CyberOptics Semiconductor WaferSense® AVS User's Guide

General Information

WaferSense AVS Wafer and Link

Changes or modifications not expressly approved by CyberOptics Semiconductor, Inc., may void your authority to operate the WaferSense AVS.

The radio contained in the WaferSense AVS meets all the applicable FCC requirements for RF Safety. While in operation, the FCC requires users and nearby persons to maintain a minimum separation distance of 20 cm (8 inches) or farther from the WaferSense AVS.

The WaferSense AVS Wafer and Link have been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This ISM device complies with Canadian ICES-001.

Cet appareil ISM est conforme à la norme NMB-001 du Canada.

WaferSense Technical Support

Technical support is available from CyberOptics Semiconductor Monday through Friday, 8:00 A.M. to 5:00 P.M. Pacific Time.

E-mail:	CSsupport@cyberoptics.com
Phone:	800-366-9131 (US and Canada only)

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Chapter 1

Introduction

The CyberOptics Semiconductor WaferSense® Auto Vibration System (AVS) can monitor three-axis accelerations and vibrations while moving through semiconductor process equipment. The VibeView™ software application makes it easy to monitor vibration readings in real time. The large display and wireless link let you place the computer at a convenient distance from the AVS wafer.

AVS consists of the following components:

- **AVS wafer.** The AVS is designed with a wafer-like form factor, so it can fit in most wafer-handling equipment. The AVS wafer is also vacuum compatible.
- **VibeView and VibeReview™ software.** The VibeView software application monitors the AVS wafer and displays and records vibration information in real time. VibeReview lets you play back vibration log files recorded in VibeView. Both applications run on most personal computers that use the Microsoft Windows operating system.
- **Wireless link.** The software communicates with the AVS wafer by using a Bluetooth wireless link that attaches to a USB port on a personal computer.
- **Charging clean box.** The AVS wafer is powered by an internal rechargeable battery, which you recharge by placing the AVS wafer into the charging clean box.
- **Carrying case.** The carrying case makes it easy to take your complete AVS system with you in the plant or on the road.

The following chapter gives you instructions for installing your AVS system.

Chapter 2

Installing Your AVS

This chapter describes the procedures you need to perform to install your AVS and get it ready for use. For best results, perform the procedures in the order they are presented in this chapter:

1. Installing the software
2. Installing the wireless link on the USB port
3. Checking communications between the link and the AVS wafer
4. Activating your software
5. Registering your AVS wafer
6. Running the VibeView application

Caution

Dropping the AVS wafer or hitting it against a hard object can bend, break, or chip the housing; damage the internal components. While it is not as fragile as an actual silicon wafer, handle the AVS wafer with care, as you would any precision instrument. If the AVS wafer is damaged, see Chapter 5, "Maintaining Your AVS."

Caution

The AVS wafer is thicker than a standard silicon wafer so use **extreme care** to assure that the wafer has proper clearances when being transported through the tool. For example, when you use the wafer in a tool for the first time, move the AVS wafer through the tool in manual mode, visually verifying all clearances. Even when clearances are sufficient for safe AVS pass-through, if the robot end-effector is taught too high, you risk crashing and damaging the AVS wafer.

Installing the Software

To run the WaferSense AVS software, your computer must have the following:

- Windows 2000, Windows XP, Windows Vista (32-bit and 64-bit), or Windows 7 (32-bit and 64-bit) operating system

- One free high-power USB 1.1 or USB 2.0 port

To install the WaferSense AVS software:

1. Log on using an account with Administrator privileges.
2. Insert the WaferSense AVS Installation Disk into the CD drive.

   The InstallShield Wizard starts automatically, as shown in Figure 2.1. If the wizard doesn't start automatically, use Windows Explorer to view the contents of the CD and double-click the **setup.exe** program.

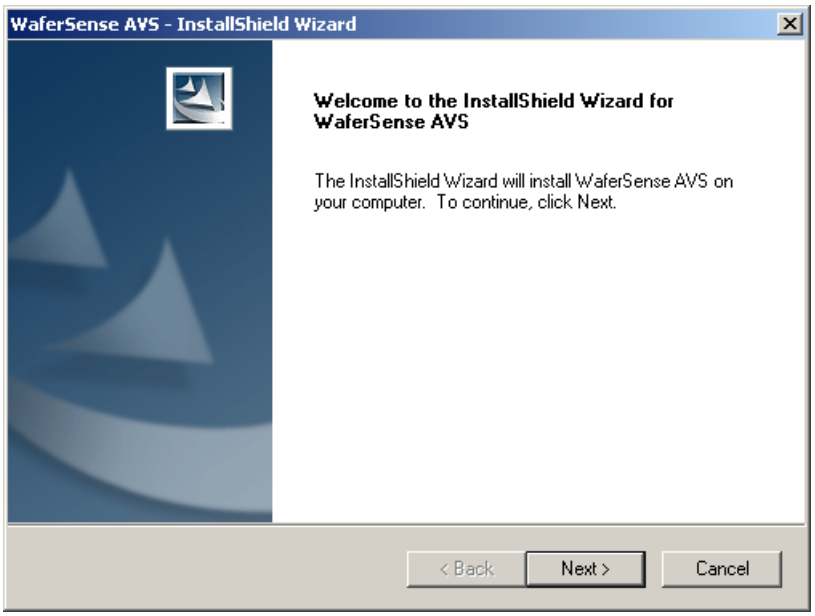


Figure 2.1: The InstallShield Wizard

3. Follow the instructions provided by the wizard to install the software.
4. After you complete the instructions for all of the wizard screens, click **Finish**.

   By default, the Setup program installs the VibeView and VibeReview applications in a new program group called WaferSense AVS. Setup also installs an online copy of this user's guide, which is available from the VibeView and VibeReview **Help** menus and in the WaferSense AVS program group in the Windows **Start** menu. A License Manager application for activating the software is also installed in the program group (see "Activating Your Software," on page 2.6).

After the installation wizard for WaferSense AVS finishes, a new wizard for the WaferSense Link Installer appears.

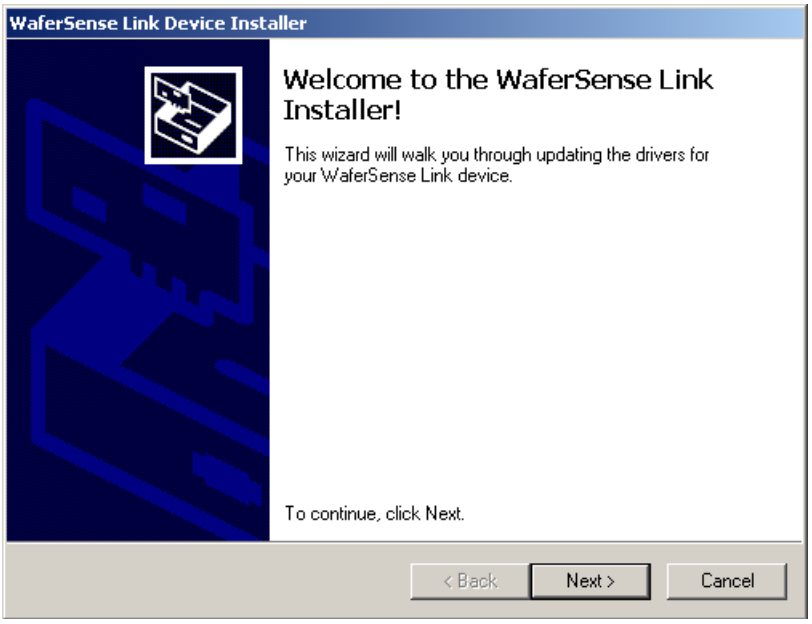


Figure 2.2: WaferSense Link Installer

5. Follow the instructions to install drivers for the WaferSense link.
6. After the wizard installs the drivers, click **Finish**.

That completes the installation of the software.

Installing the Wireless Link

To install the wireless link:

1. Turn on your computer.
2. Locate an unused, high-power USB port on your computer. The AVS wireless link module requires a high-power USB port, such as the built-in ports on your computer and ports on USB hubs that have power cords. Unpowered USB hubs won't work.
3. The USB cable provided with your AVS has a different plug on each end. Locate the end with the plug that matches the USB port on your computer and plug the cable into the port.
4. Plug the other end of the cable into the link module.

   The Windows operating system recognizes the new link module hardware and installs it.

   The **Power** light on the module turns on indicating that the module is getting power from the USB port. Ignore the **Pair Status** and **Connection Status** lights for now.

Checking Communications Between the Link and the Wafer

To complete the installation, verify that the AVS wafer and link can communicate:

1. The AVS wafer operates from an internal rechargeable battery. Before using the AVS wafer for the first time, charge it for two hours. For information on checking the charge on the battery and the procedure for recharging, see "Using the Rechargeable Battery," on page 3.44.
2. Remove the AVS wafer from the charging clean box and press the **ON OFF** button to turn on the AVS wafer.

   The **On** light on the AVS wafer turns on.
3. Verify that the **Pair Status** lights on both the AVS wafer and link module are on. If either light is not on, your AVS wafer and link might not be paired with each other. To reset the pairing, see "Changing the Pairing Between the AVS wafer and Link," on page 3.47.
4. Immediately after turning on the AVS wafer, the **Connection Status** lights on the AVS wafer and link will blink slowly. After a few seconds the AVS wafer and link will connect and both lights will be on and no longer blinking. If the lights continue to blink, see "Monitoring the Wireless Connection to the AVS wafer," on page 3.46.
5. After starting the VibeView application (see "Running the VibeView Application," on page 2.9), you can verify the connection to the AVS wafer by comparing the serial number printed on the AVS wafer to the serial number shown in the About your AVS Wafer dialog, which is available in the VibeView application by choosing the **Help > About your AVS Wafer** menu item. If the VibeView application isn't running, the AVS wafer turns off automatically after ten minutes.

Activating Your Software

You may use the VibeView and VibeReview applications without activating them for a 30-day evaluation period. You can activate the software anytime after installation. Once activated, the software may be used only on the computer from which the software was activated.

To activate your AVS software:

1. From the Windows **Start > All Programs** menu, choose **WaferSense AVS > License Manager**.

   The License Manager application starts as shown in Figure 2.3 on page 2.6.

Figure 2.3: The License Manager Application

2. In the **License Number** field, enter your activation key and click **Activate**.
3. Follow the instructions to register and activate your software.

That completes the installation of your AVS.

If you need to move the software to a different computer in the future:

1. On the computer where the software is currently activated, run License Manager.
2. Use the De-activate feature to deactivate the software on that computer.
3. Install the software on the new computer and run License Manager again to activate the software on the new computer.

Registering Your AVS Wafer for Service

To maintain optimum performance, every twelve months you should have the battery in your AVS wafer replaced. This service can be performed only at the factory.

To help you keep track of the next service date so you can schedule this service when it is convenient, register your WaferSense AVS wafer with the factory. When you start the VibeView application (see "Running the VibeView Application," on page 2.9), it prompts you to register your AVS wafer for service. You can also register your AVS wafer in any of the following ways:

- On the Internet: **http://cyberoptics.com/semiconductor_categories/ws-registration.html**
- By sending an e-mail message containing the model, serial number, and contact information to: wsregister@cyberoptics.com

Running the VibeView Application

To start the VibeView application:

1. From the Windows **Start > All Programs** menu, choose **WaferSense AVS > VibeView**.

   The VibeView application starts, as shown in Figure 2.4. Initializing communications usually takes less than a second. For information on using VibeView, see Chapter 3, "Using Your AVS." If you haven't registered your AVS wafer, VibeView also displays the Service Registration dialog. To complete the registration, proceed to the next step.

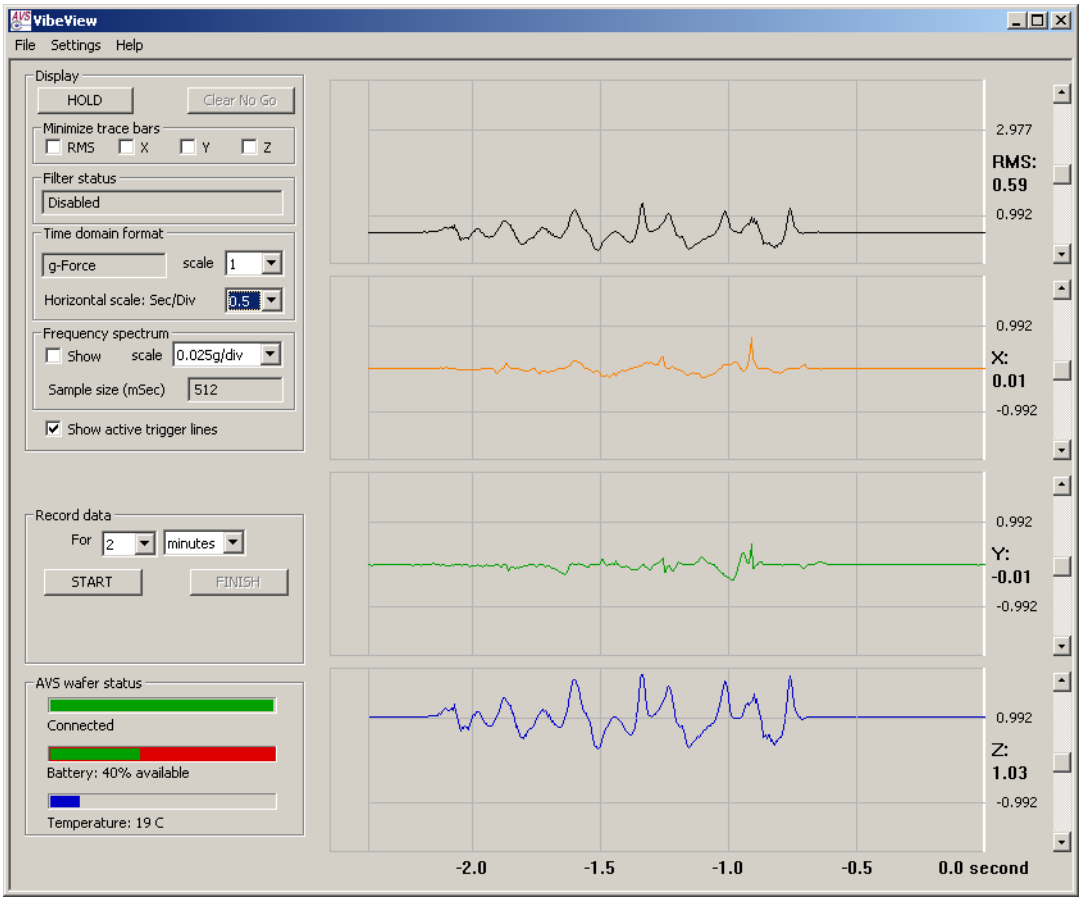


Figure 2.4: Starting the VibeView Application

2. If VibeView displays the WaferSense AVS Service Registration dialog, as shown in Figure 2.5, you haven't registered your AVS wafer. Follow the instructions in the dialog to complete the registration.

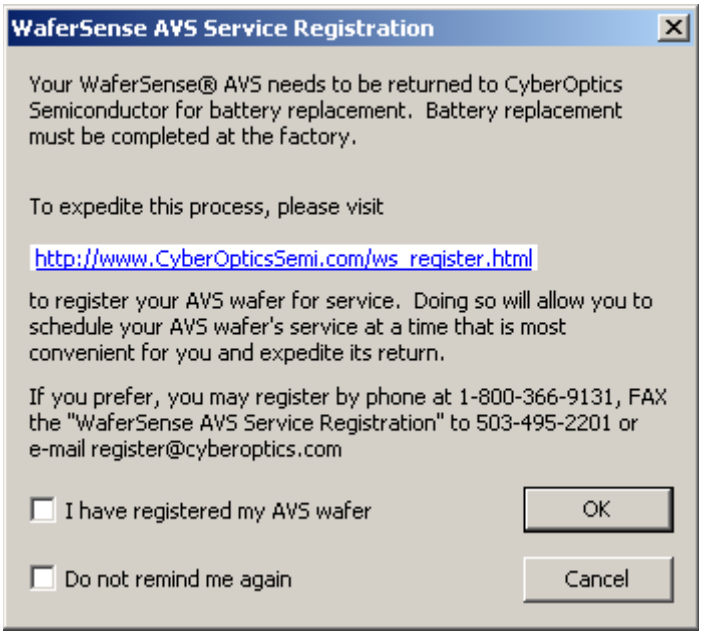


Figure 2.5: Service Registration Dialog

The VibeReview application is described in Chapter 4, "Viewing Log Files."

Technical Support

CyberOptics Semiconductor offers free technical support to customers. If the AVS hardware or software appear to be malfunctioning, please contact us, and we'll be happy to assist you.

When you contact us, please make sure that you have the following information available:

- A detailed description of the problem you are having, including the exact text of any error messages and a list of steps to reproduce the problem.
- Information about your computer, including manufacturer, CPU type, version of Windows, and memory size.
- The version of the VibeView application. The software version is available in the VibeView application by choosing the **Help > About VibeView** menu item.

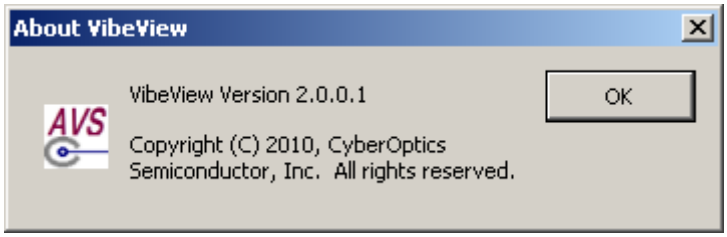


Figure 2.6: The About VibeView Dialog

If you are using VibeReview, a similar dialog is available from the **Help > About VibeReview** menu item.

- The serial number of your AVS wafer. The serial number of the AVS wafer is printed on a label on the top of the AVS wafer. The serial number is also available in the VibeView application by choosing the **Help > About your AVS Wafer** menu item.

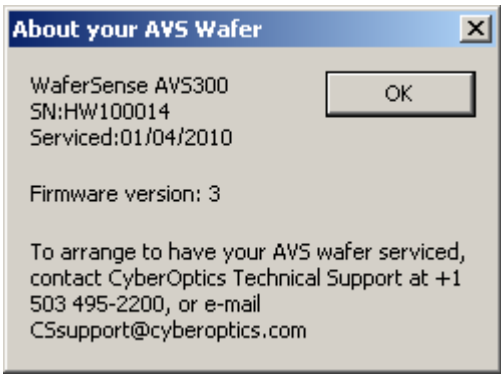


Figure 2.7: The About your AVS Wafer Dialog

Technical support is available Monday through Friday, 8:00 A.M. to 5:00 P.M. Pacific Time.

- Toll free: 800-366-9131 (US and Canada only)
- Fax: (503) 495-2201
- Internet: **www.Cyberoptics.com**

Chapter 3

Using Your AVS

This chapter gives you instructions for performing the following tasks with the AVS:

- Opening and closing the clean box
- Using the AVS wafer buttons and status lights
- Reading the VibeView trace display
- Monitoring traces for excessive vibration levels
- Recording the traces
- Configuring the trace display
- Printing the VibeView window
- Monitoring the operating temperature
- Using the rechargeable battery
- Monitoring the wireless connection to the AVS wafer
- Changing the pairing between the avs wafer and link
- Saving your settings

Opening and Closing the Clean Box

The AVS wafer comes in a plastic clean box that is used for storing the wafer when not in use and for charging the rechargeable battery in the wafer (see "Using the Rechargeable Battery," on page 3.44).

To open the case:

1. Place your thumbs in the raised circles on the top of the case (see Figure 3.1).

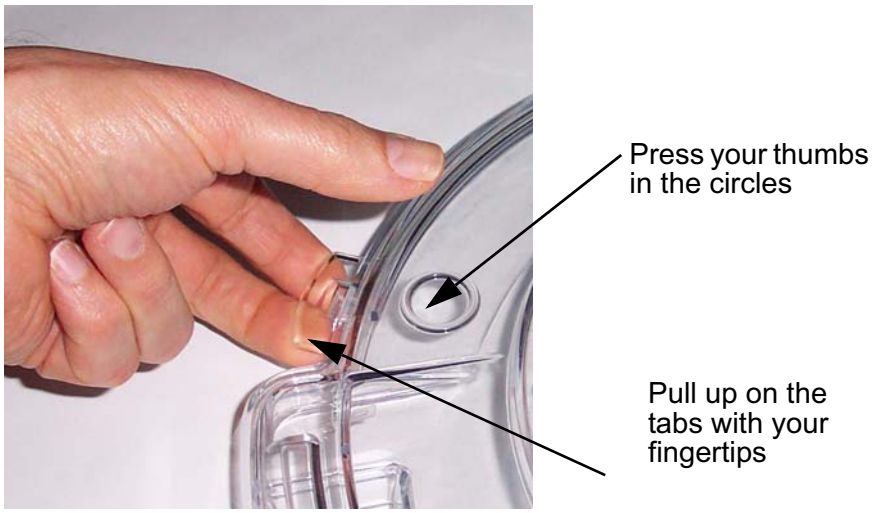


Figure 3.1: Opening the Clean Box

2. Using your fingertips under the tabs, lift up on the lid of the clean box while you press down with your thumbs, as shown in Figure 3.1.

To close the clean box:

1. Lower the lid.
2. Place both thumbs on the raised circles on the top of the case (see Figure 3.1) and press down until the case snaps shut.

Using the AVS Wafer Buttons and Status Lights

AVS wafers have two buttons:

- **ON OFF.** Turns the AVS wafer on and off. If the VibeView application isn't running, the AVS wafer turns off automatically after ten minutes.
- **NEW PAIR.** Changes the pairing between an AVS wafer and a link (see "Changing the Pairing Between the AVS wafer and Link," on page 3.47).

AVS wafers also have the following status lights:

- **On.** Glows red while the AVS wafer is turned on.
- **Charging.** Glows red when the AVS wafer is being charged in the charging case.
- **Charging Done.** Glows red when the battery has reached at least 90% of full charge.
- **Connect Status.** Glows red when the AVS wafer has established communication with the link. Blinks slowly while the AVS wafer is trying to establish a connection with the link.
- **Pair Status.** Glows red when the AVS wafer is paired with a link (see "Changing the Pairing Between the AVS wafer and Link," on page 3.47).

Reading the VibeView Trace Display

The Auto Vibration System is like a seismograph, but instead of charting movements in the earth's plates, you'll probably be using the AVS to look for unwanted vibrations in wafer handling and processing equipment. The AVS wafer continuously detects vibrations and transmits the readings to the VibeView application. VibeView displays the readings as traces, similar to the traces on a seismograph drum. You can place the wafer in a piece of equipment, run the equipment through its paces, and watch the VibeView display for levels of vibration that might indicate a problems with the equipment, such as places where the wafer is making unwanted contact with a tool.

To use the AVS system:

1. Make sure the computer running the VibeView application is within the range of the link module, up to 30 ft (10 m).
2. Normally, you would place the AVS wafer on the equipment you want to check and then start the equipment in motion, monitoring the VibeView display. To get a feeling for how the AVS system works, for now just set the wafer on a desk or table and turn on the wafer.
3. Start the VibeView application. The VibeView window appears, as shown in Figure 3.2 on page 3.5.

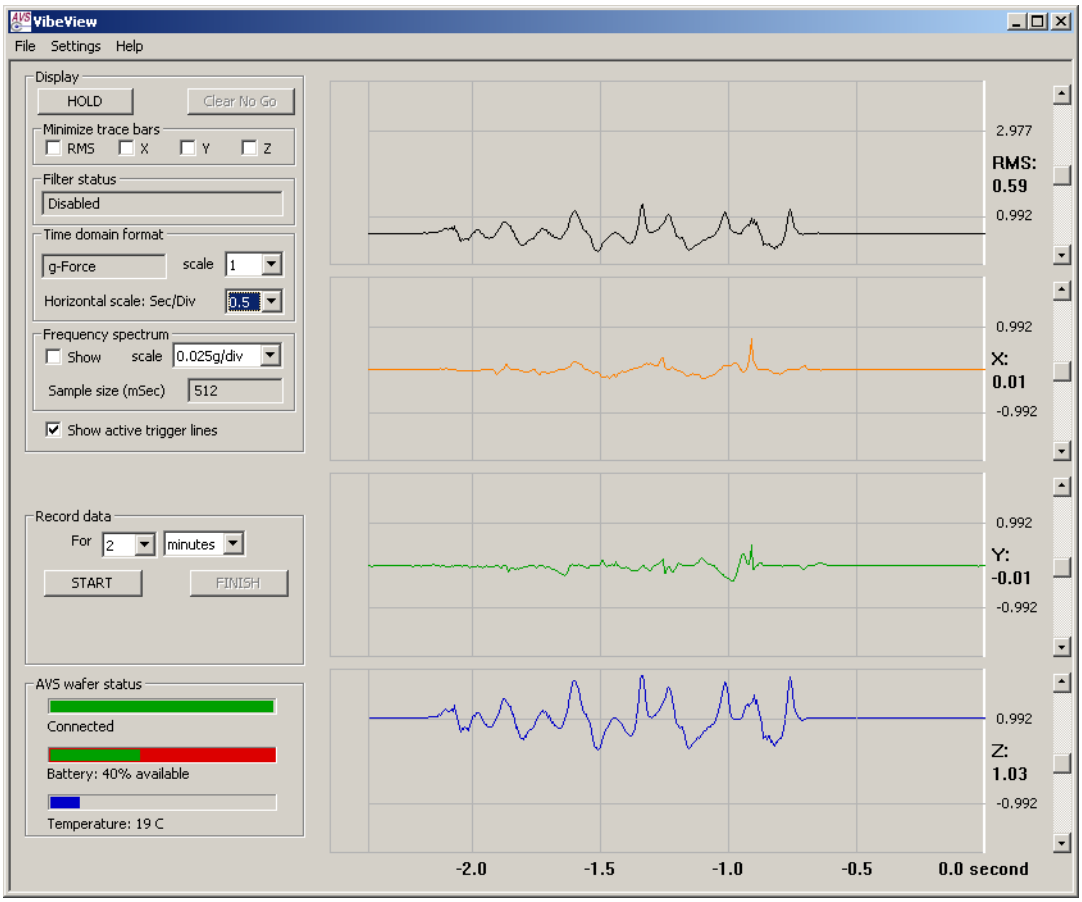


Figure 3.2: Reading the VibeView Display

The gridded area of the display on the right shows the traces. When the wafer is turned on and has a connection to the computer running VibeView, the wafer transmits vibration data in nearly real time.

4. Give the wafer a light tap. A spike in the traces will appear at the far right of the VibeView display. New readings always appear at the far right edge of the display. As more readings are displayed, the spike scrolls to the left and eventually disappears. The trace area of the display is described below:

   - **X, Y, and Z.** These traces show the vibration measured in each of three directions. Looking down on the wafer with the AVS logo at the top, the X trace shows horizontal movement to left and right, the Y trace shows horizontal movement to top and bottom, and the Z trace shows vertical movement.

     AVS measures vibration in units of **g-force**, which is actually a measure of acceleration. One g is the acceleration of gravity (approximately 32 ft/s^2 or

9.81 m/s^2), with a range from -2 g to +2 g. The number displayed below the label (X, Y, or Z) at the far right of the window is the current value: the value displayed at that instant at the far right of edge of the trace. The default vertical scale shows units of g-force, but you can change the units to galileos (1 Gal = 0.01 m/s^2). You can also change from displaying acceleration to displaying the signal energy (g^2-s). For more on the displayed readings and scales, see "Changing the Time Domain Format," on page 3.30).

You can minimize the display of one or more traces, to focus on the trace or traces of most interest (see "Minimizing Trace Bars," on page 3.28).

- **RMS.** The RMS trace displays the calculated root mean square of the X, Y, and Z values: $\sqrt{\frac{1}{3} \times (x^2 + y^2 + z^2)}$. The default vertical scale shows units of g-force, but you can change the units to galileos (1 Gal = 0.01 m/s^2). You can also change from displaying acceleration to displaying the signal energy (g^2-s). For more on the displayed readings and scales, see "Changing the Time Domain Format," on page 3.30).
- **Grid lines.** The vertical grid lines represent time intervals. The default interval between grid lines is 0.5 seconds, with 100 data points plotted in each interval. To change the horizontal scale for the traces, see "Changing the Horizontal Time and Scale," on page 3.33.
- **Scroll bars.** Scroll bars let you move the traces by ±2g. As you increase the vertical scale factor, you might need to scroll to view the full range of a trace, see "Changing the Vertical Scale," on page 3.32.

Freezing the Trace Display

When the AVS wafer is turned on and connected to the VibeView application, the wafer sends blocks of 100 readings to VibeView every 100 ms. VibeView displays the data continuously in nearly real time. That means that the display is constantly moving. If you notice a spike in one of the traces, it could scroll off the left side of the display and disappear in as little as a half second, depending on the display settings. VibeView includes a hold feature that lets you freeze the display (though not the data stream).

- To freeze the trace display, click **HOLD** (see Figure 3.3). The **HOLD** button changes to **RELEASE** and the traces stop moving, but the AVS wafer continues to send data to VibeView.

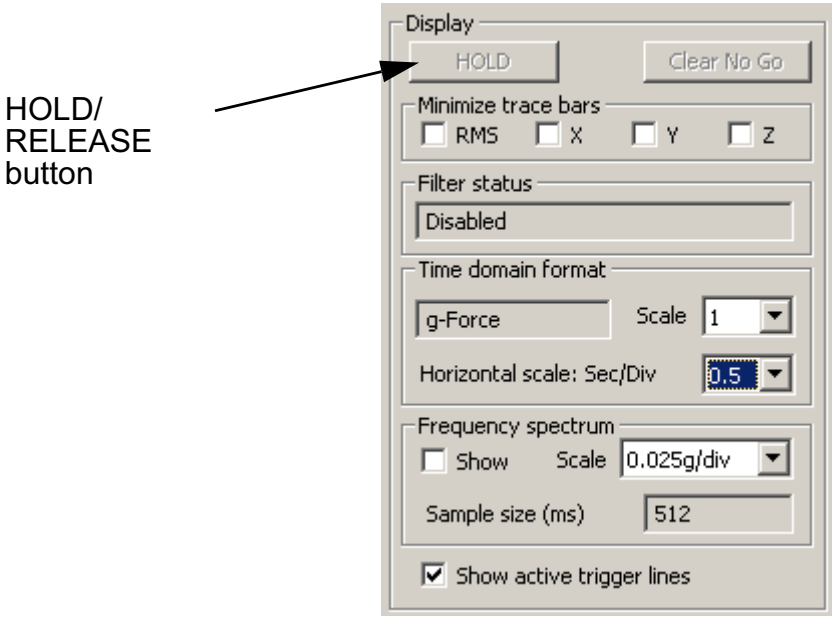


Figure 3.3: Pausing the Trace Display

To resume the trace display, click **RELEASE**. The traces jump ahead to display the most current data and start moving again. If the hold is long enough, some of the data received during the hold might not be displayed when the trace display resumes.

Monitoring Traces for Excessive Vibration Levels

You can use the Go/No Go feature in VibeView to monitor the traces for excessive levels of vibration and indicate when your specified levels are exceeded. Figure 3.4 shows the trace display with the Go/No Go feature active.

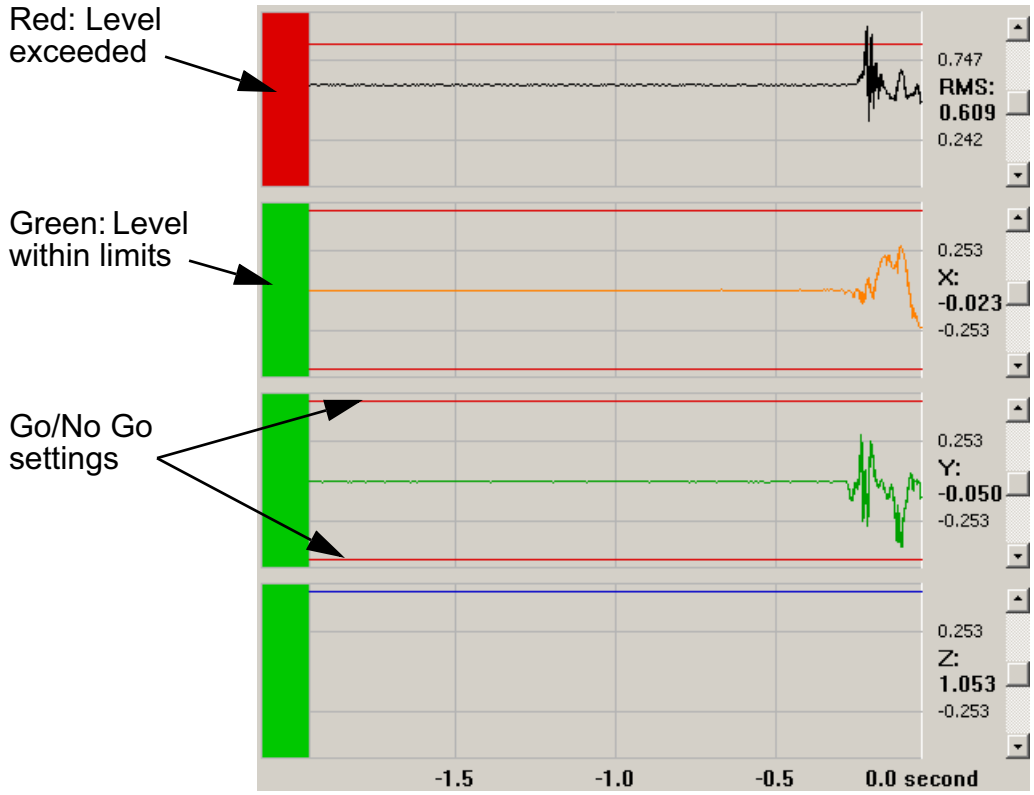


Figure 3.4: Go/No Go Indicators

Parallel red lines in each trace indicate the Go/No Go settings, which you can set separately for each trace. A vertical green bar appears at the far left of each trace to indicate that the trace is within your specified settings. When the trace exceeds your settings continuously for more than 1 ms (the qualification time), the vertical bar changes to red. You can specify a qualification time from one to 10 milliseconds. If the trace exceeds your settings, but remains so for less than the qualification time, the No Go setting is not triggered, and the bar remains green.

You can set the amount of time the red bar remains on from one to 10 seconds, or to stay on until you clear it with the **Clear No Go** button. Extending the length of time the red bar remains on makes it easier to catch narrow spikes. However, if another Go/No Go event

occurs while the bar is already red, it restarts the timer for displaying the red bar. So in practice, a red bar might remain on for many seconds when multiple events occur in close succession.

In addition to the visible bar indicating the Go/No Go, VibeView can issue an audible beep to indicate when a trace exceeds a Go/No Go setting.

To set the Go/No Go criteria:

1. Choose the menu item **Settings > Set Go/No Go**. The Set Go/No Go dialog is displayed.

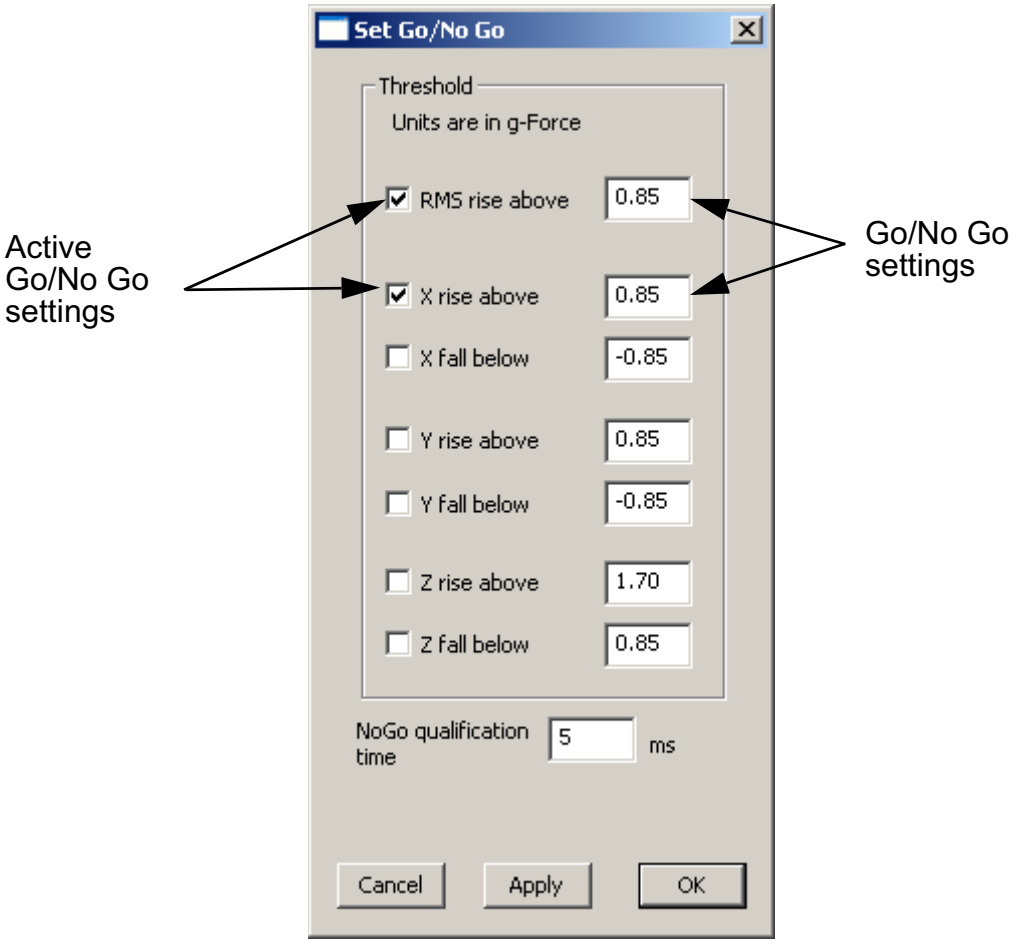


Figure 3.5: Set Go/No Go Dialog

2. Check the boxes to activate Go/No Go for one or more traces.
3. For each trace you activated, specify the Go/No Go settings. You can specify separate upper and lower settings for X, Y, and Z. The units for Go/No Go settings depend on the time domain format you have specified ("Changing the Time Domain Format," on page 3.30).

4. For **NoGo qualification time**, specify the length of time any trace must exceed any Go/No Go setting before the No Go condition is triggered. A trace that exceeds a setting for less than the qualification time will not trigger a No Go condition.
5. Click **Apply**. The Go/No Go settings take effect immediately.

   When the next active No Go event lasting longer than the qualification time occurs, VibeView changes the green Go/No Go bar to red and optionally beeps.
6. You can leave the Set Go/No Go dialog open while using VibeView. Doing so makes it easy to change the Go/No Go settings. If you want to close the dialog, click **OK**.

To set the options for No Go indicators:

1. Choose the menu item **Settings > Options**. The options dialog is displayed.

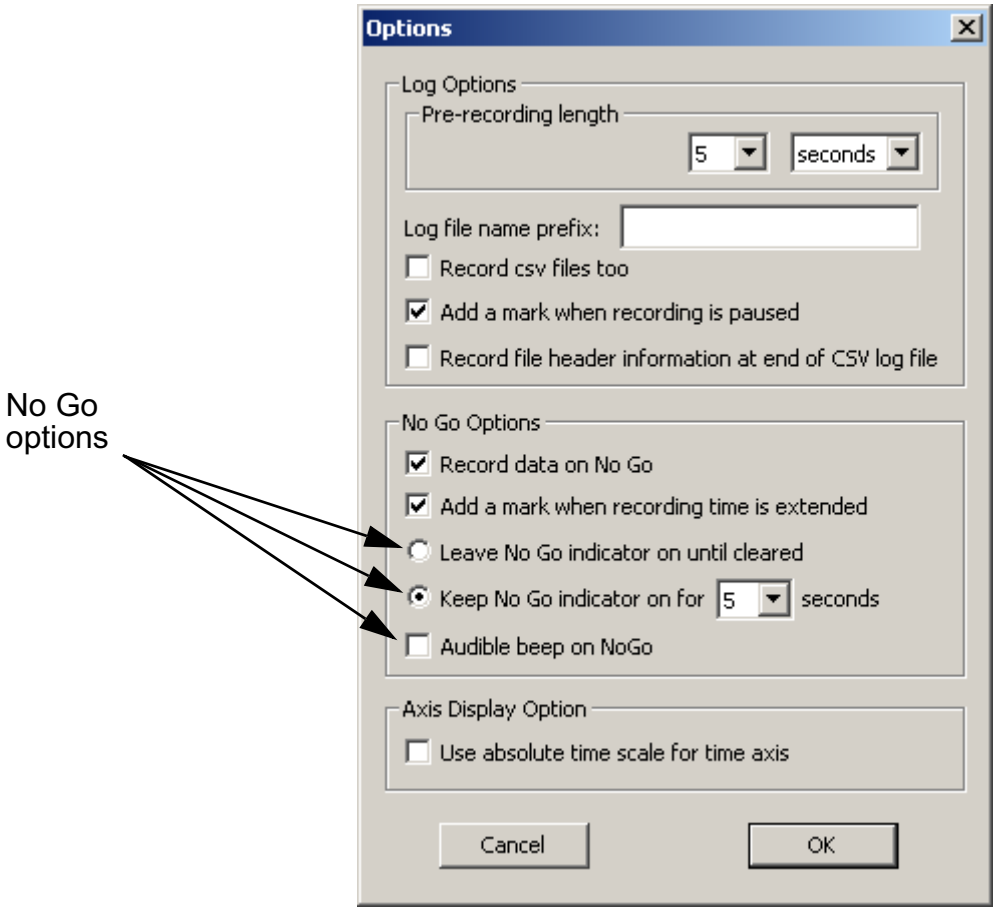


Figure 3.6: No Go Indicator Options

2. If you want the indicator to remain red until you clear it by clicking the **Clear No Go** button, choose **Leave No Go indicator on until cleared**.

3. If you want the indicator to remain red for a certain length of time following the event, choose **Keep No Go indicator on for**, and choose the number of seconds.
4. If you want VibeView to alert you with an audible beep when a Go/No Go condition is exceeded, check **Audio Beep on NoGo**.
5. Click **OK**. The No Go options take effect immediately.

Recording the Traces

You can record the vibration data to a log file and then play it back later. For information on playing back log files, see Chapter 4, "Viewing Log Files," on page 4.1. You can start a recording session manually (see "Manual Recording," below) or automatically (see "Automatic Recording," on page 3.13). Once VibeView starts recording, it records for the length of time you specify. The log file includes data for five seconds prior to the event that initiates the recording (see "Changing the Pre-Recording Length," on page 3.18).

Log files include the vibration data, user-specified data, and trigger information. All data received by VibeView (1000 points per second) is recorded regardless of the display settings.

Detailed information on recording log files is described in the following sections.

Manual Recording

With manual recording, you start the recording by clicking a button and the recording runs for the length of time you specify, unless you stop the recording. You can also pause recording and later resume recording in the same log file.

The manual recording controls for pausing and stopping recording are active even when recording is started by using triggers or No Go events (see "Automatic Recording," on page 3.13).

To record vibration data manually:

1. In the **Record Data** controls, use the **For** lists to set the length of time for the recording. You can choose recording times of up to four hours. Note that four hours of recording at 1000 data points per second will fill about 150 Mbytes of disk space.
2. To start recording, click **START**. The **START** button changes to **PAUSE**. VibeView will record for the specified length of time. The remaining time is shown below the **PAUSE** button, with a red background to indicate that recording is in progress. See Figure 3.7.

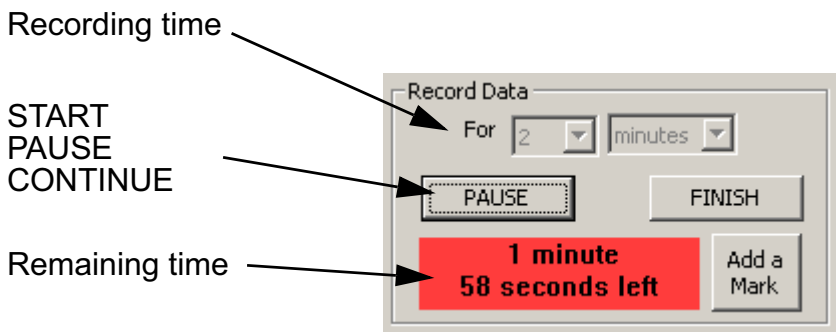


Figure 3.7: Recording Vibration Data

While a recording is in progress, holding the pointer over the PAUSE/CONTINUE button displays a ToolTip with the name of the current log file and the event that initiated recording.

3. To stop the recording before the specified recording time has expired, click **FINISH**. Clicking **FINISH** closes the current log file.
4. To temporarily stop recording but keep the current log file open, click **PAUSE**. When you want to continue recording, click **CONTINUE**. While recording is paused, VibeView continues to display data in real time. During a pause, the background color for the countdown timer changes to yellow, and the countdown pauses.

   While a recording is in progress or paused, holding the pointer over the PAUSE/CONTINE button displays a ToolTip that shows the name of the log file and the trigger event.

Automatic Recording

Instead of starting a recording manually, by clicking **START**, you can have VibeView start the recording automatically when one of the VibeView traces rises above, or falls below, a specified value. Once the recording starts, VibeView records for the length of time you specify, or until you click **FINISH**.

You have two options for starting recording automatically:

- **Triggers.** The triggers feature is primarily for recording data. Triggers don't give you any visual indication in the display when the traces exceed your specified limits. You can't set a qualification time for triggers; a trigger starts recording immediately when the trigger level is exceeded. For more information, see "Recording with Triggers," below.
- **Go/No Go.** The Go/No Go feature is primarily for helping you view events in the data on the display (see "Monitoring Traces for Excessive Vibration Levels," on page 3.8). During a recording initiated by a Go/No Go event, subsequent events extend the recording time, which is not true for triggers. For more information, see "Recording with Go/No Go," on page 3.15.

Recording with Triggers

Once recording has started, any subsequent trigger events are ignored. When recording stops, any active trigger event can start a new recording.

To record vibration data using triggers:

1. In the **Record Data** controls, use the **For** lists to set the length of time for the recording. You can choose recording times of up to four hours. Note that four hours of recording at 1,000 data points per second will fill about 150 MB of disk space. Once triggered, VibeView records data for the specified length of time (or until you manually stop or pause recording), regardless of any subsequent trigger events.

2. Choose the menu item **Settings > Set Triggers**. The Set Triggers dialog is displayed.

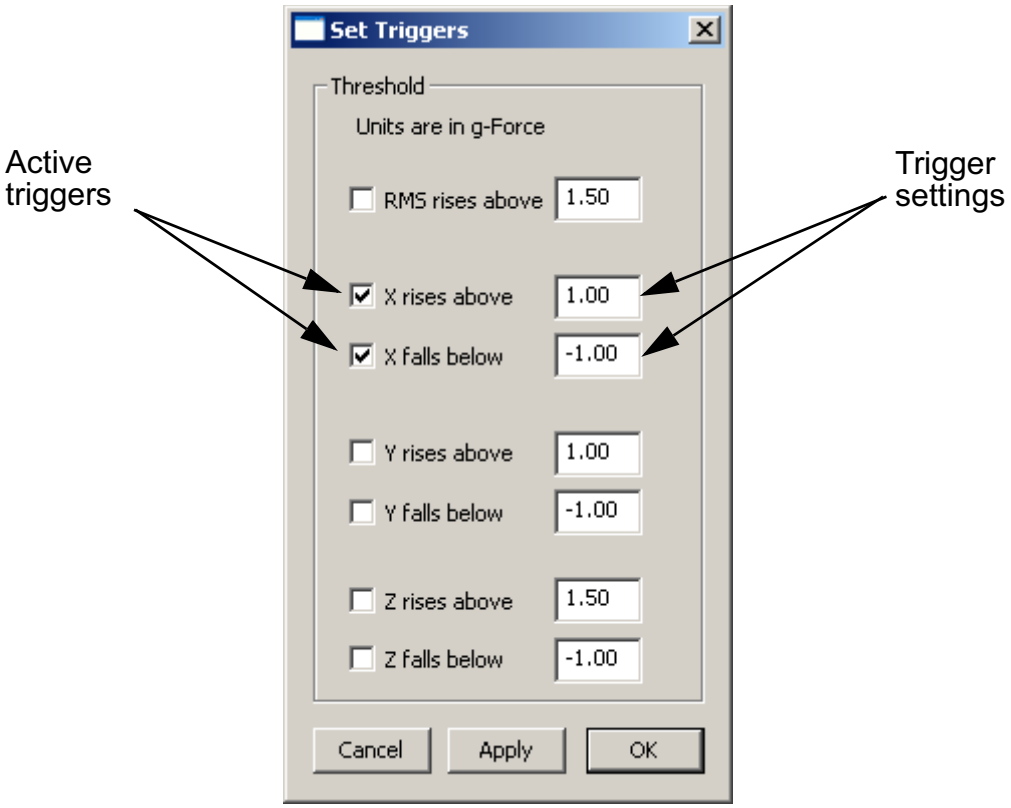


Figure 3.8: Set Triggers Dialog

3. Check the boxes to activate triggers for any events that you want to trigger the start of recording.
4. For each of the triggers you activated, specify the value that you want to trigger the start of recording. You can have VibeView start recording when a trace rises above a specified value or when a trace falls below a specified value. The units for trigger settings are the same as the units for the time domain format you have specified ("Changing the Time Domain Format," on page 3.30).
5. Click **Apply**. The trigger settings take effect immediately.

   When the next active trigger event occurs, VibeView starts recording data. VibeView records for the specified length of time, unless you click **FINISH** or **PAUSE** (see "Manual Recording," on page 3.12). The remaining time is shown below the **FINISH** and **PAUSE** buttons.
6. You can leave the Set Triggers dialog open while using VibeView. Doing so makes it easy to change the triggers. If you want to close the dialog, click **OK**.

Recording with Go/No Go

Once recording has started, any subsequent No Go events cause the recording time to be extended. Recording continues for the specified time from the moment of the most recent event. When recording stops, any active No Go event can start a new recording.

To record vibration data using Go/No Go settings:

1. In the **Record Data** controls, use the **For** lists to set the length of time for the recording. You can choose recording times of up to four hours. Note that four hours of recording at 1,000 data points per second will fill about 150 MB of disk space. The recording time is restarted every time a No Go event occurs. So, if you set the time for 30 seconds, but a second No Go event occurs after recording has been in process for 20 seconds, the total recording time will be 50 seconds.

2. Choose the menu item **Settings > Set Go/No Go**. The Set Go/No Go dialog is displayed.

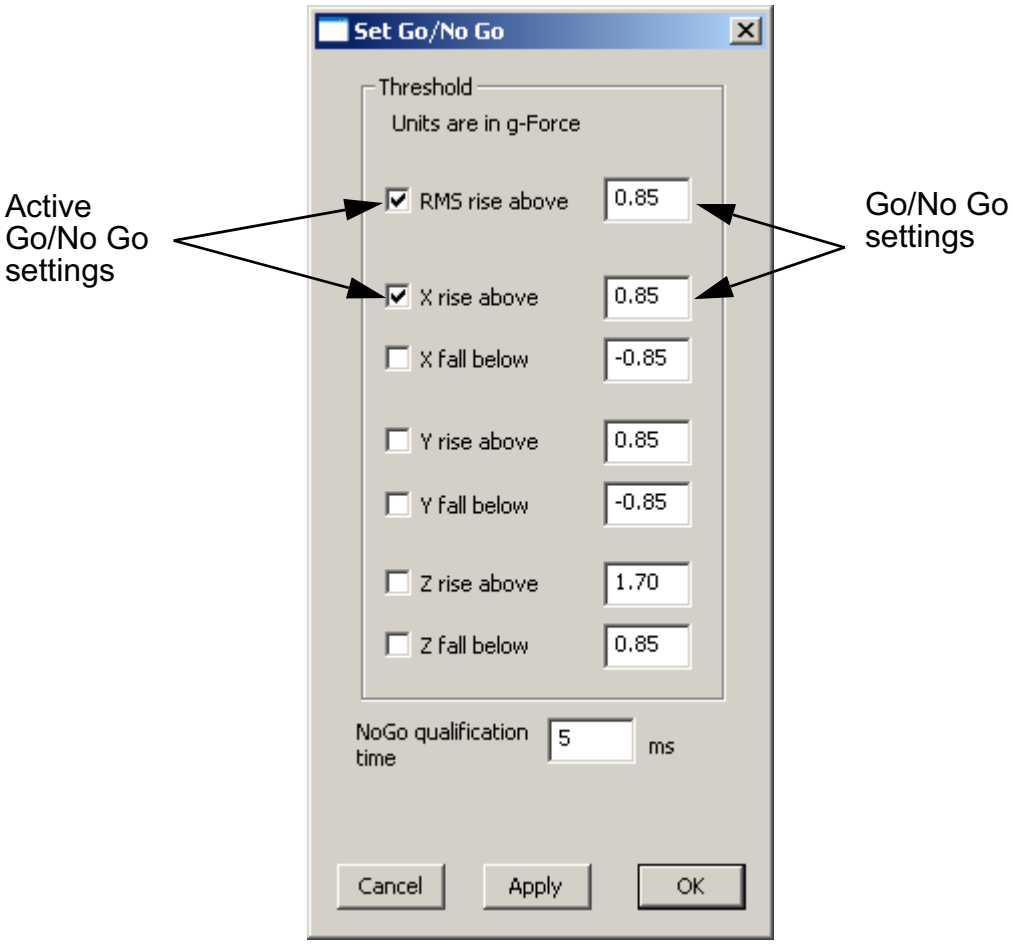


Figure 3.9: Set Go/No Go Dialog

3. Check the boxes to activate Go/No Go for one or more traces.
4. For each trace you activated, specify the Go/No Go settings. You can specify separate upper and lower settings. The units for Go/No Go settings are the same as the units for the time domain format you have specified ("Changing the Time Domain Format," on page 3.30).
5. For **NoGo qualification time**, specify the length of time any trace must exceed any Go/No Go setting before the No Go condition will start recording. A trace that exceeds a setting for less than the qualification time will not start recording.
6. Click **Apply**.

7. You can leave the Set Go/No Go dialog open while using VibeView. Doing so makes it easy to change the Go/No Go settings. If you want to close the dialog, click **OK**.
8. Choose the menu item **Settings > Options**. The options dialog is displayed.

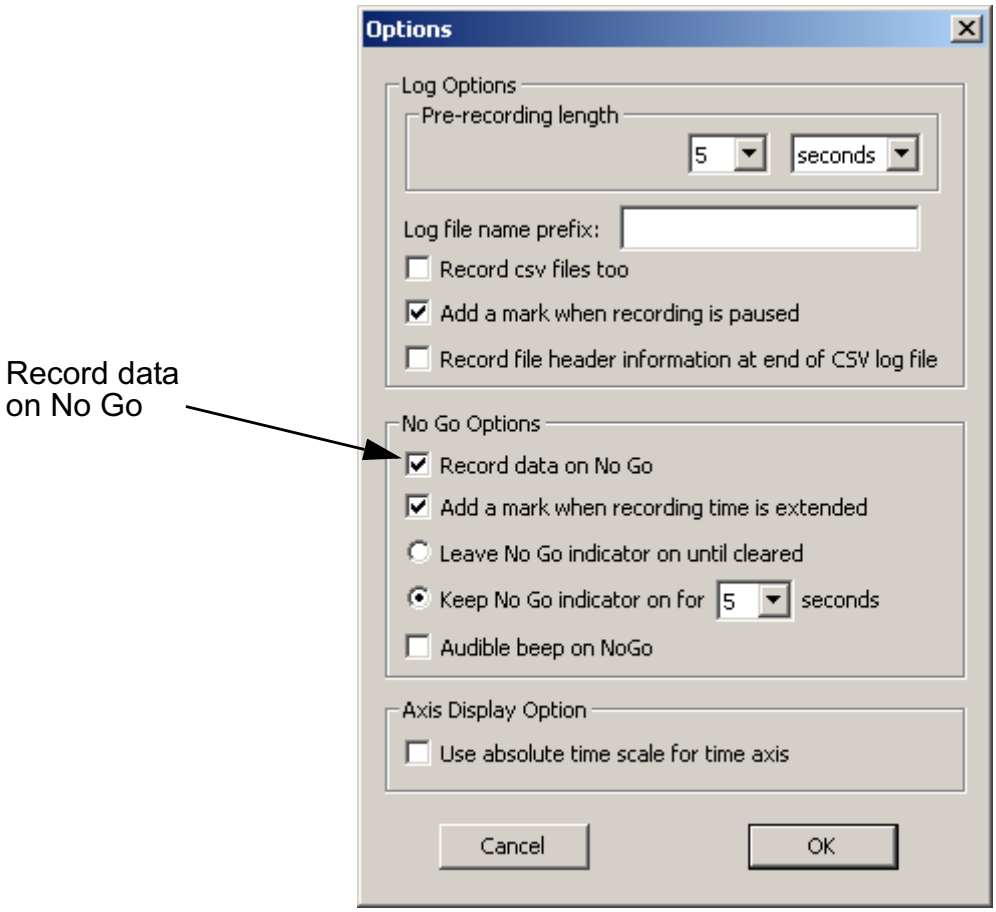


Figure 3.10: Recording Data on No Go Events

9. Check the box **Record data on No Go**.
10. Click **OK**.
11. When the next active No Go event lasting longer than the qualification time occurs, VibeView starts recording data. VibeView records for the specified length of time, unless you click **FINISH** or **PAUSE** (see "Manual Recording," on page 3.12), or the time is extended by the occurrence of another No Go event. The remaining time is shown below the **FINISH** and **PAUSE** buttons.

Changing the Pre-Recording Length

When recording data, VibeView includes data in the log file beginning five seconds prior to the event that initiates the recording, whether that event is the **START** button, a trigger, or a No Go event. When you play back a log file in VibeReview, this length of pre-recording data allows you to see a few seconds of data just prior to the event that started the recording. You can adjust the length of this pre-recording data from zero to five minutes.

To set the length of time for pre-recording data:

1. Choose the menu item **Settings > Options**. The options dialog is displayed.

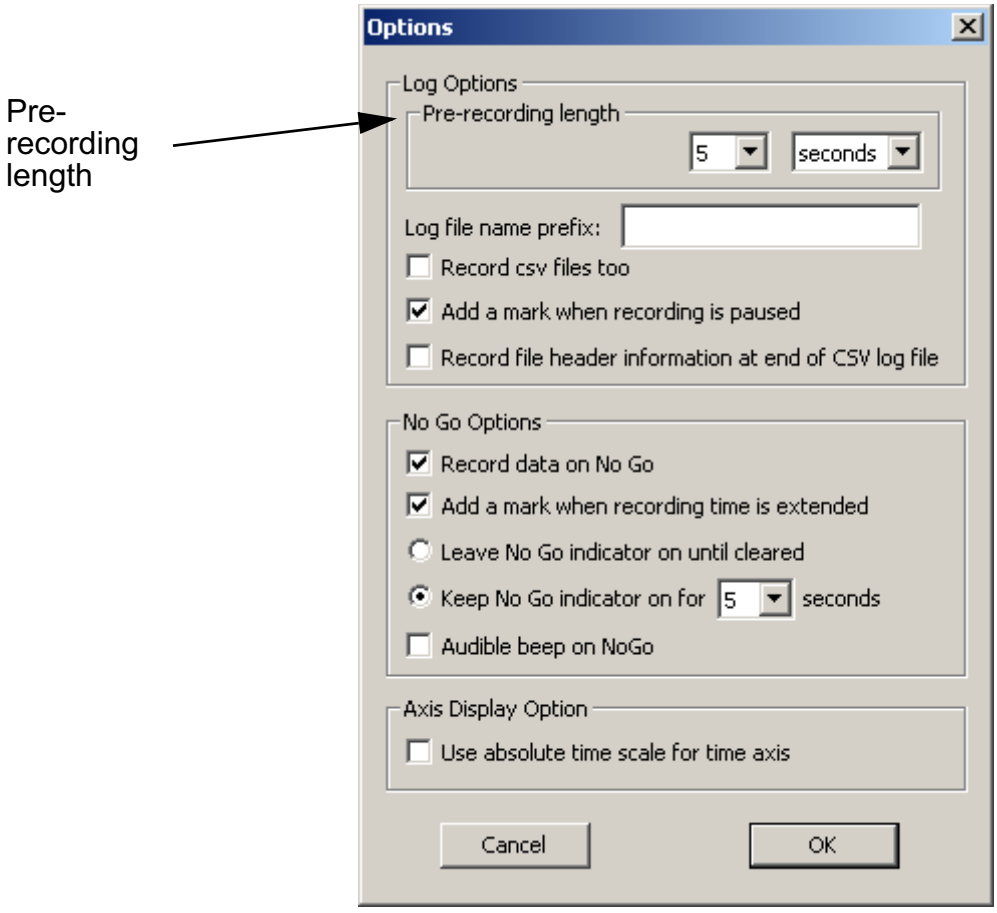


Figure 3.11: Changing the Pre-Recording Length

2. Under **Pre-recording length**, choose the interval of time and the units for pre-recording data.
3. Click **OK**.

Placing Marks in a Log File

At the start of recording, at trigger events, at No Go events, and when VibeView loses communication with the wafer, VibeView automatically places marks in the log file. You can also have VibeView automatically mark locations in the log file for other events. In addition to marks created automatically by VibeView, you can manually create your own marks in a file while you are recording, and you can add annotations to the marks. When you use VibeReview to play back the log file (see "Viewing Log Files," on page 4.1), you can quickly jump to the location of any mark in the file.

Adding Marks Automatically for Pauses and Recording Time Extensions

In addition to the marks that VibeView places in the log file for the start of recording, trigger events, No Go events, and when VibeView loses communication with the wafer, you can have VibeView mark locations in the file where you pause recording and where the recording time is extended by additional No Go events.

To have VibeView add marks for pauses and recording time extensions:

1. Choose the menu item **Settings > Options**. The options dialog is displayed.

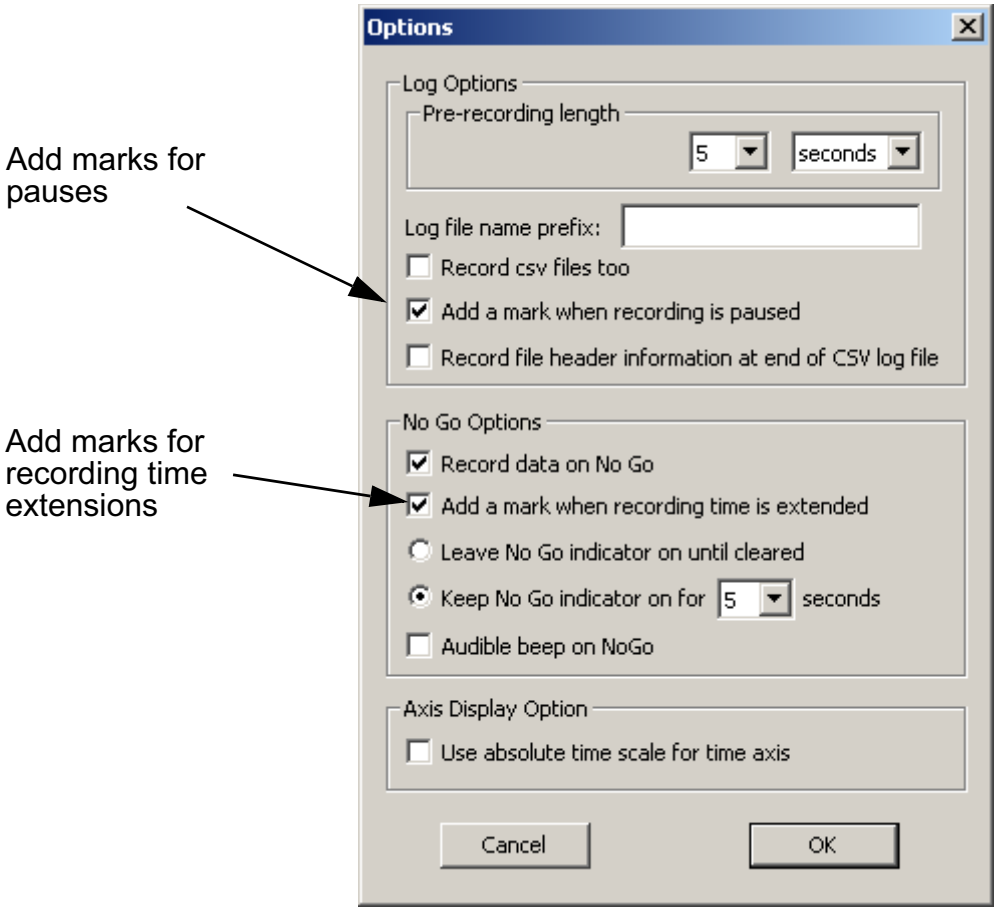


Figure 3.12: Marks for Pauses and Recording Time Extensions

2. To have VibeView add a mark to the log file each time you pause recording, check the box **Add a mark when recording is paused**.

3. To have VibeView add a mark to the log file each time recording is extended by an additional No Go event, check the box **Add a mark when recording is extended**.
4. Click **OK**.

Adding Marks Manually

To manually add a mark to a log file:

1. Choose the menu **Settings > Show Annotation Dialog**. This menu item toggles the display of the Annotate Mark dialog on and off. The setting is off by default.
2. While you are recording data, click **Add a Mark** (see Figure 3.13).

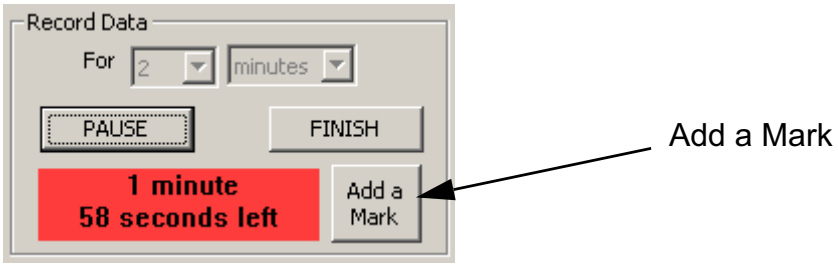


Figure 3.13: Adding a Mark

The Annotate Mark dialog is displayed (see Figure 3.14).

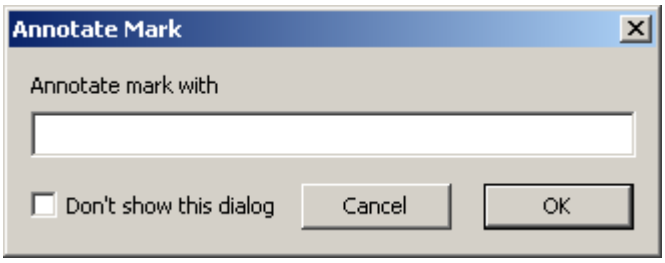


Figure 3.14: Annotating a Mark

3. In the Annotate Mark dialog, type the text you want to record with the mark location in the file and click **OK**. The mark is placed in the log file at the instant you click **Add a Mark**, even though it might be some time before you click **OK** in the Annotate Mark dialog. You can't add another mark until you click **OK**.

   If you don't want to be prompted with the Annotate Mark dialog when you click **Add a Mark**, the next time the dialog appears, check **Don't show this dialog** and click **OK**. If you have previously checked this box, and you now want to have the dialog displayed again, choose the menu **Settings > Show Annotation Dialog** to toggle the display of the Annotate Mark dialog on again.

Including User-Specified Information in the Log File

Operator, **Tool**, **Station**, and **Comment** are text fields you can use to record your own information in each log file. You can fill in any text information you want in these fields.

To include user-specified information for logging:

1. Choose the **Settings > Set Station Information** menu item.

   The Set Station Information dialog is displayed, as shown in Figure 3.15.

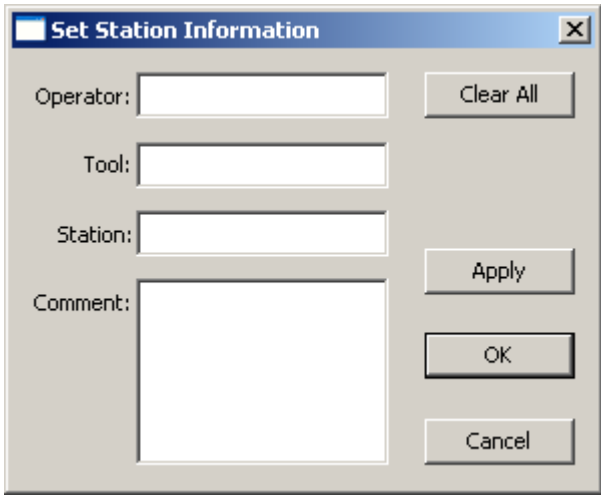


Figure 3.15: Set Station Information Dialog

2. Type your text into the **Operator**, **Tool**, **Station**, and **Comment** text fields.
3. Click **Apply** to accept the changes without closing the dialog. To accept the changes and close the dialog, click **OK** instead.

   You can leave the Set Station Information dialog open while using VibeView (drag it off to the side, so it doesn't cover the VibeView window). Doing so makes it easy to change the **Comment** or other fields each time you start recording, or as needed. Be sure to click **Apply** after you finish making changes, though, or VibeView won't use the latest changes for the next log file.

You can change or delete this information at any time for future log files. To quickly clear all of the fields, click **Clear All**.

Log File Names

By default, log file names are automatically assigned by VibeView and consist of the serial number for the AVS wafer followed by the date and time (see Figure 3.16).

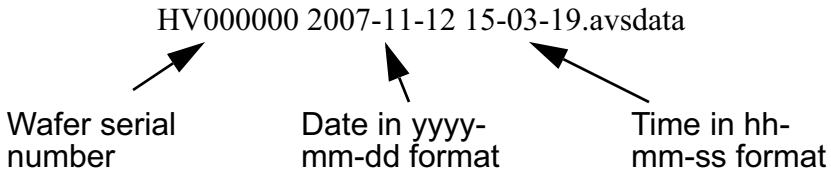


Figure 3.16: Default Log File Names

When you add marks to the log file (see "Placing Marks in a Log File," on page 3.19), VibeView creates a second file with the same name as that of the log file but with the file extension *avsmarks*.

You can specify a different log file name prefix to replace the wafer serial number, in which case, VibeView still adds the date, time, and the appropriate extension.

To specify a different flog file prefix:

1. Choose the menu item **Settings > Options**. The options dialog is displayed.

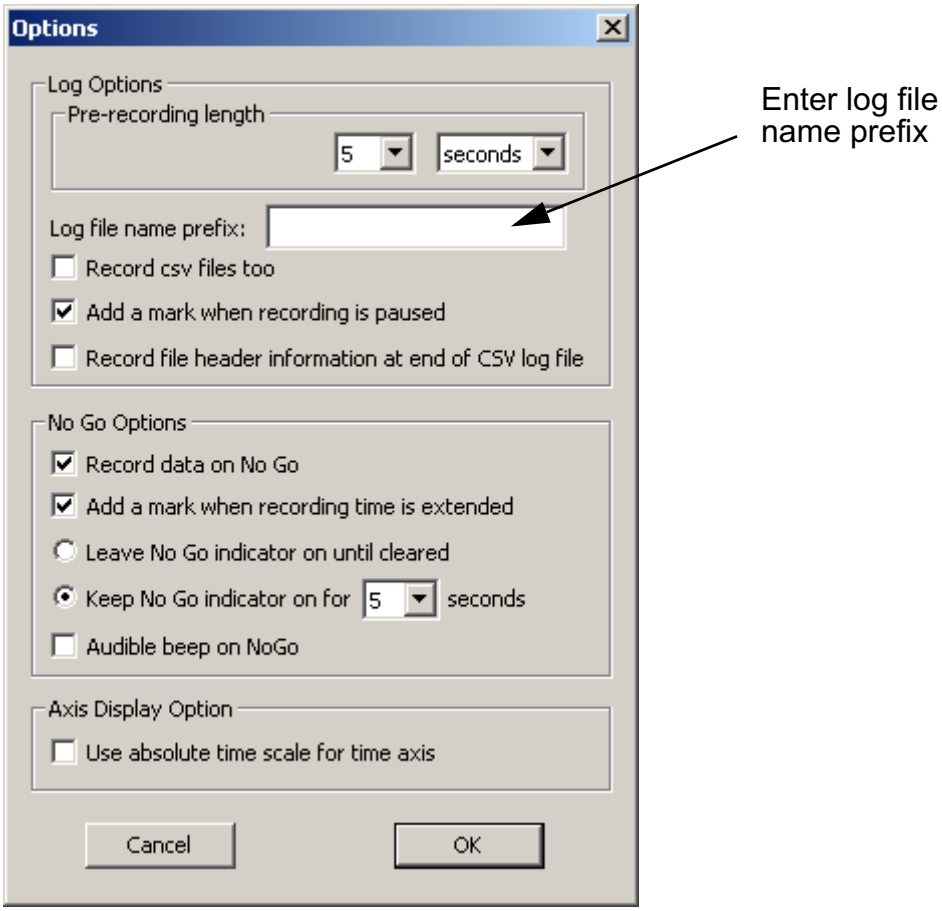


Figure 3.17: Specifying a Log File Name Prefix

2. In the **Log file name prefix** box., enter the file name prefix you want to use for log files.
3. Click **OK**.

Importing Log Files Into Other Applications

If you want to be able to import AVS log files into other programs, such as MATLAB or Microsoft Excel, you need to have AVS write log files in comma-delimited format (also called comma-separated-values, or CSV, files), as well as the standard binary *.avsdata* file format. Note that only relatively short files (65,000 readings, or about one minute) can be imported into Excel.

When you set VibeView to record CSV files, VibeView records both the *.avsdata* file and a *.csv* file. Data written to the *.avsdata* file is in g-force units with no filtering. Data written to the *.csv*

file has been filtered (if filtering is active) and converted to the units for the currently set time domain format. For more information on filtering and units, see "Filtering the Data," on page 3.29 and "Changing the Time Domain Format," on page 3.30.

At the top of the file, VibeView writes a file header including the sensor serial number and the current settings for the filter and time domain format. Each line of data consists of six entries: RMS, X, Y, Z, Time, and Marks with annotations, if any. You can choose to have the header information recorded at the end of the file, instead of at the beginning (see "Importing Log Files Into Other Applications," on page 3.24), which can be useful for importing the data into some applications.

The comma-delimited files are named as described in "Log File Names," on page 3.23, but with two differences:

- The file extension is *.csv*, rather than *.avsdata*.
- The filter settings are appended to the log file name. For example:

  HW10001000 2010-4-10 12-01-07 **BandPass 1Hz~5Hz**.csv

AVS includes a sample Script M-file that you can use to import files into MATLAB to generate a Fast Fourier Transform frequency analysis. The file is *AvsFft.m* and is located in the \Program Files\CyberOptics Semiconductor\WaferSense AVS\Matlab folder.

To have VibeView record comma-delimited files:

1. Choose the menu item **Settings > Options**. The options dialog is displayed (see Figure 3.18).

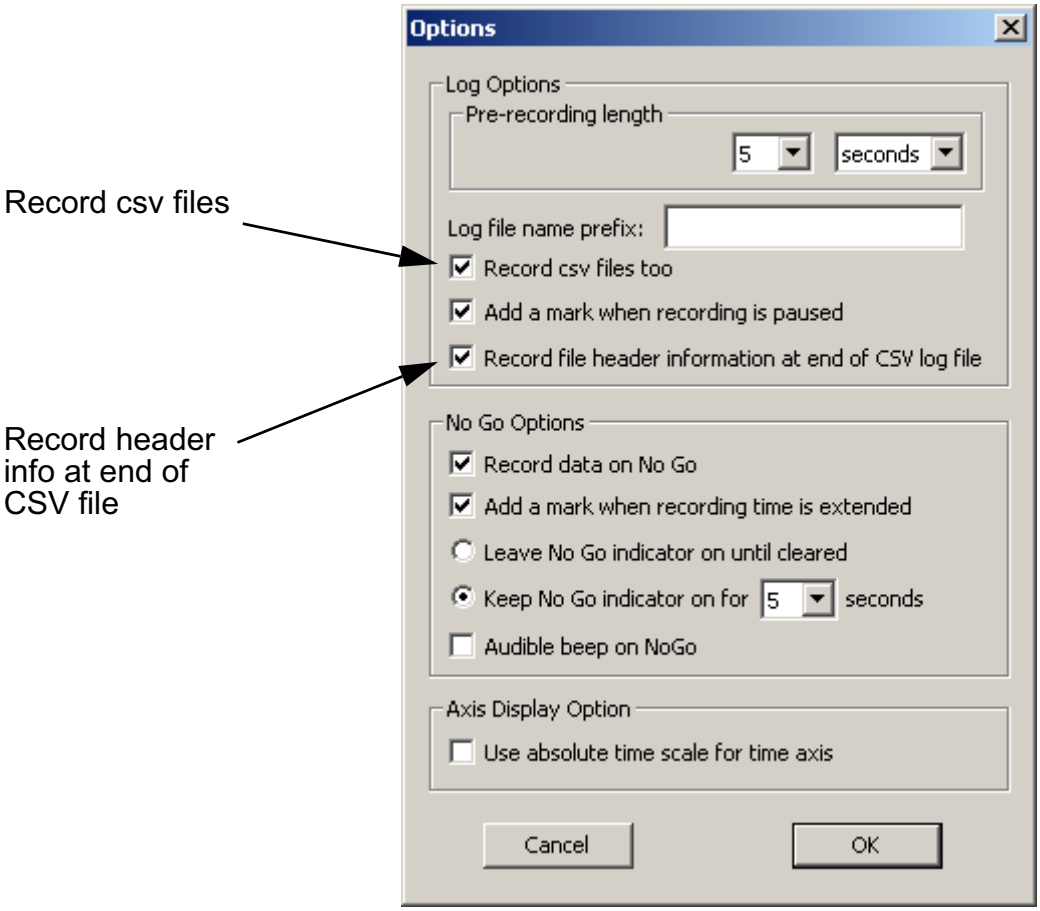


Figure 3.18: Recording Comma-Delimited Files

2. Check the box **Record csv files too**.
3. To have VibeView record the header information (sensor serial number and the current settings for the filter and time domain format) at the end of the file, instead of at the beginning, check the box **Record file header information at end of CSV log file**.
4. Click **OK**.

Changing the Log File Directory

By default, VibeView writes log entries to the directory My Documents\AVS Files\. If you prefer, you can specify a different directory.

To change the log file directory:

1. Choose the **File > Select Log Directory** menu item.
2. In the Browse For Folder dialog, specify the folder name for the log files, and click **Save**.

Configuring the Trace Display

You can change the way the vibrational traces are displayed by minimizing or maximizing the bars for displaying the traces, by applying a filter to the data, by changing the vertical and horizontal scales, by changing the colors of traces and other elements in the display, and by showing or hiding the trigger settings and frequency spectrum.

Minimizing Trace Bars

You can minimize the bars for displaying the traces. Minimizing the bar for a trace collapses the height of the bar for that trace. The heights of the bars for the remaining traces expand to fill the area. You can minimize the bars for up to three traces at any time; at least one trace is always maximized.

To minimize the bar for displaying a trace:

- In the Display controls, under **Minimize trace bars**, check the boxes for the traces you want to minimize (see Figure 3.19).

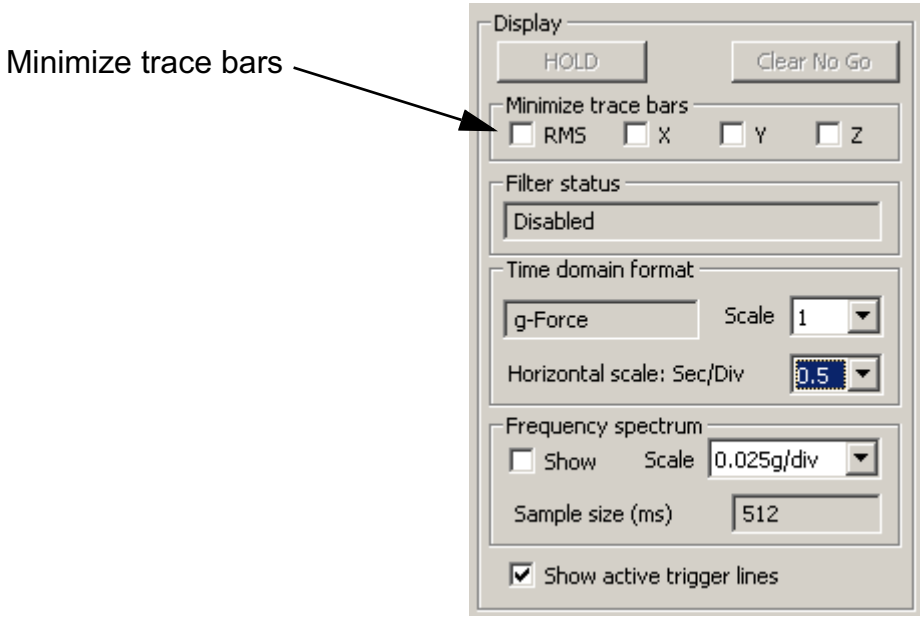


Figure 3.19: Minimizing Trace Bars

To restore the bar for a trace to its normal height:

- Uncheck the box for that trace under **Minimize trace bars**.

Filtering the Data

VibeView can filter the data to remove unwanted parts of the signal spectrum before displaying it. You can choose a low-pass filter, a high-pass filter, or a band-pass filter. Changing the filter can dramatically affect the range of values in the data, which affects trigger and Go/No Go values, so when you change filter settings, VibeView automatically disables all trigger and Go/No Go settings. If you make any changes to the filter (enabling, disabling, changing filter type or band pass settings), you'll need to adjust and re-enable any triggers or Go/No Go settings.

Filters can be useful for a variety of situations, including:

- Removing constant g-force
- Removing very low frequency acceleration resulting from slow moves
- Removing high frequency noise

The filter affects the display of the data but does not affect the data written to the *.avsdata* log file. However, the filter does affect the data written to the optional *.csv* file (see "Importing Log Files Into Other Applications," on page 3.24).

To set up the filter:

1. Choose the menu item **Settings > Set Filter**. The Set Filter dialog is displayed (see Figure 3.20).

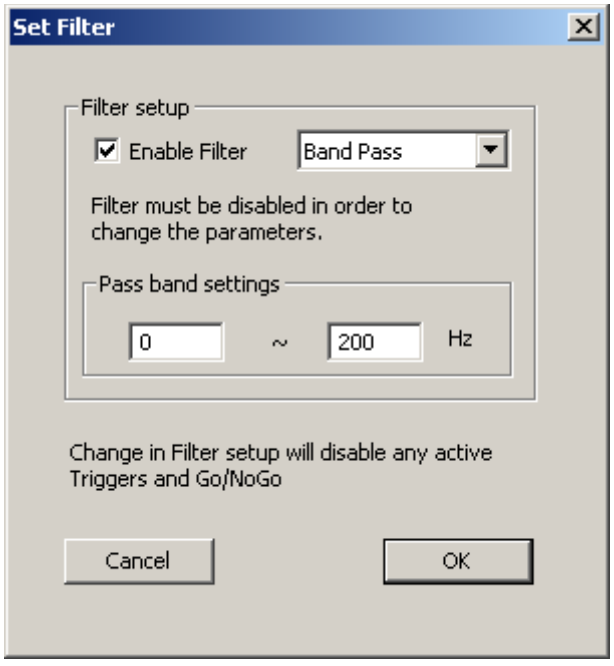


Figure 3.20: Set Filter dialog

2. If **Enable Filter** is checked, clear the box. You can't make any changes to the filter settings when the filter is enabled.
3. From the list, choose the type of filter you want to apply to the data: Low Pass, High Pass, or Band Pass.
4. Specify the **Pass band settings** for the filter.
5. Check **Enable Filter** and click **OK**. The new filter settings take effect immediately. Any trigger or Go/No Go settings are disabled. If you want to use triggers or Go/No Go, you must re-enable them.

Changing the Time Domain Format

VibeView gives you three options for setting the time domain format for traces (see Figure 3.21 on page 3.31):

- **g-Force.** Displays acceleration values from -2 g to +2 g. One g is the acceleration of gravity (approximately 32 ft/s^2 or 9.81 m/s^2). With this vertical scale setting, when the wafer is sitting motionless and horizontal, the Z trace will show 1 g, the X and Y traces will show 0 g, and the RMS trace will show 0.58 g. This is because the wafer senses the acceleration of the earth's gravitational field, which is 1 g in the vertical (Z) direction. You can also choose to display the absolute value of acceleration in g-Force. Using the absolute value can be helpful when comparing traces. When displaying absolute value, you will usually want to also use the high-pass filter ("Filtering the Data," on page 3.29).
- **Gal.** Displays values in galileo units, where 1 g = 981 Gal. With this vertical scale setting, when the wafer is sitting motionless and horizontal, the Z trace will show 981 Gal, the X and Y traces will show 0 Gal, and the RMS trace will show 566 Gal. This is because the wafer senses the acceleration of the earth's gravitational field, which is 981 Gal in the vertical (Z) direction. You can also choose to display the absolute value of acceleration in Gals. Using the absolute value can be helpful when comparing traces. When displaying absolute value, you will usually want to also use the high-pass filter ("Filtering the Data," on page 3.29).
- **Energy.** Displays the signal energy for the last *n* acceleration values:

$$\frac{1}{N} \cdot \sum_{k=1}^{n} x^2(k)$$

Where *N* is the sample rate (1 KHz for AVS); *n* is the number of samples, which is the sample size you have set for the frequency spectrum (see "Displaying the Frequency Spectrum," on page 3.38); and *x(k)* is kth sample of the acceleration in g-force. Using the energy format with appropriate Go/No Go settings can identify vibrations that

don't have large amplitudes (and might not trip Go/No Go settings for g-force or Gals) but extend for longer periods of time.

Values that are too large to display are truncated.

Changing the time domain format can dramatically affect the range of values in the data, which affects trigger and Go/No Go values, so when you change time domain format settings, VibeView automatically disables all trigger and Go/No Go settings. If you change the time domain format, you'll need to adjust and re-enable any triggers or Go/No Go settings. For more information, see "Recording with Triggers," on page 3.13 and "Monitoring Traces for Excessive Vibration Levels," on page 3.8 or "Recording with Go/No Go," on page 3.15.

To change the time domain format:

1. Choose the menu item **Settings > Set Time Domain Format**. The Set Time Domain Format dialog is displayed (see Figure 3.21).

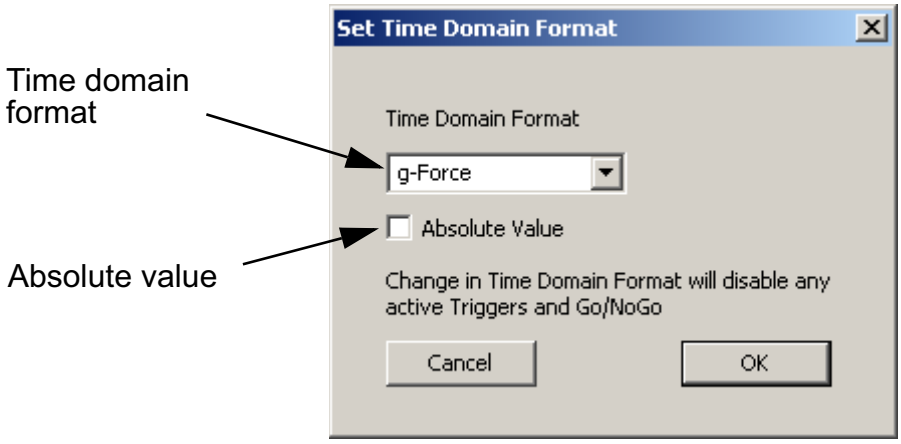


Figure 3.21: Set Time Domain Format dialog

2. From the list, choose your time domain format.
3. If you want VibeView to display the absolute value of the acceleration values, check the box for **Absolute Value**.
4. Click **OK**.

   When you change the time domain format, triggers and Go/No Go settings are disabled. You might need to re-enable these settings.

Changing the Vertical Scale

At the default vertical scale, VibeView displays a range of ±2g for each trace. You can expand the vertical scale by factors of two, from one to 128 times. When you increase the scale, less of the ±2g range is visible, but scroll bars are provided so that you can see the full range for each trace.

To change the vertical scale:

- Using the **Scale** list, choose a scale factor. The new scale setting takes effect immediately.

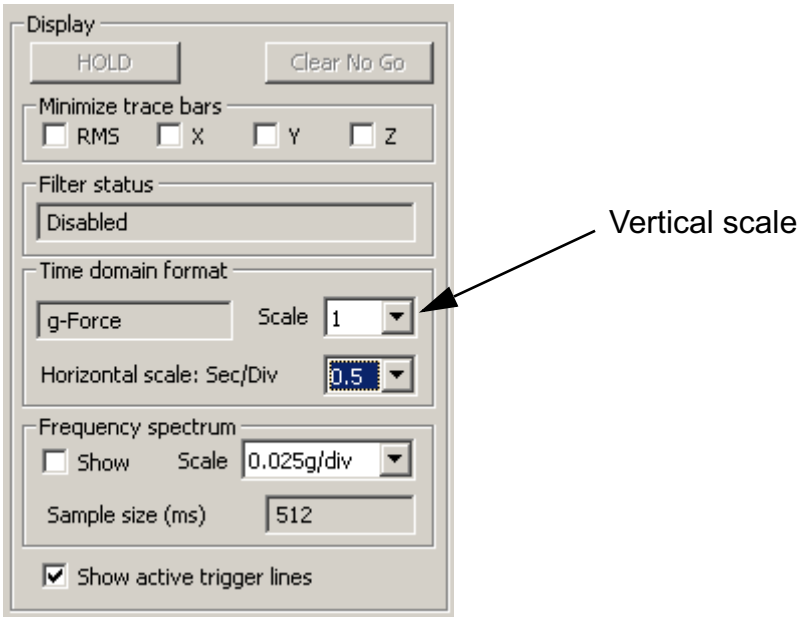


Figure 3.22: Vertical Scale

Changing the Horizontal Time and Scale

The default horizontal axis labels show time relative to the right edge of the trace where the newest data points are plotted. See Figure 3.23.

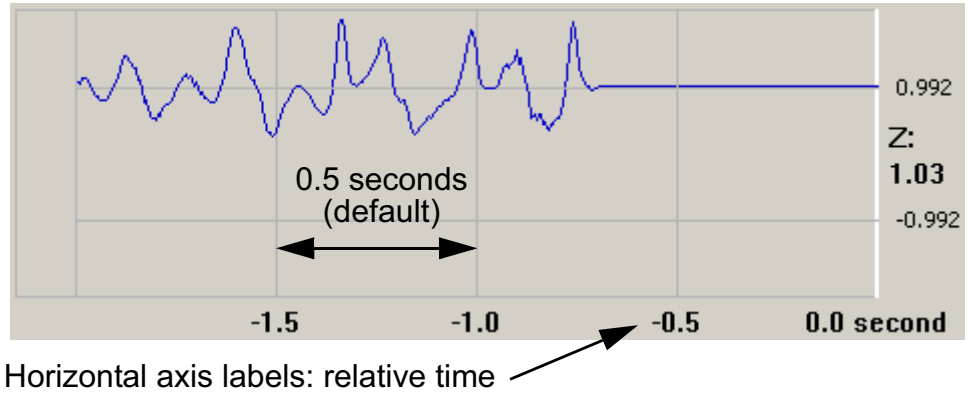


Figure 3.23: Horizontal Axis Labels and Scale

With this relative time scale, the time labels on the horizontal axis indicate the time that has elapsed since the data was first displayed at the right edge. The numbers increase negatively as you move from right to left indicating that the older data is to the left. You can change the horizontal scale to show *absolute* time since the start of recording, rather than *relative* time (see Figure 3.24). When you aren't recording, the scale always shows time relative to the right edge.

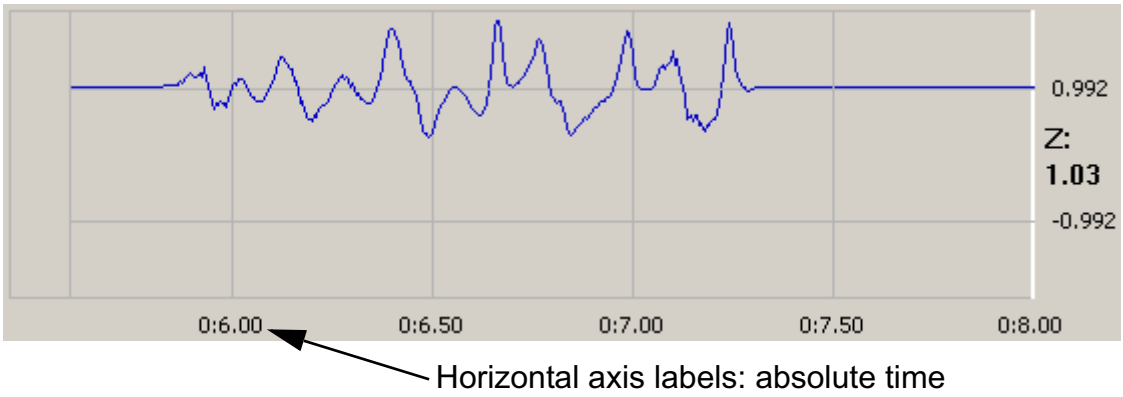


Figure 3.24: Absolute Time Scale

The default horizontal scale shows 0.5 seconds between vertical grid lines and plots one point for ever five readings received from the AVS. You can change the horizontal scale to show from 0.1 seconds to 100 seconds between the grid lines. At the 0.1 s setting, VibeView displays

every reading received from the AVS wafer (one data point per millisecond). When displaying at the higher scales, VibeView can't display every reading received from the AVS, so it displays a vertical bar indicating the range of values for the time span represented by any given point on the horizontal axis. For example, at the default scale of 0.5 seconds/division, each vertical bar plotted represents five readings and shows the range of those five readings. The horizontal scale setting doesn't affect the data recorded, only the data displayed.

Changing the Horizontal Axis Time

To change the horizontal axis time:

1. Choose the menu item **Settings > Options**. The Options dialog is displayed.

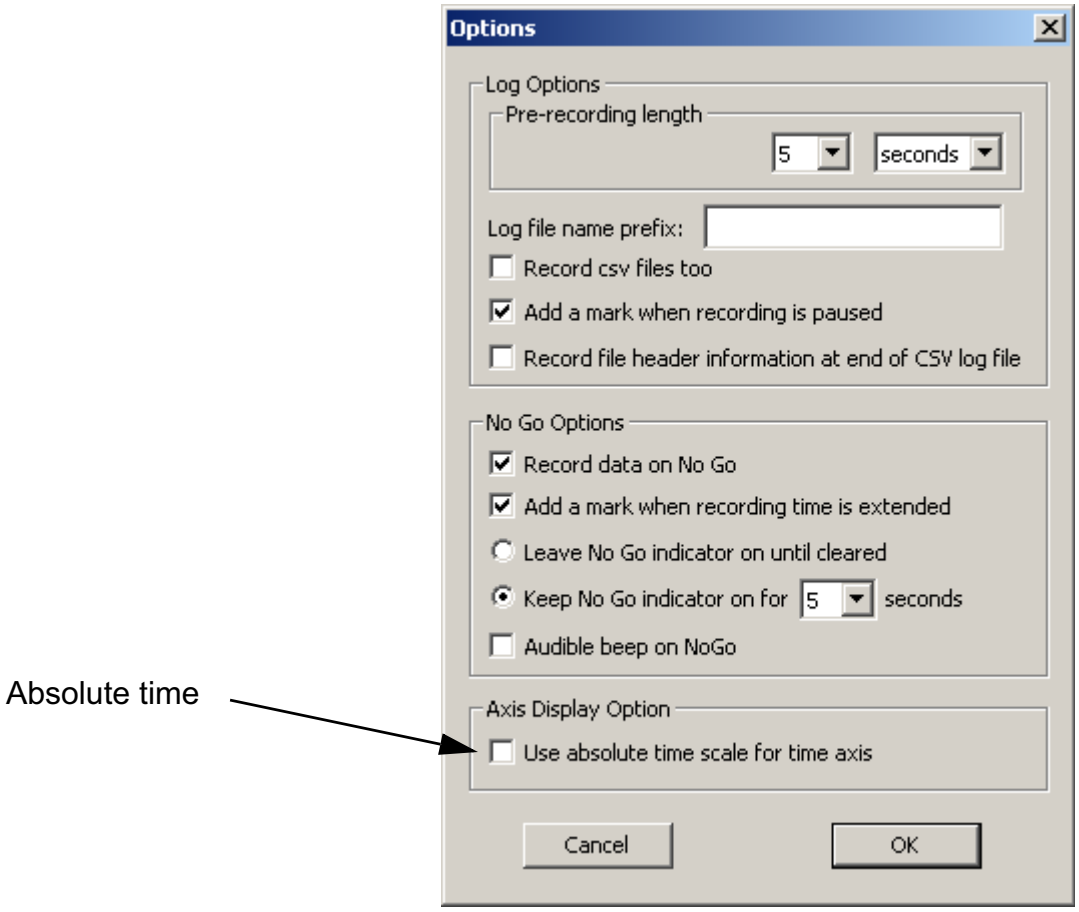


Figure 3.25: Changing to Absolute Time

2. For absolute time, check the **Use absolute time scale for time axis** box.
3. Click **OK**.

Changing the Horizontal Scale

To change the horizontal scale:

- Using the **Horizontal scale** list, choose the time interval you want between vertical grid lines. The new scale setting takes effect immediately.

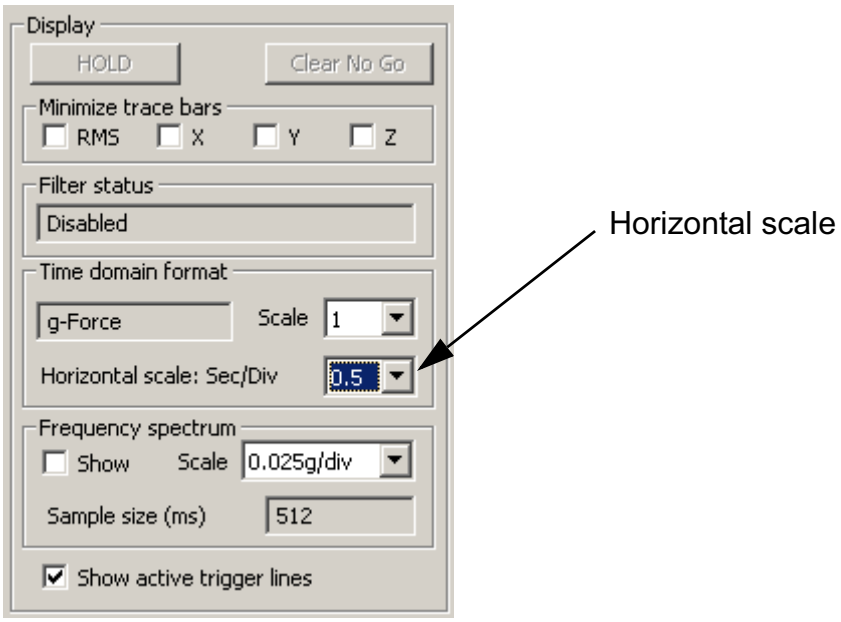


Figure 3.26: Setting the Horizontal Scale

Changing Colors

You can change the colors used to display traces and other elements of the display. The table below shows the display elements that you can change:

Display Element	Description
RMS	RMS trace
X	X trace
Y	Y trace
Z	Z trace
Indicator	Vertical line at the right edge of the trace display where new data is first displayed
Go/No Go Lines	Horizontal lines showing current active Go/No Go settings
Trigger Lines	Horizontal lines showing current active trigger settings
Grid Lines	Horizontal and vertical section lines
Text	Labels on axes and for annotations
Background	Background color of the trace area

To change colors:

1. From the **Settings > Select Colors** menu item, choose the display element you want to change. The color palette is displayed (Figure 3.27).

Figure 3.27: The Color Palette

2. If you want to use one of the existing color definitions, skip to the next step. If you want to define a custom color, click **Define Custom Colors**. The color palette expands, as shown in Figure 3.28 on page 3.37. Specify the color as a combination of Hue, Saturation, and Luminosity or as a combination of Red, Green, and Blue, and click Add to Custom Colors.

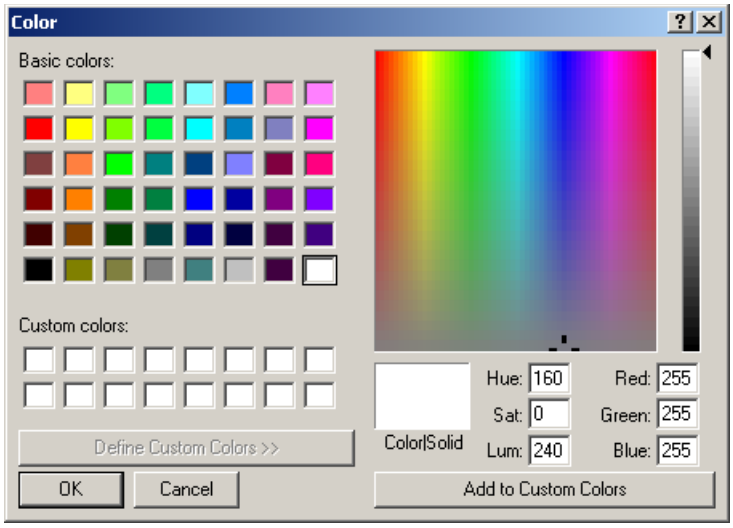


Figure 3.28: The Custom Colors Palette

3. Click on the color you want to use for the display element and click **OK**.

To reset all colors to the default values:

- From the **Settings > Select Colors** menu item, choose **Restore Defaults to All**.

To reset only the background color to the default value:

- From the **Settings > Select Colors** menu item, choose **Restore Default Background**.

Displaying the Frequency Spectrum

By default, VibeView displays time-domain data: vibration readings over time. You can also have VibeView display frequency-domain data: the frequency spectrum determined by a Fast Fourier Transform (FFT) of the time-domain data. As shown in Figure 3.29, when displaying a frequency spectrum, VibeView divides the trace area, showing the vibration traces on the right and the frequency spectrum on the left.

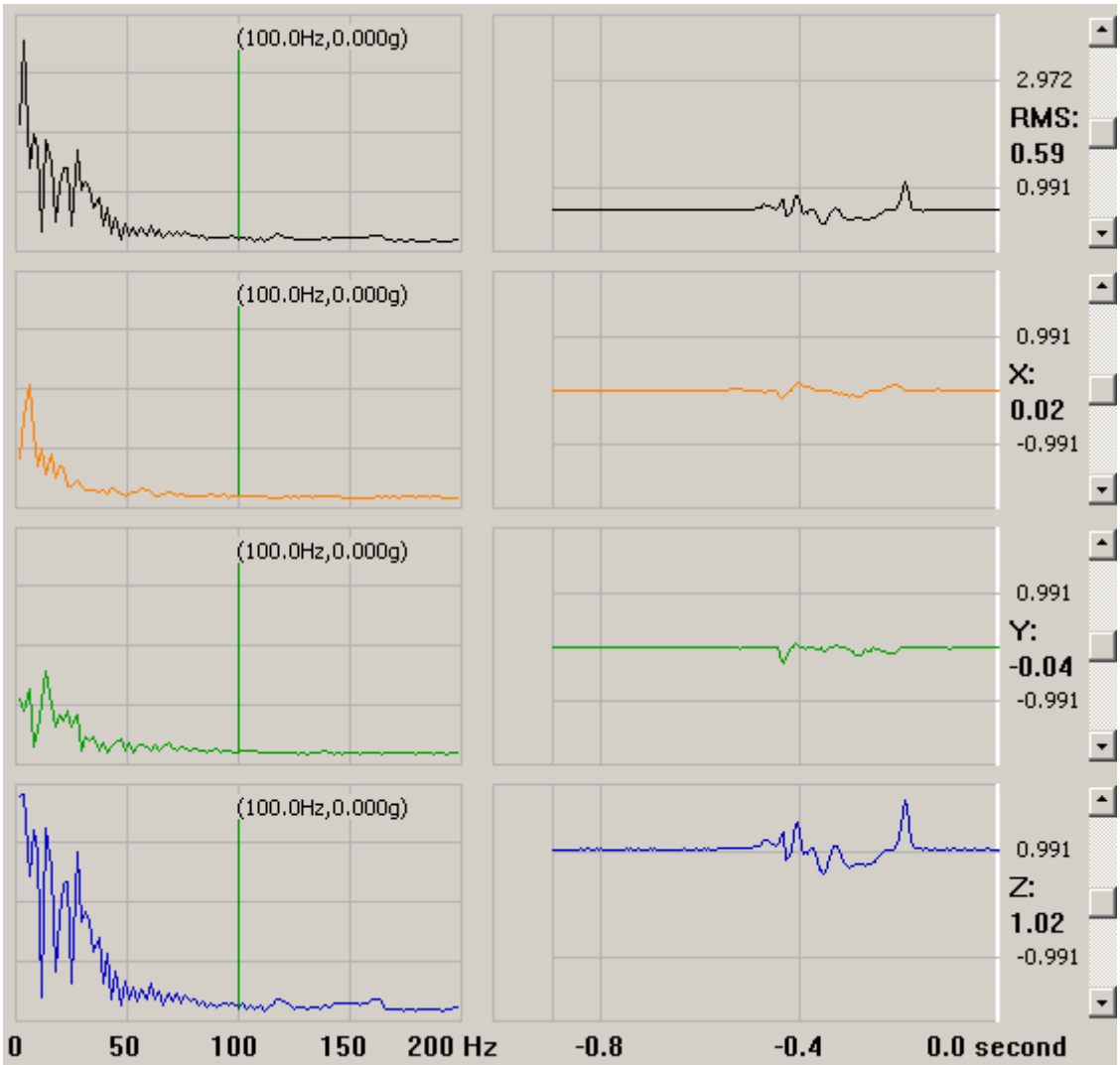


Figure 3.29: Displaying a Frequency Spectrum

In the frequency spectrum display, the horizontal axis is the vibration frequency, and the vertical axis displays the amplitude for that frequency. Both scales are linear. Frequencies are limited to 200 Hz and below by the AVS electronics.

Each frequency display has a vertical green line. The line is positioned at a particular frequency (100 Hz, by default), and the text at the top of the line identifies the frequency and the current amplitude for that frequency. You can move the lines to monitor the amplitude at different frequencies.

By default, VibeView performs the frequency analysis using a sample of 512 data points (512 ms of data). VibeView receives data from the wafer in packets of 100 data points. The FFT is computed every 100 milliseconds, using the latest packet of 100 points plus the previous 412 data points. You can specify a different sample size. Increasing the sample size increases the resolution of the frequency spectrum, but the additional data points cause the FFT results to respond more slowly to changes, similar to the way a rolling average tends to smooth out changes. When you change the FFT sample size, VibeView automatically disables all trigger and Go/No Go settings. After changing the sample size, you'll need to adjust and re-enable any triggers or Go/No Go settings.

To display a frequency spectrum in VibeView:

1. Under **Frequency spectrum**, check the **Show** box.

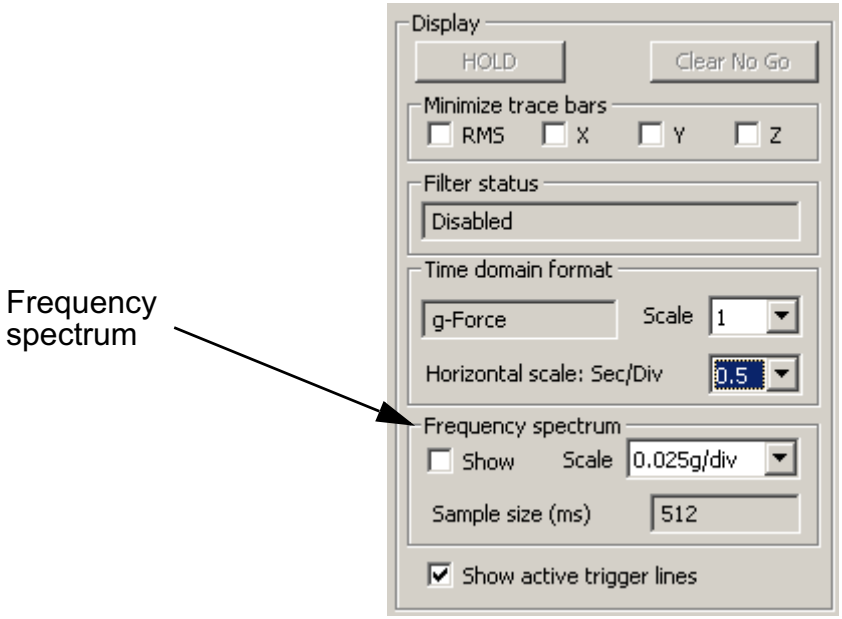


Figure 3.30: Show Frequency Spectrum

2. To adjust the vertical scale of the frequency spectrum, choose a value from the **Scale** list. The new setting takes effect immediately.

3. To display the amplitude for any specific frequency component, move the green lines:
   - To move one of the vertical green lines, right-click in the frequency spectrum display.
   - To adjust the position of a line after using right-click, press the left- or right-arrow keys.
   - To line up all of the green lines, double-right-click.

   When you move the green line, it moves between the frequency values determined by the FFT, which in general are not integer values.
4. To change the FFT sample size, choose the menu item **Settings > Set FFT Sample Size**. The Set FFT Sample Size dialog is displayed (see Figure 3.31).

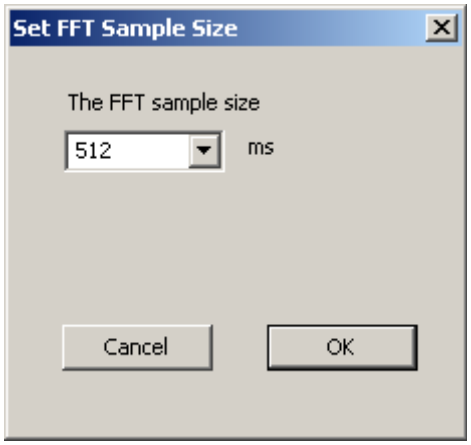


Figure 3.31: Set FFT Size dialog

5. From the list, choose a sample size and click **OK**. The new setting takes effect immediately.

   When you change the FFT sample size, triggers and Go/No Go settings are disabled. You might need to re-enable these settings.

Showing and Hiding the Trigger Settings

You can add lines to the trace displays to show the active trigger settings. For more information on triggers, see "Recording with Triggers," on page 3.13.

- To show active trigger lines on the display, check the box for **Show active trigger lines** (see Figure 3.32 on page 3.41).

- To hide all trigger lines on the display, clear the box for **Show active trigger lines**.

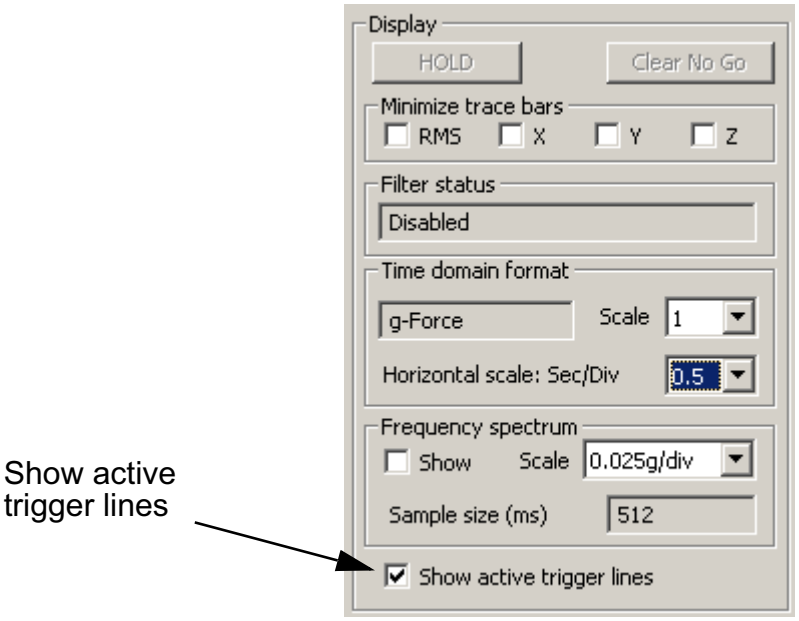


Figure 3.32: Displaying Triggers

Printing the VibeView Window

You can print an image of the VibeView window to have a graphical record of the session.

To print an image of the VibeView window:

1. Choose **File > Print**.
2. In the Print dialog, click **OK**.

You can also select a printer other than the default and change the printer setup, or see a preview of what VibeView will print:

- To select a different printer, change the paper selection or print orientation, or set printer properties, choose the **File > Print Setup** menu item.
- To see a preview of what VibeView will print, choose the **File > Print Preview** menu item.

Monitoring the Operating Temperature

The operating range for the AVS wafer to achieve the specified accuracy for readings is 20 °C to 70 °C. The AVS wafer can withstand exposure to 120 °C (5 minutes or less) if not in direct contact with the heating element. The **Temperature** monitor in the **AVS wafer status** area of the VibeView window (see Figure 3.33) shows the current operating temperature of the AVS wafer with a numeric readout and a bar graphic.

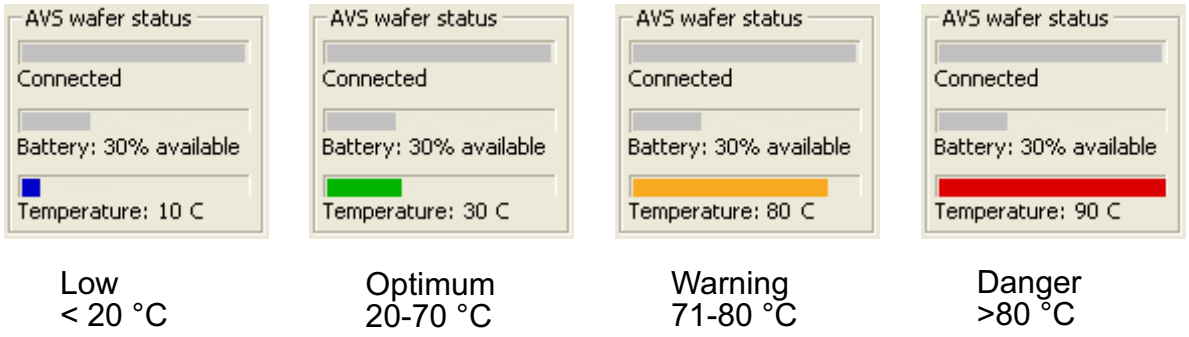


Figure 3.33: Temperature Monitoring Gauge

The temperature bar changes color to indicate where the current temperature is relative to the accurate operating range:

- **Blue.** Less than 20 °C; the AVS wafer is operating below the range where it produces accurate readings.
- **Green.** 20 °C to 70 °C; the AVS wafer is operating in its optimum temperature range, where it produces readings meeting the specified accuracy.
- **Orange.** 71 °C to 80 °C; the AVS wafer is operating above the range where it produces the most accurate readings, but not so hot that the AVS wafer will be damaged.
- **Red.** Greater than 80 °C; the AVS wafer is operating at a temperature so high that it might be damaged.

Using the Rechargeable Battery

The AVS wafer operates from an internal rechargeable battery. From a full charge, the battery provides about four hours of continuous use. Before using your AVS wafer for the first time, charge it for two hours.

The battery can be recharged about 500 times before the charge life starts to degrade significantly. The battery is not user replaceable. For information on replacing the battery, see "Annual Factory Battery Replacement," on page 5.1.

Battery performance degrades at temperatures outside the temperature range: 20 °C - 50 °C.

Monitoring the Battery Level

VibeView receives frequent updates from the AVS wafer on the state of the AVS wafer's battery. The **Battery** indicator in the **AVS wafer status** area of the VibeView window shows the approximate percentage of operating time remaining before you must charge the battery.

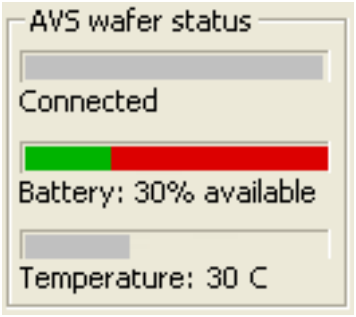


Figure 3.34: Battery Monitor

Charging the Battery

To charge the AVS wafer's battery:

1. Use only the battery charger supplied with your AVS wafer. Using a different battery charger might damage your AVS wafer or create a safety hazard.
2. Do not charge the AVS wafer if its internal temperature is higher than 45 °C. Charging the AVS wafer at a temperature higher than 45 °C might damage your AVS wafer or create a safety hazard.
3. Place the AVS wafer in the charging clean box (see "Opening and Closing the Clean Box," on page 3.2). Rotate the wafer until the WaferSense AVS logo is right side up and approximately level when the hinged edge of the box is away from you. Close the lid.
4. Plug the charger line adapter into a 100 VAC to 240 VAC supply and plug the other end into the charging clean box.

The **Charging** light is on while the AVS wafer is charging. If the **Charging** light does not turn on, make sure the lid of the box is closed completely and the charging pins in the charging clean box are making electrical contact with the AVS wafer.

5. Charge the AVS wafer until the **Charging Done** light turns on or until you need to use the AVS wafer (you don't need to wait until the AVS wafer is fully charged).

   Fully charging the battery takes about two hours. Charging for one hour charges the battery to about 80% of its capacity. You can leave the AVS wafer in the charging case when not in use; the battery won't overcharge.

Monitoring the Wireless Connection to the AVS wafer

The VibeView application communicates with the AVS wafer by using a Bluetooth wireless link. The wireless link has a range of up to 30 ft (10 m).

The **Connection** indicator in the **AVS wafer status** area of the VibeView window shows the quality of the wireless connection between the AVS wafer and the link module. The connection quality is indicated by the color of the bar and the wording below the bar (see Figure 3.35):

- **Green - Connected.** The connection between the link and AVS wafer is good. With a good connection, the AVS wafer is sending the maximum number of readings per second to the link module (at least 200 readings per second).
- **Yellow - Poor connection.** There is some interference or other problem with the signal that is preventing the link and AVS wafer from communicating at their maximum rate. When the indicator is yellow, the readings are still accurate but aren't being updated as frequently.
- **Red - No connection.** Indicates that there is no connection between the AVS wafer and link module. The values in the display do not update when the indicator is red.

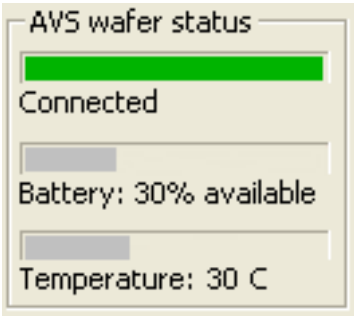


Figure 3.35: Wireless Connection Monitor

The Bluetooth wireless link technology used in the AVS is a low-power technology that operates in the 2.4 GHz radio frequency band. This unlicensed band is also used by many other types of devices, such as cordless phones and microwave ovens. Another 2.4 GHz device operating in close proximity could interfere with the AVS system. When this happens, separating the devices by at least 6 ft (2 m) usually solves the problem.

Other factors can also affect the wireless link, such as the distance between the wafer and link, and obstacles between the wafer and link that block the signal. If VibeView indicates that the connection isn't good, try moving the wireless link module a few feet closer to the AVS wafer.

After turning off the AVS wafer, the Connection indicator might not change to red for a few seconds.

Changing the Pairing Between the AVS wafer and Link

Each AVS wafer is paired with a specific link module at the factory and will operate with only that particular link module. You can change this pairing, so that you can use your AVS wafer with a different AVS link module, or vice versa. Link modules for different CyberOptics WaferSense products, such as Auto Gapping Sensors (AGS), are not interchangeable.

To pair an AVS wafer and link module:

1. If you are changing the pairing of an AVS wafer that is already paired with a link module, first unplug the currently paired link module. You can't pair an AVS wafer with a new link module while the currently paired link module is powered on.
2. Make sure the **Power** light is illuminated on the link module you want to pair, and make sure the **On** light is illuminated on the AVS wafer.
3. On the AVS wafer, press and hold the **NEW PAIR** button until the **Pair Status** and **Connection Status** lights start to blink rapidly (about four times per second).
4. On the link module, press and hold the **NEW PAIR** button until the **Pair Status** and **Connection Status** lights start to blink rapidly (about four times per second).

   The **Pair Status** and **Connection Status** lights will continue to blink until the AVS wafer and link have established a new pairing, after which the lights will be on and no longer blinking.

Saving Your Settings

Each time you exit the VibeView application, it saves your current settings for the triggers, Go/No Go, horizontal scale, vertical scale, and other display settings, recording duration, and log file directory in the Windows registry. The next time you start VibeView, it restores those saved settings. You can also tell VibeView to save your settings to a file you specify, and you can have VibeView read those settings back at any time. This lets you have several different configurations for VibeView and be able to switch between them easily, without having to reenter the settings.

To save your settings in a file you specify:

1. Choose the **File > Save Settings As** menu item.
2. In the AVS Settings File dialog, specify the directory and file name and click **Save**.

   VibeView saves your settings, and the file you specified becomes the current settings file.

To save your settings in the current settings file:

- Choose the **File > Save Settings** menu item.

Each time you start VibeView, the application automatically reads in the most recent settings from the Windows registry, including the last settings file you specified, if any.

Loading Settings from a File

To load settings from a file:

1. Choose the **File > Open Settings** menu item.
2. In the AVS Settings File dialog, specify the directory and file name and click **Open.**

   VibeView reads the settings from the specified file and applies the settings. These settings are also written to the Windows registry and will be loaded the next time you start the VibeView application.

Chapter 4

Viewing Log Files

The VibeReview application lets you replay log files that you previously recorded using VibeView. This chapter gives you instructions for performing the following tasks with the VibeReview:

- Running VibeReview
- Using the playback controls
- Working with marks
- Monitoring traces for excessive vibration levels
- Comparing log files
- Changing VibeView settings from VibeReview
- Changing log files
- Configuring the trace display
- Displaying user-specified information from the log file
- Saving a subset of a log file
- Creating reports and importing data into other applications
- Printing the VibeReview window

This chapter assumes that you are familiar with the information in Chapter 3, "Using Your AVS."

Running VibeReview

To view a log file:

1. From the Windows **Start > All Programs** menu, choose **WaferSense AVS > VibeReview**.

   The VibeReview application starts, as shown in Figure 4.1.

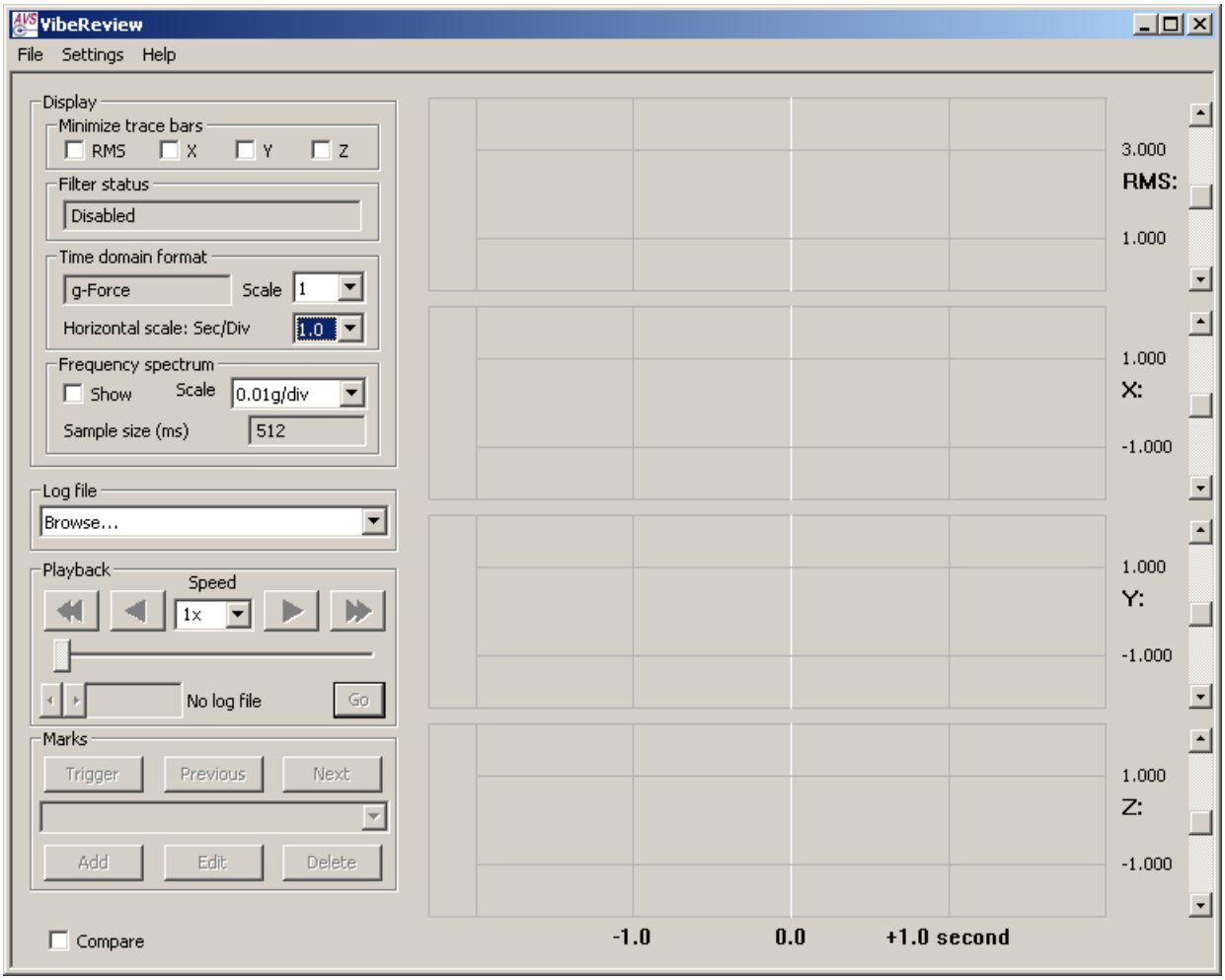


Figure 4.1: Running the VibeReview Application

2. From the **File** menu, choose **Open Log File**. The AVS Log Files dialog is displayed.

3. Choose a log file and click **Open**. VibeReview opens the log file and displays the traces at the beginning of the file (see Figure 4.2).

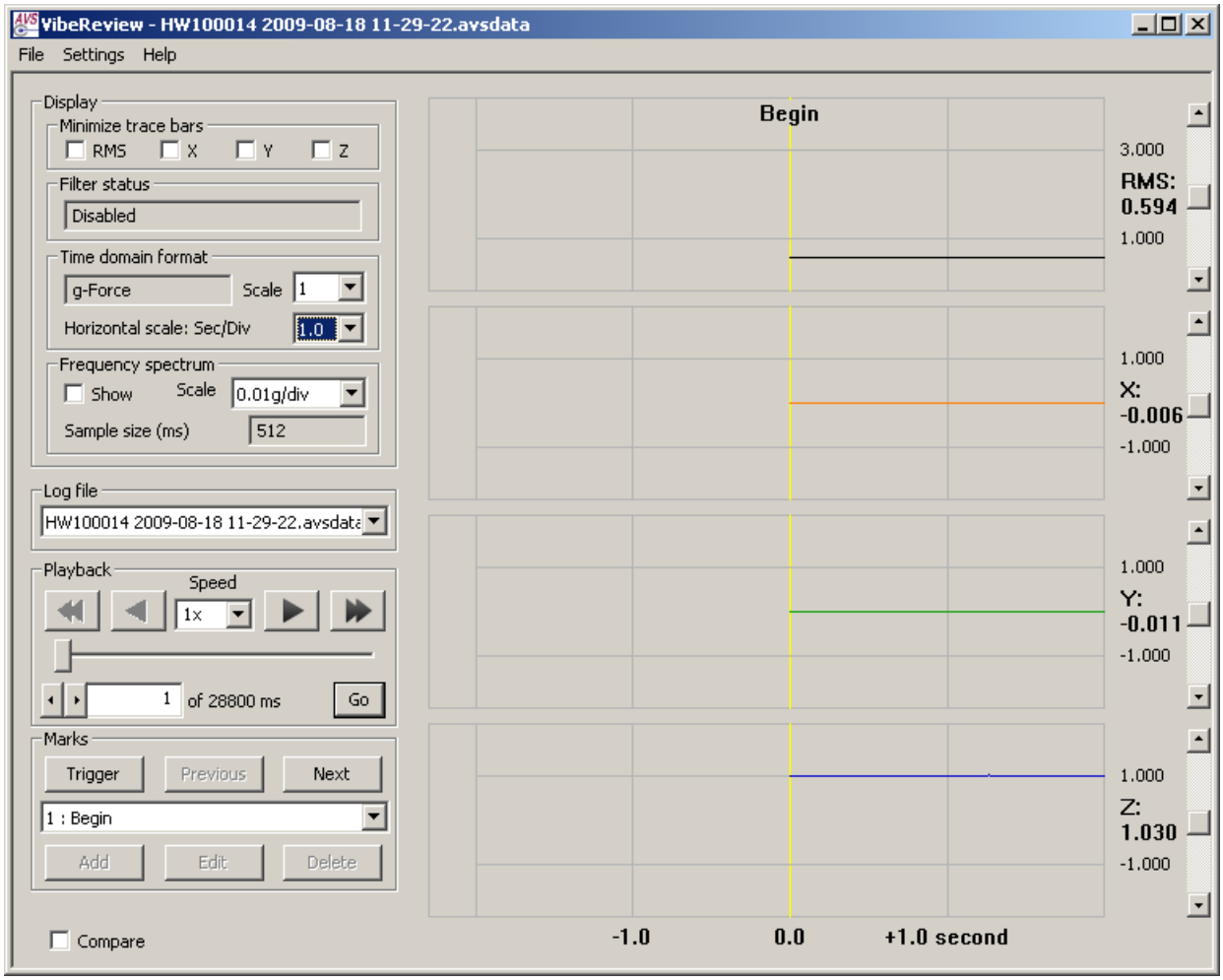


Figure 4.2: Opening a Log File

Settings stored in the log file for the filter, FFT sample size, Go/NoGo, and Time domain format are all applied when you open a log file.

4. To start the log file playing, click Play ▶. The traces start scrolling from right to left and the Play button changes to Pause ⏸.

   You can use the other Playback controls to jump ahead or back or to a particular place in the file, play the file in reverse, and adjust the playback speed (see "Using the Playback Controls," on page 4.4).

Using the Playback Controls

You can play a log file forward or in reverse, pause during playback, and jump ahead or back by using the playback controls (see Figure 4.3) You can also move around in log files by jumping to marks or triggers (see "Working with Marks," on page 4.8).

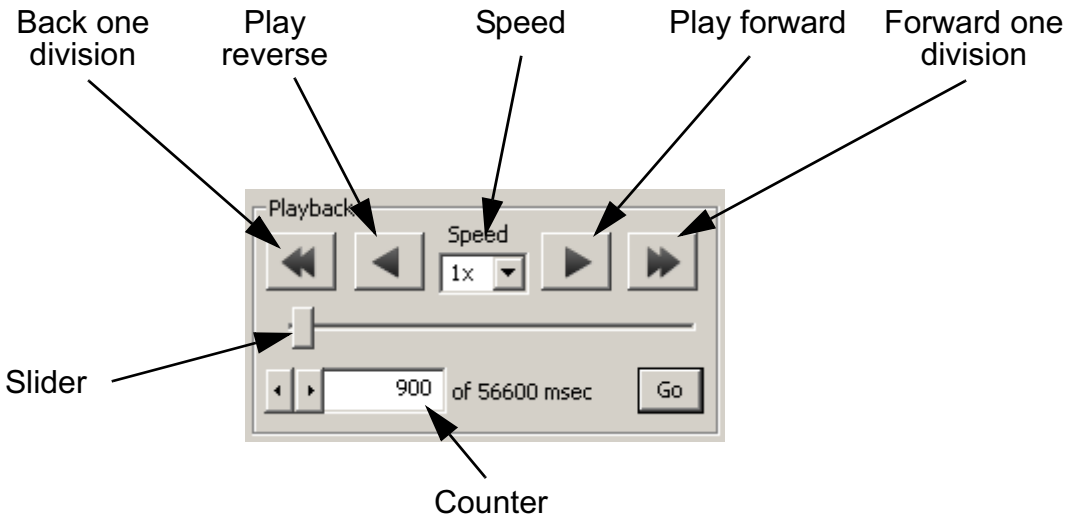


Figure 4.3: Playback Controls

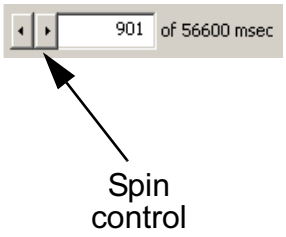
The individual playback controls are described below:

Play Forward/Play Reverse/Pause. Play forward starts the file playing from the current position forward in the file and changes the **Play forward** button to a **Pause** button. Clicking **Pause** halts the playback at the current position and changes the button back to **Play forward**. **Play reverse** works similarly, but plays backward toward the beginning of the file.

Back One Division/Forward One Division. Jumps forward or back one division. One division refers to the time between the vertical grid lines, which can be from 100 ms to 100,000 ms, depending on the horizontal scale setting (see "Configuring the Trace Display," on page 4.20).

Slider. Dragging the slider lets you quickly move to any position in the file.

Speed. The speed control lets choose a playback speed from 1x to 10x. Playing a file containing 60,000 milliseconds of data at 1x takes about 60 seconds; at 10x, the same file plays in about 6 seconds. This playback speed is not affected by the horizontal scale setting.



Counter. The counter shows the current position within the file at any given time. The indicator, the white vertical line in the middle of the trace display, marks the point in the trace that corresponds to the counter value (see Figure 4.4 on page 4.6). The count is the number of milliseconds (equivalent to the number of data points), regardless of the horizontal scale setting.

The value to the right of the counter is the total length of the file in milliseconds (or data points). To change the position in the file, you can type a number into the counter text field and click **Go**. Compared to the slider, the counter gives you more precise control over positioning within the file.

You can also change the position in the file by using the arrows in the spin control. A single click increments (right arrow) or decrements (left arrow) the counter by one. Clicking and holding causes the counter to increment or decrement repeatedly, changing faster the longer you hold down the arrow button.

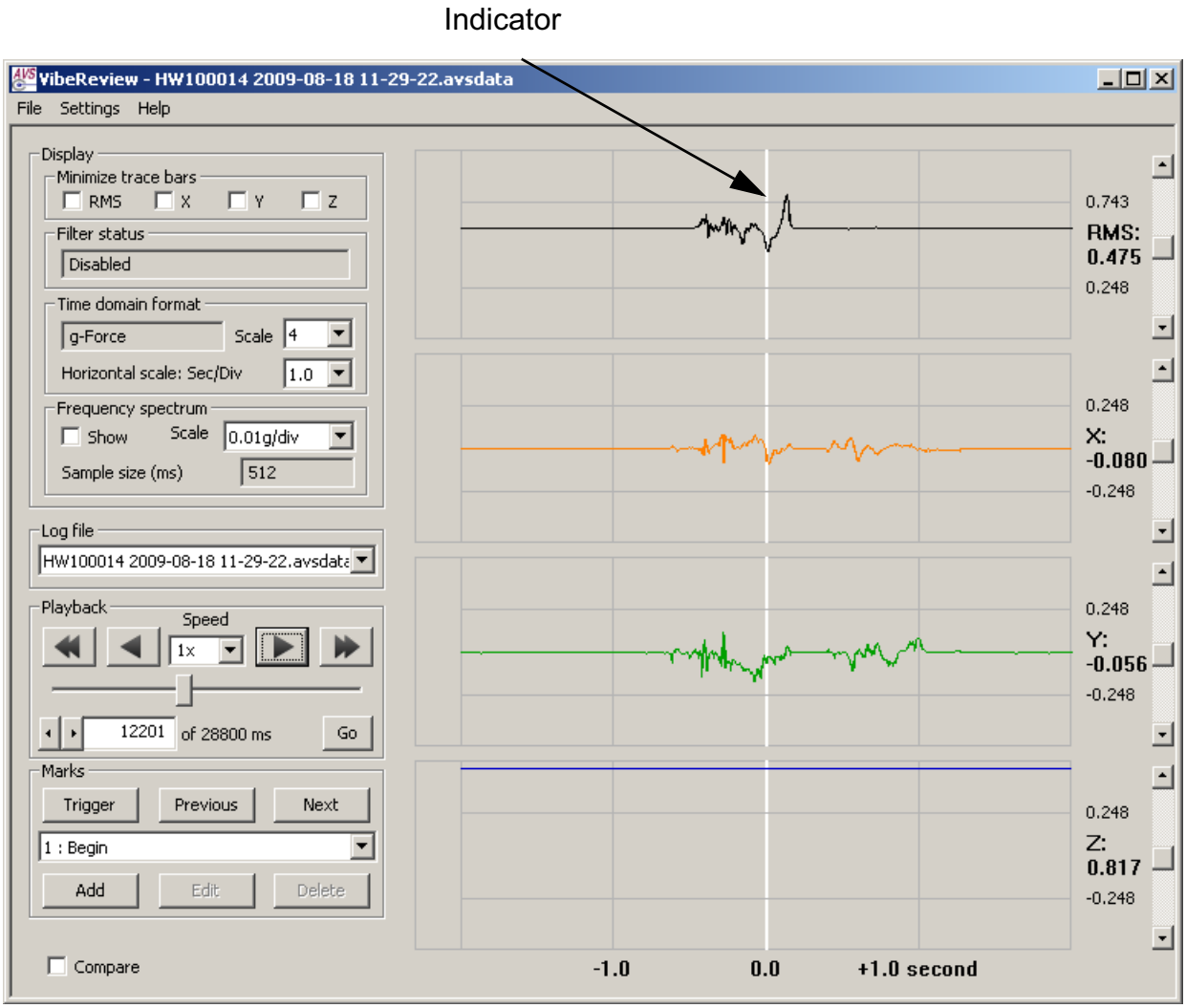


Figure 4.4: The Indicator

Clicking and Dragging the Traces

When the trace display is paused, you can use the counter in the playback controls to move the trace display to a different location in the log file. However, for small changes, you might find it easier to move the traces by clicking and dragging. When you click and drag the traces, the counter changes accordingly.

To click and drag the traces:

1. Move the cursor into the trace area. The cursor changes to a pointing hand.
2. Click and hold the left mouse button.

3. Drag the mouse to the left or right and release the mouse button. When you release the button, the trace display jumps forward or back the distance you moved the mouse.

Working with Marks

Marks indicate points of interest within log files. Every log file has one trigger mark that tells you where recording started and what caused the recording to start. Clicking the **START** button, the occurrence of the first trigger event in one of the traces, or the first Go/No Go event will cause VibeView to place a trigger mark in the file. You can also create your own marks in a file while you are recording in VibeView, and you can add annotations to the marks. For more information on triggers and marks, see "Recording with Triggers," on page 3.13 and "Placing Marks in a Log File," on page 3.19.

Finding Marks in a File

In VibeReview, you can quickly go to the position in the file that corresponds to the trigger or to another mark.

To go to the trigger event in a log file:

- Click **Trigger** (see Figure 4.5). Note that the "trigger event" can be clicking the START button, an actual trigger, or a No Go event.

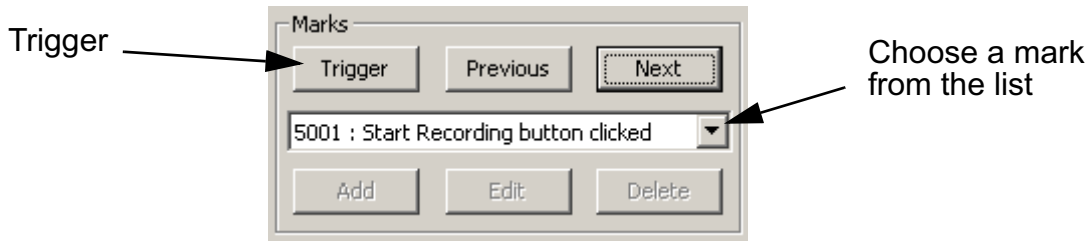


Figure 4.5: Finding Marks

To go to a specific mark in a file:

- Use the drop-down list in the **Marks** area to choose a mark (see Figure 4.5). As soon as you click on a mark in the list, VibeReview jumps to that position in the file.

Next and **Previous** let you jump to the next or previous marks in the file. At the last mark, clicking **Next** takes you to the end of the file. At the first mark, clicking **Previous** takes you to the beginning of the file.

When you go to a trigger mark or to a user-defined mark in the file, the counter shows the file position of the mark. For example, if you go to a mark at 45000 in a data file, the playback counter will show 45000, and the list of marks will show 45000 with the mark annotation, if any. When you use the playback controls to move from that mark, the counter shows the new location, but the list of marks does not change. The counter always shows the current location in the file, but the list of marks shows the last mark that you selected, even if the position in the file has moved from that mark.

When the trigger event is visible in the trace display, the trigger event is marked by a vertical red line with an annotation (see Figure 4.6). Other marks appear as vertical yellow lines with annotations.

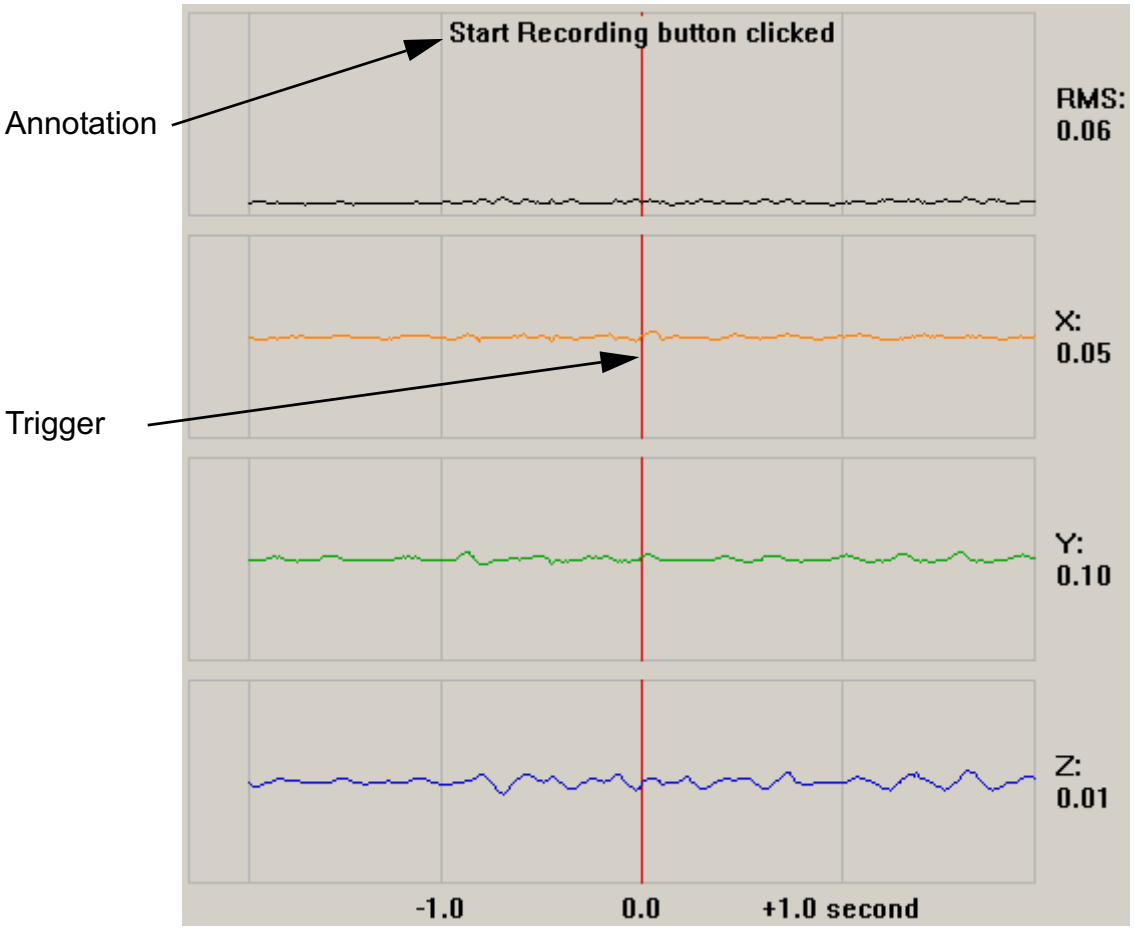


Figure 4.6: Trigger Mark and Annotation

Adding Marks to a File

You can add marks to a file whenever playback is paused. VibeView automatically creates marks at the beginning and end of the file and for the trigger event. You can't add user-created marks where VibeView has created the Begin, End, and Trigger marks. The **Add** button in VibeReview works just as the **Add a Mark** button does in VibeView. For more information, see "Placing Marks in a Log File," on page 3.19.

Editing Existing Marks

You can edit the annotation text that is associated with a user-created mark. You can also delete a user-created mark from a file. You can't edit or delete the Begin, End, or Trigger marks.

To delete or edit a mark:

1. Choose the mark you want to edit from the drop-down list under **Marks** (playback must be paused). You can also go to the mark using **Next** and **Previous**. When you are at a mark, the **Edit** and **Delete** buttons are active (except for the Trigger, Begin, and End marks).
2. To delete the mark, click **Delete** (see Figure 4.7). To edit the annotation associated with the mark, click **Edit**. When you click **Edit**, the Annotate Mark dialog appears.

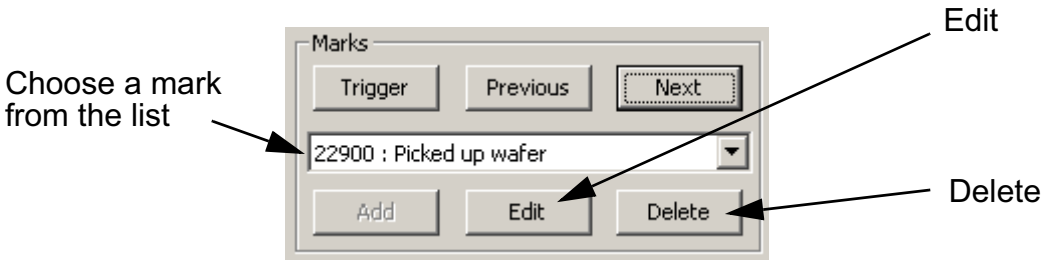


Figure 4.7: Editing Marks

3. If you clicked **Edit**, edit the text in the Annotate Mark dialog and click **OK** to save the change.

Monitoring Traces for Excessive Vibration Levels

You can use the Go/No Go feature in VibeReview to monitor the traces for excessive levels of vibration and indicate when your specified levels are exceeded. Figure 4.8 shows the trace display with Go/No Go feature active.

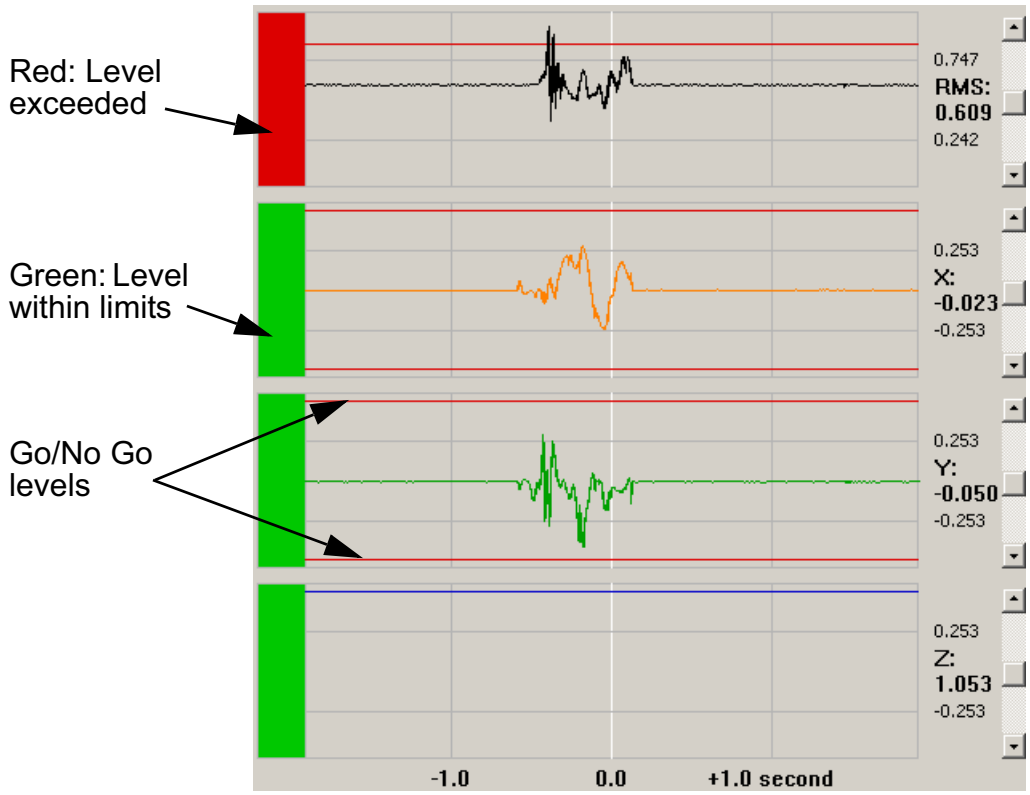


Figure 4.8: Go/No Go Indicators

Parallel red lines in each trace indicate the Go/No Go settings, which you can set separately for each trace. A vertical green bar appears at the far left of each trace to indicate that the trace is within your specified settings. When the trace exceeds your settings continuously for more than 1 ms (the qualification time), the vertical bar changes to red. You can specify a qualification time from one to 10 milliseconds. If the trace exceeds your settings, but remains so for less than the qualification time, the No Go setting is not triggered, and the bar remains green.

In addition to the visible bar indicating the Go/No Go, VibeReview can issue an audible beep to indicate when a trace exceeds a Go/No Go setting.

To set the Go/No Go criteria:

1. Choose the menu item **Settings > Set Go/No Go**. The Set Go/No Go dialog is displayed.

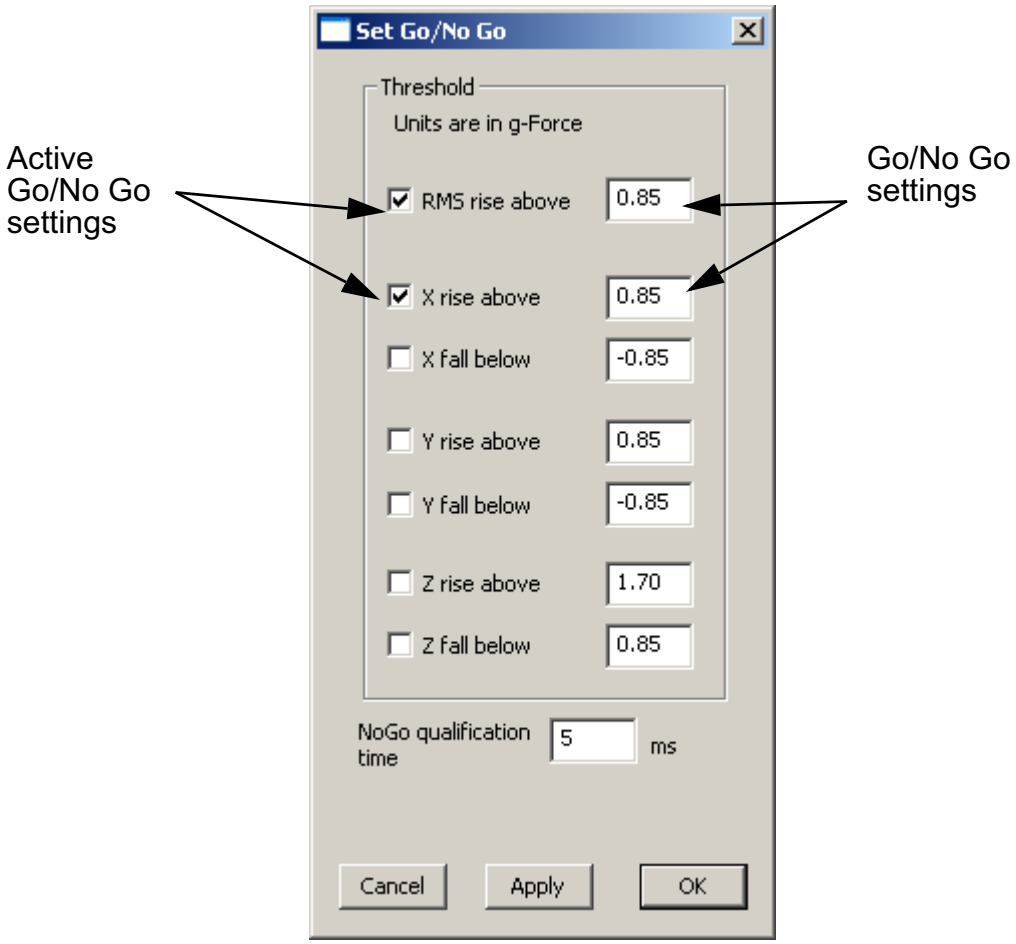


Figure 4.9: Set Go/No Go Dialog

2. Check the boxes to activate Go/No Go for one or more traces.
3. For each trace you activated, specify the Go/No Go settings. You can specify separate upper and lower settings. The units for Go/No Go settings depend on the time domain format you have specified ("Changing the Time Domain Format," on page 4.22).
4. For **NoGo qualification time**, specify the length of time any trace must exceed any Go/No Go setting before the No Go condition is triggered. A trace that exceeds a setting for less than the qualification time will not trigger a No Go condition.
5. Click **Apply**. The Go/No Go settings take effect immediately.

When the next active No Go event lasting longer than the qualification time occurs, VibeReview changes the green Go/No Go bar to red and optionally beeps.

6. You can leave the Set Go/No Go dialog open while using VibeReview. Doing so makes it easy to change the Go/No Go settings. If you want to close the dialog, click **OK**.

Comparing Log Files

You can compare two log files, using the playback controls to move through the traces from both files in unison. When comparing files, by default VibeReview displays all individual traces from the first file, but only one trace from the second file. You can select which trace (X, Y, Z, or RMS) to display from the second file. In addition to having VibeReview display one of the traces from the second file, you can have it overlay all traces from the second file in the traces for the first file. Overlaid traces appear in gray along with the colored traces from the first file.

To compare two log files:

1. From the **File** menu, choose **Open Log File**. The AVS Log Files dialog is displayed.
2. Choose the first log file you want to compare, and click **Open**. VibeReview opens the log file and displays the traces at the beginning of the file.
3. In the lower-left corner of the VibeReview window, check the **Compare** box. A second set of log file controls appears (see Figure 4.10).

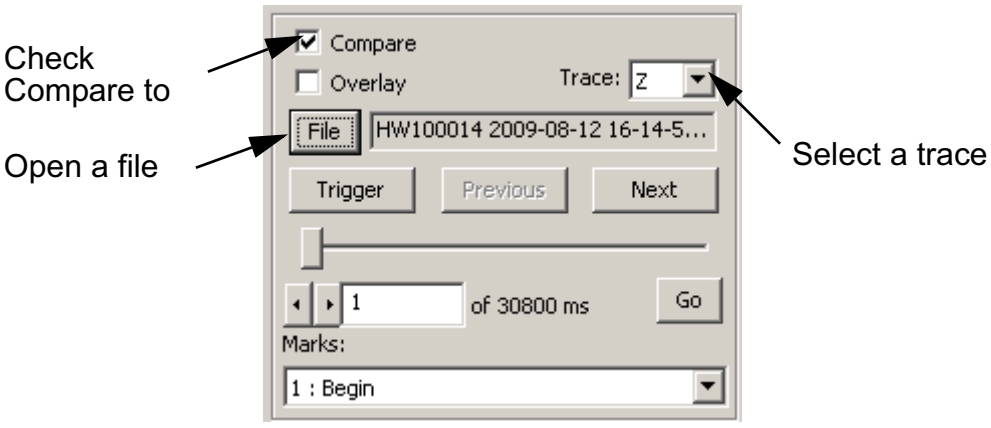


Figure 4.10: Controls for Second Log File

4. In the **Compare** controls, click **File**. The AVS Log Files dialog is displayed.
5. Choose the second log file you want to compare, and click **Open**. VibeReview opens the log file and displays one of the traces at the bottom of the window, below the traces for the first file. By default, VibeReview displays all traces from the first file but only one trace at a time from the second file. See Figure 4.11 on page 4.15.

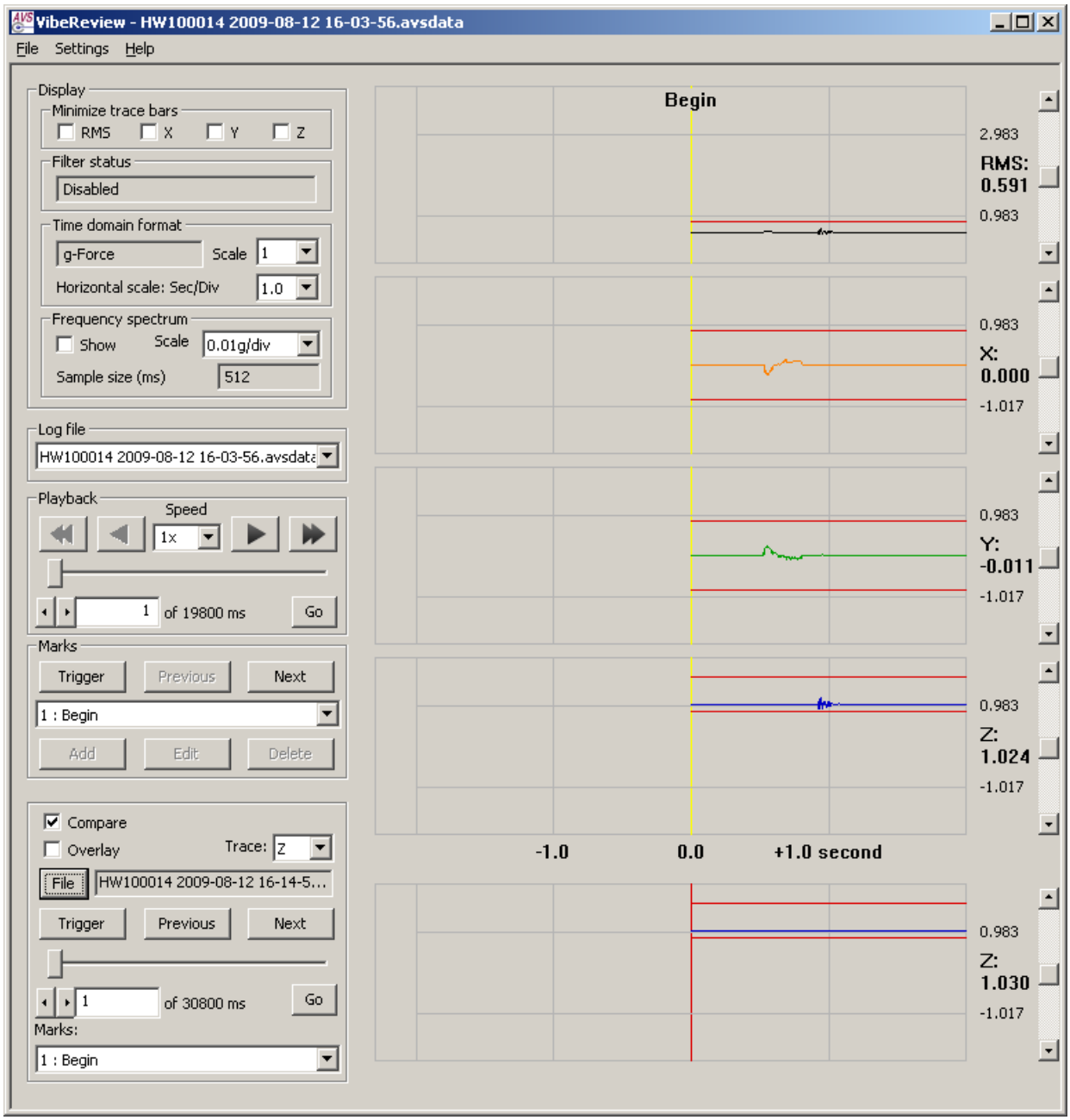


Figure 4.11: Comparing Two Log Files

6. To change which trace from the second file is displayed at the bottom of the window, select a different trace from the **Trace** list (see Figure 4.10 on page 4.14).

7. To have VibeReview overlay all traces from the second file on the corresponding traces from the first file, in the **Compare** controls, check **Overlay**. The traces from the second file appear as gray lines over the traces from the first file (see Figure 4.12).

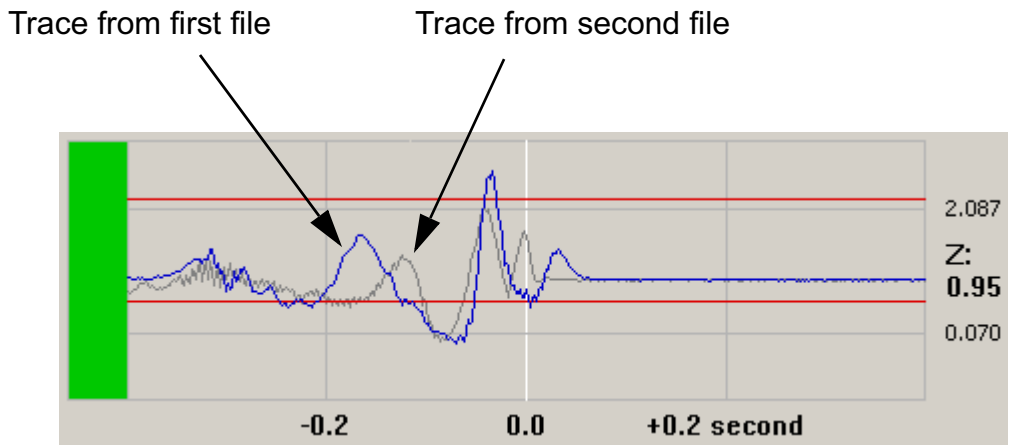


Figure 4.12: Trace Overlay

8. To synchronize the two files to a common event, use **Trigger**, **Next**, and **Previous** or **Marks** to find corresponding events for the two files. To synchronize based on times, use the counters for each file. You can also make adjustments by clicking and dragging the traces (see "Clicking and Dragging the Traces," on page 4.6). Separate slider, counter, and marks controls for each file let you manipulate them independently.
9. When you have the traces synchronized, use the playback controls to play the log files. The playback controls play both log files in unison. See "Using the Playback Controls," on page 4.4.

Changing VibeView Settings from VibeReview

Based on what you see in reviewing a log file in VibeReview, you might want to change some of the settings that you will use for a subsequent run in VibeView. For example, you might notice a specific event in the log file that you want to take a closer look at with another VibeView run. VibeReview makes this easy to do by allowing you to open a VibeView settings file, make changes, and save the file without leaving VibeReview. In VibeReview, you can change VibeView settings for Go/No Go events, for filters, for time domain format, for FFT sample size, and for the user-specified information.

To change VibeView settings from VibeReview:

1. In VibeReview, make your selections for Go/No Go settings ("Monitoring Traces for Excessive Vibration Levels," on page 4.11), for filter ("Filtering the Data," on page 4.21), for time domain format ("Changing the Time Domain Format," on page 4.22), and for FFT sample size ("Displaying the Frequency Spectrum," on page 4.31).
2. Choose the menu item **Settings > Modify VibeView Settings**. The Modify VibeView Settings dialog is displayed (see Figure 4.13).

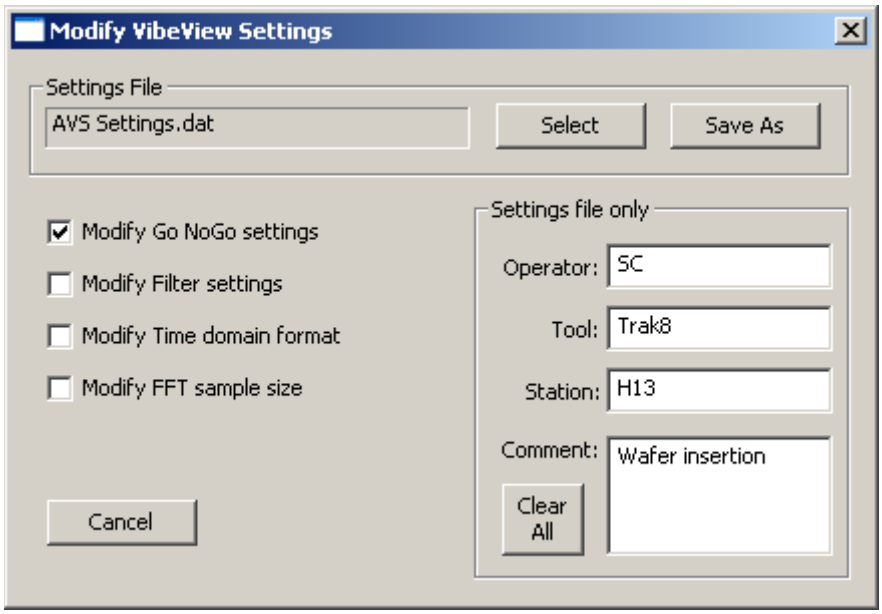


Figure 4.13: Modify VibeView Settings Dialog

3. To open a VibeView settings file, click **Select**, choose a settings file from the AVS Settings File dialog, and click **Open**.
4. In the Modify VibeView Settings dialog, check the **Modify** boxes for any settings you want to save in the settings file.

5. Modify any of the user-defined information for **Operator**, **Tool, Station**, and **Comment**. **Clear All** lets you clear all of these fields.
6. To save the settings for a future VibeView run, click **Save As**. In the AVS Settings File dialog, edit the file as needed and click **Save**. Note the file name so that you can open it in VibeView.
7. To close the Modify VibeView Settings dialog, click **Cancel**.

Changing Log Files

You can open a log file using the **Open Log File** command on the **File** menu, as described in "Running VibeReview," on page 4.2. If you have previously opened files in VibeReview, the last few files you opened are listed in the **Log file** pull-down menu. That gives you a quick way to select a recently opened log file (see Figure 4.14). If you don't see the file you want in the list, choose **Browse** at the end of the list to open the log file.

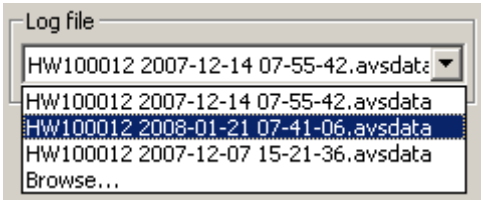


Figure 4.14: Selecting a Log File

Settings stored in the log file for the filter, FFT sample size, Go/NoGo, and Time domain format are all applied when you open a new log file.

Configuring the Trace Display

You can change the way the vibrational traces are displayed by minimizing or maximizing the bars for displaying the traces, by changing the vertical and horizontal scales, by changing the colors of traces and other elements in the display, and by showing or hiding the trigger settings.

Minimizing Trace Bars

You can minimize the bars for displaying the traces. Minimizing the bar for a trace collapses the height of the bar for that trace. The heights of the bars for the remaining traces expand to fill the area. You can minimize the bars for up to three traces at any time; at least one trace is always maximized.

To minimize the bar for displaying a trace:

- Under **Minimize trace bars**, check the boxes for the traces you want to minimize (see Figure 4.15).

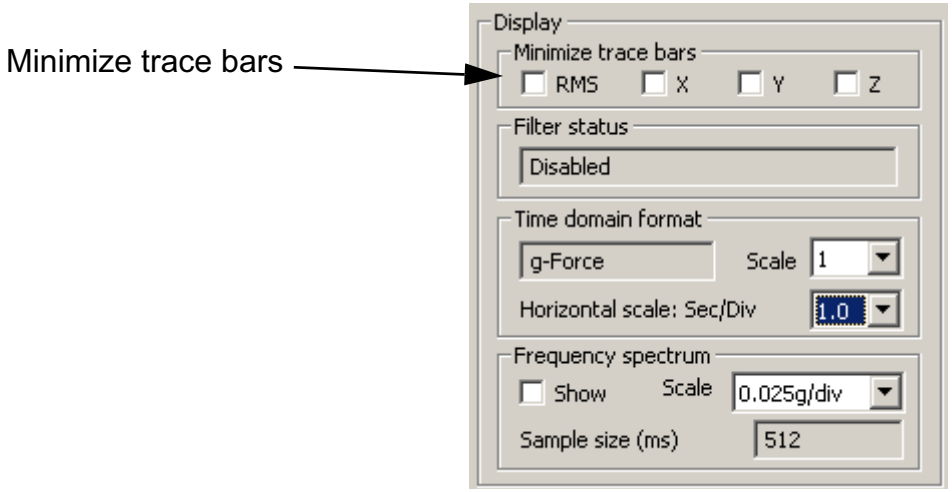


Figure 4.15: Minimizing Trace Bars

To restore the bar for a trace to its normal height:

- Uncheck the box for that trace under **Minimize trace bars**.

Filtering the Data

VibeReview can filter the data before displaying it. You can choose a low-pass filter, a high-pass filter, or a band-pass filter.

To set up the filter:

1. Choose the menu item **Settings > Set Filter**. The Set Filter dialog is displayed (see Figure 4.16).

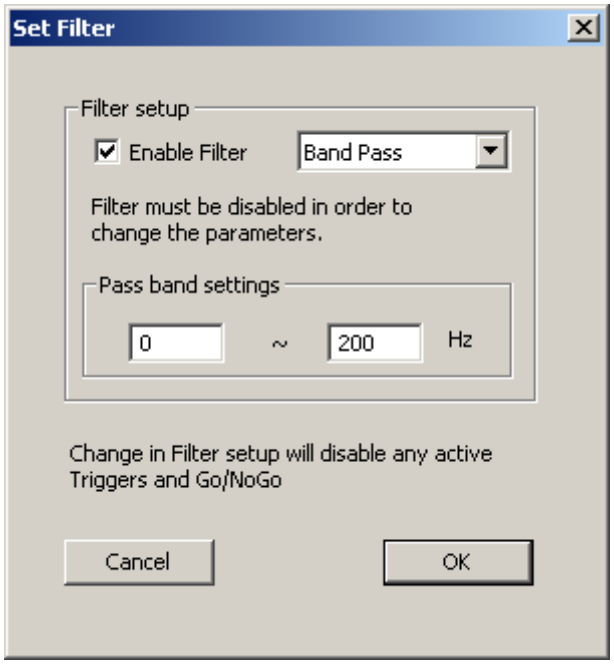


Figure 4.16: Set Filter dialog

2. If **Enable Filter** is checked, clear the box. You can't make any changes to the filter settings when the filter is enabled.
3. From the list, choose the type of filter you want to apply to the data: Low Pass, High Pass, or Band Pass.
4. Specify the **Pass band settings** for the filter.
5. Check **Enable Filter** and click **OK**. The new filter settings take effect immediately.

Changing the Time Domain Format

VibeReview gives you three options for setting the time domain format for traces (see Figure 4.18 on page 4.23):

- **g-Force.** Displays acceleration values from -2 g to +2 g. One g is the acceleration of gravity (approximately 32 ft/s^2 or 9.81 m/s^2). With this vertical scale setting, when the wafer is sitting motionless and horizontal, the Z trace will show 1 g, the X and Y traces will show 0 g, and the RMS trace will show 0.58 g. This is because the wafer senses the acceleration of the earth's gravitational field, which is 1 g in the vertical (Z) direction. You can also choose to display the absolute value of acceleration in g-Force. Using the absolute value can be helpful when comparing traces. When displaying absolute value, you will usually want to also use the high-pass filter ("Filtering the Data," on page 4.21).
- **Gal.** Displays values in galileo units, where 1 g = 981 Gal. With this vertical scale setting, when the wafer is sitting motionless and horizontal, the Z trace will show 981 Gal, the X and Y traces will show 0 Gal, and the RMS trace will show 566 Gal. This is because the wafer senses the acceleration of the earth's gravitational field, which is 981 Gal in the vertical (Z) direction. You can also choose to display the absolute value of acceleration in Gals. Using the absolute value can be helpful when comparing traces. When displaying absolute value, you will usually want to also use the high-pass filter ("Filtering the Data," on page 4.21).
- **Energy.** Displays the signal energy for the last *n* acceleration values:

$$\frac{1}{N} \cdot \sum_{k=1}^{n} x^2(k)$$

  Where *N* is the sample rate (1 KHz for AVS); *n* is the number of samples, which is the sample size you have set for the frequency spectrum (see "Displaying the Frequency Spectrum," on page 4.31); and *x(k)* is kth sample of the acceleration in g-force. Using the energy format with appropriate Go/No Go settings can identify vibrations that don't have large amplitudes (and might not trip Go/No Go settings for g-force or Gals) but extend for longer periods of time.

Values that are too large to display are truncated.

Narrow peaks in the traces can be difficult to analyze because the need to pause and position the peak right on the indicator to check the amplitude. To make it easier to analyze peaks, you can tell VibeReview to hold a peak for a specified period of time. When the hold peak feature is

active, each time a signal peak is detected, VibeReview holds the trace level at that peak value for your specified time period. See Figure 4.17

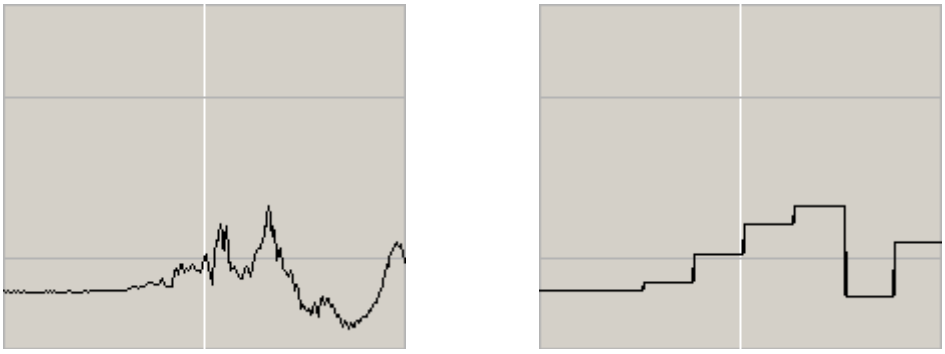


Figure 4.17: Hold Peak Feature

Changing the time domain format can dramatically affect the range of values in the data, which affects Go/No Go values, so when you change time domain format settings, you might need to adjust Go/No Go settings. For more information, "Monitoring Traces for Excessive Vibration Levels," on page 4.11.

To change the time domain format:

1. Choose the menu item **Settings > Set Time Domain Format**. The Set Time Domain Format dialog is displayed (see Figure 4.18).

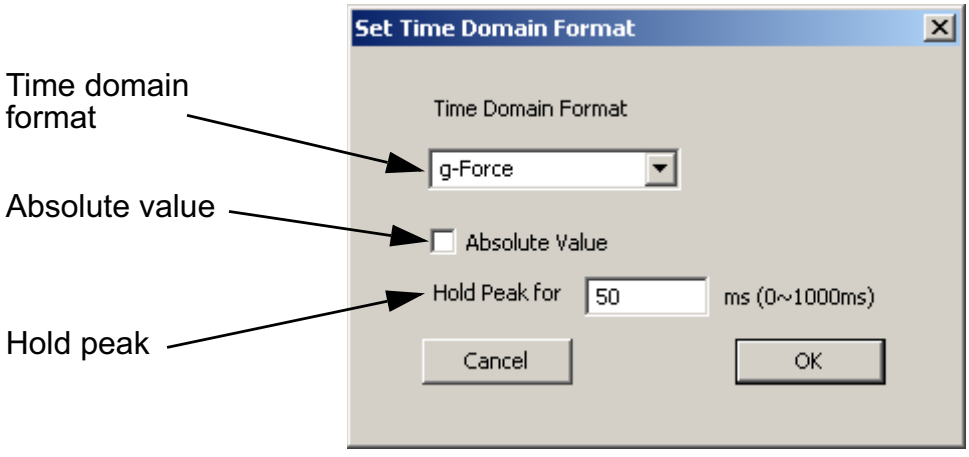


Figure 4.18: Set Time Domain Format dialog

2. From the **Time Domain Format** list, choose your time domain format.

3. If you want VibeReview to display the absolute value of the acceleration values, check the box for **Absolute Value**.
4. If you want VibeReview to hold and display peak values, specify the hold time in the **Hold Peak for** box.
5. Click **OK**.

   When you change the time domain format, you might need to adjust Go/No Go settings.

Changing the Vertical Scale

At the default vertical scale, VibeReview displays a range of ±2g for each trace. You can expand the vertical scale by factors of two, from one to 128 times. When you increase the scale, less of the ±2g range is visible, but scroll bars are provided so that you can see the full range for each trace.

To change the vertical scale:

- Using the **Scale** list, choose a scale factor. The new scale setting takes effect immediately.

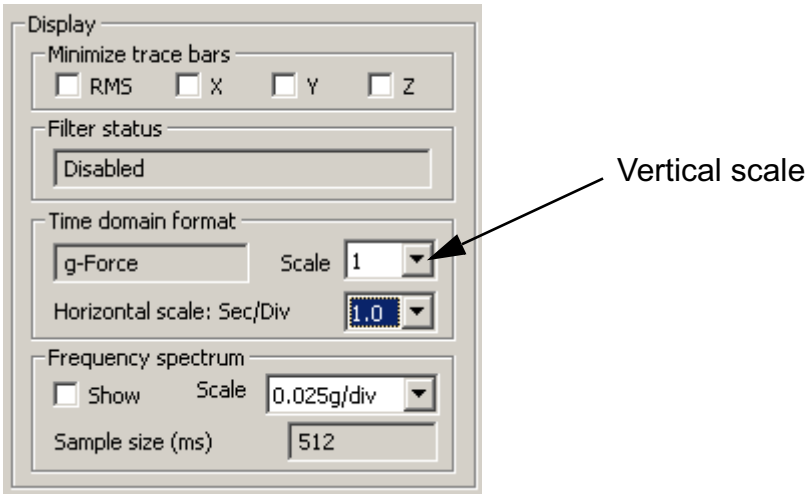


Figure 4.19: Vertical Scale

Changing the Horizontal Time and Scale

The default horizontal axis labels show time relative to the current position in the log file, shown by the white indicator line in the center of the trace display. See Figure 4.20.

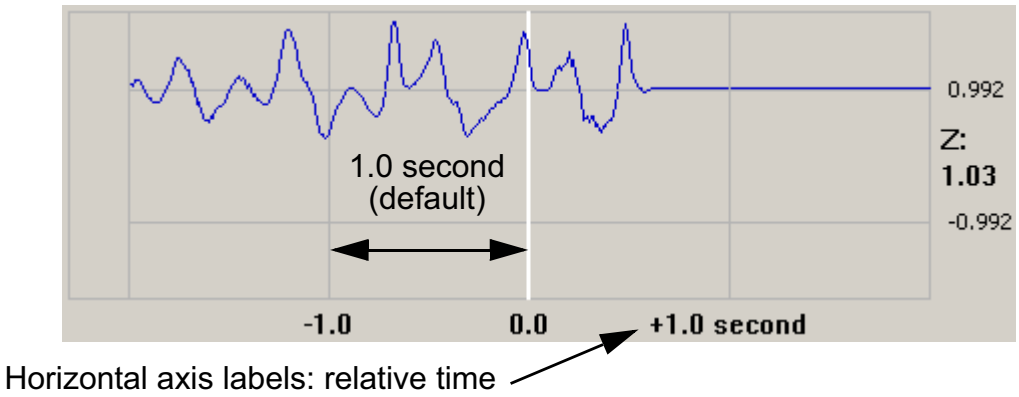


Figure 4.20: Horizontal Axis Labels and Scale

With this relative time scale, the numbers are positive as you move to the right, indicating newer data, and negative as you move to the left, indicating older data. You can change the horizontal scale to show *absolute* time since the start of recording, rather than *relative* time (see Figure 4.21).

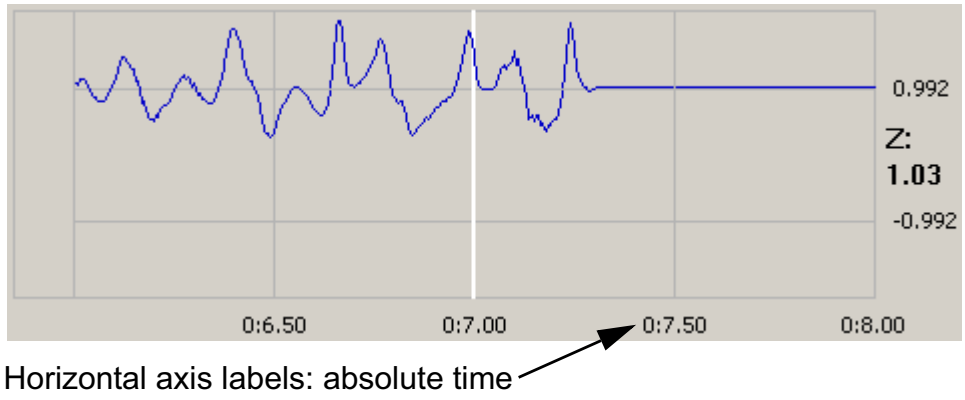


Figure 4.21: Absolute Time Scale

The default horizontal scale shows 1.0 second between vertical grid lines and plots one point for ever ten readings received from the AVS. You can set the horizontal scale to show from 0.1 seconds to 100 seconds between the grid lines. At the 0.1 s setting, VibeReview displays every reading received from the AVS wafer (one data point per millisecond). When displaying at the higher scales, VibeReview can't display every reading received from the AVS, so it displays a

vertical bar indicating the range of values for the time span represented by any given point on the horizontal axis. For example, at the default scale of 1.0 second/division, each vertical bar plotted represents ten readings and shows the range of those ten readings.

Changing the Horizontal Axis Time

To change the horizontal axis time:

1. Choose the menu item **Settings > Options**. The Options dialog is displayed.

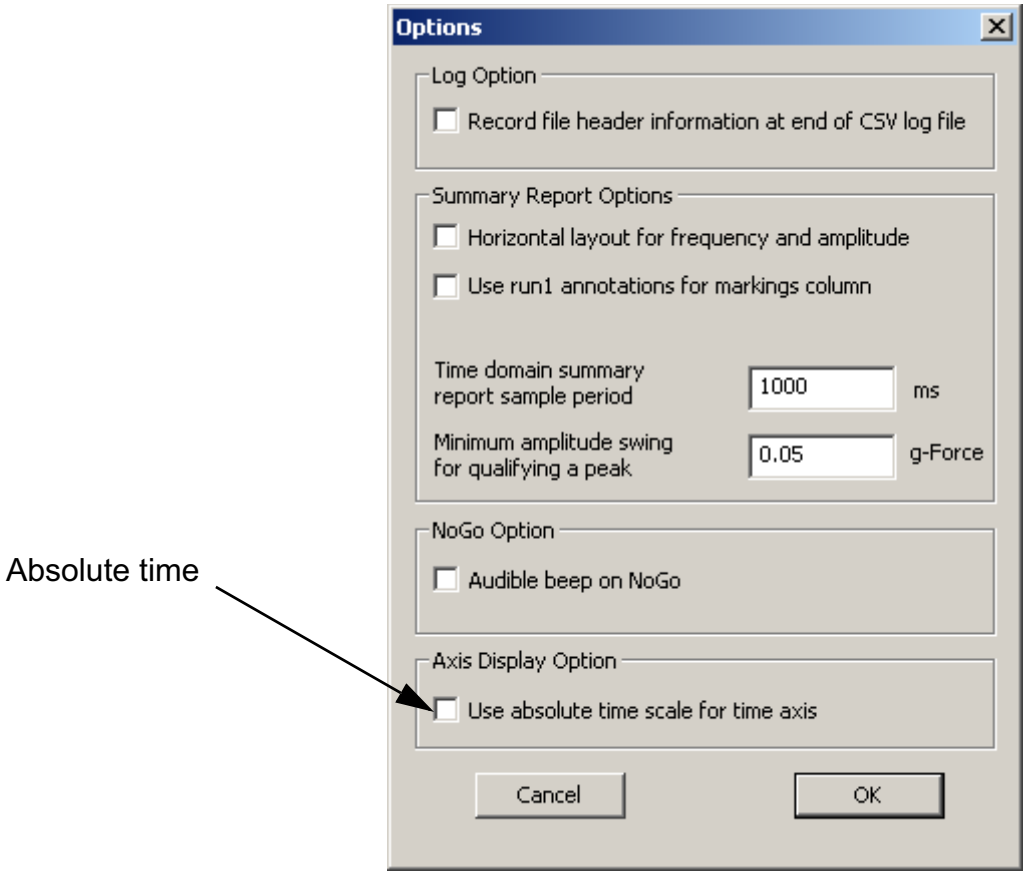


Figure 4.22: Changing to Absolute Time

2. For absolute time, check the **Use absolute time scale for time axis** box.
3. Click **OK**.

Changing the Horizontal Scale

To change the horizontal scale:

- Using the **Horizontal scale** list, choose the time interval you want between vertical grid lines. The new scale setting takes effect immediately.

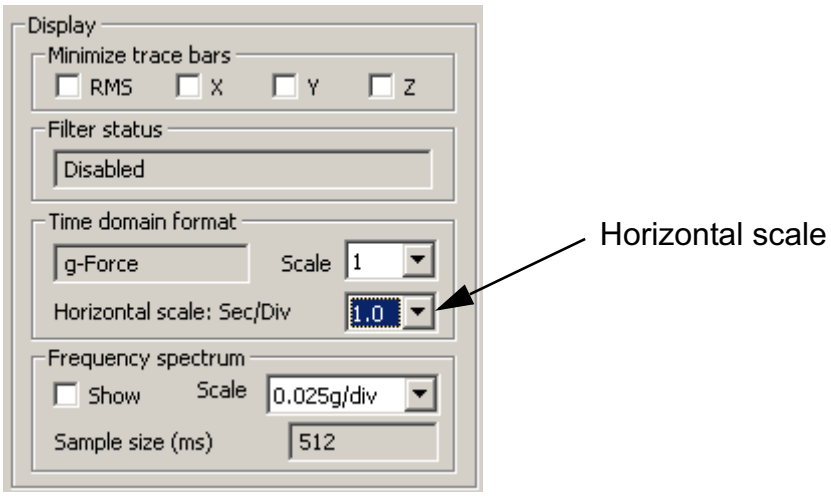


Figure 4.23: Setting the Horizontal Scale

Changing Colors

You can change the colors used to display traces and other elements of the display. The table below shows the display elements that you can change:

Display Element	Description
RMS	RMS trace
X	X trace
Y	Y trace
Z	Z trace
Marks	Vertical lines that correspond to user-defined marks in the trace
Trigger	Vertical line indicating the trigger event
Indicator	Vertical line in the center of the trace display that marks the point in the trace that corresponds to the counter value
Go/No Go Lines	Horizontal lines showing current active Go/No Go settings
Grid Lines	Horizontal and vertical section lines
Text	Labels on axes and for annotations
Overlay	Traces from the second file that are superimposed on traces from the first file when comparing two log files.
Background	Background color of the trace area

To change colors:

1. From the **Settings > Select Colors** menu item, choose the display element you want to change. The color palette is displayed (Figure 4.24).

Figure 4.24: The Color Palette

2. If you want to use one of the existing color definitions, skip to the next step. If you want to define a custom color, click **Define Custom Colors**. The color palette expands, as shown in Figure 4.25 on page 4.30. Specify the color as a combination of Hue, Saturation, and Luminosity or as a combination of Red, Green, and Blue, and click **Add to Custom Colors**.

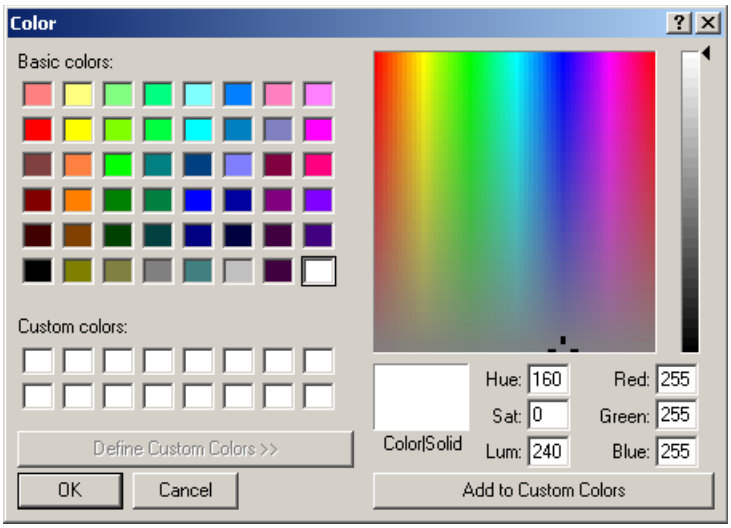


Figure 4.25: The Custom Colors Palette

3. Click on the color you want to use for the display element and click **OK**.

To reset all colors to the default values:

- From the **Settings > Select Colors** menu item, choose **Restore Defaults to All**.

To reset only the background color to the default value:

- From the **Settings > Select Colors** menu item, choose **Restore Default Background**.

Displaying the Frequency Spectrum

By default, VibeReview displays time-domain data: vibration readings over time. You can also have VibeReview display frequency-domain data: the frequency spectrum determined by a Fast Fourier Transform (FFT) of the time-domain data. As shown in Figure 4.26, when displaying a frequency spectrum, VibeReview divides the trace area, showing the vibration traces on the right and the frequency spectrum on the left.

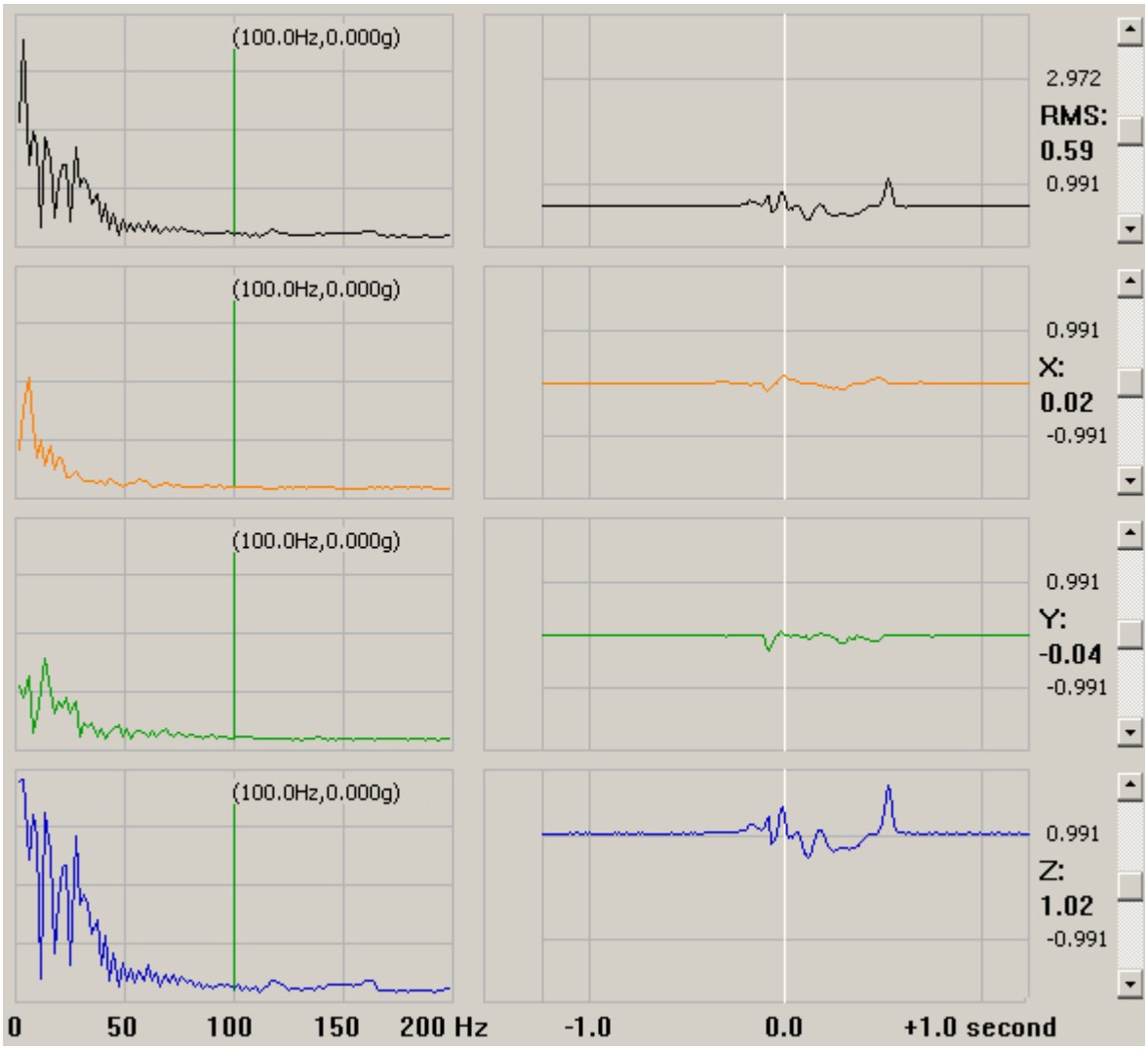


Figure 4.26: Displaying a Frequency Spectrum

In the frequency spectrum display, the horizontal axis is the vibration frequency, and the vertical axis displays the amplitude for that frequency. Both scales are linear. Frequencies are limited to 200 Hz and below by the AVS electronics.

Each frequency display has a vertical green line. The line is positioned at a particular frequency (100 Hz, by default), and the text at the top of the line identifies the frequency and the current amplitude for that frequency. You can move the lines to monitor the amplitude at different frequencies.

By default, VibeReview performs the frequency analysis using a sample of 512 data points (512 ms of data). VibeReview receives data from the wafer in packets of 100 data points. The FFT is computed every 100 milliseconds, using the latest packet of 100 points plus the previous 412 data points. You can specify a different sample size. Increasing the sample size increases the resolution of the frequency spectrum, but the additional data points cause the FFT results to respond more slowly to changes, similar to the way a rolling average tends to smooth out changes.

To display a frequency spectrum in VibeReview:

1. Under **Frequency spectrum**, check the **Show** box.

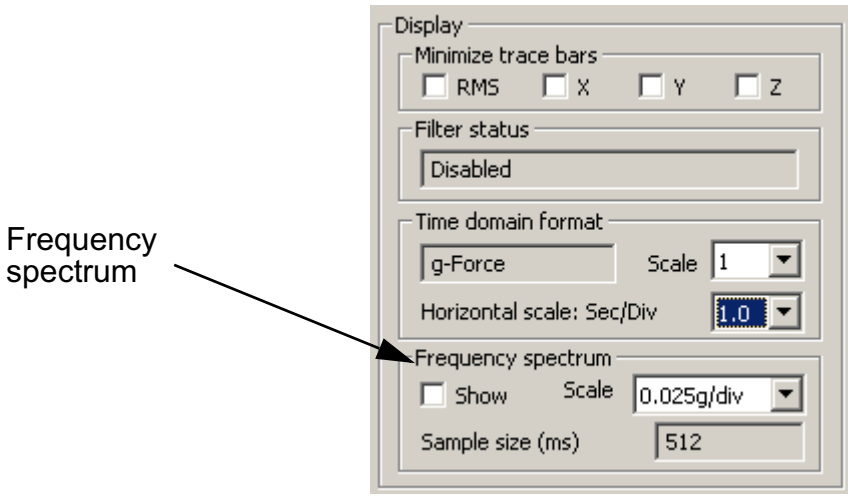


Figure 4.27: Show Frequency Spectrum

2. To adjust the vertical scale of the frequency spectrum, choose a value from the **Scale** list. The new setting takes effect immediately.

3. To display the amplitude for any specific frequency component, move the green lines:
   - To move one of the vertical green lines, right-click in the frequency spectrum display.
   - To adjust the position of a line after using right-click, press the left- or right-arrow keys.
   - To line up all of the green lines, double-right-click.

   When you move the green line, it moves between the frequency values determined by the FFT, which in general are not integer values.
4. To change the FFT sample size, choose the menu item **Settings > Set FFT Sample Size**. The Set FFT Sample Size dialog is displayed (see Figure 4.28).

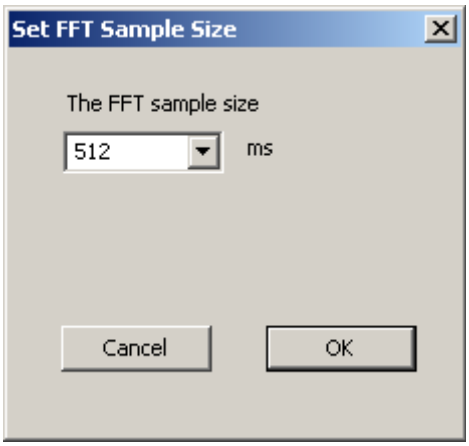


Figure 4.28: Set FFT Size dialog

5. From the list, choose a sample size and click **OK**. The new setting takes effect immediately.

Displaying User-Specified Information from the Log File

Operator, **Tool**, **Station**, and **Comment** are user-specified text in VibeView that can be recorded in a log file along with the vibration data.

To display the user-specified information for a log file:

1. Choose the **Settings > Show Station Information** menu item.

   The Station Information dialog is displayed, as shown in Figure 4.29.

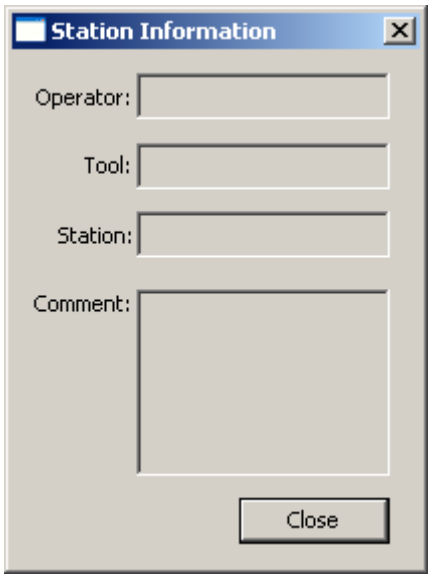


Figure 4.29: Station Information Dialog

You can leave the Station Information dialog open while using VibeReview, or you can click **Close** to close the dialog.

Saving a Subset of a Log File

AVS takes readings at the rate of 1000/second, so log files can become quite large. You can save a subset of a log file by specifying the beginning position and the ending position, so that the partial log file contains only your selected data. You can also modify the associated filter setting, time domain format, FFT size, and Go/No settings when saving a partial log file.

To save a subset of a log file:

1. From the **File** menu, choose **Save Partial Log File**. The Save Partial Data dialog is displayed prompting you to specify the start position of the subset of the log file that you want to save.
2. Using the playback controls, locate the starting point of the data subset you want to save, aligning that point on the indicator line in the center of the trace display.
3. In the Save Partial Data dialog, click **Next**. The Save Partial Data dialog now prompts you to specify the end position of the subset of the log file that you want to save.
4. Using the playback controls again, locate the end position of the subset of the log file that you want to save.
5. In the Save Partial Data dialog, click **Next**. The AVS Data Log File dialog is displayed.
6. Specify a filename for the partial log file that you want to save and click **Save**. VibeReview saves the partial log file.

Creating Reports and Importing Data Into Other Applications

If you want to be able to import AVS log file data into other programs, such as MATLAB or Microsoft Excel, you need to save the data in comma-delimited format (also called comma-separated-values, or CSV, files). Note that only relatively short files (65,000 readings, or about one minute) can be imported into Excel. VibeView can write CSV files while it records *.avsdata* files (see "Importing Log Files Into Other Applications," on page 3.24). VibeReview also gives you additional options for saving data in CSV files:

- **File > Create CSV File > Save Full Data to CSV File**. Saves the entire log file in CSV format. This file is identical to the file that VibeView writes when you tell VibeView to record csv files.
- **File > Create CSV File > Save Screen Data to CSV File**. Saves just the portion of the log file data that is currently displayed.
- **File > Create CSV File > Compile Summary Report > Peak Acceleration and Frequency**. Lets you open multiple log files and then saves a report showing, for each mark in each file, the frequency at which the maximum acceleration was recorded and the amplitude of that acceleration for each of the X, Y, and Z traces.
- **File > Create CSV File > Compile Summary Report > Peak Excursion and Frequency**. Lets you open multiple log files and then saves a report showing, for each mark in each file, the frequency at which the maximum excursion occurred and the amplitude of that excursion for each of the X, Y, and Z traces.
- **File > Create CSV File > Compile Summary Report > Time Domain Statistics**. Lets you open multiple log files and then saves a report showing the following statistics: slippage factor, number of peaks, mean, maximum, minimum, standard deviation, and integral, computed at each mark in the file over a user-specified sample period beginning at the mark.

These options for saving data in CSV files are described in more detail in the following sections.

Saving Log File Data to CSV Files

To save all data from the currently open log file in CSV format:

- Choose **File > Create CSV File > Save Full Data to CSV File**.

To save only the portion of the data currently displayed from the currently open log file in CSV format:

- Choose **File > CSV File > Save Screen Data to CSV File**.

In both cases, VibeReview automatically assigns a filename using the naming conventions described in "Importing Log Files Into Other Applications," on page 3.24. At the top of the file, VibeReview writes a file header including the sensor serial number and the current settings

for the filter and time domain format. Each line of data consists of six entries: RMS, X, Y, Z, Time, and Marks with annotations, if any. You can choose to have the header information recorded at the end of the file, instead of at the beginning, which can be useful for importing the data into some applications.

To have VibeReview write the header information at the end of the CSV files, rather than at the beginning:

1. Choose the menu item **Settings > Options**. The Options dialog is displayed.

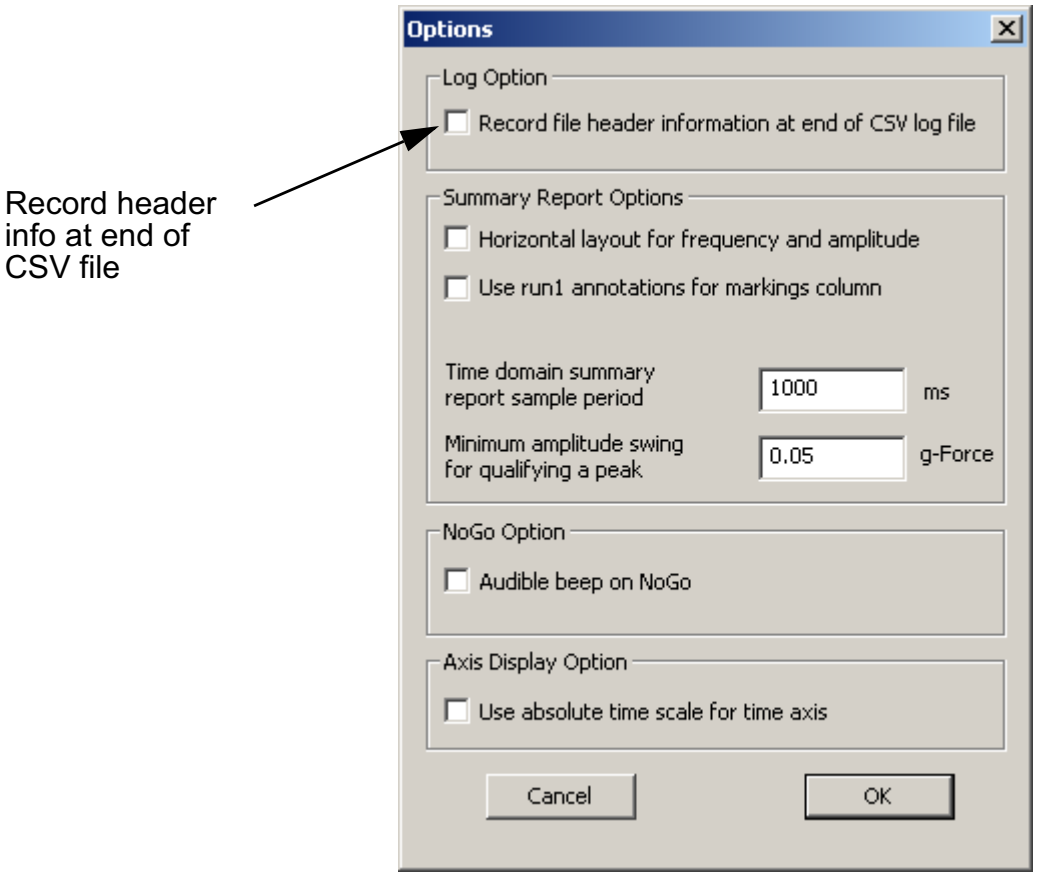


Figure 4.30: Record Header at End of File

2. Check the **Record file header information at end of CSV log file** box.
3. Click **OK**.

Compiling a Peak Acceleration Summary Report

A peak acceleration summary report shows, for each mark in each file, the frequency at which the maximum acceleration was recorded and the amplitude of that acceleration for each of the X, Y, and Z traces. The report can summarize data from up to 50 log files.

Different log files can have different settings for time domain format, filter, and FFT sample size, so when compiling a report, VibeReview uses the same settings for all files. The settings are determined by:

- The settings for the most recent log file opened (other than a comparison file).
- The settings you make using the **Settings** menu items.

The default report format uses a vertical layout for each of the X, Y, and Z traces: the table of amplitude data is listed first, and the table of frequency data follows below the amplitude data. You have the option of choosing a horizontal layout: the table of frequency data is listed to the right of the table of amplitude data.

Different log files can have different annotations for the marks in the file, so by default, the report identifies the marks as Mark1, Mark2, and so on. You have the option of having the report identify the marks by using the annotations for the marks from the first file you open.

To compile a peak acceleration summary report:

1. Choose the menu item **Settings > Options**. The Options dialog is displayed.

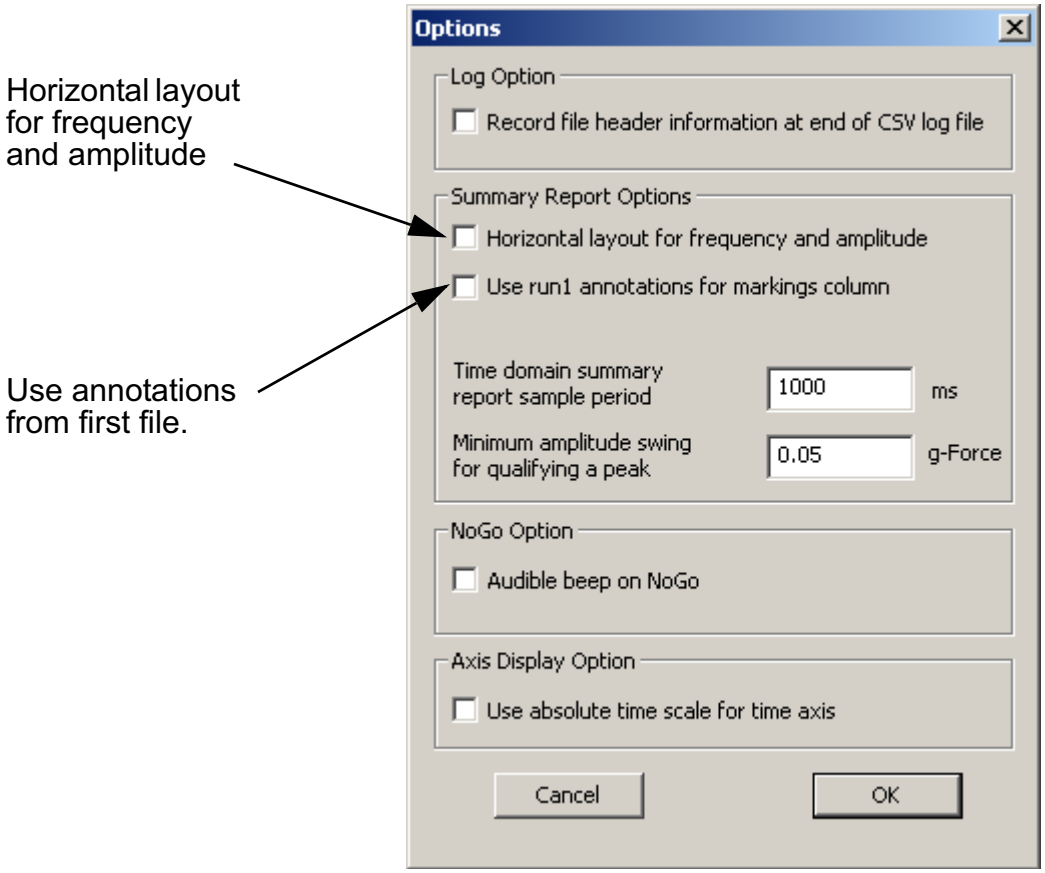


Figure 4.31: Changing Report Options

2. If you want the frequency and amplitude data shown horizontally in the report, check the box **Horizontal layout for frequency and amplitude**. If you want the frequency data shown below the amplitude data in the report, clear the check box.
3. If you want the marks identified with the annotations for the marks in the first file you open, check the box **Use run1 annotations for markings column**. If you want the marks identified generically (Mark1, Mark2, and so on), clear the check box.
4. Click **OK**.
5. Choose the menu item **File > Create CSV File > Compile Summary Report > Peak Acceleration and Frequency**. The AVS log files dialog is displayed.
6. Select the files that you want to include in the report. To select a range of files, click the first filename and then shift-click the last filename. To select multiple files individually,

select each using ctrl-click. When you have selected all files you want, click **Open**. The CSV file dialog is displayed.

7. Enter a name for the peak acceleration summary report file and click **Save**.

   VibeReview compiles and saves the summary report. You can open the report in applications, such as Microsoft Excel, that can read CSV files.

Compiling a Peak Excursion Summary Report

A peak excursion summary report shows, for each mark in each file, the frequency at which the maximum displacement (peak excursion) of the AVS wafer was recorded and the amplitude of that displacement for each of the X, Y, and Z traces. The amplitude is shown in units of millimeters.

The peak excursion at each mark is found from the frequency domain data by calculating the displacement, *d*, for each frequency:

$$d = \frac{A}{\omega^2}$$

Where the frequency is $\omega/2\pi$ Hz, and *A* is the amplitude at that frequency. The maximum excursion for a given mark is the largest value of *d* for the frequency spectrum at that mark, with the following restrictions:

- Only frequencies above 5 Hz are evaluated because of limits in the AVS electronics.
- Only sustained signals are evaluated, that is signals that last longer than the FFT sample size.

The report can summarize data from up to 50 log files. Different log files can have different settings for filter and FFT sample size, so when compiling a report, VibeReview uses the same settings for all files. The settings are determined by:

- The settings for the most recent log file opened (other than a comparison file).
- The settings you make using the **Settings** menu items.

The default report format uses a vertical layout for each of the X, Y, and Z traces: the table of amplitude data is listed first, and the table of frequency data follows below the amplitude data. You have the option of choosing a horizontal layout: the table of frequency data is listed to the right of the table of amplitude data.

Different log files can have different annotations for the marks in the file, so by default, the report identifies the marks as Mark1, Mark2, and so on. You have the option of having the report identify the marks by using the annotations for the marks from the first file you open.

To compile a peak acceleration summary report:

1. Choose the menu item **Settings > Options**. The Options dialog is displayed.

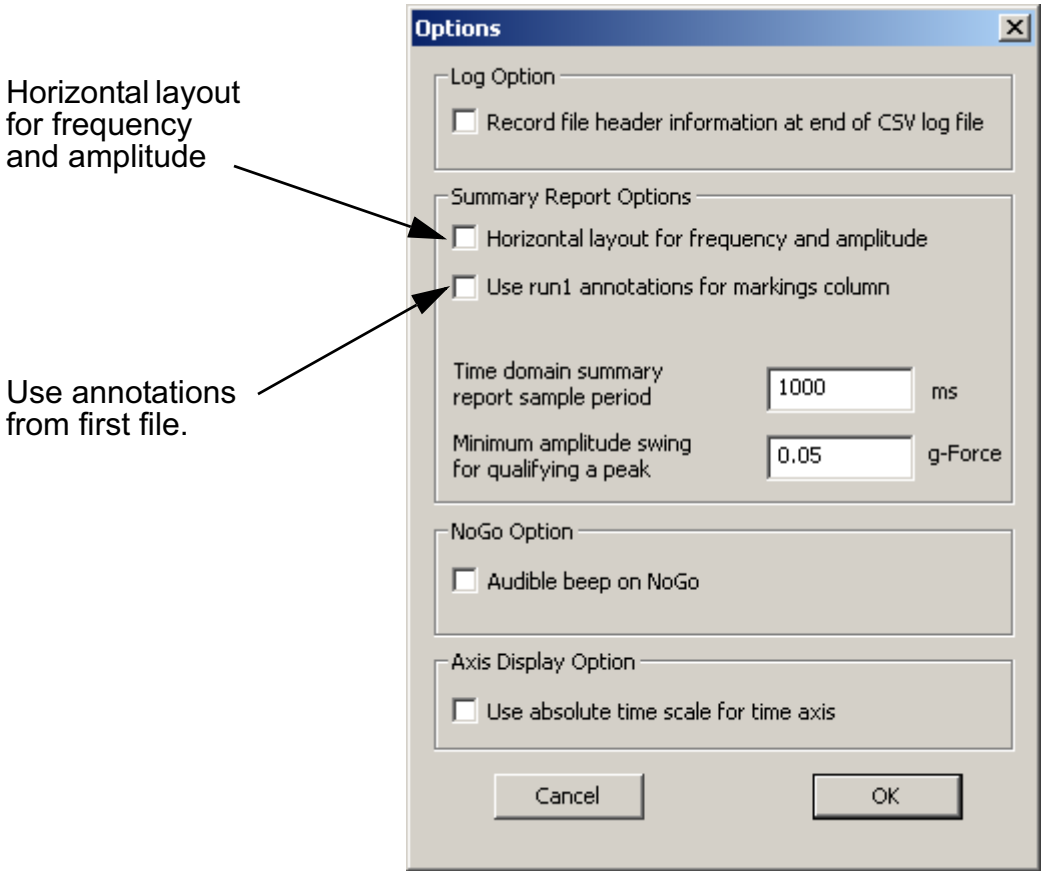


Figure 4.32: Changing Report Options

2. If you want the frequency and amplitude data shown horizontally in the report, check the box **Horizontal layout for frequency and amplitude**. If you want the frequency data shown below the amplitude data in the report, clear the check box.
3. If you want the marks identified with the annotations for the marks in the first file you open, check the box **Use run1 annotations for markings column**. If you want the marks identified generically (Mark1, Mark2, and so on), clear the check box.
4. Click **OK**.
5. Choose the menu item **File > Create CSV File > Compile Summary Report > Peak Excursion and Frequency**. The AVS log files dialog is displayed.

6. Select the files that you want to include in the report. To select a range of files, click the first filename and then shift-click the last filename. To select multiple files individually, use ctrl-click. When you have selected all files, click **Open**. The CSV file dialog is displayed.
7. Enter a name for the peak excursion summary report file and click **Save**.

   VibeReview compiles and saves the summary report. You can open the report in applications, such as Microsoft Excel, that can read CSV files.

Compiling a Time Domain Statistics Summary Report

A time domain statistics summary report shows the slippage factor for each mark in each file. For each mark in each file, for the X, Y, and Z traces, the report also shows the following statistics: number of peaks, mean, maximum, minimum, standard deviation, and integral.

The slippage factor is defined as:

$$\frac{\sqrt{x^2 + y^2}}{z}$$

For counting the number of peaks, you can have the report ignore small peaks by specifying the minimum amplitude swing that qualifies a peak to be counted.

The statistics are computed at each mark in the file over a user-specified sample period beginning at the mark.

Different log files can have different annotations for the marks in the file, so by default, the report identifies the marks as Mark1, Mark2, and so on. You have the option of having the report identify the marks by using the annotations for the marks from the first file you open.

To compile a time domain statistics summary report:

1. Choose the menu item **Settings > Options**. The Options dialog is displayed.

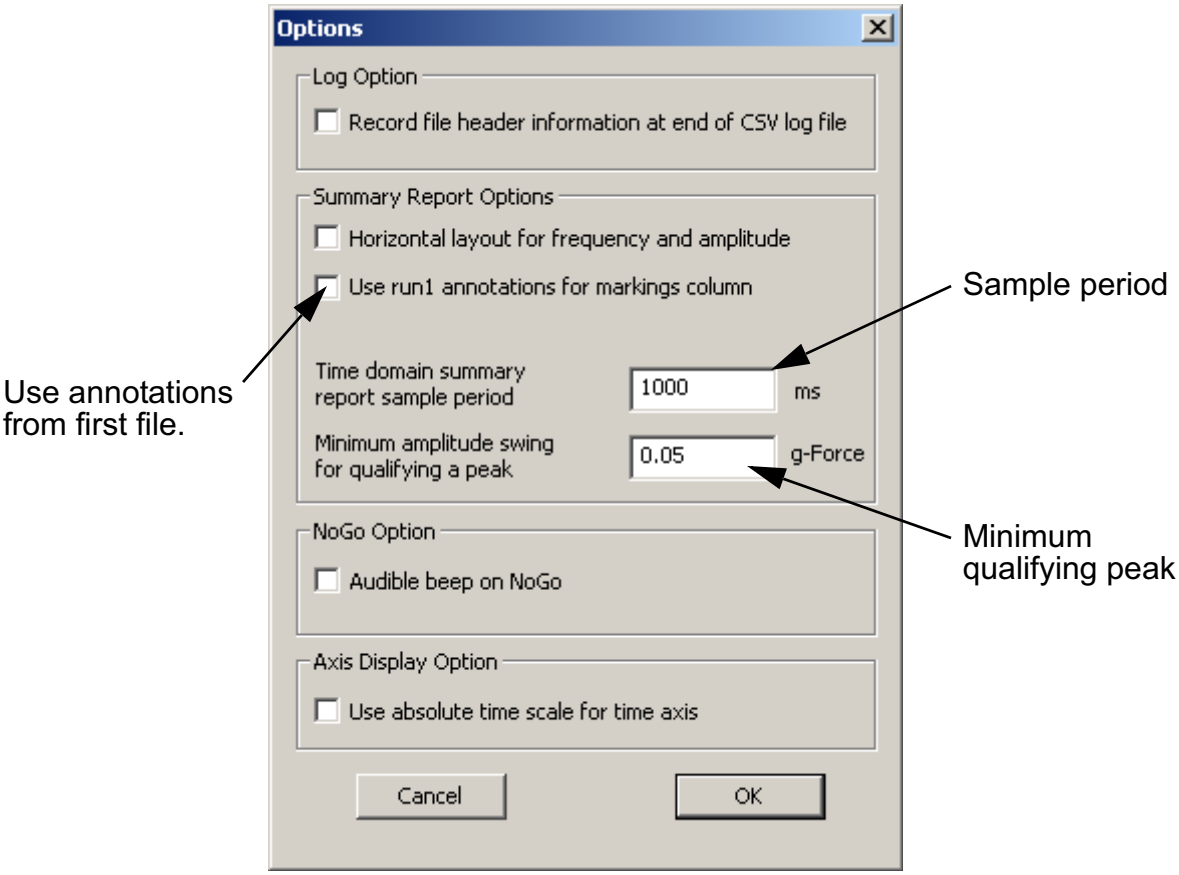


Figure 4.33: Changing Report Options

2. If you want the marks identified with the annotations for the marks in the first file you open, check the box **Use run1 annotations for markings column**. If you want the marks identified generically (Mark1, Mark2, and so on), clear the check box.
3. In the **Time domain summary report sample period** box, specify the sample period you want VibeReview to use in calculating statistics for each mark.
4. In the **Minimum amplitude swing for qualifying a peak** box, specify the minimum amplitude you want VibeReview to use for counting an amplitude change as a peak
5. Click **OK**.
6. Choose the menu item **File > Create CSV File > Compile Summary Report > Time Domain Statistics.** The AVS log files dialog is displayed.

7. Select the files that you want to include in the report. To select a range of files, click the first filename and then shift-click the last filename. To select multiple files individually, use ctrl-click. When you have selected all files, click **Open**. The CSV file dialog is displayed.
8. Enter a name for the time domain statistics summary report file and click **Save**.

   VibeReview compiles and saves the summary report. You can open the report in applications, such as Microsoft Excel, that can read CSV files.

Printing the VibeReview Window

You can print an image of the VibeReview window to have a graphical record of the session.

To print an image of the VibeReview window:

1. Choose **File > Print**.
2. In the Print dialog, click **OK**.

You can also select a printer other than the default and change the printer setup, or see a preview of what VibeReview will print:

- To select a different printer, change the paper selection or print orientation, or set printer properties, choose the **File > Print Setup** menu item.
- To see a preview of what VibeReview will print, choose the **File > Print Preview** menu item.

Chapter 5

Maintaining Your AVS

This chapter discusses the following:

- Annual factory battery replacement
- Battery use and disposal
- Cleaning the AVS wafer

Warning

The edges of the AVS wafer are thin. It may be possible to sustain an injury from these edges if the AVS wafer is not handled with proper care.

Warning

Protection afforded by compliance to EN61010-1 (2001) may be impaired if the equipment is not used as specified.

Caution

The AVS wafer is thicker than a standard silicon wafer so use **extreme care** to assure that the wafer has proper clearances when being transported through the tool. For example, when you use the wafer in a tool for the first time, move the AVS wafer through the tool in manual mode, visually verifying all clearances. Even when clearances are sufficient for safe AVS pass-through, if the robot end-effector is taught too high, you risk crashing and damaging the AVS wafer.

Periodic battery replacement is the only regular maintenance your AVS requires:

Annual Factory Battery Replacement

Every twelve months, you should return your AVS wafer to the CyberOptics Semiconductor factory, where we will replace the internal rechargeable battery. You can find the date when the

AVS wafer was last serviced at the factory by choosing the **Help > About your AVS Wafer** menu item in the VibeView application.

Battery Use and Disposal

Your AVS wafer contains a lithium-polymer battery. To avoid damage to the AVS wafer, use the supplied charger only. Do not charge the AVS wafer at temperatures outside the specified range (0 °C to 45 °C). Do not incinerate or dispose of the AVS wafer into fire. Do not immerse the AVS wafer when cleaning or spill liquids on the AVS wafer.

For proper battery disposal, please return the AVS wafer to CyberOptics,

or contact customer support (see "Technical Support," on page2.11).

Cleaning Your AVS Wafer

If cleaning is required, wipe the outside of the AVS wafer with IPA (isopropyl alcohol). If the AVS wafer is used in a clean environment, follow proper procedures for cleaning devices for this environment.

Warning

Do not immerse the AVS wafer or the link module in liquid. Do not spill liquids on the AVS wafer or on the link module.

Chapter 6

Specifications

System Requirements

To run the WaferSense AVS software and link, your computer must have:

- Windows 2000, Windows XP, or Windows Vista (32-bit and 64-bit), or Windows 7 (32-bit and 64-bit) operating system
- One free high-power USB 1.1 or USB 2.0 port

AVS Hardware

Environmental

Operating pressure range: 10^{-6} Torr to 760 Torr.

Storage temperature range: -20 °C to 70 °C.

Charging temperature range: 0 °C to 45 °C

Operating temperature range: 20 °C to 70 °C.

Power

Battery charger requires 100 - 240 VAC at 47 - 63 Hz input.

Battery usage on a full charge: approximately 4 hours. Battery performance degrades at temperatures outside the optimum operating temperature range.

Typical battery recharge cycles: approximately 500.

Range and Accuracy

Range. ±2 g.

Resolution. ±0.01 g.

Frequency response. 0 to 200 Hz, -3 dB.

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