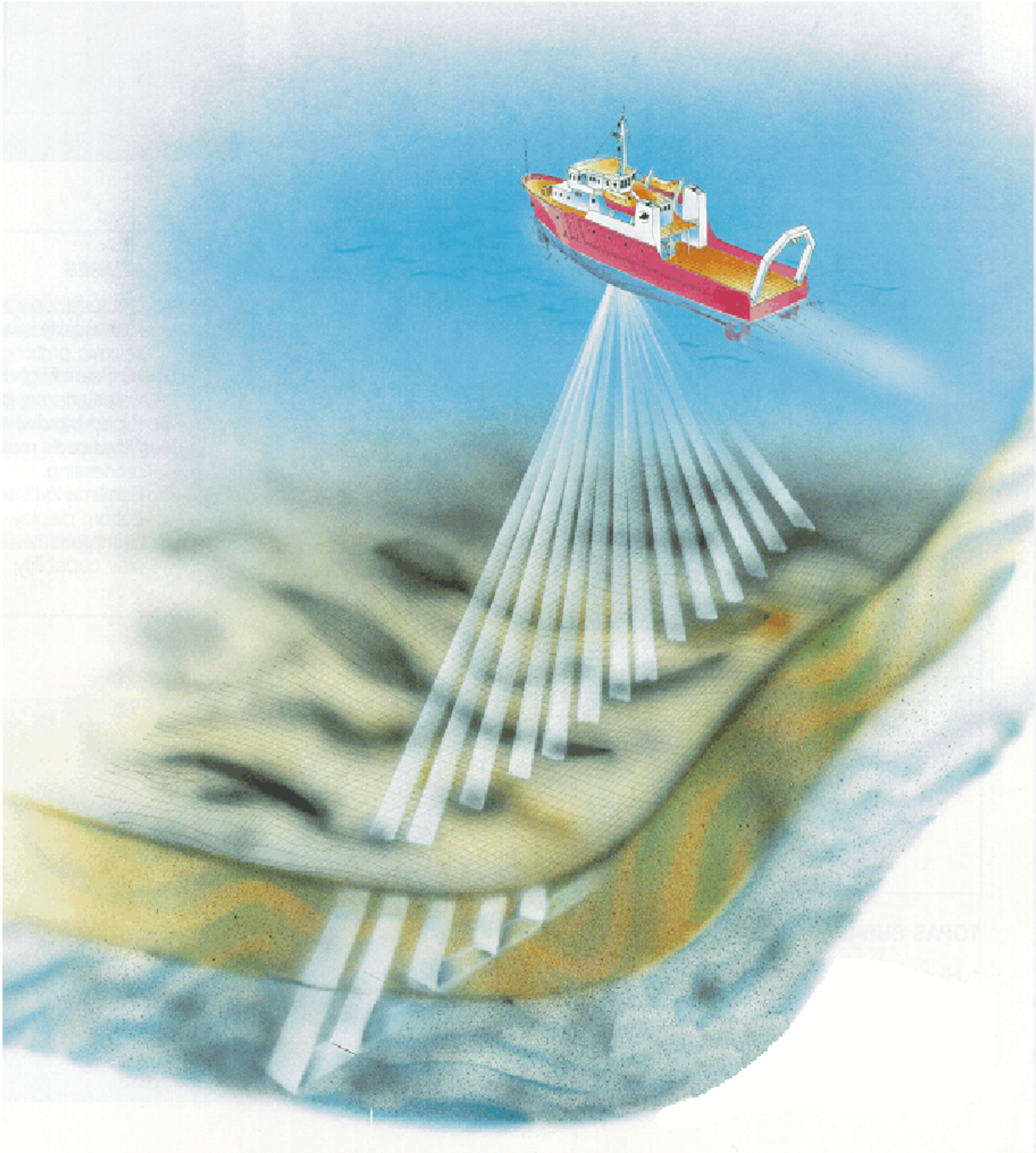
Operator Manual

KONGSBERG

TOPAS PS 18

Parametric Sub-bottom Profiler



TOPAS PS 18

Parametric Sub-bottom Profiler

Operator manual

OPER60192165 / Rev. L. 28/06/2013

NOTE!

Kongsberg Defence Systems (KDS) makes every effort to ensure that the information contained within this documentation is correct. However, our equipment is continuously being improved and updated, so we cannot assume liability for any errors that may occur.

WARNING!

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

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

KONGSBERG

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Sections

This book is the operator manual for the TOPAS PS 18 parametric sub-bottom profiler. It describes how to use the program installed on the TOPAS PS 18 Operator Station.

Remarks

References

Further information about the TOPAS PS 18 system may be found in the following manuals:

- TOPAS PS 18 Installation Manual
- TOPAS PS 18 Maintenance Manual

The reader

This operator manual is intended to be used by the system operator. He/she should be experienced in the operation of positioning systems, or should have attended a KDS training course.

Note

This manual is issued according to a registered distribution list. In the event of changes to this manual, only authorized copies with copy numbers will be updated.

TOPAS support

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Document logistics

Rev	Documentation department		Hardware/Software design		Project/Product Management	
	Date	Sign	Date	Sign	Date	Sign
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Document history

Rev. A	First issue.
Rev. B	Updated to cover new SW features
Rev. C	Updated to comply with TOPAS SW version 1.3
Rev. D	Updated to comply with TOPAS SW version 1.4
Rev. E	Updated to comply with TOPAS SW version 1.4b
Rev. F	Updated to comply with TOPAS SW version 1.5
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Rev. K	Updated to comply with TOPAS SW version 1.8.1. Removed bugs and added new functionality.
Rev. L	Bug fixes and new functionality. Complies with TOPAS SW version 1.9.2.

High voltage safety warning

Precautionary measures

The voltages used to power this equipment are potentially lethal. Even 110 volts can kill! Whenever possible, the following precautionary measures must be taken before any work is carried out inside the equipment:

- Switch off all high-voltage power supplies.
- Check the operation of any door interlock sand any other safety devices.
- Completely discharge all high-voltage capacitors.

It should be noted that interlocks and safety devices are normally located only at regular access points, and high voltages may be exposed during dismantling.

Never work alone on high-voltage equipment!

First aid in the event of electric shock

Normally, even a high voltage electric shock will not kill instantly. The victim can still be revived even when his breathing and heart-beat have ceased.

Could YOU save someone’s life?

In the event of electric shock, the correct actions, performed quickly may well save the victim’s life. Make sure you know what to do!

Immediate action

While shouting for help, remove the source if power from the victim. Switch off the supply if possible, or using a dry, non-conductive material (rubber gloves, broom handle etc.) to insulate yourself, separate the victim from the source. If the voltage exceeds 1000 volts, switch off the supply and be ready to catch the victim. Take care- do not become a victim yourself.

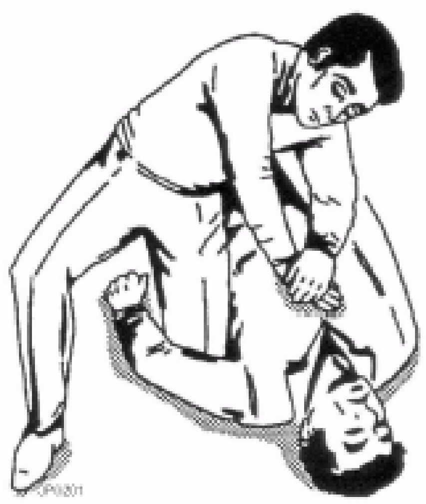
Commence first aid on the spot. Continue to shout for assistance till someone arrives.

1. Lay the victim flat on his back and loosen any tight clothing (collar, tie, belt etc.).
2. Open his mouth and check for and remove any false teeth, chewing gum etc.
3. Check if the victim is breathing. If not, check if his heart is beating. The pulse is normally easily found in the main arteries of the neck, either side of the throat, up under the chin.

If his heart is beating but he is not breathing, commence artificial respiration. If the victim’s heart is not beating, commence external cardiac massage (ECM). Continue to shout for assistance till someone arrives.

External cardiac massage

1. Kneel beside the victim. Place the heel of one hand in the centre of his chest, at a position half way between the notch between the collar-bones at the top of his chest, and the dip in the breast-bone at the base of his rib cage. Place the other hand on top of the first.
2. Keeping the arms straight and using your entire weight, press down rapidly so that the breast bone is depressed four- five cm, then release the pressure. Repeat rhythmically at a rate of one cycle per second. This will be hard work, but keep going. His life depends on YOU. Do not worry about breaking his ribs - these will heal if he survives.

- 

Artificial respiration

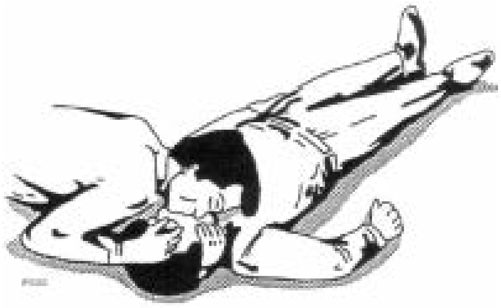
Kneel besides the victim's head. Place one hand under his neck and lift, allowing his head to fall back. This will lift his tongue and open the air passage in his throat.

Place the palm of the hand on his forehead to maintain the "chin-up" position.

Using the index finger and thumb of the same hand, pinch the victim's nostrils closed. Open his mouth.

Take a deep breath and cover his mouth with yours. Blow steadily into his lungs to expand his chest. Remove your mouth from his to allow the air to escape from his chest. You should be able to see his chest deflate.

Repeat the "inflation-deflation" cycle at a rate of about 12 cycles per minute till the victim begins to breath normally again.



Combining ECM and artificial respiration

If you are alone, perform one cycle of artificial respiration for every five cycles of ECM. This will be hard work, but keep going. His life depends on you!

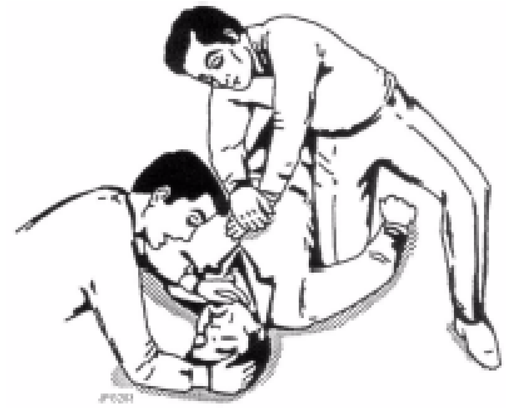
If there are other people available to help, one should perform the ECM while one performs the artificial respiration for every five cycles of ECM. It will be much more efficient with two people.

Once the victim's heart is beating and he is breathing, rolls him onto his side and support him in that position. As consciousness returns he may vomit, and this will allow any liquid to drain out of his mouth.

Remove the victim to a hospital as soon as possible, but do not interrupt the artificial respiration and ECM cycles till his heart beat and breathing returns.

If started quickly and performed correctly, the resuscitation methods described will keep a sufficient volume of oxygenated blood flowing trough the victim's body to allow full recovery.

Proficiency in the resuscitation methods can only be achieved trough training. All personnel concerned should attend courses on a regular basis. Remember, someone's life could depend on you.



Do you know what to do?

1 SYSTEM OVERVIEW

1.1 Introduction

The TOPAS PS 18 Parametric Sub-Bottom Profiler is narrow beam, high resolution, and full ocean depth sub-bottom profiler.

→ *Refer to* Figure 1-1 *on page 3 for a system diagram.*

It uses a common transducer for both transmission and reception. Due to the parametric operation of the transmitter, transducer dimensions are very small compared to non-parametric systems.

Optionally the wideband receiver array used in the Kongsberg EM 12x multibeam echo sounder system or a large, separate receiver array may be used as the TOPAS receiver to further increase receiver signal-to-ambient noise ratio.

1.2 Purpose

The primary application of the TOPAS PS 18 is to do imaging of sediment layers and buried objects. Image quality is influenced by:

- The spatial resolution of the system; its ability to distinguish objects and features separated in angle and/or range. The spatial resolution is given by two separate system properties:

  1) The angular resolution given by the size of the array and geometry, i.e. the beamwidth.

  2) The range/time resolution given by the signal bandwidth.
- The ping rate relative to the vessel speed. Dense probing along track gives smoother pictures.
- The angle of incidence of the transmit beam. The echoes received are primarily caused by specular reflections at interfaces between layers of different acoustic impedance. These specular echoes are only strong close to normal incidence.

1.3 TOPAS PS 18 - Key specifications

The TOPAS PS 18 Sub-Bottom Profiler has a much narrower beamwidth than conventional sub-bottom profilers do have with correspondingly less data smearing and lower reverberation levels. It thus provides deeper penetration into the bottom sediments due to low signal-to-reverberation ratio, and higher angular resolution.
The normal transmit waveform is a Ricker or CW pulse in shallow water or high resolution operation while the linear or hyperbolic chirps (which is an FM pulse where the frequency is swept linearly or hyperbolically with time) is used in deep water or high penetration operation. The outer limits for the start and stop frequencies of the chirp are 0.5 and 6 kHz, providing a maximum vertical resolution of approximately 0.2 milliseconds. In addition to chirps (LFM & HFM) and Ricker pulses, the system offers CW pulses and user defined pulses. TOPAS PS 18 has a typical beamwidth around 4 to 6 degrees depending on frequency and maximum source level is at least 206 dB re 1µPa @ 1 meter at 5 kHz. The peak electrical power consumption is below 3 kW.

Typical average power consumption is approximately 600 W.

For more detailed specifications, see Chapter TOPAS PS 18 Technical specifications at page 293.

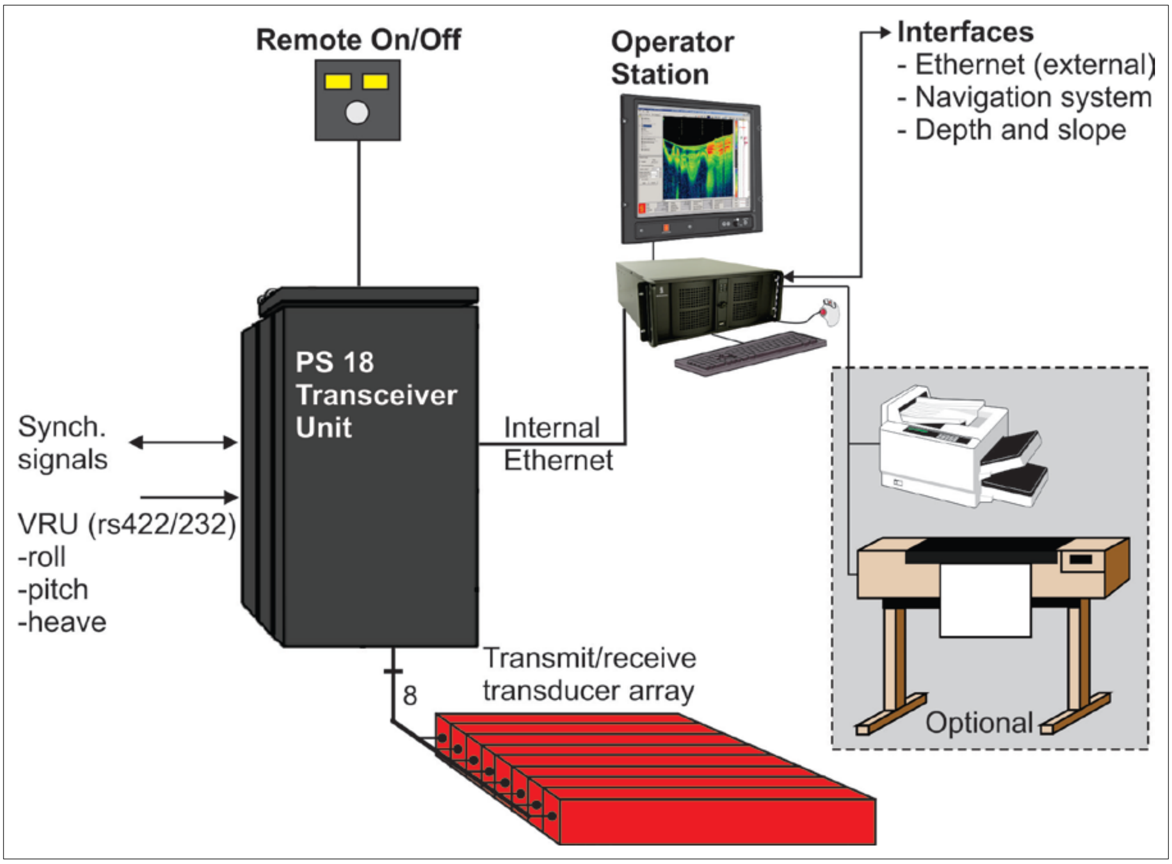


Figure 1-1 Schematic block diagram of the TOPAS PS 18 system.

1.4 Beam stabilisation

The TOPAS PS 18 beam is electronically stabilized for heave, roll and pitch movements of the sensor platform; i.e. vessel. The acoustic beam can also be steered to take into account bottom slope when information on slope is available from a multibeam echo sounder system like Kongsberg EMxxx or similar.

1.5 Ping modes

The TOPAS PS 18 system has two main transmission modes:

- Normal
- Burst

In the transmit mode *Normal*, the system pings once and then waits to collect the return signal before the next ping. Maximum ping rate is software limited in software configuration file to 5 Hz. However, the system can accommodate ping rates up to 20 Hz if required.

In the transmit mode *Burst*, the system allows a number of pulses to be launched into the water before the first return signal. The interval between the pulses should be longer or equal to the desired acquisition trace length. This mode is practical in deep water when the system operates sequentially or in parallel with other acoustic systems like single and multibeam echo sounders etc.

There are two main trigger modes:

- Internal
- External

When Trigger is in *Internal* mode the trigger or ping interval is set by the system itself.

In *External* mode the interval is set by an external system like a synchronizing unit, other echo sounders etc.

When trigger mode is internal, the trig interval can be set in the following ways:

- Manual
- Auto
- Multi

In *Manual* mode, the operator sets the trigger interval.

In *Auto* mode, the water depth determines the optimal interval. The depth must be detected either internally by the system or supplied digitally from an external source.

In *Multi*-mode the system is set to ping at a constant rate which results in more than one pulse is transmitted before the echo of the first pulse is received: The transmit and receive periods are interlaced so that a high constant ping rate can be maintained even in deep waters.

1.6 Transducer arrays

The TOPAS PS 18 transducer, which is used for both transmission and reception, has a physical width of 120 cm, a depth of 35 cm and a length of 110 cm.

Optionally, the EM 12xxx receive array or similar may be used as an alternative receiver array. This solution results in a lower noise level due to narrow, steered reception beam.

1.7 Data logging and real-time processing

The data produced by the TOPAS PS 18 are logged in the TOPAS RAW format or in the SEG Y format. The latter allows post-processing by standard seismic processing software packages.

Note *It is recommended to log data in RAW format to guarantee storage of all system parameters! Data may also be logged tin SEG-Y format in parallel or converted automatically afterwards.*

1.8 Cabinets and Operator Station

The transmitter and receiver electronic circuitry required for the TOPAS PS 18 Sub Bottom Profiler is housed in a common transceiver cabinet.

The optional receiver and beamformer for use with EM12x or other receiver array are installed in a separate cabinet.

The operator interface and display system is implemented on a dedicated PC-based operator station.

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2 OPERATIONAL PROCEDURES

2.1 Introduction

This chapter presents the most important operational procedures required to operate the TOPAS PS 18 Sub-bottom Profiler.

The TOPAS PS 18 can be operated in **survey** and **replay** or **replay** and **repeat** mode depending on the start-up parameters in the shortcut menu.

- The **survey** mode is used during the survey. The application is used to control the TOPAS Parametric Sub-bottom Pro0filer, to store the received data, and to present the data.
- The **replay** mode is used after the survey has been completed, and the data has been stored on disk. The replay mode is used for processing and presentation of stored data. Data acquisition cannot take place during replay operation. In this mode, it is possible to adjust the replay speed so hardcopy devices are able to handle the processed data stream.
- The **repeat** mode (slave mode) is used for receiving TOPAS data blocks on Ethernet sent by another TOPAS operator unit. The users can then perform processing, present data, store data etc. independently of what is set up on the operator unit. Data rate will be the same as acquired by the operator unit (master). However, it is not possible to alter settings for the transceiver unit (Receiver & Transmitter menus) in repeat mode
- The **reader** mode allows the user to perform conversion to SegY format of bandpass og matched filtered TOPAS raw data. Limited functionality makes it possible to run the program without the license dongle!

The following main operational procedures are described in this chapter:

→ *Starting the TOPAS PS 18 system: page 13*

→ *Preparing the system for use: page 14*

→ *Running a survey: page 22*

→ *Shutting down the TOPAS PS 18 system: page 23*

→ *Logging: page 24*

→ *Installing software updates: page 28*

→ *File conversion: page 30*

In addition, the following are described:

→ *Configuration files: page 26*

→ *Processing chain: page 29*

Operational procedures for the various peripheral utilities, such as printer and plotter, are not found in this book. Please refer to the individual reference manuals

2.2 Operational principles

2.2.1 General

Some parameters need input from the operator depending on type of operation or survey and water depth.

The operator may start by loading a predefined set of parameters stored in a configuration file written in XML-format. While pinging, the operator can adjust parameters and observe the effect of the adjustments on the displayed data. A new set of parameters can be stored in dedicated configuration files for later retrieval.

The operators are assumed to have reasonable detailed knowledge about the Windows 7/XP operative systems and that they are familiar in using them.

2.2.2 System interaction

All interactions with the TOPAS PS 18 Sub-bottom Profiler system take place via a windows based menu program on the Operator Station. Before operation of the system starts, it is assumed that power to all system units is switched on.

→ *For information about switching on power, refer to page 13.*

Navigating in the menus and sub-menus is done by using the mouse. The keyboard is used for entering numerical and character strings into the parameter fields.

Some commands such as starting/stopping pinging and starting/stopping logging of data may be controlled remotely, either via a web server or command telegrams sent to the system.

Note

It may take some time for the receiver system to be ready due to booting of the Receiver Units, which are running under WindowsXP/ Windows 7. It is advised to wait for a couple of minutes after powering up the transceiver cabinet before the TOPAS application is started!

2.2.3 Application window

The TOPAS PS 18 application window is divided into several areas and menus - ”sections” - that display different type of information to the operator. The operator may hide some of these sections if desired.

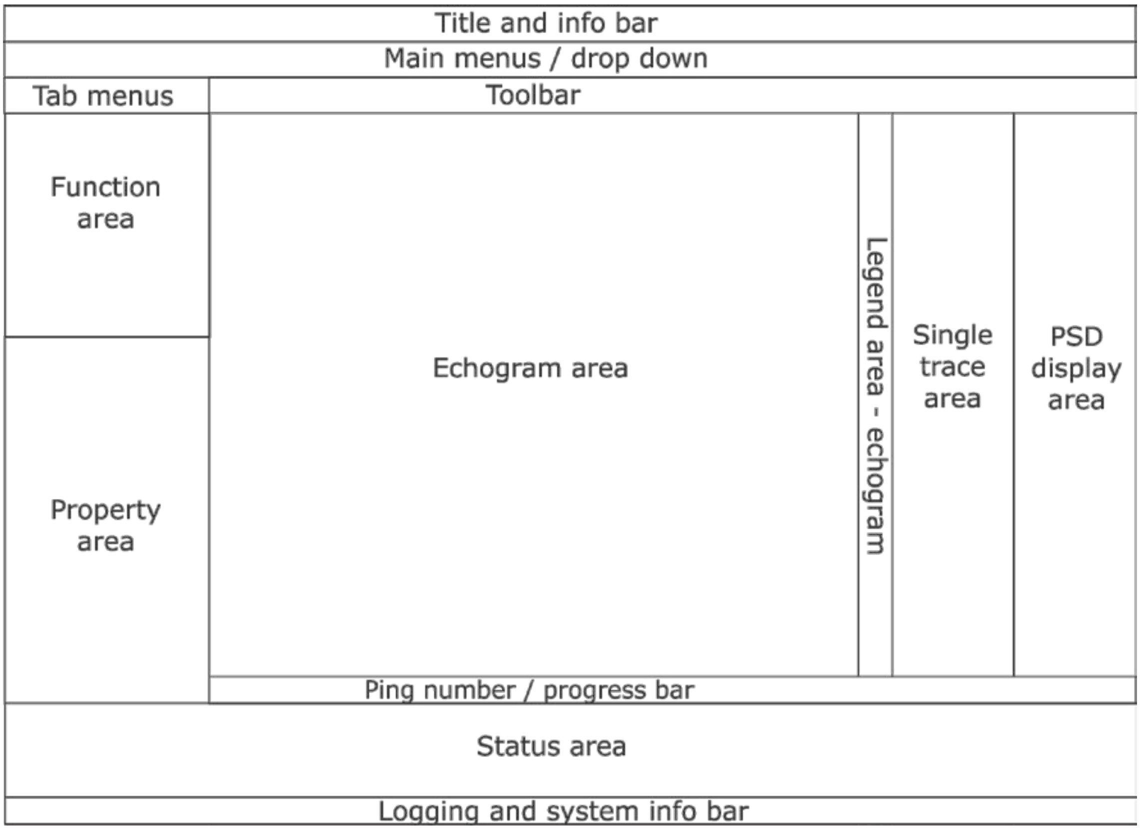


Figure 2-1 TOPAS application window.

Brief descriptions of the various areas and menus are given:

- Title and info bar
  Refer to page 49.
- Main (drop down) menus
  Refer to page 34.
- TAB menus area
  Refer to page 37.
- Property area
  Refer to page 54.
- Toolbar
  Refer to page 48.
- Echogram area
  Refer to page 50.
- Legend area
  Refer to page 59.
- Single trace area
  Refer to page 61.

- PSD display area
  Refer to page 63.
- Ping number and file length (only in Replay mode)
  Refer to page 64.
- Status area
  Refer to page 65.
- System and cursor area
  Refer to page 67.

2.2.4 Survey mode operation procedures

To start the TOPAS PS 18 system, follow this procedure:

1 Power up the system *refer to page 13.*

2 Log in and start the application, *refer to page 13.*

3 Optionally: Load configuration file

4 Check the installation parameters, *refer to page 14.*

5 Check/set the runtime parameters (transmitter / receiver), *refer to page 14.*

6 Check/set the real-time processing, *refer to page 17.*

7 Check/configure display properties, *refer to page 18.*

8 Check the external inputs, *refer to page 21*.

9 Start pinging, *refer to page 22.*

10 Check the local depth and the main echo sounder functions

11 Enter the survey job and line parameters

12 Move the vessel to the start of the first survey line

13 Start logging, *refer to page 24.*

14 Run the survey

15 Stop logging

16 Repeat from item **10** until last survey line.

17 Power down, *refer to page 23.*

2.2.5 Starting the TOPAS PS 18

2.2.5.1 Power on

To switch the power on, follow this procedure:

1 Power up the TOPAS PS 18 Transceiver Unit.

2 If present, power up the Beamformer Unit (Optional).

3 Power up the Operator Station peripherals.
Your system may include a number of peripheral devices. Consult the applicable manufacturer's documentation.

4 Power up the TOPAS PS 18 Operator Station.

2.2.5.2 Software initialisation and Login

The operating system on the TOPAS PS 18 Operator Station loads automatically. When the boot process is finished, you must log on to the operating system. The user "topas" is normally created during system installation. Default password created is ***topas0.*** However, the various customers may change these items.

You can now start the TOPAS PS 18 program from the desktop icon, named ”TOPAS” or similar. You are automatically logged on as user ”User” to the program, but in the **LogOn** menu you can also log on as ”Root” with the authority to change parameters that normally should not be changed and for configuring the system. The”Root” user is password protected.

The Root-password is ***root***.

Note — *It the power on the transceiver system has been switched OFF and ON again, it is recommended to restart the TOPAS application on the operator station!*

Caution — *Only people with detailed knowledge of the TOPAS system and installation should modify configuration parameters. Wrong settings may result in a non-operational system*

2.2.6 Preparing the system for use

2.2.6.1 Load a configuration file

The system will by default start with the configuration used when the program was last closed. The operator may wish to load a predefined configuration file suitable for the planned operation.

For more details, see *Configuration files.*

→ *Page 26.*

Note *Check that the system is in survey mode.*

2.2.6.2 Check the installation parameters

The installation parameters are installation angles and positions of transducer arrays, motion reference unit and GPS antenna relative to the ships' co-ordinate system, the water level relative to the ships' point of reference, and the number of transceiver and receiver channels. If nothing is changed, these should not be altered.

If these parameters have been changed for example for experimental purposes, or in case the installation configuration file is corrupted, it is necessary to restore the correct parameters. The easiest might be to load a configuration file with a correct set of parameters. Otherwise, the installation parameters must be entered manually.

Note *This can only be done while logged on as "Root" user.*

The check on the installation parameters is not needed during normal operation not needed.

2.2.6.3 Check / set runtime (transmitter / receiver) parameters

Check that the runtime parameters are set as expected from the selected configuration file. Table 2-1, Table 2-2 and Table 2-3 contain suggestions for how to initialise the runtime parameters before a standard survey.

Note *The number of runtime parameters is large. In order to minimize the list, our philosophy has been to display the parameters relevant to the current settings only.*

Note *Keep in mind that the TOPAS PS 18 generates signals in the audible range. At maximum power, the TOPAS PS 18 has a very high source level. Out of consideration to human beings (divers) and mammals living in the sea, we recommend to increase the source power gradually.*

Note *Never start pinging in dry dock or when transducer in out of water! The transducer may be permanently destroyed!*

Transmitter parameters	**Symbol**	**Value**	**Unit**	**Note**
Transmit mode		Normal		
Trigger mode		Internal		
Ping interval		500	ms	1
Pulse form		CW		
Frequency		4,000	Hz	
Period		1		
Power level		0	dB	2
HRP stabilisation		Checked		
Beam control		Manual		
Beam offset pitch		0	deg	
Beam offset roll		0	deg	
TX Sound speed		1,500	m/s	

Table 2-1 Typical transmitter parameters values - shallow water / high resolution

Transmitter parameters	**Symbol**	**Value**	**Unit**	**Note**
Ping interval		1,000	ms	1
Pulse form		LFM		3
Start frequency		2,000	Hz	
Stop frequency		6,000	Hz	
Chirp length		10	ms	

Table 2-2 Typical transmitter parameter values - deep water / high penetration (parameters to be modified)

Notes

1 The ping interval must be larger than the sum of trigger delay and trace length (receiver parameters). If not, the transmitted pulse may be interfering with the received data.

2 The dB unit is relative maximum power. Entering 0 dB means maximum power, -3 dB means half power, etc.

3 A LFM or HFM with bandwidth *B* and duration *T>>1/B* is a standard pulse used for sediment profiling because of noise issues. Maximum bandwidth $B \approx FH\text{-}FL$ ensures maximum range resolution, and the long pulse length *T>>1/B* improves signal-to-noise ratio by $10 \bullet log10(B \bullet T)$ compared to short pulses of duration *T* and bandwidth B≈1/T. The parameters suggested in the table gives an increase in SNR of approximately 20 dB.

Receiver parameters	Symbol	Value	Unit	Note
Delay control		Manual		1
Trig delay		TBD	ms	1, 4
Sample rate		30	kHz	6
Trace length		250	ms	2
Gain		TBD	dB	3
HP-filter		2	kHz	5

Table 2-3 Typical receiver parameters

Notes

1 Either:

1) Compute the delay manually by using $TD = 2 \bullet D/c \bullet 1000 - TL/4$ where *TD* is trigger delay, *TL* is trace length, *c* is the velocity of sound [m/s] and *D* is the depth [m].

or

2) Select Delay control = Automatic (in the acquisition parameter sheet) and have the delay automatically calculated using:

a) External depth D input

or

b) Depth D (or delay) from the Processing chain.

Select between the two sources of depth in the depth selector (located in Acquisition TAB).

2 At start-up: If there is high uncertainty regarding the actual depth D used to initiate the TD, use a large TL until bottom is detected. In an area with no or little penetration, one might wish to reduce the TL in order to save disk space. In very rough terrain it might be necessary to increase the TL in order to acquire the interesting signals.

3 Gain is adjusted so the signal is visible on the graphical display. *NB! Do not increase the gain so clipping of the input signal occurs, see the Data plotter window, Chapter 3.1.9.*

4 (checkbox) If a reliable external depth is available, this can be checked from the beginning to have an automatic calculation and adjustment of the acquisition delay. Otherwise this feature should not be enabled until the internal bottom tracker is found to track bottom.

5 When using Chirp signatures, set the HP-filter to 1.0 kHz.

Note *Make sure that the internal bottom tracker is enabled. See information about the processing chain.*

6 If the raw data is being stored or converted to SegY format, the sampling rate must be one of the following in order to get a correct integer sampling interval: 10, 20, 25, 40, 50 or 100 kHz.

2.2.6.4 Check / configure the real-time processing

The list of objects in the processing chain contains many more items that what should be used during normal operation.

The table below suggests suitable settings for an ordinary survey. Objects not listed should be disabled, while those listed should be enabled. Enabled objects are displayed in black in the processing chain, while disabled objects are dimmed (grey).

Note *The sequence of processing is important, except for the data plotters. The data plotters do not affect the final image. Their only purpose is to visualise the signal at various steps of the processing chain. Thus they can freely be moved up and down in the processing chain. Disabling both will cause the single trace area to be blank which may cause some confusion.*

Note *The real-time processing does not directly affect the data logged by the raw data logger because the data are stored before any processing is applied. Nevertheless the processing is important because the output, displayed in the echogram area(s), is what tells the operator if good data is acquired and if adjustments of run-time parameters need to be done.*

Processing chain	Setting	Note
Data plotter 1	Enable	1
Filters	None for Ricker and Matched for LFM and HFM wavelets	2
Bottom tracker	Enable	3

Time variable gain	Enable	4
Attribute processing	Instantaneous amplitude	5
Gain	-	6
Data plotter 2	Enable	7

Table 2-4 Typical real-time processing parameters

Notes

1 In this position, Data plotter 1 plots the signal prior to applied gain and matched filter.

2 LFM and HFM pulses require matched or spiking filter in order to get maximum resolution and an increase in SNR by *10•log10(B•T)*. For CW-pulses and Ricker: Apply bandpass filtering.

3 Attempts to detect bottom. Check visually that it tracks the right echo.

4 This TVG is intended for application to sub-bottom echoes. Consequently, in TVG mode ”Tracking” the start of the TVG locks to the bottom tracker. The gain [dB/ms] is always set manually.

5 Calculates the envelope of the signal.

6 Enable gain to add a fixed amount of gain to the data when necessary. Specify manually a positive (or negative) gain value whenever the signal appears weak (or saturated) in the echogram areas. Check auto gain function in the Gain parameter sheet if you would like to ”equalize” the peak magnitude for consecutive pings.

7 In this position, Data plotter 2 plots the signal at the end of the processing chain.

2.2.6.5 Check / configure display properties

There are two areas for data graphical data display; single ping area and echogram area.

A. In the Single trace area, the last beam received/processed is displayed. The position of Data plotter 1 and Data plotter 2 in the processing chain will determine what will be shown. The grid is determined by the depth tic spacing, which is set from Display → Single trace.

B. In the echogram areas, the output from the processing chain is shown. The layout of an echogram image is determined by its echogram and legend objects in the Display property sheet.

The following suggestions are intended as guidelines for inexperienced users. Potential pitfalls are marked with Warning.

Parameter	**Recommended setting**	**Note**
Echogram image		
Trace width	-	1
Adjust range to last acquisition window	Checked	2
Grid enable	Checked	3
Grid depth unit	ms	4
Ping tick spacing	200	5
Depth tick spacing	20	6
Selected beam number	0	
Bottom lock	Unchecked	7
3D	Unchecked	8

Table 2-5 Typical echogram image parameters

Notes

1 This determines width of each beam displayed in the echogram image.

2 Should be unchecked in order to display terrain with high dynamics. Warning: If this feature is turned off, the Min depth and Max depth to be entered manually determine what part of incoming data that will be displayed. If the incoming data are completely outside the limits given by these depth parameters, nothing will be displayed!

3 Most users will prefer to have a grid in the echogram area.

4 Selecting meters (m) cause the range axis to be scaled using the sound velocity in the water column. This will position bottom accurately if the sound velocity is accurate. However, regarding penetration depth and the thickness of sediment layers, the meter axis will only give an estimate. Usually, this will give a lower estimate because the velocity of sound is normally higher sub-bottom than in the water column.

5 The vertical grid lines are drawn with this interval.

6 Choice dependent upon the length of the acquisition window (and the level of zoom).

7 Select 0 (zero) to view the centre beam. Step up and down to view the along track echogram as seen by other beams. Positive beam numbers are to the port side of the ship.

8 May be used to align all bottom echoes at a constant range position in the echogram area. Requires that the bottom tracker is locked on the seafloor echo.

Parameter	**Recommended setting**	**Note**
View mode	Normal	
Polarity	+/-	1
Scale	Logarithmic	
Colour map	JET, INV GREY, GREY	2
Background	Black	2
Foreground	White	2
Upper threshold [dB]	0	3
Lower threshold [dB]	-54	4
Maximum value [dB]	0	5
Dynamic range [dB]	-54	6
Scale unit	dB	7

Table 2-6 Typical legend parameters

1 Warning: Selecting “-” means nothing will be displayed in logarithmic mode when instantaneous amplitude is calculated.

2 Other common choices for colour maps are grey scale and inverse grey scale. With these colour maps we are free to select only the foreground colour, which is the colour of the grids and tick labels.

3 All data with magnitude higher than this value are displayed with the ”peak magnitude” colour.

4 All data with magnitude lower than this value are displayed with background colour.

5 Specifies maximum value at top of colour bar.

6 Selects the dynamic range of the displayed colour bar.

7 Specifies the text at the top of the colour bar.

2.2.6.6 Check the external inputs

Proper operation of the external sensors is vital for the TOPAS PS 18 operation.

Attitude: While pinging, you may verify that attitude (roll, pitch and heave) information is received in the Status area.

Navigation reader: Check that position etc. is received on the Title and info bar or in the Status area.

2.2.7 Running a survey

2.2.7.1 Start the echo sounder (Start ”pinging”)

Make sure **Survey mode** is selected.

→ *Refer to page 7 for information about survey mode.*

1 Press the **Start** button.

The echo sounder will now start transmitting and data will be displayed after a few seconds.

→ *For a description of the “Start” button, refer to page 172.*

2.2.7.2 Check the basic operation

Before you start logging, you must make sure that either the internal bottom tracker of the TOPAS PS 18 has locked on to bottom, or that the correct depth is provided externally.

Note

It is important that the TOPAS PS 18 is running in transmit mode: Normal, until the internal bottom tracker has locked onto the bottom.

2.2.7.3 Run survey

1 Identify ”Job name” and ”Line”

In order to start a new survey, the ”Job name” and ”Line” parameters should be identified. This is done in the Status window.

2 Move to the beginning of the line

3 Start Logging

We recommend to always log raw data in the RAW format.

Be careful not to overwrite an existing file by accident. This happens if you choose an existing filename.

→ *Refer to page 24 for more information about logging.*

4 Run the Survey

5 If more survey lines, go to item **2**.

6 Stop logging at the end of the line.

2.2.8 Shutting down the TOPAS PS 18 system

2.2.8.1 Software

1 **Exit** the TOPAS PS 18 by selecting the Exit alternative on the **File** menu.

You will be asked to update the *TopasConfig.xml* file, which contains the current system and operation parameters, or not. Terminating the application by selecting the **X** in the upper right hand corner of the TOPAS window, exits without updating any files.

2 **Log out** and **Shut down** the operator unit.

2.2.8.2 Hardware units

Operator Station

1 Locate the unit's mains switch, and switch off.

2 Switch off all the peripherals.

Transceiver Unit

Switch the power off by using the remote power switch.

Beamformer Unit (Optional)

Locate the unit's mains switch, and switch off.

2.2.9 Data Logging

By logging of data, we mean logging of raw beam data unless we specifically state ”logging of processed data”. Depending on the choice of real-time processing and the position of the processed data logger in the processing chain, processed data may become worthless. By logging the raw data, no information is lost and the data can be post-processed over and over to optimise the result. We recommend always logging data in RAW format during surveys.

When you start logging, you have to specify the name of the log file or a directory in which to store the data. We recommend logging to a directory: This minimizes the risk overwriting existing files because the file names are automatically generated based on date and time.

Raw data can be logged in either the RAW format or the SEGY format. Data logged in the RAW format contain some information (heading, vessel speed, attitude, etc.) that is not logged in the SEGY format. We recommend logging in RAW format, and later convert to SEGY when needed, unless the extra information provided by the RAW format is considered redundant or not interesting.

→ *Refer to page 30 about file conversion.*

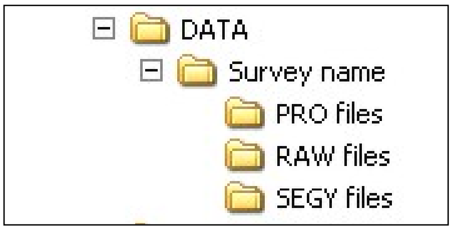
A smaller part of an existing raw data file can be extracted by start logging during replay (from pushbutton or the Processed data logger in the processing chain).

→ *Refer to page 152 for more information about the Processed data logger.*

Default file name extensions used for logging are:

- **RAW** for raw data files
- **PRO** for processed data files (file format is equal to the raw data format)
- **SEG** or **SGY** for SEGY data files

A typical folder structure for logging data is shown below.



2.2.9.1 Logging in survey mode

When you want to log RAW data in survey mode, the **Log button** (**red dot**) on the toolbar is used for starting and stopping logging. However, logging has to be enabled in the **RAW data logger 1** found on the Acquisition tab.

→ *Refer to page 172 for more information about the Log button.*

→ *Refer to page 156 for more information about the RAW data logger.*

Note

*If there is more than one channel in the system, logging is enabled in the **RAW data logger X** menu where X is the channel number. Logging is simultaneously started/stopped for all enabled channels by using the **Log Button**.*

When you want to log Processed data in survey mode, the **Log button** (**green dot**) on the toolbar is used for starting and stopping logging. However, logging has to be enabled in the **Processed data logger 1** menu found on the Acquisition tab.

→ *Refer to page 152 for more information about the Processed data logger.*

Note

*If there is more than one channel in the system, logging is enabled in the **Processed data logger** for each channel. Logging is simultaneously started/stopped by using the **Log Button**.*

2.2.9.2 Logging in replay mode

When you want to log in replay mode, the **Log button** (green dot) on the toolbar is used for starting/stopping logging. However, the **Processed data logger** found on the Processing tab must be enabled.

→ *Refer to page 172for more information about the Log button.*

→ *Refer to page 152 for more information about the Processed data logger.*

Note

*If there is more than one channel in the system, logging is enabled in the **Processed data logger** for each channel. Logging is simultaneously started/stopped by using the **Log Button**.*

2.2.10 Configuration files

The TOPAS PS 18 system is very flexible. Both in the setting of runtime parameters, which affect the acoustic signal, and in the configuration of the online processing and choice of data display, it is possible to ”get lost” for an inexperienced operator.

Almost all configurable parameters, including the installation parameters and the setup of the network communication and the serial lines, are stored in two configuration files. The default configuration files are named “***TopasInstall.xml***” and “***TopasConfig.xml***” and they are normally located in the TOPAS installation directory.

The TopasInstall-file contains parameters related to installation of the system which is not supposed to be changed unless changes to the physical system configuration have taken place. This file can only be accessed when logged on to the application as “Root”.

Note

Installation and communication line parameters should normally not be changed when the configuration file is loaded. If, for example, some of the installation parameters are changed, the system must be restarted in order for the new parameters to take effect.

The TopasConfig-file contains parameters related to the operation of the system.

When the operator unit application is closed in normal manner, the current settings are stored in the TopasConfig-file. This means the default configuration is the configuration used at the end of the previous session, so quitting the application to start over is no remedy against an unfavourable set of parameters where for example no signal is observed in the data. In addition to parameters, the last paths to the various catalogues accessed from files menus are stored in the configuration file.

We strongly recommend to make backups of one or more ”good” configurations files. As experience is gained, the operator(s) may want to make backups of configuration files for various situations. There may be different configuration files for any combination of deep or shallow water, rough or nice weather externally triggered or internally triggered transmissions, etc.

Note

You may write-protect some of the configuration files in order to avoid accidental destruction of carefully designed configurations. This is done from the Windows operator system of the op-

*erator unit. But the **TopasConfig.xml** must NOT be write-protected!*

Examples on configuration file contents can be found chapter 7.9 on page 360.

2.2.11 Installing software updates

Software updates will normally be distributed on CDs but it may also be distributed as attachments to emails.

Installation instructions will accompany the software.

Personnel from Kongsberg Defence Systems should preferably carry out control software updates in the transceiver unit.

A description of updating the software is also given in Appendix: SW Organisation on page 299.

2.2.12 Processing chain

The real-time processing and post-processing available in TOPAS software is located under the ”Processing” tab in the property area. A large number of standard and more specialized processing objects are located here in a list. The sequence of the items in this list determines in which sequence the various processing steps are applied to the signals. The signals enter at top of the chain, and they proceed down the chain.

Any item can be disabled, in which case it will be displayed in grey. Using the Move up/down arrows located in each object, all items can be moved freely up/down the processing chain. This does not imply that enabled items can be positioned in any sequence without serious consequences. As an example: Calculating instantaneous amplitude (attribute processing) prior to matched filtering is a very bad idea.

The signal output at the end of the chain is the input to the echogram areas.

Some of the objects in the processing chain may never or rarely be used. User ”Root” is given access to an ”Exclude” checkbox. Checking this check box for an object in the processing chain, will make the object invisible to the standard ”User”.

2.2.13 File conversion

Files can easily be converted from the RAW format to the SEG Y format from the TOPAS PS 18 operator unit.

Using the file conversion utility you are allowed to easily:

- Convert a single file from one format to the other.
- Convert a directory of files of one format to a directory of files of the other format.
- Convert a directory of files of one format to a single file of the other format.
- Convert a single file of one format to a directory of files of the other format.

This utility also gives you the opportunity to:

- Merge a number of files into a single file.
- Create a number of smaller files from a single file.

Prior to starting the conversion process you should specify what maximum file size you want and uncheck/check the ”Log selected beam” check box in the *Ping logger* or *Processed data logger* data sheet. If you check that check box, you must remember to set which beam number you want to extract.

Also the “Keep file name when saving” check box setting will be applied during conversion.

The conversion process is initiated from the ”File” drop down menu by choosing ”Convert file(s)”. In the pop-up window ”Choose input file or directory”, you have the option of specifying either the input file or the input directory in either the RAW or one of the SEG Y formats from the ”Files of type” drop-down menu. When you have specified the input file or directory, a new pop-up window, ”Choose format and output file or directory”, appear. There you must specify the output format and output file or directory (in the ”Files of type” drop-down menu) and the name of the file or directory.

Note

Data logged in the RAW format contain some information (heading, vessel speed and attitude) that is not logged in the SEG Y format. ***We therefore strongly recommend logging in RAW format****, and then convert to SEG Y when needed, unless the missing information is considered redundant or not relevant.*

In conversion process to SEG Y, position information may be converted from latitude / longitude to UTM coordinates. The coordinate conversion is enabled in the *Survey info* menu under the **Acquisition** tab.

Warning ***Conversion or storing to SegY format results in an error when the number of samples is higher than 64k.***

Warning ***In order to get correct integer sampling interval (in µS) in the SegY file, the sampling frequency defined in the receiver menu must be one of the following: 10, 20, 25, 40, 50 or 100 kHz.***

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3 MENU SYSTEM

3.1 Principles

The menu system on the TOPAS PS 18 Parametric Sub-bottom Profiler operator unit is designed the same way as most Window™ compatible software. The main menu bar on the top of the window provides access to a number of drop-down menus.

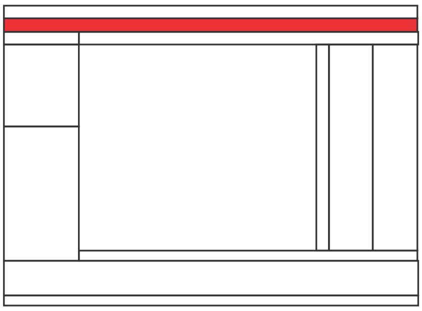
Parameters are accessed through the tab menus in the Property area on the left side on the screen.

→ *Main menu (drop-down menu), page 34*

→ *Tab menus, page 37*

→ *Toolbar menu, page 47*

3.1.1 Main menu (drop-down menu)

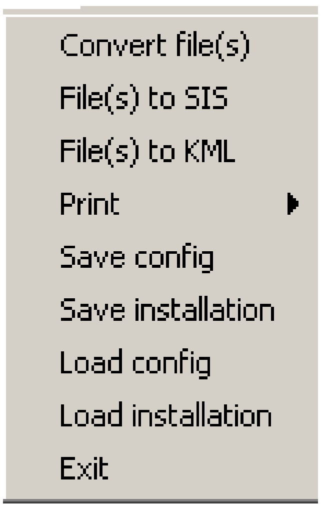


The main menu is located on the top. It provides the following choices:

- File
- View
- LogOn
- Help

3.1.1.1 File

The **File** drop-down menu gives you the following choices:



→ *Convert file(s), page 88.*

→ *File(s) to SIS, page 112.*

→ *File(s) to KML, page 113.*

→ *Print, page 143.*

→ *Save config, page 176.*

→ *Save installation, page 177.* *

→ *Load installation, page 122.* *

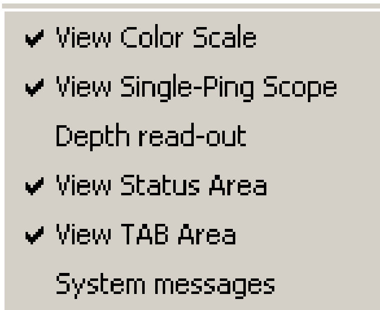
→ *Load config, page124.*

→ *Exit, page 108.*

Note **) Only visible when logged on as Root!*

3.1.1.2 View

The **View** drop-down menu allows you to view different areas. The following choices are available:



→ *View Colour Scale, page 226.*

→ *View Single-Ping Scope area, page 225.*

→ *Depth read-out area, page 230.*

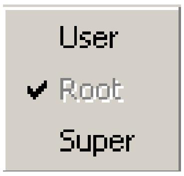
→ *View Status Area, page 228.*

→ *View TAB area, page 227.*

→ *System messages, page 229.*

3.1.1.3 LogOn

The **LogOn** drop-down menu allows you to define the set-up conditions for your echo sounder. The following choices are available:



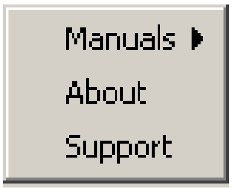
→ *User, page 223.*

→ *Root, page 175.*

→ *Super (access only for Kongsberg personnel)*

3.1.1.4 Help

The **Help** drop-down menu provides access to the online help system. The following choices are available:

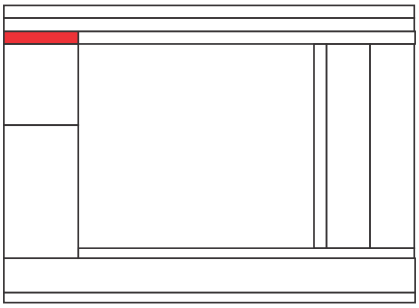


→ *Manuals, page 129.*

→ *About, page 73.*

→ *Support, page 194.*

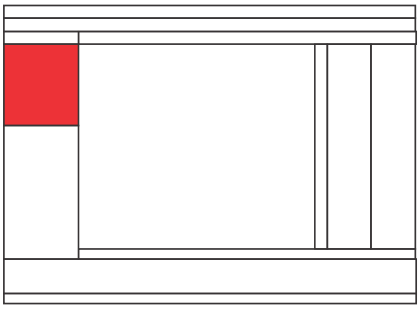
3.1.2 Tab menus



The tab menus contain various tabs for selecting parameter sheets.

The tab menus are found in the property area which is located on the left side of the screen.

Each tab opens a tab function area.



It provides access to the following functions:

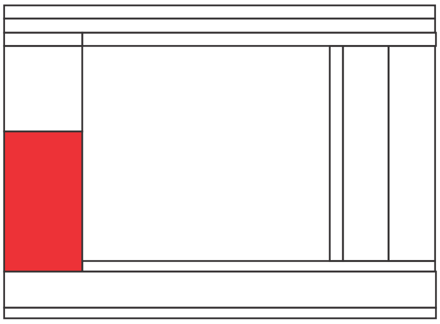
- **Acquisition**
  Presenting parameter area for specifying operational parameters for the system hardware.
- **Processing**
  Presenting parameter area with processing functions.
- **Display**
  Presenting parameter area for functions relevant for displaying the data.
- **Print**

  Presenting parameter area for functions relevant for printing the data on printers and grey scale recorders, and for sending data to parallel, serial or UDP ports.
- **Configuration**
  Presenting parameter area for hardware and system installation configuration parameters. The TAB is only present when logged on as ***Root***.

- **BIST**

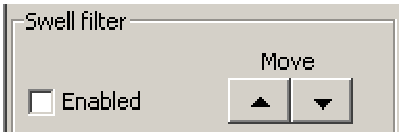
  Presenting parameter area for performing Built-In-Self-Test and presentation of internal hardware configuration parameters.

Each function has an associated Property sheet where parameter values are entered.



Under the various tabs, objects are listed in parameter sheets. Some of the objects, specifically under the *Processing* tab, can be moved up and down in the list they appear, using the arrows under Move. This applies to objects located in the different data selectors and to objects in the processing chain.

3.1.2.1 Enabled checkbox



You can activate the different objects on the tab menus by checking the *Enabled* check box. When an object is enabled, it will appear as black. When disabled, it will appear as grey.

When an object is disabled (grey), the parameters it contains, are out of function.

3.1.3 Tabs

3.1.3.1 Configuration

Note

This tab menu and parameter sheets will only be visible when you are logged on as Root.

The exploded layout of the **Configuration** tab menu is shown in Figure 3-1.

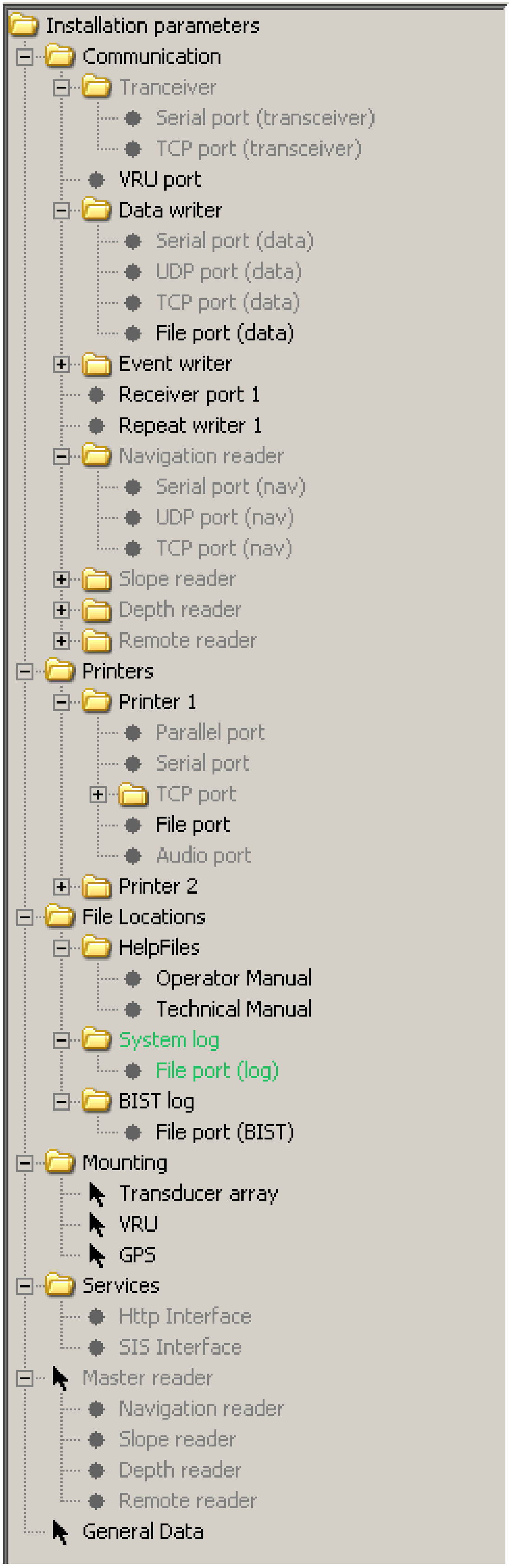


Figure 3-1 Configuration tab with expanded structure.

The **Configuration** tab menu gives you the following choices for **Communication**:

→ *Transceiver port, page 215*

→ *VRU port, page 232*

→ *Data writer, page 90*

→ *Event writer, page 108*

→ *Receiver port X, page 162*

→ *Repeat writer X , page 171*

→ *Navigation reader, page 137.*

→ *Slope reader, page 187.*

→ *Depth reader, page 97.*

→ *Remote reader, page 163.*

The X–parameter is 1, 2 or 3 depending on number of receiver channels present in the system.

The **Configuration** tab menu gives you the following choices for **Printers** configuration:

→ *Printer X, page 148*

The X–parameter is 1 or 2 referring to on of the two printers which can be used simultaneously in the system.

The **Configuration** tab menu gives you the following choices for **File Locations**:

→ *HelpFiles, page 124*

→ *System log, page 200*

→ *BIST log, page 80*

The **Configuration** tab menu gives you the following choices for **Mounting**:

→ *Transducer array, page 215*

→ *VRU, page 231*

→ *GPS, page 122*

The **Configuration** tab menu gives you the following choices for **Services**:

→ *Http Interface, page 125*

→ *SIS Interface, page 182*

The **Configuration** tab menu gives you the following choices for **Master Reader**:

→ *Navigation reader, page 135.*

→ *Slope reader, page 185.*

→ *Depth reader, page 97.*

→ *Remote reader, page 163.*

The **Configuration** tab menu gives you no choices for **General data**.

3.1.3.2 Acquisition

Figure 3-2 shows the layout of the Acquisition menu.

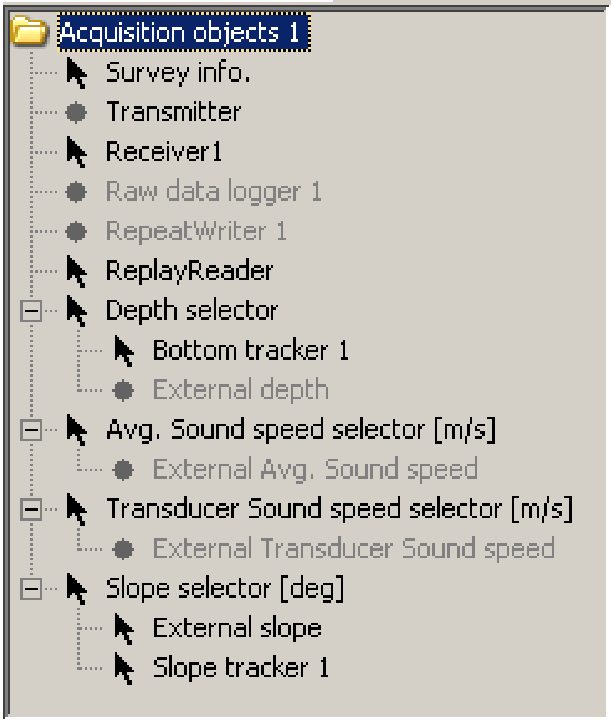


Figure 3-2 Layout of Acquisition menu.

Below you will find that some menus and some of the parameters are marked with an (**S**) or an (**R**). This means:

(**R**) only visible to user in Replay mode.

(**S**) only visible to user in Survey mode.

The **Acquisition** tab menu gives you the following choices:

→ *Survey info, page 193.*(**S**)

→ *Transmitter, page 207.*(**S**)

→ *Receiver X, page 163.*(**S**)

→ *RAW data logger X, page 156. *(**S**)

→ *Repeat writer X, page 163.*(**S, R**)

→ *Replay reader, page 174.*(**R**)

→ *Depth selector, page 99.*(**S**)

→ *Avg. Sound speed selector, page 191.*(**S**)

→ *Transducer Sound speed selector, page 191.*(**S**)

→ *Slope selector, page 188.*(**S**)

The X–parameter is 1, 2 or 3 depending on number of receiver channels present in the system.

3.1.3.3 Processing

Figure 3-3shows the layout of the Processing menu.

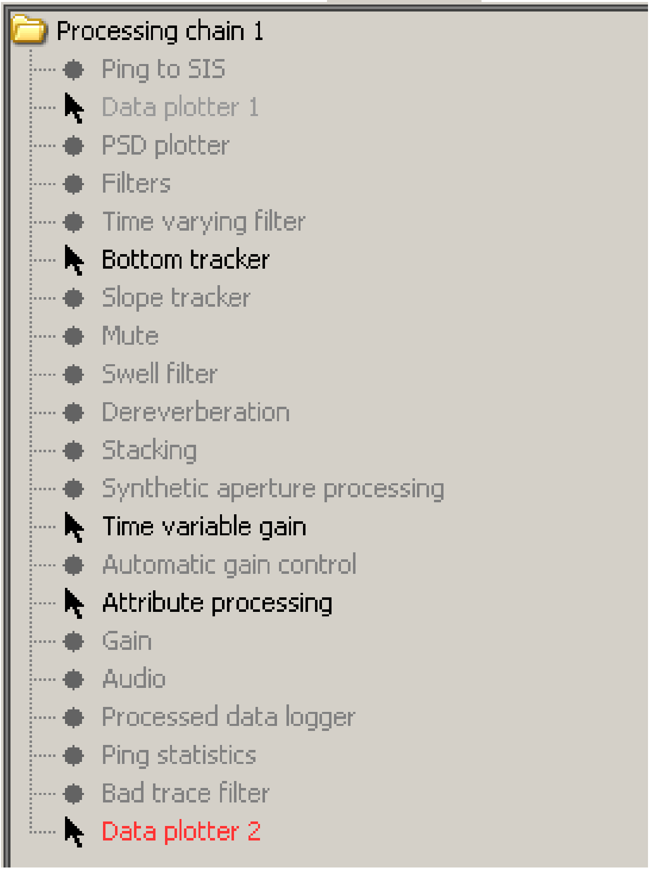


Figure 3-3 Layout of Processing menu.

The **Processing** tab menu gives you the following choices under Processing chain:

→ *Attribute processing, page 74.*

→ *Automatic gain control (AGC), page 77.*

→ *Audio, page 76.*

→ *Bad trace filter, page 79.*

→ *Bottom tracker, page 80.*

→ *Data plotter X, page 89.*

→ *Dereverberation, page 100.*

→ *Filters, page 115.*

→ *Gain, page 120.*

→ *Mute, page 134.*

→ *Ping statistics, page 138.*

→ *Ping to SIS, page 141.*

→ *Processed data logger, page 152.*

→ *PSD plotter, page 156.*

→ *Slope tracker, page 189.*

→ *Stacking, page 192.*

→ *Swell filter, page 197.*

→ *Synthetic aperture processing, page 197.*

→ *Time variable filter (TVF), page 204.*

→ *Time variable gain (TVG), page 205.*

The X–parameter is 1 or 2 and refers to one of the two plotters available in the system.

3.1.3.4 Display

The **Display** tab menu allows you to change settings for the echogram area. The following choices are available:

→ *Echogram, page 101.*

→ *Single trace, page 181.*

→ *Legend, page 84.*

→ *PSD trace, page 158.*

3.1.3.5 Print

The expanded layout of the **Printer** tab menu is shown in Figure 3-4

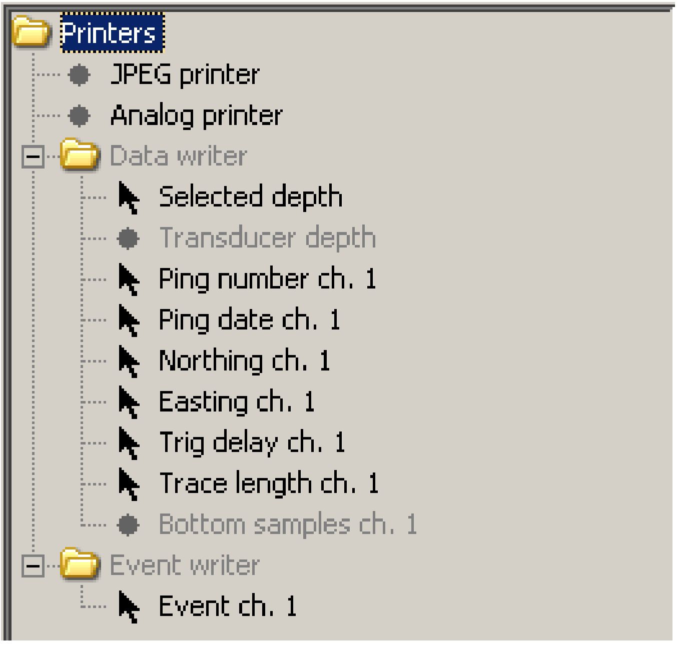


Figure 3-4 Layout of Printer tab menu items.

The **Printer** tab menu allows you to change settings for two printers and one data writer. The following choices are available:

→ *Printer 1 (here: JPEG printer), page 144.*

→ *Printer 2 (here: Analog printer), page 144.*

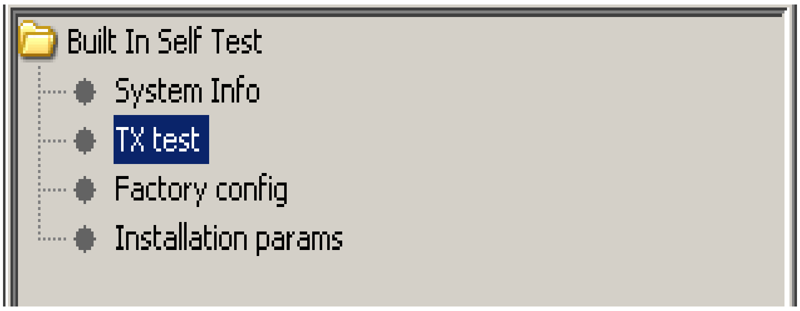
→ *Data writer, page 90.*

→ *Event writer, page 108.*

The two printer names depend on the printer configuration settings under the Configuration tab.

3.1.3.6 BIST

The expanded layout of the **BIST** tab menu is shown in Figure 3-4



The **BIST** tab menu gives you the following choices under BIST chain:

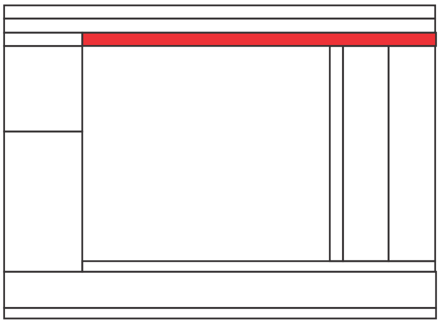
→ *System Info, page 200*.

→ *TX test, page 220*.

→ *Factory config, page 111*.

→ *Installation params, page 125*.

3.1.4 Tool bar



The Tool bar is located underneath the main menu bar. It contains buttons for direct access to important functions.

The following buttons etc. are present:

- Channel selection button

→ Refer to page 83.

- FIX button

→ *Refer to page 118.*

- Replay or Survey pull-down menu

→ *Refer to page 172.*

- Start, stop, pause, log (raw & processed data), etc. buttons

→ *Refer to page 172.*

- View mode buttons

→ *Refer to page 224.*

- Polarity buttons

→ *Refer to page 141.*

- Intensity mapping buttons

→ *Refer to page 177.*

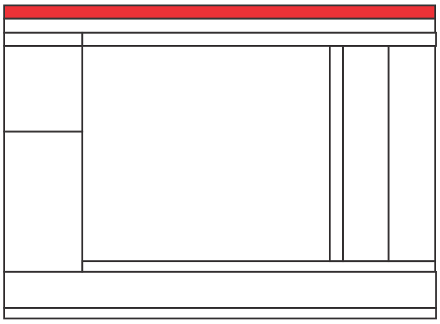
- Zoom buttons

→ *Refer to page 234.*

- Full trace button

→ *Refer to page 118.*

3.1.5 Title and info bar



Displays program name and available online information like date, time, position, heading, speed and depth.

The system does not have to ping in order to update the information; data will be shown as they become available on the various ports etc.

In replay mode, the top line in the program window shows the following items:

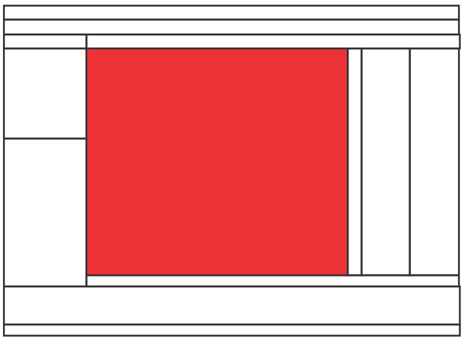
- Program name
- Current date and time
- Replayed file name

In survey mode (when present) the items are:

- Program name
- Current date and time
- Current position (latitude and longitude degrees and minutes)*
- Current heading in degrees *
- Current speed in meter/second. *
- Current depth in meters. *

*) Requires input from external sensors like navigation system and echo sounder.

3.1.6 Echogram area



This area is used to present the processed real-time or replay data. The data displayed are from the channel indicated by the selected tab.

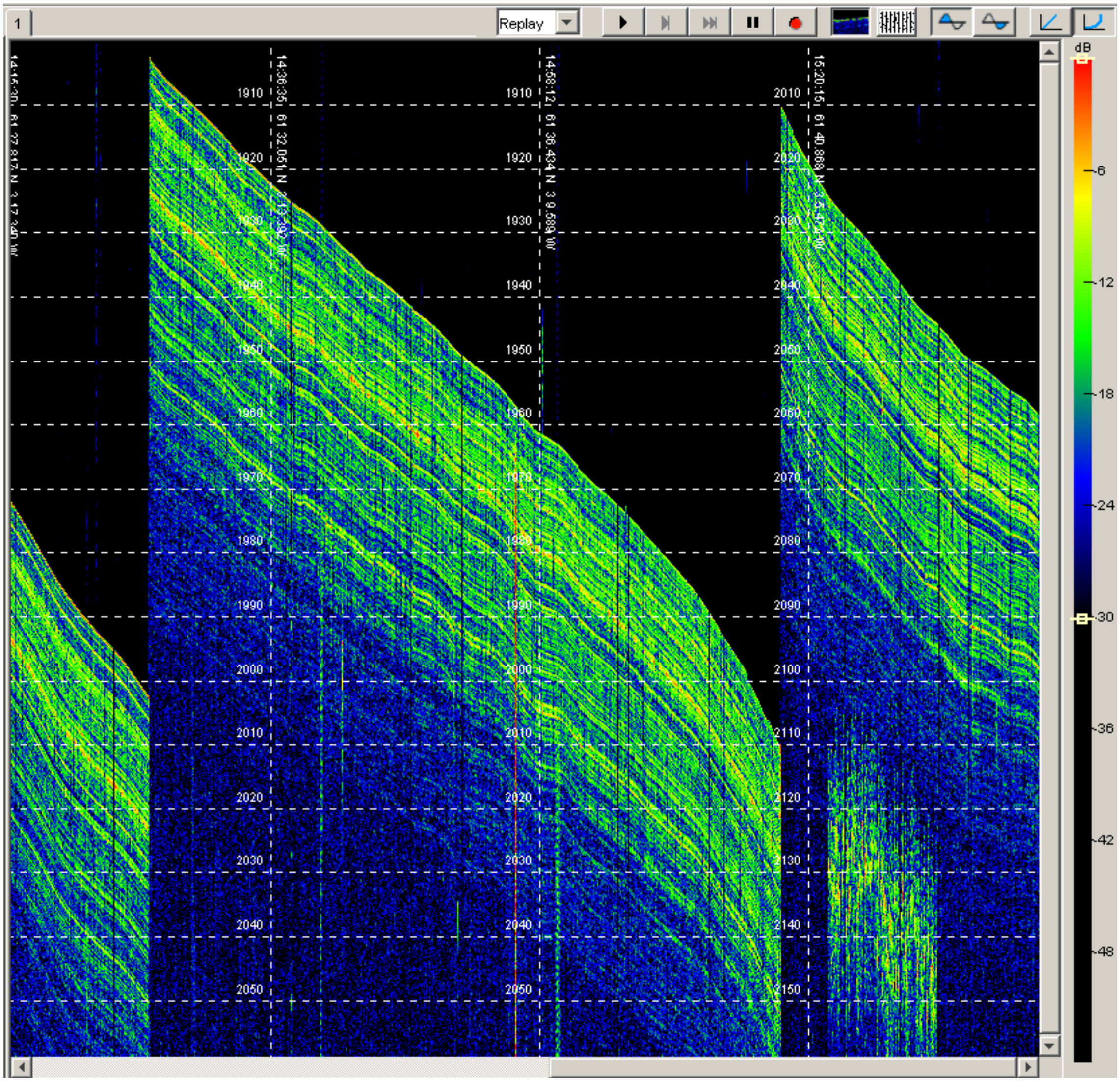


Figure 3-5 Echogram area.

The data presentation in the Echogram area is controlled by Zoom buttons on the toolbar, the Legend parameters, and by Echogram area parameters.

The Zoom buttons is used to zoom vertically. When vertical zoom is applied, a vertical scrollbar appear on the right-hand side of the Echogram area.

→ *Refer to page 234for a description of the Zoom buttons.*

The Legend and its parameters is used to control among other things linear/logarithmic scale, dynamic range, and the choice of colour map.

→ *Refer to page 84 for details about Legend area.*

The Echogram area parameters are found in the property area under the Display tab.

The **Trace width** is used to set the pixel width of each trace on the screen. This parameter provides a horizontal zoom. When the echogram area no longer fit inside the available part of the screen, a horizontal scrollbar appear at the bottom of the echogram area. This bar makes it possible to display traces that have disappeared on the left-hand side of the Echogram area.

The trace display buffer has a default size of 1,600 traces. A start-up parameter in the short-cut menu may be used to change this number.

Normally the check box **Adjust to current window** should be checked.

Note

If you choose to uncheck this box in order to manually set the minimum and maximum range, the incoming data will only be displayed if a part of the trace is within these limits.

The **Show selected beam only** should normally be checked when present and the user can specify which beam direction to display in sequential scanning mode.

If **Bottom lock** is checked, the data traces will be aligned to make the detected bottom appear at a fixed horizontal position within the display. This position is controlled by the appurtenant parameter **Bottom position**.

To view a receiver fan (across track echogram) you must check the **3D enabled** check box. Use the Beam width parameter to adjust the width of the fan. When Bottom lock is checked, the vertical axis is range. When Bottom lock is unchecked, the data are corrected to display ”depth” on the vertical axis: every echo is positioned as if they were targets at the centre of the beam (range times cosine of the beam angle). In deep waters it is most convenient to have the Bottom lock checked. When the x-shift and y-shift parameters are both set to zero, the view is an ordinary 2D view displaying just a plain across track echogram. It is possible to obtain a 3D effect by applying x- and y-shift and selecting a transparency mode (refer to Legend).

<u>Menu Shortcuts in the Echogram area:</u>

Access to Echogram parameters

This shortcut requires the Property area to be visible.

A single mouse-click inside the echogram area will bring the Echogram parameters to the front (requires that the Property area is visible).

To deselect the Zoom buttons

Simply right-click within one of the display areas (an echogram area or the single trace area)

Access to Legend parameters

These parameters may be brought to front by clicking on the colour bar within the Legend area.

Mouse position

As the mouse is moved over an along track echogram the depth and position of the pixel pointed at is displayed at the bottom of the application window. In the single trace area only the depth is displayed.

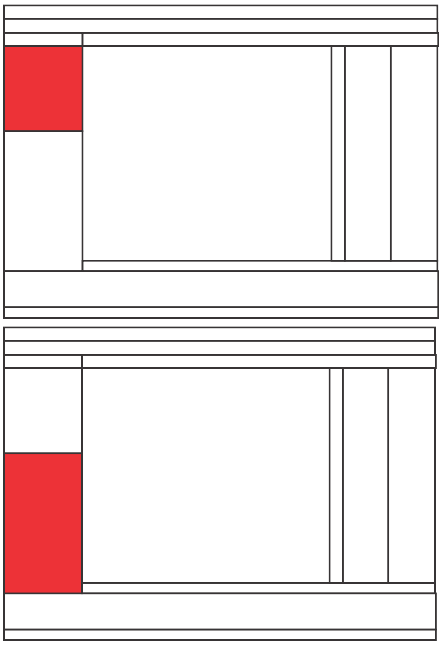
Horizontal and vertical distance

Click, hold, and drag the mouse over an along track echogram to have the horizontal and vertical distance over which the mouse has been dragged displayed at the bottom of the application window. Vertical distance is given in meters if meters is selected for the scale lines in the display.

Ping pick

To examine a particular ping in the echogram area, position the mouse over the trace and click. The time series will then be displayed in the single trace area, and the positioned you clicked at is marked with a horizontal blue line in the single trace area.

3.1.7 Function and Property areas



The function and property area is located on the left side, top and bottom, respectively. It contains the following items:

- Tabs for selecting relevant parameter sheets.
- Parameter sheets related to the current tab selection.

→ *The property areas may be hidden by the operator in order to get a larger echogram area. Refer to page 227.*

3.1.7.1 Property area tabs

This area contains tabs for various main parameter groups.

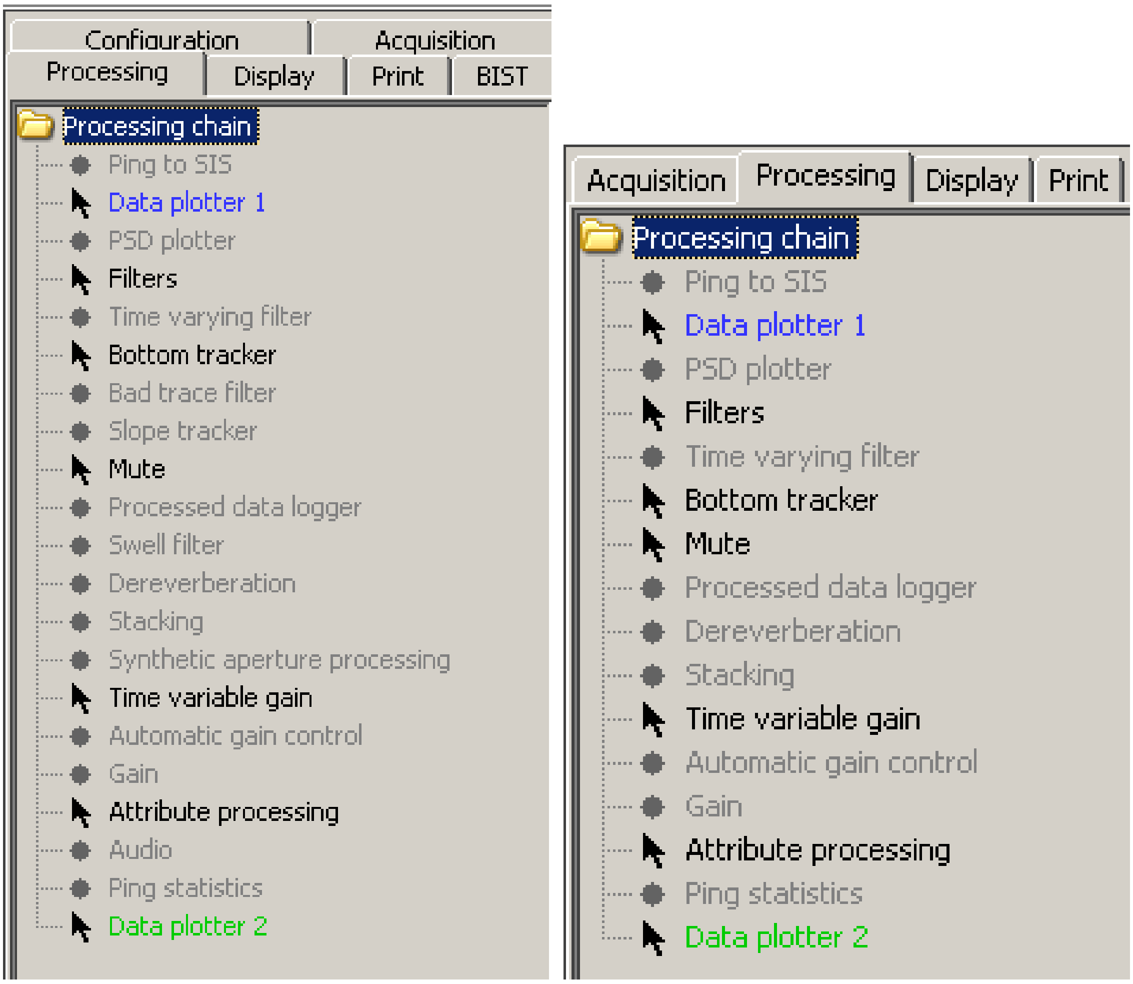


Figure 3-6 Function area (for Processing tab) for *Root* (left) and *User* (right) operators.

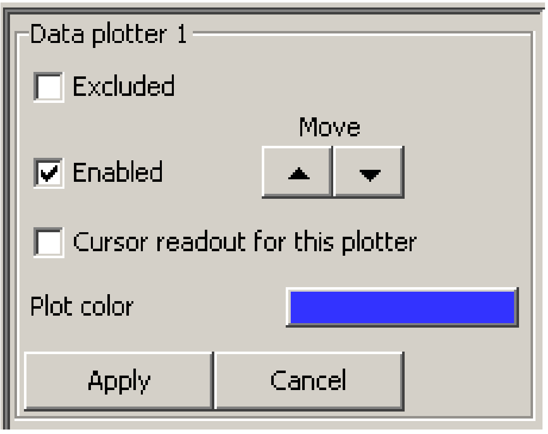
There are four tabs present when logged on as *User*:

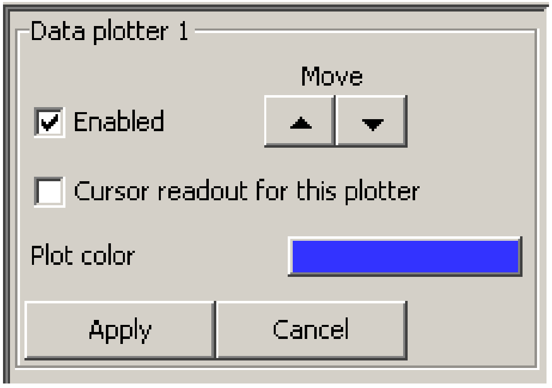
- Acquisition
- Processing
- Display
- Print

Two additional tabs are present when logged on as *Root*:

- Configuration
- BIST

The Property areas (parameter sheets) for the Function area *Data Plotter 1* displayed in Figure 3-6 are displayed here:





Note

When logged on as User, only processing items not excluded from the menu page are shown.

3.1.7.2 Property area parameter sheet

The parameter input area may comprise of a function menu in the upper part and the corresponding parameter sheet in the bottom part. Some of the parameters have a tree structure where sub-parameters are revealed when the higher level is selected.

Parameter fields are one of the following:

- Parameter value, text or number, is written directly in the box.

- Parameter value, number, is, either, written in the box or incremented or decremented in fixed steps by using the up and down arrow buttons.

- Parameter is selected from the drop-down menu, which is presented by clicking the down arrow button.

- This parameter is selected by checking the check box..

Background colour codes and parameter sheet buttons:

Grey: The value in this field can not be changed manually by a normal user. (Only user Root is allowed to change it).

Yellow: You have changed the value, but the new value is not yet applied.

Red: The entered value is outside the allowed range.

White: The value is in use.

In the parameter sheets where there are Apply and Cancel buttons, they have to be used. They have the following functions:

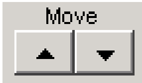
Apply: Button for accepting the modified parameter values. A yellow background colour in the parameter field indicates that the value has not been accepted yet.

Note

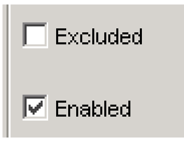
New parameters will take effect without any additional warning.

Cancel: Button for discarding the modified parameter. This is indicated by that the yellow background colour turns white, and the value returns to the original value.

In the Processing parameter sheet there is an additional field for moving the current processing function up or down in the **Processing chain**.

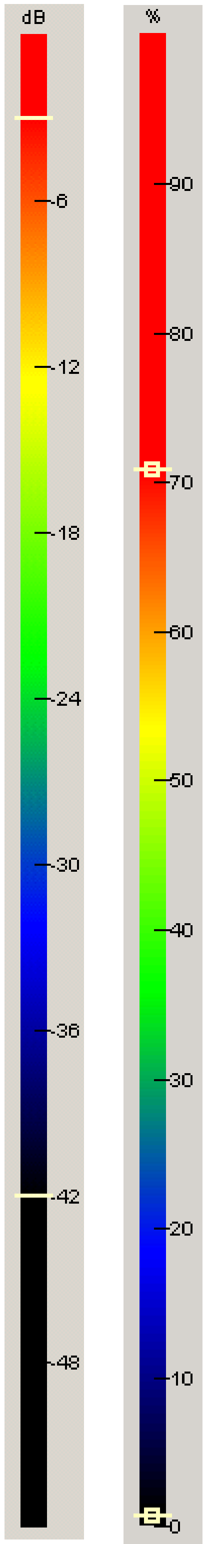


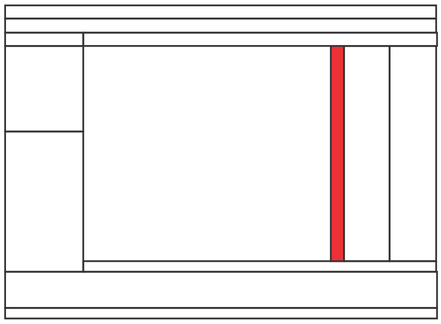
When logged on as *Root*, another checkmark field is present, the *Excluded* field:



By checking this field, the current processing item is removed from the **Processing tab** when logged on as *User*. This is done to reduce the amount of functions in the menus which are not regularly used

3.1.8 Legend area





Location of the colour coding bars.

→ *The legend areas may be hidden by the operator in order to get larger echogram areas.* *Refer to page 226.*

The **Legend areas** show how the intensity in the signal is colour coded in the *Echogram areas*.

The parameters that belong to the legends are found on the Property sheet under the Display tab.

→ *A fast way to bring these parameters to front on the Property sheet is to click by the mouse on the colour bar in a Legend area.*

Two small horizontal bars are found on the colour bar. These bars show the maximum and the minimum signal level of the colour scale to be displayed. The bars may be grabbed by the mouse pointer and moved up or down to change the display thresholds. These thresholds can also be changed by entering numerical values on the Legend parameter sheet. On the Legend parameter sheet you also choose between linear and logarithmic scale, and you can choose from a number of colour maps.

The numbers given along the scale will be either in % steps or dB steps for linear and logarithmic coding, respectively.

If the "3D enabled" check box is checked in the corresponding echogram area, the user is also given access to a transparency mode parameter. Transparency may be used together with the x and y- shift of the receiver fan to obtain a three-dimensional effect.

Ten different colour maps are available for the colour coding, see Figure 3-7. They are selected in the *Colour map* field in the *Legend* parameter sheet.

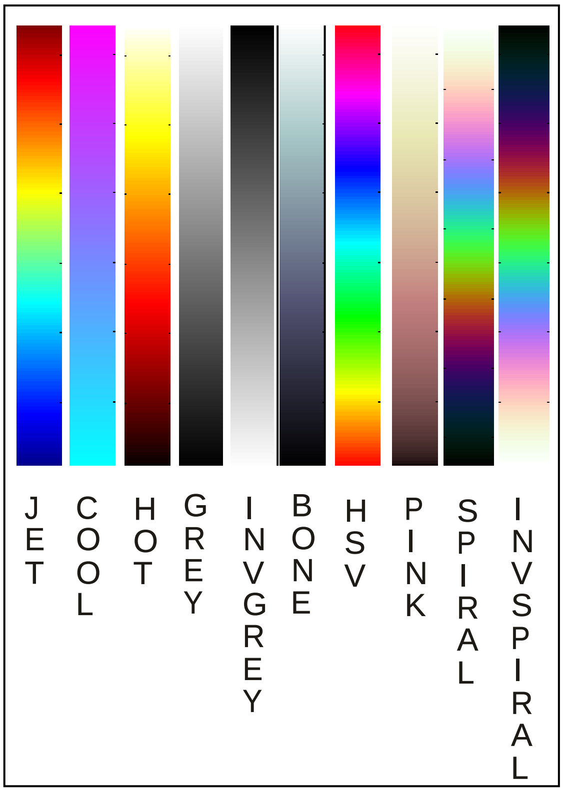
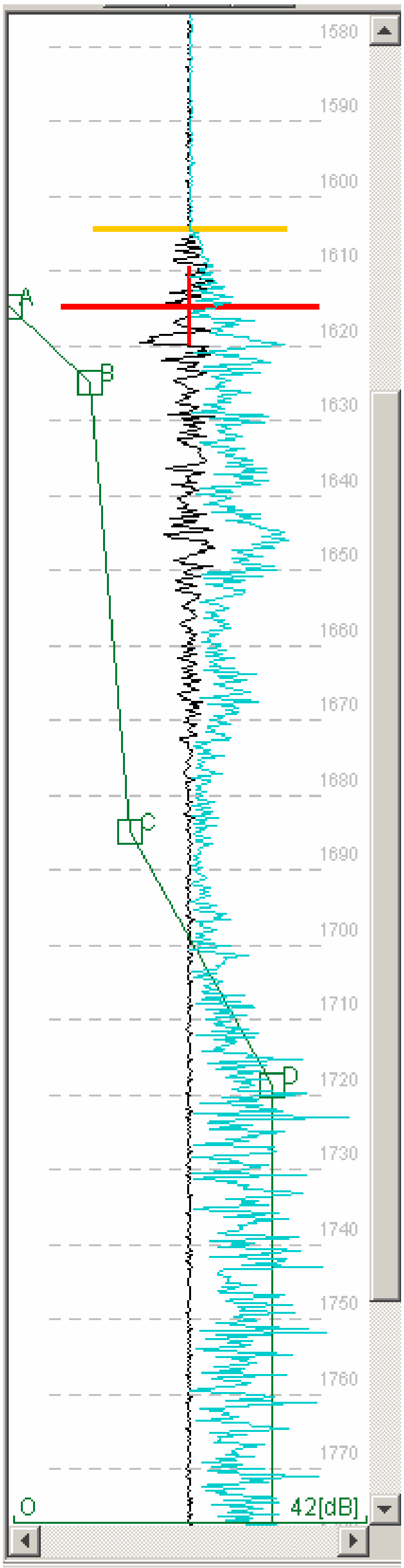
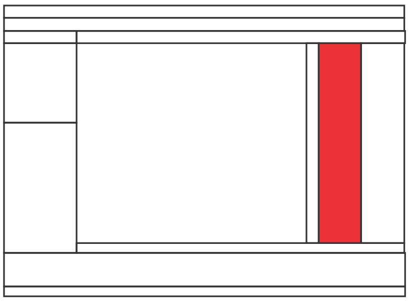


Figure 3-7 Available colour maps

Note *The SPIRAL colour maps are reproduced with correct intensity in grey scale (e.g. grey scale printers, copying machines etc.).*

3.1.9 Data plotter area





On the right-hand side of the TOPAS window, the **Single trace area** is located. This area is primarily used for QC check of the acquired signal.

The area displays the trace data in “scope” mode. Two curves can be displayed at the same time, showing the trace shape at different places in the processing chain.

This area also shows graphical information for the TVG-curve, seabed tracking, external depth and limits for automatic trigger delay change.

The data presented in the window is selected in the *Ping plotter 1 & 2* functions on the *Processing tab*. Remember to place the Ping plotter(s) in the desired position on the *Processing tab*, using the Move buttons. This means that two curves may be displayed at the same time, taken from different locations in the processing chain.

The Zoom buttons can be used to zoom along the range axis. The tic spacing is set on the Property sheet under the Display tab. This parameter may be brought to front on the Property sheet by clicking the mouse within the single trace area.

There are several markers in the area, which are described in the following:

Horizontal red bar: When the seabed tracking function is enabled, a red horizontal bar is displayed at the location where the seabed is detected.

Vertical red bar: When the seabed tracking function is enabled, a red vertical bar is displayed indicating the search area for seabed detection in the next trace.

Horizontal yellow bar: This bar is present when ”Show master depth” is checked in the bottom tracker. It shows the selected master depth is located. Master depth is chosen in the Depth selector in the Acquisition page. If external depth is supplied to the system in survey mode, the two-way range is computed based on this depth and a yellow bar is used to indicate the externally provided range. In replay mode the yellow bar shows the depth stored together with the beam data.

Horizontal blue bar: When using the beam picking feature (Echogram area), a blue horizontal bar shows which sample the mouse pointed at when the beam was selected.

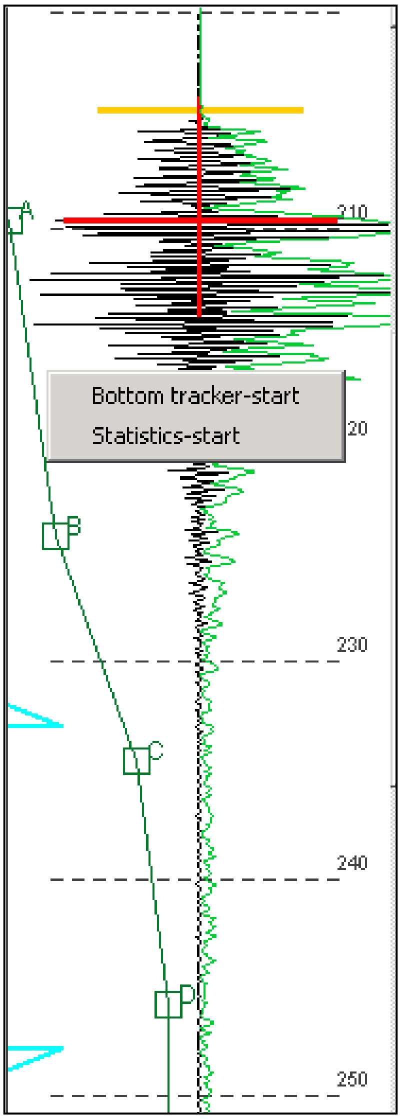


Figure 3-8 Single trace Sub-menu.

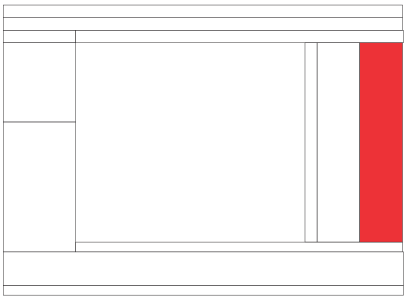
TVG: A green curve, with markers A, B, C and D (not shown) is shown when the TVG (Time Variable Gain) is enabled. This curve displays the TVG currently used. The different sections may be modified interactively by dragging the small squares using the mouse.

→ *The Single trace area may be hidden by the operator in order to get a larger echogram area. Refer to page 225.*

By positioning the cursor in the single display area and clicking the right mouse button, a shortcut -menu appears. From this menu absolute time indicated by the cursor when clicking will be sent to the function selected in the menu.

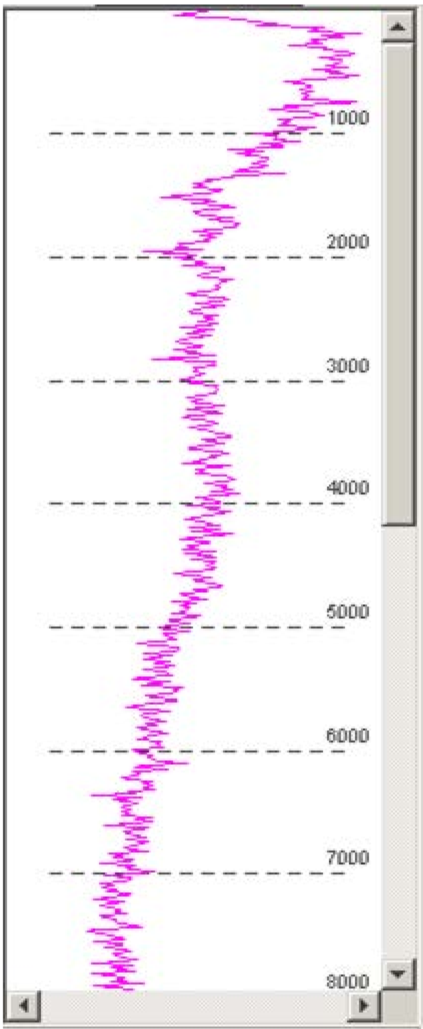
The two turquoise indicators on the left hand side of the single trace display, indicates which trace section is used for statistics calculations.

3.1.10 PSD display area

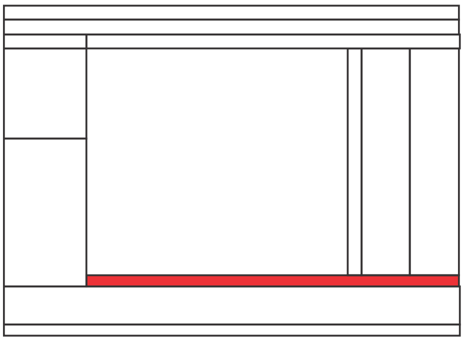


On the far right-hand side of the TOPAS window, the **PSD display** is located. This area is primarily used for displaying the power spectral density of the acquired signal or a smaller section of it.

The area displays the data in “scope” mode.



3.1.11 Ping number and file length



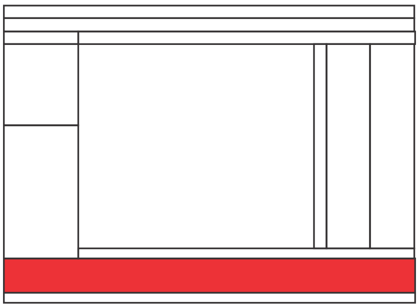
The text field on the left indicates the number of the current ping in survey mode.

The slide bar indicates the relative position in the file during replay in replay mode.

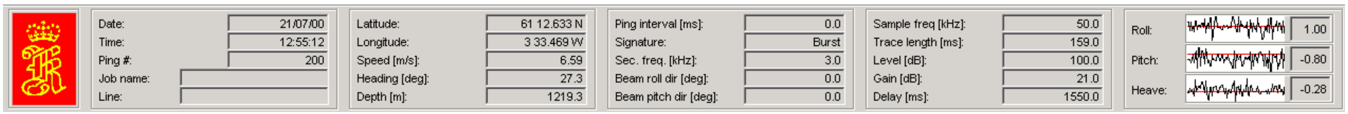
Use the slide bar to move fast backwards and/or forwards in the file during replay.

Note *This slide bar is only present in Replay mode.*

3.1.12 Status area



This area shows the current parameters and status for the system during online operation, which also will be stored together with the recorded data or stored parameters during playback.



→ *The Status area may be hidden by the operator. Refer to page 228.*

The lower part of the TOPAS window shows system information and status. During real-time operation, this area is updated once for each ping. In replay mode it is updated for each ping replayed.

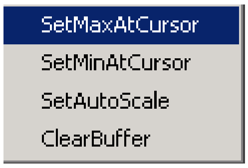
The information is grouped in the following main categories:

- When
- What - job info
- Where
- Transmitter parameters
- Receiver parameters
- Attitude information

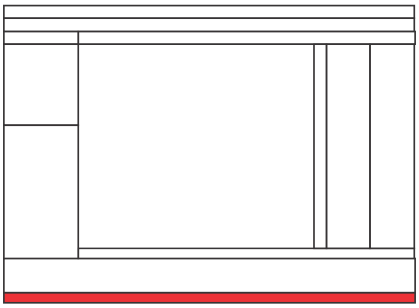
The Attitude information also displays historical information for roll, pitch and heave in addition to numerical values for the last ping. The graphic displays are scaled automatically depending on the current range of values shown in the display.

If you hold the mouse over the curve, you can see the value for that exact point in the text field on the right. You will also be given a peak-to-peak value.

By placing the cursor in the graphical part of the attitude display and right-clicking, the menu shown below appears. Now one of the menu choices may be selected.



3.1.13 System and info area



This area shows the current parameters and status for the system during online operation and information about the data at the current cursor position in the Echogram or Single ping areas.

The following information is displayed:

- Depth or time delay (depending on the grid unit), position at current cursor location in **Echogram** area and amplitude of the signal under the cursor.

- By pressing the left hand button on the mouse, the status area is updated with information relevant to the current cursor position.
- By dragging the cursor in the **Echogram** area, depth (in meters or ms) and horizontal distance (in meters) along the line, angle of the horizontal offset relative to the water depth and slope of the path dragged in degrees.
- 

- Depth or time delay at current cursor position in **Single plot** area. If **Cursor readout for data plotter** is enabled, signal level (in samples; -32,767 to 32,768) at cursor position is displayed as well.
- Log file name is displayed when logging is enabled. When not logging, the message **Not logging** is displayed. Background colour is **green** while logging. When remaining disk space is sufficient for X hours logging time or less, (*Processed data logger* menu), the colour turns **orange**! The value of X is set in the appropriate data logger menus.

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4 PARAMETER SHEETS, BUTTONS AND DIALOGUE BOXES

4.1 Introduction

This chapter presents and describes the parameter sheets, buttons and dialogue boxes for the TOPAS PS 18 main application.

4.2 Alphabetical list of functions etc.

All the parameter sheets, buttons and dialogue boxes are listed alphabetically below:

→ *Event writer, page 108.*

→ *Event writer port, page 109.*

→ *Exit, page 110.*

→ *Factory config, page 111.*

→ *File(s) to SIS, page 112.*

→ *File(s) to KML, page 113.*

→ *Filters, page 115.*

→ *FIX button, page 118.*

→ *Full trace button, page 119.*

→ *Gain, page 120.*

→ *General data, page 122.*

→ *GPS, page 123.*

→ *Help Files, page 124.*

→ *Http Interface, page 125.*

→ *Installation params, page 126.*

→ *Load config, page 127.*

→ *Load installation, page 128.*

→ *Manuals, page 129.*

→ *Master reader, page 130.*

→ *Monitor window, page 133.*

→ *Mute, page 134.*

→ *Navigation reader, page 135.*

→ *Navigation reader port, page 137.*

→ *Parallel port, page 138.*

→ *Ping statistics, page 139.*

→ *Ping to SIS, page 141.*

→ *Print (file pull down menu), page 143.*

→ *Printer 1 & 2, page 148.*

→ *Processed data logger, page 152.*

→ *PSD plotter, page 156.*

→ *PSD trace, page 158.*

→ *Raw data logger X, page 159.*

→ *Receiver, page 163.*

→ *Receiver port X, page 162.*

→ *Remote reader, page 168.*

→ *Remote reader port, page 169.*

→ *Repeat writer X, page 170.*

→ *Repeat writer port X, page 171.*

→ *Replay buttons, page 172.*

→ *Replay reader, page 174.*

→ *Root, page 175.*

→ *Save config, page 176.*

→ *Save installation, page 177.*

→ *Serial port, page 179.*

→ *Services, page 179.*

→ *Single trace, page 181.*

→ *SIS Interface, page 182.*

→ *Slope from external slope, page 183.*

→ *Slope from slope tracker, page 184.*

→ *Slope reader, page 185.*

→ *Slope reader port, page 187.*

→ *Slope selector, page 188.*

→ *Slope tracker, page 189.*

→ *Sound speed selector - average, page 191.*

→ *Sound speed, external, page 190.*

→ *Stacking, page 192.*

→ *Super, page 193.*

→ *Support, page 194.*

→ *Survey info, page 193.*

→ *Swell filter, page 197.*

→ *Synthetic aperture processing, page 198.*

→ *System info, page 200.*

→ *System log, page 202.*

→ *TCP port, page 200.*

→ *Time Variable Filter, page 204.*

→ *Time Variable Gain, page 205.*

→ *Transceiver port, page 215*.

→ *Transducer array, page 217*.

→ *Transducer sound speed selector, page 219*.

→ *Transmitter, page 207*.

→ *TX test, page 220*.

→ *User, page 223*.

→ *UDP port, page 222*.

→ *View legend area, page 226*.

→ *View property area, page 227*.

→ *View single trace area, page 225*.

→ *View status area, page 228*.

→ *View system messages, page 229*.

→ *VRU, page 231*.

→ *VRU port, page 232*.

→ *WEB server*, *page 232*.

→ *Zoom buttons, page 234*.

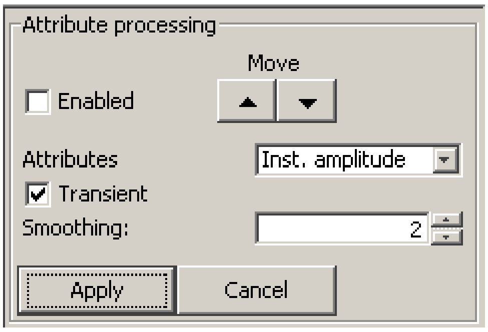
4.2.1 About

The **About** dialogue box is accessed from the **Help** menu.

It contains information about the TOPAS application, such as version number and date.

4.2.2 Attribute processing

The **Attribute processing** parameter sheet is accessed on the Processing tab. (If the **Processing Chain** folder is closed, double-click the folder to open).



Attributes are calculated based on the complex, analytical signal. Performing a FFT on the real signal, removing the imaginary part, multiplying the real part by two, and then taking the inverse FFT produces this signal (Hilbert transform).

→ *More information about Attribute calculation can be found on page 260.*

Attribute processing parameters

Attributes:

- **Inst. amplitude**: Instantaneous amplitude is the magnitude of the analytical signal which equals to the envelope of the real signal.

  The following context sensitive parameters are displayed:

  - **Transient**: If checked, the derivative of the Instantaneous Amplitude signal is displayed.
  - **Smoothing**: Sample step size used for the calculation. A larger number has a smoothing effect on the result.

- **Inst. phase**: Instantaneous phase is the phase calculated based on the analytical signal.

- Inst. frequency: Instantaneous frequency is the local frequency content in the signal trace. The scale in the display is starting at zero Hz and ends at half of the current sampling frequency. The *Gain* parameter may be used to increase resolution if the gain function is located below the *Attribute processing* function in the processing sequence. Setting *Gain* to 6 dB increases the frequency resolution by a factor of two.

The colour bar limits may also be used to modify the scale of the frequency. Linear scale should be used!

Note *The Gain function must be located after the Attribute processing in the Processing chain in order to be used with phase and frequency scaling!*

→ *Refer to page 120 for information about Gain.*

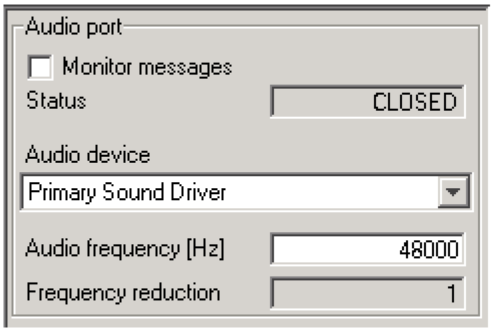
- App. polarity: Apparent polarity shows the polarity of the real trace signal at local maxima in the instantaneous amplitude. The polarity is scaled by the instantaneous amplitude level.

Note *The result for all attribute functions are mapped to positive values only, even bipolar values like phase and polarity. The zero point for these values is at 50% of full positive range and the maximum negative value for the function is at the zero level!*

4.2.3 Audio port

The **Audio port** parameter sheet is accessed from several specified printer folders under the **Printer** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*



Audio processing is used for directing the processed signal to the audio output on the PC.

Audio parameter

Audio device: Java Sound Audio Engine is the default audio device.

Audio frequency [Hz]:

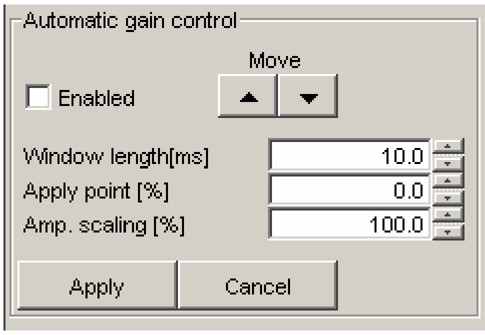
Used for selecting the upper frequency in the downshifted frequency band of the original acquired data.

Frequency reduction: Shows the reduction factor of the output sampling frequency relative the data acquisition sampling frequency. The time duration of the analogue output signal is also increased with this factor.

Note *Audio cannot be used at the same time as analogue printing is enabled as they are using the same hardware.*

4.2.4 Automatic gain control - AGC

The **AGC** parameter sheet is accessed from the **Processing** tab. (If the **Processing Chain** folder is closed, double-click the folder to open).



The **AGC** or Automatic Gain Control function is used for optimising the display of the data traces.

The **AGC** adjusts the gain. Weak portions of the data traces are amplified and strong portions are attenuated. The result has a filtering effect, reducing noise and reverberation.

AGC parameters

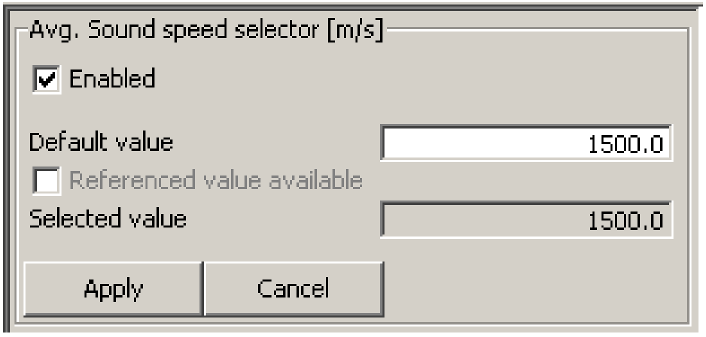
Window length [ms]: This parameter specifies the window length used for calculation the normalising or gain factor. The length is given in percent of the full trace length. Legal values are from 1 to 10000 ms.

Apply point [%]: This parameter specifies which sample within the window the normalising and scaling shall be applied to. The value is given in percent of the window length. 0% and 100% refers to first and last sample, respectively. Legal values are from 0% to 100%.

Amp. scaling [%]: The scaling parameter is used to adjust the output of the AGC processing to a suitable level. The scaling is given in percentage. The default 100% does not influence the result at all.

4.2.5 Avg. sound speed selector

The **Avg. Sound speed selector** parameter sheet is accessed from the **Acquisition** tab.



The operator can set default value of the sound speed.

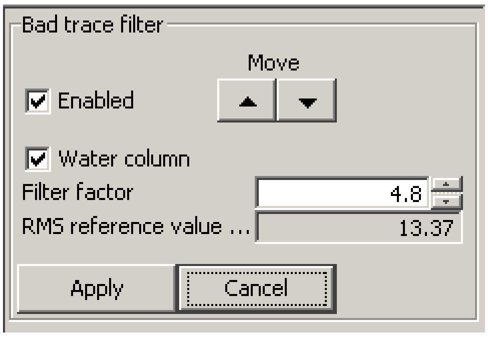
The **Avg. Sound speed selector** has one child:

- External Avg. Sound speed

If the External Avg. Sound speed is enabled, the sound speed value is taken from the slope telegram (SRV-telegram) if it is available from an EM multibeam system.

4.2.6 Bad trace filter

The **Bad trace filter** parameter sheet is accessed from the **Processing** tab. (If the **Processing Chain** folder is closed, double-click the folder to open).



The bad trace filter is used for suppressing "bad traces" from the main display and printed data. The raw data is NOT removed!

"Bad traces" may be noisy traces, typically with interference from other acoustic sources. A trace is defined as bad when the RMS level in that trace is higher than the average RMS level of the last traces by a factor between 1 and 10 (Filter factor)

Note

*The **Bad Trace Filter** should be located after the **Bottom Tracker** in the Processing chain!*

Bad trace filter parameters

Water column: Check this to use only the water column for defining a bad trace. Bottom tracking have to be applied!

Filter factor high: Sets the multiplying factor for the threshold definition for the bad trace removal. Traces with higher level are supressed.

Filter factor low: Sets the multiplying factor for the threshold definition for the bad trace removal. Traces with lower level are supressed.

RMS reference value: Shows the RMS of the sample values in the water column or the full trace.

4.2.7 BIST log

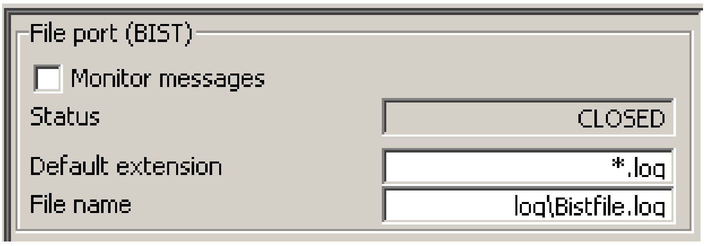
The **BIST log** parameter sheet is accessed from the **File Locations** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note — *You have to be logged on as Root in order to get access to the Configuration tab.*

The menu page is used for specifying the port type for the BIST log. The options are:

- No port
- File port

The child of the **BIST log** is shown below:



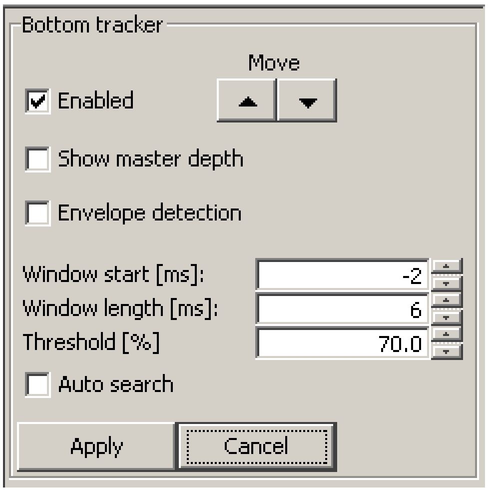
File port parameters

Default extension: User selectable file extension for the **BIST log** file.

File name: User selectable file name and file location for the **BIST log** file. The location is relative to the default TOPAS directory.

4.2.8 Bottom tracker

The **Bottom tracker** parameter sheet is accessed from the **Processing** tab. (If the **Processing Chain** folder is closed, double-click the folder to open).



The bottom tracker is used for finding and detecting the seabed. The bottom tracker's function is to track the seabed in profile data. This information can be used in several functions like TVG, swell filter, mute, bottom lock, dereverberation and in automatic trigger delay adjustments.

Bottom tracker parameters

Show master depth: Check this to have the external depth displayed in the single trace area (yellow horizontal bar).

Envelope detection: Check this to perform bottom detection on the signal envelope instead of the magnitude of the bottom return signal.

Window start [ms]: Sets the starting point for searching for the seabed. This value is only used each time the tracker is enabled. Legal values are from 0 to 15,000 ms. Default value is 0 ms.

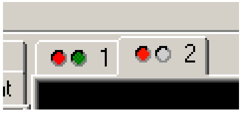
Window length [ms]: The window eliminates picking on noise spikes et cetera in other parts of the trace. Legal values are from 1 to 100 ms. Default value is 8 ms.

Threshold [%]:	Sets the pick threshold in percent of the peak value in the trace, which normally will be the seabed return. Legal values are from 0% to 100%. Default value is 70%.
Auto search:	If track is lost, the window will open up to allow for automatic re-establishing bottom track. When this occurs, the window will return to the specified value.

4.2.9 Channel selector (Echogram area)

When more than one receiver channel is enabled in the system, selection of the channel to be displayed in the echogram area and for parameter selection regarding receiver, logging and processing is done by pushing the relevant tab. The channel numbering starts with number 1.

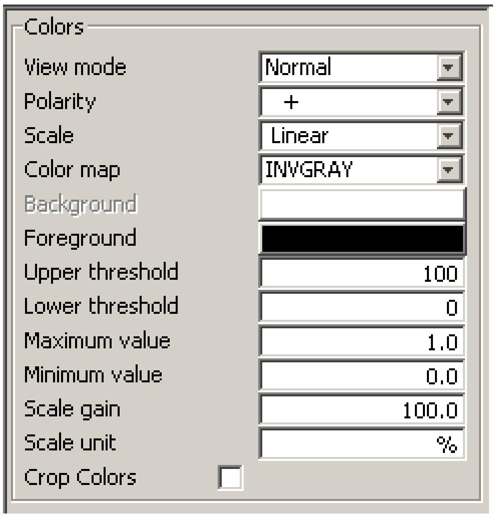
The red and green dots in the channel tabs show whether raw and processed data are currently being logged for the channels.

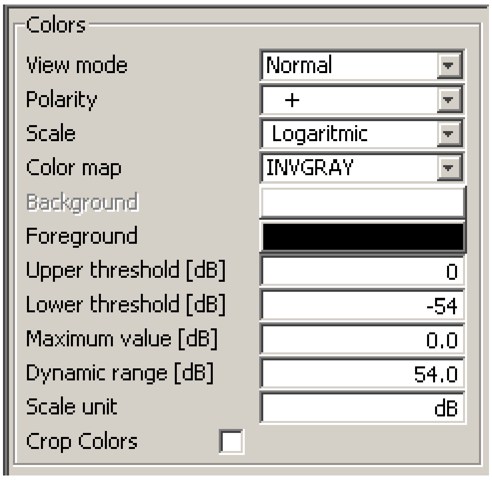


4.2.10 Colours / Legend

The **Colours** parameter sheets are accessed from the **Display** tab. (If the **DisplayList** folder is closed, double-click the folder to open). **Legend** controls the settings for *Echogram area.*

Parameters present depend on scale selection; Linear or Logarithmic.





Colour / Legend parameters

View mode: Choose between Normal and Wiggle mode.

Polarity: Drop-down menu for selecting which part of the processed signal to be displayed. The choices are as follows:

+ (displays positive parts of signal)

- (displays negative parts of signal)

+/- (displays both positive and negative parts of signal)

Scale: Drop-down menu for selecting how the magnitude of the signal amplitudes is mapped to the colour scale. Choices are:

– Linear

– Logarithmic

Color map: Drop-down menu for selecting various colour-coding scales. Choices are:

- JET
- COOL
- HOT
- GRAY
- INVGRAY
- BONE
- HSV
- PINK
- SPIRAL
- INVSPIRAL

Background: Button for selecting background colour menu. A new menu window is displayed when the button is pushed. This menu is shown in Figure 4-1.

Foreground: Button for selecting foreground colour menu. A new menu window is displayed when the button is pushed. This menu is shown in Figure 4-1. Select the colour you want on your grid.

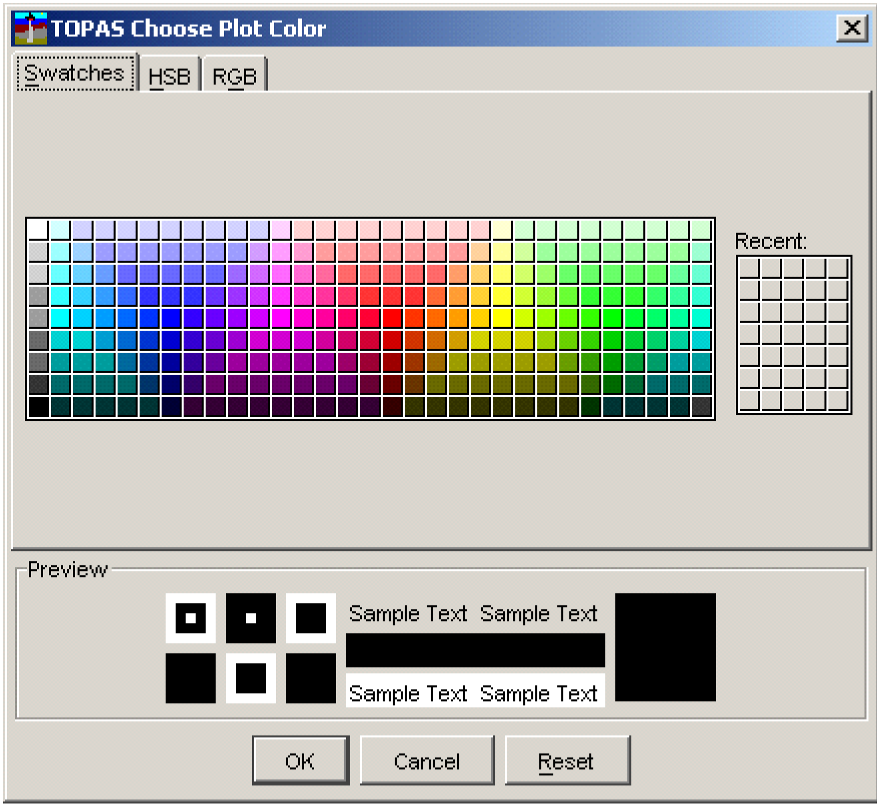


Figure 4-1 Colour menu for selection of foreground and background colours.

Upper threshold: Parameter field for setting the relative amplitude to be displayed. The value is used to lower upper level for indicating maximum signal value in the presented data. Values are given in percent if linear mode is selected and in decibels if logarithmic mode is selected.

Lower threshold: Parameter field for setting the relative amplitude to be displayed. The value is used to suppress low level signal value in the presented data. Values are given in percent if linear mode is selected and in decibels if logarithmic mode is selected.

Transparency mode: Choose between Off, Constant and Linear. If you choose Constant, a new parameter, Transparency value, will show up.

Note

The Transparency mode is only visible when 3D is enabled in the echogram area properties.

Transparency value: *(Only visible if you select Constant transparency mode)*. Parameter field for setting transparency on the data in the *Echogram area*. Values are from 0 to 100%. 0 is opaque and 100% is transparent.

Maximum value: Sets the maximum value referred to the top of the colour bar. The unit depends on which scale is selected; linear or logarithmic.

Dynamic range [dB]: *(Only visible when Logarithmic scale is selected).* Sets the total dynamic range of the colour bar.

Minimum value: *(Only visible when Linear scale is selected).* Sets the minimum value for the colour bar.

Scale gain: *(Only visible when Linear scale is selected).* Sets a multiplication factor for the colour bar.

Scale unit: Defines the text printed at the top of the colour bar.

Crop colors: Checkbox for locking the colour scale. Makes it simpler to compare levels. Figure 4-2 shows an example of using the function.

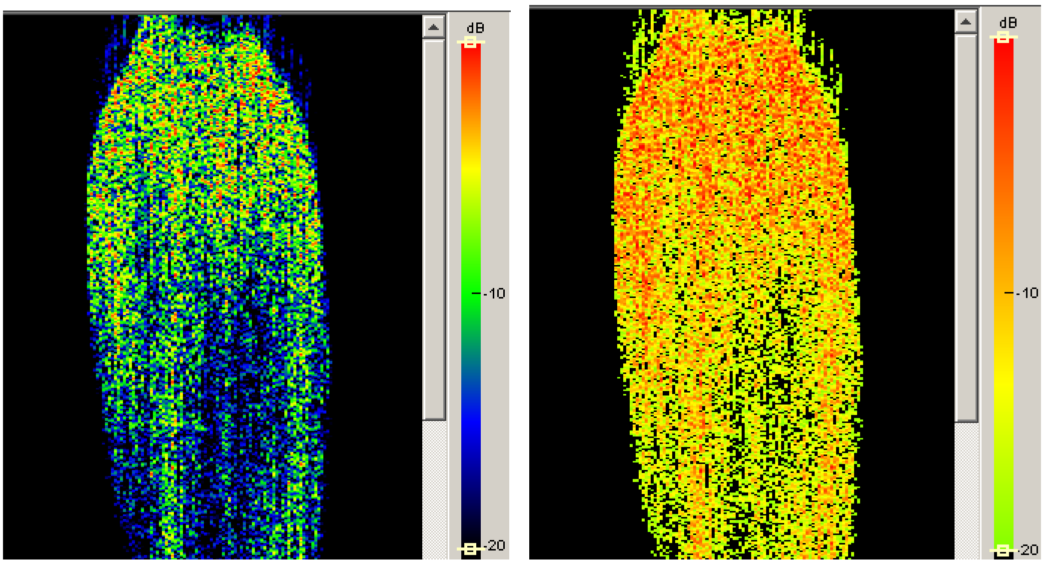


Figure 4-2 Effect of colour cropping; without and with, left and right respectively.

4.2.11 Convert file(s)

The **Convert file(s)** parameter sheet is accessed from the **File** drop-down menu.

First an input file chooser opens where the input file directory or files and type are selected. The choices are:

- File saved in SEG Y [*.seg] format
- File saved in SEG Y [*.sgy] format
- File saved in TOPAS [*.pro] format
- File saved in TOPAS [*.raw] format
- Directory for SEG Y [*.seg] files
- Directory for SEG Y [*.sgy] files
- Directory for TOPAS [*.pro] files
- Directory for TOPAS [*.raw] files

When directory mode is selected, all files of correct type are chosen for conversion. When file mode is selected, only the selected file is converted.

Note *The file extensions **seg** and **sgy** points to the same SegY format!*

Secondly an output file chooser opens where the same choices are present. When directory mode is selected, the converted files are written in the chosen directory. When file mode is selected, the input files are concatenated into one single file.

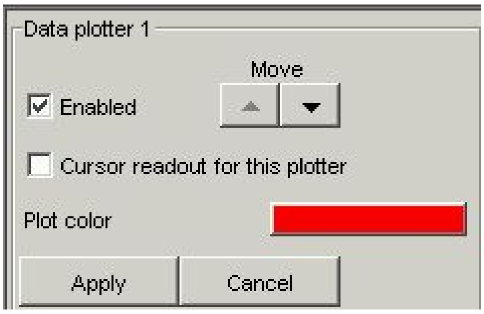
When the selection has been made, the file conversion takes place in the background.

→ *For more information about file conversion, see page 30.*

Warning ***In order to get correct sampling interval in the SegY format, sampling frequency defined in the receiver menu must be one of the following: 10, 20, 25, 40, 50 or 100 kHz.***

4.2.12 Data plotter 1 & 2

The **Data plotter** parameter sheet is accessed from the **Processing** tab.



The data plotter is used to display single ping data in the *Single trace area*.

Two plotters are available. **Data plotter 1** is often close to the top of the processing tree to display the raw data, after applied gain. **Data plotter 2** can be used at other locations in the processing tree to see effects of the various processing steps.

Data plotter parameters

The **Data plotter 2** parameter sheet has the following parameters:.

Cursor readout for this plotter:

Enables cursor readout of amplitude value in *Data area*. The values are sample values from -32767 to 32768.

Plot colour: Used to select the colour of the curve drawn in the *Data area*. Note that the text in the Processing sheet will reflect the colour chosen for curve!

→ *Refer to page 61 for information about the Single trace area.*

A similar dialogue box is present for **Data plotter 1**.

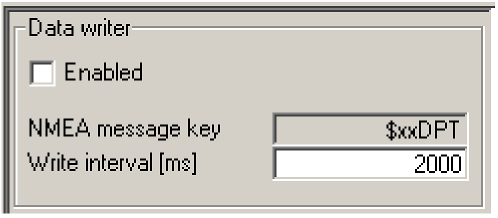
4.2.13 Data writer

The **Data writer** parameter sheet is accessed from the **Print** tab.

When enabled, the system sends various depth and other parameter datagrams to output ports for use by external systems.

The parameters can be selected by the operator.

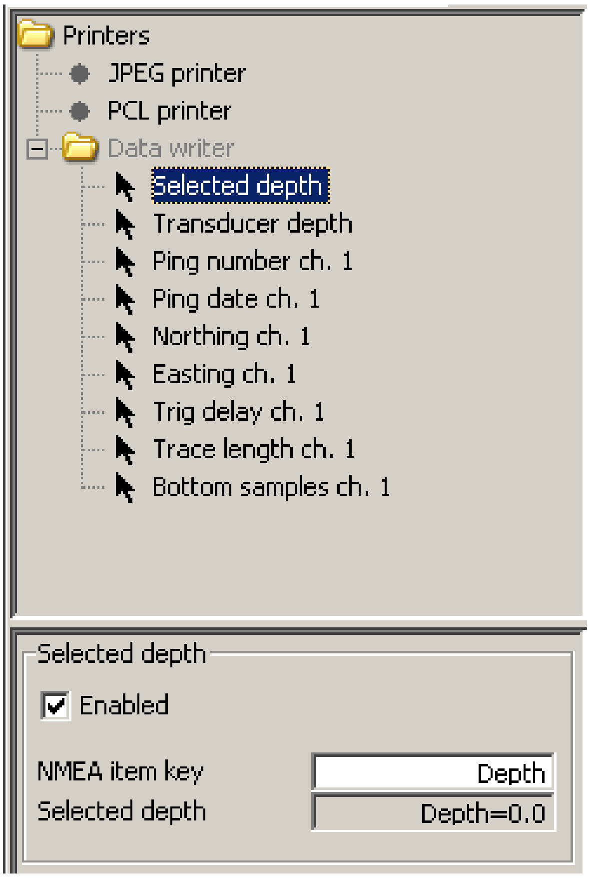
Note *Configuration of the output datagrams can be done when logged on as Root!*



Data writer parameters:

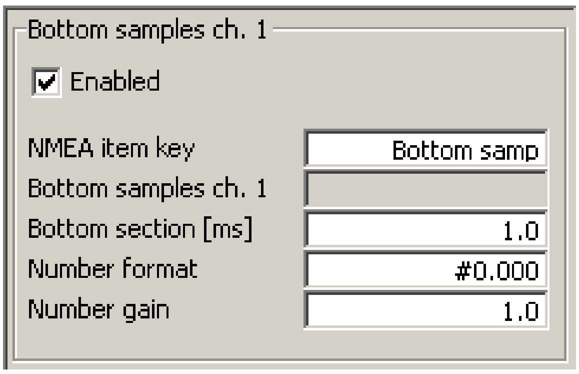
NMEA message key: Shows the NMEA prefix to the datagram.

Write interval [ms]: This item specifies the time interval between each telegram written to the port. When the interval is set to zero, a telegram is written for each ping!



The user can define **NMEA item key** when logged on as *Root*. The field will then be writable.

In the case of Bottom samples, more parameters can be selected.



NMEA item key: Specifies the prefix to the datagram value.

Bottom samples: Shows the values of the bottom samples.

Bottom section [ms]: This item specifies the length from the detected bottom position to be written.

Number format: Specifies the number format to be used.

Number gain: Specifies a gain factor to be used when printing the data. By default set to 1.

The format of the output string may look like this (no new-lines):

$xxOUT,

968.9,

0.0,

324,

2004/09/06 115616.96,

36 7.4236 N,

4 44.5144 W,

1188.0,

300.0,

8.0,400.0,25,0.072,0.082,0.088,0.090,0.088,0.082*79

Where the items are as follows:

NMEA message key,

depth,

transducer depth,

ping no.,

date and time,

latitude,

longitude,

trig delay,

trace length,

#samples, sample values,.. *check sum

No NMEA item keys are used in the example above.

In the following an example is shown with item keys included (user selectable):

$xxOUT,

Depth=982.0,

TX depth=0.0,

Ping no=656,

Date&time=2004/09/06 120438.28,

Lat=36 7.7079 N,

Lon=4 42.9122 W,

Trig del=1188.0,

Trace length=300.0,

Bottom samp=5,0.038,-0.195,-0.284,-0.112,0.163*5B

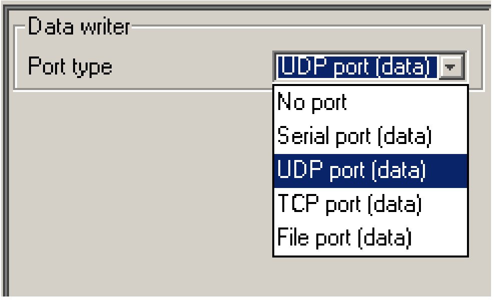
4.2.14 Data writer port

The **Data writer** port parameter sheet is accessed from the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note

You have to be logged on as Root in order to get access to the Configuration tab.

The layout of the parameter sheet is identical to the navigation and slope reader ports!



Data writer port parameters

Port type: Selects the port where depth information is available. The choices are:

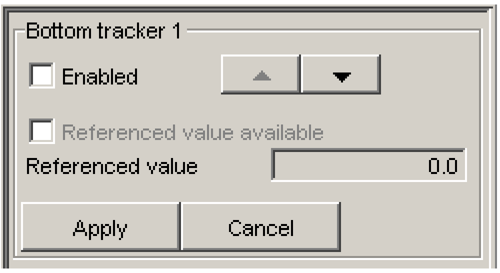
- No port
- Serial port
- UDP port
- TCP port
- File port

Configuration of the port is done one step lower down in the configuration tree.

4.2.15 Depth from bottom tracker

The depth from **Bottom tracker X** parameter sheet is accessed from the **Acquisition** tab. (If the folder is closed, double-click the folder to open). X may be 1, 2 or 3 depending on the number of receiver channels installed.

The depth from **Bottom tracker** is found in the **Depth selector** sub folder.



Note

The depth may be used for automatic adjustment of runtime parameters. The last one of the “Depth from”-objects has the highest priority.

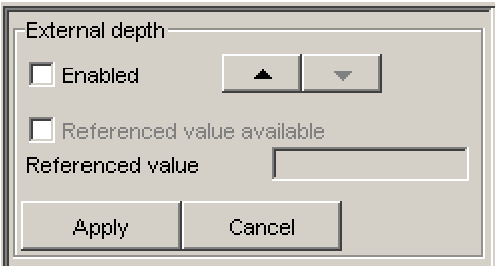
Parameter

Referenced value: Depth relative to transducer.

4.2.16 Depth from external depth

The depth from **External depth** parameter sheet is accessed from the **Acquisition** tab. (If the folder is closed, double-click the folder to open

The depth from **External depth** is found in the **Depth selector** sub folder.



Note

The depth may be used for automatic adjustment of runtime parameters. The last one of the "Depth from"-objects has the highest priority.

Parameter

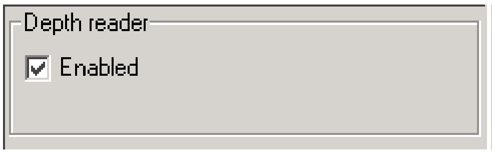
Referenced value: Depth relative to transducer.

4.2.17 Depth reader

The **Depth reader** parameter sheet is accessed from the **Master reader** item in the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*

Note *The parameter fields are only present when data are received by the TOPAS system from the relevant external sensor, i.e. echo-sounder or similar.*



Depth displayed is the depth received from the source specified in the **Depth selector** in the Acquisition menu. The choices would be between depth from bottom trackers or external depth.

This depth may be used in the TOPAS OPU for tracking purposes etc.

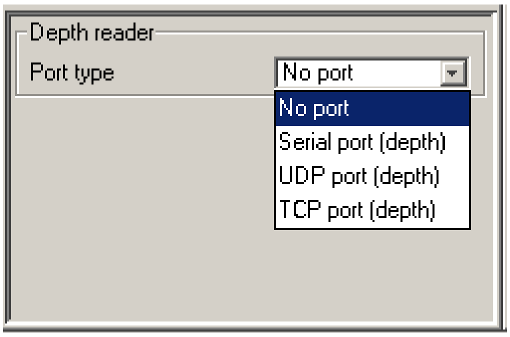
4.2.18 Depth reader port

The **Depth reader** port parameter sheet is accessed from the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note

You have to be logged on as Root in order to get access to the Configuration tab.

The layout of the parameter sheet is identical to the navigation and slope reader ports!



Depth port parameters

Port type: Selects the port where depth information is available. The choices are:

- No port
- Serial port
- UDP port
- TCP port

Configuration of the port is done one step further down in the configuration tree.

4.2.19 Depth selector

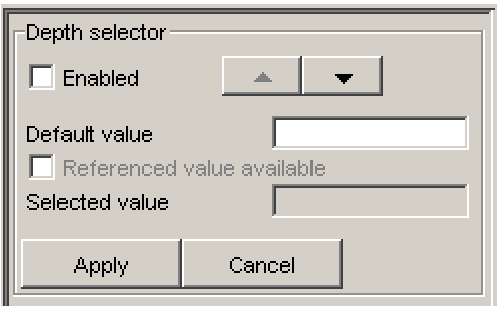
The **Depth selector** is accessed from the **Acquisition** tab. (If the folder is closed, double-click the folder to open).

The Depth selector is used for selecting which depth value should be used for transmitter **Ping interval** and receiver **Trigger delay**.

The **Depth selector** has at least two children depending on number of installed receiver channels:

- Bottom tracker X
- External depth

where X refers to receiver channel 1, 2 or 3. Only channel 1 is installed by default!



Note

The depth may be used for automatic adjustment of runtime parameters. The last one of the "Depth from"-objects has the highest priority.

Parameter

Default value: The default value is selected if no other value is available. The default value must be entered by the operator.

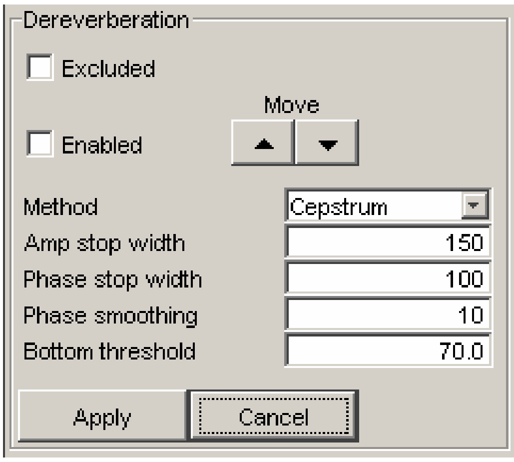
Referenced value available:

Indicates if depth relative to transducer available.

Selected value: The selected depth measured relative to the transducer.

4.2.20 Dereverberation

The **Dereverberation** parameter sheet is accessed from the **Processing** tab. (If the **Processing Chain** folder is closed, double-click the folder to open).



The dereverberation function performs a multiple reduction operation. This function is relevant to use in very shallow (~10 to <200 meters water depth) areas where the second bottom return masks sub-bottom features. Two methods for doing the processing are implemented.

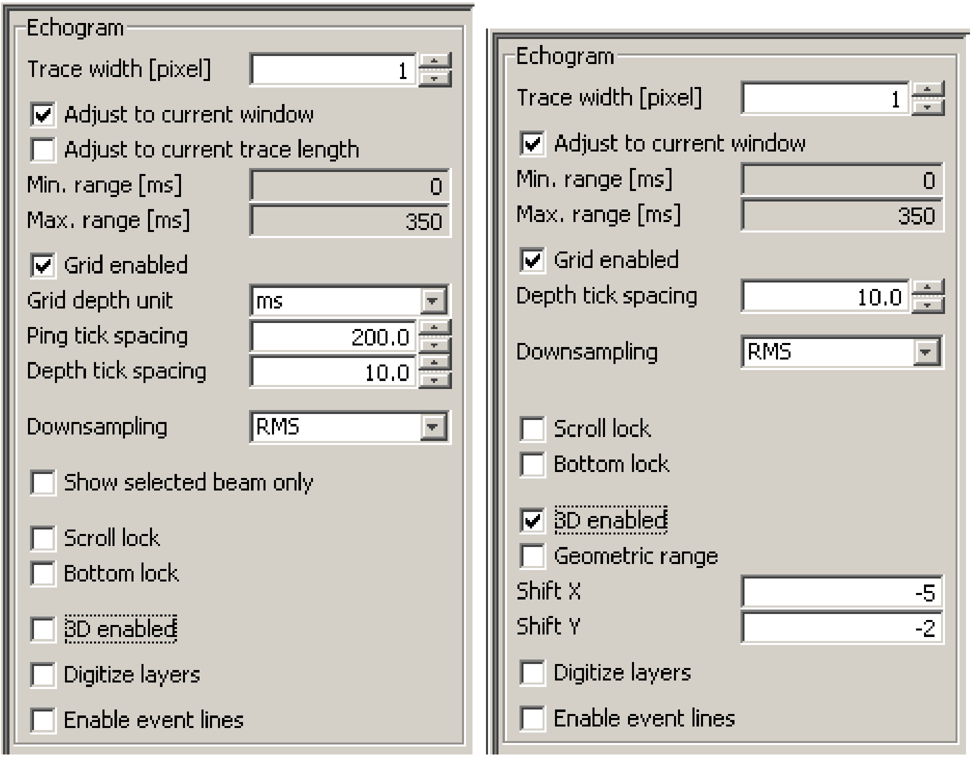
The **Direct Method** uses a cross-correlation technique and the **Cepstrum Method** operates in the Cepstrum space. The latter method seems to be more robust and gives better results

Dereverberation parameters

Method:	Selects the processing method to be used. Choices are **Direct Method** and **Cepstrum**.
Amp. stop width:	Defines an amplitude stop width in the cepstrum space given in frequency points for the filter.
Phase stop width:	Defines a phase stop width in the cepstrum space given in frequency points for the filter.
Phase smoothing:	Defines a smoothing factor in the cepstrum space given in frequency points for the filter.
Bottom threshold:	Sets the detection threshold for seabed detection in percent of the peak level.

4.2.21 Echogram

The **Echogram** parameter sheets are accessed from the **Display** tab.



Parameters

Trace width [pixel]: Use the arrow buttons or the text field to enter the desired trace width.

Adjust to current window:

The first check box adjusts the Echogram image automatically to fit the depth range to the current acquisition window.

Figure 4-3 shows the result.

Adjust to current trace length:

The second check box adjust the Echogram image automatically to fit the current trace length. The seabed will be discontinuous when a change in **Trigger delay** is made. Figure 4-4 shows the result. *Not present in 3D mode!*

If you want to adjust the depth yourself, uncheck both checkboxes and put your range values into the text boxes **Min range** and **Max range**.

Figure **4-5** shows the result.

Grid enabled: The second check box gives you the choice to enable/disable the grid on the background of the Echogram area.

Grid depth unit: Drop-down menu for selecting the grid annotation value. Choices are: ms or meter. *Not present in 3D mode!*

Ping tick spacing: Sets the spacing between the vertical grid lines in number of traces. *Not present in 3D mode!*

Depth tick spacing: Sets the spacing between the horizontal grid lines in the grid depth unit.

Down sampling: Defines how to select data pixels to be displayed in the main echogram. Number of available pixels on the display is generally much lower than number of samples in to be displayed. In the following, the sample/pixel ratio is set to **N**. The following options are available:

- Average – displays the average of every N samples
- RMS – display the RMS value of every N samples
- Peak – display the peak value of the N samples
- Sample – display each N-te sample

Show selected beam only:

Checkbox for selecting beam number to display. *Not present in 3D mode!*

Selected beam number:

Select the beam you want to display. The centre beam is number zero. *Not present in 3D mode!*

Bottom lock: Makes the system lock onto the bottom see Figure 4-6.

Bottom position [%]: Specifies the relative position of the locked bottom in the full trace display.

3D Enabled: Checkbox for enabling presentation of sequential scanning data.

Geometric range: Compensates for beam angle when plotting data on the screen. *Only present when 3D is checked!*

Shift X: Shift on the display in X-direction after one scan is finished. *Only present when 3D is checked!*

Shift Y: Shift on the display in Y-direction after one scan is finished. *Only present when 3D is checked!*

Scroll lock: Adjusts the display so the bottom is presented in the central part of the screen.

Digitize layers: Enables display and manual digitization of sediment layer interfaces.

Enable event lines: Enables display of event or fix marks in the echogram display.

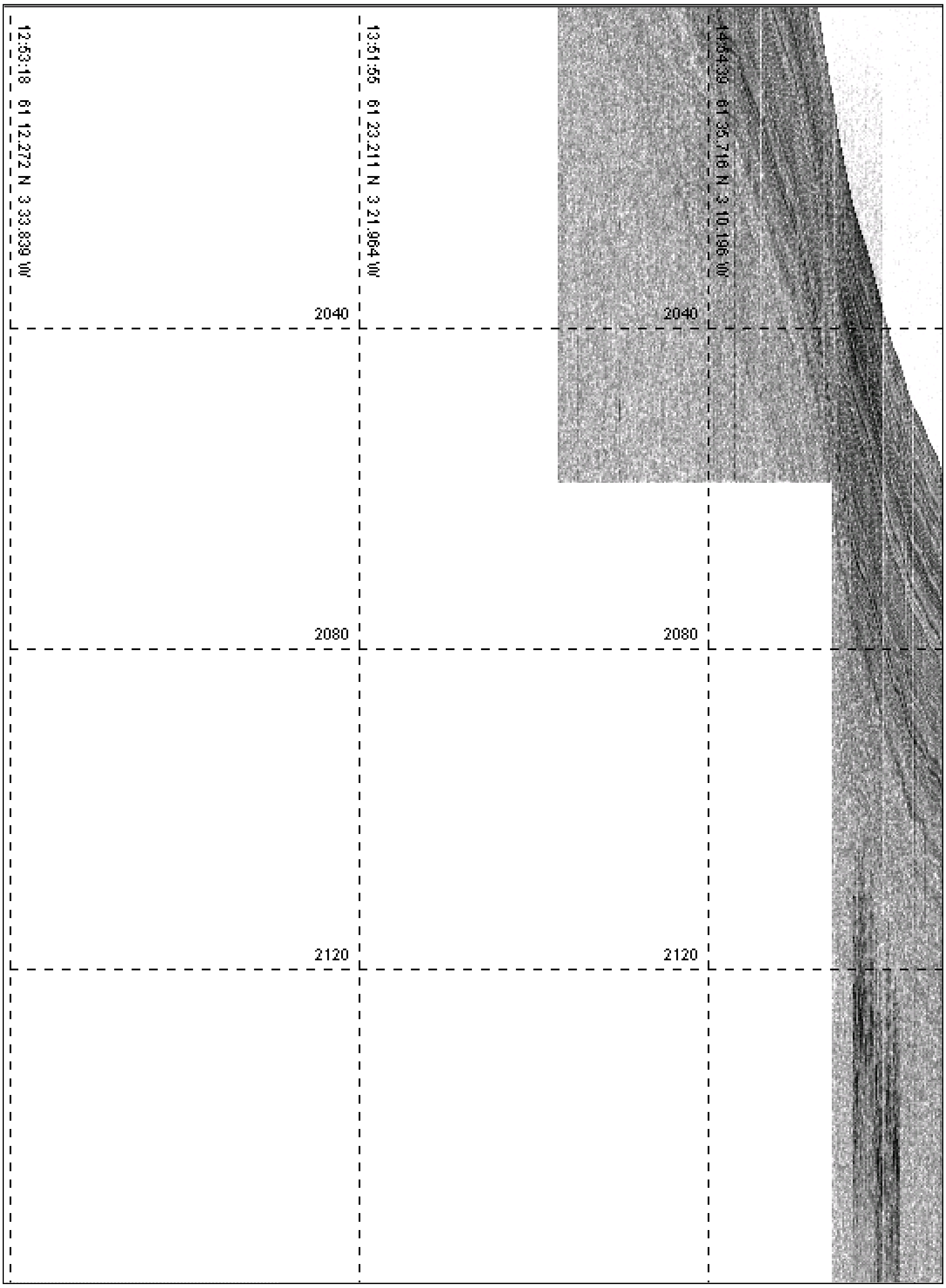


Figure 4-3 The figure shows the echogram area when "Adjust range to last acquisition window" is checked.

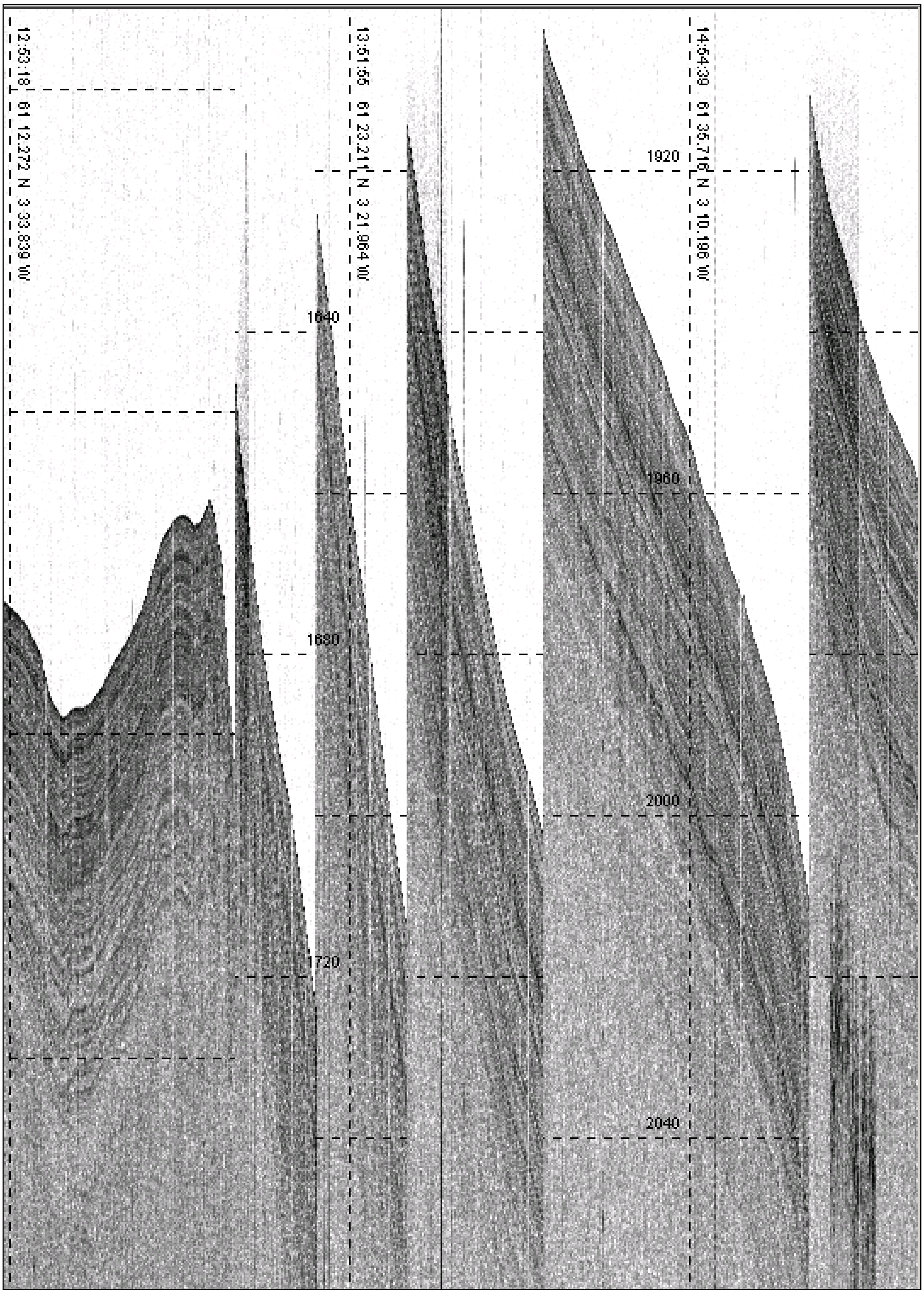


Figure 4-4 The figure shows the echogram area when “Adjust range to actual acquisition window” is checked.

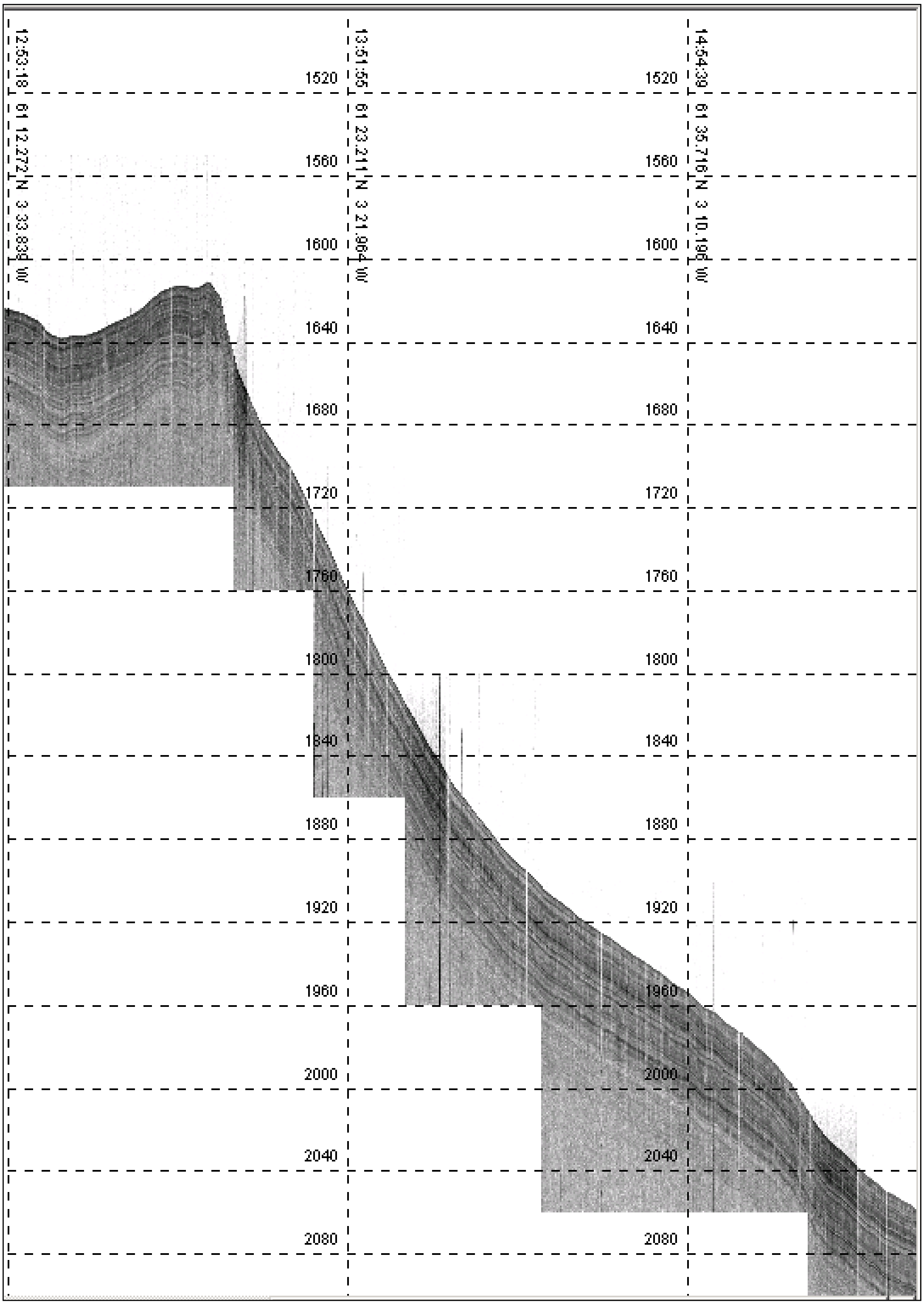


Figure 4-5 Manual selection of maximum and minimum range.

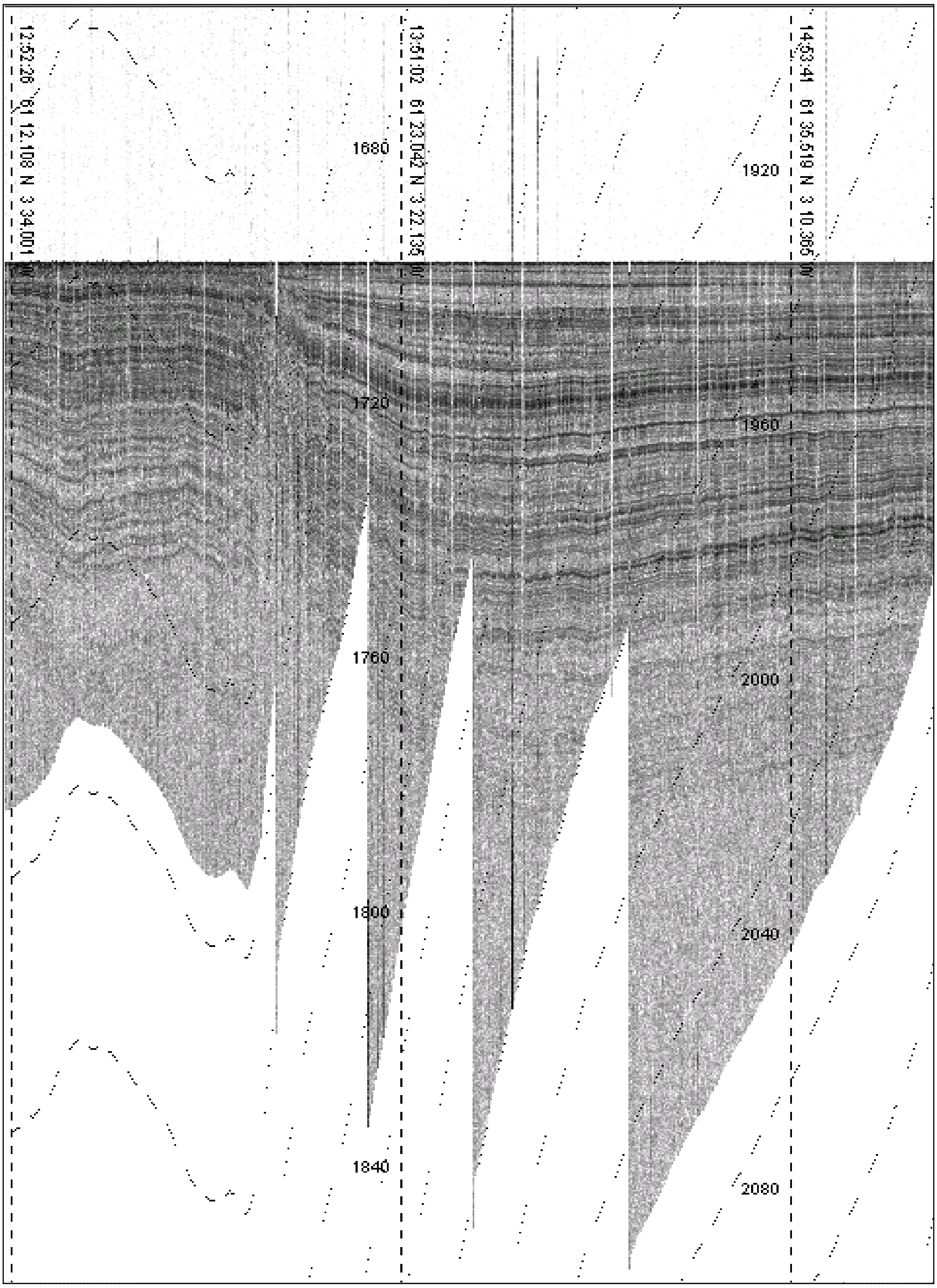


Figure 4-6 The figure shows the echogram area when “Bottom lock” is enabled.

The seabed surface is displayed at a fixed offset (selectable). The layers are shown relative to the seabed surface.

4.2.22 Event writer

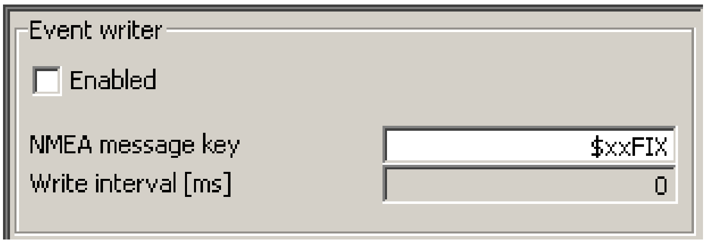
The **Event writer** parameter sheet is accessed from the **Print** tab.

When enabled, the system sends various parameter datagrams to output ports, primarily for logging to file.

The parameters can be selected by the operator.

Note

Configuration of the output datagrams can be done when logged on as Root!

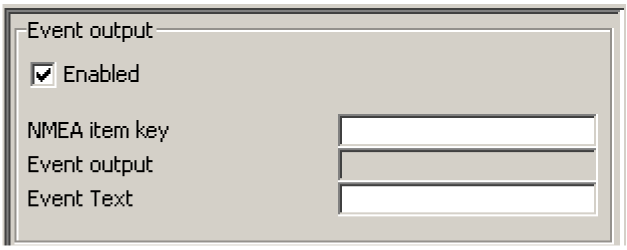


Event writer parameters:

NMEA message key: Shows the NMEA prefix to the datagram. Defined by user.

Write interval [ms]: This item is not used, a string is written every time an event or fix is generated.

The parameter has a child parameter item, **Event Output**, having this parameter sheet:



Event output parameters:

NMEA item key: Shows the NMEA prefix to the text. Defined by user.

Event output: Displayed text.

Event text: Event text defined by the user.

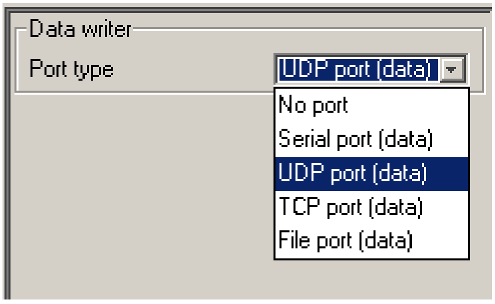
4.2.23 Event writer port

The **Event writer** port parameter sheet is accessed from the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note

You have to be logged on as Root in order to get access to the Configuration tab.

The layout of the parameter sheet is identical to the navigation and slope reader ports!



Event writer port parameters

Port type: Selects the port where depth information is available. The choices are:

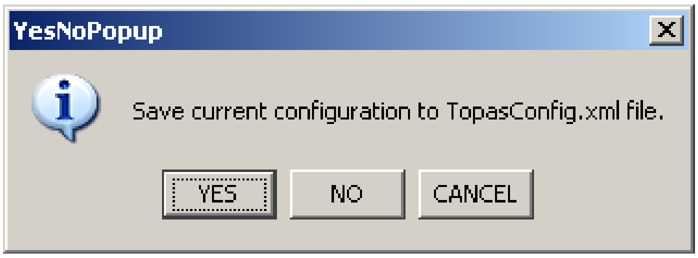
- No port
- Serial port
- UDP port
- TCP port
- File port

Configuration of the port is done one step lower down in the configuration tree.

4.2.24 Exit

Exit is accessed from the **File** menu. This choice will open a confirmation window where you can select to update the default *TopasConfig.xml* configuration file or not.

You will also have the option to cancel program termination.



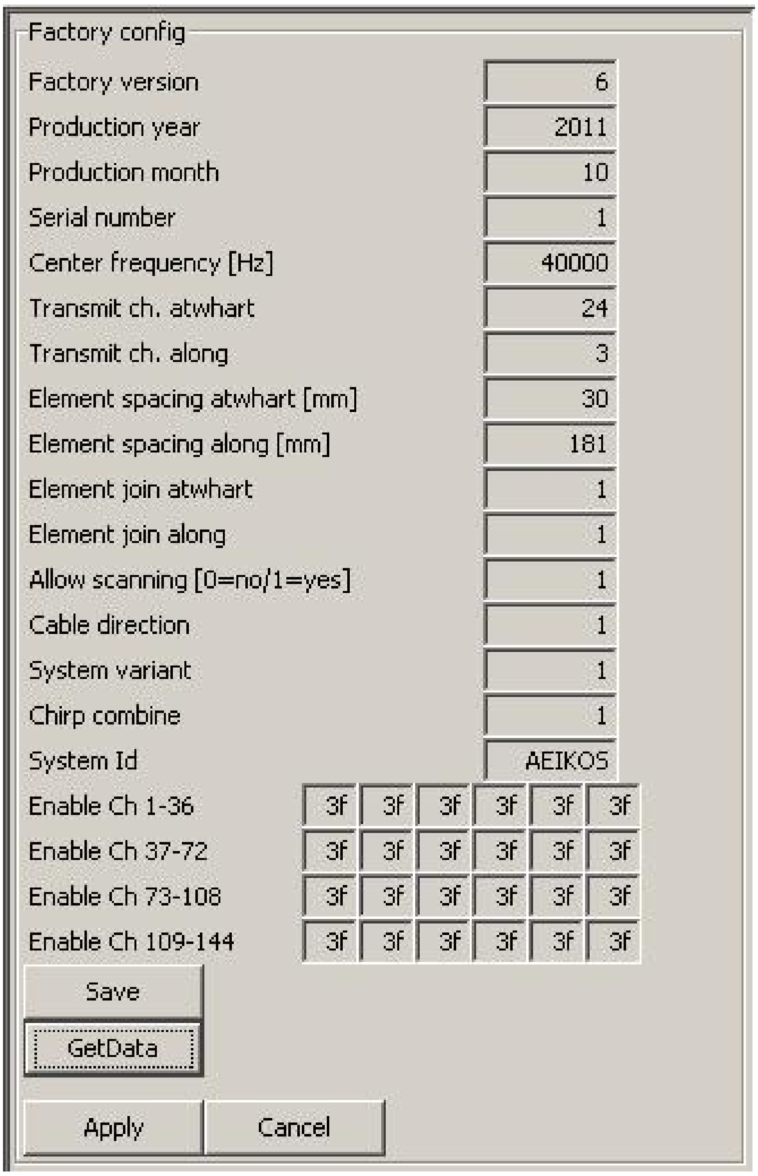
Selecting **YES** or **NO** will close all the programs controlled by the TOPAS application.

You will however still be logged on the workstation.

4.2.25 Factory config

The **Factory config** parameter sheet is accessed from the **Factory config** folder under the **BIST** tab. (If the **Factory config** folder is closed, double-click the folder to open).

Note — *You have to be logged on as Root in order to get access to the BIST tab.*



The **Factory config** sheet shows the configuration of the TA_CTRL DSP board.

The data may be saved to file by selecting **Save**.

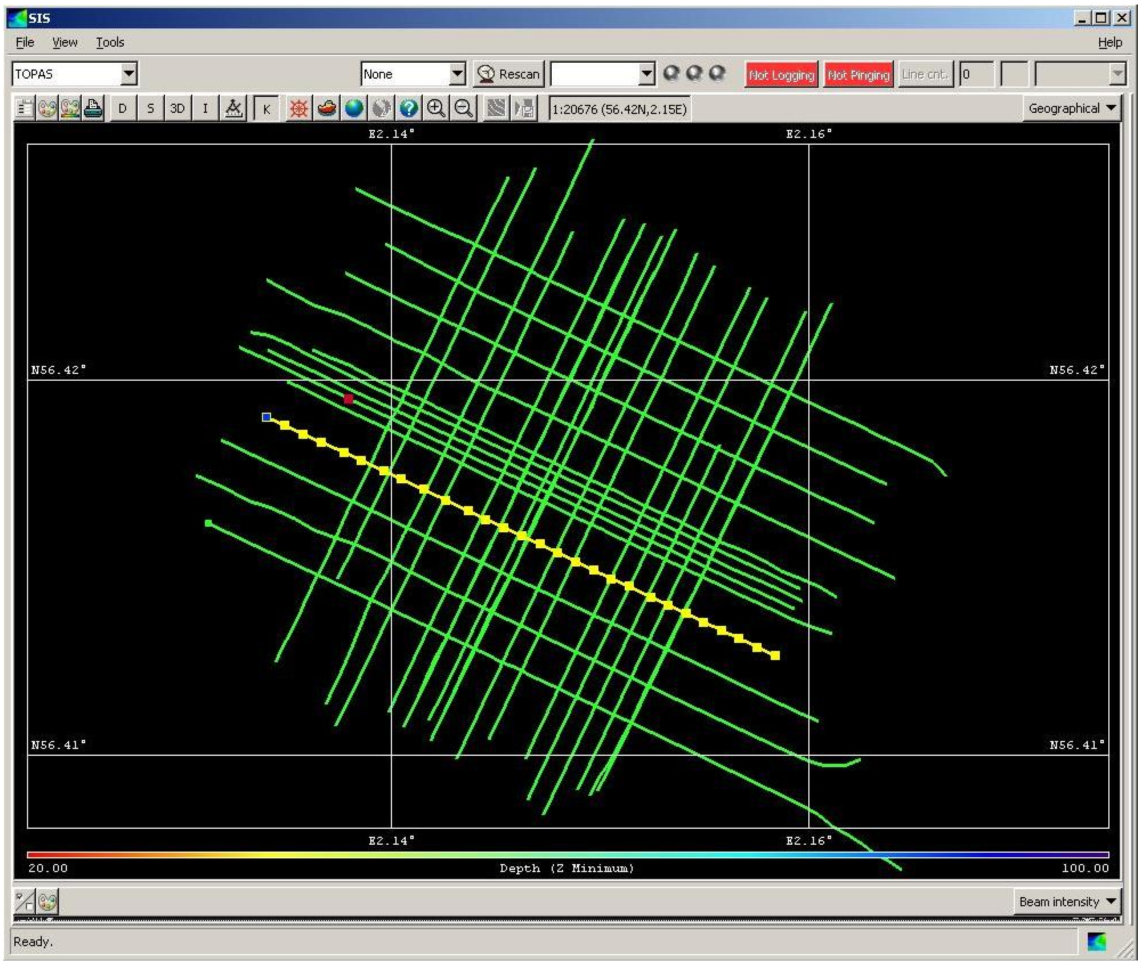
Note — *This information may be of interest when contacting support!*

4.2.26 Files to SIS

The **Files to SIS** parameter sheet is accessed from the **File** drop-down menu. First an input file chooser opens where the input file directory or files are selected.

Track information from the selected files is transferred to the Seabed Information System (SIS) to be displayed on the SIS geographical display.

When directory mode is selected, all files of correct type are chosen for transfer. When file mode is selected, only the selected file is transferred.



When displayed in the SIS display, a track may be selected for automatically replay on the TOPAS operator unit.

Note

The communication to SIS must be configured before this functionality will work!

4.2.27 Files to KML

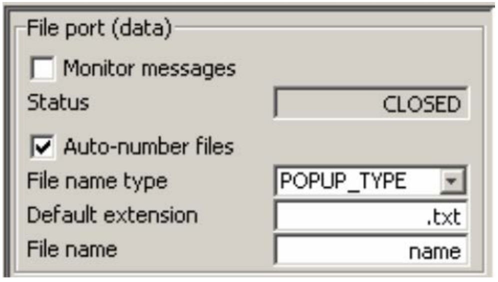
The **Files to KML** parameter sheet is accessed from the **File** drop-down menu. First an input file chooser opens where the input file directory or files are selected.

Track information from the selected files is transferred to a KML-file which can be opened and displayed in Google Earth.

4.2.28 File port

The **File port** parameter sheet is accessed from several specified communication folders under the **Printer** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*



Parameters

Monitor messages: Checkbox for enabling monitor window for messages. See Chapter 4.2.42 Monitor window at page 133 for description of the window.

Status: Displays the current status of the port: *Open*, *Error* or *Closed*.

Auto-number files: When checked, the system adds a number to the proposed file name automatically (Test_001.jpg, Test_002.jpg, etc.) for each file generated.

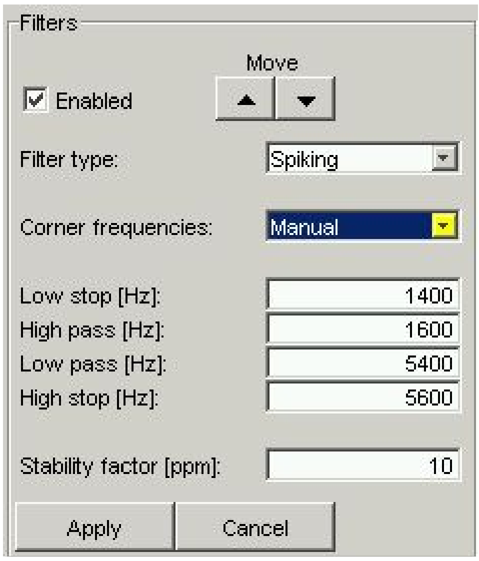
File name type: Selects the way of creating the files. **NAME_TYPE** uses the **File name** parameter as the file name and places the file in the default TOPAS directory. **POPUP_TYPE** pops the file chooser when a new printer file is to be stored.

Default extension: Defines the default extension to be used with this file chooser. The dot **must** be included in the extension (.txt, .jpg etc).

File name: Defines the current file name *or* shows the last file name and path used in the file chooser popup menu.

4.2.29 Filters

The **Filters** parameter sheet is accessed from the **Processing** tab. (If the **Processing Chain** folder is closed, double-click the folder to open).



The **Filters** are used for filtering the acquired data. Matched filter processing results in pulse compression of long coded wavelets in order to increase the signal-to-noise ratio and resolution. When short pulses are used, reduced sidelobe levels may also be achieved.

The filter is implemented in the frequency domain with flat response and 100% transmission within the pass band and 0% transmission in the stop-bands. The transition between the bands follows a raised cosine function.

→ *Refer to Figure 4-7.*

Filters parameters

Filter type: Choose between *Bandpass*, *Matched* and *Spiking*. Depending on what you choose, different parameters will appear.

Corner frequencies: Choose between **Manual** or **Auto** selection of corner frequencies in filter window.

– **High res**: The frequencies are selected automatically depending on the start and stop frequencies of the relevant chirp signature. The window has a $\cos^2$ roll-of.

– **Low sidelobe**: The frequencies are selected automatically depending on the start and stop frequencies of the relevant chirp signature. The window has a $\cos^2$ shape.

– **Manual**: The following fields are present:

Low stop [Hz]: Specifies the low stop frequency of the filter. Legal values are from 100 Hz to 150,000 Hz.

High pass [Hz]: Specifies the high pass frequency of the filter. Legal values are from 100 Hz to 150,000 Hz.

Low pass [Hz]: Specifies the low pass frequency of the filter. Legal values are from 100 Hz to 150,000 Hz.

High stop [Hz]: Specifies the high stop frequency of the filter. Legal values are from 100 Hz to 150,000 Hz.

Stability factor [ppm]: This parameter is present for Spiking filter. Adds a constant to the filter denominator for stabilizing purposes.

Replica shaping: Checkbox for enabling replica shaping in Matched filter. The shaping is performed by multiplying the filter by a Hanning window.

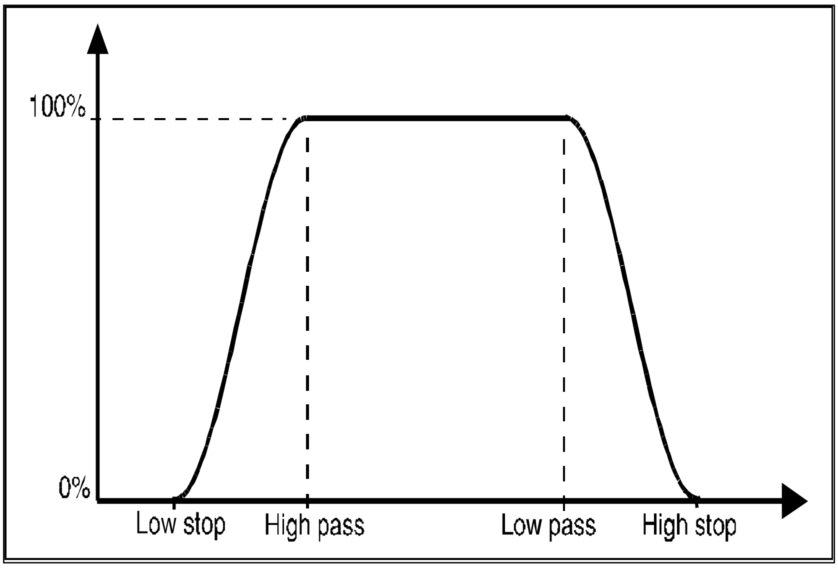


Figure 4-7 Parameter definition for the digital bandpass filter.

4.2.30 FIX button

The **FIX button** is located right above Echogram area.

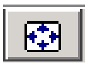
This button creates an internal fix or event mark. A negative fix number is generated and written to file. This number is decreased for each fix.

External events will be supplied by the CODA navigation string as positive numbers!

Fix or event information will be written to file if the **Event writer** is configured!

4.2.31 Full trace button

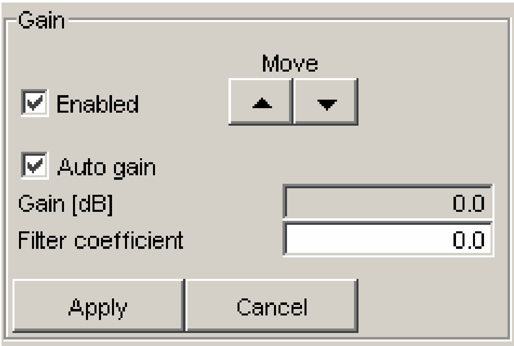
The **Full trace button** is located right above Echogram area.



This button selects display of the full trace length for both the *Echogram area* and for the *Single trace area*.

4.2.32 Gain

The **Gain** parameter sheet is accessed from the **Processing** tab. (If the **Processing Chain** folder is closed, double-click the folder to open).



The Gain function is used for application of additional gain to the processed data in order to make presentation on display or printer as nice as possible.

Gain parameters

Auto gain: When unchecked, the gain **G** can be specified manually (see below). When checked, the parameter filter coefficient **C** appears and the autogain function tries to use the dynamic range of the processing chain according the specified filter coefficient value. Gain **G** is calculated by the following formula:

$$G = (1-C) / Peak_{new} + C \bullet G_{previous}$$

where Peak_{new} is the peak value of the current ping and $G_{previous}$ is the gain applied to the previous ping. C = 0 means no history! Typical values range from 0.9 up to 0.99. under difficult conditions (such as when the signal is lost due to air under the transducer) the autogain function does not behave properly and you should switch to manual gain.

Filter Coef.: This field will not be visible unless Auto gain is enabled. (See above). *NextGain = LastGain•Coef+ThisGain•(1-Coef)*

Gain [dB]: Sets the gain factor. The gain is given in dB. Zero dB does not influence the result at all.

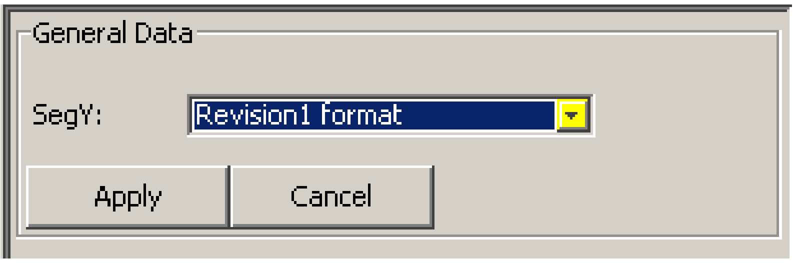
4.2.33 General data

The **General data** parameter sheet is accessed from the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note

You have to be logged on as Root in order to get access to the Configuration tab.

The menu page is used for specifying the SegY format to be used during conversion and storing of data in SegY format.



The formats available are:

- SegY Revision 1
- Fugro segy format

Detailed description of the SegY formats are found in Chapter 7.7.

4.2.34 GPS offset

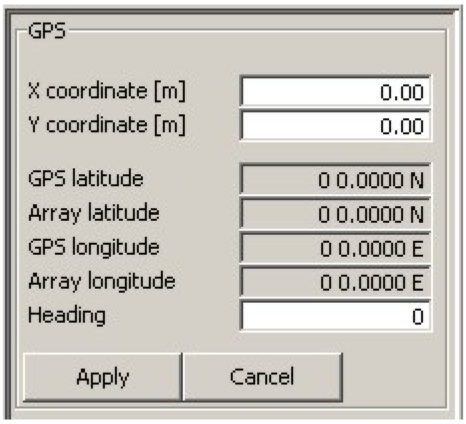
The **GPS** parameter sheet is accessed from the **Mounting** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*

The GPS (Global Positioning System) parameters are used to calculate correct position of the TOPAS transducer array.

Note *All offsets are measured **from** centre-of-gravity (COG) **to** the actual sensor.*

Definition of the coordinate system is given on page 215.



GPS offset parameters

X coordinate [m]: X-distance from COG to the GPS

Y coordinate [m]: Y-distance from COG to GPS.

GPS latitude: Display current GPS latitude

Array latitude: Display current transducer array latitude

GPS longitude: Display current GPS latitude.

Array Longitude: Display current transducer array longitude

Heading: Sets a heading value for testing array position offset.

4.2.35 HelpFiles

The **HelpFiles** parameter sheet is accessed from the **File Locations** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note

You have to be logged on as Root in order to get access to the Configuration tab.

The menu page is used for specifying file name and location of

- Operator Manual
- Technical Manual

The location must be given relative to the TOPAS directory!

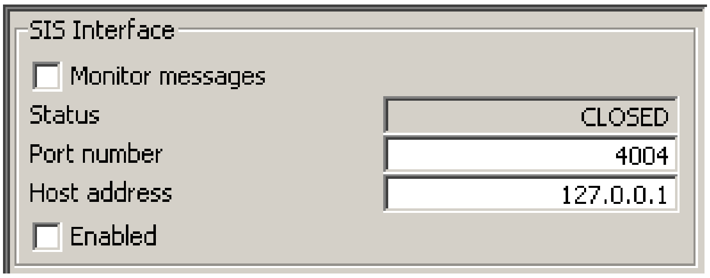
4.2.36 Http Interface

The **Http Interface** parameter sheet is accessed from the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*

The layout of the parameter sheet is identical to the **SIS Interface** parameter sheet!

The Http Interface is used for accessing an internal web server for remote control of start/stop of pinging and data logging!



Http Interface parameters

Port number: Selects the port number for web access to the TOPAS work station

Host address: Selects the current IP-address for the TOPAS work station.

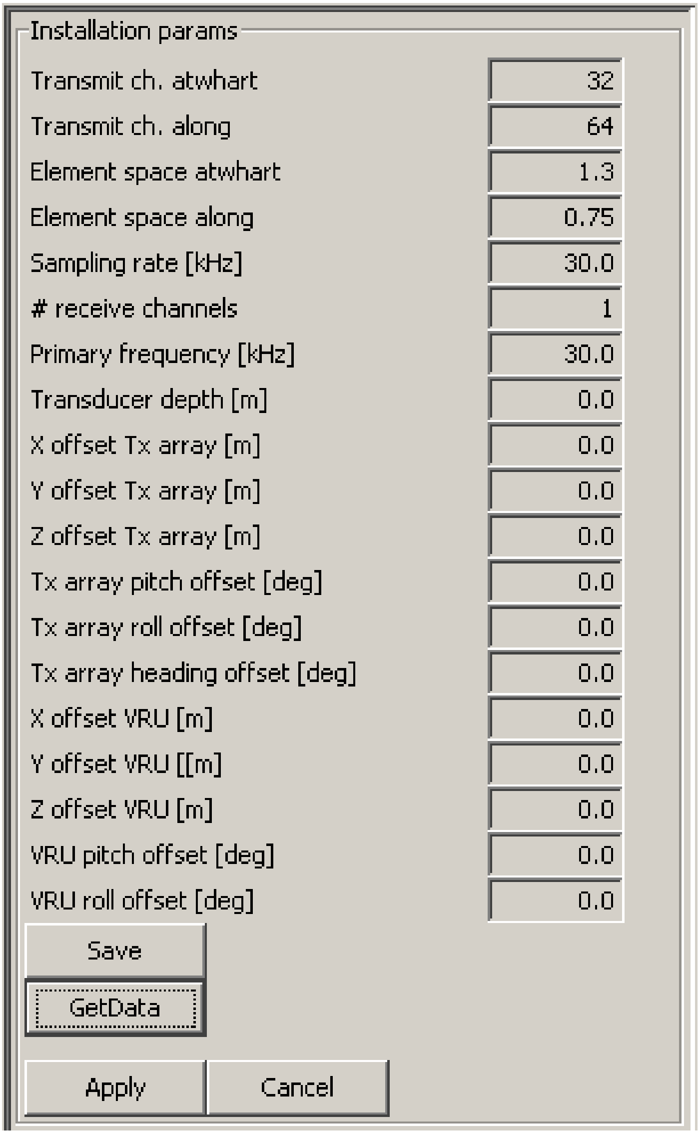
Enable: Enables remote web control of the TOPAS work station.

4.2.37 Installation parameters

The **Installation params** parameter sheet is accessed from the **Installation params** folder under the **BIST** tab. (If the **Installation params** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the BIST tab.*

The **Installation params** sheet shows the installation configuration of the TOPAS system.



The data may be saved to file by selecting **Save**.

Note *This information may be of interest when contacting support!*

4.2.38 Load config

The **Load config** dialogue box is accessed from the **File** menu.

When using the **Load config**, the parameters previously stored into an .xml file by the **Save config** command are used.

You can select between different parameter configurations with different names if they are present. But it has to be in .xml format.

→ *For information about the Save config, refer to page 176.*

4.2.39 Load installation

The **Load installation** dialogue box is accessed from the **File** menu when you are logged on as ***Root***.

When using the **Load installation**, the installation parameters previously stored into an .xml file by the **Save installation** command are used. The default *TopasInstall.xml* file is loaded automatically.

Note

The user should be careful storing and loading installation files. It may result in faulty operation of the system!

You can select between different installation parameter configurations with different names if they are present. However, it has to be in .xml format.

→ *For information about the **Save installation**, refer to page 177.*

4.2.40 Manuals

The **Manuals** access sheet is accessed from the **Help** pulldown menu. When pdf-files for manuals are installed, the submenu of the Manuals field may look like the following:

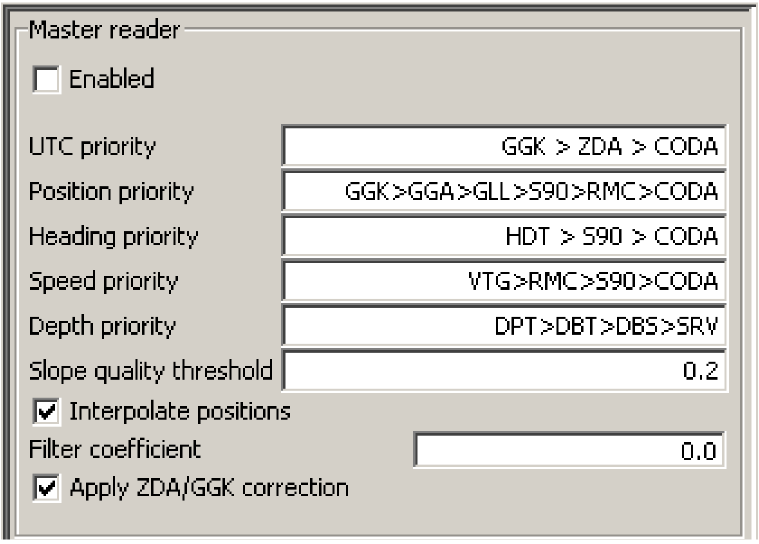
Left-clicking one of the manuals, it will be displayed using Acrobat Reader.

Note

Both Acrobat Reader and the manual files have to be installed in the system

4.2.41 Master reader

The **Master reader** parameter sheet is accessed from the **Configuration** tab. When no sensors are supplying data to the system, the reader Window looks like this:



Master reader parameters

UTC priority: Selects priority of NMEA telegram to be used for time information coming from the navigation system; 1^{st} > 2^{nd} > 3^{rd} > ...

Position priority: Selects priority of NMEA telegram to be used for position information coming from the navigation system; 1^{st} > 2^{nd} > 3^{rd} > ...

Heading priority: Selects priority of NMEA telegram to be used for heading information coming from the navigation system; 1^{st} > 2^{nd} > 3^{rd} > ...

Speed priority: Selects priority of NMEA telegram to be used for vessel speed information coming from the navigation system; 1^{st} > 2^{nd} > 3^{rd} > ...

Depth priority: Selects priority of NMEA telegram to be used for external depth information coming from other system; 1^{st} > 2^{nd} > 3^{rd} > ...

Slope quality threshold:

Specifies the RMS deviation of the bottom samples from the fitted slope plane. A low value requires a better fit! If the requirement is not fulfilled, the previous slope value will be used.

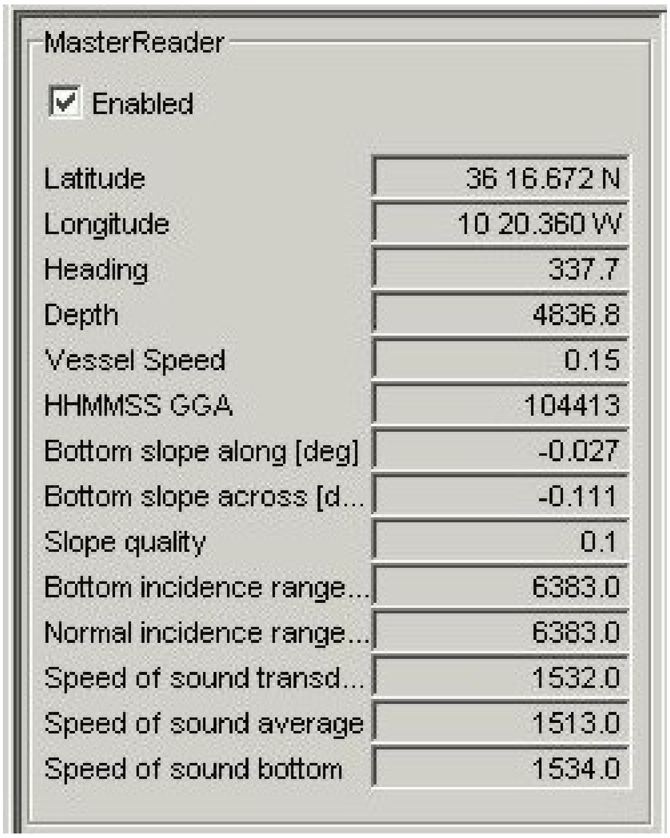
Interpolate positions: Enables interpolation of positions when ping rates are high (>1 Hz) in order to avoid several pings stored with the same position.

Filter coefficient: Interpolation filter coefficient. 0.0 indicates no filtering and 0.99 is maximum filtering.

Apply ZDA/GGK correction:

Enables synchronization of time used by the TOPAS application to the UTC time from the navigation system.

The window changes when data are present and the fields depend on type of data present.



Replay reader parameters

Position, heading and **vessel speed** is data received directly from the navigation system.

Depth may come from the navigation system, echo sounder system or other sources supplying depth information.

HHMMSS GGA is time of the position fix included in the NMEA GGA format. If the ZDA telegram is present, GGA is replaced by the ZDA and an option for synchronizing the operator unit to this time appears.

Bottom slopes and **quality** is supplied by multibeam echo sounders configured to generate this information. The information is used to steer the acoustic beam from the TOPAS system perpendicular to the seabed to increase penetration.

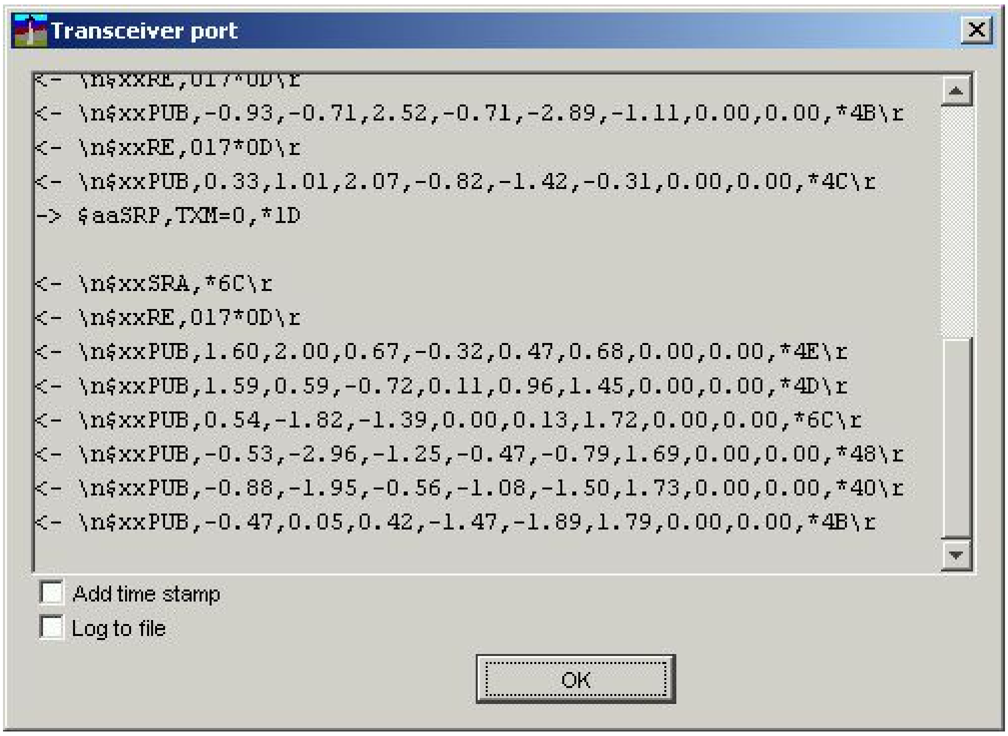
Bottom and **Normal incidence** displays water depth vertical and perpendicular to the seabed.

Speed of sound fields display the sound velocity at the transducer, the average sound speed and the sound speed at the bottom.

The average sound speed may be used by the TOPAS system for calculating the water depth.

4.2.42 Monitor window

The **Monitor window** is accessed from most of the communication setting sheets by ticking off the Monitor messages field.



All communication on the port is displayed in the window and it is primarily used for system setup, debugging and control.

→ indicates data sent from the operator station to the target/source

← indicates data received from a target/source

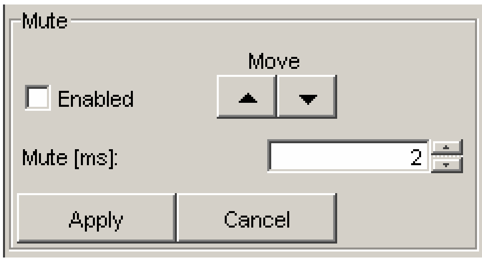
Monitor window parameter

Add time stamp: Adds date and time in front of the message before it is displayed.

Log to file: Logs the messages to a file named after the port name monitored, here it would be: *TransceiverPort.log*. The location of the file will be in the default TOPAS SW-directory, most often: *C:\TOPAS*.

4.2.43 Mute

The **Mute** parameter sheet is accessed from the **Processing** tab.



The mute function is used for muting or zeroing all trace values located from start of trace and to a specified offset from the seabed position.

Mute parameter

Mute [ms]: Sets the offset from the detected seabed position for the mute.

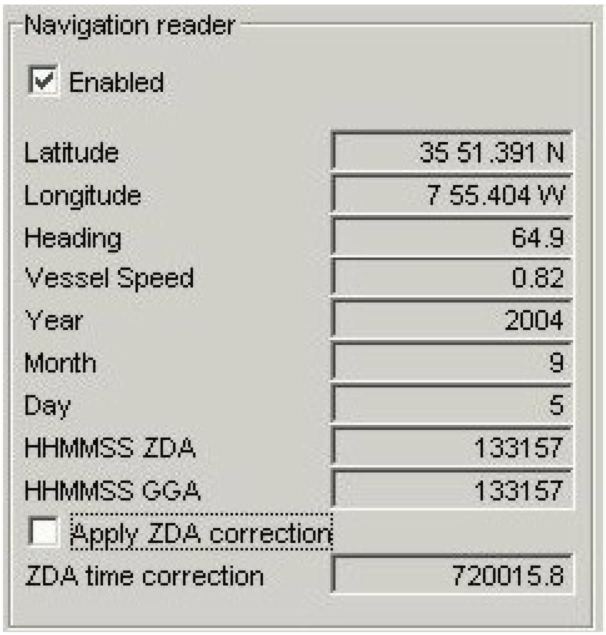
4.2.44 Navigation reader

The **Navigation reader** parameter sheet is accessed from the **Master reader** item in the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*

The data displayed here is also shown one level up, in the **Master reader** parameter sheet!

Note *The parameter fields are only present when data are received by the TOPAS system from the relevant external sensor, i.e. navigation system or similar.*



Navigation reader output parameters

Latitude: Displays the latitude received from the navigation system.

Longitude: Displays the longitude received from the navigation system.

Heading: Displays the heading received from the navigation system.

Vessel speed: Displays the vessel received speed from the navigation system.

Year: Displays the year received from the navigation system.

Month:	Displays the month received from the navigation system.
Day:	Displays the day received from the navigation system.
HHMMSS ZDA:	Displays the UTC time received from the navigation system, from ZDA datagram.
HHMMSS GGA:	Displays the UTC time received from the navigation system, from GGA datagram.
Apply time corr.:	Checkbox for applying time correction to time information used in TOPAS operation.
Time correction:	Displays the calculated time correction in seconds.

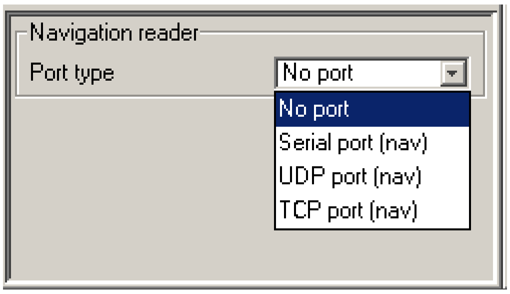
4.2.45 Navigation reader port

The **Navigation reader** port parameter sheet is accessed from the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note

You have to be logged on as Root in order to get access to the Configuration tab.

The layout of the parameter sheet is identical to the slope and depth reader ports!



Navigation port parameters

Port type: Selects the port where navigation information is available. The choices are:

- No port
- Serial port
- UDP port
- TCP port

Configuration of the selected port is done one step lower down in the configuration tree.

4.2.46 Parallel port

The **Parallel port** parameter sheet is accessed from **Printer X** subfolders under the **Printers** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

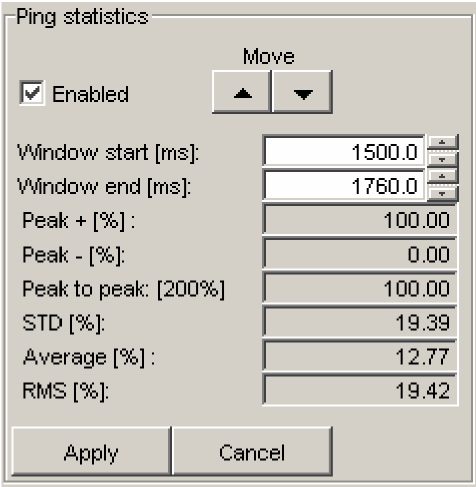
Note *You have to be logged on as Root in order to get access to the Configuration tab.*

Parameters

Monitor messages:	Checkbox for enabling monitor window for messages. See Monitor window at page 133 for description of the window.
Status:	Displays the current status of the port. Open or closed.
Par Port:	Allows you to select the desired parallel port to use.

4.2.47 Ping statistics

The **Ping statistics** parameter sheet is accessed from the **Processing** tab. It can also be accessed by right clicking in the single trace display and selecting Statistics start. Two turquoise markers appear which the mouse can adjust.



Ping statistics calculates some statistic parameters based on a section of the received data trace. The values calculated are given in % of maximum amplitude level of the receiver system.

Note

The values may be greater than 100% if TVG, Gain, AVC etc. has been applied to the signal prior to the Ping statistics function.

Parameters

Window start [ms]: Specifies the absolute position of the trace for start of calculation.

Window stop [ms]: Specifies the absolute position of the trace for end of calculation.

Peak +: Shows the peak positive signal level within the calculation window.

Peak -: Shows the peak negative signal level within the calculation window.

Peak-to-peak: Shows the peak-to-peak signal level within the calculation window.

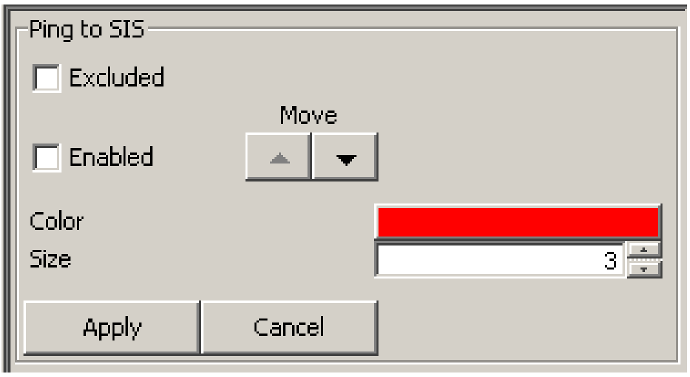
STD: Shows the standard deviation of signal level within the calculation window.

Average:	Shows the average signal level within the calculation window.
RMS:	Shows the root-mean-square of signal level within the calculation window.

4.2.48 Ping to SIS

The **Ping to SIS** parameter sheet is accessed from the **Processing** tab.

When enabled, track information is sent to SIS in real time.



Parameters:

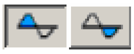
Enable:	Enable data transfer to SIS.
Colour:	Sets the colour to be displayed on the SIS display.
Size:	Sets the line thickness to be used on the SIS display.

Note

Communication to SIS has to be configured for the transfer of track information to take place!

4.2.49 Polarity buttons

The **View mode buttons** are located right above the **Echogram area**.



These buttons are operated individually, however, one has always to be or will always be pushed in. Both buttons pushed in displays both positive and negative values of the data.

4.2.50 Print (File pull down menu)

The **Print** parameter sheet is accessed from the **File** menu.

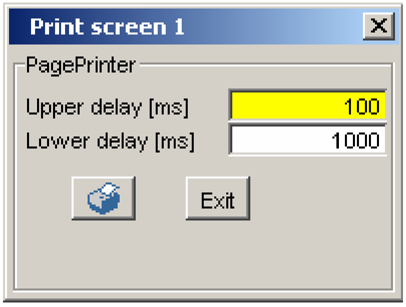
Selecting **Print** from the **File** menu results in the following choice:

- Print screen

A dialogue box will appear, and you can choose parameters.

4.2.50.1 Print screen

The **Print screen** parameter sheet is used for selecting parameters for a screen dump of the *Echogram area* to a system printer.



Parameters:

Upper delay [ms]: Sets the minimum absolute delay for data to be dumped on system printer.

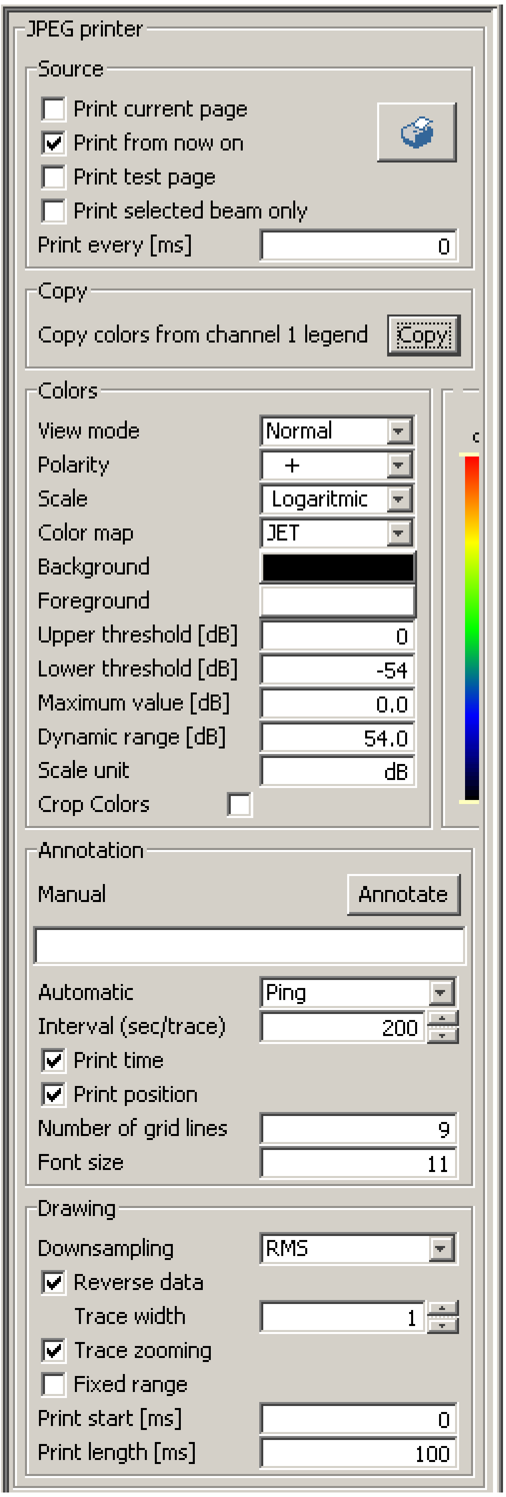
Lower delay [ms]: Sets the maximum absolute delay for data to be dumped on system printer.

This button opens the standard Windows printer dialog box for selecting printer.

Exit: Exits the **Print screen** dialog parameter sheet.

4.2.51 Print (TAB menu)

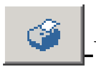
The printer parameter sheets are accessed from the **Print** tab. There are options for selecting two *Printers* and one *Data writer*. The data writer is described in paragraph 4.2.13 on page 90.

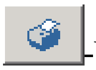


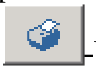
If the printers have been configured under the **Configuration** tab, the printer or driver name will be displayed. If not, **Printer** will be displayed for the two options.

Print parameters

Active channels: Selects which channel to be printed on the same printer. This selection is only available when more than one receiver channel is installed in the system.

Print current page: Select this option to print the currently presented data on the screen. Printing starts when -button is pressed.

Print from now on: Select this option to printing from the current trace (ping). Printing starts when -button is pressed.

Print test page: Select this option to print a test page. Printing starts when -button is pressed. The test result may look like this depending on settings in **Colour** section:

Print selected beam only:

Prints only data in the selected beam direction. This is only relevant when running in sequential scanning mode (optional).

Selected beam: Select direction of beam to be printed. Present only when previous item is checked!

Print every [ms]: Selects print interval in ms. Set to zero selects the ping interval as the print interval. However, when more than one channel is printed to the same printer and the channels are triggered at different rate, a specific interval should be chosen in order to synchronize the channel output to the printer.

Copy colours from channel X legend:
Automatically transfer the colour setting from the main echogram display to the printer settings.

Colour: Description of this group of parameters can be found in chapter 4.2.10 on page 84.

Annotate: Pressing the button annotates the data printed with the **Manual** annotation string. Time, date and position may also be present.

Automatic: Selects if annotation is active synchronized to time or ping.

Interval (sec/trace): Selects interval size for automatic annotation.

Print time: Select for printing time/date info in annotation.

Print position: Select for printing position info in annotation.

Number of grid lines: Sets the number of grid lines to be printed.

Font size: Selects font size to use in annotations.

Reverse data: Select to print data in opposite direction.

Trace width: Selects the print width for each ping in number of “pixels” on the current printer.

Trace zooming: Select to enable printing of a reduced part of the full trace.

Fixed range: Select to enable printing over a large range than the current trace length. Range is specified by the next two parameters..

Trace start [ms]:	Sets the start point of the trace in absolute value.
Trace length [ms]:	Sets the length of the trace to be printed.

4.2.52 Printer 1 & 2 Configuration

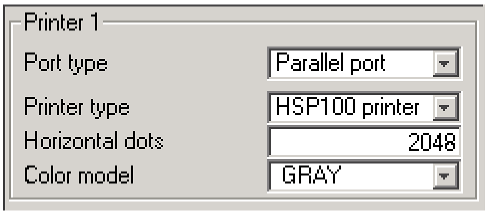
The **Printer 1 & 2** parameter sheets are accessed from the **Printers** page under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab*

The printer port setup sheet is used for configuring the communication to a printer and specifying a printer model where data will be displayed.

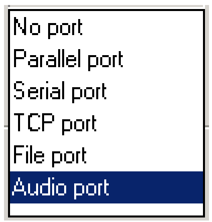
Maximum two printers may be used at the same time!

The configuration sheet depends on **Printer type** selection. The following sheet is for a *grey scale recorder*.



Printer 1 & 2 setup parameters:

Port type: Selects which port the actual printer is connected to. The choices are:



Note *The configuration of the port parameters are done from the next lower level in the menu.*

Printer type: Specifies the actual printer model connected to the port printer language sent to the port. The choices are (with comments in parentheses):

- No printer
- Analog printer (using Audio output)

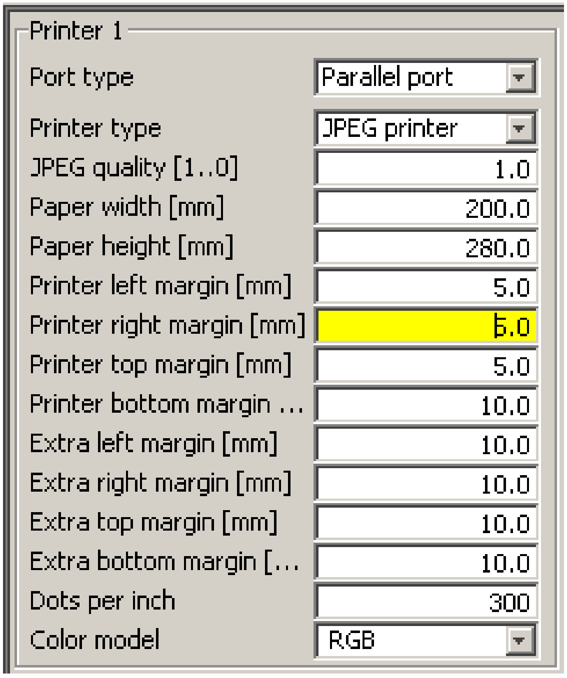
- JPEG printer (for printing high resolution to file)
- GSP1086 printer (EPC)
- HSP100 printer (EPC)
- Ultra and Waverly printers (now Coda Octopus)
- EPC9800 printer
- EPSON ESC/P2 printer
- PCL printer (HP DeskJet/LaserJet)
- PCL3GUI printer (HP DesignJet 120/130)

Horizontal dots: Number of dots per sweep on grey scale recorders.

Colour model: Colour model used; only grey for line scan recorders.

Lines per inch: Sets lines per inch for the EPC 9800 printer. This item is only visible when **EPC9800 printer** is selected!

The configuration sheet shown here is for *colour printers*.



JPEG quality [1..0]: Specifies print quality for printing to a file in JPEG format. Selecting 1 gives the best quality.

This option is only available when **JPEG printer** is selected!

Paper width [mm]: Physical width of the paper the paper used.

Paper height [mm]: Physical height of the paper used. A value of zero indicates continuous paper!

Paper left margin [mm]:

Width of the left hardware dependent margin.

Paper right margin [mm]:

Width of the right hardware dependent margin.

Paper top margin [mm]:

Width of the top hardware dependent margin.

Paper bottom margin [mm]:

Width of the bottom hardware dependent margin.

Extra left margin [mm]:

Width of the additional user defined left margin.

Extra right margin [mm]:

Width of the additional user defined right margin.

Extra top margin [mm]:

Width of the additional user defined top margin.

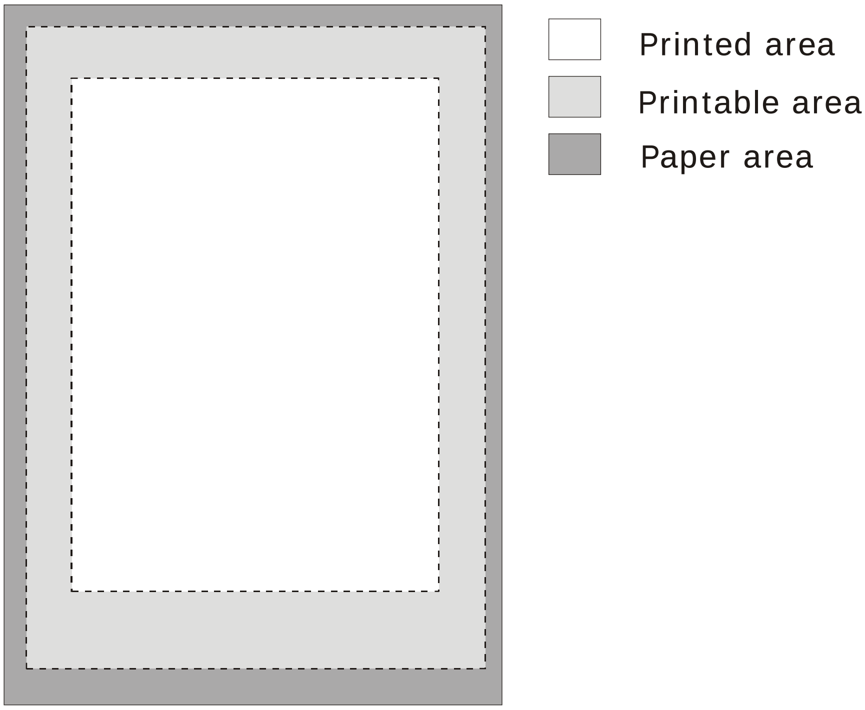
Extra bottom margin [mm]:

Width of the additional user defined bottom margin.

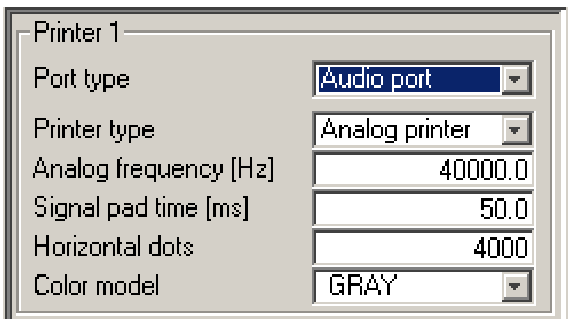
Dots per inch: Sets the printer resolution on the paper. The values are depending on the printer model.

Colour model: Specifies the colour model to use with the printer. Typical choices are (context sensitive): BW, CMY, CMYK, RGB.

The paper/margin description is shown in the following figure where the grey tones define relevant areas on the paper. Dark grey defines the physical paper, the light grey defines the area printable by the printer and the white area is the area where acoustic data are printed. The margin given as dark grey is given by the actual printer documentation.



The configuration sheet shown below is for *analogue printer*.



Analog frequency [Hz]:

Samplings frequency with which data are supplied to the audio output.

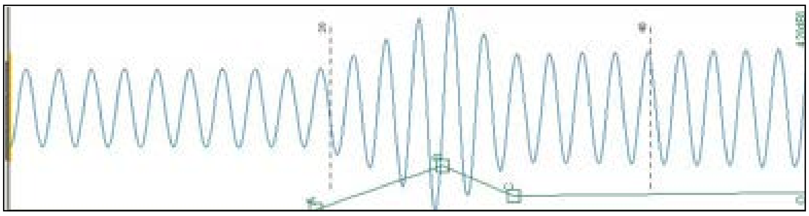
Signal pad time [ms]: Padding of the signal trace for reducing problem with writing new data before old data are clocked out.

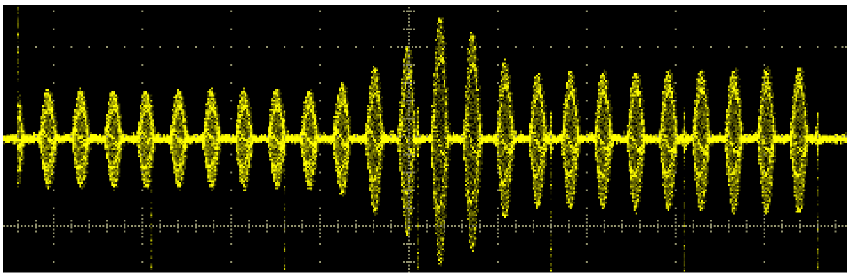
Horizontal dots: Number of samples to send to the audio output. Duration of the output signal is fixed equal to <Horizontal dots>/<Analog frequency>. Any time duration of the recorded data is mapped into this fixed length.

The TOPAS data shown in the upper figure is a snapshot of a 50 ms data trace from the QC-display on the operator console.

The lower figure shows what is sent to the audio output for use by an analogue printer. The system is here set up for printing negative signal values and a fixed duration of 90 ms (3600 samples at 40 kHz).

The analogue printer should be set up for printing both positive and negative values.



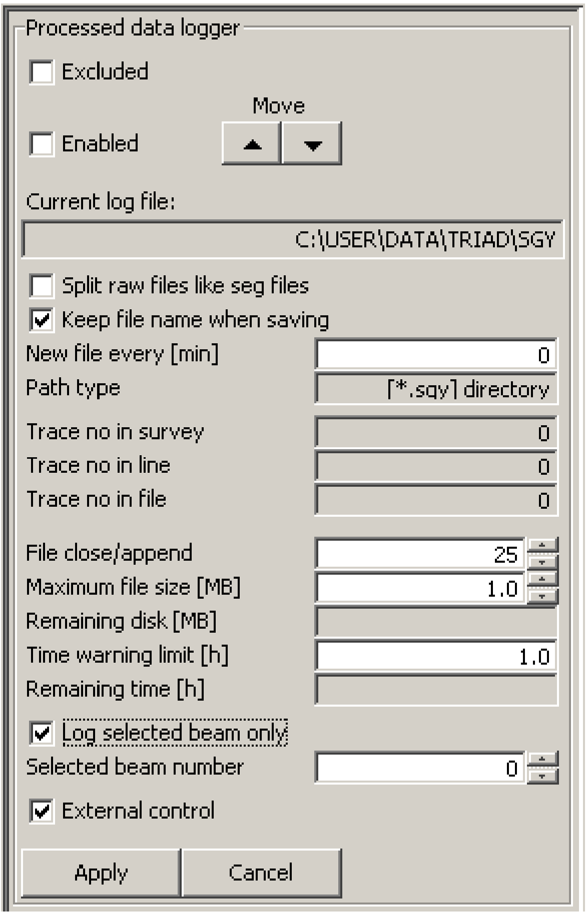


4.2.53 Processed data logger

The **Processed data logger** parameter sheet is accessed from the **Processing** tab.

Note that the position of the parameter sheet determines what kind of data is stored. When the **Processed data logger** is positioned above all other enabled items in the processing chain, it logs data in the RAW format. This way the **Processed data logger** may be used to extract a part of an existing RAW file. If the parameter sheet is positioned after the (for instance) **Matched filter** is applied, it logs pulse compressed data.

When you mark the check box for **Enabled**, a dialogue box will appear. Choose the format you want to log in. And select if you want to log to file or directory. Press **OK** when you are done. You will see the path and the log file name in the **Current log file** window.



When the size of a file exceeds the maximum file size (see below in Parameters), a new file will be created. The new file will be given a new name.

Parameters

Current log file: Path and name of the current log file.

Split RAW files like SEG Y files:

Check box for selecting file splitting based on parameter changes similar to the SEG Y format splitting.

Keep file name when saving:

Used for keeping the same file name during storing of processed data in PRO-format and SEG Y format. Files have to be saved to directory!

New file every [min]: The system creates a new file every xx minutes where xx is the parameter specified in the field. When set to zero, no file splitting occurs. See *Maximum file size* below!

Path type: Displays what kind of logging format and if it is a file or directory.

Trace no in survey: A counter for the current survey. The counter is reset when a new **Job name** is entered in the **Survey info** menu page under the **Acquisition** tab.

Trace no in line: A counter for the current line. The counter is reset when a new **Line** is entered in the **Survey info** menu page under the **Acquisition** tab.

Trace no in file: A counter for the current file. The counter is reset when a new log file is started.

File close/append: Selects number of pings between close – append action to the log file. This will protect the system from losing a completed data file if the system crashes during operation. No more than the selected number of pings may be lost!

Maximum file size [MB]:

Use the arrow buttons or the text field to enter the maximum file size you want for your files or directories. When the size of a file exceeds this value, a new file will be created. If the value is zero, only one log file is used! See *New File every* parameter above!

Remaining disk [MB]: This field shows the amount of remaining disk space available on the log disk.

Time warning limit [h]:

This parameter sets the time for warning about limited disk space for logging. When the logging time is less than the limit, the logging indicator background colour turns orange.

Remaining time [h]: This field shows the amount of remaining log time available for logging to the log disk at the current ping rate and samples per ping.

Log selected beam only:

Enable this if you want to extract a single beam from data containing a number of sequentially scanned beams.

Selected beam number:

This field opens when **Log selected beam only** is checked! Select the beam you want to log; zero is the centre beam of the sector.

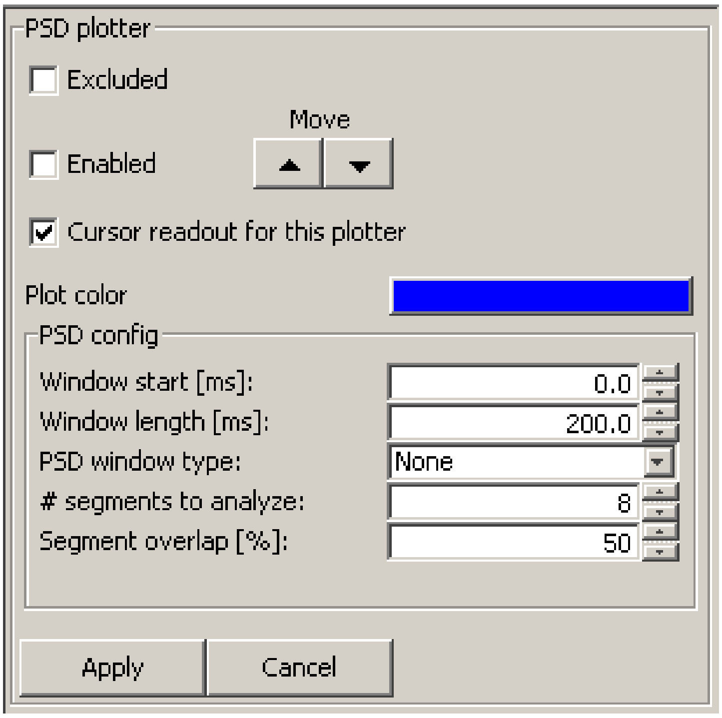
External control:

Enable this if you want to control start/stop of logging of processed data from external computer, either by using the remote telegram or by using a web server.

Note *Press **Apply** to add changes.*

4.2.54 PSD plotter

The **PSD plotter** parameter sheet is accessed from the **Processing** tab.



The PSD plotter is used to display Power Spectral Density data in the *Single trace area*.

PSD plotter parameters

The **PSD plotter** parameter sheet has the following parameters:.

Cursor readout for this plotter:
Enables cursor readout of power spectrum values in *PSD display area*. The values are shown in dB or absolute values.

Plot colour: Used to select the colour of the curve

Window start [ms]: Start point in data trace for analysis**.**

Window length [ms]: Length of analysis window**.**

PSD window type: Selection of window type for analysis
- None (Rectangular)
- Welch
- Barlett
- Hanning

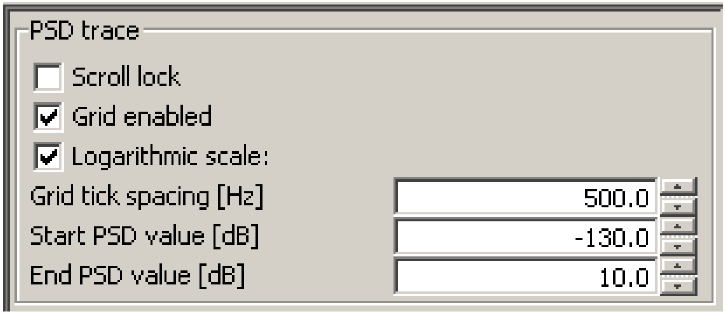
 # segments to analyze:

Number of segments to split the analysis window into.

Segment overlap [%]: Overlap of the segments

4.2.55 PSD trace

The **PSD trace** parameter sheet is accessed from the Display tab.



Parameters

Scroll lock: Displays the seabed in the middle of the display. The **Bottom tracker** has to be **Enabled**.

Grid enable: Checkbox for enabling the grid in the Single trace window.

Logarithmic scale: Selection of logarithmic amplitude axis.

Grid tick spacing [Hz]:

Sets grid tick spacing in Hz.

Start PSD value [dB]: Minimum value of spectrum amplitude axis.

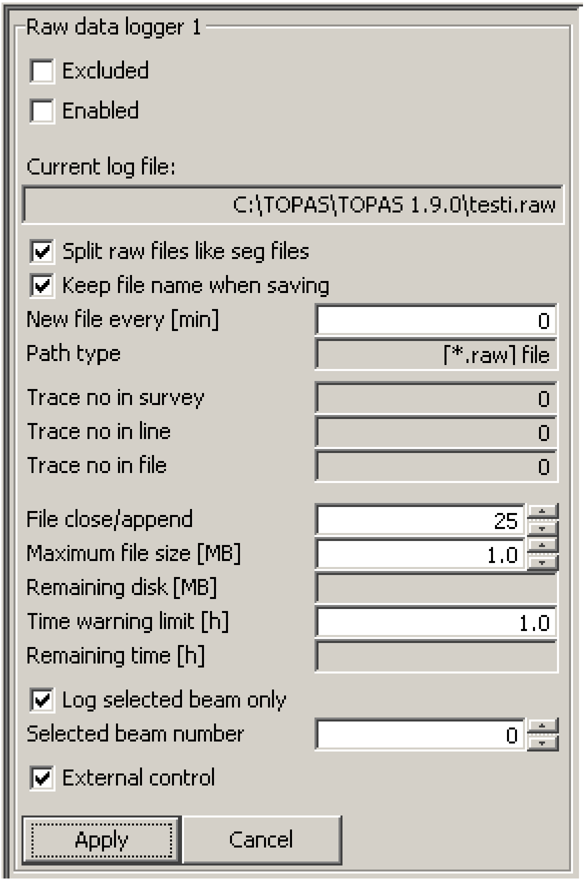
End PSD value [dB]: Maximum value of spectrum amplitude axis.

4.2.56 RAW data logger

The **RAW data logger** parameter sheet is accessed from the **Acquisition tab**.

When you mark the check box for **Enabled**, a dialogue box will appear. (If the check box is already marked, uncheck it and check it again). Choose the format you want to log in. And select if you want to log to file or directory. Press **OK** when you are done.

You will see the path and the log file name in the **Current log file** window.



When the size of a file exceeds the maximum file size (see below in Parameters), a new file will be created. The new file will automatically be given a new name.

Parameters

Current log file: Path and name of the current log file.

Split RAW files like SEG Y files:

Check box for selecting file splitting based on parameter changes similar to the SEG Y format splitting.

New file every [min]: The system creates a new file every xx minutes where xx is the parameter specified in the field. When set to zero, no file splitting occurs. See *Maximum file size* below!

Path type: Displays what kind of format and if it's a file or directory.

Trace no in survey: A counter for the current survey. The counter is reset when a new **Job name** is entered in the **Survey info** menu page under the **Acquisition** tab.

Trace no in line: A counter for the current line. The counter is reset when a new **Line** is entered in the **Survey info** menu page under the **Acquisition** tab.

Trace no in file: A counter for the current file. The counter is reset when a new log file is started.

File close/append: Selects number of pings between close – append action to the log file. This will protect the system from losing a completed data file if the system crashes during operation. No more than the selected number of pings may be lost!

Maximum file size [MB]:

Use the arrow buttons or the text field to enter the maximum file size you want for your files or directories. When the size of a file exceeds this value, a new file will be created. This feature is nice to use in order to have files of reasonably size. If the value is zero, only one log file is used for the logged data! See *New File every* above!

Remaining disk [MB]: This field shows the amount of remaining disk space available on the log disk.

Time warning limit [h]:

This parameter sets the time for warning about limited disk space for logging. When the logging time is less then the limit, the logging indicator background colour turns orange.

Remaining time [h]: This field shows the amount of remaining log time available for logging to the log disk at the current ping rate and samples per ping.

Log selected beam only:

Enable this if you want to extract a single beam from data containing a number of sequentially scanned beams.

Selected beam number: This field opens when **Log selected beam only** is checked! Select the beam you want to log; zero is the centre beam of the sector.

External control:

Enable this if you want to control start/stop of logging of raw data from external computer, either by using the remote telegram or by using a web server.

Note *Press **Apply** to add.*

→ *For more information about Logging, refer to page 24.*

4.2.57 Receiver port X

The **Receiver X** parameter sheets, where X may be 1, 2 or 3, is accessed from the **Configuration** menu tab. The sheet is present only when optional receiver channels are present in the system.

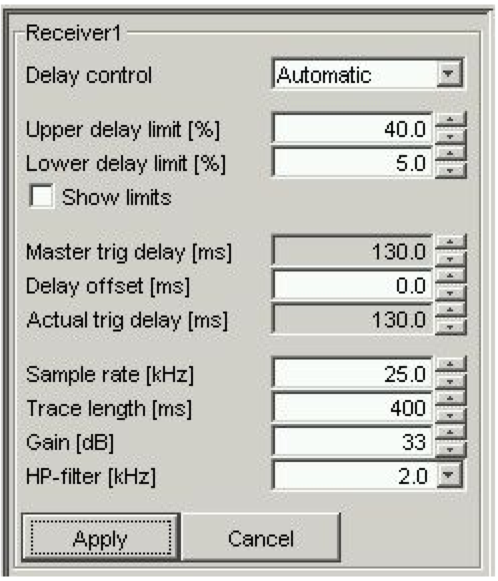
Parameters

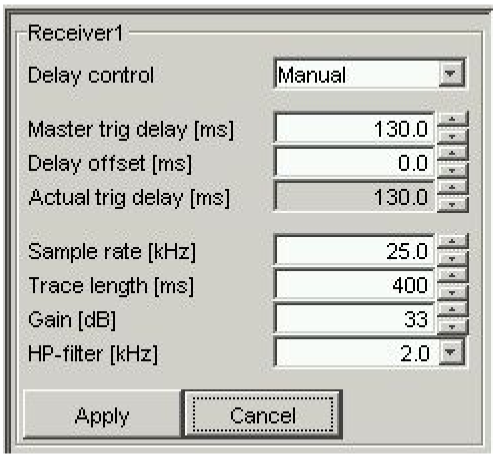
Stub port number: Port number for the receiver. Default port number is 49999.

Stub address: Ethernet address for the receiver. Default address is 192.168.70.2.

4.2.58 Receiver

The **Receiver** parameter sheet is accessed from the **Acquisition** tab. The parameters are used for setting up the receiver system. Some of the fields in the sheet is context sensitive and depends on other fields. If more channels are present, individual sheets will be available for individual setting of the channels.





Receiver parameters

Delay Control: Pull down menu with the following choices; Manual and Automatic. This choice will influence all receiver channels in the system!

– **Manual**: In this mode, the delay must be changed manually by the operator as the seabed and sub-bottom layers disappear out of the acquisition trace. When the acquisition is finished before seabed return is received, the delay has to be increased to compensate for transmission through the water column and vice versa. An approximate value for the delay can be estimated from the following expression: *delay < depth / 0.75.*

– **Automatic**: In this mode, the delay is controlled by detecting the seabed automatically on the received signal itself or in an optional high frequency channel.

The average of three consecutive depth values either in increasing or decreasing order are used for determining the Master trigger delay.

Or by depth data supplied on the comm. port from an external echo sounder.

Upper delay limit [%]:

Parameter sets the minimum delay in the display window in percent of trace length. When the seabed gets closer to the transducer (decreasing water depth), the delay is automatically decreased.

Lower delay limit [%]:

Parameter sets the maximum delay in the display window in percent of trace length. When the seabed gets further away from the transducer (increasing water depth), the delay is automatically increased.

The position of the seabed will stay between the upper and lower limit in the display and automatically adjust the trigger delay accordingly.

Show limits: Enables the display of the limits in the QC-display.

Master trig delay [ms]:

Sets the delay from transmitted pulse till start of acquisition. The value may be 0 and from 20 to 15,000 ms. A value of zero milliseconds, which is the default value, starts acquisition at the same time as an acoustic pulse is transmitted. Optional additional channels will use the value in the system also. This field is active in *Manual* mode only!

Delay offset [ms]: Parameter sets a local offset from the delay set by Master trig delay *or* the delay calculated based on seabed detection or external input (depending on *Depth selector* setting).

Actual trig delay [ms]:

This output field shows the actual trig delay used by this receiver channel.

Sample rate [Hz]: Selecting sampling frequency for A-to-D conversion. Frequency choices in Hz are up to 333,333 Hz. The exact, closest value are calculated by the A-to-D converter card and returned to the program for updating the relevant fields.

The sampling frequency selected depends primarily on the desired sample resolution, length of acquired data trace and the bandwidth of the input signal to be sampled.

The trace is automatically truncated when the **Apply** button is pressed.

The sampling frequency should be at least four times the maximum frequency of interest in the received signal in order to make a good presentation on paper/monitor.

Trace length [ms]: This parameter sets the desired trace length for acquisition. For practical reasons since it is a digital system, continuous traces are not recorded. The minimum trace length is 1 ms and the maximum is 8,000 ms. Actual length is determined by the current sampling frequency according to the following expression: trace length ≤ 16k/sampling frequency. In general, it is an advantage to use long traces for acquisition as this gives a larger signal window when the water depth is varying.

In order to increase throughput in the acquisition system, it is desirable with a low number of samples. By selecting parameters so that the maximum number of samples is reduced will give an increase in the real-time processing throughput. This is of importance it the ping rate is high and the system is skipping traces.

Gain [dB]: This parameter sets the gain in the front-end amplifier. Minimum gain is 0 dB and maximum gain is 72 dB in steps of 1 dB. Default gain is 0 dB. Internally the gain steps are arranged in 6 and 1 dB steps where the 6 dB steps are implemented in hardware and the 1 dB steps are implemented in software.

The gain s set by the operator to a level where the returned signals are clearly seen in the display. Care must be taken so the signal is not saturated in the analogue input channel. This may occur when the system is operated at full output power in shallow waters and the gain is set too high. Monitoring the raw data in scope mode is the best way to control the level.

HP-filter [kHz]: This pull down field is used for selecting the high pass corner frequencies for the analogue high pass filter in the front-end unit. The available choices depend on the type of front-end implemented. For low frequency front-ends, the following parameter sets is available:

0.1 kHz (0.03 kHz) / 0.5 kHz / 1.0 kHz / 2.0 kHz

This filter is used to reduce influence of unwanted low frequency noise signals that may be a problem around vessels, in harbour areas etc. The value chosen should be as low as possible to remove or reduce the influence of the low frequency noise signals. In addition, it must be lower than the lowest significant frequency component in the transmitted wavelet.

For the optional high frequency front-ends, the following parameter set is used:

10 kHz / 20 kHz / 30 kHz / 60 kHz

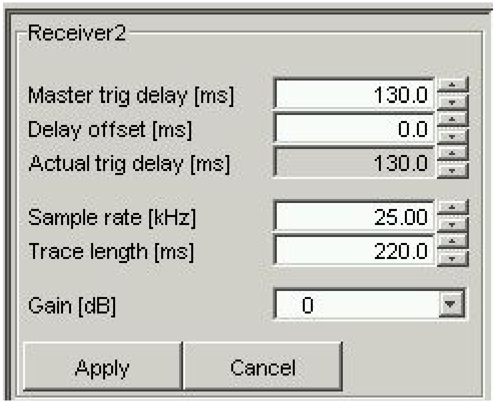
Here the filter is primarily used to filter the primary or especially the second harmonic signal from the ParaSource.

Receiver sensitivity [dB re V/µPa]:

This parameter sets the hydrophone sensitivity as measured at the receiver input. The field is only present when logged on as ***root***.

The peak input voltage to the A-to-D converter is 5.0 volts.The fixed gain in the system is 45 dB (when front-end gain is set to 0 dB).

Optional additional receivers, *Receiver 2 or 3,* will have the following receiver parameter sheet:



Master trig delay [ms]:

Sets the delay from transmitted pulse till start of acquisition. The value may be from 0 ms to 15,000 ms. A value of zero milliseconds, which is the default value, starts acquisition at the same time as an acoustic pulse is transmitted.

The same value will be used by all channels in the system.

This field is active only when *Manual mode* is selected in *Receiver 1*!

Delay offset [ms]: Parameter sets a local offset from the delay set by Master trig delay *or* the delay calculated based on seabed detection or external input (depending on *Depth selector* setting).

Actual trig delay [ms]:

This output field shows the actual trig delay used by this receiver channel.

4.2.59 Remote reader

The **Control reader** parameter sheet is accessed from the **Master reader** item in the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*

Note *The parameter fields are only present when data are received by the TOPAS system from the relevant external sensor, i.e. echo sounder or similar.*

This is used for receiving messages for remote start/stop of pinging and data logging.

Commands sent to the **Control Reader Port** is as follows:

$aaR00,*h	Stop both pinging and logging
$aaR10,*h	Stop logging, continue or start pinging
$aaR12,*h	Start logging

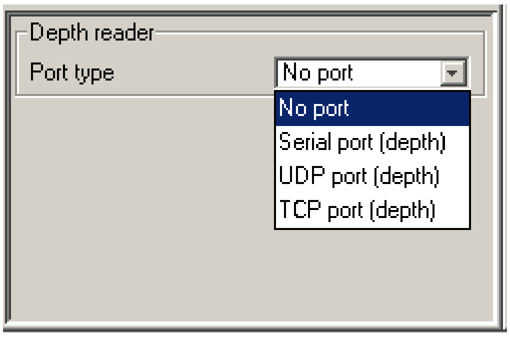
4.2.60 Remote reader port

The **Control reader** port parameter sheet is accessed from the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note

You have to be logged on as Root in order to get access to the Configuration tab.

The layout of the parameter sheet is identical to the navigation and slope reader ports!



Control port parameters

Port type: Selects the port where depth information is available. The choices are:

- No port
- Serial port
- UDP port
- TCP port

Configuration of the port is done one step lower down in the configuration tree.

4.2.61 Repeat writer X

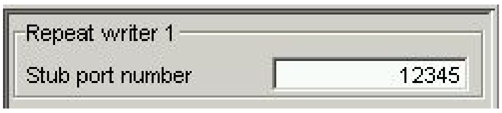
The **Repeat writer X** parameter sheets, where X may be 1, 2 or 3 depending on associated receiver channel number, are accessed from the **Acquisition** menu tab. The sheet is present only when optional receiver channels are present in the system.

Checking the checkbox starts transmission of the TOPAS data blocks on the configured port number on Ethernet, see page 171. Either real-time data or replayed date may be transmitted.

The checkbox is cleared every time the TOPAS program is started!

4.2.62 Repeat writer port X

The **Repeat writer X** port parameter sheets, where X may be 1, 2 or 3, depending on associated receiver channel number, are accessed from the **Communication** sheet under the **Configuration** menu tab. The sheet is present only when optional receiver channels are present in the system.



Parameters

Stub port number: Port number for data transmission. Default number is 50005.

4.2.63 Replay and survey buttons

The **Replay and Survey buttons** are located right above the *Echogram area.*

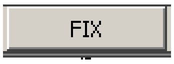


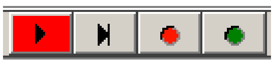
Figure 4-8 Event button.

Push this button to create a fix / event mark in the data. The mark may be displayed on the Echogram area and stored in the raw data file.

Figure 4-9 Chose between Replay and Survey mode.

This is where you select between replay and survey mode. Depending on what you choose, the replay or survey buttons are shown. They are described below:

Figure 4-10 Replay mode.

Not pinging: 

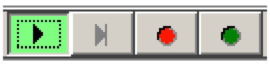
Pinging: 

Figure 4-11 Survey mode.

The “Start” button: 

- **Survey mode**: Start with transmit mode normal.
- **Replay mode**: Start replay of data.
-

The “Single ping / step” button: 

- **Survey mode**: Start with transmit mode single ping.
- **Replay mode**: When replay is paused, this button can be used to step or single trace further.

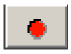
–

The ”Transmit mode burst / Single receiver fan step” button:


- **Survey mode**: Not present!
- **Replay mode**: Replays one complete scan each time the button is pushed when replay is paused.

The ”Pause” button: 

- **Replay mode**: Pause replay.

The red ”Log” button: 

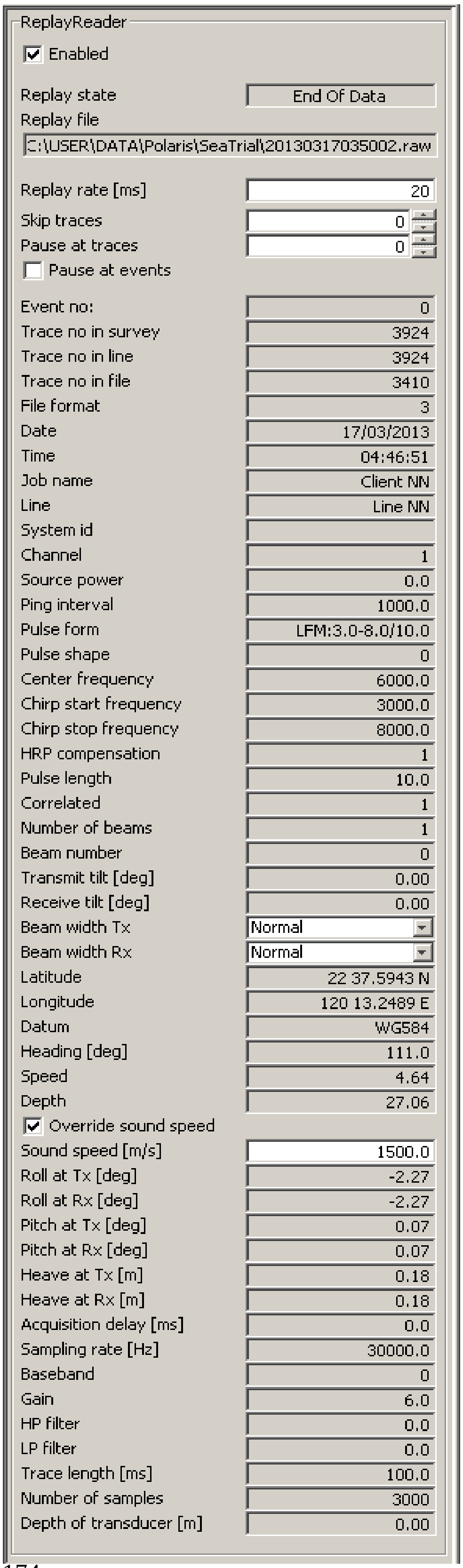
- Logs sampled raw data for later replay. When you press this button a file name dialogue box will appear. Data from all enabled **Raw data loggers** will be logged simultaneously to individual files.

The green ”Log” button: 

- Logs processed data for later replay. When you press this button a file name dialogue box will appear. Data from all enabled **Processed data loggers** will be logged simultaneously to individual files.

4.2.64 Replay reader

The **Replay reader** parameter sheet is accessed from the **Acquisition** tab.



Replay reader parameters

Replay file: Gives you information about which file is replayed and where it is located.

Replay rate (ms): Sets minimum time interval between reading each ping from file.

Skip traces: Sets the number of traces to skip in order to compress the data horizontally.

Pause at trace: Pause replay at trace number specified.

Pause at events: Pause replay at event/fix number specified.

Stop at event no: Specify the event/fix number to pause at. A value of zero will pause replaying at all events!

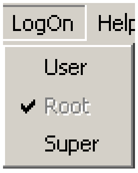
The remaining data displayed are header information in the traces stored on file; see TOPAS File Format at page 325 for description.

Override sound speed:

Checkbox for overriding the stored sound speed values during processing.

4.2.65 Root

The **Root** dialogue box is accessed from the **LogOn** menu.



A password window pops up for entering the *root* password.

When **Root** is logged on, you get access to most of the parameters. The parameters that are grey when a normal user is logged on will turn white as an indication of this.

Password is *root*.

4.2.66 Save config

The **Save config** dialogue box is accessed from the **File** menu.

When using the **Save config**, the current parameters are stored into the file <TopasConfig.xml>.

You can save different parameter configurations with different names. But it has to be in .xml format.

If you want to use a different configuration, use the *Load config*.

→ *For information about the Load config, refer to page 122.*

4.2.67 Save installation

The **Save installation** dialogue box is accessed from the **File** menu.

When using the **Save installation**, the installation parameters are stored into the file <TopasInstall.xml>.

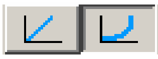
You can save different installation configurations with different names. But it has to be in .xml format.

If you want to use a different configuration, use the *Load install*.

→ *For information about the* Load installation*, refer to page 128.*

4.2.68 Scale buttons

The **Scale buttons** are located right above the **Echogram area**.



The buttons selects the colour coding or intensity coding for the data presented in the main data display area. The scaling alternatives are linear or logarithmic.

The parameter may be set in the **Legend** parameter sheet under the **Display** tab.

→ *For information about the Legend, refer to page 84*

.

4.2.69 Services

The **Services** folder is accessed from under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

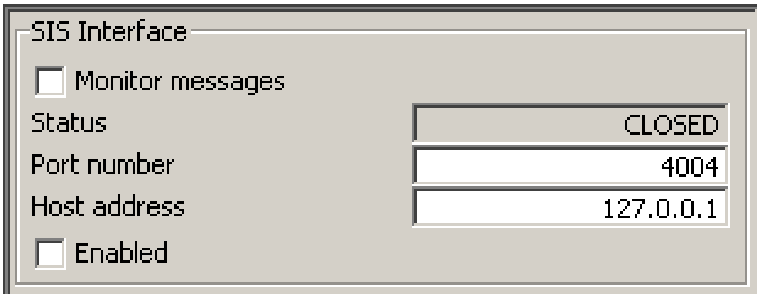
Note

You have to be logged on as Root in order to get access to the Configuration tab.

The folder contains two children:

Http interface:	Configures communication for remote control via web server.
SIS interface:	Configures communication with the SIS computer.

The two interfaces are having similar parameter sheets.

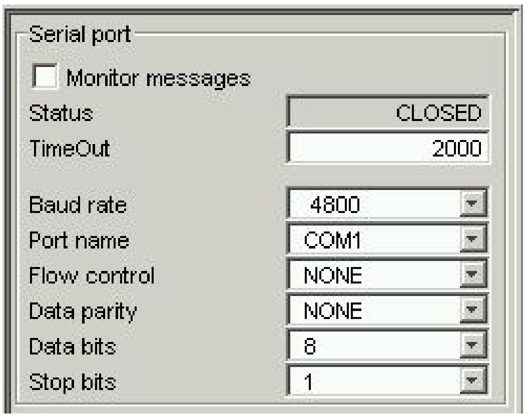


Port number:	IP-port number.
Host address:	IP-address on host computer.
Enable:	Check mark to enable interface.

4.2.70 Serial port

The **Serial port** parameter sheet is accessed from several specified communication folders under the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*



Parameters

Monitor messages: Checkbox for enabling monitor window for messages. See Monitor window at page 133 for description of the window.

Status: Displays the current status of the port. Open or closed.

TimeOut: Allows you to set time out on the port in milliseconds. Set to a large number (>10,000)!

Baud rate: Gives you the following choices: 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200.

Port name: Select the com port of current interest. Choices are from COM1 to COM8 or NONE. However, the number of ports is limited by the number installed ports.

Flow control: Select between NONE, XON/XOFF and Hardware.

Data parity: Select between NONE, EVEN and ODD.

Data bits: Select between 5, 6, 7, and 8.

Stop bits: Select between 1, 1.5 and 2.

4.2.71 Single trace

The **Single trace (QC display)** parameter sheet is accessed from the Display tab.

Single trace parameters

Scroll lock: Displays the seabed in the middle of the display. The **Bottom tracker** has to be **Enabled**.

Grid enable: Checkbox for enabling the grid in the Single trace window.

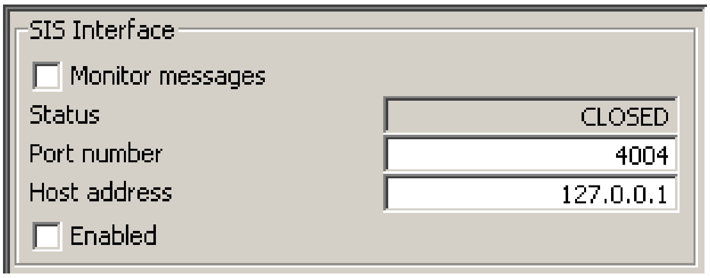
Grid tick spacing: Sets the spacing between the vertical grid lines in number of milliseconds.

4.2.72 SIS Interface

The **SIS Interface** parameter sheet is accessed from the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*

The layout of the parameter sheet is identical to the **Http Interface** parameter sheet!



SIS Interface parameters

Port number: Selects the port number for the SIS work station

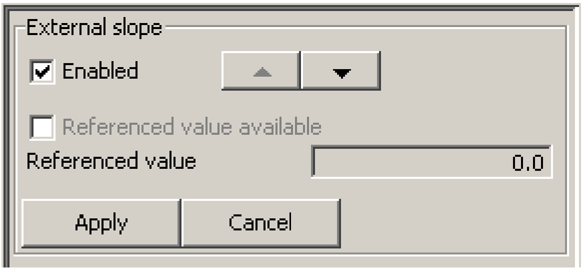
Host address: Selects IP-address for the SIS work station.

Enable: Enables communication with the SIS work station.

4.2.73 Slope from external slope

The slope from **External slope** parameter sheet is accessed from the **Acquisition** tab. (If the folder is closed, double-click the folder to open

The depth from **External slope** is found in the **Slope selector** sub folder.



Note

The slope value is used for automatic adjustment of beam direction to achieve 90 degree angle of incidense on the seabed.

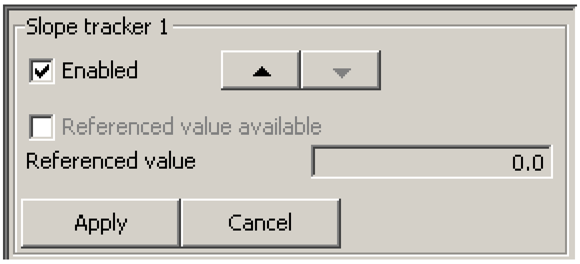
Slope from external slope parameter

Enable:	Enable the use of external slope data.
Referenced value:	Bottom slope

4.2.74 Slope from slope tracker

The slope from **Slope tracker X** parameter sheet is accessed from the **Acquisition** tab. (If the folder is closed, double-click the folder to open). X may be 1, 2 or 3 depending on the number of receiver channels installed.

The slope from **Slope tracker** is found in the **Slope selector** sub folder.



Note

The slope value is used for automatic adjustment of beam direction to achieve 90 degree angle of incidence on the seabed.

Slope from slope tracker parameter

Referenced value: Bottom slope.

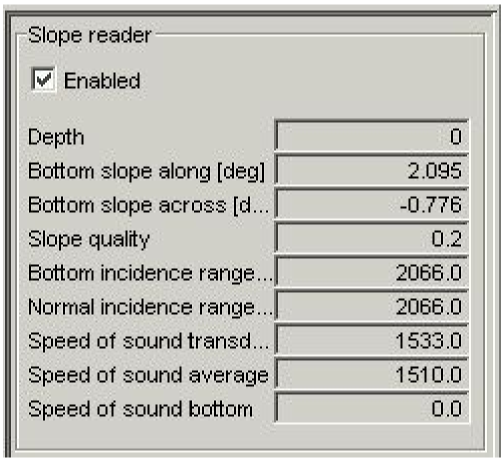
4.2.75 Slope reader

The **Slope reader** parameter sheet is accessed from the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*

The data displayed here is also shown one level up, in the **Master reader** parameter sheet!

Note *The parameter fields are only present when data are received by the TOPAS system from the relevant external sensor, i.e. EM12x, EM30x, EM70x or similar.*



Slope reader parameters

Bottom slope along: Bottom slope along the vessel.

Bottom slope across: Bottom slope across the vessel.

Slope quality: Shows the quality/reliability of the slopes. Low values indicated good quality (normalized std. dev. of fit)!

Bottom incidence range:

Vertical distance to the seabed.

Normal incidence range:

Distance to seabed at normal incidence.

Speed of sound at transducer:

Sound speed measured at the transducer.

Speed of sound average:

The average sound speed between the transducer and bottom. This value may be used by the system, see paragraph 4.2.79.

Speed of sound at bottom:

Sound speed measured at the bottom.

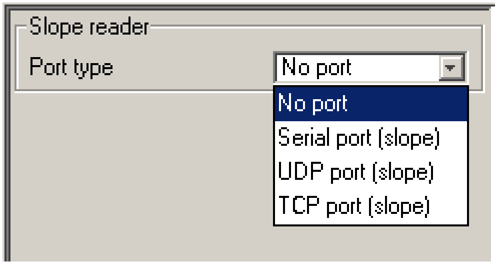
4.2.76 Slope reader port

The **Slope reader** port parameter sheet is accessed from the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note

You have to be logged on as Root in order to get access to the Configuration tab.

The layout of the parameter sheet is identical to the navigation and depth reader ports!



Slope reader port parameters

Port type: Selects the port where slope information is available. The choices are:

- No port
- Serial port
- UDP port
- TCP port

Configuration of the port is done one step lower down in the configuration tree.

4.2.77 Slope selector

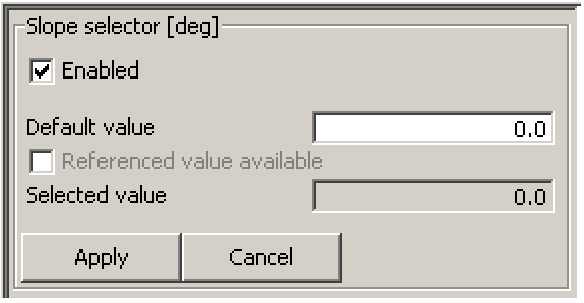
The **Slope selector** is accessed from the **Acquisition** tab. (If the folder is closed, double-click the folder to open).

The Slope selector is used for selecting which slope value input should be used for controlling the beam steering when **Acquisition>Transmitter>Beam control** is set to **Auto**,

The **Slope selector** has at least two children depending on number of installed receiver channels:

- External slope
- Slope tracker X

where X refers to receiver channel 1, 2 or 3. Only channel 1 is installed by default!



Note

The slope value is used for automatic adjustment of beam direction to achieve 90 degree angle of incidence on the seabed.

Slope selector parameter

Default value: The default value is selected if no other value is available. The default value must be entered by the operator!

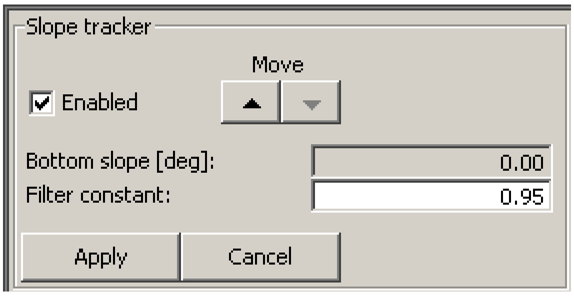
Referenced value available:

Indicates if an external slope is available.

Selected value: The selected slope value used.

4.2.78 Slope tracker

The **Slope tracker** parameter sheet is accessed from the **Processing** tab. (If the **Processing Chain** folder is closed, double-click the folder to open).



The slope tracker is used for estimating the seabed slope. The slope tracker's function is to track the seabed depth versus position or distance. This information can be used for adjusting transmitter beam direction to achieve a perpendicular angle of incidence on the seabed..

Slope tracker parameters

Bottom slope: Shows the estimated bottom slope in degrees.

Filter constant: Filter constant (0 – 1.0) for smoothing of the slope estimate. A high value puts more emphasis on the previous slope value!

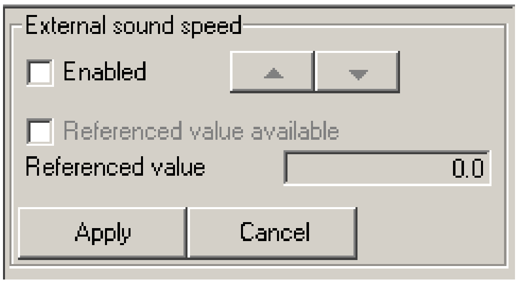
Note

*The **Bottom tracker** has to be enabled in order to use the **Slope tracker** properly. In addition, the **Slope tracker** has to be located below the **Bottom tracker** in the Processing menu!*

4.2.79 Sound speed - external

The sound speed from **External sound speed** parameter sheet is accessed from the **Acquisition** tab. (If the folder is closed, double-click the folder to open

The sound speed from **External sound speed** is found in the **Sound speed selectors** sub folder.



Note *The sound speed used for converting external depth to travel time for automatic adjustment of runtime parameters and for performing correct beam steering.*

External sound speed parameter

Referenced value: Sound speed from external source.

Note *This function requires an external sound speed input. This is available in the Slope reader, see paragraph 4.2.75!*

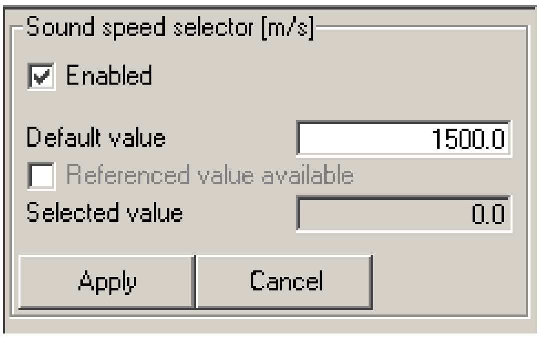
4.2.80 Sound speed selector

The **Sound speed selectors** are accessed from the **Acquisition** tab. (If the folder is closed, double-click the folder to open).

There are two selectors, one for the average sound speed in the water column and one for the sound speed at the transducer surface. The selectors are used for selecting between manual or external sound speed values to be used for converting between depth and time delay used for displaying depth calculated from travel time and for calculating transmitter **Ping interval** and receiver **Trigger delay** based on external depth input, and for steering the beam correctly in pitch and roll.

The **Sound speed selectors** have one child each:

- External sound speed



Note *The sound speed is used in calculations used for automatic adjustment of runtime parameters.*

Sound speed selector parameter

Default value: The default value is selected if no other value (external) is available. The default value must be entered by the operator!

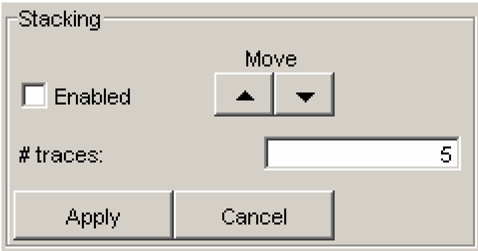
Referenced value available:

Indicates if an external sound speed value is available.

Selected value: The selected sound speed used.

4.2.81 Stacking

The **Stacking** parameter sheet is accessed from the **Processing** tab.



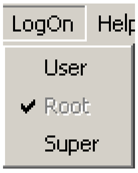
The stacking or trace mixing function is used for reducing incoherent noise in adjacent traces. A given number of traces are averaged sample by sample to produce a new trace of averaged samples. Optimal performance is achieved when reflecting horizons are fairly parallel and horizontal. The improvement in signal-to-noise ratio for correlated signals will be approximately 10 * log (N) where N is number of traces used in the processing.

Stacking parameter

 # Traces: Sets the number of adjacent traces to be used in the averaging.

4.2.82 Super

A **Super** dialogue box can be accessed from the **LogOn** menu when logged on as *root*..



A password window pops up for entering the *Super* password.

Note

This access is not open for customers. It is only accessible for KDS representatives.

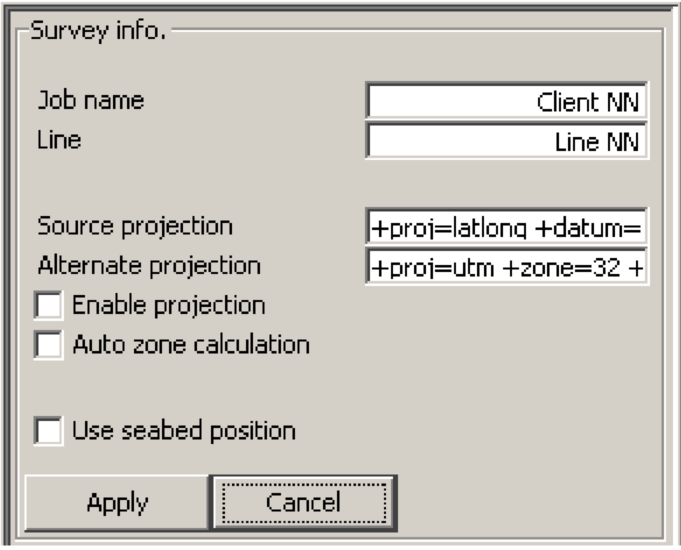
4.2.83 Support

The **Support** dialogue box is accessed from the **Help** menu.

It contains information about the TOPAS support, such as telephone number, email addresses etc.

4.2.84 Survey info

The **Survey info** parameter sheet is accessed from the **Acquisition** tab.



Survey info parameter

Job name: Space for giving the current survey a name, which will be stored together with other information on file when logging.

Note *Every time the name is changed, the variable **Trace number in survey** will be reset!*

Line: Space for giving the current survey line a name or number, which will be stored together with other information on file when logging.

Note *Every time the name is changed, the variable **Trace number in Line** will be reset!*

Source projection: This field defines the default coordinate projection used in GPS/navigation systems. The string <`+proj=latlong +datum=WGS84`> indicate that input coordinates are latitude/longitude and the projection is WGS84. See chapter 7.3 Coordinate Conversion on page 309 for more information.

Alternate projection: This field defines the coordinate projection used in the conversion. The string < `+proj=utm +zone=32 +ellps=WGS84` > indicated that coordinates are UTM, zone number is 32 and the projection is WGS84. The main parameter to change is normally only the zone number! See chapter 7.3 Coordinate Conversion on page 309 for more information.

Enable projection: Enables coordinate transformation between source and alternate projection systems. The function is primarily used for converting geographical to UTM coordinates.

When enabled, converted coordinates is presented on display, on printer and on data files written in SEG Y format.

Note

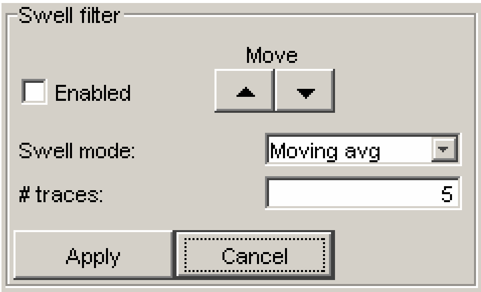
Only the projection parameter fields are available in Replay mode!

Auto zone calculation: Enables automatic zone number calculation based on the current position..

Use seabed position: Enables estimation of position of the acoustic footprint on the seabed. It may be useful when the transmitted acoustic beam is steered away from vertical.

4.2.85 Swell filter

The **Swell filter** parameter sheet box is accessed from the **Processing** tab.



The swell filter is used to reduce the influence of the heave movement of the vessel on sub-bottom data when a VRU is not integrated in the system. The system detects the current seabed location and compares it with previous locations. If there is an offset, the last location is moved to the average of a number of previous locations.

Note *The swell filter may remove any information about sand waves on the seabed and should therefore be used with care.*

The bottom tracker is used for finding and detecting the seabed.

Swell filter parameters

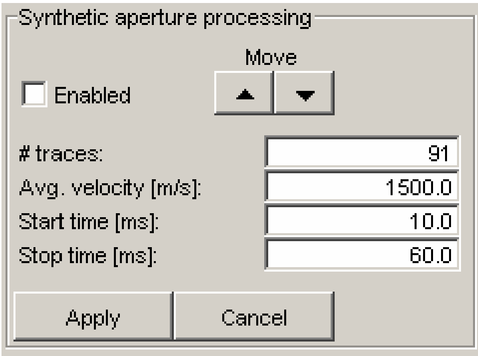
Swell Mode: This drop-down menu contains options for the filtering function:

- **Moving avg**: The seabed position is calculated as the average of the seabed position in the last N number of pings. Each position has the same weighting factor.
- **Linear weight**: The seabed position is calculated as the average of the current position plus the previous N detected positions minus the previous average position.

 # traces: The number of pings used in the calculations.

4.2.86 Synthetic aperture processing

The **SAS (Synthetic aperture sonar)** processing parameter sheet is accessed from the **Processing** tab.



Synthetic Aperture Sonar (SAS) processing is used to increase lateral resolution of the TOPAS PS 18 system. It is primarily used where small features and objects buried in the sediments are of special interest.

Note

*In order to get good results by using SAS, accurate vessel speed and heave compensation has to be present during data acquisition. In addition, the ping rate should be >2*vessel speed (in m/s).*

SAS parameters

 # traces: Sets the number of traces/pings to be used in the SAS processing.

Avg. velocity [m/s]: Average sound speed in the water used in the processing.

Start time [ms]: Start time for the part of the traces to be used for processing. The reason for selecting only a part of the trace is to reduce CPU requirement as the SAS-processing is quite CPU consuming.

Stop time [ms]: Stop time for the SAS-processing window.

Figure 4-12 shows definition of parameters. Number of traces is approximately the number of pings recorded during the passage from position 1 to position 3. As seen, all pings in between will get an echo from the spherical “object” buried in the seabed. For each ping, the position is compensated for the varying distance between the sensor and the object thereby accumulating reflected energy from individual resolution cells in the processing window limited by the start and stop times and the length. The physical length is approx. *#traces * ping interval * vessel speed*.

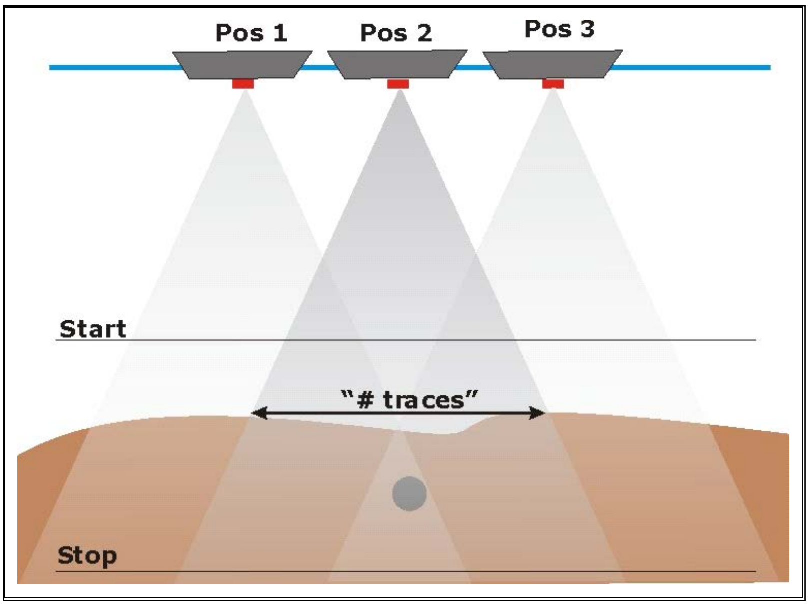


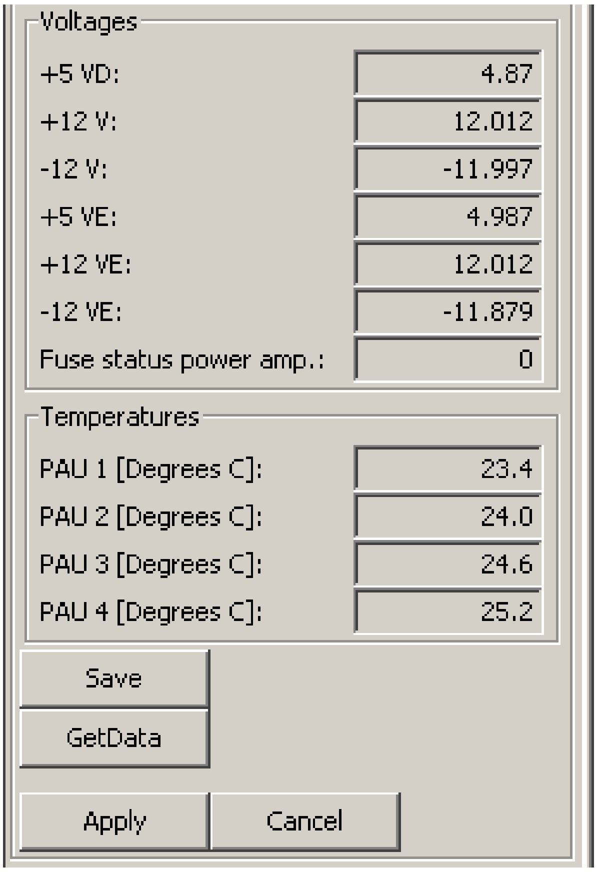
Figure 4-12 SAS processing parameters.

4.2.87 System info

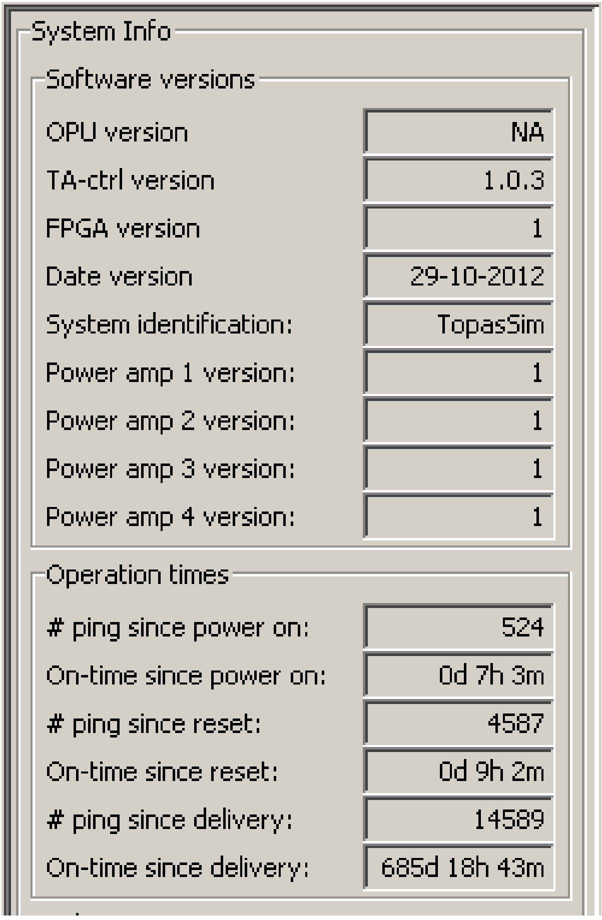
The **System info** parameter sheet is accessed from the **System info** folder under the **BIST** tab. (If the **System info** folder is closed, double-click the folder to open).

Note

You have to be logged on as Root in order to get access to the BIST tab.



The **System info** sheet shows the installation configuration of the TOPAS system,



Data may be updated by pushing the **GetData** buttin.

The data may be saved to file by selecting **Save**.

Note *This information may be of interest when contacting support!*

4.2.88 System log

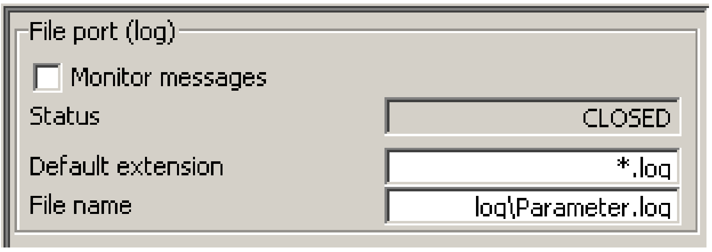
The **System log** parameter sheet is accessed from the **File Locations** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*

The menu page is used for specifying the port type for the System log. The options are:

- No port
- File port

The child of the **System log** is shown bellow:



File port parameters

Default extension: User selectable file extension for the **System log** file.

File name: User selectable file name and file location for the **System log** file. The location is relative to the default TOPAS directory. The date of the current month will be added to the file name in the format: *_0dd*.

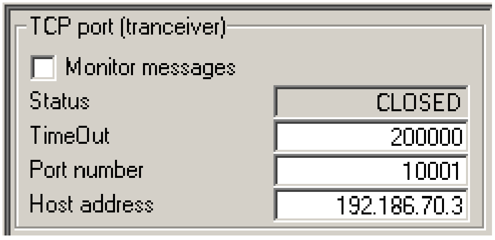
Note *After one month an existing file with the same date will be over written by the current information!*

4.2.89 TCP port

The **TCP port** parameter sheet is accessed from several specified communication folders under the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note

You have to be logged on as Root in order to get access to the Configuration tab.



Parameters

Monitor messages: Checkbox for enabling monitor window for messages. See Chapter 4.2.42 Monitor window on page 133 for description of the window.

Status: Displays the current status of the port. Open, Error or closed.

TimeOut: Allows you to set time out on the port in milliseconds. Set to a large number (>100,000)!

Port number: The port number used for communicating with the device

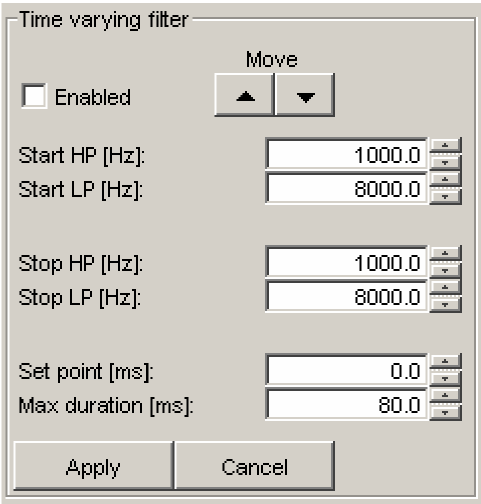
Host address: The host address of the device/host.

4.2.90 Time varying filter (TVF)

The **TVF** parameter sheet is accessed from the **Proc** tab. (If the **Processing Chain** folder is closed, double-click the folder to open).

To make the **TVF** active, check the **Enabled** box on the top of the dialogue box.

The time varying filter is used for band pass filtering of the acquired data using a linearly varying bandwidth as a function of position in the trace.



TVF parameters

Start HP [Hz]:	Sets the high pass corner frequency at the filter start.
Start LP [Hz]:	Sets the low pass corner frequency at the filter start.
Stop HP [Hz]:	Sets the high pass corner frequency at the filter end.
Stop LP [Hz]:	Sets the low pass corner frequency at the filter end.
Set point [ms]:	Sets the starting point of the linear change in the trace in absolute time.
Max duration [ms]:	Sets the duration of the linear change in the trace in milliseconds.

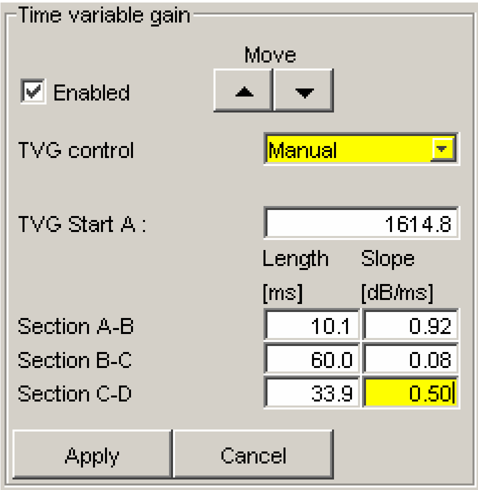
4.2.91 Time variable gain (TVG)

The **TVG** parameter sheet is accessed from the **Processing** tab. (If the **Processing Chain** folder is closed, double-click the folder to open).

To make the **TVG** active, check the **Enabled** box on the top of the dialogue box.

The TVG is used for compensating propagation attenuation and spreading losses in the signal. Due to the high dynamic range of the analogue-to-digital converter, the TVG is applied digitally.

Three different slopes may be used.



TVG parameters

TVG Control: Selects how the start position of the TVG curve is controlled. The choices are Manual and Auto.

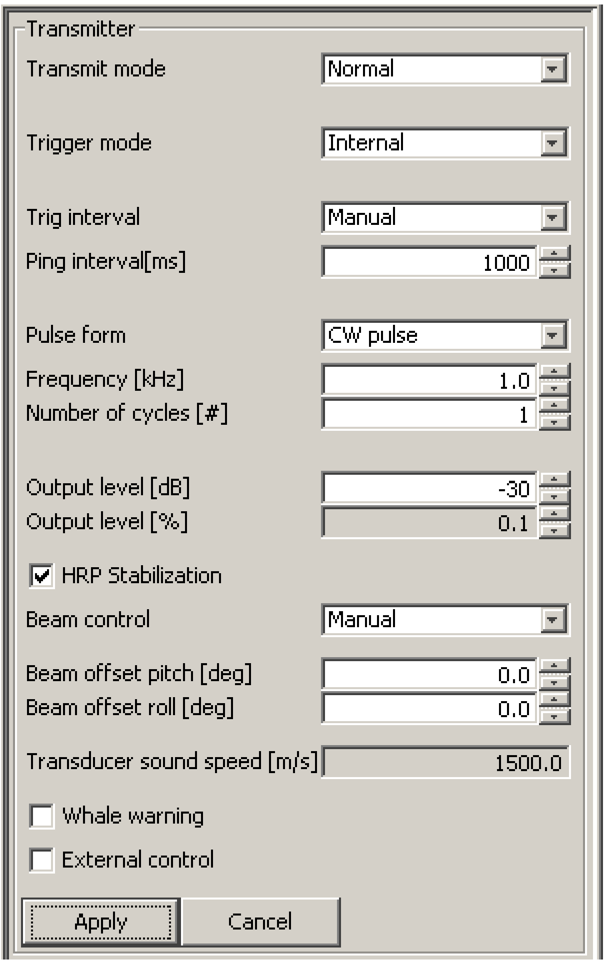
- **Manual**: The start position is fixed until the operator specifies a new start value.
- **Auto**: The start position follows the Bottom tracker with a specified off-set.

TVG Start A: Gives an offset for the start point in tracking modes. In Manual control the reference time is zero. In Auto control the reference time is the current detected bottom position.

TVG start offset:	
Section A-B,	
Section B-C,	
Section C-D:	Specifies the various slope sections in the TVG curve.
Length [ms]:	This parameter determines the starting point for the TVG curve sections relative to the start of the ping. Legal values are from 0 to 15,000 ms.
Slope [dB/ms]:	This parameter sets the slopes of the gain curves for the TVG. Legal values are from 0 to 20 dB/ms.

4.2.92 Transmitter

The PS 18 **Transmitter** parameter sheet is accessed from the **Acquisition** tab. This parameter sheet is used for setting up parameters for the transmitter. Some of the value fields in the sheet are context sensitive meaning that they are depending on other fields.

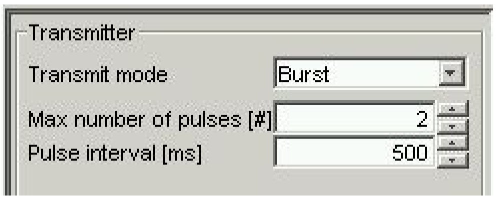


Transmitter parameters

Transmit mode: This parameter field consists of pull down menu with the following choices of desired transmission modes: Normal and Burst. The individual modes are described in the following.

- **Normal**: This is the normal transmission mode where one pulse is sent for each internal or external trig pulse.
- **Burst**: This mode transmits a series of identical pulses for each trig. Number of pulses and interval between them are set in the context sensitive menu. The burst mode is normally used when operating synchronized to a

multibeam echosounder where ping interval may be very long.

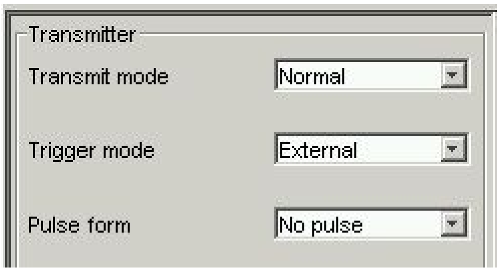


– **Max number of pulses:** This field is used for selecting the number of pulses to include in the burst.
– **Pulse interval [ms]:** This field specifies the interval between the pulses. This value should be larger than the acquired trace length in order to avoid interference between transmitter and received signals. An error message will be displayed if the pulse interval is shorter than the shortest trace length defined.

Note *The product of max number of pulses (NP) and pulse interval (BIV) must be less than ping interval (PIV) minus maximum trigger delay (TD), and the product must be less than the trig delay; NP•PIV < PIV – TD and < TD. An error message will be generated if the condition is not met and the values are not changed!*

Trigger mode: This parameter field consists of pull down menu with two selections of desired trigger modes. The individual modes, Manual and External, are described in the following.

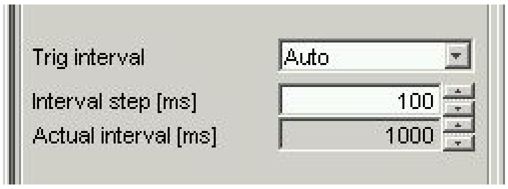
– **Internal:** This choice enables the operator to specify the ping interval manually.
– **External:** This choice allows the system to accept an external trigger signal from a synchronizing unit.



Trig interval: This parameter field consists of pull down menu with three selections of desired trigger interval options. The individual modes, *Manual, Auto* and *Multi*, are described in the following:

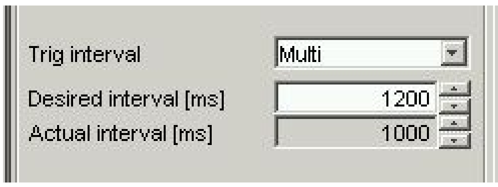
- **Manual:** This choice enables the operator to specify the ping interval manually.
- **Ping interval [ms]:** This item specifies the ping interval or shot interval. Default value is 1000 ms resulting in one ping/shot every second. Legal range for Ping interval is 200 ms to 15,000 ms. Actual ping interval should be adapted to the water depth in the area.

- **Auto**: This choice enables the system to find an optimal ping interval based on the water depth. The interval will be changed in steps given by the operator. Initial interval is the current ping interval used.



- **Interval Step [ms]**: This field is used for selecting the ping interval steps. The ping interval will not change until the change is greater or equal to the selected value.
- **Actual interval [ms]**: This field displays the actual ping interval used by the system.

- **Multi:** This mode transmits pulses at a repetition interval shorter than the travel time from the transducer to the sea-bed. By using this mode, more pulses will be present in the water column at the same time.



- **Desired interval [ms]:** This field sets the desired ping interval. If **Bottom tracking** in enabled or if external depth information is available, the system will find the closest

Ping interval which is not making interference with the received data.

- **Actual interval [ms]**: This field displays the actual ping interval used by the system.

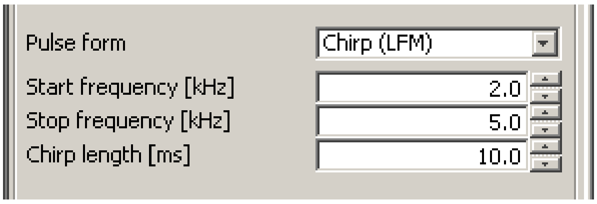
Pulse form: This parameter field consists of pull down menu with four selection of desired pulse form. The individual signatures, No pulse, CW pulse, Ricker, Chirp, Uploaded and Downloaded, are described in the following.

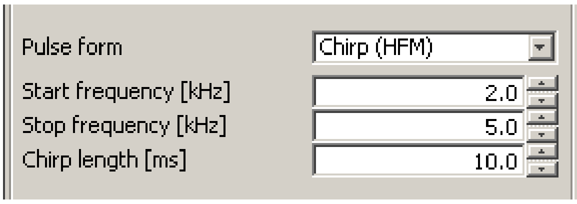
- **No pulse**: This choice does not generate any transmitted wavelet. It generates only an internal trigger signal for the acquisition unit and is primarily intended for test purposes and noise measurements.
- **CW pulse**: This choice generates a number of periods at the secondary frequency. Default is one period. Using more than one period reduces the resolution but improves final signal-to-noise ratio as a narrower bandpass filter can be used for filtering.
  - **Frequency [kHz]:** This parameter specifies the centre frequency of a frequency burst. Minimum value is 500 Hz and maximum value is 6,000 Hz. The choice of frequency depends on several factors: High frequency gives high resolution, but low penetration, as high frequency components are more attenuated than low components. For measurements as a function of frequency, the choice depends on the desired frequencies.
  - **Period #:** This field is used for selecting how many periods of the Burst is to be transmitted. When the number of periods is increased, the range resolution is reduced and using a narrower band pass filter may increase the signal-to-noise ratio.

- **Ricker Pulse**: The Ricker wavelet is a single pulse with nice time domain behaviour for very high-resolution work. This wideband wavelet requires a high signal-to-noise ratio for optimal performance.

- **Chirp (LFM** and **HFM)**: These wavelets are a coded wavelet where the signal energy is stretched out in time. The bandwidth is determined by the start and stop frequencies for the sweep. On reception of this wavelet, matched or spiking filtering is required in order to concentrate the energy into a narrow pulse. **LFM** is a linearly coded wavelet where the frequency changes linearly with time. **HFM** is a hyperbolically coded waveform where the frequency changes hyperbolically with time. The latter waveform is less influenced by Doppler shift.

In general, an increased penetration can be achieved by using a Chirp wavelet. This is due to the increased amount of energy, which is transmitted into the water. The increase in signal-to-noise ratio can be expressed as ***10•log (BW•T)*** where ***BW*** is the chirp bandwidth and ***T*** is the duration of the chirp.



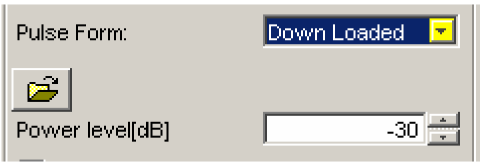


- **Start frequency [Hz]:** This parameter specifies the start frequency of the linear frequency sweep for the ***Chirp*** signatures.
- **Stop frequency [Hz]:** This parameter specifies the stop frequency of the linear frequency sweep for the ***Chirp*** signatures.

  The choice of start and stop frequency depends on several factors. High bandwidth gives high resolution. As the high frequency components are more attenuated than the low frequency components, the waveform will be degraded as it penetrates the sediments, This means that the centre of the frequency spectrum moves towards a lower frequency due to the reduces bandwidth, The resolution achieved will therefore be lower at higher penetration.
- **Chirp length [ms]:** This parameter specifies the duration of the ***LFM*** and ***HFM*** signatures. A long duration increases the amount of energy transmitted. On the other hand, at long duration, the output level should be reduced in order to have a constant output level during the whole pulse.

– **Down loaded:** This choice, which is present in ***Root user*** mode, is used for downloading the digital signal definition from a file. The user will have to generate the correct signal in another application. The ASCII file contains number of samples and sample values between +127 and -128. A file selection button appears.

Caution *The operator is responsible for using correct signal definitions and operator parameters for the Downloaded signal! KDS is not responsible for any malfunctioning or damaging of the system due to erroneous parameters!*



– **Up loaded:** This choice, which is present in ***Root user*** mode, is used for applying an analogue signal to the transmitter. A digital gating signal of the same length has to be applied at the same time. Analogue input signal must be within +/-5 Vpp and the gating signal is TTL level.

Caution *The operator is responsible for using correct signal definitions and operator parameters for the Uploaded signal! KDS is not responsible for any malfunctioning or damaging of the system due to erroneous parameters!*

Output level [dB]: This parameter field is used for setting the relative transmitting amplitude level from the transmitter. Output levels will be from -30 dB to 0 dB.

When the TOPAS program is started, pinging is disabled.

In situations where the received signal level is so strong that it saturates the receiver, a reduction in the transmitted level will solve this problem.

The level is referred to the primary frequency output level. The variation in the secondary (difference) frequency level will vary as PL^X where PL is the primary level and X is a number between 1 and 2, depending on frequency, beam profile source level etc.

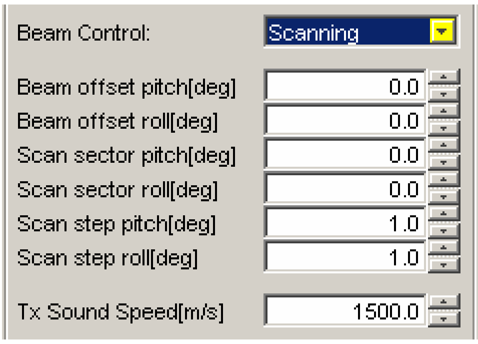
Output level [%]: This field displays the selected output level in percentage of maximum output level.

HRP Stabilization: This checkbox field enables/disables heave-roll-pitch compensation. This choice adjusts the beam direction and the point in time when the acoustic pulse is transmitted and the trigger time for the receiver in order to eliminate the influence of the vessel movement.

In order for the compensation to work, a vertical reference unit (VRU) has to be interfaced to the TOPAS transceiver.

Beam control: This parameter field consists of pull down menu with three selections for beam control. The individual parameters, *Manual, Scanning* and *Auto*, are described in the following.

- **Manual**: Bbeam pointing direction is set by the operator.
  - **Beam offset pitch [deg]:** This parameter selects the pointing direction for the centre beam along ship. All angles are relative to vertical.
  - **Beam offset roll [deg]:** This parameter selects the pointing direction for the centre beam athwart ship. All angles are relative to vertical.
- **Scanning**: The beam is set to do a sequential scanning in both roll and pitch direction based on the actual input parameters.



Note

Scanning parameters are only accepted in systems with sequential scanning option included!

Additional parameter in **Scanning mode**:

- **Scan sector pitch [deg]:** This parameter is not relevant for the standard single beam TOPAS sub-bottom profilers. It requires that the sequential scanning option be included in order to be activated.

  This parameter specifies the scan sector along ship. Minimum value is zero degree meaning single beam operation.
- **Scan sector roll [deg]:** This parameter is not relevant for the standard single beam TOPAS sub-bottom profilers. It requires that the sequential scanning option be included in order to be activated.

  This parameter specifies the scan sector athwart ship. Minimum value is zero degree meaning single beam operation.

– **Scan step pitch [deg]:** This parameter is used for specifying the scan step for the sequential scanning in pitch direction.

– **Scan step roll [deg]:** This parameter is used for specifying the scan step for the sequential scanning in roll direction.

– **Auto**: The system estimates bottom slope based on internal data or reads bottom slope information from an external sensor like the Kongsberg EM MBES or similar for directing the beam perpendicular towards the seabed for maximal performance. No additional parameters are needed in this mode.

Common for all parameters is the following item:

Transducer Sound Speed [m/s] : This parameter field displays the current sound velocity at the transducer surface. It is used to calculate correct beam steering angle.

The value is set in the *Acquisition* menu page.

Whale warning : This parameter field enables the whale warning function. A parameter window opens where it is possible to specify the ramp-up time until the output reaches desired level.

Target output level and remaining time is also displayed.

External control : This parameter field enables external start/stop of transmission.

4.2.93 Transceiver port

The **transceiver port** parameter sheet is accessed from the Communication folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

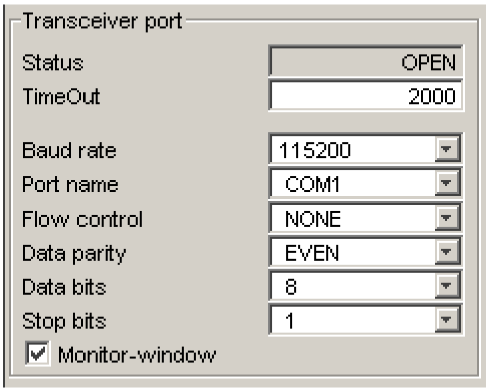
Note *You have to be logged on as Root in order to get access to the Configuration tab.*

There are two ways to communicate with the Transceiver:

- Serial port (RS232)
- TCP port

4.2.93.1 Serial port comm.

The serial port parameter sheet is as follows:



Transceiver port parameters

Status: Displays the status of the com port.

TimeOut: Sets the time-out on the port in milliseconds. Should be set to values >200,000.

Baud rate: Drop-down menu with the following choices: 1200, 2400, 4800, 9600, 19200, 38400, 57600 and **115200**.

Port name: Drop-down menu for selecting actual comm port. Choices are COM1 to COM8. However, actual ports will be limited to the number installed.

Flow control: Drop-down menu for selecting flow control. The choices are: **NONE**, XON/XOFF and Hardware.

Data parity: Drop-down menu for selecting data parity. The choices are: NONE, **EVEN** and ODD.

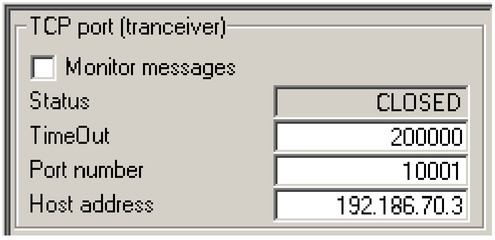
Data bits: Drop-down menu for selecting data bits. Choices are: 5, 6, 7 and **8**.

Stop bits: Drop-down menu for selecting stop bits. Choices are: **1**, 1.5 and 2.

Default values are printed in **bold** letters!

4.2.93.2 TCP port comm.

The TCP port parameter sheet is as follows:



Parameters

Monitor messages: Checkbox for enabling monitor window for messages. See Monitor window at page 133 for description of the window.

Status: Displays the current status of the port. Open, Error or closed.

TimeOut: Allows you to set time out on the port in milliseconds. Set to a large number (>100,000)!

Port number: The port number used for communicating with the device. 10001 is the default for the transceiver.

Host address: The host IP address of the device/host. Default IP address is: 192.168.70.3.

4.2.94 Transducer array

The **Transducer array** parameter sheet is accessed from the Mounting folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

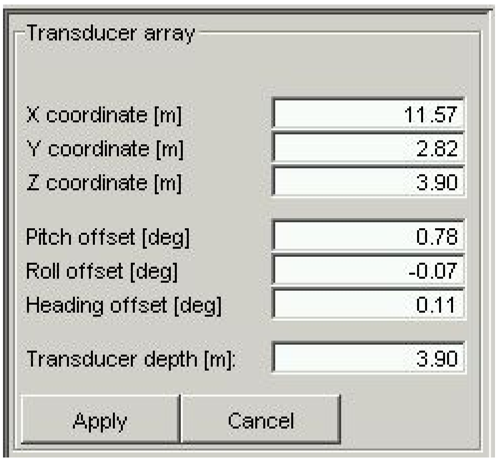
Note *You have to be logged on as Root in order to get access to the Configuration tab.*

The **Transducer array** parameters are used to calculate correct heave compensation, roll and pitch beam directions and depth calculations.

The coordinate system used is defined as follows:

- Positive X-axis is pointing forwards.
- Positive Y-axis is pointing towards starboard.
- Positive Z-axis is pointing downwards.
- Positive roll towards starboard.
- Positive pitch when bow moves up.

Note *All offsets are measured from centre-of-gravity (COG).*



Transducer array parameters

X_coordinate [m]: X-distance from COG to the to the TOPAS transducer.

Y_ coordinate [m]: Y-distance from COG to the TOPAS transducer.

Z_ coordinate [m]: Z-distance from COG to the to the TOPAS transducer.

Pitch offset [deg]: Pitch offset for transducer installation.

Roll offset [deg]: Roll offset for transducer installation.

Heading [deg]: Heading offset for the transducer installation.

Transducer depth [m]:

Z-distance from sea surface to the transducer face.

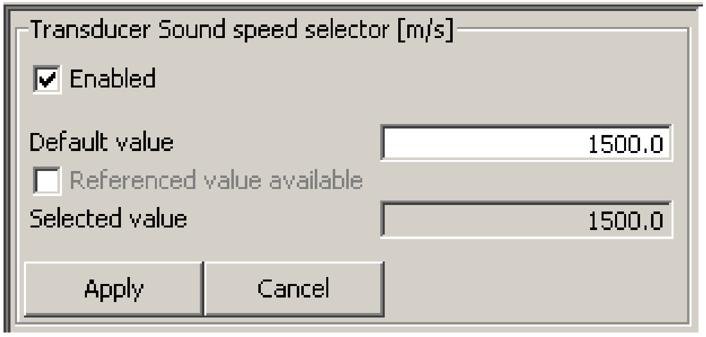
Pitch offset [deg]: Pitch offset from horizontal for the transducer installation.

In some installations the COG may be defined in the VRU. In this case the offsets relative to the VRU shall be used.

4.2.95 Transducer sound speed selector

The **Transducer Sound speed selector** parameter sheet is accessed from the **Acquisition** tab.

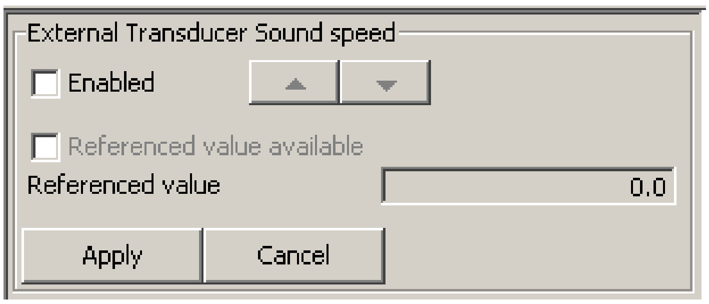
This sound speed is used by the system for steering the transmitted beam.



The operator can set default value of the sound speed.

The **Transducer Sound speed selector** has one child:

- **External Transducer Sound speed**



If the **Transducer Sound speed** is enabled, the sound speed value is taken from the slope telegram (SRV-telegram) if it is available from an EM multibeam system.

4.2.96 TX test

The **TX test** parameter sheet is accessed from the **System info** folder under the **BIST** tab. (If the **TX test** folder is closed, click the folder to open).

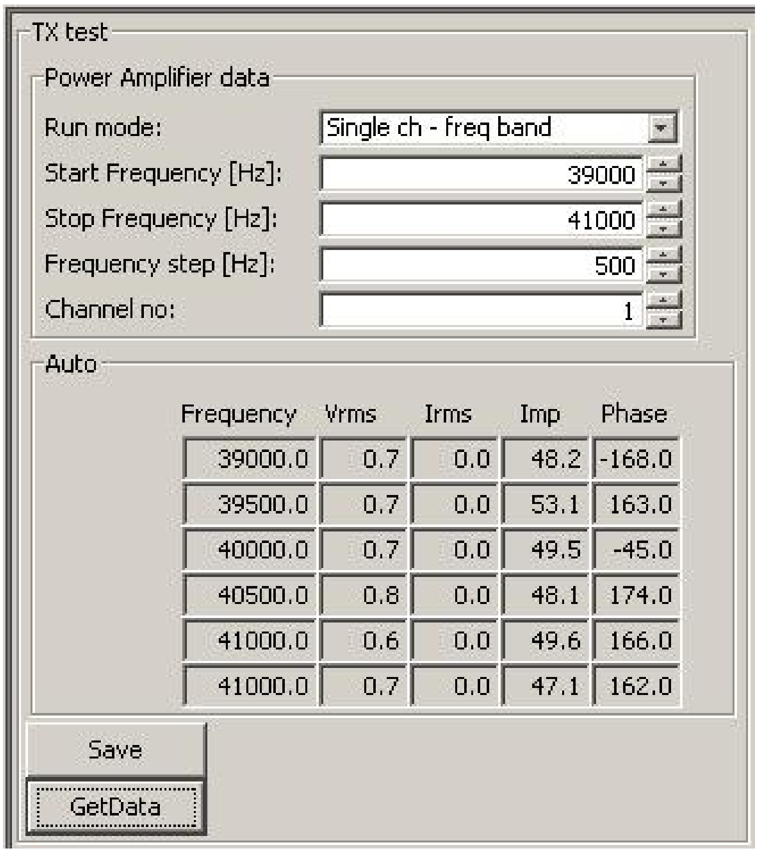
Note *You have to be logged on as Root in order to get access to the BIST tab.*

The **TX test** sheet shows the result of testing the transducer channels in the TOPAS system,

Note *The TX test functions will only be present for power amplifier with version numbers larger than 0!*

The result vs. frequency will be: voltage, current, phase and impedance (only shown in the first figure).

TX test parameters



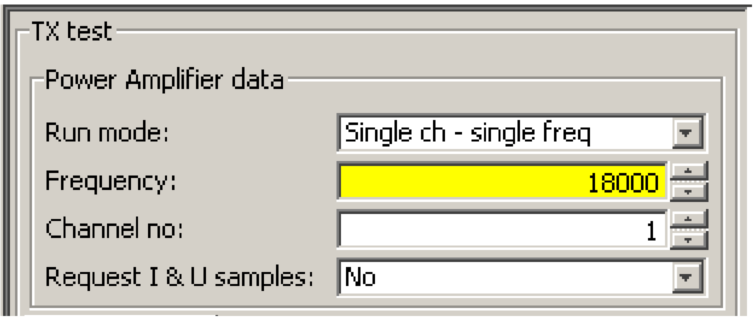
Run mode: Single channel – frequency band

Start frequency [Hz]: Start of frequency band.

Stop frequency [Hz]: Stop of frequency band.

Frequency step [Hz]: Measurement step.

Channel no.: Channel number to be measured.

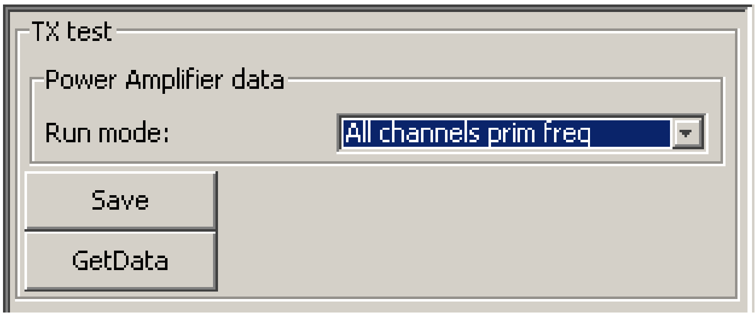


Run mode: Single channel – single frequency

Frequency [Hz]: Measurement frequency.

Channel no.: Channel number to be measured.

Request I & U samples: Option to plot current and voltage curves.



Run mode: All channels – primary frequency.

Measure impedance for all channels in the system at the primary frequency.

Data may be updated by pushing the **GetData** buttin.

The data may be saved to file by selecting **Save**.

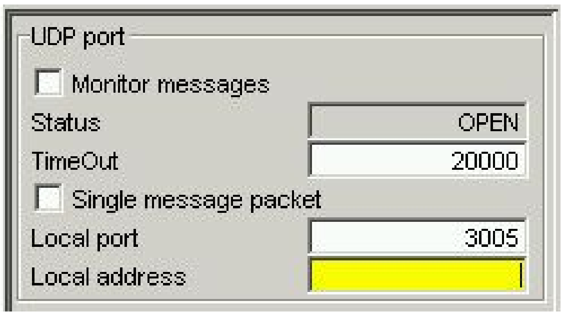
Note *This information may be of interest when contacting support!*

4.2.97 UDP port

The **UDP port** parameter sheet is accessed from several specified communication folders under the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note

You have to be logged on as Root in order to get access to the Configuration tab.



Parameters

Monitor messages: Checkbox for enabling monitor window for messages. See Monitor window at page 133 for description of the window.

Status: Displays the current status of the port. Open, Error or closed.

TimeOut: Allows you to set time out on the port in milliseconds.

Single message packet: Checkbox for selecting single message packets.

Local port: The port number used for receiving the information

Local address: The local address of the device/host. May have to be used when several network cards are used in the operator station.

4.2.98 User

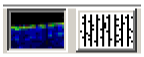
User is accessed on the **LogOn** menu.

There can only be one user logged on the system.

The Root user has access to critical parameters in the system and is normally used during installation, configuration of I/O etc.

4.2.99 View mode buttons

The **View mode buttons** are located right above the **Echogram area**.



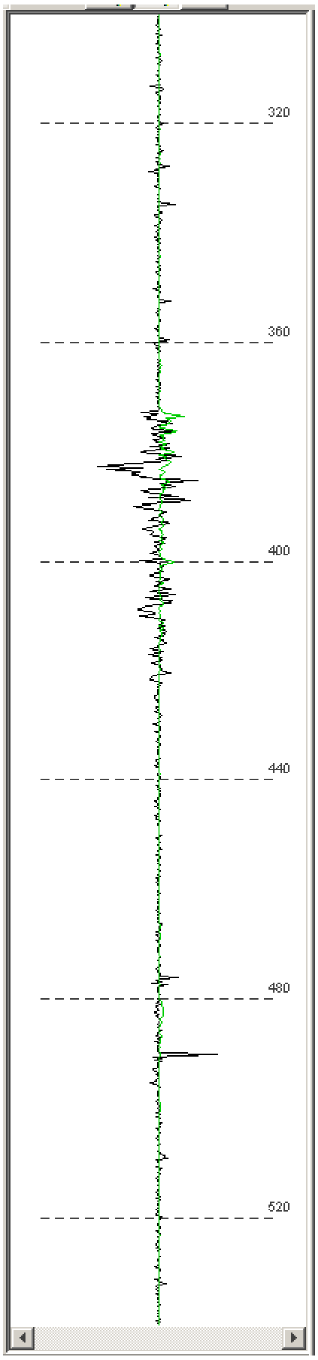
The button toggles between intensity coding and wiggle display.

4.2.100 View single-ping scope

View single-ping scope is accessed from the **View** menu.

If desirable, the data area can be removed from the screen. This is done by choosing **View single-ping scope**. The checkmark will disappear.

To get the data area back, choose **View single-ping scope**. The checkmark will return.



4.2.101 View Colour Scale

View Colour Scale is accessed from the **View** menu.

If desirable, the legend area can be removed from the screen. This is done by choosing View legend area. The checkmark will disappear.

To get the legend area back, choose view legend area. The checkmark will return.

4.2.102 View TAB area

View TAB area is accessed from the **View** menu.

If desirable, the property area can be removed from the screen. This is done by choosing **View TAB area**. The checkmark will disappear.

To get the property area back, choose **View TAB area**. The checkmark will return.

4.2.103 View status area

View status area is accessed from the **View** menu.

If desirable, the status area can be removed from the screen. This is done by choosing **View status area**. The checkmark will disappear.

To get the status area back, choose **View status area**. The checkmark will return.

4.2.104 View system messages

View system messages are accessed from the **View** menu.

Use this if you want to view the system messages.

If you want to remove them from the screen, you can either select View system messages or click the OK button on the dialogue box. The checkmark will disappear.

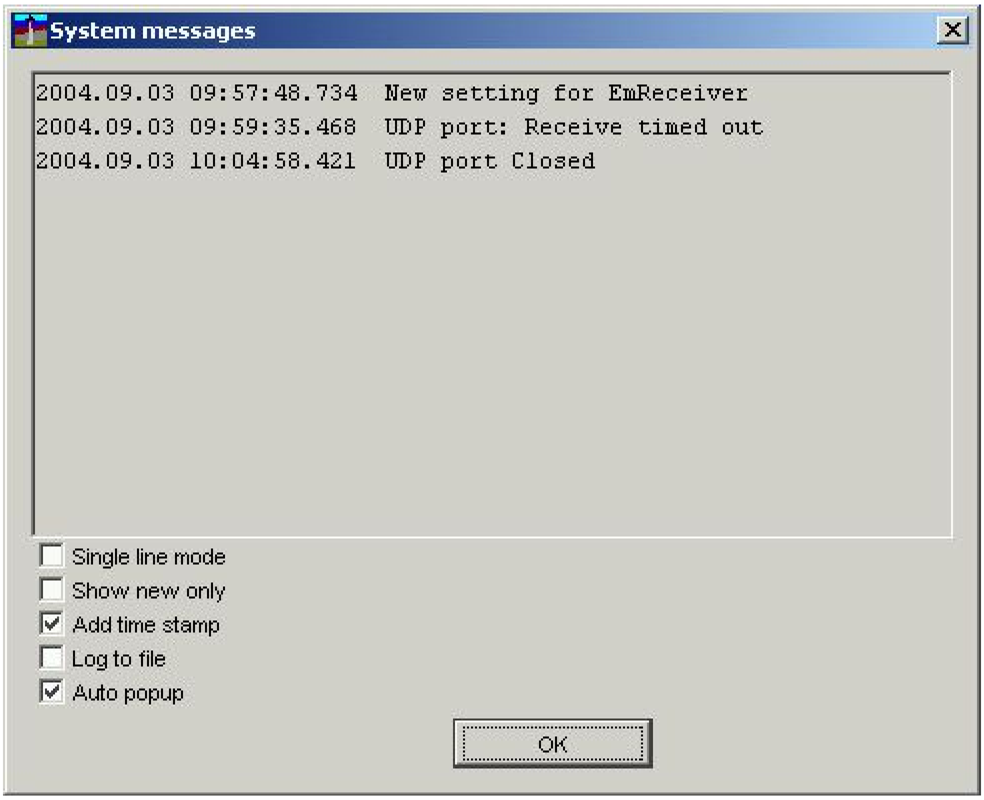


Figure 4-13 System messages popup pane.

System messages parameters:

Single line mode: Display data in single line mode shows only one line of data at the time.

Show new only: Displays only new messages.

Add time stamp: Add time stamp to arriving messages.

Log to file: Log messages to *SystemMessages.log* file in default TOPAS program directory (normally *C:\TOPAS*).

Auto popup: Enables/disables automatic popup of the message window when a new message arrives

4.2.105 View Depth read-out

Depth read-out is accessed from the **View** menu.

This display will show water depth detected by the system in large font. If more than one receiver channels are present, the desired channel is chosen in the **Depth Selector** parameter field in the **Acquisition** tab.

The display can be removed by clicking the **X** in the upper right hand part of the window or removing the check mark in the **View** menu.

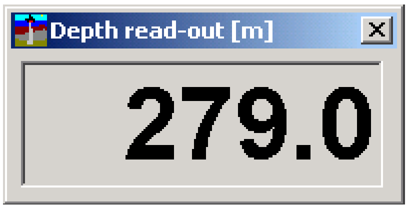


Figure 4-14 Depth display.

4.2.106 VRU offset

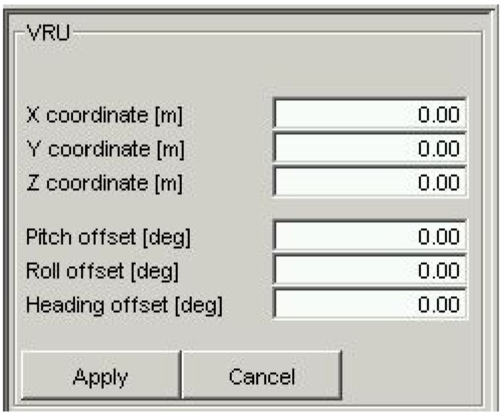
The **VRU** parameter sheet is accessed from the **Mounting** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*

The VRU (Vertical Reference Unit) parameters are used to calculate correct heave compensation, roll and pitch beam directions and depth calculations.

Note *All offsets are measured* ***from*** *centre-of-gravity (COG)* ***to*** *the actual sensor.*

Definition of the coordinate system is given on page 215.



VRU offset parameters

X coordinate [m]: X-distance from COG to the vertical reference unit (VRU).

Y coordinate [m]: Y-distance from COG to VRU.

Z coordinate [m]: Z-distance from COG to VRU.

Roll offset [Deg]: Sets the roll offset for the installation of the VRU unit.

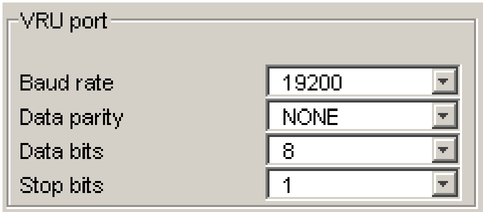
Pitch offset [Deg]: Sets the pitch offset for the installation of the VRU unit.

Heading offset [Deg]: Sets the heading offset for the installation of the VRU unit.

4.2.107 VRU port

The **VRU port** parameter sheet is accessed from the **Communication** folder under the **Configuration** tab. (If the **Configuration** folder is closed, double-click the folder to open).

Note *You have to be logged on as Root in order to get access to the Configuration tab.*



The VRU-port parameters are sent to the Transceiver controller DSP.

VRU port parameters

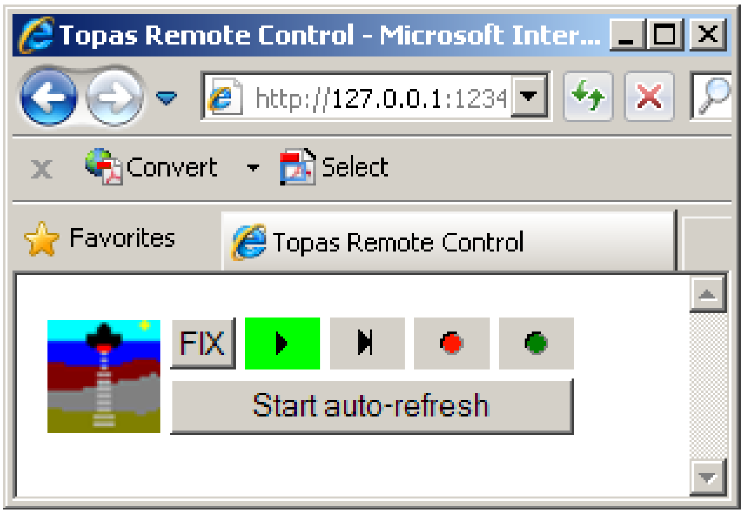
Baud rate:	Drop-down menu with the following choices: 1200, 2400, 4800, 9600, **19200**, 38400, 57600 and 115200.
Data parity:	Drop-down menu for selecting data parity. The choices are: **NONE**, EVEN and ODD.
Data bits:	Drop-down menu for selecting data bits. Choices are 5, 6, 7 and **8**.
Stop bits:	Drop-down menu for selecting stop bits. Choices are **1**, 1.5 and 2.

Default values are printed in **bold** letters.

Note *There is no monitoring possibilities for the VRU messages!*

4.2.108 WEB server

The **Web server** may be used for controlling start/stop pinging and data logging. It can be accessed from a computer on the same network as the operator unit by connecting to the **HTTP Interface** specifications given in Chapter 4.2.36.



The following operations can be done by pushing the buttons:

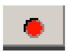
Create a fix/event mark in the data.


Start/stop pinging.

Note

***External control** has to be enabled in the **Transmitter** menu, see chapter 4.2.92 on page 207.*


Perform a single ping.


Start/stop logging of raw data.


Start/stop logging of processed data.

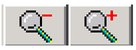
Note

***External control** has to be enabled in **RAW** and **Processed data logger**, see chapter 4.2.56 and 4.2.53 on page 159 and 153, respectively.*

Start/stop of auto refresh of button status. Auto refresh updates button status every second to reflect the situation on the operator unit.

4.2.109 Zoom buttons

The **Zoom buttons** are located right above the **Echogram area**.



These two buttons are used for zooming in and out of the Echogram areas and the Data area.

There is one set of buttons covering both of the two display areas; depending in which area the mouse button is pushed. Each push on the left hand button zooms in or out of the display by a factor of 1.5. To disable the current zooming, press the right hand mouse button or left-click on the active zoom-button..

Note

The zooming is only performed in the trace length.

5 TECHNICAL REFERENCES

5.1 Introduction

This chapter describes the theoretical background and features relevant for the TOPAS PS 18 Parametric Sub-bottom Profiler.

The TOPAS sub-bottom profiler systems are designed around a parametric antenna utilising the non-linear propagation characteristics of water to generate a low frequency acoustic pulse from a short, high frequency burst or from the inter-modulation of two high frequency signals. Some advantages of this technique are the possibilities of generating a narrow acoustic, low frequency beam from a small transducer surface, generating a beam with no sidelobes and no ringing, having a very stable and repetitive signal and being able to electronically steer the beam for roll and pitch compensation.

The received echoes are amplified, digitised, processed and displayed on-line. The main processing steps are bandpass filtering, spiking deconvolution (FM sweeps), de-reverberation, trace mixing (stacking), time variable gain (TVG), automatic gain control (AGC), swell filtering and attribute calculation. Data may be displayed on the colour monitor, on a line scan recorder and on a colour printer.

Raw, unprocessed data may be stored on disk for later retrieval and processing. Processed data may also be stored on disk. Backup is normally done to CD-ROM or DVD. Optionally, a USB tape drive may be connected to the system for backup.

5.2 The Parametric Array

5.2.1 Basic principle

The speed of propagation for an acoustic signal in water depends on the local pressure which is given as **c =** $c_o + \gamma p$ where c is the velocity, c_o is the average velocity, **p** is the pressure amplitude of the propagating signal and γ is a conversion factor from the change in pressure to change in velocity. This means that the velocity in high-pressure parts of the signal is higher than in low-pressure parts of the signal. As the signal travels the shape of the wave will be distorted. If a sinusoidal waveform is transmitted with sufficient high amplitude, the distortion will eventually lead to a saw tooth waveform containing higher harmonics of the transmitted frequency. Since the attenuation increases with frequency, the higher frequency components will disappear after some distance and the signal again resembles an attenuated version the original transmitted signal. Figure 5-1 shows an example on how this distortion develops as the wave propagated away from the source (transducer).

The fact that water is not a linear medium is used in non-linear or parametric generation of acoustic signals. The non-linearity is, however, very weak and can be described by a quasi-linear method. According to this method the contribution to the parametric sound field, q, is given by volumetric source strength. Here P_i is the instantaneous pressure at the point, c_o is the speed of sound, r_o is the water density and b is a dimension-less parameter. The parametric radiation at a position given by R is then obtained by integrating over the volume where interaction takes place.

$$q = \frac{\beta}{c_o^4 \rho_o^2} \frac{\delta}{\delta t} p_i^2$$

$$P_s(\mathrm{R}) = -\frac{\rho_o}{4\pi} \int_v \frac{\delta q}{\delta t} \frac{\exp[jk(\mathrm{R}-\mathrm{R}')]}{|\mathrm{R}-\mathrm{R}'|} dV$$

Generation of a low frequency signal is accomplished by using a conventional transducer simultaneously excited by two primary frequencies $\mathbf{f_1}$ and $\mathbf{f_2}$ separated by Δf and centred around a mean primary frequency f_o:

$f_1 = f_0 - \Delta f/2$

$f_2 = f_0 + \Delta f/2$

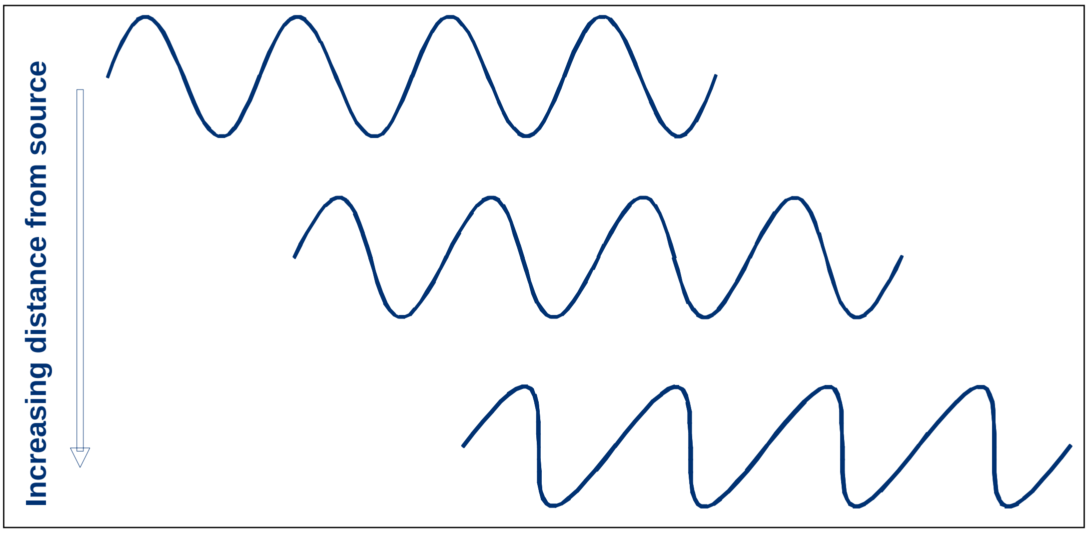


Figure 5-1 Effect of non-linear propagation on a sinusoid versus distance from source.

The non-linearity will cause the two primary waves to interact thereby generating a sum and a difference frequency component of which only the difference frequency Δf is of interest for sub-bottom profiling applications. The difference frequency component can be calculated by evaluating the primary sound pressure and integrating over the volume of interaction. This volume is approximately bounded as indicated in Figure 5-2. In the near field of the transducer the primary waves are collimated and bounded by the transducer area. At larger distances the volume becomes wider and will at long distances, be limited either by absorption or by spherical divergence.

The calculation of the secondary sound level is in general quite complicated and approximations and numerical methods must be used. A particular simple and illustrative case is when the near field extends so far out that interaction is limited by absorption in the near field. The difference frequency source distribution then resembles a continuous end-fire array with an exponential taper. This case was originally treated by Westervelt and gives the secondary source level as

$$P_s = const \bullet (\Delta f)^2 P_i^2 \qquad (1)$$

with a directivity pattern as a function of angle defined as

$$D_s(\theta) = \frac{1}{[1 + (2\pi \frac{\Delta f}{c_o \alpha})^4 \sin^2(\frac{\theta}{2})]} \qquad (2)$$

and with a beamwidth of

$$\theta_o \approx 2\sqrt{\frac{2\alpha c_o}{\pi \Delta f}} \qquad (3)$$

where θ_o is the 3 dB beamwidth, Δf is the difference frequency, c_o is the velocity of sound and α is the absorption coefficient.

These results are only valid for a particular case but they illustrate some important properties of the well-designed parametric source. The secondary source level will increase with the square of the primary sound pressure and with the square of the difference frequency. The directivity pattern is without significant sidelobes and almost as narrow as the primary beamwidth. A typical ratio between the primary frequency and difference frequency is between 5 and 10, which means that secondary beamwidth is considerably less than conventional operation of a transducer of the same size.

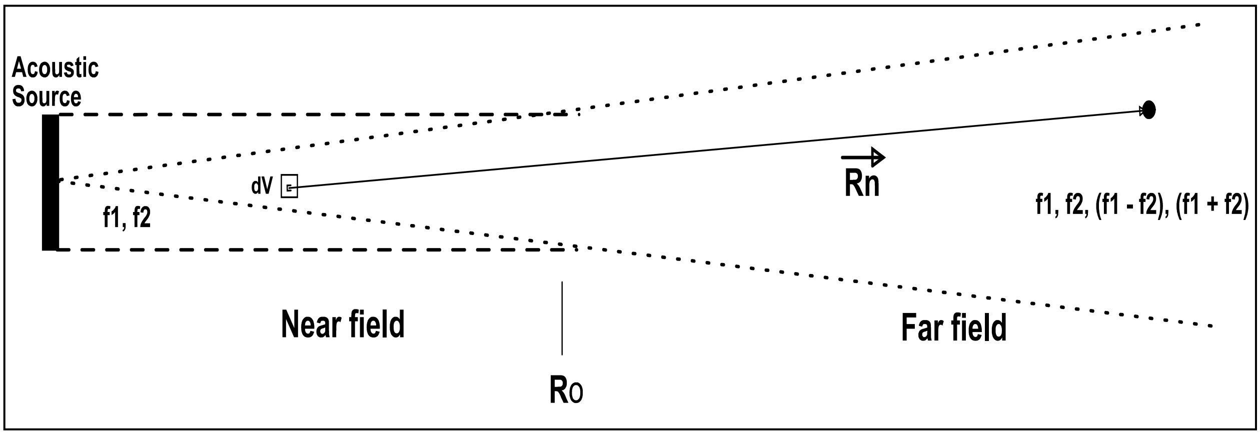


Figure 5-2 Model for calculating the secondary wave field for a parametric antenna.

5.2.2 Examples on calculations

In the following are shown some examples on calculated data for input parameters, which are typical for PS 18. Primary source level is assumed to be 243 dB // µPa @ 1 meter for each frequency component. Secondary frequency is assumed to be 1, 2, 4 and 6 kHz.

Figure 5-3 shows calculated source level for the secondary frequency as a function of distance from the source and sound pressure level from top and down, respectively.

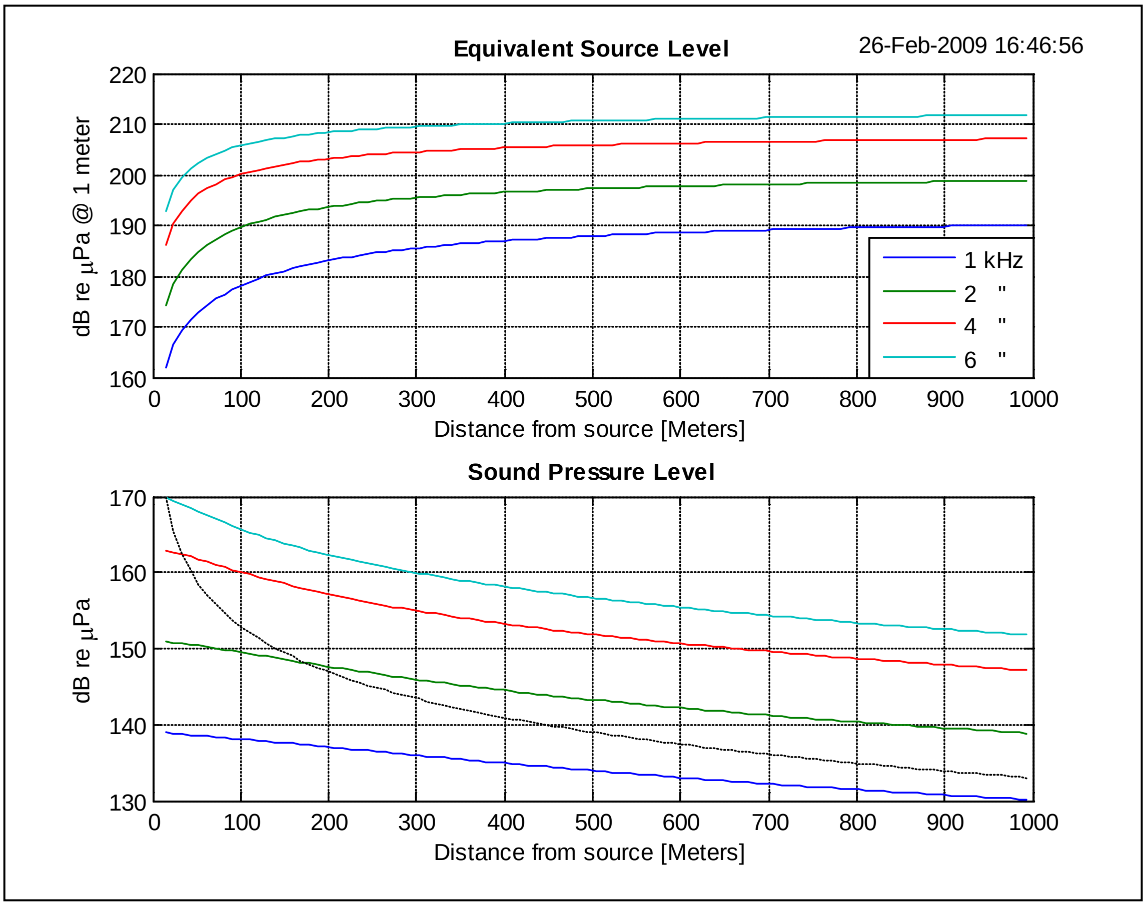


Figure 5-3 Calculated SL for 1 to 6 kHz.

It is seen from the top curve that the source level increases as the distance from the source increases. This is due to non-linear contribution from larger volumes of water as distance increases.

From the lower curve it is seen that the variation in Sound Pressure Level (SPL) is very little compared to what would be observed for a conventional acoustic source. This is shown in the middle curve. For the parametric source the variation from 14 to 500 meters is approximately 13 dB compared to approximately 31 dB for the conventional source.

A calculated beam profile is shown in Figure 5-4 where the input parameters are the same as in the previous example. Beam profiles for the primary 18 kHz signal and the secondary 4 kHz signal are shown. Three profiles for the latter shows the difference in the profiles at 15, 200 and 1000 meters. The Rayleigh distance for the 18 kHz primary signal is about 15 meter. The reason for the wider beam close to the source is that the sound pressure level is not fully built up at this distance.

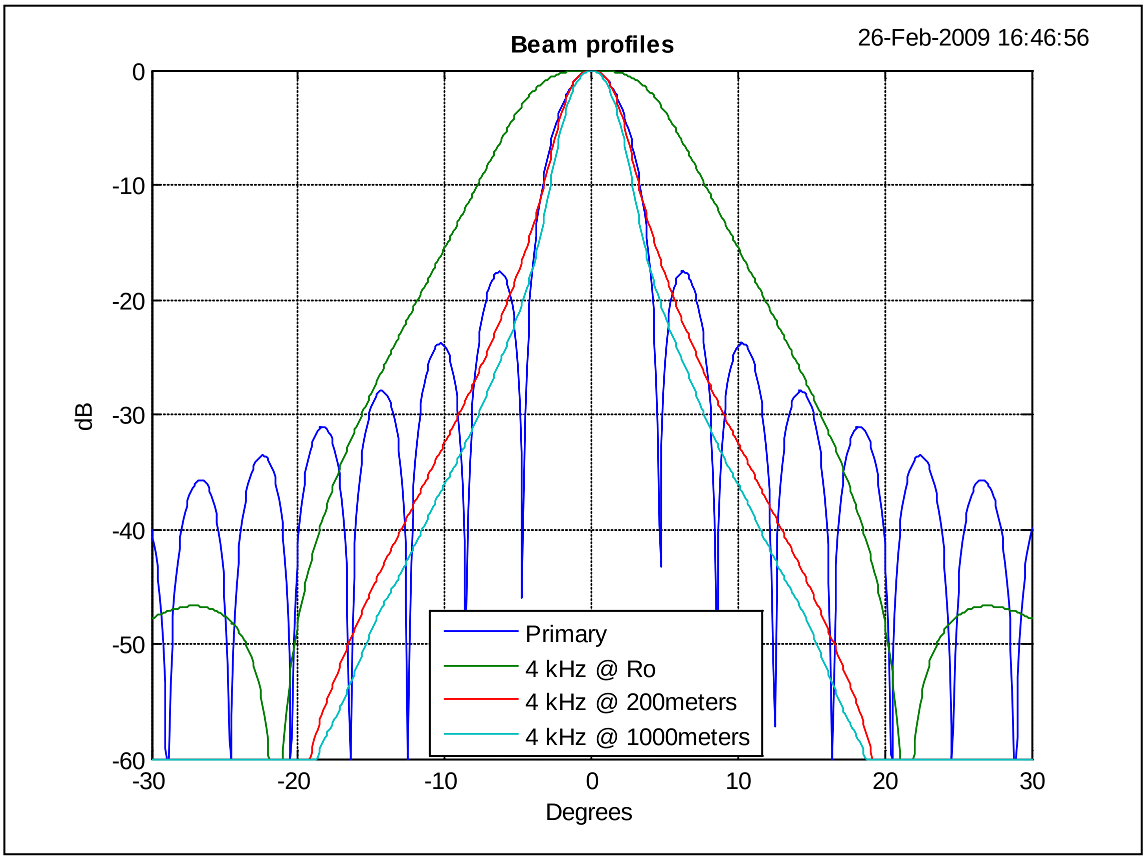


Figure 5-4 Beam profiles for the primary and secondary signals.

5.2.3 Wavelet generation

Three types of secondary wavelets are used in the parametric system for sub-bottom profiling:

- Ricker wavelets
- CW wavelets
- FM sweeps (chirp) wavelets

5.2.3.1 Ricker wavelet

In order to generate a short, low frequency single pulse a weighted RF-burst at the primary frequency is transmitted. Through the non-linear propagation in the water column, a so-called self-demodulation takes place and a low frequency wavelet is formed. Figure 5-5 shows both the primary waveform and secondary waveform when Gaussian weighting is used. The secondary waveform generated from this primary signal is called a Ricker pulse.

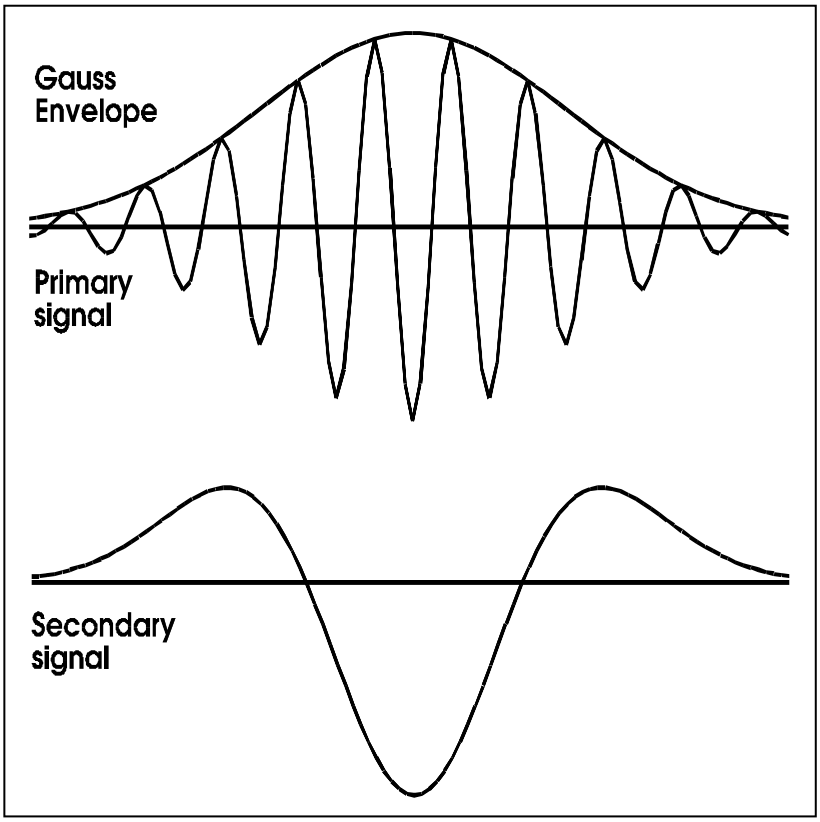


Figure 5-5 Self-demodulation: generation of a Ricker pulse.

5.2.3.2 CW wavelet

Long secondary frequency bursts, CW wavelet, are generated by transmitting a signal consisting of the product of the primary frequency signal and the desired secondary frequency signal.

The length of the wavelet is selected by setting the desired number of periods in the Transmitter menu page.

Figure 5-6 shows an example of the primary and the resulting secondary waveform consisting of two periods.

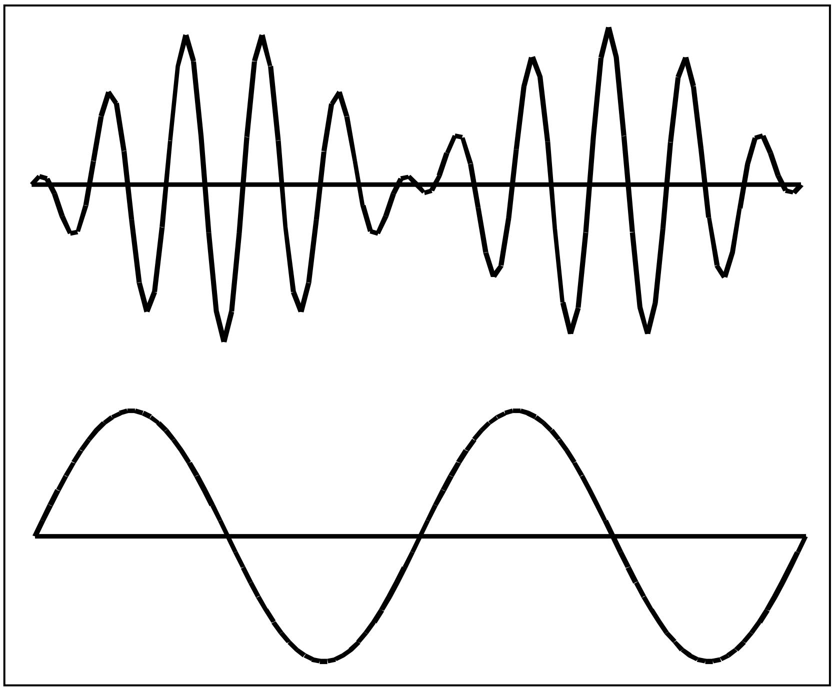


Figure 5-6 Generation of a low frequency CW burst.

5.2.3.3 Chirp wavelets

Chirp waveforms, Figure 5-7 are used for increasing the total transmitted energy thereby increasing the signal-to-noise ratio and correspondingly the penetration, see Figure 5-8. These wavelets are generated by transmitting a burst consisting of two high frequencies swept in opposite directions.

Two versions of the Chirp waveforms are available:

- Linear FM (LFM)
- Hyperbolic FM (HFM)

The hyperbolic version is less sensitive for Doppler shifts in the received signal, which occurs during the vertical movement of the transducer created by swell/pitch. Figure 5-9 shows the result of using HFM instead of LFM in the presence of Doppler.

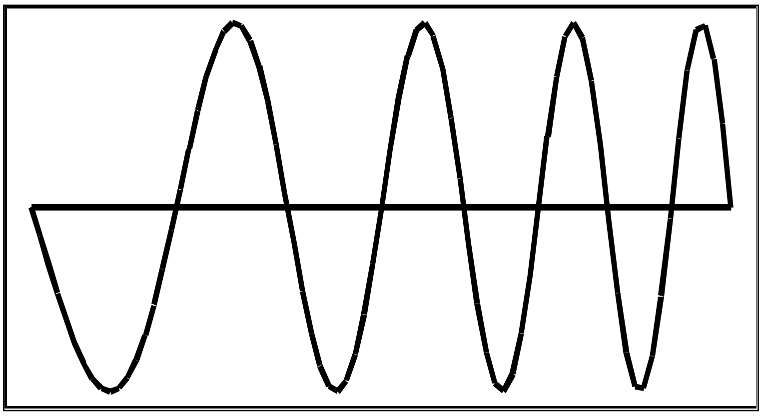


Figure 5-7 Typical Chirp LFM waveform.

Using Chirp mode of operation requires deconvolution or correlation processing in order to compress the energy into a narrow pulse thereby restoring the high-resolution capability.

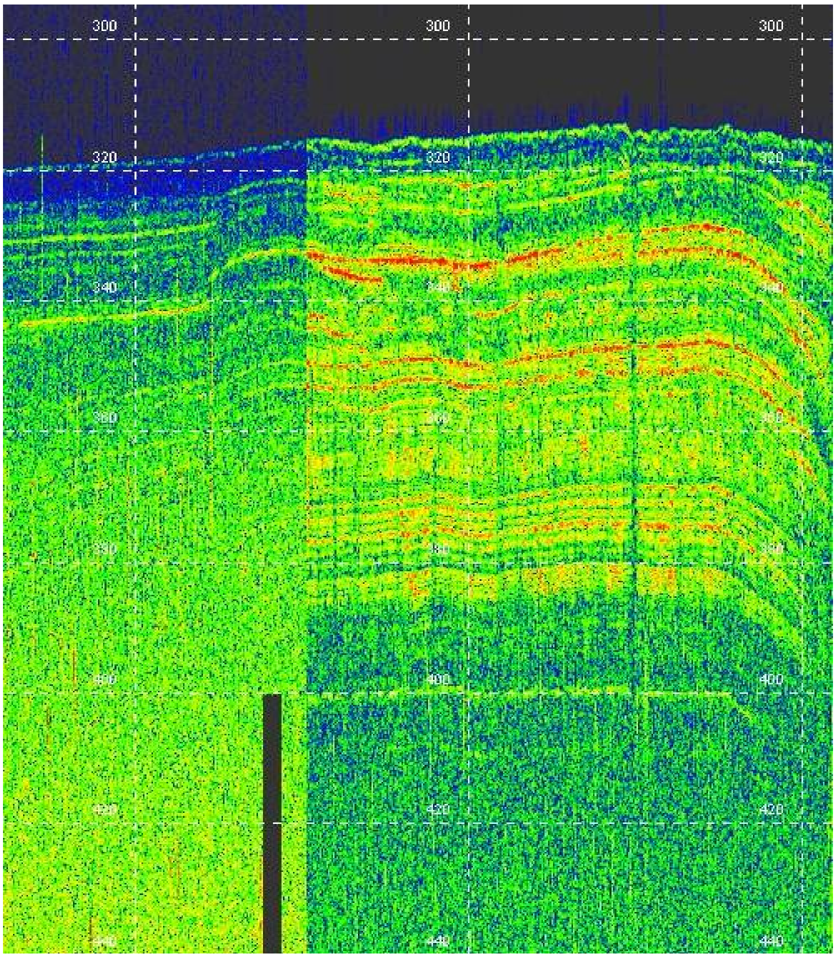


Figure 5-8 Difference between a 5 kHz Ricker pulse (left) and 2 - 6 kHz Chirp with 10 ms duration (right).

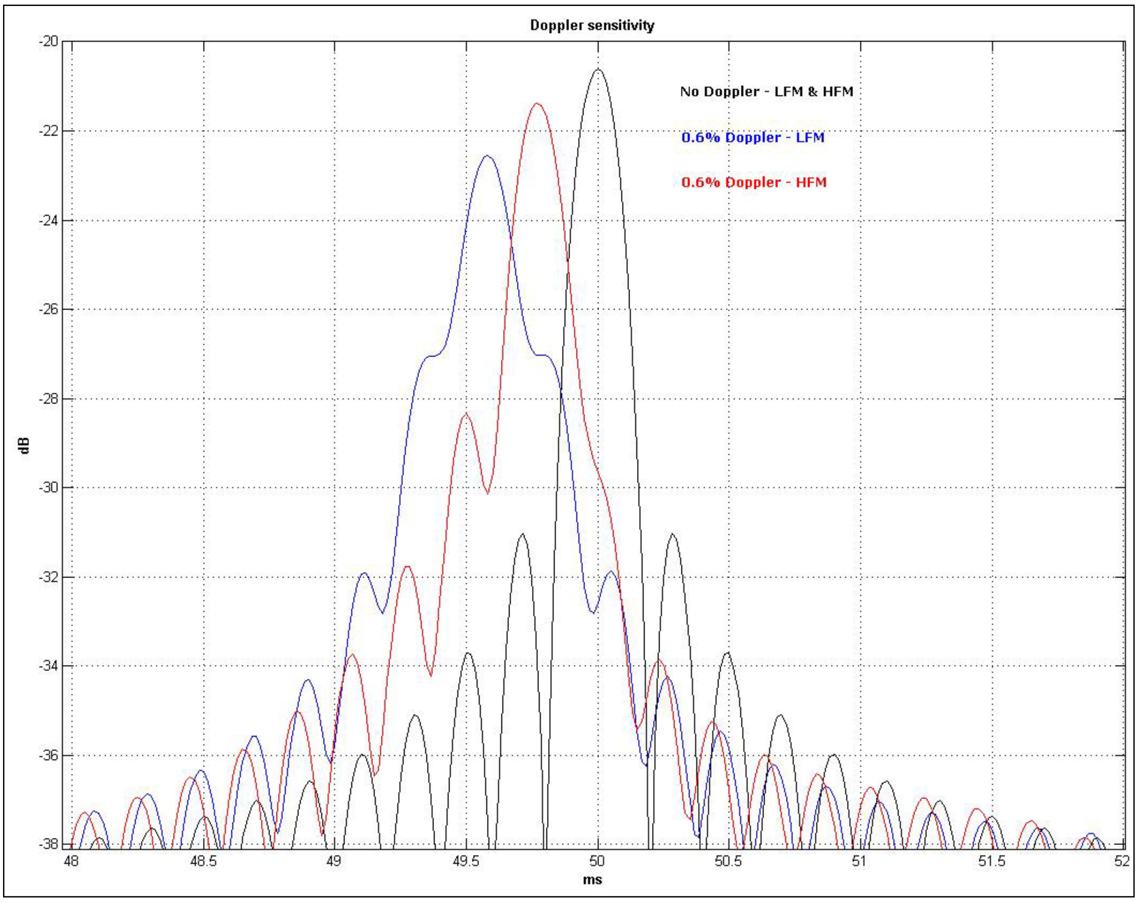


Figure 5-9 Differences between LFM and HFM wavelets in the case of 0.6% Doppler shift. **Black** is the ideal result, **Blue** is LFM and **Red** is HFM.

The mathematical description of the LFM waveform is as follows;

The linear chirp has a quadratic phase response as a function of time:

$\varphi(t) = \pi \cdot \mu \cdot t^2/2$ for $0 \leq t \leq T$

where $\mu = (f_{stop} - f_{start})/T$ and T is signal duration

The instantaneous frequency is given by:

$f(t) = f_{start} + \mu \cdot t$ for $0 \leq t \leq T$

The mathematical description of the HFM waveform is as follows;

The hyperbolic chirp has a quadratic phase response as a function of time:

$\varphi(t) = (2\cdot\pi\cdot f_{start}\cdot f_{stop}\cdot T/\mu)\cdot \ln(1-(\mu\cdot t)/f_{stop}\cdot T)$ for $0 \leq t \leq T$

where $\mu = (f_{stop} - f_{start})/T$ and T is signal duration

The instantaneous frequency is given by:

$f(t) = f_{start}\cdot f_{start}\cdot T/(f_{stop}\cdot T+\mu\cdot t)$ for $0 \leq t \leq T$

As mentioned previously the non-linear contribution to the secondary frequency signal level will eventually be reduced due to absorption or spreading losses for the primary signal resulting in no further increase in source level. For practical applications of a parametric source, this means that a certain water depth where interaction takes place is needed for optimal performance.

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5.3 Analogue Signal Processing

In order to record as much as possible of the information in the low frequency acoustic echoes received by the hydrophone, analogue processing like bandpass filtering and time variable gain (TVG) etc., are kept to a minimum. One important function is, however, to reduce the influence of the high primary signal level, which can be several times stronger than the signals of interest, and therefore may saturate the front-end. In addition, very low frequency signals generated by vessel movements etc. are filtered out.

The digitised received signal should be a replica of the signal received at the hydrophone. To ensure this property, the analogue processing must be a linear process meaning that no saturation effects must occur and that the phase response for the filters and gain stages must be linear.

5.3.1 Preamplifier

The transducer/hydrophone has an integrated, low frequency preamplifier module. The first section in this module comprises of a passive lowpass filter, which reduces the primary signal level. The next stage is a low noise input amplifier and a differential driver stage, which increases the signal level to a higher level suitable for connection to the front-end module.

The preamplifier has a fixed gain of 20 dB +/-1 dB. This gain is included in the receiving sensitivity of the hydrophone.

Note *The primary and harmonic signals for the optional receiver channels are connected directly to the dedicated front-end units.*

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5.3.2 Front-end

The front-end module receives the differential signal from the preamplifier. This module contains a bandpass filter section where the highpass corner frequency can be changed by the operator (*Acquisition tab -> Receiver page)*. This is primarily of interest for filtering out noise generated locally by mechanical sources such as engines, pumps, propeller and flow noise.

The gain stage can be programmed for gain setting from 0 to 72 dB in 6 dB steps. This gain is necessary to utilise the full dynamic range of the analogue-to-digital converter. Time variable gain is not implemented in the analogue part of the system. A theoretical dynamic range corresponding to 16 bits is 96 dB and is sufficient to handle the total dynamic range of a typical signal from the hydrophone.

Due to single-ended to differential signal conversion, a fixed gain of 6 dB has to be added to the programmable gain to get correct total front-end gain.

5.3.3 Data acquisition

Data acquisition is performed by a sigma-delta analogue-to-digital converter. The converter is running at a sampling frequency up to 300 kHz at a resolution of 16 bits.

Maximum input voltage span is 10 Vpp.

A single board PC running Windows XP or 7 directly controls the conversion process.

The acquired data are sent to the operator unit via Ethernet.

The 10 Vpp input data are normalized to 2 Vpp before storing the data on disk.

5.4 Digital signal processing

5.4.1 General

To enhance the presentation of the information contents in the acquired data, various processing steps are introduced. The simplest step is amplitude scaling of the data. Two scaling function are implemented: the first is in 1 dB steps and is only used for interpolation between the 6 dB gain-steps selected in hardware and the other scaling function is a multiplication by a factor which is given as a number between -30 dB and 100 dB. The other main processing steps are described individually in the following paragraphs.

5.4.2 Bandpass filtering

The TOPAS system is very flexible regarding selection of output signature. When operating in a noisy environment it is important to optimise the signal-to-noise ratio. This can be done by bandpass filtering over a bandwidth that covers the spectrum of the received signal.

The bandpass filtering is performed in the frequency domain by applying a window to the complex Fourier transformed time series of the acquired signal and perform a subsequent inverse Fourier transform. The window characteristic, which is displayed in Figure 5-10, is defined by four frequencies: lowstop (LS), highpass (HP), lowpass (LP) and highstop (HS). These frequencies are defining full stop and full pass points. The transition between these points has a cosine shape.

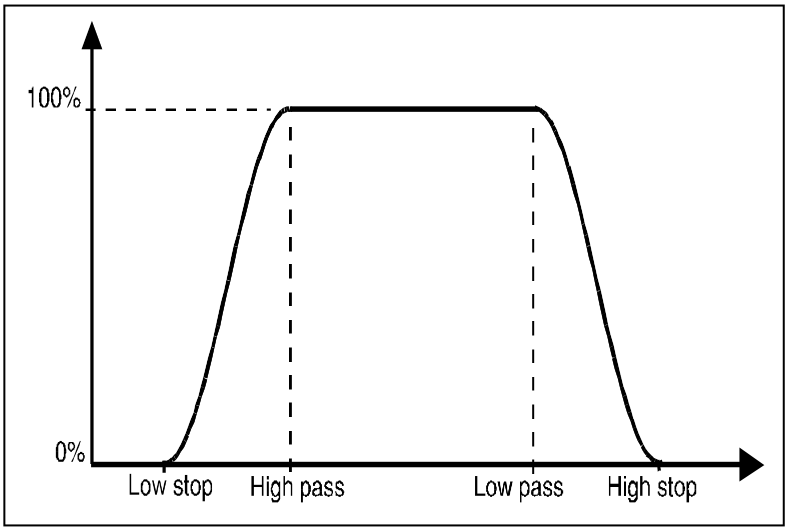


Figure 5-10 Characteristics of the digital bandpass filter.

5.4.3 Matched filter

There are various ways to increase the signal-to-noise ratio in the TOPAS system. One is to transmit coded wavelets. An example of such wavelet is the FM-sweep or chirp signal. Typical for this wavelet is the long duration in time increases the transmitted energy. Without processing, the resolution will be reduced. In order to compress the signal energy in time it has to go through a matched filter. The filter used is described by the following formula:

$F(f) = W^*(f)$

where ***W(f)*** is the complex Fourier transform of the transmitted wavelet, * indicates the complex conjugated, and ***c*** is a stabilising factor for the filter depending on the power spectrum of the wavelet and the noise power spectrum. The filter is weighted by the current bandpass filter envelope. When the Fourier transform of the acquired data trace is given by ***T(f)*** then the output of the filter will be given by

$S(f) = F(f) \bullet T(f)$

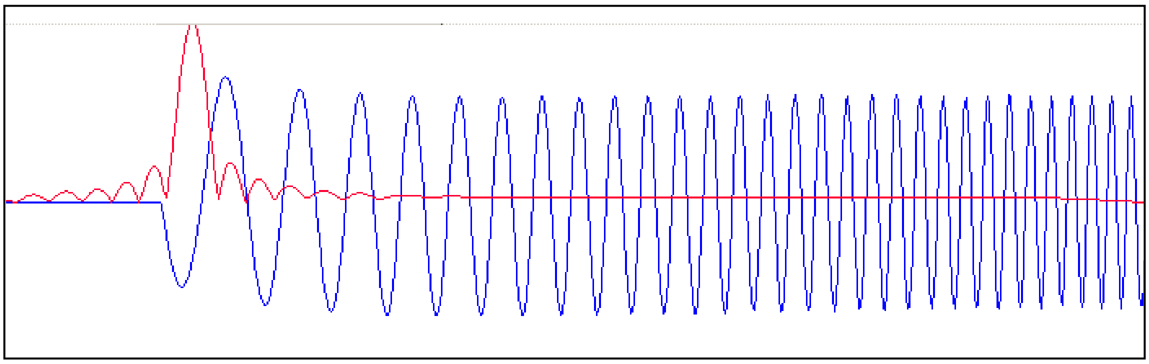


Figure 5-11 Matched filtered data (red) and unfiltered 1-5 kHz, 10 ms Chirp (blue).

5.4.4 Spiking deconvolution

There are various ways to increase the signal-to-noise ratio in the TOPAS system. One is to transmit coded wavelets. An example of such wavelet is the FM-sweep or chirp signal. Typical for this wavelet is the long duration in time increases the transmitted energy. Without processing, the resolution will be reduced. In order to compress the signal energy in time it has to go through a deconvolution process or a matched filter. The filter used is described by the following formula:

$$F(f) = \frac{W^*(f)}{|W(f)|^2 + c}$$

where ***W(f)*** is the complex Fourier transform of the transmitted wavelet, * indicates the complex conjugated, and ***c*** is a stabilising factor for the filter depending on the power spectrum of the wavelet and the noise power spectrum. The filter is weighted by the current bandpass filter envelope. When the Fourier transform of the acquired data trace is given by ***T(f)*** then the output of the filter will be given by

$$S(f) = F(f) \bullet T(f)$$

In an ideal case where the received wavelet is identical to an attenuated sample of the transmitted wavelet and the noise level is negligible, W(f) = T(f) and c = 0. Substituting into the expression for the deconvolution filter yields S(f) = 1 which is equivalent to a delta pulse in time domain.

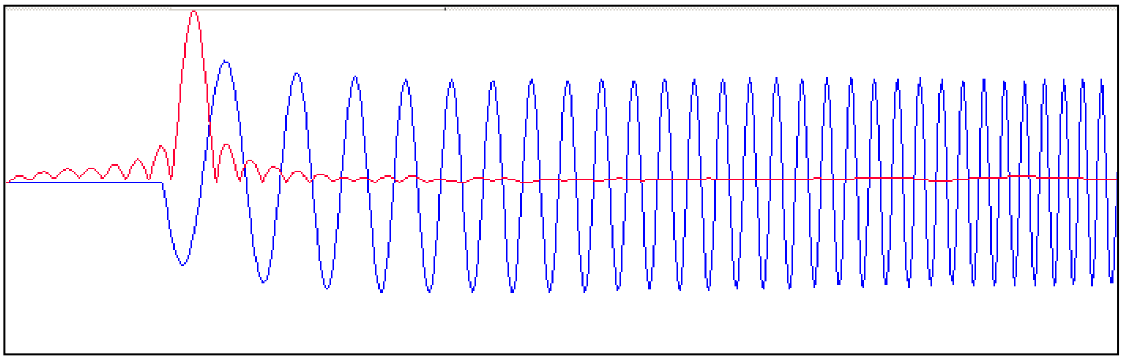


Figure 5-12 Spiking deconvolved data (red) and unfiltered 1-5 kHz, 10 ms Chirp (blue).

By adjusting the high-pass/low-pass corner frequencies manually in the shading function, see Figure 5-10, sidelobe levels can be reduced..

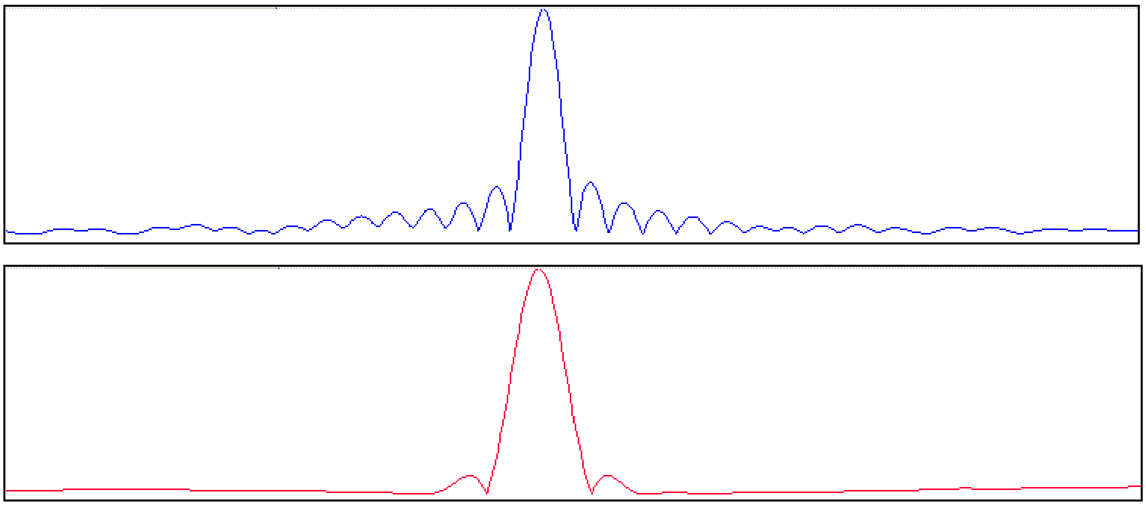


Figure 5-13 Use of shading function for reducing processing sidelobes; blue - no shading, red - shading.

Figure 5-14 shows the same effect by displaying the intensity in logarithmuic scale. Blue colour corresponds to 40 dB lower intensity than the red colour.

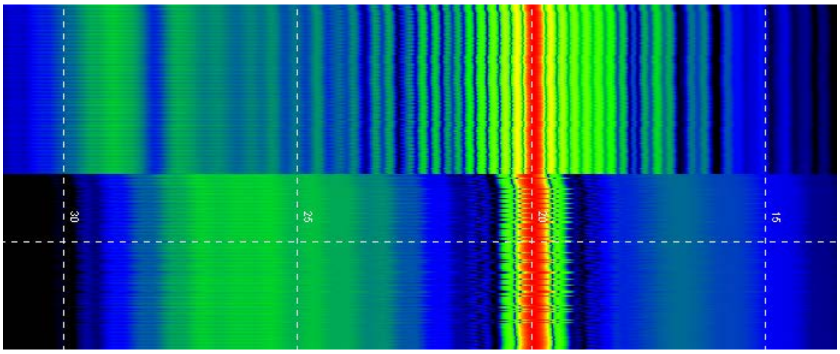


Figure 5-14 Intensity coded display of the time series in Figure 5-13; top – no shading, bottom - shaded.

5.4.5 Variable gain functions

There are two main reasons for using variable gain functions in the processing: Time Variable Gain (TVG) is used to compensate for spherical spreading losses and signal attenuation primarily in the sediments, while Automatic Gain Control (AGC) is used for enhancing low-level parts of the data trace on display and hardcopy. TVG maintains amplitude information in the trace while AGC destroys the real amplitude information.

TVG follows a predefined gain curve as a function of time. Typical gain curves for compensating for spreading losses may be proportional to 10·log *R*, 20·log *R*, 30·log *R* etc. where *R* is the distance from the transducer. Time *t* is *R/c* where *c* is the speed of sound. Attenuation loss is given as dB/length (or travel time). The curve is split into three sections where slope (dB/ms) and length can be changed individually. Attenuation values are often given as β dB/λ which can be written as *f(kHz)•β* when given in dB/ms.

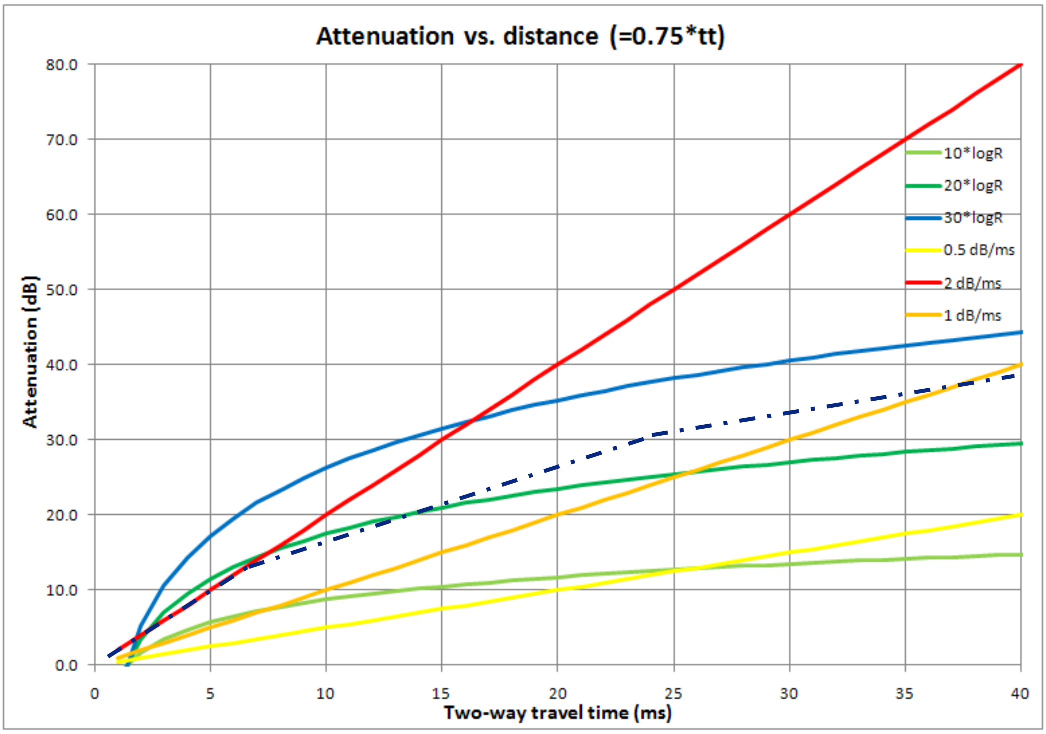


Figure 5-15Typical gain curves for spreading and attenuation losses.

The dashed curve indicates a TVG-curve based on combination of sections from the three straight attenuation curves.

The TVG can also be set up in automatic mode where the gain curve is calculated based on the average signal level in several sections along the trace.

AGC is a sliding scaling function where the scaling factor is the inverse of the average signal amplitude in a window around the point to be scaled. The position in the window of the point to be scaled can be selected by the operator. The result of this scaling is that signal level in low-level parts of the trace is amplified more than signals in high level parts of the trace.

5.4.6 Power Spectral Density

The Power Spectral Density (PSD) is used for analysing the frequency content in the received signal. It is very useful when analysing noise received by the system.

The method used is based on time averaging over short, modified periodograms. The estimation is done as follows: The signal is divided into K number of segments. Each segment is multiplied with a window function to form a sequence and the Fourier transform, F_k, is taken of each of these sequences. The modified periodogram is obtained as $L*|F_k|^2/U$ where L is length of each segment and U is the average of the window function. The Spectral estimate is then calculated as the average of the K periodograms.

Figure 5-16shows an example of the time series with indication of segments and overlaps.

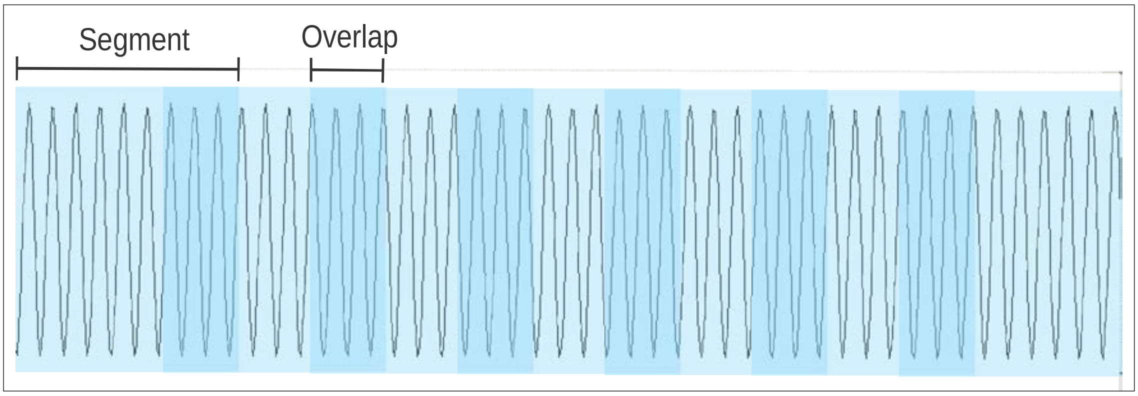


Figure 5-16 4 kHz sine test wave for PSD test.

Four window functions are available to apply:

- No window - rectangular
- Welch
- Barlett
- Hanning

Rectangular window gives the best frequency resolution while the Hanning window gives the best sidelobe suppression. Figure 5-17shows examples of using these windows on the 4 kHz CW signal.

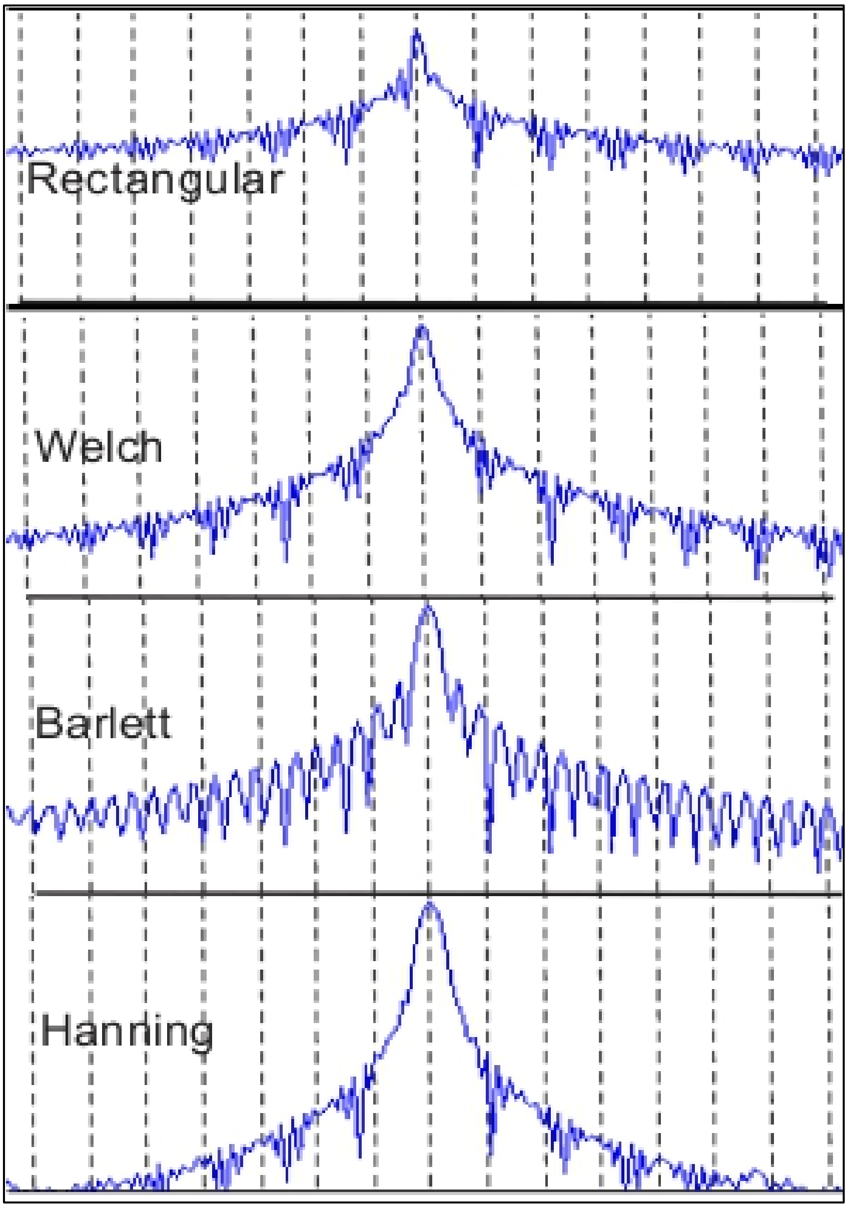


Figure 5-17 PSD of a 4 kHz CW signal with various window functions. The dynamic range in the displays is approx. 140 dB.

Another example of PSD displays is for noise estimation analysis in order to find sources of noise generation etc. in the received data. This is important in order to optimize system performance on a vessel. Analysis is done at various survey speeds, machinery in operation etc.

Figure 5-18 shows PSD results from 0 to 15 kHz of a real vessel. Dynamic range in the display is 140 dB.

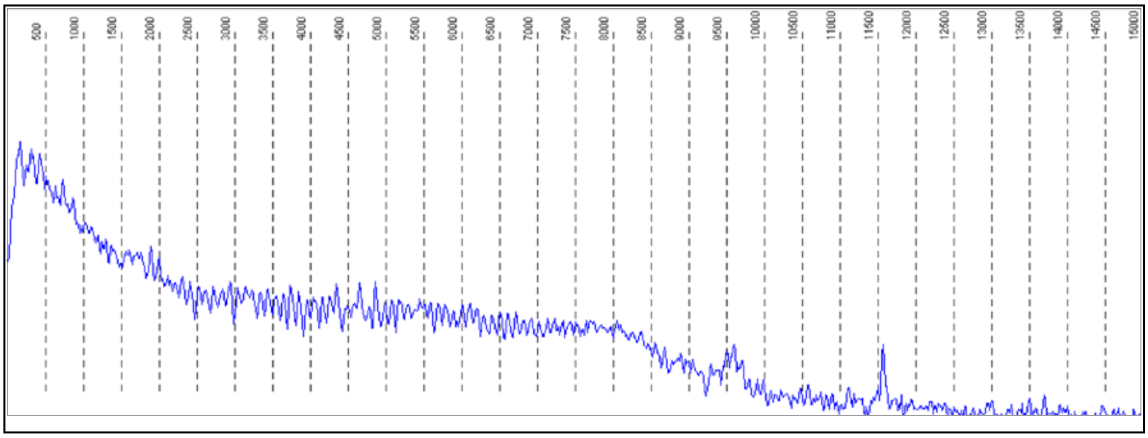


Figure 5-18 PSD analysis (Welch) of vessel noise at 4 knots speed.

5.4.7 Stacking

Trace stacking or trace mixing is a process that is regularly used in multi-channel seismic processing. In single channel systems, it is basically used to reduce influence of un-correlated noise in the trace. The processing is done on trace-by-trace basis where a sample of the processed trace is the average of corresponding samples in 2 to N of the previous traces. Sample number ***i*** in trace number ***k*** is given by the following expression:

$$s_i^k = \frac{1}{N} \sum_{j=k-N}^{k} s_i^j$$

where ***N*** is number of traces. Noise reduction is approximately proportional to √N. If the sea floor or sub-bottom structures have steep and abrupt changes, care should be taken using stacking processing since it tends to smear out such features. Figure 5-19 shows an example of Stacking.

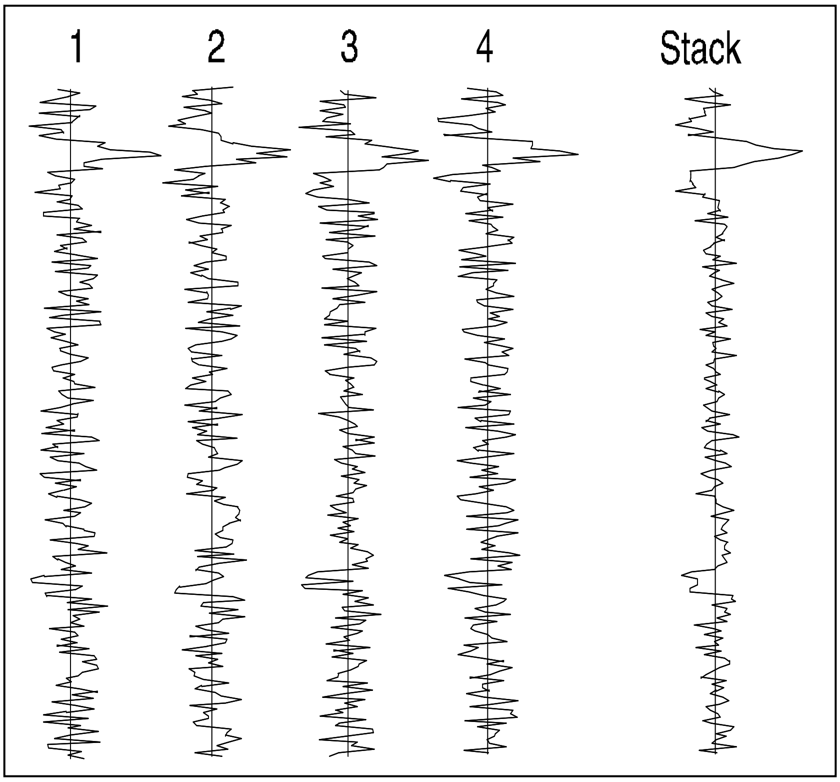


Figure 5-19 Result of stacking 4 traces. The rms. noise level is reduced by a factor of 2.

5.4.8 Swell filtering

Swell filtering is used if no external heave compensation is available, to handle the influence of vertical vessel, or transducer, movements due to the undulations of the swell. In principle this is done by first performing sea floor detection on the received data and then adjusts the trace up or down so that the position of the detected sea floor matches the position detected in the previous trace. In order to allow for variation in the bathymetry, an average of previous N detected sea floor locations is used as the location in the trace where the last trace is shifted. Using a large N may result in loss of details regarding the ability to follow the sea floor while small N might not remove the swell completely. N is a sort of time constant for the filter, which also depends on the shot interval. Figure 5-20 shows an example on swell filtering.

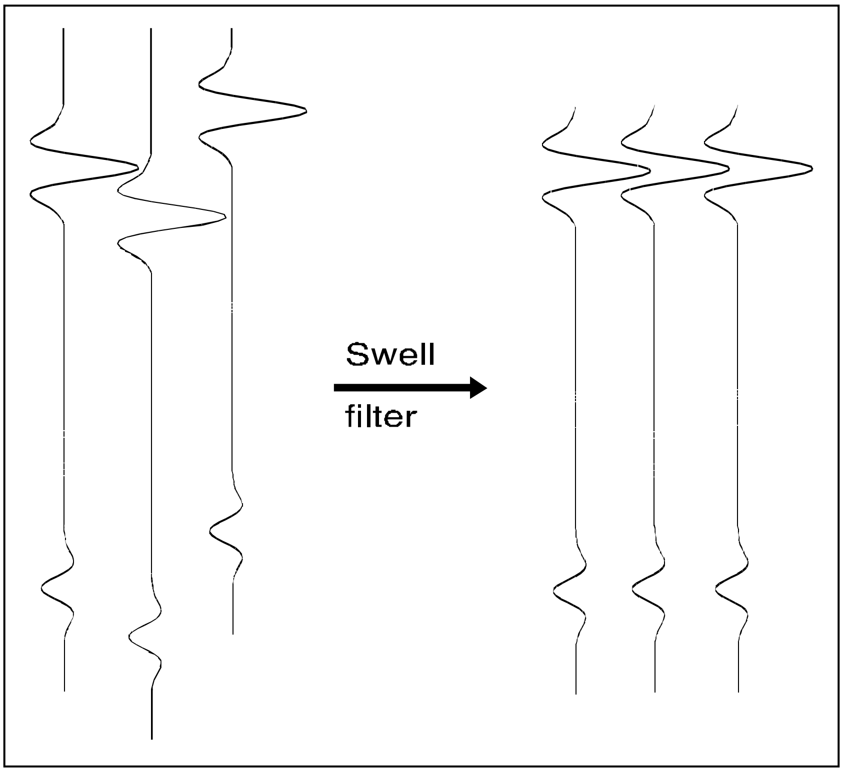


Figure 5-20 Swell filter function.

5.4.9 Attribute calculation

In order to make interpretation of seismic signals easier, attributes can be calculated based on a complex seismic trace analysis. The attributes of interest are:

- Instantaneous amplitude or reflection strength
- Instantaneous phase
- Instantaneous frequency
- Apparent polarity

The complex trace is computed as

$$F(t) = f(t) + jf^*(t)$$

where f(t) is the real trace, j = √-1 and * indicates the complex conjugated. The complex trace is calculated by inverse transforming the real part of the Fourier transformed real trace multiplied by two (Hilbert transform). The various attributes are now calculated as follows:

Instantaneous amplitude is given by

$$A(t) = [\,f^2(t) + f^{*2}(t)\,]^{\frac{1}{2}} = |\,F(t)\,|$$

Instantaneous phase is given by

$$\Theta(t) = \arctan[\,f^*(t)/f(t)\,]$$

Instantaneous frequency is given by

$$\omega(t) = \frac{d\,\Theta(t)}{dt}$$

Apparent polarity is defined as the sign of ***f(t)*** when ***A(t)*** has a local maximum. Positive or negative sign is assigned assuming a zero-phase wavelet and a positive or negative reflection coefficient, respectively.

The significance of the calculated attributes are described in the following:

Instantaneous amplitude:

Reflection strength or instantaneous amplitude is independent of phase. It may have its maximum at phase points other than peaks or troughs of the real trace, especially where an event is the composite of several reflections. High-reflection strength is often associated with major lithologic changes between adjacent sediment layers, such as across non-conformities and boundaries associated with sharp changes in sea level or decompositional environments. High-reflection strength also is often associated with gas accumulation.

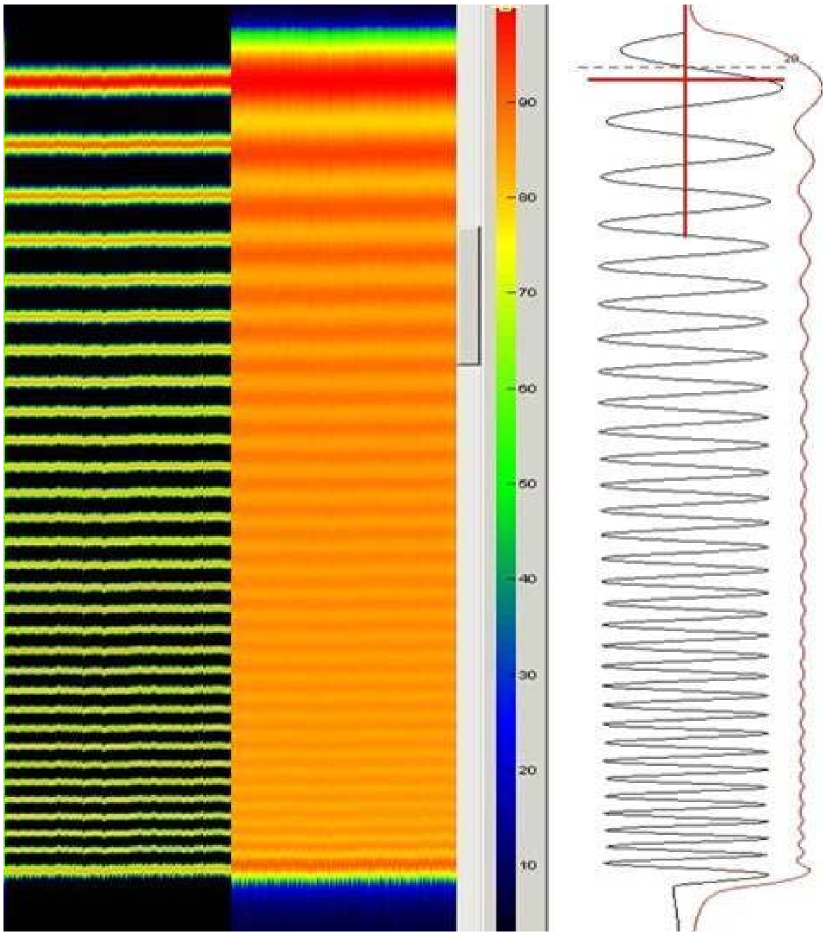


Figure 5-21 Unprocessed and instantaneous amplitude processed data shown in both intensity plot and scope plot;

Selecting the **Transient** checkbox, the derivative of the Inst. Amplitude is displayed.

Figure 5-22 shows the Inst.Amplitude of a matched filtered Chirp signal, which will have the shape of |sinX/X| and Figure 5-23 shows the derivative of the same signal. This mode may improve interpretation of the signals and reduce background noise.

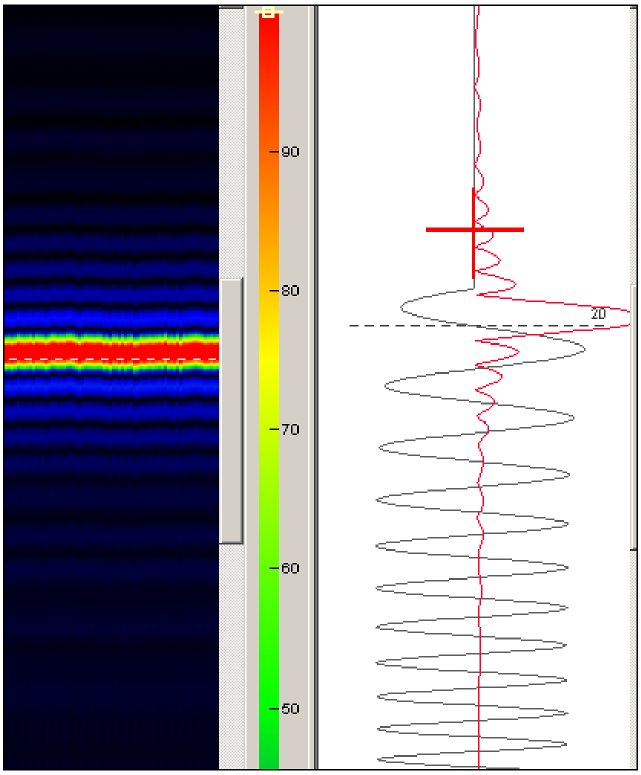


Figure 5-22 Inst.Amplitude display of a match filtered Chirp signal.

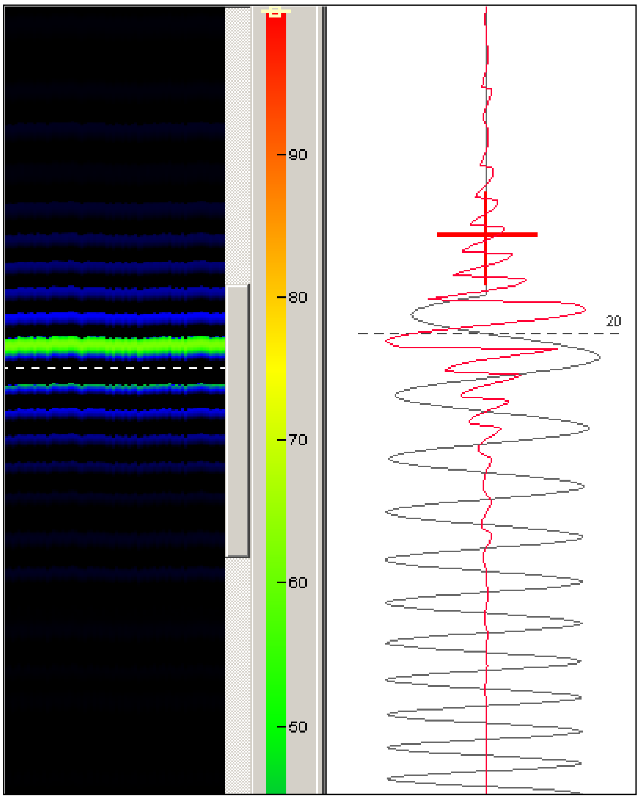


Figure 5-23 Transient display of the Inst. Amplitude signal.

Instantaneous phase:

The instantaneous phase emphasises the continuity of events. It is a value associated with a point in time and thus is quite different from phase as a function of frequency as given by a Fourier transform. Because phase is independent of reflection strength, it often makes weak coherent events clearer. Phase displays are effective in showing discontinuities, faults, pinch outs, angularities and events with different dip attitudes, which interferes with each other.

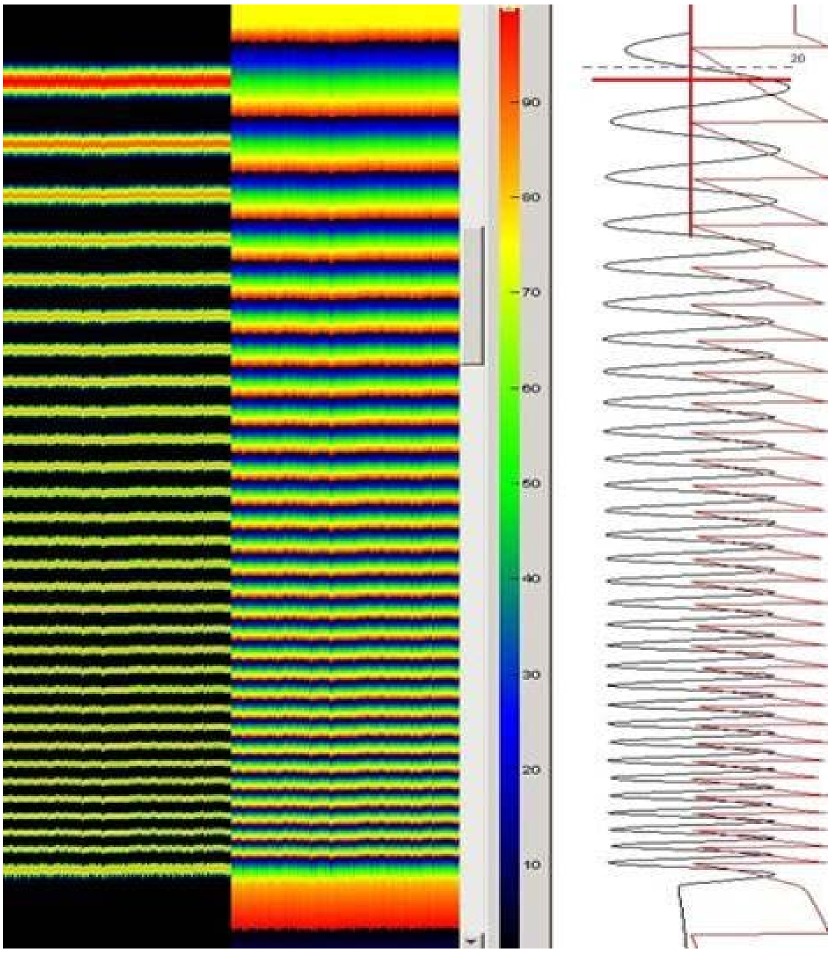


Figure 5-24 Unprocessed and instantaneous phase processed data shown in both intensity plot and scope plot.

Instantaneous Frequency:

The instantaneous frequency is a value associated with a point in time like the instantaneous phase. Most reflection events are the composite individual reflections from a number of closely spaced reflectors, which remains nearly constant in acoustic impedance contrast and separation. The superposition of individual reflections may produce a frequency pattern, which characterises the composite reflection. Frequency character often provides a useful correlation tool. The character of a composite reflection will change gradually as the sequence of layers gradually changes in thickness or lithology. Variations, as at pinch outs and edges of hydrocarbon-water interface, tend to change the instantaneous frequency more rapidly.

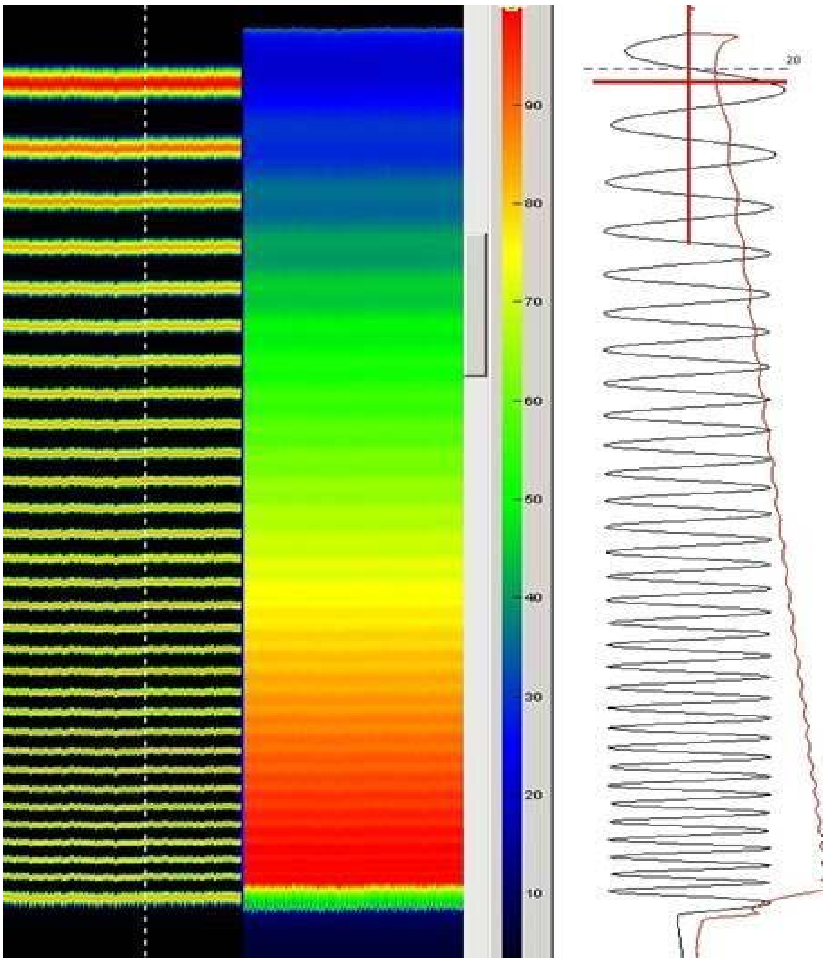


Figure 5-25 Unprocessed and instantaneous frquency processed data shown in both intensity plot and scope plot.

Apparent polarity:

Apparent polarity is very sensitive to data quality. Interference may result in reflection strength maximum occurring near a zero crossing of the seismic trace so the polarity may change sign as noise causes the zero crossing of the trace or the location of the reflection strength maximum to shift slightly. The analysis of apparent polarity assumes a single reflector, a zero-phase wavelet and no ambiguity due to phase inversion. Bright spots associated with gas accumulation in sediments usually have lower acoustic impedance than the surrounding beds and hence show a negative polarity for reservoir top reflections and a positive reflection for reflections from gas-water or gas-sediment interfaces. Figure 5-26 shows the Apparent polarity of a matched filtered Chirp signal.

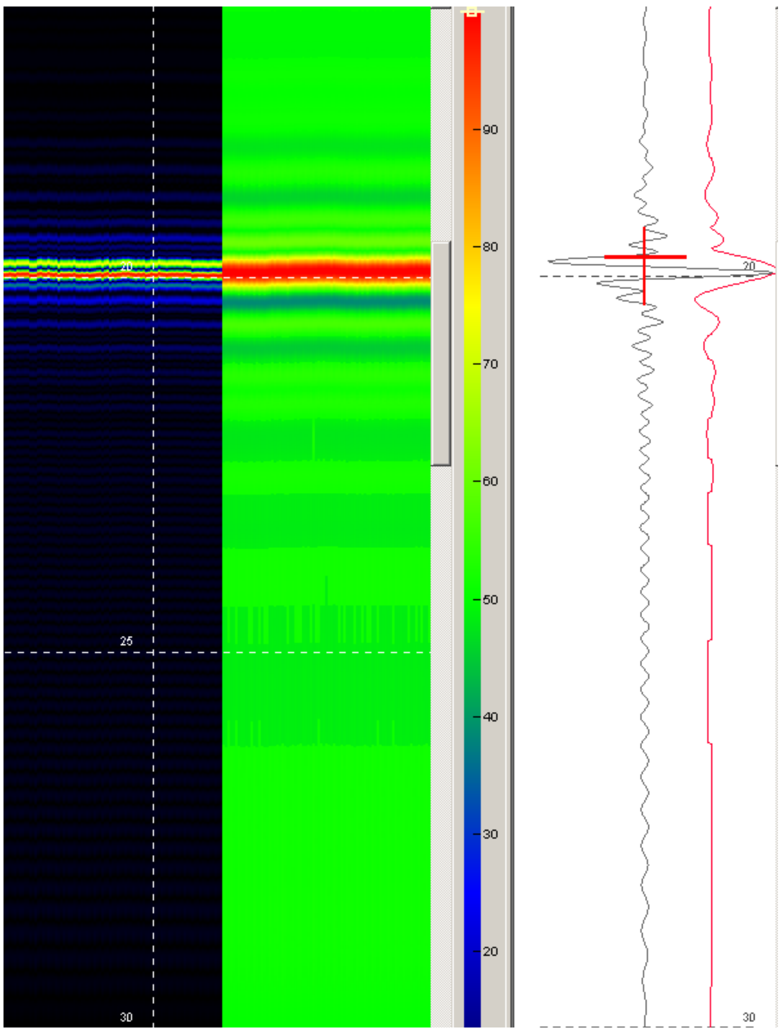


Figure 5-26 Unprocessed and apparent polarity of matched filtered data shown in both intensity plot and scope plot. Dark green-blue colours are negative polarity and yellow-red are positive.

5.4.10 Dereverberation

Dereverberation processing is used for reducing the influence of multiple echoes in shallow water sub-bottom profiling. Such undesired multiples degrade the quality of acquired data and makes it more complicated to interpret the data.

The theory behind the processing is based on the fact that multiples generate ripples in the power spectrum. By applying a Fourier transform toe the logarithm of the frequency spectrum, a peak will be observed where the multiples are present. This peak is removed and the data is inverse transformed back to the time domain.

This processing approach is more robust to variation on the structure of the multiple signals than direct methods are and is therefore used here.

Figure 5-27 shows the result of this processing applied to TOPAS data.

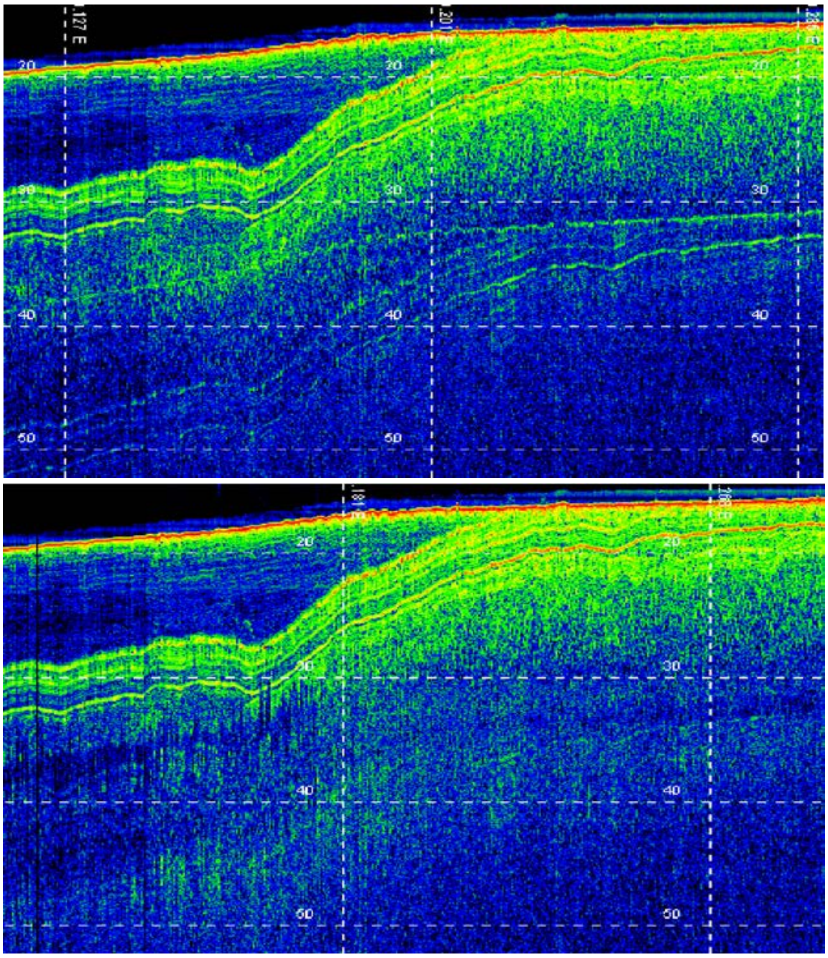


Figure 5-27 Dereverberation; Record with multiple before (top) and after (bottom) dereverberation processing.

5.4.11 Synthetic aperture processing

Synthetic aperture processing is used for increasing lateral resolution in acquired data. A simple processing is done by adding contributions from a given number of pings by taking into account propagation delays to each target position.

It is further assumed that the data are acquired along a straight line and that the vessel is moving at constant speed. The speed is taken from the navigation system. The ping rate must comply with a vessel movement of <0.5 meter between each ping. This is equivalent to a ping rate equal to vessel speed (in m/s) / 0.5.

Figure 5-28 shows the acquired data as they will look without any synthetic aperture processing. The echo from the buried sphere is stretched over a long distance and makes it difficult to differentiate between closely spaced targets.

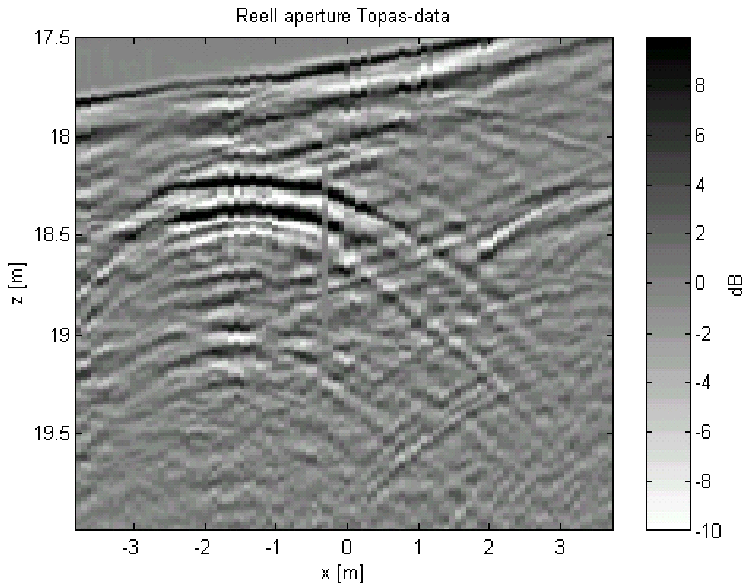


Figure 5-28 Data recorded from a buried sphere.

Figure 5-29 shows the result of applying synthetic aperture processing to the data in previous figure. The details in the figure are much better than for the unprocessed case!

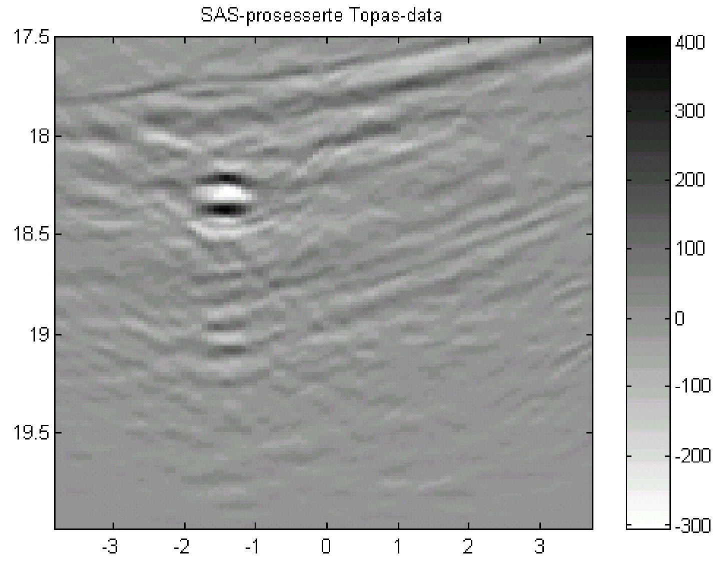


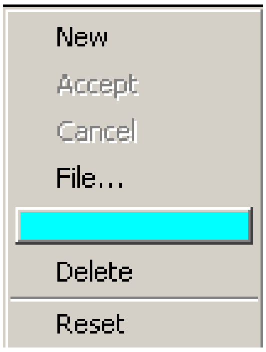
Figure 5-29 Result of synthetic aperture processing.

5.5 Interpretation of seismic data

In order to be able to transfer information about sediment layer interfaces to other tools for further analysis, a digitizing function has been included in the TOPAS software.

The digitization is supposed to be performed on replayed data and the information about layer number, position and delay (depth) is stored in a text file, The user has to convert delays to depths in an offline process.

In order to enable the digitization, the **Digitize layers** checkbox in the **Echogram** parameter sheet has to be checked. Then, by using right mouse button in the main echogram area, the following menu appear:



Select **New** to start digitizing a new layer. Normally the first layer should be the seabed. The layers are automatically numbered from 1001 and up. The numbering can be reset to 1001 by selecting **Reset**.

Note

*By selecting **Reset**, all digitized layers not stored, but present in the display will also be deleted!*

Digitizing is done by pointing the cursor to the point of interest and simultaneously Ctrl+Left mouse button. The current point can be deleted by simultaneously pressing Shift+Left mouse button. When the last point in the layer is digitized, select **Accept** to accept the layer and get ready for a new layer, or **Cancel** to cancel the current layer.

For the next layer repeat the sequence by first selecting Right mouse button, then selecting **New** and start to select points to digitize.

When all layers have been digitized, all layers to be stored to file must be selected one-by-one using Alt+Left mouse button. When all layers have been selected, select **File** in the menu. A file chooser is opened and file name and location can be selected.

Figure 5-30 shows a screen dump from the echogram area after digitizing layers.

The layer colour may be changed by selecting a colour prior to digitization or by selecting a digitized layer and then select colour.

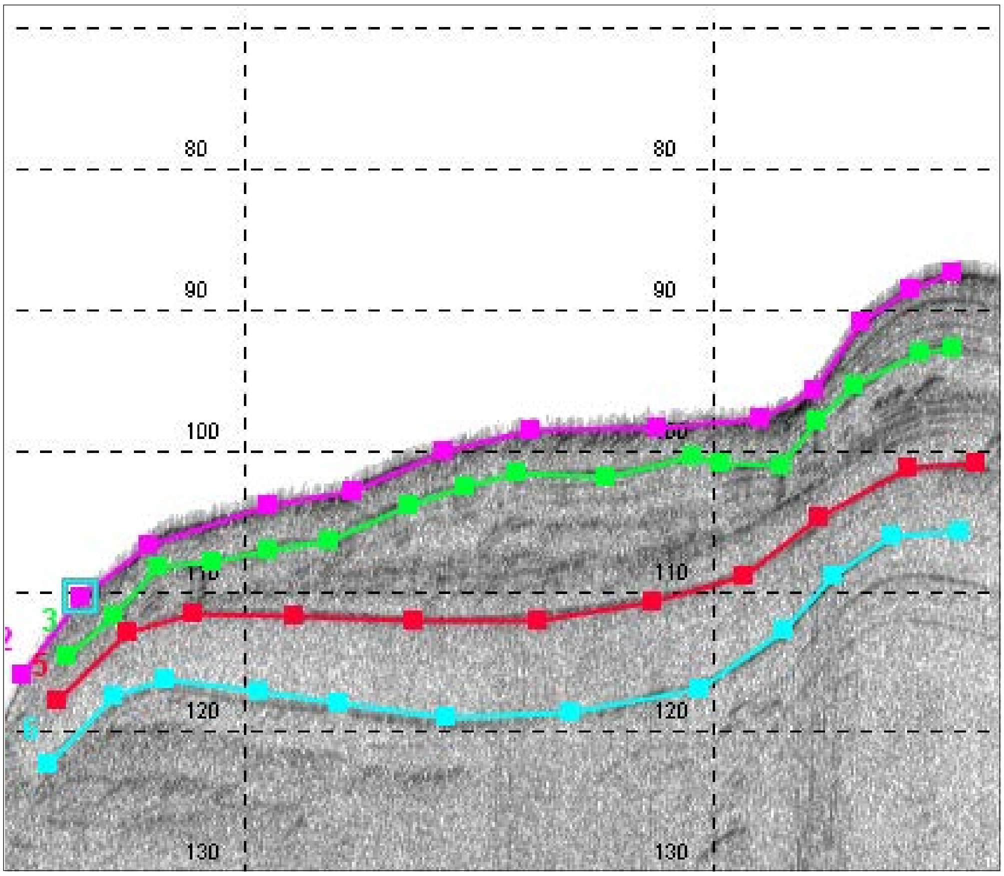


Figure 5-30 Example of digitized layers. Note that the layer numbers is not updated in this example.

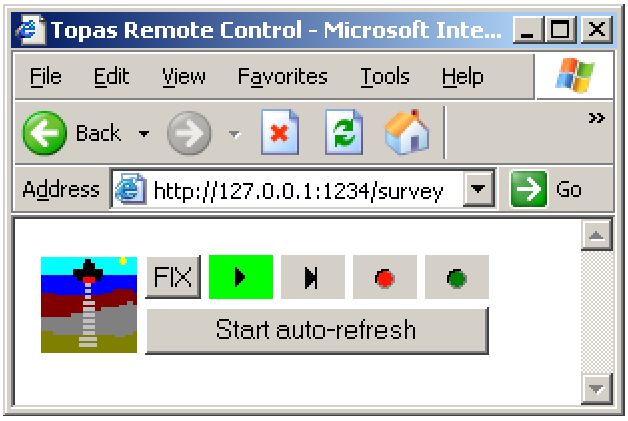
The digitized layer information shown in Figure 5-30 is stored in an ASCII-file. The format of the file containing the digitized information will look like this:

```
LayerNo. PointNo. Lat.North Lon.East Delay
2; 1; 63 26.5562 N; 10 22.7531 E; 115.83
2; 2; 63 26.5487 N; 10 22.7226 E; 110.32
2; 3; 63 26.5407 N; 10 22.6901 E; 106.65
2; 4; 63 26.5259 N; 10 22.6301 E; 103.81
```

2; 5; 63 26.5162 N; 10 22.5879 E; 102.81
2; 6; 63 26.5060 N; 10 22.5434 E; 99.98
2; 7; 63 26.4953 N; 10 22.4999 E; 98.47
2; 8; 63 26.4806 N; 10 22.4360 E; 98.31
2; 9; 63 26.4676 N; 10 22.3850 E; 97.64
2; 10; 63 26.4614 N; 10 22.3595 E; 95.64
2; 11; 63 26.4561 N; 10 22.3360 E; 90.80
2; 12; 63 26.4500 N; 10 22.3106 E; 88.46
2; 13; 63 26.4454 N; 10 22.2893 E; 87.29
3; 1; 63 26.5504 N; 10 22.7296 E; 114.50
3; 2; 63 26.5447 N; 10 22.7068 E; 111.66
3; 3; 63 26.5395 N; 10 22.6853 E; 108.15
3; 4; 63 26.5326 N; 10 22.6575 E; 107.82
3; 5; 63 26.5259 N; 10 22.6301 E; 106.99
3; 6; 63 26.5188 N; 10 22.5994 E; 106.32
3; 7; 63 26.5100 N; 10 22.5598 E; 103.81
3; 8; 63 26.5031 N; 10 22.5318 E; 102.48
3; 9; 63 26.4969 N; 10 22.5069 E; 101.48
3; 10; 63 26.4868 N; 10 22.4618 E; 101.81
3; 11; 63 26.4764 N; 10 22.4198 E; 100.31
3; 12; 63 26.4724 N; 10 22.4034 E; 100.81
3; 13; 63 26.4646 N; 10 22.3736 E; 100.98
3; 14; 63 26.4609 N; 10 22.3571 E; 97.81
3; 15; 63 26.4567 N; 10 22.3383 E; 95.30
3; 16; 63 26.4490 N; 10 22.3058 E; 92.97
3; 17; 63 26.4454 N; 10 22.2893 E; 92.63
5; 1; 63 26.5516 N; 10 22.7342 E; 117.67
5; 2; 63 26.5429 N; 10 22.6998 E; 112.83
5; 3; 63 26.5351 N; 10 22.6668 E; 111.49
5; 4; 63 26.5225 N; 10 22.6164 E; 111.66
5; 5; 63 26.5094 N; 10 22.5575 E; 111.99
5; 6; 63 26.4943 N; 10 22.4952 E; 111.99
5; 7; 63 26.4812 N; 10 22.4383 E; 110.66
5; 8; 63 26.4700 N; 10 22.3942 E; 108.82
5; 9; 63 26.4609 N; 10 22.3571 E; 104.65
5; 10; 63 26.4500 N; 10 22.3106 E; 101.14
5; 11; 63 26.4429 N; 10 22.2774 E; 100.81
6; 1; 63 26.5528 N; 10 22.7389 E; 122.17
6; 2; 63 26.5447 N; 10 22.7068 E; 117.33
6; 3; 63 26.5385 N; 10 22.6806 E; 116.17
6; 4; 63 26.5270 N; 10 22.6347 E; 117.00
6; 5; 63 26.5178 N; 10 22.5948 E; 117.84
6; 6; 63 26.5054 N; 10 22.5410 E; 118.84
6; 7; 63 26.4912 N; 10 22.4809 E; 118.50
6; 8; 63 26.4753 N; 10 22.4151 E; 116.83
6; 9; 63 26.4646 N; 10 22.3736 E; 112.66
6; 10; 63 26.4594 N; 10 22.3501 E; 108.82
6; 11; 63 26.4523 N; 10 22.3200 E; 105.98
6; 12; 63 26.4449 N; 10 22.2869 E; 105.65

5.6 Remote operation

When **Services > Http Interface** is enabled it will be possible to control start/stop pinging and start/stop logging from a web-server. By accessing the TOPAS operator unit via the IP-address and port number specified in the **Http Interface** parameter page, the following buttons will be available in the remote web page:



Note

The specified IP-address must be the same as IP-address as for the TOPAS operator unit!

For the commands to work, the TOPAS program has to be set up for real-time operation, i.e. **Survey** mode.

The buttons will have the same functions on the remote PC as on the main operator unit.

The **Start auto-refresh** button initiates polling of the button states every second and the button changes to **Stop auto-refresh**.

If auto refresh is stopped, the refresh button in the web browser can be used for updating the button status!

5.7 TOPAS data on SIS display

When **Services > SIS Interface** is enabled it will be possible to transfer track positions and depth from the TOPAS operator console to the SIS console, and it will be possible to select a TOPAS track on the SIS display which will be replayed on the TOPAS console.

The **File(s) to SIS** command transfers all TOPAS tracks/lines in a directory or single lines.

When **Processing > Ping to SIS** is enabled, track information is from the currebt line is transferred.

The coloured lines and marks are defined as follows:

TOPAS tracks

Selected line

Start of selected line

Current ping position in line

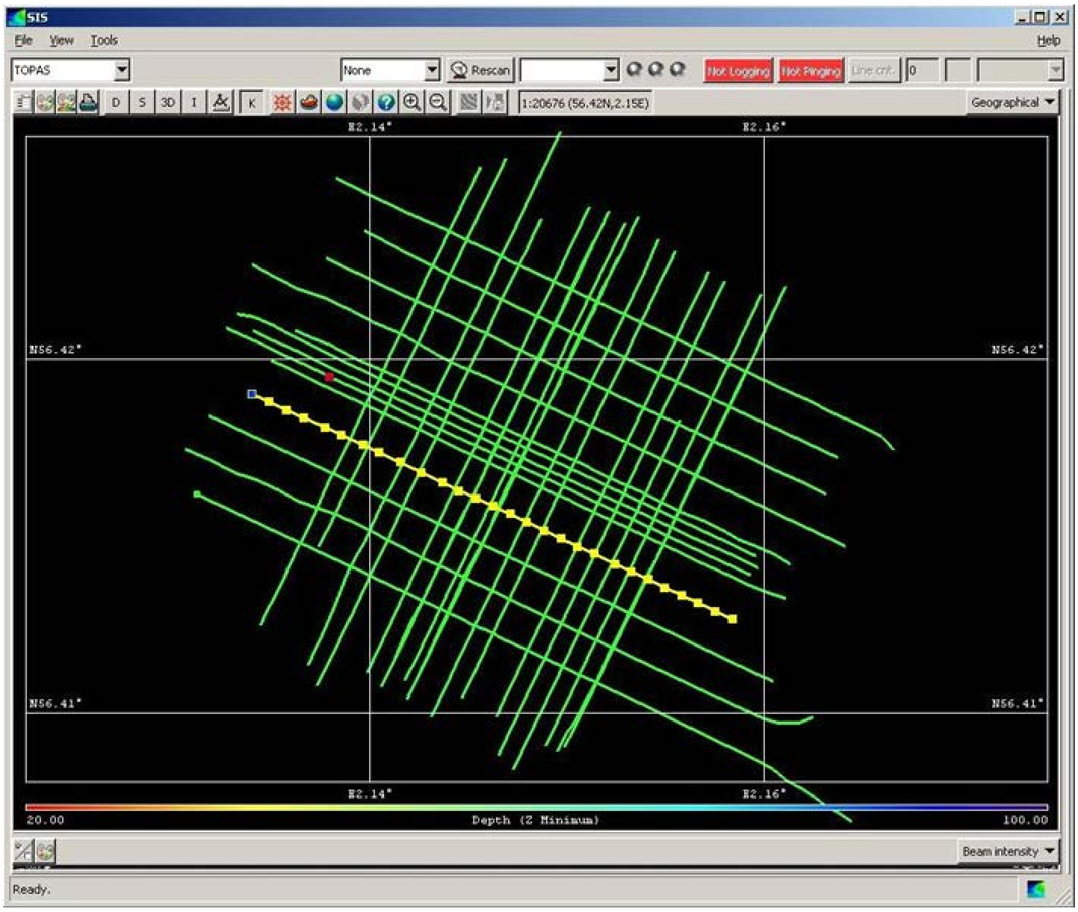


Figure 5-31 SIS display of tracks comming from TOPAS console.

To operate on tracks in the SIS display, the following commands are used:

Select track: **Ctrl**-button and **Left-click** on track

Start replay: **Ctrl**-button, **Right-click** on selected track and select **Mark** in submenu.

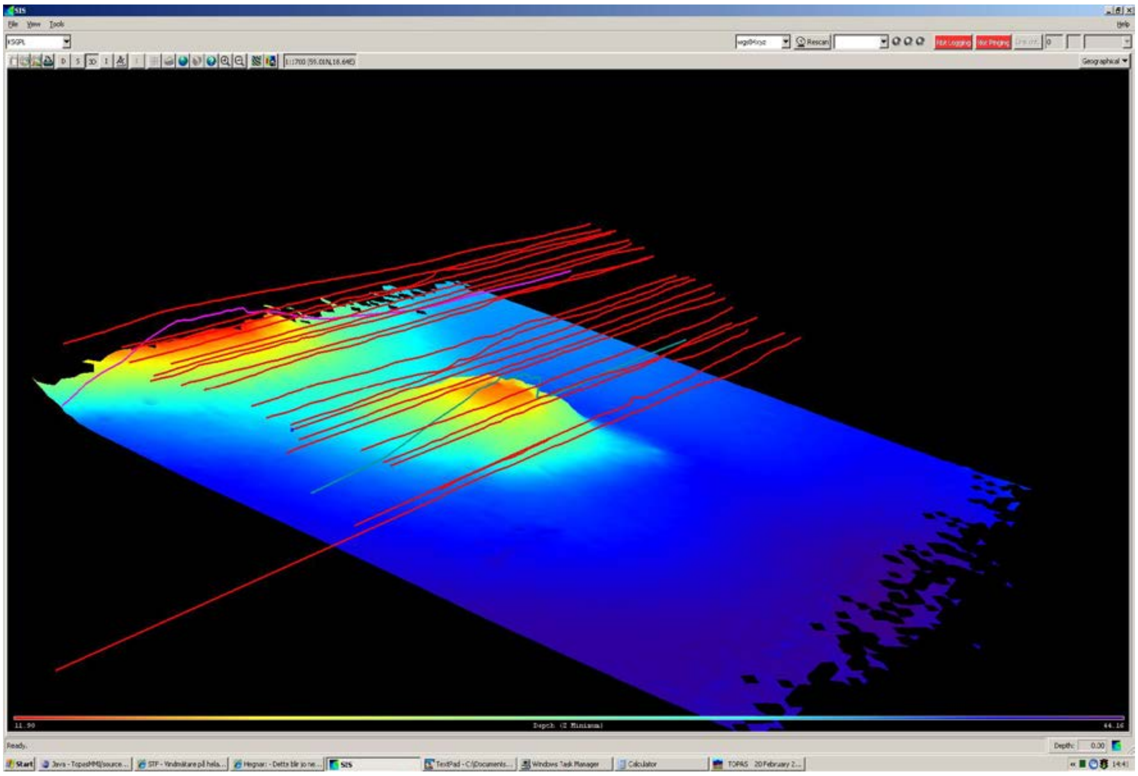


Figure 5-32 SIS display showing seabed topography and TOPAS tracks.

If bottom detection is enabled in TOPAS, the detected depth profile from TOPAS is also shown, green and purple lines in **Figure 5-32**

5.8 Main operational modes

The main operational modes are selected by the runtime parameters *Transmit mode, Trigger mode* and *Trig interval*.

The various transmit modes are:

- **Normal**: In this mode there will only be one single pulse in the water at a time (multipath is neglected).
- **Burst**: In burst mode several pulses are transmitted before the return signal from the first transmission is received.

Synchronization of TOPAS PS 18 to other equipment is provided by external trigger inputs. The purpose of synchronization is to avoid, or at least have control over, interference with other acoustic systems.

Synchronized mode is achieved by setting Trigger mode to *External*. One external trigger input is available. This is normally connected to other external equipment such as a synchronization unit.

Below we treat the standard combinations of transmit mode and synchronization. But first it is necessary to introduce a few other runtime parameters:

Trace length: This parameter (unit is milliseconds) specifies the length of the acquisition window. This observation window should be long enough to collect all interesting return signals. In order to reduce the amount of data to be store during surveys, it might be sensible to reduce this window in areas with poor penetration, limited penetration required etc.

Master trig delay: This parameter specifies where to position the start of the acquisition window relative to the time of transmission. The position of the acquisition window should normally be such that the first bottom return is located somewhere at the first half of the acquisition window

---

Example

If the depth measured relative the transducers is 75 m and the average velocity of sound in the water column is 1500 m/s, the first bottom return will arrive after *t = 2•75/1500 [m/(m/s)] = 100 ms*.

Note

We are working with two-way travel times! If the trace length is 40 ms, a suitable trigger delay could be 90 ms.

It is possible to have the trigger delay calculated automatically either

1) from the depth detected by the bottom tracker of the TOPAS PS 18 or

2) from the depth input from Kongsberg EM MBES or another echo sounder.

This feature is enabled by selecting *Automatic* for *Delay control*. Further information about this feature is found in section **Calculate delay from depth** on page 281.

To control which depth to use, see the description of the *Depth selector*.

Ping interval: This parameter is used to set the minimum/desired interval between two consecutive pings. The actual ping interval used is displayed beside the desired/minimum ping interval input by the operator. The ping interval used is calculated considering maximum power duty cycle, trigger delay, trace length, pulse length and maximum ping rate.

Burst pulse interval: This parameter is the interval between two transmissions in burst mode.

Steering parameters

This is introduced as a generic term for pulse length, trigger delay and trace length. These parameters have the highest priority when timing schemes are composed in the various modes discussed below.

Normal mode and internal trigger

In normal mode, the transceiver unit transmits a single pulse and then waits for the return signal. A new pulse will not be transmitted before the return signal from the previous ping is acquired. Depending on the relation between operator specified ping interval and the steering parameters, the TOPAS PS 18 may be considered as operating in one of two sub-modes. If the steering parameters allow it, the TOPAS PS 18 will be pinging at a fixed rate with the ping interval specified by the operator. If the user specified ping interval is too short considering the steering parameters, the system will give the shortest ping interval possible. In combination with the “calculate delay from depth” feature, this will cause the system to be “free running” which means that the ping rate in normal mode will be as high as possible.

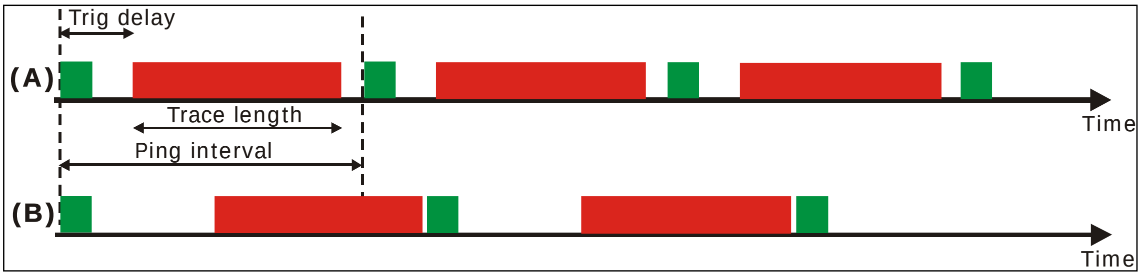
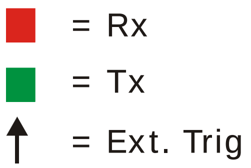


Figure 5-33 Internally triggered normal mode.

The TOPAS PS 18 allows the user to specify a minimum ping interval (PIV). If feasible this ping interval will be provided (A). If the ping interval is too short for the system to collect the desired return signal, the system will provide the shortest ping interval possible (B).



Normal mode and external trigger

The TOPAS PS 18 can be triggered from an external source in order to avoid (control) interference between the TOPAS PS 18 and other acoustic systems.

In this mode, the TOPAS PS 18 will ping at a fixed rate provided the external trigger is running at fixed rate. The TOPAS PS 18 will possibly ping at a lower, fixed rate than the one given by the external trigger. This will be the case whenever the next trigger signal comes before the system has finished acquiring data from the ping initiated by the previous trigger signal.

This is illustrated in Figure 5-34 where we can see that for a given set of the steering runtime parameters, increasing the rate of external trigger signal actually causes a decrease in the ping rate of the TOPAS PS 18.

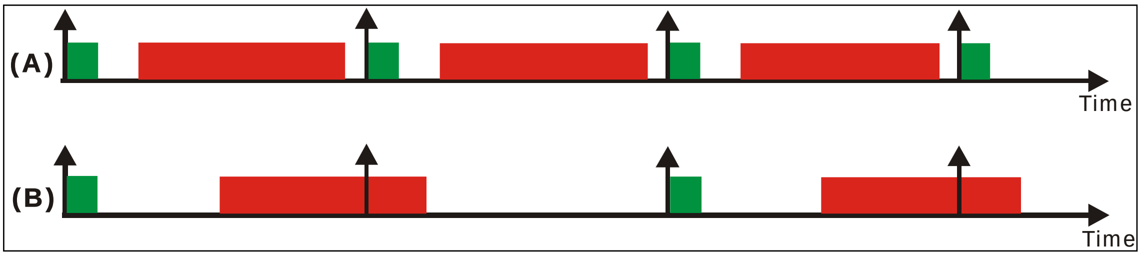


Figure 5-34 Externally triggered normal mode.

In this case the ping rate is determined by external equipment (A). Once the TOPAS PS 18 has transmitted in response to a trigger signal, it does not accept a new trigger until it has finished receiving the echo from the previous transmission. Accordingly the ping rate of the TOPAS PS 18 might be lower than one should expect from the external trigger signal (B).

Burst mode *(Transmit mode = Burst)*

For hydrographical echo sounders, both multibeam and single beam, it should be acceptable to have the TOPAS PS 18 transmit until the first bottom echo is returned. Using burst mode, it is possible to have several pulses transmitted during this period which is equal to the trigger delay. This operational mode is illustrated in Figure 5-35. After the last pulse in the burst is transmitted, the first observation window is returned. The maximum (or desired) number of pulses in the period is specified by the operator, and the system tries to squeeze in as many pulses as the steering parameters, power duty cycle and maximum ping rate permit.

Note

The number of pulses times the pulse length must be less than trigger delay and *the product must be less than the difference between the pin interval and the trigger delay.*

Of course, this will lead to non-uniform sampling of the bottom along track. However, the alternative in synchronized operation is to have just one ping per trigger pulse. Under many circumstances, this will just not be sufficient to image sediments. We think it is better to have several short segments of high along track resolution than to have uniform probing along track with poor resolution.

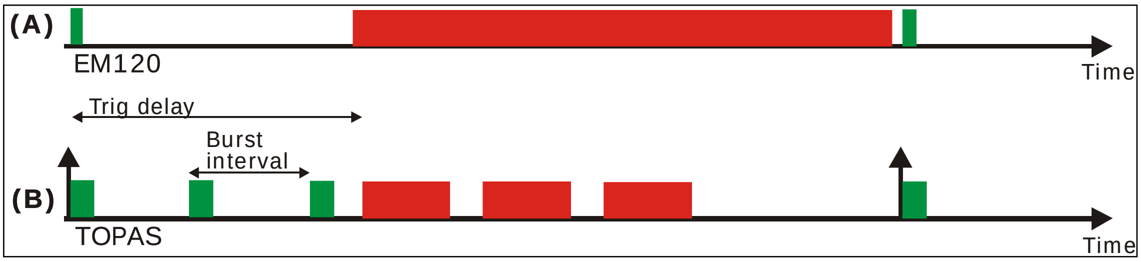


Figure 5-35 Burst mode.

This mode may be useful when the TOPAS PS 18 is synchronized with equipment with long receptions windows; typically a multibeam echo sounder. It is assumed that the TOPAS PS 18 is allowed to transmit until the first bottom return arrives. For each external trigger, the TOPAS PS 18 transmits as many burst pulses as possible under given constraints such as maximum duty cycle of the transmitter and the length of the reception windows. This gives a piecewise much denser sampling of bottom than the externally triggered normal mode would.

Multi-pulse operation (*Trig interval = Multi*)

When the system is triggered internally, there is no need to limit the period of transmission to the trigger delay of the ping. We can have transmission pulses and acquisition windows interlaced within one burst. In this way, bottom will be probed at a uniform rate provided vessel speed is constant. We refer to this operation mode as multi-pulse. The multi-pulse mode can provide high along track sampling rate almost independent of depth and vessel speed.

Sometimes the trigger delay changes so much that the timing of the burst pulses has to be changed. In order to avoid collisions between periods of transmission and periods of reception (which is necessary because we have combined transmitter/receiver channels), the TOPAS PS 18 will have to calculate a new ping interval and trigger delay.

To allow this adjustment of the trigger delay to take effect as fast as possible, the number of pulses allowed per burst will not exceed the number of pulses that can be transmitted during one acquisition delay. Consequently, the transmission period do not overlap with the corresponding reception period.

Note

Unless depth is input externally, one should not start pinging in Multi-pulse mode. Start pinging in normal mode, and stay in this mode until bottom is found. Then switch to Multi-pulse mode.

Note

There is a chance that the second return from one pulse will arrive in the reception window of another. Due to strong attenuation of the direct signal sub-bottom, the strongest parts of the second return may well be stronger than parts of the primary echo. Hence, the second return may appear as sediments with high reflection coefficients. Generally, it may be hard to tell when this happens. The exception is in rough weather, where these "false" sediments will be undulating because they will not be properly heave corrected. If the sub-bottom image changes "dramatically" when changing operating mode to Multi-pulse mode, this is an indication of a problem with second returns. To get out of this situation, change the number of burst pulses (or change an essential parameter) in order to obtain a different burst interval.

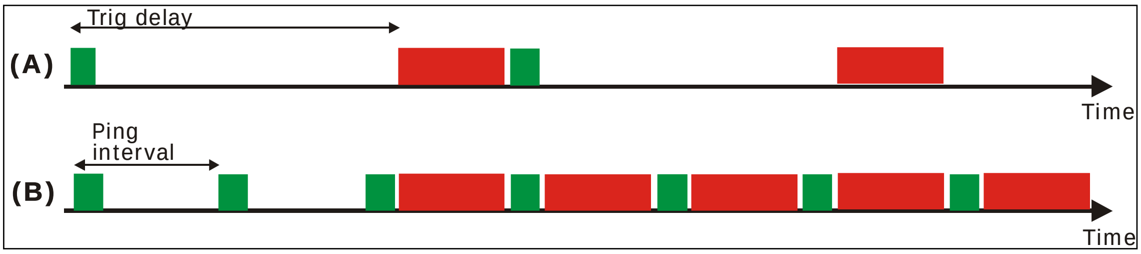


Figure 5-36 Multipulse mode.

In (A) we see how a timing scheme are composed for normal mode. can By allowing the next ping to start once the transmissions of the previous ping has finished, we may have a high uniform ping rate even in deep waters as shown in (B).

Calculate delay from depth

There is a parameter, *Delay control*, on the receiver parameters property sheet, which is set to *Automatic*, and the delay this is referring to is the trigger delay. Once the TOPAS PS 18 has found the bottom, the range found by the bottom tracker can be used to position the acquisition window. Two user configurable parameters determine how this feature will behave. There is the delay hysteresis that determines how much the bottom range must change before the trigger delay is adjusted, and there is the bottom screen position, which is controlling where in the acquisition window bottom should be positioned.

Unless external input depth/bottom range is used, the bottom tracker of the TOPAS PS 18 must be locked on to bottom before this feature can be enabled. That is; initially the operator must manually enter an acquisition delay and an acquisition window length that will contain the echo from the bottom. Once the bottom tracker is locked to bottom, the automatic mode can be enabled.

With bottom range input from Kongsberg EM MBES or another echo sounder, this automatic adjustment of acquisition window will function instantly.

This option should be enabled during most surveys. An exception is when the bottom tracker and/or the externally input depths are unreliable. This may be the case when the seafloor is changing abruptly or in rough weather conditions when air bubbles may block the acoustic signals. In such cases it might be necessary to enter the acquisition delay manually and perhaps also to use a long acquisition window.

Depth selector

The depth selector is used to choose the source to use for automatic adjustment of the trigger delay and ping interval. This selector is found under ”Acquisition” in the property area. The sequence of the ”depth from” items determines the priority of the depth sources. Further down in the chain means higher priority, which means that when ”depth from Bottom tracker 1” is below ”depth from external”, the preferred source of depth information is depths from the external depth reader.

Attitude compensation

Echoes are mainly caused by specular reflections, which are strong close to normal incidence. Because of the narrow beamwidths of the TOPAS PS 18, attitude corrections are necessary in order to maintain strong echoes when the ship is pitching and rolling. The transmit beam is tilted, accounting for the array installation angles and the ships attitude, aiming at keeping the beams vertically in global co-ordinates.

The data are heave corrected, accounting for heave at transmission and reception.

Bottom slope corrections

In sloping terrain, it is possible to have the Kongsberg MBES or similar MBEs calculating the bottom slopes along track and across track. This information is passed on to the TOPAS PS 18 operator unit, and the operator can choose to use this information to the steer the beam in order to obtain normal incidence. In this way, it is possible to maintain strong specular echoes in spite of the narrow beamwidth of the TOPAS PS 18.

6 SURVEY OPERATION - PRACTICAL INFO

In the following chapter a brief description on sub-bottom profiling with high resolution, narrow beam systems contra conventional systems is given. In addition, a practical description on possible problems encountered operating TOPAS systems together with other acoustic systems like single and multibeam echo sounders, and how a synchronising unit may reduce interference.

6.1 Sub-bottom profiling

In conventional sub-bottom profiling in the offshore industry, typical vessel speed is around 3 to 5 knots. The ping rate for sub-bottom profilers are set as high as possible (2 - 5 Hz) in order to get nice looking profiles, which are easier to interpret. The ping rate is in general limited by the two-way travel time and/or system duty cycle. In the North Sea area, this value is typically from 2 to 4 Hz. This results in an over-sampling of the seabed and gives a better visual picture of the recorded features in the sediment structures.

Increasing the speed reduces the effective sampling rate of the seabed and degrades the visual impression of the records. The same degradation will also occur when the ping rate is reduced which normally has to be done in deeper water.

Figure 6-1 shows the effect of a reduced efficient sampling rate on the seabed. The top part shows a "real" seabed profile. The second row shows outlines of footprints where the difference in effective sampling rate of the seabed equals a factor of four. The third row shows the same when the water depth is one third of the previous depth. The fourth row indicates what the recorder output (EPC etc.) may look like. Paper speed is the same in the two examples. The fifth row shows the effect of increasing the paper speed by a factor of four. It has been assumed that there is a well-defined return from the seabed. That may not be the case when the footprint is large compared to the structural details in the sediment/seabed. The returned echo is integrated over the footprint area. This will degrade the data quality in a real operation when the footprints are large which will be the case with wide beam systems or in deep-water operation.

It is obvious that a low sampling rate reduces the amount of details in the record. In addition, it makes it more difficult to interpret the recorded data.

Increasing the water depth will degrade the quality because the footprint is increased. This results in an echo, which is integrated over a larger area smearing out details that are less than the footprint size.

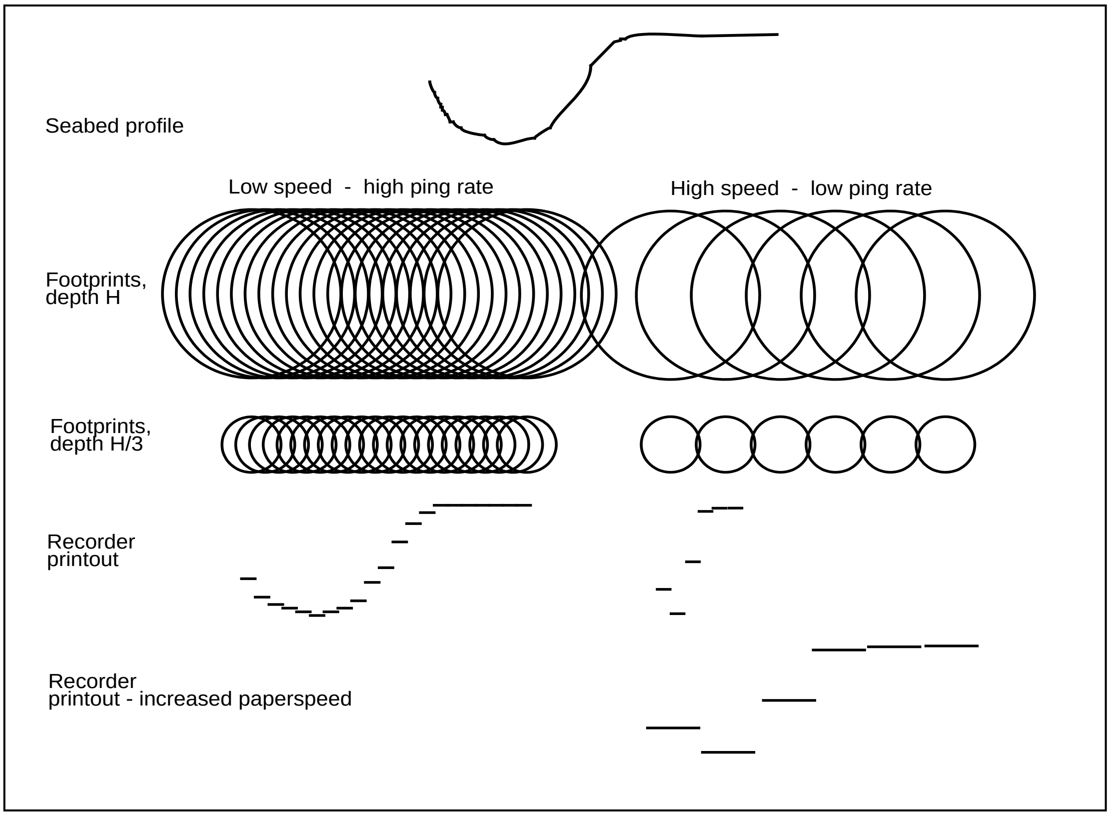


Figure 6-1 Schematic showing relationship between sampling rate, depth, details and resolution on graphical recorders.

6.1.1 Beam width - narrow / wide.

Narrow beam sub-bottom profiler systems gives very high lateral resolution and vice versa for wide beam systems, which shows a lot of refraction in areas with rough seabed and many details. In areas with slopes the result achieved with a wide beam system appears to be better than for the narrow beam system because the incident acoustic beam more often will insonify an area at 90 degrees angle of incidence. This gives rise to a stronger return in the direction of the receiver and hence, a better definition of the seabed. Although the return may not come from a location vertically down from the transducer. There may be a large offset in the XY-directions, typically some hundred meters in deep water with steep slopes. At 1000 meters water depth and a seabed slope of 10 degrees, the offset may be as large as 200 meters.

Figure 6-2 shows the situation with horizontal (top) and a sloping (10 degrees) seabed (lower). It is assumed that the seabed acts like a mirror on the acoustic signal. Normally this is not completely true. Lambert's law describes the angular dependence of acoustic scattering from a rough surface. According to this law the amount of backscattered signal as a function of angle of incidence can be described as $S_B = 10 \cdot \log \mu + 10 \cdot \log \sin^2 \theta$ where μ is a proportionality constant and θ is angle of incidence.

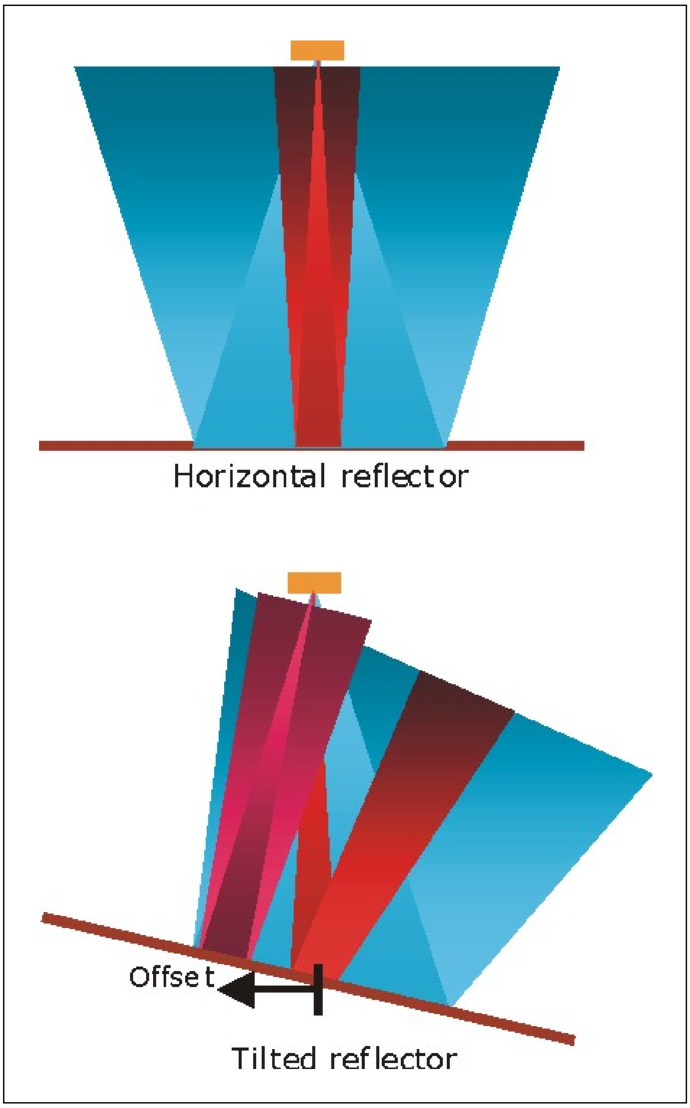


Figure 6-2 Narrow and wide beam systems used in horizontal and sloping areas. Blue assumes wide beam system and red indicates narrow beam system.

In the sloping case, the reflected narrow beam misses the receiver resulting in a poor signal-to-noise ratio and problems in detecting the seabed. The wide beam, however, does not miss the receiver although the reflected signal is coming from a different location than expected; see the lower part of Figure 6-2.

The TOPAS sub-bottom profiler systems are narrow beam systems with a beam width of around 5 degrees. One of the main features with these systems is very high spatial resolution. However, as explained previously, the narrow beam may result in reduction in signal quality in slopes.

What can be done to reduce the problems in slopes? There are two possibilities:

- Increase beam width
- Apply beam steering

Applying so called shading of the transducer may increase the beam width of the TOPAS system. The disadvantage is a reduction in source level with a correspondingly reduction in signal-to-noise ratio and a reduction in lateral resolution. Currently there is no operator interface for varying the beam width.

Beam steering may be used to direct the beam so that it hits the seabed at an angle of incidence of 90 degrees. The disadvantage is, however, that the operator needs information about the slope on the seabed at the current locations. Using slope information from a multibeam system can solve the latter task.

Without any kind of adjustments, TOPAS operation may give god results in slopes of 5 to 10 degrees depending on the roughness of the seabed and sediment interfaces. The results will be better if the roughness increases.

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6.2 Echo sounder - TOPAS PS 18 operation.

During survey operation where both EM 12x Multibeam Echo sounder and TOPAS PS 18 Sub-bottom Profiler are used, interference may occur. The EM 12x is most sensitive to this interference due to the automatic detection of the seabed. The interference on the TOPAS records is observed as a noisy ping and do not interfere severely with any processing.

The reason for the interference is that each system transmits acoustic pulses at a very high intensity at frequencies fairly close to each other. As an example, EM xxx uses a narrow frequency band around 12 kHz and PS 18 uses a broad frequency band around 18 kHz. The strong signals transmitted on one system tend partly to saturate the receivers on the other system, and for the EMxxx system, the reflected TOPAS 18 kHz signal from the seabed may enter into the receiver and if it is sufficiently strong, it may be interpreted as a “real” return.

The problem with interference can be avoided by using a synchronising unit, which controls the transmission from the various interfering systems by initiating a sequential transmission. In many cases, a parallel transmission may also be possible if the returned 18 kHz signal from TOPAS is not interfering with the EMxxx system. Figure 6-3 shows typical timing for TOPAS and EMxxx systems.

In order to have optimal performance for TOPAS system the ping rate should be high, typically 0.5 to 2 Hz in deep water. This means that multi-pulse operation is required. The EM xxx system operates at a much lower ping rate because it has to cover a much larger distance and multi-pulse operation is not possible. As seen from Figure 6-3 this causes interference. By synchronising the system, EM xxx will normally be the master. This results in a very low ping rate for the TOPAS system and consequently a degradation of the results. In a water depth of 1500 meters on flat seabed, the ping rate for the EM xxx may be around 0.1 to 0.2 Hz, which is typically 1/10th of the optimal rate for TOPAS in the same water depth. On the other hand, the vessel speed may be around 8 to 10 knots for EM xxx operation, while it should have been around 4 knots for optimal sub-bottom profiler operation. By combining these numbers, it is seen that the optimal effective sampling rate is reduced by more than a factor of 20.

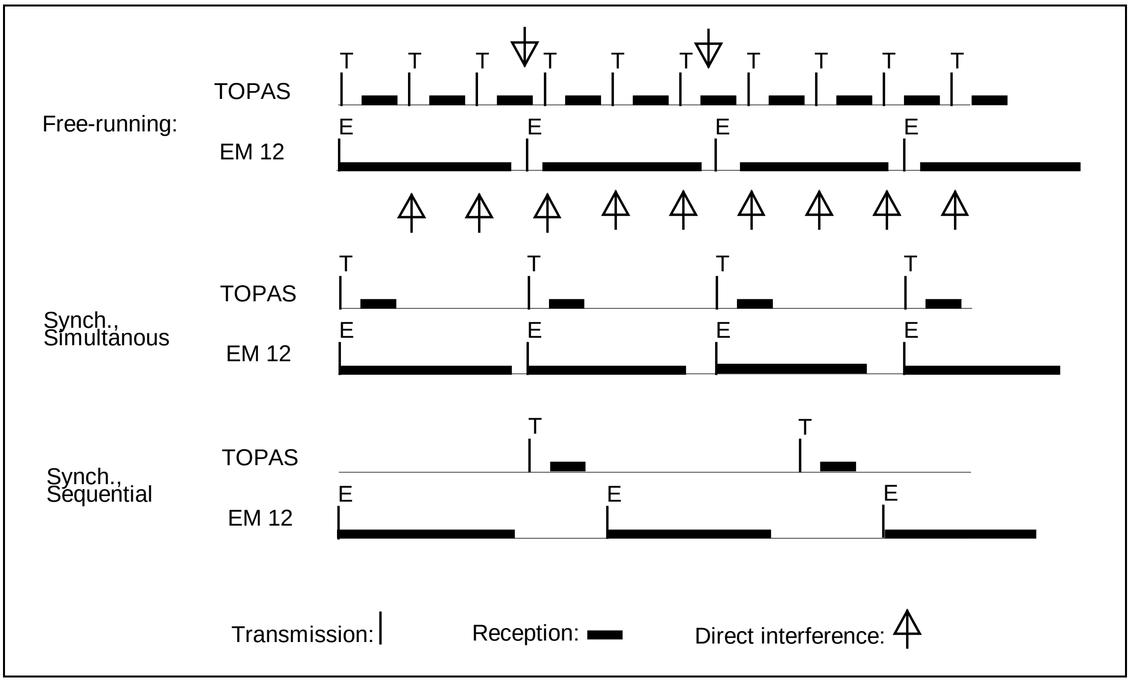

Figure 6-3 Timing diagram for TOPAS and EMxxx systems.

Is it possible to get around this problem? The problem can be reduced by compromising on vessel speed, level of interference etc. It can be completely avoided by running separate survey lines for the bathymetry and for the sub-bottom profiling. Alternatively, additional sub-bottom profiler lines may be run in areas, which are more critical to the following operations (cable laying etc.).

Another option, which will reduce the problem, may be to modify the transducer installation so the distance between the *EM xxx* and TOPAS transducers is increased considerably in order to reduce the level of direct interference. However, it may be difficult to find suitable locations regarding structural noise in the hull. However, this method will not, reduce problems with undesired seabed returns from the TOPAS primary signal.

6.3 Multi pulse operation.

In deep water, ping rate may become very low since maximum rate is limited by the two-way travel time for the acoustic pulse. This can be avoided by careful selection of a higher ping rate. The critical factor is not to transmit during reception of a previous ping. Figure 6-4 shows some a diagram indication how the ping interval depends on water depth and desires number of pings, **N**, in the water at the same time.

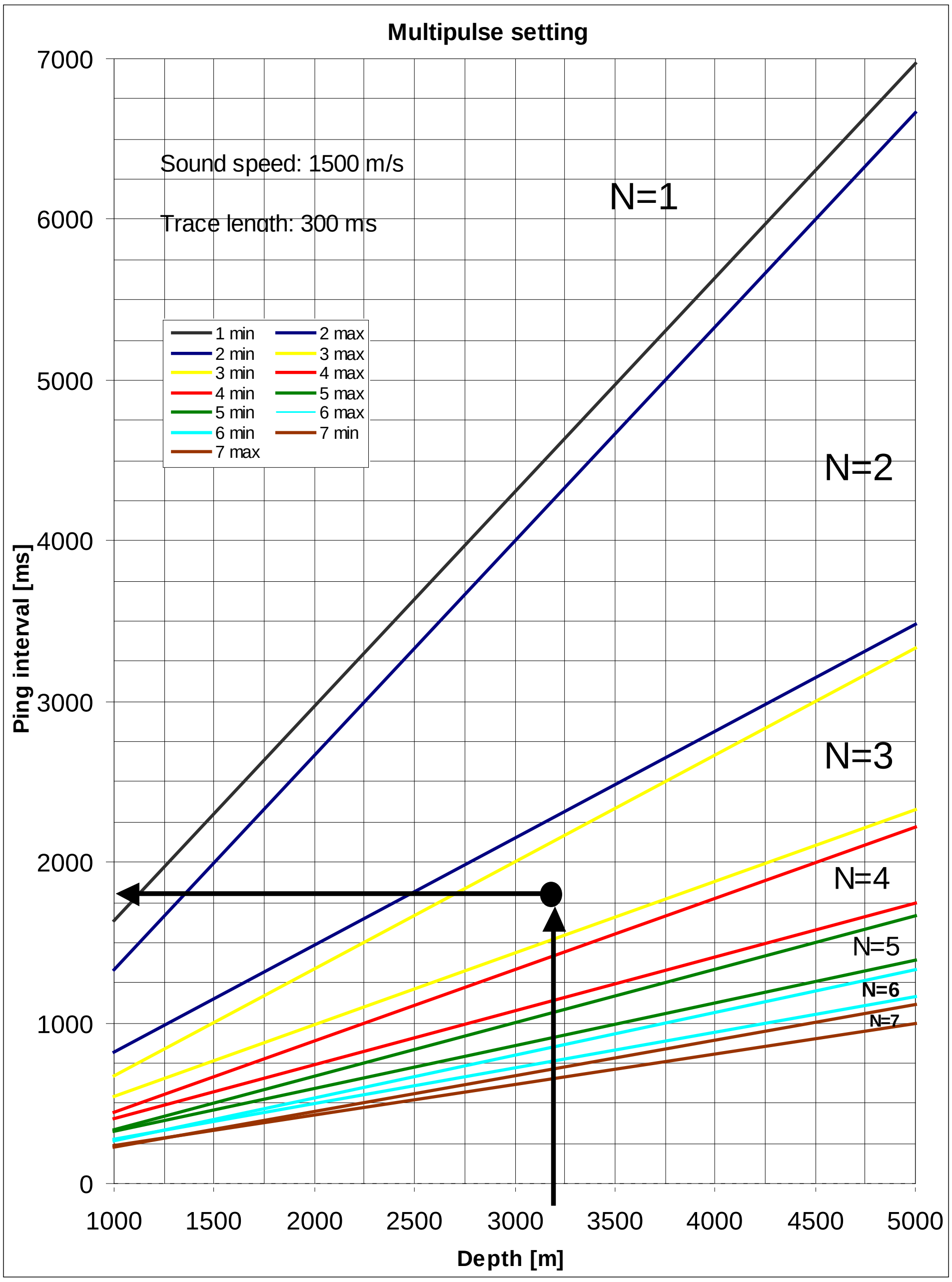

Figure 6-4 Multi pulse operation.

The curves presented here are estimated for trace lengths of 300 ms and sound velocity of 1,500 m/s.

How to use the diagram when you initiate multi ping:

1. Select the current water depth on the horizontal axis.
2. Move vertically into an area between two lines of the same colour. More pings in the water reduce the ping interval, but results in shorten periods between adjustments of the ping interval.
3. Then move to the left to find the ping interval.

How to use the diagram when multi ping is initiated:

1. By monitoring water depth, observe the location of crossing between the horizontal and the vertical arrow lines in the figure.
2. When this point gets close to one of the coloured lines, modify the ping interval so the point is located more centrally between lines of the same colour.
3. Continue with point 1.

7 APPENDIXES

7.1 TOPAS PS 18 Technical specifications

This chapter presents the main technical specifications of the TOPAS PS 18 Parametric Sub-bottom Profiler System. The information includes operational qualities, electronic design, power and environmental requirements and physical dimensions.

Note *The specifications may change without further notice!*

7.1.1 Overall specifications

Typical source level (4 kHz) .... >206 dB re μPa @ 1 meter

....(0.2 bar @ 1 meter)

Typical beamwidth .... 5 degrees @ 3 kHz

Output wavelets ..... CW, Ricker, Chirp (LFM) and Chirp (HFM)

Output modes..........................single pulse, multi pulse and burst

Range resolution .... < 0.25 meter

Penetration capability .... > 200 meters

............(depending on sediment, water depth and ambient noise)

Operational water depth .... <10 meters to Full Ocean depth

Data storage rate ....<2 Mbyte per min. @ 1 Hz ping rate *)

Sequential scanning sector .... 80 degrees (+/- 40 degrees)

High frequency channels (optional).. ~18 kHz primary frequency

....~36 kHz 2nd harmonic

*) Assuming approx. 4,000 samples per ping.

7.1.2 Transmission and reception

7.1.2.1 Transmitter

Primary operating frequency .... 15-21 kHz

Primary beam width .... 4.5 degrees

Primary source level (max).................. 243 dB re µPa @ 1 meter

Secondary frequency .... 0.5 to 6.0 kHz

Secondary beam width .... <5.5 degrees

.... (depending on frequency)

Secondary source level (typical) 185 to 208 dB re µPa @ 1 meter

.... (depending on frequency)

Sidelobe level .... no distinct sidelobes

Beam steering sector .... 80 degrees in 1-degree steps

Number of output channels .... 128 channels

Electrical output power .... >32 kVA

Ping interval .... 0.2 to 15 s

7.1.2.2 Receiver

Receiver sensitivity, LF version .... -185 dB re V/µPa

Receiver sensitivity, HF version (18 kHz) ..... -165 dB re V/µPa

Gain setting .... 0 to 72 dB in 6 dB steps

Bandpass filter, LF version .... 0.1 to 7 kHz

Bandpass filter, optional LF version .... 0.030 to 7 kHz

Bandpass filter, optional HF version .... 10 to 100 kHz

Max sampling frequency .... 300 kHz

Digital resolution .... 16 bits

Maximum number of receiver channels 3

7.1.3 Interfaces

Serial interfaces (RS232 or RS422) with operator controlled baud rate, parity, data and stop bit length for:

- Interface for vertical reference unit (roll, pitch and heave) in EM 3000 format.

Serial, UDP or TCP interface for:

- Navigation in either Simrad 90, CODA or NMEA 0183 GLL/GGA/GGK format.
- Speed, depth, slope and heading in either Simrad 90 or NMEA 183 VTG/DPT/HDT format.
- Data output in NMEA-like format. Parameters to send are configurable in the software.

Digital interfaces for:

- External trigger input (synch unit)
- Trigger output (synch unit)
- Blanking output (synch unit)
- Blanking input (synch unit)
- Transmitting output (synch unit)

Other interfaces:

- Parallel port, serial port and/or Ethernet interface for colour printer and line scan recorders:
  - EPC GSP-1086
  - EPC 9800
  - EPC HSP 100
  - Ultra 120
  - Epson ESC/P2 printers
    - Stylus Color 1520
  - PCL3 printers
    - HP Deskjet
    - HP Laserjet
  - PCL3GUI printers
    - HP Designjet 120

  - HP Designjet 130
- Analogue interfaces for line scan recorders (PC audio).
- Ethernet LAN

7.1.4 Electronic units

7.1.4.1 Transceiver unit

Complete transducer incl. mounting frame:

Width .... 1,142 mm

Length .... 1,140 mm

Height .... 260 mm

Weight excl. cable .... 525 kg

Weight incl. cable .... 637 kg

(Weight of frame.. 173 kg)

Transceiver cabinet:

Width .... 600 mm

Depth .... 756 mm

Height .... 1,188 mm

Weight .... ~170 kg

Optional receiver array (without frame):

Width .... ~150 mm

Length .... ~4500 mm

Height .... ~220 mm

Weight .... ~150 kg

Environmental:

Operating temperature .... 0 – 50 °C

Storage temperature .... -25 – 80 °C

Relative humidity .... 0 - 95% non-condensing

Power requirement (peak) .... 230 Vac, < 2,500 W, 50/60 Hz

7.1.4.2 Operator station

Operator station PC:.

Width .... 427 mm

Depth .... 480 mm

Height .... 127 mm

Weight .... 23 kg

Environmental:

Operating temperature .... 0 – 40 °C

Storage temperature .... -40 – 75 °C

Relative humidity .... 0 - 95% non-condensing

Power requirement .....115 Vac or 230 Vac, < 450 W, 60/50 Hz

LCD colour display:.

Width .... 483 mm

Depth incl. bracket... 179 mm

Height incl. bracket.. 509 mm

Weight .... 12 kg

Environmental:

Operating temperature .... -15 – 55 °C

Storage temperature .... -20 – 60 °C

Relative humidity (operating)............. 30 - 90% non-condensing

Relative humidity (storage) .... 10 - 90% non-condensing

Power requirement .... 115 or 230 Vac, 100 W, 60/50 Hz

7.2 SW Organisation

7.2.1 Introduction

The TOPAS system is based on the use of a standard PC as an operator console.

The TOPAS software is Java based. This means that in principle it can be run on any operative system using a native Java virtual machine and necessary libraries for communicating with the serial ports and parallel ports in the computer.

The data acquisition is performed by a National Instrument (NI) ADC board that is controlled by a single board computer (SBC) running Windows XP or Windows 7.

Two version of the receiving software exists:

- Standard receiver version, which communicates over the Ethernet with a SW module in the SBC that performs the data acquisition. This approach is used for higher throughput.
- Previous receiver version which uses NI software for setting up remote operation of the SBC based acquisition hardware. The NI software is set up for server – client operation. Communication with this unit is done via Ethernet. This approach works similar to having the acquisition hardware connected directly to the OPU PC.

The SW has been tested on Windows 7 (both 32 and 64 bit versions) and Windows XP platforms.

Note *The TOPAS software is protected by the HASP HL hardware based copy protection system. A USB key is needed to run the system!*

7.2.2 Software Structure – Operator PC

The following software must be installed on the operator station:

Java Runtime Environment (JRE), v. 1.6 or later

CommAPI software

HASP HL Driver, v. 1.2 or later

TOPAS software, v. 1.3 or later

(Optional) National Instrument NI-DAQ software version 6.9.3. (Previous receiver version).

Installing the JRE is done by default and the relevant folders are located in the **Program Files** folder. A typical structure for the JRE installation is shown in Figure 7-1.

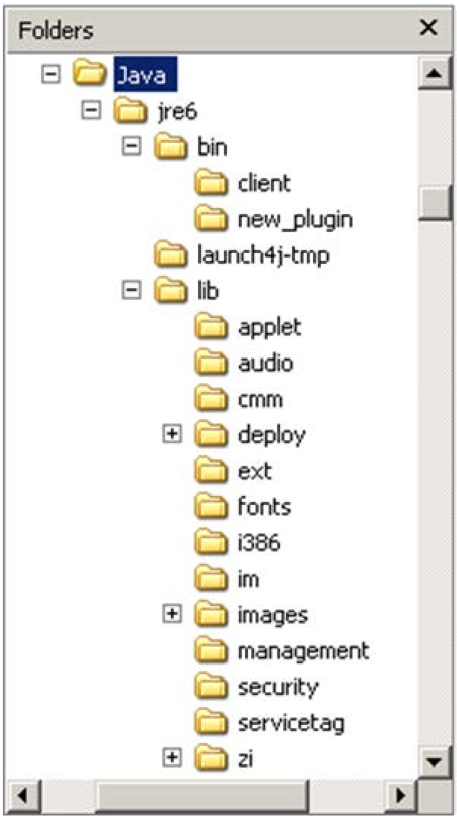

Figure 7-1 Example on file structure for the JRE.

Some additional files from the JRE/CommAPI-package are placed as follows in the JRE structure:

win32com.dll is copied to the **..\bin** directory

HASPJava.dll is copied to the **..\bin** directory

jproj.dll is copied to the **..\bin** directory

TopasKey.dll is copied to the **..\bin** directory

comm.jar is copied to the **..\lib\ext** directory

javax.comm.properties is copied to the **..\lib** directory

The HASP HL driver for the hardware key is installed by running the file: **HASPUserSetup.exe** in the HASP HL directory. All parameters are set to their default values.

Standard and MCR version receiver software:

The hosts-file on the computers should be updated with IP-addresses and corresponding system host name as follows (assuming default settings):

192.168.70.1 topas

192.168.70.2 RxTopas

192.168.70.4 RxMCR

Host file location is: **C:\WINDOWS\system32\drivers\etc**

Application software:

The TOPAS jar-file may be installed anywhere suitable in the directory structure, even in a different partition. The jar-file is compressed and contains all required application files.

Figure 7-2 shows the structure of the TOPAS directory.

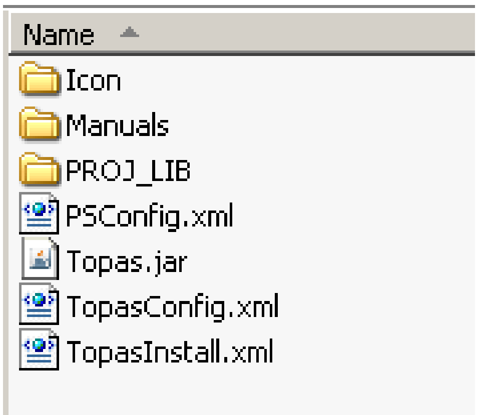

Figure 7-2 TOPAS directory structure.

The **PROJ_LIB** directory, containing the PROJ4 configuration files, must be placed in the same directory as the TOPAS.jar file, typically **C:\TOPAS**. However, the name and location of this directory may be defined by the user, and the shortcut has to be updated accordingly!

The **Icon** dicrtory contains the icon used in the shortcut.

The **Manuals** directory may contain the operator and maintenance manuals..

The TOPAS program is started by a shortcut to the jar-file. The shortcut may look like the one shown in Figure 7-3 where *Target* is:

"C:\Program Files\Java*jreX*\bin\java.exe" –Xms16m –Xmx1024m –jar Topas.jar *tx* *rx(a)(b)* …

where

X is 6 or 7 depending on JRE version.

tx is **TxMkii** for the PS 18 system.

rx is **RxMkii** for standard receiver and **RxEmEa** for multi channel receiver. If more than one receiver is used, the number of *rx* items should correspond to number of receivers. **RxDaq** is used for the previous receiver version.

(a) is optional and is used for modifying display buffer in order to scroll data through more pings. Default buffer size contains 1,600 pings. This size is changed by adding (a), where a is (*bufferSize*=desired buffer size in pings), to the RxMkii parameter <RxMkII(bufferSize=xxxx)>.

(b) is an optional parameters used on channel 2 or 3 in order to decouple the values of **Master trigger delay** parameter. Normally the delay value is common for all channels. To enable this use: *(commonMaster=false).*

The *Start in* field points to the directory where the **TOPAS.jar** file is located, normally **C:\TOPAS**.

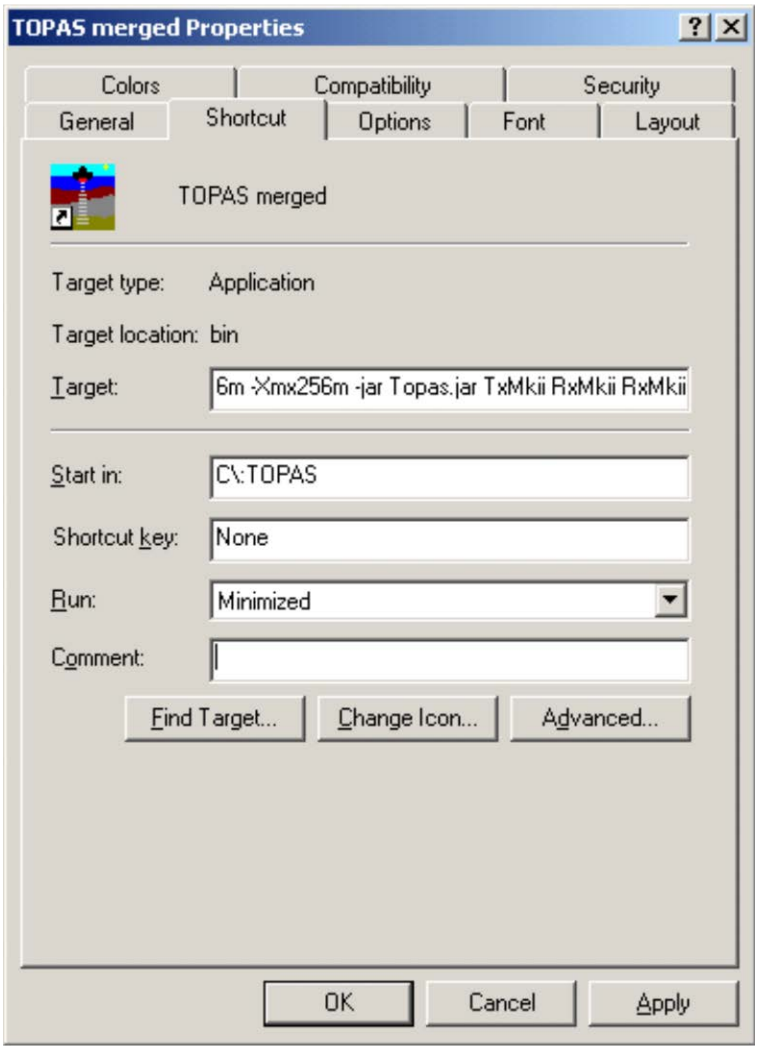

Figure 7-3 Example of shortcut properties for TOPAS SW.

<u>Previous version receiver software:</u>

The **DaqController.dll** file, which is used for communication with the ADC unit in the standard receiver, should be placed in the **..\bin** directory.

The NI-DAQ software must be installed and set up for accessing the remote NI acquisition boards. During installation of version 6.9.3, a menu for selecting features pops up, see Figure 7-4. Do not install features marked with **x**.

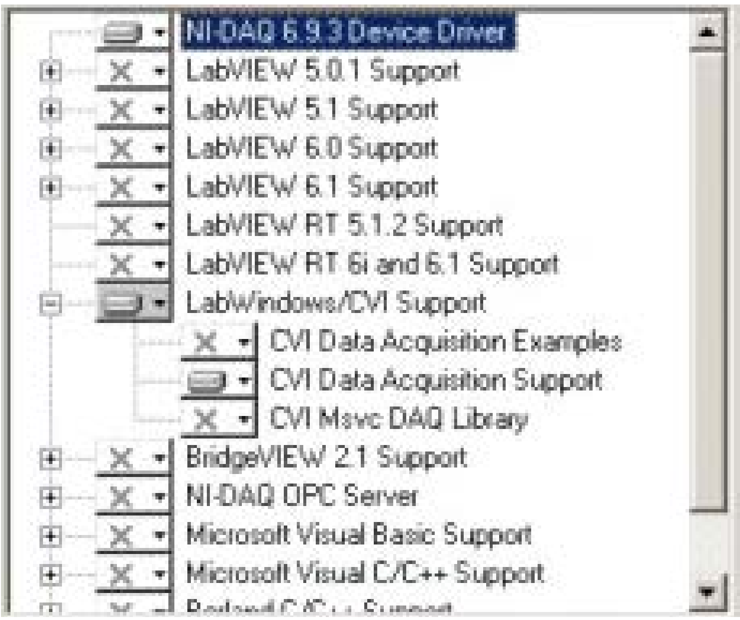

Figure 7-4 Feature selection during NI-DAQ installation, previous SW version.

After installation, the *Measurement & Automation* program must be started to configure the connection to the remote acquisition board. The configuration is done by *Devices and Interfaces* and then *Create New*. IP-address to the receiver unit is required!

7.2.3 Default IP-addresses

When delivered from KDS the following IP-addresses are implemented in the system (default names are shown in parenthesis):

192.168.70.1 Operator MMI computer (TOPAS)

192.168.70.2 Receiver single board computer (RxTopas)

192.168 70.3 Ethernet-to-RS232 converter in the transceiver cabinet.

192.168.70.4 Optional Multi channel receiver (RxMCR)

In some older installations, the following IP-addresses are used:

172.20.1.190 Operator MMI computer (TOPAS)

172.20.1.191 Receiver single board computer (RxTopas)

172.20 1.192 Ethernet-to-RS232 converter in the transceiver cabinet.

Note

When upgrading a system already using these addresses, just keep them!

7.2.4 UDP / TCP port numbers

In systems using UDP-ports for data acquisition and distribution, the proposed port numbers used in the system should be as follows:

Unit	**Port no.**	**Comments**
RxMkii	49999	Single channel receiver, LF
RxMkii	49999	Additional single channel no. 2 (optional)
RxMkii	49999	Additional single channel no. 3 (optional)
RxEmEa receiver	50001	Multi-channel receiver (optional)
Repeat Writer	50002	Recommended port for distributing TOPAS data blocks on the network
Repeat Reader	50002	Same port number as used on RepeatWriter. Used on “slave” systems in Repeat mode.
Printers	9100	Network printer port
SIS	4004	Interface port to SIS computer/application.

Table 7-1 Port numbers used in TOPAS

7.2.5 Software Structure – Receiver PC

Note

Access to the receiver PC can be achieved by connecting a separate keyboard, monitor and USB CD drive. Files may also be transferred from the operator PC to the receiver PC via the Ethernet connection.

The software on the receiver single board PC (SBC) depends on the system version; previous version or standard version.

The following software must be installed on the operator station:

- National Instrument NI-DAQ software version 6.9.3.
- Intel libraries (standard receiver)
- Component factory (standard receiver)
- Acquisition software (standard receiver)

The NI-DAQ software must be installed and set up for configuring the NI acquisition boards.

During installation of version 6.9.3, a menu for selecting features pops up, see Figure 7-5. Do not install features marked with X.

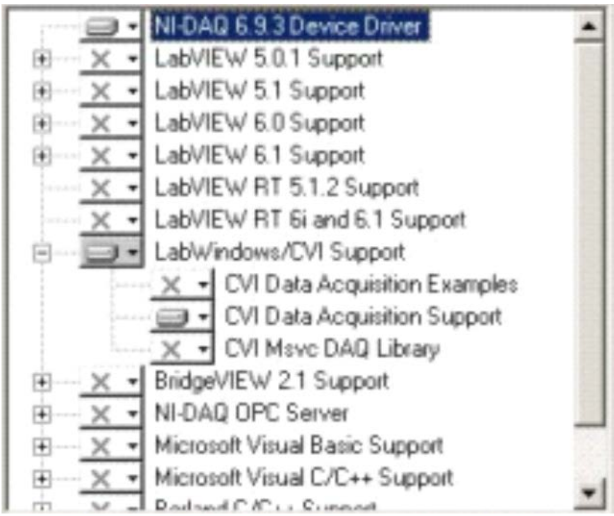

Figure 7-5 Feature selection during NI-DAQ installation, receiver PC.

After installation, the *Measurement & Automation* program must be started to establish contact with the installed A-to-D converter board(s).

Depending on system version, additional files may have to be installed.

Standard version

The Intel libraries must be copied to the receiver system SBC.

Also add the path to the Intel libraries to the Windows system environment variables. When the library is copied to the C-drive, a typical string would be:
C:\Intel\IPP\bin;C:\Intel\MKL\ia32\bin

The following two files should be copied to C:\:

ComponentFactory.exe

TopasReceiver.exe

The Component Factory application should be started automatically during the booting process.

Previous version

No additional files have to be installed. However, the NI Remote Device Access Server has to be added to the Start-up folder for automatic start-up when the SBC boots.

The hosts-file on the computers should be updated with IP-addresses and corresponding system host name as follows (assuming default settings):

192.168.70.1 topas

192.168.70.2 RxTopas

192.168.70.4 RxMCR

Host file location is: **C:\WINDOWS\system32\drivers\etc**

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7.3 Coordinate conversion

The TOPAS system normally receives position data from a GPS based navigation system. Such systems transmit positions in a NMEA 0183 format where they are given in latitude and longitude given in degrees and decimal minutes. Many users would like to have the positions in UTM or Cartesian coordinates which are more convenient in engineering work etc.

The coordinate conversion function, which is available from the **Survey info** menu under the **Acquisition tab**, is based on the PROJ.4 Cartographic Projections library.

The program *proj*, which in the TOPAS program is accessed as a library function, is a standard filter function which converts geographic longitude and latitude coordinates into Cartesian coordinates, $(\lambda, \varphi) \rightarrow (x, y)$, by means of a wide variety of cartographic projection functions. For many of the projection functions the inverse conversion, $(x, y) \rightarrow (\lambda, \varphi)$, can also be performed.

Cartographic characteristics of the projections are given minimal coverage in this manual and the reader should refer to Map Projections—A Working Manual (Snyder, 1987) and An Album of Map Projections (Snyder and Voxland, 1989) for more complete discussions.

Critical parameters are projection, ellipsoid, and zone number.

7.3.1 Map projections

The following list shows the projections available for the +proj argument:

Acronym:	Name:
aea	Albers Equal Area
aeqd	Azimuthal Equidistant
airy	Airy
aitoff	Aitoff
alsk	Mod. Stererographics of Alaska
apian	Apian Globular I
august	August Epicycloidal
bacon	Bacon Globular
bipc	Bipolar conic of western hemisphere
boggs	Boggs Eumorphic
bonne	Bonne (Werner lat_1=90)
cass	Cassini
cc	Central Cylindrical
cea	Equal Area Cylindrical
chamb	Chamberlin Trimetric
collg	Collignon
crast	Craster Parabolic (Putnins P4)
denoy	Denoyer Semi-Elliptical
eck1	Eckert I
eck2	Eckert II
eck3	Eckert III
eck4	Eckert IV
eck5	Eckert V
eck6	Eckert VI
eqc	Equidistant Cylindrical (Plate Caree)
eqdc	Equidistant Conic
euler	Euler
fahey	Fahey
fouc	Foucaut
fouc_s	Foucaut Sinusoidal
gall	Gall (Gall Stereographic)

Acronym:	**Name:**
geocent	Geocentric
gins8	Ginsburg VIII (TsNIIGAiK)
gn_sinu	General Sinusoidal Series
gnom	Gnomonic
goode	Goode Homolosine
gs48	Mod. Stererographics of 48 U.S.
gs50	Mod. Stererographics of 50 U.S.
hammer	Hammer & Eckert-Greifendorff
hatano	Hatano Asymmetrical Equal Area
imw_p	International Map of the World Polyconic
kav5	Kavraisky V
kav7	Kavraisky VII
krovak	Krovak
labrd	Laborde
laea	Lambert Azimuthal Equal Area
lagrng	Lagrange
larr	Larrivee
lask	Laskowski
latlong	Lat/long (Geodetic)
longlat	Lat/long (Geodetic)
lcc	Lambert Conformal Conic
lcca	Lambert Conformal Conic Alternative
leac	Lambert Equal Area Conic
lee_os :	Lee Oblated Stereographic
loxim	Loximuthal
lsat	Space oblique for LANDSAT
mbt_s	McBryde-Thomas Flat-Polar Sine (No. 1)
mbt_fps	McBryde-Thomas Flat-Pole Sine (No. 2)
mbtfpp	McBride-Thomas Flat-Polar Parabolic
mbtfpq	McBryde-Thomas Flat-Polar Quartic
mbtfps	McBryde-Thomas Flat-Polar Sinusoidal
merc	Mercator
mil_os	Miller Oblated Stereographic
mill	Miller Cylindrical
mpoly	Modified Polyconic
moll	Mollweide

Acronym:	Name:
murd1	Murdoch I
murd2	Murdoch II
murd3	Murdoch III
nell	Nell
nell_h	Nell-Hammer
nicol	Nicolosi Globular
nsper	Near-sided perspective
nzmg	New Zealand Map Grid
ob_tran	General Oblique Transformation
ocea	Oblique Cylindrical Equal Area
oea	Oblated Equal Area
omerc	Oblique Mercator
ortel	Ortelius Oval
ortho	Orthographic
pconic	Perspective Conic
poly	Polyconic (American)
putp1	Putnins P1
putp2	Putnins P2
putp3	Putnins P3
putp3p	Putnins P3'
putp4p	Putnins P4'
putp5	Putnins P5
putp5p	Putnins P5'
putp6	Putnins P6
putp6p	Putnins P6'
qua_aut	Quartic Authalic
robin	Robinson
rpoly	Rectangular Polyconic
sinu	Sinusoidal (Sanson-Flamsteed)
somerc	Swiss. Obl. Mercator
stere	Stereographic
tcc	Transverse Central Cylindrical
tcea	Transverse Cylindrical Equal Area
tissot	Tissot
tmerc	Transverse Mercator
tpeqd	Two Point Equidistant

Acronym:	Name:
tpers	Tilted perspective
ups	Universal Polar Stereographic
urm5	Urmaev V
urmfps	Urmaev Flat-Polar Sinusoidal
utm	Universal Transverse Mercator (UTM)
vandg	van der Grinten (I)
vandg2	van der Grinten II
vandg3	van der Grinten III
vandg4	van der Grinten IV
vitk1	Vitkovsky I
wag1	Wagner I (Kavraisky VI)
wag2	Wagner II
wag3	Wagner III
wag4	Wagner IV
wag5	Wagner V
wag6	Wagner VI
wag7	Wagner VII
weren	Werenskiold I
wink1	Winkel I
wink2	Winkel II
wintry	Winkel Tripel

Table 7-2 Map projections used in coordinate conversions

The default source projection used is:

+proj=**latlong** or +proj=**longlat**.

The default alternate projection used is:

+proj=**utm**.

7.3.2 Ellipsoids

The following list shows the ellipsoids available for the +ellps argument (a – semi major axis in meters, b – semi minor axis in meters, rf – reciprocal of flattening):

Acronym:	Semi major axis (a):	Semi minor axis (b), 1/flattening (rf):	Name:
MERIT	a=6378137.0	rf=298.257	MERIT 1983
SGS85	a=6378136.0	rf=298.257	Soviet Geodetic System 85
GRS80	a=6378137.0	rf=298.257222101	GRS 1980(IUGG, 1980)
IAU76	a=6378140.0	rf=298.257	IAU 1976
airy	a=6377563.396	b=6356256.910	Airy 1830
APL4.9	a=6378137.0.	rf=298.25	Appl. Physics. 1965
NWL9D	a=6378145.0.	rf=298.25	Naval Weapons Lab., 1965
mod_airy	a=6377340.189	b=6356034.446	Modified Airy
andrae	a=6377104.43	rf=300.0	Andrae 1876 (Den., Iclnd.)
aust_SA	a=6378160.0	rf=298.25	Australian Natl & S. Amer. 1969
GRS67	a=6378160.0	rf=298.2471674270	GRS 67(IUGG 1967)
bessel	a=6377397.155	rf=299.1528128	Bessel 1841
bess_nam	a=6377483.865	rf=299.1528128	Bessel 1841 (Namibia)
clrk66	a=6378206.4	b=6356583.8	Clarke 1866
clrk80	a=6378249.145	rf=293.4663	Clarke 1880 mod.
CPM	a=6375738.7	rf=334.29	Comm. des Poids et Mesures 1799
delmbr	a=6376428.	rf=311.5	Delambre 1810 (Belgium)
engelis	a=6378136.05	rf=298.2566	Engelis 1985
evrst30	a=6377276.345	rf=300.8017	Everest 1830
evrst48	a=6377304.063	rf=300.8017	Everest 1948
evrst56	a=6377301.243	rf=300.8017	Everest 1956
evrst69	a=6377295.664	rf=300.8017	Everest 1969

Acronym:	Semi major axis (a):	Semi minor axis (b), 1/flattening (rf):	Name:
evrstSS	a=6377298.556	rf=300.8017	Everest (Sabah & Sarawak)
fschr60	a=6378166.	rf=298.3	Fischer (Mercury Datum) 1960
fschr60m	a=6378155.	rf=298.3	Modified Fischer 1960
fschr68	a=6378150.	rf=298.3	Fischer 1968
helmert	a=6378200.	rf=298.3	Helmert 1906
hough	a=6378270.0	rf=297.	Hough
intl	a=6378388.0	rf=297.	International 1909 (Hayford)
krass	a=6378245.0	rf=298.3	Krassovsky, 1942
kaula	a=6378163.	rf=298.24	Kaula 1961
lerch	a=6378139.	rf=298.257	Lerch 1979
mprts	a=6397300.	rf=191.	Maupertius 1738
new_intl	a=6378157.5	b=6356772.2	New International 1967
plessis	a=6376523.	b=6355863.	Plessis 1817 (France)
SEasia	a=6378155.0	b=6356773.3205	Southeast Asia
walbeck	a=6376896.0	b=6355834.8467	Walbeck
WGS60	a=6378165.0	rf=298.3	WGS 60
WGS66	a=6378145.0	rf=298.25	WGS 66
WGS72	a=6378135.0	rf=298.26	WGS 72
WGS84	a=6378137.0	rf=298.257223563	WGS 84
sphere	a=6370997.0	b=6370997.0	Normal Sphere (r=6370997)

Table 7-3 Ellepsoide parameters.

The default source datum and alternate ellipsoid is: **WGS84**. This is the default parameter for GPS systems.

7.3.3 Cartesian units

The following units can be used for presenting the Cartesian data (UTM). The default is meter.

Acronym:	Equiv. meters:	Name:
km	1000	Kilometer
m	1	Meter
dm	01-Oct	Decimeter
cm	1/100	Centimeter
mm	1/1000	Millimeter
kmi	1852	International Nautical Mile
in	0.0254	International Inch
ft	0.3048	International Foot
yd	0.9144	International Yard
mi	1609.344	International Statute Mile
fath	1.8288	International Fathom
ch	20.1168	International Chain
link	0.201168	International Link
us-in	1./39.37	U.S. Surveyor's Inch
us-ft	0.30480061	U.S. Surveyor's Foot
us-yd	0.914401829	U.S. Surveyor's Yard
us-ch	20.11684023	U.S. Surveyor's Chain
us-mi	1609.347219	U.S. Surveyor's Statute Mile
ind-yd	0.91439523	Indian Yard
ind-ft	0.30479841	Indian Foot
ind-ch	20.11669506	Indian Chain

Table 7-4 Cartesian units used in coordinate conversions

7.3.4 The UTM zone parameter

The UTM zone is defined by the current position automatically. The value is in the range from 1 to 60. Each zone is 6 degrees wide. There are a few exceptions from this general rule which is shown in the figure presented on the next page.

Zone 1 is centred at 177 degree West and zone 60 is centred at 177 degree East. Zone 30 and 31 is centred at 3 degree West and 3 degree East, respectively.

Datum transformation to WGS84 can be done by introducing the parameter

+towgs86=x,y,z,x-rot,y-rot,z-rot,scale.

Either the first 3 are used or all 7 parameters are used. This parameter is added to the *Source projection* field.

The first three spatial translation parameters are given in meters, the next three rotational parameters are given in seconds of arc and the last scaling parameter is given in parts per million (ppm).

A typical command string for datum transformation of WGS84 to new datum and Clarke80 ellipsoid could be as follows:

Source projection:

+proj=latlong +datum=WGS84 +towgs84=140,-52,298

Alternate projection:

+proj=utm +zone=33 +ellps=clrk80

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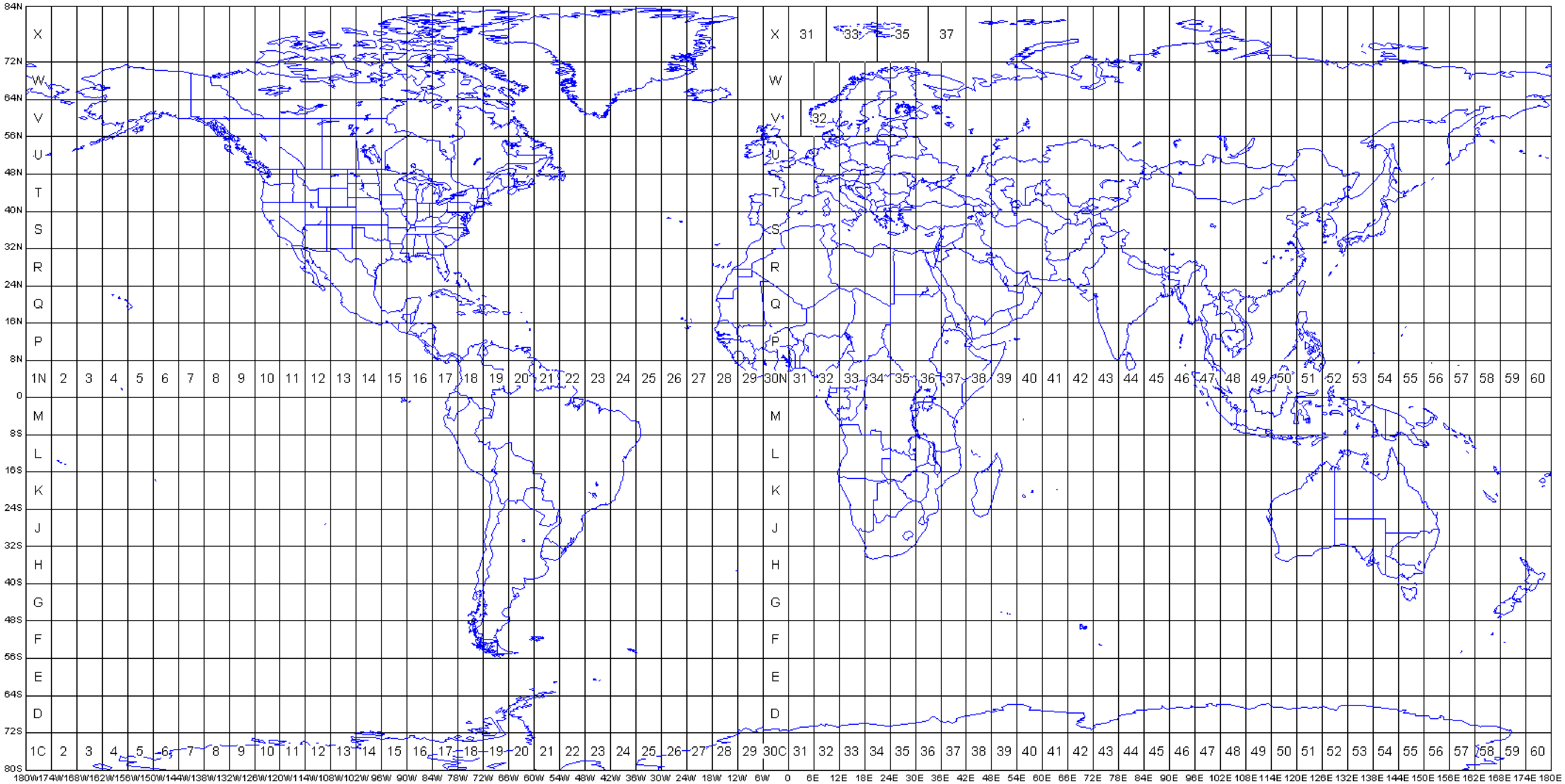
84N 72N 64N 56N 48N 40N 32N 24N 16N 8N 0 8S 16S 24S 32S 40S 48S 56S 64S 72S 80S
X W V U T S R Q P M L K J H G F E D
1N 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30N 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
1C 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30C 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
180W 174W 168W 162W 156W 150W 144W 138W 132W 126W 120W 114W 108W 102W 96W 90W 84W 78W 72W 66W 60W 54W 48W 42W 36W 30W 24W 18W 12W 6W 0 6E 12E 18E 24E 30E 36E 42E 48E 54E 60E 66E 72E 78E 84E 90E 96E 102E 108E 114E 120E 126E 132E 138E 144E 150E 156E 162E 168E 174E 180E

7.4 Time synchronization

TOPAS system normally uses date and time information from the internal PC clock. This relates to time tagging of received data traces, annotation of printouts, generating filenames etc. Accuracy of the PC master clock may vary considerably from the UTC time, which normally is used by other data acquisition systems on the vessel. There are basically three ways of synchronizing the time used by the TOPAS SW:

1. Synchronise the PC clock manually to an external time source.
2. Use a NTP server in the network.
3. Use the internal synchronization feature in the software.

The manual synchronization of the PC clock may result in accuracy within one second depending on how precise the operator is performing the operation.

Using a NTP server will keep the PC-clock at correct time all the time. Accuracy will depend on the master clock and delays in the network.

If the NMEA ZDA datagram is available from the navigation computer, UTC time may be used to generate the difference between the PC-clock and the UTC time. This difference will be used as an offset when the TOPAS SW uses the internal PC-clock for time tagging etc. Any abrupt, large changes in time difference will be adjusted smoothly at a rate of approximately 0.1% per second, which means it takes about 15 minutes to fully compensate the offset. Time differences of less than one second are ignored!

Use of the ZDA time is enabled/disabled in the *Master reader* or *Navigation reader* parameter sheet located under the Configuration tab when the datagram is available.

Note

TOPAS software will always use the GMT/UTC time adjusted for the current time zone setting and daylight saving time setting on the operator PC!

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7.5 Error messages

7.5.1 TOPAS transmitter messages

The TOPAS transmitter, the ParaSource, will produce a printout in the serial port monitoring window depending on what happens in the processor. These Runtime Error messages are described in the following.

The syntax of the messages is:

$xxRE,yyy,*C

where yyy is the error number and C is the checksum.

The following error codes are defined:

001 Unknown message received.

002 Received message too long.

003 Timeout for external trigger (30 s). Trigger mode have to be reinitialized.

004 VRU data with full accuracy.

005 Timeout for VRU communication (5 s).

008 Translation error in received message.

009 Duty cycle is too high for external trig pulses.

010 Ping interval is too short, results in overload (too high duty cycle)

011 Data from VRU has reduced accuracy.

012 Data from VRU is invalid.

013 Timeout for external analogue signal (30 s). Pulse form must be reinitialized.

014 Error in PLD on power amplifier boards.

015 200 VDC power not ready.

016 Not used!

017 Temperature reading out of range.

018 No external gating pulse for external signature.

019 Failed to load new signature to memory on power amplifier PCBs.

020 Error in VRU sensor.

1xx Fuse blown on power amplifier PCB no. xx.

2xx Acknowledgement error on power amplifier PCB no. xx.

3xx Acknowledgement missing from power amplifier PCB no. xx.

4xx High temperature on power amplifier PCB no. xx.

7.6 TOPAS File Format

In the following the data structure used for storing TOPAS data in TOPAS format is shown. The structure contains all necessary information for replaying a file containing data from a survey line.

There are four TOPAS formats which are slightly different. The program will be able to read all formats. But logging will only be done in format version 3.

TOPAS format version 3 is described in the following.

7.6.1 TOPAS format version 3

TOPAS format version 3, which is the newest format and which is now being used by the new PC-based TOPAS systems, is described below.

The block length in the file is varies with number of samples in a shot or ping. The size of one ping in number of bytes is: 384 + #samples • 4 bytes.

In the table shown below the following definitions are used:

- **byte** variables are defined as 1 bytes
- **short** variables are defined as 2 bytes
- **int** variables are defined as 4 bytes
- **long** variables are defines as 8 bytes
- **float** variables are defined as 4 bytes.
- **double** variables are defined as 8 bytes

Byte offset in record:	**Variable type:**	**Variable name:**	**Comment:**
0	short	ping_nr	Ping number in file; reset when new file
2	short	format	TOPAS format version = 3 (Old format version TOPAS = 0)
4	short	year	
6	short	month	
8	short	day	
10	short	hour	
12	short	min	
14	short	sec	

Byte offset in record:	**Variable type:**	**Variable name:**	**Comment:**
16	short	msec	
18	byte	file_name[16]	Original file name
34	byte	line_id [18]	Line identity
52	byte	customer [20]	Job name
72	short	ch_no	Channel number: 0 - 2 for 1 to 3 channels, respectively. Also used for file prefix when more than one channel is used
74	float	level	Transmitter amplitude level in dB relative max output (0 - -30 dB).
78	float	interval	Ping/shot interval (100 – 15,000 ms)
82	short	pulsform	0=No output pulse, 1=CW, 2=Ricker, 3=Chirp(LFM), 7=Chirp(HFM) 4=Upload, 5=Download
84	short	HRP_comp	Attitude compensation on/off (1/0)
86	float	sec_freq	CW/Ricker centre frequency (500 – 10,000 Hz)
90	float	chirp_start	Chirp start frequency (500 – 10,000 Hz)
94	float	chirp_stop	Chirp stop frequency (500 – 10,000 Hz)
98	float	chirp_length	Chirp mode: Chirp duration (1 – 100 ms) CW mode: Pulse length (ms)
102	short	correlated	0/1 = not correlated 2 = matched filtered/ spiking deconvolution
104	float	beam_dir_along	Beam pointing direction alongship (+/-10 deg relative to vertical; positive value

Byte offset in record:	Variable type:	Variable name:	Comment:
			is forward)
108	float	scan_sec_along	Beam scanning sector alongship (0 - 20 deg)
112	float	scan_step_along	Beam step size alongship (0 – 10 deg)
116	float	beam_dir_athwart	Beam pointing direction athwartship (+/-40 deg relative to vertical, positive value is toward port)
120	float	scan_sec_athwart	Beam scanning sector athwartship (0 – 80 deg)
124	float	scan_step_athwart	Beam step size athwarttship (0 – 10 deg)
128	double	lat_north	
136	double	lon_east	
144	double	zone_lon	
152	float	heading	Vessel heading (deg)
156	float	speed	Vessel speed (m/s)
160	short	system	0 = geo coord (Lat/Lon) 1 = UTM
162	short	zone_no	UTM zone
164	float	depth	Depth from transducer to the seabed (m)
168	float	tx_heave	Instantanous heave value at transmission (m)
172	float	tx_roll	Instantanous roll value at transmission (deg)
176	float	tx_pitch	Instantanous pitch value at transmission (deg)
180	float	rx_heave	Instantanous heave value at reception (m)
184	float	rx_roll	Instantanous roll value at reception (deg)
188	float	rx_pitch	Instantanous pitch value at reception (deg)

Byte offset in record:	**Variable type:**	**Variable name:**	**Comment:**
192	float	delay	Trigger delay from transmission to start acquisition (0 – 15,000 ms)
196	float	length	Trace duration (1 – 1,000 ms)
200	float	frequency	Sampling frequency (1 -300 kHz)
204	float	gain	Front-end user adjustable receiver gain (0 – 72 dB)
208	short	baseBand	0 = normal 1 = baseband (de-modulated / down sampled)
210	float	hp_filter	Front-end HP-filter setting (kHz)
214	float	lp_filter	Front-end LP-filter setting (kHz)
218	float	roll_dir	Instantanous tx beam direction, roll. (deg relative vertical; positive for port side up)
222	float	pitch_dir	Instantanous tx beam direction, pitch (deg relative vertical; positive for bow up)
226	float	transducerDraft	Transducer draft/depth below sea surface (m)
230	short	beamWidthTx	Dummy (used by SBP 120)
232	short	beamWidthRx	Dummy (used by SBP 120)
234	short	beamNumber	Dummy (used by SBP 120)
236	short	numberOfBeams	Dummy (used by SBP 120)
238	short	pulseShape	Dummy (used by SBP 120)
240	float	soundSpeed	Used in depth calculations (m/s)

Byte offset in record:	Variable type:	Variable name:	Comment:
244	int	traceInSurvey	Ping number in survey; reset when new survey name
248	int	traceInLine	Ping number in line; reset when new line
252	int	pingNumber	Ping number (used with SBP)
256	float	rxSensitivity	NA
260	float	sourceLevel	NA
264	short	externalDelay	External delay from CODA nav string
266	int	eventMarkCounter	Counter for FIX marks; >0 for external events, <0 for internat events.
270	float	KP	Kilometer point (CODA)
274	short	dummy[49]	
372	int	trace_size	Trace length when trace lengths are > 64k samples
376	short	trace_size	Trace length in # samples = sampling frequency * trace duration. For values >64k: = =0
378	float	trace [trace_size]	Trace samples array. The format is 4-byte float and values are typically between +/- 1.0 for RAW data.
378+4* trace_size	short	dummy[3]	
384+4* trace_size		EOR	End Of Record

Table 7-5 TOPAS format version 3.

Note

If the data is to be used on a PC-based system, remember to swap high byte and low byte of the 16-bit word when reading and writing the data file.

7.7 SEG Y file format

The TOPAS OPU can log data directly to SEG Y format revision 1. A description of the format and the options used by the program is presented in the following.

The file structure consists of the following

- 3200 byte ASCII file header
- 400 byte binary file header
- 240 byte trace header
- Trace data

Each ping will comprise of one set of trace header and trace data.

The first 3200-byte Textual File Header record contains 40 lines of textual information, providing a human readable description of the data in the SEG Y file. The information is in free form, however the standard do provide a suggested layout for the first 20 lines as indicated in the table below.

3200-byte textual ASCII file header:

C01 CLIENT: customer COMPANY: <none> CREW NO: <none>
C02 LINE: line_id[18] AREA: <none> MAP ID: <none>
C03 REEL NO: 1 DAY-START OF REEL: <none> YEAR: <none> OBSERVER: <none>
C04 INSTRUMENT: TOPAS MODEL: TOPAS SERIAL NO: <none>
C05 DATA TRACES/RECORD: 1 AUX.TRACES/RECORD: <none> CDP FOLD: 1
C06 SAMPLE INTERVAL: SAMPLES/TRACE: BITS/IN: 16 BYTES/SAMPLE: 2
C07 RECORDING FORMAT: FORMAT THIS REEL: MEASUREMENT SYSTEM:
C08 SAMPLE CODE: FLOATING PT CORRELATED
C09 GAIN TYPE: <none>
C10 FILTERS: <none>
C11 SOURCE: <none>
C12 PATTERN <none>
C13 SWEEP: START HZ END HZ LENGTH MS CHANNEL NO TYPE
C14 TAPER <none>
C15 SPREAD: <none>
C16 GEOPHONES: <none>
C17 PATTERN: <none>

C18 TRACES SORTED BY: <none>
C19 AMPLITUDE RECOVERY: <none>
C20 MAP PROJECTION <none>
C21 PROCESSING: <none>
C22 PROCESSING: <none>
C23 <none>

C38 <none>
C39 SEG Y REV1
C40 END TEXTUAL HEADER

Table 7-6 3200-byte textual ASCII file header

The 400-byte Binary File Header record contains binary values that affect the whole SEG Y file. The values in the Binary File Header are defined as two-byte or four-byte, two's complement integers. Certain values in this header are crucial for the processing of the data in the file, particularly the sampling interval, trace length and format code.

400-byte BINARY file header:

3201-3204 Job Identification number
3205-3208 Line number.
3209-3212 Reel/file number = 1
3213-3214 Number of data traces per ensemple = 1
3215-3216 Num aux.traces/rec = 0
3217-3218 Sample interval in microsec = 1,000,000/frequency
3219-3220 Samp.int in us of orig. field rec = 1,000,000/frequency
3221-3222 Num.samples/trace = trace_size
3223-3224 Num.samples/trace orig. recording = trace_size
3225-3226 Data sample format code = 5 (4-byte IEEE floating point) = 3 (2-byte IBM integer) = 1 (4-byte IBM floating point)
3227-3228 CMP fold = 1
3229-3230 Trace sorting code = 1 (as recorded)
3231-3232 Vertical sum code = 1 (linear, no sum)
3233-3234 Sweep freq.start = chirp_start
3235-3236 Sweep freq.stop = chirp_end
3237-3238 Sweep freq.length = chirp_length
3239-3240 Sweep type = Chirp_Type (LFM=1, HFM=2, Other=4)
3241-3242 Trace number of sweep channel = 0
3243-3244 Sweep trace taper length at start = 0
3245-3246 Sweep trace taper length at end = 0
3247-3248 Taper type: 3 (Other)
3249-3250 Correlated data trace = 1 (No=1, Yes=2)
3251-3252 Binary gain recovered = 2
3253-3254 Amplitude recovery method = 1
3255-3256 Measurement system = 1
3257-3258 Impulse signal = 2
3259-3260 Vibrator polarity code = 1
3261-3500 = 0 Unassigned
3501-3502 Revision no. = 0x0100
3503-3504 Fixed length trace flag = 1 (Fugro SegY format: 0)
3505-3506 No. of extended textual file headers = 0
3507-3508 Output power level = (TOPAS)
3509-3510 Scan sector athwart*10 = (TOPAS)

3511-3512 Scan step athwart*10 = (TOPAS)
3513-3600 = 0

Table 7-7 400-byte BINARY file header

The SEG Y trace header contains trace attributes, which are defined as two-byte or four-byte, two's complement integers. The values are relevant for modern signal processing, and they are limited and intended to provide information that may change on a trace-by-trace basis and the basic information needed to process and identify the trace.

240-byte BINARY trace header:

001-004	Trace sequence num within line = traceInLine
005-008	Trace sequence num within reel/file = ping_nr
009-012	Orig. field rec.no = traceInSurvey
013-016	Trace no. within original field rec = beam number
017-020	Energy source point no. = 0
021-024	CDP ensemble no. = 1
025-028	Trace no. within CDP ensemble no = beamnumber
029-030	Trace identification code = 1
031-032	Num.vertical summed traces yielding this one = 1
033-034	Num.horizontal summed traces yielding this = 1
035-036	Data use = 1
037-040	Distance from source point to receiver group = 0
041-044	Receiver group elevation = 0
045-048	Surface elevation at source = 0
049-052	Source depth below surface = transducer_draft
053-056	Datum elevation at receiver group = 0
057-060	Datum elevation at source: = 0
061-064	Water depth at source: depth = depth
065-068	Water depth at receiver group = 0
069-070	Scaler for elevations byte 41 = 1
071-072	Scaler for coords byte 73: if UTM -10 else -1000
073-076	Src coordx: lon_east, pos=east
077-080	Src coordy: lat_north, pos=north
081-084	Group coord. x: = 0
085-088	Group coord. y: = 0
089-090	Coordinate units = (UTM=1, Latlon=2)
091-092	Weathering velocity: = 0
093-094	Subweathering velocity = 0
095-096	Uphole time at source = 0
097-098	Uphole time at group = 0
099-100	Source static correction = 0

101-102	Group static correction = 0
103-104	Total static correction = 0
105-106	Lag time A = 0 (Fugro SegY format: CODA delay time)
107-108	Lag time B = 0
109-110	Sampling delay = trig delay
111-112	Mute time start = 0
113-114	Mute time end = 0
115-116	Number of samples in this trace = trace_size
117-118	Samp.int,usec for trace = 1000000/frequency
119-120	Gain type = 1
121-122	Instrument gain constant = Gain
123-124	Instrument early or initial gain = 0
125-126	Correlated yes/no: = 1
127-128	Sweep freq start = chirp_start
129-130	Sweep freq end = chirp_stop
131-132	Sweep length mSec = chirp_length
133-134	Sweep type: (LFM=1, HFM=2, Other=4)
135-136	Sweep traces taper length start ms = 0
137-138	Sweep traces taper length end ms = 0
139-140	Taper type = 3 (Other)
141-142	Alias filter freq = 0
143-144	Alias filter slope = 0
145-146	Notch filter freq = 0
147-148	Notch filter slope = 0
149-150	Low cut freq = hp_filter
151-152	High cut freq = lp_filter
153-154	Low cut slope = 6
155-156	High cut slope = 6
157-158	Year data recorded = year
159-160	Day of year = day of year
161-162	Hour of day = hour
163-164	Minute of hour = min
165-166	Second of minute = sec
167-168	Time basis code = (GMT=2, UTC=4)
197-200	FIX counter
201-202	= 1 Scalar for shot point; 197-200
203-204	= 0 Trace value measurement unit (Unknown)
205-210	= 0 Transduction constant
211-212	= 0 Transduction units (Unknown)
213-214	= Device/Trace identifier
215-216	= 1 Scalar to times in 95-114
217-218	= 0 Source Type Orientation (Unknown)
219-224	= roll_dir * 10 (TOPAS)
225-230	= 0 Source measurement
231-232	= 0 Source measurement unit (Unknown)

233-236	= pitch_dir * 10 (TOPAS)
237-238	= beamwidth_tx (BPS) (237– Fugro SegY format: KP*1,000)
239-240	= beamwidth_rx (BPS) (–240 Fugro SegY format: KP*1,000)

Table 7-8 240-byte BINARY trace header

The Trace Data follows each Trace Header. The seismic data in SEG Y file is organized as single traces.

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7.8 Datagrams

7.8.1 Introduction

The communication between the TOPAS series sub-bottom profilers and external devices is performed through an interchange of *datagrams*. These datagrams are described in this document.

The following datagram type is included:

Navigation input

- Data received from external navigation (positioning) systems.

Depth input/output

- Data received from external echo sounder systems or sent to external devices.

Attitude input

- Data received from external VRU systems.(binary format).

Slope input

- Data received from external bottom slope calculation source (EM MBES etc.).

RAW data output

- Data sent from the TOPAS system on TCP (binary format).

7.8.2 Description of the ASCII datagrams (NMEA)

The message part of the datagram is divided into several data fields, each consisting of one or more data bytes. The message part is described according to this form:

Description	Format	Valid range	Note
1)	2)	3)	4)

7.8.2.1 Message contents and definitions

1) **Description**

Short-form description of a data field.

2) **Format**

Note

This document uses a number and a lowercase h to describe a hexadecimal value. Example: 02h is equal to 2 in hexadecimal representation

This data field defines the coding of each unit. Two coding methods are used:

ASCII (American Standard Code for Information Interchange)

ASCII values are transmitted with the most significant byte first, i.e.:

Transmitted value 1234 = 31h32h33h34h

Byte 1: 31h

Byte 2: 32h

Byte 3: 33h

Byte 4: 34h

ASCII numeric values may be signed or unsigned. A signed value has a + (positive) or a - (negative) in its first byte. The value is signed if the table field *valid range* includes both positive and negative values.

ASCII numeric values may be with or without decimals. Decimal notation is either positional or by a decimal character. The decimal notation is positional if the maximum valid value, not counting the decimal, is equal to the number of bytes available. Otherwise, the value is given with a decimal point (.) included. The position of the decimal point is given in the field *valid range*.

BINARY

Binary values are transmitted with the least significant byte first, i.e.:

Transmitted value: 1234 = 04D2h

Byte 1: D2h

Byte 2: 04h

Binary values may be signed or unsigned. A signed negative value is given in two's complement representation. Unsigned values may use all bits for positive representation of a number. The value is signed if the field *valid range* includes both positive and negative values.

3) **Valid range**

The valid range field defines a units valid range in the format defined by the *format* field. Text enclosed by <> is used for describing the contents and not the actual value (i.e. <TEXT> is a text string consisting of any character in the current format). _ is used as notation for a space.

4) **Note**

Corresponds to notes applicable to the table.

In the Simrad90 format a Length value is also included in the table. This defines the parameter length in bytes.

7.8.3 Datagram input

7.8.3.1 General

The TOPAS series of sub-bottom profilers support input from a range of positioning systems. This document describes the datagram formats accepted by the TOPAS series.

Positioning datagrams are accepted on the RS-232 serial line or UDP ports on the Operator Unit.

Recommended serial port setup is *4800 baud, 8 data bits, 1 stop bit, no parity,* except where noted. This baud rate is high enough for the accuracy required and the necessary throughput and it is low enough to avoid errors that might occur due to computer workload.

The following formats are accepted:

- Simrad 90 (Position, heading and speed) (Obsolete)
- CODA (position, Kp, speed, heading, line, fix, delay, time and date.) (Fugro)
- NMEA 0183 format
    - GLL (Position)
    - GGA (Position, time)
    - GKK (Position)
    - RMC (Position and speed)
    - ZDA (Time)
    - HTD (Heading)
    - VTG (Speed)
    - DPT (Depth)
    - SRV (Bottom slope)
- Simrad EM3000 and EM1000 (VRU)
- Atlas Fansweep 20
- TOPAS RAW data

7.8.3.2 Simrad 90 position input

This input format is supported on all systems. It is the recommended format with the TOPAS sub-bottom profiler.

Structure of Simrad 90:

Description	Format	Length	Valid range	Note
Start character = $	Always 24h	1	-	-
Talker identifier	aa	2	Capital letters	-
Sentence formatter	Always S90,	4	-	-
Date of position	DDMMYY,	7	010100 to 311299	-
UTC of position as hour, minute, second, second/100	hhmmssss,	9	00000000 to 23595999	-
Latitude in degree, minutes and decimal minutes	xxxx.xxxx	9	0000.0000 to 9000.0000	A
Hemisphere identifier	a,	2	N or S	A
Longitude in degree, minutes and decimal minutes, or depth in meters	xxxxx.xxxx	10	00000.0000 to 18000.0000	A
Hemisphere or depth indetifier	a.	2	E, W or D	
Northing or range in meters	xxxxxxxxx.x,	12	000000000.0 to 999999999.9	B
Easting or range in meters	xxxxxxx.x,	10	0000000.0 to 9999999.9	B
UTM zone number	xx,	3	01 to 60	-
User defined central meridian longitude or bearing	xxxxx.xxxx	10	00000.0000 to 35999.9999	C
Hemisphere or bearing identifier	a,	2	E, W or B	C
System descriptor	x,	2	0 to 7 ,	1
Fix quality indicator	x,	2	0 to 9 and A to F	2
Speed over ground in m/s	xx.x,	5	00.0 to 99.9	3
Heading over ground in degrees	xxx.x	5	000.0 to 359.9	3
End of sentence delimiter = ,CRLF	Always 2Ch 0Dh 0Ah	3	-	-

Table 7-9 Structure of Simrad 90 telegram.

Note 1

Value of system descriptor defines content of datagram as follows. (Note that the Kongsberg TOPAS sub-bottom profiler systems will only accept values less than 3):

- 0 The position is longitude latitude in global coordinates given in the fields noted A.

- 1 The position is Northing Easting on the Northern hemisphere given in the fields noted B. If the projection is defined to be UTM the UTM zone number or a user definable central meridian longitude may be given in the field noted C.

- 2 As for system descriptor equal to 1, but the position is on the Southern Hemisphere.

- 3 As for system descriptor equal to 0, but in addition the depth is given in the Easting field noted B.

- 4 As for system descriptor equal to 1, but in addition the depth is given in the longitude field noted A.

- 5 As for system descriptor equal to 2, but in addition the depth is given in the longitude field noted A.

Note 2

The position fix quality given in the position output datagram will be derived from the quality indicator (this differs from the original definition of the format) as follows (in m):

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
0.01	0.02	0.05	0.1	0.2	0.5	1	2	5	10	20	50	100	200	500	1000

Note 3

If these fields have valid values they will be copied to equivalent fields in the position output datagram. They may be used in filtering of the positioning during postprocessing. (The original definition of the format had line heading in the course field and its use was to orient real-time displays).

7.8.3.3 CODA position input

This input format is supported on all systems.

Structure of CODA:

Description	Format	Valid range	Note
Start characters	Always CODA	Capital letters	-
Easting	x.x	0.0 -	-
Northing	x.x	0.0 -	-
Kp	x.x	0 -	-
Vessel speed	x.x	0.0 -	-
Vessel heading	x.x	0.0 – 360.0	-
Line name	a	-	-
Fix number	n	0 -	-
Delay	x.x	-	-
Time	hhmmss		
Date	ddmmyyyy		

Note *All fields are separated by one space!*

7.8.3.4 NMEA 0183 position input

The GLL, GGA, RMC, ZDA, HDT and VTG datagrams are supported on all systems.

Structure of GLL:

Description	Format	Valid range	Note
Start character = $	Always 24h	-	-
Talker identifier	aa	Capital letters	-
Sentence formatter	Always GLL,	-	-
Latitude in degrees and minutes, plus optional decimal minutes	llll.ll,	0000 to 9000.0...	-
Hemisphere	a,	N or S	-
Longitude in degrees and minutes, plus optional decimal minutes	yyyyy.yy,	00000 to 18000.00	-
Hemisphere	a	E or W	-
Checksum	*hh	-	-
End of sentence delimiter = CRLF	Always 0Dh 0Ah	-	-

Table 7-10 Structure of the NMEA 0183 GLL telegram.

Structure of GGA:

Description	Format	Valid range	Note
Start character = $	Always 24h	-	-
Talker identifier	aa	Capital letters	-
Sentence formatter	Always GGA,	-	-
UTC of position	hhmmss.ss,	000000 to 235959.9...	-
Latitude in degrees and minutes, plus optional decimal minutes	llll.ll,	0000 to 9000.0...	-
Hemisphere	a,	N or S	-
Longitude in degrees and minutes, plus optional decimal minutes	yyyyy.yy,	00000 to 18000.00	-
Hemisphere	a,	E or W	-
GPS quality indicator	x,	0 to 8	1
Used satellites	xx,	00 to 12	-
HDOP	x.x,	0 to	1
Antenna altitude re mean sea level	x.x,	-	2
Units of antenna altitude	M,	-	-
Geoidal separation	x.x,	-	2
Units of separation	M,	-	-
Age of DGPS data	x.x,	-	-
DGPS station ID	xxxx	0000 to 1023	-
Checksum	*hh	-	-
End of sentence delimiter = CRLF	Always 0Dh 0Ah	-	-

Table 7-11 Structure of the NMEA 0183 GGA telegram

Note 1

The HDOP (Horizontal Dilution Of Precision) value will be scaled and copied to the ”Measure of position fix quality” field in the position output datagram. The scale factor depends upon the GPS quality indicator’s value:

• 1 - (SPS or standard GPS) => 1000

• 2 - (differential GPS) => 100

• 3 - (PPS or precise GPS) => 200, but 10 if GGA is treated as RTK. (See Note 2)

• 4 - (kinematic GPS with fixed integers) => 10

• 5 - (kinematic GPS with floating integers) => 50

• 6 - (estimated or dead reckoning mode) => 1000

• 7 - (manual input mode) => 1000

• 8 - (test mode) => 1000, but 10 if GGA is treated as RTK. (See Note 2)

• The ”Measure of position fix quality” field will be set to 65534 (largest valid number) if the indicator is zero (non-valid position).

This scaling is used to give at least a relatively correct position fix quality change (in the order of cm) if there are dropouts in differential, precise or kinematic measurements, although HDOP is not a meter value.

Note 2

When the quality factor is 4 or 5 a height output datagram is automatically generated, and also if the quality factor is 3 or 8 and the operator has set the GGA position to be an RTK position. The height is the sum of these two fields which are assumed positive upwards (antenna above geoid).

Structure of GGK:

Description	Format	Valid range	Note
Start character = $	Always 24h	-	-
Talker identifier	aa	Capital letters	-
Sentence formatter	Always GGK,	-	-
Time of position	hhmmss.ss,	000000 to 235959.9...	-
Datae of position	MMDDYY,	010100 to 123199	-
Latitude in degrees and minutes, plus optional decimal minutes	llll.lllll,	0000 to 9000.0...	-
Latitude – N/S	a,	N or S	-
Longitude in degrees and minutes, plus optional decimal minutes	yyyyy.yyyyyy,	00000 to 18000.00	-
Longitude – E/W	a,	E or W	-
GPS quality indicator	x,	0 to 3	1
Number of satellites in use	xx,	00 to 12	-
DOP	x.x,	-	1
Antenna ellipsodial hight	x.x,	-	-
Units of ellepsodial hight	M,	-	-
Units of ellepsodial hight	x.x,	-	-
Checksum	*hh	-	-
End of sentence delimiter = CRLF	Always 0Dh 0Ah	-	-

Table 7-12 Structure of the NMEA 0183 GGK telegram

Note 1

The DOP (Dilution Of Precision) value will be scaled and copied to the ”Measure of position fix quality” field in the position output datagram. The scale factor depends upon the GPS quality indicator’s value:

• 1 - (SPS or standard GPS) => 1000

• 2 - (differential GPS) => 100

• 3 - (kinematic GPS with fixed integers) => 10

The “Measure of position fix quality” field will be set to 65534 (Largest valid number) if the indicator is zero (non-valid position).

This scaling is used toi give at least a relaitive correct position fix quality change (in cm) if there are dropouts in differential, precise and kinematic measurements, although DOP is not a meter value.

The GPS manufacturers may have different GPS quality indicators.

Structure of RMC:

Description	Format	Valid range	Note
Start character = $	Always 24h	-	-
Talker identifier	aa	Capital letters	-
Sentence formatter	Always RMC,	-	-
UTC of position fix	hhmmss.ss,	000000 to 235959.9...	-
Data status	a,	A or V	
Latitude in degrees and minutes, plus optional decimal minutes	llll.ll,	0000 to 9000.0...	-
Hemisphere	a,	N or S	-
Longitude in degrees and minutes, plus optional decimal minutes	yyyyy.yy,	00000 to 18000.00	-
Hemisphere	a,	E or W	-
Speed over ground in knots	x.x,	0 to 99.9	
Course made good in degrees	x.x,	0 to 359.9	
Date	ddmmyy,	010100 to 311299	
Magnetic variation in degrees	x.x,	-180.0 to 180.0	
Hemisphere	a	E or W	
Checksum	*hh	-	-
End of sentence delimiter = CRLF	Always 0Dh 0Ah	-	-

Table 7-13 Structure of the NMEA 0183 RMC telegram

Structure of HDT (Heading datagram):

Description	Format	Valid range	Note
Start character = $	Always 24h	-	-
Talker identifier	aa	Capital letters	-
Sentence formatter	Always HDT,	-	-
Heading, degrees true	x.x,T	0 – 359.9	-
Checksum	*hh	-	-
End of sentence delimiter = CRLF	Always 0Dh 0Ah	-	-

Table 7-14 Structure of the NMEA 0183 HDT telegram

Structure of VTG (Speed datagram):

Description	Format	Valid range	Note
Start character = $	Always 24h	-	-
Talker identifier	aa	Capital letters	-
Sentence formatter	Always VTG,	-	
True course over ground	x.x,T,	0 – 359.9	1
Magnetic course over ground	x.x,M,	0 – 359.9	1
Speed, knots	x.x,N,	0 -	1
Speed, km/hour	x.x,K,	0 -	1
Mode indicator	a	A,D,E,M,S or N	-
Checksum	*hh	-	-
End of sentence delimiter = CRLF	Always 0Dh 0Ah	-	-

Table 7-15 Structure of the NMEA 0183 VTG telegram

Note 1

Only true course and the first valid speed field will be used.

Structure of DPT (Depth datagram):

Description	Format	Valid range	Note
Start character = $	Always 24h	-	-
Talker identifier	aa	Capital letters	-
Sentence formatter	Always DPT,	-	-
Depth from transducer in meter	x.x,	0.1 -	-
Offset of transducer from waterline	x.x,	0 -	1
Maximum range scale in use	x.x	-	-
Checksum	*hh	-	-
End of sentence delimiter = CRLF	Always 0Dh 0Ah	-	-

Table 7-16 Structure of the NMEA 0183 DPT telegram

Note 1

A negative value implying that the offset is from the keel should not be used.

Note *The DPT datagram is also used for sending depth information on the RS232 port to external hardware.*

Structure of DBS (Depth below surface datagram):

Description	Format	Valid range	Note
Start character = $	Always 24h	-	-
Talker identifier	aa	Capital letters	-
Sentence formatter	Always DBS,	-	-
Depth from surface in feet	x.x,f,	0.1 -	1
Depth from surface in meters	x.x,M,	0.1 -	1
Depth from surface in Fathoms	x.x,F	0.1 -	1
Checksum	*hh	-	-
End of sentence delimiter = CRLF	Always 0Dh 0Ah	-	-

Table 7-17 Structure of the NMEA 0183 DBS telegram

Note 1

The decoding priority will be meter field, feet field and fathom field with the depth value extracted from the first field with valid data.

Structure of DBT (Depth below transducerdatagram):

Description	Format	Valid range	Note
Start character = $	Always 24h	-	-
Talker identifier	aa	Capital letters	-
Sentence formatter	Always DBS,	-	-
Depth from surface in feet	x.x,f,	0.1 -	1
Depth from surface in meters	x.x,M,	0.1 -	1
Depth from surface in Fathoms	x.x,F	0.1 -	1
Checksum	*hh	-	-
End of sentence delimiter = CRLF	Always 0Dh 0Ah	-	-

Table 7-18 Structure of the NMEA 0183 DBT telegram

Note 1

The decoding priority will be meter field, feet field and fathom field with the depth value extracted from the first field with valid data.

Structure of ZDA (UTC time datagram):

Description	Format	Valid range	Note
Start character = $	Always 24h	-	-
Talker identifier	aa	Capital letters	-
Sentence formatter	Always ZDA,	-	-
UTC	hhmmss.ss,	000000 – 235959.99	-
Day of month	xx,	01 to +31	-
Month of year	xx,	01 to +12	-
Year	xxxx,	0000 to 9999	-
Local zone hours	xx,	-13 to +13	1
Local zone minutes	xx	00 to +59	1
Checksum	*hh	-	-
End of sentence delimiter = CRLF	Always 0Dh 0Ah	-	-

Table 7-19 Structure of the NMEA 0183 ZDA telegram

Note 1

Local zone time is not used. An offset time may be entered by the operator to get the system clock to show a different time than UTC.

7.8.3.5 NMEA type bottom slope input

The SRV datagram is supported on all systems.

Structure of SRV (Bottom slope):

Description	Format	Valid range	Note
Start character = $	Always 24h	-	-
Talker identifier	aa	Capital letters	-
Sentence formatter (Slope, Range, Velocity)	SRV,	-	-
Slope along ship in degrees	BSX=x.x,	-40.0 to 40.0	1
Slope across ship in degrees	BSY=x.x,	-40.0 to 40.0	1
Slope quality estimate factor [%]	QEF=x.x,	0 to 1.0	1
Bottom Incidence Range re reference point [ms]	BIR=x.x,	0 to 10,000	
Normal Incidence Range re reference point [ms]	NIR= x.x,	0 to 10,000	
Speed of sound at transducer [m/s]	SST= x.x,	1000 to 2000	2
Average speed of sound in water column [m/s]	SSA= x.x,	1000 to 2000	3
Speed of sound at bottom [m/s]	SSB= x.x,	1000 to 2000	
Source of SRV information	EMX=x- -x,		4
Duration of EM transmission	EMD=x.x		
Checksum	*hh	-	-
End of sentence delimiter =CRLF	0Dh0Ah	-	-

Table 7-20 Structure of the special SRV telegram

Note 1

The bottom slope angles are calculated by fitting EM xxx data to a plane. The quality factor QEF is (100 times the standard deviation of the distance between the detections and the plane) / (bottom incidence range in meters), meaning that if the data fit the plane perfectly – a very unlikely event – the QEF will be zero. If the standard deviation is 2 meters and the depth straight down is 200 meters, the QEF = 0.01 = 1.0 %. That is: The lower the QEF, the more reliable are the bottom slope angles.

Note: The detections used are from within a fan of limited width centred about the vertical. A few pings are needed, the ship must be moving, and EM xxx must have information about position in order to calculate the bottom slopes.

Note 2

Used for steering of the beams.

Note 3

Used to convert range in [seconds] to range in [meters] and vice versa wherever necessary.

Note 4

SIS can generate SRV messages based on data from any EM sounder, thus valid values of EMX are i.e. 120, 122, 710, 302

7.8.3.6 Simrad EM3000 - binary format

The Simrad EM3000 format consists of a fixed-length message using single-byte unsigned, 2-byte unsigned and 2-byte two-complement integer data elements. For the 2-byte elements, the least significant byte (LSB) is transmitted first.

Format:

Element	Scaling	Format	Bytes	Value
Status byte		Unsigned	1	00h or Sensor status= 90h - AFh
Header		Unsigned	1	90h
Roll	0.01 degrees	Integer	2	-17999 to 17999
Pitch	0.01 degrees	Integer	2	-17999 to 17999
Heave	1 cm	Integer	2	-999 to 999
Heading	0.01 degrees	Unsigned	2	0 to 35999

Table 7-21 Structure of the EM3000 telegram

Roll is positive when port side goes up. Pitch is positive when bow goes up. Heave is positive upward direction.

Non-valid data is assumed when a value is outside the valid range.

How roll is assumed to be measured is operator selectable, eitherwith respect to the horizontal plane (the Hippy 120 or TSS convention) or to the plane tilted by the given pitch angle (i.e. as a rotation angle around the pitch tilted forward pointing x-axis). The latter convention (called Tate-Bryant in the POS/MVdocumentation) is used inside the system in all data displays andin logged data (a transformation is applied if the roll is givenwith respect to the horizontal).

Note that heave is displayed and logged as positive downwards (the sign is changed) including roll and pitch induced lever arm translation to the system’s transmit transducer.

The sensor manufacturers have been requested to include sensor status in the format using the first synchronisation byte for this purpose. It is thus assumed that

The status byte can have the following values:

Value	Interpretation
90h	Valid measurement, full accuracy
91h – 99h	Reduced performance (decreasing accurasy with increasing number)
9Ah – 9Fh	Non-valid data but notrmal operation
A0h - AFh	Sensor error status

Table 7-22 Status byte values from VRU.

7.8.3.7 Atlas Fansweep 20 - binary format

The Atlas Fansweep 20 format consists of a fixed-length message using single-byte unsigned, 2-byte unsigned and 2-byte unsigned data elements. For the 2-byte elements, the most significant byte (MSB) is transmitted first.

Format:

Element	Scaling	Format	Bytes	Value
DLE		Unsigned	1	0x01
Roll	Resolution: 360/65535 deg. Range: -180 to 180 deg.	Unsigned	2	0 to 65535
Pitch	Resolution: 360/65535 deg. Range: 0-90 deg and 360 – 270 deg	Unsigned	2	0 to 65535
Heave	1 mm	Signed	2	-32767 to 32767
Status		Unsigned	1	0x06 0x07
DLE		Unsigned	1	0x10

Table 7-23 Structure of theAtlas Fansweep 20 telegram

Roll is positive when port side goes up; 0 – 180 degrees.

Pitch is positive when bow goes up; 0 – 90 degrees.

Heave is positive upward direction.

Non-valid data is assumed when a value is outside the valid range.

Note that heave is displayed and logged as positive downwards (the sign is changed) including roll and pitch induced lever arm translation to the system’s transmit transducer.

The status byte can have the following values:

Value	Interpretation
90h	Valid measurement, full accuracy
0x06	Sensor alignment is fully settled
0x07	Sensor alignment settling

Table 7-24 Status byte values from VRU.

7.8.3.8 TOPAS RAW export datagram

TOPAS RAW data datagram may be exported on TCP from the TOPAS Operator Unit *and*/*or* the TOPAS Post Processing Unit. It can be read by any TOPAS Post Processing Unit listening on the network.

The description of the datagram is given in Chapter 7.6.1 on page 325.

7.9 Configuration files

There are two types of configuration parameters used with the system: *Configuration of parameter limits during program initialization phase* and *Configuration parameters for the system in the current installation and operation*.

7.9.1 Parameter limits

The parameter limits is contained in the *PSConfig.xml* file which is write protected. The parameters here are critical for system operation and must not be changed.

For the PS 18 system, the file content may look like this:

```
<?xml version="1.0" encoding="UTF-8" ?>
<PSConfig>
  <PSData PSVersion="PS18"
    amplitudeMin="-30"
    amplitudeMax="0"
    amplitudeStep="3"
    amplitudeDef="-30"
    pingIntMin="300"
    pingIntMax="15000"
    pingIntStep="100"
    pingIntDef="500"
    freqMin="1000"
    freqMax="10000"
    freqStep="100"
    secFreqDef="4000"
    chirpStartDef="2000"
    chirpStopDef="6000"
    chirpLengthMin="1"
    chirpLengthMax="100"
    chirpLengthStep="5"
    chirpLengthDef="10"
    scanSectAthwMin="0.0"
    scanSectAthwMax="80.0"
    scanSectAthwStep="5.0"
    scanSectAthwDef="0.0"
    scanSectAlongMin="0.0"
    scanSectAlongMax="10.0"
    scanSectAlongStep="2.0"
    scanSectAlongDef="0.0"
    beamDirAthwMin="-40.0"
    beamDirAthwMax="40.0"
    beamDirAthwStep="5.0"
    beamDirAthwDef="0.0"
```

```
beamDirAlongMin="-5.0"
beamDirAlongMax="5.0"
beamDirAlongStep="1.0"
beamDirAlongDef="0.0"
scanStepsMin="0.0"
scanStepsMax="10.0"
scanStepsStep="1.0"
scanStepsDef="1.0"
trigDelayMin="0"
trigDelayMax="15000"
trigDelayStep="10"
trigDelayDef="0"
offsetMin="-100"
offsetMax="100"
offsetStep="1"
offsetDef="0"
windowStartMin="0"
windowStartMax="15000"
windowStartStep="10"
windowStartDef="0"
delayMin="0.0"
delayMax="100.0"
delayStep="5.0"
lowerDelayDef="5.0"
upperDelayDef="40.0"
sampleRateMin="1000"
sampleRateMax="300000"
sampleRateStep="5000"
sampleRateDef="30000"
traceLengthMin="1"
traceLengthMax="1000"
traceLengthStep="10"
traceLengthDef="260"
rxGainMin="0"
rxGainMax="72"
rxGainStep="3"
rxGainDef="0"
bandPassMin="100"
bandPassMax="150000"
bandPassStep="100"
bandLowPassDef="8000"
bandHighPassDef="2000"
TVFPassMin="100.0"
TVFPassMax="40000.0"
TVFPassStep="100.0"
TVFLowPassDef="8000.0"
TVFHighPassDef="1000.0"
```

```
    TVFSetPointMin="0.0"
    TVFSetPointMax="15000.0"
    TVFSetPointStep="10.0"
    durMin="0.0"
    durMax="0.0"
    durStep="10.0"
    thresholdMin="0.0"
    thresholdMax="100.0"
    thresholdStep="1.0"
    thresholdDef="70.0"
    bottomLockMin="0.0"
    bottomLockMax="100.0"
    bottomLockStep="1.0"
    bottomLockDef="10.0"
    muteMin="-100"
    muteMax="100"
    muteStep="1"
    muteDef="2"
    AGCLengthMin="1.0"
    AGCLengthMax="100.0"
    AGCLengthStep="1.0"
    AGCLengthDef="10.0"
    AGCApplyMin="0.0"
    AGCApplyMax="100.0"
    AGCApplyStep="1.0"
    AGCApplyDef="0.0"
    AGCAmpMin="0.0"
    AGCAmpMax="1000.0"
    AGCAmpStep="10.0"
    AGCAmpDef="100.0"
    gainMin="-30"
    gainMax="100"
    gainStep="3"
    gainDef="0" />
    hpFilterText_0="3 0.1 0.1 0.1"
    hpFilterValue_0="3 0.1 0.1 0.1"
    hpFilterText_1="3 0.5 0.5 0.5"
    hpFilterValue_1="3 0.5 0.5 0.5"
    hpFilterText_2="3 1.0 1.0 1.0"
    hpFilterValue_2="3 1 1 1"
    hpFilterText_3="3 2.0 2.0 2.0"
    hpFilterValue_3="3 2 2 2" />
</PSConfig>
```

7.9.2 System configuration parameters

The system parameter configuration is contained in two files: *TopasInstall.xml* file for storing installation parameters which are critical for correct operation of the system and *TopasConfig.xml* file for storing operational parameters which may change depending on operational parameters. The *TopasConfig.xml* type of files may be stored for each set of user defined parameter setting under user defined names in the **Save config file** menu. The *TopasConfig.xml* file is updated with the current operational parameters every time the application is exited.

7.9.2.1 TopasInstall.xml file

For the PS 18 system, the *TopasInstall.xml* file content may look like this:


```
<?xml version="1.0" encoding="UTF-8" ?>
  <TopasConfig>
    <TopasMKII>
      <InstallationParameters>
        <Communication>
          <Tranceiver portType="Serial port
            (transceiver)">
           <SerialPortTransceiver timeOut="200000"
             portName="COM5" flowControl="0"
             baudRate="115200" dataParity="2"
             dataBits="8" stopBits="1" />
           <TCPPortTransceiver timeOut="200000"
             portnum="10001"
             hostaddr="192.168.70.3" />
          </Tranceiver>
          <VRUPort baudRate="19200" dataParity="0"
            dataBits="8" stopBits="1" />
         <DataWriter portType="No port">
          <SerialPortData timeOut="2000"
            portName="NONE" flowControl="0"
            baudRate="9600" dataParity="0"
            dataBits="8" stopBits="1" />
          <UDPPortData timeOut="2000"
            localPort="1234" localAddress=""
            remotePort="1234"
            remoteAddress="127.0.0.1"
            singleMessagePacket="true" />
          <TCPPortData timeOut="2000"
            portnum="1234" hostaddr="127.0.0.1" />
```

```
      <FilePortData openType="1"
        autoNumber="true" fileName="test.jpg"
        fileExtension="*.jpg" />
    </DataWriter>
    <ReceiverPort1 stubPort="49999"
      stubAddress="192.168.70.2" />
    <RepeatWriter1 stubPort="12345" />
  <NavigationReader portType="No port">
    <SerialPortNav timeOut="200000"
      portName="COM1" flowControl="0"
      baudRate="9600" dataParity="0"
      dataBits="8" stopBits="1" />
    <UDPPortNav timeOut="2000"
      localPort="1234" localAddress=""
      remotePort="1234"
      remoteAddress="127.0.0.1"
      singleMessagePacket="true" />
    <TCPPortNav timeOut="2000"
      portnum="1234" hostaddr="127.0.0.1" />
  </NavigationReader>
  <SlopeReader portType="No port">
    <SerialPortSlope timeOut="2000"
      portName="NONE" flowControl="0"
      baudRate="9600" dataParity="0"
      dataBits="8" stopBits="1" />
    <UDPPortSlope timeOut="2000"
      localPort="1234" localAddress=""
      remotePort="1234"
      remoteAddress="127.0.0.1"
      singleMessagePacket="true" />
    <TCPPortSlope timeOut="2000"
      portnum="1234" hostaddr="127.0.0.1" />
  </SlopeReader>
  <DepthReader portType="No port">
    <SerialPortDepth timeOut="200000"
      portName="COM2" flowControl="0"
      baudRate="9600" dataParity="0"
      dataBits="8" stopBits="1" />
    <UDPPortDepth timeOut="2000"
      localPort="1234" localAddress=""
      remotePort="1234"
      remoteAddress="127.0.0.1"
      singleMessagePacket="true" />
    <TCPPortDepth timeOut="2000"
      portnum="1234" hostaddr="127.0.0.1" />
  </DepthReader>
</Communication>
```

```
    <Printers>
      <Printer1 portType="No port" printerType="No
        printer">
        <ParallelPort portName="" timeOut="2000" />
        <SerialPort timeOut="2000"
          portName="NONE" flowControl="0"
          baudRate="9600" dataParity="0"
          dataBits="8" stopBits="1" />
        <TCPPort timeOut="2000" portnum="1234"
          hostaddr="127.0.0.1">
          <EPCCommandPort timeOut="2000"
            portnum="1234" hostaddr="127.0.0.1"
            />
        </TCPPort>
        <FilePort openType="1" autoNumber="true"
          fileName="test.jpg" fileExtension="*.jpg"
          />
        <AudioPort timeOut="2000" audioDevice="0"
          />
      </Printer1>
    <Printer2 portType="No port" printerType="No
      printer">
       <ParallelPort portName="" timeOut="2000" />
       <SerialPort timeOut="2000" portName="NONE"
         flowControl="0" baudRate="9600"
         dataParity="0" dataBits="8" stopBits="1" />
       <TCPPort timeOut="2000" portnum="1234"
         hostaddr="127.0.0.1">
         <EPCCommandPort timeOut="2000"
           portnum="1234" hostaddr="127.0.0.1" />
       </TCPPort>
       <FilePort openType="1" autoNumber="true"
         fileName="test.jpg" fileExtension="*.jpg" />
       <AudioPort timeOut="2000" audioDevice="0" />
    </Printer2>
  </Printers>
<Mounting>
    <TransducerArray OffsetX="0.0" OffsetY="0.0"
      OffsetZ="0.0" OffsetXangle="0.0"
      OffsetYangle="0.0" OffsetZangle="0.0"
      TransducerDepth="0.0" />
    <VRU OffsetX="0.0" OffsetY="0.0" OffsetZ="0.0"
      OffsetXangle="0.0" OffsetYangle="0.0"
      OffsetZangle="0.0" />
    <GPS OffsetX="0.0" OffsetY="0.0" />
</Mounting>
```

```
      <MasterReader Enabled="false" name="Master reader"
        utcPriority="GGK > ZDA"
        posPriority="GGK>GGA>GLL>S90>RMC"
        zdaCorrect="true" posCorrect="true" posFilter="0.0">
        <NavigationReader Enabled="false"
          name="Navigation reader" />
        <SlopeReader Enabled="false" name="Slope reader"
          />
        <DepthReader Enabled="false" name="Depth
          reader" />
       </MasterReader>
      </InstallationParameters>
      <Legend />
      <SystemMessages />
    </TopasMKII>
  </TopasConfig>
```

7.9.2.2 TopasConfig.xml file

For the PS 18 system, the *TopasConfig.xml* file content may look like this:

```
<?xml version="1.0" encoding="UTF-8" ?>
<TopasConfig>
 <TopasMKII ConfigFileName="C:\\Topas
  v1.5\\TopasInstall.xml" InstallFileName="C:\\Topas
  v1.5\\TopasInstall.xml" OperationMode="2">
  <Transmitter TransmitMode="1" TransmitPattern="0"
    TriggerMode="0" PulseForm="0" ChirpLength="10.0"
    PowerLevel="-30" StartFrequency="2.0"
    StopFrequency="5.0" Frequency="3.0"
    NoOfPulses="2" AutoStep="100" BurstInterval="200"
    MultiInterval="1000" ManualInterval="500"
    AutoInterval="1000" PingInterval="500"
    HrpStabilization="true" StepPitch="1.0"
    StepRoll="1.0" WidthPitch="0.0" WidthRoll="0.0"
    OffsetPitchMan="0.0" OffsetRollMan="0.0"
    OffsetPitchScan="0.0" OffsetRollScan="0.0"
    SpeedOfSound="1500.0" BeamControl="0"
    Periods="1" />
  <Printers>
    <DataWriter Enabled="false" msgId="$xxDPT">
      <SelectedDepth Enabled="true" nmeaKey="" />
      <TransducerDepth Enabled="true" nmeaKey="" />
      <PingNumberCh1 Enabled="true" nmeaKey="" />
      <PingDateCh1 Enabled="true" nmeaKey="" />
      <NorthingCh1 Enabled="true" nmeaKey="" />
      <EastingCh1 Enabled="true" nmeaKey="" />
      <TrigDelayCh1 Enabled="true" nmeaKey="" />
      <TraceLengthCh1 Enabled="true" nmeaKey="" />
    </DataWriter>
  </Printers>
 <Printer_0 fontSize="9" channelActive="5 true false false
   false false" printCurrent="false" printFromNow="false"
   autoEvent="1" gridLines="5" printInterval="0"
   eventInterval="300" manualAnnotation="" traceW="1"
   isZooming="false" fixedZoom="false"
   startZoomMs="0.0" lengthZoomMs="0.0"
   selectBeam="false" reverseData="true"
   selectedBeam="0">
   <ColorArray Scale="1" ColorMap="1" Polarity="3"
     ViewMode="1" colormapWiggle="-1"
     backgroundWiggle="-16777216" backgroundJet="-
```

```
16777216" backgroundCool="-16777216"
backgroundHot="-16777216" backgroundBone="-
16777216" backgroundHsv="-16777216"
backgroundPink="-16777216" backgroundSpiral="-
16777216" backgroundInvSpiral="-1"
foregroundWiggle="-1" foregroundJet="-1"
foregroundCool="-1" foregroundHot="-1"
foregroundBone="-1" foregroundHsv="-1"
foregroundPink="-1" foregroundSpiral="-1"
foregroundInvSpiral="-16777216"
foregroundGray="-1" foregroundInvGray="-
16777216" alphaMode="0" alphaValue="255"
maxLinValue="1.0" minLinValue="0.0"
maxLogRange="54.0" ThresholdHi="1.0"
ThresholdLo="0.0" linScaleGain="100.0"
linScaleUnit="%" logScaleUnit="dB" />
<AnalogPrinter paperWidth="200.0" paperHeight="0.0"
printerLeft="0.0" printerRight="0.0"
printerTop="0.0" printerBottom="0.0"
marginLeft="0.0" marginRight="0.0"
marginTop="0.0" marginBottom="0.0"
colorModel="1" dotsPerInch="300"
frequency="10000.0" padTime="0.1" />
<JPEGPrinter paperWidth="200.0" paper-
Height="280.0" printerLeft="0.0" printerRight="0.0"
printerTop="0.0" printerBottom="0.0"
marginLeft="0.0" marginRight="0.0"
marginTop="0.0" marginBottom="0.0"
colorModel="2" dotsPerInch="300"
jpegQuality="1.0" />
<GSP1086Printer paperWidth="200.0"
paperHeight="0.0" printerLeft="0.0"
printerRight="0.0" printerTop="0.0"
printerBottom="0.0" marginLeft="0.0"
marginRight="0.0" marginTop="0.0"
marginBottom="0.0" colorModel="1"
dotsPerInch="260" syncByte="false" />
<HSP100Printer paperWidth="200.0"
paperHeight="0.0" printerLeft="0.0"
printerRight="0.0" printerTop="0.0"
printerBottom="0.0" marginLeft="0.0"
marginRight="0.0" marginTop="0.0"
marginBottom="0.0" colorModel="1"
dotsPerInch="260" />
<UltraPrinter paperWidth="200.0"
paperHeight="0.0" printerLeft="0.0"
printerRight="0.0" printerTop="0.0"
printerBottom="0.0" marginLeft="0.0"
marginRight="0.0" marginTop="0.0"
marginBottom="0.0" colorModel="1"
dotsPerInch="301" />
```

```
<EPC9800Printer paperWidth="200.0"
   paperHeight="280.0" printerLeft="0.0"
   printerRight="0.0" printerTop="0.0"
   printerBottom="0.0" marginLeft="0.0"
   marginRight="0.0" marginTop="0.0"
   marginBottom="0.0" colorModel="1"
   dotsPerInch="520" dotsPerLine="4096"
   linesPerInch="150" />
<EPSONESCP2Printer paperWidth="200.0"
   paperHeight="280.0" printerLeft="0.0"
   printerRight="0.0" printerTop="0.0"
   printerBottom="0.0" marginLeft="0.0"
   marginRight="0.0" marginTop="0.0"
   marginBottom="0.0" colorModel="0"
   dotsPerInch="360" />
<PCLPrinter paperWidth="200.0"
   paperHeight="280.0" printerLeft="0.0"
   printerRight="0.0" printerTop="0.0"
   printerBottom="0.0" marginLeft="0.0"
   marginRight="0.0" marginTop="0.0"
   marginBottom="0.0" colorModel="0"
   dotsPerInch="300" />
<PCL3GUIPrinter paperWidth="200.0"
   paperHeight="280.0" printerLeft="0.0"
   printerRight="0.0" printerTop="0.0"
   printerBottom="0.0" marginLeft="0.0"
   marginRight="0.0" marginTop="0.0"
   marginBottom="0.0" colorModel="0"
   dotsPerInch="300" />
</Printer_0>
<Printer_1 fontSize="9" channelActive="5 true false
  false false false" printCurrent="false"
  printFromNow="false" autoEvent="1" gridLines="5"
  printInterval="0" eventInterval="300"
  manualAnnotation="" traceW="1" isZooming="false"
  fixedZoom="false" startZoomMs="0.0"
  lengthZoomMs="0.0" selectBeam="false"
  reverseData="true" selectedBeam="0">
  <ColorArray Scale="1" ColorMap="1" Polarity="3"
    ViewMode="1" colormapWiggle="-1"
    backgroundWiggle="-16777216" backgroundJet="-
    16777216" backgroundCool="-16777216"
    backgroundHot="-16777216" backgroundBone="-
    16777216" backgroundHsv="-16777216"
    backgroundPink="-16777216" backgroundSpiral="-
    16777216" backgroundInvSpiral="-1"
    foregroundWiggle="-1" foregroundJet="-1"
    foregroundCool="-1" foregroundHot="-1"
    foregroundBone="-1" foregroundHsv="-1"
    foregroundPink="-1" foregroundSpiral="-1"
    foregroundInvSpiral="-16777216"
```

```
   foregroundGray="-1" foregroundInvGray="-
   16777216" alphaMode="0" alphaValue="255"
   maxLinValue="1.0" minLinValue="0.0"
   maxLogRange="54.0" ThresholdHi="1.0"
   ThresholdLo="0.0" linScaleGain="100.0"
   linScaleUnit="%" logScaleUnit="dB" />
<AnalogPrinter paperWidth="200.0"
   paperHeight="0.0" printerLeft="0.0"
   printerRight="0.0" printerTop="0.0"
   printerBottom="0.0" marginLeft="0.0"
   marginRight="0.0" marginTop="0.0"
   marginBottom="0.0" colorModel="1"
   dotsPerInch="300" frequency="10000.0"
   padTime="0.1" />
<JPEGPrinter paperWidth="200.0" paper-
   Height="280.0" printerLeft="0.0"
   printerRight="0.0"
   printerTop="0.0" printerBottom="0.0"
   marginLeft="0.0" marginRight="0.0"
   marginTop="0.0" marginBottom="0.0"
   colorModel="2" dotsPerInch="300"
   jpegQuality="1.0" />
<GSP1086Printer paperWidth="200.0"
   paperHeight="0.0" printerLeft="0.0"
   printerRight="0.0" printerTop="0.0"
   printerBottom="0.0" marginLeft="0.0"
   marginRight="0.0" marginTop="0.0"
   marginBottom="0.0" colorModel="1"
   dotsPerInch="260" syncByte="false" />
<HSP100Printer paperWidth="200.0"
   paperHeight="0.0" printerLeft="0.0"
   printerRight="0.0" printerTop="0.0"
   printerBottom="0.0" marginLeft="0.0"
   marginRight="0.0" marginTop="0.0"
   marginBottom="0.0" colorModel="1"
   dotsPerInch="260" />
<UltraPrinter paperWidth="200.0"
   paperHeight="0.0" printerLeft="0.0"
   printerRight="0.0" printerTop="0.0"
   printerBottom="0.0" marginLeft="0.0"
   marginRight="0.0" marginTop="0.0"
   marginBottom="0.0" colorModel="1"
   dotsPerInch="301" />
<EPC9800Printer paperWidth="200.0"
   paperHeight="280.0" printerLeft="0.0"
   printerRight="0.0" printerTop="0.0"
   printerBottom="0.0" marginLeft="0.0"
   marginRight="0.0" marginTop="0.0"
   marginBottom="0.0" colorModel="1"
   dotsPerInch="520" dotsPerLine="4096"
   linesPerInch="150" />
<EPSONESCP2Printer paperWidth="200.0"
```

```
    paperHeight="280.0" printerLeft="0.0"
    printerRight="0.0" printerTop="0.0"
    printerBottom="0.0" marginLeft="0.0"
    marginRight="0.0" marginTop="0.0"
    marginBottom="0.0" colorModel="0"
    dotsPerInch="360" />
  <PCLPrinter paperWidth="200.0"
    paperHeight="280.0" printerLeft="0.0"
    printerRight="0.0" printerTop="0.0"
    printerBottom="0.0" marginLeft="0.0"
    marginRight="0.0" marginTop="0.0"
    marginBottom="0.0" colorModel="0"
    dotsPerInch="300" />
  <PCL3GUIPrinter paperWidth="200.0"
    paperHeight="280.0" printerLeft="0.0"
    printerRight="0.0" printerTop="0.0"
    printerBottom="0.0" marginLeft="0.0"
    marginRight="0.0" marginTop="0.0"
    marginBottom="0.0" colorModel="0"
    dotsPerInch="300" />
</Printer_1>
<ClockTimer delay="1000" />
<TOPAS Width="1278" Height="986">
  <MainPanel>
    <Xbox>
      <Ybox>
        <Xbox>
          <SplitPane dividerLocation="254">
            <PropertyArea visible="true">
              <TabPane>
                <Configuration>
                  <SplitPane dividerLocation="258" />
                </Configuration>
                <Runtime>
                  <SplitPane dividerLocation="150" />
                </Runtime>
                <Acquisition>
                  <SplitPane dividerLocation="201" />
                </Acquisition>
                <Processing>
                  <SplitPane dividerLocation="450" />
                </Processing>
                <Display>
      <SplitPane dividerLocation="250" />
            </Display>
                <Print>
                  <SplitPane dividerLocation="150" />
                </Print>
              </TabPane>
            </PropertyArea>
```

```
                <OverlayPanel>
                 <TabPane>
                  <_1>
                   <Xbox>
                    <SplitPane dividerLocation="818">
                     <EchogramPanel1>
                      <Ybox>
                       <ScrollPane>
                        <EchogramArea1>
        <Echogram fitToLastPing="true"
           fitToActualPing="false" minDepth="0.0"
           maxDepth="100.0" deltaX="1"
           enableGrid="true" pingTicSpacing="200.0"
           depthTicSpacing="20.0" selectBeam="false"
           selectedBeam="0" bottomPosition="20.0"
           enable3D="false" geometricRange="true"
           shiftX="-5" shiftY="-2" />
                        </EchogramArea1>
                       </ScrollPane>
                      </Ybox>
                     </EchogramPanel1>
                     <Ybox visible="true">
                      <ScrollPane>
                       <PingArea>
        <SingleTrace gridEnabled="true"
           depthTicSpacing="10.0" />
                       </PingArea>
                      </ScrollPane>
                     </Ybox>
                    </SplitPane>
                   </Xbox>
                  </_1>
                 </TabPane>
                </OverlayPanel>
               </SplitPane>
              </Xbox>
            </Ybox>
          </Xbox>
         <OverlayPanel>
            <Ybox visible="true" />
          </OverlayPanel>
        </MainPanel>
          <EstablishingContactWithParasource Xpos="605"
             Ypos="181" Width="370" Height="40" />
          <DepthReadOutM visible="false" Xpos="200"
             Ypos="200" Width="200" Height="100" />
          <SystemMessages Xpos="500" Ypos="500"
```

```
        Width="500" Height="300" />
      <MenuBar>
        <File>
          <ConvertFileS>
            <SetMember Enabled="true" Excluded="false"
            />
          </ConvertFileS>
        </File>
      </MenuBar>
    </TOPAS>
    <General>
        <SurveyInfo ClientName="Client NN" Line="Line
          NN" enableProj4="false" falseNorthing="false"
          SrcProj="+proj=latlong +datum=WGS84"
          DestProj="+proj=utm
          +zone=32+ellps=WGS84" />
    </General>
  <RuntimeData>
    <ThreadList>
      <ReplayTimer delay="100" />
      <DataWriterTimer delay="2000" />
    </ThreadList>
    <FileConverter>
        <FileReader Enabled="true" PathType="" />
        <FileWriter SequenceIx="1" Excluded="false"
          Enabled="false" LogPath="" PathType=""
          SplitRaw="false" KeepFileName="false"
          SplitEveryMin="0" CloseAppend="25"
          MaxFileSize="10.0" MinFreeTime="1.0"
          selectBeam="false" selectedBeam="0" />
      </FileConverter>
    </RuntimeData>
        <Legend Scale="2" ColorMap="1" Polarity="1"
          ViewMode="1" colormapWiggle="-1"
          backgroundWiggle="-16777216"
          backgroundJet="-16777216" backgroundCool="-
          16777216" backgroundHot="-16777216"
          backgroundBone="-16777216"
          backgroundHsv="-16777216"
          backgroundPink="-16777216"
          backgroundSpiral="-16777216"
          backgroundInvSpiral="-1" foregroundWiggle="-
          1" foregroundJet="-1" foregroundCool="-1"
          foregroundHot="-1" foregroundBone="-1"
          foregroundHsv="-1" foregroundPink="-1"
          foregroundSpiral="-1" foregroundInvSpiral="-
          16777216" foregroundGray="-1"
```

```
        foregroundInvGray="-16777216"
        alphaMode="0" alphaValue="255"
        maxLinValue="1.0" minLinValue="0.0"
        maxLogRange="54.0" ThresholdHi="1.0"
        ThresholdLo="0.0" linScaleGain="100.0"
        linScaleUnit="%" logScaleUnit="dB" />
<Channel1>
  <AcquisitionObjects1>
    <Receiver1 Enabled="true" MasterDelay="0.0"
        DelayOffset="0.0" DelayControl="1"
        TrigDelay="0.0" showDelayShift="false"
        upperDelayShift="5.0" lowerDelayShift="40.0"
        SampleRate="50.0" TraceLength="100.0"
        GainSetting="0.0" FilterSetting="0"
        ReceiverSensitivity="0.0" />
    <RawDataLogger1 SequenceIx="3"
        Excluded="false" Enabled="false"
        LogPath="E:\\10Vpp input.raw"
        PathType="[*.raw] file" SplitRaw="false"
        KeepFileName="false" SplitEveryMin="1"
        CloseAppend="25" MaxFileSize="10.0"
        MinFreeTime="1.0" selectBeam="false"
        selectedBeam="0" />
    <RepeatWriter1 Enabled="false" />
    <ReplayReader Enabled="true"
        replayPath="E:\\nav test.raw"
        PathType="[*.raw] file" />
  </AcquisitionObjects1>
    <ProcessingChain selectBeam="false"
        selectedBeam="0" maxBackLog="64">
    <DataPlotter1 SequenceIx="0" Excluded="false"
        Enabled="true" mousePlotter="false"
        PingColor="-16777216" />
    <Filters SequenceIx="1" Excluded="false"
        Enabled="false" Frequencies1="2"
        Frequencies2="1" Frequencies3="1"
        LowStopFreqBP="1000.0"
        HighPassFreqBP="2000.0"
        LowPassFreqBP="8000.0"
        HighStopFreqBP="9000.0"
        LowStopFreq="1900.0" HighPassFreq="2100.0"
        LowPassFreq="4900.0" HighStopFreq="5100.0"
        NoiseFactor="10.0" ReplicaShaping="false" />
    <TimeVaryingFilter SequenceIx="2"
        Excluded="false" Enabled="false"
        StartHighPass="1000.0" StartLowPass="8000.0"
        EndHighPass="1000.0" EndLowPass="8000.0"
```

```
SetPoint="0.0" Duration="80.0" />
<BottomTracker SequenceIx="3" Excluded="false"
  Enabled="false" WindowStart="-3"
  WindowLength="10" Threshold="70.0"
  autoSearch="false" showExternalBottom="false"
  />
<Mute SequenceIx="4" Excluded="false"
  Enabled="false" Mute="2" />
<SwellFilter SequenceIx="5" Excluded="false"
  Enabled="false" SwellMode="1" NoOfTraces="5"
  />
<Dereverberation SequenceIx="6"
  Excluded="false" Enabled="false" Method="1"
  AmplStopwidth="150.0"
  PhaseStopwidth="100.0"
  PhaseSmoothing="10.0"
  BottomThreshold="70.0" />
<Stacking SequenceIx="7" Excluded="false"
  Enabled="false" PingNoOf="5" />
<SyntheticApertureProcessing SequenceIx="8"
  Excluded="false" Enabled="false"
  NoOfPings="91.0" SoundVelocity="1500.0"
  TimeStart="10.0" TimeStop="60.0" />
<TimeVariableGain SequenceIx="9"
  Excluded="false" Enabled="false" TvgMode="2"
  AutoOffset="0.0" DelayA="6.8"
  SlopeAB="0.53198844" DelayB="10.704963"
  SlopeBC="0.33556205" DelayC="8.485628"
  SlopeCD="0.09321169" DelayD="10.182768"
  />
<AutomaticGainControl SequenceIx="10"
  Excluded="false" Enabled="false"
  WindowLength="10.0" SetPoint="0.0"
  AmplitudeScaling="100.0" />
<AttributeProcessing SequenceIx="11"
  Excluded="false" Enabled="false" Attributes="1"
  />
<Gain SequenceIx="12" Excluded="false"
  Enabled="false" Gain="0.0" autoGain="false"
  autoFilter="0.0" />
<Audio SequenceIx="13" Excluded="false"
  Enabled="false" AudioFrequency="8000.0" />
<ProcessedDataLogger SequenceIx="14"
  Excluded="false" Enabled="false" LogPath=""
  PathType="" SplitRaw="false"
  KeepFileName="false" SplitEveryMin="0"
  CloseAppend="25" MaxFileSize="10.0"
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  </Channel1>
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      <BottomTracker1 SequenceIx="1" Enabled="true"
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    </DepthSelector>
    <SoundSpeedSelectorMS Enabled="true"
        defaultValue="0.0">
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  </DataSelectors>
      <SystemMessages singleLine="false"
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</TopasMKII>
</TopasConfig>
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ABBREVIATIONS

2D	Two dimensional
3D	Three dimensional
µPa	Micro Pascal; 1 µPa = 10^{-11} Bar
AGC	Automatic gain control
ASCII	American Standard Code for Information Interchange
AVC	Automatic volume control
AVG	Average
BW	Band width
CMY	Colour space: Cyan, Magenta and Yellow as primary colours
CMYK	Colour space: Cyan, Magenta, Yellow and Black as primary colours
COG	Centre of gravity
CW	Continuous wave
dB	Decibel
ECM	External cardiac massage
EOF	End of file
EOR	End of record
FFT	Finite Fourier transform
FM	Frequency modulated
GMT	Greenwich Meridian Time
GPS	Global Positioning System
HFM	Hyperbolic Frequency Modulation
HRP	Heave, roll and pitch
HP	High pass
HS	High stop
Hz	Hertz
JRE	Java Real-time Environment
kb	Kilobit (1024)

kB	Kilobyte (1024)
KDS	Kongsberg Defence Systems
kHz	Kilohertz
LFM	Linear Frequency Modulation
LP	Low pass
LS	Low stop
Mb	Megabit (1024*1024)
MB	Megabyte (1024*1024)
MBES	Multibeam echo sounder
MMI	Man-machine interface
MRU	Motion reference unit
ms	Milli second
NI	National Instrument Inc.
NMEA	National Marine Electronics Association
NTP	Network Time Protocol
OPU	Operator unit
PCB	Printed circuit board
PLD	Programmable logic device
PSD	Power Spectral Density
RBG	Colour space: Red, Blue and Green as primary colours
RF	Radio frequency
RMS	Root mean square
RX	Receiver
s	Second
SAS	Synthetic aperture sonar
SAP	Synthetic aperture processing
SBC	Single board computer
SEG Y	Society of Exploration Geophysicists Y format
SL	Source level
SPL	Sound pressure level
STD	Standard deviation
TCP	Transmission Control Protocol
TOPAS	Topographic parametric sonar

TVF	Time variable filter
TVG	Time variable gain
TX	Transmitter
UDP	User Datagram Protocol
UTC	Universal Time Coordinated (=Greenwich Meridian Time (GMT))
UTM	Universal Transverse Mercator
V	Volt
VAC	Volt – alternating current
VDC	Volt – direct current
VRU	Vertical reference unit

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To assist us in making improvements to the product and to this manual, KDS would welcome comments and constructive criticism. Please send all such, in writing, to:

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