

COMPUTER PROGRAM MANUAL  
(SURVEY DATA REDUCTION MANUAL)

# DAT61LX2

Version 1.02

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# 1. Introduction

Survey data reduction program DAT61LX2 for Geonics EM61-LX2 ground conductivity meter data operates under Windows 10/7, and Windows XP. DAT61LX2 supports EM61-LX2 data files which include Global Positioning System (GPS) data recorded directly in the Archer2 logger operating under the control of program EM61LX2wm (referred later as EM61LX2) for Windows Mobile.

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## 1.1 About DAT61LX2

The program DAT61LX2 is designed to process data collected in the field computer Archer2 using data acquisition program EM61LX2, or data acquired directly in the computer through the RS232 interface (program EM61LX2xp). The program can be used to display, edit, print and plot data files. Data can be plotted on the computer screen and on any printer supported by Windows. There is also an option to create files that can be used as input for the GEOSOFT or SURFER contouring packages, or any other contour software, if three or more columns are required, then the [X, Y, data1, data2, data3, ...] format is suitable.

This Windows based version of DAT61LX2 provides an easy interface and information on the screen. The amount of readings are limited only by the capacity of a computer hard drive. It supports any printer or plotter that is supported by Windows.

EM61-LX2 readings are arranged in profile lines. Every profile line can consist of unlimited number of segments. Each profile line can contain up to six separate channels: three for Left sensor LE, LL, LF (Early, Late, and Filtered), and three for the Right sensor RE, RL, RF (Early, Late, and Filtered). Note that the Quadrature component is generally referred to as Conductivity in this manual.

One sample data file, TEST.LX2 is included on the program disk. It allows the user to become familiar with running the DAT61LX2 program.

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## 1.2 Contents of DAT61LX2 Distribution Disk

Program DAT61LX2 is supplied on one CD disk. Disk contains following files and directories:

- SETUP61LX2.EXE - setup program for DAT61LX2.
- Documentation - directory containing manuals available in PDF format
- EM61LX2.EXE - data acquisition program for the field computer Archer2

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## 1.3 DAT61LX2 Software Installation

DAT61LX2 uses setup program to load files on your computer. The following section describes the installation process.

To install DAT61LX2 insert the DAT61LX2 CD disk into computer CD disk drive. Exit all Windows applications before installing the program.

In Windows Explorer Browse for the file Setup61LX2.EXE in the CD folder or in any other location if the file was downloaded (Figure 1.1) and double click to launch the Setup program.

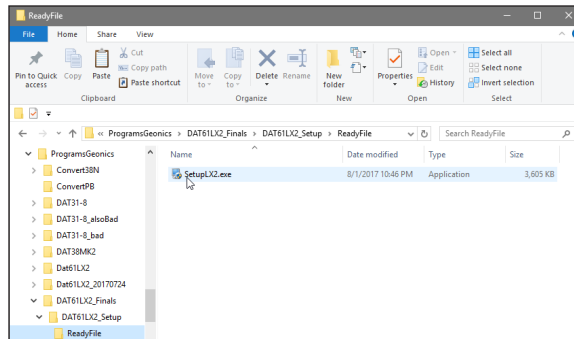


Figure 1.1 Starting Setup program

Once the Setup determines your computer configuration the Welcome window opens (Figure 1.2).

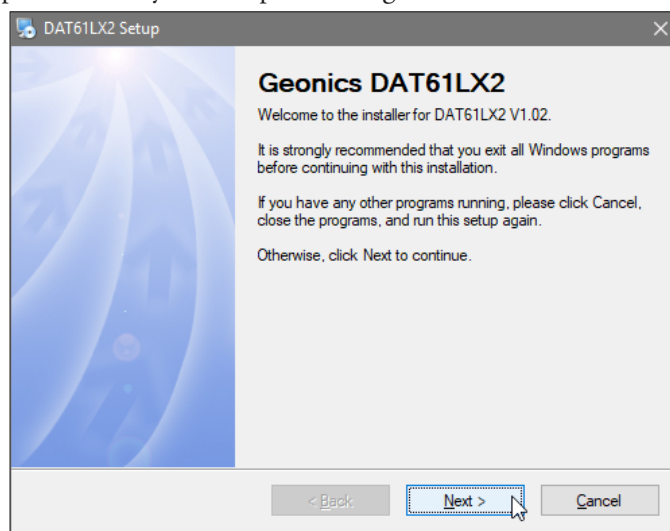


Figure 1.2 Welcome window

Read the text and click the **N**ext button and the Serial Number window opens (Figure 1.3).

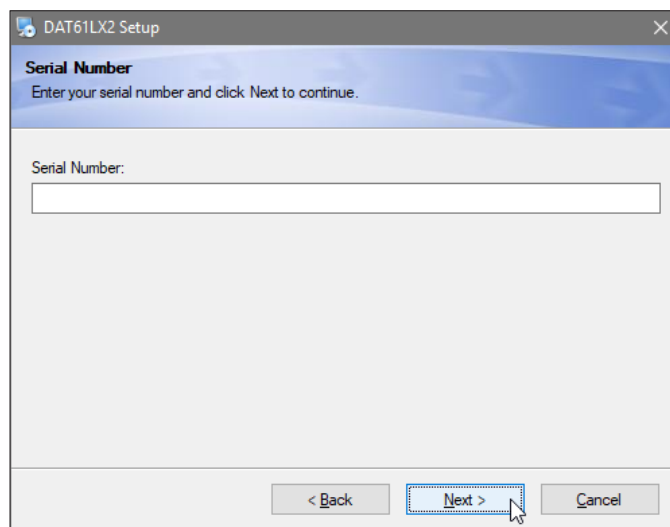


Figure 1.3 Installation Directory window

After the serial number is entered the Installation Folder window will appear (Figure 1.4).

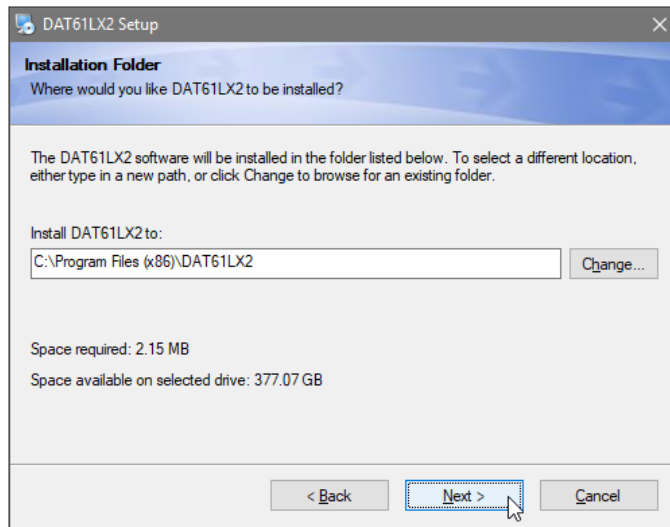


Figure 1.4 Installation Directory window

The default directory is c:\Geonics\DAT61LX2. Click the **Next** button to install the program to this directory. If you wish to install DAT61LX2 to another directory, click the **Browse** button and the Select Installation Directory window will open (Figure 1.5).

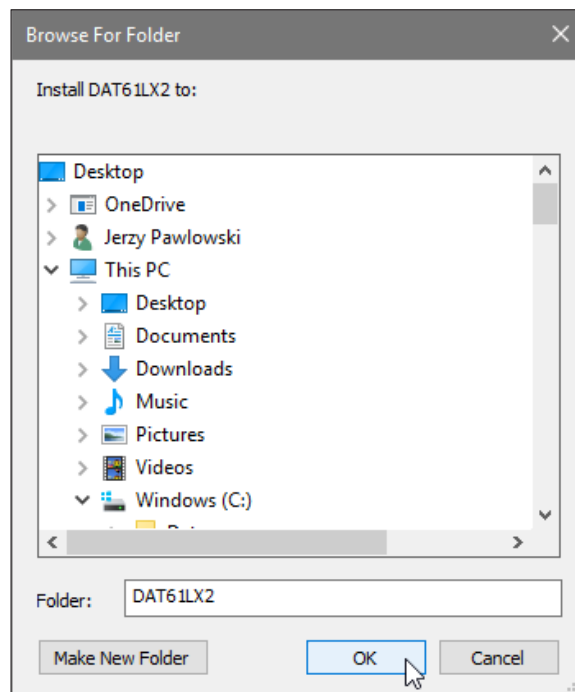


Figure 1.5 Select Installation Folder window

Select a target directory and click **OK**. The Select Installation Directory window closes, and the Installation Folder window opens with the selected directory listed. Click the **Next** button. The Select Short cut Folder window opens (Figure 1.6).

The setup program will create a DAT61LX2 menu item in the Program menu accessible by clicking **Start**. If you do not want to use the proposed folder, you can either enter a new name, or select an existing folder from the list. Click **Next** and Ready to Install window will follow (Figure 1.7).

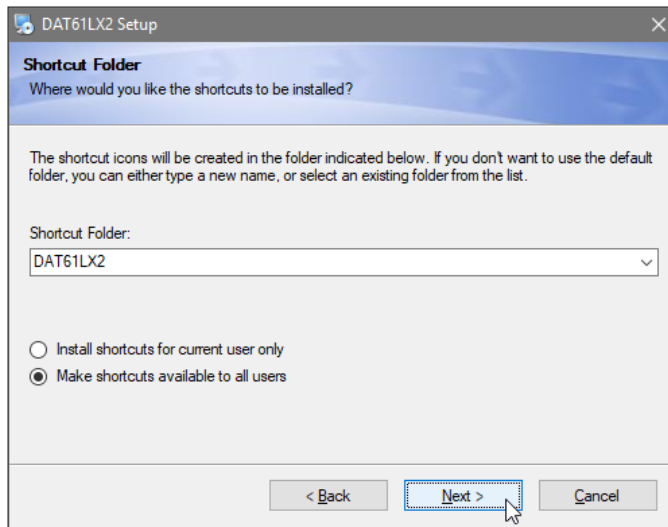


Figure 1.6 Select Shortcut Folder window

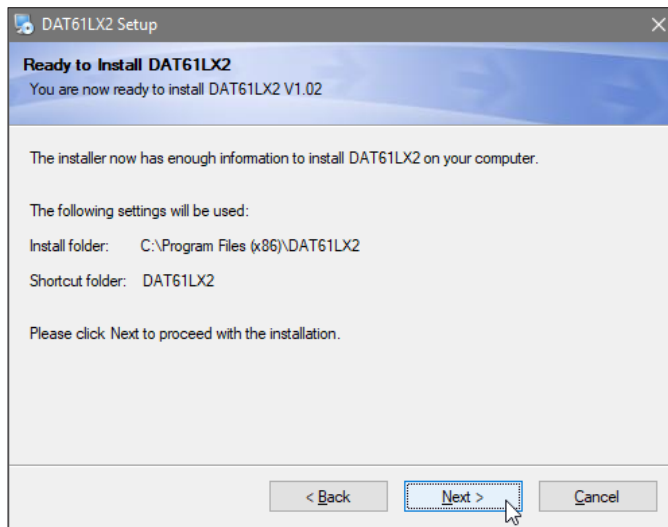


Figure 1.7 Ready to Install window

In case you would like to make any changes before installation, click **Back**. To abort installation click **Cancel**. If you are ready to start installation, click **Finish**. The installation progress bar will appear.

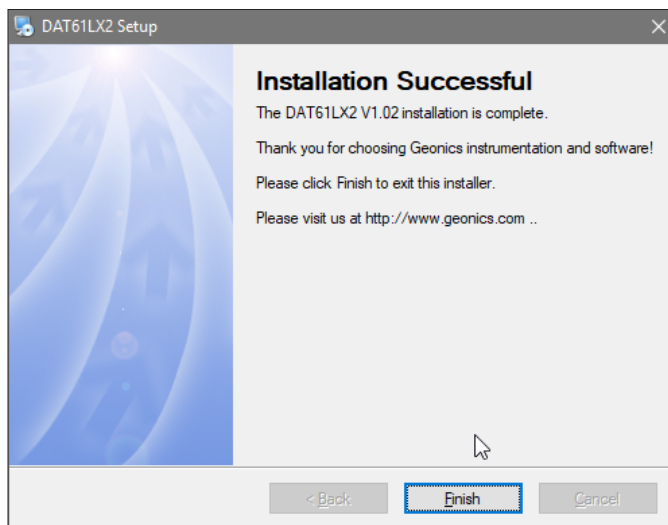


Figure 1.8 Finished window



The Installing Files window with a progress bar displays the percentage of the installation completed. When finished, the End of Installation window will appear (Figure 1.8).

Click **Finish** to end installation. Setup61LX2 creates a DAT61LX2 program group and places **DAT61LX2** and **Uninstall** icons into it. The setup program creates also a **DAT61LX2** menu item in the Program menu accessible by clicking **Start**. A reminder to restart the system may be displayed on some systems at the end of the Setup61LX2 program.

## 1.4 Data File Transfer

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Data files are saved in the Archer2 with extension L61. Transfer of files to desktop PC can be performed with MS ActiveSync or by USB memory module. Data files with extension L61 are binary raw data files. These files have to be converted to DAT61LX2 format with extension LX2 (option “Convert” in DAT61LX2). Files in LX2 format can be loaded and processed in the DAT61LX2.

**Please do not open binary L61 files in a text editor. While it is possible to view these files in text editor, any accidental Save will damage data file. If any binary data file is to be viewed in text editor please make a copy of the file first.**

Also, please retain raw binary files till the end of the project. If any problem will arise binary files in L61 format contain all necessary information that allows to trace potential problem.

## 1.5 Program Overview

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Start the DAT61LX2 by double clicking the DAT61LX2 icon in the **Start|Programs** menu, in Windows Explorer, or on the desktop if a shortcut was created. At the start, DAT61LX2 occupies the entire screen (Figure 1.9):



Figure 1.9 DAT61LX2 Initial screen

The DAT61LX2 defaults to a maximized screen and clicking the minimize button allows access to other applications behind DAT61LX2. At this point, the user can:

- convert raw binary data files (L61) to DAT61LX2 format LX2,
- load data DAT61LX2 profile files (.LX2 files) and display in form of stacked profiles,
- display the DAT61LX2 program version,
- exit the program.

After DAT61LX2 profile file (LX2) is loaded the program menu expands and several more options become available. Twenty separate data files can be loaded and displayed concurrently by the present version of the program. The DAT61LX2 with displayed profile window has following shape (Figure 1.10). At this stage, the user can:

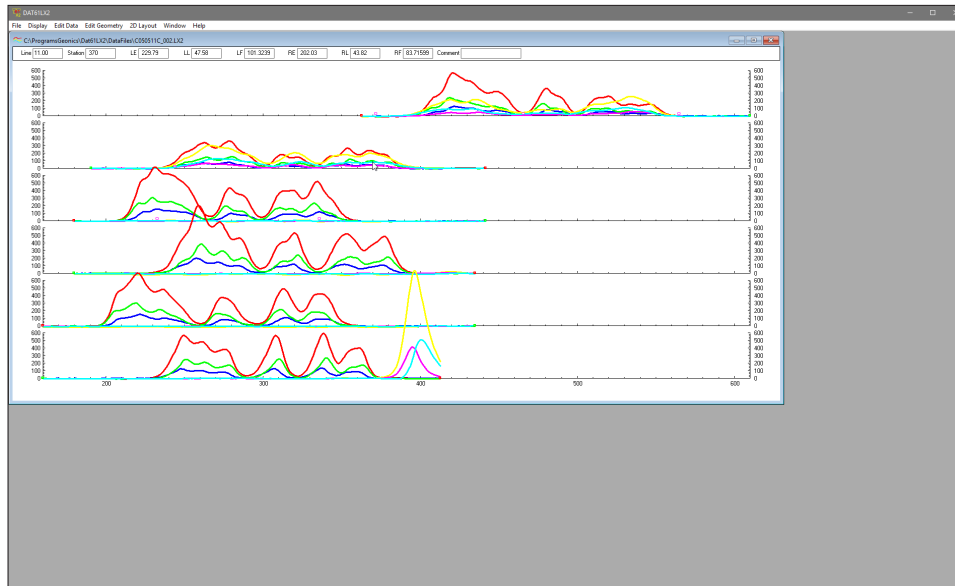


Figure 1.10 DAT61LX2 screen after profile file is loaded

- save, or save as files after editing,
- print profiles on any Windows supported printer,
- manage survey lines: specify selection of survey lines that will be displayed, rename and delete survey lines,
- display profiles with selected parameters,
- specify range of values and axes tics, separately for stations and EM61LX2 channels,
- display grid lines,
- change colours and thickness of lines for each sensor and channel,
- shift selected data set Up or Down in user specified steps, selection applies to survey lines as well as to any combination of sensor and channel,
- edit survey geometry: set line limits, shift survey lines left or right, and position markers and line ends,
- export data set to XYZ file based on grid positioned data (based on survey line names as one coordinate and station numbers as another coordinate),
- export data set to XYZ file based on embedded GPS positions.

A stacked profile display can be enlarged to occupy the entire screen by clicking the maximize button as shown in Figure 1.11.

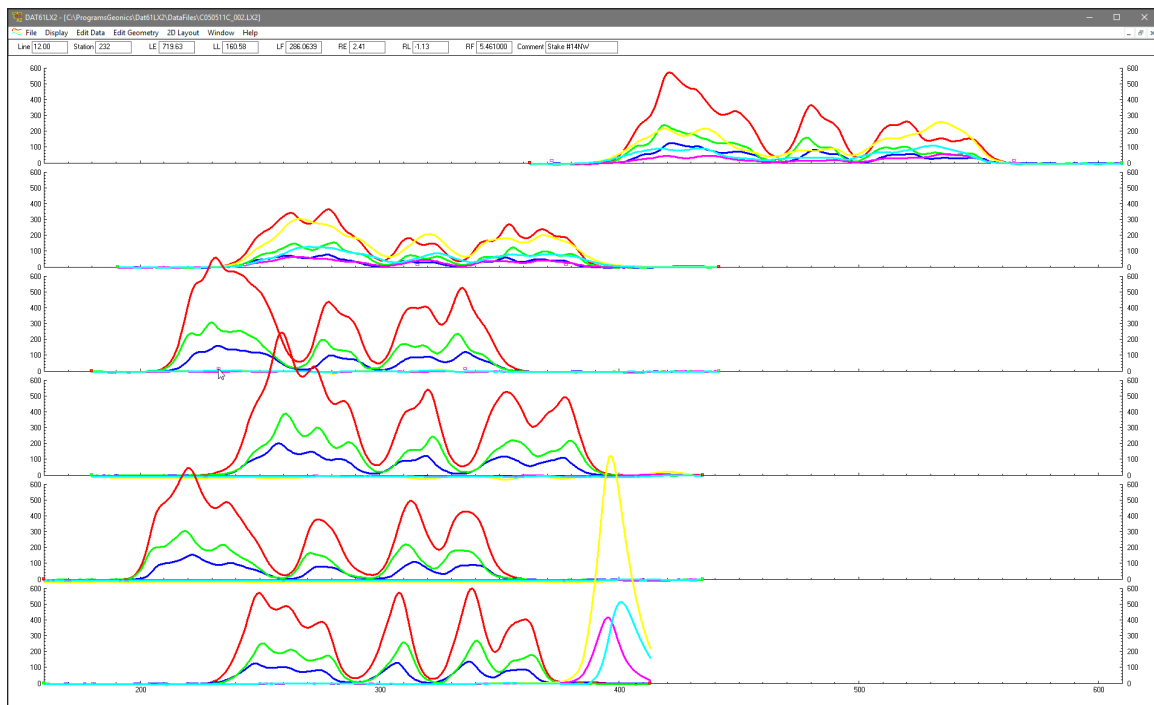


Figure 1.11 DAT61LX2 screen with maximized profile window



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## 2. Quick Start

This chapter is intended for users who wish to quickly start downloading and editing an EM61-LX2 survey with the files necessary to collect field data. Detailed information about all functions and capabilities of the program is given in later sections. It is assumed that the field computer Archer2 was loaded with files necessary to collect field data.

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### 2.1 Transfer Raw Data Files and Convert File Format

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The data acquisition program EM61LX2, operating in the field computer, saves readings in a raw (binary) files format which are given the extension name L61. Transfer of raw files from the Archer2 field computer to desktop PC can be performed with MS ActiveSync or by USB memory module. The latter method provides faster and much more convenient transfer of data files. The default data folder in the Archer2 is named DATA61LX2. This folder is created in the Allegro after the data acquisition program is run for the first time and data files in raw (binary) format are placed in this folder.

DAT61LX2 uses the ASCII format of data files. These files are given the extension name LX2. When the binary (raw) data file is transferred from the field computer it must be converted to DAT61LX2 (LX2) format. An option called **Convert** allows you to convert the raw data files (L61) to ASCII files (LX2).

This function is also useful if the data acquisition program, EM61LX2xp, is used on a laptop field computer. In this case transfer of raw data files is not applicable and data files saved in L61 format can be rewritten to LX2 using the Convert option. These LX2 files can be loaded to the DAT61LX2 program in the same computer.

To convert L61 files select **Convert** in the program menu and then select the **Convert Raw (L61) Files to Profile (LX2) Files** item. The Convert EM61-LX2 Allegro Files to LX2 Format window will appear (Figure 2.1).

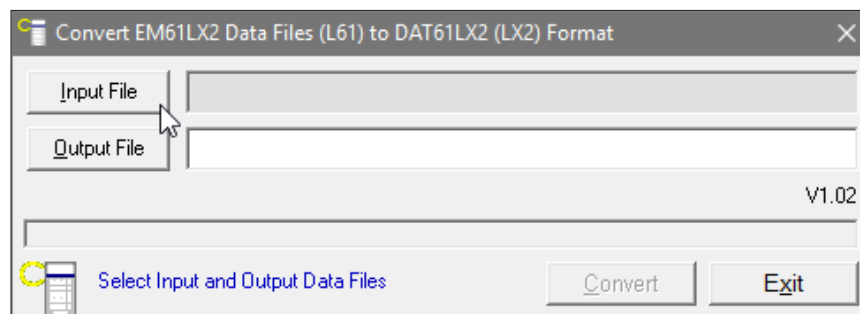


Figure 2.1 Convert EM61-LX2 Archer2 Files to LX2 Format window

Select the file to be converted by clicking on the **Input File** button. An open file window will appear with list of available L61 files. In a similar way click on the **Output File** button and specify the output file name with extension LX2. After both files are displayed in the corresponding text windows the button **Convert** will be activated. When the **Convert** button is clicked the selected L61 file is converted to LX2 format. This file can be subsequently loaded to the program as a “Profile” file.

The above procedure can be repeated for any number of remaining raw data files to be converted.

## 2.2 Displaying Data as Profiles

### Loading and Displaying Data Files

To display data, select **File|Open Profile File** in the DAT61LX2 program menu. The **Open EM61-LX2 File** window will be displayed (Figure 2.2).

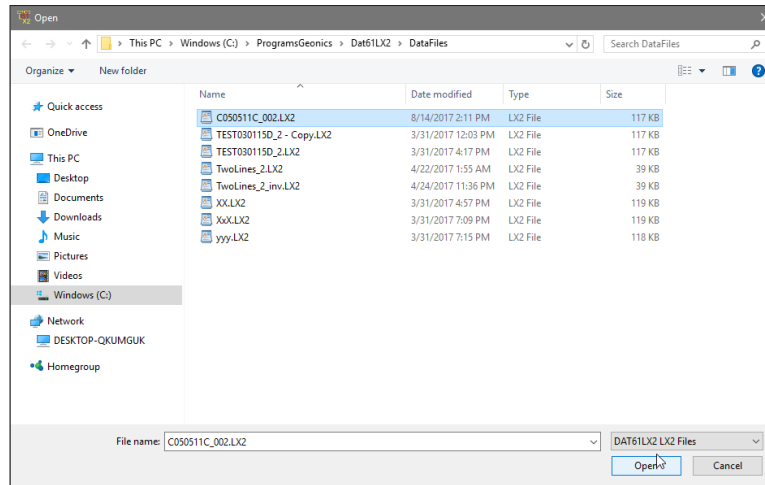


Figure 2.2 Open EM61-LX2 File window

Select a directory and file name and then click on **Open** (you can also simply double click the left mouse button or press **Alt\_O** on the keyboard). The **Open EM61-LX2 File** window displays available files with the extension name LX2.

After the file is loaded, data is displayed in the stacked profile format shown in Figure 2.3. Survey lines are organized in panels, which contain recorded data. In general, each survey line belongs to a separate panel, although, in the case where two or more survey lines have the same line name and same instrument mode, they will be placed in the same panel. In order to display these lines in separate panels the line names must be changed. A sequence of small windows located below the program menu displays current Line Name, Station, and values of all readings at survey line and station pointed by mouse cursor.

Each panel will include one or more data channels. Channels represent sensors: Left and Right, and response type: Early, Late, and Filtered. Channels Early and Late are measured and saved in data file, while the Filtered Channel is calculated by the program (based on channels Early and Late). All channels are listed in the Select Data Type window. This window can be access from the main menu by selecting **Display|Select Data Type**. See Select Data Type section below.

This description of the EM61-LX2 data types is used through the entire program in several windows. Each data type (channel) is described by an abbreviation:

<b>LE</b>	-	<b>Left sensor,</b>	<b>Early channel</b>
<b>LL</b>	-	<b>Left sensor,</b>	<b>Late channel</b>
<b>LF</b>	-	<b>Left sensor,</b>	<b>Filtered channel</b>
<b>RE</b>	-	<b>Right sensor,</b>	<b>Early channel</b>
<b>RL</b>	-	<b>Right sensor,</b>	<b>Late channel</b>
<b>RF</b>	-	<b>Right sensor,</b>	<b>Filtered channel</b>

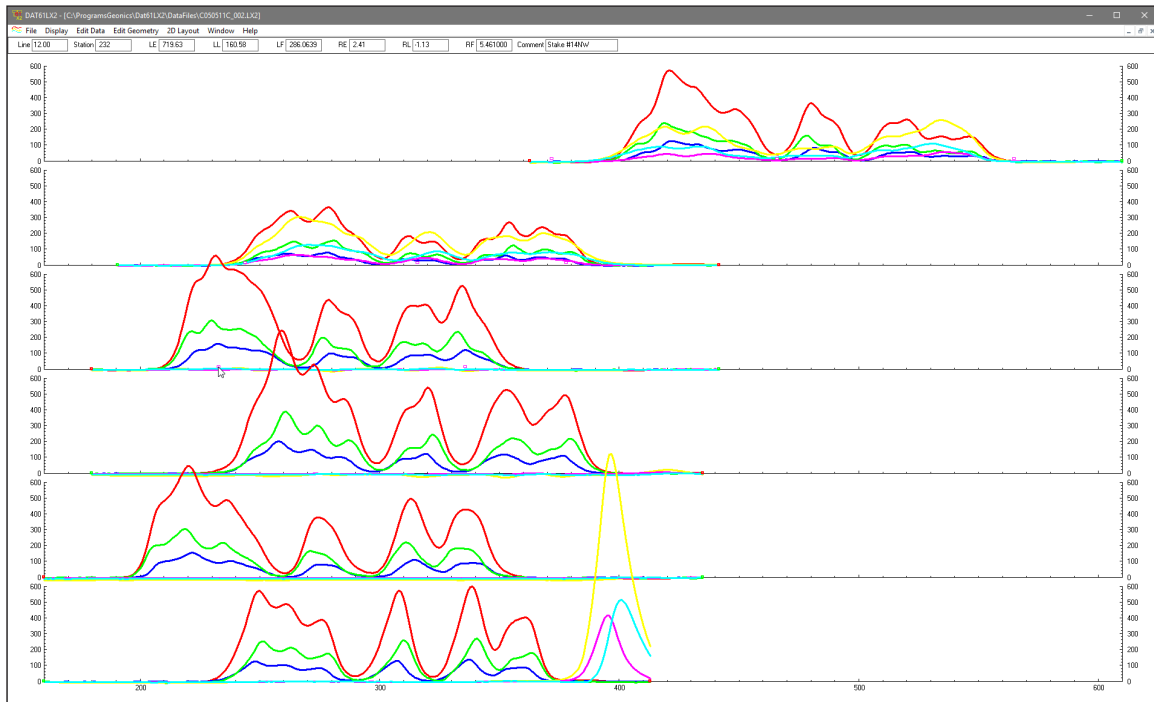


Figure 2.3 DAT61LX2 screen with stacked profiles

By default all channels are displayed for all survey lines. Both vertical axes are labeled in mV. Comments entered during the survey are denoted by small magenta rectangles above the horizontal axes. The text of each comment can be displayed in a box above profile plot while mouse cursor points on the corresponding magenta rectangle as shown in Figure 2.3.

## Selecting Survey Lines

When a data file is loaded, all survey lines are profiled. To display a selection of available survey lines select **Display>Select Lines** in the program menu. The Select Survey Lines window is shown in Figure 2.4.

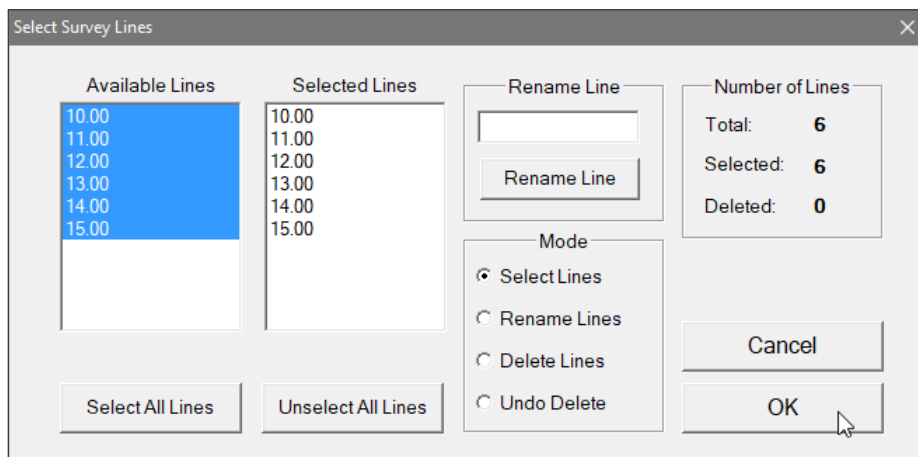


Figure 2.4 Select Survey Lines window

Select and deselect lines to be displayed, by clicking on the line names in list boxes labeled **Available Lines** and **Selected Lines**. Buttons **Select All** and **Unselect All** are also available. All highlighted line names will be profiled on the screen after clicking on the **OK** button.

## Deleting and Renaming Survey Lines

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The most common initial task in data processing is deleting and renaming survey lines. Both tasks can be accomplished in the **Select Lines** window (Figure 2.4).

To delete a survey line from the loaded set of data, click on the radio button labeled **Delete Lines** located in the section labeled Mode. When the radio button is checked, click on the appropriate line name in the Available Lines list box. The letter **D** will be displayed next to the line name. These lines will not be displayed nor written to the output file during **Save** or **Save As** tasks.

Survey lines also can be renamed in the Select Lines window. Click on the radio button labeled **Rename Lines** and then click on the line name in the Available Lines list box. The highlighted line name will appear in the edit box located in the Rename Line section. Edit the name in the Edit Box and click the **Rename Line** button. The updated name will now be displayed in both line names list boxes.

Please refer to section 3 (Data Display) for a detailed description of the Select Survey Lines window.

**Please note that Deleted and Renamed lines will be valid as long as the program is running. In order to save changes permanently use “Save As” or “Save” option to create a new data file which can be used later by the program. It is recommended that you use “Save As” and keep the original data in an unedited form.**

## Selecting Data Types to Display

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To select the type of data to be displayed select the **Display|Select Data Type** from the program top menu. The Select Data Type window will appear as shown in Figure 2.5.

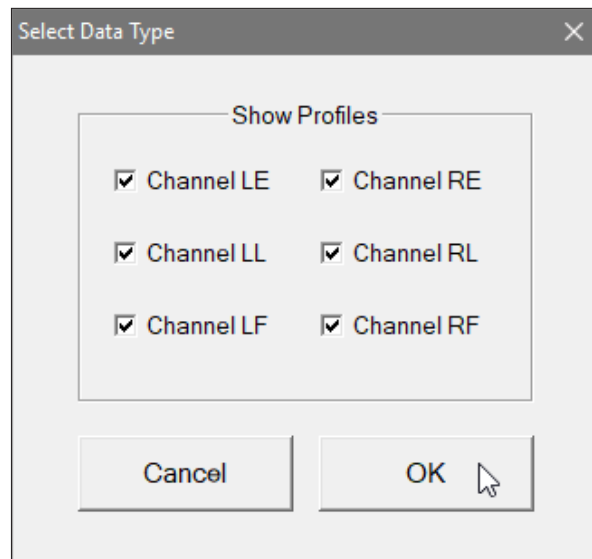


Figure 2.5 Select Data Type window

The Select Data Types window contains check boxes for each type of EM61-LX2 data. Each Data Type (channel) is described by an abbreviation:

<b>LE</b>	-	<b>Left sensor,</b>	<b>Early channel</b>
<b>LL</b>	-	<b>Left sensor,</b>	<b>Late channel</b>
<b>LF</b>	-	<b>Left sensor,</b>	<b>Filtered channel</b>



<b>RE</b>	-	<b>Right sensor,</b>	<b>Early channel</b>
<b>RL</b>	-	<b>Right sensor,</b>	<b>Late channel</b>
<b>RF</b>	-	<b>Right sensor,</b>	<b>Filtered channel</b>

The Select Data Type window is divided into two columns, channels for Left sensor and Right sensor. The dialog lets you select channels to be displayed as profiles. All Data Types will be displayed as numeric values in display boxes located under the menu bar regardless of the selection for profile display in this option.

## Changing Display Parameters

To adjust the range of displayed parameters select **Display|Set Display Parameters** in the program menu. The **Set Display Parameters** window is shown in Figure 2.6.

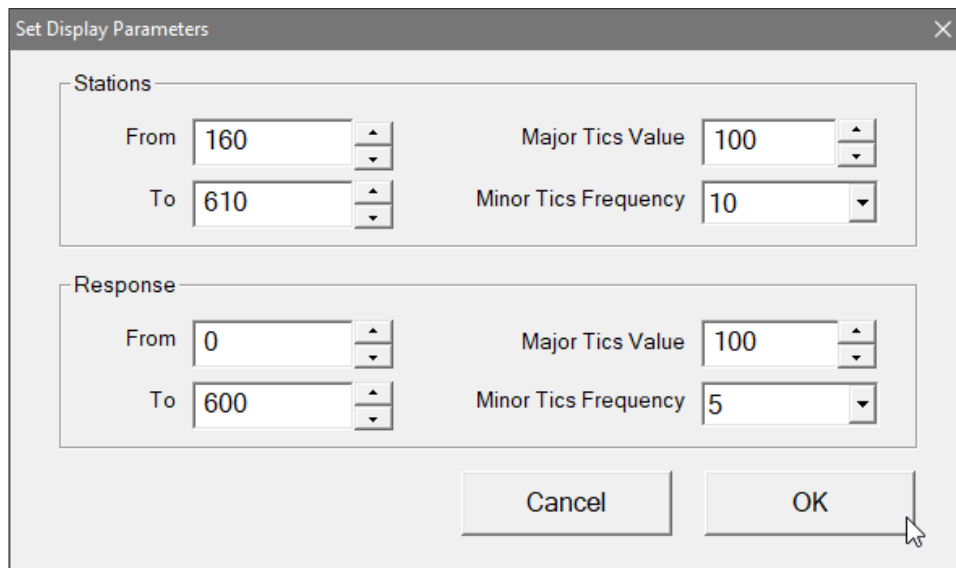


Figure 2.6 Set Display Parameters window

This option allows a range to be set for the length of the line (stations displayed), and the EM61-LX2 response amplitudes in mV. The major axis tick intervals as well as minor tics frequency are also controlled through this window. (Labels and optional grid lines are plotted at the major ticks only.)

## 2.3 Editing Survey Geometry

The Edit Geometry option allows adjustment of the profile geometry, including the repositioning of both the start and end stations of each line, shift survey lines, as well as any station marked with the fiducial switch. To display the Edit Geometry menu select **Edit Geometry** in the main menu at the top of the screen (Figure 2.7).

The Edit Geometry menu contains three items:

**Set Line Limits** changes the position of the start and end stations of any selected group of survey lines;

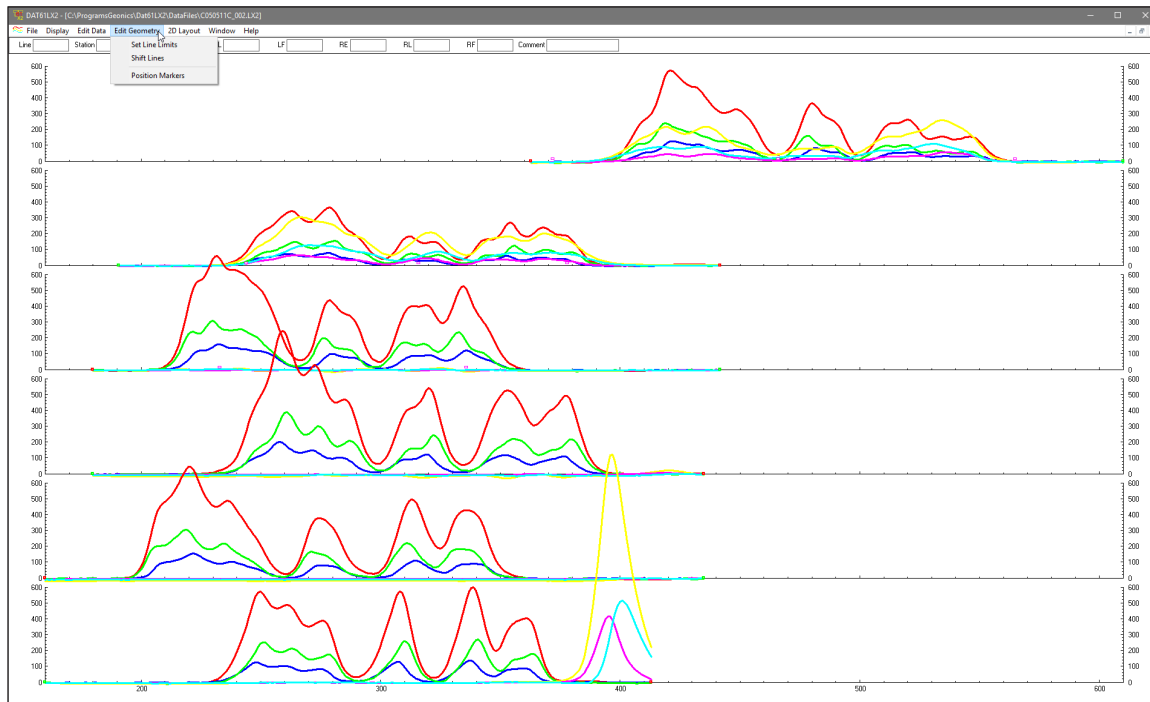


Figure 2.7 Edit Geometry menu

**Shift Survey Lines** can be used to move any selected group of survey lines in either a positive or negative direction along the profile axis;

**Position Markers** is an efficient tool for aligning fiducial markers and the start and end points of survey lines.

### Survey Conducted without Fiducial Markers

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A survey that was done without using the fiducial markers will generally not require any editing of data positions. Corrections of common field errors, such as an incorrect start station or line direction, can be made using the **Set Line Limits** or **Shift Survey Lines** option in the Edit Geometry menu shown in Figure 2.7.

**Please note that ends of survey lines can also be easily adjusted by the Position Markers tool even if during the survey fiducial markers were not used. The Start and End stations of each survey line can be edited in the same way as stations tagged by fiducial markers.**

### Survey Conducted with Fiducial Markers

---

If data was recorded with fiducial markers, the following two step procedure is recommended:

Adjust the ends of the survey lines using either the **Adjust Survey Line** or **Set Line Limits** options, or by using Position Markers option (see the note above), and then position fiducial markers using the **Position Markers** option.

## 2.4 Creating XYZ Files

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To display the 2D Layout menu select **2D Layout** in the main menu at the top of the screen. The menu contains two options: Create Grid Based XYZ File and Create GPS Based XYZ File.

The first option, **Create Grid Based XYZ File** lets you generate files with N-S and W-E configuration of survey lines, when readings are collected along grid that it is layout before the survey. Therefore, it is strongly recommended that data files be organized so that each file contains parallel lines surveyed in one direction, either W-E or S-N. The program assumes that stations along survey lines correspond to one of coordinates (X or Y) and line names indicate another coordinate (X or Y). If line names do not correspond to an appropriate coordinate they can be easily changed by the **Rename** function in the **Select Survey Lines** window. Position of stations (line end points, fiducial markers) along survey lines should be organized using the **Edit Geometry** function prior to creating XYZ file.

The second 2D Layout menu item, **Create GPS Based XYZ File** can be used only when EM61-LX2 data is collected together with GPS positioning data. In this method the GPS receiver is connected to the Archer2 (or other field computer logging EM61-LX2 readings) serial port and GPS data is collected in the EM61-LX2 data file.

### Create Grid Based XYZ File

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After you select the **2D Layout|Create Grid Based XYZ File** from the profile menu the Create Grid Based XYZ File window is displayed (Figure 2.8).

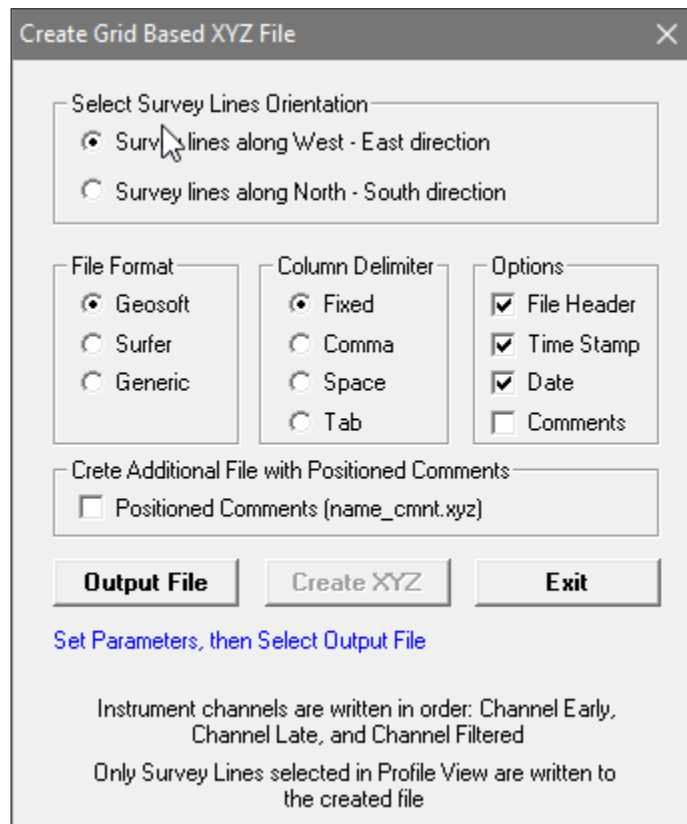


Figure 2.8 Create Grid Based XYZ File window

Several parameters which affect the contents and format of the created XYZ file must be specified. Specifically, these are the Orientation of Survey Lines, the EM61-LX2 Data Type and other parameters to be written to the file, format of the output file, and the output file name. For each parameter there is only one option for each layout which you select by clicking the appropriate radio or check box button.

The program positions Left and Right sensors automatically assuming 1m separation between coils centers. Therefore, if a survey line is in North direction position of the left coil is 0.5 m to the left of the line and right coil 0.5 to the right while facing direction of movement.

### **Orientation of Survey Lines**

The W-E orientation corresponds to a layout where lines are parallel and oriented in the X direction (assuming that the North or Y coordinate points to the top, and that the East or X coordinate points to the right edge of a page). The S-N orientation corresponds to the perpendicular layout, with survey lines oriented in the Y direction.

If W-E orientation is selected, it is assumed that the line name gives the Y (S-N) coordinate and stations are aligned along the X (W-E) axis. If survey lines are parallel and oriented in W-E direction, but line names do not correspond to the Y coordinate, then rename the lines in the Select Lines window. It should be noted that if the line name starts with a number and ends with a letter, e.g. 10N, only the number will be recognized as a Y coordinate.

### **File Format**

Indicate the appropriate option for the contouring software to be used. The Generic option will create a multicolumn file without any text strings. This file can be used as an input file for many contouring packages (including Geosoft and Surfer). When Geosoft is selected then file extension name XYZ will be given as a default, and extension names DAT and ASC will be given respectively for Surfer and Generic selections respectively.

### **Column Delimiter**

Select column delimiter that is required by your application. The option Fixed corresponds to fixed field for each column with space or spaces between columns. This format is suitable for most applications and a file created with this selection provides the easiest option if file is to be viewed using any standard text editor.

### **Options**

There are three items listed: File Header, Time Stamp, Date, and Comments entered during survey. File Header occupies one line at the top of file and contains description of each column included in the file. Time Stamp and Date will be written in two columns (or one if any of two selected) that follow instrument readings. Comments, if selected, will be written as text filed between corresponding stations. The latter option is disabled if there is no comment in data set.

### **Create Additional File with Positioned Comments**

Additional file containing positions (preceding the comment entry) and text of the comment will be created. File name is created by adding "\_cmnt" to the base name of the Output File (below), for example ABC\_cmnt.xyz. This option is disabled (grayed out) if there is no comment in data set.

### **Output File**

When the **Output File** button is clicked, a Select XYZ File Name window is displayed. The EM61-LX2 file name with an extension corresponding to the selected output file format

(xyz, dat, or asc) is given as a default. After the Output File is specified the **Create XYZ** button is activated.

When you click on the **Create XYZ File** button a progress bar, located at the left bottom corner of the window, will indicate the percentage of the created file that has been completed.

## Create GPS Based XYZ File

Data can be positioned directly to an XYZ file format by selecting the **2D Layout|Create GPS Based XYZ File** menu option. The Create XYZ File Based on GPS Positions window is displayed (Figure 2.9).

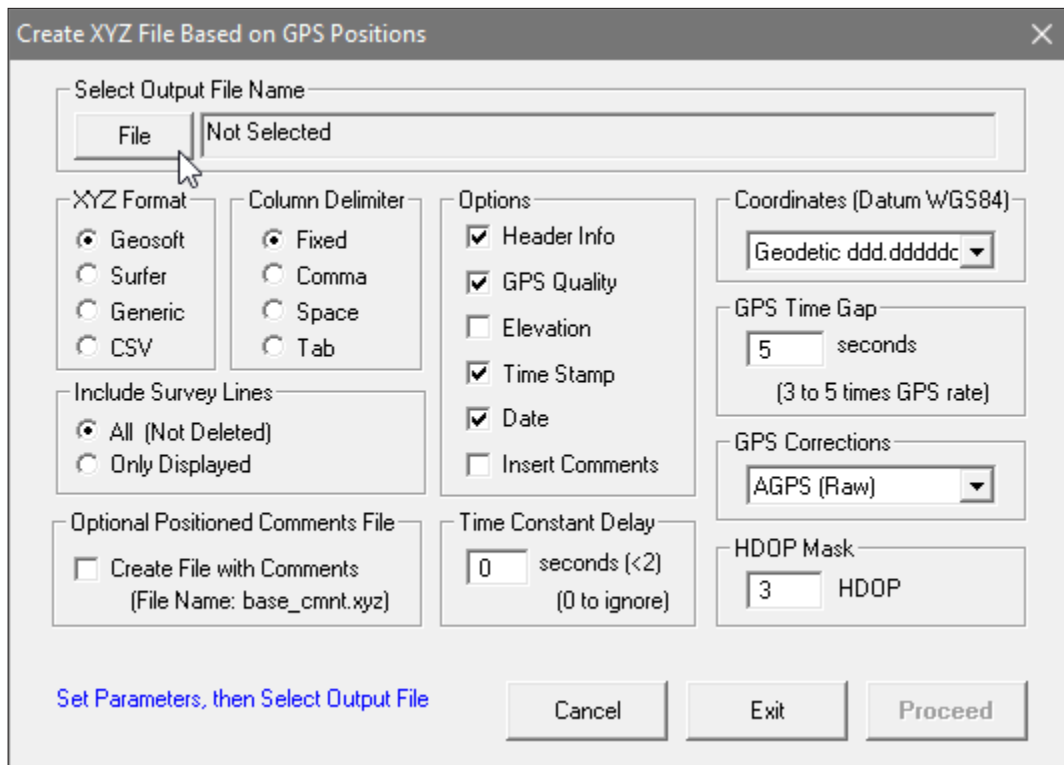


Figure 2.9 Create XYZ File Based on GPS Positions window

The program positions Left and Right sensors automatically assuming 1m separation between coils centers. Therefore, position of the left coil is 0.5 m to the left of the line and right coil 0.5 to the right while facing direction of the instrument movement based on GPS positions.

Before creating the XYZ file the following parameters must to be specified:

### Output File

Click on the **File** button. The Select XYZ File window is displayed. Select a file name and click the **Save** button. The Select XYZ File window will close and the selected file name will be displayed beside the **File** button in the GPS Positioning window.

When Input and Output files are specified the **Proceed** button in the Create XYZ File Based on GPS Positions becomes active.

### Create Additional File with Positioned Comments

Additional file containing positions (between two neighbouring GPS positions) and text of the comment will be created. File name is created by adding "\_cmnt" to the base name of the Output File (below), for example ABC\_cmnt.xyz. This option is disabled (grayed out) if there is no comment in data set.

### Options

There are six items listed: File Header, GPS Quality, Elevation, Time Stamp, Date, and Comments. File Header occupies two lines at the beginning of file, the first line contains Datum description and the second line contains labels with description of each column included in the file. GPS Quality, Elevation, Time Stamp and Date will be written in columns (in the order as listed in this dialog) that follow instrument readings. The GPS Quality contains parameters in three columns: Quality (degree of differential corrections), number of satellites, and HDOP parameter. Comments, if selected, will be written as text filed between corresponding stations. The latter option is disabled if there is no comment in data set.

### XYZ Format

Indicate the appropriate option for the contouring software to be used. The Generic option will create a multicolumn file without any text strings. This file can be used as an input file for many contouring packages (including Geosoft and Surfer). A comment indicating column contents and used coordinates will be written at the beginning of file if Header More detailed description is given in the XYZ File Format section.

### Column Delimiter

Select column delimiter that is required by your application. The option Fixed corresponds to fixed field for each column with space or spaces between columns. This format is suitable for most applications and a file created with this selection provides the easiest option if file is to be viewed using any standard text editor.

### Coordinates

Positions can be written in the output file as geodetic (geographical) coordinates (Latitude/Longitude) or they can be converted to UTM coordinates. The program uses the WGS1984 datum.

Geodetic coordinates are given in degrees, while UTM coordinates can be generated in meters, feet or US Survey feet.

### GPS Time Gap

The **GPS Time Gap** parameter specifies the maximum time during which the EM61-LX2 data will be linearly interpolated between two GPS positions. Enter this parameter (in seconds) in the edit box labelled GPS Time Gap. In most cases a value 2 to 3 times larger than the GPS acquisition frequency is adequate.

### GPS Corrections

Select item in combo box placed in a section labeled **GPS Corrections** to write selected or higher degree of GPS differential corrections.

### HDOP Mask

Specify value of HDOP parameter the section labeled **HDOP Mask**. Readings associated with GPS positions that have HDOP values higher than specified will not be written to the file.

### **Time Constant Delay**

Correction for the Time Constant Delay for the system will be calculated automatically. The value of the delay must be established experimentally since it depends on the EM61-LX2 delay and GPS delay combined, however it is approximately 0.3 to 0.4 second for most setups. Enter zero to ignore this correction.

When you click on the **Proceed** button a progress bar, will appear above command buttons and it will indicate the percentage of the created file that has been completed.





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# 3. Displaying Data

The DAT61LX2 requires that files have to be displayed in the form of stacked profiles prior to any editing, reorganizing survey lines, or creating grid or GPS based XYZ data file for a mapping systems. Files containing EM61-LX2 readings and displayed in the program as profiles have the extension name LX2. These files are described in this section. Conversion of binary raw (L61) format to LX2 format is described in section 2.1. The Archer2 (with extension L61) raw data files and DAT61LX2 file (LX2) formats are described in Appendix A.

Two coil (Left and Right) separated by 1.0 m are available only when data was collected using the EM61-LX2 instrument, while instrument EM61-LX2-1 is equipped with one coil. Data files collected with both versions of the instrument are recognized automatically by the DAT61LX2 program.

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## 3.1 Loading Profile Files

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### Loading Data File

The DAT61LX2, when started, has a very simple menu. Only Loading and Convert functions are available before data files are loaded and displayed. To load EM61-LX2 data file in LX2 format select **File|Open Profile File** in the menu (Figure 3.1).



Figure 3.1 DAT61LX2 File menu before any data file is loaded

The **Open Profile File** window will be displayed (Figure 3.2). Select the directory and file name and then click the **Open** button (or double click the left mouse button, or press **Alt\_O** on the keyboard). Data files in DAT61LX2 format have the extension name LX2. When a larger data file in DAT61LX2 format is loaded to the program a progress bar may show the percentage of file loaded.

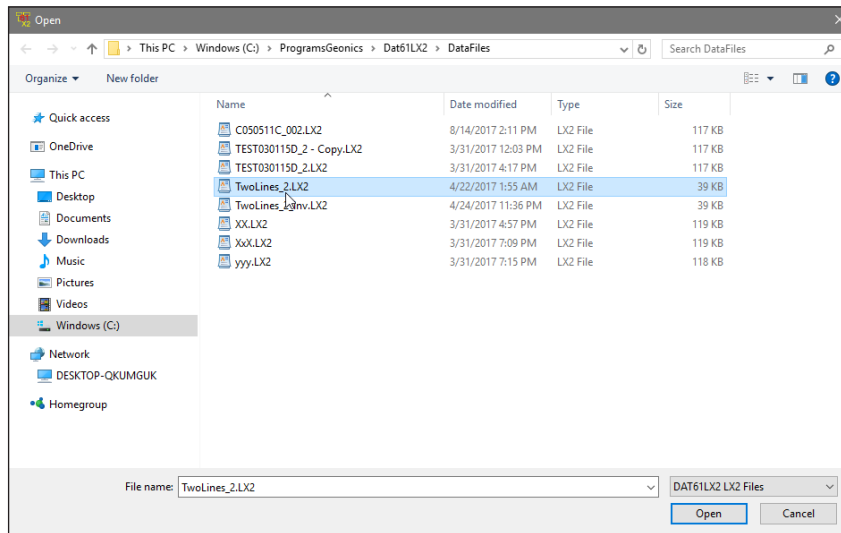


Figure 3.2 Open EM61-LX2 File window

After a DAT61LX2 profile file is loaded, data is displayed in a stacked profile format as shown in Figure 3.3. Survey lines are organized in panels, which contain the recorded readings. In general, each survey line surveyed in one instrument mode appears in a separate panel. In the case where two or more survey lines have the same line name, however, they will be placed in the same panel. In order to display these lines in separate panels the line names must be changed (see section 3.3).

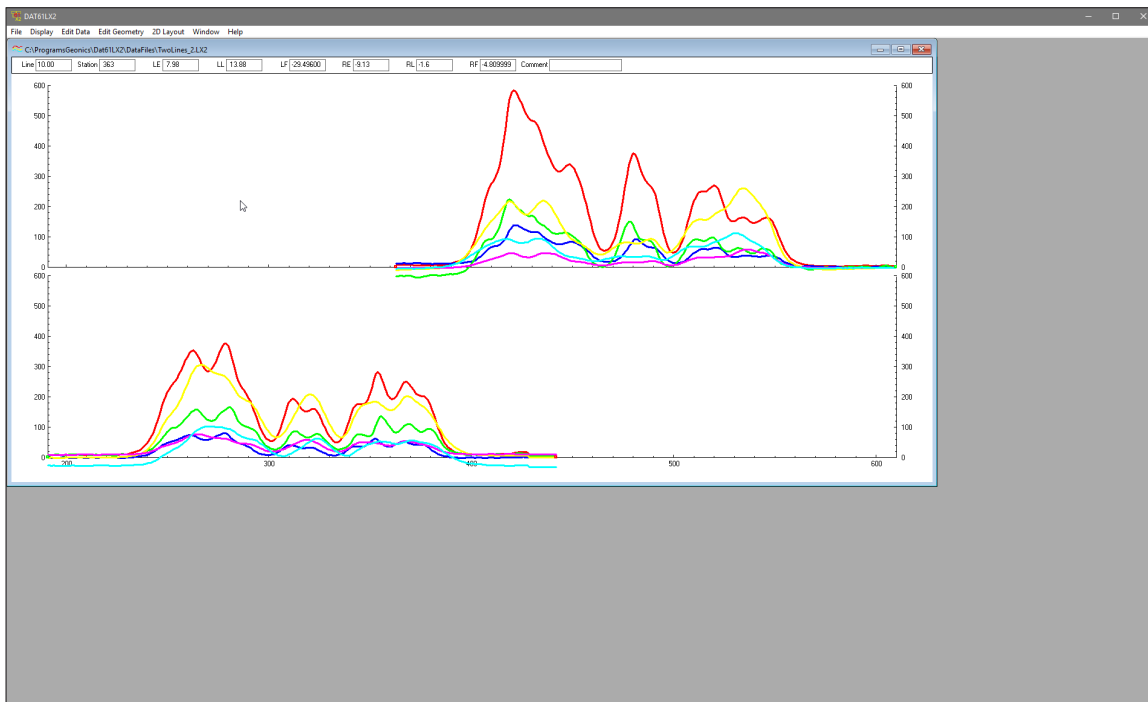


Figure 3.3 DAT61LX2 screen with stacked profiles

In each panel the data type selected for display (see section 3.4 below) are profiled. In the default settings, all data types (Early, Late, and Filtered channels for Left and Right sensors) are profiled. Therefore each panel may contain up to 6 profiles for each survey line, or 3 profiles if one sensor is used. Both vertical axis corresponds to EM61-LX2 response labeled in mV.

## Loading Additional Data Files to Separate Windows

To display another data set (can be exactly same data file) in a separate window select **File|Open Profile File** in the menu (Figure 3.4). The Open EM61-LX2 File window will be displayed (Figure 3.2). Select directory and file name and then click the **Open** button (or double click the left mouse button, or press **Alt\_O** on the keyboard).

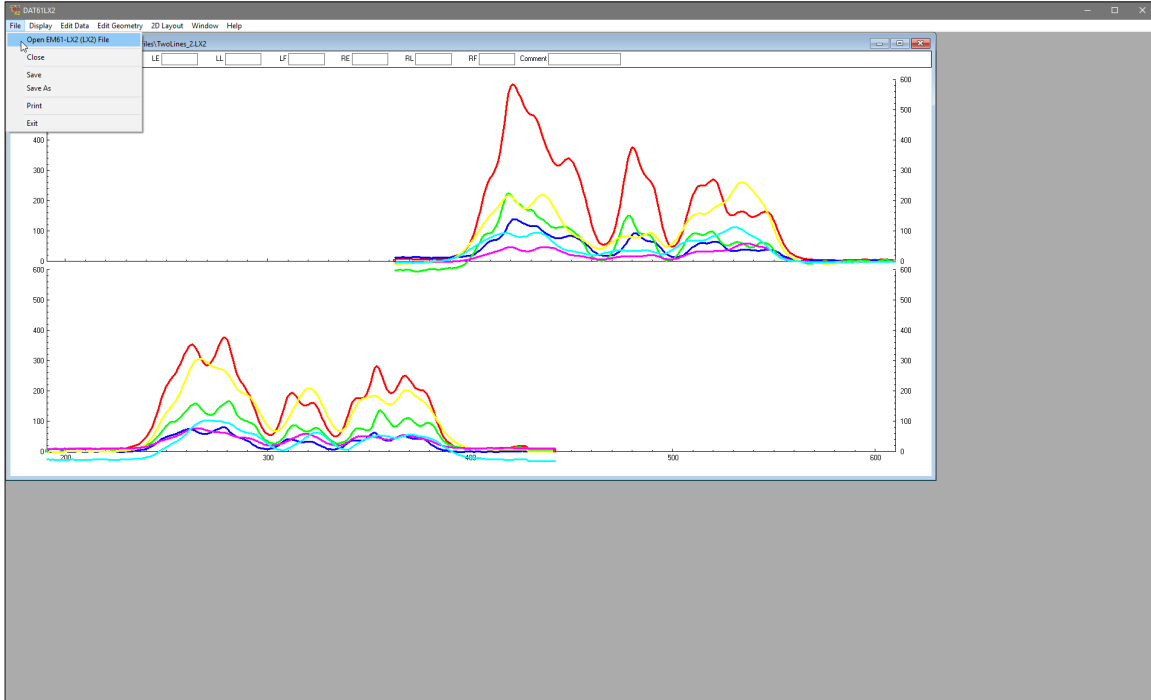


Figure 3.4 DAT61LX2 File menu after data files are loaded

After the new profile file is loaded, data is displayed in a stacked profile format in a new window, as shown in Figure 3.5. Up to 20 document windows can be displayed by the present version of the

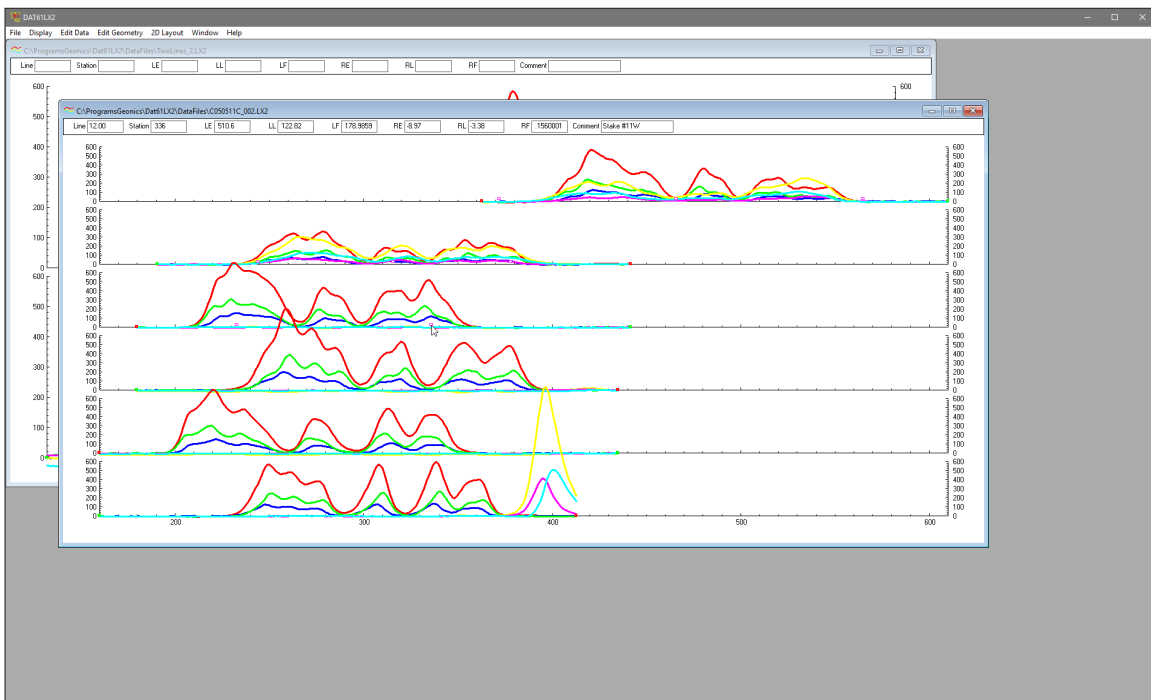


Figure 3.5 DAT61LX2 screen with stacked profiles in two separate windows

program at the same time. This includes multiple entry of the same file name, so the same data set can be displayed in separate windows. Windows can be resized or tiled (vertically or horizontally) using the Window menu. The menu displayed at the top of the screen is always associated with the active window.

## Adding Data to the Existing Window

To insert data to the existing window select **File|Add Profile File** in the menu (Figure 3.4). The Open EM61-LX2 File window will be displayed (Figure 3.2). Select directory and file name and then click the **Open** button (or double click the left mouse button, or press **Alt\_O** on the keyboard).

After the new profile file is loaded, data is appended to the existing data set and displayed in a stacked profile format in the same window (Figure 3.6). Any number of files (limited only by the capacity of the computer memory) can be loaded to one window.

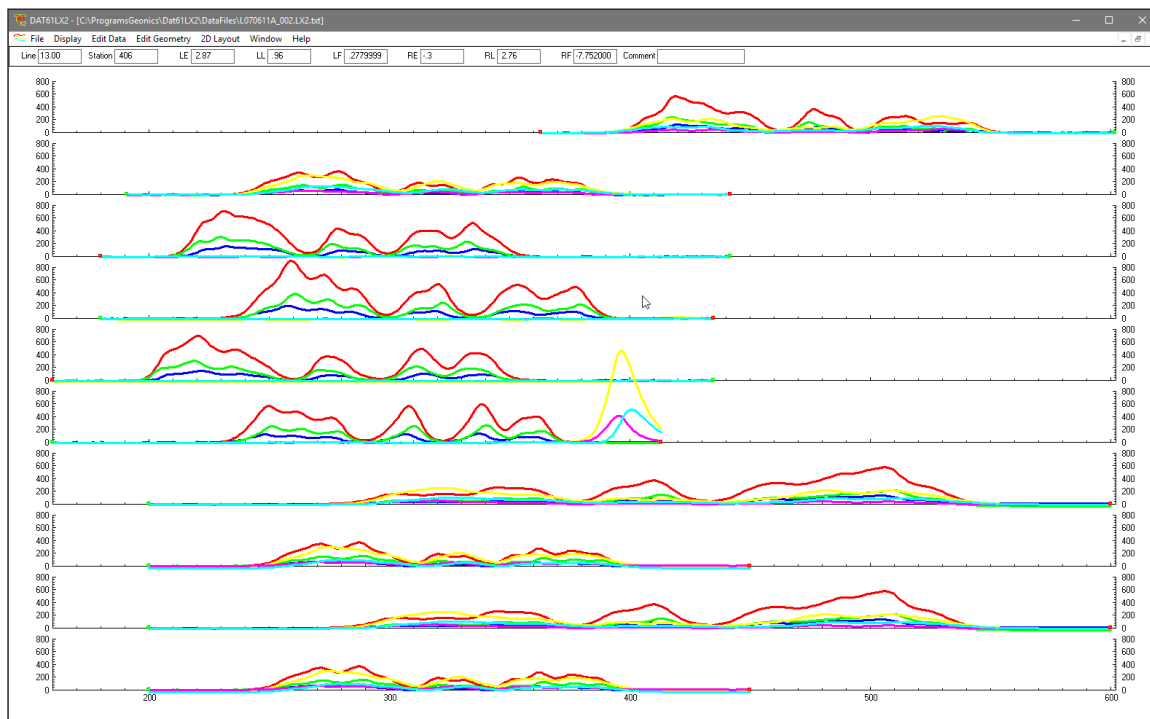


Figure 3.6 DAT61LX2 screen with content of two files in one window

Data loaded to one window can be saved only as a single file. After several files are loaded to one window it is worthwhile saving the data set (using function **Save As**) as a separate data file in order to preserve the content of the original data files.

This option may be not available in all versions of the program.

## 3.2 Closing Profile Window and Saving Data

### Closing Active Window

To close any active window select **File|Close** in the menu (Figure 3.7). This procedure can also be performed by clicking the close button of the active window.

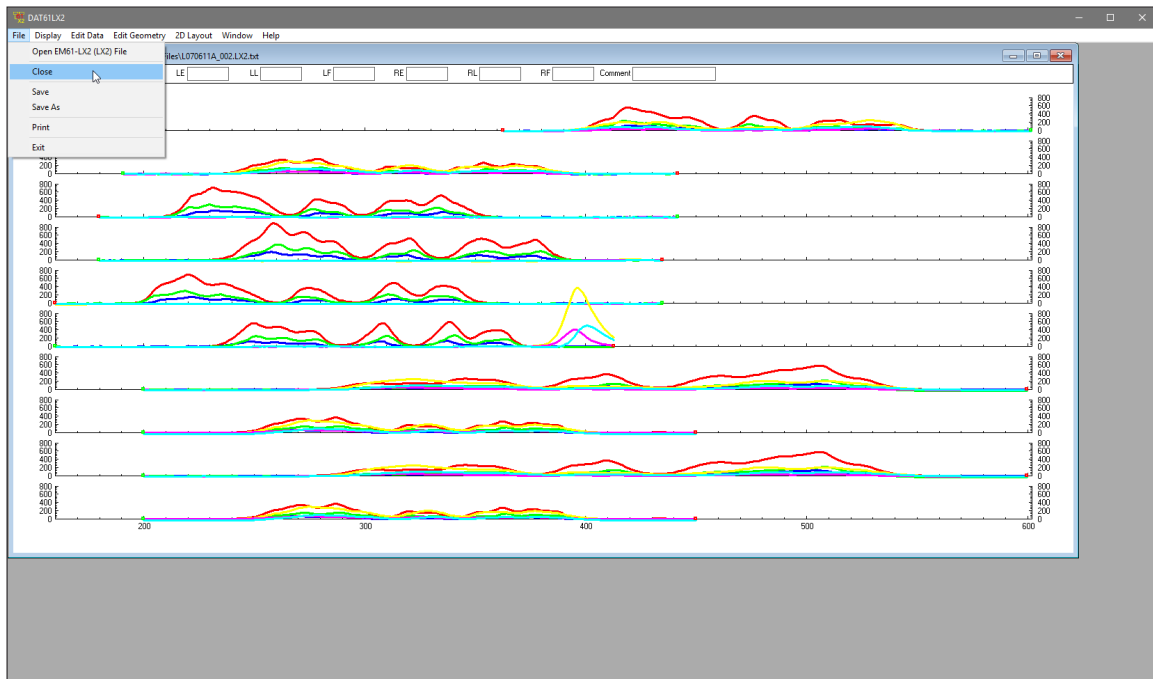


Figure 3.7 DAT61LX2 File menu

If any data processing was performed on the loaded data set and items not saved using **Save** nor **Save As** functions (see below), a Save Changes window will appear as shown in Figure 3.8.

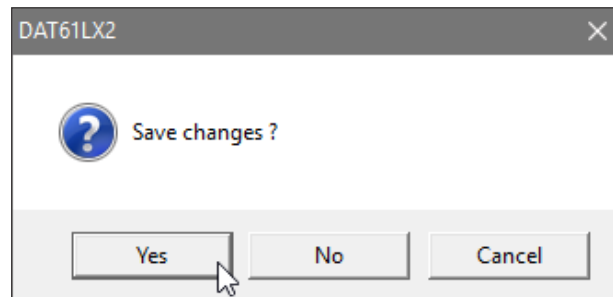


Figure 3.8 Save Changes window

## Save Data

To save data to the currently opened file select **File|Save** in the menu (Figure 3.7) or click the left mouse button on the toolbar button. If several files are open, the caption displayed at the top of the active window will be used as the file name.

**It is recommended that you use the option Save As, to maintain the original data in an unedited form.**

## Save Data to Specified File (Save As)

To save data to a different file select **File|Save As** from the top menu (Figure 3.7). The Save As window will be displayed (Figure 3.9). Select a directory, specify a file name and then click the **Save** button (or double click the left mouse button, or press **Alt\_S** on the keyboard). Data files containing EM61-LX2 readings will have the extension name LX2.

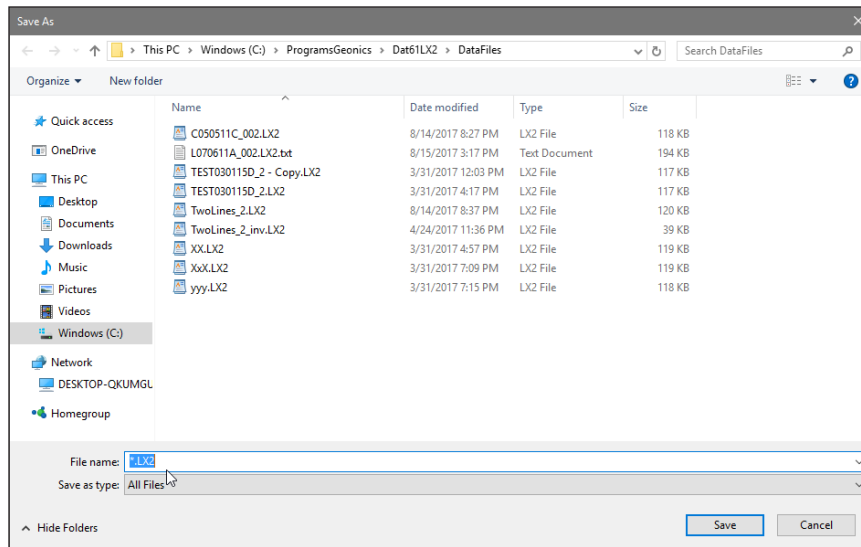


Figure 3.9 Save As window

### 3.3 Select, Delete and Rename Survey Lines

#### Selecting Survey Lines

When a data file is loaded, all survey lines contained in the file are displayed. To display a selection of survey lines select **Display>Select Lines** from the top menu (Figure 3.10).

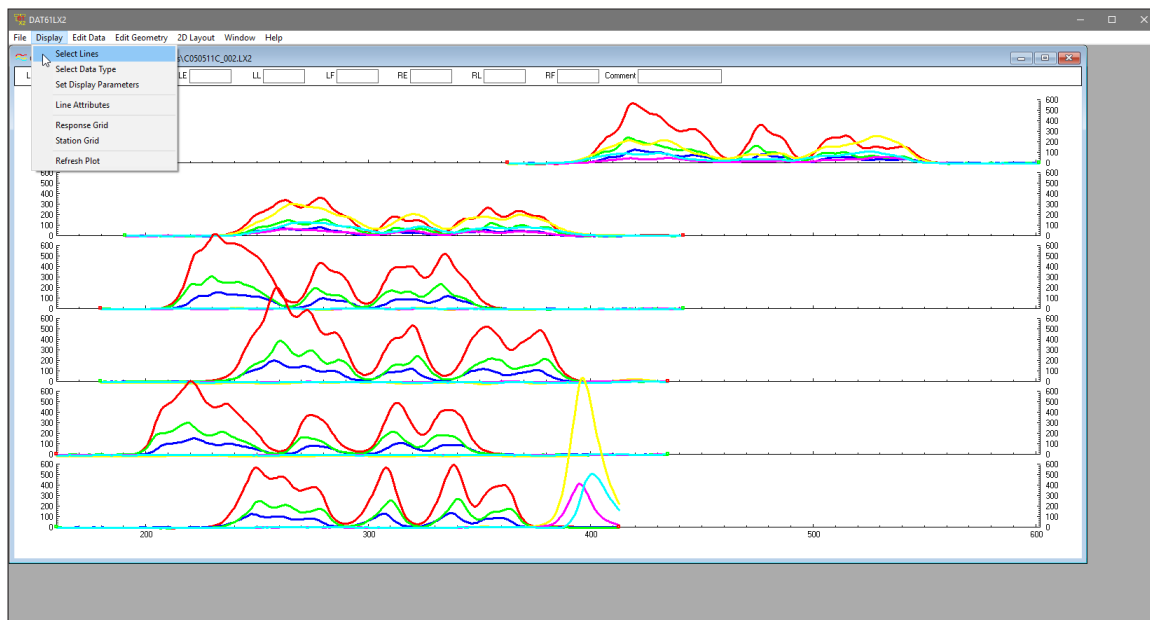


Figure 3.10 DAT61LX2 Display window

The Select Lines window is shown in Figure 3.11. In the top right section the number of available survey lines (Total), the number of currently selected lines (Selected.), and the number of deleted lines (Deleted) are displayed.

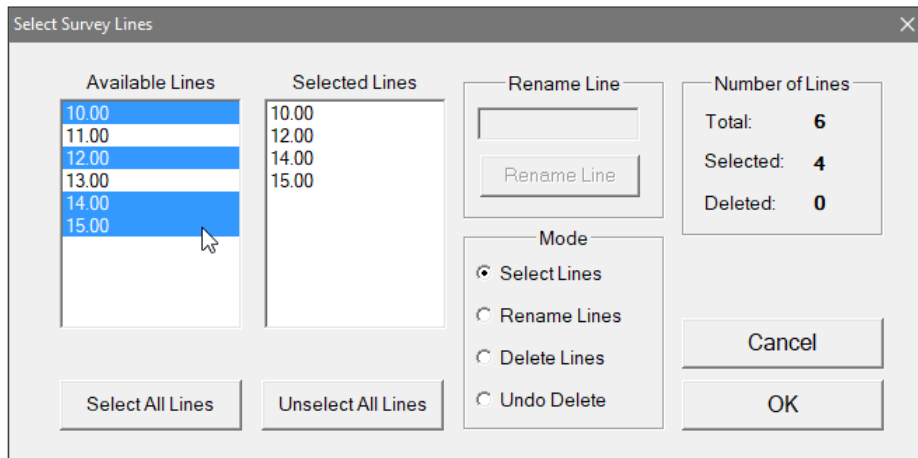


Figure 3.11 Select Lines window

The left list box, labeled Available Lines, displays all available lines. The right list box, labeled Selected Lines, shows the lines selected for display. When saving data (**Save** or **Save As** options), data will be saved in the order shown in the Select Lines window.

Select (and deselect) lines to be displayed by clicking the line names in the corresponding list box. **Select All Lines/Unselect All Lines** functions are also available. Clicking on the **Reverse Order** button will change sequence of all previously selected survey lines (from top to bottom of the display). All highlighted line names will be displayed on the screen after clicking the **OK** button. Figure 3.12 is an example of a screen with three selected lines. (The corresponding Select Lines window is shown in Figure 3.11.)

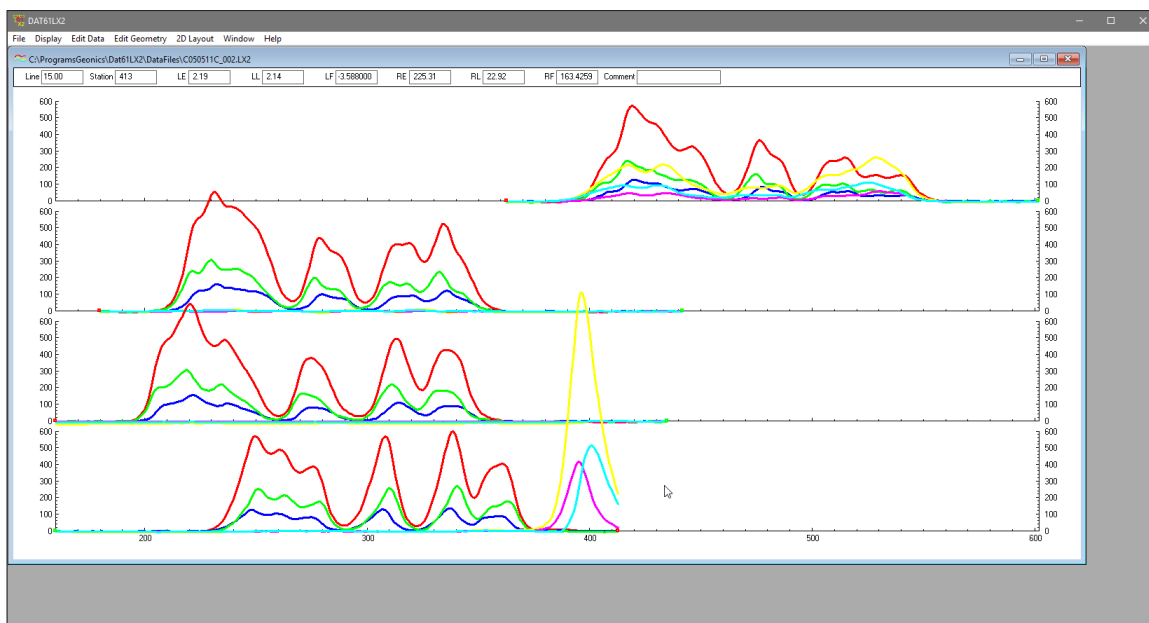


Figure 3.12 DAT61LX2 screen with selected four survey lines

The selection of lines has no effect on the execution of **Save**, **Save As**, **Create Grid Based XYZ File**, **Create GPS Based XYZ File** options. Select Lines only affects the current display. Therefore, one or two survey lines can be displayed and examined in detail and then saved with all other (not deleted) survey lines to a new file.

## Deleting Survey Lines

You can also delete and rename lines with the **Select Lines** window while using Delete and Rename mode (Figure 3.11).

To delete a survey line from the loaded set, first click the **Delete** radio button in the section labeled Mode. When the radio button is checked click the appropriate line name in the list box labeled **Available Lines**. The letter **D** will be displayed next to the line name in the Available Lines list (Figure 3.13). These lines will not be displayed nor written to the output file during **Save**, **Save As**, **Create XYZ File** tasks.

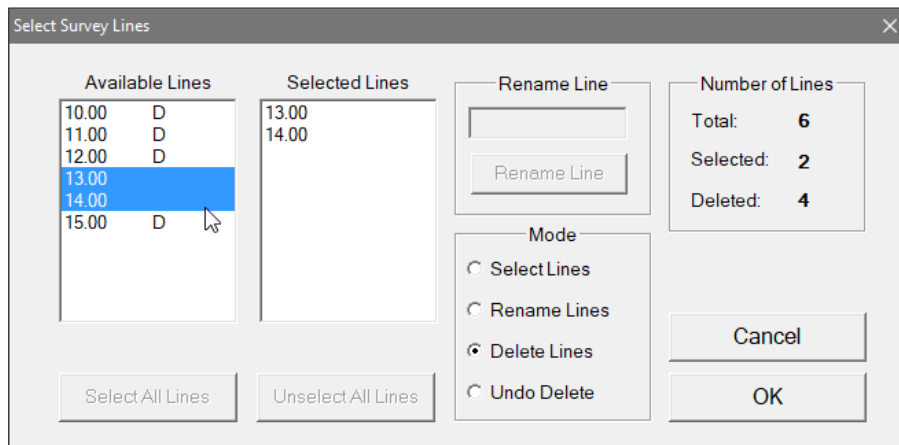


Figure 3.13 Select Lines window during Delete Line procedure

Lines can be undeleted as well. To undo previously deleted lines (as long as program is running), first click the **Undo Delete** radio button. When this radio button is marked in the Mode section click the appropriate line name (with letter D next to its name) in the list box. The letter **D** will disappear and the survey line can be displayed, edited, and saved.

## Renaming Survey Lines

You can rename survey lines in the Select Lines window as well. Click on the radio button labeled **Rename Lines** in the Mode section and then click on the appropriate line name in the Available Lines list box. The highlighted line name will appear in the Rename Line edit box (Figure 3.14). Edit the name and click the **Rename Line** button. The updated name will now be displayed in the Available Lines list.

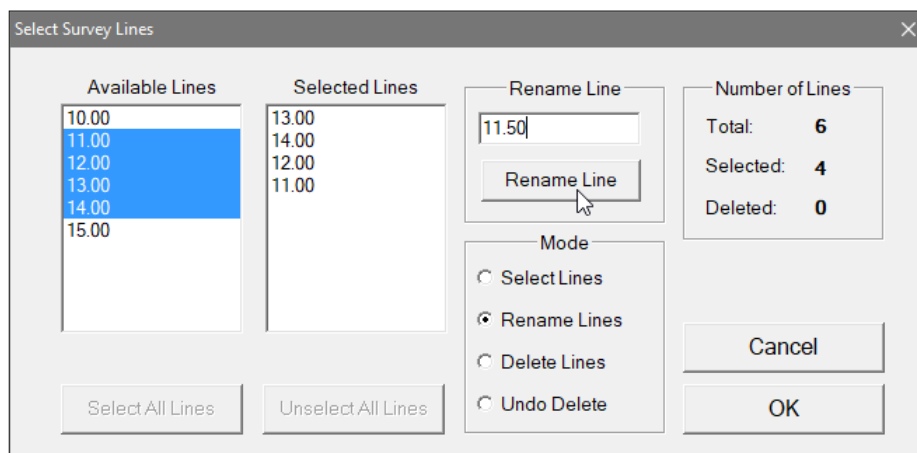


Figure 3.14 Select Lines window during Rename Line procedure



Deleted and Renamed lines will be valid as long as the program is running. In order to save changes permanently, use the Save As option to create a new data file which can be used later by the program. It is recommended that you use the option Save As in order to maintain the original data in an unedited form.

### 3.4 Select Data Type

To select the type of data to be displayed select the **Display|Select Data Type** from the top menu (Figure 3.10). The Select Data Type window will appear as shown in Figure 3.15.

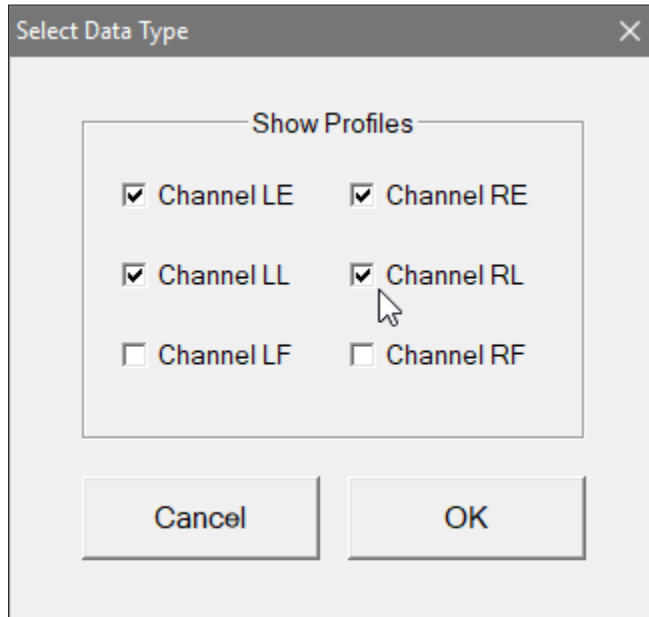


Figure 3.15 Select Data Type window

The Select Data Types window contains check boxes for each type of EM61-LX2 data. Each Type is described by an abbreviation:

<b>Channel LE</b>	-	<b>L</b> eft sensor,	<b>E</b> arly channel
<b>Channel LL</b>	-	<b>L</b> eft sensor,	<b>L</b> ate channel
<b>Channel LF</b>	-	<b>L</b> eft sensor,	<b>F</b> iltered channel
<b>Channel RE</b>	-	<b>R</b> ight sensor,	<b>E</b> arly channel
<b>Channel RL</b>	-	<b>R</b> ight sensor,	<b>L</b> ate channel
<b>Channel RF</b>	-	<b>R</b> ight sensor,	<b>F</b> iltered channel

The Select Data Type window is divided into two columns referring to Left and Right sensors. The dialog lets you select channels to be displayed as profiles. To select a data type click on the check box next to the data type name. All Data Types will be displayed in display boxes located under the menu bar regardless of data type selection for profile view.

To select a data type click on the check box next to the data type name.

After all parameters are selected click the **OK** button located at the bottom of the window. Clicking the **Cancel** button will cancel the selection and the display will not change.

## 3.5 Set Display Parameters

To open the Set Display Parameters window (Figure 3.16) select **Display|Set Display Parameters** from the top menu (Figure 3.10).

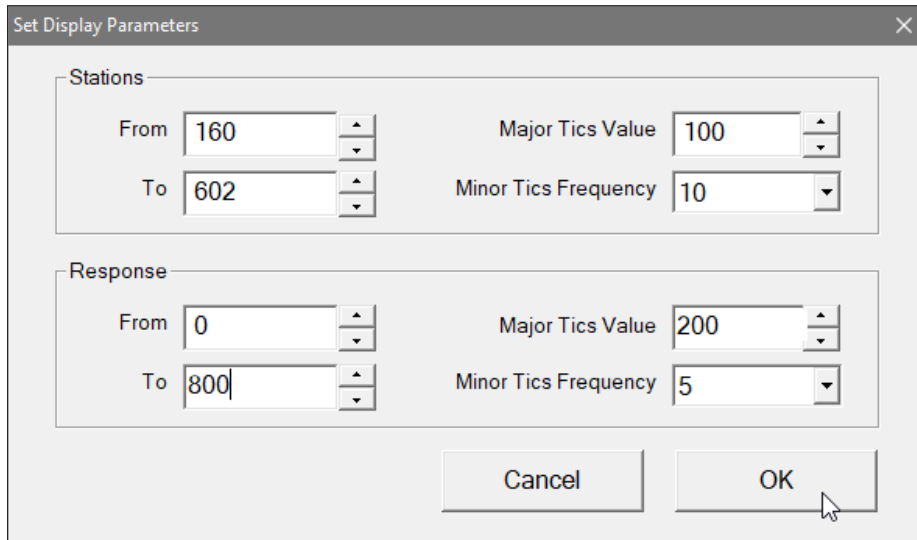


Figure 3.16 Set Display Parameters window

This option allows a range to be set for the length of the line (stations displayed), and the EM61-LX2 response amplitude. The major axis tick intervals as well as minor tics frequency are also controlled through this window. (Labels and optional grid lines are plotted at the major ticks only.) After all parameters are set, press the **OK** button and the profile display will be updated.

## 3.6 Line Attributes

To change the colour and/or thickness of the profile lines of each channel (component/dipole mode/coil separation) select **Display|Line Attribute** from the top menu (Figure 3.10). The **Select Line Attributes** window is shown in Figure 3.17.

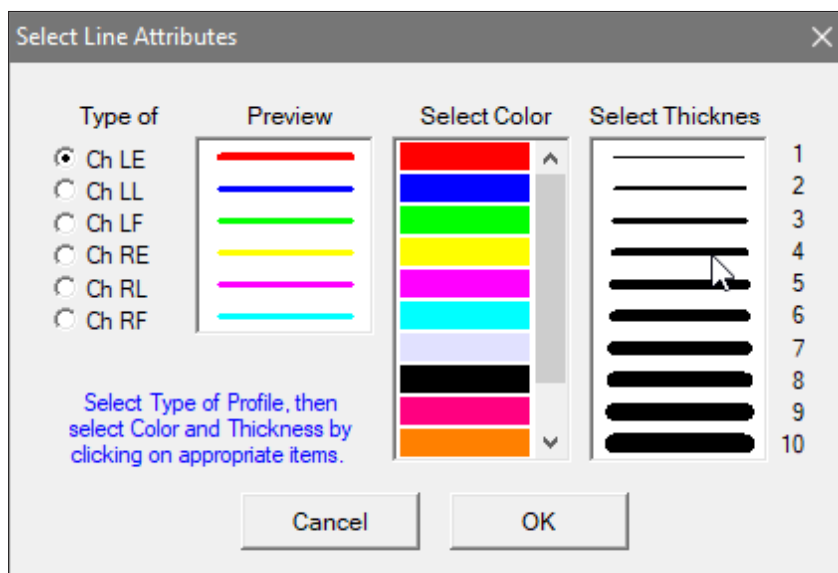


Figure 3.17 Select Line Attributes window

Each profile line is of a different type, given by the data type indicating instrument channel (see section 3.4 above). The line types are displayed in the column of radio buttons located at the left edge of the window. Samples of the lines are placed in a box labeled Preview. To change colour or thickness of the profile, click the appropriate radio button to select profile type, then click the desired colour bar in the Select Colour box and thickness in the Select Thickness box. Samples of lines are updated in real time in the box labeled Preview.

After all attributes are set, click the **OK** button and the profile display will be updated. Line attributes are written to the DAT61LX2 initial file and during future executions of the program these attributes will be used as default settings.

### 3.7 Grid Lines

To obtain horizontal and/or vertical lines at major ticks along the axes, select **Display|Response Grid** or **Display|Station Grid** from the display menu (Figure 3.10). The screen with grid lines is shown in Figure 3.18.

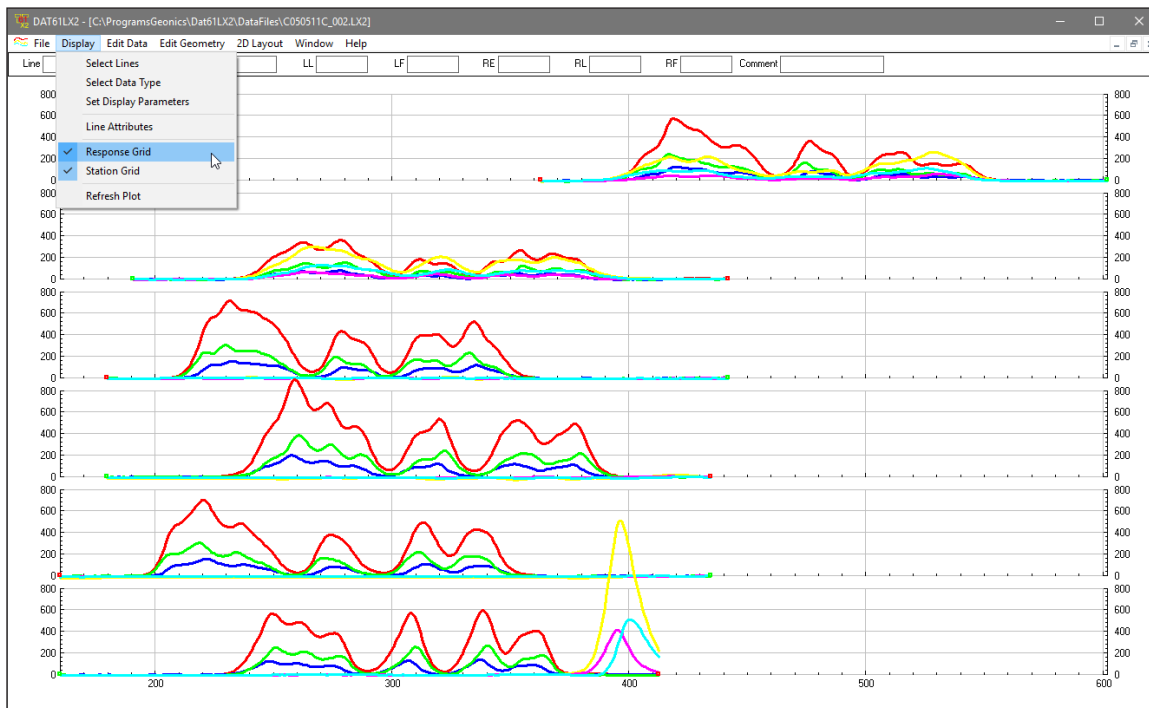


Figure 3.18 DAT61LX2 screen with stacked profiles display while grid lines for the response and stations are enabled

Grid lines are plotted across each panel at corresponding major ticks as light grey lines. These options can be useful in examining the alignment of anomalies which are distributed across more than one survey line, as well as for comparing anomaly amplitudes.



# 4. Edit Data

To display the Edit Data menu select **Edit Data** from the main menu at the top of the screen (Figure 4.1). The Edit Data menu in the present version of the program contains three items Shift Data Set, Linear Drift Correction, and Smoothing Data.

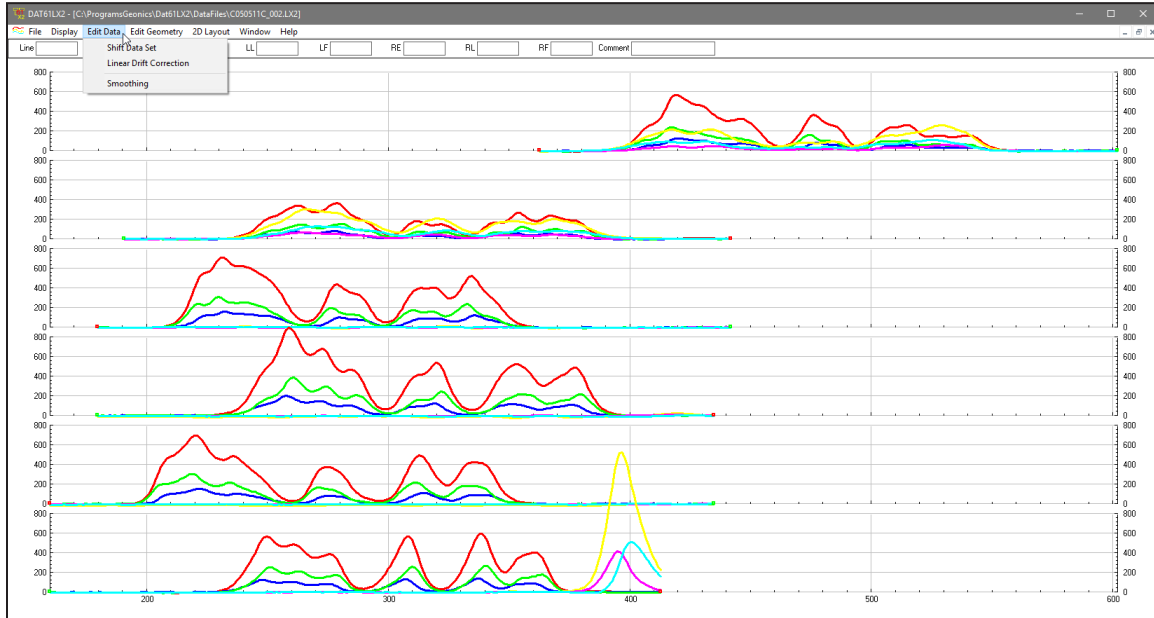


Figure 4.1 DAT61LX2 Edit Data menu

## 4.1 Shift Data Set

To display the **Shift Data Set** window select **Edit Data|Shift Data Set** from the main menu (Figure 4.1). The window that will appear is shown in Figure 4.2.

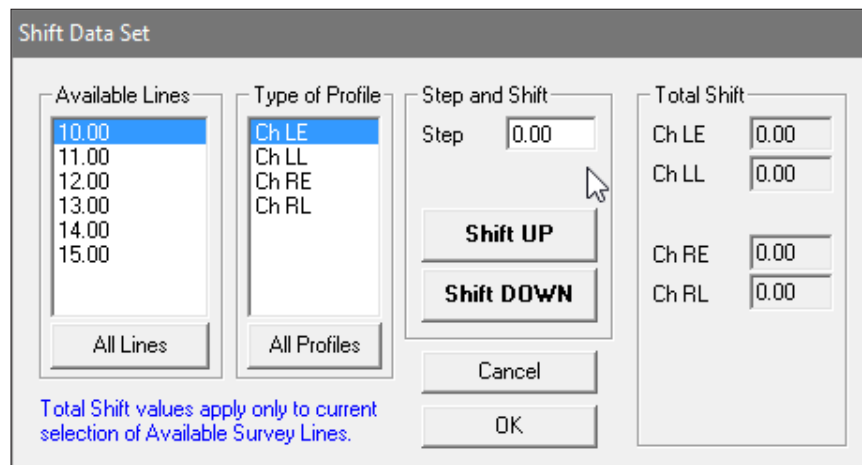


Figure 4.2 Shift Data Set dialog

The data shifting - to increase or decrease the values of all readings on a survey line by a constant amount - can be applied to any number of selected survey lines and to any selected data types (channels). Survey lines can be selected by clicking on Line Names in the box labeled **Available Lines**, while data types can be chosen by clicking on data types listed in the box labeled **Type of Profile**.

Channels LF and RF are not listed since they are calculated based on Channels LE and LL, and RE and RL. Any changes in Early and Late channels are reflected on the plot in real time. Selected survey lines and data types will be highlighted, see Figures 4.2 and 4.3.

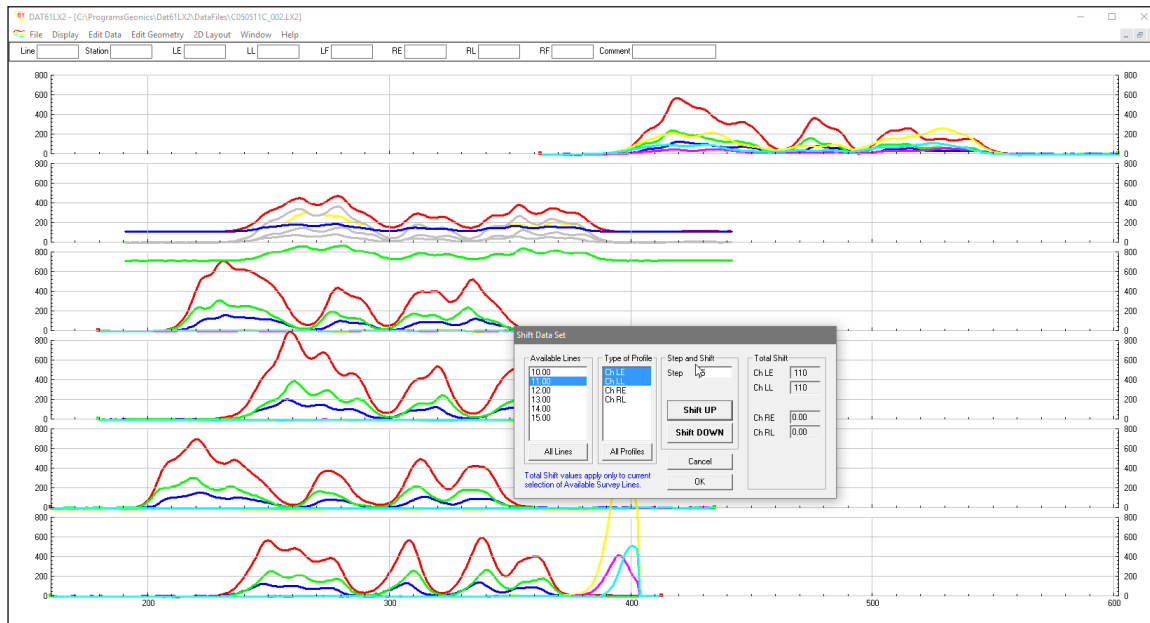


Figure 4.3 DAT61LX2 during Shift Data operation

To select all lines and data types click on the **All Lines** button and on the **All Profiles** button to shift data for all survey lines and types listed in the Available Lines and Type of Profile list boxes.

Data is shifted in increments specified in the edit box labeled Step in the section labeled **Step and Shift**. The increment (step) can be set from the keyboard (after positioning the cursor in the edit box).

To shift data for the selected survey lines click on the **Shift UP** or **Shift DOWN** button. The total shift will be shown in the display box labeled **Total Shift** and the graphic display (profile view) will be updated in real time. The Shift Data Set window can be moved to a section of the screen where it will be the least obstructive (Figure 4.3). The screen with the shifted readings is shown in Figure 4.3, please compare to Figure 4.1. Original profiles are plotted as gray lines during shift data procedure.

To close the Shift Data Set window click on **OK** or the close window button. This will temporarily save any changes in the data set.

## 4.2 Linear Drift Correction

To display the **Linear Drift Correction** dialog select **Edit Data|Linear Drift Correction** from the main menu (Figure 4.1). The window that will appear is shown in Figure 4.4.

In some cases, when elimination of linear drift caused by the site properties or any other possible source is necessary any of two ends of the survey line can be shifted up or down. All readings will be recalculated and plotted on the screen in real time. This procedure can be applied to any number of selected survey lines and to any selected data types (channels). Survey lines can be selected by clicking on Line Names in the box labeled **Available Lines**, while data types can be chosen by clicking on data types listed in the box labeled **Type of Profile**. Channels LF and RF are not listed in the Data Type section since they are calculated based on Channels LE and LL, and RE and RL.

Any changes in Early and Late channels are reflected on the plot of Filtered Channel in real time. Selected survey lines and data types will be highlighted, see Figures 4.4 and 4.5.

Data is shifted in increments specified in two edit boxes labeled **Step** in two sections labeled **Left End** and **Right End**. The increment (step) can be set from the keyboard (after positioning the cursor in the edit box).

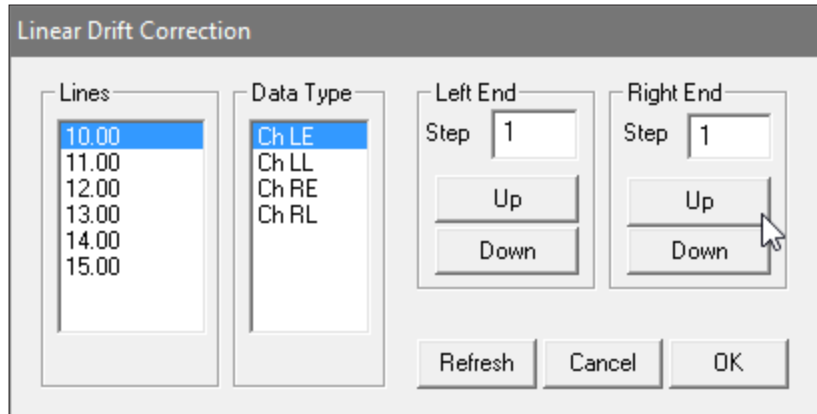


Figure 4.4 Linear Drift Correction dialog

To shift data for the selected survey lines and data types click on the **Up** or **Down** button in one of sections corresponding to Left or Right end of lines. The total shift will be shown in the display box labeled **Total Shift** and the graphic display (profile view) will be updated in real time. The Shift Data Set window can be moved to a section of the screen where it will be the least obstructive (Figure 4.5). The screen with linearly shifted readings is shown in Figure 4.5, please compare to Figure 4.1. Original profiles are plotted as gray lines during shift data procedure.

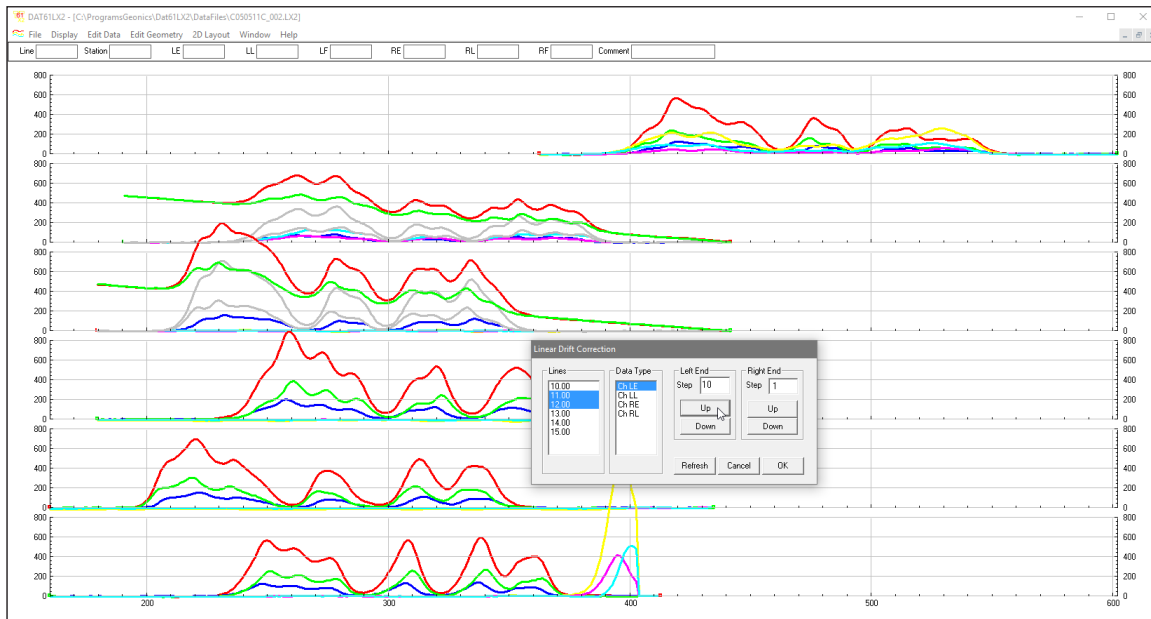


Figure 4.5 DAT61LX2 during shifting left ends of two selected lines

To close the Linear Drift Correction dialog click on **OK** or the close window button. This will temporarily save any changes in the data set. Permanent saving requires Save or Save As items in File menu.

## 4.3 Smoothing Data

To display the **Smooth Data** window select **Edit Data|Smooth Data** from the main menu (Figure 4.1). The window that will appear is shown in Figure 4.6

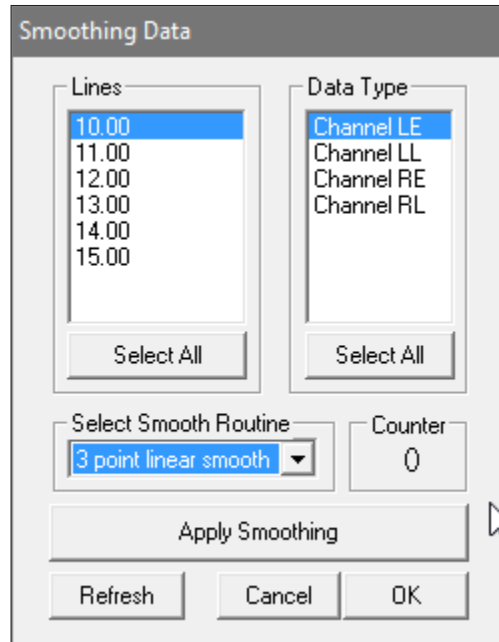


Figure 4.6 Smooth Data dialog

The smoothing procedure can be applied to any number of selected survey lines and data types. To select lines click on all appropriate lines in the list box labeled Lines and select channels in the Data Type section. Several methods of smoothing are available: 3 point linear smooth, 5 point linear smooth, etc. They are listed and selected using the Select Smooth Routine pull down menu (Figure 4.7).

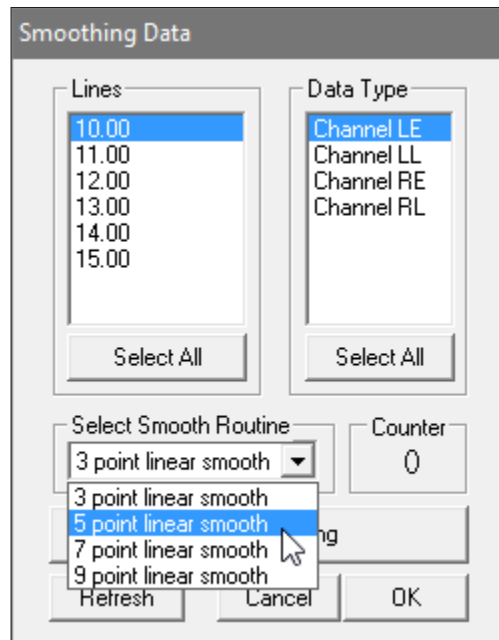


Figure 4.7 Available Smooth Routines



After the survey lines and the method of smoothing have been selected, press the Apply button to smooth. Smoothing can be applied to a selected set of data several times. The number of smoothing applications is displayed and updated in at the bottom of the window (left to the Apply button), labeled times. The graphic display is updated in real time, with the original curves displayed in grey, as shown in Figure 4.8.

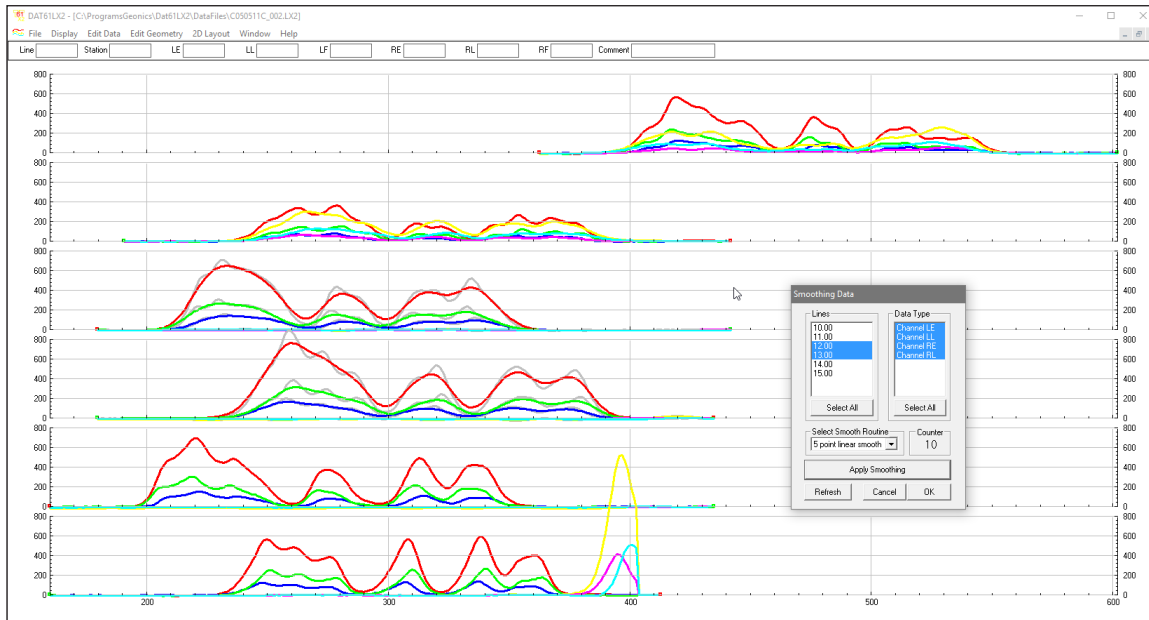


Figure 4.8 DAT61LX2 during smoothing two selected lines

The simple, three point linear smoothing function, applied several times, is adequate for “average” EM61-LX2 data. Ultimately, however, the method of smoothing and the degree of smoothing depends on the particular data set, objectives, desired method of presentation, etc.

Closing the Smooth Data window using OK or the close window button will temporarily save changes in the data set.

Note that changes are saved temporarily in the in the program memory while the window associate with the data set is active. Changes can be saved permanently with the Save or Save As option. (It is recommended to use Save As instead of Save, to preserve the original data.)



# 5. Edit Survey Geometry

The Edit Geometry option allows adjustment of the profile geometry, including the repositioning of both the start and end stations of each line, as well as any station marked with the fiducial switch. To display the Edit Geometry menu select **Edit Geometry** in the main menu at the top of the screen (Figure 5.1).

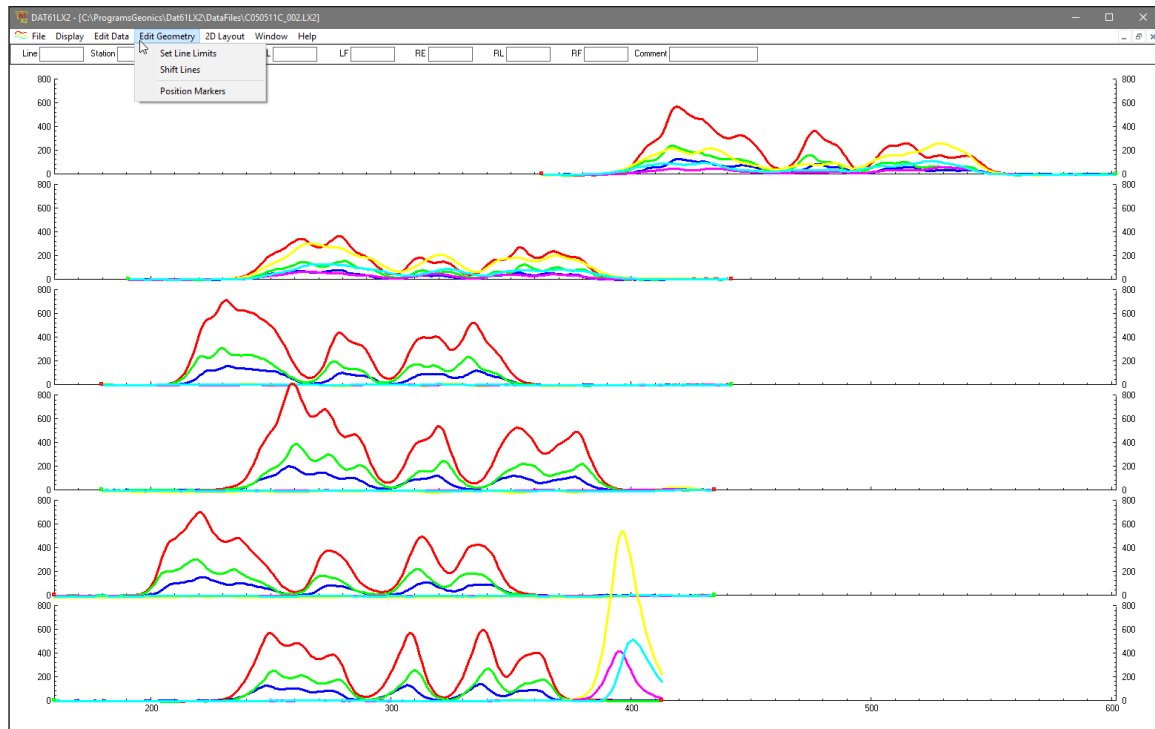


Figure 5.1 DAT61LX2 Edit Geometry menu

The Edit Geometry menu contains three items:

**Set Line Limits** changes the position of the start and end stations of any selected group of survey lines;

**Shift Survey Lines** can be used to move any selected group of survey lines in either a positive or negative direction along the profile axis;

**Position Markers** is an efficient tool for aligning fiducial markers and the start and end points of survey lines.

## 5.1 Set Line Limits

To display the **Set Line Limits** window select **Edit Geometry|Set Line Limits** in the menu (Figure 5.1). The Set Line Limits window is shown in Figure 5.2.

You can set line limits (positions of the start and end stations) for any number of selected survey lines at one time. To select lines, use the list box labeled Select Line(s). In the Current Line Limits display box, the minimum (Left) and maximum (Right) positions of stations are shown. (Left corresponds to the minimum station positions on the left side of the screen, while Right corresponds to the maximum positions on the right side for the selected survey lines.) You can specify new Left and Right positions can be specified in the two edit boxes labeled **Set Line Limits to**.

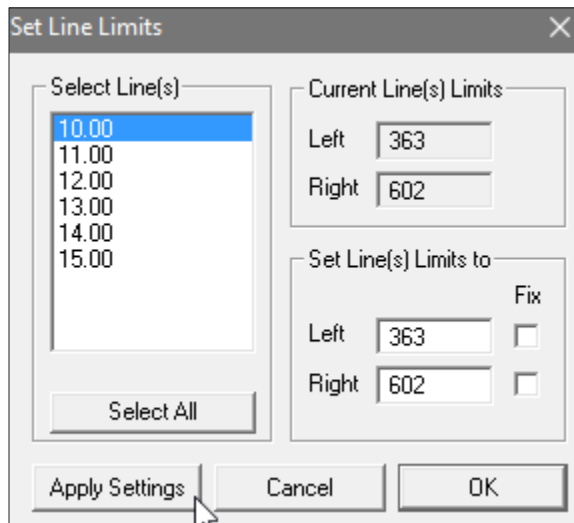


Figure 5.2 Set Line Limits window

If both edit boxes are not checked (Figure 5.2), both ends of the selected survey lines will be repositioned to the specified values. In this case, the station intervals will be adjusted accordingly. If only one edit box is checked (Figure 5.3), the active station will be repositioned to the specified location, while the non-active station (checked) will remain unchanged.

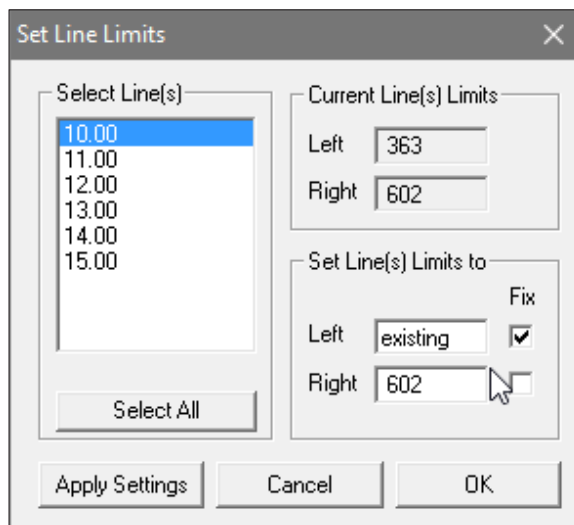


Figure 5.3 Set Line Limits window with one edit box checked (end station fixed)

After you click the **Apply Setting** button, the specified adjustments are completed. The graphic display will be updated in real time. The procedure can be repeated for any additional sets of survey lines and settings.

An example is shown in Figures 5.4 and 5.5 where three first lines are to be set to new positions of left and right end stations of lines, and after clicking on the **Apply Settings** button these stations are repositioned (Figure 5.5). This action is temporary, in order to save new geometry of adjusted survey lines the **OK** button must be clicked and then data set must be saved.

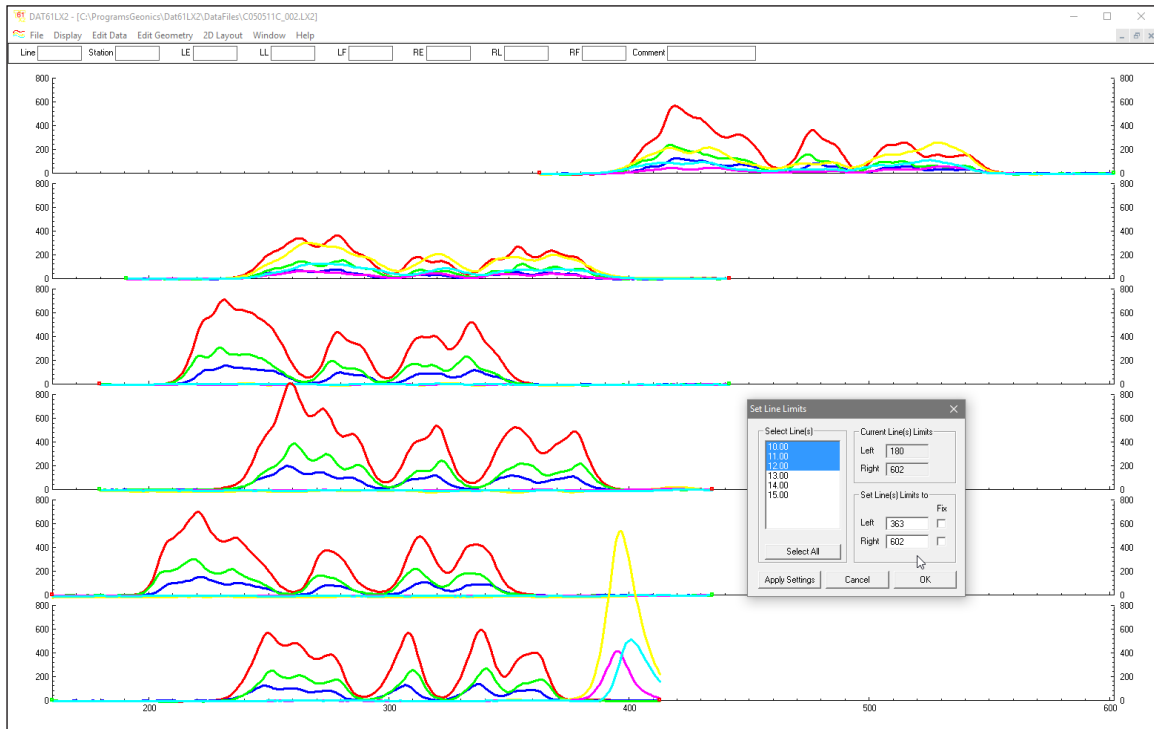


Figure 5.4 DAT61LX2 profile display before Set Line Limits adjustment

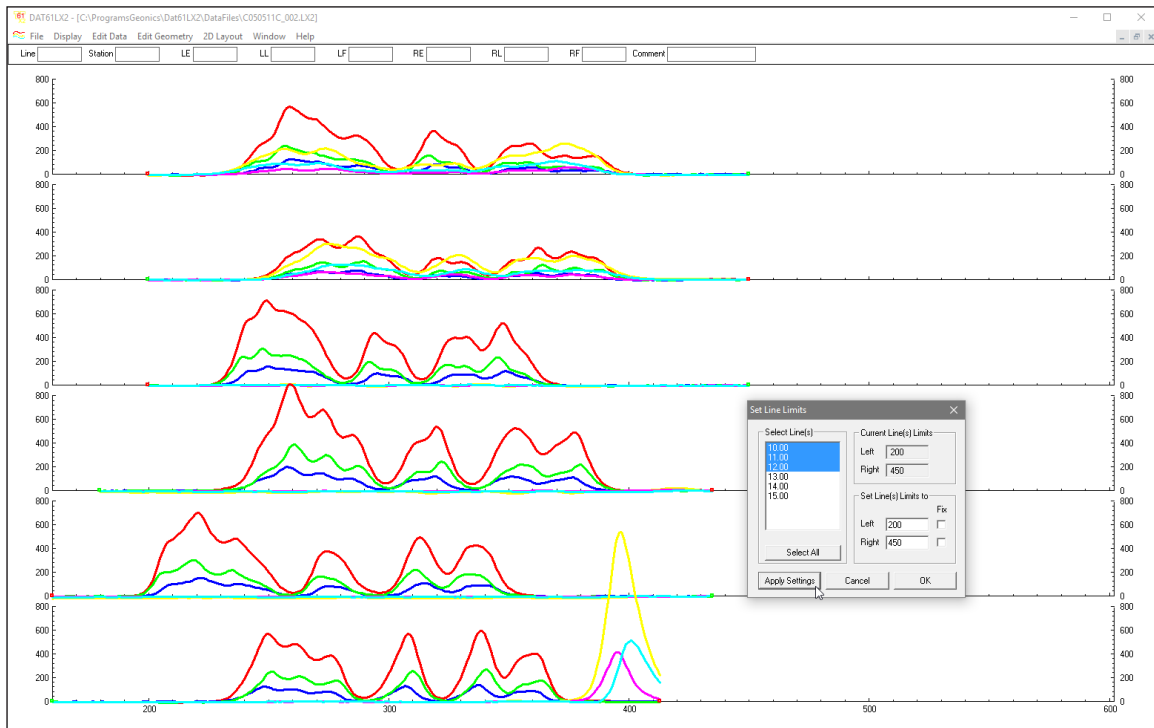


Figure 5.5 DAT61LX2 profile display after action in Set Line Limits has been applied by clicking on the Apply Settings button

If any change is not satisfactory, click the **Cancel** button to close the Set Line Limits window and return all stations to their original positions. Clicking the **OK** button will close the Set Line Limits window and apply the changes.

## 5.2 Shift Survey Lines

To display the **Shift Survey Lines** window select **Edit Geometry|Shift Survey Lines** from the main menu (Figure 5.1). The window is shown in Figure 5.6.

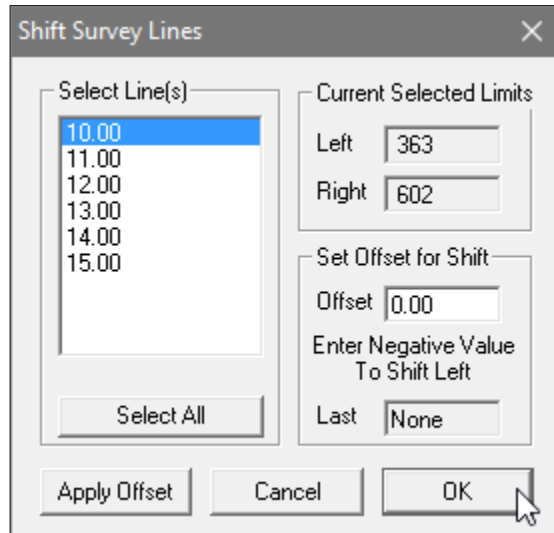


Figure 5.6 Shift Survey Lines window

This option lets you shift any number of selected survey lines, left or right, along the profile axis. The survey lines can be selected from the list box labeled **Select Line(s)**. The information on current positions of the end points of the current line is shown in the display box labeled Current Position. The shift increment (step) can be entered in the edit box labeled **Set Offset for Shift**. If the step is positive, the selected lines will be shifted to the right, with the station numbers increasing accordingly. A negative step will shift survey lines to the left, with station numbers decreasing accordingly. The lengths of the survey lines will not change.

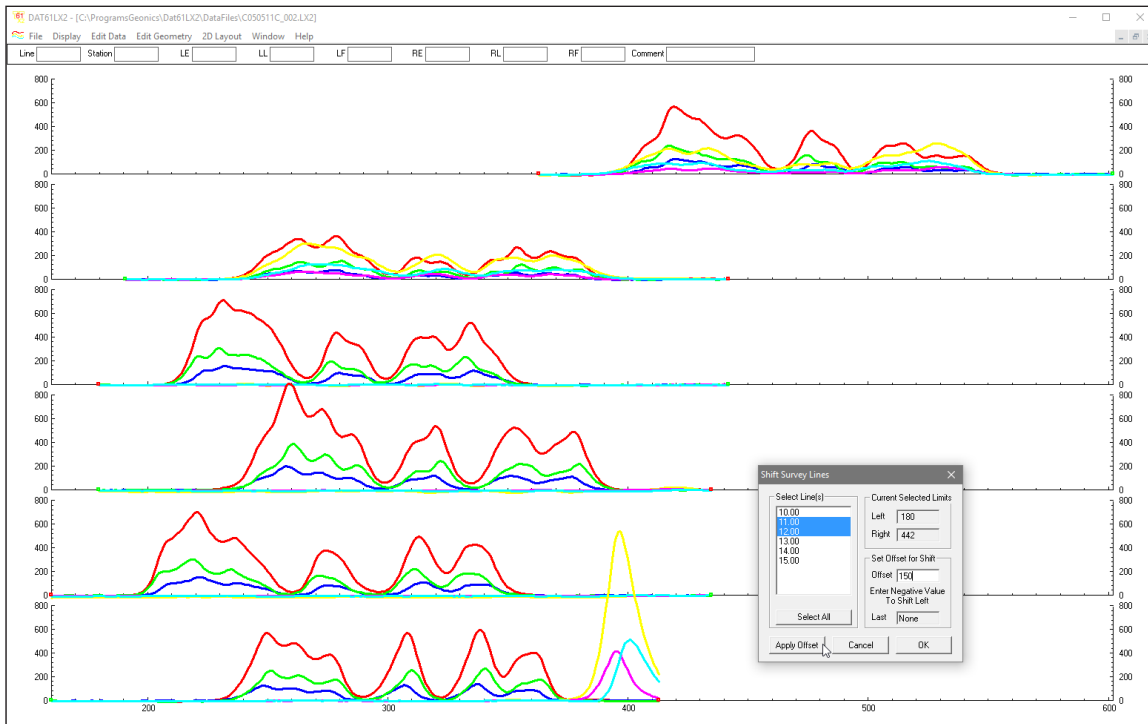


Figure 5.7 DAT61LX2 profile display before Shift of survey lines is applied

After the step is entered, click on the **Apply Offset** button to shift the selected lines. The graphic display will be adjusted in real time. An example is shown in Figures 5.7 and 5.8 where lines 11 and 12 are shifted 150 stations to the right, entered shift is +150 (Figure 5.7).

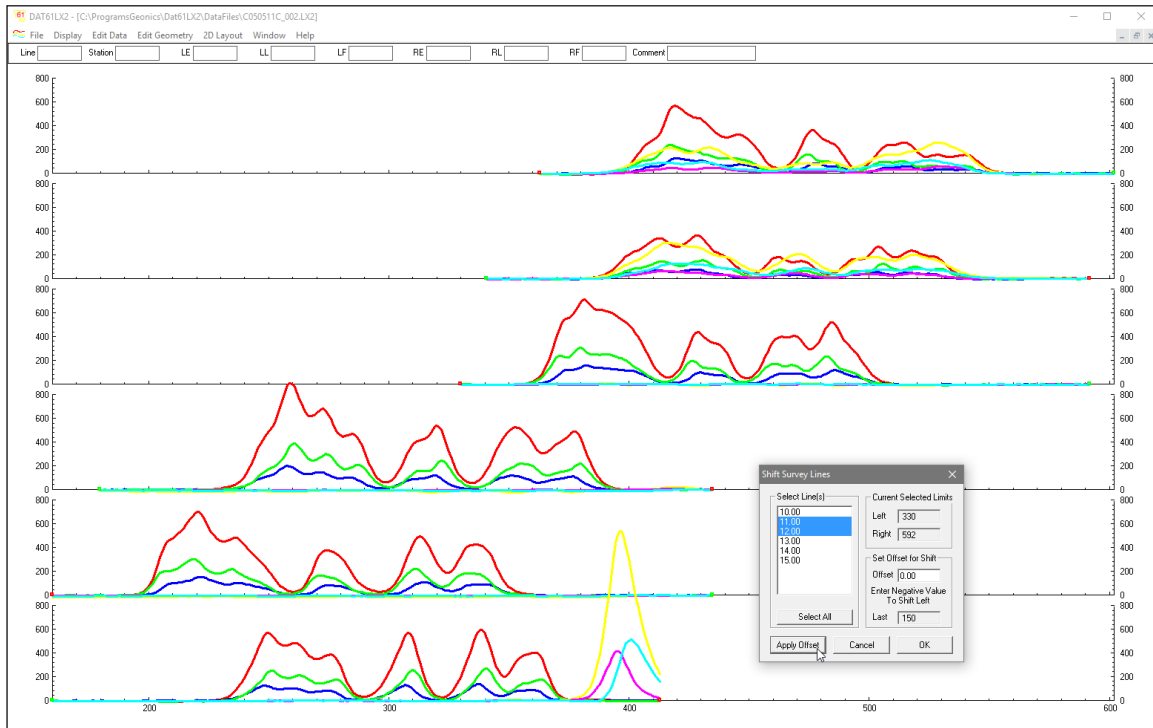


Figure 5.8 DAT61LX2 profile display after Shift of 150 stations has been applied to survey lines 11 and 12 (please compare with Figure 5.7)

To end this operation, click on **OK**: the Shift Survey Lines window will close, and all changes will be applied.

If any change is not satisfactory, click the **Cancel** button to close the Shift Survey Lines window and return all stations to their original positions.

### 5.3 Position Markers

To display the **Position Markers** window select **Edit Geometry|Position Markers** from the main menu (Figure 5.1). The Position Markers window is shown in Figure 5.9.



Figure 5.9 Position Marker window

This option allows you to reposition fiducial points that were marked by pressing fiducial marker while logging. You can adjust a selected marker, and also change start and end stations.

The Position Marker window is simple and small in order to allow a maximum view for the profiles. An un-labeled edit box is provided for entry of the position to where the marker or the start/end station will be moved. The position can be entered using the keyboard.

If the **Info** button is clicked a window with related help information will be displayed.

To close the window click the Exit button located at the bottom of the window.

## Repositioning A Selected Marker

In the edit box, enter a position to which the marker (or line end) is to be moved. Position the mouse cursor on (or near) the marker or end to be moved and click. The marker will be repositioned to the station entered in the edit box and all points between the adjacent markers will be adjusted accordingly. If markers on several survey lines are to be adjusted, the fastest way will be to enter the station in the edit box and then click on all appropriate markers before entering a new station in the Position Markers window.

Figures 5.10 and 5.11 show an example of positioning of markers that were moved from various stations to station 200 in the first five survey lines from the bottom of the display. The DAT61LX2 profile plot is shown in Figure 5.10 where value 200 is entered in Position Markers window.

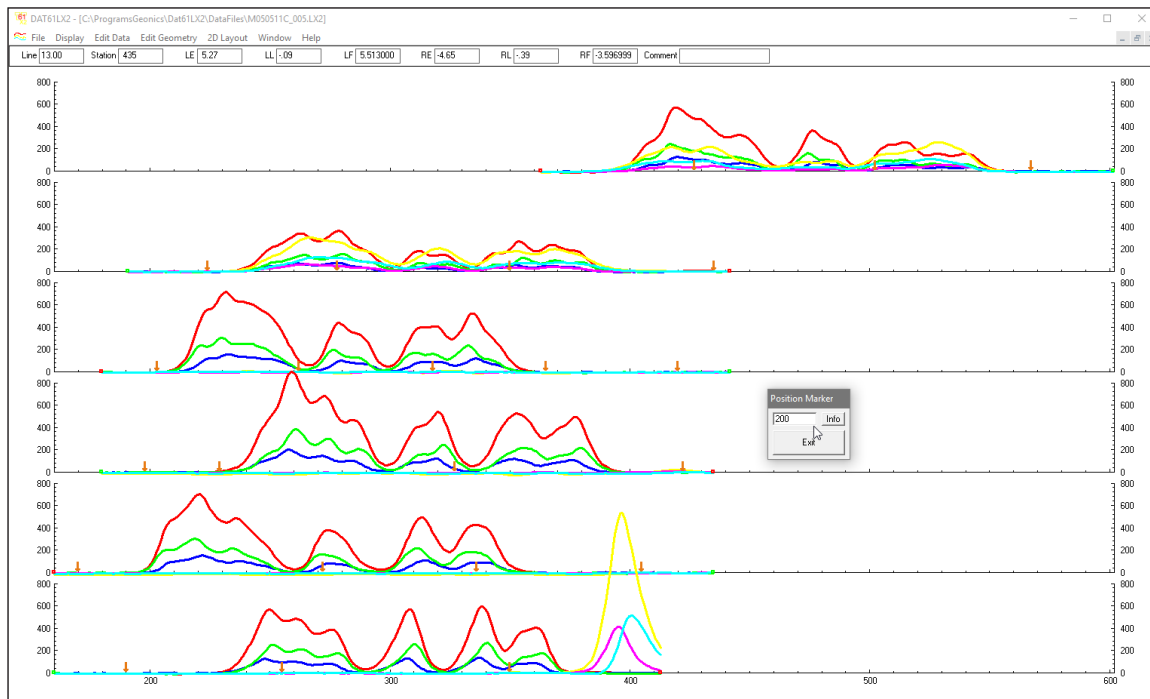


Figure 5.10 DAT61LX2 profile plot before adjustment of markers

Figure 5.11 shows profile plot after five markers (located in vicinity of station 100) have been clicked in five survey lines (sequence of bottom five lines). Three markers at station 100 are perfectly aligned in corresponding survey lines (compare with Figure 5.10).



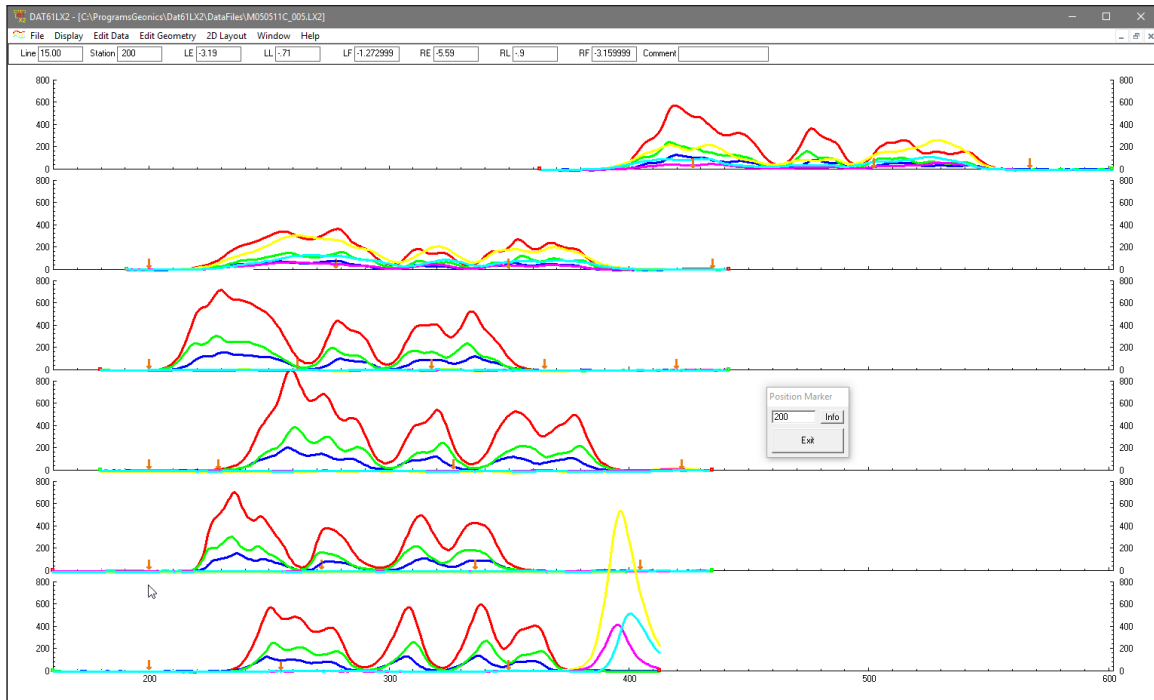


Figure 5.11 DAT61LX2 profile plot after positions of five markers located in vicinity of station 200 have been adjusted

Start and final stations of survey lines act as markers when the Position Markers function is used. An example is shown in Figure 5.12 where start station (located at the right end of the line - negative increment) of the third line from the top of the display was moved to station 500, please compare with Figure 5.11.

Please note that all markers and end points of each survey line are organized and aligned in the example shown in Figure 5.12.

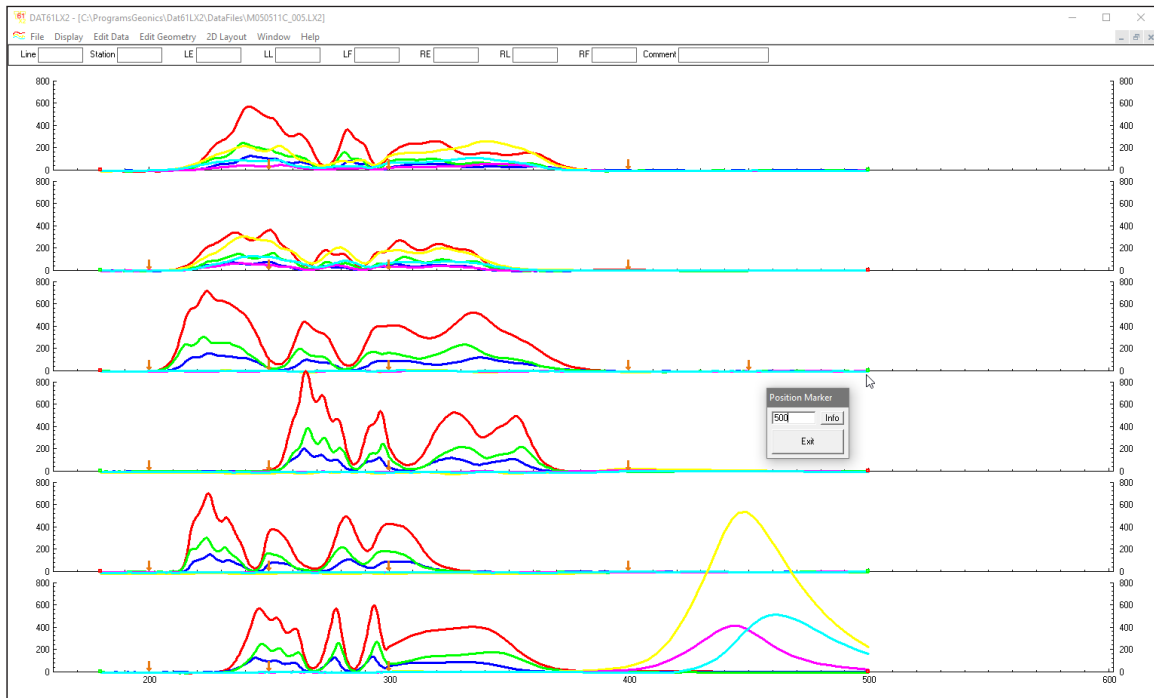


Figure 5.12 Repositioning start station

Please note that the marker must not be moved past neighboring marker (or end of survey line). If the specified station is beyond this range a warning message will be displayed (Figure 5.13). In the event that a marker must be repositioned beyond the range of a neighboring marker, either reposition or delete the adjacent marker first.

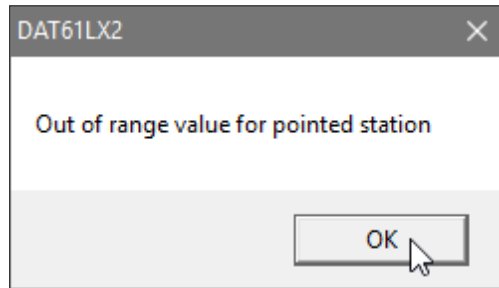


Figure 5.13 Warning message

# 6. 2D Layout (Create XYZ File)

The **2D Layout** option lets you create a two dimensional (XYZ type) file which can be used as an input file for various contouring systems. The created ASCII file contains three or more columns: X, Y, Z1, Z2 etc. (where Z1 corresponds to e.g. conductivity in mS/m, depending on the Create XYZ File settings). All data must be entered in the **Load Profile File** or **Add** menus prior to running this option.

To display the 2D Layout menu select **2D Layout** in the main menu at the top of the screen (Figure 6.1). The menu contains two options: Create Grid Based XYZ File and Create GPS Based XYZ File.

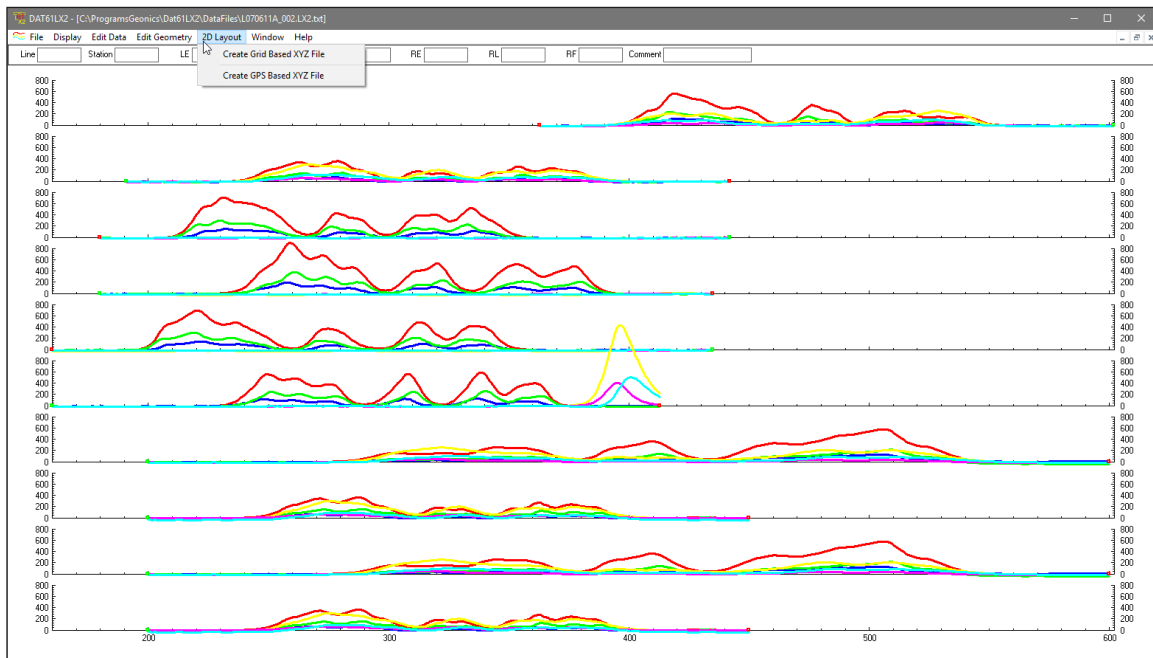


Figure 6.1 DAT61LX2 2D Layout menu

The first option, **Create Grid Based XYZ File** lets you generate files with N-S and W-E configuration of survey lines, when readings are collected along grids that are laid out before the survey. Therefore, it is strongly recommended that data files be organized so that each file contains parallel lines surveyed in one direction, either W-E or S-N. The program assumes that stations along survey lines correspond to one of coordinates (X or Y) and line names indicate another coordinate (X or Y). If line names do not correspond to an appropriate coordinate they can be easily changed by the **Rename** function in the **Select Survey Lines** window. Position of stations (line end points, fiducial markers) along survey lines should be organized using the **Edit Geometry** function prior to creating XYZ file.

The second 2D Layout menu item, **Create GPS Based XYZ File** can be used only when EM61-LX2 data is collected together with GPS positioning data. In this method the GPS receiver is connected to the Archer2 (or other field computer logging EM61-LX2 readings) serial port and GPS data is collected in the EM61-LX2 data file. This method can be used with virtually any GPS receiver that can stream a **GGA** message (standard NMEA-0183 data string). The program is using GPS positions as received from employed GPS receiver, therefore differentially corrected positions (DGSP or any RTK system) provide better accuracy. When Create GPS Based XYZ File option is used, the DAT61LX2 positions EM61-LX2 readings based on simultaneously recorded GPS data and time stamps associated with EM61-LX2 and GPS records. A GPS positioned survey does not require the use of the survey lines feature, however it is strongly recommended

that while conducting project with a GPS, the survey is organized along parallel, or semi parallel lines if possible. Also, entry of line numbers may be helpful to locate specific area in case a portion of survey is to be repeated. At the same time a data set organized in survey lines can be displayed as stacked profiles, even if profiles are not perfectly organized it is easier to note some features on several lines instead of viewing one very long line.

## 6.1 Create Grid Based XYZ File

After you select the **2D Layout|Create Grid Based XYZ File** from the profile menu the Create Grid Based XYZ File window is displayed (Figure 6.2).

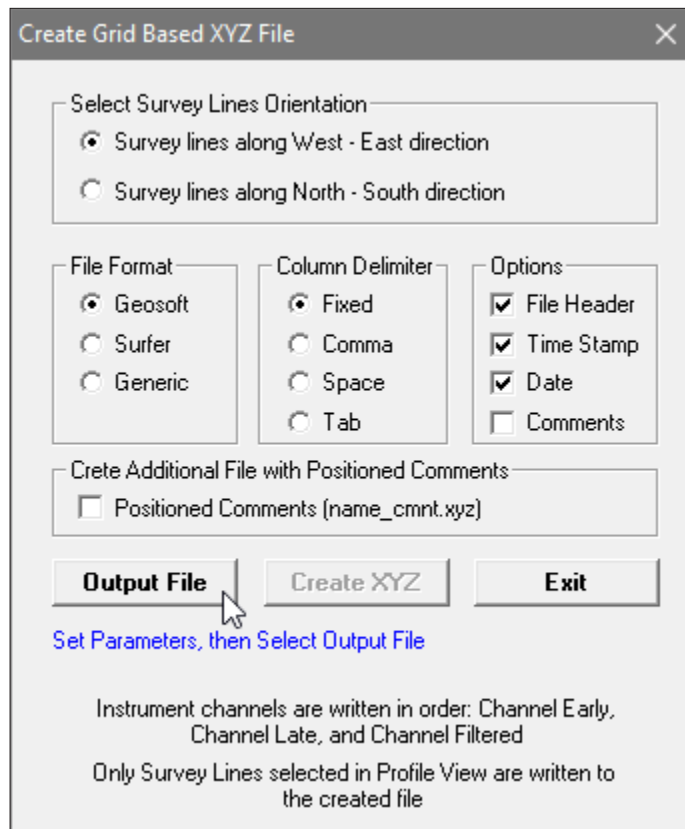


Figure 6.2 Create Grid Based XYZ File dialog

Several parameters which affect the contents and format of the created XYZ file must be specified. Specifically, these are the Orientation of Survey Lines, the EM61-LX2 Data Type and other parameters to be written to the file, format of the output file, and the output file name. For each parameter there is only one option for each layout which you select by clicking the appropriate radio or check box button.

The program positions Left and Right sensors automatically assuming 1m separation between coils centers. Therefore, if a survey line is in North direction position of the left coil is 0.5 m to the left of the line and right coil 0.5 to the right while facing direction of movement.

Readings are positioned separately for each coil. Each survey lines contains readings for Left coil first and then readings for the Right coil. Data is always placed in the created XYZ file in the following order: X coordinate, Y coordinate, Channel Early, Channel Late, Channel Filtered, following by parameters selected in the Options section.

## Orientation of Survey Lines

Choose Regular **W-E** or **S-N** orientation of survey lines. The W-E orientation corresponds to a layout where lines are parallel and oriented in the X direction (assuming that the North or Y coordinate points to the top, and that the East or X coordinate points to the right edge of a page). The S-N orientation corresponds to the perpendicular layout, with survey lines oriented in the Y direction.

If W-E orientation is selected, it is assumed that the line name gives the Y (S-N) coordinate and stations are aligned along the X (W-E) axis. If survey lines are parallel and oriented in W-E direction, but line names do not correspond to the Y coordinate, then rename the lines in the Select Lines window. It should be noted that if the line name starts with a number and ends with a letter, e.g. 10N, only the number will be recognized as a Y coordinate.

If the S-N orientation is selected, the line name corresponds to the X (W-E) coordinate and stations are aligned along the Y (S-N) axis. Again, if survey lines are parallel and oriented in S-N direction, but line names do not correspond to the X coordinate, then rename the lines in the Select Lines window. It should be noted that if the line name starts with a number and ends with a letter, e.g. 10A, only the number will be recognized as an X coordinate.

Please note that the program does not recognize letters as an indication of positive or negative coordinates. Stations and line names should be clearly named with negative sign (for example -10) if they correspond to negative side of X or Y coordinate.

## Format

Indicate the appropriate option for the contouring software to be used. The Generic option will create a multi column file without any text strings. This file can be used as an input file for many contouring packages (including Geosoft and Surfer). When Geosoft is selected then file extension name XYZ will be given as a default, and extension names DAT and XYZ will be given respectively for Surfer and Generic selections respectively. Surfer and Generic are basically same formats with different file extension names. Format CSV is fixed, it contains sequential reading number in the first columns, then time in seconds elapsed from UTC midnight, coordinates, elevation (if selected), and selected instrument readings.

## Column Delimiter

Select column delimiter that is required by your application. The option Fixed corresponds to fixed field for each column with space or spaces between columns. This format is suitable for most applications and a file created with this selection provides the easiest option if file is to be viewed using any standard text editor. Remaining column delimiters are Comma, Space (single), and Tab.

## Output File

When the **Output File** button is clicked, a Select XYZ File Name window is displayed. The EM61-LX2 file name with an extension corresponding to the selected output file format (xyz, dat, or asc) is given as a default (Figure 6.3).

Accept the default or specify a new file name and click the **Save** button. If the specified file exists on the hard disk a warning message will be displayed.

The Select XYZ File Name window will close and the selected file name will be displayed at the bottom of the Create Grid Based XYZ File window. At the same time the **Create XYZ** button is activated (Figure 6.4).

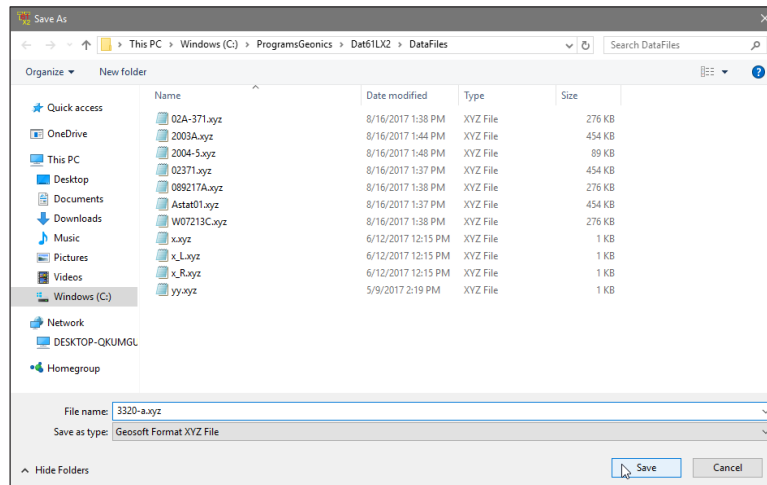


Figure 6.3 Select XYZ File Name window

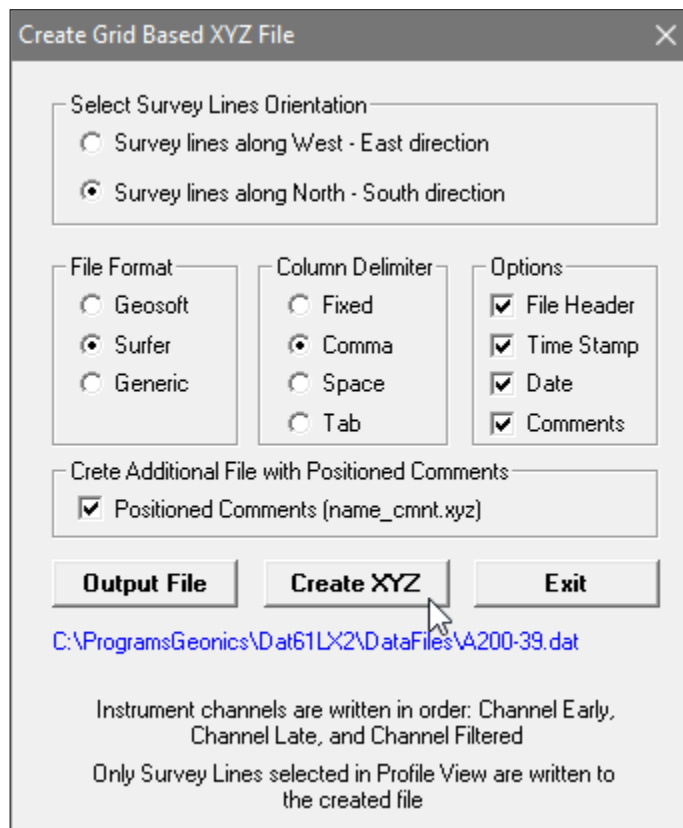


Figure 6.4 Create Grid Based XYZ File window after Output File is specified

## Options

There are three items listed: File Header, Time Stamp, Date, and Comments entered during survey. File Header occupies one line at the top of file and contains description of each column included in the file. Time Stamp and Date will be written in two columns (or one if any of two selected) that follow instrument readings. Comments, if selected, will be written as text filed between corresponding stations. The latter option is disabled if there is no comment in data set.

### Create Additional File with Positioned Comments

Additional file containing positions (preceding the comment entry) and text of the comment will be created. File name is created by adding "\_cmnt" to the base name of the Output File (below), for example ABC\_cmnt.xyz. This option is disabled (grayed out) if there is no comment in data set.

When all parameters are properly set the output XYZ file can be created. After you click on the **Create XYZ File** button a progress bar, located at the bottom of the window, will indicate the percentage of the created file that has been completed. After the file is created a label indicating selected file name will change and it will display that operation is completed.

## 6.2 Create GPS Based XYZ File

This option of the DAT61LX2 program can be used when the GPS receiver is connected to the EM61-LX2 logger serial port and GPS data is recorder in the EM61LX2 data file. The EM61-LX2 data can be positioned directly to an XYZ file format by selecting the **2D Layout>Create GPS Based XYZ File** menu option. The Create XYZ File Based on GPS Positions window is displayed (Figure 6.5).

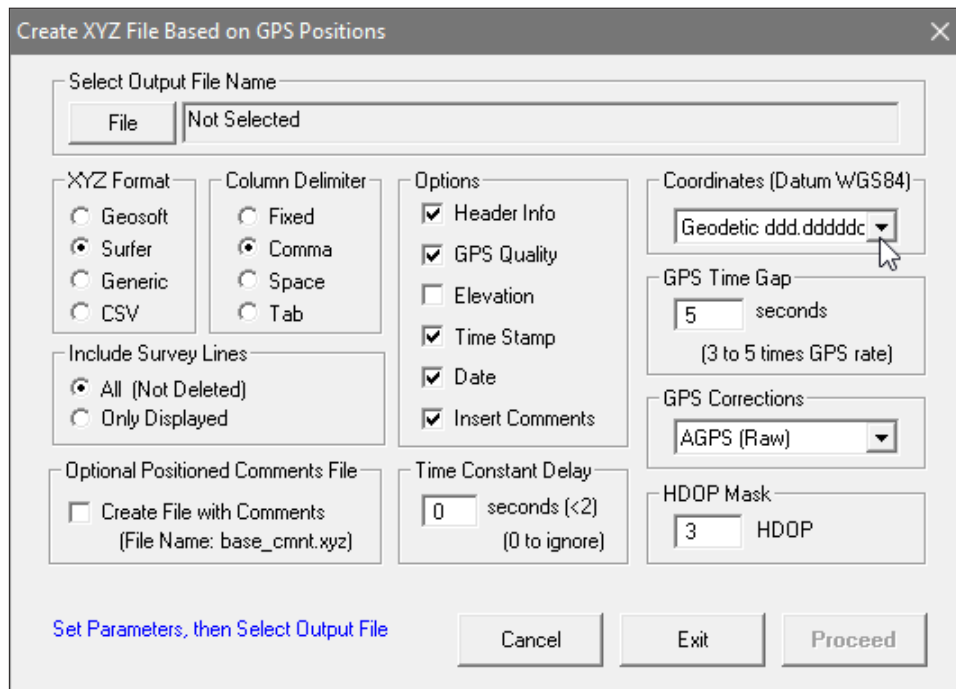


Figure 6.5 Create XYZ File Based on GPS Positions window

Before creating the XYZ file several parameters must be specified. These are XYZ file name, the format of coordinates in the output file, and several parameters associated with GPS signal.

The program positions Left and Right sensors automatically assuming 1m separation between coils centers. Therefore, position of the left coil is 0.5 m to the left of the line and right coil 0.5 to the right while facing direction of the instrument movement based on GPS positions.

In addition to the base XYZ file, two additional files separate for Left and Right sensors are created. These are named (assuming ABC is specified XYZ file name): ABC\_L.xyz and ABC\_R.xyz.

Data is always placed in the created XYZ file in the following order (for each sensor): X coordinate, Y coordinate, Channel Early, Channel Late, Channel Filtered, following by parameters selected in the Options section.

**File** (Output File)

Click on the **File** button. The Select XYZ File window is displayed (Figure 6.6).

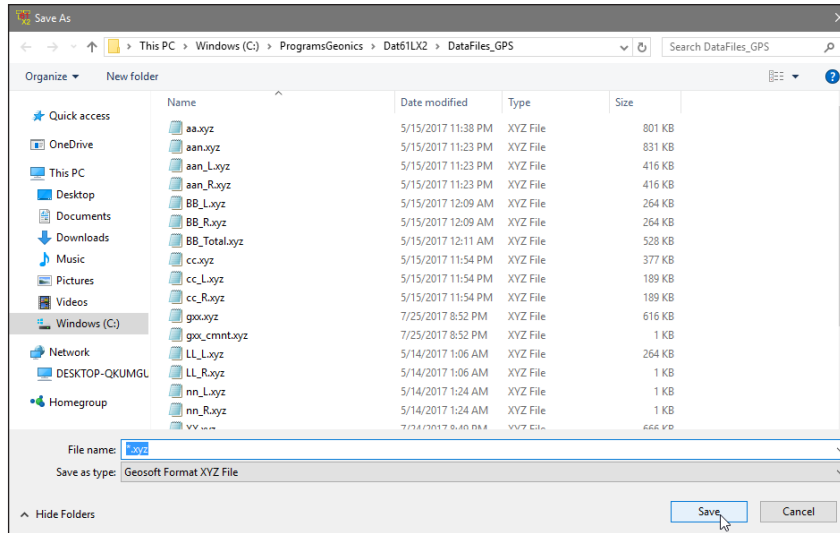


Figure 6.6 Select XYZ File window

The XYZ file name extension default will be determined by the selected output file format (xyz, dat, or asc) in XYZ File Format section. The XYZ File Format option must be selected before clicking on the **File** button.

Specify or select a file name and click the **Save** button. The Select XYZ File window will close and the selected file name will be displayed beside the **File** button in the Create XYZ File Based on GPS Positions window.

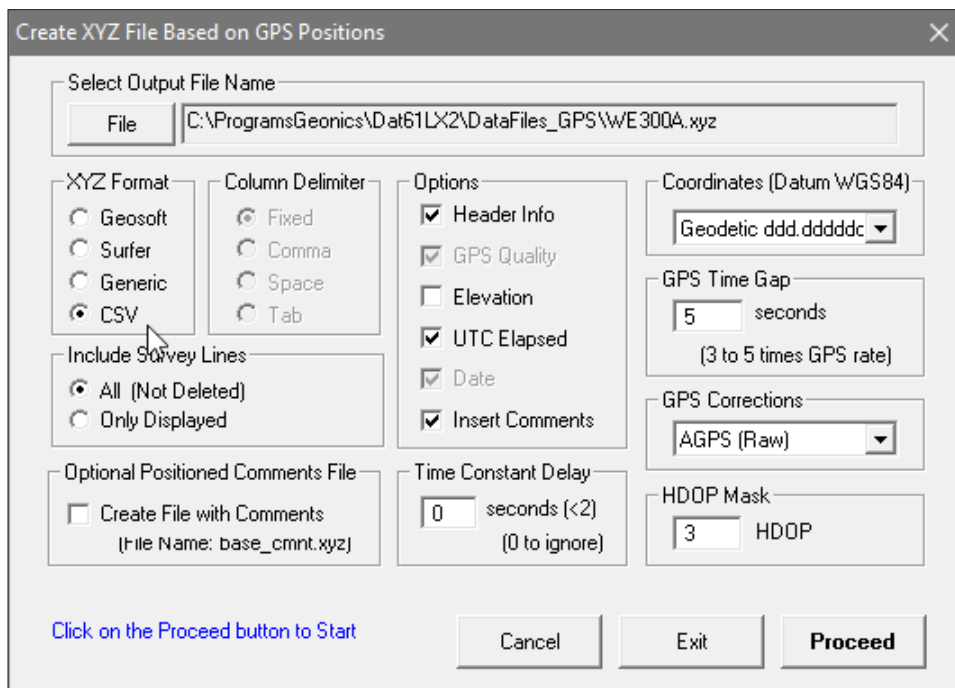


Figure 6.7 Create XYZ File Based on GPS Positions window after Output File name is specified



When Output Files is specified the **Proceed** button in the Create XYZ File Based on GPS Positions becomes active and name of selected file is displayed in the window associated with the **File** button (Figure 6.7).

### XYZ File Format

Indicate the appropriate option for the contouring software to be used. The Generic option will create a multi column file without any text strings. This file can be used as an input file for many contouring packages (including Geosoft and Surfer). The CSV option will create comma delimited file. This parameter will also determine a default file extension name during specifying XYZ file name. The program will prompt extension file names XYZ, DAT, ASC, or CSV for formats Geosoft, Surfer, Generic, and CSV respectively.

### Coordinates

Positions can be written in the output file as geodetic (geographical) coordinates (Latitude/Longitude) or they can be converted to UTM coordinates. The program uses the WGS1984 datum.

Geodetic coordinates are given in degrees. They can be written in format ddd.ddddd. UTM coordinates can be generated in meters, feet or US Survey feet. To select Geodetic or UTM (and units) coordinates click one of the item listed in the combo box labeled Coordinates (Datum WGS 1984), see Figure 6.8.

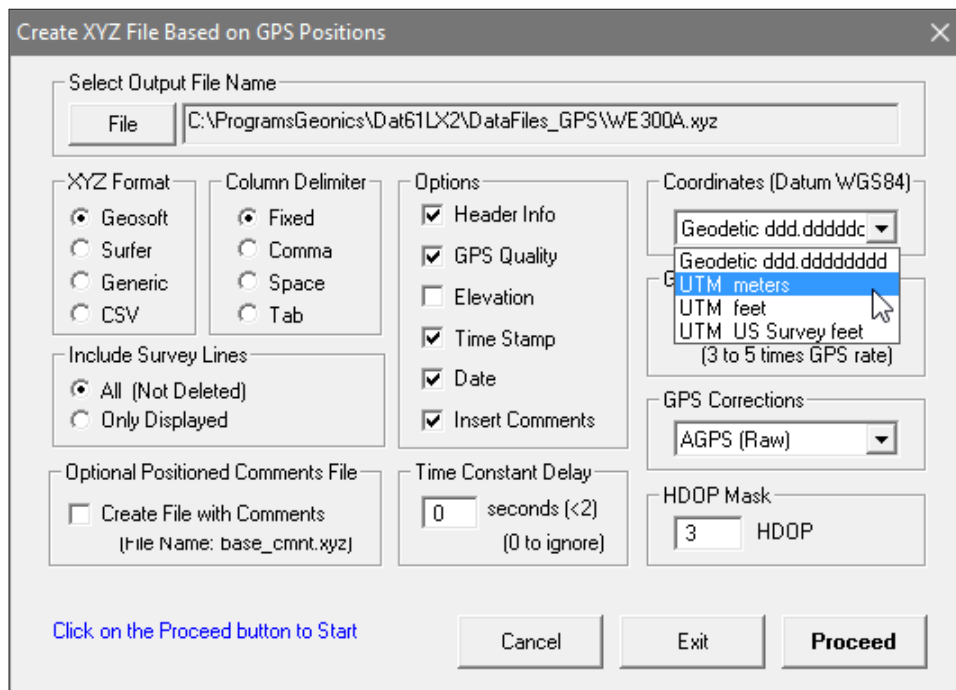


Figure 6.8 Selecting Coordinates in Create XYZ File Based on GPS Positions dialog

### Column Delimiter

Select column delimiter that is required by your application. The option Fixed corresponds to fixed field for each column with space or spaces between columns. This format is suitable for most applications and a file created with this selection provides the easiest option if file is to be viewed using any standard text editor. Remaining column delimiters are Comma, Space (single), and Tab.

## Options

There are six items listed: File Header, GPS Quality, Elevation, Time Stamp, Date, and Insert Comments. File Header occupies two lines at the beginning of file, the first line contains Datum description and the second line contains labels with description of each column included in the file. GPS Quality, Elevation, Time Stamp and Date will be written in columns (in the order as listed in this dialog) that follow instrument readings. The GPS Quality contains parameters in three columns: Quality (degree of differential corrections), number of satellites, and HDOP parameter. Comments, if selected, will be written as text filed between corresponding stations. The latter option is disabled if there is no comment in data set.

## GPS Time Gap

The **GPS Time Gap** parameter specifies the maximum time during which the EM61-LX2 data will be linearly interpolated between two GPS positions. Enter this parameter (in seconds) in the edit box labelled GPS Time Gap. In most cases a value 2 to 3 times larger than the GPS acquisition frequency is adequate

## GPS Corrections

Select item in combo box placed in a section labeled **GPS Corrections** to write selected or higher degree of GPS differential corrections. Selection includes: 1 AGPS (Raw), 2 Differential (DGPS), 3 RTK (RTK-3), 4 RTK (RTK-4), 5 RTK (RTK-5), and 6 Higher (>5), see Figure 6.9. The latter option covers future RTK options as well as WAAS option that is indicated by Quality Indicator 9. The specified parameter indicates the lowest acceptable degree of corrections. For example, if Raw is selected then all GPS positions will be accepted by the program (obviously with the exception of NO FIX that has Quality Indicator = 0), and if DGPS is selected than all positions with Quality Indicator = 1 (Raw) will be ignored by the program filter and DGPS and higher degree of corrections will be accepted.

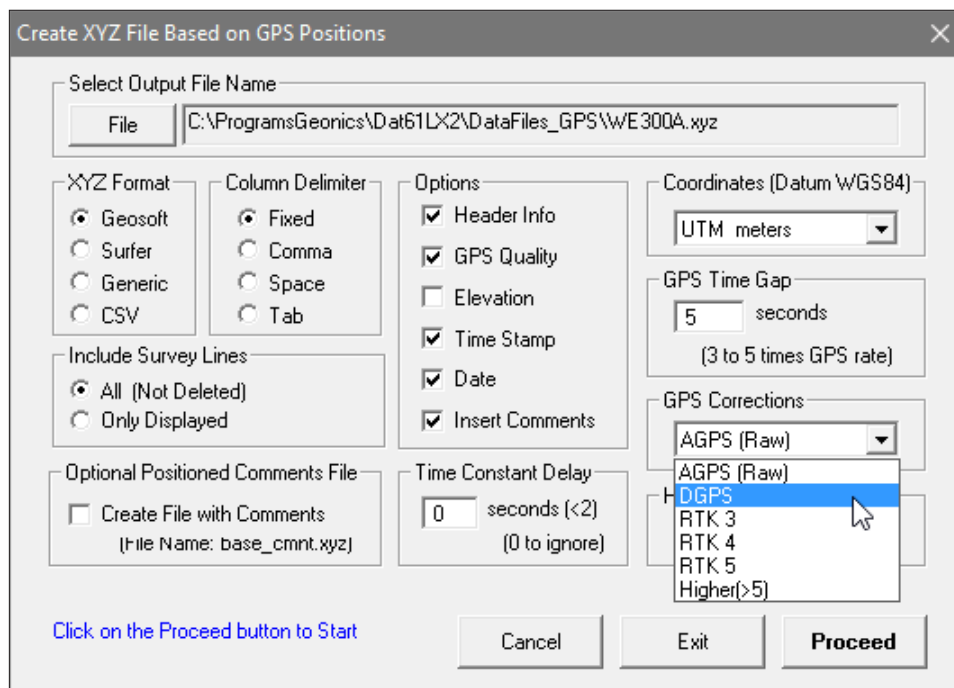


Figure 6.9 Selecting GPS Corrections in Create XYZ File Based on GPS Positions dialog

### **HDOP Mask**

Specify value of HDOP parameter the section labeled **HDOP Mask**. Readings associated with GPS positions that have HDOP values higher than specified will not be written to the file.

### **System Time Constant Delay** (System Latency)

This option allows for the system time constant delay correction. While the EM61-LX2 time constant is known the time constant of the combined EM61-LX2 and GPS receiver system is a function of these two devices. The best method to determine the time delay is to survey a few lines (in two directions) with varying speeds over the same small metallic target. When displaying the image the anomaly associated with the sample target may be slightly displaced or extended in size on neighboring lines. After the correct time constant for the system is determined the anomaly should be at the same location for each survey line. The alternative, possibly easier method to determine the time constant of the system is to survey a known buried pipe. After the proper time constant delay correction is applied the linear anomaly associated with the pipe should be free of any “hearing bone” effect.

Since the image of two dimensional data can be displayed in a mapping system (after gridding) the procedure can be time consuming, however it only needs to be done once for a given GPS receiver and EM61-LX2.

In order to apply the correction the generated XYZ file must have Time Stamp option selected in the Options section.

Time Delay must be entered in seconds (maximum 2 seconds). Default value is 0 seconds. When specified, value zero seconds ignores this option and no correction is applied.

### **Create Additional File with Positioned Comments**

Additional file containing positions (between two neighbouring GPS positions) and text of the comment will be created. File name is created by adding “\_cmnt” to the base name of the Output File (below), for example ABC\_cmnt.xyz. This option is disabled (grayed out) if there is no comment in data set.

### **Include Survey Lines**

This option contains two items, choose by clicking on the appropriate radio button. When the **All** is selected then all (not deleted) survey lines in the loaded data set will be included in the created XYZ file. If the **Only Displayed** radio button is marked then survey lines that are actually displayed in stacked profile active window will be placed in the XYZ file.

After all parameters are specified and you click on the **Proceed** button a progress bar, will appear above command buttons and it will indicate the percentage of the created file that has been completed, see Figure 6.10 on the next page.

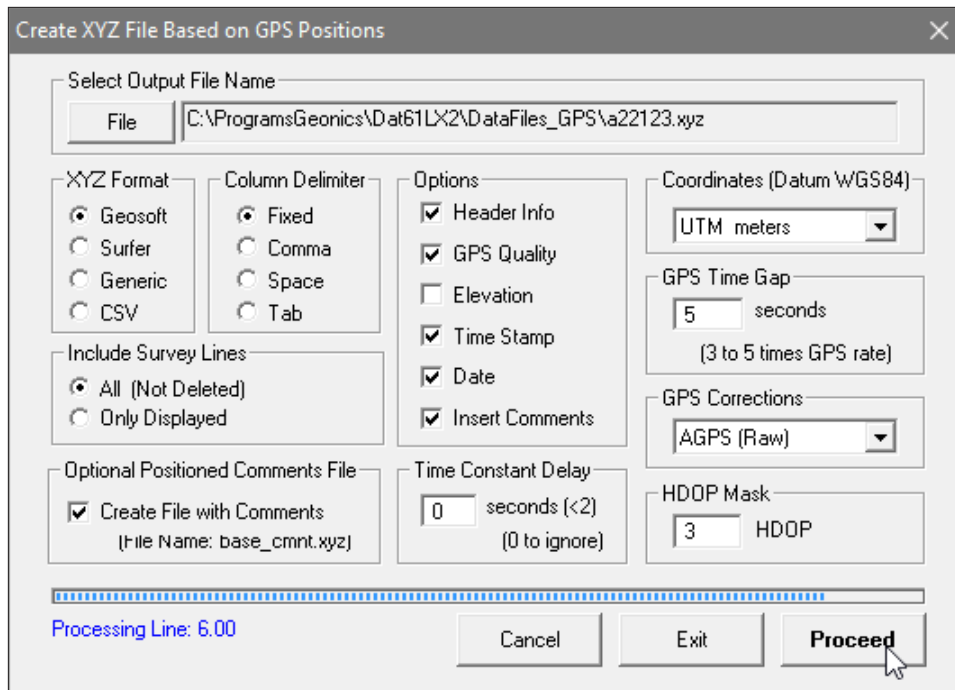


Figure 6.10 Create XYZ File Based on GPS Positions dialog during creating output file