eZ-TOMAS

Total Online Monitoring & Analysis Software

Machine Vibration Monitoring

iOtech

Table of Contents

Introduction

In regard to data acquisition systems, the following terminology is used:

⊕ **ZonicBook** refers to a ZonicBook/618E.

⊕ **WaveBook** refers to WaveBooks in general, except when a specific model is specified.

⊕ **IOtech 600 Series** refers to dynamic signal analyzers of the 640e and 650e Ethernet type and 640u and 650u USB2.0 models.

Reference Note:
The information provided in this manual applies to the above noted analyzers with exceptions as noted. Refer to your system's specific hardware documentation in regard to hardware setup. PDF versions of documents are included on CD and on our website. They are also installed in the Programs group on your PC as a part of product support, during the software installation process.

What is eZ-TOMAS?

eZ-TOMAS (Total Online Monitoring and Analysis Software) is designed to acquire, limit check, store, and analyze vibration and process data from rotating machinery. eZ-TOMAS can be used with ZonicBook, WaveBook, and IOtech 600 Series hardware.

Analog input signals are typically associated with a specific machine train; and can be any combination of the following:

- Proximity
- Velocity
- Accelerometer
- Tachometer
- DC proportional voltage
- Microphone
- Pressure

Installing and Starting the Application

System Requirements

Verify that your computer system meets or exceeds the following minimum requirements.

- For Ethernet devices - 10/100BaseT Ethernet port [on PC or on a hub connected to the Ethernet]
- Monitor: SVGA, 1024 x 768 screen resolution
- <u>Windows 2000 SP4 and Windows XP users</u>:
  PC with Intel™ Pentium, 1 GHz or equivalent;
  512 MB memory; 10 GB disk space
- <u>Windows Vista users:</u>
  PC must be *Windows Vista Premium Ready*

Verify that you have:

- Dynamic Signal Analysis (DSA) CD
- License Keys for eZ-TOMAS
- Data acquisition hardware: ZonicBook, WaveBook, or IOtech 600 Series device and associated cables and power supplies (for eZ-TOMAS users wanting to acquire data)
- User documentation: available in pdf format on CD and on-line at:
  www.iotech.com/manuals.html

Software Installation

1. Start Windows.

2. Close all running applications.

3. Insert the Dynamic Signal Analysis 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 the type of data acquisition device you are using from the drop-down list.

6. Continue to follow the on-screen instructions.

Reference Notes:
Adobe Acrobat PDF versions of documents pertaining to 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*.

Running eZ-TOMAS

To run eZ-TOMAS double-click the associated icon or use your Windows desktop Start button to navigate to the program. This is located in the programs group by default.

The first time you start the application you will be prompted for your name, your company name, and a password. This password is the software key that will activate eZ-TOMAS for every day operations.

If you are loading your software from a CD the password accompanies the CD. If you downloaded your software from the website, your password will be e-mailed to you within one business day.

You will be prompted to set up your project's security password. When you click the <Save> button the *Password Confirm* window opens. Retype your security password and click the <Confirm> button.

The program's Main window appears after your password is accepted.

Connecting Signals

WaveBook and ZonicBook Users

Connect the analog signals to the analog input BNC connectors. WaveBooks, ZonicBooks and the WBK14 and WBK18 dynamic modules require no physical hardware configuration. Configuration is accomplished via software.

Reference Note:
Information regarding the following products is provided in documentation as follows:
- WBK14 and WBK18 - *WBK Options Manual* (p/n 489-0902).
- WaveBook - *WaveBook User's Manual* (p/n 489-0901).
- ZonicBook/618E - *ZonicBook/618E User's Manual* (p/n 1106-0901).

PDF versions of the documents are included on CD, website, and are installed in the Programs group on your PC during software installation as a part of product support.

IOtech 600 Series Users

Connect the analog signals to the analog input BNC connectors. These dynamic signal analyzers require no physical hardware configuration. Configuration is accomplished via software.

Reference Note:
Information regarding the 600 Series products is provided in documentation as follows:
- *640u and 650u Quick Start* (324540A-01)
- *640e and 650e Quick Start* (324539A-01)
- *IOtech 600 Series User's Manual* (372160A-01)

PDF versions of the documents are included on CD, website, and are installed in the Programs group on your PC during software installation as a part of product support.

The Order of Operation
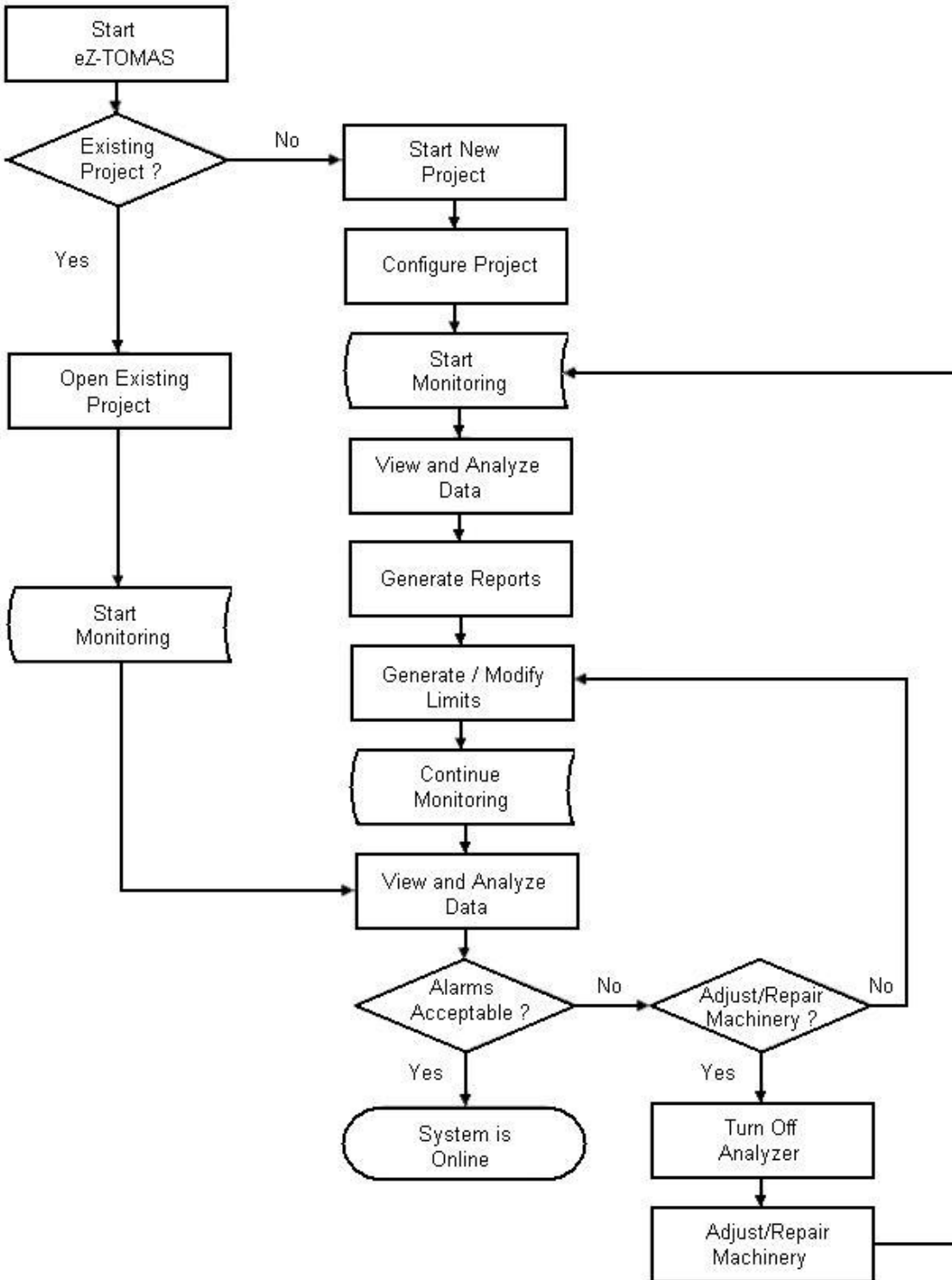
A Look at the Gauge Window & Control Pull-down Menu

The Gauge Display Window is used to show real-time values and measurement status. Gauge Display is not used for historical data analysis.

The main window of the GUI (graphical user interface) includes a set of virtual gauges, which use one of 14 spectral bands, discussed shortly. There will always be a vertical gauge associated with each input channel. When the 1x Amp/Phase selection is made, spectral bands for "1x Amplitude" and "1x Phase" are simultaneously displayed, with the later being in a circular phase gauge (see second figure).

In addition to spectral band gauge displays, eZ-TOMAS can interactively display data in a variety of other formats, including: Orbit, Polar, Time, Bode, Cascade/Waterfall, Strip Chart, and Shaft Centerline. You can control the acquisition through toggle switches on the lower panels or through the Control pull-down menu.
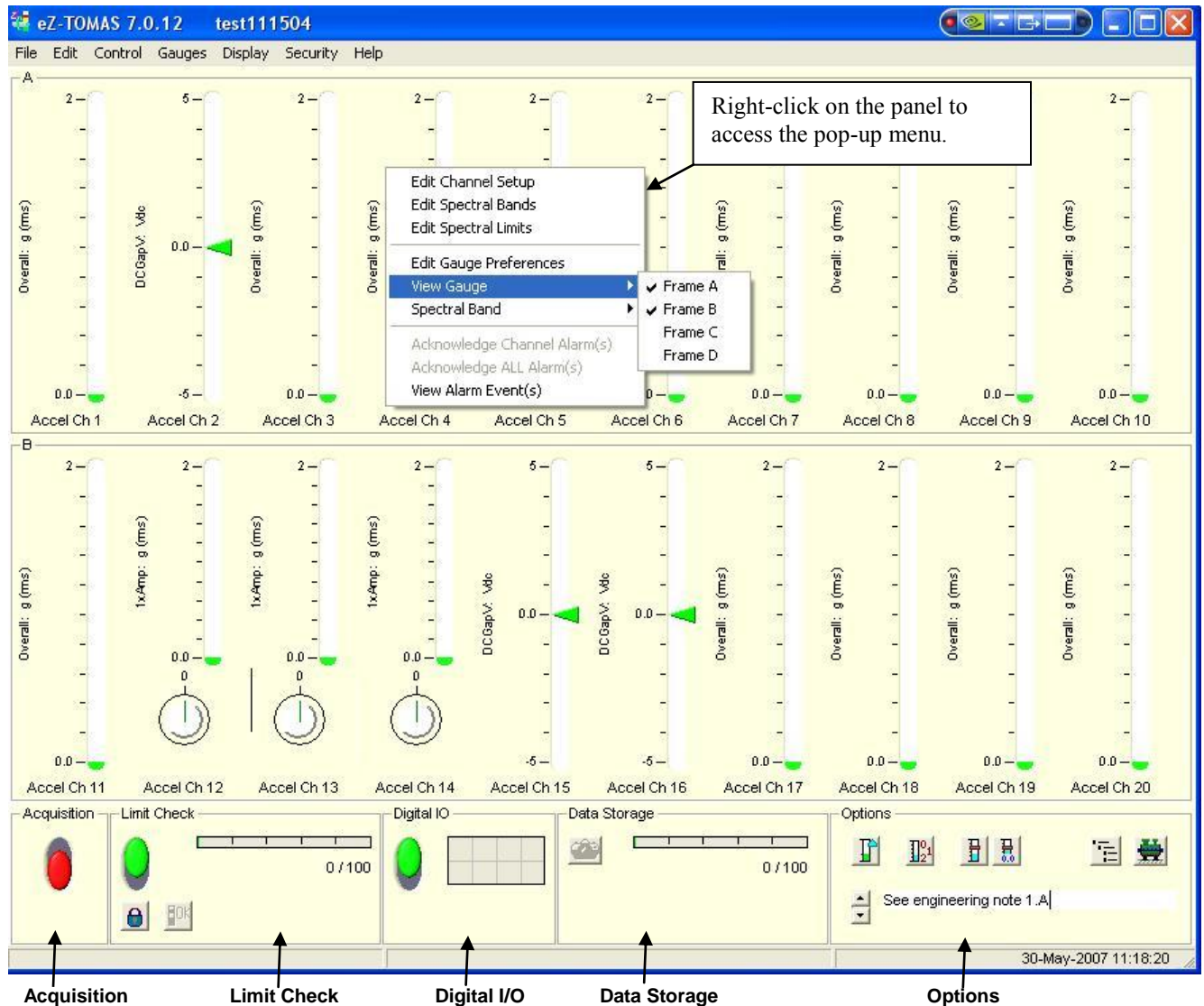
Gauge Window Display - Various Spectral Bands

Tip: You can use the mouse to accomplish the following.

- o   Double-click the left-mouse button on an area of the gauge window to access a plot display window.
- o   When limit pointers are used for a vertical gauge you can use the mouse to drag them to new positions, thus setting new limit values.
- o   When applicable, you can drag limit-lines on circular phase gauges to new positions, thus setting new values for the phase angle limits.
- o   Right-click on an area of the gauge window to bring up a menu with several edit options (see frame A in figure).

The data acquired by eZ-TOMAS and the supporting configuration information are stored in user-defined files. This allows a single eZ-TOMAS system to be used with several different machines. The acquired data is stored according to user-defined event changes, e.g., alarms, time, overall, and rotating speed.

Acquisition, instrumentation, and storage configuration parameters are also definable. These parameters are stored over time. Configuration changes do not invalidate previously acquired data.
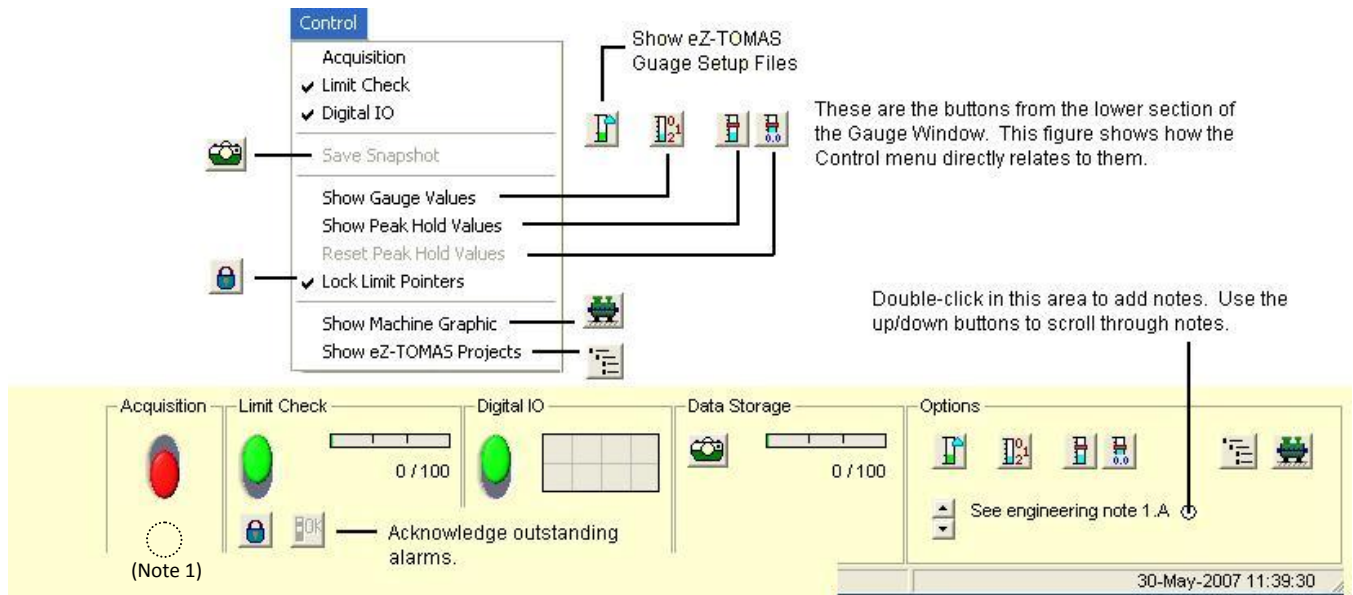
Control Pull-Down Menu's Relation to Lower Panels

Acquisition

The Acquisition Panel contains one slide switch, which determines the ON/OFF status of data acquisition. Turn the data acquisition ON (Up/Green), or OFF (Down/Red).

Note 1: A yellow or green indicator can appear here during an acquisition. Yellow indicates that gating is enabled, but that gating conditions are not satisfied; green indicates that gating is enabled and conditions are satisfied. Refer to the Storage Panel section on page 3-12 for details.

Limit Check Panel

The Limit Check panel contains a slide switch, an alarm log progress bar, a padlock button, and an <OK> button. The Limit Check slide switch determines the ON/OFF status of the Limit Checking feature [ON is Up/Green; or OFF is Down/Red.

The Alarm Log Progress Bar graphically indicates how full the Alarm File is. The log can be accessed from the Display pull-down menu. The most recent alarm event will appear below the bar.

When there is an alarm event, channel labels will flash until the event is acknowledged. Click on the <OK> button to acknowledge all outstanding alarm events. You can right-click on a channel gauge to acknowledge alarm events for an individual channel. To list alarm events for a given channel, right-click on the channel's gauge, then select the View Alarm Event(s) menu option.

The padlock button is used to lock or unlock limit pointers.

Digital I/O Panel

The Digital I/O Panel contains an ON/OFF slide switch and a Relay Output Status display, which consists of 8 switches.

If the Digital IO slide switch is turned on, Digital I/O relay switches will activate [or deactivate] depending on the configuration set in the *Digital I/O Configuration window* (detailed in chapter 4). The window is accessible via the **Control** pull-menu.
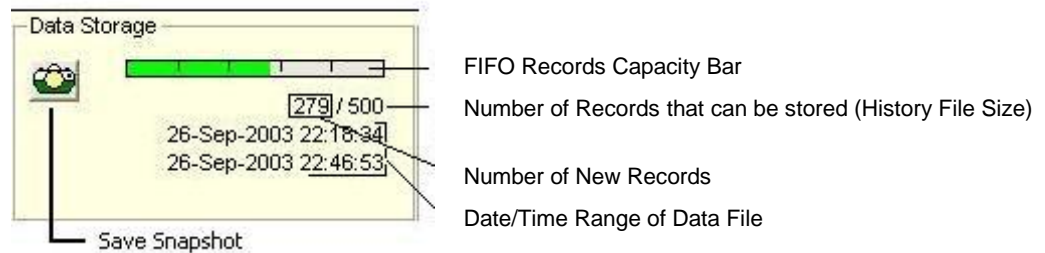
During an acquisition you can manually activate each switch by clicking on the associated button.

Data Storage Panel

The Data Storage Panel is easily recognized by its Snapshot [camera] button and the bar for Current Data Record / History File Size. Data storage uses the *First In First Out* (FIFO) method of receiving and releasing data.

The bar graphically indicates how full the file is. Two numbers, separated by a slash, reside just below the progress bar. In the example this is 279 / 500. The first number is the current data record number (279 new records); the second number is the entire number of records stored in the FIFO file 500. The number of new records is referred to as the History File Size. In this case the History File Size is 279.

Clicking the **<Snapshot>** (**camera**) button will save "N" seconds of data to the history file; where "N" is defined in the *User Snapshot* field of the Storage Tab [in the Configuration Panel] The Configuration Panel is accessed through the Edit pull-down menu. The Gauge Window's data storage panel includes the data file's Date/Time Range.

FIFO Records Capacity Bar

Number of Records that can be stored (History File Size)

Number of New Records

Date/Time Range of Data File

Options Panel

The Options Panel includes the following items.

(1) Show eZ-TOMAS Gauge Setup Files
(2) Display All Gauge Values
(3) Display Peak Hold Gauge Pointers
(4) Reset Peak Hold Gauge Values
(5) Display List of TOMAS Projects
(6) Display Machine Graphic Picture
(7) Enter a Project Note / Previously Saved Notes

Item (5), "Display List of TOMAS Projects," brings up a window that lists the available .tom project data files that can be displayed in eZ-TOMAS. The projects listed are those which are located in the folder for the current project, as well as the two folders adjacent to it. To locate other projects you can use the File pull-down menu, select "Open" and then use the "Look in" feature to locate available projects. The TOMAS Projects window displays the following for each project: File, Folder, Size, and Date Modified. To open a project in the list, double-click on it.

Item (6), "Display Machine Graphic Picture," brings up a selected .jpg or .bmp image to represent the associated machine or process being tested. The Machine Name is defined in the Project Information Window (see Edit Menu).

In regard to the graphic image, if you right-click in the window, two choices will appear: "Load graphic picture" and "Remove Graphic Picture." Clicking on the former allow you to browse your PC for the appropriate graphic. Note that this can also be accomplished through the Edit pull-down menu.

Item (7) Double-click in the indicated area to enter a note. Use the up/down arrow buttons to scroll through the notes. The note text, preceded by date appears in the Configuration Setup (tomas_Config.txt) Notepad, under *Project Information, Notes*. You can access the Notepad via the Display pull-down menu.

PROJECT Information -----------------

Company: Cosmic Industrial
Plant: Alpha Drive
Job No.:   2387-A
Machine 1:   33909919-A1
Machine 2:   77890998-A2
Note(s):
31-May-2007   See engineering note 1.A

Example of a Note (bottom line) as it Appears in Configuration Setup

A Look at the Gauges Pull-down Menu

Most of the Gauge window is occupied by gauges which display values for spectral bands and tachometers. Selection of the band types can be made from the "Gauges" pull-down menu.

The window supports up to four frames (A, B, C, D). Each frame can accommodate up to ten gauges.
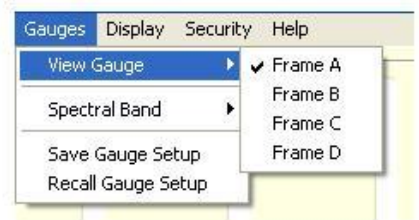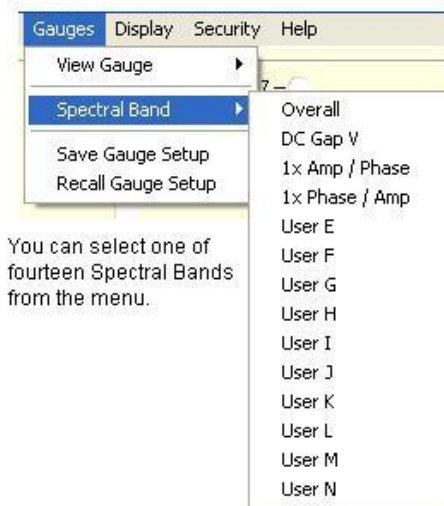
Gauges Pull-down Menu – Two Views

You can define the parameters of User Defined bands E through N in the Spectral Bands window as follows:

1. Open the Edit pull-down menu.
2. Select *Spectral Bands*.
3. Set the parameters of the User Defined bands (E through N) as desired.

Additional information of primary importance to the gauge window is included in chapter three, which concerns the window's Edit menu.

Monitoring a Machine 2

Note: The File Menu discussed in this chapter is located in the Gauge Window's menu bar. It is not to be confused with the Plot Window's File Menu.

An eZ-TOMAS Project is a collection of data files, typically associated with a monitored machine. The data files include configuration and measured data. When eZ-TOMAS is activated it attempts to open the last eZ-TOMAS Project accessed.

Note: If you are monitoring a machine for the first time, you should create a new eZ-TOMAS Project to store the machine's configuration and vibration data.

If you have already created an eZ-TOMAS Project for the machine, use the **File** pull-down menu and select **Open** to pick up where you left off.

The configuration and data files have a FIFO design. When you turn on the acquisition switch, data will be appended to the data files.

Using the File Pull-down Menu   *[In Gauge Window]*

Open Project

Though this function is listed third on the menu list, we will mention it first here as it is frequently used and requires very little explanation. The **Open Project** option provides a means of locating and opening an existing eZ-TOMAS project.

Note: When eZ-TOMAS is started, it opens the last active project.

New (Clone) Project – Creates a Copy of a Project and its Data

Cloning a project keeps all of the values from the original project.

The **New (Clone) Project** option opens the *Save As* window. The first step in creating a new project is to select or create a Folder where the new project's files should be saved. Enter a filename for the project, then click the <**Save**> button.

Each eZ-TOMAS Project contains eZ-TOMAS **configuration** and **data** files. You should logically equate an eZ-TOMAS Project with a specific machine. This is accomplished as follows:

1. On the **File** pull-down menu, select **New (Clone) Project**. This opens the **Save As** window.
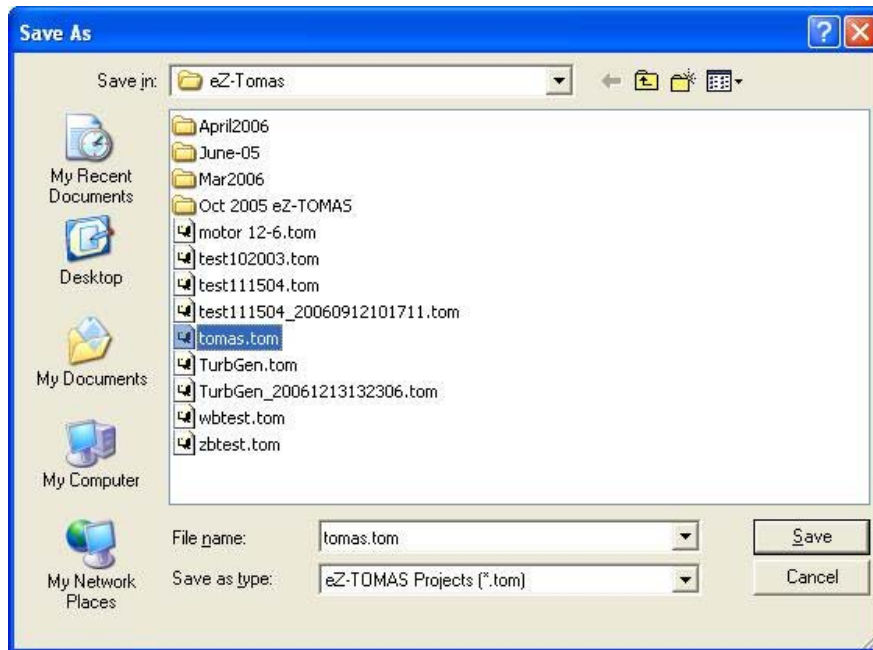
Save As Window, Being Used to Create a New File

2. Select [or create] a Windows folder for the eZ-TOMAS Project.

3. Enter the desired filename for this project.

4. Click the <**Save**> button to create the new project.

Initialize Project – Creates a New Project and Sets the Number of Available Channel Inputs

When a project is initialized you are essentially starting with a "clean slate." No data is carried over as when a project is cloned.

To inform eZ-TOMAS as to what type of hardware will be used, select "Initialize Project" from the Gauge Window's File pull-down menu. The resulting window allows you to select a Hardware Device and the applicable number of input channels.

> **If you have multiple hardware modules, and change the number of Input Channels, you need to use the *initialize* function to create a new eZ-TOMAS Project. This needs to be done once, for the first implementation of the new hardware setup. An explanation of how to access and use the *Initialize Project* function follows.**
>
> **When a project is initialized you are essentially starting with a "clean slate." No data is carried over, as would be when a project is cloned.**

"Initialize Project" is accessed from the File pull-down menu. Initialize Project provides a means of selecting the hardware device and setting the number of input channels. For example: If you had an 8 channel ZonicBook/618E and were going to change your acquisition to 24 channels, for example, using the ZonicBook/618E and two WBK18 modules, you would need to use the *Initialize Project* feature.

Complete the following steps to initialize a project. Note that the step numbers correspond to the numbers in the figure.
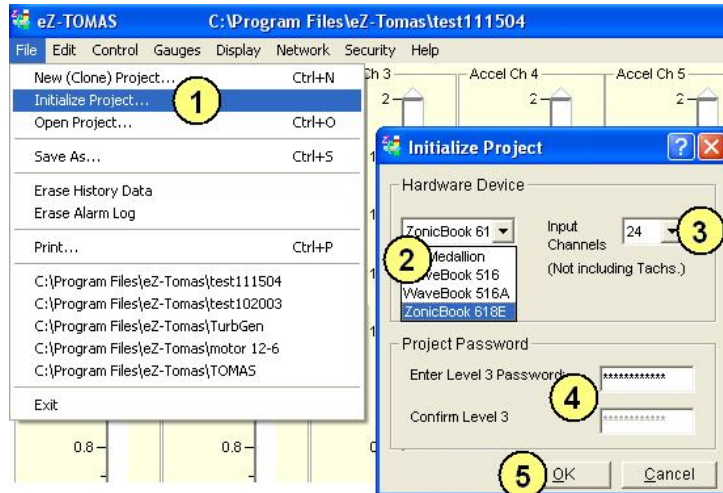
1. From the File pull-down menu, open "Initialize Project." An Initialize Project dialog will open.

2. Select the Hardware Device (e.g. 640u, ZonicBook/618E) from the associated pull-down list.

3. Select the number of analog input channels from the associated pull-down list. For ZonicBook/618E do not count the separate tach channels as input channels.

4. If applicable, enter and confirm the project password.

5. Click the <OK> button.

Note that the last section of the preceding chapter includes an example for 24 channels.

Save As

The **Save As** option allows you to backup history files in a binary file format, or export files in an ASCII file format. This command opens the **Backup/Save eZ-TOMAS Project** window. The options in this window change as you make selections. You can backup and export full or partial files.

> **Note:** The disk space required to backup the selected records is displayed on the left panel.

Entire Project

The **Entire Project** option is only available when data acquisition is turned off. Entire Project performs a file copy operation to the specified Windows Directory. This backup method is the fastest.
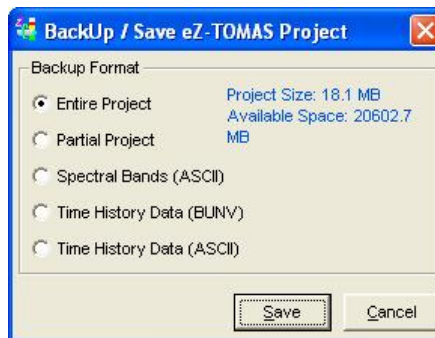
Save As… Entire Project

Partial Project

The **Partial Project** option can be used when data acquisition is active. This option copies data and the configuration setup to the designated folder for the date and time range specified in the panel on the right.

To make a partial backup:

1. Select the range you want to backup [see next section, Selecting Range Limits].

2. Click the <**Save**> button. The *Save As* window will open.

3. Select the folder where the file is to be saved.

4. Enter a filename.

5. Click the <**Save**> button.

Save As… Partial Project

Selecting Range Limits

For each backup format, with exception of "Entire Project," you will need to select the start and stop points to define the range of data. This section explains how to use the Date/Time panel to set the range.

o **Button <A>** [in the following figure] resizes to the default history range.

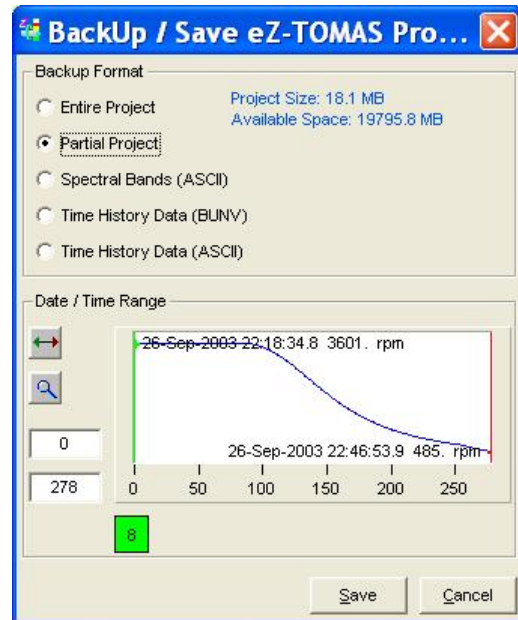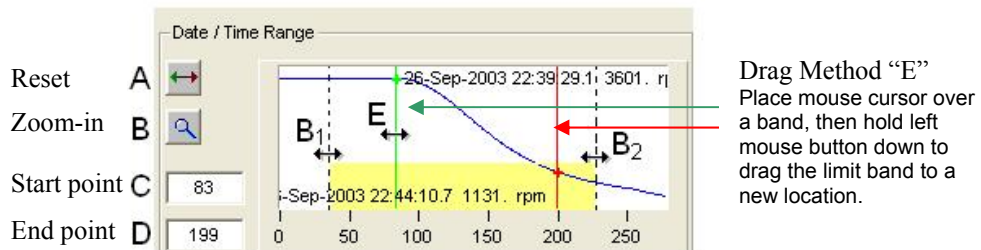o **Button <B>** zooms in on the history range. This affects the view, not the range. After clicking on the button, put the mouse cursor at a point on the screen where you want the viewing area to begin (such as B_1 in the figure) and drag the mouse to the desired zoom end-point (for example, B_2). We have used a yellow band to show what would be in the new viewing area. Note that clicking button <A> would now reset the range.

o **Numeric fields "C" and "D"** allow you to enter range start and stop points. In the example these are 83 and 199. Note that the displayed Date/Time/RPM information changes to reflect the associated range end-point as you move the green or red limit band.

o **"Drag Method E"** You can place the mouse cursor over the green (start) and red (end) limit bands, and then use the mouse to drag the selected band to a new range point.

o Click the <**Save**> button once you have selected the desired range.

Backup Format – Spectral Bands (ASCII)

This option creates an exportable ASCII file for the spectral band data that resides within the specified Date/Time range.
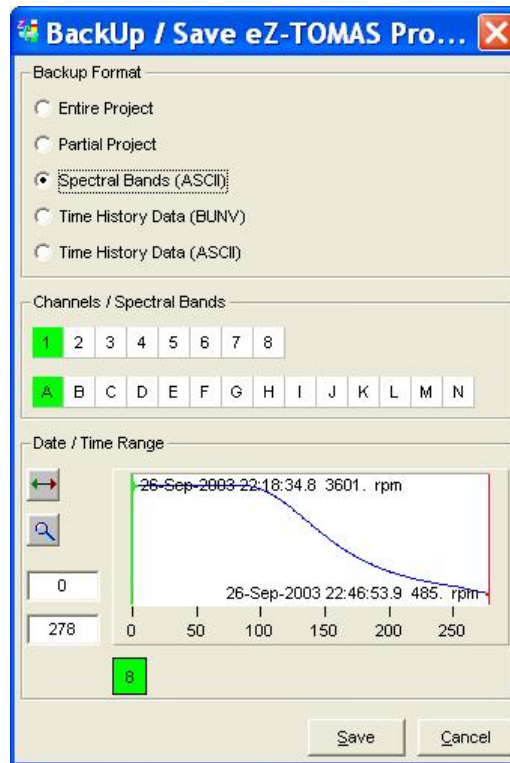
Save As… Spectral Bands (ASCII)

Backup Format – Time History Data (BUNV)

This option creates an exportable Binary Universal (UFF-58B) format (BUNV) file for the Time History data that resides within the specified Date/Time range.
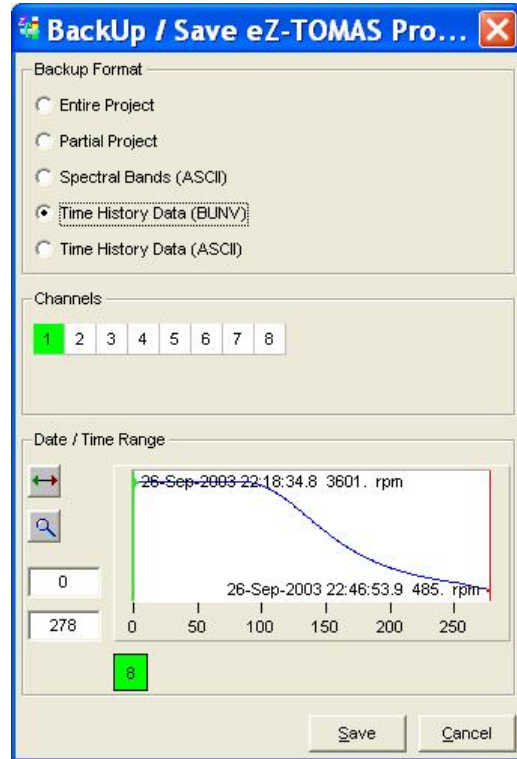
Save As… Time History Data (BUNV)

BackUp Format – Time History Data (ASCII)

You can save time history data in ASCII format. Select the: *File-Save As* menu option, then Click on the Time History Data (ASCII) menu option.

NOTE:

This option can result in relatively large files.

Save As… Time History Data (ASCII)

```
EZ-TOMAS 5.5.09
ASCII Time Waveform Data Report generated 30-Aug-2006 11:15:01
Project Path: J:\Tomas Software\Data\Unit #2 Pre Outage\Ops Duwn 92603

Start Date:   26-Sep-2003 22:39:13
End Date:     26-Sep-2003 22:43:00

Sampling Rate:  1280. samples/second
Delta Time:     0.00078125 seconds

1.       Brg 1Y  mils
2.       Brg 1X  mils
4.       Brg 2 "X"      mils

Date / Time             mSec    Sample  Time Waveform Data

26-Sep-2003 22:39:13    190     1       0.1830 -1.014 1.362
26-Sep-2003 22:39:13    190     2       0.6764 -1.136 1.266
26-Sep-2003 22:39:13    190     3       1.131  -1.195 1.460
26-Sep-2003 22:39:13    190     4       1.456  -1.136 1.793
26-Sep-2003 22:39:13    190     5       1.702  -0.9803 1.991
26-Sep-2003 22:39:13    190     6       1.773  -0.8245 1.996
26-Sep-2003 22:39:13    190     7       1.729  -0.6158 1.920
26-Sep-2003 22:39:13    190     8       1.580  -0.3180 1.988
26-Sep-2003 22:39:13    190     9       1.288  -0.1010 1.878
26-Sep-2003 22:39:13    190     10      0.8858 0.1411 1.709
Etc…
```
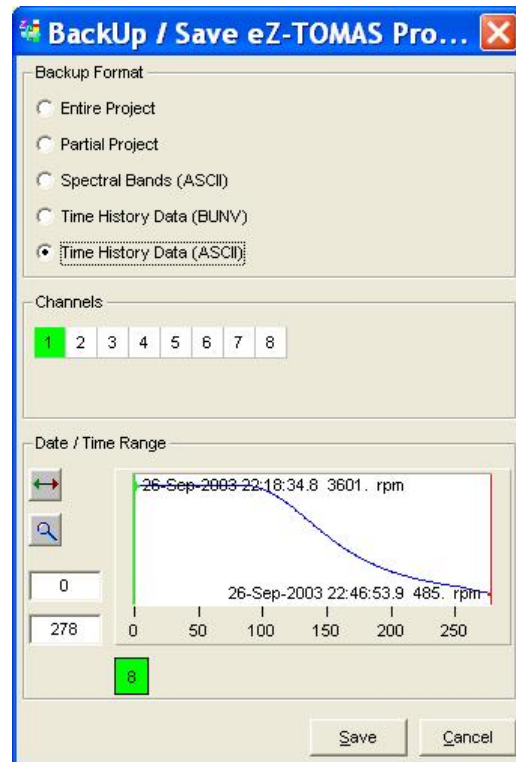
Erase History Data

Use the Erase History Data option with caution. This menu item will erase History Data for the project.   All data for the active project will be permanently removed. It is not recoverable.
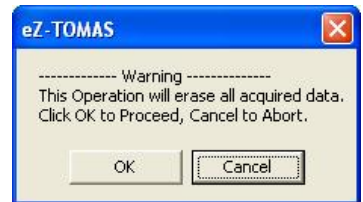
Warning for Erase History

Erase Alarm Log

Use the Erase Alarm Log option with caution. This menu item will erase the Alarm Log file for the project. It is not recoverable.

Warning for Erase Alarm Log

Print   "Print" brings up the Print Window for printing the current screen.

Exit   Closes the eZ-TOMAS application.

Configuring the Project

A default configuration is automatically loaded when you open an eZ-TOMAS file. However, you may want to make some changes to the configuration. To make changes:

1. From the eZ-TOMAS Main Window, open the **Edit** pull-down menu.

2. Select **Project Information** to open the associated window (following figure). Update information and/or add notes as applicable.

Project Information Window

3. After the Project Information is as desired, click the <OK> button.

4. In the Edit menu select **Configuration**. The **Setup Configuration** window will appear (following figure).

Reference Note:
The four tabs of the Setup Configuration window are labeled: *Acquisition, Input Channels, Spectral Bands,* and *Storage*. They are discussed briefly in this section and in detail at the beginning of *Chapter 4, Edit Menu*.

5. Make sure that the Hardware panel reflects the correct device, e.g., ZonicBook/618E.
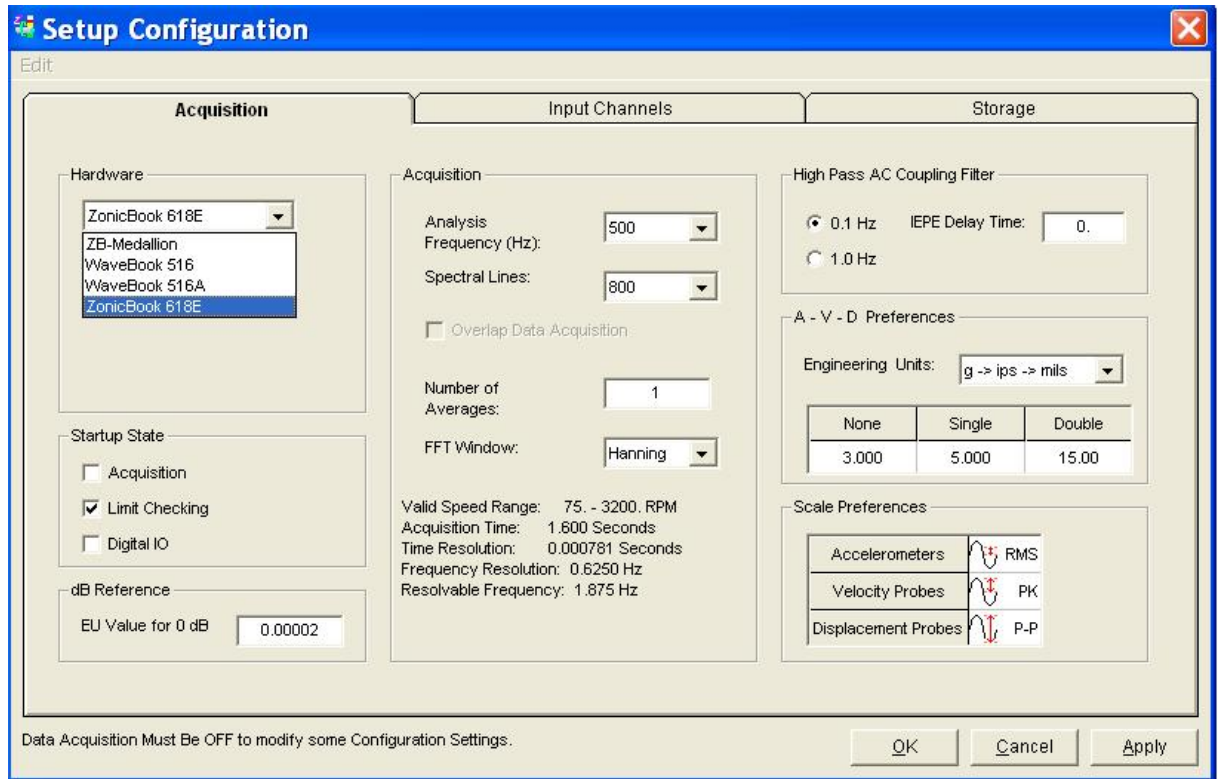
Setup Configuration Window, Acquisition Tab

> **Clicking the <Cancel> button will undo all the changes you've made since you opened the *Setup Configuration Window*.**

6. Make the desired changes for each of the tabs and then click the <**Save**> button.

You can start monitoring immediately.

Acquisition Tab – From the Acquisition tab you can set up parameters that include, but are not limited to: Block Size, Analysis Frequency, Low Cutoff Frequency, FFT Window, and Number of Averages.

Input Channels Tab – From the Input Channels Tab you can change channel parameters. This includes, but is not limited to assigning channel types, customizing channel names, setting the instrument range per channel, and assigning units.

Storage Tab - From the Storage Tab you can specify how you want trigger data storage. If any one event is triggered, data from all channels is stored. Data storage events are triggered when a change occurs in the monitored machine's condition. The basic idea is to activate storage based on **Time Change** *and/or* **Speed Change** *and/or* **Amplitude Change**.

Refer to chapter 3 for more information regarding the Setup Configuration tabs.

Starting an Acquisition

After you configure your eZ-TOMAS Project, click the <**Acquisition> Switch** to place it in the ON (green) position. This starts the data acquisition. The switch is located in the in the lower left corner of the eZ-TOMAS gauge window.

When acquisition is active, real time overall values are displayed in the instrument gauges.

To stop data acquisition, click the switch. It appears in the slide-down position for OFF (red).

Viewing Spectral Bands

You can set spectral band options from the Main Gauge Window. There are several methods of setting gauges; these are discussed below.

In the partial gauge window at the right, we see five gauges with spectral bands selected as follows, from left to right.

1. DCGapV. Vdc
2. 1xAmp: mils (p-p)
3. 1xAmp: mils (p-p)
4. DCGapV: Vdc
5. Overall: mils (p-p)

We can change the spectral band for each gauge, independently; or we can make a global change – where we would apply the same spectral band to all gauges at once.
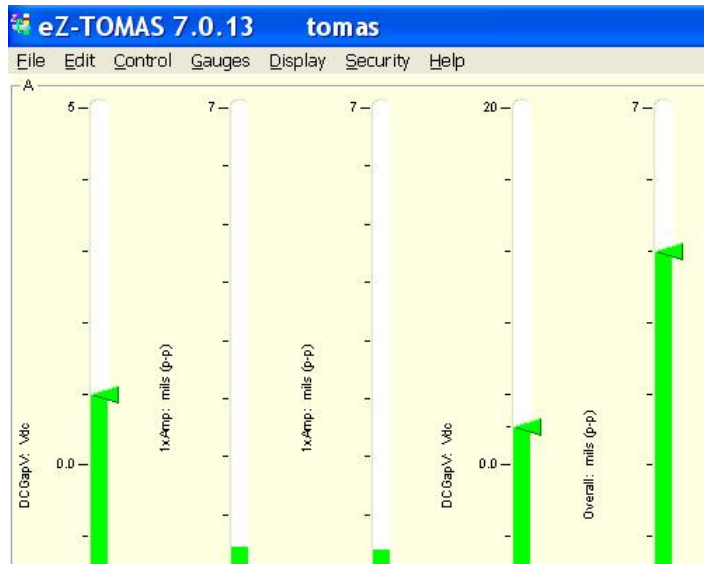
To set a gauge independent of other gauge settings:

1. Right-click in the applicable gauge.
2. Select "Spectral Band."
3. Select the desired band type.
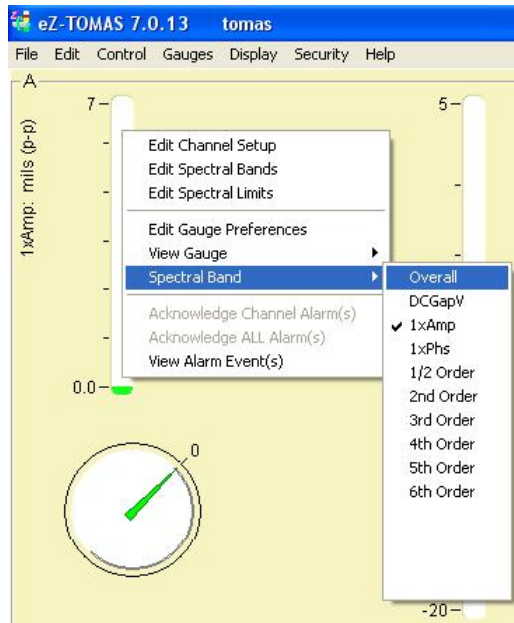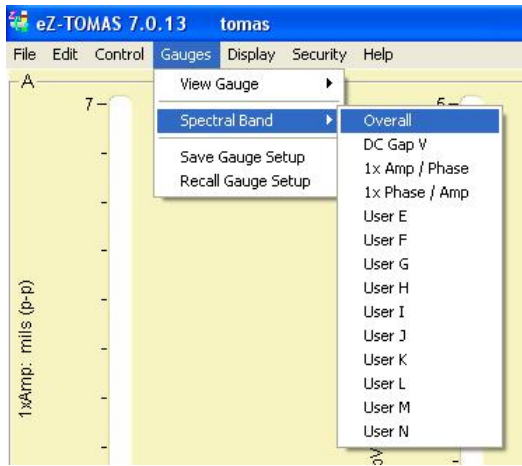
To set all gauges to the same type of spectral band, i.e., to make a global change:

1. Open the **Gauges** pull-down menu.
2. Select the band of interest.

As soon as step 2 is performed, all gauges will change to the selected spectral band.

Note: Selecting 1x Amp/Phase or 1x Phase/Amp results in two gauge types. In both of these instances, a vertical gauge will display for 1x Amplitude and a circular phase gauge will display for 1x Phase.
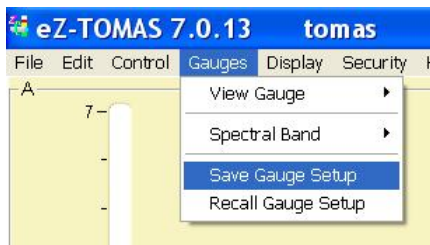
To set all gauges to a previously established set of gauge settings:

You must first have one or more saved gauge setup files. When you have a setup that you believe you will use frequently, open the Gauges pull-down menu and select "Save Gauge Setup." In the "Save As" window that appears, select a Filename and a location. Then save the .tgs file.

You can either:

(a) use the Gauges pull-down menu and select "Recall Gauge Setup" or

(b) click on the <Show eZ-TOMAS Gauge Setup Files> button.

You can also affect the Gauge Window from the Edit pull-down menu.

Selecting "Gauge Preferences" opens an associated window. See following figure. From there you can drag a desired spectral band type over to a specific gauge. The Gauge Preferences window is discussed in detail in chapter 3, Edit-menu.
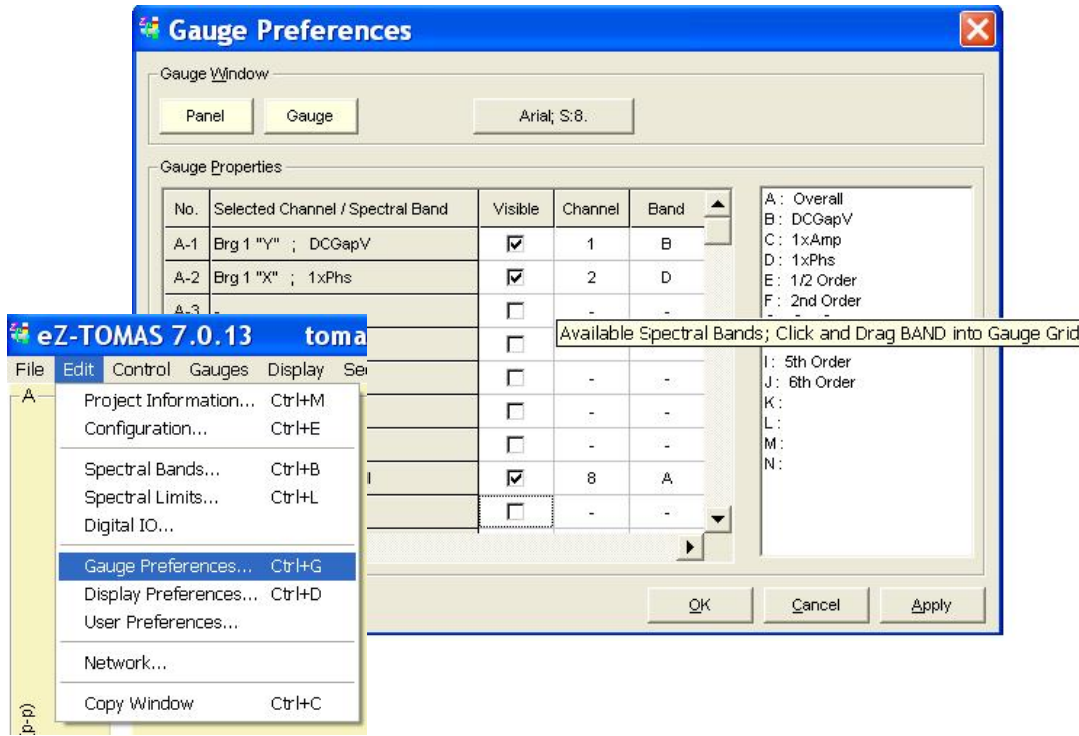
The "Spectral Bands" selection in the Edit-menu opens up a window which resembles the following. Making changes in this window will impact the Gauge Window.

Refer to chapter 3 for details on this and other aspects of the Edit menu.

Spectral Bands

Edit

Input Channels

`1 2 3 4 5 6 7 8`

Selected Channels:
1. Brg 1 "Y"

Spectral Bands: Brg 1 "Y"

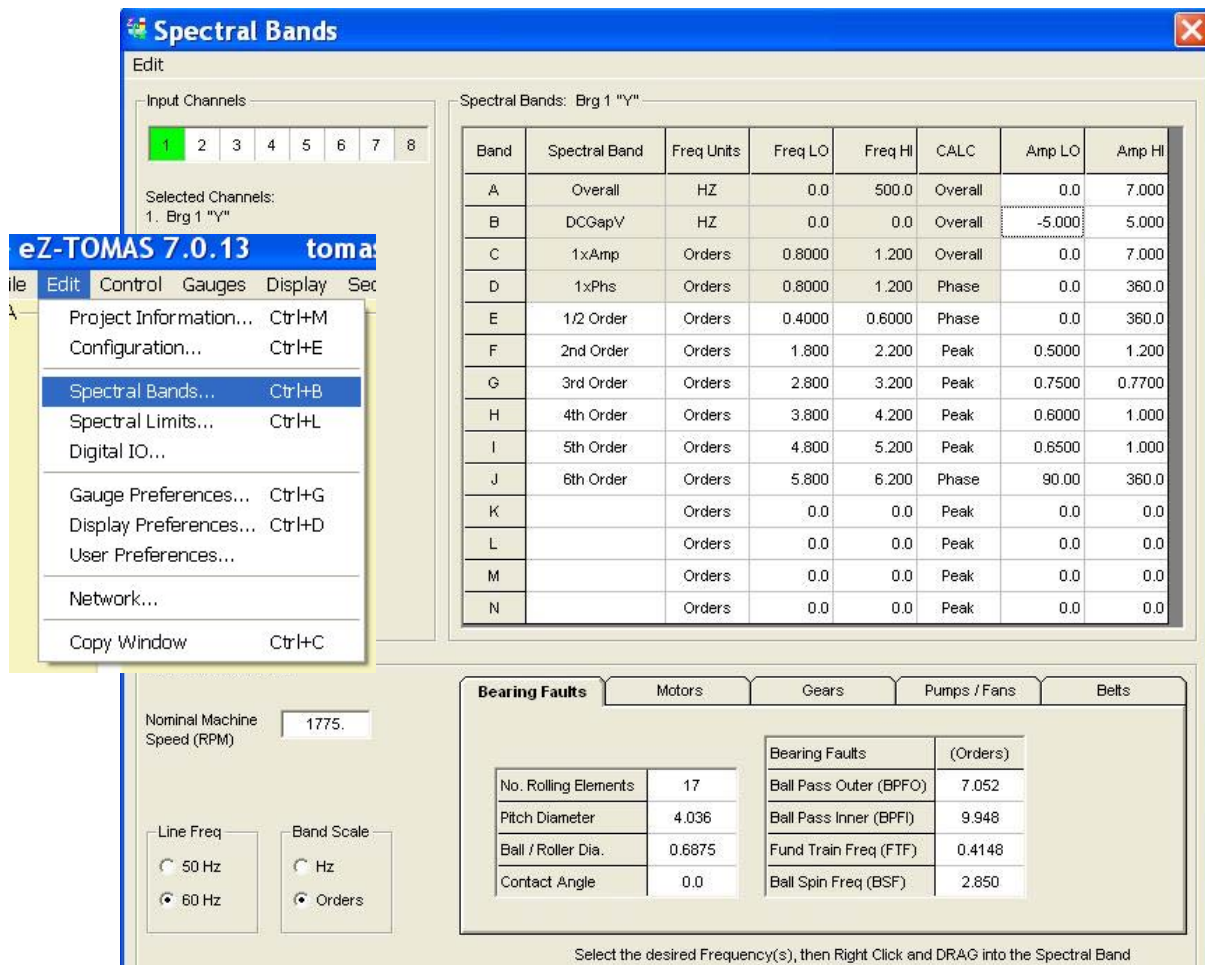| Band	Spectral Band	Freq Units	Freq LO	Freq HI	CALC	Amp LO	Amp HI
A	Overall	HZ	0.0	500.0	Overall	0.0	7.000
B	DCGapV	HZ	0.0	0.0	Overall	-5.000	5.000
C	1xAmp	Orders	0.8000	1.200	Overall	0.0	7.000
D	1xPhs	Orders	0.8000	1.200	Phase	0.0	360.0
E	1/2 Order	Orders	0.4000	0.6000	Phase	0.0	360.0
F	2nd Order	Orders	1.800	2.200	Peak	0.5000	1.200
G	3rd Order	Orders	2.800	3.200	Peak	0.7500	0.7700
H	4th Order	Orders	3.800	4.200	Peak	0.6000	1.000
I	5th Order	Orders	4.800	5.200	Peak	0.6500	1.000
J	6th Order	Orders	5.800	6.200	Phase	90.00	360.0
K		Orders	0.0	0.0	Peak	0.0	0.0
L		Orders	0.0	0.0	Peak	0.0	0.0
M		Orders	0.0	0.0	Peak	0.0	0.0
N		Orders	0.0	0.0	Peak	0.0	0.0

eZ-TOMAS 7.0.13   toma:

ile **Edit** Control Gauges Display Sec

Project Information...	Ctrl+M
Configuration...	Ctrl+E
Spectral Bands...	Ctrl+B
Spectral Limits...	Ctrl+L
Digital IO...	
Gauge Preferences...	Ctrl+G
Display Preferences...	Ctrl+D
User Preferences...	
Network...	
Copy Window	Ctrl+C

Nominal Machine Speed (RPM)   1775.

Line Freq
○ 50 Hz
● 60 Hz

Band Scale
○ Hz
● Orders

| Bearing Faults | Motors | Gears | Pumps / Fans | Belts |

			Bearing Faults	(Orders)
No. Rolling Elements	17		Ball Pass Outer (BPFO)	7.052
Pitch Diameter	4.036		Ball Pass Inner (BPFI)	9.948
Ball / Roller Dia.	0.6875		Fund Train Freq (FTF)	0.4148
Contact Angle	0.0		Ball Spin Freq (BSF)	2.850

Select the desired Frequency(s), then Right Click and DRAG into the Spectral Band

Plotting Data

Click on "**Display"** in the main window's menu bar, then select "**Plot Windows**." The Data Display Window will open. Note that you can double-click on a gauge to open the Data Display Window to plot data for that specific channel.

Multiple Plots

1. On the second row of the Plot Windows toolbar, click the <Open New Plot Window> button (see figure). This opens a second display window. As an alternative to using the button you can open a new Window from the Window pull-down menu.

2. On the **Window** pull-down menu of the Plots window, select either *Tile Vertically* or *Tile Horizontally*.

   All display windows will be shown simultaneously.

3. Select the Channel(s) and Display type for each window.

File   Edit   Window   Help

Open New Plot Window
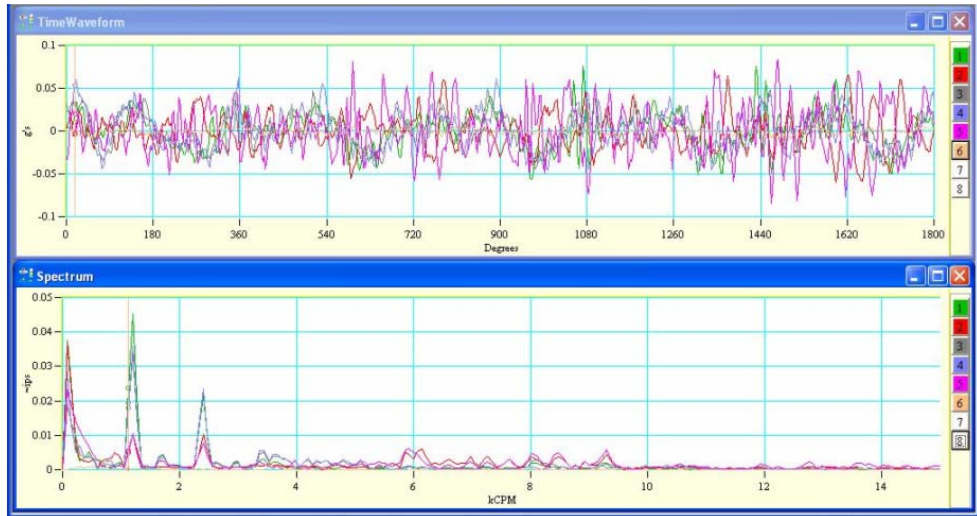
Time Display and Spectrum Display Plots Tiled Horizontally
Each plot is longer in the horizontal direction.

A **cursor** is provided with each display. To move the cursor, place your mouse icon over the cursor and drag it to the desired location on the trace or use the East / West Arrows.

"Real Time" Plot Controls

"Real Time" is the default data source. For **Real Time** displays you can **Halt and Resume** the display of data by using the <**Pause/Continue**> toggle button (see following figure). As an option to the **<Pause/Continue>** button you can use the "**P**" key on the PC's keyboard. A table, which identifies all control buttons follows shortly.

The **<Clear Real Time Plot Buffer>** button, which looks like a black "X,"allows you to clear the data in the realtime trend displays. This display option can be used to clear the plot displays prior to starting a test.
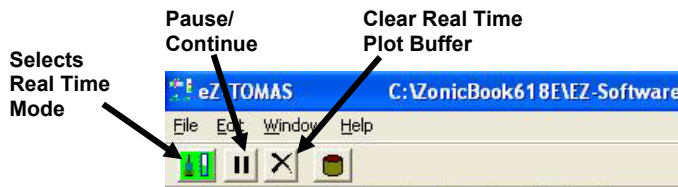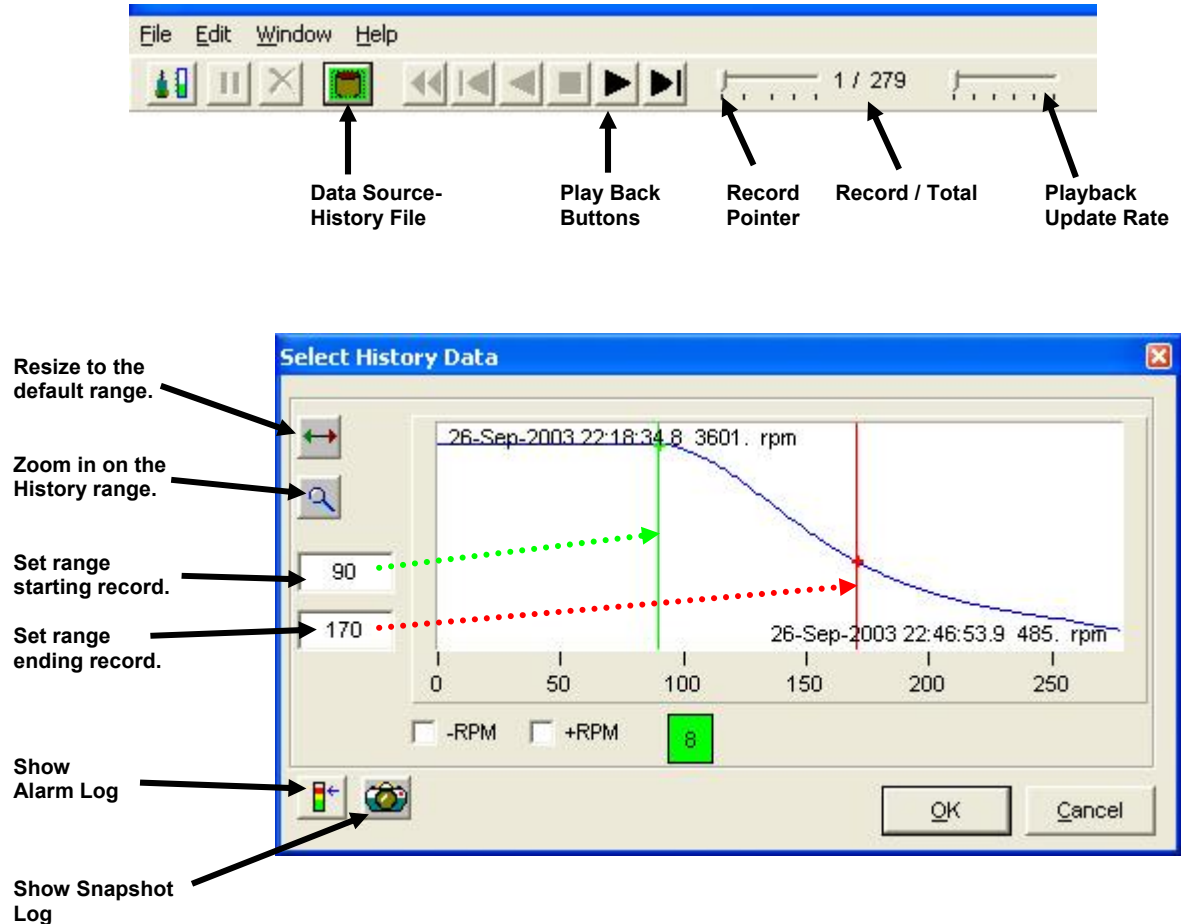

Real Time Mode is Selected

Reference Note:
Refer to chapter 6 for more detailed information regarding Plots and the associated toolbar buttons and other controls.

"History Data" Plot Controls

When viewing **History Data** (pre-recorded data files), you can use the set of playback buttons or the slider bar to navigate through the data. A table, which identifies all control buttons, is included in chapter 6. Note that the playback buttons and slider remain hidden in the GUI when eZ-TOMAS is in the Real Time mode.

History Data is accumulated according to the parameters setup in the Setup Configuration window's Storage Tab, which is accessed via the Gauge Panel window's Edit Menu.


| Data Source-History File | Play Back Buttons | Record Pointer | Record / Total | Playback Update Rate |

Resize to the default range.

Zoom in on the History range.

Set range starting record.

Set range ending record.

Show Alarm Log

Show Snapshot Log

Reference Note:
Refer to chapter 6 for more detailed information regarding Plot displays, associated toolbar buttons, and other controls.

Viewing Reports

eZ-TOMAS can generate the following types of reports, which are accessible from the Display pull-down menu.
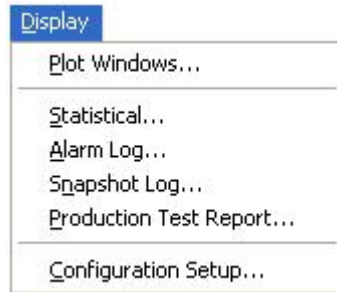
Display Pull-down Menu

The **Statistical Report** lists the historical spectral band data. It includes the instrument, the engineering units, the minimum value, the mean average value, the maximum value, and the standard deviation by channel.   Statistical reports can be used to automatically generate limit values based on historical data.

The **Alarm Log** is a record of the last "N" number of alarm events. The number of alarms was specified in the Setup Configuration window under the Storage Tab. The Alarm Log includes the date and time, the channel number, reference tachometer, instrument name, spectral band type, alarm type, and value of the alarm signal.

The **Snapshot Log** can be accessed from the Reports pull-down menu, or from the History Data Window. The Snapshot Log file contains entries which were created whenever the user clicked the **<Snapshot>** button, which is located in the *Gauge Window's Data Storage* panel.

The **Production Test Report.** The feature allows you to generate a custom report, which can include the company logo or other graphic, such as a machine image. The Production Test Report application is primarily used by manufacturers, as it summarizes the results of each tested machine state in an easy-to-read report. The feature uses Microsoft Excel 2000 (version 9.x) or later.
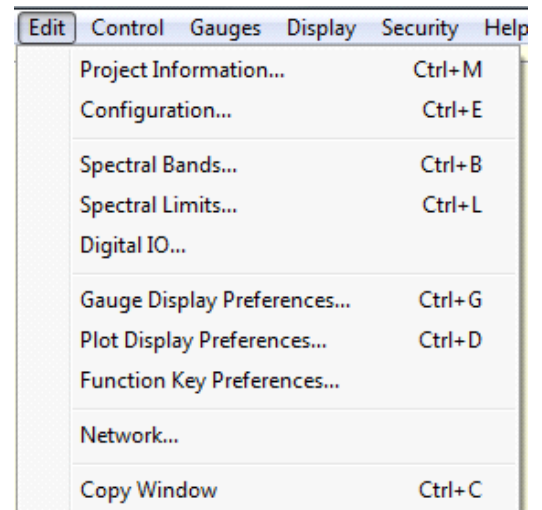
Selecting **Configuration Setup** from the Reports pull-down menu creates a text file that contains configuration details of the current project.


Reference Note:
Refer to Chapter 6, *Display… Reports*, for detailed information regarding each report type and for instructions pertaining to generating limits.

Edit	Control	Gauges	Display	Security	Help
Project Information...				Ctrl+M	
Configuration...				Ctrl+E	
Spectral Bands...				Ctrl+B	
Spectral Limits...				Ctrl+L	
Digital IO...					
Gauge Display Preferences...				Ctrl+G	
Plot Display Preferences...				Ctrl+D	
Function Key Preferences...					
Network...					
Copy Window				Ctrl+C	

Note: The Edit Menu discussed in this chapter is located in the Gauge Window's menu bar.
It is not to be confused with the Plot Window's Edit Menu.

Project Information
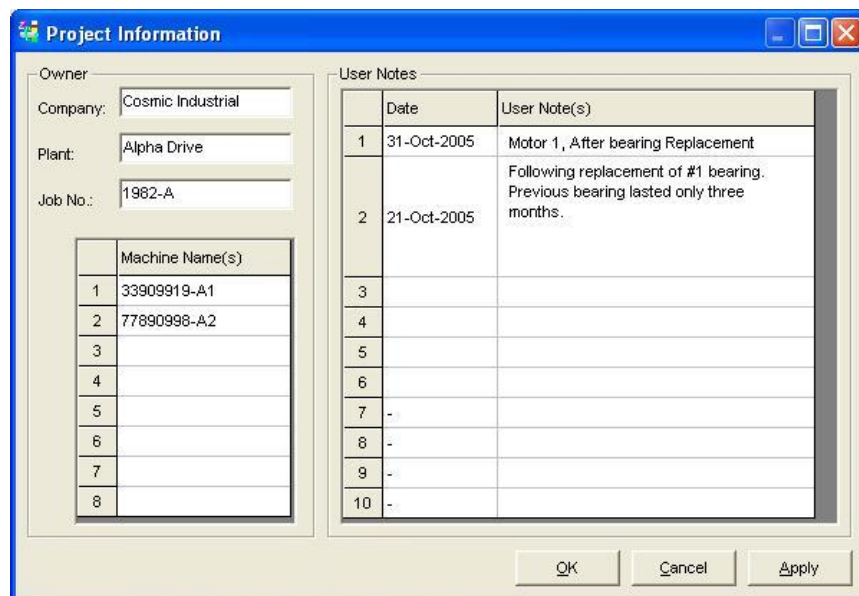
The Project Information window allows you to add general details to the eZ-TOMAS project: Company, Plant, Job Number, and up to 8 alphanumeric Machine Names.[1]   Up to 10 user notes [each up to 256 characters] can be added to each project. Double-click in a text field to add or edit information.

The information in this window can be added to analysis displays as plot annotation, which can be useful when generating reports.

[1]**Note**: When entering project information that uses an ampersand, for example "Smith @ Jones," the ampersand
might not appear on reports. If this is the case, entering the ampersand twice should remedy the issue.
Thus an entry of "Smith @@ Jones" would result in "Smith @ Jones."
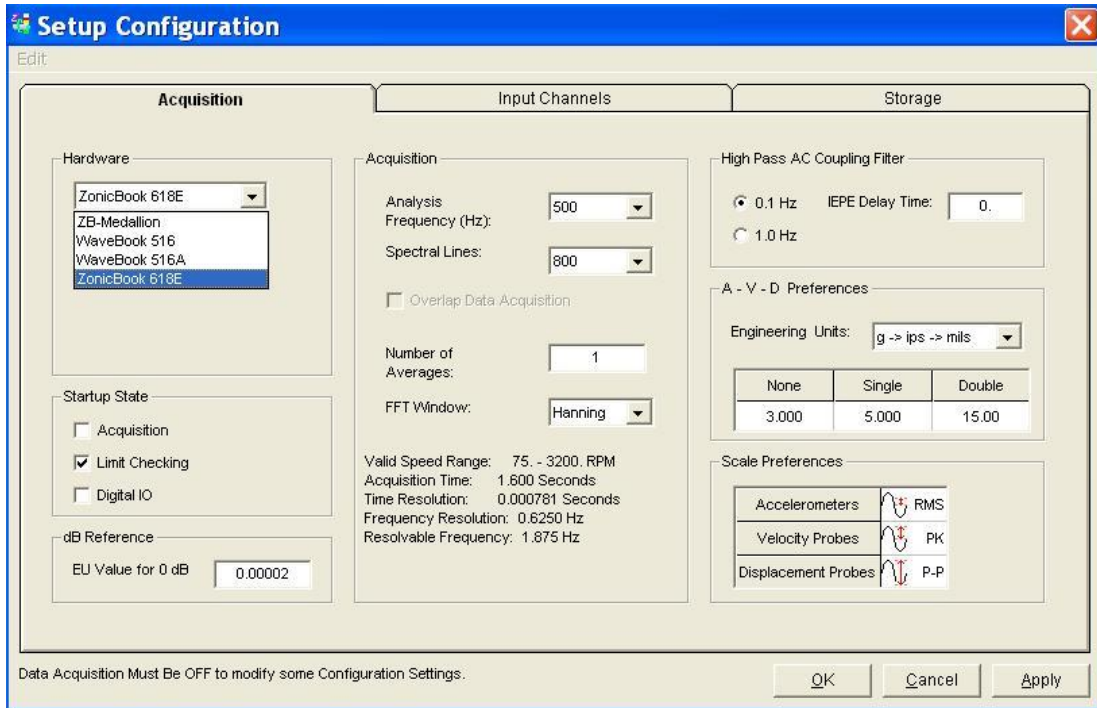
Configuration……

This opens the *Setup Configuration* Window, which has three separate tabs for configuring the acquisition device. Click the appropriate tab [Acquisition, Input Channels, or Storage], make the necessary changes in each, then click the <**OK**> button to save all your changes and close the window.

> **Clicking the <Cancel> button will undo all unsaved changes.**
>
> **You must turn acquisition off and then on again for Acquisition Configuration changes to take effect.**

Acquisition Tab

Acquisition Tab

The Acquisition tab is used to configure how the data will be acquired and processed. For eZ-TOMAS, **sampling rate** and **through-put** rate are determined by two user-set parameters: **Analysis Frequency** and **Spectral Lines**. The following table shows parameter relationships. Information was obtained from the above screen-shot.

| Parameter	Calculation (based on above Acquisition Tab)	
Sampling Rate = Analysis Frequency x Nyquist Factor	= 500 Hz x 2.56 = 1280 samples per second	*The sampling rate applies to ALL input channels.*
Time Resolution = 1 / Sampling Rate	= 1 / 1280 samples per second = 0.000781 seconds	
Acquisition Time = Spectral Lines / Analysis Frequency	= 800 Lines / 500 Hz = 1.6 seconds	
Frequency Resolution = Analysis Frequency / Spectral Lines	= 500 Hz / 800 Lines = 0.625 Hz	
Block of Time Data = Spectral Lines x Nyquist	= 800 x 2.56 = 2048 samples	

## Panels of the Acquisition Tab

Hardware
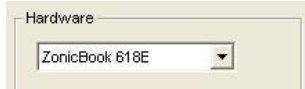
The Hardware Panel has a pull-down list from which the applicable data acquisition device must be selected: IOtech 600 Series, WaveBook, ZonicBook, Medallion.

Startup State
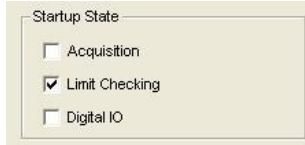
Used to set the default startup state for the Project's Acquisition, Limit Checking, and Digital IO processes.   eZ-TOMAS will turn on the selected processes when the project is opened.

dB Reference
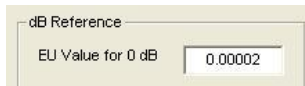
This panel is used to set the 0 dB reference point in Engineering Units (EU). The EU value for 0 dB reference is used with microphone input channel types. The default setting is 20 micro-Pascals (0.000020 pa).

Acquisition
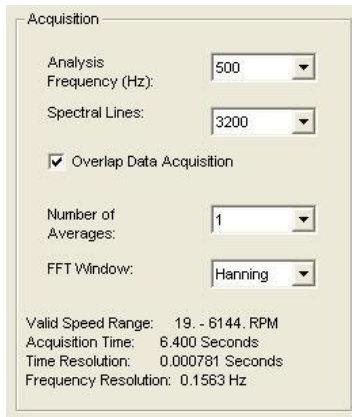
Analysis Frequency (Hz) The maximum frequency of interest. The sampling rate will be 2.56 times the analysis frequency. Verify the maximum frequency response of your probes. For a Tach signal, your Analysis Frequency should be a higher multiple of the maximum rotating speed. Typically, this multiple is at least 10 times the rotating frequency.

Spectral Lines The number of lines per spectrum and the number of data samples used in the FFT (Fast Fourier Transform) process. The more spectral lines, the greater the data resolution.   As the number of spectral lines increases, so does the time that it takes to collect the data and the amount of disk space.

Overlap Data Acquisition For slow speed data acquisition applications, you have the option to select overlap data processing to speed up real time data displays. This option is enabled when the Acquisition Time is greater than 2 seconds.

If you select Overlap Data Acquisition, eZ-TOMAS will automatically determine the overlap percentage needed to achieve a 1 to 2 second display update rate. For example, if your analysis frequency is 500 Hz and you have 3200 spectral lines, the acquisition time is 6.4 seconds. With Overlap Data Acquisition, the overlap percentage will be 75% and the update rate will be 1.6 seconds. (6.4 sec / 4). The divisor is a power of 2.

Number of Averages The number of data blocks averaged before a block of data is accepted and displayed. Typically, the value is "1" indicating *no averaging*.

FFT Window Fast Fourier Transform. FFT is 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. The FFT Window is a weighting window, typically either Hanning or Flat Top. Hanning provides better frequency resolution. Flat Top provides better amplitude resolution.

High Pass AC Coupling Filter (Hz)
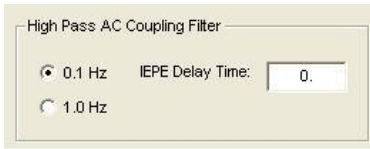
High Pass AC Coupling Filter: When AC Coupling is selected in the Input Channels tab, the associated input signals will pass through a **0.1 Hz** or a **1.0 Hz** High Pass Filter, depending on which radio button is selected.

IEPE Delay Time - The typical IEPE charge time for a 0.1 Hz AC coupling filter is 40 to 60 seconds, and 4 to 6 seconds for a 1.0 Hz AC coupling filter. While the IEPE is charging, you will see large DC offsets in the acquired data.

For this reason you may want to enter an IEPE Charge delay time. eZ-TOMAS will pause data acquisition and storage for the indicated time period.

Acceleration – Velocity – Displacement Preferences
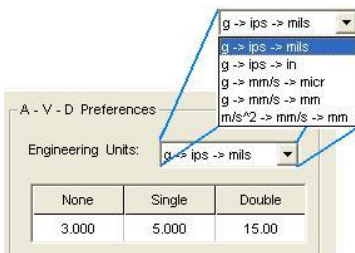
Accelerometer and Velocity signals can be integrated. Select the desired integration units from the Engineering Units pull-down list.

The High Pass Display Filter applies to the frequency displays and calculations, such as the Overall Vibration Level. The filter values (Hz) can be defined for each integration type. Frequency data below the set filter value is zeroed. This is useful when you want to remove the "Ski-Slope" effect of integration.
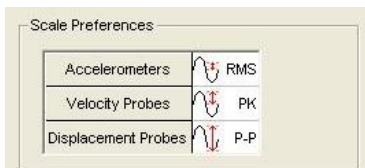
Important: **Make sure the Filter Value is lower than the Machine running speed, by at least 50%.**
Example: For a running speed of 1200 RPM we would need to set the filter value to 10 Hz or lower. Calculated as follows:
$0.5(1200_{rev}/60_{sec}) = 0.5(20_{rev}/_{sec}) = 10Hz$

For related information, see INT/DIFF on page 3-7.

Scale Preferences

The instrument scale preferences can be defined for Acceleration, Velocity, and Displacement input types.

You can select one of the following for each of the three instrument types:

RMS

Peak (PK)

Peak-to-Peak (P-P)

Terms and factors related to the Acquisition Panel

|	
Nyquist Factor	In eZ-TOMAS waveform frequency is multiplied by a nyquist factor of 2.56. This ensures that a sampled analog signal is accurately reconstructed. The 2.56 nyquist factor is the most efficient in FFT Analysis.
Sampling Rate	A rate that is 2.56 times the Analysis Frequency. If the Analysis Frequency was 1000 Hz and if the Spectral Lines was 800 lines; then the Sampling Rate would be 2560 samples per second. This rate would apply to each channel. Derived from: Analysis Frequency x 2.56 = 1000 x 2.56 = 2560.
Spectral Resolution	Spectral Resolution equals the Analysis Frequency divided by the number of Spectral Lines.

Example: Analysis Frequency: 1000 Hz
                  Spectral Lines: 800
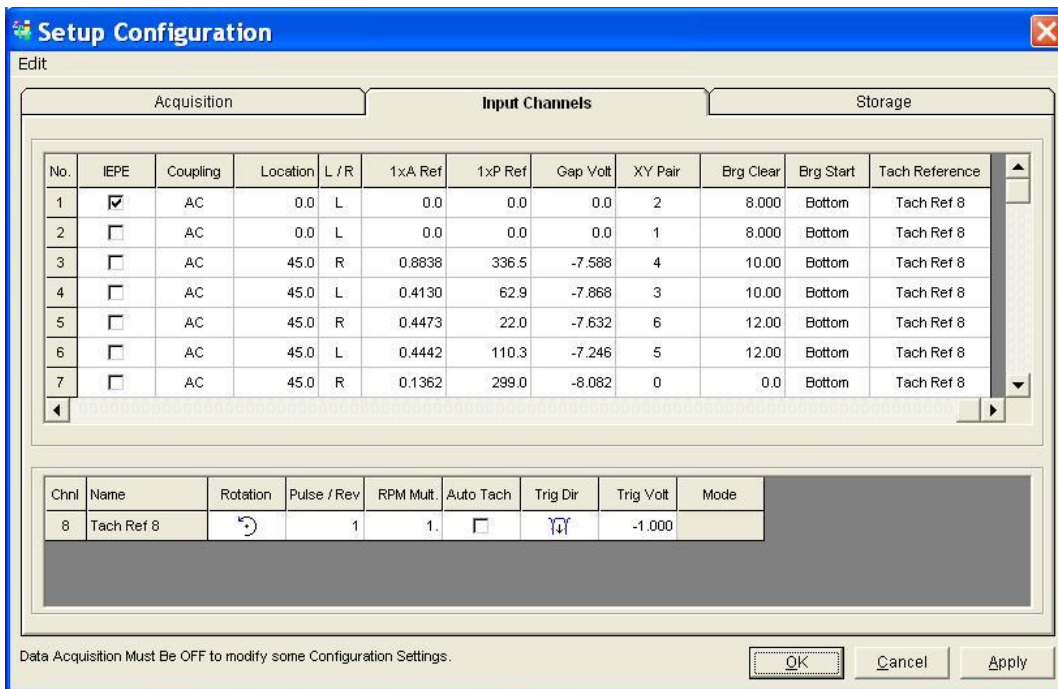   Spectral Resolution: 1.25 Hz per spectral line

1000 Hz / 800 = 1.25 Hz

Input Channels Tab

This tab is used to configure each channel for your project. The available setup options in this window are dependent on the instrument type selected.
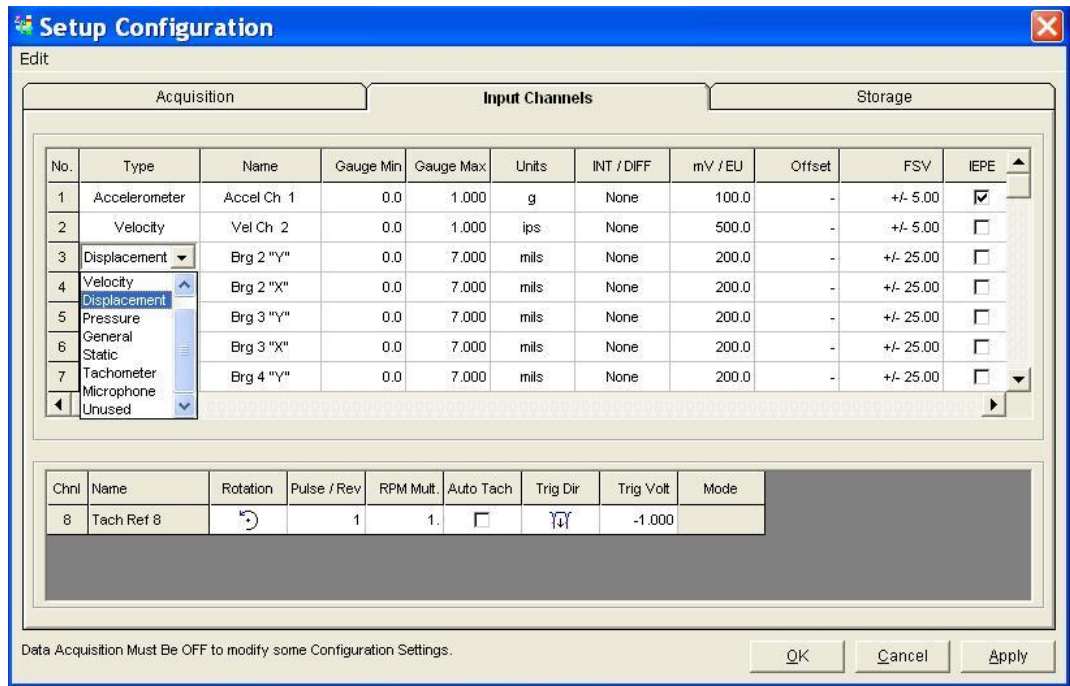
Input Channels Tab, Scrolled Left - Showing the Leftmost Column

Input Channels Tab, Scrolled Right - Showing the Rightmost Column

To configure a channel:

1. Select the channel to be configured.
2. Set the instrument type.
3. Set the value for each attribute of the channel.

Repeat this process for each channel.

The parameters of one channel can be copied to another channel by using options on the Edit menu.

Input Channels Tab Column Functions

No. is the channel number. Selecting the channel number highlights all attributes for that channel.

Type is the type of instrument attached to the channel. Options are:

o Accelerometer	o Microphone
o Velocity	o Pressure
o Displacement	o General
o Static	o Unused (select "Unused" for channels that have no instrument attached.)
o Tach	

Name is a Label you will use to identify the channel.

Gauge Min, Gauge Max represent the instrument range minimum and maximum gauge values.

Units the Engineering Units label you want to use.

INT/DIFF   This column is used for setting a *single or double integration*, or a *single or double differential*. It can be used for the following three types: Accelerometer, Velocity, Displacement.

Note that the integration value (g's/ips/mils, g's/ips/in, or g's/mmps/mm) is selected in the Acquisition Tab.

Possible INT/DIFF column selections for Accelerometer, Velocity, and Displacement are:

Accelerometer	Velocity	Displacement
None Single Integration Double Integration	None Single Integration Single Differential	None Single Differential Double Differential

Comments:

(1) If the signal is **acceleration**, then *single integration* results in **velocity**; and *double integration* results in **displacement**.

(2) If the signal is **velocity**, then *single integration* results in **displacement**; and *single differential* results in **accelerometer**.

(3) If the signal is **displacement**, then *single differential* results in **velocity**; and *double differential* results in **accelerometer**.

mV / EU   is the instrument sensitivity. (Typical displacement probes: 200 milli-Volts per mil. Typical accelerometer probes: 100 milliVolts per G. For Tach probes enter 1000.) For static channels, this property represents the slope variable (**m**) of the linear equation $y = mx + b$.

Offset   Sets the offset factor that is to be applied to the Engineering Units.

FSV   FSV (Full Scale Voltage) is the maximum input voltage for the instrument. If you are unsure of the instrument's maximum voltage value, select a high voltage value.

IEPE   A constant bias current is available for IEPE (ICP) transducers that are used as signal input for IOtech 600 Series and ZonicBook/618E analog input channels, and for compatible expansion modules [used with the ZonicBook/618E] that accept ICP transducers, for example, the WBK18. The bias current is sourced through the center conductor of the input channel BNC connector and returns to the analyzer via the BNC's outer conductor.

The current source features an operating compliance voltage (see product specifications) and is protected in regard to both short-circuit and overvoltage. Operating compliance refers to the highest voltage that can be applied without change of the current source value.   In the absence of a transducer, the current source will output an open circuit voltage. For applications that do not require bias, the current source can be disconnected from the input by un-checking IEPE in the Input Channels tab on a per-channel basis.

When the IEPE cell is checked for a channel, the current source is enabled and the input voltage is continuously monitored with level detection circuitry. Recognition of a voltage slightly greater than compliance voltage (transducer open) or a very low voltage (transducer short) triggers a transducer fault condition for the affected channel. ZonicBook/516E and WBK18 indicate the error via a front panel LED. For IOtech 600 Series, indication of these errors is via software only. When recognized, an error is latched until the commencement of a new acquisition. Consequently, even intermittent faults are detected and communicated. Detection of a fault does not, however, alter the acquisition process or its data.
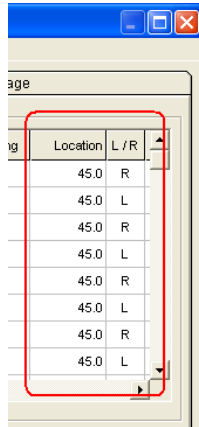
When the IEPE function is not available to a channel a dash appears in the IEPE column of the associated channel.

Coupling   Each input can be AC or DC-coupled. The AC-Coupling High Pass Filter selection is located on the Acquisition Tab. Proximity and Static Probes are typically DC-coupled. All other types are usually AC-coupled. AC-coupling can be set to a high pass filter value of 0.1 Hz or 1 Hz. The value is selected in the Edit Menu's Acquisition Tab. Note that when DC-Coupling is selected the high pass filter is bypassed.

When the Coupling function is not available to a channel, or not used by a channel, a dash appears in that channel's Coupling column.

[Probe]
**Location
L / R**

The probe location and L/R columns are used to define the physical *angular location* of a probe, from 0° to 180° left or right of Top Dead Center (TDC). The two columns are in the Input Channels tab, as indicated in the figure below. Probe location is used for Orbit, Polar, and Shaft Center Line displays.

Note: Orientation of view is looking from the *Driver to the Driven*. Zero degrees is always given as top dead center (TDC). With eZ-TOMAS versions 5.5.09 and higher, the probe location is defined as "N" degrees Left or Right of TDC. Projects created in earlier versions of eZ-TOMAS defined location as being CCW from TDC. That convention is automatically converted to the newer one, represented in the figure at the right.
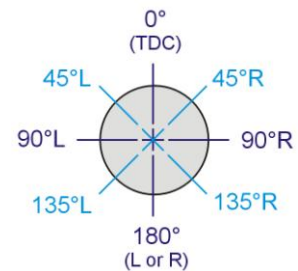
**1xA Ref and
1xP Ref**   1x Amplitude Reference and 1x Phase Reference are the slow roll values used for Runout Compensation on Bode, Polar, Time Waveform, or Orbit displays.

Gap Volt   is the DC voltage value when the shaft is at rest. This value is used for Shaft Center Line displays.

XY Pair	XY Pair associates 2 probes on a bearing. Typically, probe pairs are located 90 degrees apart. Orbit and Shaft Centerline displays require a Channel Pair.
Brg Clear	**Bearing Clearance** is measured in the instrument's engineering units. You can optionally overlay the bearing clearance circle onto an orbit display or shaft centerline.
Brg Start	**Bearing Start** is the location of the shaft relative to the bearing when the machine is at mechanical rest. Three possible locations are taken into consideration: Bottom, Center, and Top. For horizontal shafts, a bearing start of bottom is typical, due to gravity; However, in some situations mechanical linkage can result in a bearing start with the shaft at the top. For shafts that are oriented vertically, a bearing start of center is likely.
Tach Reference	This column defines allows you to define a reference tachometer for each channel. Thus, on Gauge Display and Plot Display eZ-TOMAS can show 1x values relative to the preferred tach. When two or more tachs are defined eZ-TOMAS computes spectral data relative to each. For example, with two tachs: If Tach 1 measures 3000 rpm and Tach 2 measures 4500 rpm eZ-TOMAS computes 1xA values for each. With the RPMs given, the resulting 1x Frequency values are 50 Hz for Tach 1 and 75 Hz for Tach2.

Clicking the **Tach Reference** column brings up a pull-down list which indicates the tachometer channels available for use as reference [for the currently displayed data].

Chnl	Name	Rotation	Pulse / Rev	RPM Mult.	Auto Tach	Trig Dir	Trig Volt	Mode
8	Tach Ref 8	↻	1	1.	☐	↓↓	-1.0000	

Tach Section of the Input Channels Tab

Rotation	is the shaft's rotation direction, either clockwise or counter-clockwise. The direction indicated is as viewed from the driver end of the machine train.
Pulse/Rev	is the number of pulses per 360 degree revolution. (Default: 1)
RPM Mult.	Used to enter an RPM multiplier value. This is useful if your tachometer is measuring an RPM that is proportional to another value of interest, such as in a gear train. For example, you want to see the RPM for shaft "X" which is known to turn at 2.5 times the RPM of gear "Z;" but it is impractical for a tachometer to measure the RPM of the shaft by any direct means. In this case, we would enter a multiplier of 2.5 for the gear's RPM to obtain the shaft's RPM.
Auto Tach	If a Analog Input Channel is defined as a Tachometer Input. You can either manually specify a trigger level or use the Auto-Tach detection option. During acquisition eZ-TOMAS can automatically detect and adjust the analog tach's trigger settings. This can be useful when the tach signal changes voltage levels during machine operation.
Trig Dir	is the "negative' [down arrow] or "positive" [up arrow] direction of the moving shaft.
Trig Volt	defines the Tach pulse for tach signals. A **keyway** will generate a Negative Tach pulse. Typical Tach signals will generate at least a 1 V pulse. You can check the voltage value using a Time display.
Mode	Used to select one of three available modes: Voltage, Counter, or Period.

Tachometer Notes	
To Assign a Tachometer to a Channel	1. Navigate in eZ-TOMAS as follows: Edit [pull-down men] \ Configuration \ Input Channels Tab \ Tach Reference column. 2. Click in the Tach Reference column and select the desired tachometer from the pull-down list.
To Edit a Tachometer Channel's Parameters	1. Navigate in eZ-TOMAS as follows: Edit [pull-down menu] \ Configuration \ Input Channels tab. 2. Edit the parameters on a column by column basis, as desired. Note that there are two places from which you can edit tachometer parameters: (a) The main area of the Input Channels tab. This is where, for a Tachometer *type*, you can edit the tachometer channel's name, minimum and maximum gauge values, units, etc. (b) The lower panel of the Input Channels tab. From here you can configure the tachometer channel's rotation (CW or CCW), trigger/revolution, trigger direction (POS or NEG), and trigger voltage. For applicable illustrations of the channel configuration areas, refer to the preceding two figures.
To obtain optimal noise rejection	1. Setup the input for Voltage Mode. 2. Take a measurement. 3. View the Tach Signal on a TimeWaveform plot. 4. Set the Trigger Slope [Trig Slope] to Positive (POS) or Negative (NEG).

Synopsis of Tach Modes

When you connect a tach sensor to a tachometer designated connector, such as the ZonicBook/618E's TACH BNCs (TACH1, TACH2, TACH3, or TACH4) you can select one of the following three modes: Counter, Period, or Voltage.

If tachometer triggers will occur at a rate greater than or equal to the "scan rate divided by 10" then the Period Mode must be used.

Counter Mode
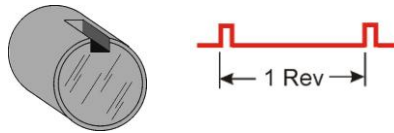
Use Counter Mode when Pulses per Revolution are needed.

Counter Mode can be used for phase shift observance.

Counter Mode generates a Pulse of Amplitude "+1" for each tach trigger. The counter mode can be used when the number of pulses is less than the scan rate divided by ten (< scan rate / 10).

Once you have established the phase relationship of a machine running near optimum, the observance of phase shifts can be used to signal the development of a mechanical problem.

Period Mode
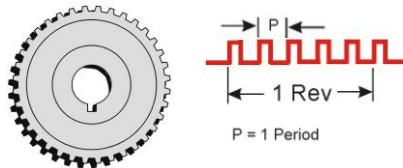
P = 1 Period

Use Period Mode when multiple pulses are involved, such as from gear teeth.

Period Mode cannot be used for phase shift observance.

The period is the time from the rising edge of one pulse to the rising edge of the next pulse, or the time from the falling edge of one pulse to the falling edge of the next pulse.

The Period Mode is used for Tachometer inputs which exhibit multiple pulses per revolution. The mode provides accurate overall RPM without sacrificing scan rate. Phase measurements are not possible when using period mode.

Note: 60 seconds divided by the period [in seconds] equals RPM.

Voltage Mode

Region from which to select a trigger voltage.
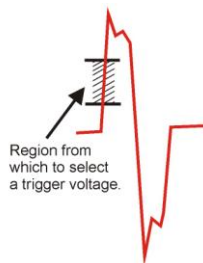
Use Voltage Mode when you need to determine a trigger voltage.

Voltage Mode is used for Tachometer inputs to view actual input voltages from the Tach Sensor. Voltage mode is useful for locating an ideal Tach Trigger Voltage setting. An ideal trigger voltage is one that is in a clean region of a leading edge. Note that Voltage Mode cannot be used for Phase measurements between Analog Inputs and Tachometer Inputs.

Storage Tab

Storage Tab

Basic Description

Data storage is activated by trigger events. If any one event is triggered, data from all channels is stored. Data storage events are triggered when a change occurs *within the range of your defined parameters*. An example follows the parameter definitions.

Note: For Static Input Channel types (selected in the Input Channels "Type" column) eZ-TOMAS calculates and stores the averaged value in the time block.

Panel	Description
History FIFO	Displays the number of storage records in the History FIFO (First-In-First-Out) file. Based on the configuration, values for both the required and the available disk space are shown. The panel includes a checkbox to enable backing up the project. If the project backup feature is enabled, the backup files will be stored in your EZ-TOMAS project folder. They will have the same file name, followed by an underscore and a number; for example, the first backup of a file called: TurbGen.tom would be TurbGen_1.tom.
RPM Range	The speed range in which data storage is permitted.
RPM Change	An RPM-based trigger for the storage of data. Data will be stored when the machine speed changes by the specified RPM value. To enable the delta RPM storage trigger check the "Enabled" checkbox and enter an RPM value.
Time Change	A time-based trigger for the storage of data. Enter the number of seconds, minutes, hours, or days between desired storage events. To enable the time-based trigger check the "Enabled" checkbox.
Overall Change	An amplitude-based trigger that can be defined for each channel. Data is stored when the overall amplitude changes by the specified value. The user must check the "Enabled" box for each channel that is to be used as an overall change trigger.
User Snapshot	Used to specify the duration of continuous data gathering (in seconds) for a snapshot of data. When the snapshot button is clicked [the button with the camera image], data will be collected for the specified duration.
Gating (Signal Gating)	Allows a designated state of a selected input signal to control *storage* and *limit checking* operations. Refer to the following page for details.

The history file is a FIFO file. You can define the depth of the history file; however, the amount of time the needed to fill the file depends on the trigger event values. The smaller the trigger values, the faster the history file fills. The current data storage status is shown in the *Main* Window.

Example

Assume that a motor typically runs at 3600 RPM and we would like to store data when the motor is running above 200 RPM and below 5000 RPM.

1. Open the Edit menu.

2. Select "Setup." The *Setup Configuration* window will open.

3. Select "Storage Tab."

4. For RPM Range enter a value of 5000 for the maximum and 200 for the minimum.

5. Set one or more of the following to trigger data storage:
   a) Time Change
   b) RPM Change
   c) Overall Change (the overall change in engineering units)

   For this example assume that Time Change and RPM Change were both set to "None" and the Overall Change trigger for a channel was set to set to 0.25 mils.

6. Click <OK>.

With this configuration, data will be stored if . . . the motor's speed is greater than 200 RPM and less than 5000 RPM and the overall value changes by 0.25 mils [since the last trigger event]. In this case eZ-TOMAS will store time waveform and spectral gauge (band) data for all channels. All event triggers are reset whenever any event trigger occurs.

In other words:

> **IF minRPM < Motor Speed < maxRPM**
>
> **AND IF {delta Time, OR delta Speed, OR delta EU = specified setting}**
>
> **THEN data is stored.**

Gating (Signal Gating)

A signal gating allows a designated state of a selected input signal to control *storage* and *limit checking* operations.

The signal state sensed is strictly level based, in other words, *above* or *below* a designated overall level in scaled units. Use of a signal for gating does not change the configuration or operations of that signal.

Setup of the gating feature is accomplished within the Storage tab, located in the Storage Configuration dialog (Edit Configuration). An example, showing Gating enabled, is presented by way of the following figure.

Gating Panel, Located within the Storage Tab

When gating is *disabled* the system ignores all gating specifications, i.e., the panel's indicated signal channel, above/below state, and level value parameters have no effect. This means eZ-TOMAS will check limits and storage specifications with no imposed restrictions.

When gating is *enabled* you can select an input signal from the Signal pull-down list. In the previous figure, Accelerometer Channel 2 (Accel Ch 2) is selected.

The *above/below* radio buttons indicate that gating (or enabling) of system operation will occur when the overall value of the specified signal is above or below (respectively) the level specified in the Level field. When gating is enabled and the set condition is met a green indicator will display below the Acquisition switch.

Gating Condition is Met
(green indicator)

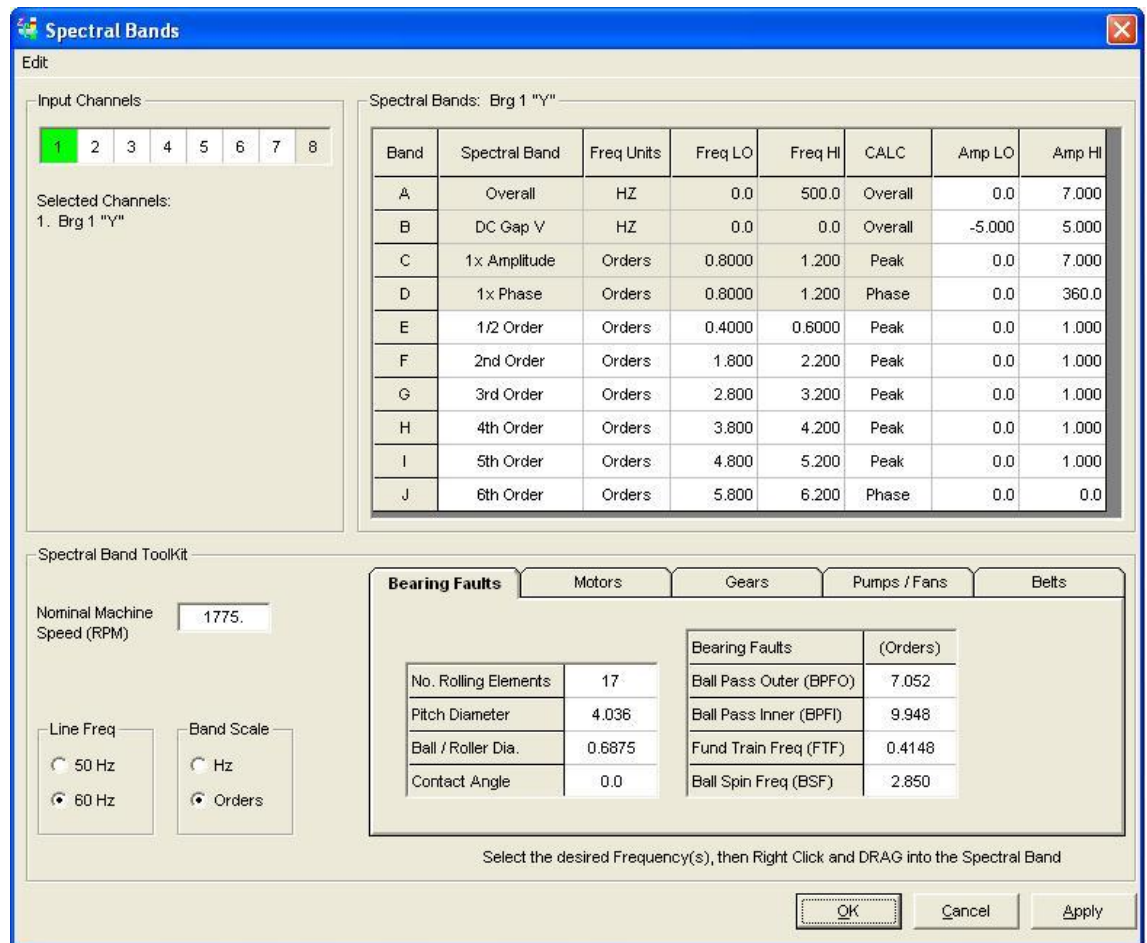**Gating Condition is Not Met** (yellow indicator)
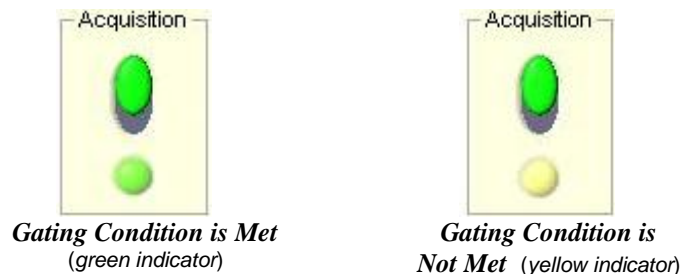
When the gating condition is not met, but gating is enabled, a yellow indicator will appear beneath the Acquisition switch.

Note that there is no indicator when gating is disabled.

Spectral Bands

Up to 14 Spectral Bands (A through N) can be selected for each dynamic channel. The first four bands (A, B, C, D) named Overall, DC Gap V, 1x Amplitude and 1x Phase are pre-defined and cannot be modified. However, the *user-defined bands* (E through N) can be customized for specific applications.

Spectral Band values are displayed on the dynamic instrument gauges. All gauges are vertical, with exception of circular phase gauges. When either 1x Amplitude, or 1x Phase is selected, both a vertical gauge [for 1x Amplitude] and circular phase gauge [for 1x Phase] are displayed.

Spectral Bands Window

The Spectral Bands Window contains:

Input Channels

Selected Channels:
1. Brg 1 "Y"

Spectral Bands: Brg 1 "Y"

Band	Spectral Band	Freq Units	Freq LO	Freq HI	CALC	Amp LO	Amp HI
A	Overall	HZ	0.0	500.0	Overall	0.0	7.000
B	DC Gap V	HZ	0.0	0.0	Overall	-5.000	5.000
C	1x Amplitude	Orders	0.8000	1.200	Peak	0.0	7.000
D	1x Phase	Orders	0.8000	1.200	Phase	0.0	360.0
E	1/2 Order	Orders	0.4000	0.6000	Peak	0.0	1.000
F	2nd Order	Orders	1.800	2.200	Peak	0.0	1.000
G	3rd Order	Orders	2.800	3.200	Peak	0.0	1.000
H	4th Order	Orders	3.800	4.200	Peak	0.0	1.000
I	5th Order	Orders	4.800	5.200	Peak	0.0	1.000
J	6th Order	Orders	5.800	6.200	Phase	0.0	0.0

Spectral Band ToolKit

Nominal Machine Speed (RPM): 1775.

Line Freq: 50 Hz / 60 Hz (60 Hz selected)

Band Scale: Hz / Orders (Orders selected)

Bearing Faults | Motors | Gears | Pumps / Fans | Belts

		Bearing Faults	(Orders)
No. Rolling Elements	17	Ball Pass Outer (BPFO)	7.052
Pitch Diameter	4.036	Ball Pass Inner (BPFI)	9.948
Ball / Roller Dia.	0.6875	Fund Train Freq (FTF)	0.4148
Contact Angle	0.0	Ball Spin Freq (BSF)	2.850

Select the desired Frequency(s), then Right Click and DRAG into the Spectral Band

OK   Cancel   Apply

Spectral Bands Window

Input Channels Panel

Selected channels have green backgrounds. Non-selected channels appear with white backgrounds. Selected channels are listed by channel number and name. The channel name is the one that is assigned in the Input Channels tab of the Edit menu's Setup Configuration window, under the "Name" column.

Spectral Bands Panel

Band (A thru N)	is the **Spectral Band** of interest. Only the "User Defined" bands [E through N] can be modified.
Spectral Band	is the name you assign to a spectral band. It is displayed on the dynamic instrument gauge in the main window. A, B, C, and D are pre-defined.
Freq Units	can be either Frequency or Orders. If you do not have a tach defined, the Orders option will not be available.
Freq LO Freq HI	Used to set the range of the frequency or order. It is a good practice to set the range 2 to 4 spectral lines wider than the frequency of interest. This is due to the FFT window. For example, if your frequency of interest is the 3rd order. You should specify a range of 2.9 to 3.1 orders
CALC	Specifies to calculate Peak, Overall, Phase, or Unused. **Peak** is the highest spectral amplitude within the specified range. **Overall** is the sum of vibrations of each spectral amplitude, within the specified range. **Phase** is the time relationship between the vibration probe and tach signal. **Unused** does not calculate a value for the spectral band.
Amp LO Amp HI	Used to set the low and high amplitudes. These high and low values define the gauge range.

The lower potion of the Spectral Bands Window consists of a Spectral Band Toolkit panel. The toolkit includes a field to enter machine speed in RPM, selection for 50 or 60 Hz line frequency, and selection for a band scale in Hz or Orders. Aside from these, the toolkit includes 5 tabs: Bearing Faults, Motors, Gears, Pumps / Fans, and Belts.

Spectral Band Toolkit Panel

Nominal Machine Speed (RPM)	Enter the machine's nominal running speed.
Line Frequency	Select 60 Hz or 50 Hz, depending on the frequency of the power supply.
Band Scale	Choose Hz or Orders.

Examples from the toolkit tabs follow.

Spectral Band Toolkit Tabs – Examples

Bearing Faults

No. Rolling Elements	17
Pitch Diameter	4.0355
Ball / Roller Dia.	0.68750
Contact Angle	0.0

Bearing Faults	(Hz)
Ball Pass Outer (BPFO)	587.66
Ball Pass Inner (BPFI)	829.01
Fund Train Freq (FTF)	34.568
Ball Spin Freq (BSF)	237.48

Motors

No. of Poles 2

Sychronous Speed = 3600. RPM

Slip Frequency = 26.667 Hz
Pole Pass = 53.333 Hz
(Look for sidebands at these Frequencies)

Motor Faults	(Hz)
Rotor Bar	33.333
Air Gap	120.00
Pole Pass	53.333

Gears

	Teeth G1	Teeth G2	Output RPM	Gear Mesh (Hz)
Single Reduct / Incr	26	101	515.	866.67
Double Reduct / Incr	31	97	165.	266.01

Pumps Fans

No. of Blades: 5

Pump / Fan Faults	(Hz)
Blade Pass	166.67
Oil Whirl	15.000

Belts

P1 Pitch Dia	9.0000
P2 Pitch Dia	11.750
Center Distance	21.000

Belt Drive Faults	(Hz)
P1 Align/Eccen	33.333
P2 Align/Eccen	25.532
Belt Frequency	12.621

Belt Length = 74.684
P2 Nominal Speed = 1531.9 RPM

Each of the tabs includes parameters related to a specific type of fault. The tabs calculate and display frequencies [or orders] which you can select with the left mouse button, then [with a click of the right mouse button] drag into the Spectral Bands panel. In the following figure, 4 frequencies *associated with bearing faults* have been highlighted and dragged into position for spectral bands E, F, G, and H.

Applying Bearing Fault Frequencies from the Toolkit to Bands E, F, G, and H

Spectral Limits (Limit Configuration Window)

Overview

The Limit Configuration window is accessed from the Edit pull-down menu by selecting "Spectral Limits." The window provides the user with a means of setting limits and ranges for multiple machine states for 1 or more Input Channels.

A machine state can be defined by RPM and Delay Time (minutes). For example, a machine state could be defined as 5001 to 10,000 RPM, but with a delay of 3minutes. Thus the speed would need to be at least 5001 RPM for 3 minutes.

Six states are supported, where "0" is an RPM state not covered by the defined RPM ranges 1, 2, 3, 4, 5. See top central panel, following figure.
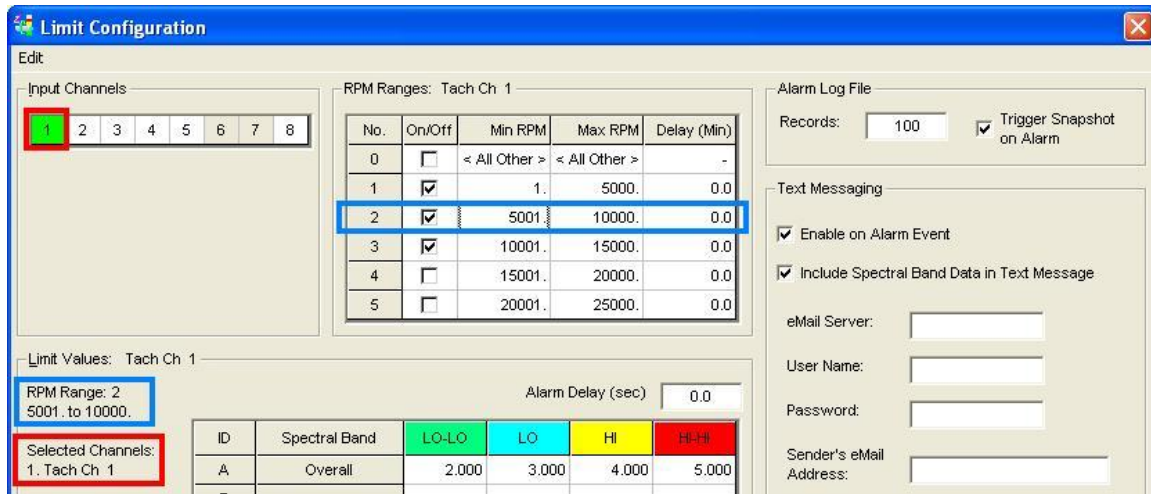
There can be gaps between user-defined RPM ranges; however, the ranges may not overlap. For example: Range 1 could be assigned to cover 400 to 800 RPM, and Range 2 could be set to cover 900 to 1000 RPM, thus ignoring the 801 to 899 RPM range. But you could not then reset Range 2 to cover 700 to 1000 RPM because this new range 2 value overlaps those of Range 1. When RPM ranges are used, there is a unique set of limit set-points for each combination of: Input Channel, RPM Range, and Spectral Band. For convenience, you may copy and paste limit settings between Channels.

A different set of Limit Values for Spectral Bands A through J can be assigned to each of the six RPM ranges. Click on one of the cells for an RPM range to see the limits assigned to that range. The range currently selected is listed at the left side of the Limit Values panel. In the above figure RPM Range 2 (5001 to 10,000) RPM is selected.

Up to four limits can be defined for each channel's operating condition (LO-LO, LO, HI, HI-HI). The alarm colors are defined in the Plot Display Preferences window. If the channel value is lower than the LO-LO limit, the bar graph will change to the color indicated in the LO-LO column header (see following figure). A value between LO-LO and LO limits will cause the bar graph color to change to the specified LO limit color. HI and HI-HI limits have the same effect, relative to channel value. A bar will be green for normal channel values (those between the LO and Hi limits).

The window includes a Text Messaging feature that allows a message to be sent to up to 5 e-mail addresses. Such messages are typically sent when triggered by an alarm condition. The user can elect to include Spectral Band Data in the message by checking the associated checkbox.

Facts Regarding Spectral Limits

■ To configure two or more channels to the same limit settings, you can click on the first channel; then use <Shift>/*click*, or <Control>/*click* to select the range of channels that are to have the common limits.

■ Limit values are not used if:
      (a) the limit value is outside of the instrument range, or
      (b) the limit value is set to Zero.

■ Limits from one channel can be copied to another from the Limit Configuration Window's Edit pull-down menu, using the "Copy Channel" option, or by selecting multiple channels.

■ Use the Input Channels Tab of the Configuration Window (selected from the Edit pull-down menu) to Select the Tach Reference on a per channel basis.

■ You can modify limits on the graphical bar graph display in the main window by dragging the *limit arrows* and then opening the Spectral Limits window to save your changes. Note that right-clicking on a gauge activates a pop-up [following figure] with several selection options, including "Edit Spectral Limits.".

Gauge Window Pop-up

■ The Alarm Log File panel [upper right of the Limit Configuration window] has a numeric field for entering "Records" is the number of Alarm events logged. When an alarm occurs, eZ-TOMAS automatically saves the data to the History FIFO file.

■ The colors for the four limits (set in Edit Menu / Plot Display Preferences) are used in the Gauge Window, as illustrated in the following figure.

■ The Statistical Report can be used to generate limits for each machine state. You can select channels, spectral bands, and variance for high and low limits. A Limit Generation dialog box is accessed via the Statistical Report's File pull-down menu.

Spectral Band	LO-LO	LO	HI	HI-HI
Overall	0.2000	0.5000	1.500	1.800
DC Gap V	1.000	2.000	3.000	4.000
1x Amplitude	0.5000	0.7000	0.8000	0.9000

Partial Spectral Limits Panel Showing
User-set Color Indications for LO-LO, LO, HI, and HI-HI
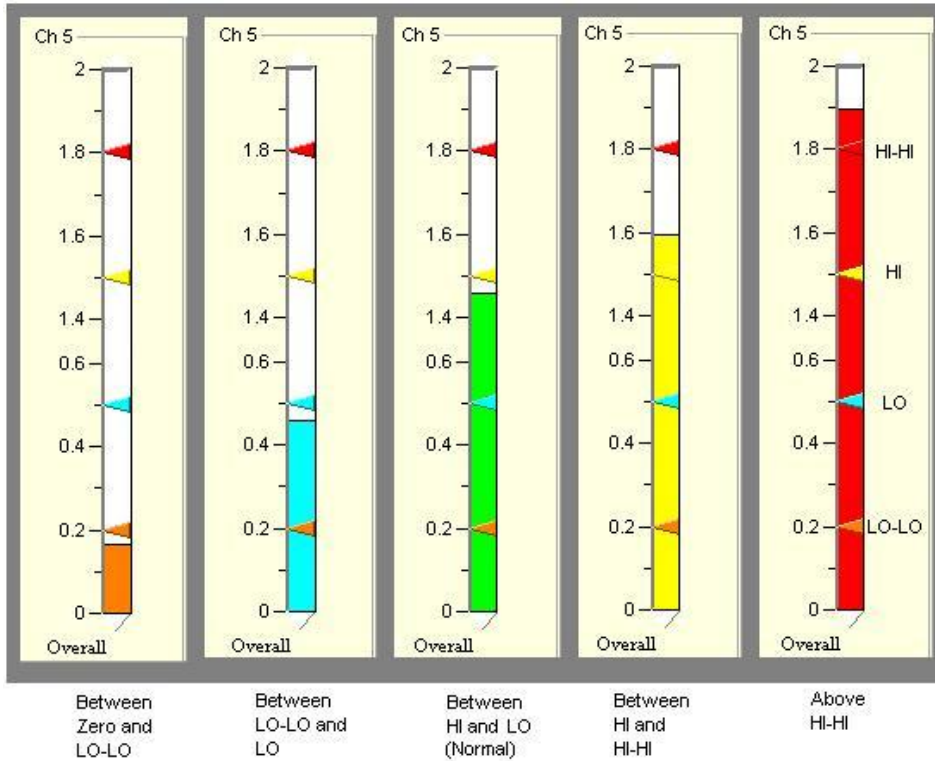
Example of Limits Effects on the Gauge Colors

Note: The Statistical Report can be used to generate limits for each machine state. You can select channels, spectral bands, and variance for high and low limits. The Limit Generation dialog box is accessed via the Statistical Report's File pull-down menu. See chapter 8 for more information.

Digital I/O Configuration

Hardware Panel

The top panel of the Digital I/O Configuration Window is the Hardware panel.

For <u>NDT Relay Modules</u>:

(1) An NDTRelay must be connected as indicated in separate NDTRelay documentation.

(2) The applicable **COM Port** must be identified. Select the RS232 COM (serial) Port to which the output Relay module is connected

For <u>600 Series Analyzers</u>:

For 600 Series analyzers the Digital outputs are accessed via a 9-pin connector on the rear panel. Refer to the *IOtech 600 Series User's Manual* for pinout and additional details. A copy of the user's manual is located on the *Dynamic Signal Analysis* CD.
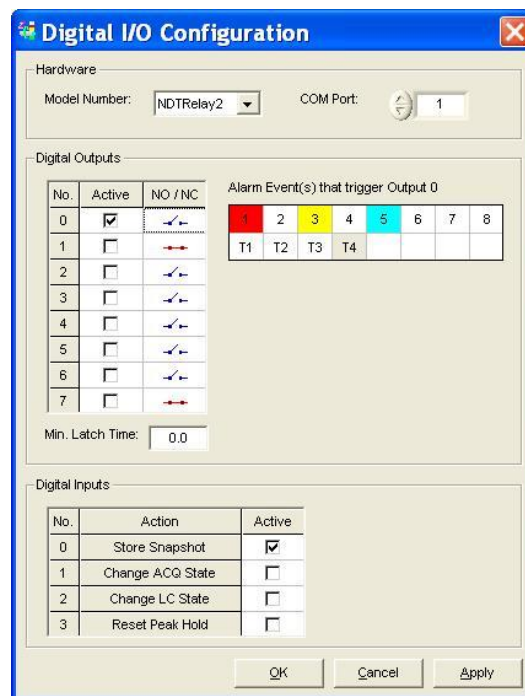
Digital I/O Configuration

Relay Outputs Panel

Relay outputs can be used to communicate Alarm Status to external devices. Up to 8 relay outputs are supported. You must indicate, by checkmark, if a relay output is to be active. For an "active" relay, the normal state is either Normally Open (NO) or Normally Closed (NC). In the preceding figure, only Relay Output 0 is "Active."

When you click on one of the cells associated with a relay output, the "Alarm Events" that will trigger it appear to the right of the output's switch graphic. In the preceding figure we see the events that will trigger Relay Output 0. When any of the defined Alarm Events are True, the relay will be in the state other than indicated in the NO/NC column. For example, in the following figure Output Relay 0 is normally closed; thus the relay will open when (a) Input Channel 1 is in Red Alarm Condition, or (b) Input Channel 3 is in Yellow Alarm Condition, or (c) Input Channel 5 is in Cyan Alarm Condition.

Output Relay 0, Active, Normally Closed –
Shown set to Open on Alarm Conditions on Channels 1, 3, or 5

Digital Inputs Panel

Digital Patterns can be used to trigger eZ-TOMAS Actions.

Each supported action is assigned to specific digital pattern. For example, in the figure at the right, Store Snapshot is assigned to digital pattern "0." This means that the Store Snapshot action will occur when the digital pattern changes to the "0" state. If "3" (Reset Peak Hold) was selected to be active, then when the digital pattern changed to "3" the peak hold values would reset.

Note: Digital Inputs are available in NDTRelay2, but not NDTRelay1.
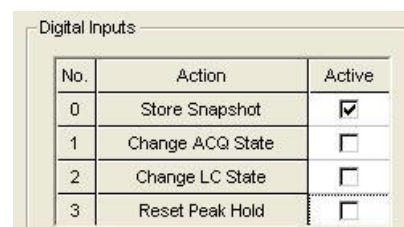
Store Snapshot Selected for Digital Pattern 0

Note: Each number in the "No." column represents a specific Digital Pattern.

Gauge Display Preferences   [in Edit Menu]

The Gauge Preferences window provides
a means of independently setting the
background colors of the control panel
and primary gauge panel. The Gauge
Preferences window includes a font
styles button which allows you to apply a
global font change to the gauge and
control panels. The lower section of the
Gauge Preferences window pertains to
Gauge Properties. In regard to the
"Bands" column, to make a change you
can drag a new Spectral Band type from
the far right into the Band column. You
can also double-click in a cell and enter a
desired Spectral Band letter (from A
through N). Channels can be edited in a
similar manner.
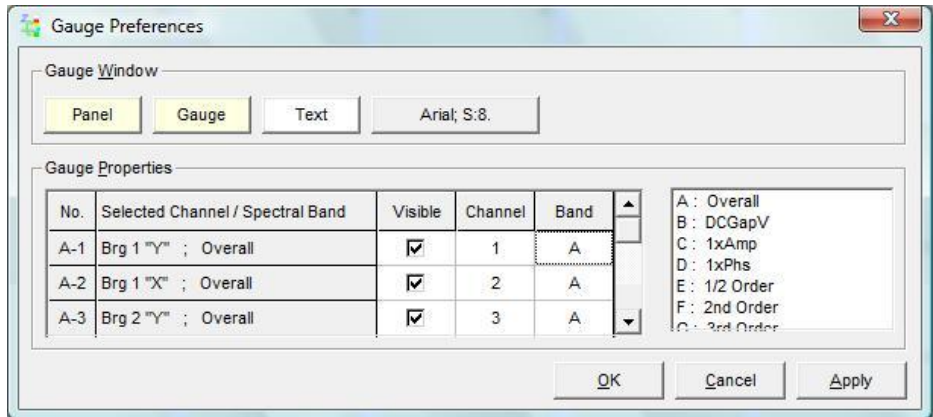
Plot Display Preferences   [in Edit Menu]

The Display Preferences Window provides a means of
changing various display colors for the Plot Window. It
also allows you to change other display parameters,
including, but not limited to, Waterfall latitude and
longitude angles, and units for the frequency axis.

Although most display preference functionality is self-
explanatory, the following information may be useful to
some.

The *Plot Window panel* allows you to define the Plot
Display's border, background, grid colors, and the font
style and size. The panel includes an RT Buffer numeric
field for indicating Realtime Trend. This value defines the
amount time [in minutes] that data will be displayed
before scrolling will begin. For example, if the Realtime
Trend was set for 2 minutes the trend display would show
the data being collected for two minutes, and then start
scrolling after 2 minutes. In this example the screen will
always display the most recent 2 minutes of data.

The *Plot Trace Colors panel* allows you to define colors
for use in the plot displays. If you select "**By Trace**" the
sequential order of the Trace Number will define the plot
color. If you select "**By Channel**" colors will be assigned
to specific channels according to the numbered color
squares.

The *Alarms panel* defines alarm colors. The panel
includes two numeric fields. The upper field indicates the
number of records to be displayed. The lower field, for
Pre/Post Alarm Event, defines the amount of data that
will be displayed when using the Alarm Log report.
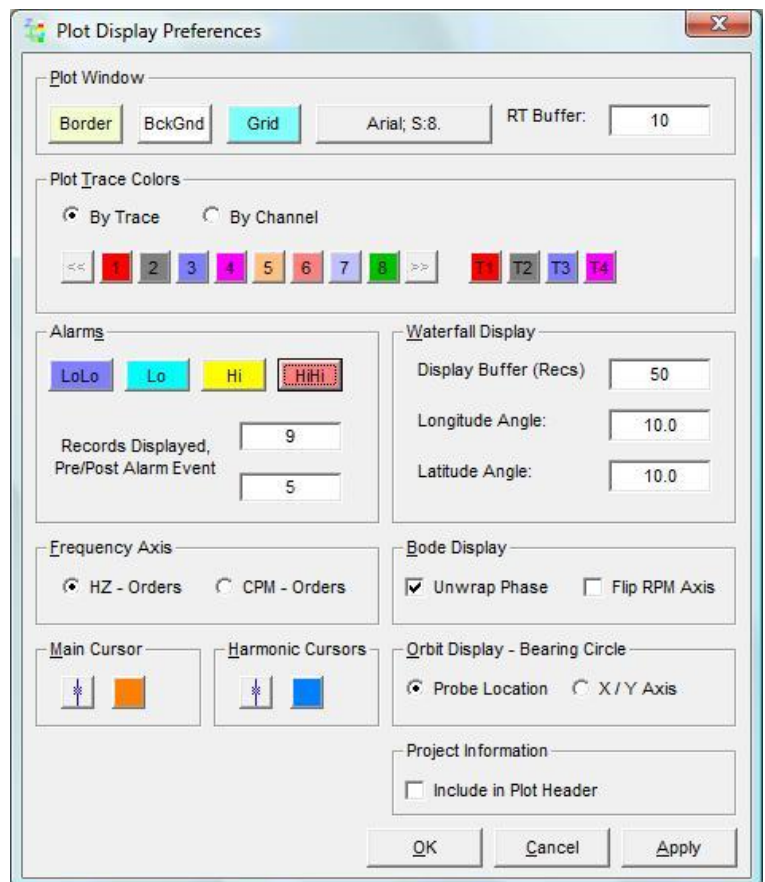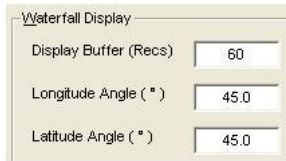
The *Waterfall Display panel* is limited to a fixed number of spectrum traces, up to 100 traces. The Longitude Angle defines the vertical tilt of the display. The Latitude Angle defines the horizontal tilt.

The *Frequency Axis panel* is used to set the frequency axis to Hz or CPM. Select **Hz-Orders** for *cycles per second*; or select **CPM-Orders** for *cycles per minute*.
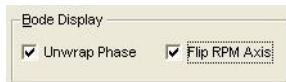
The *Bode Display panel* includes two checkboxes: Unwrap Phase and Flip RPM Axis.

Unwrap Phase – when "checked," the Y-axis scale can span multiple 360 degrees. Data will smoothly transition across the 0 / 360 boundary. When "not-checked" the Y-axis scale is 0 to 360 degrees; and data that straddles the 0 / 360 boundary will show a vertical line.

Flip RPM Axis – is typically used for shutdowns (coastdowns). When "checked," the X-Axis (for RPM) reverses. Thus an X-axis from 0 to 6000 RPM would "flip" to show 6000 to 0 RPM.

In addition to color changes, the *Main Cursor* and *Harmonic Cursors* can be shown with or without a vertical line. Click on the first button [in the associated cursor panel to toggle to the desired choice (line or no line).

The Orbit Display - Bearing Circle panel allows the user to select "Probe Location" or "X / Y Axis." The selection defines the Bearing Circle on the Orbit display. If the bearing clearance is elliptical, select the locations that will be used to measure the clearance.
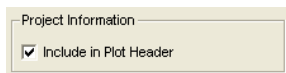
When checked, the following information will appear in the header when you copy and paste a plot into a document or paint application: *Company, Plant, Job No., Machine Name(s)*. This information will be as entered in the Project Information window, which is accessed from the Edit menu.

Function Keys Preferences   [in Edit Menu]

eZ-TOMAS can be controlled through a network via keyboard **function keys** (F1 through F12).   The Function Key Preferences feature allows you to define computer keyboard function key actions.

When you click on a **Function Key** row (such as F5 in the figure) a pull-down list appears – allowing for easy selection of a function.

You can assign the keys to control starting and stopping acquisitions, limit checking, data storage, and to indicate what project is open. Network Communication is via Port 7652.

You can assign the "**File – AutoBackup**" menu-option to a function key. The **AutoBackup** feature allows you quickly backup the current eZ-TOMAS Project. When this function is used a date and time string is added to the project name.   Note that the File Attributes of the backed up project are *Read Only*. The **AutoBackup** feature can be useful in Conjunction with the Network access of the function keys.

Note!   **Close the display window before using AutoBackup. This is necessary because the AutoBackup function will attempt to store the data that is being used in the active plot display. You can reopen plot displays after the AutoBackup operation is complete.**

You may contact IOtech for an example application. If doing so, please request: **EZT_netfkey**.
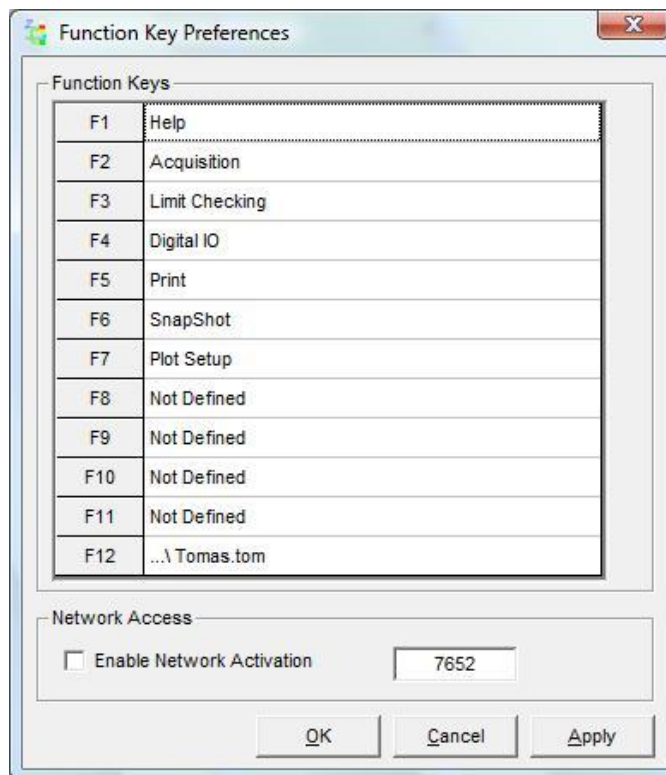
Network . . .   Configuration

This feature is available for IOtech internal use only.

Copy Window   [in Edit Menu]

"Copy Window" is not a window, but a command to copy the currently selected window to the clipboard. After using this command you can paste the copied window into another application, such as Microsoft Word or Excel.   The feature is useful for creating reports, or sending screen images to others via e-mail.

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Control Menu 4

The Control pull-down menu provides a means of initiating several functions which can also be initialized via buttons on the lower panels of the Gauge Window, as indicated in Chapter 1 and in the figure below.   For convenience, the applicable information from that chapter is being repeated here.
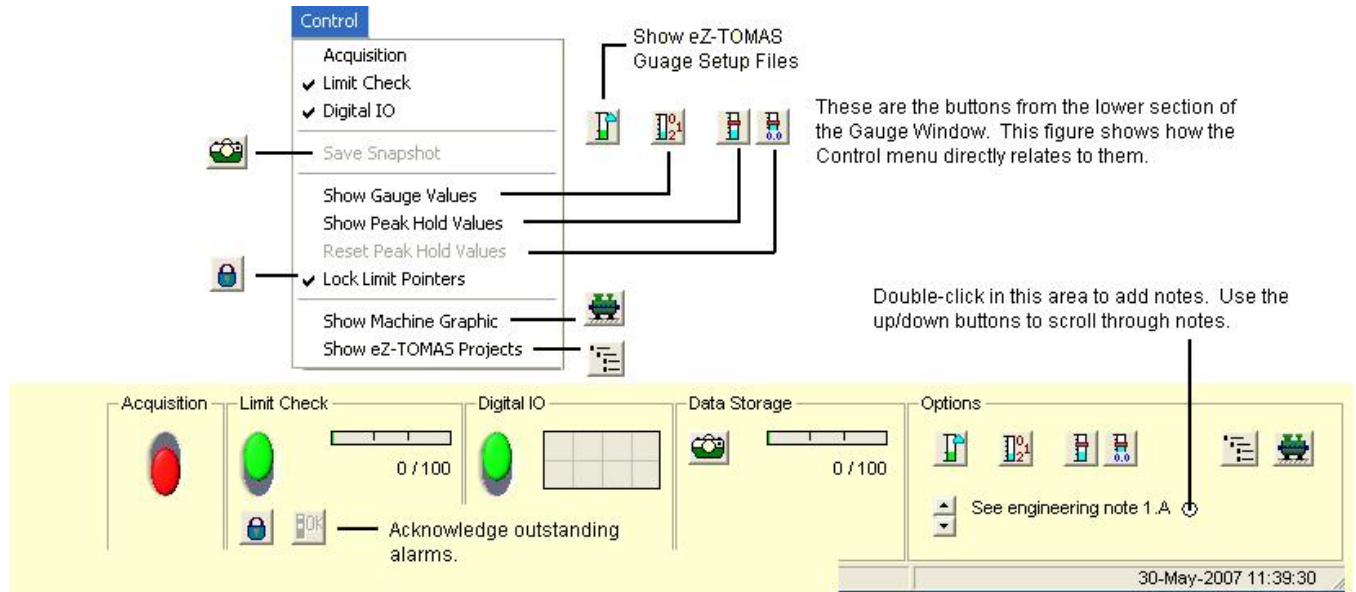
Control Pull-Down Menu's Relation to Lower Panels

Acquisition

The Acquisition Panel contains one slide switch, which determines the ON/OFF status of data acquisition. Turn the data acquisition ON (Up/Green), or OFF (Down/Red).

Limit Check Panel

The Limit Check panel contains a slide switch, an alarm log progress bar, a padlock button, and an <OK> button. The Limit Check slide switch determines the ON/OFF status of the Limit Checking feature [ON is Up/Green; or OFF is Down/Red.

The Alarm Log Progress Bar graphically indicates how full the Alarm File is. The log can be accessed from the Display pull-down menu.   The most recent alarm event will appear below the bar.

When there is an alarm event, channel labels will flash until the event is acknowledged. Click on the <OK> button to acknowledge all outstanding alarm events. You can right-click on a channel gauge to acknowledge alarm events for an individual channel. To list alarm events for a given channel, right-click on the channel's gauge, then select the View Alarm Event(s) menu option.

The padlock button is used to lock or unlock limit pointers.

Digital I/O Panel

The Digital I/O Panel contains an ON/OFF slide switch and a Relay Output Status display, which consists of 8 switches.   If the Digital IO slide switch is turned on, Digital I/O relay switches will activate [or deactivate] depending on the configuration set in the *Digital I/O Configuration window* (detailed in chapter 4). The window is accessible via the **Control** pull-menu.

During an acquisition you can manually activate each switch by clicking on the associated button.

Data Storage Panel

The Data Storage Panel is easily recognized by its Snapshot [camera] button and the bar for Current Data Record / History File Size. Data storage uses the *First In First Out* (FIFO) method of receiving and releasing data.

The bar graphically indicates how full the file is. Two numbers, separated by a slash, reside just below the progress bar. In the example this is 279 / 500. The first number is the current data record number (279 new records); the second number is the entire number of records stored in the FIFO file 500. The number of new records is referred to as the History File Size. In this case the History File Size is 279.

Clicking the **<Snap Shot>** (**camera**) button will save "N" seconds of data to the history file; where "N" is defined in the *User Snapshot* field of the Storage Tab [in the Configuration Panel] The Configuration Panel is accessed through the Edit pull-down menu. The Gauge Window's data storage panel includes the data file's Date/Time Range.

FIFO Records Capacity Bar

Number of Records that can be stored (History File Size)

Number of New Records

Date/Time Range of Data File

Options Panel

The Options Panel includes the following items.

(1) Show eZ-TOMAS Gauge Setup Files
(2) Display All Gauge Values
(3) Display Peak Hold Gauge Pointers
(4) Reset Peak Hold Gauge Values
(5) Display List of TOMAS Projects
(6) Display Machine Graphic Picture
(7) Enter a Project Note / Previously Saved Notes

Item (5), "Display List of TOMAS Projects," brings up a window that lists the available .tom project data files that can be displayed in eZ-TOMAS. The projects listed are those which are located in the folder for the current project, as well as the two folders adjacent to it. To locate other projects you can use the File pull-down menu, select "Open" and then use the "Look in" feature to locate available projects. The TOMAS Projects widow displays the following for each project: File, Folder, Size, and Date Modified. To open a project in the list, double-click on it.

Item (6), "Display Machine Graphic Picture," brings up a selected .jpg or .bmp image to represent the associated machine or process being tested. The Machine Name is defined in the Project Information Window (see Edit Menu).

In regard to the graphic image, if you right-click in the window, two choices will appear: "Load graphic picture" and "Remove Graphic Picture." Clicking on the former allow you to browse your PC for the appropriate graphic. Note that this can also be accomplished through the Edit pull-down menu.

Item (7) Double-click in the indicated area to enter a note. Use the up/down arrow buttons to scroll through the notes. The note text, preceded by date appears in the Configuration Setup (tomas_Config.txt) Notepad, under *Project Information, Notes*. You can access the Notepad via the Display pull-down menu. The text box at the right includes an example of a note (bottom line) as it would appear in Configuration Setup. In this example the note is "31-May-2007 See report A-02."

```
PROJECT Information ----------
Company:      Cosmic Industrial
Plant:        Alpha Drive
Job No.:      2387-A
Machine 1:    33909919-A1
Machine 2:    77890998-A2
Note(s):
31-May-2007      See report A-02.
```

Introduction

The Display pull-down menu [following figure] provides a means of displaying plot windows, logs, and reports. This chapter covers the Plot Windows aspect. Chapter 6 pertains to the various logs (reports) that can be generated from the menu.

Select Plots from the Display Pull-down Menu

Selecting **Plot Windows** from the Display pull-down menu opens a *Data Display window* (see following Window). Note that you can double-click on a gauge to open a Data Display window for plotting that gauge's data.

For real-time displays, you can halt and resume the display of data by using the Pause/Continue toggle button, or use the "P" key on the keyboard. When viewing historical data, you can use the playback buttons and the slider to navigate through the data.

You can view either real-time data or historical data. In the examples that follow we are view historical data, thus the History button has been clicked, and appears "active" [green] on our screen.

Prior to viewing a plot you need to:

- **select the channels to be displayed**
- **select the desired data display format, e.g., Time Display, Spectrum, or Waterfall**
- **select the data source, i.e., a "Real Time" source, or a history data file.**

Reference Notes:
For toolbar button functions refer to chapter 6.
For examples of various plot display types refer to chapter 7.
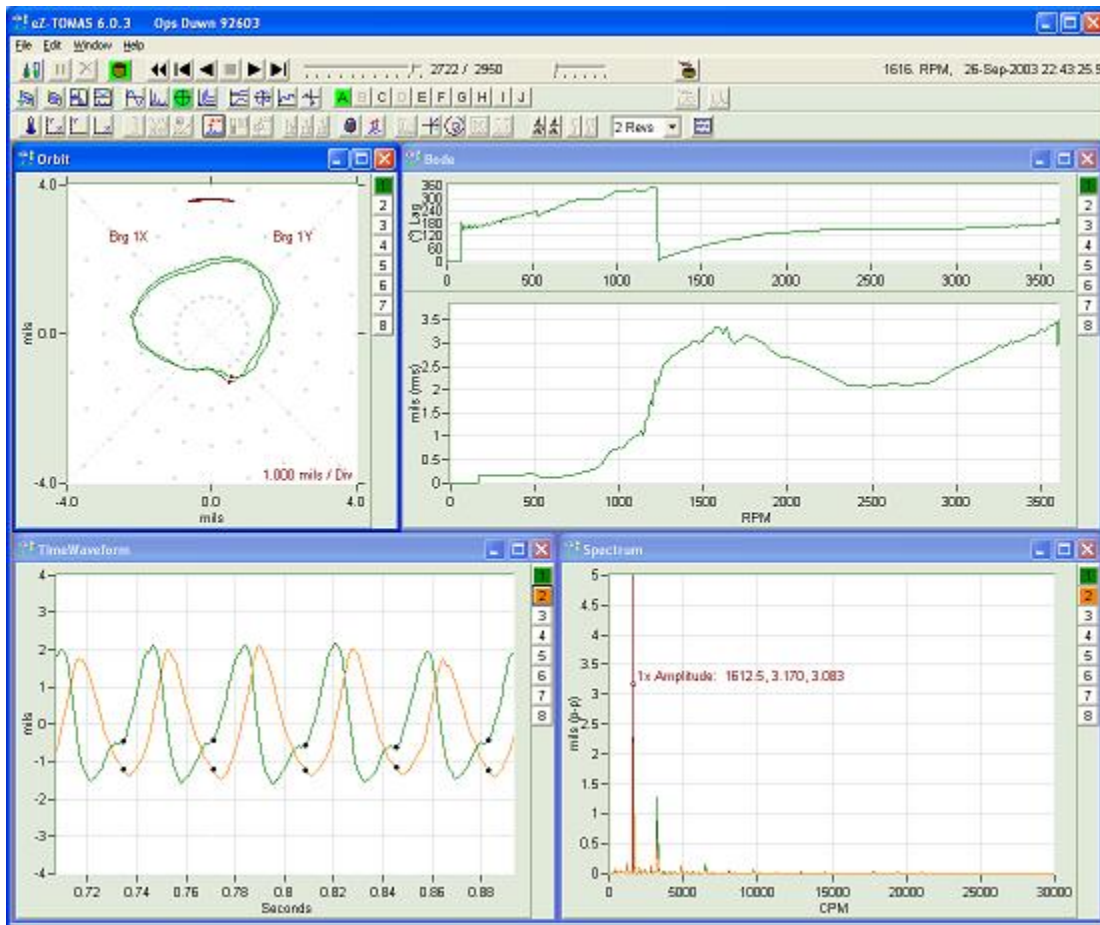
History Data – Orbit, Bode, Time Waveform, and Spectrum Displays

Plot controls can be data that is in "Real Time" or pre-recorded, i.e., "History Data." A different set of control buttons will be present depending on which mode you are using. In addition, Time Display and Spectrum Display formats differ in regard to certain control options.

Reference Notes:
For toolbar button functions refer to chapter 6.
For examples of various plot display types refer to chapter 7.

Saving and Recalling Plot Setups

You can save and recall plot setups. If you typically need to display data in a fixed format, this option can simplify the display setup process. After you can setup your plot displays, select the "Save Plot Setup" file menu option and save the setup. The next time you need to display data in that format, you can use the "Recall Plot Setup" file menu option to quickly display data in that format.
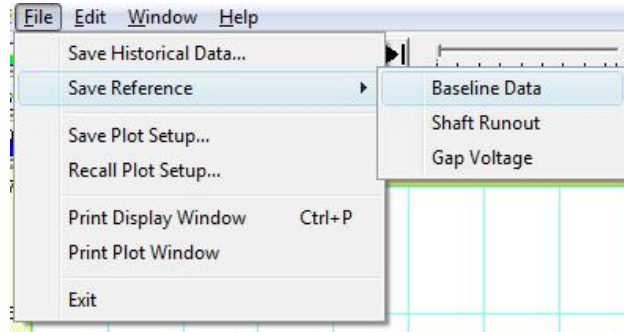
File Pull-down Menu
for Plot Displays

Preparing to Save a Plot Setup
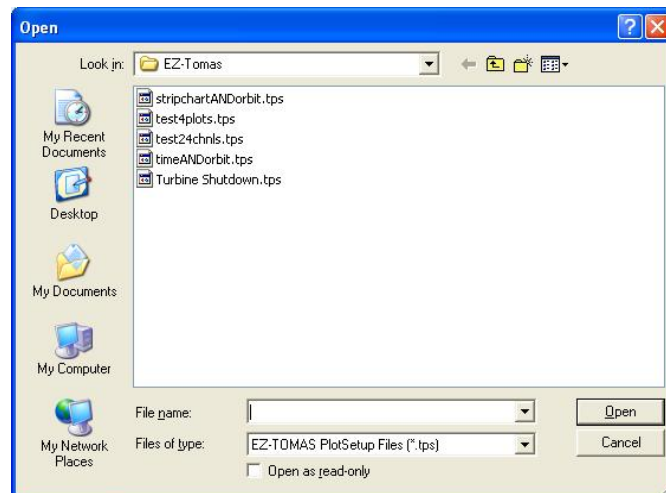
Preparing to Recall [Open] a Plot Setup

Changing Display Ranges and Scales **To change the maximum or minimum range value** (following figure): Left-click on upper or lower scale value that is to be changed, then enter the new value. An example follows. This technique works for both X and Y axis.
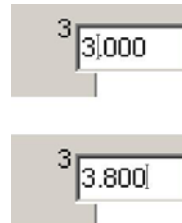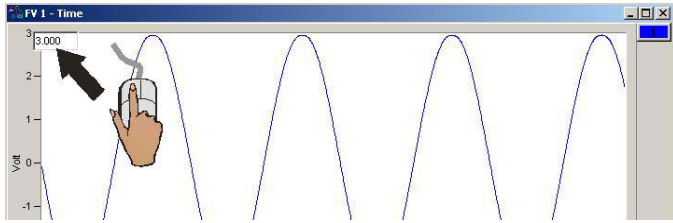
In this example, the cursor and PC keyboard were used to change the maximum scale value from 3.000 volts to 3.800 volts.

To change the X-Axis (following figures): 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. As an alternative, you can click the X-Scaling button and then drag the mouse cursor horizontally on the plot.
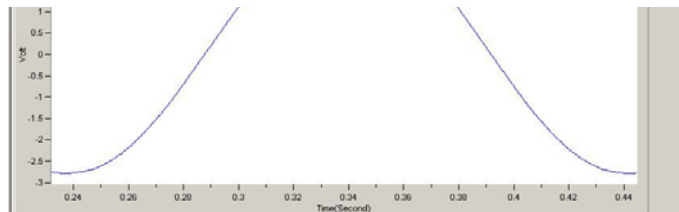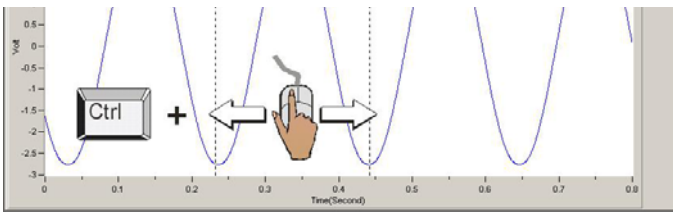
To change the Y-Axis (following figures): Hold down the **<Alt>** key, at the same time, left-click and drag the mouse cursor vertically on the plot. Two horizontal cursor lines will define the new Y-axis end-points. As an alternative, you can click the Y-Scaling button and then drag the mouse cursor vertically on the plot.
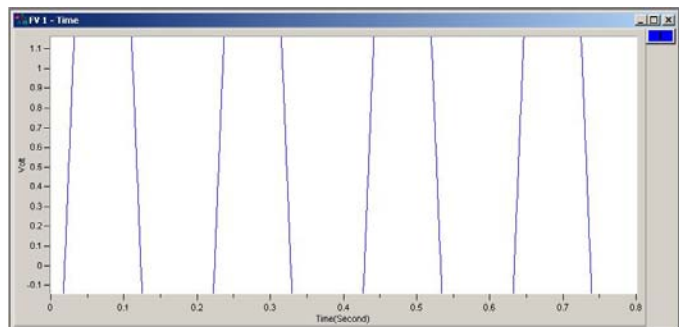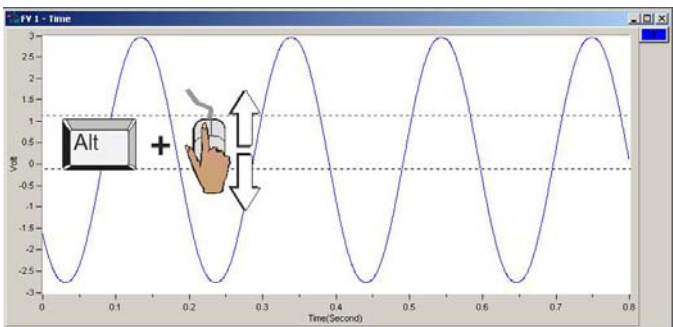
To simultaneously change the X & Y Axes (following figures): Hold down the **<Ctrl>** and **<Alt>** keys, at the same time, left-click and drag the mouse cursor diagonally on the plot. A rectangle will define the new area of the plot. As an alternative, you can click the X-Y-Scaling button and then drag the mouse cursor diagonally on the plot.
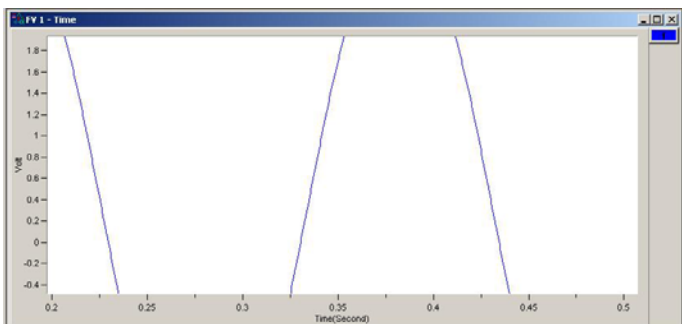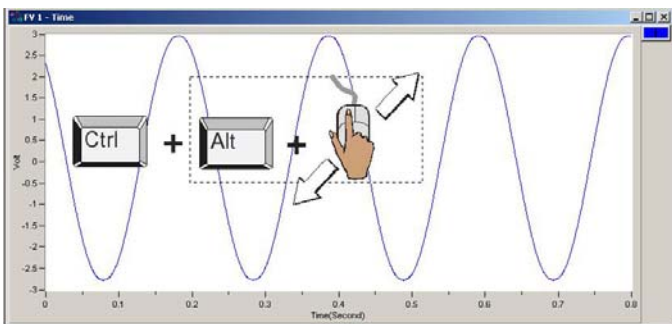
Note: In regard to using toolbar buttons to change axis ranges, refer to Chapter 6.

"Real Time" Plot Controls

"Real Time" is the default data source. For **Real Time** displays you can **Halt and Resume** the display of data by using the <**Pause/Continue**> toggle button (see following figure). As an option to the **<Pause/Continue>** button you can use the "**P**" key on the PC's keyboard. A table, which identifies all control buttons follows shortly.

The **<Clear Real Time Plot Buffer>** button, which looks like a black "X," allows you to clear the data in the realtime trend displays. This display option can be used to clear the plot displays prior to starting a test.

Real Time Mode is Selected

"History Data" Plot Controls

When viewing **History Data** (pre-recorded data files), you can use the set of playback buttons or the slider bar to navigate through the data. A table, which identifies all control buttons, is presented in chapter 6. Note that the playback buttons and slider remain hidden in the GUI when eZ-TOMAS is in the Real Time mode.

History Data is accumulated according to the parameters setup in the Setup Configuration window's Storage Tab, which is accessed via the Gauge Panel window's Edit Menu.
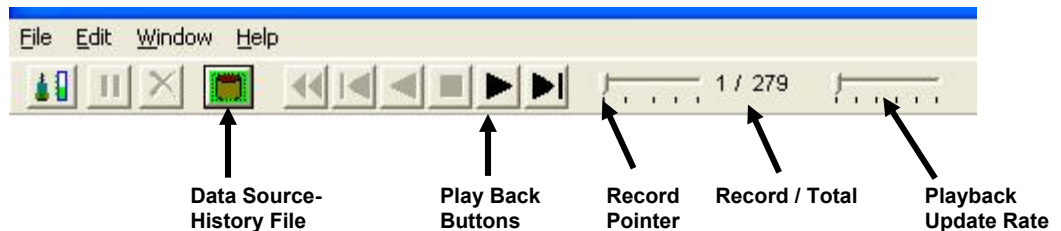
History Data (Playback) Mode is Selected

The playback buttons from left to right are: Rewind, Step backward one record, Play Backward, Stop, Play, and Step forward one record

Note that you can drag the History Data Slider (at the right of the play buttons) to a specific area of the file before you start playing back the data.

The Playback Update [Delay] Slider allows you to slow down (delay) the playback update. The delay value can be set to anywhere from 0 to 1000 milliseconds, in 200 millisecond increments.
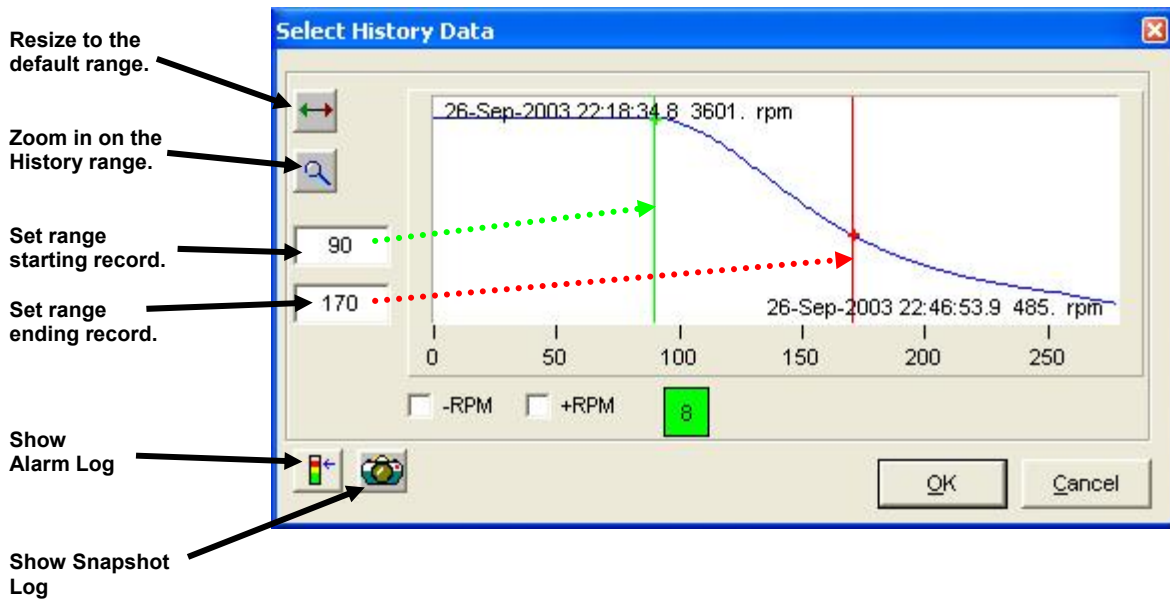
Resize to the default range.

Zoom in on the History range.

Set range starting record.

Set range ending record.

Show Alarm Log

Show Snapshot Log

Select History Data

26-Sep-2003 22:18:34.8 3601. rpm

90

170

26-Sep-2003 22:46:53.9 485. rpm

0   50   100   150   200   250

☐ -RPM   ☐ +RPM   8

OK   Cancel

Reference Note:
Refer to chapter 6 for more detailed information regarding Plot displays, associated toolbar buttons, and other controls.

The default is the entire history file. To change the start and end dates drag the green and red bands to the desired start and stop times, respectively. As an alternative, you can enter the record numbers in the numeric fields for starting and ending records. After defining the range, click <OK>.

From the plot window, click the play button to play back the file.

The History Data window includes a **Show Alarm Log** button. Click the button to open a table of alarm events that are included in the file (if applicable). You can select an alarm event to display the data that surrounds the event.

The History Data window also includes a **Show Snapshot Log** button. Click the button to open a list of data snapshots. You can select a snapshot from the list to view it in the plot window.

RPM Filter – This feature eliminates hysterisis and is therefore useful for trend displays, e.g., Stripchart, Polar, Shaft Centerline and Bode. If the RPM Filter checkbox is checked eZ-TOMAS will only display data for increasing or decreasing RPM.

Channels
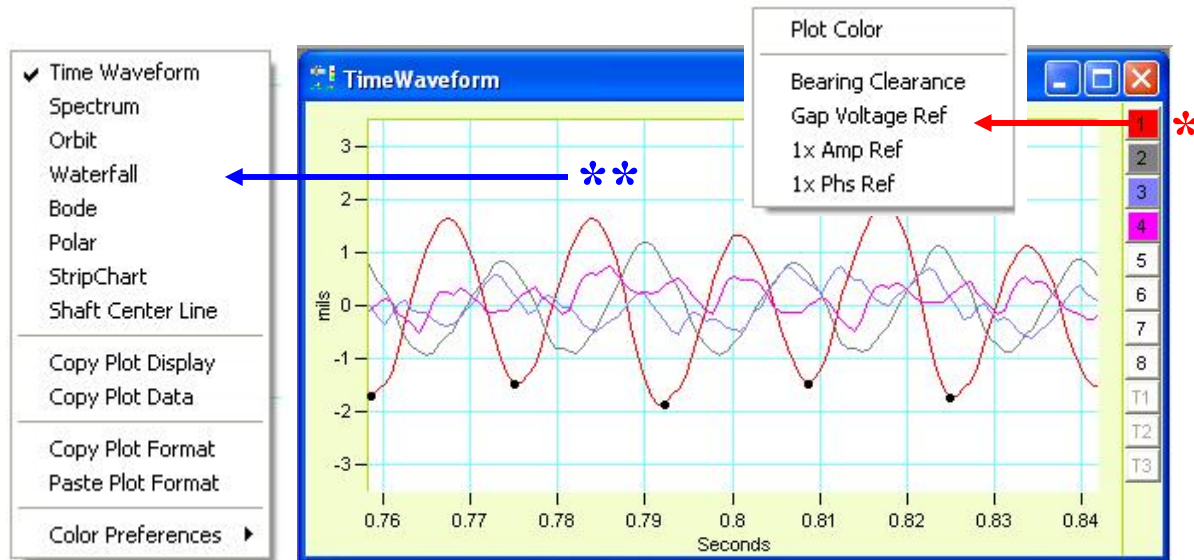
A Time Waveform Display of 4 Channels

* Right-clicking on a channel button brings up a menu (see figure) which allows for changing some of the display characteristics for that channel, such as the color of the plot [channel trace].

** Right-clicking anywhere in the plot display area brings up a menu of many display options. Refer to the menu at the left, in the above figure.

The vertical channel bar at the right-hand edge of each plot represents the input channels. The number of channels that can be displayed is dependent on the plot display format. Some points regarding channels follow.

- A **color-filled channel box** indicates that the channel is currently being displayed as a trace of matching color.

- A **white channel box** indicates that the channel is active, but is not being displayed.

- A **dimmed channel number** is not active, thus there is no data to display.

- **Multiple channels** can be plotted on Time, Spectrum, Strip Chart, and Bode displays. Examples of plot types are provided in chapter 7.

- A **single channel** can be plotted on Waterfall, Polar, and Shaft Center Line displays.

- For **Orbit** displays and for **Shaft Centerline** displays, the time display of a channel pair is displayed.

Reference Notes:
For toolbar button functions refer to chapter 6.
For examples of various plot display types refer to chapter 7.

Notes

1st Toolbar

1		**Data Source-Real Time** – selects the "Real Time" live data acquisition mode or the "History Data" (Play Back) mode.
2		**Pause / Continue** – toggles to pause or continue data monitoring. Applies only to the Real Time mode.
3		**Clear Real Time Plot Buffer** allows you to clear the data in the realtime trend displays. This display option can be used to clear the plot displays prior to starting a test.
4		**Data Source-History File** – Opens the History Data Dialog Box to select a file for viewing via the playback (history data) mode. After clicking this button the playback buttons and related slider will appear.
5		**Playback Buttons** – From left to right, the buttons are: Rewind, Step Backward One Record, Stop, Play, and Step Forward One Record.

2nd Toolbar

1		**Select Plot Setup File** – Pops-up a list of saved plot setup files (.tps) which you can select to display.
2		**Open New Plot Window** – Adds one more plot window to the screen. Note that there is a limit of 8 plot windows.
3		**Align Plots, Vertical Orientation** – Affective with 2 or more plots. This function orients the plot windows such that they are longer in the vertical direction. With 8 plot windows, eZ-TOMAS will display 2 rows of 4 plot windows.
4		**Align Plots, Horizontal Orientation** – Affective with 2 or more plots. This function orients the plot windows such that they are longer in the horizontal direction. With 8 plot windows, eZ-TOMAS will display 4 rows of 2 plot windows.
5		**Time Waveform** - Selects Plot Display window for which the x-axis is in units of time.
6		**Spectrum** – Selects a Plot Display window for which the x-axis is in frequency-related units.
7		**Orbit** – Used to plot a time waveform for a channel pair. The data will is displayed in a polar format.
8		**Waterfall** – Selects a Plot Display window that makes use of x, y, and z axis. Waterfall plots display data as a series of Spectral Maps. Some users refer to Waterfall Plots as Cascades.
9		**Bode** – Selects a plot display window in which the x-axis is scaled in RPM.
10		**Polar** – Selects a window for a circular plot. Displays 1x Amp and Phase data in a polar format.
11		**Stripchart** – Selects a stripchart type plot display window.
12		**Shaft Centerline** – Used to plot a shaft centerline orbit as a trend in Gap Voltage for a channel pair. The data is displayed in a polar format.
13		**Spectral Bands** – Bands A, B, C, and D are pre-defined as follows: A-Overall, B-DC Gap Voltage, C-1xAmp/Phase, D-1xPhase/Amp. E through N are user-defined
14		**Overlap Process - Calculate and Save** – Opens the Overlap Processing dialog box. Overlap Processing can be used to analyze machine transients using continuous data in the FIFO history file. This button is related to the Overlay Overlap Data button (15).
15		**Overlay Overlap Data** – Use this button to plot overlap processed data onto Bode or Polar displays. The feature can be used to compare various startup and shutdown data. This button is closely related to the <Overlap Process - Calculate and Save> button (14).
16		**Show Baseline** – superimposes a pre-recorded baseline on top of display data. This option is only available in the Time or Spectrum plots. Show Baseline is typically used to compare a spectrum with another (the baseline) which was taken when the machine was known to be in good working condition. Show baseline is only available for multiple plot applications.

3rd Toolbar	

1		**Scale** – Toggles between **Instrument Scale**, **Auto Scale**, and **User Scale**. Instrument Scale is shown in the figure.
		Instrument Scale is the default. It displays the data based on the instrument's Engineering Units range.
		Instrument Scale
		Auto Scale automatically scales the axes based on the data being displayed.
		Auto Scale
		User Scale is used to display data in relation to a user-defined scale. You can quickly customize a scale as follows: (1) press the <Ctrl> + <Alt> keys and hold them in. (2) press the <left mouse button> and hold in (3) move the mouse cursor to draw a rectangle around the area of the plot that you desire to view. (4) release the mouse button and the two keys. Your plot should now have a new and more practical scale.
		User Scale
2		**Manually Scale X and Y Axis** – A diagonally oriented dual-arrow cursor appears. The cursor lets the user simultaneously adjust both the X-axis and Y-axis by dragging the mouse.
3		**Manually Scale Y Axis** – A vertical dual-arrow cursor appears. The cursor lets the user manually adjust the Y-axis by dragging the mouse.
4		**Manually Scale X Axis** – A horizontal dual-arrow cursor appears. The cursor lets the user manually adjust the X-axis by dragging the mouse.
5		**Linear / Log Scale Y Axis** – Spectrum Display Only. This button allows you to switch between Linear and Log Y-axis scaling. If you expand the data plot this feature is disabled until the plot is returned to its original scale via the Auto Scale button.
6		**Frequency Axis** – Used to set the x-axis to Hz, CPM, or Orders. Applies to Spectrum Plot Windows only. Each click of the Frequency Axis button toggles the x-axis unit of measure.
7		**Delta Time or Delta Record** – For Stripcharts Only: Selects one of two X-axis spacing types. (a) When button (7) is gray, Delta Time is selected for the X-Axis. **Delta Time** spacing displays data with absolute time for the X-axis. (b) When button (7) is green, Delta Record is selected for the X-Axis. **Delta Record** has X-axis time spacing based on record changes. Thus the time line on the X-axis is not uniform. Delta Record spacing is good when there are short acquisition durations over long periods of time as vacant time slots are eliminated from the display.
	With **Stripcharts** selected	
	With **Waterfall** selected	**Skip Records or Use All Records** – **For Waterfalls Only**: Selects one of two display modes. (a) When button (7) is gray, "use all Records" is selected and the entire Waterfall will scroll. Scrolling can be forward or backward. (b) When button (7) is green a maximum of 100 records will be scrolled based on a Skip Record Factor. SRF = History Records / Waterfall Records - 1. Thus if we had 634 history records and 100 waterfall records we would have a skip factor of 6.4 records, i.e., 634 / 100-1 = 6.4 records. This skip factor would result in 100 records being scrolled. Note that the SRF is automatically calculated and applied by software.
8		**Display Cursor Values** – allows you to show a plot cursor with annotation. A cursor is provided with each plot trace. Cursors can be visible or hidden.
9		**Show Frame Annotation** – Shows a framed set of information such as machine names, user notes, and spectral bands.
10		**Show RPM / Time Annotation -** Active with Polar, Waterfall, and Shaft Centerline Plots. Use this button to superimpose RPM or Time values onto the displayed data.

3rd Toolbar *(continued)*

11		*Harmonic Cursors* – Can only be used when 1 trace is displayed. 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. If Display Gauge Values is selected, the applicable values will be shown for all cursors. Harmonic cursors can only be moved by moving the primary cursor.
12		*Side Band Cursors* – Can only be used when 1 trace is displayed. Results in several cursors spaced at even intervals on both sides of the primary cursor. Unlike the harmonic cursors, the sideband cursors can be moved by the user. Once adjusted, they remain in position at until the next adjustment. If Display Gauge Values is selected, the applicable values will be shown for all cursors.
13		*Peak Cursors* – Can only be used when 1 trace is displayed. The cursors will automatically position at the highest peaks on the trace.
14		**Multiple Trace Cursor** *Locked* - When locked, cursors for like plots are moved simultaneously. As you move cursors in one spectrum, the cursors in the other spectrum plots move to the same X position. *Unlocked* - When unlocked, you can only move the cursors in the plot that has focus.
15		**Cursor Update - Fixed X axis / Peak Search** – When this button has a gray background, the x-axis is fixed and the cursor will not move when a new spectrum is plotted. When the button has a green background "Peak Search" is in effect and the cursor will automatically move to the highest point on the plot. The button is typically used for Spectrum plots, either Real Time or Historical Data.
16		**Overlay Limits** – For Spectrum, Stripchart, and Polar plot windows. Superimposes the limit values onto the displayed data.
17		**Runout Compensation** – displays a graph of the RunOut compensated values for Bode and Polar plots. RunOut compensation is a vector math operation in which the referenced first-order amplitude and phase vector is subtracted from the displayed first order vector. For Time Waveform and Orbit plots this shows time waveform compensation.
18		**Overlay Bearing Clearance Circle** – For Orbit and Shaft Centerline this button is used to superimpose the bearing clearance circle over the plot display.
19		**Apply DC Coupling** – For Bode, Stripchart, and Time Waveform this button is used to apply DC Coupling. Commonly used with Displacement Probes.
		-/+ Spectrum Full – Sets the x-axis to have both negative and positive on the scale.
20		**Double Differential** – Changes the display by a double differential, for example, from Displacement to Accelerometer.
21		**Single Differential** – Changes the display by a single differential, for example, from Displacement to Velocity, or Velocity to Accelerometer.
22		**Single Integration** – Changes the display by a single integration, for example, from Velocity to Displacement, or from Accelerometer to Velocity.
23		**Double Integration** – Changes the display by a double integration, for example, from Accelerometer to Displacement.
24	5 Revs	**Shaft Revolution Filter** – Used with Time and Orbit plots. This filter selection is used to limit the amount of data displayed. The limitation is set by selecting "n," where "n" is equal to the number of shaft revolutions. The Shaft Revolution Filter is used to make the plot display cleaner by reducing clutter from excess data. Selection options are: N/A, 1 rev, 2 revs, 5 revs, and 10 revs.
25		**Show User Notes** – Displays the User Notes from the Project Information window. The notes are displayed in a free-moving, re-sizeable box. You can enter text in this field.

Notes

Plot Examples 7

This chapter provides examples of the various plot types. The following chapters are directly related to this one and may need reviewed or referred to.

Chapter 5, *Display Menu… Plot Windows*, discusses:
- how to save and recall plot setups
- change display ranges
- change scales
- Real Time and History Data (playback) modes
- channels
- filtering data

Chapter 6, *Toolbar Buttons*, identifies the layout of the toolbars and explains the purpose of each button.

> **Selecting Plots from the Display pull-down menu opens a *Data Display window*. Note that you can double-click on a gauge to open a Data Display window for plotting the data for that guage.**

For real-time displays, you can halt and resume the display of data by using the Pause/Continue toggle button, or use the "P" key on the keyboard. When viewing historical data, you can use the playback buttons and the history data slider to navigate through the data.

You can view either real-time data or historical data. In the examples that follow we are viewing historical data, thus the History button has been clicked, and appears "active" [green] on our screen.

Prior to viewing a plot you need to:

- **select the channels to be displayed**
- **select the desired data display format, e.g., Time Display, Spectrum, or Waterfall**
- **select the data source, i.e., a "Real Time" source, or a history data file**

The examples in this chapter consist of the following:

Time Waveforms …… 7-2

Spectrum …… 7-6

Orbit …… 7-8

Waterfall …… 7-12

Bode …… 7-14

Polar …… 7-16

Strip Chart …… 7-19

Shaft Centerline …… 7-22

Time Waveform Displays

Time Waveform displays show vibration amplitude as a function of time (seconds) for a block of time domain data. This Block is the measured data used in Spectral Displays. Note that multiple channels can be shown on the Time Display.

Tach Pulse locations are shown with a black dot.
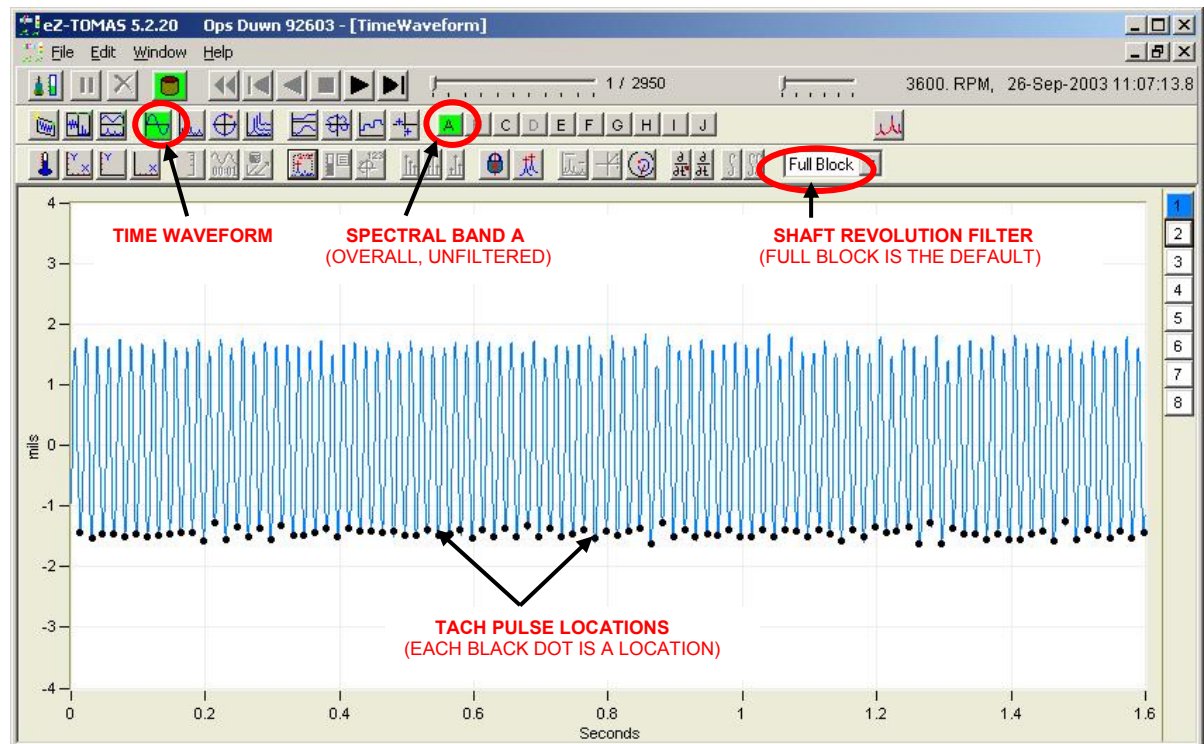
Time Waveform, Fig. 1 - Unfiltered, Channel 1, Full Time Block, No Cursors
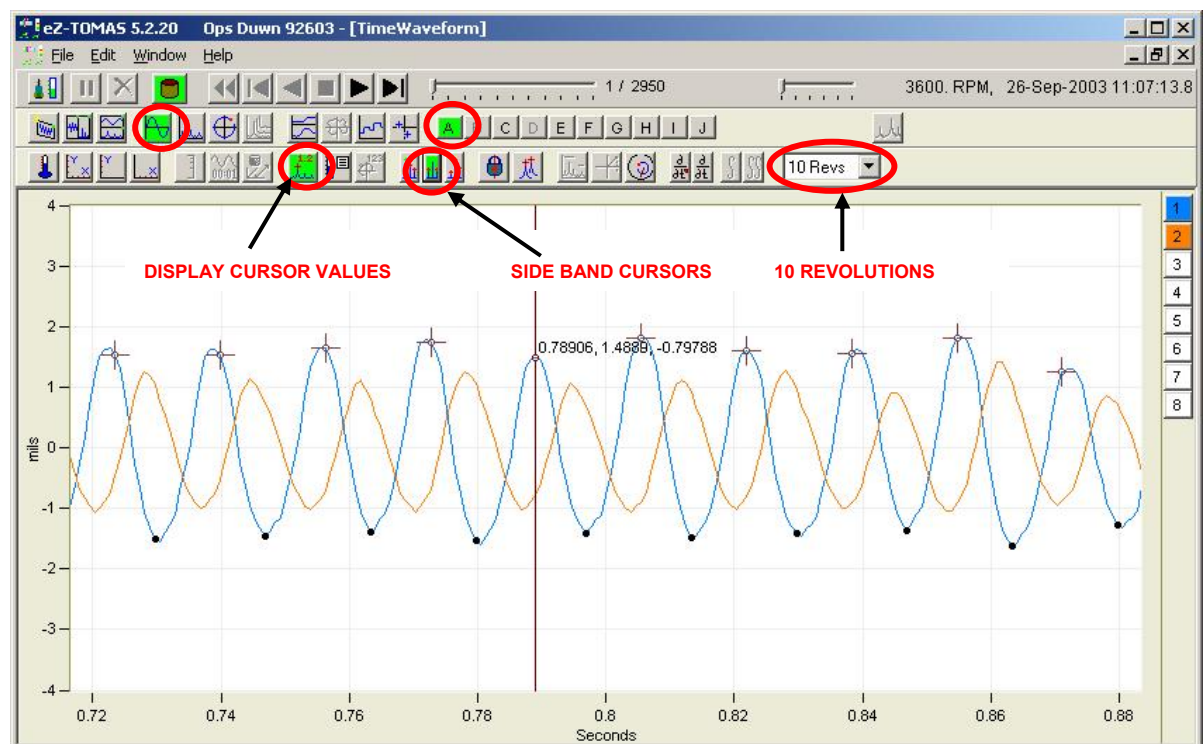
Time Waveform, Fig. 2 - Unfiltered, Channels 1 and 2, 10 Revolutions, Cursor plus Sidebands

Time Waveform, Fig. 3 - Unfiltered, Channel 1, 10 Revolutions, Cursor, Single Differential

Time Waveform, Fig. 4 - Unfiltered, Channels 1 and 2, Full Block, Cursor with Frame Annotation, DC Coupling
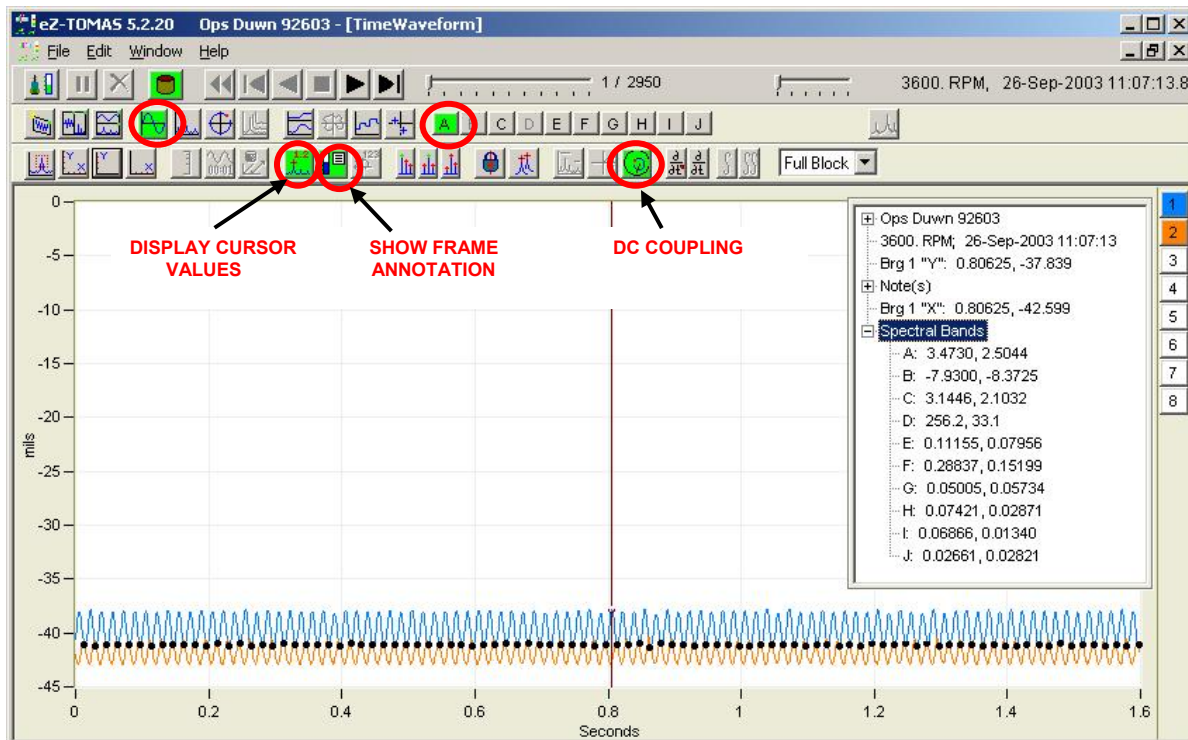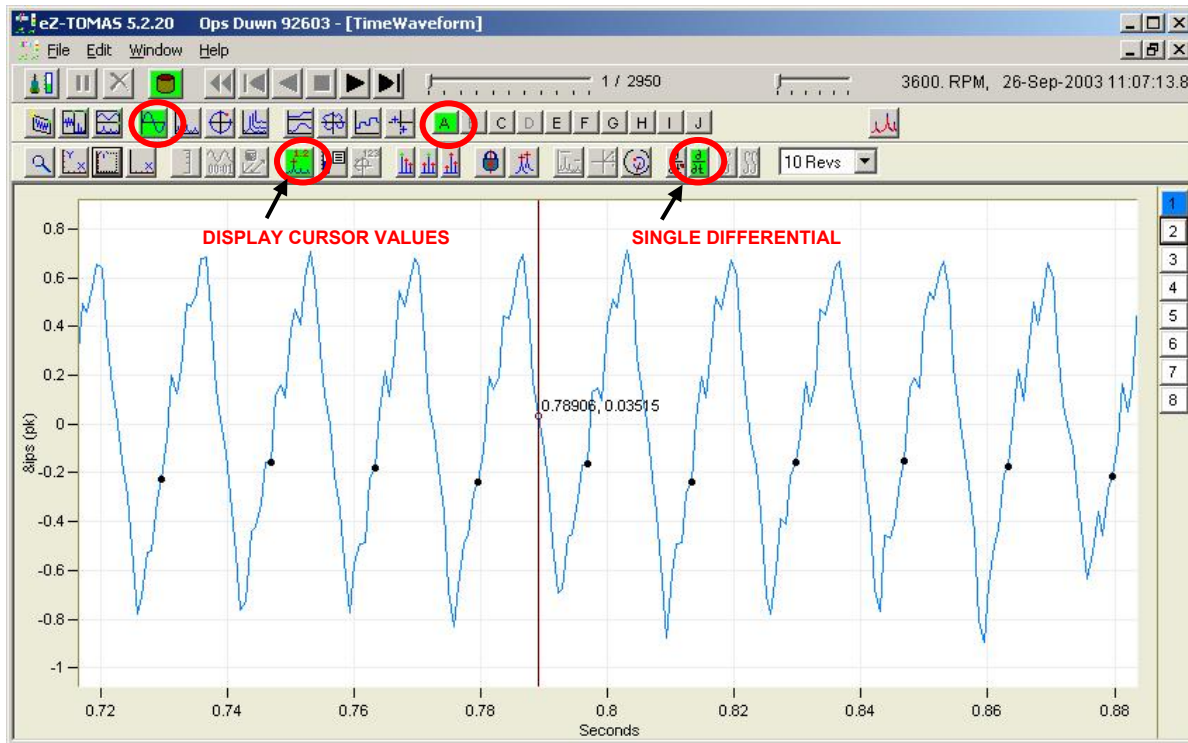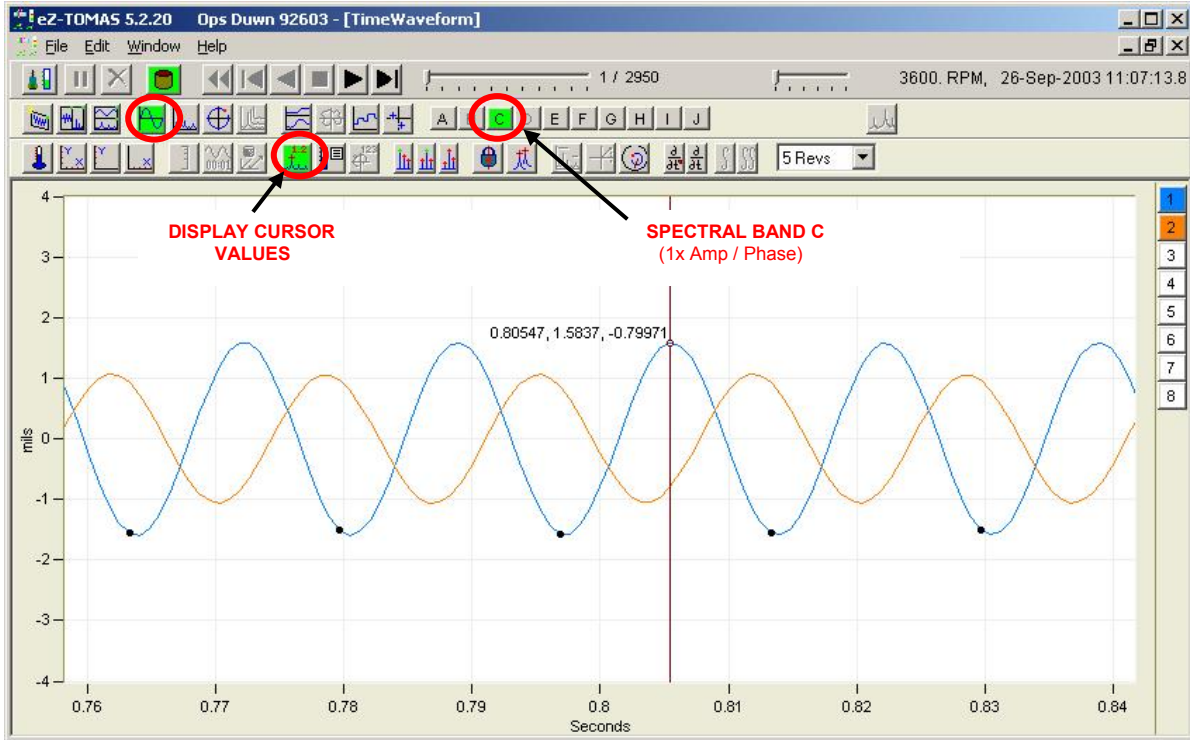
Time Waveform, Fig. 5 - Filtered 1x, Channels 1 & 2, 5 Revolutions, Cursor

Time Waveform Compensation *(selectable option)*

As an option, you can display compensated Time Waveforms. Typically this compensation function is used to remove shaft runout from the data display.

To use this feature:
(a) view the history data
(b) select the *slow roll* condition
(c) select: File
(d) select: Export
(e) select: Runout

You can now view data at steady state and select *Runout Compensation*.

The following example, using channel 14, shows *Uncompensated* and *Compensated* plots.
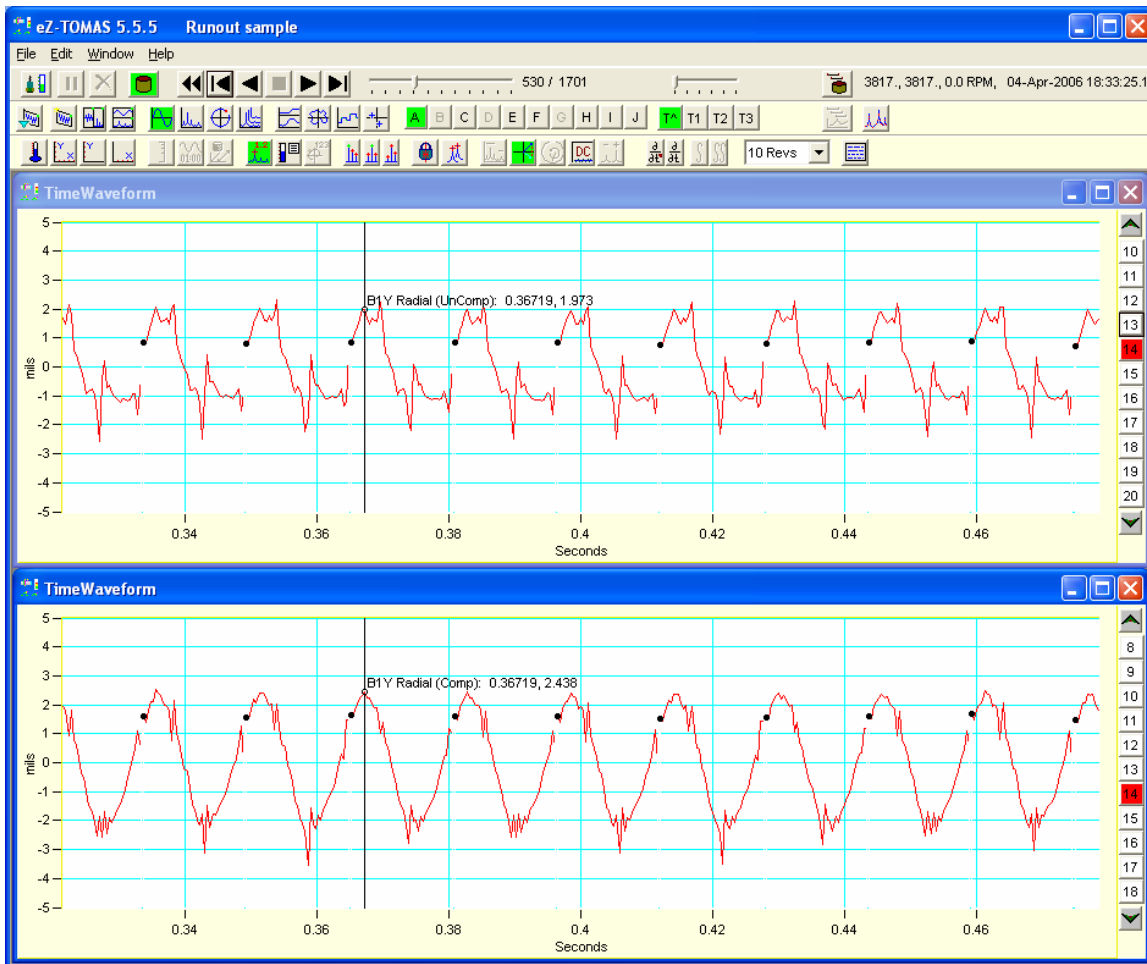
Time Waveform, Fig. 7 - Uncompensated and Compensated (Upper & Lower respectively)

Spectrum Displays

Spectrum Displays show vibration amplitude as a function of frequency. The frequency units can be either Hertz (Hz), cycles per minute (CPM) or orders. Multiple channels can be shown on the Spectrum Display.

Spectrum, Fig. 1
Channel 1, Instrument Scale, Cursor, and X-axis in Hz

Spectrum, Fig. 2
Chs 1 & 2, Linear Scale, Cursor + Harmonic with Frame Annotation, X-axis is in Orders
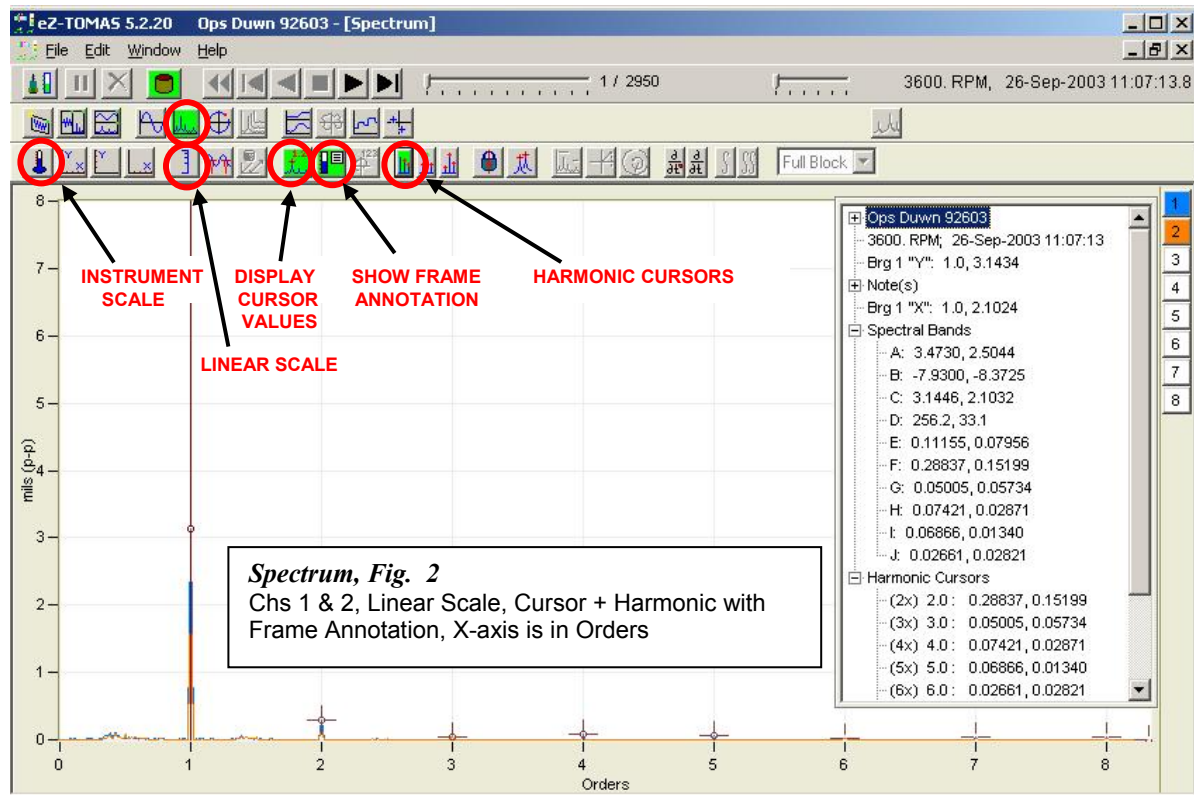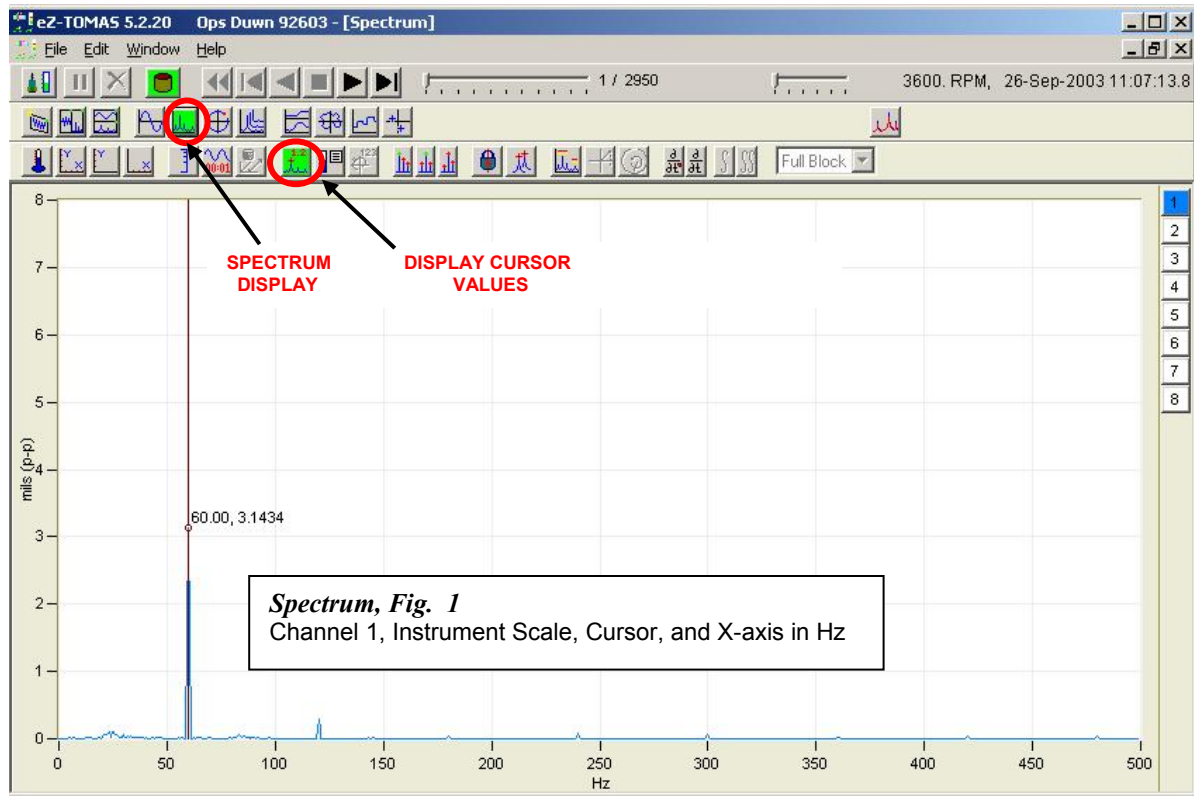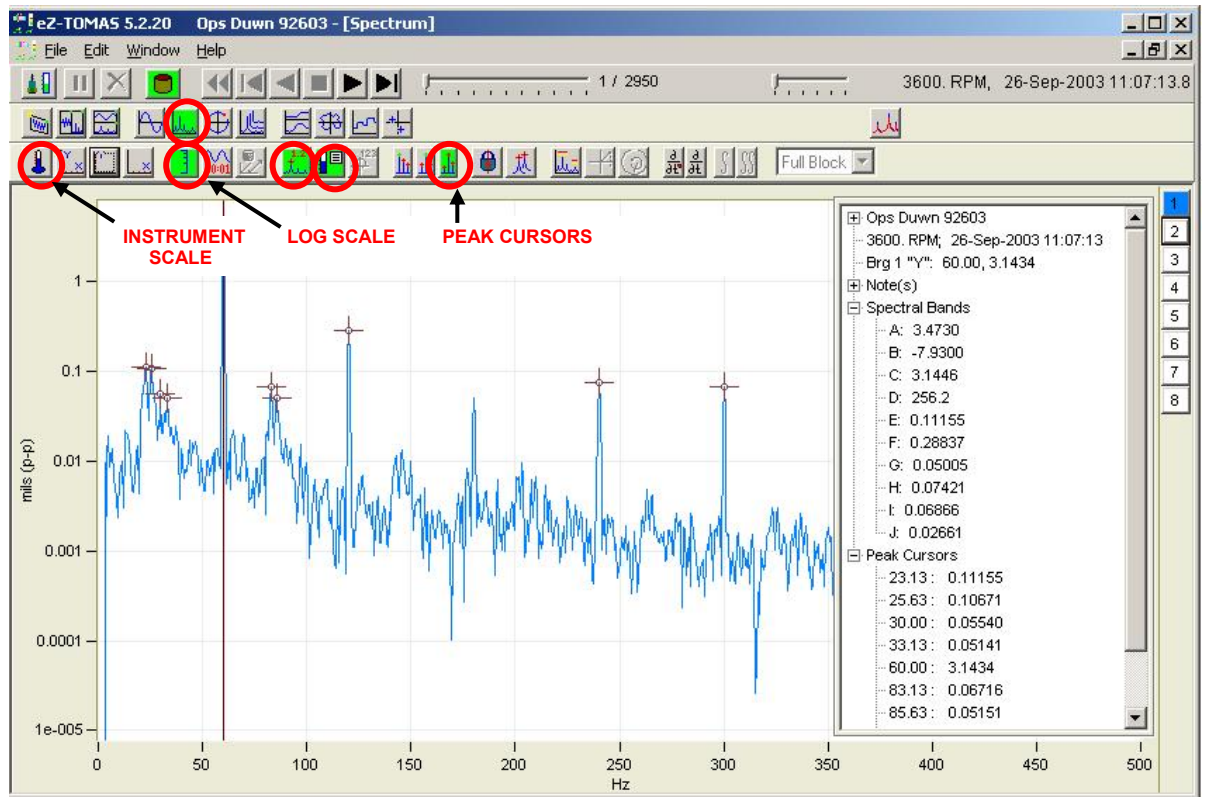
Spectrum, Fig. 3 -   Channel 1, Log Scale, Cursor plus Peaks with Frame Annotation, X-axis is in Hz
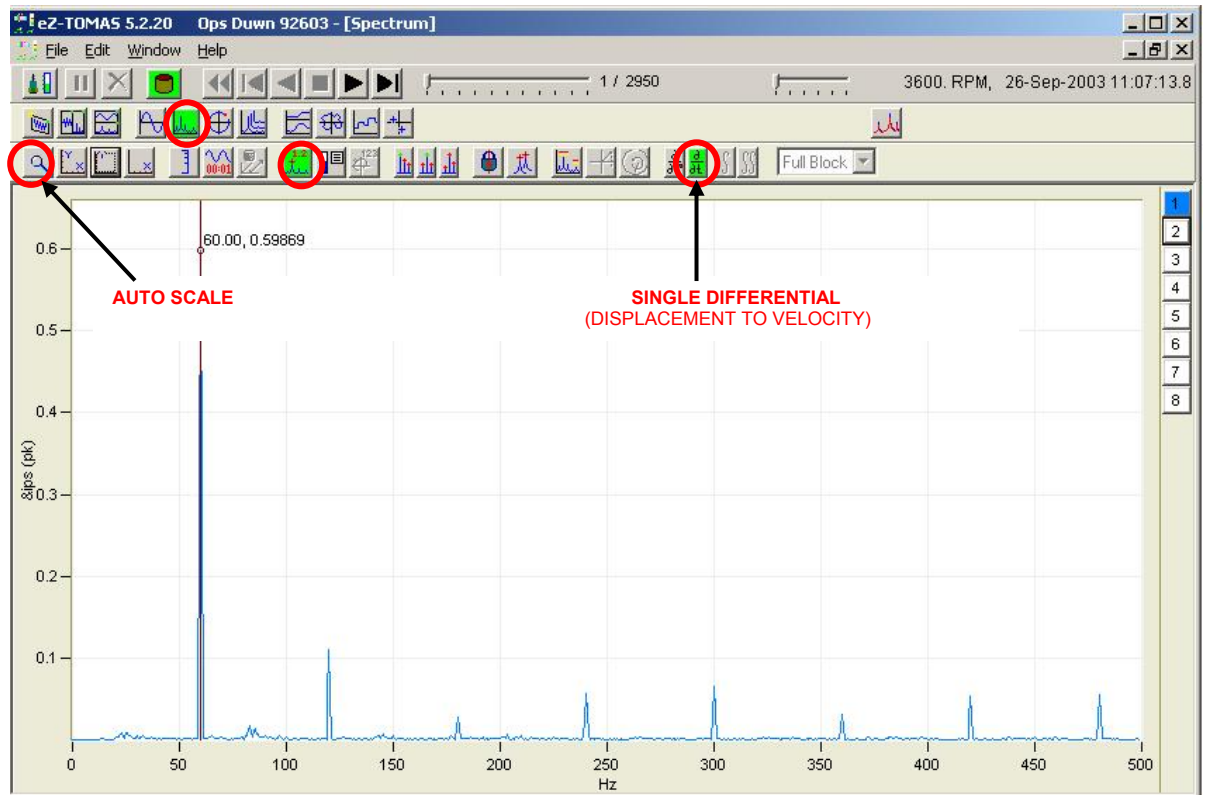
Spectrum, Fig. 4 - Ch 1, Auto Scale, Cursor, X-axis is in Hz, Single Differential (Displacement to Velocity)

Orbit Displays

Orbit Displays show simultaneous time domain vibration amplitude for an X and Y probe pair.

The location of each Tach pulse is shown on the orbit plot using black circles; and a rotation direction label ("CCW" or "CW") is shown next to these (see figure).

The default display is "Full Block" of time data. However, a specific number of Shaft Revolutions can be displayed (1, 2, 5, or 10) by using the associated pull-down list (see figure). The orbit display is corrected for probe location.

You can optionally overlay the orbit onto a shaft center line display by clicking the **Shaft Centerline** button. The center of the orbit trace in SCL computes the difference between the current gap voltage and the reference gap voltage. Information regarding shaft centerline plots is presented on page 7-20.

To display an overlay of the bearing circle clearance, as indicated below (third plot), click the <Overlay Bearing Clearance Circle> button (see figure).

Note: Only one probe pair can be shown on the Orbit Display.
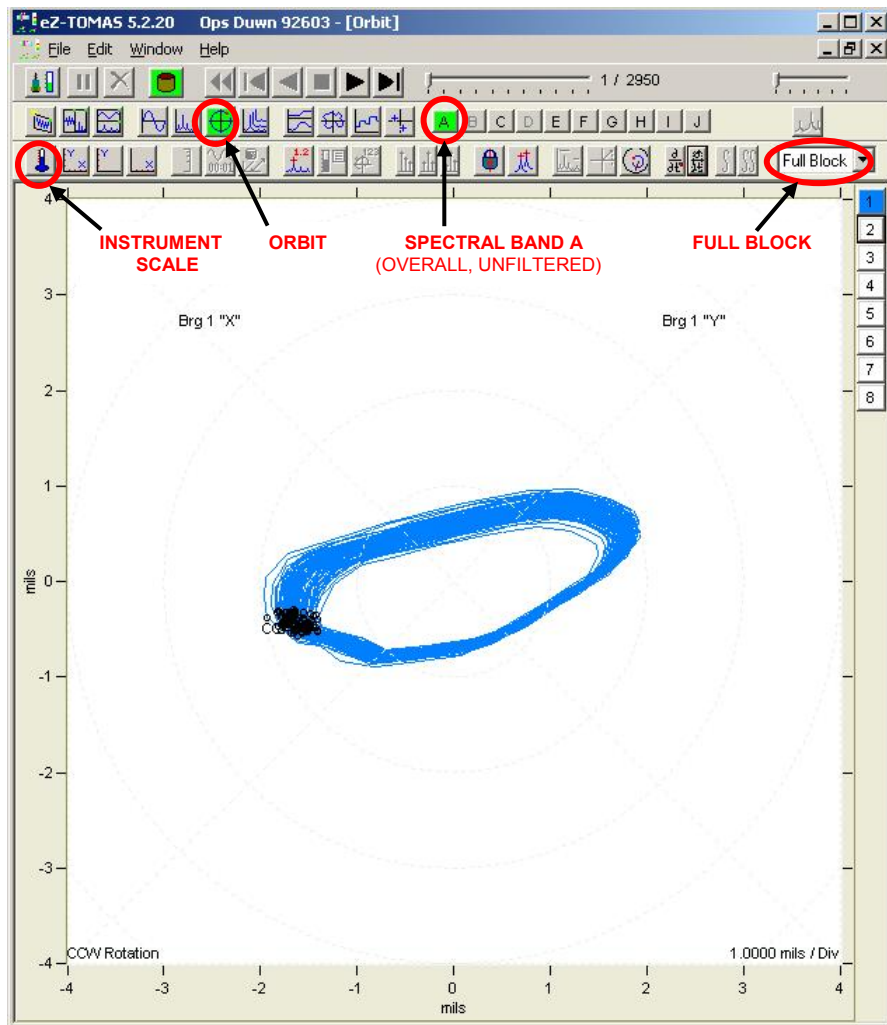
Orbit, Fig. 1 - Channels 1 & 2* Unfiltered, Full Block, Instrument Scale

*Channel 2 Pairing is from the Setup Configuration Window, Input Channels Tab, XY Pair Column
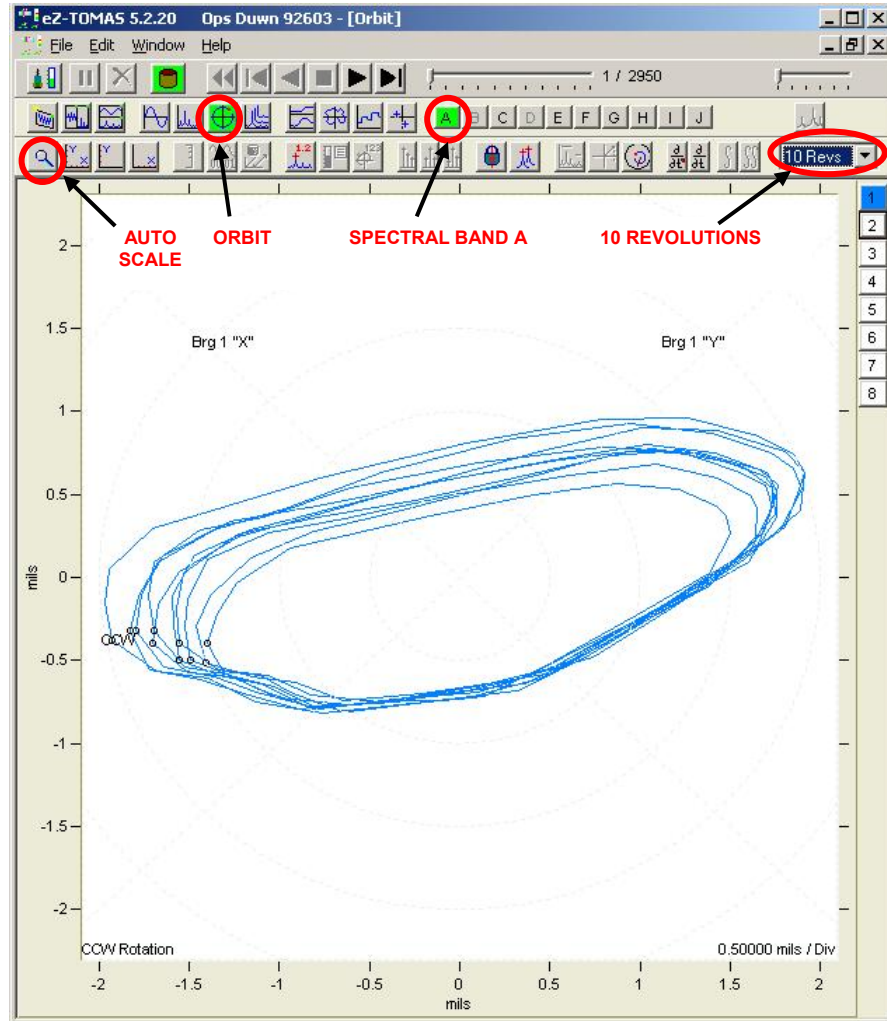
Orbit, Fig. 2 - Channels 1 & 2* Unfiltered, 10 Revolutions, Autoscale

*Channel 2 Pairing is from the Setup Configuration Window, Input Channels Tab, XY Pair Column
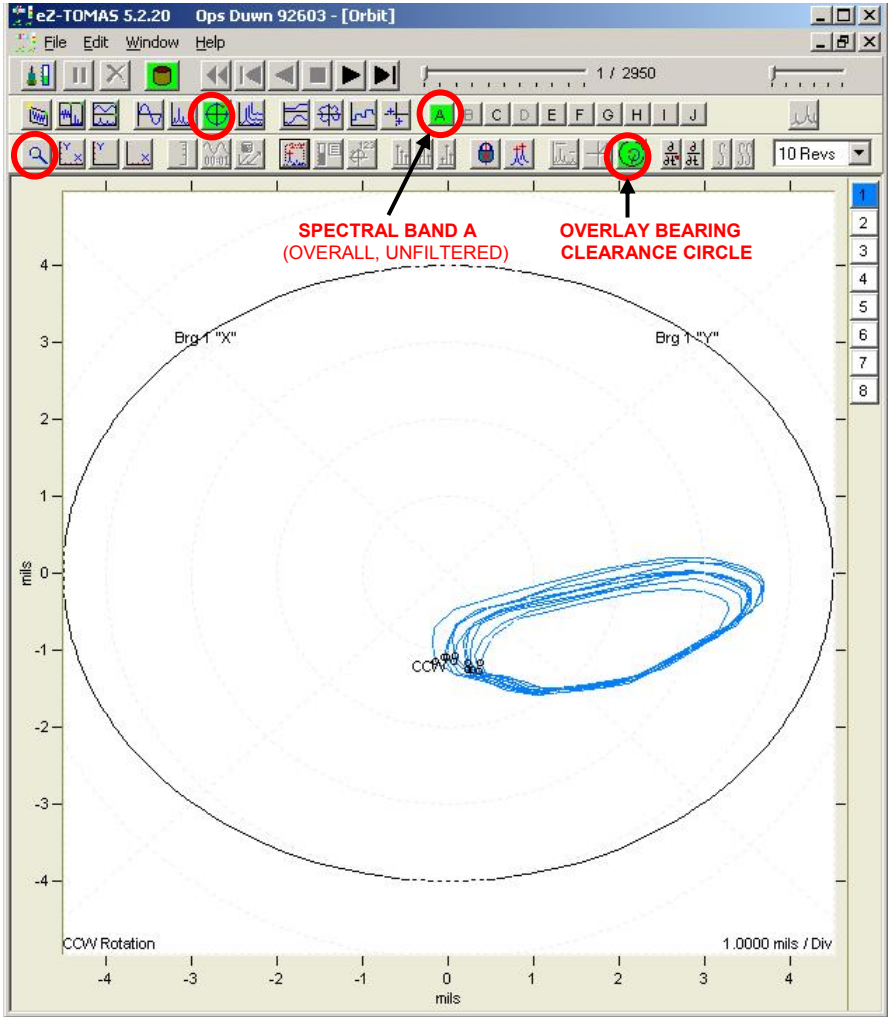
Orbit, Fig. 3 - Chs 1 & 2* Unfiltered, 10 Revs, Autoscale, Overlay Bearing Clearance Circle

*Channel 2 Pairing is from the Setup Configuration Window, Input Channels Tab, XY Pair Column
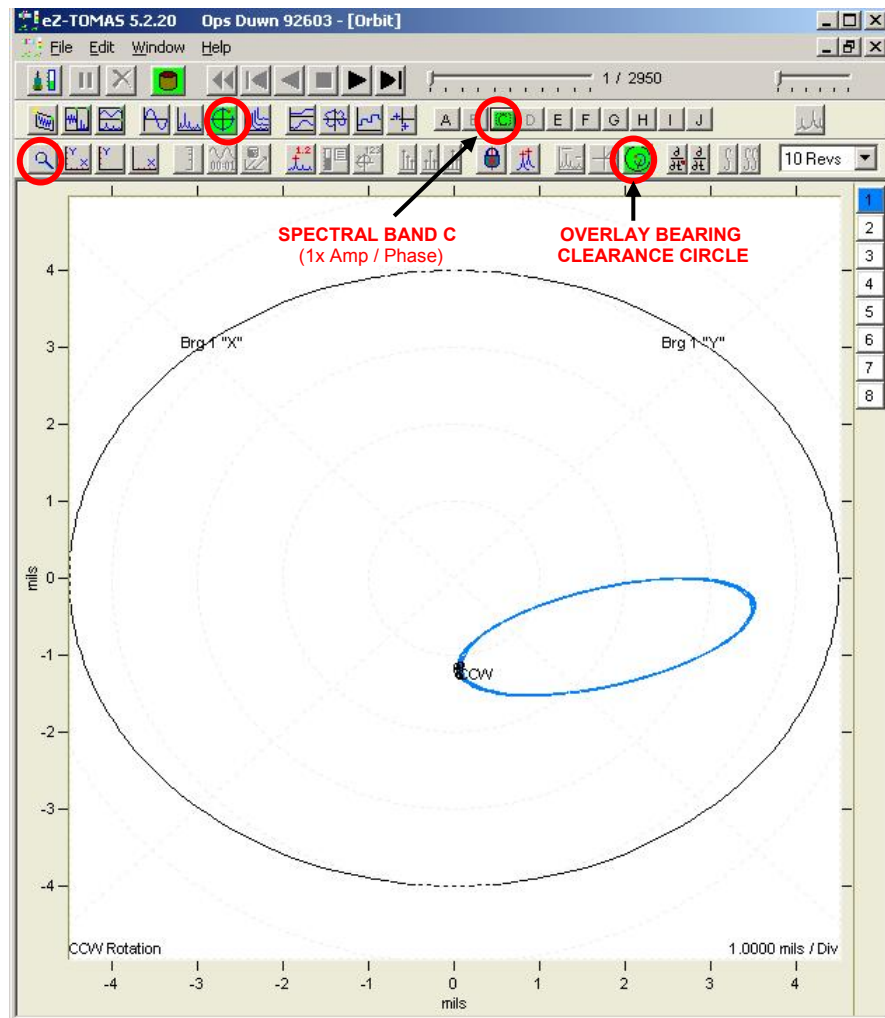
Orbit, Fig. 4 - Chs 1 & 2* Filtered 1x, 10 Revs, Autoscale, Overlay Bearing Clearance Circle

*Channel 2 Pairing is from the Setup Configuration Window, Input Channels Tab, XY Pair Column

Waterfall Displays

Waterfall Displays show a series of Spectrums on a 3D graph. The X-axis is Frequency either Hz or CPM. The Y Axis is Vibration Amplitude. And the Z Axis is time.   Three examples follow.
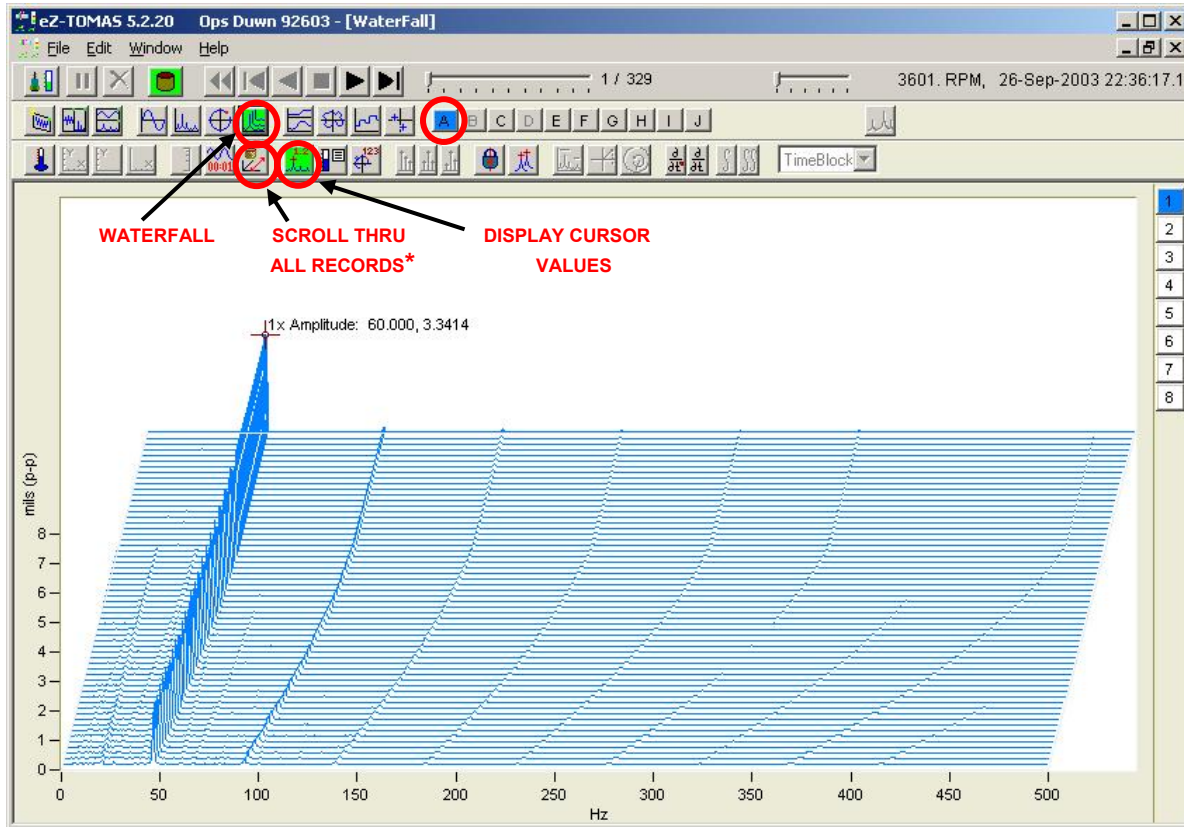
Waterfall, Fig. 1 - Channel 1, Scrolling Buffer, Cursor

To adjust the Latitude Angle (Vertical Pitch) of the Waterfall display, Right Click in the Y-axis area and enter a value between 0 and +75 degrees. This is indicated in the upper left corner of the display (see figure). Unless you right-click in the Y-axis region, this feature will remain hidden.

To adjust the Longitude Angle (Horizontal Pitch) of the Waterfall display, Right Click in the X-axis area and enter a value between -75 and +75 degrees. This is indicated in the lower right corner of the display (see figure). Unless you right-click in the X-axis region, this feature will remain hidden.

*Note: **Use All Records or Skip Records** – When Waterfall is selected this button determines which one of two display modes will be in effect.

- o **Show Entire Range (Use All Records)**: When the button is gray, as indicated above, "**Use all Records**" is selected and the entire Waterfall will scroll. Scrolling can be forward or backward.

- o **Skip History Record**: When the button is green a maximum of 100 records will be scrolled based on a **Skip Record Factor**. SRF = History Records / Waterfall Records - 1. Thus if we had 634 history records and 100 waterfall records we would have a skip factor of 6.4 records, i.e., 634 / 100-1 = 6.4 records. This skip factor would result in 100 records being scrolled. Note that the SRF is automatically calculated and applied by software.

  Waterfall Figure 3 is an example of Skip History Record.
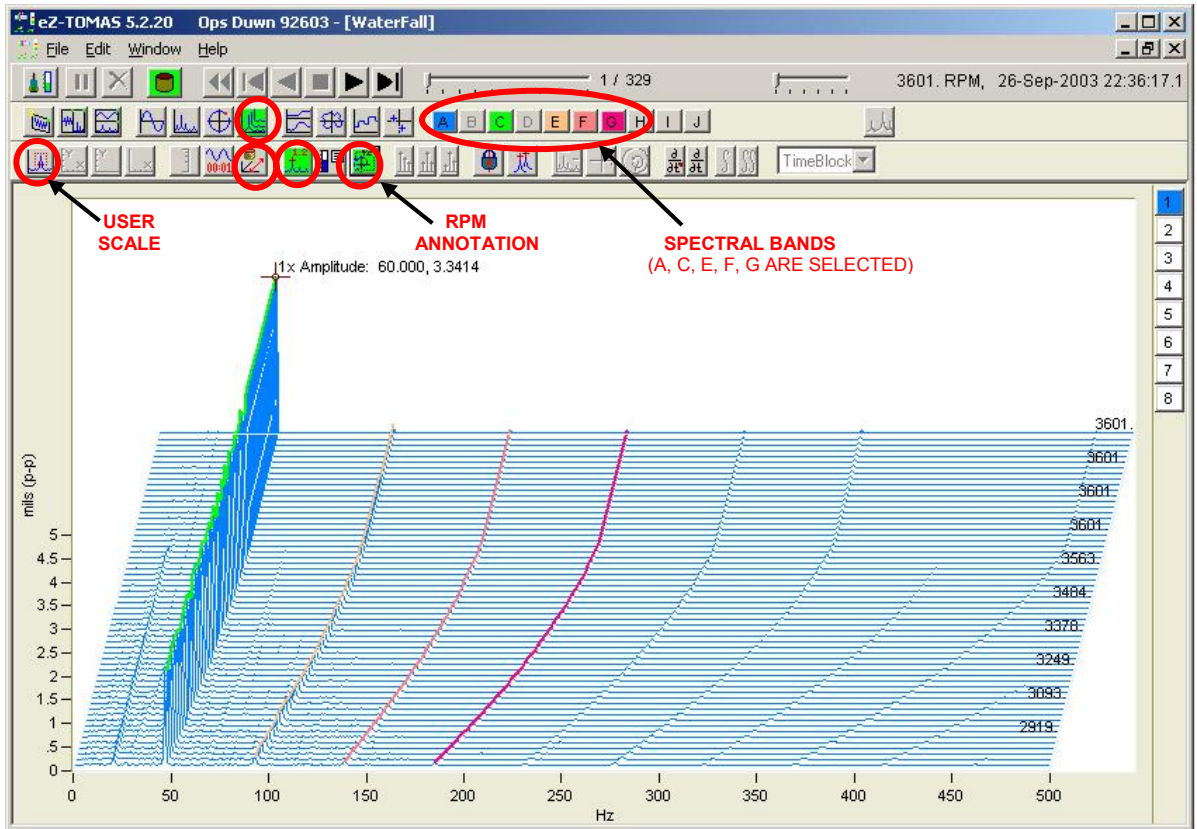
Waterfall, Fig. 2 - Ch 1, Scrolling Buffer, Cursor, Overlay 1xA & 2xA & 3xA & 4xA, RPM Annotation
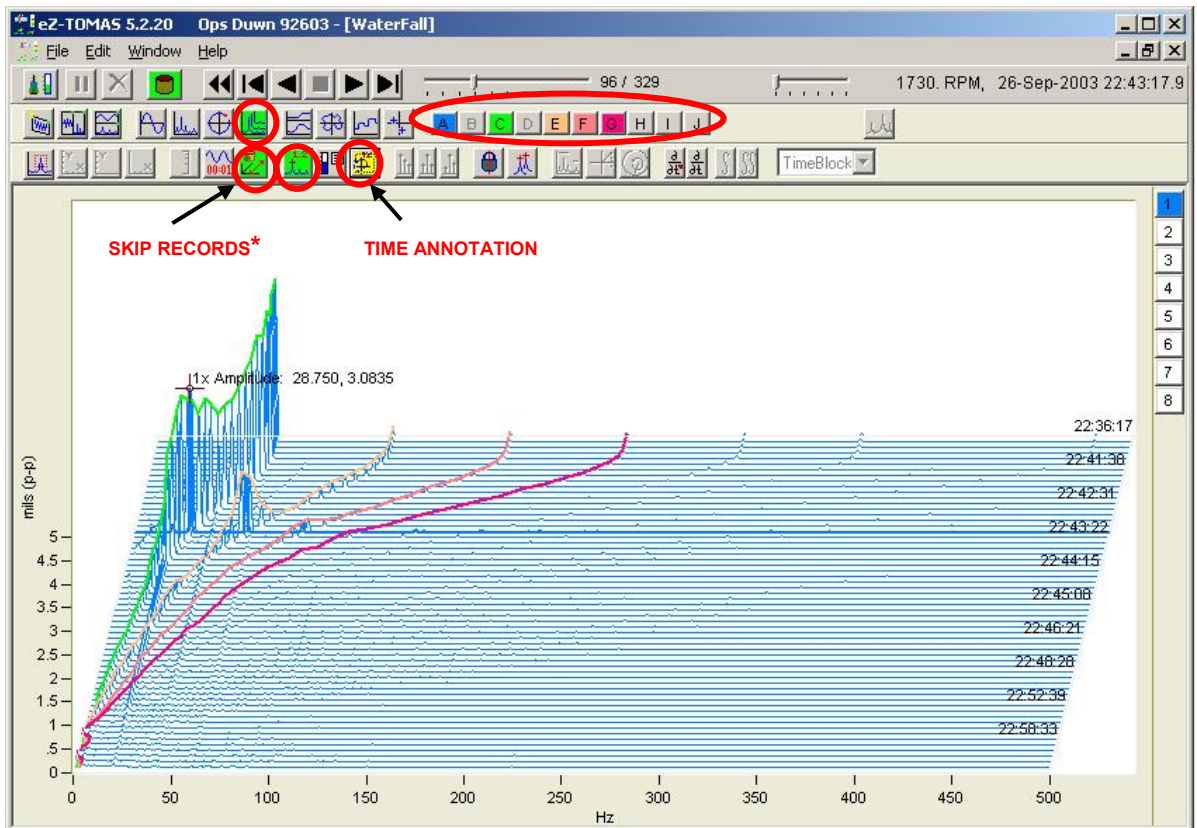
Waterfall, Fig. 3 - Ch1, Skip Records Fill Buffer, Cursor, Overlay 1xA & 2xA & 3xA & 4xA, Time Annotation

* In regard to "Skip Records," see *Waterfall Figure 1* and the associated note page 7-11.

Bode Displays

Bode Displays show vibration amplitude and phase as a function of rotating speed. You can display the runout compensation values on the same plot by clicking the <Runout Compensation> button (see Bode, Figure 3). Runout Compensation is a vector math operation, in which the referenced first order amplitude and phase vector is subtracted from the displayed first order vector. Bode displays can only be used when one channel is selected.

Bode, Fig. 1 - Channel 1, 1xA & 1xP, Cursor

Bode, Fig. 2 - Channel 1, Overall & 1xA & 1xP, Cursor

Bode, Fig. 3 - Channel 6, 1xA & 1xP, Cursor

You can view displays as either Compensated or Uncompensated. When Runout Compensation is selected, a single "Compensated" trace is displayed.
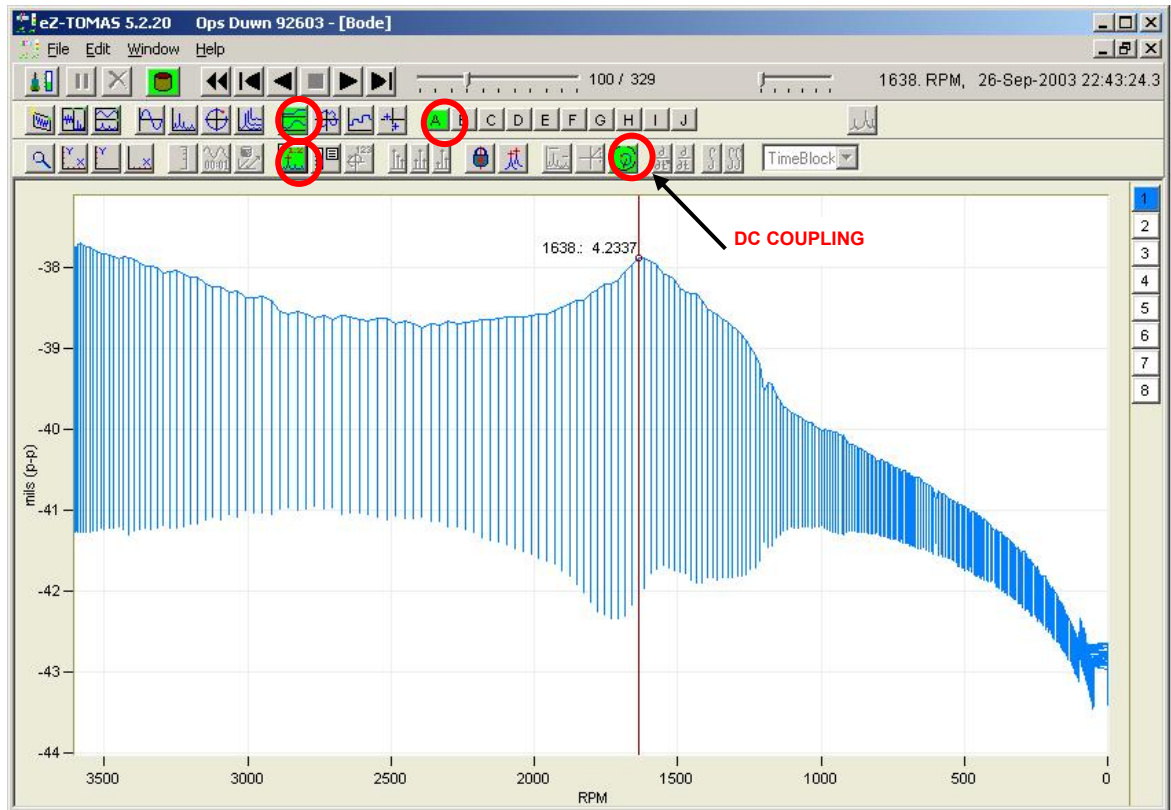
Bode, Fig. 4 - Channel 1, Overall, DC Coupling Applied, Cursor

Polar Displays

Polar Displays show vibration amplitude and phase lag on a polar plot format. The data is corrected for probe location. Phase lag is opposite the direction of rotation. You can optionally display the "Runout" compensated values by clicking the associated button (see figure). The compensation values are specified for each channel in the setup configuration.

Runout Compensation is a vector math operation, in which the referenced first order amplitude and phase vector is subtracted from the displayed first order vector.

Note: Only one channel can be shown on a Polar Display.
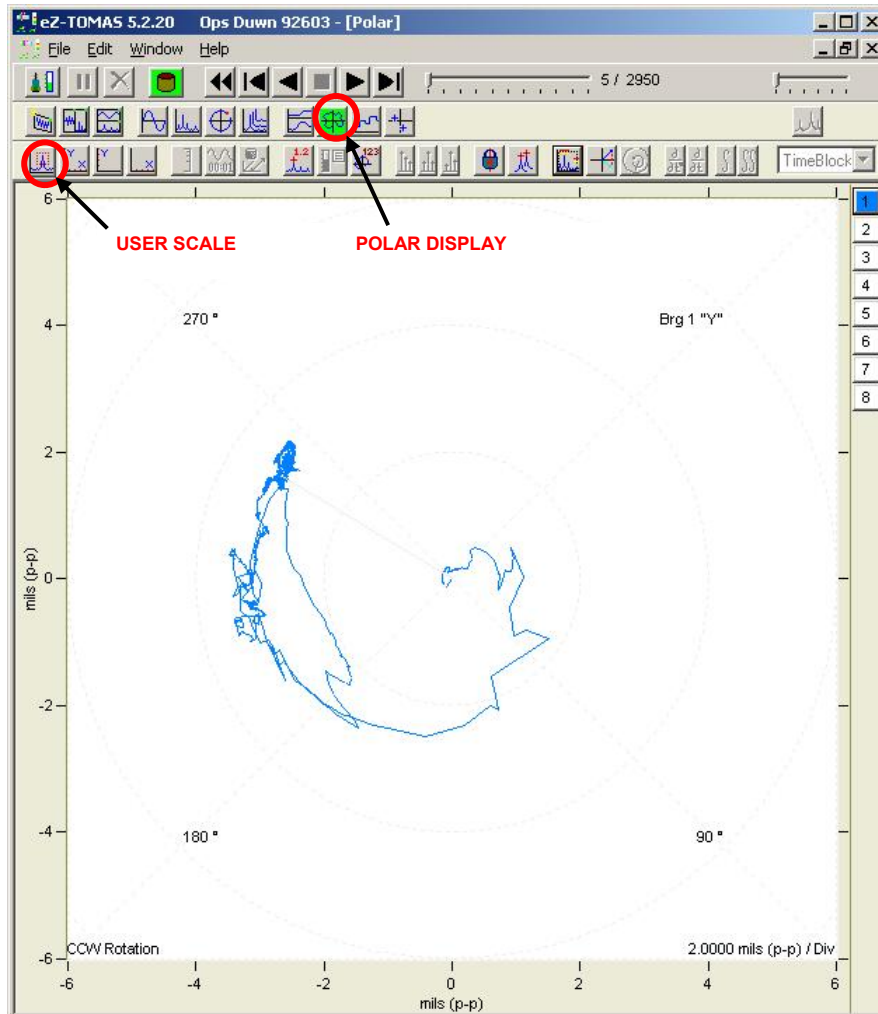
Polar, Fig. 1 - Channel 1, User Scaled
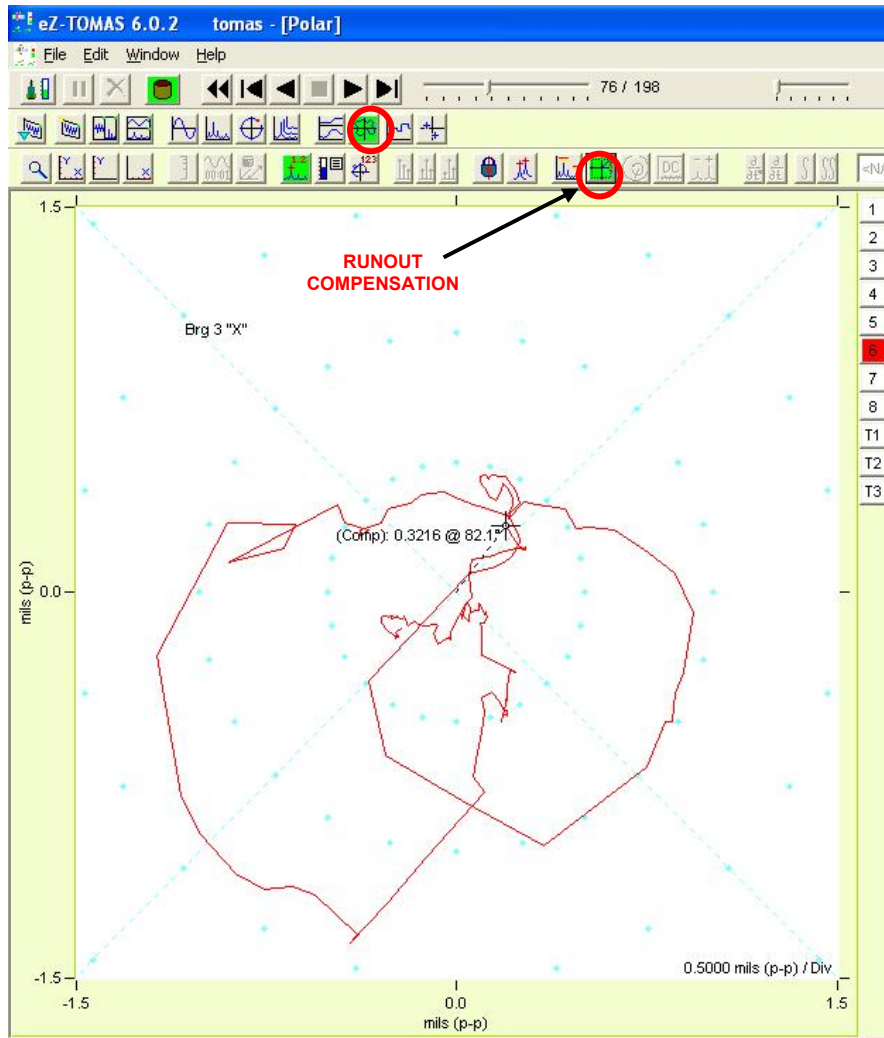
Polar, Fig. 2 - Channel 6, Runout Compensation

You can view displays as either Compensated or Uncompensated. When Runout Compensation is selected, a single "Compensated" trace is displayed.
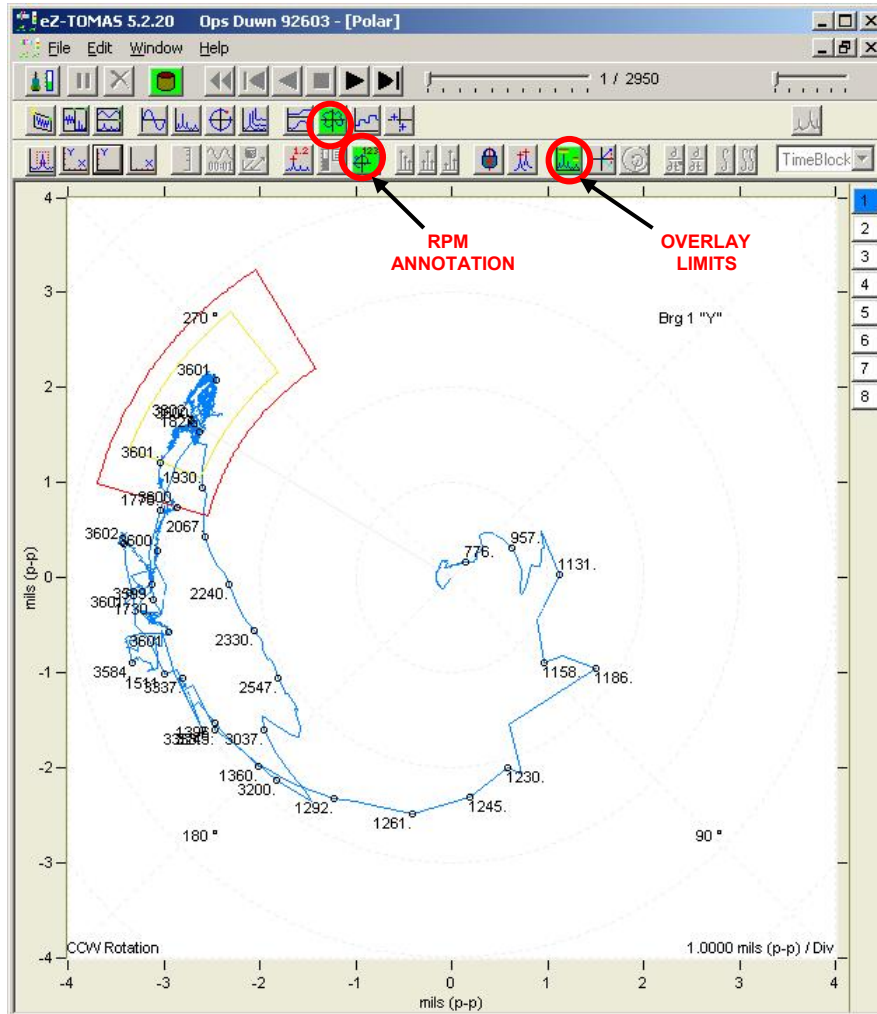
Polar, Fig. 3 -   Channel 1, Limit Region Overlay, RPM Annotation

Strip Chart Displays

 Strip Chart Displays show selected instrument gauge values as a function of date and time. Five examples follow.
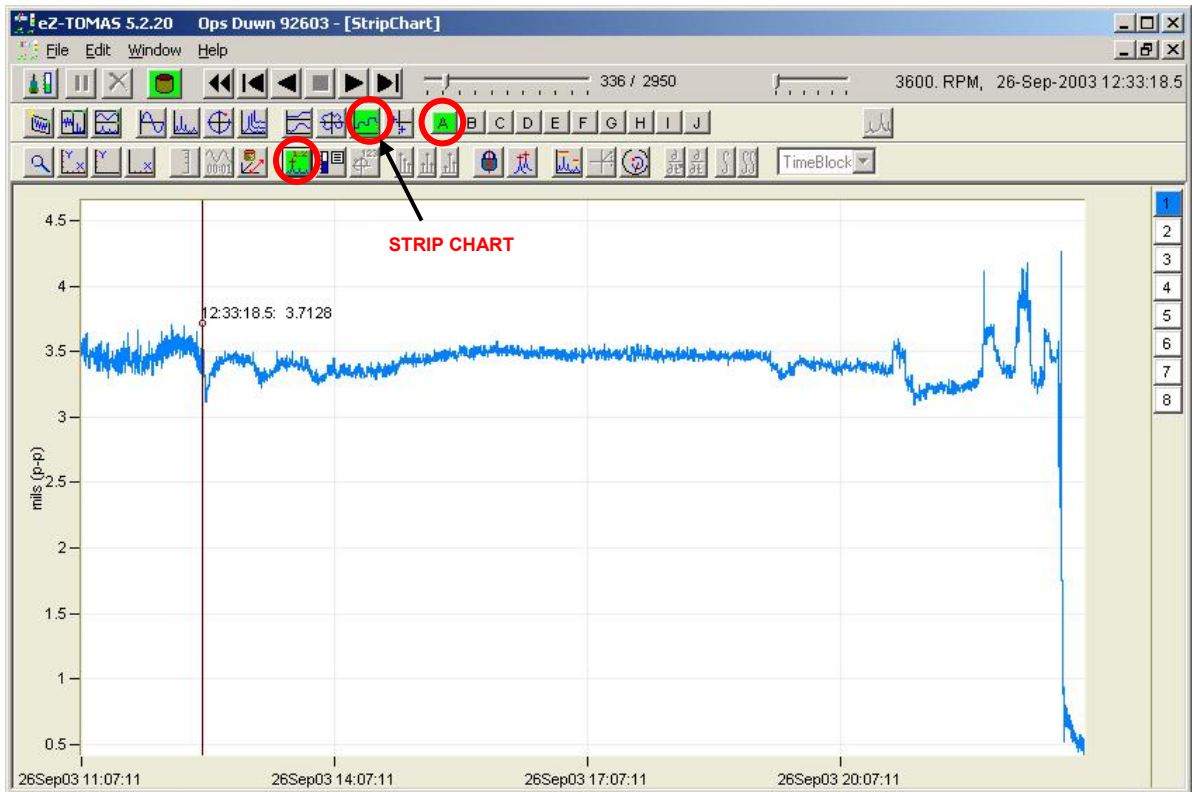
Strip Chart, Fig. 1 - Channel 1, Overall, Cursor
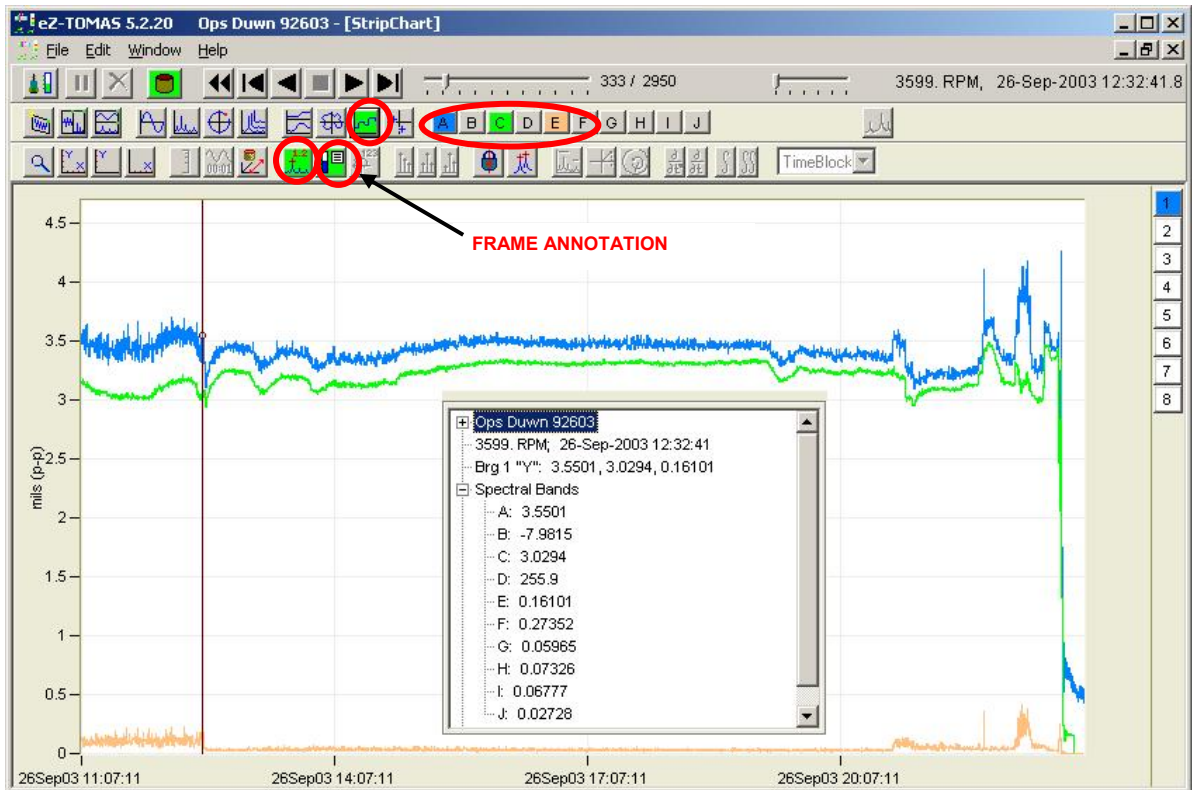
Strip Chart, Fig. 2 - Channel 1, Overall & 1xA & 2xA, Cursor with Frame Annotation

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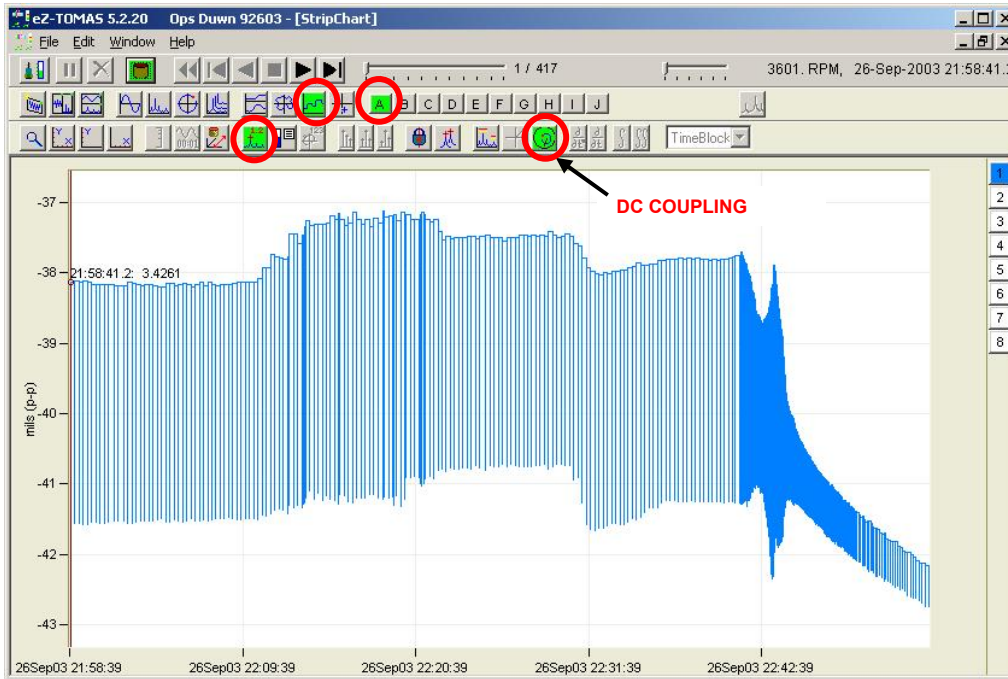
Strip Chart, Fig. 3 - Channel 1, Overall with DC Coupling Applied, Cursor
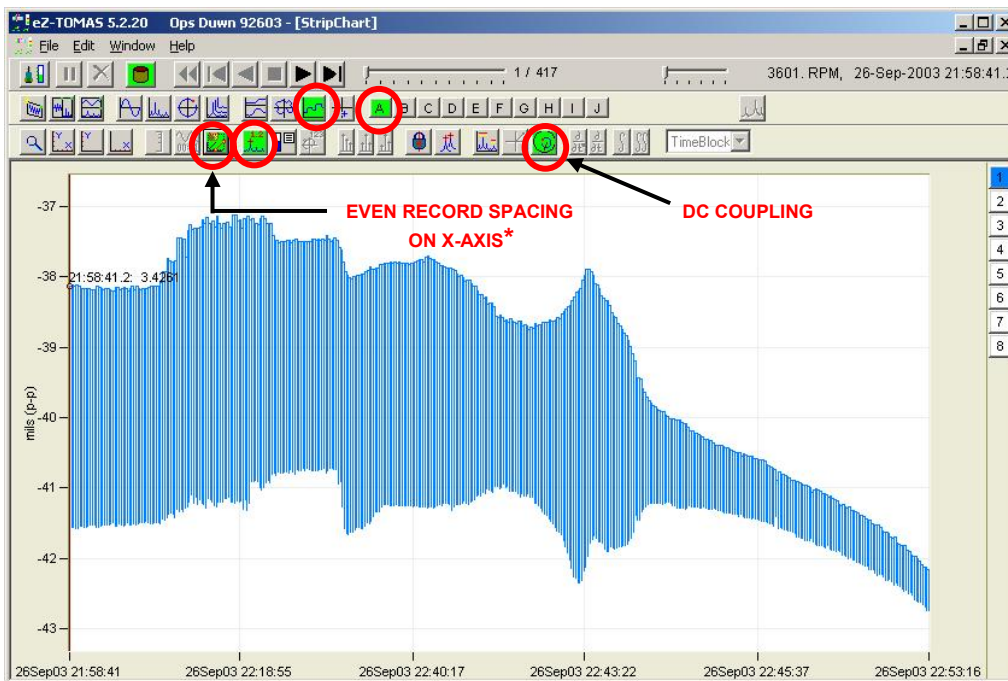
Strip Chart, Fig. 4 - Ch 1, Overall with DC Coupling Applied, Even Record Spacing on X-axis, Cursor

***Note**:   **Delta Time or Delta Record** – When this button is used with Strip Charts, one of the two following modes will be effect. Each pertains to X-axis spacing.

(a) When the button is gray (as in the upper plot display), Delta Time is selected for the X-Axis. **Delta Time** spacing displays data with absolute time for the X-axis.

(b) When the button is green (as in the lower plot display), Delta Record is selected for the X-Axis. **Delta Record** has X-axis time spacing based on record changes. Thus the time line on the X-axis is not uniform. Delta Record spacing is good when there are short acquisition durations over long periods of time as vacant time slots are eliminated from the display.
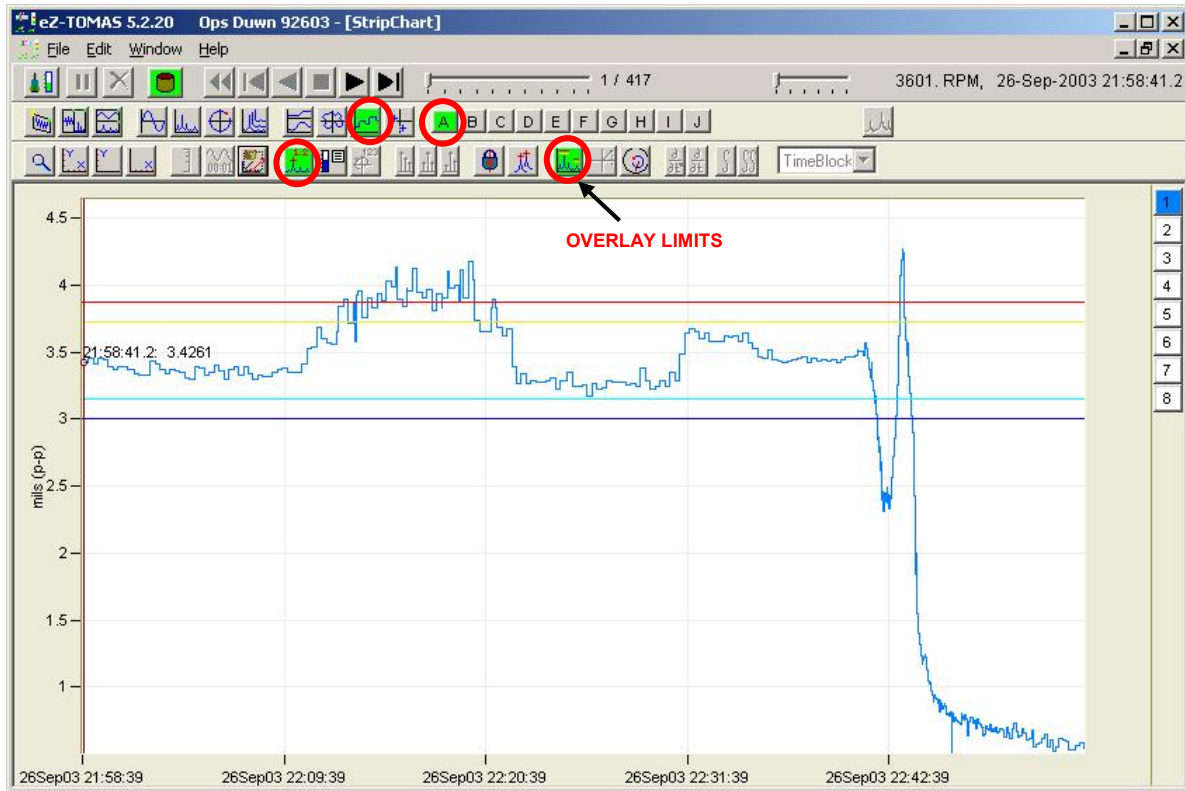
Strip Chart, Fig. 5 - Channel 1, Overall, Limit Values Overlayed, Cursor

Shaft Center Line (SCL)

Shaft Centerline (SCL) is used to display the change in gap voltage for a Channel Pair. SCL is typically used in conjunction with Displacement Probes.

> **In order to get valid SCL displays the input channels must be DC coupled.**

The measured DC Gap Voltage is corrected to the Gap Reference Value and Shaft Starting Location (Brg Start), which are set in the Edit pull-down menu's Setup Configuration window, in the Input Channels tab.
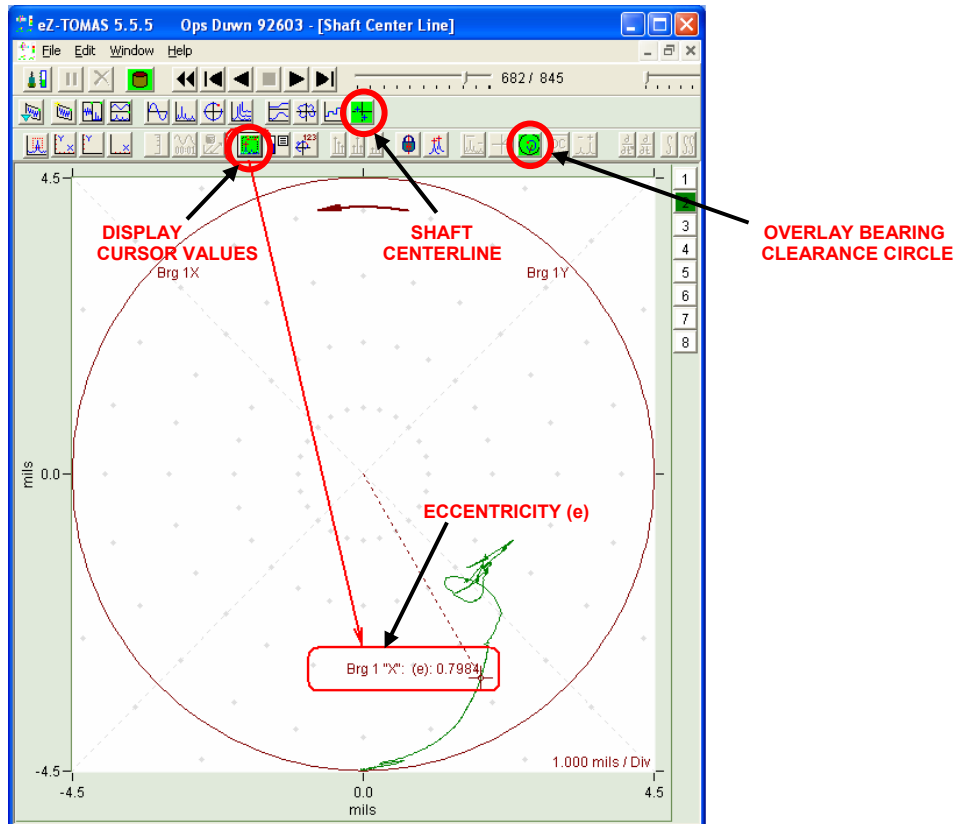
Shaft Centerline, Fig. 1

Note: Eccentricity "(e)" is computed and displayed as a cursor value for Shaft Centerline plots. Eccentricity is the ratio of current gap to the bearing clearance.
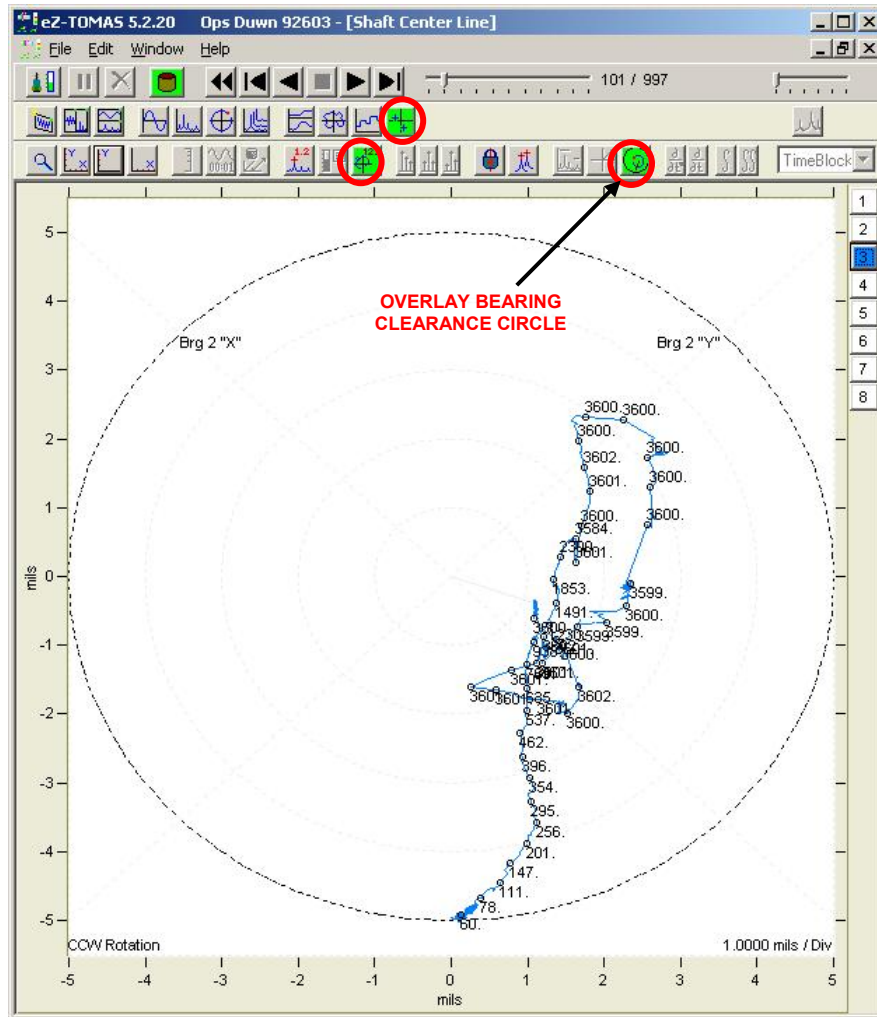
Shaft Centerline, Fig. 2 - Ch 3 & 4*, Bearing Clearance Circle, RPM Annotation

*Channel 4 Pairing is from the Setup Configuration Window, Input Channels Tab, XY Pair Column

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Display Pull-down Menu

eZ-TOMAS can generate the following types of logs and reports: Statistical, Alarm, Snapshot, Production Test, and Configuration Setup text file (.txt).   Note that Plot Windows, which can also be selected from the Display pull-down menu, are discussed in Chapters 5, 6, and 7.

Statistical Report

The Statistical Report lists the historical spectral band data. It includes the instrument, the engineering units, the minimum value, the mean average value, the maximum value, and the standard deviation by channel.

The Statistical Report can be accessed from the Gauge Window's Reports Pull-down menu.

Statistical Report

The report can be saved as an ASCII text file for further use.

This data can be used to generate or fine tune limits. Note that you can have eZ-TOMAS automatically compute limit values by selecting *Generate Limits* on the File menu. You can view and modify limits by selecting Limits in the Gauge Window's Edit pull-down menu. Chapter 2 contains additional information.

Accessing a Statistical Report

To obtain a Statistical Report you need to specify the time period that the report is to cover. This is accomplished as follows:

1. From the Gauge Window's Display pull-down menu, select Statistical. The Select History Data window will open (see following figure).
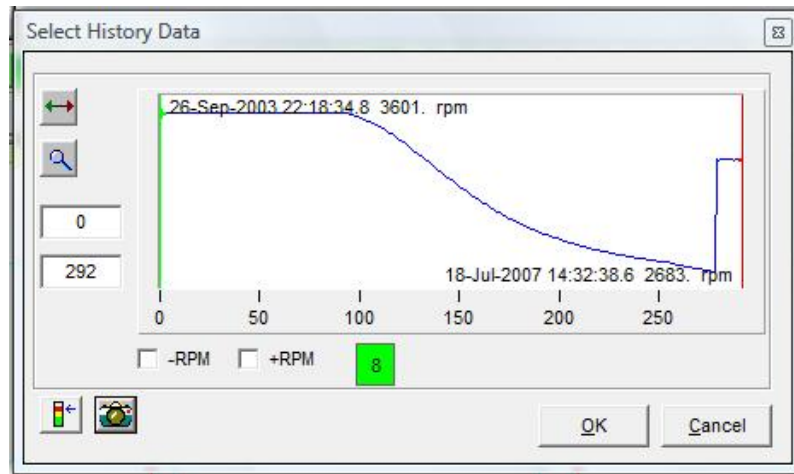
Select History Data Window

2. Select the start and end points to define the period the report is to cover. You can do this by entering record numbers in the numeric fields at the left, or by dragging the green and red bands. Page 2-4 of this manual contains detailed instructions.

3. Click the **<OK>** button to display the report.

4. To save the Statistical Report as an ASCII text file, select *Save the Report* from the Statistical Report's File pull-down menu (see following figure).

The Statistical Report's File Pull-down Menu

With options to "Save the Report" and to "Generate Limits"

Statistical reports can be used to automatically generate limit values based on historical data. If your monitored machine has been operating at a steady state condition and if you have stored data at this condition, then eZ-TOMAS can use this data to determine limit values based on the average and variance of the data. However, you probably will want to edit these limits if the machine is experiencing amplitude or frequency shifts.

When the AutoBackup function stores data, that data is not available for use in the *Statistical Report*. Therefore, before generating a *Statistical Report* ensure there is no AutoBackup in progress. If there is a backup in progress allow it to complete before creating the report.

Using a Statistical Report to Generate Limits

Statistical reports can be used to automatically generate limit values based on history data. If you have acquired and stored data at a steady state machine condition Tomas can calculate limits for you based on the Average and Variance of the data.

1. On the **Display** pull-down menu select **Statistical**; the History Data window will open.

2. Drag the top slide pointer across the time scale to select the Start Date and Time for the report.

3. Drag the lower slide pointer across the time scale to select the End Date and Time for the report.

4. Click the <**OK**> button. The Statistical Report will be displayed.

5. Open the **File** menu (in the Statistical Reports window).

6. Select "**Generate Limits**." The Limit Generation dialog box will appear (see following figure).

7. Use the checkboxes, as applicable, to select: (a) the **Input Channels** for which you want Limit Calculations performed, (b) the **Spectral Bands** for which limits should be generated, (c) the **RPM Ranges**, if applicable, (d) the Standard Deviation to be used for **HI HI (Danger), HI (Alert), LO (Alert), and LO LO (Danger)**. (See following figure).

> **Limit values are not used if:**
>
> **(a) the 'HiHi limit value' minus the 'LoLo limit value' is less than 5% of the instrument scale, or**
>
> **(b) the limit value is outside of the instrument range.**

Limit Generation

8. Click the <**OK**> button. A prompt will appear, asking if you want to Save New Limits.

9. Click <**Yes**>.

Alarm Log

eZ-TOMAS triggers data storage based on Alarm Events. Whenever an alarm occurs, the program automatically stores the following Time Blocks for all Input Channels:

- o **One Time Block prior to the Alarm Event**
- o **The Time Block which the Alarm Event occurred in**
- o **"N" Time Blocks after the Alarm Event**

From the Alarm Log you can select an event of interest, then click the <Display> button to display data from the event, the preceding time block, and a specified number of blocks following the event.

The Alarm Log (following figure) includes the date and time, the channel number, reference tachometer, instrument name, spectral band type, alarm type, and value of the alarm signal.

You can access the Alarm Log from the Gauge Window's Display pull-down menu, or by clicking the **<Show Alarm Log>** button [located in the History Data File window].
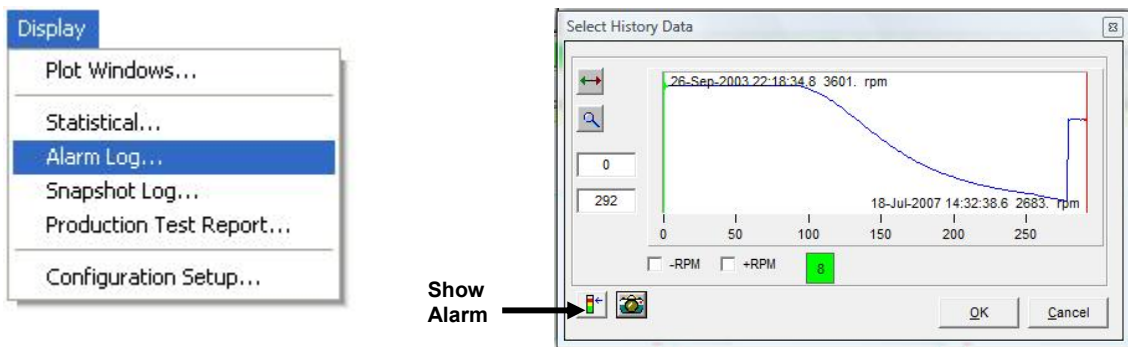
Two Ways to Access the Show Alarm Log

Alarm Log

The Alarm Log contains the last "N" number of alarm events, where "N" is the number of Records specified in the Limit Configuration window. In the following figure the number of records has been set to "100."
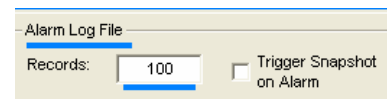
*Alarm Log File Records
in the Limit Configuration Window*

In the visible portion of the following Alarm Log we see that the LoLo alarm state occurred 7 times, the Lo alarm state 2 times, and the HI HI alarm state 5 times.

Alarm Log

Note: From the Alarm Log you can select an alarm event then click the <Display> button to display data from that alarm event. You can also display the data by *double-clicking* on the desired alarm event

To save the Alarm Log select "Save the Report" from the window's File Menu. The log is saved as a TXT file associated with the TOMAS project. Notepad is automatically activated to show the Alarm log.

Snapshot Log
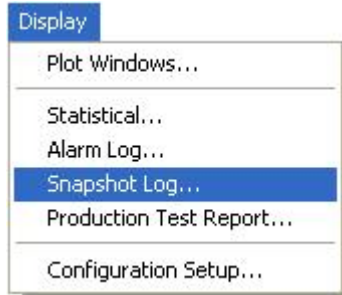
*Two Ways to Access
the Snapshot Log*
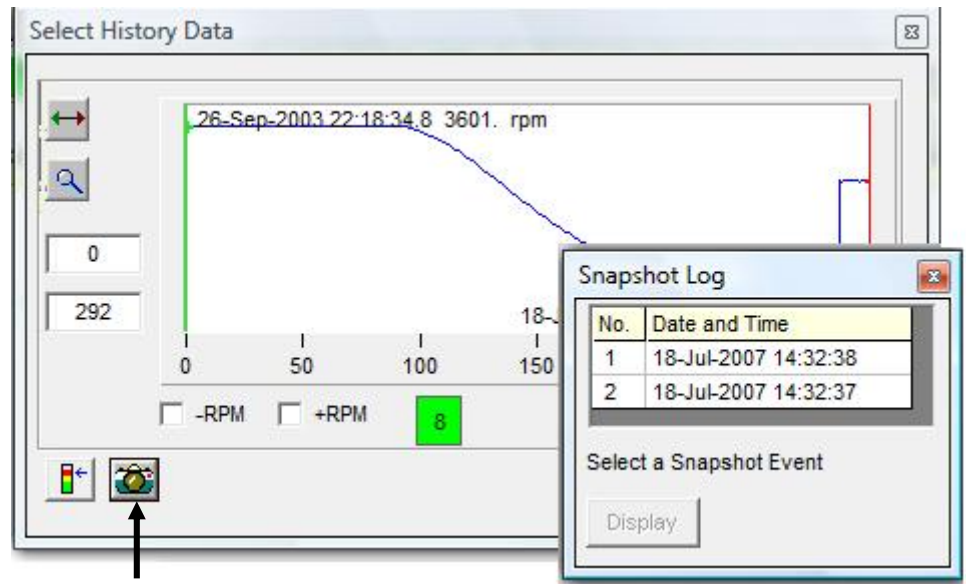
Snapshot Log Button

The Snapshot Log can be accessed from the Gauge Window's Display pull-down menu, or from the History Data Window.

The Snapshot Log file contains entries which were created whenever the user clicked the **<Snapshot>** button, which is located in the *Gauge Window's Data Storage* panel (see following figure). That button should not be confused with the **<Show Snapshot Log>** button, which is located in the *History Data Window*.

The <Snapshot> button captures "N" seconds of continuous data which is stored in the log. In the above figure the log contains 2 entries.
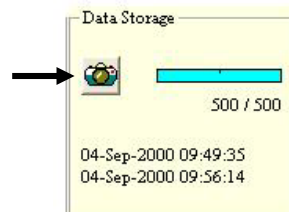
*<Snapshot Button>
on the Gauge Window*

**This similar button [on the gauge window] can
also be used to <u>take a snapshot</u> of data.**

Do not confuse this button with the Snapshot Log Button.

Production Test Report . . .

You can use eZ-TOMAS to create a Production Test Report. When the feature is selected from the Display pull-down menu, a screen similar to the following will appear.

Configuring a Production Report

Reports are created using your custom settings. Among the options available you have your choice of:

- Input Channels
- RPM Ranges
- Spectral Bands
- Start and End Dates in the History File
- Format Options: including Portrait or Landscape, Displaying Minimum and/or Maximum values, display Pass and Fail labels (for example, you could have "Schedule Maintenance" as a label.
- Machine Test Information (from the Project Information dialog box)

Example of a Production Test Report

Configuration Setup [.txt File]

Selecting "Configuration Setup" from the Reports pull-down menu creates a text file that contains configuration details of the current project. The printed text file provides a backup of the project's configuration.

*The Beginning of a Setup Configuration .txt File*
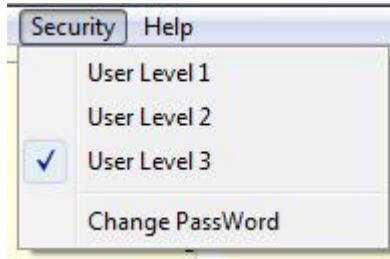
Security Pull-Down Menu

eZ-TOMAS has 3 Security Levels.

- **User Level 1 -** allows users to View Gauge data in the Main menu and Print.

- **User Level 2** - Level 2 operators cannot start or initialize a project, erase the History file, edit the configuration, or change the security password..

- **User Level 3** - has full privileges, which include the ability to start new projects and erase History files. Level 3 is password protected.

After selecting User Level 3, a dialogue box similar to the following will appear. The user must enter the project's Level 3 password to enable full privileges.
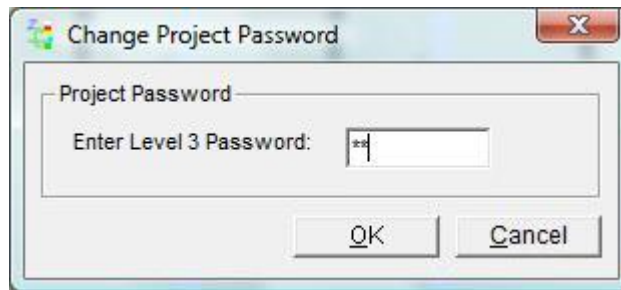
Security Level 3 Dialog Box

No password is required to go from Level 3 down to Level 2 or to Level 1. However, the project password is required to move from Level 1, or Level 2, to a higher level.

The "**Change Password**" command, in the Security pull-down menu, opens the *Change Project Password* dialog box (see following figure). This dialog box will only be visible when the user selects the "Change Password." option. Note that you can only access the *Change Project Password* box from User Level 3.

Changing the Project Password

To change the password:

1. Open the Security pull-down menu.

2. Select "Change Password." Note that you can only do this from User Level 3. The Change Project Password dialog box will open.

3. Type the desired password in the field below "Enter Level 3 Password."

4. Re-enter the password in the "confirm" text box.

5. Press the <**OK**> button.

If the confirmed password was entered correctly the new password will be in effect.