos System -** forces timetag to be found inside incoming position datagram.

2 **Position Filter -** This enables the position filter.
   - **Max Speed (m/s) -** This field lets you set the max speed to limit the maximum possible distance between two positions. This choice is valid when **Position Filter** is turned on.

3 **SVP Interpolate -** If a SVP Interpolate rule exists in your destination survey, the raw data will be recalculated with new sound speed profiles.

Compress Survey Data - This option starts a routine for storing data in a more compact way. This can be done without loosing any of the information in the data files.

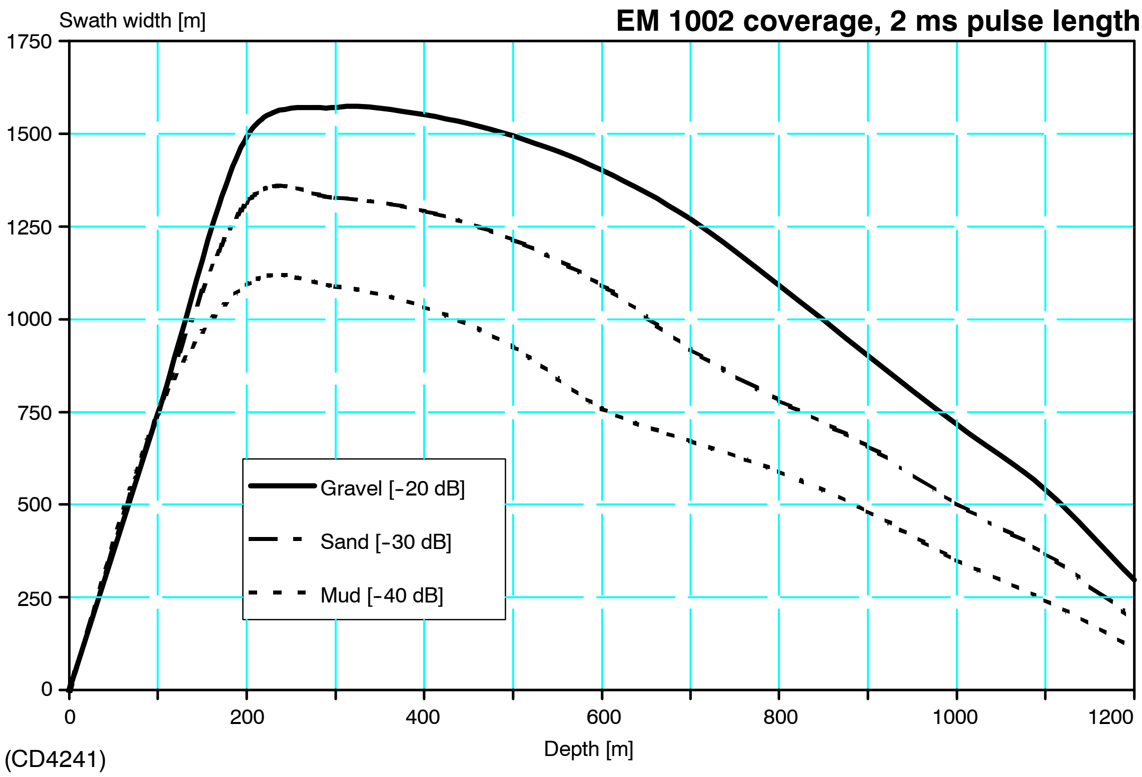
When all your settings are to your satisfaction, you can start **Replay**, or if you may **cancel** to exit the program.

- When you choose **OK**, the replay/conversion will start, and all the *.all*-files in the raw data survey will be replayed or converted.

17 TECHNICAL REFERENCES

17.1 Introduction

This chapter provides basic reference information useful to understand settings and parameters used throughout the EM 1002 system. In order to understand some of the information, you may need to have a more technical background than the average EM 1002 user.



(CD4241)

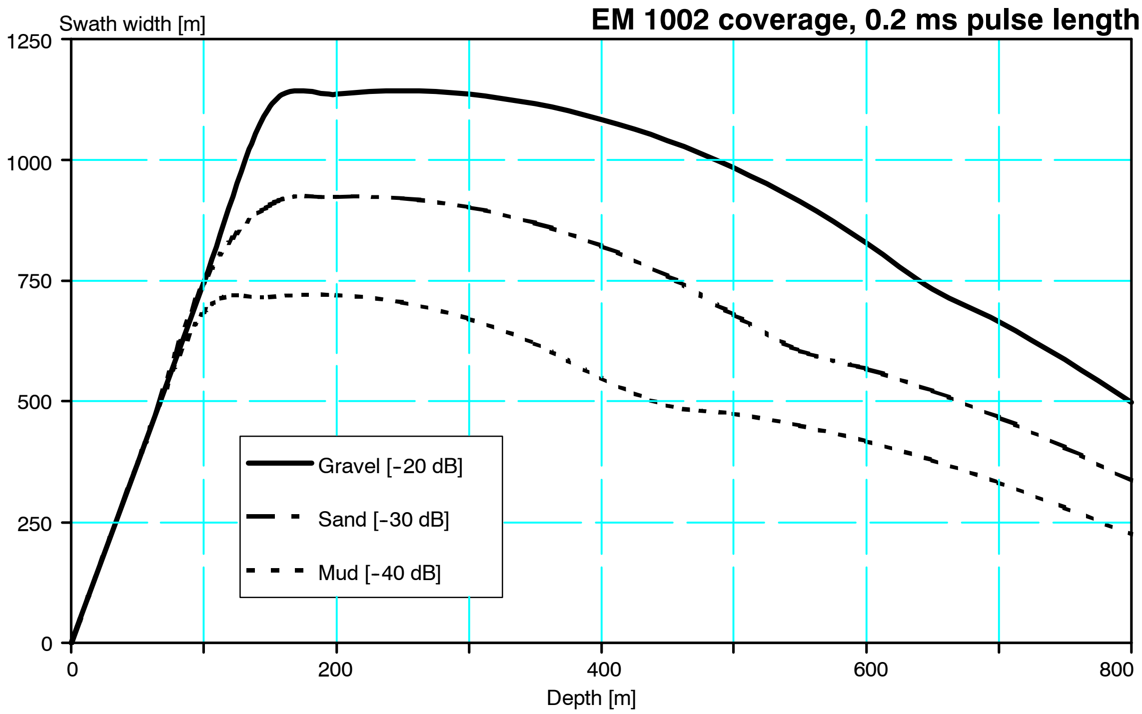


Figure 120 - EM 1002 coverage

17.2 Bottom Detection

Conventional techniques

A single beam echo sounder obtains depth by measuring the time a sound pulse takes to propagate to the bottom and multiplying this time value by the mean speed of sound in the water column. Good accuracy depends on:

- small beamwidths in the echo sounder transducer
- a good estimate of sound speed
- a well-designed pulse receiver and detector

A single beam echo sounder normally only measures the depth vertically. To measure to the side, one could imagine using a mechanically tiltable transducer or multiple transducers, but electronic beamforming, i.e. the forming of multiple beams from a single transducer array, achieves the same results in a more cost-effective way. For good measurement density, the beamforming on the receiver side must be fast enough to allow simultaneous detections in all beams. The transmit transducer in a multibeam echo sounder must ensonify the area to be measured within the coverage of the receive transducer, which in principle does not require the use of multiple transmit beams.

The accuracy of a multibeam echo sounder depends on the same factors as those of the ordinary echo sounder. In addition, it is not enough merely to know the mean sound speed in the water column, but a detailed knowledge of how the sound speed varies with depth is also required. This is because the sound path is usually not straight when it is not vertical, and the resulting so-called “ray bending” must be calculated by the use of the actual sound speed profile to find the correct depth and location of soundings taken to the side.

Both single beam and simpler multibeam echo sounders use only amplitude detection to determine the travel time of the sound pulse. When the sound has a zero angle of incidence to the seabed, a good detection principle is to estimate the time of arrival of the leading edge of the returned echo. As the angle of incidence increases with beams measured to the side or when the seabed directly below the vessel is not horizontal, the returned echo loses its sharp leading edge. When the angle of incidence becomes sufficiently large, the echo will be so smeared out in time that an accurate simple amplitude detection is no longer possible. One is then required to use more sophisticated methods, for example using the variation in echo strength over the beam.

Sidescan sonars provide a ”photographic” image of the seabed, and this may give an indication of the bathymetry. In some sidescan systems, an approximate measurement of depth has been achieved by using phase detection through an interferometric principle. By comparing the phase of the returned echo on two or more physically separated transducers, the angle of arrival may be estimated in addition to the range. However, this only works when the angle of incidence is large or the seabed is relatively flat, as the phase information may be destroyed when simultaneous echoes are received from different parts of the seabed. Note that a similar phase detection principle is used with success in short or ultra-short baseline acoustic positioning systems, in radars (usually called monopulse) and in optics (usually called splitbeam, a term which is also used in connection with ultra-short baseline positioning systems).

Advanced techniques

Phase detection method

The problem of multiple echoes with the phase detecting sidescan sonars can to a large extent be overcome by combining phase detection with the multi-beam principle. For each beam, two additional so-called halfbeams are formed from different sub-arrays of the receive transducer, with all three beams having the same pointing direction. The phase difference between the halfbeams, which is a measure of the angle of arrival of the returned echo, is calculated from the complex conjugate product of the two received signals, usually after some averaging of the product is done. The degree of averaging needed is determined by a combination of pulse duration, range and incidence angle, and is in practice derived from extensive simulations and experimental verifications. The averaging stabilizes the phase determination, reducing the effect of glint or random variation in signal strength due to destructive interference from different parts within the area producing the echo at any given time.

The distance between the acoustical centre of the two sub-arrays used to form the halfbeams determines the relationship between electrical phase and angle of arrival. When the phase is zero, the returned echo from the bottom comes in the centre of the beam. The phase as a function of time will theoretically be a second order function for a flat bottom, modulated by local changes in bottom curvature and by noise. A curve fit made to this time series of phase, from which the zero phase crossing can be determined, will therefore allow a very accurate determination of the range to the bottom in the centre of the beam, with a much higher accuracy than any method based only on amplitude information can provide.

Amplitude detection method

To achieve a valid curve fit to the angle of arrival time series, a minimum number of samples is required, so that the incidence angle or depth cannot be too small. Thus an amplitude-based method is required as a backup to the phase detection method. As noted earlier, at normal incidence the leading edge of the echo may be used, while at larger angles of incidence, the amplitude series across the beam is required.

If the bottom is flat or has a constant slope with uniform seabed composition, the amplitude time series will have a variation which is determined only by the beam pattern. Then, the maximum amplitude or, somewhat better, the mean of for example the -3 dB points, may be used to determine the range at the centre of the beam. However, with local slopes or variation of backscattering strength within the beam footprint, these simple detection principles do not give consistent results. Presently the best amplitude detection method seems to be the determination of the centre of gravity of the echo within the beam, but even this method is affected by local variations in seabed composition. Its use should thus be restricted to reasonably short echoes, which fortunately makes it a good alternative for the cases where the phase detection method fails.

EM 1002 solution

In the EM 1002, the bottom detection is done as follows:

1 A search in range in each beam is first performed on sample amplitudes to determine where the bottom echo is.
The search is:

- limited to be within a range window whose extent has been established from where the bottom has been found in previous pings
- based on a sliding mean of the sample amplitudes to limit effects of noise. A minimum amplitude is required based upon the bottom backscattering strength found in previous pings.

2 Phase detection is then done, provided that there are more than 10 range samples within the -3 dB part of the beam pattern.

- If the curve fit has a sufficiently low variance, the resulting detection is accepted (both a second and a first order curve fit are tried, the latter over 3/4 of the samples, and the result of the one with the lowest variance is retained).
- If phase detection is not accepted an amplitude detection is done, provided that the number of samples within the -10 dB points is not too large.

The first round of detections is performed independently in all beams. A filtering of the detections is then done to eliminate spurious detections due to sidelobe echos, echos from fish, noise, etc. The severity of this filtering is determined by menu input from you.

3 A second round of detections is then performed on the beams with missing or rejected detections, but within limited range intervals as determined from where the bottom is (calculated from the ranges determined in neighbouring beams with accepted detections).

As in the first round phase detection is tried first and amplitude detection only if phase detection fails. Relaxed acceptance criteria are used in this second round, and a final filtering is done afterwards. With this procedure, the choice of detection method is not dependent upon the past history, but may adapt instantly to changing bottom topography.

After bottom detection the raw ranges and beam angles are converted to depths and positions relative to the water level and the vessel positioning system location respectively. Full account is taken of:

- sound speed at the transducer depth and through the water column
- the installation angles and location of the transducer
- vessel attitude at transmit and receive
- any lever arm corrections needed to calculate additional heave due to pitch and roll not being measured at the transducer location
- the vessel draft and the location of the positioning system

17.3 Error sources

General

A multibeam echo sounder has, as any other measuring instrument, an inherent limit in its achievable accuracy. The total measurement accuracy, i.e. the uncertainty in the depth and location of the soundings, will in addition depend upon the inherent errors of additional instruments, i.e. vessel motion and heading sensors and positioning system, and the sensor(s) used to measure the speed of sound at the transducer and through the water column. In this section these error sources are quantified and discussed as far as possible, thus allowing the user of the multibeam system to judge the possible accuracy achievable under the specific conditions in which the system is operating.

All errors given below may be assumed to be RMS errors provided the sensor errors used are also RMS errors or RMS uncertainties. With this simplification the total system error can be calculated by the root mean squared addition of the individual contributions. Note that because of this, no effort has been made with respect to the signs of the individual error terms, and as given below the signs may thus not always be correct.

The coordinate system used assumes the x-axis to point forwards (alongtrack), the y-axis to point starboard (acrosstrack), and the z-axis to point vertically downward. A normal installation is assumed with all beam-steering in the y-z plane

Errors in range (ΔR in m) and angle ($\Delta\phi$ in radians) will translate into vertical errors (Δz) by simple geometry with ϕ as the angle from the vertical considered:

$$\Delta z = \Delta R \cos\phi$$

$$\Delta z = \Delta\phi R \sin\phi = \Delta\phi D \tan\phi$$

The position error (Δx or Δy) is also determined by range and angular errors:

$$\Delta x \; or \; \Delta y = \Delta R \sin\phi$$

$$\Delta x \; or \; \Delta y = \Delta\phi R \cos\phi = \Delta\phi D$$

Echo sounder errors

The error of a multibeam echo sounder is theoretically dependent upon a signal-to-noise ratio. However, provided that the signal-to-noise ratio is above 10 dB, the following equations have been found to model the depth and acrosstrack position errors of the Kongsberg Simrad multibeam echo sounders very well:

$$\Delta_{Z_A} = \sqrt{\left[(\frac{\Delta R_s}{2})^2 + (\frac{c\tau}{4})^2 \right] \cos^2\phi + \frac{\Psi_y^2 D^2 \tan^2\phi}{144}}$$

$$\Delta_{Z_P} = \sqrt{\left[(\frac{\Delta R_s}{2})^2 + (\frac{c\tau}{4})^2 \right] \cos^2\phi + 0.04 \Delta R_s \Psi_y D \sin\phi}$$

$$\Delta_{Y_A} = \sqrt{\left[(\frac{\Delta R_s}{2})^2 + (\frac{c\tau}{4})^2 \right] \sin^2\phi + \frac{\Psi_y^2 D^2}{144}}$$

$$\Delta_{Y_P} = \sqrt{\left[(\frac{\Delta R_s}{2})^2 + (\frac{c\tau}{4})^2 \right] \sin^2\phi + \frac{0.04 \Delta R_s \Psi_y D \cos\phi}{\tan\phi}}$$

Here, ΔR_s is the range sampling distance, Ψ_y is the acrosstrack beamwidth, and the indexes A and P refer to amplitude and phase detections respectively. The first term in the above equations is due to range error and the second to angular error. The system will usually use phase detection for long echoes (oblique beams) and amplitude detection for short echoes (near-nadir beams).

The alongtrack position error (Δx)

$$\Delta x = \frac{\psi_x R}{\sqrt{12}} \approx \frac{0.3\psi_x D}{\cos\phi}$$

Here, ψ_x is the alongtrack beamwidth.

Seabed topography will in principle contribute to vertical error by the effect it has on echo level and hence signal-to-noise ratio. Local variations of depth within the beam footprint will cause vertical errors, with amplitude detection being most affected. Seabed slope will in principle not cause vertical errors, but repeatability will be affected. As it will not be possible in post-processing to discern between the two; it is prudent to convert the total position error to a vertical error by multiplying the total position error by the slope gradient.

Any errors in system installation measurements larger than recommended in the *Installation Manual* and any errors in vessel draft, tide and datum heights will contribute directly to the total position system error.

Motion errors

In addition to the inherent errors of the multibeam echo sounder, the errors in motion sensor and gyrocompass measurements of heave, roll, pitch and heading errors contribute to total measurement accuracy.

Heave

Errors in heave will contribute directly to the total vertical error.

Roll errors

Errors in roll will contribute to depth and acrosstrack position errors:

$$\Delta z = D\Delta r \tan\phi$$

$$\Delta y = D\Delta r$$

Note that with older motion sensors there may be dynamic errors additional to the manufacturer's stated inaccuracy due to vessel horizontal accelerations, for example resulting from vessel turns.

Pitch errors

Errors in pitch will cause depth and alongtrack errors given by:

$$\Delta z = \frac{D\Delta p^2}{2}$$

$$\Delta x = D\Delta p$$

Heading errors

Errors in heading will cause alongtrack errors (Δx) and acrosstrack errors (Δy) given by:

$$\Delta x = D\Delta h \tan\phi$$

$$\Delta y = \frac{D\Delta h^2 \tan\phi}{2}$$

Note that the heading error of a gyrocompass is latitude-dependent and also usually influenced by horizontal accelerations.

In practice only roll error will be significant with regard to depth error and heading error in a gyrocompass with regard to alongtrack position error, while other motion and heading sensor angular error effects can usually be ignored. However the pitch error may be significant if the fore-and-aft distance between the motion sensor and the transducers is very large. Note also that while the dynamic pitch and roll accuracy of high performance motion sensors are in the order of 0.05°, there may be much larger static offset errors due to incorrect alignment of the motion sensor which may be significant. If the heading is from a system where two GPS receivers are used to derive heading, the heading accuracy may approach 0.05°, making the heading error contribution to total system accuracy insignificant.

Sound speed errors

Errors in sound speed will cause different errors depending on their nature and on the transducer configuration of the multibeam echo sounder. Sound speed errors may be due to sensor errors which can be modelled as an offset or bias plus noise. Especially the offset may be temperature- and depth-dependent. Sound speed errors may also be due to unmeasured changes in the water column with time and position. Sound speed errors are difficult to quantify in practice and the problems with temporal and positional variations may sometimes be so large that the only practical solution is to limit angular coverage.

Sensor-related errors

Noise in the measurement of the sound speed profile will not lead to any significant depth or position errors if it has a zero mean through the water column.

A fixed offset in the sound speed sensor will always give a range error and, if beam electronic steering is used (in which case the beam pointing angle will be in error), also an angular error:

$$\Delta R = \frac{R\Delta c}{c}$$

$$\Delta\phi = \frac{\Delta c \tan(\phi - \beta - r)}{c}$$ only with electronic beam steering

Here, β is the installation tilt angle of the transducer array and the roll angle.

Without electronic beam steering, the resulting depth and acrosstrack position errors are:

$$\Delta z = \frac{\Delta cD}{c}$$

$$\Delta y = \frac{\Delta cD \tan\phi}{c}$$

With electronic beam steering, the resulting depth and acrosstrack position errors are:

$$\Delta z = \frac{\Delta cD}{c}\left[1 - \tan\phi \tan(\phi - \beta - r)\right]$$

$$\Delta y = \frac{\Delta cD}{c}\left[\tan\phi + \tan(\phi - \beta - r)\right]$$

To keep the sound speed sensor-related error to a nearly negligible magnitude, the sensor offset should be less than 1.5 m/s for a non-steered transducer, and less than 0.25 m/s for a horizontally mounted linear array with 140° coverage.

Sea surface related errors

Temporal and position-dependent sound speed variations may be modelled as for sensor errors, except when the sound speed variation is at the surface, or more correctly, at the transducer depth. The resulting error then depends upon transducer configuration, or on how much electronic beam steering is applied. For a curved or semi-circular transducer array, no or only a limited amount of steering is required, depending on the angular extent of the transducer with respect to angular coverage capability. For a linear or flat array, electronic beam steering is always applied except for the beam normal to the array, but the amount of steering applied for a particular beam pointing angle with respect to the vertical will depend upon the installation tilt angle of the array and also on the amount of roll.

The following equations assume that the sound speed error at the surface is modelled as a change in value from that actually used in the calculation of beam pointing angles and raybending. It is assumed that the change takes place at the transducer depth only, in which case there is no range error, but an angular error regardless of whether electronic beam steering is applied or not.

$$\Delta\phi = \frac{\Delta c}{c}\tan\phi \quad \text{without electronic beam steering}$$

$$\Delta\phi = \frac{\Delta c}{c}\left[\tan\phi - \tan(\phi - \beta - r)\right] \quad \text{with electronic beam steering}$$

Without electronic beam steering, the resulting depth and acrosstrack position errors are:

$$\Delta z = \frac{\Delta c}{c} D \tan^2\phi$$

$$\Delta y = \frac{\Delta c}{c} D \tan\phi$$

With electronic beam steering, the resulting depth and acrosstrack position errors are:

$$\Delta z = \frac{\Delta c}{c} D \tan\phi\left[\tan\phi - \tan(\phi - \beta - r)\right]$$

$$\Delta y = \frac{\Delta c}{c} D\left[\tan\phi - \tan(\phi - \beta - r)\right]$$

If the change in sound speed at the transducer depth extends deeper, there will be an additional range error, but the angular error remains unchanged. This range error is usually too small to be significant, however, unless the change in sound speed is very large or is effective over a large depth range, in which case the sound speed profile should be re-measured.

Implications

Note that with a horizontally mounted linear (and thus electronically steered) transducer the total error due to varying sound speed at the transducer depth is zero except for a small roll-dependent term. This is because there are two errors involved:

1) the beam pointing angle error

2) the error in the first step of the ray bending calculations

Each of these errors has the same magnitude but opposite signs, thus cancelling each other when roll is zero. In marked contrast, no such error cancellation takes place with a curved non-steered array and very little with a linear array which is tilted much from the horizontal.

As sound speed variations at the surface are often much larger than sound speed sensor errors, it can be concluded that the curved non-steered array is significantly more sensitive to sound speed errors than the horizontally mounted steered linear array. That this somewhat surprising conclusion is the opposite of that drawn for sonars, is due to the fact that sonars are usually used looking horizontally while a multibeam echo sounder looks vertically.

For both a curved transducer and a flat transducer tilted say 40°, the sound speed at the transducer should be known to within 0.1 m/s if the resulting depth error is to be negligible within a 150° angular measurement sector. For a horizontally mounted flat transducer an uncertainty of up to 2 m/s is not significant assuming 130° coverage and 5° of roll. With more roll and larger coverage the sound speed uncertainty must be less for its effect to be insignificant, for example within 0.5 m/s with 140° coverage and 10° roll. In areas where one can expect larger surface sound speed changes than this, it is advisable to include a real-time sound speed sensor at the transducer depth with the system, otherwise a reduction in usable coverage or a reduced depth accuracy must be accepted. Note that in addition to correcting for surfaced-induced sound speed errors, the measured transducer depth sound speed can also be used as an indicator for when a new sound speed profile should be measured.

Bottom-related errors

It may sometimes not be practical to measure the sound speed profile all the way to the bottom and there will usually be an error in the necessary extension of the profile.

Another type of bottom-related sound speed problem that can be significant in not too deep waters occurs when a layer near the bottom with significantly different sound speed than the layer above moves upwards or downwards with changing depth due to current, and the change is not taken into account. The resulting vertical errors and acrosstrack position errors may in both cases be modelled as an error due a constant sound speed error from a particular depth (D_E) and all the way to the bottom:

$$\Delta z = \frac{\Delta c}{c}(D - D_E)(1 - \tan^2\phi)$$

$$\Delta y = \frac{2\Delta c}{c}(D - D_E)\tan\phi$$

This is a "worst-case" model, and a more realistic assumption could be to assume an error in sound speed linearly increasing from zero at a particular depth (D_E) to Δc at the bottom, in which case the depth and position errors are half of those assuming a constant sound speed error.

Other sound speed related errors

There are areas in the world where the sound speed changes very much over a short depth interval, and where the depth at which this change takes place shifts with time and position. Such an unaccounted shift gives a range error but no angular errors, resulting in the following vertical and acrosstrack position errors:

$$\Delta z = \frac{\Delta c \Delta D}{c}$$

$$\Delta y = \frac{2\Delta c \Delta D \tan\phi}{c}$$

Finally, it should be noted that how ray bending calculations are performed (with regard to transducer depth in relation to the depths in the measured sound speed profile) may cause heave-induced errors if the sound speed changes much through the profile.

For example, if the calculations are done through a table look-up, this implies that the sound speed profile is anchored at the transducer, and may cause errors due to heave. This error is avoided if the calculations assume the transducer to move with heave relative to the sound speed profile. On the other hand, if there is a significant change in sound speed around the nominal transducer depth, there is in practice no way of knowing how the transducer moves relative to the sound speed profile with heave, although intuitively it would seem most correct to assume that the transducer moves with heave while the profile remains fixed.

It may also be noted that an inherent limitation in ray bending calculations is that one is usually forced to assume that the sound speed changes only with depth and that any change with position is negligible, at least for a particular beam.

17.4 Range capability

The fundamental equation for determining the range capability of an echo sounder is the sonar equation:

$$EL = SL - 2TL + BS$$

Here, EL is the received echo level, SL is the transmitter source level, $2TL$ is the two-way transmission loss, and BS is the backscattering strength of the target.

The two-way transmission loss is:

$$2TL = 2\alpha R + 40\log R$$

Here, α is the absorption coefficient and R is the range. The absorption coefficient may be calculated from actual water temperature, salinity, depth and sounder frequency.

The backscattering strength will depend on seabed conditions and on the area (A) of the seabed seen by the echo sounder at each sample time:

$$BS = BS_B + 10\log A$$

$$A = \psi_T\psi_R R^2 \text{around normal incidence } (\phi \approx 0)$$

$$A = \frac{c\tau\psi_T R}{2\sin\phi} \text{ elsewhere}$$

Here, c is the sound speed, τ is the pulse length, and ψ_T and ψ_R are the transmitter and receiver beamwidths respectively. The first equation for the area is valid until the bottom incidence angle is larger than the largest of the following two angles, given by:

$$\cos\phi_{L1} = \left(1 + \frac{c\tau}{2D}\right)^{-1}$$

$$\sin\phi_{L2} = -\frac{\Psi_R D}{c\tau} + \sqrt{\left(\frac{\Psi_R D}{c\tau}\right)^2 + 1}$$

The intrinsic backscattering strength of the seabed (BS_B) is usually very dependent upon the incidence angle, with the largest variation around normal incidence, and typically a Lambert's law dependence at larger incidence angles. It seems natural to define:

$BS_B = BS_N$ . . . . at normal incidence ($\phi = 0$)

$BS_B = BS_O\cos^2\phi$ . . . . for ϕ > about 10-25°

From 0° and to an incidence angle of about 10-25°, it can be judged from the literature that the backscattering strength to a good approximation varies linearly with angle. The angle at which the cross-over between the two regions takes place, in effect defining the sharpness of the normal incidence peak, is very dependent upon seabed material type.

Typically, BS_N will be about -15 dB, BS_O (O for oblique) about -35 dB, but the values may change within ±10 dB or even more depending upon seabed material type and roughness.

Putting all the above into a single equation, the result is:

$$EL = SL - 2\alpha R - 20\log R + 10\log\psi_T\psi_R + BS_N \quad ....(\phi = 0^\circ)$$

$$EL = SL - 2\alpha R - 30\log R + 10\log\frac{c\tau\psi_T\cos\phi}{2\tan\phi} + BS_o \quad ..(\phi > 10 - 25^\circ)$$

The echo level has to be above the noise level (NL) by a certain amount, typically 10 dB when using phase detection and 20 dB with amplitude detection, if the detections are to be reliable. At high sonar frequencies, the noise level is usually determined by the electronic self-noise of the preamplifiers, while at low frequencies, the sea noise level will usually dominate if the vessel is quiet. Vessel noise will vary with speed and often propeller revolution rate, and may be the dominant noise source even at high sonar frequencies if the vessel is small and is travelling at a high speed. The noise level is given by:

$$NL = NSL + 10\log BW - DI_R$$

Here, NSL is the noise spectral level, DI_R is the receive transducer directivity index and BW is the receiver bandwidth.

$DI_R = 46.2 - 10\log\Psi_x\Psi_y$ with the beamwidth given in degrees.

The source level SL for EM 1002, is 226 dB.

17.5 Time Varied Gain (TVG)

The longer it takes for the sound pulse to return, the weaker will be the returning echo. To compensate for this, the received signal will be amplified to a varying degree depending on the time since the signal was emitted. This is called Time Varied Gain (TVG).

The strength of the returned echo from a particular area on the bottom will depend upon many parameters:

- Range
- Angle of incidence
- Bottom backscatter strength
- Water column absorption coefficient
- Echo sounder inherent parameters

The TVG is applied to use the dynamic range of the receiver efficiently, and to have a fairly constant echo level on which to perform the bottom detection. The amount of gain applied as a function of time is derived from a model of the echo strength depending on the various parameters. As some of these are bottom dependent, they will be estimated and updated by the EM 1002 system based upon data from previous pings, unless automatic bottom tracking is manually disabled.

The amount of TVG that may be applied during a ping is limited, and a fixed gain level is thus additionally defined to put the average signal level at the optimum level in the receiver.

17.6 The vessel coordinate system

A main function of the parameters required for system installation is to inform the system of the relative positions between the various sensors and the angular orientation of the sensors with respect to the vessel. A reference point somewhere on the vessel has to be selected, and a Cartesian right-handed coordinate system - as shown in the figure below - must be defined with its origin in the reference point. The location of this reference point has no physical significance - it may be anywhere on the vessel. The placement of the various instruments must be identified with forward, starboard and downward coordinates in this coordinate system.

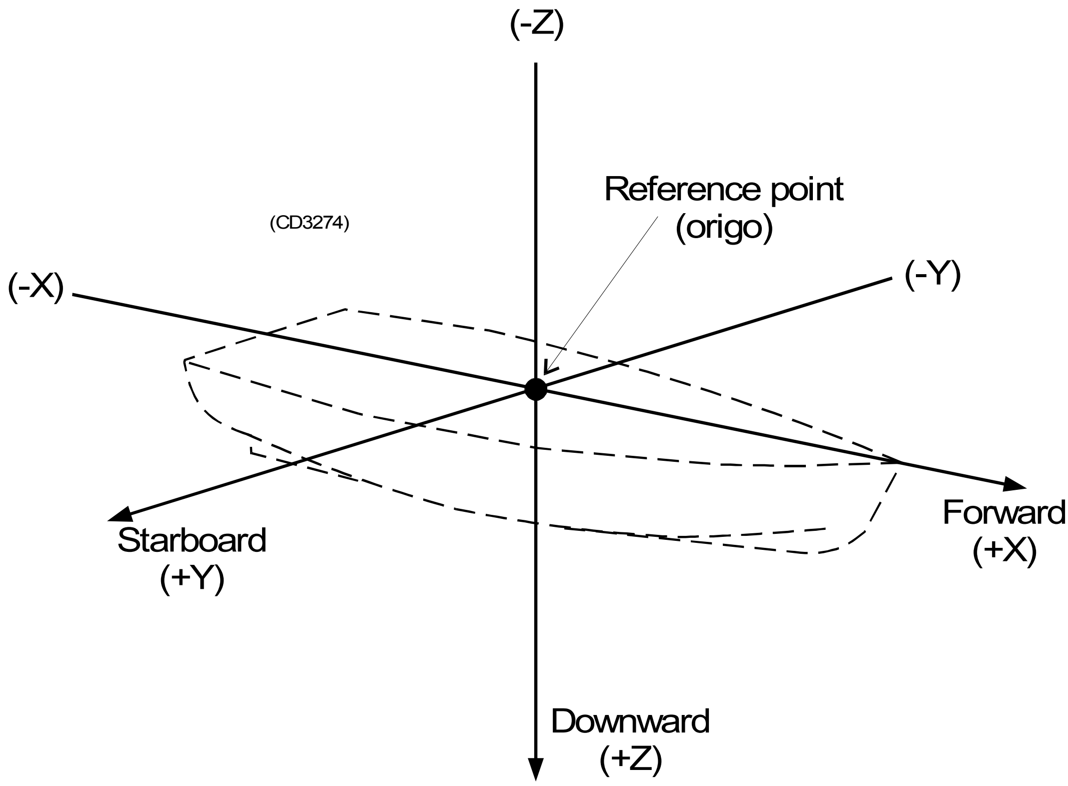


Figure 121 - The Vessel Coordinate system

The forward axis (X) must be parallel to the vessel keel, and the downward axis (Z) must be vertical when the vessel is trimmed normally. The plane defined by the forward and starboard axes will then be horizontal, and the attitude sensor should then, if properly installed and calibrated, measure zero roll and pitch with a normally trimmed vessel lying still.

Forward position (X)

Forward position is defined on the X-axis (refer to the illustration below). Locations further forward than the reference point are positive.

(CD3514)

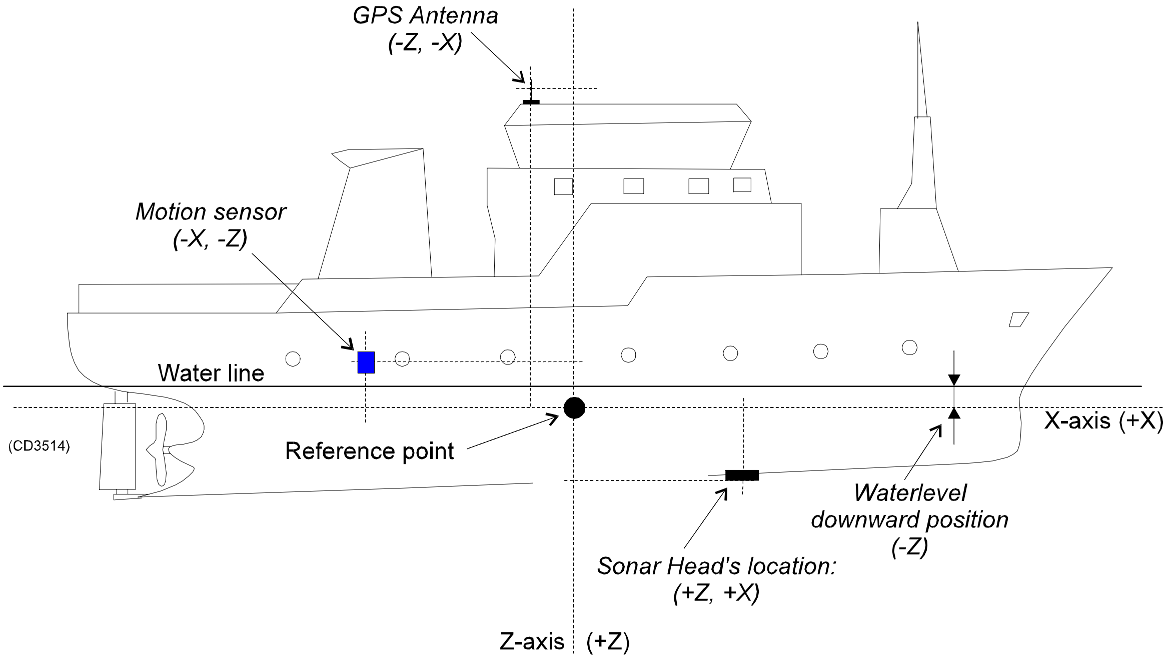


Figure 122 - Sensor locations (example)

Downward position (Z)

Downward position is defined on the Z-axis (refer to the illustration above). Locations below the reference point are positive.

Starboard position (Y)

If a sensor location is on the starboard side of the reference point, the value will be positive.

17.7 Timing

Introduction

Time synchronization between the echo sounder, the motion sensors and the positioning system is vital in order to achieve the best possible accuracy. The required time synchronization accuracy is better than 5 ms for attitude with roll being the most critical parameter. For the positioning, the required timing accuracy depends upon required position accuracy and the vessel's speed.

Example: With a vessel speed of 10 knots or 5 m/s, 100 ms timing accuracy is required for 0.5 m position accuracy.

Internal clock

An internal clock in the Transceiver Unit is used to time stamp all time critical data. It is a software clock with 1 millisecond resolution, and it is synchronized to an internal hardware counter. An interrupt is generated in the Transceiver Unit at each ping as a reference for the time of ping, and the clock is read at the reception of external sensor data. The internal clock is stable and jitter free, excepting a long-term drift of the hardware counter (typically a few seconds per 24 hours), and possible 1-2 millisecond jumps due to the internal counter not operating at exactly 1 kHz.

The software clock may be synchronized to an external 1 PPS (pulse per second) signal. This signal is normally available from a GPS receiver, and this is the preferred method to synchronize the echo sounder to an external clock. At the reception of a 1 PPS pulse the millisecond field of the internal clock is set to zero. If it was larger than 200 ms, the second is incremented (with a possible incrementation of time and date if required). Note that this method of synchronization implies that loss of a few 1 PPS pulses has no significance.

The internal clock's time and date is adjustable to that given by an external clock, the positioning system or the operator station. However, this is only possible if the system is not logging data. Adjustment of the internal clock during data logging is not recommended as it would cause loss of synchronization between depth and attitude data.

If an external clock is connected on a serial line the input data is time stamped and logged as any other external sensor data. This allows a continuous estimation of any drifts between the two clocks. The setting of the internal clock will be to the time and date from the source, including milliseconds as available. Note that the GGA positioning datagram does not contain any date entry. Setting from the operator station allows a manual setting of the clock.

Time stamping

For each datagram of attitudes (roll, pitch, heave and possibly heading), a time stamp is generated at the reception of the first byte of the datagram. As the attitude data may be delayed due to processing time in the motion sensor, an adjustable time delay may be applied. The attitude data are applied to the acquired ranges and beam angles to derive xyz coordinates of the soundings after bottom detection.

The only significant uncertainty in the time synchronization of attitude and depths will thus be due to possible variations in the time delay or a wrong estimation of it. However, with most motion sensors the risk of errors is small. The manufacturer’s estimate of delay should be used, and a possible prediction facility in the sensor should not be employed. As the attitude data may be logged as a continuous time record, it is possible to postprocess the data to determine and correct for any error in applied time delay.

As for the attitude data, a time stamp is generated at the reception of the first byte of each position datagram, and an adjustable time delay may be applied to this time stamp. If the real variation in this time delay is sufficiently small with respect to the position accuracy and vessel speed, the internal time stamp will give sufficiently accurate time synchronization. The time delay must of course be determined to a sufficient accuracy which is done by comparing data from survey lines run at different vessel speeds in the same direction up or down bottom slopes or over significantly distinctive bottom features. Any necessary correction of the applied time delay may be done in the postprocessing.

If the variation in the time delay of the positions is too large with respect to the desired accuracy, even after position filtering during postprocessing, an alternative satisfactory solution will require two things: that the positioning system's own time stamp in the position datagram has a sufficient accuracy; and that the clocks of the echo sounder and the positioning system are synchronized. When postprocessing the positioning system's time stamp must be used which is possible as both time stamps are retained in the logged data. If the positioning time stamp is not good enough, the positions will have to be filtered during postprocessing to diminish the effect of the variable timing. The inertia of the vessel will set the limit of accuracy achievable by such filtering.

The conclusion and recommendations are as follows:

- The delay in the data from the motion sensor must be constant and known to within 5 ms.
- If the delay in the position data is known within an accuracy commensurate with the position accuracy and vessel speed, no synchronization of clocks is required, but it is recommended to synchronize the echo sounder to a 1 PPS signal if it is available.
- If the delay in the position data is variable and cannot be filtered to a sufficient accuracy in postprocessing or the positioning is required to also be accurate for real-time displays, the echo sounder and positioning system clocks must be synchronized: The synchronization of the two clocks should be done from a common 1 PPS signal (which may be contained in the positioning system). The echo sounder should be set up to use the positioning system time stamp (datagram time) to which any position time delay will be applied. The postprocessing system must also be set up to use the positioning system time stamp (a time delay may have to be applied to either the position or depth data).

The absolute setting of time in the echo sounder is usually not critical with respect to other sensors. However it would be advisable to synchronize the echo sounder to a 1 PPS signal if it is available, and not to reset the echo sounder clock except at the start of a survey. This will ensure that any time delays remain constant during a survey. If an external clock is additionally connected on serial line and logged, this will allow a check of clock consistency during postprocessing, but this would usually not be worth the effort.

17.8 Sound speed formulas

The echo sounder computes bottom depth, taking full account of the raybending caused by the variation of sound speed in the water column. The **Sound speed profile** is entered manually, automatically from a sound speed profile probe, from an external computer, or by a combination of these methods.

If measured sound speed values are not available, they may be derived from tables, or, if the temperature and salinity profiles are known or estimated, calculated from a formula. While many formulae exist, the one from UNESCO Technical Paper in Marine Science, No. 44, is usually regarded as being authoritative. However, it is cumbersome and recent experiments showed that it has errors in the 1000-4000 m depth range. Therefore, a simpler formula with adequate accuracy is as follows (from Coppens, JASA March 1981, with a modified very deep water correction which follows the recent experimental data).

- For the surface:

  $$c(0,T,S) = 1449.05 + T(4.57 - T(0.0521 - 0.00023T))$$
  $$+ (1.333 - T(0.0126 - 0.00009T)(S - 35)$$

  where: **T** is temperature in °C
  S is salinity in ppt

- For depths to 200 m in fresh water and 1000 m in the ocean:

  $$c(Z,T,S) = c(0,T,S) + 16.5Z$$

  where: **T** is temperature in °C
  S is salinity in ppt
  Z is depth in km

- For depths to 2000 m in fresh water and to 11000 m in the ocean (assuming that the water is very cold at great depths):

  $$c(Z,T,S) = c(0,T,S) + Z(16.3 + Z(0.22 - 0.003Z\sqrt{T + 2}))$$

  where: **T** is temperature in °C
  S is salinity in ppt
  Z is depth in km

- For depths greater than 5000 m, a latitude correction should be applied:

  $$c(Z,T,S) = c(0,T,S) + Z'(16.3 + Z(0.22 - 0.003Z\sqrt{T+2}))$$

  where: **Z'** = Z(1 - 0.0026 cos2**ϕ**)
  ϕ is latitude in degrees
  T is temperature in °C
  S is salinity in ppt
  Z is depth in km

17.9 Absorption coefficient

The mean absorption coefficient of the water column is used in the gain setting in the receiver.

A typical value is 30 dB/km (Frequency 95 kHz, surface temperature = 20C and salinity = 30 ppt)

The absorption coefficient is important in determining the correct backscattering strength of the seabed used in the seabed imaging. Setting a correct value is therefore always recommended if the backscatter data are to be used, especially if the results are to be compared with those from other areas.

The absorption coefficient α is given by the following equation:

$$\alpha = \frac{A_1 f_1 f^2}{f^2 + f_1^2} + \frac{A_2 P_2 f_2 f^2}{f^2 + f_2^2} + A_3 P_3 f^2$$

where

$$A_1 = \frac{8.86 \cdot 10^{(0.78\,pH - 5)}}{c}$$

$$A_2 = \frac{21.44\ S(1 + 0.025T)}{c}$$

$$A_3 = 4.937 \cdot 10^{-4} - T(2.59 \cdot 10^{-5} - T(9.11 \cdot 10^{-7} - 1.5 \cdot 10^{-8} \cdot T)), T \leq 20^{\circ}C$$

$$A_3 = 3.964 \cdot 10^{-4} - T(1.146 \cdot 10^{-5} - T(1.45 \cdot 10^{-7} - 6.5 \cdot 10^{-10} \cdot T)), T \geq 20^{\circ}C$$

$$P_2 = 1 - Z(0.137 - 0.0062\ Z)$$

$$P_3 = 1 - Z(0.0383 - 4.9 \cdot 10^{-4}\ Z)$$

$$f_1 = 2.8 \sqrt{\frac{S}{35}} \cdot 10^{\left[4 - \frac{1245}{273 + T}\right]}$$

$$f_2 = \frac{8.17 \cdot 10^{\left[8 - \frac{1990}{273 + T}\right]}}{1 + 0.0018(S - 35)}$$

Here, $\boldsymbol{\alpha}$ is given in dB/km, the sound speed $\boldsymbol{c}$ in m/s, the temperature $\boldsymbol{T}$ in °C, the depth $\boldsymbol{Z}$ in km, the salinity $\boldsymbol{S}$ in ppt, and the frequency $\boldsymbol{f}$ in kHz. The ***pH*** of the ocean is in the order of 7.6-8.2.

The mean values are the mean absorption coefficient from the surface to the depth indicated, and is the value to be entered in the menu.

The absorption coefficient equation is from R. E. Francois and G. R. Garrison, ¨Sound absorption based on ocean measurements: Part II: Boric acid contribution and equation for total absorption,¨ J. of Acoust. Soc. Am. **72**(6), Dec. 1982, p 1886.

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