

A Reference Manual for:

- eZ-Analyst
- eZ-FrequencyView
- eZ-TimeView



the smart approach to instrumentation™

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eZ-Analyst Series

Software Reference

p/n **1086-0922** Rev. **8.0**

Note: As this document goes to press, *eZ-Analyst* can only be used with WaveBook or ZonicBook type devices. Other devices, such as LogBook, DaqBook, and MultiScan, are, at present, not compatible with *eZ-Analyst*. However, they can make use of a related “view” application, e.g., *eZ-PostView*, *eZ-TimeView*, or *eZ-FrequencyView*.

Manual Layout

This document is a reference manual for *eZ-Analyst* and its related series of “view” applications. It is intended for use with the following:

- **eZ-Analyst**
- **eZ-FrequencyView**
- **eZ-TimeView**

The document is a reference to Menu options, associated Toolbar buttons, and resulting GUI screen images. Where deemed beneficial, examples were placed to supplement the primary material. For example, after describing the entry fields for “Double-Hammers,” an example demonstrates a typical setup.

The document discusses *eZ-Analyst* in relation to both ZonicBook and WaveBook applications. It should be noted that certain *eZ-Analyst* functions that apply to ZonicBook, do not apply to WaveBook, and visa versa. These differences are pointed out in the document, when applicable.

The document is arranged as follows:

An Introduction to eZ-Analyst Series Software – compares *eZ-PostView*, *eZ-TimeView*, and *eZ-FrequencyView* to the *eZ-Analyst* program and discusses how the manual relates to each.

Installing the “View” Applications provides instructions for installing *eZ-PostView*, *eZ-TimeView*, and *eZ-FrequencyView*.

Ch 1 – Getting Started with eZ-Analyst briefly explains what *eZ-Analyst* is and provides instructions for installing *eZ-Analyst* software for ZonicBook and WaveBook applications.

Ch 2 – Menus and Windows explains the Menus, software buttons, and windows that are part of *eZ-Analyst*’s Graphical User Interface (GUI).

Ch 3 – Interactive Features of the Plot Display Window explains how to change plot display characteristics, including display functions, by using the interactive features of the display window.

Appendix A – Keyboard Controls for eZ-Analyst identifies keys for controlling plot display, menus, windows, and record/playback functions.

Appendix B – Using Banks and Function Files discusses simultaneous measurement of signal groups, automatic and manual incrementing of banks, and skip factor.

Glossary



Check the **README.TXT** file, if present, for information that may not have been available at the time this manual went to press.

* Though this document can be used with *eZ-PostView*, we recommend that *eZ-PostView* users refer to the PDF document, **eZ-PostView User’s Guide** (p/n 1086-0926). The reason is that most of the material in this document does not apply to *eZ-PostView*. Refer to the table on page 0-2 in regard to application features that do apply.

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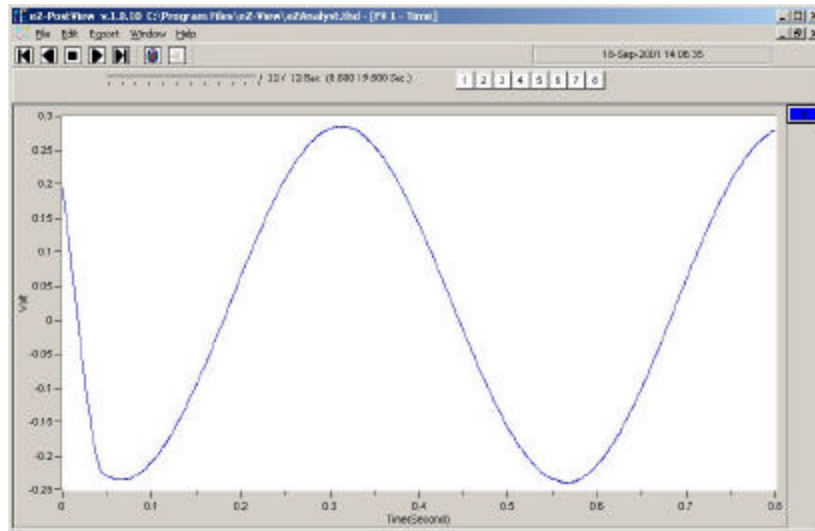
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Glossary

An Introduction to eZ-Analyst Series Software



A Screen Capture from eZ-PostView

eZ-PostView, *eZ-TimeView*, and *eZ-FrequencyView* are part of the *eZ-Analyst* “series” software. Each is a **post-acquisition** analysis application that was derived from the more powerful *eZ-Analyst* program. The latter is given an overview in chapter 1 and is detailed throughout the rest of the manual.

Features of the view applications vary from one application to another, and are listed in the comparative table on the following page.

The “view” applications are integrated with the primary data acquisition software, including *DaqView*, *Personal DaqView*, *ChartView*, *LogView*, and *WaveView*. The *eZ-PostView* application provides easy-to-use post-acquisition analysis capability, and is included free of charge as a part of product support. The other two view programs (*eZ-TimeView* and *eZ-FrequencyView*) have additional features and are available for purchase. These more versatile “view” applications are initially accessed via an authorization-code. Note that the code is only required to “unlock” the application for its first run and is not required for subsequent startups.

The following table compares the “view” applications to the *eZ-Analyst* program, from which they were derived. At present, the *eZ-Analyst* program is only compatible with WaveBook and ZonicBook devices.

Comparing the “View” Applications to eZ-Analyst

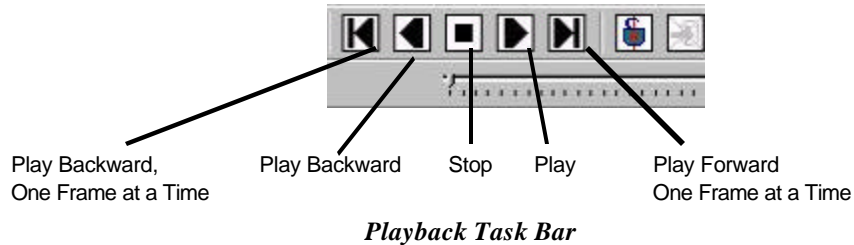
eZ-Analyst Series Comparison Matrix				
Feature	Post-Acquisition Viewing Package			eZ-Analyst
	eZ-PostView	eZ-TimeView	eZ-FrequencyView	
File Input Format Support for: <i>DaqView</i> , <i>WaveView</i> , <i>Personal DaqView</i> , <i>ChartView</i> , UFF-58B.	Yes	Yes	Yes	Yes
File Export to: ME'Scope and SMS Modal, Microsoft Excel, Binary Universal File, and ASCII text files.	-----	Yes	Yes	Yes
Display Windows, number of	8	8	8	8
Channel Traces per Display Window	16	16	16	16
Automatic Data Scaling	Yes	Yes	Yes	Yes
Configurable Data Display for channels and trace colors	Yes	Yes	Yes	Yes
Multiple Tiling of display windows	Yes	Yes	Yes	Yes
Cursor Support - for both Single Cursor and Band Cursor	-----	Yes	Yes	Yes
Data Strip Chart Display	-----	Yes	Yes	Yes
Peak-to-Peak Calculations	-----	Yes	Yes	Yes
Peak Searching, minimum and maximum	-----	Yes	Yes	Yes
Mean Calculations	-----	Yes	Yes	Yes
RMS Calculations	-----	Yes	Yes	Yes
Zooming [of the data display]	-----	Yes	Yes	Yes
Windowed Time Display Function	-----	Yes	Yes	Yes
Cross Channel Support	-----	-----	FRF, Cross, Coherence, Transfer Function	FRF, Cross, Coherence, Transfer Function
Transfer Function Display Types	-----	-----	Note 1	Note 1
Complex Function Display Types	-----	-----	Note 2	Note 2
Scale Types	-----	RMS, Peak, Peak-to-Peak	RMS, Peak, Peak-to-Peak	RMS, Peak, Peak-to-Peak
Function Display Types	-----	Time, Strip Chart	Note 3	Note 3
Octave Types	-----	-----	1/3, Full	1/3, Full
Octave Weighting	-----	-----	Linear, A, B, C	Linear, A, B, C
Integration/Differentiation (Single/Double)	-----	-----	Yes	Yes
Response Channel FFT Windows	-----	-----	Note 4	Note 4
Reference Channel FFT Windows	-----	-----	Rectangular, Cosine Taper	Rectangular, Cosine Taper
Low-Pass DC Noise Filtering	-----	-----	Yes	Yes
Strip Chart Display Synchronization	-----	-----	Yes	Yes
Record and Save Data to Disk	-----	-----	-----	Yes
“Real Time” Data Display	-----	-----	-----	Yes

- Notes:**
- 1) **eZ-Analyst** and **eZ-FrequencyView** - each offers the following **Transfer Function Display Types**: Inertance, Mobility, Compliance, Apparent Mass, Impedance, and Dynamic Stiffness.
 - 2) **eZ-Analyst** and **eZ-FrequencyView** - each offers the following **Complex Function Display Types**: Magnitude, Phase, Real, Imaginary, Nyquist, Magnitude and Phase, and Real and Imaginary.
 - 3) **eZ-Analyst** and **eZ-FrequencyView** - each offers the following **Function Display Types**: Spectrum, Auto-Spectrum, PSD (Power Spectral Function), Strip Chart (Time).
 - 4) **eZ-Analyst** and **eZ-FrequencyView** – each offers the following **Response Channel FFT Windows**: Hanning, Flat Top, Exponential, and Blackman-Harris.

The eZ-Analyst Series “view” programs make use of eZ-Analyst’s Playback Mode and, therefore, do not require the presence of physical hardware. In fact, when eZ-Analyst is in Playback Mode, it is functioning in the exact manner as eZ-FrequencyView. In other words, when in PlayBack Mode, eZ-Analyst is strictly a post-acquisition display and analysis program.

Raw time-domain data, that has been recorded-to-disk, can be played back for analysis repeatedly. For example, a raw signal could be played back several times, each time using a different filtering algorithm to manipulate the original signal. Once the desired results have been achieved the new data can be exported in a new format and to a different file. The original file can remain unchanged, and kept for future analysis.

The “view” programs make use of a Play Task Bar, as depicted in the following figure.



How the Rest of this Manual Relates to the “View” Applications

This manual was originally written as a reference guide for users of eZ-Analyst prior to the development of the “view” applications. However, since the post-acquisition “view” programs were derived directly from eZ-Analyst, it is easy to apply the appropriate sections of the manual to your specific “view” application, i.e., to eZ-PostView, to eZ-TimeView, or to eZ-FrequencyView.

Note: WaveBook user’s who want to have post-data analysis *view capabilities* accessible from WaveView’s <View Data> button will need to install one of the “view” applications, i.e., eZ-PostView, eZ-TimeView, or eZ-FrequencyView. The latter two applications are available for purchase. The eZ-PostView application is free.

eZ-FrequencyView

When you are using eZ-FrequencyView, you are essentially running eZ-Analyst in its Playback Mode. The table on page 0-2 indicates the applicable features. You can not record data from eZ-FrequencyView.

eZ-FrequencyView is supported by the primary data acquisition programs, for example, DaqView, LogView, and WaveView. It can be accessed through the primary application’s View Data button, or accessed independently from your program files directory (where you installed your software).

The first time you run eZ-FrequencyView, you will need to enter an authorization code. The code is supplied when the package is purchased.

eZ-TimeView

When you are using eZ-TimeView, you are essentially running eZ-Analyst in its Playback Mode, minus several analysis features that are available in eZ-FrequencyView and eZ-Analyst. For example, when using eZ-TimeView there are no Transfer Function Display Types, Complex Function Display Types, or FFT Windows available. However, the application does provide calculation options pertaining to peak-to-peak, mean, RMS, and does allow for data zooming. Refer to the table on page 0-2 for a complete list of the applicable features. Note that you can not record data from eZ-TimeView.

eZ-TimeView is supported by the primary data acquisition programs, for example, DaqView, LogView, and WaveView. It can be accessed through the primary application’s View Data button, or accessed independently from your program files directory (where you installed your software).

The first time you run eZ-TimeView, you will need to enter an authorization code. The code is supplied when the package is purchased.

eZ-PostView

eZ-PostView provides simple “time-domain” viewing. From this application you can display up to 8 time-domain function windows and display up to 16 channel traces per window. Data is automatically scaled to optimize its fit in the window. Window, channel trace, and cursor colors can be customized.

eZ-PostView is a free “view” program. The application has no Transfer Function Display Types, Complex Function Display Types, or FFT Windows available. Refer to the table on page 0-2 for a complete list of the applicable features. Note that you can not record data from *eZ-PostView*.

eZ-PostView is supported by the primary data acquisition programs, for example, *DaqView*, *LogView*, and *WaveView*. It can be accessed through the primary application’s View Data button, or accessed independently from your program files directory (where you installed your software).

You do not need to enter an authorization code to run *eZ-PostView*.



Reference Note :

Although this document can be used for *eZ-PostView*, a great deal of the material does not apply, as can be seen from the table on page 0-2. If you are only making use of *eZ-PostView* you may want to refer to the *eZ-PostView User’s Guide*, p/n 1086-0926. A PDF version of that document is installed onto your hard-drive as a part of product support.

Note that PDF versions of documents can be read directly from the installation CD.

Installing the “View” Applications



Reference Notes:

- If you purchased *eZ-Analyst* for use with a ZonicBook, skip this section and proceed to chapter 1, *Getting Started with eZ-Analyst*.
- If you purchased *eZ-Analyst* for use with a WaveBook device, and will not be using *WaveView*, skip this section and proceed to chapter 1, *Getting Started with eZ-Analyst*.
- If you will be using *WaveView* and desire post-data analysis capability, install one of the three view applications as discussed in this section.

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System Requirements

Before setting up the hardware or installing the software, verify that you have the following items.

- Data Acquisition System, for example, WaveBook, DaqBook, Personal Daq, LogBook.
- Power Supply with cord
- Data Acquisition CD
- Authorization Code for *eZ-TimeView* or *eZ-FrequencyView*, if applicable. Both are options that can be purchased.

In addition, verify that your computer meets the following **minimum** requirements.

- Intel™, Pentium 90 MHz or equivalent
- 64 MB Memory
- 100 MB Hard Disk space
- Monitor: SVGA, 800 x 600 resolution
- One of the following Microsoft® Windows Operating Systems:
 - Windows 98
 - Windows Me
 - Windows NT
 - Windows 2000
 - Windows XP

Optional, but recommended:

- EPP (Enhanced Parallel Port), or
- ECP (Extended Capabilities Port)



If you purchased software, associated authorization codes will accompany your installation CD. If this is the case, keep your codes in a safe place. You will need to enter them once, during an actual run of the purchased software.

Note that no authorization code is required to run *eZ-PostView*.

Software Installation



Before installing a version of our data-acquisition software, remove all previous versions of that software.



Reference Notes:

- Adobe Acrobat PDF versions of documents pertaining to your system hardware and software are automatically installed onto your PC's hard-drive as a part of product support at the time of software installation. The default location is the **Programs** group, which can be accessed via the *Windows Desktop Start Menu*.
- PDF versions of documents can be read directly from the data acquisition CD.
- After your software is installed you can setup your data acquisition device, e.g., WaveBook, DaqBook, LogBook, and connect it to the host computer. Instructions for hardware setup are included in your device user's manual, which is included on the CD.

When you first install software for your acquisition device, *eZ-PostView* will automatically be selected for installation along with the primary acquisition software application. For example, when a WaveBook is selected, both *WaveView* and *eZ-PostView* will show as pre-selected software options.

To install one of the three view applications ...

1. Start Windows.
2. Close all running applications.
3. Insert the Data Acquisition CD into your CD-ROM drive and wait for the CD to auto-run.

If the CD does not start on its own:

- (a) click the desktop's <Start> button
- (b) choose the Run command
- (c) select the CD-ROM drive, then select the **setup.exe** file.
- (d) click <OK>.

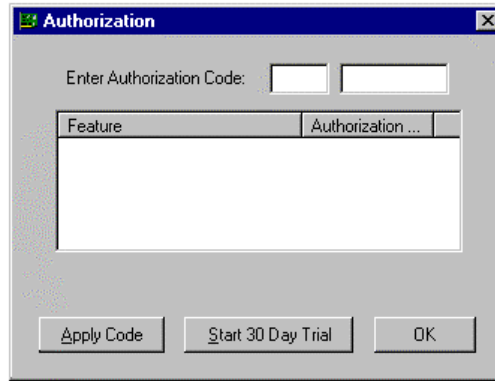
An *Opening Screen* appears.

4. Click the <**ENTER SETUP**> button.
5. On the hardware selection screen [which follows a licensing agreement], select your hardware from the resulting drop-down list
6. On the resulting software options screen, select the software options that are applicable to your system. If you purchased *eZ-TimeView* or *eZ-FrequencyView*, select that application, then de-select *eZ-PostView*.
7. Click the <**Install**> button and follow the screen prompts.



You will be prompted to enter an Authorization Code.

- If you purchased *eZ-TimeView* or *eZ-FrequencyView* enter the code for the associated application; then click the <Apply Code> button.
- If you are installing *eZ-PostView* [which requires no code], simply click the <OK> button or, if you prefer, click the <Start 30 Day Trial> button to try out the more powerful *eZ-FrequencyView* Application.

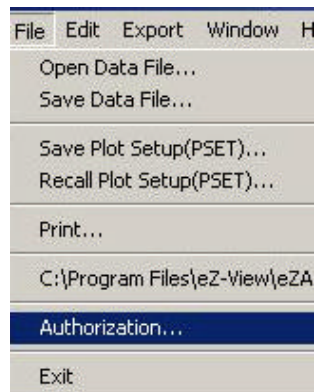


Authorization Dialog Box

Note: Entry of your Authorization Code is only required once. However, you can enter a new code at a future date, for example, if you wanted to upgrade from *eZ-PostView* to *eZ-FrequencyView*.

To open the Authorization Dialog Box:

1. Open *eZ-PostView*. You can open *eZ-PostView* by clicking the <**ViewData**> button in your primary data acquisition program, e.g. *WaveView*, *DaqView*, *LogView*, etc.
2. From *eZ-PostView*'s File Pull-Down menu, select *Authorization* (following figure). The *Authorization* dialog box appears.



File Menu

To enter a code:

1. Type-in the code, as it appears on your Authorization Sheet.
2. Click the <**Apply Code**> button.



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ZonicBook, eZ-Analyst Install 1-5
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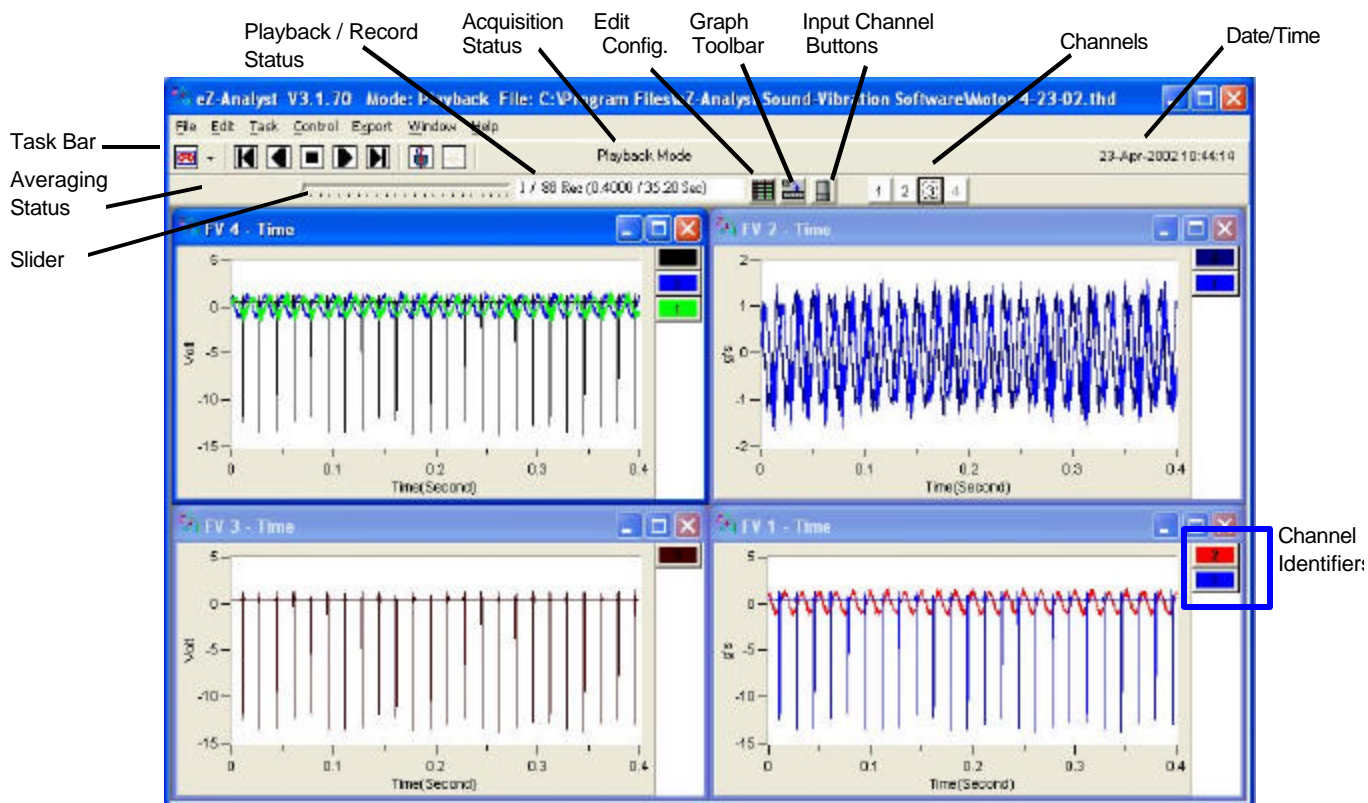
At present, *eZ-Analyst* can only be installed as software support for *ZonicBook* and *WaveBook* devices. If your system is making use of another type of data acquisition device, e.g., *DaqBook*, *DaqBoard*, or *LogBook*, you can not install *eZ-Analyst*, but can install one of its related “view” programs. To install *eZ-PostView*, *eZ-TimeView*, or *eZ-FrequencyView*, refer to the section, *Installing the “View” Applications*, which begins on page 0-5.



Reference Note :

This chapter applies to *eZ-Analyst*. If you are using a “view” application, and not *eZ-Analyst*, be sure to read the two previous sections, *An Introduction to eZ-Analyst Series Software* and *Installing the “View” Applications*. If you are not using *eZ-Analyst*, you should skip this chapter and continue with chapter 2.

An Introduction to eZ-Analyst

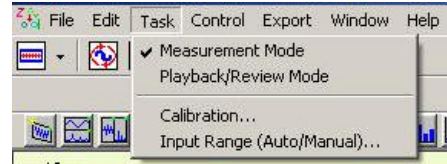


Four Function View Windows in Playback Mode

eZ-Analyst is a graphical analysis application that can be used to collect, analyze, record, and play back recorded data. Using *ZonicBook* or *WaveBook* hardware systems, *ez-Analyst* can collect and display multiple channels of data in real-time. The graphical displays can consist not only of the raw time-domain data, but also plots of frequency domain data. For example, real time FFT (*Fast Fourier Transform*) plots.

Data that is recorded to disk-file is in the raw *time domain* and can be played back for additional analysis time and time again. For example, a raw signal can be played back over-and-over using different filtering algorithms to manipulate the signal. Once the desired results have been achieved, the new data can be exported to a different file and format, while preserving the original file. In addition, the playback capability does not require the presence of a ZonicBook or WaveBook system.

From the Task Menu, the user selects either the Measurement Mode or the Playback mode. The Task Tool Bar automatically changes to accommodate the selected mode.



1	Status Message	A message regarding the status, if applicable, will be displayed in this area. Examples of possible messages are: Double Hammer Rejected, Overload Rejected, Reject (Manual Reject Mode), and GAP.
2	Acquisition Status	<p>Indicates the status of the acquisition.</p> <p>Waiting Trigger indicates that a trigger has not been recognized since the Acquire button was clicked.</p> <p>Triggered indicates <i>eZ-Analyst</i> is capturing and processing data based on the setup conditions.</p> <p>Acquiring indicates that data is being acquired, but is not being recorded to disk.</p> <p>Recording indicates that data is being recorded-to-disk, as it is being acquired.</p> <p>Completed indicates <i>eZ-Analyst</i> has finished processing the frame of data. The "Averages Count" increments by 1 at this time.</p>
3	Date/Time	Provides time in the following format: Day-Month-Year, Hour: Minutes: Seconds. When in Record Mode the current time is displayed. When in Playback Mode the measured time is displayed.
4	Slider Bar	The sliding bar indicates the relative location of the displayed data. The record number and the number of records in the file are listed to the right. The slider can be used to quickly locate a specific record. Note that both the Record and the Playback mode make use of the slider bar.
5	Playback / Recording Status	<p>Displays the current record and the total number of records to be collected. Time equivalents are included in parenthesis</p> <p>Example, 12/25 means that the record currently displayed is the 12th record, out of a total of 25 records.</p>
	Averaging Status	This field shows when the Averaging Mode is used, during the Scope Mode or the Playback Mode. A display of 2/5 would indicate that 2 averages have been performed out of a total of 5 averages to be performed.
6	Channels	<p>Each numbered box represents a channel. Drag a channel [channel-box] to the plot area to have its data displayed. That channel's data is plotted in a distinct color and a color-coded channel button is displayed to the right of the plot.</p> <p>Reference channels are bold and italic. The underlined channel is the current reference channel. Use the right mouse button to select current reference channel. Reference channels are specified in the Configuration accessed via the Edit Menu.</p>

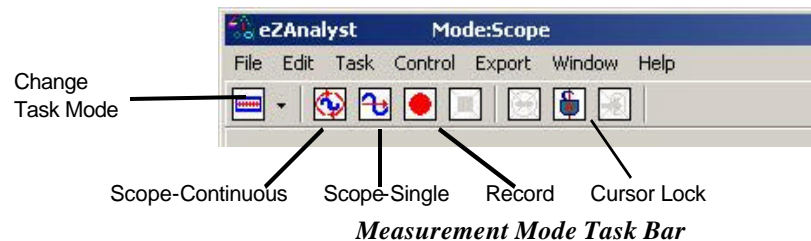
Measurement Mode

The Measurement Mode is an active data-collecting mode, which, for that reason, requires the use of data acquisition hardware. The Measurement Mode can only be selected if a ZonicBook or WaveBook is available; otherwise, *eZ-Analyst* will run in the Playback Mode only.

The Measurement Mode acquires data using one of the following three methods: (1) *Scope-Continuous*, (2) *Scope-Single*, and (3) *Record*.

The *Scope-Continuous* and *Scope-Single* methods display data, but do not log data. The scope methods are useful for signal validation and checkout. The *Record* method, in addition to displaying data, logs data-to-disk based on user-defined start and stop criteria.

In addition to being selected from the Task Menu, the Measurement Mode can be selected from the Task Tool Bar by clicking the <**Change Task Mode**> button while in the Playback Mode. Clicking this button from Measurement Mode will change the task mode tool bar to Playback.



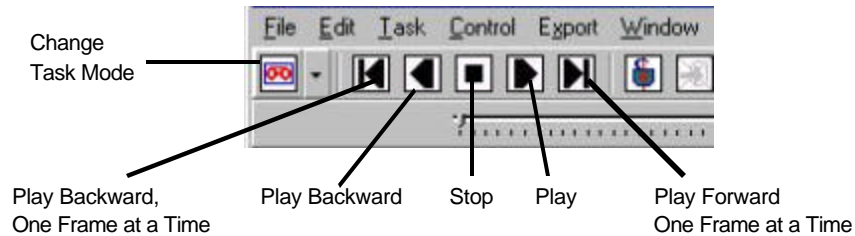
Note that *grayed-out* buttons indicate that the associated function is not available due to a prerequisite not being met.

Change Task Mode		Changes the task from Measurement Mode to Playback Mode. The Task Bar buttons will change accordingly.
Record		Starts recording data-to-disk in continuous time . Note that a ZonicBook or WaveBook must be used to acquire data.
Scope-Continuous		Starts a block-time data acquisition . This scope method is typically used to acquire impact data or to take measurements when data storage is not required.
Scope-Single		Starts a single-time run data acquisition . This scope method is typically used to acquire impact data or to take measurements when data storage is not required.
Signal Generator		The Signal Generator button toggles between two images and is only active when hardware is present.
Indicates that the Generator is turned ON		The sign wave button indicates that the generator is ON. Clicking on it will turn the generator OFF and the button image will change to a circled red line, indicating that the generator is OFF.
Indicates that the Generator is turned OFF		Clicking the button, while the "Off Status" image is present, will turn the Signal Generator back ON, and will change the button to show the sign wave image.
Cursor Lock		An active cursor lock button will have the image of an opened or locked padlock. When the padlock is locked (closed), cursors in multiple windows will be synchronized and locked, providing that the windows are of the same time domain, frequency domain, or have the same octave band data. An opened padlock image indicates that cursors in multiple windows have independent cursor movement, i.e., they are unsynchronized.
Export		This button exports data, if export conditions are set. For details, see the section, <i>Export Menu > Save Export Function Data</i> , in chapter 2.

Playback Mode

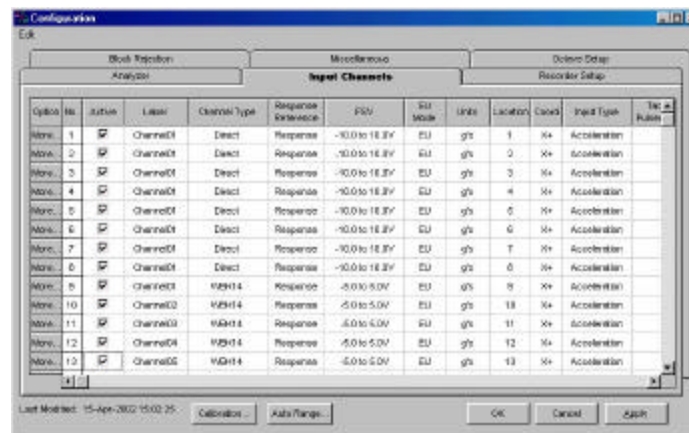
The Playback Mode does not require the presence of physical hardware. When in Playback, *eZ-Analyst* is strictly a post-acquisition display and analysis program. Raw time-domain data, that has been recorded-to-disk, can be played back for analysis repeatedly. For example, a raw signal could be played back several times, each time using a different filtering algorithm to manipulate the original signal. Once the desired results have been achieved the new data can be exported in a new format and to a different file. The original file can remain unchanged, and kept for future analysis.

To activate the Playback Mode, select Playback/Review on the Task Menu. An option is to click the **<Change Task Mode>** button (the first button in the tool bar) while in the Measurement Mode. Also, note that when a WaveBook or ZonicBook is not available, *eZ-Analyst* will automatically enter the Playback mode and will display the data that was most recently recorded to disk.



Playback Mode Task Bar

A Word About Configuration



Configuring Input Channels

eZ-Analyst makes use of various Windows and menus for the purpose of configuration. Chapter 2, *Menus and Windows*, is the heart of this document and should be referred to in regard to the various configuration aspects.

ZonicBook, eZ-Analyst Install

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Note: This section does not apply to the “View” applications.

Introduction

ZonicBook 4, 8, and 16-channel data acquisition modules are built to take advantage of PCs running under Windows operating systems.

Inside each ZonicBook is an analog to digital converter with anti-aliasing filters for each channel. Synchronous sampling of all channels ensures accurate phase relationships and the correlation of data.

The interface between the ZonicBook and the host PC is a type III PCMCIA card, which we will refer to as a “DSP Card” (Digital Signal Processing Card). A proprietary chip set on the card provides the digital signal processing of both time history and *Fast Fourier Transform* (FFT) analysis data. A four-megabyte buffer is used to ensure gap-less data, independent of available processor memory.

Machine conditions and analysis solutions can be shared instantaneously with associates, providing that ZonicBook’s host PC is connected to an Ethernet LAN, file server, internet, or intranet.

The ZonicBook is operated via Graphical User Interface (GUI). Prior to using a ZonicBook system, it is essential that:

- the DSP program has been loaded into the DSP Card
- the ZonicBook is initialized
- system communications are working properly



This document discusses the installation of *eZ-Analyst* software. Be sure to install the software prior to performing the hardware installation. In regard to hardware installation, refer to your *ZonicBook User’s Manual*, p/n 1086-0901.



Reference Note :

Adobe Acrobat PDF versions of documents pertaining to ZonicBook are automatically installed onto your PC’s hard-drive as a part of product support at the time of software installation. The default location is the Program Files directory, which can be accessed via the *Windows Desktop Start Menu*.

System Requirements

Before setting up the hardware or installing the software, verify that you have the following items.

- ZonicBook Data Acquisition Module
- ZonicBook DSP-Card
- Universal Power Supply with cord (U.S.)
- Data Acquisition CD
- Passwords for purchased software

In addition, verify that your computer meets the following **minimum** requirements.

- Intel™, Pentium 90 MHz or equivalent
- a slot for a Type III PCMCIA Card
- 64 MB Memory
- 100 MB Hard Disk space
- Monitor: SVGA, 800 x 600 resolution
- One of the following Microsoft® Windows Operating Systems:
 - Windows 98
 - Windows Me
 - Windows NT
 - Windows 2000
 - Windows XP

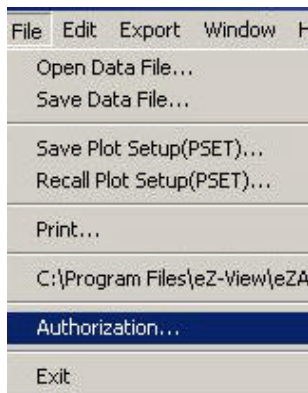


If you purchased software, associated passwords will accompany your installation CD. If this is the case, keep your passwords in a safe place. You will need to enter them once, during an actual run of eZ-Analyst.

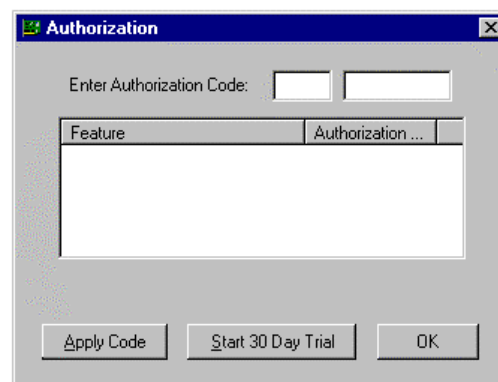
Note that entry of your Authorization Code is only required once. You can enter the code from the *eZ-Analyst* application during its initial run.

Complete these simple steps to enter the code:

1. Open *eZ-Analyst*.
2. From the File Pull-Down menu, select *Authorization*.
The *Authorization* dialog box appears (see figure).
3. Enter your Authorization Code from the code sheet that was included with your purchase.
4. Click the **<Apply Code>** button to enable your new software features.



File Menu



Authorization Dialog Box

Software Installation for Windows 98/Me/2000/XP/NT

1. Start Windows.
2. Close all running applications.
3. Insert the Data Acquisition CD into your CD-ROM drive and wait for the CD to auto-run.

If the CD does not start on its own:

- (a) click the desktop's <Start> button
- (b) choose the Run command
- (c) select the CD-ROM drive, then select the **setup.exe** file
- (d) click <OK>

An *Opening Screen* will appear.

4. Click the <**ENTER SETUP**> button.
5. On the hardware selection screen [which follows a licensing agreement], select **ZonicBook Systems** from the drop-down list.
6. On the resulting software options screen you will see that **eZ-Analyst Real-Time FFT Analyzer Software** has been automatically selected. If applicable to your ZonicBook System, select other install options.
7. Click the <**Install**> button; then follow the on screen prompts to complete the installation.



If you purchased software, associated authorization codes will accompany your installation CD. If this is the case, keep your codes in a safe place. You will need to enter them once, during an actual run of eZ-Analyst.

A Special Note for Windows NT Users

Windows NT

If your PC is using Windows NT, perform the following after you have installed the software.

1. Verify that you are logged on with Administrator capabilities.
2. Verify IRQ and I/O Port availability. This is done as follows:
 - (a) From the Start menu, navigate as follows:
Program ▸ Windows NT Diagnostics ▸ Resources
 - (b) Verify and write down the I/O Port Address; for example: 0110-011F
 - (c) Verify and write down available IRQs; for example: 9, 10, 11.
3. Open the *Control Panel*.
4. Double-click the **CACDSP icon**. This opens the *CAC API Configuration Utility* window.
5. In the data entry box, enter the I/O Port Address [from step 8b].
Typically the I/O Port is either 0x0110 or 0x0120.
6. In the data entry box, enter an available interrupt (IRQ) for your system [from step 8c].
Typically this is 10 or 11.
7. Click the *DSP Tab*.
8. Select PCMCIA.
9. Click the <ADD> button.

Note: For Windows NT operating systems, the I/O Port Address and IRQ values do not show up in the menus after you close the window. They are; however, stored in memory.

10. Click <OK.>
11. Restart your computer.

Your computer is now ready to run ZonicBook software and communicate with the ZonicBook module.

If the DSP-Card does not respond in Windows NT, try the following:

1. From the desktop, open the *Control Panel*. This is done by navigating as follows:
Start ▸ Settings ▸ Control Panel ▸ System ▸ Device Manager ▸ CACDSP
Note: “CACDSP” represents the DSP-Card device
2. Double-click the “CACDSP” (DSP-Card) device.
3. Click the <Start> button. This starts the DSP-Card without the need to reboot the computer.
4. To enable or disable the DSP-Card, click the <Startup> button, then click the <Enable> or the <Disable> button as applicable.
5. Click the <HW Profiles> button.
6. If the *Startup* method is not set to “Automatic,” set the DSP-Card for “Automatic” startup.

Hardware Setup and DSP-Card Installation (All Windows Systems)



Reference Note :

If you have not already set up your hardware and installed your DSP-card, refer to your ZonicBook User's Manual (p/n 1086-0901), and do so at this time.

Verifying DSP-Card Installation

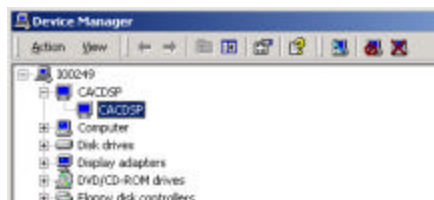
You can use the Window's Device Manager to verify that the DSP-card has been properly installed. The steps for this method are as follows.

1. From the Windows Desktop, click <Start>.
2. Click *Settings*.
3. Click *Control Panel*.
4. Click the *System* icon.
5. Click the "Device Manager" tab.
6. Locate one of the following nodes, as applicable to you Window's operating system.
 - Windows 98 and Windows Me users should locate a node called **D32DSP**.
 - Windows 2000, Windows XP, Windows NT users should locate a node called **CACDSP**.
7. Expand that node by clicking on the "+" symbol.

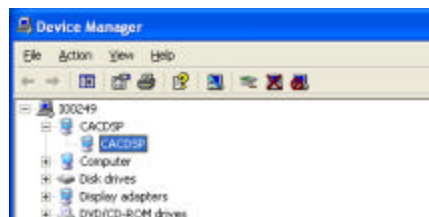
At this point you should see a screen similar to one of the following, depending on which operating system your PC is using.



DSP Verification, Windows 98 and Windows Me



DSP Verification, Windows 2000



DSP Verification, Windows XP

Note: A screen image is not shown for Windows NT. However, Windows NT makes use of a CACDSP node, as do Windows 2000 and Windows NT.



WaveBook, eZ-Analyst Install

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Note: This section does not apply to the “View” Applications.



eZ-Analyst will only work with one WaveBook installed in the Daq Configuration Control Panel.

Introduction

WaveBooks are 1MHz portable data acquisition devices that can be used in a variety of applications, such as testing engine strain, multi-channel acoustics, mechanical integrity, and vibration/shock/strain. With WaveBook, *eZ-Analyst* offers a channel count of up to 64 channels, relatively high frequency analysis capabilities, and a selection of input channel types, including Analog filtering, Strain Gage, and ICP.

System Requirements

Before setting up the hardware or installing the software, verify that you have the following items .

- WaveBook Data Acquisition System
- Power Supply with cord
- Data Acquisition CD
- Passwords for purchased software

In addition, verify that your computer meets the following **minimum** requirements.

- Intel™, Pentium 90 MHz or equivalent
- 64 MB Memory
- 100 MB Hard Disk space
- Monitor: SVGA, 800 x 600 resolution
- One of the following Microsoft® Windows Operating Systems:
 - Windows 98
 - Windows Me
 - Windows NT
 - Windows 2000
 - Windows XP

Optional, but recommended:
 EPP (Enhanced Parallel Port), or
 ECP (Extended Capabilities Port)



If you purchased software, associated passwords will accompany your installation CD. If this is the case, keep your passwords in a safe place. You will need to enter them once, during an actual run of eZ-Analyst.

Software Installation



Remove any previous-installed versions of WaveBook software before installing a new version.

1. Start Windows.
2. Close all running applications.
3. Insert the Data Acquisition CD into your CD-ROM drive and wait for the CD to auto-run.

If the CD does not start on its own:

- (a) click the desktop's <Start> button
- (b) choose the Run command
- (c) select the CD-ROM drive, then select the **setup.exe** file.
- (d) click <OK>.

An *Opening Screen* will appear.

4. Click the <**ENTER SETUP**> button.
5. From the hardware selection screen [which follows a licensing agreement], select **WaveBook Systems** from the drop-down list.
6. On the resulting software options screen you will see that **WaveView** and **eZ-PostView** have been automatically selected. If you plan to use eZ-Analyst in place of *WaveView*, de-select *WaveView* and *eZ-PostView*; otherwise, keep both options selected.
7. Select **eZ-Analyst Real -Time FFT Analyzer Software**.



If you purchased software, associated authorization codes will accompany your installation CD. If this is the case, keep your codes in a safe place. You will need to enter them once, during an actual run of eZ-Analyst.

8. If applicable, select other install options.
9. Click the <**Install**> button.
10. Follow the on-screen prompts to complete the installation process.

Note that the *eZ-Analyst* authorization code is entered via an Authorization Dialog Box, which is accessed from *eZ-Analyst*'s File pull-down menu. This is described in the Authorization Certificate that is included with your purchase of eZ-Analyst. Page 1-6 contains additional information.



Reference Notes:

- Adobe Acrobat PDF versions of documents pertaining to WaveBook are automatically installed onto your PC's hard-drive as a part of product support at the time of software installation. The default location is the **Programs** group, which can be accessed via the *Windows Desktop Start Menu*.
- After your software is installed you can setup your WaveBook device and connect it to the host computer. Instructions for *Hardware Setup* are included in your *WaveBook User's Manual*.

Foreword

In addition to use as a reference for *eZ-Analyst*, this chapter can also be used for *eZ-PostView*, *eZ-TimeView*, and *eZ-FrequencyView*. However, there are many cases where a menu or window does not apply to one or more of these “view” applications. In these instances, functions or selection options that can not be used will be either “grayed-out” or hidden in the actual application. The table on page 2-2 can be used as a quick reference as to what features apply to a particular application.

The menus, with exception of the **Task Menu**, are presented in the order that they appear on *eZ-Analyst*'s main window. The Task Menu is discussed first since it is from this menu that the user (1) selects **Measurement Mode** or **Playback Mode** and (2) makes use of the **Auto-Ranging** feature for **input channels**.

Note that the “view” programs have no Task Menu. This is because they actually have only one task, “Playback Mode.”

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Notes:

- At present, *eZ-Analyst* only applies to ZonicBook and WaveBook devices.
- Our other acquisition devices, e.g., LogBooks, DaqBoards, DaqBooks, ChartScans, etc., can not currently use *eZ-Analyst*, but can make use of one of its derived “view” applications.
- The operational differences between the use of *eZ-Analyst* in ZonicBook and the WaveBook are minor. However, the differences are noted. For example, the discussion of *Autorange* is broken down into two sections, one sub-titled “ZonicBook Applications” and the other “WaveBook Applications.”

Comparing the “View” Applications to eZ-Analyst

eZ-Analyst Series Comparison Matrix				
Feature	Post-Acquisition Viewing Package			eZ-Analyst
	eZ-PostView	eZ-TimeView	eZ-FrequencyView	
File Input Format Support for: <i>DaqView</i> , <i>WaveView</i> , <i>Personal DaqView</i> , <i>ChartView</i> , UFF-58B.	Yes	Yes	Yes	Yes
File Export to: ME'Scope and SMS Modal, Microsoft Excel, Binary Universal File, and ASCII text files.	----	Yes	Yes	Yes
Display Windows, number of	8	8	8	8
Channel Traces per Display Window	16	16	16	16
Automatic Data Scaling	Yes	Yes	Yes	Yes
Configurable Data Display for channels and trace colors	Yes	Yes	Yes	Yes
Multiple Tiling of display windows	Yes	Yes	Yes	Yes
Cursor Support - for both Single Cursor and Band Cursor	----	Yes	Yes	Yes
Data Strip Chart Display	----	Yes	Yes	Yes
Peak-to-Peak Calculations	----	Yes	Yes	Yes
Peak Searching, minimum and maximum	----	Yes	Yes	Yes
Mean Calculations	----	Yes	Yes	Yes
RMS Calculations	----	Yes	Yes	Yes
Zooming [of the data display]	----	Yes	Yes	Yes
Windowed Time Display Function	----	Yes	Yes	Yes
Cross Channel Support	----	----	FRF, Cross, Coherence, Transfer Function	FRF, Cross, Coherence, Transfer Function
Transfer Function Display Types	----	----	Note 1	Note 1
Complex Function Display Types	----	----	Note 2	Note 2
Scale Types	----	RMS, Peak, Peak-to-Peak	RMS, Peak, Peak-to-Peak	RMS, Peak, Peak-to-Peak
Function Display Types	----	Time, Strip Chart	Note 3	Note 3
Octave Types	----	----	1/3, Full	1/3, Full
Octave Weighting	----	----	Linear, A, B, C	Linear, A, B, C
Integration/Differentiation (Single/Double)	----	----	Yes	Yes
Response Channel FFT Windows	----	----	Note 4	Note 4
Reference Channel FFT Windows	----	----	Rectangular, Cosine Taper	Rectangular, Cosine Taper
Low -Pass DC Noise Filtering	----	----	Yes	Yes
Strip Chart Display Synchronization	----	----	Yes	Yes
Record and Save Data to Disk	----	----	----	Yes
“Real Time” Data Display	----	----	----	Yes

- Notes:**
- 1) **eZ-Analyst** and **eZ-FrequencyView** - each offers the following **Transfer Function Display Types**: Inertance, Mobility, Compliance, Apparent Mass, Impedance, and Dynamic Stiffness.
 - 2) **eZ-Analyst** and **eZ-FrequencyView** - each offers the following **Complex Function Display Types**: Magnitude, Phase, Real, Imaginary, Nyquist, Magnitude and Phase, and Real and Imaginary.
 - 3) **eZ-Analyst** and **eZ-FrequencyView** - each offers the following **Function Display Types**: Spectrum, Auto-Spectrum, PSD (Power Spectral Function), Strip Chart (Time).
 - 4) **eZ-Analyst** and **eZ-FrequencyView** – each offers the following **Response Channel FFT Windows**: Hanning, Flat Top, Exponential, and Blackman-Harris.

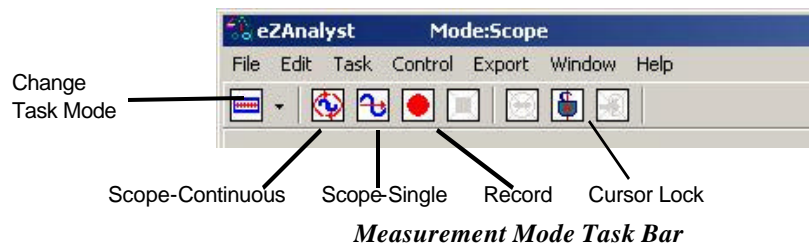
Task Menu > Measurement Mode

The Measurement Mode is an active data-collecting mode, which, for that reason, requires the use of data acquisition hardware. The Measurement Mode can only be selected if a ZonicBook or WaveBook is available; otherwise, eZ-Analyst will run in the Playback Mode only.









The Measurement Mode acquires data using one of the following three methods: (1) *Scope-Continuous*, (2) *Scope-Single*, and (3) *Record*.

The *Scope-Continuous* and *Scope-Single* methods display data, but do not log data. The scope methods are useful for signal validation and checkout. The *Record* method, in addition to displaying data, logs data-to-disk based on user-defined start and stop criteria.

In addition to being selected from the Task Menu, the Measurement Mode can be selected from the Task Tool Bar by clicking the <**Change Task Mode**> button while in the Playback Mode. Clicking this button from Measurement Mode will change the task mode tool bar to Playback.



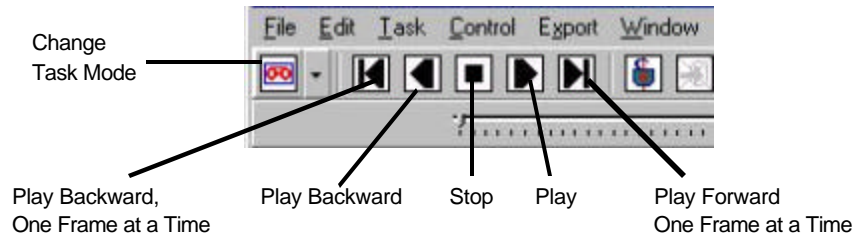
Note that *grayed-out* buttons indicate that the associated function is not available due to a prerequisite not being met.

Change Task Mode		Changes the task from Measurement Mode to Playback Mode. The Task Bar buttons will change accordingly.
Record		Starts recording data-to-disk in continuous time . Note that a ZonicBook or WaveBook must be used to acquire data.
Scope-Continuous		Starts a block-time data acquisition . This scope method is typically used to acquire impact data or to take measurements when data storage is not required.
Scope-Single		Starts a single-time run data acquisition . This scope method is typically used to acquire impact data or to take measurements when data storage is not required.
Signal Generator		The Signal Generator button toggles between two images and is only active when hardware is present.
Indicates that the Generator is turned ON		The sign wave button indicates that the generator is ON. Clicking on it will turn the generator OFF and the button image will change to a circled red line, indicating that the generator is OFF.
Indicates that the Generator is turned OFF		
		Clicking the button, while the "Off Status" image is present, will turn the Signal Generator back ON, and will change the button to show the sign wave image.
Cursor Lock		An active cursor lock button will have the image of an opened or locked padlock. When the padlock is locked (closed), cursors in multiple windows will be synchronized and locked, providing that the windows are of the same time domain, frequency domain, or have the same octave band data.
		An opened padlock image indicates that cursors in multiple windows have independent cursor movement, i.e., they are unsynchronized.
Export		This button exports data, if export conditions are set. For details, see the section, <i>Export Menu</i> > <i>Save Export Function Data</i> .

Task Menu > Playback / Review Mode

The Playback Mode does not require the presence of physical hardware. When in Playback, *eZ-Analyst* is strictly a post-acquisition display and analysis program. Raw time-domain data, that has been recorded-to-disk, can be played back for analysis repeatedly. For example, a raw signal could be played back several times, each time using a different filtering algorithm to manipulate the original signal. Once the desired results have been achieved the new data can be exported in a new format and to a different file. The original file can remain unchanged, and kept for future analysis.

To activate the Playback Mode, select Playback/Review on the Task Menu. An option is to click the <**Change Task Mode**> button (the first button in the tool bar) while in the Measurement Mode. Also, note that when a WaveBook or ZonicBook is not available, *eZ-Analyst* will automatically enter the Playback mode and will display the data that was most recently recorded to disk.



Playback Mode Task Bar

Task Menu > Input Range (Auto/Manual)

Auto-ranging is a procedure that automatically sets the input full-scale voltage (FSV) range for input channels. The FSV is set by measuring a representative sample of real-time data. Auto-ranging is only performed on active channels.

WaveBook Application

Auto-ranging works best if you supply the maximum expected voltage range for the data that will be captured during the acquisition. Therefore, make the Auto Range **Duration** long enough to apply a typical signal. The maximum duration is 65535 mSecond. Also, make sure that the Auto Range **Analysis Frequency** is fast enough to capture the high frequency component. Typically the **Analysis Frequency** will be the same setting as *eZ-Analyst's* Acquisition Analysis Frequency.

Chnl	Label	Active	FSV	RMS	Minimum	Maximum
1	Channel 1	<input checked="" type="checkbox"/>	0.0 to 2.0V	0.0694	0.0634	0.0696
2	Channel 2	<input checked="" type="checkbox"/>	0.0 to 2.0V	0.0814	0.0762	0.0817
3	Channel 3	<input checked="" type="checkbox"/>	0.0 to 2.0V	0.1343	0.1293	0.1350
4	Channel 4	<input checked="" type="checkbox"/>	-1.0 to 1.0V	-0.0396	-0.0524	-0.0389
5	Channel 5	<input checked="" type="checkbox"/>	0.0 to 2.0V	0.0218	0.0120	0.0221
6	Channel 6	<input checked="" type="checkbox"/>	0.0 to 2.0V	0.0613	0.0526	0.0619
7	Channel 7	<input checked="" type="checkbox"/>	0.0 to 2.0V	0.0216	0.00848	0.0306
8	Channel 8	<input checked="" type="checkbox"/>	-1.0 to 1.0V	-0.00287	-0.0225	-0.00281
9	Channel 9	<input checked="" type="checkbox"/>	-0.025 to 0.025V	0.00320	-0.00084	0.00351
10	Channel 10	<input checked="" type="checkbox"/>	-0.025 to 0.025V	0.00298	-0.00122	0.00320
11	Channel 11	<input checked="" type="checkbox"/>	-0.025 to 0.025V	0.00397	-0.00038	0.00427
12	Channel 12	<input checked="" type="checkbox"/>	-0.025 to 0.025V	0.00305	-0.00122	0.00351
13	Channel 13	<input checked="" type="checkbox"/>	-0.025 to 0.025V	0.00275	-0.00168	0.00328
14	Channel 14	<input checked="" type="checkbox"/>	-0.025 to 0.025V	0.00313	-0.00183	0.00366
15	Channel 15	<input checked="" type="checkbox"/>	-0.025 to 0.025V	0.00298	-0.00160	0.00320
16	Channel 16	<input checked="" type="checkbox"/>	-0.025 to 0.025V	0.00267	-0.00198	0.00305
17	Channel 17	<input type="checkbox"/>	N/A			
18	Channel 18	<input type="checkbox"/>	N/A			

Start OK Cancel

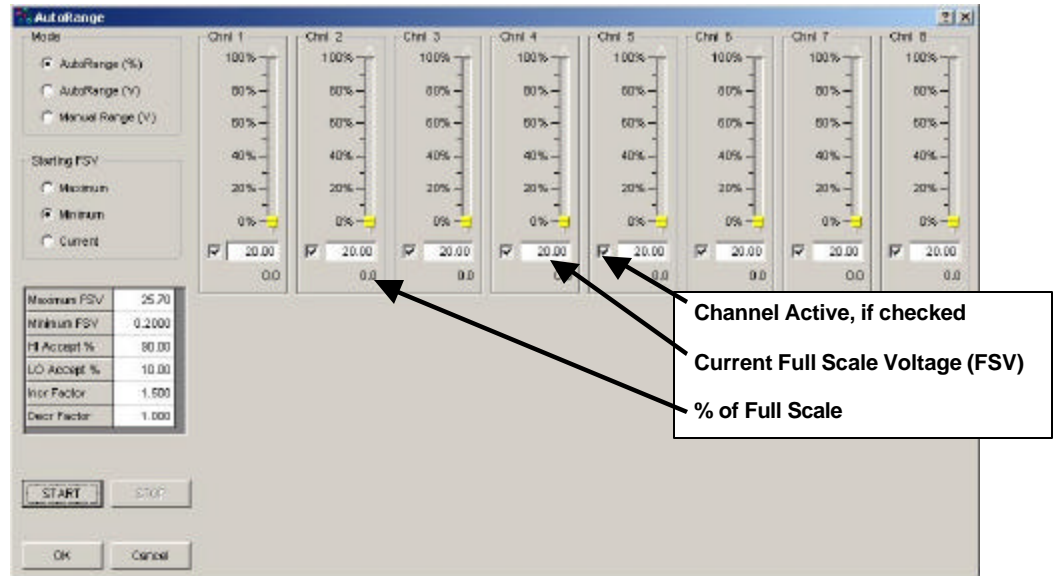
Auto Range Dialog Box, WaveBook Applications

You can access the dialog box for WaveBook by clicking the <**Auto Range**> button, which is located on the Input/Output Channels tab, when in the "Measurement Mode."

ZonicBook Applications

Auto-ranging works best if you supply the maximum expected voltage range for the data that will be captured during the acquisition.

The AutoRange window can be accessed from the Task pull-down menu when in Measurement Mode. The window has four basic sections: Mode panel, Starting FSV panel, Channel Gauges, and a %, FSV, Factors Display display.



Auto Range Display, ZonicBook

Mode

The Mode panel consists of three radio buttons, which are used to select one of the following range modes: AutoRange(%), AutoRange(V), or ManualRange(V).

Starting FSV

The Starting FSV (Full Scale Voltage) panel consists of three radio buttons, which are used to set the starting FSV to Maximum, Minimum, or Current.

Channel Gauges

The channel gauges, one per channel, display the instantaneous peak value as percentage or voltage, depending on the mode that was selected. The color of the vertical bar has the following significance:

Yellow	=	signal range is from 0 to the minimum Full-Scale Voltage set in the Auto-range Setup window.
Green	=	signal range is from the minimum to the maximum of the Full-Scale Voltage set in the Auto-range Setup window.
Red	=	signal range is over the maximum of the Full-Scale Voltage set in the Auto-range Setup window.

% , FSVF, & Factors Display

Maximum FSV is the high-end limit for the input voltage. Note that 25.7 V is the highest possible FSV for a ZonicBook.

Minimum FSV is the low-end limit for the input voltage. In the figure at the right Minimum FSV is set to 0.2 volts.

HI Accept % defines the highest acceptable percentage of peak input voltage for the selected FSV, i.e., *Current*, *Minimum*, or *Maximum*. Thus, if our selected FSV was 0.2 V and we had an upper limit of 90%; then our upper limit in volts would be 0.18 V. An example follows as to how exceeding this value causes a range adjustment.

Maximum FSV	25.70
Minimum FSV	0.2000
HI Accept %	90.00
LO Accept %	10.00
Incr Factor	1.500
Decr Factor	1.000

LO Accept % defines the lowest acceptable percentage of peak input voltage for the selected FSV, i.e., (*Current*, *Minimum*, or *Maximum*). Thus, if our selected FSV was 0.2 V and we had a lower limit of 10%; then our actual low limit in volts would be .02 V.

Incr Factor (Increasing Factor) is the factor by which the *Current FSV* will increase, should the peak exceed the upper limit. In the figure we see that the Increasing factor is 1.5.

Decr Factor (Decreasing Factor) is the factor by which the *Current FSV* will decrease, should the peak not reach the lower limit. Keeping the decrease factor at “1” will result in no decrease of the Current FSV. Setting the Decrease Factor to 0.8 would cause the Current FSV to decrease to 80% of its value if the peak fell short of the low limit.

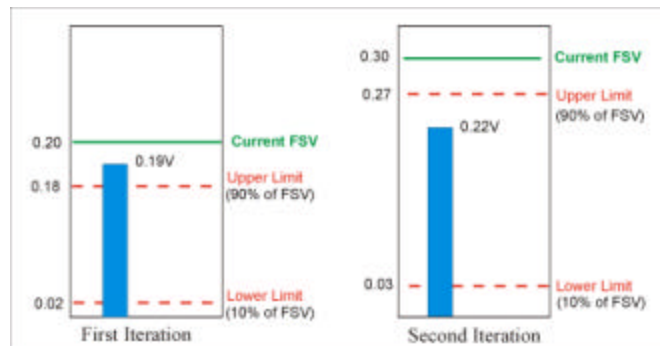
Note: These are the same values that were entered in the Vpeak column in the Channel Setup window. The values are immediately replaced when the Auto ranging process begins.

An Example of Auto-Ranging

Maximum FSV set at 25.7 V
Minimum FSV set at 0.2 V
Upper Limit set at 90%
Lower Limit set at 10%
Increasing Factor set at 1.5
Decreasing Factor set at 1

In this example we have set the radio button for **Current FSV** instead of *Minimum* or *Maximum* (note 2). The starting value, in the example, is 0.20 V.

In the **first iteration** we see that we have a peak of 0.19 V. This falls outside of our band of 0.02 to 0.18 V that was established by our upper and lower limit percentages; i.e., 90% of the Current FSV and 10% of the FSV.



An Example of Auto-Ranging

As a result, the Current FSV is increased by a factor of 1.5 (our Increasing Factor) and the Current FSV becomes 0.30 V. Our limits, in volts, also changed since we are now looking at percentages of 0.30 volts instead of the same percentages of 0.20 volts.

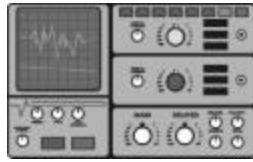
In the **second iteration** of our example, we see a 0.22 volt peak. This value is within our established limits so the Current FSV does not change.

Note 1: If the Capture Mode is the Input Channel (Trigger Mode), the Auto Range process waits for a trigger.

Note 2: A Start FSV of Minimum or Maximum can selected instead of Current FSV, as in our example. Minimum FSV is the default.

Task Menu > Calibration

When calibration is performed, a signal of known Peak level [or RMS value] is supplied to a transducer that is connected to an active input channel. An accelerometer calibrator or piston phone is typically used to generate the calibration signal for vibration sensors and microphones, respectively.



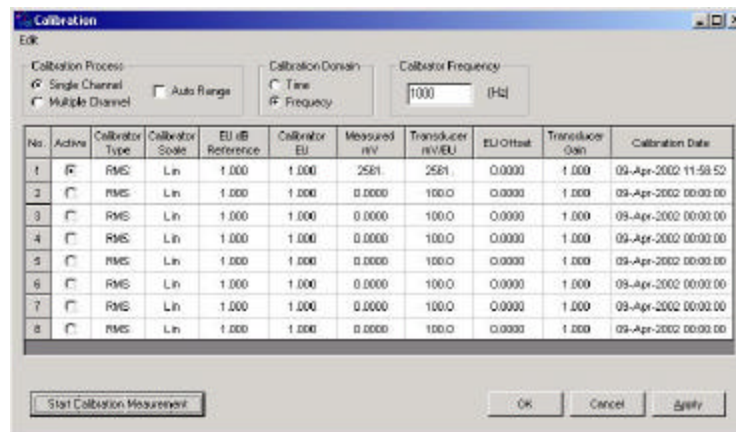
Examples:

Accelerometer calibrators typically make use of **linear** engineering units and, as their name implies, are used for calibrating accelerometers.

Piston phones are most often used for calibrating microphones. Piston phones typically make use of decibel (**dB**) engineering units.

eZ-Analyst includes a Calibration window for selecting the channels to be calibrated and for entering several signal-related parameters. In addition, the calibration is actually started from the window.

When you are in “Measurement Mode” you can access the Calibration window from the Task Menu or from the Input/Output Channels tab.



Calibration Display Screen



- When a channel is calibrated, the number of averages used will be 5, or the number that is designated in the “No. of Averages” field (located on the Analyzer Tab). The greater of the two values will be used, automatically.
- When a channel is calibrated, the blocksize of the acquisition will automatically be 4096, or the blocksize value that is stated on the Analyzer Tab, providing it is 4096 or higher.

A discussion of the various regions of the Calibration window now follows. The section concludes with an example.

Calibration Process

- Single Channel** Used to select one active channel at a time. When the calibrator only has one channel output, the Single Channel method must be used. When Single Channel is selected, the “Active” column shows a radio button next to each channel.
- Multiple Channel** Used to select two or more channels for simultaneous calibration. This is only an option when the calibrator offers more than one output. When Multiple Channel is selected, the “Active” column shows a checkbox next to each channel.
- Auto Range** Auto-range sets the input full-scale voltage (FSV) range for the input channels to be calibrated. FSV is determined by measuring a representative sample of real-time data.

Calibration Domain

With the use of *Fourier Transform*, any signal can be viewed from a *time domain* or a *frequency domain*. Either domain can be selected for use in the calibration process.

- Time** The overall value is computed using time domain data.
- Frequency** The overall value is computed with frequency domain data by summing up frequency component of FFT spectrum.

Calibrator Frequency (Hz)

This field is used to enter the frequency setting of the calibrator. The analysis frequency, which is twice this frequency, is used if possible. Otherwise, the maximum allowed analysis frequency is used.

Columns on the Calibration Window

- No.** This column displays channel numbers [1, 2, 3, ... etc.] for easy reference to their associated cells. The channel numbers, being for display indication only, are fixed and can not be edited.
- Active** When “**Single Channel**” is selected, you can click on a radio button in the “Active” column to enable one channel for calibration. When the calibration is complete, select the radio button for the next channel to be calibrated.
- When “**Multiple Channel**” is selected, the radio buttons are replaced by checkboxes. Ensure that each channel to be calibrated has the associated box checked, and that the remaining channels remain unchecked. For multiple channel applications note that you can click on the column label, i.e., the word “Active” to simultaneously check or uncheck all channel checkboxes in the column.
- Note:** The channel settings in the Calibration window are independent of the selections that appear in the Input Channel Setup window. Only active channel shows up at calibration window.

Calibrator Type	<p>This column is used to select Peak or RMS* as the calibrator type. Highlight a cell, or range of cells, in the grid, then select Peak or RMS from the popup menu.</p> <p>Peak Uses the peak amplitude of the spectrum around the specified frequency of the calibration signal.</p> <p>RMS Uses a compensated overall level calculation to determine the RMS level of the calibration signal, as specified in the Units field.</p> <p>*RMS – <i>Root-mean-square</i>, is the square root of the arithmetic mean of the squares of a set of numbers.</p>
Calibrator Scale	<p>This column is used to select the calibrator scale to linear or to decibel.</p> <p>Lin Select Lin if the calibrator is in linear scale.</p> <p>dB Select dB if the calibrator scale is dB.</p> <p>Note: While there are several definitions to dB, in our application we are using dB to express the ratio of the magnitudes of two quantities equal to 20 times the common logarithm of the ratio.</p> <p>The formula for dB is:</p> $\text{dB} = 20 \log (x/\text{dB EUref})$
EU dB Reference	<p>This field is used to enter the Engineering Units dB reference.</p> <p>dB EU Reference is applied to displayed data when the Y-axis scale is set to dB. This is valid only for frequency domain data.</p> <p>Note: The dB Reference (Volt) can be changed simultaneously for all channels from the associated entry box in the <i>FFT Setup Tab</i>, page 2-32.</p> <p>The formula for dB display for Unaveraged Spectrum, Averaged Spectrum, and FRF is:</p> $\text{dB} = 20 \log (x/\text{dB EUref})$ <p>The formula for dB display for Autospectrum, Cross Spectrum, and PSD is:</p> $\text{dB} = 10 \log [x/((\text{dB EUref})^2)]$
Calibrator EU	<p>This field is used to set the Calibrator's Engineering Units.</p>
Measured mV	<p>Displays the measured value of the channel in milli-volts.</p>
Transducer mV/EU	<p>The Transducer mV/EU value can be entered manually, or by the measurement process. Highlight a cell, or cells, in the grid before typing a value in the data entry box. Then press the <OK> button to accept the value. All other fields linked to this value are updated when the value is accepted.</p> <p>mV/EU= Volts/Units * Transducer Gain</p>
EU Offset	<p>EU Offset is used for DC signal compensation. Offset is added to, or subtracted from the measured EU value.</p>
Transducer Gain	<p>Transducer Gain is used as auxiliary scaling to compensate for the transducer amplifier gain. Gain is a multiplied function.</p>

Calibration Date	This column displays the date and time of the last calibration. If any channel value changes, even if the original number is restored, the calibration date and time are automatically removed for that channel.
Start Calibration Measurement	Clicking this button starts the calibration process for all selected channels. At the completion of the calibration, the measured mV and the Transducer mV/EU value for the applicable channels are automatically updated.

Calibration Procedure, an Example

Accelerometer type - Piezotronics 303A03

Calibrator - Piezotronics 394B05 - 1.02 G (RMS) at 80Hz

Unit of acceleration - in/sec²

Note: 1.02 G RMS is equivalent to 393.811 in/sec² (1G=386.089in/sec²).

This is a linear scale, thus we will be selecting Lin in the Calibrator Scale column.

In this example we will be calibrating channel 1.

1. Attach the accelerometer to the calibrator (signal source). Connect the other end of the accelerometer cable to the channel 1.
2. Set the FSV into a proper range (i.e. 32.4 mV) in the Input Channels Setup window, then click the <Apply> button.
3. Set the desired **blocksize** in the Analyzer Tab if a block size of greater than 4096 is desired.
4. Set the “**No. of Averages**” in the Analyzer Tab if an average count of greater than 5 is desired.
5. Open the Calibration Window from the Task Menu, or from the Input/Output Channels Tab.
6. Select “**Single Channel.**”
7. Select “**Auto Range,**” if desired.
8. Select a Calibration domain. In this case, either “Time” or “Frequency” can be selected.
9. Enter **80 Hz** in the *Calibrator Frequency* field.
10. Ensure the radio button for *Channel 1* is **enabled** (in the Active column.)
11. Select **RMS** for the *Calibrator Type*.
12. Select **Linear** in the *Calibrator Scale* field.
13. Leave *EU dB Reference* set at **1.000**. Note that this step can be skipped when linear scale is used.
14. Set *Calibrator EU* at **1.02** ; implying an engineering unit of 1G.
15. Enter **393.811** in the *Transducer mv/EU* field.
16. Leave the *EU Offset* at **0.0000**. We are assuming no offset in this example.
17. Leave **1.000** as the *Transducer Gain*. No amplifier or attenuator is being used in our example.
18. Click <Apply> so your new values will not be lost.
19. Click the <**Start Calibration Measurement**> button to begin calibration.

File Menu

The File Menu provides a means to print plotted data, as well as open, save, and export data files.

Open Time History Data (.thd or .dsc)

Used to locate and open saved files. ZonicBook uses files with **.thd** extensions. WaveBook uses files with **.dsc** extensions.

Save [or Open] Multiple Data Set (.mds)

These two menu items provide a means of saving [or opening] function files. Time and auto-spectrum data is saved. If there is any reference channel cross-spectrum is saved for all channel pairs. The file extension is **.mds**.

Save [or Recall] Hardware Setup (.set)

These two menu items provide a means of saving [or recalling] current settings and processing conditions. In addition, **.thd** files and **.mds** files can be used to recall setup conditions, because these file -types include setup conditions in addition to measured data. Note that only the setup condition is recalled.

Save [or Recall] Plot Setup (.pset)

These two menu items provide a means of saving [or recalling] the current plot condition, such as window locations and window content, including: channel numbers, function type, axis -type, and range. These files can be recalled at a later date to process customized plot conditions.

Without user intervention, the plot setup file is automatically saved with **.mds**, **.dsc**, and **.thd** files.



You can have plot setups automatically recalled whenever you recall data files. To select this option, open the Preferences window [accessed through the Edit pull-down menu] and check the box labeled “Recall Plot Setup When Recall Data Files.”

Print

The standard print window associated with your specific computer will open. Select a printer and the number of copies needed before clicking <OK>.

Note: In regard to printing, black plot backgrounds changed to white.

Authorization

Opens an Authorization Dialog box that provides a means of entering an authorization code to enable the features of purchased software, i.e., *eZ-FrequencyView*, *eZ-TimeView*, or *eZ-Analyst*. The dialog box includes an option to run a 30-day trial version of *eZ-Analyst*.

Exit

This menu item closes the *eZ-Analyst* application.



Edit Menu

The Edit Menu provides a means of configuring *eZ-Analyst* in regard to both functionality and appearance. The menu contains the following selections, each of which is detailed in the subsequent sections:

- Configuration..... 2-13
- Playback Setup Window..... 2-39
- Display Preferences Window..... 2-41

Edit Menu > **Configuration . . .**

The **Configuration** item provides a means of changing the majority of *eZ-Analyst* settings in regard to collecting data and in determining how the collected data is manipulated. The Configuration selection displays the **Configuration Window** with one of several tab dialogs displayed. Possible tab displays for both *eZ-Analyst* and the “view” programs are as follows:

Edit Menu > Configuration Window	
Tabs in <i>eZ-Analyst</i>	Corresponding Tabs of the “View” Programs
Analyzer Tab..... 2-15	Acquisition Setup Tab
Input/Output Channels Tab 2-21	Input Channels Tab
Recording Setup Tab..... 2-25	n/a
Block Rejection Tab.....2-30	n/a
FFT Setup Tab.....2-32	Miscellaneous Tab Does not apply to <i>eZ-PostView</i> .
Octave Setup Tab 2-37	Octave Setup Tab Does not apply to <i>eZ-PostView</i> . Does not apply to <i>eZ-TimeView</i> .

A Note Regarding Frequency Resolution

This note pertains to frequency resolution and is related to the values seen in the Analyzer Tab's Acquisition Panel (next two figures). The frequency resolution is related to the Analysis Frequency (bandwidth) and the Blocksize (the number of data points in one block of data). The following equations apply.

$$w = b / 2.56f$$

Where:

w = Frame Width
 b = Blocksize
 2.56 is a constant
 f = Analysis Frequency

$$\text{Delta X} = 1/w$$

Where:

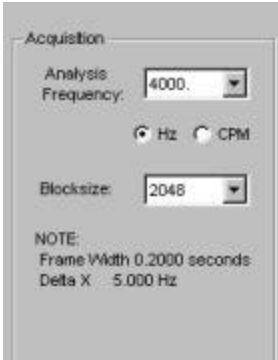
Delta X is the frequency resolution
 w = Frame Width
 the lower the Delta X, the higher the resolution.

Note: With other factors unchanged –

Increasing Blocksize increases Frequency Resolution.
 Increasing Analysis Frequency decreases Frequency Resolution.

The lower the “Delta X” frequency, the higher the Frequency Resolution. Thus, a Delta X of 5 Hz indicates a higher frequency resolution than does a Delta X of 80 Hz.

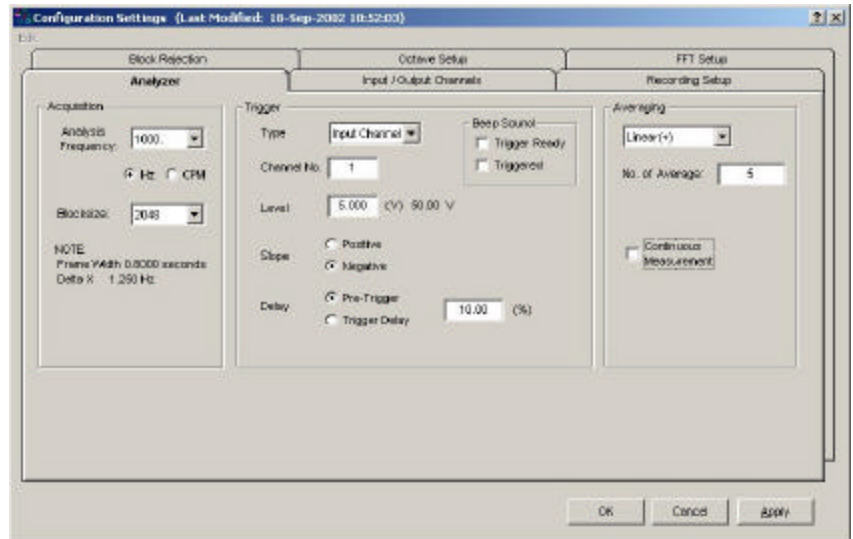
With these equations we can see how the Frame Width and Delta X are calculated.

<p>Example 1 (see figure)</p> <p>Given: Analysis Frequency <u>4000 Hz</u> Blocksize <u>2048</u></p> $w = b / 2.56f$ $= 2048 / (2.56)(4000)$ $= 0.2 \text{ seconds}$ <p>Delta X = 1/w</p> $= 1 / 0.2$ $= 5 \text{ Hz}$	 <p><i>Acquisition Panel on the Analyzer Tab</i></p> <p>The values shown pertain to example 1.</p>	<p>Example 2 (no figure)</p> <p>Given: Analysis Frequency <u>4000 Hz</u> Blocksize <u>128</u></p> $w = b / 2.56f$ $= 128 / (2.56)(4000)$ $= 0.0125 \text{ seconds}$ <p>Delta X = 1/w</p> $= 1 / 0.0125$ $= 80 \text{ Hz}$
<p>Note: A Delta X of 5 Hz indicates a higher frequency resolution than does a Delta X of 80 Hz.</p>		

Higher frequency resolutions indicate that the signal trace will be based on more data points for a given time frame. The higher the frequency resolution, the smoother the trace will be.

The Analyzer Tab consists of three panels:

- Acquisition,**
- Trigger,** and
- Averaging**



Analyzer Tab

Edit Menu > Configuration > Analyzer Tab: Acquisition Panel

The Acquisition Panel provides a means of setting Analysis Frequency and Blocksize. A note regarding the relationship of Analysis Frequency and Blocksize, to Frame Width and Delta X, is located on the preceding page.

Analysis Frequency: This section of the Acquisition Panel is used to set the maximum bandwidth for analysis. Frequency components above the Analysis Frequency setting will result in aliasing errors in the data. The bandwidth measurement can be set for Hertz (Hz) or Cycles Per Minute (CPM) by use of radio buttons. Note that the processing time for a selected blocksize is fixed by CPU speed.

Increasing the analysis frequency results in: (a) the hardware streaming packets of data more frequently to the software, (b) a greater demand placed on the software to process the data blocks, and (c) less time between data blocks available for task performance

Blocksize: This section of the Acquisition Panel is used to set the number of data points in a frame or block of data. Acceptable blocksizes range from 128 to 16384 data points.

Blocksize can be viewed as chunks, or packets of data, that move through *eZ-Analyst's* software algorithms. As blocksize increases, the amount of data increases, the time required to acquire a block of data increases, and the amount of space required to save the data increases.

Effects of Changing Analysis Frequency or Blocksize (Note)				
Changing: Analysis Frequency	File Size (Recorded Data)	Block Acquisition-Time*	Data Displayed in Scope Mode	Frequency Resolution
Increase	Larger disk file	Faster	Faster screen updates	Lower (higher Delta X)
Decrease	Smaller disk file	Slower	Slower screen updates	Higher (lower Delta X)
Changing: Blocksize	File Size (Recorded Data)	Block Acquisition-Time*	Data Displayed in Scope Mode	Frequency Resolution
Increase	Larger disk file	Slower	Slower screen updates	Higher (lower Delta X)
Decrease	Smaller disk file	Faster	Faster screen updates	Lower (higher Delta X)

Note: The effects indicated by the table pertain to changing the Analysis Frequency while the Blocksize remains unchanged, and visa versa. If both the Analysis Frequency and the Blocksize are changed [for the same acquisition] the effect on the other variables can differ, depending on the magnitude and direction of change that was made to Analysis Frequency and Blocksize.

***Block Acquisition-Time:** The time it takes to acquire one block of data.

Edit Menu > Configuration > Analyzer Tab: Trigger Panel

The Trigger Panel provides a means of setting and defining trigger-related parameters.

Triggering defines how *eZ-Analyst* is to begin the task of capturing and processing data.. To capture data without using a trigger, select *Free Run* from the pull-down list. To capture transient data, select *Input Channel* from the pull-down list [as indicated in the figure to the right] and specify the applicable parameters.



*Trigger Panel
on the Analyzer Tab*

A Breakdown of the Analyzer Tab's Trigger Panel	
Category	Description
Type	If " Free Run " is selected as the Type, the data acquisition and processing will begin as soon as the <Acquire> button is clicked. Select "Free Run" if you want to measure data in a <i>continuous or Scope mode manner</i> [from an active system]. If " Input Channel " is selected as the Type, the data acquisition and processing begin after the signal on the specified channel reaches the defined trigger conditions. Select "Input Channel" if you want to capture transient data.
Channel No.	Specifies the channel that the trigger condition applies to.
Level	This value is the point that the signal must pass through to be considered as a candidate for a trigger. When using a ZonicBook this value is entered as a percentage of FSV. When using the WaveBook this value is entered as volts and must be within the select FSV.
Slope	The slope radio buttons are used to selects the " Positive " increasing (rising), or "Negative" decreasing (falling) slope of the signal that defines a trigger condition. The signal must be on the defined slope before it can be considered for use as a trigger
Delay	Selecting the " Pre-Trigger " radio button instructs the system to capture a specified percentage of data [a specified percent of the frame size] prior to the <i>start of trigger event</i> . In the previous figure we see that "Pre Trigger" is selected for 10.00 (%). Selecting the " Trigger Delay " radio button instructs the system to skip a specified percentage of data [a specified percent of the frame size] after the <i>start of trigger event</i> . If we selected "Trigger Delay" and entered 10.00 in the percent box, we would see 10% of the data skipped, in relation to frame size.
Beep Sound	If desired, check a box so a "beep" will sound when the Trigger is Ready , or when the system has Triggered . If rapid triggering/acquiring data events are taking place in succession, then the beep sound may become erratic.



Select **Free Run** from the Analyzer Tab's Trigger Panel if you want to measure data in a *continuous or Scope mode manner* [from an active system].

To capture **transient data**, go to the Configuration dialog found under the Edit menu and on the Analyzer tab select **Input Channel** and specify the applicable channel and conditions.



Trigger-related items [in the *Analyzer Tab* or *Recording Setup Tab*] being locked-out indicates that the current mode is for *playback operation*. If so, perform the following:

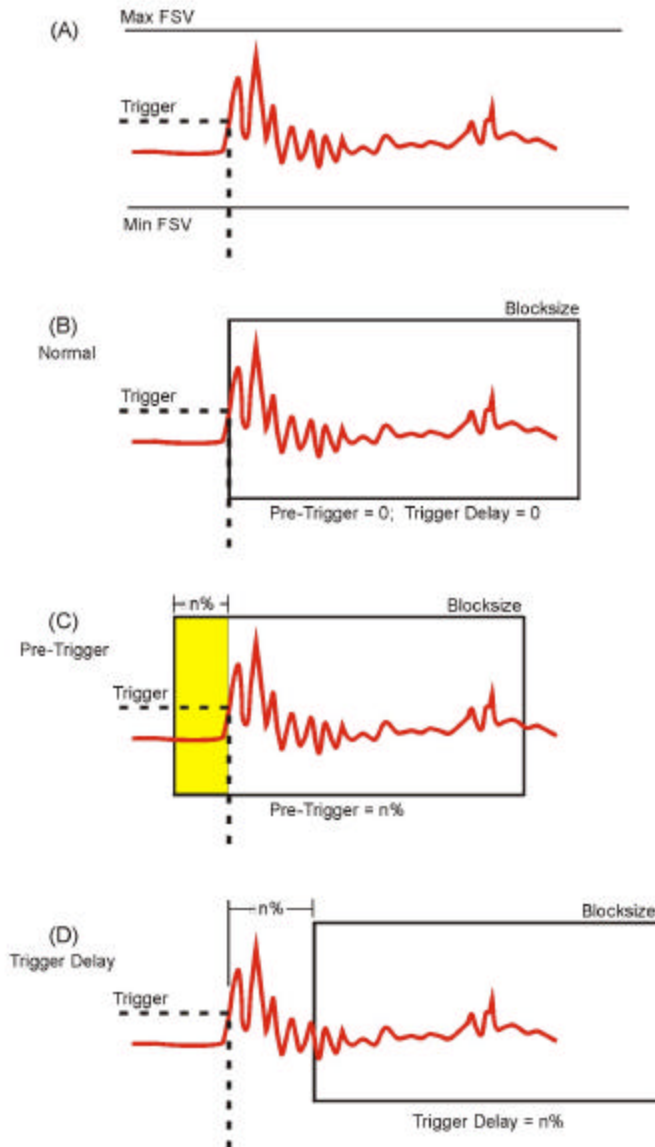
- (1) close the Configuration Window
- (2) select "Measurement Mode" from the Task pull-down menu
- (3) open the Configuration window

Capturing Transient Data

Setting *eZ-Analyst* to trigger on an Input Channel captures transient data when the associated parameters are correctly specified. The following sections discuss the associated parameter and how they apply to a signal such as an impact hammer striking an object. The signal shown is from an accelerometer located in the hammer's head.

Set Trigger level:

The first and most important parameter is the trigger level. This parameter specifies the level in which the signal must pass through in order for an acquisition process to begin. An ideal level will assure that the signal is well above any noise or erroneous movement that will cause a trigger. An ideal level will also assure that the level is not above the maximum output of the signal source. Violating these ideal conditions can result in either a premature trigger or no triggering at all. For example, if a signal has a noise floor of 0.5 volts and the trigger level is set to 0.2 volts the acquisition will always trigger for obvious reasons. Conversely, if the maximum signal output is 5.0 volts and the trigger is set to 5.5 volts the acquisition will never trigger.



Shifting a Waveform with Pre-Trigger and Trigger Delay

Note: For **ZonicBook** applications, the trigger level is specified in **percentage** of full-scale voltage (FSV). For **WaveBook** applications, the trigger level is an **absolute signal level** that must be within the physical input range (also FSV).

(A) Setting Signal Position

Once an acceptable trigger level has been ascertained, positioning the signal within a block of sampled data (and in the display window) is the next consideration. Often it is necessary to capture the events that lead up to the trigger point. If this is the situation then positioning should be set for Pre-trigger capturing. On the other hand, if the signal of interest occurs after the trigger point, then positioning should be set for Trigger-Delay capturing.

(B) Normal Trigger

Normal Triggering is obtained by specifying zero for the Pre-Trigger and zero for the Trigger Delay; where the trigger point occurs at the first sample point as pictured in the figure to the left.

(C) Pre-Triggering

To capture information before the trigger point, select Pre-Trigger and specify a percentage of the blocksize (see note). For example, if the blocksize was set at 1024 samples, then setting the Pre-Trigger to 10% would result in capturing 102 sample points that exist prior to the trigger point. This has the effect of shifting the waveform to the right as pictured in the figure.

(D) Trigger Delay

Trigger Delay is the opposite of Pre-Trigger. The Delay causes *eZ-Analyst* to wait "n%" samples before it begins filling a block of data. This has the effect of shifting the signal to the left.



Reference Notes:

The following sections of this document contain information that closely relates to the subject of Capturing Transient Data. Reading over the following material should improve your understanding of the important concepts involved.

- *Capturing Transient Data*, page 2-17.
- *Block Rejection Tab*, page 2-30.
- *Considerations Regarding Double Hammer Rejection*, page 2-31.
- *Recording Setup*, page 2-25.

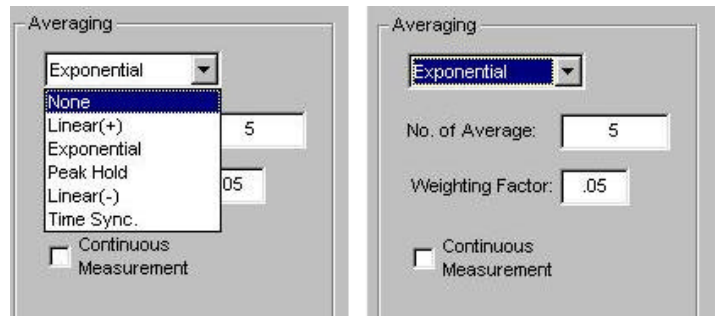
Edit Menu > Configuration > Analyzer Tab: Averaging Panel

The Averaging Panel is used to select the *type of averaging* that will be calculated during data acquisition.



- To apply averaging to time-demand data, the Function View Window must be changed to a Windowed “Time Function,” otherwise all averaging will be applied to a spectral date.
- Averaging can be used to decrease the noise in a measurement.

In the figure to the right, the first scenario shows the pull-down menu expanded, revealing the types of averaging that can be selected. The second scenario shows that “Exponential” has been selected. Exponential makes use of a Weighting Factor, which is not used by the other averaging types.



Averaging Panel of Analyzer Tab (2 Scenarios)

A brief description of averaging types and other panel terms now follows.

Linear (+): All blocks of data are treated equally in terms of their effect on the averaged result.

Exponential: Similar to linear averaging, Exponential requires a weighting factor that either increases or decreases the effect of each new data block on the resultant average.

Weighting Factor: The Weighting Factor either increases or decreases the effect of each new data block on the resultant average when Exponential Averaging is used.

$$\text{New Average} = ((\text{New Data}) * \text{A.W.F.}) + (\text{Old Average} * (1-\text{A.W.F.}))$$

Peak Hold The resultant block of data is a collection of points that represent the peak amplitude for each point in the block. With each new block of data, the current data is compared with the new data on a point by point basis. The highest amplitude for each point in the block is retained.

Linear (-): Also known as Negative Averaging; Linear (-) Averaging is a technique used to identify the natural frequencies of in-service machines that cannot be shut down for analysis. Linear (-) Averaging is a two step process. First, a reference average is acquired. Second, a normal linear average is acquired for each frame. The running average is subtracted from the reference average and the result is displayed. The first time you attempt to start data acquisition after you select Linear (-) averaging, the Negative Averaging Setup/ Measurement window opens.

Time Sync: Time synchronous averaging uses a keyway, or a similar point of reference, as a trigger. The blocksize is set to allow enough time for at least one full revolution. This must be performed in Scope Mode. Channel trigger mode should be used in conjunction with this selection.

Number of Averages: This number specifies the condition for terminating a data acquisition sample. After the number of averages (blocks/frames of data) have been captured and averaged, the *eZ-Analyst* will automatically stop taking new data. This sample can then be saved. If the number of averages is set to zero, acquisition is continuous and must be halted by the user.

Continuous Measurement: Checking this option restarts the *averaging process* without user intervention. Note that the data itself is not continuous between measurements. This option is not meaningful for *non-averaging* operations. The section entitled *Measurement Panel*, on page 2-49, contains additional information.



Reference Notes:

The following sections of this document contain information that closely relates to the subject of Averaging. Reading over the following material should improve your understanding of the important concepts involved.

- *Capturing Transient Data*, page 2-17.
- *Block Rejection Tab*, page 2-30.
- *Considerations Regarding Double Hammer Rejection*, page 2-31.
- *Recording Setup*, page 2-25.

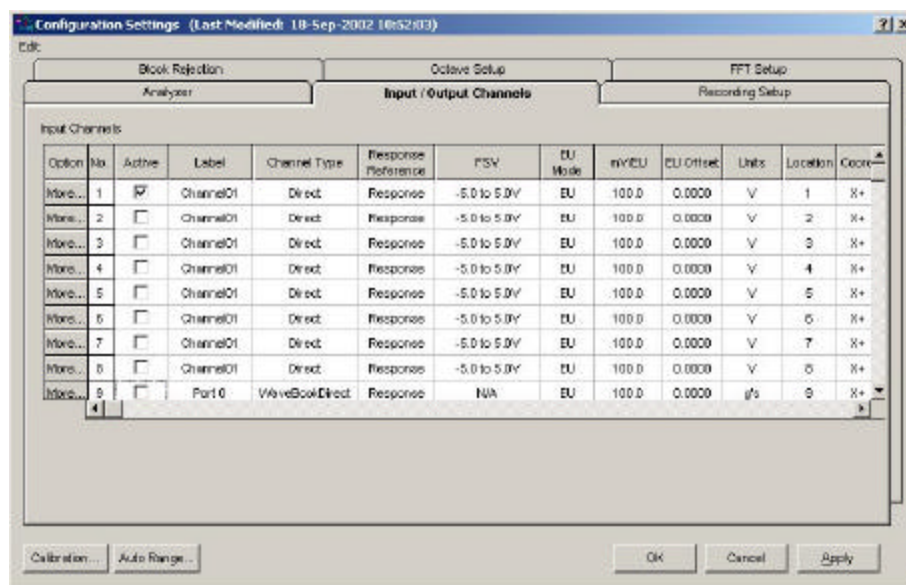


The Input/Output Channels panel displays the current setup conditions of the input channels on a channel-by-channel basis. Changes are accepted as soon as they are *applied* or *okayed*. In addition, the Input/Output Channels Tab provides a means of configuring outputs for ZonicBook and WaveBook applications.

The “Output” aspect of the tab only applies to eZ-Analyst.



When using WaveBook hardware, *eZ-Analyst* supports up to 64 channels of input. If your WaveBook’s hardware configuration has more than 64 channels, *eZ-Analyst* will display an error message, then go into the Playback mode. If you wish to run in the Measurement mode you will have to reduce the channel count by removing expansion modules. **To remove the extra expansion modules you must physically disconnect them from the WaveBook.**



Input / Output Channels Tab Selected – WaveBook Application*

*Note: For a screen image of ZonicBook’s Input/Output Channels Tab, see page 2-23.

- No.:** This column lists all available channels.
- Active :** Initially all input channels are active. Set unused channels to OFF by removing the check from the “Active” column’s checkbox.
- Label:** This should be a meaningful name that you assign to the signal received on a channel. The channel number is automatically assigned. Highlight a cell before typing a label. When you press the Enter key, the value is accepted.
- Channel Type (WaveBook Only)** This column applies to WaveBook systems. It does not apply to ZonicBook applications. The column consists of a fixed label, which indicates each channel’s parent hardware. Main unit channels, i.e., those that connect directly to a WaveBook [as opposed to an expansion module] are denoted by the label, “Direct”. Channel Type can not be edited.
- Response Reference** There are two types of channels, **Response** and **Reference**. All channels are initialized as Response channels. If you are using a force channel, then (1) highlight that channel’s Response/Reference cell, and (2) select Reference on the resulting popup menu.
- FSV:** Full-Scale Voltage. The cells in this column are used to set the FSV value in Volts.
- EU Mode:** E(ngineering) U(nits): Select EU or Volt.



Reference Note: Gain and offset adjustments are made from the *Calibration display screen*, see page 2-7. The following parameters apply:

- **mV/EU** to set the scaling factor of millivolts to Engineering Units.
- **EU Offset** to set the offset factor that is to be applied to the Engineering Units.
- **dB EU Ref** is applied to displayed data when the Y-axis scale is set to dB. This is valid only for frequency domain data.

Units: Enter the measurement units you will be using.

Location: This is a simple numbering system. The channel number is the default value for location. However, you can highlight a cell and type a different location number. When you press the Enter key, the value is accepted.

Coord: This is the axial direction of the transducer connected to the channel. Make your selection on the popup menu that appears after clicking in the applicable cell.

Input Type: This is the type of instrument attached to the channel. Menu selections include: Acceleration, Velocity, Displacement, Force, Pressure, Stress, Strain, General, and Tach (Tachometer).

Note: *Tachometer properties* are set in the FFT Setup tab. Refer to that section for additional information.

Location	Coord	Input Type
1	X+	Tach
2	X+	Velocity
3	X+	Displacement
4	X+	Force
5	X+	Pressure
6	X+	Stress
7	X+	Strain
		General
		Tach
		Acceleration

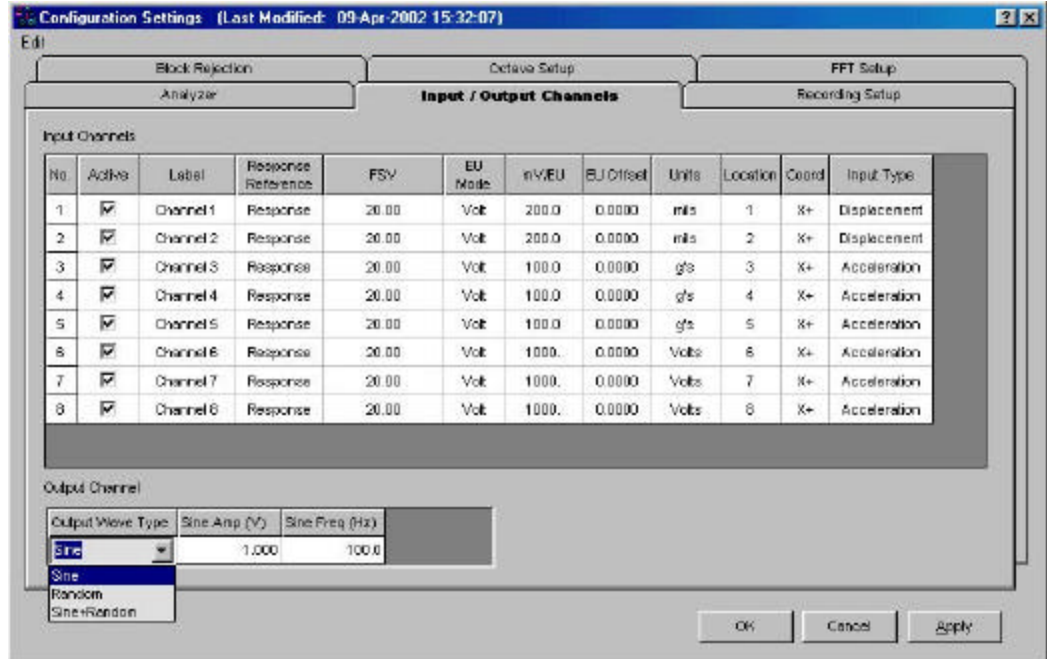
Selecting the Input Type

ZonicBook Applications



Reference Note: This section only pertains to ZonicBook applications.
For WaveBook applications refer to page 2-24.

In regard to ZonicBook, the Internal Signal Generator is set up in the Output Channel panel. The output waveform (**Sine**, **Random**, or **Sine+Random**) is selected from the pull-down menu (see figure).



Input / Output Channels Tab – ZonicBook Applications

Output Wave Type	Text Box Entries (see figure)
Sine Waveform	<p>Amplitude: The maximum amplitude range is 1.4 volts zero-to-peak. The value is typed in the text-box. The units are volts.</p> <p>Frequency: This is the frequency, in Hz, of a sine waveform. The maximum value is 2000 Hz. The value is typed in the text-box.</p>
Random Waveform	<p>Amplitude: This is the amplitude variance for the Random output signal. The maximum value is 1.4 volts zero-to-peak. . The value is typed in the text-box. The units are volts.</p>
Sine + Random	Displays text box areas for the Sine Waveform and Random Waveform signal types just described.

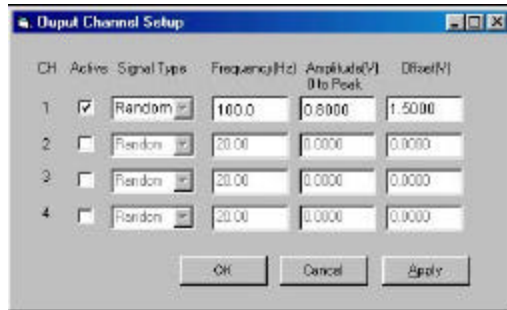


The signal output option is only valid when the analysis frequency is less than, or equal to, 4000Hz. Thus, whenever analysis frequency is set above 4000Hz, the signal generator button is disabled.

WaveBook Applications

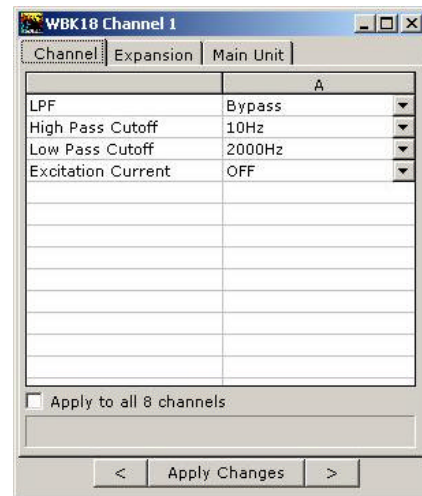
In regard to WaveBook applications, Analog Output is only supported when *eZ-Analyst* detects a WBK14 expansion unit, and only one output is available from each WBK14. The Excitation Source can be for either Random or Sine wave output. Instead of an Output Channel Tab, as seen in the previous figure, *eZ-Analyst* brings up an Output Channel Setup box similar to that shown in the following leftmost figure.

Note that setting up WBK module channels will appear different, depending on the module. An example for WBK18 appears, lower right.



Output Channel Setup

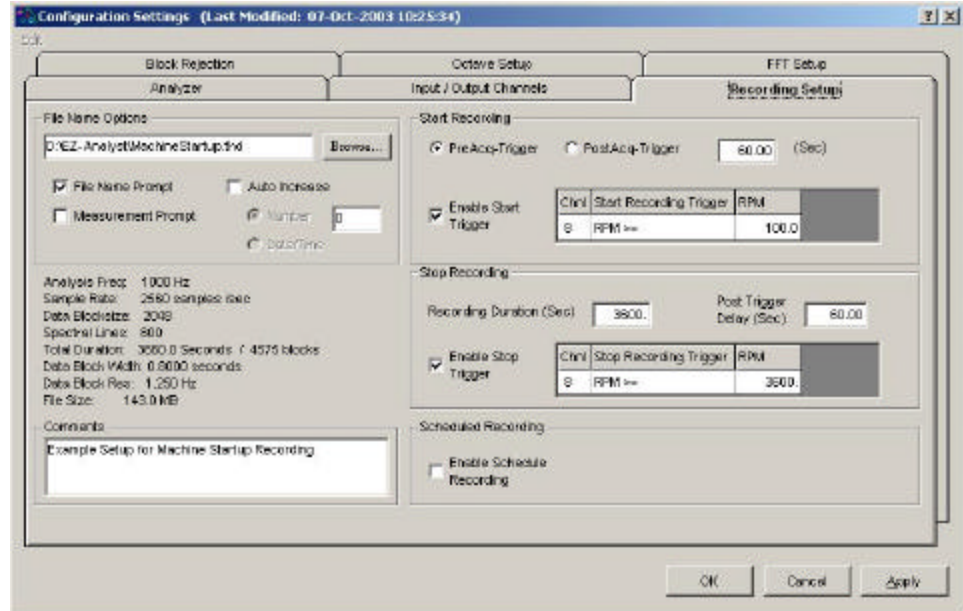
Channel 1 selected as an active output channel.



Setting Parameters for Channel 1 of a WBK18 Module

WaveBook applications Only. The figure does not apply to ZonicBook applications.

Setup Category	Description (see figures)
CH	Identifies the output channel. These numbers are a fixed part of the screen image and can not be changed by the user.
Active	Place a check in the "Active" box for each applicable output channel. In the above example, only Channel 1 is "Active."
Signal Type Sine	<p>Frequency (Hz): This is the frequency, in Hz, for a Sine waveform. The maximum value is 100000 Hz (100 kHz).</p> <p>Amplitude (V) 0 to Peak: This is the amplitude for the Sine waveform output signal. The maximum value is 5.00 volts zero-to-peak.</p> <p>Offset (V): This is the DC offset voltage that is applied to the output signal. The maximum value is ± 5.0 volts.</p>
Signal Type Random	<p>Frequency (Hz): This is the frequency, in Hz, for a Sine waveform. The maximum value is 100000 Hz (100 kHz).</p> <p>Amplitude (V) 0 to Peak: This is the amplitude for the Random output signal. The maximum value is 0.85 volts zero-to-peak.</p> <p>Offset (V): This is the DC offset voltage that is applied to the output signal. The maximum value is ± 5.0 volts.</p>



Recording Setup Tab

Edit Menu > Configuration > Recording Setup Tab: **Start Recording Panel**

Provide a means of setting the following parameters that pertain directly to the start condition.

Note that the Start Recording panel is not available for WaveBook applications.

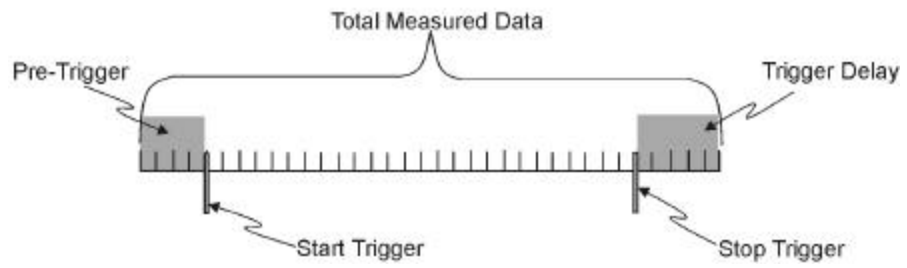
PreAcq-Trigger – select this function to include [with the recording] data that precedes the trigger event by the set number of seconds.

PostAcq-Trigger – select this function to exclude [from the recording] data that follows the trigger event by the set number of seconds.

Note: You can not set a Start Delay for the start recording if PreAcq-Trigger is selected, and visa versa.

Enable Start Trigger – if the checkbox is checked, *amplitude-based data* can be set as a PreAcq-Trigger condition to Start Recording. The following options are provided.

Amplitude-Based Data Types	Peak Time >=	Spectrum >=
	Peak Time <	Spectrum <
		at specified frequency



Understanding Total Measured Data

In this figure, the Start Recording panel's PreAcq-Trigger data and the Stop Recording Panel's Trigger Delay data are both saved as part of the total measured data.

Edit Menu > Configuration > Recording Setup Tab: Stop Recording Panel

Provide a means of setting the following parameters that pertain directly to stop recording:

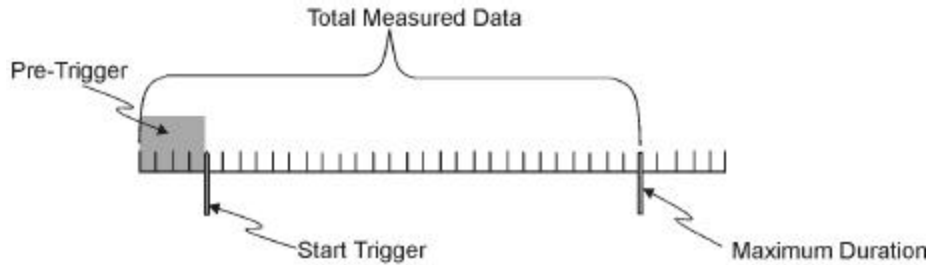
Recording Duration sets a “time-out” which the recording event is not to exceed. If an acquisition has been triggered, the measurement will run until either (a) the amplitude-based Enable Stop Trigger Condition is met, or (b) the Recording Duration is met, whichever occurs first. When the Recording Duration value is met, the recording event is aborted.

Note: Entering a value of “0” in the Recording Duration block sets the duration to infinity.

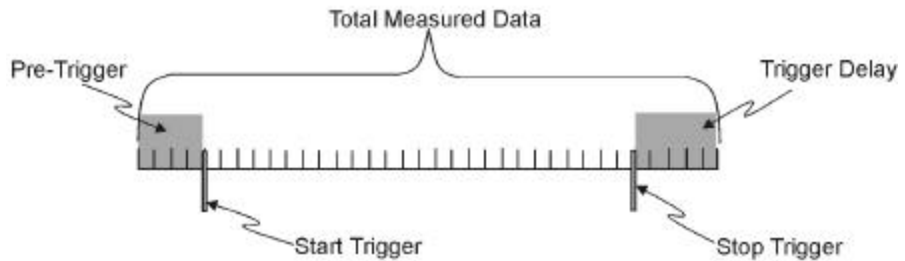
Enable Stop Trigger – if the checkbox is checked, *amplitude-based data* can be set as a **stop condition** for the recording. The following options are provided.

Amplitude-Based Data Types	Peak Time >=	Spectrum >=
	Peak Time <	Spectrum <
		at specified frequency

Delay (sec) – this function is used to include [with the recording] data that follows the stop trigger event by the set number of seconds, as specified by the delay.



Maximum Duration Limit Terminating a Measurement

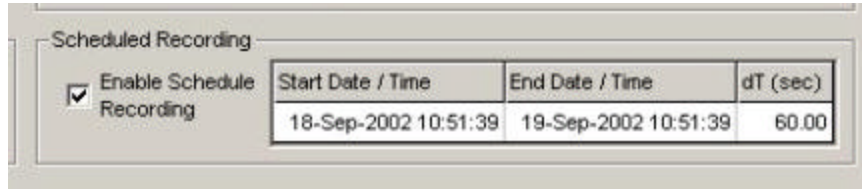


Understanding Total Measured Data

In this figure, the Start Recording’s PreAcq-Trigger data and the Stop Recording’s Delay data are both saved as part of the total measured data.

Edit Menu > Configuration > Recording Setup Tab: **Scheduled Recording Panel**

The Scheduled Recording panel includes a checkbox to enable the “scheduled recording” function. It also includes three text fields (see following figure). The panel provides a means of setting time conditions for starting and stopping a recording. dT is the delay time in seconds.

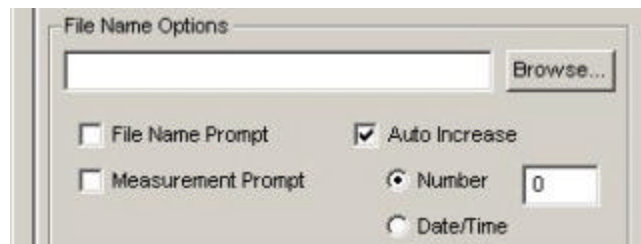


Scheduled Recording Panel



- When using Scheduled Recording, you need to set up the recording options for automatic .thd file creation. This is done in the Recording Setup Tab’s “File Name Options” panel, discussed below.
- When using WaveBook hardware, features of the Start Recording panel are not available.

Edit Menu > Configuration > Recording Setup Tab: **File Name Options**

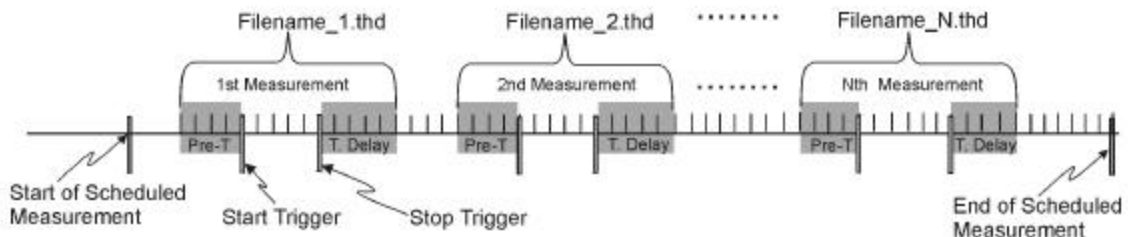


File Name Options Panel

When using the Scheduled Recording feature the following steps should be taken to ensure that each file will be automatically named by the program.

From the File Name Options panel, at the upper left of the Recording Setup Tab, verify that the following is true. Make changes if needed.

- **File Name Prompt** – Not Checked
- **Measurement Prompt** – Not Checked
- **Auto Increase** – Checked
- **Date/Time** – Select the “Date/Time” radio-button if you want the Filenames to automatically increase by a Date/Time convention, otherwise select “Number.”
- **Number** – Select the “Number” radio-button if you want the Filenames to automatically increase by a numerical sequence (1, 2, 3, ...N) convention, otherwise select “Date/Time.”



An Example of Filename Auto-Incrementing by Number

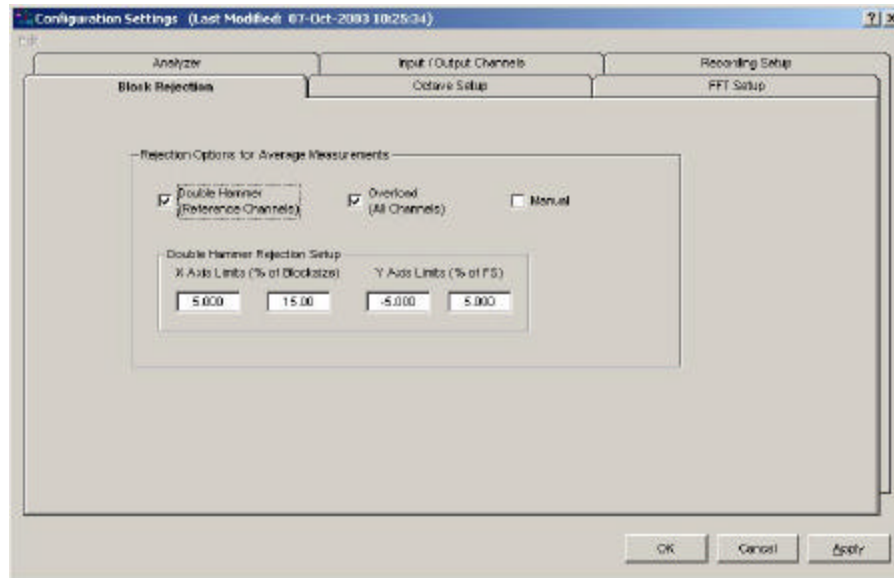
Edit Menu > Configuration > Recording Setup Tab: Comments Panel

The comments panel can be used to enter a variety of information regarding the recording. For example, you may want to include the environmental conditions that existed at the time of the recording, the phase of the project, or a problem that is being investigated. Note that the comments are saved as part of the data file.

The Block Rejection Tab exists to allow the software (or user) to reject blocks of data that result from hammer double strikes, overloads, or simply because the data block “doesn’t look right.”

There are three block rejection modes: **Double Hammer** protects measurements against double hammering, **Overload** protects the measurement by automatically rejecting overloaded data, and **Manual** allows you to inspect a measurement and optionally reject it. You can select any or all of the rejection modes. Also see: *Considerations Regarding Double Hammer Rejection*, page 2-31.

Note: The Block Rejection panel is only active when “Measurement Mode” is selected from the Task menu.



Block Rejection Tab

Block rejection looks at the acceptable parameters for a block, and rejects blocks that do not meet those parameters.

- Double Hammer:** A double hammer occurs when a signal goes outside of the acceptable range that is set up in the Hammer Rejection section. Click in the Double Hammer box to turn the Double Hammer option ON and OFF. When the box is checked, the option is ON.
- Overload:** An overload is any input signal that reaches or exceeds the specified input Full Scale range. Click in the Overload box to turn the Overload Rejection option ON and OFF. When the box is checked, the option is ON.
- Manual:** This option allows you to review each block of data before acquiring the next block. When manual rejection is selected, a <Reject?> button is activated in the main window. At the end of each average, if you want to reject that measurement, click on the <Reject?> button. *eZ-Analyst* will then reject the current frame of data. The data and average counter will go back to the previous measurement. Click in the Manual box to turn the Manual option ON or OFF. When the box is checked, the option is ON.



Block Rejection is used in conjunction with *Capturing Transient Data (Input Channel triggering)* and *Averaging*. These topics are discussed on pages 2-17 and 2-18, respectively.

Edit Menu > Configuration > Block Rejection Tab: Hammer Rejection Panel

This panel is used to define the acceptable range for a hammer signal. Any signal outside of the defined range is detected as a *double hammer*. The acceptable range will appear as a rectangle whose boundaries are defined by high and low limits for the blocksize, and by high and low limits for scale. Respectively, these are x- and y- axis limits.

X-axis Limits (% of blocksize): Used to set a Low point and a High point along the x-axis, for which the hammer impact must occur to be acceptable. An example setting is 5% to 15% (of blocksize).

Y-axis Limits (% of F(ull) S(cale): Used to set a Low point and a High point along the y-axis, for which the hammer impact must occur to be acceptable. An example is -5.000 to + 5.000 (% of Full Scale).

Considerations Regarding Double Hammer Rejection

There are three major interrelated components to consider when setting up a double-hammer rejection condition. These are:

- **Trigger Mode and Delay**
- **Force Window**
- **Double Hammer Region**

A trigger is used to ensure time synchronous measurements across all the active channels.

As indicated in the *Trigger Panel* section of this document (beginning on page 2-16), a **pre-trigger** indicates that data captured before a trigger event [the amount of which is specified by the delay] will be prefixed to the data following the trigger event. Also, a **trigger delay** [in reference to the Start Trigger Condition] indicates that a specified amount of data after the start trigger [the amount of which is specified by the delay] will be skipped (ignored) before a block of data is captured.

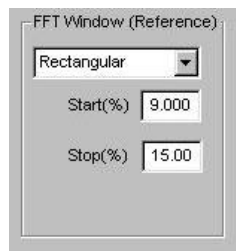
Double hammer reject is only meaningful with the pre-trigger specified. Double hammer rejection protects the measurement from a bad hammering.

It is desirable to set the pre-trigger to fall within the hammer region, since it is a common practice to set the trigger channel to an impact channel.

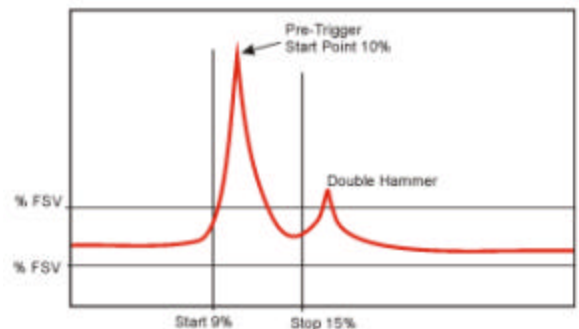
Example

In this example, a test engineer is looking for a trigger event that occurs somewhere after 10% of the data block, but before 15% of the block. Therefore:

- (1) **Pre-Trigger is set for 10% Delay**, using the *Trigger Panel* (on the Analyzer Tab).
- (2) A **Rectangular Force Window** is selected and set for a Start point of 9% and a Stop point of 15%. This is done in the FFT Setup Tab's *FFT Window (Reference) Panel*. Page 2-33 contains additional information.

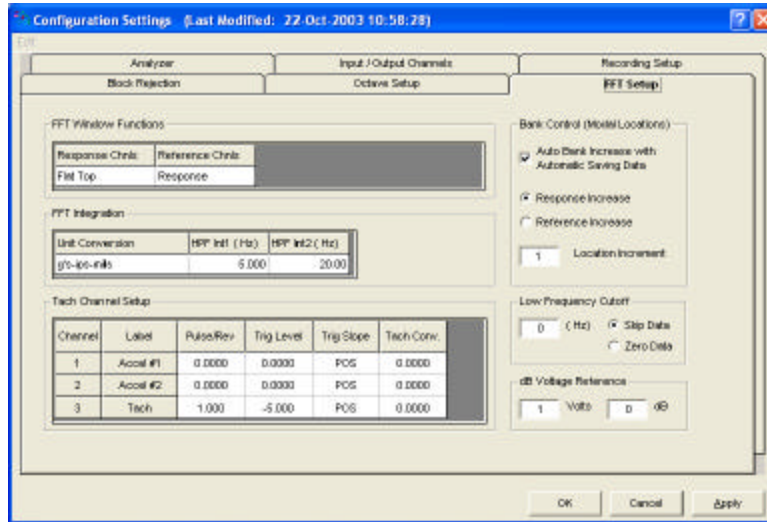


Selecting a Rectangular Force Window and Setting Points for 9% and 15%
Selected and set in the FFT Setup Tab.



A Double Hammer Event

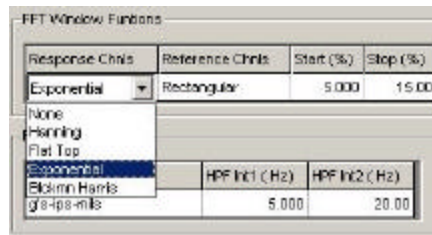
When impact testing we want to make sure that a double hammer does not occur. Through trial and error we may start by setting the Double Hammer range at 12% and 14%, or 11% and 13% of the block. Typically this range is fine tuned using sample acquisitions prior to starting a real test.



FFT Setup Tab

Edit Menu > Configuration > FFT Setup Tab: FFT Window Functions / Response Channels

The FFT (Response) window is a time-domain, weighting window. A response window is usually applied to data to reduce FFT leakage errors. FFT theory assumes that the signal being analyzed is periodic in the data acquisition block. When this is not the case, energy from a signal at a specified frequency can leak into nearby spectral bins causing spectral amplitude inaccuracies. Applying a windowing function controls, but doesn't completely eliminate, the error by multiplying each data frame by a suitable time-domain weighting window. This calculation reduces the amplitude/magnitude of the data near the ends of each data frame prior to performing the FFT and forces the data to be nearly periodic in the window, thus reducing leakage errors. Response window options are as follows:



FFT Window Functions, Response Channels Pull-down List

- None:** No weighting window is applied.
- Hanning:** The Hanning window is typically used to analyze continuous signals. It offers a reasonable trade-off of frequency accuracy versus amplitude accuracy.
- FlatTop:** Compared to the very similar 4-term “Max Flat Top,” this window also has a very low peak amplitude error, and its frequency resolution is somewhat better. Its side lobes are considerably higher. Its effective noise bandwidth is still almost twice that of the Hanning window, therefore this window is used mainly to measure accurate peak amplitudes of discrete spectral components that are known to be separated by several spectral lines.
- Blackman-Harris:** This window function was designed to provide the minimum side lobe level of any three-term window. Compared with the very similar Hanning window, it has a slightly wider main lobe but much better dynamic range. This window has the smallest 60 dB bandwidth of any window listed. The Blackman-Harris window may be preferred over the Hanning for measurements requiring better dynamic range.

Exponential : An exponential weighting window is equal to 1.0 at the beginning of the block and decays exponentially to a smaller value at the end of the block. Exponential is used only with transient data that is captured with pre-trigger to assure that the initial values in all data channels are very close to zero. Exponential can be used with all transient excitation methods in order to force the signals to decay close to zero, (See Response Decay Percent,) even if the block length is not sufficient to capture all of the naturally occurring response. If the data decays naturally to a low amplitude within the block, so that leakage is not significant, exponential windowing can improve the signal-to-noise ratio by giving reduced weight to the very low-amplitude data at the end of the block.

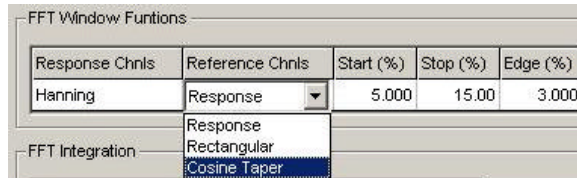
Decay % : Decay Percent is used when an Exponential Window is applied to the Response Channel. It is the weighting factor present at the last block value. For example, a decay of 5% means that the weighting factor at the beginning of block is 100% and that the weighting factor of the last block is 5%. In other words, the weighting factor dropped (decayed) to 5% through the length of block.

Edit Menu > Configuration > FFT Setup Tab: FFT Window Functions / Reference Channels

The FFT Reference Window is applied to the output of a transducer to avoid collecting extraneous signals caused by an excitation device, such as an impulse hammer. Possible selections are: Response, Rectangular, and Cosine Taper.

When **Rectangular** is selected, specify the Start(%) and End(%) of the rectangle as a percentage of the Frame Period.

When **Cosine Taper** is selected, specify the Start(%), End(%), and Edge(%) the Cosine Taper as a percentage of the Frame Period.



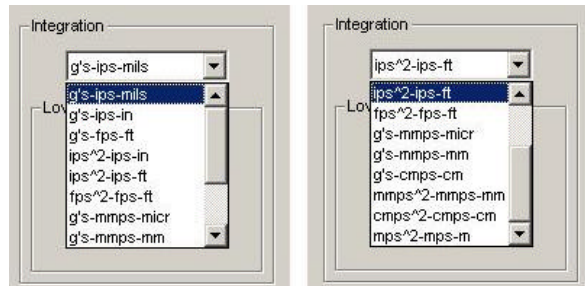
FFT Window Functions, Reference Channels Pull-Down List

Start (%) : The percent of the Frame Period at which the Rectangular and Cosine Taper Windowing functions start.

Stop (%) : The percent of the Frame Period at which the Rectangular and Cosine Tape Windowing functions stop.

Edge (%) : This is the percent of the Frame Period during which the Cosine Taper Windowing function tapers up and down.

Edit Menu > Configuration > FFT Setup Tab: Integration Panel / Unit Conversion



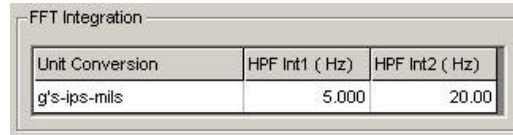
Integration Panel – 2 Views

The left-hand view is with the scrollbar up, the right-hand view is with the scrollbar down.

Integration : Provides the means to select an integration, such as **g's-ips-mils** or **g's-ips-in**. Several other possibilities exist, as can be seen in the above images of the Integration Panel.

Edit Menu > Configuration > FFT Setup Tab: Integration Panel / HPF Int1 and Int2

The High Pass Filter Integration 1 (HPF Int1) and Integration 2 (HPF Int2) are used to remove the low frequency effects of integration. All data points that exist below the specified value are set to zero. When “Hz” is selected for the Acquisition Analysis Frequency via radio button on the Analyzer Tab, “Hz” is seen as the units, when “CPM” is selected for the Acquisition Analysis Frequency via radio button on the Analyzer Tab, “CPM” appears as the HPF units.



Low Frequency Cutoff Panel – 2 Views

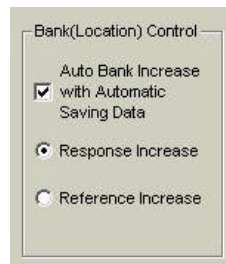
HPF Int1 (Hz): Enter a value for the cutoff amount for the first integration.

HPF Int2 (Hz): Enter a value for the cutoff amount for the second integration.

Edit Menu > Configuration > FFT Setup Tab: Bank (Location) Panel

Bank Location does not apply to eZ-PostView or to eZ-TimeView.

This panel relates to the Modal Locations window, which is accessed from *eZ-Analyst* Window’s pull-down menu. The Bank (Location) Control Panel contains one check box and two radio buttons. Descriptions of each follow.



Bank (Location) Control Panel

Note: This option is only effective when the *averaging mode* is used.

Auto Bank Increase with Automatic Saving Data: A Bank is a set of response channels. You can have *eZ-Analyst* increment the banks automatically after each measurement, or you can manually increment the banks. The number of active channels is used as the skip factor for bank switching.

If the Auto Bank Increase checkbox is checked, then the bank is automatically incremented, but only when the automatic saving data option is selected at Setup Export Function Data menu.

Response Increase: If the *Response Increase* radio-button is selected, the reference channel’s location doesn’t change. The response’s location(s) are increased [or decreased] for next available location numbers.

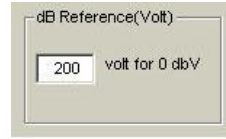
Reference Increase: If the *Reference Increase* radio-button is selected, the response channel’s location doesn’t change. The reference’s location(s) are increased [or decreased] for next available location numbers.

Note: Decreasing location numbers are only available with the manual bank <Down> button on the Modal Locations window. Modal Locations is accessed from *eZ-Analyst* Windows pull-down menu.

Edit Menu > Configuration > FFT Setup Tab: dB Reference (Volt) Panel

dBReference (Volt) does not apply to eZ-PostView or to eZ-TimeView.

dBReference (Volt) is applied to all channels of displayed data when the Y-axis scale is set to dB and EU/Volt mode set to Volt. This is valid only for frequency domain data.



dB Reference (Volt) Panel



Reference Note: The dB EU Reference Volt *column* is located in the Input/Output Channels Tab.

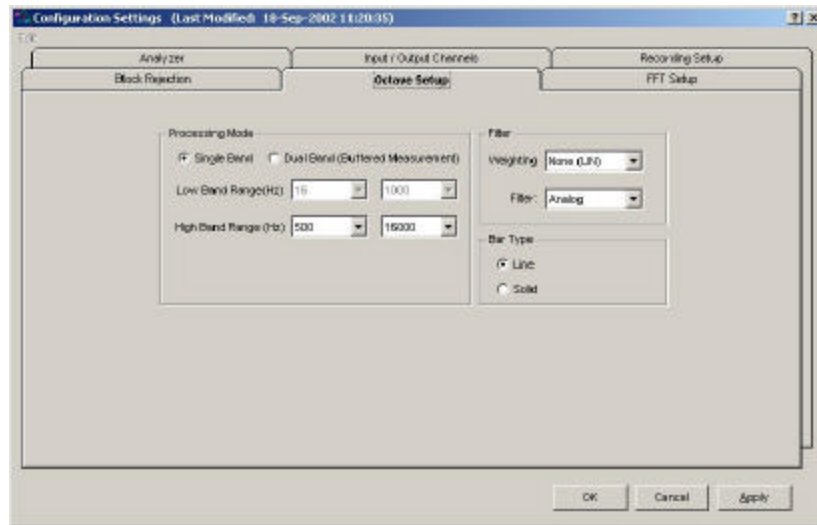
Tach Channel Setup

Tach Channels are selected by changing the **Input Type** to “**Tach**” on the Input/Output Channels tab. Once the Tach Channel type is selected, columns are enabled for Pulses per Revolution, Trigger Level, Trigger Slope, and Conversion. The table below explains each tachometer-related property that is displayed by the Input/Output Channels tab.

Channel	Label	Pulse/Rev	Trig Level	Trig Slope	Tach Conv.
1	Accel #1	0.0000	0.0000	POS	0.0000
2	Accel #2	0.0000	0.0000	POS	0.0000
3	Tach	1.000	-5.000	POS	0.0000

Tachometer Properties	
Tach-Pulse/Rev	Displays the number of pulses per revolution.
Tach-Trigger Level	Specifies the pulse level that the RPM algorithm considers valid.
Tach-Trigger Slope	Specifies whether counting is <i>active on rising</i> signal levels, or <i>active on falling</i> signal levels.
Tach-Conversion	This column is used for entering a <i>tachometer-conversion</i> value for converting RPM into other units. For example, you can enter a value to convert RPM to Miles per Hour, Revolutions Per Second, or HZ. The desired conversion factor is entered as a multiplier. To divide, you would simply enter an appropriate decimal, e.g., to divide by 2 you would enter a value of 0.5.





Octave Setup Tab

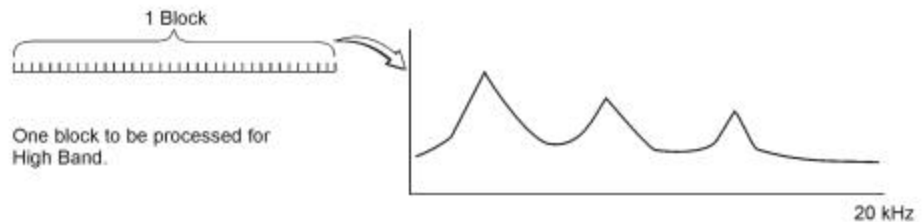
Edit Menu > Configuration > Octave Setup Tab: **Processing Mode Panel**

Single Band:

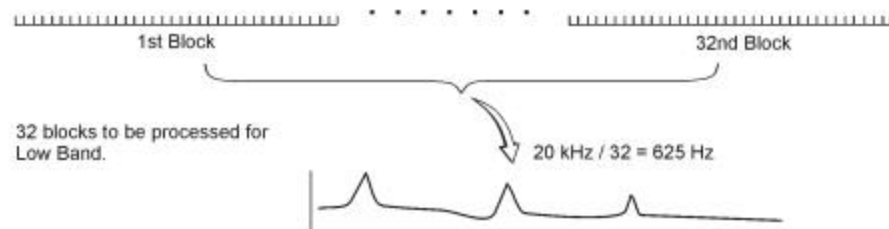
Single Band is the conventional mode, and as the name suggests, is used for single band processing. When Single Band is selected, lower and upper limits can be set for the High Band Range only.

Dual Band (Buffered Measurement):

Dual Band, also referred to as “Buffered Measurement,” provides for octave band processing with a wide band limit for a lower frequency range. This mode uses buffer memory for processing the lower frequency limit. Dual Band uses 32 block sizes; thus making it possible for *eZ-Analyst* to simultaneously process 32 “time segments” of the lower frequency range.

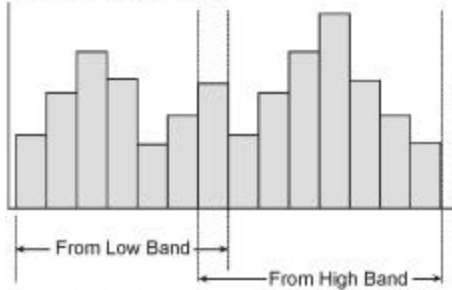


1 Block Processed for High Band



32 Blocks Processed for Low Band

The two spectrums, i.e., Low and High, are combined into an Octave Band Plot.



Note that some bands can overlap because the "Averaged Value" from High and Low Band processed data is used.

Octave Band Plot from Dual Band Processing

Dual Band processing provides the following benefits:

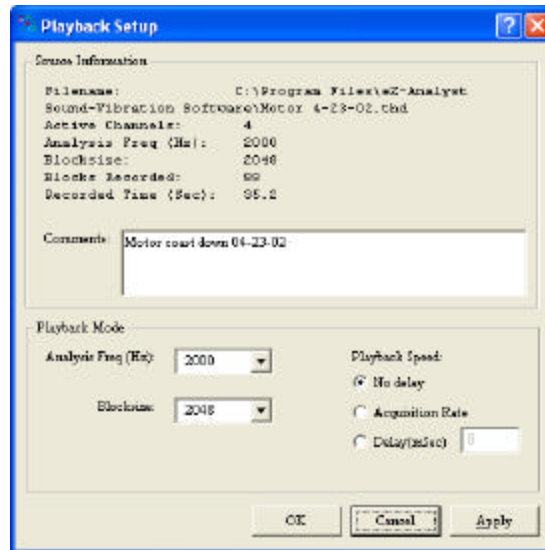
- A wider range of octave band data with no increase in block size.
- A much wider range of data, in comparison to the data from the Single Band mode.
- The use of buffered data means that High Band and Low Band data can be captured simultaneously.
- When compared to Single Band, the Dual Band processing mode produces more stable, precise data, at a lower range of frequency.

Edit Menu > Configuration > Octave Setup Tab: Filter Panel

- Weighting:** Provides the means to select one of four weighting possibilities: None (LIN), A, B, or C
- Filter:** Provides the means to select Analog Filter or Digital Filter.

Edit Menu > Configuration > Octave Setup Tab: Bar Type Panel

- Line:** Selecting "Line" sets the Octave Plot to appear in line format.
- Solid:** Selecting "Solid" sets the Octave Plot to appear filled-in solid, as opposed to a line plot.



Playback Setup Window

Edit Menu > Playback Setup Window: Source Information Panel

Provides general file related information such as filename, file location, the number of active channels, analysis frequency, block size, blocks recorded, and record time. The panel includes a Comments box for user remarks.

Edit Menu > Playback Setup Window: Playback Mode Panel

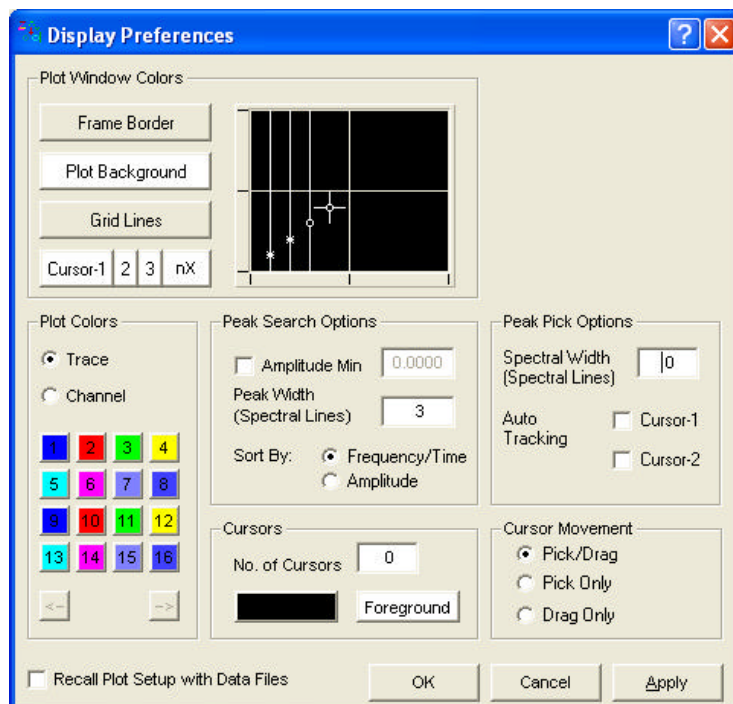
After you open a recorded file to be played back, you have the option to change the following for viewing purposes:

Anal. Freq. (Frequency Range) - selections are from recorded frequency range to 20Hz by dividing by 2. For example: recorded 4000hz and options are 4000, 2000, 1000, 500, 250, 125, 62.5, 31.25.

Blocksize - selections are from recorded blocksize to 16384 by multiplying by 2. For example: recorded 1024 then options are 1024, 2048, 4096, 8192, 16384.

Play Speed – No Delay, Real Speed, or Delay (mSec)





Display Preferences

Plot window defaults are:

Frame Border = Grey
 Plot Background = Black
 Grid Lines = Grey
 Cursor = White

Cursor types include:

Single cursor
 Band cursors
 Peak cursor
 Harmonic cursor

1. To change a Plot Window display color, click on the button that applies to the display characteristic, for example, <Plot Background>. A Color Palette will open.
2. Select a color by clicking on a color square, or by defining a Custom Color.
3. Click <OK>.
4. Repeat the steps 1 through 3 for each Plot Window color that you want to change.
5. When finished, click <OK> in Colors [Color Palette] window.

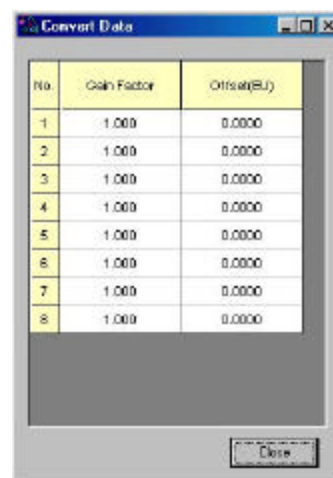
Plot Colors:	Defines colors for traces or for channels, depending on which radio button is selected. Click on a channel's color chip to open a color palette. Pick a new color, then click <OK>.
Foreground:	Defines colors for <i>on-plot</i> text, such as cursor values.
Monitor Window:	Sets how the monitor window displays information.
Cursor Movement Control:	<p>Sets the cursor's action. Options are: <i>Pick/Drag</i>, <i>Pick Only</i>, and <i>Drag Only</i>.</p> <p>Pick/Drag: Makes use of both the Pick Mode and the Drag Mode.</p> <p>Pick Only: Clicking the left mouse button allows the cursor to move instantaneously with the band cursor. The chosen cursor moves to the location when the mouse is clicked.</p> <p>Drag Only: Move the mouse pointer to the cursor location. The pointer will change to a "Left and Right Arrow." Click and drag the cursor to the designated location.</p>
Peak Search Options:	<p>Peak averages are evaluated by first finding a peak and then averaging the specified number of spectral lines on either side of the peak. This section of the window is used to set the preferences regarding peak search. Options are as follows:</p> <p>Minimum: Used to set the Minimum threshold value for peak searching, i.e., the lowest value of data to be considered for the search. "Minimum is typically set above the extraneous noise level.</p> <p>Band (+ - Bin): Sets the <i>eZ-Analyst</i> to search data, according to a cursor-selected range (band). The band takes into account the Minimum threshold value for peak searching, if defined. The default setting for Band (+ - Bin) is 3. This number specifies the number of data bins used for peak searching. For example, "3" indicates that the peak value will be searched at the current cursor position and the ± 3 adjacent positions.</p> <p>Sort By: Specifies the order of the data in the peak search table. Sorting will be done by <i>Frequency/Time</i>, or by <i>Amplitude</i>.</p> <p>Peak Pick: This mode sets the system to search for a peak within the pre-defined band (data range) only when the cursor is moved, or clicked. This is a manual method, when compared with Auto-Tracking.</p> <p>Band (+ - Bin):</p> <p>Auto Tracking Selects Cursor-1 and/or Cursor-2 to automatically search for peaks. The feature makes use of range definitions for "+" and "-" Bin numbers, for example: ± 5 indicates that the peak value will be searched at the current cursor position and the ± 5 adjacent positions. The cursor automatically moves to the peak position within the specified range.</p>

Export Menu > Export **ZonicBook Only**

This menu item is for exporting Recorded Files.



Export Window



Convert Data Window

Accessed via the Export Window's <Convert> button.

Export Menu > Export > Destination Information Panel

1. Select the type of file you want. There are two choices of file format:
 - THD (Time History Data), which is Binary
 - Text (ASCII)
2. In the Filename data entry box, type the directory path and file name for the recorded file, or use the <Browse> button to locate the desired file. The correct file extension will be appended to the file name when the <OK> button is clicked.
3. If desired, enter remarks in the Comments data entry box.
4. Specify the channels of interest. Click to place a checkmark in the channel box for each of the channels you want to export. The selected channels will be adjusted to continuous channels starting with channel 1, but all the properties [including labels] will retain the old definition. For example, selected channels 1,3,5,6,8,16 will be adjusted to channels 1,2,3,4,5,6 in the exported file.
5. Specify the First (Starting) and Last (Ending) records (blocks) that you want saved. In the first figure above, "1" is specified for the Starting Block and "12" is specified for the Ending Block.
6. Click the <OK> button.

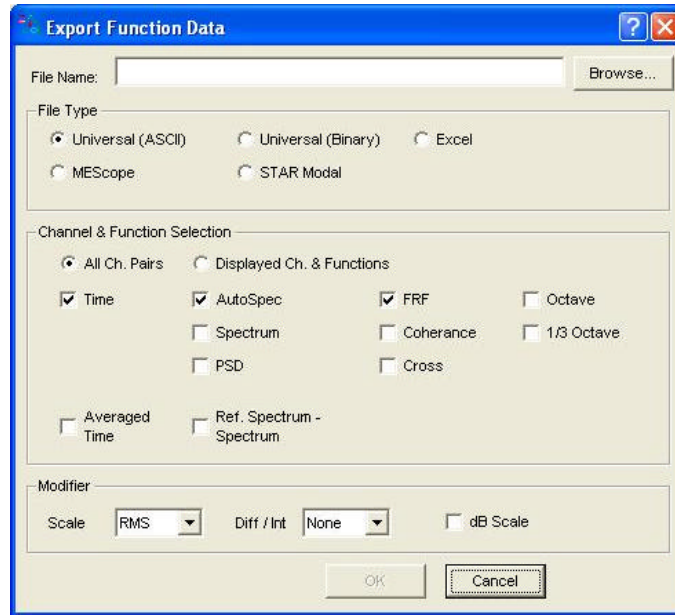
Export Menu > Export > Convert

The upper left corner of the Export window includes a <Convert> button. **Note that the outline of the button appears only when the mouse cursor passes over it.**

Click on the <Convert> button to bring up a second window (see upper right-hand figure). From this window you can adjust the channel data value prior to exporting it. Data adjustments can be accomplished by setting channel offset and/or gain.

Export Menu > Export > Setup Export Function Data*

This menu item is for exporting function files.



Export Function Data

***View-Program Users:** The Export Function Data Screen has a slightly different appearance in eZ-TimeView and eZ-FrequencyView. The export function does not apply to eZ-PostView.

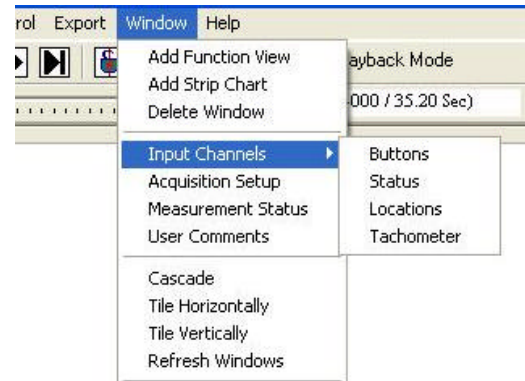
1. Type the directory path and file name for the function file, or use the <Browse> button to locate the desired file.
2. Select the type of file you want.
3. If you want to have records automatically appended to the specified file, select *Automatic Save after Averaging*.
4. Specify either **All Ch. Pairs**, or **Displayed Ch. & Functions**.
 - **All Ch. Pairs** - exports all the data for all the channels pairs so that all functions can be retrieved if desired.
 - **Displayed Ch. & Functions** - exports only the data for the displayed functions.
5. Click to place a checkmark by each of the functions to be saved. See the following note.
6. Click <OK>.

Note: Selected functions can not be saved without the display of a *warning prompt*. This is in case the selection is not valid. For example: if the functions FRF, Cross, and Coherence were selected, but no reference channels were selected, then the three functions could not be saved. This is because these three functions require a reference channel.

Window Menu

Menu Items

- Add Function View (FV) 2-45
- Add Strip Chart 2-45
- Delete Window 2-46
- Input Channels 2-46
 - Buttons 2-47
 - Status 2-46
 - Locations 2-49
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- Acquisition Setup 48
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- Tile Horizontally 2-51
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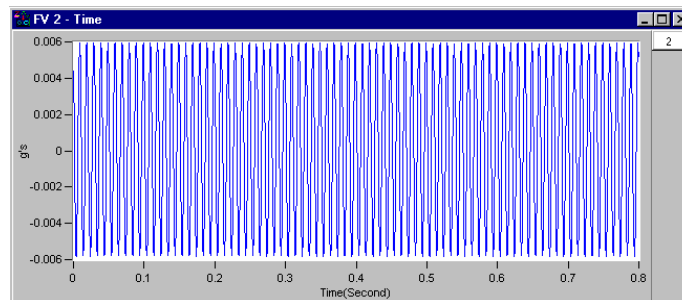


Reference Note :

For information regarding the interactive features of Plot Display Windows, including the Graphic Toolbar buttons, refer to chapter 3. The interactive features are not selected from the Window Menu, but are accessed via toolbar buttons, the mouse and/or hotkeys. Appendix A provides tables of the various hotkey functions.

Window Menu > Add Function View (FV)

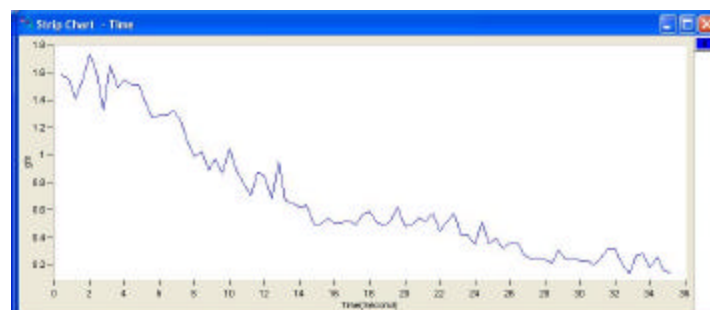
This menu selection opens an additional plot window.



Example of an Added Function View

Window Menu > Add Strip Chart

This menu selection opens a strip chart plot window. This feature does not apply to *eZ-PostView*.



Example of an Added Strip Chart

Window Menu > Delete Window

Deletes the window that is currently in focus. When multiple plot windows are open, one is always the “focus window. When a window does not have focus, its title bar is dimmed. To change the “focus window,” simply click on top or side border of the window of interest.

Window Menu > Input Channels

The Input Channels window is selected from the *eZ-Analyst Windows* pull-down menu. This Window only applies to *eZ-Analyst*.

Buttons

When selected, “Buttons” removes the channel button boxes from the toolbar and displays them in a floating window. The buttons are used in the exact same manner as when they were located on *eZ-Analyst*’s main window. Removing the checkmark from “Buttons” places the channel buttons back onto the toolbar. Note that the <Input Channel Buttons> button [located on the toolbar, just to the left of where the channel buttons reside] provides the same functionality. See chapter three for location.

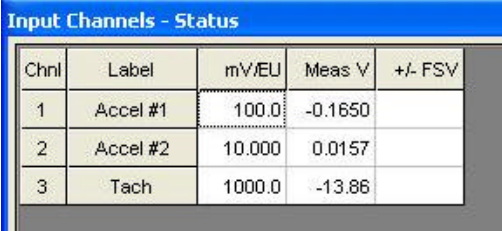
- **To add a channel:** use the mouse to click and drag a channel box from the complete channel button display into the plot area.
- **To remove a channel:** use the mouse to click and drag a channel box (from the right-side of the plot) into the plot area.

Status

The Status dialog box (following figure) uses a chart to indicate the followings:

- Volts linear
- percent of the Full-Scale Voltage (FSV)

The status box includes “maximum” bars to show the highest level of signal value reached by each channel during the measurement process.



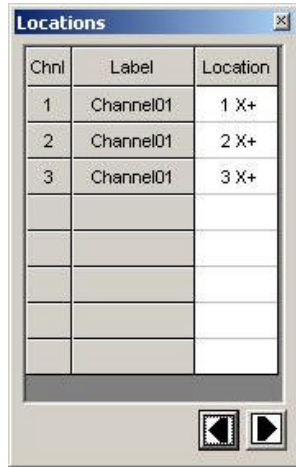
Chnl	Label	mV/EU	Meas V	+/- FSV
1	Accel #1	100.0	-0.1650	
2	Accel #2	10.000	0.0157	
3	Tach	1000.0	-13.86	

Status

- Meas V** Measured Voltage
- +/- FSV** The Full-Scale Voltage
- Delta %** The percentage difference between the measured voltage and the Full-Scale voltage, such that Meas V is n% of FSV; with n being the value of Delta %.

Locations

This window displays the current modal locations. The window only applies to *eZ-Analyst* and to *eZ-FrequencyView*.

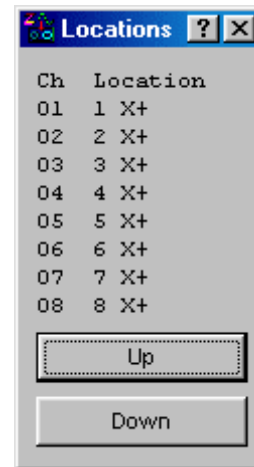


The screenshot shows a window titled "Locations" with a table containing three columns: "Chnl", "Label", and "Location". The data is as follows:

Chnl	Label	Location
1	Channel01	1 X+
2	Channel01	2 X+
3	Channel01	3 X+

At the bottom of the window, there are two arrow buttons: a left-pointing arrow and a right-pointing arrow.

*Modal Locations Window,
As it appears in eZ-Analyst*



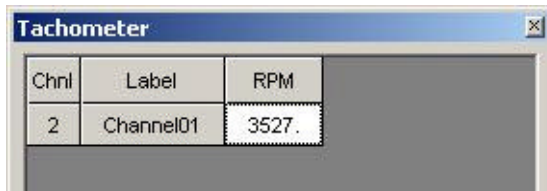
The screenshot shows a window titled "Locations" with a list of channels and their locations. Below the list are two buttons: "Up" and "Down".

Ch	Location
01	1 X+
02	2 X+
03	3 X+
04	4 X+
05	5 X+
06	6 X+
07	7 X+
08	8 X+

*Modal Locations Window,
As it appears in eZ-FrequencyView*

Clicking on the left or right arrow keys [<Up> or <Down> buttons in *eZ-FrequencyView*] increments or decrements the modal locations based on the bank setup criteria set in the Configuration - FFT Setup Tab. The change in locations is dependent upon the active reference and response channels, and whether Response Increase or Reference Increase is selected.

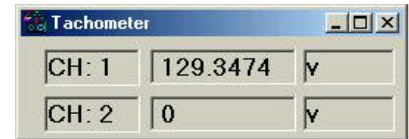
Tachometer



The screenshot shows a window titled "Tachometer" with a table containing three columns: "Chnl", "Label", and "RPM".

Chnl	Label	RPM
2	Channel01	3527.

Tachometer, as seen in eZ-Analyst



The screenshot shows a window titled "Tachometer" with two rows of data, each with three columns: channel label, measurement value, and a checkmark.

CH: 1	129.3474	✓
CH: 2	0	✓

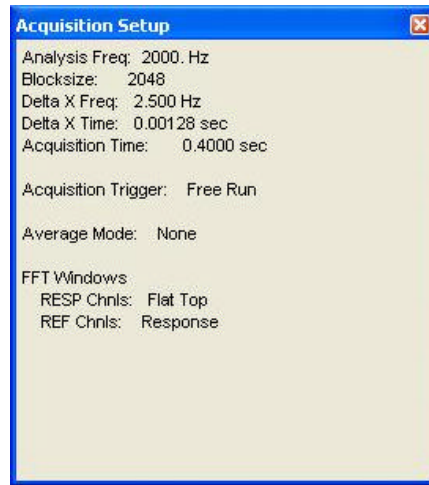
*Tachometer, as seen in eZ-TimeView
and eZ-FrequencyView*

This window displays three fields: tachometer channel number, measurement, and units. Tachometer channels are set up in the *Input Channels Window*. See page 2-35, *Tach Channel Setup*, for additional information. **Tachometer does not apply to *eZ-PostView*.**

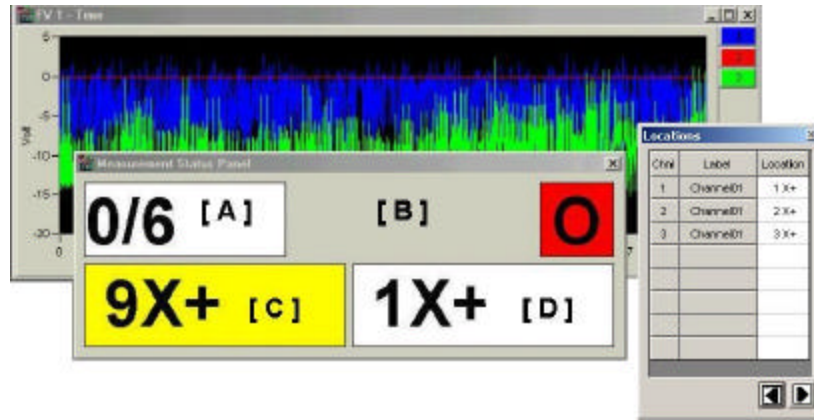
Window Menu > Acquisition Setup

Applies to eZ-Analyst Only

Selecting “Acquisition Setup” brings up a display of setup information pertaining to the acquisition, e.g., Analysis Frequency, Blocksize, Trigger, Mode, etc.



Acquisition Setup



The Measurement Status Panel and Modal Locations Window on Top of a Plot Window

Note: The bracketed letters pertain to definitions provided in the following text.

The Measurement Status Panel only applies to eZ-Analyst. It provides basic, but important information, including trigger and processing conditions, and reference and response coordinates. Status Areas of the panel are as follows:

[A] – Averaging Status. Displays the number of measurements completed followed by the total number of measurements. For example, “1/6” indicates that 1 of 6 measurements has been completed.

[B] – Trigger/Processing Status. Displays the following:

T – Triggered

W – Waiting for Trigger

S – Saved the data

C – Completed measurement

O – Overload rejected

D (with yellow background) – Double Hammer Rejected

[C] – First Response Coordinate. Shows the channel number and the modal location. (Note 1)

[D] – First Reference Coordinate. Shows the channel number and the modal location. (Note 1)

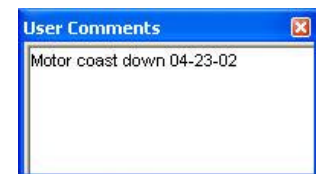
Note 1: A Response or a Reference Coordinate with a yellow background indicates that the field is used for the “increasing” method. For example, the Response Field (figure, item “C”) with a yellow background means that the response increase method is being used. This is discussed in the *FFT Setup Tab* section of the document, beginning on page 2-32.

Note 2: Measurement Status indicators are disabled when recording.

The large size of the status areas allows the user to see the measurement status from a relatively long distance, i.e., as compared to the very limited viewing range offered by standard-sized GUI text display fields. The feature has proven useful in one-man “impact-testing” operations pertaining to modal type measurements.

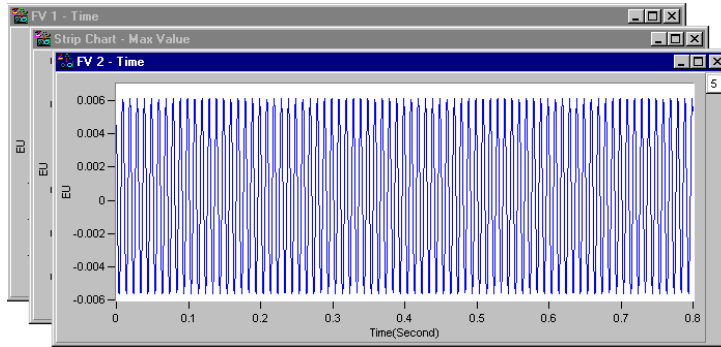
Window Menu > User Comments

Selecting “User Comments” brings up a size-adjustable dialog box, which consists of a text field. User Comments provides the user a means by which he or she may review previous comments and add new ones.



Window Menu > Cascade

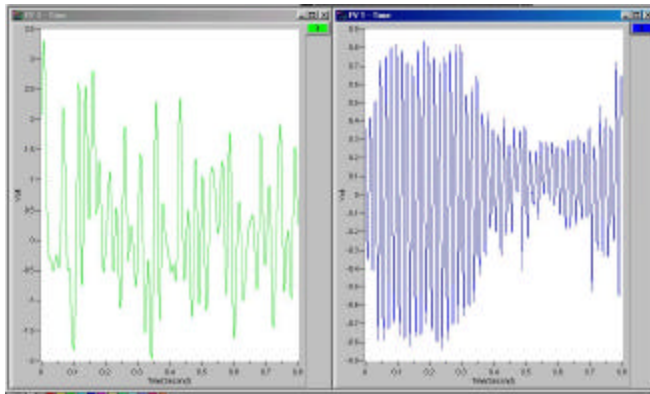
When you have multiple plot windows open, this menu selection arranges them on your screen as shown.



Example of using Cascade with three Plot Windows

Window Menu > Tile Vertically

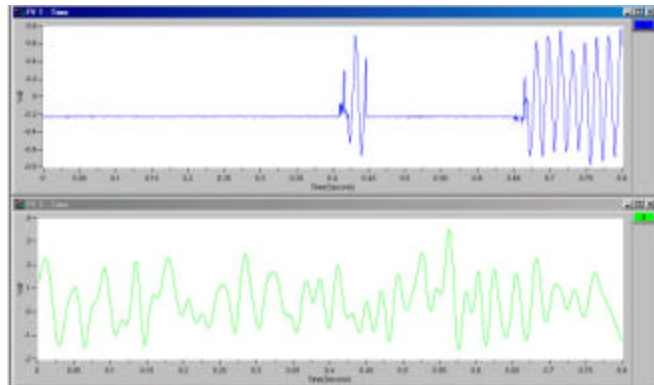
When you have multiple plot windows open, this menu selection arranges them on your screen as shown. The Graph Toolbar, discussed in chapter 3, includes a button to allow for quick vertical tiling. Refer to that chapter for button descriptions and locations.



Example of using Vertical Tile with two Plots
Each plot is longer in the “vertical” direction.

Window Menu > Tile Horizontally

When you have multiple plot windows open; this menu selection arranges them on your screen as shown. The Graph Toolbar, discussed in chapter 3, includes a button to allow for quick horizontal tiling. Refer to that chapter for button descriptions and locations.



Example of using Horizontal Tile with two Plots
Each plot is longer in the “horizontal” direction.

Window Menu > Refresh Windows

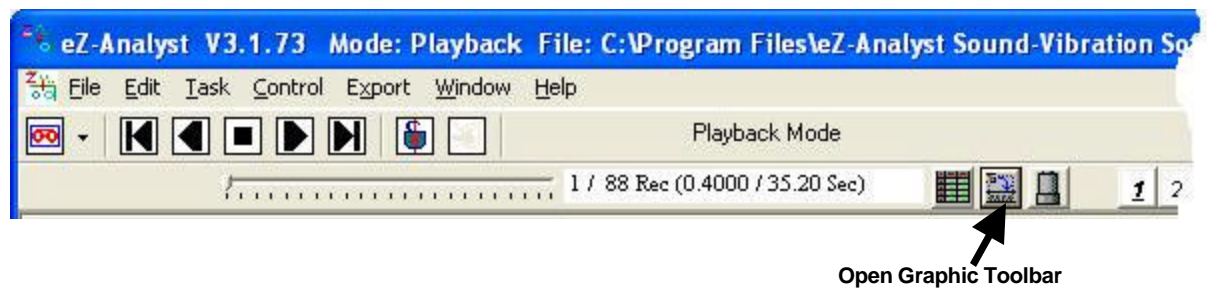
Used to refresh a window; for example, to refresh a Strip Chart. In this case, the refresh function blanks out the present Strip Chart, essentially providing you with a new, clean window.

- Introduction3-1**
- Adding and Removing Channels 3-1**
- Using the Toolbar Buttons 3-2**
- Additional Functionality 3-6**
 - Copy 3-6
 - Strip Charts..... 3-6
 - XLS Overlay 3-7
 - Displaying Channel Pairs 3-8
 - Changing the Display Range 3-8
 - Changing Format, Scale, and Grid 3-10

Introduction

To change a plot’s display characteristics; it must be the “focus plot.” For focused plots you can use toolbar buttons [listed in the following table]; or use the mouse or key commands to make changes to the way in which the data is displayed.

Focus can refer to the window that is in focus, as well as to a plot that is in focus. When multiple plot windows are open, one is always the “**focus window.**” When a window does not have focus, its title bar is dimmed. **To change the “focus window,” simply click on title bar of the window of interest.**



Clicking the “Open Graph Toolbar” button will bring up a buttons toolbar, which provides a means of quickly implementing various plot display functions. An alternative to using the buttons is to “right-click” in a plot display, then use the resulting function menu. When the graphic toolbar is open, clicking the button again will close it.

Adding and Removing Channels

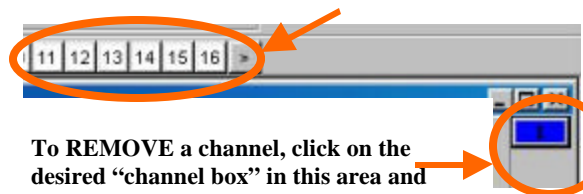
To add a channel to a plot . . .

With your mouse, click and drag a white **channel box** into the plot area.

To remove a channel from a plot . . .

With your mouse, click and drag a **channel box** from the *right of the plot* into the plot area.








To **ADD** a channel, click -on the desired “channel box” and drag it into the plot region.



To **REMOVE** a channel, click on the desired “channel box” in this area and drag it into the plot region.








Using the Toolbar Buttons



Function	Description / Comments
1	Add New FV Window Adds a new Function View.
2	Tile Horizontally Tiles two or more Function Views such that they are longer in the horizontal direction.
3	Tile Vertically Tiles two or more Function Views such that they are longer in the vertical direction.
4	Time A single-channel display function. Displays a time domain waveform of filtered, sampled data scaled in either Volts or EUs.
5	Auto-Spectrum A single-channel display function. Displays the square of the magnitude of the complex (one-side) Fourier spectrum of $x(t)$. Autospectra are calibrated so that if A is the peak amplitude of a sinusoidal signal $x(t)$, then the autospectrum has the value A^2 (or use A power 2) at the sinusoidal frequency.
6	PSD (Power Spectral Density) Power Spectral Density (PSD) displays the power of random vibration intensity as "mean-square acceleration per frequency unit." PSD is a single-channel display function. It is the Fourier Transform of the Auto-correlation function. This normalization should be used with continuous random signals.
7	Spectrum A dual-channel display function. Displays averaged linear spectrum computed as the square root of the averaged autospectrum.
8	FRF* A dual-channel function for the single-input, single-output (SISO) frequency response function between two specified input channels. FRF is the averaged cross-spectrum divided by the averaged autospectrum of the input (the second named channel). When the FRF (#8) or the Cross (#9) button is clicked on; then the following buttons for more complex data displays become active. These buttons, not shown in the above figure, will appear in the toolbar between buttons #15 and # 21.  Magnitude: Plots only the magnitude of real or complex data.  Phase: Plots only the phase of complex data.  Magnitude and Phase: Plots both Magnitude and Phase data.  Real: Plots only the Real numbered data.  Imaginary  Real and Imaginary: Plots both Real and Imaginary data.  Nyquist: A Nyquist plot is another way to display real and imaginary data. The real numbered data is plotted on the X-axis and the imaginary numbered data is plotted on the Y-axis with consecutive points joined by line segments. From basic vibration theory, a Nyquist plot of a mobility function should trace out a circle (counter-clockwise) as the frequency is increased through an isolated structural resonance.
9	Cross* A dual-channel display function in the frequency domain. It is equal to the product of the complex Fourier spectrum of $y(t)$ (the numerator or first named channel) times the complex conjugate of the Fourier spectrum of $x(t)$ (the denominator or second named channel). The special case $y=x$ yields the autospectrum. Averaging of these functions (frequency-domain averaging) forms the basic foundation on which virtually all other multichannel, frequency-domain analysis is built. The cross spectrum is calibrated in units of (peak EUy) (peak EUx). When the Cross (#9) or FRF (#8) button is clicked on; then the following buttons for more complex data displays become active. The buttons will appear in the toolbar between buttons #15 and # 21 and are briefly discussed in the FRF section (preceding row) of this table.
10	Coherence* A dual-channel display function. At each frequency, the coherence is a value between 0.0 and 1.0, which indicates the degree of consistent linear relationship between two signals during the averaging process. A value of less than one indicates that phase cancellation occurred during cross-spectrum averaging, which may be due to uncorrelated noise on one or both signals or to a nonlinear relationship between signals.
11	Octave Many sounds, including audible noise for a transmission line, are broad band, having components that are continuously distributed over a range of frequencies. The spectrum of such a sound can be approximated in terms of a series of octave band or one-third octave band pressure levels. A band is designated by its center frequency, f_0 , which is the geometric mean of the upper and lower frequencies of the band. (See ANSI/ASC S1.6-1984.) This button activates two Octave Type buttons, i.e., Full Octave (#16) and 1/3 Octave (#17).

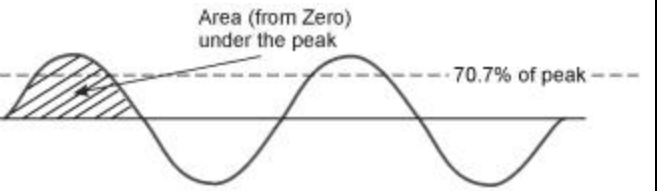
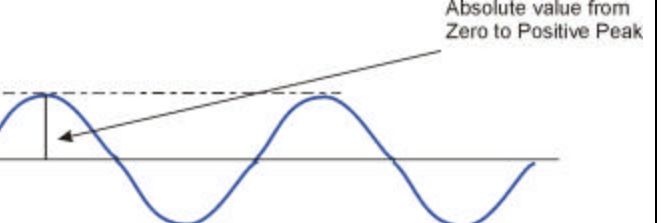
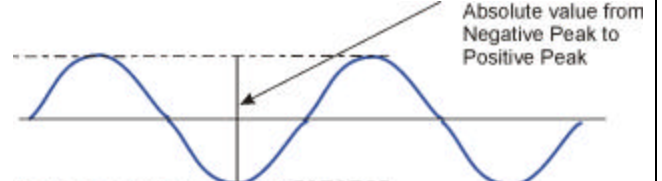
* Buttons 9, 10, 11 will only be active if there is a "Reference Channel." A channel can be selected to "Reference" in the Input/Output Channels Tab via the Response/Reference column.



Function	Description / Comments
12	<p>Transfer Function</p> <p>Activates additional buttons for the Transfer Type options. The 6 buttons appear in the toolbar area between buttons #15 and #21 when the Transfer Function button is clicked on [they are not shown in the above figure]. The Transfer Function buttons are:</p> <p> Inertance, which is: Acceleration divided by Force.</p> <p> Mobility, which is: Velocity divided by Force.</p> <p> Compliance, also known as Receptance, which is: Displacement divided by Force.</p> <p> Apparent Mass, which is: Force divided by Acceleration.</p> <p> Impedance, which is: Force divided by Velocity.</p> <p> Dynamic Stiffness, which is: Force divided by Displacement.</p>
	<p> Transfer function displays assume the reference channel is a force channel. You MUST define the response channels to be the correct type of data (acceleration, velocity, or displacement) that you are acquiring. Define these in the data type column of the Calibration window. This allows the data to be integrated or differentiated correctly to derive the desired transfer function.</p>
13	<p>Averaged Time</p> <p>A single-channel display function. Displays a time domain waveform of filtered, averaged, sampled data scaled in either Volts or EUs.</p>
14	<p>Negative Spectrum</p> <p><i>Reference Spectrum minus Current Spectrum</i> displays the difference between the Reference Spectrum and the Current Spectrum when the following is specified: Linear (-), Negative Averaging</p>
15	<p>Windowed Time</p> <p>Applies to the FFT Response window specified in the Miscellaneous Tab of the Configuration window to time data.</p>
16	<p>Full Octave</p> <p>Extends from a lower frequency, $f_0/2$ to twice the lower frequency ($2f_0$). The <Full Octave> button is only active when the <Octave> button (#11) is selected.</p>
17	<p>1/3 Octave**</p> <p>Extends from a lower frequency ($f_0/2$) to 32 times the lower frequency ($32 f_0$). The Octave (one-third octave) band sound-pressure level is the integrated sound-pressure level of all spectral components in the specified octave or one-third octave band. The <1/3 Octave> button is only active when the <Octave> button (#11) is selected.</p>
18	<p>Edit Configuration</p> <p>Opens the Configuration Settings window.</p>
19	<p>Graph Toolbar</p> <p>Opens [or closes] the graph toolbar, which consists of buttons 1 through 17 and 21 through 30.</p>
20	<p>Input Channels Button</p> <p>Open: makes a floating window of channel buttons. Closed: keeps the buttons on the toolbar.</p>
n/a	<p>Strip Charts</p> <p>As this document goes to print, there is no toolbar button for Strip Chart. To add a Strip Chart:</p> <ol style="list-style-type: none"> Go to the Plots menu-bar and open the Window pull-down menu. Select the "Add Strip Chart" option. <p>For detailed information refer to the upcoming subsection entitled, <i>Strip Charts</i>, pg 3-6.</p>



Function		Description / Comments
21	XY Axis Grids	Used to add or remove vertical and horizontal grid lines.
22	Auto Scale XY Axis	Lets the application automatically adjust the X and Y axis.
23	Manually Scale Y Axis	Lets the user manually adjust the Y-axis.
24	Manually Scale X Axis	Lets the user manually adjust the X-axis.
25	Manually Scale X & Y Axis	Lets the user manually adjust both the X and Y -axis.
26	Cursors	Cycles through the following cursor options: Cursor Off, Single Cursor, or Side Band Cursor, Harmonic, or Peak. Use the Annotation button (#27) to view X and Y values associated with the cursors.
		Cursor Off – Turns all cursors off.
		Single Cursor – Provides a single cursor that applies to one channel.
		Band Cursor (Dual Cursor) – Provides two cursors that apply to one channel. Note that if the second cursor is not seen it is because it is at the far left of the x-axis. Both cursors can be repositioned.
		SideBand – Used for one channel trace. Results in several cursors spaced at even intervals on both sides of the primary cursor. With the use of Annotation (button #27) values will be shown for all cursors.
		Harmonic – Used for one channel trace. Results in several cursors positioned to the right of the primary cursor and at intervals that are at twice the x-axis value of the primary cursor. For example: When the primary cursor is at 100 Hz, the first harmonic cursor will be at 200 Hz, the second at 400 Hz, the third at 600 Hz, etc. Moving the primary cursor to 400 Hz would result in the first harmonic cursor residing at 800 Hz, the second at 1200 Hz, etc. With the use of Annotation (button #27) values will be shown for all cursors.
		Peak – Used for one channel trace. This selection will set up to 20 cursors (according to the cursor setting in Display Preferences) and automatically position them to the highest peaks on the trace. Note that the Annotation (button #27) frame will only provide X and Y values for up to 6 cursors.
27	Annotation	Provides a means of displaying cursor values in terms of x and y. Annotation can be displayed as numbers at the cursor or in a frame, which includes forward and backward scrolling arrows. Note that the annotation color will match the "Foreground" color as set in Edit/Display Preferences. Note that the Annotation frame will only display up to 6 sets of cursor values.
28	Differential	Differential (also referred to as Differentiation) is for display purpose only and does not modify the data. Differentiation is only active when frequency domain data is displayed. Select single or double differentiation or none by continuous clicks of the button (#28). In the plot display's "Y-Axis" label, a "&" indicates single differentiation, "&&" indicates double differentiation, and <i>no ampersand</i> indicates no differentiation. Note that both Differentiation and Integration are calculated by dividing each element of the function by $(jw)^n$, where j is the square root of -1; w is the product of 2 pi times the frequency of the block element; and n is an integer from +2 to -2. If the signal is displacement, then single differentiation (&) results in velocity, and double differentiation (&&) results in acceleration.
29	Integral	Integral (also referred to as Integration) is for display purpose only and does not modify the data. Integration is only active when frequency domain data is displayed. Select single or double integration or none by continuous clicks of the button (#29). In the plot display's "Y-Axis" label, a "~" indicates single integration, "~~" indicates double integration, and <i>no ampersand</i> indicates no integration. Note that both Differentiation and Integration are calculated by dividing each element of the function by $(jw)^n$, where j is the square root of -1; w is the product of 2 pi times the frequency of the block element; and n is an integer from +2 to -2. If the signal is acceleration, then single integration (~) results in velocity, and double integration (~~) results in displacement. Note: Engineering Units change when the instrument type is Acceleration and integration is implemented.

Function	Description / Comments
30	Scale - RMS, Pk, Pk-Pk
	<p>The Scale button allows the user to cycle through the following scales:</p> <p>RMS: (Root Mean Square): The square root of the average of the square of the value of the function taken throughout one period. Peak: Zero to Peak. Pk-Pk: Peak to Peak. Refer to the following illustrations.</p>
RMS	<p>RMS Level</p> 
Peak	
Peak-to-Peak	

Additional Functionality

Copy [No associated toolbar button]

Data
Plot Window
Screen

To Open the **Copy** Menu: Press “D” + “C,” then release the keys. The **Copy** selection will be highlighted. Press “Enter.”

Next, use the down arrow key to select the item you desire to copy: **Data, Plot Window, or Screen**, then press “Enter.”

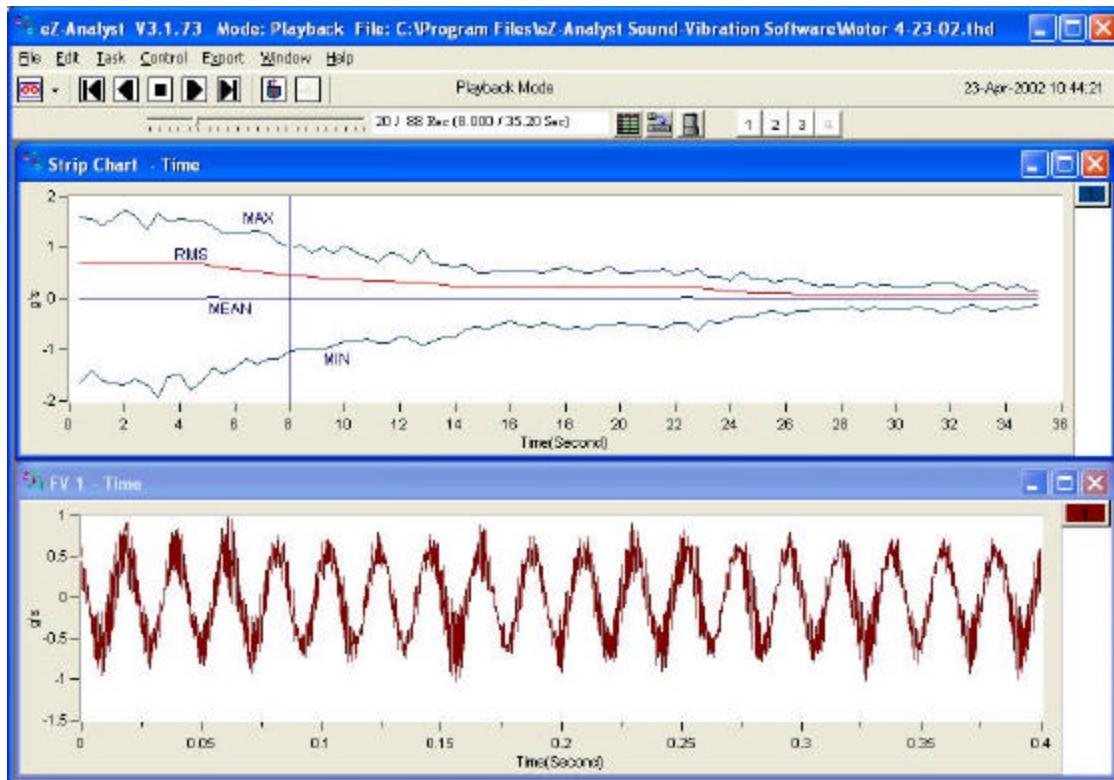
You can paste the copied item into other applications. For example, plotted data can be copied into Notepad, Word, or Excel for use in reports or in the case of Excel further calculations.

The plot window and full screen can be copied and then pasted into any application that accepts graphics, such as MSPaint or Word.

Function Type:Octave 1/3:None (LIN)	
g's<Lin> [RMS]	
Overall	0.00603
Freq.	CH.2
500.0	0.00097
630.0	0.00171
800.0	0.00132
1000.	0.00114
1250.	0.00117
1600.	0.00160
2000.	0.00135
2500.	0.00182
3150.	0.00191
4000.	0.00197
5000.	0.00177
6300.	0.00196
8000.	0.00241

Plot Window Data
Copied and Pasted into Word

Strip Charts [No associated toolbar button]



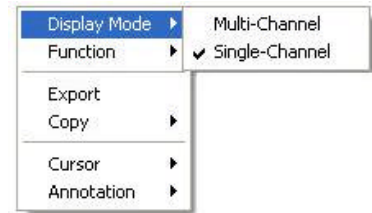
Upper Plot Display - Strip Chart with 4 Traces for 1 Channel
Lower Plot Display - Time Function View

To add a strip chart, open the Window pull-down menu and select “Add Strip Chart.”

A strip chart has two display modes . These are Single-Channel and Multi-Channel.

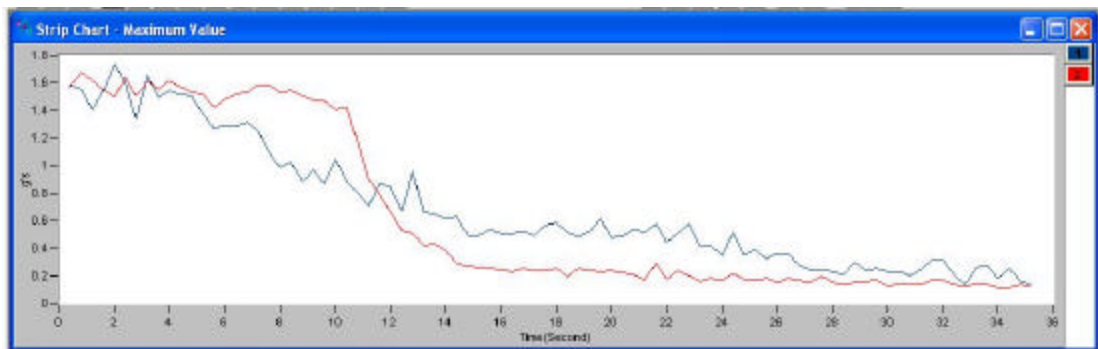
To select the strip chart's mode:

1. Right-click within the strip chart.
2. Position the mouse-cursor over the text "Display Mode."
3. Select Single Channel of Multi-Channel, as desired.



Single Channel – When this mode is selected the strip chart will show 4 traces for a single channel. The traces are for maximum values, minimum values, the mean, and RMS. The top plot display in the preceding figure illustrates the single channel mode.

Multi-Channel – When this mode is selected the strip chart will show one or more channels, as determined by the user. When in multi-channel mode, only traces of the maximum values for each channel will be displayed. An example of a strip chart with two channels follows.



Strip Chart, Multi-Channel Mode

Overlays of XLS Files

eZ-Analyst allows you to overlay an Excel (XLS) file within a function view, providing that the data type is in agreement with that in the view. For example, a function view with an x-axis in Time will not accept an overlay in which the x-axis is frequency. Likewise, the units (y-axis) must also be compatible.

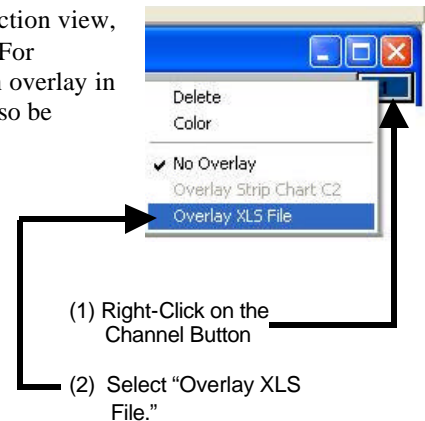
To overlay an Excel file:

1. Right-Click on the channel button.
2. Select "Overlay XLS File."

The Import Overlay Function Data Set(s) window will open.

3. Browse for the applicable file. Remember that the file's data type must match that of the data in the function view.
4. Select and open the file.

If the file is compatible, the XLS file will overlay into the display. If it is not compatible a message box will inform you of the mismatch.



Displaying Channel Pairs

A channel pair is a reference channel and a response channel used to display a dual channel function, such as an FRF.

In the Input channel configuration panel, set at least one channel as a reference channel. After you click OK and look at the channel buttons in the main window, you will notice that each reference channel now has a bold number. One of them also is underlined. That channel will be used as the reference channel for any dual function displays.

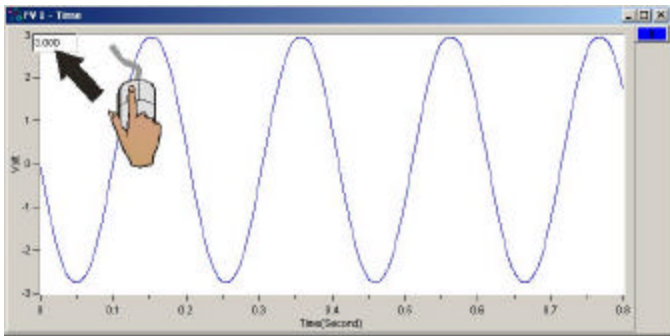
To change to another reference channel, right click on the channel of interest. It will now be underlined.



All channels are response channels, even those that have been designated as reference channels.

Changing the Display Range

To change the maximum or minimum range value: Left-click on upper or lower scale value that is to be changed, then enter the new value. An example follows.

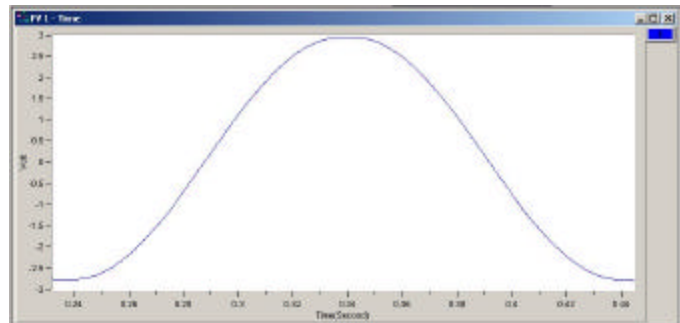
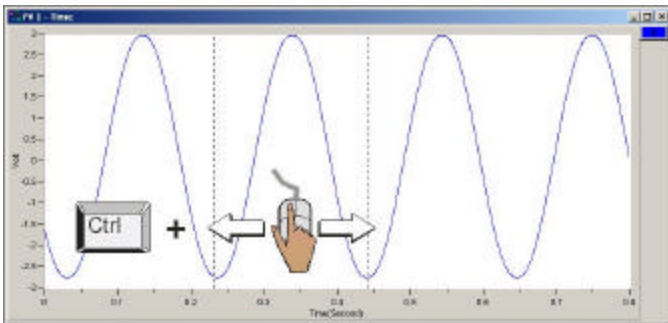


3
3.000

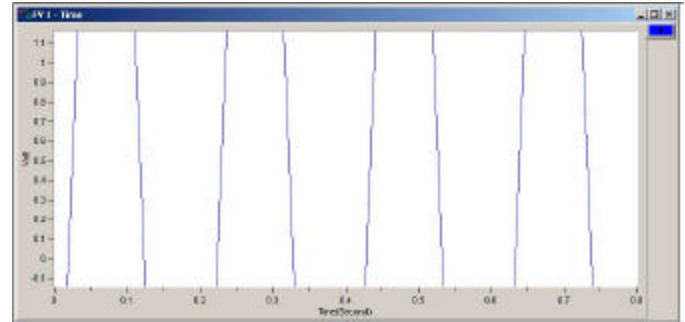
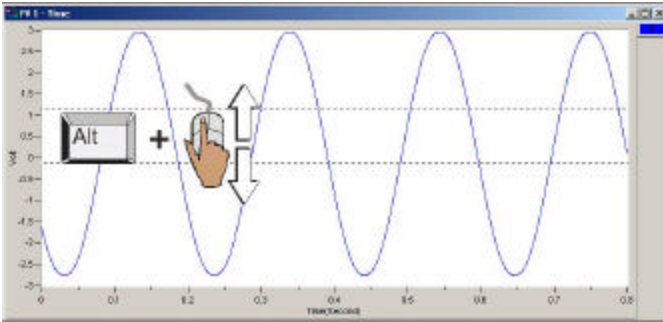
In this example, the cursor and PC keyboard were used to change the maximum scale value from 3.000 volts to 3.800 volts.

3
3.800

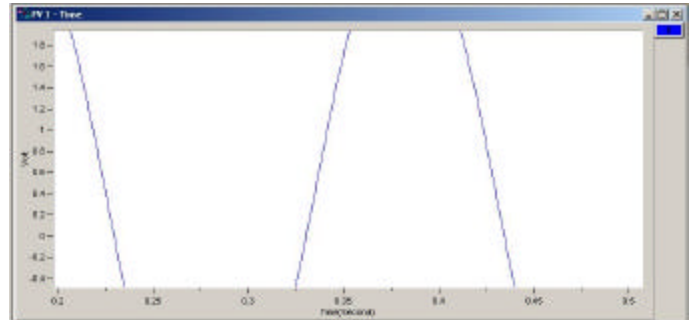
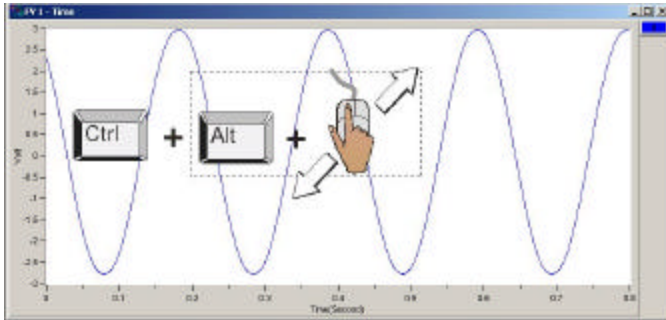
To change the X-Axis: Hold down the <Ctrl> key, at the same time, left-click and drag the mouse cursor horizontally on the plot. Two vertical cursor lines will define the new x-axis end points.



To change the Y-Axis: Hold down the <Alt> key, at the same time, left-click and drag the mouse cursor vertically on the plot. Two horizontal cursor lines will define the new Y-axis end-points.



To simultaneously change the X & Y Axes: Hold down the <Ctrl> and <Alt> keys, at the same time, left-click and drag the mouse cursor diagonally on the plot. A rectangle will define the new area of the plot.

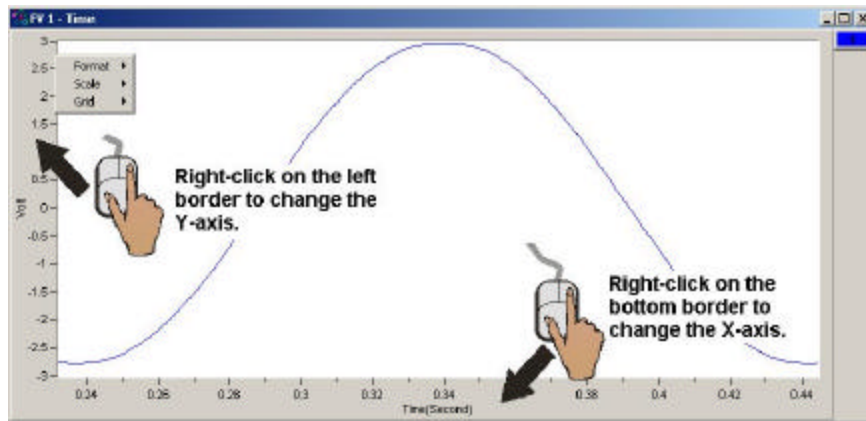


Changing the Plot's Format / Scale / Grid

Right-Click on the plot's border to open a popup menu (see figure). If you want to change the y-axis, right-click on the plot's left border. If you want to change the x-axis, right-click on the plot's bottom border.



Changing the plot Format, Scale, or Grid affects the display only. It does not change the real data.



Format

The Format menu allows you to change the axis format of the plotted data. Choices are Linear, Log, and dB (valid only for the y-axis).

Scale

The Scale menu allows you to change the plot scale to AutoScale, FixedScale, or Manual. Autoscale ensures that all the captured data is visible on the plot.

Grid

The Grid menu allows you to place and remove grid lines from the graph of plotted data. You can also turn the grid on and off by pressing the “G” hot key.

This appendix consists of several hot key tables for the benefit of those who prefer to use keys in place of mouse/cursor interaction with a GUI. However, for certain functions, such as changing axis scales, a mouse will be needed. Mouse use is pointed out in the tables, when applicable.

Record / Playback Control		
Keys	Function	Comments
p	Play Forward	----
<Shift> + p	Play Backward	----
o	Step Forward and Record	----
<Shift> + o	Step Backward and Record	----
H	Halt Playback	----

Measurement, Scope, and Generator Control		
Keys	Function	Comments
H	Halt the measurement	----
R	Start recording	----
S	Start Scope Mode (Measurement)	----
W	Turn the signal generator On	----

Menu and Window Control		
Keys	Function	Comments
Alt + E ...	Presents the Edit Menu .	----
... C	Presents the Plot Window Colors window.	After pressing Alt + E to access the Edit Menu, press C to get the Colors Window. Use the Tab key to select a characteristic, then hit <Enter>.
... M	Presents the Configuration window.	After pressing Alt + E to access the Edit Menu, press M to get the Configuration Window. You will need a mouse to access all panels. Also, see Ctrl + M.
... P	Presents the Playback Setup window.	After pressing Alt + E to access the Edit Menu, press P to get the Playback Setup Window. Use the Tab and arrow keys to make selections within this window. Then hit <Enter>.
Alt + F	Presents the File Menu .	----
Alt + W	Presents the Window Menu .	You will need a mouse to make selections.
Ctrl + M	Presents the Configuration window.	You will need a mouse to access all panels. An alternative to Ctrl + M is to press M when the Edit Menu is open.
Ctrl + O	Presents the Open File Dialog window.	From within the window, use the Tab and arrow keys. An alternative to Ctrl + O is to press O when the File Menu is open.
Ctrl + P	Presents the Print Dialog window.	An alternative to Ctrl + P is to press P when the File Menu is open.
D	Presents the Display Menu , also referred to as the Plot Display Characteristics Menu .	Refer to the following table for control options related to the Display Menu.

Display Menu Control		
Keys	Function	Comments
D	Opens the Plot Display Characteristics Menu	Option: "Right-clicking" the mouse, while the cursor is over the plot will also open this menu.
D + C (3 functions)	Used to open the Complex Type Display Menu . This option is only available when a function with complex data is displayed. Menu choices are: Magnitude, Phase, Real, Imaginary, Magnitude + Phase, Real + Imaginary, and Nyquist	Press D + C; release, then press <Enter>. The Complex Type Display Menu will open. Use the arrow keys to highlight the type of display, then press <Enter>.
	Used to open the Copy Menu . Menu choices are: Data, Plot Window, Screen.	Press D + C; release, then use the arrow key to select Copy. After selecting Copy, press <Enter>.
	Used to open the Cursor Menu . Menu choices are: Single Cursor, Band Cursor, or Cursor Off.	Press D + C; release, then use the arrow key to select Cursor. After selecting Cursor press <Enter>.
D + F	Opens the Display Functions Menu . Note that right-clicking on the plot will also open this menu.	Use arrow keys to highlight your selection, then press <Enter>. In some cases you can select the first letter of an option to select it.
D + I	Opens the Integration/Differentiation Menu .	Use arrow keys to highlight your selection, then press <Enter>.
D + L	Opens the Label / List Menu .	Use arrow keys to highlight your selection, then press <Enter>.
D + O	Opens the Octave Menu .	Use arrow keys to highlight your selection, then press <Enter>.
D + S	Opens the Scale Type Menu . Menu choices are RMS, Peak, Pk-Pk.	Use arrow keys to highlight your selection, then press <Enter>.
D + T	Opens the Transfer Type Menu .	Use arrow keys to highlight your selection, then press <Enter>.

Plot Display Controls (Note)		
Keys	Function	Comments
<i>Mouse-Click Bottom Border</i>	Change the X-axis in regard to format, scale, and grid.	Right-click on the plot's bottom border to access a menu for changing the X-axis in regard to Format, Scale, and Grid.
<i>Mouse-Click Left Border</i>	Change the Y-axis in regard to format, scale, and grid.	Right-click on the plot's left border to access a menu for changing the Y-axis in regard to Format, Scale, and Grid.
,	Moves the primary cursor left along the trace.	When in Band Cursor mode, the comma moves the primary cursor to the left.
.	Moves the primary cursor right along the trace.	When in Band Cursor mode, the period moves the primary cursor to the right.
<	Moves the secondary cursor left along the trace.	When in Band Cursor mode, the "<" moves the secondary cursor to the left.
>	Moves the secondary cursor right along the trace.	When in Band Cursor mode, the ">" moves the secondary cursor to the right.
<shift>	Peak search.	Press the <shift> key while depressing the left mouse button to search for peaks along the trace.

Note: Also see the Display Menu Control Table.

Continued



Reference Note: For more detailed information, which includes graphics, refer to chapter 3, *Interactive Features of the Plot Display Window*.

(continued)

Plot Display Control (Note)		
Keys	Function	Comments
A	Turns Auto-scale On.	-----
Alt	Expands or contracts the Y-Axis .	(a) While holding down the <Alt> key, place the cursor at the desired start point of the Y-axis, (b) click the left mouse button, (c) drag the mouse vertically until the cursor is at the new end point of the scale.
b	Bank up.	-----
<shift> + b	Bank down.	-----
C	Toggles the cursor On or Off; or cycles the cursor options as follows (if Band Cursor is selected): Adds a Cursor, Adds a second Cursor, turns both cursors Off.	When Band Cursor is selected, the "C" key cycles through On (add a cursor), add a second cursor, and Off.
Ctrl	Expands or contracts the X-Axis .	(a) While holding down the <Ctrl> key, place the cursor at the desired start point of the X-axis, (b) click the left mouse button, (c) drag the mouse horizontally until the cursor is at the new end point of the scale.
Ctrl + Alt	Simultaneously expands [or contracts] both the X and Y axes .	(a) While holding down both the <Ctrl> and <Alt> keys, place the cursor at the desired start point on the plot, (b) click the left mouse button, (c) drag the mouse diagonally until the cursor is at the new end point of the scale.
F2 or Z (2 functions)	Zooms in or out.	When you depress one of these keys, while dragging with the right mouse button depressed, you will zoom in or out, according to the cursor-defined region.
	Pan along the X-axis, Y-axis, or both.	By depressing one of these keys, while dragging with the left mouse button depressed, you can pan in the direction of the drag.
F3	Zoom in or out.	Use F3 with the left mouse button to zoom in our out.
G	Turns Plot Grid On or Off.	Toggles the grid to On or Off.
L	Changes the Scale to Linear or to Log .	Toggles the scale to Linear or to Log.
R	Start Recording	-----
S	Start Scope Mode (Measurement)	-----
X	Presents the X-Axis Menu	-----
Y	Presents the Y-Axis Menu	-----
Z or F2	Zooming or Panning.	See " F2 ."

Note: Also see the Display Menu Control Table.



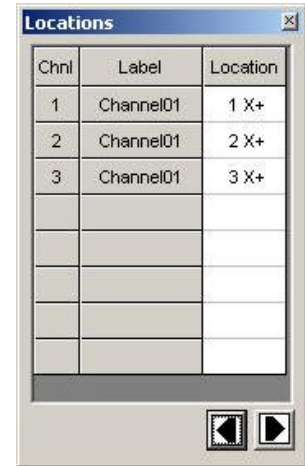
Reference Note: For more detailed information, which includes graphics, refer to chapter 3, *Interactive Features of the Plot Display Window*.



A Bank is defined as a group of signals that are selected for simultaneous measurement, together with all the associated transducer definitions and channel assignment information. The concept of “banks” is helpful with a modal test where the number of transducers on the test article exceeds the number of input channels on your analyzer.

You can have the analyzer increment your banks automatically after each measurement, or you can manually increment the banks. The Skip Factor is typically the number of measurement points in a bank.

Use the buttons in the Modal Location window to increment or decrement your banks. The Bank control options are set up in the FFT Setup tab at WaveBook configuration window. Increment or decrement the Bank by the Skip Factor. The number of channels [associated with a bank] is based on the Response Channel and the Skip Factor.



Modal Locations Window

Hints for Setting up Banks and Skip Factors

Visualize a test object with 27 transducer locations in 3 rows of 9. You have 1 reference, and 27 responses. Using all 8 channels you can build channel pairs with channel 1 as the reference, and 2 through 8 as the responses. Your 7 channel pair relationships would be 2,1 3,1 4,1 5,1 6,1 7,1 and 8,1

In the Channel Pairs window specify channel 1 as a reference channel; then click the Build Pairs Button to create the channel pairs listed above.

In the Input Channel tab at the WaveBook configuration window, select Reference for Channel 1 and select Response for other active channels, i.e., Channels 2 through 8, inclusive.

Bank	Reference channel/location	Response channel/location
1	1/1	2/2, 3/3, 4/4/, 5/5, 6/6, 7/7, 8/8
2	1/1	2/9, 3/10, 4/11, 5/12, 6/13, 7/14, 8/15
3	1/1	2/16, 3/17, 4/18, 5/19. 6/20, 7/21, 8/22
4	1/1	2/23, 3/24, 4/25, 5/26, 6/27

Before starting the data acquisition, use the increase or decrease button at the Modal Location window. After each acquisition, click the <Export> button to create an FRF file for each channel pair, or use the *automatic saving option* to save data and bank up to the next locations.

Each file name uses the function abbreviation to identify:

- the Reference Location and the orientation
- the Response Location and the orientation

The function abbreviations differ, depending on the file format used.

The file type is selected in the “*Setup Export Function Data window,*” as discussed in the Export Menu section of chapter 2.



Glossary

Accelerometer

A type of transducer that produces an output voltage proportional to acceleration.

Acquisition

A collection of scans acquired at a specified rate as controlled by the sequencer.

Analog Signal

A signal of varying voltage or current, resistance, temperature such as the output of a sensor. Many analog signals are in the form of sine waves.

Apparent Mass

Force/Acceleration. A *transfer type* that is the reciprocal function of Inertance. Apparent Mass is derived by taking the inverse of the magnitude, and multiplying the phase angle by “-1.”

Auto-Spectrum Function

A single-channel display function. Displays the square of the magnitude of the complex (one-side) Fourier spectrum of $x(t)$. Autospectra are calibrated so that if A is the peak amplitude of a sinusoidal signal $x(t)$, then the autospectrum has the value A^2 (or use A^2) at the sinusoidal frequency.

Averaged Time Function

A single-channel display function. Displays a time domain waveform of filtered, averaged, sampled data scaled in either Volts or Engineering Units (EUs).

Bank

A set of response channels.

Blackman-Harris

An FFT window function. This window function was designed to provide the minimum side lobe level of any three-term window. Compared with the very similar Hanning window, it has a slightly wider main lobe but much better dynamic range. This window has the smallest 60 dB bandwidth of any window listed. The Blackman-Harris window may be preferred over the Hanning for measurements requiring better dynamic range.

Channel

A single *input*, or *output* for the acquisition device. In a broader sense, an *input channel* is a signal path between the transducer at the point of measurement and the data acquisition system. A channel can go through various stages (buffers, multiplexers, or signal conditioning amplifiers and filters). Input channels are periodically sampled for readings. An *output channel* from a device can be digital or analog. Outputs can vary in a programmed way in response to an input channel signal.

Coherence Function

A dual-channel display function. At each frequency, the coherence is a value between 0.0 and 1.0, which indicates the degree of consistent linear relationship between two signals during the averaging process. A value of less than one indicates that phase cancellation occurred during cross-spectrum averaging, which may be due to uncorrelated noise on one or both signals or to a nonlinear relationship between signals.

Compliance, also referred to as Receptance

Displacement/Force. The *transfer type* function is calculated by dividing the *cross spectrum* of the channel pair by the *auto spectrum* of the reference (force) channel.

CPM

Cycles per Minute. 60 CPM is equal to 1 Hz.

Cross Spectrum Function, or Cross Function

A dual-channel display function in the frequency domain. It is equal to the product of the complex Fourier spectrum of $y(t)$ (the numerator or first named channel) times the complex conjugate of the Fourier spectrum of $x(t)$ (the denominator or second named channel). The special case $y=x$ yields the auto spectrum. Averaging of these functions (frequency-domain averaging) forms the basic foundation on which virtually all other multi-channel, frequency-domain analysis is built. The cross spectrum is calibrated in units of (peak EUy) (peak EUx).

Crosstalk

An undesired transfer of signals between system components or channels. Crosstalk often causes signal interference, more commonly referred to as *noise*.

dB

Decibels. A logarithmic unit of amplitude for noise or vibration. While there are several definitions to dB, in our application we are using dB to express the ratio of the magnitudes of two quantities equal to 20 times the common logarithm of the ratio.

$$\text{dB} = 20 \log (x/\text{dBEUref})$$

In this equation, “x” refers to the value of the voltage being measured and “dBEUref” refers to the reference voltage.

Decay %

Decay %, also referred to as Response Decay Percent, is used when an Exponential Window is applied to the FFT Response Channel. It is the weighting factor present at the last block value. For example, a decay of 5% means that the weighting factor at the beginning of block is 100% and that the weighting factor of the last block is 5%. In other words, the weighting factor dropped (decayed) to 5% over the length of block.

Digital

A digital signal is one of discrete value, in contrast to a varying signal. Digital data is represented by combinations of binary digits (0s and 1s).

Dynamic Stiffness

Force/Displacement. A *transfer type* that is the reciprocal function of Receptance. Dynamic Stiffness is derived by taking the inverse of the magnitude, and multiplying the phase angle by “-1.”

EU

Engineering Unit.

Excitation

Some transducers [e.g. strain gages, thermistors, and resistance temperature detectors (RTDs)] require a known voltage or current input in order for the sensor to operate. This known input is called the Excitation.

Exponential Weighting Window

An exponential weighting window is equal to 1.0 at the beginning of the block and decays exponentially to a smaller value at the end of the block (see *Decay %*). Exponential is used only with transient data that is captured with pre-trigger to assure that the initial values in all data channels are very close to zero. Exponential can be used with all transient excitation methods in order to force the signals to decay close to zero, even if the block length is not sufficient to capture all of the naturally occurring response. If the data decays naturally to a low amplitude [within the block], so that leakage is not significant, exponential windowing can improve the signal-to-noise ratio by giving reduced weight to the very low-amplitude data at the end of the block.

Fast Fourier Transform (FFT)

An efficient technique for calculating the frequency of components in a time-domain waveform based on digitized voltage measurements. The result is a display of amplitude versus frequency and phase versus frequency.

Fast Fourier Transform (FFT) Reference Window is applied to the output of a transducer to avoid collecting extraneous signals caused by an excitation device, such as an impulse hammer. Possible selections are: Response, Rectangular, and Cosine Taper.

Fast Fourier Transform (FFT) Response Window

The FFT (Response) window is a time-domain, weighting window. A response window is usually applied to data to reduce FFT leakage errors. FFT theory assumes that the signal being analyzed is periodic in the data acquisition block. When this is not the case, energy from a signal at a specified frequency can leak into nearby spectral bins causing spectral amplitude inaccuracies. Applying a windowing function controls, but doesn't completely eliminate, the error by multiplying each data frame by a suitable time-domain weighting window. This calculation reduces the amplitude/magnitude of the data near the ends of each data frame prior to performing the FFT and forces the data to be nearly periodic in the window, thus reducing leakage errors. Response window options include Flat-Top, Blackman-Harris, and Hanning.

Flat-Top Window, also written as **Flattop Window**

An FFT window function that provides accurate measurement of peak-amplitude. Compared to the very similar 4-term “Max Flat Top,” this window also has a very low peak amplitude error, and its frequency resolution is somewhat better. Its side lobes are considerably higher. Its effective noise bandwidth is still almost twice that of the Hanning window, therefore this window is used mainly to measure accurate peak amplitudes of discrete spectral components that are known to be separated by several spectral lines.

Free Run (Free Running)

A state in which a data acquisition device acquires the next block of data when it has finished the previous block. Free Run is a continuous collection of data, with a constant display update.

Frequency-Domain

A domain where amplitudes are graphed in relation to frequency. Also see *Time-Domain*.

FRF (Frequency Response Function)

A dual-channel function for the single-input, single-output (SISO) frequency response function between two specified input channels. FRF is the averaged cross-spectrum divided by the averaged autospectrum of the input (the second named channel).

FSV (Full Scale Volts)

Maximum FSV refers to the high-end limit for the input voltage. Minimum FSV is the low-end limit for the input voltage.

g

Acceleration due to gravity. In relation to earth’s gravity, **1 g = 980 cm/sec², or 32.2 ft/sec².**

Gain

The degree to which a signal is amplified (or attenuated) to allow greater accuracy and resolution; can be expressed as $\times n$ or \pm dB.

Hanning

An FFT window function. The Hanning window is typically used to analyze continuous signals. The Hanning function reduces leakage and provides a relatively good compromise between frequency resolution and amplitude accuracy.

Hz

Hertz, one cycle per second. Also, see CPM.

Impedance

Force/Velocity. A *transfer type* that is the reciprocal function of Receptance. Impedance is derived by taking the inverse of the magnitude, and multiplying the phase angle by “-1.”

Inertance

Acceleration/Force. The *transfer type* function is calculated by dividing the *cross spectrum* of the channel pair by the *auto spectrum* of the reference (force) channel.

Integration/Differentiation

Integration/Differentiation is for display purpose only and does not modify the data. It is only active when frequency domain data is displayed. Select single or double integration, single or double differentiation or none. Make your selection on the popup menu. Differentiation and Integration are calculated by dividing each element of the function by $(jw)^n$, where j is the square root of -1; w is the product of 2 pi times the frequency of the block element; and n is an integer from +2 to -2.

n = 2 is double integration

n = 1 is single integration

n = 0 has not effect

n = -1 is single differentiation

n = -2 is double differentiation.

If the signal is acceleration, then single integration (Int1) results in velocity, and double integration (Int2) results in displacement.

If the signal is displacement, then single differentiation (Diff1) results in velocity, and double differentiation (Diff2) results in acceleration.

Isolation

The arrangement or operation of a circuit so that signals from another circuit or device do not affect the *isolated* circuit. *Isolation* usually refers to a separation of the direct link between the signal source and the analog-to-digital converter (ADC). Isolation is necessary when measuring high common-mode voltage.

Leakage

Leakage refers to an error in the FFT process due to the use of finite time blocks that do not match at the blocks' ends. At lower amplitudes, leakage results in a smearing of frequency lines. FFT window functions, such as Hanning, can be used to minimize the error that is introduced by leakage.

Linearization

Some transducers produce a voltage in linear proportion to the condition measured. Other transducers (e.g., thermocouples) have a nonlinear response. To convert nonlinear signals into accurate readings requires software to calibrate several points in the range used and then interpolate values between these points.

Mobility

Velocity/Force. The *transfer type* function is calculated by dividing the *cross spectrum* of the channel pair by the *auto spectrum* of the reference (force) channel.

Nyquist Plot

A Nyquist plot is one method used to simultaneously display real and imaginary data. The real numbered data is plotted on the X-axis and the imaginary numbered data is plotted on the Y-axis. Line segments are used to join consecutive points. From the perspective of basic vibration theory, a Nyquist plot of a mobility function should trace out a circle (counter-clockwise) as frequency is increased through an isolated structural resonance.

Octave

The interval between two frequencies, where one frequency is twice the value of the other. For example, frequencies of 500 Hz and 1 kHz are one octave apart; and 1 kHz and 2kHz are one octave apart. Many sounds are broad band, having components that are continuously distributed over a range of frequencies. The spectrum of such a sound can be approximated in terms of a series of octave band or one-third octave band pressure levels. A band is designated by its center frequency, f_0 , which is the geometric mean of the upper and lower frequencies of the band. (See ANSI/ASC S1.6-1984.)

PSD Function

Power Spectral Function. A single-channel display function. It is the Fourier Transform of the Auto-correlation function. This normalization should be used with continuous random signals.

Receptance, also referred to as Compliance

Displacement/Force. The *transfer type* function is calculated by dividing the *cross spectrum* of the channel pair by the *auto spectrum* of the reference (force) channel.

Response Decay Percent

See *Decay %*.

Sample (reading)

The signal value that is observed on a channel at an instant in time. When triggered, the analog-to-digital converter [of the data acquisition device] reads the channel and converts the sampled value into a digital representation.

Scan

A series of measurements across a pre-selected sequence of channels.

Spectrum Function

A dual-channel display function. Displays averaged linear spectrum computed as the square root of the averaged autospectrum. This function is calibrated in peak engineering units (EU).

Time-Domain

A domain where amplitudes are graphed in relation to time. Also see *Frequency-Domain*.

Time Function:

A single-channel display function. Displays a time domain waveform of filtered, sampled data scaled in either Volts or Engineering Units (EUs).

Transfer Type Functions

Functions that are calculated by dividing the *cross spectrum* of the channel pair by the *auto spectrum* of the reference (force) channel. The following are transfer type functions: Inertance (acceleration/force), Mobility (velocity/force), and Receptance or Compliance (displacement/force). Reciprocal functions can be derived by taking the inverse of the magnitude, and multiplying the phase angle by “-1.” Apparent Mass (force/acceleration), Impedance (force/velocity), and Dynamic Stiffness (force/displacement) are reciprocal functions of Inertance, Mobility, and Receptance, respectively.

Note: *Transfer function displays* assume that the reference channel is a force channel. You MUST define the response channels to be the correct type of data (acceleration, velocity, or displacement) that you are acquiring. These are defined in the data type column of the Calibration window. This allows the data to be integrated or differentiated correctly to derive the desired transfer function.

Trigger

An event to start a scan or mark an instant during an acquisition. A trigger can be a TTL signal, a specified signal level, a button manually or mechanically engaged, or a software command.

Unaveraged Spectrum

A display function of the magnitude of instantaneous unaveraged spectrum.

Windowed Time

Time data which determined by the FFT Response window; specified in the Miscellaneous Tab (of the Configuration window).

