



KONGSBERG

***SIS***  
***Seafloor Information System***  
***Reference Manual***  
***Release 5.9***

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## Document information

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## Warning

*The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment and/or injury to personnel. You must be familiar with the contents of the appropriate manuals before attempting to operate or work on the equipment.*

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

## Disclaimer

*Kongsberg Maritime AS endeavours to ensure that all information in this document is correct and fairly stated, but does not accept liability for any errors or omissions.*

## Support information

If you require maintenance or repair, contact Kongsberg Maritime's support organisation. You can also contact us using the following address: [km.hydrographic.support@kongsberg.com](mailto:km.hydrographic.support@kongsberg.com). If you need information about our other products, visit <https://www.kongsberg.com/maritime>.

KM Support is also available in the KM-App.

The KM-Support App is available for free in the App Store and Google Play. The use of the KM-Support App is free of charge. The user's mobile phone provider may charge the costs of the phone call communication to the caller.

## Table of contents

<b>ABOUT THIS MANUAL</b> .....	<b>7</b>
<b>SIS</b> .....	<b>9</b>
System description .....	10
Network security .....	10
Support information .....	12
<b>GETTING STARTED</b> .....	<b>13</b>
Installing the SIS operating software .....	14
Installing the SIS operational software for remote use .....	15
Installing the Mosquitto MQTT message broker .....	16
Connect the Remote Operator PC to the MQTT message broker .....	17
Connect the HWS on the vessel to the MQTT message broker .....	18
Defining the file and folder settings for raw data recording .....	19
<b>OPERATING PROCEDURES</b> .....	<b>21</b>
Planning surveys .....	22
Creating a job .....	22
Continuing a job .....	23
Creating a new survey .....	24
Continuing an existing survey .....	25
Calibration .....	26
Calibration Single Head System .....	26
Calibration Dual Head System .....	35
Sound speed quality inspection .....	48
Selecting a sound velocity profile .....	50
Converting the SVP file to .asvp .....	50
Using a SVP file .....	50
Importing a SVP profile from a third party probe .....	52
Converting the SVP file to .asvp .....	53
Defining a new filter .....	53
Interfacing peripheral equipment .....	54
Setting up a positioning system .....	54
Setting up an attitude system .....	55
Setting up the time system .....	55
Changing the colour palette ("skin") used in the display presentations .....	56
<b>USER INTERFACE</b> .....	<b>57</b>
User interface familiarization .....	58
Top bar description .....	59
Geographical view .....	61

Geographical view toolbar .....	62
Helmsman Display view .....	64
Beam Intensity view .....	65
Cross Track view .....	66
Numerical Display view .....	67
Scope view .....	68
Stave view .....	69
Seabed view .....	70
Sound Velocity Profile view .....	71
Time Series view .....	72
Water Column view .....	73
Waterfall view .....	74
Status bar .....	74
<b>MENU SYSTEM .....</b>	<b>76</b>
Main menu .....	77
File menu .....	78
View menu .....	80
Tools menu .....	83
<b>FUNCTIONS AND DIALOG BOXES.....</b>	<b>85</b>
File menu: Functions and dialog boxes .....	86
New Survey dialog box .....	86
Advanced Settings dialog box .....	87
View menu: Functions and dialog boxes .....	89
Colour Setup dialog box .....	90
Remote Operator Settings .....	91
Installation Parameters dialog box .....	92
Sensor Setup dialog box .....	93
Network Setup dialog box .....	97
Transducer setup dialog box .....	97
BIST (Built-In Self Test) dialog box .....	99
Runtime dialog box .....	100
Sector coverage dialog box .....	101
Depth settings dialog box .....	103
Transmit control dialog box .....	105
EM MultiFrequency Mode dialog box .....	106
Sound Velocity dialog box .....	108
Filter and gains dialog box .....	109
Extra Detections dialog box .....	112
Runtime Survey dialog box .....	113
Sound Velocity Management dialog box .....	113

Preferences dialog box .....	115
Select colors dialog box .....	119
Tools menu: Functions and dialog boxes .....	120
External Sensors dialog box .....	120
SVP Editor (Web).....	122
PU Replayer dialog box .....	123
Data Distribution Configuration dialog box.....	123
Parameter Setup dialog box.....	124
SVP Editor (legacy).....	125
Helmsman.....	125
<b>MULTIPLE DISKS FOR LOGGING .....</b>	<b>127</b>
Install multiple disks .....	128
Remove current active disk (special case).....	129
Multiple disk issues .....	131
<b>REMOTE OPERATION .....</b>	<b>133</b>
Remote operation .....	134
Connect Remote Operator PC to MQTT message broker .....	135
Connect HWS on the vessel to MQTT message broker .....	135
Autonomous survey operation .....	136
Connecting to Blue Insight .....	137
Realtime Data Controller .....	138
Helmsman Display.....	138
Blue Insight.....	139
<b>HELMSMAN .....</b>	<b>141</b>
Helmsman .....	142
File menu .....	142
View menu .....	143
Tools menu.....	143
<b>SVP EDITOR .....</b>	<b>145</b>
SVP Editor (Web) .....	146
File menu.....	146
View menu.....	147
Tools menu .....	147
Defining a new filter .....	148
Converting the SVP file to .asvp .....	148
SVP Editor (legacy).....	150
File menu.....	151
Tools menu .....	151
<b>CALIBRATION.....</b>	<b>153</b>

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Calibration dialog box .....	153
File menu .....	154
<b>CONCEPT DESCRIPTIONS .....</b>	<b>155</b>
About Clock setup .....	156
Internal clock .....	156
Time stamp .....	157
Time difference PU-ZDA and PU-POS indications .....	158
Vessel coordinate system .....	159
Constant corridor width .....	161
Absorption coefficient .....	162
Salinity based absorption coefficient profiles .....	162
CTD based absorption coefficient profiles .....	163
Calibrate a dual head system .....	165
Processing grid .....	167
Map objects .....	168
Projections .....	168
Geoid .....	169
Geoid file .....	170
Tide .....	172
Faulty depth value detections .....	174
kmall datagram .....	176

# About this manual

The purpose of this publication is to provide the descriptions, procedures and detailed parameter explanations required to allow for safe and efficient use of the SIS system. The publication also provides you with a thorough understanding of the parameters and adjustments provided by the SIS system.

## **Target audience**

This publication is intended for all users of the SIS system. Due to the nature of the descriptions and the level of detail provided by this publication, it is well suited for those who are - or wish to be - expert users.

A good understanding of system functions and controls is essential to fully take advantage of the functionality provided. Sea conditions vary, sometimes drastically. The acoustic conditions are also changing. Temperature and salinity layers differ from one day to the next, and from one position to another. It is not possible to identify settings that will provide the best data at all times. A careful study of the information in this manual is highly recommended, preferably while exploring the functionality offered by the SIS system.

## **Note**

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*This manual is written for all EM systems. The systems have different options in many ways and you will not find everything described here in your system.*

---

## **Online information**

For information about the SIS and other products from Kongsberg Maritime, visit our website.

<https://www.kongsberg.com/maritime>

## **Software version**

This SIS Reference Manual complies with software version 5.9.

## **Registered trademarks**

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Windows® is a registered trademark of Microsoft Corporation in the United States and other countries.



# SIS

## Topics

[System description, page 10](#)

[Network security, page 10](#)

[Support information, page 12](#)

## System description

SIS is the software and user interface for real time data processing for hydrographic instruments. It is included on all deliveries of multibeam echo sounders from Kongsberg Maritime.

SIS is an intuitive and user friendly interface for the surveyor, providing the functionality needed for running a survey efficiently.

SIS runs on a Windows operating system, and is compatible with the Hydrographic Work Station (HWS ) hardware. Up to four screens can be used on one HWS, and SIS can also show geographical displays on several remote computers in the network.

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.

### Key features

- Screen layout with flexible, simultaneous display windows defined by the user
- Enhanced functions for visual and automated data quality control
- Graphical displays for sound speed at sonar head and sound speed profile
- Built in health tests of the multibeam echo sounder and continuous monitoring the quality of input data
  - Error situations are logged, and user notifications are given advising what action to take
- Imaging of acoustic reflectors in the water column (e.g. fish, biomass)
- Real time computation of the mean sea level using a geoid model
- Real time compensation for tide
- Fully operational when an echo sounder is mounted on an ROV/AUV
- Delayed (true) heave logging for post-processing

## Network security

If a SIS system is connected to a local area network, data security is important.

Equipment manufactured by Kongsberg Maritime is frequently connected to the vessel's local area network (LAN). When you connect a computer to a local area network you will always expose the data on that computer. All other computers connected to the same network may be able to access your data. Several threats may immediately occur:

- Remote computers can read the data.

- Remote computers can change the data.
- Remote computers can change the behavior of the computer, for example by installing unwanted software.

Usually, two parameters are used to define the threat level:

- 1 The likelihood that any remote computer will do any of the above.
- 2 The damage done if a remote computer succeeds doing this.

Kongsberg Maritime has no information regarding the complete system installation on any vessel. Systems provided by Kongsberg Maritime are regarded as stand-alone offline systems. They are stand-alone even though they may be connected to a network for sensor interfaces and/or data distribution.

**Note**

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*No network safety applications are installed on Kongsberg Maritime computers. The computers are therefore not protected against viruses, malware or unintentional access by external users.*

---

Securing the SIS system itself has no meaning unless there is a policy in place that secures all computers in the network. This policy must include physical access by trained and trusted users. The customer/end user of the SIS system will always be in charge of defining and implementing a security, policy and providing the relevant network security applications.

**Note**

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*Kongsberg Maritime will not accept any responsibility for errors and/or damages caused by unauthorized use of or access to the SIS system.*

---

If you wish to connect the SIS system to the ship's local area network, you must implement the same security mechanisms on the SIS computer(s) as for the rest of the network. This is a task for the network responsible person on board. Some key elements here must be:

- The same anti-virus protection on all computers, including routines for updating this protection.
- The same settings for the firewall on all computers.
- Controlled physical access to computers on the network.
- Trusted and trained operators.
- Log-in access mechanisms.
- Same policy for attaching peripheral equipment to the computers (USB devices, hard drives etc).
- Installation of programs on any computer in the network, verification that each program is authentic.

- Definition of which programs are allowed to run on each computer.
- Logging mechanism of computer activity, and inspection of these logs.

How to define and implement these rules depends on each end user's network system configuration, which again must be a result of the policies and threat levels the end user has defined for the complete installation. For some products the network consists of only processor units and/or work stations, transceivers and a few sensors. On other vessels, larger computer systems can be installed to include numerous products and data systems. There must be one responsible person for the security of the system, large or small.

## Support information

Should you need technical support for your SIS system you must contact a Kongsberg Maritime office. A list of all our offices is available on our website. You can also contact our main support office in Norway.

A 24 hour telephone support service may also be available depending on your Service Level Agreement.

- **Company name:** Kongsberg Maritime AS
- **Address:** Strandpromenaden 50, 3183 Horten, Norway
- **Website:** <https://www.kongsberg.com/maritime/>
- **Email address:** [km.hydrographic.support@kongsberg.com](mailto:km.hydrographic.support@kongsberg.com)

# Getting started

## Topics

[Installing the SIS operating software, page 14](#)

[Installing the SIS operational software for remote use, page 15](#)

[Installing the Mosquitto MQTT message broker , page 16](#)

[Connect the Remote Operator PC to the MQTT message broker, page 17](#)

[Connect the HWS on the vessel to the MQTT message broker, page 18](#)

[Defining the file and folder settings for raw data recording, page 19](#)

## Installing the SIS operating software

Install the program on the Hydrographic Work Station.

### Prerequisites

#### Note

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*SIS settings will be lost when installing a new version of SIS.*

*PU-parameters (Installation- and Runtime-parameters for the transducers) are kept.*

---

#### Note

---

*Installing a previous version of program must be done by performing a complete program installation.*

*Do not replace .exe-files only as this may cause the system to malfunction.*

---

In order to install the software, you need the relevant file set on a suitable media.

You need one install file for each echo sounder.

#### Note

---

*Make sure that you have administrative rights on the computer. You need this to install the software. If you purchased your own computer, you must make sure that it meets the technical requirements for use with the SIS system. Do this before you install the software.*

---

### Procedure

- 1 Turn on the computer.
- 2 Insert the software media.
- 3 Use a file manager application to access the software files.
- 4 Double-click the `EMx_vx_SIS_vx.exe` file.

The file name depends on the echo sounder you are installing and the software versions.

- 5 Allow the installation wizard to run. Follow the instructions provided.

We recommend that you install the SIS in the default folder suggested by the wizard.

- 6 Insert the SIS license dongle in any USB connector on the Hydrographic Work Station.

- 7 Once the software installation has been completed, double-click the SIS icon on the desktop to start the program.
- 8 Depending on your operating system parameters, certain dialog boxes may open.
  - a The Windows® Firewall may open a dialog box requesting information about the network. Select **Public**, and then select **Allow access**.
  - b The operating system may also open other dialog boxes to verify that the SIS software can run on the computer. You must permit this.

## Installing the SIS operational software for remote use

SIS can be used in a remote setting where the data collected from Echo Sounders can be transferred in real time to a remote location, this also enables remote control of the Echo Sounder from either a remote office or from a mothership.

### Context

The remote solution in SIS can be used for communication between a smaller survey vessel (called survey launch) and a mothership. The survey launch will have a regular SIS installed with the remote communication and with the remote license in the license dongle, and remote control enabled. SIS will run all collected data through a decimation filter, before it sends the data to the mothership. The data sent consist of status messages, real time depths, ping display information and the complete terrain model files collected.

The mothership can in return alter runtime settings, installation parameters and start/stop pinging on the survey launch. Communication devices used can be for instance the Maritime Broadband Radio.

### Note

---

*Both the ship and the remote SIS connects to the MQTT broker, this needs to be running somewhere in the network. The installation and software for an MQTT broker is not part of the SIS installation since this can be done in various ways. The testing done on SIS Remote has been performed with the Mosquitto MQTT-broker by Eclipse <https://www.eclipse.org/mosquitto/>.*

---

## Installing the Mosquitto MQTT message broker

The MQTT message broker is used to communicate messages between ship and shore.

### Context

Eclipse Mosquitto is an open source (EPL/EDL licensed) message broker that implements the MQTT protocol versions 3.1 and 3.1.1.

<https://mosquitto.org/>

This installation must be done for each computer the MQTT message broker shall be installed in.

### Procedure

- 1 Download the software from <https://mosquitto.org/download/>.  
Select the Windows 64 bits version of the file.  
Kongsberg can't distribute the MQTT broker, so you have to download this yourself. The file itself is very small, approximately 350 kB.
- 2 Run the downloaded install file on the computer you want to install the MQTT message broker to.
- 3 Read the file `C:\Program Files\mosquitto\readme-windows.txt`.  
This file is located where the MQTT message broker was installed. Here you find how to install the MQTT as a service.
- 4 Download the Win64 OpenSSL Light from <http://slproweb.com/products/Win32OpenSSL.html>
- 5 Install the downloaded file.
- 6 Open a command window **as administrator**.
- 7 Run `"C:\Program Files\mosquitto\mosquitto" install`  
This installs the MQTT as a service.

#### Note

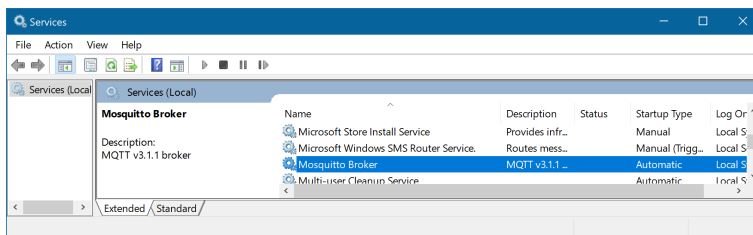
---

*You must be logged in as an administrator to do this.*

---

- 8 Open service.
- 9 Verify that Mosquitto Broker is running.





## Connect the Remote Operator PC to the MQTT message broker

The MQTT message broker must be configured Remote computers and vessels need unique identities.

### Context

The configuration must be done for each computer the MQTT message broker is installed in. All remote computers and vessels each need unique identities.

### Procedure

- 1 Under *View* menu select *Remote Operator Settings* and *Blue Insight Connector Configuration*.

In *Remote Insight Connector* view

- 2 Select *Remote*

Under *Remote settings*, these fields require attention.

- 3 *Server URL or Ip-address*:

This is the IP-address of the MQTT message broker. Please refer to the network configuration to find this address.

- 4 *Vessel mode*:

This switch must be set to Vessel mode (NB. Label of this switch changes when switched).

- 5 *Vessel name*:

Write the name of the vessel here. You will be using this name to subscribe to data form this vessel when configuring remote location.

If MQTT broker is set up with credentials and/or special port. Advanced settings must be configured.

Otherwise go to step 11.

- 6 Select *Advanced settings*

Under *More remote operation communication settings*

- 7 *Server client id*:

Optional field

8 *Server Port:*

Recommend using port 443, since this port is open by default in most firewalls.

9 *Server User:*

Username on MQTT broker.

10 *Server password:*

Password on MQTT broker

After configuration is finished

11 Click **Save** at the bottom left of *Remote operator settings* view

12 Restart SIS.

## Connect the HWS on the vessel to the MQTT message broker

Set up SIS Remote on the survey vessel to reach the MQTT message broker. Remote computers and vessels need unique identities.

### Context

Enabling remote mode on HWS:

### Procedure

1 Select *Preferences* in *View* menu.

In *Preferences* menu

2 Select *Application* menu.

3 Set *Vessel Remote Controlled* to **On**.

4 Restart SIS.

After restart of SIS

5 Under *View* menu select *Remote Operator Settings* and *Blue Insight Connector Configuration*.

In *Remote Insight Connector* view

6 Select *Remote*

Under *Remote settings*, these fields require attention.

7 *Server URL or Ip-address:*

This is the IP-address of the MQTT message broker. Please refer to the network configuration to find this address.

8 *Vessel mode:*

This switch must be set to Vessel mode (NB. Label of this switch changes when switched).

9 *Vessel name:*

Write the name of the vessel here. You will be using this name to subscribe to data from this vessel when configuring remote location.

If MQTT broker is set up with credentials and/or special port. Advanced settings must be configured.

Otherwise go to step 15.

10 Select *Advanced settings*

Under *More remote operation communication settings*

11 *Server client id:*

Optional field

12 *Server Port:*

Recommend using port 443, since this port is open by default in most firewalls.

13 *Server User:*

Username on MQTT broker.

14 *Server password:*

Password on MQTT broker

After configuration is finished

15 Click **Save** at the bottom left of *Remote operator settings* view

## 16 Restart SIS.

## Defining the file and folder settings for raw data recording

The SIS allows you to record both raw and processed echo data. The data are saved on the hard disk, or on an external data storage device, according to the preferences you have defined.

### Context

**Advanced Settings** controls how and where the raw and survey files are saved on the Hydrographic Work Station hard disk, or on an external storage device. By adding a prefix to the file names you can identify the files you have recorded during a specific survey.

Tip

---

*Set up the file and folder parameters before you start the recording.*

---

**Procedure**

- 1 Select **New Survey** on the **File** menu.
- 2 Select **Advanced Settings** in the **Settings Summary** area.
- 3 Open a file explorer to the disk and folder where you want the raw files.
- 4 Copy that address and paste it in the section for the raw files.
- 5 Do the same for the survey files.
- 6 Add a sub-structure with the buttons for year, month, day, ship name, sounder type and serial number in whatever order is useful for the surveys.
- 7 Type in the name of the ship in the ship name section.
- 8 Select **Append ship name to raw files** if you want the name of the ship to be part of the file name.

# Operating procedures

## **Topics**

[Planning surveys, page 22](#)

[Calibration, page 26](#)

[Selecting a sound velocity profile, page 50](#)

[Interfacing peripheral equipment, page 54](#)

[Changing the colour palette \("skin"\) used in the display presentations, page 56](#)

# Planning surveys

## Topics

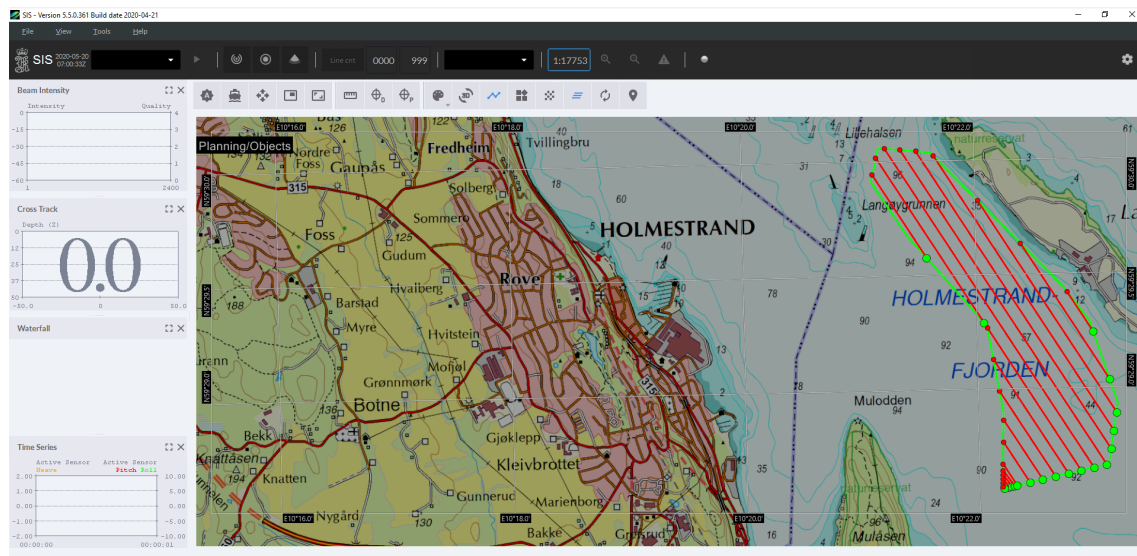
- [Creating a job, page 22](#)
- [Continuing a job, page 23](#)
- [Creating a new survey, page 24](#)
- [Continuing an existing survey, page 25](#)

## Creating a job


You plan a job by adding lines in the geographical view.

## Context

Define and edit planned lines, make parallel lines, define survey areas using polygons. You can save the planned lines to a planned job, and retrieve a planned job from disk. Jobs can be imported and exported between systems.



## Procedure

- 1 Select **Open Terrain Model** or **Import GeoTIFF Image** in the File menu.
- 2 Open the map or previous survey for the area where you are planning this job.
- 3 Select **Planning mode**  on the **Geographical toolbar**.
- 4 Use the mouse and mouse buttons to create and edit the lines for the survey job. Right-click to see the menu for new line or new polygon.

### New polygon

Define the area you want to survey with a polygon. The polygon can have as many edges as needed. Click to start a polygon and double-click to close the polygon.

### New line

Click to make a new point and double-click when the line is finished. Select the line to edit it.

Make a line in the direction you want the survey lines to go. Make sure the line is longer than the polygon you are about to fill. Select the polygon and the line. Right-click and select **Fill polygon**.

- 5 Select **Planning** and **Save Job as** in the **Tools** menu.


## Continuing a job

You plan a job by adding lines in the geographical view.

### Context

Define and edit planned lines, make parallel lines, define survey areas using polygons. You can save the planned lines to a planned job, and retrieve a planned job from disk. Jobs can be imported and exported between systems.

### Procedure

- 1 Select **Open Terrain Model** or **Import GeoTIFF Image** in the **File** menu.
- 2 Open the map or previous survey for the area where you are planning this job.
- 3 Select **Planning mode**  on the **Geographical toolbar**.
- 4 Select **Planning** and **Open Job** on the **View** menu to start editing or using a job.
- 5 Continue to make polygons and lines for the survey.

### New polygon

Define the area you want to survey with a polygon. The polygon can have as many edges as needed. Click to start a polygon and double-click to close the polygon.

### New line

Click to make a new point and double-click when the line is finished. Select the line to edit it.

Make a line in the direction you want the survey lines to go. Make sure the line is longer than the polygon you are about to fill. Select the polygon and the line. Right-click and select **Fill polygon**.

- 6 Select **Planning** and **Save Job** in the **Tools** menu.
- 7 Select **Planning** and **Send grid and job to Helmsman** in the **Tools** menu to send the planned job to Helmsman if needed.

## Creating a new survey

A survey is used to measure and record detailed information about an area of the seafloor.

### Prerequisites

Make sure the **Advanced Settings** are correct.

### Procedure

- 1 Select **File**.
- 2 Select **New Survey**.  
[New Survey dialog box, page 86](#)
- 3 Give the survey a unique name.  
Use only normal letters and numbers, no symbols or spaces.
- 4 Add any comment to the survey.
- 5 Check the settings in the **Settings Summary** area.
- 6 Make sure the **Advanced Settings** are correct.  
[Advanced Settings dialog box, page 87](#)
- 7 Select **Start new survey**.  
The active survey updates, you can now close the dialog box.



## Continuing an existing survey

When you are carrying out a survey in an area where part of the seabed has been surveyed, it can be time saving and help improve data collecting to use an already existing survey.

### **Prerequisites**

You can only continue a survey you have started with the same ship and sensors as previously.

### **Procedure**

- 1 Select the same transducer as you used for the survey before from the list on the top bar.
- 2 Select the same survey as before from the list on the top bar.

# Calibration

## Topics

[Calibration Single Head System, page 26](#)

[Calibration Dual Head System, page 35](#)

[Sound speed quality inspection, page 48](#)

## Calibration Single Head System

### Topics

[Calibrating the roll offset – single head, page 27](#)

[Calibrating the pitch offset – single head, page 29](#)

[Calibrating the heading offset – alt 1— single head, page 31](#)

[Calibrating the heading offset – alt 2 — single head, page 33](#)

## Calibrating the roll offset – single head

The roll offset calibration is made over a flat seafloor. Two survey lines are used. These must be placed on top of each other, and must be run in opposite directions.

### Context

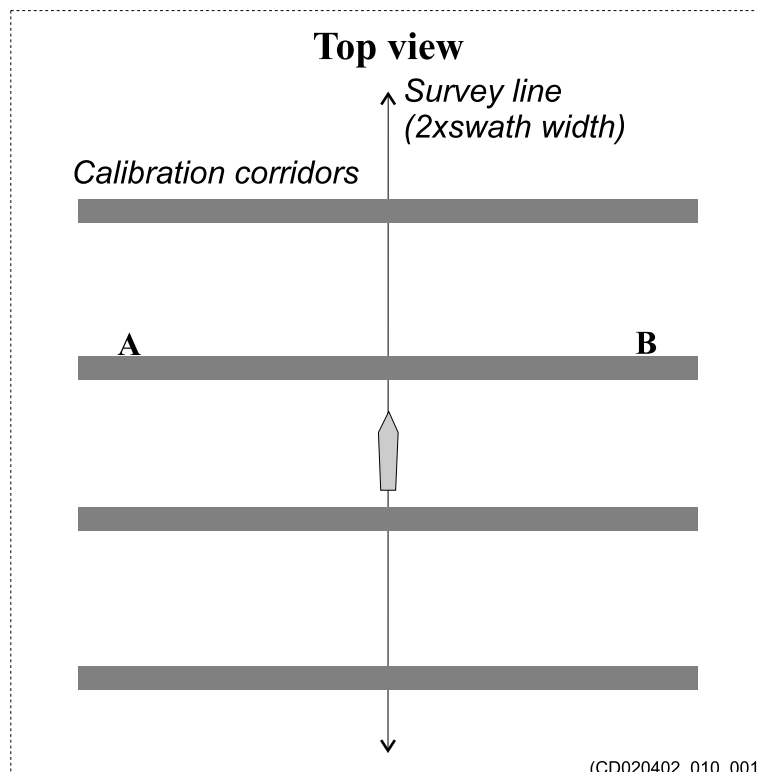
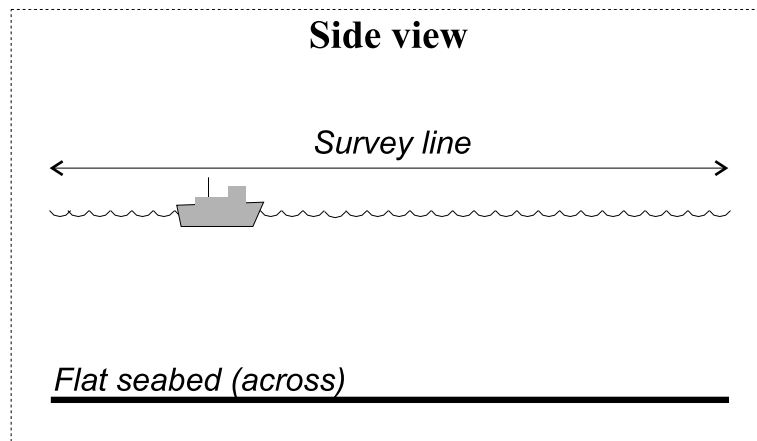
To determine any local variations across the swath, we recommend that you run calibration survey lines that covers two times the swath width.

### Procedure

- 1 Select a horizontally flat area (at least across-track).
- 2 Survey two lines in opposite directions. Make sure that sufficient lead-in time to the line is used allowing the roll sensor to stabilise.
- 3 Select **Calibration** in the **Tools** menu.

In *Geographical* view

- 4 Select the two opposite lines.
- 5 To select lines, right-click in the *Geographical* view and select **Select Lines**. Select lines by pressing **ctrl** and right click on line names.
- 6 Place a calibration corridor orthogonally to the survey lines.
- 7 Right-click in the *Geographical* view and select **New Corridor**. Select corridor by point and click at start and point and click at end of wanted corridor.



- 8 Right-click in the *Geographical* view and select **Calibrate** to open the *Calibration* view.

In *Calibration* view

- 9 Compare depth data from the two lines in the selected corridor. If there is a roll offset, there will be a depth difference between the two data sets, increasing with across-track distance from the centre where it is zero.

Enter the found offset angles to the installation parameters.

- 10 Select **Installation Parameters** in the **View** menu. Right-click the **wrench** icon and select **Transducer setup**.
- 11 Add found roll offset to RX and TX Angular roll offset.

## Calibrating the pitch offset – single head

The pitch offset calibration is made along a sloping seafloor.

### Context

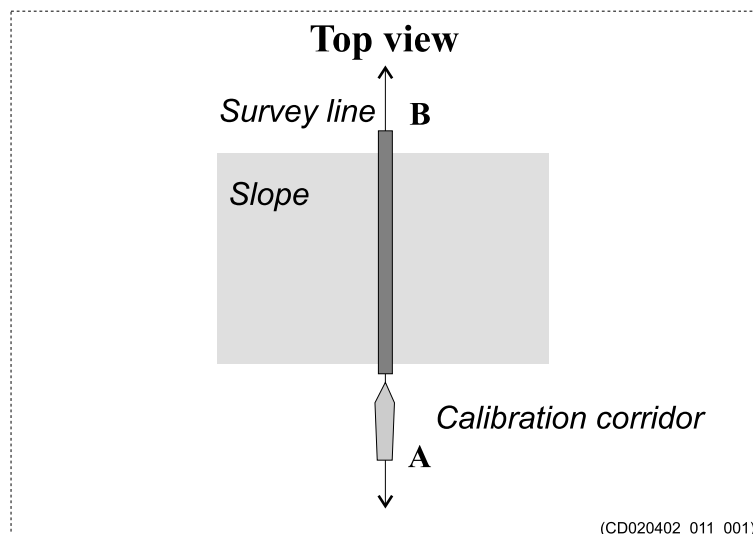
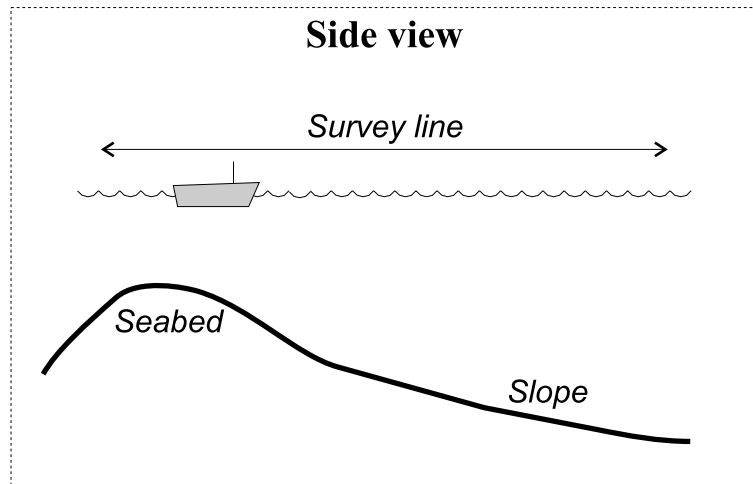
To determine any local variations across the swath, we recommend that you run calibration survey lines that covers two times the swath width.

### Procedure

- 1 Select an area with a continuous but not too steep slope alongtrack.
- 2 Survey two lines in opposite directions with constant vessel speed along each line.
- 3 Select **Calibration** in the **Tools** menu.
- 4 Select the two opposite lines.
- 5 To select lines, right-click in the *Geographical* view and select **Select Lines**. Select lines by pressing **ctrl** and right click on line names.
- 6 Right-click in the *Geographical* view and select **New Corridor**. Select corridor by point and click at start and point and click at end of wanted corridor.
- 7 Place a calibration corridor parallel to the survey lines, on top of the vessel track.
- 8 Right-click in the *Geographical* view and select **Calibrate** to open the *Calibration* view.

In *Calibration* view

- 9 Compare depth data from the two lines in the selected corridor.



(CD020402\_011\_001)

- 10 Determine any pitch offset.  
A depth error on a constant gradient slope, due to pitch offset, increases with increasing depths. Errors due to distance offset is independent of depth and speed.
- 11 Change the value for *Attitude Pitch offset angle*, in the *Calibration* view, to make both lines as equal as possible.

Enter the found offset angles to the installation parameters.

- 12 Select **Installation Parameters** in the **View** menu. Right-click the **wrench** icon and select **Transducer setup**.
- 13 Add found pitch offset to RX and TX Angular pitch offset.

## Calibrating the heading offset – alt 1– single head

The best check of the gyro is done using land survey methods while in harbour.

### Context

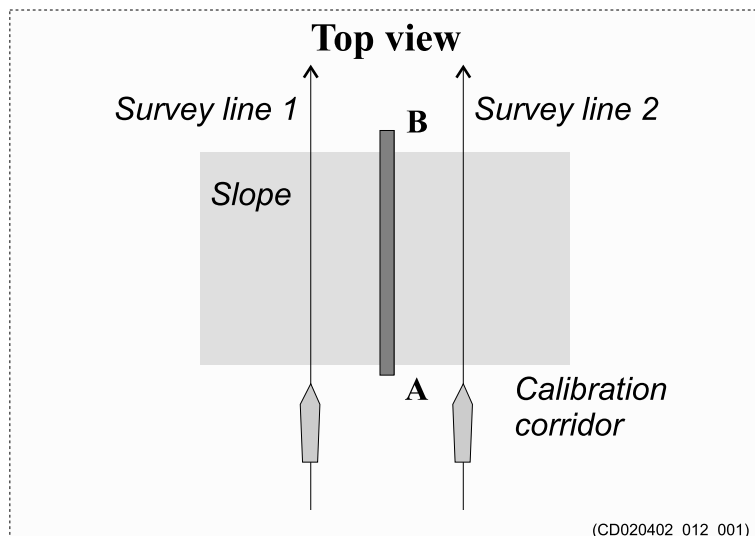
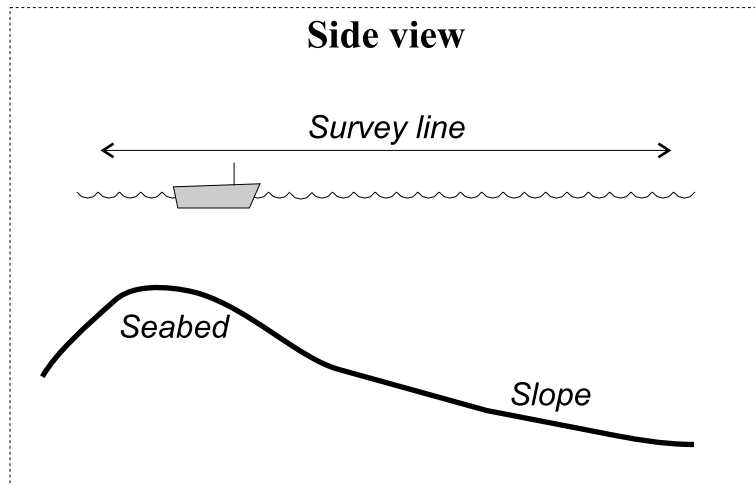
To determine any local variations across the swath, we recommend that you run calibration survey lines that covers two times the swath width.

### Procedure

- 1 Run two parallel lines up or down a slope in the same direction, separated, but with overlap between them.
- 2 Select **Calibration** in the **Tools** menu.
- 3 To select lines, right-click in the *Geographical* view and select **Select Lines**. Select lines by pressing **ctrl** and right click on line names.
- 4 Right-click in the *Geographical* view and select **New Corridor**.  
Select corridor by point and click at start and point and click at end of wanted corridor.
- 5 Select a calibration corridor. The corridor used for comparison must be placed alongtrack between the lines.
- 6 Right-click in the *Geographical* view and select **Calibrate** to open the *Calibration* view.

In *Calibration* view

- 7 Compare depth data from the two lines in the selected corridor. Any heading offset will give a depth difference between the two lines.



(CD020402\_012\_001)

- 8 Change the value for *Attitude heading offset angle*, in the *Calibration* view, to make both lines as equal as possible.

Enter the found offset angles to the installation parameters.

- 9 Select **Installation Parameters** in the **View** menu. Right-click the **wrench** icon and select **Transducer setup**.
- 10 Add found heading offset to RX and TX Angular heading offset.



## Calibrating the heading offset – alt 2 – single head

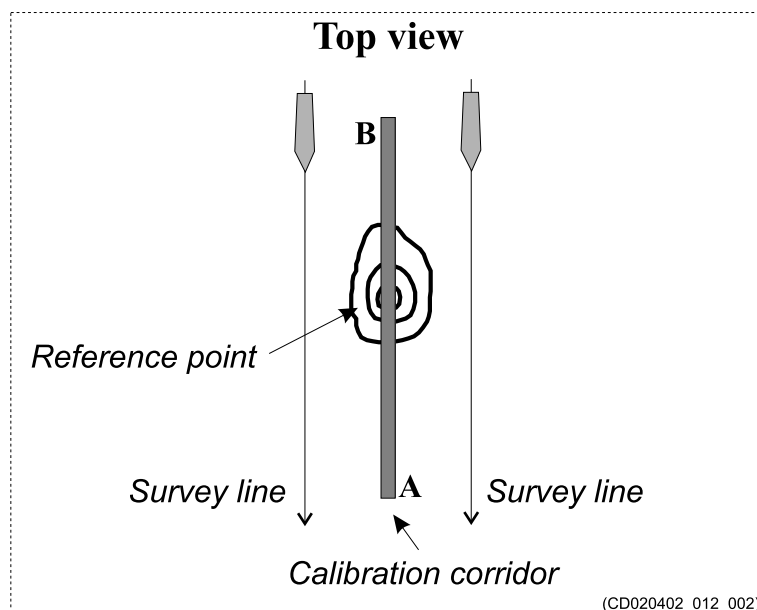
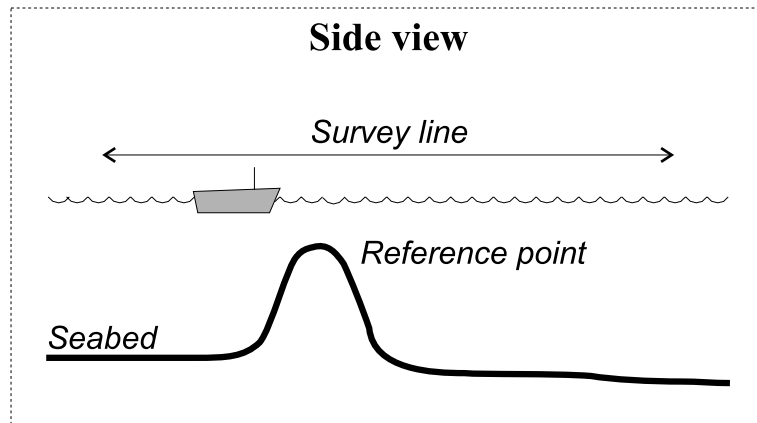
The best check of the gyro is done using land survey methods while in harbour.

### Context

To determine any local variations across the swath, we recommend that you run calibration survey lines that covers two times the swath width.

### Procedure

- 1 Find an easy recognizable point or feature on the bottom such as a peak or a depression.
- 2 Run two survey lines at 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.
- 3 Select **Calibration** in the **Tools** menu.
- 4 To select lines, right-click in the *Geographical* view and select **Select Lines**.  
Select lines by pressing **ctrl** and right click on line names.
- 5 Right-click in the *Geographical* view and select **New Corridor**.  
Select corridor by point and click at start and point and click at end of wanted corridor.
- 6 Select a calibration corridor. The corridor used to compare data from the two survey data sets must be placed so that it intersects the feature, and is parallel to the survey lines.



(CD020402\_012\_002)

- 7 Right-click in the *Geographical* view and select **Calibrate** to open the *Calibration* view.

In *Calibration* view

- 8 Compare depth data from the two lines in the selected corridor. Any heading offset will give a depth difference between the two lines.
- 9 Change the value for *Attitude heading offset angle*, in the *Calibration* view, to make both lines as equal as possible.

Enter the found offset angles to the installation parameters.

- 10 Select **Installation Parameters** in the **View** menu. Right-click the **wrench** icon and select **Transducer setup**.

## Calibration Dual Head System

### **Topics**

[Calibrate a dual head system, page 36](#)

[Calibrating the roll offset – dual head, page 37](#)

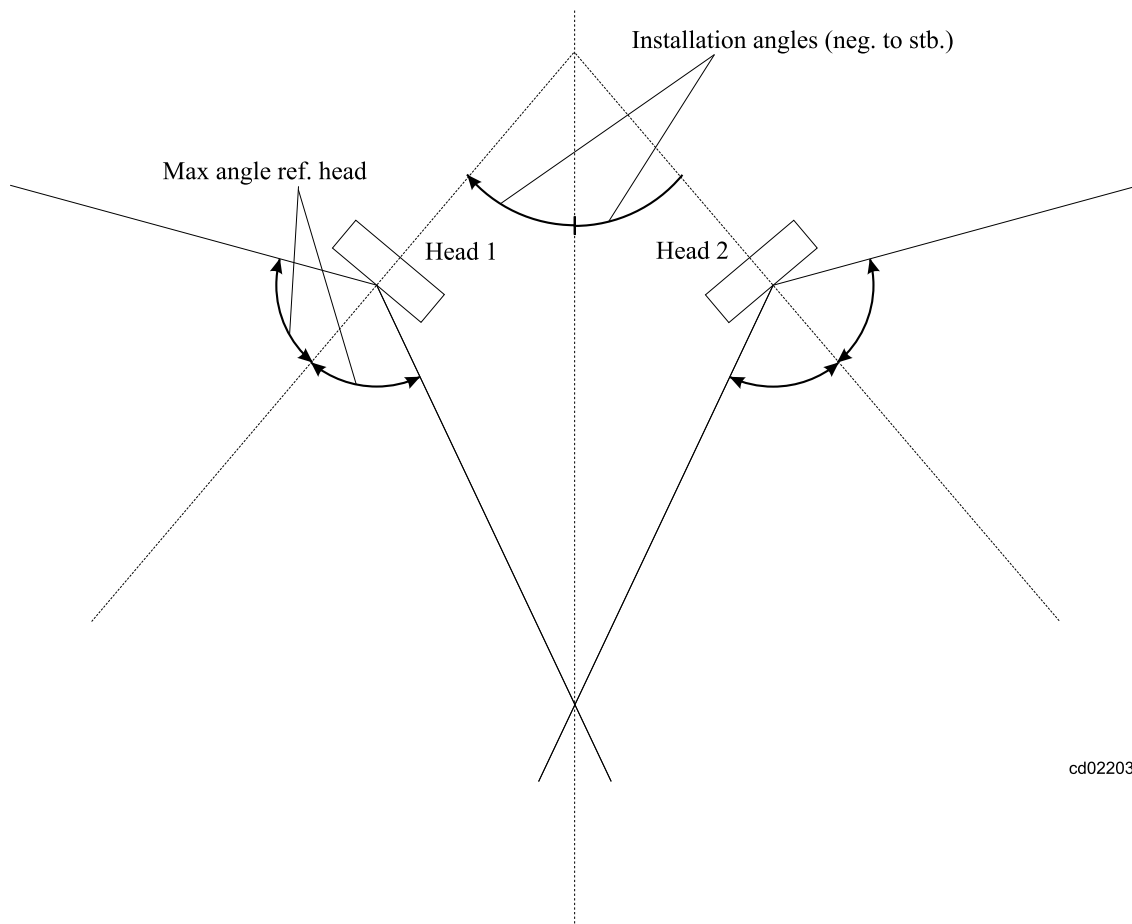
[Calibrating the pitch offset – alt 1 – dual head, page 39](#)

[Calibrating the pitch offset – alt 2 – dual head, page 41](#)

[Calibrating the heading offset – alt 1 – dual head, page 43](#)

[Calibrating the heading offset – alt 2 – dual head, page 45](#)

## Calibrate a dual head system



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If you have a multibeam echo sounder with two heads installed there are some additional concerns related to calibration you need to consider:

- You have to determine offset values separately for both heads.
- The heads will normally be installed pointing sideways instead of down calling for a different calibration survey pattern.

### Note

---

*A valid sound velocity profile must be used to obtain a correct result.*

---

The calibration should be performed in the following order and the values from each calibrations entered in the system before the next calibration:

- Rough roll calibration.
- Pitch and time delay calibration.
- Heading calibration.
- Roll calibration.

The calibration should be repeated until the calibration results are within  $\pm 0.1$  degree. Use the Calibration module to evaluate the data and determine the offset value.

### Calibrating the roll offset – dual head

The roll offset calibration is made over a flat seafloor.

#### Prerequisites

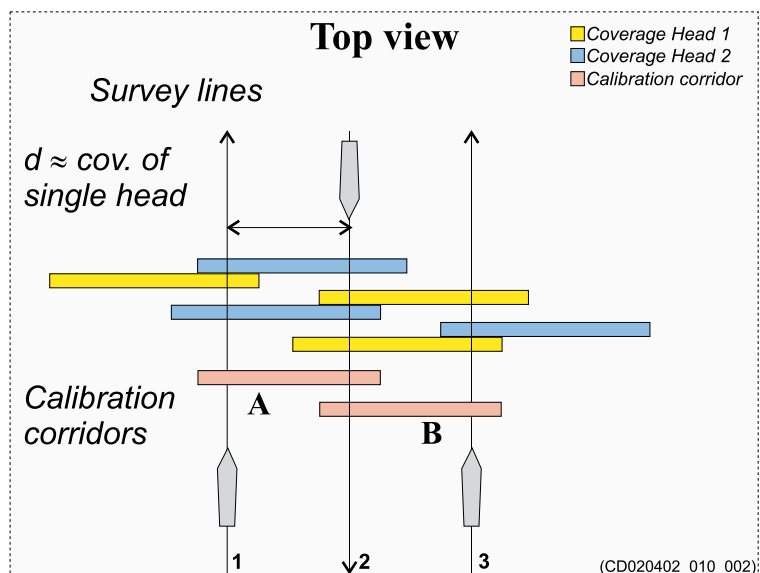
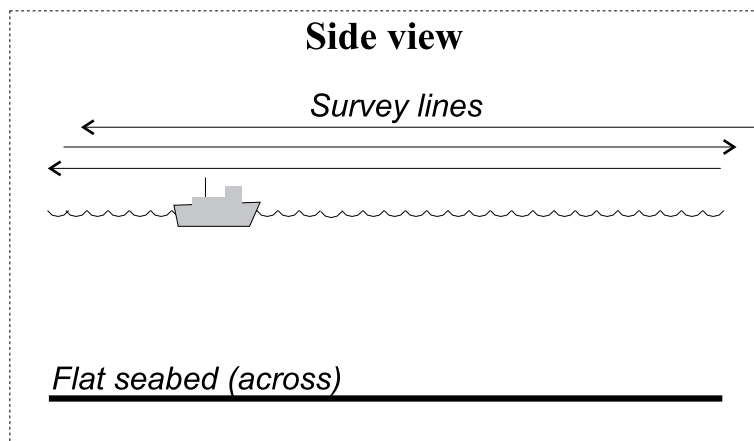
##### Important

The tide and sound velocity profile must be correct to have a correct calibration.

To determine any local variations across the swath, we recommend that you run calibration survey lines that covers two times the swath width.

#### Procedure

- 1 Select a horizontally flat area (at least across-track).
- 2 Survey three lines in opposite directions and with distance between the lines to ensure full overlap for each head, approximately half the swath width. Survey these lines at the same speed. Make sure that sufficient lead-in time to the line is used allowing the roll sensor to stabilise.



Calibration of Head 2.

- 3 Select **Calibration** in the **Tools** menu.

In *Geographical* view

- 4 Select line 1 and line 2 that gives full overlap for Head 2 and place a calibration corridor (A) orthogonally to the survey lines.
- 5 To select lines, right-click in the *Geographical* view and select **Select Lines**. Select lines by pressing **ctrl** and right click on line names.
- 6 Right-click in the *Geographical* view and select **New Corridor**. Select corridor by point and click at start and point and click at end of wanted corridor.
- 7 Right-click in the *Geographical* view and select **Calibrate** to open the *Calibration* view.

In *Calibration* view

- 8 Select *Head: 2*, in the **Display Mode**.
- 9 Compare depth data from the two lines in the selected corridor. If there is a roll offset, there will be a depth difference between the two data sets, increasing with across-track distance from the centre where it is zero.
- 10 Change the value for *Attitude Roll offset angle*, in the *Calibration* view, to make both lines as equal as possible.
- 11 Make a note of the offset for Head 2.

Calibration of Head 1.

In *Geographical* view

- 12 Select line 2 and line 3 that gives full overlap for Head 1 and place a calibration corridor (B) orthogonally to the survey lines.
- 13 Do step 5 to step 10, but Select Head: 1 in step 8.
- 14 Make a note of the offset for Head 1.

Enter the found offset angles to the installation parameters.

- 15 Select **Installation Parameters** in the **View** menu. Right-click the **wrench** icon and select **Transducer setup**.
- 16 Add found roll offset to each RX and the average roll to the TX, as shown in the example.

### Example

Transducer Angular offset	Surveyed installation angle	offset	New installation angle
1 RX transducer Port	+35.0°	0.4	+35.4°
2 RX transducer Starboard	-35.0°	0.2	-34.8°
1 TX transducer Port	0.0°	0.3	+0.3°
2 TX transducer Starboard	0.0°	0.3	-0.3°

## Calibrating the pitch offset – alt 1 – dual head

The pitch offset calibration is made along a sloping seafloor.

### Prerequisites

Reduce the opening angle to  $\pm 50^\circ$  on the outer sectors. Open the inner angle to  $\pm 20^\circ$  on the inner sectors.

To determine any local variations across the swath, we recommend that you run calibration survey lines that covers two times the swath width.

### Procedure

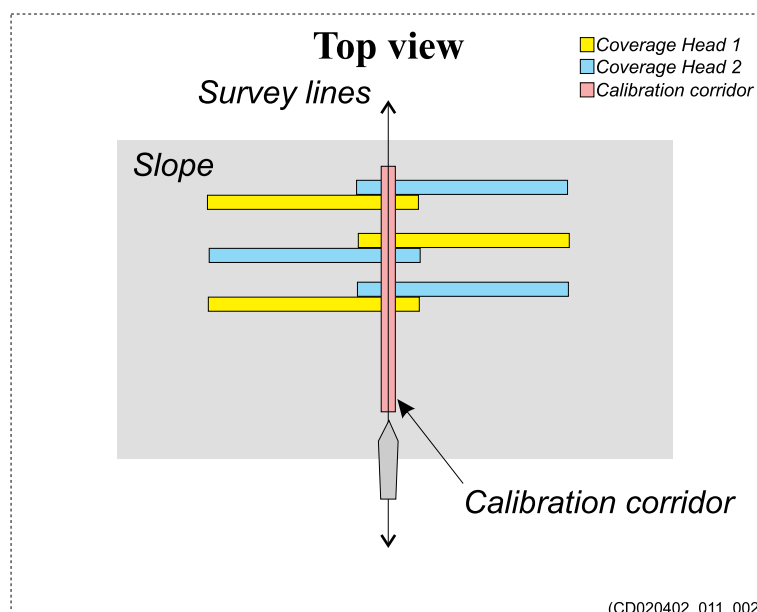
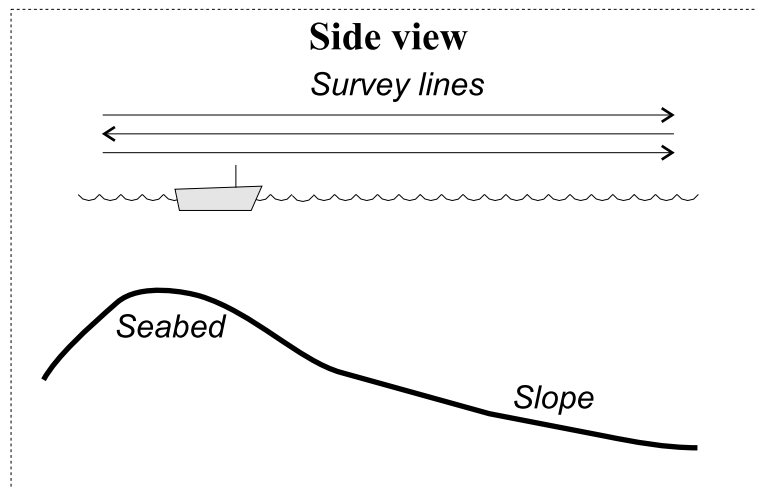
- 1 Select an area with a continuous but not too steep slope along track.
- 2 Survey two lines in opposite directions with constant vessel speed along each line.

Calibration of Head 1.

- 3 Select **Calibration** in the **Tools** menu.
- 4 Select the two opposite lines.
- 5 To select lines, right-click in the *Geographical* view and select **Select Lines**.

Select lines by pressing **ctrl** and right click on line names.

- 6 Right-click in the *Geographical* view and select **New Corridor**.
- 7 Place a calibration corridor parallel to the survey lines, on top of the vessel track. Select corridor by point and click at start and point and click at end of wanted corridor.
- 8 Right-click in the *Geographical* view and select **Calibrate** to open the *Calibration* view.



In *Calibration* view

- 9 Select *Head: 1*, in the **Display Mode**.
- 10 Compare depth data from the two lines in the selected corridor.
- 11 Determine any pitch offset.
- 12 Change the value for *Attitude Pitch offset angle*, in the *Calibration* view, to make both lines as equal as possible.
- 13 Make a note of the offset for Head 1.

Calibration of Head 2.

In *Geographical* view

- 14 Select *Head: 2*, in the **Display Mode**.
- 15 Do step 10 to 12.
- 16 Make a note of the offset for Head 2.

Enter the found offset angles to the installation parameters.

- 17 Select **Installation Parameters** in the **View** menu. Right-click the **wrench** icon and select **Transducer setup**.
- 18 Add found pitch offset to each RX and TX, as shown in the example. Add found pitch offset to each RX, as shown in the example.

**Note**

*If the two offset values differ, then something is wrong.*

*Recheck the setup parameters or calibration.*

**Example**

Transducer	Surveyed installation angle	offset	New installation angle
Head 1 (Port) RX transducer	0.0°	0.3	+0.3°
Head 2 (Starboard)RX transducer	0.0°	0.3	+0.3°
TX transducer	0.0°		+0.3°



## Calibrating the pitch offset – alt 2 – dual head

The pitch offset calibration is made over a shallow flat seafloor with one distinctive feature such as a pronounced elevation or a deep ravine.

### Prerequisites

Reduce the opening angle to  $\pm 50^\circ$  on the outer sectors. Open the inner angle to  $\pm 20^\circ$  on the inner sectors.

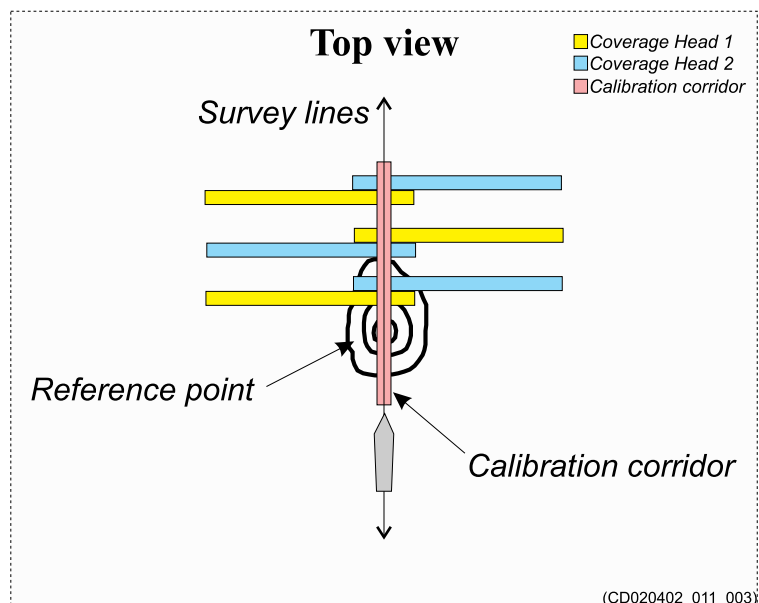
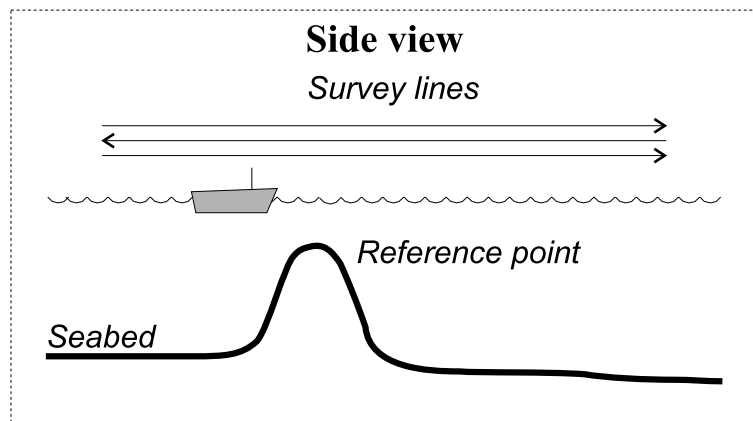
To determine any local variations across the swath, we recommend that you run calibration survey lines that covers two times the swath width.

### Procedure

- 1 Find an easy recognizable point or feature on the bottom such as a peak or a depression.
- 2 Survey two lines in opposite directions with constant vessel speed along each line.

Calibration of Head 1.

- 3 Select **Calibration** in the **Tools** menu.
- 4 Select the two opposite lines.
- 5 To select lines, right-click in the *Geographical* view and select **Select Lines**.  
Select lines by pressing **ctrl** and right click on line names.
- 6 Right-click in the *Geographical* view and select **New Corridor**.
- 7 Place a calibration corridor parallel to the survey lines, on top of the vessel track. Select corridor by point and click at start and point and click at end of wanted corridor.
- 8 Right-click in the *Geographical* view and select **Calibrate** to open the *Calibration* view.



In *Calibration* view

- 9 Select *Head: 1*, in the **Display Mode**.
- 10 Compare depth data from the two lines in the selected corridor.
- 11 Determine any pitch offset.
- 12 Change the value for *Attitude Pitch offset angle*, in the *Calibration* view, to make both lines as equal as possible.
- 13 Make a note of the offset for Head 1.

Calibration of Head 2.

In *Geographical* view

- 14 Select *Head: 2*, in the **Display Mode**.
- 15 Do step 10 to 12.
- 16 Make a note of the offset for Head 2.

Enter the found offset angles to the installation parameters.

- 17 Select **Installation Parameters** in the **View** menu. Right-click the **wrench** icon and select **Transducer setup**.
- 18 Add found pitch offset to each RX and TX, as shown in the example.

**Note**

*If the two offset values differ, then something is wrong.*

*Recheck the setup parameters or calibration.*

---

**Example**

Transducer	Surveyed installation angle	offset	New installation angle
Head 1 (Port) RX transducer	0.0°	0.3	+0.3°
Head 2 (Starboard)RX transducer	0.0°	0.3	+0.3°
TX transducer	0.0°		+0.3°

## Calibrating the heading offset – alt 1 – dual head

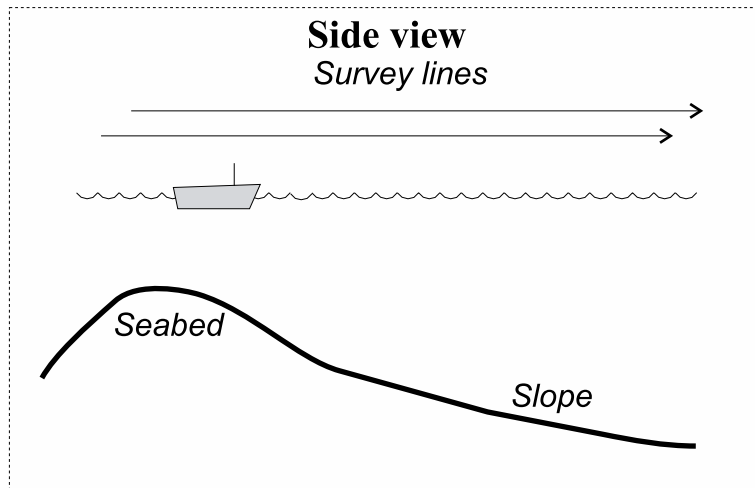
The best check of the gyro is done using land survey methods while in harbour.

### Context

To determine any local variations across the swath, we recommend that you run calibration survey lines that covers two times the swath width.

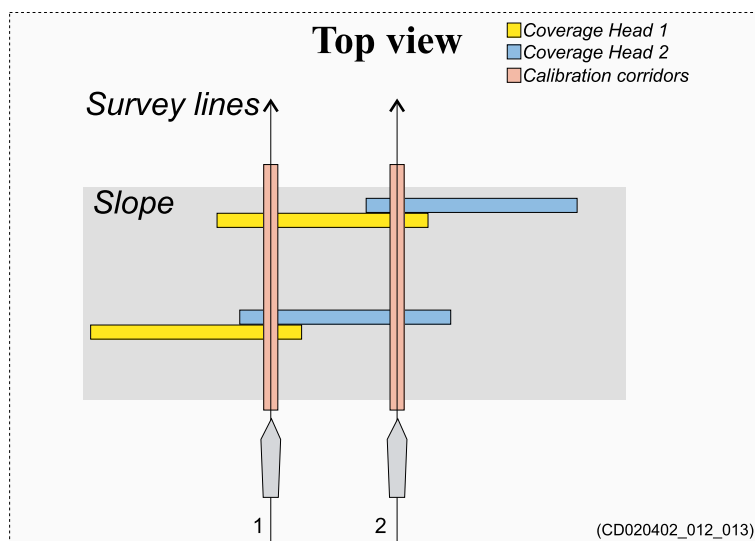
### Procedure

- 1 Run two parallel lines up or down a slope in the same direction, separated, but with overlap between them.



Calibration of Head 1.

- 2 Select **Calibration** in the **Tools** menu.
- 3 To select lines, right-click in the *Geographical* view and select **Select Lines**. Select lines by pressing **ctrl** and right click on line names.
- 4 Right-click in the *Geographical* view and select **New Corridor**. Select corridor by point and click at start and point and click at end of wanted corridor.
- 5 Place a calibration corridor on top of line 1.
- 6 Right-click in the *Geographical* view and select **Calibrate** to open the *Calibration* view.



In *Calibration* view

- 7 Select *Head: 1*, in the **Display Mode**.
- 8 Compare depth data from the two lines in the selected corridor. Any heading offset will give a depth difference between the two lines.

Calibration of Head 2.

In *Geographical* view

- 9 Right-click in the *Geographical* view and select **New Corridor**.  
Select corridor by point and click at start and point and click at end of wanted corridor.
- 10 Place a calibration corridor on top of line 2.
- 11 Right-click in the *Geographical* view and select **Calibrate** to open the *Calibration* view.

In *Calibration* view

- 12 Select *Head: 2*, in the **Display Mode**.
- 13 Compare depth data from the two lines in the selected corridor. Any heading offset will give a depth difference between the two lines.
- 14 Change the value for *Attitude heading offset angle*, in the *Calibration* view, to make both lines as equal as possible.

Enter the found offset angles to the installation parameters.

- 15 Select **Installation Parameters** in the **View** menu. Right-click the **wrench** icon and select **Transducer setup**.
- 16 Add found heading offset to each RX and TX, as shown in the example.

**Note**

---

*If the two offset values differ, then something is wrong.  
Recheck the setup parameters or calibration.*

---

**Example**

Transducer	Surveyed installation angle	offset	New installation angle
Head 1 (Port) RX transducer	0.0°	0.4	+0.4°
Head 2 (Starboard)RX transducer	0.0°	0.4	+0.4°
TX transducer	0.0°		+0.4°

## Calibrating the heading offset – alt 2 – dual head

The best check of the gyro is done using land survey methods while in harbour.

### Context

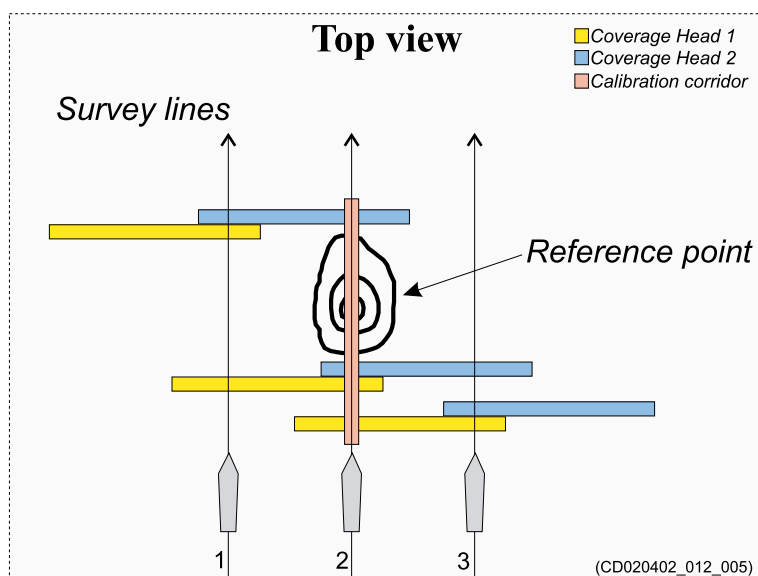
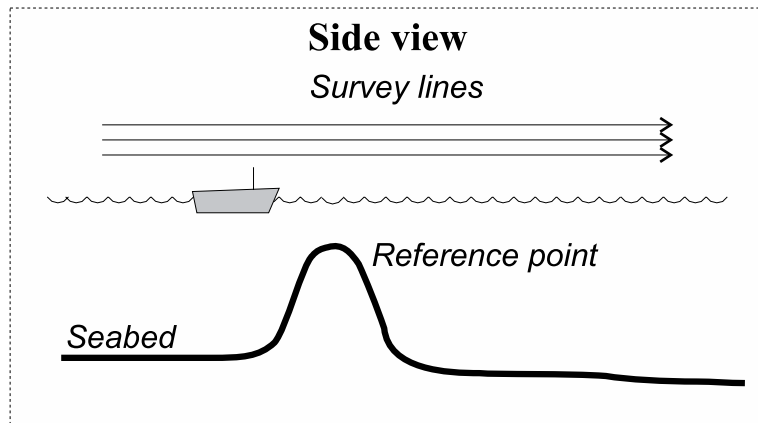
To determine any local variations across the swath, we recommend that you run calibration survey lines that covers two times the swath width.

### Procedure

- 1 Find an easy recognizable point or feature on the bottom such as a peak or a depression.
- 2 Run three survey lines, one on each side of the feature, and one on top of it. Survey these three lines in same direction and at the same speed. The lines should be separated, with overlap between them.

Calibration of Head 2.

- 3 Select **Calibration** in the **Tools** menu.
- 4 Select lines 1 and 2 that gives full overlap for Head 2. Make a calibration corridor along the center beam of line 2.
- 5 To select lines, right-click in the *Geographical* view and select **Select Lines**. Select lines by pressing **ctrl** and right click on line names.
- 6 Right-click in the *Geographical* view and select **New Corridor**. Select corridor by point and click at start and point and click at end of wanted corridor.
- 7 Place a calibration corridor on the survey line on top of the object, line 2.



- 8 Right-click in the *Geographical* view and select **Calibrate** to open the *Calibration* view.

In *Calibration* view

- 9 Select *Head: 2*, in the **Display Mode**.
- 10 Compare depth data from the line in centre with the lines on each side of the object. Any heading offset will give a depth difference between the two lines.

Calibration of Head 1.

In *Geographical* view

- 11 Select lines 2 and 3 that gives full overlap for Head 1. Make a calibration corridor along the center beam of line 2.
- 12 To select lines, right-click in the *Geographical* view and select **Select Lines**. Select lines by pressing **ctrl** and right click on line names.
- 13 Right-click in the *Geographical* view and select **New Corridor**. Select corridor by point and click at start and point and click at end of wanted corridor.
- 14 Place a calibration corridor on the survey line on top of the object, line 2.
- 15 Right-click in the *Geographical* view and select **Calibrate** to open the *Calibration* view.
- 16 Select *Head: 1*, in the **Display Mode**.
- 17 Compare depth data from the two lines in the selected corridor. Any heading offset will give a depth difference between the two lines.
- 18 Change the value for *Attitude heading offset angle*, in the *Calibration* view, to make both lines as equal as possible.

Enter the found offset angles to the installation parameters.

- 19 Select **Installation Parameters** in the **View** menu. Right-click the **wrench** icon and select **Transducer setup**.
- 20 Add found heading offset to each RX and TX, as shown in the example.

**Note** \_\_\_\_\_

*If the two offset values differ, then something is wrong.*

*Recheck the setup parameters or calibration.*

---

**Example**

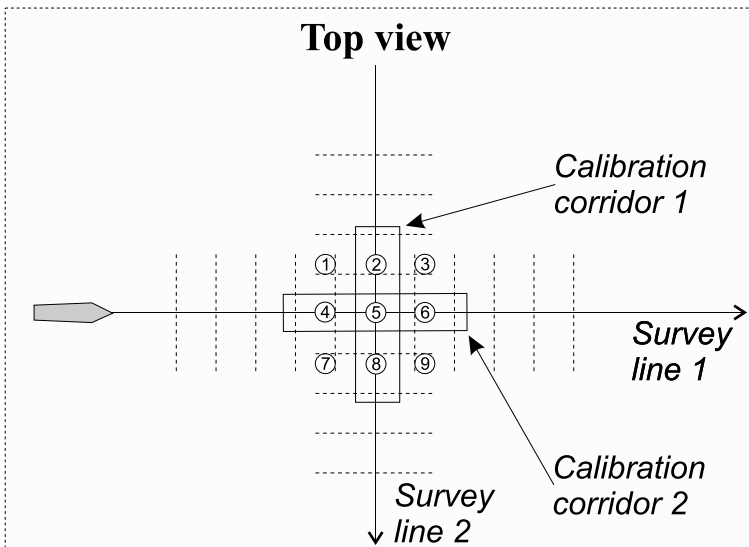
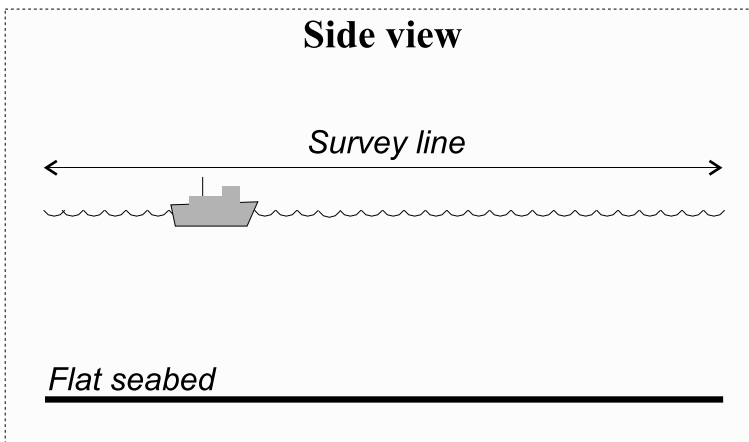
<b>Transducer</b>	<b>Surveyed installation angle</b>	<b>offset</b>	<b>New installation angle</b>
Head 1 (Port) RX transducer	0.0°	0.4	+0.4°
Head 2 (Starboard)RX transducer	0.0°	0.4	+0.4°
TX transducer	0.0°		+0.4°

## Sound speed quality inspection

A correct sound velocity profile (SVP) is vital for all depth measurements. A measurement must be made before calibration starts. Two survey lines on flat seafloor are then used to verify that the profile you are using is acceptable.

### Procedure

- 1 Survey two lines or more, perpendicular to each other. That is, the two lines in the pair must cross each other on a flat area of the sea floor with a difference in the sailing direction of about 90 degrees.
- 2 Create calibration corridors in the crossover area.



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- 3 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. Depth



error due to sound speed has the same sign, while those due to roll changes sign across the centre line.

## Selecting a sound velocity profile

### Topics

[Converting the SVP file to .asvp, page 50](#)

[Using a SVP file, page 50](#)

[Importing a SVP profile from a third party probe, page 52](#)

[Converting the SVP file to .asvp, page 53](#)

[Defining a new filter, page 53](#)

### Converting the SVP file to .asvp

SIS reads the sound velocity format in the standard `.asvp` (Ascii Sound Velocity Profile) format. The sound velocity data must be converted to the `.asvp` format before it can be applied.

### Context

#### Procedure

- 1 On the **Tools** menu, select **SVP Editor**.
- 2 On the **File** menu, select **Open**.
- 3 In the folder browser select your way to the file folder.  
The next time you open a file this path will be on the **Recent directories** list.
- 4 Select the file.
- 5 Select **OK**.
- 6 Go to **Save As**.
- 7 In the folder browser select your way to the file folder where you want to save the new `.asvp` file.
- 8 Type a name for the new `.asvp` file.
- 9 Select **Save**.

### Using a SVP file

A correct sound velocity profile is very important for the quality of the survey.

#### Prerequisites

You have to convert your sound velocity data to `.asvp` before they can be used.

**Procedure**

- 1 On the **View** menu, select **Sound Velocity Management**.
- 2 Select **File** in the **Sound Speed Profile** section.
- 3 Use the browser to find the file.
- 4 Select **Use Sound Velocity Profile**.

## Importing a SVP profile from a third party probe

The sound velocity is important for accurate data, using a probe you measure the sound velocity there and then.

### Prerequisites

A third party sound velocity profile probe is available, and the necessary interface software is installed on the computer. You are familiar with the use of both the probe and the relevant software.

See the relevant instructions provided by the probe manufacturer.

### Procedure

- 1 Prepare the probe for data logging.  
There are two methods depending on the probe.
  - You can collect data through a cable between the probe and the computer while the probe is submerged.
  - You can collect the data in the probe, and transfer it to the computer once the probe has been recovered.
- 2 Lower the probe slowly from the surface to the bottom, or to the required depth.  
Best practice is to use a slow turning winch for deployment and retrieval.  
If you are logging data directly into the computer, make sure that the data flow is present.
- 3 Recover the probe using the same speed as during deployment.
- 4 Connect the probe to the computer.  
This is normally done using a serial line.
- 5 Start the interface software provided with the probe, retrieve the data, and save it on the computer (or a network disk).

## Converting the SVP file to .asvp

You have to convert your sound velocity data to .asvp before they can be used. This is a procedure for the Web version of the svp editor. From SIS 5.9 the SVPEditor accepts native formats from Valeport and AML, making it easy to use their native file formats.

### Prerequisites

The filter must already be defined for the file type you want to convert.

For more information: [Defining a new filter, page 53](#)

### Context

SIS reads the sound velocity format in the standard .asvp (Ascii Sound Velocity Profile) format. The sound velocity data must be converted to the .asvp format before it can be applied.

From SIS 5.9 the SVPEditor can read native formats from both Valeport and AML, making it easy to use these probes.

New in SIS 5.9 is that **Fix Profile** will perform both extending and thinning of the profile. This will make the SVP file ready for export to SIS.

### Procedure

- 1 On the **Tools** menu, select **SVP Editor (Web)**.  
In *SVP Editor* view.
- 2 On the **Tools** menu, select **Fix Profile**.
- 3 On the **Tools** menu, select **Export SVP to SIS** .

## Defining a new filter

You have to define a new filter for each file type you want to convert to .asvp. This is a procedure for the Web version of the svp editor.

### Context

SIS reads the sound velocity format in the standard .asvp (Ascii Sound Velocity Profile) format. The sound velocity data must be converted to the .asvp format before it can be applied.

### Procedure

- 1 On the **Tools** menu, select **SVP Editor (Web)**.
- 2 On the **View** menu, select **Filter**.

- 3 Select all parameters for the filter in the **Define new filter** section.
- 4 Type a name for the filter in the **Save As** section.
- 5 Type the file's postfix in the **Save As** section.
- 6 Select Save filter in the **Save As** section.

## Interfacing peripheral equipment

### Topics

[Setting up a positioning system, page 54](#)

[Setting up an attitude system, page 55](#)

[Setting up the time system, page 55](#)

### Setting up a positioning system

It is possible to set up three different positioning systems and select one to be active.

#### Prerequisites

- The sensor is physically connected to the computer using a serial or Ethernet cable.
- The relevant communication parameters required for the sensor interface are known.

#### Procedure

- 1 Select **Installation Parameters** on the **View** menu.
- 2 Select the **Installation Parameters** icon and select **Input Setup**.
- 3 Type in a custom name.  
The name is saved locally, another computer will not see this.
- 4 Enter the location offset from the vessel's reference point to the positioning system's reference point.
- 5 Turn **Position motion correction** on to use the correction from this positioning system.
- 6 Enter the position delay in seconds.
- 7 Select **Off** for standard quality indicators, or make your own.
- 8 Select which time system to use.
- 9 Select which datum to use, geodetic (e.g. WGS 84)
- 10 Select which format the positioning is coming in.
- 11 Select the port where the positioning system is connected.

- 12 Enter all the relevant information about the serial or net port.
- 13 Enter the information for up to two other positioning systems.
- 14 Select the system to use in the **Active position system** list.

## Setting up an attitude system

It is possible to set up two different attitude systems and select one to be active.

### Prerequisites

- The sensor is physically connected to the computer using a serial or Ethernet cable.
- The relevant communication parameters required for the sensor interface are known.

### Procedure

- 1 Select **Installation Parameters** on the **View** menu.
- 2 Select the **Installation Parameters** icon and select **Input Setup**.
- 3 Type in a custom name.  
The name is saved locally, another computer will not see this.
- 4 Enter the location offset from the vessel's reference point to the positioning system's reference point.
- 5 Enter the roll, pitch and heading installation angles of the sensor if not already applied in sensor.

## Setting up the time system

To get accurate map data, the time is very important.

### Procedure

- 1 Select **Installation Parameters** on the **View** menu.
- 2 Open the tab Time system and check the parameters. Usually ZDA shall be used to set the wall-clock time and PPS shall be used to keep the clock in the PU synchronized to the GPS.
- 3 Type in a custom name.  
The name is saved locally, another computer will not see this.

## Changing the colour palette ("skin") used in the display presentations

Depending on the ambient light, it is possible to change the colours the SIS system uses in its display presentation. This can help you see the information better. The **Palette** function allows you to choose which colour theme ("skin") to be used by the SIS system.

### **Context**

Select a palette to suit the ambient light conditions and your personal preferences. The choice you make has no effect on the overall performance of the SIS system.

### **Procedure**

- 1 On the **View** menu, select **Palettes**.
- 2 Select the colour palette ("skin") you want to use.



# User interface

## Topics

[User interface familiarization, page 58](#)

[Top bar description, page 59](#)

[Geographical view, page 61](#)

[Geographical view toolbar, page 62](#)

[Helmsman Display view, page 64](#)

[Beam Intensity view, page 65](#)

[Cross Track view, page 66](#)

[Numerical Display view, page 67](#)

[Scope view, page 68](#)

[Stave view, page 69](#)

[Seabed view, page 70](#)

[Sound Velocity Profile view, page 71](#)

[Time Series view, page 72](#)

[Water Column view, page 73](#)

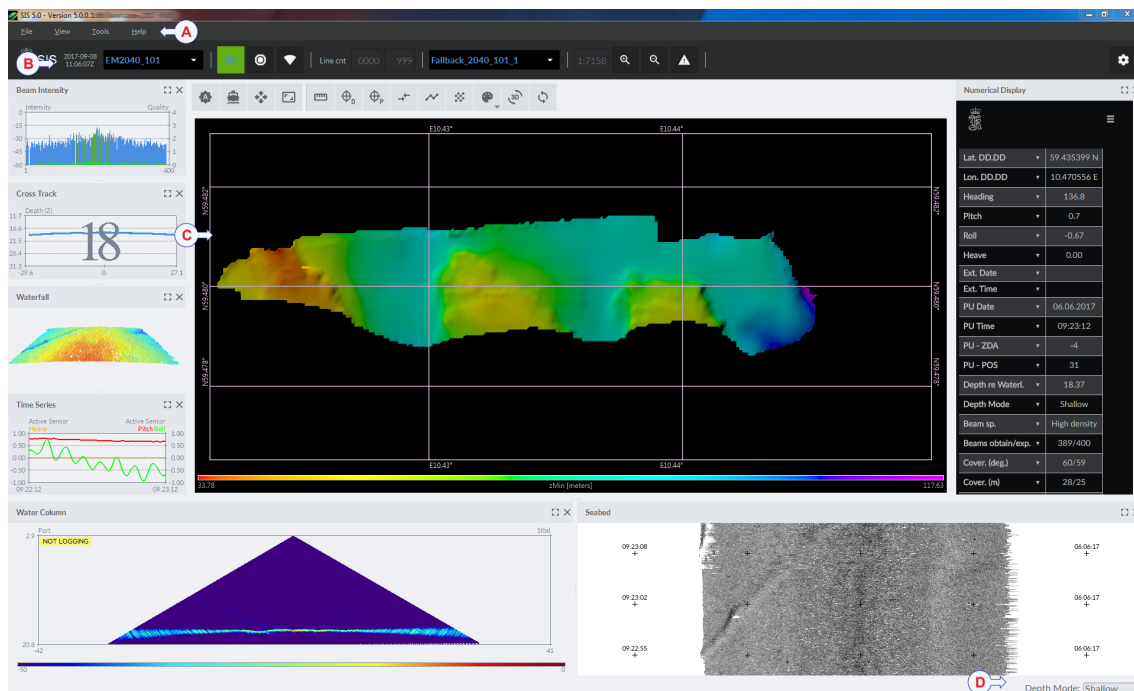
[Waterfall view, page 74](#)

[Status bar, page 74](#)

## User interface familiarization

By default, the display presentation covers the entire screen. The display presentation provided by the SIS system consists of specific visual elements that work together. The visual elements provide you with the echo information you need, they help you to control the functionality needed to understand this information, and finally, they allow you to control the operational parameters.

This screen capture shows you a typical operational situation. The presentation provides you with a lot of information. You can easily switch between the views.



### A Main menu

The **Main** menu is located at the top of the presentation.

### B Top bar

The top bar is located below the **Main** menu. The top bar contains information about which survey that is active, the selected echo sounder, and buttons that enable you to start logging and pinging, as well as the survey track line.

### C Geographical view

The *Geographical* presentation mode offers the *Horizontal* view and the main purpose of presentation mode is to show the geographical data.

### D Status bar

The status bar is located at the bottom of the presentation. You may select what to present on the status bar from the **View** menu.

## Top bar description

The top bar is located below the **Main** menu. The top bar contains information about which survey that is active, the selected echo sounder, and buttons that enable you to start logging and pinging, as well as the survey track line.



### A Logo and product name

This information identifies the brand and the product.

### B Date and time

See the current date and time in Coordinated Universal Time (UTC) format.

### C Echo sounder

All the available echo sounders detected on the network at start-up are listed. There is a # in front of the detected echo sounders. This tag indicates that the echo sounder is not started. To start an echo sounder you need to select it from the list. The # tag is removed, indicating that the echo sounder has been selected.

### D Run

Select this button to start the selected echo sounder.

### E Ping

The purpose of the **Ping** function is to enable or disable the acoustic transmissions into the water. Such transmissions are often referred to as "pinging".

### F Logging

Select this button to start and stop logging. When the logging is on, raw data is stored to disk. The colour of the button is green while logging and red when stopped.

### G Water column logging

Select this button to start and stop logging the water column data. When the logging is on, data is stored to disk. The colour of the button is green while logging and grey when stopped.

### H Line count

Select this button to start a new file with a new line number.

### I Current line number

Shows the current line number.

### J Time to automatic line change

This section shows the time in minutes until a new file is started.

### K Survey

Select the survey. Click to select survey from the list.

**L Map scale**

This is the current map scale.

**M Zoom**

Zoom in or out.

**N Messages**

Messages from the SIS system can be related to any type of hardware or software errors.

**O Preferences**

Click to open the **Preferences** dialog box.

## Geographical view

The *Geographical* presentation mode offers the *Horizontal* view and the main purpose of presentation mode is to show the geographical data. The mode has an associated toolbar on top. It can also be referred to as the main view.

### How to open

The *Geographical view* is always open.

### Description

The main purpose of the *Geographical* view is to show geographical data.

- Terrain models from surveys
- Geographical net (geographic and projection net)
- Depth difference in each grid cell
- Number of points inside each grid cell

It is possible to show 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.

In 3D mode the seafloor surface can be viewed from different angles and in different resolutions, the light source can be shifted, and the surface can be rotated around all axes to obtain the best view.

Projection coordinates are used to display the data. You define the map projection when you create the New Survey

The terrain model can be generated based on various depth values.

- $Z$  – the distance from the surface to the seafloor
- $Z_t$  – tide corrected depth using a tide file
- $Z_v$  – tide corrected depth based on GPS observations and a geoid model
- $Z_g$  – the distance from the seafloor to the geoid
- $Z_r$  – the distance from the seafloor to the ellipsoid

For each grid cell you can select if you want to see the minimum, median or maximum depth.

### Note

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*The median depth, not the mean depth, is calculated for each cell. The mean depth is an artificial depth which has not been observed, whilst the median is a real, quality controlled observed depth.*

---

## Geographical view toolbar

Tools for the geographical view is found under the top bar.

### Details



Follow vessel

Select **Follow vessel** to follow the ships movements.



Zoom to vessel

Select **Zoom to vessel** to zoom to wherever the ship is located in the world.



Zoom to world

Select **Zoom to world** to zoom out to an area covering all loaded survey data.

Note

*If the data area are small and widely spread out the data may become invisible.*



Zoom to region

Select **Zoom to region** to select a specific region in the geographical view.



Zoom to area

Select **Zoom to area** to display a specific area in the geographical view.



Measure distance

Select **Measure distance** to display the distance in the geographical view.



Show depth

Select **Show depth** to display the depth at the location where you hover the cursor in the terrain model.



Show position

Select **Show position** to display the position at the location where you hover the cursor in the terrain model.



View mode

Select **View mode** to select what to see in the geographical view.



3D mode

Select **3D mode** to see the geographical view in 3D mode.



Planning mode

Select **Planning mode** to start planning.



Reset depth tail

Click **Reset depth tail** to remove old real time depths in the geographical view.



Point selection mode

Select **Point selection mode** to start edit the planned lines.



Show/Hide depth tail

Click **Show/Hide depth tail** to show or hide real time depths in the geographical view.



Reset depth tail

Click **Reset depth tail** to remove old real time depths in the geographical view.



Save position to file

Click **Save position to file** for saving the boat current position to file.

[Preferences dialog box, page 115](#)

## Helmsman Display view

The *Helmsman Display* view provides steering guidance of the ship relative to planned survey lines. This view applies to all instruments.

### How to open

Select *Helmsman Display* on the **View** menu.

### Description

A line may have several waypoints, and the DTK, XTE, CMG and DST 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 have to steer port or starboard to relocate. Before the ship reaches the start of the line, the indicator will form an arrow pointing downwards.

When reaching the end of the line (or before entering the line) the Helmsman view will continue to show the ship's position relative to the continuation of the last line segment of the planned line.

### Note

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**Helmsman** or *Helmsman Display* view must be active when SIS is controlling the *Autopilot*.

---



## Beam Intensity view

The *Beam Intensity* view gives a graphical presentation of the bottom conditions based on the backscattered amplitude intensity from each beam.

### How to open

Select *Beam Intensity* on the **View** menu.

### Description

#### Note

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*This view is only available for multibeam echo sounders.*

---

Backscatter is the reflection of waves back to the direction they came from. It is possible to extract information about bottom structure and hardness by analysing the amplitude of the returning sound wave, allowing for identification of bottom types. A strong return signal indicates a hard surface, and a weak return signal indicates a soft surface.

As the backscatter signal varies with the angle of the beam, the angle of incidence can strongly influence the backscatter level.

The backscatter strength usually decreases as the angle of incidence increase. The relationship between backscatter strength and incidence angles are dependent on the seafloor properties.

Normally the echo signal strength will be at the highest straight down, typically the acoustic energy has only decreased by -15 dB, and at the lowest at the outermost beams, typically -35 dB. The echo signal strength depends on the type of seabed and roughness ( $\pm 15$  dB or more).

Each beams amplitude is shown as either blue or red. The colour reflects what type of bottom detection that was employed for each beam. Blue is used for amplitude detection and red for phase detection.

The view contains scales along the left and right vertical axes. On the left you will see by how much energy (dB) the returned beam has decreased. The quality of the returned beam data is indicated by the green as seen on the right hand side.

The number of beams are shown below the horizontal axis. This number varies, depending on the type of echo sounder.

## Cross Track view

The *Cross Track* view shows the depth for each beam from the last ping. The x-axis can show the area covered, expressed in metres, by selecting the metre option. Default is the number of returned beams.

### How to open

Select *Cross Track* on the **View** menu.

### Description

The *Cross Track* view displays the measured depths for all beams from the last ping.

The view 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 the type of detection that has been used to calculate the depth. Red is used to show beams where the phase detection technique was used and blue is used to show beams where the amplitude detection technique was employed. Beams that failed to be detected will not be displayed.

## Numerical Display view

The *Numerical display* view allows you to monitor various application parameters.

### **How to open**

Select *Numerical Display* on the **View** menu.

### **Description**

This view is only for monitoring and the parameters cannot be changed here. Exceeded limits are red. It is possible to make the writing larger, to easily see the parameters from a distance.

### **Note**

---

*Some parameters applies to specific instruments only.*

---

## Scope view

The *Scope* view is used for investigating the receiver echo data. It is mainly used for test purposes. The data is not logged.

### How to open

Select *Scope* on the **View** menu.

### Description

Time is represented by the horizontal x-axis, while the strength of the receiver echo level on the vertical y-axis. Beams close to 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. Amplitude detection, filtered amplitude detection and phase detection are plotted.

You can choose which beam whose details you want to have a closer look at. For a system that has a dual swath capability, the swath number can be specified.

[Filter and gains dialog box, page 109](#)

## Stave view

The *Stave* view shows a graphical presentation of the status of all the receiver elements, or staves, in the multibeam. The number of staves varies depending on the echo sounder type.

### How to open

Select *Stave* on the **View** menu.

### Description

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

### Note

---

*This view applies to multibeam echo sounders with stave display capabilities.*

---

The *Stave* view 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 displays 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 metres, and the scale along the horizontal axis at the bottom shows the stave number.

## Seabed view

The *Seabed* view shows an image of the seabed within the coverage sector. The seabed images help in the detection of objects and seabed features.

### How to open

Select *Seabed* on the **View** menu.

### Description

SIS provides different views of seabed data from multibeam echo sounders.

The intensity of the seabed backscatter is recorded in a series of cross track slices. These slices are then put together swath by swath to create the image of the seabed in the direction of motion.

The image resolution depends on the pulse length, the shorter the pulse length the better the target resolution.

The seabed image is displayed along a time-axis. In the Geographical view the user can see a low resolution seabed image by simply displaying reflectivity per cell. However, if required a high resolution seabed image can be displayed on top of the terrain model.

## Sound Velocity Profile view

A sound velocity profile is used to calculate correct depths in the water column during a survey.

### How to open

Select *Sound Velocity Profile* on the **View** menu.

### Description

The *Sound Velocity Profile* view is used for displaying the sound velocity profile being used by the multibeam echo sounder. It is not an editor.

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

We recommend that you collect at least two profiles at each location. If the two profiles deviates significantly, you should carry out further attempts until you are confident that you have a representative sound velocity profile.

The method used for collecting a sound velocity profile depends on the type of sound velocity probe you are using. You must refer to your sound velocity probe's user documentation for instructions on how to collect the sound velocity data.

SIS reads the sound velocity profile in the .asvp and .actd formats only. The .asvp format is an ascii format consisting of a header row and data rows for each depth and sound speed.

The .actd format is a special format containing water density in addition to the sound speed. It is used in ROV operations where the scaling factor is automatically calculated.

A sound speed profile must always be taken within the survey area and loaded into 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 must be planned, and the survey line schedule adjusted to take this into account.

## Time Series view

The *Time series* view is used for presenting data from external sensors. Normally heave, roll and pitch data from the active sensor is displayed.

### How to open

Select *Time Series* on the **View** menu.

### Description

The time series view is used to display heave, roll and pitch data from the active motion sensor.

Time series may be useful for detection of incorrect performance of the sensors or of incorrect depth determination.

Information from one or more sensor or beams can be selected. The following can also be displayed:

- Depths and backscatter from four beams selected by the user
- Depth below the water surface for the most vertical beam
- Depth and backscatter of the centre beam
- Single beam and multibeam depths for comparison



## Water Column view

The *Water column* view shows a graphical image of biomass and other acoustic reflections that are present in the water column.

### How to open

Select *Water Column* on the **View** menu.

### Description

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

The *Water column* view shows a graphical image of biomass and other acoustic reflections that might be present in the water column. The received amplitude of the reflected signal through the entire water column for each beam is presented. The vertical scale on the left shows the depth in metres. The horizontal scale along the bottom shows the across track distance in metres. The seabed is shown as a yellow or red band in the view.

The view is useful for debugging and for habitat monitoring.

A Time Varying Gain function (x log) is applied to the data.

There is a shortcut to forcing the bottom detection around the depth selected by the mouse. There is also a shortcut to select scope display beam number.

### Note

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*The Water column view applies to multibeam echo sounders with water column capabilities.*

---

## Waterfall view

The *Waterfall* view shows the depth levels for an area based on a collection of cross track data. It is fully implemented with 3D capabilities. You can zoom, pan and rotate freely in 3D, and the z-axis can be expanded to see small objects better.

### How to open

Select *Waterfall* on the **View** menu.

### Description

The **Waterfall** view shows an image of depth levels for an area. It is basically a collection of the most recent cross tracks. The depth levels for each beam from each ping (cross track) is used to generate the waterfall image. These are displayed as a function of a cross track horizontal distance with a small vertical offset between each profile. This gives a crude 3D representation of the most recently measured area.

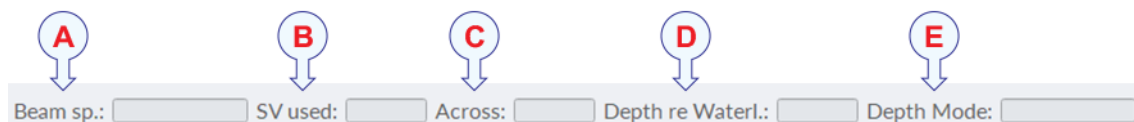
### Note

*The colours applied indicates the depth levels, and not bottom detection.*

---

## Status bar

The status bar is located at the bottom of the SIS presentation.



### A Beam spacing

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

[Sector coverage dialog box, page 101](#)

### B Sound Velocity

Sound velocity shows the velocity in metres per second at the transducer at the time of midpoint of the first tx pulse.

### C Across

Across shows the distance in metres between the outmost beams to port and starboard.

**D Depth re Waterl**

The water depth from the surface in metres.

**E Depth mode**

The choices vary for the different transducers and systems.

[Depth settings dialog box, page 103](#)

**Tip**

---

*Select **Status bar items** on the **View menu**, to select which items you want on the status bar.*

---

# Menu system

## Topics

[Main menu, page 77](#)

[File menu, page 78](#)

[View menu, page 80](#)

[Tools menu, page 83](#)

## Main menu

The **Main** menu is located at the top of the presentation.

### How to open

The **Main** menu is always open.

### Description

- File menu

In the **File** menu you can start surveys and save parameters.

[File menu, page 78](#)

- View menu

Select all the views and change the display settings in the view menu.

[View menu, page 80](#)

- Tools menu

The **Tools** menu contains options for the operation of SIS.

[Tools menu, page 83](#)

- Help menu

The **Help** menu lets you open the help file and find the current software version of SIS.

## File menu

In the **File** menu you can start surveys and save parameters.

### How to open

Open the **File** menu from the **Main** menu.

### Description

- **New Survey**

A survey is used to measure and record detailed information about an area of the seafloor.

[New Survey dialog box, page 86](#)

- **Open Terrain Model**

Select the terrain model you want to use.

- **Unload Terrain Model**

Remove the previous terrain model.

- **Create All Grid Models**

By default SIS only generates three Digital Terrain Models (DTMs): Median value per grid cell made from the distance from waterline to seafloor, the minimum distance in each grid cell made from the same distance, and the seabed image mosaic. More DTM can be created using this menu item. It is recommended that this is done when the EM is not pinging to reduce the workload on the HWS.

- **Create ASCII XYZ-data**

Create ascii xyz-data from the current DTM.

- **Import GeoTiff Image**

Select where to find the GeoTIFF images.

- **Unload GeoTiff Images**

Remove the GeoTIFF images from the view.

- **Load Preferences**

- **Save Preferences**
- **Save PU Parameters**
- **Load PU Parameters**
- **Storage location**

Choose storage locations for popular file types.

- **Remove Echo Sounder from Database**
- **Exit**

Click to close the SIS software.

## View menu

Select all the views and change the display settings in the view menu.

### How to open

Select **View** on the **Main** menu.

### Description

- **Colour Setup**

All the colours in the different views can be customised. The **Colour Setup** dialog box lets you change the ones in the geographical view.

[Colour Setup dialog box, page 90](#)

- **Status Bar Items**

You may select what to present on the status bar from the **View** menu.

[Status bar, page 74](#)

- **Palettes**

A choice of colour palettes is available to fit ambient light conditions.

- **Remote Operator Settings**

Settings for transfer rate of Realtime-data.

- **Installation Parameters**

The **Installation Parameters** dialog box defines fixed installation parameters, such as communication parameters, installation offset angles and physical locations. These parameters are set under system calibration or system installation.

[Installation Parameters dialog box, page 92](#)

- **Runtime Parameters**

In **Runtime Parameters** you find the parameters you can change during operation.

[Runtime dialog box, page 100](#)

- **Runtime Survey**

In **Runtime Survey** you find the main parameters you can change during operation.

[Runtime Survey dialog box, page 113](#)

- **Sound Velocity Management**

Edit everything that has to do with sound speed and sound velocity profiles.

[Sound Velocity Management dialog box, page 113](#)



- **Helmsman Display**

The *Helmsman Display* view provides steering guidance of the ship relative to planned survey lines. This view applies to all instruments.

[Helmsman Display view, page 64](#)

- **Beam Intensity**

The *Beam Intensity* view gives a graphical presentation of the bottom conditions based on the backscattered amplitude intensity from each beam.

[Beam Intensity view, page 65](#)

- **Cross Track**

The *Cross Track* view shows the depth for each beam from the last ping.

[Cross Track view, page 66](#)

- **Numerical Display**

The *Numerical display* view allows you to monitor various application parameters.

[Numerical Display view, page 67](#)

- **Scope**

The *Scope* view is used for investigating the receiver echo data.

[Scope view, page 68](#)

- **Stave**

The *Stave* view shows a graphical presentation of the status of all the receiver elements, or staves, in the multibeam. The number of staves varies depending on the echo sounder type.

[Stave view, page 69](#)

- **Seabed**

The *Seabed* view shows an image of the seabed within the coverage sector. The seabed images help in the detection of objects and seabed features.

[Seabed view, page 70](#)

- **Sound Velocity Profile**

The view shows the current sound velocity profile.

[Sound Velocity Profile view, page 71](#)

- **Time Series**

The *Time series* view is used for presenting data from external sensors. Normally heave, roll and pitch data from the active sensor is displayed.

[Time Series view, page 72](#)

- **Water Column**

The *Water column* view shows a graphical image of biomass and other acoustic reflections that are present in the water column.

[Water Column view, page 73](#)

- **Waterfall**

The *Waterfall* view shows the depth levels for an area based on a collection of cross track data. It is fully implemented with 3D capabilities. You can zoom, pan and rotate freely in 3D, and the z-axis can be expanded to see small objects better.

[Waterfall view, page 74](#)

- **Show/Hide Debug Windows**

This view is for troubleshooting and debug purposes.

- **Hide Toolbar**

Select **Hide Toolbar** to hide the top bar.

- **Preferences**

[Preferences dialog box, page 115](#)

## Tools menu

The **Tools** menu contains options for the operation of SIS.

### How to open

Select **Tools** on the **Main** menu.

### Description

- **External Sensors**

All changes to external sensors are set in this dialog box.  
[External Sensors dialog box, page 120](#)
- **View Sensor in 3D**

A 3D view over the installation of multi beam and external sensors.
- **Planning**
  - **Open Job**
  - **Save Job**
  - **Save Job As**
  - **Clear Job**
  - **Send Grid and Job to Helmsman**
  - **Remove Grid and Job from Helmsman**
  - **Send Plan To External Host**

You plan a job by adding lines in the geographical view.
- **User Objects**
  - **Load from file**
  - **Save to file**
  - **Load from database**
  - **Save to database**
  - **View saved positions**
  - **Remove all from view**

The **User Objects** function is used to handle the objects marked in the *Graphical View*.
- **Calibration**

The intention of the SIS calibration is to find remaining biases in the installation angles and to find any time synchronization biases between the systems.
- **SVP Editor (Web)**

This is a program to edit the sound velocity profile.

- **Helmsman**  
The **Helmsman** program provides steering guidance of the ship relative to planned survey lines.
- **PU Replayer**  
This tool is used to replay previously logged files in SIS.
- **Data Distribution Configuration**  
Select datagrams to send to given IP addresses on the network.
- **Parameter Setup**
- **SIS Data Logger**  
Log the received input on Processing Unit and SIS (HWS).
- **SVP Editor (legacy)**  
This is a program to edit the sound velocity profile.
- **Restart SIS User Interface**  
The SIS User Interface might freeze at times, and a restart will not interrupt the logging.
- **Restart HDDS**  
The graphic part of the program might freeze at times, and restarting the Handle Data Distribution System will restart the graphics without interrupting the logging.

# Functions and dialog boxes

## Topics

[File menu: Functions and dialog boxes, page 86](#)

[View menu: Functions and dialog boxes, page 89](#)

[Tools menu: Functions and dialog boxes, page 120](#)

## File menu: Functions and dialog boxes

### Topics

[New Survey dialog box, page 86](#)

[Advanced Settings dialog box, page 87](#)

### New Survey dialog box

A survey is used to measure and record detailed information about an area of the seafloor. Save the settings that fits this area the best.

#### How to open

Select **New Survey** on the **File** menu.

#### Description

The **New Survey** dialog box guides you through the configuration of all essential survey parameters. These include projection data, background maps and storage location. These are parameters that are vital for the data acquisition, and incorrect settings may not be possible to correct for in post processing.

A survey will contain data about the seabed based on a set of specified parameters.

Essential parameters like where to save the data are saved in the **Advanced Settings** dialog box.

[Advanced Settings dialog box, page 87](#)

#### Details

##### New Survey Information

The survey parameters that can be set and administrated from these dialogs partly overlap each other, but differs slightly depending on whether a new survey is being set up or the survey parameters are being modified.

##### New Survey Name

Enter a unique name for your survey.

##### Comment

Enter a description for your survey.

##### New projection

Select the map projection that will be used for the survey, or make your own.

[Projections, page 168](#)

### Start new survey

Select this to start the survey.

### Details

#### Setting Summary

See your selected projection and the grid cell size for your echo sounder. Change other parameters in the **Advanced Settings** dialog box.

#### Active survey

The currently active survey.

### Related tasks

[Creating a new survey, page 24](#)

## Advanced Settings dialog box

The **Advanced Settings** dialog box offers settings that are not required during daily use of the SIS

### How to open

Select **New Survey** on the **File** menu. Select **Advanced Settings** in the **Settings Summary** area.

### Description

### Details

#### Directory Management

Create the directory names to save the files.

#### Data directory for raw files

Create the directory where the raw files will be saved.

#### Data directory for survey files

Create the directory where the survey files will be saved.

#### Storage-structure Management

Set the naming structure for the raw data files.

#### Data storage structure for raw data files

Data storage structure for raw files

#### Select data storage structure

Select from the structure elements to build a structure for your survey.

*Example*

D:\sisdata\raw\MySurvey\2020\05\18\MyShip\EM2040\123

**Clear structure**

Click **Clear structure** to clear the file name structure.

**Select data storage structure**

Select from the structure elements to build a structure for your survey.

**Related topics**

[New Survey dialog box, page 86](#)



## View menu: Functions and dialog boxes

### Topics

- [Colour Setup dialog box, page 90](#)
- [Remote Operator Settings, page 91](#)
- [Installation Parameters dialog box, page 92](#)
- [Sensor Setup dialog box, page 93](#)
- [Network Setup dialog box, page 97](#)
- [Transducer setup dialog box, page 97](#)
- [BIST \(Built-In Self Test\) dialog box, page 99](#)
- [Runtime dialog box, page 100](#)
- [Sector coverage dialog box, page 101](#)
- [Depth settings dialog box, page 103](#)
- [Transmit control dialog box, page 105](#)
- [EM MultiFrequency Mode dialog box, page 106](#)
- [Sound Velocity dialog box, page 108](#)
- [Filter and gains dialog box, page 109](#)
- [Extra Detections dialog box, page 112](#)
- [Runtime Survey dialog box, page 113](#)
- [Sound Velocity Management dialog box, page 113](#)
- [Preferences dialog box, page 115](#)
- [Select colors dialog box, page 119](#)

## Colour Setup dialog box

All the colours in the different views can be customised. The **Colour Setup** dialog box lets you change the ones in the geographical view.

### Prerequisites

**Colour Setup** is only available when you have a grid available in the system.

### How to open

On the **View** menu, select **Colour Setup**. Select the feature you want to change the colour of.

### Description

The settings in the **Colour Setup** dialog box are organized in two groups.

Which colour scale to use is mainly a personal preference based on ambient light conditions, the nature of the echoes and your own experience.

### Details

#### Range

Select **Auto** if you want to see the whole range. The range can be limited by selecting a minimum and a maximum value and an out of range method.

#### Start

Select the colour of the start range.

See the effect of the change in the band below the selection tool.

#### Stop

Select the colour of the end of the range.

See the effect of the change in the band below the selection tool.

#### Direction

Select clockwise or counterclockwise for the start and end of your colour scale.

#### Out of range

Select **Cut**, **Clamp** or **Wrap**.

Cut when you don't want to see outside of the range. Clamp when you want the colour to stay the same as the edge. Wrap when you want the scale to repeat.

#### Static ranges

Make your own ranges with your own colours.

## Remote Operator Settings

SIS 5 has the capability to operate the EM-system from a remote location. The EM-system can be installed on one survey vessel and the operator can be located on shore or on a different vessel in the vicinity.

### Prerequisites

A license setting must be set for SIS Remote. Customer network or a connection to Kongsberg's cloud solution Blue Insight , must be available

### How to open

On the **View** menu,select **Remote Operator Settings**.

### Description

#### Details

##### Realtime Data Controller

Settings for transfer rate of Realtime-data.

[Realtime Data Controller, page 138](#)

##### Blue Insight Connector Configuration

Remote operator settings for Blue Insight Connector.

[Connecting to Blue Insight, page 137](#)

## Installation Parameters dialog box

The **Installation Parameters** dialog box defines fixed installation parameters, such as communication parameters, installation offset angles and physical locations.

### How to open

On the **View** menu, select **Installation Parameters**.

### Description

Before you can use SIS all the communication ports and offsets have to be set up.

### Note

---

*The parameters can not be modified during normal operation.*

---

Select the spanner icon to see the dialog boxes.

- Sensor Setup

The **Sensor Setup** dialog box allows you to define the parameters for communication between the sensors (speed, navigational, motion) and the Processing Unit.

[Sensor Setup dialog box, page 93](#)

- Network Setup

In the **Network Setup** dialog box you define the output setup for broadcasting the \*.kmall datagrams from the Processing Unit to the network.

[Network Setup dialog box, page 97](#)

- Transducer setup

The **Transducer setup** dialog box contains all the parameters for the transducers.

[Transducer setup dialog box, page 97](#)

- BIST

The **BIST** dialog box provides several automatic tests to check the operation of the echo sounder system.

[BIST \(Built-In Self Test\) dialog box, page 99](#)

## Sensor Setup dialog box

The **Sensor Setup** dialog box allows you to define the parameters for communication between the sensors (speed, navigational, motion) and the Processing Unit.

### How to open

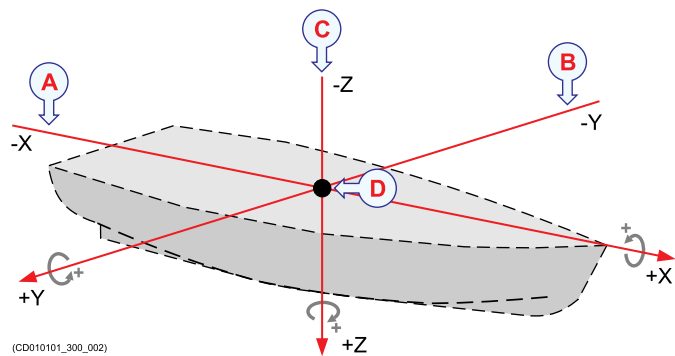
On the **View** menu, select **Installation Parameters**. Select the spanner icon, then select **Sensor Setup**.

### Description

The Sensor setup dialog box lets you define which type of data to receive on the different serial and Ethernet ports to the Processing Unit. Define the communication parameters for each port.

**Note** \_\_\_\_\_

*All sensors, active or not, are logged in the \*.kmall format for use in post processing.*



### Details

#### Position system 1

Set up the primary positioning system.

#### Name

Type in a custom name. The name is saved locally, another computer will not see this.

#### Location offset

Enter the location offset from the vessel's reference point to the positioning system's reference point.

#### Position motion correction

When the vessel moves due to roll, pitch and heave, the antenna on the positioning system moves as well. **Position motion correction** allows the system to compensate for this movement by adjusting the values from the positioning system based on current information from the motion sensor(s). Correct timing of the positions is very important to improve position accuracy.

#### Position delay

**Position delay** is used to define the delay of the position caused by the network, 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 constant delay with respect to the time of validity of the positions in the position datagrams. This delay is the position delay to enter.

#### Quality indicators

Enter the quality indicator numbers (comma separated) that you want to interpret as accepted height observations. The quality factor applies to GGA and GPK position data only.

The default setting is Off, where the system uses the standard quality indicators. When you use a custom quality indication, you must make sure the quality is good enough.

#### Time to use

Usually the input datagram's timestamp is used. It is then assumed that the multibeam echo sounders clock is set from External ZDA clock, that both the PU system clock and the positioning system clock are synchronized with the 1PPS signal and that there is no time difference between the two clocks. Select System or Datagram. Both time stamps are stored. The time reference can be changed or corrected in post processing.

Select **System** and the multibeam echo sounder will use its own internal time stamp when applying positions to the real time display.

**Datagram** is the time of the observation read from the position datagram.

#### Datum

Datum enables you to set the internal datum identical to what the positioning system sends to the echo sounder. This will also be logged. The projection reference in the survey module must also be set accordingly.

#### Format

Select the format the sensor uses.

#### Input

Select the input port the sensor uses and fill in the information about the port.

#### Position system 2

Set up the secondary positioning system.

#### Position system 3

Set up the tertiary positioning system.

#### Attitude system 1

Set up the primary attitude system.

#### Angular offset

Enter the roll, pitch and heading installation angles of the sensor if not already applied in sensor. It is recommended to configure this in the sensor.

#### Attitude delay

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 the manufacturer.

#### Roll reference plane

The roll reference plane is used to define which roll angle to measure. Select Rotation or Horizontal.

Select Rotation if roll is measured against a plane defined as horizontal in the across-track direction, but following the vessel pitch in the along-track 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).

Select Horizontal 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.

#### Attitude system 2

Set up the secondary attitude system.

#### Depth/Pressure

Setup the depth sensor for a ROV.

#### **Depth sensor delay**

The delay of the depth sensor in seconds.

#### Sound velocity probe

Set up the sound velocity probe.

#### Time system

Set up the time system.

#### Source

Select which time format to import. Select time datagram or position datagram.

#### 1PPS

Select whether to use the pulse per second synchronisation or not. Select Off, On rising edge or On falling edge.

#### Set active systems

Select which position and attitude systems to be active.

#### Active position system

Select the system you want active.

Active attitude system

Select the system you want active.



## Network Setup dialog box

In the **Network Setup** dialog box you define the output setup for broadcasting the \*.kmail datagrams from the Processing Unit to the network.

### How to open

On the **View** menu, select **Installation Parameters**. Select the spanner icon, then select **Network Setup**.

### Description

Define the addresses to broadcast datagrams to.

### Details

Multicast address

Enter the multicast address to broadcast data to.

Multicast port

Enter the port to broadcast to.

Secondary net address

Enter the secondary net's address.

Secondary net subnet

Enter the secondary net's subnet address.

## Transducer setup dialog box

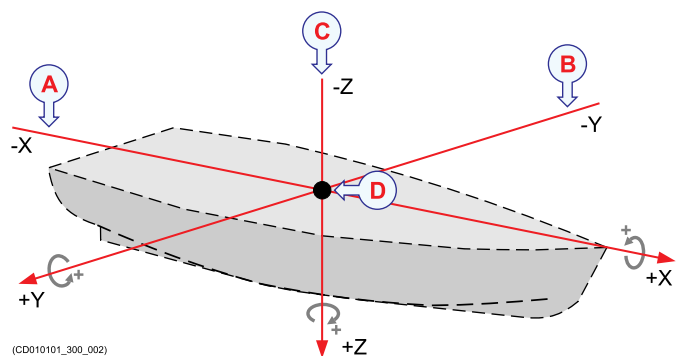
The **Transducer setup** dialog box contains all the parameters for the transducers. Settings for the water line and the ships noise level are also here.

### How to open

On the **View** menu, select **Installation Parameters**. Select the spanner icon, then select **Transducer Setup**.

### Description

In order to make correct computations, SIS must know the physical location of all sensors, including it's transducers. The locations must be referred to the vessel's reference point. The location 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.

Compact transducers have transceiver and receiver electronics in one unit and is referred to as a sonar head in the **Transducer setup** dialog box.

### Details

#### TX Location offset

Enter the location offset from the vessel reference point and the transducer reference point in the x, y and z direction.

#### TX Angular offset

Enter the installation angular offset for roll, pitch and heave.

#### TX Size

The size of the beam angle in degrees.

#### RX Location offset

Enter the location offset from the ship's origin in the x, y and z direction.

#### RX Angular offset

Enter the angular offset in roll, pitch and heave.

#### RX BS offset

Enter the backscatter offset in dB.

#### Water line vertical location

Enter the distance between the vessel reference point and the water level.

## BIST (Built-In Self Test) dialog box

The **BIST** dialog box provides several automatic tests to check the operation of the echo sounder system.

### How to open

Select **Installation Parameters** on the **View** menu. Select the spanner icon, then select **BIST**.

### Description

Various test are available, depending on what system you have.

### Details

Test

Select the test you want to run.

Clear

Select **Clear** to delete the tests already run.

### BIST result

All the tests will be listed as they are done.

Time

The time the test was run showing as yyyyymmdd-hhmmss.

Result

The result showing as Passed or Failed.

Description

A short description of the test. Select the description or the text file to get more details.

## Runtime dialog box

In **Runtime** you find the parameters you can change during operation.

### How to open

On the **View** menu, select **Runtime Parameters**.

### Description

The runtime parameters can be modified during operation to change information such as ping rate, coverage and sound speed profiles.

Select the cog symbol to see the dialog boxes.

- Sector coverage

The **Sector coverage** dialog box allows you to define the swath width for each ping as well as the spacing between the depth points within this swath.

[Sector coverage dialog box, page 101](#)
- Depth settings

Depth settings allows you to specify that the echo sounder listens for echoes between a defined depth range, and ignore echoes outside of this range.

[Depth settings dialog box, page 103](#)
- Transmit control

The transmit control configuration parameters are used to ensure an even distribution of depth soundings.

[Transmit control dialog box, page 105](#)
- EM MultiFrequency Mode

This dialog box is only used by the systems that offers the multifrequency function.

[EM MultiFrequency Mode dialog box, page 106](#)
- Sound Velocity

The **Sound Velocity** dialog box lets you to select a sound velocity profile, or to manually enter a sound velocity.

[Sound Velocity dialog box, page 108](#)
- Filter and gains

The **Filter and gains** dialog box lets you define values to ignore certain echoes, to clean the measurements and remove false sea floor detection.

[Filter and gains dialog box, page 109](#)
- Extra Detections

**Extra Detections** starts the system searching for more bottom candidates in all beams and for all ranges.

[Extra Detections dialog box, page 112](#)

## Sector coverage dialog box

The **Sector coverage** dialog box allows you to define the swath width for each ping as well as the spacing between the depth points within this swath. The more narrow the coverage angle, and the higher the number of depth points within the coverage sector, the greater the resolution.

### How to open

On the **View** menu, select **Runtime Parameters**. Select the cog icon, then select **Sector Coverage**.

### Description

The sector coverage dialog box is used to define the sector coverage and the beam spacing. The sector coverage/swath width and the beam spacing option are used together in order to achieve the most detailed seafloor information for each swath. The beam spacing options allows you to define how to distribute the retrieved echoes.

Initially, all the parameters have a value which depends on the active echo sounder.

If the coverage is too wide this may result in the echoes received by the outer beams being too weak. As a result these are rejected, resulting in poor seafloor information, that is, low resolution. To avoid this, the sector coverage area must be reduced.

By setting the coverage mode to automatic, the system will automatically decrease the sector coverage/swath width before the next ping, increasing the chance that the signals detected by each beam is approved, thus rendering detailed information for the sector.

### Note

---

*The **Auto** option is selected by default.*

---

### Details

Port <-> Starboard

This button swaps the settings for the port and starboard sector coverage parameters. This is convenient when logging along a shoreline and the vessel is turning around.

Maximum angle (deg)

The maximum angle coverage in degrees.

Maximum coverage

Define the maximum swath width to each side by selecting values in metres. The port and starboard angles will be adjusted accordingly by the system if the **Angular coverage mode** is set to auto.

Angular coverage mode

Select Auto or Manual.

When 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 are not used. The outermost beams may be lost if the angular coverage set is larger than the coverage capability at the current depth.

When the angular coverage is set to auto, the maximum coverage and the maximum angles will set the swath width limit. The most limiting of the two criteria is 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. The number of beams accepted should be almost equal to the numbers of beams available in the **Numerical display**.

#### Sector mode

Sector mode controls the use of transmit sectors. Select Normal, Single sector port, Single sector starboard, Single sector centre

When the sector mode is normal all sectors are transmitted simultaneously.

When the sector mode is single sector port, the starboard RX head is automatically turned off.

When the sector mode is single sector starboard, the port RX head is automatically turned off.

When the sector mode is single sector centre only the centre sector is used.

When using the **Port <-> Starboard** swap button, the sector mode port and starboard selections are also swapped automatically.

#### Beam spacing

Depending on the purpose of the survey, you may define the distribution of the beams on the seafloor. Select equidistant, equiangle or high density equidistant.

##### 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 equidistant

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.

## Depth settings dialog box

Depth settings allows you to specify that the echo sounder listens for echoes between a defined depth range, and ignore echoes outside of this range.

### How to open

On the **View** menu, select **Runtime Parameters**. Select the cog icon and select **Depth Settings**.

### Description

You can define the depth range in which the echo sounder will listen for echoes, and ignore echoes outside of this range. You can also choose the frequency and the length of the pulse emitted, the higher the frequency and the shorter the wavelength, the better the resolution.

### Details

#### Force depth

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.

#### Minimum depth

This is the minimum depth in metres at which the echo sounder starts listening for bottom echoes.

#### Maximum depth

This is the maximum depth in metres where the echo sounder stops listening for bottom echoes.

#### Dual swath mode

Two pings are transmitted simultaneously. The intention is to obtain a more dense coverage of the sea floor without decreasing vessel speed. Select Off, Fixed or Dynamic.

Select off to disable dual swath.

Select fixed and the alongship angle between the two transmit fans is equal to the alongship TX opening.

Select dynamic and the alongship angle between the two transmit fans is determined based on vessel speed, ping rate and depth in order to provide uniform alongship sampling of the sea floor.

#### Frequency

The frequency may be changed for certain transducers.

Depth mode

Select Auto, Shallow, Medium, Deep or Very deep. The choices vary for the different transducers and systems.

Detector mode

Select detector mode to optimise the systems ability to recognize the bottom, wreck or structures, depending on water condition. Select Normal, Waterway, Tracking, or Min. depth.

Select normal for the normal bottom detection mode.

Select waterway for shallow channels and rivers.

Select tracking for a shallow water mode for tracking of targets and sudden depth changes

Select minimum depth for detecting wrecks.

FM disable

Turn off the use of FM pulses. It is recommended to keep this button off.

Select on to stop using FM pulses, CW only.

Select off to use FM pulses as well as CW.

Generate water column data

Select **Generate water column data** to start saving all data in the water column.

Extra detection

Select Extra detection to make sure echoes from depth points that deviate noticeably from its adjacent depth points, are displayed on the screen and logged. This is useful when surveying wrecks as this ensures that, for instance, echoes from a mast, are displayed.



## Transmit control dialog box

The transmit control configuration parameters are used to ensure an even distribution of depth soundings.

### How to open

On the **View** menu, select **Runtime Parameters**. Select the cog icon, then select **Transmit control**.

### Description

The maximum electronic tilt is limited to  $\pm 10$  degrees. The ship's 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 and yaw stabilisation.

### Details

#### Pitch stabilisation

At open sea, the swath area of the bottom will move back and forth following the vessel pitch. This will lead to loss of sampling regularity, and limit the vessel speed at which 100 % bottom coverage is possible. To account for this effect the system's transmit angle may be set to vary with the pitch in order to stabilise the direction of the emitted vertical transmit ping. This option should normally be ON.

#### Transmit angle along

Transmit angle along is used to tilt the transmit sector forward and backwards. This can be used to avoid a too strong echo at the normal incidence.

#### Yaw stabilisation mode

The yaw stabilisation creates an even alongship sounding spacings when the vessel's course is variable. The parameter has variable tilt angles on the individual transmitter beams. Select Off, Relative mean heading or Manual.

Select off and no stabilisation takes place. The transmitter sector follows the current heading of the vessel and 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 metres).

Relative mean heading places the transmitter sector perpendicular to a filtered course corresponding to the vessel's current mean heading. The course input is then taken from the gyro, and filtered with the Heading filter parameter. Relative mean heading is the recommended yaw stabilization mode. Selecting Relative mean heading will make sure the average yaw steering will be close to zero, avoiding an offset caused by, for example, a crab angle. Also the operator does not have to remember to set the course.

Select manual and the transmit beams are placed perpendicular to a manually selected course. This option should only be selected for long and straight survey

lines. It is also useful if you need to compensate for a crab angle caused by current or wind.

#### Manual heading

Manual heading allows you to enter the vessel's heading manually.

#### Heading filter

Heading filter specifies the level of filtering of the heading. The heading filter will even out minor course adjustments due to wind, waves 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. Select Weak, Medium or Hard.

#### Frequency

Select the transmit frequency. The frequencies available varies depending on the system.

#### Max ping rate

The ping rate defines the interval between each ping, and the distance between the swaths. The closer the swaths, the more details about the seafloor. To achieve this, several pulses are produced during one ping. The result is that the distances between the consecutive swath decreases.

#### Min swath distance

The minimum swath distance defines the distance allowed between consecutive swaths in metres. The aim is to ensure that a survey will contain a minimum of, and a constant, data density. To obtain the required data density the ping interval is based on the measured depth and the vessel speed. The default value is 0, indicating not used. The range is 0.1 – 1000.0 metres. The resolution is 0.1 metre. A warning is issued if the required data density can not be obtained. A second warning can be issued if the data density is too high, this warning is disabled by default.

#### External trigger

Select External trigger when the echo sounder is synchronised with an external trigger pulse.

#### Note

---

*If no trigger pulse arrives, the echo sounder will never ping.*

---

## EM MultiFrequency Mode dialog box

This dialog box is only used by the systems that offers the multifrequency function.

### How to open

On the **View** menu, select **Runtime Parameters**. Select the cog icon, then select **EM MultiFrequency Mode**.

## **Description**

MultiFrequency mode enables the system to change the swath configuration between multibeam pings. This allows you to dynamically define the frequency, swath width (coverage) and pulse mode for up to five consecutive pings, generating a true multi-layered dataset.

## **Details**

### **Swath**

Define the frequency, swath width and pulse mode for up to five swaths.

### **Frequency**

Select the frequency for up to five swaths. Different echo sounder systems have different frequency selections.

### **Maximum angle (deg)**

The maximum angle coverage in degrees.

### **Depth mode**

Select Auto, Shallow, Medium, Deep or Very deep. The choices vary for the different transducers and systems.

### **Detector mode**

Select detector mode to optimise the systems ability to recognize the bottom, wreck or structures, depending on water condition.

### **Beam spacing**

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

## Sound Velocity dialog box

The **Sound Velocity** dialog box lets you to select a sound velocity profile, or to manually enter a sound velocity. The information is used to give accurate depth in the survey area.

### How to open

On the **View** menu, select **Runtime Parameters**. Select the cog icon, then select **Sound Velocity**.

### Description

In order to have accurate depth determination, you must know the sound velocity profile in the survey area. This profile may change with both time and position in the survey area. It may be necessary to determine the profile several times during a survey. The profile is stored as a file and sent to the Processing Unit.

SIS uses the depth information generated in the Processing Unit. This means that the depth points have been generated using the sound speed profile.

The sound speed profile currently used by the Processing Unit is shown in the Sound velocity profile view.

### Details

#### Sound Velocity source

Select the source for the Sound Velocity at the transducer. Select Probe/Sensor, Manual or Profile.

Select Probe/Sensor when you have a probe or sensor available near the transducer.

Select manual to enter a value manually.

#### Note

---

*The manual setting is only for experienced users.*

---

Select profile to derive the sound velocity near the transducer using applied sound velocity profile at the depth indicated by the motion reference input.

#### Sound Velocity

Set the sound velocity at the transducer directly to a fixed value. This function is only available if **Manual** is selected.

#### Water temperature

Set the water temperature at the transducer directly to a fixed value.

## Filter and gains dialog box

The **Filter and gains** dialog box lets you define values to ignore certain echoes, to clean the measurements and remove false sea floor detection. It also includes settings for the bottom backscatter measurement and the sea floor imaging.

### How to open

On the **View** menu, select **Runtime Parameters**. Select the cog icon, then select **Filter and Gains**.

### Description

There is always a risk of false detections due to schools of fish, acoustical interference from other systems, passing over vessel wakes, soft sediments, bad weather, aeration and so forth. The different filters are used to determine what echoes to detect, and decrease the number of undesired echo detections.

Only apply different filter settings than those recommended if the occurrence of false detections is too high to be acceptable.

The echo signal detection is performed twice during each ping. Filtering is performed after every pass. The first pass is done on all received echoes. The second pass is done only on echoes which lack valid detection. The system uses relaxed acceptance criteria using range information derived from neighbouring echoes, each containing a valid echo detection.

### Note

---

*It is always advantageous to eliminate undesired detections prior to post-processing.*

---

### Details

#### Spike filter strength

Spike filter strength defines to what degree a spiky seabed is accepted. The filter removes depth points that deviate too much from their neighbouring beams' depth point, resulting in a graphics that present a seemingly smooth surface. The stronger the filtering, the fewer depth points, or spikes, are shown. Select **Off**, **Weak**, **Medium** or **Strong**.

Select **Off** to have no filtering and all spikes to show. These will be recognized as spikes/peaks of different heights on an otherwise smooth surface.

Select **Weak** and depth points which varies from a certain degree from their adjacent depth points will be displayed.

Select **Medium** and only depth points where the depth varies only slightly from the adjacent depth points are shown in the sea floor graphics, resulting in the near absence of spikes/peaks.

Select **Strong** and only the depth points having the same depth are shown, resulting in a complete absence of peaks.

#### Range gate size

Range gating is used to detect only the echoes emanating from the desired target range. Consequently, echoes from outside the target range, are ignored. This vastly improves the tracking of the seafloor during bad weather and in situations where aeration occurs. During the survey the depth will vary, and the range gate value defines at which depth the echo sounder will next start to listen for echoes. Depending on the selected option, the depth at which the echo sounder starts listening for echoes from a ping, is increased by a fixed percentage using the depth of the previous ping's echoes as the basis. Select **Small**, **Normal** or **Large**.

Select **Small** to reduce the existence of sidelobe influence.

Selecting **Normal** is recommended.

If the depth varies considerably alongtrack it may be useful to select a **Large** range gate. This may also increase the probability of registering false echoes from side lobes, interference or other sources of noise. Selecting a large range gate may reduce the ping rate slightly.

#### Phase ramp

Phase ramp is used to specify the range overlap between the detections. Phase detection improves depth resolutions in the outer beams. It specifies how many samples that will be used for the phase detection, for each depth. The shorter the phase ramp, the higher the resolution. This results in increased noise in the data. Select **Short**, **Normal** or **Long**.

Select **Short** and the number of samples used for phase detection will be equal to the range distance between the beam and its neighbours. As a result, there will be no averaging of phase detections between beams. A short phase ramp gives the best resolution, but a side effect can be that the detected bottom will give increased noise. Provided that a minimum number of phase samples are available to do proper phase detection.

The number of samples used for phase detection will normally be equal to twice the range distance between the beam and its neighbours for **Normal** phase ramping. There will be a slight averaging of phase detection between beams. This is the recommended setting

A fixed portion of the phase curve, corresponding to  $\pm 40$  degrees phase angle, is used for the **Long** phase detection. This results in an increasing averaging of phase detections between beams with increasing beam angle.

#### Penetration filter strength

Reduce the chance that the central beams will track sediment layers below the seafloor, in areas where the seafloor is soft and consists of distinct sediment layers. Select **Off**, **Weak**, **Medium** or **Strong**.

#### Special TVG

Special TVG reduces the problems concerning multipaths, false echoes, in shallow waters.

#### Slope filter

It is recommended that the slope filter always is enabled. 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.

#### Aeration filter

Air bubbles below the transducer may cause problems for the bottom tracking. In areas with relatively constant depths, performance will be increased. However, if the bottom depth varies considerably, the filter may have an adverse effect. When enabled, the system puts more emphasis on previous pings when tracking the bottom. This results in improved performance and makes the system more stable in conditions where air sweep-downs frequently block the acoustic signals to/from the transducers.

#### Interference filter

If the vessel is equipped with other echo sounders or sonars operating on frequencies close to the one that the echo sounder uses, you may experience interference. To avoid this situation the most effective solution is to synchronise the operation of the different systems. If synchronisation is not possible, activating this filter may reduce interference problems.

#### Special amp. detect

An alternative detection mode for beams close to the normal incidence. This detector mode can reduce noise spikes in the data for some bottom types.

#### Normal incidence corr.

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

#### Use Lambert's law

Select to use Lambert's law, which results in the adjustment of backscatter values based on loss due to low incident angle. Using Lambert's law is recommended.

#### Transmit power level

The maximum power by which the sound is emitted from the transmitter can be decreased by 10 or 20 dB, resulting in a reduced power (dB) used for the emitted sound (ping). The maximum coverage will be reduced when the power is decreased. Select Normal, -10 dB or -20 dB.

Water column X log

Set the range exponent to increase the intensity for a weak echo, or noise, fish and so forth, in the water column. The gain affects water column data only and the changes due to entering a different exponent is seen instantly in the water column view.

Water column TVG offset

The offset is visible in the water column view, the offset is calculated in the Processing Unit prior to displaying the water column. You will typically want to increase the dB offset when objects in the water column are of interest. The amplitude range data of the backscatter changes accordingly.

Sonar mode

Select Off, Sonar active or Sonar passive.

## Extra Detections dialog box

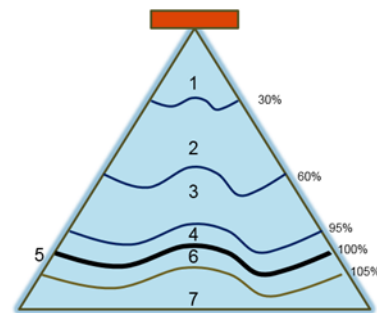
**Extra Detections** starts the system searching for more bottom candidates in all beams and for all ranges.

### How to open

On the **View** menu, select **Runtime Parameters**. Select the cog symbol, then select **Extra Detections**.

### Description

Any false detections, like side lobe echoes, will be removed. The remaining candidates are organized into classes. These classes are depth ranges with some acceptance criteria. They are user definable with an initial default setup. All candidates which are accepted into a class are subsequently stored. There are seven classes of detections, CL1–CL7. The seafloor is always defined as 100 %. The classes are enabled by default, but can be individually enabled and disabled. Disabled classes are stored, but will not be displayed.



### Details

**Class**

Define each class, and select which ones to enable.

**Start depth**

Define the start depth in percentage for each class.

**Stop depth**

Define the stop depth in percentage for each class.



**Quality factor**

This is the estimated depth error.

**Reflectivity**

This is the backscatter.

**Confidence level**

This is the Signal to Noise Ratio.

**Alarm threshold**

This is the number of extra candidates to trigger the alarm flag for the specific class.

## Runtime Survey dialog box

In **Runtime Survey** you find the main parameters you can change during operation.

**Description**

The runtime parameters can be modified during operation to change information such as ping rate, coverage and sound speed profiles.

Select the cog symbol to see the dialog boxes.

The **Runtime Survey** dialog box varies for the different echo sounder systems. It has a selection of the most used functions for each system.

**Tip**

---

*Select the cog symbol and select **Runtime full**; start typing to quickly find the function you are after.*

---

## Sound Velocity Management dialog box

Edit everything that has to do with sound speed and sound velocity profiles.

**How to open**

On the **View** menu, select **Sound Velocity Management**.

**Description**

In order to have accurate depth determination, you must know the sound velocity profile in the survey area. This profile may change with both time and position in the survey area. It may be necessary to determine the profile several times during a survey. The profile is stored as a file and sent to the Processing Unit.

Enter all the relevant sensors and profiles to get the most accurate sound velocity profile.

## Details

### Sound Velocity Profile

Select the Sound Velocity Profile file you want to use. The file must be a .asvp file.

### File open

Select where the Sound Velocity Profile file is located.

### Absorption coefficient files, salinity

Shows where the absorption coefficient files (based on salinity) are located.

### Absorption coefficient files, CTD

Shows where the absorption coefficient files (based on salinity) are located.

### Sound Velocity at Transducer

Select the Sound Velocity source.

### Source

Select the Sound Velocity source you want to use.

- Probe at HWS  
A probe connected to the computer.
- Manual  
Enter a sound speed manually.
- Profile  
Use the sound velocity profile.
- Probe at EM  
A probe connected to the processing unit.

### Sound Speed

Enter the sound speed if you chose a manual value.

### Sensor Offset

Enter the probe's offset.

### Filter

Enter the filter length.

### Absorption coefficient

Select the source for the absorption coefficient files.

### Source

Select the source you want to use for the calculation of the absorption coefficients.

- Salinity  
Enter the salinity and the absorption coefficients is calculated from the value.

- CTD Profile  
Use the values from a CTD probe to calculate the absorption coefficients.
- Manual  
Enter the absorption coefficients manually.


#### Salinity

Enter the salinity.

## Preferences dialog box

The **Preferences** dialog box is used to set up system preferences such as colours and what to include in the geographical view.

### How to open

Select **Preferences** on the **View** menu or the  button in the top right corner.

### Description

The **Preferences** dialog box allows you to customize the look of the geographical view. The depth measurement unit is metres and can not be changed.

### Details

#### Terrain model

Find all options related to the terrain model here.

#### Visibility

Select the check box to make the terrain model visible.

#### Operation

Select whether to see the minimum or median depth.

#### Quick gridding

Restart SIS to effectuate.

Select to create terrain for Z and backscatter only.

#### Scale factor

Select a scale factor for the survey, x1, x2, x5 or x10.

#### Override LOD

Offsets the level of detail used for rendering terrain. E.g: If set to 3, terrain will render with levels of detail higher then default.

#### Light direction

Select the direction of where the light shines from. Select North West, North East, South East or South West.

#### Ships track

Find all options related to the ships track here.

##### Show Realtime Positions

Select the check box to make the realtime positions visible.

##### Realtime Position Colour

Select the realtime position colour in the Geographical view.  
Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

##### Show stored track

Select the check box to make the stored track visible.

##### Stored Track Colour

Select the colour of the stored track line.  
Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

##### Stored Line width

Select the stored line width in points.

#### Overlay

Find all options related to the overlay here.

##### Background colour

Select the background colour in the geographical view.  
Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

##### Graticule colour

Select the graticule colour in the geographical view.  
Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

##### Show graticule

Select the check box to make the graticule visible.

##### Graticule Label Format

Select a format for the survey. Select DD.DDD, DD MM.MM, DD MM SS.SS or projection.

#### Depth Tail

Find all options related to the depth tail here.

##### Show depth tail

Select the check box to make the depth tail visible.

Depth tail point size

Select the depth tail width in points.

Depth Tail Number of Points

Select the number of points in the depth tail.

Depth Tail Thinning

Select whether to show all pings, or having a display rate of 2 or 10 kHz.

Miscellaneous

Find the rest of the options here.

Highlight colour

Highlight colour used in the 2D and 3D graphical views. Selected objects will be shown in this colour.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

Vessel colour

Select the colour of the vessel on the geographical view.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

Show COG vector

Select the check box to turn off the COG (course over ground) vector visibility.

COG vector length

Select the COG vector length in points.

COG Vector Colour

Select the COG vector colour.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

Show logging label

Select the check box to make the logging label visible.

Safety Contour Colour

Select the colour of the safety contour in 2D Geographical view.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

Safety Contours Visibility

Select the check box to make the safety contours visible.

Planning and User Objects

Planning and user objects related things.

Show Planning and User Objects

Select the check box to make planning and user objects visible.

Planned Line Colour

Select colour of planned line in 2D geographical view.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

Planned Polygon Colour

Select colour of planned polygon in 2D geographical view.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

Active Line Colour

Select colour of active line in 2D geographical view.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

Line Start Colour

Planned line start point colour used in 2D geographical view.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

Line End Colour

Planned line end point colour used in 2D geographical view.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

Active Line Start Colour

Active planned line start point colour used in 2D geographical view.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

Active Line End Colour Safety Contour Colour

Active planned line end point colour used in 2D geographical view.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

User Def. Point Colour

User defined point colour used in 2D geographical view.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

User Def. Line Colour

User defined line colour used in 2D geographical view.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

User Def. Poly Colour


User defined polygon colour used in 2D geographical view.

Specify colour by changing values for Red, Green, Blue and Alpha. Set custom colour by clicking the box to the right far end of dialog box.

## Select colors dialog box

is used to change and tune the colour setting for items in the geographical view.

### How to open

Custom colour setting, click the  box to the far right end of the colour setting dialog box.

### Description

Use this dialogue box to make custom colour.

### Details

Basic colors

Click on any of the boxes to select a predefined basic colour.

Custom colors

If you have created custom colours, click on any of the boxes to select a custom colour. To create new *Custom colors*, select a colour from the colour palette and click **Add to Custom colors**.

To specify colour, enter *Hue*, *Sat* (saturation), *Val* (value for luminance), *Red*, *Green* and *Blue* values for desired colour. Alternatively, colour can be changed by moving the cross in the colour palette. Alternatively, luminance can be set by dragging the arrow pointing the bar to the far right.

*Alpha channel* indicates how opaque the colour setting will be.

## Tools menu: Functions and dialog boxes

### Topics

[External Sensors dialog box, page 120](#)

[SVP Editor \(Web\), page 122](#)

[PU Replayer dialog box, page 123](#)

[Data Distribution Configuration dialog box, page 123](#)

[Parameter Setup dialog box, page 124](#)

[SVP Editor \(legacy\), page 125](#)

[Helmsman, page 125](#)

### External Sensors dialog box

All changes to external sensors are set in this dialog box.

#### How to open

Select **External Sensors** on the **Tools** menu.

#### Description

The **External Sensors** dialog box is used to define interfaces to external sensors that are attached directly to the computer.

#### Note

---

*Interfaces to external sensors that are attached to the Processing Unit (PU) are defined in the Installation parameters.*

---

#### Details

Sound velocity probe

Set up the sound velocity probe.

Probe available

Select the check box if you have a sound velocity probe available.

Probe type

Select the probe type from the list.

Realtime tide

Set up the real time tide.



Realtime tide available

Select the check box if you have real time tide available.

Realtime tide port

Select the port for the real time tide.

Applanix

Set up sensors from Applanix.

Interval for new line

Select how many minutes between each sensor data.

Source port for ATH data

Select the port for the heave data.

ATH log parameters

Set the data for the ATH parameters.

Start Applanix Pos MV True Heave logging

Start logging the true heave data.

PPP log parameters

Set the data for the PPP parameters.

Start Applanix Pos MV raw GPS logging

Start logging the GPS data.

Auto pilot

Set up the auto pilot data.

Auto pilot available

Select the check box if you have auto pilot available.

Auto pilot port

Set up the auto pilot port.

Dyn pos

Set up the dynamic positioning data.

Serial

Select if the dynamic positioning is connected with a serial line.

Dyn pos port

Select the port for the dynamic positioning.

LAN

Select if the dynamic positioning is connected with a LAN.

Dyn pos IP address

Select the IP address for the dynamic positioning.

Depth below keel

Set up the DPT data.

Depth below keel available

Select the check box if you have depth below keel available.

Seapath

Set up Seapath sensors.

RTCM log parameters

Set the data for the RTCM parameters.

Start Seapath RTCM logging

Start logging the RTCM data.

Source port for Seapath RTCM data

Select the port for the RTCM data.

SRH log parameters

Set the data for the SRH parameters.

Start Seapath real heave logging

Start logging the real heave data.

Source port for SRH data

Select the port for the SRH data.

COM port settings

Select the port settings for the COM port.

## SVP Editor (Web)

This is a program to edit the sound velocity profile. You have to convert your sound velocity data to .asvp before they can be used. From SIS 5.9 the SVPEditor accepts native formats from Valeport and AML, making it easy to use their native file formats.

### How to open

On the **Tools** menu, select **SVP Editor (Web)**.

### Description

In order to have accurate depth determination, you must know the sound velocity profile in the survey area. This profile may change with both time and position in the survey area. It may be necessary to determine the profile several times during a survey. The profile is stored as a file and sent to the Processing Unit.

SIS uses the depth information generated in the Processing Unit. This means that the depth points have been generated using the sound speed profile.

## PU Replayer dialog box

This is the replayer for the SIS.

### Prerequisites

The computer must be connected to a network for replay to work. A virtual loopback network is sufficient.

### How to open

On the **Tools** menu, select **Replay**.

### Description

Use the processing unit replayer to go into details of your recorded files.

### Details

Select folder

Select folder opens a standard explorer window. Browse to where the replay files are.

Speed

Select either real time or fixed speed.

Realtime

Selecting **Realtime** will attempt to send the datagrams at the speeds they were recorded in.

Fixed

Selecting Fixed can be used to send the datagrams at a slower interval. This can be used for easier debugging.

## Data Distribution Configuration dialog box

Select datagrams to send to given IP addresses on the network.

### How to open

Select **Data Distribution** on the **Tools** menu.

### Description

Use this dialog box to distribute datagrams from one source to up to four different destinations. Up to ten sources can be set up.

## Details

### Parameter Setup dialog box

Edit parameters and limits.

#### How to open

On the **Tools** menu, select **Parameter Setup**.

#### Description

Set many different parameters in this dialog box.

## Details

### Ship

Type in values to set how the ship looks in the geographical view.

### Positions

Type in error limits and filter settings for the positioning.

### Display

Type in settings for the geographical view.

### Logging

Type in logging parameters.

### Sound speed

Type in sound speed error limits and other sound speed parameters.

### Error model parameters

Type in values for total propagation error.

### Sensor options

Type in values for alarm settings for loss of attitude data.

### Startup options for system

Type in values for how SIS and the processor unit is starting up.

### Corridor adjustment

This settings are used to control the outer beam angles of the EM®-system.

## SVP Editor (legacy)

This is a program to edit the sound velocity profile. You have to convert your sound velocity data to .asvp before they can be used.

### How to open

On the **Tools** menu, select **SVP Editor**.

### Description

In order to have accurate depth determination, you must know the sound velocity profile in the survey area. This profile may change with both time and position in the survey area. It may be necessary to determine the profile several times during a survey. The profile is stored as a file and sent to the Processing Unit.

SIS uses the depth information generated in the Processing Unit. This means that the depth points have been generated using the sound speed profile.

### Details

#### Primary svp

Select the primary sound velocity profile from the list. Select **Open** on the **File** menu to add profiles to the list.

#### Secondary svp

Select the secondary sound velocity profile from the list. Select **Open** on the **File** menu to add profiles to the list.

#### Copy row

Copy the selected row to edit it.

#### Delete row

Delete the selected row.

#### Reset selections

This removes all selections from the list of depth/speed points.

#### Redraw

Redraw the sound velocity profile after editing.

## Helmsman

The **Helmsman** program provides steering guidance of the ship relative to planned survey lines. This view applies to all instruments.

### How to open

Select **Helmsman** on the **Tools** menu.

### **Description**

A line may have several waypoints, and the DTK, XTE, CMG and DST 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 have to steer port or starboard to relocate. Before the ship reaches the start of the line, the indicator will form an arrow pointing downwards.

When reaching the end of the line (or before entering the line) the Helmsman view will continue to show the ship's position relative to the continuation of the last line segment of the planned line.

### **Note**

---

**Helmsman** or *Helmsman Display* view must be active when SIS is controlling the *Autopilot*.

---

# Multiple Disks for logging

SIS is capable of handling a pool of disks dedicated for data logging. SIS will always keep the information about the currently used raw data disk and paths. When SIS is re-started this information is used to resume operations in the same context as before.

## Note

---

*At first start of SIS after installation, SIS will ask for location of Raw Data Disk and Grid Data Disk.*

*To use Multiple disks option, select Enable Multi Raw Disk support.*

---

The major properties of this solution are:

- A pool of minimum two or more prepared disks dedicated for data logging.
- Logging can continue uninterrupted for as long as there is an alternate disk with free capacity available in the disk pool.
- A full disk can be dismounted and physically removed from the system while SIS is still actively logging on another disk.
- It is possible to mount, at any time, any number of new empty disks to simply replace a full or previously removed disk, or to extend the number of available disks for continued logging.

## Note

---

*SIS will not handle the issue of mounting and dismounting disks or assigning disk letters. Refer to standard Windows practise on how to do these tasks.*

---

Using this solution it is therefore no longer necessary to stop SIS to copy the logged data and clear the full disk before SIS can be restarted again and logging can continue.

The current status of all mounted disks belonging to the data disk pool can be inspected by opening a web page *Multidisk Management* using URL address, <http://localhost:8188/> This web page can be opened on any computer in the network (provided that the access rights to the Hydrographic Work Station is OK). It is vital that this web page is consulted before any disk is removed (dismounted) as it will display which disk is actively used and which disk can be safely removed.

To avoid unnecessary system load this disk monitoring task is performed at intervals, typically some minutes apart. The interval is a system constant and can not be changed by the operator.

It is an essential requirement that the disks included in the dedicated data disk pool must be recognizable by SIS. Only the relevant disks should be used for logging and they must be distinguished from any other disks available on the SIS computer or on the connected network.

A simple solution to this requirement is to use the disk volume label. By naming each individual disk in the pool according to a simple naming rule SIS will be able to manage the disks in the pool independent from any others disks.

## Topics

[Install multiple disks, page 128](#)

[Remove current active disk \(special case\), page 129](#)

[Multiple disk issues, page 131](#)

# Install multiple disks

The installation and use of the multiple data disk feature is described below.

## Prerequisites

At least one data disk should be prepared before the installation commences. The preparation is usually done in an other PC than the Hydrographic Work Station. Follow the steps below to do this.

## Procedure

- 1 Mount the relevant disk and open a Windows File Explorer.
- 2 Locate the relevant disk in the node tree. Right-click the disk representation (icon) and select *Rename*.
- 3 Enter a new name of the disk consisting of the name base (default is RAW) and a sequence number (e.g. 00). The result should be like RAW00.
- 4 Mount the new disk in the SIS Hydrographic Work Station.
- 5 Repeat the steps above when preparing additional disks. Make sure the sequence number is increment for each disk. It is not necessary to have an uninterrupted sequence. Gaps are allowed. However, the sequence number must be a number with no additional inclusions of letters or symbols, e.g. RAW0\_01 is illegal.

## Result

No other information apart from the volume label is necessary to prepare a disk. The required directory structure will be created automatically by SIS when the disk is used.



## Remove current active disk (special case)

SIS will always keep the information about the currently used raw data disk and paths. When SIS is re-started this information is used to resume operations in the same context as before. To dismount and remove the current disk in a safe manner therefore requires some specific handling to secure that SIS operation is disrupted.

There are now two different alternative methods to remove the current log disk and using the SIS Multiple Disk fallback feature.

### Alternative 1.

#### Using the SIS Multiple fallback feature.

When SIS has been installed with the Multiple option it will automatically search for an available new logging disk when the current is disk is full. When SIS is re-started this automatic search feature has been extended to also cover the case where the expected current disk is not found. This fallback feature is simple: First, SIS will try to find any unused disk according to standard multiple naming rules (e.g. RAW05). If not successful SIS will resort to using disk C: as final alternative.

Use the following operational procedure to remove the currently used logging disk:

- 1 Make sure an additional disk that complies with the multiple naming rules, and with free capacity, has been mounted as described in the Installation chapter.
- 2 Stop SIS
- 3 Dismount and remove the current disk by using the appropriate operating system resources or tools as indicated in the Restrictions section below.
- 4 When SIS is re-started an alternative disk has automatically been select for logging.

#### Note

---

*If the C: disk is selected as the new logging disk this must be corrected as soon as possible. The C: drive should normally never be used for raw data logging purposes. Prepare a new disk, with free capacity, according to the multiple naming rules and mount it into the system as described in the Installation chapter.*

---

### Alternative 2.

#### Using disk substitution.

This alternative is essentially a disk swap where the new disk has the same drive letter as the current (old) disk.

Follow the operational procedure below to perform the swap:

- 1 Note the disk letter of the current disk.
- 2 Stop SIS.
- 3 Dismount and remove the current disk by using the appropriate operating system resources or tools as indicated in the Restrictions section below.

- 4 Mount a new replacement disk (or copy and empty the current disk) and make sure it has the same drive letter as the disk removed in step 1. Again use the operating system resources to change the drive letter if necessary. (E.g. use the **Disk Management** settings found in the **This PC** and **Manage** view or alternatively by right-clicking in the lower-left corner of the screen, and select **Disk Management**. Next, right-click the new disk and select **Change Drive Letter and Paths**.
- 5 When SIS is restarted it will use the remembered drive letter and find the appropriate disk.

### Restrictions

#### 1 Disk types

SIS will allow the following types of disks to be prepared as legal disks for multiple data disk logging:

- Removable disks, e.g. USB
- Fixed disks.
- Network drives.

#### Note

---

*The following types can not be used:*

- *CD/DVD/BD drives*
  - *RAM disks*
- 

- 2 Due to the transitory status of the data disks when using the multiple data disk feature (i.e. the disks can be removed by the operator) they should not be used for any other purposes. The following items summarize some major issues:

#### Note

---

*During installation never set the grid drive and the raw data drive the same.*

---

This will work initially, but will cripple the purpose of using the multiple .kml data disk feature as the grid disk must never be removed, or SIS will crash.

#### Note

---

*Do not use the data disks for any other purpose than for logging of data from the echo sounders. Specifically do not use them for logging of Javad and Trimble, ATH, PPP, RTC or SRH data.*

---

The default storage directories for Javad and Trimble, ATH, PPP, RTC and SRH is now moved to the grid drive, as set during the installation. To change the default storage directories see the **Runtime parameters**→**GPS and Delayed Heave** frame.

If any of these storage directories is changed to use the .kmail data disk this may block the dismount of this disk and also cause SIS to crash if the disk is removed.

3

Note

---

*SIS will not handle the issue of mounting and dismounting disks or assigning disk letters.*

---

This must be accomplished outside of SIS by using the operating system resources or external tools like hard drive hot swap applications.

The standard Windows operating system resources for this handling is the *Safely remove and eject hardware* tool on the taskbar and the *Disk Management* and *Device Manager* tools found in the **Computer**→**Manage** frame.

4 *Internet Explorer 10* and *Google Chrome* have been used for testing on Windows 7 and XP to show the data disk management status. Any other browser can not be guaranteed to show the web page correctly, but should work in principle. Not using a compatible browser can result in an inaccurate display of the status information, e.g. missing colors or a missing status field.

5 The multiple data disk logging feature will currently work for only one started echo sounder in SIS.

Note

---

*Never start a second echo sounder in the same SIS instance. The multiple data disk management system is currently able to handle only one active echo sounder.*

---

## Multiple disk issues

SIS will not handle the issue of mounting and dismounting disks or assigning disk letters. Refer to standard Windows practise on how to do these tasks.

The task of dismounting, ie removing, a disk from the system, is in principle simple, but may sometimes encounter problems. A short description of the problems and some suggested solutions are presented below.

The standard Windows resource for handling this task is the 'Safely remove Hardware and Eject Media' tool on the taskbar, - and the 'Disk Management' and 'Device Manager' tools found in the 'This PC->Manage' frame or alternatively by right-clicking in the lower-left corner of the screen and do the selection.

When using the 'Safely remove Hardware and Eject Media' the operation may sometimes report back that the disk is still in use and the device can not be ejected. The following is a suggestive list of actions to try to solve the problem:

- Try again several times if the problem persists as it might be the OS (Operator System) that is using the device( for e.g. virus- or indexing operations...).
- If SIS is running, make sure that SIS is not using the disk by checking the disk monitoring web page (see chapter 'Monitor Multidisk status'). If SIS is running and using the disk, SIS must be stopped before trying again.
- If the problem still persists it may still be safe to remove the disk! Open the 'This PC->Manage->Storage->Disk Management' frame. In the graphical bottom half of the page open the 'Properties' page for the relevant disk.
- If previous step is not relevant another option is to put the disk in offline mode before removing it:  
In *File browser*, select *This PC*, from *System* menu select *Manage*. In the Computer Management view, select *Storage* and *Disk Management*. In the bottom half of the view, select *Offline* for the relevant disk (right-click).  
Remove the disk.  
Remember that when the disk is introduced into the system again it must be put in *Online* mode before it can be used.
- If all else fails, stop SIS, stop the computer and remove the disk.

# Remote operation

## Topics

[Remote operation, page 134](#)

[Connect Remote Operator PC to MQTT message broker, page 135](#)

[Connect HWS on the vessel to MQTT message broker, page 135](#)

[Autonomous survey operation, page 136](#)

[Connecting to Blue Insight, page 137](#)

[Realtime Data Controller, page 138](#)

[Helmsman Display, page 138](#)

[Blue Insight, page 139](#)

## Remote operation

SIS 5 has the capability to operate the EM-system from a remote location. The EM-system can be installed on one survey vessel and the operator can be located on shore or on a different vessel in the vicinity.

### Description

SIS 5 Server is installed on the vessel carrying the EM-system and the SIS 5 Client is installed at the remote location. There must be a network connection between the two, and depending on the price and bandwidth of this carrier more or less data are transferred from Server to Client.

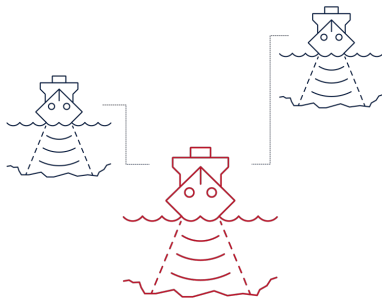
Since SIS 5.9, the licenses for SIS with SIS Remote is only needed on the boat.

### Description

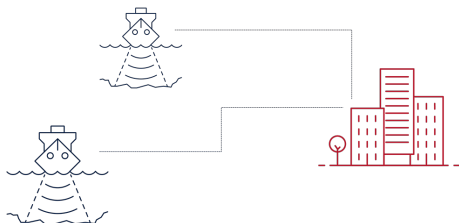
#### Remote operation from shore or another vessel

Remote operation from shore or from another vessel is set up in the same way.

#### Remote from ship



#### Remote from shore



In both previous figures SIS 5 Server is installed on the survey vessels, and SIS Client is installed either on the mothership or on a PC on shore. In both cases the SIS 5 Client displays data from all survey vessels in the same display, and can control each EM-system independently. In this configuration a permanent network connection is assumed between SIS 5 Server on the launches and SIS 5 Client on the mothership or in shore.

If the network connection is not very reliable, SIS 5 Server will still be able to log the data, and transmit the data to the mothership when the connection is restored.

## Connect Remote Operator PC to MQTT message broker

The MQTT message broker must be installed and configured.

Select **View** on the **Main** menu.

Select **Remote Operator settings** on the **View** menu.

Select **Blue Insight Connector** on the **Remote Operator Settings**

Pay attention to following fields:

- *Server URL or Ip-adress*: This is the IP-address of the MQTT message broker. Please refer to the network configuration to find this address.
- *Remote operation*: This switch must be set to Remote Operation (NB. Label of this switch changes when switched)
- *Vessel(s)*: Write the vessel(s) you want to subscribe data from. The vessel names here must correspond with the ones configured on the actual vessel.

If MQTT broker is set up with credentials and/or special port. Advanced settings must be configured:

- *Server client id*: Optional field.
- *Server Port*: Recommend using port 443, since this port is open by default in most firewalls.
- *Server User*: Username on MQTT broker.
- *Server password*: Password on MQTT broker.


After configuration is finished click **save** and restart SIS.

## Connect HWS on the vessel to MQTT message broker

Remote operator PC must be connected to MQTT message broker, before connecting the HWS.

### **Enable remote vessel control**

Connect SIS 5 Remote on the survey vessel to reach the MQTT message broker.

Select **Preferences** on the **View** menu or the  button in the top right corner.

Select **Application** folder. At **Vessel Remote Controlled** select the check box to enable remote vessel control.

It is required to restart SIS after this setting. It is required to restart SIS after enabling remote vessel control.

**Note**

---

*It is required to restart SIS after this setting.*

---

Select **View** on the **Main** menu.

Select **Remote Operator settings** on the **View** menu.

Select **Blue Insight Connector** on the **Remote Operator Settings**

Pay attention to following fields:

- *Server URL or Ip-adress*: This is IP-address of the MQTT message broker. Refer to network configuration to find this address.
- *Vessel mode*: Set switch to Vessel mode (NB. Label of this switch changes when switched).
- *Vessel name*: Write the name of the vessel here. You will be using this name to subscribe to data from this vessel when configuring remote location.

If MQTT broker is set up with credentials and/or special port. **Advanced settings** must be configured:

- *Server client id*: Optional field
- *Server Port*: Recommend using port 443, since this port is open by default in most firewalls.
- *Server User*: Username on MQTT broker
- *Server password*: Password on MQTT broker

**Note**

---

*After configuration is finished click **save** and restart SIS.*

---

## Autonomous survey operation

In this case the survey vessel is running in autonomous mode. This situation can also be illustrated by the second figure, the only difference is that in autonomous mode the network connection between the survey vessel and shore is not available all the time. This link can be broken for hours while the survey vessel is operating in autonomous mode.



## Connecting to Blue Insight

Both Remote Operation and Autonomous operation can be connected to Blue Insight.



When SIS 5 Remote Operation is set up with a mothership, data from all survey launches are transmitted to the mothership. From there data from all EM-systems are sent to Blue Insight over a network connection. From Blue Insight the progress can be monitored from anywhere on the network.

The same thing happens if the survey launches are controlled from shore. Then data from the launches are sent to Blue Insight over a regular network connection.



In autonomous mode there is no permanent network connection between SIS 5 on the boat and SIS 5 on shore. However, SIS 5 can be set up on the survey vessel to transmit some data at regular intervals to Blue Insight directly over a network connection. From Blue Insight the progress can be monitored from anywhere on the network. This provides the operator with a very good situation report to verify that the autonomous operation is going as planned.

## Realtime Data Controller

Setting of realtime data rate transfer to remote receiver is set in this dialog box.

### How to open

On the **View** menu, select **Remote Operator Settings** and **Realtime Data Controller**.

### Description

- *Across track (beams)*  
Number of beams in the ping to transfer  
Click **Enable** to activate this data transfer.
- *Along track Update*  
Set time for how often to update.  
Click **Enable** to activate this data transfer.
- *Display data*  
Display data is the item that uses the most bandwidth. If there is no need for Crosstrack and Beam Intensity, this item should be off.  
Set time for how often to update.  
Click **Enable** to activate this data transfer.
- *NumDisp data*  
NumDisp data is a separate item that uses less bandwidth then Display data.  
Click **Enable** to activate this data transfer.
- *Position Update*  
Set time for how often to update.  
Click **Enable** to activate this data transfer.
- *Terrain Upload*  
Set time for how often to update.  
Click **Enable** to activate this data transfer.

## Helmsman Display

The SIS 5 Helmsman's Display can always be installed on the survey vessel. The helmsman can always see exactly what is going on with the EM-system even though it is being controlled from a remote location.

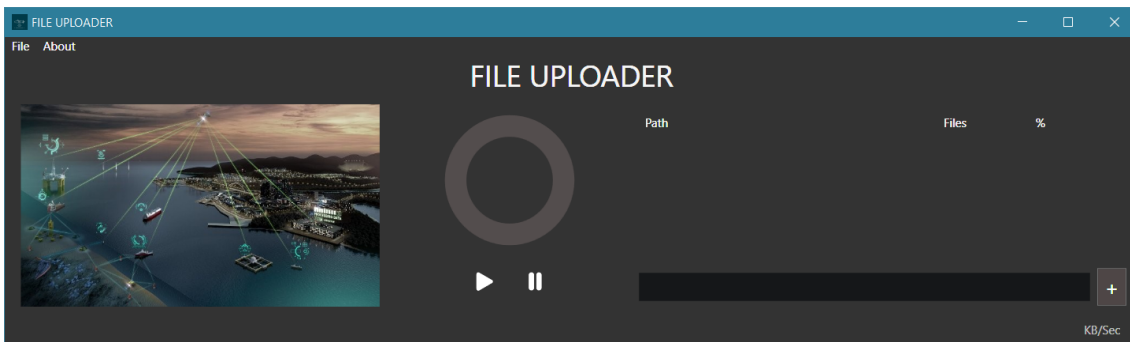
## Blue Insight

SIS 5 has the capability to operate the EM-system from a remote location. Blue Insight is Kongsberg's cloud solution.

### Description

SIS is installed on a virtual machine, running in Blue Insight. This virtual machine can be accessed from anywhere in the world with an internet connection. When you are running SIS on a virtual machine, it looks just like a normal version of SIS. Thanks to SIS Remote's very moderate bandwidth requirements, typically only 30 kB/s, SIS Remote will run smoothly even over satellite connections.

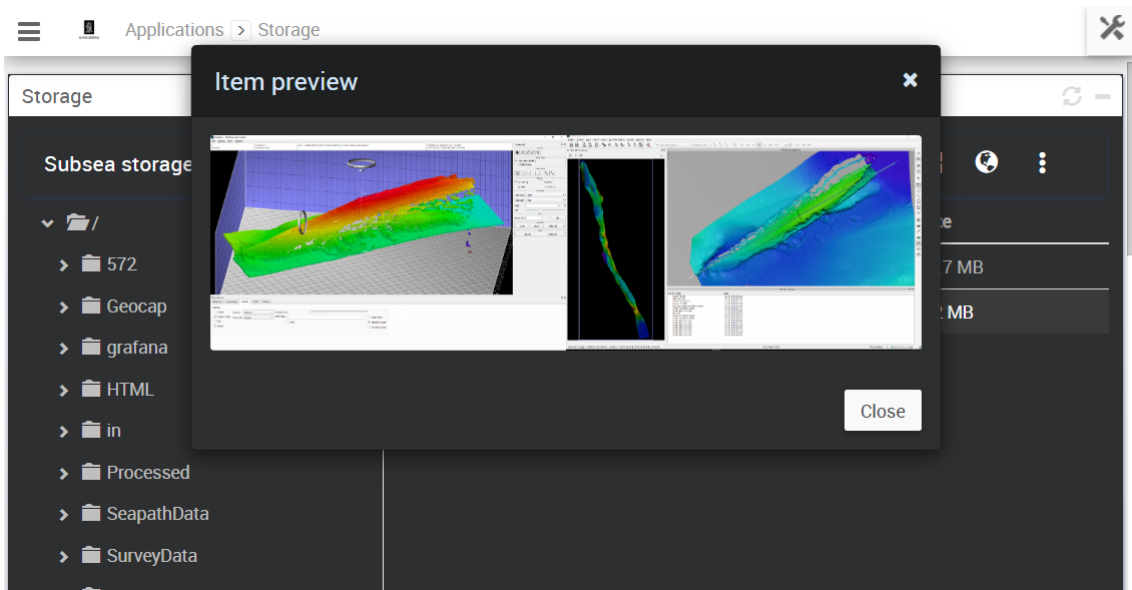
### File Uploader



File Uploader can run both as a service in the background on the computer on the ship, or as a desktop application. With File Uploader it becomes easy to upload files from a local computer to Blue Insight. Using the desktop version allows the operator to simply drag-and-drop files from Windows file explorer to File Uploader to copy files. When you are running File Uploader as a Windows service, any files copied into a specified directory on the local computer will be copied to Blue Insight automatically.

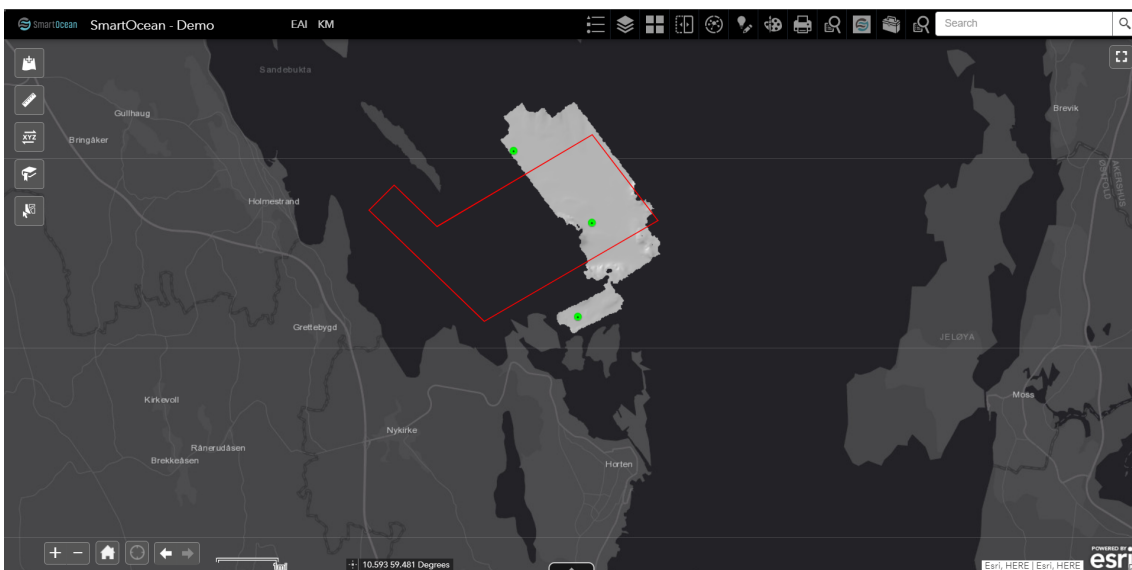
### Accessing files in Blue Insight

Accessing the files in Blue Insight is done through a web browser. Simply log into the Blue Insight storage and you will handle the files using a file explorer very similar to a regular Windows file explorer. There is also a preview of some file types. Once the files are in Blue Insight, any regular program for making maps can be used to process the data further into a map product.



### Sending data to other cloud services

Other software vendors like Earth Analytic can be given access to the data to provide further processing possibilities in the cloud.



The owner of the data in Blue Insight owns the data exclusively. Access must be granted explicitly to others if they are to use them.

# Helmsman

## Topics

[Helmsman, page 142](#)

[File menu, page 142](#)

[View menu, page 143](#)

[Tools menu, page 143](#)

## Helmsman

The **Helmsman** program provides steering guidance of the ship relative to planned survey lines. This view applies to all instruments.

### How to open

Select **Helmsman** on the **Tools** menu.

### Description

A line may have several waypoints, and the DTK, XTE, CMG and DST 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 have to steer port or starboard to relocate. Before the ship reaches the start of the line, the indicator will form an arrow pointing downwards.

When reaching the end of the line (or before entering the line) the Helmsman view will continue to show the ship's position relative to the continuation of the last line segment of the planned line.

### Note

---

**Helmsman** or *Helmsman Display* view must be active when SIS is controlling the *Autopilot*.

---

## File menu

In the **File** menu you can start surveys and save parameters.

### How to open

Open the **File** menu from the **Main** menu.

### Description

- **Close Survey**  
Select which open survey to close.
- **Open Terrain Model**  
Select the terrain model you want to use.
- **Import GeoTiff Images**  
Select where to find the GeoTIFF images.
- **Unload GeoTiff Images**  
Remove the GeoTIFF images from the view.

- **Load from file**
- **Load Preferences**
- **Save Preferences**
- **Exit**  
Close the program.

## View menu

Select all the views and change the display settings in the view menu.

### How to open

Select **View** on the **Main** menu.

### Description

- **Palettes**  
A choice of colour palettes is available to fit ambient light conditions.
- **Colour Setup**  
All the colours in the different views can be customised. The **Colour Setup** dialog box lets you change the ones in the geographical view.  
[Colour Setup dialog box, page 90](#)
- **Helmsman Display**  
The *Helmsman Display* view provides steering guidance of the ship relative to planned survey lines. This view applies to all instruments.  
[Helmsman Display view, page 64](#)
- **Preferences**  
[Preferences dialog box, page 115](#)

## Tools menu

The **Tools** menu contains options for the operation of SIS.

### How to open

Select **Tools** on the **Main** menu.

### Description

- **Planning**

- **Open Job**
- **Save Job**
- **Save Job As**
- **Clear Job**

You plan a job by adding lines in the geographical view.



# SVP Editor

## Topics

[SVP Editor \(Web\), page 146](#)

[SVP Editor \(legacy\), page 150](#)

## SVP Editor (Web)

This is a program to edit the sound velocity profile. You have to convert your sound velocity data to .asvp before they can be used. From SIS 5.9 the SVPEditor accepts native formats from Valeport and AML, making it easy to use their native file formats.

### How to open

On the **Tools** menu, select **SVP Editor (Web)**.

### Description

In order to have accurate depth determination, you must know the sound velocity profile in the survey area. This profile may change with both time and position in the survey area. It may be necessary to determine the profile several times during a survey. The profile is stored as a file and sent to the Processing Unit.

SIS uses the depth information generated in the Processing Unit. This means that the depth points have been generated using the sound speed profile.

### Topics

[File menu, page 146](#)

[View menu, page 147](#)

[Tools menu, page 147](#)

[Defining a new filter, page 148](#)

[Converting the SVP file to .asvp, page 148](#)

## File menu

Select the **File** menu to open, save and close the sound velocity profiles.

### How to open

Open the **File** menu from the **Main** menu.

### Description

- **Open**  
Select the sound velocity profile you want to see.
- **Save SVP**  
The file will be saved in the format it already has.
- **Close SVP**  
Close all sound velocity profiles that are opened.

## View menu

Select all the views and change the display settings in the view menu.

### How to open

Select **View** on the **Main** menu.

### Description

- **File Info**  
Information about the selected sound velocity profile.
- **Sound Velocity Profile**  
Show/hide the Sound Velocity Profile view.
- **Raypath**  
Raypath is a tool for spotting errors in the sound velocity profile.
- **Filter**  
Make a new filter, open a filter or add temperature and salinity to the sound velocity profile.

## Tools menu

Find the tools for editing the sound velocity profile here.

### How to open

Select **Tools** on the **Main** menu.

### Description

- **Check Profile**  
**Check profile** checks that the sound speed profile doesn't contain upwards bends in the depth or duplicates, one fault after the other. The table shows which points to remove.
- **Fix Profile**  
Fix profile checks that the sound speed profile doesn't contain upwards bends in the depth or duplicates, and removes these points automatically. This is the preferred method for repairing the sound velocity profile.  
  
Extending the profile is done by using the values in the file `C:\ProgramData\Kongsberg Maritime\sisdata\svp_abscoeff\SVPExtension.txt`  
  
This function will normally make a valid profile.
- **Export SVP to SIS**  
The edited SVP will be the current SVP profile used by SIS.

## Defining a new filter

You have to define a new filter for each file type you want to convert to .asvp. This is a procedure for the Web version of the svp editor.

### Context

SIS reads the sound velocity format in the standard .asvp (Ascii Sound Velocity Profile) format. The sound velocity data must be converted to the .asvp format before it can be applied.

### Procedure

- 1 On the **Tools** menu, select **SVP Editor (Web)**.
- 2 On the **View** menu, select **Filter**.
- 3 Select all parameters for the filter in the **Define new filter** section.
- 4 Type a name for the filter in the **Save As** section.
- 5 Type the file's postfix in the **Save As** section.
- 6 Select Save filter in the **Save As** section.

## Converting the SVP file to .asvp

You have to convert your sound velocity data to .asvp before they can be used. This is a procedure for the Web version of the svp editor. From SIS 5.9 the SVPEditor accepts native formats from Valeport and AML, making it easy to use their native file formats.

### Prerequisites

The filter must already be defined for the file type you want to convert.

For more information: [Defining a new filter, page 148](#)

### Context

SIS reads the sound velocity format in the standard .asvp (Ascii Sound Velocity Profile) format. The sound velocity data must be converted to the .asvp format before it can be applied.

From SIS 5.9 the SVPEditor can read native formats from both Valeport and AML, making it easy to use these probes.

New in SIS 5.9 is that **Fix Profile** will perform both extending and thinning of the profile. This will make the SVP file ready for export to SIS.

**Procedure**

1 On the **Tools** menu, select **SVP Editor (Web)**.

In *SVP Editor* view.

2 On the **Tools** menu, select **Fix Profile**.

3 On the **Tools** menu, select **Export SVP to SIS** .

## SVP Editor (legacy)

This is a program to edit the sound velocity profile. You have to convert your sound velocity data to .asvp before they can be used.

### How to open

On the **Tools** menu, select **SVP Editor**.

### Description

In order to have accurate depth determination, you must know the sound velocity profile in the survey area. This profile may change with both time and position in the survey area. It may be necessary to determine the profile several times during a survey. The profile is stored as a file and sent to the Processing Unit.

SIS uses the depth information generated in the Processing Unit. This means that the depth points have been generated using the sound speed profile.

### Details

#### Primary svp

Select the primary sound velocity profile from the list. Select **Open** on the **File** menu to add profiles to the list.

#### Secondary svp

Select the secondary sound velocity profile from the list. Select **Open** on the **File** menu to add profiles to the list.

#### Copy row

Copy the selected row to edit it.

#### Delete row

Delete the selected row.

#### Reset selections

This removes all selections from the list of depth/speed points.

#### Redraw

Redraw the sound velocity profile after editing.

### Topics

[File menu, page 151](#)

[Tools menu, page 151](#)

## File menu

Select the **File** menu to open, save and close the sound velocity profiles.

### How to open

Open the **File** menu from the **Main** menu.

### Description

- **Open**  
Select the sound velocity profile you want to see.
- **Open in editor**  
The **Raw Svp File Editor** is a separate program to edit the SVP files. It can be used to convert other files to .asvp and to edit the .asvp files themselves.
- **Save as**  
Save the current file as .asvp, .actd, .csv or any other SVP file.
- **Save primary svp**  
Save the primary svp to its original file. The original file is overwritten.
- **Send primary svp to SIS**  
Information about the primary svp is sent to SIS where all mean absorption coefficients are recalculated using the depths found in the .asvp file. If the selected profile have no associated absorption coefficients files, a warning message is issued, and no absorption coefficients file updates will be done.
- **Close primary svp**  
Close the primary svp file and remove it from the editor. It is not saved.
- **Close all**  
Close all sound velocity profiles that are opened.

## Tools menu

Find the tools for editing the sound velocity profile here.

### How to open

Select **Tools** on the **Main** menu.

### Description

- **Check Profile**  
**Check profile** checks that the sound speed profile doesn't contain upwards bends in the depth or duplicates, one fault after the other. The table shows which points to remove.
- **Check profile automatic**

**Check profile automatic** runs several checks on the profile until all faults are found.

- **Extend Profile...**

Extend the profile with another file with a different depth.

- **Extend Profile**

Extend Profile extends the current profile to 0 – 12,000 metres.

- **Replace primary with data from secondary**

If the primary svp contains depths from 0 to 12,000 metres and the secondary contains data from 0 to 100 metres, the values from 0 to 100 metres in the primary svp will be replaced with the data from the secondary svp.

- **Thin Profile**

Thin Profile removes some points from the sound velocity profile.

- **MDM 500**

MDM 500 is a *Marine Data Management* system for general purpose data logging.

For more information visit Kongsberg Maritime at <https://www.kongsberg.com/maritime>



# Calibration

## Calibration dialog box

For maximum reliability and accuracy of the seabed mapping, the SIS and its sensors must be calibrated before first use.

### Prerequisites

All sensors must be accurately surveyed with respect to the vessel's reference point and with respect to the vessel's reference plane during installation of the system. The physical alignment of the sensors and the dimensional survey must be finished before calibrating.

The tide and the sound velocity profile must be correct.

### How to open

On the **Tools** menu, select **Calibration**.

### Description

The intention of the SIS calibration is to find remaining biases in the installation angles and to find any time synchronization biases between the systems. The biases can originate from transducer alignment, from the alignment of the attitude sensor or be caused by time synchronization differences between the sensors.

The correct calibration of the vessel's attitude sensors as well as determining the time delay of the positioning system is vital to the quality of the depth data determined by the multibeam echo sounder.

The calibrations should be repeated until the calibration results are within  $\pm 0.1^\circ$ .

## File menu

In the **File** menu you can send the calibrated values to SIS and exit the **Calibration** program.

### How to open

Open the **File** menu from the **Main** menu.

### Description

- **Send Parameters**  
Send the calibrated values to SIS.
- **Exit**  
Close the program.

# Concept descriptions

## Topics

[About Clock setup, page 156](#)

[Vessel coordinate system, page 159](#)

[Constant corridor width, page 161](#)

[Absorption coefficient, page 162](#)

[Calibrate a dual head system, page 165](#)

[Processing grid, page 167](#)

[Map objects, page 168](#)

[Projections, page 168](#)

[Geoid, page 169](#)

[Tide, page 172](#)

[Faulty depth value detections, page 174](#)

[kmall datagram, page 176](#)

## About Clock setup

Time synchronization between the echo sounder, the motion sensors and the positioning system is vital in order to achieve the best possible accuracy. The requirement for 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 PU 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 PU 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 (one 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

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*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

---

*The GGA positioning datagram does not contain any date entry. A parameter setting from the operator station allows a manual setting of the clock.*

---

## Time stamp

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 are small. The manufacturer's estimate of delay should be used, and a possible prediction facility in the sensor should not be used. As the attitude data may be logged as a continuous time record, it is possible to post process 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 post processing.

If the variation in the time delay of the positions is too large with respect to the desired accuracy, even after position filtering during post processing, 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 post-processing, 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 post processing 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. It is recommended to synchronize the echo sounder to a 1PPS signal, if available. It is also recommended not to reset the echo sounder clock, except for 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 and logged, this will allow a check of clock consistency during post processing, but this is usually not worth the effort.

The conclusion and recommendations are as follows:

- It is recommended to synchronize the echo sounder to a 1PPS signal if available.
- 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.
- If the delay in the position data is variable and cannot be filtered to a sufficient accuracy in post processing, or the positioning is required to also be accurate for realtime displays, the echo sounder and positioning system clocks must be synchronized.

The synchronization of the two clocks must be done from a common 1PPS signal (which may be contained in the positioning system). The echo sounder must be set up to use the positioning system time stamp (datagram time) to which any position time delay will be applied. The post processing 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 Numerical display can be set to monitor the PU-ZDA and PU-POS time differences. The colour indications used 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.

In most situations the acceptable time difference is +/- 1 sec, but with 1PPS off and time tag from the system the acceptable time difference is considerably larger.

The time delay limitations are system parameters and can not be changed by the operator.

	1PPS On	1PPS Off
D		
A	Timediff +/- 1 sec.	Timediff +/- 1 sec.
T	RED in 'PU-ZDA' field when Ext. clock	RED in 'PU-ZDA' field when Ext. clock
A	RED in 'PU-POS' field when Active pos.	RED in 'PU-POS' field when Active pos.
G	RED in 'PU-POS'* field when Operator st.	RED in 'PU-POS'* field when Operator st.
R		
A		
M		
S		
Y	Timediff +/- 1 sec.	Timediff +/- 30 sec.
S	RED in 'PU-ZDA' field when Ext. clock.	YELLOW in affected field.
T	RED in 'PU-POS' field when Active pos.	
E	RED in 'PU-POS'* field when Operator st.	Timediff +/- 600 sec.
M		RED in affected field.

\* Conceptually not correct, but not able to compare with operator

## Vessel coordinate system

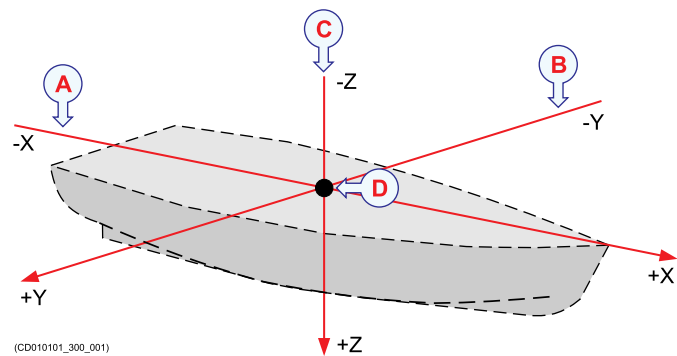
The vessel coordinate system is established to define the relative physical locations of system units and sensors..

When you have several different sensors and transducers on your vessel, and you wish each of them to provide accurate data, you need to know their relative physical positions. The antenna of a position sensor is typically mounted high above the superstructure, while a motion sensor is located close to the vessel's centre of gravity. Both of these are physically positioned far away from the transducer, which may be located closer to the bow. Very often, the information from one sensor depends on data from an other. It is then important that the relevant measurements are compensated for these relative distances.

### Example

If you wish to measure the actual water depth, you will need to know the vertical distance from the echo sounder transducer to the water line. Since the vessel's displacement changes with the amount of cargo, fuel etc, the physical location of the water line on the hull must either be measured at a regular basis, or measured with a second sensor.

In order to establish a system to measure the relative distance between sensors, a virtual coordinate system is established. This coordinate system uses three vectors; X, Y and Z.



- A** *The X-axis is the longitudinal direction of the vessel, and in parallel with the deck. A positive value for X means that a sensor or a reference point is located ahead of the reference point (origin).*
- B** *The Y-axis is the transverse direction of the vessel, and in parallel with the deck. A positive value for Y means that a sensor or a reference point is located on the starboard side of the reference point (origin).*
- C** *The Z-axis is vertical, and in parallel with the mast. A positive value for Z means that a sensor or a new reference point is located under the reference point (origin).*
- D** *Reference point (Ship Origin)*

### Coordinate system origin

The *origin* is the common reference point where all three axis in the vessel coordinate system meet. All physical locations of the vessel's sensors (radar and positioning system antennas, echo sounder and sonar transducers, motion reference units, etc.) are referenced to the origin. In most cases, the location of the vessel's "official" origin

has been defined by the designer or shipyard. This origin is normally identified with a physical marking, and also shown on the vessel drawings.

Frequently used locations are:

- Aft immediately over the rudder (frame 0)
- Vessel's centre of gravity
- The physical location of the motion sensor

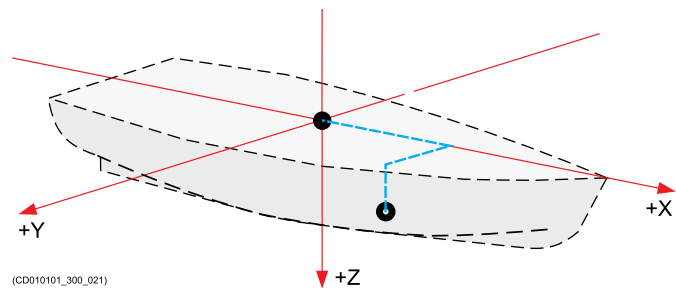
### Coordinate system alternative origins

If necessary, other origin locations may be defined for specific products or purposes. One example is the *Navigation Reference Point* that is frequently used. Whenever a vessel is surveyed to establish accurate offset information, the surveyor may also establish an alternative origin location. Whenever relevant, any such alternative locations must be defined using offset values to the "official" origin established by the designer or shipyard. A commonly used alternative origin is the physical location of the vessel's motion sensor.

### Defining the physical location of each sensor

By means of the vessel coordinate system, the physical location of every sensor can be defined using three numerical values for X, Y and Z. These values must define the vertical and horizontal distances from a single reference point; the origin. The physical location of the motion reference unit (MRU) is often the most important sensor to define. For many systems, the vessel heading is also a critical measurement.

In this example, a second reference point has been established. It is defined with three positive offset values for X, Y and Z. All values are positive because the new reference point is in front of and below the origin, and on the starboard side.



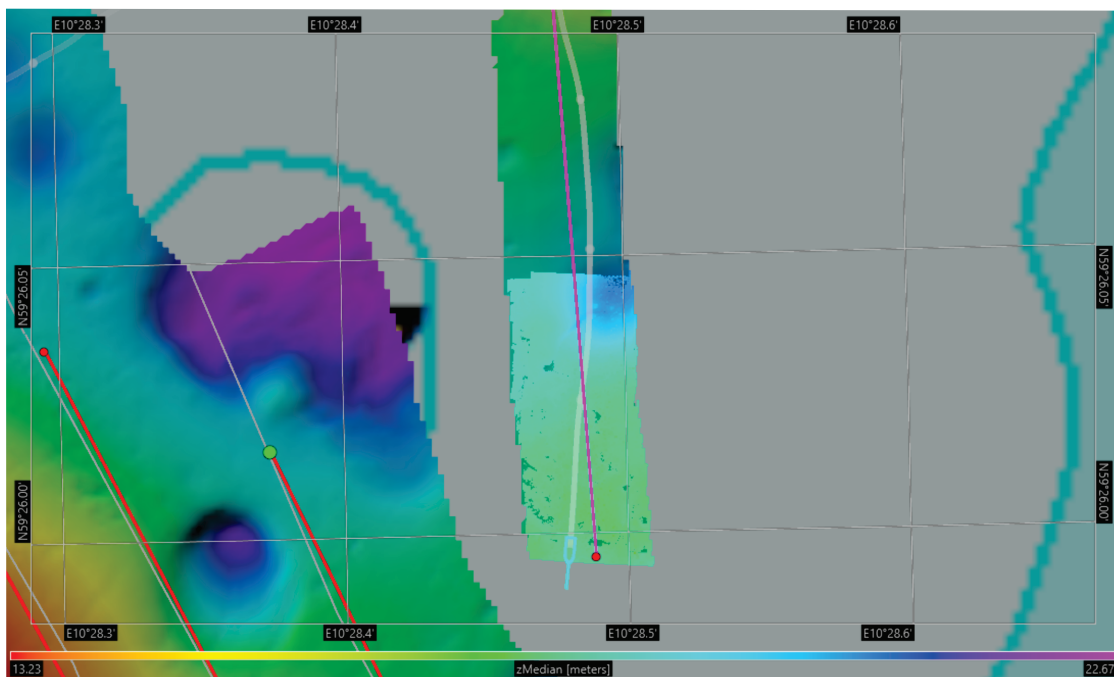
The accuracy of the three numerical values for X, Y and Z defines the accuracy of the sensor data. If you require a high accuracy, for example for underwater positioning, underwater mapping or scientific measurements, you must have each sensor positioned using professional land surveying. For such use, a good alignment survey is critical for high quality results. Surveys are normally done by qualified and trained surveyors using proven survey equipment and methods.



## Constant corridor width

Controlling the outer beam angles will give a constant width of mapping corridor following the planned line.

In **Tools** -> **Parameter Setup** there is a chapter named *Corridor adjustment*. This feature is used to control the outer beam angles of the EM®-system, either from SIS or from an external system.



The effect of this beam control is to be seen in the picture above. As the boat sails down the planned line the outer beam angles are automatically adjusted to keep the corridor width constant and the planned line in centre. The crosstrack offset is sent to the EM®-system with update rate set to 5 seconds by default. Rapid changes in the terrain will cause the edges to be uneven.

SIS will receive UDP-messages on port 4001 either as NMEA APB or XTE sentences from the autopilot

## Absorption coefficient

The absorption coefficient of the water column is used for the gain setting in the receiver. The absorption coefficient is important in determining the correct backscatter strength of the seafloor.

The absorption coefficients in SIS is set using two different sources:

- CTD profile
- Salinity

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.

Absorption coefficients are dependent on the used frequency. All profile sets must therefore contain one absorption coefficient file for each frequency used by the multibeam echo sounders.

The echo sounders will freely change the frequencies during a survey. This require that SIS will recalculate both the salinity based and CTD based absorption coefficients.

### Salinity based absorption coefficient profiles

This type of absorption coefficient profiles is based on a depth and sound speed profile and the currently set salinity value.

#### Note

---

*To use the salinity based file set instead of the CTD file set make sure that the **Source** parameter is set to **Salinity***

---

The depth and sound speed profiles can be obtained from two sources:

- 1 Receiving SSP datagram of format S00 or S10 from the network. (All SSP datagrams results in the generation of an .asvp file which contains the necessary profile).
- 2 The operator may select an ordinary SVP from **Sound Speed Profile in Runtime parameter**.

In both cases a set of absorption coefficient files are generated. All files in a set use the same naming convention: In case of a SSP datagram, 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.

Example of salinity file set based on SSP

```
20191230_183344_salinity_03900.asvp
```

```
20191230_183344_salinity_03900_50kHz.abs
```

20191230\_183344\_salinity\_03900\_60kHz.abs

Example of salinity file set based user selected SVP; Horten20190304.asvp

20190304\_salinity\_03900.asvp

20190304\_salinity\_03900\_50kHz.abs

20190304\_salinity\_03900\_60kHz.abs

#### Note

---

*There is a .asvp file in each file set containing the depth and sound speed data used in the calculations. The .asvp file is named the same as the rest of the files in the set, except that the frequency part is absent. This file is constructed based on the SSP input or the user selected SVP. In the latter case, the file contains exactly the same data as the original SVP file. For example, 'Horten20190304.asvp' and 'Horten20190304\_salinity\_03900.asvp' contains exactly the same data. The duplication and renaming is done so it is simple to retrieve a complete file set including the .asvp file using only the basic file name as key.*

---

A new salinity based absorption coefficient file set is generated in the following instances:

- Receiving a new SSP datagram for immediate use (S00 - S07) from the network.
- Operator select a new SVP is from **Sound Velocity Management**.
- When the **Source** is **Salinity** and the salinity value is changed and no existing file set is found.
- When the user selects **Salinity** as **Source** and no existing file set is found.

## 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 contain the necessary CTD data to calculate the absorption coefficient profiles for all required echo sounder frequencies.

#### Note

---

*To use the CTD based file set instead of the salinity file set make sure that the **Source** parameter is set to **CTD***

---

When received, the SSP datagrams S01, S02, S03, S04, S05, S06 and S07 will result in an automatic and immediate use of the contained information. Therefore it is not necessary for the operator to make a manual selection of the associated SVP.

The name of the CTD based absorption coefficient file sets are 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:

20191230\_183344.asvp

20191230\_183344\_50kHz.abs

20191230\_183344\_50kHz.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**

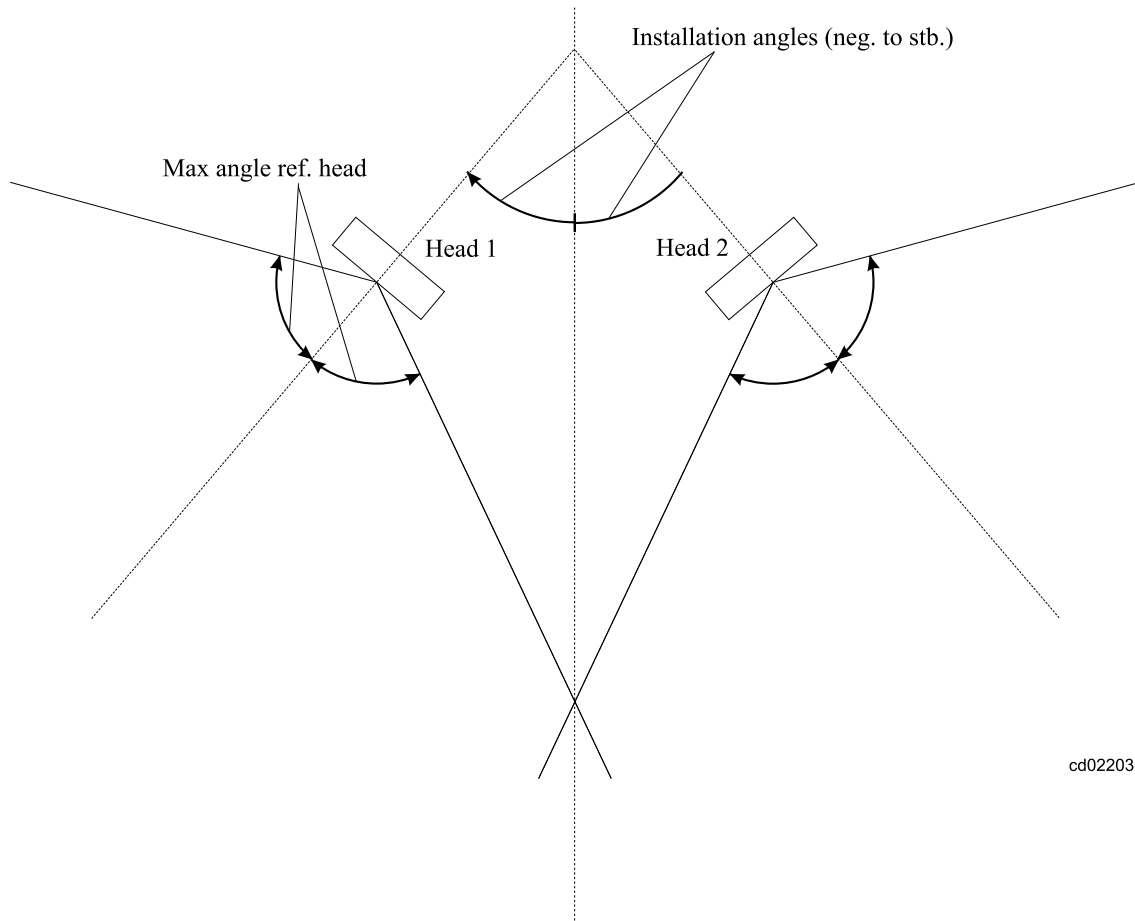
---

*When selecting a SVP, it is regarded as a CTD file set only if the file name does not contain salinity and all frequency files are present.*

---

A new salinity based file set is always generated from the generated .asvp and current salinity. That is, when a CTD based file set is used immediately (S01, S02, S03, S04, S05, S06, S07) a corresponding file set for the currently selected salinity is also made.

## Calibrate a dual head system



cd022033

If you have a multibeam echo sounder with two heads installed there are some additional concerns related to calibration you need to consider:

- You have to determine offset values separately for both heads.
- The heads will normally be installed pointing sideways instead of down calling for a different calibration survey pattern.

### Note

*A valid sound velocity profile must be used to obtain a correct result.*

The calibration should be performed in the following order and the values from each calibrations entered in the system before the next calibration:

- Rough roll calibration.
- Pitch and time delay calibration.
- Heading calibration.
- Roll calibration.

The calibration should be repeated until the calibration results are within  $\pm 0.1$  degree. Use the Calibration module to evaluate the data and determine the offset value.

## Processing grid

The grid engine receives depth point information that includes its north and east coordinates and depth. Ultimately these depth points are used to create a terrain model.

A processing grid file will contain information about each of its cells and their individual depth points. The depth point information from this file is saved to a display grid file before being displayed in the display grid, where they will create the terrain model in the *Geographical* view.

First the depth point information is stored in processing grid files, then three points are stored in a display grid file. These three depth points are the ones with the maximum depth, minimum depth and the median depth. Anyone of these can be used to create a terrain model, but only one type can be chosen at any one time.

The next generation Grid Engine and 3D-graphics in SIS 5 has greatly simplified the definition of the processing grid.

In the **New Survey** dialog box, the type of EM-system in use is detected automatically and the grid cell size of the processing grid is set accordingly.

[New Survey dialog box, page 86](#)

For very advanced users, the grid cell size can still be edited in the file `/programdata/ksis/Kongsberg Maritime/SurveyInfo.ini`. This file contains the definitions used by SIS to set the grid cell size of the processing grid.

## Map objects

Map objects must be configured before use. You must define your object types first. An object type is based on one of the following basic types: line (2D), line (2.5D), i.e. depth contours, area (polygon), point (2D), point (3D), image, video or HTML.

From one of the basic types, you create a new object type with a name and a definition describing how that object type shall be drawn in the map. As an example, a new object type can be coastline, which will be based on line (2D), and it may be drawn as a solid green line two pixels wide.

Once all the object types have been defined, they can be written to a file. This file can then be imported later. This means that you only have to define your object types once, later you simply import them.

In the Geographical view select the KSGPL button to turn on/off object types to display. you can turn on/off all objects or choose which types to see.

The Geographical view changes into KSGPL mode and allows you to edit the objects. You can then add, delete and select objects in the Geographical view.

## Projections

SIS map projections uses the PROJ library. PROJ now supports 7 parameter datum transformation and EPSG-numbers to identify map projections.

In <https://epsg.io/> search for the projection you like.

Tip

---

*32632 is the UTM-projection on the WGS 84 ellipsoid for southern Norway.*

---

Copy the text for PROJ.4 and paste it into SIS projection setup. Change +units=m to +units=cm as SIS uses centimetres rather than metres in projections. Give your projection a name you recognize and save.

The projection setups are stored in files in the directory `\ProgramData\Kongsberg Maritime\ksis` and the file suffix is `.projsetup`. It is possible to define projections into such files directly, and these files can easily be shared with others.

When you create a **New Survey**, you can select this map projection to be used.

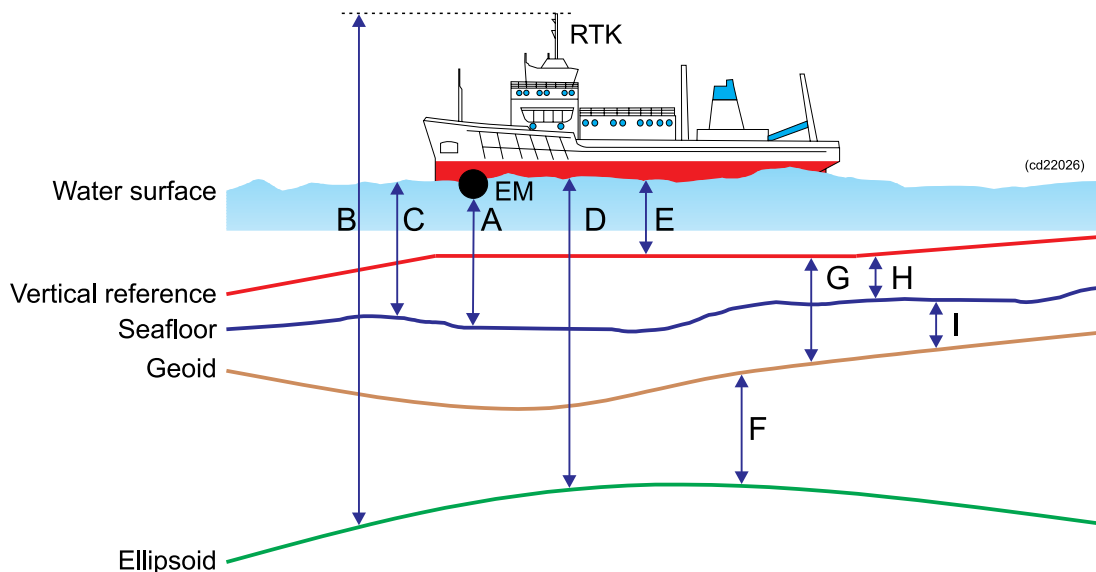
[Creating a new survey, page 24](#)



## Geoid

If high accuracy antenna heights (e.g. RTK GPS or other high accuracy position systems) are extracted, predefined geoid models can be used to obtain the distance from the seafloor to your vertical reference plane (for example, Mean Sea Surface).

The figure below shows the various distances used in the calculating the depth to the seafloor relative to the vertical reference.



- 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.

The measured distance from the echo sounder to the seafloor is corrected for transducer offset and motion (heading, roll, pitch and heave) to obtain the distance from the water surface to the seafloor.

Because the heave sensor only reacts to fast changes, the water surface is in reality defined by the 0-level of the heave sensor.

- D Motion corrected distance (height) from water surface to ellipsoid.

The geoid, unlike the reference ellipsoid, is irregular and too complicated to serve as the computational surface on which to solve geometrical problems like point positioning.

The position system gives the distance from the antenna to the ellipsoid, **B**. This distance is corrected for antenna offset and motion to give **D**, which is the distance from the sea surface to the ellipsoid.

### Note

*Both the corrected echo sounder depth **C** and the GPS based height above the ellipsoid **D**, are now referred to the same vertical level, the sea surface.*

E Distance from the sea surface to the vertical reference (tide):

The tide **E** is computed as  $E = D - F - G$ .

F Distance from the ellipsoid to the geoid (geoid undulation), positive if the geoid is above the ellipsoid.

This value is given by the geoid model.

G Distance from the geoid to the vertical reference, positive if the vertical reference is above the geoid.

This value is given by the geoid model.

H This is the distance from the vertical reference to the sea floor and can be computed as  $H = C - E$ .

I This is the distance from the sea floor to the geoid and is computed as  $I = G - H$ .

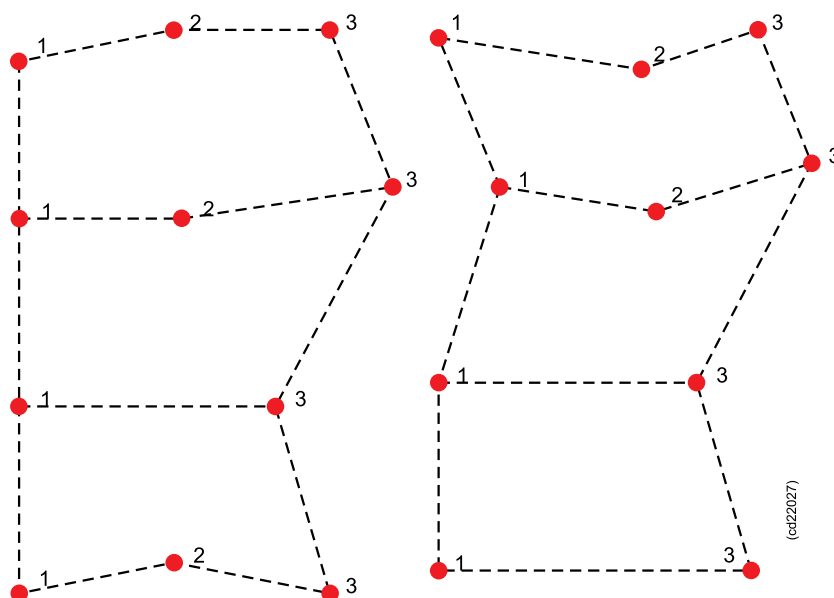
In the **Preferences** dialog box you can choose which vertical reference to see.

[Preferences dialog box, page 115](#)

## Geoid file

The geoid file **geoidmodel.geoid** must be stored together with the background data.

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 cross profiles along the river (the vertical lines are the riverbanks). It is possible to define several “rivers” in one file thus allowing general areas to be defined.



The file format is as follows:

1 latitude(degrees) longitude(degrees) F(metres) G(metres).

- 2 latitude(degrees) longitude(degrees) F(metres) G(metres).
- 3 latitude(degrees) longitude(degrees) F(metres) G(metres) - where F is distance from the ellipsoid to the geoid and G is distance from the geoid to the vertical reference.

The line starting with 2 is optional. The cross profile may be defined using two or three points, the first point with id 1 and the last point 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 cross profiles. A model (river) must always have at least two cross profiles. Several models (rivers) in the same file must be separated by an empty line.

The geoid undulation **F** and the vertical reference **G** is interpolated using straight lines between cross profiles.

## Tide

The tide input is either real time tide or predicted tide.

Real time tide details is sent as discrete tide datagrams using a serial link or the network using UDP port 4001. The format of the tide datagram is as follows:

```
$ATIDE,20040512073406,1.74*00
```

The header is always *\$ATIDE*. Next comes the time *YYYYMMDDhhmmss*, and then the tide expressed in meters.

The checksum is currently not used, but must be present.

**Note**

---

*The tide value is added to the measured value for the depth points.*

---

**Note**

---

*The file realtime.tide will be created every time the application is started.*

---

A tide file with the name `predictedtide.tide` can be stored together with the background data for the survey.

The format for the data file is as follows:

```
(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 in the header must be **Tide**. Next comes the tidal data. The time format is YYYYMMDDhhmmss and the tidal value is expressed in metres.

The tidal value is added to the measured depth value for each depth point.

## Faulty depth value detections

Sound waves need a compressible medium (like water) for propagation. Sudden changes in this medium (that is, changes in the sound speed or changes in the acoustic impedance) bends or reflects the sound waves. Changes like these are present in the transition (or boundary) between water and the seafloor, and are necessary for depth detection when using an echo sounder.

When the boundary is smeared or stretched out, the sounder may have problems determining the accurate numeric value representing the sea depth. These conditions vary with frequency.

While bedrock gives a distinct echo for most frequencies, the situation is more complicated for sedimentary seabed. For example, sometimes the upper part of the seafloor consists of a liquid like layer, changing to more solid with depth. The boundary between this layer and water can be indistinct for sufficient registration at certain frequencies.

Low frequency echo sounders (like 12 kHz) can penetrate the boundary of this layer with almost no reflections, whilst higher frequencies, (say, 100 kHz and above) usually give reflections sufficient for detection. The result is differences in the numerical depth readings when different frequencies are used.

The registration of the seafloor may also vary with the incidence angle of the sound beam, specially when the sounders are using different frequencies.

### Seafloor penetration

The seafloor is an interface between water and earth, that is, a transition between liquid and solid materials. Usually, on the accuracy scale to which the depths are to be measured, the interface is sufficiently clearly defined. However, in some cases this is not so, usually because the interface is not distinct enough with the top sediment being partly solid and partly water. Then the echo reflected back to the sounder is a combination of echoes both from the seafloor and reflectors beneath the seafloor. The echo sounder might then have problems distinguishing where the seafloor really is, causing too deep and hence erroneous detections, as is not unusually observed on dual frequency single beam echo sounders.

1FPS On		1FPS Off	
D			
A	Timediff +/- 1 sec.		Timediff +/- 1 sec.
T	RED in 'PU-ZDA' field when Ext. clock		RED in 'PU-ZDA' field when Ext. clock
A	RED in 'PU-FOS' field when Active pos.		RED in 'PU-FOS' field when Active pos.
G	RED in 'PU-FOS'* field when Operator st.		RED in 'PU-FOS'* field when Operator st.
R			
A			
M			
S			
Y	Timediff +/- 1 sec.		Timediff +/- 30 sec.
S	RED in 'PU-ZDA' field when Ext. clock.		YELLOW in affected field.
T	RED in 'PU-FOS' field when Active pos.		
E	RED in 'PU-FOS'* field when Operator st.		Timediff +/- 600 sec.
M			RED in affected field.

\* Conceptually not correct, but not able to compare with operator

The seafloor reflects a part of an incoming sound wave due to the change of the acoustic impedance, between the seafloor and water. Most of the sound energy not going into the seafloor will be reflected away as a specular reflection (that is, as if the bottom is a mirror), but some of the energy will be scattered in other directions (hopefully with some backscattering to the echo sounder). The angular response of the seafloor will depend upon its material and its smoothness (in relation to the sound wavelength). A smooth seafloor (such as silt or mud) will have a narrow specular region of a few degrees with a very weak signal reflected in other directions. On a rough seafloor (such as gravel), the specular peak will be quite wide and not very strong, and the reflected signal in other directions will not be much weaker. Reflected signal strength will however always decrease with increasing angle away from the specular direction.

Penetration will usually be a bigger problem on soft bottoms than on hard, due to the impedance contrast being less. Sound penetrating into the seafloor may be reflected from objects such as large rocks or from layers of different material energy will just dissipate away due to bottom losses. The absorption coefficient of soft sediments has been shown experimentally to usually increase approximately linearly with frequency. Typical values at for example 12 kHz is in the range of 1-5 dB/m with the lowest values encountered when the seafloor has a very high porosity (> 65%) which implies a very small particle size (< 10 mm). Assuming that signals attenuated more than 20 dB within the seafloor, will not affect the bottom detection, penetration of up to about 10 m could be possible at 12 kHz and up to 30 cm at 300 kHz.

When there is a problem with penetration, it will mainly affect the centre of the swath. In the outer parts of the swath the penetration range may be of the same order as for the centre, but the depth decrease due to the incidence angle. In the specular region, usually at or very close to the vertical, the degree of penetration might not be problematic due to the strong specular reflection, but this might not be consistent over a large survey area. It might also be noted that when the sub-bottom of fine particles, penetration and hence too deep detections may happen all over the swath, fairly independent of beam pointing angle, although probably more often the erroneous detections will be concentrated at the centre.

The bottom detection process is aimed at avoiding false detections and only providing correct ones. However, when the bottom is such that the echoes received from the sub-bottom are stronger than those from the seabed surface, too deep detections may invariably occur. Usually this will mostly only happen on fairly smooth bottoms, which could be handled in post-processing by filtering, but unfortunately only by removal of any fine bottom features or object from the data. If this is not acceptable, the only possible alternative in an area where penetration is problematic, is to see whether any parts of the swath are less affected by others, and to only use data from these parts in the processing. The disadvantage of this procedure is of course the unavoidable large penalty in extra surveying time required.

## kmall datagram

The proprietary .kmall datagram contains the full raw files from the EM echo sounders.

### **Description**

The KMall format is described in it's own document. See the [Software downloads](#) page.



# Index

- 1PPS  
 Sensor Setup dialog box ..... 95
- 3D mode  
 geographical view toolbar ..... 62
- A**
- about  
 Clock setup ..... 156  
 document downloads ..... 7  
 Faulty depth value readings ..... 174  
 Geoid ..... 169  
 Geoid file ..... 170  
 Internal clock ..... 156  
 online information ..... 7  
 predicted tide ..... 172  
 processing grid ..... 167  
 purpose of this manual ..... 7  
 real time tide ..... 172  
 registered trademarks ..... 7  
 Seafloor penetration ..... 174  
 software version ..... 7  
 status bar ..... 74  
 target audience ..... 7  
 Time stamp ..... 157
- abs. coeff files, CTD  
 Sound Velocity Management dialog box ..... 114
- abs. coeff files, salinity  
 Sound Velocity Management dialog box ..... 114
- absorption coefficient  
 Sound Velocity Management dialog box ..... 114
- Absorption coefficient  
 concept ..... 162
- absorption coefficient files  
 Sound Velocity Management dialog box ..... 114
- active attitude system  
 Sensor Setup dialog box ..... 95
- active position system  
 Sensor Setup dialog box ..... 95
- Active survey  
 New Survey dialog box ..... 87
- Add to Custom Colors  
 Color dialog box ..... 119
- Advanced Settings dialog box  
 description ..... 87  
 details ..... 87  
 purpose ..... 87
- aeration filter  
 Filter and Gain dialog box ..... 111
- alternative origin  
 vessel coordinate system ..... 160
- angular coverage mode  
 Sector Coverage dialog box ..... 101
- angular offset  
 Sensor Setup dialog box ..... 94
- applanix  
 External Sensors dialog box ..... 121
- ATH log parameters  
 External Sensors dialog box ..... 121
- attitude delay  
 Sensor Setup dialog box ..... 94
- attitude secondary  
 Sensor Setup dialog box ..... 95
- attitude system  
 installation ..... 55  
 Sensor Setup dialog box ..... 94
- audience  
 this manual ..... 7
- auto pilot  
 External Sensors dialog box ..... 121
- auto pilot avail  
 External Sensors dialog box ..... 121
- auto pilot port  
 External Sensors dialog box ..... 121
- autonomous survey  
 remote operation ..... 136
- B**
- Basic colors  
 Color dialog box ..... 119
- beam spacing  
 Sector Coverage dialog box ..... 102
- BIST dialog box  
 BIST result ..... 99  
 clear ..... 99  
 description ..... 99  
 result ..... 99  
 test ..... 99  
 time ..... 99
- BIST result  
 BIST dialog box ..... 99
- Blue Insight  
 Remote Operator Setting ..... 91
- Blue Insight Connector  
 Remote Operator Setting ..... 91
- book  
 purpose ..... 7  
 target audience ..... 7
- C**
- Calibrate a dual head system  
 concept ..... 36, 165
- calibration ..... 153  
 Dual Head System ..... 35  
 Single Head System ..... 26
- Calibration dialog box  
 description ..... 153
- clear  
 BIST dialog box ..... 99
- Clock setup  
 concept ..... 156
- COG vector length  
 Preferences dialog box ..... 117
- Color dialog box  
 Add to Custom Colors ..... 119  
 Basic colors ..... 119  
 Custom colors ..... 119

Define Custom Colors.....	119	Data Distribution dialog box	
description .....	119	description .....	123
details.....	119	details.....	123
colour palette		datagram format	
changing.....	56	KMall.....	176
Colour Setup dialog box		datum	
description .....	90	Sensor Setup dialog box .....	94
details.....	90	Define Custom Colors	
direction.....	90	Color dialog box .....	119
out of range.....	90	defining	
range.....	90	file and folder settings for data recording.....	19
start .....	90	defining a new filter	
static ranges.....	90	SVP Editor.....	53, 148
stop .....	90	depth below keel	
COM port settings		External Sensors dialog box.....	121
External Sensors dialog box.....	122	depth below keel available	
Comment		External Sensors dialog box.....	122
New Survey dialog box .....	86	depth delay	
concept		Sensor Setup dialog box .....	95
Absorption coefficient.....	162	depth mode	
Calibrate a dual head system.....	36, 165	Depth Settings dialog box .....	103
Clock setup .....	156	Depth Settings dialog box	
CTD based absorption coefficient profiles .....	163	depth mode .....	103
Faulty depth value readings .....	174	description .....	103
Geoid .....	169	details.....	103
Geoid file.....	170	detector mode .....	104
Internal clock.....	156	dual swath mode .....	103
predicted tide .....	172	extra detection.....	104
processing grid.....	167	FM disable.....	104
real time tide.....	172	force depth.....	103
Salinity based absorption coefficient		frequency.....	103
profiles .....	162	generate water column data .....	104
Seafloor penetration .....	174	maximum depth .....	103
Time difference PU-ZDA and PU-POS		minimum depth .....	103
indications.....	158	depth tail number of points	
Time stamp .....	157	Preferences dialog box.....	117
connect remote PC		depth tail point size	
remote operation .....	135	Preferences dialog box.....	116
connecting to Blue Insight		depth/pressure	
remote operation .....	137	Sensor Setup dialog box .....	95
continue		description	
job.....	23	Advanced Settings dialog box .....	87
continuing an existing survey		BIST dialog box .....	99
survey.....	25	Calibration dialog box .....	153
converting the SVP file to .asvp		Color dialog box .....	119
SVP Editor.....	50, 53, 148	Colour Setup dialog box.....	90
coordinate system		cross track view.....	66
alternative origin.....	160	Data Distribution dialog box .....	123
origin .....	159	Depth Settings dialog box .....	103
vessel .....	159	EM MultiFrequency Mode dialog box.....	107
Creating a new survey		External Sensors dialog box.....	120
Survey dialog box.....	24	Extra Detections dialog box.....	112
cross track view		File menu .....	78, 142, 146, 151, 154
description .....	66	Filter and Gains dialog box.....	109
purpose.....	66	geographical view .....	61
CTD based absorption coefficient profiles		geographical view toolbar .....	62
concept .....	163	helmsman .....	126, 142
Custom colors		helmsman display view .....	64
Color dialog box .....	119	Installation Parameters dialog box .....	92
<b>D</b>		Main menu.....	77
data		Network Setup dialog box.....	97
defining the file and folder settings for data		New Survey dialog box .....	86
recording.....	19	numerical display view.....	67
		origin in the vessel coordinate system .....	159
		Parameter Setup dialog box .....	124

- Preferences dialog box ..... 115
- PU Replayer dialog box ..... 123
- remote operation ..... 91, 134, 139
- Runtime parameters dialog box ..... 100, 113
- scope view ..... 68
- seabed view ..... 70
- Sector Coverage dialog box ..... 101
- Sensor Setup dialog box ..... 93
- Sound Speed Management dialog box ..... 113
- Sound Velocity dialog box ..... 108
- sound velocity profile view ..... 71
- status bar ..... 74
- stave view ..... 69
- SVP Editor dialog box ..... 122, 125, 146, 150
- system ..... 10
- system test dialog box ..... 99
- time series view ..... 72
- Tools menu ..... 83, 143, 147, 151
- Top bar ..... 59
- transducer setup dialog box ..... 97
- Transmit control dialog box ..... 105
- vessel coordinate system ..... 159
- View menu ..... 80, 143, 147
- water column view ..... 73
- waterfall view ..... 74
- details
  - Advanced Settings dialog box ..... 87
  - Color dialog box ..... 119
  - Colour Setup dialog box ..... 90
  - Data Distribution dialog box ..... 123
  - Depth Settings dialog box ..... 103
  - External Sensors dialog box ..... 120
  - Filter and Gains dialog box ..... 109
  - geographical view toolbar ..... 62
  - Network Setup dialog box ..... 97
  - New Survey dialog box ..... 86
  - Parameter Setup dialog box ..... 124
  - Preferences dialog box ..... 115
  - PU Replayer dialog box ..... 123
  - Sector Coverage dialog box ..... 101
  - Sensor Setup dialog box ..... 93
  - Sound Speed Management dialog box ..... 114
  - Sound Velocity dialog box ..... 108
  - SVP Editor dialog box ..... 125, 150
  - system test dialog box ..... 99
  - transducer setup dialog box ..... 98
  - Transmit control dialog box ..... 105
- detector mode
  - Depth Settings dialog box ..... 104
- dialog box
  - Advanced Settings dialog box description ..... 87
  - Calibration dialog box description ..... 153
  - Color dialog box description ..... 119
  - Colour Setup ..... 90
  - Data Distribution dialog box description ..... 123
  - Depth Settings dialog box description ..... 103
  - EM MultiFrequency Mode ..... 107
  - External Sensors dialog box description ..... 120
  - Extra Detections ..... 112
  - Filter and Gains dialog box description ..... 109
  - Installation Parameters dialog box
    - description ..... 92
  - Network Setup dialog box description ..... 97
  - New Survey dialog box description ..... 86
  - Parameter Setup dialog box description ..... 124
  - Preferences dialog box description ..... 115
  - PU Replayer dialog box description ..... 123
  - Runtime parameters dialog box
    - description ..... 100, 113
  - Sector Coverage dialog box description ..... 101
  - Sensor Setup dialog box description ..... 93
  - Sound Speed Management dialog box
    - description ..... 113
  - Sound Velocity dialog box description ..... 108
  - SVP Editor dialog box description ..... 122, 125, 146, 150
  - system test dialog box description ..... 99
  - Transmit control dialog box description ..... 105
- direction
  - Colour Setup dialog box ..... 90
- display organisation
  - description ..... 58
- display views
  - description ..... 58
- documents
  - download from website ..... 7
- download
  - documents from website ..... 7
- dual swath mode
  - Depth Settings dialog box ..... 103
- Dyn Pos
  - External Sensors dialog box ..... 121
- E**
  - echogram presentation
    - description ..... 58
  - EM MultiFrequency Mode dialog box
    - description ..... 107
  - enable remote vessel control
    - remote operation ..... 135
  - External Sensors dialog box
    - applanix ..... 121
    - ATH log parameters ..... 121
    - auto pilot ..... 121
    - auto pilot avail ..... 121
    - auto pilot port ..... 121
    - COM port settings ..... 122
    - depth below keel ..... 121
    - depth below keel available ..... 122
    - description ..... 120
    - details ..... 120
    - Dyn Pos ..... 121
    - interval for new line ..... 121
    - IP address ..... 121
    - LAN ..... 121
    - port ..... 121
    - PPP log parameters ..... 121
    - probe available ..... 120
    - probe type ..... 120
    - realtime tide ..... 120
    - realtime tide available ..... 120
    - realtime tide port ..... 121
    - RTCM log parameters ..... 122
    - seapath ..... 122
    - serial ..... 121
    - sound velocity probe ..... 120
    - source port for ATH data ..... 121
    - source port for seapath RTCM data ..... 122
    - source port for SRH data ..... 122

SRH log parameters .....	122
start applanix PosMV (raw GPS) logging .....	121
start applanix PosMV TrueHeave logging .....	121
start seapath real heave logging .....	122
start seapath RTCM logging .....	122
external trigger	
Transmit control dialog box .....	106
extra detection	
Depth Settings dialog box .....	104
Extra Detections dialog box	
description .....	112
<b>F</b>	
Faulty depth value readings	
concept .....	174
file extension	
.kmall .....	176
file locations	
defining the file and folder settings for data	
recording .....	19
File menu	
description .....	78, 142, 146, 151, 154
how to open .....	78, 142, 146, 151, 154
file open	
Sound Velocity Management dialog box .....	114
file setup	
defining the file and folder settings for data	
recording .....	19
filter	
Sound Velocity Management dialog box .....	114
Filter and Gain dialog box	
aeration filter .....	111
interference filter .....	111
normal incidence corr. ....	111
penetration filter strength .....	110
phase ramp .....	110
range gate size .....	109
slope filter .....	111
sonar mode .....	112
special amp. detect .....	111
special TVG .....	110
spike filter strength .....	109
transmit power level .....	111
use Lambert's law .....	111
water column TVG offset .....	112
water column X log .....	111
Filter and Gains dialog box	
description .....	109
details .....	109
FM disable	
Depth Settings dialog box .....	104
folder locations	
defining the file and folder settings for data	
recording .....	19
follow vessel	
geographical view toolbar .....	62
force depth	
Depth Settings dialog box .....	103
format	
Sensor Setup dialog box .....	94
frequency	
Depth Settings dialog box .....	103
Transmit control dialog box .....	106

**G**

generate water column data	
Depth Settings dialog box .....	104
geographical view	
description .....	61
geographical view toolbar	
3D mode .....	62
description .....	62
details .....	62
follow vessel .....	62
measure distance .....	62
planning mode .....	62
point selection mode .....	63
reset depth tail .....	63
save position to file .....	63
show depth .....	62
show position .....	62
Show/Hide depth trail .....	63
user object mode .....	63
view mode .....	62
zoom to area .....	62
zoom to region .....	62
zoom to vessel .....	62
zoom to world .....	62
Geoid	
concept .....	169
Geoid file	
concept .....	170
graticule colour	
Preferences dialog box .....	116
graticule label format	
Preferences dialog box .....	116
Grid cell size	
New Survey dialog box .....	87

**H**

heading filter	
Transmit control dialog box .....	106
helmsman	
description .....	126, 142
purpose .....	125, 142
helmsman display	
remote operation .....	138
helmsman display view	
description .....	64
purpose .....	64
help	
support offices .....	12
how to	
change the colour palette used in the	
presentation .....	56
continue an existing survey .....	25
convert the SVP file to .asvp .....	50, 53, 148
create a new survey .....	24
define a new filter .....	53, 148
define the file and folder settings for data	
recording .....	19
import a SVP probe file .....	52
install the attitude system .....	55
install the operational software .....	14-16
install the positioning system .....	54
make a new survey .....	24
use the SVP file .....	50

- how to open
  - File menu ..... 78, 142, 146, 151, 154
  - Main menu ..... 77
  - Tools menu ..... 83, 143, 147, 151
  - View menu ..... 80, 143, 147
- I**
- importing a SVP probe file
  - SVP Editor ..... 52
- information
  - online ..... 7
  - support ..... 12
- input
  - Sensor Setup dialog box ..... 94
- installation
  - attitude system ..... 55
  - positioning system ..... 54
  - software ..... 14–16
- Installation Parameters dialog box
  - description ..... 92
- interference filter
  - Filter and Gain dialog box ..... 111
- Internal clock
  - concept ..... 156
- internet
  - network security ..... 10
- interval for new line
  - External Sensors dialog box ..... 121
- IP address
  - External Sensors dialog box ..... 121
- J**
- job
  - continue ..... 23
  - planning ..... 22
  - start ..... 22
- K**
- key features
  - system ..... 10
- KMall
  - datagram format ..... 176
- Kongsberg Maritime
  - support ..... 12
- L**
- LAN
  - External Sensors dialog box ..... 121
- light direction
  - Preferences dialog box ..... 115
- location offset
  - Sensor Setup dialog box ..... 93
- M**
- Main menu
  - description ..... 77
  - how to open ..... 77
- manual
  - purpose ..... 7
- target audience ..... 7
- manual heading
  - Transmit control dialog box ..... 106
- Map objects
  - concept ..... 168
- max ping rate
  - Transmit control dialog box ..... 106
- maximum angle
  - Sector Coverage dialog box ..... 101
- maximum coverage
  - Sector Coverage dialog box ..... 101
- maximum depth
  - Depth Settings dialog box ..... 103
- measure distance
  - geographical view toolbar ..... 62
- menu
  - File menu description ..... 78, 142, 146, 151, 154
  - Main menu description ..... 77
  - Tools menu description ..... 83, 143, 147, 151
  - View menu description ..... 80, 143, 147
- min swath distance
  - Transmit control dialog box ..... 106
- minimum depth
  - Depth Settings dialog box ..... 103
- miscellaneous
  - Preferences dialog box ..... 117
- mode
  - remote operation ..... 134, 139
- MQTT message broker
  - connect to remote operator ..... 17
  - connect to vessel ..... 18
- multicast address
  - Network Setup dialog box ..... 97
- multicast port
  - Network Setup dialog box ..... 97
- Multiple disks
  - Installation ..... 128
  - Issues ..... 131
  - Remove ..... 129
- N**
- name
  - Sensor Setup dialog box ..... 93
- network security ..... 10
- Network Setup dialog box
  - description ..... 97
  - details ..... 97
  - multicast address ..... 97
  - multicast port ..... 97
  - secondary net address ..... 97
  - secondary net subnet ..... 97
- new survey
  - creating ..... 24
- New Survey dialog box
  - Active survey ..... 87
  - Comment ..... 86
  - description ..... 86
  - details ..... 86
  - Grid cell size ..... 87
  - New survey name ..... 86
  - Projection ..... 86
  - purpose ..... 86
  - Start new survey ..... 86
- New survey name

New Survey dialog box .....	86	Sensor Setup dialog box .....	94
normal incidence corr.		positioning system	
Filter and Gain dialog box .....	111	installation .....	54
numerical display view		PPP log parameters	
description .....	67	External Sensors dialog box .....	121
purpose .....	67	predicted tide	
<b>O</b>		concept .....	172
offices		preferences	
support .....	12	defining the file and folder preferences for raw	
online		data recording .....	19
information .....	7	Preferences dialog box	
open		COG vector length .....	117
File menu .....	78, 142, 146, 151, 154	depth tail number of points .....	117
Main menu .....	77	depth tail point size .....	116
Tools menu .....	83, 143, 147, 151	description .....	115
View menu .....	80, 143, 147	details .....	115
operation		graticule colour .....	116
Preferences dialog box .....	115	graticule label format .....	116
operational software		light direction .....	115
installation .....	14–16	miscellaneous .....	117
origin		operation .....	115
vessel coordinate system .....	159	overlay .....	116
out of range		override LOD .....	115
Colour Setup dialog box .....	90	planning and user objects .....	117
overlay		quick gridding .....	115
Preferences dialog box .....	116	safety contours visibility .....	117
override LOD		scale factor .....	115
Preferences dialog box .....	115	ships track .....	115
<b>P</b>		show COG vector .....	117
palette		show depth tail .....	116
changing .....	56	show graticule .....	116
Parameter Setup dialog box		show logging label .....	117
description .....	124	show planning and user objects .....	117
details .....	124	show realtime position .....	115
penetration filter strength		show stored track .....	115
Filter and Gain dialog box .....	110	stored line width .....	115
phase ramp		terrain model .....	115
Filter and Gain dialog box .....	110	vessel colour .....	117
pitch stabilisation		visibility .....	115
Transmit control dialog box .....	105	presentation	
planning		changing the colour palette .....	56
job .....	22	description .....	58
planning and user objects		probe available	
Preferences dialog box .....	117	External Sensors dialog box .....	120
planning mode		probe type	
geographical view toolbar .....	62	External Sensors dialog box .....	120
point selection mode		procedure	
geographical view toolbar .....	63	changing the colour palette used in the	
port		presentation .....	56
External Sensors dialog box .....	121	continuing an existing survey .....	25
Port Starboard		converting the SVP file to .asvp .....	50, 53, 148
Sector Coverage dialog box .....	101	creating a new survey .....	24
position delay		defining a new filter .....	53, 148
Sensor Setup dialog box .....	93	defining the file and folder settings for data	
position motion correction		recording .....	19
Sensor Setup dialog box .....	93	importing a SVP probe file .....	52
position secondary		installing the attitude system .....	55
Sensor Setup dialog box .....	94	installing the operational software .....	14–16
position system		installing the positioning system .....	54
Sensor Setup dialog box .....	93	making a new survey .....	24
position tertiary		using the SVP file .....	50
		processing grid	
		concept .....	167
		product	
		key features .....	10

Projection	
New Survey dialog box .....	86
PU Replayer dialog box	
description .....	123
details .....	123
publication	
purpose .....	7
target audience .....	7
purpose	
Advanced Settings dialog box .....	87
cross track view .....	66
helmsman .....	125, 142
helmsman display view .....	64
New Survey dialog box .....	86
numerical display view .....	67
scope view .....	68
seabed view .....	70
sound velocity profile view .....	71
stave view .....	69
this manual .....	7
water column view .....	73
waterfall view .....	74
<b>Q</b>	
quality indicators	
Sensor Setup dialog box .....	94
quick gridding	
Preferences dialog box .....	115
<b>R</b>	
range	
Colour Setup dialog box .....	90
range gate size	
Filter and Gain dialog box .....	109
raw data	
recording preferences .....	19
raw file	
datagram format .....	176
reader	
this manual .....	7
real time tide	
concept .....	172
Realtime Data Controller	
Remote Operator Setting .....	91
realtime tide	
External Sensors dialog box .....	120
realtime tide available	
External Sensors dialog box .....	120
realtime tide port	
External Sensors dialog box .....	121
record	
defining the file and folder settings for data	
recording .....	19
recording	
defining the file and folder preferences for raw	
data recording .....	19
registered trademarks .....	7
remote operation	
autonomous survey .....	136
connect remote PC .....	135
connecting to Blue Insight .....	137
description .....	134, 139
enable remote vessel control .....	135
helmsman display .....	138
Realtime data controller .....	138
Remote Operator Setting	
Blue Insight .....	91
Realtime Data Controller .....	91
reset depth tail	
geographical view toolbar .....	63
result	
BIST dialog box .....	99
roll reference plane	
Sensor Setup dialog box .....	95
RTCM log parameters	
External Sensors dialog box .....	122
Runtime parameters dialog box	
description .....	100, 113
RX angular offset	
transducer setup dialog box .....	98
RX BS offset	
transducer setup dialog box .....	98
RX location offset	
transducer setup dialog box .....	98
<b>S</b>	
safety contours visibility	
Preferences dialog box .....	117
salinity	
Sound Velocity Management dialog box .....	115
Salinity based absorption coefficient profiles	
concept .....	162
save position to file	
geographical view toolbar .....	63
scale factor	
Preferences dialog box .....	115
scope view	
description .....	68
purpose .....	68
seabed view	
description .....	70
purpose .....	70
Seafloor penetration	
concept .....	174
seapath	
External Sensors dialog box .....	122
secondary net address	
Network Setup dialog box .....	97
secondary net subnet	
Network Setup dialog box .....	97
Sector Coverage dialog box	
angular coverage mode .....	101
beam spacing .....	102
description .....	101
details .....	101
maximum angle .....	101
maximum coverage .....	101
Port Starboard .....	101
sector mode .....	102
sector mode	
Sector Coverage dialog box .....	102
security	
network .....	10
sensor offset	
Sound Velocity Management dialog box .....	114
Sensor Setup dialog box	
1PPS .....	95

active attitude system	95	description	113
active position system	95	details	114
angular offset	94	sound velocity	
attitude delay	94	Sound Velocity dialog box	108
attitude secondary	95	sound velocity at transducer	
attitude system	94	Sound Velocity Management dialog box	114
datum	94	Sound Velocity dialog box	
depth delay	95	description	108
depth/pressure	95	details	108
description	93	sound velocity	108
details	93	Sound velocity source	108
format	94	water temperature	108
input	94	Sound Velocity Management dialog box	
location offset	93	abs. coeff files, CTD	114
name	93	abs. coeff files, salinity	114
position delay	93	absorption coefficient	114
position motion correction	93	absorption coefficient files, CTD	114
position secondary	94	absorption coefficient files, salinity	114
position system	93	file open	114
position tertiary	94	filter	114
quality indicators	94	salinity	115
roll reference plane	95	sensor offset	114
set active systems	95	sound speed	114
sound velocity probe	95	sound velocity at transducer	114
source	95	sound velocity profile	114
time system	95	source	114
time to use	94	sound velocity probe	
serial		External Sensors dialog box	120
External Sensors dialog box	121	Sensor Setup dialog box	95
set active systems		sound velocity profile	
Sensor Setup dialog box	95	Sound Velocity Management dialog box	114
ships track		sound velocity profile view	
Preferences dialog box	115	description	71
show COG vector		purpose	71
Preferences dialog box	117	Sound velocity source	
show depth		Sound Velocity dialog box	108
geographical view toolbar	62	source	
show depth tail		Sensor Setup dialog box	95
Preferences dialog box	116	Sound Velocity Management dialog box	114
show graticule		source port for ATH data	
Preferences dialog box	116	External Sensors dialog box	121
show logging label		source port for seapath RTCM data	
Preferences dialog box	117	External Sensors dialog box	122
show planning and user objects		source port for SRH data	
Preferences dialog box	117	External Sensors dialog box	122
show position		special amp. detect	
geographical view toolbar	62	Filter and Gain dialog box	111
show realtime position		special TVG	
Preferences dialog box	115	Filter and Gain dialog box	110
show stored track		spike filter strength	
Preferences dialog box	115	Filter and Gain dialog box	109
Show/Hide depth trail		SRH log parameters	
geographical view toolbar	63	External Sensors dialog box	122
slope filter		start	
Filter and Gain dialog box	111	Colour Setup dialog box	90
software		start applanix PosMV (raw GPS) logging	
installation	14–16	External Sensors dialog box	121
version	7	start applanix PosMV TrueHeave logging	
sonar mode		External Sensors dialog box	121
Filter and Gain dialog box	112	Start new survey	
sound speed		New Survey dialog box	86
Sound Velocity Management dialog box	114	start seapath real heave logging	
Sound Speed Management		External Sensors dialog box	122
using the SVP file	50	start seapath RTCM logging	
Sound Speed Management dialog box		External Sensors dialog box	122



- 
- starting
    - job ..... 22
  - static ranges
    - Colour Setup dialog box ..... 90
  - status bar
    - description ..... 74
  - stave view
    - description ..... 69
    - purpose ..... 69
  - stop
    - Colour Setup dialog box ..... 90
  - stored line width
    - Preferences dialog box ..... 115
  - support information ..... 12
  - survey
    - continuing an existing survey ..... 25
  - Survey dialog box
    - Creating a new survey ..... 24
  - SVP Editor
    - converting the SVP file to .asvp ..... 50, 53, 148
    - defining a new filter ..... 53, 148
    - description ..... 122, 125, 146, 150
    - importing a SVP probe file ..... 52
  - SVP Editor dialog box
    - description ..... 122, 125, 146, 150
    - details ..... 125, 150
  - system
    - description ..... 10
    - key features ..... 10
  - system software
    - installation ..... 14–16
  - system test dialog box
    - description ..... 99
    - details ..... 99
- T**
- target audience
    - this manual ..... 7
  - technical support
    - offices ..... 12
  - terrain model
    - Preferences dialog box ..... 115
  - test
    - BIST dialog box ..... 99
  - this manual
    - purpose ..... 7
    - target audience ..... 7
  - time
    - BIST dialog box ..... 99
  - Time difference PU-ZDA and PU-POS indications
    - concept ..... 158
  - time series view
    - description ..... 72
  - Time stamp
    - concept ..... 157
  - time system
    - Sensor Setup dialog box ..... 95
  - time to use
    - Sensor Setup dialog box ..... 94
  - Tools menu
    - description ..... 83, 143, 147, 151
    - how to open ..... 83, 143, 147, 151
  - Top bar
    - description ..... 59
  - trademarks
    - registered ..... 7
  - transducer setup dialog box
    - description ..... 97
    - details ..... 98
    - RX angular offset ..... 98
    - RX BS offset ..... 98
    - RX location offset ..... 98
    - TX angular offset ..... 98
    - TX location offset ..... 98
    - TX size ..... 98
    - water line vertical location ..... 98
  - transmit angle along
    - Transmit control dialog box ..... 105
  - Transmit control dialog box
    - description ..... 105
    - details ..... 105
    - external trigger ..... 106
    - frequency ..... 106
    - heading filter ..... 106
    - manual heading ..... 106
    - max ping rate ..... 106
    - min swath distance ..... 106
    - pitch stabilisation ..... 105
    - transmit angle along ..... 105
    - yaw stabilisation mode ..... 105
  - transmit power level
    - Filter and Gain dialog box ..... 111
  - TX angular offset
    - transducer setup dialog box ..... 98
  - TX location offset
    - transducer setup dialog box ..... 98
  - TX size
    - transducer setup dialog box ..... 98
- U**
- use Lambert's law
    - Filter and Gain dialog box ..... 111
  - user interface
    - description ..... 58
  - user object mode
    - geographical view toolbar ..... 63
  - using the SVP file
    - Sound Speed Management ..... 50
- V**
- version
    - software ..... 7
  - vessel colour
    - Preferences dialog box ..... 117
  - vessel coordinate system
    - alternative origin ..... 160
    - origin ..... 159
    - principles ..... 159
  - View menu
    - description ..... 80, 143, 147
    - how to open ..... 80, 143, 147
  - view mode
    - geographical view toolbar ..... 62
  - visibility
    - Preferences dialog box ..... 115

**W**

water column TVG offset	
Filter and Gain dialog box .....	112
water column view	
description .....	73
purpose .....	73
water column X log	
Filter and Gain dialog box .....	111
water line vertical location	
transducer setup dialog box .....	98
water temperature	
Sound Velocity dialog box .....	108
waterfall view	
description .....	74
purpose .....	74
website	
download documents .....	7

**Y**

yaw stabilisation mode	
Transmit control dialog box .....	105

**Z**

zoom to area	
geographical view toolbar .....	62
zoom to region	
geographical view toolbar .....	62
zoom to vessel	
geographical view toolbar .....	62
zoom to world	
geographical view toolbar .....	62



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