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SPSPro

OPERATION MANUAL

DISCLAIMER
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TECHNICAL SUPPORT
Support for licensed users on any topics covered in this manual and for the use of the software described herein may be obtained from:

Email: support@fgps.com

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1 OVERVIEW

SPSPro is a software program which runs on the Microsoft Windows operating system, designed to enable the user to QC, analyse and manage Shell Processing Support (SPS) files used to record land and OBS seismic survey positioning data. The installation and licensing of this program is documented separately from this manual.

The SPS dataset need not contain any header records. If header records are present then certain features of the program will make use of this.

Note: When using header records the program assumes all headers found in the entire dataset are identical, and will read only the first header found.

1.1 Projects

A project is a set of parameters defining all of the file locations and program parameters. This information is stored in a Project File with the extension “prj”. When the software is initially installed, the default Project File is “SPSPro.prj”, located in the folder: <*spspro_program_folder*>\Project.

1.1.1 Creating and Opening a Project

A project is created by first saving the current project as a new project by choosing *File* | *Save Project As* from the main menu, and then changing the setup parameters (see Setup).

To open a previously saved project, choose *File* | *Open Project* from the main menu.

1.2 Main Toolbar

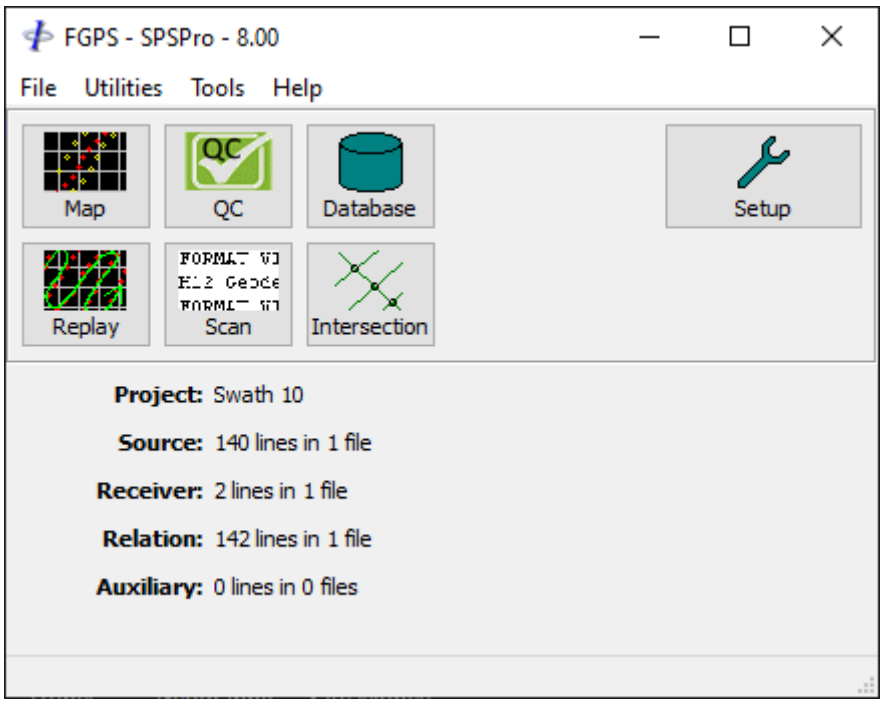
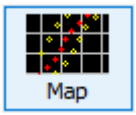
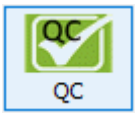


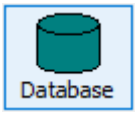
Figure 1-1 – Main Form



Displays interactive map of the SPS file set for the selected display type.

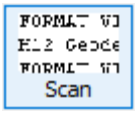


Quality Control, interactive time series plots, comparisons, statistical testing and trend analysis.

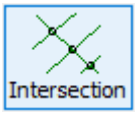


Used to manage files and display and edit data. Also provides functions for data interpolation.

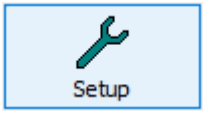
Replays the SPS data set as acquired.



Format and integrity checking.



Compute coordinates and differences in interpolated attribute data at line intersections.



Edit all application parameters.

1.3 Main Menu

1.3.1 File

New Project: Create a new project.

Open Project: Dialog to open a previously saved project definition file.

Edit Project: Change project parameters: name and folder.

Save Project As: Dialog to copy the current project definition file.

Recent Projects: Lists the last 8 opened projects for quick re-opening.

Printer Setup: Invokes the Printer Setup dialog.

Exit: Exits the program.

1.3.2 Utilities

Attach Header: Dialog to select a header file to attach to the beginning of all SPS files in the project.

Remove Headers: Removes the header from all SPS files in the project.

Export to Shapefile: Used to convert selected files into ESRI Shape format.

SPS to P1/90: Converts selected SPS files into UKOOA P1/90 format.

SP number is assumed to be right justified and only the rightmost six digits will be used in order to maintain P1/90 format compliance.

Floating point SP numbers (SPS format rev. 2.1) will be rounded to integer.

For northings with 10 digits only the rightmost 9 digits will be used in order to maintain P1/90 format compliance.

P1/90 to SPS: Converts selected UKOOA P1/90 files into SPS format.

SPS 1.0 to SPS 2.1	Convert files recorded in the SPS Rev. 1.0 format to the SPS Rev. 2.1 format.
Split by Line Name:	Splits selected SPS files into their constituent lines. For each unique line name found in a consecutive block of records a separate SPS file named by the line name is produced. Duplicate lines are written to a file whose name contains an incremental number.
Split by Point Index:	Split files in separate files each containing only one point index.
Split by Point Code:	Split files in separate files each containing only one point code.
Replace Tidal Corrections:	See section 1.3.2.1 below.
Extract Point Range:	Extract SPS file(s) with specified inclusive point range.

1.3.2.1 Replace Tidal Corrections

This utility is used to replace tidal corrections, recorded in the Surface Elevation field, in the selected SPS files. After selecting the SPS files the tide data file dialog appears as shown in Figure 1-2. The following options are presented:

File:	Enter the tide file name or click the *Browse* button to display the file selection dialog.
Data:	The tide file contents are displayed. Click on a record in this file to enable highlighting of field specification in that record.
Format:	Specify the format string. Click *Format Description* for a description of the various format specifiers.
Fixed width:	Specifies that the file contains fixed width fields.
Delimited width:	Specifies that the file contains delimited fields.

Field delimiter: If delimited width is specified, enter the field delimiter. The default is a comma (,).

Start at record: Enter the number of the first record in the file to be used.

Treat colon as delimiter: When checked, colons will be interpreted as delimiters when parsing the record. This is typically used when time in the format hh:mm:ss is present in an otherwise field delimited file.

Max time difference: The maximum time between a data record and a tide record.

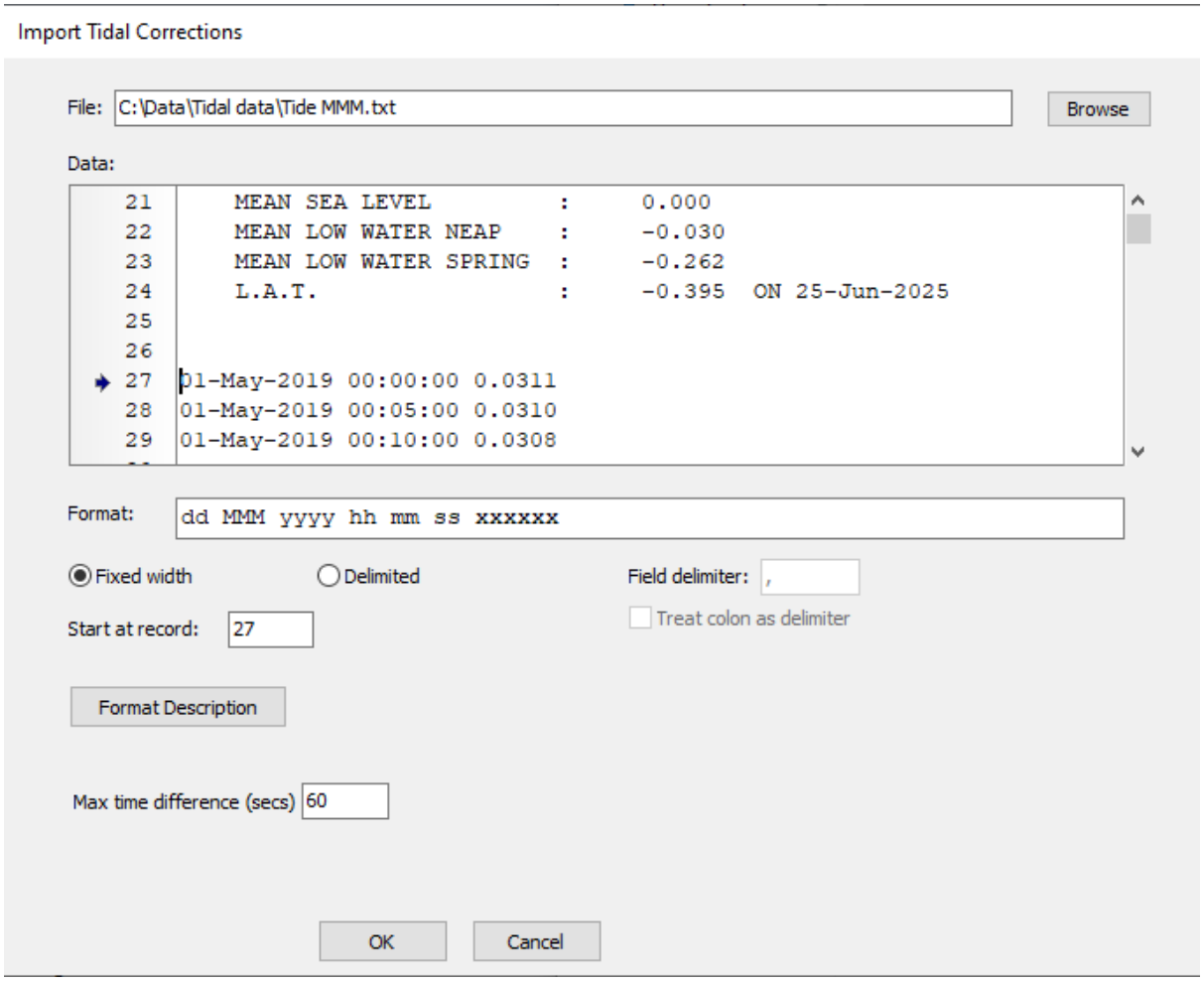


Figure 1-2 – Utilities: Replace Tide Data

1.3.3 Help

Manual: Opens the user manual.

About: Displays the program version, licence number, number of days remaining for the licence and technical support contact details.

Licence: Open the licence management window.

2 SETUP

Click on the *Setup* button on the main toolbar to display or edit the current Project parameters.

When changes are made to any of the parameters described in this section, click on the *Apply* button to apply the *whole* parameter set to the SPS dataset. The project file will be saved and changes cannot be automatically undone.

Click on the *Cancel* button to discard all changes and revert to the initial parameter set.

2.1 Files

The SPS dataset comprising source, receiver and relational files are specified in the *Source, Receiver* and *Relation* pages of the Setup window, as shown below in Figure 2-1. An additional set, *Auxiliary*, can be used for any type of SPS files. Each page has identical functionality.

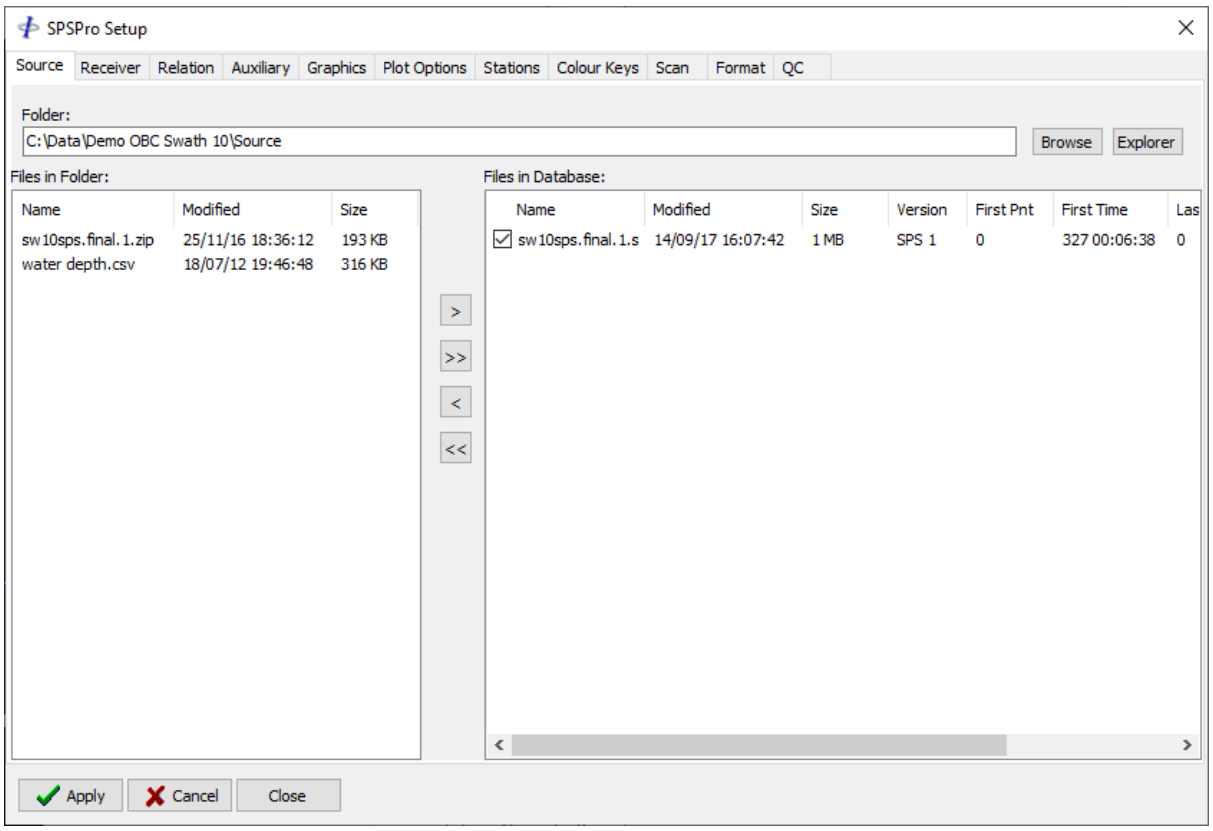


Figure 2-1 – Setup: Files

Enter, or browse for, the folder which contains the files required. All files in the folder, including non-SPS files, will be listed. Those which have previously been selected for

inclusion in the database appear in the right list (*Database* list) and all remaining files appear in the left list (*Folder* list).

Click on the *Explorer* button to open the selected folder in Windows Explorer.

Files may be moved between the lists by either double clicking on the filename or using the arrow buttons.

Each list is initially sorted by file name. Clicking on the column headers will change the sort method to the attribute in the column title. Consecutive clicks on the same column header will toggle the sort between first-last and last-first.

2.1.1 SPS Format

The software will attempt to automatically detect which SPS format revision (1.0 or 2.1) in which input files are recorded. If it is unable to do so (e.g., there is no file header) then the user will be prompted to enter the format revision.

Important: without the correct format revision specified unexpected results will be seen throughout.

2.1.2 File Display Attributes

Right click on a file to display the popup menu. From this menu the plot visibility and colour for the selected file(s) can be changed. The attributes can also be changed by clicking on the file checkbox and colour box.

2.1.3 Viewing/Editing Files

A file may be opened for viewing/editing by right clicking on the file name and selecting *Edit* from the popup menu.

Standard file and text editing functions are available from the popup menu invoked by right clicking on the window, as shown above in Figure 2-2.

When the file is saved it is automatically re-read into the database if included in the dataset.

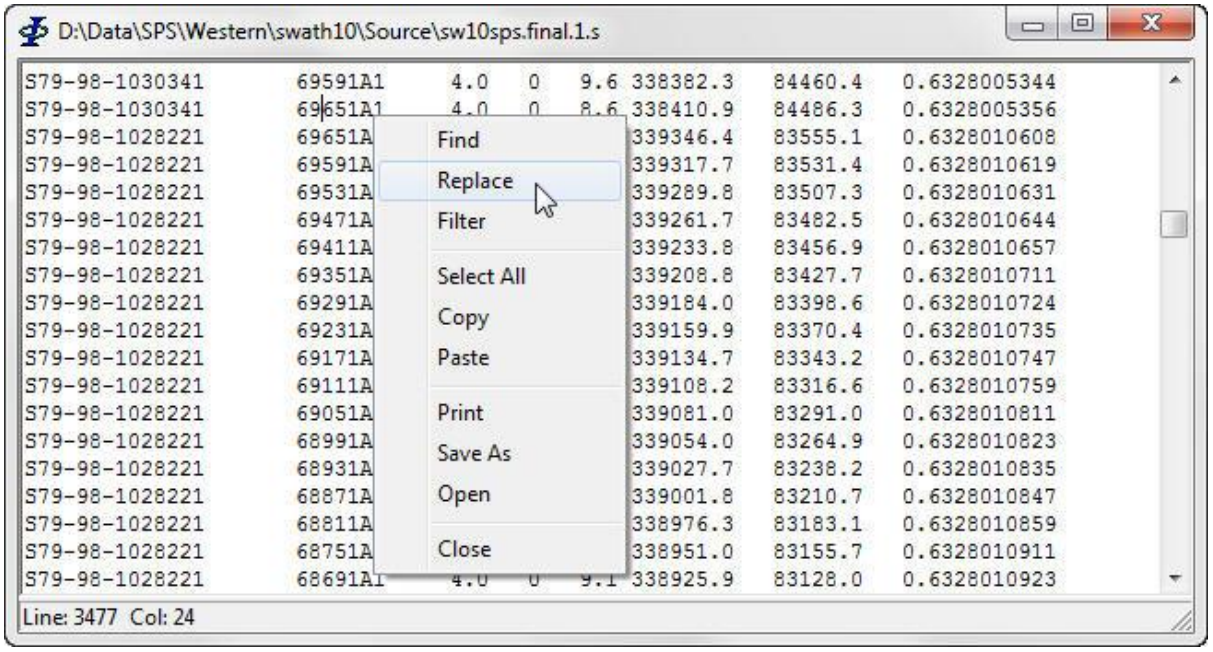


Figure 2-2 – File Editor

2.1.4 Relation Files

Relation files are not required in order to plot the source and receiver files. They are required to highlight the link between source and receiver files.

2.1.5 Auxiliary Files

The Auxiliary category can be used to include any source or receiver files that are not an integral part of the SPS dataset, e.g., preplot files. These will then be available for display on the map, in the database and performing comparisons.

2.1.6 Imported Graphics Files

Graphics files in DXF and ESRI Shape format may be displayed on the map. Click the *Add Files* button to add files.

Set the colour and visibility from the popup menu by right clicking on the selected file(s).

2.2 Map

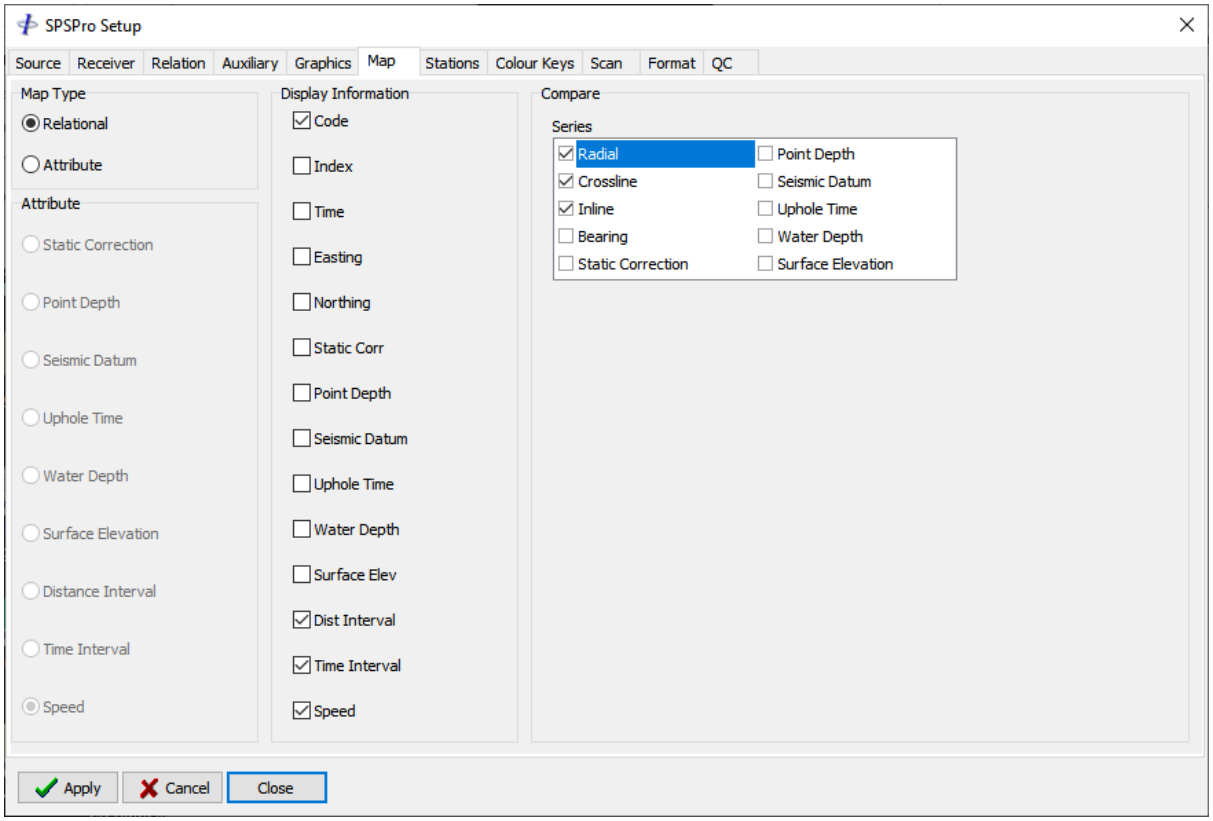


Figure 2-3 – Setup: Map

2.2.1 Display Type

The *Display Type* group is used to specify what is displayed on the interactive map.

When set to *Relational* the sources and receivers are plotted using their specified *Active* colours (See section 0). This setting allows interactive visualisation of the active receivers for each source.

Selecting any one of the remaining attributes will map the sources and receivers using the specified colour legend (see section 2.4).

2.2.2 Display Information

The *Display Information* group is used to specify which attribute values are displayed in the on the interactive map when the mouse cursor is positioned over a source or receiver station. This information is also displayed when selecting points using one of the selection methods (see section 3).

Up to four attributes can be selected for simultaneous display. To change the selection first deselect the unwanted attributes before selecting those required.

2.2.3 Compare

These settings apply to comparisons that are carried out on a selected area of the lines plotted on the map.

Series: Check the series to be compared.

2.3 Stations

2.3.1 Codes and Indexes

The code and index lists are populated from those found in the data records.

2.3.2 Plot

The *Plot* group allows the user to specify which stations are to be plotted on both the map display and the time series plots based on instrument code and station index.

To change the plot status for either of these attributes highlight the required attributes in any of the lists and then click on the *Plot* button or *Don't Plot* button.

2.3.3 Killed Stations

Optionally enter in the *Codes* list the 2-character codes which represent killed stations.

Optionally enter in the *Indexes* list the integer index numbers which represent killed stations.

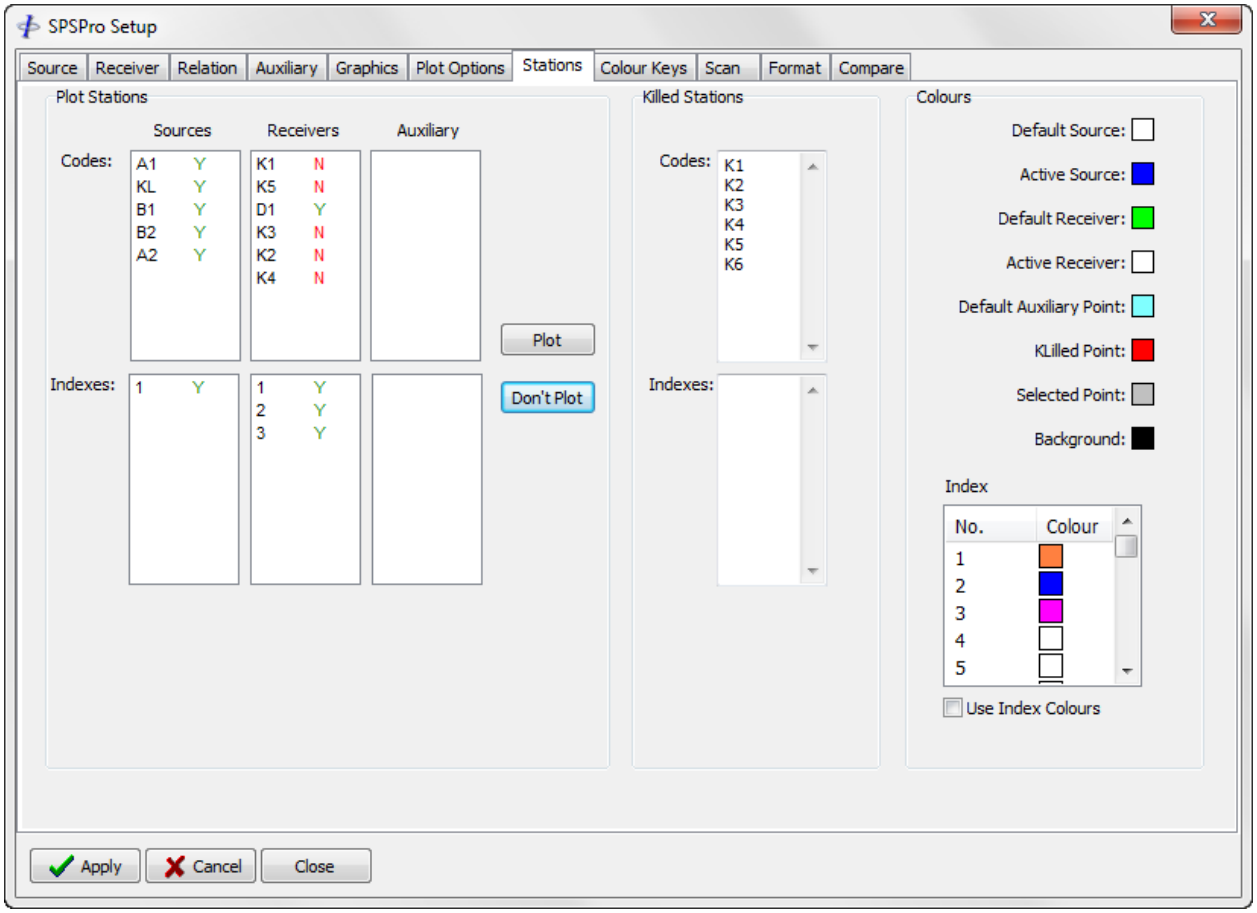


Figure 2-4 – Setup: Stations

2.3.4 Colours

The *Colours* group allows the user to specify which colours to use for plotting the stations on the map display and for specifying the map background colour.

To change any colour, click on the colour key with the left mouse button and select the new colour from the colour dialog.

Colours may be copied and pasted by right clicking on the colour key and selecting from the respective options in the popup menu.

2.3.5 Index

Individual index colours can optionally be specified. When enabled, these colours will be used to plot the specified indexes instead of their default colours.

2.4 Colour Keys

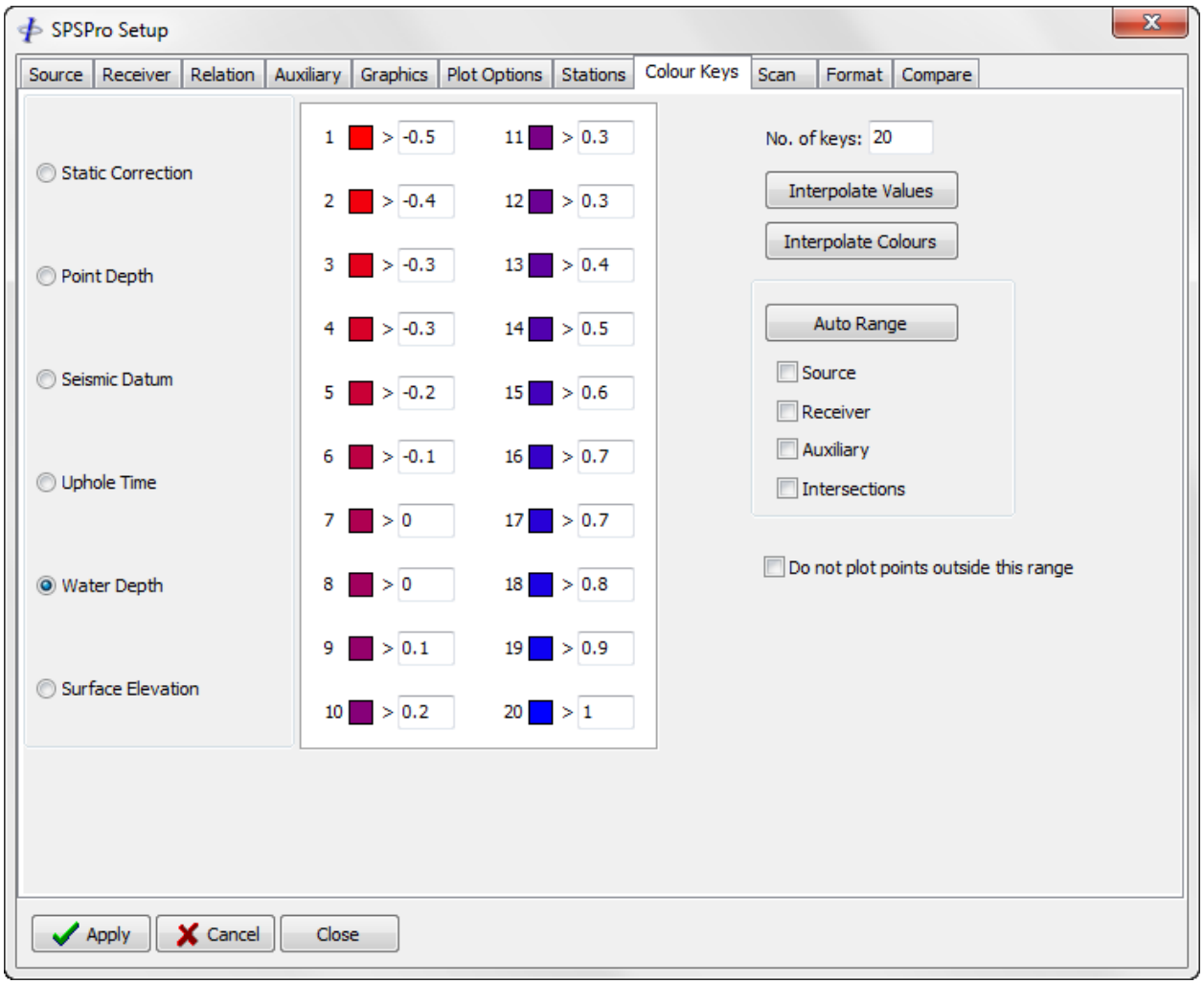


Figure 2-5 – Setup: Colour Keys

The *Colour Keys* page allows the user to specify the colours and corresponding values for attribute mapping (see Display Type).

The points whose attribute value is *greater than* the key value will be plotted in the corresponding colour.

To change any colour, click on the colour key with the left mouse button and select the new colour from the colour dialog.

Colours may be copied and pasted by right clicking on the colour key and selecting from the respective options in the popup menu.

2.4.1 Interpolation

To automatically interpolate the values, enter the first and last values then click the *Interpolate Values* button. The remaining values will be interpolated.

To automatically interpolate the colours, set the first and last colours then click the *Interpolate Colours* button. The remaining colours will be interpolated.

Interpolation may also be done for a sub-set by setting the required first and last value/colour of the sub-set and entering the sub-set range in the dialog that appears when the interpolation button is clicked.

2.4.2 Auto Range

To set the range and value interpolation to match the maximum and minimum values found in the dataset click the *Auto Range* button. Auto ranges will be applied to the selected categories – source, receiver, auxiliary and intersections (if intersections have been computed).

2.4.3 Outside Range

To suppress plotting of points whose value falls outside the specified maximum and minimum values check the *Do not plot…* checkbox.

2.5 Scan

Refer to section 7 Scan.

2.6 Format

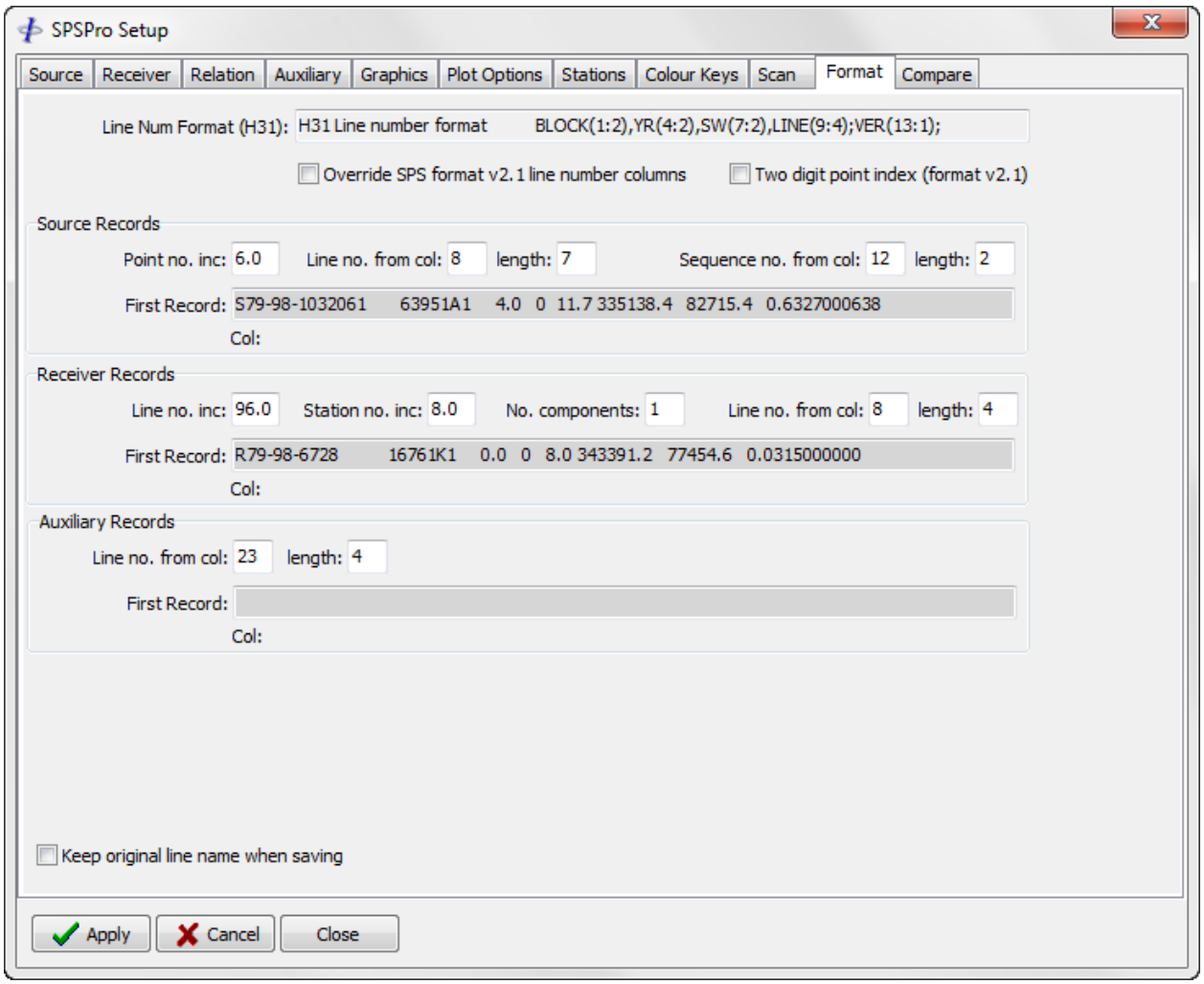


Figure 2-6 – Setup: Format

The *Format* page is used to specify how the data records are parsed.

Important: For SPS format revision 1.0 the line number location specification is not optional and needs to be correctly specified in order for the program to function correctly in all respects.

Important: It is expected that all files in the same category (source, receiver, auxiliary) are formatted identically.

2.6.1 Line Number Format

As an aid the H31 record (SPS format revision 1 only) in the first header found in the SPS dataset is displayed.

Additionally, first Source, Receiver and Auxiliary data records found in the SPS dataset are displayed in the *First Record* fields of their respective parameter groups. When the cursor is placed in these fields the cursor column position is displayed directly below the field.

2.6.2 SPS Revision 2.1

The SPS revision 2.1 format does not normally require manual specification of the line number location. However, it may be necessary to override the number location as stored in the file. Check the *Override…* checkbox to apply the line number location as specified in the *Source Records* and *Receiver Records* sections on this page.

Check the *Two-digit point index* checkbox if the SPS file utilises column 23 and 24 in the file for the point index.

2.6.3 Source Records

Point Number Increment:	Enter the expected shotpoint numbering increment.
Line No:	Enter the starting column and number of characters (field length) used for the receiver line number. Optional for SPS format rev. 2.1.
Sequence No:	Enter the starting column and number of characters (field length) used for the line sequence number. This may be left blank.

2.6.4 Receiver Records

Line Number Increment:	Enter the expected receiver line numbering increment.
Station Number Increment:	Enter the expected receiver station numbering increment.
No. Components:	Enter the number of receiver components (different instrument codes for each point).

Line No: Enter the starting column and number of characters (field length) used for the receiver line number. Optional for SPS format rev. 2.1.

The line numbering increment and station numbering increment are specified for use in scanning the receiver file to report any exceptions in the ordering of the records. (Receiver records should be ordered by line number, point number and index number).

2.6.5 Auxiliary Records

Line No: Enter the starting column and number of characters (field length) used for the line number. This could be a receiver line or a source line depending on which file type has been selected for the auxiliary dataset. Optional for SPS format rev. 2.1.

2.6.6 Relation Records

For SPS format rev. 1 the line number positions within the line name are expected to be the same as in the source and receiver records, therefore no further parameters are required.

2.7 Quality Control

2.7.1 Overview

The basis of the Quality Control (QC) module is a set of *QC Items* from which plots may be generated. Each item will contain one or more *Series*, optionally associated with each *Series* are any number of *Tests*.

After making any changes, click *Apply* to save the changes or *Cancel* to discard the changes.

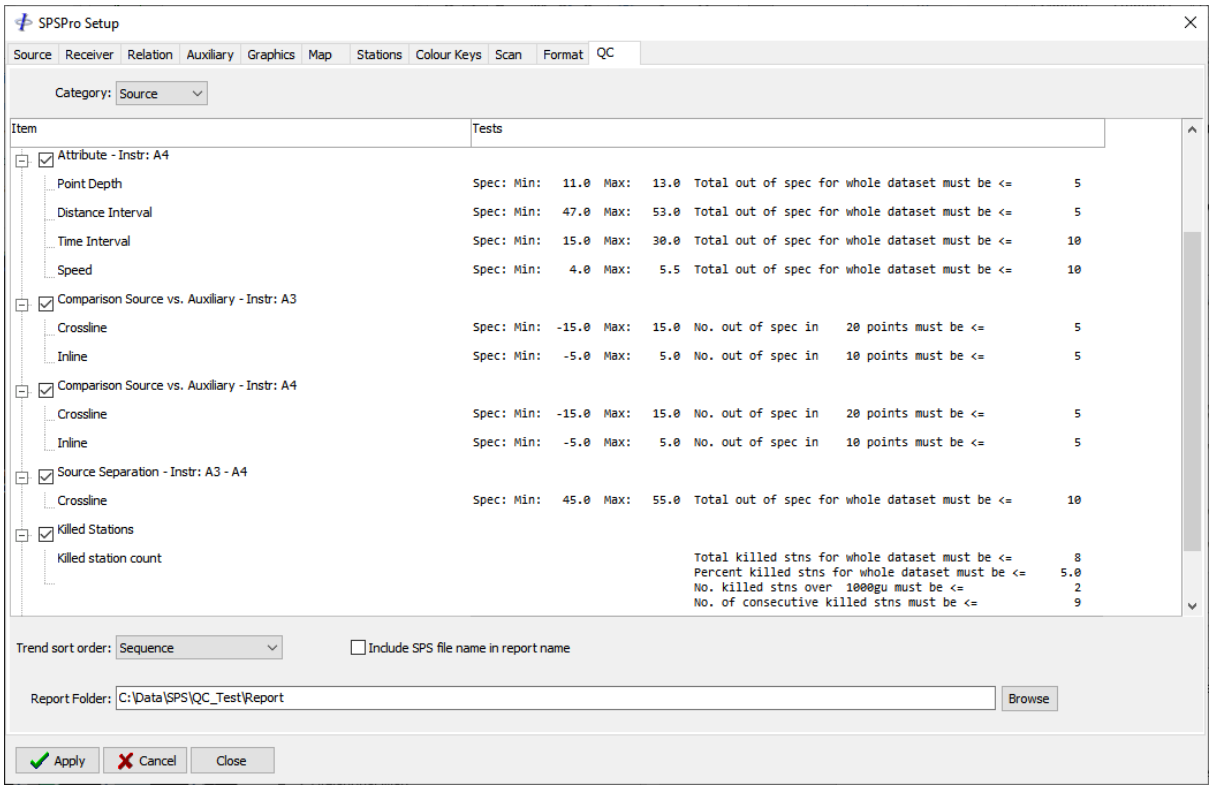


Figure 2-7 – Setup: Quality Control

2.7.2 Controls

Category: Select *Source* or *Receiver* from the dropdown list. All *QC Items* specified will be for the specified *Category*. The *Category* can be changed without losing the existing configuration.

Trend Sort Order: The specified *Trend Sort Order* will be the default sort order when producing trend plots.

Include SPS file name in report name:	When checked, the name of the SPS file is included in the report file names. This will ensure that report files are uniquely named for different versions of the same line recorded in different files.
Report Folder:	Enter the report folder location.

2.7.3 Popup Menu:

All configuration is done by accessing the popup menu by right clicking the mouse.

Add Item:	Invoke the dialog to add a new QC item.
Edit Selected Item:	Make changes to the selected *QC Item*.
Remove Selected Items:	Delete the selected *QC Items*.
Add Test for Selected Series:	Invoke the dialog to add a new test.
Edit Test for Selected Series:	Invoke the dialog to edit the selected test(s).
Copy Tests	Copy the selected tests. Selected tests must be for a single *Series.*
Apply Copied Tests:	Apply the copied tests to the selected *Series*.
Remove Test for Selected Series:	Invoke the dialog to delete a test from the selected *Series*.
Enable All:	Enable all items for processing.
Disable All:	Disable all item for processing.
Collapse All:	Collapse all items.
Expand All:	Expand all items.

2.7.4 QC Item Setup

From the popup menu select *Add Item* or *Edit Selected Item*.

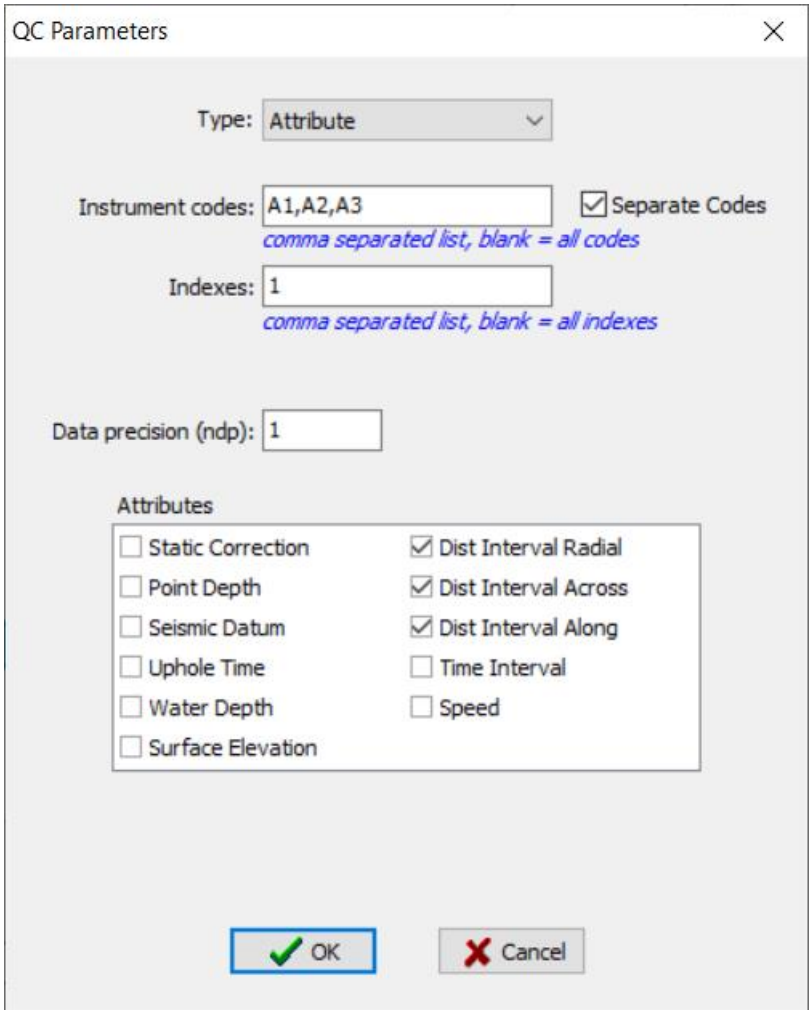


Figure 2-8 - Setup: QC Item Dialog - Attribute

2.7.5 Item Type

Attribute: Optionally specify the instrument code(s). If not specified then all codes will be included for this plot.

Select any set of the available *Series*. Each *Series* selected will provide a separate time series plot.

Comparison:

Optionally specify the instrument code(s). If not specified then all codes will be included for this plot.

Select any set of the available *Series*. Each *Series* selected will provide a separate time series plot.

Select from the dropdown list the category from which lines with matching numbers will be compared. The default is *Auxiliary*. See section 2.6 for specification of line number.

Source Separation:

Specify the instrument codes for the two sources for which separation is to be calculated. If more than one instrument pair is to be calculated then a separate *QC Item* must be configured.

Note: the position of the non-firing source (*To instrument code*) is interpolated to the time of the firing source (*From instrument code*) for the separation calculation.

Note: the azimuth used for the separation calculation is the current CMG of the firing source.

Killed Stations:

Optionally specify the instrument codes. If not specified then all codes will be included for this plot.

Stations for which the code or index is included in the killed station definition will be counted.

If a code is specified then only those points whose second character matches the specified code will be considered and the second character of the code will be used to match with a kill code.

E.g.: for instrument code A3, only points whose second character is ‘3’ will be counted, and any which correspond to one of the specified kill codes whose second character is ‘3’ will be counted as killed.

See section 2.3.3 for specification of killed stations.

Missed Stations: Stations missed based on the specified point increment will be counted. See section 2.6 for specification of point increment.

2.7.6 Item Settings

Item settings will change according to the selected *Item Type*.

Instrument Codes: Optionally enter the instrument codes for all instruments to be included in this QC item. The list must be comma separated.

Leave blank to include all instrument codes in the dataset.

Does not apply to *Source Separation* or *Missed Stations*.

Separate Codes: Applies only to derived attributes for distance intervals and time interval.

Checked: each point's derived attribute is calculated from the previous point of the same code.

Unchecked: each point's derived attribute is calculated from the previous point regardless of instrument code.

From instrument code: Specify a single instrument code.

Applies to *Source Separation* only.

To instrument code: Specify a single instrument code.

Applies to *Source Separation* only.

Indexes: Optionally enter the indexes for all stations to be included in this QC item. The list must be comma separated.

Leave blank to include stations of all indexes in the dataset.

Data precision Specify the precision, in number of decimal places, to be used.

Compare file list: Select the category from which the comparison lines will be taken. The default is *Auxiliary.*

2.7.7 Test Setup

Select one or more *Series*. From the popup menu select *Add Test for Selected Series* or *Edit Test for Selected Series*.

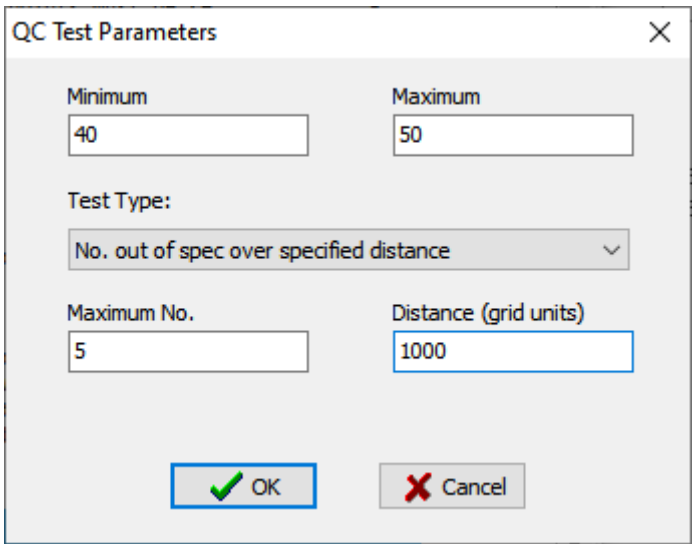


Figure 2-9 – Setup: Acceptance Test Dialog

Test parameters vary depending on the *QC Item* type and the *Test* type, as tabulated in the following tables.

QC Item Types	**Parameters**
Attribute, Comparison, Source Separation	Minimum value Maximum value Any value outside the range specified is counted as *Out of Spec*.
Killed Stations, Missed Stations:	None Killed or missed points are counted.

In the table below, depending on the *QC Item* type, * = *Out of Spec*, *Killed Stations* or *Missed Stations*.

Test Type	**Parameters**
*Total * for whole line:*	Maximum number
*Percent * for whole line:*	Maximum number
*Number of Consecutive *:*	Maximum number
*Number * in specified number of points:*	Maximum number Number of points
*Number * over specified distance:*	Maximum number Distance in grid units
Absolute average out of spec in specified number of points:	Number of points
Absolute average out of spec over specified distance:	Distance in grid units.
*Average * for whole line:*	None.

Note: For tests specifying a window in number of points, these points are taken from the test dataset which may not be the whole line, e.g., if only one instrument code is defined then only records containing that instrument code will constitute the dataset.

2.7.8 QC Item Selection

Only checked *QC Items* will be processed.

The order of *QC Items* can be changed by dragging with the mouse.

3 MAP

Click on the *Map* button on the main toolbar to display the map of the selected attribute as specified in the *Setup* | *Plot Options* | *Display Type*.

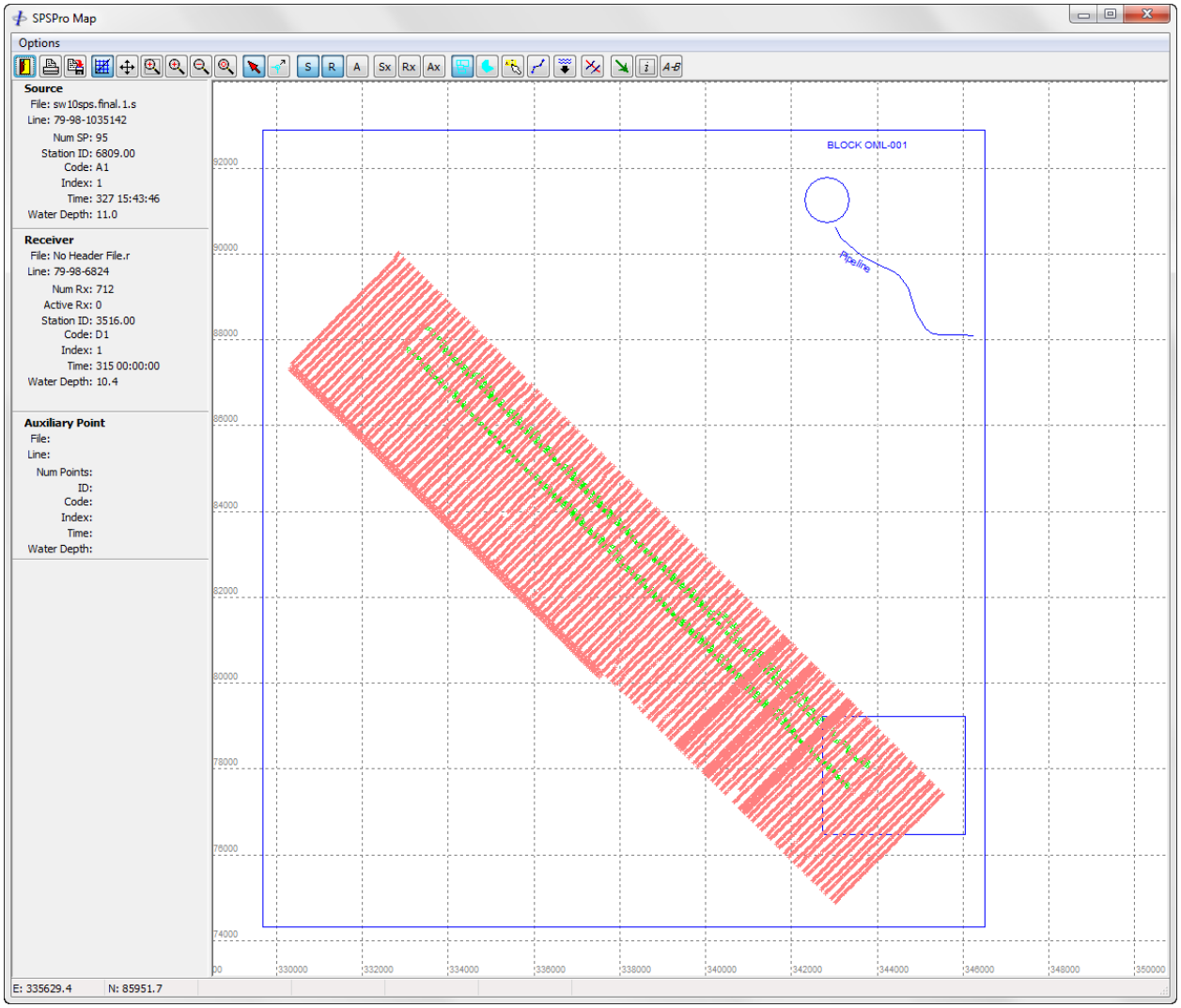


Figure 3-1 – Map

Sources are plotted as crosses, receivers as circles and auxiliary points as squares.

The information shown in the panel to the left of the map pertains to the source and/or receiver at the current cursor position. The information given is the line name, point number and the attributes specified in *Setup* | *Plot Options* | *Display Information*.

The Grid coordinates of the mouse cursor position are displayed in the lower left panel.

To make distance and azimuth measurements on the map drag the mouse between the required points keeping the right mouse button depressed. The distance, delta east and north, and azimuth are displayed in the lower left panel.

To zoom in around an area use the left mouse button to define a rectangle. To zoom in or out centred at the mouse location use the mouse wheel.

3.1 Menu

Options | *Selection Mode*	Set the selection mode to use when selecting points on the map.

3.2 Toolbar

 Close the display.

 Send the display to the default printer.

 Save the display as a Windows bitmap file (.bmp).

 Scale both axes the same.

 Enable mouse panning.

 Enable window zoom.

 Zoom in.

 Zoom out.

 Zoom extents.

 When down, the mouse can be used to highlight the active receivers for the clicked source and active sources for the clicked receiver.

 Enable editing of a point by dragging with the mouse.

Toggle source display on/off.

Toggle receiver display on/off.

Toggle auxiliary display on/off.

Plot source station numbers.

Plot receiver station numbers.

Plot auxiliary station numbers.


Toggles display of imported DXF files.


Toggles display of imported Shape files.


Display hint window with selected attribute values when mouse over point.


Connect stations as a visual aid.


When plotting water depths, toggles application of tidal reductions stored as the Surface Elevation attribute. When invoked, water depths displayed in the information panel on the left and the hint window are the reduced depths.


Select points using the selection method as specified under *Options* | *Selection Mode*.


Display the specified attributes of the selected points in a separate window.

Compare the selected points.

3.3 Logging

SPSPro allows logging of selected points on the map to a file. File types supported are comma separated value (.csv), tab delimited (.txt) and space delimited (.txt).

From the Main Menu select *File* | *Station Logging.* In the dialog select the file type. Select an existing log file or enter the name of a new log file. Click *Open*.

The menu item will be checked and the log file name and path will be displayed in the status bar of the main window. If the file already exists any new points logged will be appended to the file.

Click on *Map* in the main toolbar. As long as logging is enabled by clicking on a source or receiver on the map that point's position and all attributes will be written to the log file with each field separated by a comma, and the record terminated by a carriage return/line feed. The Windows Default Beep will play when a point is logged.

To stop logging and close the log file select *File* | *Station Logging* again. This menu item will then be unchecked.

3.4 Kill Point

A *KL* code can be applied to a point by right clicking on the point with the mouse and selecting *Kill Point* from the pop-up menu. To resurrect a point, select *Un-kill Point* from the pop-up menu.

3.5 Relational Map

Under *Setup* | *Plot Options* | *Display Type* | select the *Relational* option, then click on the *Map* button.

The relational map allows visualisation of the active spread into which a shot is fired. Sources and receivers are plotted in the colours specified in *Setup* | *Stations* | *Colours*.

To highlight the active receivers or active sources, with the  button down, click on any source or receiver point with the left mouse button. Active receivers or active sources will be plotted in the Active Receiver colour or Active Source colour.

When the mouse cursor is positioned over a receiver the number of active receivers in that line is displayed in the *Receiver* panel.

The total number of active receivers for the last clicked source point is displayed in the *Source* panel.

The total number of active sources for the last clicked receiver point is displayed in the *Receiver* panel.

3.5.1 Source / Receiver Gathers

When a source or receiver station is clicked when in Relational display, the corresponding receiver or source stations respectively are highlighted and their total is displayed in the Relation panel.

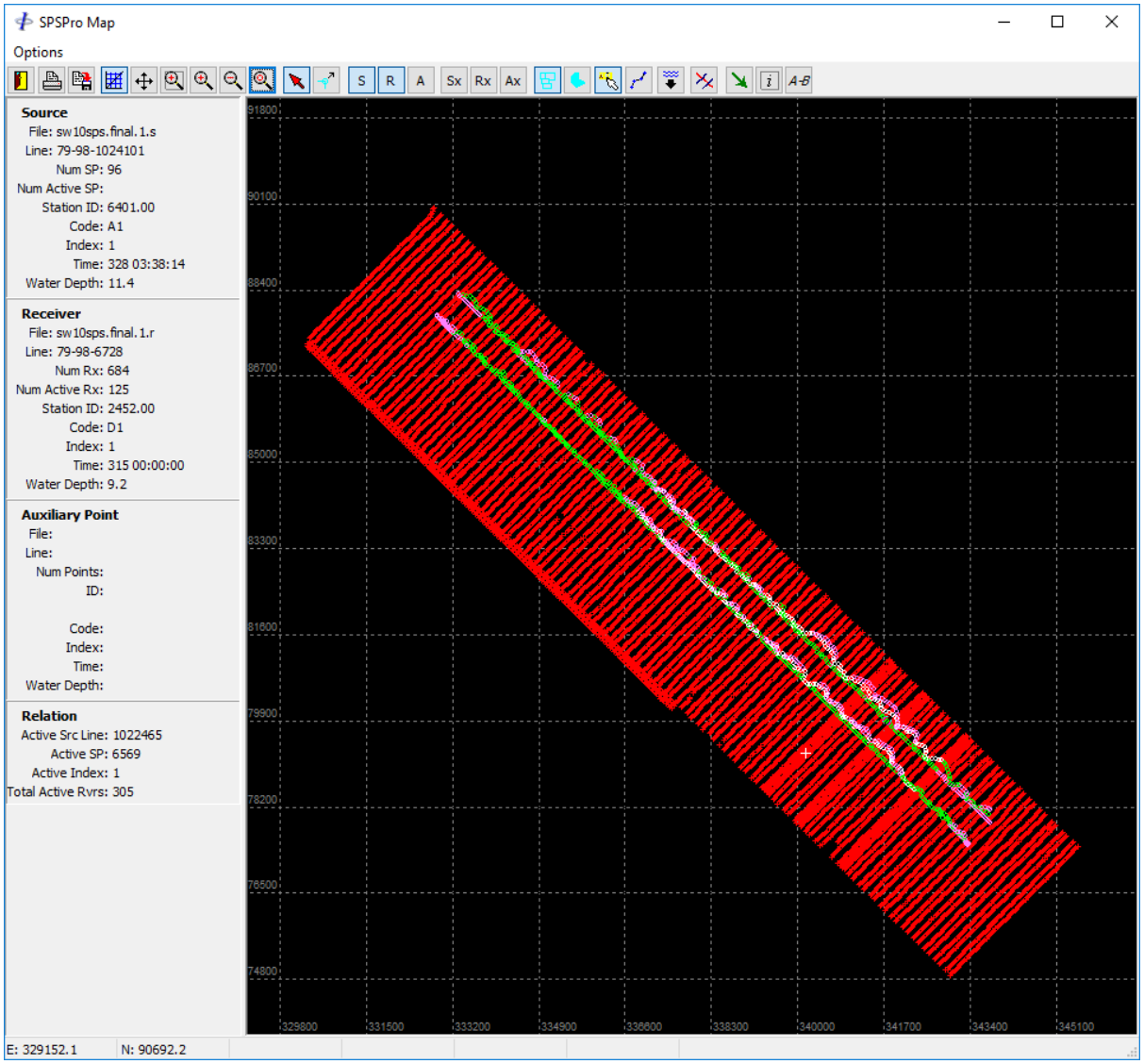


Figure 3-2 – Relational Map

3.6 Attribute Map

Under *Setup* | *Plot Options* | *Display* | select one of the attributes, then click on the *Map* button.

The attribute map displays values from the selected attribute colour coded according to the colour key settings for that attribute specified in *Setup* | *Colour Keys*.

Any one of the following attributes can be mapped provided the data is present in the SPS data file:

Static Correction
Point Depth
Seismic Datum
Uphole Time
Water depth
Surface Elevation

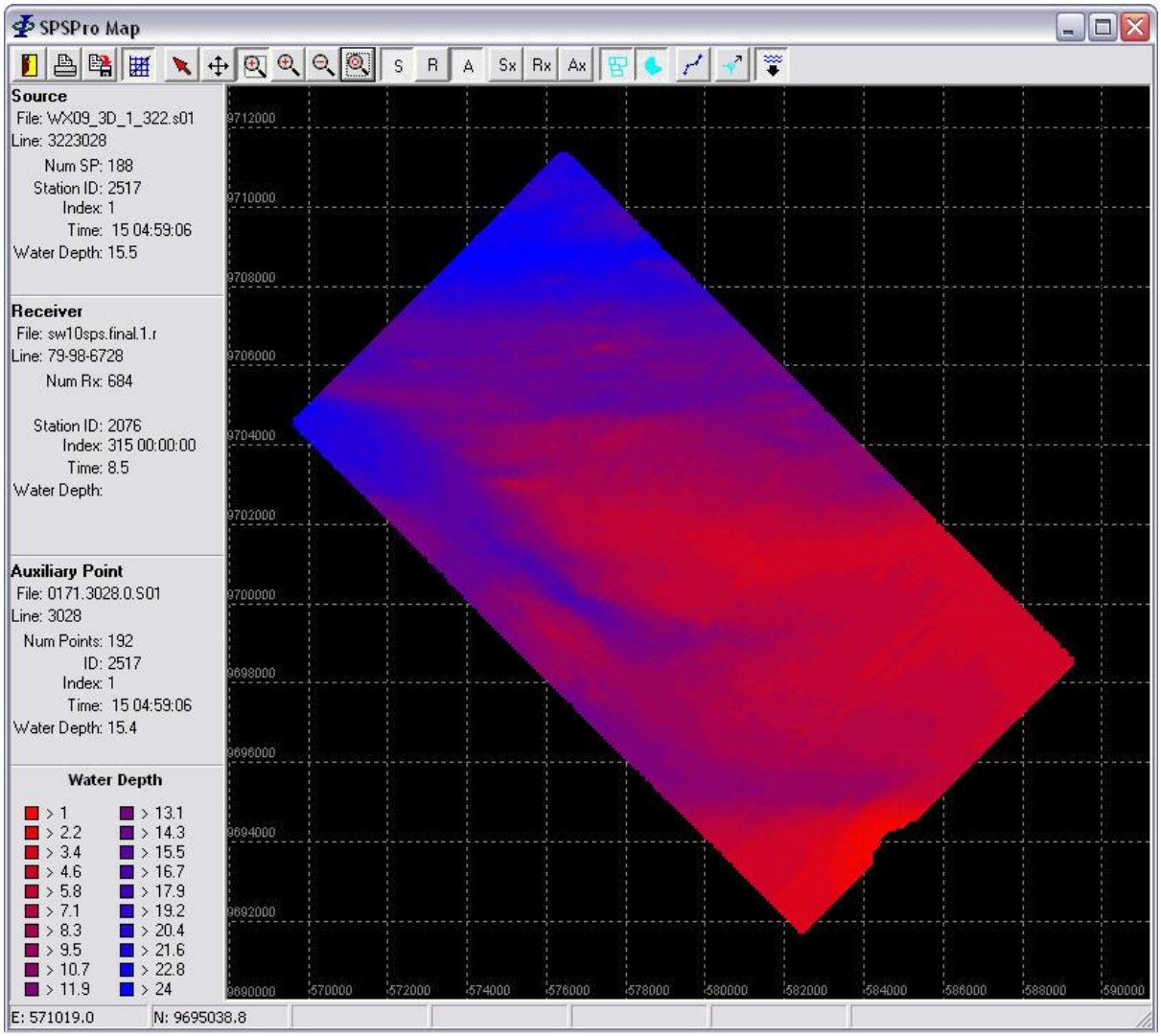


Figure 3-3 – Attribute Map

3.6.1 Intersections

If intersections have been computed then to display attribute differences at intersections on the map, under *Setup* | *Colour Keys* use the *Intersections* option for calculating the legend range automatically.

3.6.2 Selection

Points on the map may be selected for the purpose of gathering attribute information and performing comparisons. Before selecting points set the selection method from the *Menu* | *Options* | *Selection Mode*. The following selectin modes are supported:

Rectangle

Circle

Freehand

From external graphics Click on or near to the plotted object from one of the imported graphics files. E.g., as polygon representing an area of interest.

Click the *Selection* button,  , and use the mouse to perform the selection. The selected poits will appear in grey. Multiple selections can be made. To cancel the existing selectionn click the selection button again.

To display the specified attributes (see section 2.2.2) click the *Attributes* button,  .

3.6.3 Comparisons

Comparisons can be performed on points that fall within a selected area by clicking the *Compare* button,  , after making a selection. Matching points from different lines of the same line number will be compared according to the comparison settings as described in secion **Error! Reference source not found.**.

4 QUALITY CONTROL

The QC module provides the interface to execute the QC functions as configured in the Setup module (see section 2.7), and to produce plots of the results.

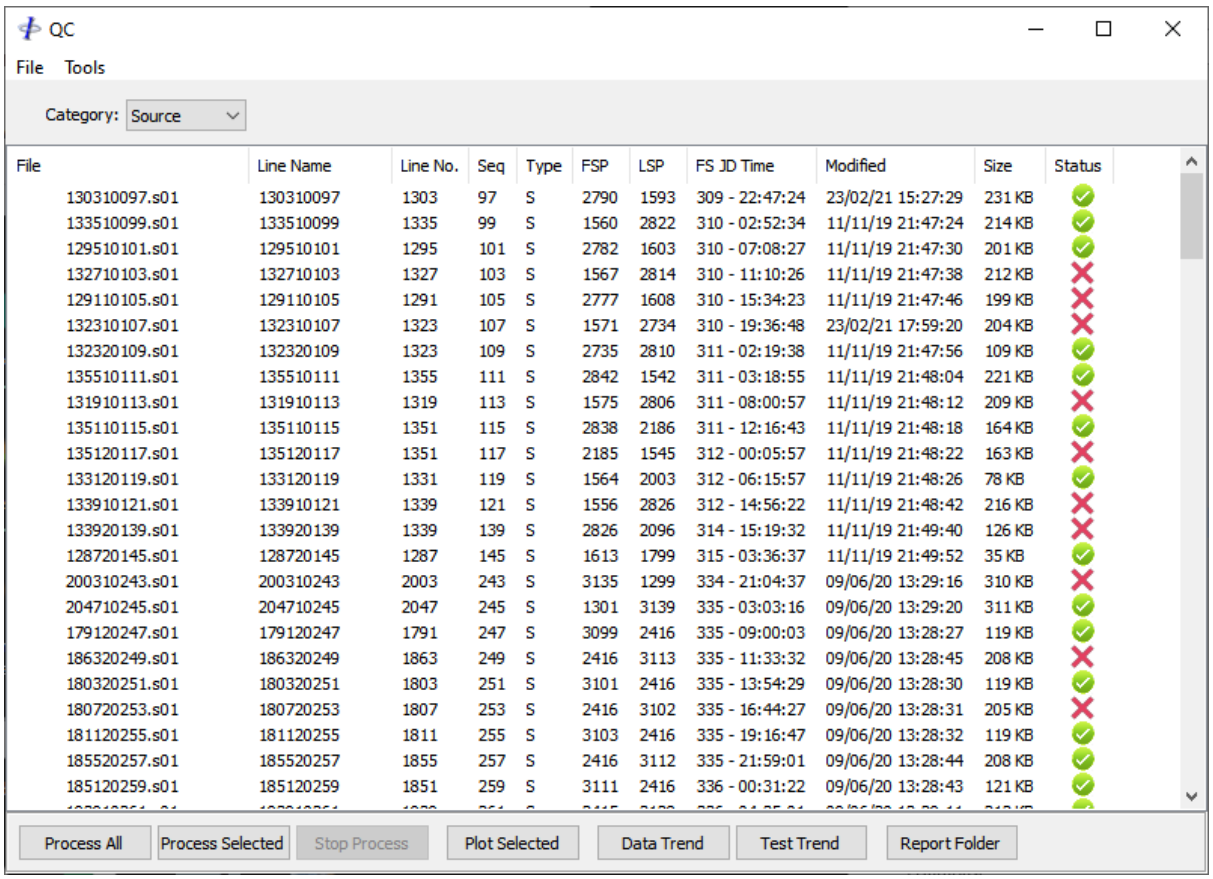


Figure 4-1 – Quality Control

4.1 Menu

Tools

Clean Database: Removed all database references to lines, QC Items, QC Series and acceptance tests which have been removed from the project.

4.2 Controls

Category: Select from *Source* and *Receiver.*

Process All:	Process all lines.
Process Selected:	Process selected lines.
Stop Process:	Stop processing.
Plot Selected:	Plot the time series for the selected lines.
Data Trend:	Plot the data trends for the selected lines.
Test Trend:	Plot the test trends for the selected lines.
Report Folder:	Open the report folder in Windows Explorer.

4.3 Line List

The line list contains all lines in the project in the specified category (Source or Receiver).

Clicking on a column header will sort the list by the contents of the selected column.

Repeated clicks will reverse the sort order.

4.3.1 Status


Not yet processed.


Processed successfully with no failures.


Processed successfully but with failures.


Processing not complete due to error.

4.3.2 Line List Popup Menu

Right click on the line list to display the popup menu.

Select All:	All lines will be selected.
Select None:	No lines will be selected.
Select by Attribute:	From the sub-menu select which attribute to filter and enter a filter string. All lines whose selected attribute contains the specified filter string will be selected.

Select by Status:	From the sub-menu select which status to filter by. All lines with the specified status will be selected.
Invert Selection:	Inverts the current selection.
Remove:	Removes the selected lines from the list. This can also be done by pressing the <Delete> button on the keyboard.
Filter:	From the sub-menu select which attribute to filter and enter a filter string. All lines whose selected attribute does not contain the specified filter string will be removed.
Edit:	Displays the contents of the selected file for viewing/editing. Does not apply to multiple selections.
Set Point Range:	Display the dialog to set the point range to be used for the selected line. All QC items for the selected line will be carried out on the specified point range.
Revert to first-last point:	Revert to using the first to last points in the line.
Report:	Open the QC report (PDF) for the selected line.

4.4 Process

Processing consists in the following:

1. All *QC Items* that are checked (see section 2.7.8), along with any associated tests, will be processed.
2. The results stored in the database. Existing results will be overwritten.
3. A PDF QC Report for each line is saved in the specified report folder. Existing reports will be overwritten.
4. A single text file containing all test results is saved in the report folder.
5. For comparisons additional reports are saved in sub-folders under the report folder.

The process can be stopped by clicking the *Stop Process* button.

4.4.1 Derived Attributes

Derived attributes are:

- Point distance interval
  - Radial
  - Along line
  - Across line

- Point time interval
- Point speed

4.4.2 Source Line Identification

It is conventionally required, in the case of derived attributes for sources, that these pertain to an individual source line.

Important: A point on the same source line is identified as having the same second character of the instrument code.

E.g.:
The following codes are considered to be on the same source line:
L1, K1, A1

The following codes are considered to be on different source lines:
A1, A2, A3

4.5 Report

Report is saved in the specified category's report folder.

The following reports are produced for each line:

- A PDF report comprising the following for each *QC Item*:
  - A separate time series plot of each series.
  - The test result for each series, indicating *pass* (green) or *fail* (red), and stating the maximum / minimum value(s).
- A csv file with the following columns:
  - Instrument code
  - Line number
  - Point index
  - Point index (in comparison dataset)
  - For each series configured:
    - Series data
    - For each test configured:
      - Test parameters
      - Test result (blank or FAIL).

The following summary reports are generated and updated after re-processing:

- A csv file for all lines containing the following columns:
  - File name
  - Line name
  - Sequence

  - Instrument code(s) if specified
  - Index(s) is specified
  - FSP
  - LSP
  - Number of shots
  - For each series:
    - Mean
    - Minimum
    - Maximum
- Summary text report for all lines

4.6 Plot

For all selected line, displays interactive plots of the time series for all *QC Item Series* in a single instance of the *Multiplot* module.

Refer to the MultiPlot manual for description of the *Multiplot* module.

4.7 Data Trend

This function is used to display interactive plots of the data trends for all *QC Item Series* for the selected lines. If less than three lines are selected all lines will be included in the plot. The line sort order used for the plot is the current sort order of the line list.

For each *QC Item Series*, the plot contains three series showing the mean, minimum and maximum value for each line, except for *Killed Stations* and *Missing Stations*.

For *Killed Stations* and *Missing Stations* the plot displays the number of killed or missing stations for each line as a bar chart.

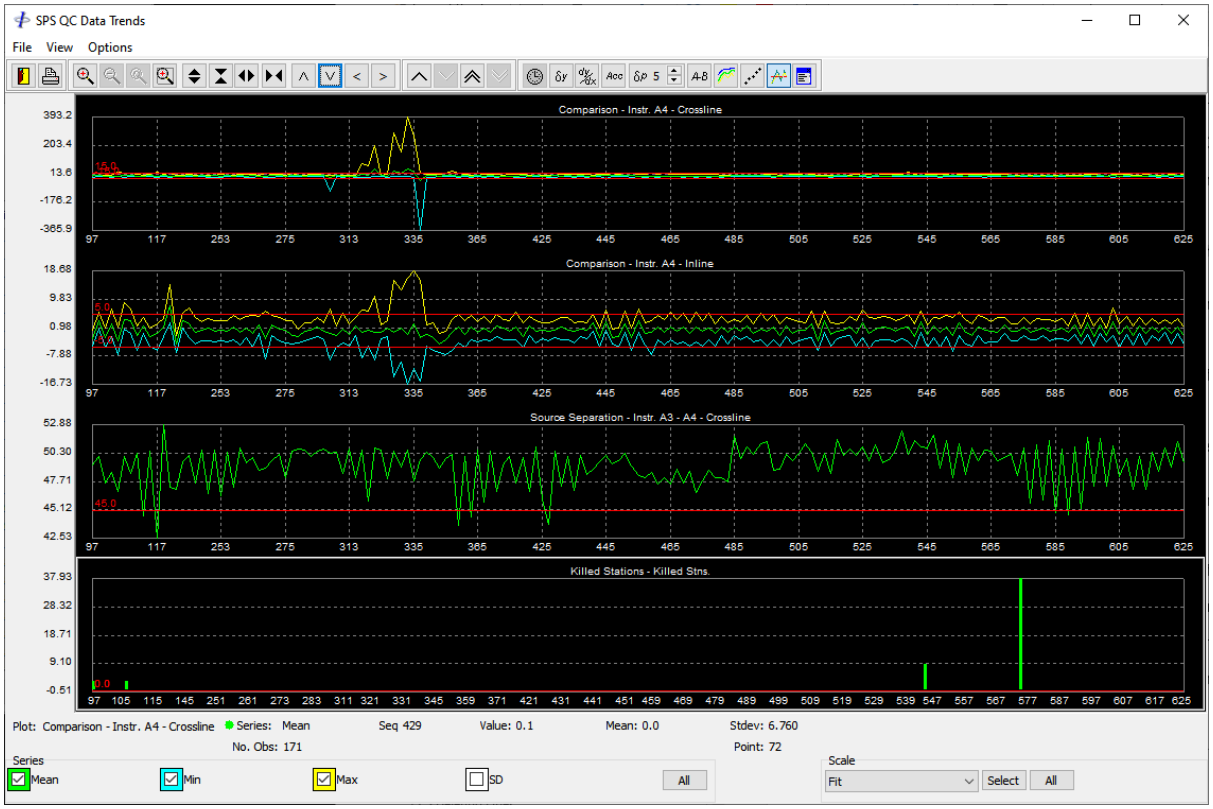


Figure 4-2 - Quality Control: Data Trend Plot

4.8 Test Trend

This function is used to display interactive plots of the test results as a Boolean value for all *tests* for the selected lines. If less than three lines are selected all lines will be included in the plot. The line sort order used for the plot is the current sort order of the line list.

For a single *test*, each line is plotted as single bar, green for a pass and red for a fail.

Refer to the MultiPlot manual for description of the *Multiplot* module.

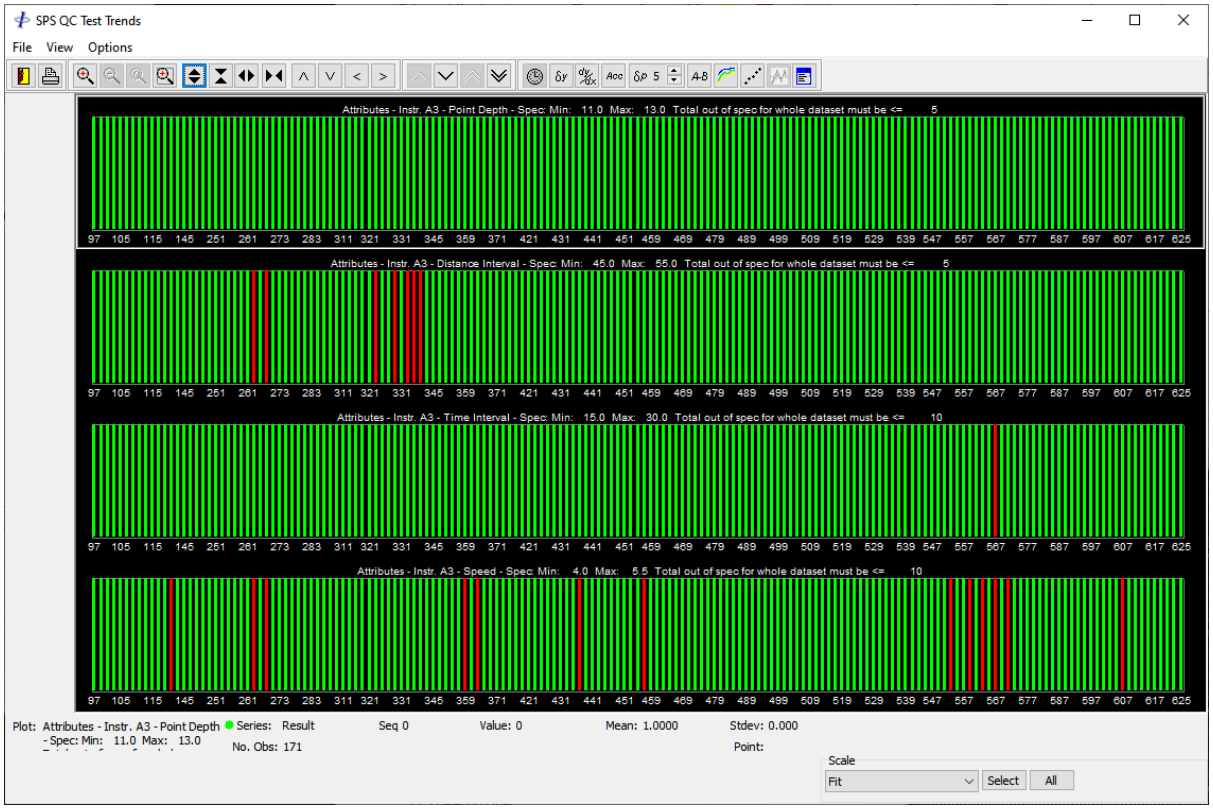


Figure 4-3 - Quality Control: Test Trend Plot

5 DATABASE

The Database module provides the means to organize, browse and edit the SPS dataset. It also provides a number of utilities for modifying the data.

From the main menu click on the *Database* button.

Data is organised in a tree with five main branches:

- Header
- Source
- Receiver
- Relation
- Auxiliary

5.1 Header

Click on the *Header* branch to display the header records as shown in Figure 5-1 below.

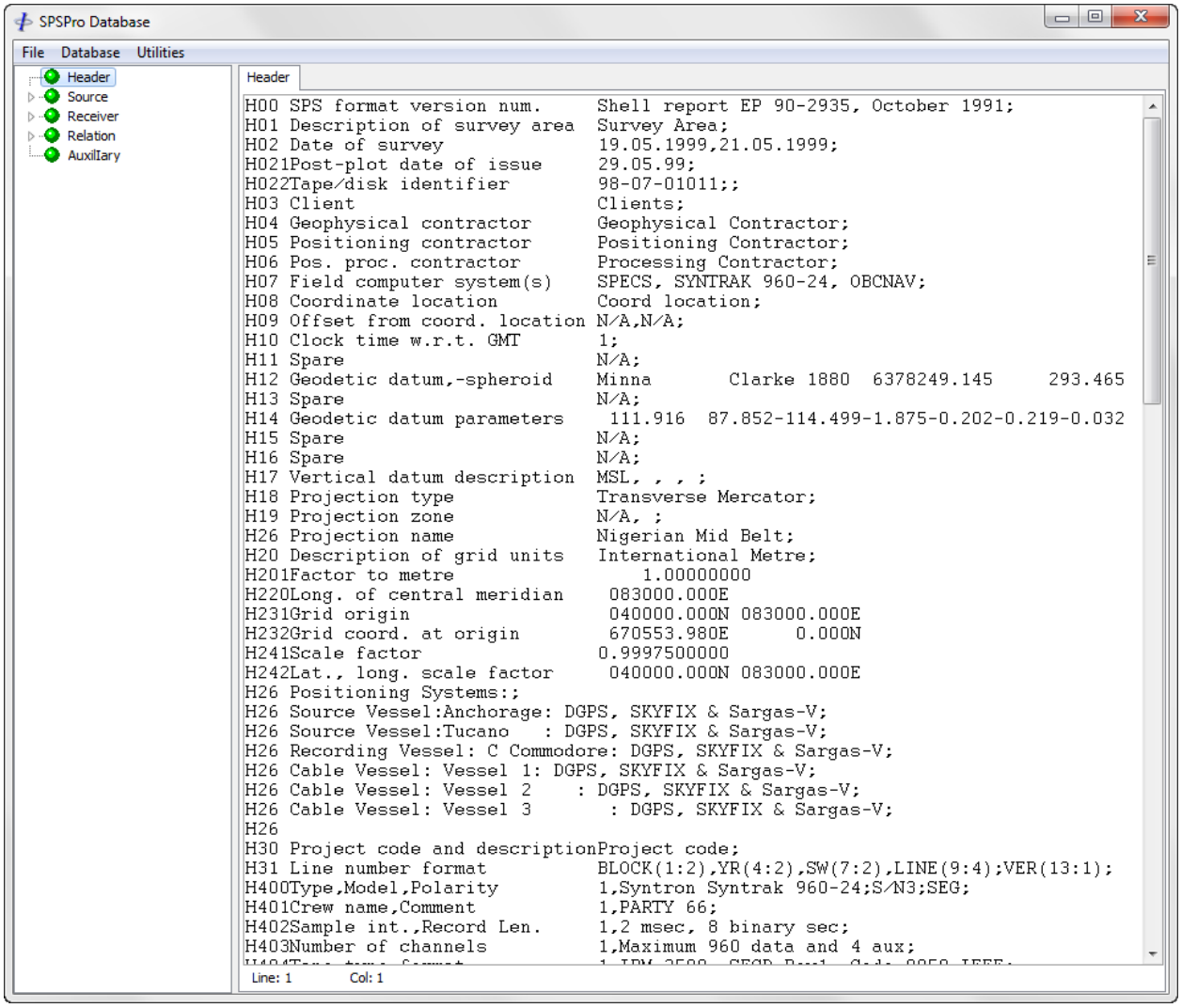


Figure 5-1 – Database: Header

The header is the first header read in the whole SPS dataset. It may be edited and saved to all SPS files in the project by choosing from the menu *File* | *Save*.

The header may be saved to a separate file by choosing *File* | *Save As* from the menu.

5.2 Data

The SPS dataset is subdivided by *Type*, i.e.: source, receiver and relation, *File* and *Line*, represented in the tree by level 1, 2 and 3 branches respectively, as shown in Figure 5-1 above.

To display attributes of the main data types, click on the relevant level 1 branch. In the right panel the folder, number of files and number of lines are displayed.

5.2.1 Files

To display file data, click on any level 2 branch, as highlighted in Figure 5-2 below.

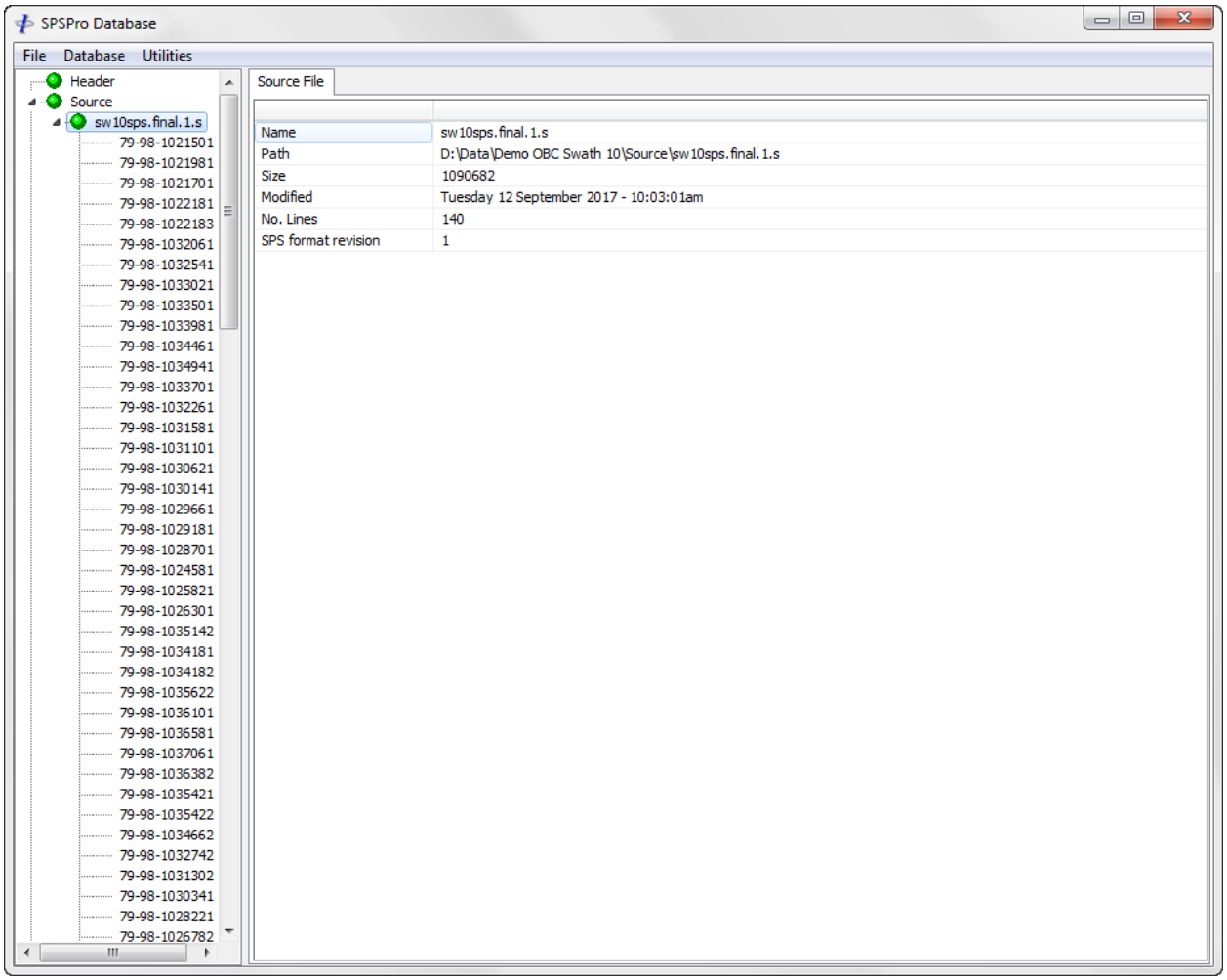


Figure 5-2 – Database: File

The attributes applicable to the file are displayed in the panel on the right. None of these attributes can be edited.

5.2.1.1 Creating Files

To create a new file into which existing lines may be copied, from the menu choose *File* | *New*, then select from the sub-menu which type of file to create: source, receiver or relation.

5.2.1.2 Renaming Files

To rename a file click twice on the branch label or press <*F2*>, type in the new name and press <*Enter*>.

5.2.2 Copying Lines

To copy an existing line to a different file, highlight the required line branches and using the left mouse button drag them onto the destination file as shown in Figure 5-3 below.

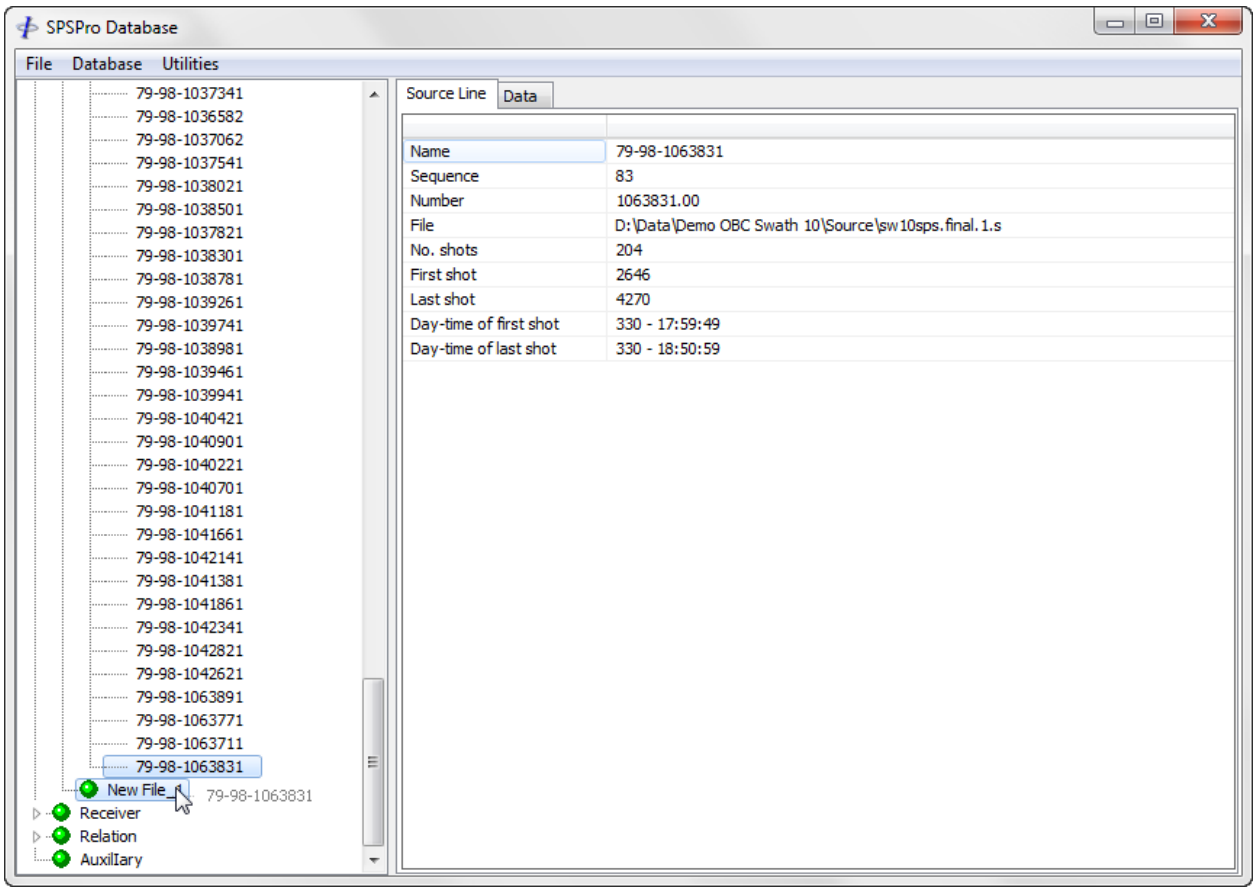


Figure 5-3 – Database: Copy Lines

Lines cannot be copied to files of a different data type.

The file and data type icons change to red to indicate that the file has been edited.

5.2.3 Deleting Lines

To remove lines from the database, highlight the lines in the list and from the menu choose *Database* | *Delete Lines*.

The file and data type icons change to red to indicate that the file has been edited.

5.2.4 Line Data

Each file is subdivided into the individual lines found within that file which are represented by level 3 branches as highlighted in Figure 5-4 below.

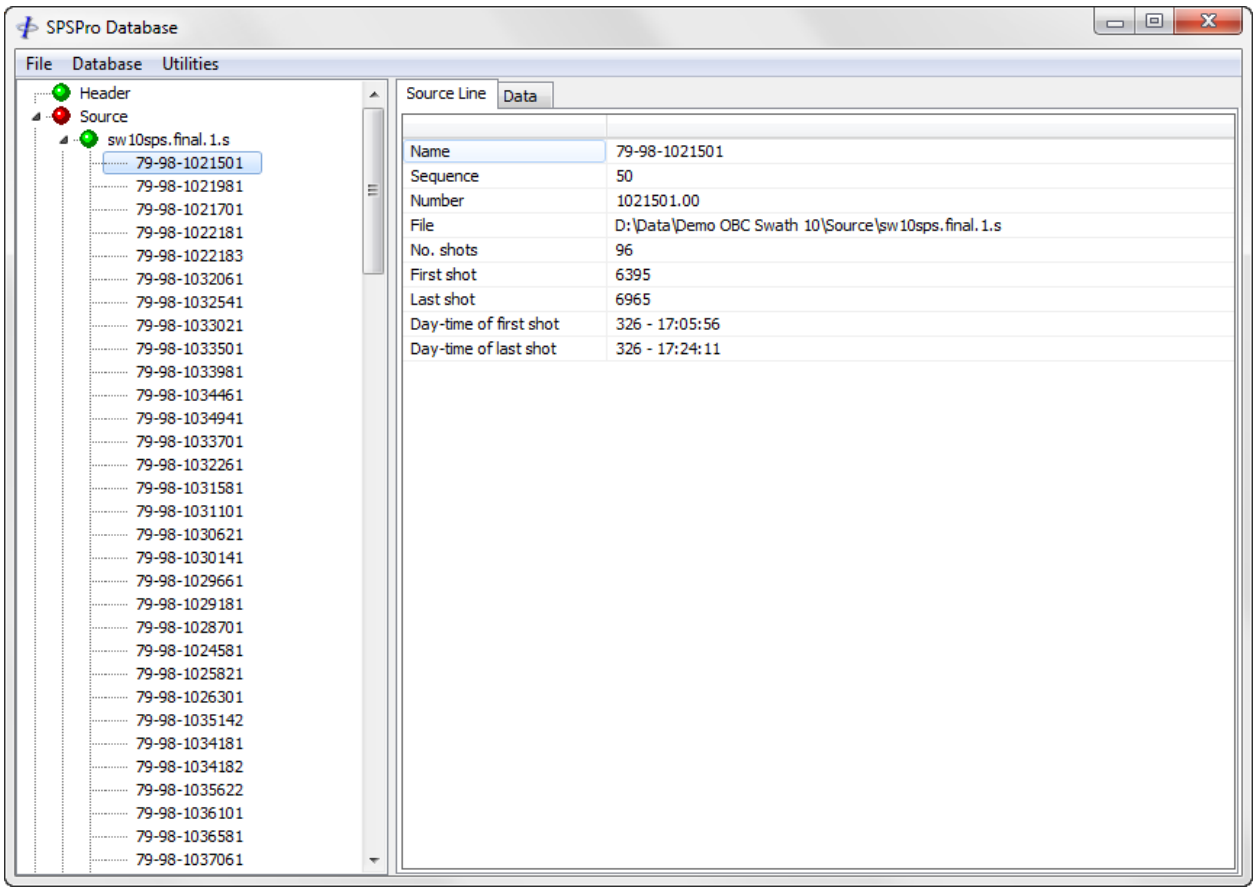


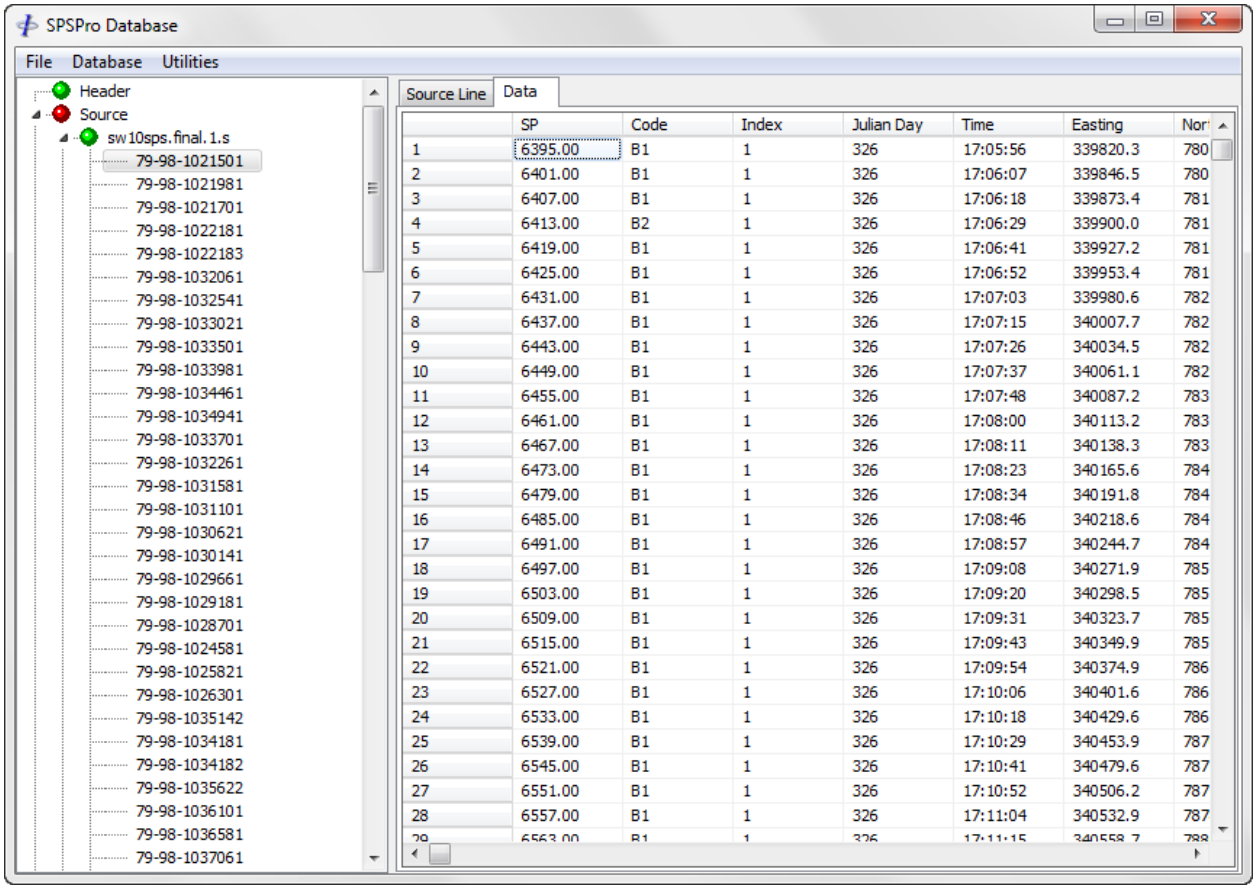
Figure 5-4 – Database: Line

The attributes applicable to the line are displayed in the *Line* tab page in the panel on the right. Of these only the line name may be edited.

5.2.4.1 SPS Records

The individual records in the file for the selected line are displayed in the *Data* tab page in the panel on the right, as shown in Figure 5-5 below.

All record attributes may be edited by typing in the new value.



	SP	Code	Index	Julian Day	Time	Easting	Nor
1	6395.00	B1	1	326	17:05:56	339820.3	780
2	6401.00	B1	1	326	17:06:07	339846.5	780
3	6407.00	B1	1	326	17:06:18	339873.4	781
4	6413.00	B2	1	326	17:06:29	339900.0	781
5	6419.00	B1	1	326	17:06:41	339927.2	781
6	6425.00	B1	1	326	17:06:52	339953.4	781
7	6431.00	B1	1	326	17:07:03	339980.6	782
8	6437.00	B1	1	326	17:07:15	340007.7	782
9	6443.00	B1	1	326	17:07:26	340034.5	782
10	6449.00	B1	1	326	17:07:37	340061.1	782
11	6455.00	B1	1	326	17:07:48	340087.2	783
12	6461.00	B1	1	326	17:08:00	340113.2	783
13	6467.00	B1	1	326	17:08:11	340138.3	783
14	6473.00	B1	1	326	17:08:23	340165.6	784
15	6479.00	B1	1	326	17:08:34	340191.8	784
16	6485.00	B1	1	326	17:08:46	340218.6	784
17	6491.00	B1	1	326	17:08:57	340244.7	784
18	6497.00	B1	1	326	17:09:08	340271.9	785
19	6503.00	B1	1	326	17:09:20	340298.5	785
20	6509.00	B1	1	326	17:09:31	340323.7	785
21	6515.00	B1	1	326	17:09:43	340349.9	785
22	6521.00	B1	1	326	17:09:54	340374.9	786
23	6527.00	B1	1	326	17:10:06	340401.6	786
24	6533.00	B1	1	326	17:10:18	340429.6	786
25	6539.00	B1	1	326	17:10:29	340453.9	787
26	6545.00	B1	1	326	17:10:41	340479.6	787
27	6551.00	B1	1	326	17:10:52	340506.2	787
28	6557.00	B1	1	326	17:11:04	340532.9	787

Figure 5-5 – Database: Line Data

5.2.5 Editing Data

5.2.5.1 Editing

To enter edit mode in a cell, click twice in the cell, or press <*F2*>. The cursor appears and the cell contents may be edited.

To exit edit mode either press <*Enter*> or click on a different cell.

5.2.5.2 Deleting

Records (entire rows) may be deleted by first highlighting at least one cell of each record to be deleted, then from the menu choosing *Database* | *Delete Records*.

5.2.5.3 Copying and Pasting Data

To copy selected cells of data to the clipboard highlight the cells with the mouse, or by using the shift and cursor keys, right click and from the popup menu select *Copy*. Key combinations <Ctrl> + <Insert> and <Ctrl> + C may also be used to copy the selection to the clipboard.

To highlight the whole column, click on the column header.

To paste data from the clipboard, highlight the cells into which the data is to be pasted, right click, and from the popup menu select one of the paste functions. All but the first of these functions are numeric. These are:

Replace:	Replaces the data in the cell with the data in the clipboard. Key combinations <Shift> + <Insert> and <Ctrl> + V may also be used to paste the contents of the clipboard.
Add:	Adds the value of the data in the clipboard to that in the cell.
Subtract:	Subtracts the value of the data in the clipboard from that in the cell.
Multiply:	Multiplies the data in the cell by the value of the data in the clipboard.
Divide:	Divides the data in the cell by the value of the data in the clipboard. If the value of the data in the clipboard is zero then no action takes place.

If the paste selection is greater than the copied selection then only the number of cells copied will be pasted

It is possible to copy and paste to and from external applications e.g., spreadsheets and text files with carriage return/line feed.

5.2.5.4 Saving Edits

When edits are made to the table, including deletion of records, they are not put into effect until changes are saved to the database by choosing from the menu *Database* | *Save Line*. Once the database has been saved after any changes have been made, these changes are immediately made available to all other SPSPro program features such as the *Map Display*.

At the same time, the *File* and *Data Type* branch icons turn red to indicate that the database

is now different from the file on disk.

These changes are only saved to the file on disk when the file is saved.

Warning: Once the file has been saved the changes are not reversible. It is advisable that backups are made to all original SPS files before selecting them for use in the project.

5.2.5.5 Undoing Edits

For files which have not been saved, i.e., those whose branch icons are red, all edits which have been made may be undone by choosing from the menu *Database* | *Undo All Edits*.

5.3 Sorting

The default sort order for S records is by time. In the case of files with no time or identical time stamps, e.g., preplots, the sort order is by line number, point number, point index.

The default sort order for R records is line number, point number, point index.

The default sort order for source lines is time, and for receiver lines is line number. These sort orders can be changed by going to *Utilities* | *Sort Lines By*.

Before sorting by line number can be done with SPS format revision 1.0 files the line number fields must be correctly specified in the *Setup* module, *Format* page.

Before sorting by sequence can be done the sequence fields must be correctly specified in the *Setup* module, *Format* page.

5.4 Utilities

The following sections describe the utilities accessed from the *Utilities* menu.

5.4.1 Importing Data

External ascii data can be imported into any of the following columns:

Static correction
Point depth
Seismic datum
Uphole time
Water depth
Surface elevation

To import external data first in the tree list, highlight the lines into which the data is to be imported. Then from the menu select *Utilities* | *Import Data*. The External Data dialog appears, an example of which is shown below in Figure 5-6. When the parameters are

correctly set up click the *OK* button.

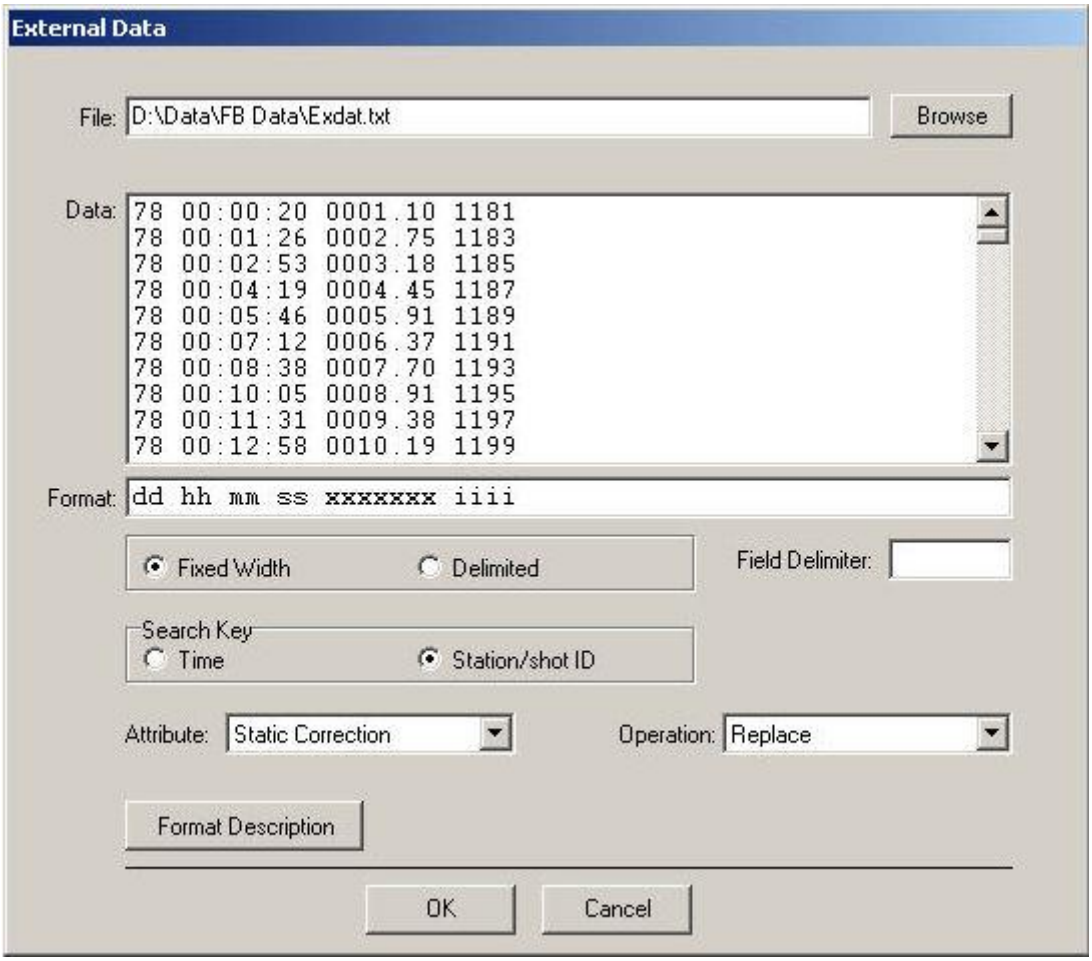


Figure 5-6 – Database: Importing data

5.4.1.1 Format

The external data field format can be fixed width or de-limited. Each record must be terminated by a carriage return/line feed.

The format is defined by entering a format definition string in the *Format* field using the following convention:

d = Julian day h = hour
m = minute s = second
i = station/shot id x = data value
any other character = do not import field

Fixed width:
format characters must match exact file positions

e.g.
data: `2001 306  6:24:09.3 294.5`
format: `yyyy ddd hh mm ssss xxxxx`

Delimited:
only one character is used to represent a field,
field delimiter character(s) must be provided

e.g.
data: `2001,306,16,24,9.3,294.5`
format: `ydhmsx`
field delimiter: `,`

5.4.1.2 Synchronisation

The external data is synchronised with the SPS records either by time or station/shot ID. One of these must be therefore present in the external data records. Both can be present but only that selected as the S*earch Key* will be used, and the appropriate field should be defined in the format string.

5.4.1.2.1 Time

The *Search Key* must be set to *Time*.

The external data records must be in chronological order.

The time for each SPS record must fall within the time range of the external data otherwise no data will be imported for that record and an entry will be made to the error log.

If the SPS record time does not match exactly an external data record time then the imported attribute value will be linearly interpolated.

5.4.1.2.2 Station or Shot ID

The *Search Key* must be set to *Station/shot ID*.

For each SPS record the program searches the external data file from the last used record for a matching ID number. If no match is found then all remaining SPS records will be unchanged and an entry for each record made in the error log.

In the following two examples all SPS records will be matched:

External file ID	SPS file1 ID	SPS file 2 ID
1	1	2
2	2	2

3	3	4
4	4	4
5	5	6
6	6	6
7	7	8
8	8	8
9	9	10

In the following example only the first SPS record will be matched:

External file ID	SPS file1 ID
1	1
3	2
5	3
7	4
9	5
11	6
13	7
15	8
17	9

5.4.2 Exporting Data

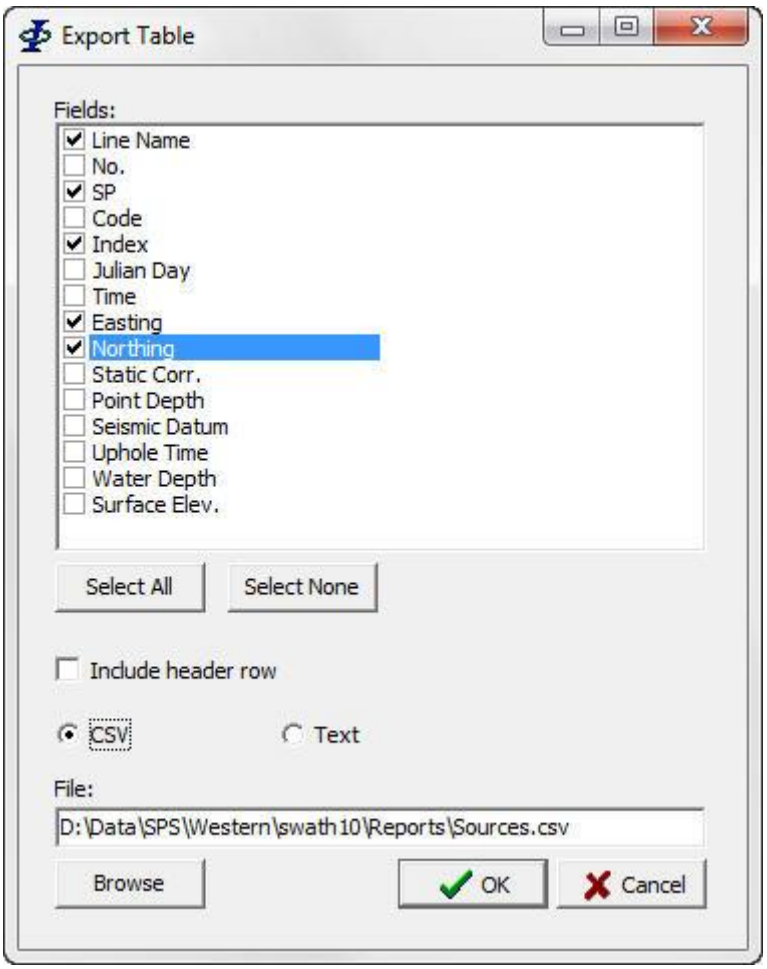


Figure 5-7 – Database: Exporting data

Selected attributes from the currently displayed table for all selected lines can be exported to CSV or text file by selecting form the menu *Utilities* | *Export Data*.

Highlight all lines in the tree display from which data is to be exported.

Check the fields which are to be exported.

Specify whether or not to include the header row.

Specify the file type.

Click *OK*.

5.4.3 Interpolating Receivers

This function is used to interpolate receivers in situations where only certain receiver positions have been computed at regular intervals. For example every 5th receiver may have been computed using an acoustic positioning system and it is required to interpolate the receivers between the existing ones.

The SPS receiver file should contain only the computed receivers, for example as shown in Figure 5-8 and Figure 5-9.

Station	Code	Index	Julian Day	Time	Easting	Northing
1275		1	0	00:00:00	537206.4	409490.2
1280		1	0	00:00:00	537158.6	409535.8
1285		1	0	00:00:00	537098.6	409617.2
1290		1	0	00:00:00	537037.3	409695.7
1295		1	0	00:00:00	536973.8	409771.6
1300		1	0	00:00:00	536911.6	409850.5
1305		1	0	00:00:00	536847.8	409930.8
1310		1	0	00:00:00	536790.0	410010.6
1315		1	0	00:00:00	536728.8	410093.2
1320		1	0	00:00:00	536668.8	410168.9
1325		1	0	00:00:00	536607.6	410249.3
1330		1	0	00:00:00	536556.6	410324.1

Figure 5-8 – Database: Interpolating receivers

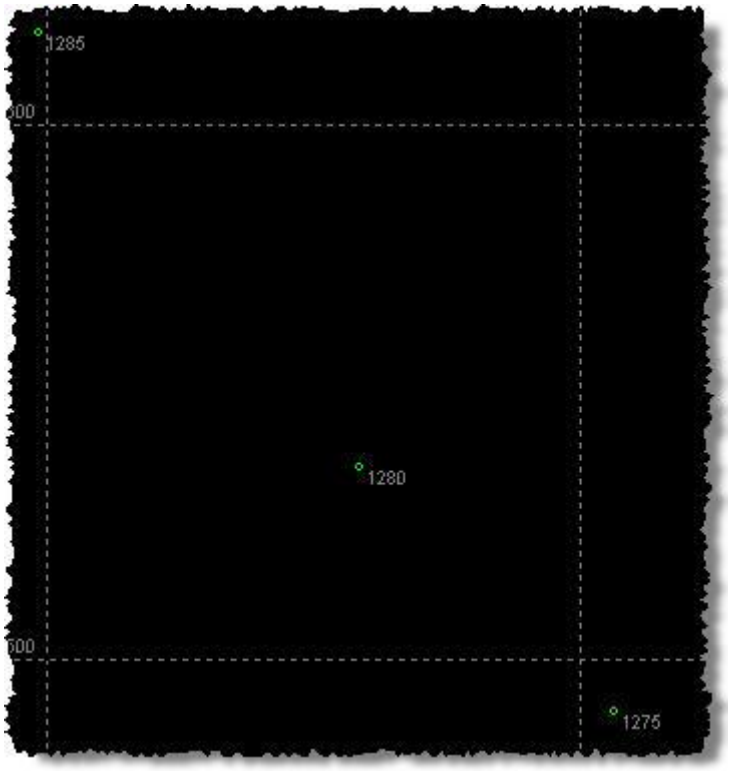


Figure 5-9 – Database: Interpolating receivers

From the menu select *Utilities* | *Interpolate Receivers*. Enter the required receiver number interval – for the above example to interpolate four new receivers between existing ones enter 1.

The new receivers are linearly interpolated between the existing receivers. The same example after interpolation is shown in Figure 5-10.

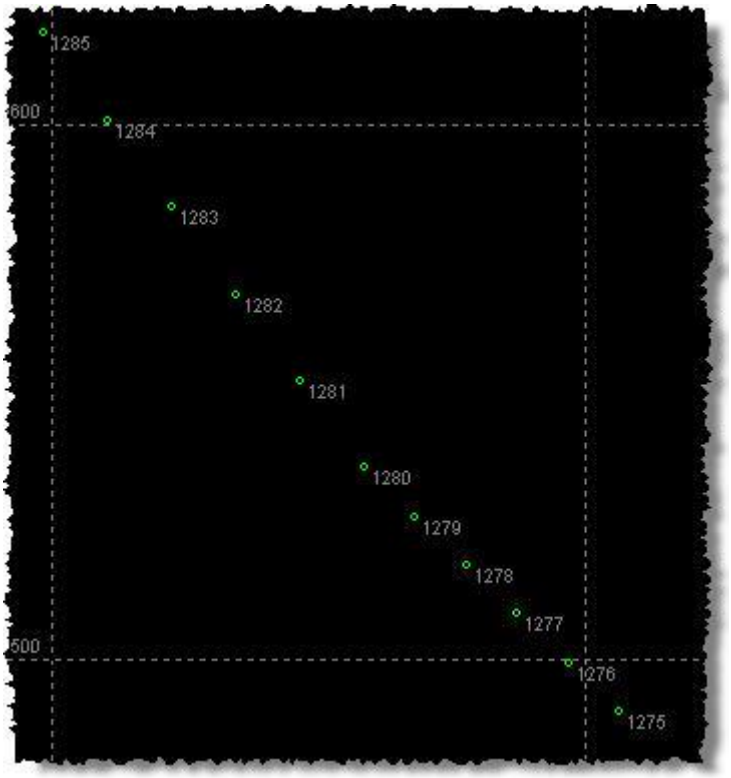


Figure 5-10 – Database: Interpolating receivers

5.4.4 Interpolating Killed Points

This function is provided to interpolate source and receiver points for which the computed position has been deemed unacceptable. A killed point is identified by having either an instrument code or point index which is amongst the list of killed codes or indexes, Refer to section 2.3.3.

Select the objects in the tree in the left hand side panel for which interpolation is required. These may be either at category level, file level or line level. Multiple selections can be made by holding down the <*Ctrl*> key.

From the menu select *Utilities* | *Interpolate Killed Receivers*.

Killed points in the selected lines will be linearly interpolated between the nearest “good” points either side. The instrument codes and indexes are not changed. To change instrument codes, refer to section 5.4.7.

Note: no extrapolation is carried out and therefore the first and last points in the line cannot be interpolated.

5.4.5 Interpolate Receiver Depths from Source Depths

To interpolated receiver depths from source depths, select from the menu *Utilities* | *Interpolate receiver depths from source depths*.

Enter the search radius. This is the distance from each receiver within which all source locations will be used. The specification of this parameter would depend upon the density and distribution of source locations and the seabed topography.

A linear interpolation will be carried out, using data from each source location within the search radius, weighted according to the inverse of the square of the distance from the receiver location.

5.4.6 Interpolate Depths from Bathymetry File

From the menu select *Utilities* | *Interpolate Depths from Bathymetry File*.

The bathymetry file should contain grid coordinates and water depth. It may optionally also contain tidal reductions along with their times.

The water depth interpolation is performed using the weighted inverse square method. All depths within a specified search radius are used and weighted by the inverse of the square of their distance from the point being interpolation.

Tide data, if present, will be interpolated linearly using the specified interpolation limit as a maximum.

On completion if there are errors then these will be listed in a separate window and the reason for each failure is given.

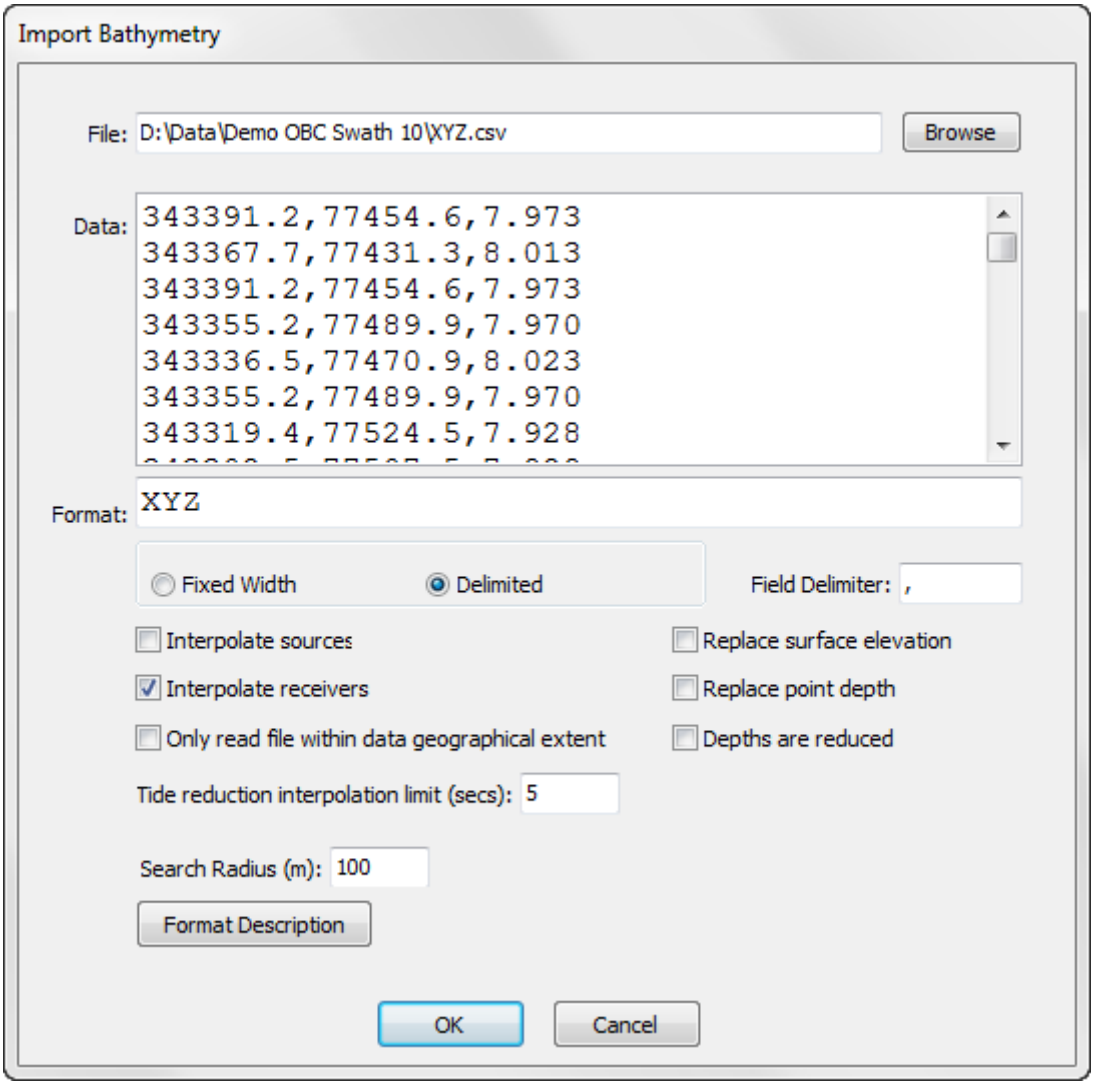


Figure 5-11 – Database: Interpolate depths from bathymetry file

Select the file.

Specify the file format:

The following fields are mandatory:
X = easting
Y = northing
Z = depth (with or without tide - see below)

The following field group is optional if Z is
not the reduced depth:
T = tidal reduction

D = day of year
H = hour
M = minute
S = second

Any other character = do not import field

File records must be terminated with a carriage return and line feed, or newline.

Fixed width:
format characters must match exact file positions.

e.g.
```
data:   12345.6 34567.8 45.6 1.2 123123456
format: XXXXXXX YYYYYYY ZZZZ TTT DDDHHMMSS
```

Delimited:
only one character is used to represent a field, field delimiter character(s) must be provided.

e.g.
```
data:   12345.6,34567.8,45.6,1.2,123,12,34,56
format: XYZTDHMS
```
field delimiter: ,

The following options are available:

Interpolate sources:	Interpolate source depths
Interpolate receivers:	Interpolate receiver depths
Only read file within data geographical extent:	If reading very large files then checking this option will save time by restricting reading of the file to the geographical extent of the data.
Replace surface elevation:	Replace the surface elevation attribute with the interpolated value of the tide.
Replace point depth:	Replace the value of the point depth attribute with the water depth.
Depths are reduced:	If checked then the tide, if available, is removed from the depth before populating water depth and/or point depth attributes.

Tide reduction interpolation limit:	The maximum time, in seconds, allowed for tide interpolation.
Search radius:	All points within the specified radius will be used for the weighted depth interpolation.

5.4.7 Instrument Code Processing

Select from the menu *Utilities* | *Instrument Code Processing*.

This utility provides the means to change, delete and add instrument codes, including conversion of single component files to multi-component files.

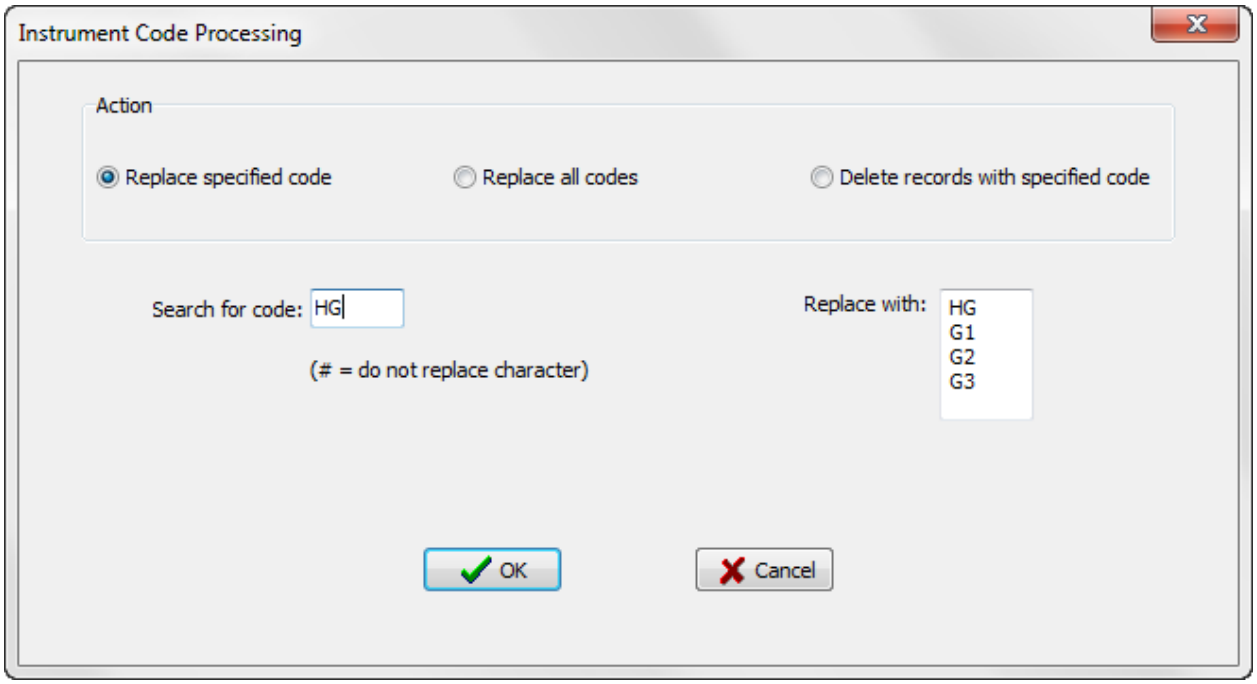


Figure 5-12 – Database: Instrument code processing

Options:

Replace specified code:	Replace only the code specified as the *Search for code*.
Replace all codes:	Replace all codes. The *Search for code* is not used.

Delete records with specified code:	Records whose instrument code is the *Search for code* will be deleted.
Search for code:	The instrument code to search for when performing some of the above operations.
Replace with:	The codes listed here will be used to replace the codes in the file. The example shown in Figure 5-12 would be used to convert a single-component file to a four-component file.

All instrument codes must be two characters.

No changes are made to the file header.

5.4.8 Merge Lines

The *Merge Lines* utility provides options for handling multiple station positions. A typical example would be a partial reshoot after stations have been moved.

From the menu select *Utilities* | *Merge Lines*.

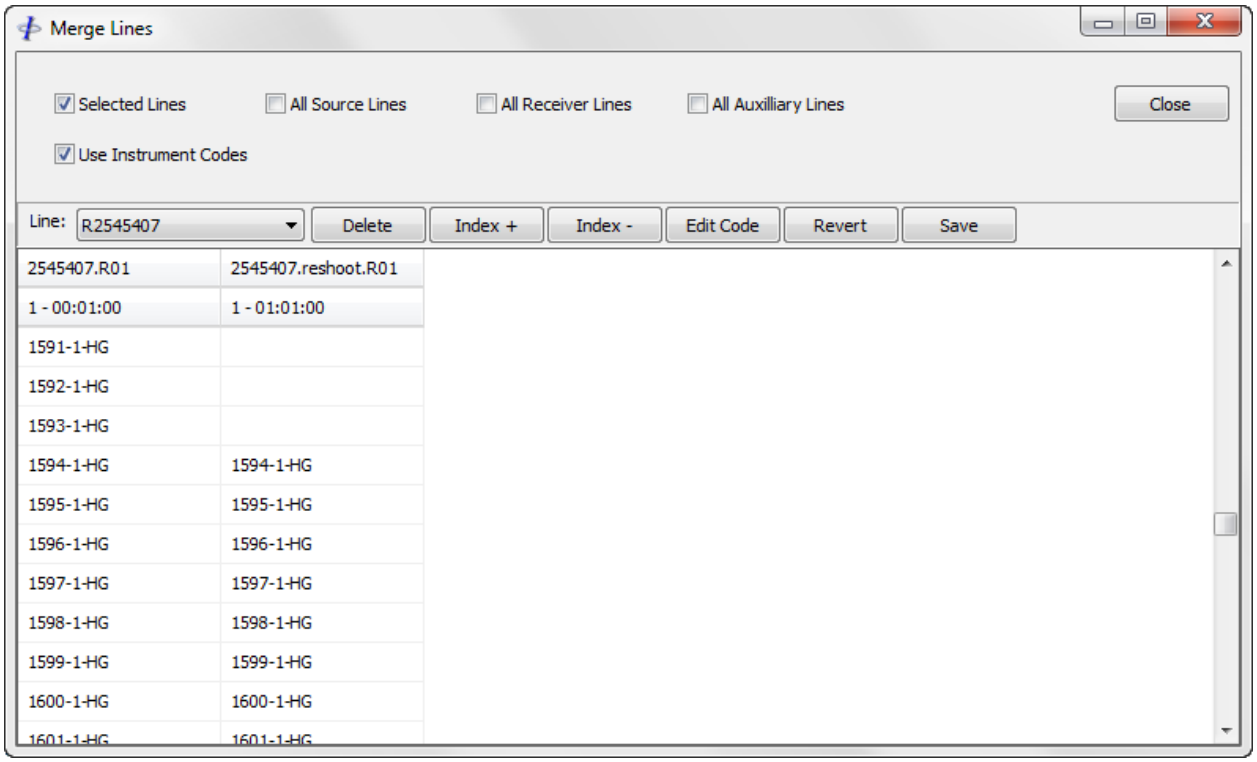


Figure 5-13 - Database: Merge lines

Options:

Selected lines:	Include only the selected lines in the database tree for potential merging.
All source lines:	Include all source lines as candidates for merging.
All receiver lines:	Include all receiver lines as candidates for merging.
All auxiliary lines:	Include all auxiliary lines as candidates for merging.
Use instrument codes:	Display and enable editing of instrument codes.
Line:	Select the line to merge from the dropdown list. All lines with the same line number will appear, each in a separate column.
Delete:	Delete the selected points.
Index +:	Increment the index for the selected points.
Index -:	Decrement the index for the selected points.
Edit Code:	Edit the instrument code for the selected point. A dialog will appear to enter the new code.
Revert:	Revert all changes to the current line.
Save:	Save changes to the current line. A prompt will appear to enter a name for the merged file

Select all points in a column by clicking on the column header.

The second row displays the time of the first point.

When saving, the points in all columns will be merged into a single file. A warning will be given if duplicate points are found before saving.

5.4.9 Auto-index Source Points

From the menu select *Utilities* | *Auto-index Source Points*.

This utility will re-index all duplicate source points in chronological order. Points with the same line number, point number and index will be given incremental indexes so that a duplicate point with a later time stamp will have an incremented index.

5.4.10 Renumber Lines

From the menu select *Utilities* | *Renumber Lines*.

This utility will add a specified increment to the line number of the specified lines.

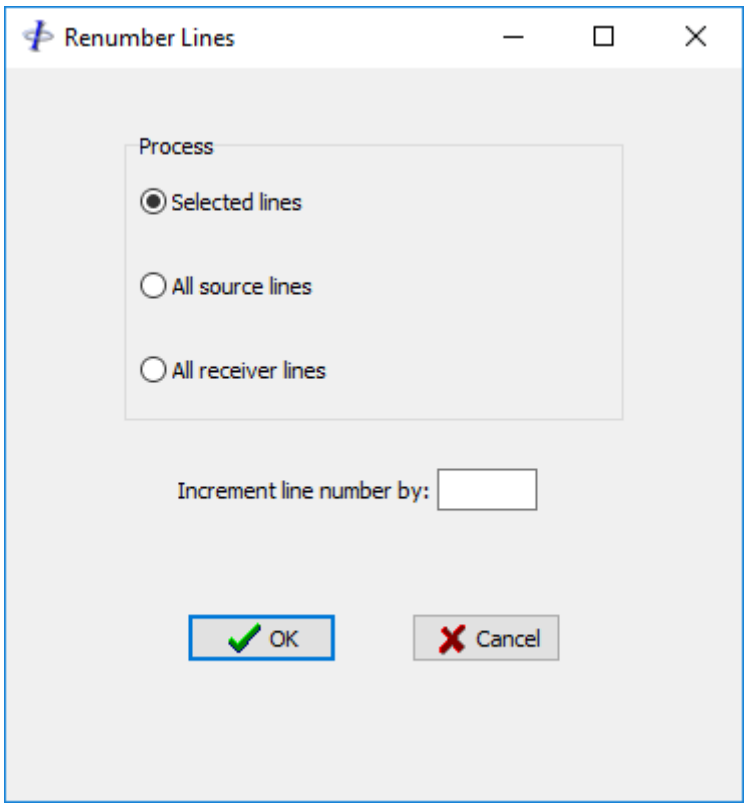


Figure 5-14 - Database: Renumber lines

Options:

Selected lines:	Include only the selected lines in the database tree for renumbering.
All source lines:	Include all source lines for renumbering.
All receiver lines:	Include all receiver lines for renumbering.
Increment line number by:	Enter the value by which to increment the line numbers. Specify a negative value to decrement the line numbers.

After processing, the line databases will need to be saved, then the files will need to be saved.

6 REPLAY

Under *Setup* | *Plot Options* | *Display* | select the *Relational* option. On the main toolbar click on the *Replay* button. The replay toolbar shown below in Figure 6-1 appears.

Replay replays the swath as it was acquired, displaying the active spread for each shot, provided that the Source and Relation records are sorted chronologically as is required by the SPS format.

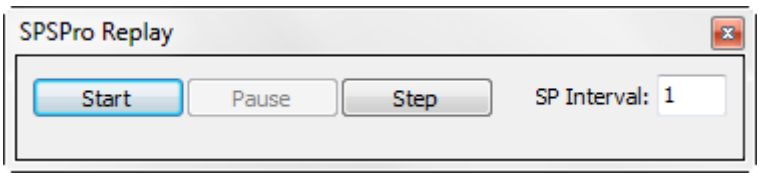


Figure 6-1 – Replay

Start: Start replay. This button then changes to the *Stop* button.

Pause: Pauses replay.

Step: Replays the next shot.

SP Interval: Replays only every *n*th shot where *n* is the specified interval.

Click on the *Start* button or *Step* button to commence replay.

The speed of replay can be increased by increasing the SP interval.

The active source's selected attributes are displayed in the left panel.

Once replayed, sources are plotted in grey as shown below in Figure 6-2.

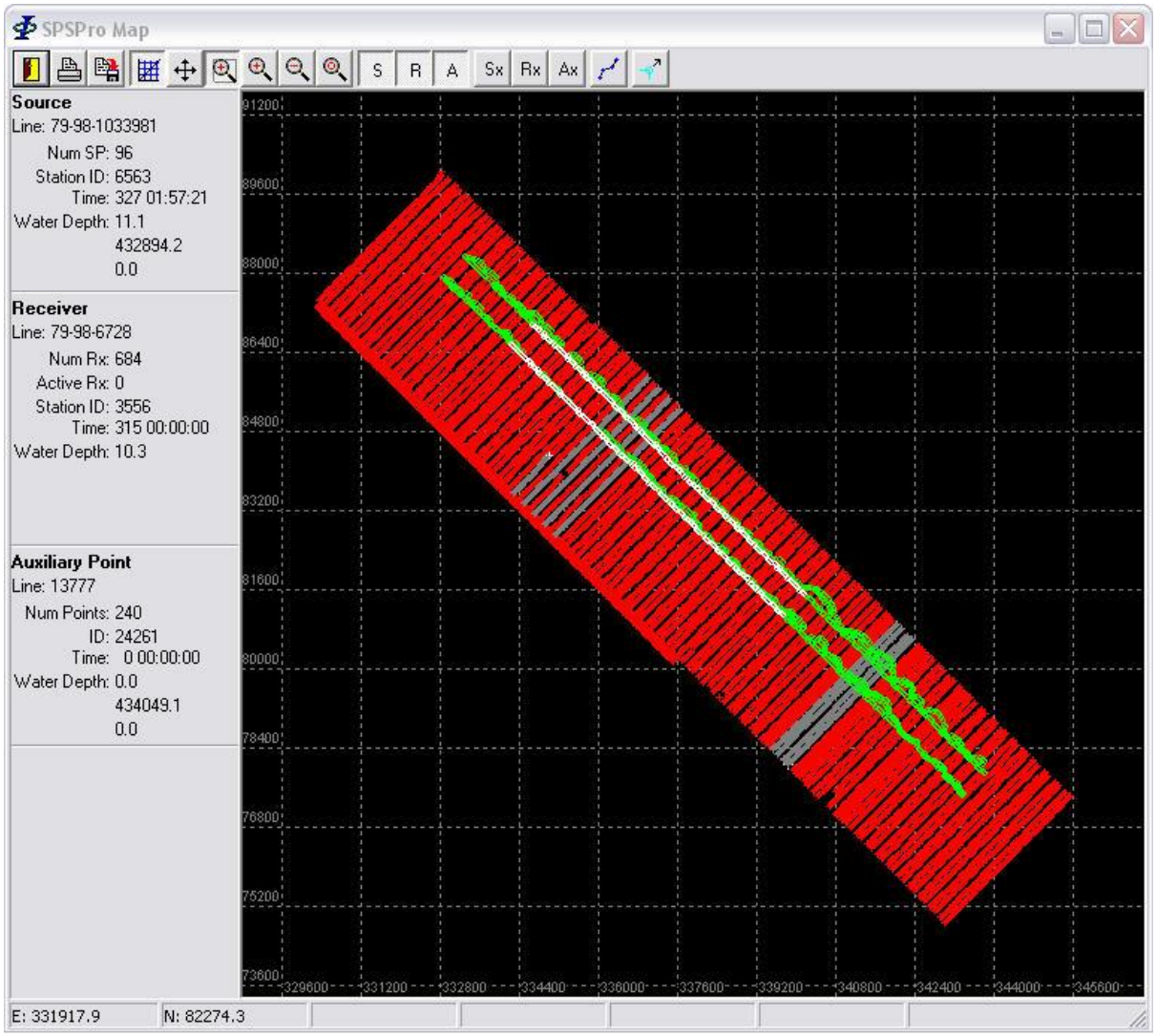


Figure 6-2 – Replay Map

7 SCAN

The *Setup* | *Scan* page, in conjunction with the Setup | *Format* page allows the user to specify the parameters used to check all files in the SPS dataset for integrity and format compliance. See section 2.6 above for the format setup.

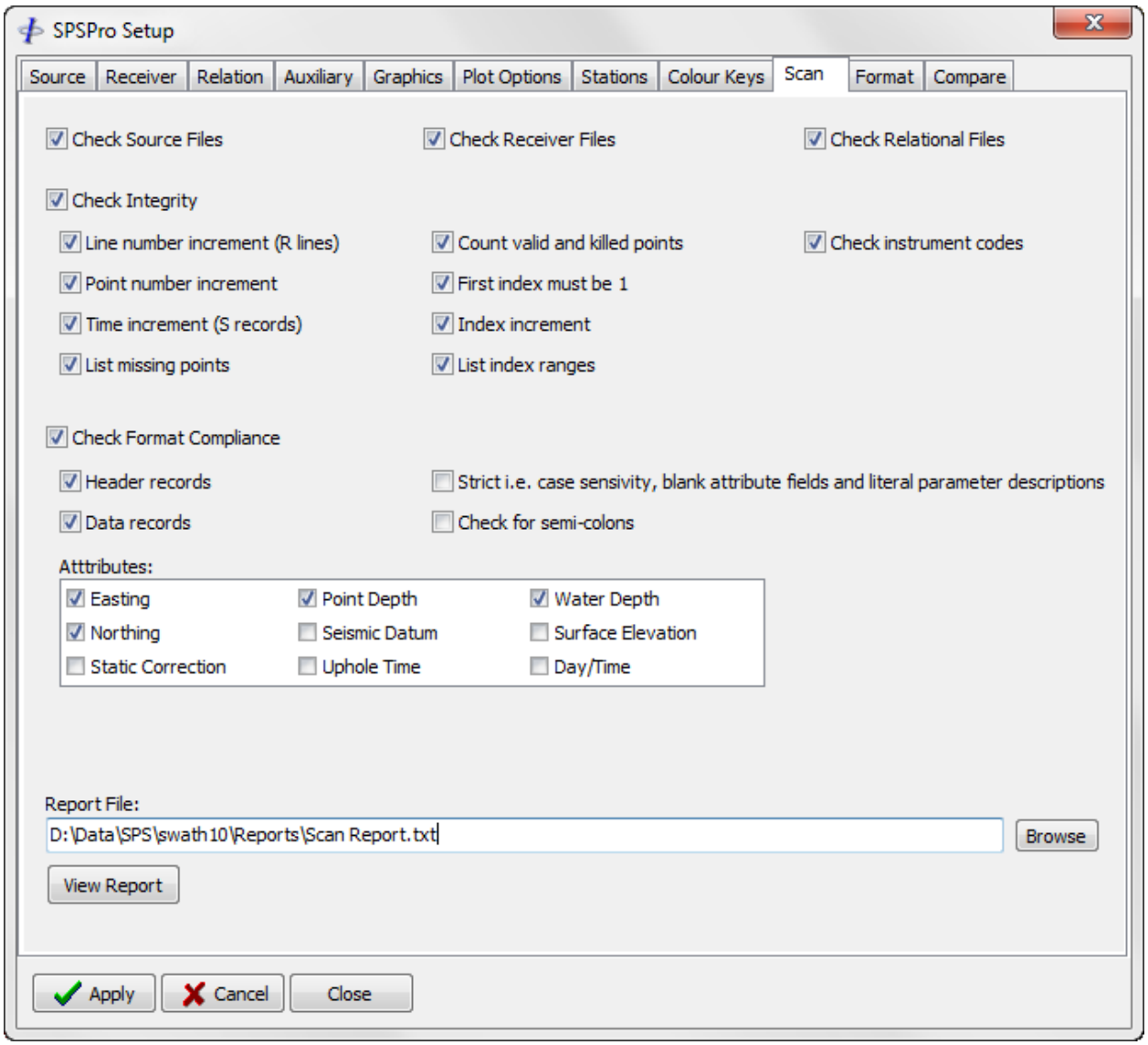


Figure 7-1 – Scan

7.1 Setup

Check the file checkboxes at the top of the form to specify which file categories to be included in the scan.

Check all options required. These are explained below.

Specify the path and name of the report file to which the scan report will be written.

7.2 Integrity Checks

Integrity checks are performed on a line-by-line basis.

Line number increment:	Reports exceptions to the receiver line number increment specified under *Setup* | *Format*.
Point number increment:	Reports exceptions to the receiver and shot number increments as specified under *Setup* | *Format*.
Time increment:	Shot records must be sorted by time. This option reports records in source files for which the shot time decrements.
List missing points:	Lists all missing points based upon the shot and receiver number increments specified under *Setup* | *Format*.
Count valid and killed points:	Reports the number of killed and not killed points. A killed point is defined as having the instrument code “KL”.
First index must be 1:	Reports exceptions where the first index of a point is greater than 1.
Index increment:	Reports records for which the increment in index for the same point ID is greater than 1.
List index ranges:	Lists the point ranges for each index found in the line.
Check instrument codes:	Reports records for which the instrument code does not appear in the header. Do not enable this option if there is no file header.

7.3 Format Compliance

Format compliance on data records will be performed only on those fields corresponding to the attributes whose checkboxes are checked.

Check Header Records:	Include header records i.e., all records starting with ‘H’ when checking format compliance.

Check Data Records: Include data records i.e., all records starting with ‘S’, ‘R’ or ‘X’ when checking format compliance.

Strict Format Checking: Case sensitive checking is performed for string literals in the header record descriptions.

Check for semi-colons: Check for the presence of semi-colons at the end of each header record with the format specified as 12A4.

Microsecond time: Check if microsecond times are expected in the dataset.

7.4 Relation-specific Operations

Count shot gathers: For each shot, report the total number of active receivers based on the relational file and the actual receivers recorded.

Count receiver gathers: For each receiver, report the total number of active shots based on the relational file and the actual shots recorded.

Relational statistics For each line in the relational file, report the

- first and last tape
- first and last SP
- first and last record
- number of records
- first and last time