# Analytics Software of Testing Pile by Reflected Wave

## Instruction Manual

**Beijing ZBL Science & Technology Co.，Ltd.**

# Contents

# Conventions in this manual

1. Word with gray background and black box is a button on the interface, e.g. OK.
2. The keys on the instrument panel are represented by 【】, e.g. 【SAVE】.
3. Word with white background and black box represent software menu command in Windows, and "→"is a separator between different menu levels. e.g. File→Open means the command of selecting "Open" under the "File" menu.
4. Word with gray background but without box indicates the name of the control (choice box, input box, etc.) of the popup window on the screen, such as the input box of File Name in the open-file window.
5. The sign  means special attention is needed here.
6. Besides the descriptions in the manual, some prompt messages may show automatically in the use of the software. Please operate accordingly.
7. The bitmap file in the operation manual is a graphics file with an extend name as BMP file.
8. Interface of this software comprises of multiple parts or views. A certain part will become the focus after it is clicked.
9. Window pictures for illustration in this manual are offered by the WindowXP system. Window style or name of this software will be slightly different when installed in other systems.
10. The software interfaces and photos in manual are only for reference. There will be changes with software upgrade and improvement of products. No further notice is provided.

# Chapter 1 Brief Introduction

Analytics Software of Testing Pile by Reflected Wave is a kind of application software launched by Beijing ZBL Science＆Technology Co., Ltd. It is mainly used for analytical processing of the data of foundation pile integrity assessed by ZBL-P810 foundation pile dynamic tester.

This software is user-friendly in interface and easy in operation, whose operational approach and interface forms completely correspond with the style of Windows. Users familiar with the operation of Windows application software will find it easy to use this software. This software is designed specifically for people engaged in engineering detection. It can work on computers installed with operating system of Windows95, Windows98, WinMe, WindowsXP, Windows2000 or Windows NT.

The main functions of this software:

1) Managing the engineering information, pile information and multiple waveform data, etc of foundation pile detection in engineering;
2) Acquiring statistical information(minimum wave velocity, maximum wave velocity, average wave velocity; pile amount of Ⅳ, Ⅱ ,Ⅲ, Ⅳ, etc) of the detected foundation pile; generating a summary table in Excel;
3) Smoothing, integrating, filtering and exponential or linear magnifying, etc the detecting waveform, useful information in the waveform being highlighted; Analyzing the amplitude spectrum or power spectrum in the waveform and making aided analysis for foundation pile integrity;
4) Scaling, stretching, compressing, shifting and rotating, etc

the waveform conveniently;

5) Setting the position of pile head, pile toe and defect easily and saving the result.
6) Regaining original waveform at any time and reprocessing analytical process if the result is not satisfactory;
7) Saving the waveform, spectrogram and pile schematic of foundation pile detection in the form of bitmap, so that other graphics software can process them;
8) Print preview and printout of results.

This software involves five different kinds of files, which are shown in table 1.1.

table 1.1 List of file type

| Type | Extension | Illustration |
|---|---|---|
| Project File | ZPJ | Engineering Data File |
| Data File | ZIT | Single Waveform Data File |
| Graphic File | BMP | Bitmap File |
| Text File | TXT | ASCII File |

# Chapter 2 Installation & Running & Uninstallation

Installation of this software is similar to that of common Windows software. Installation of this software and the preparation work before usage will be specifically introduced in this chapter.

Files needed for the installation of this software are stored in the attached U-disk along with the instrument.

## 2.1 Installation

1. Insert the U-disk into the computer, find the file of P8Setup.exe under the root directory in the U-disk and run it. The installation wizard will uncompress the needed files into computer (Figure 2.1). Once uncompress is completed, the installation wizard (Figure 2.2) will be started automatically to instruct the users how to make installation. After several minutes, a welcome screen like Figure 2.3 will appear.

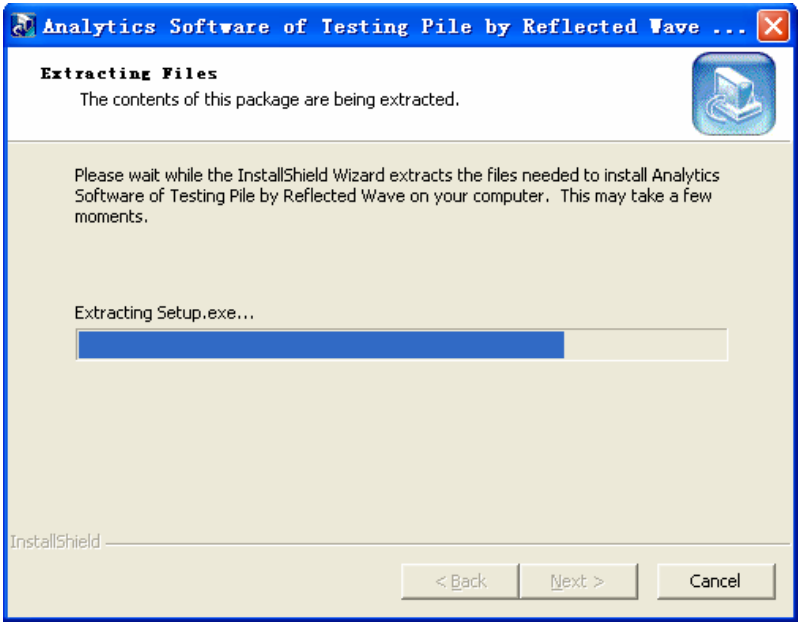



Figure 2.1 Uncompress Interface

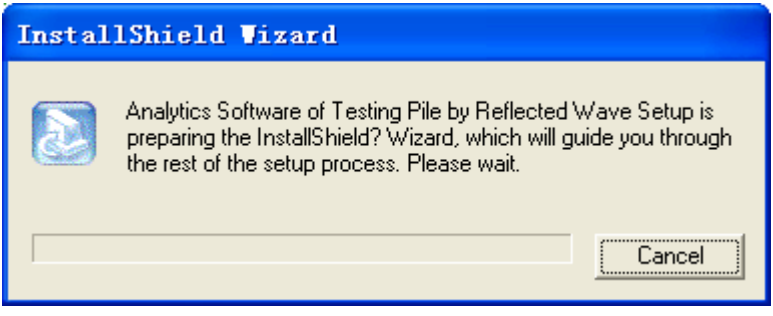



Figure 2.2 Start the Installation Wizard Interface

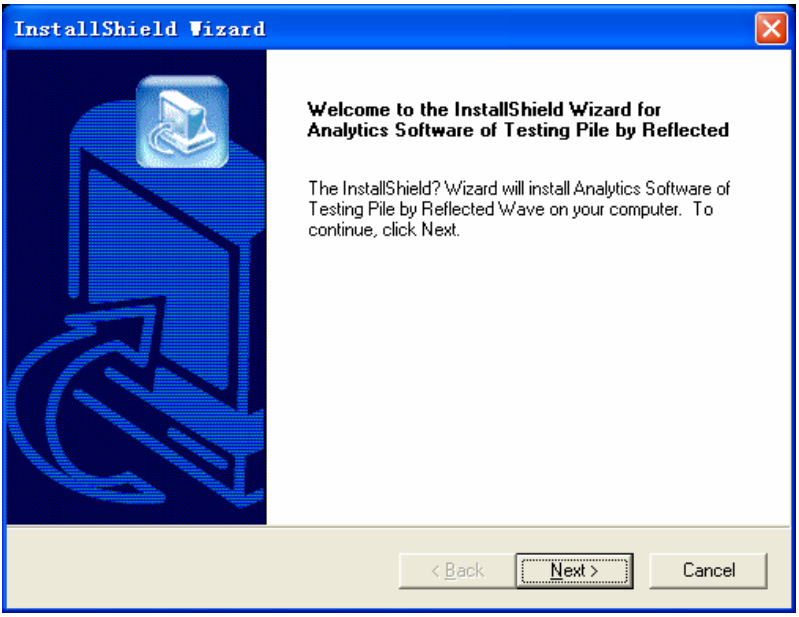



Figure 2.3 Welcome Screen

2. To quit Setup please click Cancel on the welcome screen. By clicking the Next button, users can see the User Information dialog box in Figure 2.4;

3. After entering the user's information in the dialog box in Figure 2.4, if click the Back button you will return to the interface in Figure 2.3; If you click the Cancel button you will quit Setup; Click the Next button you will see a pop-up Select Installation Folder dialog box (Figure 2.5)

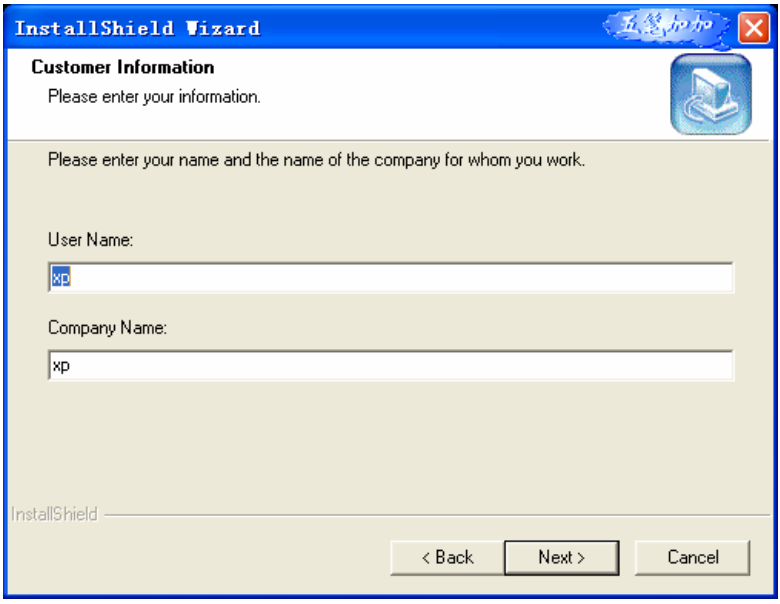



Figure 2.4 User Information Dialog Box

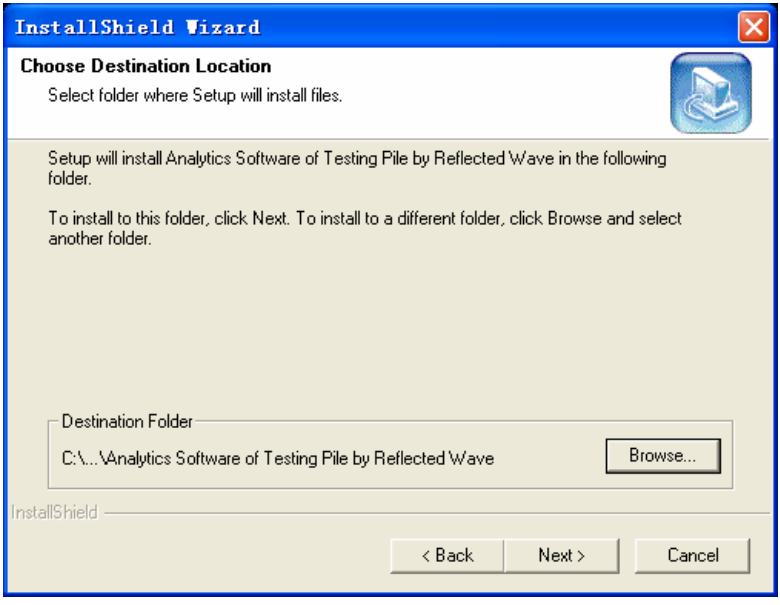



Figure 2.5 Select Installation Folder

4. After selecting a target folder by clicking Browse button on the window in Figure 2.5, if click the Back button you will return to the interface in Figure 2.4; If click the Cancel button you will quit Setup; If click the Next Button you will see a pop-up Information Browse interface (Figure 2.6).

5. In the dialog box in Figure 2.6, if click the Back button you will return to the interface in Figure 2.5; If click the Cancel button you will quit Setup; If click the Next button you will begin to copy the files, and it will pop up an Installation Progress dialog box (Figure 2.7). The consumed time is related to the hardware configuration of computer, ranging from a few seconds to a few minutes. You can quit Setup at any time during the process by clicking the Cancel button.

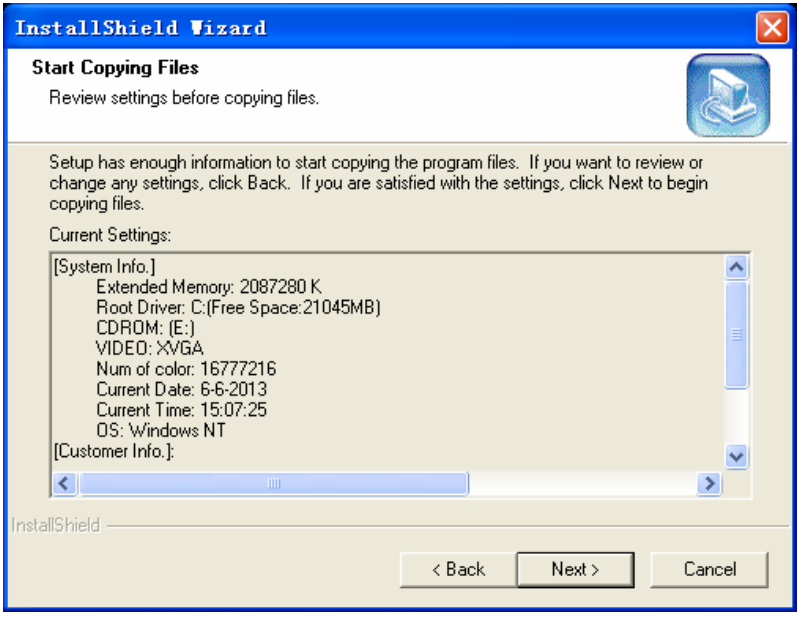



Figure 2.6 Information Browse Dialog Box

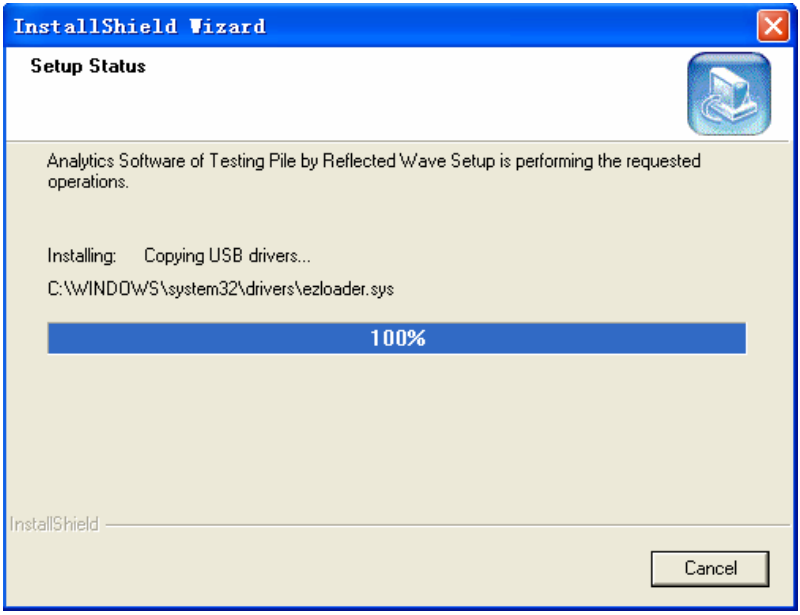



Figure 2.7 Installation Progress

6. Once the files are copied completely, you will see a pop-up Install Completion dialog box (Figure 2.8). Click the Finish button you will end the installation. After that a shortcut icon to invoke this software will appear on the desktop and program package. Select the option of "now restart computer" if there is one, then the system will restart automatically and finish the installation.

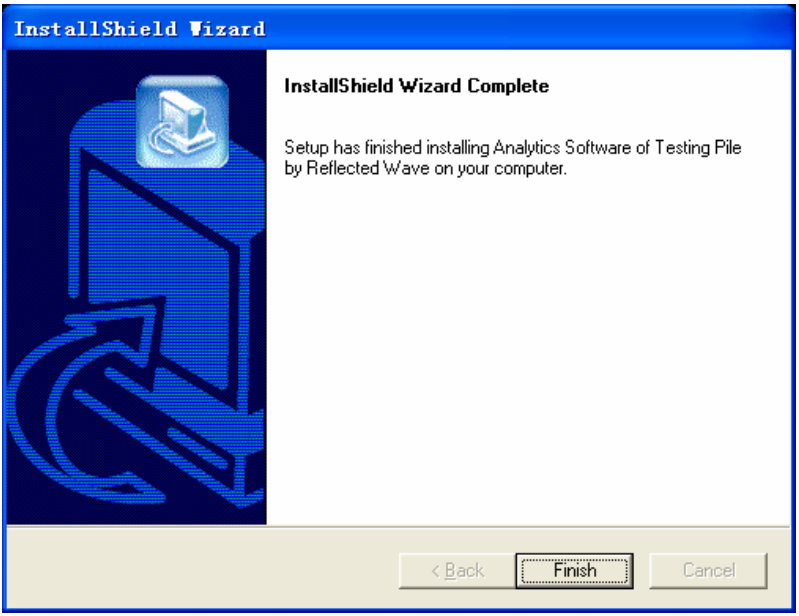



Figure 2.8 Install Completion

NOTE: Please close all the application software, such as antivirus program or firewall, etc before installation, otherwise some problems may appear.

## 2.2 Running

Once the installation is completed, you can run this software by selecting the following with mouse: Startup→ All Programs→Beijing ZBL→ Analytics Software of Testing Pile by Reflected Wave→Analytics Software of Testing Pile by Reflected Wave. Besides, you can also run it by double clicking the shortcut icon Analytics Software of Testing Pile by Reflected Wave on desktop.

## 2.3 Uninstallation

Once this software is updated, if the upgrade is needed, you should uninstall the software of old version. There are two methods for uninstallation:

Method 1: Similar to other application program in Windows, you can double click the "Add/Remove Programs" icon in "Control Panel", select the software to be uninstalled (Analytics Software of Testing Pile by Reflected Wave) in the pop-up dialog box and then click the Add/Remove button to start Uninstall Wizard. The remaining steps can be found in method 2.

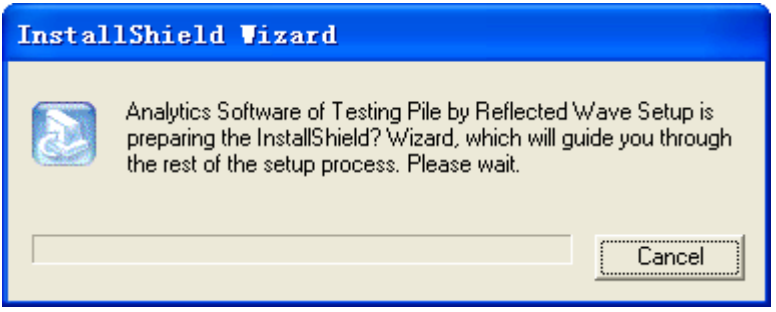



Figure 2.9 Start Uninstall Wizard

Method 2: The Uninstall Wizard can be started by selecting the following options: Startup→ All Programs→Beijing ZBL→ Analytics Software of Testing Pile by Reflected Wave→ Uninstall Analytics Software of Testing Pile by Reflected Wave. Later the Installation Options dialog box in Figure 2.10 will appear.

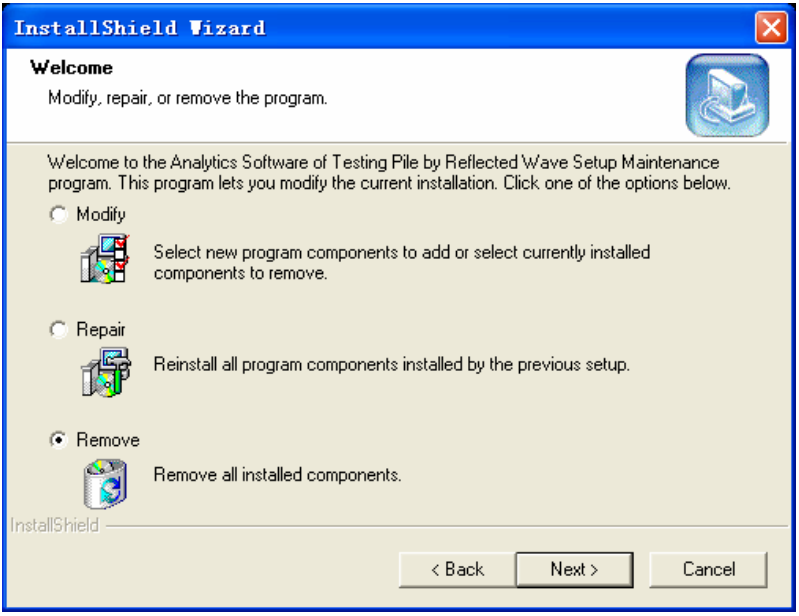



Figure 2.10 Installation Options Dialog box

Selecting the third option Remove in the Installation Options dialog box, if choose Cancel button you will end the uninstallation; If choose Next button you will start the process of automatic uninstallation, followed by the Uninstallation Progress dialog box (Figure 2.11). When the uninstallation is finished, the Uninstallation Completion dialog box (Figure 2.12) will pop up. Click the Finish button and this software will be uninstalled completely.

NOTE: Installation Options dialog box will pop up when you want to reinstall this analysis software if this software has already been installed. On this condition, you should select the first or the second option——Modify or Repair. By clicking the Next button, the upgrade of this software will be completed.

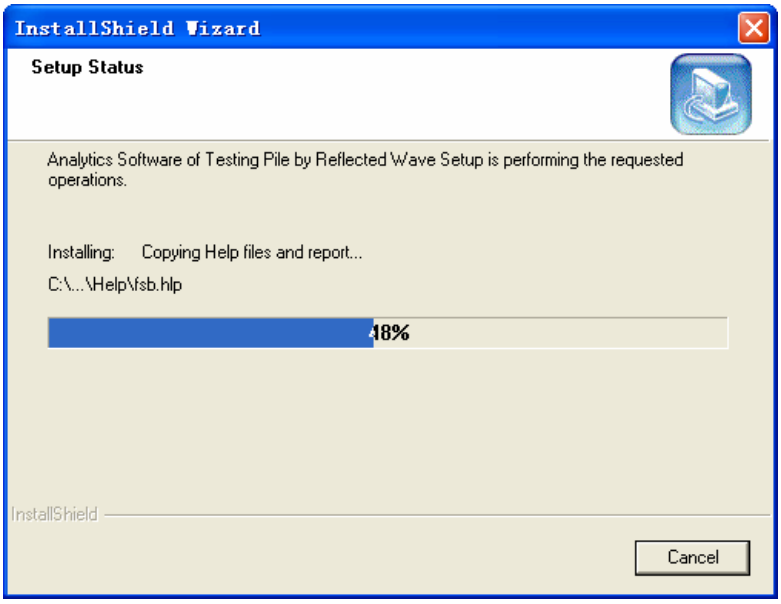



Figure 2.11 Uninstallation Progress Dialog Box

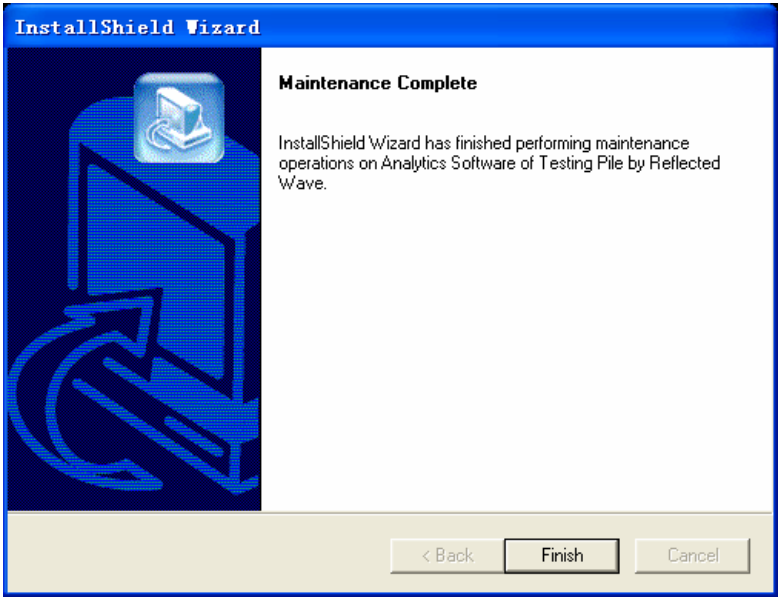



Figure 2.12 Uninstallation Completion Dialog Box

# Chapter 3 Analytics Software of Testing Pile by Reflected Wave

Before using Analytics Software of Testing Pile by Reflected Wave to analyze the signal of testing foundation pile, you should store the detected data file into computer having been installed with this analysis software. As for P8 series of foundation pile dynamic testers, first the newly detested data should be copied into U disk, and then data in the U disk shall be copied into a certain folder of this computer; as for P800 foundation pile dynamic tester, because the data is stored directly in the laptop computer liked with apparatus, it can be transferred into computer installed with this analysis software for further analysis.

## 3.1 Introduction to Software Interface

The interface of this software is composed of seven parts (Figure 3.1.1): Title Bar, Menu Bar, Tool Bar, Status Bar, Pile Information Area, Pile List Area, Wave Diagram Area and Pile Diagram Area.

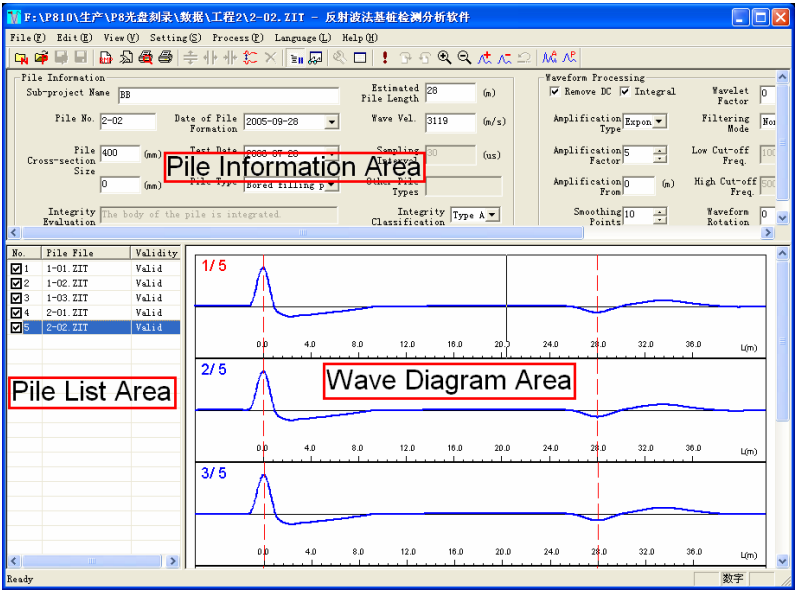



Figure 3.1.1 Software Main Interface

1. Title Bar displays from left to right the following: Software Icons, Current Pile File Name, Software Brand and three standard application buttons in Windows  . The functions of these three buttons are minimum, maximum/restoration and closure of program.
2. Menu Bar comprises of seven drop-down menus: File, Edit, View, Settings, Process and Help. By clicking any menu item, you will see one drop-down menu accordingly, corresponding a set of function respectively. Submenu items of the seven menu items include all the functions of this software. When some menus are grayed out, their functions are invalid at current state.
3. Tool Bar is composed of a series of buttons (Figure 3.1.2), every button represents one common function. Although these commands are already included in the menu commands, it is much more

convenient for users to invoke these common commands through toolbar buttons. The cursor hovering over a certain button for a moment, the function tip of this button will appear on screen automatically. When the button is grayed out, it means its function is invalid at current state.

Figure 3.1.2 Tool Bar

4. Status Bar is mainly for displaying short helping information and related data.

5. Pile Information Area displays the current basic information and the process parameters of the chosen pile (Figure 3.1.3). Users can set and modify the process parameters. After modification, if users press the ↵ button, the process parameters will be processed according to the setting. By pressing the Default button, users set the process parameters as the recent one; by pressing the Para. Recovery button, users set the process parameters value as the default one.


Figure 3.1.3 Pile Information Area

6. Pile List Area is used for displaying all the piles and their validity of current project. It is located at the left half of the main interface (Figure 3.1.4). Users can open a certain pile file by double clicking it for the analytical processing. Also users can open a pile file by doing the following steps: selecting a pile file by ↑ and ↓button; then pressing the ↵button.

By clicking the left mouse button on Pile Files or the title bar of Validity (Figure 3.1.4.a), users can sort all the pile files in ascending or descending order. By clicking the left mouse button on the title bar

of No. (Figure 3.1.4 b), users can set all the pile files into state of validity or invalidity.

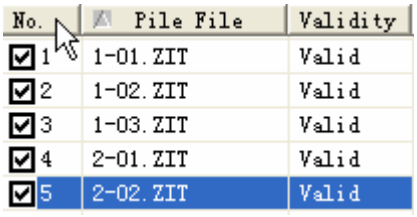
By clicking the left mouse button on the check box in front of sequence number, users can select or unselect the corresponding pile files, setting the validity of the pile file; also after selecting multiple pile files, users can modify the validity of all the chosen pile files by using "File" menu, "Validity Modification" in the right-mouse menu or pressing Space key.

The pile files can be sorted by dragging and dropping the left mouse button. Specific steps are as follows: after selecting one or more pile files (Figure 3.1.4c), users can click the pile files with left mouse button while keep holding down the mouse; drag the selected object on top of one pile files (Figure 3.1.4d) and then loose the left mouse button. Thus, the selected pile files are shifted behind the original one, rearranging the pile files.

In addition, users can modify the name of a pile file in the Pile List Area: first click the row of the pile file to be modified with the left mouse button; then click the name of the pile file one more time to make an edit box appear (Figure 3.1.4e); at last input the file name and press ↵ key or click anywhere to finish the modification.

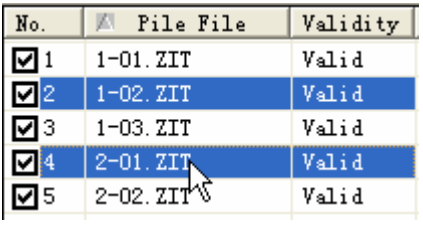
| No. | Pile File | Validity |
|---|---|---|
| ☑ 1 | 1-01.ZIT | Valid |
| ☑ 2 | 1-02.ZIT | Valid |
| ☑ 3 | 1-03.ZIT | Valid |
| ☑ 4 | 2-01.ZIT | Valid |
| ☑ 5 | 2-02.ZIT | Valid |

a) Automatic Sorting



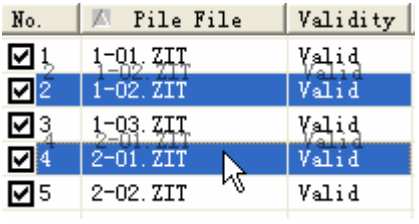
| No. | Pile File | Validity |
|---|---|---|
| 1 | 1-01.ZIT | Valid |
| 2 | 1-02.ZIT | Valid |
| 3 | 1-03.ZIT | Valid |
| 4 | 2-01.ZIT | Valid |
| 5 | 2-02.ZIT | Valid |

b) Validity or Invalidity Setting of All Pile Files



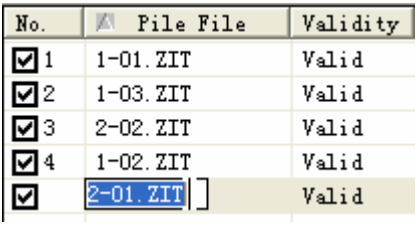
| No. | Pile File | Validity |
|---|---|---|
| 1 | 1-01.ZIT | Valid |
| 2 | 1-02.ZIT | Valid |
| 3 | 1-03.ZIT | Valid |
| 4 | 2-01.ZIT | Valid |
| 5 | 2-02.ZIT | Valid |

c) Selection of Files



| No. | Pile File | Validity |
|---|---|---|
| 1 | 1-01.ZIT | Valid |
| 2 | 1-02.ZIT | Valid |
| 3 | 1-03.ZIT | Valid |
| 4 | 2-01.ZIT | Valid |
| 5 | 2-02.ZIT | Valid |

d) Drag and Drop



| No. | Pile File | Validity |
|---|---|---|
| 1 | 1-01.ZIT | Valid |
| 2 | 1-03.ZIT | Valid |
| 3 | 2-02.ZIT | Valid |
| 4 | 1-02.ZIT | Valid |
| | 2-01.ZIT | Valid |

e) Rename Pile File

Figure 3.1.4 Pile List Area

The methods of selecting multiple pile files in the Pile List Area:

1) To select the target pile files, click the left mouse button while holding down the Ctrl button;
2) To select all the pile files between two pile files, click the left mouse button respectively while holding down the Shift

button;

3) To select multiple pile files, select pile file one by one by ↑ and ↓ key while holding down Shift key.

7. Wave Diagram Area, displaying the current pile oscillogram, is located at the right part of the main interface, as shown in Figure 3.1.1.

The Waveform Area will display all the detected waveform in the current pile successfully. When there are many waveforms which can not be fully displayed in one screen, there will be a scroll bar at the right of the Waveform Area for examining. All the waveforms will be magnified in one time by double clicking the left mouse at any waveform. Also, all the waveforms can be restored by double clicking the left mouse.

The black dotted line in the middle of every waveform is the basic line. The underneath is scales whose scale value can be either time or length. The two vertical red dotted lines in every waveform represent the place of pile head and pile toe; the green vertical dotted line is the defected place set by the users, and there is the defected place under the dotted line. On the top left corner, there is a sign of "n/m"，in which the numerator "n" represents the place of the current channel waveform among the whole waveforms in the pile files. The denominator "m" represents the total number of waveform in the current pile files. If the number is red, this waveform is the current waveform; otherwise, it will be in blue.

In the Waveform Area, users can set this channel as the current channel by clicking the left mouse on a certain waveform, followed by the displaying of phonation time T of mouse position (relative to the starting point of waveform), jet lag DT (relative to the pile head), length L, wave velocity C and range of waveform Y in the status bar. By holding down the left mouse and dragging the cursor, users can check the above parameter of cursor position. Besides, removing

cursor by pressing ← and → buttons, users can check the parameter value. Keeping down the ← and → buttons, users can also move the cursor rapidly.

When the current focus is at the Waveform View, users can make shift among channels by ↑ and ↓ keys. For example, when the channel is moved to the last one, users can move the channel to the first by pressing ↓ key; when the way is moved to the first one, users can move the channel to the last one by pressing ↑ key. Also users can page down and page up by pressing the keys of Page Up and Page Down; by pressing the Home key users can move the channel to the first one; by pressing the End key users can move the channel to the last one.

By clicking the right mouse button on the Waveform Area, users will see a pop-up menu shown in Figure 3.1.5. Its function is exactly the same as the one of corresponding menu in menu bar. Besides, this menu will also pop up by pressing ↵ button in the Waveform Area.

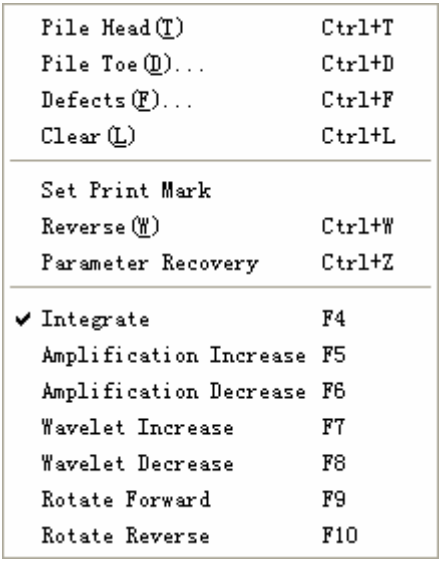



Figure 3.1.5 Pop-Up Menu

If the analysis of amplitude spectrum or auto-power spectrum of all the current waveforms in current piles is implemented, the amplitude spectrum diagram or auto-power spectrum diagram will be displayed in the Waveform Area, shown in Figure 3.1.6. In every spectrum diagram, the red dotted line represents a peak frequency; the upper right shows the related frequency data with this spectrum diagram in blue (dominant frequency Fm, frequency resolution F0, respective peak frequency and frequency difference); the underneath is frequency scale value.

When the Waveform Area displays the spectrum diagram, the operation of switchover of channels, patterns and cursors will be the same as the displaying of time domain of waveform. When the cursor is shifting, the position of cursor is showed as F frequency in the status bar.

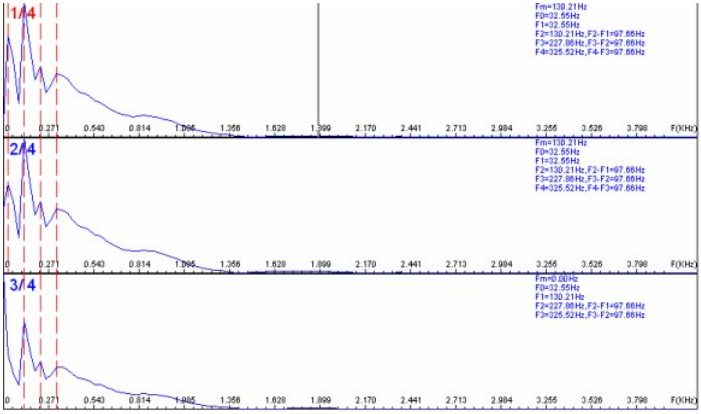



Figure 3.1.6 Amplitude Spectrum Diagram

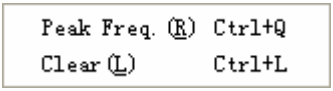



Figure 3.1.7 Pop-Up Menu in the Spectrum Area

When the Waveform Area displays the spectrum diagram, users will see a pop-up menu shown in Figure 3.1.7 in the Spectrum Area by clicking the right mouse button, whose function is exactly the same

as the corresponding menus in the menu bar.

8. Pile Diagram Area, displaying the current pile schematic, is located below the last waveform diagram of the Wave Diagram Area. This area shows the pile after analysis and schematic of the defects. Without analysis, this region is empty. When the Wave Diagram Area displays the spectrogram, the Pile Diagram Area is empty

# 3.2 Menu commands

## 3.2.1 File Menu

### 1. New Project

The creation of a new project data file (extension ZPJ) is mainly used to manage the project information and a summary of all the foundation piles.

After selecting New Project menu, there will pop-up dialog box of “Project Information” showed in figure 3.2.1 to set the information related to new project in which the Project Name can not be empty. After setting the project information, if users select the ZBL-P810 Pile Dynamic Tester and click OK button, there will pop-up a dialog box of “Opening File” as showed in figure 3.2.2; then users can select the folder where the files to be added in the Look in; furthermore users can select the file type from the box of Files of type and input the name of a file in the “File name” box or select one or more files to be added from the file list box; finally after clicking Open button , users can make a choice in “ Do you really want to add the selected files to the project?”. Clicking Yes button, the files will be added into the project; Clicking No button, all the files under the same folder will be added into the project; clicking the Cancel button, not added.

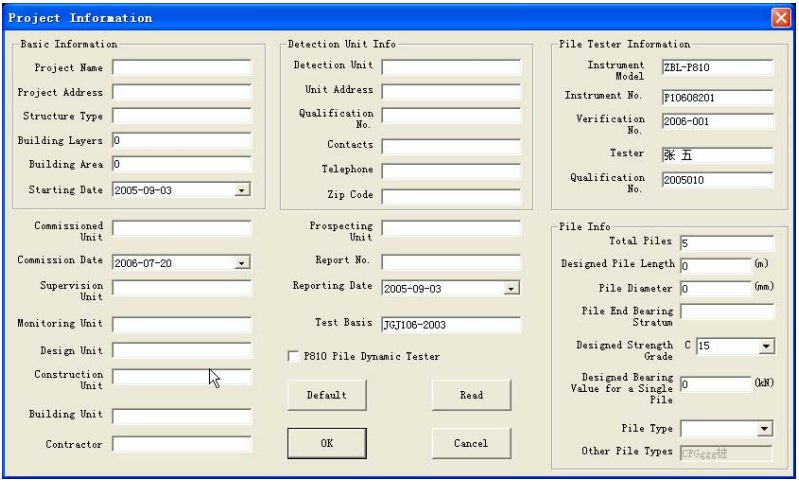



Figure 3.2.1 Project Information Dialog Box

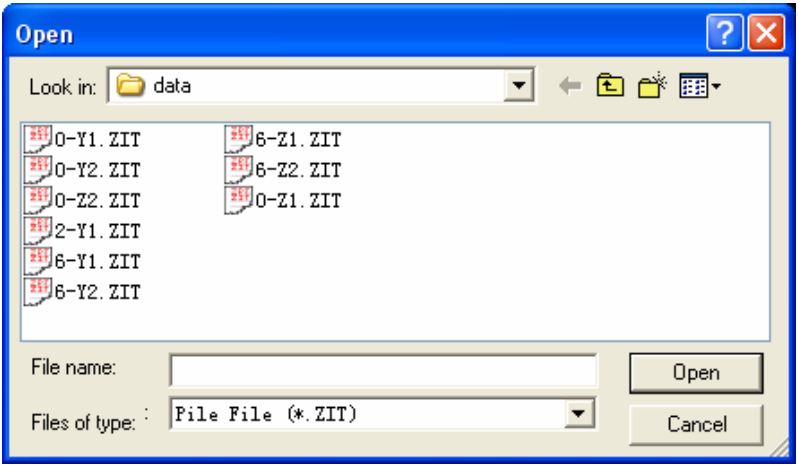



Figure 3.2.2 Adding Files Dialog Box

After the creation of new project, the automatic open of the first pile file in the project files will make the corresponding data or information displayed in all the areas showed in Figure 3.1.1.

Before the creation of a new project file, if the previously-opened file has already been changed, the system will give the warning of whether save it or not. Choosing Yes button, the modification will be

saved; choosing No button, not saved.

## 2. Open Project

After opening a project (extension ZPJ), the automatic open of the first pile file in the project files will make the corresponding data or information displayed in all the areas showed in Figure 3.1.1.

After selecting the Open Project menu, the dialog box of "Open File" will appear. By selecting the folder where the project file to be opened in Look in; selecting the file type from the Files of type box ; inputting the name in the "File name" box or choosing the files to be opened from the list and clicking Open button, the file can be opened.

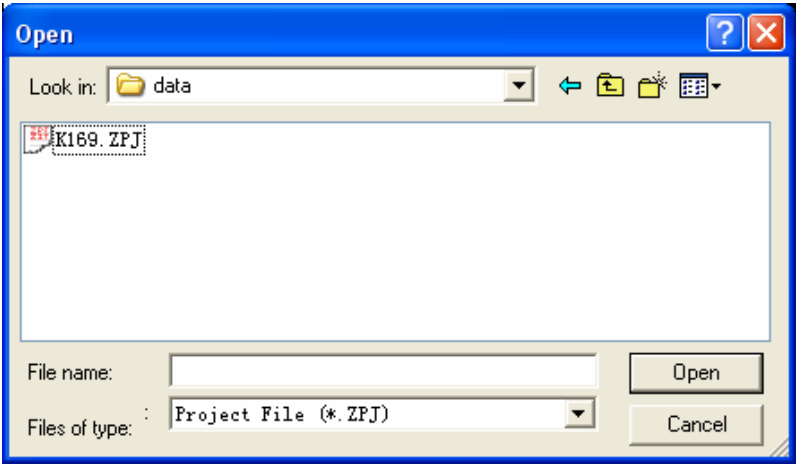



Figure 3.2.3 Open Project File Dialog Box

Before opening a new project file, if the previously-opened file has already been changed, the system will give the warning of whether save it or not. Choosing Yes button, the modification will be saved; choosing No button, not saved.

## 3. Save Project

To save the current project data, if it is newly created, the function of this menu will be the same as Save Project As menu. If the file is not modified, this menu is invalid. Once the file is modified, the

menu will be valid.

### 4. Save Project As

To save the currently opened project file as a new project file, users shall do the following steps: selecting Save Project As menu and selecting the folder where the files to be saved at in the pop-up "Save As" dialog box shown in Figure 3.2.4; entering the file name in the File name box. To save the file, press the Save button; to not save, the Cancel button.

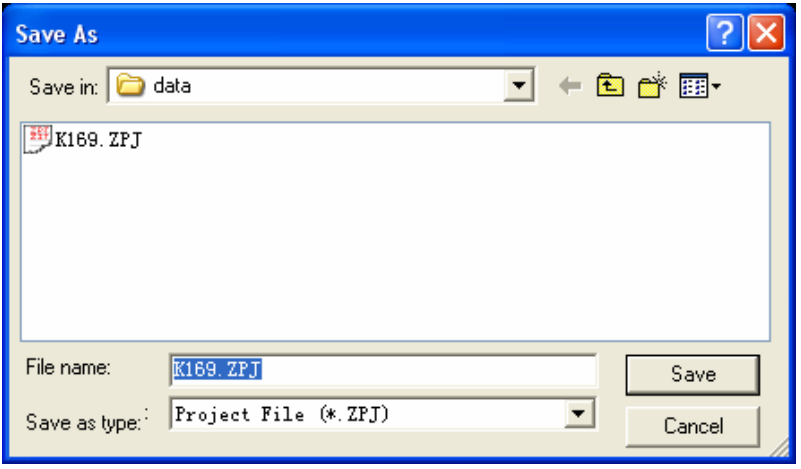



Figure 3.2.4 Save Project As Dialog Box

Before saving the file, if there is a file with the same name, this soft will give users a warning of whether to overwrite the file. Choosing Yes button, the former file be overwritten and lost, not being restored; choosing No button, the file is not saved and return to the dialog box shown in Figure 3.2.4, reentering the file name.

If the path (folder) of saved as project file has changed, all the pile documents it contains will be copied to the new folder.

### 5. Close Project

To close the currently opened project file and return it to the original operating status of the program, users must check whether the

current project files and pile documents are saved or not. If not saved, users are prompted to “Save or Not”. To save, click Yes button; to not save, click No button.

### 6. Add Files

This menu is used to add files of other piles to the current project file, in order to carry out unified management.

After choosing Add Files menu, there will pop-up the “Open File” dialog box shown in Figure 3.2.6. Users, from the Look in, can select the folder which they want to add files, select the file type in the Files of type box, enter the file name in the “File name” box or select the file to be added from the file list box. Then users will be asked “Whether add the selected file to the project or not” by pressing the Open button. To add the selected files to the project, press Yes button; To add all the files under the folder to the project, press No button; to not add, press Cancel button.

This menu is valid only when the focus is in the Pile List Area. If the pile files to be added is not at the same file folder of the current project file, the pile file to be added shall be copied to the folder where the current project file is in.

### 7. Remove Files

After selecting one or more pile files in the Pile List Area and choosing the Remove Files menu, there will pop-up a dialog box shown in Figure 3.2.5, after selecting to Remove files or Delete files, press OK button to remove or delete the selected files; to not remove or delete, press Cancel button.

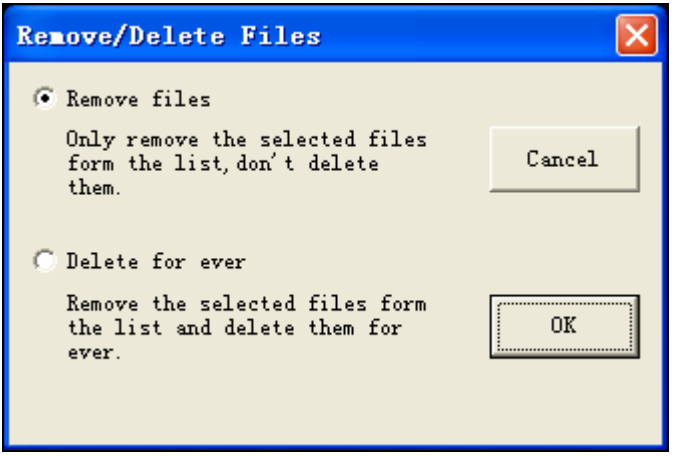



Figure 3.2.5 Delete/Remove file Dialog Box

The menu is valid only when the focus is in the Pile List Area.

NOTE: Removing the files will only remove the selected pile files from the project file and will not delete them. Deleting the files will remove the selected pile files from the project file and delete them completely. At least one pile file shall be kept in the project files.

8. Validity Modification

After selecting one or more pile files from the pile list area, users can modify the validity of the selected pile files by choosing the Validity Modification menu.

NOTE: The printout and generation of bitmap and summary sheet is only available for the valid pile files in the current project.

9. Open Files

Open the data file of the single pile (extension ZIT) to analyze and process it. After opening the pile file, various areas in the interface in Figure 3.1.1 (except Pile List Area) will display the corresponding data or information.

After selecting Open File menu, users can see a pop-up "Open

File" dialog box shown in Figure 3.2.6. Users can open the file by doing the following: selecting the folder in the Look in where the files to be opened located in; selecting the file type to be opened in the Files of type box, entering file names in the "File name" box or selecting files from the file list box; pressing the Open button.

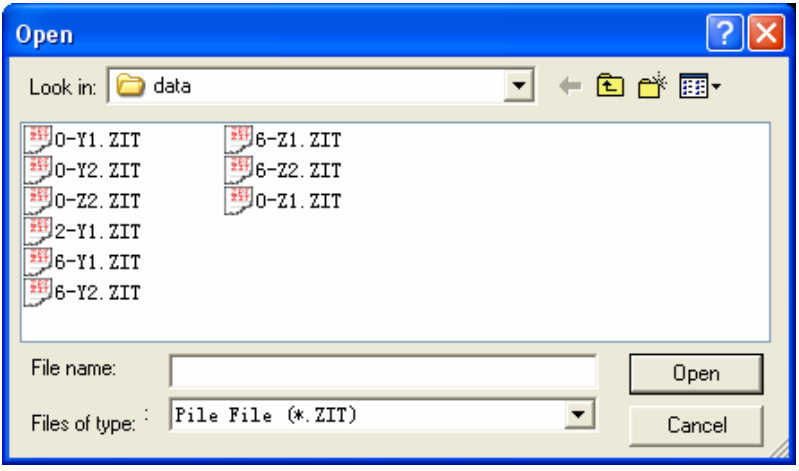



Figure 3.2.6 Open Files Dialog Box

Before opening the new file, if the previously-opened file has been modified, users will see the warning of save or not. To save the modification, press Yes button; to not save, press No button.

## 10. Save Files

To save the current pile files, if it is newly created, its function will be the same as "Save Project As" menu. If the file is not modified, this menu is invalid. Once the file is modified, the menu will be valid.

## 11. Save File As

To save the currently opened pile file as a new pile file, users shall follow the following steps: selecting Save File As menu and selecting the folder where the files to be saved at in the pop-up "Save As" dialog box shown in Figure 3.2.7; entering the file name in the File name box. To save the file, press the Save button; to not save,

press the Cancel button.

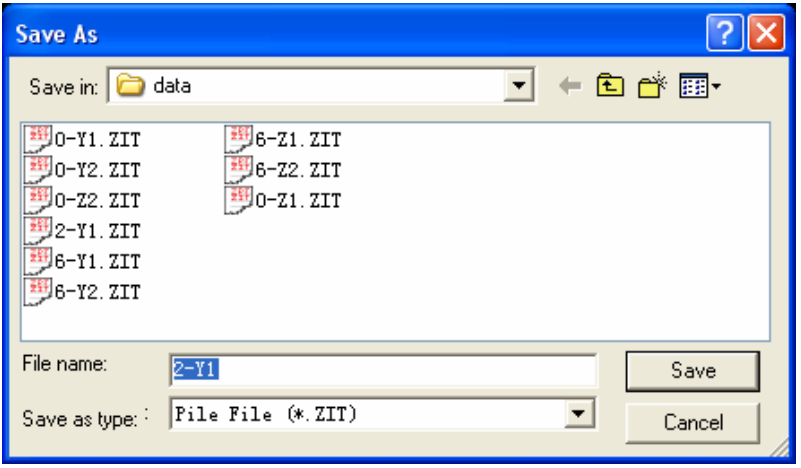



Figure 3.2.7 Save File As Dialog Box

Before saving the file, if there is a file with the same name, this soft will give users a warning of whether to overwrite the file. Choosing Yes button, the former file be overwritten and lost, not being restored; choosing No button, the file is not saved and return to the dialog box shown in Figure 3.2.7, reentering the file name.

## 12. Exporting Text Files

After saving the related information of pile file and waveform data after analysis, users can open them by software like Notepad.

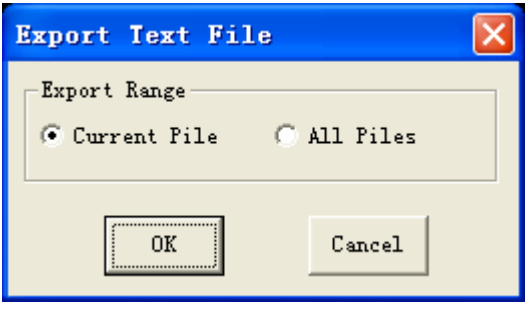



Figure 3.2.8 Exporting Text Files Dialog box

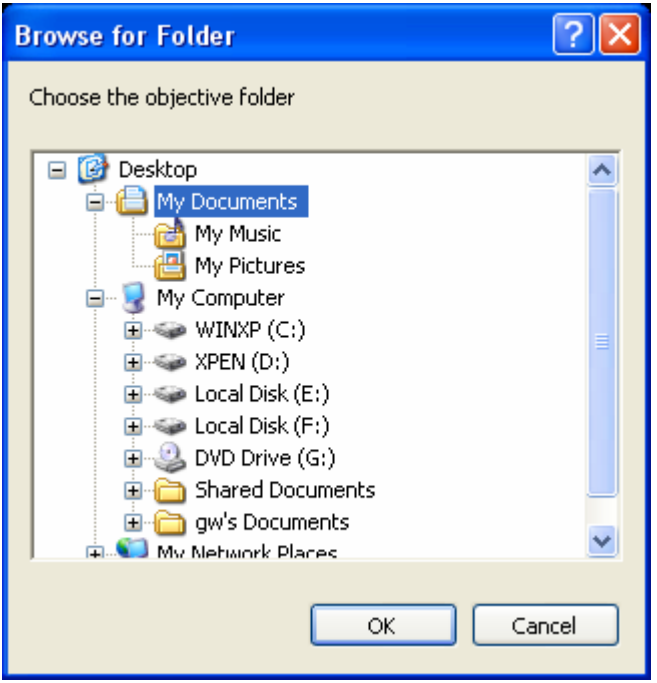



Figure 3.2.9 Folder Selection Dialog Box

After selecting Export Text Files menu, users will see a pop-up dialog box of "Exporting Text Files" shown in Figure 3.2.8, from which users can select the range of exporting text files. Pressing the Cancel button, not export; pressing the OK button, the Folder Selection dialog box will pop up (Figure 3.2.9). By selecting the targeted folder for the saving of text file and pressing the OK button, users can establish a subfolder named after the Project Name under the chosen folder (if the Project Name is empty, the subfolder will be named project). In such a way, all the generated text files will be kept in the subfolder with file name in accordance with the pile file name.

NOTE: When exporting the text files, users can only export pile information and the original data of that waveform after pile form analysis.

## 13. Generate Bitmaps

After selecting Generate Bitmaps, Folder Selection dialog box will pop up (Figure 3.2.9). By selecting the targeted folder for the saving of bitmap and pressing the OK button, users can establish a subfolder named after the Project Name under the chosen folder (if the Project Name is empty, the subfolder will be named project). In such a way, all the generated bitmaps will be kept in the subfolder with the default name of "pile file name-waveform sequence. bmp".

After generating a bitmap, a dialog box will pop up of "whether insert this bitmap into the word or not". Pressing the Yes button, users will establish a new Word file and insert all the bitmap into it.

NOTE: When generate a bitmap, users shall output in accordance with the "print range and content" "header information", etc in the "print setup".

## 14. Print

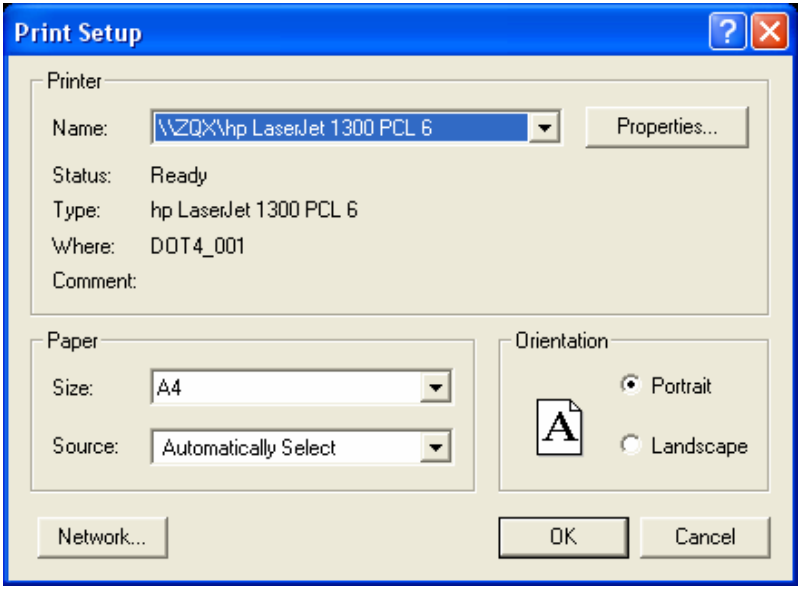



Figure 3.2.10 Print Dialog Box

After selecting Print, users will see a pop-up dialog box shown in Figure 3.2.10. Choosing the printer, page scope and print copies, users can print according to the parameter in the "Print Setup" by pressing the Print button; pressing the Cancel button, print operation not being executed.

### 15. Print Preview

After selecting Print Preview, users will see a print preview page and check the effect.


Figure 3.2.11 Print Preview Toolbar

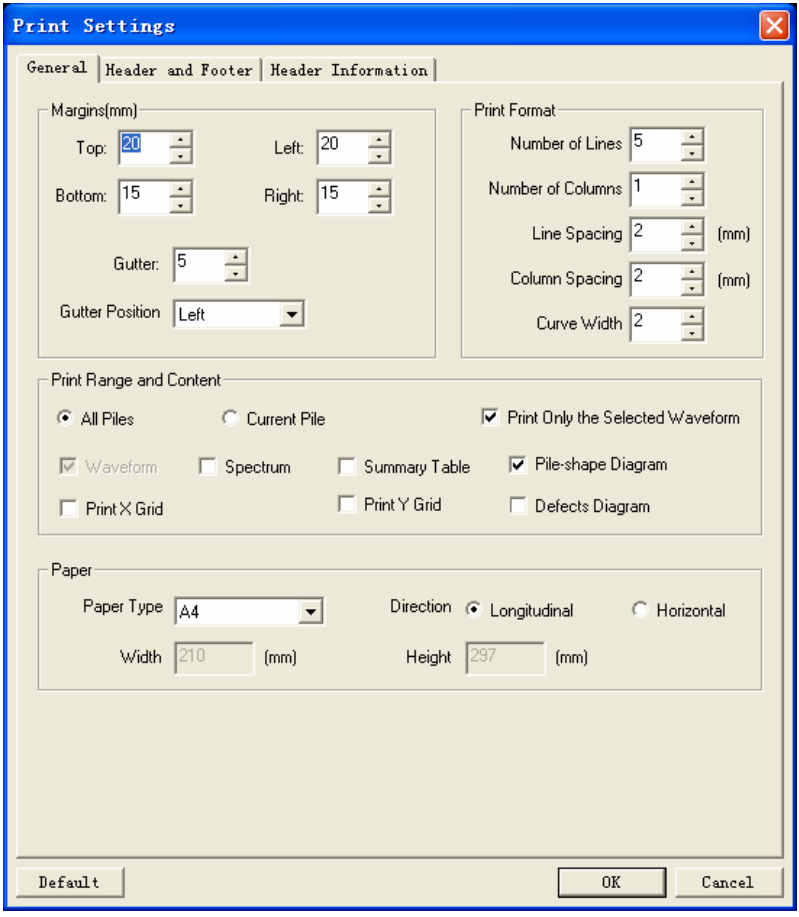
Figure 3.2.11 is the toolbar of the preview interface. The following is the function of the toolbar: Print button is for the print output, whose function is same as print of the main menu; Next Page button is for paging down and the current page means the last page when the button is grayed out (invalid); Prev Page button is for paging up and the current page means the first page when the button is grayed out (invalid); Two Page/ One Page is for displaying two pages or one page side by side at the same time; Zoom In and Zoom Out buttons are for magnifying and narrowing display. When the button is in a gray state it means it can't be magnified or narrowed; also by clicking the left mouse button on preview interface, functions like magnifying and narrowing will be performed; Close button is used for quitting the interface of print preview and returning to the main interface.

### 16. Print Setup

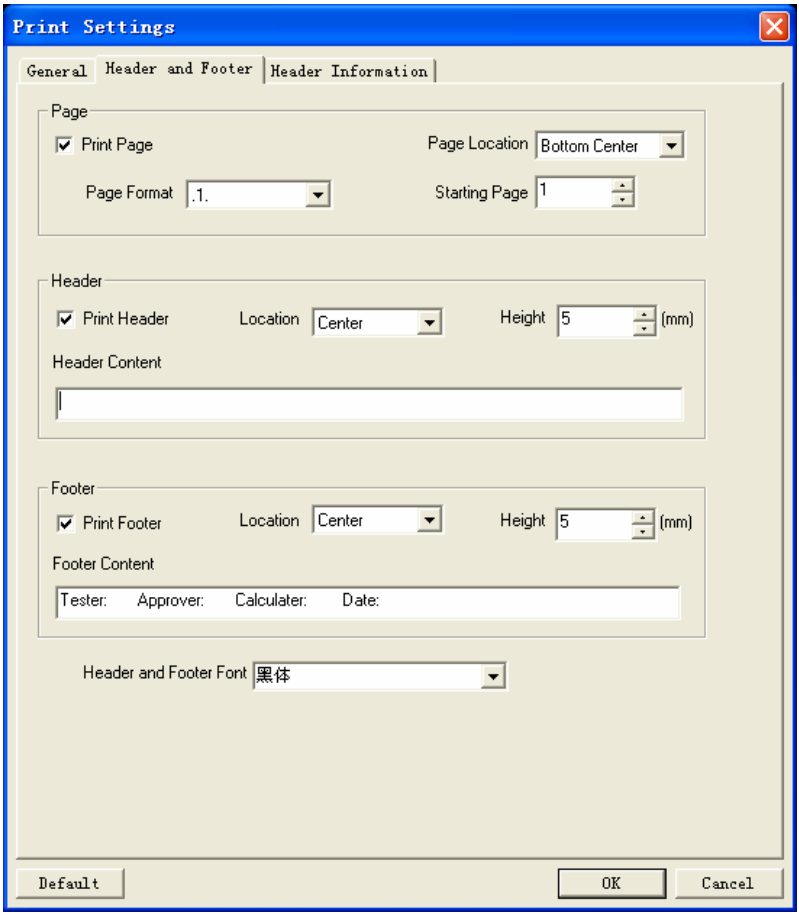
Before printing, users can do some print setup. After selecting the Print Setup menu, users will see the pop-up "Print Setup" dialog box in Figure 3.2.12. There are three pages in the dialog box, namely, General, Header and Footer, and Header Information, which are showed from Figure (a) to Figure (c). By clicking the left mouse on the label, uses can change the page to the corresponding one and go on

different print setup on each page.

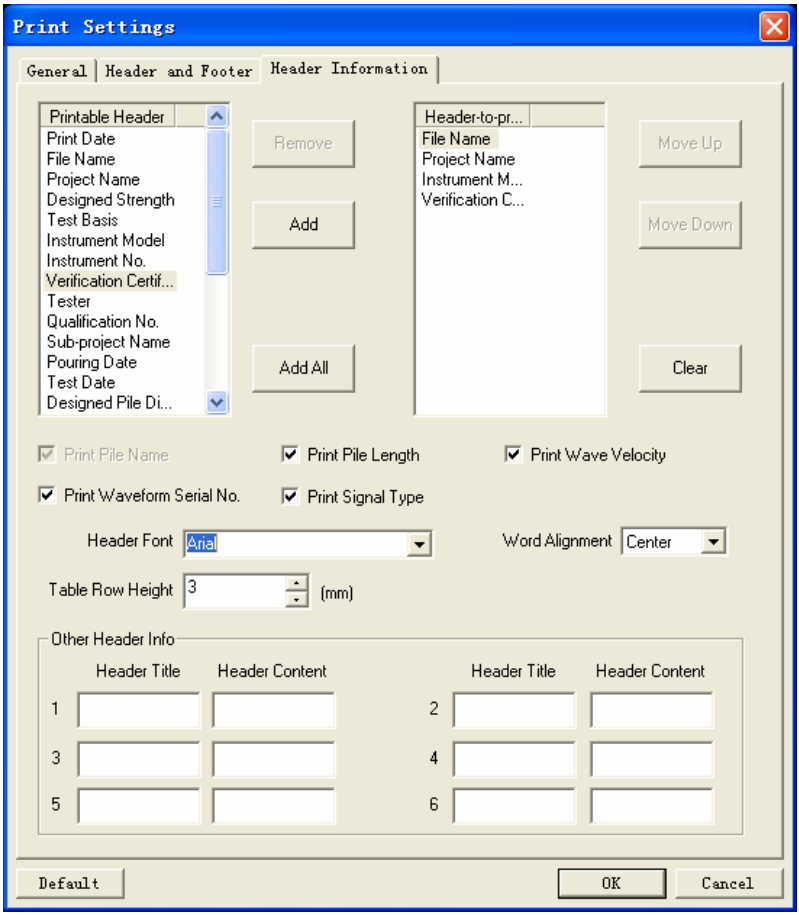
In General page, users can set up page margins, print format, print range and content and paper type, etc.




(a) General Page




(b) Header and Footer Page




(c) Header Information Page

Figure 3.2.12 Print Setup Dialog Box

In Header and Footer page, users can choose whether Print Page Number or not(when decide to print the page number, users can set up the position, format and the starting page number)，whether Print Header or not (when decide to print the header, users can set up the position of header, height and content ), whether Print Footer or not (when decide to print footer, users can set up the position of footer, height and content) and the Font of Header and Footer, etc.

In the "Header Information" page, the list box of Pintable Header lists all the printable header information and the list box of To Be Printed Header lists all the selected header information to be printed. By selecting one or more items in the list box of Pintable Header and pressing the Add button, users can transfer all the selected ones to the list box of Header To Be Printed; by selecting one or more items in the list box of Header To Be Printed and pressing the Remove button, users can remove the selected ones from the list box of Header To Be Printed. Also after selecting a certain item in the list box of Header To Be Printed, users can adjust the sequence of header information in the printout by pressing the Move Up button and Move Down button. By pressing the Add All button, users can transfer all the printable header information to the list box of Header To Be Printed. By pressing the Remove button, users can remove all the header information from the list box of Header To Be Printed. Besides, users can input the Header Title and Header Content in the box of "Other header information" below, maximum number of 6. Also, users can select information like header font, table row height and text alignment, etc.

By pressing Default button at any page, users can set up all the parameter at every page as the default value.

NOTE: This software is mainly available for the paper specification of A4 and B5. When choosing other paper specification, users may meet some troubles. For the best effect, please use A4 specification.

17. Print to Bitmaps

When choose Print to Bitmaps, users can obtain bitmaps generated from the printout, each page being a bitmap. Those bitmaps are at the same folder of data files with file name of "Project name-P page.bmp". Once the bitmap is generated, there will emerge a box asking "whether insert the bitmap into Word or not". By pressing Yes button, users can establish a new Word and insert all the bitmaps into

it.

18. Recent Project Files

On the pop-up menu of this menu, there are four recent project files opened by users. Thus, users can open one of them by clicking one of them directly. Also, users can clear the list of file name on the menu just by clicking the following menu items Recent Project Files → Clear record.

19. Recent Pile Files

On the pop-up menu of this menu, there are four recent pile files opened by users. Thus, users can open one of them by clicking one of them directly. Also, users can clear the list of file name on the menu just by clicking the following menu items Recent Pile Files → Clear record.

20. Exit

By closing the current project file and data file, users can log out the system. Before closing the files, users will see a prompt for saving files if the project file or the current pile file has been modified.

## 3.2.2 Edit Menu

For the convenience of users to examine detected waveforms, this menu is mainly for zooming in and zooming out of waveform vertically; expanding and compressing of waveform horizontally.

1. Pile Head Alignment

After selecting the menu item of Align Pile Head, users can align the pile head of all channels waveform in the current pile file with the backmost pile head of all channels waveform in this file.

2. Waveform Reversing

By selecting the menu of Reverse, users can reverse all channels waveform in current pile file.

### 3. Waveform Stretching

When the current focus is at the Waveform Area, by selecting the menu item of Stretch, users can display all channel waveforms in current pile file by stretching them horizontally (axis of time or length). Beyond a certain extent, this menu becomes invalid. If the current focus is not at the Waveform Area, this menu is invalid as well.

### 4. Waveform Compressing

When the current focus is at the Waveform Area, by selecting the menu item of Compress, users can display all channel waveforms in current pile file by compressing them horizontally (axis of time or length). Beyond a certain extent, this menu becomes invalid. If the current focus is not at the Waveform Area, this menu is invalid as well.

NOTE: The stretching and compressing of waveform can also be implemented by dragging the slider of "tensile compressive ratio" in the Pile Information Area.

### 5. Waveform Zooming

After selecting a row of waveform in the Waveform Area and choosing the menu of Zoom, users can zoom in or zoom out the waveform by dragging the left mouse button up and down, Besides, the + and − buttons also can perform this function.

NOTE: When selecting "Normalization Display" in "Setting→ Options", users will find it not available, for this menu is grayed out.

### 6. Waveform Overlapping

After selecting the menu of Overlap, people will see a pop-up dialog box shown in Figure 3.2.13. By selecting more than two waveforms, users can make a overlapping of the selected ones by pressing OK button with the waveform after overlapping being added to the final place of this file. By pressing Cancel button, there will be

no overlapping.


Figure 3.2.13 Waveform Overlapping Dialog Box

### 7. Waveform Deletion

By selecting the Delete Waveform menu, users can delete the current waveform in the current pile file. This menu is available only when the current focus is at the Waveform Area.

NOTE: Be cautious, for the deleted waveform can not be restored!

## 3.2.3 View Menu

### 1. Sampling Parameter

By selecting the Sampling Parameter item, users will see a pop-up dialogue shown in Figure 3.2.17, which can display the sampling parameter information of the current pile file and modify sensor type as well as sensitivity.

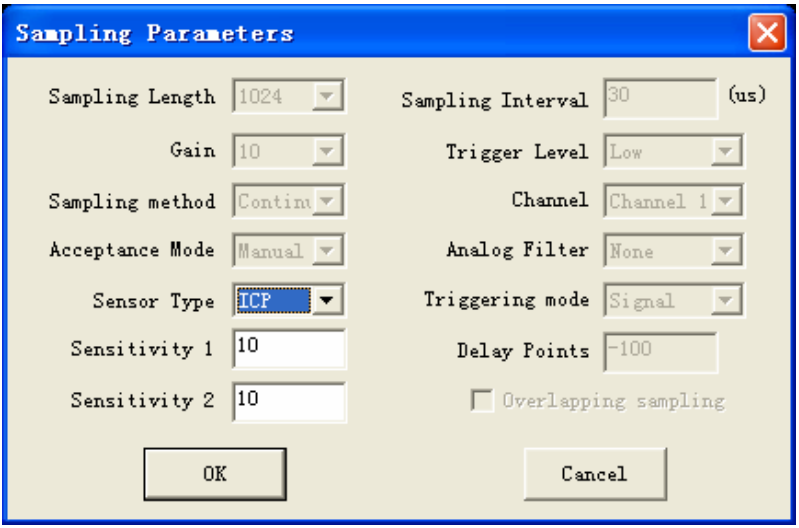



Figure 3.2.17 Sampling Parameter Dialog box

1) Sampling Length is the points when taking sample of the signal.

2) Sampling Interval is the time difference between every two sampling of the signal and the range of it is 5μs~64ms.

3) Gain is the amplification factor of the instruments to the electric signal received by transducer, that is, fixed point amplification.

4) Trigger Level is the signal level when starting the instrument to take sample and it has three gears of high, middle and low.

5) Sampling Method has two modes: single collection and continuous collection. Single Collection means users can only collect the waveform once every time according to the setting of parameters; and Continuous Collection means that several continuous samplings process in the same parameter setting until users stop it.

6) Channel Selection: Dynamic measuring devices have two receiving channels. Users can use either **Channel 1** or **Channel 2** to collect when testing or use them simultaneously. Choose the channel

to which the sensor is connected, or users can not collect signals. If users choose **Dual Channel 1**, it means double channel sampling and the trigger channel is channel 1; if users choose **Dual Channel 2**, it means double sampling and the trigger channel is channel 2.

7) Acceptance Mode: In the field detection, the stand or fall of knocking will affect the quality of the collected signals. Knocking with too much force makes the signals distort while with too little force, pile toe signal may not come out, so the force must be moderate. Users can judge the size of force according to the strength of the signals.

Acceptance Mode consists of three types: Manual, Automatic or None.

8) Analog filtering means to conduct low-pass filtering to the original signal on the hardware.

9) Sensor Type: Dynamic measuring devices can be allocated to ICP acceleration, speed, the common acceleration (output charge) sensor for testing, so users should select this option according to the types of transducer.

10) System Sensitivity Setting: The value of the system sensitivity is demarcated by metrological service, always set when leaving factory and users needn't modify. After setting the type of the transducer, the instrument will set the system sensitivity as factory default automatically. Users need to modify it only when the system is demarcated again and the sensitivity changes or users use transducers that are not from our company.

The unit of the value of the system sensitivity of the ICP is $mV/m\cdot s^{-2}$, and the velocity sensor is $mV/cm\cdot s^{-1}$, and the acceleration transducer is $pC/m\cdot s^{-2}$.

Users can collect with dynamic measuring devices by double channels simultaneously, so there are two values of the system sensitivity (sensitivity 1, sensitivity 2) need to be set.

11) Triggering Mode contain Signal Trigger and External Trigger and users should use signal trigger when testing piles. External trigger is only used during verification when leaving factory to verify system noise and dynamic range and other index, and it can also be used on other testing occasions.

12) Delay Points: Generally, this parameter needn't be modified, users can just use the default value (-100). Delay points should between -512~512, negative means negative delay (Trigger in advance), zero means zero delay (Trigger at once), positive means delay trigger.

## 2. Pile Information Area

By selecting the item of Pile Info. Area, users can display or hide the Pile Information Area in the main page. To display, put a "√" before the menu; otherwise, it will be hidden.

## 3. Statistical Information

By selecting the item of Statistical Info., users will see a pop-up dialog box shown in Figure 3.2.18, which shows all the pile statistical information of the current project file.

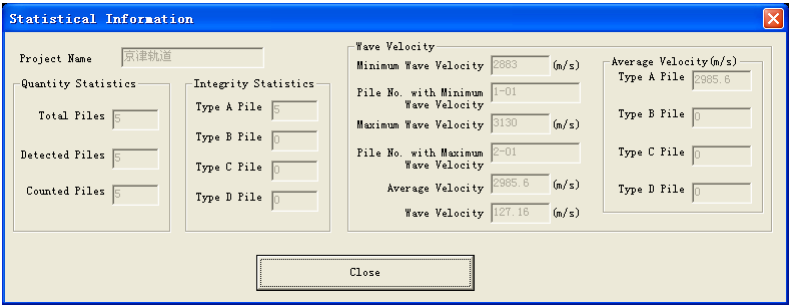



Figure 3.2.18 Statistical Information Dialog Box

## 4. Tool Bar

This menu is mainly for hiding or displaying tool bar. System default is displaying tool bar. (The menu item is displayed if there is a "√" in front of menu bar; otherwise it will not be displayed.)

### 5. Status Bar

This menu is mainly for hiding or displaying status bar. System default is displaying status bar. (The menu item is displayed if there is a "√" in front of menu bar; otherwise it will not be displayed.)

## 3.2.4 Setting Menu

### 1. Options

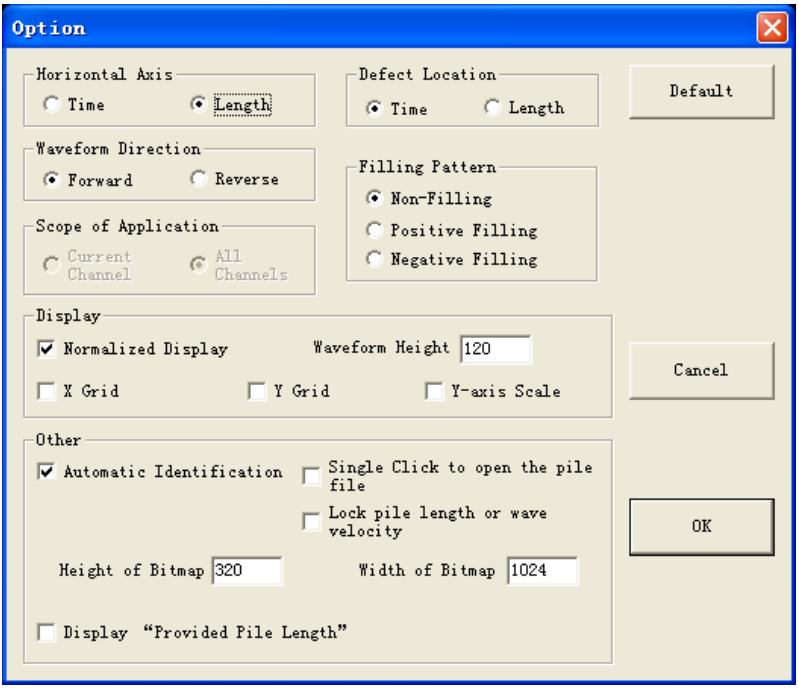



Figure 3.2.19 Options Setting Dialog Box.

When users select the Options menu item, the dialog box as Figure 3.2.19 shows pops up. In the dialog box, values of all parameters default to the ones which are set most recently. Users can select Horizontal Axis (time or length, which can change the units and

scale values in the horizontal axis of each waveform), Filling Pattern (non-filling, positive filling or negative filling, non-filling in all waveforms, fill in positive or negative half cycle), Waveform Direction (forward or reverse, which can change the display direction of all waveforms), Scope of Applications (current channel or all channels), Automatic Identification, Normalized Display. If users have set all parameters, press OK and the setting is valid or press Cancel and invalid.

If users select "Automatic Identification", the system will automatically find the pile head position (crest or trough of direct wave) in analyzing and processing and automatically find the peak frequency in the spectrum analysis. If users want to set the pile head position manually, users should never select the option (to remove " √ ").

The "Normalized Display" means that regardless of the maximum amplitude of the waveform, the system will maximize its display on the condition that each waveform display is full of the waveform area. If users don't select the option, users may not see when sometimes the waveform amplitude is small and need to manually scale the waveform. The "Waveform Height" refers to the height which the single-channel waveform in the waveform district displays (unit: pixel); the "X Grid" means to draw vertical grid line when to display waveform; the "Y Grid" means to draw horizontal grid line.

### 2. Project Information

When users select the Project Info. menu item, the dialog box as Figure 3.2.20 shows pops up. Users can set a series of related information like Project Name, Construction Unit, Detection Unit, Qualification No., Report No. and so on. If users have finished the setting, press OK and the input information is valid; press Cancel and invalid. If users press Default, all parameters in the dialog box are the

most recently set values; press Read, the dialog box of "Open Project File" pops up. Then, users can select a project file in the dialog box and press OK, the project information of the selected project file is read; if users press Cancel, its project information is not read.

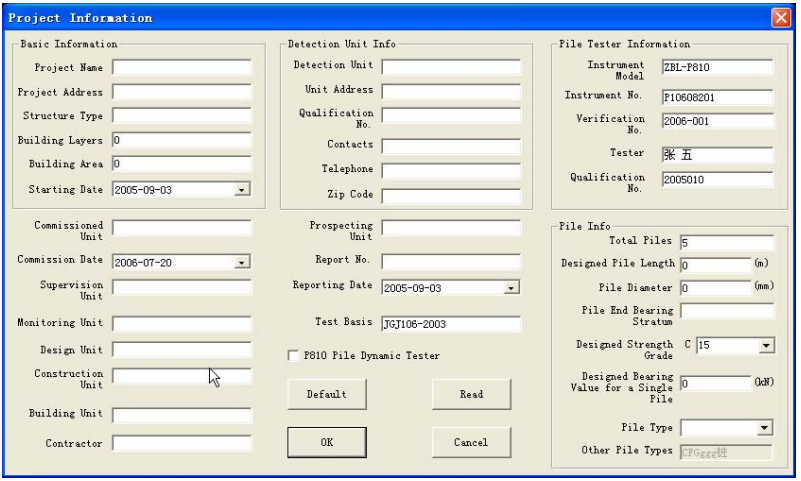



Figure 3.2.20 Project Information Setting Dialog Box


Figure 3.2.21 Date Selecting Input

Click ▼ behind the column of Starting Date in the dialog box and the date input interface as Figure 3.2.21 shows pops up. The input method is as follows: 1) click the Year (2005) position in the interface with the left mouse button, 2005 appears and the year can be

adjusted by pressing ▲ and ▼; 2) click ◄ and ► of the left side and right side at the top of the interface and users can adjust the month. Users can also click Month (May) position and select the month in the pop-up list; 3) click date figures and users can adjust the date. Click on other positions rather than date input interface and the interface disappears, with the date updated.

NOTE: In other dialog boxes or interfaces, the above interface will pop up in all positions where the date is input. Besides, the input method is alike.

3. Pile Head

When the waveform area shows the oscillograph, select a waveform in the area and move the cursor to the location where the pile head is to be set. If users select the Pile Head menu item, the position of the current cursor is set to the position of the pile head.

If users want to set the pile head manually, users must remove the "Automatic Identification" option from the Options menu, or the system will find the position of the pile head automatically in analyzing and processing and thus the manual setting does not work.

NOTE: The pile head cursor must locate within the waveform area. Besides, the pile head can not locate behind the pile toe.

4. Pile Toe

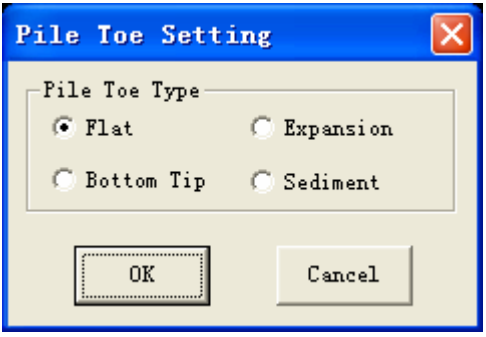



Figure 3.2.22 Pile Toe Setting Dialog Box.

When the waveform area shows the waveform figures, select a waveform in the area and move the cursor to the position where the pile toe id going to be set. If users select the Pile Toe menu item, the dialog box as Figure 3.2.22 shows pops up and users can choose the type of the pile head. Press OK and the setting is valid; press Cancel and invalid.

NOTE: The pile toe cursor must locate with the waveform area. Besides, the pile toe can not locate before the pile head.

5. Defects

When the waveform area shows the waveform figures, select a waveform in the area and move the cursor to the defect location. If users select the Defects menu item, the dialog box as Figure 3.2.23 shows pops up and users can choose the Defects Type and its Severity. Press OK and the setting is valid; press Cancel and the setting is invalid.

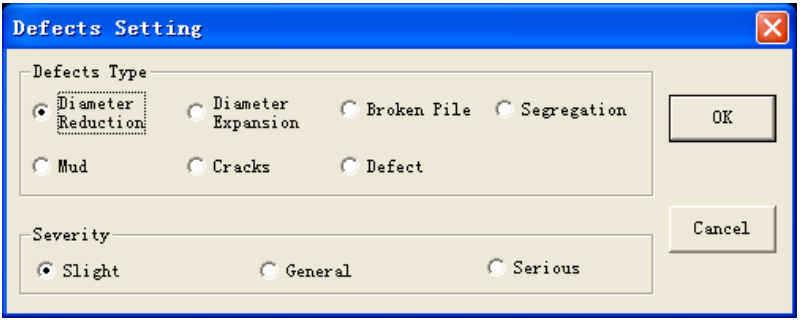



Figure 3.2.23 Defects Setting Dialog Box.

NOTE: The defect location must be between the pile head and the pile toe. If the gap of the defect location between two consecutive settings is less than 0.1 m and their types and severities are identical, the defect is canceled. If the gap is less than 0.1 m and their types and severities are different, the defect setting in this location is updated.

### 6. Peak Frequency

When the waveform area shows the spectrum, select a spectrum in the spectrum area and move the cursor to the location where the peak is to be set. Select the Peak Freq. menu item and set the frequency of the current cursor location to a peak frequency. After that, the information related to the peak frequency will display in the right side of the spectrum. As Figure 3.2.24 shows, Fm is the main frequency value, F0 is the frequency resolution, and F1 to F5 are the set frequency peaks. At most 5 frequency peaks can be set.

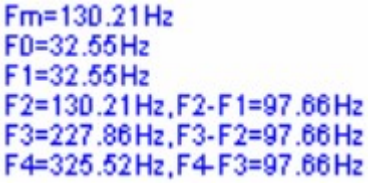



Figure 3.2.24 Peak Frequency

If users want to set the peak frequency manually, users must remove the "Automatic Identification" option from the Options menu item, or the manual setting does not work.

If the set peak frequencies in two times are equal, the peak frequency is canceled.

### 7. Clear

If the waveform area shows the time domain waveform figure, select the Clear menu item and all defect settings are removed. If the waveform area shows the amplitude spectrum or power spectrum, select the Clear menu item and all the peak frequency settings are removed.

### 8. Print Mark

If users have selected a waveform in the waveform area, select the Set Print Mark menu item and a red "√" will appear in the upper right corner of the waveform. If users want to remove the print mark,

after users have selected the waveform, select the Remove Print Mark menu item and the "√" in the upper right corner will disappear.

## 3.2.5 Processing Menu

There often exist some "Clutters" (noise signals) in the waveform data collected at the scene or the signals in the pile toe are weak. In that case, in order to highlight useful signals, digital signal processing methods must be used to process it. In the analysis software, several processing approaches are referred:

1) Integration: When using the accelerometer to detect, the collected signal is the acceleration signal. It seems that it is relatively "messy" and often has a general need for the integration processing to turn it into a speed signal. In that way, it will look relatively clear. The integration can't apply to the speed signal. In the bottom of the pile-shaped area, "Vel" and "Acc" appears to respectively show the signal of speed and acceleration.
2) Signal Amplification: When the signal in the pile toe is weak, there is a general need for the waveform to take amplification processing to highlight the signal in the pile toe. If users want to take digital amplification to the collected signal, users should set the amplification type (exponential, linear, or full scale), the amplification starting point and the amplification factor. Exponential or linear amplification is to amplify the signal from the starting point to the pile toe according to the exponential or linear mode; the full factor amplification is to take linear or exponential amplification on the purpose of identical signal amplitude in the pile toe and amplitude in the first wave. The amplification starting point is the starting position taking exponential or linear amplification (relative to the pile head, unit:

m). the scope of amplification starting point is from 0m to 0.8 times the length of the pile. Multiples of the exponential or linear amplification should not be too large, as long as the signal in the pile toe can be saw.

3) Wavelet Analysis: The wavelet analysis is a new time-frequency analysis mode developed in recent years. It is a great breakthrough in signal processing, image compression, speech coding, pattern recognition, seismic exploration and many other non-linear scientific fields, which has been widely applied. If users apply it to the analysis of dynamic test signal, users can get a better effect. The wavelet factor needs setting (range of 1~8). The greater the factor is, the more "gentle" the signal is. Generally speaking, the wavelet factor is set to any number between 1~3 because too large number can result in miscarriage with defect signals removed.

4) Digital Filtering: It is made up of three filtering approaches, low-pass, high-pass and band-pass. The low-pass filtering is to filter the signal which is larger than a certain cut-off frequency. The high-pass filtering, however, is to filter the signal which is smaller than a certain cut-off frequency. The band-pass filtering is to filter the signal which is larger than the high cut-off frequency and smaller than the low cut-off frequency. Figure 3.2.25 is a sketch map of filtering. In analysis, the low-pass filtering is frequently used. The value of cut-off frequency can be set from experience. The longer the pile is, the lower the low-pass cut-off frequency. The setting of the value of cut-off frequency can be also based on the spectrum analysis of signals.

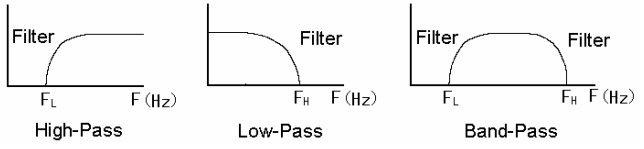



Figure 3.2.25 Filtering Sketch Map

5) Smoothing: When high-frequency “Clutters” appear in the signal, smoothing can be used to filter them. The larger the smoothing point is, the more “gentle” the smoothed waveform. The range of the smoothing point is from 3~512, generally set to 10.

6) Waveform Rotation: Sometimes, when having taken integral processing or any other processing to the signal, the end of the waveform may upwarp. In that case, waveform needs rotation to pull the end part into the position of baseline. The percentage of rotation is relative to the direct wave amplitude. The positive number means the rotation forward and the negative number means the rotation inverse. If the first wave amplitude is A and the amplitude in the end of the signal is B, the percentage of rotation is (100×B/A).

In the above-mentioned processing modes, the wavelet analysis, digital filtering and smoothing can all filter. So users can just choose one method from them and users can also use them simultaneously. The employed parameters should be appropriate, or miscarriage may happen with some useful signals removed.

All processing parameters can modify in the Pile Information Area (Figure 3.1.3). If users have finished the modification, users can process all waveforms in the current pile according to the set parameters by pressing ↵. For some parameters, users can also click  with the left mouse button to make modification.

## 1. Batch

When users select the Batch menu item, the dialog box as Figure 3.2.26 shows pops up and users can choose the parameters which will apply to all piles in the current project. Press OK and the setting is valid; press Cancel and the setting is invalid.

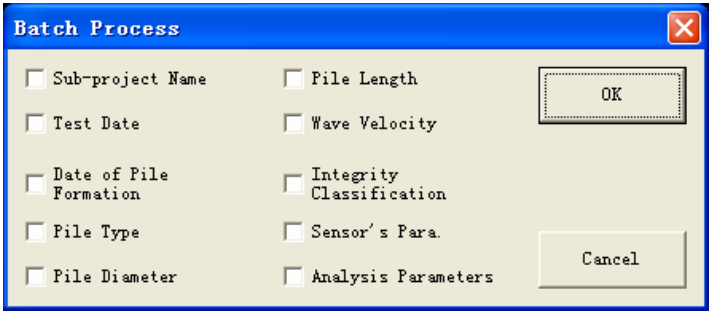



Figure 3.2.26 Batch processing dialog box

2. Integration

When users select the Integrate menu item, the waveform is integrated. To select the menu item again and the operation is cancelled. **The shortcut key for the function is F4.**

3. Amplification Increase

When users select the Amplification Increase menu item, the amplification factor increase 1 on the basis of the current level and directly process the waveform. **The shortcut key for the function is F5.**

4. Amplification Decrease

When users choose the Amplification Decrease menu item, the amplification factor decrease 1 on the basis of the current level and directly process the waveform. **The shortcut key for the function is F6.**

5. Wavelet Increase

When users select the Wavelet Increase menu item, the wavelet factor increase 0.5 on the basis of the current level and directly process the waveform. **The shortcut key for the function is F7.**

6. Wavelet Decrease

When users select the Wavelet Decrease menu item, the wavelet factor decrease 0.5 on the basis of the current level and directly process the waveform. **The shortcut key for the function is F8.**

### 7. Rotate Forward

When users select the Rotate Forward menu item, the percentage of waveform rotation increase 5 on the basis of the current level and directly process the waveform. **The shortcut key for the function is F9.**

### 8. Rotate Reverse

When users select the Rotate Reverse menu item, the percentage of waveform rotation decrease 5 on the basis of the current level and directly process the waveform. **The shortcut key for the function is F10.**

### 9. Parameter Recovery

When users select the Parameter Recovery menu item, the processing parameter of the current pile is recovered to the default value. It means that without any processing, the waveform is recovered to the original waveform. **The shortcut key for the function are Ctrl +Shift+ Z.**

### 10. Amplitude Spectrum

When users select the Amplitude Spectrum menu item, all waveforms of the current pile are analyzed by amplitude spectrum. The amplitude spectrum is shown in the waveform area as Figure 3.1.6 shows. If the present view is amplitude spectrum, tick " √ "before the menu item. If users want to show time domain waveform, select this menu item again and just remove " √ ".

### 11. Auto-power Spectrum

When users select the Auto-Power Spectrum menu item, all waveforms of the current pile will be analyzed by auto-power spectrum. The auto-power spectrum is shown in waveform area, as Figure 3.1.6 shows. If the present view is auto-power spectrum, tick " √ " before this menu item. If users want to show time domain wave, then select this menu item again and just remove " √ ".

## 3.2.7 Help Menu

### 1. About

Display our company's name, software name and version number or any other information.

### 2. Visit the Company's Website

For more and better understanding of our company, please select Visit ZBL to link to our company's home page

### 3. Write to Our Company

In order to feedback to us timely, users can select Email to call the Out Look to send email to our company.

# Appendix 1 Common Shortcut Keys

In the software, users can use the shortcut keys (keys listed behind the menu item) to operate some common functions to improve the working efficiency. They are listed as follows:

## 1. Shortcut Keys in File Menu

| Function | Keys | Function | Keys |
|---|---|---|---|
| New Project | Ctrl+N | Open File | Alt+O |
| Open Project | Ctrl+O | Save File | Alt +S |
| Save Project | Ctrl+S | Generate Bitmaps | Ctrl+B |
| Remove Files | Shift+Del | Print | Ctrl+P |
| Validity Modification | Space | Print Preview | Ctrl+V |

## 2. Shortcut Keys in Edit and View Menu

| Function | Keys | Function | Keys |
|---|---|---|---|
| Reverse | Ctrl+W | Delete Waveform | Ctrl+Del |
| Stretch | Ctrl+＋ | Page Turn | PageUp、PageDn |
| Compress | Ctrl+- | Channel Switch | ↑、↓ |

## 3. Shortcut Keys in Setting Menu

| Function | Keys | Function | Keys |
|---|---|---|---|
| Pile Head | Ctrl+T | Peak Frequency | Ctrl+Q |
| Pile Toe | Ctrl+D | Clear | Ctrl+L |
| Defects | Ctrl+F | | |

# 4. Shortcut Keys in Processing Menu

| Function | Keys | Function | Keys |
|---|---|---|---|
| Amplification Increase | F5 | Rotate Forward | F9 |
| Amplification Decrease | F6 | Rotate Reverse | F10 |
| Wavelet Increase | F7 | Amplitude Spectrum | F2 |
| Wavelet Decrease | F8 | Auto-Power Spectrum | F3 |
| Parameter Recovery | Ctrl+Shift+Z | Integrate | F4 |

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