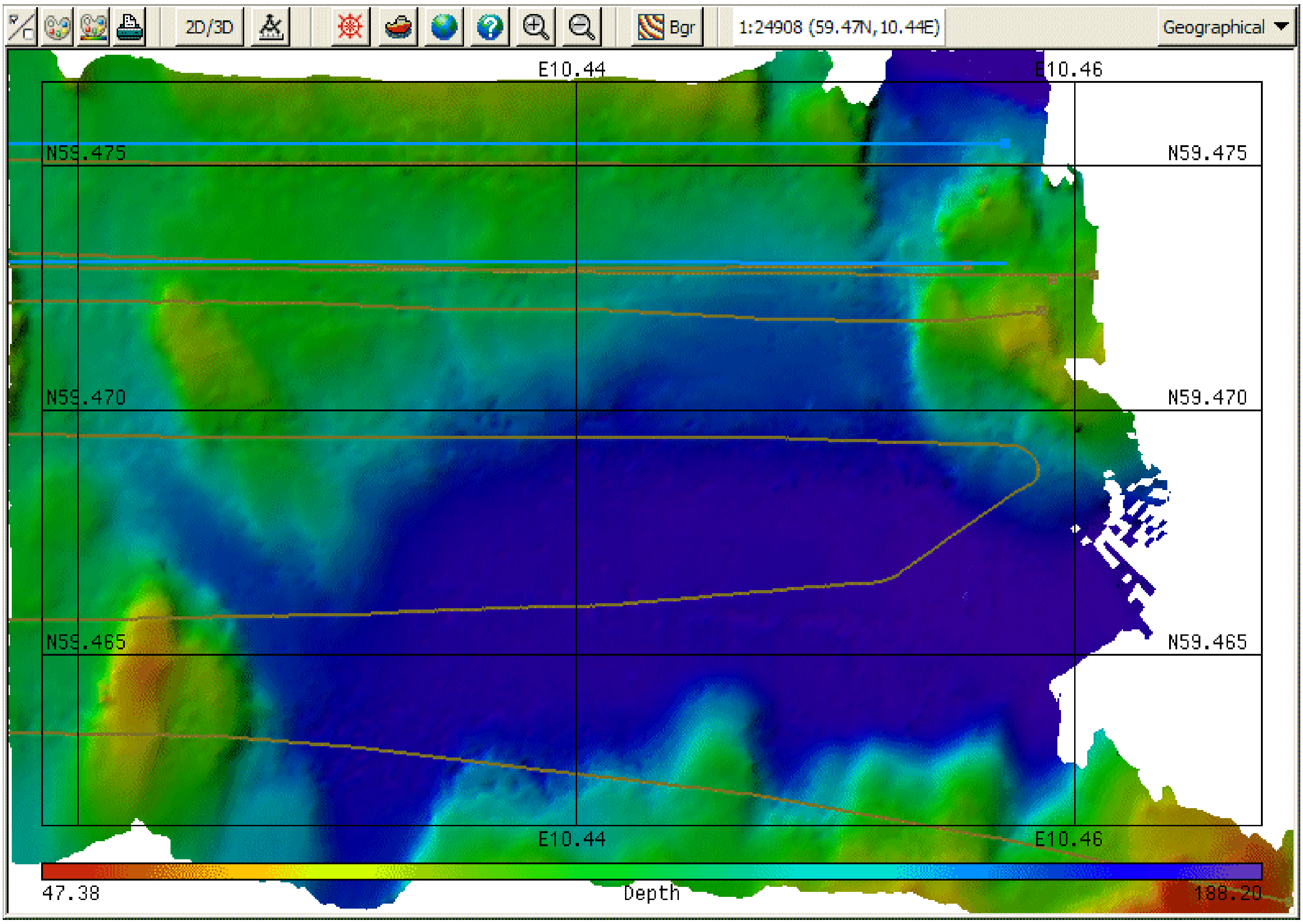
Operator Manual

KONGSBERG

SIS - Seafloor Information System



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SIS
Seafloor Information System

Operator manual

Document revisions

Rev	Date	Written by	Checked by	Approved by
E	31.01.06	ASM	BH	TP
	General update: System description, Graphical user interface, Operational procedures, Frames, Menu system, CUBE and Technical references.			

About this document

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Chapters

1 SYSTEM DESCRIPTION

1.1 Introduction

The Seafloor Information System (SIS) is a real time software designed to be the user interface and real time data processing system for hydrographic instruments produced by Kongsberg Maritime.

SIS is included on all deliveries of multibeam echo sounders from Kongsberg Maritime. SIS can also log data from single beam echo sounders supplying output data on NMEA format, or from standalone navigation systems.

SIS operates under Windows™ as well as Linux™ operating systems, and is compatible with the HWS 10 Work Station hardware. One or two display screens can be used.

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

The Kongsberg Maritime echo sounders are complete systems. All necessary sensor interfaces, data displays for quality control and sensor calibration, seabed visualization, and data logging are standard parts of the systems, as is integrated seabed acoustical imaging capability (sidescan).

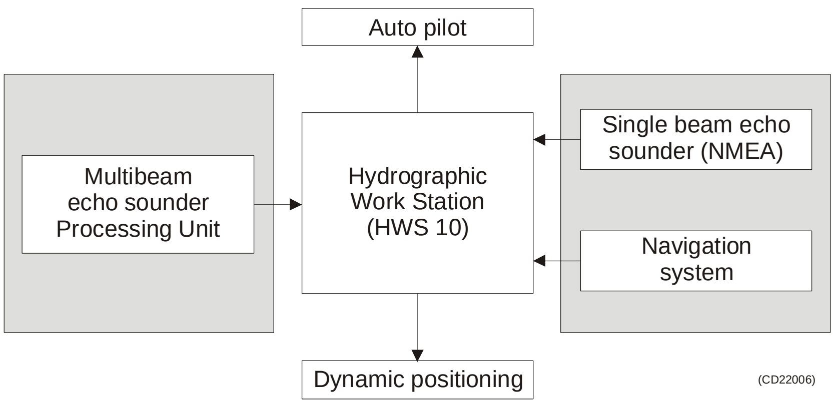


Figure 1 Instrument interfaces

1.2 SIS system information

Operating systems supported:

- Windows XP™
- Linux™

Hardware supported:

- HWS 10 / HWS 11 or equivalent
- 1 or 2 displays

License control:

- By dongle connected to USB port

Options/versions:

- Basic/Instrument control
- Multibeam echo sounder support
- Real time data cleaning
- Water column imaging

1.3 SIS licenses

The SIS software is subject to license control. Licensing of SIS is controlled by a HASP dongle. This dongle is programmed according to what SIS version has been purchased.

A licensed version of SIS contains all functionality available, and will then be complete software for operation. However, there are two options for multibeam echo sounders:

- Water column data storage
- CUBE implementation

The control part of SIS is unlicensed. This version gives access to the following applications:

- Installation and runtime parameters
- Start/stop logging
- Survey administration
- New survey
- Messages, Beam intensity, Cross track, Time series, Seabed image, Numerical display and Water column windows

An unlicensed version of SIS will also work as an interface to third party software.

The figure below shows the principle drawing of the hardware setup with the SIS software package, integrated with single beam or multibeam echo sounder systems.

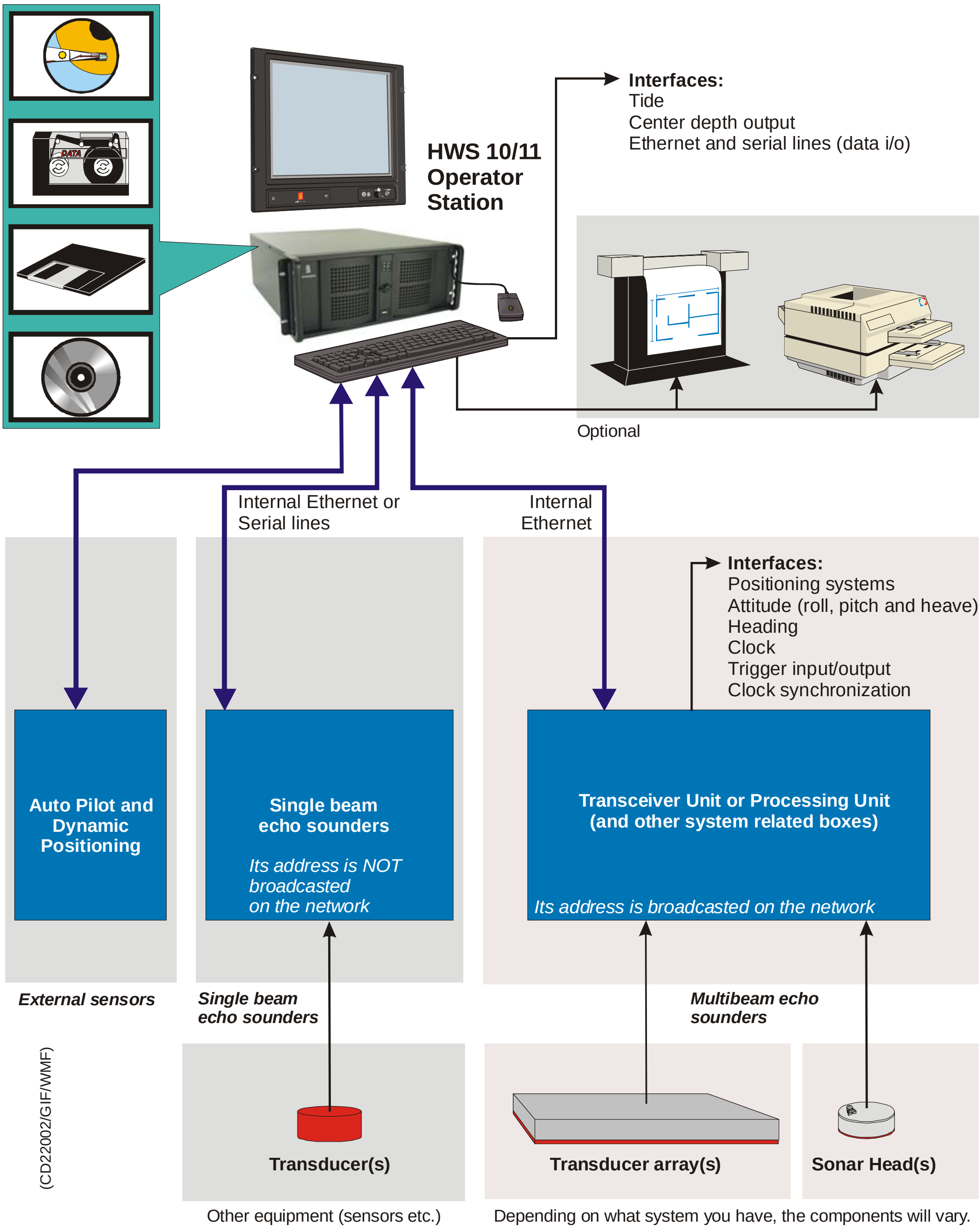


Figure 2 Principle drawing, hardware setup with SIS

1.4 SIS system overview

Introduction

The main task of SIS is to be a logical and user friendly interface to the surveyor, providing him with the functionality that he needs for running a survey efficiently.

The main features of SIS are:

- Control of both single- and multibeam echo sounders
- Real Time Data Cleaning module. This module processes first a set of pings from the current line, but also does area based processing where all previous data from the same area is processed together.
- Real time terrain models are built from the cleaned dataset
- 3D-displays using OpenGL
- C-MAP background maps can be used as underlay for the survey
- Import of xyz-data from other sources (such as Neptune) can be used as background maps

Basic version / instrument control

With this you can select which instrument to operate, switch the instrument on or off, change setup and operating parameters, record/export data, and you have access to graphic windows for simple quality checking of the data produced. Sound velocity at the transducer and sound velocity profile is interfaced and handled.

Instrument control also includes activation of instrument hardware testing, and reporting of error situations and system messages.

The Geographical window can be displayed in 2D or in 3D. In 2D mode it will typically include a background map (DXF, C-MAP and KSGPL formats supported), planned survey lines, a vessel symbol, and a raw (limited) or gridded (unlimited) representation of sounding data which has been collected. There is functionality for defining and editing survey lines, and for selection of information content.

The geographical window can be zoomed and panned, it can also follow the vessel position automatically.

The real time gridding which takes place for the sounding data, updates a multiple resolution grid, and the display resolution is adjusted automatically to fit the scale. In this way one can view large areas efficiently, and one can zoom in to a smaller area and view the data with a high resolution.

Grid models based upon previous surveys can be imported for comparison purposes.

In 3D mode, the seafloor surface can be viewed from different angles/resolutions, the light source can be shifted, and one can rotate the surface in order to obtain the best view.

Screen dumps or just one display window can be copied to a graphic printer. The resolution of the plot is then given by the display resolution.

Multibeam echo sounder support

Licensed multibeam support gives access to:

- More QA views for the multibeam data
- System calibration
- Visualisation of high resolution seabed backscatter data
- Plotting of survey results with full plotter resolution
- Support for remote Helmsman Display, connected via Ethernet

Real time data cleaning

SIS includes efficient algorithms for automatic flagging of soundings which should be eliminated from the survey results. The soundings are not physically removed from the data set, so it is possible to reverse the decisions and apply a completely new data cleaning during post processing. However, for the majority of user needs, the real time data cleaning will be satisfactory so that further processing is made either not necessary or at least reduced substantially. The cleaning algorithms are based on the Tukey algorithms.

Water column imaging

Some multibeam echo sounders, depending on model and purchased options, have built-in support for imaging of acoustic reflectors also in the water column. Such reflectors are for example fish or other biomass, but can also be submerged buoys, moorings or mines.

1.5 SIS operational principles

General

Some parameters need starting values from the operator depending on type of operation and water depth.

You may start by loading a predefined set of parameters, stored in a database, and then modify some of the individual parameters observing the effect on the displayed data. The modified parameters, including all the remaining parameters, can then be stored as a user specified set-up.

All parameters, as well as all the survey information, are stored in a database. The raw data is stored to disk.

The experienced operator may wish to optimise system performance by adjusting several of the parameters in the system. When the results are as desired, the current parameters set may be stored in a database for later retrieval.

The operators are assumed to have reasonable detailed knowledge about Windows XP or Linux operating system(s) and some familiarity in using them.

System interaction

All interactions between operator and the system take place through the windows system on the Operator Station. The following input tools are used:

- Keyboard
- Pointing device (by default an optical mouse with scroll wheel)

Navigating in the menus, tabs and dialogue boxes is done with the pointing device. The keyboard is used for entering numerical and character strings into the parameter fields.

Survey handling

Every echo sounder logs data to a survey. If the user does not create a survey, data will be logged to a predefined “fallback” survey.

The user can define his own default surveys. A default survey contains information about where to store the raw and processed data on the disks, what projection to use, coastlines to display etc.

When the user creates a new survey, he can use a default survey as a template for the new survey. This may save a lot of parameter definitions.

1.6 SIS as a Controller

This manual also describes the use of SIS as an interface between Kongsberg Maritime’s multibeam echo sounders and third party data acquisition software packages. The two third party software packages that has been tested and verified by Kongsberg are at this moment Hypack ® and Qinsy ®. When SIS is working as a controller, the full SIS functionality is not needed.

An unlicensed version of SIS will work as a controller. The purpose of this is as follows:

- Provide installation parameters needed by the Processing Unit in real-time
- Provide run-time parameters (ping rate, coverage etc.)
- Operation and activation of the echo sounder
- Export of echo sounder datagrams to the third party software package
- Data logging in Kongsberg format

The data logging above is only provided for testing and debug in case of problems with the equipment. In this case all installation settings have to be set correctly inside the controller. In addition, position, gyro and attitude must be interfaced to the processing unit. When SIS operates as a controller, the following will not be a part of the controller and should be provided by the third party software:

- Installation parameters to calculate the correct depths (not needed by the sounder in real-time)
- Calibration
- Quality control of the data
- Data logging for daily operation
- Data cleaning and post-processing
- Creation of DTM, charts, printouts etc.

The installation values needed in the controller will only be the one needed by the echo sounder itself to export quality data to third party software. Example: If the echo sounder is roll stabilized, it needs roll data, correct installation angles for motion sensor and sonar head.

Hypack ®

The Hypack software package will threat the echo sounder as a separate sensor and provide the drivers for interfacing. The motion data needed for correction of the echo sounder data is read from the network (provided by the sounder) together with the range data. The position is interfaced and logged by Hypack in a standard way (read from serial line).

Note

The motion data provided by the echo sounder is moved from it's initial position to the location of the echo sounder. This is done inside the echo sounder Processing Unit.

Qinsy ®

Qinsy read the echo sounder range datagrams from the network and all other sensors are interfaced by Qinsy directly. In other words position and attitude data is interfaced to a serial line directly on the Qinsy PC. To provide correct timing of depths and attitude data the Qinsy PC and the Processing Unit need to be synchronized. This is done by connecting a 1PPS cable from the position system to the echo sounder Processing Unit as well as the Qinsy PC itself. In addition ZDA clock datagrams has to be provided to the two units. If the echo sounder is roll stabilized then roll data has to be sent to the Processing Unit.

→ *For detailed information on the setup of software from Hypack or Qinsy, refer to the manufacturer's documentation.*

Note

Data logged in the Kongsberg format has been timetagged in the Processing Unit of the echosounder. This means that the time tagging is accurate and reliable. If other logging systems are used, the time tagging of the data is the responsibility of that logging software if they bypass these files.

1.7 Terminology and abbreviations

This list gives a short explanation on some of the application components and the most common abbreviations.

Terminology

Application components

Combo box - A dialogue box option that is a text box with an attached list box. The list can be visible or it can be a closed version of a combo box with an arrow next to it. Clicking the arrow opens the list. Users can either type or select their choice.

Check box - A square box that is selected or cleared to turn on or off an option. More than one check box can be selected.

Dialogue box - Dialogue boxes contain command buttons and various kinds of options through which users can carry out a particular command or task. For example, in the “Save As” dialogue box, the user must indicate in which folder and under what name the document should be saved.

Tab - A parameter sheet that contains a labeled group of options used for many similar kinds of settings.

Text box - A rectangular box in which the user can type text. If the box already contains text, the user can select that default text or delete it and type new text.

Transducer Array / Sonar Head

All multibeam echo sounder systems use transducer arrays but in some models the transducers are integrated in sonar heads.

→ *Refer to the installation manual to find out more about your system .*

Abbreviations

The following abbreviations are used in this document:

1PPS - One Pulse Per Second synchronixation signal

ABDC - Area Based Data Cleaning

APB - Autopilot format B sent by SIS/planning stations to allow them to be used to control an autopilot unit

AUV - Autonomous Underwater Vehicle

BD - Bottom detection

BIST - Built-In Self Test

BS - Backscatter

BSP - Beamforming and Signal Processing

CCU - Central Command Unit, the software unit that controls all echo sounders

CMG - Course made good, course from beginning of planned line

COG - Course over ground

CPU - Central Processing Unit

CUBE - Combined Uncertainty and Bathymetry Estimator

CW - Clockwise

CCW - Counterclockwise

DBS - Depth below surface

DBT - Depth below transducer

DDS - Data Distribution System, responsible for logging datagrams

DPT - Depth

DST - Distance to end of line

DTK - Desired track, direction of planned line

DTM - Digital Terrain Model

DXF - Data Exchange File, a three-dimensional graphics file format

EA - A type of singlebeam echo sounder

EM - A type of multibeam echo sounder

ETA - Estimated time of arrival

GGA - Global Positioning System Fix Data (time, position and fix related data for a GPS receiver)

GGK - Position

GMT - Greenwich Mean Time

GPS - Global Positioning System (in this manual GPS includes all kinds of positioning systems)

GUI - Graphical User Interface

HDDS - Handle Data Distribution System, read from disk the data written by the DDS and process the data to xyz

HDM - Heading, magnetic

HDOP - Horizontal Dilution Of Precision

HDT - Heading, true

HWS 10 - Hydrographic Work Station

IP - Internet Protocol

IRLS - Iterated Reweighted Least Squares

KSGPL - Kongsberg SIS Graphic Programming Language

LBDC - Line Based Data Cleaning

LOD - Level Of Detail

ODBC - Open DataBase Connectivity, a standard database access method

OpenGL - A 3-D graphics language

PU - Processing Unit (for multibeam echo sounders with a Transceiver Unit, the PU is included in the TRU)

RAM - Random access memory

RGB - Red, green and blue (primary colours on a computer monitor)

ROV - Remotely Operated Vehicle

RTDC - Real Time Data Cleaning, the real time processing tool in SIS

RTK - Real Time Kinematic

RX - Receiver

SCSI - Small Computer System Interface, a parallel interface standard

SH - Sonar Head

SIS - Seafloor Information System, the new front-end for all echo sounders

SISDB - SIS Database, the database used by SIS to store parameters

SOG - Speed over ground

SQL - Structured Query Language, a standardized query language for requesting information from a database

SSP - Sound speed input diagram

SV - Sound velocity sensor

SV&P - Sound velocity and depth (pressure) sensor

SV&T - Sound velocity and temperature sensor

TCP - Transmission Control Protocol

TRU - Transceiver Unit

TVG - Time Variable Gain

TVG FG - TVG Fixed Gain

TVG NIB - TVG Normal Incidence Backscatter

TVG OB - TVG Oblique Backscatter

TVG RN - TVG Range To Normal Incidence

TX - Transmitter

UDP - User Datagram Protocol, a connectionless protocol

UPS - Universal Polar Stereographic

UTC - Universal Time Conversion

UTM - Universal Transverse Mercator

VRML - Virtual Reality Modeling Language, a specification for displaying 3-D objects

WGS84 - World Geodetic System 1984

XTE - Cross track error, measured, distance to planned line

ZDA - UTC and local date/time data

2 GRAPHICAL USER INTERFACE

2.1 The application window

All interactions with the system take place via a windows based interface on the Operator Station.

The application window is divided into several frames that display different types of information. Depending on what kind of instrument you are using, different options will appear. A principle drawing of the application window is displayed below.

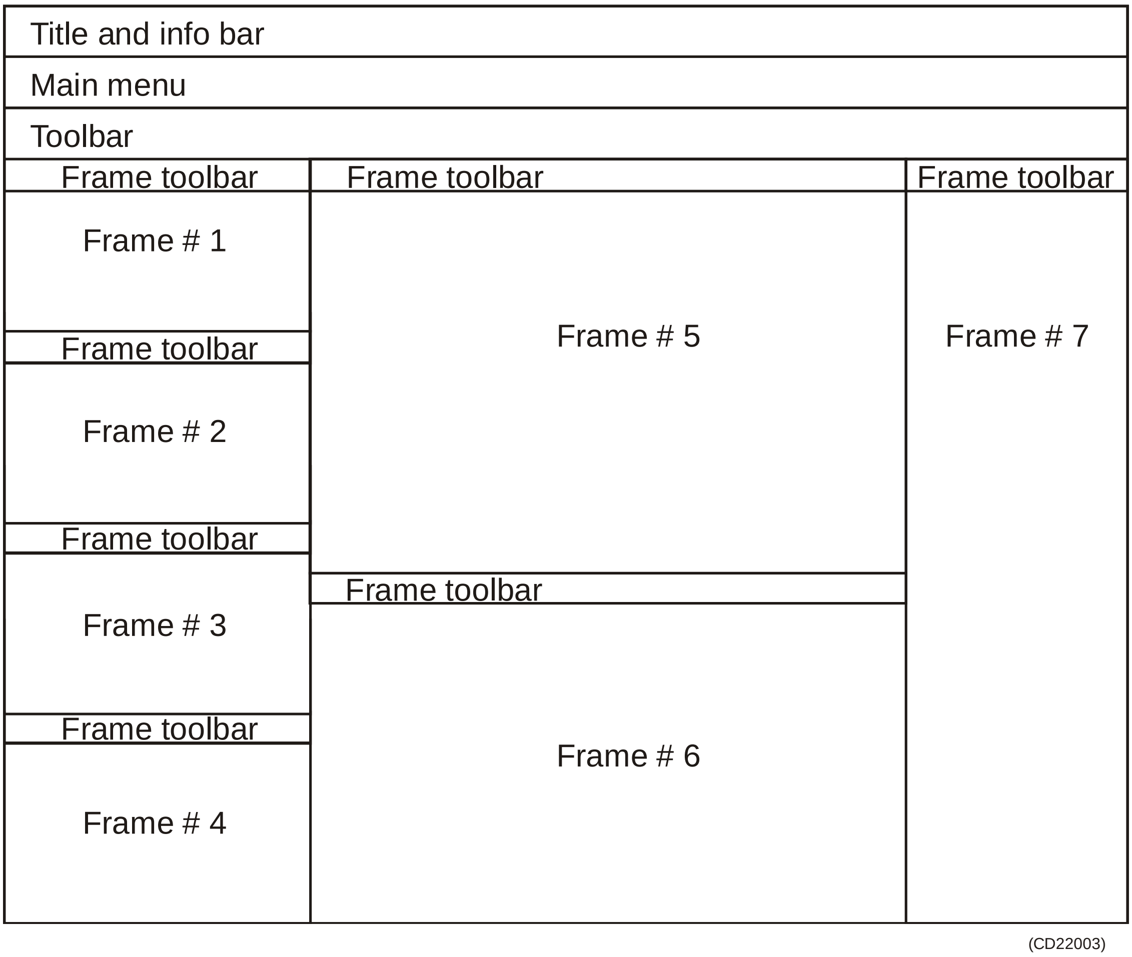


Figure 3 Principle drawing - the application window

Brief descriptions of the various frames and menus are given here:

→ *Frame contents, page 66.*

→ *Menus, page 287.*

→ *Toolbar, page 339.*

SIS defines a screen layout with up to seven simultaneous display windows (or frames). The boundaries between the frames can be shifted so that the frame sizes are adjusted to the user needs, but the system will make sure that no display frame is ever hidden behind another one. The information contents of each display frame can be changed according to the needs.

SIS has many windows, but there are always seven frames. The operator can choose from a list of windows for each frame, and he can save and read his own set up.

The frames are designed so that they will never overlap. This makes it impossible to hide one window behind another. The operator can change the size of the frames by moving the slide-bars. The four frames on the left are separated by three slide-bars which can be moved up and down, and the two frames in the middle are also separated with a slide-bar. There is also a slide-bar to the left of the four frames, and there is a slide-bar at the frame to the right.

The menu bar at the top contains common actions such as save/read settings, exit etc.

The next menu bar contains basic controls for all echo sounders. There are dropdown lists for surveys and survey settings, and for detected echo sounders and the echo sounder currently being operated. There are also control buttons to rescan for echo sounders, start/stop logging or pinging and line counting. Status lamps indicates hardware status for multibeam echo sounders.

2.2 SIS windows

The various windows available in the SIS display are:

- Geographical
- Beam intensity
- Cross track
- Seabed image
- Numerical display
- Message service
- Helmsman Display
- Colour coded depth
- New survey
- Survey administration
- Planning module
- Time series
- Waterfall
- Water column
- Sound velocity profile
- Scope display
- Stave display
- Installation parameters
- Runtime parameters
- Calibration

Note *Not all windows are available for single beam echo sounders and GPS-equipment.*

→ *An example of a SIS frame setup is displayed in figure 4.*

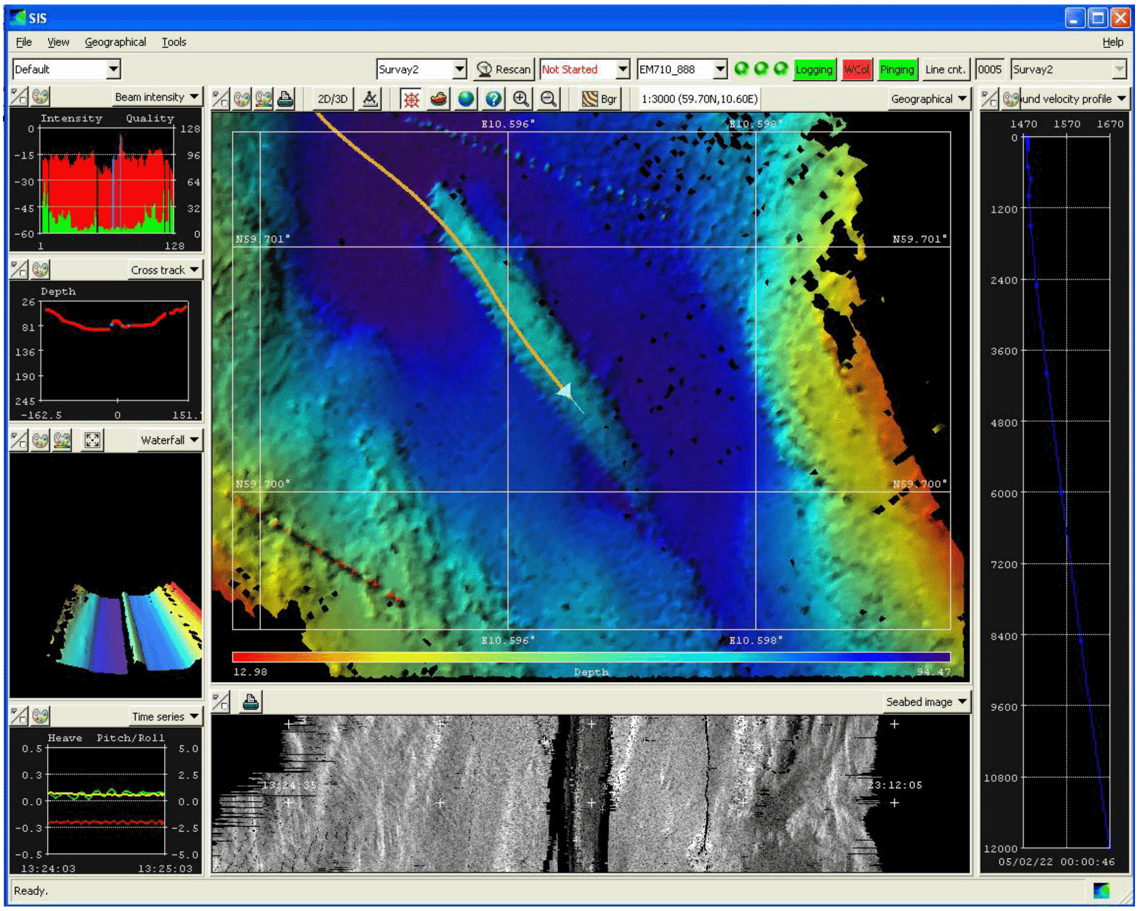


Figure 4 Example of SIS frame setup

Geographical

The Geographical window is used to display all geographical data such as:

- C-MAP background maps
- DXF-files
- Terrain models generated form ASCII xyz-files
- Terrain models from surveys
- Geographical net (geographic and projection net)
- Other kinds of background data from ASCII-files.

It is possible to display several terrain models at the same time, both the terrain model that is being generated by the current survey and terrain models generated from previous surveys. If the data is in ASCII xyz-files, a terrain model can be generated and displayed as background data.

- Depth difference in each grid cell
- Number of points inside each grid cell

The Geographical window use OpenGL for smooth rendering. This means that all views are 3D-enabled and can be rotated in any direction.

SIS uses projection coordinates to display the data. The projection set-up is done in the New survey or Survey administration tabs. The user can define his own projection or choose from a wide range of predefined projections. A 7-parameter datum transformation is also available.

The Geographical window can display a lot of different information. The operator can select from a long list of features what to display.

Note that the terrain models can display a lot of features, such as the distance from the sonar head to the seafloor (Z) and tide corrected depth using a tide file (Zt). If Real Time Kinematic GPS and a geoid model is available, the tide corrected depth (Zv), the distance from the sea floor to the geoid (Zg) and the distance from the sea floor to the ellipsoid (Zr) can also be displayed.

For each grid cell the operator can choose if he wants to see the minimum, median or maximum depth. Note that SIS calculates the median depth, not the mean depth for each cell. The mean depth is an artificial depth which has not been measured, but the median is a real, quality controlled measured depth.

Beam intensity

The Beam intensity window shows the signal strength for each beam. Blue means amplitude detection and red is phase detection. Green indicates the quality for each measurement.

Cross track

The Cross track window shows the depth from each beam, and the x-axis can either be meters or beams. Blue is amplitude detection and red is phase detection.

Seabed image

The Seabed image window logs seabed image data. The resolution in across direction depends upon the size of the window, the width of the swath and the resolution of the sonar. In the across direction a grid will be created to give the highest possible resolution in the window, and then each and every ping is stacked on top of each other.

Numerical display

The Numerical display window shows 26 different parameters at any time. The operator can choose from a list which parameter to display in any of the 26 fields.

There is also some error indication in this window. If one parameter goes beyond its limits, the background will change to yellow (warning) or red (error). This makes it possible to see if there is a problem with some parts of the equipment (i.e. if the PPS is sometimes dropping out). Errors found in the Numerical display window are logged in the Message service window.

Message service

All messages from SIS are stored in the SIS database, SISDB. The operator can open the Message service window and see all messages that have arrived, and when they arrived. One can mask certain types of messages and write the messages to a file. One can also choose which time frame to display the messages between.

Helmsman Display

The Helmsman Display window is usually used together with the Planning module.

When the operator has selected a planned line for surveying, the Helmsman Display window will show status information to the helmsman:

- Current position
- Speed over ground (SOG)
- Depth (DPT)
- Course over ground (COG)
- Direction of planned line (desired track, DTK)
- Course from beginning of planned line (Course Made Good, CMG)
- Distance to planned line (crosstrack error, XTE)
- Estimated time to arrival (ETA)
- Distance to end of line (DST)

There is also a history of XTE and a graphic presentation of the XTE and the operator can choose which of these parameters to display.

Colour coded depth

The Colour coded depth window shows the depth from each beam directly. The y-axis is always time and the x-axis is always beam number.

New survey

In the New survey window the user creates a new survey. A new survey can be of a predefined type which makes it easy to define such things as the projection, background data and storage location for the survey. Normally only the survey name and a comment is required.

Survey administration

In the Survey administration window the operator can define survey types. A survey type define such things as projection, background data to display and where the survey shall be stored on disk. Normally the default set-up can be used, but the operator is free to define any of these parameters at will.

Planning module

The operator can choose to set the Geographical window in Planning mode. One can then create planned lines, create parallel lines, define the survey area and fill it with parallel lines etc. One can save the planned lines to a planned job, and read a planned job from disk.

Time series

The Time series window is used to display different kinds of time series. Normally heave, roll and pitch from the active sensor is displayed. The following can also be displayed:

- Depths from four beams selected by the user
- Depth below the water surface for the most vertical beam.
- Depth of the centre beam
- Single beam and multibeam depths for comparison
- Height
- Heave, roll and pitch from active and/or inactive motion sensor

Waterfall

The Waterfall window is fully implemented with 3D capabilities. The operator can zoom, pan and rotate freely in 3D, and the z-axis can be exaggerated to see small objects better.

Water column

The Water column window shows a graphical representation of the beamformed data for the entire water column for each beam. This window is only valid for echo sounders with water column capabilities.

Sound velocity profile

SIS uses the depths generated in the Processing Unit. This means that the depths have already been corrected for sound speed profile. The current sound speed profile in use by the Processing Unit is shown in the Sound velocity profile window.

Scope display

The Scope display window can be used to investigate the receiver echo data, and is used mainly for test purposes. The data is not logged. This window is valid for multibeam echo sounders.

Stave display

The Stave display window shows a graphical representation of the signal level of all of the receiver elements (i.e. staves). This can be helpful for debug and for performance checks (display of interference signals, air bubbles, saturation, etc.) The data is not logged. This window is valid for multibeam echo sounders with stave display capabilities.

Installation parameters

The Installation parameters window is used to set constant installation parameters such as the distance from the reference point to the sonar head, motion reference unit and the position sensors. These parameters are normally set only once, but may need some calibration before they are found. The parameters can not be modified during operation.

Runtime parameters

The Runtime parameter window contains parameters that can be changed by the operator, such as mode, sound speed profile, filter settings and so on.

In addition the operator may set the parameters employed by the Real Time Data Cleaning module using the dialogue shown.

Calibration

In the Calibration window the operator will see a cross-section of the data from the selected survey lines. The operator will set the Geographical window in calibration mode, select the survey lines to use (at least two), and then define the cross-section. Then he can change the pitch, roll, heading and time offsets and see the impact in the calibration window. The offsets must then be put into the installation parameters.

2.3 Keyboard and mouse operations

The Left mouse button is used to perform a selected operation in the graphic window. The user selects what operation to perform by selecting a pushbutton in the toolbar attached to the window.

The Right mouse button may also be used to perform operations in some cases.

The operator has also direct access to operations by using the mouse and keyboard as described in the table below:

Mouse and keyboard	Function	Windows	Operation
Left mouse button	Zoom to region	Geographical Sound velocity profile Stave display Water column	Press the Left mouse button, drag the mouse to a new area and then release the mouse button.
Left mouse button + Ctrl key	Selection and editing functions		Hold down the Ctrl key, then click the Left mouse button to select or edit an object.
Right mouse button	Quick menu	Geographical Calibration	Click the Right mouse button to open a quick menu.
Right mouse button + Shift key	Rotation	Waterfall	Hold down the Shift key, right click the grid and drag the mouse.
Right mouse button	Panning	Geographical	Right click in the grid, hold down and drag the mouse.
Right mouse button + Alt key	Panning	Waterfall	Hold down the Alt key, right click the grid and drag the mouse.
Mouse wheel	Zooming	Geographical Waterfall	Scroll the mouse wheel forward to zoom the view in, scroll backward to zoom out.
Mouse wheel + Ctrl key	Zooming	Sound velocity profile	Hold down the Ctrl key and scroll the mouse wheel forward to zoom the view in, scroll backward to zoom out.

Mouse and keyboard	Function	Windows	Operation
Mouse wheel + Alt key	Panning	Sound velocity profile	Hold down the Alt key and scroll the mouse wheel forward to pan the view up, scroll backward to pan down.
Ctrl key + S key	Screen capture	Complete SIS application	Saved to file to the directory /sisdata/common/screendumps. *.bmp for Windows and *.png for Linux. Current date and time is included in the filename.

3 OPERATIONAL PROCEDURES

3.1 Introduction

This chapter presents the most important operational procedures required to operate the SIS software.

Note

The SIS software is used by single beam or multibeam echo sounders. When you run a survey, you can log data from more than one system at a time. This implies that not all information herein will be relevant for all systems. This is further explained for each window.

SIS is operated in **online** or **offline** mode.

- The **online** mode is used during the survey. The application is then used to control the (multibeam) echo sounder, to store the data, and to present various views of the data for quality assurance.
- The **offline** mode is used after the survey has been completed, and the data is stored on disk. The application is then used to view the results of the survey.

The standard SIS application will generate a full documentation of the survey results, and provide output for survey statistics, contour charts, illuminated plots etc. For some purposes this may be sufficient, but normally the post-processing packages available are used for data cleaning, image processing and final chart production.

Main operational procedures on how to start and exit SIS, plan and run a survey, set installation and runtime parameters etc. are described in this chapter.

3.2 Prepare for use

When you log in, two programs will start automatically:

- Licence server
- Web-server

The licence server connects to the dongle, and provides you with the licenc(es) you have bought. The web-server called Jetty is used by SIS. You can close these programs, but remember to start them before you start SIS (normally done automatically).

The multibeam echo sounders broadcasts their existence on the network. The single beam echo sounders and the sensors transmitting NMEA datagrams must be set up manually in SIS.

The external sensors, connected directly to the HWS 10, as sound velocity probe, heading and position sensors are registered in the **External sensors** found on the **Tools** menu. Single beam echo sounders and other isntruments transmitting NMEA datagrams must also be registered manually. Use the **Add instruments combinations** found on the **Tools** menu. Afterwards they are handled the same way as echo sounders that broadcast their existence on the network.

When the SIS program starts it will automatically scan the network for connected echo sounders. This will normally take approximately 10 seconds. The detected echo sounders will be compared with a list of echo sounders detected on the previous run. If new echo sounders are detected they will automatically be configured in the SIS program according to a predefined setup for each echo sounder type. This will take approximately 5-10 seconds for each new echo sounder. All echo sounders will then be listed in the **Current echo sounder** combo box, used for selection of an echo sounder for further configuration.

In addition, the same echo sounders may be listed in an **Echo sounder - not started** combo box, depending on whether the autostart mechanism is triggered or not. The autostart mechanism will automatically start all detected echo sounders, if they are exactly the same as on the previous run, that is, if no echo sounders are missing and no new echo sounders are added since the last run. Otherwise the **Echo sounder - not started** combo box will be displayed and the echo sounders must be started manually.

Choose which system you want to change the parameters for, by selecting it from the **Current echo sounder** combo box.

Since several types of echo sounders, with different purpose and capabilities, are handled by the SIS software, the parameter settings for the different types may also be different. For example, not all settings for single beam echo sounders or GPS equipment will be the same as for a multibeam echo sounder.

Note *It is important that the default parameter settings for each echo sounder is checked and/or modified according to the operational and physical settings relevant for the current echo sounder.*

Related topics

→ *Instrument combinations, page 315.*

→ *Echo sounder - not started list, page 344.*

→ *Current echo sounder, page 345.*

3.3 Normal operational sequence

To start the SIS controlling and echo sounder, follow this procedure:

1 Start SIS

→ *Refer to page 28.*

2 Check installation and runtime parameters

→ *Refer to page 29.*

3 Start the echo sounder

→ *Refer to page 41.*

4 Enter survey and operator parameters, set projection

→ *Refer to page 42.*

5 Import a Neptune grid (option)

→ *Refer to page 43.*

6 Start pinging

→ *Refer to page 44.*

7 Check sensor input

→ *Refer to page 45.*

8 Check echo sounder main functions

→ *Refer to page 46.*

9 Start and stop logging

→ *Refer to page 47.*

10 Perform a system calibration (option)

→ *Refer to page 49.*

11 Plan a survey (option)

→ *Refer to page 59.*

12 Run the survey

→ *Refer to page 62.*

13 Export data

→ *Refer to page 63.*

14 Operate Helmsman Display (option)

→ *Refer to page 64.*

15 Exit SIS

→ *Refer to page 65.*

3.4 Start SIS

Power on

Observe the following procedure:

1 Power up the echo sounder units.

2 Power up the Operator Station peripherals.

- Your system may include a number of peripheral devices. Consult the applicable manufacturer's documentation.

3 Configure the single beam echo sounder(s) - if you have any.

4 Power up the SIS Operator Station.

When SIS starts, two background windows will be started:

- Licence server
- Web-server

The licence server connects to the hardware licence dongle and provides the licences to the SIS program. The web-server is an internal SIS component.

The dongle is connected to an USB port on the HWS 10. It is required to run the advanced options of SIS.

Note *Do not stop these applications, they must be running.*

Software initialization and login

The operating system on the SIS Operator Station loads automatically. When the boot process is finished, you can open the SIS program. This is done by clicking on the SIS icon on the desktop or by selecting the program from the Windows™ start menu.

3.5 Check installation and runtime parameters

Installation and runtime parameters are associated with the echo sounder and not with the survey. This means that the installation and runtime parameters are configured separately for each individual echo sounder and that these parameter settings will be the same for that echo sounder, independent of which survey that is run.

The parameter settings for each echo sounder will be stored in a database. As explained in the chapter *Preparing for use,* when an echo sounder is detected for the first time, all parameters will be set to a default value, determined by the type of echo sounder. It is important that the installation and runtime parameters are checked and updated if necessary.

Note *A list of the parameters and the used settings should be kept in a safe and accessible place.*

External sensors: The Communication parameters must be configured connecting to any instrument. Heading and position data can be transferred to one or several single beam echo sounders.

Instrument combinations: Single beam echo sounders and GPS must be registrered manually. When the instruments are registered, the user can move on to the installation and runtime parameters. (GPS does not have runtime parameters).

Note *The Installation parameter window can be displayed at any time, but parameters can only be modified when pinging and logging is deactivated.*
The Runtime parameter window can be displayed at any time, independent of pinging and logging status.

Note *If SIS has been left inactive for some time, the operating system may have swapped the complete SIS process to disk. The operating system must then read SIS into the RAM again. This may take a few seconds, during which datagrams including installation and runtime parameters should not be sent to the Processing Unit.*

Related topics

→ *Installation parameters for multibeam echo sounders, page 31.*

→ *Installation parameters for single beam echo sounders and GPS equipment, page 35.*

→ *Runtime parameters for multibeam echo sounders, page 37.*

→ *Runtime parameters for single beam echo sounders and GPS equipment, page 40.*

→ *External sensors, page 310.*

→ *Instrument combinations, page 315.*

Installation parameters for multibeam echo sounders

The installation parameters are divided into three main groups:

- Communication setup parameters

  The communication setup parameters define the input and output settings for the serial - and network (Ethernet) ports on the echo sounder Processing Unit. In addition this parameter group also defines the type of information (datagrams) that is received and/or sent on the individual ports.

  To be able to set these parameters correctly it is necessary to know the type of equipment that is connected to each individual PU port. Depending on the port type, the connections are either direct, using a serial link, or remote via the system network.

  The equipment type and which port the different equipment types may be connected to, is defined by a set of rules/restrictions.

  → *These restrictions are defined on page 163.*

Note

If the communication setup is not correct this may result in loss or corrupted functionality - and in the worst case an inoperable system.

- Sensor setup parameters

  In order to measure correct depths the system must know the physical positions, angles, offset values and delays for all transducers and sensors. This information belongs in the second main group of installation parameters - sensor setup parameters.

  Also, based on the set of equipment that is connected to the echo sounder PU (Processing Unit), it may be necessary to select what equipment to use as active units when several alternatives are available.

  If no selection is made, the system will automatically use the sensor connected to the lowest numbered port when two or more alternatives are available.

- BIST - self tests

  The options available allows you to test individual functions and hardware items.

How to open the installation parameter interface

The installation parameters for the different echo sounders are located in the **Installation parameter** window, but all external sensors not connected to the PU (Processing Unit) but the HWS 10 Operator Station, are located in the **External sensors** dialogue box found on the *Tools* drop-down menu.

In order to open the installation parameter interface perform the following actions:

1 Select the echo sounder you want to change parameters for in the **Current echo sounder** combo box.

2 Either:

- Use the **Frame** button to select **Installation parameters** in the desired frame.

or

- Locate the **Manage Windows** selection from the *View* menu.
- Select **Installation parameters** from one of the combo boxes and press OK.

The “Installation parameters” window opens.

Select and modify

1 Select the first main tab, **PU Communications Setup**, if not already opened. Three sub-tabs are displayed.

2 In turn, select and modify, as appropriate, the following sub tabs:

Input Setup tab

In turn, select each port in the Input port combo box and change the corresponding communication and input format settings as appropriate.

Output Setup tab

In turn, select each port in UDP Host Port combo box and change the Datagram subscriptions on the selected port as appropriate.

The basic functionality is dependent on the default settings.

- The Host UDP1 and UDP3 defines formats used internally in the operator station and cannot be changed.

- The Host UDP2 defines datagrams logged to file (.all files).
- The Host UDP4 is available for third party software.

Caution *UDP1 to 3 should not be changed.*

Clock Setup tab

The PU clock can be set to use the same time and date as an external clock, the clock in the active positioning system or the clock in the operator station. The clock drift can be corrected by a one pulse per second signal (1PPS) normally available from a GPS receiver.

3 Next, select the tab **Sensor Setup**. Five sub-tabs are displayed.

4 In turn, select and modify, as appropriate, the following sub tabs:

Settings tab

Select settings for position, heading and motion systems on the different ports. Decide which sensors that should be active by selecting the port where the relevant sensor is connected.

Locations tab

Enter the measured position for the different sensors and transducers. Note that if the vessel’s deplacement or trim changes during a survey, the waterline value must be updated accordingly.

Angular Offsets tab

Enter the measured angle offsets for the different sensors and transducers.

System Parameters tab

Enter backscatter offsets and system related parameters.

ROV Specific tab

Only required if the transducers is mounted on a subsea vehicle.

5 Next, select the tab **PU BIST**. It contains several tests you can perform to check the operation of the echo sounder system.

6 Press the OK button to save new settings or Cancel to revert back to current settings.

Related topics

→ *External sensors, page 310.*

→ *Current echo sounder, page 345.*

→ *Installation parameters, page 160.*

→ *Input Setup, page 161.*

→ *Output Setup, page 165.*

→ *Clock Setup, page 167.*

→ *Settings, page 169.*

→ *Locations, page 173.*

→ *Angular Offsets, page 175.*

→ *ROV Specifics, page 178.*

→ *System Parameters, page 180.*

→ *PU BIST, page 186.*

Installation parameters for single beam echo sounders and GPS equipment

Installation parameters for single beam echo sounder and GPS equipment are divided into two main groups in the same way as for the multibeam echo sounders:

However, the number of parameters is greatly reduced compared to multibeam echo sounders.

- Communication setup parameters

  The communication setup parameters define the input settings for the serial- and network (Ethernet) ports on the Operator Station (external sensors).

  To be able to set these parameters correctly it is necessary to know the type of equipment that is connected to each individual port. Depending on the port type the connections are either direct, using a serial link, or remote via the system network.

Note *If the communication setup is not correct this may result in loss or corrupted functionality - and in the worst case an inoperable system.*

- Sensor setup parameters

  In order to measure exact depths and their positions the system must know the physical positions and delays for transducers and sensors (positioning equipment). This information belongs in the second group of installation parameters - Sensor setup parameters.

How to open the installation parameter interface

The installation parameters are found on different places. Most of them are located in the **Installation parameter** window but all external sensors are gathered in the **External sensors** dialogue box found on the *Tools* drop-down menu.

To open the installation parameter interface perform the following actions:

1 Select the echo sounder you want to change parameters for in the **Current echo sounder** combo box.

2 Either:

- Use the **Frame** button to select **Installation parameters** in the desired frame.

or

- Locate the **Manage Windows** selection from the *View* menu.

- Select **Installation parameters** from one of the combo boxes and press the OK button.

The “Installation parameters” window opens (Single beam installation or GPS installation window).

Select and modify

1 In turn, select and modify, as appropriate, the following:

Sensor name

Use the combo boxes to select Heading and Position.

Serial/Ethernet connections (not for GPS)

Set the serial port parameters if a serial port is to be used or select an Ethernet port and set corresponding IP and port address.

Locations (m) (not for GPS)

Enter the measured position for the different sensors and transducers (single beam only). Note that if the vessel’s deplacement or trim changes during a survey, the waterline value must be updated accordingly.

2 Press the OK button to save new settings or Cancel to revert back to current settings.

Related topics

→ *External sensors, page 310.*

→ *Current echo sounder, page 345.*

→ *Installation parameters, page 160.*

Runtime parameters for multibeam echo sounders

Runtime parameters are divided into four main groups:

- Sounder Main parameters
- Sound Speed
- Filter and Gains
- Data Cleaning

The content of these groups may vary depending on echo sounder type. Additional groups may also exist.

Sounder main

The sounder main settings concern the operational parameters for the echo sounder including coverage, depth and swath control.

Sound speed

Sound speed settings concerns selection and use of sound speed profiles and sound speed at transducer settings.

Filter and gains

Filter and gains settings concern filtering to avoid erroneous measurements, for example, false bottom detection. It also includes settings for the bottom backscatter measurement and seabed imaging.

Data Cleaning

Data Cleaning defines rule sets for how the gridding should be performed. There are two parameter groups: Ping processing rules and Grid processing rules.

How to open the runtime parameter interface

To open the runtime parameter interface perform the following actions:

1. Select the echo sounder you want to change parameters for in the **Current echo sounder** combo box.
2. Either:
   - Use the **Frame** button to select **Runtime parameters** in the desired frame.

   or

   - Locate the **Manage Windows** selection from the *View* menu.
   - Select **Runtime parameters** from one of the combo boxes and press the OK button.

The Runtime Parameters window opens.

Select and modify

1 In turn, select and modify, as appropriate, the following:

Sounder Main tab

- Set the sector coverage parameters: <set to match local conditions>.
- Set the depth parameters: <set to match local conditions>.

  The Min and Max depth settings are used to guide the echo sounder in tracking the bottom. Incorrect settings may result in a failure to detect the bottom and thus a disabled system. If the echo sounder has problems detecting the bottom within the min-max range use the Force Depth button with a measured depth or a depth from a chart.
- Set the swath control parameters: <set to match local conditions> if present.
- Set Pitch and Yaw stabilization: <set to match local conditions>.

Sound Speed tab

This tab contains Sound Speed profile and Sound speed at transducer.

In order to ensure accurate data, you must know the sound speed profile in the survey area. The profile may change with both time and position in the survey area. It may therefore be necessary to measure the profile several times during a survey. A profile is stored in a file and can be found using the browse button (the button marked with "…"). When found and selected, the profile is activated by pressing the button marked "Use Sound Speed Profile".

Set the Sound speed at transducer source:

i) Manual: Sound speed value must be entered.

ii) Profile: A value from the sound speed profile is used (existing or interpolated).

iii) Probe: Values from the probe is used. The offset value must then be specified.

Filters and Gains tab

Three subgroups are present: Filtering, Absorption Coefficient and Normal Incidence Sector.

- Set the Filtering parameters: <set to match local conditions>.

    * It is recommended to change the filtering parameters from the default setting only if the occurrence of false detections is too high to be acceptable.

- Set the Absorption Coefficient parameters: <set to match local conditions>.
    * A correct value for the absorption coefficient is important with respect to the validity of the bottom backscatter measurements.
- Set the Normal Incidence Sector parameters: <set to match local conditions>.
    * Degrees from nadir defines the angle at which the bottom backscatter can be assumed to be independent of the strong increase at normal incidence. The value is dependent on bottom type.

Data Cleaning tab

Here you can define rule sets for how the gridding should be performed. There are two parameter groups: Ping processing rules and Grid processing rules.

It is recommended that only experienced users should change the processing parameters from the default values.

Related topics

→ *Current echo sounder, page 345.*

→ *Runtime parameters, page 200.*

→ *Sounder Main, page 201.*

→ *Sound Speed, page 225.*

→ *Filter and Gains, page 232.*

→ *Data Cleaning, page 261.*

Runtime parameters for single beam echo sounders

Processing defines rule sets for how the gridding should be performed. There are two parameter groups: Ping processing rules and Grid processing rules.

It is recommended that only experienced users should change the processing parameters from the default values.

Related topics

→ *Current echo sounder, page 345.*

→ *SB Runtime, page 278.*

3.6 Start the echo sounder

Before you start pinging, an echo sounder must be running. The echo sounders are normally started automatically by the autostart mechanism. If the autostart mechanism is not triggered, the echo sounders must be started manually. This is done by selecting the desired echo sounder from the "**Echo sounder - not started**" combo box. The **Logging**, **Pinging** and **Line counter** buttons will all be disabled until the echo sounder is ready. When the echo sounder is ready, you can start to ping.

Single beam echo sounders must be set up and started manually on its own Operator Station.

Related topics

→ *Main toolbar, page 340.*

→ *Echo sounder - not started list, page 344.*

3.7 Enter survey and operator parameters, set projection

In order to start a new survey you must identify the survey parameters. This is done in the **New survey** window.

Related topics

→ *New survey, page 134.*

3.8 Import a Neptune grid to SIS (option)

SIS requires that a projection file is stored in the same folder as the gridded data. This applies both to Neptune and SIS grids. A projection file can be created as follows:

1 Open the New survey window.

2 Select the Projection tab under the Advanced options tab.

3 Press the "Create new projection" button on the Projections tab. This opens the Projections dialogue box.

4 Press the "Select projection in the database" button in the Projections dialogue.

5 Select a projection from the list displayed and press OK. The name of the selected projection is now shown in the Projection definition field.

6 Press the "Write projection to file.." button.

7 Browse for the same folder as where the survey is stored. This folder contains two sub-folders named Display and Process, and two files named GridIndex.properties and GridManager. properties.

8 Name the file sis_proj.txt and save it.

Now the grid can be imported to SIS using the Import/Export... option accessible from the File menu.

If the desired projection is not stored in the database, a new projection can be defined by pressing the "New" button in the Projection definition field.

Related topics

→ *New survey, page 134.*

→ *Projections, page 142.*

→ *Import/Export..., page 290.*

3.9 Start pinging

Pinging must be started manually after the echo sounder is ready. When pinging is **ON**, the **Waterfall**, **Cross track** and **Beam intensity** windows will become active.

1. In the **Current echo sounder** combo box, select the echo sounder you want to ping with.
2. On the toolbar: Press the **Pinging** button. The button is red when off and green when on.
   - The selected echo sounder will now start transmitting.

Related topics

→ *Main toolbar, page 340.*

→ *Current echo sounder, page 345.*

3.10 Check sensor input

Proper operation of the external sensors are vital for the SIS operation. These are sensors connected to the PU (Processing Unit) and not directly to the Operator Station.

Sound speed at transducer depth is connected directly to the HWS 10 Operator Station (if present).

External sensors are continously monitored in SIS. The **Time series** window display data from the motion sensor. Sensor data is also displayed in the **Numerical display** window. Errors from the sensors are reported in the **Message service** window.

Related topics

→ *Numerical display, page 89.*

→ *Message service, page 93.*

→ *Time series, page 100.*

3.11 Check echo sounder main functions

Before you start logging, you are adviced to make sure that the (echo sounder) system is locked on the bottom and that the swath coverage is as expected.

This is shown in the ping display.

The **Geographical** window presents a real-time view of the system(s) performance during on-line operation. The window shows the raw data from the system(s) after corrections have been applied for vessel attitude and sound speed.

Note *The following information is only valid for multibeam echo sounders. Single beam echo sounders and GPS equipment does not have this option.*

While pinging or logging, realtime depths can be displayed in the **Geographical** window with the following setup:

1 Press the *show/hide* button for the Geographical window.

2 Select the Realtime depths selection.

3 Press OK.

Check the following windows for proper operation:

- Check the **Waterfall** window for a continuous bottom.
- Check the **Cross track** window to see the depths for all the beams ping by ping.
- Check the **Beam intensity** window for reasonable backscattering strengths for each individual beam.
- Check the sensor status in the **Numerical display** window.

Related topics

→ *Geographical, page 67.*

→ *Beam intensity, page 78.*

→ *Cross track, page 81.*

→ *Numerical display, page 89.*

→ *Waterfall, page 105.*

3.12 Start and stop logging

Logging must be started manually after the echo sounder is ready. In the **Current echo sounder** combo box, select the echo sounder you want to ping with.

Note that if pinging is **off** when logging is turned **on**, pinging will automatically be turned **on**. If logging is **on** and pinging is turned **off**, logging will automatically be turned **off.**

Alternative 1

During the survey, the vessel navigates along the pre-planned survey lines. Logging must be started at the beginning of each line. Stop the logging at the end of each line and start it again at the beginning of the next

At the start of every survey line:

1 Press the red **"not logging"** button on the toolbar.

- Logging starts and the button turns green.

2 Allow the vessel to navigate along the survey line.

3 Press the green **"logging"** button when the vessel has reached the end of the line.

4 Transit to the next line.

5 Press the red **"not logging"** button when you start the new line.

When the final survey line has been completed:

6 Press the green **"logging"** button.

Alternative 2

You can also start the logging at beginning of the first line and let it run continuously, toggling survey line change as appropriately.

At the start of the first survey line:

1 Press the red **"not logging"** button on the toolbar.

- Logging starts and the button turns green.

2 Press **Line Cnt (xxxx)** at the beginning of each survey line.

- This assigns a new line number.

When the final survey line has been completed:

3 Press the green **"logging"** button.

Saving data

When the echo sounder has started logging, data is automatically saved to disk.

The Line counter button on the toolbar displays the line count for the currently selected echo sounder.

To avoid very large log files the counter for all active echo sounders are incremented automatically every 30 minutes (this is configurable). This, however, only happens when the counter has not been incremented by other means within the last 30 minutes. (This is done by pressing the line counter button or by stopping and starting logging).

Disk usage and disk full warnings are reported by Windows XP. When such warnings are received, the operator must copy the surveyed data to an external storage device and delete the data from the logging computer.

Related topics

→ *Current echo sounder, page 345.*

→ *Line counter, page 346.*

3.13 Perform a system calibration (option)

Note *This applies to multibeam echo sounders only.*

Introduction

To ensure maximum reliability and accuracy from the system, the system and externally connected sensors should be calibrated before the start of a new survey.

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 SIS 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 SIS 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 5.*

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, increasing with acrosstrack distance from the centre where it is zero.

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 6.*

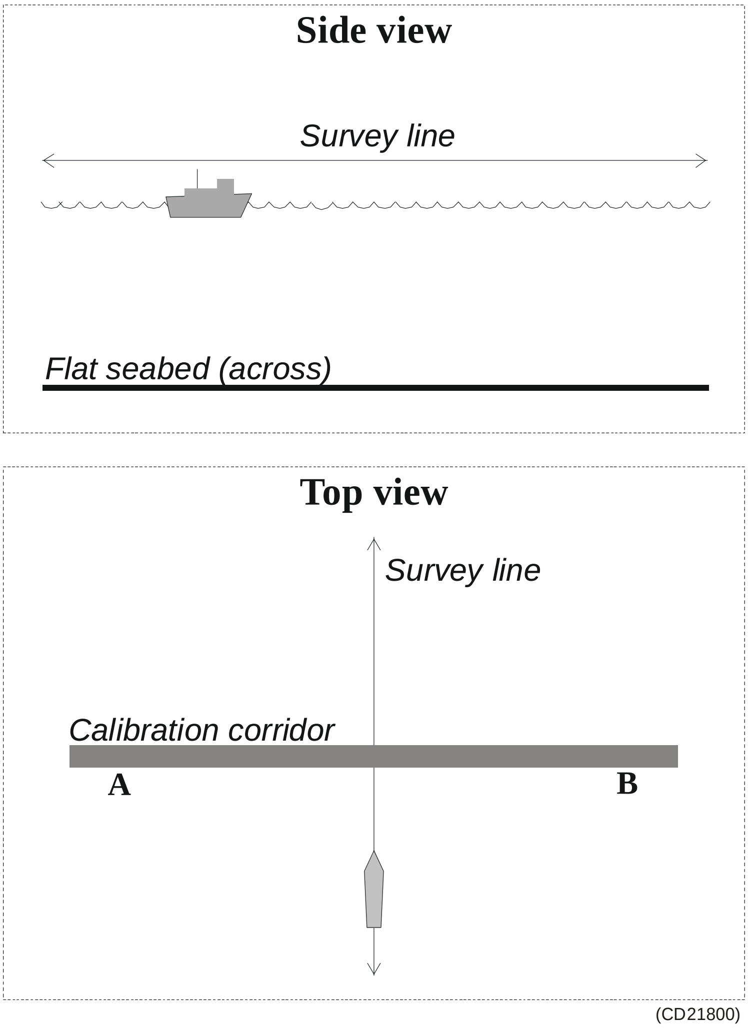


Figure 5 Roll offset calibration procedure

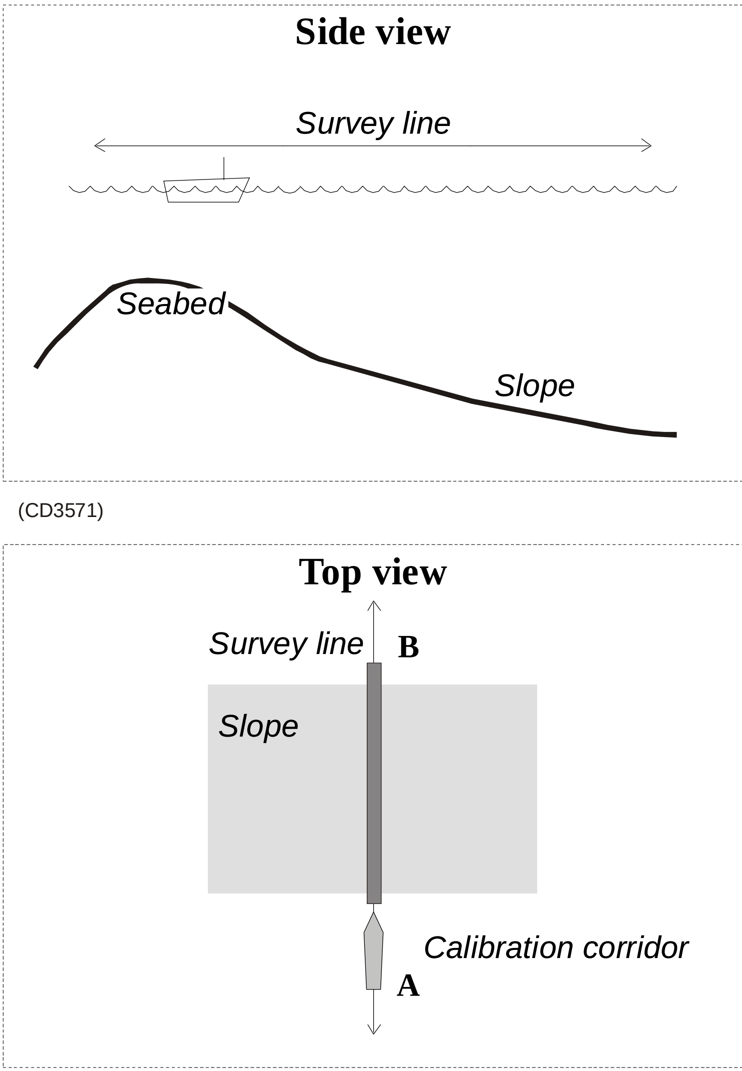


Figure 6 Pitch offset and time delay calibration procedure

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 is supposed to be valid.
- Multibeam echo sounders with transducers: 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, while that due to distance offset is independent of depth and speed.

Comparing data from the two lines in the same direction, but with different vessel speed, will thus allow the time delay to be found. After the correction for any time delay error has been applied to the data, the pitch offset can be determined 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.

→ *Refer to figure 7.*

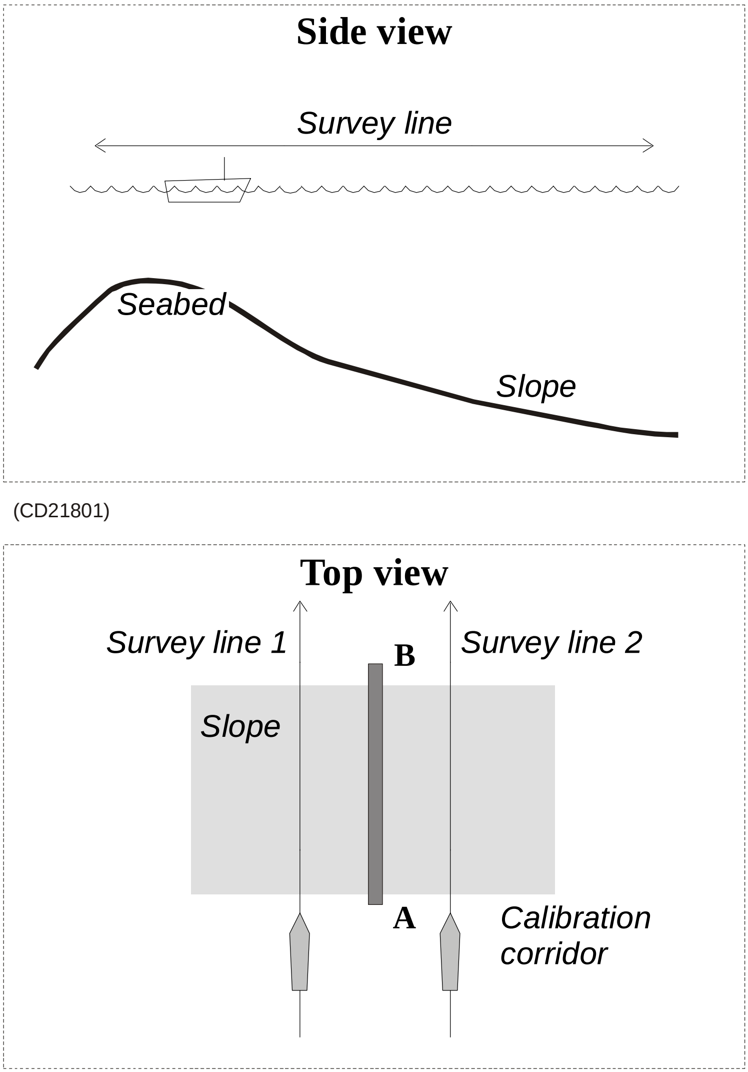


Figure 7 Heading offset calibration procedure (alternative 1)

<u>Alternative 2</u>

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.

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 8.*

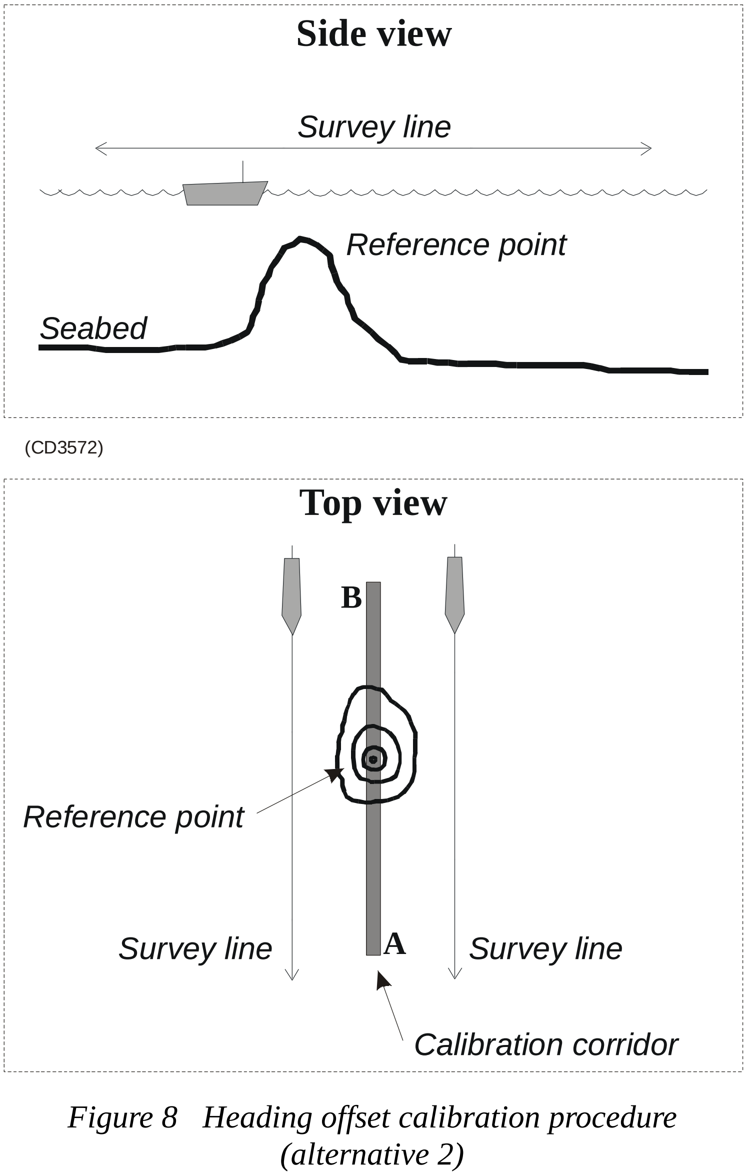


Figure 8 Heading offset calibration procedure (alternative 2)

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.

Sound speed quality inspection

Use one or more pairs of lines on a flat sea floor, where the lines are perpendicular to each other. This means that the two lines in the pair cross each other on a flat area of the sea floor with a difference in the sailing direction of about 90 degrees. Compare the depth in different points in the crossover region. Depth differences along the two centre lines with respect to the outer edges of the swath from the other line (i.e. points 2, 4, 6, 8) will be due either to roll or sound speed errors. Note that the depth error due to sound speed has the same sign, while those due to roll changes sign across the centreline.

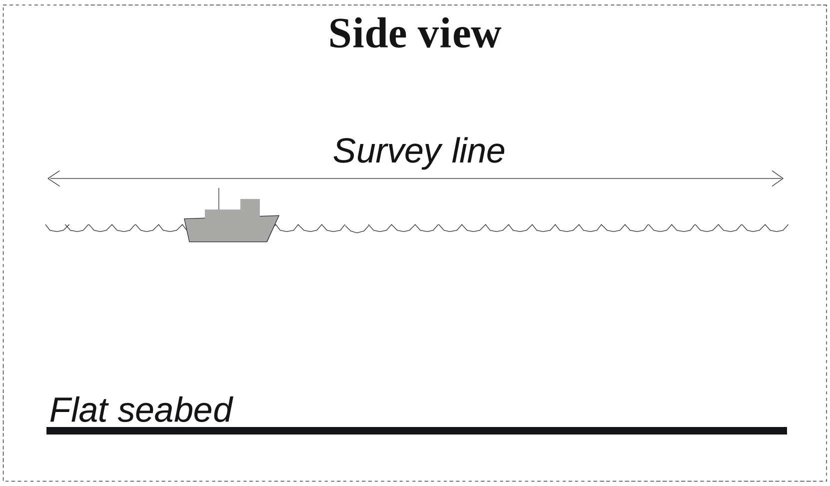
→ *Refer to figure 9.*

Outer beam angle offset calibration (for EM 1002 only)

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 the figure above. 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

Note *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.*



(CD 1065)

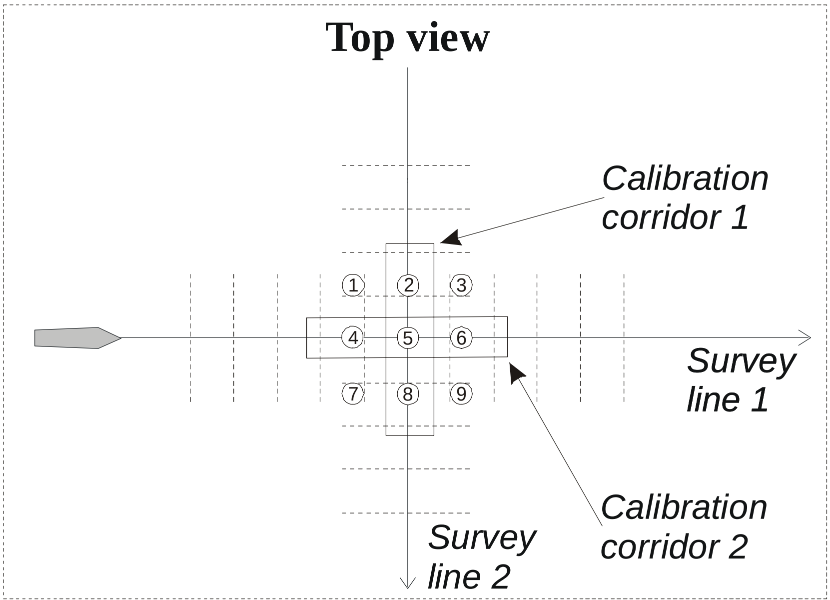


Figure 9 Offset beam angle calibration

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.

→ *Refer to figure 9.*

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 0.1 degrees).

Automatic calibration

Perform an automatic calibration for test of system installation and calibration. The automatic calibration is executed by the **SeaCal** program.

Related topics

→ *Calibration, page 282.*

→ *SeaCal, page 430.*

3.14 Plan a survey

Introduction

As a general rule, the survey should be properly planned. The plan can be based upon a chart where the planned survey lines are plotted. General knowledge about the bottom conditions may be useful.

- Communication
- Offset and location definitions

If any of these settings have changed, the system parameters must be adjusted accordingly before the survey starts.

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

The planned lines must take into account islands, coastlines, shoals or other obstacles within the survey area which may affect 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 instead being used to determine what lines 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.

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 module is thus to provide help before and during the survey.

Factors to consider

A survey is normally planned taking into account

- Echo sounder coverage
- Seafloor topography
- Sound speed variations
- Current weather conditions.

The need for calibration of the positions (time delay), heading, roll and pitch sensors should be considered, and how and where to gather sound speed profiles.

Coverage capability determines line spacing, and as it varies with bottom reflectivity, this must be estimated. Usually 10% overlap between lines is sufficient, but if large variations in bottom reflectivity is expected, or reflectivity is unknown, it may be necessary to increase overlap. The overlap must also be increased if the vessel’s roll is excessive.

If there are steep slopes on the bottom, it is strongly advised to run along these slopes, not up or down them. This will be beneficial in keeping coverage reasonably constant along survey lines, thus making survey planning easier. However the main reason for this advice is that the echo sounder performance will usually be poorer when running up or down a slope rather than along. This is because much less acoustic energy is reflected back towards the transducer from steep slopes, causing less detections and the possibility of false detections in sidelobes. Sidelobe detections should however be very rare in the Kongsberg multibeam echo sounders due to the advanced signal processing implemented. Note that if circumstances require that survey lines are run up or down a slope, reduction of vessel speed may be required to allow the echo sounder to track the bottom continuously.

Coverage capability is also affected by weather conditions and possibly also by vessel speed. Heavy seas and possibly vessel speed lead to increased noise level, and may also cause aeration on the Sonar Head or the transducer array.

Aeration is a function of sea state, but also of the heading with respect to the wave direction and the vessel speed. It is strongly advised that one builds a record of coverage and aeration problems versus sea state, heading with respect to wave direction, and vessel speed. This record could be very helpful in ensuring that surveys can be performed efficiently with a minimum of line rejections and corresponding reruns and infills.

Any drift rates of roll, pitch and heading offsets should also be recorded to enable efficient planning of calibration intervals. If calibration is required before a survey, a suitable calibration area should be determined before reaching the survey area.

A sound speed profile should always be taken in the surveying area and loaded into the SIS before the survey is started. In some areas the profile will vary, mostly due to fresh water inflows from rivers or currents from areas with different salinity. Surface sound speed variation may be strongly affected by solar warming. If variations can be expected, where and when sound velocity profiles are to be taken should be planned ahead, and the survey line schedule adjusted to take this into account.

If the measured sound speed value at the Sonar Head depth or the transducer array depth is continuously measured, it should be compared with that measured by the profiling instrument to evaluate the need for measuring a new profile.

Note that in some cases the coverage capability of the echo sounder cannot be fully utilized, because errors in roll and sound speed profile measurements, which are critical in maintaining the accuracy of the outer beams, become too large in relation to the accuracy requirements of the survey. The ray bending effect (Snell’s law) might also reduce the online coverage since the energy can bend inwards.

Related topics

→ *Planning module, page 153.*

3.15 Run the survey

Retrieve a planned job

As previously described, a survey should be properly planned before start.

Before the logging starts, you can retrieve a planned job.

1 Open both the Geographical and the Planning Module windows.

2 In the Geographical display, activate the Show/Hide button and select the Planning checkbox.

3 After closing the Show/Hide button, press the “P” button on the Geographical toolbar to activate the Planning module.

4 A shortcut to the above is to select “Planning” from tne Settings combo box, and then press the “P” button.

5 Select the “Jobs” tab on the Planning module display.

6 Press the “Open Job” button to browse for the plan for the current survey.

To monitor the progress

There are different ways to monitor the progress depending on what kind of system you are running.

Status information

The logging and system status is observed, with additional data available.

The following is a summary of the status information:

- On the right hand side of the toolbar there are three buttons. They give you the status on logging, pinging and line number.
- In the numerical display view you can select the sensor data values you want to monitor.
- In the message survey display view you will be given warnings, error reports and other information.
- Three status lamps on the main toolbar give status on hardware units (multibeam echo sounders only).

Related topics

→ *Numerical display, page 89.*

→ *Message service, page 93.*

→ *Planning module, page 153.*

3.16 Export data

If you want to export data use the **Import/Export** dialogue box found on the *File* menu.

Related topics

→ *Import/Export..., page 290.*

3.17 Operate Helmsman Display (option)

The Helmsman Display must be connected to the echo sounder’s operator station (normally the HWS10). From the HWS10 Operator Station the operator can control what surveys shall be displayed on the remote Helmsman Display. The operator at the HWS10 Operator Station imports the surveys he wants to see, and from the Planning module he chooses “Transfer grids”. The same grids (terrain models) will then be displayed on the Helmsman Display.

Also, the operator on the HWS10 Operator Station can choose to display all the currently planned lines on the Helmsman Display. This is done when you choose “Transfer plan” in the Planning module.

The currently active line will always be sent from the HWS10 Operator Station to the remote Helmsman Display. Here, the operator can see the distance from the planned line to the current position and some more status information about the current line.

The operator at the Helmsman Display can then freely set his own colors, shading, scale and area to display. He can choose to see a completely different area than what is currently surveyed. This makes it possible for the operator at the Helmsman Display to do his own quality assesment of the surveyed data and to take action if necessary.

If the logging stops for whatever reason, the Helmsman Display will no longer update. This allows the operator at the Helmsman Display to verify that the survey is progressing as planned.

Related topics

→ *Helmsman Display, page 95.*

→ *Planning module, page 153.*

Installation of a Helmsman Display is described in the *SIS Installation procedure* document.

3.18 Exit SIS

Software

You can either exit the SIS program by selecting **Quit** from the **File** drop-down menu or you can press the “close” button up to the right in the SIS program window.

Hardware units

Operator Station

The SIS Operator Station is powered down first.

1 Switch the power off.

2 Switch off all the peripherals.

Processor or Transceiver Unit

1 Open the door on the Processor/Transceiver Unit and switch power off. Alternatively use the remote power switch.

4 FRAME CONTENTS

4.1 Introduction

This chapter describes the various windows shown by the SIS program.

Seven frames can be displayed at the same time. The content of each and every frame is decided in the Manage Windows or by using the **Frames** button.

Note — *Not all windows are available for all instruments.*

Monitoring windows

→ *Geographical, page 67.*
→ *Beam intensity, page 78.*
→ *Cross track, page 81.*
→ *Seabed image, page 86.*
→ *Numerical display, page 89.*
→ *Message service, page 93.*
→ *Helmsman Display, page 95.*
→ *Color coded depth, page 98.*
→ *Time series, page 100.*
→ *Waterfall, page 105.*
→ *Water column, page 111.*
→ *Sound velocity profile, page 120.*
→ *Scope display, page 124.*
→ *Stave display, page 127.*

Survey administration windows

→ *New survey, page 134.*
→ *Survey administration, page 146.*
→ *Planning module, page 153.*

Parameter setup windows

→ *Installation parameters, page 160.*
→ *Runtime parameters, page 200.*

Calibration window

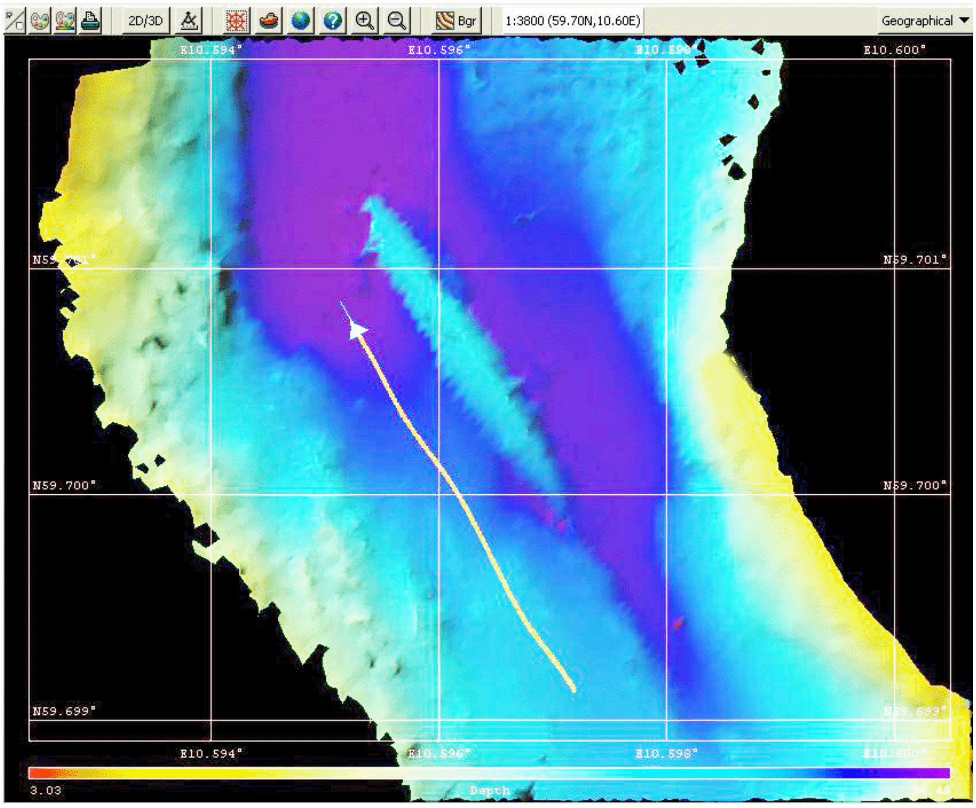
→ *Calibration, page 282.*

4.2 Geographical

The **Geographical** window is either accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

The main purpose of the Geographical window is to show geographical data like surveys, shipstracks, coverage, planned lines and so on. The window consists of one geographical region with a toolbar on top. It can also be referred to as main window.

This window is valid for all instruments.



Zooming

In addition to using the zoom buttons (see descriptions below) you can also:

- Zoom in or out on the data by using the mousewheel
- Zoom in on a specific region by pressing the left mouse button, drag the mouse to a new location and then release the mouse button
- Set the “camera” to view a given region by pressing the Zoom to region button and enter the wanted scale and position

Hints on Geographical frame settings

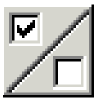
To see a good model of the seafloor, use the Show/hide button and choose **Depth operations: Min**. This will select the minimum value in each grid cell and create a surface from them. Noise will be hidden in this surface, but it will be the shallowest surface drawn very smooth.

To look for artifacts in the data, use the Show/hide button and choose **Depth operations: Median**. This will select the median value in each grid cell and the result will be that artifacts can be seen more easily. Also select **Level of Detail** from the **GeoView** menu and choose a smaller level of detail. When looking at the data in a small scale, artifacts can be seen. The operator should not set level of detail to 0 to begin with, as this may overload the system resources. Instead try to use an increasingly smaller level of detail until a good picture is found. Then try to turn the **Static light source** on and off selected from Geographical, Light Source, from the main menu. When off, the light source will follow the mouse cursor and make it easier to see shadows from different angles. Also try to change the **Depth scale factor** in the Show/hide button to see shadows even better.

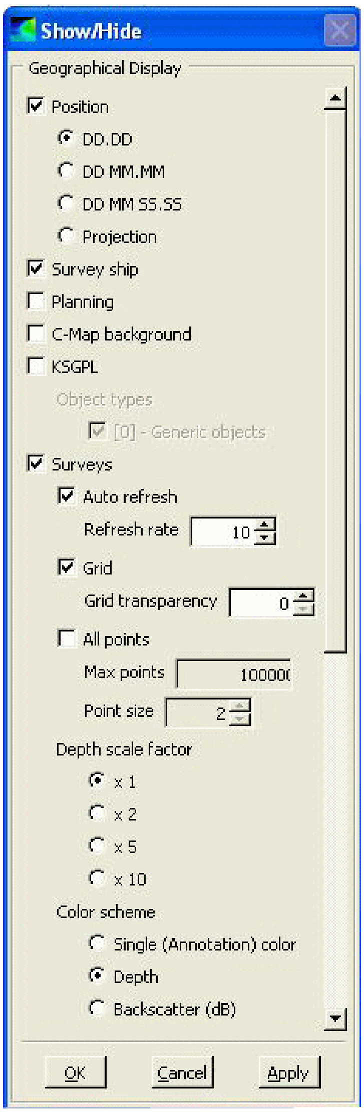
Toolbar buttons

The toolbar holds the following buttons (from left to right):

- Show/hide
- Annotation colours
- Dynamic colours
- Print
- 2D/3D Toggle
- Position and distance measure
- Follow ship
- Zoom to ship
- Zoom to world
- Zoom to given region
- Zoom in
- Zoom out
- Background
- Information field (not a button)
- KSGPL edit mode (when selected in Show/hide)
- Planning edit mode (when selected in Show/hide)
- Calibration edit mode (when selected in Show/hide)
- C-Map manipulation mode (when selected in Show/hide).



Show / Hide button



Position: Show or hide the position text fields (latitude and longitude).

- DD.DD: Display position as decimal degrees.
- DD MM.MM: Display position as degrees and decimal minutes.
- DD MM SS.SS: Display position as degrees, minutes, and decimal seconds.
- Projection: Display position as projection coordinates.

Survey ship: Show the survey ship or not.

Planning: This will enable the planning module in the Geographical window. An Edit button will be added to the Geographical window toolbar.

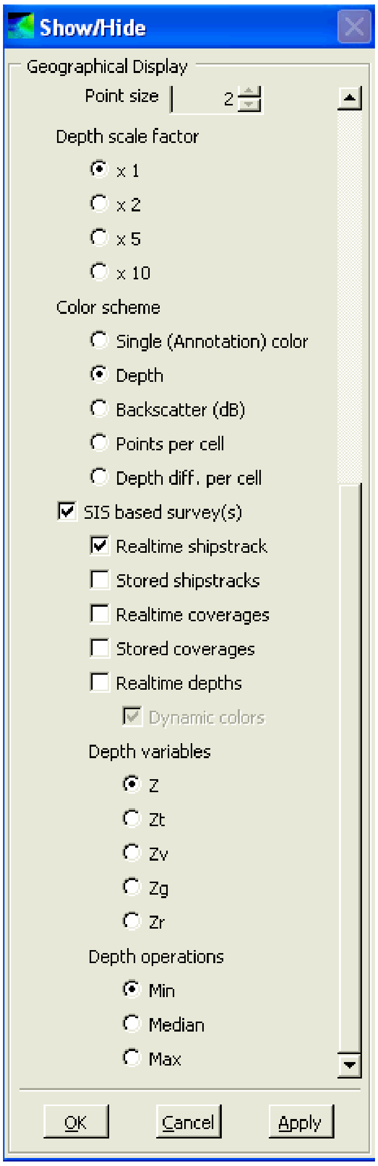
C-MAP background: Use C-MAP as Background map. When the C-Map edit is enabled, clicking the right mouse buton in the geographical view will display additional C-Map objects information .

KSGPL: Turn KSGPL (Kongsberg SIS Graphic Programming Language) on or off.

- Unchecked: No input/output is allowed. This will also hide all the loaded KSGPL objects.
- Checked: Use predefined settings.
- Object types: Available object types.
  - [0] - Generic objects (objects without an object type)
  - [1] - Coast
  - [2] - Dryfall
  - [3] - Riverbank
  - [4] - Text

Surveys: Show surveys or not.

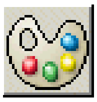
- Auto refresh: Select if the loaded surveys should be auto-reloaded or not. Data will not be refreshed when you are in 3D mode.
  - Refresh rate: Set how often you want the data to be reloaded in seconds.



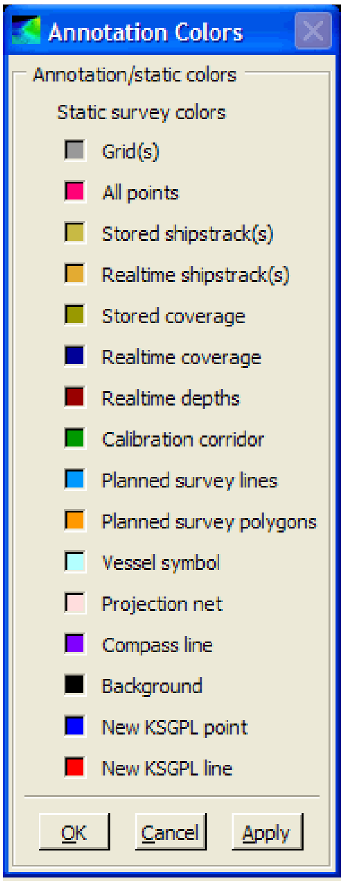
- Grid: Show grid(s) or not
  - Grid transparency: Set grid transparency. Choose values from 0 (not transparent) to 100 (maximum transparent).
- All points: All points in the given area are shown.
  - Max points: This is the maximum number of points allowed. If there are more points in the area than this no points will be displayed.
  - Point size: Point size in number of pixels.
- Depth Scale Factor: Factor by which to multiply the depth. This has the effect of stretching the grid along the depth axis (i.e. a depth scaling factor of 2 stretches the waterfall grid to twice its normal height). This can make it easier for example to discover artefacts.
  - x 1: No scaling.
  - x 2: Scale the depth by 2.
  - x 5: Scale the depth by 5.
  - x 10: Scale the depth by 10.
- Color scheme: What kind of color scheme to be used on the surveys.
  - Single (Annotation) color: Use only one colour on the loaded grid(s). The colour used is selected in the Annotation colors dialogue.
  - Depth: Dynamic colours by depth.
  - Backscatter (dB): In grayscale.
  - Points per cell: Dynamic colours by points per cell.
  - Depth diff. per cell: Dynamic colours by depth difference per cell.
- **SIS based survey(s):**
  - Realtime shipstrack: Show shipstrack current line or not.
  - Stored shipstracks: Show the stored shipstrack or not. The currently logged line/realtime shiptrack will be stored to disk as a stored shipstrack whenever a new line is being created.
  - Realtime coverages: Show coverage from current line or not.
  - Stored coverages: Show the stored coverages or not. The currently logged line/realtime coverages will be stored to disk as a stored coverages whenever a new line is being created.
  - Realtime depths: Show realtime depths or not. All depths can be shown as a tail behind the ship.

    * Dynamic colours: Show the realtime depths with dynamic colours.
- Depth variables: Select depth variable to be displayed.
    * Z: Depth, sea surface to sea bottom distance.
    * Zt: Tide file corrected depth, vertical datum to seafloor distance.
    * Zv: Geoide and RTK corrected depth, vertical datum to seafloor distance.
    * Zg: Seafloor to geoide distance.
    * Zr: Seafloor to ellipsoid distance.
- Depth operations: This is the value inside the cell.
    * Min (minimum)
    * Median
    * Max (maximum)

• **Neptune based survey(s):** (This choice is only available if you have imported Neptune based surveys).
  - Color scheme: What kind of colour scheme to be used on the surveys.
    * Annotation/static colours: Use only one colour on the loaded grid(s). The colour used is selected in the Annoation Color dialogue box.
    * Dynamic colours by depth



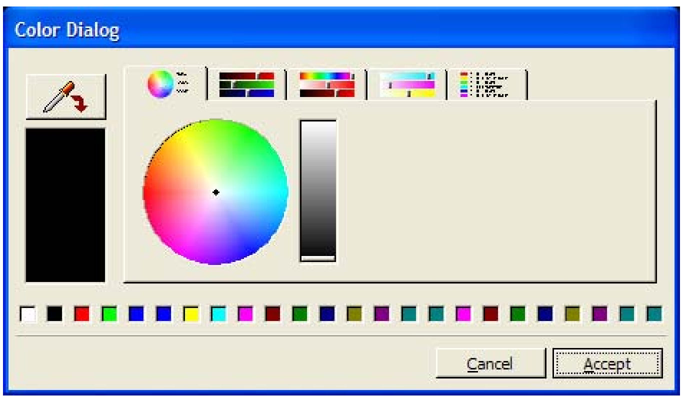
Annotation colours button

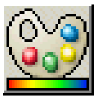


Display Colors: You can change the colours for Grid(s), All points, Stored shipstrack(s), Realtime shipstrack, Stored coverage(s), Realtime coverage, Realtime depths, Calibration corridor, Planned survey lines, Planned survey polygons, Ship symbol, Projection net, Compass line, New KSGPL point, New KSGPL line and Background colour.

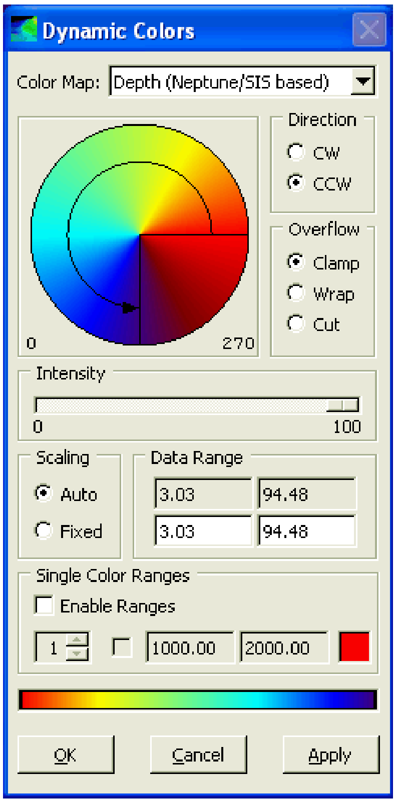
This is done by double-clicking in the checkbox(es). The **Color Dialog** window will appear. New colours can be selected in a number of different ways (using the eye dropper tool, entering the RGB colour code, using predefined colours etc.).

Select the new colour and click Accept to apply. Cancel if you do not want to change the colour.





Dynamic colors button



Color map: Select which objects to set the dynamic colours (depth, points per cell or depth difference per cell).

Color wheel: Set the colour representation of the dynamic colours. Drag the arrow to set the start and stop limits.

Direction: Set the direction of the arrow (CW or CCW).

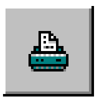
Overflow: Choose a overflow strategy for the colours. (Clamp - lock to the limits, wrap - restart when reaching a limit, cut - do not show data outside the limits.) Only valid when fixed scaling is selected.

Scaling: Select automatic or fixed scaling.

Data Range: Manually set the range (max/min) for the selected objects. The total range is found automatically from the data.

Intensity: Set the intensity of the colors in the color map. This can be used to dim the color map for low light conditions.

Single Color Ranges: Click in the Enable check box to set a range of data values to a single colour. For each set of depth range a different colour can be chosen. Double-click in the right checkbox to open the **Color Dialog** window.



Print button

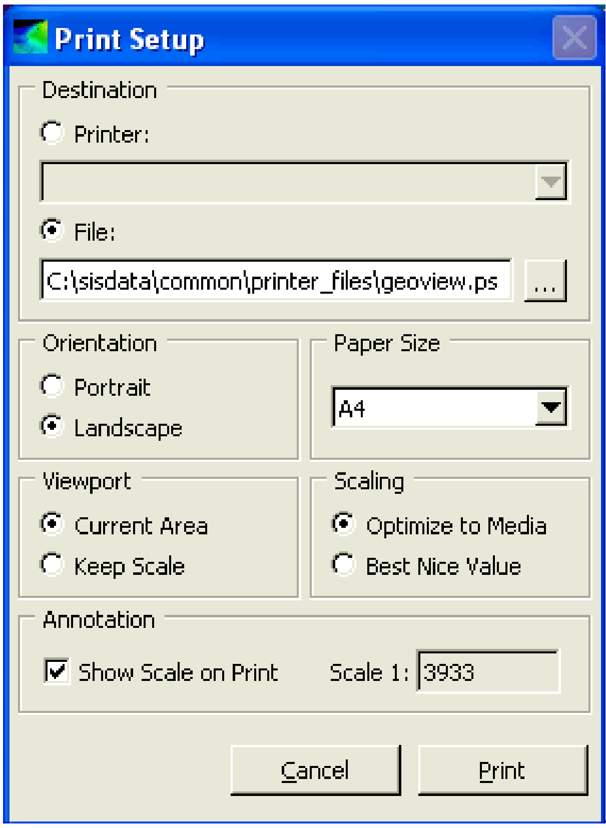
Press this button to print the geographical view. The Print Setup dialogue will open.

The following options are available:

Destination: Select if you want to send sounder data to a postscript printer or directly to file. Files are saved in postscript format (*.ps).

Orientation: Select page orientation.

Paper Size: Select paper size.



Viewport: Select “Current Area” to print the visible view.

Select “Keep Scale” to send a larger area to the printer (set by the “Zoom to region” dialogue”). When selecting “Keep Scale”, the centre of the view will correspond to the centre of the printout.

Scaling: Select “Optimize to Media” to print view with its actual scale.

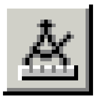
Select “Best Nice Value” to print the view with rounded scale values.

Annotation: Show the scale on the printout or not.

Note *Only postscript printers or plotters can be used.*

2D/3D Toggle button

Press this button to enter the 3D mode. This will allow you to pan, zoom and rotate the currently loaded grid(s) in 3 dimensions. Panning and zooming will work both in 2D and 3D. Shift + Right mouse button will rotate the data. Note that no new data will be reloaded in 3D mode.



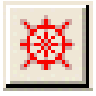
Compass button

The compass button is used to extract position, distance and heading information from the Geographical window.

Use Ctrl + Right mouse button inside the Geographical window to open the **Compass action** short-cut menu. The following options are available:

- **Measure position:** This is used to find position of a given point in the view. Move the cursor inside the view. Position information (lat/lon) is given at the cursor’s tip.

- **Measure distance and heading:** This is used to measure position, distance and heading between two points in the view. Use Ctrl + Left mouse button to mark position 1. Draw a line to position 2 and use Ctrl + Left mouse button to mark this position. The requested information is given at the cursor’s tip.



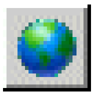
Follow ship button

This button is used to force the camera to follow the ship wherever it moves in the world. It is possible to pan the ship to a user defined location on the screen.

Zoom to ship button

When you press this button, the Geographical window will zoom to wherever the ship is located in the world. It will find the scale and coordinates automatically.

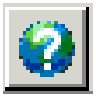
This button will be disabled if no vessel is present.



Zoom to world button

When you press this button, the Geographical window will zoom out to the largest area possible. It will find the scale and coordinates automatically.

Note that if the data areas are too small and too much spread out the data may be more or less invisible to the operator.

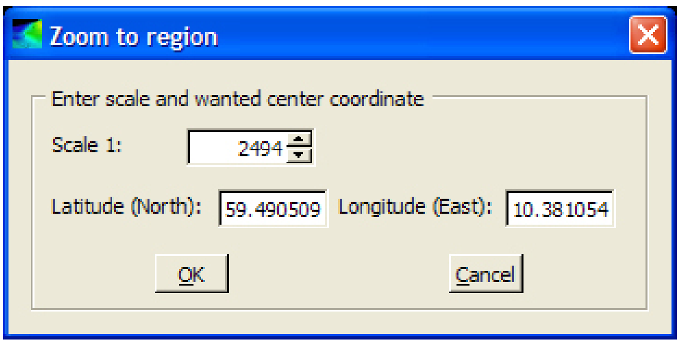


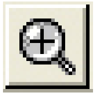
Zoom to given region button

Any user-defined region can be zoomed up to fill the geographical display view. To define the region, perform the following:

1 Press the button and a new dialogue box shown will appear. This dialogue box is called “Zoom to region”.

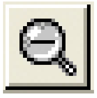
2 Fill in the desired scale and the centre coordinates.





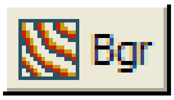
Zoom in button

When you press this button, the magnification of the Geographical view will increase.



Zoom out button

When you press this button, the magnification of the Geographical view will decrease.

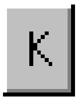


Background button

Press this button to add background data to the Geographical window. Data can be loaded from the current active survey or you can browse for stored background files (*.bgksgpl).

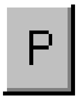
Information field

This field gives you information about the scale of the Geographical window and its position. The monitor size is read from the database.



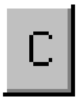
KSGPL edit mode button

Press this button to allow KSGPL manipulation. This button is only made available if the KSGPL option is selected in the Show/hide dialogue box.



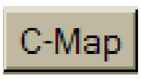
Planning edit mode button

Press this button to allow Planning manipulation. This button is only made available if the Planning option is selected in the Show/hide dialogue box.



Calibration edit mode button

Press this button to allow Calibration manipulation. This button is only made available if the Calibration window is opened in one of the other frames.

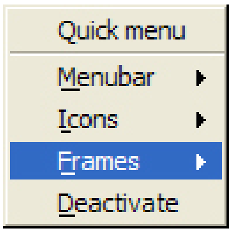


C-Map manipulation mode button

Press this button to allow C-Map manipulation. This button is only made available if the Calibration window is opened in one of the other frames.

Note

There can only be one edit button activated at a time.



Quick menu

The Geographical window have a quick menu accessed by clicking on the right mouse button inside the view.

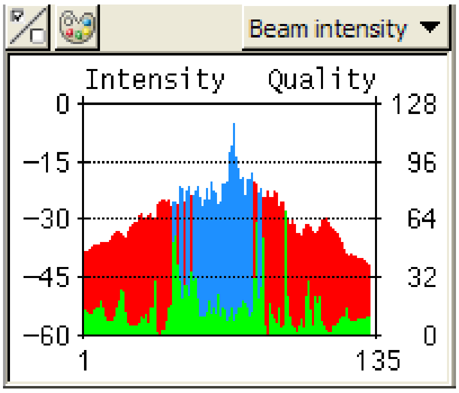
- Menu bar
  - Show / Hide
  - Annotation colours
  - Dynamic colours
  - Print
- Icons
  - Small icons
  - Large icons
- Frames
  - Empty
  - All available display frames
- Activate/Deactivate - toggle between Activate/Deactivate depending on the current mode of the Geographical window

4.3 Beam intensity

The **Beam intensity** window is either accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

It gives a graphical description of the beam intensity and quality factor.

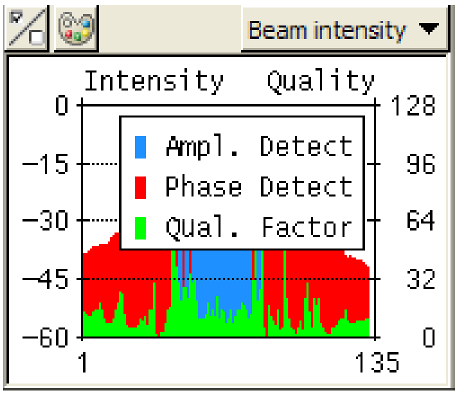
This window is valid for multibeam echo sounders.



The window contains scales along the left and right vertical axes, giving the signal strength in dB values (left side) for the intensity bars, and the quality measure (right side) for the data quality bars. The beam numbers are shown along the horizontal axis. This number depends on the echo sounder model.

The window presents two bars for each individual beam. One bar, which is either blue or red, 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). The bar colour indicates type of bottom detection; blue for amplitude and red for phase.

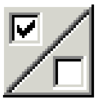


The green bar shows a data quality measure for each beam. Small values (on a scale from 0 to 64 or 128) convey good data quality.

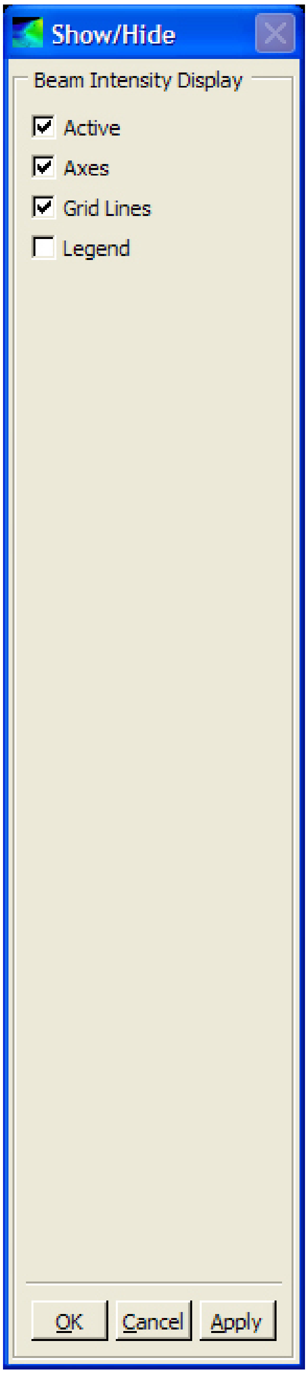
Toolbar buttons

The toolbar holds the following buttons (from left to right):

- Show/hide
- Annotation colours



Show / Hide button

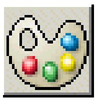


Active: Activate or decativate the display. Deactivating the display will minimize the CPU usage of the display.

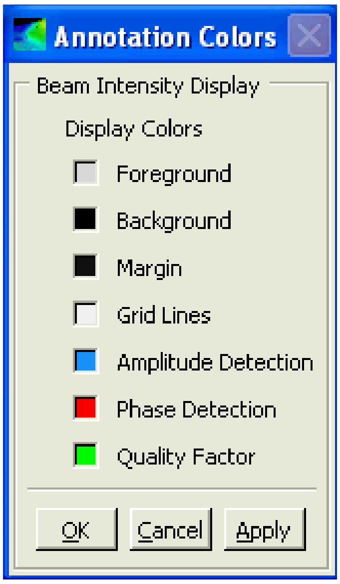
Axes: Show or hide the axes.

Grid Lines: Show or hide the grid lines.

Legend: Show or hide the legend.



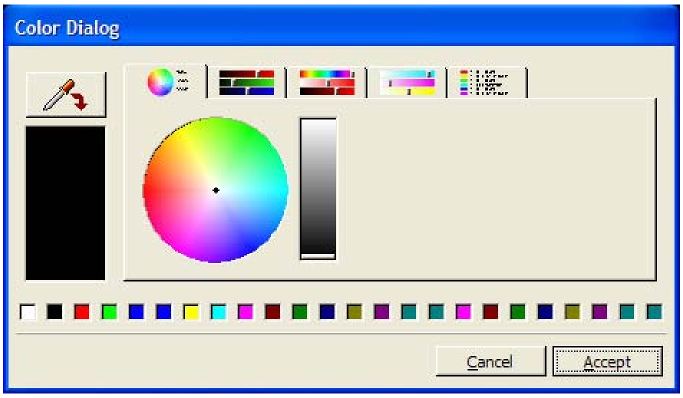
Annotation colours button



Display Colors: You can change the colours for Foreground, Background, Margin and Grid Lines, Amplitude Detection, Phase Detection and Quality Factor.

This is done by double-clicking in the checkbox(es). The **Color Dialog** window will appear. New colours can be selected in a number of different ways (using the eye dropper tool, entering the RGB colour code, using predefined colours etc.).

Select the new colour and click Accept to apply. Cancel if you do not want to change the colour.

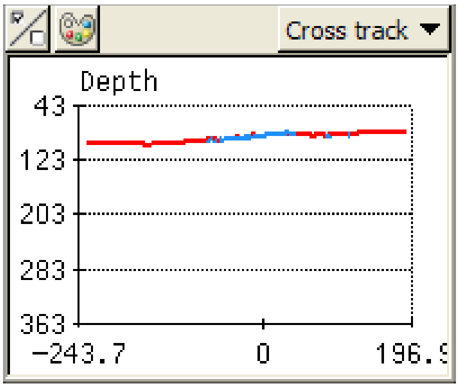


4.4 Cross track

The **Cross track** window is either accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

The cross track window shows the measured depths in all beams from the last ping. The display is updated once per second.

This window is valid for multibeam echo sounders.



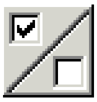
The display contains a depth scale along the left-hand (vertical) axis and beam numbers or metres along the horizontal axis.

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 is used to show beams with phase detection, blue is used to show beams with amplitude detection. Beams without any detection are not shown.

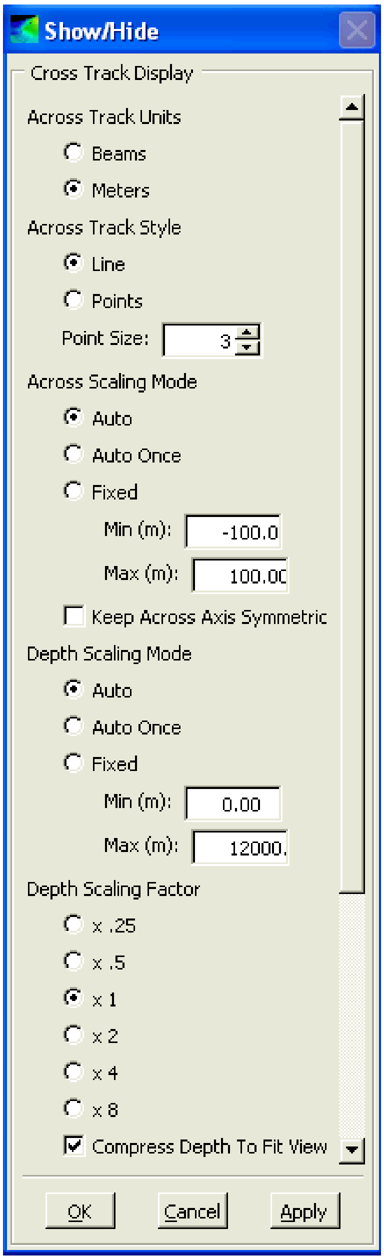
Toolbar buttons

The toolbar holds the following buttons (from left to right):

- Show/hide
- Annotation colours



Show / Hide button



Across Track Units: Select the units for the horizontal axis.

- Beams: Units for the across track scale are beams.
- Meters: Units for across track scale are meters.

Across Track Style: Select the line style for the across track plot.

- Line: The across track plot is displayed as a continuous line.
- Points: The across track plot is displayed as a series of points.
- Point size: The size of each point in pixels when the style is ’Points’. The line width in pixels when the style is ’Line’.

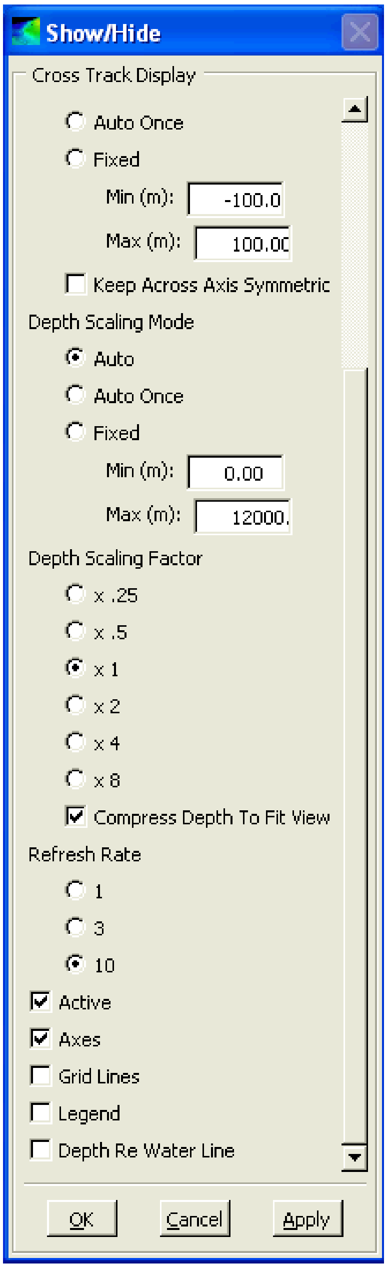
Across Scaling mode: Options for controlling the scaling mode for the across axis.

- Auto: Automatically adjust the start and stop ranges to show the entire range of data each time data is received.
- Auto Once: Automatically set the start and stop ranges to show the entire data range once, then switch to fixed range mode. This option provides a quick way to set a fixed range that will show all data.
- Fixed: Use the start and stop ranges entered in the min and max text boxes.
  - Min (m): “Fixed” start (min) range in meters.
  - Max (m): “Fixed” stop (max) range in meters.

Keep Across Axis Symmetric: Keeps the across axis symmetric. If this option is selected, the across axis will be symmetric about 0 metres, even if the coverage is not the same to both sides.

Depth Scaling mode: Options for controlling the scaling mode for the depth axis.

- Auto: Automatically adjust the start and stop ranges to show the entire range of data each time data is received.



- Auto Once: Automatically set the start and stop ranges to show the entire data range once, then switch to fixed range mode. This option provides a quick way to set a fixed range that will show all data.

- Fixed: Use the start and stop ranges entered in the min and max text boxes.

- Min (m): “Fixed” start (min) range in meters.
- Max (m): “Fixed” stop (max) range in meters.

Depth Scaling Factor: Factor by which to multiply the depth for auto scaling calculations. This has the effect of stretching or compressing the cross track plot along the depth axis (i.e. a depth scaling factor of 0.25 compresses the cross track plot to a quarter of its normal height). This can make it easier for example to discover artefacts.

- x .25: Scale the depth by 0.25.
- x .50: Scale the depth by 0.50.
- x 1: No scaling.
- x 2: Scale the depth by 2.
- x 4: Scale the depth by 4.
- x 8: Scale the depth by 8.

Compress Depth to Fit View: When this option is selected, the data will not be stretched outside the current view. In cases where the depth scaling factor would cause the data to be stretched outside the view, this option has the effect of overriding the current depth scaling factor and using the next largest factor that will allow the plot to remain inside the current view. If the current depth scaling factor would not otherwise stretch the data outside the current view, then this setting has no effect.

Refresh Rate: Specify the rate at which the display is updated (i.e. number of times per second).

- 1: Update the display once time each second.
- 3: Update the display three times each second.
- 10: Update the display ten times each second.

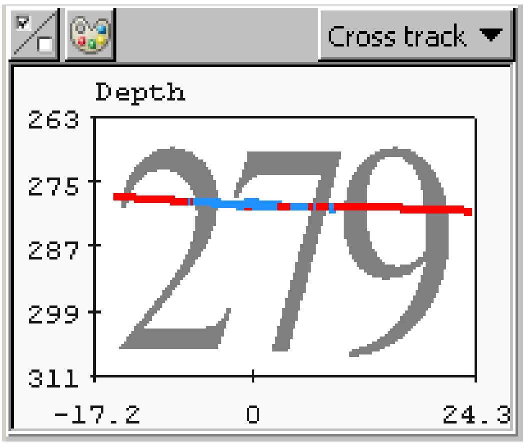
Active: Activate or decativate the display. Deactivating the display will minimize the CPU usage of the display.

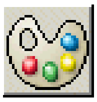
Axes: Show or hide the axes.

Gridlines: Show or hide the gridlines.

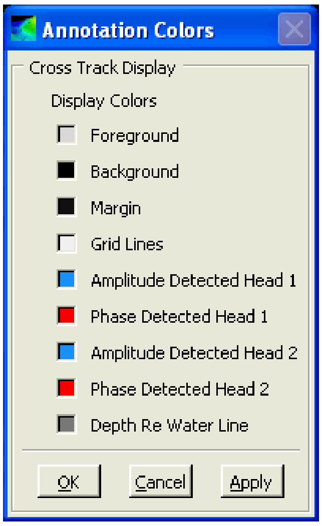
Legend: Show or hide the legend.

Depth Re Water Line: Show the depth (referenced to the water line) of the most vertical beam in the background of the cross track display. The text showing the depth is scaled to fit the background an is large enough to see at a distance.





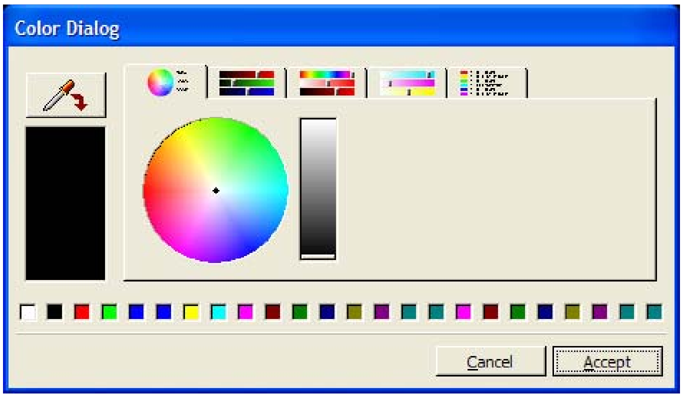
Annotation colours button



Display Colors: You can change the colours for Foreground, Background, Margin, Grid Lines, Amplitude Detected and Phase Detected.

This is done by double-clicking in the checkbox(es). The **Color Dialog** window will appear. New colours can be selected in a number of different ways (using the eye dropper tool, entering the RGB colour code, using predefined colours etc.).

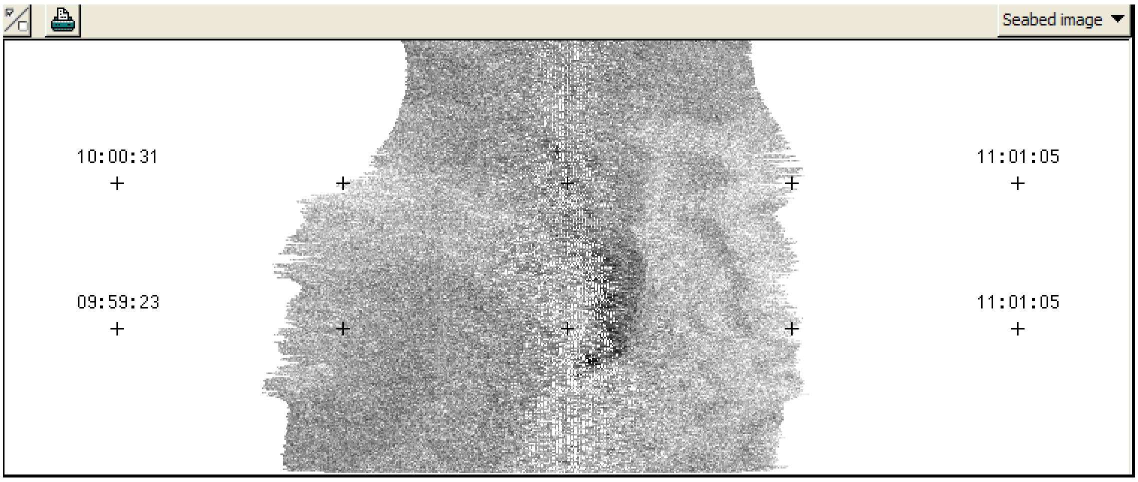
Select the new colour and click Accept to apply. Cancel if you do not want to change the colour.



4.5 Seabed image

The **Seabed image** window is accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

The **Seabed image** 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.



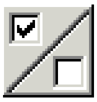
The horizontal distance between the outermost crosses in the view is set by the swath width across parameters (max and min). If these are selected to be ± 50 m respectively, the total distance is 100 m. This can be used to make rough dimension estimates of artefacts on the seabed.

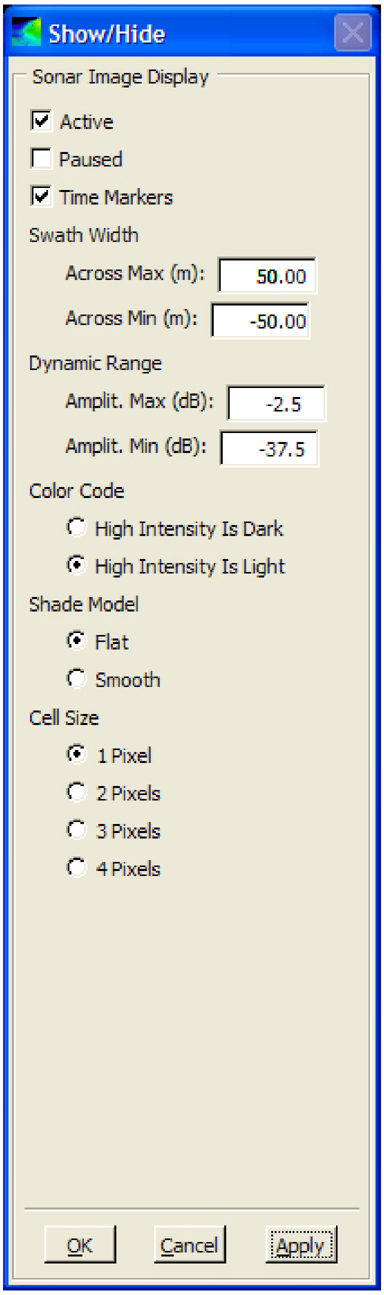
This window is valid for multibeam echo sounders.

Toolbar button

The toolbar holds the following buttons:

- Show/hide
- Print





Show / Hide button

Active: Activate or deactivate the display. Deactivating the display will minimize the CPU usage of the display.

Paused: Pause or continue the display. While paused, the display is shown, but it is not updated with new data.

Time Markers: Show or hide the time markers.

Swath Width: Options for setting the displayed swath width.

- Across Min (m): Across track start (min) range in meters.
- Across Max (m): Across track stop (max) range in meters.
- Autoscaling is enabled by setting the Swath Width to “Across Max(m): 1.0 m and Across Min(m): -1.0 m.

Dynamic Range: Options for setting the amplitude range used for colour mapping.

- Amplit. Min (dB): Miniumum expected amplitude.
- Amplit. Max (dB): Maximum expected amplitude.

Color Code: Options for setting the type of colour coding used by the display.

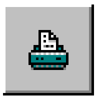
- High Intensity is Dark: Darker colour (i.e. more black) indicates higher intensity.
- High Intensity is Light: Lighter colour (i.e. more white) indicates higher intensity.

Shade Model: Options for setting the shade model used for displaying the data. Smooth shading may provide slightly better results when the cell size is set larger than 1 pixel.

- Flat: Each cell has a distinct colour.
- Smooth: Colours are smoothly interpolated between cells.

Cell Size: Sets the cell size in pixels. Choosing a larger cell size reduces the CPU usage of this display significantly.

- 1 Pixel: Cell size is 1 pixel
- 2 Pixels: Cell size is 2 pixels
- 3 Pixels: Cell size is 3 pixels
- 4 Pixels: Cell size is 4 pixels

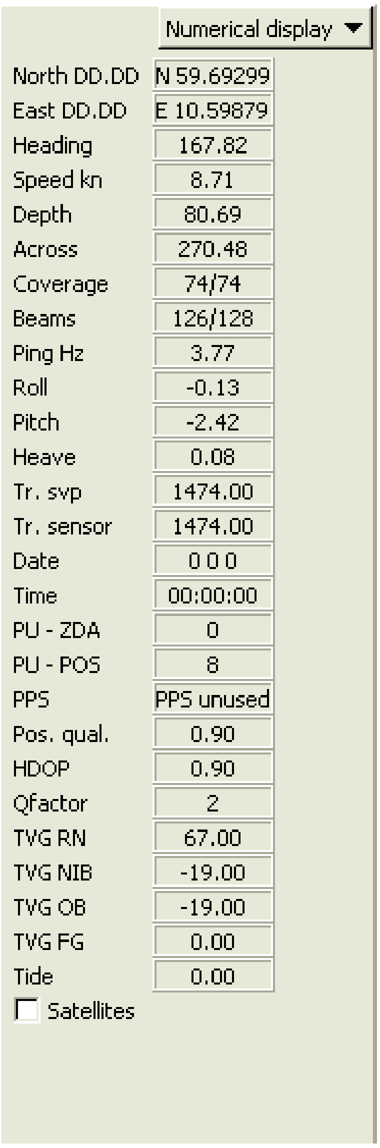


Print button

Press this button to print the seabed image view. The seabed image will be sent to a high speed plotter.

Note that this is a toggle on/off button, so the image will print continuously until the button is turned off.

4.6 Numerical display



The **Numerical display** window is accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

This window allows you to monitor several parameters but the parameters cannot be changed here. Faults are indicated in red.

If you press the button next to the text, a list with selectable parameters will appear. Choose the parameter(s) you want to monitor.

This window is valid for all instruments.

Numerical display parameters

Note that all systems do not have all the parameters given in this list.

North: Northing in meters in projection coordinates.

East: Easting in meters in projection coordinates.

North DD.DD: Northing in decimal degrees.

East DD.DD: Easting in decimal degrees.

North DDMM.MM: Northing in decimal minutes.

East DDMM.MM: Easting in decimal minutes.

Pos. qual: The position quality calculated from information in the position telegrams. This is an indicator of the relative accuracy of the current position. Refer to the EM datagram manual.

Speed m/s: Speed over ground in meters/second.

Speed kn: Speed over ground in knots.

Heading: The heading from the position datagram. The heading information itself is coming from the external heading sensor.

ROV depth: The current depth of the sonar head when used on a ROV (normally from a depth sensor).

Depth: The current centre depth from the waterline to the seafloor.

Across: Across distance between the outermost beams (same as swath width).

Coverage: Coverage in degrees to port and starboard.

Beams: Beams received versus maximum available beams.

Date: The date from the clock datagram. The datagram is created by the PU (Processing Unit), but the date information itself comes from an external input, either ZDA or Trimble UTC.

Time: The time from the clock datagram.

PU-ZDA: Time difference between PU clock and ZDA clock received in PU.

→ *For more information, see Timing chapter on page 389.*

PU-POS: Time difference between PU clock and time in position datagram received in PU.

→ *For more information, see Timing chapter on page 389.*

Ping Hz: The ping rate (pings per second).

Pingno: The current ping number.

Roll: The current roll angle in degrees.

Pitch: The current pitch angle in degrees.

Heave: The current heave in meters.

Mode: The current mode used by the echo sounder. Refer to the EM datagram manual.

Tr. svp: The sound velocity used by the echo sounder.

Tr. sensor: The filtered sound velocity from the real time sensor. The filter length is set in the Runtime menu.

Height: The height from the depth pressure or height datagram.

No. sat.: The number of satellites from the position datagram.

PPS: The PPS status from the clock datagram.

- ON: PPS is connected
- OK: Normal operation
- OFF (and red colour): Failure
- UNUSED: No PPS is connected

Yaw. stab: Heading offset angle used by the Transmitter to compensate for ship’s yaw.

TVG RN: TVG Range To Normal Incidence from the PU status output datagram.

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:

- Range (equal to depth on flat bottom) to normal incidence
- Normal incidence backscatter strength

This parameter will be used for the TVG calculations.

TVG NIB: TVG Normal Incidence Backscatter from PU status output datagram.

This parameter is used to define a value for the backscatter strength at normal incidence and to estimate a fixed gain for the next ping.

TVG OB: TVG Oblique Backscatter from the PU status output datagram.

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 5 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 estimated TVG is used in the next ping.

TVG FG: TVG Fixed Gain from the PU status output datagram.

The preamplifier system normally has two independent gain controls; a fixed gain consistent during each ping, and the TVG setting implemented in the system software.

Tx. pow.: Transmit power level from the Runtime parameter datagram.

PU load: PU (Processing Unit) load from the PU status output datagram.

Tide: Tide used (predicted or real time).

Geo. und.: Geoid undulation used (the distance from the ellipsoid to the geoid).

Geo vref.: Distance from geoid to vertical reference from geoid model.

HDOP: GPS position HDOP indicator derived from the position input GGA datagram.

Qfactor: GPS position quality indicator derived from the position input GGA/GGK datagram.

Temp probe C: Real time temperature sensor data (in degrees Celsius).

SVP probe: Raw unfiltered real time sensor data.

Port/Stb.: Across distance in meters of beams on port and starboard side.

GSA HDOP: HDOP (Horizontal Dilution Of Precision) from the NMEA GSA datagram.

DGPS age: Age of differential GPS data in seconds from the NMEA GGA datagram.

GST HSTD: HSTD (Horizontal Standard Deviation) derived from the NMEA GST datagram.

Ref. st.: Name and Id of differential reference station derived from NMEA GGA datagram and file containing reference station names.

GGA time: UTC time from NMEA GGA datagram.

GGA height: Height derived from NMEA GGA datagram.

Beam. sp: Type of footprint/distribution of the beams on the seafloor, for example equidistant or equiangular.

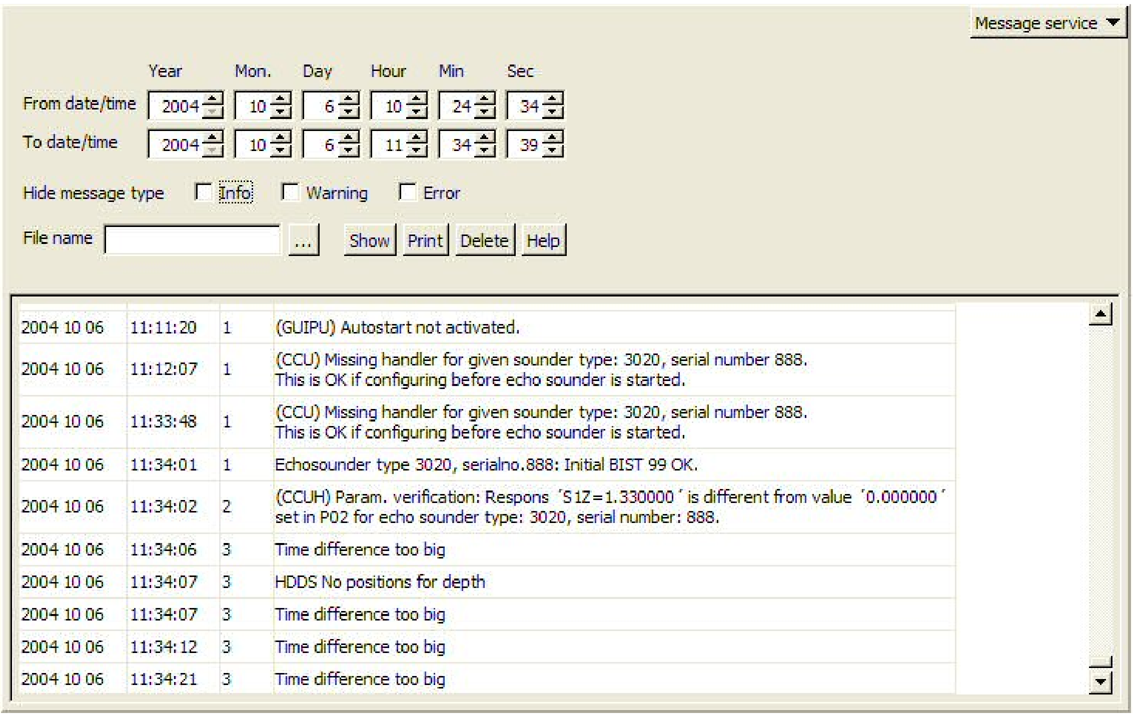
Satellites: Satellites in view. From NMEA GSV datagrams (maximum 36 satellites). Each satellite is identified by:

- Satellite **Id** number
- Elevation, **Elev**., in degrees (maximum 90 deg.)
- Azimuth, **Azim**, in degrees True (000 to 359 deg.)
- Signal-to-noise ratio, **SNR**, in dB (0 to 99 dB)

4.7 Message service

The **Message service** window is accessed through the *Manage windows* in the *View* drop-down menu or by selecting it from the **Frames** button.

This window is valid for all instruments.



You can display the messages you find relevant from a specific time interval. Use the arrows next to the textfields or write the desired values directly into them. The time is given by the PC Clock (but will later be changed to use the PU Clock).

There are three types of messages:

- Info
- Warning
- Error

You can hide the messages you find irrelevant by checking the check box(es).

A limit of 10000 messages in the database exists. When this limit is exceeded the system will automatically write all messages into a file and delete the messages in the database afterwards. The filename is given by the system and will have the following structure: <“current date”_“current time”_msg.txt>.

Select the file by writing its name in the textfield or use the browse button (three dots).

Show: Displays the messages in the field below.

Print: The message(s) will be sent to file. The name of the file is given in the **File name** text field.

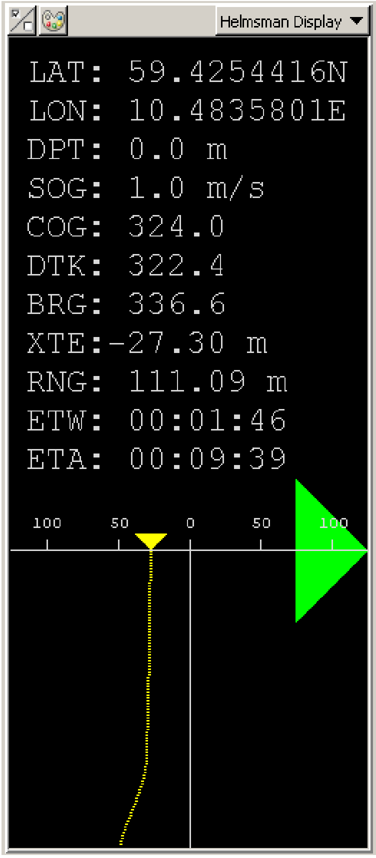
Delete: Delete messages. When deleting messages all messages are shown.

Help: This button provides on-line help.

4.8 Helmsman Display

The **Helmsman Display** window is accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

This window is valid for all instruments.



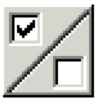
A line may have several waypoints and the DTK, XTE, TTG, DST and XTE deviation indicators all show their values to the next waypoint or to the current line segment. The scale changes automatically. Red and green arrows indicate that the helmsman should steer port or starboard to relocate. Before the ship reaches the start of the line, the indicator will form an arrow pointing downwards.

When you reach the end of the line (or before you come to the line) the Helmsman Display will continue to display the ship's position relative to the continuation of the last line segment of the planned line.

Toolbar buttons

The toolbar holds the following buttons (from left to right):

- Show/hide
- Annotation colours



Show / Hide button

Active: Activate or deactivate the display. Deactivating the display will minimize the CPU usage of the display.

Position: Show or hide the position text fields (latitude and longitude).

- DD.DD: Display position as decimal degrees.
- DD MM.MM: Display position as degrees and decimal minutes.
- DD MM SS.SS: Display position as degrees, minutes, and decimal seconds.
- Projection: Display position as projection coordinates.

DPT: Show or hide the water depth text field.

SOG: Show or hide the speed over ground text field.

- m/s: Display speed over ground in units of meters per second.
- Knots: Display speed over ground in units of knots.

COG: Show or hide the course over ground text field.

DTK: Show or hide the desired track text field. This is the heading of the current line segment.

BRG: Show or hide the course to waypoint text field. This is the heading from the current position to the next waypoint.

XTE: Show or hide the cross track error text field. This is the shortest distance to the current line segment.

RNG: Show or hide the range to waypoint text field. This is the distance from the current position to the next waypoint.

ETW: Show or hide the estimated time to the next waypoint text field. This is the estimated time of arrival at the next waypoint.

ETA: Show or hide the estimated time of arrival text field. This is the estimated time of arrival at the last point in the current planned line.

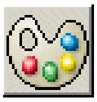
XTE Plot: Show or hide the cross track error plot.

APB Output: Enable or disable output of the NMEA APB message to the autopilot.

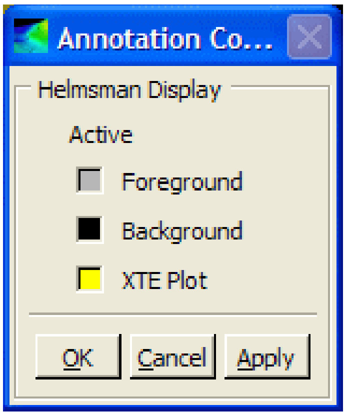
→ *For the setup of the serial line see external sensor, page 310.*

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. The APB output is only available when the Helmsman Display window is open.



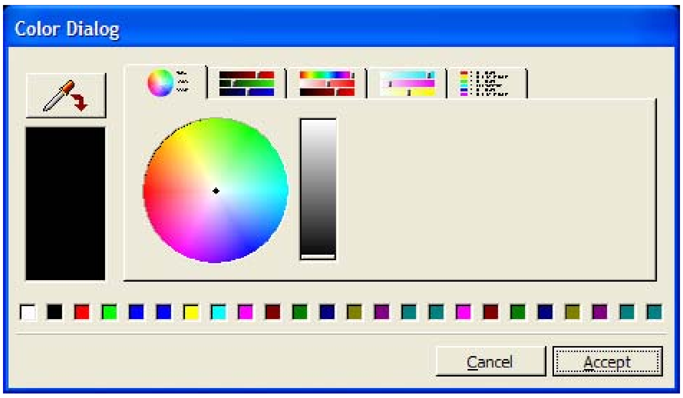
Annotation colours button



Display Colors: You can change the colours for Foreground, Background and XTE Plot.

This is done by double-clicking in the checkbox(es). The **Color Dialog** window will appear. New colours can be selected in a number of different ways (using the eye dropper tool, entering the RGB colour code, using predefined colours etc.).

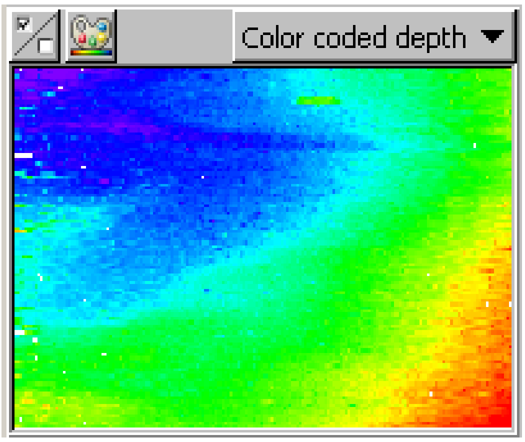
Select the new colour and click Accept to apply. Cancel if you do not want to change the colour.



4.9 Color coded depth

The **Color coded depth** window is either accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

This window is valid for multibeam echo sounders.

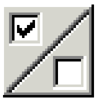


The Color coded depth window shows the colour coded depth per beam using a history buffer of varying size. The size of the history buffer depends on the size of the display. One vertical screen unit (pixel) is used per ping. Increasing the vertical size of the display area increases the number of vertical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

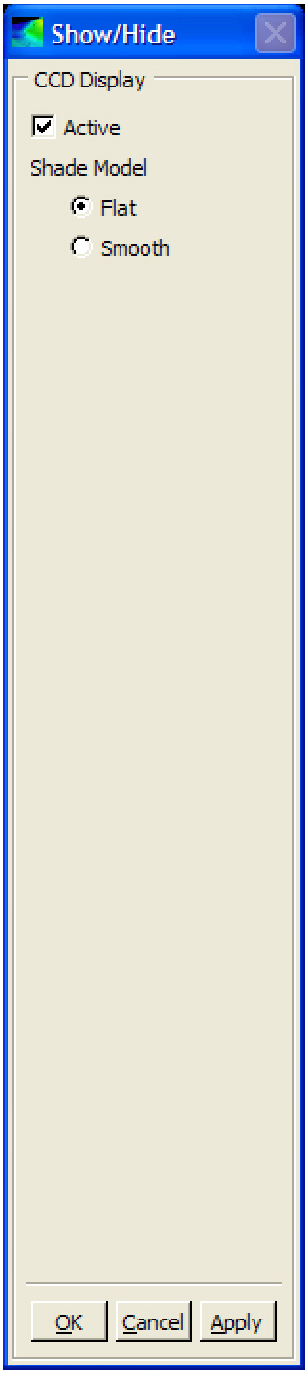
Toolbar button

The toolbar holds the following button:

- Show/hide



Show / Hide button



Active: Activate or decativate the display. Deactivating the display will minimize the CPU usage of the display.

Shade Model: Options for setting the shade model used for displaying the data.

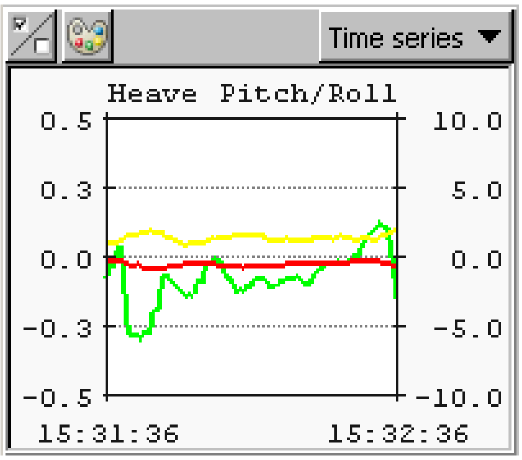
- **Flat:** Each cell has a distinct colour.
- **Smooth:** Colours are smoothly interpolated between cells.

4.10 Time series

The **Time series** window is accessed through the *Manage Windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

The Time Series window is used for displaying either external interfaces or depth information. The information for one or more sensors or beams are selectable.

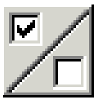
The information displayed can indicate to the operator if a sensor is performing incorrectly or the depth is calculated incorrectly.



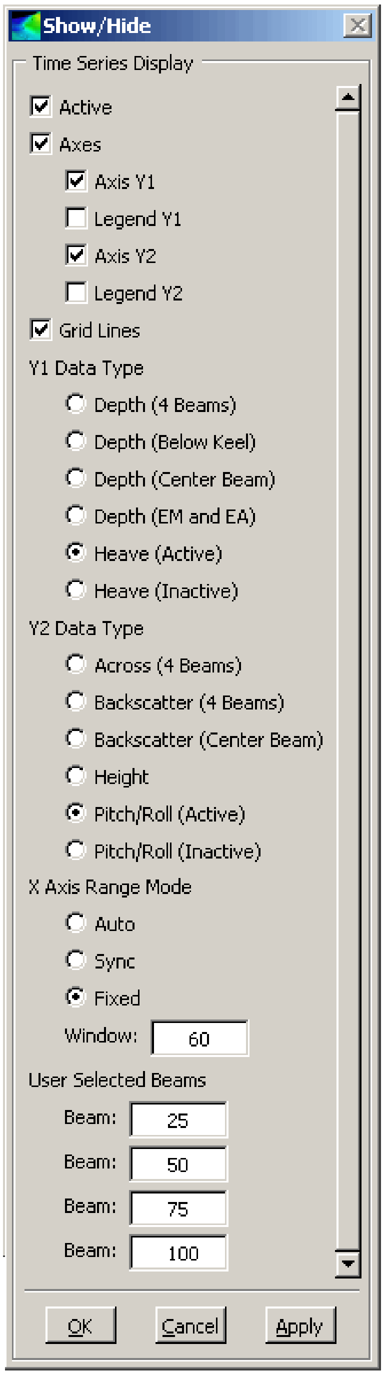
Toolbar buttons

The toolbar holds the following buttons (from left to right):

- Show/hide
- Annotation colours



Show / Hide button



Active: Activate or deactivate the display. Deactivating the display will minimize the CPU usage of the display.

Axes: Makes the axes and/or legends visible.

- Show or hide axis Y1.
- Show or hide legend Y1.
- Show or hide axis Y2.
- Show or hide legend Y2.

Grid lines: Show or hide the grid lines.

Y1 Data Type: Select the data type to plot on the Y1-axis.

- Depth (4 beams): Depth of four user selected beams.
- Depth (below keel): Depth below the water surface for the most vertical beam. The centre beam is most likely not the most vertical beam due to the roll of the vessel.
- Depth (center beam): Depth of the centre beam.
- Depth (EM and EA): Depth of the EA (single beam echo sounder) compared to the depth of the shallowest EM (multibeam echo sounder) beam (in the ping) that lies within the footprint of the EA sounder.
- Heave (active): Heave from the active motion sensor. This is selected for graphical presentation.
- Heave (inactive): Heave from the inactive motion sensor. This is logged onto the hard disk.

Y2 Data Type: Select the data type to plot on the Y2-axis.

- Across (4 beams): Across track distance of four user selected beams.
- Backscatter (4 beams): Backscatter strength of four user selected beams.
- Backscatter (center beam): Backscatter strength of the centre beam.
- Height: Height from the height sensor.

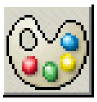
- Pitch/Roll (active): Pitch and roll from the active motion sensor. This is selected for graphical presentation.
- Pitch/Roll (inactive): Pitch and roll from the inactive motion sensor. This is logged onto the hard disk.

X axis Range Mode: Mode used to set the X-axis (time axis) range.

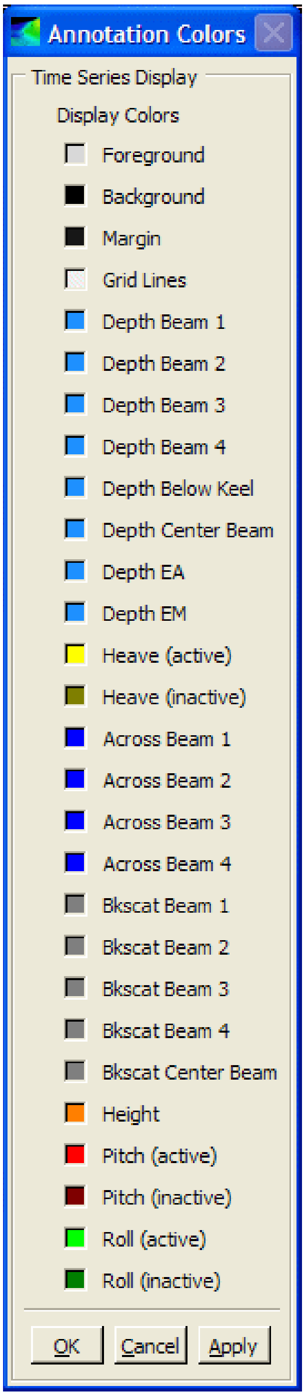
- Auto: Use the range of the longest displayed data series (show all data).
- Sync: Use the longest range common to all the displayed data series.
- Fixed: Set the range to a fixed number of seconds.
  - Window: Range (time window) in seconds.

User Beams: The beams for the data types which require the user to select four beams. This feature is used to compare beams, normally on a flat seabed.

- Beam: First user selected beam.
- Beam: Second user selected beam.
- Beam: Third user selected beam.
- Beam: Fourth user selected beam.



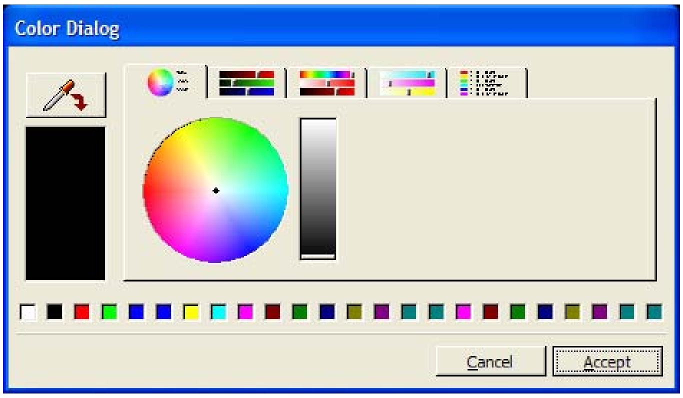
Annotation colours button



Display Colours: You can change the colours for Foreground, Background, Margin, Grid Lines, Height, Heave, Pitch, Roll, Beams etc.

This is done by double-clicking in the checkbox(es). The **Color Dialog** window will appear. New colours can be selected in a number of different ways (using the eye dropper tool, entering the RGB colour code, using predefined colours etc.).

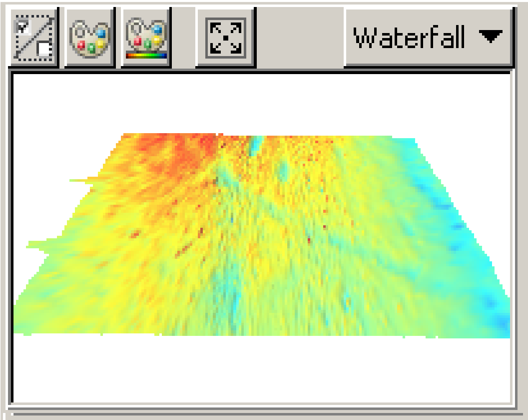
Select the new colour and click Accept to apply. Cancel if you do not want to change the colour.



4.11 Waterfall

The **Waterfall** window is accessed through the *Manage Windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

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



The color 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.

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

Inside the Waterfall presentation the operator can rotate, pan and zoom using the mouse and keyboard combinations.

Rotation (Shift key + Right mouse button)

To rotate the waterfall grid using the mouse, hold down the Shift key, right click on the waterfall grid, and drag the mouse.

To understand how to rotate the grid, it may be helpful to visualize a “virtual trackball” in the center of the view. To rotate the grid, click and drag the mouse as if you were trying to rotate this “virtual trackball”. For example, if you click the mouse in the center of the view (i.e. the center of the virtual trackball) and drag straight up or down, the virtual trackball will rotate about it’s horizontal axis (i.e. the x-axis). This results in the grid rotating purely about the x-axis.

If you click the mouse in the center of the view and drag straight to the left or right, the virtual trackball will rotate about it's vertical axis (i.e. the y-axis). This results in the grid rotating purely about the y-axis.

If you click the mouse at the edge of the view, and then drag the mouse, the virtual trackball will rotate about an axis perpendicular to the plane of the view (i.e. the z-axis). This results in the grid rotating purely about the z-axis.

Panning (Alt key + Right mouse button)

To pan the waterfall grid using the mouse, hold down the Alt key, right click on the waterfall grid, and drag the mouse.

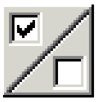
Zooming (mouse wheel)

To zoom in or out on the waterfall grid using the mouse wheel, rotate the wheel forward to zoom in, or backward to zoom out.

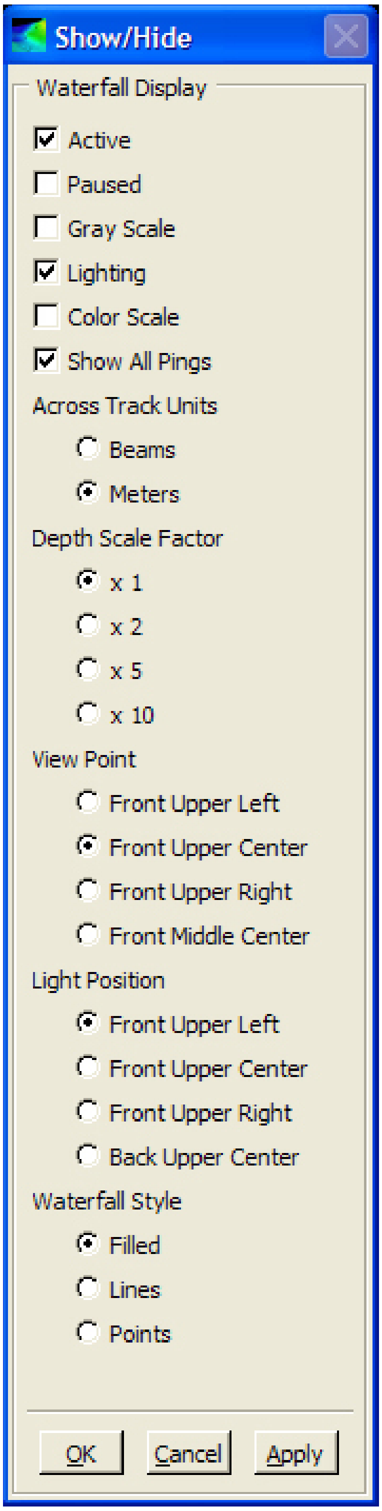
Toolbar buttons

The toolbar holds the following buttons (from left to right):

- Show/hide
- Annotation colours
- Dynamic Colors Button
- Reset View Button



Show / Hide button



Active: Activate or decativate the display. Deactivating the display will minimize the CPU usage of the display.

Paused: Pause or continue the display of waterfall data. While paused, the display is visible, but it is not updated with new data.

Gray Scale: Display the Waterfall in grayscale. This mode requires much less CPU than the full colour mode.

Lighting: Enable or disable lightning (and 3D shading). Useful in situations where the shape of the grid is such that shading makes the grid (or portions of the grid) difficult to see.

Color Scale: Show or hide the colour scale legend (shown along the bottom of the grid).

Show All Pings: When selected, all pings are displayed. When not selected, only the most recent ping is displayed. Deselecting this options can reduce the CPU load of this display significantly (depending on the ping rate).

Across Track Units: Select the units for the horizontal axis.

- Beams: Units for the across track scale are beams.
- Meters: Units for across track scale are meters.

Depth Scale Factor: Factor by which to multiply the depth. This has the effect of stretching the waterfall grid along the depth axis (i.e. a depth scaling factor of 2 stretches the waterfall grid to twice its normal height). This can make it easier for example to discover artefacts.

- x 1: No scaling.
- x 2: Scale the depth by 2.
- x 5: Scale the depth by 5.
- x 10: Scale the depth by 10.

View Point: Set the point from where the grid is viewed

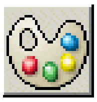
- Front Upper Left: Set the view point to the front upper left of the grid.
- Front Upper Center: Set the view point to the front upper center of the grid.
- Front Upper Right: Set the view point to the front upper right of the grid.
- Back Upper Center: Set the view point to the back upper center of the grid.

Light Position: Set the position of the light source.

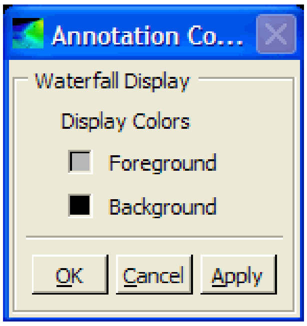
- Front Upper Left: Position the light source at the front upper left of the grid.
- Front Upper Center: Position the light source at the front upper center of the grid.
- Front Upper Right: Position the light source at the front upper right of the grid.
- Back Upper Center: Position the light source at the back upper center of the grid.

Waterfall Style: Set the style in which the waterfall grid is displayed.

- Filled: The grid is displayed as a surface.
- Lines: The grid is displayed as a triangle mesh.
- Points: The grid is displayed as a point set.



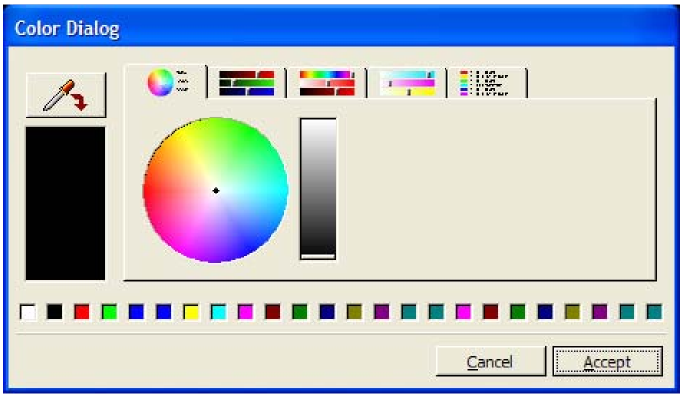
Annotation colours button



Display Colors: You can change the colours for Foreground and Background.

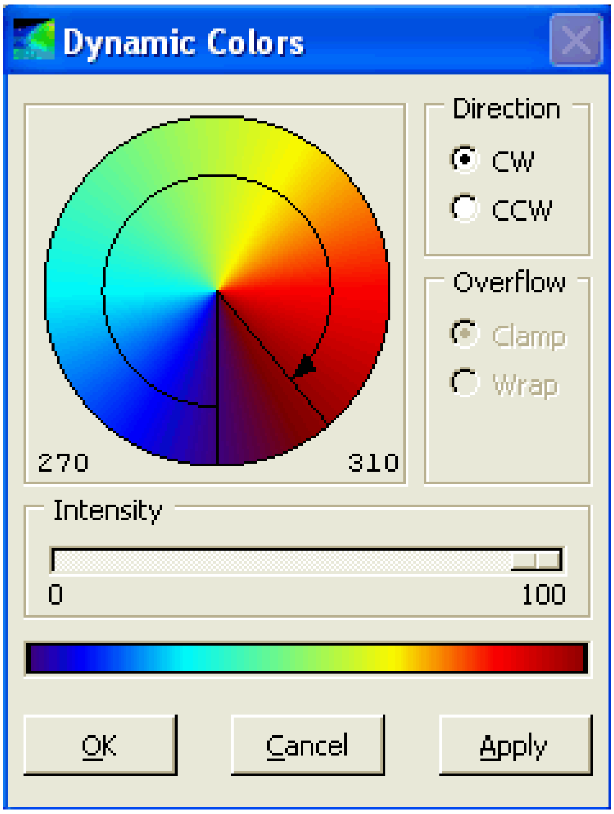
This is done by double-clicking in the checkbox(es). The **Color Dialog** window will appear. New colours can be selected in a number of different ways (using the eye dropper tool, entering the RGB colour code, using predefined colours etc.).

Select the new colour and click Accept to apply. Cancel if you do not want to change the colour.



Dynamic colours button

Map a range of colors to the range of depths displayed on the Waterfall Display.



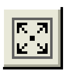
Color Wheel: Set the range of colors. Drag the lines to set the start color and end color in the range.

Direction: Set the direction of traversal of the color map. This determines if the coloer wheel is traversed in a clockwise or in a counter clockwise direction when mapping colord to depths.

Overflow: The Overflow options are not enabled for this display.

Intensity: Set the intensity of the colors in the color map.

Reset View Button



Reset pan, zoom, and rotation to default values.

4.12 Water column

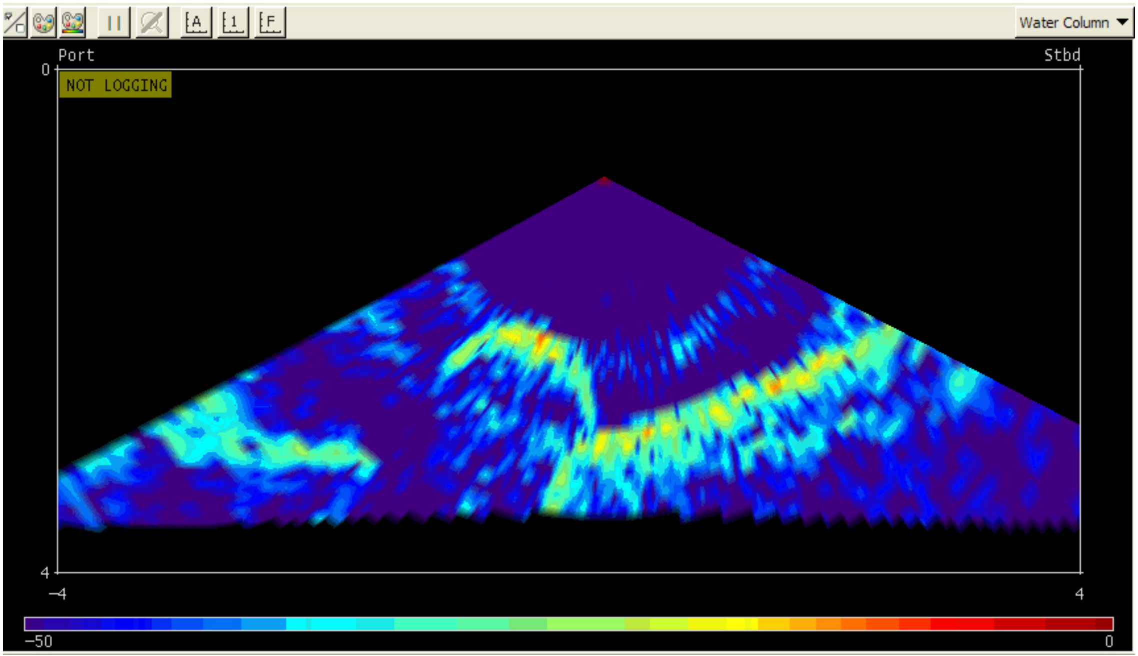
The **Water column** windows is accessed through the *Manage windows* in the *View* drop-down menu or by selecting it from the **Frames** button.

The Water Column display shows a graphical representation of the beamformed data for the entire water column for each beam. The display can be useful for debugging and for habitat monitoring.

Note

Sound velocity corrections and ray bending corrections are not corrected for.

This window is valid for multibeam echo sounders with water column capabilities (for example EM 710 and EM 3002).



The display shows the received amplitude of the entire water column for each beam. The vertical scale on the left of the display shows the depth in metres, and the horizontal scale along the bottom of the display shows the across track distance in metres. The seafloor is shown as a yellow or red band in the data view.

The Water column window is associated with a status button for water column logging - WCol. This button is located on the toolbar between the logging and pinging buttons.

The button reflects the status of water column logging. This is set in the show/hide parameters and is visible even if the water column window is closed.

Red WCol: indicates Not logging.

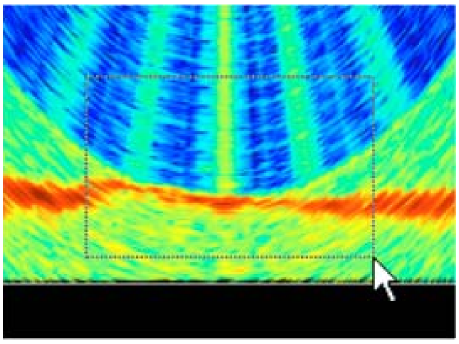
Green WCol: indicates Logging enabled.

Note

Water column data is being logged only when water column logging is enabled (green WCol button) and normal raw data logging is on i.e green Logging On/Off button.

Zooming

It is possible to zoom in on a region of the grid by clicking the left mouse button and dragging a rectangle around a region of the grid. When the left mouse button is released, the region of the grid to which you have zoomed will be displayed.



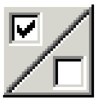
Note also, that the Zoom Reset button will now be enabled (i.e. it is no longer dimmed). It is possible to zoom in even further, by clicking and dragging a rectangle inside the zoomed region.

To reset the zoom, click the Zoom Reset button. This will return the display to the scaling mode that existed prior to the original zoom operation. You can also reset the zoom by selecting one of the auto range options from the Show/Hide dialogue.

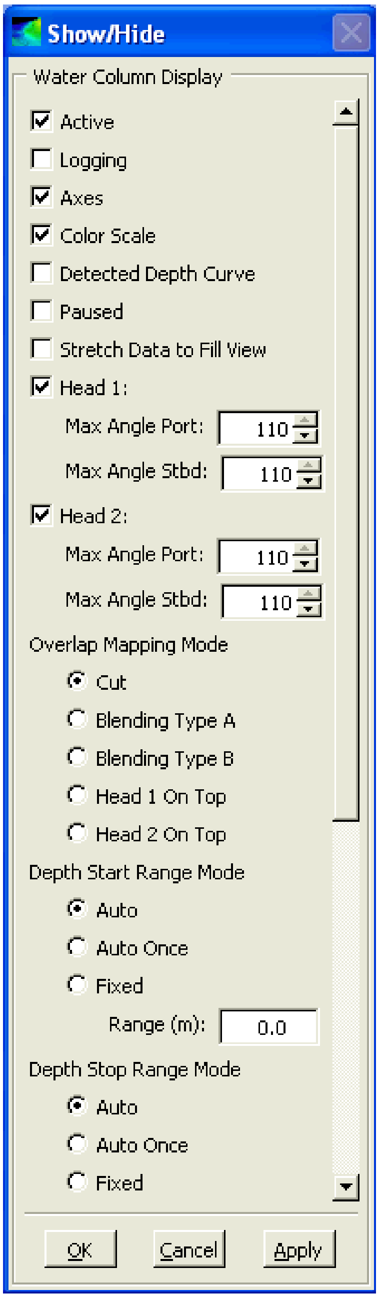
Toolbar buttons

The toolbar holds the following buttons (from left to right):

- Show/hide
- Annotation colours
- Dynamic colours
- Paused
- Zoom Reset
- Auto Scale
- Auto Scale Once
- Fixed Scale



Show / Hide button



Active: Activate or deactivate the display. Deactivating the display will minimize the CPU usage of the display.

Logging: Select whether to log data to local hard disk or not. The logged data amount is very large and must be started separately from the normal logging sequence. Typical datarate is 1 to 2 Gb per hour.

Axes: Show or hide the axes.

Color Scale: Show or hide the colour scale legend (shown along the bottom of the grid).

Detected Depth Curve: Show or hide a curve showing the detected depth for all beams. The curve is shown on top of the water column data

Paused: Pause or continue the display of water column data. While paused, the display is visible, but it is not updated with new data.

Stretch Data to Fill View: When this option is not selected, the same scale is used for both x- and y-axes. In this case, the data is displayed with correct proportions, but this may result in a lot of unused space in the view.

When this option is selected, the x-and y-axes are scaled such that the data fills the display.

Head 1: Show or hide the data from sonar head 1.

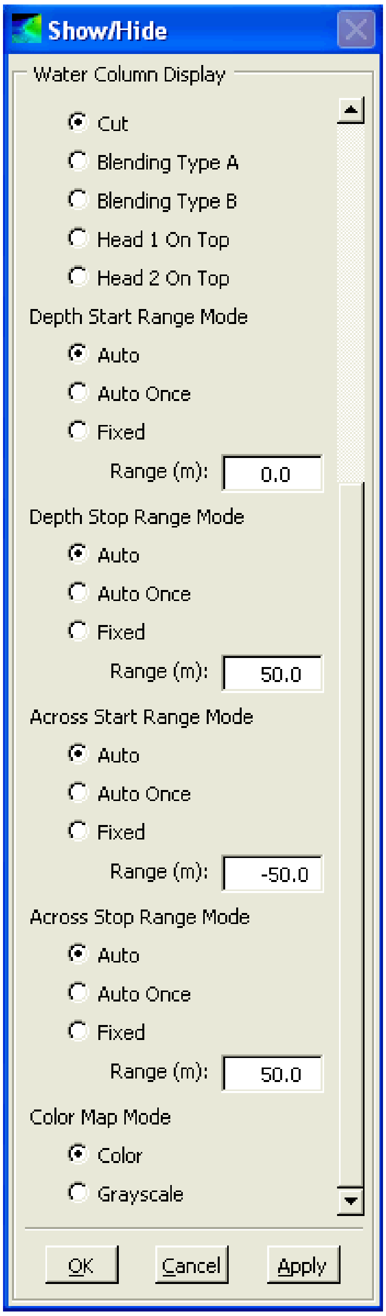
- Max Angle Port: The maximum beam angle to the port side for sonar head 1.
- Max Angle Stbd: The maximum beam angle to the starboard side for sonar head 1.

Head 2: Show or hide the data from sonar head 2 (applicable for dual sonar head sounders only).

- Max Angle Port: The maximum beam angle to the port side for sonar head 2.
- Max Angle Stbd: The maximum beam angle to the starboard side for sonar head 2.

Overlap Mapping Mode: Options for controlling how the data in the overlapped region is displayed (valid for dual sonar head echo sounders only).

- Cut: The data from each head is “cut” vertically at 0 meters across.
- Blend 1: The overlap area is blended using alpha blending. No saturation in the overlap area.



- Blend 2: The overlap area is blended using alpha blending. Saturated in the overlap area.
- Head 1: The data from head 1 is displayed on top of the data from head 2.
- Head 2: The data from head 2 is displayed on top of the data from head 1.

Depth Start Range Mode: Options for controlling the start range mode of the depth axis scale.

- Auto: Automatically set the start range to match the minimum range of the data each time data is received.
- Auto Once: Automatically set the start range of the depth axis to match the minimum range of the data (once), then switch to fixed range mode.
- Fixed: Use the range entered in the Range (m) text box.

- Range (m): “Fixed” start range (in metres).

Depth Stop Range Mode: Options for controlling the stop range mode of the depth axis scale.

- Auto: Automatically set the stop range of the depth axis to match the maximum range of the data each time data is received.
- Auto Once: Automatically set the stop range of the depth axis to match the maximum range of the data (one time), then keep this fixed range.
- Fixed: Use the range entered in the (Stop) Range text box.
  - Range (m): “Fixed” depth axis stop range (in metres).

Across Start Range Mode: Options for controlling the start range mode of the across axis scale:

- Auto: Automatically set the start range of the across axis to match the minimum range of the data each time data is received.
- Auto Once: Automatically set the start range of the across axis to match the minimum range of the data (once), then switch to fixed range mode.
- Fixed: Use the range entered in the (Start) Range text box .
  - Range (m): “Fixed” across axis start range (in metres).

Across Stop Range Mode: Options for controlling the stop range mode of the across axis scale.

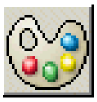
- Auto: Automatically set the stop range of the across axis to match the minimum range of the data each time data is received.
- Auto Once: Automatically set the stop range of the across axis to match the minimum range of the data (once), then keep this fixed range.
- Fixed: Use the range entered in the (Stop) Range text box .
  - Range (m): “Fixed” across axis stop range (in metres).

Color Map Mode: Select the type of colour mapping to be used by the display.

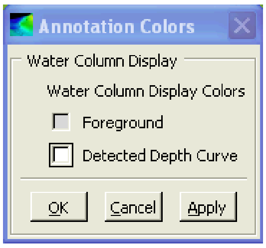
- Color: Map a range of colours to a range of data. The range of colours and the data range to which the colours are mapped are set via the Dynamic Colors dialogue.
- Grayscale: Map a grayscale range (i.e. black to white) to a range of data. The grayscale range and the data range to which the grayscale is mapped are set via the Dynamic Colors dialogue.

Note

Blending Type A and Blending Type B Overlap Mapping Mode options are not enabled if the background color is any color other then black. Although it is not possible to change the background color using Water Column Display menus, The SIS application does provide a means to change the background color (via the Color Palette menu).



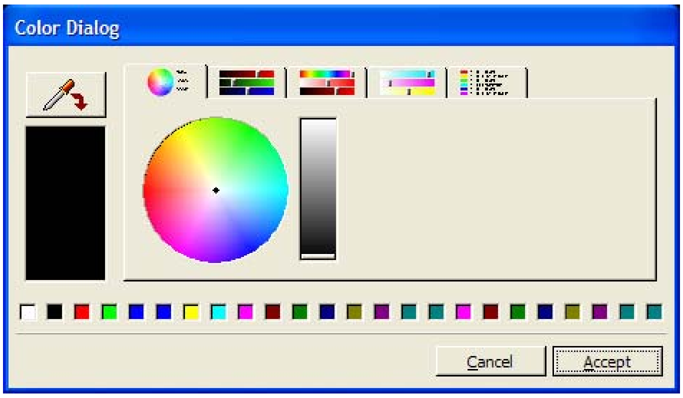
Annotation colours button

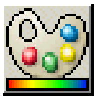


Display Colours: You can change the colours for Foreground and Detected Depth Curve.

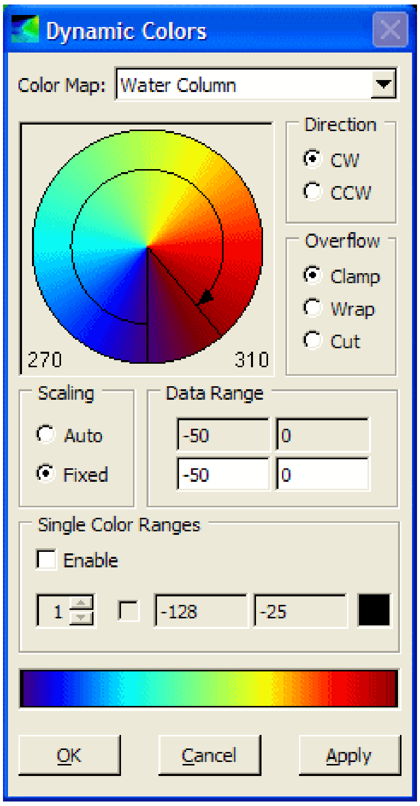
This is done by double-clicking in the checkbox(es). The **Color Dialog** window will appear. New colours can be selected in a number of different ways (using the eye dropper tool, entering the RGB colour code, using predefined colours etc.).

Select the new colour and click Accept to apply. Cancel if you do not want to change the colour.





Dynamic colours button



Color map: Select which objects to set the dynamic colours.

Color wheel: Set the colour representation of the dynamic colours. Drag the arrow to set the start and stop limits.

Direction: Set the direction of the arrow (CW or CCW).

Overflow: Choose a overflow strategy for the colours. (Clamp - lock to the limits, wrap - restart when reaching a limit, cut - do not show data outside the limits.) Only valid when fixed scaling is selected.

Scaling: Select automatic or fixed scaling.

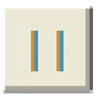
Data Range: Manually set the range (max/min) for the selected objects. The total range is found automatically from the data.

Single Color Ranges: Click in the Enable check box to set a range of data values to a single colour. For each set of dB range a different colour can be chosen. Double-click in the right checkbox to open the **Color Dialog** window.

The dialogue can also be used to filter out all data below a certain amplitude threshold. For example, this might be useful for easily identifying targets within the water column.

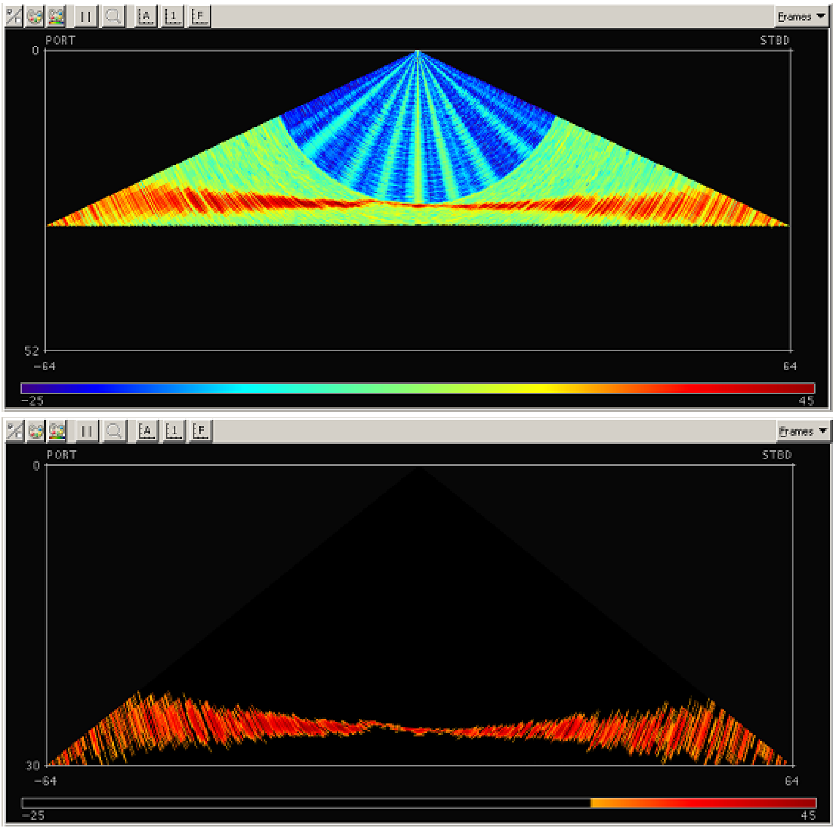
The two figures below show the display before and after all of the values below 25 dB have been filtered out.

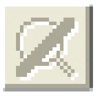
Note that data range values must be entered in the Dynamic colors dialogue in dB (not metres).



Paused button

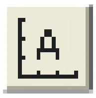
Pause or continue the display of water column data. While paused, the display is visible, but it is not updated with new data.





Zoom Reset button

Reset the display after a zoom operation. This button is only active if the display has been “zoomed”. Clicking on this button will reset the start and stop ranges and the start and stop range modes.



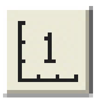
Auto Scale button

Set both the Start Range Mode and the Stop Range Mode of both the depth and across axes to Auto.

When the Start Range is set to Auto, the start range of the each axis is automatically set to the minimum value in the data set each time data is received. When the Stop Range is set to Auto, the stop range of each axis is automatically set to the maximum value in the data set each time data is received.

This button provides a quick and convenient way to set both the start and stop ranges to Auto.

Pressing this button is equivalent to opening the Show/Hide dialogue and selecting Start Range → Auto and Stop Range → Auto for both the depth and across axes.



Auto Scale Once button

Set both the Start Range Mode and the Stop Range Mode (of both the depth and across axes) based on the values of the current data set, then keep this range setting for the rest of the data.

The fixed start and stop range values in the Show/Hide dialogue will be updated with the new values. This is a quick and convenient way to change to Fixed range mode and simultaneously update the fixed start and stop ranges with values appropriate for the current water column data.

Note

Pressing this button will update the Fixed start range value and the Fixed stop range value in the Show/Hide dialogue.

Fixed Scale button

Set both the Start Range Mode and the Stop Range Mode of both the depth and across axes to Fixed. The start and stop ranges will be set to the values that were last entered in the respective Start/Stop Range text boxes in the Show/Hide dialogue.

This button provides a quick and convenient way to set the start and stop ranges of both axes to Fixed.

Pressing this button is equivalent to opening the Show/Hide dialogue and selecting Start Range → Fixed and Stop Range → Fixed.

Note that this is not equivalent to clicking on the Auto Scale Once button because the Fixed Start/Stop Range values in the Show/Hide dialogue are not updated in this case.

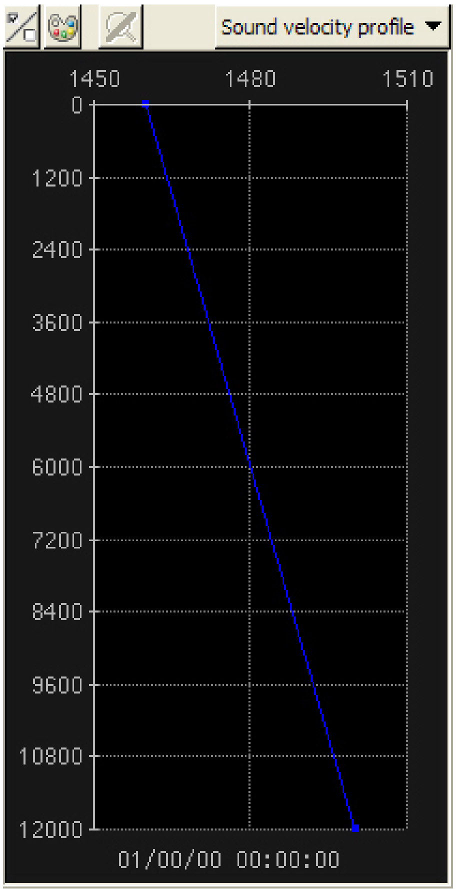
4.13 Sound velocity profile

The **Sound velocity profile** window is accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

The Sound velocity profile window is used for displaying the profile the multibeam echo sounder is using. It is not an editor.

→ *SVP Editor, page 442.*

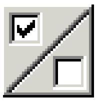
The profile is a sequence of points. These have coordinates with increasing depth values.



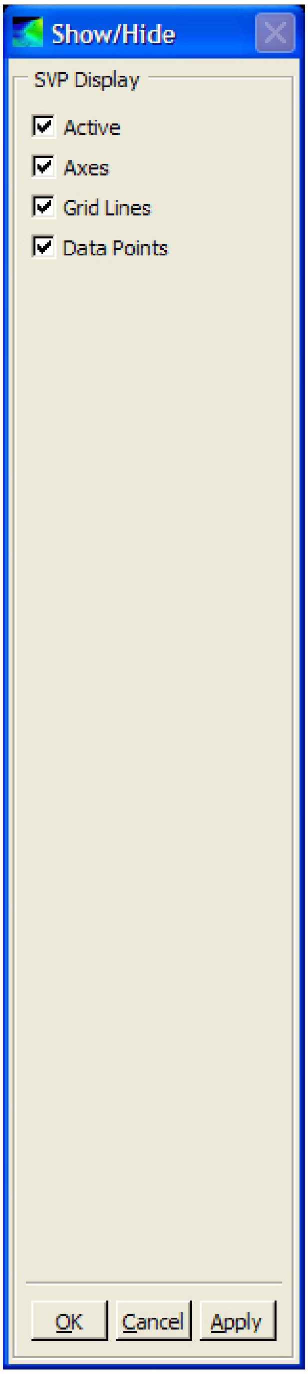
Toolbar buttons

The toolbar holds the following buttons (from left to right):

- Show/hide
- Annotation colours
- Zoom Reset



Show / Hide button

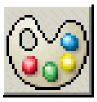


Active: Activate or deactivate the display. Deactivating the display will minimize the CPU usage of the display.

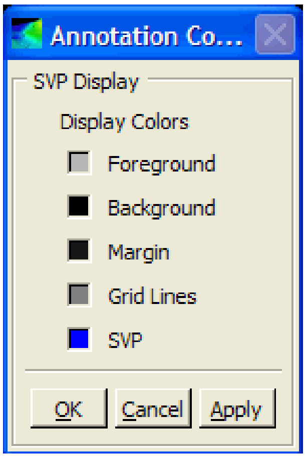
Axes: Show or hide the axes.

Grid Lines: Show or hide the grid lines.

Data Points: Show the sound velocity profile sample values on the sound velocity profile plot.



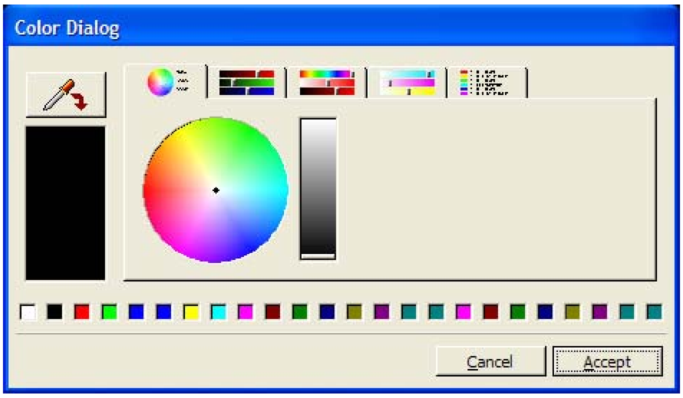
Annotation colours button

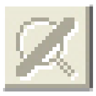


Display Colors: You can change the colours for Foreground, Background, Margin, Grid Lines and SVP.

This is done by double-clicking in the checkbox(es). The **Color Dialog** window will appear. New colours can be selected in a number of different ways (using the eye dropper tool, entering the RGB colour code, using predefined colours etc.).

Select the new colour and click Accept to apply. Cancel if you do not want to change the colour.





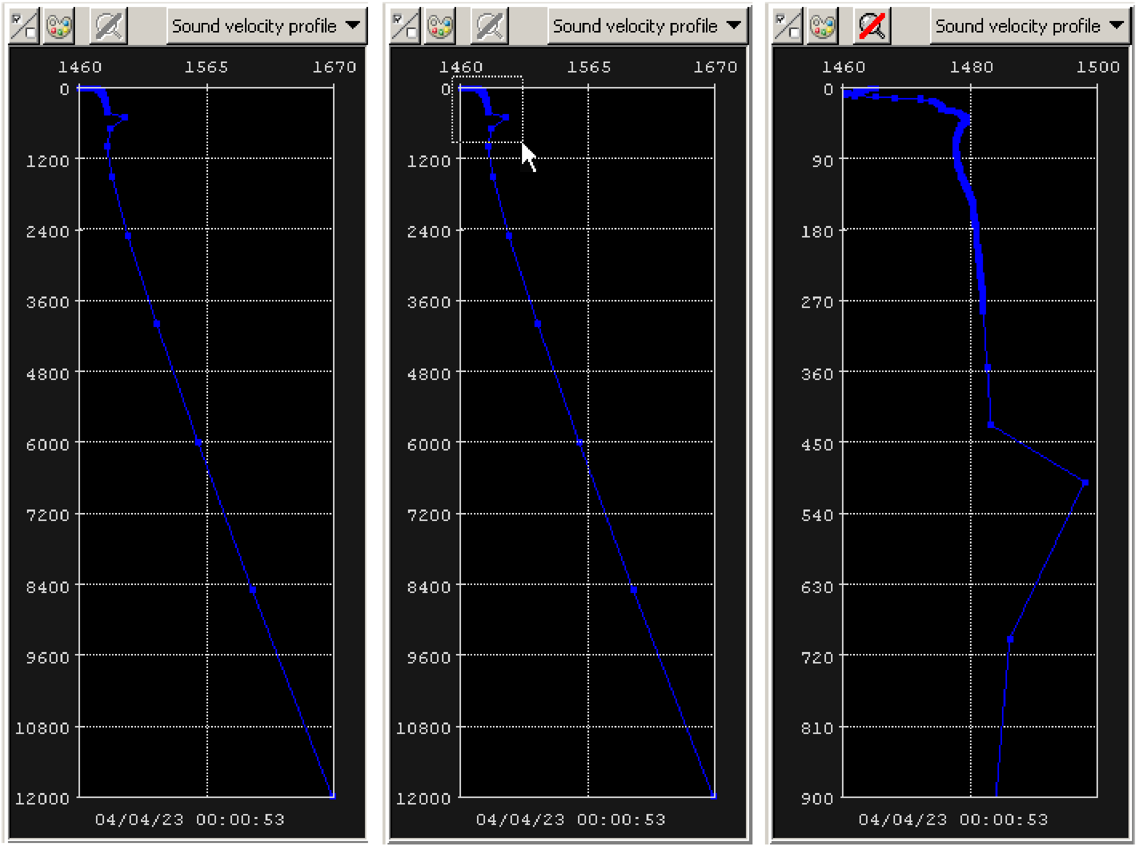
Zoom Reset button

Reset the display after a zoom operation. This button is only active while the display is "zoomed". Clicking on this button will reset the start and stop ranges.

Zooming

Using the Left mouse button: You can zoom to a region of the sound velocity profile using the left mouse button. To zoom to a region of the sound velocity profile, use the left mouse button to drag a rectangle around the region of the plot to which you want to zoom. Press the "Zoom Reset Button" to return the display to the normal (un-zoomed) state.

The following figures display, from left to right, a sound velocity profile before, during and after zooming respectively.



Using the mouse wheel: You can zoom in or out on the displayed region of the sound velocity profile using the mouse wheel. To zoom in/out using the mouse wheel, hold down the Ctrl key and spin the mouse wheel forward (to zoom in) or backward (to zoom out). Press the "Zoom Reset Button" to return the display to the normal (un-zoomed) state.

Panning

Using the mouse wheel: You can pan up or down on the displayed region of the sound velocity profile using the mouse wheel. To pan up or down using the mouse wheel, hold down the Alt key and rotate the mouse wheel forward (to pan up) or backward (to pan down). Note that you can not pan up or down, unless you have previously zoomed in on a region of the sound velocity profile.

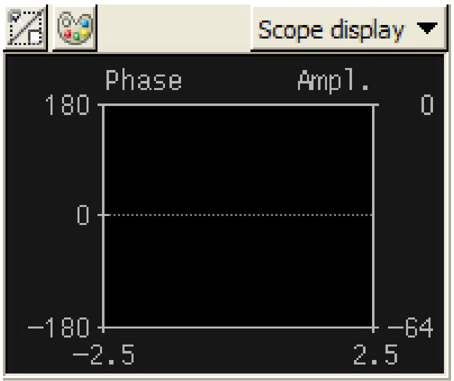
4.14 Scope display

The **Scope display** window is accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

The window can be used to investigate the receiver echo data, and is used mainly for test purposes. The data is not logged.

This window is valid for multibeam echo sounders.

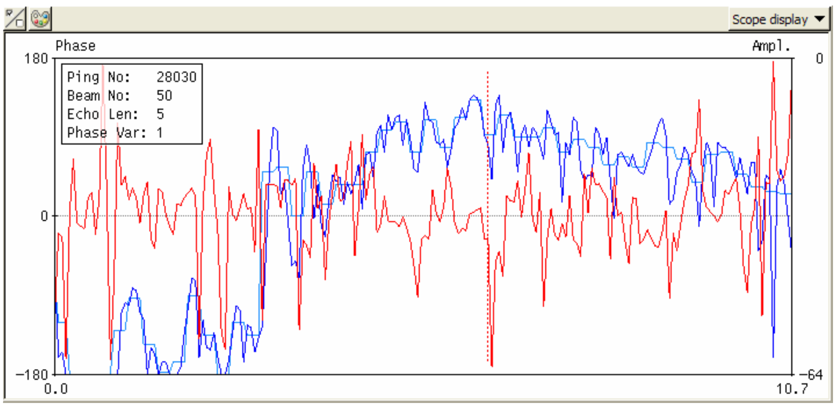
The data is shown with time on the horizontal x-axis and level on the vertical y-axis. Beams close to the normal incidence will have a short echo and a noisy split beam phase signal. The outer beams will normally have a long echo and a well-defined phase curve. The range for the bottom detection is indicated by a vertical dotted line. A dark blue line indicates an amplitude detection, and a red line indicates a phase detection.



Which beam to investigate is set in the *Simulator* tab on the *Runtime parameters* window.

→ *Simulator tab, page 273.*

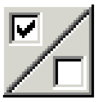
The example below shows a phase detection for beam number 50.



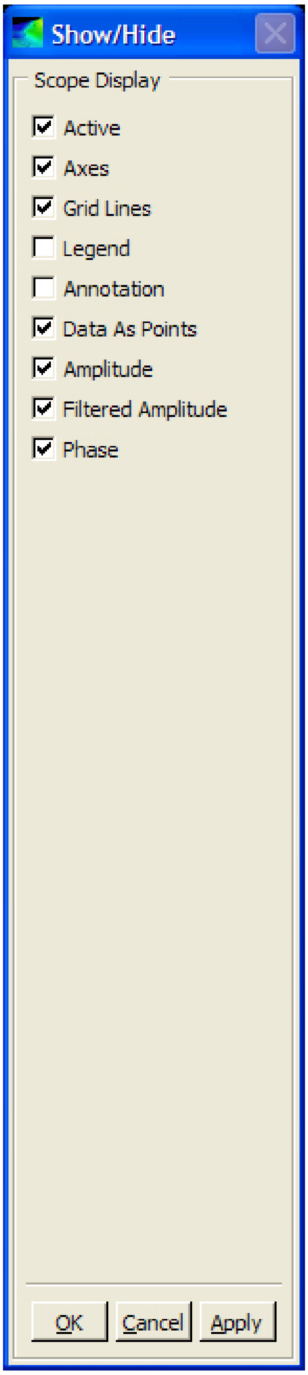
Toolbar buttons

The toolbar holds the following buttons (from left to right):

- Show/hide
- Annotation colours



Show / Hide button



Active: Activate or deactivate the display. Deactivating the display will minimize the CPU usage of the display.

Axes: Show or hide the axes.

Grid Lines: Show or hide the grid lines.

Legend: Show or hide the legend.

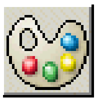
Annotation: Show or hide the on screen text annotation.

Data As Point: Show the data series as a series of points, rather than a solid line.

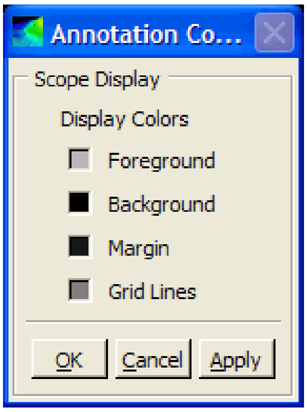
Amplitude: Show or hide the amplitude plot. The amplitude of the received echoes is plotted in a dark blue colour.

Filtered Amplitude: Show or hide the plot of the filtered amplitude. The filtered amplitude is plotted in a light blue colour.

Phase: Show or hide the plot of the electrical phase difference between the two so-called half beams. This is also called the interferometric, or split beam phase signal. The phase is plotted in a red color.



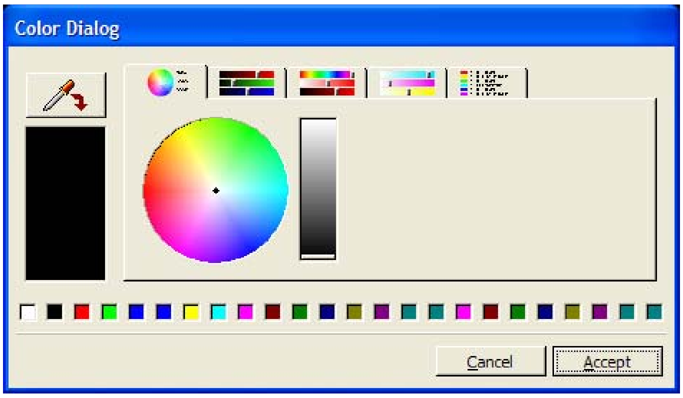
Annotation colours button



Display Colors: You can change the colours for Foreground, Background, Margin and Grid Lines.

This is done by double-clicking in the checkbox(es). The **Color Dialog** window will appear. New colours can be selected in a number of different ways (using the eye dropper tool, entering the RGB colour code, using predefined colours etc.).

Select the new colour and click Accept to apply. Cancel if you do not want to change the colour.



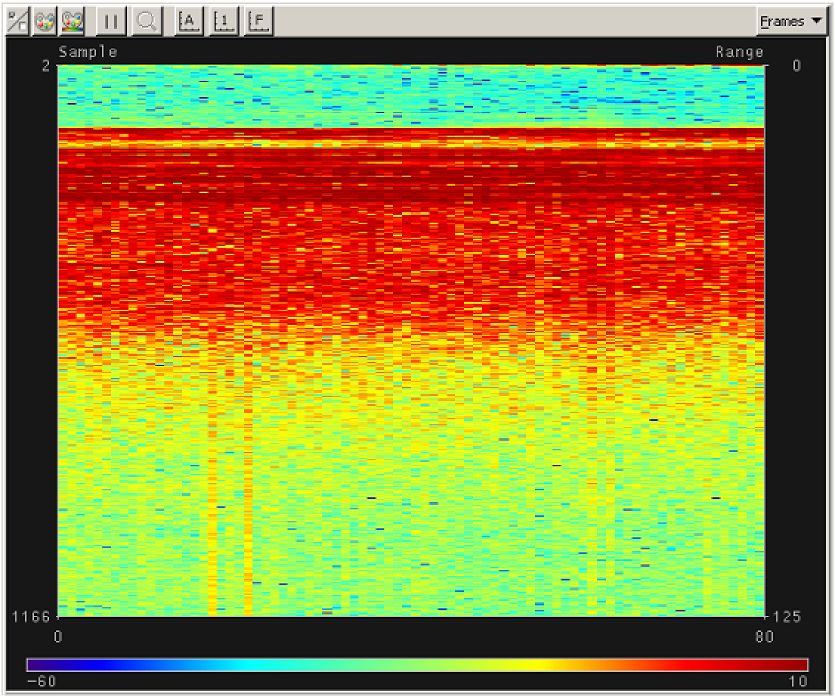
4.15 Stave display

The **Stave display** window is accessed through the *Manage windows* in the *View* drop-down menu or by selecting it from the **Frames** button.

The Stave display window shows a graphical presentation of all the receiver elements or staves in the multibeam. The number of staves varies from multibeam to multibeam.

The Stave display can be helpful for debugging and performance check of the system, establishing if there are interference from other systems, if there are air bubbles etc. The data is not logged.

This window is valid for multibeam echo sounders with stave display capabilities (for example EM 710 and EM 3002).

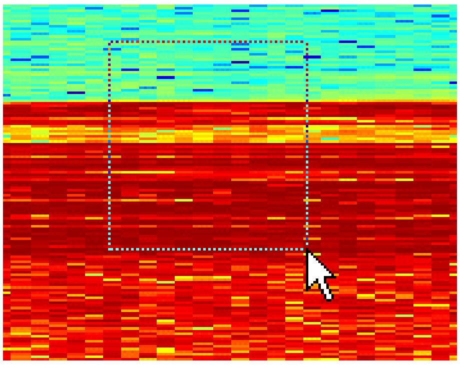


The Stave display presents a grid in which each row of the grid corresponds to one data sample, and each column in the grid corresponds to one receive stave. Each grid cell shows the received signal level for the corresponding sample and stave.

The scale along the left vertical axis shows the sample number, the scale along the right vertical axis shows the range in meters, and the scale along the horizontal axis at the bottom shows the stave number.

Zooming

It is possible to zoom in on a region of the grid by clicking the left mouse button and dragging a rectangle around a region of the grid.

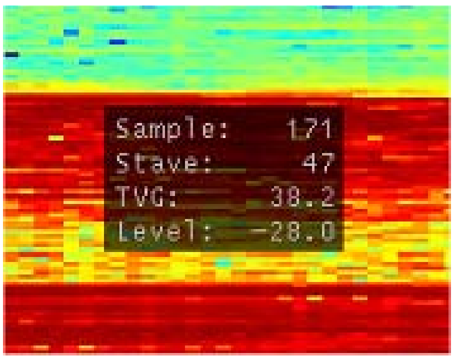


When the left mouse button is released, the region of the grid to which you have zoomed will be displayed. Note also, that the Zoom Reset button will now be enabled (i.e. it is no longer dimmed). It is possible to zoom in even further, by clicking and dragging a rectangle inside the zoomed region.

To reset the zoom, click the Zoom Reset button. This will return the display to the scaling mode that existed prior to the original zoom operation. You can also reset the zoom by selecting one of the auto range options from the Show/Hide dialogue.

Displaying cell information

It is possible to display the sample number, stave number, TVG, and level for any grid cell. To display the cell information, hold down the Ctrl key and left click the desired grid cell. Because the size of the grid cells sometimes is very small (often there are several cells per screen pixel), is it often necessary to first zoom into a region of the grid before clicking on a cell.

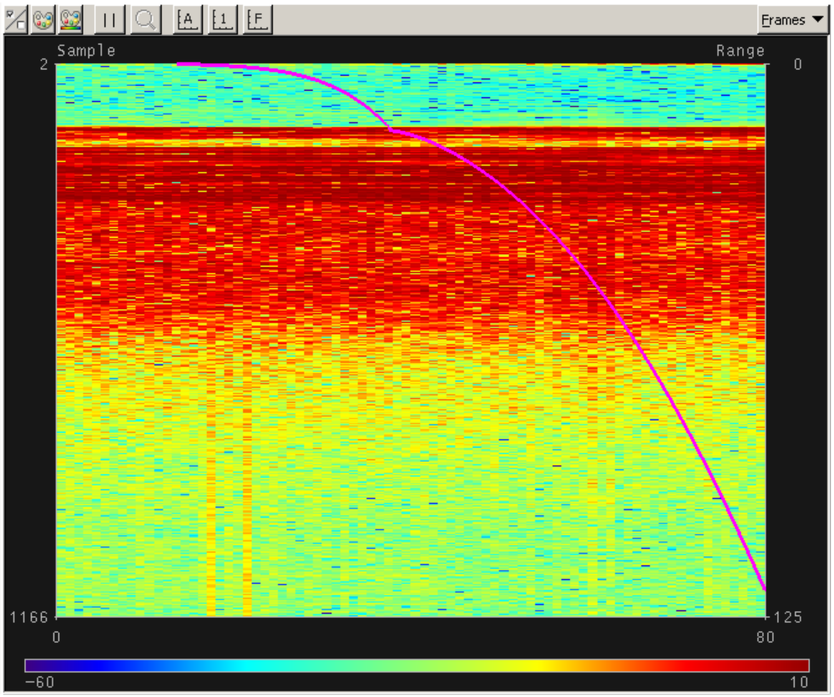


The cell information will remain on the screen (and will be updated in real time as stave data is received) until the user left clicks somewhere inside the grid.

The user can repeatedly display cell information for several cells by holding down the Ctrl key, and repeatedly left clicking on different grid cells. In this case, it may be helpful to pause the display first (otherwise the data will continue to be updated in real time).

TVG curve

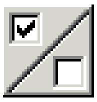
It is possible to display the TVG curve on top of the stave data. The TVG curve can be shown or hidden from the Show/Hide dialogue. A scale for the TVG curve is not shown, however it is possible to determine the TVG at any location on the curve by pressing the Ctrl key and left clicking at that location on the curve.



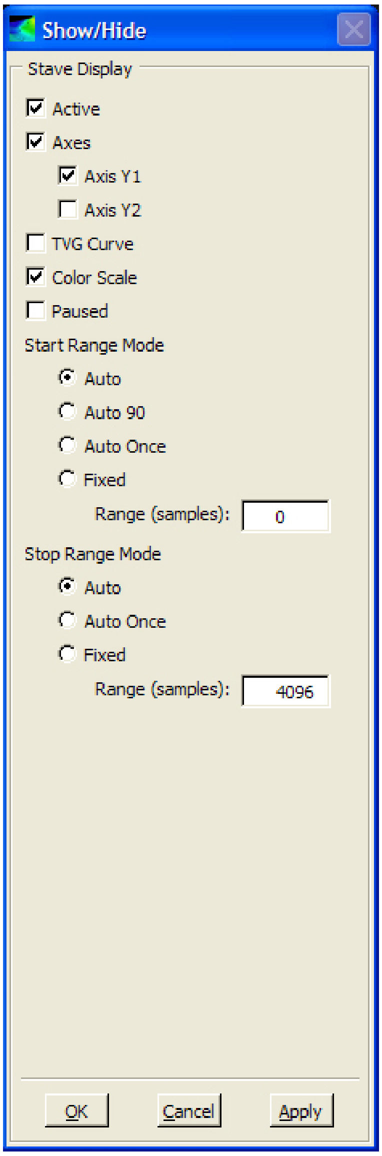
Toolbar buttons

The toolbar holds the following buttons (from left to right):

- Show/hide
- Annotation colours
- Dynamic colours
- Paused
- Zoom Reset
- Auto Scale
- Auto Scale Once
- Fixed Scale



Show / Hide button



Active: Activate or decativate the display. Deactivating the display will minimize the CPU usage of the display.

Axes: Show or hide the axes.

- Axis Y1: Show or hide the Sample axis (the vertical axis to the left of the grid).
- Axis Y2: Show or hide the Range axis (the vertical axis to the right of the grid).

TVG Curve: Show or hide the TVG (time varying gain) curve. When shown, the TVG curve is displayed on top of the Stave data grid.

Color Scale: Show or hide the colour scale legend (shown along the bottom of the grid).

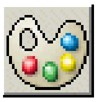
Paused: Pause or continue the display of stave data. While paused, the display is visible, but it is not updated with new data. This may be useful for example if you want to look at the cell information of more than one cell in the grid for a single ping.

Start Range Mode: Options for controlling the start range mode for the vertical scale(s).

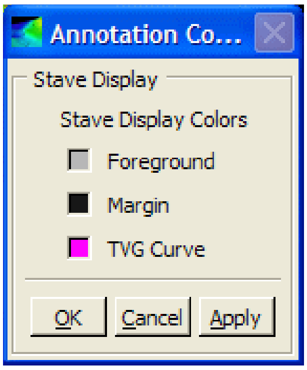
- Auto: Automatically set the start range to match the minimum range of the data each time data is received.
- Auto 90: Automatically set the start range to be 90 percent of the range to normal incidence each time data is received.
- Auto Once: Automatically set the start range (once) to match the minimum range of the data, then keep this fixed range.
- Fixed: Use the range entered in the Range (samples) text box.
  - Range (m): “Fixed” start range (in samples).

Stop Range Mode: Options for controlling the stop range mode for the vertical scale(s).

- Auto: Automatically set the stop range to match the maximum range of the data each time data is received.
- Auto Once: Automatically set the stop range (once) to match the maximum range of the data, then keep this fixed range.
- Fixed: Use the range entered in the Range (samples) text box.
  - Range (m): “Fixed” stop range (in samples).



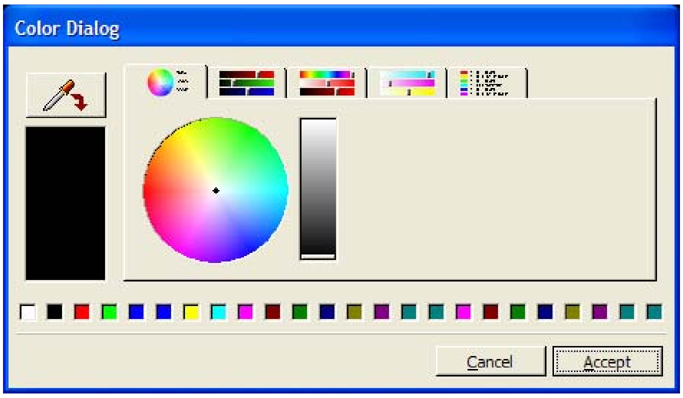
Annotation colours button

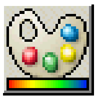


Display Colours: You can change the colours for Foreground, Margin and TVG Curve.

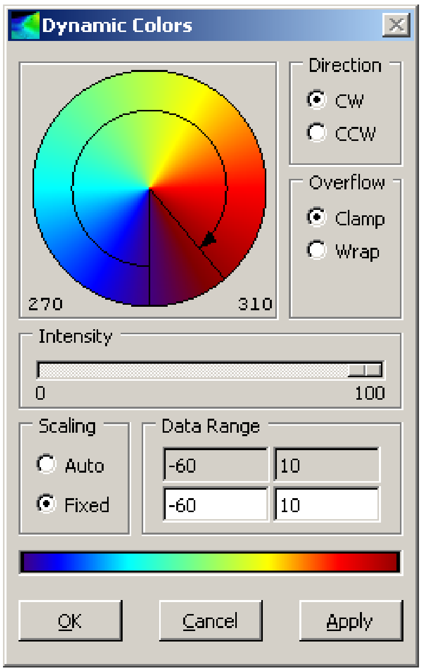
This is done by double-clicking in the checkbox(es). The **Color Dialog** window will appear. New colours can be selected in a number of different ways (using the eye dropper tool, entering the RGB colour code, using predefined colours etc.).

Select the new colour and click Accept to apply. Cancel if you do not want to change the colour.





Dynamic colours button



Color map: Select which objects to set the dynamic colours.

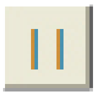
Color wheel: Set the colour representation of the dynamic colours. Drag the arrow to set the start and stop limits.

Direction: Set the direction of the arrow (CW or CCW).

Overflow: Choose a overflow strategy for the colours. (Clamp - lock to the limits, wrap - restart when reaching a limit, cut - do not show data outside the limits.) Only valid when fixed scaling is selected.

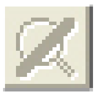
Scaling: Select automatic or fixed scaling.

Data Range: Manually set the range (max/min) for the selected objects. The total range is found automatically from the data.



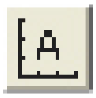
Paused button

Pause or continue the display of stave data. While paused, the display is visible, but it is not updated with new data. This may be useful for example if you want to look at the cell information of more than one cell in the grid for a single ping.



Zoom Reset button

Reset the display after a zoom operation. This button is only active while the display is “zoomed”. Clicking on this button will reset the start and stop ranges.



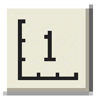
Auto Scale button

Set both the Start Range Mode and the Stop Range Mode to Auto.

When the Start Range is set to Auto, the start range of the Sample (and Range) axis is automatically set to the minimum value in the data set each time data is received. When the Stop Range is set to Auto, the stop range of the Sample (and Range) axis is automatically set to the maximum value in the data set each time data is received.

This button provides a quick and convenient way to set both the start and stop ranges to Auto.

Pressing this button is equivalent to opening the Show/Hide dialogue and selecting Start Range → Auto and Stop Range → Auto.



Auto Scale Once button

Set both the Start Range Mode and the Stop Range Mode based on the values of the current data set, then keep this range setting for the rest of the data.

The fixed start and stop range values in the Show/Hide dialogue will be updated with the new values. This is a quick and convenient way to switch to Fixed range mode and simultaneously update the fixed start and stop ranges with values appropriate for the current stave data.

Note — *Pressing this button will modify the Fixed start range value and the Fixed stop range value in the Show/Hide dialogue.*

Fixed Scale button

Set both the Start Range Mode and the Stop Range Mode to Fixed. The start and stop ranges will be set to the values that were last entered in the respective Start/Stop Range text boxes in the Show/Hide dialogue.

This button provides a quick and convenient way to set both the start and stop ranges to Fixed.

Pressing this button is equivalent to opening the Show/Hide dialogue and selecting Start Range → Fixed and Stop Range → Fixed.

Note that this is not equivalent to clicking on the Auto Scale Once button because the Fixed Start/Stop Range values in the Show/Hide dialogue are not updated in this case.

4.16 New survey

The **New survey window** is accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

This window is valid for all instruments.

It contains the following tab-menus:

→ *Basic Parameters, page 135.*

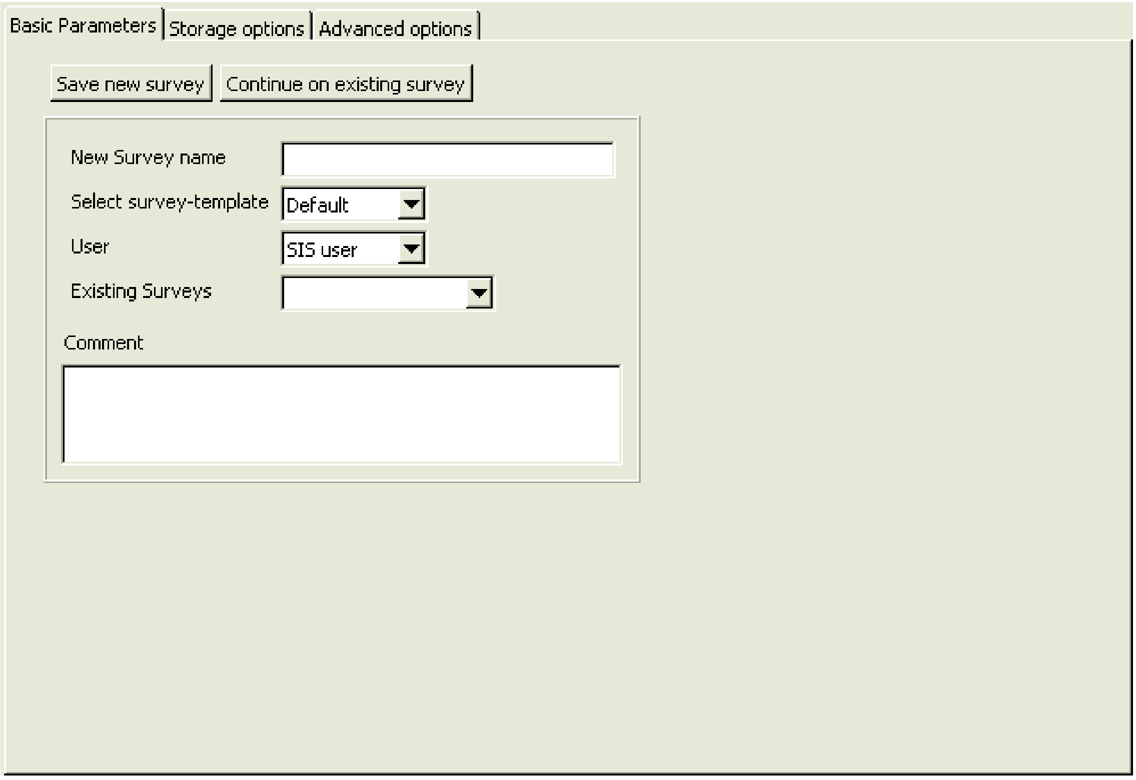
→ *Storage options, page 137.*

→ *Advanced options, page 139.*

Basic Parameters

The **Basic parameters** is located under the *New survey* display view.

The user need only to enter a survey name and a comment when creating a new survey. It is then required that the parameters for the default surveys are maintained by the user.



Parameters

New Survey name: Enter the new survey name in the text field.

Select survey-template: Select a survey template for the parameters for Storage options and Advanced options.

User: Select a user from the combo box. To add new user(s), you must use the *User handling*.

→ *User handling, page 147.*

Existing Surveys: Select an existing survey from the combo box. Press the **Continue on existing survey** button before the survey can be changed.

Comment: Write your own comment for the survey in the text field.

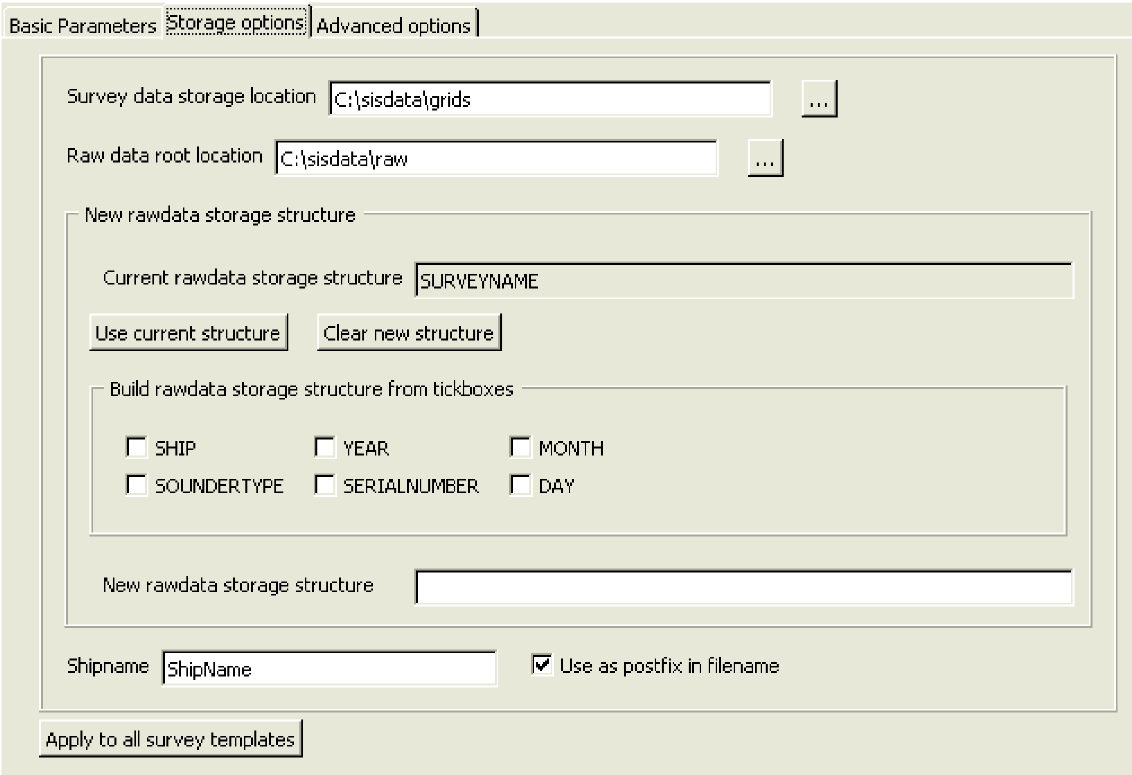
Save new survey: Press this button to create the new survey. All parameters stored under the *Storage options* tab and the *Advanced options* tab are stored in the database for this new survey.

→ *Storage options, page 137.*

→ *Advanced options, page 139.*

Storage options

Storage options is located on the *New survey* display view and under the *Survey templates handling* tab on the *Survey administration* display view.



Parameters

Survey data storage location: The text field is used to identify the preferred location of the Survey Data files. Enter the folder identification directly, or use the browse-button to navigate.

Raw data root location: The text field is used to identify the preferred location of the Raw Data files. Enter the folder identification directly, or use the browse-button to navigate. Press the “Apply to all default surveys” button to apply.

Current rawdata storage structure gives you a description of the current structure. Press **Use current structure** if you want to keep the current structure or press **Clear new survey** if you want to create a new structure.

You can build a new storage structure by enabling the check boxes of the parameters you want to use. The new structure will appear in the text field behind **New rawdata storage structure**.

Apply to all default surveys: This will update these parameters for all the default surveys currently in the database.

If you want to store these parameters to a particular survey, you must use the Basic Parameters.

→ *Basic Parameters, page 135.*

Advanced options

Advanced options is located on the *New survey* display view and under the *Survey templates handling* tab on the *Survey administration* display view.

It contains three new tabs:

→ *Background data, page 140.*

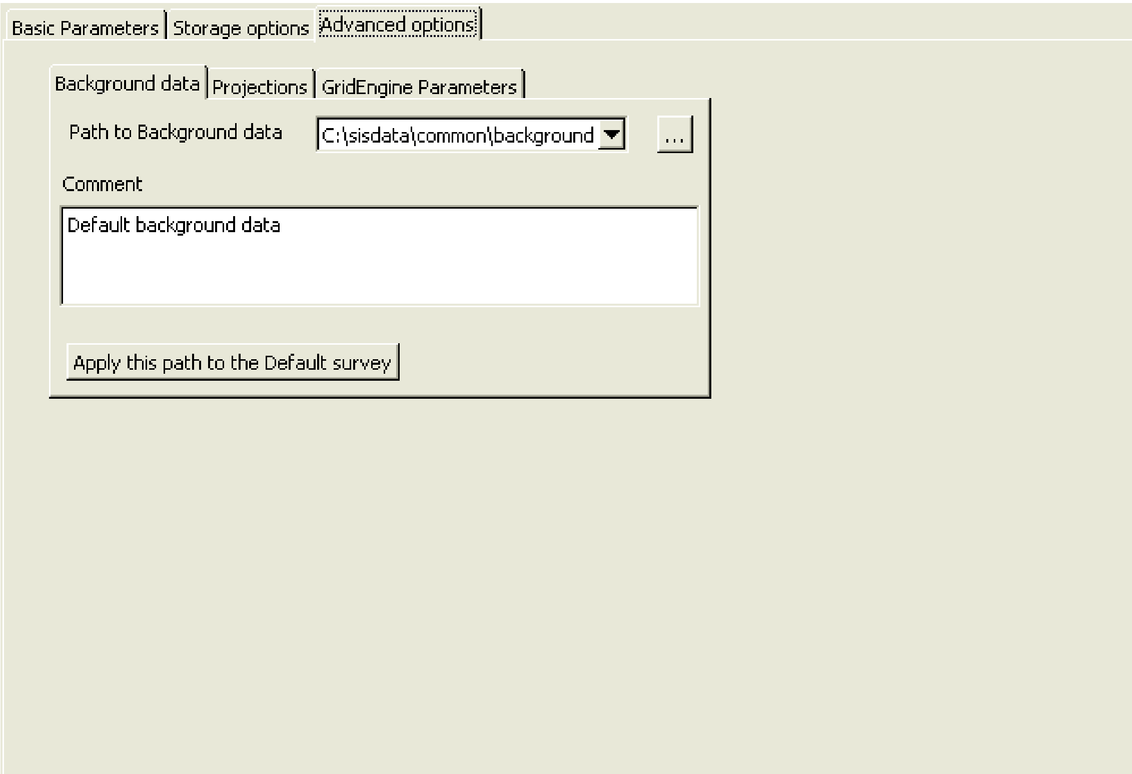
→ *Projections, page 142.*

→ *GridEngine Parameters, page 144.*

Background data

Background data is located under the *Advanced options* tab on the *New survey* display view and under the *Advanced options* tab under the *Survey templates handling* tab on the *Survey administration* display view.

This connects the background data to a new survey.



Parameters

Path to Background data: Choose the path you want to use for the background data. You can use the browse button to find a path.

In the background data directory these files can be stored:

- Projection setup: proj.txt, used to define the geographic projection for this survey.
- KSGPL background data: *.ksgpl, KSGPL-formatted files with background data to be shown in the Geographical display.
- Predicted tide: predictedtide.tide, predicted tide file.
- Geoid model: geoidmodel.geoid, geoid model.

Comment: Write your own comment for the background data.

Apply this path to Default survey: Press this button to apply the path.

If you want to store these parameters to a particular survey, you must use the Basic parameters (New survey) or Basic parameters (Survey administration) .

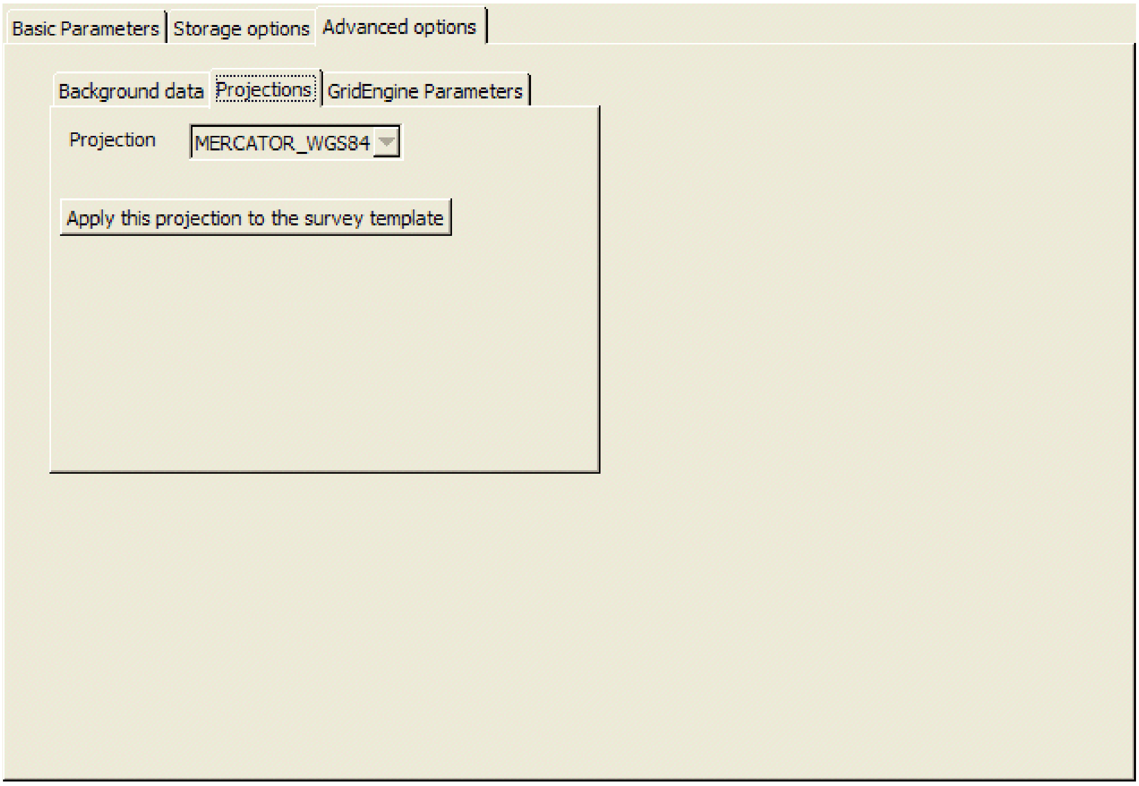
→ *Basic Parameters (New survey), page 135.*

→ *Basic Parameters (Survey administration), page 151.*

Projections

Projections is located under the *Advanced options* tab on the *New survey* display view and under the *Advanced options* tab under the *Survey templates handling* tab on the *Survey administration* display view.

When you define a survey or a survey template, you can define what projection to use in that survey or survey template. New projections can be created and tested using the Projection setup application available from the *Tools* > *Custom* menu.



Parameters

Projection: Select a projection from the drop-down combo box.

→ *The Projection component, page 406.*

If a new survey has been stored, or pinging or logging is started, the surveys held inside SIS is locked to this projection. Only surveys with the same projection can be shown in the Geographical view.

It is possible to change projection after a projection has been set.

Apply this projection to the Default survey: These projections will be saved in the database for all default surveys.

If you want to store these parameters to a particular survey, you must use the Basic parameters (New survey) or Basic parameters (Survey administration) .

→ *Basic Parameters (New survey), page 135.*

→ *Basic Parameters (Survey administration), page 151.*

Change projection

It is possible to change projection after a projection has been set. Shut down SIS or perform the following procedure:

1 Stop pinging.

2 Close the Geographical and New survey windows (if open).

3 Set the active survey to “None”.

4 Open the New survey window and access the Projections tab. The Projection drop-down combo box is now enabled, and you can select a new projection.

5 Open the Import/Export dialogue box from the File menu, and remove the old survey. This can only be removed after a new survey is established to the echo sounder.

6 Save the new survey.

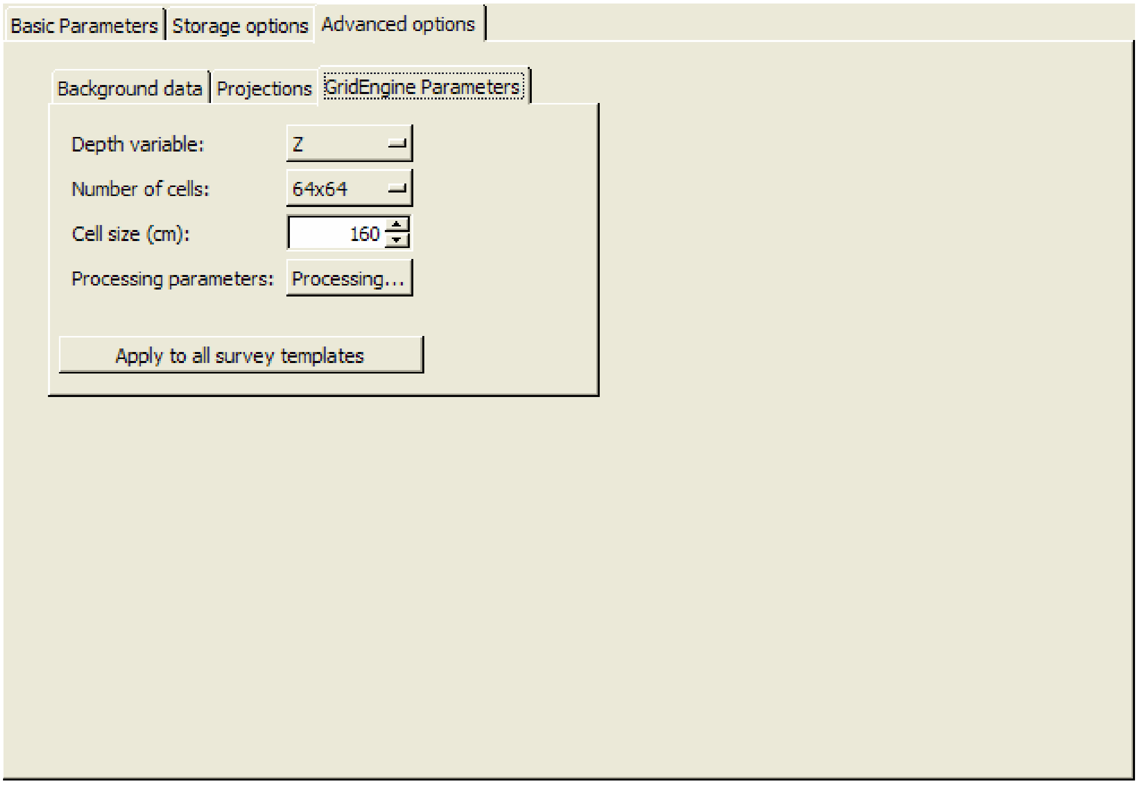
7 Start pinging.

8 Open the Geographical window.

GridEngine parameters

The **GridEngine parameters** is located under the *Advanced options* tab on the *New survey* display view and under the *Advanced options* tab under the *Survey templates handling* tab on the *Survey administration* display view.

When you define a survey or a survey template, you can define what parameters to use for the GridEngine in that survey or survey template.



Parameters

Depth variable: Set the depth variable to be displayed.

- Z: Depth, sea surface to sea bottom distance.
- Zt: Tide file corrected depth, vertical datum to seafloor distance.
- Zv: Geoide and RTK corrected depth, vertical datum to seafloor distance.
- Zg: Seafloor to geoide distance.
- Zr: Seafloor to ellipsoid distance.

Number of cells: Set the number of cells in the processing grid.

- 16 x 16
- 32 x 32
- 64 x 64

- 128 x 128
- 256 x 256
- 512 x 512

The terrain modelling module uses a Processing Grid internally. Nine Processing Grids may be loaded into RAM simultaneously. The Processing Grid is a square, and the size of one side should be approximately the expected swath width.

The parameter Grid Cell Size multiplied with the number of Grid Cells should then be approximately the expected swath width. Reducing the Grid Cell Size will enable a more detailed view of the terrain, but then the number of Grid Cells should be increased as well.

If the computer has enough RAM, a small Grid Cell Size should be selected, and the number of Grid Cells in the Processing Grid should be increased.

Cell size (cm): Set the cell size (in cm). The selectable range is from 10 to 50,000 cm.

Processing parameters: Press this button to set the Ping processing and Grid processing rules. These rules are explained under the Data Cleaning tab.

→ *Data Cleaning, page 261.*

Apply to all survey templates: This will update these parameters for all the survey templates currently in the database.

If you want to store these parameters to a particular survey, you must use the Basic parameters (New survey) or Basic parameters (Survey administration) .

→ *Basic Parameters (New survey), page 135.*

→ *Basic Parameters (Survey administration), page 151.*

4.17 Survey administration

The **Survey administration** window is accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

It contains the following tab-menus:

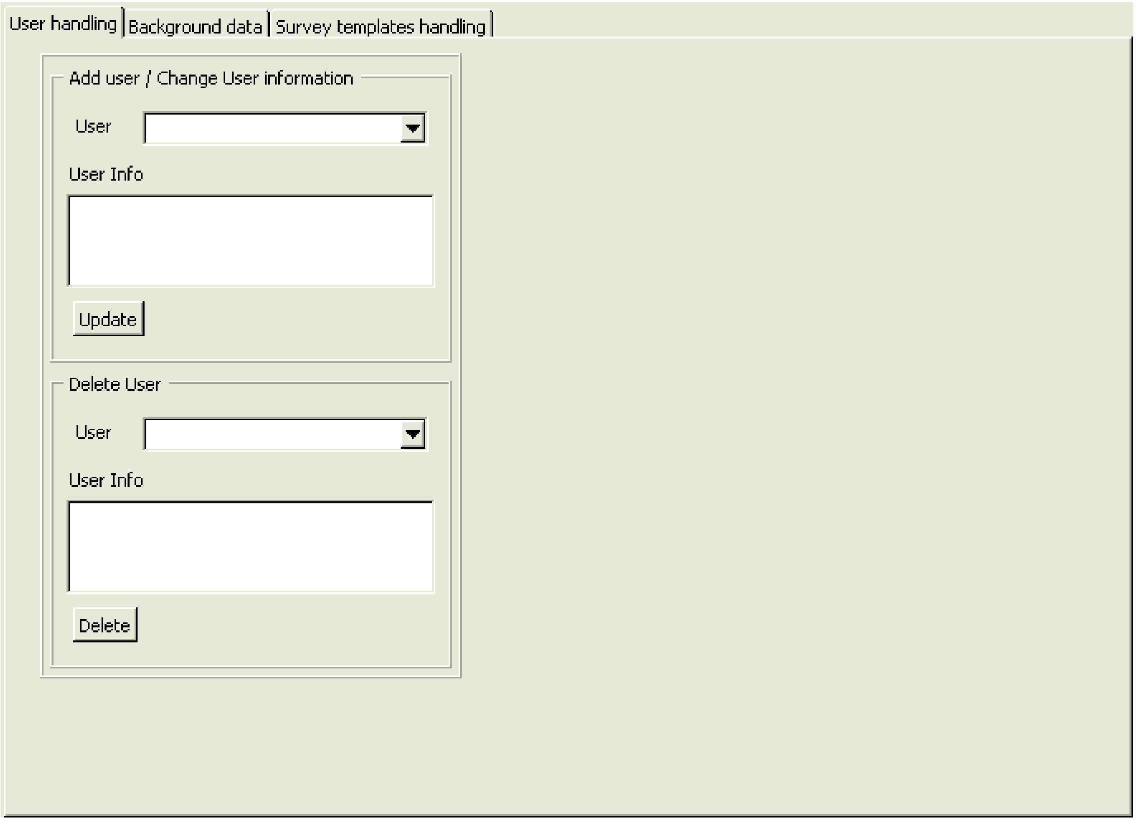
→ *User handling, page 147.*

→ *Background data, page 148.*

→ *Survey templates handling, page 150.*

User handling

User handling is located under the *Survey administration* display view.



Parameters - Add user / Change user information

User: Use the combo box to write the new user's name.

The user parameter is logged in the raw survey format files (.all-files). This makes it possible to recall who was responsible for the survey.

User Info: Use the text field if you want to add information about the user

Update: Apply your changes.

Parameters - Delete user

User: Select the user you want to delete from the combo box.

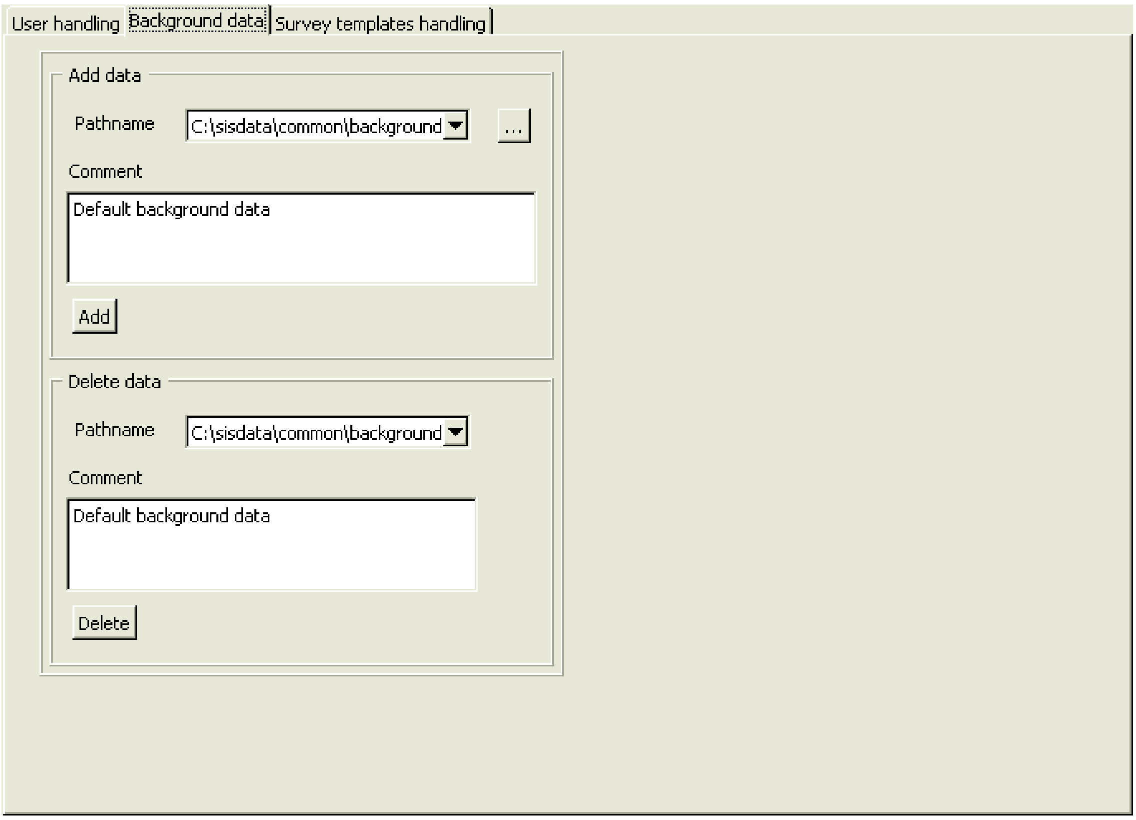
User Info: This text field displays information about the selected user.

Delete: Delete the selected user.

Background data

Background data is located under the *Survey administration* display view.

This permits the user to add pathname and comments for the background data in the database. Corresponding, the pathname can be set from the database. Data can also be deleted here by selecting the pathname.



Parameters - Add data

Pathname: Choose the path you want to use for the background data.

In the background data directory these files can be stored:

- Projection setup: proj.txt, used to define the geographic projection for this survey.
- KSGPL background data: *.ksgpl, KSGPL-formatted files with background data to be shown in the Geographical display.
- Predicted tide: predictedtide.tide, predicted tide file.
- Geoid model: geoidmodel.geoid, geoid model.

Comment: Write your own comment for the background data.

Add: Add the selected path.

If you want to store these parameters to a particular survey, you must use the Basic Parameters.

→ *Basic Parameters, page 151.*

Parameters - Delete data

Pathname: Select the path you want to delete from the combo box.

Comment: This text field displays information about the selected path.

Delete: Delete the selected path.

Survey templates handling

The **Survey templates handling** is located on the *Survey administration* display view.

It contains three new tabs:

→ *Basic Parameters, page 151.*

→ *Storage options, page 137 (see note).*

→ *Advanced options, page 139 (see note).*

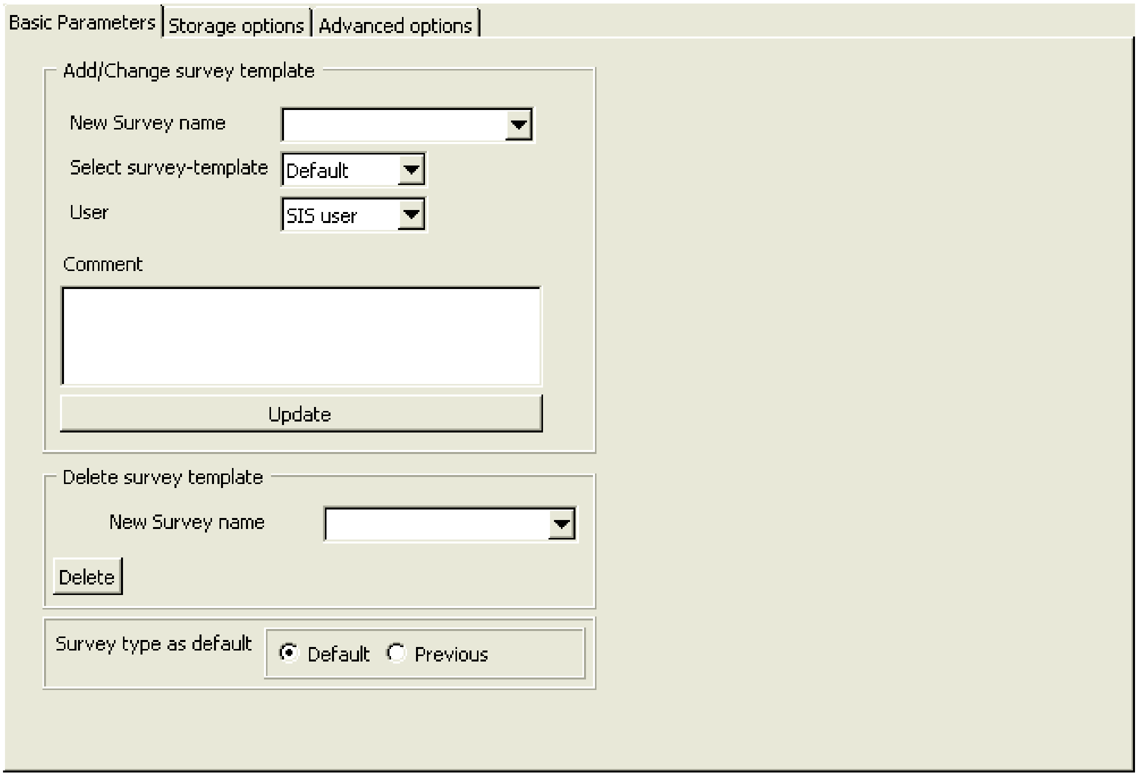
Note

The Storage options *and* Advanced options *tab-menus are identical with the corresponding items in the* New survey *display view.*

Basic Parameters

The **Basic parameters** is located under the *Survey templates handling* tab on the *Survey administration* display view.

The Survey template handling manages the default surveys used as template.



Parameters - Add/Change survey template

New Survey name: Select the survey you want to add/change from the combo box.

Select survey-template: Select a survey template for the parameters for Storage options and Advanced options.

User: Select a user from the combo box. To add new user(s), you must use the *User handling*.

→ *User handling, page 147.*

Comment: Write your own comment for the survey template in the text field.

Update: Update the exisiting default survey or add a new default survey to the database. This includes the parameters stored under the *Storage options* tab and the *Advanced options* tab.

→ *Storage options, page 137.*

→ *Advanced options, page 139.*

Parameters - Delete survey template

Survey name: Select the survey you want to delete from the combo box.

Delete: Delete the selected survey.

Parameters - Survey type as default

Default/Previous: Define which default survey is to appear in the “Select survey-type” combo box.

4.18 Planning module

The **Planning module** window is accessed through the *Manage windows* in the *View* drop-down menu or by selecting it from the **Frames** button.

Remember that you have to activate the Planning module through the Geographical window before starting to use it. All planning buttons are disabled until this is done.

This window is valid for all instruments.

Common interactions

All editing and manipulation in the Geographical window are done by holding the Ctrl key down while using the mouse.

Most actions need to be either accepted or cancelled. This is usually done by holding Ctrl key down while clicking on the right mouse button. This will open the “Confirm changes” dialogue.

Actions done directly by pressing a button will not require to be confirmed. As an example, no confirmation is necessary when deleting a selected object.

The current action is automatically cancelled if the current option is changed, for example if pressing “New Polygon” while creating a new line.

Selecting a line or a polygon is done by holding the Ctrl key down while clicking on the object to be selected. Anonther object already selected will be deselected.

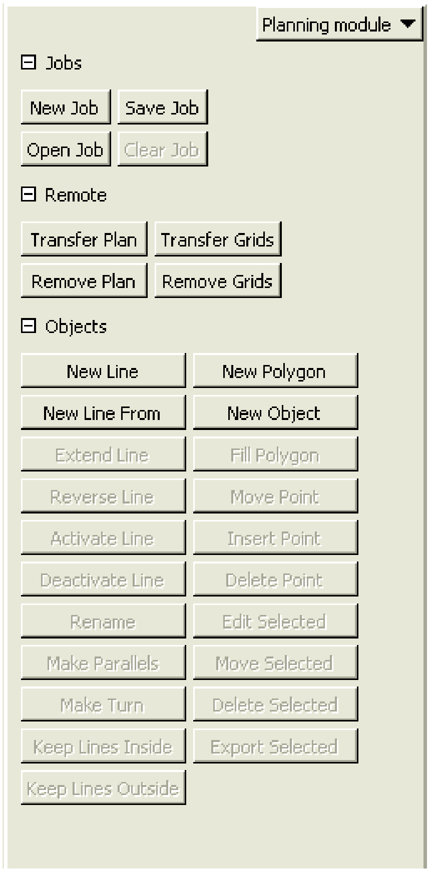
Deselecting multiple objects can be done by holding the Ctrl key down while clicking on the right mouse button. This will open the “Selected objects” dialogue, where the user can choose to deselect all selected lines, polygons or both.

Tabs

The Planning module has three elements:

- Jobs
- Remote
- Objects

Each element has a number of functions assigned to specific buttons. Show or hide the buttons by clicking the +/- check boxes.



Jobs

These buttons are used to create and save a new job, or to reactivate an existing job.

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.

The following options are available:

New Job: Create a new job.

Open Job: Open an existing job.

Save Job: Save the current job.

Clear Job: Clear the current job from the graphical display.

Remote

These buttons are used to transfer data to a remote Helmsman Display.

→ *Helmsman Display, page 95.*

Whenever data is transferred to the remote display it will replace whatever is already there. All defined lines, polygons and grids will automatically be transferred if Transfer Plan or Transfer Grids is selected.

Transfer Plan: Transfers lines and polygons to the remote display.

Remove Plan: Removes lines and polygons from the remote display.

Transfer Grid: Transfers the terrain data to the remote display.

Remove Grid: Removes the terrain data from the remote display.

Object

These buttons are used to create and manipulate lines and polygons within an existing job.

Note

Buttons may be disabled from time to time if the given action is not allowed. As an example, a line must be activated in order to be able to deactivate it.

New Line: Create a new line by holding the Ctrl key down while clicking the left mouse button for each new point. At the end of the line, click the right mouse button to accept or cancel the operation.

This option is active until the user changes to another option or presses the button once more.

New Line From:

Extend Line: Any line can be extended in this option. First select the line, then press the Extend Line button to show the two end points of the line. Select which end you want to extend by holding the Ctrl key down while clicking on it with the left mouse button.

After adding the desired points, click the right mouse button to accept or cancel the operation. When accepting, the object is deselected.

This option is only allowed if one line only is selected.

Activate Line: First select the line, then press the Activate Line button to make the line active. The activated line will have a new colour and be deselected. This line will be sent to the Helmsman display (if present).

This option is only allowed if one line only is selected.

Deactivate Line: First select the line, then press the Deactivate Line button to make the line unactive. This line will be removed from the Helmsman display (if present).

This option is only allowed if one line only is selected.

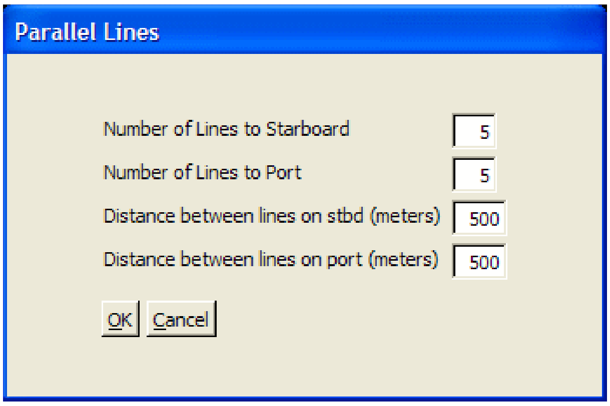
Reverse Line: Every line has a defined direction, shown by a dot at the start of the line. Pressing the Reverse Line button will reverse the direction of all selected lines. Accepting this action will unselect the lines. Click the right mouse button to accept or cancel the operation. When accepting, the object is deselected.

This option is only allowed if one or more lines are selected. Any selected polygons are ignored.

Rename: Press the Rename button to open a dialogue where you can change the object’s name. The object will remain selected.

This option is only allowed if one object only is selected.

Make Parallels: A user defined number of lines parallel to a selected line can be created using this option. Select a line and then press the button to open the "Parallel Lines" dialogue. This dialogue allow you to define how many lines to create in both directions (port and starboard). The distance and spacing between the lines (in metres) can also be specified. Click the right mouse button to accept or cancel the operation. When accepting, the line is deselected.



This option is only allowed if one line only is selected. Any selected polygons are ignored.

Make Turn: This option is used to create a turn between two lines. Pressing the Make Turn button will create a turn by adding a new line between the end point of the first line and the start point of the second line.

This option is only allowed if two (and only two) lines are selected.

Keep Lines Inside: This option is used to clip the parts of a line lying outside the borders of a polygon. When accepting, the objects are deselected. Multiple lines can be selected.

Keep Lines Outside: This option is used to clip the parts of a line lying inside the borders of a polygon. When accepting, the objects are deselected. Multiple lines can be selected.

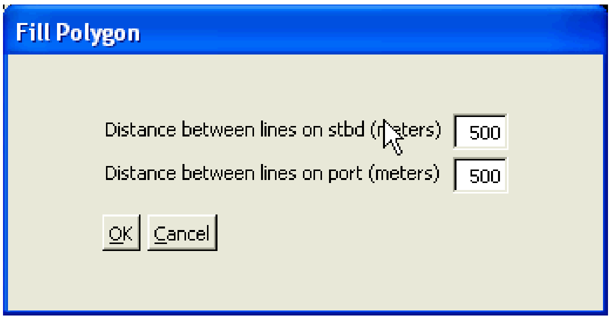
New Polygon: Create a new polygon by holding the Ctrl key down while clicking the left mouse button for each node in the polygon. Note that a polygon must have at least three nodes. After completing the polygon, click the right mouse button to accept or cancel the operation.

This option is active until the user changes to another option or presses the button once more.

New Object:

Fill Polygon: This option is used to fill a polygon.

Select a polygon and then press the button to open the “Fill Polygon” dialogue. This dialogue allow you to define the distance and spacing between the parallel lines to be created (both port and starboard directions). The lines will be clipped at the polygon’s border. When accepting, the objects are deselected.



This option is only allowed if one line and one polygon is selected.

Move Point: Any point can be moved. Select a line or a polygon and press the Move Point button to show all points of the selected object. Select which point you want to move by holding the Ctrl key down, pressing the left mouse button and then moving the mouse. The point in question will move with the mouse cursor until releasing the left mouse button. Pressing the left mouse button again elsewhere in the view, will continue moving the point with the mouse cursor until the mouse button is released again. This action needs to be confirmed prior to moving other points. When accepting, the line is deselected.

This option is only allowed if one object only is selected.

Note

It may be difficult to hit a point on one object if the point is directly on top of another object. Zooming in on the point can help.

Insert Point: A point can be inserted to an existing line or polygon. Select a line or a polygon and press the Insert Point button to show all points of the selected object. Insert a point by holding the Ctrl key down and clicking on one of the line segments with the left mouse button. After inserting the desired number of points, click the right mouse button to accept or cancel the operation. When accepting, the object is deselected.

This option is only allowed if only one object only is selected.

Note *Inserting a point can be difficult on some systems. You can increase a value in the SIS database if you experience this problem.*

The SIS database value can be increased the following way:

1 Get the current threshold value by calling:
`“getParameter.bat GEOVIEW_PLANNING_INSERT_VERTEX_THRESHOLD 1”`

2 Increase this value by 20 and update the database by calling:
`“setParameter.bat GEOVIEW_PLANNING_INSERT_VERTEX_THRESHOLD 1 N”`
where ’N’ is the new value.

3 Open the Show/Hide button in the Geographical display, deselect the “Planning” check box, press Apply, then check “Planning” and press “OK”. If this did not help, try to increase the value a bit more.

Delete Point: Any point can be deleted. Select a line or a polygon and press the Delete Point button to show all points of the selected object. Delete a point by holding the Ctrl key down and clicking on it with the left mouse button. After deleting the desired number of points, click the right mouse button to accept or cancel the operation. When accepting, the object is deselected.

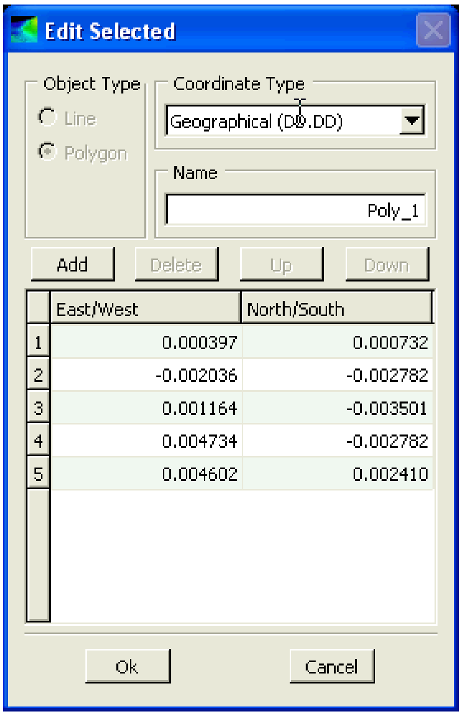
Note that when deleting points, you must leave at least two points on a line and three points on a polygon.

This option is only allowed if one object only is selected.

Note *It may be difficult to delete a point on one object if the point is directly on top of another object. Zooming in on the point can help.*

Edit Selected: This option is used for editing objects. Select an object and press the button to open the “Planning Edit Module” dialogue.

This dialogue allow you to change, delete or add points as well as renaming the object. After updating, the object is deselected.



This option is only allowed if one object only is selected.

Move Selected: Any object can be moved. Select one or more objects and press the “Move Selected” button. Move the objects by holding the Ctrl key down, pressing the left mouse button and then moving the mouse. The objects in question will move with the mouse cursor until releasing the left mouse button.

After moving the objects to the desired location, click the right mouse button to accept or cancel the operation. When accepting, the objects are deselected.

This option is only allowed if at least one object is selected.

Delete Selected: Press this button to remove all selected objects from memory. No confirmation is required.

This option is only allowed if at least one object is selected.

Export Selected: Press this button to append all selected objects to an already existing job (to file).

This option is only allowed if at least one object is selected.

4.19 Installation parameters

The **Installation parameters** window is accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

The Installation parameters window is used to set parameters for all navigation systems, motion sensors and sonar heads or transducers connected to the hydrographic system. Such parameters may typically be:

- Sensor locations (x, y, z)
- Angular offsets
- Waterline reference
- Navigation input system
- Clock reference
- PU input/output datagrams

Depending on which echo sounder you have choosen, different tab-menus will appear:

Multibeam echo sounders

<u>PU Communication Setup</u>

→ *Input Setup, page 161.*
→ *Output Setup, page 165.*
→ *Clock Setup, page 167.*

<u>Sensor Setup</u>

→ *Settings, page 169.*
→ *Locations, page 173.*
→ *Angular Offsets, page 175.*
→ *ROV Specific, page 178.*

<u>System Parameters</u>

→ *System Parameters, page 180.*

<u>Built-In Self Test (BIST)</u>

→ *PU BIST, page 186.*

Singlebeam echo sounders

→ *Single beam installation, page 197.*

GPS equipment

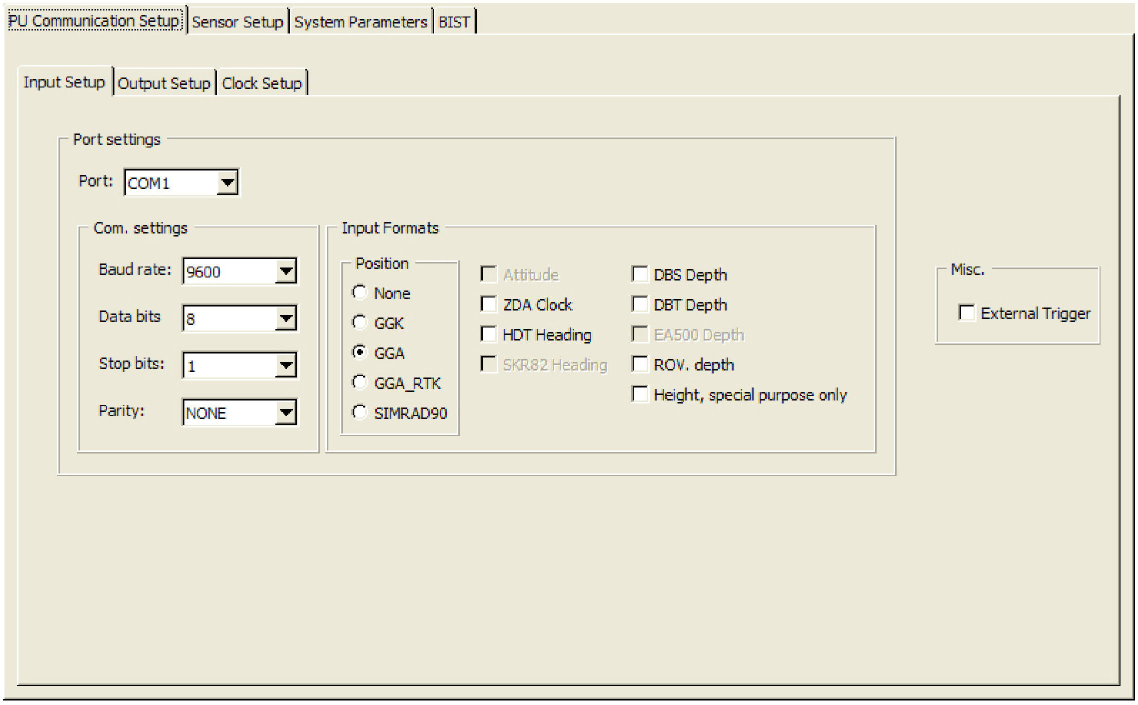
→ *GPS installation, page 199.*

Input Setup

Input Setup is located under the *PU Communication Setup* tab on the *Installation parameters* display view.

Note

When the Input Setup configuration is changed the Sensor. Setup must be checked. Specifically it's important to check the Active Senors setting.



Parameters

Input port: This drop-down combo-box is used to select which of the PU (Processing Unit) ports the dialogue box shall apply to. Choose between the serial ports COM1 to COM4 or the network port UDP2.

- COM1: Normally used for position, clock and depth input.
- COM2: Designated to input from a motion sensor.
- COM3: Optional (position, motion and heading input).
- COM4: Optional (position and heading input).
- UDP2: Position and depth input.

Note *If the UDP2 port is used, a network switch must be installed or the Data Distribution program can be used..*

→ *Data Distribution program, page 424.*

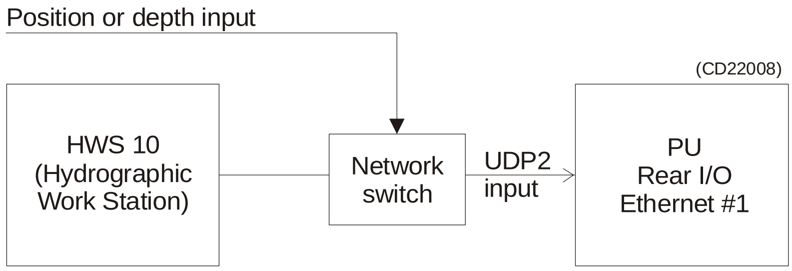


Figure 10 UDP input principles

Note *A switch is only recommended for a local net, not for the ship's main network, as this may overload the Processor Unit.*

- The network adresses are as follows:
  * EM 300/EM 120: 157.237.14.60
  * EM 710: 157.237.2.71
  * EM 1002: 157.237.15.60
  * EM 2000/EM 3000: 157.237.2.58
  * EM 3002: 157.237.2.61
- The UDP have the following port setting:
  * UDP2: 2022

Baud rate: Define the baud rate for the currently selected serial port.

Data bits: Select the number of data bits for the currently selected serial port.

Stop bits: Select the number of stop bits for the currently selected serial port.

Parity: Select the parity for the currently selected serial port.

Input Formats: This area allows you to define what type of external sensor is connected to the serial or network port you selected in the Input port combo box.

Inputs in the following formats are available:

- GGK Positions
- GGA Positions
- Simrad90 Positions

- GGA_RTK Positions
- Simrad90 Positions
- Attitude
- ZDA Clock
- HDT Heading
- SKR82 Heading
- MK39 Heading
- DBS Depth (NMEA)
- DBT Depth (NMEA)
- EA500 Depth
- ROV Depth
- Height (special purpose only)

Refer to the Datagram Formats in the appropriate user documentation for a description of these formats.

Restrictions to sensor input

A number of restrictions apply to the selection of the PU (Processing Unit) input formats. These restrictions are integrated into the user interface and will be reflected in the enabling/disabling of check boxes for the different ports. The restrictions are as follows:

- Only one positioning system is allowed on each port, with a maximum of three.
- Positioning system 1 is by definition on COM1.
- Positioning system 2 is by definition on COM3.
- Positioning system 3 is by definition on COM4 or UDP2. (AUV Processing Units do not have COM4).
- Only one motion sensor is allowed on each port, with a maximum of two.
- Motion sensor 1 is by definition on COM2.
- Motion sensor 2 is by definition on COM3.
- A motion sensor cannot share a serial line (COM) with other sensors.
- Only one stand alone heading sensor is allowed.
- The Sperry MK39 MOD2 motion sensor (roll, pitch, heading) can only be used on serial line COM3.
- A stand alone heading sensor using SKR80/82 format can only be used on a COM (serial line) port. This port cannot be shared by others sensors when in use.

- Only one clock input (normally ZDA) is allowed (plus a single 1PPS clock sync. signal - see *PU Clock Setup*).

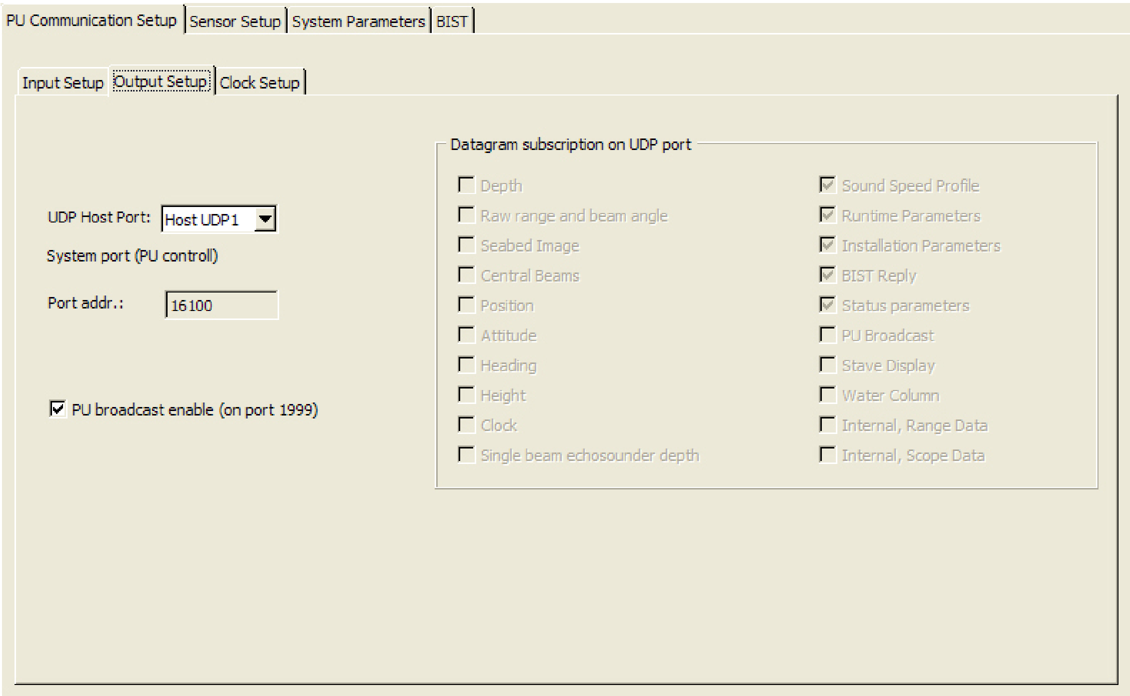
  → *PU Clock Setup, page 167.*

- Only one depth sensor is allowed (pressure sensor for ROV).
- The EA500 format can only be used on UDP2.

External Trigger: When selected, an external trigger signal causes the echo sounder to send a ping. The Pinging on/off function must be on.

Output Setup

Output Setup is located under the *PU Communication Setup* tab on the *Installation parameters* display view.



Parameters

UDP host port: Select which of the interfaces the dialogue box shall apply to.

- The “Host UDP1” port is used by the system to receive PU (Processing Unit) status and response datagrams. The settings for this link should normally not be changed. All buttons are therefore disabled for user operation.
- The “Host UDP2” port is used by the system to receive datagrams from the PU (Processing Unit) for logging and retransmission. The buttons are available for user operation, but care should be taken to avoid turning off essential information (for example depth or position).
- The “Host UDP3” port is used by the system to receive PU (Processing Unit) datagrams intended for the Ping displays (Beam intensity, Cross track, Waterfall, Time series etc.). These buttons are disabled for user operation.
- The “Host UDP4” port is user configurable, for example when SIS is used as a controller.

Note

Port number 2999 is reserved for internal use.

Port address: Port address. NOT changeable.

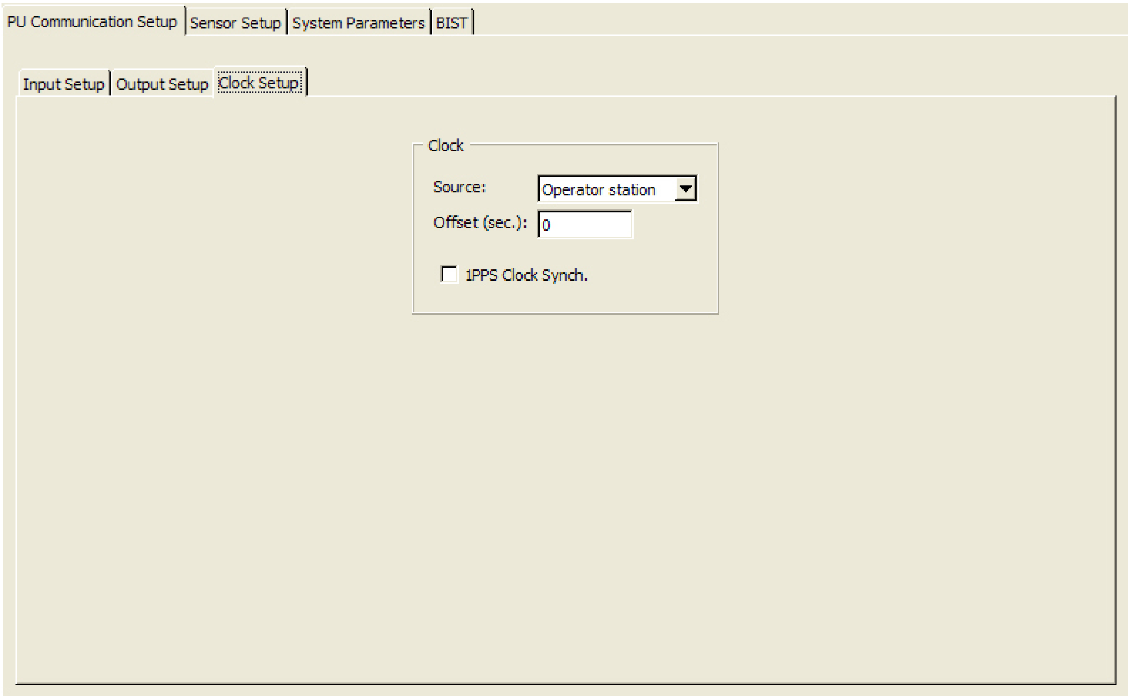
PU broadcast enable: Tell the PU (Processing Unit) to broadcast its presence on the network, using port 1999. The PU will send out a broadcast datagram every second to port 1999.

Datagram subscription on the UDP port: The table below gives datagram subscriptions available for various multibeam echo sounders.

Datagram	Echosounder						
	EM120	EM300	EM710	EM1002	EM2000	EM3000	EM3002
Depth	x	x	x	x	x	x	x
Raw range and beam angle	x	x	x	x	x	x	x
Seabed image	x	x	x	x	x	x	x
Central beams	x	x					
Position	x	x	x	x	x	x	x
Attitude	x	x	x	x	x	x	x
Heading	x	x	x	x	x	x	x
Height	x	x	x	x	x	x	x
Clock	x	x	x	x	x	x	x
Single beam echo sounder depth	x	x	x	x	x	x	x
Sound Speed Profile	x	x	x	x	x	x	x
Runtime parameters	x	x	x	x	x	x	x
Installation parameters	x	x	x	x	x	x	x
BIST reply	x	x	x	x	x	x	x
Status parameters	x	x	x	x	x	x	x
PU broadcast	x	x	x	x	x	x	x
Internal - Scope data	x	x	x	x	x	x	x
Internal - Range data	x	x	x	x	x	x	x
Stave display			x				x
Water column			x				x
Hull Unit				x			

Clock Setup

Clock Setup is located under the *PU Communication Setup* tab on the *Installation parameters* display view.



The echosounder system has an internal clock with 1 millisecond resolution. This clock is used to time stamp all logged data. The clock will drift, typically some seconds per day, unless it is synchronized to a 1PPS (pulse per second) input signal. This signal will then determine the clock's drift rate, and in practice reduce it to zero using a GPS receiver as source.

The clock may be set in three situations:

1 When the PU is initialized during start-up of PU from SIS.

2 When the Clock Source is changed.

3 When a new survey is started.

A fully correct clock is only necessary if the output data are later to be combined with other time critical data logged or created by other systems, for example an accuracy of up to one minute would be necessary to apply tidal changes.

If the timestamp supplied in the position input datagrams is to be used, it is imperative that the system clock is correctly set and that 1PPS synchronization is used.

Parameters

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)
- Active Positioning System
- Operator Station
- No sync.

Offset [sec]: 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.

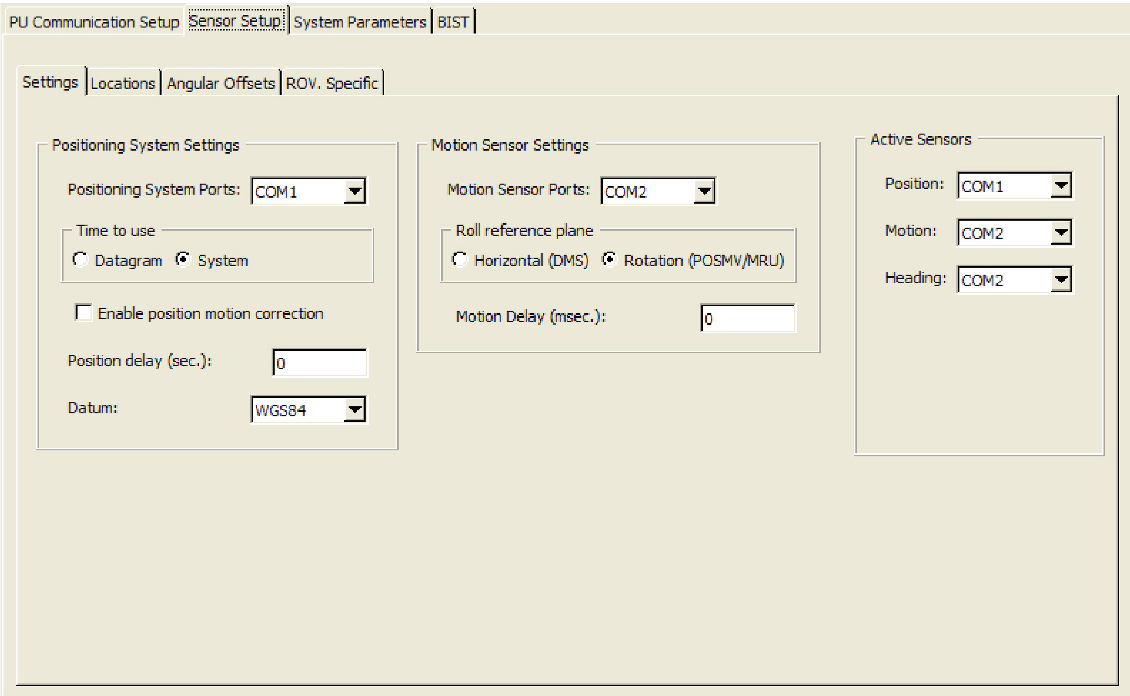
1PPS Clock Sync: Click to turn on the 1 pulse per second external clock synchronization.

1PPS input signal is normally “resting” at a high level. Each second, a low going 100 μS-1000 μS pulse adjusts the second counter in the PU (Processing Unit). Since 1PPS is a TTL-signal, a high level at the input connector must be higher than 2.7 Vdc (the margin is then 0.3 Vdc) and a low level (during the pulse) must not exceed 0.6 Vdc (the margin is then 0.2 Vdc).

Settings

Settings (of sensors) is located under the *Sensor Setup* tab on the *Installation parameters* display view.

Note — *When the Input Setup configuration is changed the Settings must be checked!*



Positioning systems

You can connect three positioning systems to the multibeam echo sounder, but only one can be active at any one time. One positioning system may be connected on a network port (UDP2) instead of a serial line.

Data from all positioning systems are logged, and may all be used in post-processing. However, only the positioning system selected as “active” will be used in the real-time displays. (See Active sensors below).

For each of these positioning systems, you need to define certain basic parameters.

Parameters - Positioning Systems Settings

Positioning System Ports: Use this drop-down combo box to choose which positioning system you wish to set the parameters for. The positioning system is thus not identified by its name, but by the port it is connected to.

The following ports are available:

- COM1 (positioning system 1)
- COM3 (positioning system 2)
- COM4 (positioning system 3)
- UDP2 (positioning system 3)

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 (see below).

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 multibeam echo sounder 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.

- Select Datagram or System:
  - **Datagram:** This choice allows the use of the time stamp in the input datagram when applying positions to the realtime display.
  - **System:** The multibeam echosounder will use its own internal time stamp when applying positions to the real time display.

Note

Both time stamps are stored, hence the time reference can be changed or corrected in post processing.

Enable position 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 (sec): 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 set the internal datum identical to what the positioning system sends to the echo sounder. This will also be logged onto the harddisk. The projection reference in the survey module must also be set accordingly.

Motion sensors

You can connect two motion systems to the multibeam echo sounder, but only one can be active at any one time. Data from both systems are to be logged. The motion system you have selected will be used in the real time displays. For each of these motion systems some basic parameters need to be set.

Parameters - Motion Sensors Settings

Motion Sensor Ports: Use this to choose which motion sensor you wish to set the parameters for. The motion system is not identified by name, but by the port it is connected to.

The following ports are available:

- COM2 (motion sensor 1)
- COM3 (motion sensor 2)

Roll reference plane: The roll reference plane is used to define the reference plane against which the angle for roll is measured.

- Select Horizontal or Pitch/Roll Plane:
  - **Horizontal:** 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 pointing axis of the vessel coordinate system. This is the convention usually used by inertial systems such as the POS/MV (the Tate-Bryant convention).

Motion delay (msec): 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.

Active sensors

Only one positioning system, one motion sensor and one heading sensor can be active at any time.

The selection of which system/sensor to be active is performed by selecting which input port the relevant equipment is connected to. The available choices for each system/sensor is dependant on the settings made in the *Input Setup* configuration of the PU (Processing Unit).

→ *Refer to page 161 for more information about the Input Setup.*

There is a drop-down combo box for each of the system/sensor types.

Note *When the Input Setup configuration is changed the Active Sensor setting must be checked.*

Parameters - Active Sensors

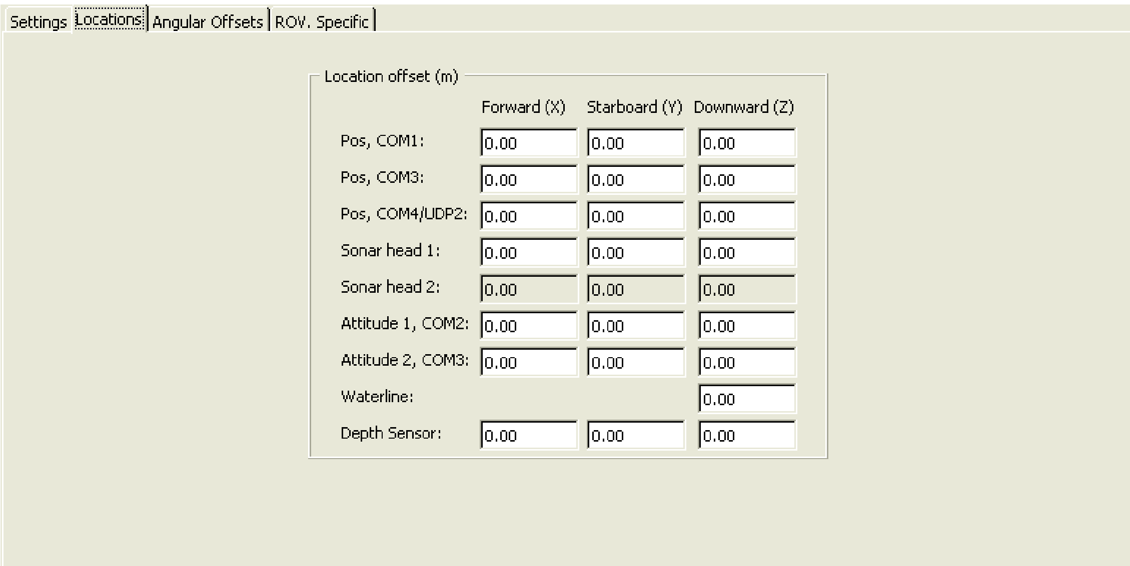
Position: Select active positioning system.

Motion: Select active motion sensor.

Heading: Select active heading sensor.

Locations

Locations (of sensors) is located under the *Sensor Setup* tab on the *Installation parameters* display view.



Note *The screen layout above is an example only. Some echo sounder use "Transducer" instead of "Sonar head".*

In order to make accurate measurements, the system 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.

Parameters

Positioning systems (Pos): These settings are used to define the physical location of the selected positioning system's position point, i.e. the point on the ship where the position is valid.

Note *This point may be different from the antenna's position, depending on the positioning system.*

The downward positions are required if RTK is to be used to position the bottom with respect to a datum vertically.

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.

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.*

Transducer array(s) / Sonar Head (s): Use these settings to define the physical location of the centre of the face of the respective transducer arrays or sonar heads.

Motion sensor (Attitude): The Motion Sensor parameters allow you to define where the sensor is physically located, or where its data are valid in case the motion sensor is programmed to calculate heave at a different location than where it is actually mounted.

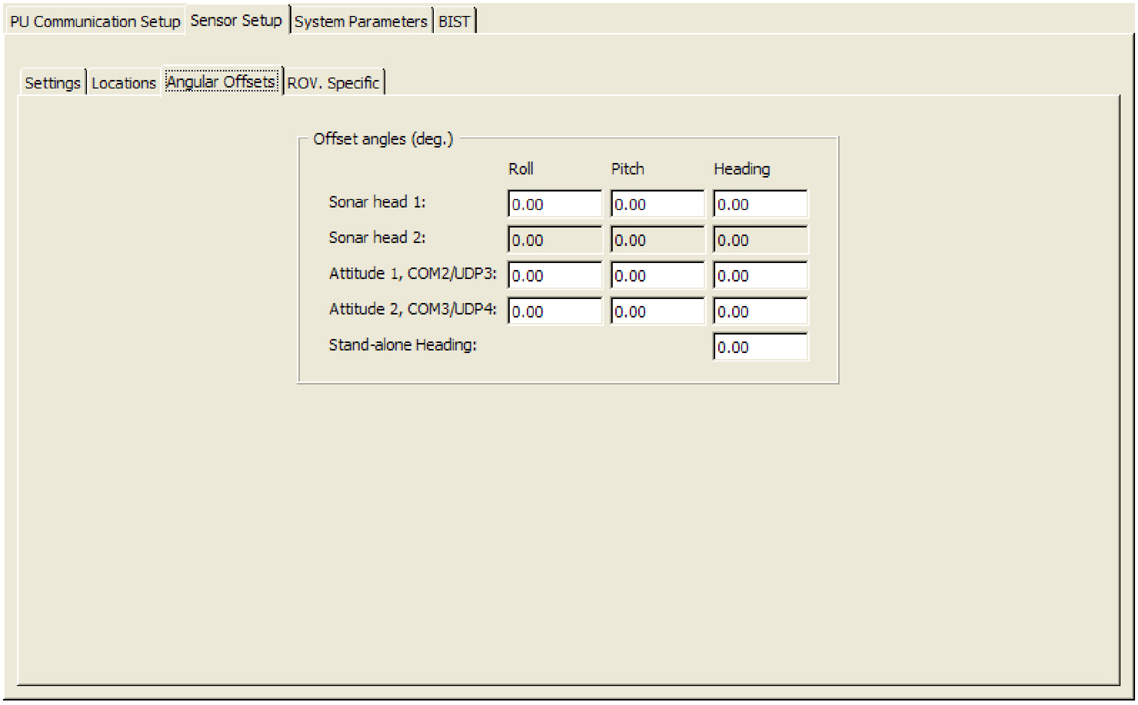
Waterline: Enter the vessel's waterline (in normal trim) related to the vessel's reference point. The value should be an average of two measurements; one on each side of the vessel. The measurement must be made at the same alongship location as the physical location of the motion sensor.

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

Depth sensor: Position of depth sensor.

Angular Offsets (not EM 710)

Angular Offsets (of sensors) is located under the *Sensor Setup* tab on the *Installation parameters* display view.



Note

The screen layout above is an example only. Some echo sounders use "Transducer" instead of "Sonar head".

In order to make accurate measurements, the system must know the physical angles between the transducers, sensors and the vessel coordinate system.

Parameters

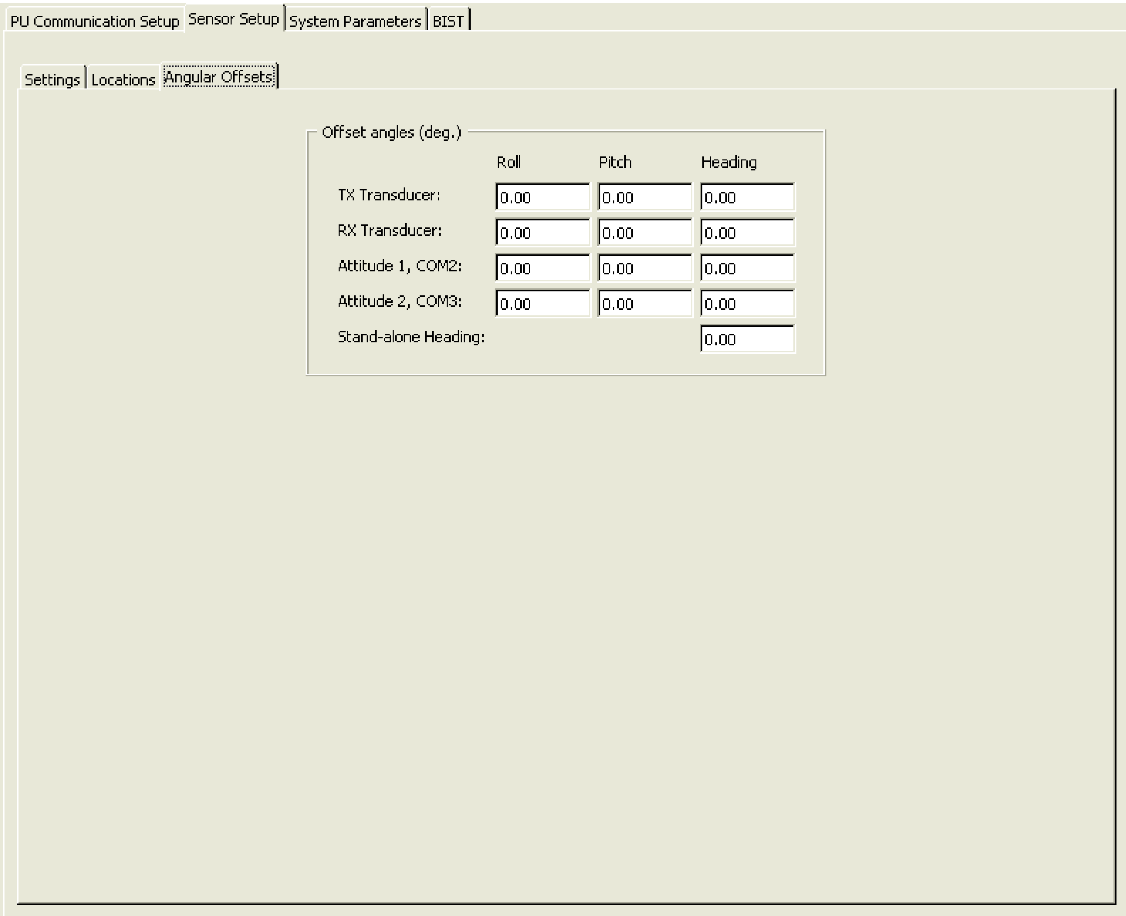
Transducer array(s) / Sonar Head(s): Use these settings to enter the installation angles. These settings are normally entered once and for all, but if the vessel undergoes repair or maintenance etc. and the array is moved, the installation measurements must be repeated and new angles defined.

Motion sensors (Attitude): Use these settings to set a correction offset for the corresponding values received from the motion sensors. The settings are added to the values received from the sensors.

Stand-alone Heading: Use this setting to set a correction offset from the values received from the heading sensor. It is only allowed to enter positive values. Example: If the offset is -0.15, you must enter 359.85.

Angular Offsets (for EM 710)

Angular Offsets (of sensors) is located under the *Sensor Setup* tab on the *Installation parameters* display view.



In order to make accurate measurements, the system must know the physical angles between the transducers, sensors and the vessel coordinate system.

Parameters

Transducer array(s) / Sonar Head(s): Use these settings to enter the installation angles. These settings are normally entered once and for all, but if the vessel undergoes repair or maintenance etc. and the array is moved, the installation measurements must be repeated and new angles defined.

If mounting is in accordance with the default orientation, the installation heading is the measured value coming from the alignment.

If the TX array(s) is mounted with cables pointing to port side, 180 degrees must be added to the TX measured heading. In this case the sign of the TX array installation roll and pitch angles must also be inverted.

If the RX array(s) is mounted with the cables pointing towards the bow, 180 degrees must be added to the RX measured heading. In this case the sign of the RX array installation roll and pitch angles must also be inverted.

The exact roll, pitch and heading values for both RX and TX are measured during the alignment procedure.

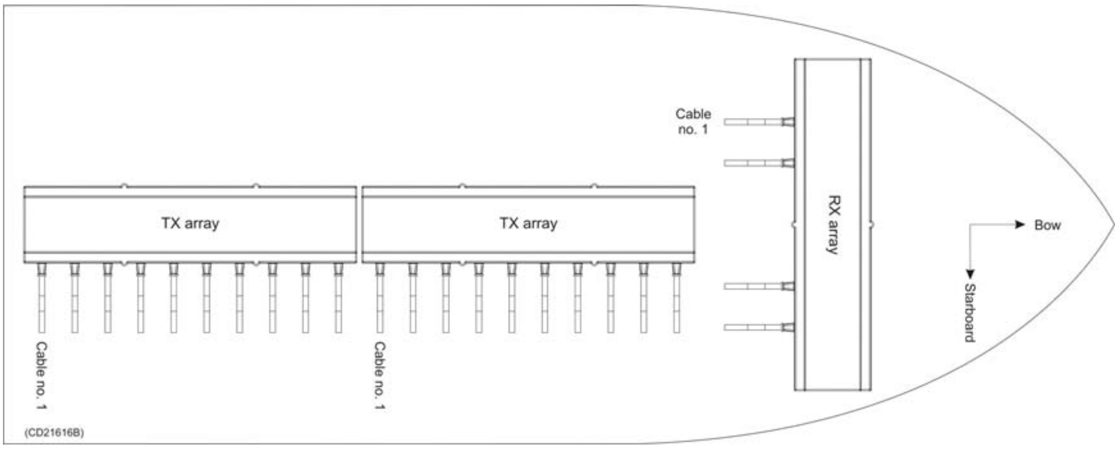


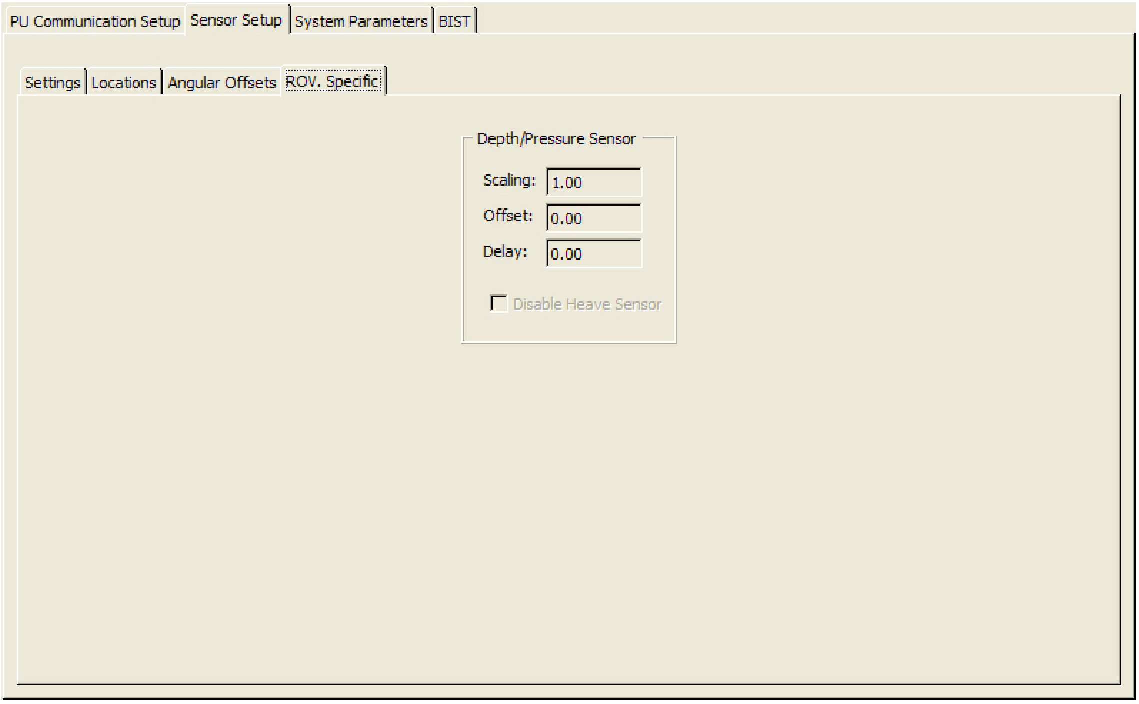
Figure 11 Orientation of TX and RX transducers default installation

Motion sensors (Attitude): Use these settings to set a correction offset for the corresponding values received from the motion sensors. The settings are added to the values received from the sensors.

Stand-alone Heading: Use this setting to set a correction offset from the values received from the heading sensor. It is only allowed to enter positive values. Example: If the offset is -0.15, you must enter 359.85.

ROV Specific (EM 2000, EM 3000 and EM 3002 only)

ROV Specific is located under the *Sensor Setup* tab on the *Installation parameters* display view.



Parameters

The parameters are available only if ROV depth is selected in the Input Setup frame (page 161). Otherwise they are disabled. Aslo note that when deselecting the ROVdepth selection in the Input Setup frame these parameters vil be reset to default an disabled.

Scaling: A depth sensor may not measure the depth of an underwater vehicle from the surface, but for example the absolute pressure. The scaling factor is used to convert actual measurement values to meters. It is also applied to the depth sensor offset.

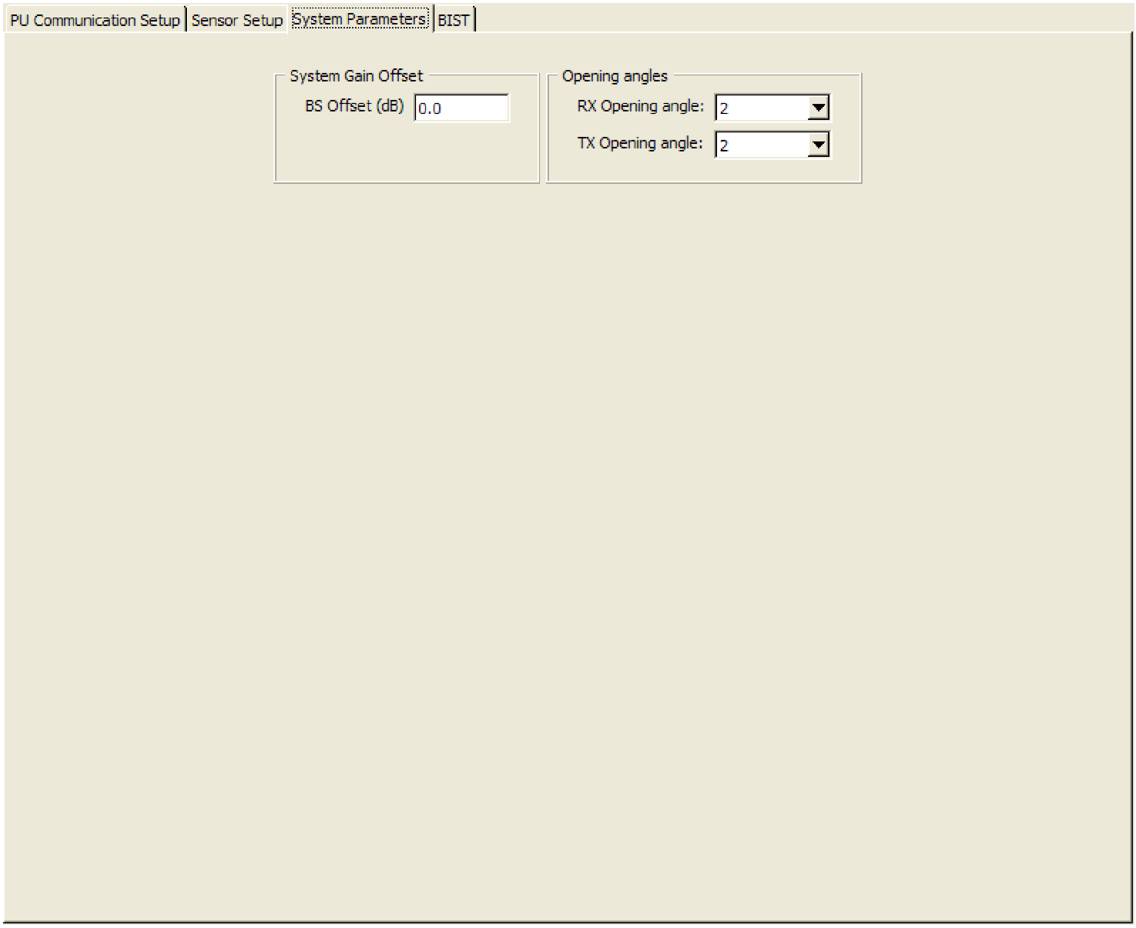
Offset: If the depth sensor measures pressure, the atmospheric pressure at sea level must be subtracted before converting the measurements to meters below the surface.

Delay: This parameter is used to define the expected time delay of the sensor data.

Disable Heave Sensor: This should always be unchecked unless the effect of heave is taken into account by another sensor. An example would be the depth of an ROV measured by a pressure sensor whose output also includes any heave effect unless the depth is large.

System parameters (for EM 120, EM 300 and EM 710)

System parameters is located on the *Installation* display view.



Parameters

BS (Backscatter) Offset (dB): The acoustic backscatter strength of the bottom is calibrated in our factory, and have a typical accuracy of ±1 dB.

However, this value may be offset from zero to serve as a correction factor, for example if there is a change with the age of the system, or if data from two different systems are merged and there is a systematic offset between the two systems.

RX Opening angle: Specify the installed Rx array. Choose between:

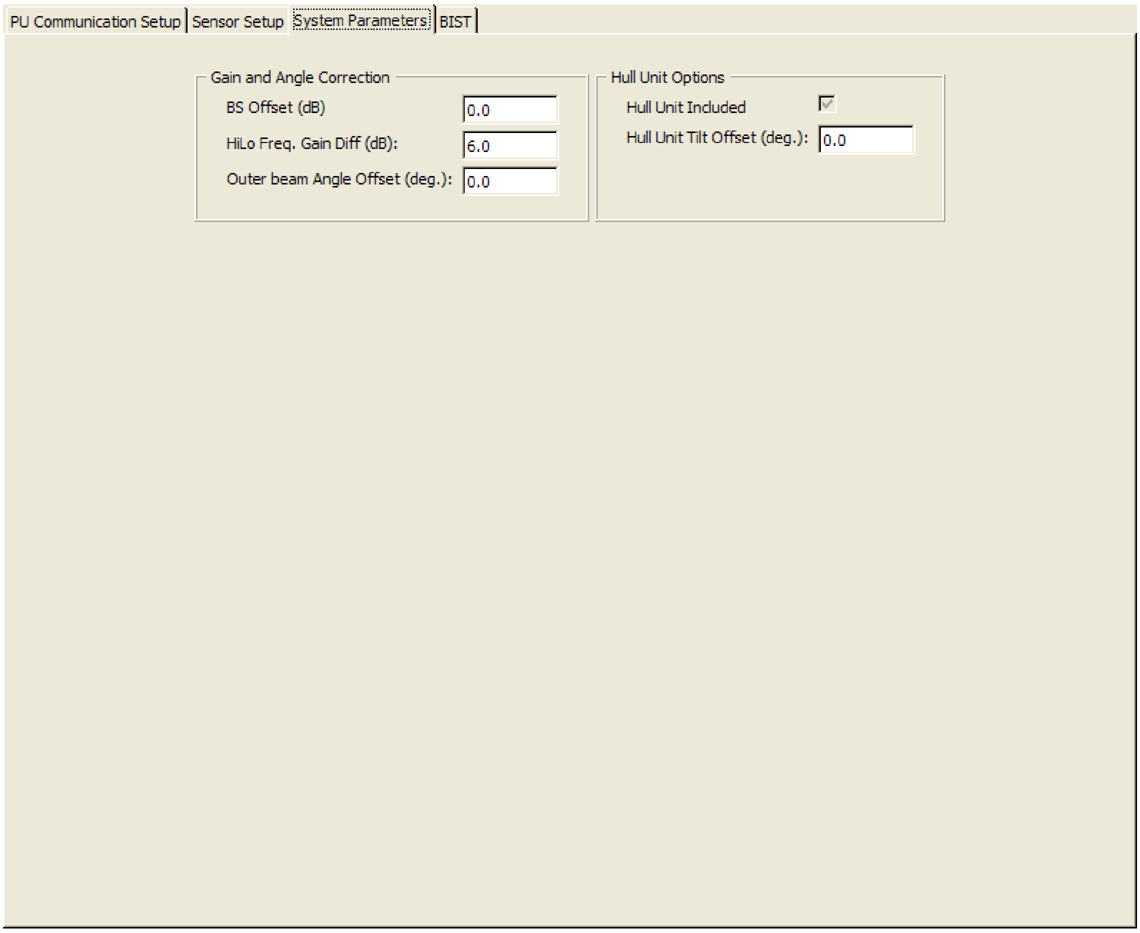
- 1, 2 or 4 degrees for EM 120 and EM 300
- 1 or 2 degrees for EM 710

TX Opening angle: Specify the installed Tx array. Choose between:

- 1 or 2 degrees for EM 120 and EM 300
- 0.5, 1 or 2 degrees for EM 710

System parameters (for EM 1002)

System parameters is located on the *Installation* display view.



Parameters - Gain and Angle Correction

BS (Backscatter) Offset (dB): The acoustic backscatter strength of the bottom is calibrated in our factory, and have a typical accuracy of ±1 dB.

However, this value may be offset from zero to serve as a correction factor, for example if there is a change with the age of the system, or if data from two different systems shall be merged and the data from them show a systematic offset.

HiLo Freq. Gain Diff (dB) (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 Offsets (deg): 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 beampointing angle error in degrees by comparing the depths measured in +75° beam pointing angle with that measured with the vertical beam. This is most easily done by running two lines perpendicularly and using the roll calibration application to find the angle offset.

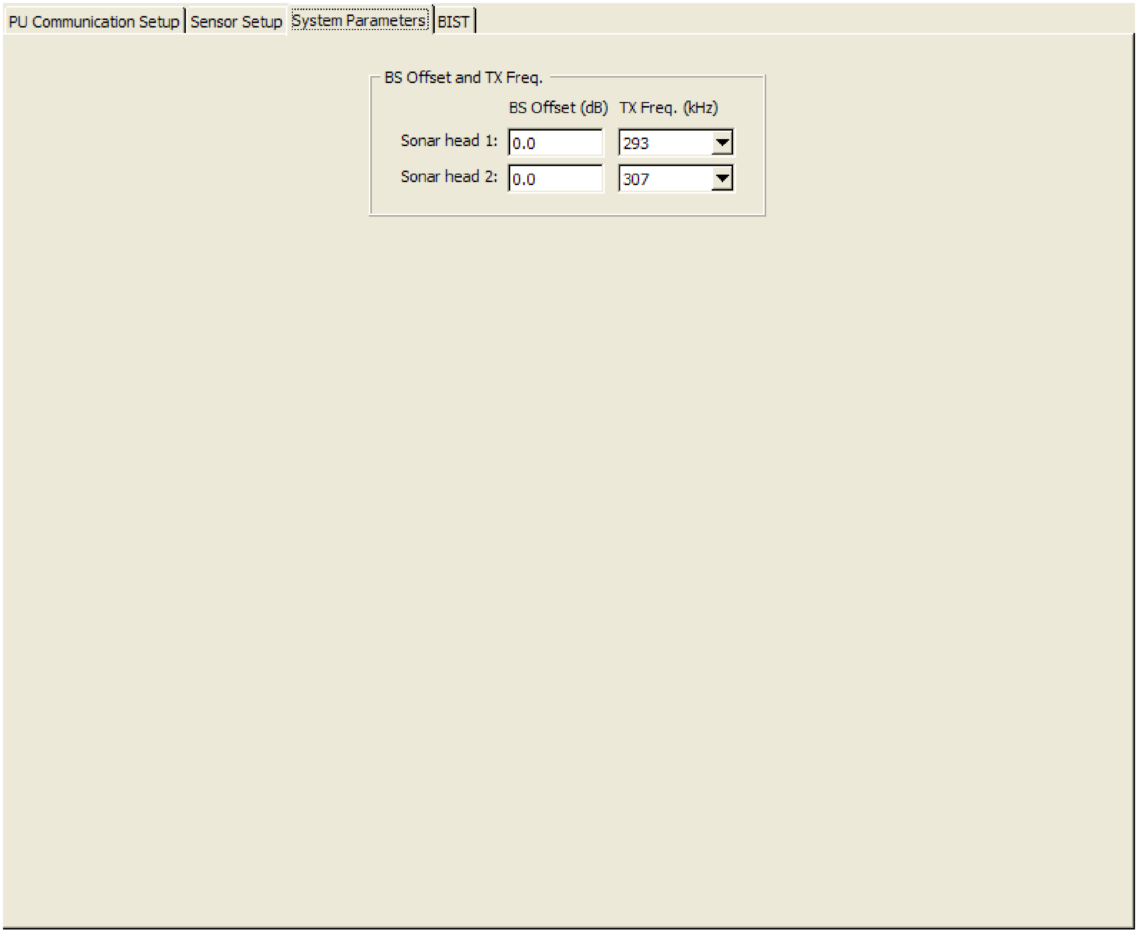
Parameters - Hull Unit Options

Hull Unit included: The EM 1002 may be supplied with a Hull Unit with mechanical pitch compensation. This information is obtained from the Transceiver Unit and the parameter is not changeable.

Hull Unit Tilt Offsets (deg): This setting is used to compensate for a fixed tilt setting of the Hull Unit. It is only enabled for update if a Hull Unit is present.

System parameters (for EM 3000 and EM 3002)

System parameters is located on the *Installation* display view.



Parameters

BS (Backscatter) Offset (dB): The acoustic backscatter strength of the bottom is calibrated in our factory, and have a typical accuracy of ±1 dB.

However, this value may be offset from zero to serve as a correction factor, for example if there is a change with the age of the system, or if data from two different systems shall be merged and the data from them show a systematic offset.

TX Freq. (kHz): When you use two sonar heads, choose operational frequencies to avoid interference.

300 kHz should normally be used when only one EM 3000/EM 3002 Sonar Head is connected to the system. On a dual system, the frequency on each sonar head is selectable, for example 293 kHz for Sonar Head 1 (main) and 307 kHz for Sonar Head 2 (secondary).

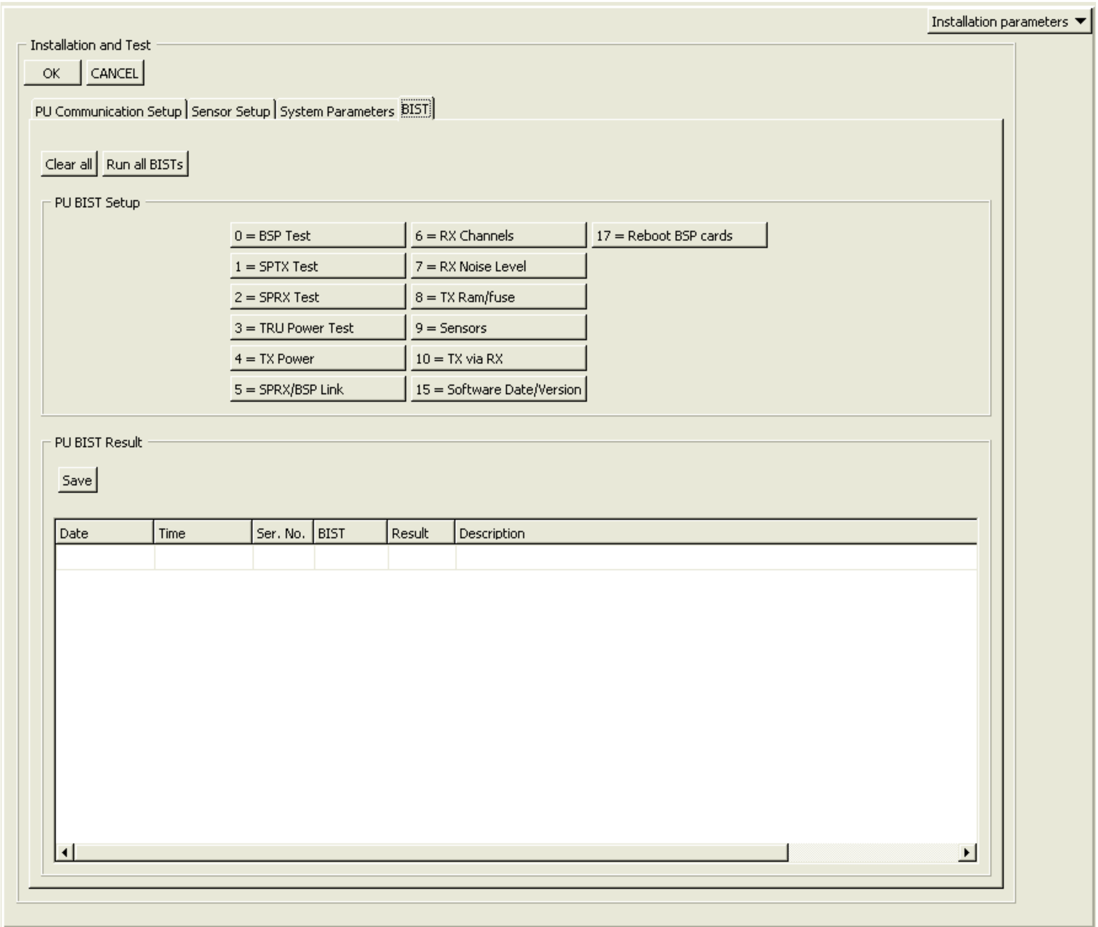
Note *The entries for Sonar Head 2 will be disabled when only one head is detected (available) at start-up.*

BIST (for EM 120 and EM 300)

BIST is located on the *Installation parameters* display view.

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

The results are presented in the “PU BIST Result” area.



Clear all: Press to clear results of previous BIST tests.

Run all BISTs: Press to run all available BIST tests.

Parameters - PU BIST Setup

Select Head / Transceiver Unit: Select the sonar head or Transceiver Unit you want to run test(s) for.

BIST test: Select the test(s) you want to run from the drop-down list..

Note — *The test is executed when selected.*

Refer to the echo sounder’s maintenance manual for detailed BIST descriptions.

BIST test buttons: Alternatively singular BIST tests can be run by pressing the corresponding test buttons. The button turns green if the test was successfully accomplished, otherwise the button turns red.

The following tests are available:

0 BSP Test

1 SPTX Test

2 SPRX Test

3 TRU Power Test

4 TX Power

5 SPRX/BSP Link

6 RX Channels

7 RX Noise Level

8 TX Ram/fuse

9 Sensors

10 TX via RX

15 Software Date/Version

17 Reboot BSP Cards

Parameters - PU BIST Result

Save: The results of the BIST tests may be saved to file. Press Save to set file name and storage location.

PU BIST Result area: The results are presented in this area with the following information for each test:

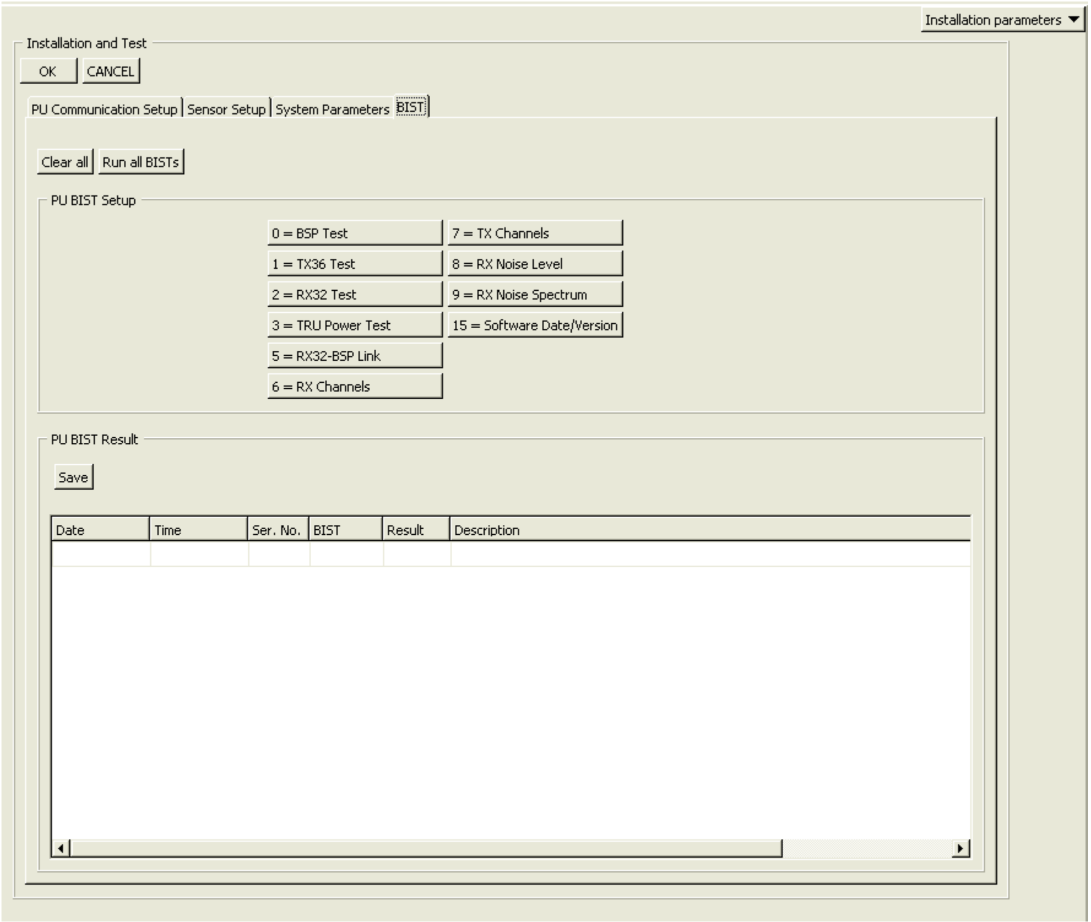
- Date: Date when the test was run.
- Time: Time when the test was run.
- Ser. No: Serial number of the transducer.
- BIST: The number of the BIST test that has been run.
- Result: The overall result of the test.
- Description: A description of the test returned from the PU (Processing Unit).

BIST (for EM 710)

BIST is located on the *Installation parameters* display view.

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

The results are presented in the "PU BIST Result" area.



Clear all: Press to clear results of previous BIST tests.

Run all BISTs: Press to run all available BIST tests.

Parameters - PU BIST Setup

Select Head / Transceiver Unit: Select the sonar head or Transceiver Unit you want to run test(s) for.

BIST test: Select the test(s) you want to run from the drop-down list..

Note *The test is executed when selected.*

Refer to the echo sounder’s maintenance manual for detailed BIST descriptions.

BIST test buttons: Alternatively singular BIST tests can be run by pressing the corresponding test buttons. The button turns green if the test was successfully accomplished, otherwise the button turns red.

The following tests are available:

0	BSP Test
1	TX 36 Test
2	RX 32 Test
3	TRU Power Test
5	RX 32-BSP Link
6	RX Channels
7	TX Channels
8	RX Noise Level
9	RX Noise Spectrum
15	Software Date/Version

Parameters - PU BIST Result

Save: The results of the BIST tests may be saved to file. Press Save to set file name and storage location.

PU BIST Result area: The results are presented in this area with the following information for each test:

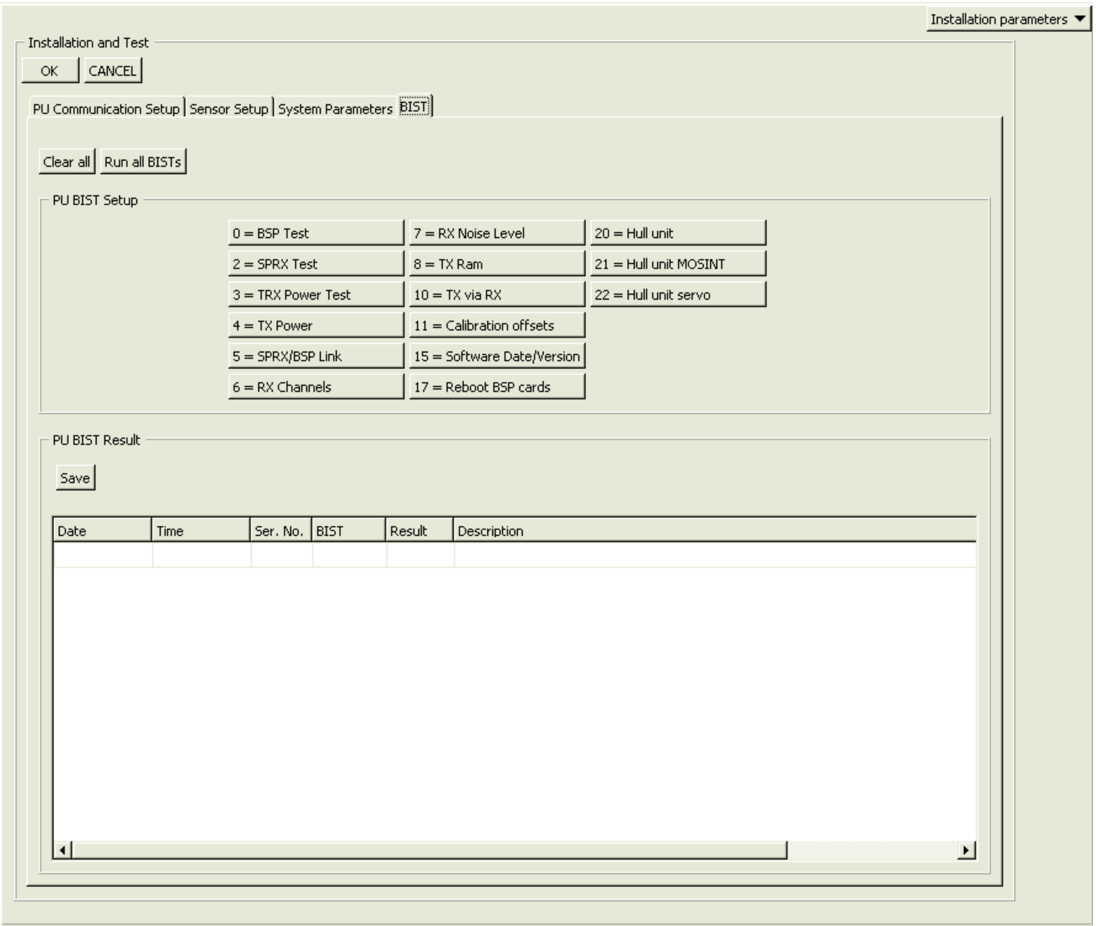
- Date: Date when the test was run.
- Time: Time when the test was run.
- Ser. No: Serial number of the transducer.
- BIST: The number of the BIST test that has been run.
- Result: The overall result of the test.
- Description: A description of the test returned from the PU (Processing Unit).

BIST (for EM 1002)

BIST is located on the *Installation parameters* display view.

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

The results are presented in the "PU BIST Result" area.



Clear all: Press to clear results of previous BIST tests.

Run all BISTs: Press to run all available BIST tests.

Parameters - PU BIST Setup

Select Head / Transceiver Unit: Select the sonar head or Transceiver Unit you want to run test(s) for.

BIST test: Select the test(s) you want to run from the drop-down list..

Note — *The test is executed when selected.*

Refer to the echo sounder’s maintenance manual for detailed BIST descriptions.

BIST test buttons: Alternatively singular BIST tests can be run by pressing the corresponding test buttons. The button turns green if the test was successfully accomplished, otherwise the button turns red.

The following tests are available:

0	BSP Test
2	SPRX Test
3	TRX Power Test
4	TX Power
5	SPRX/BSP Link
6	RX Channels
7	RX Noise Level
8	TX Ram
10	TX via RX
11	Calibration offsets
15	Software Date/Version
17	Reboot BSP Cards
20	Hull Unit
21	Hull Unit MOSINT
22	Hull Unit servo

Parameters - PU BIST Result

Save: The results of the BIST tests may be saved to file. Press Save to set file name and storage location.

PU BIST Result area: The results are presented in this area with the following information for each test:

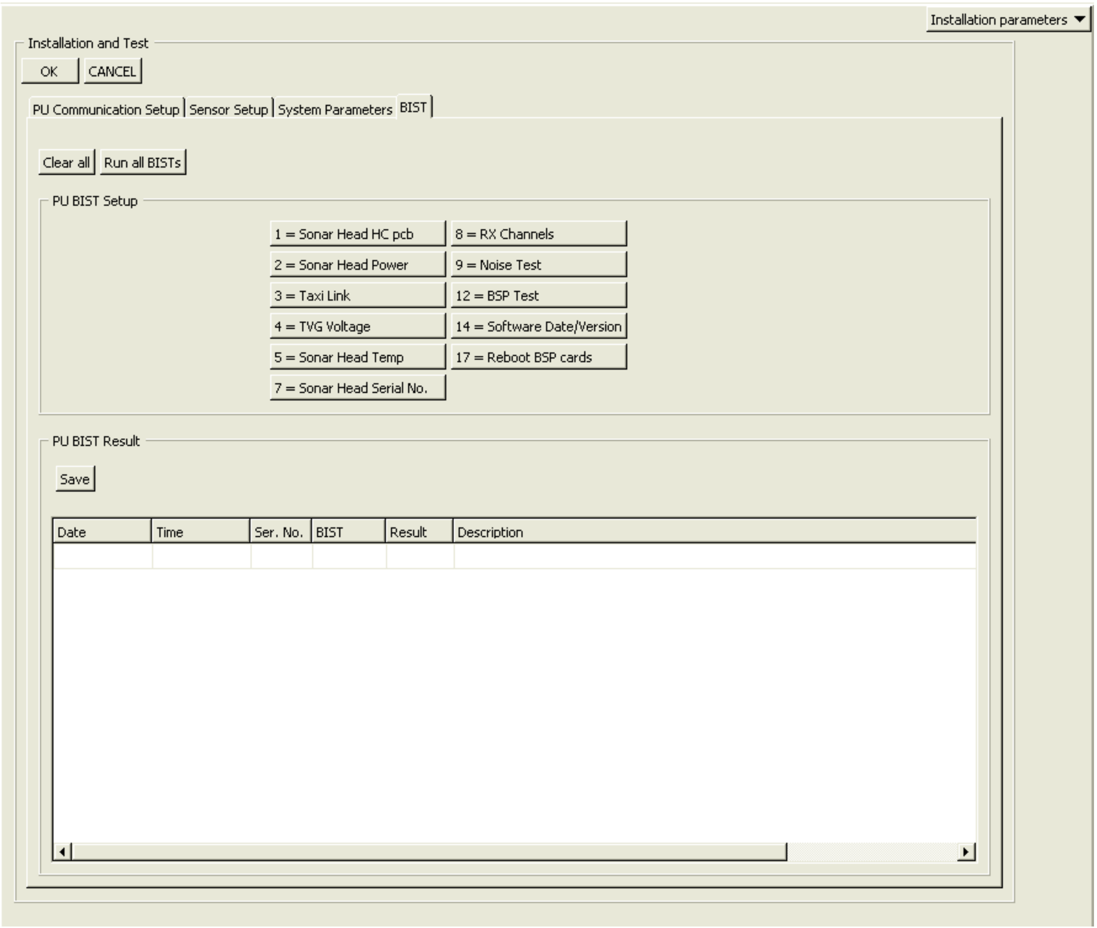
- Date: Date when the test was run.
- Time: Time when the test was run.
- Ser. No: Serial number of the transducer.
- BIST: The number of the BIST test that has been run.
- Result: The overall result of the test.
- Description: A description of the test returned from the PU (Processing Unit).

BIST (for EM 2000)

BIST is located on the *Installation parameters* display view.

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

The results are presented in the "PU BIST Result" area.



Clear all: Press to clear results of previous BIST tests.

Run all BISTs: Press to run all available BIST tests.

Parameters - PU BIST Setup

BIST test: Select the test(s) you want to run from the drop-down list..

Note

The test is executed when selected.

Refer to the echo sounder's maintenance manual for detailed BIST descriptions.

BIST test buttons: Alternatively singular BIST tests can be run by pressing the corresponding test buttons. The button turns green if the test was successfully accomplished, otherwise the button turns red.

The following tests are available:

1 Sonar Head HCT PCB

2 Sonar Head Power

3 Taxi Link

4 TVG Voltage

5 Sonar Head Temp

6 TX Channels

7 Sonar Head Serial No.

8 RX Channels

9 Noise Test

12 BSP Test

14 Software Date/Version

17 Reboot BSP Cards

Parameters - PU BIST Result

Save: The results of the BIST tests may be saved to file. Press Save to set file name and storage location.

PU BIST Result area: The results are presented in this area with the following information for each test:

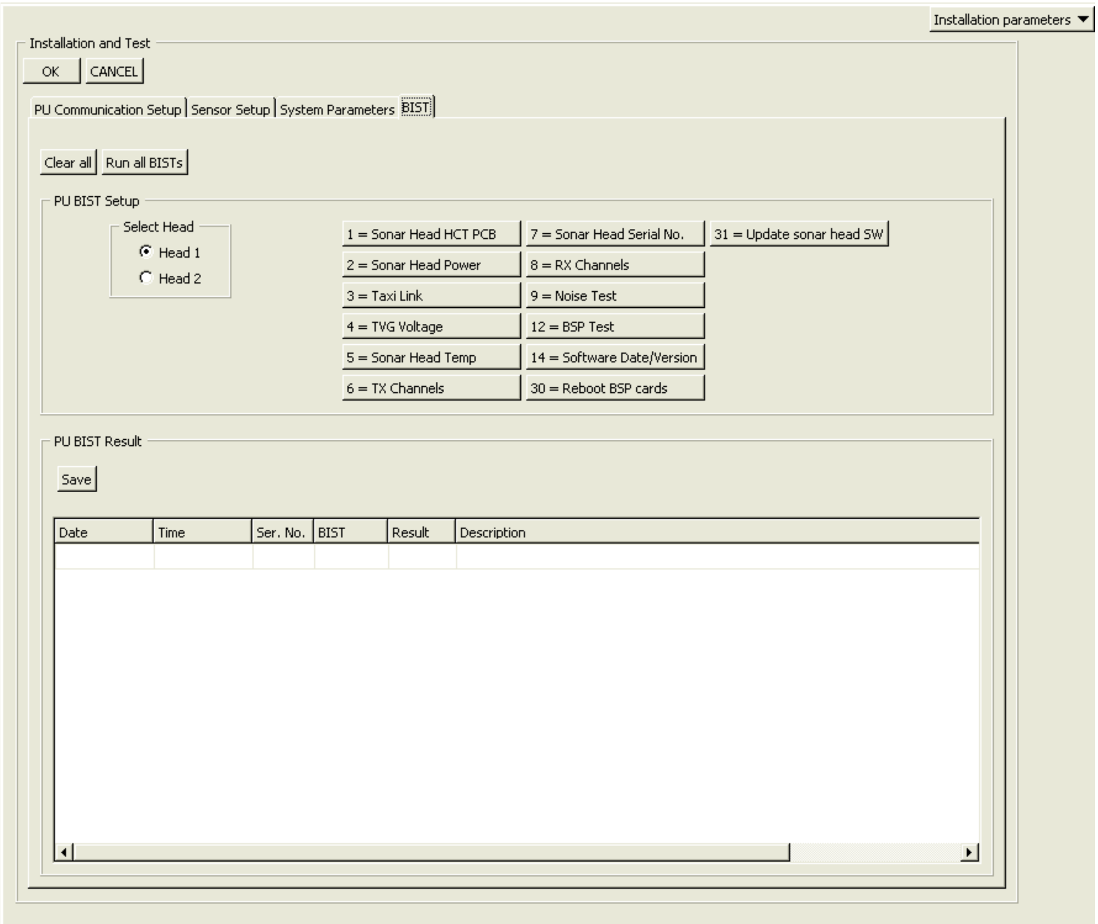
- Date: Date when the test was run.
- Time: Time when the test was run.
- Ser. No: Serial number of the head where the test was run. (As indicated, a test may only be executed on one head at a time).
- BIST: The number of the BIST test that has been run.
- Result: The overall result of the test.
- Description: A description of the test returned from the PU (Processing Unit).

BIST (EM 3000 and EM 3002)

BIST is located on the *Installation parameters* display view.

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

The results are presented in the “PU BIST Result” area.



Clear all: Press to clear results of previous BIST tests.

Run all BISTs: Press to run all available BIST tests.

Parameters - PU BIST Setup

Select Head / Transceiver Unit: Select the sonar head you want to run test(s) for.

Note that Head 2 will be unavailable if only one head is available.

BIST test: Select the test(s) you want to run from the drop-down list..

Note *The test is executed when selected.*

Refer to the echo sounder's maintenance manual for detailed BIST descriptions.

BIST test buttons: Alternatively singular BIST tests can be run by pressing the corresponding test buttons. The button turns green if the test was successfully accomplished, otherwise the button turns red.

The following tests are available:

1	Sonar Head HCT PCB
2	Sonar Head Power
3	Taxi Link
4	TVG Voltage
5	Sonar Head Temp
6	TX Channels
7	Sonar Head Serial No.
8	RX Channels
9	Noise Test
12	BSP Test
13	BIF/BSP (EM 3000 only)
14	Software Date/Version
30	Reboot BSP Cards
31	Update Sonar Head SW (EM 3002 only)

Parameters - PU BIST Result

Save: The results of the BIST tests may be saved to file. Press Save to set file name and storage location.

PU BIST Result area: The results are presented in this area with the following information for each test:

- Date: Date when the test was run.
- Time: Time when the test was run.
- Ser. No: Serial number of the head where the test was run. (As indicated, a test may only be executed on one head at a time).
- BIST: The number of the BIST test that has been run.

- Result: The overall result of the test.
- Description: A description of the test returned from the PU (Processing Unit).

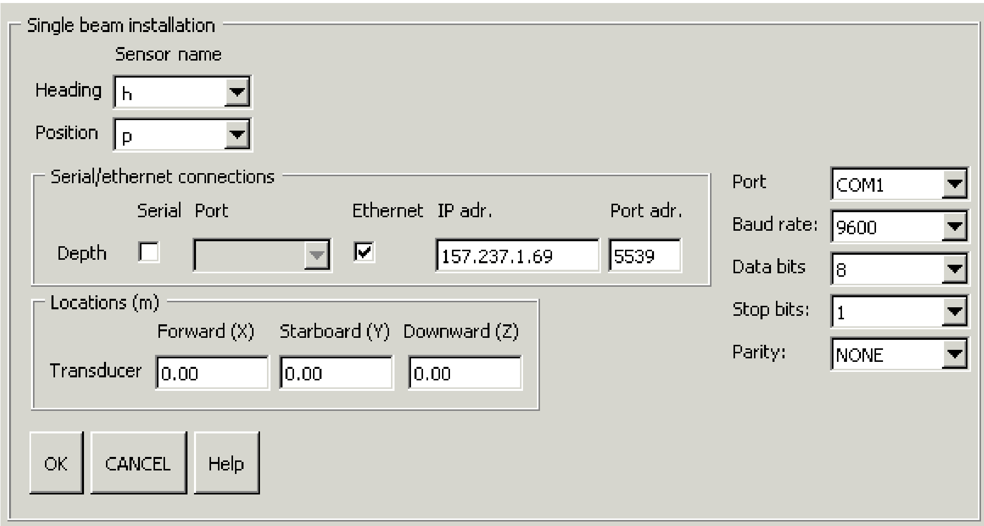
Single beam installation

The **Single beam installation** window is accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

This parameter sheet is only available for single beam echo sounders. If you have not already chosen a single beam system, select one from the **current system** combo box.

→ *Refer to page 345 for more information about the “system combo box”.*

The single beam echosounder equipment can be read with either a serial line or an Ethernet connection.



Heading and position

Heading and Position: You can choose between the sensors already defined in the **External sensors** under the **Tools** drop-down menu.

Parameters - Serial/Ethernet connections

Depth: First you have to decide whether to use a serial port or Ethernet.

- If you choose a serial port, mark the check box under “Serial” and select the port you want to use by selecting them from the combo box under “Port”. The communication parameter is set with the respectively combo box.
- If you want to use an Ethernet connection, mark the check box under “Ethernet”. The IP address and the port to send data to is displayed in the text field to the right.

Parameters - Serial line

The following parameters are for serial line(s) only:

Port: Choose the port you want to use.

Baud rate: Choose the desired baud rate.

Data bits: 7 or 8.

Stop bits: 1 or 2.

Parity: NONE, ODD or EVEN.

Parameters - Locations

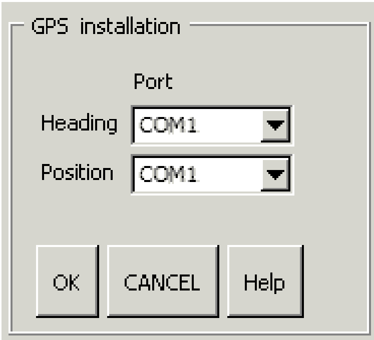
Transducer: Use the text fields to enter the transducer’s position.

GPS installation

The **GPS installation** window is accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

This parameter sheet is only available for GPS equipment. If you have not already chosen a GPS system, select one from the **current system** combo box.

→ *Refer to page 345 for more information about the "system combo box".*



Parameters

Heading and Position: You can choose between the ports already defined in the **External sensors** under the **Tools** drop-down menu.

→ *External sensors, page 310.*

4.20 Runtime parameters

The **Runtime parameters** window is accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

The window will differ, depending on what kind of echo sounder is currently chosen.

Equipment with a Processing Unit (multibeam echo sounders) contains the following tab-menus:

→ *Sounder Main, page 201.*

→ *Sound Speed, page 225.*

→ *Filter and Gains, page 232.*

→ *Data Cleaning, page 261.*

→ *Simulator, page 273.*

Single beam echo sounders contains the following window:

→ *SB Runtime, page 278.*

In addition to the fall Runtime parameters window described above a scaled down window with only a set of essential parameters are also defined. This reduced runtime parameters window will occupy very little space while allowing the operator easy access to basic runtime settings:

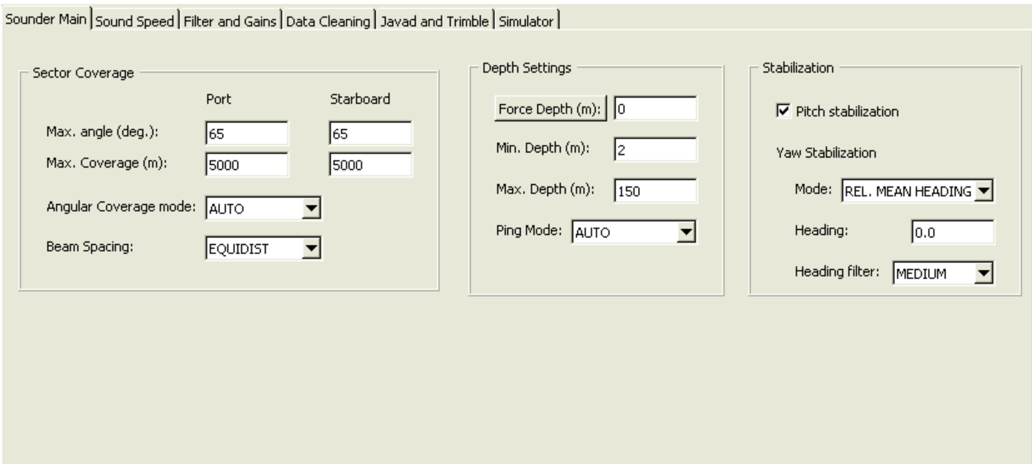
→ *Runtime parameters Mini, page 280.*

Sounder Main (for EM 120 and EM 300)

Sounder Main is located on the *Runtime parameters* display view.

These parameters allow you to:

- Define the pingmode, 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
- Select stabilisation (pitch, yaw)



Parameters - Sector Coverage

Max angle (deg), port / starboard: 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 (m), port / starboard: These parameters allow 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 mode to Auto.

Angular Coverage mode: Choose between Manual and Auto.

- **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 swathwidth limit. The most limiting of the two criteria will be used. If the system is not able to fulfil the above, it will reduce the swath width further and as a consequence nearly all the beams will be valid. You may observe this in the *Numerical display,* as the numbers of beams accepted should almost equal to the number of beams available.

→ *Numerical display, page 89.*

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:** The in-between spacing is intended for surveys with high priority on seabed image data. Compared to equidistant spacing, this mode gives higher density of soundings in the central part (near equiangle) of the swath, and maintains an acceptable density in the outmost parts (near equidistant).

Parameters - Depth Settings

Force depth (m): If there is a lot of acoustic interference or if the water is very aerated, the echo sounder may not find the correct depths. In order to help, you can then enter the approximate 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.

Min. / Max. depth (m): These parameters 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. In some cases 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 and compared with the settings 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.

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

- Auto
- Very shallow
- Shallow
- Medium
- Deep
- Very deep
- Extra deep (EM 300 only)

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.

If you wish to select mode manually, note the following specifications and recommended depth ranges:

EM 120					
	Very shallow	Shallow	Medium	Deep	Very deep
Pulse length (ms)	2	2	5	15	15
Minimum beamwidth	4 deg	2 deg	1 deg	1 deg	1 deg
Minimum depth (m)	10	50	300	800	6000
Maximum depth (m)	100	600	1400	9000	12000

EM 300						
	Very shallow	Shallow	Medium	Deep	Very deep	Extra Deep
Pulse length (ms)	0.7	0.7	2	5	5	15
Minimum beam-width	4 deg	2 deg	1 deg	1 deg	1 deg	1 deg
Minimum depth (m)	5	30	100	500	1000	3000
Maximum depth (m)	50	300	1000	3000	6000	6000

Note

Extra deep is limited to maximum +/- 18 degrees coverage sector!

Parameters - Stabilization

Pitch stabilization: At open sea, the swath area on the bottom will move back and forth following the vessel pitch. This would lead to loss of sampling regularity, and thus also limit the vessel speed at which 100% bottom coverage is possible. To counter this effect the system's transmit angle may be set to vary with the pitch in order to stabilize the direction of the emitted vertical transmit fan. This option should thus normally be ON.

The maximum electronic tilt is limited to ±10 degrees. The ships attitude and the applied transmitter tilt is always used to calculate the x, y and z parameters for each bottom detection. This assures that the x, y and z values are correctly calculated, even if more tilting was needed to do a full pitch stabilization.

Yaw stabilization: The yaw stabilization creates even alongship sounding spacings when the vessel's course is variable. The parameter is implemented with variable tilt angles on the individual transmitter beams. The echo sounder operates most efficiently when the transmission angle is as close to 0 degrees as possible relative to the vessel's heading.

The maximum electronic tilt is limited to ±10 degrees. The ships attitude and the applied transmitter tilt is always used to calculate the x, y and z parameters for each bottom detection. This assures that the x, y and z values are correctly calculated, even if more tilting was needed to do a full yaw stabilization.

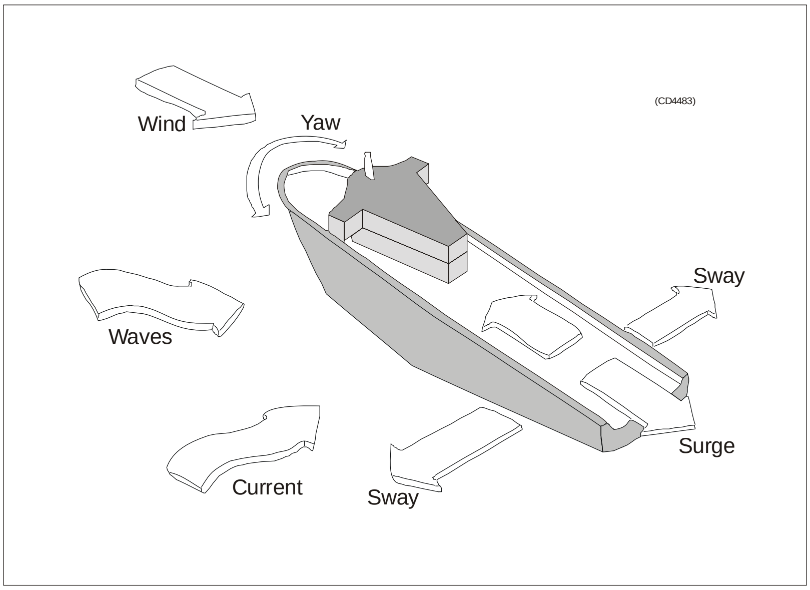


Figure 12 The forces acting on the vessel during the survey

Mode: Three stabilization modes are available.

- **Off:** No heading stabilizationn takes place. The transmitter sector follows the current heading of the vessel. Unless the vessel's heading is 100% straight you may experience "blind zones" on the survey coverage when you operate in deeper waters (exceeding 300 to 500 meters).
- **Manual:** The transmit fan is placed perpendicular to a manually selected course. This course is selected with the Yaw Compensation parameter described below. The setting should only be used on long and straight survey lines, but it is also useful if you need to compensate for a crab angle caused by current or wind.
- **Rel. mean heading:** This setting places the transmitter sector perpendicular to a filtered course corresponding to the the vessel's current mean heading. The course input is then taken from the course gyro, and filtered with the Heading Filter parameter described below.

Heading: Allows you to enter the vessel's heading manually.

Heading filter: This parameter specifies the level of filtering of the heading.

Applying this filter will even out minor course adjustments due to wind, sea or current. The filter strength required depends upon the vessel properties, and how well the vessel is steered.

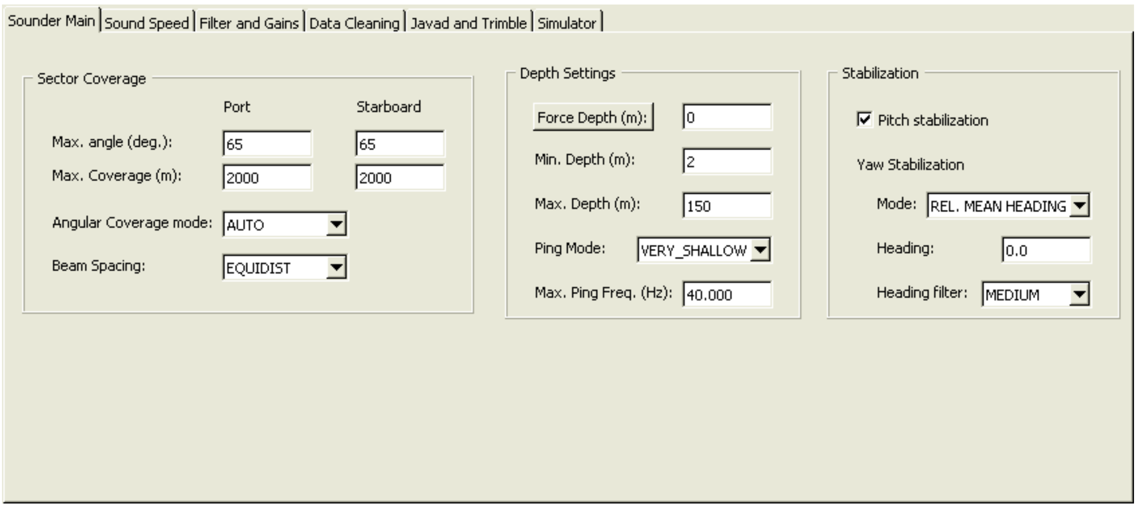
The heading filter controls how fast the filtered heading used during logging will follow the actual heading of the vessel.

Sounder Main (for EM 710)

Sounder Main is located on the *Runtime parameters* display view.

These parameters allow you to:

- Define the pingmode, 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
- Select stabilisation (pitch, yaw)



Parameters - Sector Coverage

Max angle (deg), port / starboard: 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 (m), port / starboard: These parameters allow 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 mode to Auto.

Angular Coverage mode: Choose between Manual and Auto.

- **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 swathwidth limit. The most limiting of the two criteria will be used. If the system is not able to fulfil the above, it will reduce the swath width further and as a consequence nearly all the beams will be valid. You may observe this in the *Numerical display,* as the numbers of beams accepted should almost equal to the number of beams available.

→ *Numerical display, page 89.*

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.
- **High density:** In this mode the number of soundings are increased. This is achieved by directing some of the beams closer to the centre of the survey line and performing several soundings per beam on the edge of the swath. This results in an equidistant distribution of the soundings.

Parameters - Depth Settings

Force depth (m): If there is a lot of acoustic interference or if the water is very aerated, the echo sounder may not find the correct depths. In order to help, you can then enter the approximate 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.

Min. / Max. depth (m): These parameters allow 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. In some cases 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 and compared with the settings 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.

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

- Auto
- Very shallow
- Shallow
- Medium
- Deep
- Very deep
- Extra 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.

Note *The actual ping modes available are dependent on the licensing of this feature.*

Max. Ping Freq. (Hz): This parameter defines the maximum ping frequency of the multibeam echo sounder. You can select any value in the range from 0.1 to 50 Hz.

Parameters - Stabilization

Pitch stabilization: At open sea, the swath area on the bottom will move back and forth following the vessel pitch. This would lead to loss of sampling regularity, and thus also limit the vessel speed at which 100% bottom coverage is possible. To counter this effect the system's transmit angle may be set to vary with the pitch in order to stabilize the direction of the emitted vertical transmit fan. This option should thus normally be ON.

The maximum electronic tilt is limited to ±10 degrees. The ships attitude and the applied transmitter tilt is always used to calculate the x, y and z parameters for each bottom detection. This assures that the x, y and z values are correctly calculated, even if more tilting was needed to do a full pitch stabilization.

Yaw stabilization: The yaw stabilization creates even alongship sounding spacings when the vessel's course is variable. The parameter is implemented with variable tilt angles on the individual transmitter beams. The echo sounder operates most efficiently when the transmission angle is as close to 0 degrees as possible relative to the vessel's heading.

The maximum electronic tilt is limited to ±10 degrees. The ships attitude and the applied transmitter tilt is always used to calculate the x, y and z parameters for each bottom detection. This assures that the x, y and z values are correctly calculated, even if more tilting was needed to do a full yaw stabilization.

Mode: Three stabilization modes are available.

- **Off:** No heading stabilizationn takes place. The transmitter sector follows the current heading of the vessel. Unless the vessel's heading is 100% straight you may experience "blind zones" on the survey coverage when you operate in deeper waters (exceeding 300 to 500 meters).
- **Manual:** The transmit fan is placed perpendicular to a manually selected course. This course is selected with the Yaw Compensation parameter described below. The setting should only be used on long and straight survey lines, but it is also useful if you need to compensate for a crab angle caused by current or wind.
- **Rel. mean heading:** This setting places the transmitter sector perpendicular to a filtered course corresponding to the the vessel's current mean heading. The course input is then taken from the course gyro, and filtered with the Heading Filter parameter described below.

Heading: Allows you to enter the vessel's heading manually.

Heading filter: This parameter specifies the level of filtering of the heading.

Applying this filter will even out minor course adjustments due to wind, sea or current. The filter strength required depends upon the vessel properties, and how well the vessel is steered.

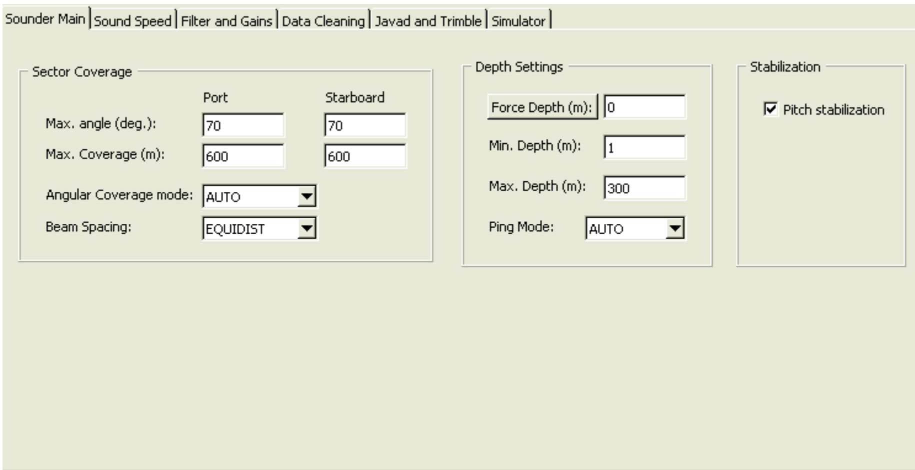
The heading filter controls how fast the filtered heading used during logging will follow the actual heading of the vessel.

Sounder Main (for EM 1002)

Sounder Main is located on the *Runtime parameters* display view.

These parameters allow you to:

- Define the pingmode, 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



Parameters - Sector Coverage

Max angle (deg), port / starboard: 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 (m), port / starboard: These parameters allow 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 mode to Auto.

Angular Coverage mode: Choose between Manual and Auto.

- **Manual:** If Angular Coverage is set tomanual, 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 swathwidth limit. The most limiting of the two criteria will be used. If the system is not able to fulfil the above, it will reduce the swath width further and as a consequence nearly all the beams will be valid. You may observe this in the *Numerical display,* as the numbers of beams accepted should almost equal to the number of beams available.

→ *Numerical display, page 89.*

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 fewon the edge of the swath.
- **In-between:** The in-between spacing is intended for surveys with high priority on seabed image data. Compared to equidistant spacing, this mode gives higher density of soundings in the central part (near equiangle) of the swath, and maintains an acceptable density in the outmost parts (near equidistant).

Parameters - Depth Settings

Force depth (m): If there is a lot of acoustic interference or if the water is very aerated, the echo sounder may not find the correct depths. In order to help, you can then enter the approximate 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.

Min. / Max. depth (m): 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.

Ping Mode: This parameter defines the operational mode of the 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.

Parameters - Stabilization

Pitch stabilization: This setting is only available if a Hull Unit is installed. When pitch stabilization is selected (i.e. ON), the transducer array is mechanically stabilized to compensate for the vessel's pitch movement.

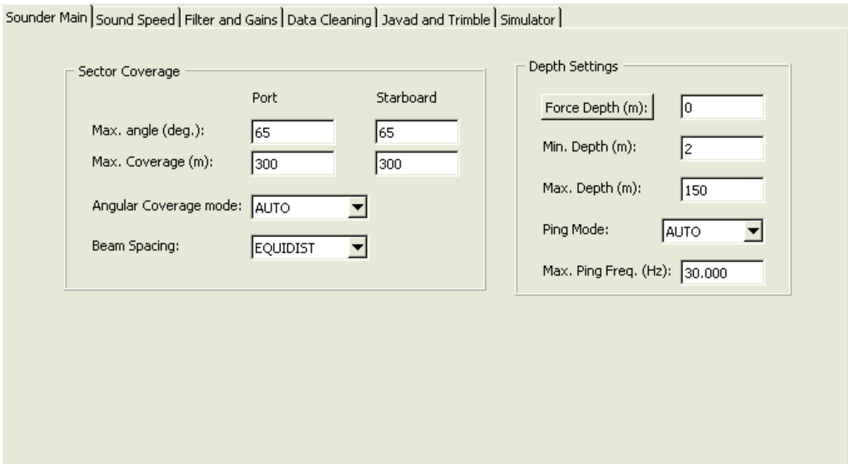
At open sea, the swath area on the bottom will move back and forth following the vessel pitch. This would lead to loss of sampling regularity, and thus also limit the vessel speed at which 100% bottom coverage is possible. To counter this effect the Hull Unit may be set to compensate for the pitch in order to stabilize the direction of the emitted vertical transmit fan. This option should thus normally be ON.

Sounder Main (for EM 2000)

Sounder Main is located on the *Runtime parameters* display view.

These parameters allow you to:

- Define the pingmode, 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
- Limit the ping frequency



Parameters - Sector Coverage

Max angle (deg), port / starboard: 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 (m), port / starboard: These parameters allow 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 mode to Auto.

Angular Coverage mode: Choose between Manual and Auto:

- **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 swathwidth limit. The most limiting of the two criteria will be used. If the system is not able to fulfil the above, it will reduce the swath width further and as a consequence nearly all the beams will be valid. You may observe this in the *Numerical display,* as the numbers of beams accepted should almost equal to the number of beams available.

→ *Numerical display, page 89.*

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:** The in-between spacing is intended for surveys with high priority on seabed image data. Compared to equidistant spacing, this mode gives higher density of soundings in the central part (near equiangle) of the swath, and maintains an acceptable density in the outmost parts (near equidistant).

Parameters - Depth Settings

Force depth (m): If there is a lot of acoustic interference or if the water is very aerated, the echo sounder may not find the correct depths. In order to help, you can then enter the approximate 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.

Min. / Max. depth (m): These parameters 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. In some cases 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 and compared with the settings 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.

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

- Auto
- Shallow
- Deep

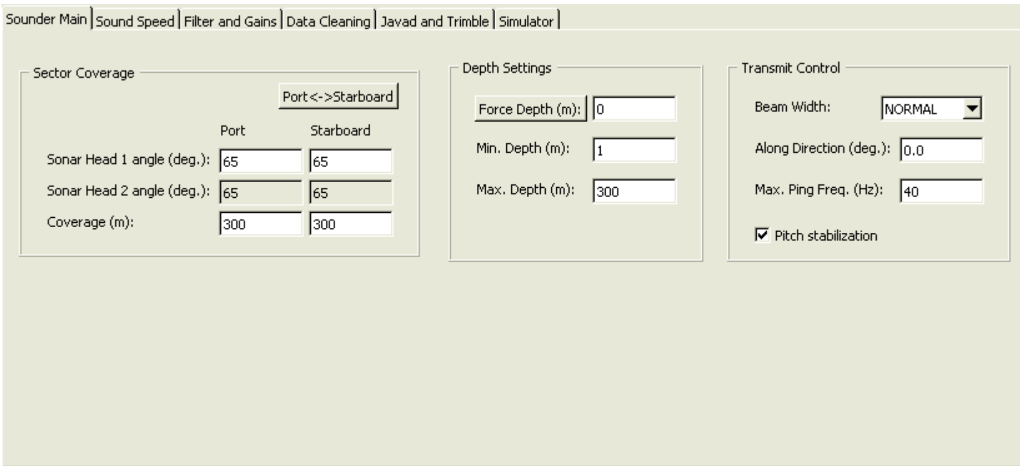
During normal operating conditions, you are advised to set the ping mode to **Auto**. The system will then automatically use the most appropriate mode, and - if necessary - switch between the modes to obtain maximum coverage.

Sounder Main (for EM 3000)

Sounder Main is located on the *Runtime parameters* display view.

These parameters allow you to:

- Define 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
- Limit the ping frequency



Parameters - Sector Coverage

Port < - > Starboard: This button allows the settings for the port and starboard sector coverage parameters to be swapped. This is convenient when logging along a shoreline and the vessel is turning around.

Sonar Head angle (deg): Allows you to define the minimum and maximum swath width by setting the minimum and maximum port and starboard angles. The values are entered in degrees. The values are relative to the vertical.

Coverage (m): Allows you to define the minimum and 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.

Parameters - Depth Settings

Force depth (m): If there is a lot of acoustic interference or if the water is very aerated, the echo sounder may not find the correct depths. In order to help, you can then enter the approximate 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.

Min. / Max. depth (m): Allows 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. In some cases 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 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.

Parameters - Transmit Control

Beam width: This function is used to set the beamwidths the system shall use.

Choose between Auto, Normal, Nearfield or Tracking.

With the standard beamforming algorithm, the resolution (physical width or footprint) of a beam is at ranges larger than about 7 m determined by the range multiplied by the beamwidth (1.5°). At lesser ranges the achievable resolution will not follow this law, but will remain fairly constant at about the transducer size, i.e. 20 cm.

Furthermore, the returned echo strength will fluctuate at ranges less than about 4 m, making accurate backscatter measurements impossible at very shallow depths. To overcome these limitations, which are due to physics, the system has a nearfield beamforming algorithm which, when used, will improve the resolution for ranges less than 3 m, with at best a 10 cm resolution, and also to allow valid backscatter measurements to less than 1 m depths.

The options have the following consequences:

- **Auto:** With this option the system switches automatically between normal and nearfield beamforming as the depth changes from shallow to deep or vice versa. The switch depths are 2 and 4 m respectively to avoid to frequently changes of beamforming algorithm. This option should be used when the depth is variable with a significant part of the bottom having depths less then 2 m.
- **Normal:** With this option the normal beamforming algorithm is always used. This option should normally be selected.
- **Nearfield:** With this option the nearfield beamforming algorithm is always used. This option should be used if most of the bottom has depths less than 2 m and there are no depths larger than about 4 m. The opening angle for both transmission and reception is 4 degrees.
- **Tracking**: This mode sets the opening angle for transmission and reception to 4 degrees and 1.5 degrees respectively. This should increase the number of pings on defined objects, and increase the detection possibility. The alongship footprint size will also increase.

Transmit angle (deg): This setting allows you to determine in which direction the system is to measure, that is how to tilt the narrow transmit fan forwards or backwards. The amount of tilting that can be applied is ±20°with respect to the Sonar Head. The displayed angle is the angular sector possible with respect to the vertical taking into account the pitch installation angle of the sonar head.

For seabed mapping, the transmit fan should be directed to point vertically. This is the default setting of the transmit angle. In very shallow waters the coverage may be increased somewhat by tilting the fan away from the vertical as much as possible.

Because the tilt is applied electronically on the transmit pulse - which is common to all beams - the effective tilt angle will vary with the beam angle. The outer beams will effectively be tilted much more than the central beams, and the result is a curved swath with a hyperbolic shape. To counter this effect, and thus to minimize the deviations from a straight line swath, the applied electronic tilt angle is less than that derived from the entered transmit angle: A 30% reduction for a single head system and 45% for the dual head system. This reduction will in the future become adaptable according to actual coverage and installation parameters.

Max. Ping Freq (Hz): This setting is used to limit the ping rate and hence the data storage rate of the system.

The time it takes for a sound pulse to reach the bottom and return to the Sonar Head will normally limit the ping frequency of the sonar head up to a maximum of 40 Hz. 100% coverage of the bottom is thus possible at vessel speeds up to about 12 knots (130 degree sector). If the vessel speed is slower, or 100% coverage of the bottom is not required, the amount of stored data from a survey may be reduced by lowering the maximum ping frequency.

The table below shows the typical data rate in Mbytes per hour at maximum ping rate for a single head system.

Depth below transducer	Bathymetry	Seabed image	Sector width
5 m	300	100	±65 deg.
10 m	200	85	±65 deg.
25 m	100	70	±65 deg.

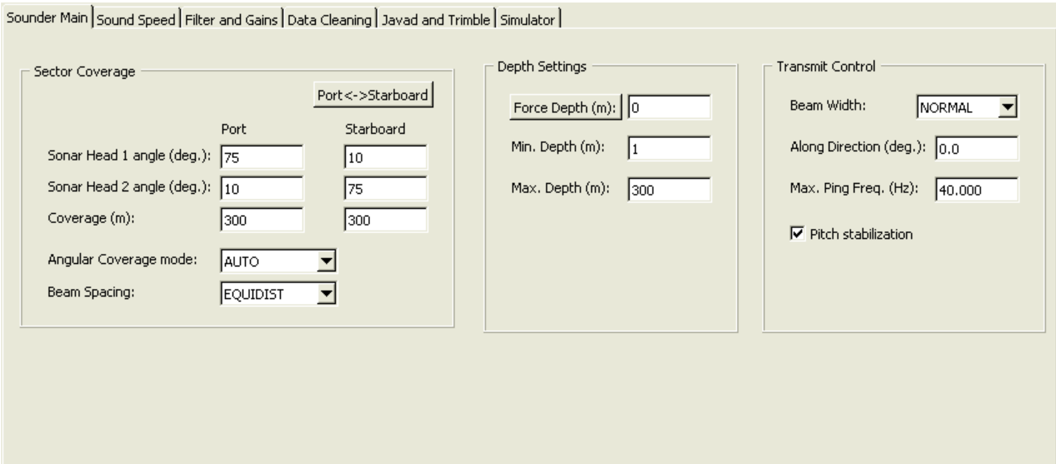
Pitch stabilization: At open sea, the swath area on the bottom will move back and forth following the vessel pitch. This would lead to loss of sampling regularity, and thus also limit the vessel speed at which 100% bottom coverage is possible. To counter this effect the system’s transmit angle may be set to varywith the pitch in order to stabilize the direction of the emitted vertical transmit fan. This option should thus normally be ON.

Sounder Main (for EM 3002)

Sounder Main is located on the *Runtime parameters* display view.

These parameters allow you to:

- Define 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
- Limit the ping frequency



Parameters - Sector Coverage

Port < - > Starboard: This button allows the settings for the port and starboard sector coverage parameters to be swapped. This is convenient when logging along a shoreline and the vessel is turning around.

Sonar Head angle (deg): Allows you to define the minimum and maximum swath width by setting the minimum and maximum port and starboard angles. The values are entered in degrees. The values are relative to the vertical.

Coverage (m): Allows you to define the minimum and 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.

AngularCoverage mode: Select between Manual and Auto.

- **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 swathwidth limit. The most limiting of the two criteria will be used. If the system is not able to fulfil the above, it will reduce the swath width further and as a consequence nearly all the beams will be valid. You may observe this in the *Numerical display,* as the numbers of beams accepted should almost equal to the number of beams available.

→ *Numerical display, page 89.*

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. The number of beams is 160.
- **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. The number of beams is 160.
- **High density:** In this mode the number of soundings are increased to 254 per sonar head (i.e. 508 for EM 3002 dual head). This is achieved by directing some of the beams closer to the centre of the survey line and performing several soundings per beam on the edge of the swath. This results in an equidistant distribution of the soundings.

Parameters - Depth Settings

Force depth (m): If there is a lot of acoustic interference or if the water is very aerated, the echo sounder may not find the correct depths. In order to help, you can then enter the approximate 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.

Min. / Max. depth (m): Allows 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. In some cases 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.

Parameters - Transmit Control

Beam width: This function is used to set the transmitter beam widths of the system. Choose between Normal (1.5°) and Wide (4°). To compensate for nearfield effects, the EM 3002 receiver is dynamically focused.

The options have the following consequences:

- **Normal:** This mode sets the opening angle for transmission to 1.5 degrees. This option should normally be selected.
- **Wide:** This mode sets the opening angle for transmission to 4 degrees. This can be used to compensate for nearfield effects at very shallow depths (less than 2 to 4 m), and for target detection. This should increase the number of pings on defined objects, and increase the detection possibility. The alongship footprint will also increase.

Along Direction (deg): This setting allows you to determine in which direction the system is to measure, that is how to tilt the narrow transmit fan forwards or backwards. The amount of tilting that can be applied is ±15°with respect to the Sonar Head. The displayed angle is the angular sector possible with respect to the vertical taking into account the pitch installation angle of the sonar head.

For seabed mapping, the transmit fan should be directed to point vertically. This is the default setting of the transmit angle. It is equal to the pitch installation angle, but with opposite sign. In very shallow waters the coverage may be increased somewhat by tilting the fan away from the vertical as much as possible.

Because the tilt is applied electronically on the transmit pulse - which is common to all beams - the effective tilt angle will vary with the beam angle. The outer beams will effectively be tilted muchmore than the central beams, and the result is a curved swath with a hyperbolic shape. To counter this effect, and thus to minimize the deviations from a straight line swath, the applied electronic tilt angle is less than that derived from the entered transmit angle: a 30% reduction for a single head system and 45% for the dual head system. This reduction will in the future become adaptable according to actual coverage and installation parameters.

Max. Ping Freq (Hz): This setting is used to limit the ping rate and hence the data storage rate of the system.

The time it takes for a sound pulse to reach the bottom and return to the Sonar Head will normally limit the ping frequency of the sonar head up to a maximum of 50 Hz. 100% coverage of the bottom is thus possible at vessel speeds up to about 12 knots. If the vessel speed is slower, or 100% coverage of the bottom is not required, the amount of stored data from a survey may be reduced by lowering the maximum ping frequency.

The table below shows the typical data rate in Mbytes per hour at maximum ping rate for a single head system.

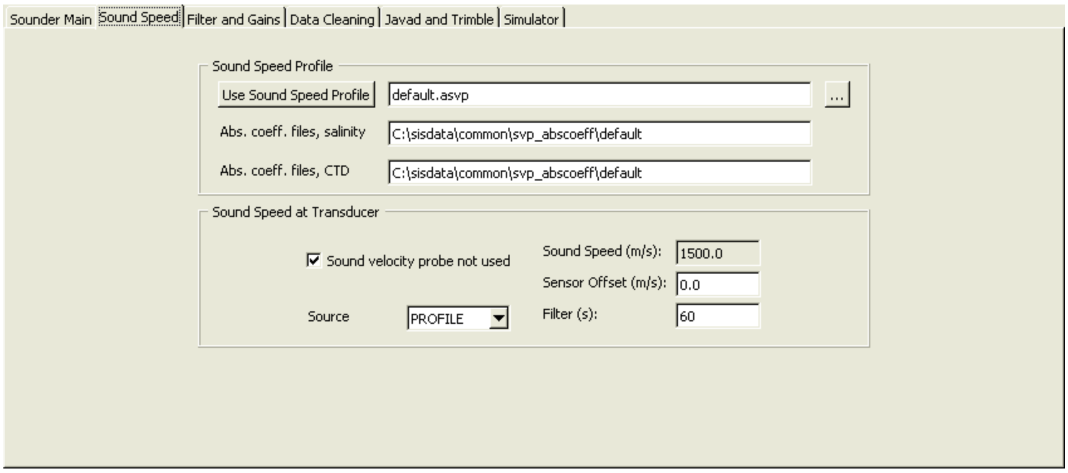
Depth below transducer	Bathymetry	Seabed image	Water column	Sector width
5 m	800	200	1500	± 65 deg.
10 m	500	150	1650	± 65 deg.
25 m	250	100	1900	± 65 deg.

Pitch stabilization: This setting is used to turn pitch stabilization on and off. Pitch movements within ±10 degrees are automatically compensated by the software, and will not affect the survey results. Larger pitch values can not be fully compensated, but the system will provide correct values for the x, y and z movements anyway.

At open sea, the swath area on the bottom will move back and forth following the vessel pitch. This would lead to loss of sampling regularity, and thus also limit the vessel speed at which 100% bottom coverage is possible. To counter this effect the system’s transmit anglemay be set to varywith the pitch in order to stabilize the direction of the emitted vertical transmit fan. This option should thus normally be **ON**.

Sound Speed (for EM 120, EM 300, EM 710 EM 2000, EM 3000 and EM 3002)

Sound Speed is located on the *Runtime parameters* display view.



Parameters - Sound Speed Profile

Use Sound Speed Profile: The Sound Speed Profile parameter allows you to select the sound speed profile to be used in the echo sounder’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.

If you want to use a different profile, click the browse-button on the right-hand side (button with three dots). When the desired profile is selected, press **Use Sound Speed Profile**.

Absorption coefficient files: When selecting a new sound speed profile, this will affect the absorption coefficient settings in the system. Each sound speed profile is associated with a set of absorption coefficient files which already exist or which are made at the moment on the basis of the selected sound speed profile and related implementation of absorption coefficients.

→ *Absorption coefficient parameters, page 240.*

→ *Implementation of absorption coefficients, page 398.*

The associated absorption coefficient file set is either of type salinity based or CTD based. As a result of the selection, one of the two following text fields is changed to reflect the selection:

- Abs. coeff. files, salinity
- Abs. coeff. files, CTD

Note *A user provided sound velocity profile (with a user defined name) does not normally have a set of associated absorption coefficient files initially. The files will therefore be generated automatically based on the current salinity value. The name of the files will contain **salinity** as a part of the file name, and this will show up in the salinity text field. In this case the Sound Speed Profile text field will show the original user selection.*

Note *If a datagram of format S00, S01, S02, S03, S04 or S05 is received this implies that the data should be used immediately. The Absorption coefficient files field are updated automatically. The **Use Sound Speed Profile** text field will be updated with the name of the new sound velocity profile. In the case of a S00 datagram it will contain **salinity** as part of the name.*

→ *For more information see Handling of SSP datagrams, page 395.*

Parameters - Sound Speed at Transducer

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

Sound velocity probe not used: Select this option if you want to stop using the sound velocity probe.

If Probe is changed to not used, the Probe option will be removed from the Source selection (see below). If Source is set to Probe - and sound velocity probe is changed to not used - Profile will be set as new Source. This Source selection may subsequently be changed by the operator.

If the probe delivers no samples within the set filter length due to an error the operator will be notified by pop-up warnings. To avoid these pop-up warnings, set sound velocity probe to “not used” until the problem has been corrected.

If the sound speed value at the transducer derived from the sound speed profile deviates too much from the probe or manual values this will be indicated in the Numerical display (Tr. svp and Tr. sensor).

Source: Select the source for the Sound Speed at Transducer. Choose between Manual, Profile and Probe.

- **Sensor:** The system will use a filtered sound speed value derived from the sound speed sensor at the transducer. The filter is configured as described below. This option will only be available if the sound velocity probe is used.
- **Manual:** The echo sounder system will use the sound speed you define.

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

- **Profile:** The system will use the sound speed profile to derive the sound speed near the transducer/sonar head. If no matching depth is found in the profile, an interpolated value is used.

Sound Speed (m/s): Set the sound speed at transducer directly to a fixed value. This function is only available if Manual is selected.

Sensor Offset (m/s): This parameter is used to set a correction offset if the Source is set to Probe. The offset will be added to the used sound speed values.

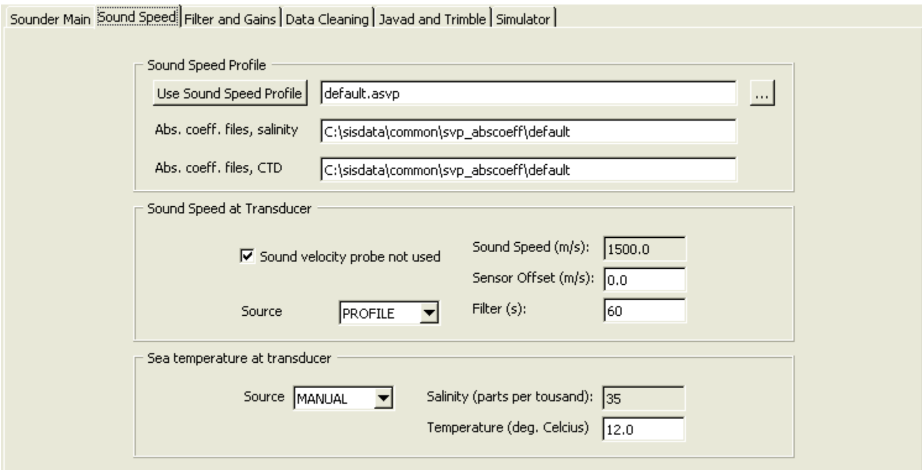
Note — *When a new profile is taken into use, always set the offset so that the sensor value is the same as that in the profile at the transducer depth. This is most easily done using the values from Numerical display.*

→ *Numerical display, page 89.*

Filter(s): The length of the filtering of the sound speed sensor data can be selected. This also sets the update rate i.e. how often a new sound speed value derived from the filter is set. The filter is a median filter. Values outside 1300 to 1800 m/s are removed before the filter is run.

Sound Speed (for EM 1002)

Sound Speed is located on the *Runtime parameters* display view.



Parameters - Sound Speed Profile

Use Sound Speed Profile: The Sound Speed Profile parameter allows you to select the sound speed profile to be used in the echo sounder’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.

If you want to use a different profile, click the browse-button on the right-hand side (button with three dots). When the desired profile is selected, press **Use Sound Speed Profile**.

Absorption coefficient files: When selecting a new sound speed profile, this will affect the absorption coefficient settings in the system. Each sound speed profile is associated with a set of absorption coefficient files which already exist or which are made at the moment on the basis of the selected sound speed profile and related implementation of absorption coefficients.

→ *Absorption coefficient parameters, page 240.*
→ *Implementation of absorption coefficients, page 398.*

The associated absorption coefficient file set is either of type salinity based or CTD based. As a result of the selection, one of the two following text fields is changed to reflect the selection:

- Abs. coeff. files, salinity
- Abs. coeff. files, CTD

Note — *A user provided sound velocity profile (with a user defined name) does not normally have a set of associated absorption coefficient files initially. The files will therefore be generated automatically based on the current salinity value. The name of the files will contain* ***salinity*** *as a part of the file name, and this will show up in the salinity text field. In this case the Sound Speed Profile text field will show the original user selection.*

Note — *If a datagram of format S00, S01, S02, S03, S04 or S05 is received this implies that the data should be used immediately. The Absorption coefficient files field are updated automatically. The* ***Use Sound Speed Profile*** *text field will be updated with the name of the new sound velocity profile. In the case of a S00 datagram it will contain* ***salinity*** *as part of the name.*

For more information see Handling of SSP datagrams, page 395.

Parameters - Sound Speed at Transducer

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

Sound velocity probe not used: Select this option if you want to stop using the sound velocity probe.

If the probe is changed to not used, the Probe option will be removed from the Source selection (see below). If Source is set to Probe - and sound velocity probe is changed to not used - Profile will be set as new Source. This Source selection may subsequently be changed by the operator.

If the probe delivers no samples within the set filter length due to an error the operator will be notified by pop-up warnings. To avoid these pop-up warnings, set sound velocity probe to “not used” until the problem has been corrected.

If the sound speed value at the transducer derived from the sound speed profile deviates too much from the probe or manual values this will be indicated in the Numerical display (Tr. svp and Tr. sensor).

Source: Select the source for the Sound Speed at Transducer. Choose between Manual, Profile and Probe.

- **Manual:** The echo sounder system will use the sound speed you define.

Caution

The manual setting is intended for experienced operators only!

- **Profile:** The system will use the sound speed profile to derive the sound speed near the transducer/sonar head. If no matching depth is found in the profile, an interpolated value is used.
- **Probe:** The system will use a filtered sound speed value derived from the sound speed sensor at the transducer. The filter is configured as described below. This option will only be available if the sound velocity probe is used.

Sound Speed (m/s): Set the sound speed at transducer directly to a fixed value. This function is only available if Manual is selected.

Sensor Offset (m/s): This parameter is used to set a correction offset if the Source is set to Probe. The offset will be added to the used sound speed values.

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 using the values from the Numerical display.

→ *Numerical display, page 89.*

Filter(s): The length of the filtering of the sound speed sensor data can be selected. This also sets the update rate. i.e. how often a new sound speed value derived from the filter is set.

The filter is a median filter. Sound speed values outside 1300 to 1800 m/s and temperature sensor values outside -5°C to +45°C are removed before the filter is run.

Parameters - Sea temperature 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.

Source: Select the source you want temperatures from.

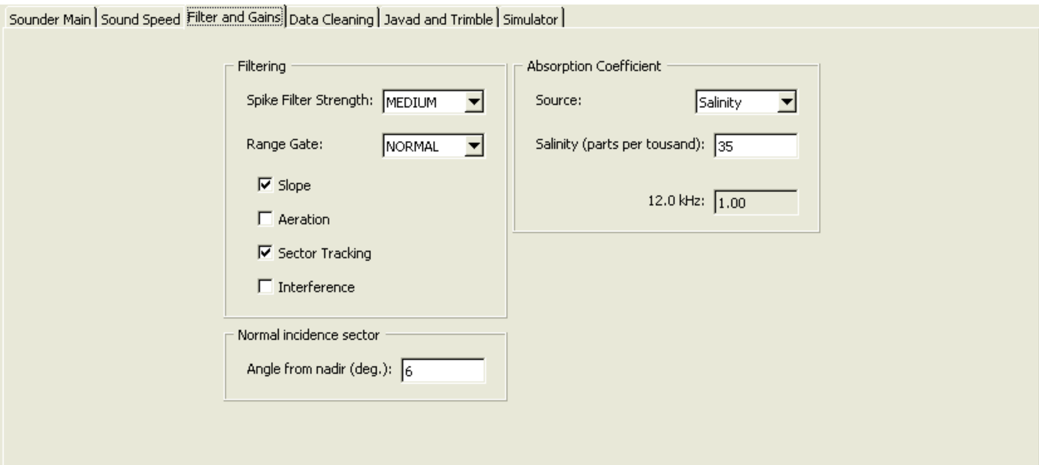
- **Sensor:** The read-out from the temperature sensor is used.
- **Salinity:** When Source is set to “Salinity”, the salinity value you enter here will be used together with sound speed at transducer to calculate temperature.
- **Manual:** The sea temperature you enter will be used.

Filter and Gains (for EM 120 and EM 300)

Filter and Gains is located on the *Runtime parameters* display view.

Note

The frequency for EM 120 is 12.0 kHz and the frequency for EM 300 is 31.5 kHz.



Parameters - Filtering

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 use different filter settings than those recommended only if the occurrence of false detections is too high to be acceptable.

The recommended settings are:

- **Spike Filter Strength:** Medium
- **Range gate:** Normal
- **Slope:** On
- **Aeration:** Off
- **Sector Tracking:** On
- **Interference:** Off

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: Choose between OFF, WEAK, MEDIUM and STRONG.

This 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.

Range Gate: Choose between SMALL, NORMAL and LARGE.

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.

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.

Slope: With this filter enabled, the 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.

The slope filter should normally be enabled.

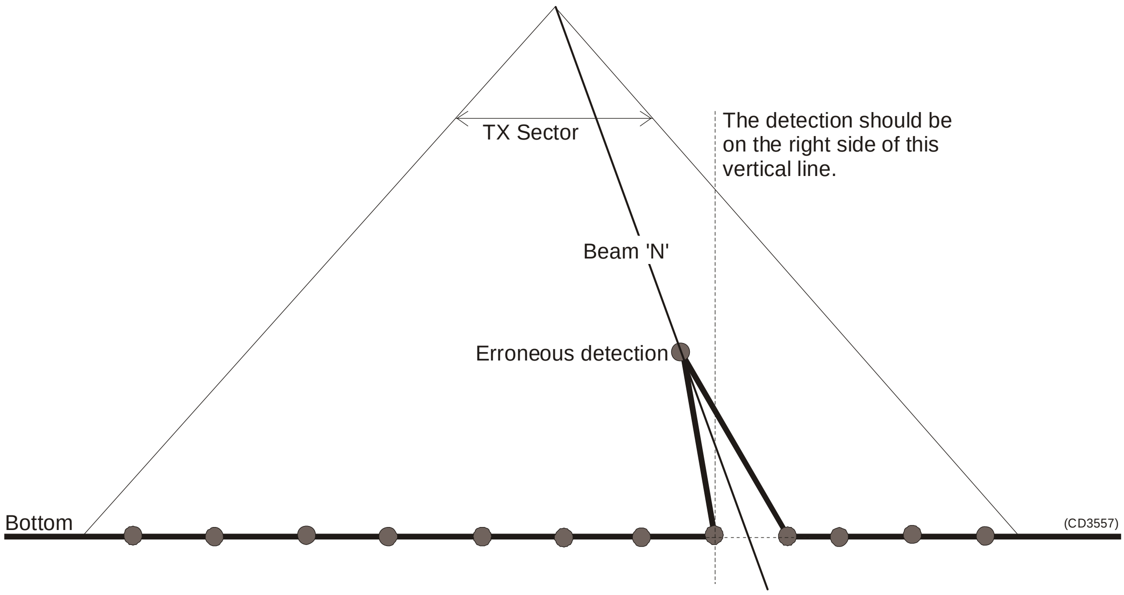


Figure 13 Slope filter principles

Aeration: If the transducer installation suffers from air bubbles close to the transducer, the system may have problems with bottom tracking. Activating this filter will force the system to keep tracking the same depth for a longer period. If you have aeration problems in areas with relatively constant depths, this filter will increase the performance of the system. However, if the bottom depth varies considerably, the filter may have an adverse effect.

Sector tracking: The transmitter operates with three or nine pulses within each ping. Each pulse covers different sectors of the total swath. This setting will turn on an automatic gain compensation to avoid amplitude offsets between these sectors. During normal operations, the Sector Tracking should be on. However, if the survey specifications demand a fully calibrated system for sidescan image, this function should be turned off.

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

Interference: If the vessel is equipped with other echo sounders on sonars operating on frequencies close to the echo sounder, you may experience interference. The best solution is to synchronize the operation of the different systems. If synchronization is not possible, this filter may reduce interference problems.

Parameters - Absorption Coefficient

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.

The absorption coefficient as a function of the depth must therefore be calculated for the frequency used by the echosounder.

Source: There are three alternatives for the operator; absorption coefficient based on salinity input (Salinity), absorption coefficient based on profile input (CTD Profile) and manually selected absorption coefficient (Manual):

- **Salinity:** If the source is set to salinity, the average absorption coefficient is calculated using the current sound profile (to find the temperature profile), the depth based on the previous pings and the specified average salinity. The average absorption coefficient will then be calculated by SIS for the relevant frequency and it will be updated and displayed with changing depths. If the salinity in the water is constant, this is the recommended setting.
- **CTD Profile:** The absorption coefficient can be calculated from a sound speed profile that includes information necessary to calculate an absorption profile.

  The sound speed input datagram (SSP) must be used. When using a CTD profile from an SSP datagram, the absorption coefficient profile will automatically be calculated by SIS for the required frequencies.

  It is also possible to specify the absorption coefficient directly in the SSP datagram, but then one datagram must be made for each frequency used by the echosounders (i.e. the full range of 12, 31.5, 60, 70, 80, 90, 95, 100, 200 and 300 kHz), and the frequency must be specified in each datagram. These datagrams must have the same acquisition date and time and must be sent with no more than 10 seconds interval.

  Using this CTD Profile option, which will increase the accuracy of the bottom reflectivity data; SIS will calculate the average absorption coefficient through the water column. The absorption coefficient values displayed will change continuously depending upon the depth.
- **Manual:** It is possible to manually specify the absorption coefficient for the relevant frequency. This must be the average absorption coefficient for the water column.

Salinity (parts per thousand): If the source is set to Salinity, the average salinity can be entered in this field.

<frequency> kHz: If the source is set to Manual, the operator may supply an absorption coefficient for the stated frequency. This frequency is as follows for the different echosounders:

EM 120	12.0 kHz
EM 300	31.5 kHz
EM 1002	95.0 kHz
EM 2000	200.0 kHz
EM 3000	300.0 kHz
EM 3002	300.0 kHz

If the source is set to Salinity or CTD, the frequency field is disabled (greyed), but it will show the current value of the absorption coefficient (dB/km) used for the frequency.

Related topics

→ *Handling of SSP datagrams, page 395.*

→ *Implementation of absorption coefficients, page 398.*

→ *The absorption coefficient equation, page 404.*

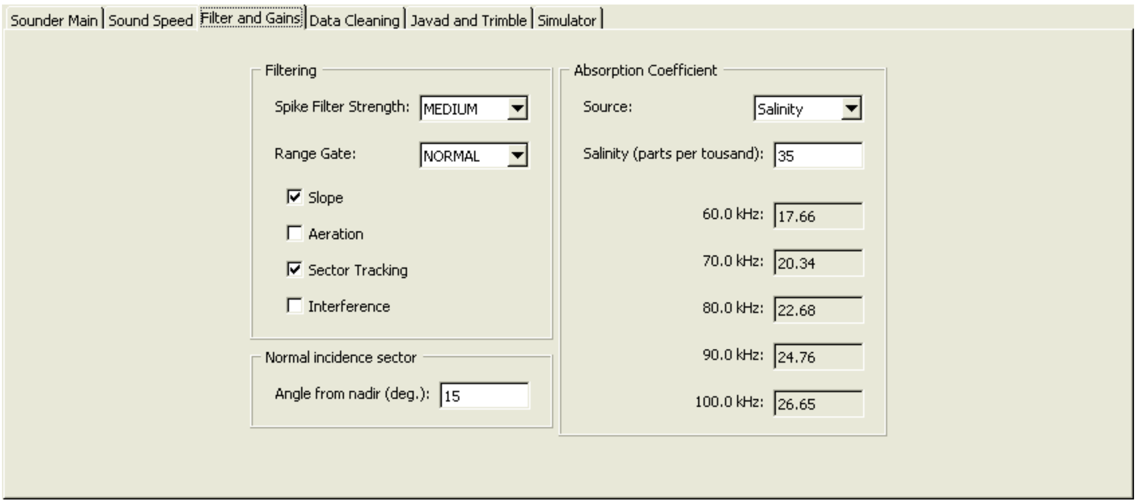
Parameters - Normal incidence sector

Angle from nadir [deg.]: 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. This is to give best use of its dynamic range. The bottom backscatter strengths in the ping display are not affected by this setting.

Filter and Gains (for EM 710)

Filter and Gains is located on the *Runtime parameters* display view.



Parameters - Filtering

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 use different filter settings than those recommended only if the occurrence of false detections is too high to be acceptable.

The recommended settings are:

- **Spike Filter Strength:** Medium
- **Range gate:** Normal
- **Slope:** On
- **Aeration:** Off
- **Sector Tracking:** On
- **Interference:** Off

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: Choose between OFF, WEAK, MEDIUM and STRONG.

This 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.

Range Gate: Choose between SMALL, NORMAL and LARGE.

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.

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.

Slope: With this filter enabled, the 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.

The slope filter should normally be enabled.

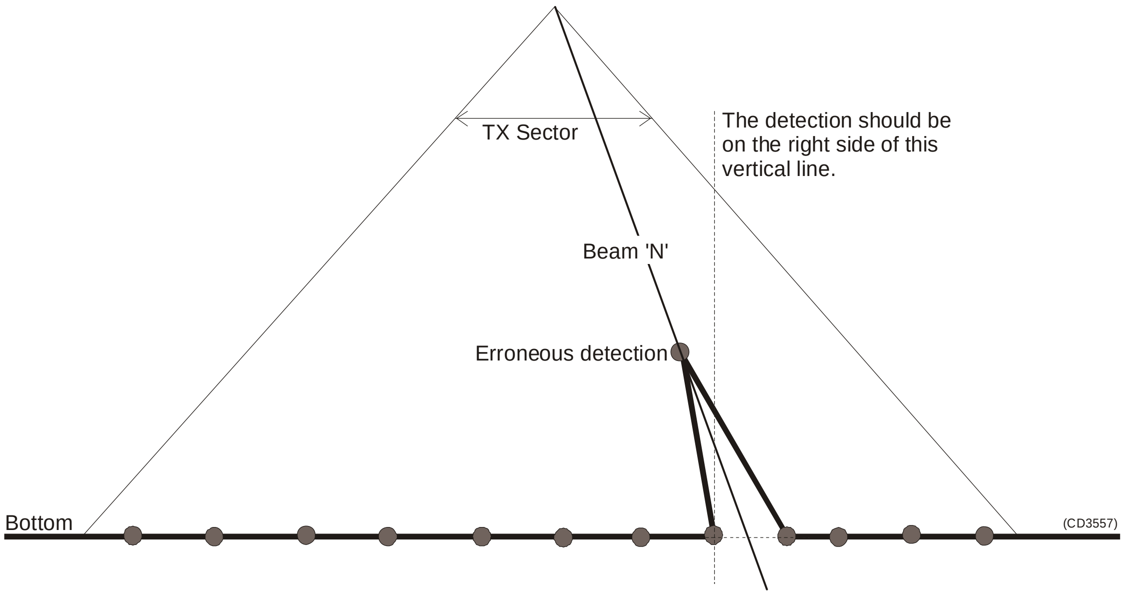


Figure 14 Slope filter principles

Aeration: For current version this button is used to enable a penetration filter.

Sector tracking: The transmitter operates with several pulses within each ping. Each pulse covers different sectors of the total swath. This setting will turn on an automatic gain compensation to avoid amplitude offsets between these sectors. During normal operations, the Sector Tracking should be on. However, if the survey specifications demand a fully calibrated system for sidescan image, this function should be turned off.

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

Interference: If the vessel is equipped with other echo sounders on sonars operating on frequencies close to the echo sounder, you may experience interference. The best solution is to synchronize the operation of the different systems. If synchronization is not possible, this filter may reduce interference problems.

Parameters - Absorption Coefficient

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.

The EM 710 uses a wide bandwidth. To correct for the absorption in the water, the absorption coefficient as a function of the depth must be calculated for a set of frequencies.

Source: There are three alternatives for the operator; absorption coefficient based on salinity input (Salinity), absorption coefficient based on profile input (CTD Profile) and manually selected absorption coefficient (Manual).

- **Salinity:** If the source is set to salinity, the average absorption coefficient is calculated using the current sound profile (to find the temperature profile), the depth based on the previous pings and the specified average salinity. The average absorption coefficient will then be calculated by SIS for each frequency and will be updated and displayed with changing depths. If the salinity in the water is constant, this is the recommended setting.
- **CTD Profile:** The absorption coefficient can be calculated from a sound speed profile that includes information necessary to calculate an absorption profile.

  The sound speed input datagram (SSP) must be used. When using a CTD profile from an SSP datagram, the absorption coefficient profile will automatically be calculated by SIS for the different frequencies. It is also possible to specify the absorption coefficient directly in the SSP datagram, but then one datagram must be made for each frequency used by the echosounders (ie. the full range of 12, 31.5, 60, 70, 80, 90, 95, 100, 200 and 300 kHz), and the frequency must be specified in the datagram. These datagrams must have the same acquisition date and time and must be sent with no more than 10 seconds interval.

  Using the C10 profile, which will increase the accuracy of the bottom reflectivity data, SIS will calculate the average absorption coefficient through the water column. The absorption coefficient values displayed will change continuously depending upon the depth.
- **Manual:** It is possible to manually specify the absorption coefficient for each frequency. This must be the average absorption coefficient for the water column.

Salinity (parts per thousand): If the source is set to Salinity, the average salinity can be entered in this field.

60.0 / 70.0 / 80.0 / 90.0 / 100.0 kHz: If the source is set to Manual, the manual or calculated absorption coefficient for each frequency from 60.0 to 100.0 kHz (in steps of 10 kHz) can be entered in these fields.

If the source is set to Salinity or CTD, these fields are disabled (grayed), but they will show the current value of the absorption coefficient used for each frequency.

Related topics

→ *SSP datagrams, page 395.*
→ *Implementation of absorption coefficients, page 398.*
→ *The absorption coefficient equation, page 404.*

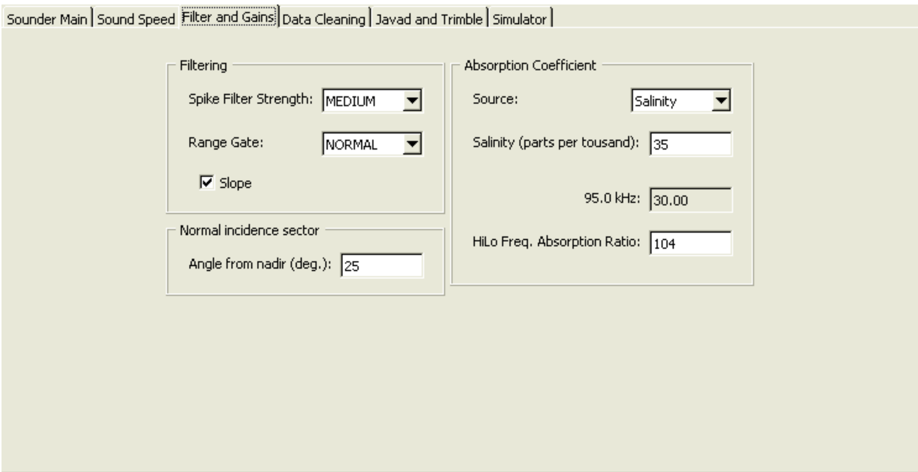
Parameters - Normal incidence sector

Angle from nadir [deg.]: 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. This is to give best use of its dynamic range. The bottom backscatter strengths in the ping display are not affected by this setting.

Filter and Gains (for EM 1002)

Filter and Gains is located on the *Runtime parameters* display view.



Parameters - Filtering

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 use different filter settings than those recommended only if the occurrence of false detections is too high to be acceptable.

The recommended settings are:

- **Spike Filter Strength:** Medium
- **Range gate:** Normal
- **Slope:** On

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: Choose between OFF, WEAK, MEDIUM and STRONG.

This 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.

Range Gate: Choose between SMALL, NORMAL and LARGE.

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.

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.

Slope: With this filter enabled, the 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.

The slope filter should normally be enabled.

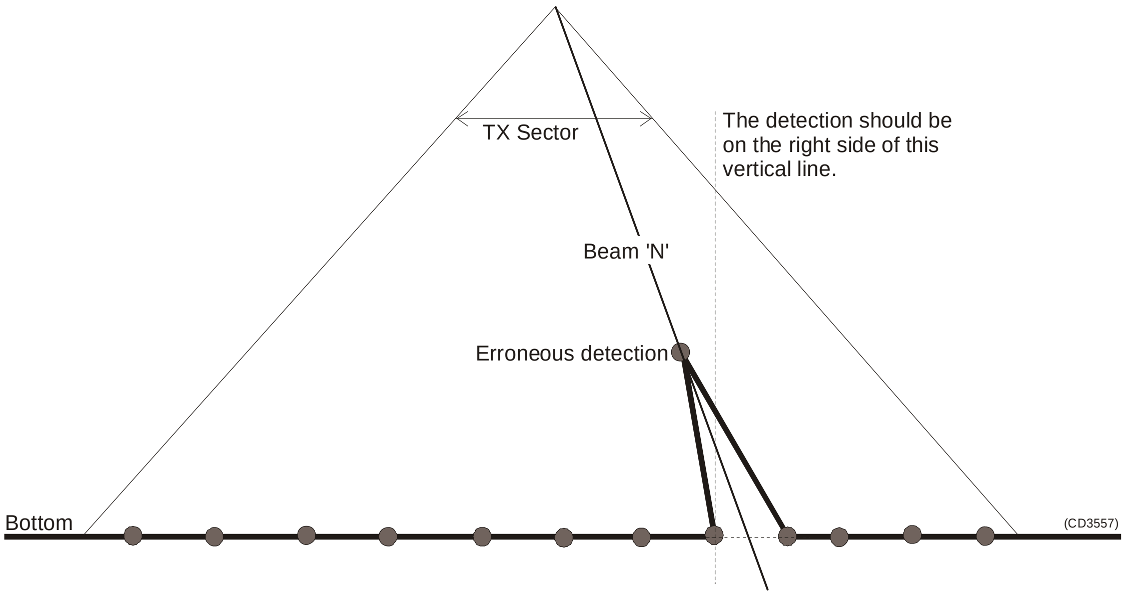


Figure 15 Slope filter principles

Parameters - Absorption Coefficient

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.

The absorption coefficient as a function of the depth must therefore be calculated for the frequency used by the echosounder.

Source: There are three alternatives for the operator; absorption coefficient based on salinity input (Salinity), absorption coefficient based on profile input (CTD Profile) and manually selected absorption coefficient (Manual):

- **Salinity:** If the source is set to salinity, the average absorption coefficient is calculated using the current sound profile (to find the temperature profile), the depth based on the previous pings and the specified average salinity. The average absorption coefficient will then be calculated by SIS for the relevant frequency and it will be updated and displayed with changing depths. If the salinity in the water is constant, this is the recommended setting.
- **CTD Profile:** The absorption coefficient can be calculated from a sound speed profile that includes information necessary to calculate an absorption profile.

The sound speed input datagram (SSP) must be used. When using a CTD profile from an SSP datagram, the absorption coefficient profile will automatically be calculated by SIS for the required frequencies.

It is also possible to specify the absorption coefficient directly in the SSP datagram, but then one datagram must be made for each frequency used by the echosounders (i.e. the full range of 12, 31.5, 60, 70, 80, 90, 95, 100, 200 and 300 kHz), and the frequency must be specified in each datagram. These datagrams must have the same acquisition date and time and must be sent with no more than 10 seconds interval.

Using this CTD Profile option, which will increase the accuracy of the bottom reflectivity data; SIS will calculate the average absorption coefficient through the water column. The absorption coefficient values displayed will change continuously depending upon the depth.

- **Manual:** It is possible to manually specify the absorption coefficient for the relevant frequency. This must be the average absorption coefficient for the water column.

Salinity (parts per thousand): If the source is set to Salinity, the average salinity can be entered in this field.

<frequency> kHz: If the source is set to Manual, the operator may supply an absorption coefficient for the stated frequency. This frequency is as follows for the different echosounders:

EM 120	12.0 kHz
EM 300	31.5 kHz
EM 1002	95.0 kHz
EM 2000	200.0 kHz
EM 3000	300.0 kHz
EM 3002	300.0 kHz

If the source is set to Salinity or CTD, the frequency field is disabled (greyed), but it will show the current value of the absorption coefficient (dB/km) used for the frequency.

HiLo Freq. Ratio: Because the EM 1002 uses two different frequencies (93 and 98 kHz), the absorption coefficient 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

Related topics

→ *Handling of SSP datagrams, page 395.*
→ *Implementation of absorption coefficients, page 398.*
→ *The absorption coefficient equation, page 404.*

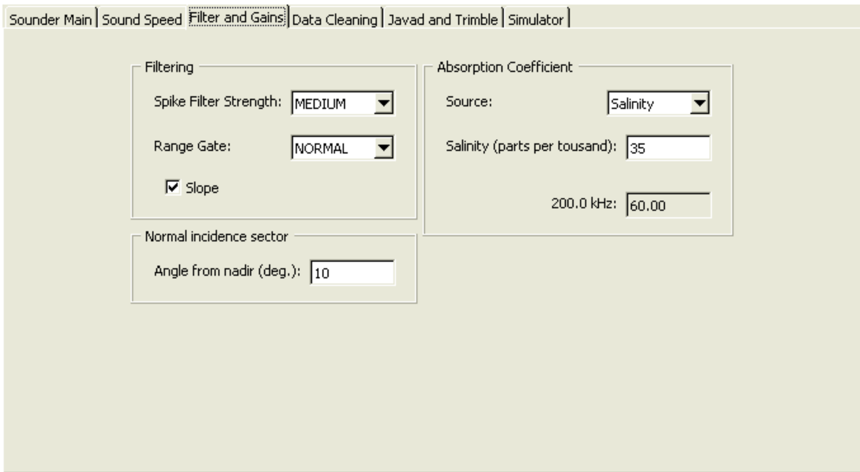
Parameters - Normal incidence sector

Angle from nadir [deg.]: 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. This is to give best use of its dynamic range. The bottom backscatter strengths in the ping display are not affected by this setting.

Filter and Gains (for EM 2000)

Filter and Gains is located on the *Runtime parameters* display view.



Parameters - Filtering

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 use different filter settings than those recommended only if the occurrence of false detections is too high to be acceptable.

The recommended settings are:

- **Spike Filter Strength:** Medium
- **Range gate:** Normal
- **Slope:** On

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: Choose between OFF, WEAK, MEDIUM and STRONG.

This 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.

Range Gate: Choose between SMALL, NORMAL and LARGE.

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.

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.

Slope: With this filter enabled, the 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.

The slope filter should normally be enabled.

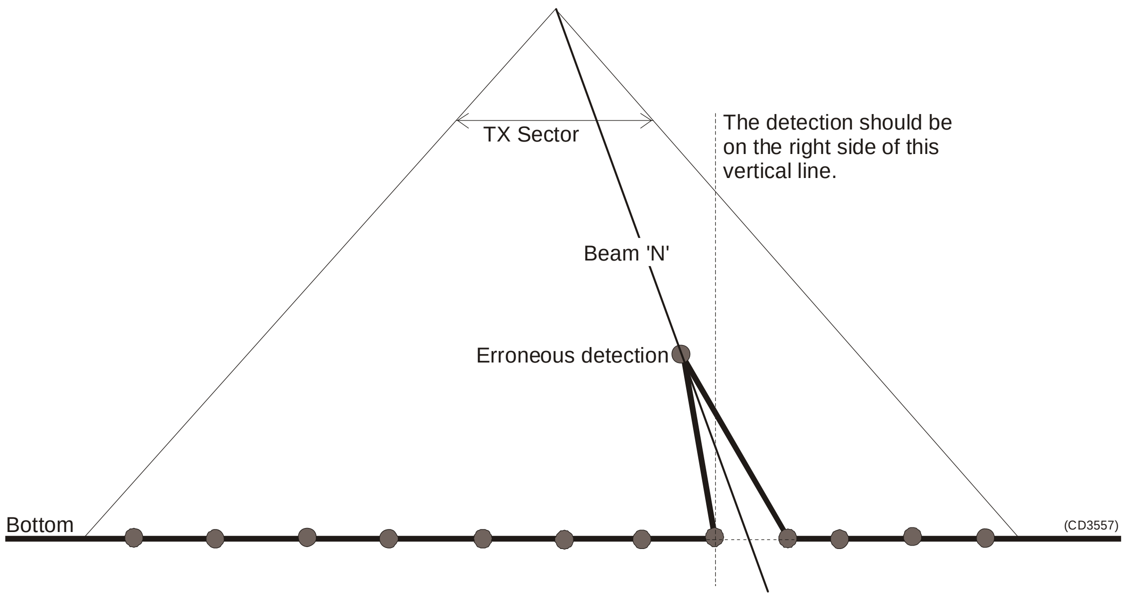


Figure 16   Slope filter principles

Parameters - Absorption Coefficient

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.

The absorption coefficient as a function of the depth must therefore be calculated for the frequency used by the echosounder.

Source: There are three alternatives for the operator; absorption coefficient based on salinity input (Salinity), absorption coefficient based on profile input (CTD Profile) and manually selected absorption coefficient (Manual):

- **Salinity:** If the source is set to salinity, the average absorption coefficient is calculated using the current sound profile (to find the temperature profile), the depth based on the previous pings and the specified average salinity. The average absorption coefficient will then be calculated by SIS for the relevant frequency and it will be updated and displayed with changing depths. If the salinity in the water is constant, this is the recommended setting.
- **CTD Profile:** The absorption coefficient can be calculated from a sound speed profile that includes information necessary to calculate an absorption profile.

The sound speed input datagram (SSP) must be used. When using a CTD profile from an SSP datagram, the absorption coefficient profile will automatically be calculated by SIS for the required frequencies.

It is also possible to specify the absorption coefficient directly in the SSP datagram, but then one datagram must be made for each frequency used by the echosounders (i.e. the full range of 12, 31.5, 60, 70, 80, 90, 95, 100, 200 and 300 kHz), and the frequency must be specified in each datagram. These datagrams must have the same acquisition date and time and must be sent with no more than 10 seconds interval.

Using this CTD Profile option, which will increase the accuracy of the bottom reflectivity data; SIS will calculate the average absorption coefficient through the water column. The absorption coefficient values displayed will change continuously depending upon the depth.

- **Manual:** It is possible to manually specify the absorption coefficient for the relevant frequency. This must be the average absorption coefficient for the water column.

Salinity (parts per thousand): If the source is set to Salinity, the average salinity can be entered in this field.

<frequency> kHz: If the source is set to Manual, the operator may supply an absorption coefficient for the stated frequency. This frequency is as follows for the different echosounders:

EM 120	12.0 kHz
EM 300	31.5 kHz
EM 1002	95.0 kHz
EM 2000	200.0 kHz
EM 3000	300.0 kHz
EM 3002	300.0 kHz

If the source is set to Salinity or CTD, the frequency field is disabled (greyed), but it will show the current value of the absorption coefficient (dB/km) used for the frequency.

Related topics

→ *Handling of SSP datagrams, page 395.*

→ *Implementation of absorption coefficients, page 398.*

→ *The absorption coefficient equation, page 404.*

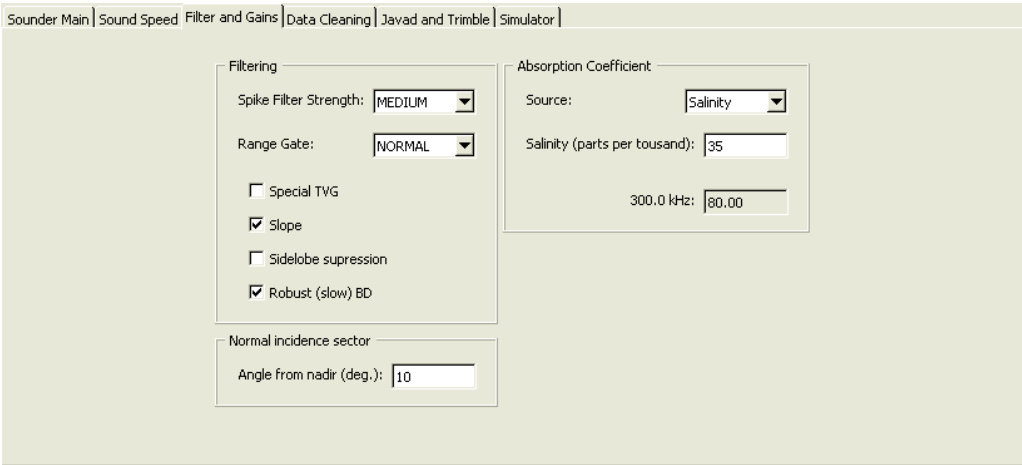
Parameters - Normal incidence sector

Angle from nadir [deg.]: 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. This is to give best use of its dynamic range. The bottom backscatter strengths in the ping display are not affected by this setting.

Filter and Gains (for EM 3000)

Filter and Gains is located on the *Runtime parameters* display view.



Parameters - Filtering

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 use different filter settings than those recommended only if the occurrence of false detections is too high to be acceptable.

The recommended settings are:

- **Spike Filter Strength:** Medium
- **Special TVG:** Off
- **Slope:** On
- **Sidelobe suppression:** Off
- **Robust (slow) BD:** 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: Choose between OFF, WEAK, MEDIUM and STRONG.

This 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.

Range Gate: Choose between NORMAL and LARGE.

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.

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.

Special TVG (Time Varying Gain): A normal TVG assumes a flat bottom, and will work well almost anywhere. However, bottoms with two distinct depths such as around manmade trenches, better results may be obtained by enabling the special TVG. The special TVG is similar to the TVG for single beam echo sounders (20 log R). Normally set to OFF.

Note

The special TVG is not taken into account in the backscatter processing!

Slope: With this filter enabled, the 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.

The slope filter should normally be enabled.

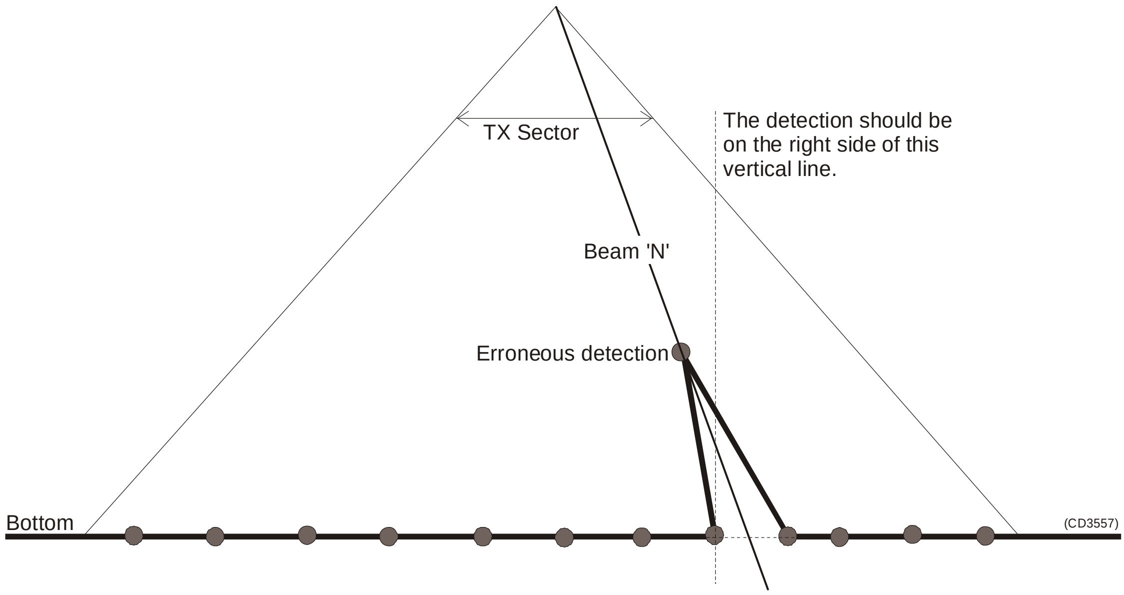


Figure 17 Slope filter principles

Sidelobe suppression: To be used to exclude data from sidelobes. This might be useful for example when surveying in waters with steep seabottom changes where sidelobe data could be stronger or in areas with a very strong echo at the normal incidence. The pingrate may be reduced with this feature enabled.

Robust (slow) BD: To improve bottom detection on rough or unusual bottoms, a new bottom detection algorithm has been implemented. Several acceptable detections per ping may be found (up to 7) and the new algorithm uses comparison with previous pings and neighbouring beams to select the ’correct’ one. The algorithm will usually decrease false detections in shallow waters and on bottoms with strong reflections.

The new algorithm is very time consuming, and hence the old algorithm is still available for use when a higher ping rate is required than is possible with the new algorithm.

Parameters - Absorption Coefficient

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.

The absorption coefficient as a function of the depth must therefore be calculated for the frequency used by the echosounder.

EM3000 and EM3002 may actually use three frequencies. However, these frequencies are in a range where there is very little variation in the absorption coefficients values due to frequency variation. By supplying the absorption coefficient for the middle frequency the two other absorption coefficient values may be deduced locally in the PU.

Source: There are three alternatives for the operator; absorption coefficient based on salinity input (Salinity), absorption coefficient based on profile input (CTD Profile) and manually selected absorption coefficient (Manual):

- **Salinity:** If the source is set to salinity, the average absorption coefficient is calculated using the current sound profile (to find the temperature profile), the depth based on the previous pings and the specified average salinity. The average absorption coefficient will then be calculated by SIS for the relevant frequency and it will be updated and displayed with changing depths. If the salinity in the water is constant, this is the recommended setting.

- **CTD Profile:** The absorption coefficient can be calculated from a sound speed profile that includes information necessary to calculate an absorption profile.

  The sound speed input datagram (SSP) must be used. When using a CTD profile from an SSP datagram, the absorption coefficient profile will automatically be calculated by SIS for the required frequencies.

  It is also possible to specify the absorption coefficient directly in the SSP datagram, but then one datagram must be made for each frequency used by the echosounders (i.e. the full range of 12, 31.5, 60, 70, 80, 90, 95, 100, 200 and 300 kHz), and the frequency must be specified in each datagram. These datagrams must have the same acquisition date and time and must be sent with no more than 10 seconds interval.

Using this CTD Profile option, which will increase the accuracy of the bottom reflectivity data; SIS will calculate the average absorption coefficient through the water column. The absorption coefficient values displayed will change continuously depending upon the depth.

- **Manual:** It is possible to manually specify the absorption coefficient for the relevant frequency. This must be the average absorption coefficient for the water column.

Salinity (parts per thousand): If the source is set to Salinity, the average salinity can be entered in this field.

<frequency> kHz: If the source is set to Manual, the operator may supply an absorption coefficient for the stated frequency. This frequency is as follows for the different echosounders:

EM 120	12.0 kHz
EM 300	31.5 kHz
EM 1002	95.0 kHz
EM 2000	200.0 kHz
EM 3000	300.0 kHz
EM 3002	300.0 kHz

If the source is set to Salinity or CTD, the frequency field is disabled (greyed), but it will show the current value of the absorption coefficient (dB/km) used for the frequency.

Related topics

→ *Handling of SSP datagrams, page 395.*

→ *Implementation of absorption coefficients, page 398.*

→ *The absorption coefficient equation, page 404.*

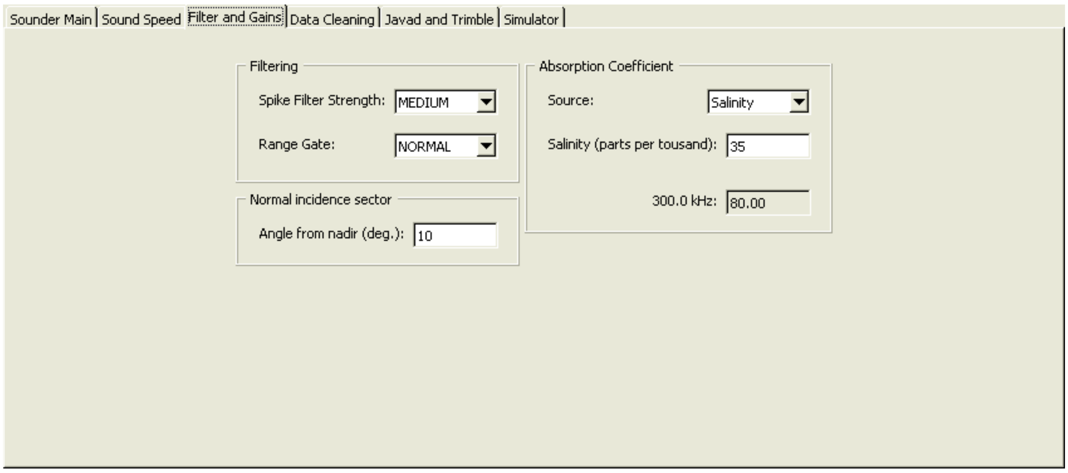
Parameters - Normal incidence sector

Angle from nadir [deg.]: 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. This is to give best use of its dynamic range. The bottom backscatter strengths in the ping display are not affected by this setting.

Filter and Gains (for EM 3002)

Filter and Gains is located on the *Runtime parameters* display view.



Parameters - Filtering

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 use different filter settings than those recommended only if the occurrence of false detections is too high to be acceptable.

The recommended settings are:

- **Spike Filter Strength:** Medium
- **Range gate:** Normal

Spike Filter Strength: Choose between OFF, WEAK, MEDIUM and STRONG.

This 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.

For detection of objects in the water column, like free spans on a pipe line, it might be best to reduce the spike filter strength. Different settings, including spike filter off, should be evaluated by the operator.

Range Gate: Choose between SMALL, NORMAL and LARGE.

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.

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.

Parameters - Absorption Coefficient

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.

The absorption coefficient as a function of the depth must therefore be calculated for the frequency used by the echosounder.

EM3000 and EM3002 may actually use three frequencies. However, these frequencies are in a range where there is very little variation in the absorption coefficients values due to frequency variation. By supplying the absorption coefficient for the middle frequency the two other absorption coefficient values may be deduced locally in the PU.

Source: There are three alternatives for the operator; absorption coefficient based on salinity input (Salinity), absorption coefficient based on profile input (CTD Profile) and manually selected absorption coefficient (Manual):

- **Salinity:** If the source is set to salinity, the average absorption coefficient is calculated using the current sound profile (to find the temperature profile), the depth based on the previous pings and the specified average salinity. The average absorption coefficient will then be calculated by SIS for the relevant frequency and it will be updated and displayed with changing depths. If the salinity in the water is constant, this is the recommended setting.
- **CTD Profile:** The absorption coefficient can be calculated from a sound speed profile that includes information necessary to calculate an absorption profile.

  The sound speed input datagram (SSP) must be used. When using a CTD profile from an SSP datagram, the absorption coefficient profile will automatically be calculated by SIS for the required frequencies.

It is also possible to specify the absorption coefficient directly in the SSP datagram, but then one datagram must be made for each frequency used by the echosounders (i.e. the full range of 12, 31.5, 60, 70, 80, 90, 95, 100, 200 and 300 kHz), and the frequency must be specified in each datagram. These datagrams must have the same acquisition date and time and must be sent with no more than 10 seconds interval.

Using this CTD Profile option, which will increase the accuracy of the bottom reflectivity data; SIS will calculate the average absorption coefficient through the water column. The absorption coefficient values displayed will change continuously depending upon the depth.

- **Manual:** It is possible to manually specify the absorption coefficient for the relevant frequency. This must be the average absorption coefficient for the water column.

Salinity (parts per thousand): If the source is set to Salinity, the average salinity can be entered in this field.

<frequency> kHz: If the source is set to Manual, the operator may supply an absorption coefficient for the stated frequency. This frequency is as follows for the different echosounders:

EM 120	12.0 kHz
EM 300	31.5 kHz
EM 1002	95.0 kHz
EM 2000	200.0 kHz
EM 3000	300.0 kHz
EM 3002	300.0 kHz

If the source is set to Salinity or CTD, the frequency field is disabled (greyed), but it will show the current value of the absorption coefficient (dB/km) used for the frequency.

Related topics

→ *Handling of SSP datagrams, page 395.*

→ *Implementation of absorption coefficients, page 398.*

→ *The absorption coefficient equation, page 404.*

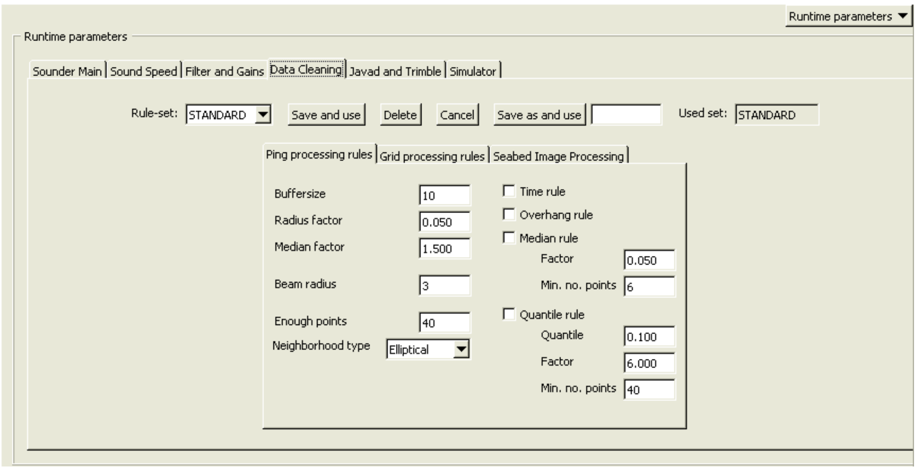
Parameters - Normal incidence sector

Angle from nadir [deg.]: 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. This is to give best use of its dynamic range. The bottom backscatter strengths in the ping display are not affected by this setting.

Data Cleaning

Data Cleaning tab is located under the *Runtime parameters* display view.



The RTDC (Real Time Data Cleaning), uses rules to process the data. A rule is a set of parameters that controls the algorithms used in the processing.

Note

*The RTDC module does **not** delete any depths, but flags that the depths are invalid. The operator has full control of this processing at all times.*

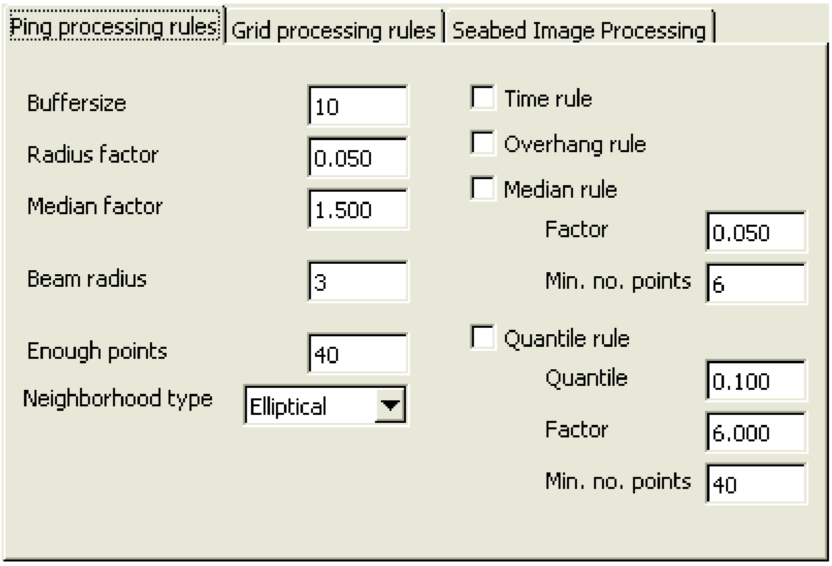
- **Rules set:** The combo box lists all selectable rule sets. When opening the Data Cleaning tab for the first time, only one **standard** rule set is available. This is a rule set with default parameter settings defined by Kongsberg Maritime.
- **Save and use:** To start using a rule set, select it from the **Rules set** combo box. Any modifications to the selected rule set is activated by pressing the **Save and use** button. Note that it is not allowed to modify the standard rule set. Any such modifications must be saved as a new rule set (see the **Save as and use** button).
- **Delete:** Delete a rule set by selecting it from the **Rules set** combo box, then press the **Delete** button. Note that the standard rule set and the currently active rule set can not be deleted.
- **Cancel:** Press this button to cancel any modifications made to a rule set before saving.
- **Save as and use:** If it is required to save modifications to an existing rule set as a new rule set, type a name for this rule set in the text box, then press the **Save as and use** button.

- **Used set:** This box displays the currently active rule set.
- **Help:** Press this button to open on-line help.

The RTDC module processes the data in real time using two different kinds of processing, ping-based and grid-based processing. Ping-based processing uses a buffer of the last pings to process the current ping (also known as line-based processing) while grid-based processing uses all the points from all lines (current and all previous) to process the data in one grid cell. Various parameters are set to control these processing types.

Ping processing rules

Ping-based processing, flags wrong depths as early as possible in the processing chain. Ping processing is performed right after the depths arrive into the RTDC module.

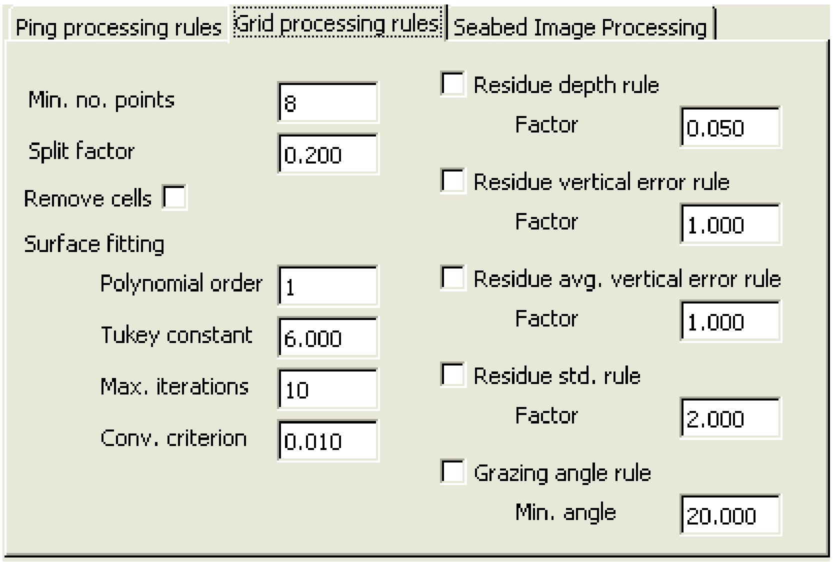


The Time rule and the Overhang rule use the current ping only, but the Median rule and the Quantile rule use several pings stored in a buffer.

The number of pings in this buffer is defined by the parameters; Max. pings in buffer, Radius factor and Median factor. The minimum number of pings is the largest number of pings defined by either Radius factor or Median factor.

Grid processing rules

The grid processing rules are applied to all depths in each grid cell. A grid cell defines an area, and all depths in this area are processed together regardless of which survey line they belong to. Every time a new depth is added to the grid cell, all depths (old and new) in the grid cell are reprocessed. Previous flagged out depths may then be set to valid and vice versa.



The first thing to do is to define the grid cell size. When the gridding starts, the operator has already defined the minimum grid cell size for the processing grid. However, the RTDC module checks if it needs to redefine this grid. It can do so by collapsing several grid cells into larger grid cells. How many cells to process together is dependent on the median depth of the cells and the parameter Split factor.

The parameter Min. no. points defines how many points a grid cell should have. If a cell has fewer than this number of depths, all depths can be flagged out if the checkbutton Remove cells is enabled.

A process grid split into processing units could then look like this:

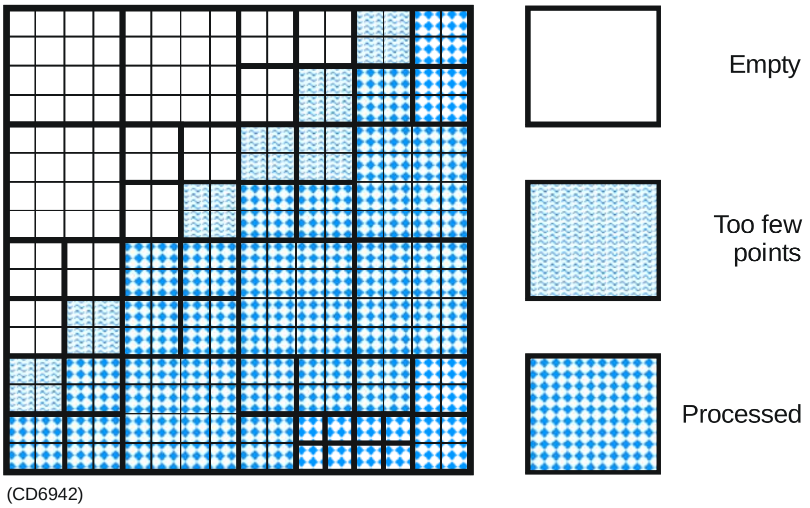


Figure 18 Process grid split into processing units

Then a best fit curved surface is created in each Cell Processing Unit, which may be more than one grid cell). This surface is a polynomial surface and the polynomial order is set by the parameter Polynomial order. The polynomial surface is then created so that it fits as good as possible to most of the point in the Cell Processing Unit.

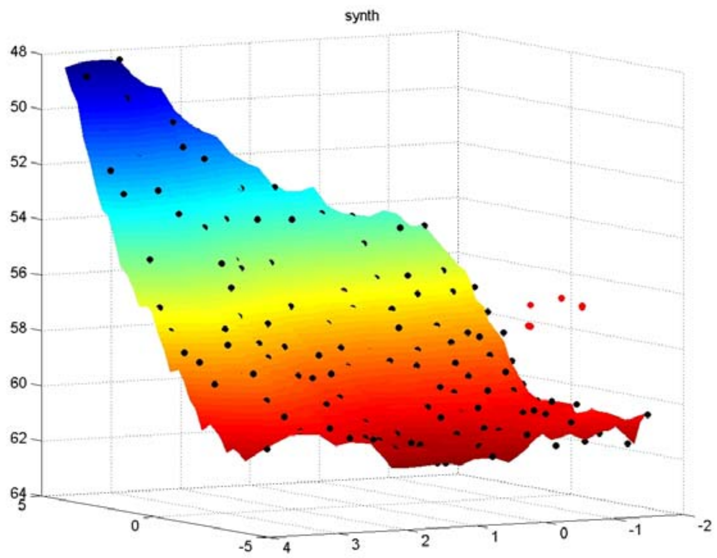


Figure 19 Best fit surface

The algorithm for creating the best-fit surface is known as the Tukey algorithm and it works like this:

Each point is considered to be equally important to begin with. The algorithm assigns a weight to each point and they all get the same weight. Then a polynomial surface is created. The distance from each depth to this surface is called the residual. Then the sum of all the residuals is calculated. Since all points have the same weight, this sum is only the sum of the residuals.

Now the Tukey estimator kicks in. Rather than giving each point the same weight, each point gets a new weight based on how far away from the surface it is. Points far away from the surface get lower weight than the ones close to the surface. The parameter Tukey constant controls how fast points loose their weight. Below are some examples:

Note that the r in the figure below is the median residue in the Cell Processing Unit. As the c (Tukey constant) changes, we see that the curve gets “broader” as c increases and “narrower” as c decreases. This means that points loose weight faster when the Tukey constant is small. The effect of loosing weight fast is that points are not used in the construction of the surface the next time the algorithm tries.

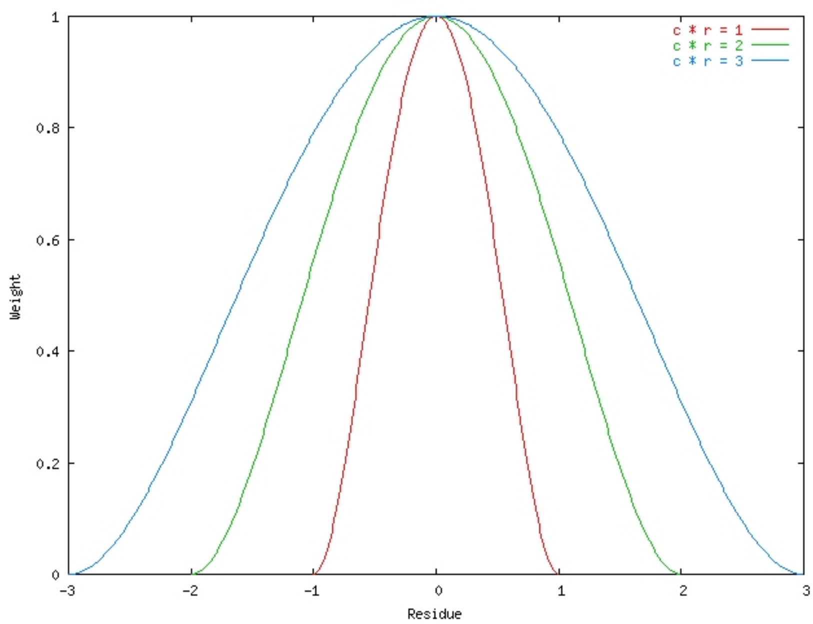


Figure 20 Tukey algorithm

This algorithm will run several times and every time new weights are given to each point. There are two ways this algorithm will stop: Either it has tried Max. iterations times to create a surface, or the change between this and the previous run is very small. If this happens, the algorithm is said to converge, which means that the best possible result has been found. The parameter Conv. criterion controls when the algorithm converges.

To sum this up:

The algorithm for the Iterated Reweighted Least Squares (IRLS) method is given as follows:

1 Start with equal weights for all points.

2 Loop until convergence or maximum iterations

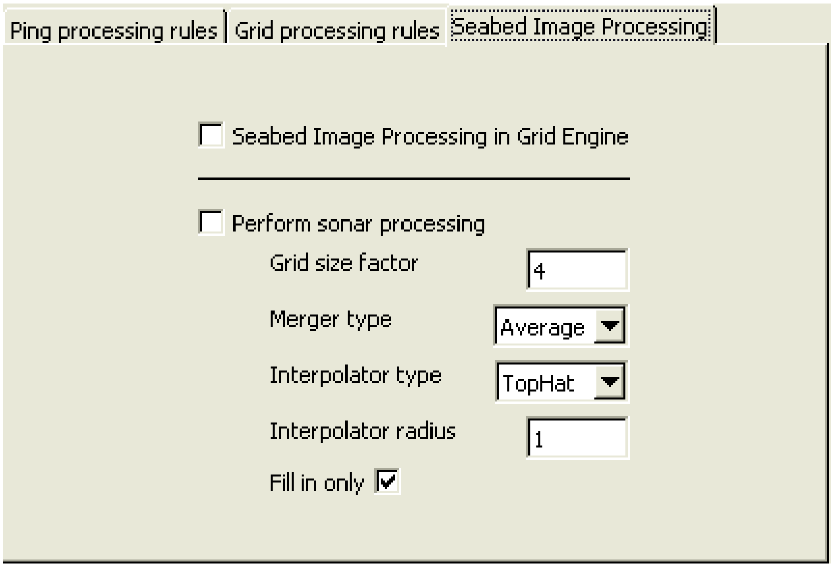
- **a** Fit the surface using weighted least squares.
- **b** Calculate residuals.
- **c** Check for convergence.
- **d** Adjust the Tukey estimator.
- **e** Evaluate new weights.

When the polynomial surface has been successfully created, various rules can be applied to flag out depths.

The distance from the created surface to the depth is called the residue. Four rules can be set to flag out depths based on the residue.

Seabed Image Processing

These parameters apply to the Seabed Image processing in the Grid Engine used by SIS. The Grid Engine is very resource demanding (both CPU and file I/O) and it is desirable to be able to turn off functionality that is not required at all times.



Parameters - Ping processing rules

Radius factor and Median factor defines the minimum number of pings in the buffer.

Buffer size: Defines the maximum number of pings in the buffer. The buffer will contain maximum two times the parameter given plus one ping.

Radius factor: Calculates the minimum number of pings in the buffer.The depth from the center beam is multiplied with this factor, and the result is a distance in the alongship direction. All pings within this distance from the current ping are always in the buffer.

Median factor: Calculates the minimum number of pings in the buffer. The median distance between the last 10 pings is calculated and then multiplied with this factor. Again the result is a distance in the alongship direction and all pings within this distance from the current ping are always in the buffer.

Beam radius: This parameter defines how many beams to either side of the current beam to use in the Median rule and Quantile rule. The number of beams used will be two times the parameter given plus one.

Enough points: If the algorithm finds this many points close to the current one, it will stop looking any further. In the example rule above 40 points are said to be enough. These 40 points will then be the ones closest to the current point.

neighbourhood type: Choose between Elliptical, Rectangular and Circular neighbourhood.

When looking for points closest to the current point, the algorithm can use three different methods for finding the nearest points to the current point. *Circular neighbourhood* uses Radius factor and Median factor to find all points within a horizontal radius of the current point. Points in the same ping are excluded. *Elliptical neighbourhood* uses two half axis, one in the alongship direction and one in the across-ship direction. To maintain approximately the same number of points in the neighbourhood independent of the beam number, this method adapts the half-axis in the across-ship direction so that it includes at least a specified number of beams (but not much more). Beam radius is used to define this half-axis. In the alongship direction the half-axis is the same as for the *Circular neighbourhood*. Points in the same ping are excluded. *Rectangular neighbourhood* consists of all points in the rectangle defined in the alongship direction by the number of pings in the buffer and in the across-ship direction by Beam radius. Again points in the same ping are excluded.

Time rule: This rule flags out beams where the time range is bigger than the time difference between two pings as illustrated in the figure below.

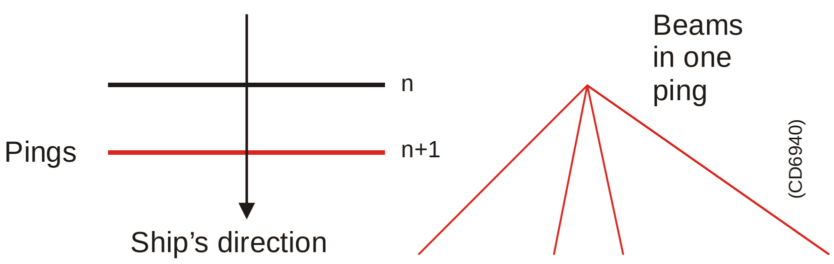


Figure 21 Time rule

If the rightmost beam has a traveltime longer than the time difference between the current (n+1) ping and the previous, that beam is flagged out.

Overhang rule: This rule flags beams that create an overhang situation, illustrated in the figure below.

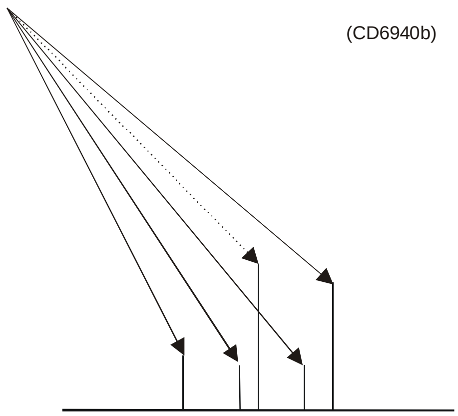


Figure 22 Overhang rule

It is not uniquely determined which beams should be flagged to remove the overhang. In the figure, it is for example possible to flag either the dotted beam or the beam to the left of the dotted beam. The strategy implemented is to consider the alternatives that imply flagging the fewest number of beams, and to keep the points that are most likely to define the ground by minimizing the length of the distances between the depths in the ping. If necessary, more than one beam is flagged to remove the overhang.

Median rule: First we calculate the depth differences between the point and all its neighbours. Then the median of these depth differences is found. Then we compare this median to the depth of the point. If this median depth difference is bigger than the depth multiplied with the scaling factor, the depth is flagged out. Also the minimum number of points in the neighbourhood for this rule to apply is set.

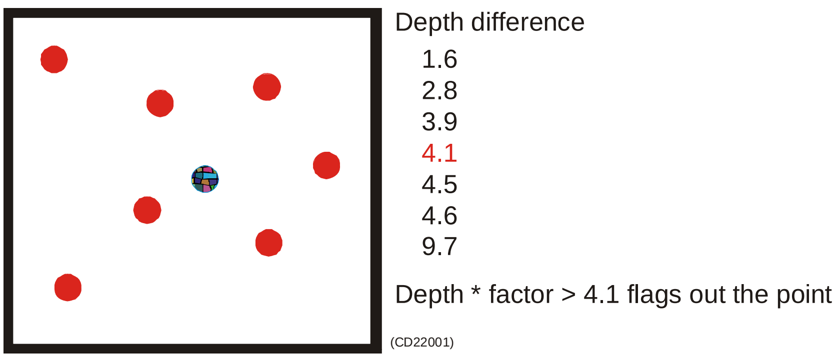


Figure 23 Median rule

The parti-coloured point is the point to be investigated. The red (one-coloured) points are the points in the neighbourhood. The median of the depth differences is 4.1, so if the depth multiplied with Factor is larger than 4.1, the blue point is flagged as invalid.

Quantile rule: First we find the median depth among the depths in the neighbourhood. Then we find the two quantiles defined by the parameter Quantile. If i.e. the quantile is defined to be 0.1, we find the depth in the neighbourhood where 90% of the depths are shallower and 10% are deeper, and this depth is then quantileDepthMax. We also find the other depth where 10% of the depths in the neighbourhood are shallower and 90% are deeper, and this is then quantileDepthMin. Then we define two limits like this: median depth - Factor * (median depth - quantileDepthMax) and ditto for quantileDepthMin. If the depth of the point is outside these limits, it is flagged out.

Depths

10.1

10.4 Lower quantile

10.5 Point to investigate

10.8 Median depth

11.1

12.4 Upper quantile

13.2

Lower limit: 10.8 + factor * (12.4 - 10.8)

Upper limit: 10.8 - factor * (10.8 - 10.4)

Parameters - Grid processing rules

Min. no. points: Defines how many points a grid cell should have.

Split factor: Defines how many cells to process together. (This is also dependent on the median depth of the cells.)

Remove cells: The parameter Min. no. points defines how many points a grid cell should have. If a cell has fewer points than the minimum number defined, all depths can be flagged out if this checkbutton is enabled.

Surface fitting: Sets parameters for a best fit plane. Note that these parameters are discussed in detail in the *Grid Processing* paragraph above.

- **Polynomial order:** This parameter controls the shape of the surface. This parameter should normally be 1, but 2 may give a better surface but it requires much more processing power. 3 may be used in very difficult terrain.

- **Tukey constant**: This parameter controls the weight each point will be given. Increasing this value means that more points will be given a weight and considered into the solution, but the process will be slower.
- **Max. iterations:** This parameter controls how many times the Tukey algorithm will try to find a solution. 1 means that there will be only one pass, but after 3 passes the surface is normally well defined. The search for a solution will stop when the algorithm has tried Max. iterations times.
- **Conv. criterion:** This parameter will stop the Tukey algorithm when the change in the results from the current and the previous run is very small. Only points with weight are considered, so the Tukey constant will have an influence on this.

Residue depth rule: Each depth in the Cell Processing Unit is multiplied with a Factor. The result is a limit, and if the residue is larger than this limit, the point is flagged out.This rule will adapt to changing depths so that the factor should be approximately the accuracy of the echosounder.

Residue vertical error rule: Each depth has a vertical error estimate. This error estimate is multiplied with Factor and the result is a limit. If the residue is larger than this limit, the point is flagged out. This rule is also adaptive because the vertical error will change with the range and beam pointing angle.

Residue vertical avg. error rule: In each cell the avereage vertical error is calculated, and the average vertical error for the Cell Processing Unit is then calculated. Then a limit is calculated from this average vertical error in the Cell Processing Unit multiplied with Factor. If the residue is larger than this limit, the point is flagged out. Note that it is the average vertical error for the Cell Processing Unit that is used, not the cell's value.

Residue std. rule: The standard deviation of the residues is also calculated. This is the standard deviation in the Cell Processing Unit, not the cell. A limit is then set by multiplying Factor to this standard deviation. Residues larger than this limit are flagged out.

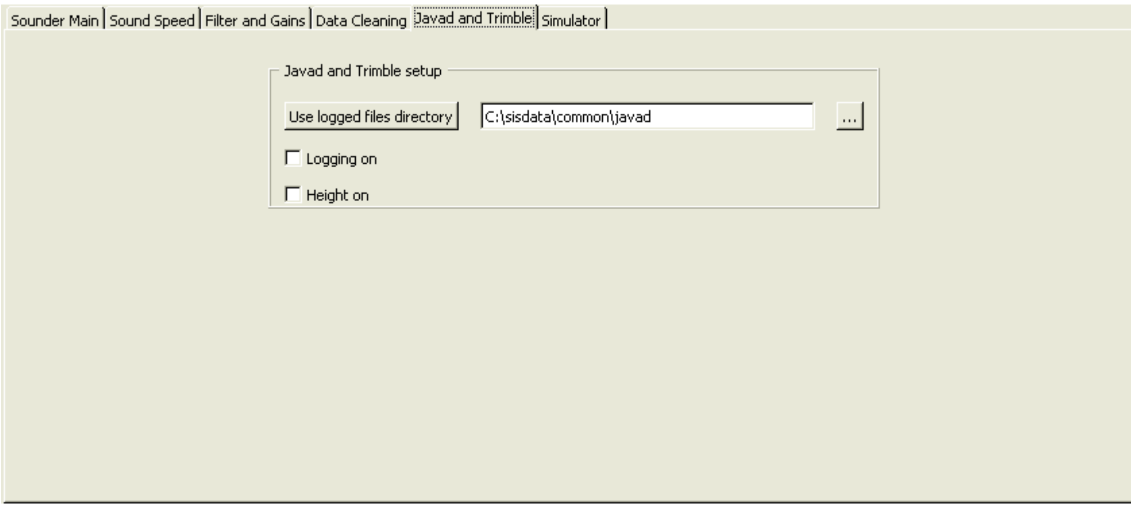
Grazing angle rule: For each depth the angle between the beam and the bottom surface is calculated. Then the parameter Min. angle can be set and all depths where the angle is less than this limit are flagged out.

Parameters - Seabed Image Processing

To be defined.

Javad and Trimble

Javad and Trimble are located on the Runtime parameters display frame.



Parameters - Javad and Trimble setup

Use logged files directory: This parameter allows you to select where the raw data files logged by Javad or Trimble should be stored. To specify the directory, use the browse button […] to find or make the relevant directory. When the directory has been specified it can be set by using the ’Use logged files directory’ button whereby the Javad/Trimple system is informed.

Note — *Note that the Javad/Trimble directory initially has a default setting (it is initially displayed in the text field and it is also highlighted in the directory structure when the browse button is pressed).*

Logging on: This tick button is used to turn Javad or Trimble logging on or off. Logging is on when ticked.

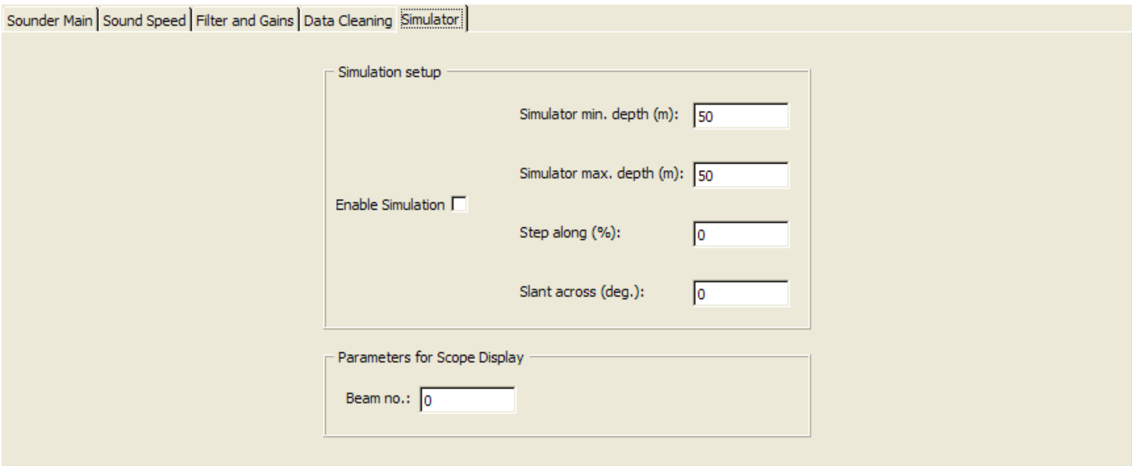
Height on: This tick button is used to turn fixed height on or off. Fixed height is on when ticked.

Note — *The “Use logged files directory“ operation also transmits the ’Logging on’ status to Javad/Trimble. In the same way the ’Logging on’ operation transmits the directory information. The “Height on“ works independently of the other two operations.*

→ *For more information on Javad and Trimbel, see page 458.*

Simulator (for EM 120, EM 300, EM 1002 and EM 3002)

Simulator is located under the *Runtime parameters* display view.



Parameters - Simulation setup

Enable Simulation: Select this parameter to enable simulation mode in the echo sounder.

Simulator min. depth (m): Set the minimum depth for simulation.

Simulator max. depth (m): Set the maximum depth for simulation.

Note

The simulation generates range samples only. All other inputs to the PU (Processing Rack in the Transceiver Unit) must be supplied via the normal PU input ports. Most important is the position data and roll, pitch and heave (i.e. attitude data).

Step along (%): The change in depth between each ping given in percent. The depth will vary within the set min/max range.

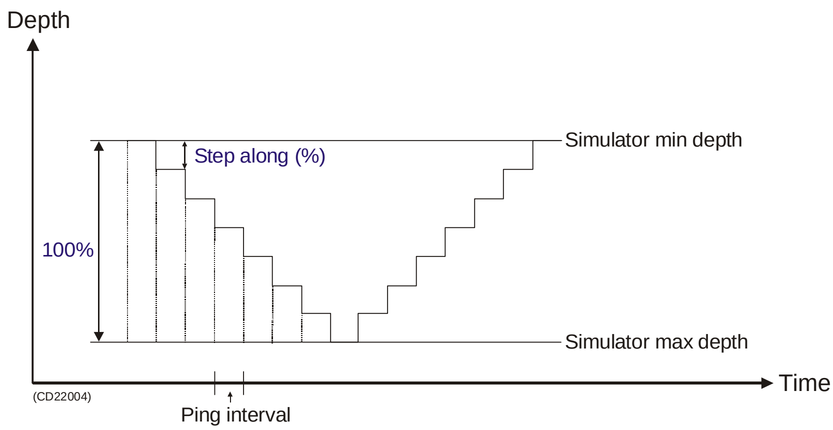


Figure 24 Step along

Slant across (deg.): The tilt of the sea bottom across track in degrees.

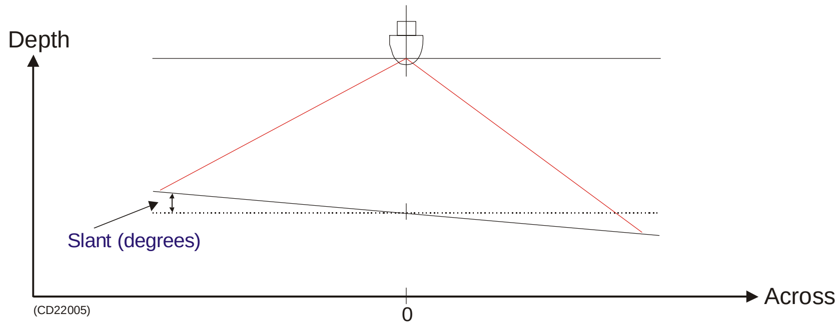


Figure 25 Slant across

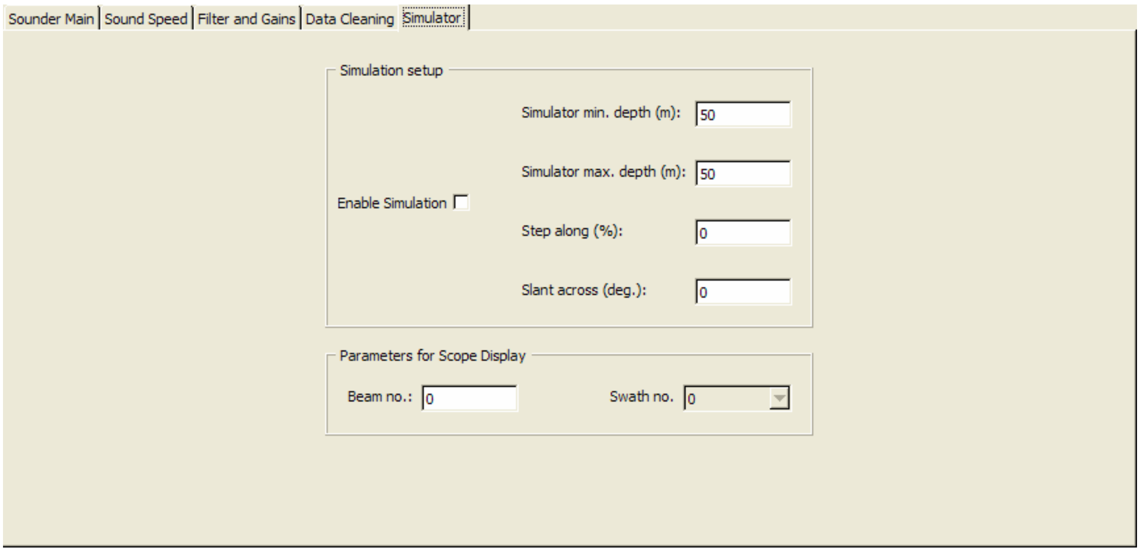
Parameters - Beam no. for Scope Display

Beam no.: Set beam number to be displayed in the Scope Display.

Set beam number to zero (0) if you want to turn off this feature.

Simulator (for EM 710)

Simulator is located under the *Runtime parameters* display view.



Parameters - Simulation setup

Enable Simulation: Select this parameter to enable simulation mode in the echo sounder.

Simulator min. depth (m): Set the minimum depth for simulation.

Simulator max. depth (m): Set the maximum depth for simulation.

Note

The simulation generates range samples only. All other inputs to the PU (Processing Rack in the Transceiver Unit) must be supplied via the normal PU input ports. Most important is the position data and roll, pitch and heave (i.e. attitude data).

Step along (%): The change in depth between each ping given in percent. The depth will vary within the set min/max range.

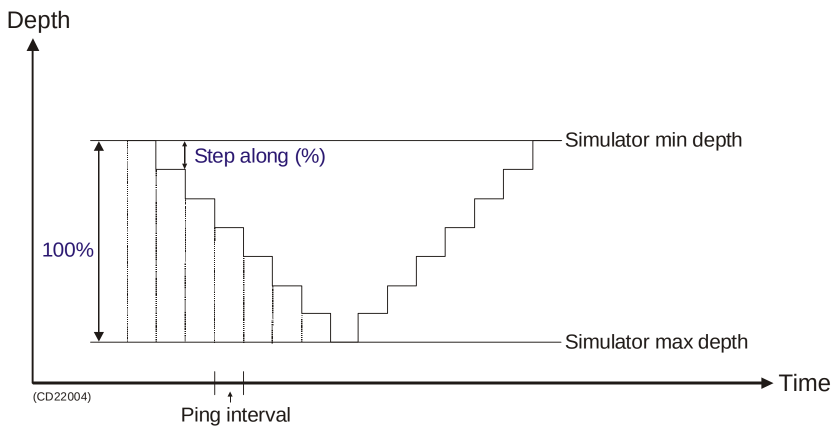


Figure 26   Step along

Slant across (deg.): The tilt of the sea bottom across track in degrees.

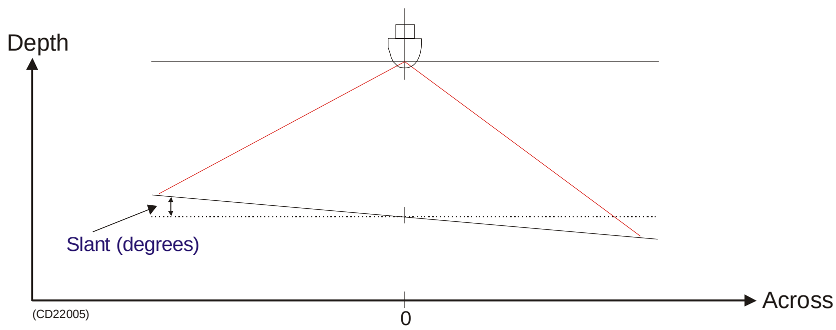


Figure 27   Slant across

Parameters - Beam no. for Scope Display

Beam no.: Set beam number to be displayed in the Scope Display.

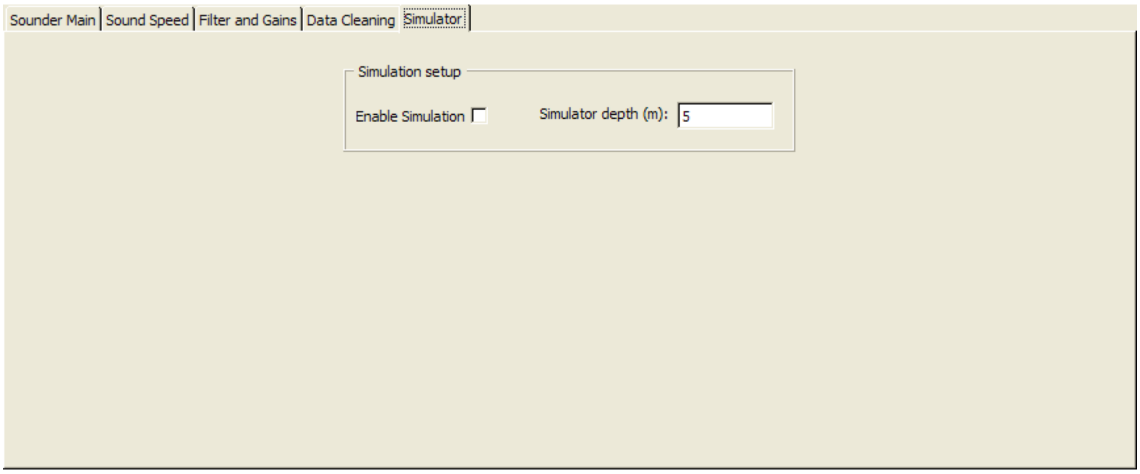
Set beam number to zero (0) if you want to turn off this feature.

Swath no.: Set which swath to be displayed. This feature is only available for an EM 710 configuration with a 0.5° transmit and 1° receive transducer, as this system can generate two separate alongtrack swaths per ping.

Set swath number to zero (0) if you want to display the foremost swath.

Simulator (for EM 3000)

Simulator is located under the *Runtime parameters* display view.



Parameters - Simulation setup

Enable Simulation: Select this parameter to enable simulation mode in the echo sounder.

Simulator depth (m): Set the simulated depth (used for the simulation).

Note

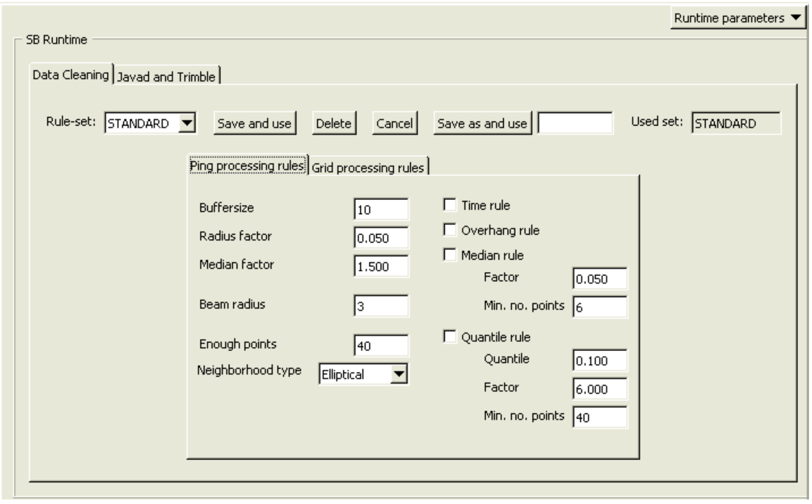
The simulation generates range samples only. All other inputs to the PU (Processing Unit) must be supplied via the normal PU input ports. Most important is the position data and roll, pitch and heave (i.e. attitude data).

Note

The (simulated) ping frequency will be reduced as the processing capacity in the Sonar Head will be used to generate depth data. Keep the depth small, the defalut value of 5 meters is recommended.

Singlebeam Runtime

The **Singlebeam Runtime** tab is found under *Runtime parameters* display view for single beam echo sounders.



The RTDC (Real Time Data Cleaning), uses rules to process the data. A rule is a set of parameters that controls the algorithms used in the processing.

Note

The RTDC module does ***not*** *delete any depths, but flags that the depths are invalid. The operator has full control of this processing at all times.*

- **Rules set:** The combo box lists all selectable rule sets. When opening the Data Cleaning tab for the first time, only one **standard** rule set is available. This is a rule set with default parameter settings defined by Kongsberg Maritime.
- **Save and use:** To start using a rule set, select it from the **Rules set** combo box. Any modifications to the selected rule set is activated by pressing the **Save and use** button. Note that it is not allowed to modify the standard rule set. Any such modifications must be saved as a new rule set (see the **Save as and use** button).
- **Delete:** Delete a rule set by selecting it from the **Rules set** combo box, then press the **Delete** button. Note that the standard rule set and the currently active rule set can not be deleted.
- **Cancel:** Press this button to cancel any modifications made to a rule set before saving.

- **Save as and use:** If it is required to save modifications to an existing rule set as a new rule set, type a name for this rule set in the text box, then press the **Save as and use** button.
- **Used set:** This box displays the currently active rule set.
- **Help:** Press this button to open on-line help.

The RTDC module processes the data in real time using two different kinds of processing, ping-based and grid-based processing. Ping-based processing uses a buffer of the last pings to process the current ping (also known as line-based processing) while grid-based processing uses all the points from all lines (current and all previous) to process the data in one grid cell. Various parameters are set to control these processing types.

Ping processing rules

→ *Refer to page 262.*

Grid processing rules

→ *Refer to page 263.*

Parameters - Ping processing rules

→ *Refer to page 267.*

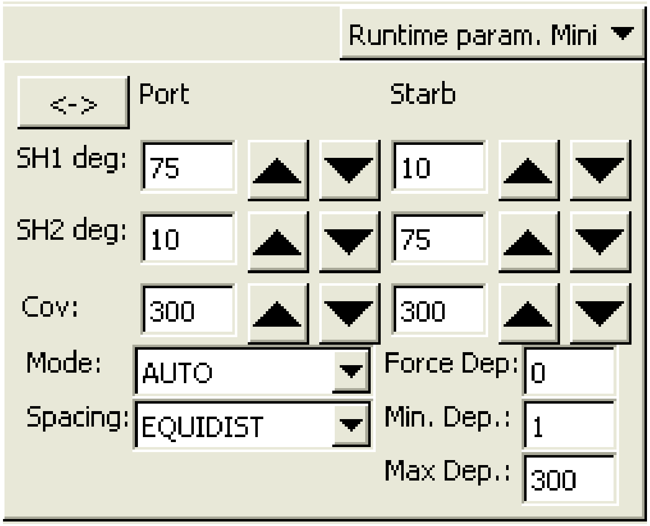
Note that the *Time* rule and the *Overhang* rule are not used by single beam echo sounders.

Parameters - Grid processing rules

→ *Refer to page 270.*

4.21 Runtime parameters Mini

The Runtime param. Mini window is either accessed through the Manage windows on the View drop-down menu or by selecting it from the Frames button.



Upp/down buttons

The up/down buttons have two modes: single press or continuous. By pressing and releasing the button once, the associated parameter is incremented/decremented by one, as expected. By pressing and holding the button, the associated parameter will be continuously updated.

When the parameters are changed, the background is marked using yellow colour. Press enter on the keyboard, or make a selection in a combo box, to confirm and send the parameters to the echo sounder (PU).

Note

when using the buttons in continuous mode no range checking will be made on the changed parameter values. The parameters can therefore be set outside legal bounds. However, when the button is released and the operator presses enter to confirm or does a single press on the same button or starts editing another parameter, an error message will pop up, if required.

Mini and full Runtime parameters frame synchronization

The mini window can be displayed together with the full Runtime parameters window. If a change is made and confirmed in one window the other window will be updated automatically, keeping the windows synchronised.

Parameters

The parameters displayed in the mini window are from the Sounder Main tab in the full Runtime parameters window.

→ *Sounder Main on page 201.*

4.22 Calibration

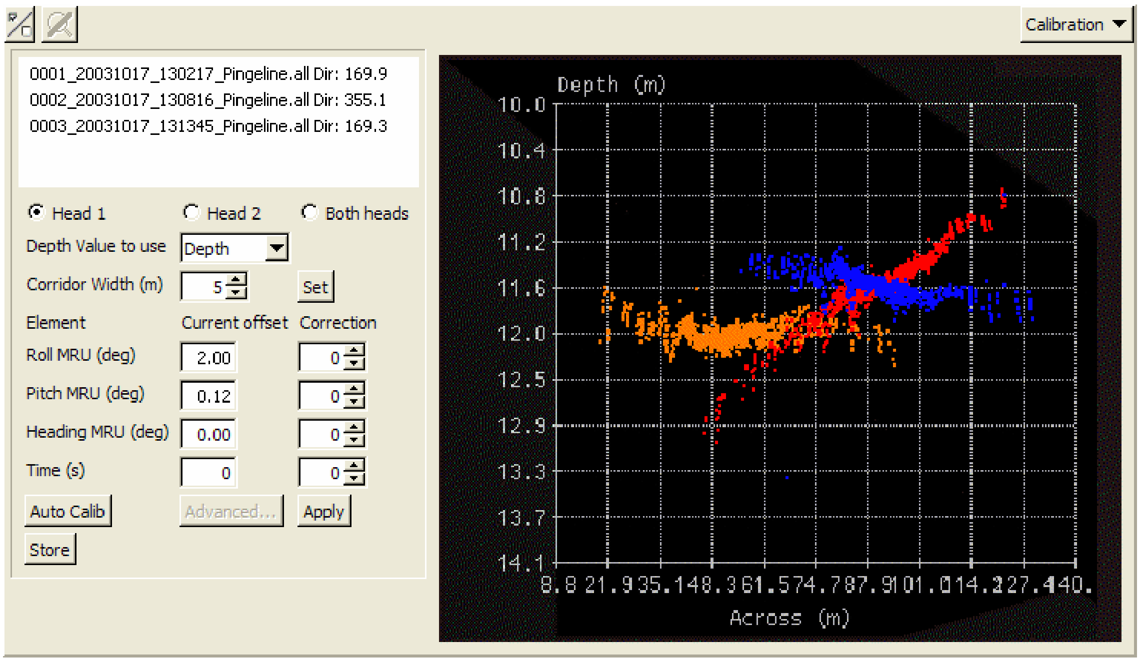
The **Calibration** window is either accessed through the *Manage windows* on the *View* drop-down menu or by selecting it from the **Frames** button.

The Calibration window is 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, heading and time offsets to see the consequences on the computed depth values. It can be used during online and offline operations.

→ *Calibration survey, page 49.*

Remember that you have to activate the Calibration window through the Geographical window before starting to use it. Press the **Show/Hide** button for the **Geographical** frame and select Calibration. A button with the letter C will turn up on the frame toolbar. Press the **C** button to activate the Calibration window.

This window is valid for multibeam echo sounders only.



Calibration will only work with two or more selected lines in a survey. These lines have to be selected in the survey display before the Calibration window is opened.

To select lines, first ensure that the **Stored Shipstracks** is turned on and that the **C** button on the Geographical toolbar is pressed. If more than one Survey is loaded, select from the Survey List box which survey to use. Hold in the Ctrl key and left click the lines to select them.

You must define a **calibration corridor**. Data from two or more lines inside this corridor will be analyzed. To create a corridor hold down the Control key and left click where you want the corridor to start and release the button. Move the cursor to the end of the corridor and hold down the Control key and left click to mark the end of the corridor. Remenber to select lines before you create a corridor.

When a corridor has been selected, the calibration module will read in raw data and display the data in a diagram. The attitude offsets in the selected files are shown, not the current ones in the Installation parameters. Take care to check that the lines used for calibration have been run with the same parameters as the current ones in the Installation parameters.

The system will use data within the corridor, which represents all points within a specified distance from a calibration line. The data will be displayed using a two-dimensional diagram 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 window you can change the relevant sensor offset and see its effect on the depths shown. The offset value that gives the best fit between 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.

To change an offset, enter a value in the appropriate field or press the spin buttons, then press "**Apply**" to calculate and display the data points.

To change the corridor width, enter a new value and press "**Set**".

If you select a new corridor, the previously used offsets will be applied and corrected data will be displayed in the diagram.

When you are satisfied with the calibration results, press the "**Store**" button to save the new offsets in the database. You must reapply the Installation parameters from the Installation parameters window to use the new settings.

Calibration 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.

Parameters

The following calibration parameters may be set:

- **Depth Value to use:** Choose between Depth, Tide Corr. Depth, Depth ref. vref.
- **Corridor width (m):** Use the slidebar or the textfield to give a new value. Press Set to activate.
- **Roll MRU (deg):** Use the slidebar or the textfield to give a new value. Press Apply to activate.
- **Pitch MRU (deg):** Use the slidebar or the textfield to give a new value. Press Apply to activate.
- **Heading MRU (deg):** Use the slidebar or the textfield to give a new value. Press Apply to activate.
- **Time (ms):** Use the slidebar or the textfield to give a new value. Press Apply to activate.

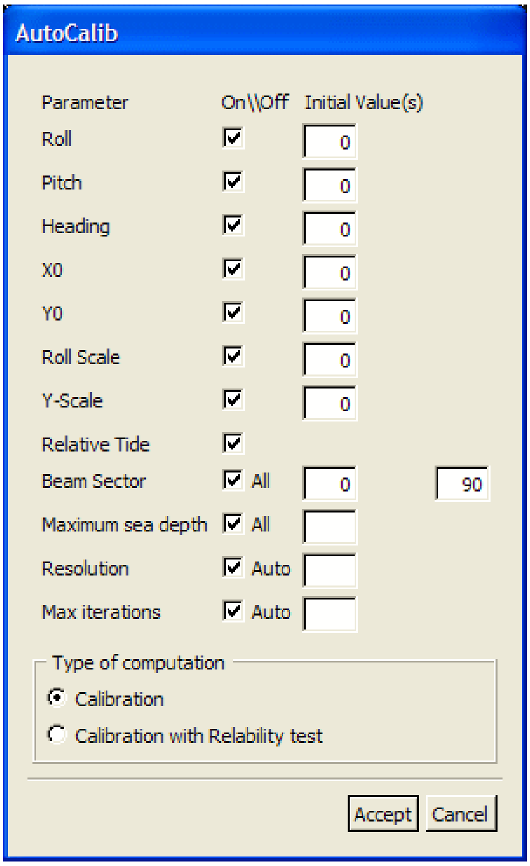
Note

The Current offsets fields cannot be changed and are used to display the offset values used when the data was logged.

Buttons

- **Head 1 / Head 2 / Both heads:** Select the sonar head(s) to be calibrated.
- **Set:** Apply changes to the corridor width.
- **Apply:** Calculate and display the data points after setting new offsets.
- **Store:** Save the new offsets in the database.
- **Advanced...:** This button is reserved for future use.
- **Auto Calib:** If licensed this button brings up the dialogue to enter parameters to be used by **SeaCal**.

→ *SeaCal, page 430.*



The following Auto Calib parameters can be entered:

- Roll
- Pitch
- Heading
- X0 (translation alongships)
- Y0 (translation athwartships)
- Roll Scale
- Y-Scale
- Relative tide
- Beam sector
- Maximum sea depth

For each parameter to be used, the corresponding On/Off button must be checked.

Resolution: The resolution of the grid model applied in the calculation affects the computing time. The “Auto” option asks SeaCal to compute the resolution, but you can also define the resolution manually.

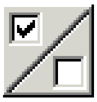
Max Iterations: Usually, SeaCal needs two or more iterations to compute the calibration. You can define the maximum number of iterations manually, or you select “Auto”, i.e., SeaCal iterates until the solution is stable.

Type of computation: It is also possible to select calibration with or without a reliability test. It is recommended to run this test, as it gives a comprehensive control of the calibration.

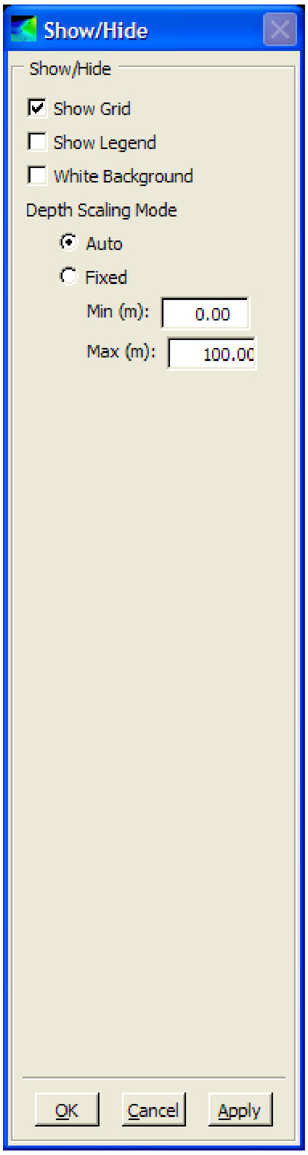
Toolbar button

The toolbar holds the following button:

- Show/hide



Show / Hide button



Show grid: Show or hide the grid.

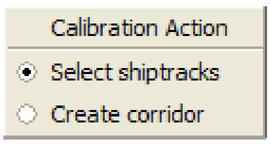
Show legend: Show or hide the legend.

White background: Make the background white.

Depth Scaling mode: Options for controlling the scaling mode for the depth axis.

- Auto - Automatically adjust the start and stop ranges to show the entire range of data each time data is received.
- Fixed - Use the start and stop ranges entered in the min and max text boxes.
  - Min (m): “Fixed” start (min) range in meters.
  - Max (m): “Fixed” stop (max) range in meters.

Quick menu



The Calibration window have a quick menu accessed by clicking on the right mouse button inside the view.

- Select shiptracks - First select two lines using Ctrl + Left mouse button.
- Create corridor - Then create a corridor using Ctrl + Left mouse button.

The system will now calculate and display the two lines from raw data. For a dual system one head at a time must be calibrated.

5 MENU SYSTEM

5.1 Introduction

The menu system of the SIS program is designed the same way as most Windows™ compatible software. The main menu on the top of the application window provides access to a number of drop-down menus.

Parameters are accessed through different parameter sheets and tab areas.

→ *Main menu, page 288*

→ *Toolbars, page 339*

5.2 Main menu

The main menu is located on the top. It provides the following choices:

→ *File menu, page 289*

→ *View menu, page 303*

→ *Tools menu, page 309*

→ *Help menu, page 328*

→ *Geographical menu, page 333 (for Geographical window only)*

5.3 File drop-down menu

The File drop-down menu gives you the following choices:

→ *Import/Export..., page 290.*

→ *Save Settings, page 296.*

→ *Save Settings As..., page 297.*

→ *Delete Setting, page 298.*

→ *Print Setup..., page 299.*

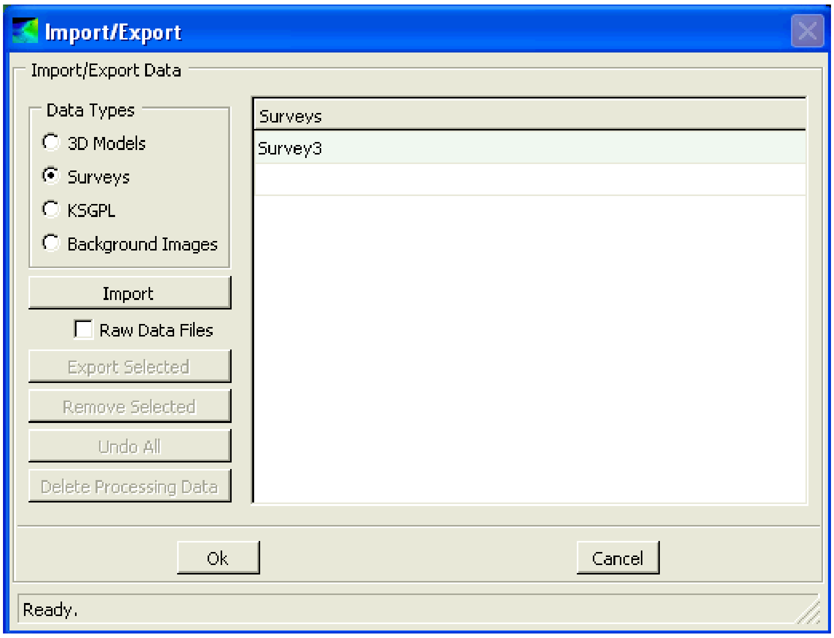
→ *Save PU parameters, page 300.*

→ *Import PU parameters, page 301.*

→ *Quit, page 302.*

Import/Export...

The **Import/Export...** is accessed from the *File* drop-down menu.



The following options are available in the Import/Export dialogue:

- **Datatypes:** The following datatypes can be imported:
  - 3D Models: The user can import AutoCAD (*.dxf), Inventor (*.iv) or VRML (*.wrl).
  - Surveys: The user can import either raw data files or already gridded data.

Note

It is possible to reprocess data based on user defined rules if importing raw data files.

  - KSGPL: The user can import background KSGPL files (*.bgksgpl).
  - Background Images: Imports background images.
- **Import...:** Press this button to import data (more details below).
- **Raw Data Files:** Check this box to import raw data files.
- **Export Selected:** Press this button to export data (more details below).
- **Remove Selected:** Loaded or 'set to be loaded' data can be unloaded by selecting the listed data items to the right and clicking this button.

Note — *No files will be deleted on disk even if e.g. a survey has been reprocessed.*

Note — *KSGPL background data can not be unloaded!*

- **Undo All:** Undo actions.

Note — *No files will be deleted on disk even if e.g. a survey has been reprocessed.*

- **Delete Processing Data:** A gridded survey consist of many different file types. One of these are called Processing Files and are used internally when crating a new grid or adding to an existing one. These files may use a lot of memory and hard-disk space, but are generally not needed if the survey is “closed” and used for visualisation only. Thus the Processing Data can be deleted. This is done by selecting the loaded surveys to be handled and pressing the “Delete Processing Data” button.
- **Background Images:** Background images can be imported by selecting the “Background Images” radio button and pressing the “Import” button. This will launch a dialog box where you can import a GeoTIFF file. This is an ordinary TIFF image file with the goreference information in the TIFF file header, and will be shown on the screen.

Note — *A background image can only be imported when a suvey is loaded.*

Note — *The Delete Processing Data and the Background Images will only be enabled if at least one of the given surveys is linked to Processing Data.*

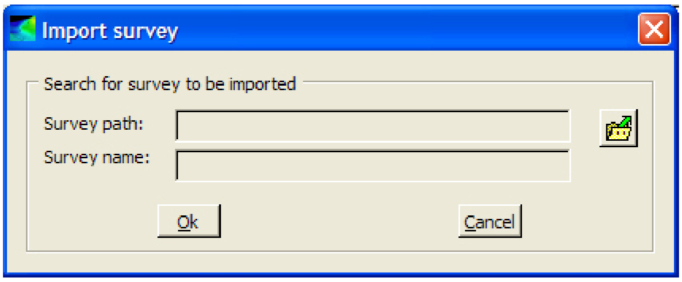
Press **Ok** to apply.

Press **Cancel** to abort.

Import of the different datatypes

Pressing the **Import...** button will launch the corresponding import dialogue box.

- **3D Models:** Browse for the wanted 3D model file(s). Please wait some time to allow the 3D model to be processed. This may take a while dependent on the size of the file. The imported 3D model(s) will be listed to the right if successfully processed/loaded.
- **Surveys (already gridded):** Browse for the directory where the already gridded survey is located.



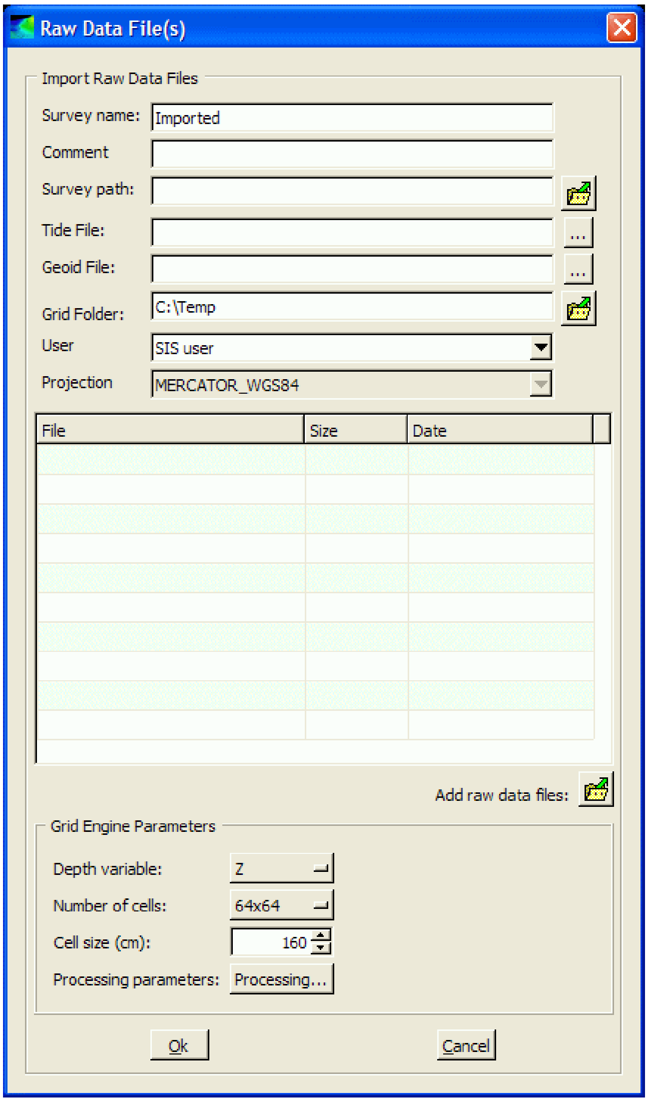
Note

The grid may fail to be loaded if the GridEngine is not up running or if a valid license is not present.

Press **Ok** to apply.

Press **Cancel** to abort.

- **Surveys (Raw Data files):** Raw data files can be reprocessed/gridded with different settings.



- Import Raw Data Files field
  - **Survey name:** Name of the survey to be gridded.
  - **Comment:** Write your own comment for the survey in the text field.
  - **Survey path:** Browse for a directory with raw data files to be processed. These files will be listed in the list box further down. Raw data files can also be added one by one by pressing the **Add raw data files** button.
  - **Tide File:** Browse for tide file to be used, if any.
  - **Geoid File:** Browse for geoid file to be used, if any.
  - **Grid Folder:** Browse for single raw data files to be processed. Raw data files can also be added by pressing the **Survey path** button.
  - **User:** Select a user from the combo box. To add new user(s), you must use the *User handling*.

    → *User handling, page 147.*
  - **Projection:** Select a projection from the drop-down combo box. If a projection already has been set in the *New survey* display view, this field is greyed out.

    → *New survey, page 134.*
- GridEngine Parameters field
  - **Depth variable:** Which depth value to be processed.
  - **Number of cells:** Number of cells in one sub grid used by the GridEngine. The numbers of cells must be a power of 2 and between 16 and 512.

  * **Cell size (cm):** Size of each cell in the lowest (the most detailed) level of detail. Min = 10 cm, max = 50,000 cm.
  * **Processing parameters:** See the *Data Cleaning* chapter.

    → *Data Cleaning, page 261.*

Press **Ok** to apply.

Press **Cancel** to abort.

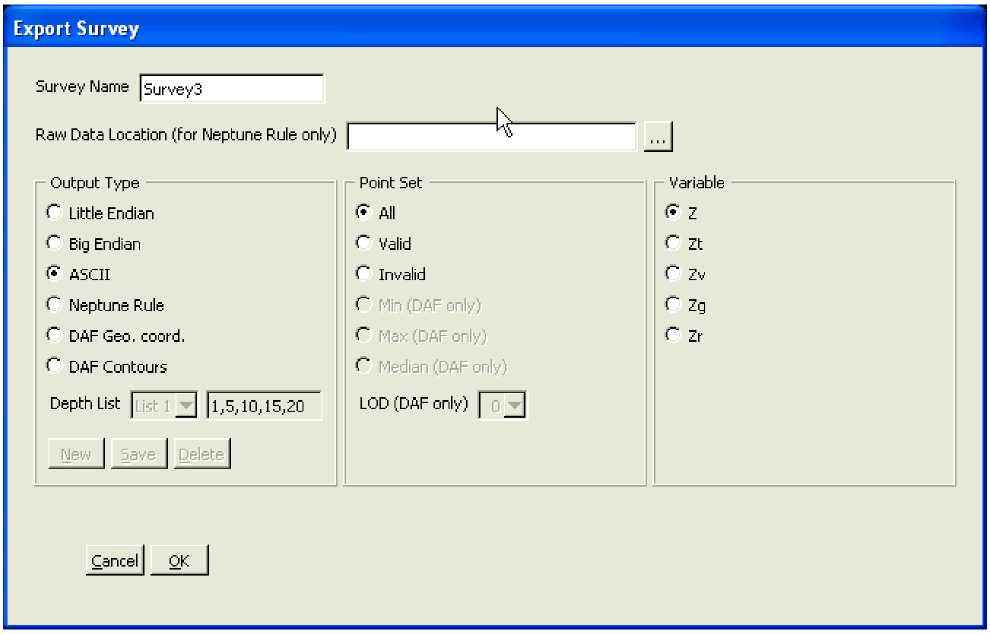
- **KSGPL:** Browse for the wanted KSGPL background file.

Note

One KSGPL file may override any other currently loaded KSGPL data.
KSGPL background data can not be unloaded!

Export of the selected data files

First select the survey data to be exported. Then pressing the **Export...** button will launch the Export Survey dialogue box.



Survey name: Name of the survey to be exported.

Raw Data Location: Browse for the disk location where the raws data files (.all files) are stored for the current survey. This is only needed for export of a Neptune Rule file.

Output Type field: Select output type of the data to be exported to file. The options are:

- **Little Endian:** Binary PC format file. See the *Export formats* chapter.

→ *Export formats, page 380.*

- **Big Endian:** Binary Unix format file. See the *Export formats* chapter.

→ *Export formats, page 380.*

- **ASCII:** Format details are written into the file itself.
- **Neptune Rule:** Create a rule file to be imported into Neptune post-processing. This setting overrides the Point Set and Variable settings.
- **DAF Geo. coord:** Creates a ASCII file with geographical coordinates in DAF format.
- **DAF Contours:** Creates at an ASCII file with contour lines in DAF format.

Note

*When exptorting **DAF formats** the only available Point Set choices are Min, Max or Median.*

Point Set field: Select if all, valid or invalid points will be exported.

Variable field: Select which Depth value will be exported. See the Depth settings in the *Geographical window* and the *Geoid* chapter.

→ *Geographical, page 67.*

→ *Geoid, page 409.*

Press **Ok** to apply.

Press **Cancel** to abort.

DAF Export

When exporting either of the DAF format, three additional Point Set variables are enabled. Select one of these to create the file. Also one can select which LOD to read data from.

When selecting DAF Contours, you must select how to create the contours. Select from the depth list or edit or create a new set.

For instance, one can select to create contours at 1, 5,10 and 15 meters, every 2 meters, every 5 meters and so on. The predefined sets can be altered or new ones can be added by editing the right-most Depth List field and pressing New or Save. Pressing Delete removes the selected set.

DAF contours can be displayed in Neptune and other applications that supports the DAF format.

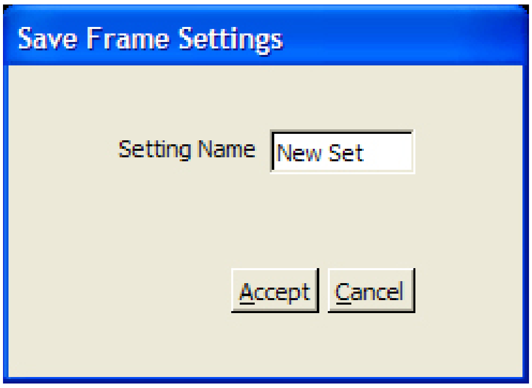
Save Settings

The **Save Settings** is accessed from the *File* drop-down menu. It will automatically save the current survey settings.

If the current survey settings cannot be saved under the chosen name, you are prompted to use the **Save settings as...** option.

Save Settings As...

The **Save Settings As...** is accessed from the *File* drop-down menu.



You can choose to save different survey setting combinations by giving them different names.

Press **Accept** to add the new survey setting.

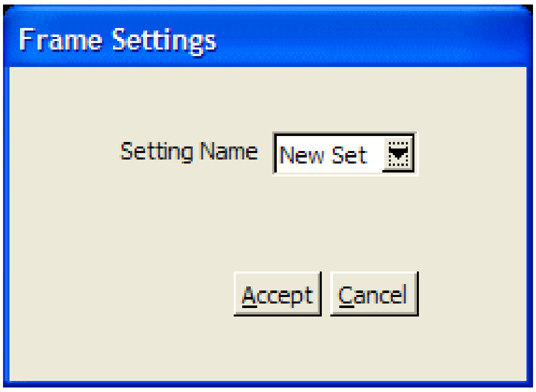
Press **Cancel** to abort.

Delete Setting

The **Delete Settings** is accessed from the *File* drop-down menu.

This is used to delete one of your predefined survey setting combinations.

Setting Name: Select the survey setting to be deleted.

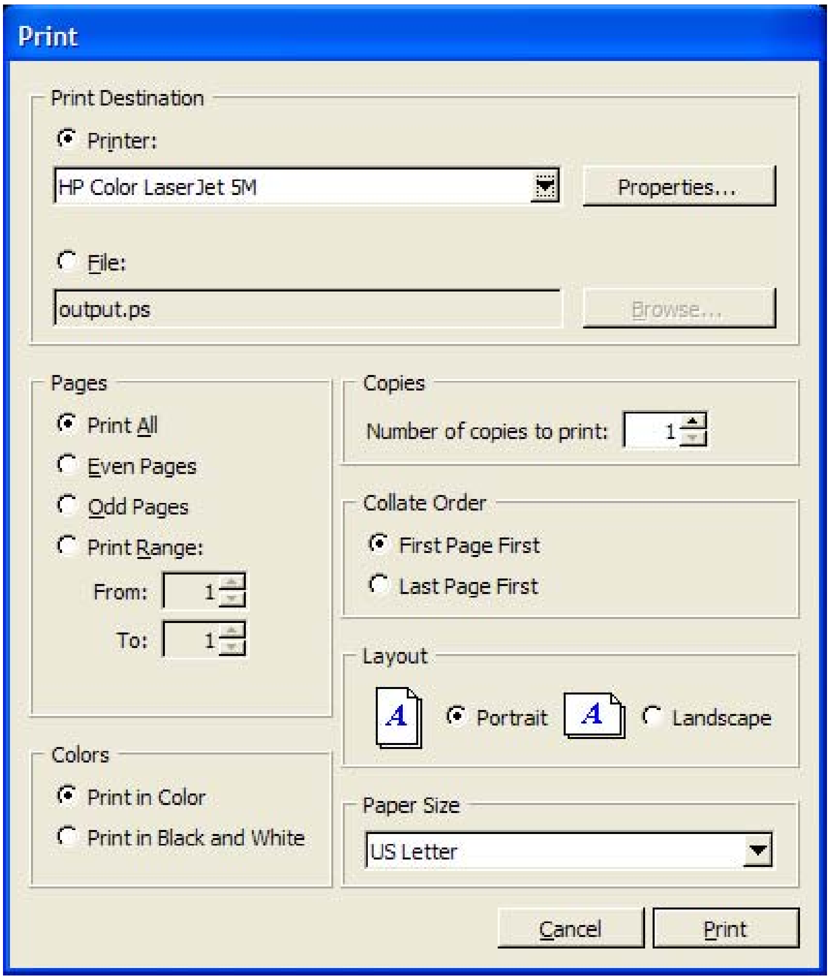


Press **Accept** to delete the selected survey setting.

Press **Cancel** to abort.

Print Setup...

The **Print Setup...** dialogue box is accessed from the **File** menu.



A standard print dialogue is opened. The following options are available:

Print Destination: Select if you want to send sounder data to printer or directly to file. Files are saved in postscript format (*.ps).

Pages: Select which pages to print.

Colors: Select printing in colours or black and white.

Copies: Select the number of copies to print.

Collate Order: Select which page to print first.

Layout: Select page orientation.

Paper Size: Select paper size.

Note *Only postscript printers or plotters can be used.*

Save PU parameters

The Save PU parameters operation is accessed from the File drop-down menu.

It is used to save the Installation and Runtime parameters for the current echo sounder to file in an ASCII readable format.

The file may later be imported whereby the saved settings are restored.

The file name and storage location can be specified in the pop-up window displayed when **Save PU parameters** is selected. A default storage location for such files is defined by SIS, but the operator is free to choose another location.

Note *The operator is encouraged to save the parameters for an echo sounder as soon as the initial configuration (i.e. installation and runtime parameters) has been completed and stored in the database.*

Note *The saved parameters file can be edited. However, this is not recommended and should only be performed by users with intimate knowledge of SIS.*

Related topics

→ *Current echosounder on page 345.*

→ *Import PU parameters on page 301.*

Import PU parameters

The Import PU parameters operation is accessed from the File drop-down menu.

It is used to read a previously saved parameters file for a specific echo sounder and restore the parameter settings for this echo sounder to the same status as when the file was saved.

The import operation can be performed without consideration of which echo sounder is currently set as active or whether the relevant echo sounder is started or even detected on the network.

Note

The echo sounder will not be automatically updated with imported settings. Only the database (SISDB) will be updated. It is therefore necessary to manually initiate an update of the echo sounder (PU) by starting it (if not previously started) or by using the Installation Parameters - or the Runtime parameters frame.

The file name and storage location of the required file can be specified in the pop-up window displayed when Import PU parameters is selected.

The Import PU parameters operation is typically used to avoid having to enter all set-up parameters manually after reinstalling SIS and the database.

Related topics

→ *Current echosounder on page 345.*

→ *Save PU parameters on page 300.*

→ *Installation parameters on page 160.*

→ *Runtime parameters on page 200.*

Quit

Quit is accessed from the *File* drop-down menu.

This will shut down the SIS program without any further confirmation of your choice.

The SIS program can also be shut down by using the **Close** button on the right hand side of the SIS title and info bar (i.e. upper right corner of the SIS application window).

Note

Closing down may take some seconds. Do not try to restart SIS until the SIS application window has disappeared.

5.4 View drop-down menu

The View drop-down menu gives you the following choices:

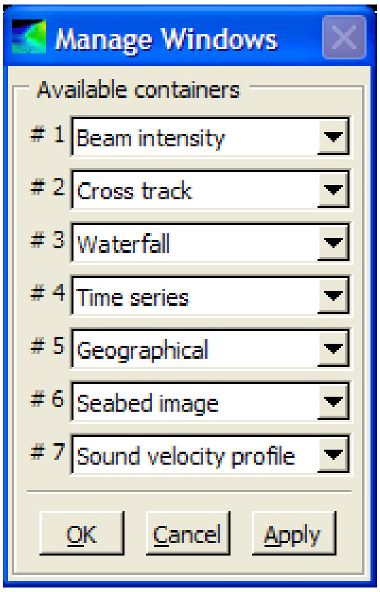
→ *Manage Windows, page 304.*
→ *Icons, page 305.*
→ *C-MAP Scale Level, page 306.*
→ *Color Palette, page 307.*
→ *Status bar, page 308.*

Manage Windows

Manage Windows is accessed from the *View* drop-down menu.

There are seven frames in the application. If you have to change the content of more than one frame, it can be adviseable to use this procedure instead of using the **Frame** button.

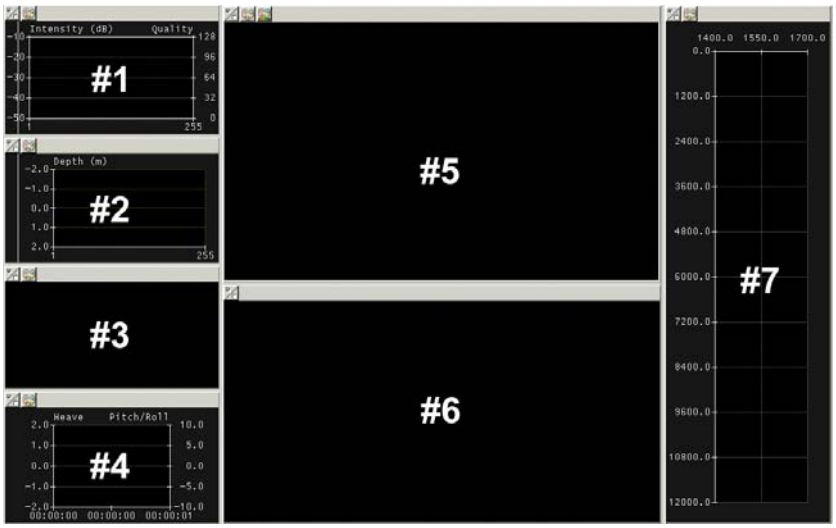
Also, if you select a window that is already in use, you have to use **Manage windows** to apply new content to the frame.



Choose the content of the frame(s) by selecting from the combo-boxes.

Remember to save your new settings. This is done with the **Save settings** or the **Save settings as** from the *File* drop-down menu.

The frames are designated from #1 to #7 as displayed below.



Icons

Icons is accessed from the *View* drop-down menu.

Choose between:

- **Small Icons:** This will make all the frame toolbar buttons smaller.
- **Large Icons:** This will make all the frame toolbar buttons larger.

C-MAP detail level

The **C-MAP detail level** is accessed from the *View* menu.

Choose between the following display levels:

- **Basic**
- **Standard**
- **Full**

Related topics

→ *C-MAP, page 437.*

Color palette

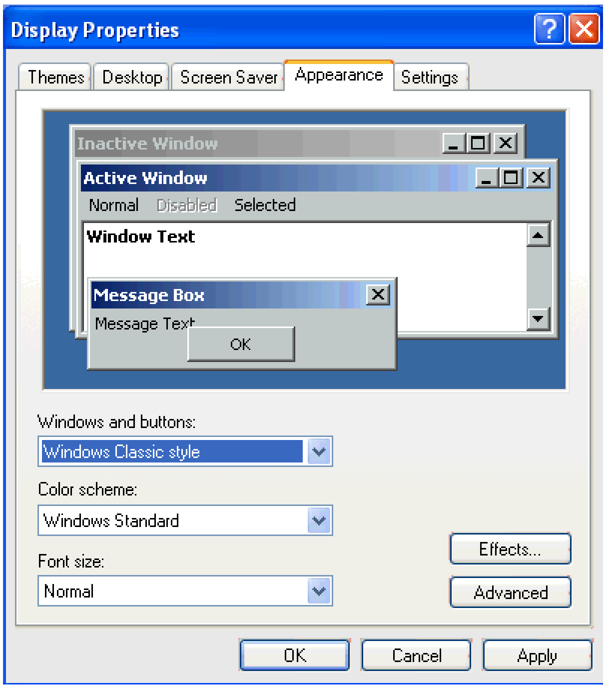
The **Color palette** is accessed from the *View* menu.

Choose between the following color palettes:

- **Day:** Bright day.
- **Day Blackback:** Day with black background.
- **Day Whiteback:** Day with white background.
- **Dusk:** Dusk.
- **Night:** Night.

Each of these palettes use a color scheme of 64 colours with different RGB value for each palette. If used together with “Palette Controller” all Windows colors will be set as well. To set all colors, Windows Choice style must be used in Display Properties - Appearance.

Running on Windows XP. If used together with **PaletteController**, selecting a palette will also change the color change the color of all other application and Windows components. To change all Windows components, like the Title bars and the Start bar, “Windows Classic” style must be selected in “Display Properties - Appearance”



Status bar

The **Status bar** is accessed from the *View* menu.

This lists four of the most useful transducer parameters. By ticking the check box for each parameter, the current parameter value will be constantly displayed on the Status bar.

The following parameters can be displayed:

- Mode
- Depth
- Swath width
- Sound speed

5.5 Tools drop-down menu

The **Tools** drop-down menu gives you the following choices:

→ *External sensors, page 310.*

→ *Instrument combinations, page 315.*

→ *Remove Equipment, page 316.*

→ *SeaCal Results, page 317.*

→ *Custom..., page 318.*

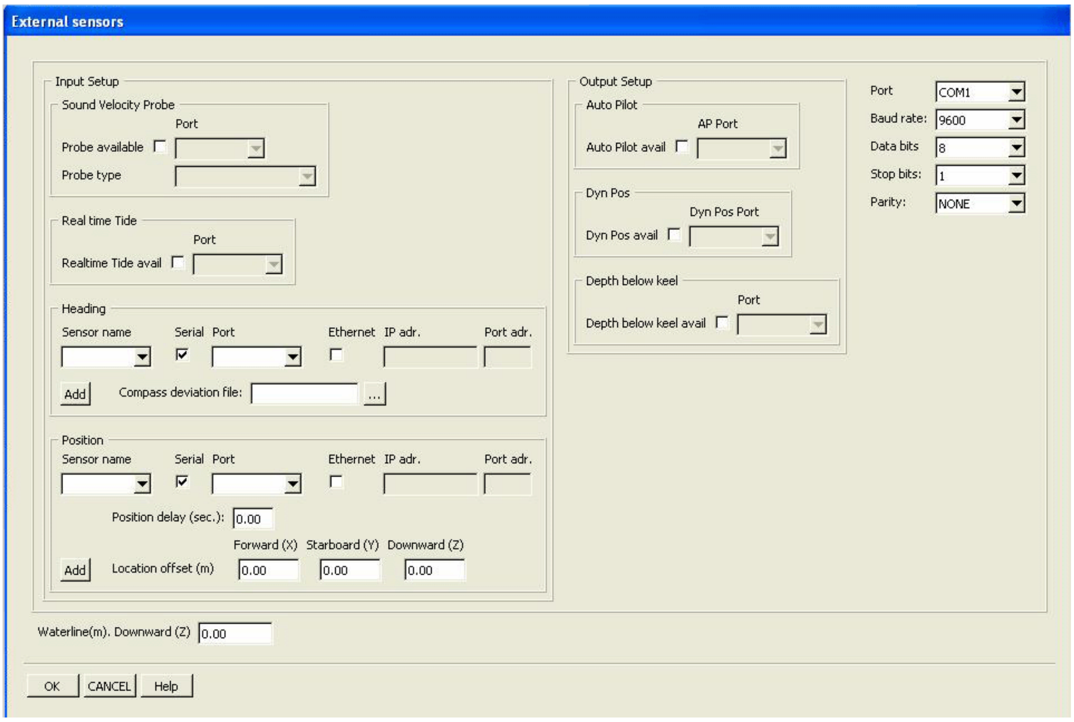
External sensors

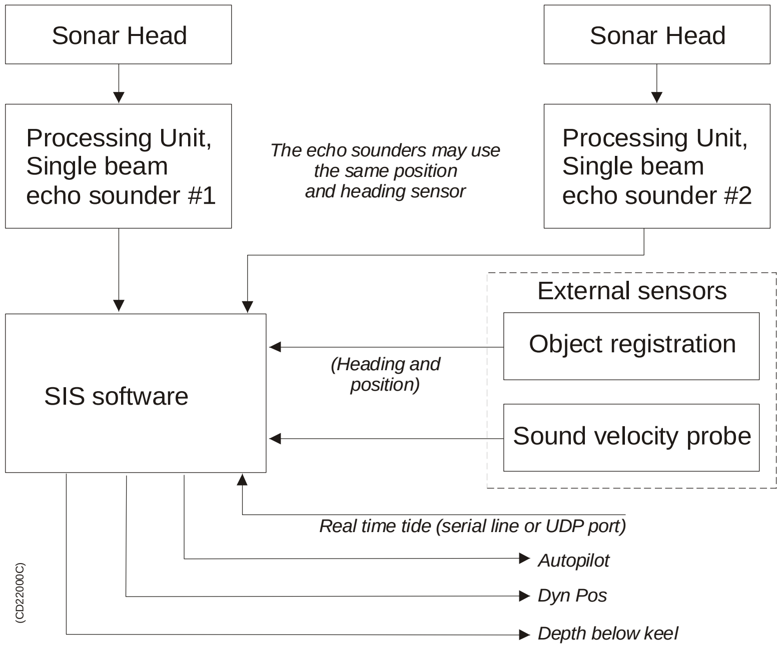
External sensors can be accessed from the *Tools* drop-down menu.

This is where you add the external sensors. These are sensors attached directly to the HWS10 computer or sensors sending their data on Ethernet to the HWS10 computer.

Note

You have to add the external sensors before you adjust the installation parameters.





Sound Velocity Probe parameters

To prepare and use an external sound velocity sensor the following steps should be followed:

1 Make sure that the external sensor is powered up and connected to an HWS 10 input port (i.e. COM port). Alternatively, in the case where SIS should receive external sound velocity datagrams via UDP the datagrams must be available on the network.

2 Next, select the type of sensor or input to use as source for the sound velocity samples:

- **a** Tick the ’Probe available’ box to signify that a sound velocity sensor or external sound velocity datagrams should be used.
- **b** The ’Probe type’ combo box is now enabled. Select the specific type of sound velocity probe to be used. The following choices are available:
  - SV (C) - only sound velocity
  - SV&T (C+T) - sound velocity and temperature
  - SV&P (C+P) - sound velocity and pressure (pressure not significant)
  - Ext. datagrams (C+T) - sound velocity and temperature
- **c** If one of the three sensors is selected (i.e. ’Ext. datagrams’ not selected) the port where this sensor is connected must be set in the ’Port’ combo box.

Note

If ’Ext. datagrams’ is selected the port combo box is disabled as UDP is used.
There is no need to set communication settings for the selected input COM ports. (Auto detect or fixed 9600 baud is assumed).

3 The final step is to configure the ’Sound speed’ parameters in the Runtime settings.

See ’Sound Speed’ in the ’Runtime parameters’ setup for the individual echo sounders for more information.

External datagram format

The format of the external UDP datagram used with the’ Ext. datagrams (C+T)’ sensor selection is as follows:

$KSSIS,80,c.c,t.t,\n\r

where

- $KSSIS specifies that this is a Kongsberg proprietary datagram format
- 80 is the datagram number indicates that this is an external sound speed sample.
- c.c is the sound speed at transducer represented as an ASCII text string e.g. 1460.95
- t.t is the temperature at transducer represented as an ASCII text string e.g. 19.25
- \n\r is the closing sequence (linefeed, carriage return)

This datagram should be sent to port 4001 on the HWS10 PC.

Sound speed sample frequency rate

The sample rate expected from the sound velocity sensors (SV, SV&T, SV&P) is 10 Hz. The sample rate of the external datagrams is 1 Hz.

These rates are used in the sound speed filtering. For more details on filtering see the ’Sound Speed’ entry in the ’Runtime parameters’ setup.

Real time tide

SIS can receive real time tide information of serial line. Select Realtime Tide available and set the communication parameters for the selectee line.

Heading and Position parameters

Write a name in the **Sensor name** combo box. The name given here will be the one that comes up in the installation parameters for GPS and single beam echo sounders.

Choose either serial line or ethernet connection. Press **Add** for each sensor.

- If you choose a serial port, mark the check box under “Serial” and select the port you want to use for heading and/or position by selecting it from the combo boxes under “Port”. The communication parameter is set with the respectively combo box.
- If you want to use an Ethernet connection, mark the check box under “Ethernet”. The IP address and the port data is to be send to is displayed in the text field to the right.
- If serial line communication is chosen a small program starts automatically when the equipment is started. It will place a small icon on the toolbar. This program receives data on RS-232 and forwards the data on UDP. The program will close down automatically.

Compass deviation file: Use the browse button (three dots) to find the desired file.

Position delay (sec): Enter the desired position delay.

The accuracy of the position sensor is vital for the data accuracy, and it is therefore important that the relative timing of vessel position data and system depth data is correct. To define the duration of life of the positioning system input data, you can enter a position delay.

Locations (m): Use the text fields to enter the location. 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

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.

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.

Auto Pilot parameters

Select **Auto Pilot available** if you want data to be sent to the auto pilot and choose a serial line from the combo box.

Enabling or disabling of NMEA APB output is done in the Show/Hide menu in the Helmsman display.

→ *See page 96.*

Dyn Pos parameters

Select **Dyn. Pos. available** if you want data to be sent to the dynamic positioning system and choose a serial line from the combo box.

Depth below keel

The Centre depth output is always sent as a NMEA DPT datagram on UDP to port number 4310. The NMEA depth output from SIS is coded. The two aa's in the string $aaDPT are set according to sounder type, see table below.

Echo Sounder Model	NMEA String
EM 2000	$DADPT
EM 3000	$DBDPT
EM 3002	$DCDPT
EM 1002	$DDDPT
EM 710	$DEDPT
EM 300	$DFDPT
EM 120	$DGDPT

If depth below keel is selected in the External sensor user interface the NMEAdatagram is sent out to the selected serial line.

Other parameters

Port: Choose the port you want to use.

Baud rate: Choose the desired baud rate.

Data bits: 7 or 8.

Stop bits: 1 or 2.

Parity: None, Odd or Even.

Waterline: Use the text field to enter the vessel's waterline vertical location (in normal trim) in the vessel's reference coordinate system. 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.

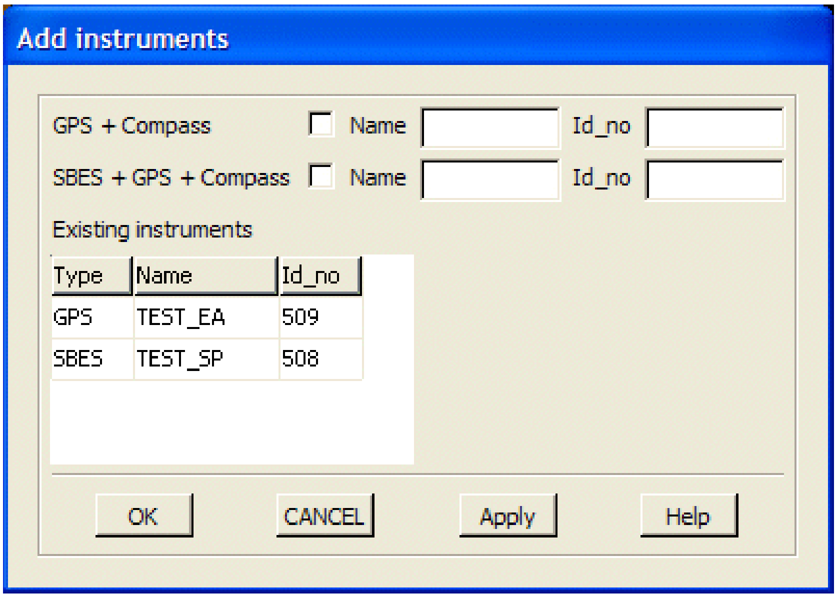
Instrument combinations

Instrument combinations can be accessed from the *Tools* drop-down menu.

This is where you add instruments and give them an identification. The instruments you add are equipment that does not have a PU (Processing Unit/Rack) and does not broadcast on the Ethernet.

The user gives the instrument an ID number. This number must be unique for each type of equipment. This ID number is treated the same way as the serial number for equipment with a PU (Processing Unit).

After the instruments are registered here they appear in the **Not Started** combo box and the **Current echo sounder** combo box on the main toolbar.



If you want to remove any of the equipment, use the Remove equipment.

→ *Refer to page 316.*

Add equipment parameters

GPS + Compass: Give the new equipment a name and an ID number.

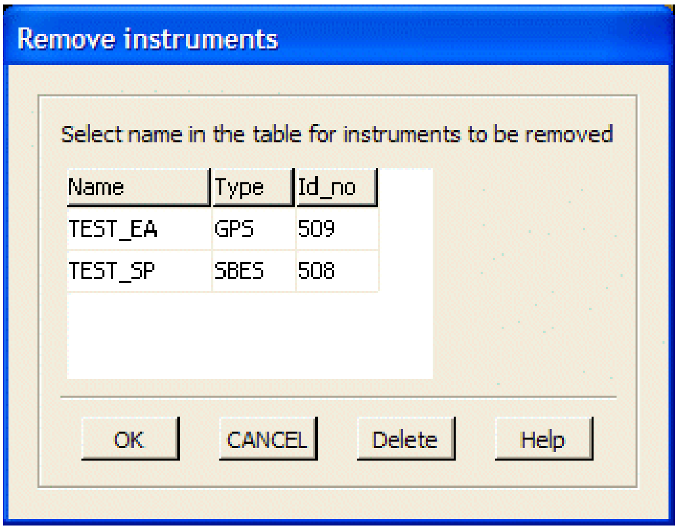
SBES + GPS + Compass: Give the new equipment a name and an ID number.

Existing equipment: A list of the equipment that already exists.

Remove Instruments

The **Remove Instruments** is accessed from the *Tools* drop-down menu.

Select the equipment you want to remove, and press **OK**.



SeaCal Results

The **SeaCal Results** is accessed from the *Tools* drop-down menu.

Use this option to browse for and open SeaCal result files (*.res).

→ *SeaCal, page 430.*

Custom...

The **Custom...** sub-menu is accessed from the *View* menu. This menu is used to access various applications. It is also possible to manage or add new applications.

Choose between the following options:

- **SVP Editor**

→ *Refer to page 442.*

- **Set parameters**

→ *Refer to page 371.*

- **Datagram distribution**

→ *Refer to page 415.*

- **Projection setup**

→ *Refer to page 319.*

- **Create grid from ascii files**

→ *Refer to page 378.*

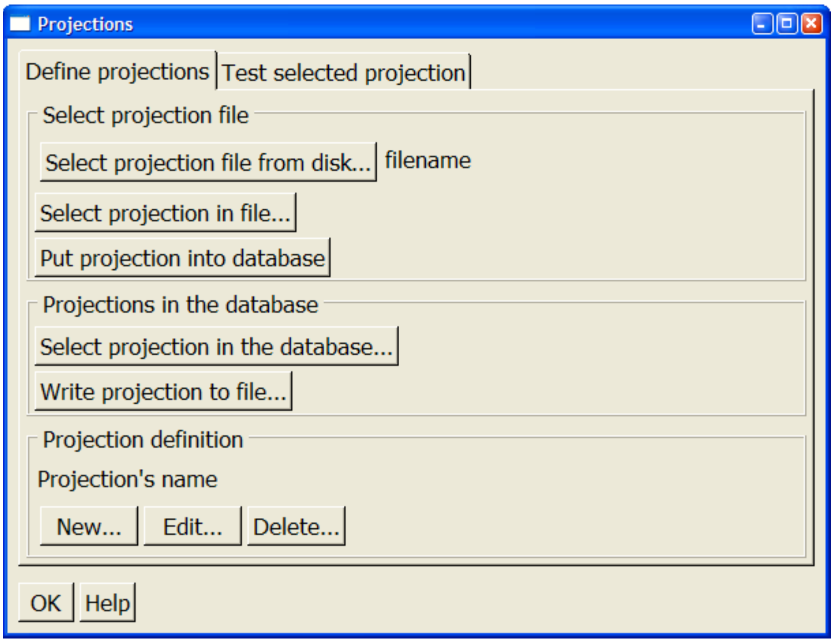
- **Licence information**
  - The log file to the license server, running on the local computer, is opened in a text editor.
- **Configure...**

→ *Refer to page 326.*

Create new projection

When creating a new projection, the Projections window opens. This window contains two tabs:

- The **Define projections** tab is where you define the projection.
- The **Test selected projection** tab allow you to test the selected projection.



“Select file from disk” opens a file selection box where the user selects the file in PROJ.4 format where projections are stored.

“Select projection in file” is then used to select the projection in the selected file. The name of the selected projection appears below.

A projection from the file can be put into the database by pressing “Put projection into database”. The database tables are updated. It is not possible to change a projection if it is used by any surveys unless the user specifies it.

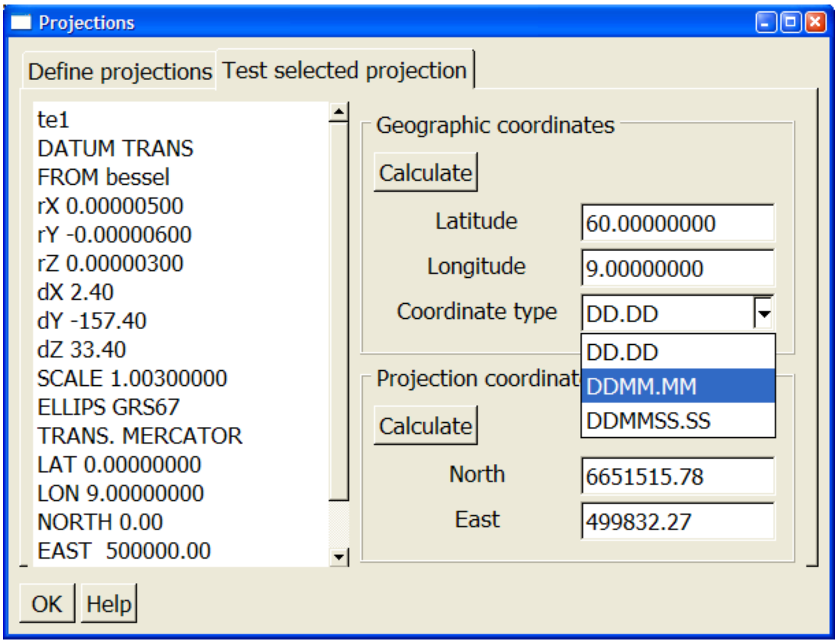
You can also select a projection from the database. It is not allowed to change a projection used by a survey unless the user specifies it.

The command line switch -n turns off file selection. The database connection is automatically removed it the database is not present.

You can create a new projection, edit a projection and delete a projection from this tab.

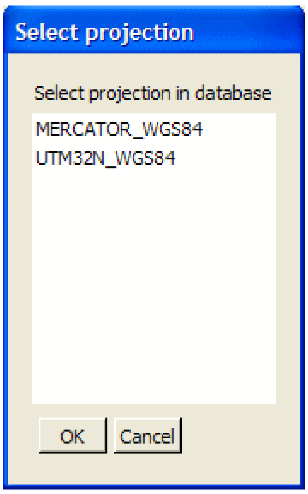
OK: Press this button to exit the application.

Help: Press this button to open online help.

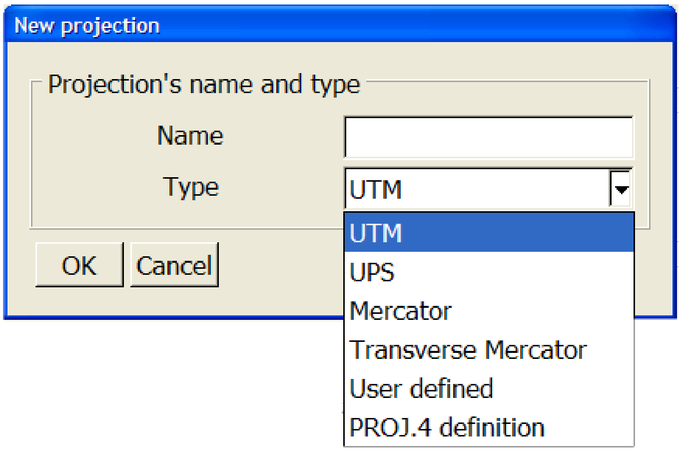


The “Test selected projection” allow you to test the selected projection. You can choose the format of the geographical coordinates to decimal degrees, decimal minutes or decimal seconds. You can then input geographical coordinates and press “Calculate” in that window to see the projection coordinates in the window below, or vice versa.

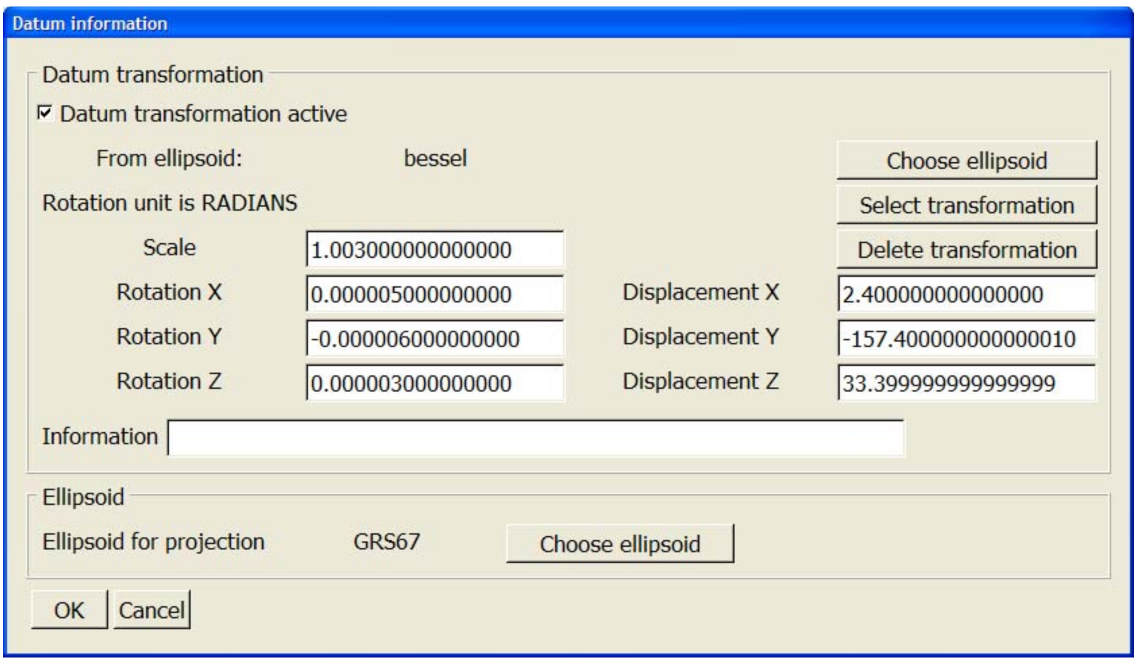
When you select a projection from the projection file, the Select projection dialogue opens. Here you can see all the names of the projections in the file.

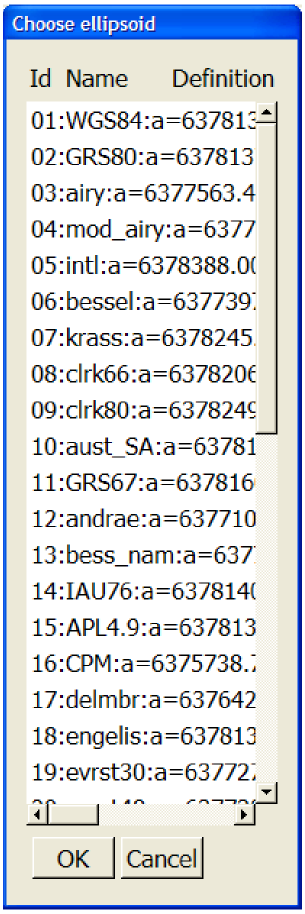


When your press “New...” in the Define projections tab, the New projections dialogue opens. Here you must give the new projection a unique name and select the projection type: UTM, UPS, Mercator, transverse Mercator, user defined or PROJ.4. Press “OK” to open the Datum information dialogue.



The Datum information dialogue is used to define the datum transformation and the ellipsoid of the projection. The datum transformation may be active or not (default is off). You MUST choose an ellipsoid for the projection by pressing the button “Choose ellipsoid” in the window named “Ellipsoid”. You can also define a 7-parameter datum transformation. First choose the ellipsoid to convert from by pressing “Choose ellipsoid”. Then define the rotation units, decimal degrees or decimal radians. Then define the transformation.





When you choose an ellipsoid, the Choose ellipsoid dialogue is opened. Each ellipsoid has a unique identifier, a name and the parameters a (major axis) and rf (reverse flattening). If there are comments attached to an ellipsoid, they are shown in this window.

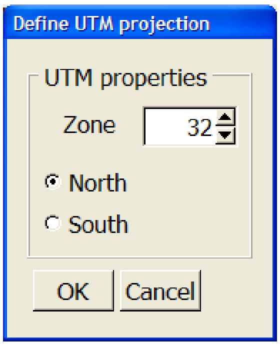
The following ellipsoids can be selected:

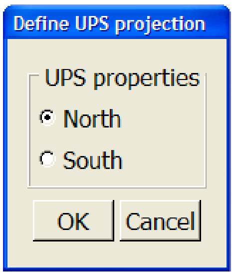
MERIT	a=6378137.0	rf=298.257	MERIT 1983
SGS85	a=6378136.0	rf=298.257	Soviet Geodetic System 85
GRS80	a=6378137.0	rf=298.257222101	GRS 1980(IUGG, 1980)
IAU76	a=6378140.0	rf=298.257	IAU 1976
airy	a=6377563.396	b=6356256.910	Airy 1830
APL4.9	a=6378137.0	rf=298.25	Appl. Physics. 1965
NWL9D	a=6378145.0	rf=298.25	Naval Weapons Lab., 1965
mod_airy	a=6377340.189	b=6356034.446	Modified Airy
andrae	a=6377104.43	rf=300.0	Andrae 1876 (Den., Iclnd.)
aust_SA	a=6378160.0	rf=298.25	Australian Natl & S. Amer. 1969
GRS67	a=6378160.0	rf=298.2471674270	GRS 67(IUGG 1967)
bessel	a=6377397.155	rf=299.1528128	Bessel 1841

bess_nam	a=6377483.865	rf=299.1528128	Bessel 1841 (Namibia)
clrk66	a=6378206.4	b=6356583.8	Clarke 1866
clrk80	a=6378249.145	rf=293.4663	Clarke 1880 mod.
CPM	a=6375738.7	rf=334.29	Comm. des Poids et Mesures 1799
delmbr	a=6376428	rf=311.5	Delambre 1810 (Belgium)
engelis	a=6378136.05	rf=298.2566	Engelis 1985
evrst30	a=6377276.345	rf=300.8017	Everest 1830
evrst48	a=6377304.063	rf=300.8017	Everest 1948
evrst56	a=6377301.243	rf=300.8017	Everest 1956
evrst69	a=6377295.664	rf=300.8017	Everest 1969
evrstSS	a=6377298.556	rf=300.8017	Everest (Sabah & Sarawak)
fschr60	a=6378166	rf=298.3	Fischer (Mercury Datum) 1960
fschr60m	a=6378155	rf=298.3	Modified Fischer 1960
fschr68	a=6378150	rf=298.3	Fischer 1968
helmert	a=6378200	rf=298.3	Helmert 1906
hough	a=6378270.0	rf=297	Hough
intl	a=6378388.0	rf=297	International 1909 (Hayford)
krass	a=6378245.0	rf=298.3	Krassovsky, 1942
kaula	a=6378163	rf=298.24	Kaula 1961
lerch	a=6378139	rf=298.257	Lerch 1979
mprts	a=6397300	rf=191	Maupertius 1738
new_intl	a=6378157.5	b=6356772.2	New International 1967
plessis	a=6376523	b=6355863	Plessis 1817 (France)
SEasia	a=6378155.0	b=6356773.3205	Southeast Asia
walbeck	a=6376896.0	b=6355834.8467	Walbeck
WGS60	a=6378165.0	rf=298.3	WGS60
WGS66	a=6378145.0	rf=298.25	WGS66
WGS72	a=6378135.0	rf=298.26	WGS72
WGS84	a=6378137.0	rf=298.257223563	WGS84

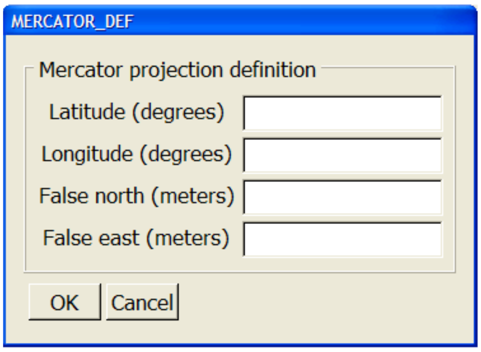
When defining the rest of the projection, you are presented with a different dialogue depending on what type of projection you have chosen.

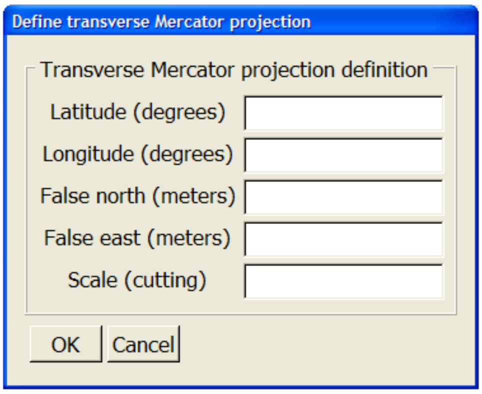
The dialogues below show the UTM and the UPS projection setup. If UTM projection is chosen, select UTM-zone and if it is on the northern or southern hemisphere. If UPS projection is chosen, select if it is on the north or south pole.



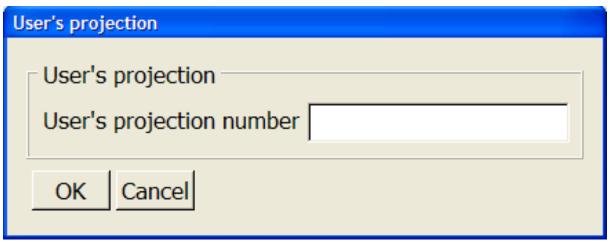


The dialogues below are used to define Mercator/transverse Mercator projections respectively.



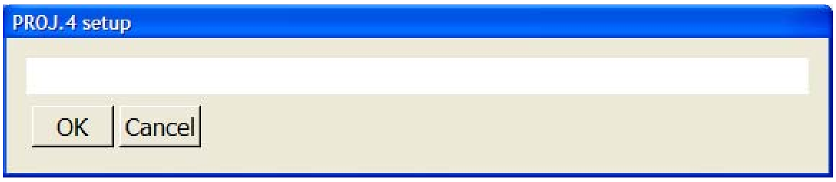


A user's own projection may be found in the static and dynamic libraries. These projections are identified by a unique number known to the user. You can choose this number in the User's projection dialogue. If this number is not implemented, the program will exit because an invalid projection is regarded a very severe error and then nothing works.



You may also input a projection PROJ.4-style directly in the PROJ.4 setup dialogue. This must be entered like this:

```
+init=my_file_with_proj4_projections:my_projection
```



You can also enter the input like this:

```
+init=\mydir\somefile.txt:my_projection
```

This will fail::

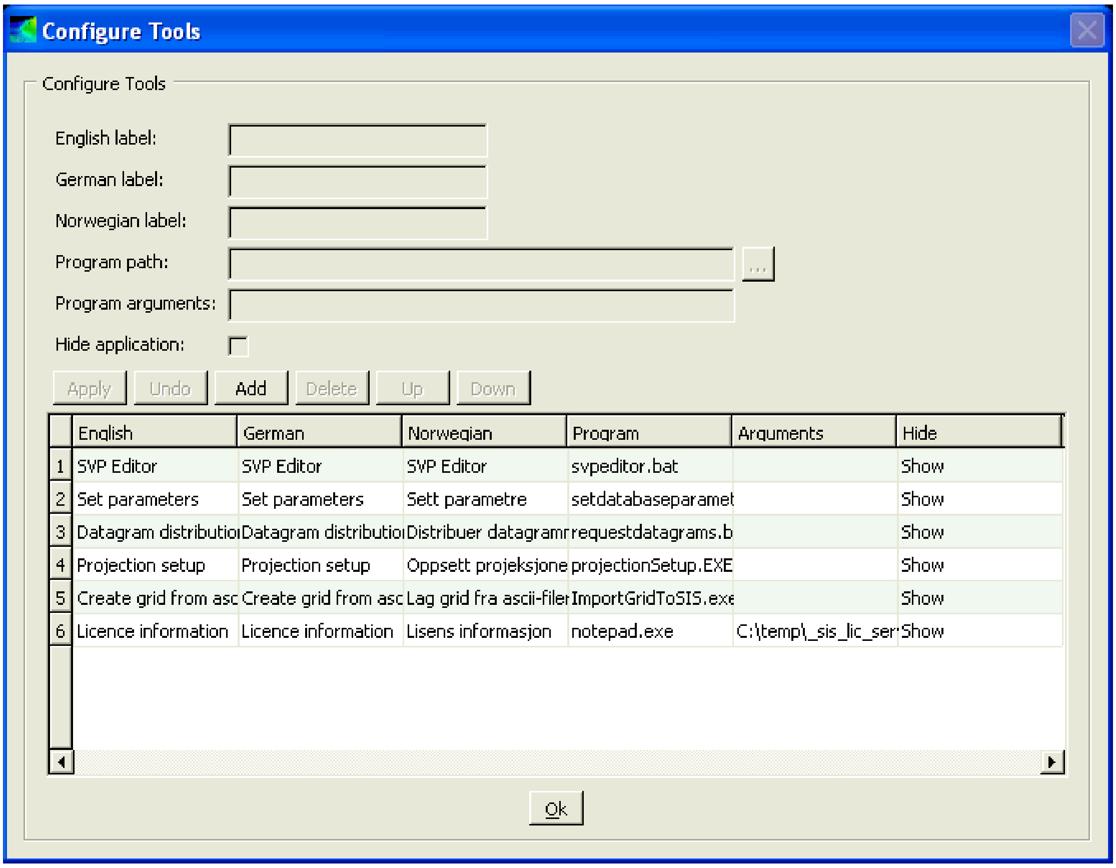
```
+init=c:\mydir\myfile.txt:my_projection
```

because the first **:** is not allowed. This means that your projection file MUST be on the same disk.

Configure...

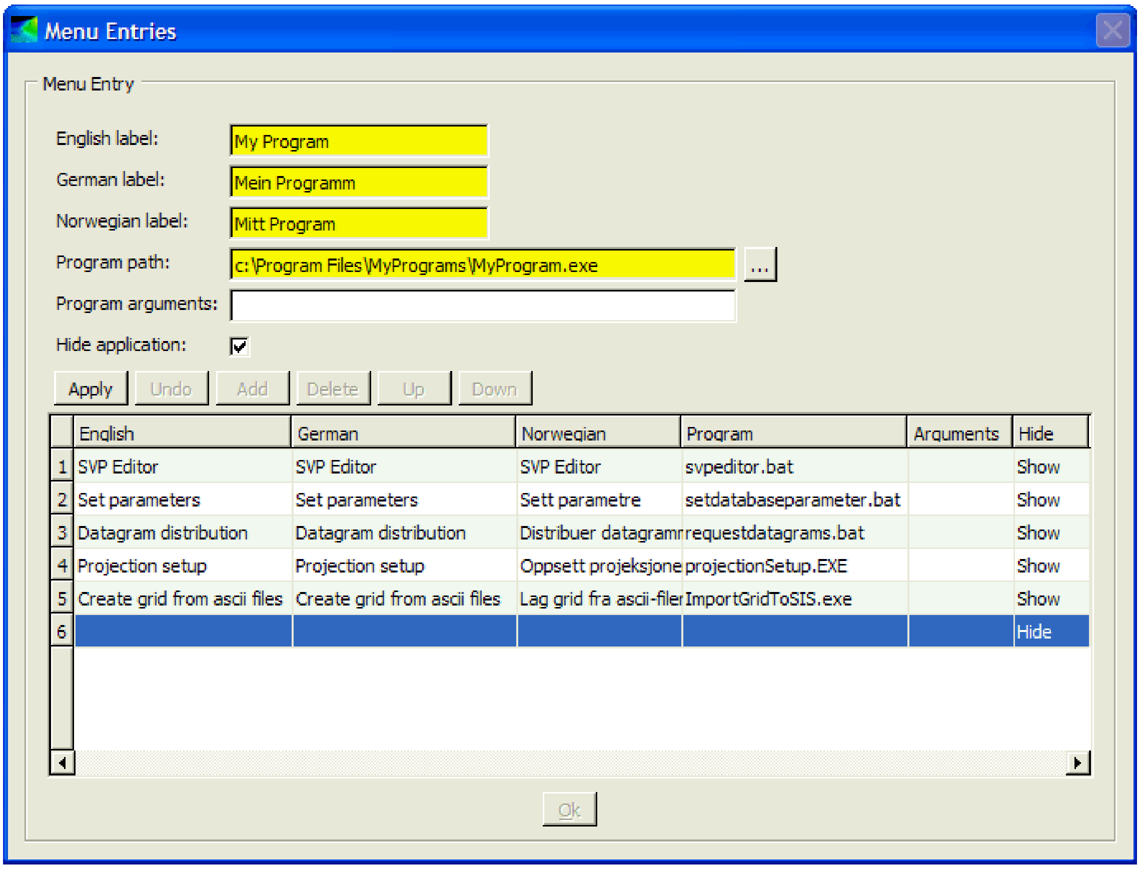
The **Configure...** item is accessed from the *Custom* sub-menu.

The Configure dialogue box is used to manage existing applications. It is possible to hide or delete applications, or change the sequence in which they appear in the Custom sub-menu. Note that it is not possible to delete any of the factory defined applications.



A new application is added by pressing the ’Add’ button in the dialogue box. Fill in all text fields marked in yellow.

Press the ’Apply’ button to add the new application to the Custom sub-menu.



Program arguments can be added, i.e. a text file if the application is a text editor.

Click the 'Hide application' box to hide a console application when starting SIS. The application will then only be visible in the Task Manager.

Press the 'OK' button to store changes.

5.6 Help drop-down men

The **Help** drop-down menu gives you the following choices:

→ *Help, page 329.*

→ *Build Info, page 330.*

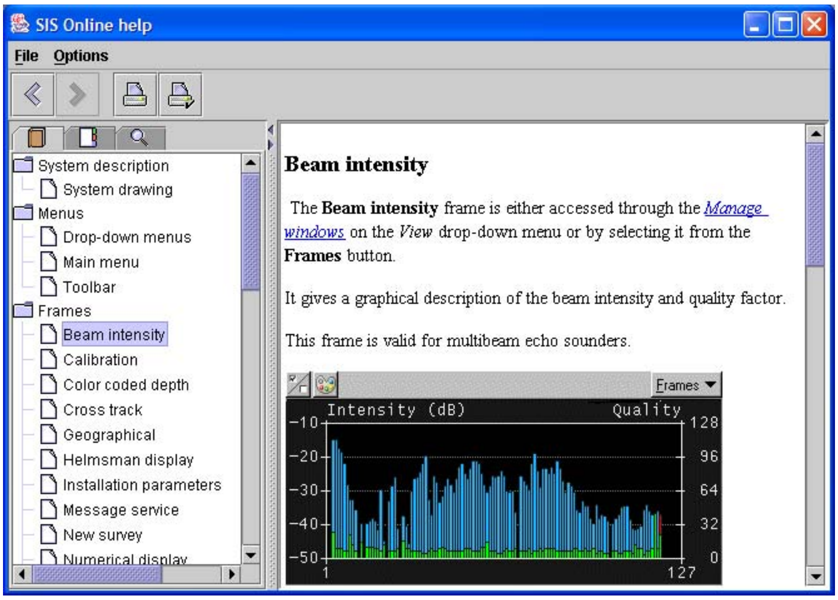
→ *OpenGL Settings, page 331.*

→ *About SIS..., page 332.*

Help

Help is accessed from the *Help* drop-down menu.

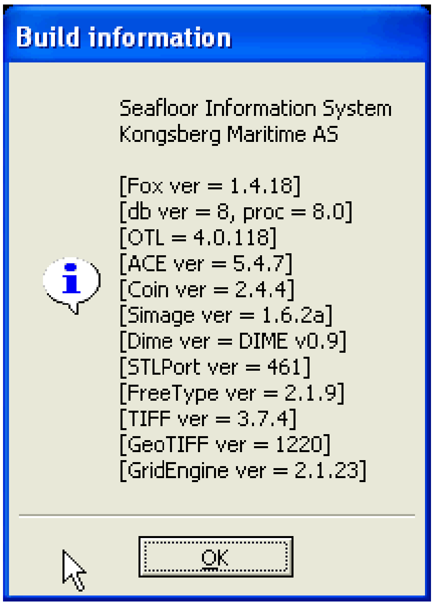
It will open the online-help system.



Build Info

The **Build Info** messsage box is accessed from the *Help* drop-down menu.

It contains information about the current SIS software build.

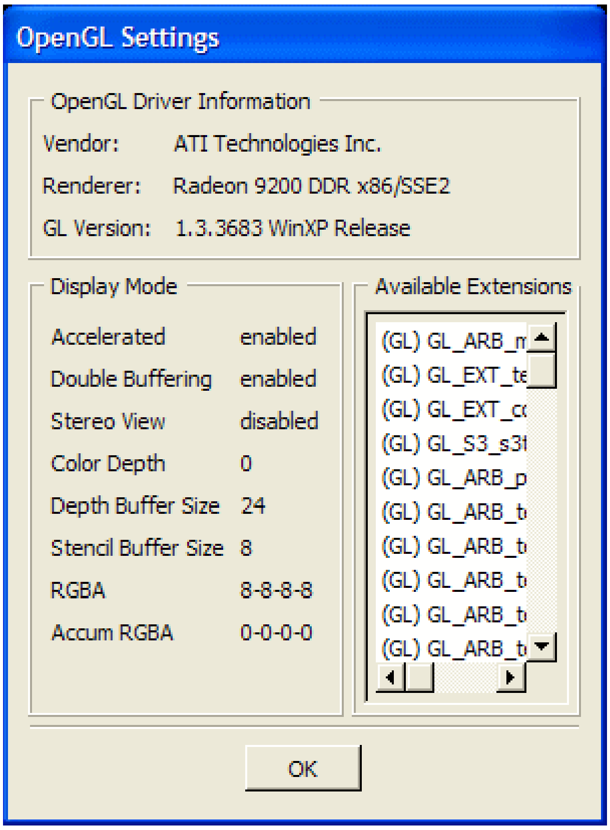


OpenGL Settings

The **OpenGL Settings** messsage box is accessed from the *Help* drop-down menu.

It provides the following information about the OpenGL settings:

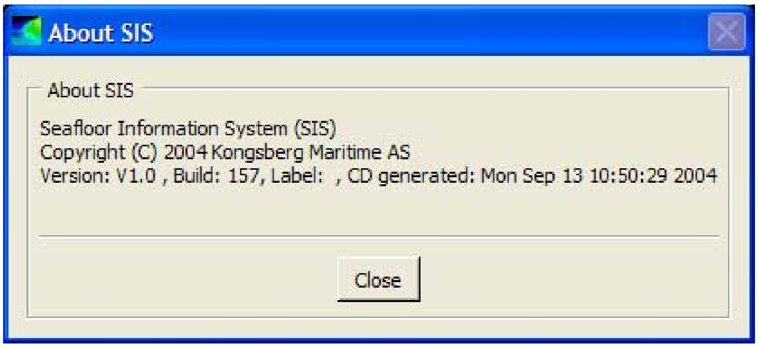
- Driver information
- Display mode
- Available extensions



About SIS...

The **About SIS** messsage box is accessed from the *Help* drop-down menu.

It contains limited information about the SIS software.



This message box can also be accessed by pressing the SIS icon far right on the status bar.

5.7 Geographical drop-down menu

The **Geographical** drop-down menu gives you the following choices:

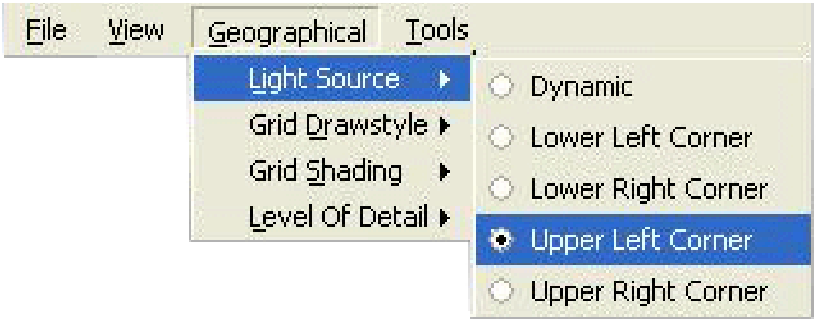
→ *Light Source, page*

→ *Grid Drawstyle, page 335.*

→ *Grid Shading, page 336.*

→ *Level Of Detail, page 337.*

This menu is only valid for the **Geographical** frame.



Light Source

The light source can be moved around in a horizontal plane above the underlying data. Choose between Dynamic, Lower Left Corner, Lower Right Corner, Upper Left Corner or Upper Right Corner:

- Dynamic: You can manually move the light source around using the pointing device (usually a mouse).
- Lower Left Corner: Position the light source at the lower left corner of the grid.
- Lower Right Corner: Position the light source at the lower right corner of the grid.
- Upper Left Corner: Position the light source at the upper left corner of the grid.
- Upper right corner: Position the light source at the upper right corner of the gird.

Grid Drawstyle

The **Grid Drawstyle** is accessed from the *Geographical* menu.

Choose between the following styles:

- **Points:** Each point is displayed as a single point in the Geographical display.
- **Triangle:** The points are displayed as triangles.
- **Filled:** The points are displayed as a continuous surface.
- **Text:** The depth values are displayed as text.
- **Text Overlay:** The depth values are displayed as text overlaid the continuous surface.

SIS organizes the data in grids. Each grid cell contains all depth points from the area defined by this grid cell. The minimum, maximum and median depths inside each grid cell will be used to draw the terrain. The exact locations of these depths are kept in each grid cell.

When the grid is drawn, a triangle is created from three neighbouring grid cells. Each point in the triangle will then come from the correct geographical location of the selected depth (minimum, maximum or median). The triangle model will thus be irregular to fit to the terrain as good as possible.

The operator can then choose to display the triangles either as points (without lines or filling), as lines (lines between the depth points without filling) or as filled triangles.

Grid Shading

The **Grid Shading** is accessed from the *GeoView* menu.

This gives options for setting the shade model used for displaying the data.

Choose between the following shadings:

- **Flat:** Each cell has a distinct colour.
- **Smooth:** Colours are smoothly interpolated between cells.

Level Of Detail

The **Level Of Detail** is accessed from the *GeoView* menu.

Data may be displayed in the Geographical window with various levels of details, based on the current map scale selected by the operator.

The gridding system use two types of grids:

- Processing grid
- Display grid

The processing grid is used for processing depth data and the display grid is used for displaying data. Data is transferred from the processing grid to the display grid and from the display grid with a lower level of detail to the display grid with a higher level of detail.

The number of levels of details depends of the number of cells in the processing grid. A processing grid with 64x64 cells will have 6 levels of detail, in other words log2(64).

The organization of process grids and display grids may look shown in the figure below.

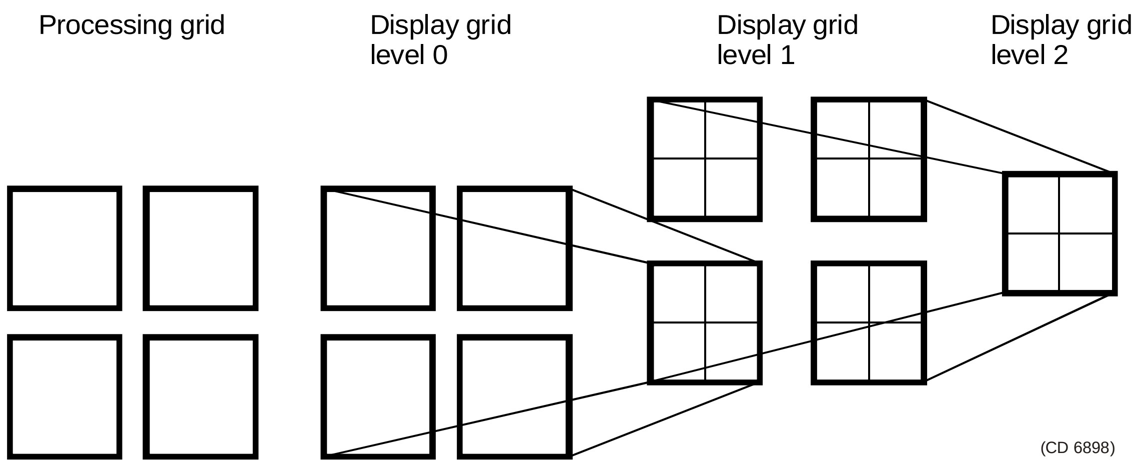


Figure 28 Orgaization of process grids and display grids (example)

When looking at a small area it can be convenient to select LOD0, as all processed data then will be displayed. In a larger scale a higher LOD should be used.

Choose between the following levels:

- LOD 0
- LOD 1
- LOD 2

- LOD 3
- LOD 4
- LOD 5
- LOD auto

5.8 Toolbars

SIS has two types of toolbars. The Main toolbar is common for all frames. Each frame also has its own individual toolbar.

→ *Main toolbar, page 340*

→ *Frame toolbars, page 343*

Main toolbar

The **Main toolbar** is located right under the Main menu. It contains several buttons and combo boxes.

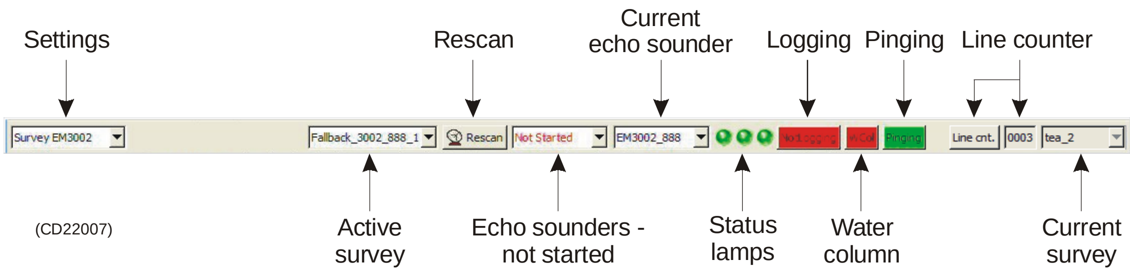


Figure 29 Main toolbar

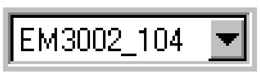
Settings: You can select different display settings from this combo box. Choose between standard settings or create your own by selecting *Save Settings As...* in the File menu.

Active survey: Select the active survey. All surveys are listed, both the surveys you log on and the ones imported. You can only calibrate the active survey.

Rescan: If for some reason contact with the echo sounder is lost, it is not necessary to shut down and restart SIS. Press the Rescan button, and the program will scan for available echo sounders.

Echo sounders - not started: This combo box displays all the echo sounders SIS has detected on the network at start-up time. All multibeam echo sounders announce themselves on the network when they are active, and then SIS can detect them automatically. Select the echo sounder you want to start from this list.

→ *More information on page 344.*



Current echo sounder: This combo box displays which echo sounder is currently being operated. The operator must choose one at the time when setting the installation and runtime parameters for the echo sounder. Select the echo sounder you want to change parameters for from this list.

→ *More information on page 345.*

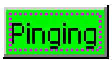
Logging: Press this button to start and stop logging. Start logging to write data to disk. The colour of the button is green while logging and red when logging is off.

If pinging is **off** when logging is turned **on**, pinging will automatically be turned **on**.

If logging is **on** and pinging is turned **off**, logging will automatically be turned **off.**

WCol: The WCol button shows if logging of Water column data is on or off. This button can not be clicked, but only shows the logging status. The On/Off control is located on the Water column frame's show/hide menu.

This button is always displayed, but is only active for echo sounders with water column capabilities (for example EM 710 and EM 3002).



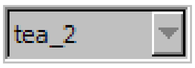
Pinging: Press this button to start and stop pinging. Start pinging to activate the echo sounder (i.e. sending sound into the water). The colour of the button is green while pinging and red when pinging is off.

Line counter: The text field displays the line count for the currently selected echo sounder. The line count is cyclic between 1 and 9999. It is possible to enter a line number manually.

If logging is *off* the line count is for the *next* line started. If logging is *on* the count is for the *current* line.

The button is used to create a new line without stopping the logging and then starting it again. The line count is incremented by one when button is pressed.

→ *More information on page 346.*



Current survey: This combo box displays the current survey name. The operator can select all surveys for the current echo sounder from this combo box. When selecting another survey, SIS will change to that survey and start logging to that survey when this is enabled.

This combo box is disabled when SIS is logging.

Status lamps: These lamps are for multibeam echo sounders only.

- **Lamp 1:** PU/TRU status (Processing Unit/Transceiver Unit)
- **Lamp 2:** BSP status (Beamforming and Signal Processing)
- **Lamp 3:** SH status (Sonar Head)

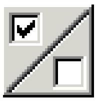
While logging, the lamps will be frequently updated.

Green	Orange	Red	Grey
OK	Warning	Error	Connected hard-ware is not in use

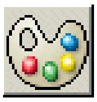
Frame toolbars

All frames have their own toolbar. On this toolbar there can be several buttons or just the **Frames** button. The most frequent buttons are described below:

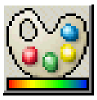
Frames: Press this button to select the content you want in that specific window frame.



Show/hide: Press this button to open the Show / hide dialogue box.



Annotation colours: Press this button to open the Annotation colours dialogue box.



Dynamic colours: Press this button to open the Dynamic colours dialogue box. The dialogue box will only be launched if at least one or more surveys are loaded.

Several frames hold special buttons. These are described in the Frame contents chapter for the frames in question.

Echo sounder - not started list

The “not started” list will be displayed in a combo box found on the right hand side of the toolbar.

The list contains all non-started echo sounders detected by SIS on the network.

The list is linked to the autostart mechanism.

→ *The autostart mechanism is explained on page 25.*

The combo box will only be displayed in two instances:

1 When echo sounders are detected by the system for the first time.

2 When the detected echo sounders differs from the set of echo sounders started in the previous SIS session. That is, if echo sounders have been added or removed from the network.

I any other circumstance the autostart mechanism will start the echo sounders automatically and the combo box will not be visible.

When you select an echo sounder from the list, you start the echo sounder and it will disappear from the list.

Note *If for any reason an echo sounder fails during start (BIST, Built-In Self Test, 99 failure) the echo sounder will remain in the list and the combo box will still be visible. The reason for this is to allow the operator to correct the problem and try a rescan.*

If the licencing allows for only one started echo sounder, the combo box will be removed as soon as the start has been performed with a positive result.

If the licencing allows for several started echo sounders, the combo box will be removed only when the list is empty, i.e. when all echo sounders has been started.

Current echosounder (or other instruments)

The combo box is found on the right hand side of the toolbar.

It gives you a list of the all the echo sounders and other instruments that are connected to the SIS software, but only the current echo sounder is visible in the text field. Press the arrow to see the entire list or click in the text field.

Select an echo sounder from the list. This echo sounder is now available for configuration. Each echo sounder is identified by name and serial number and all displyed frames will be updated to show the information from this unit, if applicable. Only one echosounder can be selected as current at any given instance, i.e. you can configure only one echosounder at a time and you can see data (for example beam intensity, cross track, numerical data etc.) only from this current unit.

If you want to add instruments without a PU (Processsing Unit/Rack) to the list, use the **External sensors** and **Instrument combinations** found on the **Tools** drop-down menu.

→ *Refer to pages 310 and 315 for a description.*

If you want to remove instruments without a PU (Processing Unit/Rack) from the list, use the **Remove instruments** found on the **Tools** drop-down menu.

→ *Refer to page 316 for a description.*

Line counter toolbar set

The **Line counter** button and **Line counter** textfield are found on the toolbar.

The Line counter textfield displays the line for the currently selected echo sounder. The count is cyclic between 1 and 9999.

→ *Refer to page 345 for a description of current echo sounder.*

When the Line counter button is pressed, the line count is incremented by one for all active, logging echo sounders and not only for the current echo sounder.

Note that if the current echo sounder is not actively logging, nothing happens when the line counter button is pressed.

The line count for an echo sounder can also be incremented by three other mechanisms in addition to using the line counter button:

1 The line count is incremented each time logging stops showing the next line to be logged. Only the count for the handled (current) echo sounder is affected.

2 To avoid very large log files (.all-files) the counter for all active echo sounders are incremented automatically every 30 minutes. (This can be configured in the Main menu; Tools > Custom... > Set parameters.). This, however, only happens when the counter has not been incremented by other means within the last 30 minutes. (This is done by pressing the line counter button or by stopping and starting logging).

3 The line counter may be manually edited, when not logging. The edited value is for the next logged line.

Note

If several echosenders are used and the line count initially is the same for all, it’s important to notice that the counts may deviate after a while. This is due to the above described behaviour.

6 CUBE

6.1 About the implementation of CUBE in SIS

The CUBE (Combined Uncertainty and Bathymetry Estimator) algorithm is developed at The Center for Coastal and Ocean Mapping (C-COM)/Joint Hydrographic Center (JHC) at University of New Hampshire. The algorithm is available as a library and is used inside one separate module in SIS. The CUBE algorithm can be used as an alternative data gridding and data cleaning method in SIS. The gridding and data cleaning is default done by the GridEngine.

Cube is not available when loging data. Cube grids are created by importing raw data files in the Kongsberg Maritime all-format. Already gridded surveys can be reimported at a later time.

The CUBE module in SIS receives ping data on UDP where depth and angle gate are applied to the data. The horizontal and vertical error estimate for each beam is calculated using the Kongsberg Maritime error model and not the error models included in CUBE. The default processing parameters for the CUBE algorithm are used.

The GridEngine holds both a processing grid and a display grid. The display grid is split up in six levels of details, LOD, to speed up the display in the geographical view when features as automatic update or ship in center are turned on. In CUBE it is the processing grid that is displayed and an automatic update or ship in center can give slow response when updating the geographical view.

The implementation of LOD in the GridEngine also results in less sensitivity to the grid cell size when displaying grids - see the next four figures. With a small grid cell size a lot of nodes get no depth value assign.

SIS must chose between ether Grid Ingine or CUBE grids. This selection is don from the Tools main menu, Custum, Set paramenters.

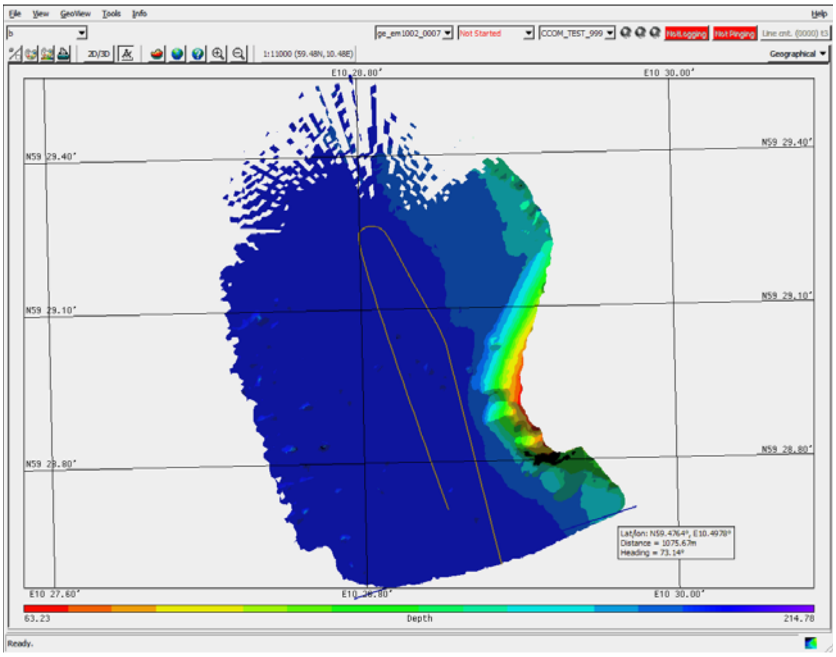


Figure 30 GridEngine, LOD3

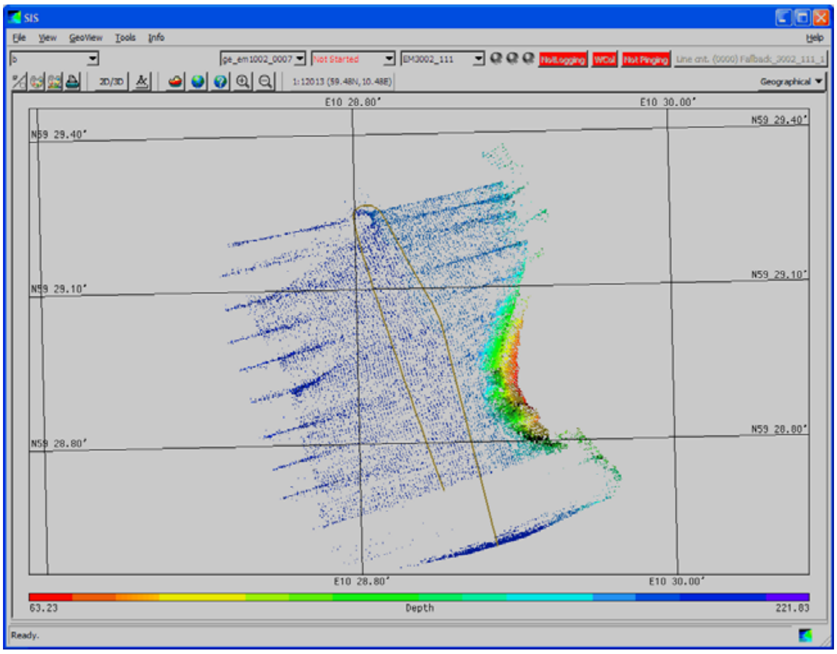


Figure 31 GridEngine, LOD1

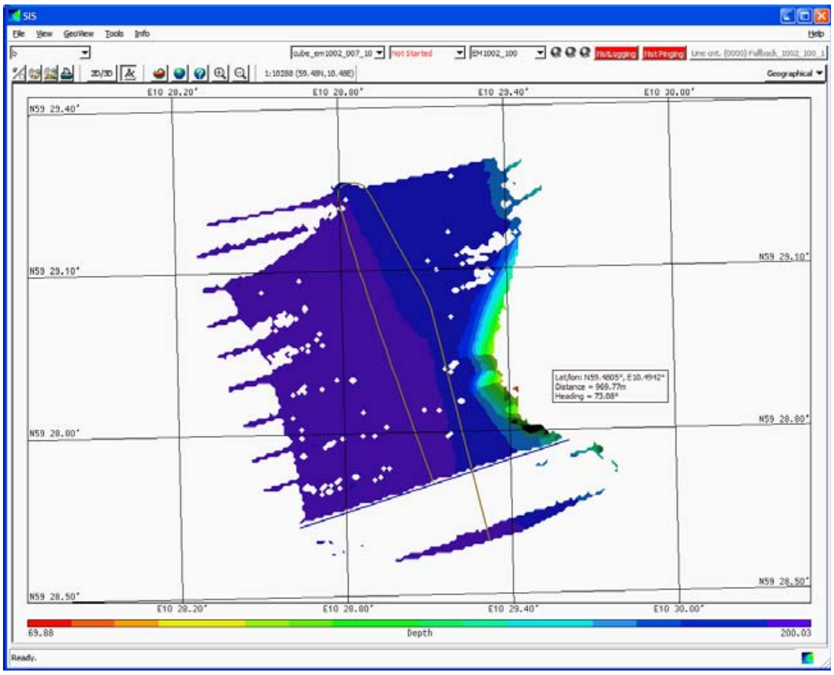


Figure 32 CUBE, grid cell size 10 m

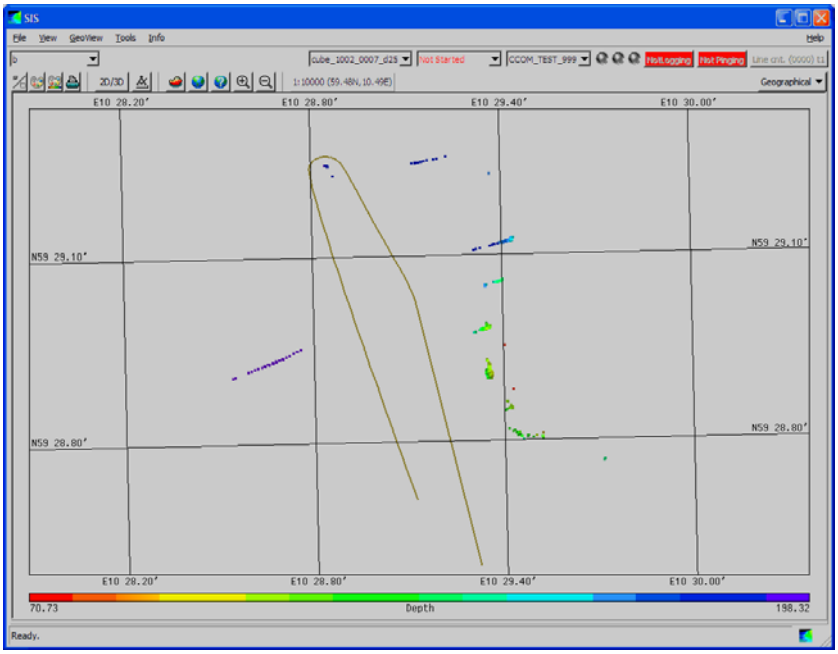


Figure 33 CUBE, grid cell size 2.5 m

CUBE also need some amount of data density to do the gridding. The grid in the next figure is from one survey line. The grid width is measured to 19 metres. With one more survey line the same distance is measured to 32 metres.

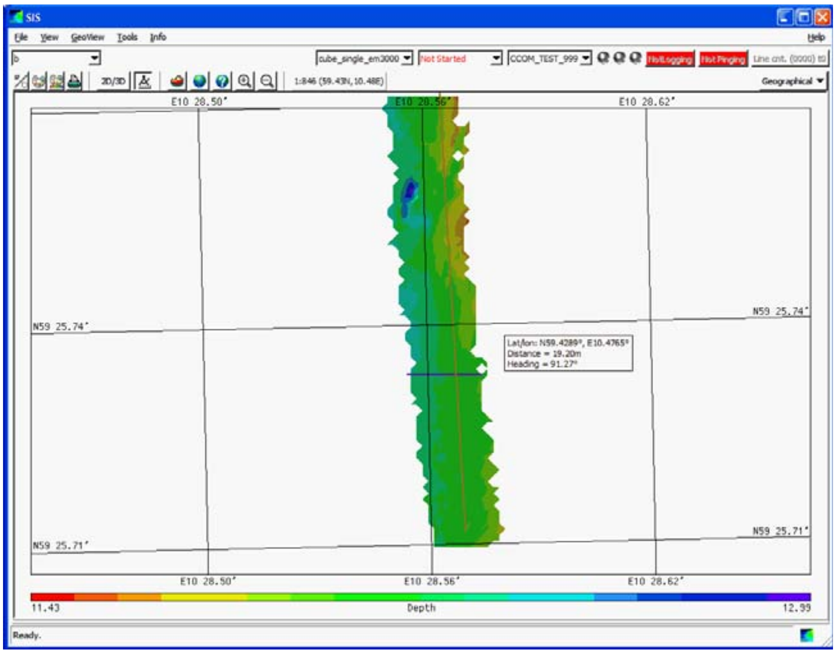


Figure 34   Grid width 19 m

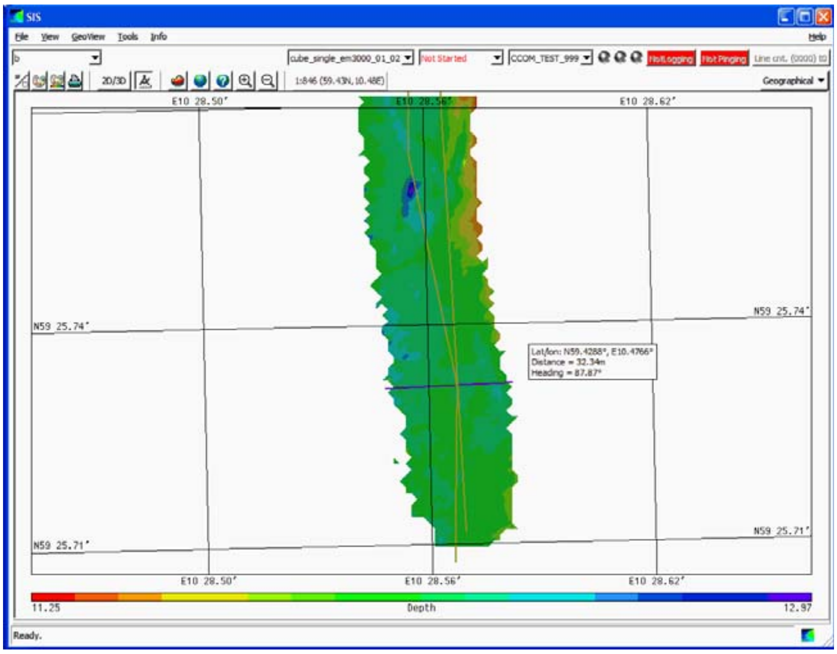


Figure 35   Grid width 32 m

In SIS only depth are extracted from the CUBE processed data. In addition to the depth, CUBE can returns uncertainty, number of hypothesis and hypothesis strength in each grid node.

6.2 User interface differences when CUBE is used

Only the differences in the user interface between CUBE and the GridEngine is treated hereafter.

Import raw data

In the window at the bottom of the user interface, the parameters for the gridding is entered. CUBE needs to know the geographical coordinates of the survey area before any processing can start. The center location for the grid, width, height and cell size must be given. Western or southern values have to be entered as a negative value.

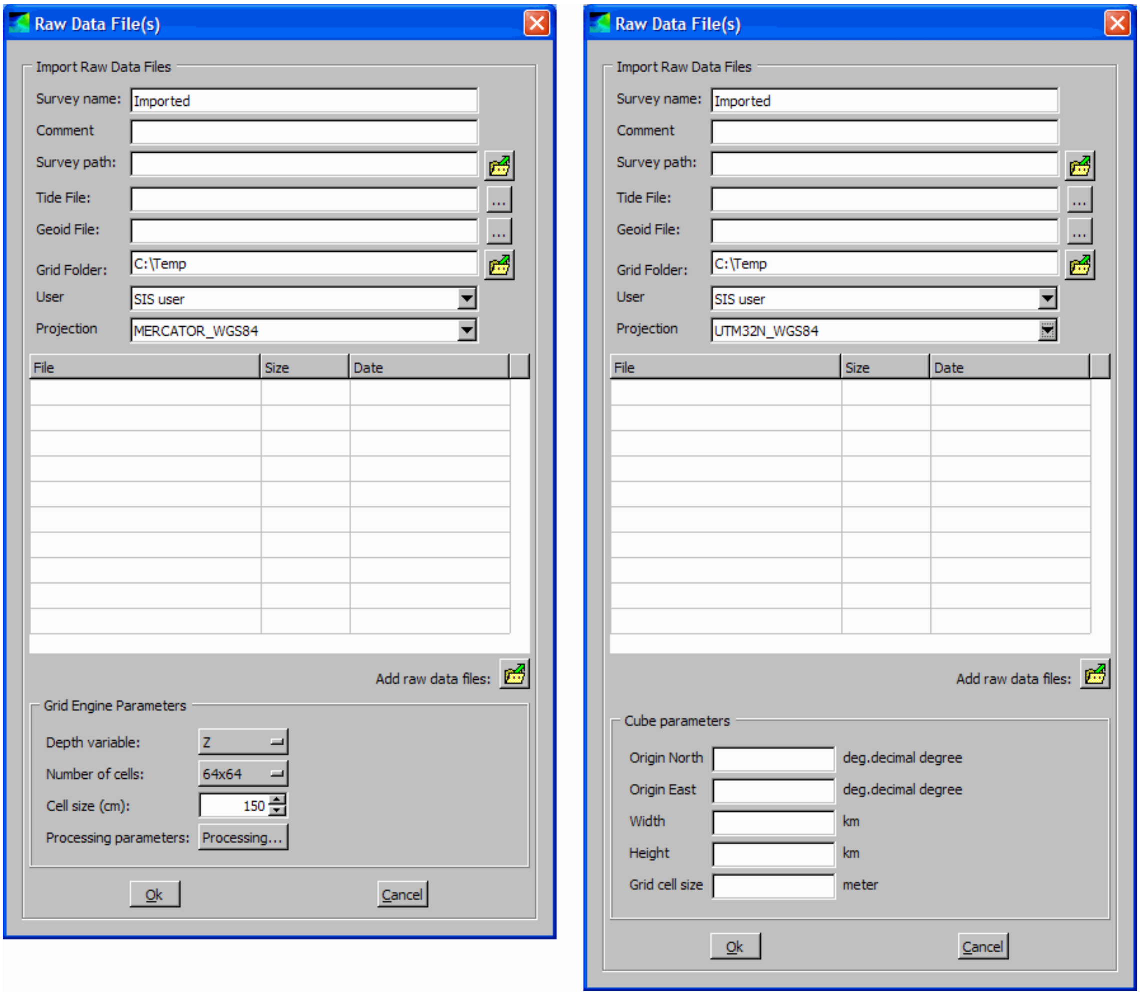


Figure 36 GridEngine (left) and CUBE (right) dialogues

A large survey area requires a coarser grid cell size. The operator is notified if the grid size is too small for the requested survey area. In this case the grid size has to be increased or the survey area has to be reduced.

Export Survey data

GridEngine surveys can be exported to ASCII-files, which can be imported in Neptune. This feature is not supported for CUBE generated grids.

The CUBE grids are however stored as GUTM-files on disc. See

`http://www.ccom.unh.edu/vislab/GeoZui3D/FileFormats.html#GUTM`

for a specification for the file format.

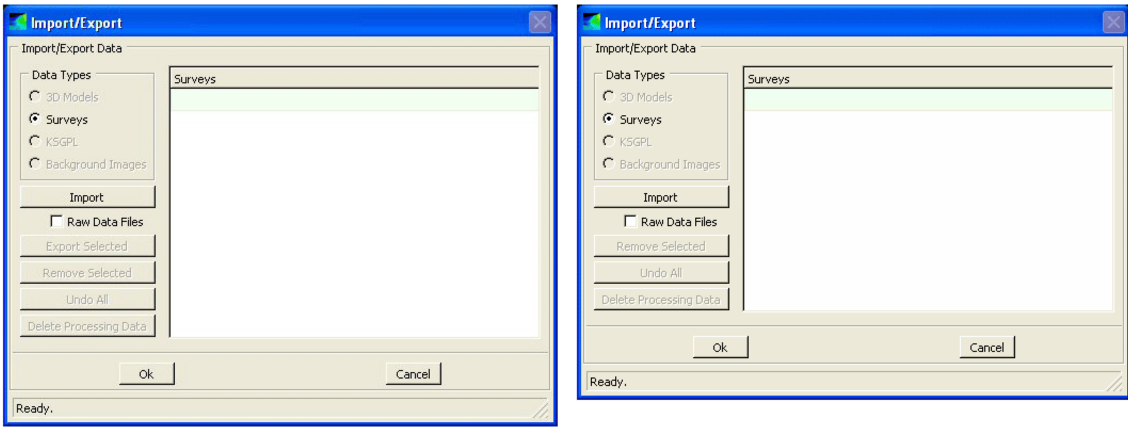


Figure 37 GridEngine (left) and CUBE (right) dialogues

Geographical window

Level of detail

The GridEngine has six levels of details, LOD, in its display grid. For CUBE only the processing grid is available for display and the choice is removed from the user interface.

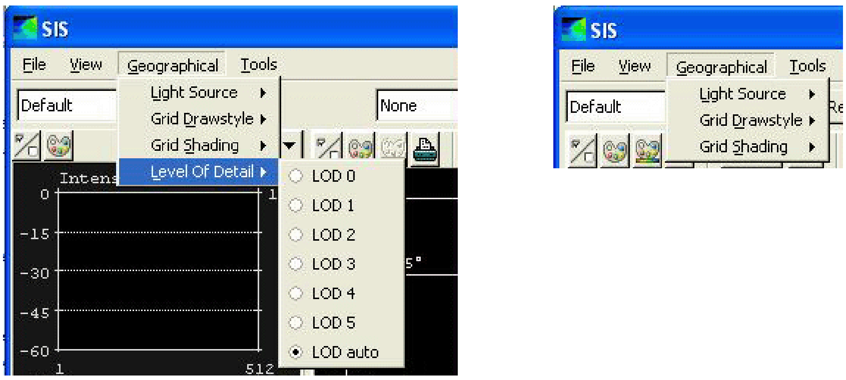


Figure 38 GridEngine (left) and CUBE (right) dialogues

Dynamic colors

For CUBE grids, only depth can be used as a colour map for the dynamic colours.

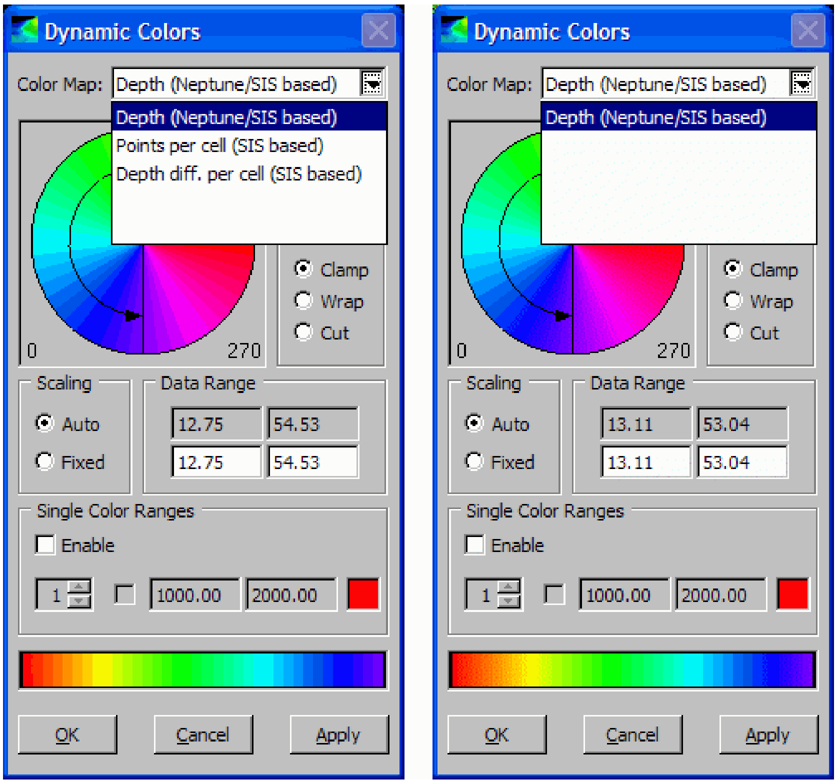


Figure 39   GridEngine (left) and CUBE (right) dialogues

The Show/hide menu

The Show/hide menu has less options since CUBE grids support less features than the GridEngine grids.

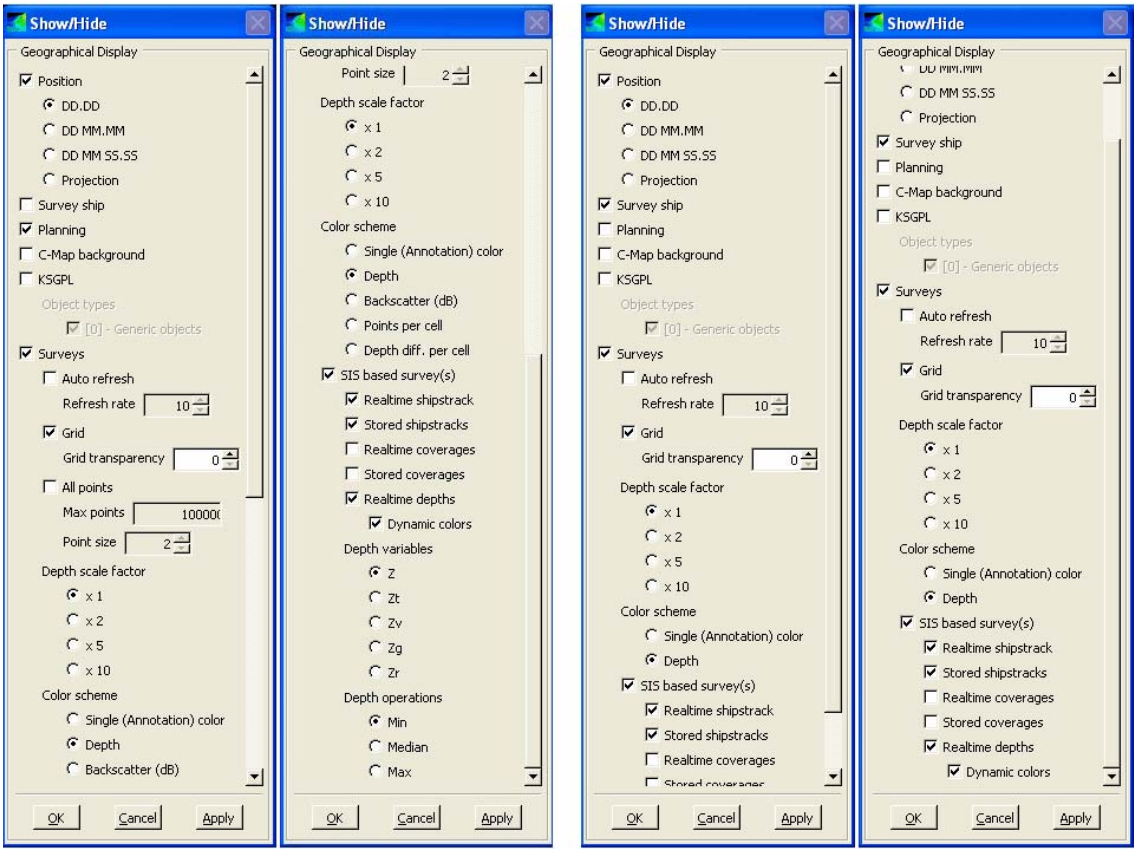


Figure 40 GridEngine (left) and CUBE (right) dialogues

6.3 Other functions not supported by CUBE

Calibration

This is not available when using CUBE. The GridEngine must be run to calibrate the echosounder.

Projection

CUBE grids in SIS can only hold UTM projected data.

7 TECHNICAL REFERENCES

7.1 Introduction

This chapter provides basic reference information useful to understand settings and parameters used throughout the SIS system. In order to understand some of the information, you may need to have a more technical background than the average SIS user.

The chapter is intended for users who would like a deeper knowledge of the technical background for and the data flow inside SIS.

7.2 SIS architecture

SIS processes

The figure below shows the main architecture of how SIS operates.

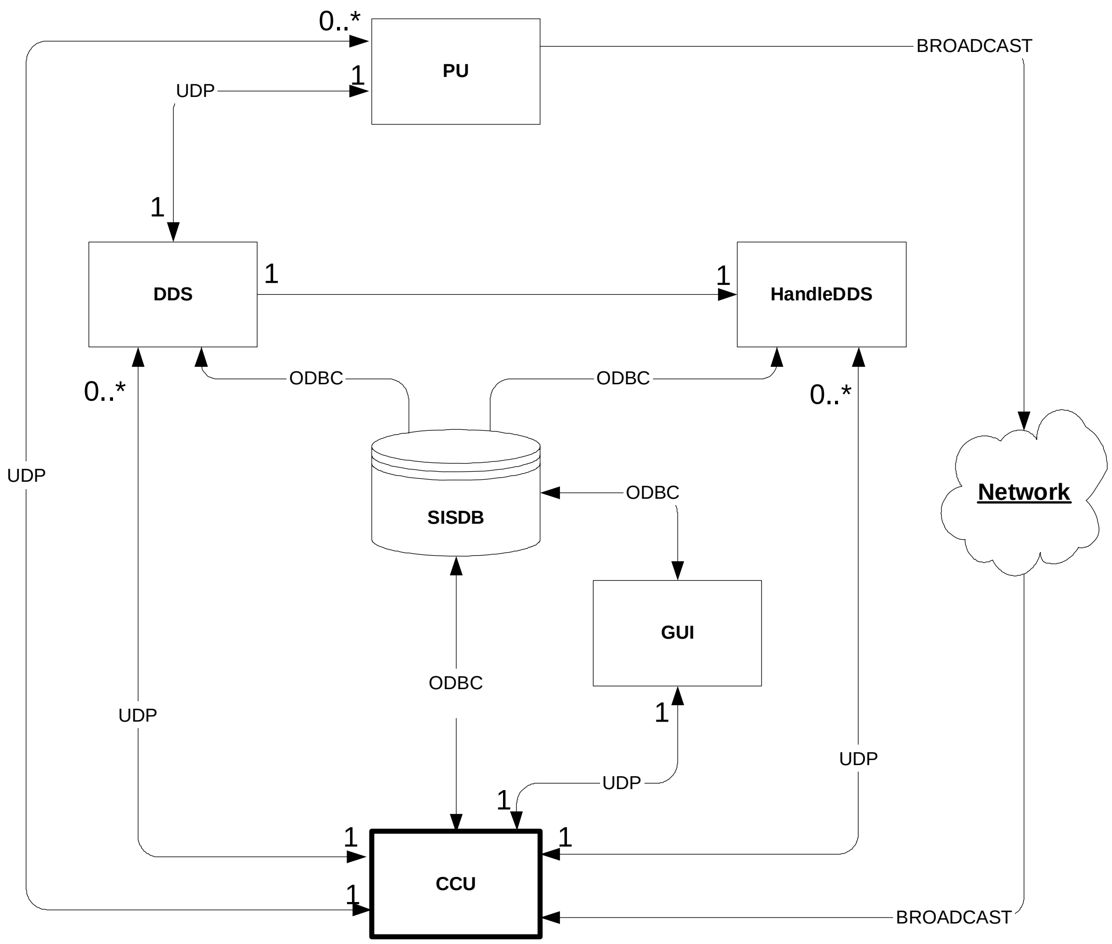


Figure 41 SIS processing line

SIS contains six main processes. This is the start-up sequence:

1 The GUI is the main application, and is started first.

2 The CCU is started by the GUI. When the power is turned on the EM Processing Unit, it starts sending broadcast messages on the network. The CCU will pick up these messages and display the EM in a list in the main GUI.

3 The operator will choose which echo sounders to start from the list in the main GUI.

4 The CCU will be informed which echo sounders to start, and then launch one DDS and one HDDS for each of the echo sounders.

- The DDS reads datagrams received from the Processing Unit from socket and stores them as raw data on disk.
- The HDDS reads raw data from disk and generates xyz data that is sent to the GridEngine.

5 The GridEngine starts to receive xyz-data from the HDDS and generates a real time terrain model from them.

6 The main GUI with the Geographical Display will now start to receive xyz-points from all echo sounders, and it will ask the GridEngine for a terrain model to display.

Main GUI

The main application is called SIS and contains the main graphical user interface (GUI).

There are three main tasks for the main GUI:

1 To display the terrain models with quality information and provide a geographical view of the surveyed data

2 To display status information about the echo sounder

3 To control the echo sounder

The Geographical window gets xyz-data from the HDDS process. It will then display all these xyz-depths as they come in, but only the last pings will be drawn. They will then appear as a tail of soundings behind the ship.

The Geographical window also reads the terrain models generated by the GridEngine. The GridEngine will contain five depths for each measured depth.

The user can choose which reference level to see. The GridEngine also generates several levels of detail so that the Geographical window will always choose the right level of detail based on the current scale.

Note that everything the HDDS process gives out, comes from data it has read from the disk. This means that the data the operator sees in the Geographical window has been safely stored on disk by the DDS process.

The Status windows get data directly from the echo sounders. This means that Status windows such as the Beam intensity window and Sound speed profile window all get the data directly. Hence the Status windows will be active when the echo sounder is active, and can always be used to monitor the current status of the echo sounder.

Control of the echo sounder is done in the Installation parameter window and in the Runtime parameter window. Also Pinging, Logging and LineCnt will invoke the control of the echo sounder. Messages are not sent from the main GUI directly, but to the CCU process. The CCU is then responsible for sending them to the right echo sounder (remember that the CCU can control several echo sounders).

Messages concerining the system operation (errors, warnings, information) are stored in SISDB, and the main GUI provides a window where the operator can see all messages as they arrive.

CCU

The CCU process is responsible for detecting all echo sounders on the network, and to make sure that the communication is established between the different processes. Also, if a new echo sounder is found during rescan, the GUI will be informed.

DDS

The DDS process is responsible for logging all the datagrams the echo sounder sends out. The CCU will tell the DDS where to store the data (complete filename). The DDS can also distribute datagrams to other processes on the network, both to SIS processes and to external processes. In SISDB the operator can define what datagrams he wants to receive from the DDS process, and when to receive them (every time they come or with a certain time interval between).

HDDS

The HDDS process is informed by the CCU process where the DDS process stores its files. Then the HDDS will read the raw data files and create xyz-data from them. For every depth the HDDS process will try to generate five depths:

- The depth measured by the echo sounder (waterline to seabed).
- If a tide file is available, look up the tide in that file and create a tide corrected depth.
- If heights are available from a Real Time Kinematic GPS, and a geoid model is available, then the distance from the vertical reference to the sea floor will be generated. In addition, the distance from the sea floor to the geoid and the distance from the sea floor to the ellipsoid will be generated.

All these depths will be sent to the GridEngine. The HDDS will also read all the sidescan data from the echo sounder and make geo-referenced sidescan data (x, y, reflectivity). All of this is also sent to the GridEngine.

The HDDS process will also do wild point editing of the positions (remove position jumps). Every position is converted from geographical coordinates to projection coordinates before it is sent to the GridEngine.

GridEngine

The GridEngine will receive data from both single beam echo sounders (EA) and multibeam echo sounders (EM). The dataformat is different in these cases. EA data is strictly xyz. This makes it possible for the GridEngine to read many kinds of xyz-data, and they may be from different sources such as ASCII-files. EM data is five depths for each measured depth, and optional sidescan data.

The GridEngine uses two different grids, one called Processing grid and the other is called Display grid. The Processing grid has a user defined resolution of its grid cells, and the user must define how many cells to keep in memory at one time. This is done by specifying the number of grid cells in x and y direction for the Processing grid. A maximum of four Processing grids are then stored in memory at any time.

The Processing grid will contain a lot of data: all the xyz-points and every xyz consists of five z-values. It will also contain all the sidescan data for all lines in that area, and it will keep track of which lines have data inside the area.

The Display grid is what the user actually sees. The Display grid is organized in a hierarchical tree structure called levels. The grid cell size of Level 0 of the Display grid is the same as the grid cell size of the Processing grid, so Level 0 Display grid will display everything from the Processing grid.

Level 1 in the Display grid is computed from four grid cells of Level 0, Level 2 is created form four cells of Level 1 and so on. All this is taken care of by the GridEngine.

The Processing grid will then be used in the Real Time Data Cleaning module, and the results will be an updated Display grid. The Geographical window will calculate the maximum resolution necessary to display the data, based on the current map scale selected by the operator. In a very small scale Display grid Level 0 will be used, and in a higher scale a higher Level of Detail will be used.

This means that the Geographical window will need to display only the necessary amount of data at any time, which again means that the rendering will be faster. The zoom and pan operations will also be very fast because the Geographical window will always get a pre-processed dataset to display. The GridEngine is written entirely in Java and is run as a servlet inside the Jetty webserver.

SISDB

To store parameter settings used in SIS a database called SISDB is created. The database server is Microsoft Desktop Engine (a lightweight version of SQL Server) or PostgreSQL on Linux. Logged data is not stored in the database, only parameters settings and system messages..

This makes it possible to exchange data between different applications which use a database, and to use standard applications and tools to browse the contents of the database.

7.3 Real time data cleaning

When data arrives into the GridEngine, it may be cleaned in real time. Depths may be flagged out, but never deleted. Their status can always be changed if necessary. The Real Time Data Cleaning (RTDC) module operates in two steps:

- As the data arrives, it will be organized as pings in an array. Then some processing will be done on these pings in the array. This is known as Line Based Data Cleaning (LBDC) because the processing only looks at data from the current line. Naturally LBDC is not sufficient for proper data cleaning because errors caused by i.e. sound speed profiles will not be found. However, LBDC can be used for flagging out obvious errors (spikes).
- After LBDC the data will be put into the Processing grid. When we later comes back into the same area, the data from the previous lines will be read back and reprocessed together with the new data. This is called Area Based Data Cleaning (ABDC) because all data from the same area is processed together. ABDC gives us the possibility to find errors in i.e. sound speed profiles and installation angles.

Before we start the ABDC routine, the GridEngine will try to split and merge the processing cells into processing units, and it is actually a processing unit that is used to create a surface. If a processing grid cell has very few points, we try to merge it with its neighbours to create a bigger area with enough points. If that is too many, we split it again. In the figure below we see cells that are empty and cells that contain enough points. On the edge of the processing area there are some cells with not enough points to do a good processing. The user can choose to automatically delete all points inside such cells.

The first thing to do in ABDC is to create a most likely reference surface in each processing unit. Traditionally this has been simply the mean depth value for the cell which means that the reference surface would always be a flat surface. In SIS we prefer to let the GridEngine construct a much more reliable surface that will model the terrain much better. The surface is a curved surface constructed by using a first, second or third degree polynome.

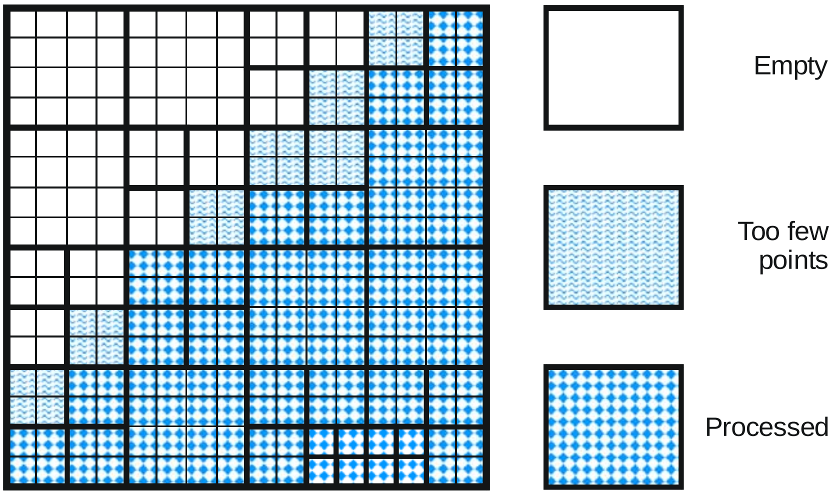


Figure 42 Process grid split into processing units

The method used to construct the reference surface is called Iterated Reweighted Least Squares (IRLS). We try to construct a surface that will be as close as possible to most of the points. Each point is then given a weight depended upon how far away from the surface it is. Points close to the surface is given more weight then the points further away.

- To begin with all points are given the same weight (which means that the first run is the same as a least squares method).
- Then we start the loop and run until we either reach a maximum number of iterations or until the difference between the current and the previous surface is very small:
  - Fit the surface using the current weights.
  - Calculate the residuals (distance from surface to point) for each point.
  - Check for convergence.
  - Adjust the Tukey estimator.
  - Evaluate new weights.
  - The Tukey estimator is found from a predefined function like the one shown in the figure.

The Tukey estimator constructs a curve for how much weight a point shall have based on how far away from the surface it is. In the figure we see that the red curve is a Tukey factor of 1 which means that the weight drops very fast when the residue increases. A Tukey factor of 3 means that the weight is not reduced that fast.

The operator can set the polynome order and the Tukey factor himself.

When the surface has been constructed for each processing unit, we can flag out points based on the result:

- Remove depths inside processing units that has too few points to construct a surface
- **Residue depth rule:** Each depth in the Cell Processing Unit is multiplied with a factor. The result is a limit, and if the residue is larger than this limit, the point is flagged out. This rule will adapt to changing depths so that the factor should be approximately the accuracy of the echo sounder.
- **Residue vertical error rule:** Each depth has a vertical error estimate. This error estimate is multiplied with factor and the result is a limit. If the residue is larger than this limit, the point is flagged out. This rule is also adaptive because the vertical error will change with the range and beam pointing angle.
- **Residue vertical average. error rule:** In each cell the average vertical error is calculated, and the average vertical error for the Cell Processing Unit is then calculated. Then a limit is calculated from this average vertical error in the Cell Processing Unit multiplied with factor. If the residue is larger than this limit, the point is flagged out. Note that it is the average vertical error for the Cell Processing Unit that is used, not the cell’s value.
- **Residue std. rule:** The standard deviation of the residues is also calculated. This is the standard deviation in the Cell Processing Unit, not the cell. A limit is then set by multiplying factor to this standard deviation. Residues larger than this limit are flagged out.
- **Angle of incidence rule:** For each depth the angle between the beam and the bottom surface is calculated. Then the parameter Min. angle can be set and all depths where the angle is less than this limit are flagged out.

7.4 KSGPL

Overview

The Kongsberg SIS Graphical Programming Language (KSGPL) is a powerful extension to SIS allowing the user to use the Geographical window to display geographical information.

The KSGPL protocol defines a set of ASCII datagrams that is sent between a user programmed application and the Geographical window in SIS. The user application opens a network connection (UDP) to the Geographical window and writes ASCII text string to this connection. These KSGPL strings can be used to send lines, points and pictures to the Geographical window, and to define the position to an earlier defined object such as a ship. Theses objects will then be drawn in the Geographical window. A lot of attributes can be set by the operator and the user application to control these objects, both at the time they are sent to the Geographical window and afterwards.

The operator may edit objects sent to the Geographical window. He can split, join, add, delete and move lines, add, delete and move points. The user's actions are sent back to the user application, which then can decide what to do next.

The user application is responsible for storing the data. This allows the programmer to decide where the data is stored, in a file or in any database system already in use. The user application can also decide to add its own user interface so that more information can be added to the objects added by the operator. KSGPL is used to add background data to the Geographical window. This background data can then not be edited.

KSGPL language reference

These datagrams are sent from the outside to the Geographical window.

```
OBJECT <id>
     POSITIONTYPE <GEO| SCREEN | RELATIVE>
     [TYPE <number>]
     [INFO <text>]
     [LINE [ [WIDTH <number>] [SOLID|DOTTED] [COLOR <number>] [TRANS <0-100>] ]
          <POS2D|POS3D> <positions>]
     [POLYGON [ [BORDERWIDTH <number>] [SOLIDBORDER|DOTTEDBORDER]
          [BORDERCOLOR <number>][BODYCOLOR <number>]
          [SHOWBORDER|NOSHOWBORDER] [SHOWBODY|NOSHOWBODY]
          [TRANS <0-100>] ] <POS2D|POS3D> <positions>]
     [POINT [ [SIZE <size>] [COLOR <number>] [TRANS <0-100>] ]
          <POS2D|POS3D> <position>]
     [TEXT <text> [ [SIZE <number>] [COLOR <number>]
          [ORIENTATION <0.0-360.0>] [TRANS <0-100>] ] <POS2D|POS3D> <position>]
     [IMAGE <file> [ [GRAVITYPOINT<0-100> <0-100>]]
          <POS2D|POS3D> <position>]
OBJECT_END
OBJECT <id> DELETE OBJECT_END
```

The two tables below shows the internal datagram descriptions:

Datagram	Description	Required
POSITIONTYPE <GEO>	Use geographical coordinates.	Yes, either GEO, SCREEN or RELATIVE.
POSITIONTYPE <SCREEN>	Centimeters on the screen (float) relative to the lower left corner of the Geographical window. This object will always stay in its position on the screen.	
POSITIONTYPE <RELATIVE>	Meters relative to origo (0.0m, 0.0m) in the world.	
INFO <text>	Name or description of this object.	No.
TYPE <number>	The id of the type this object belongs to.	No.
LINE [[WIDTH <number>]]	Width of the line in pixels.	No. Default is 1.
LINE [[SOLID|DOTTED]]	Solid or dotted line.	No. Default is SOLID.
LINE [[COLOR <number>]]	Colour of the line.	No. Default is black.
POLYGON [[BORDERWIDTH <number>]]	Width of the border in pixels.	No. Default is 1.
POLYGON [[SOLIDBORDER|DOTTEDBORDER]]	Solid or dotted border.	No. Default is SOLIDBORDER.
POLYGON [[BORDERCOLOR <number>]]	Colour of the border.	No. Default is black.
POLYGON [[BODYCOLOR <number>]]	Colour of the polygon border.	No. Default is red.
POLYGON [[SHOWBORDER|NOSHOWBORDER]]	Show the border or not.	No. Default is SHOWBORDER.

Datagram	Description	Required
POLYGON [[SHOWBODY|NOSHOW-BODY]]	Show the body of the polygon or not.	No. Default is NO-SHOWBODY.
POINT [[SIZE <number>]]	Size of the point in pixels.	No. Default is 1.
POINT [[COLOR <number>]]	Colour of the point.	No. Default is red.
TEXT [[SIZE <number>]] *	Font size.	No. Default is 9.
TEXT [[COLOR <number>]]	Colour of the text.	No. Default is red.
TEXT [[ORIENTATION<0.0–360.0>]] *	Orientation of the screen aligned text in degrees. Positive value is counter clock-wise.	No. Default is hori-zontally aligned.
IMAGE [[GRAVITYPOINT <0–100> <0–100>]] *	Gravity point of the picture in percent (i.e. where on the picture the coordinate is given). Horizontal and vertical values.	No. Default is lower left corner.

Datagram common for all objects	Description	Required
OBJECT <id>	A unique identifier. The old object will be deleted if the corresponding identifier al-ready exists in the system.	Yes.
<TYPE> <id>	What kind of type this object is.	No.
<POS2D|POS3D> <position>	Position(s) of the object. POS2D = (x,y) POS3D = (x,y,z)	Yes.
[[TRANS <0–100>]]	Transparency of the object.	No, Default is 0. (No transparency at all.) The polygon bor-der will not be af-fected by the trans-parency setting. Note: Trans-parency is disabled for images.
OBJECT_END	Datagram end.	Yes.

Note * - Not yet supported.

If the object sent into the system is missing required fields, the object is disregarded. No output is given.

An object has always an identifier that must be unique within the application. If an object with the same id exists in the Geographical window, that object is deleted (no message given as output) and the new object is put in. The object may consist of one or more instances of lines, polygons, points, texts and images.

A position has either two or three floating-point numbers and is enclosed in parentheses like: (1.1 2.2 3.3). Comma and semi-colon may be used to separate the tokens, i.e.: (1.1;2.2;3.3;t) to make the file more readable.

An object may be of a type. Object without types will be entered into the system in a default container. An object of a nonexistent type (if given) will be ignored.

Objects may be deleted from the Geographical window by the DELETE datagram. The corresponding id will be deleted.

KSGPL output from the Geographical window

The Geographical window will have line and point editing capabilities on objects that consists of one line only or one point only. Composite objects consisting of several lines and/or points cannot be edited. When the user has edited data that have been put in via KSGPL, the Geographical window will output these KSGPL datagrams:

```
ACK <status> ACK_END
OBJECT <id> MARKED OBJECT_END
OBJECT <id> MARKED OBJECT_END
OBJECT <id> DELETED OBJECT_END
OBJECT <id> CREATED OTYPE <type_id> POINT <POS2DT|POS3DT> <position> OBJECT_END
OBJECT <id> CREATED OTYPE <type_id> LINE <POS2DT|POS3DT> <positions> OBJECT_END
OBJECT <id> EDITED POINT <POS2DT|POS3DT> <position> OBJECT_END
OBJECT <id> EDITED LINE <POS2DT|POS3DT> <positions> OBJECT_END
OBJECT <id> JOINED_LINES <second_line_id> <POS2D|POS3D> <positions>
<POS2D|POS3D> <positions> OBJECT_END
OBJECT <id> SPLIT_LINES <POS2D|POS3D> <positions> <POS2D|POS3D> <positions>
OBJECT_END
```

The table below shows the external datagram descriptions:

Datagram	Description
ACK <status> ACK_END	An acknowledge message sent whenever a datagram has been received by the Internal KSGPL Handler. 'status' is an integer informing about status of the datagram just received. −1 = Datagram failed to be recognized. 0 = Reserved. 1 = Datagram successfully recognized.
OBJECT <id>	A unique identifier. This will be 0 for new (CREATED) objects.
POS2D <position(s)> POS3D <position(s)> POS2DT <position(s)> POS3DT <position(s)>	Position(s) of the object. POS2D = (x,y) POS3D = (x,y,z) POS2DT = (x,y,t) POS3DT = (x,y,z,t)
MARKED	The object has been 'marked' by the user. No changes are done to the graphics. The External KSGPL Handler can now take proper customized action(s).

Datagram	Description
DELETED	The object has been deleted by the user and removed from the scene.
CREATED OTYPE <type_id> <POINT|LINE>	The user has created a new point or line of a given type. The object has been removed from the scene.
EDITED <POINT|LINE>	The user has edited the given point or line. The object has been removed from the scene.
JOINED_LINES <second_line_id> <POS2D|POS3D> <positions_of_line_one> <POS2D|POS3D> <positions_of_line_two>	The user has joined two lines into one. The preceding 'OBJECT <id>' is the ID of the first line. <second_line_id> is the ID of the second line. The lines are connected together between the last vertex in the first line and the first vertex in the second line.
SPLIT_LINE <POS2D|POS3D> <positions_of_line_one> <POS2D|POS3D> <positions_of_line_two>	The user has split an existing line into two line segments. The preceding 'OBJECT <id>' is the ID of the original line before being split. Note: The user has *removed* one vertex in the original line (and not only deleted a sub line segment).
OBJECT_END	Datagram end.

A position has either two or three floating-point numbers and a time field enclosed in parentheses like: (1.1 2.2 3.3). POS2DT or POS3DT positions also have a time-field 't' which is given in the format: yyyyMMddhhmmSS.sss. (Year, month, day, hour, minute, seconds and decimal seconds.) POS2DT or POS3DT are only used when the user has EDITED or CREATED something in the scene. If the user has EDITED e.g. an existing POS2D line by moving one of the vertices, the unmoved vertices will have the time-field set to '00000000000000.000' when sent out. POS3D(T) are only sent if the original object was inserted into the system using POS3D coordinates. Respectively the same with POS2D(T).

Objects are assumed to be sent to an external program and deleted from the Geographical window as soon as they are CREATED or EDITED and then sent back to the Geographical window. After that, line objects may be split (SPLIT_LINES) or joined (JOINED_LINES). These operations are then only allowed on lines that have been put into the Geographical window from an external source.

Selected objects remain in the Geographical window, but CREATED, EDITED, JOINED_LINES and SPLIT_LINE are deleted from the Geographical window when these datagrams have been written to socket. It is assumed that the receiving program will handle the necessary storage of the changed items and then send them back to the Geographical window to be redrawn in a new state. This will assure the user that the data have been successfully stored.

For an edited line or point the position(s) are the new, changed position(s). A line may also get new vertices inserted into the line (both at the ends of the line and between vertices in the line) and have vertices deleted. The output will be written when the user has completed the editing of the line, not while he is editing.

New objects will have id=0. For a split line the id will be the id of the original line.

7.5 Set parameters in SIS

Parameters can be set to change the behaviour of SIS. Normally SIS must be restarted for these parameters to take effect.

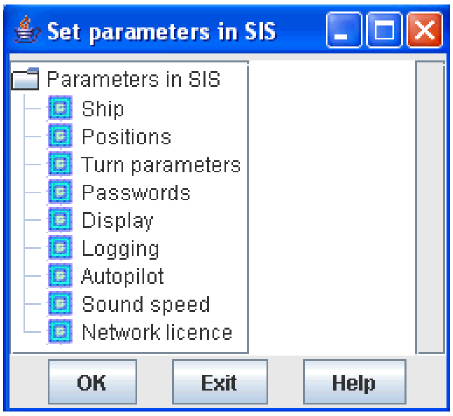


Figure 43 Set parameters in SIS

Click on the branch in the tree to the left and the window to the right will expand.

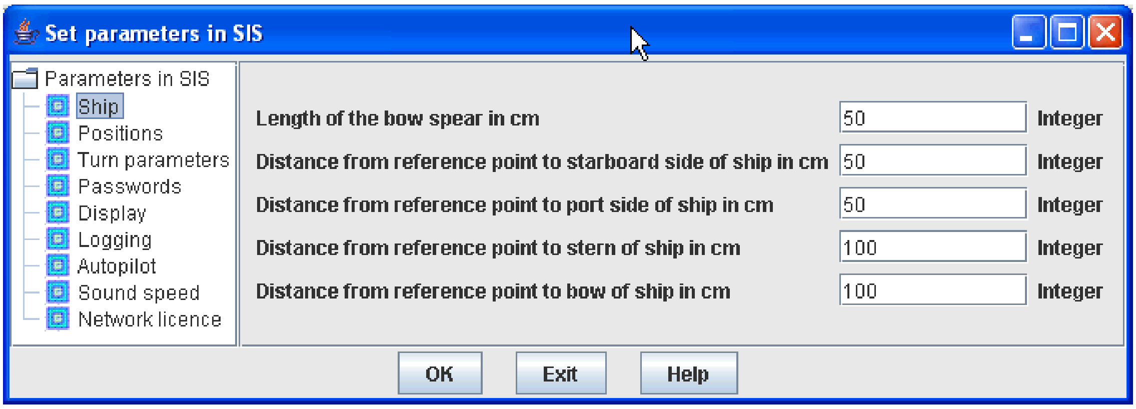


Figure 44 ***Ship*** *parameters*

- Length of spear in cm: This is the length of the line drawn from the bow of the ship.
- The next four parameters define the distances from the reference point to the edge of the ship.

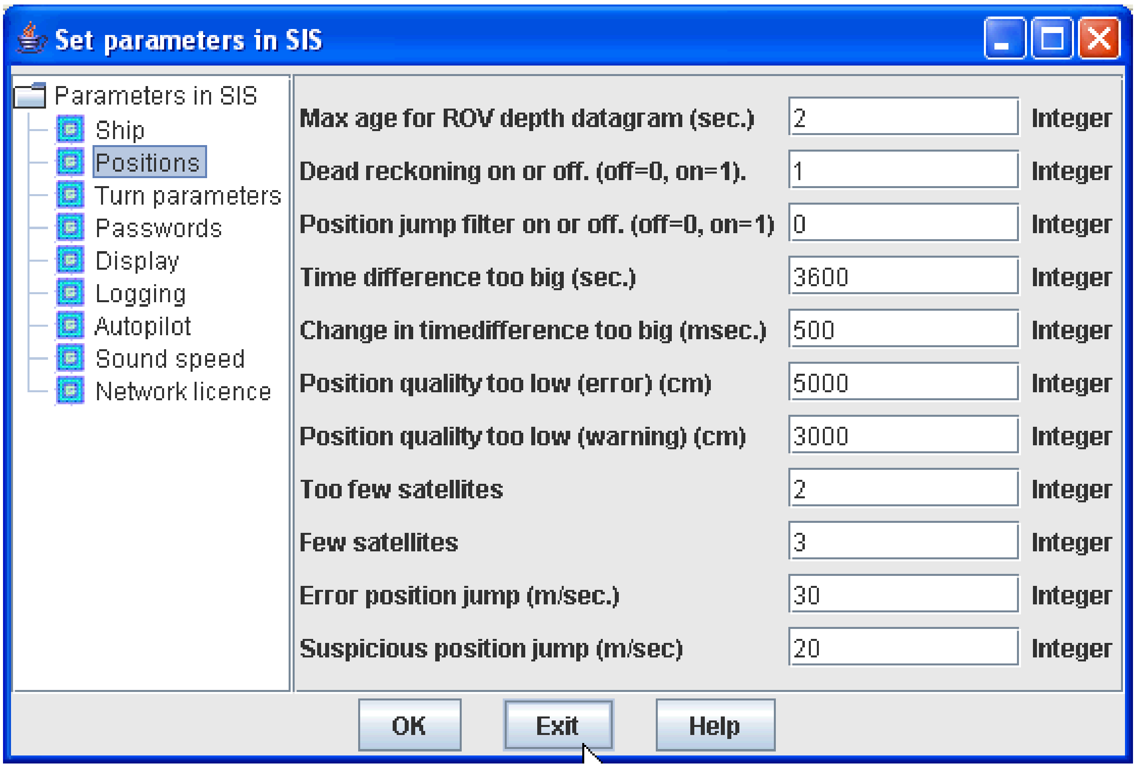


Figure 45 Set position parameters

- Max age for ROV depth datagram (sec.). Time before a missing ROV depth input datagram to the echo sounder (PU) should be flagged in the numerical display. Should never be set to 0.
- Dead reckoning on or off. (off=0, on=1). If position input stops the dead reckoning feature will calculate predicted positions for a preset time interval before stopping. The predicted positions are based on the two last positions received and the (still) incoming heading, if available. If not the last heading will be used.
- Position jump filter on or of. (off=0, on=1) . This filter is used to remove single spikes in the position input. If a position spike occur this position is disregarded and a predicted position used instead. This predicted position is based on the two previous (legal) positions and the heading.

- Time difference too big (sec): If the time difference between the timestamp and the time in the clock datagram is bigger than this value, an error is generated.
- Change in time difference too big (millisec): There is always a time difference between the timestamp and the time in the clock datagram. However, this time difference should normally be almost constant. If there is a sudden change in this difference, an error is generated.
- Position quality too low (error) (cm): Lowest acceptable limit for the computed position quality (see position datagram output in the corresponding echo sounder manual).
- Position quality too low (warning) (cm): Warning limit for the position quality.
- Too few satellites: Lowest acceptable number of satellites (error limit).
- Few satellites: Low number of satellites (warning limit).
- Error position jump (m/s): Highest possible speed of the ship. This is used to generate error messages for position jumps.
- Suspicious position jump (m/s): Warning about possible position jump.

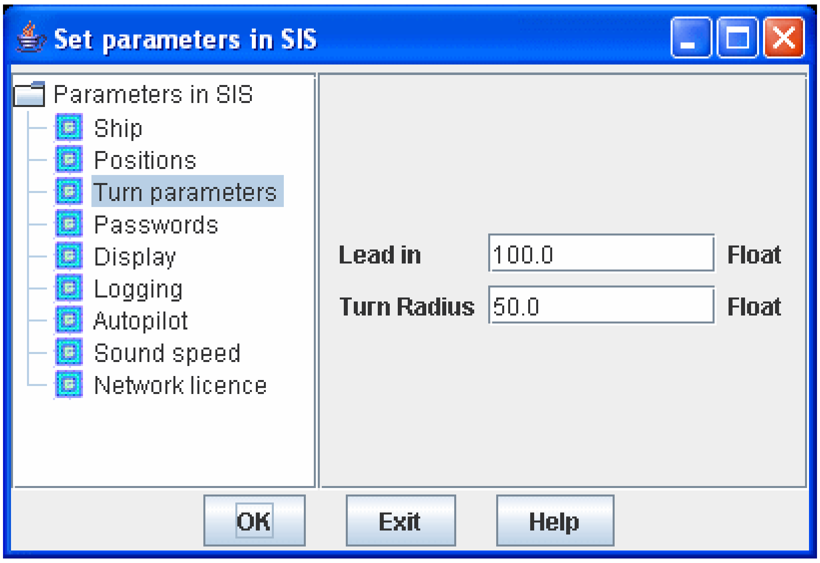


Figure 46 Set turn parameters

These parameters are used to control how the planning module in SIS shall generate turns from one planned line to the next.

- Lead in: Add these meters to the end of each planned line to allow the ship to become stable before entering the survey line.
- Turn radius: The minimum turn radius in meters that the ship can do.

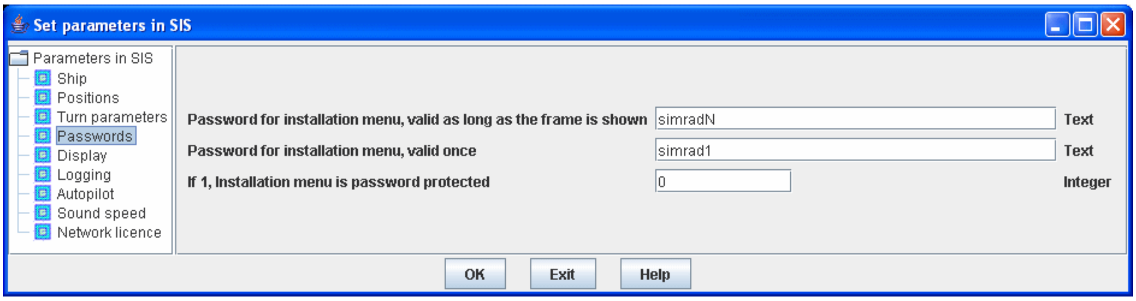


Figure 47   Set passwords

These parameters control the use of passwords in SIS.

- Password for installation menu, valid as long as the frame is shown:
- Password for installation menu, valid once:
- If 1: Installation menu is password protected: Set this parameter to 1 to enable the use of passwords, 0 to disable.

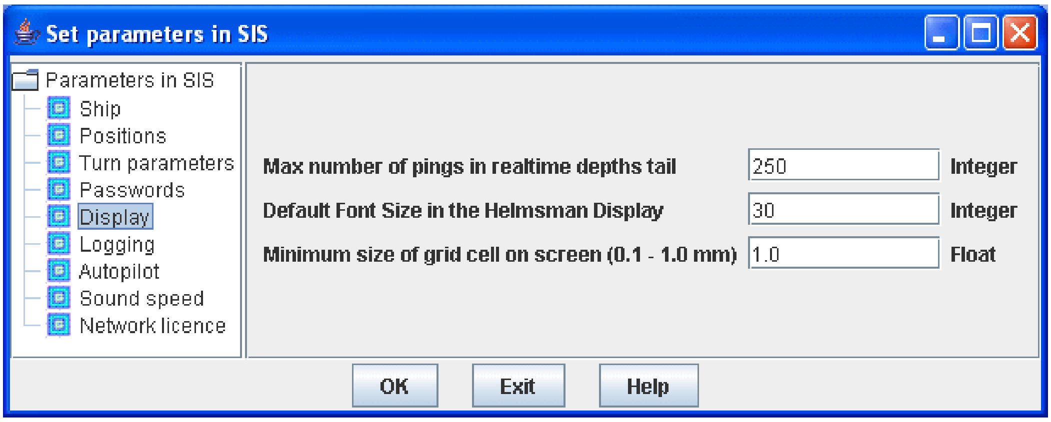


Figure 48   Set display parameters

- Minimum size of grid cell in screen (0.1 - 1.0 mm): This parameter defines when the Level of Detail in the Geographical Window shall change. Setting this value to, say 0.3, will tell SIS to keep a higher Level of Detail when the map scale decreases. This will give “sharper” images, but use more RAM and increases response time for updates.
- Max number of pings in realtime depth. The length of the realtime depth tail behind the ship in the geographical view.
- Default Font Size in the Helmsman Display. Control the font size in the Helmsman Display, both the display in SIS and the display in the Remote Helmsman application.

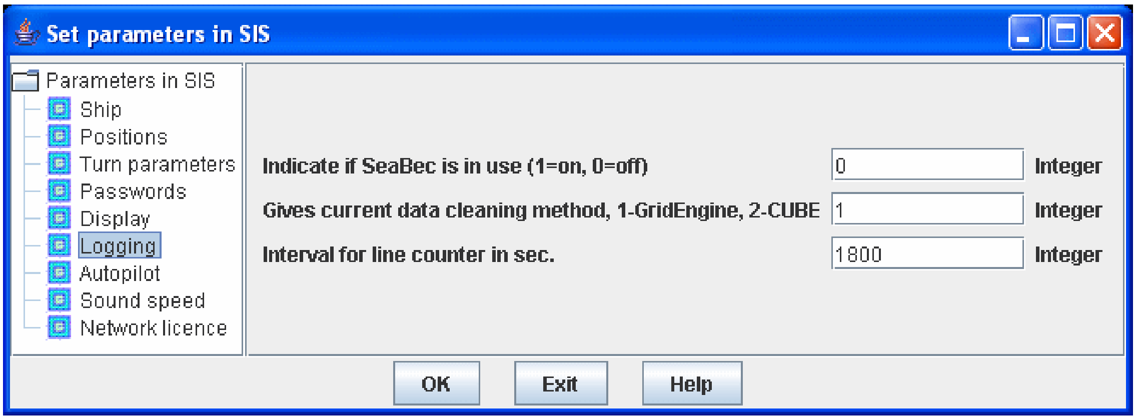


Figure 49 Set logging parameters

- Indicate if SeaBec is in use (1=on, 0=off): Normally set this to 0. This can be used to turn on Single Beam Seafloor classification if a license is found.
- Gives current data cleaning method, 1=GridEngine, 2=CUBE: This parameter controls if SIS shall use GridEngine or CUBE to generate terrain models.
- Interval for line counter in sec.: Control when new survey lines shall be generated automatically.

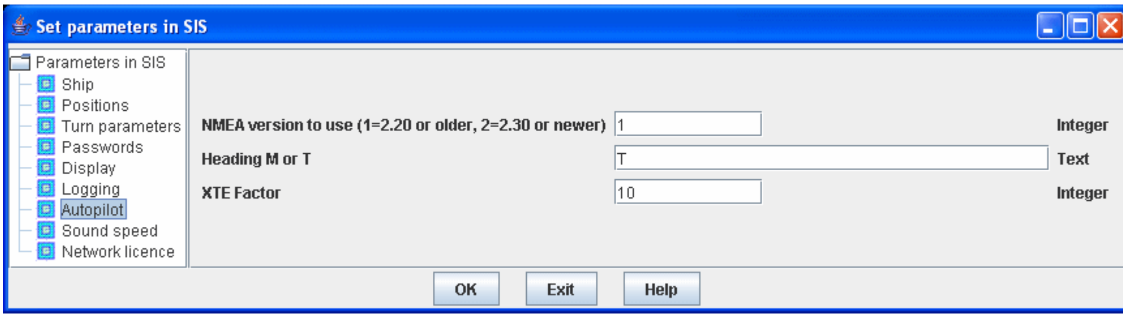


Figure 50 Autopilot parameters

- XTE factor: the XTE value in the NMEA APB sentence is multiplied with this factor. This can cause the autopilot to react more quickly, but it can make the ship oscillate along the line. This factor must be used with care.

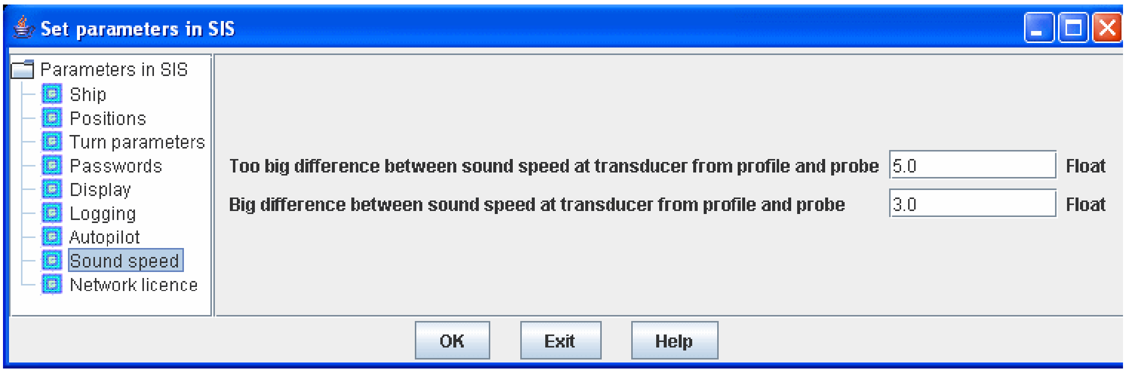


Figure 51 Sound speed parameters

Set network licence.

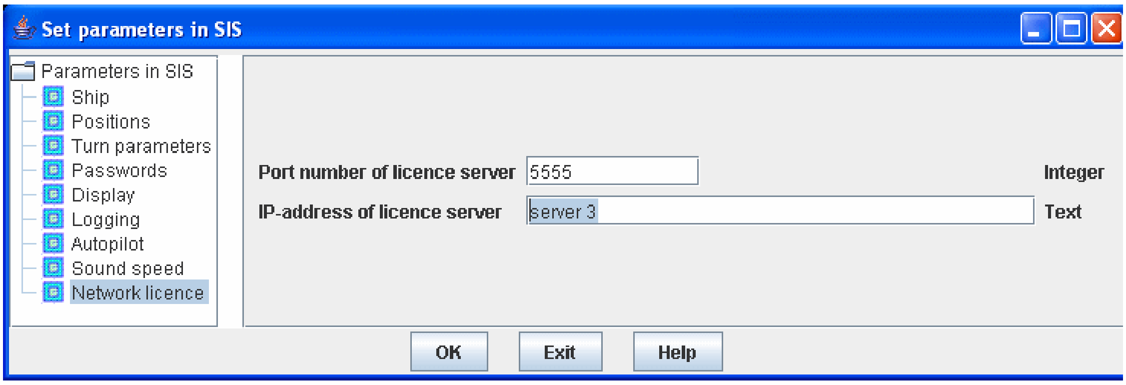


Figure 52 Network licence.

7.6 Create terrain models in SIS from ASCII-files

This tool can be used to create terrain models in SIS from ASCII files.

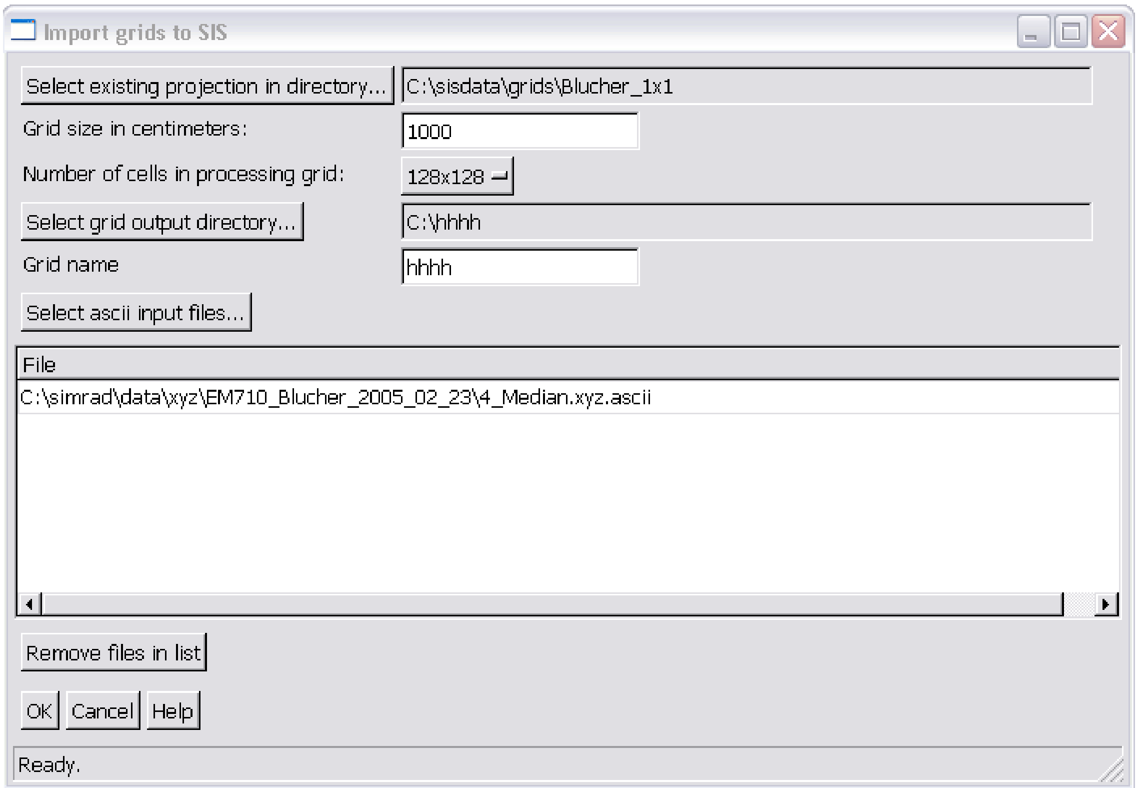


Figure 53 Create terrain models in SIS from ASCII files

The format of the ascii-file is like this:

```
*** Neptune Ascii file from Kongsberg Simrad
A/S ***
Survey name: EM710_Blucher_2005_02_23
Processing operator name: tp
Datum: WGS84
Half axis: 6378137.0000000
Flattening: 1/298.25722356300
Coordinate system: Lat/Long
Latitude min.:  59.66354720
Longitude min.:  10.59076500
Latitude max.:  59.70350375
Longitude max.:  10.62006250
Latitude cell size: 5.00 meter
Longitude cell size: 5.00 meter
Median depth of each cell

10.6148669 59.6635847 40.14
10.6149773 59.6635844 45.31
10.6150679 59.6635841 50.54
```

The first lines are the header. The first empty line ends the header, and the header must always be present. This means that the data in latitude, longitude, depth must follow after an empty line. Latitude and longitude are in decimal degrees and the depth is in meters.

This format is written by Neptune (BinStat), geographic coordinates in ascii format. Normally the median value for the grid cell is written in this format, which makes it faster to generate the grid in SIS. If the grid cell size in BinStat is, say 2 meters, use 400 cm as the grid cell size in SIS.

“Select existing projection in directory…” opens up a directory selection box where the operator chooses which projection file to use. This projection file must be found in the selected directory. Normally select the directory where the recent survey is located. This will ensure that the projections are the same in the new survey and the created grid.

“Grid size in centimeters” should normally be twice as big as the grid cell size in BinStat if median files are used.

“Number of cells in processing grid” should normally be the same as the number used in new surveys.

“Select grid output directory” selects the directory where the grid shall be stored. Note that this directory must exist and be writeable (common error on Linux).

“Grid name” is the name of the grid.

“Select ascii input files” opens a file selection dialog where the operator can choose which files to use as import.

“Remove files in list” removes the selected files from the list.

“OK” runs the process.

Note that the GridEngine must be running for this program to work.

Also note that there are many errors that can occur in this process, and they may kill the GridEngine process. If such an error occurs, this program may have to be killed from the process manager, and the GridEngine must be restarted.

7.7 Export formats

When data is exported from SIS, the user can choose different export formats.

The ASCII output contains a line describing what the file contains. Note that positions are in projection coordinates and in centimeters, depths are also in centimeters. Time is in milliseconds since epoch (0 UTC 1 January 1970).

The binary output also contains this information. Here is an example of how to read the binary files:

```
//h+//////////////////////////////////////////////////////////////////////////
/*!
//  \file    readSISBinaryOutput
//
//  \brief   Example of how to read the binary output from SIS
//  \author  Terje Pedersen
//
//  \date    10-OCT-2003
//
//  \par     Copyright:
//
//           Copyright by Kongsberg Simrad
//
//
//  \par     Revision History:
//
//  \par     01  10-OCT-2003 tp
//
//           Original Version.
//
//
*/
//h-//////////////////////////////////////////////////////////////////////////

#include <stdio.h>
#include <stdlib.h>
#include <time.h>
#include <string.h>

//! Little endian cell data
#ifdef WIN32
typedef __int64 i64;
#else
typedef long long i64;
#endif
```

```
typedef struct {
    int m_lEastCm, m_lNorthCm;
    int m_iDepthCm;
    int m_iFlag;
    int m_iResidualCm;

}SLittleEPointRec, *SLittleEPointPnt;

typedef struct {
    int m_lEastCm, m_lNorthCm;
    i64 m_lDate;// millisec. since epoch
    int m_iPingno, m_iBeamno;
    int m_iDepthCm;
    int m_iFlag;
    int m_iResidualCm;

}SLittleEPointExtraRec, *SLittleEPointExtraPnt;

//f+////////////////////////////////////////////////////////////////////////
//
/*!
//  \brief   Convert milliseconds since epoch to date
//
//  \param   mtime, milliseconds since epoch
//  \param   year, month, day, hour, min, sec, millisec
//
//  \return  void
//
//  \author  Terje Pedersen
//
//  \date    10-OCT-2003
//
//  \note
*/
//f-////////////////////////////////////////////////////////////////////////
void convertMsecToDate(i64 mtime, int *year, int *month, int
*day, int *hour, int *min, int *sec, int *msec)
{
    i64 t;
    time_t nt;
    struct tm stm, *ptm;
    if (year == NULL || month == NULL || day == NULL || hour
    == NULL || min == NULL || sec == NULL || msec ==
    NULL) return;
    t = mtime/1000;
    *msec = (int)(mtime - (t*1000));
    nt = (time_t)t;
    ptm = localtime(&nt);
```

```
    if (ptm == NULL) return;
    memcpy(&stm,ptm,sizeof(stm));
    *year = stm.tm_year+1900;
    *month = stm.tm_mon+1;
    *day = stm.tm_mday;
    *hour = stm.tm_hour;
    *min = stm.tm_min;
    *sec = stm.tm_min;
}

//f+////////////////////////////////////////////////////////////////////////
//
/*!
//  \brief   Read the binary output from SIS
//
//  \param   type, what type of file to read
//  \param   filename, name of file to read
//
//  \return  void
//
//  \author  Terje Pedersen
//
//  \date    10-OCT-2003
//
//  \note
*/
//f-////////////////////////////////////////////////////////////////////////
int readSISBinaryOutput(int type, char *filename)
{
    FILE *fd;
    SLittleEPointRec le;
    SLittleEPointExtraRec lex;

    if (type < 1 || type > 2) return -1;
    //printf(”%d %d\n”,sizeof(le),sizeof(lex));

    fd = fopen(filename,”rb”);
    if (fd == NULL){
        fprintf(stderr,”Cannot open file: %s\n”,filename);
        return -1;
    }

    if (type == 1){// Little endian point data
        while(fread(&le,1,sizeof(le),fd)){
        printf(”East %d cm, North %d cm, Depth %d cm, Flag
        %d, Residual %d cm\n”,le.m_lEastCm, le.m_lNorthCm,
        le.m_iDepthCm, le.m_iFlag, le.m_iResidualCm);
        }//while
```

```
    }//if type == 1
    if (type == 2){// Little endian point data with extras
        int year, month, day, hour, min, sec, msec;
        while(fread(&lex,1,sizeof(lex),fd)){
            convertMsecToDate(lex.m_lDate, &year, &month,
            &day, &hour, &min, &sec, &msec);
            printf(”East %d cm, North %d cm, Date %I64d
            %04d%02d%02d %02d%02d%02d.%d, Ping no. %d,
            Beam no. %d, Depth %d cm, Flag %d, Residual %d
            cm\n”, lex.m_lEastCm, lex.m_lNorthCm, lex.m_lDate,
            year, month, day, hour, min, sec, msec, lex.m_iPingno,
            lex.m_iBeamno, lex.m_iDepthCm, lex.m_iFlag,
            lex.m_iResidualCm);
        }//while
    }//if type == 2
    return 0;
}

int main(int argc, char *argv[])
{
    if (argc != 3){
        printf(”\n\nUsage: %s <type> <filename>\n\n”,argv[0]);
        printf(”Types:\n”);
        printf(”1: little endian point data without time.\n”);
        printf(”2: little endian point data with time.\n”);
        printf(”Long must be 8 bytes, it is %d
        bytes\n”,sizeof(i64));
        printf(”\n\n”);
    }//if

    return readSISBinaryOutput(atoi(argv[1]), argv[2]);
}
```

7.8 Survey plan file format

The survey plan file can be stored as a binary file with extension ***.sisplan** or as ASCII files in the existing Neptune format.

The first line gives information about the Latitude / Longitude format used in the file. There are four different options:

DEG - Degrees,decimal degrees

MIN - Degrees,minutes and decimal minutes

SEC - Degrees,minutes and seconds

PROJECTION - Projection coordinates

The next line is a comment or text that follows the job.

The next to lines is an example of a planned line. The format of a planned line is:

```
_LINE <Line Name> <Line Number> <Time of
creaton><Flag><N><E><N><E>'<Comment>
```

The time of creation is the Work Station time given in the following format:

```
YYYYMMDDhhmmss
```

where:

- **YYYY -** The Year
- **MM -** The month of the year
- **DD -** The day of the month
- **hh -** The our of the day
- **mm -** The minutes in the hour
- **ss -** The seconds of the minute

The polygon has a similar format except:

- Starts with _POLYGON.
- The name is always polygon.
- The line number is always 0.
- The flag is always 0.
- It is not possible to attach information to a polygon.

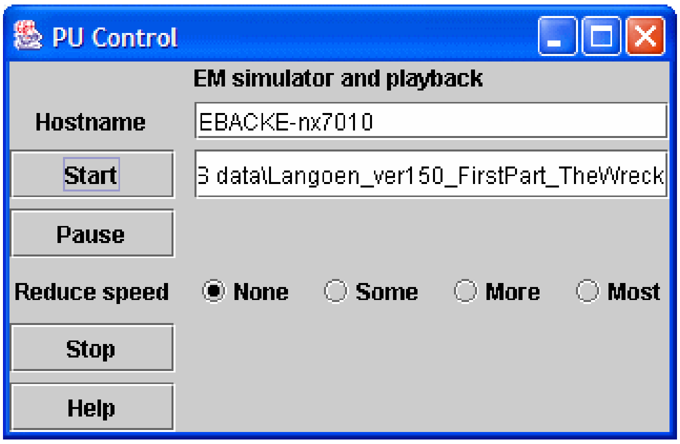
7.9 PU: EM Simulator and playback

What it does

The PU program is a playback program of logged data from EM multibeams. It can be used together with the Seafloor Information System to act as an EM simulator or playback of logged data. The program is located where you installed SIS.

How it works

PU is launched in the background and then waits for command signals.



"Hostname" is the hostname of the machine where PU is running.

The button "Start" pops up a directory selection box where the operator selects the directory where the *.all* raw data files are located. This directory is written in the textfield next to the button.

PU will then read all the *.all* files in the directory over and over again, and send out the datagrams as if they came from an EM. However, there are some differences:

- The time in the header of all datagrams will be set to the current time in GMT. Also the time in the GGA text string in the position datagrams will be set to this time.
- PU will not send broadcast datagrams to SIS before it has received the information about which directory to read from. Therefore SIS must be started after pressing the Start in PU.
- Other data in the datagrams will not change. This means that the Numerical display in SIS will display the time information from the original information datagrams.

How to do it

1 The network must be operational. You must be connected to a network or you must use the loopback plug.

2 Edit the file *SIS.bat*. Type **REM** in front of the lines **kill java.exe**, **kill PU.exe** and **start startJetty.bat**.

3 Start the program in **Start -> All Programs -> Kongsberg Maritime -> SIS -> StartJetty**.

4 Open a command window and change directory to where you installed SIS, typically c:\program files\Kongsberg Maritime\SIS\bin. Then type: **perl runsim.pl**.

5 Press the “Start” button and select the directory where the *.all* files are located. You will then see in the command window running the PU process that broadcasts are being sent to the network.

6 Start SIS from the desktop icon.

7 Choose to start echo sounder 888.

8 You can now operate SIS as you would with any other echo sounder, except that changing the Installation and Runtime parameters have no effect.

9 If you have a slow computer, you can press “Pause” to allow SIS to catch up.

10 You can control the speed of the simulator by reducing the playback rate.

11 Press “Stop” to stop the simulator.

7.10 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.

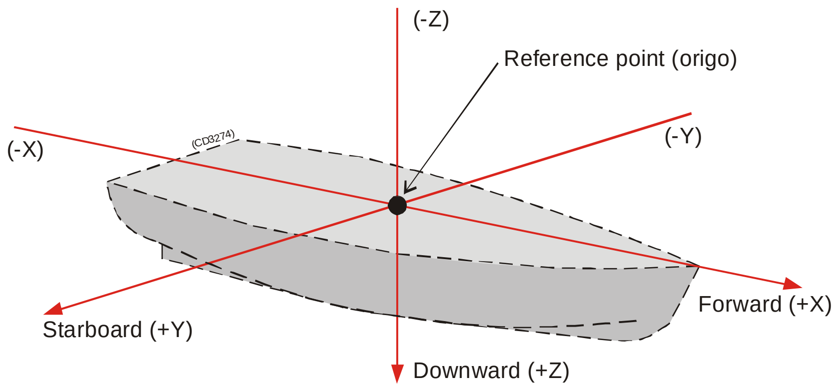


Figure 54 The Vessel Coordinate system

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.

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.

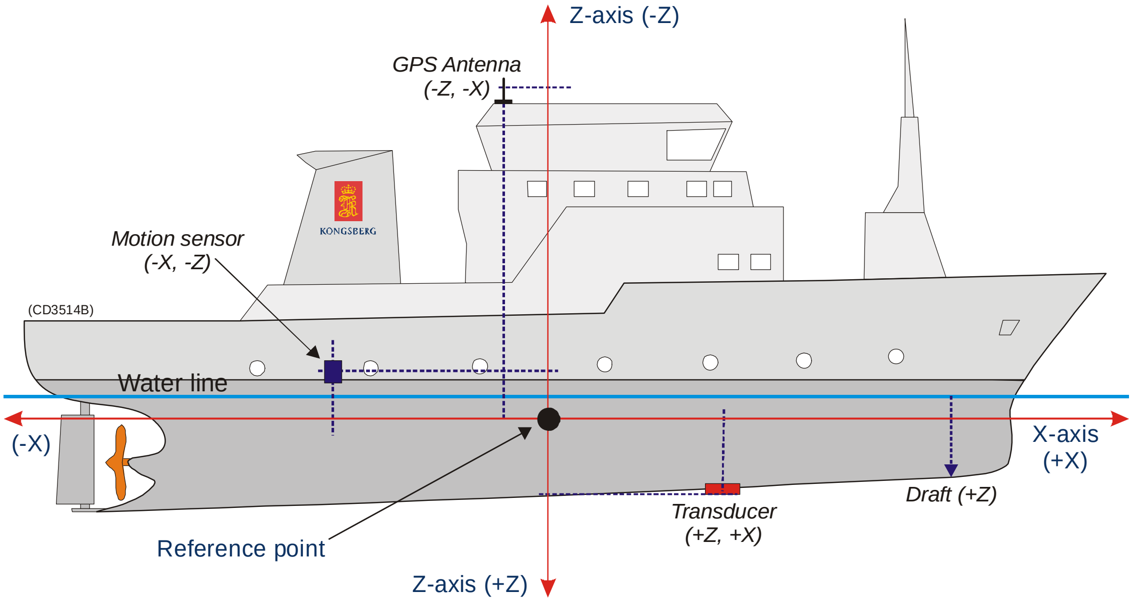


Figure 55 Sensor locations (example)

7.11 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 1PPS (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 1PPS 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 1PPS pulses has no significance. However, spurious noise recognized as 1PPS pulses will offset the clock forward, 1 second for every spurious signal accepted.

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 allowed 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. 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 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 1PPS 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.

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 1PPS 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 1PPS 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).

Time difference PU-ZDA and PU-POS indications

The color indications used in the Numerical display for PU-ZDA and PU-POS time difference are based on the **1PPS** setting, the **Time to use** setting and the clock **Source** selection. All these parameters are set in the Installation parameter frame.

→ *See page 160.*

The standard legal time difference in most situations are +/- 1 sec., but with 1PPS off and time tag from the system the legal time difference is considerably larger.

The legal time delays are system parameters and can not be changed by the operator.

	1PPS On	1PPS Off
DATAGRAM	Timediff +/- 1 sec: RED in 'PU-ZDA' field when Ext. clock RED in 'PU-POS' field when Active pos. RED in 'PU-POS'* field when Operator st.	Timediff +/- 1 sec: RED in 'PU-ZDA' field when Ext. clock RED in 'PU-POS' field when Active pos. RED in 'PU-POS'* field when Operator st.
SYSTEM	Timediff +/- 1 sec: RED in 'PU-ZDA' field when Ext. clock. RED in 'PU-POS' field when Active pos. RED in 'PU-POS'* field when Operator st.	Timediff +/- 30 sec. YELLOW in affected field. Timediff +/- 600 sec. RED in affected field.

* Conceptually not correct, but not able to compare with operator

7.12 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

7.13 Handling of SSP datagrams

Overview

The SSP datagram format is used for input of depth or pressure profiles containing:

- Sound speed (m/s)
- Temperature (°C)
- Salinity (parts per thousand)
- Absorption coefficient

SSP datagrams are sent to the Operator Station on port 4001.

The SSP format is a generic format and the actual type of information conveyed is defined by an identifier. Currently the following are defined:

Identifier	Input data	Data to be used	Comment
S00	D,c	D,c	Used immediately
S01	D,c,T,S	D,c,a(D,T,S,L)	Same as S12, but used immidiately
S02	D,T,S	D,c(D,T,S,L), a(D,T,S,L)	Same as S22, but used immidiately
S03	D,T,C	D,c(D,T,C,L), a(D,T,S,L)	Same as S32, but used immidiately
S04	P,T,S	D(P,T,S,L), c(P,T,S,L), a(P,T,S,L)	Same as S42, but used immidiately
S05	P,T,C	D(P,T,C,L), c(P,T,C,L), a(P,T,C,L)	Same as S52, but used immidiately
S10	D,c	D,c	
S11	D,c,a	D,c,a	
S12	D,c,T,S	D,c,a(D,T,S,L)	
S13	D,c,a,f	D,c,a	Frequency dependent
S20	D,T,S	D,c(D,T,S,L)	
S21	D,T,S,a	D,c(D,T,S,L),a	
S22	D,T,S	D,c(D,T,S,L),a(D,T,S,L)	
S23	D,T,S,a,f	D,c(D,T,S,L),a	Frequency dependent
S30	D,T,C	D,c(D,T,C,L)	
S31	D,T,C,a	D,c(D,T,C,L),a	
S32	D,T,C	D,c(D,T,C,L),a(D,T,C,L)	
S33	D,T,C,a,f	D,c(D,T,C,L),a	Frequency dependent
S40	P,T,S	D(P,T,S,L),c(P,T,S,L)	

S41	P,T,S,a	D(P,T,S,L),c(P,T,S,L),a	
S42	P,T,S	D(P,T,S,L),c(P,T,S,L),a(P,T,S,L)	
S43	P,T,S,a,f	D(P,T,S,L),c(P,T,S,L),a	Frequency dependent
S50	P,T,C	D(P,T,C,L),c(P,T,C,L)	
S51	P,T,C,a	D(P,T,C,L),c(P,T,C,L),a	
S52	P,T,C	D(P,T,C,L),c(P,T,C,L),a(P,T,C,L)	
S53	P,T,C,a,f	D(P,T,C,L),c(P,T,C,L),a	Frequency dependent

Legend:

a Absorption coefficient
c Sound speed
C Conductivity
D Depth
f frequency
P Pressure
L Latitude (always present)
S Salinity
T Temperature

The notation ’a(D,T,S,L)’ means that the absorption coefficient is calculated from depth, temperature, salinity and latitude.

Usage

The use of absorption coefficients from SSP datagrams are now available for all types of echo sounders..

SIS will receive the SSP datagrams over the network on port 4001. Upon reception, SIS will always generate a sound velocity profile file (.asvp), either directly (e.g. if S00, S11 is received) or by performing the necessary calculations from the supplied data.

An absorption coefficient profile file (.abs), based on the supplied data, will also be generated for all frequencies used by the echo sounders.

There is a special case for the SSP datagrams S13, S23, S33, S43 and S53. These datagrams has been extended to also include a frequency for which the contained data is valid. This makes it possible to specifically set all absorption coefficients to be used for the relevant frequency. Note that when one of these particular datagrams are used SIS will require one datagram for each of the frequencies used by the echo sounders (i.e. 12, 31.5, 60, 70, 80, 90, 95, 100, 200 and 300 kHz). They must be sent within 10 sec. (currently) of each other and have the same acquisition date and time.

A subset off the SSP datagrams, specifically S00, S01, S02, S03, S04 and S05, will be used immediately. That is the corresponding sound velocity profile and absorption coefficients will be sent to the PU(s) and the Runtime parameters frame, if present, will be updated with the new file set information.

When SSP datagrams are received by SIS, the SVP Editor will always be informed of the new .asvp and .abs files. A warning will be given if the SVP Editor is not running.

Using the SVP editor the user may edit the .asvp and .abs files and store the edited files. The user can select to use these files by selecting the .asvp file, i.e. sound profile, from the Runtime parameter’s Sound Speed’ tab.

7.14 Implementation of absorption coefficients

Overview

The absorption coefficients in SIS may be set using three different sources:

- Salinity
- CTD profile
- Manual

In principle SIS can handle several echo-sounders each with its own source setting.

As a consequence SIS must maintain and control two different sets of profiles: One based on the currently set salinity value and one based on the CTD (Conductivity, Temperature and Depth) information received in an SSP datagram. The third alternative, Manual, results in the user entered absorption coefficient values being used immediately.

→ *Absorption coefficient parameters, page 240.*
→ *SSP datagrams, page 395.*

Absorption coefficients are dependent on the used frequency. All profile sets should therefore contain one absorption coefficient file for each frequency used by the multibeam echo-sounders employing this absorption coefficient implementation.

(Today the required range of frequencies for the complete multibeam range of echo-sounders are 12, 32, 60, 70, 80, 90, 95, 100, 200 and 300* kHz. (* used to calculate for 297 and 307 kHz internally in EM 3000 and EM 3002 Processing Units).

Salinity based absorption coefficient profiles

This type of absorption coefficient profiles are based on a ’depth and sound speed profile’ and the currently set salinity value. The ’depth and sound speed’ profiles can be obtained from two sources:

1 Reception of a SSP datagram of format S00 or S10 from the network.

2 The operator may select an ordinary SVP using the runtime parameter ’Sound Speed Profile’ interface.

→ *SSP datagrams, page 395.*
→ *Runtime parameters for multibeam, echo sounders, page 37.*

In both cases a set of absorption coefficient files is generated. All files in a set use the same naming convention: In case of a SSP datagram (S00 or S10) the date and time contained in the datagram becomes first part of the file name. In case of an operator selected SVP file the original file name is used instead. Next, the currently set salinity is included together with the frequency for which the file is valid. See example sets below.

Note that there is an **.asvp** -file in each file set containing the depth and sound speed data used in the calculations. This file is named the same as the rest in the set except that the frequency part is absent. This file is constructed based on the SSP input (S00/S10) or the user selected SVP. In the latter case the file contains exactly the same data as the original SVP file used (e.g. ’Horten20050304.asvp’ and ’Horten20050304_salinity_03900.asvp’ contains exactly the same data, see example below). The duplication and renaming of the original user selected ’.asvp’ file is done so that it shall be simple to retrieve a complete file set including the ’.asvp’ file using only the basic file name as key.

Note

The absorption coefficient file with frequency 32 kHz is actually for the 31.5 kHz system (EM 300).

Example of salinity file set based on S00 or S10:

20051230_183344_salinity_03900.asvp
20051230_183344_salinity_03900_12kHz.abs
20051230_183344_salinity_03900_32kHz.abs
20051230_183344_salinity_03900_60kHz.abs
20051230_183344_salinity_03900_70kHz.abs
20051230_183344_salinity_03900_80kHz.abs
20051230_183344_salinity_03900_90kHz.abs
20051230_183344_salinity_03900_95kHz.abs
20051230_183344_salinity_03900_100kHz.abs
20051230_183344_salinity_03900_200kHz.abs
20051230_183344_salinity_03900_300kHz.abs

Example of salinity file set based on user selected SVP called ’Horten20050304.asvp’:

Horten20050304_salinity_03900.asvp
Horten20050304_salinity_03900_12kHz.abs
Horten20050304_salinity_03900_32kHz.abs
Horten20050304_salinity_03900_60kHz.abs
Horten20050304_salinity_03900_70kHz.abs
Horten20050304_salinity_03900_80kHz.abs
Horten20050304_salinity_03900_90kHz.abs
Horten20050304_salinity_03900_95kHz.abs
Horten20050304_salinity_03900_100kHz.abs
Horten20050304_salinity_03900_200kHz.abs
Horten20050304_salinity_03900_300kHz.abs

A new salinity based absorption coefficient file set is generated in the following instances:

- When a new S00 or S10 datagram is received from the network.
- When the user selects a new SVP from the runtime parameter ’Sound Speed Profile’ interface.
- When the Source is Salinity and the salinity value is changed and no existing file set is found for the new salinity.
- When the user selects Salinity as Source and no existing file set is found for the currently set salinity value.

CTD based absorption coefficient profiles

CTD based absorption coefficient profiles are only generated based on SSP datagrams with formats **other** than S00 and S10. These other datagrams may contain the absorption coefficient directly (with appropriate frequency listed) or they contain the necessary CTD data to calculate the absorption coefficient profiles for all frequencies.

→ *SSP datagrams, page 395.*

Note that when the SSP datagram contains the absorption coefficient directly (datagrams S13, S23, S33, S43, S53) this datagram is valid for **one** frequency only. To be able to generate a full set of absorption coefficient files **one** SSP datagram of the same type for each used frequency must be received. The interval between the reception of individual datagrams must be max 10 sec. (currently). The internal date and time in the SSP datatagrams **must** be the same for all in the received set.

Note again that the requirement is that one such SPP datagram must be received for each of the frequencies 12, 32, 60, 70, 80 90, 95, 100, 200 and 300 kHz.

When received by SIS, the SSP datagrams S01, S02, S03, S04 and S05 will result in an automatic and immediate use of the confined information. Therefore it's not necessary for the operator to make a manual selection for the associated SVP.

The name of CTD based absorption coefficient file sets is constructed in the same way as for S00/S10 based sets **without** the salinity part.

Example of a CTD file set, based on SSP datagrams **different** from S00 and S10:

20051230_183344_03900.asvp
20051230_183344_12kHz.abs
20051230_183344_32kHz.abs
20051230_183344_60kHz.abs
20051230_183344_70kHz.abs
20051230_183344_80kHz.abs
20051230_183344_90kHz.abs
20051230_183344_95kHz.abs
20051230_183344_100kHz.abs
20051230_183344_200kHz.abs
20051230_183344_300kHz.abs

The CTD file set also contains an '.asvp' file. This file is generated (directly or calculated) based on the contents in the SSP datagrams.

Note that when selecting a SVP from the runtime parameter 'Sound Speed Profile' interface it is regarded as a CTD file set **only** if the file name does not contain 'salinity' and all frequency files are present.

In all circumstances a new salinity based file set is also generated from the selected SVP and current salinity. That is when a CTD based file set is selected,also a corresponding file set for the currently selected salinity is made.

Modus operandi

When the system is initialized the first time a system provided default file set is used both for the salinity based and the CTD based absorption coefficients. It is therefore important that realistic file sets are generated and selected as soon as possible when using SIS. However the current salinity and CTD based file sets will always be remembered and used e.g. after a restart.

When new file sets are generated upon reception of SSP datagrams the information about the new file set is sent to the SVP editor. This editor may be used to modify the data contents of the file set (e.g. thinning). The operator may subsequently select the modified file set using the runtime parameter ’Sound Speed Profile’ interface.

→ *SVP Editor, page 442.*

A file set that has been thinned, using the SVP editor, will contain ’thinned’ in the file name, e.g.

20051230_183344_thinned_03900.asvp
20051230_183344_thinned_12kHz.abs
20051230_183344_thinned_32kHz.abs
20051230_183344_thinned_60kHz.abs
20051230_183344_thinned_70kHz.abs
20051230_183344_thinned_80kHz.abs
20051230_183344_thinned_90kHz.abs
20051230_183344_thinned_95kHz.abs
20051230_183344_thinned_100kHz.abs
20051230_183344_thinned_200kHz.abs
20051230_183344_thinned_300kHz.abs

The Processing Units are updated with new absorption coefficients according to the following principles:

- Every 15 sec. (currently) the depth measured by each echosounder is received by the CCU (which handles the core functionality of the absorption coefficient system).
- If the current selected Source is Salinity or CTD-profile an absorption coefficient deviation value is calculated for each frequency used by the echosounder. This deviation value is based on the previous and current absorption coefficient for each frequency and a max range estimated from the received depth. If the found deviation for any frequency is greater than a preset limit (currently 0.2 dB) the new absorption coefficient for each frequency are sent to the Processing Unit.
- When calculating the absorption coefficients the current Source selection determines if the Salinity based file set or the CTD based file set is used.

In any case, when a new set of absorption coefficients are sent to the PU the values for each frequency are displayed in the runtime parameter’s ’Filter and Gains’ frame.

Also, the currently used salinity and CTD-based absorption coefficient file sets are displayed in the runtime parameter ’Sound Speed Profile’ interface.

Note *Initially SIS is configured to use and store the Salinity and CTD based absorption coefficient file sets in one pre-defined directory. This can be changed by selecting a Salinity or CTD based file set from another location by using the runtime parameter 'Sound Speed Profile' interface. All new (i.e. generated) file sets of the specific type selected above (Salinity or CTD) will be stored in this new location. Thus, Salinity and CTD based file sets can be stored in different locations.*

Note *SIS will never remove any absorption coefficient file set from it's storage location(s). If any clean-up/removal is performed by the operator care should be taken not to remove the currently used Salinity or CTD based file set as listed in the display.*

Note *The system provided default absorption coefficient file set, called 'default' should* ***never*** *be deleted or moved from its original position.*

7.15 The absorption coefficient equation

The mean absorption coefficient of the water column is used in the gain setting in the receiver.

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

$$A_1 = \frac{8.86 \cdot 10^{(0.78\,pH - 5)}}{c}$$

$$A_2 = \frac{21.44\, S(1 + 0.025T)}{c}$$

$$A_3 = 4.937 \cdot 10^{-4} - T(2.59 \cdot 10^{-5} - T(9.11 \cdot 10^{-7} - 1.5 \cdot 10^{-8} \cdot T)), T \le 20^\circ C$$

$$A_3 = 3.964 \cdot 10^{-4} - T(1.146 \cdot 10^{-5} - T(1.45 \cdot 10^{-7} - 6.5 \cdot 10^{-10} \cdot T)), T \ge 20^\circ C$$

$$P_2 = 1 - Z(0.137 - 0.0062\, Z)$$

$$P_3 = 1 - Z(0.0383 - 4.9 \cdot 10^{-4}\, Z)$$

$$f_1 = 2.8 \sqrt{\frac{S}{35}} \cdot 10^{\left[4 - \frac{1245}{273 + T}\right]}$$

$$f_2 = \frac{8.17 \cdot 10^{\left[8 - \frac{1990}{273 + T}\right]}}{1 + 0.0018(S - 35)}$$

Here, **α** is given in dB/km, the sound speed ***c*** in m/s, the temperature ***T*** in °C, the depth ***Z*** in km, the salinity ***S*** in ppt, and the frequency ***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.

7.16 Projections

Scope

This chapter gives in-depth information on the Projection component. The purpose with the chapter is to describe how to program a projection and how a projection can be defined using the projection library.

Programming a projection

On the Installation CD there is a directory called **UserSrc**. This directory contains a template for programming your own projections. On a Windows system use usersrc.dsp and program the projection in Microsoft Studio. On a Linux system, simply program the projection and compile using the Makefile.

On a Windows PC the output is a dynamic link library, userProj.dll. Copy this file to the location where SIS is installed and replace the existing file.

On a Linux system, the output is a shared library libuserproj.so. Copy this file to the location where SIS is installed and replace the existing file.

You create your own projection in the file userProj.cpp. Follow the example in the file:

1 Create the routines you want to use. You have to define three routines, one for initialization of the projection, one for the projection and one for the inverse projection. It is important that the parameters are correct, see the example.

2 Edit the routine InitUserProjection. In the switch-statement add a number and call your initialization routine. The number is important. You must choose a number larger than 1000 as SIS is already using the numbers below 1000. Each projection must have an unique number.

3 Edit the routine ForwardProjection. In the switch-statement call your forward projection.

4 Edit the routine InverseProjection. In the switch-statement call your inverse projection.

5 Compile and install the shared library.

6 Start SIS. Open the “Survey templates” window and find the tab where you define the projection. Then choose “Create new projection” and this program starts.

7 Choose “New...” and give the new projection a proper name. Next choose the projection type to be “User defined”, and the number you put in must be the same as the one you just programmed.

8 Make sure to test your projection before you start using it.

You have now created your own projection.

Note

If you later reinstall SIS, this projection will be gone. You have to save the shared library file and install it after you install or upgrade SIS.

Using PROJ.4

You can also define a projection using the projection library PROJ.4. A 7-parameter datum transformation is already available in SIS.

The following text file defines a PROJ.4 projection:

```
<MyProjection>
ellps=WGS84
proj=utm
zone=32
units=cm
```

The parameter ellps must be defined, and units=cm must be used.

To add a 7-parameter datum transformation, the setup is like this:

```
<MyProjection>
ellps_from=Bessel
rotXrad=0.0000001
rotYrad=0.0000002
rotZrad=0.0000003
dXm=150.0
dYm=160.0
dZm=170.0
scale=0.9998
ellps=WGS84
proj=utm
zone=32
units=cm
```

Note that rotXrad, rotYrad and rotZrad are expressed in radians, and that dXm, dYm and dZm are expressed in meters. The primary ellipsoid is defined after ellps_from and the secondary ellipsoid will be befined by ellps.

The to and from definition of the ellipsoids are the names of the ellipsoids found in the list of ellipsoids. You see this list when you define the projection.

The transformation parameters themselves must be put in by the operator.

The operator should save this setup in a textfile. He can then define a PROJ.4 projection as described above. In the text field where he types the PROJ.4 projection, type something like this:

```
+init=/mydir/somefile.txt:my_projection
```

This means that the projection is named my_projection and is defined in the file \mydir\somefile.txt.

For PROJ.4 details see the doc - dirctory

Windows:

C:\Program Files\Kongsberg Maritime\SIS\doc

Linux:

use/local/SIS/doc

7.17 Geoid

If heights are extracted from the positioning system, geoid models can be used.

In this case the **geoidmodel.geoid** file must be put together with the background data, see *New Survey*.

→ *New survey, page 134.*

The figure below shows the various distances used in the geoid calculations.

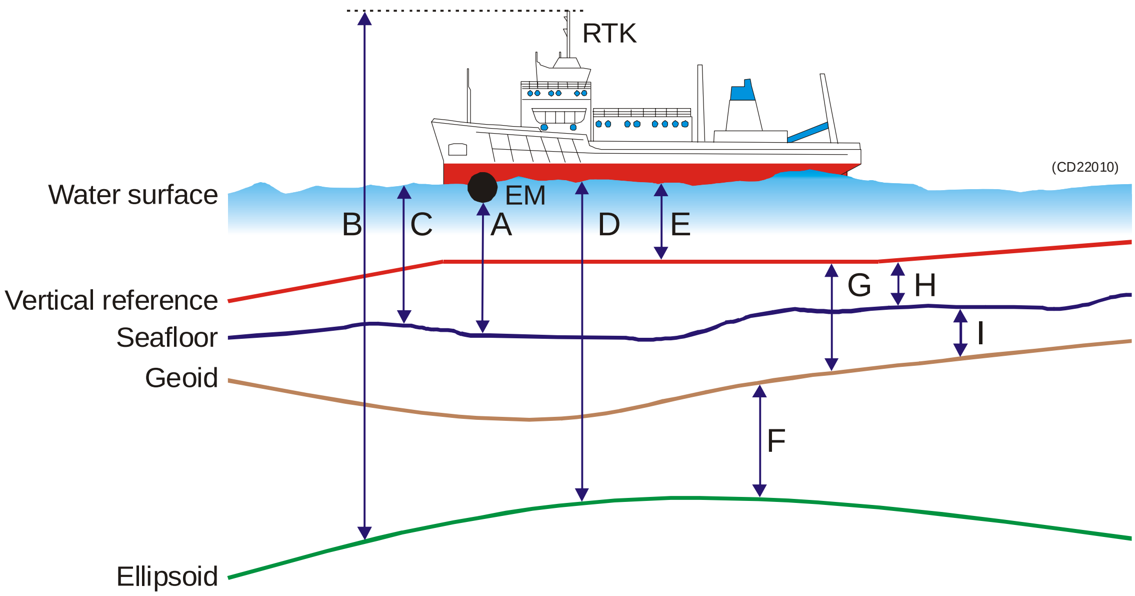


Figure 56 The RTK/geoid model

A: Distance from the echo sounder to the seafloor.

B: Distance from the antenna to the ellipsoid.

C: Motion corrected distance (depth) from water surface to seafloor.

D: Motion corrected distance (height) from water surface to ellipsoid.

E: Distance from the sea surface to the vertical reference (tide).

F: Distance from the ellipsoid to the geoid (geoid undulation), positive if the geoid is above the the ellipsoid.

G: Distance from the geoid to the vertical reference, positive if the vertical reference is above the geoid.

A is the measured distance from the echosounder to the seafloor. This distance is corrected using the installation parameters and the motion sensor to C which is then the distance from the watersurface to the seafloor.

Because the heave sensor only reacts to fast changes, the watersurface is really defined by the 0-level of the heave sensor.

The RTK-system gives the distance from the antenna to the ellipsoid (B). This distance is corrected using the installation parameters and the motion sensor to D, which is the distance from the sea surface to the ellipsoid.

Note that both the EM and the RTK is now referred to the same vertical level, the sea surface.

The geoid model contains the distance from the ellipsoid to the geoid (geoid undulation) and the distance from the geoid to the vertical reference.

The tide E is then computed like this: E = D - F - G.

H is the distance from the vertical reference to the seafloor and can now be computed like this: H = C - E.

I is the distance from the seafloor to the geoid and is computed like this: I = G - H.

The next figure shows the layout of the geoid file. This layout is chosen to fit to rivers where the geoid undulation and vertical reference is known at crossprofiles along the river (the vertical lines are then the riverbanks). It is then possible to define several “rivers” in one file thus allowing general areas to be defined. The file format is then like this:

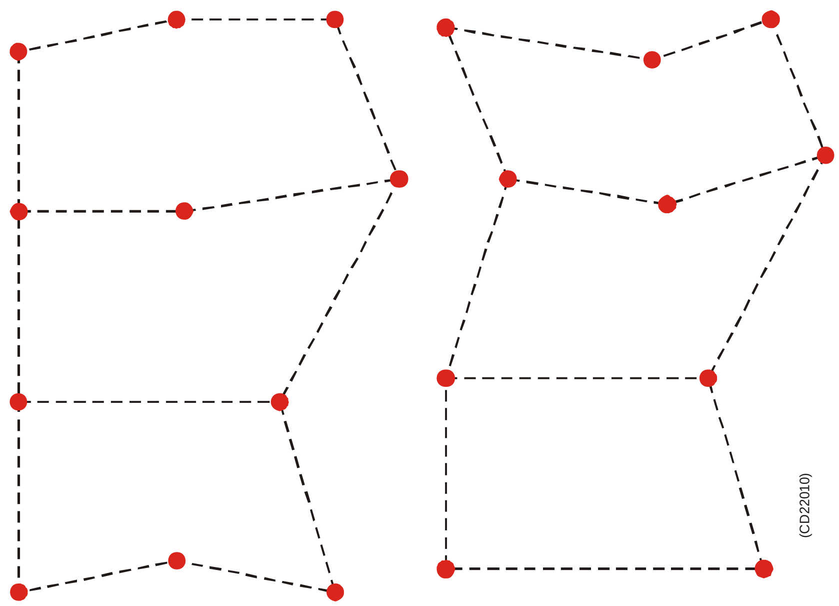


Figure 57 Layout of the RTK/geoid model

1 latitude(degrees) longitude(degrees) F(meters) G(meters)

2 latitude(degrees) longitude(degrees) F(meters) G(meters)

3 latitude(degrees) longitude(degrees) F(meters) G(meters)

The line starting with 2 is optional. The crossprofile may be defined using two or three points, the first point has the id 1 and the last point the id 3. If there is a middle point, it has the id 2. Latitude and longitude are positive north of the Equator and east of Greenwich, negative on the other side.

An area is defined between two crossprofiles. A model (“river”) must always have at least two crossprofiles. Several models (“rivers”) in the same file shall be separated by an empty line.

The geoid undulation F and the vertical reference G is interpolated using straight lines between crossprofiles.

7.18 Tide

Tide input to SIS can be either real time tide on an UDP socket from serial line or predicted tide in a file.

Realtime tide:

Datagrams like this can be sent on UDP to port 4001:

```
$ATIDE,20040512073406,1.74*00
```

The header is always $ATIDE. Then comes the time YYYYMMDDttmmss, and then the tide in meters.

The checksum is currently not used, but must be present.

Note that the tide is ADDED to the depths.

Predicted tide:

A tide file with the name predictedtide.tide can be stored together witht the background data for the survey, see *New survey.*

The format is like this:

```
(Tide)
20040512073655 1.74
20040512073755 3.42
20040512073855 5.00
20040512073955 6.43
20040512074055 7.66
20040512074155 8.66
20040512074255 9.39
20040512074355 9.85
20040512074455 10.00
20040512074555 9.85
20040512074655 9.40
20040512074755 8.67
20040512074855 7.67
20040512074955 6.44
20040512075055 5.01
20040512075155 3.43
20040512075255 1.75
20040512075355 0.02
20040512075455 -1.72
20040512075555 -3.40
20040512075655 -4.98
20040512075755 -6.41
20040512075855 -7.65
20040512075955 -8.65
20040512080055 -9.39
20040512080155 -9.84
20040512080255 -10.00
20040512080355 -9.85
20040512080455 -9.41
20040512080555 -8.67
```

The first line is a header enclosed in parenthesis. The first word must be Tide.

Then comes the tide data. The time format is YYYYMMDDhhmmss and the tide is in meters.

Note that the tide is ADDED to the depths.

7.19 Changing the behaviour of messages

Messages generated in SIS are defined in a file found in the directory where SIS is installed. For Windows, typically:

- C:\Program Files\Kongsberg Maritime\sis\bin

and for Linux:

- /use/local/sis/Database

There is a file for Windows called:

- messages_R_Sy.uni

and for Linux:

- pmess.sql

which defines all messages and the behavior in SIS when they occur.

This file is in UNICODE and must be edited in an editor that supports UNICODE, like WordPad in Windows or Kate on Linux. Here the operator can change both the text message and the type of the message.

The header of this file describes the valid types. Each message has a type-field which can be set to the operator's preferences. Simply change the type-field for the messages you want and save the file. Make sure you save it as UNICODE.

Then open a terminal window in the directory where you saved this file. Issue this command in Windows:

```
osql -Usisuser -Psimrad0 -imessages_R_Sy.uni
```

and on Linux:

SIS will now react to the messages as described in the file.

```
psql -d sis -U sisuser - f pmess.sql
```

Note

These settings may be lost when SIS is updated or reinstalled. If you want to make sure you always have these settings, save this file somewhere on your system and reapply it when SIS is reinstalled or updated.

7.20 Request datagrams from an echo sounder

When an echo sounder is registred on the network in SIS, datagrams can be routed from the echo sounder to another UDP port on the network.

First connect the echo sounder to the network and start SIS. Select the echo sounder and configure it. Then start the Request datagrams program from the Tools menu in SIS.

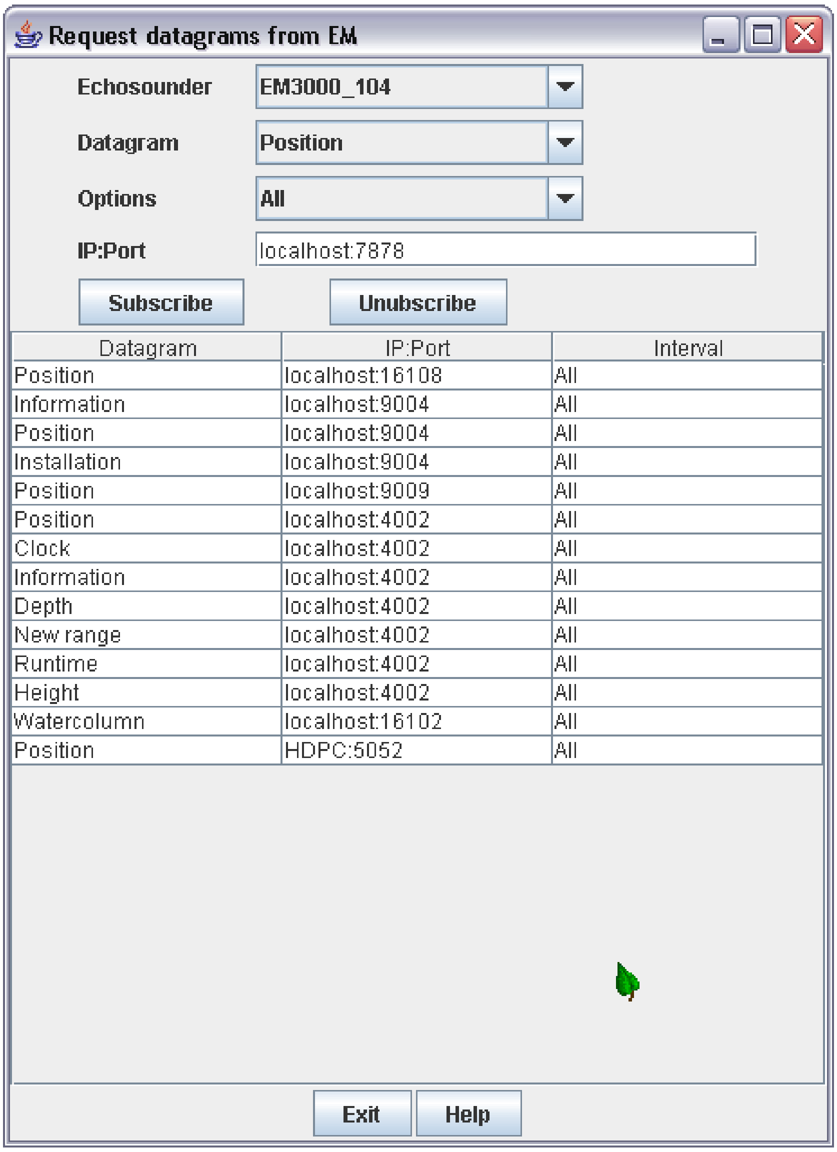


Figure 58 Request datagrams from an echo sounder

The echo sounder shall now be selected in the first pulldown menu. Then select which datagram you want from the second pulldown menu. The third pulldown menu lists the options for sending out the datagram, either all datagrams that arrives or only some datagrams at regular intervals. Fill out the textfield IP:Port with IP-address and UDP port number where the datagram shall be sent to. Remember: between the address and the port number.

Now press ’Subscribe’. The next time SIS starts the echo sounder, the requested datagram type will be sent to the requested address at the specified interval.

To stop sending datagrams, select the datagram from the list and press ’Unsubscribe’.

Never try to ’Unsubscribe’ to the factory defined datagrams.

7.21 Subscription of datagrams from DDS

Note

This chapter is intended for advanced users only. It is simpler to subscribe on datagrams by selecting ***Tools > Custom > Datagram subscription****. See page 415.*

Overview

The subscription setup of datagrams from the DDS can be performed in two ways:

1 By using a provided utility (see note above) specifying the relevant echo sounder, datagram and subscriber IP address. These entries are semi permanent i.e. valid until the database is completely rebuilt.

2 By updating the database tables manually. These changes will be permanent. Currently this option requires that the database is completely rebuilt.

Manual update of database tables

The SIS DDS has the ability to distribute (i.e. retransmit) datagrams received from the Processing Unit (and other sources) out to external recipients. This distribution is done according to settings in the SIS database. Therefore, in order for an external receipient to subscribe to a particular datagram, the SIS database must be updated to distribute the datagram.

Note that SIS contains several DDS applications of different types. Each type is adapted to handle a specific type of Processing Unit or equipment. Currently three DDS types are of interest:

1 A generic multibeam type (EM 3000, EM 3002, EM 2000, EM 1002, EM 710, EM 300, EM 120)

2 A generic NMEA single beam type (receiving NMEA DPT or NMEA DBT, NMEA GGA, NMEA HDT or NMEA HDM)

3 A type for GPS and compass (receiving NMEA GGA, NMEA HDT or NMEA HDM)

The SIS Database

The SIS database contains several tables which defines the datagram distribution setup in DDS. These tables can be divided into four categories:

1 A category with one table defining the datagrams and the distribution parameters.

2 A category with one table defining sockets used for sending datagrams.

3 A category with one table linking the two, i.e. defining which datagram to be sent on which socket.

4 A category with several tables organizing datagrams and sockets according to type of DDS process.

Table ’dds_datagrams_send’ (category 1)

This table is used to define all datagrams which can be distributed by a DDS. Each entry (i.e. row) is identified by a datagram id (’id_datagram’) which must be unique.

The ’dds_datagrams_send’ table normally only needs to be updated when new datagrams are defined or new DDS types are added. However, when a datagram subscription is defined it is necessary to know the correct ’id_datagram’ value as this value is used in other tables.

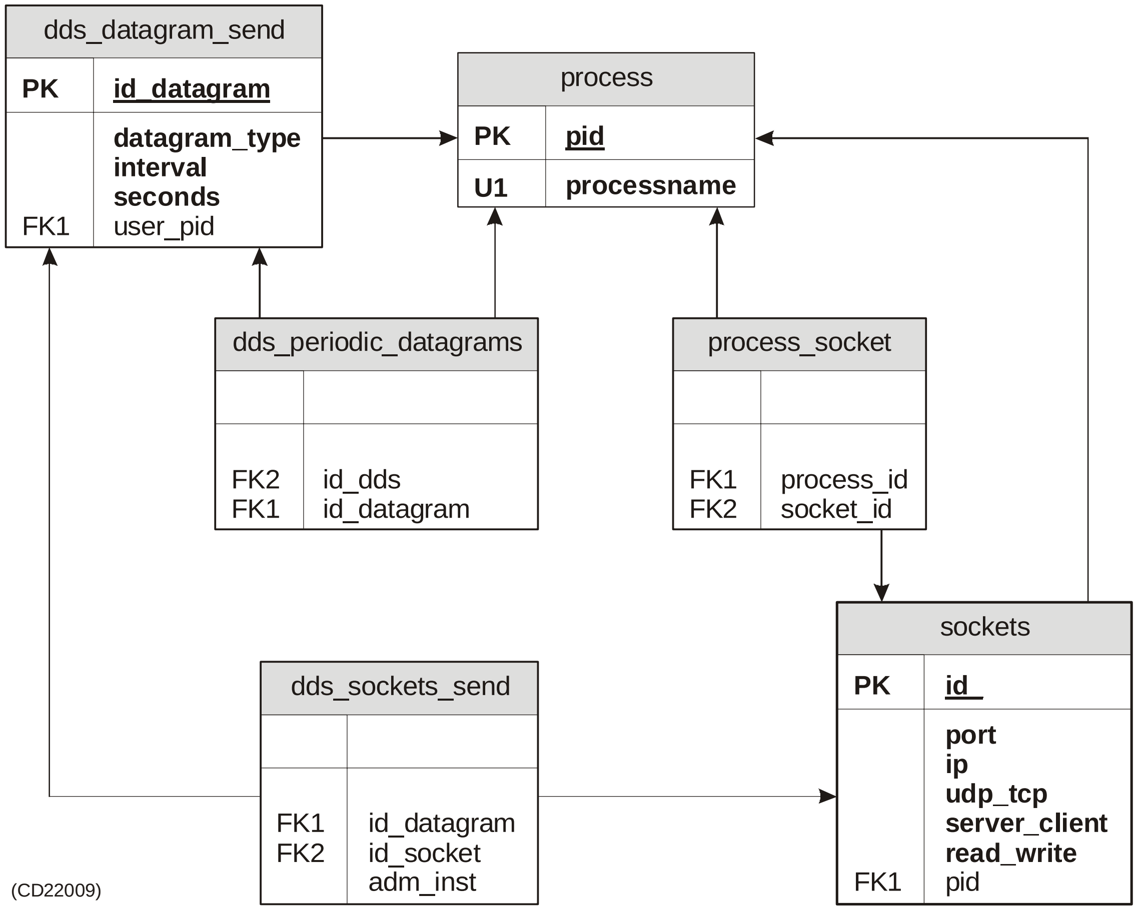


Figure 59 Relevant SIS database tables for subscription configuration

'id_datagram'

Note that the datagram identifiers are organized in ranges or sets, one for each type of DDS (i.e. PU or equipment type) - see 'user_pid' below. The generic EM multibeam set currently has an 'id_datagram' range from 36 to 302 (with some holes). NMEA singlebeam has a range from 400 to 475 and the GPS compass type has a range from 500 to 575.

'datagram_type'

The 'datagram_type' parameter defines the type of datagram (e.g. Depth ='D' = 68) associated with the specific datagram id. The same datagram type may be used in all ranges, if relevant, but only once in each range.

'interval'
'seconds'

These parameters are used to define how the associated datagram should be distributed.

The ’interval’ parameter may have the following values:

0 - Distribute signal when received.

1 - Distribute signal repeatedly with a set interval defined by the ’seconds’ parameter.

2 - Distribute signal when received and repeat, as above.

3 - Distribute signal only upon request (currently not implemented).

’user_pid’

This parameter identifies the DDS type associated with the ’id_datagram’ parameter.

The correct ’user_pid’ value is found in the ’process’ table as the ’pid’ parameter (marked with bold in entries below):

1 DDS generic multibeam type (EM 3000, EM 3002, EM 2000, EM 1002, EM 710, EM 300, EM 120) is entry: (**10**,’DDS_GENERIC_EM’)

2 Generic NMEA single beam type is entry: (**14**,’DDS_GENERIC_SINGLEBEAM_NMEA’)

3 For GPS and compass is entry: (**13**,’DDS_GENERIC_GPS’)

The range scheme and the use of the same datagram type in several ranges allow datagrams to be handled differently for each DDS type (i.e. PU/equipment type).

Table ’dds_periodic_datagrams’ (category 4)

This table defines which datagrams, (defined in ’dds_parameters_send’) belong to which DDS type. Each entry (i.e. row) defines such a relation.

The ’dds_periodic_datagrams’ table normally only needs to be updated when new datagrams are defined or new DDS types are added.

’id_dds’

This parameter identifies the DDS type. The correct value is found in the ’process’ table as the ’pid’ parameter (marked with bold in entries below):

1 DDS generic multibeam type (EM 3000, EM 3002, EM 2000, EM 1002, EM 710, EM 300, EM 120) is entry: (**10**,’DDS_GENERIC_EM’)

2 Generic NMEA single beam type is entry: (**14**,’DDS_GENERIC_SINGLEBEAM_NMEA’)

3 For GPS and compass is entry: (**13**,’DDS_GENERIC_GPS’) 'id_datagram'

Id of datagram from the correct range in the 'dds_datagrams_send' table according to DDS type.

Table 'sockets (category 2)

This table defines all sockets in the SIS system including all sockets used by DDS.

If a subscription is added or changed it may be necessary to define a new socket or change an existing socket. The socket will be used by DDS for sending the subscribed datagrams to the recipient.

'id'

Each socket in SIS should have an unique id. This is an integer number. **Before selecting an id for the socket make sure it is below 1000 and not already used** (make a search in the SISDB_v3.sql and any other SISDB_vX.sql file with a higher version than X=3).

'port'
'ip'

This is the net address for the recipient of the subscribed datagram(s).

'udp_tcp'

0 = UDP, 1 = TCP

The UDP protocol should always be used. This setting should therefore be 0.

'server_client'

0=server, 1=client, 2=unused.

SIS is a server. **This setting should therefore be 0.**

'read_write'

0=read, 1=write, 2=read and write.

The socket is always write. **This setting should therefore be 1.**

'pid'

This parameter gives an id to the recipient on the other side of the link. For the purpose of distributing datagram from the DDS to an external recipient the **pid-value must be set to 76 - NOTE this value**.

Table 'process_socket' (category 4)

This table defines which sockets, (defined in 'sockets') that belong to which process. Each entry (i.e. row) defines such a relation.

The ’process_socket’ table needs to be updated when new datagrams are defined or new DDS types are added.

’process_id’

This parameter identifies the process using the socket; in this case that is a DDS type. The correct value is found in the ’process’ table as the ’pid’ parameter (marked with bold in entries below):

1 DDS generic multibeam type (EM 3000, EM 3002, EM 2000, EM 1002, EM 710, EM 300, EM 120) is entry: (**10**,’DDS_GENERIC_EM’)

2 Generic NMEA single beam type is entry: (**14**,’DDS_GENERIC_SINGLEBEAM_NMEA’)

3 For GPS and compass is entry: (**13**,’DDS_GENERIC_GPS’)

’socket_id’

Id of the socket used to distribute datagrams to the recipient. The ’socket_id’ is found in the ’sockets’ table as the ’id’ (see above) of the relevant socket definition.

Table ’dds_socket_send’ (category 3)

The table is used to connect datagrams with sockets, i.e. it tells which datagrams (identified by ’id_datagram’) that should be sent out on which socket.

This is the essential routing information necessary to be able to distribute the datagrams to the correct recipient.

In essence, all the other tables are only help tables necessary to define the datagrams and sockets (and who they belong to) whereas the routing information in ’dds_socket_send’ is what we really want to specify.

’id_datagram’

A defined datagram id belonging to a DDS type which is the same as for ’id_socket’ below.

’id_socket’

A defined socket id belonging to a DDS type which is the same as for ’id_datagram’ above.

When making entries in this table, care must be taken to pair only datagrams and sockets associated with the same DDS type (identified by ’process_id’ in ’the ’process_socket’ table and ’id_dds’ in the ’dds_periodic_datagrams’ table respectively).

Procedure for setting up a datagram subscription

The tables to be modified are located in the ’**SISDB_v3.sql**’ file.

1. Check if the datagram to be subscribed exist in ’dds_datagram_send’ table for the relevant DDS type. If not define it. Remember the ’id_datagram’ value.
2. Check if the datagram exist in the ’dds_periodic_datagrams’ table for the correct DDS type. If not define it.
3. Make a socket for the recipient, in the ’sockets’ table using correct IP address. Remember the ’id_socket’ value.
4. Make an entry in the ’process_socket’ table with the new ’id_socket’ value and the relevant DDS type.
5. Make an entry in the ’dds_socket_send’table with the correct combination of ’id_datagram’ and ’id_socket’. Note that a socket can be used for several datagrams.
6. The SIS database must be re-built and SIS restarted.

Important notes and restrictions

- All entries in the tables described above are currently done with reference to three DDS types. These types are regarded as templates used to instantiate database entries for new echo sounders detected on the network. Instantiation is necessary due to the fact that several echo sounders can not use the same data and the same objects (e.g. sockets.) Each echo sounder will therefore get a separate set of sockets and datagram ids, which mean that the specific values entered in the tables above, are not actually used for any echo sounder.
- However, the IP address for the recipient of a datagram is a value that can not be instantiated. This implies that the DDSes for e.g. EM 3000, EM 3002, EM 2000, EM 1002, EM 710, EM 300, EM 120 will send a datagram to the same recipient if they are detected in the same SIS system.
- **When the changes in the SIS database are performed the database must be re-built and SIS restarted.**
- The settings will be semi permanent, i.e. they will be in effect until the database is completely rebuilt.
- Currently no facilities for removal or listing of subscribed datagrams are available.

7.22 Data Distribution

The DataDistrib program is included with SIS. This is a Windows application that can be used to route or distribute UDP datagrams to various destinations on the local PC or to other networked PCs.

The application has a graphical user interface where you can set up distribution of data from up to 10 different sources. In a grid you set up the incoming sockets from where to listen to data and up to four different destinations for each source. It also possible to store incoming data to a file and later replay that file. If you want to replay data, a file name is entered instead of a source port.

Make sure that you enter a Source port that is not used by any other applications, e.g. rstoudp, as two application cannot use the same port simultanously.

Only the DataDistrib.exe file must be installed on the PCs where the application should run. Settings are stored in DataDistrib.ini.

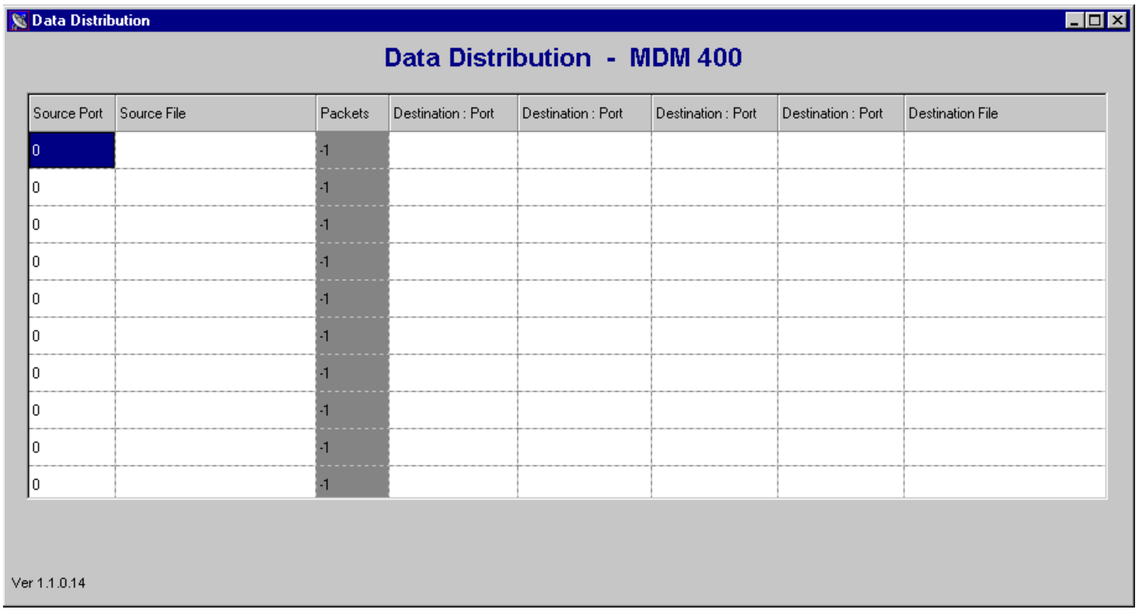


Figure 60 DataDistribution user interface

7.23 Remote datagrams

These datagrams allow external systems a minimal amount of control of SIS. The datagrams are received by SIS from the connected network using the UDP protocol.

Datagram	Received on port	Description
R00	4002	SIS to stop pingning (and logging if on).
R10	4002	SIS to stop all logging, but continue or start pinging.
R10	4002	SIS to start logging on new line
R20	4001	Echosounder to send installation, runtime and sound speed profile (**I**, **R** and **U**) datagrams.

Note

*The **Rxx** datagrams must always contain the sounder type i.e. **EMX=dddd**, **.** This is currently the only parameter in the **Rxx** datagrams that is used.*

Currently SIS has support for the following remote datagrams:

R00, R10 og R12

R00, R10 and R12 closely mimic the use of the logging and ping buttons. There are no restrictions on the sequence in which these datagrams can be sent. The following is typical:

- To start pinging: R10.
- To start logging: R12 (Note that it is not necessary to start pinging with R10 first).
- To stop logging: R10 or R00. (Note R00 also stops pinging).
- To stop pinging: R00.

When the remote **Rxx** datagrams are received the sounder type indicated in the datagram is made current. The SIS GUI is updated accordingly so that the ping and logging buttons will show the correct status.

→ *See Main Toolbar on page 340.*

Note

The relevant echo sounder must have been started for the R00, R10 and R12 datagrams to have any effect. SIS will behave as if the ping and logging buttons have been used, including line counter increment.

R20

R20 is used to get an echo sounder (PU) to transmit the setup parameters currently used. These parameters are normally distributed by the PU, to the external system(s), using its UDP4 port.

→ *See Main Toolbar on page 165.*)

Note

The relevant echo sounder must have been started for the R20 datagram to have any effect.

7.24 Global Event Marker

The Global Event Marker system consists of two programs:

- One server that runs on an Operator Station (for example the HWS 10) connected to a multibeam echo sounder (EM) Processing Unit (PU)
- One or more clients on Windows PCs in the network

The Global Event Marker Server (GEMS) needs two inputs; position datagrams from an EM PU, and events from Global Event Marker clients on the network.

Note that the PU will send position datagrams to GEMS even when the EM is not pinging.

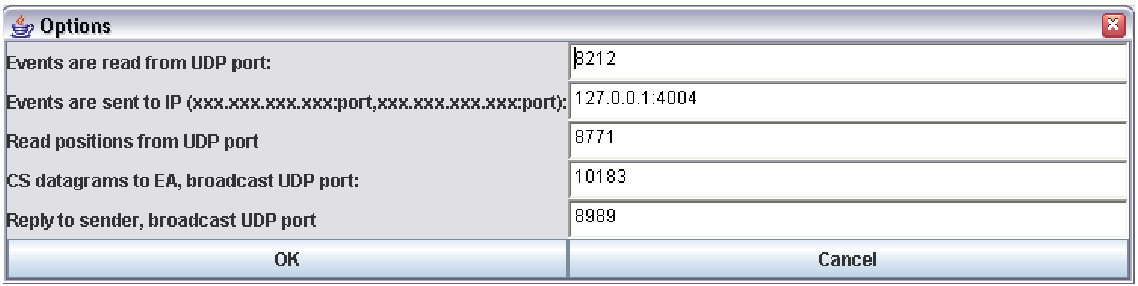
GEMS will send events to other SIS installations on the network, including Helmsman Displays. The IP addresses of these installations must be set in GEMS.

GEMS will also send CS datagrams to single beam echosounders (EA). CS datagrams are sent as broadcasts on the network, so only the UDP port must be set in GEMS.

All events are logged to a file, normally events.ksgpl. In the File menu the operator can open any file. When the file is opened, all events in that file is sent to all SIS installations.

The operator can also at any time resend all events to all SIS installations from the View menu.

The last event is displayed in the textfield together with the IP-address of the sender.



Options in GEMS are found in the File menu. The first lines set the UDP port where events arrive. This port number must be the same as the port number in the file Events.ini used by the Global Event Marker clients (see below).

Events are sent to a list of SIS programs. The format of this list is xxx.xxx.xxx.xxx:nn,xxx.xxx.xxx.xxx:nn,...

xxx.xxx.xxx.xxx is the IP address and nn is the UDP port number, normally 4012. Remember to use a comma (,) to separate the addresses.

Positions are read from a UDP port. This must be the same port number that the EM PU sends datagrams to.

EAs listen for CS datagrams on a port, normally 10183.

The last event is also sent as broadcast to all Global Event Marker Clients (GEMC). All of them will then display the time the event arrived and the associated text.

The GEMC can be installed on any Windows PC in the network. Simply copy the files Events.exe and Events.ini to a directory and run Events.exe from that directory. The file Events.ini can be used to set the parameters and texts for this window. Note that the IP-address in Events.ini is the IP address of the PC running GEMS.

The operator can then send an event to GEMS simply by pressing the button. A text is optional and can be sent together with the event.

The last event on the network is displayed in the textfield below, together with the IP-address of the sender and the time the event occured.

7.25 Connect to license server

Unless a multibeam echo sounder is present in the network, SIS must connect to a licence server. At least one licence server must be available.

You can change the settings so that a different licence server is used:

1 Use the Network License menu under Set parameter for seting up another License Server. SIS has to be restarted to change license server.

→ *See Set network licence on page 377*

2 The web-server must be restarted to change the licence server for the GridEngine.

- If no licence server is present, SIS may still be operational if a Kongsberg multibeam echosounder is found on the network. This will allow you to perform basic logging fuctions.

7.26 SeaCal

What it does

SeaCal is a program used to compute the calibration values of the multibeam echo sounder. Reliable data from the multibeam echo sounder can only be acquired after proper calibration of the static offsets in system parameters such as roll, pitch, heading, eccentricity of the transducer relative the antenna of the positioning system in x and y etc.

This calibration method is based on global match of the calibration lines. It does not presume that we have information about the true relief of the seafloor. The method computes the calibration parameters from least squares adjustment, and it offers a broad range of static offset parameters to be computed and the derivation of the correlation between them. The program computes calibration parameters from parallel or crossing lines. The calibration lines must follow straight lines, i.e., curved calibration lines are not allowed. The number and the length of the lines are limited by the amount of computer memory and the speed of the computer processor. The figure below shows the coordinate axes used.

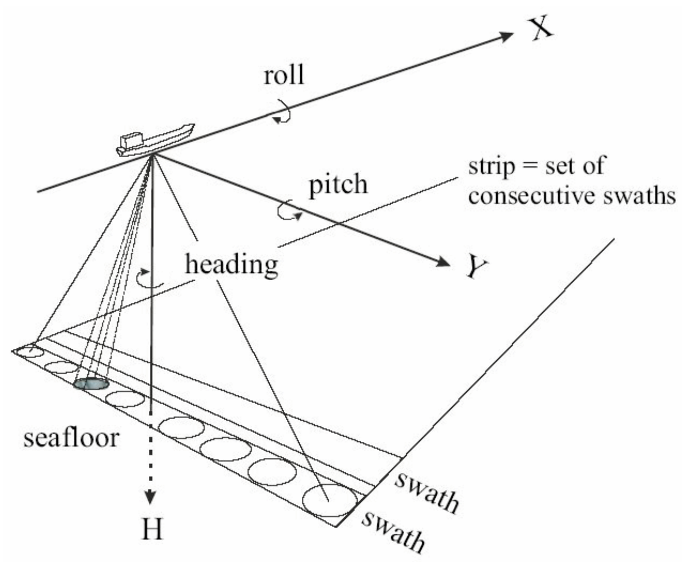


Figure 61 Definition of the coordinate axes

Calibration parameters

SeaCal is able to compute several kinds of calibration parameters. The two main groups of parameters are those common and individual for the lines. The following calibration parameters are defined:

	Symbol	Definition
• Roll	$\Delta\phi$	$\phi' = \Delta\phi + \phi$
• Pitch	$\Delta\omega$	$\omega' = \Delta\omega + \omega$
• Heading	$\Delta\kappa$	$\kappa' = \Delta\kappa + \kappa$
• Translation in x	Δx	$x_0' = \Delta x + x_0$
• Translation in y	Δy	$y_0' = \Delta y + y_0$
• Relative tide correction	Δh_0	$h_0' = \Delta h + h_0$
• Roll scale factor	m_ϕ	$\phi' = m_\phi \phi$
• Horizontal scale factor	m_y	$y' = m_y y$

x is measured along the line and y is perpendicular to x, so y is measured in the swath direction.

Factor m_ϕ is a kind of parameter related to the inner calibration of the multibeam echo sounder, but it can also be explained by uncertain computation of the refraction of the beams, i.e., the accuracy of the sound speed profile. Parameter m_y is a horizontal scale factor in the swath direction. It is motivated from the influence of errors in the sound speed.

Design of the calibration lines

The accuracy of the calibration depends on the topography of the seafloor, and the configuration of the calibration lines. Therefore, the calibration lines should be located in an area with satisfactory relief and they should follow a certain pattern, i.e., a configuration that allows the computation of the parameters.

The *Effect of offset* figure below illustrates the effect of offsets in the calibration parameters. From the figure we observe that calibration for heading and the two scale factors require lines with parallel displacement. Offsets in roll, pitch, x and y are best computed from lines in opposite directions which overlap each other 100 %.

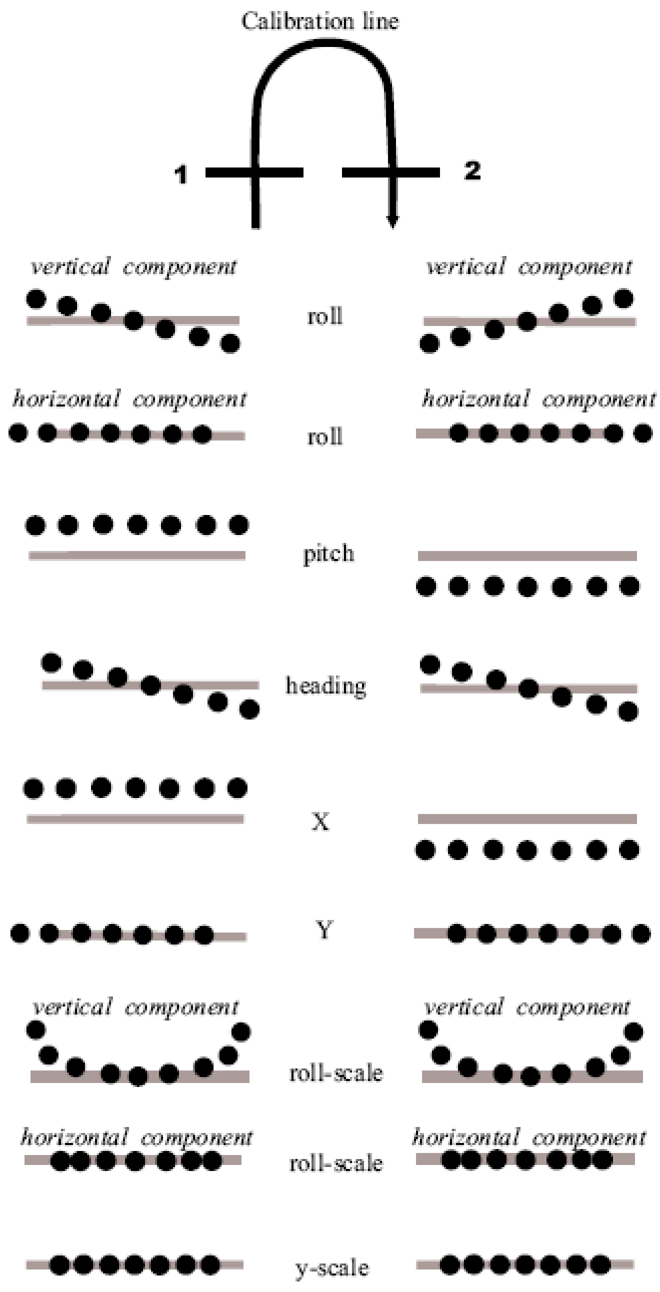


Figure 62 Effect of offsets in the calibration parameters

Roll and roll-scale have a vertical and a horizontal component. Their vertical component makes it possible to calibrate them even in a flat area.

The horizontal component of $\Delta\phi$ has very similar influence on the measured depth values as Δy. This correlation is not a problem in field calibration, since the vertical component of $\Delta\phi$ separates it from Δy.

Offsets in pitch and x have also very similar error patterns. Therefore, the two parameters are often highly correlated. Their separation depends on the relief of the seafloor. They can be separated if the seafloor has satisfactory depth variation.

Pitch, heading and x calibration require that the lines run in the direction of the terrain slope, whereas y and Y-scale calibration require terrain slope across the run direction.

Based on the geometric interpretation of the *Effect of offset* figure above, we can conclude that we need at least three calibration lines in order to compute all the parameters, i.e., two 100 % overlapping lines for the computation of $\Delta\phi$, $\Delta\omega$, Δx and Δy, and a third line for $\Delta\kappa$, m_{ϕ} and m_{y}.

Since the random measurement errors of the multibeam echo sounder and the relief of the seafloor have great impact on the accuracy of the parameters, calibration lines in addition to the minimum required will strengthen the calibration. For example, we can apply four, eight or twelve lines as illustrated in the *Configurations* figure below. How many lines to measure, depends on the relief of the seafloor, the period of time available for the calibration etc., but as a rule eight crossing lines is recommended. Eight crossing lines balance the requirement of accuracy and the cost of running the calibration lines.

How to run SeaCal

There are several ways to run SeaCal, but to get a safe and fast verification of the calibration parameters, the following procedure is recommended.

1 Apply eight crossing calibration lines as defined in the *Configurations* figure below.

2 Run the calibration with all parameters.

3 Run the reliability computation.

4 Introduce the calibration values with green reliability factor into the multibeam system.

5 Run a new calibration to verify the new settings.

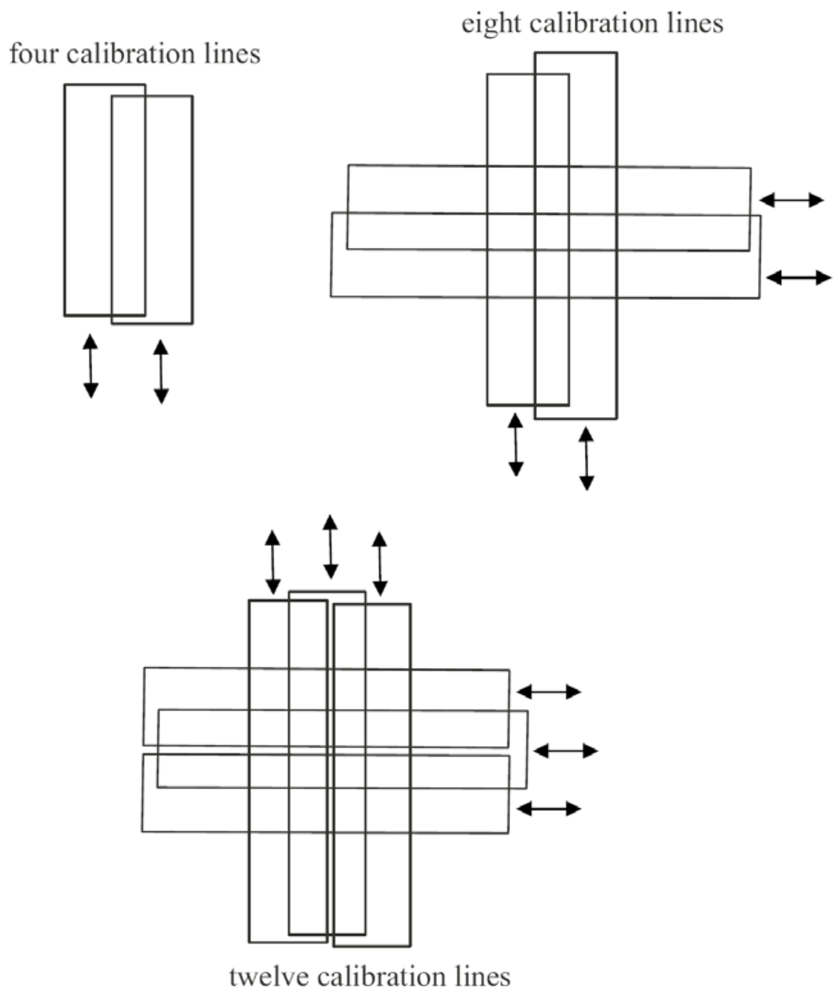


Figure 63 Different configurations of calibration lines

Resolution

The resolution of the grid model applied in the calculation effects the computing time. The option *auto* asks SeaCal to compute the resolution, but you can also define the resolution manually.

Maximum number of iterations

Usually, SeaCal needs two or more iterations to compute the calibration. You can define the maximum number of iterations manually, or you select *auto*, i.e., SeaCal iterates until the solution is stable.

More on the field calibration method

A strength of our approach is that all the survey lines are utilized in an optimal way, i.e., survey lines which cannot determine a parameter, will have minor influence on the computation. For a thorough description of the method see [2].

Often the eccentricity of the transducer is measured by land surveying methods. Since our calibration method considers the horizontal offsets in x and y, it can control that the horizontal eccentricity values are loaded correctly into the multibeam system.

SeaCal computes calibration parameters based on least-squares adjustment as:

$$V = (A^T P_1 A)^{-1} A^T P_1 L_1 \tag{1.1}$$

where V is a vector of the unknown parameters, A a coefficient matrix, P_1 a weight matrix and L_1 a vector of observations.

Since the stability of the system of equations depends on the relief of the seafloor and the configuration of the calibration lines, restrictions are put on the unknown parameters by:

$$V = (A^T P_1 A + P_2)^{-1} (A^T P_1 L_1 + P_2 L_2) \tag{1.2}$$

where P_2 is a weight matrix of the unknown parameters and L_2 a vector of a priori parameter value.

The variance-covariance matrix of the unknowns are computed from:

$$Q_V = (A^T P_1 A + P_2)^{-1} \tag{1.3}$$

Here, the diagonal elements define the variance of the parameters and the other elements their covariance. Therefore, the variance $\sigma^2_{V_i}$ of parameter V_i is derived as:

$$\sigma^2_{V_i} = Q_{V_{ii}}$$

and the covariance $\sigma_{V_i V_j}$ of the two parameters V_i and V_j is computed as:

$$\sigma_{V_i, V_j} = Q_{V_{ij}}$$

The correlation coefficient $\sigma_{V_i V_j}$ measures how separable two parameters V_i and V_j are and is derived from Q_V as:

$$\rho_{V_i, V_j} = \frac{\sigma_{V_i, V_j}}{\sigma_{V_i} \sigma_{V_j}} \tag{1.4}$$

In multibeam echo sounder calibration we usually have limited knowledge of the stochastic properties of the observations. Therefore, the standard deviation of the parameters we compute from (1.3), will be too optimistic. For this reason, we define a reliability factor R which measures the ability of the geometry to determine the calibration parameters.

The computation of R is done in a simulation procedure. In the first round the calibration V' is computed. Thereafter, the measurements are corrected according to vector ϵ of offset values and a new calibration V'' is computed with ϵ as the start value of the computation. Ideally, V' and V'' should be equal, but due to many error sources, the two may be different. The reliability factor for parameter v is computed as:

$$R = \begin{cases} 1 - \left|\frac{v' - v''}{\epsilon_v}\right| \text{for} |v' - v'| < |\epsilon_v| \\ 0 otherwise \end{cases} \tag{1.5}$$

From the definition we recognize that R is defined on the interval [0,1]. Factor 1.0 means that the simulated offset is completely determined, but from the factor value considered, we cannot draw the conclusion that the parameter is computed with no uncertainty. The maximal factor value only tells us that we have a strong geometry. In general, we can say that for low values of the reliability factor we should supplement the configuration with additional calibration lines.

The interpretation of R must also consider the weight of the parameters. If $R \approx 1$, it may happen that the parameter is given high weight. This is the case if the parameter is to be fixed to its initial value.

The reliability test is very important since it gives a comprehensive control of the calibration. Generally, it is hard to prove that a computer program works as it should, but the reliability test covers both the implementation of the calibration procedure as well as the configuration of the calibration lines.

The calibration lines must follow straight lines, i.e., curved calibration lines are not allowed. The number and the length of the lines are limited by the amount of computer memory and the speed of the computer processor.

Bibliography

[1] Jan Terje Bjørke. En metode for feltkalibrering av systemparametere i et multistråleekkolodd-system (Eng. a method for field calibration of system parameters in a multibeam echo sounder system. Norwegian patent no. 315766, Norwegian Patent Office, PO Box 8160 Dep. 0033, Oslo, Norway, 2004.

[2] Jan Terje Bjørke. Optimal method for field calibration of multibeam echo sounders. Submitted IEEE Journal of Oceanic Engineering, 2004.

7.27 C-MAP CM-93/3

What it does

The C-MAP CM-93/3 Professional is a global chart database intended for use on advanced electronic charting and navigation systems.

CM-93/3 supports all the new object classes and attributes defined by S-57 Ed. 3.0, as well as the S-57 data model and updating mechanism.

Note *The information in this chapter originates from C-MAP technical documentation.*

Specification of minimum performance

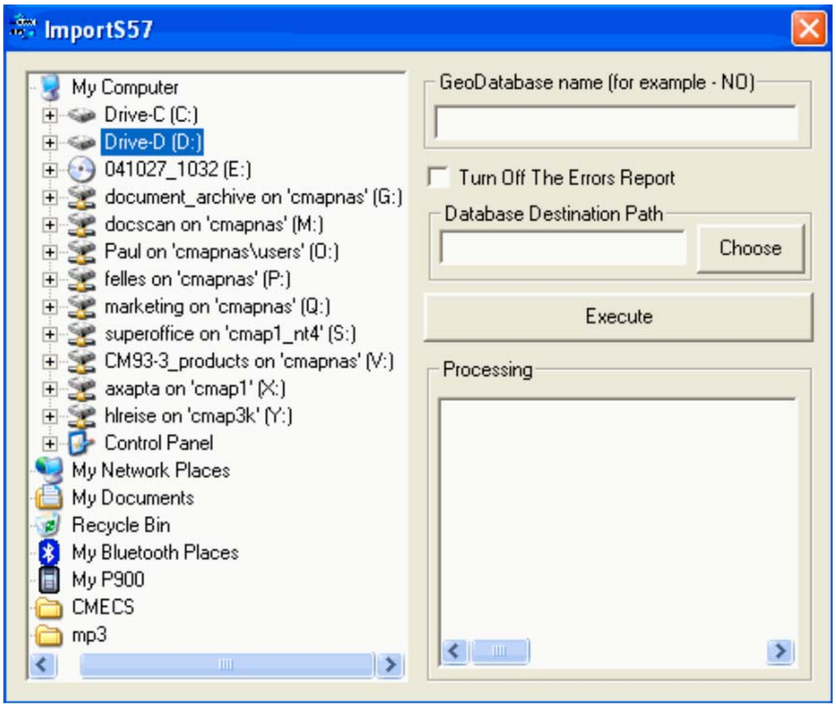
The C-MAP CM-93/3 Software Development Kits (version 3.0) have been designed to allow manufacturers to implement the various C-MAP CM-93/3 chart databases into their navigation and land based systems. In order to ensure that the CM-93/3 cartography is used and displayed correctly within manufacturers systems, the Specification of Minimum Performance document to which we will run a system audit on completion of the software development.

C-MAP S-57 Verifier and CM-93/3 Compiler

Installation

The S-57 verifier and CM-93/3 compiler (hereafter called the compiler) is installed together with the software distributed by the manufacturer. When this software is installed you should ensure that the eToken (part number: CM-eToken-S57) is inserted into one of the available USB sockets. This eToken is used to unlock the compiler and to license CM-93/3 charts. Once the software is installed clicking on the icon will start the compiler.

The compiler main screen looks approximately as follows:



Using the compiler

Browse to the location of the stored S-57/3 charts in the left hand window (normally in an ENC_ROOT directory), and enter the issuing Hydrographic Office at the top of the right hand window. The issuing Hydrographic Office code is always the same as the first two letters of the file name. For example a Norwegian ENC may read something like “NO2B0412.000” and therefore the issuing HO code is “NO”.

Enter the destination path for the compiled database. This should be an existing directory on the hard disk (for example C:\ENC).

Click on Execute to compile the S-57/3 charts to CM-93/3. If the S-57/3 is fully compliant with the IHO specification, the charts will be compiled into a local CM-93/3 database and automatically registered in the database administrator. They can then be viewed on the screen by either setting the ENC database as default or by opening the application and go to the Add Database option to add the recently imported S-57/3 into the current view.

During the verification phase it may become evident that the S-57 files being imported are not fully compliant with the S-57/3.1 specification. If this is the case then one or more warnings or errors will be displayed and the user will be given the choice to CONTINUE (in which case the compiler will continue verification but not compiler the database), to SKIP (the database will be compiled but may contain serious errors) or to CANCEL. In general warning messages will not stop the compilation process but errors may cause the database to be incorrect or even the system displaying them to crash.

The C-MAP Cartographic Service

Overview

The system that you are now using has the capability of using and displaying the latest C-MAP CM-93/3 worldwide vector chart database. These charts are fully compliant with the latest IHO S-57 3.1 specifications and, when using the CM-93/3 ENC database in an approved ECDIS, are considered equivalent to the navigational charts required by the SOLAS (Safety Of Life At Sea) convention.

In order to prepare the system for use with the C-MAP CM-93/3 database, there are a number of things that will first need to be carried out: -

Registration of the system at C-MAP Norway

When a system is installed that has the capability to use the CM-93/3 database, it is required that an Aladdin eToken supplied by C-MAP is connected to the system (if the system has and supports USB). The eToken provides the system with a unique System ID that enables C-MAP to issue correct licenses. The actual System ID can be found on the eToken itself, on the back of the installation CD box or on a sticker placed on the equipment. This ID must be quoted on all chart orders, either by email (license@c-map.no) or by fax +47 51 46 47 01.

When a system does not have a USB port or does not have support for the eToken, a file called USER.USR will be automatically created during initial installation (normally in the Program Files\CM93v3 SDK directory). This file contains the Company ID and System ID assigned to the ECDIS/ECS system when it is installed. These ID’s can be found on the back of the installation CD box or on a sticker placed on the equipment. This file must **always** be sent to C-MAP Norway by email (license@c-map.no) when installing the software. Licenses can only be generated once this file has been received and registered by C-MAP. It is important to note that the software may need to be reinstalled and reinitialised if the operating system or hardware is upgraded (see the troubleshooting section).

Please note that in some cases the manufacturer of the system will have already pre-registered the system by sending the USER.USR file to C-MAP.

If during installation you do not know your Company ID or System ID, please contact C-MAP Norway before continuing installation of the software.

Ordering charts

A chart order may be sent together with the registration of the system as described above. It is essential that the required information be sent to C-MAP when ordering charts for a system. C-MAP has issued order forms specifying the information that is required, and contains vital information that will allow us to monitor and maintain your licenses throughout the lifetime of the system. Charts can be ordered by Zone, Area or Cell and these can be seen on our Internet pages at www.c-map.no or by downloading the Chart Product Catalogue also available on the web site. Price quotations can be obtained via your chart dealer or direct from your local C-MAP office. Once the license order has been prepared it should be emailed to license@c-map.no or faxed to C-MAP Norway AS (+47 51 46 47 01).

Applying licenses

Once the order has been received at C-MAP, a license will be generated and transmitted back to the user. This may be in the form of a single alphanumerical string (16 characters), or in the form of a file called PASSWORD.USR. Once this license has been received it should be input using the License Administrator software designed and supplied by the ECDIS/ECS manufacturer. There are two types of licenses, purchase and subscription. Purchase licenses are valid indefinitely while subscription licenses need to be renewed each 12 months from the start of the subscription. Failure to renew a subscription will result in the charts becoming unavailable.

Troubleshooting

If you are having problems installing your software or charts please check the following before calling C-MAP: -

- You are installing on Windows NT, Windows 2000 or Windows 98 second edition. The system will not normally run under Windows 95 or Windows 98 first edition.
- That you have registered the WORLD database in the GDBADMIN application.
- That the registered WORLD database is available. If you are running the database from the CD drive, the CD-ROM must be loaded.
- That you have correctly typed the license string.
- That you have not reinstalled Windows or any major hardware components. If you have done this you will probably need to reinstall your software (only required for systems that are not using eToken).

Contact Information

For information or help please call you’re nearest C-MAP Office (details can be found on the reverse side of the C-MAP chart CD box) or contact C-MAP Norway: -

C-MAP Norway AS
Post Box 212
Hovlandsveien 52
4379 Egersund
Norway

Tel. +47 51464700
Fax.+47 51464701
Email: technical@c-map.no

7.28 SVP Editor

What it does

The SVP Editor is used to edit the sound speed profiles logged in .asvp-formatted files. There are a number of tools to help the operator to create a good sound velocity profile, including manual editing. The main user interface for the SVP Editor is displayed below.

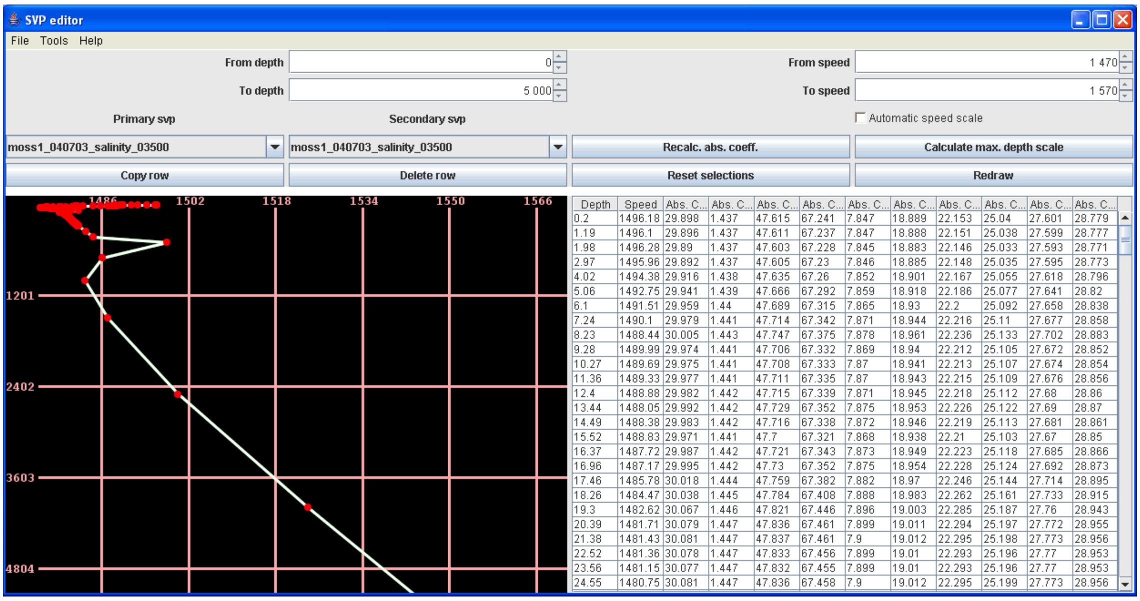


Figure 64 SVP Editor main user interface

How it works

The user can read in and display several sound velocity profiles at the same time, and the program can be started with filenames so that the profiles are read in and displayed when the program starts.

Pulldown menus

There are two pulldown menus **Primary svp** and **Secondary svp**. These menus display a list of all the profiles that are read into the program.

The primary svp is drawn using red circles and white lines, the secondary using blue circles and green lines. All others are drawn using gray circles and gray lines.

The numerical table to the right shows the data from the primary svp. The operator can at any time change the values in this table. Press “Return” to see the effects in the profile.

The operator can select one value in the profile, and then the row in the table will be selected as well. Note that the table may be too big to fit in the window so the operator may have to scroll the table to see the selected row.

Buttons

Copy row: This button copies the selected row in the table. This allows the operator to add values to the profile because he can then edit the copied row and change the data in it.

Delete row: Deletes all selected rows in the table.

Reset seletions: Resets all selections.

Redraw: Redraws the profile. The user must use this button after selecting rows in the table to see where the selected values are in the profile.

Calculate max. depth scale: By default the profiles are drawn using 100 meters as maximum depth. Pressing the button will cause the profiles to fill the entire window. You normally have to press this button only once after reading in an profile.

From depth: This scroller is used to set the start depth to be drawn. It can be used to scroll up and down the profile and the profile range will remain constant, the To depth will be updated when the operator uses the arrow buttons to scroll up and down. The operator can also set this value from the keyboard and press “Return” to see the effect.

To depth: Set the maximum depth to be displayed. This value can never be less than 5 meters larger than From depth. When the user presses the arrows to change this value, the profile will stretch and shrink because the From depth is kept constant. The operator can also set this value from the keyboard and press “Return” to see the effect.

From speed: Set the minimum speed to be displayed. It can be used to scroll the profile in the speed direction. The range will remain constant as To depth is updated. The operator can also set this value from the keyboard and press “Return” to see the effect.

To speed: Set the maximum speed to be displayed. When the user presses the arrows to change this value, the profile will stretch and shrink in the speed direction because From speed is kept constant. The operator can also set this value from the keyboard and press “Return” to see the effect.

Automatic speed scale: When this button is enabled, From speed and To speed are overridden and the minimum and maximum speed is calculated automatically from the values in all profiles.

File menu

Open: Open a .asvp -file and make the profile primary.

Open in editor: Open selected file in a separate raw editor program.

Save as: Save the primary svp with a name of your choice.

Save primary svp: Save the primary svp to its original file. Note that this file will be overwritten.

Send primary svp to echosounder: Information about the primary svp is sent to SIS where all mean absoption coefficients are recalculated using the depths found in the .asvp -file. Note that to actively use this svp it must be selected by the operator in the Sound Speed frame in the Runtime parameters view

→ *See page 225.*

Close primary svp: Close primary svp and remove it from the editor. Note that it will not be saved.

Close all: Close all profiles and remove them from the editor. Note that the profiles are not saved.

Exit: Exit the program. Note that unsaved profiles are not saved.

Tools menu

csv2asvp: Launch the program csv2asvp which helps you to convert data from the Smart Probe logged in .csv-files using the program Smart Talk. The output from csv2asvp is .asvp -files which can be edited in SVP Editor.

→ *Smart Talk, page 447.*

Morse: Launch the Morse logging program. This program will log data from the Morse sensor to an .asvp-file which can be edited in SVP Editor.

→ *Morse SVP, page 452.*

Extend profile: The profile will be extended down to 12,000 meters. Note that the profile must be continuous for this operation to be carried out. If not all depths in the profile are ascending, the rows where the depth is equal or above the previous row will be selected. The operator can then press “Delete rows” and delete them. Now this operation can be carried out.

Thin profile: Thin the profile by removing some points. The operator types in a thinning factor (0.01 to 3.0). The smaller the factor, the less thinning will be done. The results from the thinning is then presented in a table, see the figure below. Note that this operation requires that the profile is extended.

Replace primary with data from secondary: If the primary svp contains depths from 0 to 12,000 meters and the secondary contains data from 0 to 100 meters, the values from 0 to 100 meters in the primary svp will be replaced with the data from the secondary svp.

Thinning results table

The thinned primary svp is written to a file with thinned added to the filename of the primary svp. This thinned profile is then automatically read into SVP Editor.

The Thinning results table shows the results from using the original and the thinned profile. Each table has selected beam pointing angles as columns and selected depths as rows. The approximate depth used is listed in the column to the left.

Results of thinning

Warning threshold (m) 0.1 First table is depth differences (m) Second table is horizontal differences (m) Print... OK

Depths:Beam an...	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0
5.0	4,95/4,95	4,95/4,95	4,95/4,95	4,95/4,95	4,95/4,95	4,95/4,95	4,96/4,96	4,98/4,98	5,07/5,07
10.0	9,91/9,91	9,91/9,91	9,91/9,91	9,91/9,91	9,9/9,9	9,9/9,9	9,88/9,88	9,83/9,83	9,48/9,48
20.0	19,92/19,92	19,92/19,92	19,9/19,9	19,88/19,88	19,84/19,84	19,75/19,75	19,56/19,56	18,99/18,99	15,2/15,2
50.0	49,95/49,95	49,94/49,94	49,89/49,89	49,8/49,8	49,63/49,63	49,31/49,31	48,57/48,57	46,38/46,38	31,2/31,19
100.0	100,01/100,01	99,98/99,98	99,88/99,88	99,67/99,67	99,3/99,3	98,56/98,56	96,93/96,93	92,04/92,04	57,87/57,85
200.0	200,12/200,12	200,06/200,06	199,84/199,84	199,41/199,41	198,62/198,62	197,08/197,08	193,64/193,64	183,35/183,35	111,2/111,16
500.0	501,28/501,28	501,08/501,08	500,43/500,44	499,15/499,15	496,79/496,79	492,25/492,25	482,26/482,26	453,79/453,78	271,18/271,09
1000.0	1003,73/1003,73	1003,3/1003,3	1001,89/1001,89	999,1/999,1	993,92/993,92	983,79/983,79	960,89/960,89	889,84/889,83	261,34/261,55
2000.0	2008,82/2008,82	2007,91/2007,91	2004,94/2004,94	1999,05/1999,05	1988,17/1988,17	1967,06/1967,06	1920,09/1920,08	1780,8/1780,79	-99/-99
4000.0	4047,12/4047,12	4044,28/4044,28	4035,05/4035,05	4016,77/4016,77	3983,09/3983,09	3918,24/3918,24	3776,19/3776,19	3375,51/3375,5	-1/-1
6000.0	6131,33/6131,34	6124,9/6124,9	6103,95/6103,95	6062,51/6062,51	5986,25/5986,25	5839,8/5839,8	5520,89/5520,89	4637,53/4637,52	-1/-1
8000.0	8265,4/8265,4	8253,39/8253,39	8214,29/8214,29	8137/8137	7994,95/7994,95	7722,8/7722,8	7133,26/7133,26	-1/-1	-1/-1
11000.0	11567,62/1156...	11542,8/11542,8	11462,03/1146...	11302,6/11302...	11010,41/1101...	10453,61/1045...	9260,96/9260,96	-1/-1	-1/-1

Depths:Beam an...	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0
5.0	0/0	0,87/0,87	1,8/1,8	2,85/2,85	4,15/4,15	5,89/5,89	8,56/8,56	13,58/13,58	28,03/28,03
10.0	0/0	1,75/1,75	3,61/3,61	5,73/5,73	8,32/8,32	11,82/11,82	17,18/17,18	27,26/27,26	56,27/56,27
20.0	0/0	3,53/3,53	7,29/7,29	11,57/11,57	16,81/16,81	23,88/23,88	34,7/34,7	55,05/55,05	113,6/113,6
50.0	0/0	8,89/8,89	18,34/18,35	29,1/29,1	42,29/42,29	60,07/60,07	87,3/87,3	138,48/138,48	285,82/285,82
100.0	0/0	17,81/17,81	36,77/36,77	58,32/58,32	84,76/84,76	120,38/120,38	174,96/174,96	277,53/277,53	572,84/572,85
200.0	0/0	35,66/35,66	73,61/73,61	116,76/116,76	169,69/169,7	241,01/241,01	350,28/350,28	555,63/555,64	1146,89/1146,9
500.0	0/0	89,5/89,5	184,73/184,73	293,02/293,02	425,83/425,83	604,71/604,71	878,57/878,58	1392,42/1392,43	2869,05/2869,07
1000.0	0/0	179,41/179,41	370,34/370,34	587,47/587,47	853,83/853,83	1212,74/1212,74	1762,77/1762,78	2797,33/2797,34	7028,09/7028,04
2000.0	0/0	359,31/359,31	741,67/741,67	1176,45/1176,45	1709,73/1709,73	2428,09/2428,1	3528,28/3528,29	5594,27/5594,28	-99/-99
4000.0	0/0	729,24/729,24	1505,18/1505,18	2387,28/2387,29	3468,76/3468,76	4924,33/4924,34	7149,64/7149,64	11309,17/1130...	-1/-1
6000.0	0/0	1116/1116	2303,26/2303,26	3652,44/3652,45	5305,33/5305,33	7526,87/7526,87	10913,43/1091...	17198,16/1719...	-1/-1
8000.0	0/0	1521,44/1521,44	3139,61/3139,61	4977,36/4977,36	7226,25/7226,26	10242,44/1024...	14820,52/1482...	-1/-1	-1/-1
11000.0	0/0	2168,55/2168,55	4473,55/4473,56	7087,68/7087,69	10278,29/1027...	14536,73/1453...	20937,33/2093...	-1/-1	-1/-1

Figure 65 Thinning results table (example)

Note that the depth used in the calculations will differ from this depth because the raypath routine requires time as input, and the time is computed from the depth and the average sound speed in the profile, which will be different from the true profile.

In the first table the depths from the two profiles are shown, and in the second table the horizontal placement is shown using both profiles.

In the text field on top the operator can set the difference between the two profiles to be shown. If the difference between the original and the thinned profile is larger than the values set (remember to press “Return” for the value to take effect), the background of the cell will be set to red.

The operator can save these results to file by pressing the “Print...” button.

Press “OK” to return to the SVP Editor.

7.29 Smart Talk (SVP)

What it does

The Smart Talk program is used by SIS to configure and download data from sound velocity probes by Applied Microsystems. The program is installed using the SIS CD.

Normally the Smart Talk program is located under C:\Program Files\SmartTalk. If the .exe file is not routed to the desktop, the Smart Talk program can be started from this location.

How it works

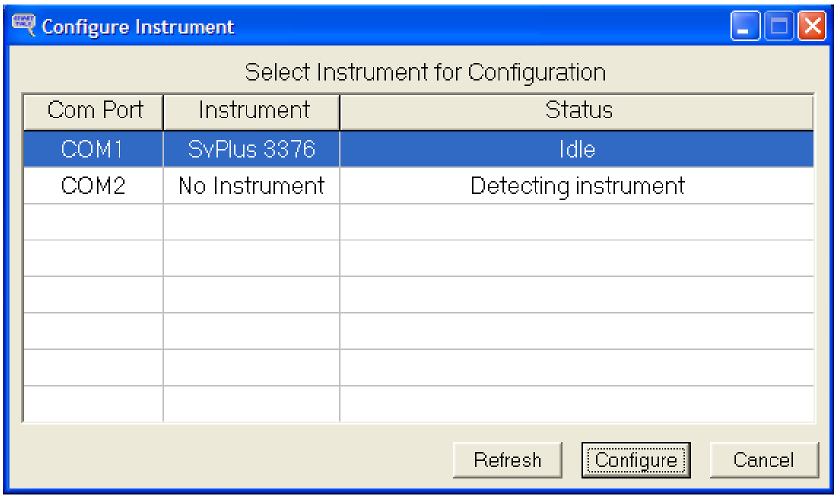
The following tasks can be performed from the application's main window:

- Configure instrument
- Download data
- View data
- Communication settings
- Configuration
- Sensor calibration

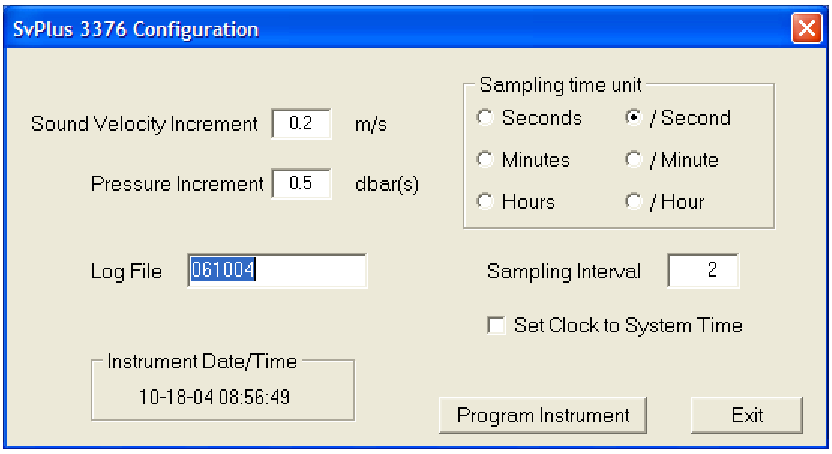
Configure instrument

Press the “Configure instrument” button to configure the profiler prior to a sound velocity dip.

The profiler is connected to a serial port on the SIS PC, and it is automatically detected by the PC.



Select the requested instrument from the list and press the “Configure” button to open the Configuration dialogue.

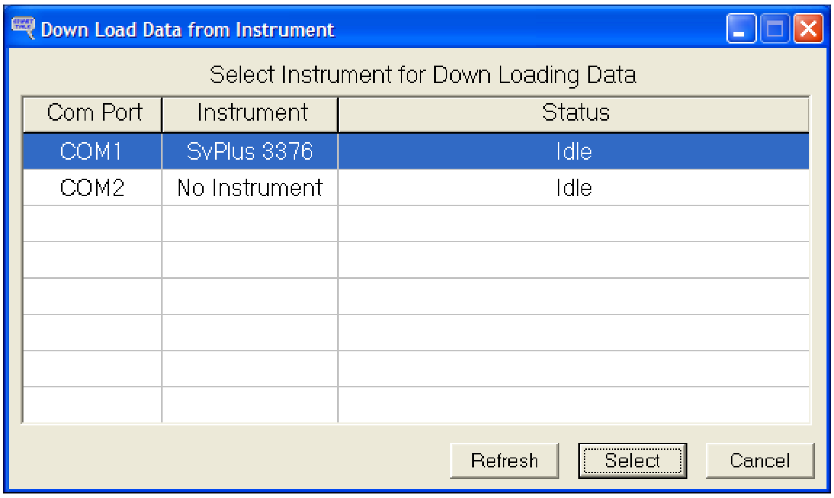


Configure the profiler. Remember to enter a file name in the “Log File” text box. When finished, press the “Program Instrument” to load the settings into the profiler.

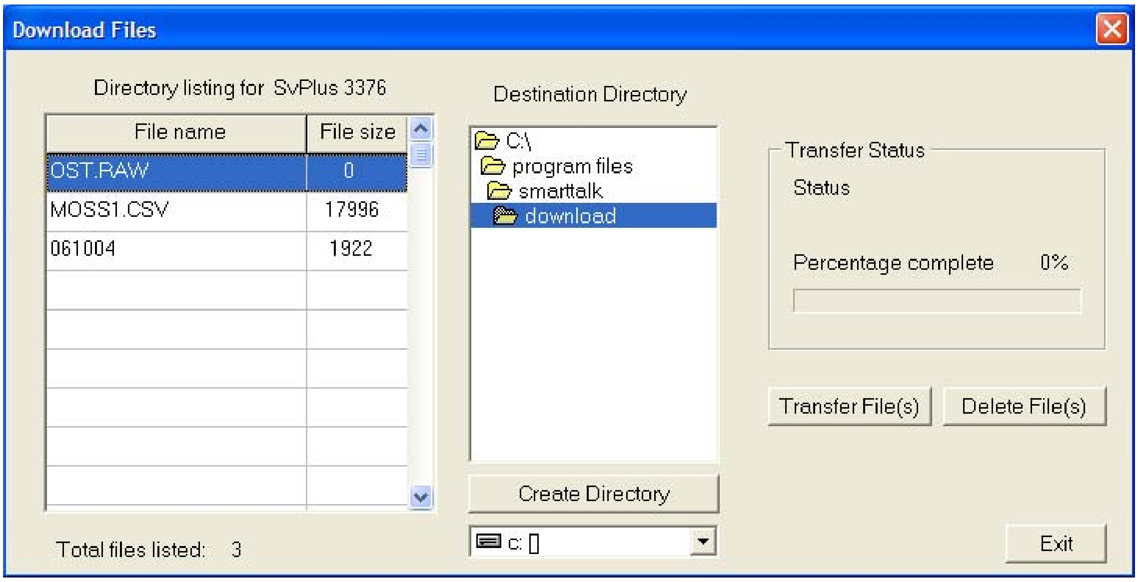
The profiler is now ready to be disconnected and launched.

Download data

Press the “Download Data” button to download SVP data after a sound velocity dip.



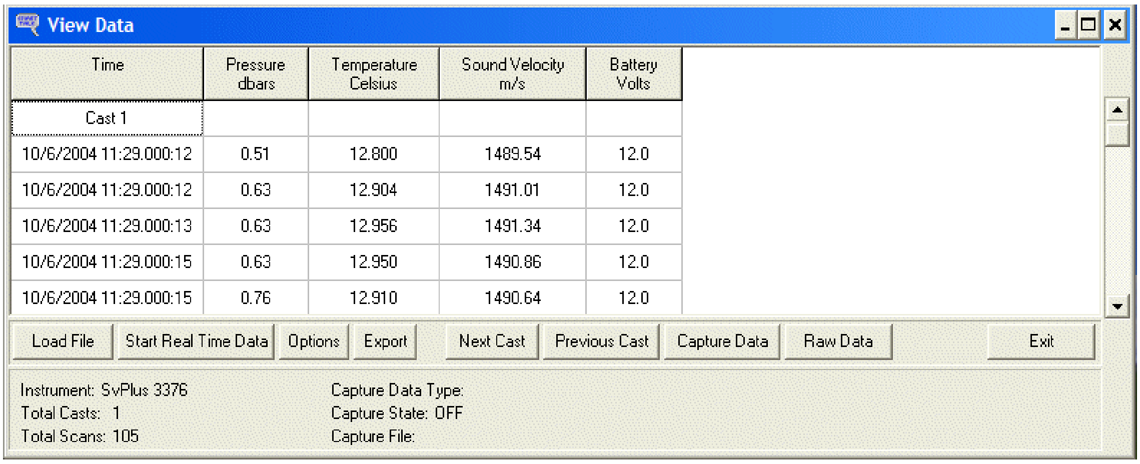
Select the requested instrument from the list and press the “Select” button to open the Download Files dialogue. All files logged inside the profiler is now displayed.



Select the correct file in the Directory listing. Specify the path to where you want the file to be stored.

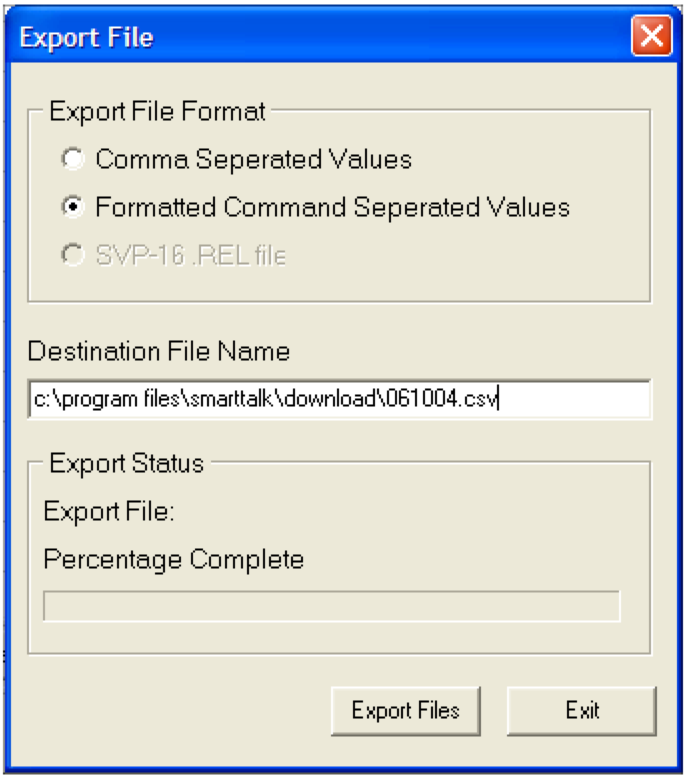
View data

Press the “View Data” button to load the profile and inspect it. In the View Data dialogue, press the “Load File” button to browse for and open the requested SVP file.



The data is logged for both downwards and upwards movement in the water column.

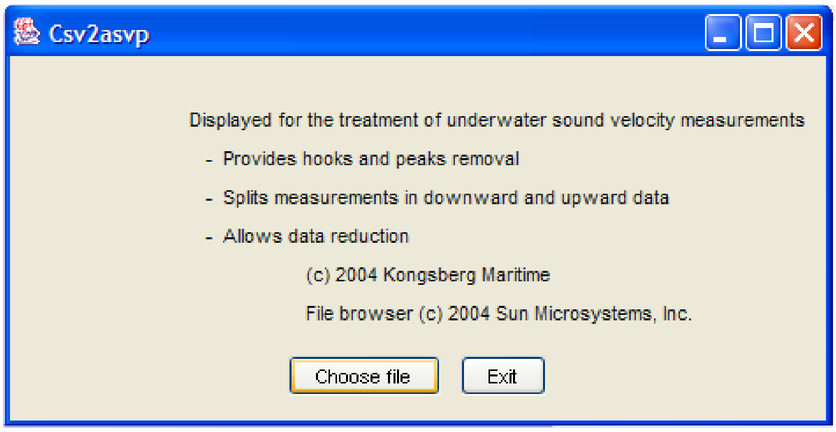
Press the “Export” button to open the Export File dialogue.

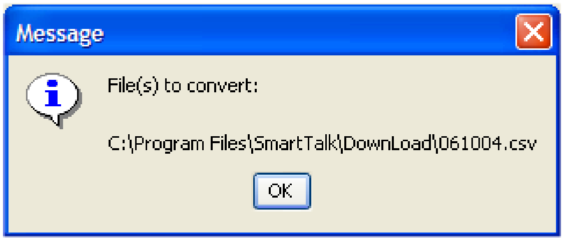


In the Destination File Name text box, type the SVP file name and add the extension *.csv. Press the “Export Files” button.

The sound velocity file includes components from both downwards and upwards SVP data in the Water colunm. The program **csv2asvp.jar** will split the data into two separate files automatically. This program is located under C:\Program Files\Kongsberg Maritime\SIS\bin.

Start the program. Press the “Choose file” button to browse for the SVP file. After selecting the requested file, press the “OK” button in the Message dialogue.





The file is now split into *_downward.asvp and *_upward.asvp components.

It is vital that valid sound velocity data is deeper than your surveying depth. If this is not the case, use an ASCII editor to extend the profile.

Finally the SVP data can be activated in the echo sounder. This is done in the Sound speed dialogue located under the Runtime parameters tab.

Related topics

→ *Sound velocity profile window, page 120.*

→ *Runtime parameters, Sound speed, page 225.*

7.30 Morse SVP handling

Running the program

This program is an interface program for handling the Morse SVP sensor. In the file **morse.bat** an instance of the program RS2UDP is started. This program sets up the communication to the serial port and the relay of data to a network port (UDP). This UDP port is then input to the program that reads the serial port. Please make sure that the settings to the serial port are the ones used by the Morse SVP sensor.

The program requires that the environment variable JAVA_HOME is set and that java is found in JAVA_HOME\bin. Also perl must be in the path, and explorer must be found at c:\windows\explorer. You can change this in the file help.pl if necessary.

Using the program

The main user interface holds the following:

File to log raw data to...: Select the raw data destination file for the data from the SVP sensor.

SVP file to write...: Set the filename the SVP will be written to. This file should end with .asvp.

Latitude in degrees: Enter the latitude in degrees. It is used to calculate the correct depth.

Surface pressure in bars: Enter the surface pressure in bars. It is used to calculate the correct depth.

When the operator presses “Start”, the values from the UDP port will be displayed in the SVP window. When the operator presses “Stop”, the contents of the .asvp-file is shown.

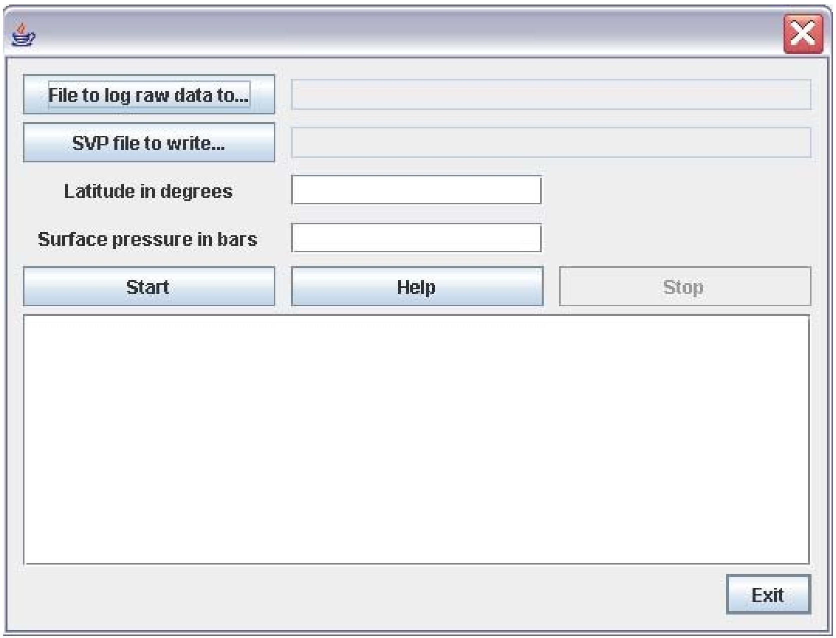


Figure 66 Morse SVP main user interface

Notes

The .asvp-file should be edited afterwards. The time and the location in the header is not correct and should be corrected by the operator.

The operator should also make sure that the profile contains a value at exactly 0.0 meters depth, and at 12,000 meters depth.

If the file contains a great number of values, the operator should concider thinning the values.

7.31 How to use SIS on an AUV

Overview

This chapter explains how to use SIS on an Autonomous Underwater Vehicle (AUV) where the EM 2000 echo sounder is installed.

Procedure

In the figure below we see how the EM 2000 on board the AUV is assumed to be controlled. When SIS starts up, it will search for all echo sounders in the network, so as long as the Ethernet is set up correctly, the EM 2000 will broadcast its existence and SIS will pick it up.

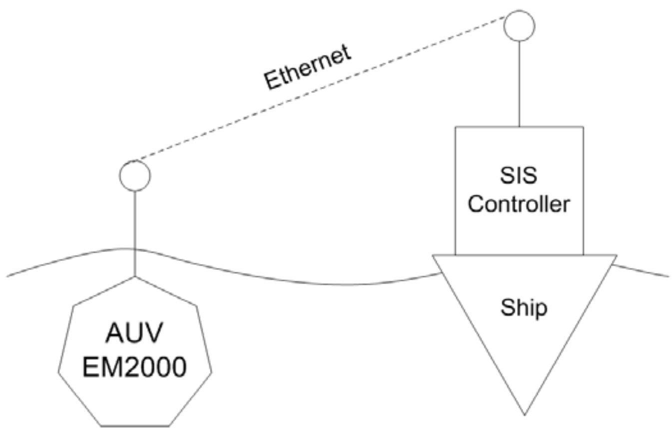


Figure 67 Setting up the EM 2000 on the AUV from SIS on the ship

1 First attach the internal disk in the EM 2000, see document "Datagram Formats" (reg. no. 850-164602) under PU Setup Command, on how to do this.

2 Open SIS, and go to Installation Parameters, see the *Enable PU logging to local disk* chapter below.

3 In Installation Parameters, see *Default or current settings at PU startup* chapter below.

4 In Installation Parameters there are four UDP port numbers, labelled UDP 1-4. When using EM 2000 logging to internal disk, UDP 4 is renamed to PU Logging. Note the UDP port number in use by UDP 2 because this is the port number where the third party software shall listen for data on.

5 You can now shut down SIS and restart the EM 2000.

When the EM 2000 is powered on again, it will start with the installation parameters set. Datagrams will be sent to the UDP ports as defined, and any software can be used to read these datagrams.

To turn on logging, send datagram P10 to port 2012 to the PU. The P10 datagram is described in the document “Datagram Formats” (reg. no. 850-164602) under Remote control command to PU. To stop logging, send P02.

In the figure below we se how the EM 2000 is set up afterwards. P10 and P02 control datagrams are used to start and stop the logging to disk.

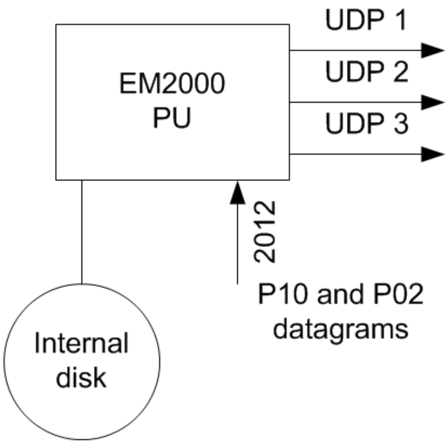


Figure 68 How the EM 2000 is set up

Enable PU logging to local disk

Note *This feature is only available for EM 2000 and EM 3000.*

The SIS user can turn this logging on and off by using a simple tick button in the installation parameter’s ’Output Setup’ frame. When this tick button is set, the ’Host UDP4’ port entry in the ’UDP Host Port’ combo box is substituted with a ’PU Logging’ port. By selecting this ’PU Logging’ port it is possible to select which datagrams that should be logged to the PU hard disk. Initially a default datagram selection is presented, but it is modifiable by the operator as indicated.

When PU logging is set the port number displayed is 2999. This is just a dummy number signifying that the PU is logging to disk.

The selected ’PU logging’ setup is activated (i.e. ’PU logging’ turned on or off) when the ’OK’ button is pressed.

Note that when the PU is logging to disk it will not send ANY datagrams out on the ’Host ’UDP4’ port.

Note that when the PU logging feature is turned off (i.e. tick button deselected) the normally configured settings for Host UDP4 will be used again. Remember to press the ’OK’ button to activate the new setting.

Default or current settings at PU startup

Note *This feature is only available for EM 2000 and EM 3000.*

When the PU is turned on this feature will enable the PU to use a standard (factory) parameter setup or a setup previously configured and installed in the PU by SIS.

In the latter case the PU may subsequently be started independently, without SIS connected. This capability will allow an AUV/ROV operator to use SIS to initialize the PU with a specific setup before disconnecting SIS and launching the AUV/ROV into the water.

The user can control of this feature by a pair of radio buttons found in the installation parameter’s ’ROV. Specific’ frame. The radio buttons are labeled ’Use default settings at PU startup’ and ’Use current settings at PU startup’ respectively.

The procedure for setting the PU to use the current parameter setting is as follows:

1 The PU must have been started by SIS.

2 Configure the required installation and runtime parameters as required using the normal configuration procedure. (Specifically make sure to press the ’PU Installation OK’ button.)

3 In the installation parameter’s ’ROV Specific’ frame press the ’Use current settings at PU startup’ radio button.

The PU is now configured and the current setting stored for use when the PU is turned on again.

The procedure for setting the PU to use the default (factory) parameter setting is as follows:

1 The PU must have been started by SIS.

2 In the installation parameter’s ’ROV Specific’ frame press the ’Use default settings at PU startup’ radio button.

The PU will now use the default (factory) settings when it is turned on the next time and it will normally require that SIS is connected to initialize and control it.

Note that when the radio buttons are pressed a signal is sent directly to the PU without the need to press the OK button (as for normal installation parameters). Therefore, when the ’Use current settings at PU startup’ radio button is pressed the required setup must already be present in the PU using the procedure above.

Note that after the ’Use current settings at PU startup’ radio button has been pressed the PU parameter setup at that time is remembered and used during next startup. If further installation and runtime configuration are performed, without pressing the radio buttons again, the changed configuration will be used until the PU is turned off and on again.

Fetch and delete data from the internal harddisk

FTP can be used to fetch and delete data from the internal harddisk, or replace the disk with another and insert it in another PC to read the data.

7.32 Javad and Trimble details

The user has to start the necessary modules to enable logging from a Javad or Trimble GPS receiver. Each module is described in sub-chapters, after the following manual start-up procedures.

Note *The “(space)” remark indicates space key in the start-up commands; the letters are not a part of the commands.*

Note *Fill inn the constituent data file or port number between the brackets <...>.*

Mean Sea level module

- Windows:
  sisMSL -d “C:\Program Files\Kongsberg Maritime\SIS\bin” -i 9044 -o 9041
- LINUX:
  ./sisMSL -d /usr/local/sis/bin -i 9044 -o 9041

Real time tide module

- sisTide -f <constituent data file> F tide5.dat -i 1 -p(space) 9041 -p 4001

Here the Mean Sea level module is set up to receives GGA messages from the Javad receiver and the Real time tide module sends data to the gpsraw module logging data from the Javad receiver.

Javad GPS receiver

- RStoUDP -com <port number>,19200,8,0,1 -udpin(space) 9049 -udpout localhost,9050 -bin
- gpsraw -p 1 -t JAVAD -i 9050 -u 9049 -c 9041 -e(space) 4002 -n 4002 -g 9044

Trimble GPS receiver

- RStoUDP -com <port number>,19200,8,0,1 -udpin(space) 9038 -udpout localhost,9039 -bin
- gpsraw -p 2 -t TR4000SSE -i 9039 -u 9038 -c 9041(space) -e 4002 -n 4002 -g 9033

Raw GPS data logging module

The raw GPS data logging module enables the user to log raw GPS measurements from a high quality GPS receiver, thus enabling the user to post process the data using any available tool, for example AbsPos (available autumn 2005 from Terratec AS).

At the moment, two different GPS receivers are supported: Javad and Trimble 4000 series (tested with Trimble 4000 SSE)

Starting the programme with the option -h (gpsraw -h) gives the following output, which should be self explanatory:

gpsraw $Revision: 1.4 $
Usage gpsraw [options]

-p <1-3> Set positioning system number

-t <gps receiver type> (JAVAD or TR4000SSE)

-i <portnum> Reads data from this port [in]

-c <portnum> Control port [in]

-e <portnum> Port for error messages [out]

-u <portnum> Port for messages to gps receiver [out]

-g <portnum> Port to receive GGA NMEA messages [out]

-n <portnum> Port to receive all NMEA messages [out]

-d Show debug messages

-v Show version and exit

-h Show this help

This programme reads raw gps data from one UDP port, interprets and logs the the data to a file, extracts nmea messages which may be distributed to other programs. It may control the gps receiver by writing control datagrams to the gps receiver. It reads control datagrams which may start or stop logging to file, or set fixed hight (if supported by the receiver).

NMEA messages may be distributed to multiple ports, by repeating the options -g and/or -n.

For output ports the port may be given as port, name:port or ip:port A control port (-c) and an inport (-i) are required options.

The control datagrams that are understood are:

- $KSSIS,102,dirname,ON	(Start logging in given directory)
- $KSSIS,102,dirname,OFF	(Stop logging)
- $KSSIS,103,ON	(Set fixed height)
- $KSSIS,103,OFF	(Reset fixed height)
- $KSSIS,105,23.45	(Geoidal separation in meters)
- $ATIDE,20051225123022,2.45	(Time and tide value [meters])
- <Installation datagram>	(To get antenna height)

The error messages which may be returned to the port given by -e have the form:

- $KSSIS,104, ; message text which may be long...

Mean Sea level module

The mean sea level module calculates the Mean Sea Level (in many places almost the same as Geoid) from a set of input files and interpolates accordingly to a position received as a GGA message on an input (UDP) port. It sends the MSL value in the given position to those who need it, in particular the raw gps logging module, which needs it for calculating antennae height when too few satellites are visible.

The programme is started from a command file or from a terminal window and using the -h option gives the following information:

Usage sisMSL <options>

Where options are:

- h	Prints this help
- d <directory>	Where to search for data files (required)
- p <pattern>	Pattern used in search. Default: .grid
- i <portnum>	Where to receive GGA messages from (required)
- o <portnum>	Where to send geoide separation (Can be repeated. At least one is required)
- D	Prints debug information

This programme reads geodie separation files from a directory and interpolates in the files from a position received on a port with NMEA GGA messages The ports can be given as either hostnum:port, ip:port or just port.

Real time tide module

The real time tide module calculates the tide from a set of input files. One normally called ”tide5.dat”, can be generated, and the other contains the constituents for the nearest harbour. The programme can calculate the tide using phase and amplitude offsets as well as correcting for the current air pressure (given that the correct tide is known). The internal clock of the computer must be correct for this real time module to work correctly.

The programme has also the capability to make a prediction file, using other options.

A typical usage for the programme, with typical options which gives the tide corrected to LAT are:

- sisTide -f stavanger.xdo -F tide5.dat -p 4001 -s 1.1(space) -t 12 -l 0.05 -z 0.65 -i 10

By using the -h option the following help message is returned:

use sisTide [options]

-h Show this message and return

-v Show version and return

-c Show copyright notice

-q Show file formats and return

-f <filename> Read constituent data from this file

-F <filename> Read Foreman data from this file

-i <number> Interval for sending or calculating data [min] (default 60)

The following two options are for sending real time predictions:

p <portnum> Send to port (default localhost:4001)

The following two options are for generating predictions for a date:

-D <YYYYMMDD> Start date for predictions

-d <number of days> Number of days to give predictions for (default 1)

Note *If -D is given, -p ignored.*

Options for changing the calculations:

-a Amplitude factor (default 1.0)
Multiply the result with this factor.

-t Secondary harbour time correction [min] (default 0)
Added to time before calculating tide (delaying tide)

-l Level correction [m] default 0.0

Add to tide after calculations

-z Use this level (positive number) [m] for Z0 (default 0.0)
Add to tide after calculations

Note *Z0 value from file is never used.*

Constituent (-f) and Foreman (-F) files must always be given.

Note *Predicted tides are always referring to UT (GMT). This can be changed using -t option (-t60 gives MET).*

Note *Environment variable TZ must be correctly set to get correct real time predictions. (e.g. TZ = MET - 1METDST).*

Note *Predicted tides are calculated relative to mean sea level unless Z0 (-z) and/or level corrections (-l) are given.*

Note *The results are negated so ADDING the results to measured depths should give tide-corrected depths.*

RStoUDP

The RStoUDP module makes it possible to control/receive data on UDP from equipment attached to RS232 serial lines:

Usage RStoUDP -com <prt>,<baud>,<databit>,<parity>,<stopbit> -udpin <port> -udpout <ip,port> -udpout[1-4] <ip,port> -ts -distudp -log <logfile> -confsock <port> -bin <buf size> -t <timeout (usec)>

Legal values for parity is 0=none, 1=odd and 2=even

Where:

-com (Comm port to use)

-udpout (Port nr. for incoming data)

-ts (Add timestamp to ASCII data)

-udpout[n] (Additional output sockets)

-distudp (Distribute incoming udp data to all udp out sockets)

-confsock (Socket for incomming config messages)

-bin <size> (Binary mode and buffer size)

-t (Timeout value when reading binary data)

Example: RStoUDP -com 4,9600,8,0,1 -udpout(space) localhost, 2020 -log log.dat

7.33 Difference in log file formats

SIS logs various types of datagrams from the echosounder in a continuous stream. Each time the operator starts a new line, a new survey data file is created which results in a break in the data stream such that a depth datagram may be located at the end of one file with its associated position datagram located at the beginning of the next.

When SIS generates xyz-data from these files, if it encounters a depth datagram at the end of the file for which there is no corresponding position datagram, it looks for the missing position datagram in the next survey file. However, when Neptune generates xyz-data from these files, if it can't find a valid position datagram after the last depth datagram, it will reject the depth datagram resulting in a "hole" in the data.

Previous versions of the Merlin logging system handled this situation by storing duplicate position datagrams in both survey files, but this is no longer done. Therefore, to eliminate this type of "hole" when generating xyz-data, Neptune will be updated with a tool that will insert the missing position datagram at the proper location in the survey data files.

8 MAIN INDEX

The next pages present the main index of this manual.

KONGSBERG

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