COMPUTER PROGRAM MANUAL
(SURVEY DATA REDUCTION MANUAL)

DAT38BW
Version 1.12

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Geonics Limited

Contents

1.   Introduction

This Windows based program replaces the DOS version of software DAT38B. Survey data reduction program for Geonics EM38B ground conductivity maters operates under Windows 95/98/XP/NT(4.0), and Windows 2000. While both versions, DOS and Windows, perform basically same functions, the Windows version of DAT38B provides a much easier users interface, better information on the screen, larger amount of readings can be operated on in one block, limited only by capacity of a computer hard drive, support for any printer and plotter supported by Windows, and has more control and faster completion of most of the tasks. In addition DAT38BW supports EM38B data files which include Global Positioning System (GPS) data recorded directly in logger Pro4000 operating under the control of program EM38Bpro.

1.1   About DAT38BW

The program DAT38BW is designed to process data collected by Polycorders 600 and 720 operating under corresponding programs EM38B and EM38B, data recorded in the field computer Allegro (or Pro4000) using data acquisition program EM38Bpro, or data acquired directly in the computer through the RS232 interface. It allows transfer of data files from the Polycorder or Allegro to a Personal Computer (PC). Subsequently, it 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 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 column [X,Y,data1] format is suitable.

This Windows based version of DAT38BW provides a much easier interface and better information on the screen. The amount of readings is limited only by the capacity of a computer hard drive. It supports any printer and plotter that is supported by Windows and gives more control and faster completion of tasks. The latter can be especially appreciated by users employing Auto mode and fiducial markers during survey. Positioning of markers and aligning of survey line ends, even in the case of large survey layouts, is much faster and easier as compared to the DOS based program.

Additional improvements were also introduced to the data downloading. The program lists the Polycorder or Pro4000 data files and their sizes, and the user may simply select files to be downloaded without having to review the Polycorder directory. Still, DOS based downloading programs are included on the disk in order to support older DOS or 16 bit Windows (3.1 or 3.11) based computers.

Overall processing of the EM38B data with this Windows based software will result in much greater productivity. File formats are compatible with older DOS based version of the DAT38B program. However to download data from the Polycorder 600 or 720 a new version of the Polycorder program EM38B (for Polycorder 600) or EM38B (for Polycorder 720) has to be installed in the logger. These new Polycorder programs are still compatible with the DOS based software so data files can be downloaded using a new DAT38BW for Windows as well as older DOS based DAT38B software.

EM38B readings are arranged in profile lines. Every profile line can consist of unlimited number of segments. Each profile line can contain up to eight separate curves: two for the Inphase and Quadrature

(Conductivity) components, for each of the Vertical and Horizontal dipole modes, and an additional two for different instrument orientation. Note that the Quadrature component is generally referred to as Conductivity in this manual.

One sample data file, DEMO1.B38 is included on the program disk. It allows the user to become familiar with running the DAT38BW program.

1.2   Contents of DAT38BW Distribution Disk

Program DAT38BW is supplied on one CD disk. Disk contains following files and directories:

SETUP38B.EXE-	setup program for DAT38BW.
UploadFiles -	directory with following Polycorder files:
	FORM38B.MK2 and EM38B.600 for Polycorder 600,
	FORMDL.720 and EM38B.720 for Polycorder 720 and analog EM38B,
	these files are also placed by Setup38B program in subdirectory UploadFiles
	of the DAT38BW program directory.
DAT38BDOS -	directory containing all EM38B DOS based program and associated files
Documentation -	directory containing manuals available in PDF format
DAT38BWdisks -	directory containing two subdirectories (Disk1, Disk2, and Disk3) for users
	that require floppy disks to run Setup38B

If EM38B software is supplied with EM38Bpro program for Pro4000 following additional file and directory are included on the CD distribution disk:

EM38Balg.EXE -	data acquisition program for the field computer Allegro
EM38Bpro.EXE -	data acquisition program for the field computer Pro4000
Pro4000disks -	directory containing contents of three floppy disks with a Pro4000 system
	files and Juniper System communication program Lynx

1.3 DAT38BW Software Installation

DAT38BW uses setup program to load files on your computer. The following section describes the installation process.

To install DAT38BW insert the DAT38BW CD disk into computer CD disk drive. Exit all Windows applications before installing the program.

From the Windows File Manager, select **Run** from the **File** menu. The Run dialog box opens (Figure 1.1).
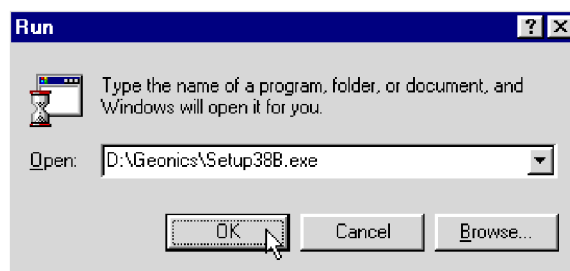
Figure 1.1:   Run Dialog window

Browse for the file SETUP38B.EXE in the directory of the diskette. Click **OK** to launch the Setup program. Once the Setup determines your computer configuration the Welcome window opens (Figure 1.2).
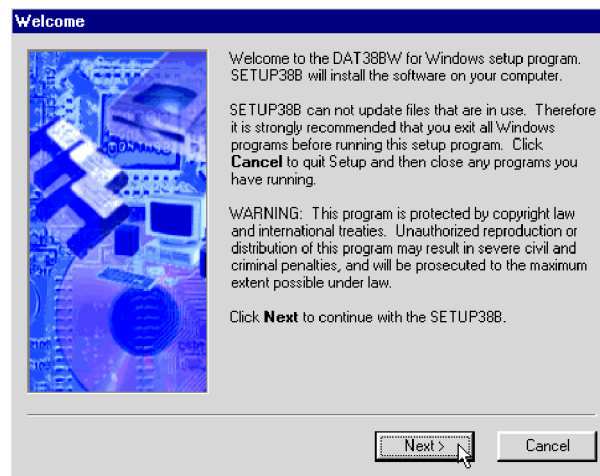
Figure 1.2:   Welcome window

Read the text and click the **Next** button. The Serial Number window will be displayed (Figure 1.3).
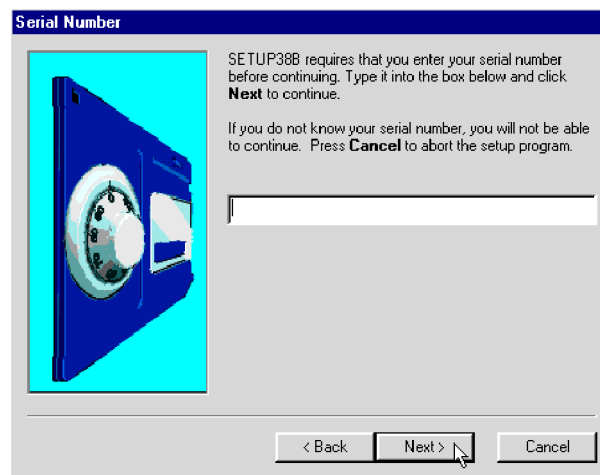
Figure 1.3:   Serial Number window

 Type the Serial Number into provided box and press the **Next** button. (If you do not know the Serial Number, you will not be able to continue.) The Installation Directory window opens (Figure 1.4).
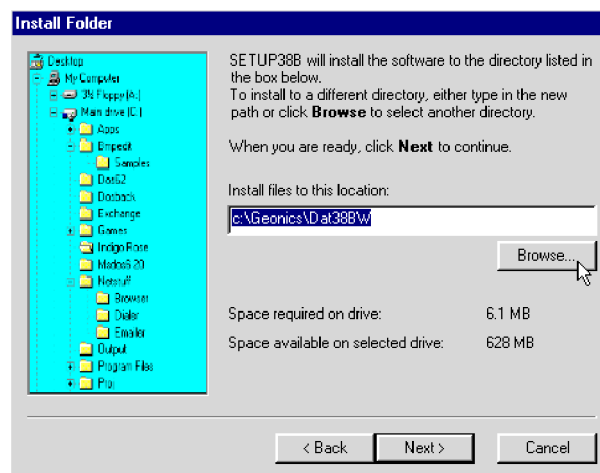
Figure 1.4:   Installation Directory window

The default directory is c:\Geonics\DAT38BW. Click the **Next** button to install the program to this directory. If you wish to install DAT38BW to another directory, click the **Browse** button and the Select Installation Directory window will open (Figure 1.5).
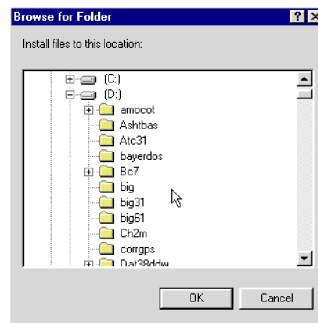
Figure 1.5:   Select Installation Directory window

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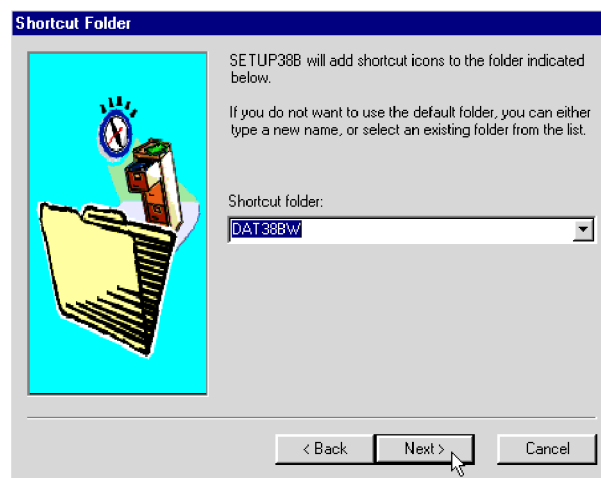
Figure 1.6:   Select Shortcut Folder window

The setup program will create a DAT38BW 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.
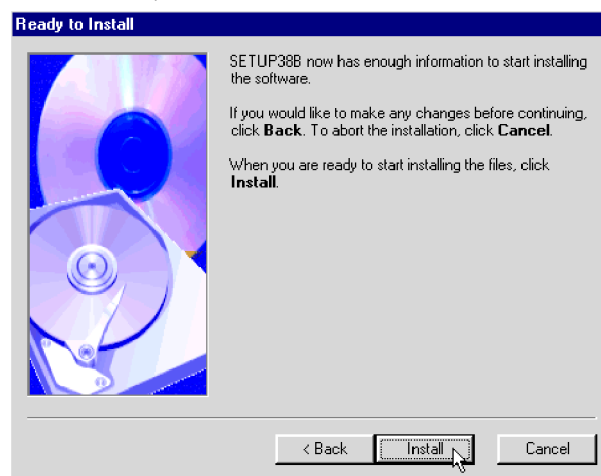
Figure 1.7:   Ready to Install window

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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).
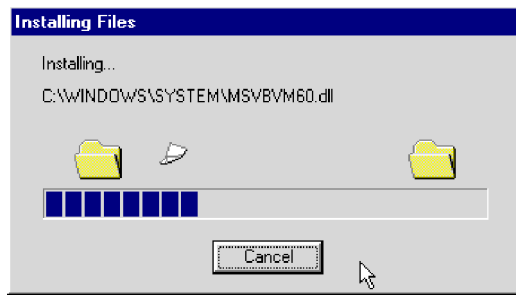
Figure 1.8:   Installing Files progress bar

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 1.9).

Figure 1.9:   Finished window

Click **Finish** to end installation. SETUP38B creates a DAT38BW program group and places **DAT38BW** and **Uninstall** icons into it. The setup program creates also a **DAT38BW** menu item in the Program menu accessible by clicking **Start**. A reminder to restart the system will be displayed at the end of the Setup38B program.
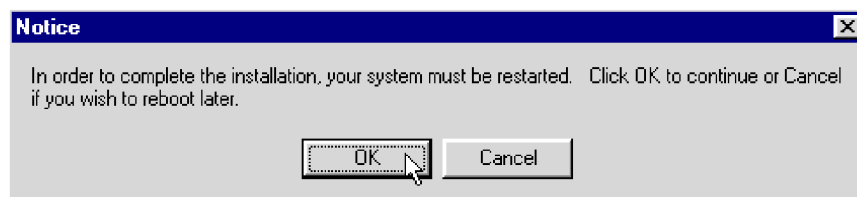
Figure 1.10: Restart Notice window

The destination directory that was chosen earlier contains program files, sample files, and the subdirectory UploadFiles that includes files necessary for uploading the Polycorder 600 or 720.

In addition, DAT38BW disk includes DOS based programs necessary for downloading data in case the field computer does not have Windows 95/98/XP or NT(4.0)/2000 installed. These files are located in the **DAT38BWDOS** subdirectory of the disk.

1.4 Program Overview

Start the DAT38BW by double clicking the DAT38BW icon in the **Start|Programs** menu, in Windows Explorer, or on the desktop if a shortcut was created. At the start, DAT38BW occupies the entire screen (Figure 1.11):
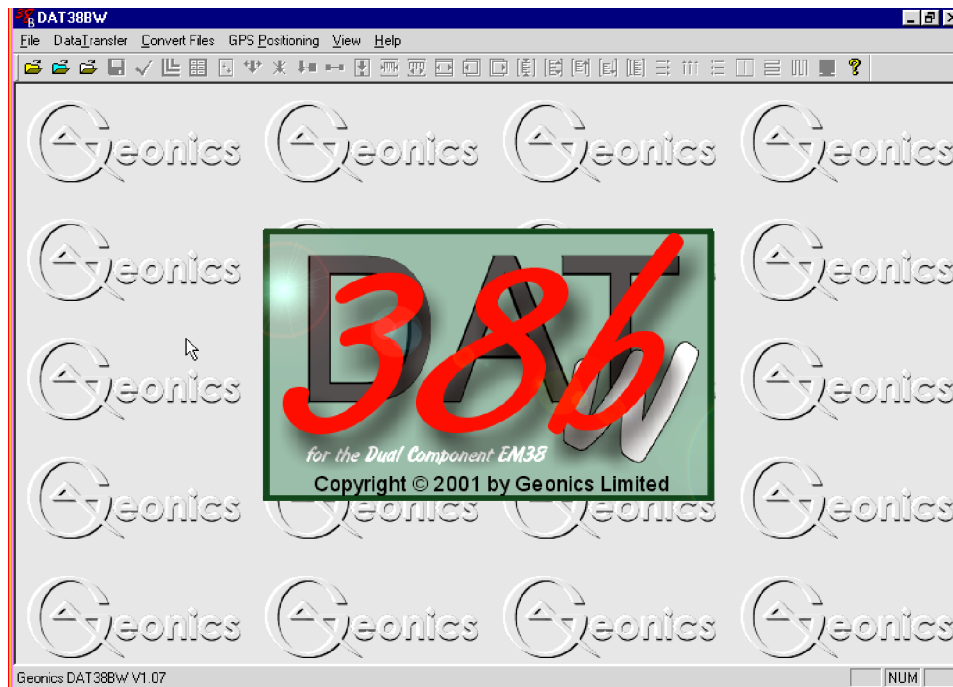
Figure 1.11: DAT38BW Initial Screen

The DAT38BW defaults to a maximized screen and clicking the minimize button allows access to other applications behind DAT38BW. At this point, the user can:

- upload program to the Polycorder,
- download data from the Polycorder,
- download data files from the Pro4000 field computer,
- merge EM38B and GPS files,
- position EM38B files containing GPS positions,
- convert raw Polycorder 600 or 720 files to DAT38B format (.B38) files,
- convert raw EM38Bpro (P38) files to DAT38B format (.B38) files,
- load data files: DAT38B profile files (.B38 files). XYZ files, and small (up to 64K) text files,
- select display (tool bar and status bar).

After DAT38B profile file (B38) is loaded tool bar becomes active and the screen has following shape (Figure 1.12):
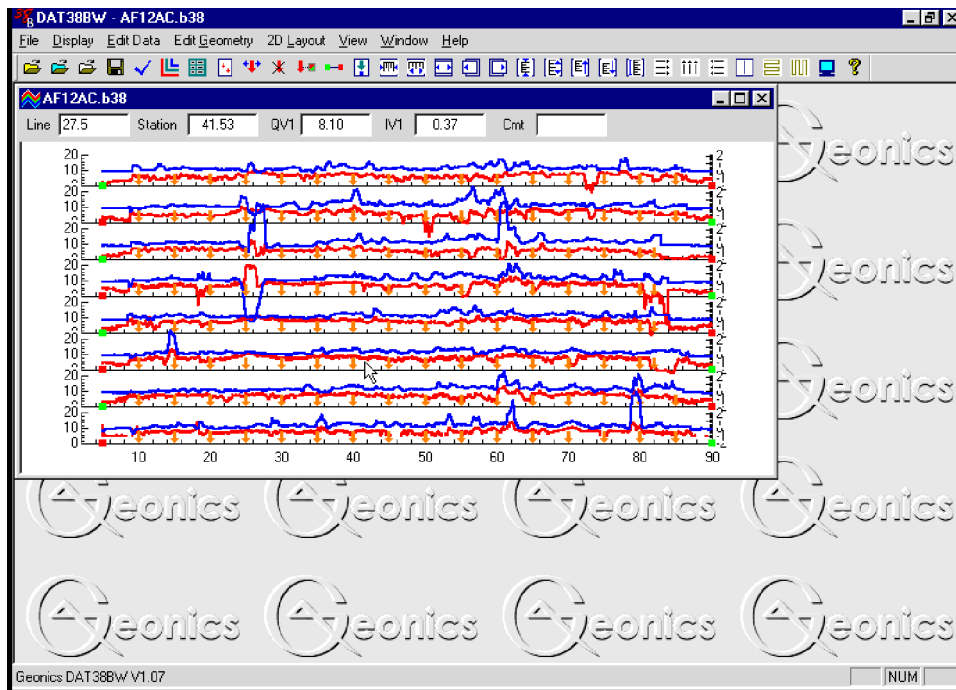
Figure 1.12: DAT38BW Screen after profile file is loaded

A stacked profile display can be enlarged to occupy the entire screen by clicking the maximize button. The tool bar (if selected in View menu) is displayed across the top of the screen. The following quick access tools (Figure 1.13) are described below, starting from the left side of the bar:

Figure 1.13: DAT38BW Tool Bar

Load EM38B profile file (data file in DAT38B format with extension name .B38).

Load XYZ file two dimensional file (DAT38BW allows user view layout of survey lines and stations).

Load text file (this function is similar to Notepad in Windows and allows user to edit small, up to 64K in size, text files).

Save As allows user to save data under different file names at any time during data processing.

Select Lines allows user to select survey lines to be displayed. This function also allows you to delete and rename survey lines.

Select Channels allows the user to select the EM38B data types (to be profiled and/or displayed numerically in windows below the tool bar.

Set Display Parameters allows user to set the range of display as well as define axes tics.

Position Markers allows user to display the Position Markers window.

Adjust Marker allows the quick adjustment of a marker position.

Remove Marker allows erasing of a chosen marker.

Adjust survey line between end of the line and a marker allows user to adjust end of the line without moving neighboring marker.

Adjust Survey Line allows user to adjust ends of survey lines. The procedure allows moving start of the line (green square) without changing its length and moving end of the line (red square) without repositioning of the start point of the line.

Position Line Segment allows the user to adjust the ends of a segment of survey lines.

Modify Horizontal Scale (group of five buttons) allows user to:

compress (squeeze) scale,

expand scale,

return to default range,

shift plot left

shift plot right,

Increments are the same increment of minor tic of horizontal axis.

Modify Vertical Scale (group of five buttons) allows user to:

compress (squeeze) scale,

expand scale,

shift plot up,

shift plot down,

return to default range.

Increments are the same increment of minor tic of vertical (conductivity) axis.

Show Moving Bar displays a vertical bar (line) which can be moved along horizontal axis. This bar may allow to compare alignment of anomalies located at various survey lines.

View XYZ/Create XYZ File allows user to display two dimensional layout of the survey oriented in W-E direction and to display Create XYZ File menu.

View XYZ/Create XYZ File allows user to display two dimensional layout of the survey oriented in S-N direction and to display Create XYZ File menu.

A detailed description of the functionality of each tool is provided in revelant sections of the manual.

2. Quick Start

This chapter is intended for users who wish to quickly start downloading and editing an EM38B survey. Detailed information on all functions and capabilities of the program is given in later sections. It is assumed that the Polycorder 600, Polycorder 720 or the field computer Allegro was loaded with necessary files to collect field data.

2.1 Download Data

Download Data from the Polycorder 600

Select **Data Transfer** in the program menu and then select the **Download EM38B Files from Polycorder 600** item (Figure 2.1).
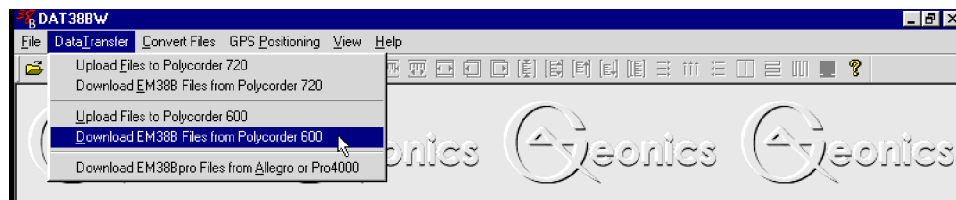
Figure 2.1:   Data Transfer menu

The Download EM38B Files from Polycorder 600 window will appear (Figure 2.2).
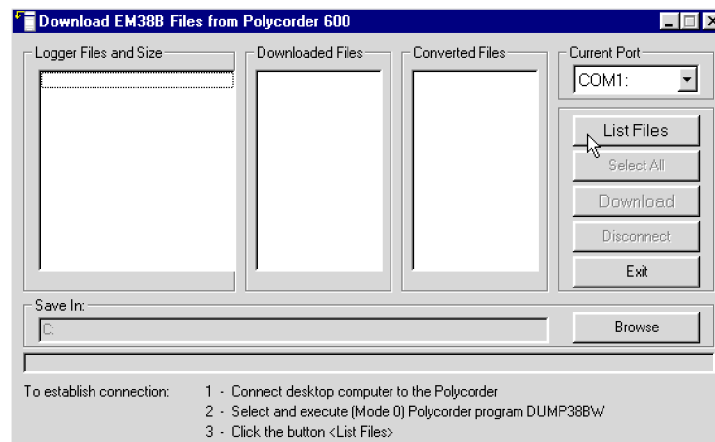
Figure 2.2:   Download Data window

The basic procedure for downloading files is displayed in the bottom of the Download EM38B Files from Polycorder 600 window, and is as follows:
*   connect the Polycorder and desktop computer with the dumping cable.
*   check the port number.

- Select and execute the **DUMPWIN** program in the Polycorder.
- click the **List Files** button to get data file names contained in the Polycorder. After several seconds, when communication is established and tested, list of all available files to download will appear in the left list box. At the same time the **Download** button will be activated.
- select files to be downloaded from the logger. Selected files are highlighted.
- click on **Download**. At this point a progress bar indicates the percentage downloaded for each file. Transferred files will be displayed in the centre list box.
- after transfer is completed files are automatically converted from raw EM38B format to DAT38B format, with the extension name B38.

Please refer to section 3 (Transfer Data) for a detailed description of downloading a data file from Polycorder 600.

Download Data from Allegro or Pro4000

Select **Data Transfer** in the program menu and then select the **Download EM38Bpro Files from Allegro or Pro4000** item (Figure 2.3).
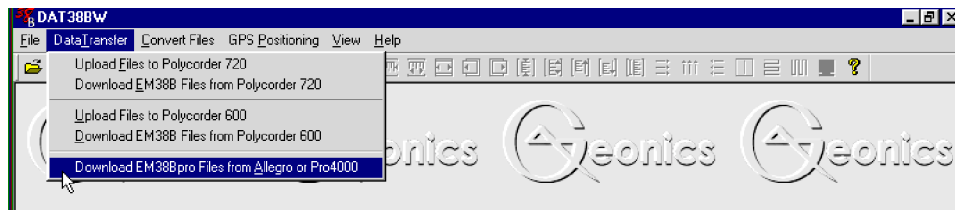
Figure 2.3:   Data Transfer menu

The Download EM38Bpro Files from Allegro/Pro4000 window will appear (Figure 2.4).
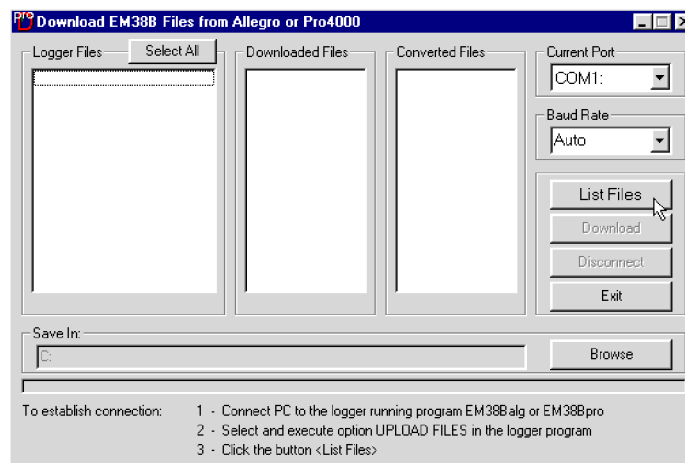
Figure 2.4:   Download EM38B Files from Allegro window

The basic procedure for downloading files is displayed in the bottom of the Download EM38Bpro Files window, and is as follows:
- connect the field computer and desktop computer with the dumping cable.
- check the port number.
- Select and execute the **Upload Files** procedure in the field computer program.
- click the **List Files** button to get data file names contained in the field computer. After several seconds, when communication is established and tested, list of all available files to download will appear in the left list box. At the same time the **Download** button will be activated.
- select files to be downloaded from the logger. Selected files are highlighted.

- click on **Download**. At this point a progress bar indicates the percentage downloaded for each file. Transferred files will be displayed in the centre list box.
- after transfer is completed files are automatically converted from raw EM38Bpro (extension name P38) format to DAT38B format, with the extension name B38.

Please refer to section 3 (Transfer Data) for a detailed description of downloading a data file from the field computer Allegro or Pro4000.

Data files can also be downloaded from Allegro by alternative utilities, i.e. Juniper Systems program Lynx. Procedure of Data File Transfer using program Lynx is described in Appendix B. These files (raw data files with extension names P38) can be converted to DAT38B format (files with extension B38) by using the **Convert Files** option which can be accessed from the main menu of the program.

2.2   Convert Files

Convert Polycorder 600 Files

The data acquisition program EM38B, operating in the Polycorder, saves readings in a raw files format. DAT38BW uses the ASCII format of data files. These files are given the extension name B38. When the raw data file is downloaded from the Polycorder it is converted at the same time to DAT38B (B38) format. In cases where files in the DAT38B format (B38) are lost, accidentally overwritten, or not available for any reason an option called **Convert Files|Convert Polycorder 600 Files** allows you to convert the Polycorder raw data files to ASCII files (B38).

To convert Polycorder files select **Convert Files** in the program menu and then select the **Convert Polycorder 600 Files** item. The Convert Polycorder EM38B Files to DAT38B Format window will appear (Figure 2.5).
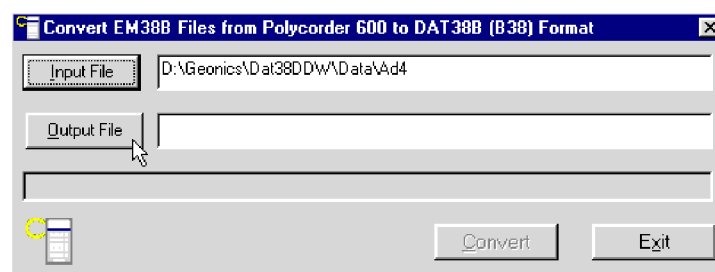
Figure 2.5:   Convert Polycorder EM38B Files to DAT38B (B38) Format window

Select the file to be converted by clicking on the **Input File** button. An open file window will appear with list of available files. (Polycorder files do not have extensions, therefore all files in the selected directory will be displayed. The user has to select EM38B data files which were created in the Polycorder.) In a similar way click on the **Output File** button and specify the output file name with extension B38. After both files are displayed in the corresponding text windows the button **Convert** will be activated. When the **Convert** button is clicked the selected Polycorder file is converted to B38 format. This file can subsequently be loaded to the program as a "EM38B Profile" file.

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

Convert EM38Bpro Files

The data acquisition program EM38Bpro, operating in the field computer Pro4000, saves readings in a raw (binary) files format which are given the extension name R38B. DAT38BW uses the ASCII format of data files. These files are given the extension name B38. When the binary (raw) data file is downloaded from the field computer it is converted at the same time to DAT38B (B38) format. In cases where files in the DAT38B format (B38) are lost, accidentally overwritten, or not available for any reason an option called **Convert Files** allows you to convert the raw data files (P38) to ASCII files (B38).

This function is also useful if the data acquisition program, EM38Balg, is used on a laptop (EM38Balg and EM38Bpro run on any MS DOS compatible computer). In this case downloading raw data files is not applicable and data files saved in P38 format can be rewritten to B38 using the Convert Files option. These B38 files can be loaded to the DAT38BW program on the same computer.

To convert P38 files select **Convert Files** in the program menu and then select the **Convert EM38Bpro Files** item. The Convert EM38Bpro Files to DAT38B (B38) Format window will appear (Figure 2.6).
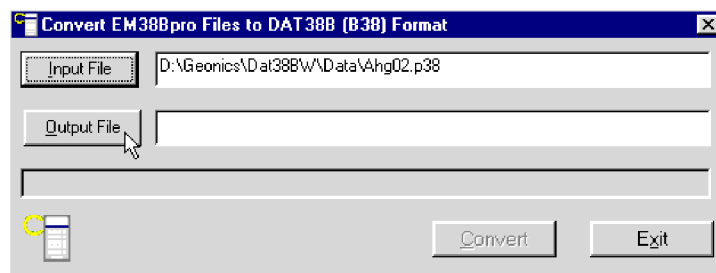
*Figure 2.6:   Convert EM38Bpro Files to DAT38B (B38)
Format window*

Select the file to be converted by clicking on the **Input File** button. An open file window will appear with list of available P38 files. In a similar way click on the **Output File** button and specify the output file name with extension B38. After both files are displayed in the corresponding text windows the button **Convert** will be activated. When the **Convert** button is clicked the selected P38 file is converted to B38 format. This file can subsequently be loaded to the program as a "EM38B Profile" file.

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

2.3 Displaying Data as Profiles

Loading and Displaying Data Files

To display data, select **File|Open EM38B Profile File** in the menu or click the left mouse button on the toolbar 📂 button (load EM38B Profile File). The **Open EM38B File** window will be displayed (Figure 2.7).

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 EM38B File** window displays available files with the extension name B38.
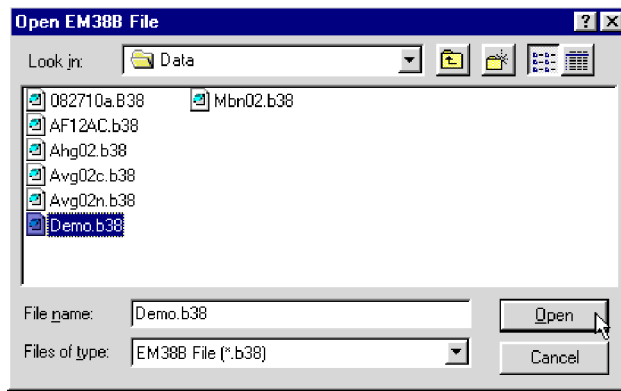
Figure 2.7:   Open EM38B File window

After the file is loaded, data is displayed in the stacked profile format shown in Figure 2.8. 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,
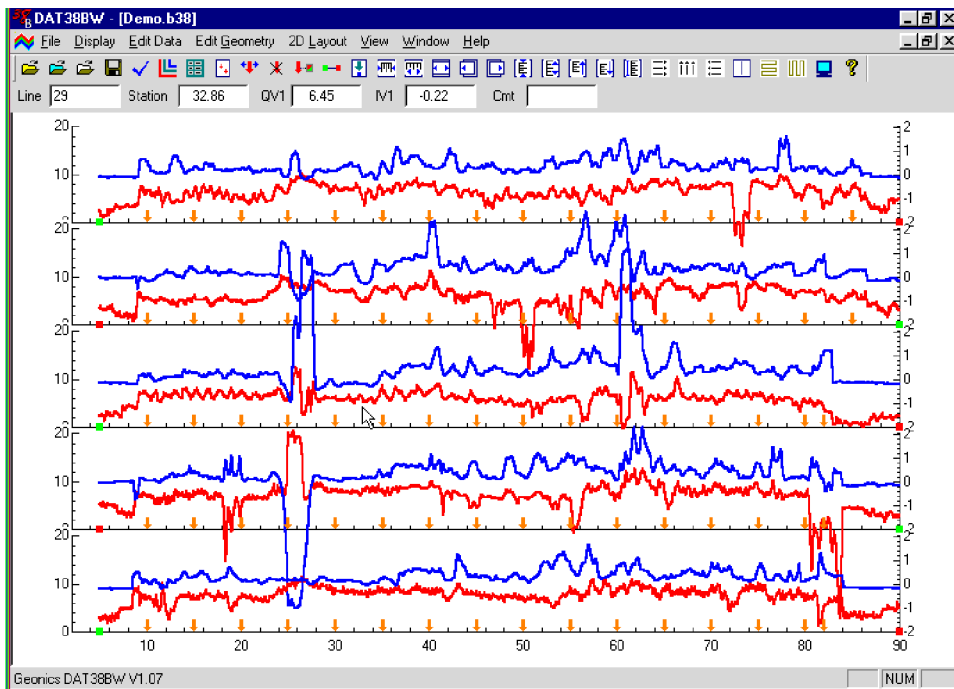
Figure 2.8:   DAT38BW screen with stacked profiles

they will be placed in the same panel. In order to display these lines in separate panels the line names must be changed.

Each panel will include one or more data types (channels) as specified in the Select Data Type window. This window can be access from the main menu by selecting **Display**|**Select Data Type** or by clicking the ▣ (Select Data Type) button located on the tool bar. See Select Data Type section below.

This description of the EM38B data types is used through the entire program in several windows. Orientation is supported only by the data acquisition program EM38B in Polycorder. Data files created by the program EM38Bpro (in aLLegro and Pro4000) have always instrument Orientation 1.

By default all channels are displayed for all survey lines. The left vertical axis relates to the EM38B apparent conductivity (Quad-phase component) and it is labeled in millisiemenses per meter (mS/m), while right axis corresponds to the EM38B Inphase response and it is labeled in parts per thousands of Primary Field (ppt).

Selecting Survey Lines

When a data file is loaded, all survey lines are profiled. To display a selection of survey lines select **Display|Select Lines** in the menu or click on the ☑ toolbar button (Select Lines). The Select Lines window is shown in Figure 2.9.
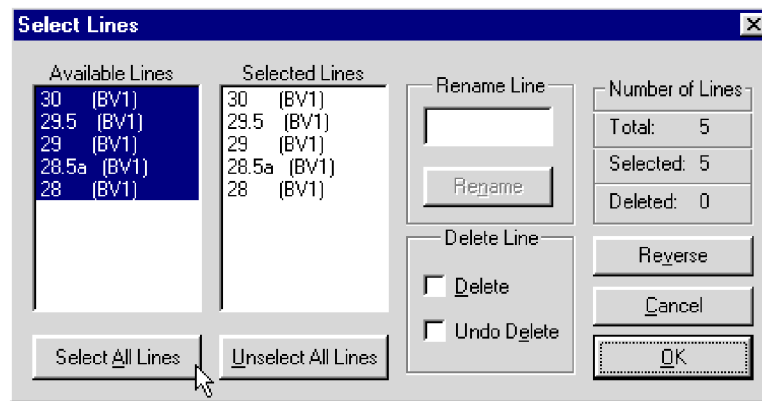
Figure 2.9:   Select Lines window

Select and deselect lines to be displayed, by clicking on the line names in list boxes. The EM38B component, dipole mode, and orientation of the instrument is displayed at each line as the EM38B Data Type. Buttons **Select All** and **Unselect All** are also available. All highlighted line names will be profiled on the screen after clicking **OK** button.

Deleting and Renaming Survey Lines

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 2.9).

To delete a survey line from the loaded set of data, click on the check box next to the Delete Line label. When a check mark is visible, click on the appropriate line name in the line name 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 name in the line names list: the highlighted line name will appear in the edit box located at the Rename Line label. Edit the name in the Edit Box and click the **Rename Line** button. The updated name will now be displayed in the line names list.

Please refer to section 4 (Data Display) for a detailed description of type of formats for data presentation.

> **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.**

Changing Display Parameters

To adjust the range of displayed parameters select **Display|Set Display Parameters** in the menu or click the left mouse button on the ▦ toolbar button. The **Set Display Parameters** window is shown in Figure 2.10.
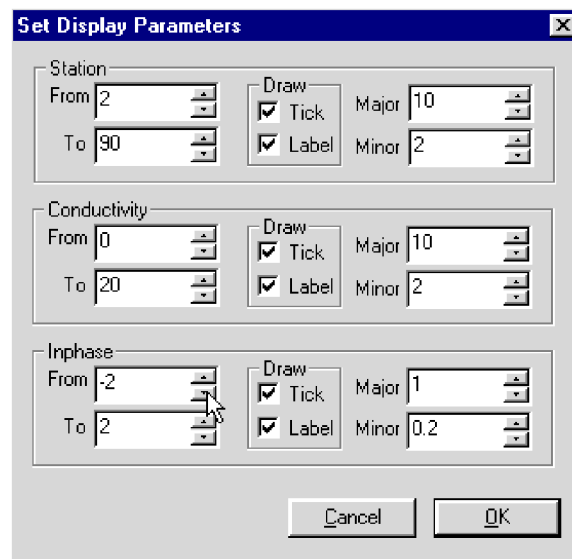
Figure 2.10: Set Display Parameters window

Selecting Data Type to Display

To set data type to be displayed select **Display|Select Data Type** in the menu or click the left mouse button on the toolbar button. The **Select Data Type** window is shown in Figure 2.11.
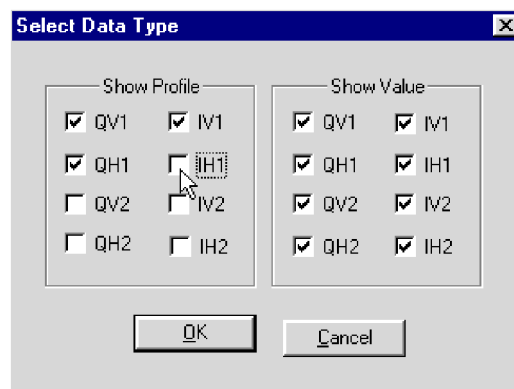
Figure 2.11: Select Data Type window

This window contains check boxes for each type of EM38B data. Each Type is described by a three character abbreviation:

QV1	-	**Q**uad-phase component (conductivity),	**V**ertical Dipole mode,	Orientation **1**
IV1	-	**I**nphase component,	**V**ertical Dipole mode,	Orientation **1**
QH1	-	**Q**uad-phase component (conductivity),	**H**orizontal Dipole mode,	Orientation **1**
IH1	-	**I**nphase component,	**H**orizontal Dipole mode,	Orientation **1**
QV1	-	**Q**uad-phase component (conductivity),	**V**ertical Dipole mode,	Orientation **2**
IV1	-	**I**nphase component,	**V**ertical Dipole mode,	Orientation **2**
QH1	-	**Q**uad-phase component (conductivity),	**H**orizontal Dipole mode,	Orientation **2**
IH1	-	**I**nphase component,	**H**orizontal Dipole mode,	Orientation **2**

The Select Data Type window is divided into two sections, Show Profile and Show Value. The profile section lets you select channels to be displayed as profiles. To select a channel click on the check box next to the channel number. The Show Value section lets you choose the channels that will be displayed in numerical form in windows located below the toolbar.

Please refer to section 4 for a detailed description of the Select Data Type to Display procedure.

2.4   Editing Survey Geometry

The program lets you adjust line geometry by changing the placement of start and end stations. It also allows you to reposition points that were marked with the fiducial switch.

Survey Conducted without Fiducial Markers

A survey that was carried 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 2.12.
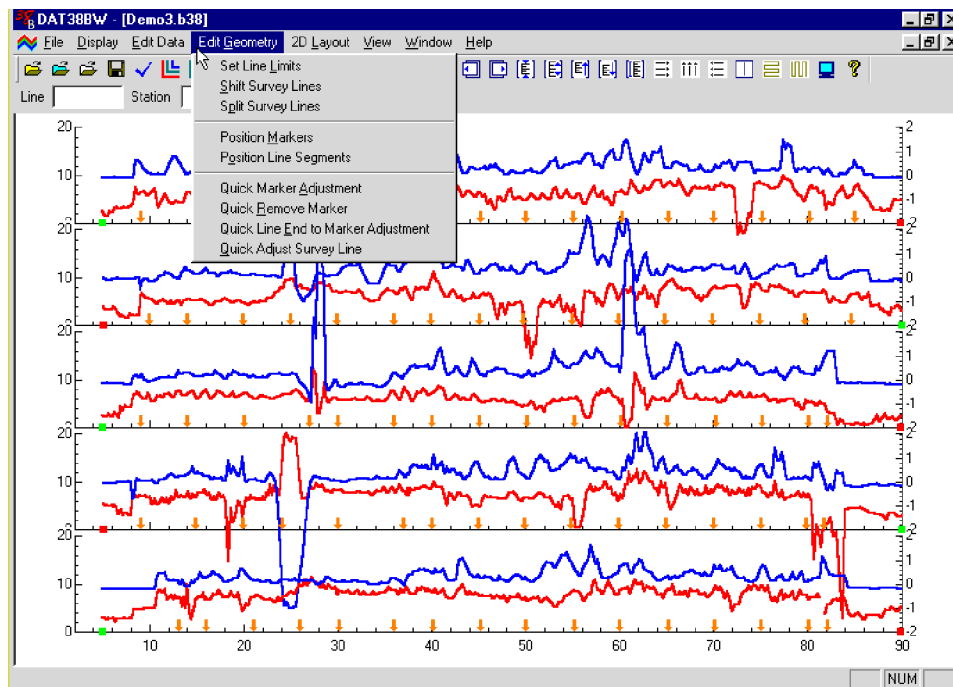
Figure 2.12: Edit Geometry menu

> **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:
1.   Adjust the ends of the survey lines using either the **Adjust Survey Line** or **Set Line Limits** option, or the **Quick Adjust Survey Line** tool (click the ▬ toolbar button).
2.   If Line Segments are present, position the ends of the segments using the **Position Line Segments** tool (click the 🔽 toolbar button).
3.   Position the ends of the lines and fiducial markers using the **Position Markers** tool (click the 🔽 toolbar button).

Step 1

Press the **Adjust Survey Line** button and drag the end points, the start and final stations, to approximately the correct locations. (Positions will be set more precisely in Step 3). This task will involve repositioning of the final station only, provided that the start station entered in the data logger during data collection gives the correct position on the survey grid. (If start stations were not correctly labeled, it is likely that the horizontal axis will need to be re-scaled to accommodate the full length of the survey grid before repositioning the end points.)

When using the **Adjust Survey Line** tool the following rules apply:
- repositioning the start station shifts the entire line, and the spacing between stations (increment) remains unchanged.
- repositioning the final station shortens or stretches the line. The start station remains in the same position, and the increment is adjusted according to the final station change.

If a survey's layout is relatively square or rectangular, then adjusting the survey lines can be made easier by using the **Set Line Limits** window (select **Edit Geometry**|**Set Line Limits**).

After the end points of all lines have been adjusted to approximately correct positions, the fiducial markers (assuming that they were regularly spaced in the field) should be roughly aligned across the stacked profiles.

Step 2

This step is used only if Line Segments were used.

Line segments are marked by blue squares at end stations of segments. If an end of a segment is the end station of the survey line, this station is treated by the program as the end of the survey line.

Press the **Position Line Segments** ⊞ button on the tool bar or select **Edit Geometry**|**Position Line Segments**. The **Position Line Segment** window will appear on the screen (similar to Position Markers window shown in Figure 2.13). This option can be applied to selected end stations or to a group of end stations of line segments.

For Group positioning:
- check the Group box in the Position Line Segments window.
- use a mouse to drag a rectangle around the group of markers to be repositioned.
- use the speed buttons or keyboard to specify the station in the edit box.
- place the cursor inside the rectangle and click the left mouse button.

All selected stations will be moved to the specified station.

Repositioning any end station of the line segment shortens or stretches given segment.

Step 3

Press the **Position Markers** ⊞ button on the tool bar or select **Edit Geometry**|**Position Markers**. The **Position Markers** window will appear on the screen (Figure 2.13). This option can be applied to selected markers or to a group of markers. Since all markers may be relatively close to their true locations (following Step 1), using Group mode can be a fast method to reposition several markers at once to a selected location.
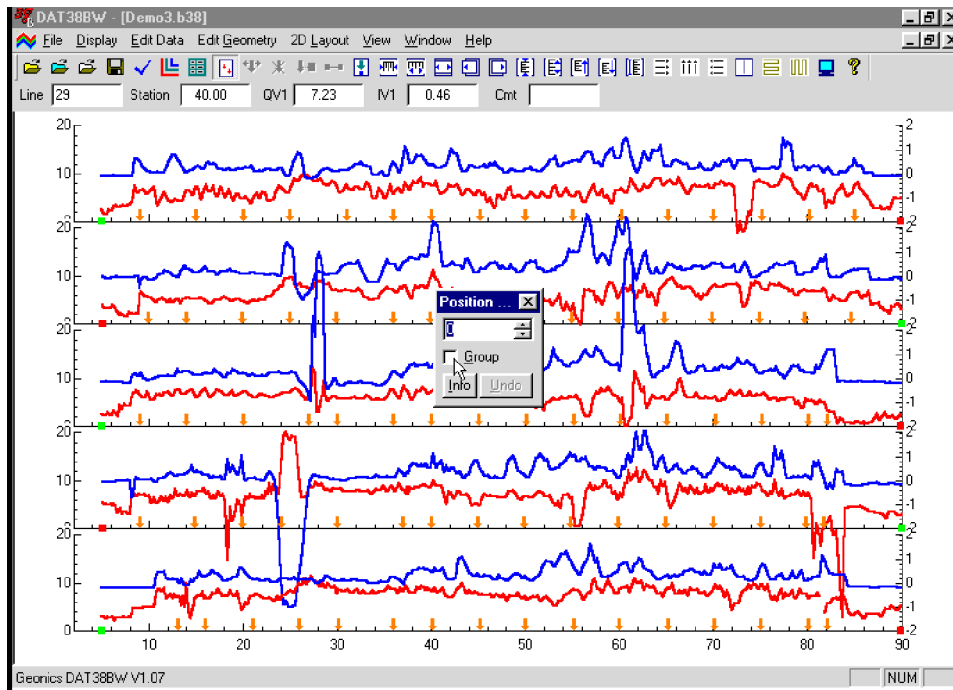
Figure 2.13: Position Markers window

    For Group positioning:
- check the Group box in the Position Marker window.
- use a mouse to drag a rectangle around the group of markers to be repositioned.
- use the speed buttons or keyboard to specify the station in the edit box.
- place the cursor inside the rectangle and click the left mouse button.

    All selected markers will be moved to the specified station. The same procedure can be applied to the start and final stations of survey lines.

The positioning of markers and end stations is described in detail in Section 5, where the procedure is illustrated with an example.

2.5   Create XYZ File

This option creates an ASCII file containing three columns: X, Y, Z1, Z2 etc. (where Z1 corresponds to e.g. conductivity in mS/m, depending on the Create XYZ File settings). This file can be used as an input file for the GEOSOFT or SURFER contour packages (or any other, if a multi column format is suitable). All data must be entered in the **Load EM38B Profile File** or **Add** menus prior to running this option.

Data can be converted directly to an XYZ file format by selecting the **2D Layout|Create XYZ File** menu option. Alternatively, the layout of the survey can first be examined by selecting the **2D Layout|View XYZ** menu, or clicking the **View XYZ (W-E)** or **View XYZ (N-S)** button on the tool bar. The view XYZ option shows a two dimensional layout of stations and survey lines oriented either in the W-E or N-S directions. Each station is represented by a dot on the screen. At this point the configuration of the layout can be examined visually and corrected if required.

After the **2D Layout|Create XYZ File** from the profile menu, or the **File|Create XYZ File** from the View XYZ menu options is selected, the Create XYZ File window is displayed (Figure 2.14).
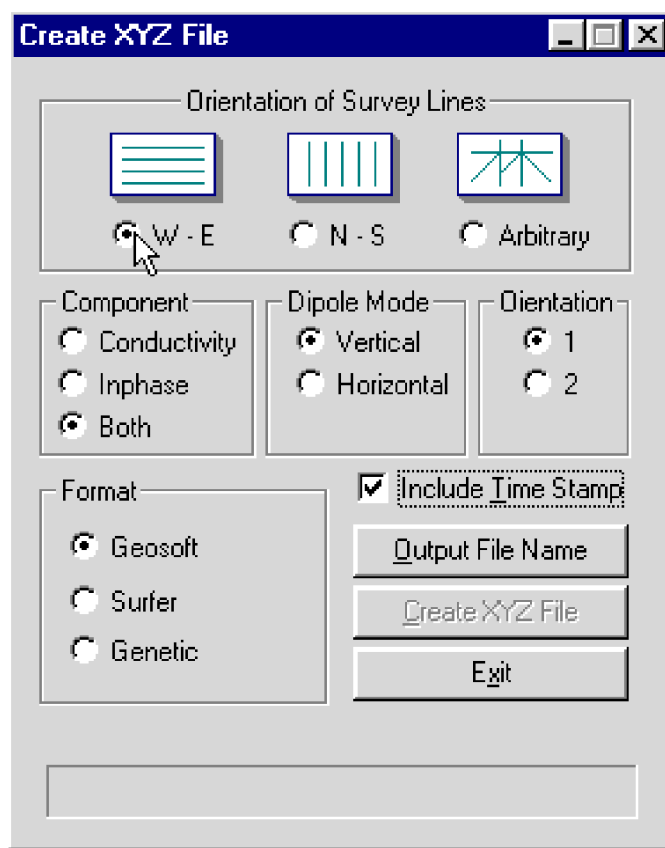
Figure 2.14: Create XYZ File window

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

Orientation of Survey Lines

> Choose Regular **W-E** or **S-N**, or **Arbitrary** 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. The Arbitrary option is designed for layouts where survey lines are not parallel.

> 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. 10E, only the number will be recognized as an X coordinate.

> The Arbitrary option is used only if lines are not parallel. To use this option click the radio button **Arbitrary** in the Create XYZ File window. The Arbitrary Orientation page becomes active (Figure 2.15).
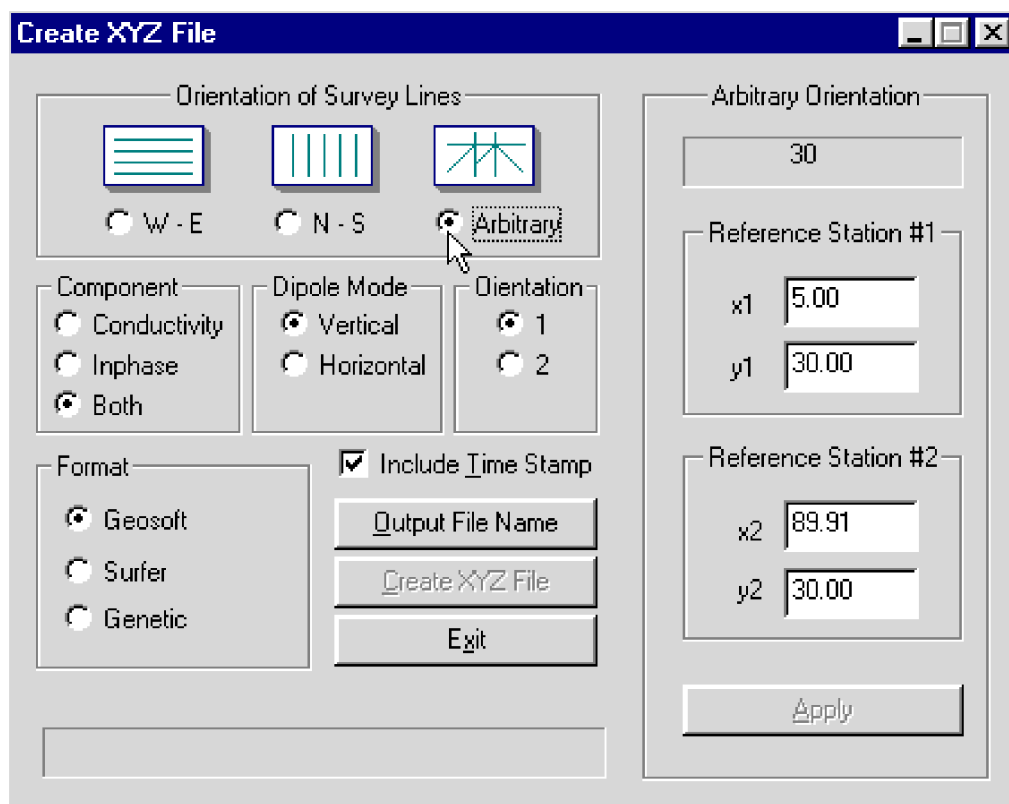
Figure 2.15: Create XYZ File window with the Arbitrary option

After the Output File Name is specified and the **Create** button is clicked, two stations must be entered for each survey line. In the edit box of Reference Station #1, enter the coordinates of the start station of the displayed survey line. For Reference Station #2, enter the coordinates of any other point on this survey line (assuming the line is a straight line only). A projection of coordinates for every station on the line will be calculated. Any XYZ file created with the arbitrary line orientation can be viewed using the **File|Open XYZ** menu option, or by clicking the **Open XYZ File** button on the tool bar.

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).

Select Data Type

To select the EM38B data type (component, dipole mode, and instrument orientation) to be written in the output file click the corresponding radio button in the Select Data Type section of the Create XYZ File window (Figures 2.14 and 2.15).

To select a data type click on the radio button next to the data type name (see Select Data Type section of this chapter). Only one type of the EM38B data can be written to created XYZ file. Data is always placed in the created XYZ file in the following order: X coordinate, Y coordinate, and one type of data. The parameter Time (time stamp for each reading) will be placed in the last column of the file (assuming that time stamp is present in data file). A comment line listing all parameters in the file is placed as a header for each created XYZ file.

When the **Output File Name** button is clicked, a Select XYZ File Name window is displayed (Figure 2.16). The EM38B file name with an extension corresponding to the selected output file format (xyz, dat, or asc) is given as a default.
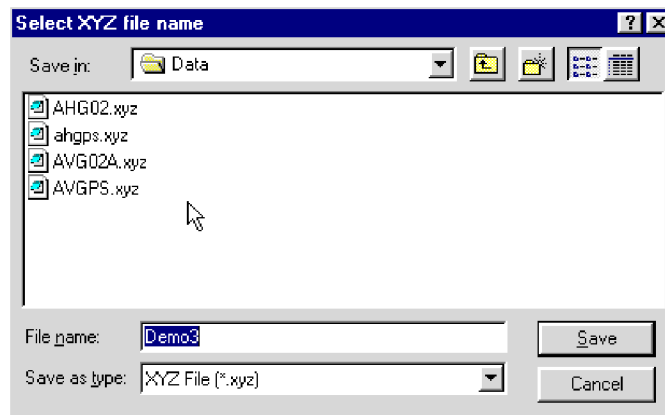
Figure 2.16: Select XYZ File window

Accept the default or specify a new file name and click the **Save** button. The Select XYZ File Name window will close and the selected file name will be displayed at the bottom of the Create XYZ File window. 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.

The creation of XYZ files is generally very fast for the W-E and S-N line orientation. Not surprisingly it is a somewhat more lengthy process for the Arbitrary survey line orientations.

Files created by this portion of the program can be viewed at any time using the **File|Open XYZ** menu, or by clicking the **View XYZ File** button located on the tool bar.

3. Data Transfer

This chapter describes the transfer of files (program and data files) between the Polycorder and the computer. Both types of Polycorders, 600 and 720, can be used with the EM38BRT Polycorder program, while EM38B can be used only in Polycorder 720 connected to analog EM38B. The transfer of data files from the Allegro or Pro4000 field computers operating under the control of the EM38Balg program is described in Section 3.5. The procedure of downloading files from the Allegro applies to the Pro4000 field computer running program EM38Bpro.

3.1 Polycorder Communication Parameters

The Polycorder communication parameters are the same for all Uploading and Downloading procedures. These parameters are usually properly set after resetting the logger with the RESET module. In case they are modified, set the communication parameters (using Polycorder Mode 5-2) according to Table 3.1.

Table 3.1:   Polycorder communication settings

Parameter	Setting	Parameter	Setting
BAUD RATE	**9600**	INP LINE TERM	**<CR>**
DATA BITS	**8**	INP MAX LENGTH	**95**
PARITY	**N**	TRANSMIT DELAY	**0**
STOP BITS	**1**	CHECKSUM	**N**
DUPLEX	**H**	END OF LINE SEQ	**<CR><LF>**
XMT PMTS	**N**	END OF PAGE SEQ	**<CR><LF>**
LINE REQ	**A**	END OF FILE SEQ	**<CR><LF>**
REPEAT REQ	**B**	MATING CALL	**A** or **<CR>**
CONTINUOUS REQ	**C**	BEEP TONE	**55**
STOP REQ	**D**	BEEP TIME	**10**

Character <CR> (Carriage Return) is represented on the Polycorder display as a left pointing arrow, while <LF> (Line Feed) is shown as a check mark.

If DOS based programs are used for Uploading or Downloading files, change the parameter MAT-ING CALL to <CR>. To set <CR> in the Polycorder press the following keys on the Polycorder keypad: CTL (one key) 0 1 3.

If necessary, refer to the manufacturer documentation for more details regarding the Polycorder communication parameters.

3.2 Upload Program Files to Polycorder

General Information

Normally, the Polycorder 600 and 720 that are supplied with the EM38BRT or EM38B systems contains all the necessary programs for running the instruments. However, there are several circumstances when uploading the Polycorder program files should be performed:

- Polycorder does not contain necessary programs.
- loading updated versions of Polycorder programs.
- changing instrument that will be used with the logger.
- after routine or necessary clean up of the Polycorder.

The Polycorder 600 is used with the EM38BRT (digital signal output) while the Polycorder 720 is used with the standard EM38B (analog output).

> **However, it is possible however to collect EM38BRT data using the Polycorder 720. In this case follow the procedures designed for the Polycorder 600, despite the fact that the Polycorder 720 is used. Other words, if the used instrument cable (connecting the Polycorder and the instrument) is connected to a 37 pin Polycorder port, the Polycorder 720 files must be uploaded, and the Polycorder 720 is the only available logger. If the instrument cable is connected to the 25 pin Polycorder connector then the Polycorder 600 files must be uploaded.**

The Polycorder EM38B and EM38BRT program supplied with the Windows based software is almost identical to the previous versions supplied with the DOS based DAT38B program. Data files created during data collection are also compatible. The difference is in the downloading of files which is handled by new routines, DUMP38BA for the Polycorder 720 and DUMP38BW for the Polycorder 600. If data is to be downloaded with Windows based software, a new version of the Polycorder programs (version 2.0 or later) must be uploaded to the Polycorder.

If data is collected using an older version of Polycorder software it should be downloaded with the DOS based software (DOS based DAT38B) and then data files in DAT38B format processed with the DAT38BW. While data files in DAT38B format (B38) can be used in both DOS and Windows based software, raw data files in Polycorder format have small differences. Therefore, if files were downloaded using DOS based DAT38B and separate conversion to DAT38B format is required, these files must be converted using DOS based DAT38B. Similarly, if files were downloaded using DAT38BW they can be converted using only Windows based DAT38BW.

It is advised to reset the Polycorder and reload the programming after several days of use. This will keep the directory file refreshed. The Polycorder has no system directory and the internal data file, DIR38BRT (or DIRFILE in EM38B), is used to log all entered file names. When the directory file contains many file names, the downloading procedure becomes more time consuming. In addition, there will be less choice in naming files. Since the EM38BRT (and EM38B) program does not allow the appending of data files, the file names present in the directory file can not be used even in the case where they were previously deleted from the system.

The Polycorder is reset with the RESET module. To reset the Polycorder, make sure that all data are downloaded and saved, since all data will be permanently deleted. Insert the RESET module to the Polycorder connector with the RESET label facing the operator and press the ON key (or OFF and ON if the logger was ON initially).

Description of Polycorder Program Files

Two file types, format files and program files have to be transferred to the Polycorder to run the EM38B or EM38BRT Polycorder programs. The Polycorder 720 requires two files: FORM38B.720 and EM38B.720, while the Polycorder 600 requires files FORM38B.600 and EM38BRT. These files are placed in the subdirectory UploadFiles of the directory chosen during DAT38BW installation. A description of Polycorder files is as follows:

Polycorder 600 files

FORM38B.600   this file contains format files necessary for EM38BRT data files and two files:

        DIR38BRT -   directory file to log entered file names. Do not edit this file.

        DUMMY01 -   small text file that can be safely erased in case additional memory is needed to run downloading programs.

EM38BRT   contains programs for Polycorder 600. It includes following programs:

        EM38BRT -   data acquisition program for Geonics EM38B (RT) instrument.

        DUMP38BW-   program to download data files while using DAT38BW (Windows based) computer program.

        DUMP38B -   program to download data files while using DAT38B (DOS based) computer program.

Polycorder 720 files

FORM38B.720 this file contains format files necessary for EM38B data files and two files:

        DIRFILE -   directory file to log entered file names. Do not edit this file.

        DUMMY01 -   small text file that can be safely erased in case additional memory is needed to run downloading programs.

EM38B.720   contains programs for Polycorder 720. It includes following programs:

        EM38B -   data acquisition program for Geonics EM38B instrument.

        DUMP38BA -   program to download data files while using DAT38BW (Windows based) computer program.

        DUMP -   program to download data files while using DAT38B (DOS based).

        BATTERY -   program to display status of the Polycorder 720 battery.

> **Format files (FORM38B.600, FORM38B.720) can be loaded only when the Polycorder is reset. The Polycorder system does not allow format files to be overwritten.**
> **Format file must be present in the Polycorder prior to uploading the corresponding program file.**

Download programs DUMP38B, DUMP38BW, DUMP38BA, and DUMP require about 500 bytes (corresponds to about 70 records) of free memory in the Polycorder. In cases where the Polycorder memory is entirely used during field work and the dump program can not be run, erase the file DUMMY01 using the Polycorder Mode 4-2.

> **When file DUMMY01 is erased and not immediately replaced through uploading, create your own "dummy" file by recording a file with about 100 readings that can be deleted, if necessary.**

Uploading Files to the Polycorder

Select the **Data Transfer|Upload Files to Polycorder 600** or **Data Transfer|Upload Files to Poly-corder 720** in the program menu (Figure 3.1).
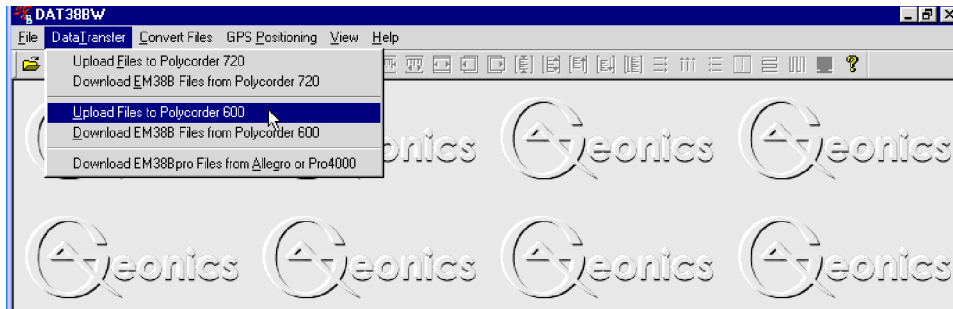
Figure 3.1:   Data Transfer menu

> **Note, that it is possible to collect EM38BRT data using the Polycorder 720. In such a case, use the procedures designed for the Polycorder 600, despite the fact the Polycorder 720 is used.**

After clicking one of the **Upload Files to Polycorder...** item shown in Figure 3.1, the Upload Files From PC to Polycorder window will appear (Figure 3.2). In this figure, files FORM38B.600 and EM38BRT for the Geonics EM38BRT are displayed in the Files to Upload list box When the Polycorder 720 is uploaded, files FORM38B.720 and EM38B.720 will be listed.
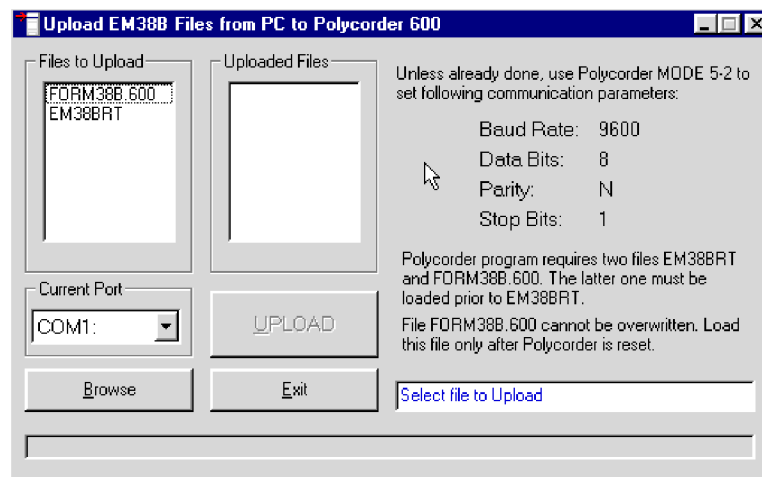
Figure 3.2:   Upload EM38B Files from PC to Polycorder 600
window

Normally, the Polycorder files are located in the subdirectory UploadFiles of the program folder (chosen during installation). The program checks this subdirectory. If the Files to Upload list box does not contain necessary files, click the **Browse** button to locate the Polycorder files.

Change of the port assignment can be done by clicking the Down arrow button in the field labeled Current Port. The pull down list box will be displayed, as shown in Figure 3.3. Select required COM port number.
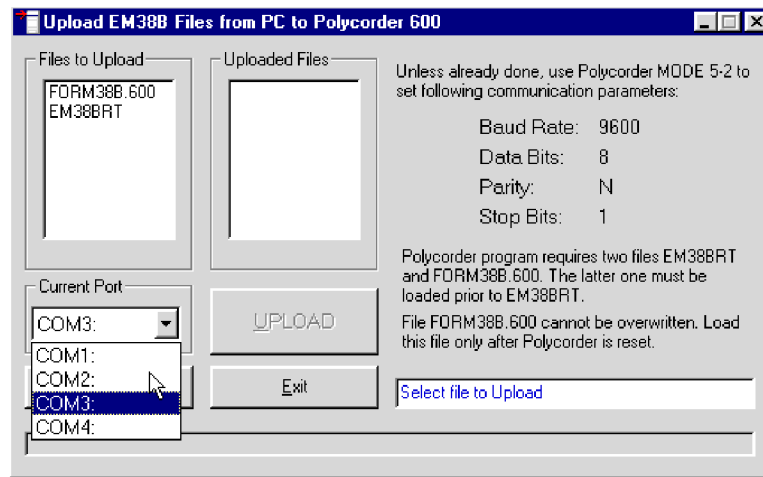
Figure 3.3: Selecting serial port number

To upload files to the Polycorder, follow the instructions on the screen (Figure 3.2). Select a file by clicking the left mouse button on the name in the list box. The file name will be highlighted and the **Upload** button will be activated. Using the left mouse button, click the **Upload** button and then, with the Polycorder turned ON, enter the Polycorder Mode 3-2. Information reminding you to enter Polycorder Mode 3-2 is displayed (Figure 3.4). If Polycorder Mode 3-2 is not entered during 15 seconds the program will reset the Upload File window.
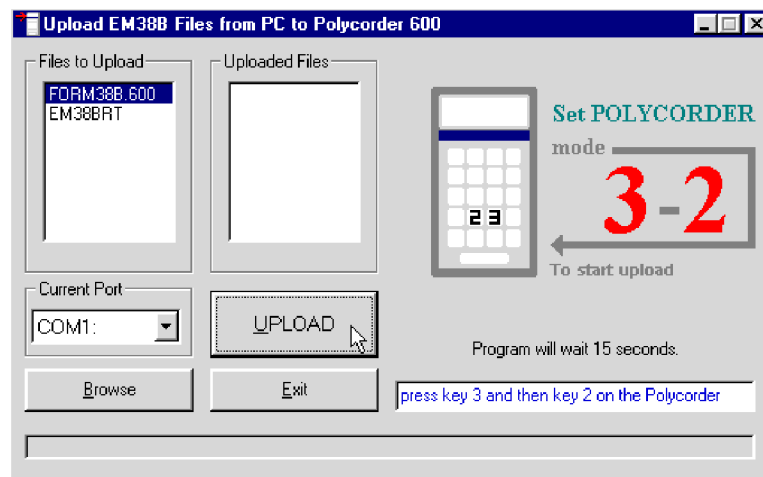
Figure 3.4: Upload File window waiting for Polycorder entry

After Mode 3-2 in the Polycorder is entered, uploading starts, which should be confirmed by an updated graphic and by a progress bar located at the bottom of the Upload File from PC to Polycorder window (Figure 3.5).
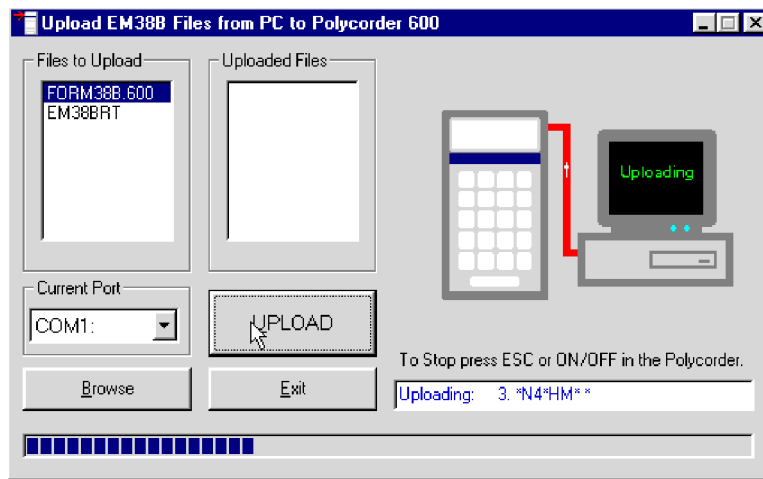
Figure 3.5: **Upload EM38B Files from PC to Polycorder 600**
window during transmission

When a file is uploaded, the file name is displayed in the Uploaded Files list box. At this point the next file can be uploaded.

Format files are loaded very quickly (within a few seconds), whereas uploading of the program files, EM38B.720 and EM38BRT, will take approximately 8 minutes.

If there is a problem during the transmission of files, the progress bar will stop moving. At this point you should check the cable and the communication parameters.

3.3 Download Data from the Polycorder

Data File Formats

Data files in the logger are formatted in proprietary Polycorder format. The Polycorder format is different for the Polycorder 600 and Polycorder 720. The Polycorder 600 (EM38BRT) data is saved in one data file. The Polycorder 720 (EM38B) data set is saved in two files: Header file and Data file. Header and Data files have a common base name, but different prefixes, H for header and D for data files.

Files in the Polycorder format (either Polycorder 600 or Polycorder 720) are automatically converted to the DAT38B format during the downloading of data. These new files have same base name with an added extension name B38. Files in the DAT38B format can be loaded and processed by the DAT38BW program.

While only files in the DAT38B format are used in data processing, it is strongly advised that data in the Polycorder format be saved as well. In case of any hardware malfunction, e.g. a damaged instrument cable, only the file in Polycorder format may indicate the source of the problem. Additionally, Polycorder files also contain useful information about the instrument settings used during field work. Files in the Polycorder format can be converted to the DAT38B format at any time using the Convert Files option of the DAT38BW menu.

Description and samples of EM38B files in the Polycorder 600 and Polycorder 720 formats, as well as an example of a file converted to the DAT38B format are placed in Appendix A.

Download Procedure

Select **Data Transfer** in the program menu and then click the **Download EM38B Files from Polycorder 600** or **Download EM38B Files from Polycorder 720** menu item (Figure 3.6).
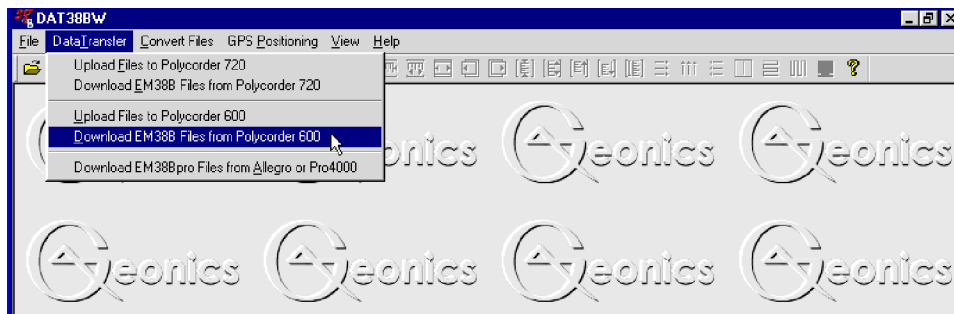
Figure 3.6:   Data Transfer menu

> **Note, that it is possible to collect EM38BRT data using the Polycorder 720. In such a case, use the procedures designed for the Polycorder 600, despite the fact the Polycorder 720 is used.**

After clicking the **Download Files from Polycorder** item shown in Figure 3.6, the Download data from Polycorder window will appear (Figure 3.7).
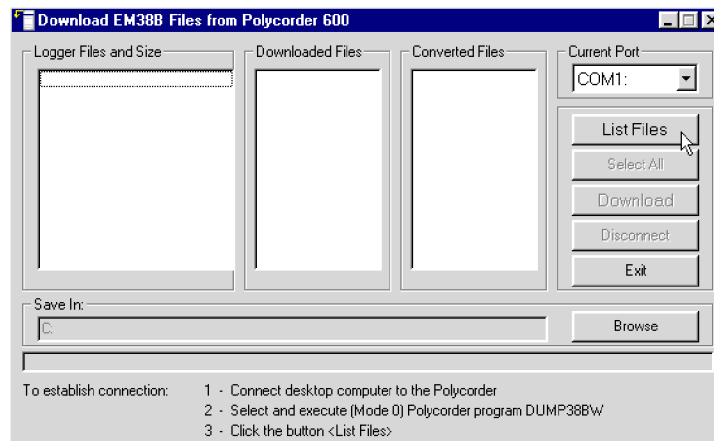
Figure 3.7:   Download EM38B Files from Polycorder window

The Download data from Polycorder window has three list boxes. The first from the left, labeled Logger File(s) and Size will contain, after **List Logger Files** button is clicked, a list of data files located in the Polycorder and available to download. Along with file names, their size in bytes is displayed. The second list box, labeled Transferred Files(s), will list downloaded data files in Polycorder format, and the third, Converted File(s), will list files converted from Polycorder to DAT38B format. If file names, either in Polycorder or DAT38B format, exist on the computer hard disk, an underscore followed by a number will be added to the base name, e.g. file name ABC would be changed to ABC_1 and ABC_1.B38.

The directory where transferred files will be placed can be selected by using the Browse function. Click the **Browse** button with the left mouse button and the Select Directory window will be displayed (Figure 3.8). After the directory is selected, it will be displayed in the bottom part of the Download data from Polycorder window. The selected directory will be saved and it will be displayed as a default directory during subsequent DAT38BW executions. If the directory is removed the main directory on C: drive will be used as a default directory.
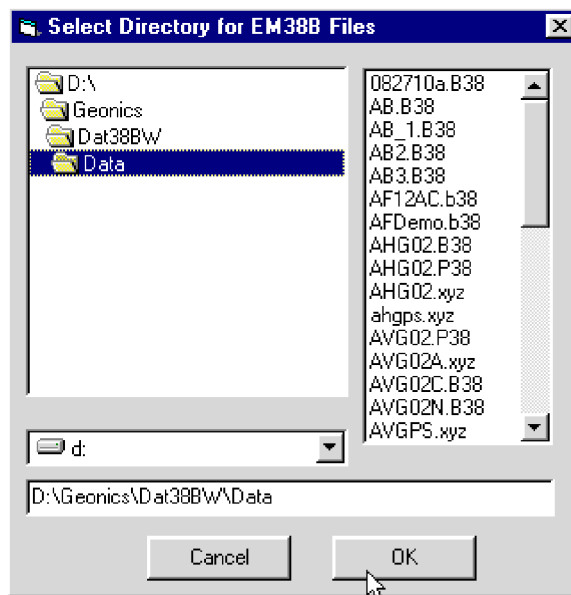
Figure 3.8:   Select Directory for EM38B Files

Change of the port assignment can be done by clicking the Down arrow button in the field labeled Current Port. The pull down list box will be displayed, as shown in Figure 3.9. Select required COM port number.
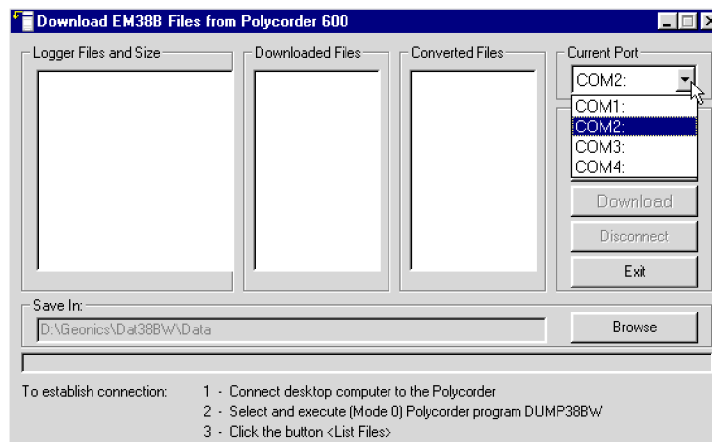
Figure 3.9:   Selecting serial port number

To start downloading the data files, connect the Polycorder and computer with the dumping cable.

Run the Polycorder program **DUMP38BW** for Polycorder 600, or **DUMP38BA** for the Polycorder 720. *(To run program in the Polycorder: enter MODE 0, select program name and press ENTER).*

> **Do not mistake the above programs with DUMP or DUMP38B files, which are included in the Polycorder for DOS based program only.**

Using the left mouse button click the **List Files** button. After several seconds the Logger File(s) and Size list box will be updated with names of data files available for download (Figure 3.10). At the same time, the window buttons **Download** , **Select All**, and **Disconnect** will be activated.
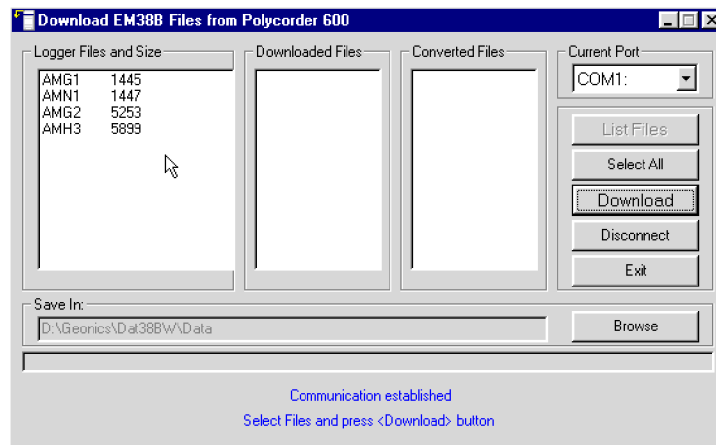
***Figure 3.10: Download EM38B Files... window after Logger
Files are listed***

Select the files to be downloaded from the Polycorder by clicking on individual file names in the list box or click the **Select All** button to select all available files. When selection of files is complete, click the **Download** button. At this point the name of each transferred file is displayed at the bottom of the window and a progress bar indicates the percentage of downloading completed for each file. Transferred files (in Polycorder format) will be displayed in the centre list box. After the transfer of all selected files is complete, files in the Polycorder format are automatically converted to the DAT38B format (with extension name B38). Converted files will be displayed in the Converted File(s) list box (Figure 3.11).
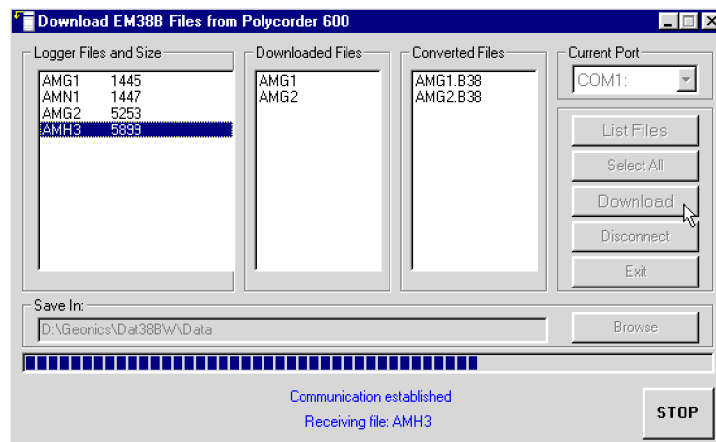
***Figure 3.11: Download EM38B Files... window during data
transfer***

Data transmission can be stopped at any time by clicking the button **STOP** located at the window bottom. All other buttons are disabled during downloading data.

Converted files (with B38 extension name) can be loaded and processed further in the DAT38BW program.

Click the **Disconnect** button to cancel communication with logger. The Download EM38B Files from Polycorder 600 (or 720) window will remain on the screen and the next data transfer session (i.e. from another logger) can be performed. Clicking the **Exit** button will stop Data Transfer function and the Download EM38B Files from Polycorder 600 (or 720) window will disappear.

3.4   Download EM38Bpro Files from Allegro/Pro4000

This chapter describes the transfer of data files from a field computer Allegro or Pro4000 to PC computer using **Download EM38Bpro Files from Allegro/Pro4000** option of the DAT38BW program. Data files can be downloaded by alternative utilities (e.g. ProShell, Lynx, or FileScout in Allegro Field PC) and then these files can be converted to DAT38B format using option **Convert Files|Conver EM38Bpro Files** in the DAT38BW menu.

Data File Formats

Data files in the field computer are formatted in proprietary EM38Bpro format. The EM38Bpro data is saved in one data file with the extension name P38.

Files in the logger format are converted to the DAT38B format during the downloading of data. These new files have same base name with an added extension name B38. Files in the DAT38B format can be loaded and processed by the DAT38BW program.

While only the DAT38B format is used in data processing, it is strongly advised that data in the raw (EM38Bpro) format be saved as well. In the case of any hardware malfunction, i.e. a damaged instrument cable, only the file in logger format may indicate the source of the problem. Additionally, raw data files also contain useful information about the instrument settings used during field work. Files in the EM38Bpro format can be converted to the DAT38B format at any time using the Convert EM38Bpro Files option of the DAT38BW menu.

Description and sample of the EM38B files in the EM38Bpro format, as well as an example of a file converted to the DAT38B format are placed in Appendix A of DAT38BW manual.

Download Files Procedure

To start downloading files from the field computer, select the **Data Transfer** item in the program menu and then click on **Download EM38Bpro Files from Allegro/Pro4000** from the menu item (Figure 3.12)
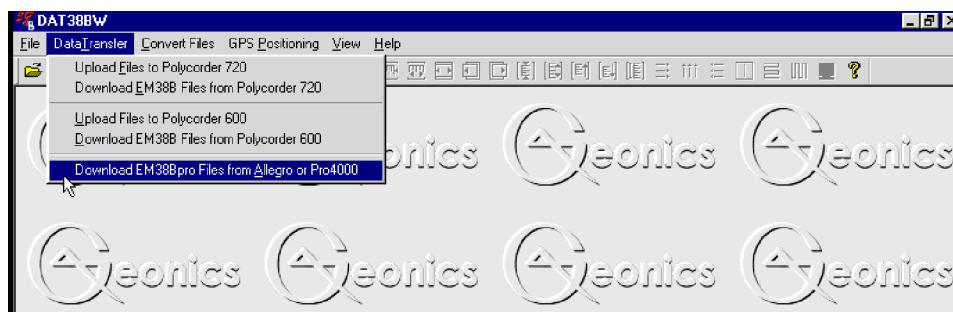
Figure 3.12: Data Transfer menu

After you click the **Download EM38Bpro Files from Allegro/Pro4000** item, the Download EM38B Files from Allegro/Pro4000 window will appear (Figure 3.13).
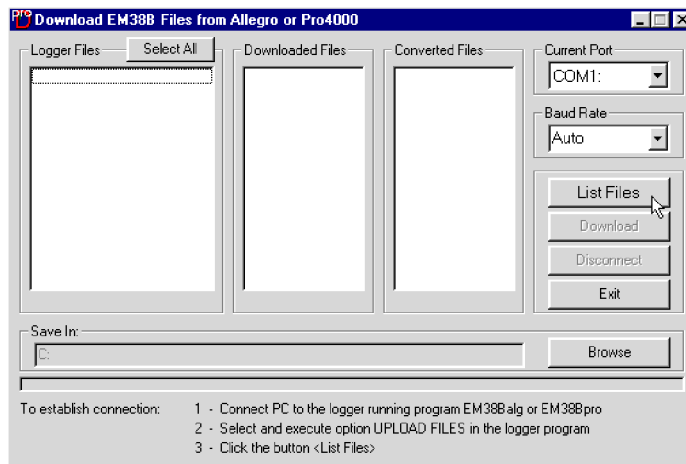
Figure 3.13: Download EM38B Files from Allegro window

The Download window has three list boxes. The first from the left, labeled Logger Files will contain, after the **List Files** button is clicked, a list of data files located in the field computer and available to download. File names, with their size in bytes will be displayed as well. The second list box, labeled Downloaded Files, will list downloaded data files in the EM38Bpro format, and the third, Converted Files, will list files converted to DAT38B format. If a file name already exists on the computer hard disk, an underscore followed by a letter will be added to the base name. (ie. file name ABC.P38 would be changed to ABC_1.P38, ABC_2.P38, and so on.)

To select the directory where transferred and converted files will be placed click the **Browse** button. The Select Directory for EM38B Files window will be displayed (Figure 3.14).
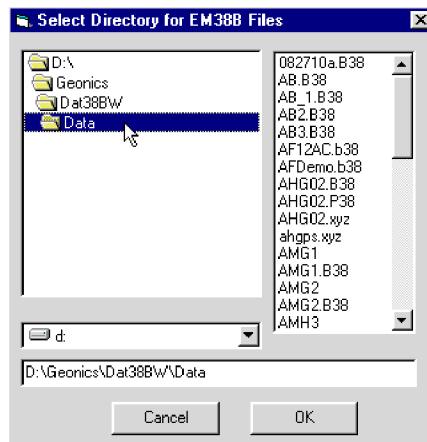
Figure 3.14: Select Directory for EM38B Files window

After the directory is selected, it will be displayed in the text box labelled **Save In** at bottom part of the Download EM38Bpro Files from Allegro/Pro4000 window. The selected directory will be saved and it will be used as the default directory during subsequent DAT38BW executions. If this directory is removed the C:\ directory will be used instead.

Change of the serial port assignment can be done by clicking the Down arrow button in the field labeled Current Port. The pull down list box will be displayed, as shown in Figure 3.15. Select required serial (COM) port number.
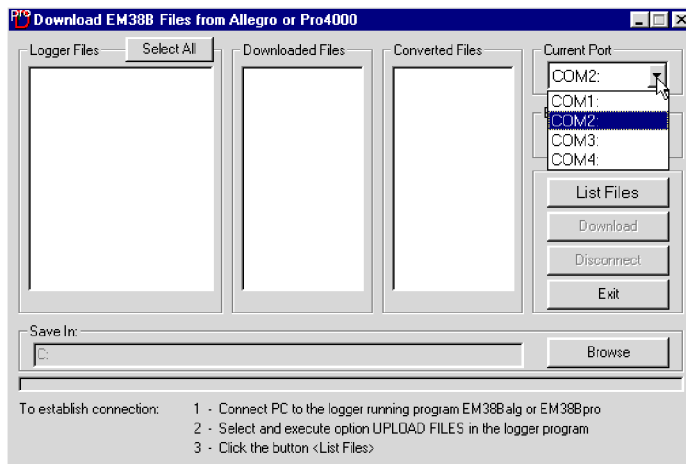
Figure 3.15: Select serial port number

Selecting Baud Rate can be done by clicking the Down arrow button in the field labeled Baud Rate. The pull down list box will be displayed (Figure 3.16). Select Auto setting or specify one of the given Baud Rates.
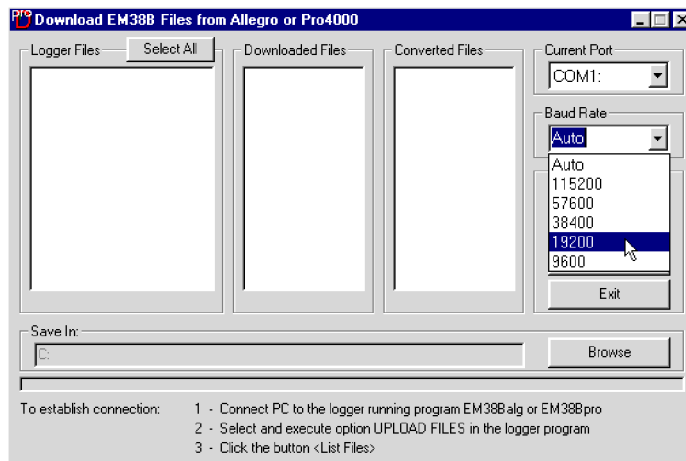
Figure 3.16: Selecting Baud Rate for selected serial port

The **Auto** setting will cause the program to establish and test the highest possible speed for data transmission for particular computer and logger. This setting is adequate for most computers. However if the program will prompt that one or more bytes were lost during transmission click on the **Disconnect** button, select a lower Baud Rate, and then repeat downloading.

To start downloading the data files, connect the field computer (Allegro or Pro4000) and PC computer with the serial cable.

Run the EM38Balg (or EM38Bpro) program in the logger. In the Main menu of the program select **Upload Files** option, and press **<ENTER>**. The logger screen will display the message "**Waiting for PC**" (shown in Figure 3.17) for up to 1 minute (if time elapses repeat the procedure). On the computer click the **List Files** button in the Download EM38Bpro Files from Allegro/Pro4000 window. At that time both programs (EM38Balg and DAT38BW) will establish and test the communication at the highest possible speed of data transfer. After several seconds the Logger Files list box will be updated with the names and sizes of
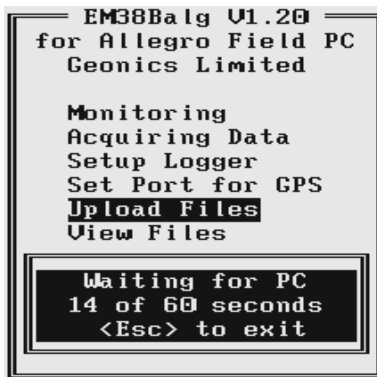
Figure 3.17: Allegro screen

data files available for download (see Figure 3.18). At the same time, the **Download** and **Disconnect** buttons will be activated, and the **List Files** button will be deactivated.
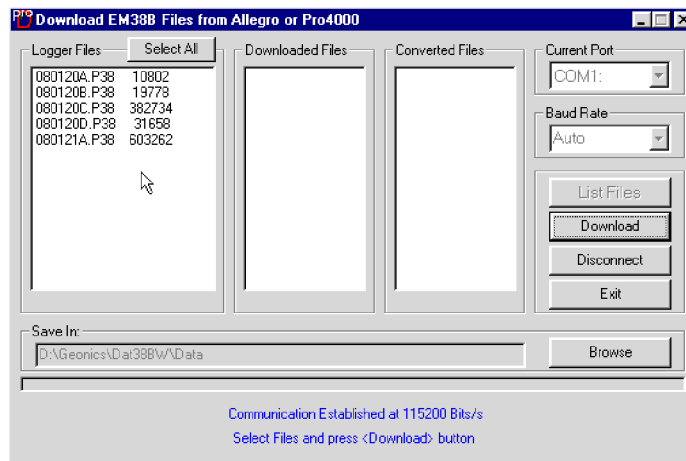
Figure 3.18: List of files available in Allegro for Download in
Download EM38B Files from Allegro window

Select the files to be downloaded from the logger by clicking on individual file names in the list box (Figure 3.19) or click the **Select All** button to select all available files. When all files are selected the **Select All** button will change to the **Unselect All** button.
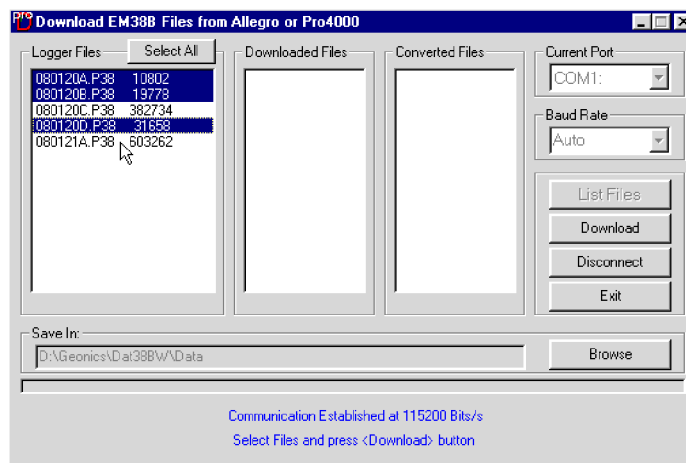
Figure 3.19 Selecting files to download

When file selection is complete click the **Download** button. The name of each transferred file is displayed at the bottom of the window as it transfers and a progress bar indicates the percentage completed, as shown in the Figure 3.20.

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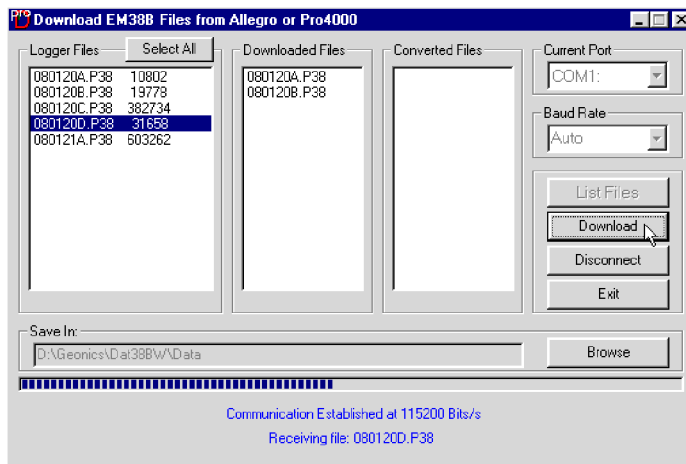
3. Data Transfer

Figure 3.20: Download window during data transmission

At the same time the logger screen displays transmitted file name and percentage of completed uploading (Figure 3.21). The transfer procedure can be stopped at any time by pressing **<Esc>** key on the logger keypad.
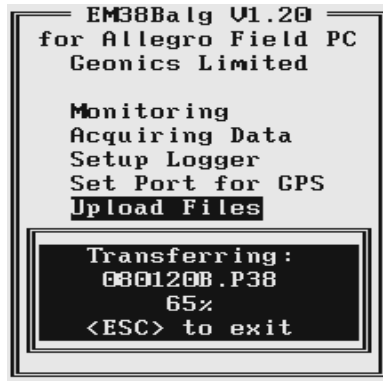
Figure 3.21: Allegro screen during data transfer

Transferred files (in EM38Bpro format) will be displayed in the centre list box. After the transfer of all selected files is complete, files in the EM38Bpro format are automatically converted to the DAT38B format (with extension name B38). Converted files will be displayed in the Converted Files list box (see Figure 3.22). Converted files (with extension name B38) can be loaded and processed further in the program.
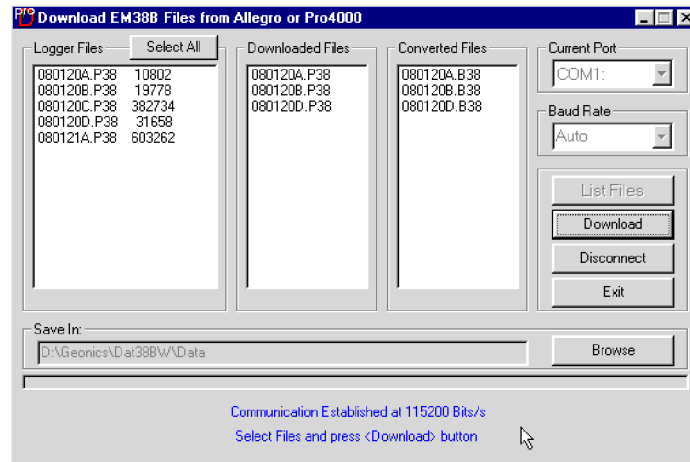
***Figure 3.22: Download EM38B Files from Allegro after
downloading selected files is completed***

Click the **Disconnect** button to cancel communication with logger. The Download EM38B Files from Allegro/Pro4000 window will remain on the screen and next data transfer session (i.e. from another logger) can be performed. Clicking the **Exit** button will stop Data Transfer function and the Download EM38B Files from Allegro/Pro4000 window will disappear.

4. Loading and Displaying Data

Three types of files can be loaded to the DAT38BW program. Files containing EM38B readings and displayed in the program as profiles have the extension name B38. These files are described in this section. The Polycorder and Allegro (with extension P38) raw data files and DAT38B file (B38) formats are described in Appendix A.

DAT38BW can also display the spatial distribution of stations in XYZ files, and the text of any ASCII file. The latter function is similar to Windows Notepad, and is limited to files not exceeding 64Kbytes in size in Windows 95 and 98.

4.1 Loading EM38B Profile Files

Loading Data File

To display data select **File|Open EM38B Profile File** in the menu (Figure 4.1) or click on the ⤢ toolbar button (marked by a yellow file symbol).
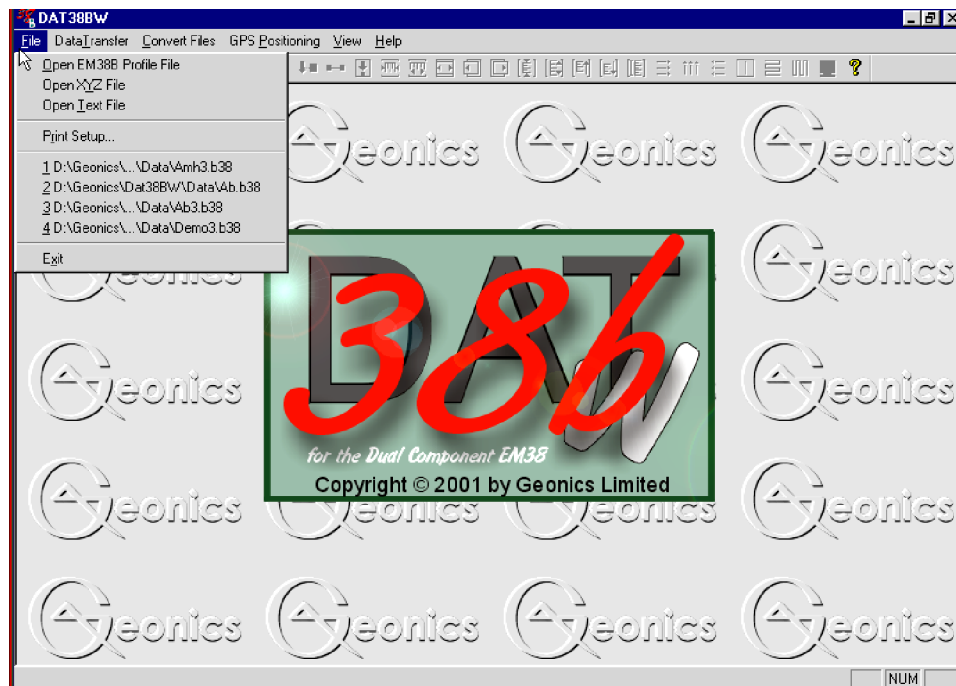
Figure 4.1:   DAT38BW File menu

The **Open EM38B Profile File** window will be displayed (Figure 4.2). 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 DAT38B format have the extension name B38.
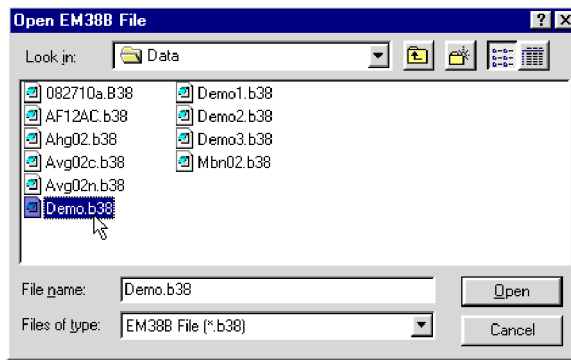
Figure 4.2:   Open EM38B File window

When a larger data file in DAT38B format is loaded to the program a progress bar shows the percentage of file loaded (Figure 4.3).
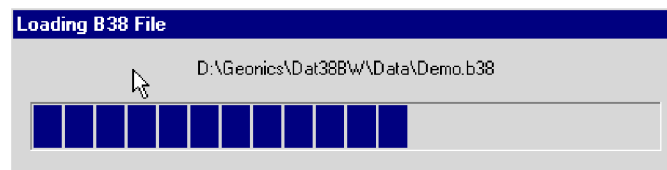
Figure 4.3:   Progress Bar during Loading .B38 File

After a DAT38B profile file is loaded, data is displayed in a stacked profile format as shown in Figure 4.4. 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 4.3).
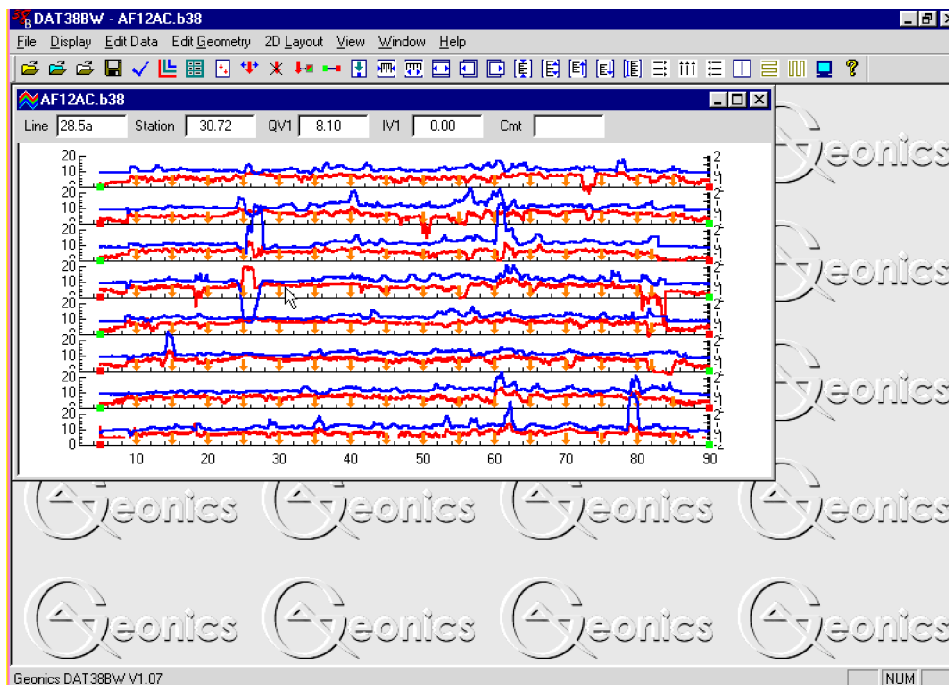
Figure 4.4:   DAT38BW screen with stacked profiles

In each panel the data type selected for display (see section 4.4 below) are profiled. In default settings, all data types (both components, both dipole modes, and both instrument orientations) are profiled. The left vertical axis corresponds to EM38B Quad-phase component (conductivity) in milliSiemens/m (mS/m), while the right axis is assigned to EM38B Inphase component in parts per thousands (ppt) of Primary Field.

Loading Additional Data Files to Separate Windows

To display more data in a separate window select **File|Open EM38B Profile File** in the menu (Figure 4.5) or click the left mouse button on the [toolbar icon] toolbar button (marked by yellow file symbol).
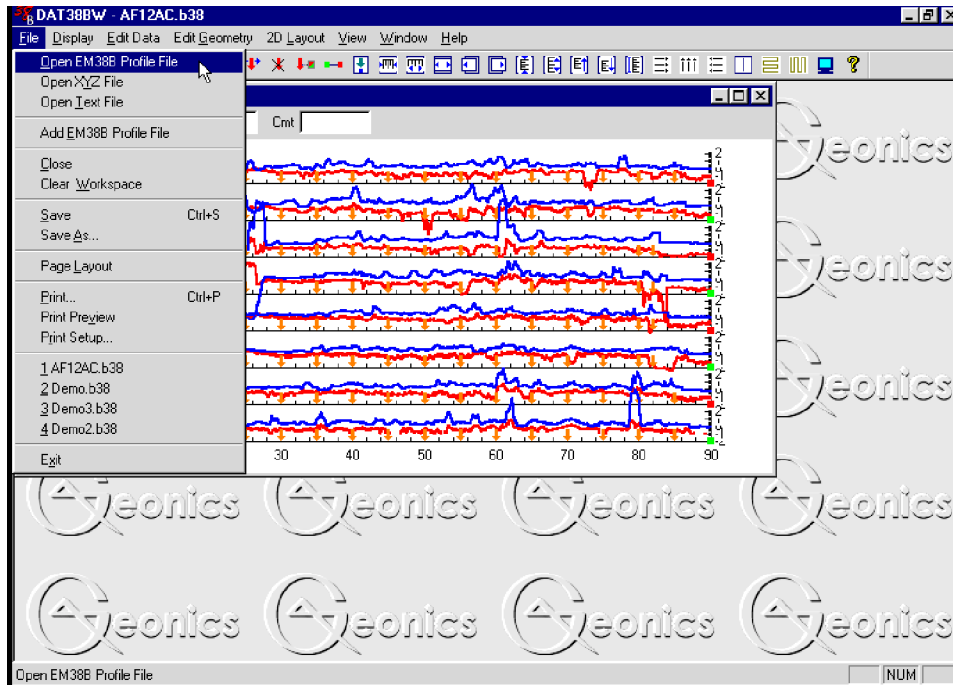
Figure 4.5:   DAT38BW File menu

The Open EM38B File window will be displayed (Figure 4.2). 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 displayed in a stacked profile format in a new window, as shown in Figure 4.6. Any number of windows (limited only by the memory of the computer) containing separate
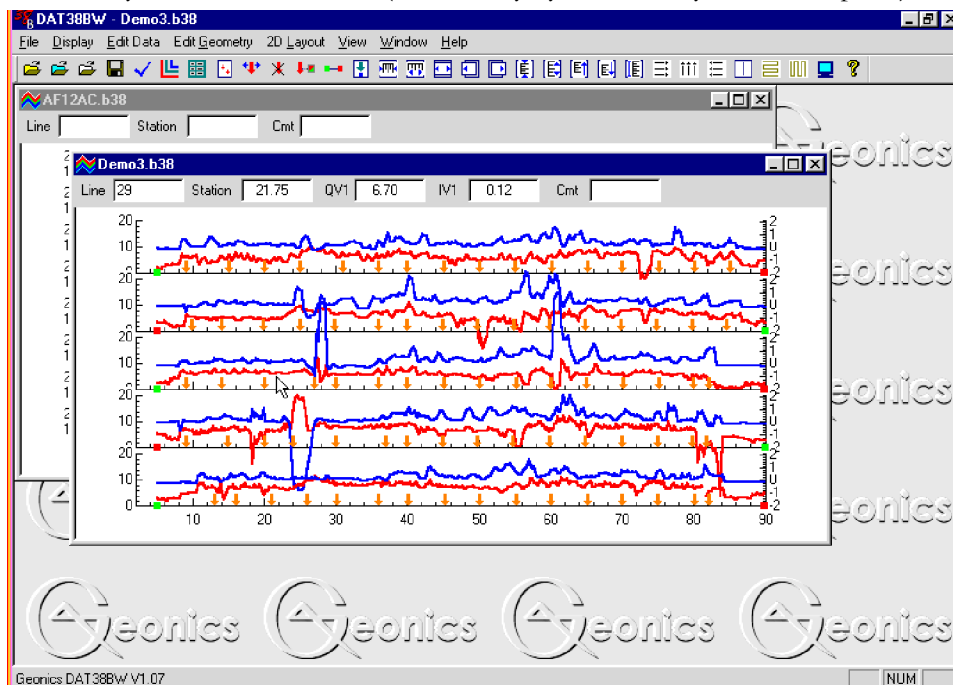
Figure 4.6:   DAT38BW screen with stacked profiles in two windows

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files can be opened. 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 EM38B Profile File** in the menu (Figure 4.5). The Open EM38B File window will be displayed (Figure 4.2). 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 4.7). Any number of files (limited only by the capacity of the computer memory) can be loaded to one window.
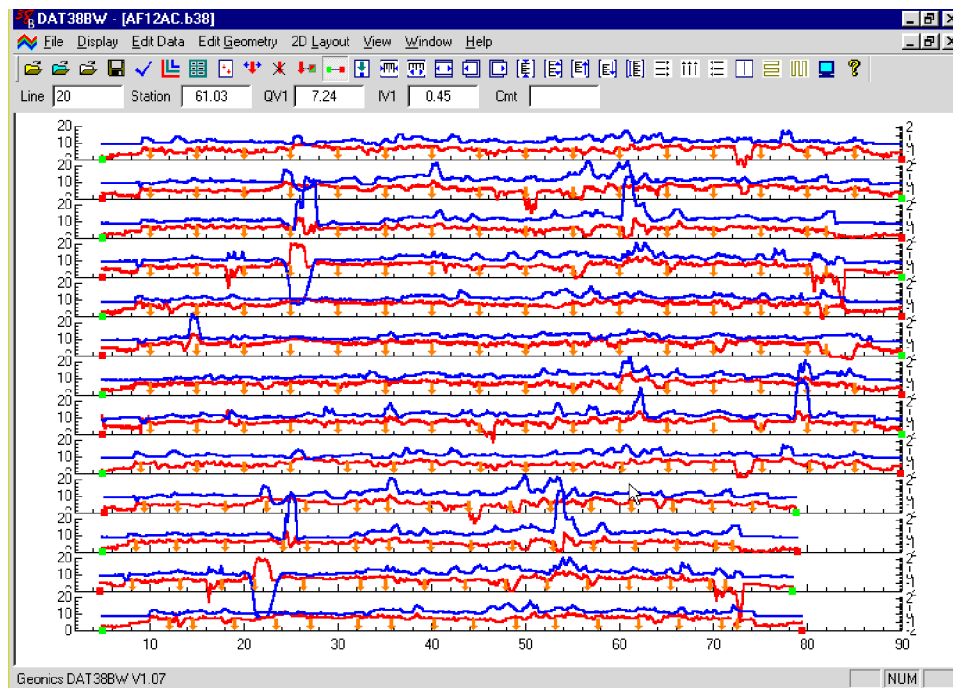
Figure 4.7:   DAT38BW screen with content of three files in one window

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.

4.2   Closing Profile Window and Saving Data

Closing Active Window

To close any active window select **File|Close** in the menu (Figure 4.8). This procedure can also be performed by clicking the close button of the active window.
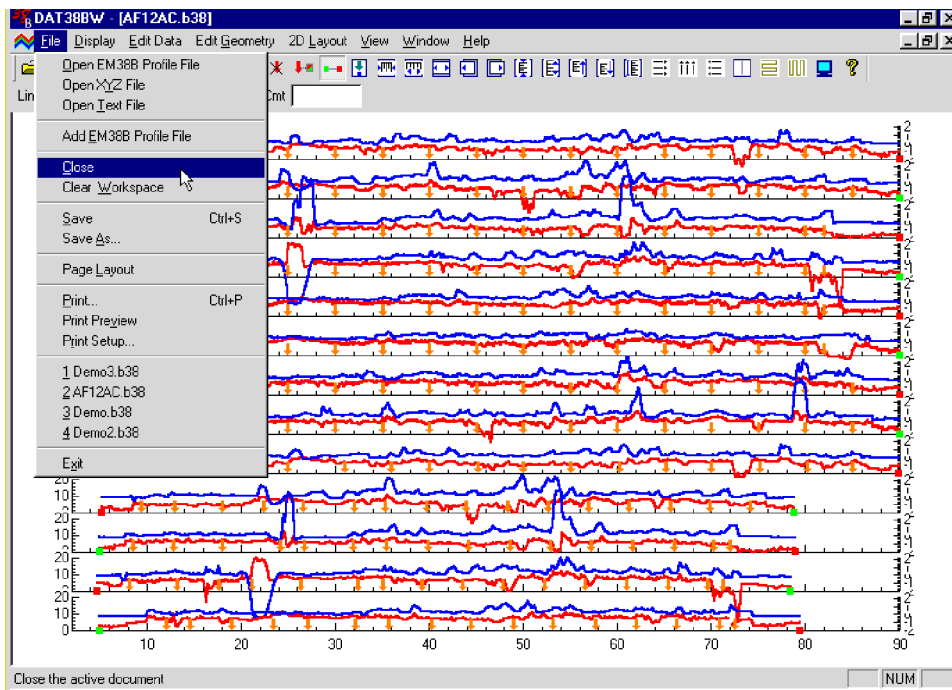
Figure 4.8: DAT38BW File menu

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 4.9.
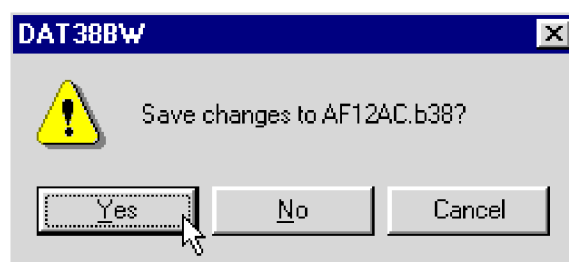
Figure 4.9: Save Changes window

Clear Workspace

To close all existing windows (data files) select **File|Clear Workspace** in the menu (Figure 4.8). Any editing of data **is not saved** during this procedure.

Save Data

To save data to the currently opened file select **File|Save** in the menu (Figure 4.8) 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 4.8). The Save As window will be displayed (Figure 4.10). 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 EM38B readings will have the extension name B38.
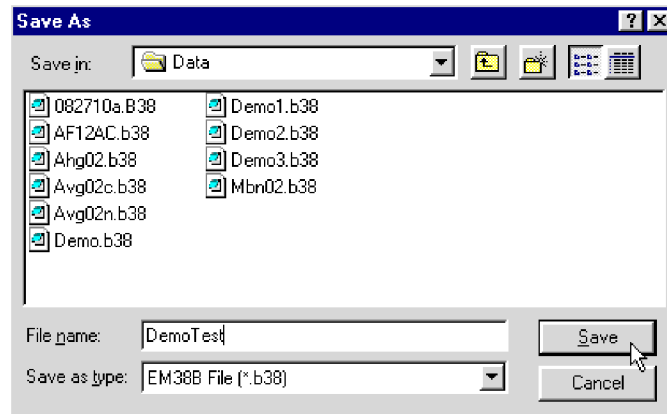
Figure 4.10: Save As window

4.3   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 4.11) or click the left mouse button on the ☑ toolbar button.
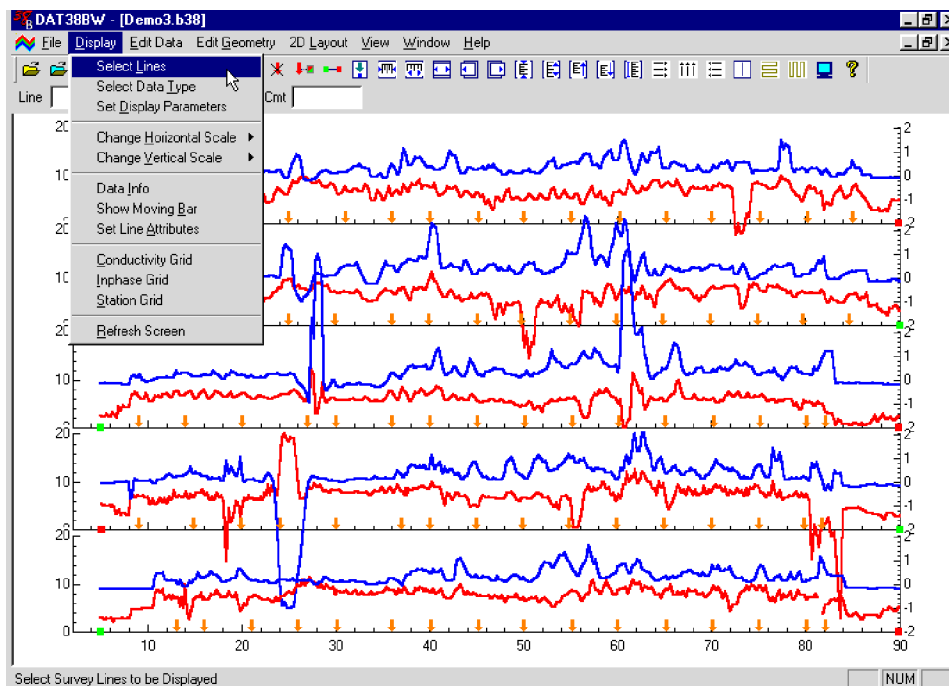
Figure 4.11: DAT38BW Display menu

The Select Lines window is shown in Figure 4.12. 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.
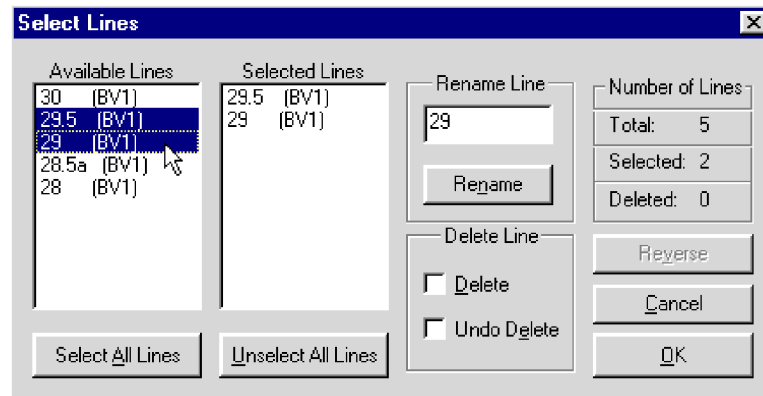
Figure 4.12: Select Lines window

The left list box, labeled Available Lines, displays all available lines, data type (EM38B component, dipole mode, and orientation). 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** are also available. All highlighted line names will be displayed on the screen after clicking the **OK** button. Figure 4.13 is an example of a screen with three selected lines. (The corresponding Select Lines window is shown in Figure 4.12.)
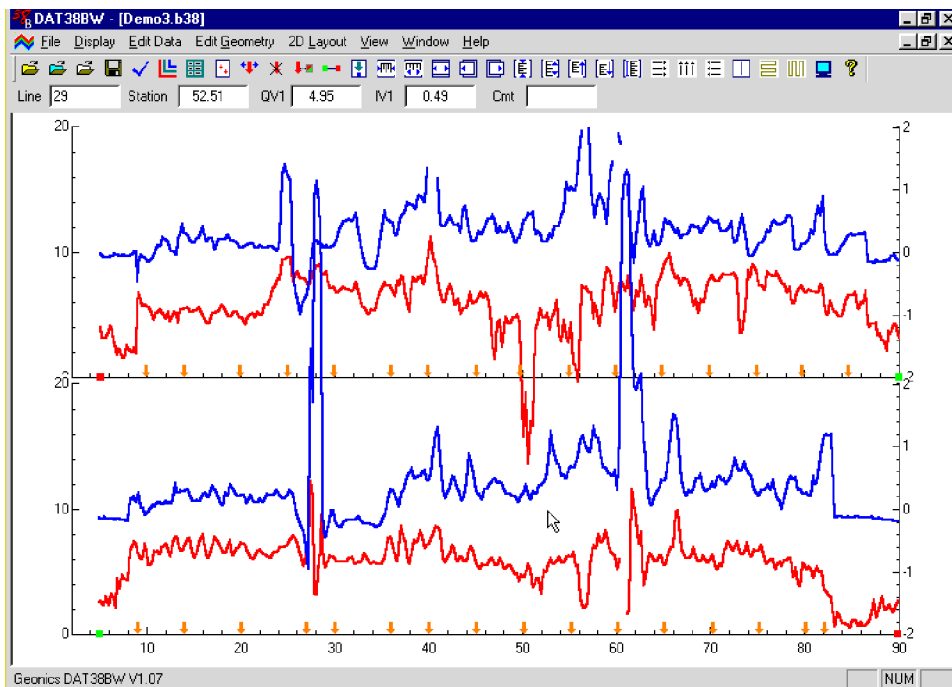
Figure 4.13: The DAT38BW screen with selected lines.

The selection of lines has no effect on the execution of **Save**, **Save As**, and **Create 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 delete and rename lines with the **Select Lines** window (Figure 4.12).

To delete a survey line from the loaded set, first click the **Delete** check box. When a check mark is visible in the box click the appropriate line name in the list box. The letter **D** will be displayed next to the line name (and corresponding sensor type and instrument mode) in the Available Lines list (Figure 4.14). These lines will not be displayed nor written to the output file during **Save**, **Save As**, **Create XYZ File** tasks.
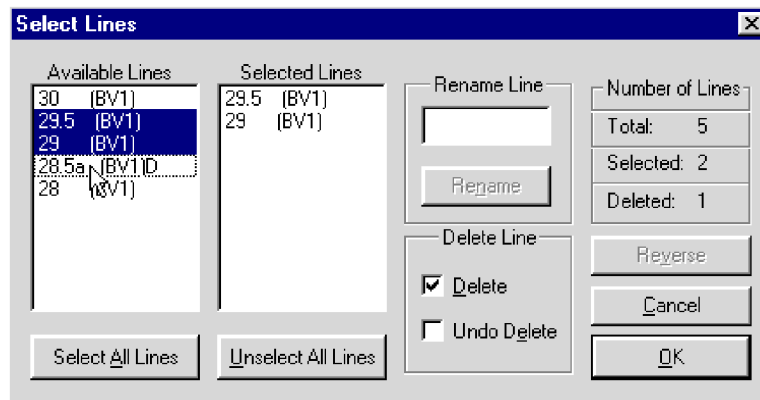
Figure 4.14: Select Lines window during Delete Line procedure

Lines can be undeleted as well. To undo previously deleted lines (as long as program is running), first click the **Undo Delete** check box. When a check mark is visible in the box 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 appropriate line name in the list box. The highlighted line name will appear in the Rename Line edit box (Figure 4.15). Enter the name and click the **Rename Line** button. The updated name will now be displayed in the line names list.
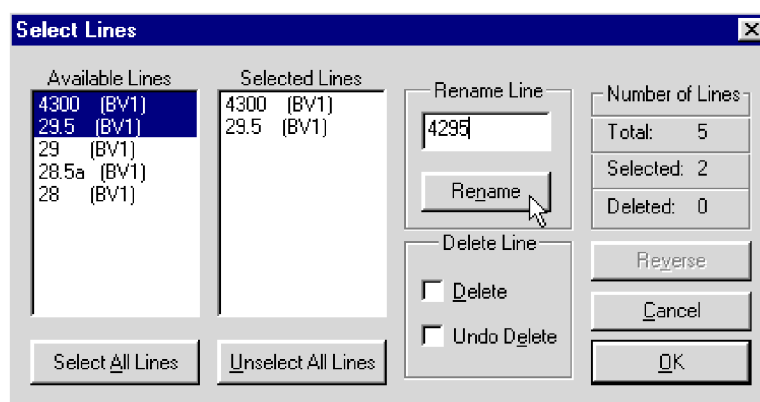
Figure 4.15: Select Lines window during Rename Line procedure

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.

4.4   Select Data Type

To select the type of data to be displayed select the **Display|Select Data Type** from the top menu (Figure 4.11) or click on the ⊞ toolbar button. The Select Data Type window will appear as shown in Figure 4.16.
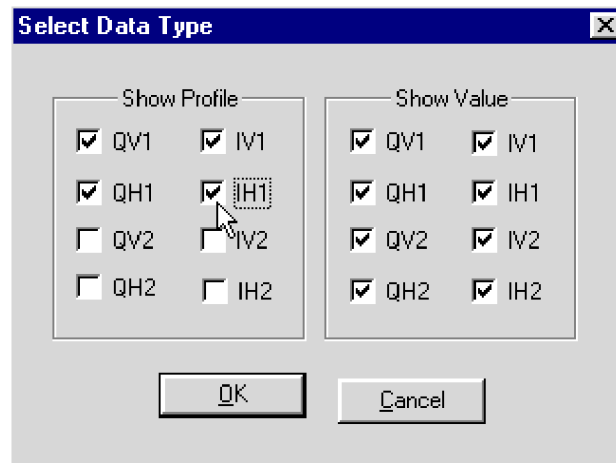
Figure 4.16: Select Channels window

The window lists all available EM38B data types. Futher, this window is divided to two sections, Show Profile and Show Value. Each section contains check boxes for all types of EM38B data. Data Type names are described by three labels which are explained below:

QV1	-	**Q**uad-phase component (conductivity),	**V**ertical Dipole mode,	Orientation **1**
IV1	-	**I**nphase component,	**V**ertical Dipole mode,	Orientation **1**
QH1	-	**Q**uad-phase component (conductivity),	**H**orizontal Dipole mode,	Orientation **1**
IH1	-	**I**nphase component,	**H**orizontal Dipole mode,	Orientation **1**
QV1	-	**Q**uad-phase component (conductivity),	**V**ertical Dipole mode,	Orientation **2**
IV1	-	**I**nphase component,	**V**ertical Dipole mode,	Orientation **2**
QH1	-	**Q**uad-phase component (conductivity),	**H**orizontal Dipole mode,	Orientation **2**
IH1	-	**I**nphase component,	**H**orizontal Dipole mode,	Orientation **2**

The Select Data Type window is divided into two sections, Show Profile and Show Value. The profile section 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 in the Show Profile section. Data Types selected in the Show Value section of the **Select Data Type** window (Figure 4.16) will be displayed in display boxes located under the toolbar. 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.

4.5   Changing Display Parameters

The display parameters can be changed by using the **Set Display Parameters** window or by employing Quick scale adjustments accessible from the tool bar. The Quick scale adjustments provide a simple and interactive means of adjusting the display parameters. The Set Display Parameters window allows for a more detailed setting of parameter while viewing the data.

Set Display Parameters Window

To open the Set Display Parameters window (Figure 4.17) select **Display|Set Display Parameters** from the top menu (Figure 4.11) or click the left mouse button on the ▦ toolbar button.
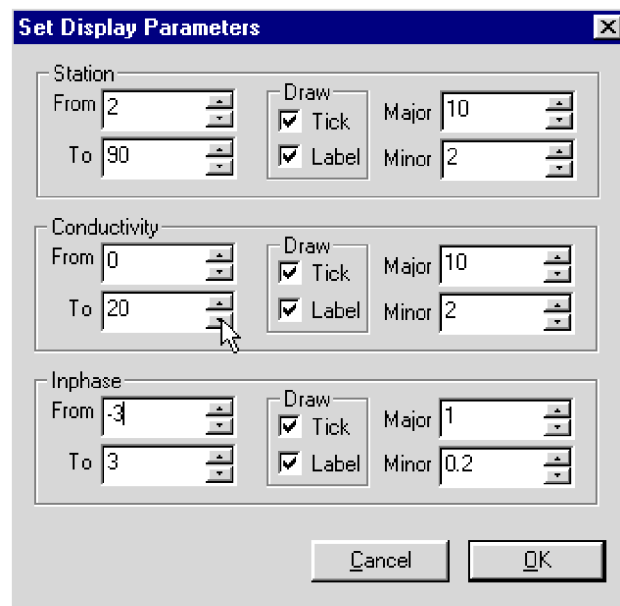
Figure 4.17: Set Display Parameters window

This option allows a range to be set for the length of the line (stations displayed), and the EM38B conductivity and Inphase amplitudes. The major and minor axis tick intervals 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.

Quick Change of Horizontal and Vertical Scales

To adjust the horizontal range of the profiles can select **Display|Change Horizontal Scale|...** in the menu (Figure 4.18), but it is much more convenient to use the buttons located on the toolbar (Figure 4.19). To access the functions click on the appropriate toolbar button.
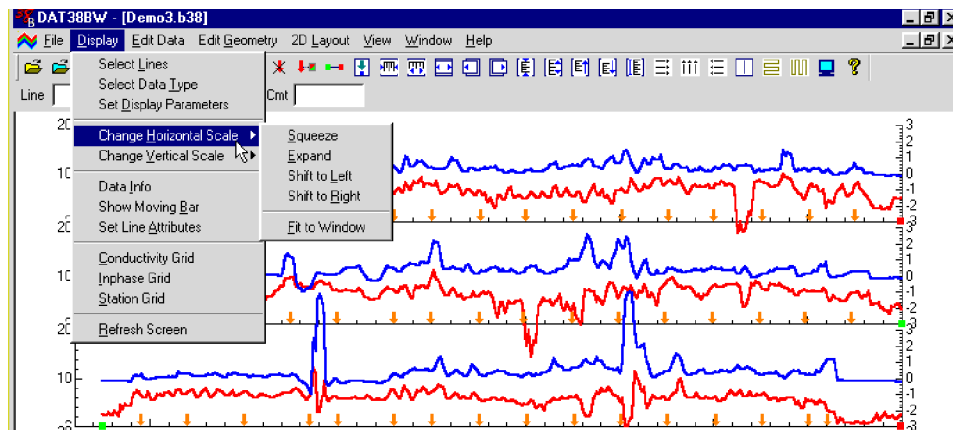
Figure 4.18: Change Horizontal Scale menu

**Figure 4.19: Change Horizontal Scale
toolbar buttons**

These options allow a quick change of the horizontal scale in increments equal to the minor tick setting (refer to the Set Display Parameters Window earlier in this section). The options are self explanatory. Buttons shown in Figure 4.19 are (from left): compress, expand, fit to the page, shift left and shift right.

To adjust the vertical parameter scale you can select the **Display|Change Vertical Scale|...** in the menu (Figure 4.20), but, as for horizontal scale, it is much more convenient to click on the appropriate toolbar buttons (Figure 4.21).
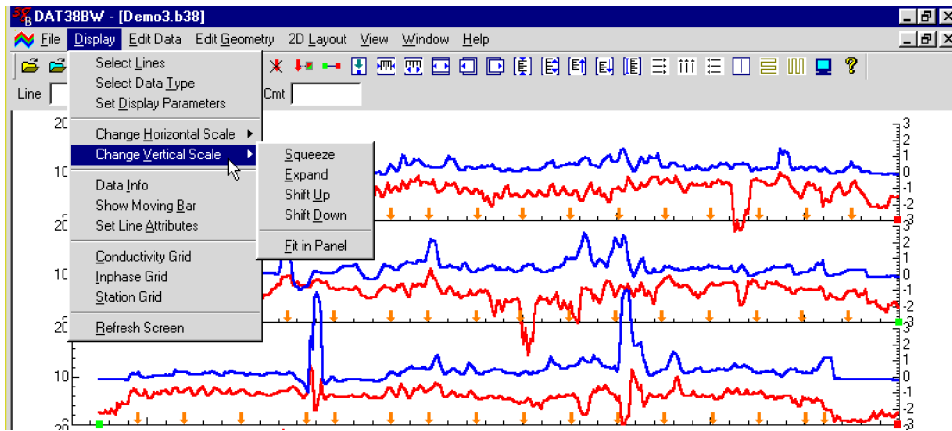
Figure 4.20: Change Vertical Scale menu

**Figure 4.21: Change Vertical Scale
toolbar buttons**

These options allow a quick change of the vertical scale in increments equal to the minor tick setting. The menu options are self explanatory. The buttons shown in Figure 4.21 are (from left): compress, expand, shift up, shift down, and scale according to the minimum and maximum values of the response.

4.6   Data Info

To obtain information about data entered into the program select **Display|Data Info** in the menu (Figure 4.20). The Data Information window that will appear is shown in Figure 4.22.

This window is divided in to four portions. The largest, top portion of the window shows Start and End station, number of readings, and availability of time stamp for each survey line. The left bottom part presents minimum and maximum values for each data type present in the data set. The right bottom part of the Data Information window shows total number of survey lines, number of readings, and minimum and maximum values for stations. At the bottom, the symbols used to denote the start and end station of each line, end of line segments, markers and comments are displayed.
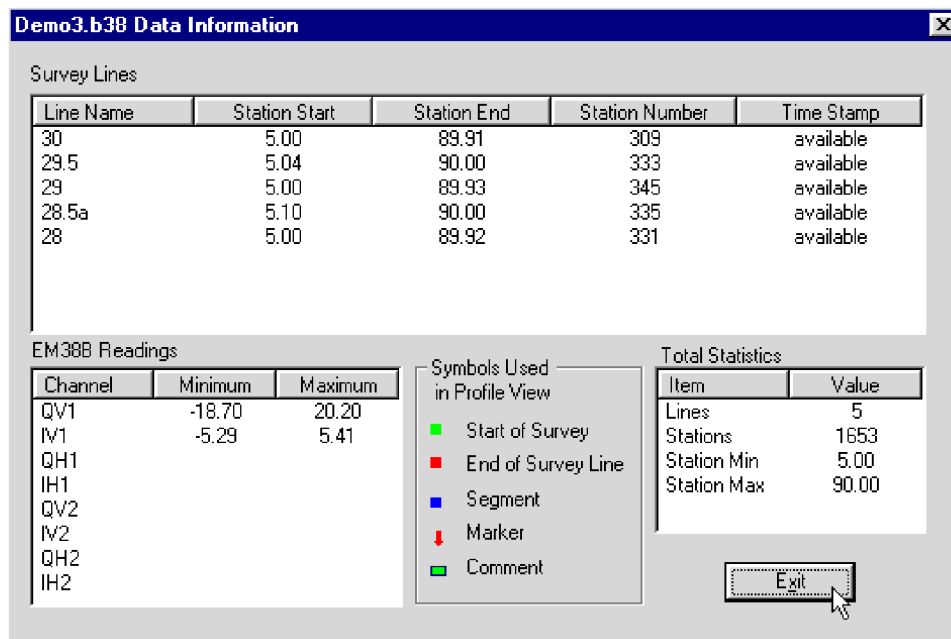
Figure 4.22: Data Information window

4.7   Grid Lines

To obtain horizontal and/or vertical lines at major ticks along the axes, select **Display|Conductivity Grid**, **Display|Station Grid** , or **Display|Inphase Grid** from the display menu (Figure 4.20). These options can also be selected by clicking on toolbar buttons [icon] , [icon] , or [icon] corresponding to Conductivity Grid, Station Grid, or Inphase Grid. The screen with grid lines is shown in Figure 4.23.
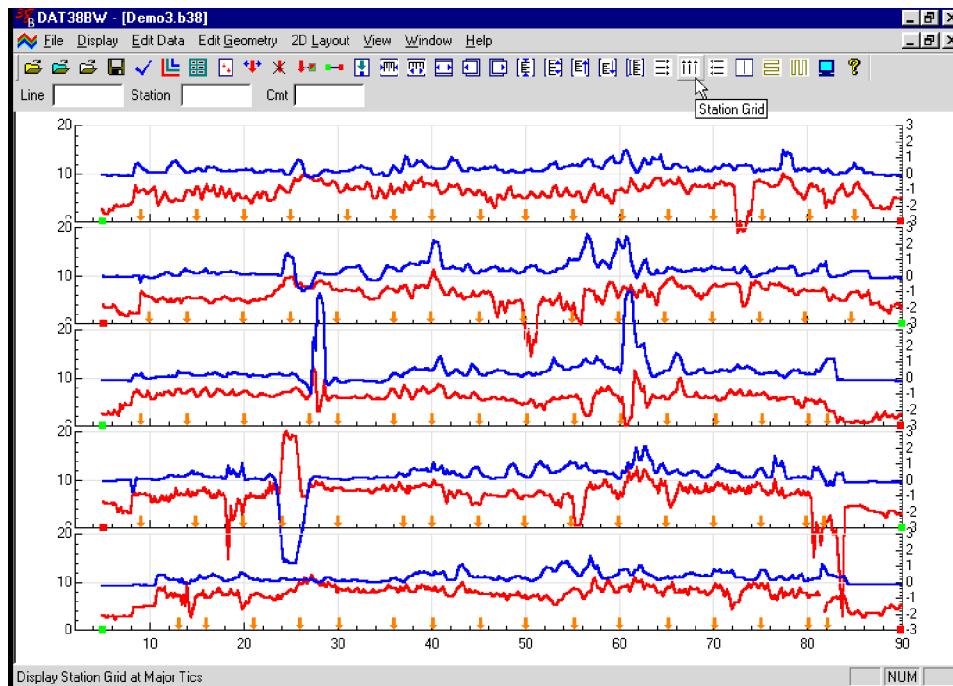
Figure 4.23: DAT38BW screen with grid lines

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.

4.8 Moving Bar

To obtain a vertical line (bar) that can be dragged by the mouse across survey lines, select **Display|Show Moving Bar** item from the top menu (Figure 4.20). Or you can click on the toolbar button . A vertical line will appear on the display (Figure 4.24). To move the line, move the mouse to the line and drag (holding the left mouse button depressed) either left or right. This option can be useful in examining the alignment of anomalies which are distributed across more than one survey line.
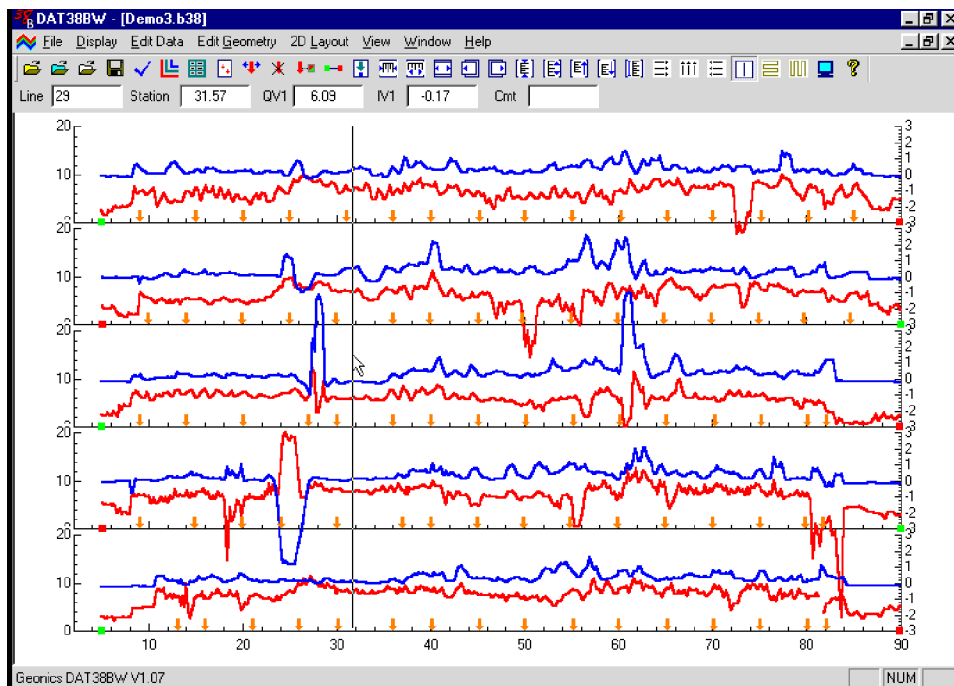
Figure 4.24: DAT38BW screen with the moving bar

4.9 Set Line Attributes

To change the colour and/or thickness of the profile lines of each channel select **Display|Set Line Attribute** from the top menu (Figure 4.20). The **Set Line Attributes** window is shown in Figure 4.25.

Each profile line is of a different type, given by the data type name indicating instrument component, dipole mode, and orientation (see section 4.4). The line types are displayed in the left list box together with samples of the lines. To change colour or thickness, click the appropriate line in the list box, then click the desired colour bar in the Colour box and thickness in the Width box. If a colour not provided in the Colour box is desired, click the **Custom** button and the Colour window with a larger selection of available colours will be displayed (Figure 4.26).
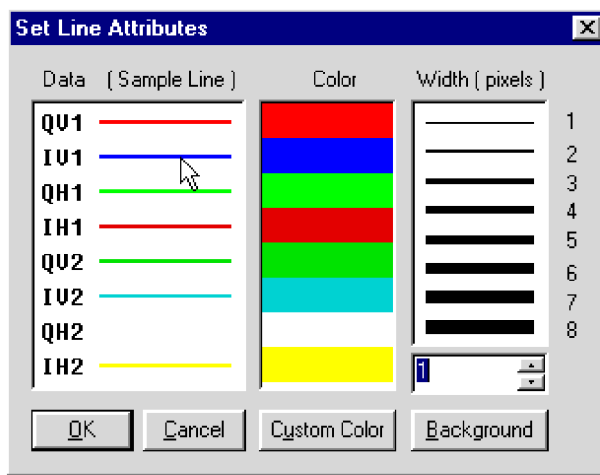
Figure 4.25: The Set Line Attributes window
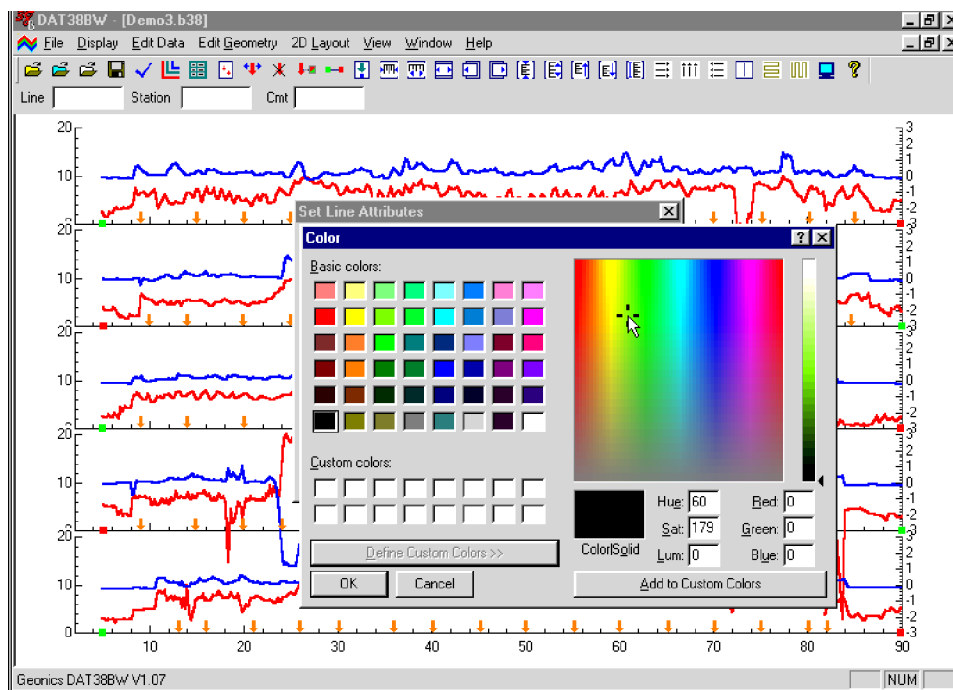
Figure 4.26: The Color window

The background colour can be changed as well. Click the **Background** button and the window shown in Figure 4.26 will appear.

After all attributes are set, click the **OK** button and the profile display will be updated. Line attributes are written to the DAT38BW initial file (DAT38BW.INI): during future executions of the program these attributes will be used as default settings.

4.10   Refresh Screen

To redraw the screen, select the **Display|Refresh Screen** item in the Display menu (Figure 4.20) or click the left button on the ▣ toolbar button. The entire screen will be redrawn immediately.

5. Editing Data

To display the Edit Data menu select **Edit Data** from the main menu at the top of the screen (Figure 5.1).
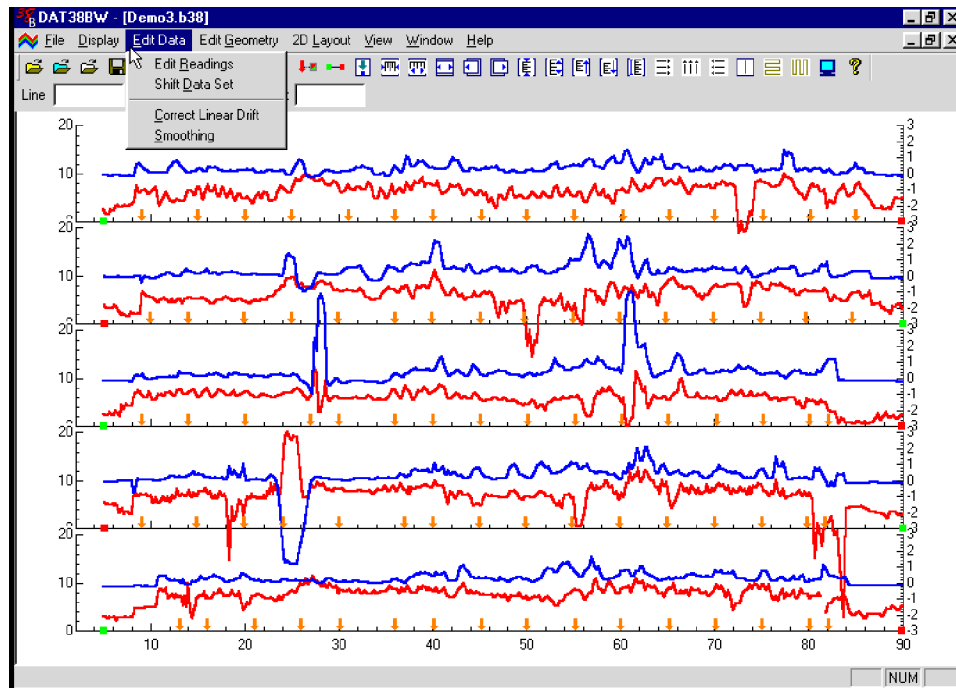
Figure 5.1: DAT38BW Edit Data menu

The Edit Data menu contains the following five items:

Edit Reading is used to display the numeric values of readings, delete selected readings, change values of any data type, and insert or remove fiducial markers.

Shift Data Set is used to increase or decrease selected channels readings for the entire data set, or selected survey lines.

Correct Linear Drift function allows you to remove linear offset for all data types.

Smoothing is used to smooth data using linear and quadratic filters.

5.1 Edit Reading

To display the Edit Reading window select **Edit Data|Edit Reading** from the main menu (Figure 5.1). The Edit Reading window is shown in Figure 5.2.
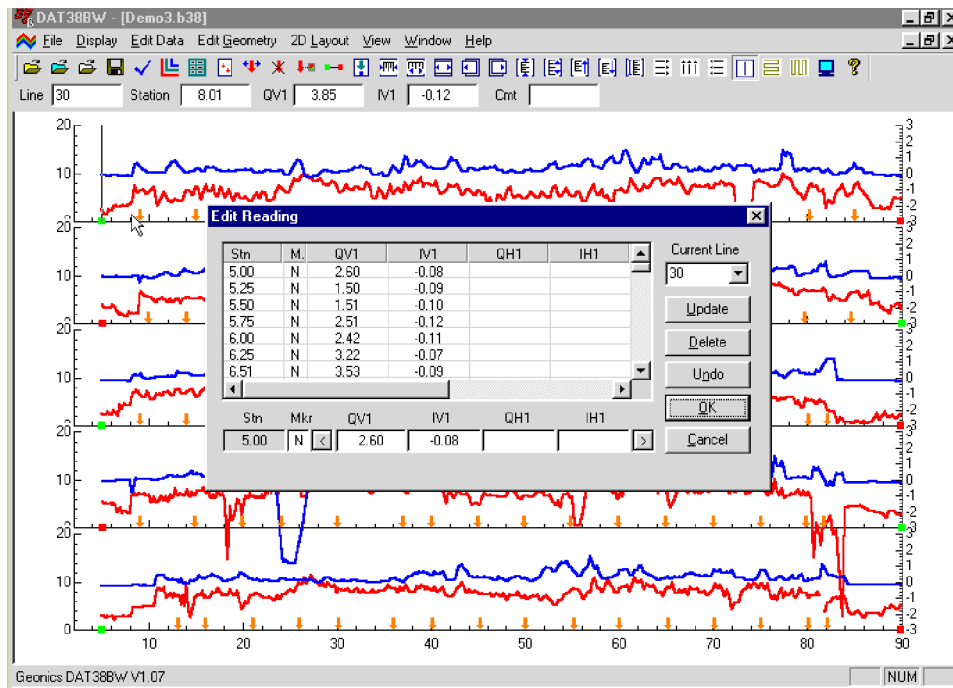
Figure 5.2:   Edit Readings window

Survey lines are selected in the section labelled Current Line. Any line can be selected by displaying a pull down list of available lines (Figure 5.3) and clicking on the one wanted. The name of the selected line is displayed in the Current Line display box.
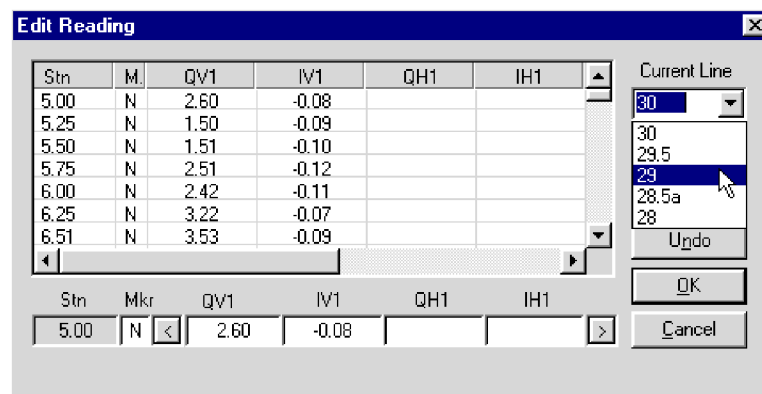
Figure 5.3:   Editing Readings window with list of Survey Lines

Readings are displayed in the list box located in the central portion of the window. Each row in this box displays: the station number **Stn**, the fiducial marker **M** (fiducial marker: N - no marker, F - marker, Y - non active marker), and **QV1**, **IV1**, **QH1**, **IH1**, and then after horizontal scrolling **QV2**, **IV2**, **QH2**, and **IH2** (readings in mS/m or ppt). The scroll bar located at the right edge is used to scroll through the stations of the selected line. Scrolling can also be performed using the keyboard Up and Down keys. A short grey bar on the profile display indicates the position of the active (highlighted) reading (Figure 5.4). A row of edit boxes with values corresponding to the selected station is located at the bottom of the Edit Readings window. These boxes are used to editing readings.

Closing the Edit Reading window with **OK**, or the close window button (right top corner of the window) will temporarily save all changes performed while the window was active. Changes can be saved permanently with the **Save** or **Save As** options (Section 4.2). Pressing the **Cancel** button will discard any editing, and data will be returned to original values.
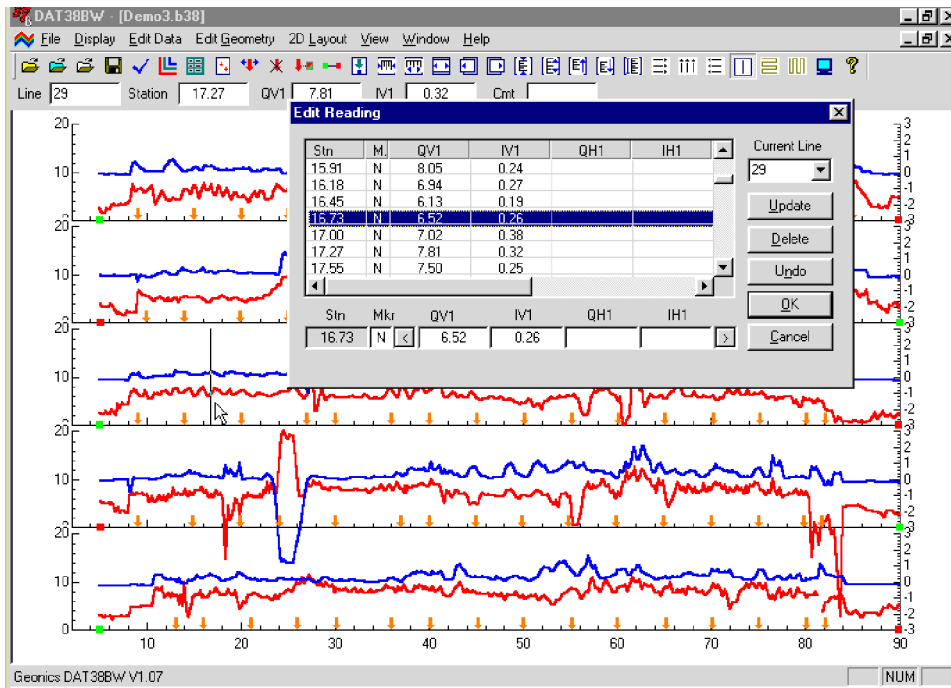
Figure 5.4:   Edit Reading window with a vertical bar indicating position of the station in the profile view.

Deleting Readings

To delete the readings at a station, click on the station in the list box of the Edit Reading window (Figure 5.4). The readings at that station will be highlighted. Then click the **Delete** button. Values for all channels at the station will be removed. Figure 5.5 shows a data set with four stations removed. Readings are removed from the profile view at the same time.
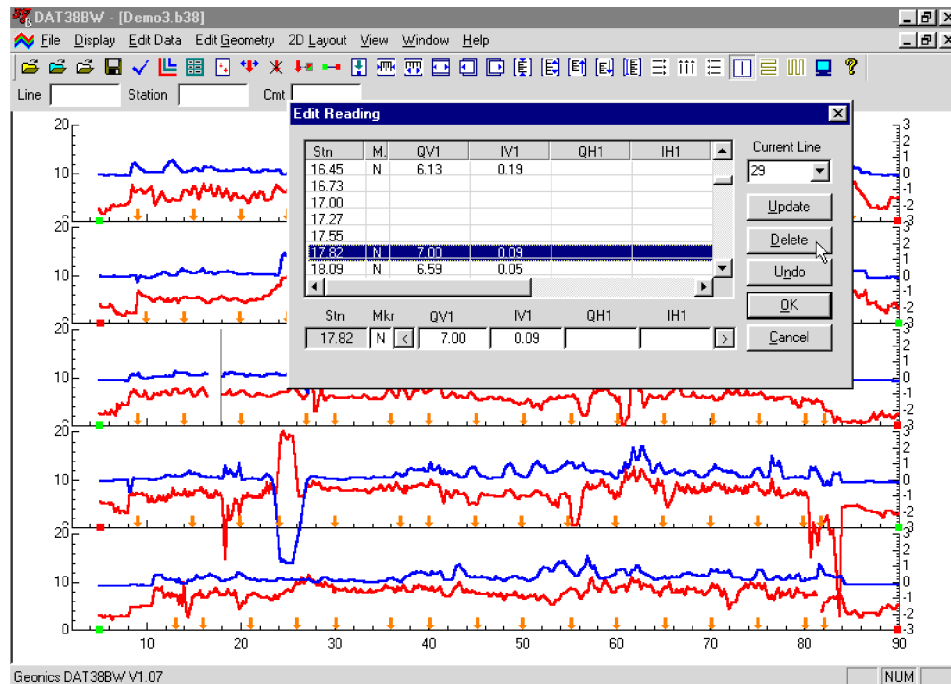
Figure 5.5:   Edit Reading window during Delete Reading procedure

The Delete Reading function can be applied to any number of stations. To undelete readings click the **Undo** button which restores removed stations one by one. The Undo function has an unlimited number of steps.

Updating Readings

To update the value of any reading, click on the appropriate station. The selected station will be highlighted. At the same time, values for the first five channels, as well as the status of the fiducial marker will be displayed in the edit boxes located in the bottom of the Edit Readings window (Figure 5.6).
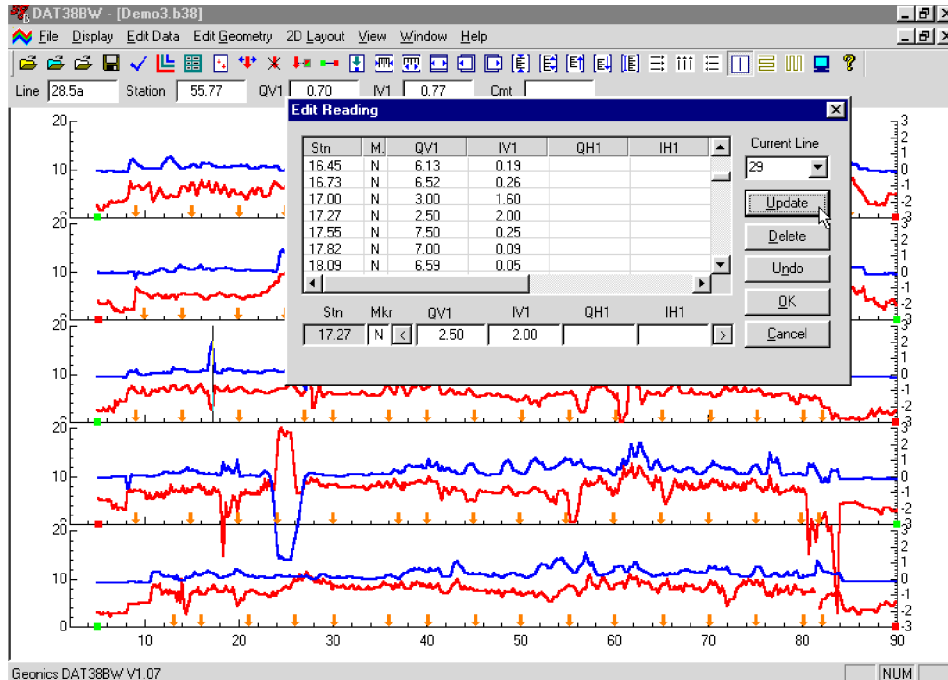
Figure 5.6:   Edit Readings window during editing value of readings

To edit any of these values, click on the appropriate edit box. After entering the new value(s) press the **Update** button. Updated values will be displayed in the station list box, and the profile view will be updated in real time (Figure 5.6).

The status of the fiducial marker can be changed using the same procedure. The character **N** indicates that no fiducial marker is associated with the station. Character **F** indicates a fiducial marker is present, and **Y** indicates that a fiducial marker is present but is not active (for the purpose of adjusting the data - see Section 6). Only active markers can be introduced in the Edit Reading window. To tag a station with a marker in the Edit Reading window just replace the character **N** (in the box labeled Mkr) by **F** or **Y**. After clicking the **Update** button the character **F** will be displayed in **M** column at the edited station. The profile display will be updated simultaneously.

Note that changes can be removed by clicking the **Undo** button. The Undo function associated with this procedure removes changes one by one and has an unlimited number of steps.

> **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 As option as discussed in Section 4.2.**
>
> **(We recommend to use Save As instead of Save, to preserve the original data.)**

5.2 Shift Data Set

To display the **Shift Data Set** window select **Edit Data** | **Shift Data Set** from the main menu (Figure 5.1). The window that will appear is shown in Figure 5.7.
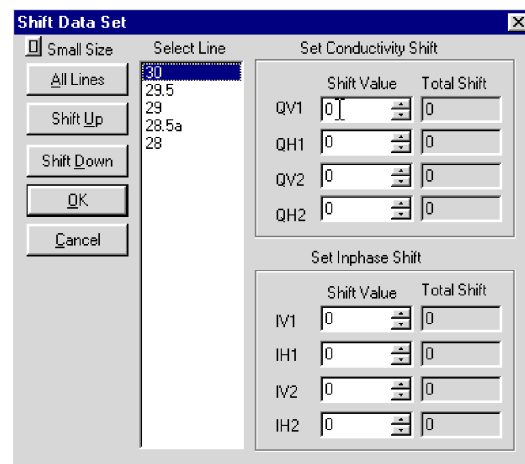
Figure 5.7: Shift Data Set window

The shifting of data function - 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. Click on the **All Lines** button to shift data for all survey lines listed in the Select Lines list box. Data is shifted in increments specified in edit boxes labeled Shift Value located in the right section of the Shift Data Set window. The increment can be set from the keyboard (after positioning the cursor in the edit box), or with the speed buttons located at the right edge of each edit box. Increment 0 causes no shift for the data.

To shift data for the selected survey lines click on the **Up** or **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 original curves will be displayed in grey. The screen with the shifted readings is shown in Figure 5.8.
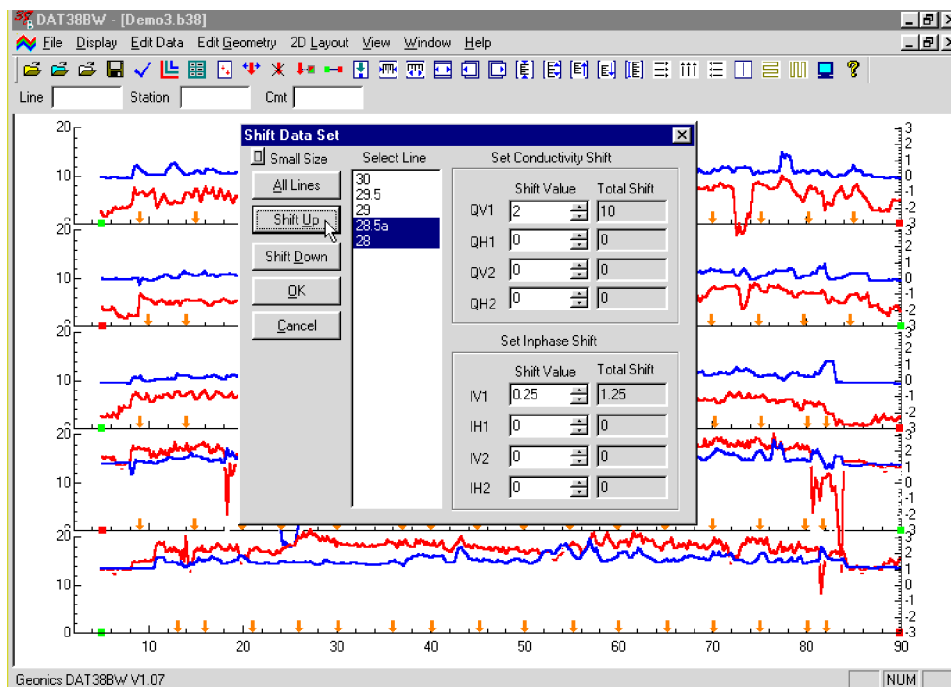
Figure 5.8: DAT38BW screen during Shift Data procedure

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5. Editing Data   **59**

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.

5.3   Linear Drift Correction

To display the Linear Drift Correction window select **Edit Data | Linear Drift Correction** from the main menu (Figure 5.1). The window that will appear is shown in Figure 5.9.
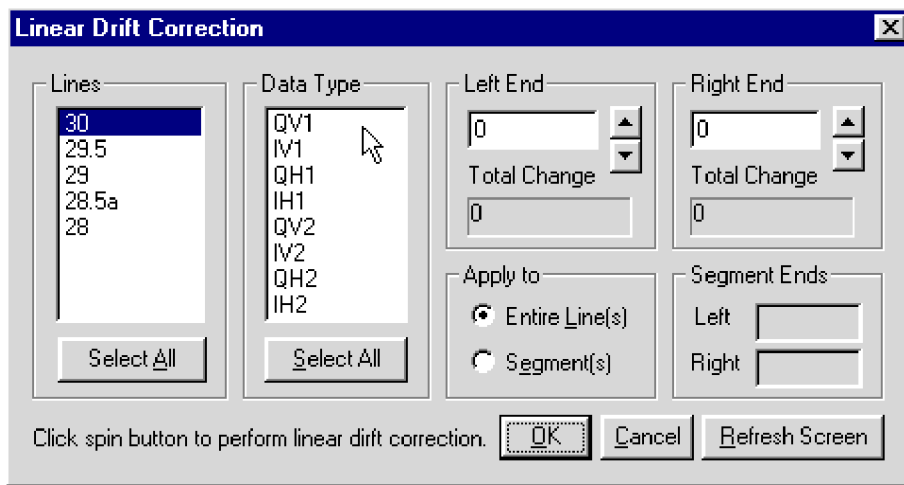
Figure 5.9:   The Linear Drift Correction window

Editing the Entire Survey Line

The linear shifting of data - to increase or decrease the values of all readings along the survey line as determined by a linear interpolation between the values at the two end points - can be applied to any number of selected survey lines. To select lines point and click the left mouse button on all appropriate lines in the list box labeled Lines. Data are shifted in increments which must be specified in the edit boxes labeled **Left End** and **Right End** located in the top right part of the window. Increments (steps) can be entered from the keyboard, after positioning the cursor in the edit box. Increment values apply to all data types. Select data to be edited in the list box labeled Data Type. Increment must be specified separately for each end station of the survey line, left and right end of the graphic display (regardless how actual Start and Final stations of the survey lines are located).

After the step is specified, data can be changed by pressing the speed buttons located at the right side of the Increment edit boxes labeled Left End and Right End. The values of steps for stations located between the start and end stations will be calculated using linear interpolation. Values of the total shift will be shown in the display boxes labeled **Total Change**. The graphic display will be updated in real time. The original curves will be displayed in grey. The screen with the shifted readings (Conductivity curve of the selected survey line) is shown in Figure 5.10.

Where results are not satisfactory, changes can be removed by clicking the appropriate speed button until the Status value displays 0.
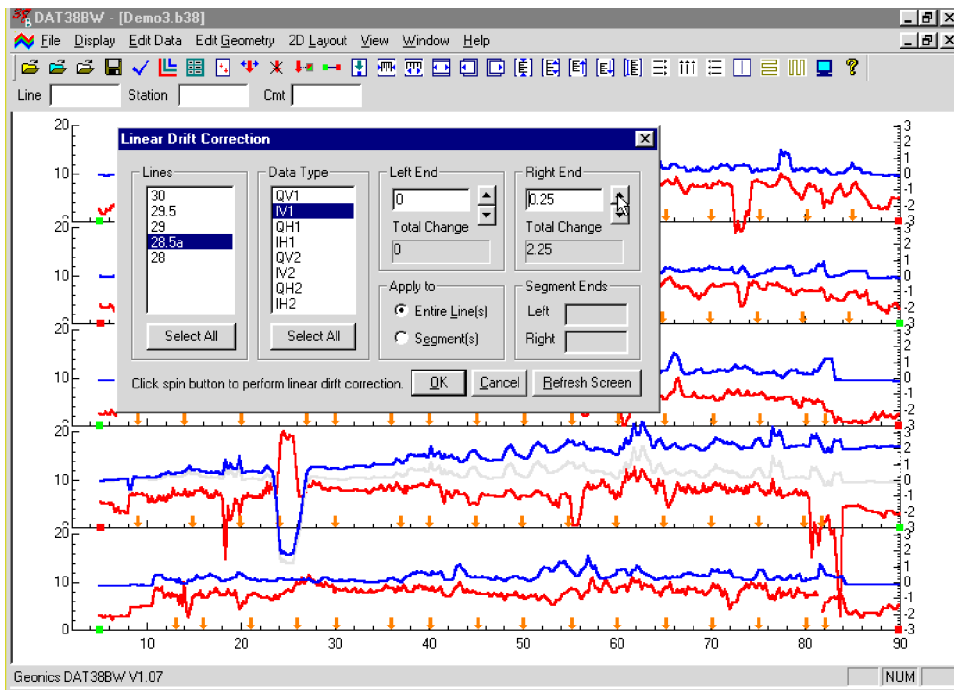
Figure 5.10: The DAT38BW screen during Linear Drift Correction for the Entire Line

Editing a Segment of the Survey line

To correct drift from within a segment of the survey line only click the **Segment(s)** button located in the **Apply to** window (Figure 5.9). The Segment Ends section will be activated as shown in Figure 5.11.
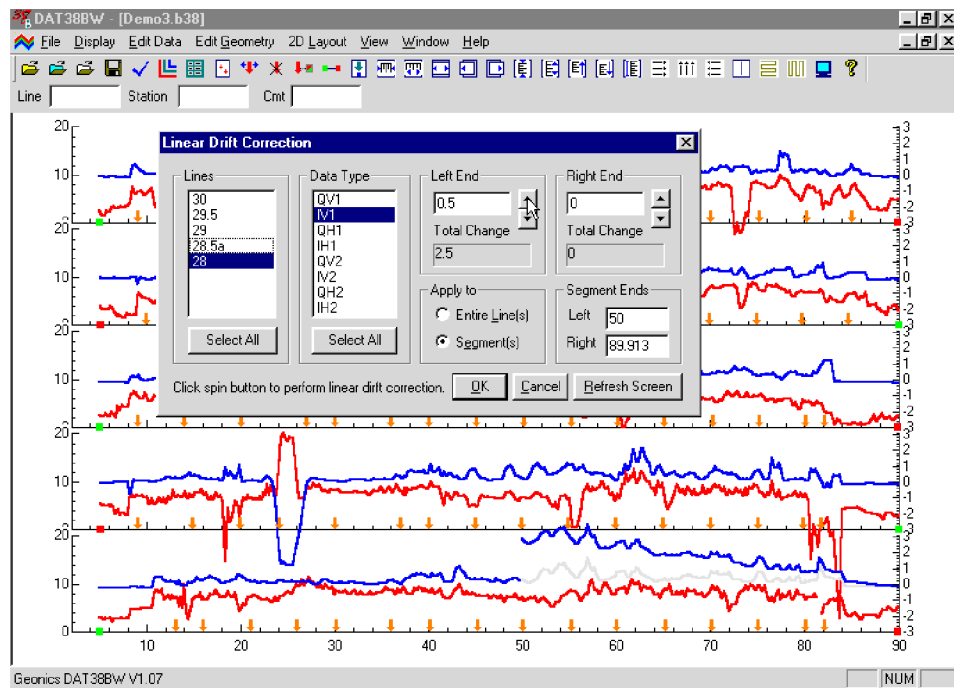
Figure 5.11: The DAT38BW screen during Linear Drift Correction of Line Segments

After specifying a segment of the survey line, the procedure is the same as for correction of the entire line. Changes will be applied only within the specified segment. An example is shown in Figure 5.11.

Closing the Linear Drift Correction window using **OK** or the close window button will temporarily save any changes in the data set.

5.4   Smooth Data

To display the **Smooth Data** window select **Edit Data|Smooth Data** from the main menu (Figure 5.1). The window that will appear is shown in Figure 5.12
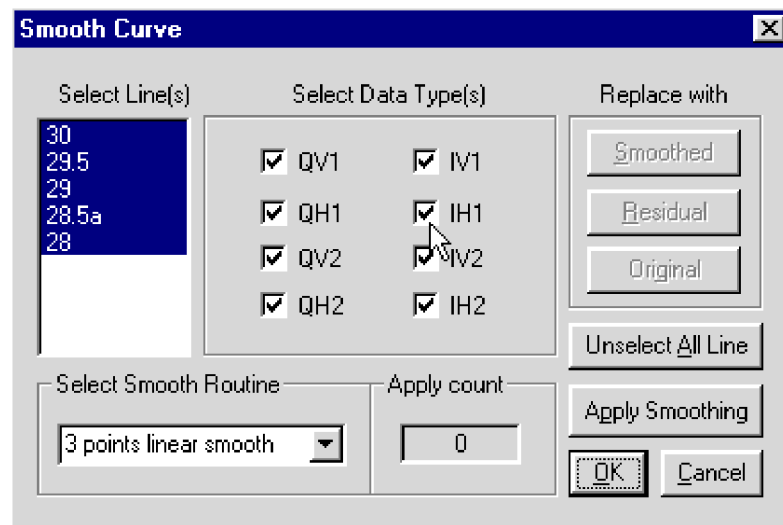

Figure 5.12: The Smooth Data window

The smoothing procedure can be applied to any number of selected survey lines and to any data type. To select lines click on all appropriate lines in the list box labeled Lines. To select data type to be smoothed click appropriate check boxes in Select Data Type(s) section of the Smooth Data window. Checking boxes labeled Conductivity or Inphase will select or deselect all data types associated with the corresponding component. 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 5.12).
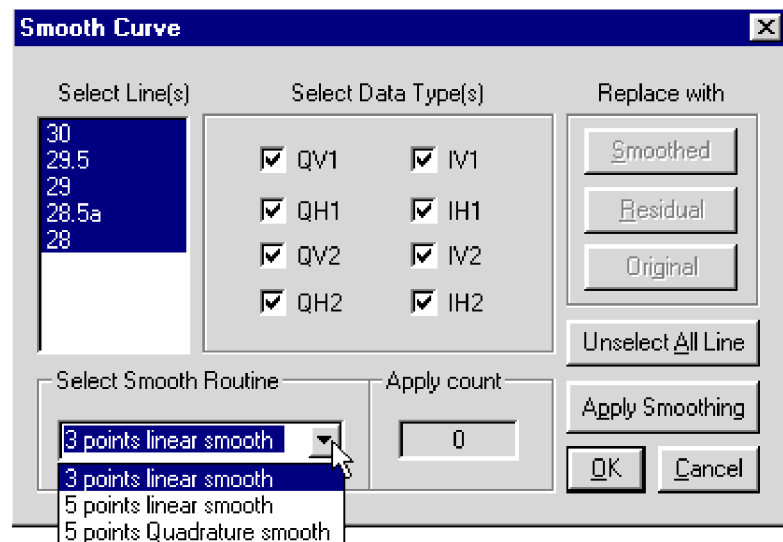
**Figure 5.13: The Smooth Data window with list of available smooth
functions.**

After the survey lines, data type and the method of smoothing have been selected, press the **Apply Smoothing** 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 the display box at the bottom of the window (left to the **Apply**

Smoothing button), labeled **Apply Count**. The graphic display is updated in real time, with the original curves displayed in grey, as shown in Figure 5.14.
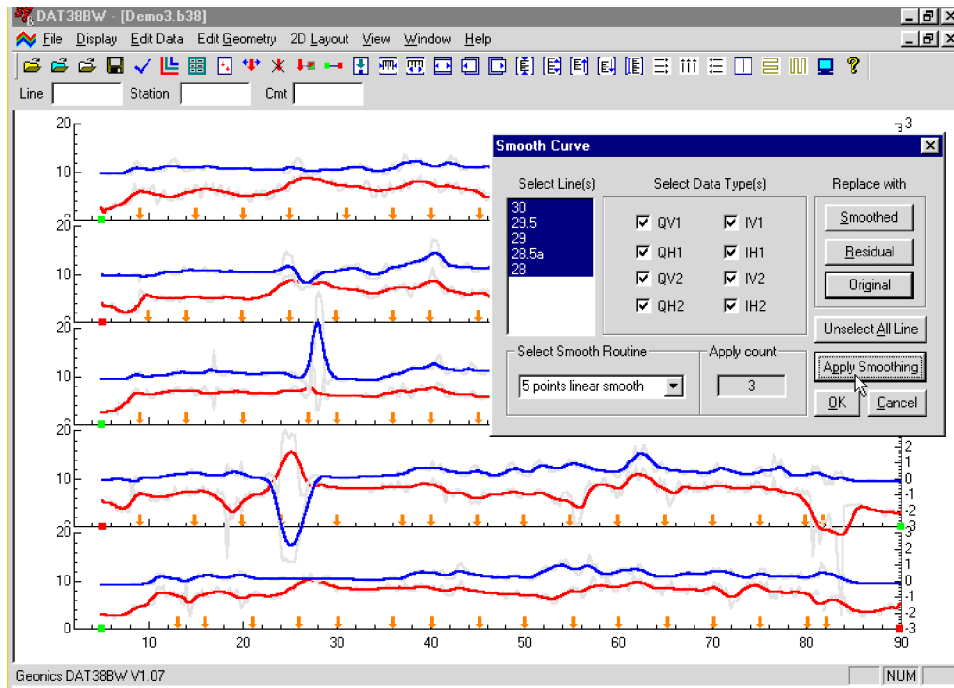
Figure 5.14: DAT38BW screen while smoothing selected data

After smoothing is applied, the buttons located in the **Replace with** window become active. The original data can be replaced with the Smoothed or Residual values at any time by pressing the corresponding button. If the smoothing result is not as desired, click on **Original** to return to the original values.

The simple, three point linear smoothing function, applied several times, is adequate for "average" EM38B data. Ultimately, however, the method of smoothing (or generating residual curves) 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 As option as discussed in Section 4.2.**
>
> **(We recommend to use Save As instead of Save, to preserve the original data.)**

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5. Editing Data

6. 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, 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 6.1).
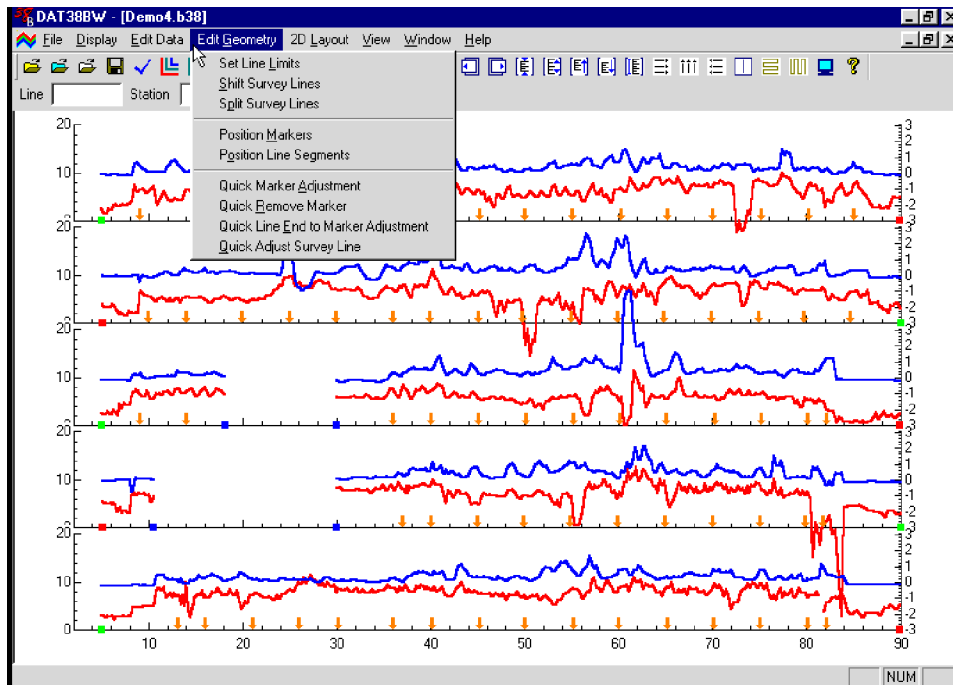
Figure 6.1: DAT38BW Edit Geometry menu

The Edit Geometry menu contains three groups of items. In the first group, **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; **Split Survey Line** will separate any related survey line into two independent survey lines.

The second group contains two items: **Position Markers** and **Position Line Segments**. **Position Markers** is an efficient tool for aligning fiducial markers and the start and end points of survey lines. **Position Line Segments** tool allows the user for adjusting positions of the segment end stations.

The third group contains four items that allow quick (although less accurate) positioning of fiducial markers, and the start and end stations of each survey line. These "quick" tools are easily accessible from buttons located on the tool bar.

The fourth group contains only one item, **Correct Time Delay**, which is a tool for adjusting station positions according to the rate of travel during data collection.

6.1 Set Line Limits

To display the **Set Line Limits** window select **Edit Geometry|Set Line Limits** in the menu (Figure 6.1). The Set Line Limits window is shown in Figure 6.2.
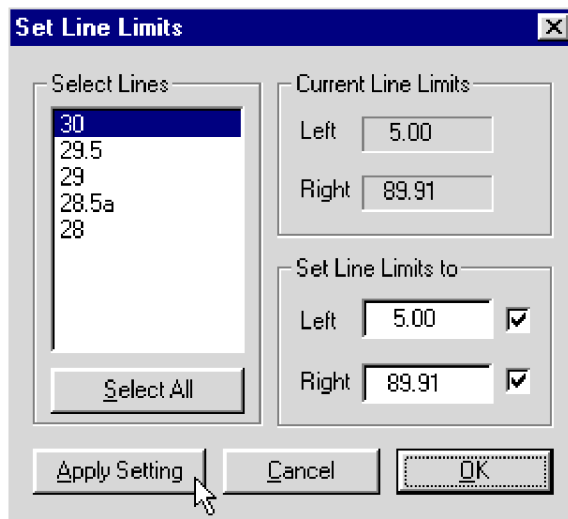
Figure 6.2: Set Line Limits window

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**.

If both edit boxes are checked (Figure 6.2), 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 6.3), the active station will be repositioned to the specified location, while the non-active station will remain unchanged.
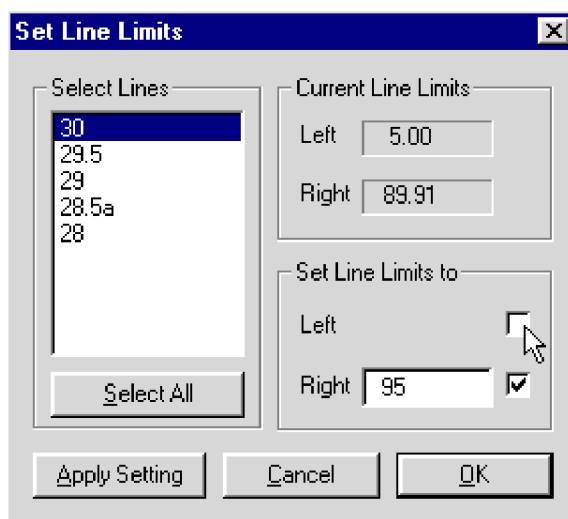
Figure 6.3: Set Line Limits window with one edit box checked

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.

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.

6.2 Shift Survey Lines

To display the **Shift Survey Lines** window select **Edit Geometry|Shift Survey Lines** from the main menu (Figure 6.1). The window is shown in Figure 6.4.
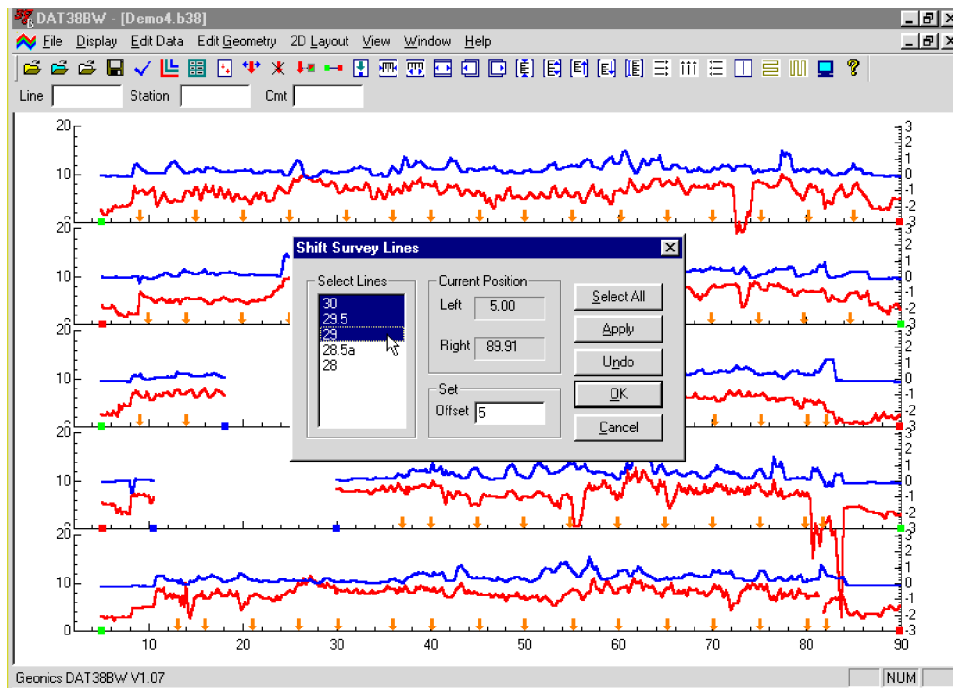
Figure 6.4:   DAT38BW screen with Shift Survey Lines window

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 Step. 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.

After the step is entered, click on **Apply** to shift the selected lines. The graphic display will be adjusted in real time. The last operation can be cancelled by clicking the **Undo** button.

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.

6.3 Split Survey Lines

To display the **Split Survey Lines** window select **Edit Geometry|Split Survey Lines** from the main menu (Figure 6.1). The window is shown in Figure 6.5.
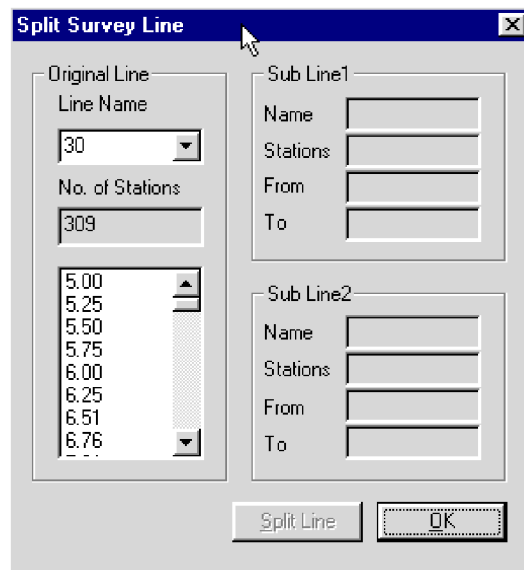
Figure 6.5: Split Survey Lines window

This option allows a survey line to be divided into two independent survey lines. The line can be further divided into any number of separate lines or segments, simply by repeating the procedure.

The line to be split is selected in the Original Line section. Click on the arrow beside the Line Name box to open the pull down list of available lines, then click on the line to be split (Figure 6.6). The number of stations in the selected line, and the positions of the stations, will be displayed below the Line Name box.
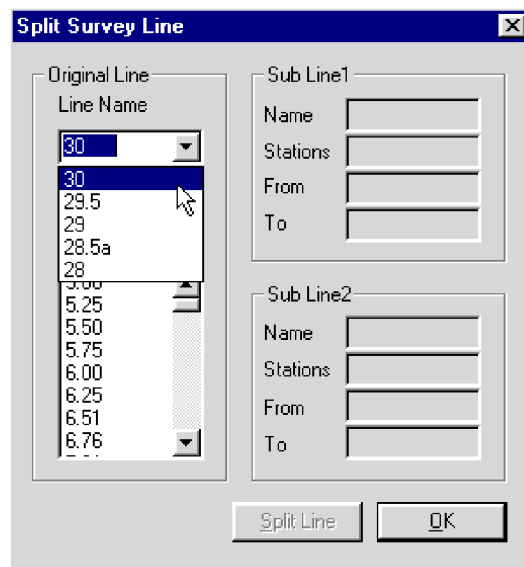
Figure 6.6: Selecting a line in the Split Survey Line window

To select the station at which the line will be split, scroll to and highlight the desired station. After splitting, the selected station will be the last station of the first line, while the next station will be the first station of the second line. This information, as well as the number of stations in each new line, is provided in the windows labeled Sub Line1 and Sub Line2 (Figure 6.7).
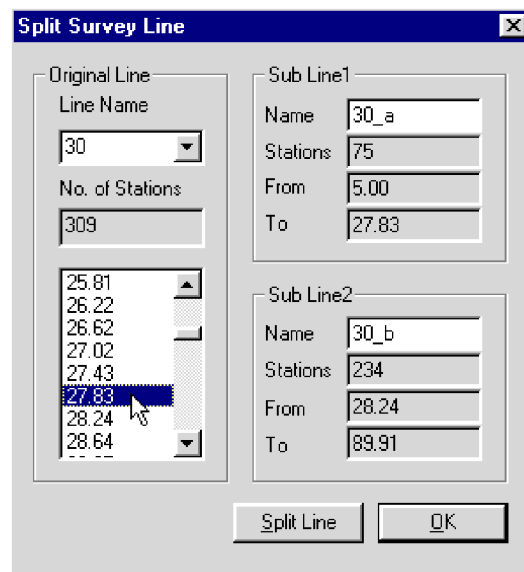
Figure 6.7:   Selecting the station in the line

A vertical bar will move along the line profile indicating the position of the selected station on screen (Figure 6.8).
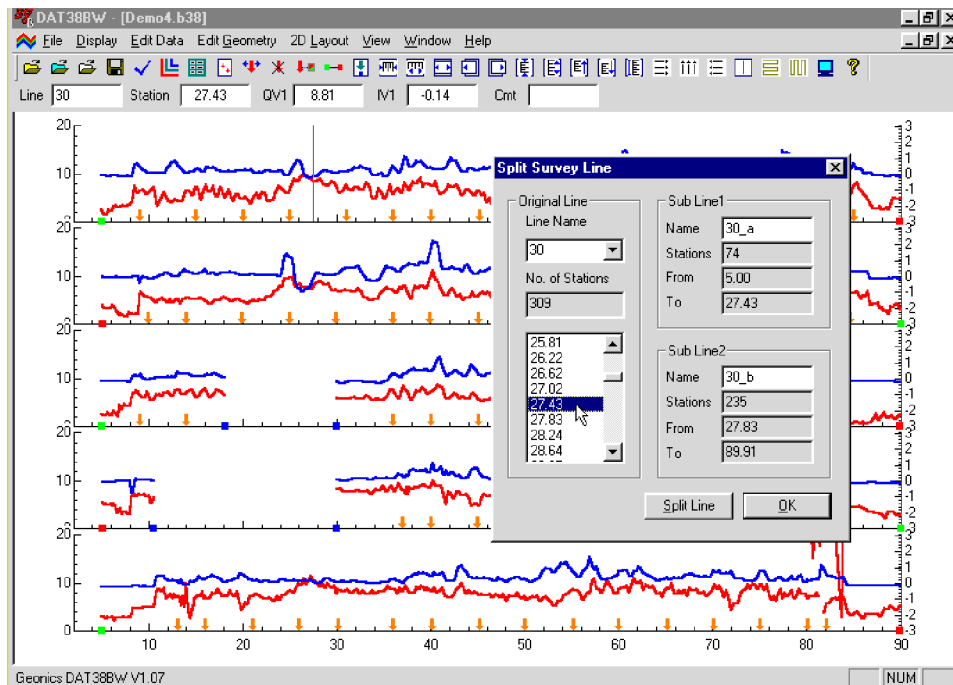
Figure 6.8:   Profile View display before survey line split

After the station is selected you can apply the split by clicking the **Split Line** button. The effect is shown in Figure 6.9.
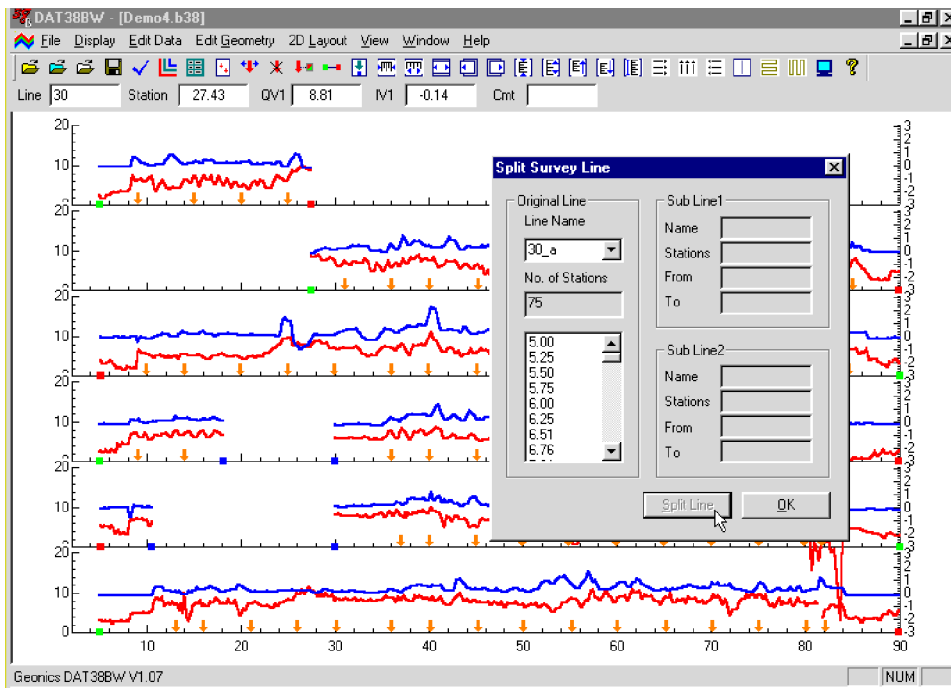
Figure 6.9:   Graphical display after survey line split

The new lines are named by using the original name with an added underscore and an alphabetic character in sequence. You can rename later using the Select Line option.

To exit click the **OK** button, and the Split Survey Line window will close, applying all changes.

6.4   Position Markers

To display the **Position Markers** window select **Edit Geometry│Position Markers** from the main menu (Figure 6.10), or click the Position Markers button 🔳 located on the tool bar. The Position Markers window is shown in Figure 6.11.
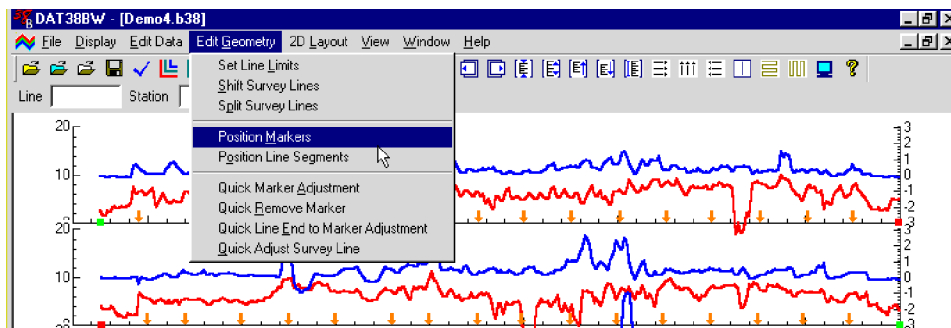
Figure 6.10: Edit Geometry menu

This option allows you to reposition fiducial points that were marked by pressing fiducial marker while logging. You can adjust a selected marker or a selected group of markers, and also change start and end stations.
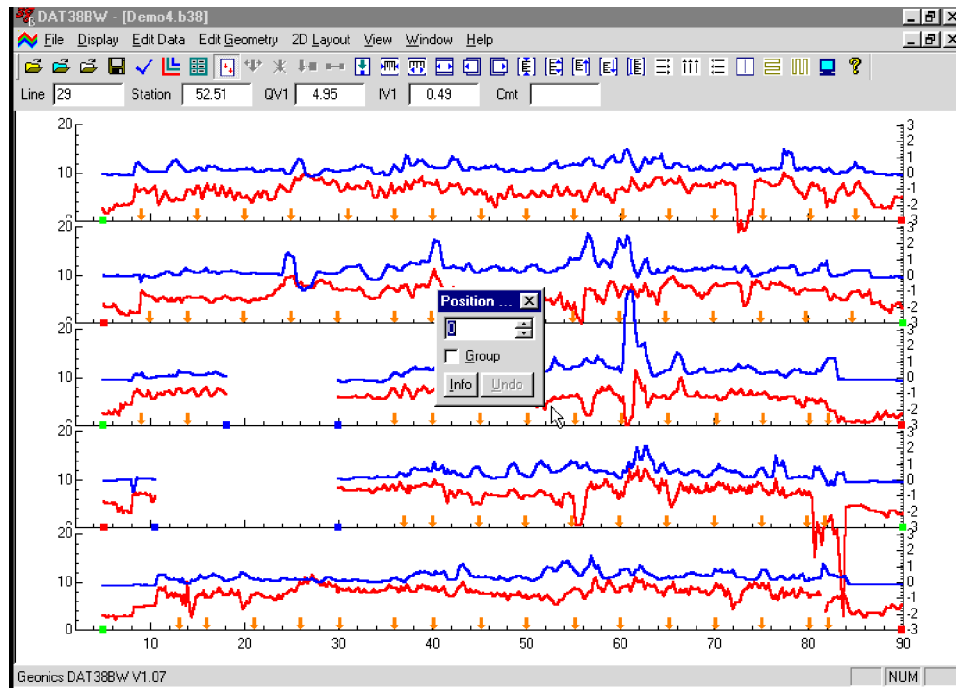
Figure 6.11: Position Markers window

The Position Marker window is simple and small in order to allow a maximum view of the profiles. An unlabeled 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 either the keyboard, or the two speed buttons.

A check box labeled **Group** is located below the edit box. The Group option is toggled on/off by clicking this box. When the check box is marked (on), repositioning will be applied to a selected group of markers. Otherwise, if the check box is unmarked (off, default) repositioning will apply to a single marker or start/ end station only.

The **Undo** button will cancel the most recently applied repositioning only. If the **Info** button is clicked a window with related help information will be displayed.

To close the window click the Close button located in the top right corner of the window, click the **Position Markers** button ⊞ on the tool bar, or uncheck the **Position Markers** item in the **Edit Geometry** menu (Figure 6.10).

Repositioning A Selected Marker

To reposition a selected marker, the **Group** box in the **Position Markers** window must be unchecked. This is the default setting. In the edit box, enter or select 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. Figure 6.12 shows a marker that was moved from station 25.00 to 30.00 in the first survey line from the top of the display.
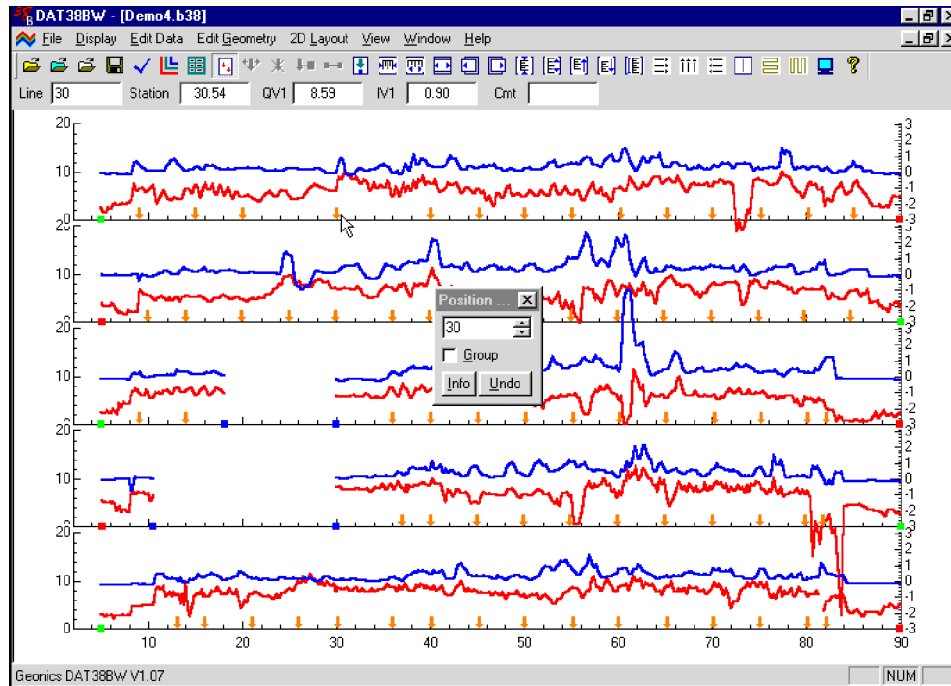
Figure 6.12: Positioning selected markers

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

Reposition a Group of Selected Markers

To reposition a group of markers the Group box in the Position Markers window must be checked. In the edit box, enter or select the position to which the selected markers (or line ends) are to be moved. Drag a rectangle around the markers to be repositioned (Figure 6.13). Position the cursor inside the rectangle and click. All markers (or start/end stations) enclosed in the rectangle will be repositioned to the station entered in the edit box (Figure 6.14), and points between adjacent markers adjusted accordingly.

The above procedure can be completed in reverse order as well. First, drag a rectangle around the selected markers, then specify the station in the edit box. Then position the cursor inside the rectangle and press the left mouse button to reposition all selected markers.

Rules for repositioning a group of markers are the same as for a single marker. The station where the markers are to be moved must not be past a neighboring marker or line end for any of the selected markers. If the specified station is beyond this range a warning will be displayed, and the affected marker will not be
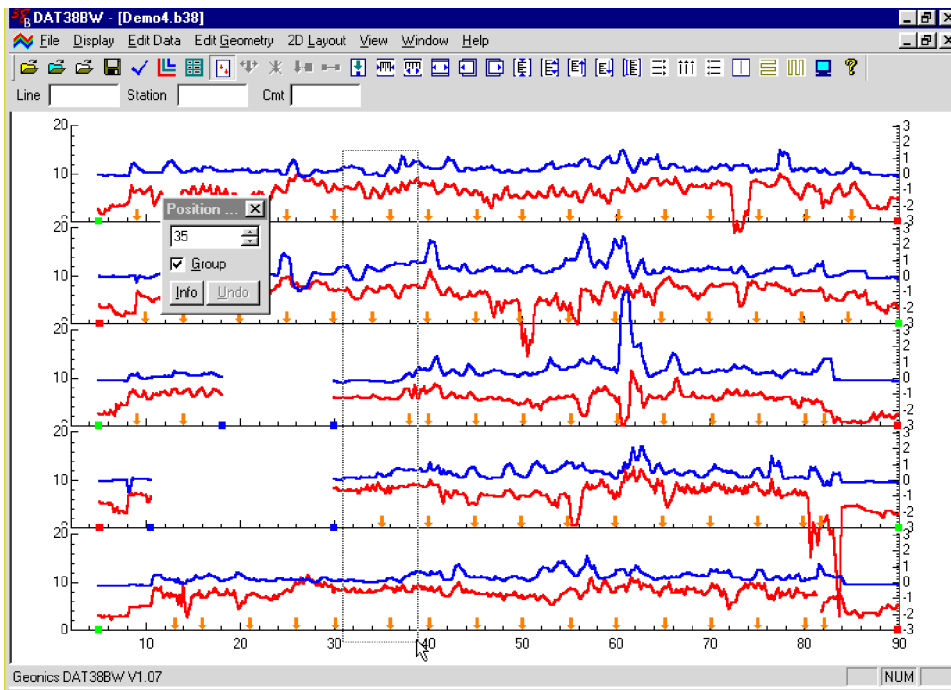
Figure 6.13: Positioning Group of Selected Markers
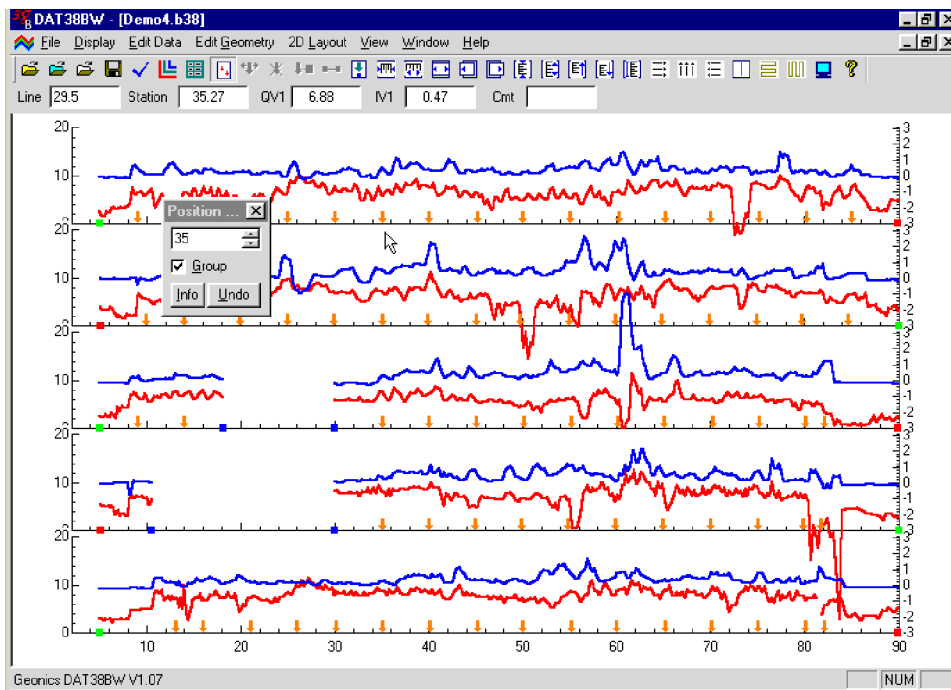
Figure 6.14: DAT38BW screen after Positioning Group of Selected Markers (see Figure above)

repositioned. In the event that a marker must be repositioned beyond the range of two neighboring markers, either reposition or delete the adjacent marker first.

Methods for adjusting profiles and fiducial markers (that's all modes) are also described in section 2.3 of this manual (Quick Start - Editing Survey Geometry), and in section 6.5 following.

6.5   Position Line Segments

To display the **Position Line Segments** window select **Edit Geometry | Position Line Segments** from the main menu (Figure 6.10), or click the Position Line Segments button 🔃 located on the tool bar. The Position Line Segments window is shown in Figure 6.15.
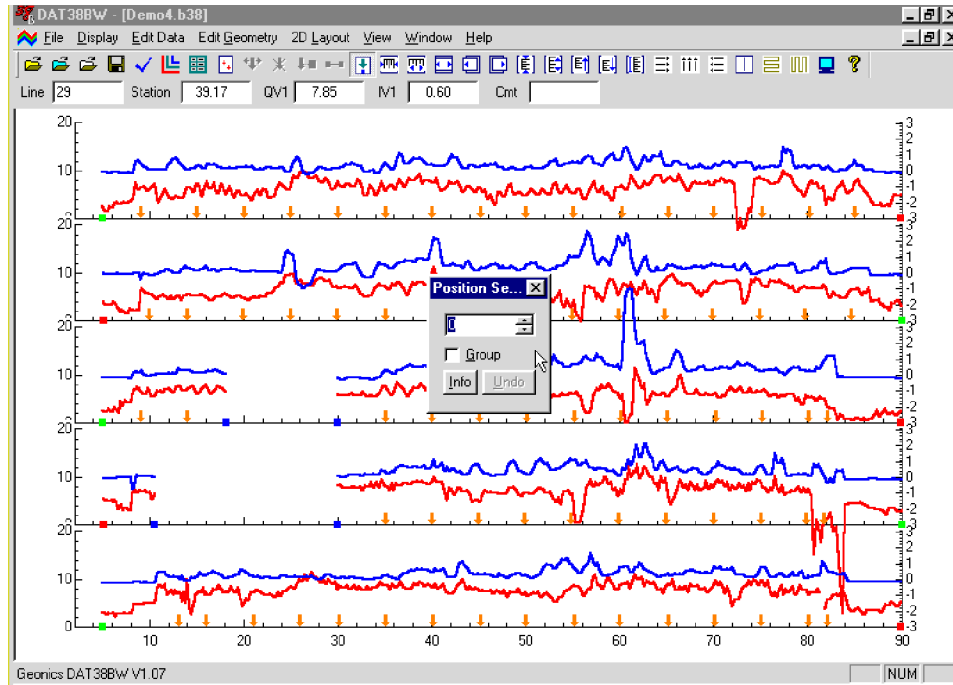

Figure 6.15:   Position Line Segments window

This option is very similar to the Position Markers function. It allows you to reposition end points of line segment. You can adjust a selected segment end point or a selected group of points, and also change start and end stations of the entire survey line.

Segments of a survey line are marked by blue squares similar to green and red points marking start and end of the survey line. Lines 29 and 28.5 (third and fourth from the top) in the example given in Figure 6.15 consist of two segments. It should be noted that changing position of line segment will change position of markers if they are present. Changing the position of start/end station or line segment will result in changing the length of the segment, regardless whether start or final station is moved.

During adjusting survey line geometry when markers and segments of the line are present the following procedure should be used. First adjust both ends of the survey line, then position end stations of each segment of the line, and at the end position fiducial markers.

This option is very similar to the Position Markers function. It allows you to reposition the end points of a line segment. You can adjust a selected segment end point or a selected group of points, and also change the start and end stations of the entire survey line.

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

A check box labeled **Group** is located below the edit box. The Group option is toggled on/off by clicking this box. When the check box is marked (on), repositioning will be applied to a selected group of markers.

Otherwise, if the check box is unmarked (off, default) repositioning will apply to a single marker or start/ end station only.

The **Undo** button will cancel the most recently applied repositioning only. If the **Info** button is clicked a window with related help information will be displayed.

To close the window click the Close button located in the top right corner of the window, click the **Position Line Segments** button ⬍ on the tool bar, or uncheck the **Position Line Segments** item in the **Edit Geometry** menu (Figure 6.10).

Repositioning a Selected End of Line Segment

To reposition a selected end station of the line segment, the **Group** box in the **Position Line Segments** window must be unchecked. This is the default setting. In the edit box, enter or select a position to which the end station is to be moved. Position the mouse cursor on (or near) the selected station (marked by blue square) to be moved and click. The selected end station of the line segment will be repositioned to the station entered in the edit box. All markers included in this segment will be adjusted accordingly. Figure 6.16 shows an end of segment station that was moved from station 10.5 (Figure 6.15) to 20 in the fourth survey line from the top of the display.
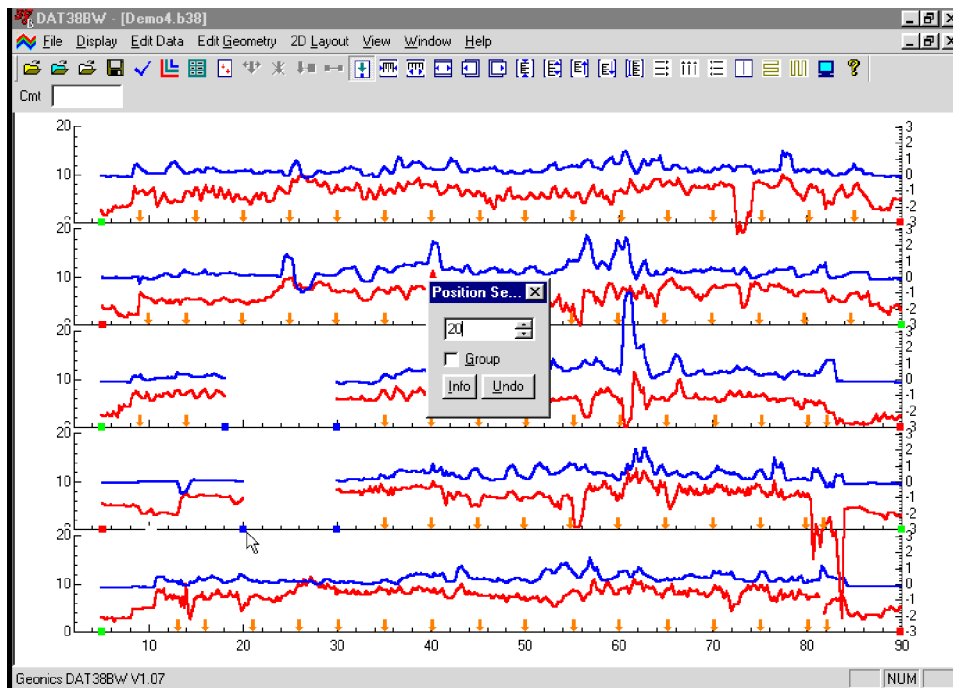
Figure 6.16:   Positioning selected end of the line segment

Please note that the end station of the line segment can be moved past another segment end points. In this case care should be taken which end points correspond to the particular line segment.

Reposition a Group of Selected Segment End Stations

To reposition a group of line segment end stations the Group box in the Position Line Segments window must be checked. In the edit box, enter or select the position to which the selected stations (or line ends) are to be moved. Drag a rectangle around the stations to be repositioned (Figure 6.17). Care should be taken that neighbouring end stations of two segments of the same sutrvey line are not included in the rectangle. Position the cursor inside the rectangle and click. All end stations of the line segments (or start/end sta-

tions) enclosed in the rectangle will be repositioned to the station entered in the edit box (Figure 6.18). Markers located in the modified line segment will be adjusted accordingly.
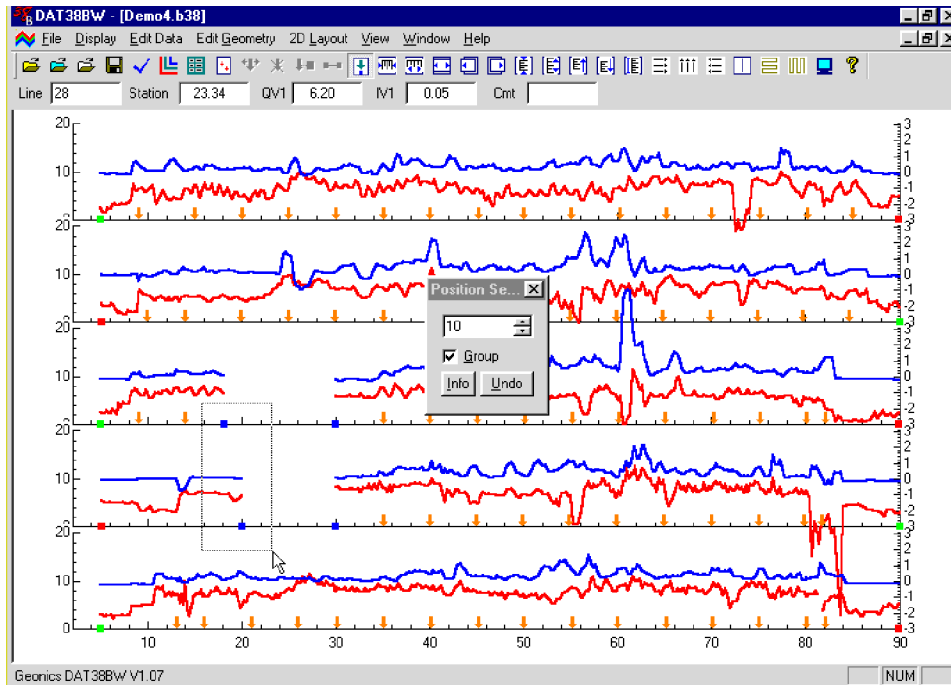
Figure 6.17: Positioning group of end stations
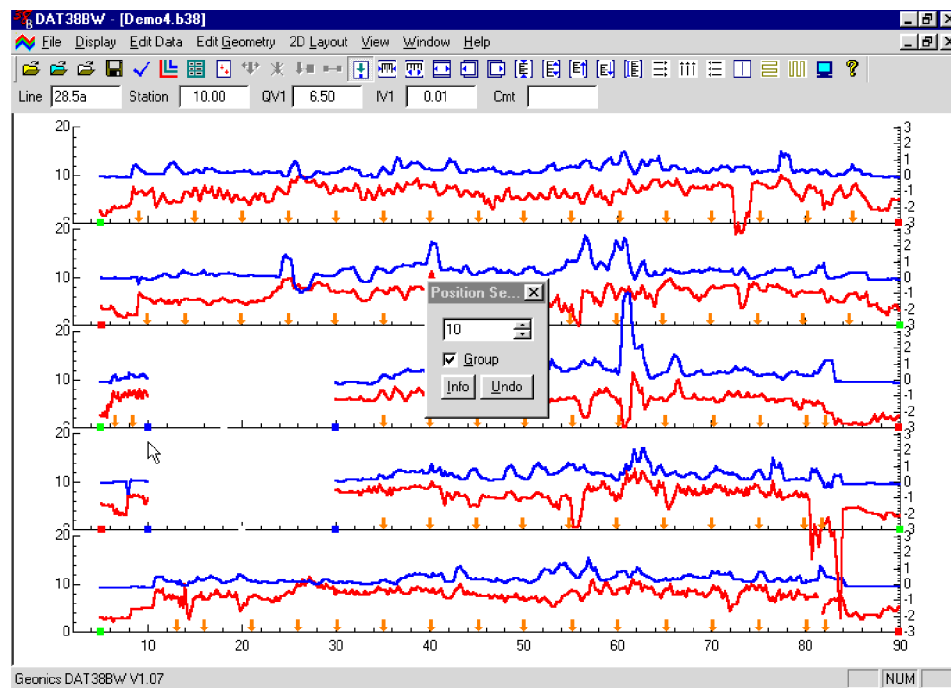
Figure 6.18: DAT38BW screen after positioning group of selected end stations (compare Figure 6.17)

The above procedure can be completed in reverse order as well. First, drag a rectangle around the selected stations, then specify the station in the edit box. Then position the cursor inside the rectangle and press the left mouse button to reposition all selected stations.

6.6   Quick Marker and Profile Adjustments

The Edit Geometry menu provides four tools for quick adjustments of start and end stations, and for deleting and repositioning fiducial markers (Figure 6.19).
These are:

  Quick Marker Adjustment

  Quick Remove Marker

  Quick Line End to Marker Adjustment

  Quick Adjust Survey Line

The accuracy of the "quick" repositioning of markers and stations is relatively limited compared to the **Position Markers** option (described in section 6.4) due to the limited resolution of the screen. They are very useful, however, for the initial adjustments of survey geometry.

To access any of these tools select **Edit Geometry|Quick...** in the menu (Figure 6.19), or click the appropriate buttons, , , , or , on the tool bar.
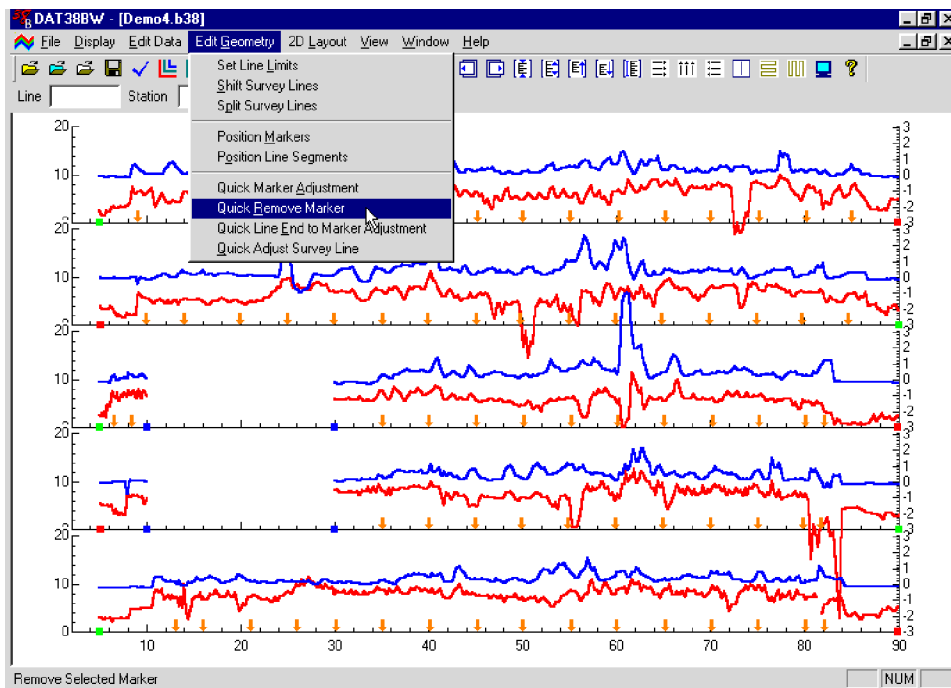
Figure 6.19: DAT38BW Edit Geometry menu

Quick Marker Adjustment

Select **Quick Marker Adjustment** in the Geometry menu, or click the   button on the tool bar. Position the cursor over the marker, then press and hold the left mouse button, and drag the marker along the survey line. The marker cannot be moved beyond a neighboring marker or line end.

Quick Remove Marker

Select **Quick Remove Marker** in the Geometry menu or click the ✗ button on the tool bar. Position the cursor over the marker, and click. A window confirming deletion (Yes/No) will be displayed. After confirmation the marker will be deleted. This tool has no Undo feature.

Quick Line End to Marker Adjustment

Select **Quick Line End to Marker Adjustment** in the Geometry menu or click ⊹ on the tool bar. This option adjusts the section of line between a line end and the closest fiducial marker. Position the mouse over the start or end station of the survey line (marked by small green (start) or red (end) circles). Press and hold the left mouse button, and drag the line end to the desired position. The position of the end will be changed without affecting the closest marker, and points in between will be adjusted accordingly.

Quick Adjust Survey Line

Select **Quick Adjust Survey Line** in the Geometry menu or click the ⊟ button on the tool bar. This option allows adjustment of the start and end stations of each survey line. To reposition any line move the mouse cursor to the start or end station of the line, marked by a small green (start) or red (end) circle Press and hold the left mouse button, and drag the station to the desired position. The positions of all points on the line will be changed according to the following rules:

If the start station is repositioned, the entire line will be shifted without changing the length of the survey line. The end station will move as well.

If the end station is repositioned, the end station will move while the start station remains fixed. The length of the survey line and distance between stations (increment) will be changed (expanded or squeezed) accordingly.

7. 2D Layout (Create XYZ File)

The **2D Layout** option lets you create and view two dimensional layouts of survey lines. The **View Survey Layout** option requires that the survey line names indicate one of the coordinates, X or Y (Easting or Northing) and stations along the lines are associated with the other coordinate. **Create XYZ File** lets you generate files with any configuration of survey lines, including Arbitrary Orientation, however this procedure is relatively time consuming since it requires manual entry of coordinates for two points per survey line. 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. 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.

To display the 2D Layout menu select **2D Layout** in the main menu at the top of the screen (Figure 7.1).
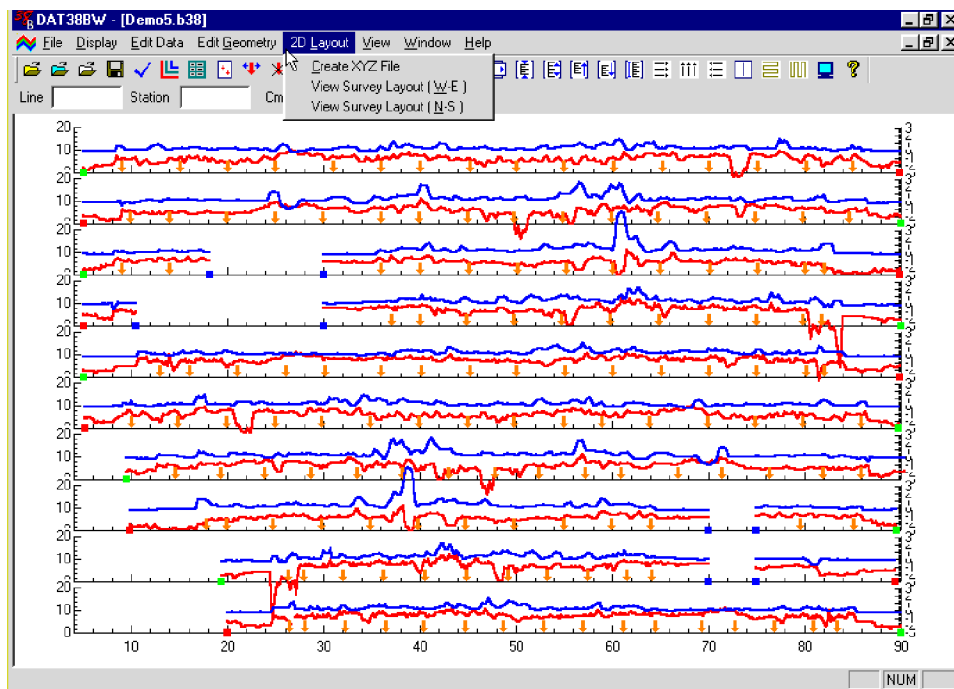
Figure 7.1:   DAT38BW 2D Layout menu

The menu contains three options. The first, Create XYZ File generates an XYZ file which can be used as an input file for various contouring systems.

The two remaining options, **View Survey Layout (W-E)** and **View Survey Layout (S-N)**, can be used to view a two dimensional layout of stations for surveys (or a portion of a survey) carried in the W-E direction (along the X coordinate) and in the S-N direction (along the Y coordinate). These last two are also accessible through buttons and located on the tool bar.

The two View Survey Layout options show a two dimensional layout of stations and survey lines. Each station is represented by a dot on the screen. At this point you can visually examine the configuration of the layout and correct it if necessary.

7.1   Create XYZ File

This option creates a file containing three columns: X, Y, Z (where Z corresponds to e.g. Conductivity in [mS/m] depending on the Create XYZ File settings) in ASCII format. This file can be used as an input file for the GEOSOFT or SURFER contour packages (or any other, if a multiple column format is suitable). Data must be entered first under the **Load EM38B Profile File** or **Add** menu before running this option.

You can convert data directly to an XYZ file format by selecting the **2D Layout|Create XYZ File** menu option, or alternatively, the layout of the survey can first be examined by selecting the **2D Layout|View XYZ** menu, or by clicking the **View XYZ (W-E)** or **View XYZ (N-S)** button on the tool bar. The view XYZ option shows a two dimensional layout of stations and survey lines oriented either in the W-E or N-S directions. Each station is represented by a dot on the screen. At this point you can examine the configuration of the layout visually and correct it if necessary.

After you select the **2D Layout|Create XYZ File** from the profile menu the Create XYZ File window is displayed (Figure 7.2).
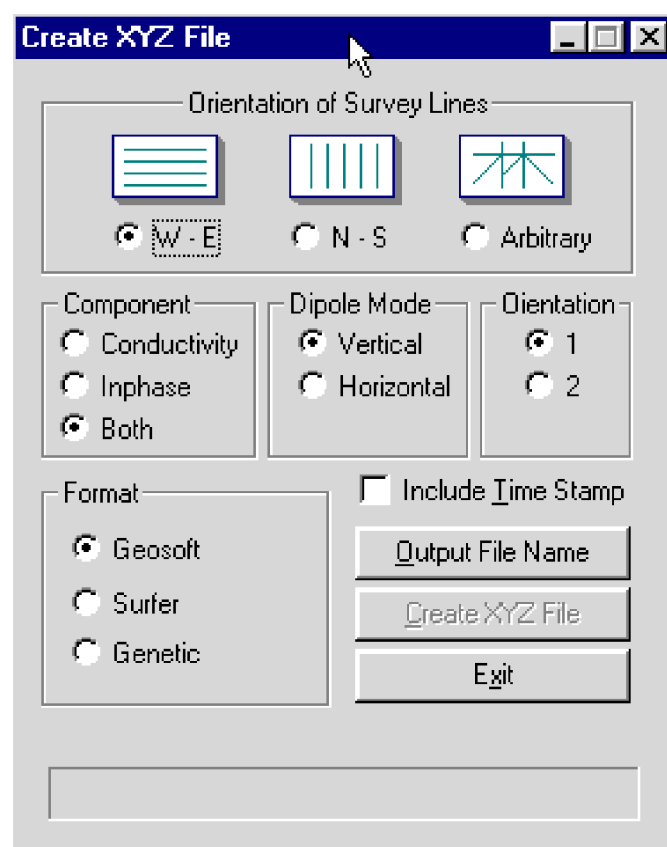
Figure 7.2:   Create XYZ File window

Parameters Describing Contents and Format of XYZ File

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 EM38B 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 button.

Orientation of Survey Lines

Choose **W-E**, **S-N**, or **Arbitrary** orientation of the survey lines. The W-E orientation corresponds to a layout where lines are parallel and oriented in the X direction. For example, the North and Y coordinates point to the top, and the East and X coordinates point to the right edge of a page. For S-N orientation the lines are parallel to and oriented in the Y direction. The Arbitrary option is designed for layouts where survey lines are not parallel.

If W-E orientation is selected, it is assumed that the line name is 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 the line names do not correspond to the Y coordinate, then rename the lines in the Select Lines window (see section 4.3). It should be noted that if the line name starts with a number and ends with letters, i.e. 10N, only the number will be recognized as a Y coordinate.

If 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 the line names do not correspond to the X coordinate, then rename the lines in the Select Lines window (see section 4.3). It should be noted that if the line name starts with a number and ends with letters, i.e. 10E, only the number will be recognized as an X coordinate.

The Arbitrary option is used only in the case where lines are not parallel. A description of creating the XYZ file while using this option is given separately at the end of this section.

Format

Check the appropriate option according to the contouring software to be used. The Generic option will create a three or more column file (see Channels above) without any text strings. This file can be used as an input file for many contouring packages (including Geosoft and Surfer). The Geosoft format will cause the program to write LINE # at the beginning of each survey line, which is necessary if the Geosoft BIGRID module is used to grid the data.

Output File Name

When you click **Browse**, a Select XYZ File Name window is displayed, as shown in Figure 7.3.
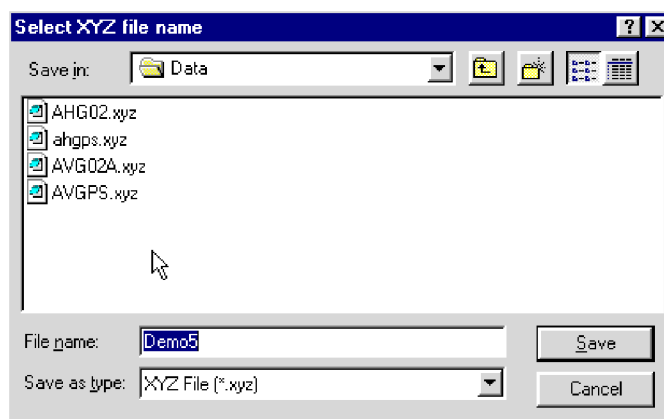
Figure 7.3: Select XYZ File Name window

The original EM38B file name with an extension corresponding to the selected output file format (xyz, dat, or asc) is given as a default. Accept the default or specify a new file name and click the **Save** button. The Select XYZ File Name window will close and the selected file name will be displayed at the bottom of the Create XYZ File window. At the same time the **Create** button is activated.

Data Type

To select channels to be written in the output file click on the proper radio button in the Select Data Type section of the Create XYZ File window as shown in Figure 7.4.
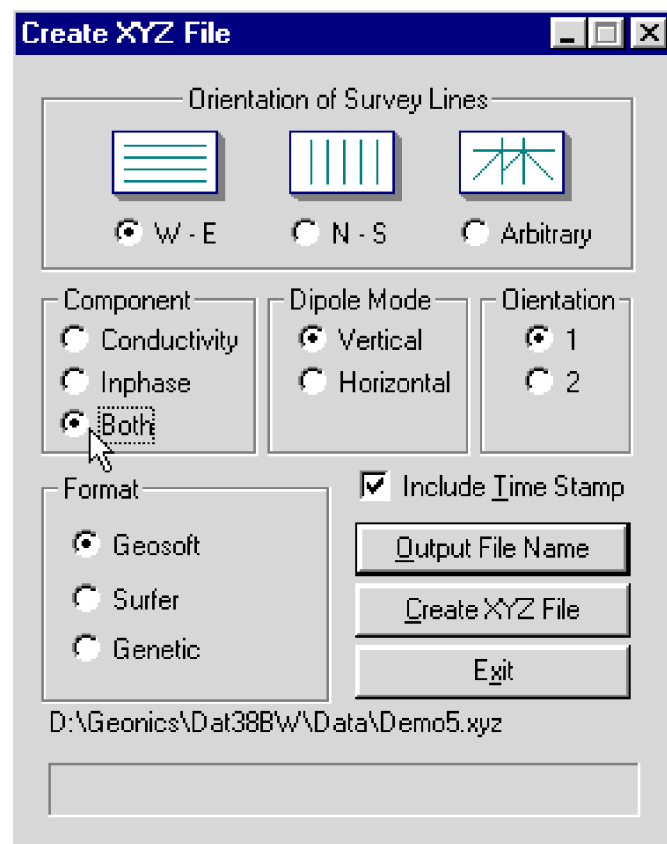
Figure 7.4: Create XYZ File window during selecting Data Type

Only one EM38B Data Type per XYZ file is allowed. To select Data Type click on the radio button next to the Component, Dipole mode, and Orientation. Data is always placed in the created XYZ file in the following order: X coordinate, Y coordinate, and marked Data Type parameters. The optional parameter Time (time stamp for each reading) can be placed in the last column of the file. A comment line listing all parameters in the file is placed as a header for each created XYZ file.

Creating an XYZ File with W-E or S-N Line Orientation

When the Orientation of Survey Lines parameter is set to W-E or S-N you only need to click on the active **Create** button to start writing the file. A progress bar located at the left bottom corner of the window will indicate the percentage of the created file that has been completed (Figure 7.5).

This operation is usually very fast for W-E and S-N line orientations. (It is a more lengthy process for the Arbitrary survey lines orientation, since several locations must be manually entered by the operator.) After the file is created, the Create XYZ File window is minimized, and the two dimensional station layout is displayed (Figure 7.6).

The displayed image shows the spatial layout of lines and stations to scale, based on the station coordinates written to the created file. The layout can be examined and printed. An option located on the menu and tool
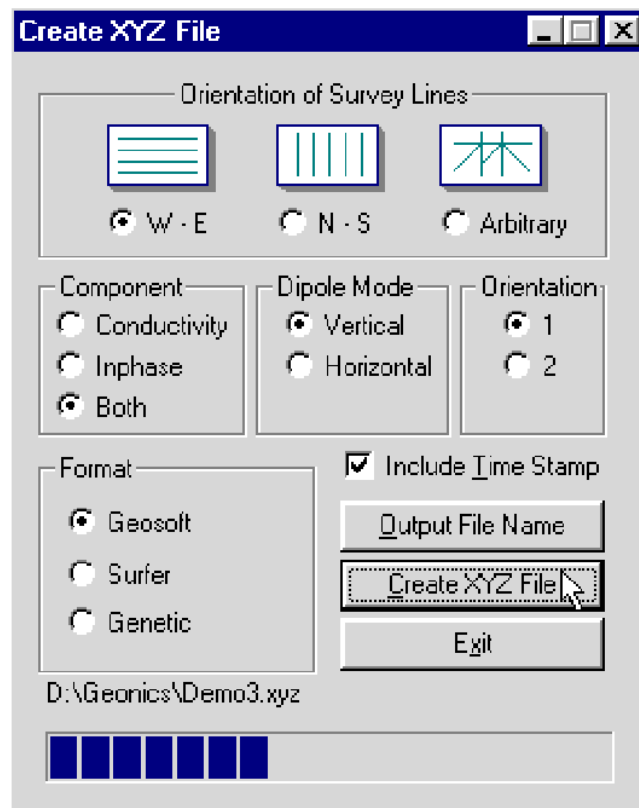
Figure 7.5:   Create XYZ File window during creating output file
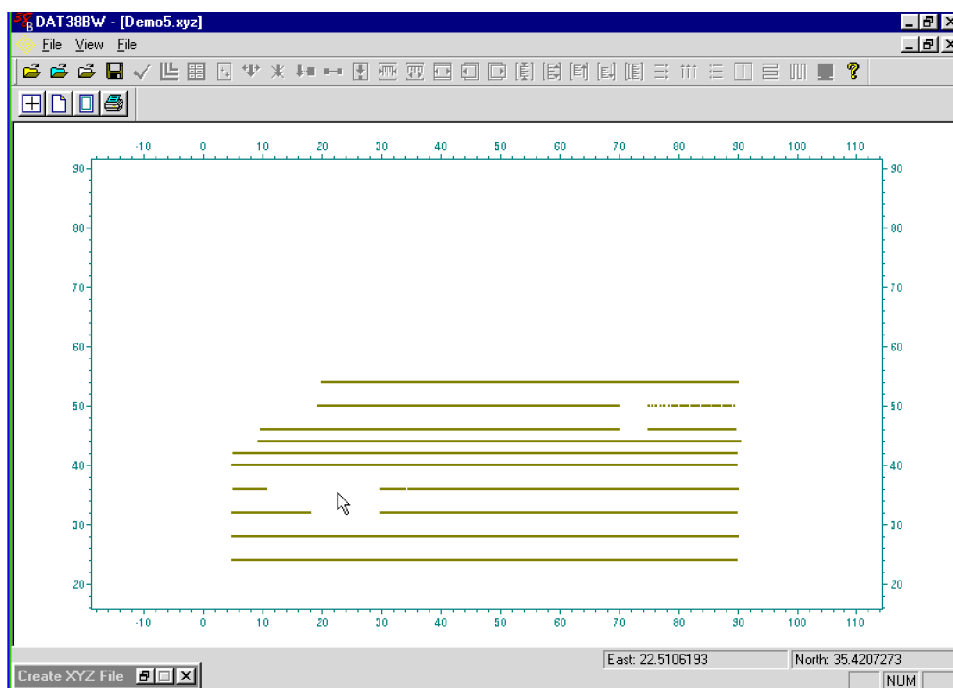
Figure 7.6:   Layout of stations after an XYZ file is created

bar of this screen lets you identify coordinates by using two perpendicular lines, horizontal and vertical, the coordinates being displayed in the bottom right portion of the screen.

Files created by this portion of the program can be also viewed at any time using the **File|Open|XYZ** menu or by clicking the **View XYZ File** button located on the tool bar.

Creating an XYZ File with Arbitrary Orientation

The Arbitrary option is used only in cases where lines are not parallel. If this option is to be used click the **Arbitrary** tab in the Create XYZ File window. The Arbitrary Orientation option becomes active (Figure 7.7).
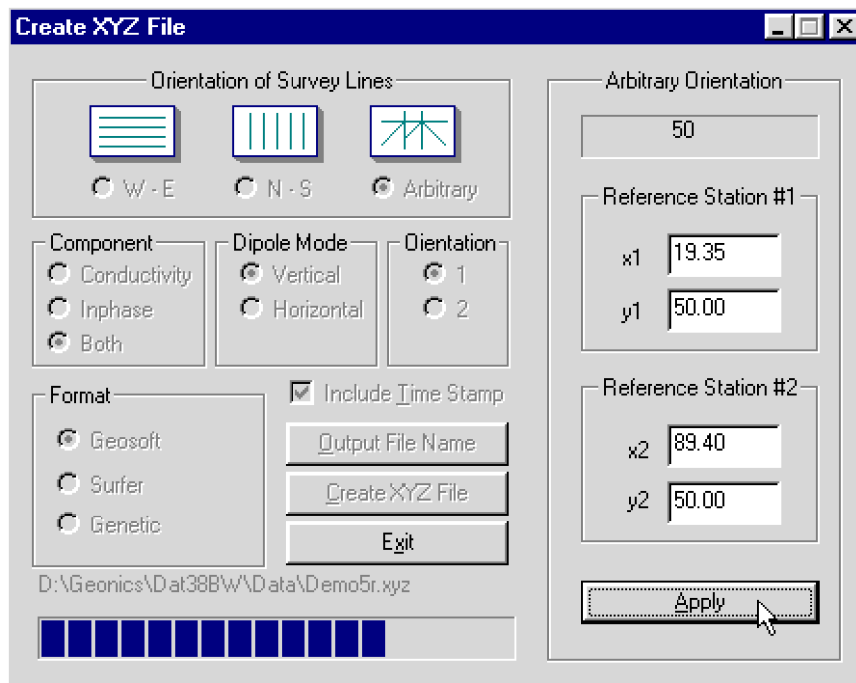
Figure 7.7:   Create XYZ File window (Arbitrary option) during writing file

After you specify the Output File Name (see Output File Name) and click **Create XYZ File**, you must enter two stations for each survey line in the file. The program will systematically preview each survey line for station coordinates entry. In the edit box for Station #1, enter the coordinates of the start station of the indicated line and, for Station #2, enter the coordinates of any other point on this survey line, assuming that the survey line is a straight line only. After coordinates for two stations are specified click on the **Apply** button. A projection of the coordinates will be calculated for every station. A progress bar located at the bottom of the window indicates percentage of data written to the file. The Create XYZ File window during this procedure is shown in Figure 7.7.

You can view any XYZ file created with the arbitrary line orientation using the **File|Open|XYZ** menu option, or by clicking the **Open XYZ File** button on the tool bar.

After the file is created, the Create XYZ File window is minimized and the two dimensional layout of stations is displayed (Figure 7.8).

The displayed image shows the spatial layout of lines and stations to scale, based on the station coordinates written to the created file. The layout can be examined and printed. An option located on the menu and tool bar of this screen lets you identify coordinates by using two perpendicular lines, horizontal and vertical: coordinates are displayed in the bottom left portion of the screen.
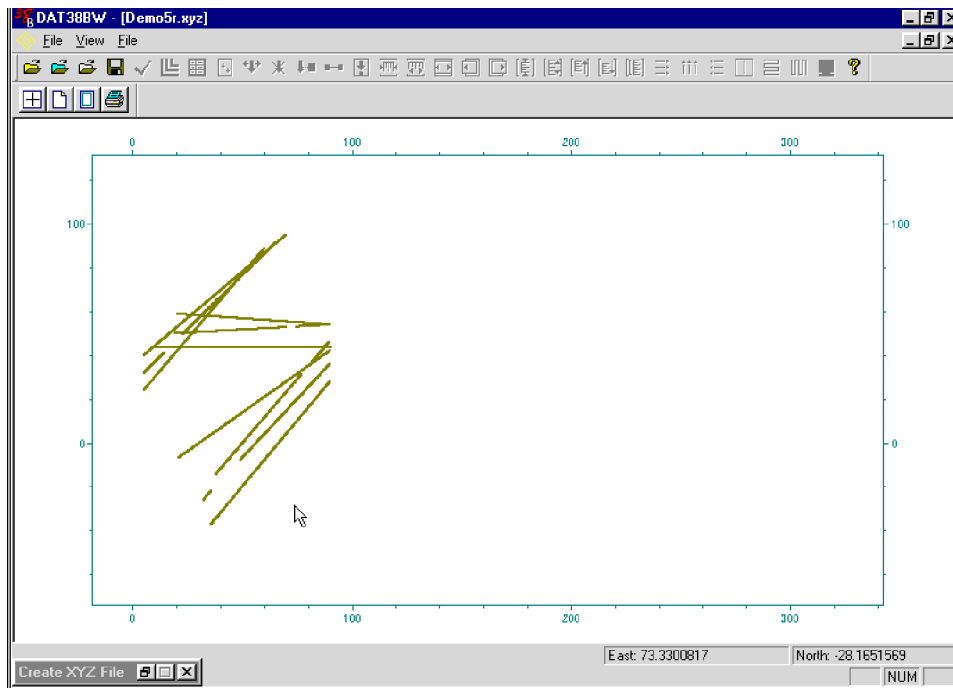
Figure 7.8: Example of layout after an XYZ file is created using the Arbitrary line orientation.

You can also view files created by this portion of the program at any time using the **File|Open|XYZ** menu or by clicking the **View XYZ File** button located on the tool bar.

7.2   View Survey Layout (W-E) or (S-N)

Two items in the **2D Layout** menu, **View Survey Layout (W-E)** and **View Survey Layout (S-N)**, let you view a two dimensional layout of stations for surveys which are carried out in the W-E direction (along the X coordinate) or in the S-N direction (along the Y coordinate). The program assumes that the survey line names indicate one coordinate (X or Y) and stations along each line are associated with the second coordinate. These two options, therefore, can be used only if the entered data set consists of parallel lines.

To view the spatial layout of stations, select **2D Layout|View Survey Layout (W-E)** or **2D Layout|View Survey Layout (S-N)** from the main menu (Figure 7.1). These two items are also easily accessible from toolbar buttons ▤ and ▥. A screen displaying survey lines oriented in S-N direction is shown in Figure 7.9.

View Survey Layout offers a quick view of the spatial configuration of survey lines to determine if any corrections are necessary. Each station is represented by a dot on the screen. Tools provided in the screen menu and the associated tool bar let you enlarge the selected areas of the survey for closer examination. The layout can also be rotated in 45 degree increments.
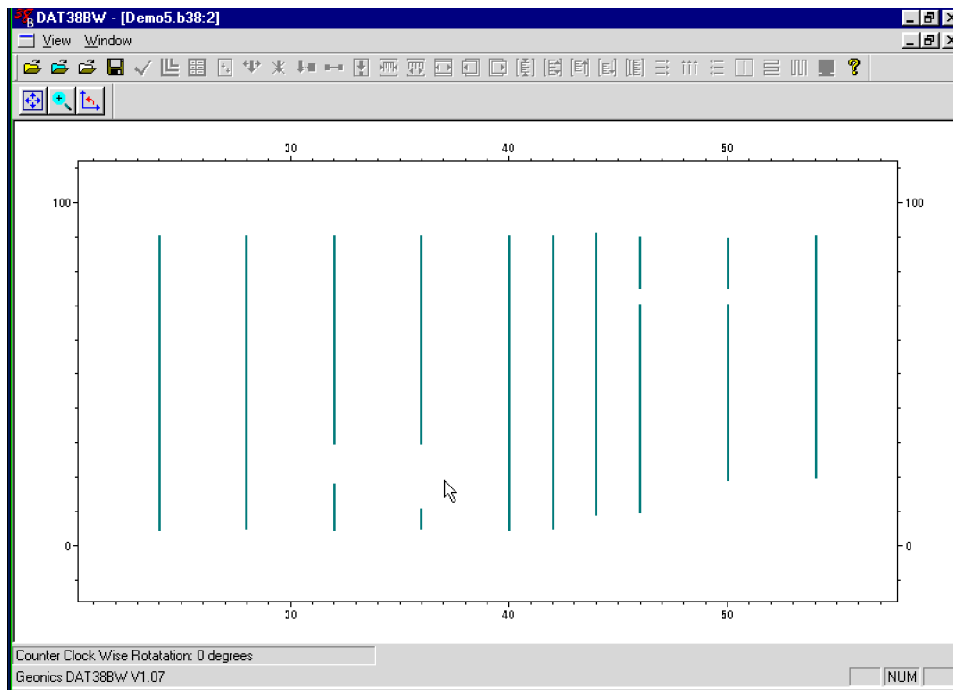
Figure 7.9: View Survey Layout (W-E) screen

View Survey Layout (S-N) provides a similar screen containing the layout of survey lines oriented in the vertical direction (along the Y coordinate).

8. GPS Positioning

Two methods for using the Global Positioning Systems are available with the EM38BRT system. In the first method EM38B data is collected in the EM38B logger while GPS data is logged separately to the GPS system logger. The **Combine EM38B and GPS Files** option of the DAT38BW lets you combine two data sets (EM38B and GPS) into one XYZ file as long as you can synchronize the EM38B logger clock with the GPS satellite time or determine the difference between these two clocks. In most cases the difference between clocks (Time Shift) can be determined with higher accuracy than the logger and satellite clocks can be synchronized. This method can be used with virtually any GPS system that can log its data, however it requires processing data using GPS software and exporting a GPS file to ASCII format that contains a minimum positioning data (Easting and Northing) as well as GPS satellite time data in 24 hour clock format.

The second method is available only when EM38B data are collected using Pro4000 (or similar) field computer operating under the control of the data acquisition program EM38Balg (or EM38Bpro). In this method the GPS receiver is connected to the EM38B logger serial port and GPS data is collected in the EM38B data file. This method can be used with Differential Global Positioning Systems (DGPS) that can provide Real Time Differential Correction of positioning data and send a **GGA** message (standard NMEA-0183 data string). Geonics has tested the program with the Trimble Ag114 and Ashtech GPS systems. Data collected using this method can be processed using the **GPS Positioning** option located in the GPS Positioning menu.

The option **Correct Time Delay in XYZ Files** can be used to correct the effect of the system (combined EM38B and GPS receiver) time constant delay in two dimensional XYZ files generated by **GPS Positioning** and **Combine EM38B and GPS Files** options.

To display the GPS Positioning menu select **GPS Positioning** from the DAT38BW main menu (at the top of the screen, Figure 8.1).
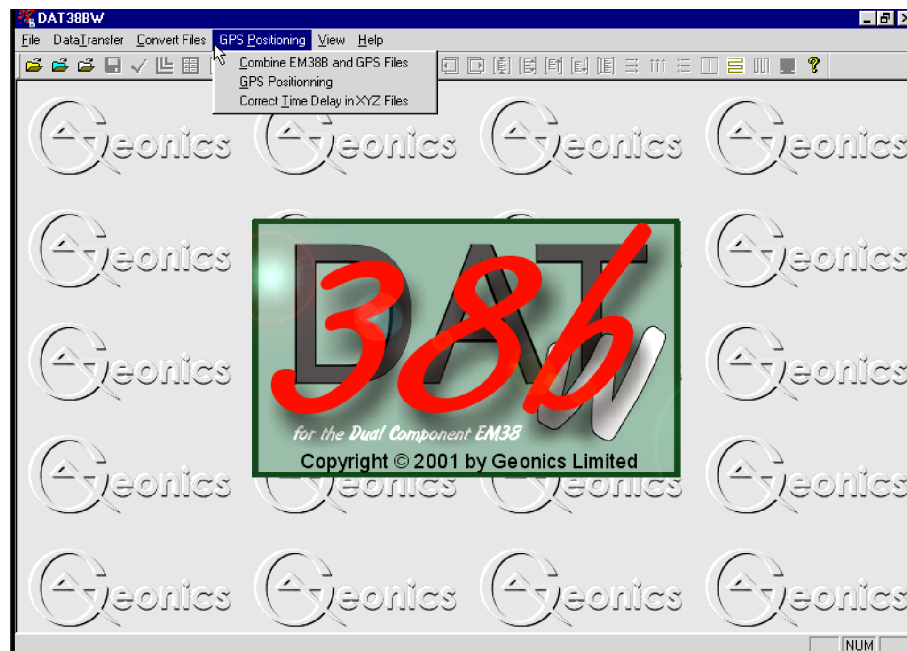
Figure 8.1:   DAT38BW GPS Positioning menu

8.1 Combine EM38B and GPS Files

This portion of DAT38B uses an EM38B data file in the .B38 format which has recorded time for each reading, plus a differentially corrected (post processed) GPS file, also with a recorded time for each reading. The data from these files are combined in an XYZ file which contains location X and Y, and one selected EM38B data type.

After **GPS Positioning|Combine EM38B and GPS Files** from the program menu option is selected, the Combine EM38B and GPS Files window is displayed (Figure 8.2).
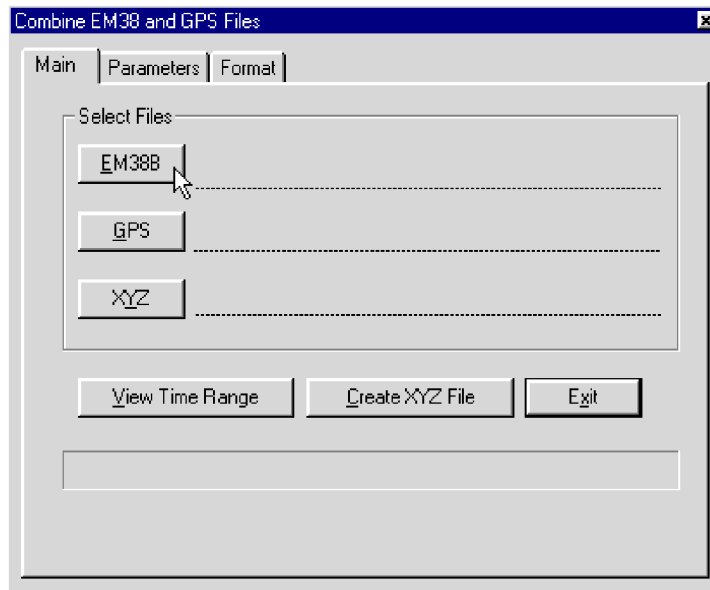
Figure 8.2:   Combine EM38B and GPS Files window

The Combine EM38B and GPS Files window contains three pages which can be activated by clicking the appropriate tabs. Each page lets you enter specific parameters necessary to combine EM38B and GPS files.

Parameters for Combine EM38B and GPS Files Window

Several parameters which affect the contents and format of the created XYZ file must be specified. These are names for the EM38B, GPS, and XYZ files (Main page), the EM38B Data Type to be written to the XYZ file, EM38B Time Shift and GPS Time Gap (Parameters Page), and formats for the XYZ File, GPS File, and GPS Time (Format page).

EM38B File

First click on **EM38B** in the Main page. The Open EM38B File window is displayed, as shown in Figure 8.3.

Select a file name (extension name B38) and click on **Open**. The Open EM38B File window will close and the selected file name will appear beside the EM38B button in the Main page of the Combine EM38B and GPS Files window.
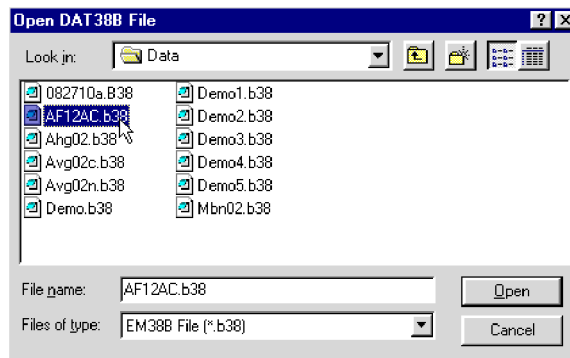
Figure 8.3: Open EM38B File window

GPS File

Next click on **GPS**. The Open GPS File window is displayed, as shown in Figure 8.4.
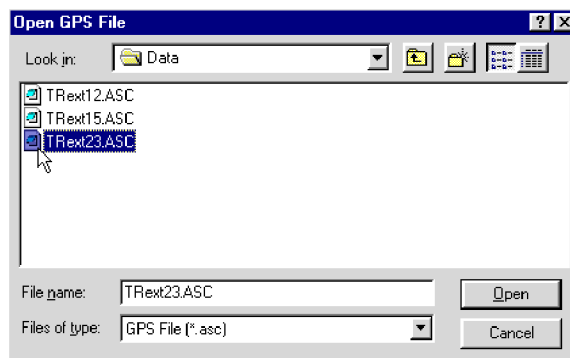
Figure 8.4: Open GPS File window

Select a file name and click an **Open** button. (GPS files in ASCII format usually have extension names ASC, POS, or TXT). The Open GPS File window will close and the selected file name will appear at the right side of the **GPS** button of the Main page.

XYZ File

When you click on **XYZ**, the Select XYZ File window is displayed, as shown in Figure 8.5.
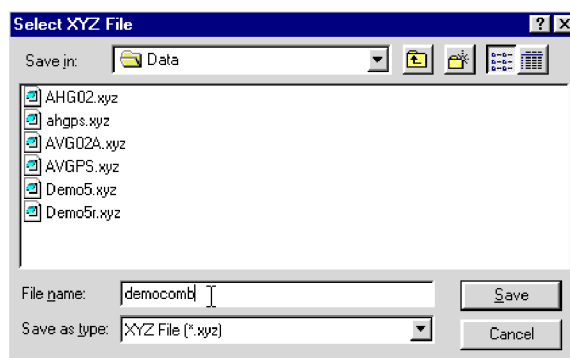
Figure 8.5: Select XYZ File window

Select or enter a name for the output file and click on **Save**. The Select XYZ File window will close and the file name will be displayed beside the **XYZ** button in Main page of the Combine EM38B and GPS Files window.

Data Type

To select EM38B Data Type to be written in the output file click the **Parameters** tab in the Combine EM38B and GPS Files window. The Parameters page will appear (Figure 8.6).
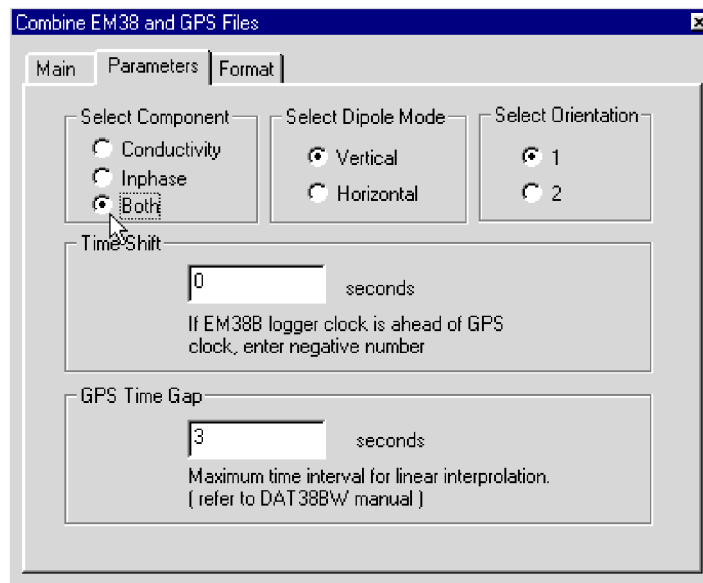
Figure 8.6:   Parameters page in the Combine EM38B and GPS Files window

This page is divided into three sections. The section labelled Data Type allows to select desired EM38B data type (component, dipole mode, and orientation) to be written in to XYZ file. Data Type names are described by three labels which are explained below:

To select a data type click on the radio button next to the data type name. Only one combination of dipole mode and orientation in EM38B data type is allowed per one XYZ file. Data is always placed in the created XYZ file in the following order: X coordinate, Y coordinate, and selected component (in chosen dipole mode and orientation). If Both was selected in the component field, then Conductivity is always placed in the third column and Inphase in the fourth column. The time stamp for each reading is placed in the last column of the file. A comment line listing all parameters in the file is placed as a header for each created XYZ file.

EM38B Time Shift

The EM38B Time Shift can be specified in the Parameters page of the Combine EM38B and GPS Files window. Click the **Parameters** tab located at the top of the window and the Parameters page shown in Figure 8.6 will appear.

If the EM38B logger and GPS system clocks are not synchronized prior to the survey, an appropriate correction (in seconds) can be entered in the edit box labelled Time Shift. In most cases, it is much easier to determine the time difference between the clocks in these two devices than to synchronize the two clocks at the outset.

During calculations the Time Shift is applied to the recorded EM38B logger time. Therefore, if the logger time is ahead of the GPS time, enter a negative value; if the EM38B logger time is behind the GPS time, enter a positive value.

GPS Time Gap

The differentially corrected GPS data often has gaps, due to differences in the constellation of satellites visible to two (fixed and moving receivers), lack of beacon signal, etc. Small gaps can also occur due to a difference in the frequency of data acquisition between the EM38B and GPS systems. These gaps are filled by DAT38BW with the assumption that the EM38B speed is essentially constant and that the motion is along a straight line during the gaps.

The **GPS Time Gap** parameter specifies the maximum time during which the EM38B data will be linearly interpolated between two GPS positions. Enter this parameter (in seconds) in the edit box labelled GPS Time Gap (Figure 8.6). In most cases a value 2 to 3 times larger than the GPS acquisition frequency is adequate.

XYZ File Format

You can specify the format of the XYZ output file in the Format page. Click the **Format** tab at the top of the window: the page is shown in Figure 8.7.
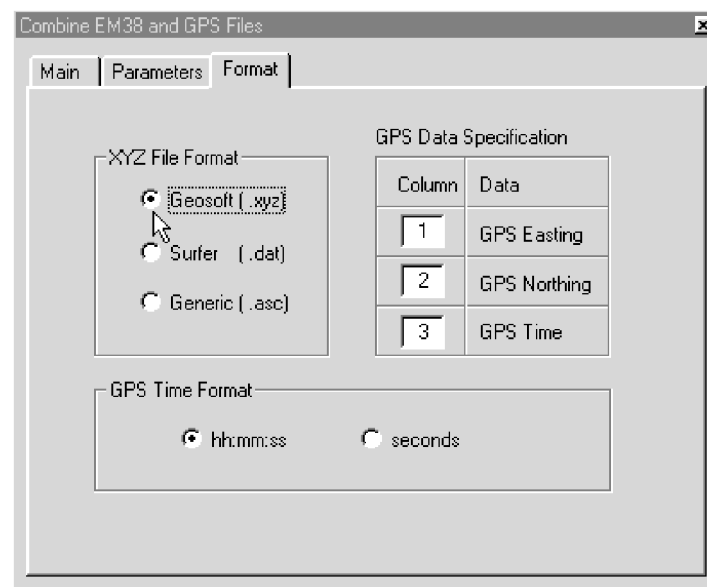
Figure 8.7:   Format page in the Combine EM38B and GPS Files window

Check the option appropriate for the contouring software used. The Generic option will create a three column file without any text strings. This file can be used as an input file for many contouring packages (including Geosoft and Surfer). Geosoft format will cause the program to write LINE # at the beginning of each survey line.

GPS File Format

The DAT38BW is designed to work with the GPS file in ASCII format. ASCII format is usually obtained by executing the Export ASCII File option available in most GPS data processing programs. This approach assures compatibility with most formats provided by GPS software manufacturers.

In order to describe the format of the GPS file, set the locations of columns containing Easting, Northing, and Time in the corresponding edit boxes under Column.

When reading the GPS file, the DAT38BW confirms that each value in the indicated column is a valid numeric parameter; if it is not, that record in the GPS file is ignored. GPS files that contain comment lines or field description header lines are therefore accepted.

GPS Time Format

This parameter further describes the format of the GPS file. GPS time is usually specified in either of two formats: hh:mm:ss (hours:minutes:seconds) or, the number of seconds elapsed from GPS midnight (or from the beginning of the GPS week). Both formats can be used by DAT38BW. Specify which format by checking the appropriate button.

While using the hh:mm:ss format, make sure that 24 hour time format is used by the GPS software.

View Time Range

After both the EM38B and GPS files have been specified, the **View Time Range** button is activated in the Main page of the Combine EM38B and GPS Files window. When the **View Time Range** button is clicked, the program begins to read both files. The progress bar at the bottom of the screen shows the percentage of files read (Figure 8.8).
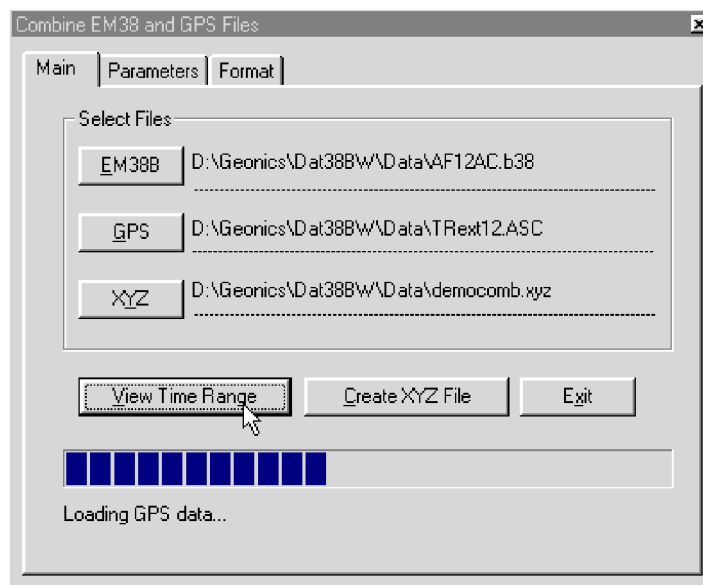
Figure 8.8: Combine EM38B and GPS Files window during reading of EM38B and GPS files

Once the files are read the Time Range window will be displayed (Figure 8.9).

Although Time Range viewing is not necessary for combining the EM38B and GPS files, the display is a quick way to visually estimate the value for the Time Shift. In those cases where the Time Shift is incorrect (i.e. wrong sign or value), the GPS Time Range and the Shifted EM38B Time Range graphs are not coincident. The most common error is the wrong sign (+/-) entered for the time shift. If the results are satisfactory, close the Time Range View window and continue work in the Combine EM38B and GPS Files window, or you can adjust the time shift in the parameter page if necessary.
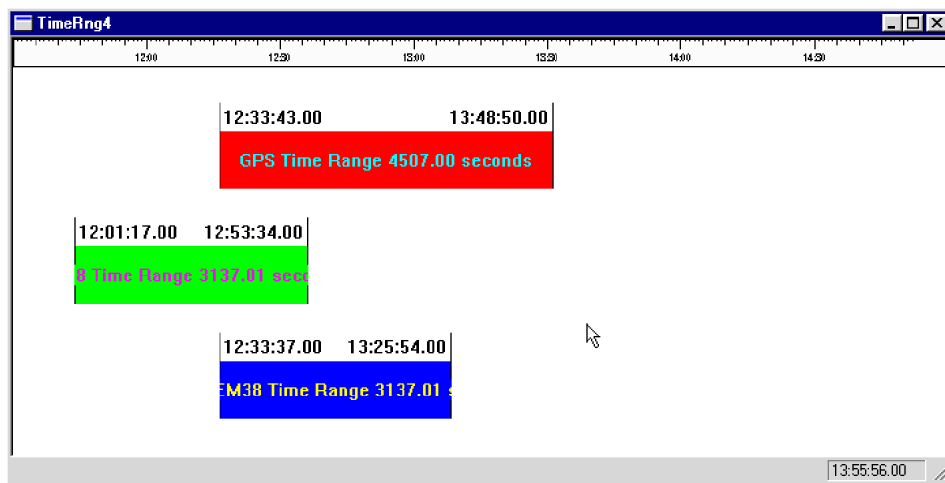
Figure 8.9:   Time Range window

Creating XYZ File

When all parameter are set and the file names (EM38B, GPS, and output XYZ file) are specified, the **Create XYZ File** button is activated in the Main page of the Combine EM38B and GPS Files window. When you click on **Create XYZ File** the program begins to read the EM38B and GPS files, interpolates EM38B stations positions based on time records and the EM38B Time Shift parameter, and writes records to the XYZ output file. The progress bar at the bottom of the screen shows the percentage read (Figure 8.10).
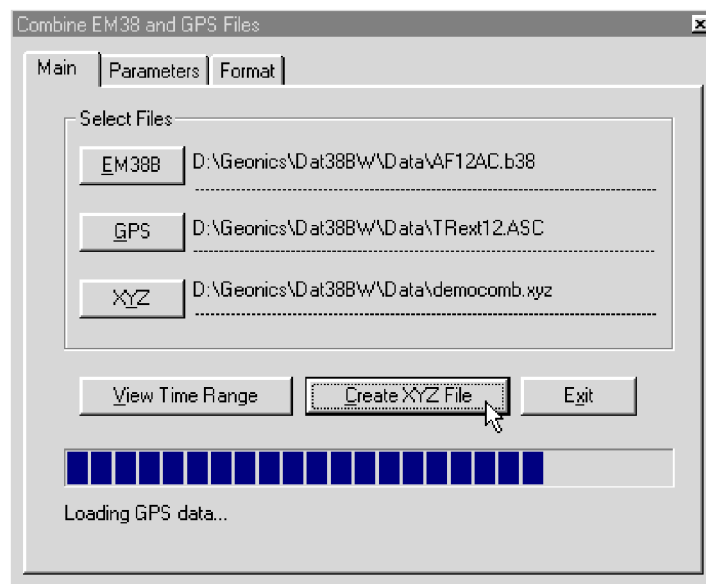
Figure 8.10: Combine EM38B and GPS Files window during reading data files and creating output XYZ file

The speed of this operation depends on the size of the input files. After the XYZ file is created, the Combine EM38B and GPS Files window is minimized and a two dimensional layout of the survey is displayed (Figure 8.11).
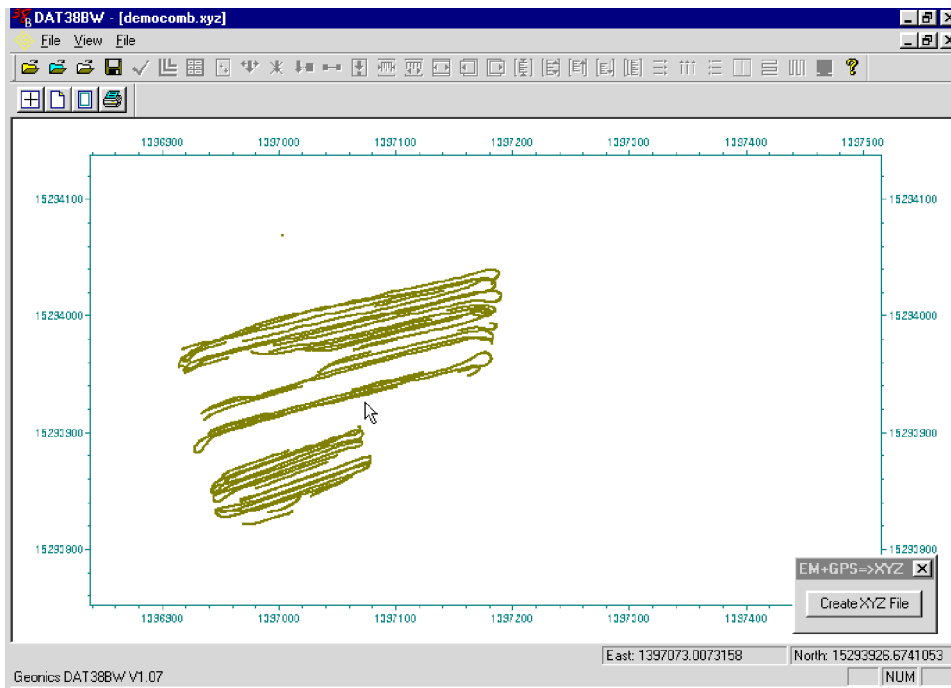
Figure 8.11: Layout of survey as created in the XYZ output file

The displayed image shows the spatial layout of lines and stations to scale, based on the station coordinates as written to the created file. The layout can be examined and printed. An option located on the menu and tool bar of this screen lets you identify coordinates using two perpendicular lines, horizontal and vertical lines. The coordinates are displayed in the bottom left portion of the screen.

Files created by this portion of the program can be also viewed at any time using the **File|Open|XYZ** menu or by clicking the ![icon] (**View XYZ File**) button on the tool bar.

8.2   GPS Positioning

This option of the DAT38BW program can be used when the GPS receiver is connected to the EM38B logger serial port and GPS data is recorder in the EM38Bpro data file (available with Allegro, Pro4000 or similar loggers). This method can be used with Differential Global Positioning Systems (DGPS) that can provide Real Time Differential Correction of positioning data and are capable of streaming NMEA-0183 message: **GGA** .

Select **GPS Positioning|GPS Positioning** from the main program menu. The GPS Positioning window is displayed (Figure 8.12).

Parameters in GPS Positioning Window

Several parameters which affect the contents and format of the created output (XYZ) file must be specified. These are the EM38B, and XYZ file names, the format of coordinates in the output file, and the GPS Time Gap.
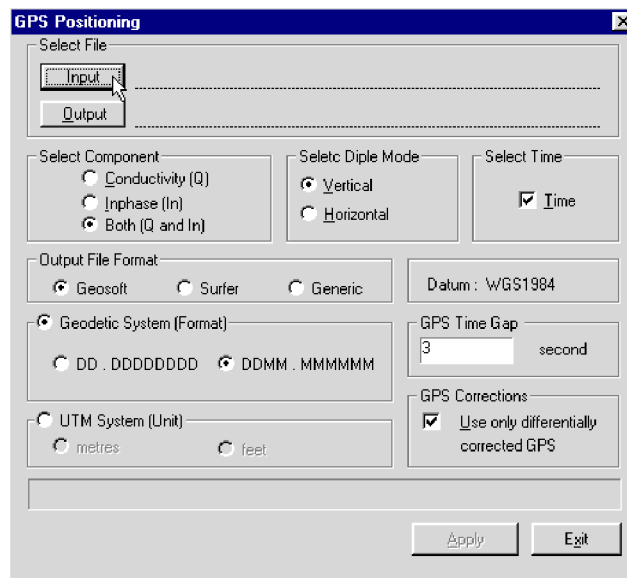
Figure 8.12: GPS Positioning window

Input File

Click on **Input** button. The Open EM38B File window is displayed (Figure 8.13).
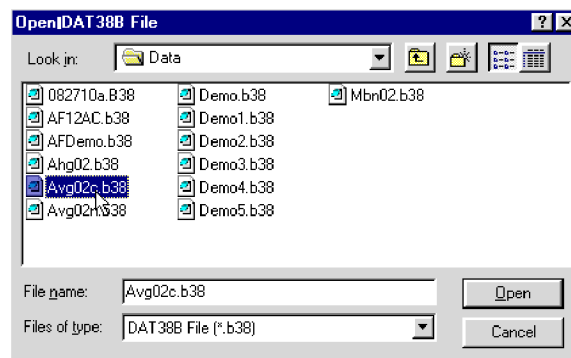
Figure 8.13: Open EM38B File window

The window lists files with extension name B38. Select a file name and click the **Open** button. The Open EM38B File window will close and the selected file name will appear next to the **Input** button in the GPS Positioning window.

Output File

Click on the **Output** button. The Select XYZ File window is displayed (Figure 8.14).
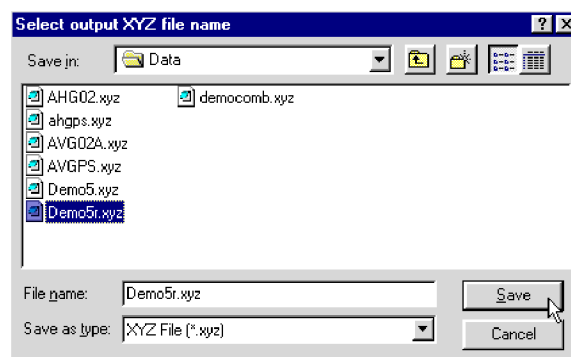
Figure 8.14: Select XYZ File window

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 **Output** button in the GPS Positioning window.

When Input and Output files are specified the **Apply** button in the GPS Positioning becomes active (Figure 8.15).
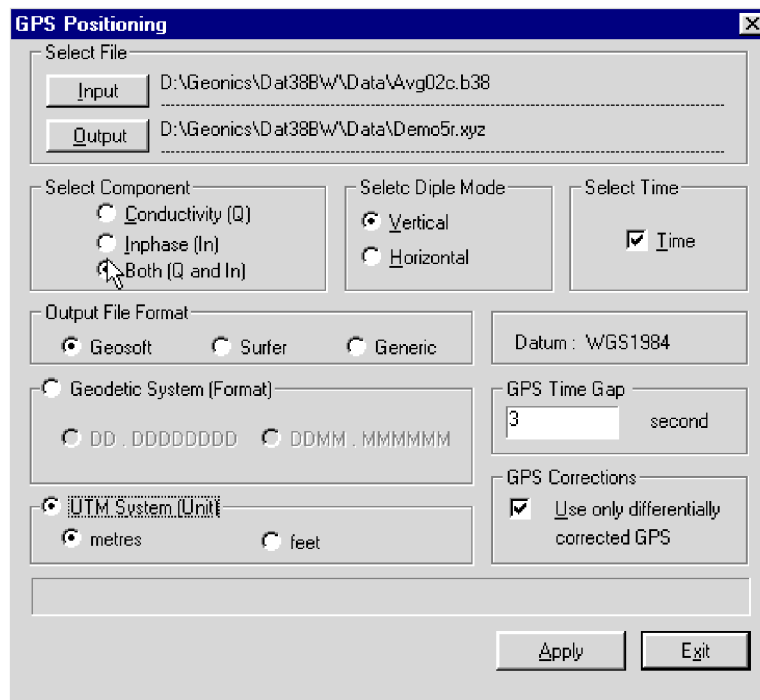
Figure 8.15: GPS Positioning window with selected Input and Output files

Data Type

The section labelled Data Type allows to select desired EM38B data type (component, dipole mode, orientation, and time stamp) to be written in to XYZ file.

To select a data type click on the radio button next to the data type name. Only one combination of dipole mode and orientation in EM38B data type is allowed per one XYZ file. Data is always placed in the created XYZ file in the following order: X coordinate, Y coordinate, and selected component (in chosen dipole mode and orientation). If Both was selected in the component field, then Conductivity is always placed in the third column and Inphase in the fourth column. The time stamp for each reading is placed in the last column of the file. A comment line listing all parameters in the file is placed as a header for each created XYZ file.

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. To select coordinates click **Geodetic** or **UTM** buttons (Figure 8.15).

Geodetic coordinates are given in degrees. They can be written in two formats DD.DDDDDDDD or DDMM.MMMMM. To select which format click the appropriate radio button (Figure 8.15).

UTM coordinates can be generated in meters or feet. To select units for UTM coordinates click one of the radio buttons located at the **UTM** button (Figure 8.15).

GPS Time Gap

Differentially corrected GPS data often has gaps, due to differences in the constellation of satellites visible to two (fixed and moving receivers), lack of beacon signal, etc. Small gaps can also occur due to a difference in the frequency of data acquisition between the EM38B and GPS systems. These gaps are filled by DAT38BW with the assumption that the GPS receiver speed is essentially constant and that it moves along a straight line during the gaps.

The **GPS Time Gap** parameter specifies the maximum time during which the EM38B data will be linearly interpolated between two GPS positions. Enter this parameter (in seconds) in the edit box labelled GPS Time Gap (Figure 8.15). In most cases a value 2 to 3 times larger than the GPS acquisition frequency is adequate.

GPS Corrections

Check the box labelled GPS Corrections only if differentially corrected position data is to be used during the creation of XYZ file. When this box is unchecked, both corrected and raw data are used to calculate positions of EM38B stations.

Creating XYZ File

When all parameter are set and input and output file names are specified, the **Apply** button is activated in the GPS Positioning window. After you click the **Apply** button, the program begins to read the input file, interpolates the EM38B station positions based on the recorded GPS readings, writes and records to the XYZ output file. A progress bar at the bottom of the screen shows the percentage read (Figure 8.16).
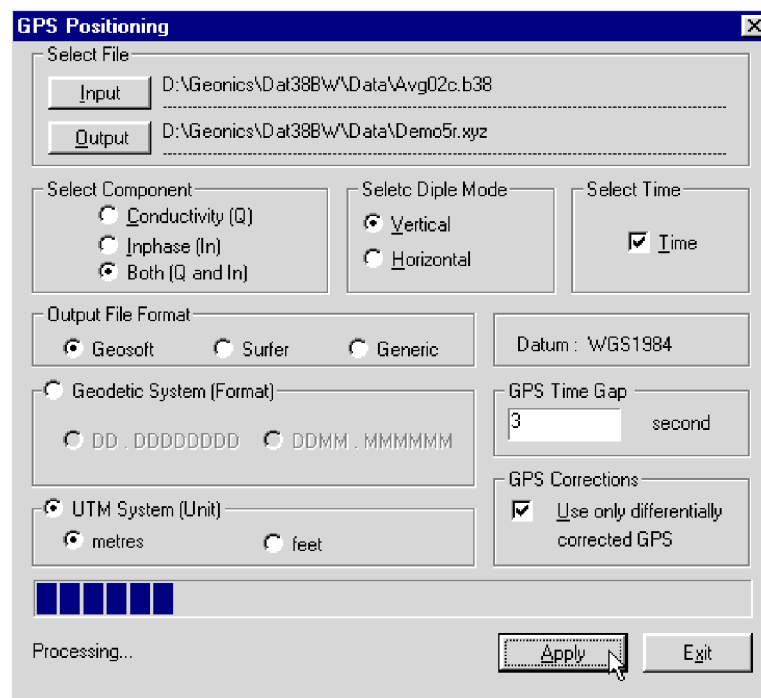
Figure 8.16: GPS Positioning window during creating XYZ (output) file

If the input file does not contain sufficient GPS information, the program will display a warning message (Figure 8.17), and the program will pause operation till the **OK** button is clicked in the warning window.
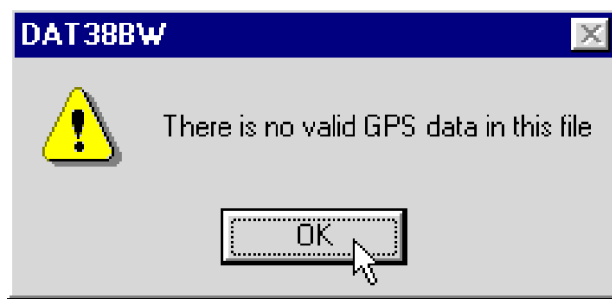
Figure 8.17: Warning window

After the XYZ file is created, you can view the two dimensional layout at any time (Figure 8.18) using the **File|Open|XYZ** menu, or by clicking the [icon] (**View XYZ File**) button on the tool bar.
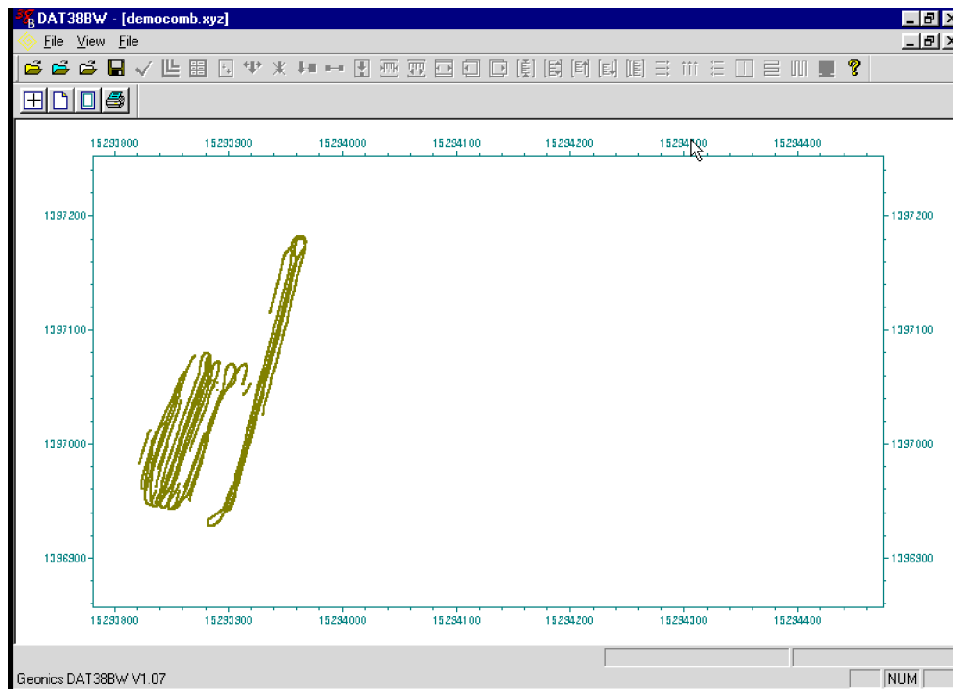
Figure 8.18: Layout of survey as created in the XYZ output file

The displayed image shows the spatial layout of lines and stations to scale, based on the station coordinates written to the created file. The layout can be examined and printed. An option located on the menu and tool bar of this screen lets you identify coordinates using two perpendicular lines, (horizontal and vertical). Coordinates are displayed in the bottom left portion of the screen.

8.3   Correct Time Delay in XYZ Files

This option allows for the system time constant delay correction. The procedure is similar to the item Correct Delay Time in Edit Geometry menu for grid based data however this option acts on two dimensional, GPS positioned data.

While the EM38B time constant is known the time constant of the combined EM38B and GPS receiver system is a funcion 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 exach 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 griding) the procedure can be time consuming, however it only needs to be done once for a given GPS receiver and EM38B.

In order to apply the correction the generated XYZ file must have time stamps. In the event input file does not have time stamp at each reading the program will display a warning message.

The correction acts on any XYZ type of file so care should be taken that data is not corrected twice or that XYZ files created from corrected grid based data are not used.

To access this option select **GPS Positioning | Correct Time Delay in XYZ File** in the menu (Figure 8.1). The Correct Time Constant Delay window will appear on the screen (Figure 8.19).
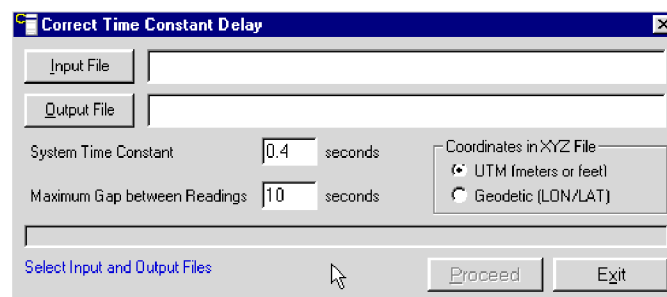
Figure 8.19: Correct Time Constant Delay window

Parameters in Correct Time Constant Delay Window

Several parameters which affect the contents and format of the created output (XYZ) file must be specified. These are the Input and Output XYZ file names, System Time Constant, Maximum Gap between Readings, and type of coordinates in the input XYZ file.

Input File

Click on **Input File** button. The Select Input XYZ File window is displayed (Figure 8.20).

The window lists files with extension names XYZ, DAT, and ASC. Select a file name and click the **Open** button. The Select Input XYZ File window will close and the selected file name will appear next to the **Input File** button in the Correct Time Constant Delay window.
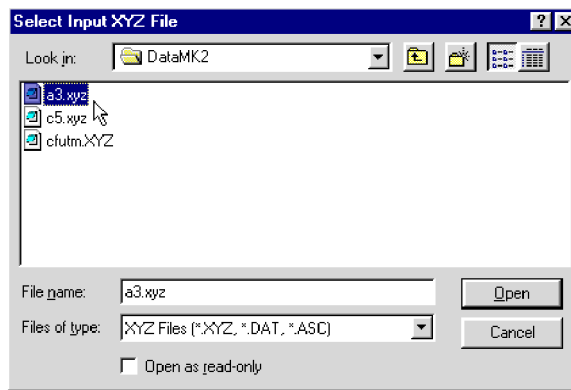
Figure 8.20   Select Input XYZ File window

Output File

Click on the **Output FIle** button. The Select XYZ File window is displayed (Figure 8.21).
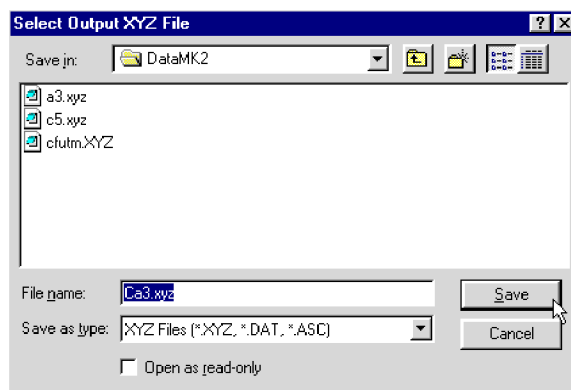
Figure 8.21   Select Output XYZ File window

As a default the Input File name with prefix C is given. Accept the default, enter, or select a file name and click the **Save** button. The Select Output XYZ File window will close and the selected file name will be displayed beside the **Output File** button in the Correct Time Constant Delay window.

When Input and Output files are specified the **Proceed** button in the Correct Time Constant Delay window becomes active (Figure 8.22).

System Time Constant

Time delay 0.35 seconds is given as a default. This value can be changed (0 to 1 seconds), however the user should experiment before choosing a final value.

Maximum Gap Between Readings

This parameter specifies the maximum time during which the EM38B data will be treated as continous data set. If the gap between two stations is larger than specified maximum gap the station that follows the gap will be assumed the first station of a new line.

Enter this parameter (in seconds) in the edit box labeled Maximum Gap between Readings. In most cases a value 2 to 3 times larger than the GPS acquisition frequency is adequate.

Coordinates in XYZ File

Specify type of coordinates in the input file. The output file will be written with the same type of coordinates.

Creating Corrected XYZ File

When all parameter are set and input and output file names are specified, the **Proceed** button is activated in the Correct Time Constant Delay window. After you click the **Proceed** button, the program begins to read and analyse the input file, and then calculates corrections for each station based on the instant velocity of the system at each station. A progress bar at the bottom of the screen shows the percentage read (Figure 8.22).
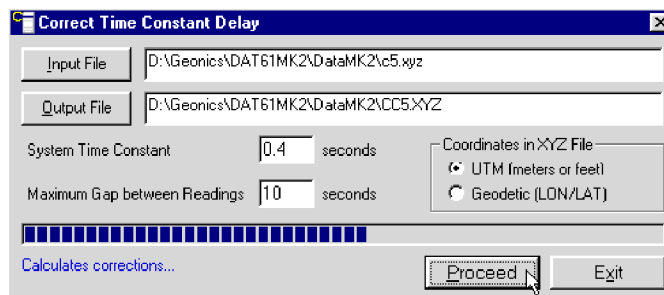
Figure 8.22   Correct Time Constant Delay window during creating corected XYZ file

If the input file does not contain time stamp information, the program will display a warning message (Figure 8.23), and the program will pause operation till the **OK** button is clicked in the warning window.
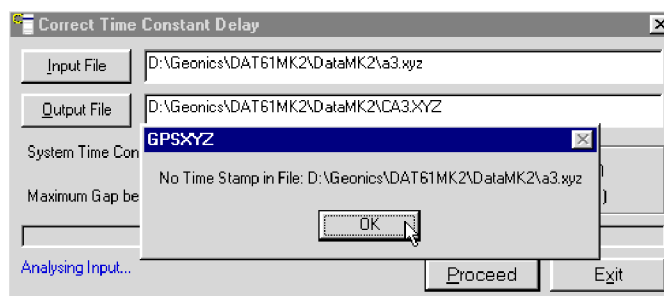

Figure 8.23   Warning message

APPENDIX A

A.1   The Data File in DAT38B (B38) Format

The first row the DAT38B data file contains name of the instrument: EM38B (or GP38B if GPS option was enabled during data acquisition in Polycorders 600 or 720), number of version, original name of file, and name of an operator (not used if file is created after editing).

The row started with L specifies beginning of the survey line, it is followed by the line name, and line parameters (three characters e.g. BB1):

1st   component (B-both, Q-Quad-phase, I-Inphase),

2nd   dipole mode (B-both, V-vertical, H-horizontal),

3rd   instrument orientation (B-both, 1 or 2),

The next field specifies line direction W, E, N, or S. At the end of this row two parameters indicate mode of data acquisition Y-Auto Mode and it is followed by time increment in seconds, N-Manual Mode is followed by 0).

The following row starts with T and contains time and date of line creation.

The rows containing data start with the four character sequence (e.g. SV10), meaning of these characters is as follows:

1st   S - reading and station,

   R - reading, it appears only when more than one reading was taken at one station,

   N - start of new segment of the line,

   D - deleted reading.

   C - comment, the text of comment follows this field.

2nd   V - reading with Vertical dipole mode,

   H - reading with Horizontal dipole mode.

3rd   1 - instrument orientation 1,

   2 - instrument orientation 2.

4th   0 - no fiducial marker,

   1 - fiducial marker pressed at this station (only in Auto Mode).

Above 4 character field is followed by station number [user units], Conductivity in mS/m and Inphase in ppt of Primary Field. If one component is recorded, it is placed into corresponding column while the other column contains zeros. Conductivity data are always placed in the second column of numbers and Inphase in the third column.

If a file was created with the EM38BRT or EM38B Polycorder program using GPS option it will contain an additional column that indicate time that reading was recorded (in 24 hour clock format).

Quad-phase and Inphase values of 8000.000 indicate skipped reading.

The DAT38B data file can be easily edited using any text editor, however care should be taken on preserving proper placement of all parameters.

Example of EM38B File in DAT38B Format

```
EM38B V2.00 TEST     JOHN              (or GP31M V2.00...in GPS option format)
L   10        BB1  W N 0                       line 10 starts
T    22/11/1990 11:31:00
SV10     0.000     20.100      3.396
RH10     0.000     20.200      3.203
SV10     1.000     20.200      3.047
RH10     1.000     20.200      2.842
SV10     2.000     20.400      2.649
RH10     2.000     20.620      2.432
C     GRASS STARTS                            comment
SV10     3.000     20.820      2.264
RH10     3.000     20.820      2.192
SV10     4.000     20.680      2.143
RH10     4.000     20.620      2.168
L   20        BV1  E Y 1.0                     line 20 starts
T    22/11/1990 11:43:00
SV10    45.000     17.580      1.301
SV10    44.611     17.580      1.276
SV10    44.222     17.760      1.301
SV11    43.833     17.640      1.301          fiducial marker
SV11    43.444     17.520      1.325
SV11    43.055     17.580      1.361
SV10    42.666     17.700      1.301
SV10    42.277     17.700      1.337
NV10    37.600     16.140      1.325          new segment starts
SV10    37.169     16.140      1.337
SV11    36.738     16.080      1.325
SV10    36.307     16.920      1.337
SV10    35.876     17.520      1.349
L   30        BVB  S N 0                       line 30 starts
T    22/11/1990 12:23:00
SV10     0.000     20.580      3.047
RV20     0.000     20.680      3.107
SV10     1.000     20.620      3.083
RV20     1.000     20.880      3.131
SV10     2.000     20.880      3.107
RV20     2.000     21.040      3.071
SV10     3.000     21.000      2.986
.......
```

EM38B file with time stamp (GPS option) will contain one more column Hour:Minute:Seconds/Hundreds of Seconds (24 h clock) e.g.:
```
SV10     3.000     21.000      2.986  12:14:12.15
```

A.2 The Data File in the Polycorder 600 Format

The EM38BRT Polycode program records a set of data in one file. The file name is supplied by the user at the **FILE**: prompt (xxxx). (There is no Header and Data file as in Geonics EM38B). The example of data file and the format of the file is as follows.

```
DAT:1999              Initial line of data file
DON1                  Name of the file as specified by the user
RT38B (or GP38B)      The Polycorder format (RS38B - standard, GP38B - GPS format)
B                     Both components (Quad-phase and Inphase)
V                     Vertical Dipole mode
1                     Orientations 1
JOHN                  Operator name
M                     Mode (here Manual, can be A for Auto)
1.0                   Samples/Record (if Auto this value indicates selected time interval)
L1                    Name of Line (name follows letter L)
06/20/99              Date
13:16:33              Time (it is the time when line was specified)
E                     Direction (East)
0.000                 Start Station
I     0.500           Increment between readings (follows letter I)
Td+0319+1121          Each reading starts with letter T, and it is followed by a
Td+0332+1172          single character (information byte). The ASCII number of this
Td+0123+2345          character indicates dipole mode, range (scale), and Marker in
Tb+0351+1251          Auto mode. The information byte is followed by two fields (5
Tf+0298+6344          places each including sign) indicating readings for Inphase and
                      Quad-phase.
TF+0407+1434          Divide these values by 4 to get the actual readings in mV.
TF+0407+1434          Information byte interpretation
TF+0512+1732             Bit      Decimal       Value and Meaning
TF+0432+1520             7  128        1              not used
TF+0432+1528             6   64        Marker =1      trigger pressed
TF+0432+1528                                 =0       otherwise
TB+0427+1512             5   32        Mode   =1      for vertical operation
Tb+0376+1327                                 =0       for horizontal operation
TB+0420+1519             4   16        Gain   =1      for Gain=8
TB+0420+1519                                 =0       for Gain=1
TB+0418+1548             3    8        0              not used
TB+0407+1513             2    4        Range 3
TD+0388+1441             1    2        Range 2
TD+0378+1415             0    1        Range 1
Td+0372+1427          Range 2 and Range 1 represent sensitivity as follows:
Td+0376+1438                                                    Multipliers
Td+0412+1397          Sensitivity I/Q    Range 2  Range 1    Inphase  Conductivity
Td+0468+1444            1000/1000           1        1       0.0288/Gain   -1/Gain
Td+0668+1223            1000/100            1        0       0.0288/Gain   -0.1/Gain
Td+0868+0140            100/1000            0        1       0.00288/Gain  -1/Gain
Tb+0376+1327            100/100             0        0       0.00288/Gain  -0.1/Gain
L2.5                  Start of the next Line (2.5)
06/20/99              Date
13:19:37              Time
W                     Direction (West)
20.000                Start Station
I    -1.000           Increment (-1)
Tf+0887+0140
...........
```

EM38B file with time stamp (GPS option) will contain two more columns Seconds/Hundreds of Seconds and Hour/Minute e.g. line

Tb+0906+0150   1215 1614

means: Reading, time (24 h clock) is 16:14:12.15

A.3 The Data File in the Polycorder 720 Format

Sample EM38B header and data files - Both components

Header file

minute — orientation
hour —
year —
pointer to data file
start station
station increment —
component B,Q or I
comment — line name

```
EM38B 2002
TEST
        6|  0|  0|  0|  0|  0|*       |0|*|*                |*        |*|*|  .0|  .0|    0|   0
     |35|16|15|39|  1|JOHNNY|B|V|TRAIL            |10       |W|Y| 1.0|  -1| 112|   1
     |10|16|16|10|  0|*      |B|*|*                |20       |E|Y| 1.0|   1|   0|   8
     | 0|  0|  0|  0|  0|*    |*|*|END OF TRAIL    |*        |*|*| 0.0| 0.0|   0|  10
     | 0|  0|  0|  0|  0|*    |B|*|*                |*        |E|Y| 1.0|   1|  50|  13
     |10|16|16|50|  0|*      |B|*|*                |30       |W|Y| 1.0|  -1| 133|  22
     &|
```

day   dipole mode V,H or B
month
profile direction   automatic mode Y/N
time if AUTO

If file was downloaded using DAT38BW procedure the third line is shifted by ten spaces and it contains value indicating number of lines in header file (2 header lines are excluded). The third or the last line of header file can be empty, containing only * and 0. It is ignored by the PC program.

Data file

In case of single component measurement the second column in the following file disappears

```
EM38B 2002
TEST
        349     7.00000    .00000     2  number of lines in file, flag for new line,
-.21300 -.02300    -4                       and pointer to row 2 of header file
-.21100 -.02300    -4
-.21300 -.02300    -4
-.22800 -.02300    -4  4 < 128 then V mode,  4 - gain is 1000 (I) and 1000 (Q),
-.25200 -.02300    -4  Conductivity = -.228*4000921 mS/m,
 .26400 -.02200    -4  Inphase = -.023*115.2 = 2.6496 ppt
7.00000  .00000     3  flag for new line 20, pointer to row 3 of header file
-.29100 -.02200    -4
4.00000  .00000     4  flag for comment
-.27200 -.02200    -4
-.26300 -.02200    -4
7.00000  .00000     5  flag for new station (new segment) of the same line
-.28100 -.02200    -4
-.30800 -.02200    -4
```

```
6.00000  .00000   0           skipped station
-.35900 -.02300   -4
-.37600 -.02400   -4
-.36900 -.02400 -132          132 > 128 then reading was taken at H mode
-.35100 -.02400   -4          132-128=4 then gain as above is 30
-.33900 -.02400   -4
7.00000  .00000   6           flag for new line 30
-.42000 -.02100   -4
5.00000  .00000   0           flag for end of file
&
...........
```

EM38B file with time stamp (GPS option) will contain two more columns Seconds/Hundreds of Seconds and Hour/Minute eg. line

```
 -.420 -.021  -4  1215 1614
```

means: Reading (3 values), time (24 h clock) is 16:14:12.15

Table of Multipliers for Gain

EM31 Instrument

Scale		Digital Representation	Multiplication Factor	
Inphase	Quad-phase		Inphase [ppt]	Quad-phase [mS/m]
1000	1000	-4	115.2	4000
1000	100	-5	115.2	400
100	1000	-6	11.52	4000
100	100	-7	11.52	400

If absolute value of digital reading is larger than 128, it indicates Horizontal mode.

If absolute value of digital reading is larger than 16, then it indicates fiducial marker.

Example

Value of digital reading is -132

132 > 128   ==> Horizontal Mode
132-128=4
4 < 16   ==> No Fiducial Marker

-4 (because absolute values were used in above calculations)

From above tables factor to multiply voltage (e.g. 0.51) is:
    0.05 * 4000 = 200 mS/m (corresponds to Gain 1000) for Quad-phase
    0.05 * 115.2 = 5.76 ppt (corresponds to Gain 1000) for Inphase

A.4 Examples of GPS File Formats

GPS File in Trimble Pathfinder ProXL/XR ASCII Format (PFINDER for DOS)

```
SSF->ASCII V2.05   Thu May 23 23:26:55 1996
Input File  : C:\BRAMP\BRA1\R052314B.COR
Output File : C:\BRAMP\BRA1\R052314B.ASC

Datum             : WGS-84
Coordinate System : UTM [ 17T ]

Output positions

      Parameter         Columns         Units
      ---------         -------         -----
Northing          [   1,  18 ]  Meters
Easting           [  20,  38 ]  Meters
Time              [  52,  70 ]
4841594.028,        607685.406,                     14:07:38.00
4841594.027,        607685.378,                     14:07:39.00
4841594.021,        607685.380,                     14:07:40.00
4841498.297,        607795.311,                     14:47:38.00
4841498.312,        607795.306,                     14:47:39.00
4841498.322,        607795.310,                     14:47:40.00
4841498.366,        607795.372,                     14:47:41.00
.................
```

GPS File in Trimble Pathfinder ProXL/XR/XRS ASCII Format
(Pathfinder Office for Windows)

```
"Note",4835682.630,608991.847,03/31/97 16:54:57,
"Logging started: 16:54:37 03/31/1997 Mon (UTC time)"
"PosnPnt",4835682.630,608991.847,03/31/97 16:54:57
"PosnPnt",4835682.681,608992.009,03/31/97 16:54:58
"PosnPnt",4835678.692,609001.027,03/31/97 16:56:35
"PosnPnt",4835678.584,609001.345,03/31/97 16:56:36
"PosnPnt",4835678.571,609001.320,03/31/97 16:56:37
"PosnPnt",4835678.644,609001.372,03/31/97 16:56:38
```

GPS File in Ashtech Reliance ASCII Format
(TXT file)

```
Generic Line
line1, 1
274.337096
1997/08/25 21:11:24.000000, 612093.955494, 4829523.731399, 29.440896, unprocessed, unprocessed, unprocessed
1997/08/25 21:11:25.000000, 612094.114538, 4829523.297356, 30.102338, unprocessed, unprocessed, unprocessed
1997/08/25 21:11:26.000000, 612094.257011, 4829522.893570, 30.760720, unprocessed, unprocessed, unprocessed
1997/08/25 21:11:27.000000, 612094.418909, 4829522.445676, 31.465749, unprocessed, unprocessed, unprocessed
1997/08/25 21:11:28.000000, 612094.566163, 4829521.952000, 32.320072, unprocessed, unprocessed, unprocessed
1997/08/25 21:11:29.000000, 612094.762445, 4829521.535781, 33.021448, unprocessed, unprocessed, unprocessed
1997/08/25 21:11:30.000000, 612094.945979, 4829521.078066, 33.708173, unprocessed, unprocessed, unprocessed
1997/08/25 21:11:52.000000, 612097.071026, 4829508.319582, 55.519831, unprocessed, unprocessed, unprocessed
1997/08/25 21:11:53.000000, 612097.122641, 4829507.634384, 56.631542, unprocessed, unprocessed, unprocessed
1997/08/25 21:11:54.000000, 612097.193598, 4829506.968742, 57.766556, unprocessed, unprocessed, unprocessed
```

A.5 Description of Data File in EM38Bpro Format

Each record contains 22 characters, including line feed at the end of each record.
Header of the file (contains two records starting with characters E and H)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
E	M	3	8	B				V	1	2	0	Survey Type			UT	ID	IM	IC			10
H			File Name							Time/Wheel/Samples											10

EM38B	-	identification of program file
V104	-	version number (V1.20)
Survey Type	-	GPS (if GPS Input Enabled) or GRD (grid)
UT	-	unit type (0 = meters, 1 = feet)
ID	-	EM38B Dipole Mode
		(0 = Vertical, 1 = Horizontal, 2 = Both)
IM	-	EM38B survey mode
		(0 = Auto, 1 = Wheel, and 2 = Manual)
IC	-	EM38B component
		(0 = Both fixed)
File Name	-	file name, maximum 8 characters
Time/Wheel/Samples -		this field depends on EM38B survey mode
		Auto Mode -Time Increment in seconds
		Wheel Mode - Wheel Increment (user units, see IT)
		Manual Mode - Samples/Reading
10	-	Line Feed character

Header at the start of survey line (contains four records starting with L, B, A, and Z)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
L		Line Name - 8 characters																			10
B		Start Station (Format F11.2)									Time in milliseconds (Format I8)										10
A	Dir								Increment (Format F11.2)												10
Z	D	D	M	M	Y	Y	Y	Y		H	H	:	M	M	:	S	S				10

Line Name	-	Line Name, maximum 8 characters
Start Station	-	Start Station for the Line, format F11.2
Time (ms)	-	Time when Line was created in ms from start of the file
Dir	-	Direction of the Line (E, W, N, or S)
Station Inc.	-	Station Increment, format F11.3
Date	-	Date when Line was created, format DD-MM-YYYY
Time	-	Real Time when Line was created, format HH:MM:SS
10	-	Line Feed character

Reading

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
I	Gn			Reading1					Reading2					Time Stamp in ms (8 digits)							10

I - indicator T, or 2
   T - First reading at the station (default for Auto mode)
   2 - second reading at station (possibble only in Manual mode)
Gn - information byte, one character parameter,
   the ASCII number of this character indicates following:

Bit	Decimal		Value and Meaning	
7	128	1		*not used*
6	64	Marker	= 1	*trigger pressed*
			= 0	*otherwise*
5	32	Mode	= 1	*Not Used*
4	16	Gain	= 1	*Gain=8*
			= 0	Gain=1
3	8	0		*not used*
2	4	Component	= 1	*Conductivity*
			= 0	*Inphase*
1	2	Range 2		
0	1	Range 1		

Sensitivity	Range 1	Range 2	Multiplication Factors	
1000	**1**	**1**	for Conductivity	-1/Gain
1000			for Inphase	-0.0288/Gain
100	**0**	**1**	for Conductivity	-0.1/Gain
1000			for Inphase	-0.0288/Gain
1000	**1**	**0**	for Conductivity	-1/Gain
100			for Inphase	-0.00288/Gain
100	**0**	**0**	for Conductivity	-0.1/Gain
100			for Inphase	-0.00288/Gain

   Multiply Reading by above factors to obtain reasult in mS/m or ppt.

Reading1 - five character field containing instrument output.
   Conductivity if Both components, Inphase if Inphase was selected.
   includes sign (+ or -) and four digits
Reading2 - five character field containing instrument output.
   Inphase if Both components, not used if Inphase was selected.
   includes sign (+ or -) and four digits
Time - time stamp of the reading in milliseconds, this is time elapsed from the start (creation) of the current data. The time in milliseconds can be linked with the computer local time by using Times in lines B and Z of Line Header.
10 - Line Feed character

Comment

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
C	Comment (maximum 11 characters)												Time Stamp in ms								10

New Station

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S	New Station (Format 11.2)												Time Stamp in ms								10

Deleted Records

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
X	Gn	Reading											Time Stamp in ms								10
X	Comment (maximum 11 characters)												Time Stamp in ms								10

GPS Data Message Records

Each GPS record (GGA Message) is broken in to several 20 characters strings and placed in the EM38Bpro data file which contains 22 characters records, including one character indicator and line feed at the end of each record. The GPS sequence starts at the line which contains character **@** as the first character, then records that contain continuation of the same message start with character **#**. The GPS sequence ends with a line starting with the character **!**. The last line contains logger time stamp in milliseconds for given GPS reading. A sample of the GPS message written in EM38pro format is given below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
@	$	G	P	G	G	A	,	h	h	m	m	s	s	.	s	s	,	d	d	m	10
#	m	.	m	m	m	m	m	,	s	,	d	d	d	m	m	.	m	m	m	m	10
#	m	,	s	,	n	,	q	q	,	p	p	.	p	,	s	a	a	a	a	a	10
#	.	a	a	,	u	,	+	x	x	x	x	.	x	,	M	,	s	s	s	,	10
#	a	a	a	*	c	c	CR	LF													10
!													H	H	M	M	S	S	h	h	10

The GPS sequence may contain 5 or 6 records. Component of the GGA message may differ in length, however they are placed in the same number of columns. Refer to Appendix A (section A.2) for definition of each component of GGA data message.

A.6 Example of Data File in EM38Bpro Format

The EM38Bpro data file records are written in binary format, therefore the file may have different shape when displayed or printed, depending on particular video or printer settings.

```
EM38B   V120GPS0000
H 122200A    0.200
L500
B       0.00 00000014
AW           1.000
Z12222001 00:05:21.58
T¤-0648-0652 00150419
T¤-0652-0656 00150591
T¤-0866-0875 00150782
T¤-0884-0888 00150824
T¤-0990-1002 00151024
@$GPGGA,050745.00,433
#6.59295,N,07936.6514
#5,W,2,7,1,140.81,M,-
#35,M,5,118*5A
!            00151087
T¤-1012-1011 00151223
T¤-0878-0873 00151411
T¤-0780-0784 00151611
T¤-0918-0929 00151811
T¤-1041-1053 00152011
@$GPGGA,050746.00,433
#6.59298,N,07936.6514
#7,W,2,7,1,141.19,M,-
#35,M,4,118*57
!            00152088
T¤-1101-1113 00152214
T¤-1284-1294 00152400
T¤-1620-1643 00152600
T¤-1814-1844 00152760
T¤-2149-2160 00152943
@$GPGGA,050747.00,433
#6.59299,N,07936.6515
#0,W,2,7,1,141.19,M,-
#35,M,5,118*50
!            00153087
T¤-2179-2180 00153218
T¤-1646-1640 00153418
T¤-1511-1507 00153617
T¤-1465-1468 00153816
T¤-1429-1433 00154015
@$GPGGA,050748.00,433
#6.59301,N,07936.6515
#0,W,2,7,1,141.13,M,-
#35,M,6,118*56
!            00154087
T¤-1420-1424 00154218
T¤-1753-1767 00154418
T¤-1897-1909 00154617
T¤-2020-2029 00154817
T¤-2166-2178 00155015
@$GPGGA,050749.00,433
#6.59303,N,07936.6514
#5,W,2,7,1,140.89,M,-
```

APPENDIX B

B.1   Short Overview of Programs Lynx and ProShell

Two programs, ProShell (includes ProLink) and Lynx, are supplied with Allegro and Pro4000 system and can be used to transfer files between the Allegro/Pro4000 and a desktop Windows based computer.

The program ProLink is factory installed in the Pro4000 ROM (drive A:). When FileScout/ProShell is run (type **FS** in Allegro or **PS** to run ProShell in Pro4000) ProLink is automatically initiated.

Lynx runs on computers equipped with Windows 95 or higher. To install Lynx, insert the Pro4000 Setup disk (Utility disk #1) into drive A: on your computer and run the Setup program. The Lynx icon will appear on your desktop after installation is complete. When Lynx is started two Windows Explorer type screens will be displayed. The top screen, labeled Local, displays the contents of the PC. The bottom screen, labeled Remote, displays the contents of the Pro4000 assuming a connection is established. Several file management functions can be performed using Lynx, including File Transfer, renaming folders, creating new folders or sub-folders, and deleting files.

B.2   Establishing Communication

To transfer data to and from a base computer, attach the cable (null modem serial communication cable) between the Pro4000 and the computer COM ports. Run ProShell on the Pro4000 (type command PS to run ProShell) and Lynx on the PC computer.

Correct communication ports must be selected on both computers. To set up the serial port on the PC, from Lynx select the **Transfer/Select COM Port** menu option. To set up the communication port on the Pro4000, press <F5>(Xfer) from main screen of ProShell, and then press <F1> to toggle between ports COM1 and COM2.

Juniper Systems recommends that the Pro4000 is in auto baud rate detection mode (the default setting). In this mode, the Pro4000 tries to establish communication at 115K baud, and in case communication fails at this rate, it automatically steps down to the next slowest rate until communication is established.

To start communication click on the **Connect** button (the green circulating arrows in the centre tool bar) or select the Transfer/Connect to Remote menu option from Lynx. When connection is established the contents of the Pro4000 Field Computer will be displayed in the Lynx bottom Remote view screen.

B.3   Transferring Files to the Pro4000 from the PC

Select the folder in the Remote view screen. Transferred files will be saved in this folder.

In the Local view screen select files to be transferred to the Pro4000.

Click the Down arrow button or select Transfer/Send to Remote from the main menu. File transfer starts immediately. In cases where the selected file exists in the logger the program will prompt for permission to overwrite.

B.4   Transferring Files from the Pro4000 to the PC

Select the folder in the Local view screen. Transferred files will be saved in this folder.

In the Remote view screen select files to be transferred to the PC.

Click the Up arrow button or select Transfer/Receive from Remote from the main menu. File transfer starts immediately. If selected files exist in the selected folder in the PC the program will prompt for permission to overwrite.

When the transferring session is finished click the Disconnect button before disconnecting the serial cable. Otherwise, the Esc key must be pressed on the logger to return the Pro4000 to normal function.

Please refer to Pro4000 Field Computer User's Manual (Section 5) for more detailed description of ProShell and Lynx functions.