Innomar SBP Data Acquisition and File Formats

Innomar Technical Note (April 2017)

This technical note describes how Innomar SES-2000 sub-bottom profilers (SBP) acquire and store data. Differences between the different Innomar data formats are explained. This technical note also illustrates the workflow how to acquire 24-bit full-waveform data.

Innomar Data Acquisition

Most Innomar SBP digitise the received signal of the LF channel using 24 bit A/D hardware at a sample rate of 96 kHz. The received HF signal is shifted into the LF band and data is then sampled similar to the LF data. For best signal-to-noise ratio all data is band-pass filtered. Filter settings are automatically chosen by the system to match the transmit pulse settings currently used.

Innomar Data Formats

There are three data formats used with the Innomar SES-2000 sub-bottom profilers:
- **SES**: envelope (magnitude) data (16 bit) at reduced sample rate (i.e. sample rate depends on range settings), number of samples is fixed to 480 samples per trace.
- **RAW**: full-waveform data (16 bit) at full ADC sample rate, number of samples per trace depends on range settings.
- **SES3**: full-waveform data (24 bit) at full ADC sample rate, number of samples per trace depends on range settings, multi-channel capability.

Recently Innomar introduced the new SES3 file format to support multi-channel systems such as the SES-2000 quattro model and to save 24-bit data for enhanced processing as required by an increasing number of customers. Today, this data format is supported by "quattro" and new "medium-100" / "medium-70" models only. SES3 data files are mostly converted to 32-bit SEGY data for using third-party post-processing software packages. Conversion of 24 bit SES3 files to 32 bit SEG-Y files is done with our SESConvert tool, see below for details.

Currently, the Innomar ISE post-processing software is limited to 16-bit SES / RAW data; SES3 files need to be converted to RAW files first when the ISE is used for data processing (conversion is done within the ISE software, see below). The 16-bit SES and RAW files can also be converted to SEG-Y and XTF data formats for using third-party software..

The following table shows a summary of the available file formats and sampling details for all Innomar SES-2000 SBP models.

Innomar SES-2000 model	Recorded sample rate and resolution	Available File Formats
compact (before 2011)	Max. 70 kHz (depends on range setting), 16 bit	SES
compact (since 2011 with option RAW)	70 kHz, 16 bit	SES, RAW (option)
compact (since 2016)	70 kHz, 16 bit	SES, RAW
light, light plus	96 kHz, 16 bit	SES, RAW
standard, standard plus	96 kHz, 16 bit	SES, RAW
quattro	96 kHz, 16 bit / 24 bit	SES3, RAW (converted)
medium-100, medium-70	96 kHz, 16 bit / 24 bit	SES, RAW, SES3
deep-36, deep-15	96 kHz, 16 bit	SES, RAW
ROV, AUV	70 kHz, 16 bit	SES, RAW

How to get 24-bit data using the Innomar SES-2000 medium-100 SBP

In order to acquire and save data in full 24-bit resolution you have to use the "seswin24bit.exe" provided by Innomar (NOT "seswin.exe").

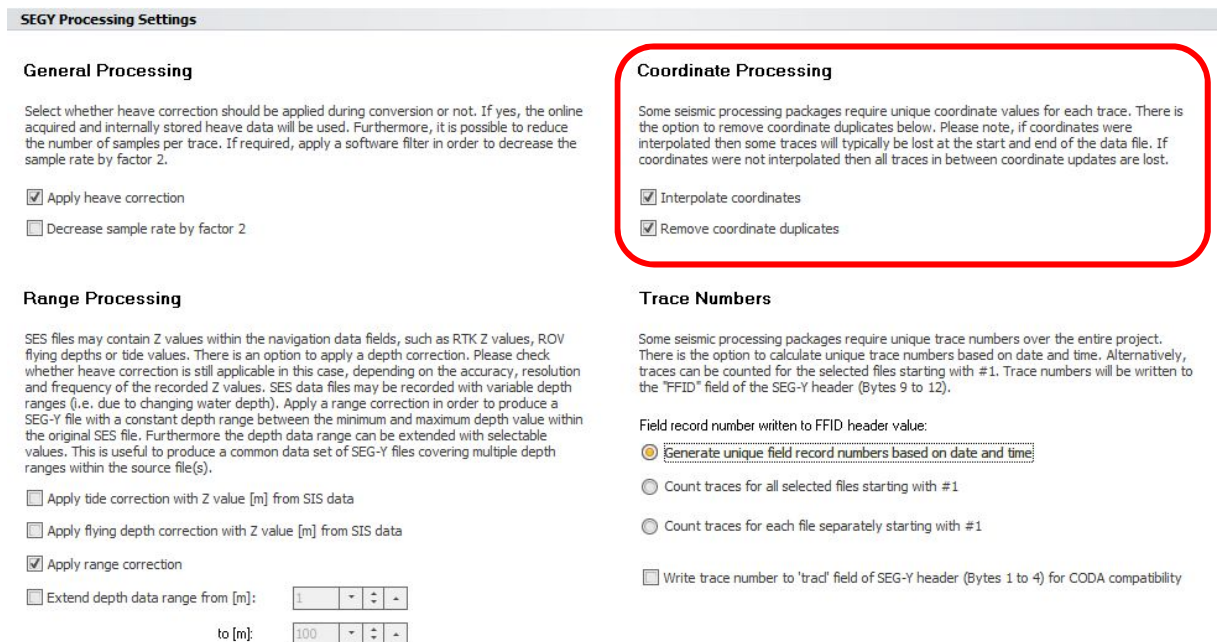This SESWIN version will record data in the new SES3 data file format only. There are no SES or RAW files as with the other SESWIN versions.
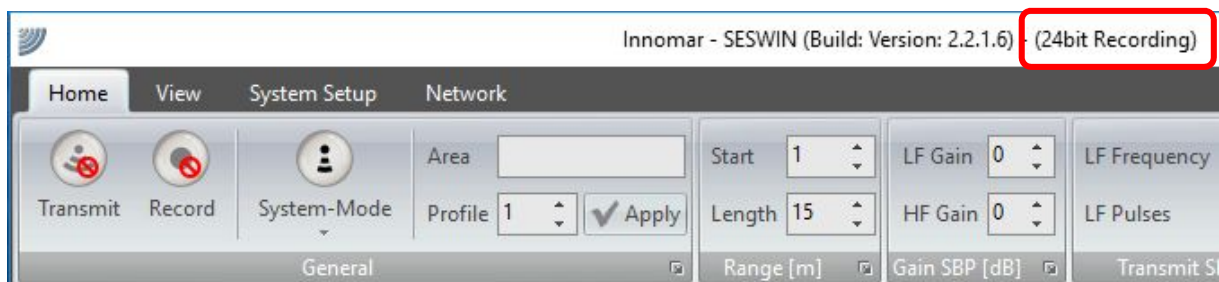
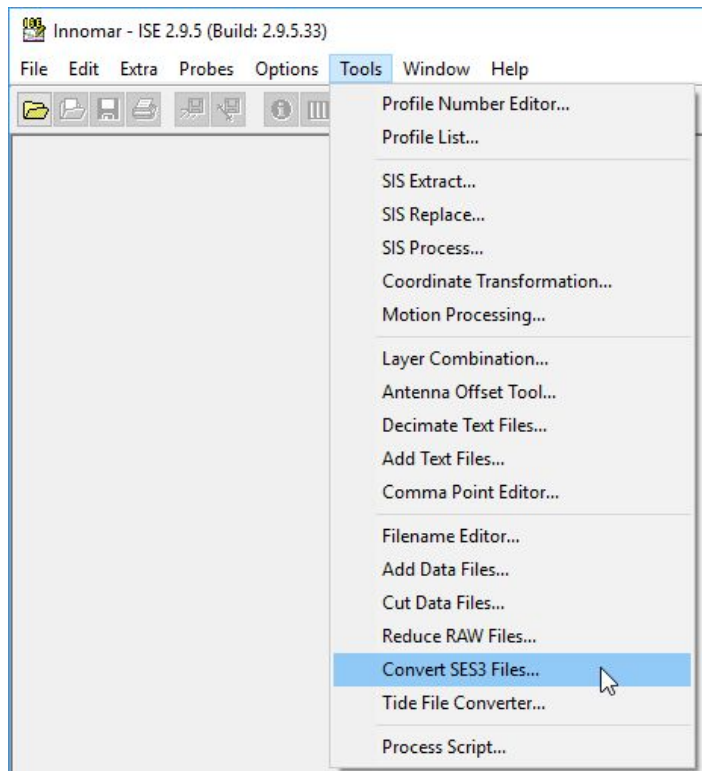

How to convert 24-bit SES3 data files to SEG-Y format

For using third-party post processing software, convert the SES3 files to SEG-Y format using Innomar's "SESconvert" software. Make sure to enable "Interpolate Coordinates" and "Remove Coordinate Duplicates" in the SEGY Processing Settings – Coordinate Processing:

SEGY Processing Settings

General Processing

Select whether heave correction should be applied during conversion or not. If yes, the online acquired and internally stored heave data will be used. Furthermore, it is possible to reduce the number of samples per trace. If required, apply a software filter in order to decrease the sample rate by factor 2.

☑ Apply heave correction

☐ Decrease sample rate by factor 2

Coordinate Processing

Some seismic processing packages require unique coordinate values for each trace. There is the option to remove coordinate duplicates below. Please note, if coordinates were interpolated then some traces will typically be lost at the start and end of the data file. If coordinates were not interpolated then all traces in between coordinate updates are lost.

☑ Interpolate coordinates

☑ Remove coordinate duplicates

Range Processing

SES files may contain Z values within the navigation data fields, such as RTK Z values, ROV flying depths or tide values. There is an option to apply a depth correction. Please check whether heave correction is still applicable in this case, depending on the accuracy, resolution and frequency of the recorded Z values. SES data files may be recorded with variable depth ranges (i.e. due to changing water depth). Apply a range correction in order to produce a SEG-Y file with a constant depth range between the minimum and maximum depth value within the original SES file. Furthermore the depth data range can be extended with selectable values. This is useful to produce a common data set of SEG-Y files covering multiple depth ranges within the source file(s).

☐ Apply tide correction with Z value [m] from SIS data

☐ Apply flying depth correction with Z value [m] from SIS data

☑ Apply range correction

☐ Extend depth data range from [m]: 1

to [m]: 100

Trace Numbers

Some seismic processing packages require unique trace numbers over the entire project. There is the option to calculate unique trace numbers based on date and time. Alternatively, traces can be counted for the selected files starting with #1. Trace numbers will be written to the "FFID" field of the SEG-Y header (Bytes 9 to 12).

Field record number written to FFID header value:

◉ Generate unique field record numbers based on date and time

○ Count traces for all selected files starting with #1

○ Count traces for each file separately starting with #1

☐ Write trace number to 'tracl' field of SEG-Y header (Bytes 1 to 4) for CODA compatibility

How to process 24-bit SES3 data files in ISE

Currently, the Innomar ISE post-processing software is limited to 16-bit data and SES3 files need to be converted to RAW files first when the ISE is used for data processing:

Tools → Convert SES3 Files

In "General Settings" **disable** the "Interpolate Coordinates" feature.

Coordinate interpolation and motion sensor data corrections (lever arms) should be applied on the RAW data files after conversion.

You may select multiple files for batch conversion.

Check that all options are disabled in the "Motion Sensor" tabs.

Press "Convert" Button in the "Conversion" tab