SIS

Seafloor Information System

Reference Manual

Release 5.6

Document information

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- **Document**: Reference Manual

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Warning

Disclaimer

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. If you need information about our other products, visit https://www.kongsberg.com/maritime.

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About this manual

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

Target audience

This manual is intended for all users of the SIS system. Due to the nature of the descriptions and the level of detail provided by this manual, 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 SIS functionality.

Note

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 5.6.

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SIS

Topics

429004/E

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 behaviour 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 _____

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 _____

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 provided 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

SIS Reference Manual

Getting started

Topics

Installing the SIS operational software

Install the program on the Hydrographic Work Station.

Prerequisites

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 verify that it meets the technical requirements for use with the SIS. Do this <u>before</u> you install the software.

Procedure

1   Turn on the computer.

2   Insert the SIS software media.

3   Use a file manager application on the computer 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 addon. The addon 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 marine 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 Eqlipse *https://www.eclipse.org/mosquitto/.*

Procedure

1   Install the software as usual on the vessel.

2   Open **KM.Subsea.Common.Edge.Connector.exe.config** located in `C:\Program Files\Kongsberg Maritime\EMSystem\EdgeConnector\Bin` with a text editor, such as Notepad.

3   Enter your connection details of the MQTT broker from your network responsible.

    The fields Server, MQTTUser and MQTTPassword must be correct.

4   Save the file.

5   Install the software as usual in the remote location.

6   Open **SISMqttClient.exe.config** located in `C:\Program Files\Kongsberg Maritime\EMSystem\SISMqttClient\Bin` with a text editor, such as Notepad.

7   Enter a unique ClientID.

8   Enter your connection details of the MQTT broker from your network responsible.

    The fields Server, MQTTUser and MQTTPassword must be correct.

9   Save the file.

10   On the vessel, select the settings icon on the top bar.

11   Select the **Application** tab.

12   Select **On**, on **Vessel Remote**.

13   Restart the program.

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/prod-ucts/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.
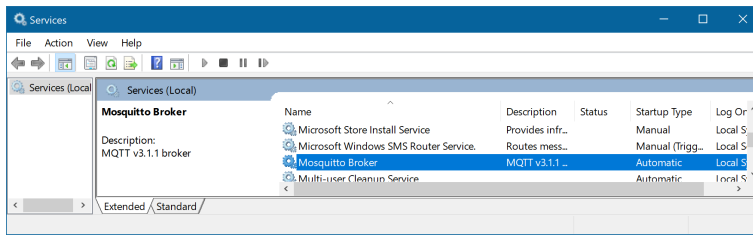
Configuring the Mosquitto MQTT message broker

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

Context

Procedure

1   Define a listener.

    a   Open the file `C:\Program Files\mosquitto\mosquitto.conf` in a text editor.

    b   Find a section called **Listeners**.

    c   Add a line for each listener.

> Note
>
> *listener 1883 157.237.245*
>
> *This will add a listener on port 1883 and IP address 157.237.245.*

    d   Save the file and restart Mosquitto.

2   Create a password file.

    a   Make sure you have Administrator privileges.

    b   Open **Command Prompt**.

    c   Go to `C:\Program Files\mosquitto`.

    d   Type **mosquitto_passwd -c pl.1 kmuser**

       This will create a password file pl.txt with the first user kmuser.

    e   Type in a password for this user in the dialog box.

    f   Type **mosquitto_passwd -b pl.1 user password** to add more users.

    g   Type **mosquitto_passwd -D pl.1 user** to remove users.

3   Copy the password file to the mosquitto folder.

`etc\mosquitto` for Linux users and `C:\Program Files\mosquitto` for Windows users.

4   Remove anonymous users from the system.

    a   Open the file `C:\Program Files\mosquitto\mosquitto.conf` in a text editor.

    b   Search for **allow_anonymous**

    c   Edit the text to **allow_anonymous false**

    d   Search for **password_file**

    e   Edit the text to **password_file pl.txt**

    f   Save the file and restart Mosquitto.

5   Mosquitto must be started with the -c option.

- For Windows users this is automatic.
- For Linux users **mosquitto -c mosquitto.config** must be used.

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 mission or survey.

Tip ───

Set up the file and folder parameters <u>before</u> 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

Topics

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.

New polygon

Define the area you want to survey with a polygon. The polygon can have as many edges as needed. 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. 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**.

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.

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

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 acrosstrack).

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   Place a calibration corridor orthogonally to the survey lines.

4   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 acrosstrack distance from the centre where it is zero.

Side view

Survey line

Flat seabed (across)

Top view

Survey line (2xswath width)

Calibration corridors

A   B

(CD020402_010_001)
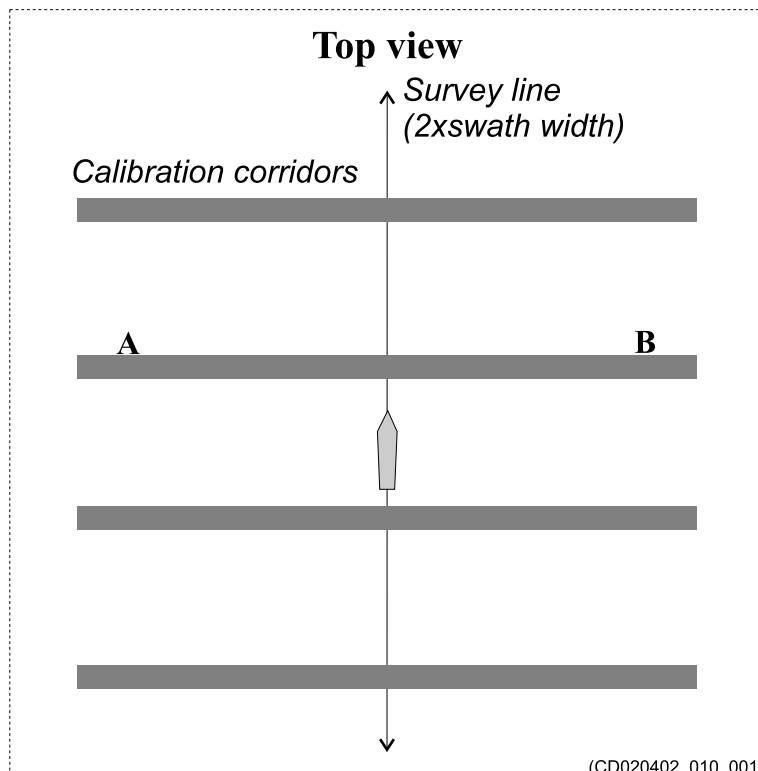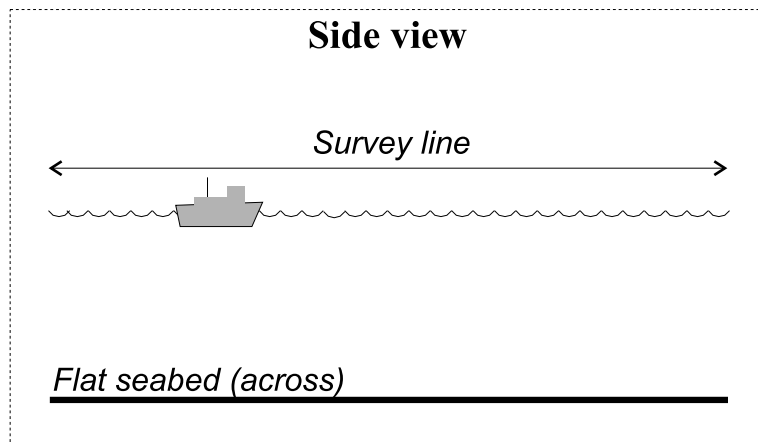
Calibrating the roll offset – dual head

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 acrosstrack).

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.

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

4   Right-click in the *Geographical* view and select **New Corridor**.

5   Select two of the lines. Select the lines that gives full overlap for one of the heads and place a calibration corridor (A) orthogonally to the survey lines.

6   Right-click in the *Geographical* view and select **Calibrate**.

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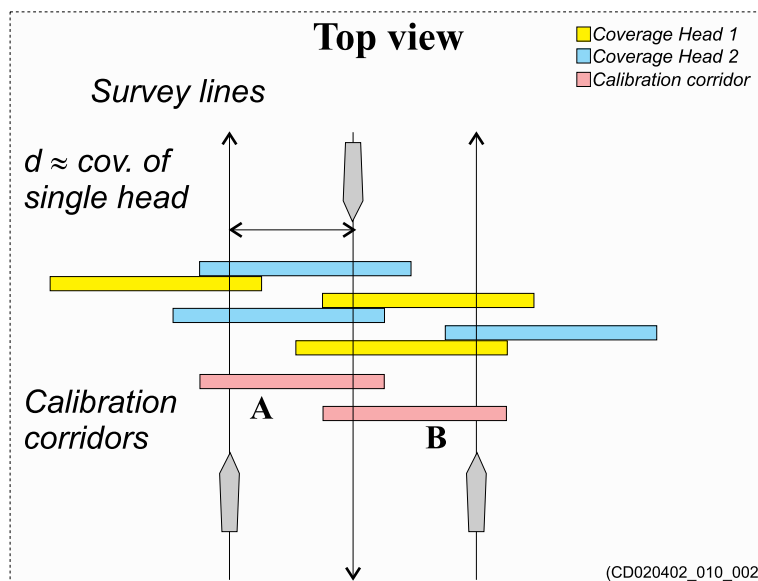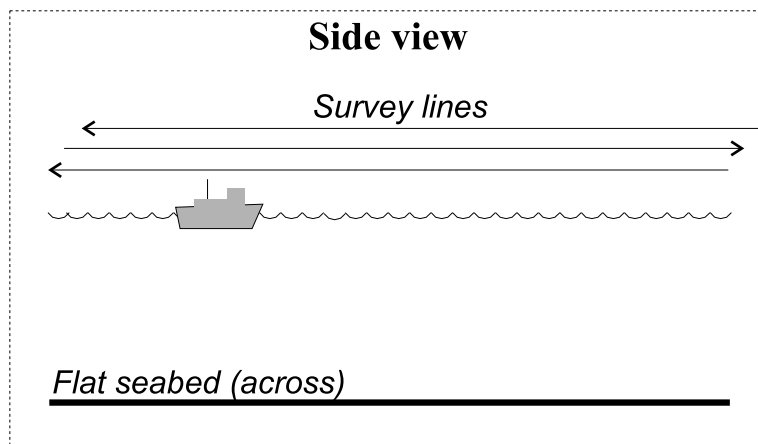
7   Compare depth data from the two lines in the selected corridor. If there is a roll offset, there will be a depth difference between the two data sets, increasing with acrosstrack distance from the centre where it is zero.

8   Change the values for the roll offset, in the calibration program, to make both lines as equal as possible.

9   Enter the offset value for Rx in the **Input setup** dialog box.

10 Select two of the lines that gives full overlap for the other head and place a calibration corridor (B) orthogonally to the survey lines.

11 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 acrosstrack distance from the centre where it is zero.

12 Right-click in the *Geographical* view and select **Calibrate**.

13 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 acrosstrack distance from the centre where it is zero.

14 Change the values for the roll offset, in the calibration program, to make both lines as equal as possible.

15 Enter the offset value for Rx in the **Input setup** dialog box.

16 Enter the average offset value for Tx in the **Input setup** dialog box.

Example

Transducer	Surveyed installation angle	Offset	New installation angle
Port RX transducer	+35°	0.4	+35.4°
Starboard RX transducer	-35°	0.2	-34.8°
TX transducer	0°		+0.3°

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.

Side view

Survey line

Seabed

Slope

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   Place a calibration corridor parallel to the survey lines, on top of the vessel track.

4   Compare depth data from the two lines in the selected corridor.

Top view

Survey line   B

Slope

Calibration corridor

A
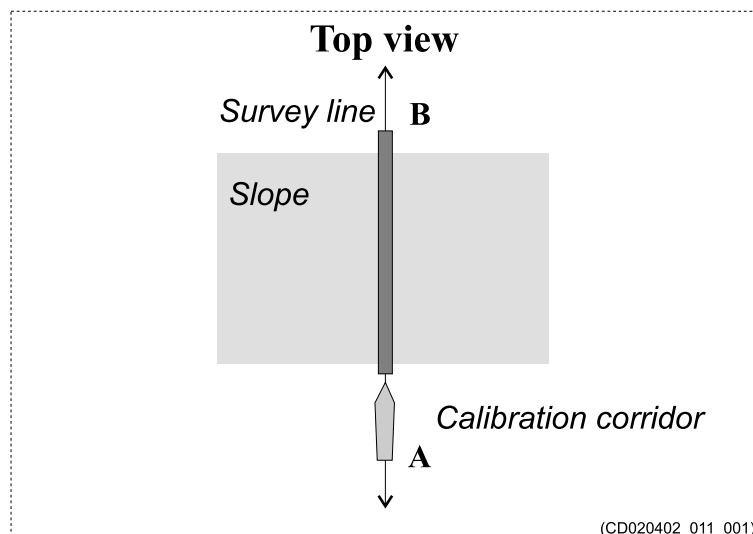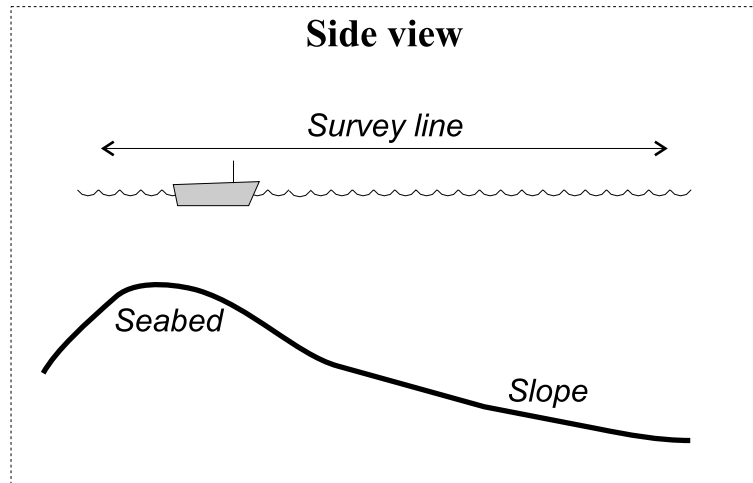
(CD020402_011_001)

Any alongtrack depth difference between the runs may be due to three different factors:

• Pitch offset

• For multibeam echo sounders with transducers a position distance offset (either due to an error in the positioning system or an error in entered locations)

• Tide difference

5   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.

The pitch offset can be determined from the two lines run in opposite directions.

Calibrating the pitch offset – alt 1 — dual head

The pitch offset calibration is made along a sloping seafloor.

Prerequisites

Reduce the opening angle to ±50° on the outer sectors. Open the inner angle to ±20° on the inner sectors.
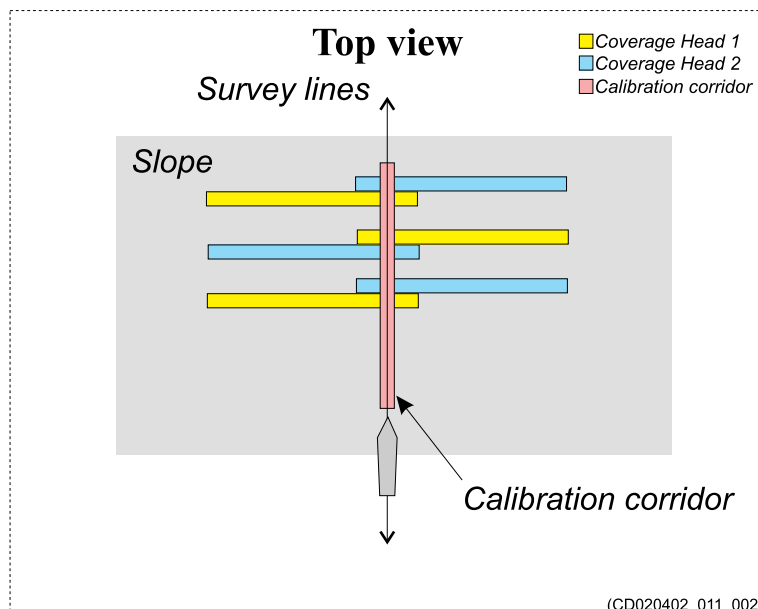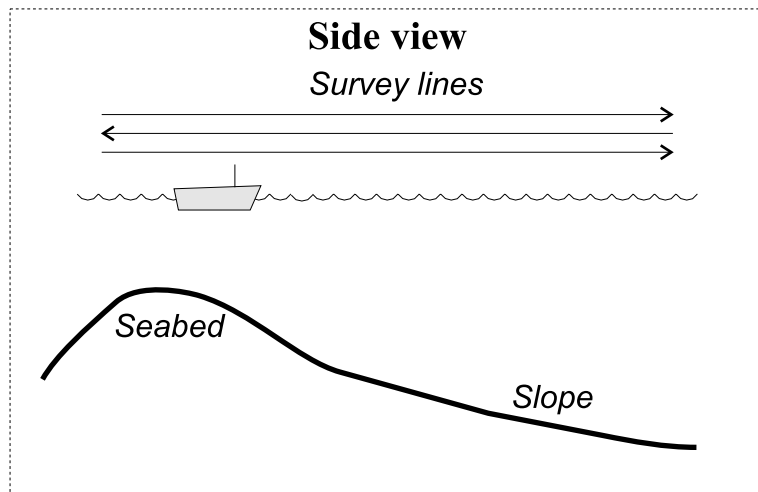
Context

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

Side view

Survey lines

Seabed

Slope

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 Place a calibration corridor parallel to the survey lines, on top of the vessel track.

4 Compare depth data from the two lines in the selected corridor.

Top view

☐ *Coverage Head 1*
☐ *Coverage Head 2*
☐ *Calibration corridor*

Survey lines

Slope

Calibration corridor

(CD020402_011_002)

Any alongtrack depth difference between the runs may be due to three different factors:

• Pitch offset

• For multibeam echo sounders with transducers a position distance offset (either due to an error in the positioning system or an error in entered locations)

• Tide difference

5 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.

Comparing data from the two lines in the same direction, but with different vessel speed, allows the time delay to be found.

The pitch offset can be determined from the two lines run in opposite directions.

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.
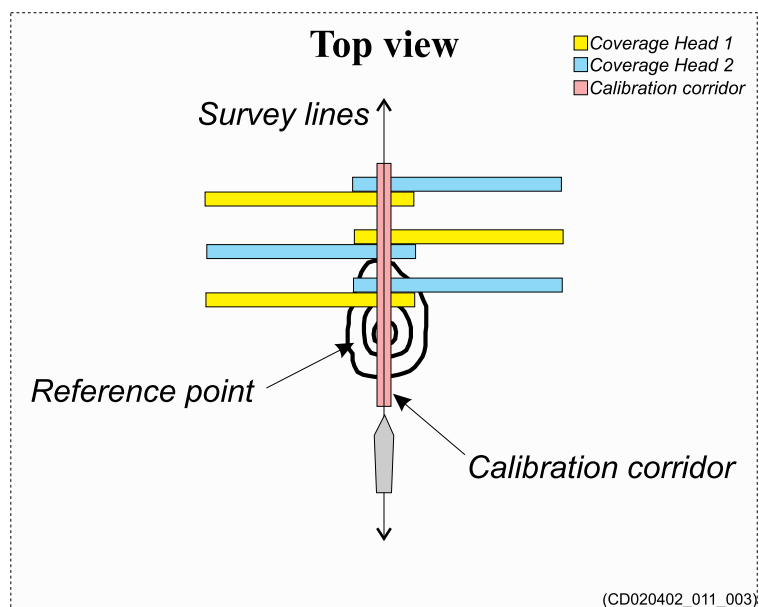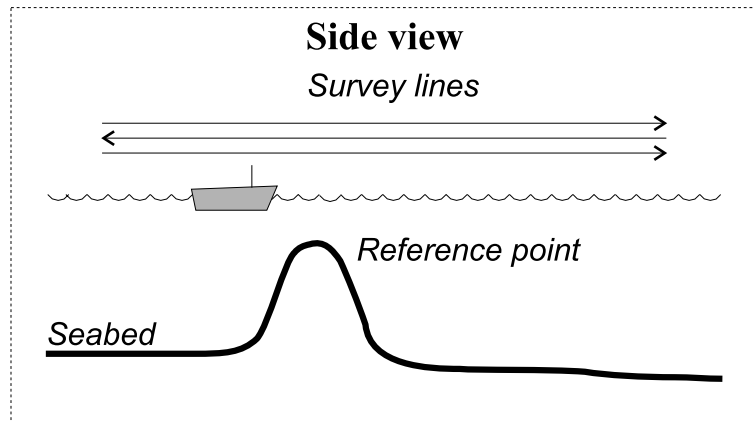
Prerequisites

Reduce the opening angle to ±50° on the outer sectors. Open the inner angle to ±20° on the inner sectors.

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 Survey two lines in opposite directions with constant vessel speed along each line.

3 Place a calibration corridor parallel to the survey lines, on top of the vessel track.

4 Compare depth data from the two lines in the selected corridor.

Side view

Survey lines

Reference point

Seabed

Top view

☐ *Coverage Head 1*
☐ *Coverage Head 2*
☐ *Calibration corridor*

Survey lines

Reference point

Calibration corridor

(CD020402_011_003)

Any alongtrack depth difference between the runs may be due to three different factors:

• Pitch offset

• For multibeam echo sounders with transducers a position distance offset (either due to an error in the positioning system or an error in entered locations)

• Tide difference

5 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.

The pitch offset can be determined from the two lines run in opposite directions.

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 a calibration corridor. The corridor used for comparison must be placed alongtrack between the lines.

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

Side view

Survey line

Seabed

Slope

Top view

Survey line 1

B

Survey line 2

Slope

A

Calibration corridor

(CD020402_012_001)

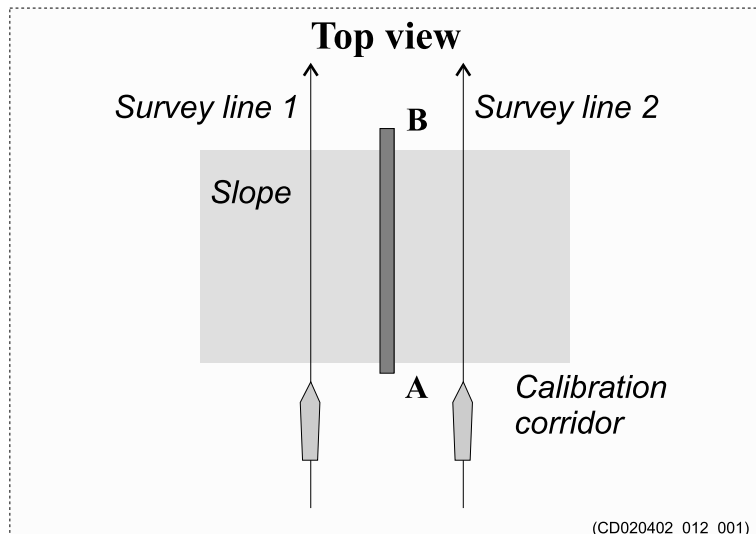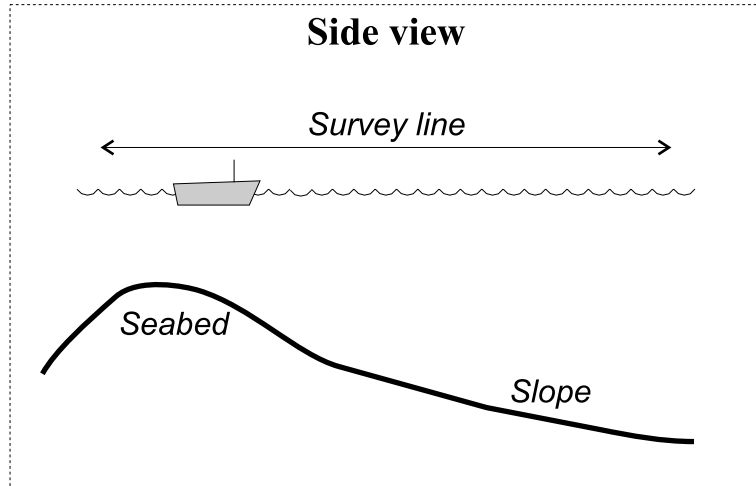# Calibrating the heading offset – alt 2 — single head

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.

Side view

Survey line

Reference point

Seabed

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.

Top view

B

Reference point

Survey line A *Survey line*

Calibration corridor

(CD020402_012_002)

Survey these two lines in same direction.

3   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.

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

Note

Accurate positions and position time delays are required.

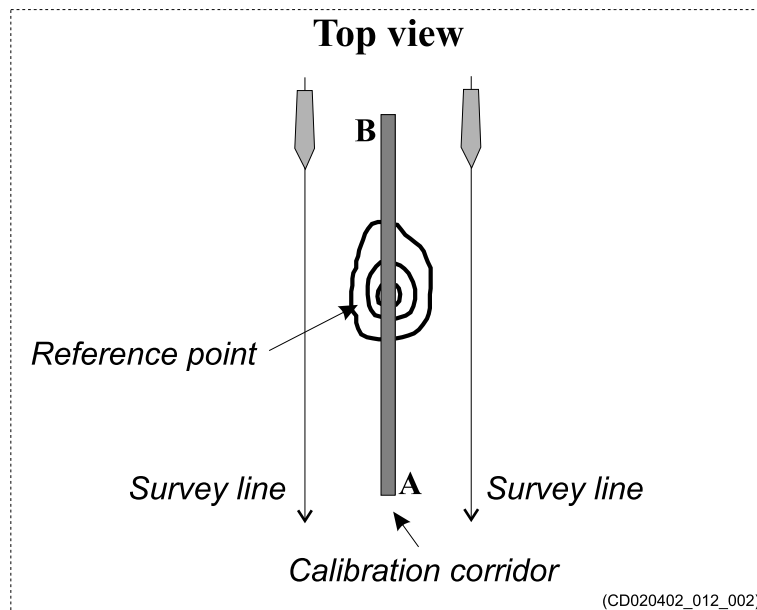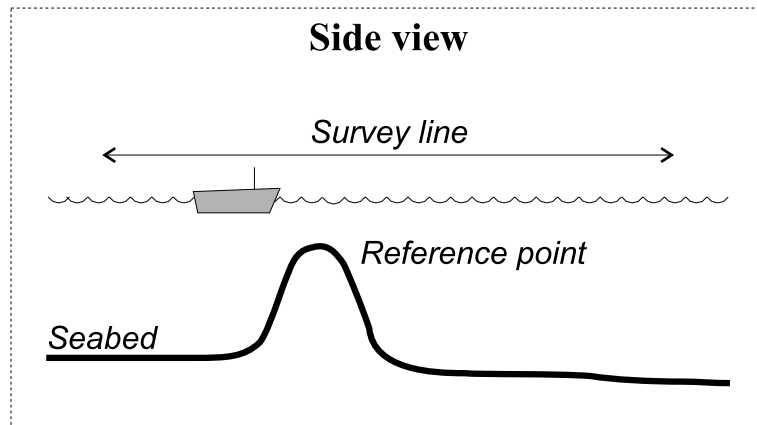# Calibrating the heading offset – alt 1 — dual head

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.

2   Place a calibration corridor on top of one of the survey lines.

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

4   Repeat step 2 and 3, create a calibration corridor on top of the other survey line to compare data for the other head.

Side view
Survey lines

Seabed

Slope

Top view

□ *Coverage Head 1*
□ *Coverage Head 2*
□ *Calibration corridors*

Survey lines

Slope

(CD020402_012_003)

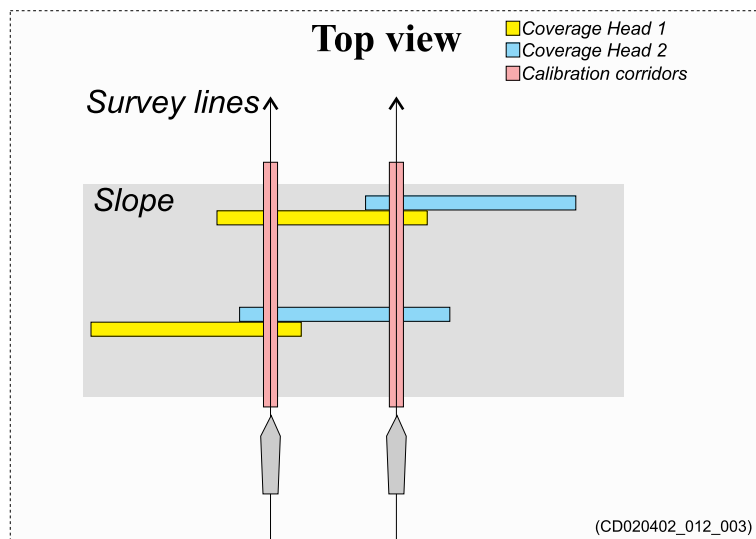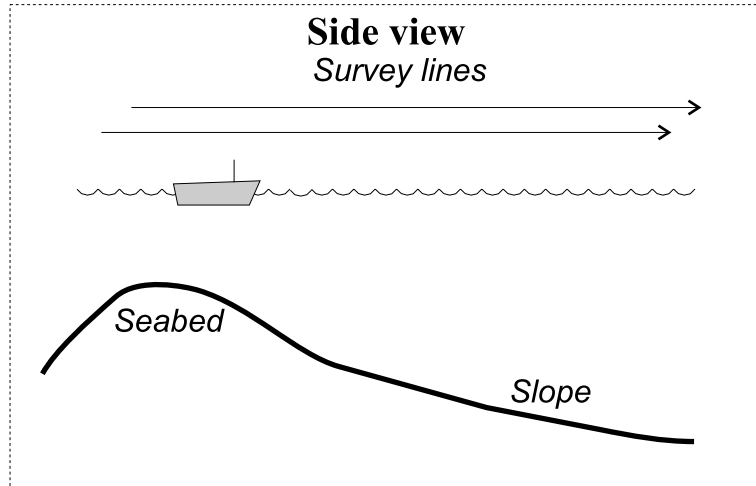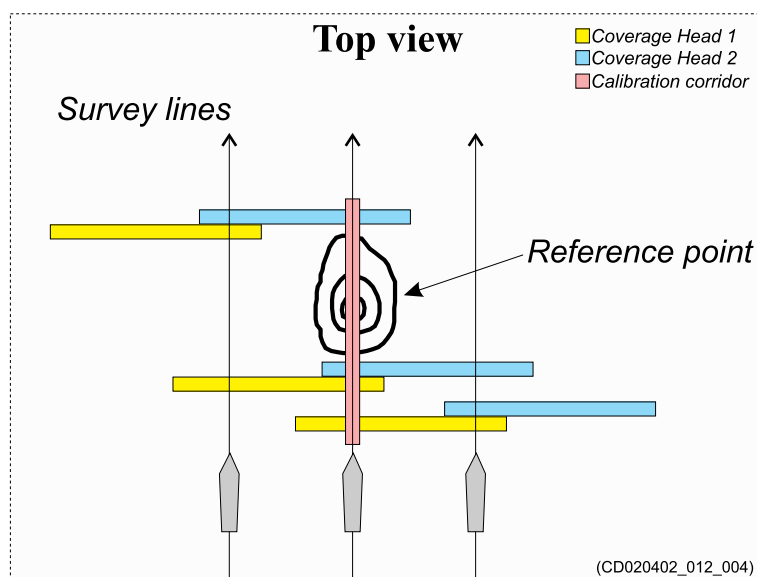# Calibrating the heading offset – alt 2 — dual head

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.

Side view

Survey lines

Reference point

Seabed

Top view

Coverage Head 1
Coverage Head 2
Calibration corridor

Survey lines

Reference point

(CD020402_012_004)
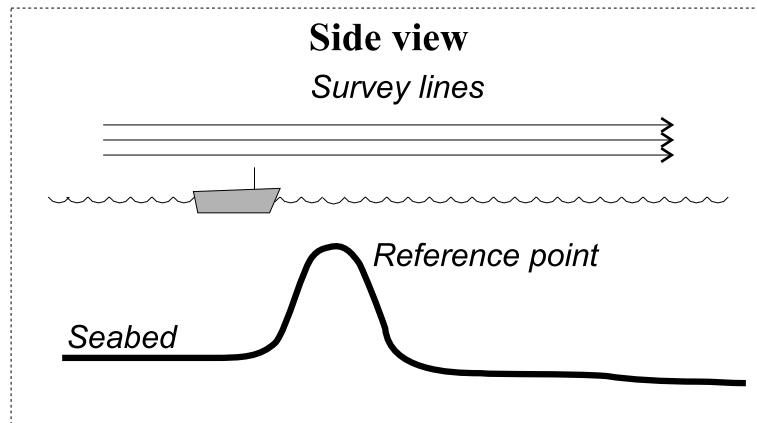
The lines should be separated, with overlap between them.

3   Place a calibration corridor on the survey line on top of the object.

4   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.

Sound speed quality inspection - single head

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.
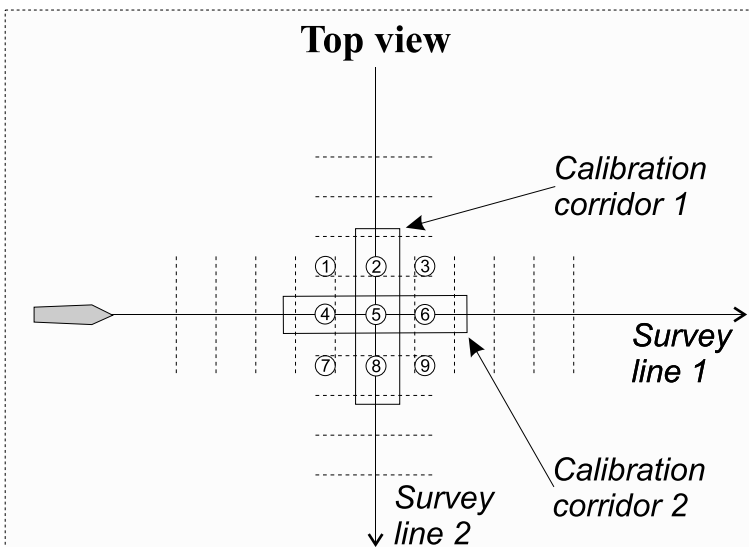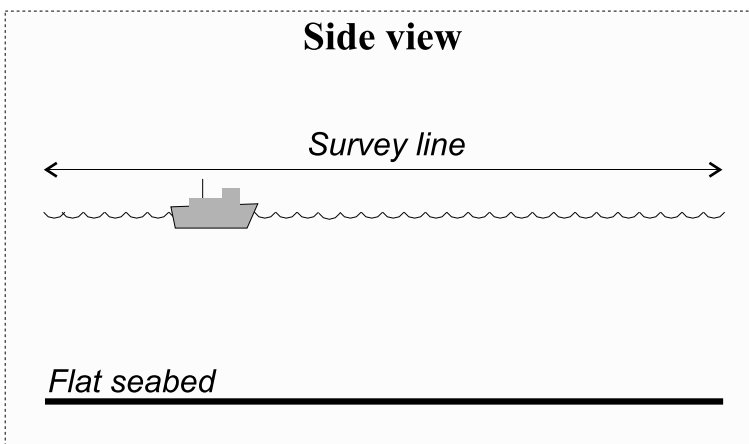
(cd022008)

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

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

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**.

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   On the **File** menu, select **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 new beta version of the svp editor.

Prerequisites

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

For more information: Defining a new filter, page 43

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 (new Beta)**.

2   On the **View** menu, select **Filter**.

3   Under **Open**, select the filter from the list.

4   On the **File** menu, select **Open**.

5   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.

6   Select the file.

7   Select **OK**.

8   On the **File** menu, select **Save As**.

9   In the folder browser select your way to the file folder where you want to save the new .asvp file.

10   Select **New File**.

11   Type a name for the new .asvp file.

12   Select **OK**.

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 new beta 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 (new Beta)**.

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

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.

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.

6

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   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.

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

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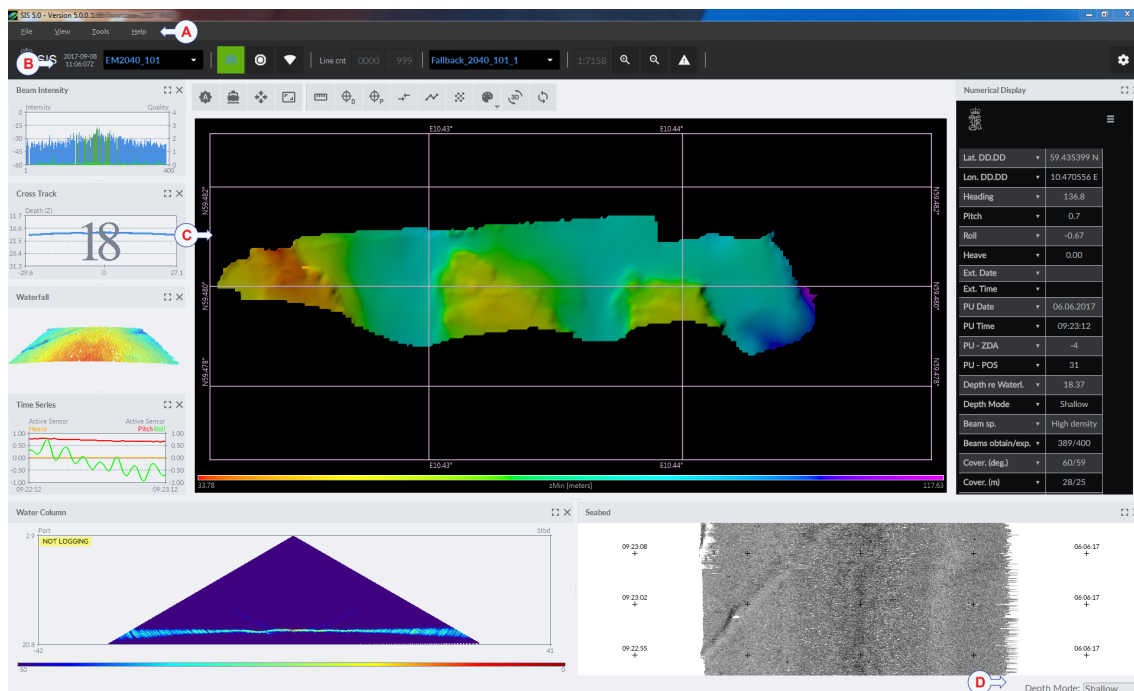
A   Main menu

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 main purpose of the *Geographical* 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 UTC.

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 SIS 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 red 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, and see the selected survey in 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 main purpose of the *Geographical* 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 can define your own projection or select from a wide range of predefined projections. A 7-parameter datum transformation is also available.

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

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.

⊕D Show depth

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

⊕P Show position

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

3D mode

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

∿ Planning mode

> Select **Planning mode** to start planning.

 Point selection mode

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

 View mode

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

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 _____

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

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 (±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.

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 ────────────────────────────────

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

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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.
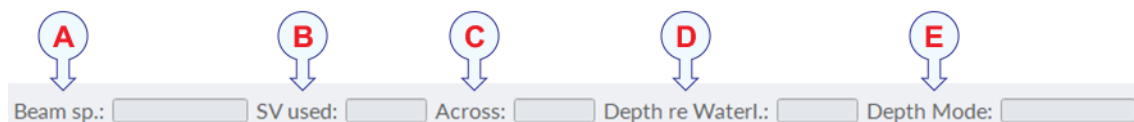
A **Beam spacing**

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

Sector coverage dialog box, page 87

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 89

Tip _____

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

Menu system

Topics

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 67

- View menu

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

  View menu, page 68

- Tools menu

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

  Tools menu, page 71

- 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.

- **Open Terrain Model**

  Select the terrain model you want to use.

- **Unload Terrain Model**

  Remove the previous terrain model.

- **Import GeoTiff Images**

  Select where to find the GeoTIFF images.

- **Unload GeoTiff Images**

  Remove the GeoTIFF images from the view.

- **Load Preferences**

- **Save Preferences**

- **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 77

- **Status bar items**

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

  Status bar, page 63

- **Palettes**

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

- **Installation Parameters**

  The **Installation Parameters** dialog box defines fixed installation parameters, such as communication parameters, installation offset angles and physical locations. These parameters are normally set only once.

  Installation Parameters dialog box, page 78

- **Runtime Parameters**

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

  Runtime dialog box, page 86

- **Runtime Survey**

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

  Runtime Survey dialog box, page 99

- **Sound Velocity Management**

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

  Sound Velocity Management dialog box, page 99

- **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 53

- **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 54

- **Cross Track**

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

  Cross Track view, page 55

- **Numerical Display**

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

  Numerical Display view, page 56

- **Scope**

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

  Scope view, page 57

- **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 58

- **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 59

- **Sound Velocity Profile**

  The view shows the current sound velocity profile.

  Sound Velocity Profile view, page 60

- **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 61

- **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 62

- **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 63

- **Hide Toolbar**

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

- **Preferences**

  Preferences dialog box, page 101

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 the external sensors must be registered in this dialog box.

- **Planning**

  - **Open Job**

  - **Save Job**

  - **Save Job As**

  - **Clear Job**

  - **Send Grid and Job to Helmsman**

  - **Remove Grid and Job from Helmsman**

  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 Object** function is used to mark objects between ships.

- **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**

  This is a program to edit the sound velocity profile.

- **PU Replayer**

  This is the replayer for the SIS.

- **Data Distribution**

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

- **Parameter Setup**

- **SIS Data Logger**

  You can log the Processing Unit, SIS and the port.

- **Helmsman**

  The **Helmsman** program provides steering guidance of the ship relative to planned survey lines.

- **SVP Editor (new Beta)**

  This is a program to edit the sound velocity profile.

- **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

.

Topics

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.

Details

New Survey Name

> Enter a unique name for your survey.

Comment

> Enter a description for your survey.

Projection

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

Start new survey

> Select this to start the survey.

Settings 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 22

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

> Select where to save the files.

Directory for raw files

> Select where to save the raw files.

Directory for survey files

> Select where to save the survey files.

Data storage structure for raw files

> Build a file structure for where to save the raw files by clicking or tapping the elements in any order.

Clear structure

> Select **Clear structure** to start building the structure for the raw files anew.

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
> > ```

Related topics

New Survey dialog box, page 74

View menu: Functions and dialog boxes

.

Topics

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.

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 79

• 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 83

• Transducer setup

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

    Transducer setup dialog box, page 83

• 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 85

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.

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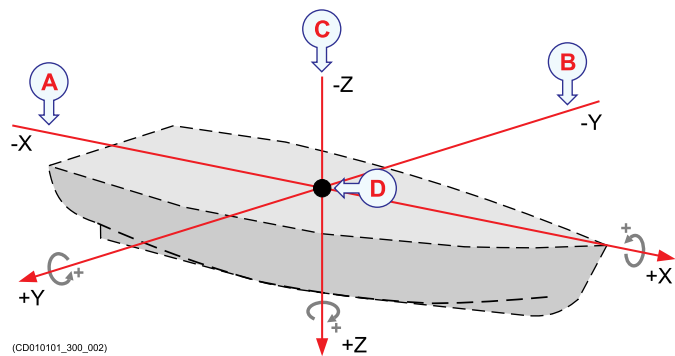
Details

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 GGK 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 acrosstrack direction, but following the vessel pitch in the alongtrack direction, i.e. as a rotation around the forward pointing axis of the vessel coordinate system. This is the convention usually used by inertial systems such as the POS/MV (the Tate-Bryant convention).

> 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 *.kmall 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

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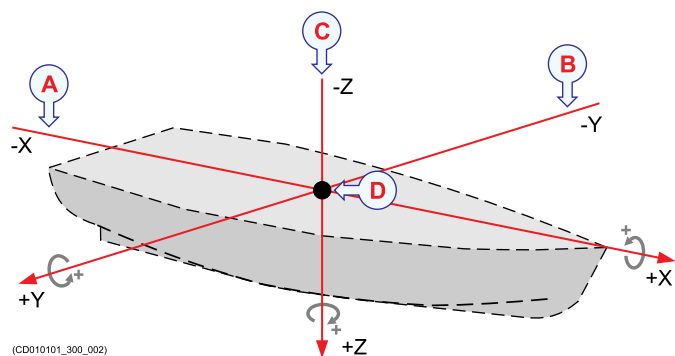
(y) position relative to the reference point. The coordinate system assumes that the x-axis follows the vessel's keel, and that the x-y plane is horizontal while the vessel is in normal trim.

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 yyyymmdd-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 87

- 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 89

- Transmit control

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

  Transmit control dialog box, page 91

- EM MultiFrequency Mode

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

  EM MultiFrequency Mode dialog box, page 92

- 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 94

- 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 95

- Extra Detections

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

  Extra Detections dialog box, page 98

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 it's 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 ±10 degrees. The ships attitude and the applied transmitter tilt is always used to calculate the x, y and z parameters for each bottom detection. This assures that the x, y and z values are correctly calculated, even if more tilting was needed to do a full pitch 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 it's 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 it's 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 ±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 were 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.
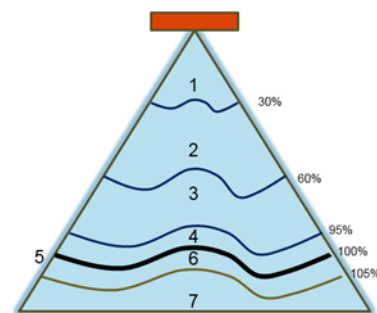
Details

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 [gear icon] 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.

Variable

Select the depth variable you want to find. Select Z (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 (distance from the seafloor to the geoid) or Z_r (distance from the seafloor to the ellipsoid).

Operation

Select whether to see the minimum or median depth.

Scale factor

Select a scale factor for the survey, 1, 2, 5 or 10.

Light direction

Select the direction of the shadings. Select North West, North East, South East or South West.

Ships track

Find all options related to the ships track here.

Line width

Select the track line width in points.

Show track

Select the check box to make the track visible.

Overlay

Find all options related to the overlay here.

Background colour

Select the background colour in the geographical view. Select the colour box on the right side to use a basic colour, or specify a custom colour with red, green and blue.

Graticule colour

Select the graticule colour in the geographical view. Select the colour box on the right side to use a basic colour, or specify a custom colour with red, green and blue.

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 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

Select the colour of the selected track line. Select the colour box on the right side to use a basic colour, or specify a custom colour with red, green and blue.

Vessel colour

Select the colour of the vessel on the geographical view. Select the colour box on the right side to use a basic colour, or specify a custom colour with red, green and blue.

Show COG vector

Select the check box to make the COG (course over ground) vector visible.

COG vector length

Select the COG vector length in points.

Show logging label

Select the check box to make the logging label visible.

Safety Contour Colour

Select the colour of the safety contour. Select the colour box on the right side to use a basic colour, or specify a custom colour with red, green and blue.

Safety Contours Visibility

Select the check box to make the safety contours visible.

Tools menu: Functions and dialog boxes

.

Topics

External Sensors dialog box

All changes to the external sensors must be registered 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

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.

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 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.

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.

Projections

Type in where the Gauss-Krüger projection file is located.

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.*

SVP Editor

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 (new Beta)**.

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.

Remote operation

Topics

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 an 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.

Remote operation from shore or another vessel

Remote operation from shore or from another vessel is set up in the same way.
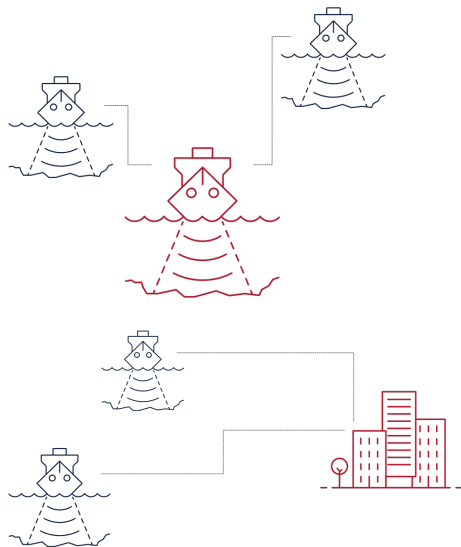
In both previous figures SIS 5 Server is installed on the survey vessels, and SIS Client is installed either on the mothership or on a PC on shore. In both cases the SIS 5 Client displays data from all survey vessels in the same display, and can control each EM-system independently. In this configuration 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.

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.

When the operator on shore needs to inspect the EM-system, SIS 5 Client is connected to SIS 5 Server on the vessel, and then the operator again has total control of the EM-system, just like a regular SIS 5 operation.

Connecting to Mapping Cloud

Both Remote Operation and Autonomous operation can be connected to Mapping Cloud.

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 Mapping Cloud over an network connection. From Mapping Cloud 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 Mapping Cloud 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 Mapping Cloud directly over an network connection. From Mapping Cloud 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.

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.

Ocean Insight

SIS 5 has the capability to operate the EM-system from a remote location. Ocean Insight is Kongsberg's cloud solution.

Description

SIS is installed on a virtual machine, running in Ocean 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
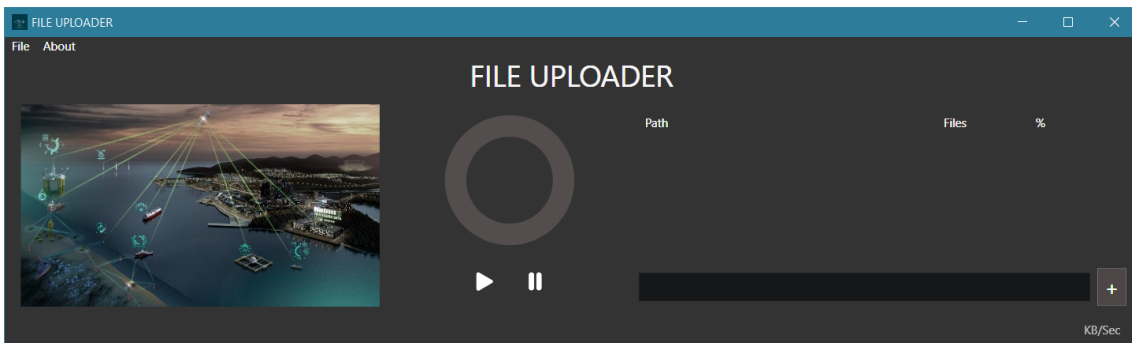
File Uploader can run both as a service in the background on the computer on the ship, or as a desktop application. With File Uploader it becomes easy to upload files from a local computer to Ocean Insight. Using the desktop version allows the operator to simply drag-and-drop files from Windows file 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 Ocean Insight automatically.

Accessing files in Ocean Insight

Accessing the files in Ocean Insight is done through a web browser. Simply log into the Ocean 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 Ocean Insight, any regular program for making maps can be used to process the data further into a map product.
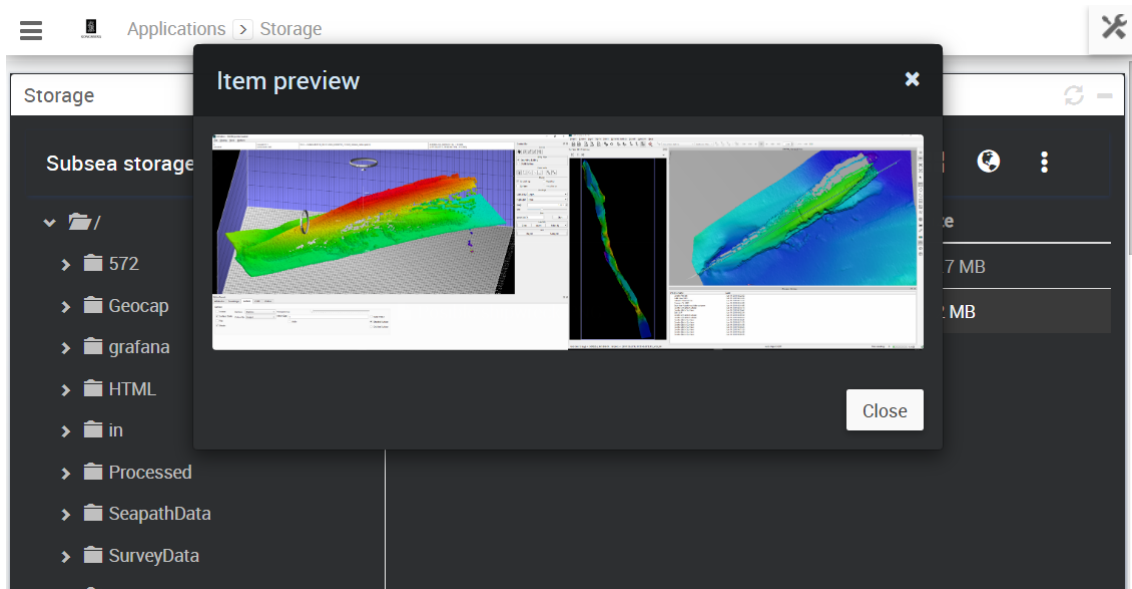
Sending data to other cloud services

Other software vendors like Earth Analytic can be given access to the data to provide further processing possibilities in the cloud.
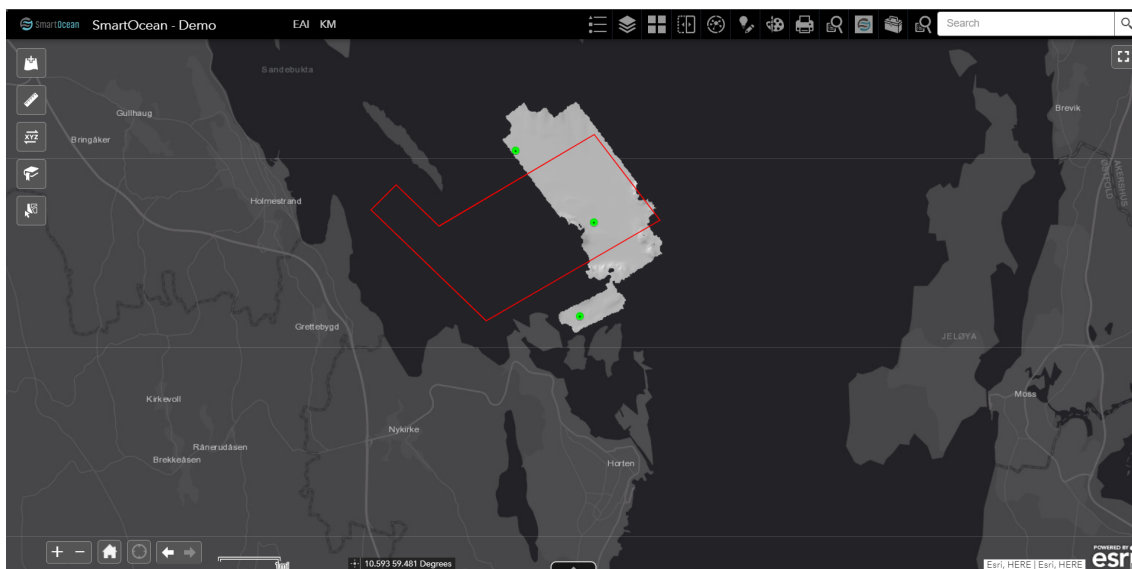
The owner of the data in Ocean Insight owns the data exclusively. Access must be granted explicitly to others if they are to use them.

Helmsman

Topics

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.

- **Helmsman Display**

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

- **Preferences**

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

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.

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.

SVP Editor

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 (new Beta)**.

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.

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 as**

  Select **New File** and where to save the sound velocity profile. It will be saved as an .asvp file.

- **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**

- **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.

- **Export SVP to SIS**

  The edited SVP will be the current SVP profile used by SIS.

- **Extend Profile**

  Extend Profile extends the current profile to 0 – 12,000 metres.

- **Extend Profile with file**

Extend the profile with another file with a different depth.

- **Extend using temp. and salinity**

  Extend the profile by using temperature and salinity measurements.

- **Thin Profile**

  Thin Profile removes some points from the sound velocity profile.

  Fix Profile is the preferred method for repairing the sound velocity profile.

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 new beta 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 (new Beta)**.

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 new beta version of the svp editor.

Prerequisites

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

For more information: Defining a new filter, page 126

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 (new Beta)**.

2 On the **View** menu, select **Filter**.

3 Under **Open**, select the filter from the list.

4 On the **File** menu, select **Open**.

5 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.

6 Select the file.

7 Select **OK**.

8 On the **File** menu, select **Save As**.

9 In the folder browser select your way to the file folder where you want to save the new .asvp file.

10 Select **New File**.

11 Type a name for the new .asvp file.

12 Select **OK**.

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 origin 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 ±0.1°.

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

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 _____

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 systems 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 on a depth sensor, 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.

(CD010101_300_001)
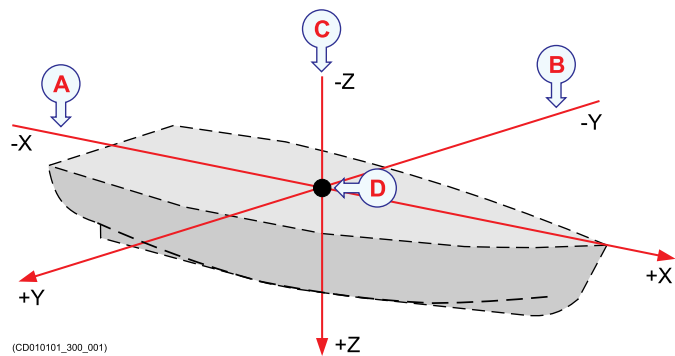
A *The X-axis is the longitudinal direction of the vessel, and in parallel with the deck. A positive value for X means that a sensor or a reference point is located ahead of the reference point (origin).*

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 reference unit (MRU)

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 reference unit (MRU).

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.

(CD010101_300_021)
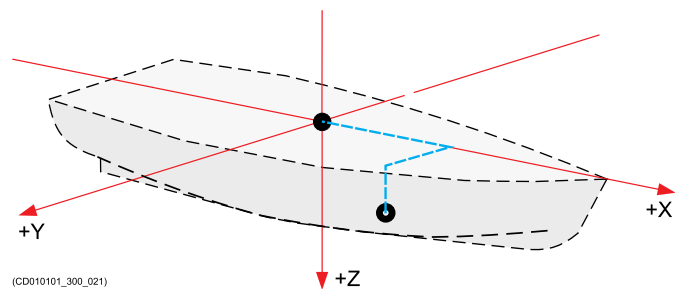
The accuracy of the three numerical values for X, Y and Z defines the accuracy of the sensor data. If you require a high accuracy, for example for underwater positioning, underwater mapping or scientific measurements, you must have each sensor positioned using professional land surveying. For such use, 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.

Absorption coefficient

The absorption coefficients in SIS may be set using three different sources:

- Salinity
- CTD profile
- Manual

In principle several echo sounders can be handled simultaneously, each with its own source setting.

As a consequence SIS must maintain and control two different sets of profiles: One based on the currently set salinity value and one based on the CTD (Conductivity, Temperature and Depth) information received in an SSP datagram. The third alternative, Manual, results in the user entered absorption coefficient values being used immediately.

Absorption 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.

Currently the required range of frequencies for the complete range of multibeam echo sounders are 12, 32, 60, 70, 80, 90, 95, 100, 200 and 300* kHz. (* used to calculate for 297 and 307 kHz internally in EM 3000 and EM 3002 Processing Units).

CTD based absorption coefficient profiles

CTD based absorption coefficient profiles are only generated based on SSP datagrams with formats other than S00 and S10. These other datagrams may contain the absorption coefficient directly (with appropriate frequency listed) or they contain the necessary CTD data to calculate the absorption coefficient profiles for all frequencies.

When the SSP datagram contains the absorption coefficient directly (datagrams S13, S23, S33, S43, S53) this datagram is valid for one frequency only. To be able to generate a full set of absorption coefficient files one SSP datagram of the same type for each used frequency must be received. The interval between the reception of individual datagrams must be max 10 sec. (currently). The internal date and time in the SSP datagrams must be the same for all in the received set.

Note ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

The requirement is that one such SPP datagram must be received for each of the frequencies 12, 32, 60, 70, 80 90, 95, 100, 200 and 300 kHz.

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When received, the SSP datagrams S01, S02, S03, S04, S05, S06 and S07 will result in an automatic and immediate use of the confined information. Therefore it is not necessary for the operator to make a manual selection for the associated SVP.

The name of CTD based absorption coefficient file sets is constructed in the same way as for S00/S10 based sets without the salinity part.

Example of a CTD file set, based on SSP datagrams different from S00 and S10:

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 an SVP from the runtime parameter Sound Speed Profile interface it is regarded as a CTD file set only if the file name does not contain salinity and all frequency files are present.

⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

A new salinity based file set is generated from the selected SVP and current salinity. That is when a CTD based file set is used immediately (S01, S02, S03, S04, S05, S06, S07) selected or a corresponding file set for the currently selected salinity is also made.

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. The depth and sound speed profiles can be obtained from two sources:

1   Receiving an 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 **Runtime parameter→Sound Speed Profile**.

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

Note ───

There is an .asvp file in each file set containing the depth and sound speed data used in the calculations. This file is named the same as the rest of the set of files, 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, 'Horten20050304.asvp' and 'Horten20050304_salinity_03900.asvp' contains exactly the same data. The duplication and renaming of the original user selected .asvp file is done so that 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:

• When a new SSP datagram for immediate use (S00 – S07) is received from the network.

• When the user selects a new SVP from the runtime parameter Sound Speed Profile interface.

• When the Source is Salinity and the salinity value is changed and no existing file set is found for the new salinity.

• When the user selects Salinity as Source and no existing file set is found for the currently set salinity value.

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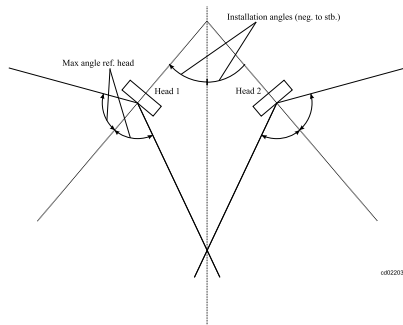
If you have a multibeam echo sounder with two heads installed there are some additional concerns related to calibration you need to consider:

• 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 ±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.

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 and 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.

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.
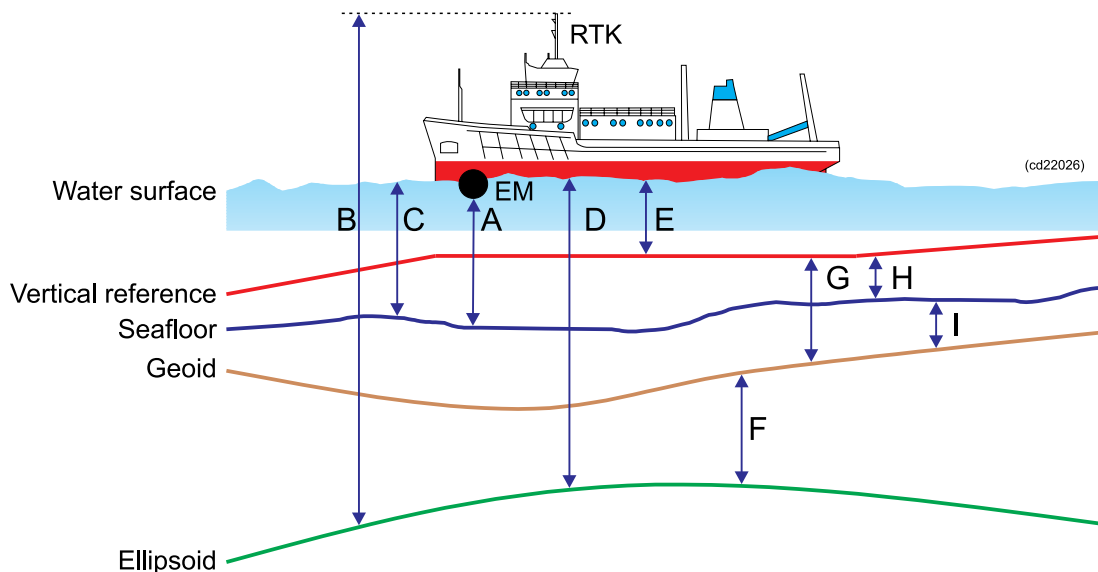
A   Distance from the echo sounder to the seafloor.

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.

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.
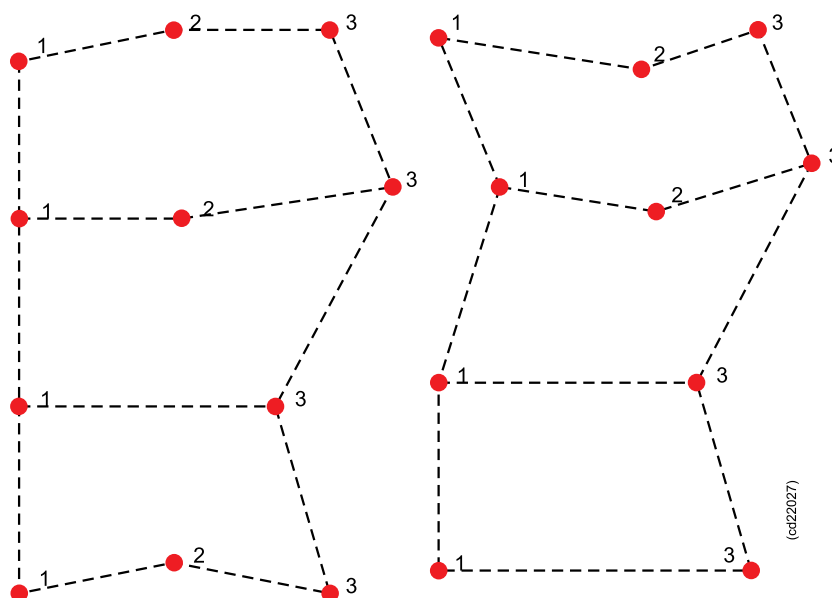
The file format is as follows:

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.

```
       |          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
```

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 if 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.

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