WinTest® 7 Software
Reference Manual

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Preface

The WinTest® Digital Control System combines the innovative Bose ESG WinTest software and the powerful, flexible PCI Series control electronics. WinTest's intuitive graphical user interface enables you to set up complex test routines quickly with minimal training and can be configured to run a wide range of test system configurations.

The typical project configuration is a uni-axial, single-station test system; however, WinTest can easily be configured for multi-axis test systems or multi-station configurations, where each station is running an independent test from one central WinTest control system. Waveform generation, data acquisition, and instrument control are all provided in the comprehensive WinTest package.

This manual is available in electronic (PDF) and printed versions. Read the manual carefully, and be sure you understand the information provided before attempting to install and operate the WinTest Control software. Keep this manual available for future reference.

IMPORTANT *Before using the WinTest 7 software to operate any Bose ESG test instrument, make sure that you have read and understand the Product Reference Manual for your system. Only persons who have successfully completed a Bose ESG training program should be allowed to operate the equipment.*

User Notes Area

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Chapter 1
WinTest® 7 Overview

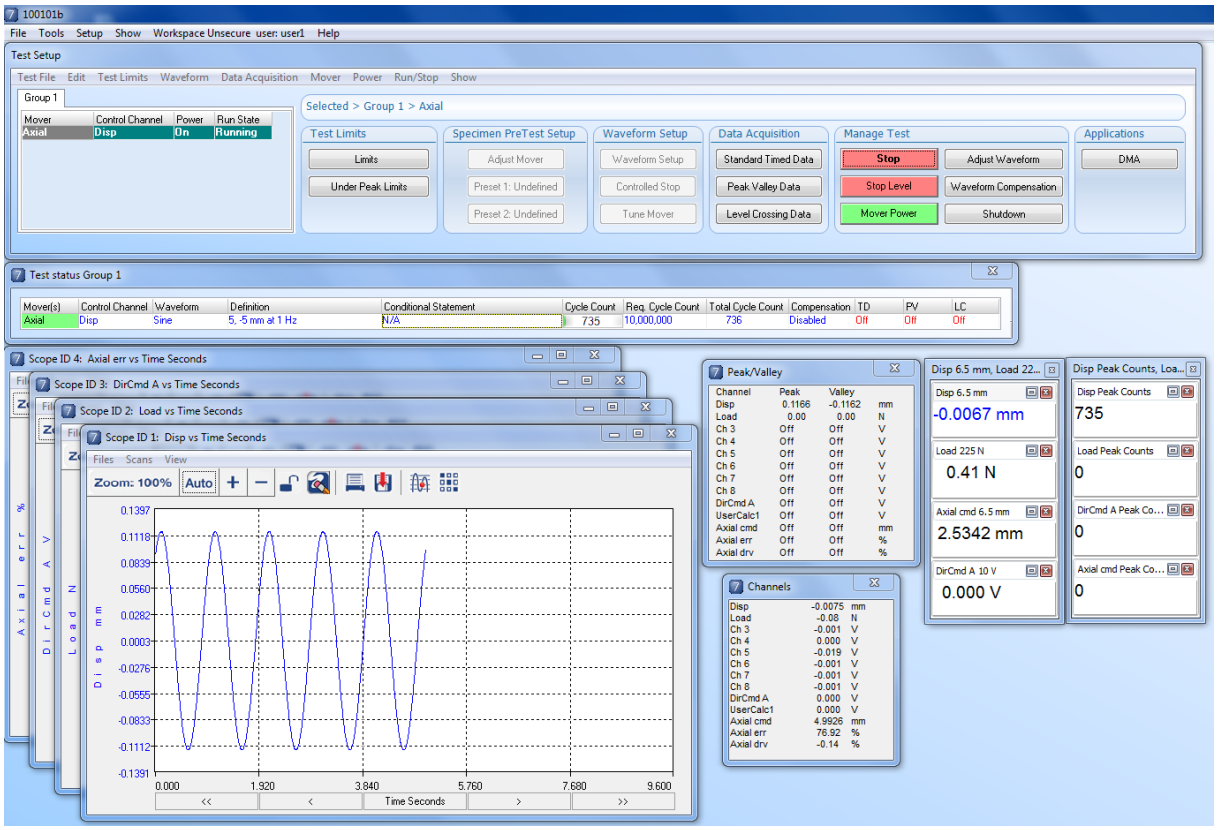
Welcome to WinTest 7

The WinTest 7 software and PCI control electronics combine to provide data acquisition, waveform generation, and instrument control in an easy-to-use integrated package. Whether you need a simple configuration for simple tests or the full power of the advanced user interface, this generation of WinTest simplifies test setup and operation to improve the productivity of your testing program.

If WinTest 7 is not already installed on your computer, follow the installation instructions provided with the WinTest 7 Software CD.

NOTE *Be sure to read the README file in the C:\Bose\WinTest folder on your hard drive to learn about the changes and new features in this WinTest version.*

If you are using the electronic (pdf) version of this manual, you can use the Bookmarks to quickly access information in the manual. A comprehensive index provides a reference to specific topics.



What's New in WinTest 7.1

To further simplify test setup and operation, and to improve the productivity of your testing program, WinTest 7.1 contains new features, as well as enhancements to several existing features. The following sections highlight some of the changes.

New Features

Stability Check

If enabled when Mover power is turned on or the control channel is changed, this feature uses a small square wave and small limits to test system stability. If the Stability check limits are reached, a shutdown is triggered. This prevents unstable (i.e., uncontrolled) motor movement, thereby protecting specimens and system hardware.

Stability check can also protect specimens and system hardware. When a user turns off Mover power, stability check will switch the control channel to DirCmd and apply a 1 Hz haversine to zero volts. The Mover power is then turned off, after which the control channel is switched back to the user-specified control channel. For more information, see the Power Settings and Power On/Off section in Chapter 11.

Acceleration Compensation (Accel Comp)

The mass and acceleration of system hardware can have an effect on the readings obtained from a sample being tested in the axial direction. Accel Comp is a method of removing that effect, providing more accurate data.

Accel Comp provides the most error reduction when a dynamic test is being run (as opposed to a steady force test) and the load cell is mounted on the motor output shaft. For more information, see the "Acceleration Compensation" section in Chapter 8.

Linearization

Linearization is an optional method of calibration used by Bose ESG technicians to further increase the accuracy of a transducer. The enabling of linearization is done inside a project file. For more information, see the Linearization Files section in Chapter 12.

Workspace Layout File

A workspace layout file (*.ini) contains window information, such as number of windows and their position on the screen, for Scope windows, Meter windows, and Peak Counts windows. For more information, see the "Working with Workspace Layout Files" section in Chapter 2.

Enhanced Features

Multiple Scopes

To provide more flexibility in monitoring tests, WinTest now gives the user the capability of having up to four Scope windows displayed at the same time. Each Scope window may have different channels displayed, accompanied by unique scaling on the X-axis and the Y-axis. For more information, see the "Scope" section in Chapter 3.

Meters - Color Change upon Channel Saturation

WinTest provides a visual cue that a channel is reaching 95% of its operating range (100% is saturation)—the background color of the channel's Meter window changes from white to yellow. For more information, see the Channel Saturation Warning section in Chapter 3.

Docking Meter Windows and Peak Counts Windows

To provide additional flexibility in monitoring tests, WinTest now gives the user the capability to have multiple individual Meter and/or Peak Counts windows docked together into a single window. Docking windows also makes it easy to move multiple windows with one motion, instead of moving individual windows one at a time.

Meter and Peak Counts windows can be docked and undocked with a simple drag-and-drop, plus more than one set of docked windows can co-exist. For more information, see the "Docking Meter Windows" section in Chapter 3.

NOTE *The docking Meter windows and Peak Counts windows feature has replaced the* ***Snap to Grid*** *option.*

Important Definitions

This *WinTest 7 Software Reference Manual* includes special terms that all WinTest users should understand.

Channels, Movers, and Control Channels

A ***channel*** represents any signal that your system can monitor and read. These include hardware-based transducer signals, digital input and output signals, and calculated channels.

A ***mover*** is any device that can apply the test conditions to the specimen. Movers include ElectroForce linear motors, air cylinders, and temperature control devices. The project configuration defines a mover for every such device in your test system, also called "movers." Typical names for movers are "Axial" or "Rotation" or "Temperature."

Each mover has these three channels:

Channel	Description	Units
Mover 1 cmd	The signal (waveform) that commands the system	in control channel units (e.g., mm)
Mover 1 err	The difference between the command channel and the control channel	in percentage (%)
Mover 1 drv	Controller output to the Mover (e.g., maximum output would read 100%)	in percentage (%)

Each mover includes at least one ***control channel***. A control channel provides a transducer signal as feedback to control the mover in closed-loop (PID) control. Typical control channel names include "Disp" (displacement), "Load," or "Torque."

DirCmd (Direct Command)

DirCmd is a control algorithm that provides an alternative to closed-loop (PID) control for Bose ElectroForce linear motors. In DirCmd mode, the WinTest command is translated directly into a current drive (in volts) for the linear motor. Because there is no closed-loop control, DirCmd does not require tuning, and the Meter windows can be used to correlate the drive signal (in volts) to a feedback parameter such as displacement or load.

DirCmd (direct command) can provide excellent performance in situations where tuning is difficult (for example, when the sample stiffness changes during the test) or when closed-loop control is not possible (for example, load control when the sample is not attached to the fixture). Direct command is used for the Cycle Indirect waveform (available for block waveforms), for the Preset functions, and for the Control Stop action. DirCmd can also be selected as the control channel for movers that support direct command.

Waveform

A ***waveform*** specifies the desired test conditions to apply to the specimen. WinTest supports several types of test waveforms: cyclic waveforms (sine, triangle, and square) and ramp waveforms are standard functions. In addition, block waveforms allow you to create more complex test protocols by combining various block waveform types in a custom sequence. WinTest also provides optional features to create nonstandard or very custom waveforms, or to use an external source as a waveform generator.

Projects and Project Files

After starting WinTest, the first task is always to open a ***project file***. Opening a project file initializes the hardware configuration and loads all of the settings that were previously saved in the project file (for all groups), including channel settings, calibration information, mover settings, and test setup settings for each group, including waveform setup, data acquisition, limits, and tuning settings.

The initial project file was created at Bose ESG for your test system configuration. Multiple project files allow you to configure the same hardware for different transducers and testing applications.

Most WinTest configurations require just one project file. If you use the same set of transducers for all your test configurations, we recommend that you use just one project file and create and save multiple test files for different specimen types and testing applications. This ensures that the calibration information in the project file is current for all tests.

Workspace Layout Files

A workspace layout file (*.ini) contains window information, such as number of windows and their position on the screen, for Scope windows, Meter windows, and Peak Counts windows. When you save a project file, the workspace layout file directly associated with that project file is saved at the same time.

You can also save a *copy* of a favorite layout file to a folder that is accessible from Secure and Unsecure workspaces (C:\Bose\WinTest\Common\Layouts). To save or to use a different layout file with a project, use commands on the **File** menu (**Project** window).

Groups and Test Files

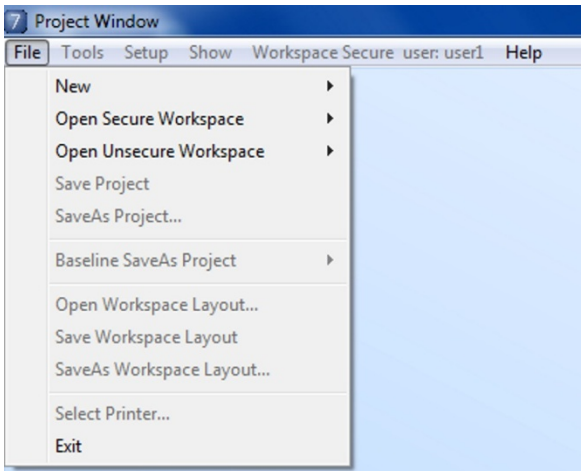
A ***Group*** consists of the mover or movers that are grouped together and that typically work on the same specimen. Although most systems include just one group, some configurations have multiple groups.

A ***Test File*** (*.gf*x*,where *x* is the group number) contains test setup information for a specific group: mover settings, channel settings, data acquisition setup parameters, tuning settings (TuneIQ and manual tuning settings), limit settings, control mode selection, and waveform setup parameters. In general, Bose recommends that you save these settings in test files rather than project files for tests that use the same hardware configuration.

When you save a project, the saved project includes information from the test file that is currently in use. To use a different test file with the same project, or to save changes to the test setup, or to save changes to the test setup in a new test file, use commands on the **Test File** menu (**Test Setup** window).

Project Window

Each time you log into WinTest, the **Project** window opens automatically, but only the **File** menu and **Help** menu are active until you open a project file. The other **Project** window menus provide access to project-level functions and become active when you open a project file.

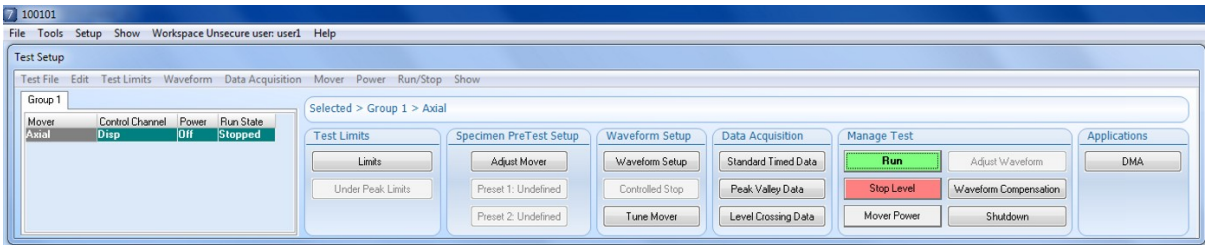


Menu	Description of Menu Commands
File	Use **File** menu commands to select and open a project file, create or open a rebuild file, or DTL program; to create a new DTL (Designer Test Language) program file; to save changes to project settings in the same project file or in a project file with a new name;. to open or save an existing Workspace Layout file or save a Workspace Layout file with a new name.
Tools	Use **Tools** menu commands to access project-level WinTest tools used to create, compile, and run DTL files, , to configure the UPS and digital polling events. This menu also provides access to advanced tools such as calibration, project configuration (Bose ESG personnel only) and set up of password protection for specific WinTest functions.
Setup	Use **Setup** menu commands to view and adjust channel settings, limit settings, Peak/Valley settings, and digital outputs.
Show	Use **Show** menu commands to open display windows: Meters, Channel Status, Channel Status, Peak/Valley readings, digital input status, and Peak Counts. The **Show** menu also provides access to the **History** window, which you can use to view activities that were recorded for the project for review and traceability. Use the **Group Panel** command to display the **Test Setup** window if it becomes hidden behind other windows.
Help	Use **Help** menu commands to access contact info for Bose ESG, including Tech Support; open the electronic version of this manual in pdf format; go to the Bose ElectroForce Web page; and to check the WinTest software version.

Test Setup Window Overview

The **Test Setup** window opens automatically when you open a project file. This window provides access to functions that apply to the current group, some of which are also provided as buttons in the **Test Setup** window. If you have multiple groups, the **Group** tabs let you switch quickly between groups.

The **Test Setup** window also helps you set up and manage your workflow by grouping basic WinTest functions and providing button access to basic tasks.



Menu	Description
Test File	Provides access to the Build function (**New**), lets you open a test file or DTL (Designer Test Language) script, and lets you save group test files
Edit	Provides access to the Clear Test File Name and the Lock functions.
Test Limits	Provides access to limit settings.
Waveform	Provides access to waveform setup functions, mover settings for waveform actions, and waveform performance (compensation and group Peak/Valley settings). This menu also lets you adjust the master span/mean/rate settings during a test, and lets you set the global waveform amplitude orientation that specifies how to define levels.
Data Acquisition	Provides menu access to data acquisition setup and to the Export and Replot functions.
Mover	Provides menu access to Adjust Mover and Presets, to manual tuning, and lets you set the control channel for the current mover. It also provides access to general and advanced mover settings.
Power	Provides menu access to Power and Shutdown functions.
Run/Stop	Provides menu access to Run, Stop, Hold, and Resume functions.
Show	Provides menu access to **Scope** windows, the **Test Status** window, and optional displays.

Emergency Stop Buttons

There are four Emergency Stop (E-STOP) buttons—one is a mechanical button that is provided with your system, the other three are provided in software. (Some systems may have a second mechanical E-STOP button.) Use these buttons to cause an immediate system shutdown in severe or emergency situations.

Mechanical E-STOP

This button is connected to the system power supply. A typical example of this button is shown in the photograph.

Software E-STOPS

There are two E-STOP buttons provided in the WinTest software, with one additional E-STOP button provided in the Notification area of the Windows Taskbar.

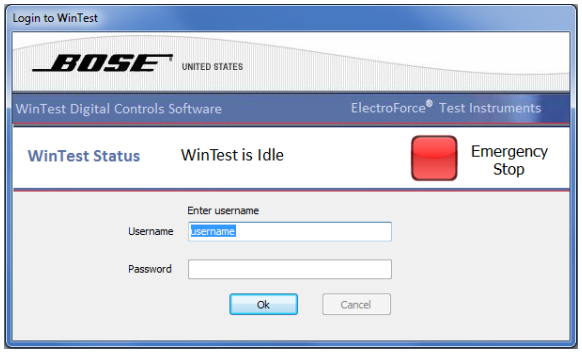
WinTest

One is the large red button located in the lower right corner of the WinTest screen. This button is always visible.

- Left-clicking this button immediately turns off power to all movers (all groups) and triggers an Abort action in WinTest.
- Right-clicking this button quits WinTest, but only when Mover power is turned off.

The second is the square red button located in the **Timeout Login** window.

- Clicking this button immediately turns off power to all movers (all groups) and triggers an Abort action in the WinTest software.



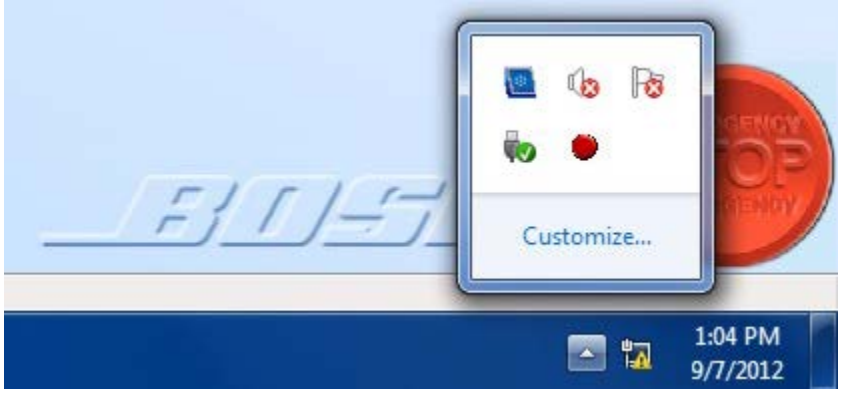
Notification Area of the Windows Taskbar

This is the small red E-STOP button located in the Notification Area, which is typically located on the right-hand end of the Windows Taskbar.

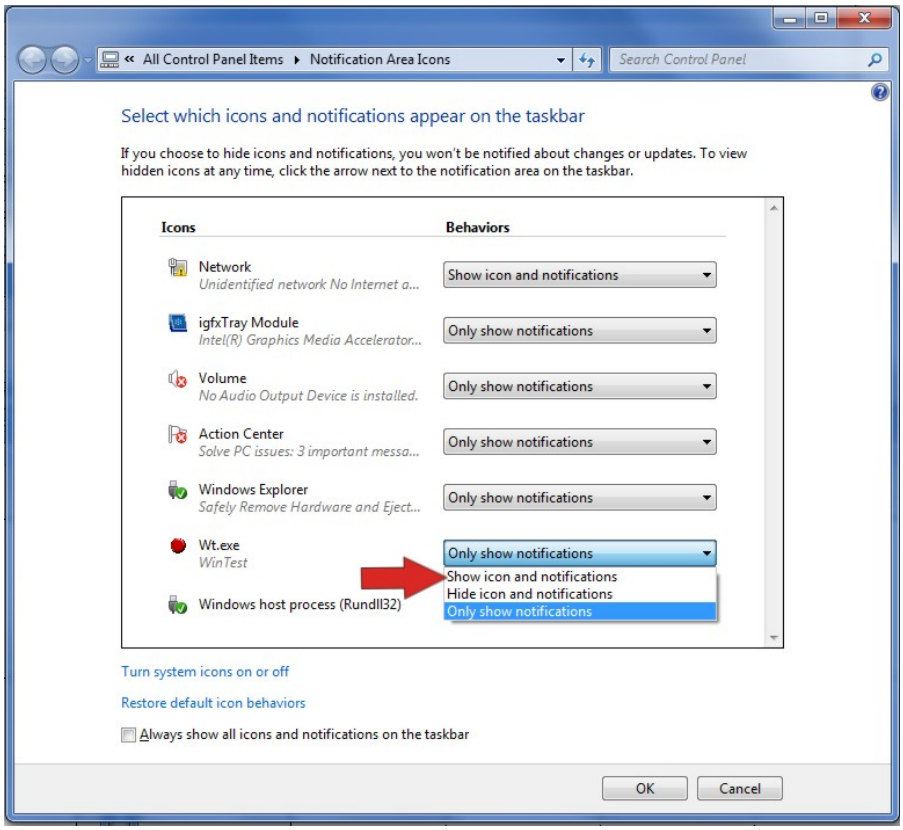
If this E-STOP button is not visible, perform the following steps in this section to make it visible.

1. Click the white Up arrow marked in the figure.

2. Click **Customize** in the window that appears.



3. In the drop-down list for Wt.exe *WinTest*, select **Show icon and notifications**, and then click **OK**.



4. The small red E-STOP button should now be visible in the Notification Area.

Security and Traceability Features

WinTest can provide advanced security features that support best practices for:

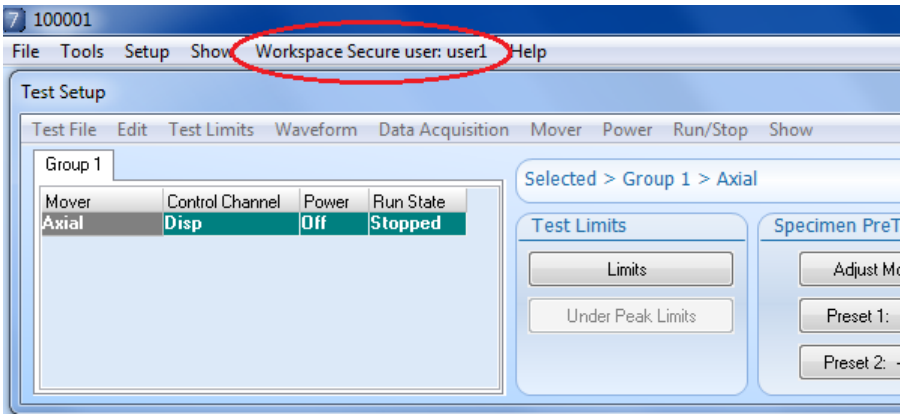
- Authentication of users
- Security of electronically stored test files and data in a Secure Workspace
- Secure activity tracking to provide traceability for test setup and execution
- Secure electronic storage of system resources, such as calibration and TuneIQ files

Security (User Authentication) Levels

The WinTest System Administrator is responsible for setting the WinTest security level to one of the following three levels (Security Disabled is the default). See the *WinTest 7 Controls Administrator Manual* for information about setting the security level and managing WinTest user accounts.

Security Level	Description
Security Enabled (Highest)	Required to run WinTest in a secure configuration. WinTest users are authenticated, and a user name and password are required to log into WinTest. Authenticated users can work with either secure projects or unsecure projects. Secure projects will automatically time out after a specified period of user inactivity. Advanced tracking features are enabled to support best practices for traceability and security of electronic data. Activity tracking records the authenticated user name for all user-initiated changes that can affect the test data.
Record User Enabled	WinTest users are recorded but are not authenticated. A user name, but not a password, is required to log into WinTest. WinTest users can only open a project in the Unsecure Workspace and cannot save files in the Secure Workspace. Activity tracking records the user for all user-originated activities as the user ID that logged in to WinTest (however, this user is not authenticated).
Security Disabled	Any user can log into WinTest. A user name is not required. WinTest users can work only in the Unsecure Workspace. Activity tracking records the user ID for all user-originated activities as "unknown." This security level does not support best practices for traceability and security of electronic data.

The menu bar in the **Project** window shows the user name currently logged into WinTest (for Security Disabled, the user name is "unknown") and whether the user is working in a secure or an unsecure workspace



Timeout

The **Timeout** option on the **Workspace** menu (**Project** window) is active only when the WinTest user is authenticated or recorded. This timeout is independent of the timeout setting for user inactivity in the Secure Workspace. Use this option to:

- Change the authenticated WinTest user without having to exit WinTest and log in again as a new user. The next user simply enters their user name and password after clicking **Timeout**, and WinTest starts recording user activities for new user.

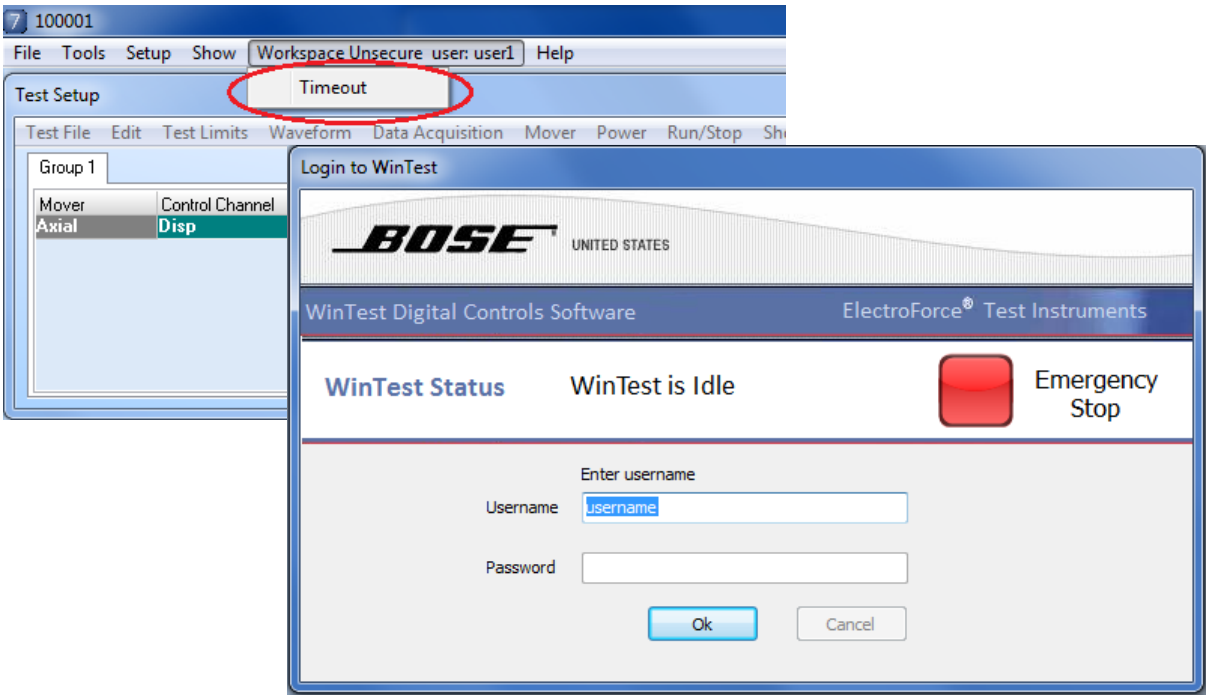
- Display the **Login** window when leaving the system unattended.

  Click Workspace *Secure or Unsecure* user: *username*
  Click **Timeout**

  This prevents unauthorized users from making changes and attributing them to an authenticated user. To regain access, enter your user name and password in the **Login** window as required.

NOTE *The **Login** window provides an **Emergency Stop** button. When mover power is on, clicking the **Emergency Stop** button immediately turns off power to all movers (all groups). Each Bose test instrument also has a mechanical E-Stop button for the same purpose.*

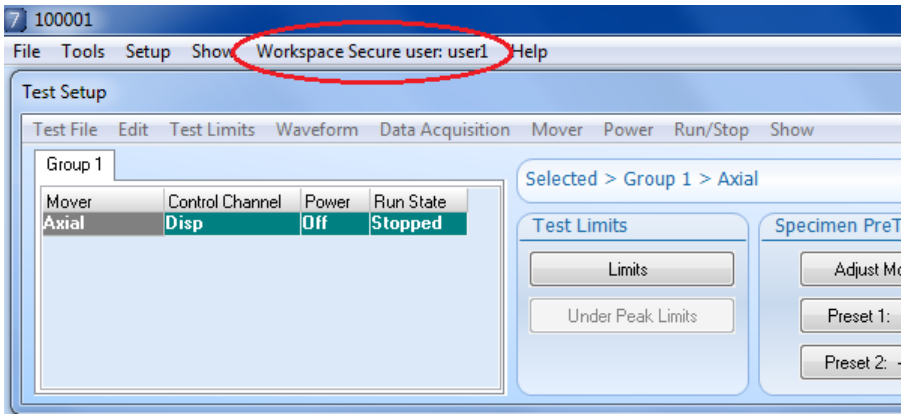
If you are an authenticated WinTest user and are working in a Secure Workspace, the system will also time out automatically and display the **Login** window after a specified period of user inactivity. This timeout period is set in a registry setting by the WinTest System Administrator. See the *WinTest 7 Controls Administrator Manual*.



Secure and Unsecure Workspaces

The WinTest file structure provides a default SecureWorkspace folder and a default UnsecureWorkspace folder. See also Chapter 14, "WinTest Files."

Whenever a project file is open in WinTest, the **Project** window shows whether the project was opened in the SecureWorkspace or the UnsecureWorkspace and shows the user ID (if the user is authenticated).



SecureWorkspace Folder

The SecureWorkspace folder provides a closed, secure workspace for WinTest users to store their files.

- Only authenticated WinTest users can open projects in the Secure Workspace folder. Authenticated users can use WinTest functions to save projects and related files (such as test files and data files) in the Secure Workspace through normal WinTest operations, but they cannot use Microsoft Windows to modify, rename, or delete any files in the Secure Workspace.
- The only way for WinTest users to save files in the SecureWorkspace is through normal use of WinTest.
- When the user is working in the SecureWorkspace, WinTest will time out after a specified period of user inactivity. This timeout period depends on facility requirements and can be adjusted by the WinTest Administrator.
- The **Baseline SaveAs** function (**Files** menu, **Project** window) allows authenticated users to save an unsecure project in the SecureWorkspace folder. See Chapter 14, "Using Baseline SaveAs," for more information about using this function.
- If an authenticated user opens a secure project file, WinTest will not allow the user to save the project file or any files related to the project anywhere except in SecureWorkspace folder. However, users can create new folders in the SecureWorkspace folder (through WinTest) to organize their files, and they can copy files out of the Secure Workspace folder into an unsecure folder.
- Secure data files carry a "secure" label in the file header.

UnsecureWorkspace Folder

The UnsecureWorkspace folder provides an open workspace for WinTest users to store unsecure files.

- Any WinTest user can open a project in the Unsecure Workspace.
- If you open an unsecure project, WinTest recognizes that the project file will not allow the user to save the project or any related files in the SecureWorkspace folder.
- Unsecure data files carry an "unsecure" label in the file header.
- Users are free to manage files in the UnsecureWorkspace folder as they choose in the WinTest and the Windows environments.

Activity Tracking

WinTest provides traceability for WinTest projects with secure project session files that create a comprehensive record of all activities that affect the project. The record is maintained through all project sessions and is carried to the new project file when a new project is created by saving a project as a new file (**Save As**). WinTest automatically creates, maintains, and stores these project session log files in a folder that is always secure, regardless of the security level set by the WinTest System Administrator. For more specific information about project session log files, see Chapter 14, "WinTest Files."

These advanced traceability features track activities back to the origin of the project file for complete traceability.

Tracking User Activities

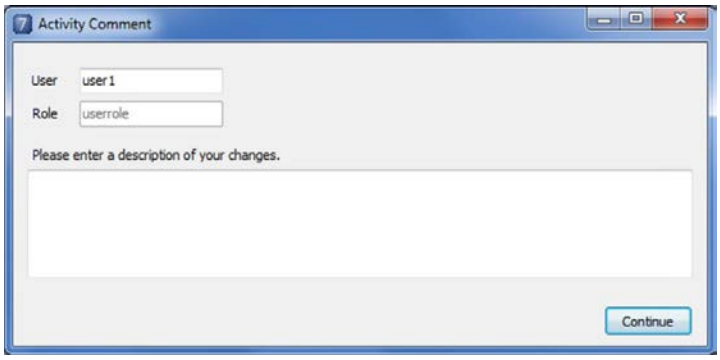
WinTest automatically tracks all activities that affect a project. When the user is authenticated or recorded, the login user ID is recorded for all activities originated by the user (changes to the waveform, limit settings, turning on power, etc.). When security is disabled, the user ID for all user-originated activities is recorded as "unknown."

WinTest users can use the **History Viewer** window to display the activity record for any project. This window also allows WinTest users to filter the information displayed for each activity, to focus on specific items, or to trace events during a test.

Activity Comment Window

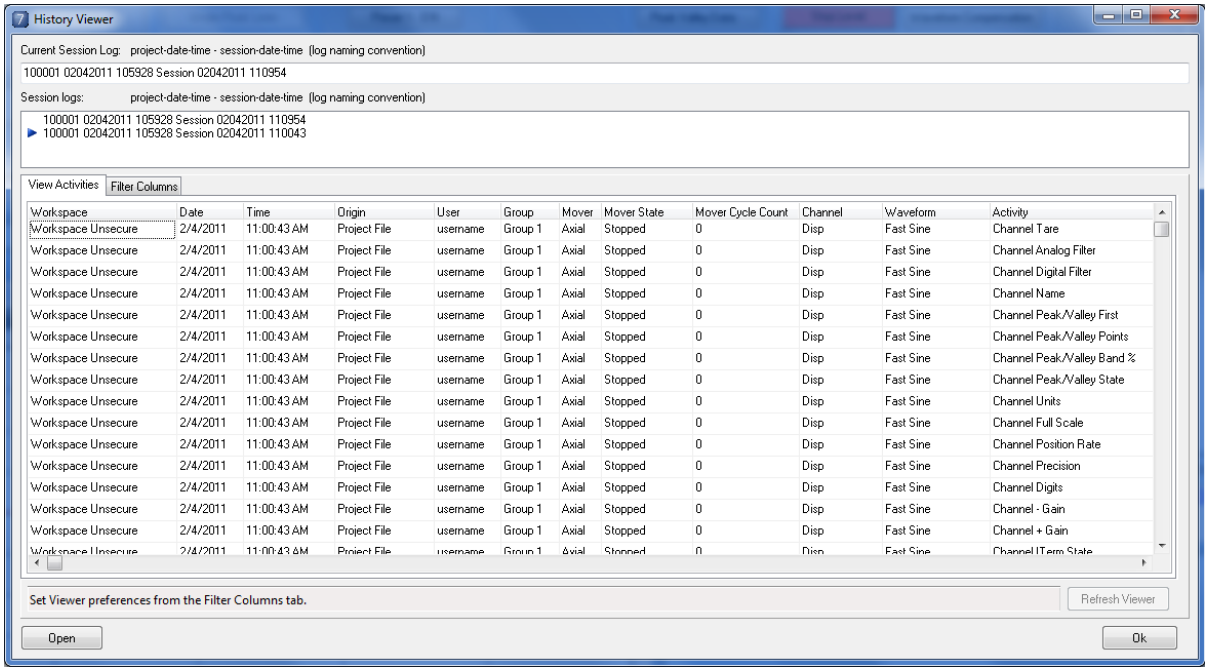
Whenever you save a project file, WinTest displays an **Activity Comment** window. In this window, you should type information about any changes that were made to the project and why they were made, and then click **Continue**. This information is required for traceability and supports best practices for traceability and security of electronic data. WinTest will track these comments in the project session log file, and they appear in the Data 1 column in the **History Viewer** window**.**

NOTE *Clicking the Close button* *in the* ***Activity Comment*** *window records a comment in the project session file that the user canceled the activity comment. This comment can be displayed in the* ***History Viewer*** *window.*



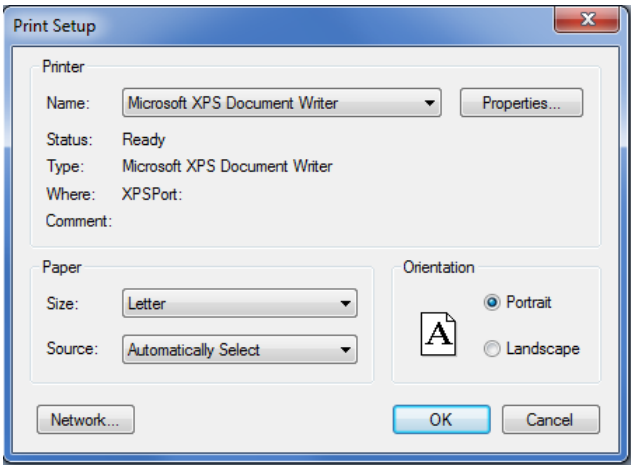
History Viewer

The **History Viewer** window lets you review the project history and analyze activities that have affected the project. Click **History** on the **Show** menu (**Project** window) to open the **History Viewer** window. See Chapter 9, "Reviewing Test Results," for specific information about the **History Viewer** window and how to filter the information from the columns that are displayed.



Printer Setup

Use the **Printer Setup** command on the **File** menu (**Project** window) to configure a printer. The printer should be directly connected to the PC, not on a network.



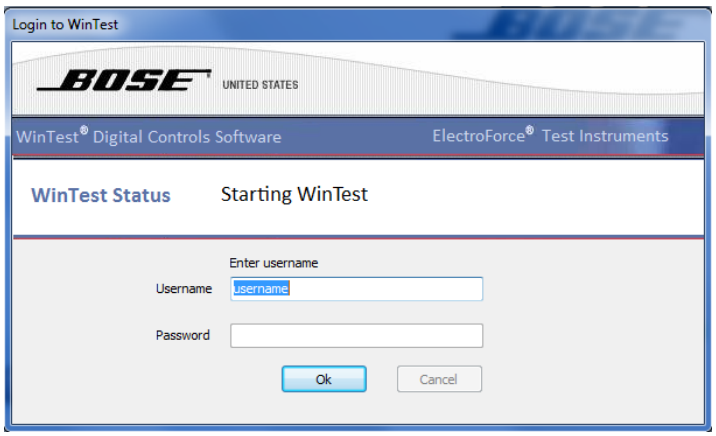
Chapter 2
Getting Started

Starting WinTest

To start WinTest:

1. Login to Windows with your username and password.

2. Double-click the **WinTest** icon on the computer desktop, or open the **Start** menu and then click **WinTest**



3. When the **Login to WinTest** window appears, you may have to enter your user name and password, depending on the security configuration:

   - WinTest may ask to *record* your user name. Enter your user name only (the password field will be disabled)..

   - WinTest may *require* a user name and password (security is enabled). Enter your user name and password.

   The following user name and password define the default user account for Windows and WinTest. This account was set at the Bose factory. If it is ever necessary to restore the system to its default settings, it may also be necessary to enter this default user name and password:

   Default user name: **user1**
   Default password: **user1**

NOTE *The Administrator is responsible for managing user accounts and passwords. Depending on site requirements, the Administrator may have disabled the default* ***user1*** *account or may have created a user account for you to use (which may also require a password). Refer to the* WinTest 7 Controls Administrator Manual *for specific information about managing user accounts and passwords.*

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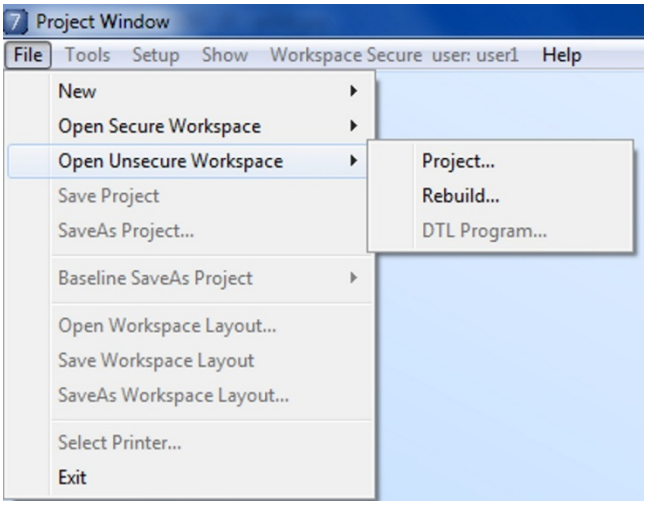
4. Open a project file (*.prj), as follows:



NOTE *If you are an authenticated WinTest user, you will have access to secure and unsecure projects.*

NOTE *You can also open a rebuild file (*.rebuild).*

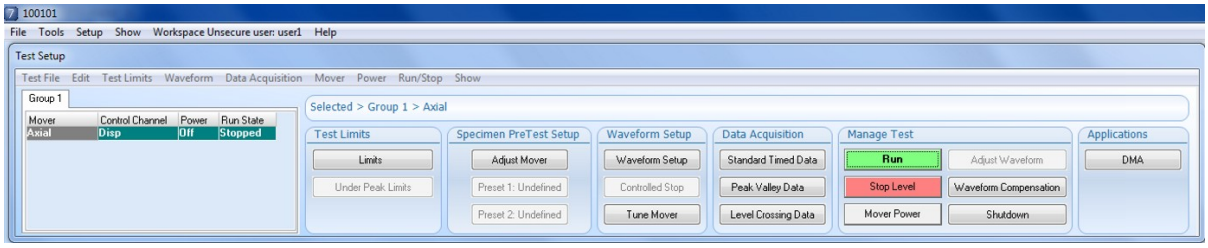
---

a. To open an unsecure project, click **Open From Unsecure Workspace** on the **File** menu, click **Project**, and then select and open an unsecure project file.

   To open a secure project, click **Open From Secure Workspace** on the **File** menu, click **Project,** and then select and open a secure project file. If you are an authenticated WinTest user, you will have access to both secure and unsecure projects.

b. When you open a project file, the **Test Setup** window opens automatically, and WinTest is ready to use.

NOTE *If your system configuration uses more than one project file, be sure to select the correct project file for your particular testing requirements.*



Applications

The WinTest software uses advanced Windows 7 security features that allow or restrict user access to run applications. If you want to run an application on the WinTest PC that was not installed at the Bose ESG factory, see your system Administrator and/or refer to the *WinTest 7 Controls Administrator Manual* under "Managing Applications," where you will find instructions on how to set up Windows 7 to run your application. These setup tasks require Administrative privileges.

Working with Project Files

NOTE *Bose ESG recommends that you save various test configurations, limit settings, tuning settings, etc. in multiple test files rather than in multiple project files.*

Opening a Different Project File

To change the project file you are using without exiting and restarting WinTest (for example, if you need to use a different calibration range or if you change your hardware configuration), do one of the following:

- Click **Open From Unsecure Workspace** on the **File** menu (Project window) to select a new unsecure project.

  or

  Click **Open From Secure Workspace** on the **File** menu to select a new secure project.

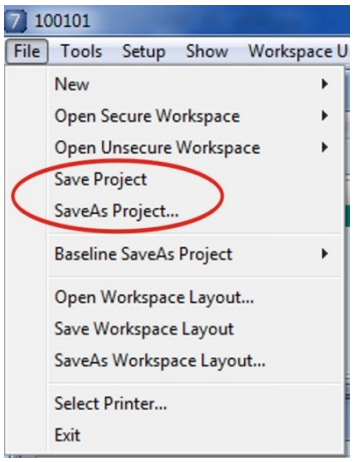
  Use one of these commands only if the new project file has the same hardware configuration as the project file you are now using.

- If the new project file has a different hardware configuration, you should exit WinTest before loading the new project file. Click **Exit** on the **File** menu (**Project** window) to exit WinTest, saving or discarding changes to the project file as appropriate. Then start WinTest again. After the **Project** window opens, click **Open From Unsecure Workspace**, or click **Open From Secure Workspace** on the **File** menu (**Project** window) and select the appropriate project file.

Saving Project Files

If you adjust settings in the project file, use the **Save Project** or **SaveAs Project** commands on the **File** menu (**Project** window) to save the project.

NOTE *Because project files store calibration information, try to keep the number of project files to a minimum. Instead, use test files to store settings for different samples and test conditions.*

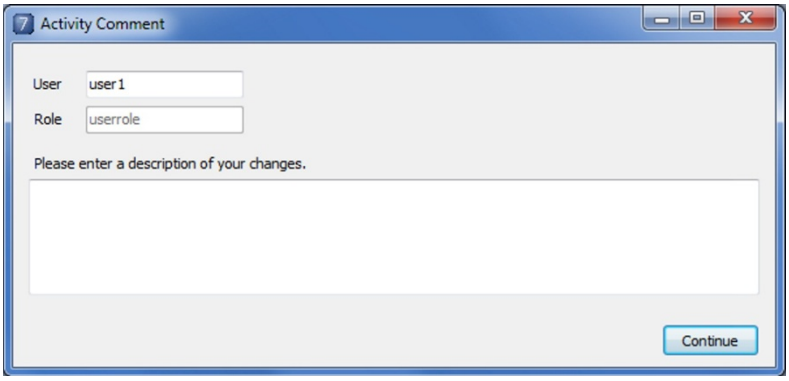


- **Save Project** saves the project with the same file name, and overwrites the previously saved file. WinTest will ask for confirmation before overwriting the existing file.
- **SaveAs Project** saves the project with a new file name, creating a new file.

NOTE *If you are working in a Secure Workspace, WinTest will direct you to save the file in the SecureWorkspace folder, but you can create new folders to organize your files.*

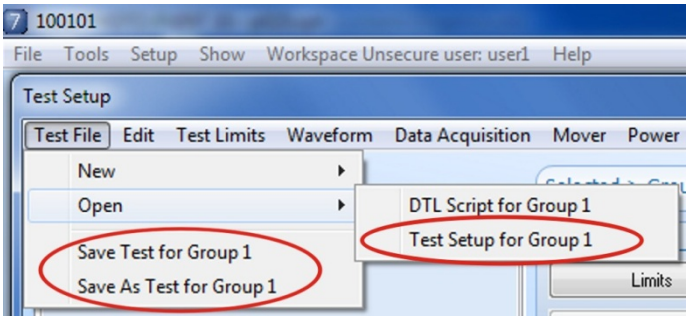
Whenever you save a project file, WinTest will automatically open the **Activity Comment** window. Type your user name and a description of what you changed in the project file before saving it, and then click **Continue**. Your comments will be recorded in the project session log and are important for traceability. Be sure to enter an appropriate comment before saving the file.

NOTE *Clicking the Close button in the **Activity Comment** window records a comment in the project session file that the user canceled the activity comment.*



Opening and Saving Test Files

When you save a project file, the current group settings are saved with the project. However, you can save group test settings such as data acquisition setup, waveform setup, tuning settings, etc., in test files (*.gf*x*, where *x* is the Group number).

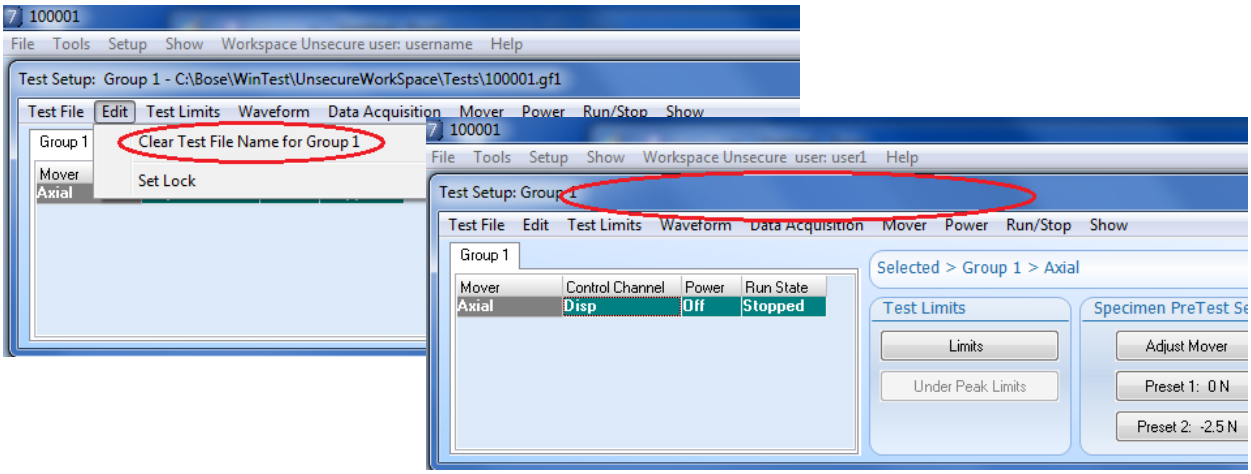


The next time you need to run a test with the same type of specimen and conditions, you can simply open the test file with the appropriate settings for quick and easy test setup, instead of readjusting the settings in WinTest.

Use commands on the **Test File** menu (**Test Setup** window) to open and save test files.

NOTE *If the project is secure, WinTest will direct you to open and save test files in the Secure Workspace only. When using **Save As**, you can use the **New Folder** button to create a new folder in the SecureWorkspace to organize your files.*

When you use one of the **Open** commands on the **Test File** menu (**Test Setup** window) to open a test file, WinTest displays the test file name in the **Test Setup** window. To clear the test name from the title bar, use the **Clear Test File Name** command on the **Edit** menu (**Test Setup** window). Once cleared, the test name remains cleared until you open another test file. Clearing the test file name has no effect on the test file.



Working with Workspace Layout Files

A Workspace Layout file (*.ini) contains window information, such as number of windows and their position on the screen, for Scope windows, Meter windows, and Peak Counts windows. When you save a project file, the Workspace Layout file directly associated with that project file is saved at the same time.

You can also save a *copy* of a favorite layout file to a folder that is accessible from Secure and Unsecure workspaces (C:\Bose\WinTest\Common\Layouts). To save or to use a different layout file with a project, use commands on the **File** menu (**Project** window).

Saving Workspace Layout Files

There are two types of workspace layout files:

- One type is directly associated with a project file, and is saved whenever the project file is saved.

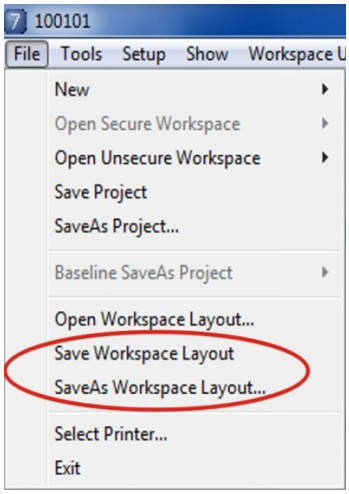
  If you change Scope windows, Meter windows, and/or Peak Counts windows, and want to keep those layout changes with the project file, use the **Save Project** or **SaveAs Project** command on the **File** menu (**Project** window) to save the project.

- The other type is a manually saved copy of the layout that exists on the screen at the time you save it.

  If you change Scope windows, Meter windows, and/or Peak Counts windows, and want to keep a copy of those layout changes, use the **Save Workspace Layout** or **SaveAs Workspace Layout** command on the **File** menu (**Project** window) to save the layout.

  - **Save Workspace Layout** saves changes to the layout file in the (C:\Bose\WinTest\Common\Layouts folder, and overwrites the previously saved file. WinTest does not ask for confirmation before overwriting the existing file.

  - **SaveAs Workspace Layout** saves the layout with a new file name, creating a new file layout file in the (C:\Bose\WinTest\Common\Layouts folder

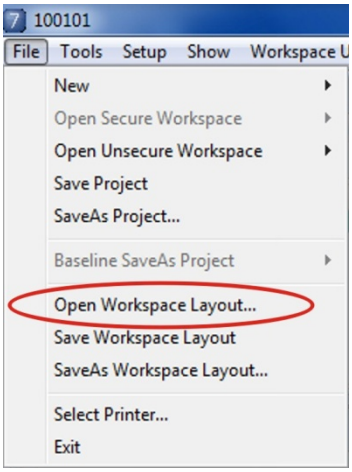


Opening a Different Workspace Layout File

Each project file has a workspace layout file that is directly associated with it, and opens each time the project file is opened.

You can change to a different workspace layout file without stopping or exiting and restarting WinTest. The workspace layout file directly associated with the project file is not changed unless you save the project file.

- Click **Open Workspace Layout** on the **File** menu (Project window) to select a different workspace layout file.



Opening and Moving WinTest Windows

WinTest windows can be conveniently arranged by dragging them to the desired location on the screen. Most windows can also be resized.

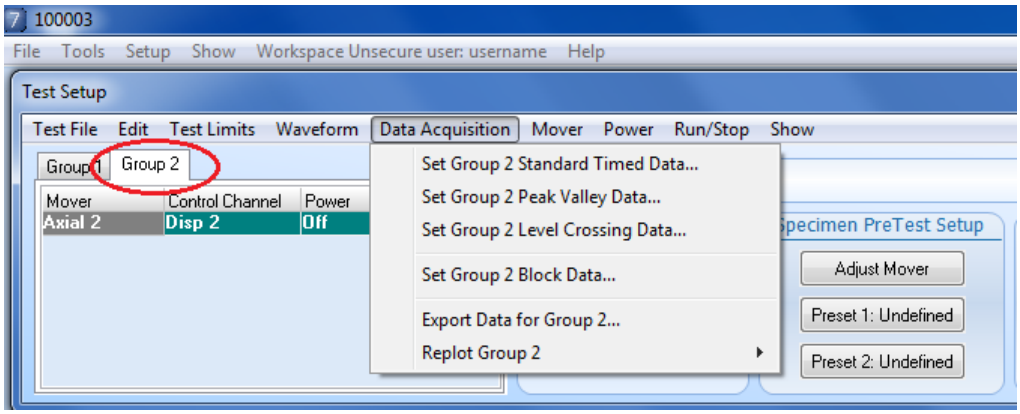
To make arranging WinTest windows easier, Meter windows and Peak Counts windows can be docked together. See the "Docking Meter Windows" section in Chapter 3.

Note that some WinTest windows are modal; that is, if the window is open, you must close it before you can open another window.

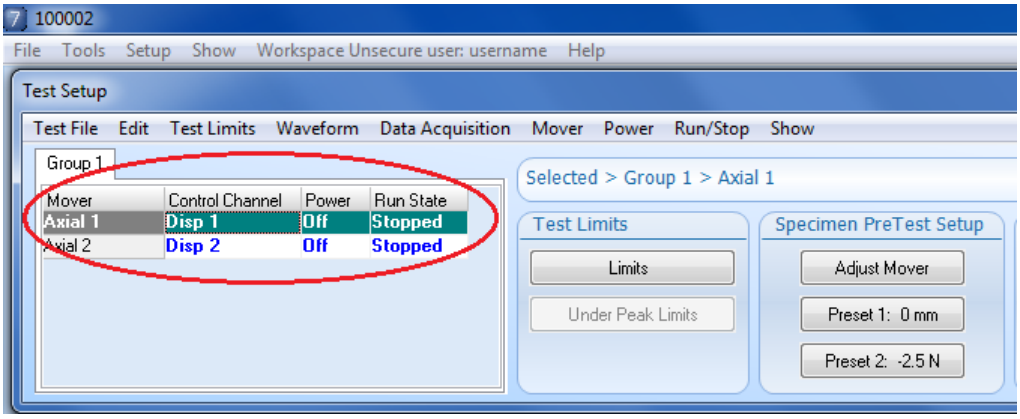
Selecting a Group and Mover

If your system is more complex and includes multiple groups or multiple movers, you will also have to select which group and mover to work with.

To select a group, click the appropriate **Group** tab (**Test Setup** window). The **Test Setup** window then provides access to settings and displays values that pertain to this group.



The **Test Setup** window also displays information about movers in the currently selected group. Mover information is below the **Group** tab(s). If the group has multiple movers, select a mover in the list before adjusting the mover settings. The current mover will be highlighted when selected. This area also shows the current control channel for each mover, whether mover power is on or off, and whether the mover is stopped or running.

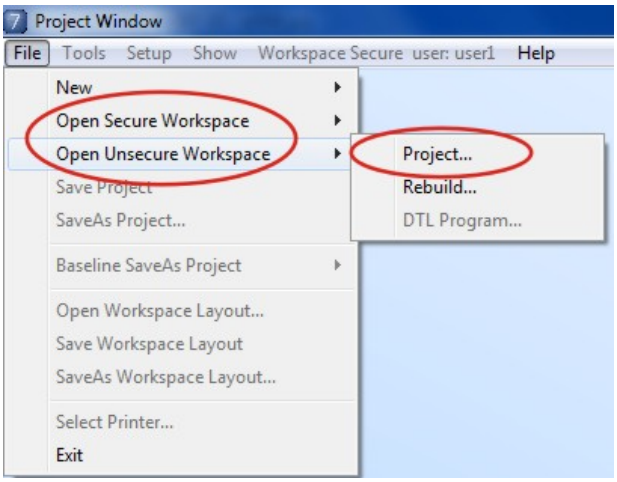


Quick Start Checklist

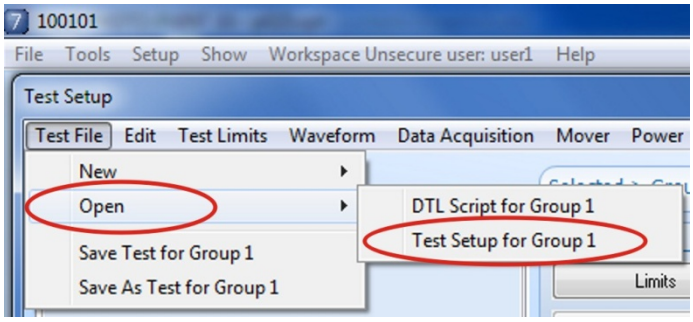
Use the following steps as a quick start checklist for the basic steps to set up and run a test using the WinTest software. The **Test Setup** window makes it easy to set up and run your test.

- ✓ What type of test do you want to run? What are the sample characteristics? What test conditions should be applied to the sample and what are the expected results?

- ✓ Login to Windows, start WinTest, and open a project file.



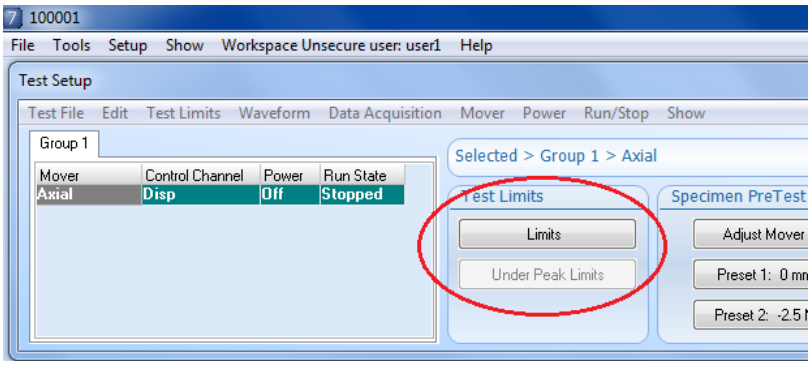
- ✓ If you want to load test settings from a previously saved test file: click **Open** on the **Test File** menu (**Test Setup** window), and then click the **Test** Setup command.



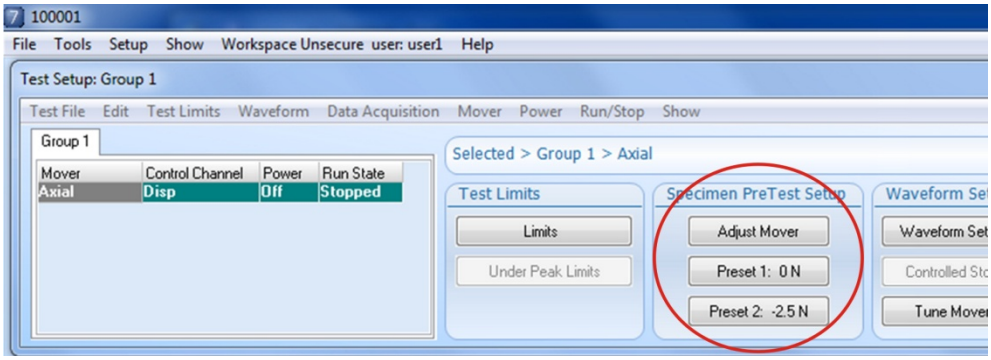
- ✓ Load your test sample with mover power off (see the operating instructions in your *System Reference Manual*). Be sure to tare the load cell after mounting the sample but before gripping both sides of the sample in the fixture (see Chapter 10, "Channel Setup Properties," for details).

- ✓ When you opened the project file, a workspace layout file was also opened. You can open a different workspace layout file, or open or close any display windows such as **Meters**, **Channel Status**, **Peak/Valley** displays, **Peak Counts**, and the **Test Status** window. Open and set up a **Scope** window to show the control channel and the command channel for the mover. See Chapter 3, "Display Windows (Show Menus)," for details. See the "Working with Workspace Layout Files" section earlier in this chapter.

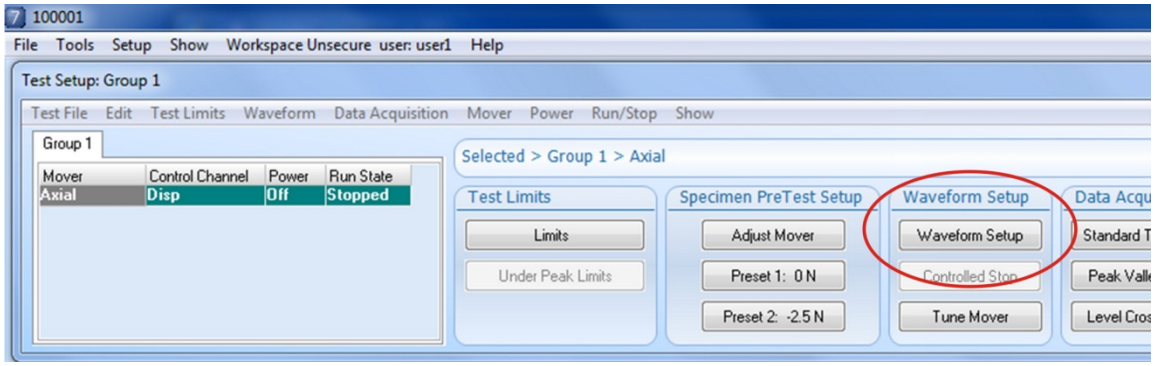
- ✓ Click the **Limits** button (**Test Setup** window) to set limits based on your desired end levels and to set actions that define how the system will respond if a limit is exceeded. Generally, set your limits just beyond the range of levels defined for your test (approximately 5–10%) so that if your test begins to drift beyond the operating range of the test, it will stop. In most situations, the Controlled Stop action is safest. See Chapter 4, "Limits and Actions," for details.



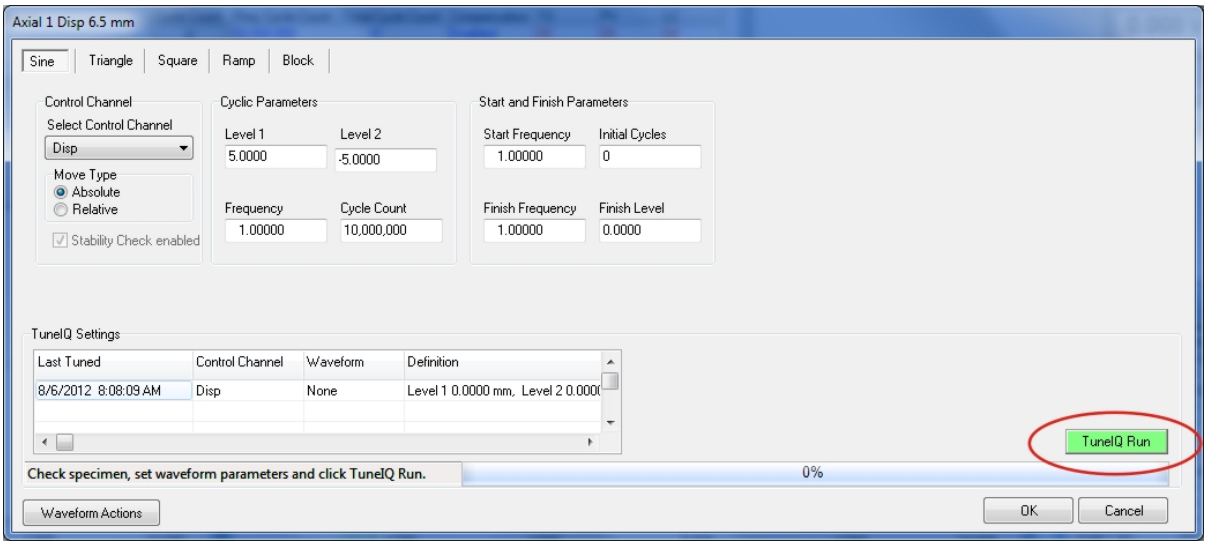
- ✓ If needed, define and use a **Preset** button or the **Adjust Mover** window to apply a preload to the sample.



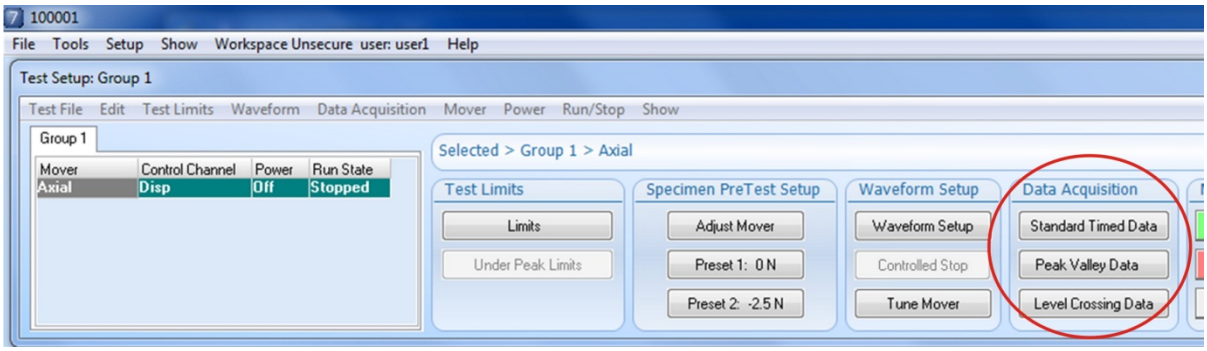
✓ Click the **Waveform Setup** button (**Test Setup** window) to define the waveform shape, test levels, and frequency. The **Waveform Actions** button provides access to the Stop Level and Hold Level settings and an optional Finish Action. See Chapter 6, "Waveform Setup," for details.



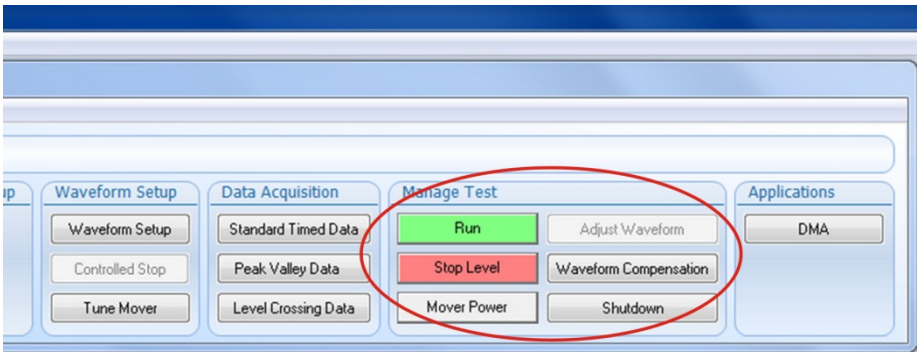
✓ Tune the system response using TuneIQ for the control channel (for example, displacement or load). You can set up and run TuneIQ from the **Waveform Setup** window. If TuneIQ displays a message that it cannot tune the sample, use manual tuning (see Chapter 13, "Manual Tuning").



✓ Use buttons in the **Data Acquisition** panel (**Test Setup** window) to set up data acquisition for the test. See Chapter 7, "Data Acquisition Setup."



✓ Turn on mover power and run your test. Use waveform compensation if needed to help the system achieve the desired levels. See Chapter 8, "Running and Managing a Test," for details.



Working with a Rebuild File

Rebuild functions let you use project files from previous WinTest versions in a new version of WinTest. Use these Rebuild functions to do the following:

- Create a rebuild file (*.rebuild) in the previous version of WinTest.
- Open this rebuild file (*.rebuild) in the current version of WinTest and then save it as a project file.

You will need to create a rebuild file for each project file that you want to use in WinTest 7.

NOTE *Starting with WinTest 7, rebuild (*.rebuild) files are always saved in the same workspace (Secure or Unsecure) as the original project file.*

Rebuilding a Project File from a Previous WinTest Version

The first step is to create a rebuild file using the previous version of WinTest. Use the instructions in Case 1 or Case 2 that correspond to the location of your previous WinTest version and data.

The second step is to open the rebuild file in WinTest 7 and save it as a project file that you can use.

Case 1: The previous version of the WinTest software and the data are accessible on the WinTest 7 computer (either the old hard drive is still connected or the files are in a backup file on the WinTest 7 hard drive named **Bose Backup *xx-xx-xxxx*,** where *xx-xx-xxxx* is the backup date. To create the rebuild file, do the following:

1. Navigate to the location that contains the previous WinTest version and data.
2. Using the previous version of WinTest, create the rebuild file or files (*.rebuild) that you need, if these files do not already exist.
3. Copy the rebuild file(s) into the following folder on the WinTest 7 drive:

   Bose\WinTest\UnsecureWorkspace\Tests

4. Use the Rebuild function in WinTest 7 to open a rebuild file and save it as a project file that you can use in WinTest 7. Refer to the "Open a Rebuild File and Save as a Project File in WinTest 7.1" section later in this chapter for instructions.

Case 2: If you recently upgraded to WinTest 7 for the first time, the WinTest 7 software was installed in the WinTest PC on a new hard drive. The old hard drive, which contains the earlier WinTest software and data, is still physically inside the PC, but it is probably disconnected. To create the rebuild file in this situation, do the following:

1. Turn off the WinTest PC.
2. Open the PC and disconnect the power cable and the Serial ATA cable from the new hard drive.
3. Connect the power cable and the Serial ATA cable that you disconnected in step 2 to the old hard drive.
4. Close the PC, start up the PC, and start the previous version of WinTest.
5. Using the previous version of WinTest, create the rebuild file or files (*.rebuild) that you need, if these files do not already exist.
6. Copy the rebuild file(s) onto a USB flash drive.
7. Shut down the PC, disconnect the power cable and Serial ATA cables from the old hard drive, and use these cables to reconnect the new WinTest 7 hard drive.
8. Copy the rebuild file(s) from the USB flash drive into the following folder on the WinTest 7 drive:

   Bose\WinTest\UnsecureWorkspace\Tests
9. Use the Rebuild function in WinTest 7 to open a rebuild file and save it as a project file that you can use in WinTest 7. Refer to the "Open a Rebuild File and Save as a Project File in WinTest 7" later in this chapter for instructions.

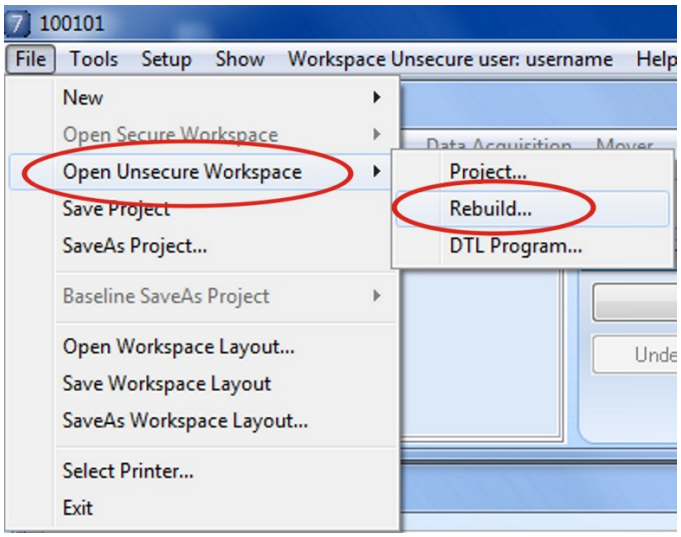
Open a Rebuild File and Save as a Project File in WinTest 7.1

Use this procedure to open a rebuild file (*.rebuild) that was created in a previous WinTest version and save it as a WinTest 7 project file.

1. Make sure the rebuild file is in the folder **Bose\WinTest\UnsecureWorkspace\Tests**

2. Start WinTest 7 and log in as usual. DO NOT open a project file.

3. Click **Open From Unsecure Workspace** on the **File** menu (**Project** window), and then click **Rebuild**.



4. Select the rebuild file (*.rebuild) in the UnsecureWorkspace folder, and then click Open.

5. After an **Activity Comment** window, the **Save Rebuild file as Project file** window opens automatically. It will be pointed at the Bose\WinTest\UnsecureWorkspace\Tests folder. The default project file name will be the same as the rebuild file name. You change the file name if desired.

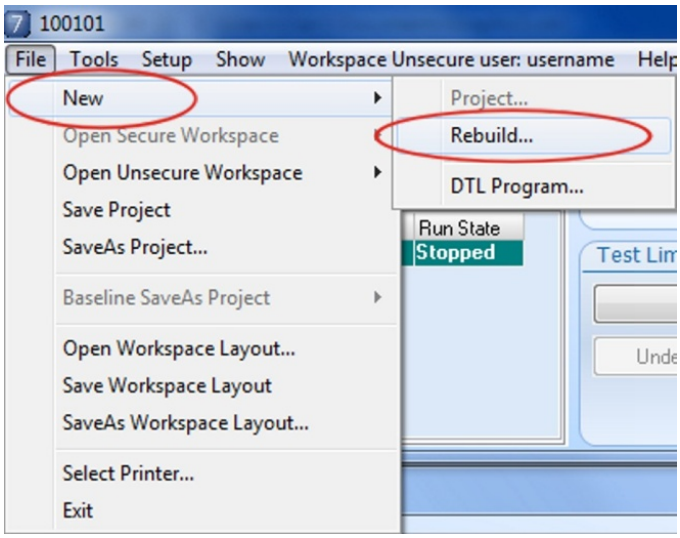
6. Click **Save**, and WinTest will save and then open the rebuilt project file.

7. If you are an authenticated WinTest user, you can now use **Baseline SaveAs** on the **File** menu (**Project** window) to save the project in the SecureWorkspace folder. WinTest will then manage it as a secure project. See the "Using Baseline SaveAs" section in Chapter 14 for information about using this function.

Creating a Rebuild File in WinTest 7.1

Use this procedure to create a rebuild file (*.rebuild) in WinTest 7.1 so that you can use the same project file in a later version of WinTest.

1. Start WinTest 7 and log in as usual.
2. Open a project file.
3. Click **New** on the **File** menu (**Project** window), and then click **Rebuild**.



4. In the **Save rebuild file to unsecure workspace** window, specify the file name and destination for the rebuild (*.rebuild) file.
5. Click **Save**. (An **Activity Comment** window will open after you click **Save**.)

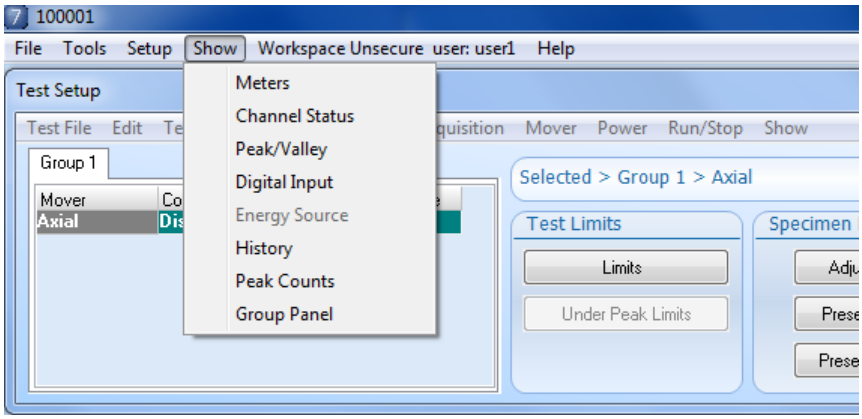
NOTE *If the project was in the Secure workspace in the previous WinTest version, it will also be saved in the Secure workspace in the new version.*

Chapter 3
Display Windows (Show Menus)

Overview

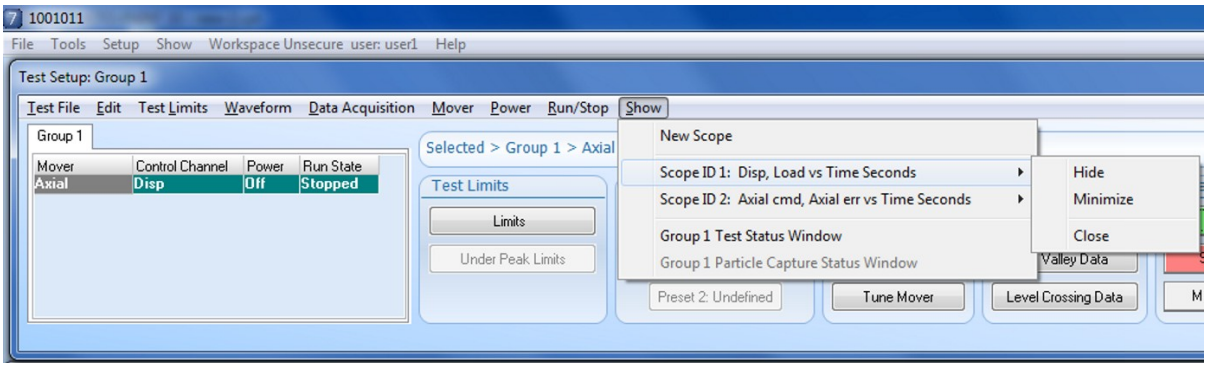
Commands on the **Show** menus (**Project** window and **Test Setup** window) let you monitor the test system and your test in different ways.

Show Menu Overview (Project Window)



Menu Command	Description
Meters	Selects **Meter** windows, one per channel, that show the current transducer output. A right-click menu provides access to channel setup properties and window commands.
Channel Status	Displays the current transducer output for a selected list of channels.
Peak/Valley	Displays the current Peak/Valley readings for a selected list of channels.
Digital Input	Displays the current state of all digital inputs.
Energy Source	*Bose personnel only; not available to WinTest users.*
History	Displays the **History Viewer** window, which displays tracking information from the current project session file. See Chapter 9, "Reviewing Test Results," for more information.
Peak Counts	Selects **Peak Counts** windows, one per channel, that show the number of times the channel has achieved a Peak since counting began. A right-click menu provides access to Peak/Valley settings and window commands.
Group Panel	Opens the **Test Setup** window or moves it to the front of the WinTest display.

Show Menu Overview (Test Setup Window)



Menu Command	Description
New Scope	This command opens a new Scope window. You can have up to four Scope windows at a time.
Scope ID #: *Channels*	A Scope window displays data scans using functions that are similar to a storage oscilloscope. Scope scans can be saved in files and exported as comma-delimited or text files. Each time a new Scope window is opened, a new menu item is inserted below the **New Scope** menu item. The new Scope is numbered, and named after the scan channels selected for display in that particular Scope. Each Scope window has its own menu items that control how it is displayed: Hide or Show, Minimize or Maximize, and Close.
Test Status Window	Displays comprehensive information for all movers in the group during test execution, including cycle counts, information about the current step in a block waveform, and information about data acquisition parameters.
Particle Capture Status Window	An optional WinTest feature. If your system includes this option, refer to your *System Reference Manual*.

Meters

Each Meter window displays the current transducer output for a specific channel. Because values are updated twice per second, Meter windows are most useful for monitoring lower frequencies or static positions.

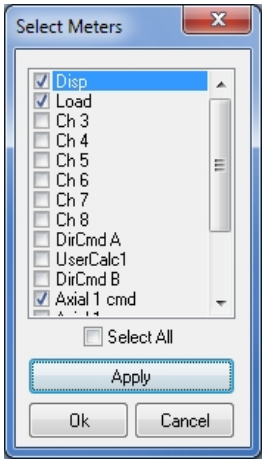
A right-click menu provides access to channel setup properties and to Meter window display options.

Meter windows can be docked together, making it easy to move multiple Meter windows with one motion, instead of moving Meter windows one at a time.

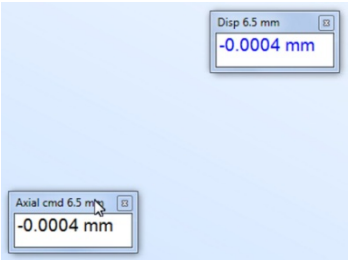
NOTE *All of the docking information in this section applies to the Peak Counts windows, too.*

Selecting Meter Channels

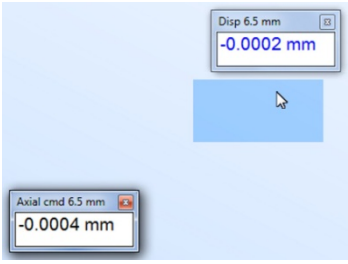
There is a Meter window for each channel, and you can select which channels to display. When you open a project file, all **Meter** windows open in their previous locations, based on the last time the project file was saved.



1. On the **Show** menu (**Project** window), click **Meters.**
2. Select or clear the check boxes to choose which individual channels to display or select the **Select All** check box to display all channels. A Meter window will open for the selected channels.
3. Click **Apply** to apply changes and leave the window open, or click **Ok** to close this window and open the **Meter** windows for the selected channels. (**Meter** windows for cleared check boxes will close.)
4. Drag Meter windows to convenient locations on the screen. Notice that dragging a Meter window only drags a "shadow" until you release the dragged window.



Grabbing a window

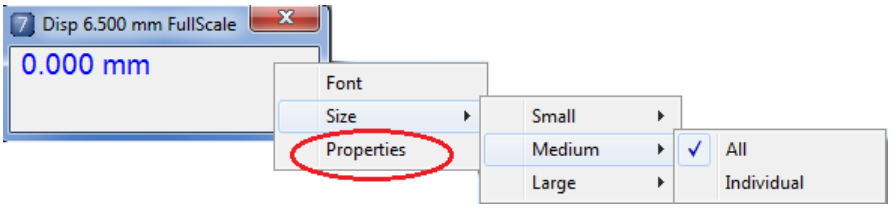


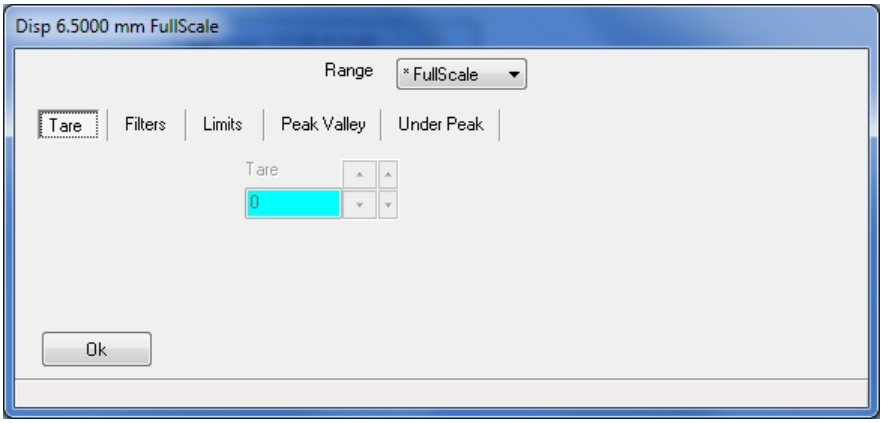
Dragging a window

Meter Window Commands

Right-click in a **Meter** window to open a list of commands:

Command	Description
Font	Lets you change the font type, style, and size in this window.
Size	Lets you resize the window to the small, medium, or large standard size. After selecting the size, click **All** on the submenu to resize all the **Meter** windows, or click **Individual** to resize this window only. You can also resize windows by dragging their corners or edges.
Properties	*Control channels and calculated channels only.* Provides access to the channel configuration settings, such as tare, filter selection, limits, Peak/Valley band, and Under Peak limits. See Chapter 10, "Channel Setup Properties," for more information.
Calculated	*Calculated channels only.* Provides access to the calculated channel configuration settings. See Chapter 10, "Channel Setup Properties," for more information.





Docking Meter Windows

This section introduces you to the docking indicator, explains how to dock and undock Meter windows, and shows examples of docked meters.

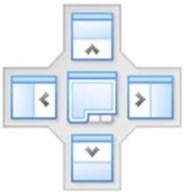
NOTE *All of the docking information in this section applies to the Peak Counts windows, too.*

Before you can dock Meter windows, you have to display them. See "Selecting Meter Channels" earlier in this chapter for more details.

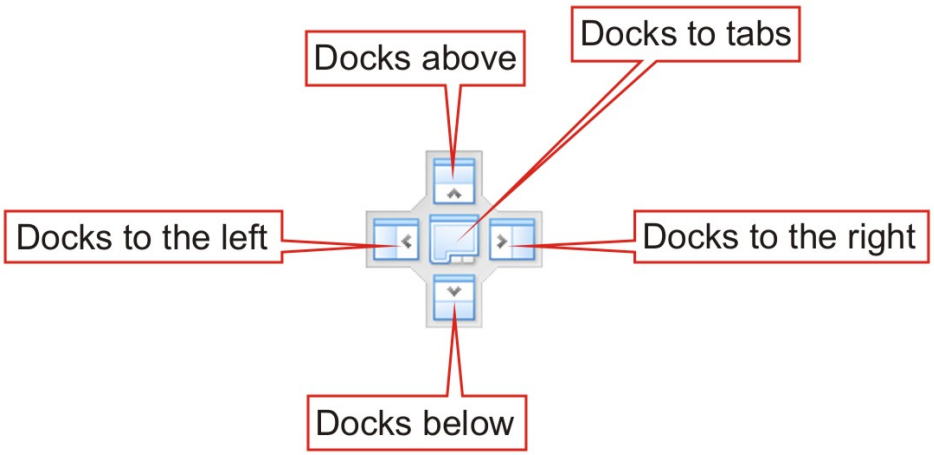
After you have selected and displayed Meter windows for the channels you want to monitor, you can dock some or all of them together. Meter windows can be docked and undocked with a simple drag-and-drop, plus multiple docked Meter windows can co-exist.

Introducing the Docking Indicator

Here's what the docking indicator looks like. (During docking, it will appear on top of a Meter window.)



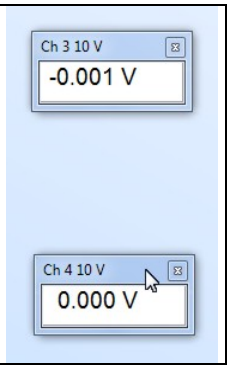
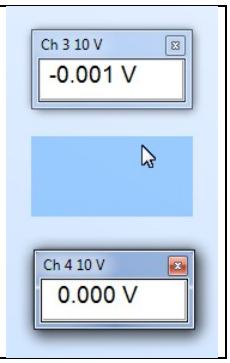
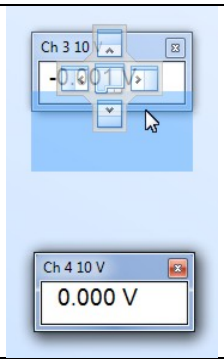
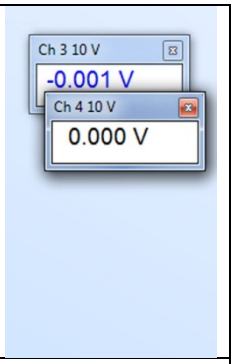
Here's what the buttons on the docking indicator do with a dragged-and-dropped Meter window.



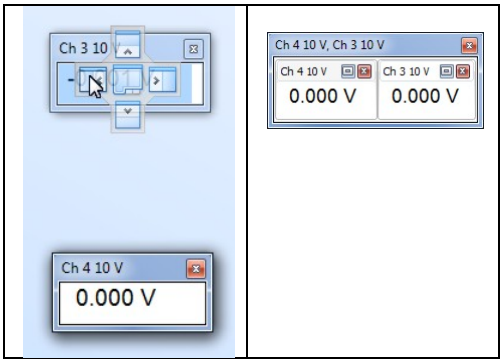
The next subsection shows how to dock Meter windows.

How to Dock Meter Windows

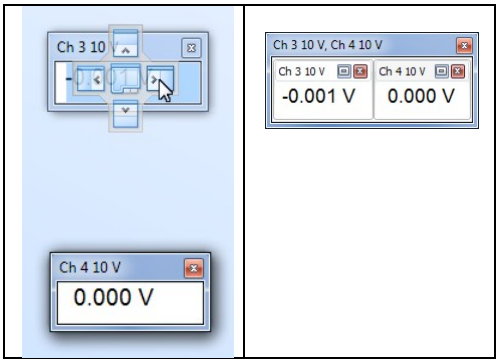
Here are the basic steps for docking two windows. The examples show the Ch 4 Meter window being docked with the Ch 3 Meter window.

With your mouse, click and hold on the title bar in the Ch 4 window.	
Drag the Ch 4 window toward the Ch 3 window.	
When the mouse cursor touches any edge of the Ch 3 window, the docking indicator appears. Note: If you drop the Ch 04 window now without moving the cursor over the docking indicator, the Ch 04 window will appear next to the Ch 03 window, but will not be docked.	  Missed docking

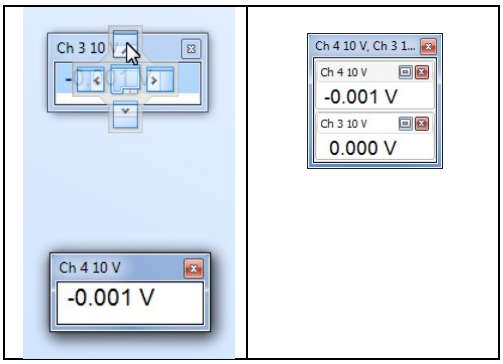
After the docking indicator appears, move the cursor over one of the docking indicator buttons and drop the window. The mouse actions and results for docking left, right, above, and below are shown in the next set of graphics.



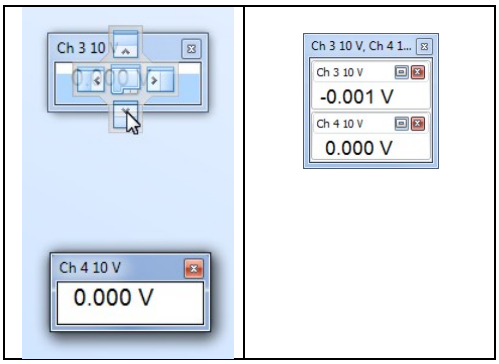
"Dock Left "Action and Result



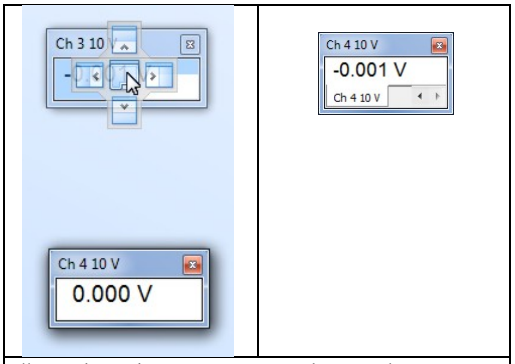
"Dock Right "Action and Result



"Dock Above "Action and Result



"Dock Below "Action and Result

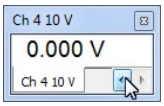
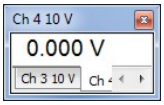
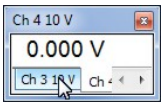
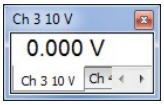


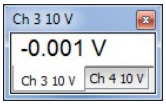
"Dock Tabs" Action and Result *

* See the "Using the Tabs Window" section on the next page.

Using the Tabs Window

There are two ways to use the tabs window.

One method is to click a navigation arrow to reveal the Ch 03 tab.	
	
Then, click the Ch 03 tab.	
The Ch 03 window is displayed.	

The other method uses the mouse to resize the window (on the left or right edge) until both tabs are visible. Then click the tab you want to display.	

How to Undock Meter Windows

Undocking a Meter window is easy, and there are two ways to do it.

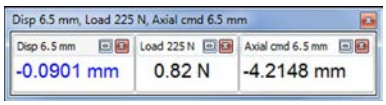
- Use the mouse to drag an individual window or tab out of a docked window and drop the window onto the workspace.
- Double-click the title bar of the Meter window you want to undock.

NOTE *If you undock the wrong window, you can double-click its title bar and it will redock itself.*

Example Docked Configurations

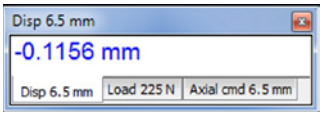
You can have more than two windows docked in a given configuration.

Horizontal



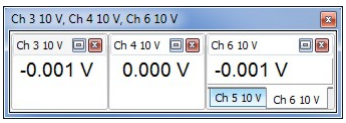
Vertical

Tabs

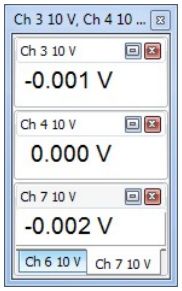


You can even dock a tabs window with a horizontal or a vertical configuration.

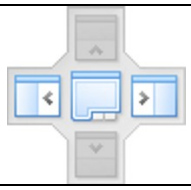
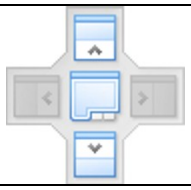
Horizontal with Tabs



Vertical with Tabs



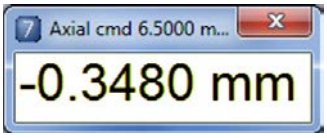
Note: *After two or more Meter windows have been docked into a horizontal or vertical configuration, additional Meters can only be added in that same configuration or in tabs. The docking indicator changes to show that.*

	
only horizontal and tabs docking are enabled	only vertical and tabs docking are enabled

Channel Saturation Warning

Channels have a maximum operating range. Saturation of a channel is when 100% of the operating range of a channel is being used. Saturation should be avoided because it can cause a waveform to become distorted, resulting in unreliable test data.

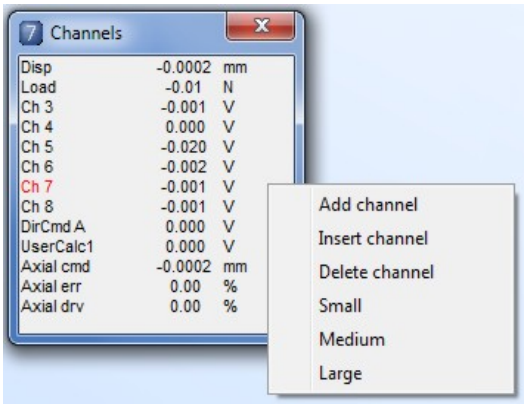
WinTest provides a visual cue that a channel has reached or exceeded 95% of its operating range—the background color of the channel's Meter window changes from white to yellow.



Normal Meter Window

Saturation Warning

Channel Status



The **Channels** window displays the current transducer output for a list of selected channels. Like the **Meter** windows, channel status values are updated twice per second. (Use **Meter** windows to show current transducer output for individual channels or to access the channel setup properties.)

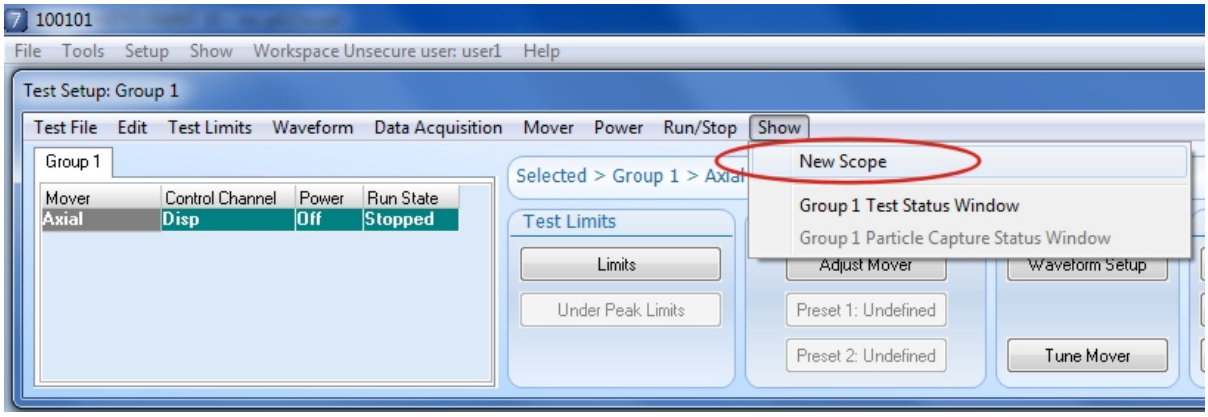
On the **Show** menu (**Project** window), click **Channel Status** to open the **Channels** window. This window also provides the following right-click commands:

Command	Description
Add channel	Lets you select and add a channel to the bottom of the channel list.
Insert channel	Lets you insert a channel above a selected channel in the channel list.
Delete channel	Removes the selected channel from the displayed channel list.
Small	Displays the window in a small size with a small font.
Medium	Displays the window in a medium size with a medium font.
Large	Displays the window in a large size with a large font.

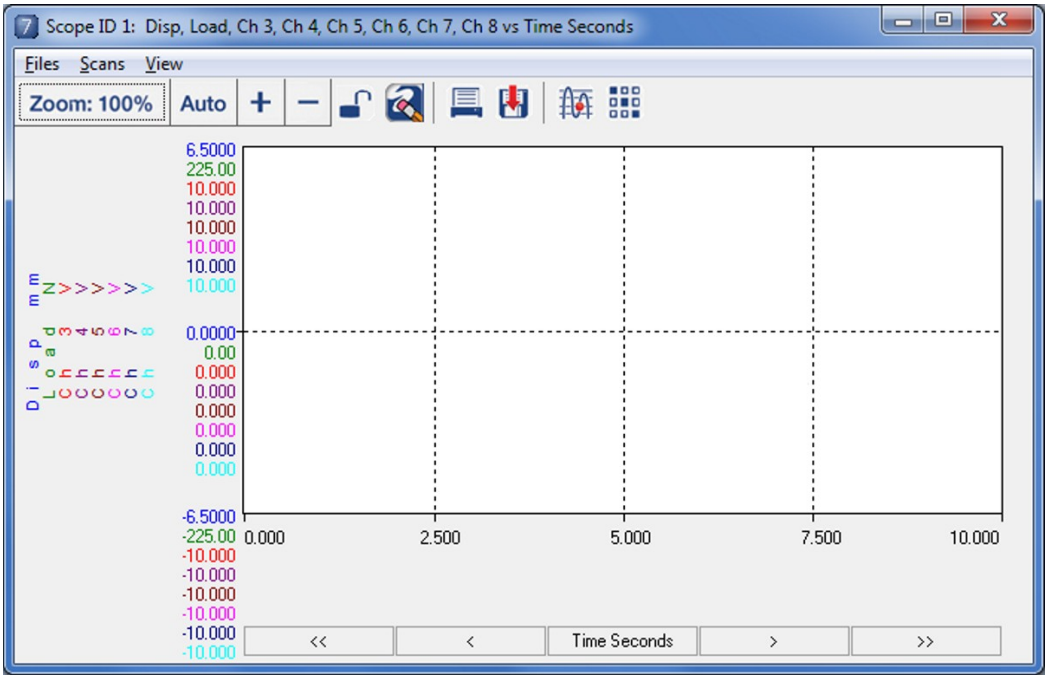
Scope

A **Scope** window displays values in real time for selected channels, with functions similar to a storage oscilloscope. WinTest allows you to have up to four Scope windows open at the same time. You can display channels as a function of time, or you can plot one channel versus one or more other channels (for example, plot load versus displacement for a hysteresis plot). Additionally, you can change a Scope window's display characteristics (scan time, scan points, channels, scaling, etc.) at any time, including when a test is running.

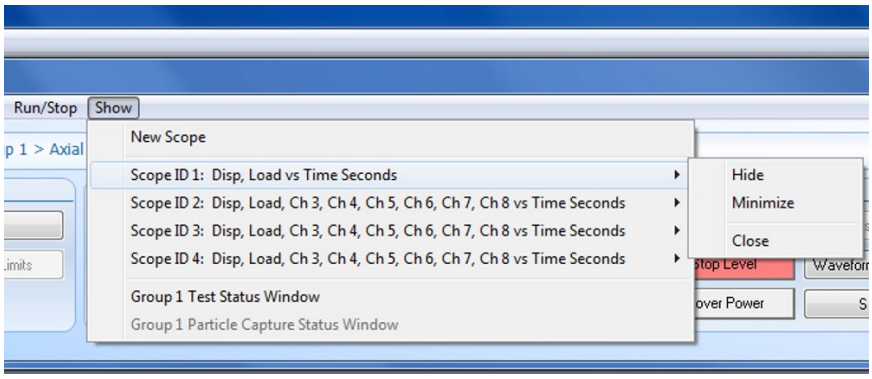
Click **New Scope** on the **Show** menu (**Test Status** window) to open a **Scope** window.



This is the default set of channels displayed in a new scope window. Later in this chapter, the "Selecting Scope Channels" section will show you how to change which channels are displayed.

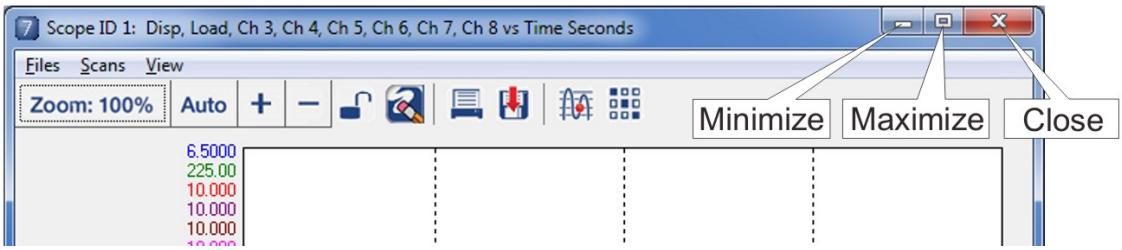


Once you have opened a Scope window, a new menu item will appear underneath the **New Scope** menu item. (Also see the "Scope Window Numbering" section later in this chapter.) The next graphic shows the menu with four Scope windows open, with Scope ID 1 having been renamed. It also shows the initial display controls available on the **Show** menu for a Scope window.

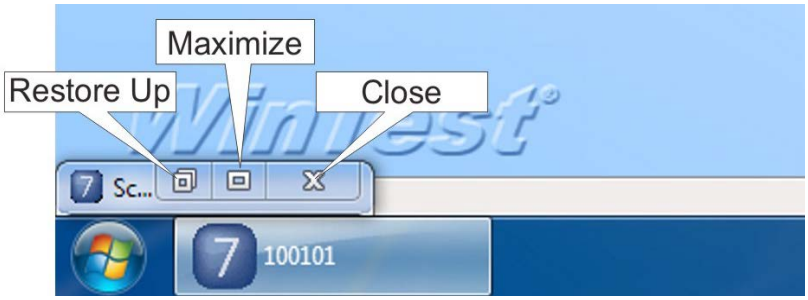


Command	Description
Hide	Removes the Scope window from the workspace, and the menu item changes from **Hide** to **Show**. Clicking **Show** is the only way to redisplay the hidden Scope window. This command is also available on the Scope's **View** menu.
Minimize	Reduces the Scope window to the lower left corner of the WinTest workspace, and the menu item changes from **Minimize** to **Restore Up**.
Close	Closes the Scope window.

This graphic shows the display controls available in an initial Scope window.

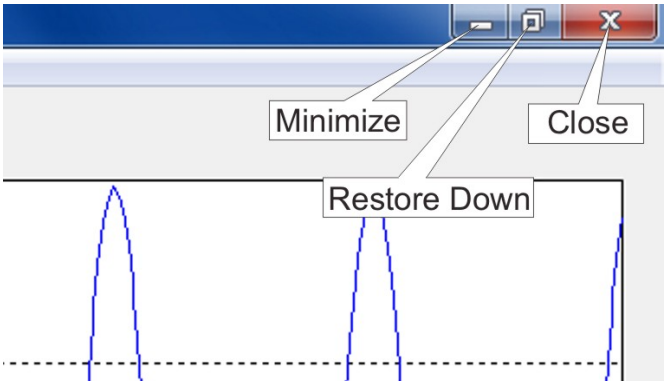


This graphic shows the display controls available in a minimized Scope window.



Command	Description
Restore Up	Returns the Scope window to the size it was when **Minimize** was clicked. This command is also available for the Scope on the **Show** menu.
Maximize	Displays the Scope window full screen.
Close	Closes the Scope window.

This graphic shows the display controls available in the upper-right corner of a maximized Scope window.

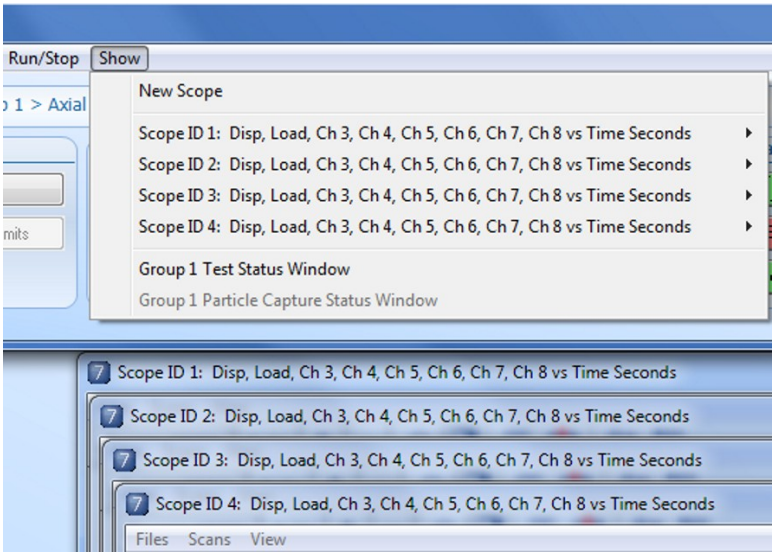


Command	Description
Minimize	Reduces the Scope window to the lower left corner of the WinTest workspace
Restore Down	Returns the Scope window to the last "medium" size it was other than **Minimize** or **Maximize**.
Close	Closes the Scope window.

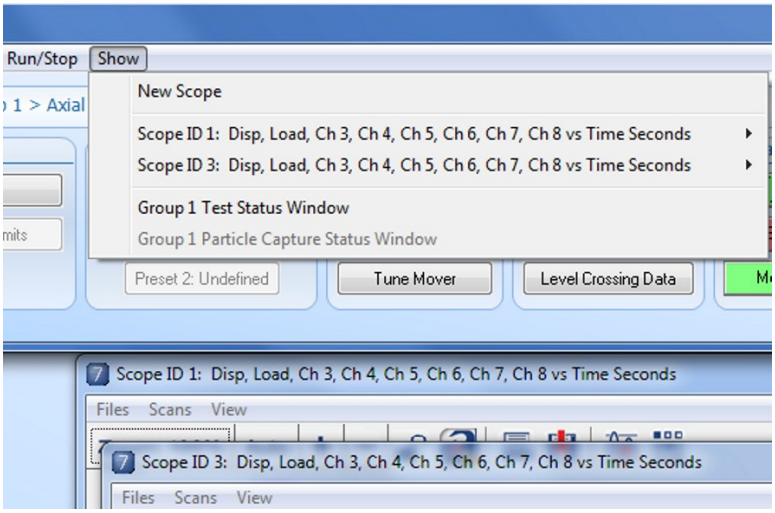
Scope Window Numbering

WinTest controls the numbering of Scope windows. The section explains how the numbering is done.

The first four Scope windows opened are numbered Scope ID 1 through Scope ID 4.



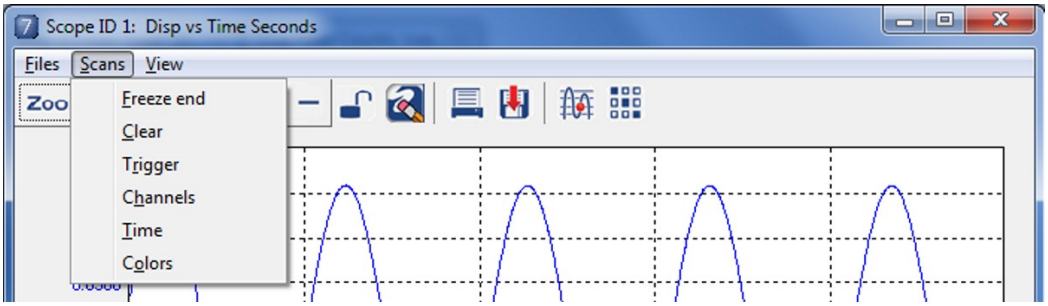
If you close Scope ID 2 window and Scope ID 4 window, the other Scope windows do not renumber.



If you open additional Scope windows, they receive the lowest unused window number. Following the example on this page, the next new Scope window will be numbered Scope ID 2.

Scans Menu

A Scope scan defines a full screen of data in the **Scope** window. Use commands on the **Scans** menu (**Scope** window) to define and manipulate Scope scans.



Command	Description
Freeze end/ Unfreeze or /	Freezes the display at the end of the current scan and changes the menu command to **Unfreeze**. System functions continue while the Scope display is frozen. While the Scope is frozen, you can view, save, or print a screen capture, zoom in and out, or click on the scan to see specific numeric values. To unfreeze a frozen scan and display current data again, click **Unfreeze** on the menu or click the button again. NOTE While a scan is being captured, the **Freeze End** button changes to a green **Unfreeze** button until the end of a full scan. At the end of the full scan, the **Unfreeze** button changes from green to red
Clear or	Clears the Scope of all data and immediately begins a new scan.
Trigger or	Define trigger criteria for starting a new Scope scan, based on time intervals, the cycle count for a particular mover, etc. See "Scan Scope Triggers" in this chapter for more information. Note While a specific trigger is enabled, the **Trigger** button changes to .
Channels or	Use this option to select channels to display on the Scope. See "Selecting Scope Channels" in this chapter for more information.
Time	Specifies the time interval (seconds) and number of data points in each Scope scan. Adjust these parameters so each scan is a smooth trace and displays a useful number of cycles. See "Scan Points/Time" in this chapter for more information.
Colors	Selects colors for the plot area and grid lines, the plot background, and channel traces.

Selecting Scope Channels

1. Click **Channels** on the **Scan** menu (**Scope** window) or click the button on the toolbar to select channels included in that specific Scope display.

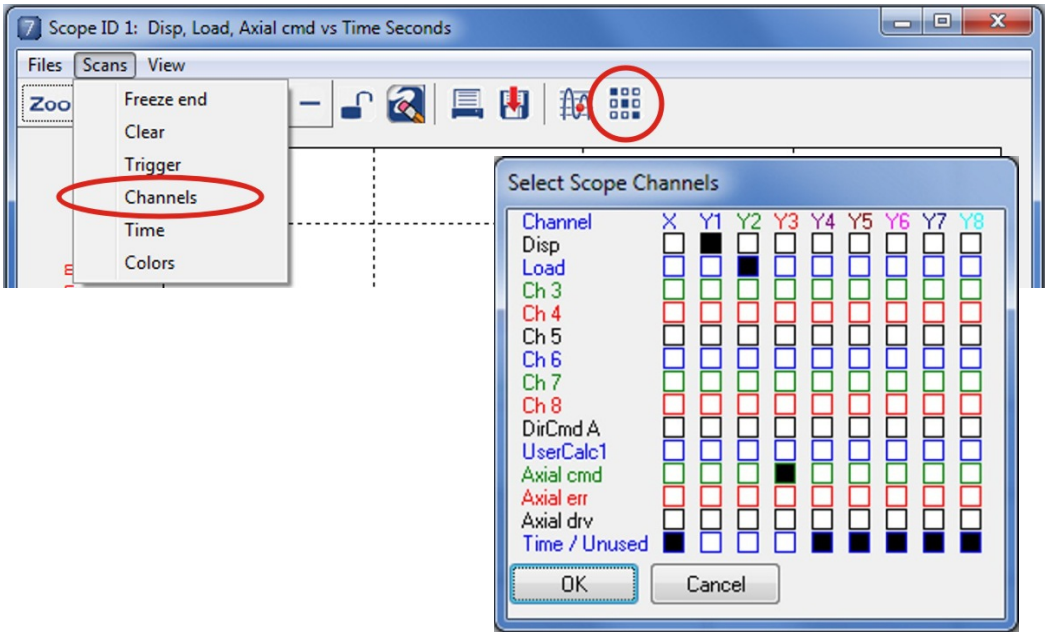
2. In the **X** column, select the **Time/Unused** check box to place time on the x-axis. To plot one channel versus another, select the channel for the x-axis.

3. In the numbered Y columns, click in the row for a channel to include in the Scope display on the y-axis. Select the **Time/Unused** check box for any unused channels.

4. Click **OK** to apply any changes.

NOTE *The names of the selected channels are displayed in the title bar of the Scope window.*

Example: The following selections display data for the Disp, Load, and Axial Cmd channels versus time in the Scope.

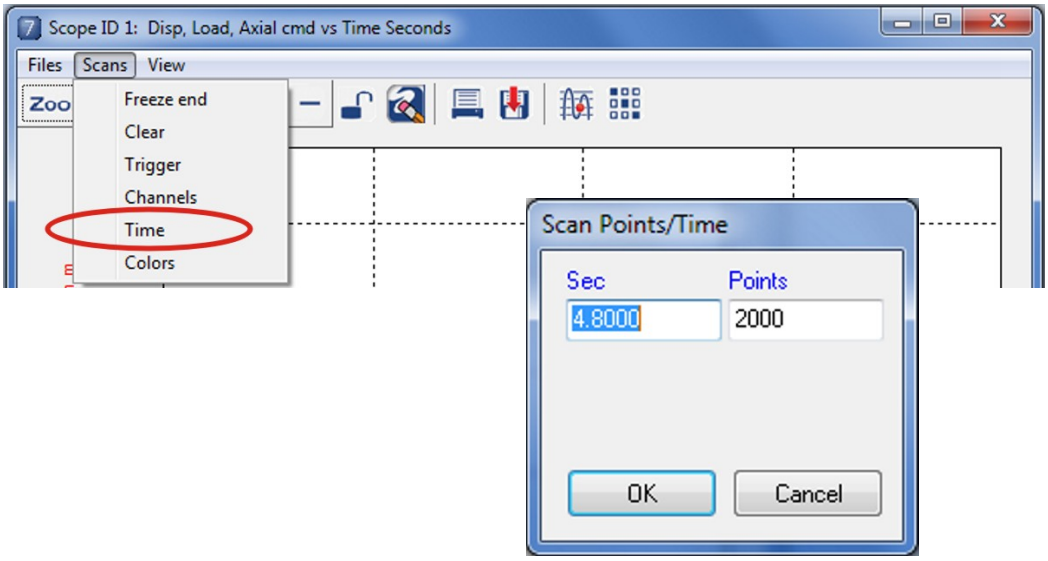


NOTE *When plotting one channel versus another, time is not displayed in the* ***Scope*** *window, but time information can be captured by saving the Scope scan.*

Scan Points/Time

The scan time and number of points per scan determine the length of time and the number of data points that are displayed in each Scope scan. Adjust these values so that the data is displayed in a useful way.

To set the scan time and number of points for a Scope window, click **Time** in the **Scans** menu (**Scope** window).



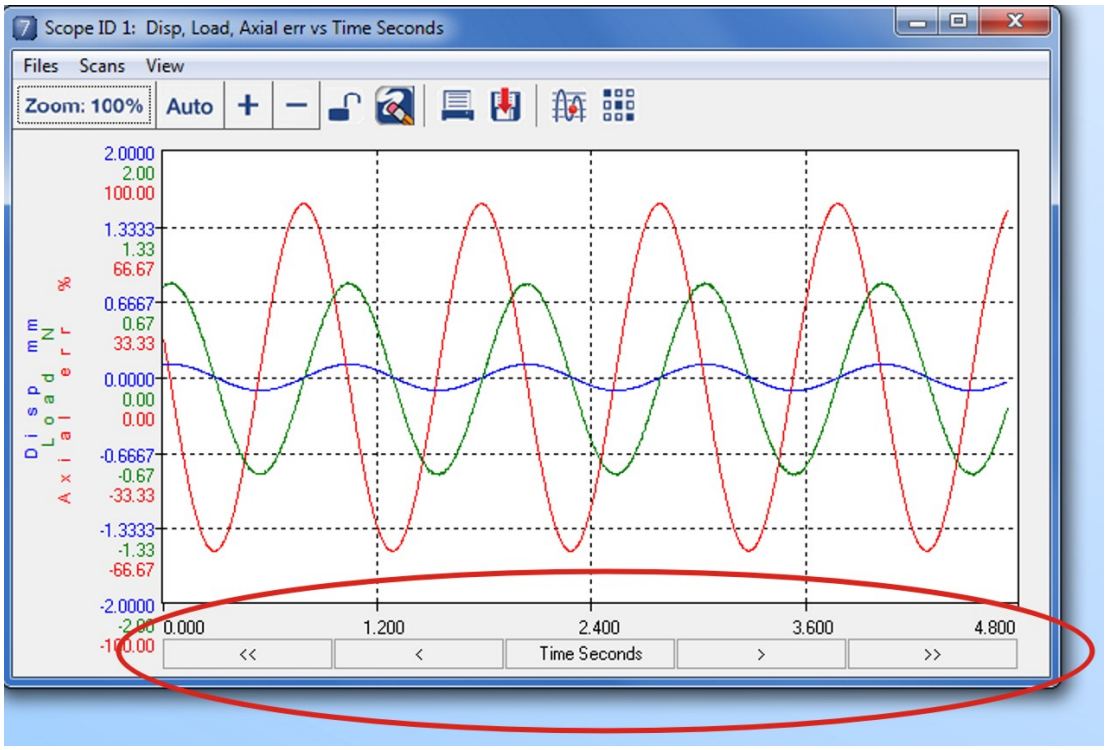
Define the scan in the **Scan Points/Time** window and click **OK** to apply any changes. It may be necessary to adjust these parameters a few times to display the data in the way most useful for you.

Parameter	Description
Sec	Time for each scan, in seconds. The valid range is displayed when you hold the cursor over this field. Set the time to display just a few cycles. You can also quickly change the scan time by clicking the arrow buttons along the bottom of the window, as described on the next page.
Points	Number of data points in each scan so that the Scope display shows meaningful data. The waveform should be smooth with no distortion or aliasing. If there is distortion, increase the number of data points. If there is aliasing, decrease the number of data points. For saved Scope scans, this value also affects the size of the Scope scan file (more data points result in a larger file).

NOTE *The time intervals along the x-axis are adapted to your system's interrupt rate and may be slightly different than what you entered.*

The arrow buttons along the bottom of a Scope display let you quickly increase or decrease the scan time in small or large increments, without opening the **Scan Points/Time** window.

Button	Description
< <<	Decreases the scan time in smaller increments. Decreases the scan time in larger increments.
>>>>	Increases the scan time in smaller increments. Increases the scan time in larger increments.

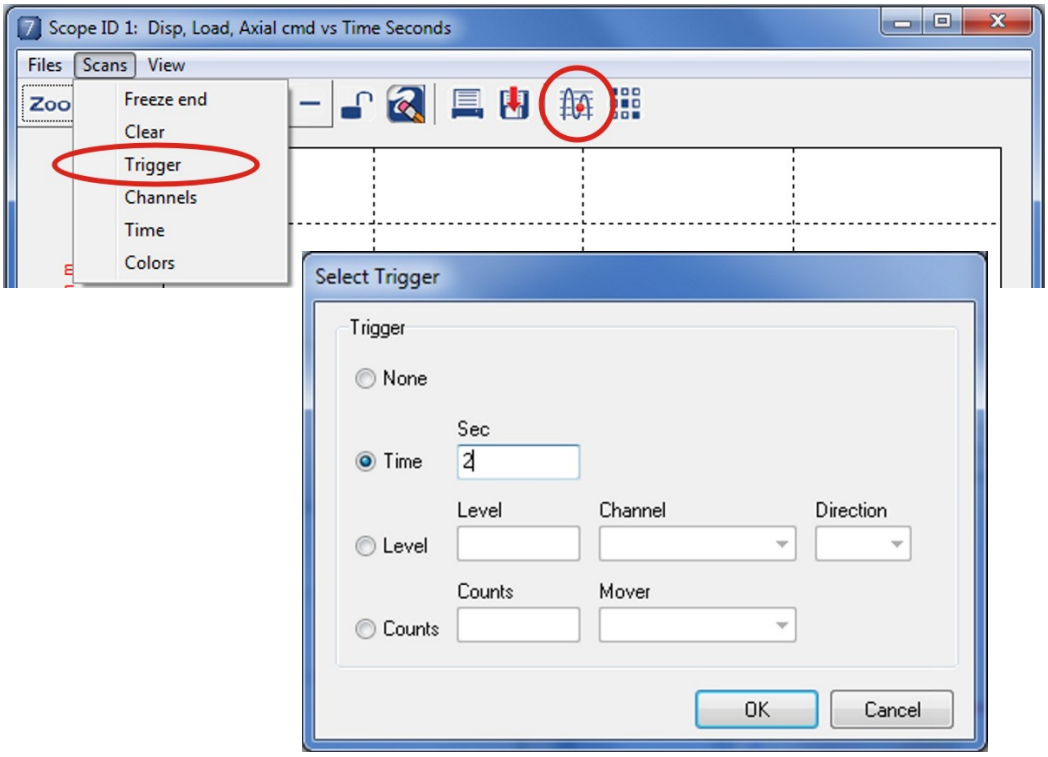


Scope Scan Trigger

Triggers define criteria for starting the next Scope scan. For example, you can define a trigger to start a Scope scan when a channel reaches a specific level, or to start a Scope scan at specific intervals based on cycle count or time.

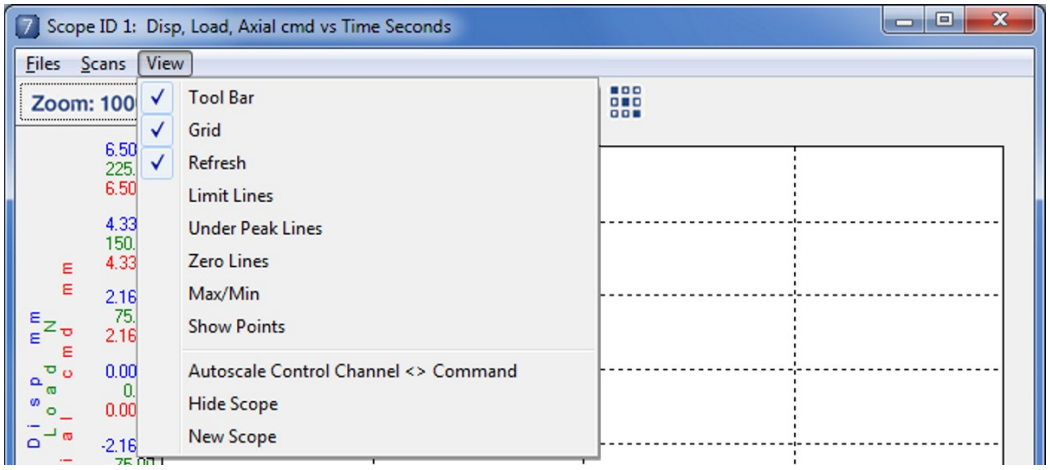
Click on the Scope toolbar, or, click **Trigger** on the **Scans** menu (**Scope** window). In the **Select Trigger** window, select the trigger type and define its parameters, and then click **OK**. When a trigger is controlling the start of the next Scope scan, the trigger icon is blue . There are four choices available under **Trigger Type**.

Trigger Type	Description
None	Data is displayed continuously.
Time	The next scan begins after the specified time interval (seconds).
Level	The next scan begins when the selected **Channel** reaches the **Level** value while moving in the selected **Direction**: **Up** (increasing) or **Down** (decreasing).
Count	The next scan begins when the cycle count for the selected **Mover** is incremented by the specified number of **Counts**.



Scope View Menu

Select options on the **View** menu (**Scope** window) to use in a Scope window. These options apply only to the **Scope** window in which they are selected—each **Scope** window's **View** options are independent of other Scope windows' **View** options.



Menu Item	When Selected
Toolbar	Displays the Scope toolbar.
Grid	Displays a grid of horizontal and vertical reference lines to help interpret the displayed values.
Refresh	Clears the display at the end of each scan and starts a new scan. (If not selected, previous scans remain on the screen for comparison).
Limit Lines	Displays Limit values (if defined) for all displayed channels, in the same color as the channel. Limit lines can visually warn users that test conditions are approaching a limit value.
Under Peak Lines	Displays Under Peak limits (if defined) for all displayed channels, in the same color as the channel. These lines can help visually warn users that test conditions are approaching an Under Peak limit value.
Max/Min	Displays minimum and maximum values for all displayed channels in a box at the top of the Scope display. *NOTE When comparing Max/Min values in the Scope to Peak/Valley values, keep in mind that the Scope values show the minimum and maximum values for each scan (updated throughout the scan), while Peak/Valley values are for each cycle.*
Show Points	Displays data as discrete points instead of as a continuous line. Use this feature to determine if the scan has sufficient data points before starting to save scans.

Menu Item	When Selected
Autoscale Control Channel <> Command	Changes the way the Auto button behaves when it automatically scales all channels. See also "Scaling the Scope Axes" in this chapter.
Hide Scope	Completely hides the **Scope** window from view. To make that **Scope** window visible again, use the **Show** menu in the **Test Setup** window.
New Scope	Adds a new Scope window to the workspace, up to a maximum of four Scope windows displayed at any one time.

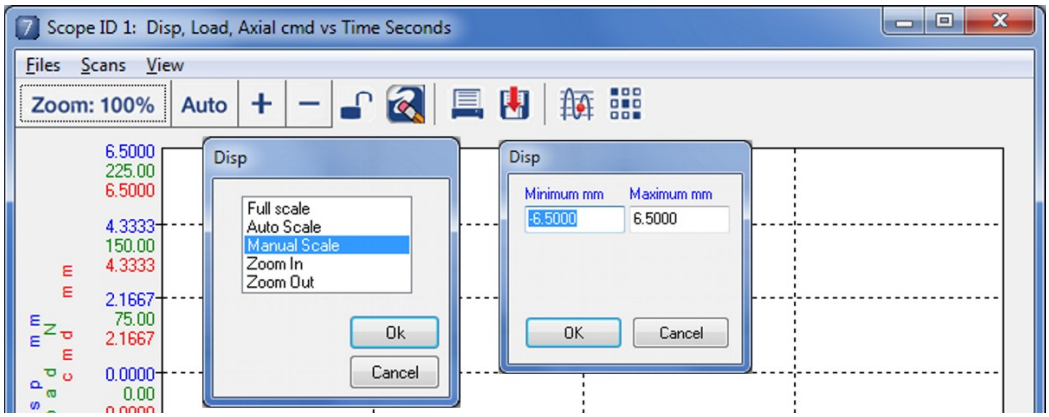
Scaling the Scope Axes

The scaling buttons on the toolbar change scaling for all displayed channels.

Click	To do this
Zoom: 100%	Changes the axis scale to 100% full scale for all channels.
Auto	Changes the axis scale for all displayed channels to values that are 10% larger than the channel maximum and 10% smaller than the channel minimum. Scaling will change as the maximum and minimum values vary for each channel. Auto scaling works best when the **Max/Min** view option is active.
+	Zoom in for all displayed channels by 5% of full scale.
–	Zoom out for all displayed channels by 5% of full scale.

To change scaling for only one specific channel:

1. Click on the axis label for the channel to rescale (left side of Scope).
2. Select a scaling option in the window that opens.
   - The **Full scale**, **Auto Scale**, **Zoom In**, and **Zoom Out** options have the same function as the corresponding toolbar buttons, but only for one channel.
   - For **Manual Scale**, enter the **Minimum** and **Maximum** scale values for the Y-axis. Be sure to enter the **Minimum** and **Maximum** values in the correct order, or the Scope display will be inverted. (**Minimum** is negative and **Maximum** is positive.)
3. Click **OK** to apply any changes.

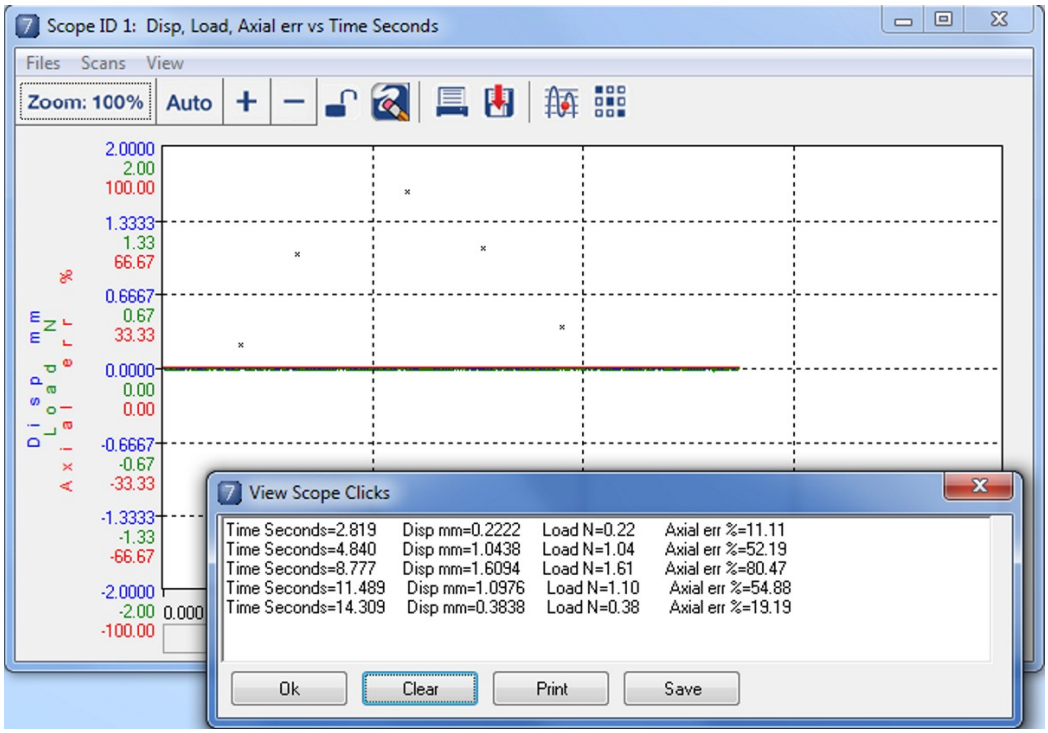


Clicking to Read Scope Data Values

These options work best when the Scope display is frozen.

Left-Click in Scope Display

When you left-click in the **Scope** display, a small x marks the spot in the display and the **View Scope Clicks** window opens. This window lists the x value and the y value using the scale defined for each channel. Each time you left-click, a new value is added to the bottom of the list. Left-clicks work the same way whether or not the Scope is frozen.



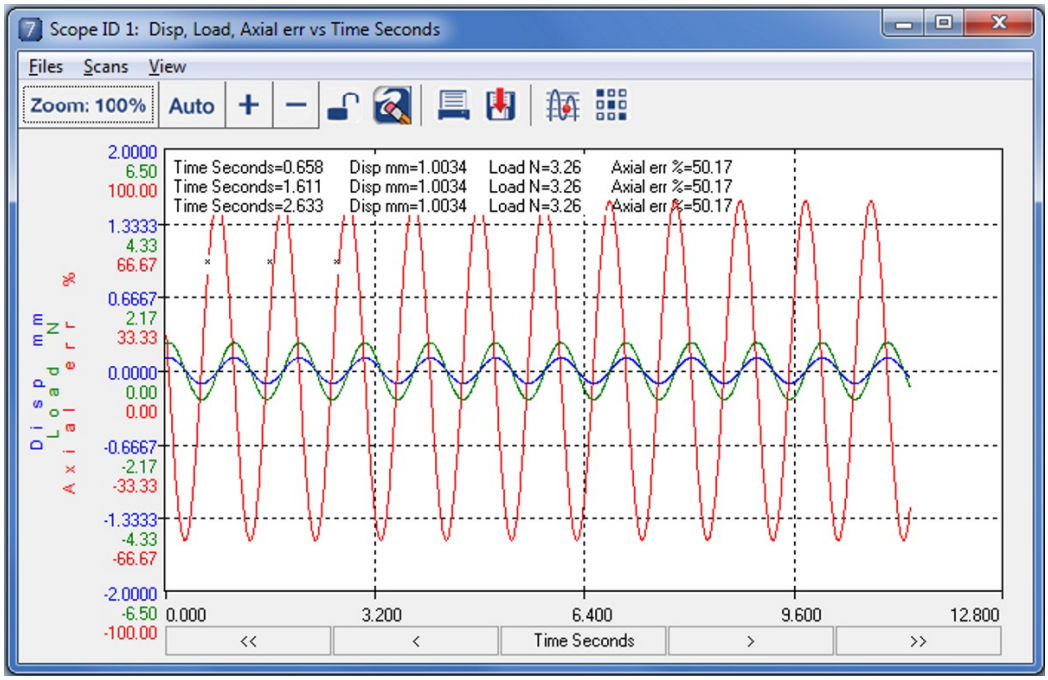
The **View Scope Clicks** window provides these command buttons:

Button	Description
Ok	Closes the window. The data in the window is retained and can be seen in the **View Scope Clicks** window the next time you left-click in a Scope display.
Clear	Clears all left-click values in the **View Scope Clicks** window and then closes the window. It also clears the small x marks in the Scope window.
Print	Prints the displayed values on the attached printer or saves them in a file, according to the selections in the **Printer Setup** window.
Save	Opens a window in which you can save the left-click values in a .txt file. WinTest will prompt you to enter the file name and destination.

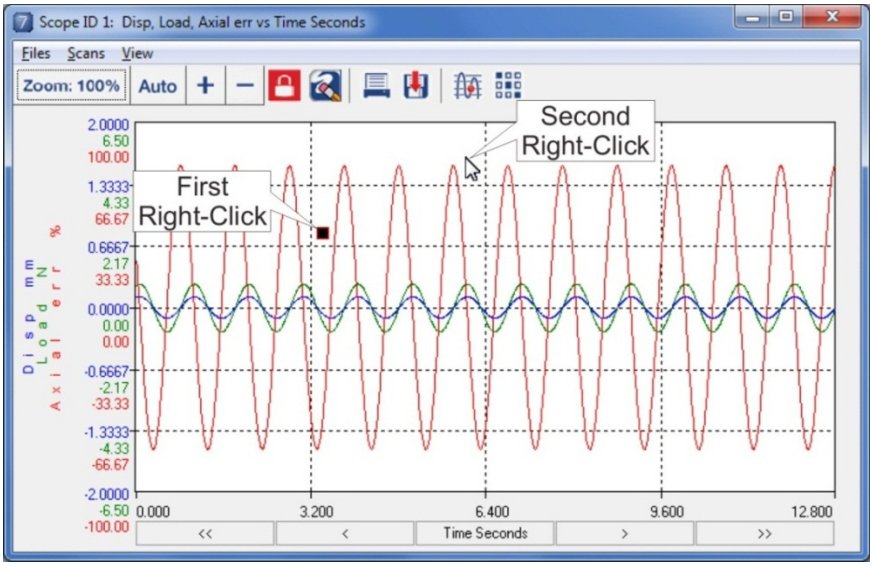
Right-Click in Scope Display

Right-clicks in a Scope display produce different effects, depending on whether the Scope display is frozen.

- Not Frozen: Each right-click in the display will display the channel and time data on the screen. However, the channel and time data on the screen is "erased" when the Scope is refreshed to display the next waveform.

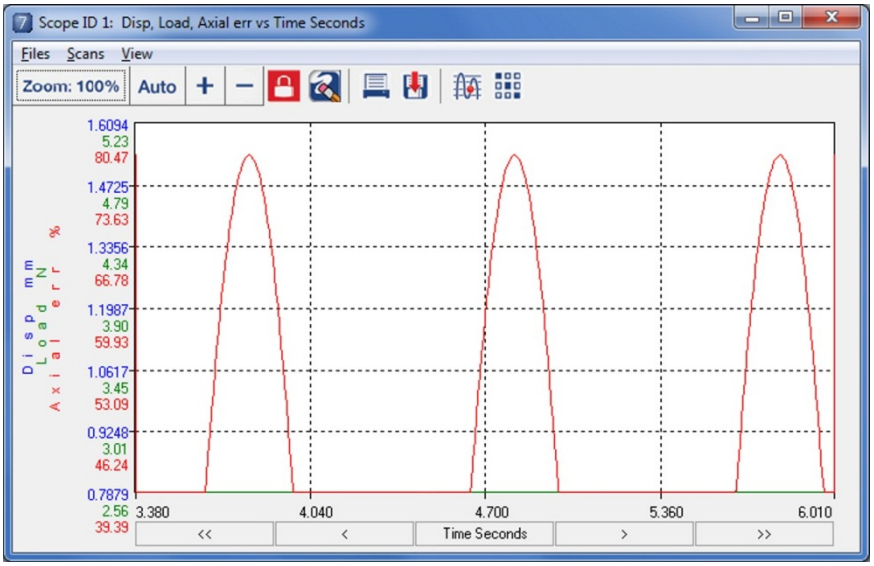


- Frozen: Right-clicking twice in the Scope display zooms into a portion of the display.



To define the zoom-in area:

- Right-click in the lower left corner of your desired zoom-in area (a small black square will appear)
- Right-click in the upper right corner of your desired zoom-in area.

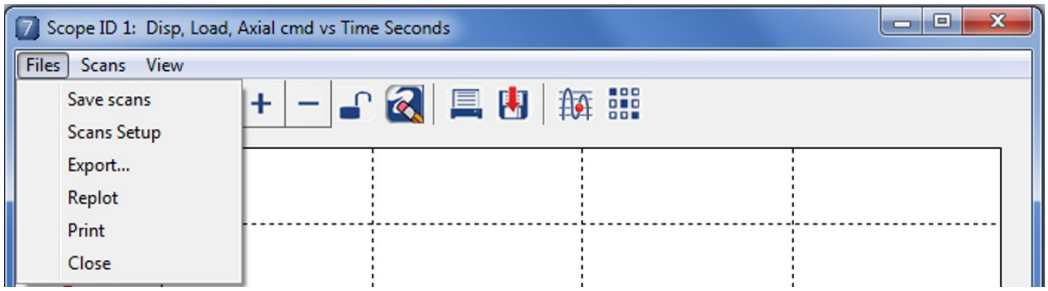


- To return to the previous display, right-click a third time anywhere in the Scope display.

NOTE *If you right-click in the Scope to zoom in but do not right-click a third time to restore the previous settings, the zoomed settings will be retained when you unfreeze the Scope. The time setting will be affected most.*

Files Menu (Scope Window)

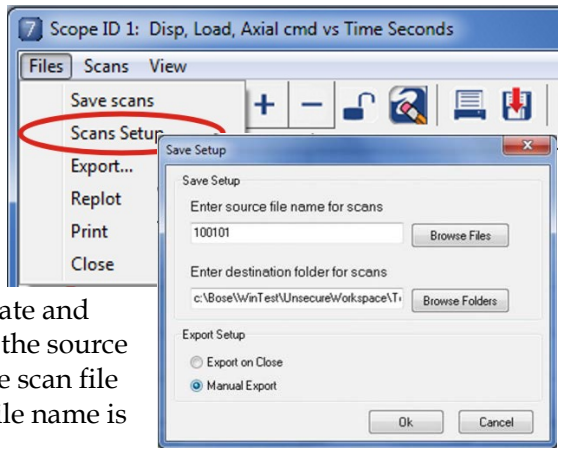
The **Files** menu on the **Scope** window provides commands for saving, printing, and exporting Scope data.



Menu Command or Toolbar Button	Description
Save scans/Stop saving scans or /	See "Scans Setup" in this chapter and "Saving and Exporting Scope Scans" in Chapter 7. **Save scans**: Click this command to start saving Scope data in the file name and destination specified using the **Scans Setup** command. When saving begins, this command changes to **Stop saving scans** on the menu, and the button changes to . **Stop saving scans**: Click this menu command or the button to stop saving Scope data and close the saved scope scans file. While the last full scan is being saved, the button changes to . After the saving or exporting of the Scan file is done, the button changes back to .
Scans Setup	Use this command to specify the file name and destination for saved scans, and to specify automatic or manual export of the saved scope scan. See "Scans Setup" later in this chapter for more information.
Export	Use this command to manually export a saved Scope scan. (This window opens automatically when you stop saving Scope scans and the **Manual Export** option is selected in the setup for saved scans.)
Replot	Use this command to plot previously saved data that was saved as a Scope scan file or a Timed Data file in the **Scope** window. See Chapter 9, "Reviewing Test Results," for specific information.
Print or	Prints the Scope display on the attached printer or saves it in a file, according to the selections in the **Printer Setup** window.
Close	Closes the **Scope** window.

Scans Setup

Use the **Scans Setup** command on the **Files** menu (**Scope** window) to specify a file name, destination, and export option for saved Scope scans. These commands will be used for all saved Scope scans and should be set up before you start to save scans.



1. Click **Scans Setup** on the **Files** menu (**Scope** window) to open the **Save Setup** window.

2. Enter the source file name for saved Scope scan files, or click **Browse Files** to select a file name to use. A date and time stamp will be added to the source file name to make each Scope scan file unique. The default source file name is the project file's file name.

3. Specify the destination, or click **Browse Folders** to find and select a destination. The default folder is "Test Data."

NOTE *If you are working in a secure workspace, WinTest will direct you to save the scope scan in a secure workspace, but you can create new folders to organize your files.*

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4. Select an option for exporting the saved Scope scan. Exporting the file converts the binary data file to a text file (*.txt) or a comma-delimited file (*.csv) file, which can be used for analysis in third-party programs.

Option	Description
Export on Close	If you select this option, the Scope scan file is automatically exported when the file is closed, using the export conditions specified in the **Export** window.
Manual Export	Use this option if you want to specify the export options for each exported file. If you select this option, the **Export** window opens when the Scope scan file is closed. Select export options and manually export the file.

5. Click **Ok** to save the settings and close the window.

Saving and Exporting Scope Scan Data

NOTE *Be sure to use the **Scans Setup** command on the **Files** menu (**Scope** window) to specify a file name, destination, and export option before starting to save your Scope scans. (See "Scans Setup" in this chapter.)*

To save Scope scans:

1. Click the **Save Scans** button on the toolbar (**Scope** window) or, click **Save Scans** on the **Files** menu (**Scope** window). While scope scans are being saved, the button on the toolbar changes to , and the screen displays the filename, destination, and export option when you move the cursor over the **Save Scans** button.

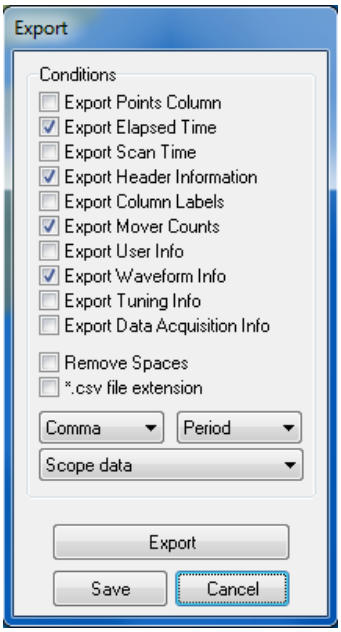
2. To stop saving Scope scans and close the file, click the **Save** button on the toolbar again, or click **Stop saving scans** on the **Files** menu (**Scope** window). While the last complete scope scan is being saved, the **Save** button on the toolbar changes to .

3. If **Export on Close** was selected for setup, the Scope scan file is automatically exported with file name and destination as specified in the setup, with export conditions as specified in the **Export** window.

4. If **Manual Export** was selected for setup, the **Export** window opens automatically when the file is closed. Select the desired export conditions in the **Export** window, verify that **Scope data** is the selected data type, and then click **Export**. The **Select scope file to export** window will open.

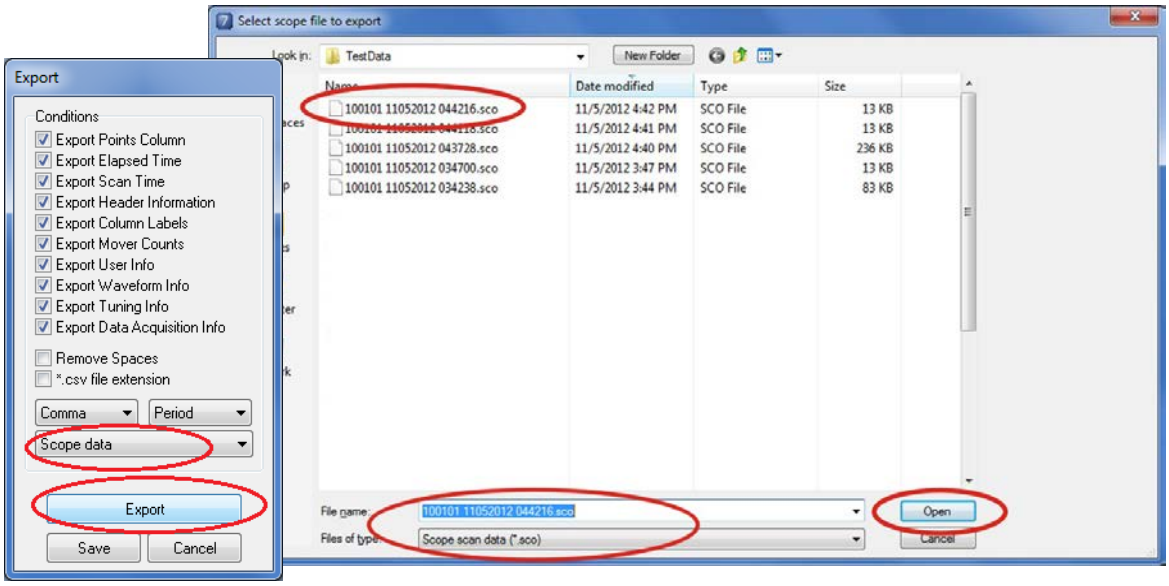
   a. Select the file to export. The default base file name specified in the **Save Setup** window is preselected (with the time and date stamp), but you can select or type a different file name. Click **Open** to export the file. The **Export to *Location filename* to** window will open.

   b. Specify the export file name and destination. The file name from the **Save Setup** window is preselected again, but you can select or type a different file name and destination). Click **Save**.



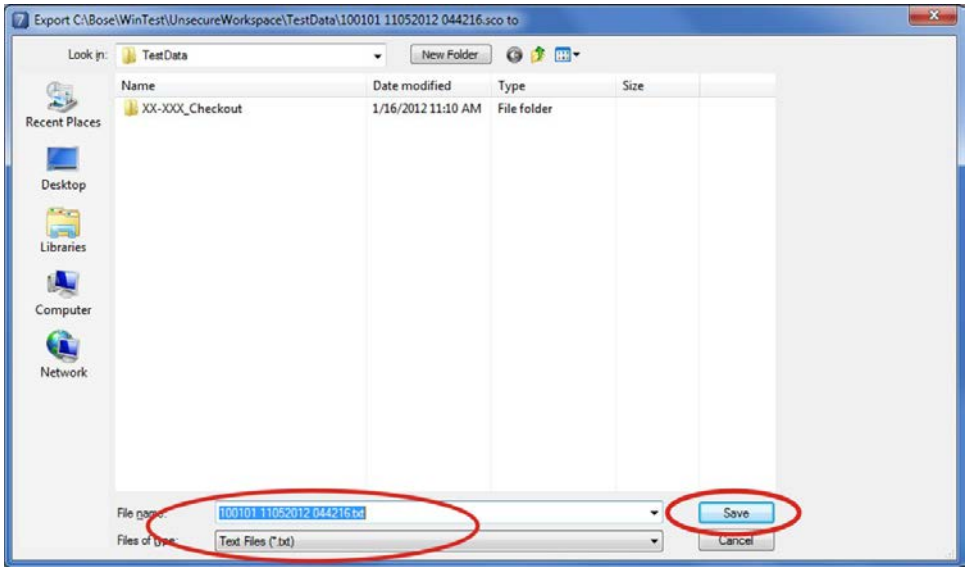
To export a saved Scope scan file:

1. On the **Files** menu (**Scope** window), click **Export**.
2. In the **Export** window, select the appropriate export conditions and **Scope data** as the file type. Click **Export**.
3. Select the Scope scan (*.sco) file to export and click **Open**.



4. Specify or select the file name and destination for the exported file and click **Save**.

NOTE *If you are working in the SecureWorkspace folder, WinTest will direct you to export the file to the secure workspace. However, you can copy the exported file and paste it in the UnsecureWorkspace folder so you can work with it in other programs.*



Older Scope Scan Files (*.sc#)

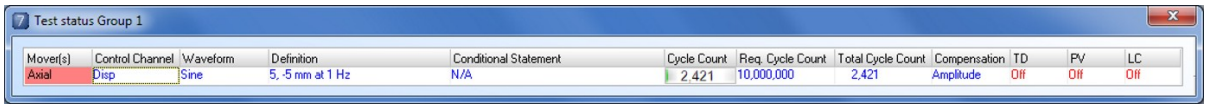
In previous versions of WinTest, Scope scan files had file extensions based on Group numbers because a Scope was tied to a Group. (e.g., *.sc1 for Group 1, *.sc2 for Group 2, etc.)

Now that Scopes are no longer tied to Groups, all new Scope scan files have the *.sco file extension.

Test Status Window

The **Test Status** window shows the current waveform generation status for the current group.

To open the **Test Status** window for a specific group, click **Group *n* Test Status Window** on the **Show** menu (**Test Setup** window).



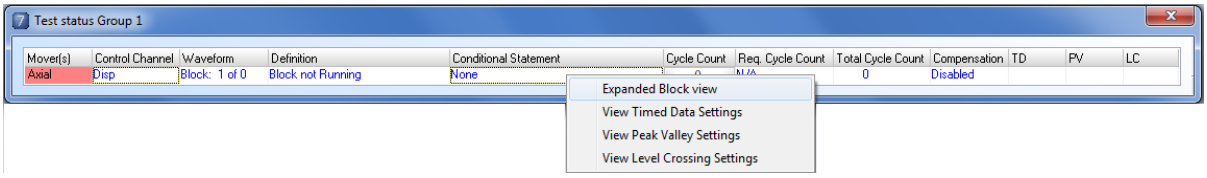
The **Test Status** window displays the following information for each mover defined for this group:

Column	Information Provided
Mover(s)	Each row shows the name of a mover in the current group. Green-shaded movers are active and running a test. Red-shaded movers are not active.
Control Channel	The current control channel for each mover.
Waveform	Ramp or cyclic waveforms: Identifies the waveform type. Block waveforms: Identifies the current block step and the total number of block steps in the test waveform.
Definition	Ramp or cyclic waveforms: Describes the test waveform characteristics. Block waveforms: Describes the block characteristics for the current block step.
Conditional Statement	Ramp or cyclic waveforms: Not applicable; always displays "None." Block waveforms: Describes the conditional statement (if any) as defined for the current block.
Cycle Count	Ramp or cyclic waveforms: Shows the total cycle count for the test. Block waveforms: Shows the total cycle count for the current step.

Column	Information Provided
Req. Cycle Count	Ramp or cyclic waveforms: Shows the number of requested cycles, as specified in the waveform setup. Block waveforms: Shows the number of cycles requested for the current step, as specified in the block waveform setup.
Total Cycle Count	Ramp or cyclic waveforms: Shows the total cycle count for the test. Block waveforms: Shows the total cycle count for all block steps that have been run.
TD	Shows whether Timed data acquisition (standard or for a block) is on or off.
PV	Shows whether Peak/Valley data acquisition (standard or for a block) is on or off.
LC	Shows whether Level Crossing data acquisition (standard or for a block) is on or off.

Test Status Right-Click Menu

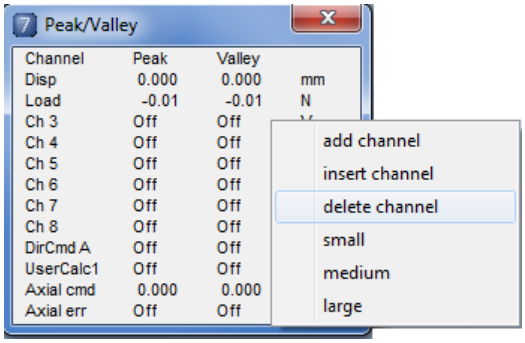
Right-click anywhere in the Mover(s) table in the **Test Status** window to access the following commands:



Command	Description
Expanded block view	For block waveform tests, selecting this option displays an expanded view of the block waveform.
View Timed Data Settings	This option is active when Timed data acquisition is active (on). Opens the **Timed Data Acquisition Setup** window, where you can view settings and start or stop data acquisition. Settings cannot be changed while data acquisition is on.
View Peak Valley Settings	This option is active when Peak/Valley data acquisition is active (on). Opens the **Peak/Valley Data** window, where you can view settings and start or stop data acquisition. Settings cannot be changed while data acquisition is on.
View Level Crossing Settings	This option is active when Level Crossing data acquisition is active (on). Opens the **Level Crossing** window, where you can view settings and start or stop data acquisition. Settings cannot be changed while data acquisition is on.

Peak/Valley Display

The **Peak/Valley** window displays the current Peak and Valley value for the channels selected for the display.



To open the **Peak/Valley** window, click **Peak/Valley** on the **Show** menu (**Project** window). This window can be moved, and it can be resized by dragging the corner or the window edges or by clicking **small**, **medium**, or **large** on the right-click menu.

Peak/Valley values that display "Off" are not set up for Peak/Valley monitoring. You can either delete these channels from the display, or you can set up these channels to monitor and display Peak/Valley readings. See Chapter 10, "Channel Setup Properties," for more information about configuring Peak/Valley properties.

Right-click in the **Peak/Valley** window to access these display commands:

Command	Description
add channel	Lets you select and add a channel to the bottom of the display.
insert channel	Lets you insert a channel above the highlighted channel in the display.
delete channel	Removes the highlighted channel from the display.
small	Displays the window in a small size with a small font.
medium	Displays the window in a medium size with a medium font.
large	Displays the window in a large size with a large font.

Peak Counts

The **Peak Counts** windows behave similarly to **Meter** windows, but they display how many times a channel has achieved a Peak since counting began. Use the **Clear** command on the right-click menu for any Peak **Counts** window to reset the Peak counter to zero for that channel.

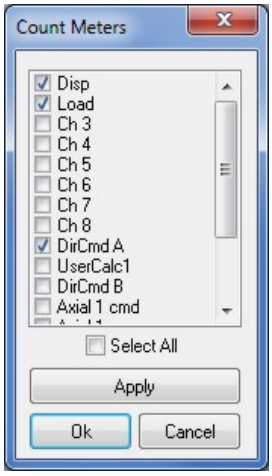
Peak Counts windows can be docked and undocked the same way that Meter windows are docked and undocked. See the "Docking Meter Windows" section in Chapter 3 for more information.

Comparing Peak counts to the cycle count during a test can help verify whether the Peak/Valley band setting for a channel is set correctly. (See Chapter 10, "Channel Setup Properties," for information about setting the Peak/Valley band.)

- If the Peak counts value is less than the reported cycle count, reduce the size of the Peak/Valley band. The Peak/Valley function is missing some true Peaks And Valleys because the band is too large.
- If the Peak Counts value is greater than the reported cycle count, increase the Peak/Valley band. The band is too small, and the Peak/Valley function is reporting Peaks and Valleys that are not really occurring.

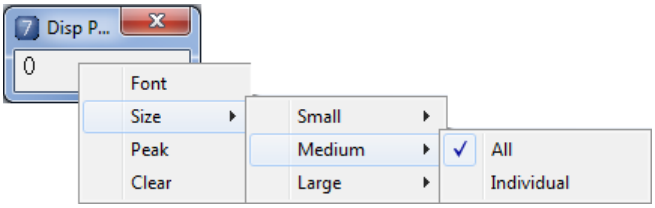
Selecting Peak Count Channels to Display

1. On the **Show** menu (**Project** window), click **Peak Counts**.
2. In the **Count Meters** window, select or clear the check boxes for individual channels or select **Select All**. An individual **Peak Counts** window will open for each selected channel.
3. Click **Apply** or **Ok** to open the **Peak Counts** windows for the selected channels. (If you cleared a check box for a window that was open, that window will close.)
4. Drag **Peak Counts** windows to convenient locations on the screen. You can also resize windows by dragging their corners or edges, or by clicking **Size** on the right-click menu. Notice that dragging a Peak Counts window only drags a "shadow" until you release the dragged window.



Peak Counts Window Commands

Right-click in any **Peak Counts** window to access these commands:



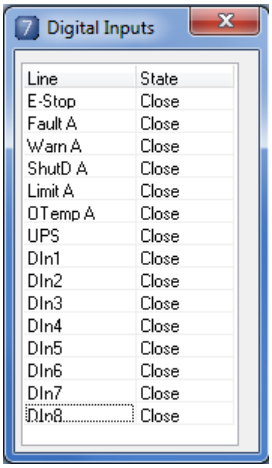
Command	Description
Font	Use this command to change the font type, style, and size for this window.
Size	Lets you resize the window as small, medium, or large standard size. Select **All** to resize all **Peak Counts** windows, or select **Individual** to resize this window only.
Peak	Opens the ***Channel*** **Define Peak/Valley** window, to view or adjust the Peak/Valley settings for this channel. See Chapter 10, "Channel Setup Properties," for more information about adjusting these settings.
Clear	Resets the Peak count for this channel to zero (WinTest will ask for confirmation).

Docking Peak Counts Windows

Peak Counts windows can be docked and undocked the same way that Meter windows are docked and undocked. See the "Docking Meter Windows" section in Chapter 3 for more information and instructions.

Digital Inputs

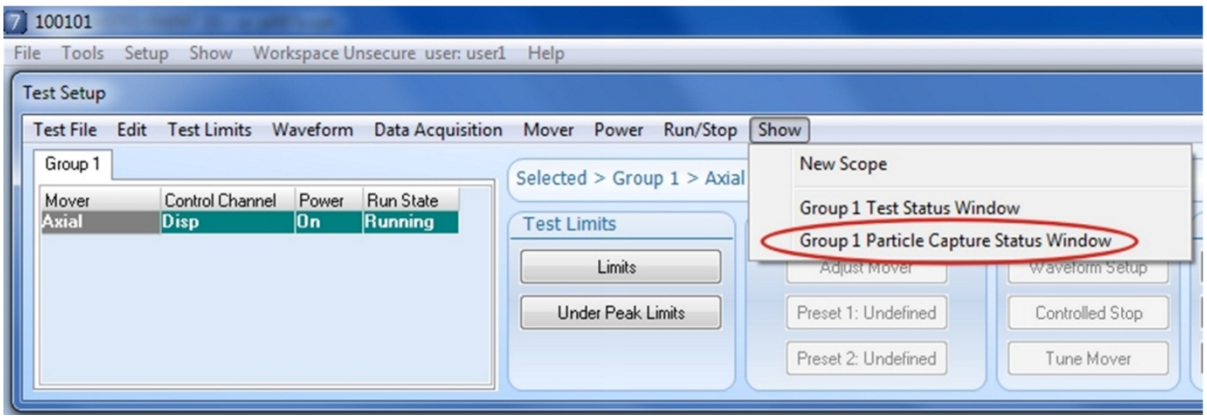
The **Digital Inputs** window shows the status for all digital input lines configured for your system. To open this window, click **Digital Input** on the **Show** menu (**Project** window). Information in this window is helpful for system setup and troubleshooting.



Each test system is configured with specific digital input channels, such as E-stop (emergency stop) and UPS (uninterruptible power supply). Other digital input channels can also be configured for specific applications (for example, to see if a warning light has turned on). See the "Digital Polling" section in Chapter 12, for additional information.

Particle Capture Status Option

If this option is active, refer to your *System Reference Manual* for more information.



User Notes Area

Chapter 4
Limits and Actions

Types of Limits

WinTest uses different kinds of limits to cause an event when a channel exceeds specific boundaries. Each limit definition sets values for these boundaries and specifies how the system will respond if the limit is exceeded.

- Factory limits are established for most control channels at the Bose factory. These limits are not user adjustable. Factory limits are defined to detect extreme conditions (for example, when a channel exceeds its full-scale range) to protect system components such as transducers. Exceeding a factory limit typically triggers a Shutdown action, which stops the test and turns off power to all movers in the group.

- Working or test limits depend on the test system, the specimen, and the test levels, so you may need to change them from one test to another. Limits can be defined for all channels, including control channels and calculated channels.

- Under Peak limits are used during cyclic tests to cause an event when the dynamic amplitude of a monitored channel is reduced by more than a preset amount, often due to sample damage or failure. Under Peak limits can be defined only when the test is running and should be set once the monitored channels have achieved the desired end levels. Under Peak limit detection also requires accurate configuration of Peak/Valley parameters for all monitored channels.

Viewing Limits on the Scope

A **Scope** window can be configured to display limits and/or Under Peak limits. These limits appear as horizontal lines on the Scope display and provide a visual warning that test conditions may be approaching the limits that were set for the test. Refer to Chapter 3, "Display Windows (Show Menus)," for more information.

Test Limits

About Test Limits

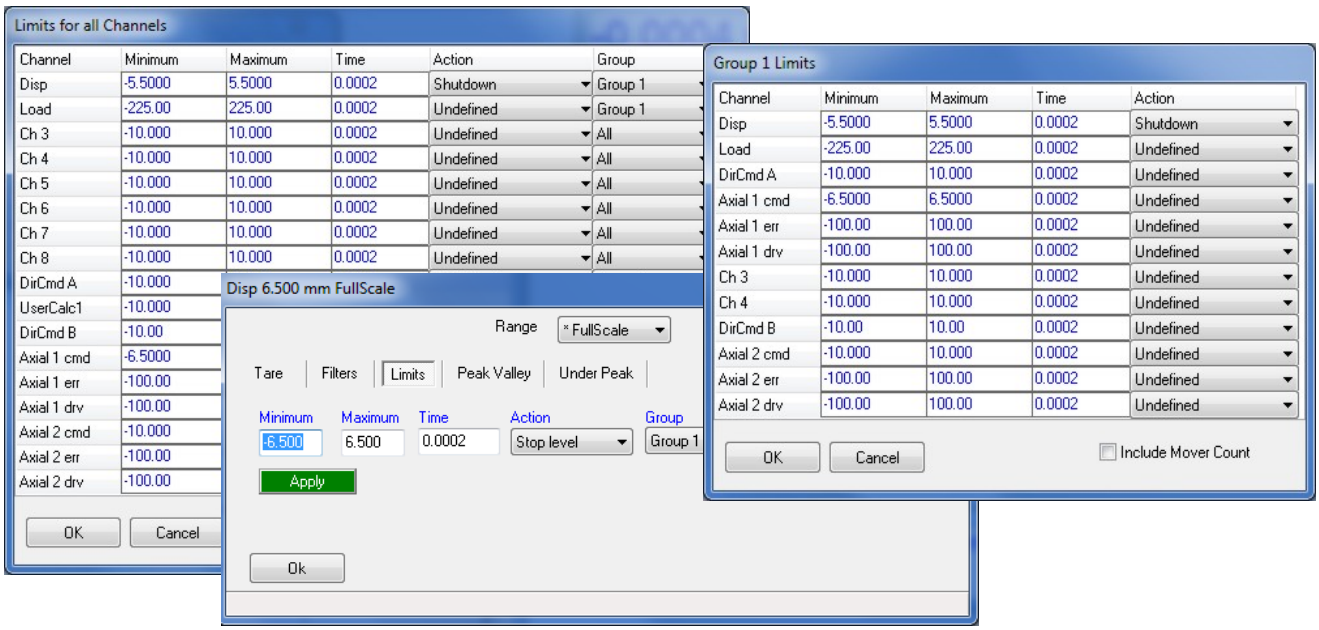
WinTest users can set test limits to monitor any channel, including calculated channels. When test limits are set up to monitor a control channel, limit settings should slightly exceed the desired or predicted end levels for the test. When limits are used to monitor error signals, limit settings should be set to stop the test if the difference between command and the control channel (error) becomes too large.

Defining Limits

1. Open the appropriate **Limits** window.

Group limits	Click the **Limits** button, or, click **Set Group Limits** on the **Test Limits** menu (**Test Setup** window)
All limits	Click **Limits** on the **Setup** menu (**Project** window),
Individual channels	Click **Channels** on the **Setup** menu (**Project** window), or, right-click in the **Meter** window and then click **Properties** for the desired channel. In both cases, click the **Limits** tab.

Multiple group configurations: Select the group before opening the **Group Limits** window. See also "Assigning Limits to Groups" in this chapter.



2. Define the limit settings. When you move the cursor over a channel in the **Group Limits** and **Limits All Channels** windows, WinTest displays the full-scale range and unit for that channel.

NOTE *Limits should be set to protect the sample and to minimize unwanted movement. As a rule of thumb, set limits to exceed the test waveform levels by approximately 10% unless levels are large. In this case, set limits to a reasonable amount outside the working levels, which the channel should not exceed.*

Limit Setting	Description
Minimum	Minimum boundary, in units for the channel.
Maximum	Maximum boundary, in units for the channel. *IMPORTANT* *For load channels, consider the weight of the fixture to ensure that the total force applied to the load cell (including the fixture) does not exceed its capacity. Exceeding the load cell capacity can damage the load cell.*
Time	Number of seconds that the channel must exceed the limit before an event occurs. This value is normally set at the Bose factory and should not be changed. However, it can be adjusted in cases where it is acceptable to exceed a limit momentarily.
Action	The action is what the system does in response to the limit event. Select an action from the list. See "Actions" in this chapter for information about the available Limit actions.
Group	This selection applies only to multi-group configurations. See "Assigning Limits to Groups" in this chapter.

3. To include the mover count when a limit event is recorded for this channel, select the **Include Mover Count** check box.

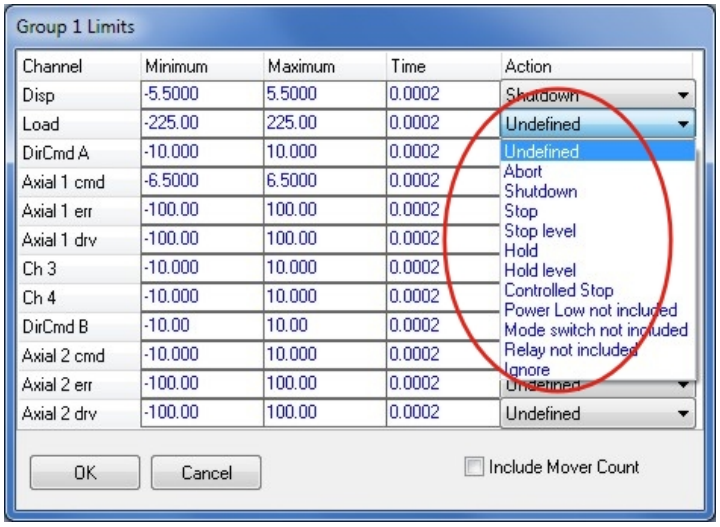
4. In the **Channel Properties** window, click **Apply** to apply your changes and then click **OK** to close the window.

   In other **Limit** windows, click **OK** to apply your changes and close the window.

Actions

Actions define how the system responds to an event, such as a limit event, Under Peak event, or digital polling event.

IMPORTANT *Assigning the correct actions to respond to limit events has implications for protecting the test system and the specimen. If you need assistance, contact Bose ESG Technical Support.*



NOTE *If your project defines multiple groups, you can assign limits to a specific group or to all groups. See "Assigning Limits to Groups" in this chapter for specific information.*

Limit Action	Description
Undefined	The system does not respond to the event, and the event is not recorded in the project session file.
Abort	Turns off power to all movers (all groups, including limits that are assigned to a specific group), and sets the command for all movers to the Stop Level specified in the mover settings.
Shutdown	Turns off power only to movers in the affected group, and sets the command for all movers in the affected group to the Stop Level specified in the mover settings. Movers in other groups are not affected.
Stop	Stops waveform generation, stops data acquisition if selected as a File Close option in the data acquisition setup, and controls movers at the current command level. If the command level exceeds either the full-scale range, the limits, or (for cyclic tests) the commanded level, the mover is held at the last measured level. Power to all movers remains on. Click **Run** (**Test Setup** window) to restart the test.

Limit Action	Description
Stop Level	Stops waveform generation, stops data acquisition if the **Close File when stopped** option is selected for the data acquisition setup, and commands all movers in the affected group to the Stop Level defined for each mover. After a Stop level action, the **Stop** button (**Test Setup** window) changes to **Run**, and power to all movers remains on. Click **Run** to restart the test. For information about the Stop Level parameters, see Chapter 6, "Waveform Setup."
Hold	Pauses the test and holds movers at their current command levels. If the command level exceeds the full-scale range, the limits, or (for cyclic tests) the commanded level, the mover is held at the last measured level. Click **Resume** on the **Run/Stop** menu (**Test Setup** window) to continue the test.
Hold level	Pauses the test and commands all movers in the affected group to the Hold Level defined for each mover. Power to all movers remains on. Click **Resume** on the **Run/Stop** menu (**Test Setup** window) to continue the test. For information about the Hold Level parameters, see Chapter 6, "Waveform Setup."
Controlled Stop	The Controlled Stop action can be used to respond to specimen failure or to prevent rapid motion of the linear motor for certain types of specimens and certain types of test situations. See "Controlled Stop Action" in this chapter for important information about using this action. *IMPORTANT* *It is extremely important to use Controlled Stop in the appropriate test situations and to specify the correct Controlled Stop Position for each mover based on the specimen and the test situation. If you are not sure how to use the Controlled Stop action or how to determine the Controlled Stop position, contact Bose ESG for assistance.*
Power Low	Holds at the current command and sets the local power source to low. Typically only available with a servo-hydraulic test system.
Mode Switch	Provides the option to choose a specific control mode. WinTest will switch modes when the vent occurs and hold at the command equal to the current feedback. Power stays on. Typically not available.
Relay	Allows a sequence of relays to be set to the open or closed position. Typically not available.
Ignore	The limit event is recorded in the History file, but no other action is executed.

Controlled Stop Action

IMPORTANT *It is extremely important to use Controlled Stop in the appropriate test situations and to specify the correct Controlled Stop Position for each mover based on the specimen and the test situation. If you are not sure how to use the Controlled Stop action or how to determine the Controlled Stop position, contact Bose ESG for assistance.*

Although an Abort or Shutdown action has been typically used to shut down the system if the specimen breaks or fails, these actions can cause rapid or unexpected movement that can put transducers and/or the specimen at risk in some situations. The Controlled Stop action was designed to eliminate the rapid, unstable motion associated with actions that turn off power if the specimen breaks or fails. When used correctly and in the appropriate testing situations, the Controlled Stop action can protect the specimen and the test system.

The Controlled Stop action can be assigned to a limit, an Under Peak limit, or a conditional statement in a block waveform. If an event occurs and the Controlled Stop action is executed, WinTest immediately and automatically switches to a special control mode that commands the movers to the Controlled Stop Position defined in the mover settings. This Controlled Stop Position value is always specified in volts because a Controlled Stop action commands the system in DirCmd (direct command).

At the end of the Controlled Stop action, WinTest continues to command the mover in DirCmd (direct command) mode at the Controlled Stop Position voltage.

When a Controlled Stop action is executed, WinTest will initiate a Stop Level action for mover types that do not support the Controlled Stop action (examples are torsion, temperature, and pumps).

When to Use Controlled Stop

The Controlled Stop action is most valuable in situations where the sample is expected to fail in the region of maximum force for the motor and where, upon failure, the specimen will no longer be coupled to the test system (instead, the specimen is in free air). Examples of these tests are tension pull-to-failure tests, compression push-to-failure tests, and cyclic tests to failure for stiff specimens that are likely to fracture.

Setting the Controlled Stop Position

Defining appropriate limits with the Controlled Stop action and setting the Controlled Stop Position for each mover depends on a thorough understanding of the test system, the specimen characteristics, and the test. You will need to determine a safe position for the mover to go to if the specimen fails, and you will need to determine the appropriate channel limits.

IMPORTANT *It is extremely important to use Controlled Stop in the appropriate test situations and to specify the correct Controlled Stop Position for each mover based on the specimen and the test situation. If you are not sure how to use the Controlled Stop action or how to determine the Controlled Stop position, contact Bose ESG for assistance.*

NOTE *Be sure to set a Controlled Stop Position for all movers that support the Controlled Stop action. For movers that do not support Controlled Stop (examples are torsion, temperature, and pumps), a Stop-Level action will be initiated.*

To set up limits with the Controlled Stop action, do the following:

1. Determine a safe position for the axial mover to go to if the specimen should break or fail. Determining this position depends on a thorough understanding of the test system, the specimen, and the test parameters.

   The Controlled Stop Position should leave the mover in a position that ensures that there is a gap between the broken ends of the specimen and/or a gap between the fixture and the specimen. This Controlled Stop position should slightly exceed the highest displacement that is defined in the test waveform.

   The following table provides guidelines for setting the Controlled Stop Position for tensile and compression tests:

Test	Recommended Controlled Stop Position
Tensile tests (such as pull to failure)	Greater than (higher) or equal to the displacement where the specimen is predicted to fail.
Compression test	Greater than (higher) or equal to the starting displacement.

IMPORTANT *In no case should the Controlled Stop position be equivalent to the full-scale value for the displacement channel. In this case, a Controlled Stop would cause the factory limit to trip and cause a Shutdown. Factory limit settings, including their assigned actions, are not accessible to WinTest users. If your test requires the machine's full range of motion, contact Bose ESG for assistance.*

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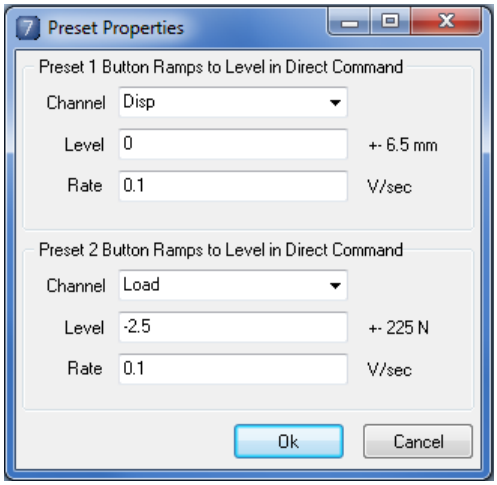
2. Select the axial mover in the **Test Setup** window.

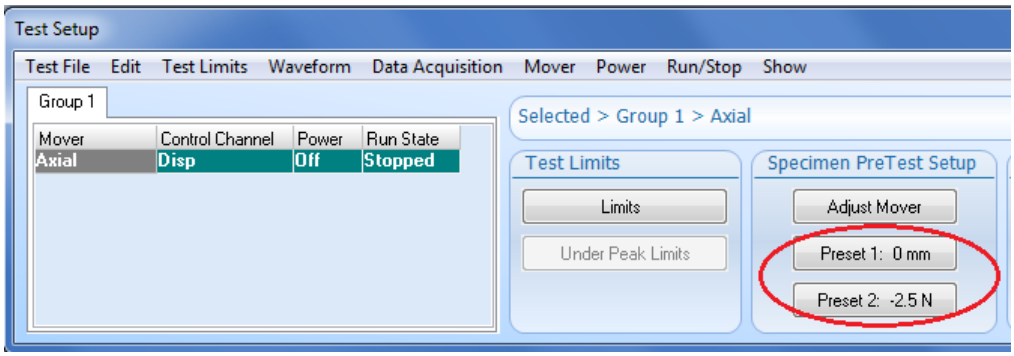
3. The sample is NOT installed. Define a **Preset** button to command the mover to the safe Controlled Stop Position that you determined in step 1.



   a. Click **Set Presets** on the Mover menu (**Test Setup** window) or right-click on a **Preset** button (**Test Setup** window) and select **Preset Properties** to open the **Preset Properties** window.

   b. In the **Preset Properties** window, set the following properties for the desired **Preset** button and then click **OK**:
   Channel: Disp
   Level: Safe displacement position (mm) determined in step 1.

4. Turn on Mover Power, and then click the **Preset** button (**Test Setup** window) that you defined in step 3. The mover will go to the specified position in DirCmd.



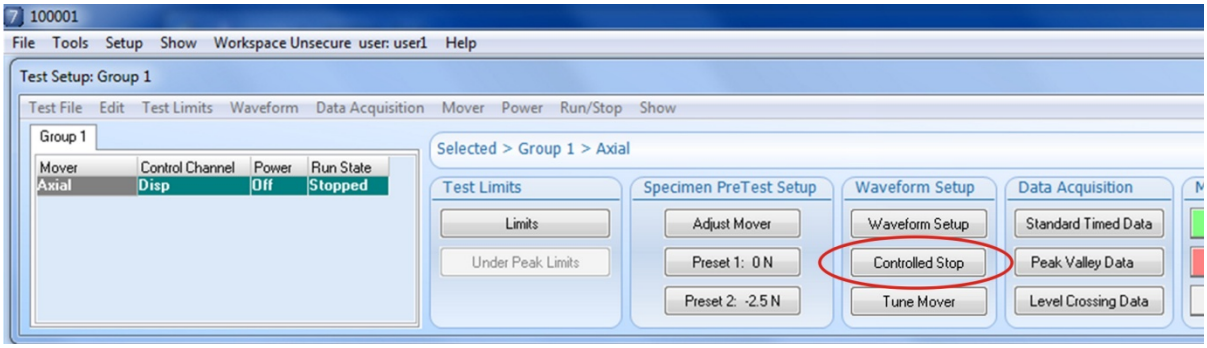
5. Open the **Meter** window for Axial Command, if this **Meter** window is not already displayed. Verify that the displayed value is in volts (the control channel is DirCmd after using the **Preset** button).

6. Open the **Setup Mover** window and click the **Controlled Stop** tab.

   - Click the **Waveform Setup** button (**Test Setup** window) to open the **Waveform Setup** window, and then click the **Waveform Actions** button. After the **Setup Mover** window opens, click the **Controlled Stop** tab.

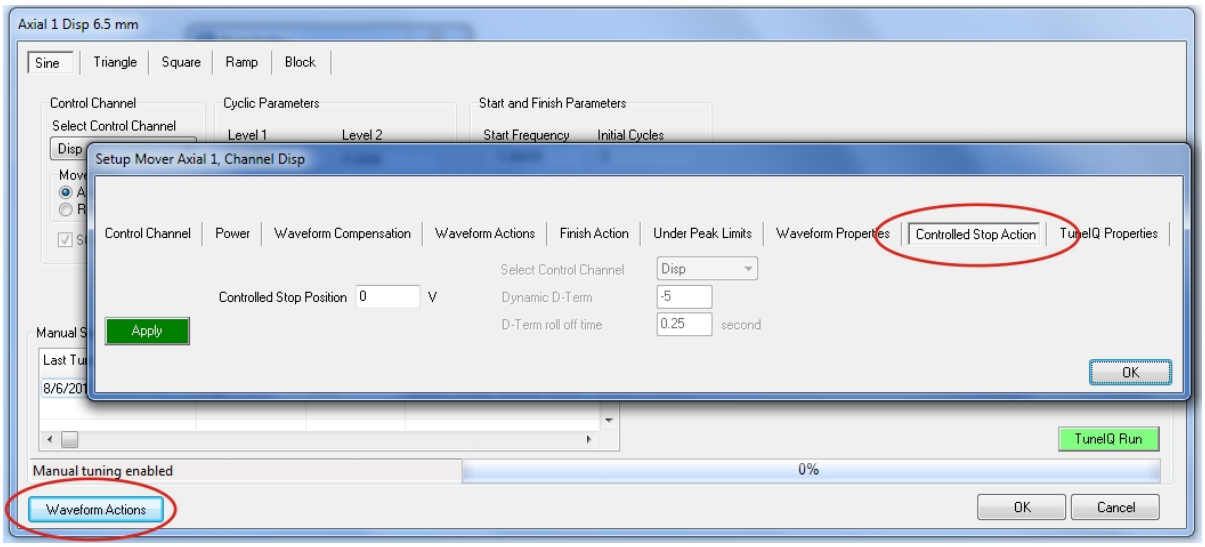
   - Alternately, you can click **Set Advanced Settings** on the **Mover** menu (**Test Setup** window), then click **Mover Setup,** and then click the **Controlled Stop** tab.)

NOTE *You can also access the Controlled Stop window by clicking the Controlled Stop button in the Waveform Setup area (Test Setup window).*



7. In the **Controlled Stop Position** box, type the Axial Command reading as displayed in the **Meter** window (volts). The example shows the factory setting (0 volts), but this value depends on the specimen and the test.

IMPORTANT *Default values for the Select Control Channel, Dynamic D Term, and D Term roll-off time parameters can cause instability and damage if the system remains coupled to a stiff specimen when the specimen fails. These settings are not accessible to WinTest users. If you are not sure whether these parameters are appropriate for your testing situation, contact Bose for assistance.*



Setting Limits to Activate Controlled Stop

When you have defined the Controlled Stop position for all movers, you can set limits and assign the Controlled Stop action to these limits.

1. Use the information in the following tables to set the following limits for the Axial mover. Tables are provided for tension (ramp) tests, compression (ramp) tests, and cyclic tests.
2. Assign the Controlled Stop action to the limit for each channel.

NOTE *Following a Controlled Stop action, the mover is in DirCmd (direct command) control and WinTest continues to command the voltage specified for the Controlled Stop Position. Do not turn off Mover Power or execute a Shutdown unless the mover position is near zero.*

Tension Tests (Ramp): Limit Settings with Controlled Stop

Channel	Limit Setting
Displacement	Minimum: Less than the starting position Maximum: Greater than displacement where sample is expected to fail, but less than the position that corresponds to the Controlled Stop Position voltage for this mover.
Load	Tension loads are positive. Minimum: Slightly less than the initial load. For most cases, this value is what will trigger the limit and execute the Controlled Stop action. Maximum: Greater than the load needed to break the sample (this limit can be set to the positive full scale value).
Axial Error	Minimum: Typically larger than the maximum Axial Error. Maximum: Set to a small value (feedback always lags command), approximately 10 to 40%. *NOTE* *Use extra care when using the Controlled Stop action with Axial Error limits for a dynamic test. Appropriate error % values are machine dependent and can be difficult to determine. You may want to start the test, monitor the error signal on a **Scope** or **Meter** window, and then set the error limit based on the observed error values.* *To determine error limits, you may want to start the test, monitor the error signal on a **Scope** or **Meter** window, and then set the error limit based on the observed error values.*

Compression Tests (Ramp): Limit Settings with Controlled Stop

Channel	Limit Setting
Displacement	Minimum: Set above the position of the load cell and fixturing Maximum: Slightly greater than the starting position, but below the displacement that corresponds to the Controlled Stop Position.
Load	Compression loads are negative. Minimum: Slightly less than the than the load required to break the sample (can be set to minus full scale) Maximum: Slightly greater load than the initial load.
Axial Error	To determine error limits, start the test, monitor the error signal on a **Scope** or **Meter** window, and then set the error limit based on the observed error values (approximately 10% to 40%). *NOTE Use extra care when using the Controlled Stop action with Axial Error limits, as the appropriate error % values machine dependent and are difficult to determine.*

Cyclic Tests: Limit Settings with Controlled Stop

Channel	Limit Setting
Displacement	Minimum: Less than the minimum cyclic displacement defined in the test waveform Maximum: Greater than the maximum cyclic displacement defined in the test waveform
Load	Minimum: Less than the minimum cyclic load defined in the test waveform Maximum: Slightly greater load than the maximum cyclic load defined in the test waveform
Axial Error	*NOTE Depending on the phase relationship between the control channel and command, assigning the Controlled Stop action to Axial Error limits for cyclic tests may not be applicable. At high frequencies, Axial Error will typically approach 100% (when the control channel is 180 degrees out of phase with command).* To determine error limits, start the test, monitor the error signal on a **Scope** or **Meter** window, and then set the error limit based on the observed error values (approximately 10 to 20%).

Assigning Limits to Groups

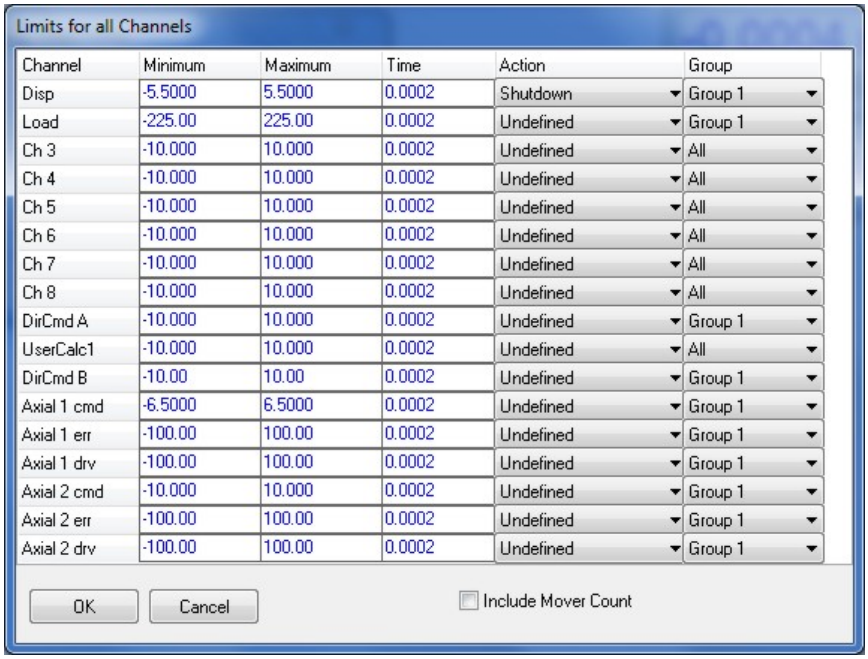
If your WinTest project files include multiple groups, you can associate certain limits with a specific group, or with all groups.

NOTE *The Abort action will always turn off power to movers in all groups, even if the limit is assigned to a specific group.*

There are two ways to assign a limit to all groups or to a specific group:

- Click **Limits** on the **Setup** menu (**Project** window). In the **Group** column for each channel, select **All** or a specific group from the list.
- Click **Channels** on the **Setup** menu (**Project** window). Click the **Limits** tab in the channel properties window. In the **Group** column, select **All** or a specific group from the list.

NOTE *When you open the **Group Limits** window, the group limits are automatically assigned to the group, even if **All** is selected in another window.*



Channel	Minimum	Maximum	Time	Action	Group
Disp	-5.5000	5.5000	0.0002	Shutdown	Group 1
Load	-225.00	225.00	0.0002	Undefined	Group 1
Ch 3	-10.000	10.000	0.0002	Undefined	All
Ch 4	-10.000	10.000	0.0002	Undefined	All
Ch 5	-10.000	10.000	0.0002	Undefined	All
Ch 6	-10.000	10.000	0.0002	Undefined	All
Ch 7	-10.000	10.000	0.0002	Undefined	All
Ch 8	-10.000	10.000	0.0002	Undefined	All
DirCmd A	-10.000	10.000	0.0002	Undefined	Group 1
UserCalc1	-10.000	10.000	0.0002	Undefined	All
DirCmd B	-10.00	10.00	0.0002	Undefined	Group 1
Axial 1 cmd	-6.5000	6.5000	0.0002	Undefined	Group 1
Axial 1 err	-100.00	100.00	0.0002	Undefined	Group 1
Axial 1 drv	-100.00	100.00	0.0002	Undefined	Group 1
Axial 2 cmd	-10.000	10.000	0.0002	Undefined	Group 1
Axial 2 err	-100.00	100.00	0.0002	Undefined	Group 1
Axial 2 drv	-100.00	100.00	0.0002	Undefined	Group 1

Under Peak Detection

About Under Peak Detection

Under Peak detection is used to cause an event when the monitored channel can no longer maintain its dynamic amplitude. Under Peak detection can also be used to detect and specimen damage or failure, and to prevent damage to the specimen and/or test system if the specimen fails.

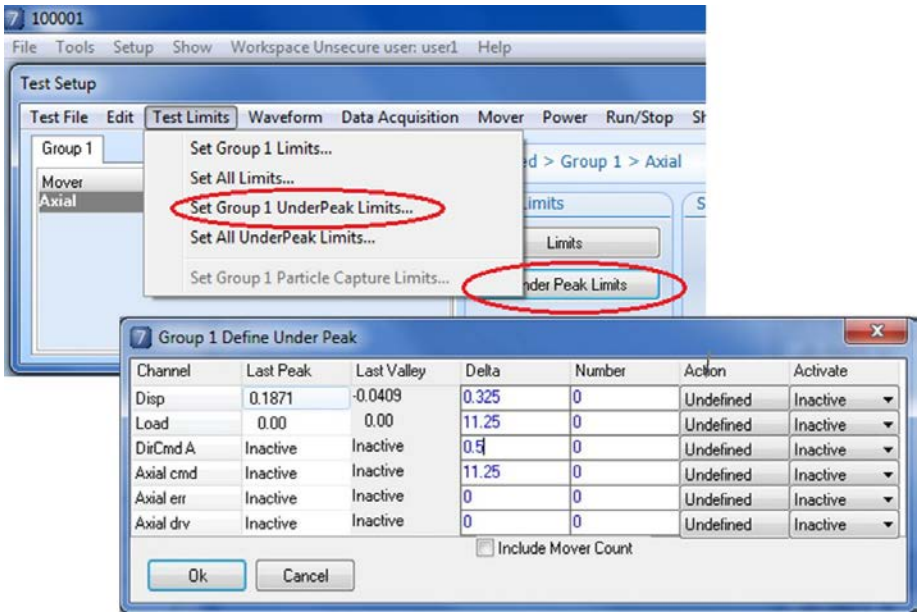
NOTE *Under Peak limits can be set only while a cyclic test is running and after a monitored channel has reached the desired end levels.*

Under Peak limit detection relies on the accuracy of the Peak/Valley band settings. If you use Under Peak detection, it is critical to set the Peak/Valley band accurately for all monitored channels. See Chapter 10, "Channel Setup Properties," for more information.

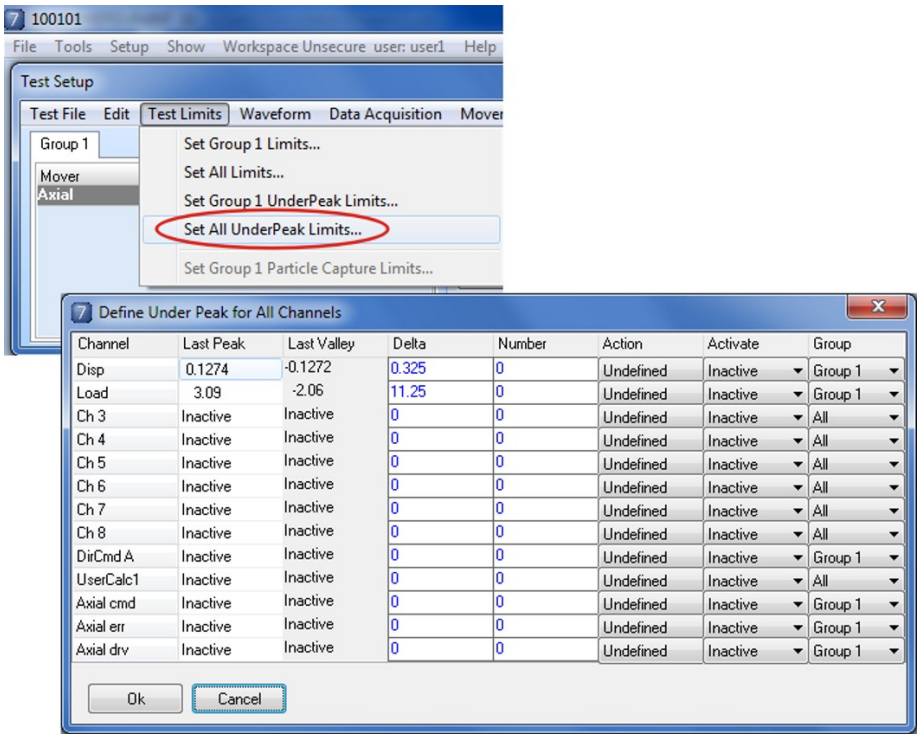
Defining Under Peak Limits

1. Open the appropriate **Under Peak Limits** window. These windows can be opened only when a test is running.

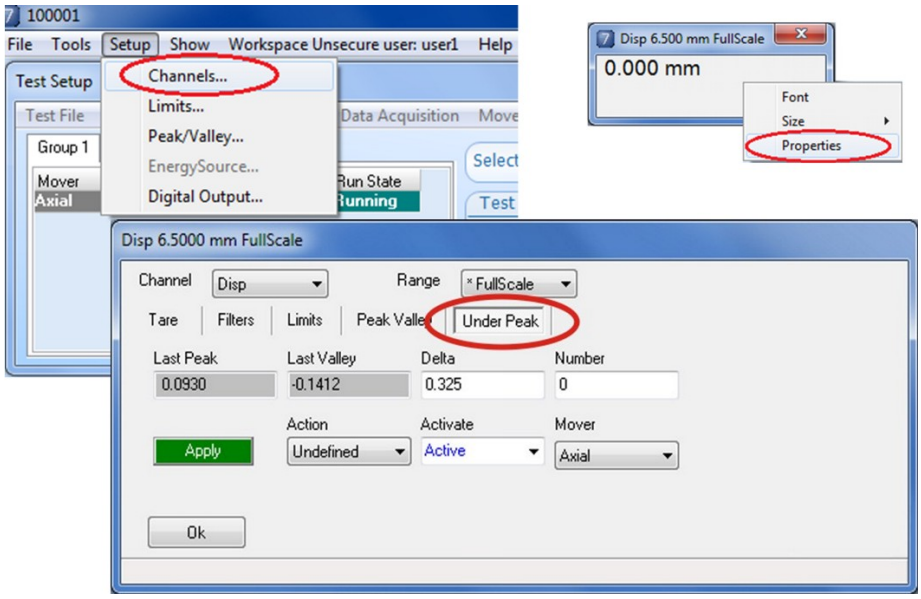
Parameter Type	Location
Group Under Peak limits	Click the **Under Peak Limits** button (**Test Setup** window) or **Set Group UnderPeak Limits** on the **Test Limits** menu (**Test Setup** window).



Parameter Type	Location
Under Peak limits for all channels	Click **Set All UnderPeak Limits** on the **Test Limits** menu (**Test Setup** window).



Parameter Type	Location
Specific channel	Click **Channels** on the **Setup** menu (**Project** window) and select the channel, or right-click in a **Meter** window and click **Properties.** Click the **Under Peak** tab in the properties window.



2. Define the Under Peak limit parameters.

Parameter	Description
Last Peak	Displays the last Peak reading for this channel.
Last Valley	Displays the last Valley reading for this channel.
Delta	This is the maximum allowable difference between the last Peak reading and the requested Peak (or Valley). If the difference is greater than the specified **Delta** value for a consecutive number of times specified in the Number parameter, an Under Peak limit event occurs.
Number	Number of consecutive times that the **Delta** value must be exceeded before the limit event occurs.
Action	System response to the Under Peak limit event. Select an action in the list. See "Actions" in this chapter for information about the available actions.
Activate	Select an option to enable or disable Under Peak limit detection. Active: Under Peak limit detection is active for this channel. Inactive: Under Peak limit detection is not active for this channel.

3. In the channel properties window, click **Apply,** and then click **Ok** to close the window. In the **Under Peak** windows, click **OK** to apply your changes and close the window.

Chapter 5
Specimen PreTest Setup

WinTest provides two functions that are useful for installing or removing a specimen or for controlling the system manually.

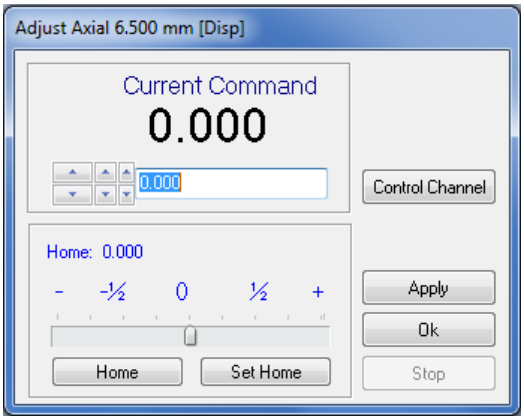
- **Adjust Mover**: Use this function to manually ramp a mover in the selected control mode to a specific level or to a predefined Home position.
- **Preset 1** and **Preset 2**: Use these functions to ramp a mover in DirCmd (direct command) to a specified level

Adjust Mover

NOTE *Using the Adjust Mover function does not change the cycle count of the affected mover. To acquire data during this manual adjustment, set the **First Scan Info** in the Timed Data setup window to **Immediate** or to an appropriate level.*

To use the Adjust Mover function:

1. For systems with multiple movers, select the mover (**Test Setup** window).
2. Turn on mover power: Click the **Mover Power** button (**Test Setup** window) and turn on power.
3. Click the **Adjust Mover** button (**Test Setup** window) or click **Adjust Axial** on the **Mover** menu (**Test Setup** window), **and** then click **Adjust Axial**.
4. To select the control channel, click the **Control Channel** button (**Adjust Axial** window) and select the desired control channel.

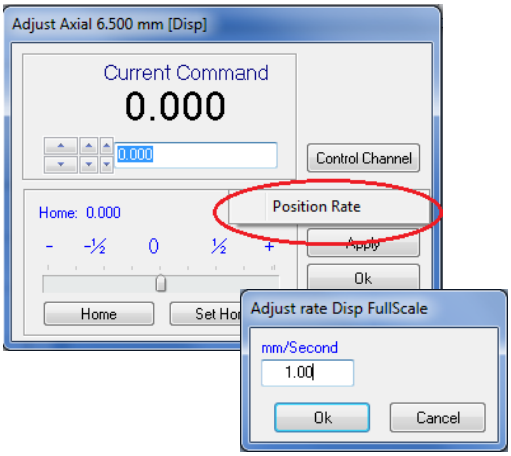


5. Adjust the position rate if necessary. This is the ramp rate used to adjust the mover to the commanded level, in control channel units per second. This should only be adjusted for specific test requirements or unusual specimen behavior.

   To view or adjust the position rate:

   a. Right-click anywhere in the **Adjust Mover** window (except the box used to enter the level) and click **Position Rate** on the menu that opens.

   b. In the window, type the desired ramp rate (in channel units per second) and click **OK**.

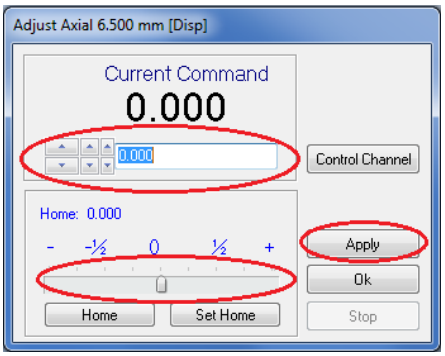


6. Adjust the mover as described below.

NOTE *To stop the mover, click the **Stop** button (**Adjust Mover** window).*

Adjusting the Mover

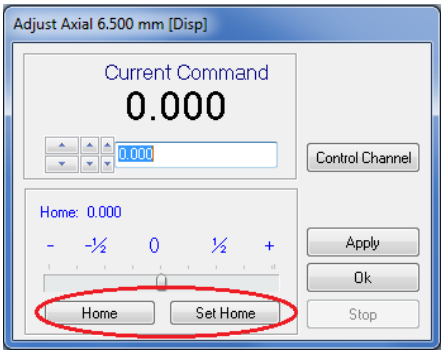
- Moves when you click **Apply**: Type the desired level in the text box and click **Apply**.
- Moves immediately: Click the arrow buttons to adjust the mover level up or down. The wider the arrow button, the larger the adjustment increment.
- Moves immediately: Drag the slider right or left to the desired level.



Moving to the Home Position

The Adjust Mover also allows you to set a predefined Home position and move adjust the mover to this position.

1. To set the Home position: Adjust the mover to the desired position and then click the **Set Home** button.
2. To adjust the mover to the Home position, click **Home**. WinTest always shows the current mover position and requires confirmation before adjusting the mover to the Home position.



Presets

About Presets

Presets make it easy to quickly put the system into a defined state. Two **Preset** buttons in the **Test Setup** window are user programmable and provide easy access and ready-to-use operation. When clicked, these buttons move the system in Direct Command to the predefined level and continues to command that voltage.

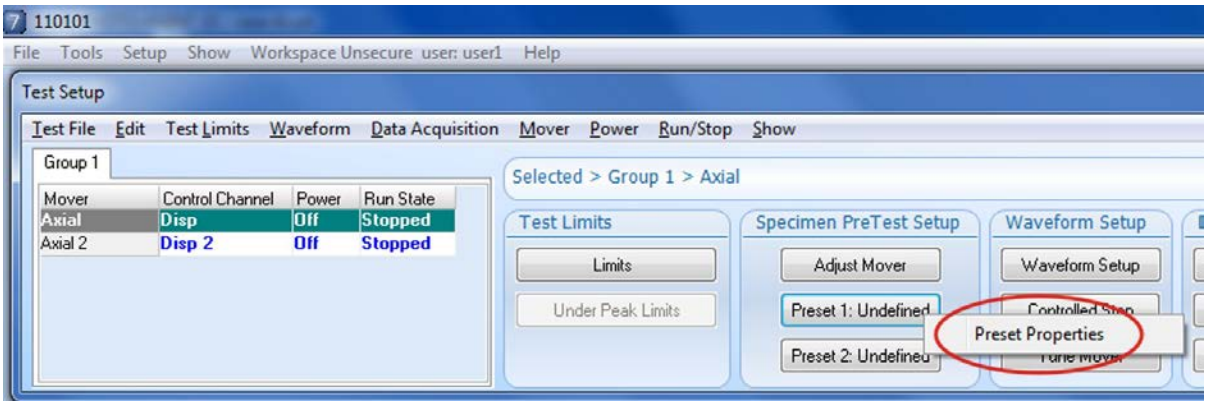
NOTE *The command voltage is held constant, not the desired level, so the actual load or displacement may drift from the original end level over time.*

For example, use Presets to do any of the following:

- Apply a small preload to the sample before switching to load control.
- Make inserting the sample easier and more repeatable.
- Determine a safe Controlled Stop position.
- Command the system to a specific level in DirCmd before turning off power.

Defining Preset Properties

If a preset button is not defined, the button label is "Undefined." Once you have defined its properties, the label shows the target level and units as defined in the **Preset Properties** window.



To define the **Preset** buttons:

NOTE *Mover power must be turned off to enable defining a Preset button.*

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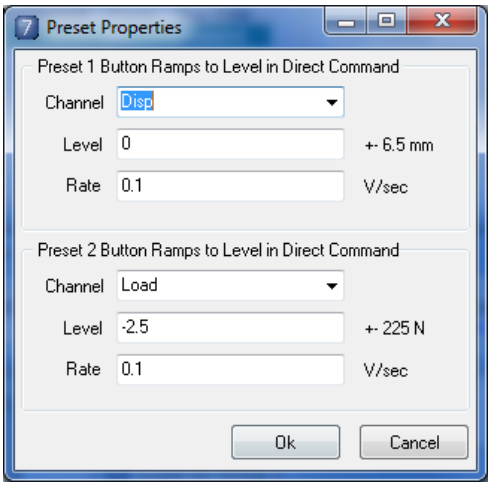
1. For multiple movers, select the mover.
2. Right-click on a **Preset** button (**Test Setup** window) and then click **Preset Properties** on the menu.

   Alternately, click **Set Axial Presets** on the **Mover** menu (**Test Setup** window).



3. Define the properties for each **Preset** button:
   a. In the **Channel** list, select the channel used to define the target level.
   b. In the **Level** box, type the target level (control channel units).
   c. In the **Rate** box, type ramp rate, in volts per second.

NOTE *This rate should be between 0.1 and 0.5 V/sec. Rates that are too fast can cause the system to overshoot the desired level.*

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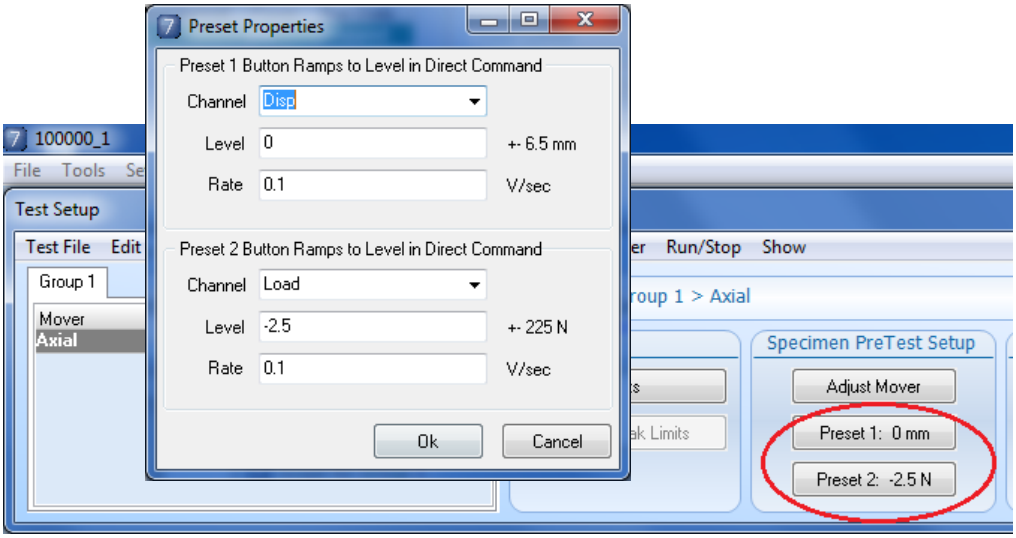
4. Click **OK**, and the **Preset** buttons (**Test Setup** window) are updated to show their current properties.

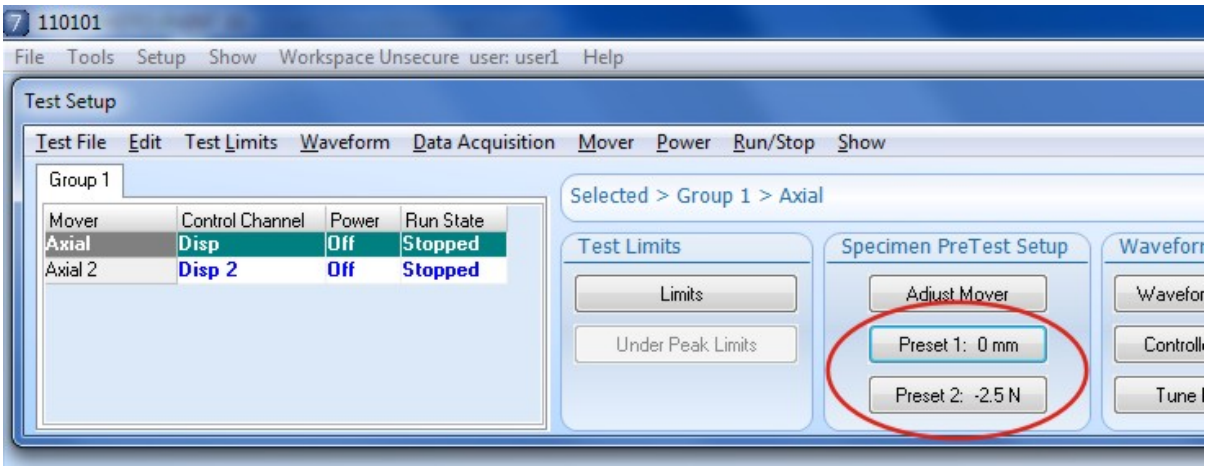


Using the Preset Buttons

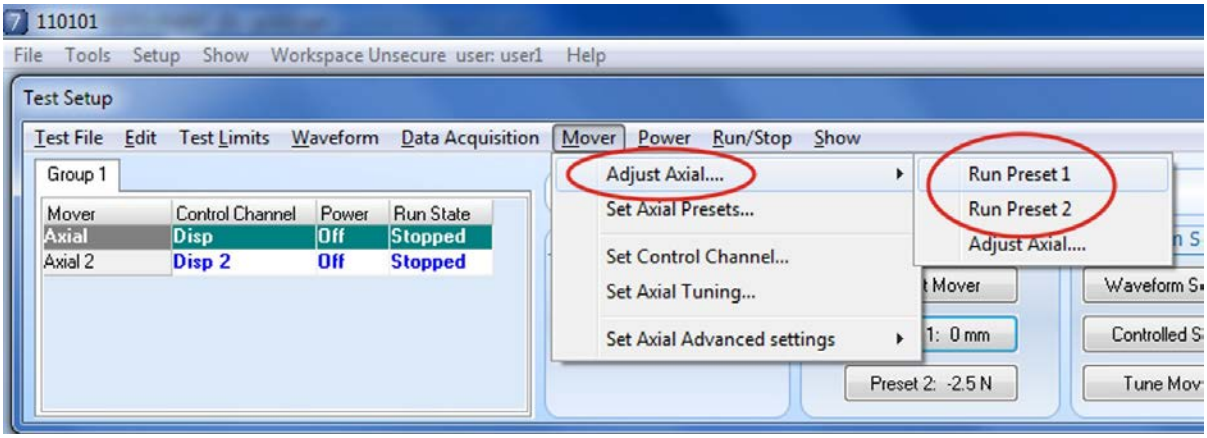
When properties for the **Preset** buttons are defined, these buttons show the target level and units defined in the **Preset Properties** window for each button.

WinTest provides two ways to use the **Preset** buttons (Mover power must be on to use these buttons):

- Click the desired **Preset** button.



- Alternately, click **Adjust Axial** for the desired button on the **Mover** menu (**Test Setup** window), and then click **Run Preset**.



NOTE *If you click a **Preset** button that is not defined, the **Preset Properties** window will open automatically.*

NOTE *If you click a **Preset** button and mover power is off, the **Power** window will open automatically. When power is turned on, the system will ramp the mover to the preset level as defined.*

User Notes Area

Chapter 6
Waveform Setup

Waveform setup for any test includes the following tasks:

- Define the characteristics of the test waveform.
- For cyclic waveforms, specify the frequency a level for the starting and ending cycle.
- For block waveforms, build a waveform by creating a series of waveform steps from available block wave types. Data acquisition can also be defined for each step in the block waveform (first mover only).
- Define parameters for the Stop Level and Hold Level waveform actions. These parameters are defined for each mover and depend on the specimen, the test system, and the test conditions.
- *Optional*. Specify a Finish Action to be executed automatically after the last test cycle is completed. If a Finish Action is not specified, the test waveform determines the system status at the end of the test.
- If the specimen and/or test conditions have changed, run TuneIQ to optimize the system response to the test waveform.

IMPORTANT *Refer also to the "Controlled Stop Setup" section in the Chapter 4, which describes how to set up the Controlled Stop action.*

The test waveform can be adjusted while running the test. See Chapter 8, "Running and Managing Tests," for more information.

Basic Waveform Types

WinTest supports the following waveform types:

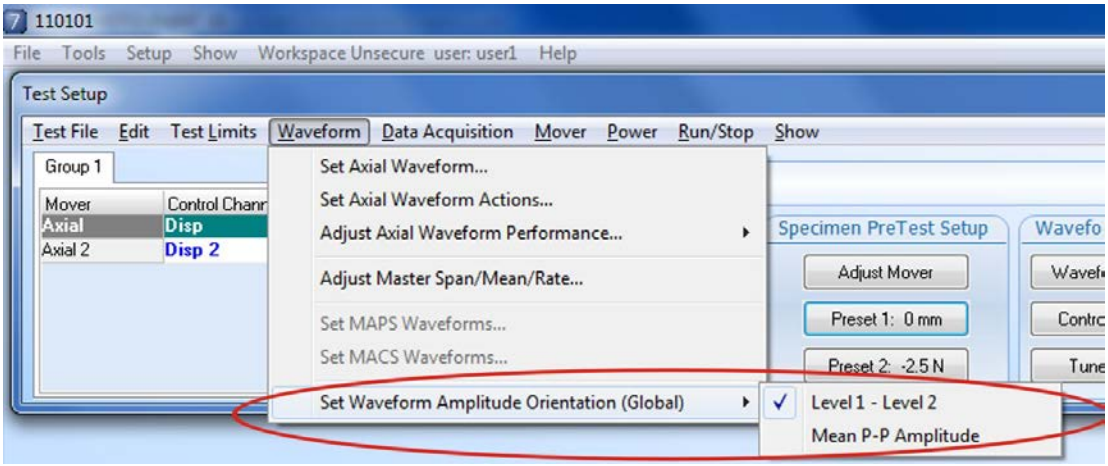
Type	Description and use
Ramp	The ramp waveform moves an actuator to a new position in PID (controlled) mode at a constant rate. (Use the Presets or Adjust Mover functions to move an actuator to a new position in DirCmd (direct command) mode.
Sine	Sine (sinusoidal) waveforms are typically used for cyclic fatigue tests, where the same waveform is repeated for a specified number of cycles. Sine waveforms are also used to measure the dynamic properties of materials and where dynamic loading of the material is primarily sinusoidal, such as in tire or axle applications.
Triangle	Triangle waves are used when the material is sensitive to the rate of loading and the rate needs to be held constant during the test. Because of the abrupt reversal in direction at the peaks, triangle waves are difficult to run at higher frequencies. For this reason, triangle waves are typically used for lower frequency tests (for example, Low Cycle Fatigue tests).
Square	Square waves are typically used to tune the system because they are the most difficult waveform for the system to follow. They are sometimes used in fatigue applications where the component has a built-in stop that creates instantaneous loading or an abrupt hold in displacement.
Block	The block waveform is often used when complicated waveforms are needed to generate test data. Examples are block cycle fatigue tests or a combination of profiles to simulate time histories.

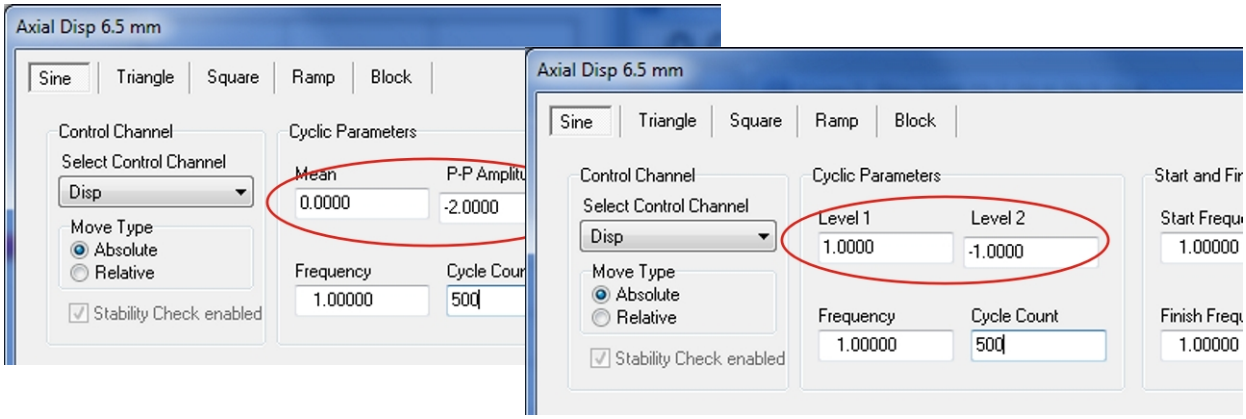
Waveform Amplitude Orientation

The amplitude of cyclic waveforms in WinTest can be defined in two ways: by specifying two levels to cycle between, or by specifying a mean level for the cyclic waveform and the amplitude of the waveform around this mean level. This setting is global and determines how you define all cyclic waveforms in the WinTest software.

NOTE WinTest always defines waveform amplitude as peak-to-peak.

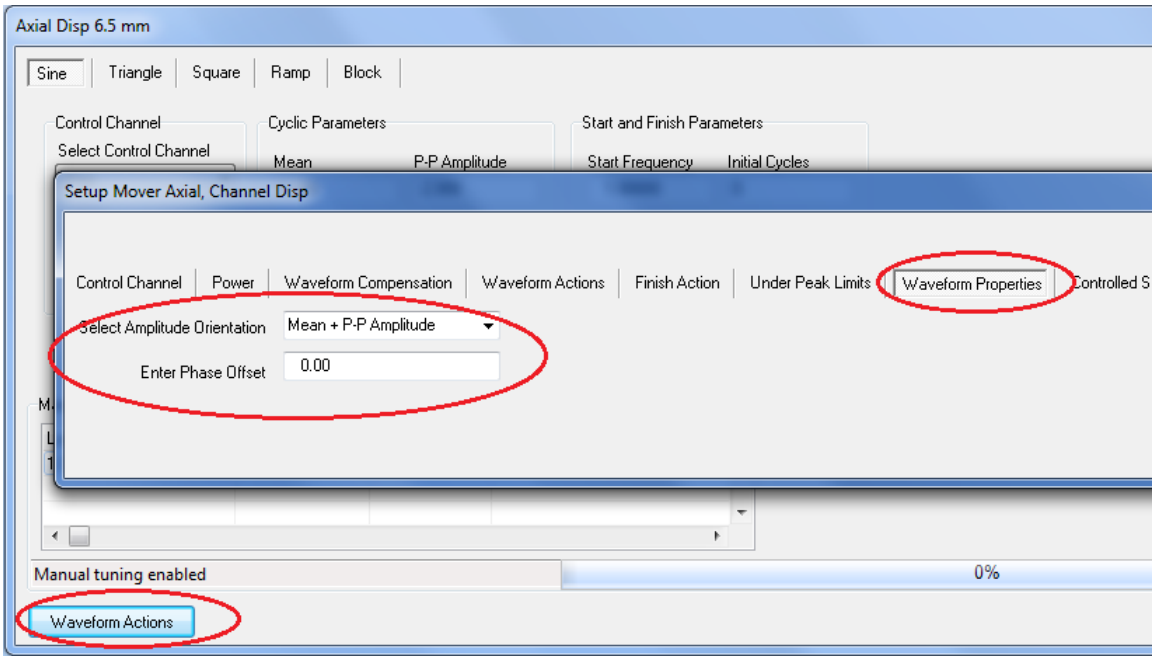
Orientation	Description and Parameters
Level 1 – Level 2	The amplitude of cyclic waveforms is defined by specifying two levels to cycle between.
Mean Peak-to-Peak (or P-P) Amplitude	The amplitude of cyclic waveforms is defined by specifying a mean value for the cyclic waveform and the amplitude (peak-to-peak) of the waveform around the specified mean level.





To set the global waveform amplitude orientation used to define waveforms for a mover, do the following:

1. Turn off power to the mover.
2. Set the waveform amplitude using either of these methods:
   - In the **Waveform Setup** window, click the **Waveform Actions** button. In the **Setup Mover** window, click the **Waveform Properties** tab and select the desired orientation (**Level 1 + Level 2** or **Mean + P-P Amplitude**). You can also enter the phase offset value. See "Waveform Compensation" in Chapter 8, "Running and Managing Tests" for information about phase offset.
   - Click the **Set Waveform Amplitude Orientation (Global)** on the **Waveform** menu (**Test Setup** window). Then select **Level 1-Level 2** or **Mean P-P Amplitude** in the submenu.

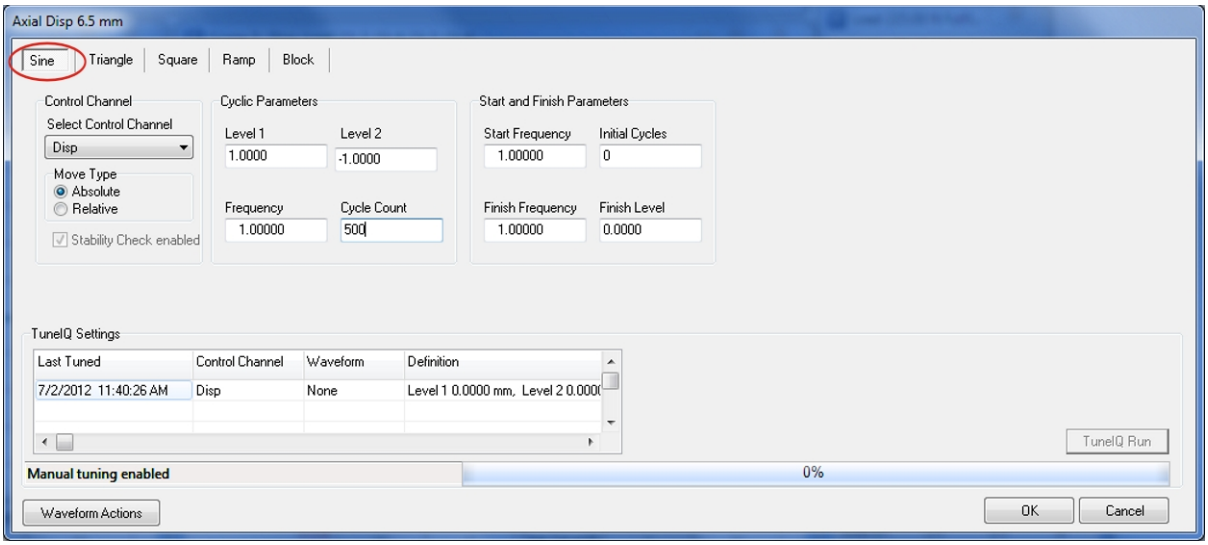


Cyclic Waveform Setup: Sine, Triangle, and Square

The cyclic waveforms—sine, triangle, and square—have very similar setup parameters. To set up a cyclic waveform, do the following:

1. Systems with multiple groups and movers: Select the group and the mover. Waveforms are defined independently for each mover.

2. Click the **Waveform Setup** button (**Test Setup** window), and then click the **Sine**, **Triangle**, or **Square** tab in the setup window, depending on which type of cyclic waveform you want to define.



3. Select the control channel in the **Select Control Channel** list.

4. Select the **Move Type.**

Move Type	Description
Absolute	Commands the mover to the specified levels, regardless of the current mover level.
Relative	Commands the mover to the specified levels, relative to the current mover level.

5. Specify the cyclic parameters.

NOTE *Either Level 1 or Level 2 can be the maximum or minimum value for the waveform. Level 1 and Level 2 values may be either positive or negative. Units are the calibrated units for the selected control channel.*

Parameter	Description
Level 1 Level 2	First level from the current position. Second level.
Frequency	Cycles per second, typically determined by test requirements.
Cycle Count	Number of requested cycles.

6. Specify the **Start and Finish Parameters** and click **OK**.

   For sine waveforms, the starting cycle is a half sine. For triangle waveforms, the starting cycle is a half triangle. For sine and triangle waveforms, WinTest counts the start cycle and finish cycle in the cycle count. (Thus, a cycle count of 10 provides 10 test conditions for level 1, but only 9 test conditions for level 2.)

   For a square waveform, the starting cycle is an immediate jump to level 1.

NOTE *If the waveform frequency is less than 20 Hz, the Start Frequency and Finish Frequency can be the same as the waveform frequency. For higher waveform frequencies, the Start Frequency and Finish Frequency should be set at approximately 10% of the waveform frequency.*

NOTE *If Stability Check is enabled, your waveform will start only after Stability Check completes successfully.*

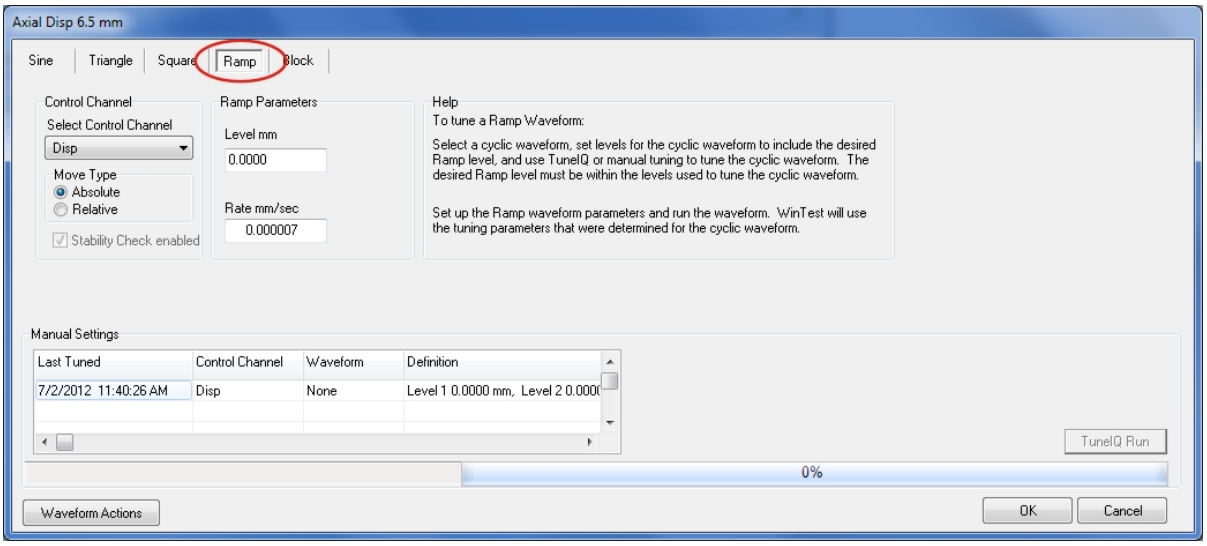
Parameter	What to enter
Start Frequency	Frequency used to command the first cycle of the test, from the current position to level 1.
Initial cycles	Specifies a starting cycle for the waveform other than cycle 1 (for example, if the test was interrupted and will be started again). When you start the test with the **Start** button (instead of **Zero Start**), WinTest will continue the cycle count from this number. See also Chapter 8, "Running and Managing Tests."
Finish Frequency	Frequency used to command the last cycle of the test.
Finish Level	Final commanded level, when all test cycles have been completed.

Ramp Waveform Setup

A ramp command commands a mover to a new level at a constant rate and increments the cycle count at the end of the ramp.

Although the **Adjust Mover** window can also be used to command an actuator to a specific level in either PID or DirCmd (direct command) mode, defining a ramp in the **Waveform Setup** window lets you specify the move as either absolute or relative and to coordinate data acquisition with the test.

NOTE *TuneIQ is not available for ramp waveforms. To tune a ramp waveform, click the tab for a cyclic waveform (Sine, Triangle, or Square) and set up a waveform with parameters that are appropriate for your test. Run TuneIQ, then click the Ramp waveform tab again and run the test. See also* *"How to Run TuneIQ"* *in this chapter.*



To define a ramp waveform:

1. Click the **Waveform Setup** button (**Test Setup** window), then click the **Ramp** tab in the setup window.
2. Select the control channel in the **Select Control Channel** list.
3. Select the **Move Type**.

Move Type	Description
Absolute	Commands the mover to the specified level regardless of the current mover level.
Relative	Commands the mover to the specified level, relative to the current mover level.

4. Type a value in each **Ramp Parameter** box.

Parameter	Description
Level	The target ramp level (units are for the selected control channel).
Rate	Specifies the constant rate of movement for the ramp (control channel units per second).

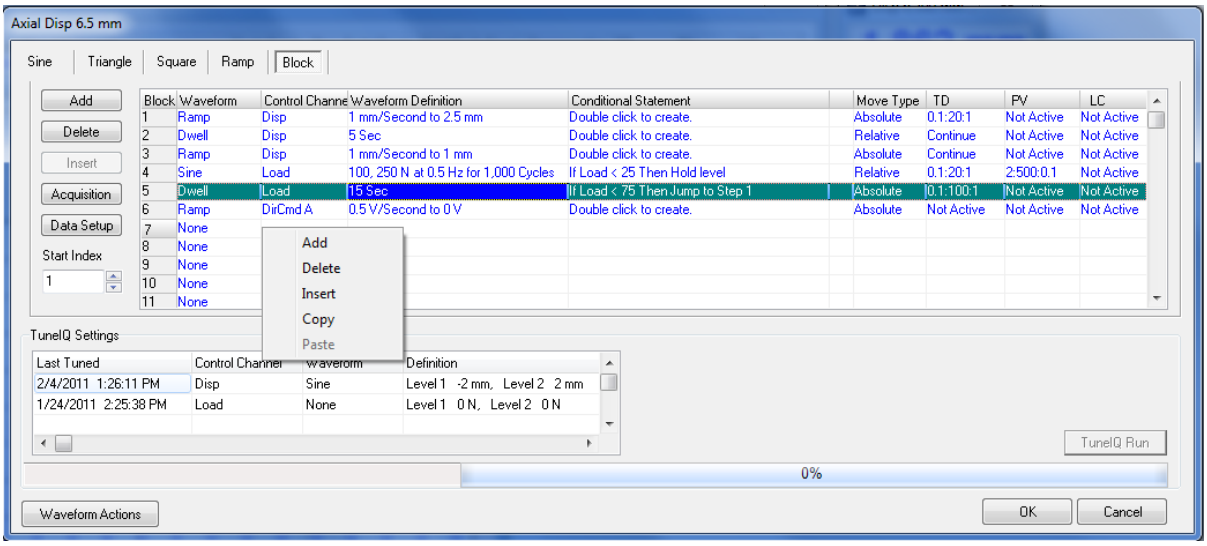
Block Waveform Setup

About Block Waveforms

Block waveform definition allows you to build custom waveforms from a set of available components to create complex test waveforms. Each block waveform for each mover can define a maximum of 50 blocks (steps). When you start the test, blocks are run in sequential order, starting with the first block or with the block specified with the **Start Index** value. You can repeat blocks within the waveform, and you can conditionally or unconditionally jump to another block in the waveform.

Use the **Block** tab in the **Waveform Setup** window to define the block waveform. Each block step in the worksheet displays the type, the control channel, the type of waveform, whether a conditional statement is defined, the move type (if applicable), and how data acquisition is defined. Lines that display "None" are not defined.

NOTE *When defining a block waveform for a multi-axial test, you can define block data acquisition for the first mover only. Be sure to tune all control channels to ensure good performance.*



The **Block Waveform Setup** window displays the following information for each block that has been defined:

Column	Description
Block	Identifies the block index number. Use the **Start Index** field to specify which block number to run first.
Waveform	Identifies the block type. See "Block Waveform Types" in this chapter.
Control Channel	Identifies the control channel for this block. If the control channel for this block is different than in the previous block, WinTest provides a smooth mode switch to the new control channel before continuing with that step.
Waveform Definition	Describes the characteristics as defined for this block. NOTE For Block Waveforms, the Stability check does not run automatically. If a Stability check is desired, it must be added as a separate step.
Conditional Statement	Describes the conditional statement defined for this block (if defined). A conditional statement defined in this column is run immediately after the command for the same block is issued, during the block step.
Move Type	Reports whether the move type for the waveform in this block was defined as **Absolute** (go to the specified absolute level) or **Relative** (go to the specified level(s) relative to the mover's current level. "N/A" means the block type does not cause command the mover to change levels.
TD	If Timed Data acquisition is defined for this block in the waveform, this column shows the data acquisition parameters. "Not active" means that Timed Data acquisition is not defined for this block.
PV	If Peak/Valley data acquisition is defined for this block in the waveform, this column shows the data acquisition parameters. "Not active" means that Peak/Valley data acquisition is not defined for this block.
LC	If Level Crossing data acquisition is defined for this block, this column shows the data acquisition parameters. "Not active" means that Peak/Valley data acquisition is not defined for this block.

Defining Block Waveforms – General Procedure

To define a block waveform for a mover:

1. For systems with multiple groups and movers: Select the Group and the mover (**Test Setup** window).
2. Click the **Waveform Setup** button (**Test Setup** window), then click the **Block** tab in the setup window.
3. Use the right-click editing functions to define up to 50 block steps. After selecting the type of block for each step, WinTest will prompt you to enter the required parameters for the selected block type. See "Creating, Editing, and Deleting Blocks" in this chapter for details.
4. Click the **Data Setup** button to specify a data acquisition file for each type of data acquisition and an export option. Then define data acquisition for each block as required for your test. See Chapter 7, "Data Acquisition Setup," for specific information about block data acquisition.

NOTE *For block waveforms, data acquisition can be defined only for the first mover.*

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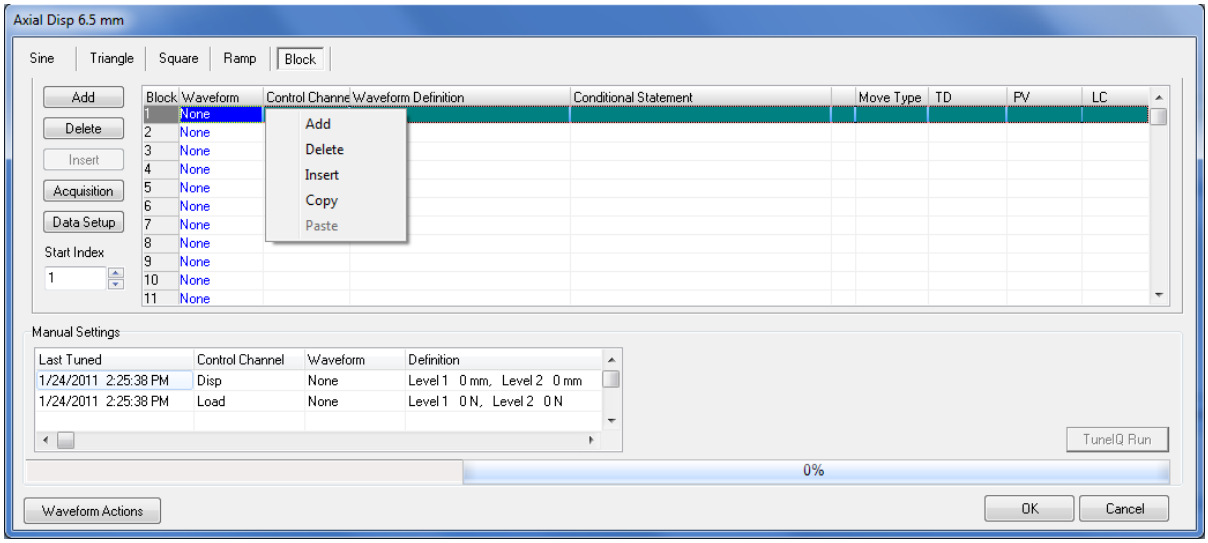
5. In the **Start Index** field, specify the starting block number. If you start a block waveform with **Start** instead of the **Zero Start** button, the test waveform will start with this block.
6. Repeat this procedure for each mover to be controlled using a block waveform during the test.

NOTE *The block waveform is saved with the test file and can be reused once you have created it.*

Creating, Editing, and Deleting Blocks

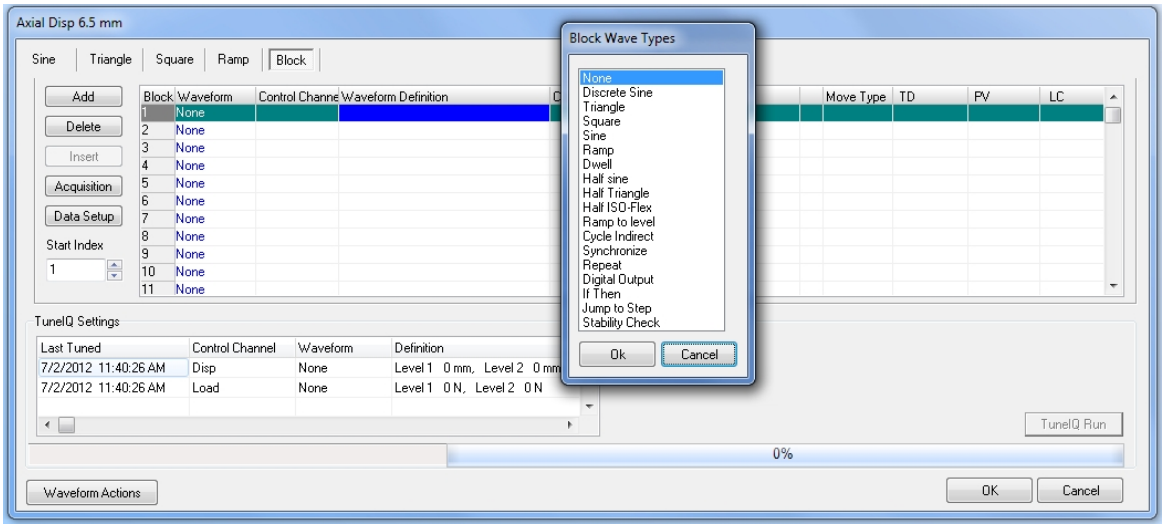
WinTest provides a set of functions to insert, add (define), delete, and to copy and paste blocks in a block waveform. Right-click in any block in the **Block Waveform Setup** window to display a list of available functions, or double-click in any block step to automatically add or edit its definition.



Command	Description
Add / Edit	Right-click in the block to define or edit. Click **Add** to define a new block, or **Edit** to modify this block. Select the block type, the control channel, and any additional parameters, which depend on the block type. See also "Block Waveform Types" in this chapter.
Delete	Right-click in the block to delete and click **Delete** (no confirmation).
Insert	Inserts a new, undefined block immediately above the highlighted block. Use the **Add** function to define the new block.
Copy	Right-click in the block or blocks to copy, then right-click and click **Copy**. Right-click again and click **Paste** to paste the copied blocks into the block waveform. This command is useful for quickly defining multiple sequences of blocks with similar parameters.
Paste	This command is active only after one or more blocks have been copied. Right-click in the block where you want to paste the copied block or blocks. (If any of these blocks are already defined, the pasted block will overwrite them.) To avoid overwriting any blocks, use **Insert** to add undefined blocks in the waveform before you paste the copied blocks.

Block Waveform Types

The following block wave types are available to define steps in a block waveform:



Wave Type	Description
None	No block type has been assigned to this block step.
Triangle	Similar to a triangle cyclic waveform. Commands a triangle waveform to the first level and then cycles in a triangle waveform between the specified levels at the specified frequency for the specified number of cycles. WinTest will prompt you to specify the control channel, the levels, frequency, cycle count, and move type (absolute or relative).
Square	Similar to a square cyclic waveform. Commands a square waveform to the first level and then cycles in a square waveform between the specified levels at the specified frequency for the specified number of cycles. WinTest will prompt you to specify the control channel, the levels, frequency, cycle count, and move type (absolute or relative).
Sine	Similar to a sine cyclic waveform. Commands a sine waveform to the first level and then cycles in a sine waveform between the specified levels at the specified frequency for the specified number of cycles. WinTest will prompt you to specify the control channel, the levels, frequency, cycle count, and move type (absolute or relative).
Ramp	Commands the mover to a target level at a constant rate. When the control channel reaches this level, the waveform generator continues to the next block in the waveform. Specify the control channel, the ramp rate, the target level, and the move type (absolute or relative).
Dwell	Holds the mover at the final command level for the previous block step for a specified period of time (seconds).

Wave Type	Description
Half sine	Similar to a ramp, but the levels are connected by a half sine and the time between the current level and the new level is defined as a frequency. Specify the control channel and the level.
Half Triangle	Similar to a ramp, with a constant rate between levels, except that the ramp rate is defined as a frequency.
Half ISO-Flex	Optional waveform type for specific test applications. See your *System Reference Manual* for specific information.
Ramp to level	Ramps a control channel at a constant rate to the specified level for the indirect channel. Specify the control channel, the indirect channel, the indirect channel level, the control channel rate, and move type.
Cycle indirect	Uses a sine wave to control the direct control channel (typically displacement) between two levels of the indirect control channel (typically load). See "Cycle Indirect Block Waveforms" in this chapter for more information.
Synchronize	Use this block type to ensure that two or more movers start certain block steps at the same time. The first mover to encounter a Synchronize command will wait for the next Synchronize command in all synchronized movers. Then the next block step for all synchronized movers will start at the same time.
Repeat	Use this block type to repeat a block for a specified number. This number is the total number of times the block step will run. You can also use the Repeat block type to create nested loops within the block waveform.
Digital Output	Use this block type to open or close a digital output line (relay) at a specific step in the block waveform. Select the digital output line and the desired state (on or off).
If Then	Use this block type to monitor a condition based on a channel level, mean, mover count, or digital input state. If the condition is satisfied, the waveform generator will jump to a specific block step or execute the specified action, as defined in the if-then statement for this block step.
Jump to Step	Use this block type to unconditionally jump to a specific block step sequentially executed from there.
Stability Check	Use this block type to test for system instability prior to turning on Mover power, or after changing the control channel. This can prevent damage to system hardware and/or specimens. NOTE For Block Waveforms, the Stability Check does not run automatically. If a Stability Check is desired, it must be added as a separate step.

Cycle Indirect Block Waveforms

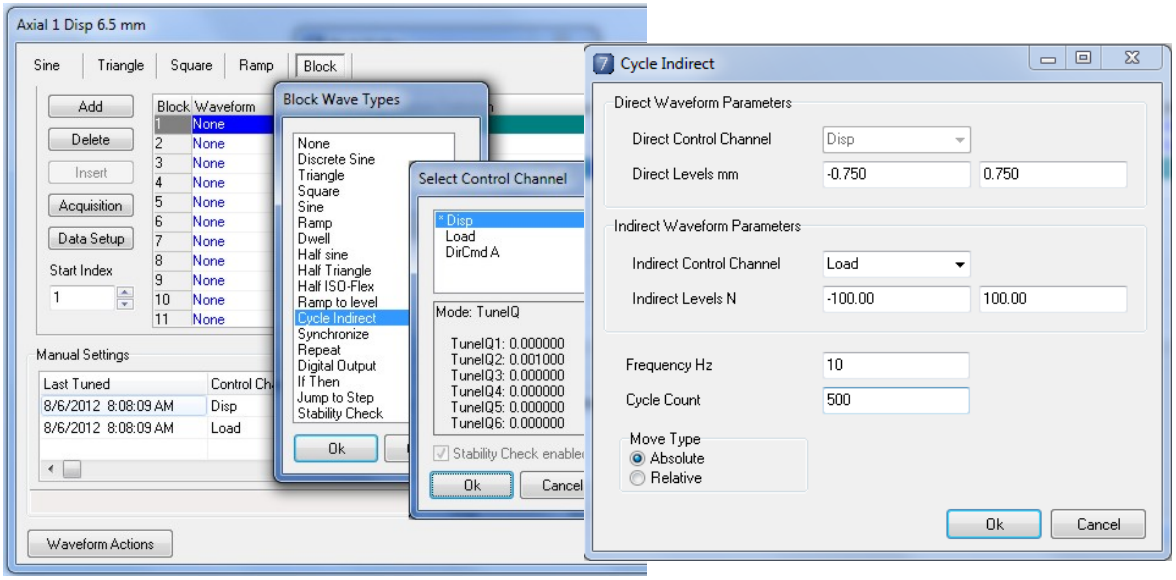
The Cycle Indirect block type uses a sine wave to control the direct control channel (typically displacement) between two levels of the indirect control channel (typically load). Cycle Indirect is often used when load control is desired, but changes in specimen compliance during the test makes tuning difficult; for example, for testing soft specimens or specimens that exhibit nonlinear behavior in one control mode but not in another.

Additional requirements for Cycle Indirect waveforms:

- The system must be tuned for the channel selected as the Direct Control channel (typically displacement).
- Make sure that Amplitude Compensation is enabled before starting the test, or the system will simply continue to command the mover at the specified direct levels.

To define a Cycle Indirect block step:

1. Use Presets to find the target direct levels that correspond to the desired indirect levels. Example: if the desired cyclic load levels are -100 N and +100N, use Presets to command the mover to these load levels and note the corresponding Meter readings for the displacement channel (for example, -1 mm and +1 mm).
2. Add or edit the appropriate block step, selecting **Cycle Indirect** for the block wave type.
3. Select the direct control channel (typically displacement) in the window that opens.



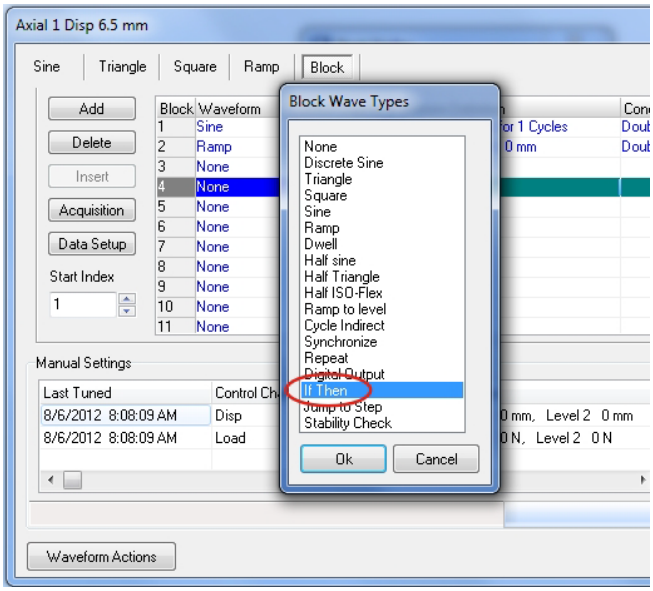
4. Select or enter parameters in the **Cycle Indirect** window:

Parameter	Description
Direct Waveform Parameters	**Direct Control Channel**: This is the channel that you selected in the previous window (typically displacement). **Direct Levels**: To avoid overshoot, enter approximately 75% of the target direct levels that you determined in step 1 (direct control channel units). These are the starting levels; WinTest will use Amplitude Compensation to adjust the command to help achieve the desired indirect levels.
Indirect Waveform Parameters	**Indirect Control Channel**: Select the indirect channel (typically load). **Indirect levels:** Enter the desired indirect levels (indirect control channel units). These are the levels you want the specimen to achieve.
Frequency	Sine wave frequency, in Hz.
Cycle count	Number of requested cycles for this block.
Move Type	**Absolute**: Target levels are the specified values, regardless of the mover's current level. **Relative**: Target levels are relative to the current mover position.

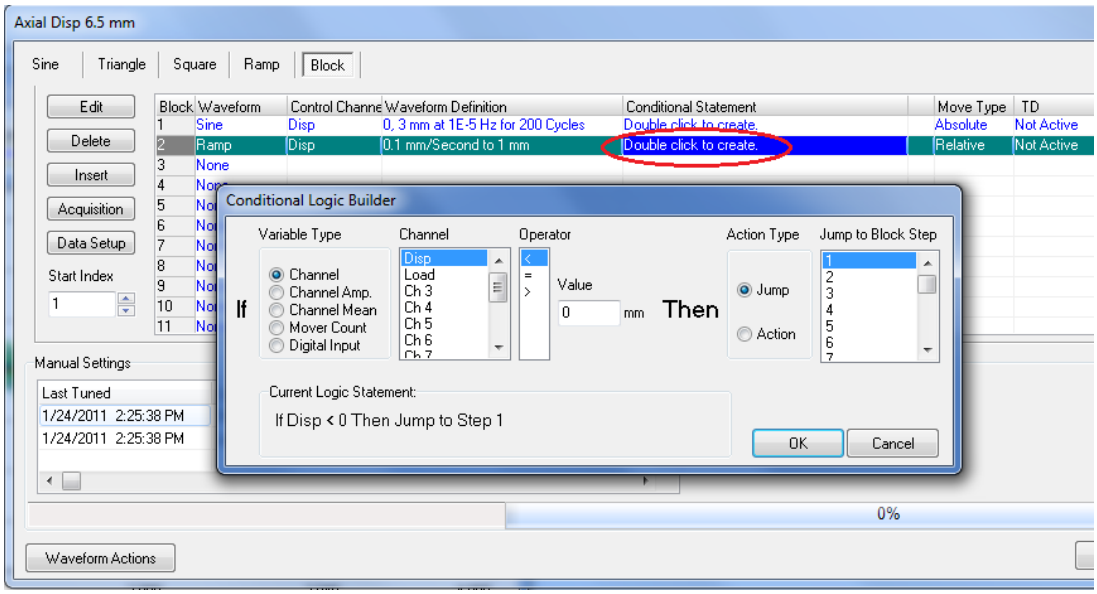
Defining Conditional Logic for Block Waveforms

WinTest provides two types of conditional logic for block waveforms:

- Define an **If Then** block step. The condition is tested once at the beginning of the step. If the condition is satisfied, WinTest will jump to the specified step or execute the specified action. If the condition is not satisfied, WinTest continues to the next step.



- Define a conditional statement within a block step. WinTest will monitor the condition throughout the entire block step. If the condition is satisfied while the step is executing, WinTest will jump to another block step or execute an action, as specified in the **Conditional Logic Builder** window, and the step ends.

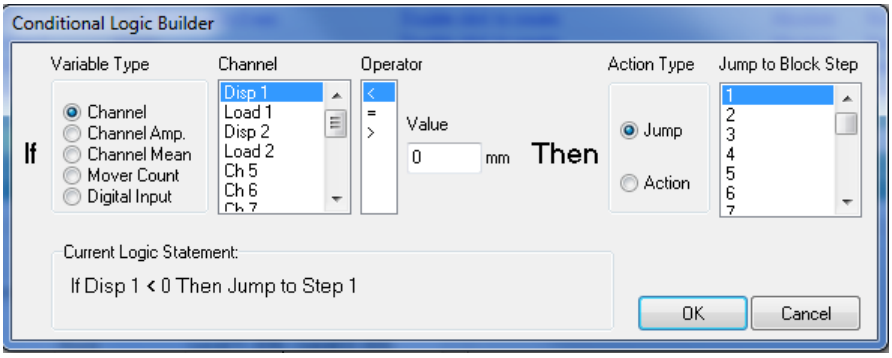


To define conditional logic for a block waveform:

1. Open the **Conditional Logic Builder** window:

   - If-then block step: Click **Add** or **Edit** in the right-click menu and then select the **If Then** block type. The **Conditional Logic Builder** window opens.

   - Conditional statement within a block step: Double-click in the **Conditional Statement** column for that block. The **Conditional Logic Builder** window opens.



2. In the **Variable Type** list, select the type of condition to test.

Condition	Description
Channel	Test for the specified value for a specific channel. Select the channel in the **Channel** list.
Channel Amp	Test for the last Peak/Valley reading for a specific channel. Select the channel in the **Channel** list.
Channel Mean	Test for the mean value for a specific channel. Select the channel in the **Channel** list.
Mover Count	Test for the cycle count for a specific mover. Select the mover in the **Count** list.
Digital Input	Test for the state of a digital input line. Select the line in the **Digital Input** list.

3. Select an operator. This specifies whether you are testing for a condition that is greater than, equal to, or less than the specified value. (Select = for the digital input variable.)

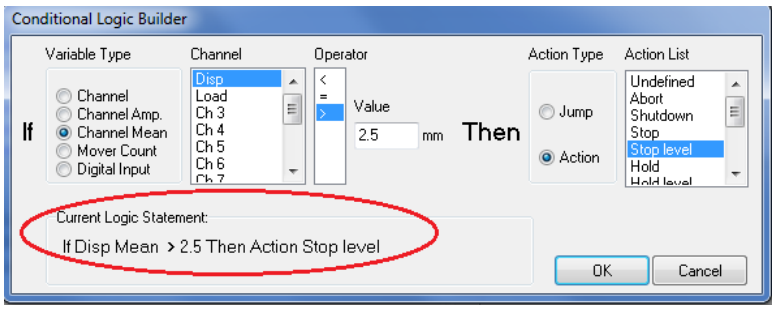
4. Type the value to test in the **Value** field. (Enter 1 for high or 0 for low for the digital input variable.)

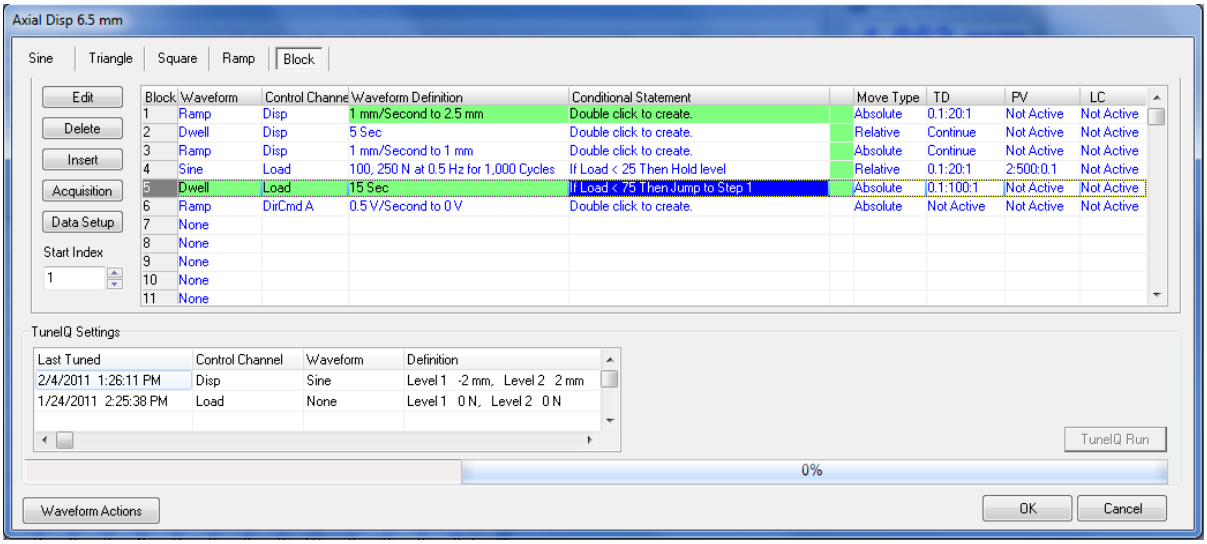
5. Select the **Action Type**. This is how the system responds if the test condition is satisfied.

Action Type	Description
Jump	Execute the specified block number and continue the block waveform from that step. Select the block number in the list to jump to.
Action	Execute an action. Select an action in the list. See Chapter 4, "Limits and Actions," for information about the available actions.

6. The **Current Logic Statement** in the window shows the conditional logic statement as defined by the selected parameters. If necessary, edit the conditional logic parameters, and click **OK** when finished.

   If you click in a jump-to block step or in a step that includes a conditional jump-to statement, a green line runs to the jump-to step for visual confirmation.

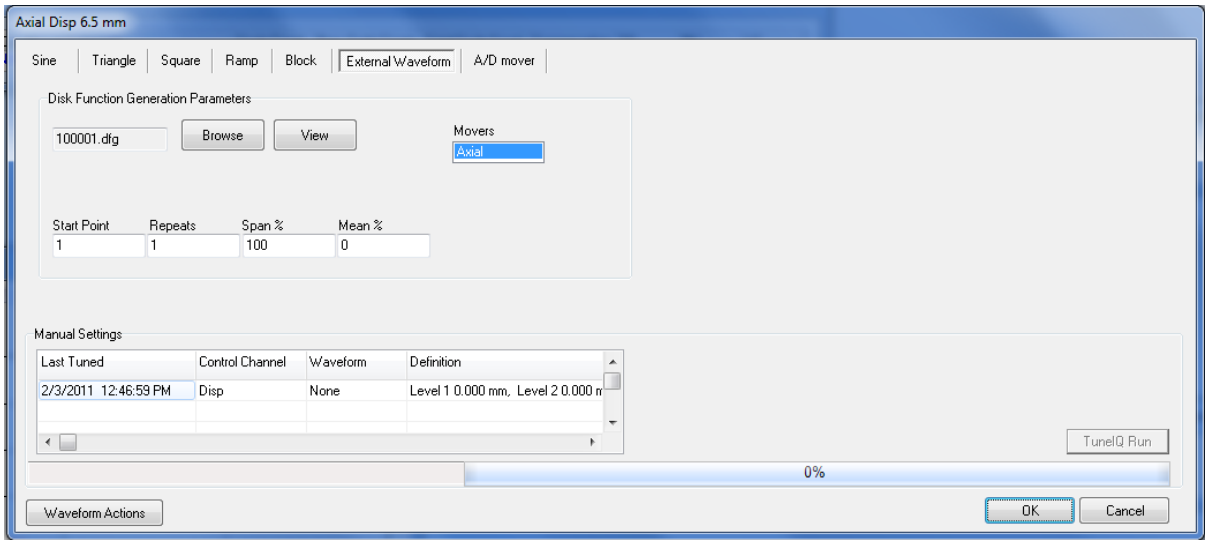




External Waveform Option

External Waveform is an optional WinTest feature that lets you run user-defined test profiles or other profiles created outside of WinTest (such as a loading history or field-recorded data), or test waveform files that were created by exporting timed data that was previously acquired in WinTest. When this option is installed, the waveform setup window includes an **External Waveform** tab.

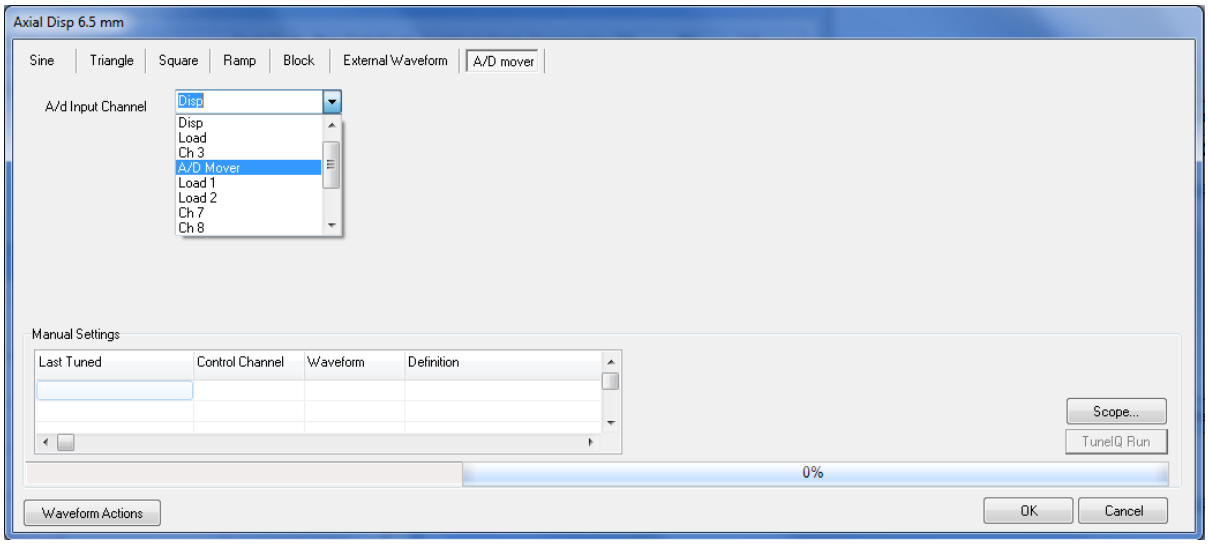
See Chapter 16, "External Waveform Option," for more information.



A/D Mover Option

A/D Mover is an optional WinTest feature that lets you connect an external waveform source to an open A/D channel as a waveform generator. When this option is installed, the **Waveform Setup** window includes an **A/D Mover** tab.

For more information, see Chapter 17, "A/D Mover Option."



Set MAPS Waveforms Option

The **Set MAPS Waveform** command on the **Waveform** menu (**Test Setup** window) is an optional WinTest feature. It is active only when WinTest is configured for use with an ElectroForce Multi-Axis Peripheral Stent (MAPS) test instrument. The MAPS test instrument simulates the complex loading conditions that peripheral stents and stented grafts experience in the peripheral arteries.

For more information, refer to the *System Reference Manual* for your MAPS test instrument.

Set MACS Waveforms Option

The **Set MACS Waveforms** command on the **Waveform** menu (**Test Setup** window) is an optional WinTest feature. It is active only when WinTest is configured for use with an ElectroForce Multi-Axis Coronary Stent (MACS) test instrument. The MACS test instrument verifies the fatigue life of coronary vascular stents under simulated physiological displacement loading conditions that include pulsatile distention, extension/compression, bending, and rotation.

For more information, refer to the *System Reference Manual* for your MACS test instrument.

Waveform Actions

The **Waveform Actions** button (**Waveform Setup** window) provides quick access to mover settings for the Stop-Level and Hold-Level actions, the Finish Action selection, and other mover settings (except Control Channel and Power).

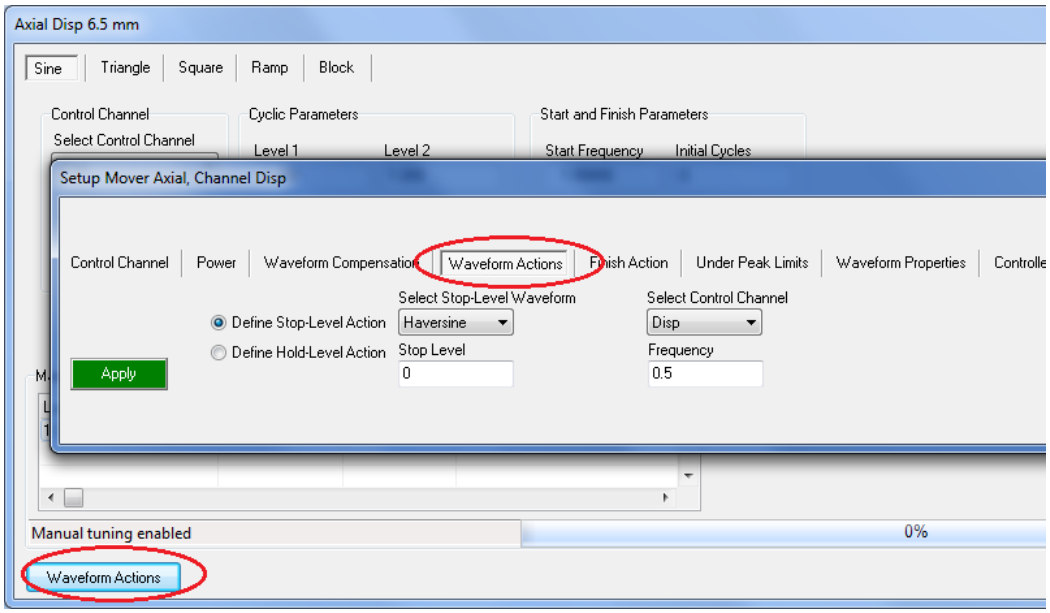
Waveform Actions – Stop Level and Hold Level

Stop-Level and Hold-Level definitions are used when you click the **Stop Level** button in the **Test Setup** window and when you click **Stop-Level** or **Hold-Level** for the control channel on the **Run/Stop** menu. These settings also apply to the Stop-Level and Hold-Level actions used for limits, Under Peak/Valley detection, and digital polling. For each mover, you will need to specify Stop-Level and Hold-Level parameters for each control channel.

NOTE *Be sure to define both Stop Level and Hold Level parameters for all control channels for all movers.*

To define the Stop-Level and Hold-Level actions for any mover:

1. In the **Waveform Setup** window, click the **Waveform Actions** button (**Waveform Setup** window). Alternately, click **Set Waveform Actions** on the **Waveform** menu (**Test Setup** window). The **Setup Mover** window opens with the **Waveform Actions** tab already selected.



2. Select the action to define: **Stop-Level Action** or **Hold-Level Action**.

3. Select a control channel in the **Select Control Channel** list. These actions are defined independently for each control channel.

4. In the **Select Waveform** list, select the waveform shape to command the Stop-Level or Hold-Level action to the specified level.

Waveform Shape	Description
Haversine or Half sine	Commands the mover to the specified level with a half-sine waveform. The mover is then held at the specified level.
Ramp	Ramps the mover to the specified level at the specified rate, then the mover is held at this level.
Immediate	Maintains the mover at its current level (same as a Stop action).

5. Unless you selected the **Immediate** waveform, type the **Stop Level** or **Hold Level** value. Units are as defined for the control channel (but are not shown).

NOTE *For load control, the Stop Level and Hold Level values should NOT be zero, because commanding zero load may not be attainable. In this case, command will increase until the factory limit is tripped, which typically turns off power. Instead, specify a small load (positive for tension or negative for compression, as appropriate for the test).*

NOTE *Bose does not recommend using a high percentage of full-scale for a Stop-Level or Hold-Level value. When held at a high level, an ElectroForce system may continue to draw high current, which can lead to a thermal shutdown.*

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6. In the **Frequency** box, type the frequency (for half sine) or the ramp rate (for ramp). This value should be the same as the working frequency or ramp rate in the test waveform.

7. Repeat this procedure to define the Stop Level and Hold level parameters for all movers and control channels defined for this test.

8. Click **Apply** to apply any changes, and then click **OK** to close the window.

   To exit without saving any changes, click **OK**. WinTest will ask whether to apply your changes. Click **No**, and then click **OK** to close the window.

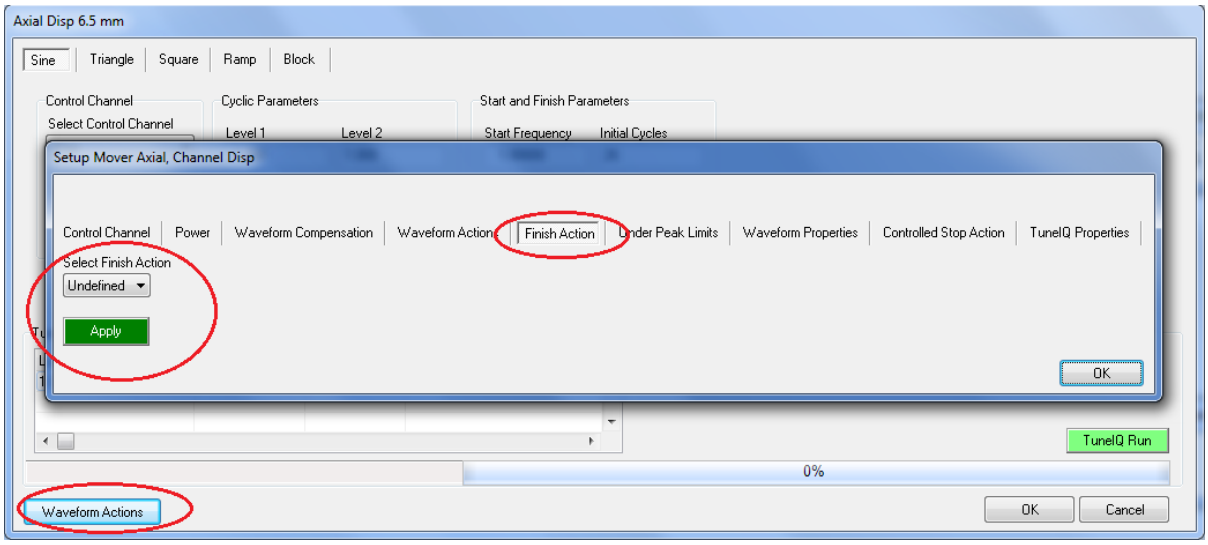
Finish Action

The Finish Action (optional) automatically causes the mover to execute a specific action when the last cycle of the test waveform (as specified in the Finish Parameters in the waveform setup) has been completed.

To define the Finish Action for the current mover:

1. Click the **Waveform Actions** button (**Waveform Setup** window). In the **Setup Mover** window, click the **Finish Action** tab.

   Alternately, click **Set Waveform Actions** on the **Waveform** menu (**Test Setup** window) and click the **Finish Action** tab. Select the mover if necessary.



2. Select the finish action in the **Select Finish Action** list.

Finish Action	Description
Undefined	No finish action is executed, and the mover is at the level defined at the end of the test waveform.
Abort	Turns off power to all movers with mover power in all groups, and sets the command for all movers to the Stop Level defined in the mover settings.
Shutdown	Turns off power to all movers in the affected group and sets the command for all movers in the group to the Stop Level defined in the mover settings. Other groups are not affected.
Stop	Stops data acquisition (if the **File Close on Stop** option is selected for data acquisition setup) and controls all movers at the current level.
Stop Level	Stops data acquisition (if the **File Close on Stop** option is selected for data acquisition setup) and controls movers in the group at the Stop Level defined for each mover.

3. Click **Apply** to save the Finish Action, then click **OK** to close the window.

   To discard any changes, click **OK** without clicking **Apply**. WinTest will ask whether to apply your changes. Click **No**, and then click **OK** to close the **Setup Mover** window.

Controlled Stop Action

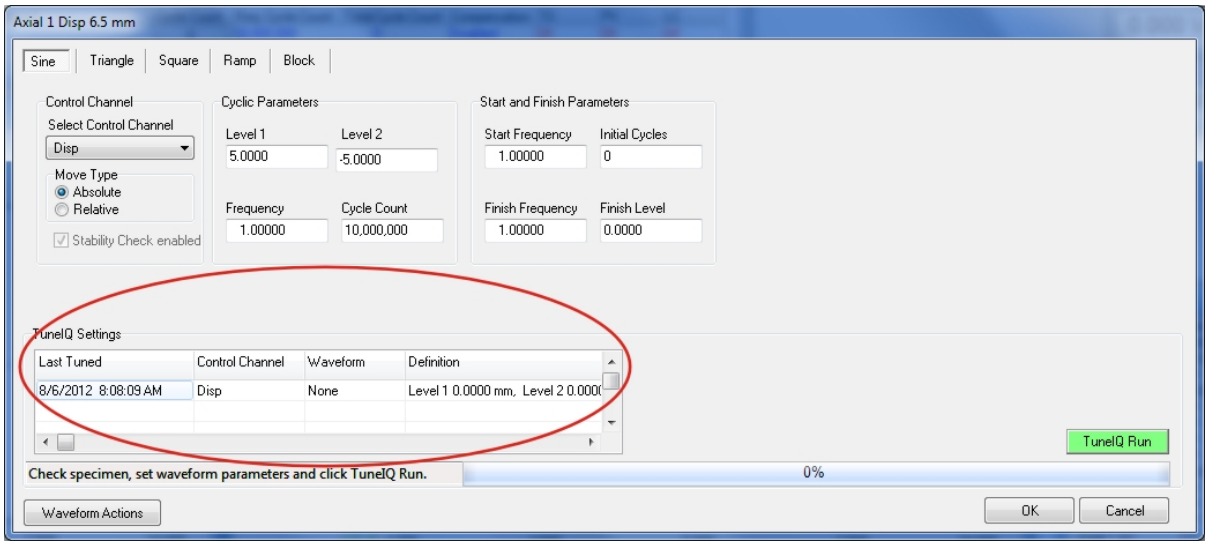
See Chapter 4, "Limits and Actions," for a detailed discussion of the Controlled Stop action and how to set the Controlled Stop Position.

IMPORTANT *It is extremely important to use Controlled Stop in the appropriate test situations and to specify the correct Controlled Stop Position for each mover based on the specimen and the test situation. If you are not sure how to use the Controlled Stop action or how to determine the Controlled Stop position, contact Bose ESG for assistance.*

Tune Modes – TuneIQ and Manual

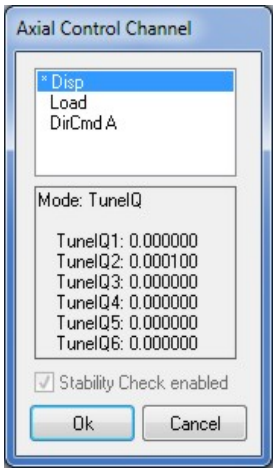
The Tune Mode that is currently selected for a control channel determines whether the TuneIQ settings or the manual tuning settings are used to optimize the system response.

The **Waveform Setup** window shows which settings are applied for the control channel selected in the waveform, the date that channel was last tuned for that mode, and information about the waveform used to generate the tuning settings.

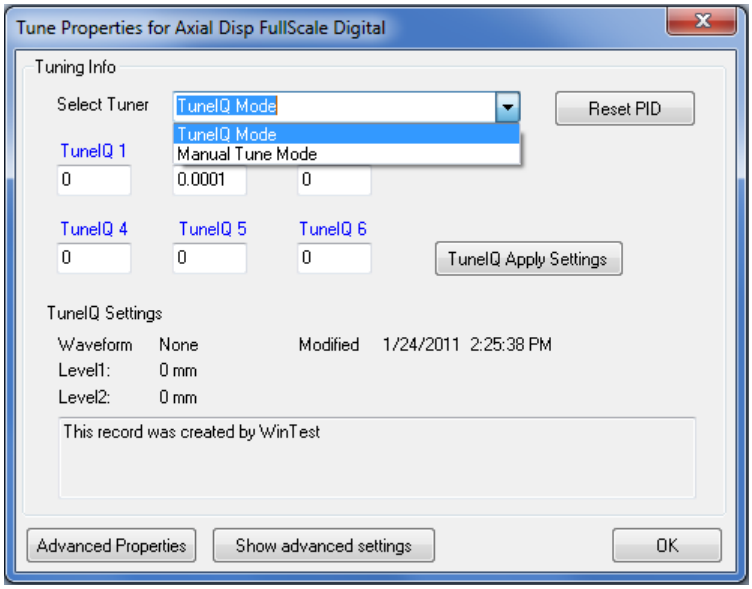


- When **TuneIQ Mode** is selected for the control channel, the current TuneIQ settings are applied to optimize the system response.
- When **Manual Tuning Mode** is selected for the control channel, the current manual tuning settings are applied to optimize the system response.

When you set the control channel for a mover in the **Adjust Axial** window or in the **Control Channel** window, the window displays the current Tune Mode and the current tuning parameters.



To change the Tune Mode for the control channel, click **Set Tuning** on the **Mover** menu (**Test Setup** window) and select the appropriate mode.



Automatic Tuning with TuneIQ

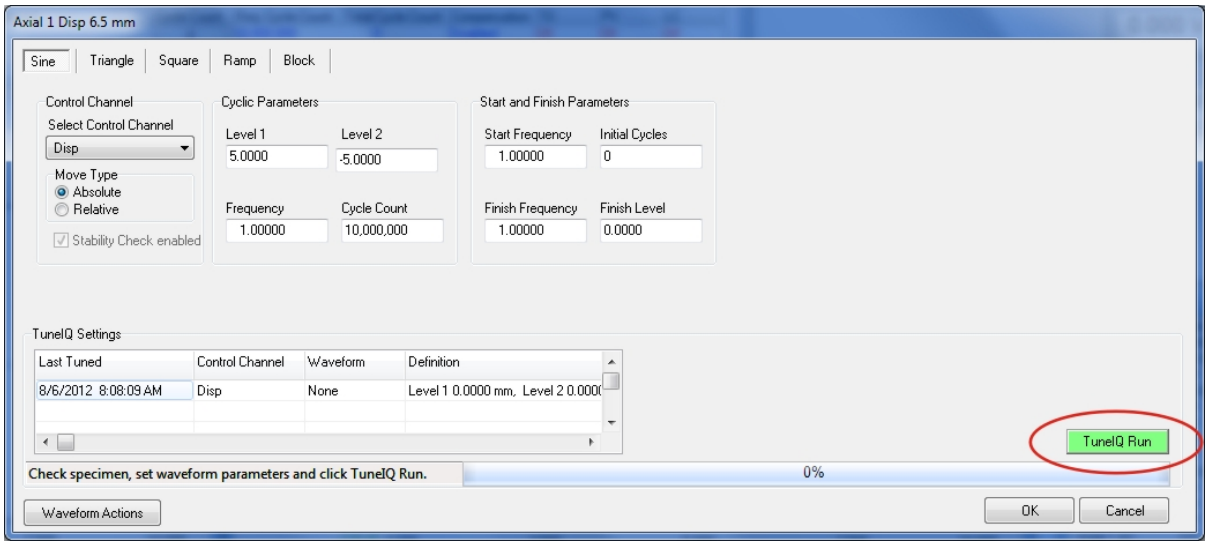
About TuneIQ

TuneIQ uses Bose-proprietary tuning algorithms to provide excellent automatic tuning for ElectroForce linear motors in both displacement and load control for nearly all tuning situations. In most situations, TuneIQ will provide not only faster, but better optimization results than careful manual tuning.

TuneIQ settings are saved in the project file and the test file, allowing quick setup for similar specimens in similar testing situations. To load the settings, open the test file.

NOTE *Manual tuning is required for mover types other than ElectroForce motors. See* *Chapter 13, "Manual Tuning,"* *for more information.*

To use TuneIQ with a cyclic test waveform, simply define the test waveform, set appropriate limits, turn on mover power, and click the **TuneIQ Run** button in the **Waveform Setup** window. (The **Tune Mover** button in the **Test Setup** window also provides access to TuneIQ.)



The **TuneIQ Run** button is disabled for ramp and block waveforms. See "How to Run TuneIQ" in the next section.

NOTE *TuneIQ will never expose the specimen to test conditions that exceed the waveform amplitude, but frequency content can exceed 200 Hz. Like any tuning situation, if tuning will adversely affect the specimen's mechanical properties or fatigue life, try using a "dummy" sample for tuning or an alternate tuning method.*

How to Run TuneIQ

Before starting TuneIQ, check the following:

- ✓ For systems with multiple movers and/or groups, select the group and the mover (**Test Setup** window).
- ✓ Install the test specimen (see your *System Reference Manual*).
- ✓ Set the appropriate limits and actions for the waveform (see Chapter 4, "Limits and Actions").
- ✓ Make sure that the Peak/Valley band setting for the control channel is appropriate for the expected waveform amplitude. See Chapter 10, "Channel Setup Reference," for specific information.

NOTE *If Amplitude Compensation is on, TuneIQ will automatically turn it off when you run TuneIQ and will turn it back on when TuneIQ is finished.*

NOTE *Run TuneIQ to adjust system tuning if the stiffness of the test specimen is significantly different than the previous specimen and/or the test amplitudes and frequencies are not similar to the previous test. If your test specimen and test amplitudes are not significantly different to the previous specimen and test, it is very likely that you can use the same TuneIQ settings as for the previous test, and it will not be necessary to run TuneIQ again. If system performance is not as expected, you can run TuneIQ again with the new specimen (or a dummy specimen with similar stiffness) and with waveform parameters that are appropriate for the new test.*

To run TuneIQ:

1. Open a Scope window, select the command and control channel signals for the mover to be tuned, and adjust scaling as needed to view the displayed signal. See Chapter 3, "Display Windows (Show Menus)," for information about scaling a Scope display.

2. Define an appropriate waveform in the **Waveform Setup** window.

   - For a cyclic test, simply define the cyclic waveform for the test.

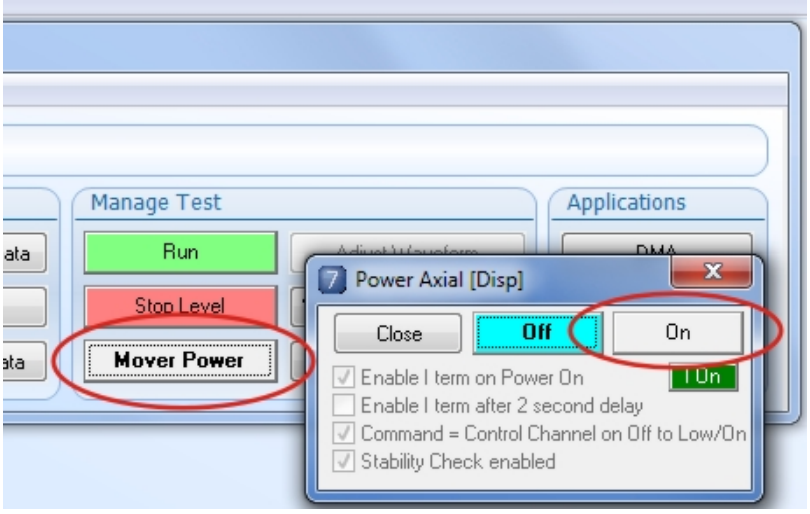
   - Ramp waveforms (general): Define a cyclic waveform with appropriate levels (these depend on the test) and a frequency that approximates the ramp rate. When TuneIQ is completed, return to the **Ramp** tab and run the test with the gains that were generated for the cyclic waveform.

   - Ramp waveforms (ramp to failure tests): For "stiff" materials (approximately 50 N/mm or greater), set up a tuning waveform with levels at 0–10% of the expected failure load. These values can be found in either load or displacement control (using Presets). For "soft" materials, tuning in free air is the best solution for displacement. For load control, the same logic applies as for "stiff" materials, but in most cases manual tuning with an I term controller is the best solution.

   - Block waveform: Define a cyclic waveform with levels and frequency that slightly exceed the maximum level and frequency defined in the block waveform (or appropriate tuning levels for the test protocol). Then return to the **Block** tab and run the test with the TuneIQ gains that were generated for the cyclic waveform.

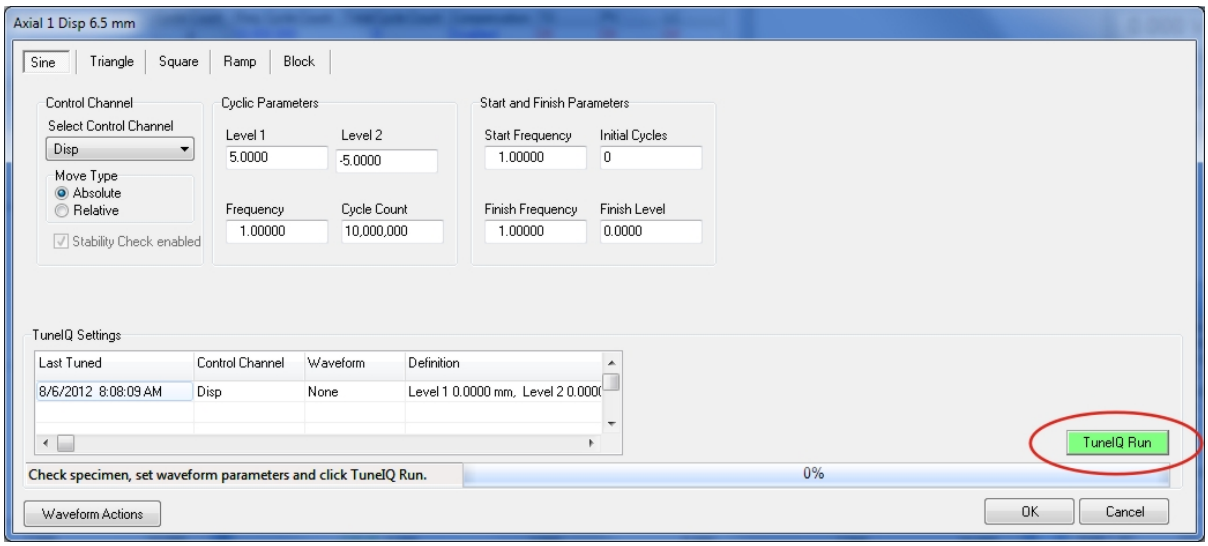
NOTE *TuneIQ will not run if the waveform amplitude is less than 0.2% of full scale.*

3. Click the **Mover Power** button (**Test Setup** window), click **On** to turn on power to the mover, and then click **Close** to close the **Power** window.



4. Click the **TuneIQ Run** button (**Waveform Setup** window) to start TuneIQ. Depending on specimen characteristics, TuneIQ takes approximately one to two minutes to finish.

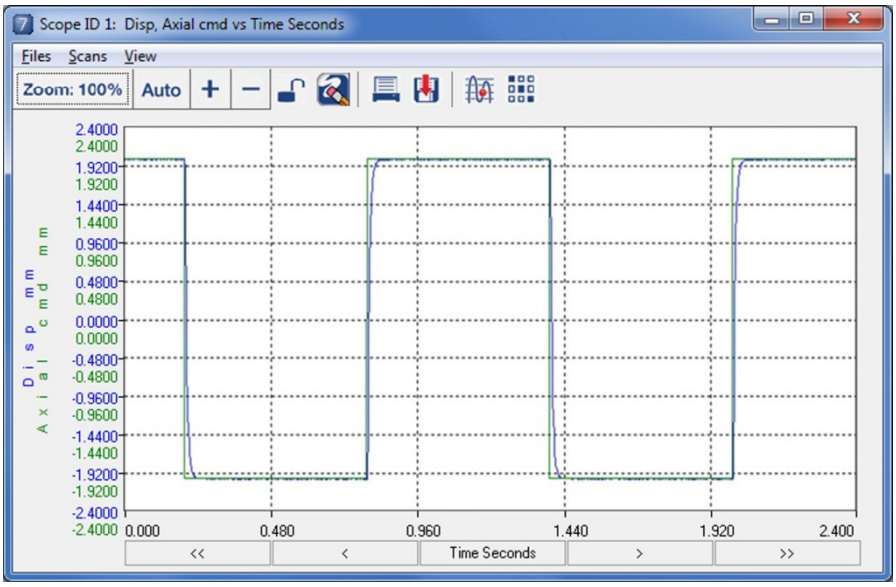
   See "TuneIQ Process" in this chapter for more information about the details of the TuneIQ process.



During the TuneIQ process, watch for messages in the lower left corner of the **Waveform Setup** window.

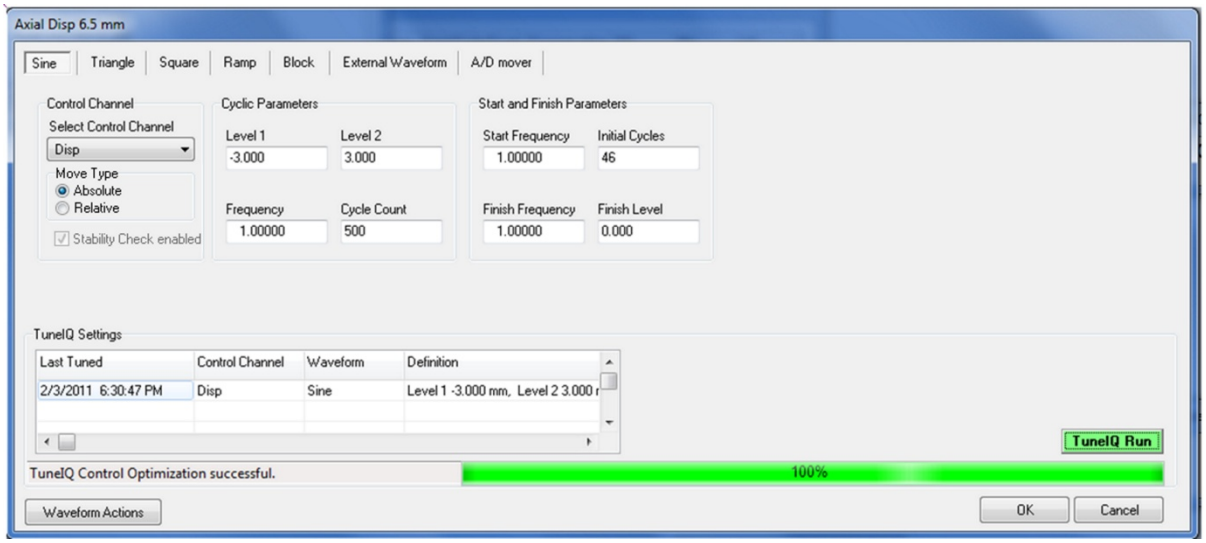
Message	Description
TuneIQ successful	WinTest exits TuneIQ with the control channel command at the desired mean level of the tuning waveform.
Error messages or TuneIQ will not start	If the waveform amplitude is too small, increase the amplitude of the cyclic waveform and run TuneIQ again. If the Peak/Valley band is too large for the waveform amplitude, WinTest displays a message and also displays the maximum Peak/Valley band percentage for this amplitude. If this occurs, you can do either of these: • Stop TuneIQ and change the waveform amplitude and/or the Peak/Valley band • Ignore the message and continue running TuneIQ with the same parameters. However, the test may be unstable or tuning may not be adequate to achieve the desired end levels. Consider using an alternate tuning method.
TuneIQ runs to completion, but is not successful	If TuneIQ cannot provide reasonable tuning parameters (for example, the specimen is too soft), WinTest displays a message and exits TuneIQ. WinTest commands the mover in DirCmd to the desired mean level of the tuning waveform. Try adjusting the waveform and/or the Peak/Valley band setting and run TuneIQ again. If still unsuccessful, try manual tuning (see Chapter 13, "Manual Tuning").

The Scope display below is typical of the response shape from the TuneIQ algorithm for a square wave. Under most circumstances, the system will return a 0.1 second rise time with no overshoot.



TuneIQ Process

TuneIQ is a multi-step characterization process that tunes the control channel automatically with excellent results. Depending on the specimen characteristics, TuneIQ takes about 1 to 2 minutes to run. Messages are displayed at each step of the process and to alert the user that the process has completed or an error has occurred.



When TuneIQ starts, it first ramps the mover to the mean level of the waveform specified in the **Waveform Setup** window.

The first TuneIQ sequence (step 1) then begins. During this sequence, a low-frequency "white noise" sine wave is applied and data is acquired. Depending on the results from the first sequence, TuneIQ may then perform a second sequence, which applies a sine sweep waveform.

For both of these sequences, TuneIQ determines the dynamic amplitude based on the waveform parameters and the specimen and test system characteristics. The TuneIQ amplitude will never exceed the amplitude of the desired waveform. TuneIQ frequencies vary by machine type and the range of samples that are typically tested on the machine.

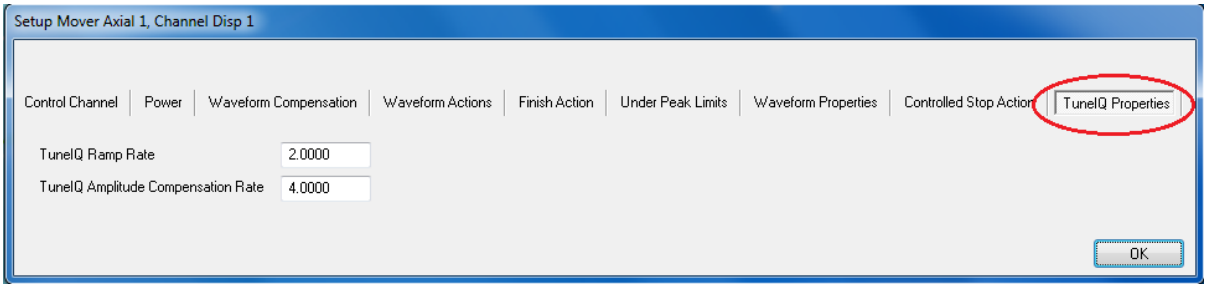
TuneIQ then computes the tuning settings. These settings can be displayed and adjusted in the **Tune Properties** window. See Chapter 13, "Advanced Tuning Properties Window" for more information about these TuneIQ settings.

Before TuneIQ is complete, it tests the computed tuning settings, evaluates whether these settings can be successfully applied, and displays a message in the lower left corner of the **Waveform Setup** window to report the results.

TuneIQ Properties

NOTE *Do not change the TuneIQ properties unless a Bose ESG expert has instructed you to do so.*

The TuneIQ Properties are specified in the **Setup Movers** window. To access these settings, click **Advanced settings** in the **Mover** window (**Test Setup** window), then click **Setup Mover,** and then click the **TuneIQ Properties** tab.



Property	Description
TuneIQ Ramp Rate	This parameter controls how quickly the actuator moves to the mean position of the desired waveform. If the TuneIQ ramp rate is too low, the system may take too long to reach the requested mean value. If this parameter is too high, the system may overshoot the mean level and trip a limit. The default ramp rate works well for most materials, but a lower ramp rate is recommended for these conditions: • A large fixture adds additional mass to the actuator output shaft • The test specimen has significant damping • The test displacement is less than 0.2% of full scale
TuneIQ Compensation	This parameter adjusts the TuneIQ amplitude correction percentage, which is independent of waveform compensation. If this parameter is too low, TuneIQ will apply more cycles to the sample over a longer period of time. Reduce this parameter for these conditions: • The sample exhibits unacceptable overshoot, which could damage the sample or trip a limit • The sample has low damping or structural resonance • A large fixture adds additional mass to the actuator output shaft • The sample has a low thickness-to-length ratio (foil, wires, etc.)

User Notes Area

Chapter 7
Data Acquisition Setup

About Data Acquisition

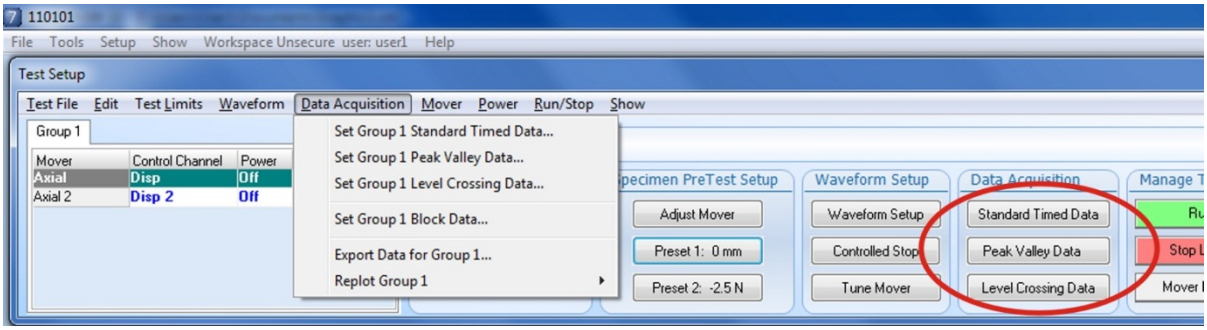
WinTest provides three ways to collect test data:

- Scheduled (standard) data acquisition starts collecting data and continues at intervals that are based on time, a mover count, or a defined trigger (when a channel reaches a specific level while moving up or down or at specified time intervals).
- Block data acquisition, allows you to specify different types of data acquisition (or none) for individual blocks in the test waveform. Block data acquisition is available for the first mover in the group.

NOTE *You can use either scheduled data acquisition or block data acquisition to collect data for block waveform test; however, both methods cannot be used at the same time.*

- Scope scans: Scope scans can also be saved as test data. These files have the same format as timed data files, but a different filename extension. See "Scope Data Acquisition" in this chapter for details.

Data acquisition is typically set up before you start a test, but you can also change data acquisition parameters during a test. See Chapter 8, "Running and Managing Tests."



Data Acquisition Types

WinTest provides three types of data acquisition for both scheduled data acquisition and block data acquisition. You can use any or all of these data acquisition types to collect data during a test. Saved Scope scans can collect timed data only, using the same parameters that were set up for the Scope scans.

Data Acquisition Types

Type	File	Description
Timed Data or Saved Scope scans	*.tdf *.sco	Acquires the specified number of data points during the specified time interval for each scan. Use Timed data acquisition to acquire data for a one-time event or to capture a set of data such as a complete hysteresis loop at given cycle count intervals. The Reverse Data Retention (RDR) buffer can also be used with Timed Data acquisition to recapture a continuous history of the 64 consecutive scans before an event such as specimen failure.
Peak Valley	*.pvf	Acquires Peak and Valley values for the selected data channels. Each scan acquires the number of Peak/Valley points specified in the channel setup for the selected channels.
Level Crossing	*.lcd	When any channel selected for Level Crossing changes by more than the delta change value defined for the channel, WinTest acquires one data point for all selected channels and writes them in the data file.

Saving WinTest Data Files

All WinTest data files are saved in binary format for faster transfer speed. However, once the data file has been closed, you can use the Export function to export the binary data files as text files (*.txt) or as comma-delimited files (*.csv) for analysis with other programs. Data files can be exported automatically, when the file is closed, or manually, at any time after the file is closed. See Chapter 9, "Reviewing Test Results," for more information about the Export function.

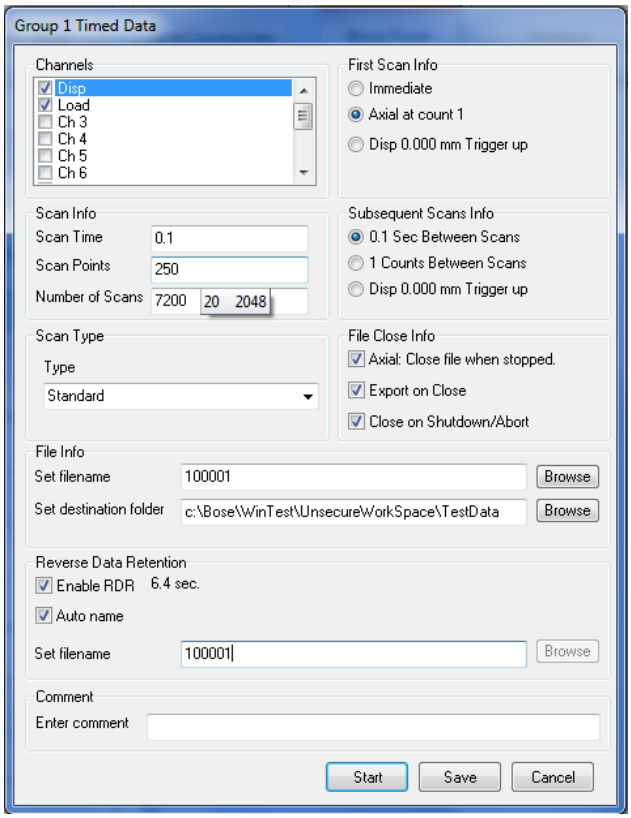
Data acquisition setup includes specifying the data file name and the destination folder. See also Chapter 14, "WinTest Files."

NOTE If you are working in a secure workspace, WinTest will direct you to save the data file in a secure workspace, but you can create new folders to organize your data files.

Standard Timed Data

About Timed Data

Each timed data scan contains the data points acquired during the specified scan time for all data acquisition channels. Use Timed Data to collect data for a single event, or to capture a set of data such as a complete hysteresis loop at given intervals based on time or cycles.



Setting Up Timed Data Acquisition

To set up timed data acquisition for the current group:

1. Click the **Standard Timed Data** button in the Data Acquisition area (**Test Setup** window) or click **Set Standard Timed Data** on the **Data Acquisition** menu (**Test Setup** window).

2. In the **Channels** list, select or clear check boxes to choose channel(s) for data acquisition.

3. In **the Scan Info** area, define the contents of each data scan.

Scan Time	Time length for each scan, in seconds.
Scan Points	Number of data points in each scan (maximum is 2048). Example: If Scan Time = 5 seconds and Scan Points = 100 points, each scan will contain 100 points acquired at 0.05 second intervals.
Number of Scans	Total number of scans to collect. For a single event, enter 1. The same information will be collected for each scan, with scan intervals specified in the **Subsequent Scans Info**. The number of scans can be large, and can even exceed the duration of the test waveform, as long as the appropriate **File Close Info** options are selected.

NOTE *If the combination of scan time and scan points exceeds the system update rate, WinTest will display a message when you click **Start** or **Save**. Increase the scan time and/or decrease the scan points.*

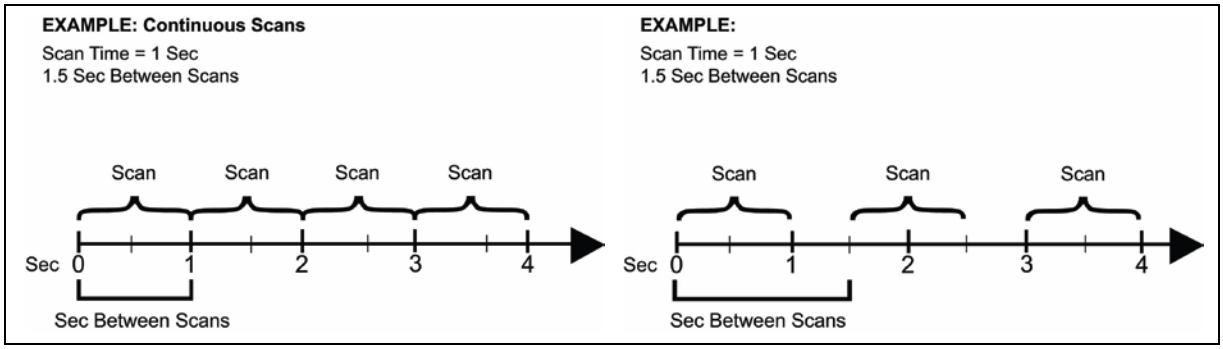
4. **First Scan Info** area: Set parameters to specify when to start the first data scan. Select an option and enter the required parameters. Each option shows its current parameters.

Option	Description
Immediate	When you click the **Start** button in this window, the first scan begins immediately.
Mover at count *x*	After you click **Start**, the first scan begins when the specified mover count reaches the specified value. Select a mover and enter the target cycle count. *NOTE* *If you redefine this parameter while a test is running, the count is relative to the current count instead.*
channel x units Trigger up (or Trigger down)	After you click **Start**, the first scan begins when the specified channel achieves the specified level while increasing (**Trigger up**) or decreasing (**Trigger down**). **Select Channel**: Select a channel from the list. **Select trigger**: Select **Trigger Up** (while increasing) or Trigger Down (while decreasing). **Trigger level/band**: Type the target level to trigger the scan (in channel units) plus a noise threshold (as a percent of full scale). Example: If the **Trigger Level** for the Disp channel is 2 mm and the band is 1% with Trigger Up and full scale is 5 mm, the first scan will begin when the Disp (displacement) channel attains 1.975 mm while the level is increasing.

5. **Subsequent Scans Info** area: Specify when to take the next data scan (up to the number of scans in the **Number of Scans** box). Select an option and enter the required parameters. Current parameters are displayed for each option.

NOTE *If the **Scan Type** selection is 1,2,4,8,16,32, the specified time or counts between scans will be multiplied by the next factor before each subsequent scan.*

Scan Type	Description
Time between scans (seconds)	Sets a time interval between subsequent scans (in seconds). For continuous scans, set this value equal to the scan time. This value specifies the time interval between the start of one scan and the start of the next scan. *Example:* If the scan time is 1 second and the time between scans is 1.5 seconds, there will be a 0.5 second delay (no data acquisition) between data scans. See illustration below.
Counts between scans	Start the next scan when the mover count has increased by the specified number.
Trigger	Start the next scan when the specified trigger conditions are satisfied. **Select Channel**: Select a channel from the list. **Select trigger**: Select **Trigger Up** to start the next scan if the channel attains the specified level while increasing; select **Trigger Down** to start the next scan if the channel attains the specified level while decreasing. **Trigger Level/band**: Type the level that the channel must attain to trigger the scan plus a noise threshold, as a percent of full scale. *Example:* If the **Trigger Level** for the Disp channel is set to 2 mm and the **Band** setting is 1% with **Trigger Up**, and the channel full scale is 5 mm, the next scan will begin when the Disp channel attains 1.975 mm while displacement is increasing.



6. Select a **Scan Type** option. This selection determines how to apply the subsequent scans information.

Option	Description
Standard	Acquires data in evenly spaced intervals as defined in the **Subsequent Scans Info** parameters.
1,2,4,8,16,32,	Acquires data in exponentially increasing intervals by multiplying the Subsequent Scan parameters by 1, then 2, then 4, then 8, then 16, and so on for each subsequent scan. Use this scan type to collect more data at the beginning of a test and at increasingly less frequent intervals as the test progresses. *Example*: If you select this scan type and set subsequent scans to occur at 100 counts between scans, the second scan will occur 100 cycles after the first scan, the third scan 200 cycles after that, the fourth scan 400 cycles after that, the fifth scan 800 cycles after that, and so on.

7. **File Close** area: Select or clear check boxes to specify when to close the data file and whether to export the file automatically. Recommended: select all of these options.

Option	Description
Close file when stopped	The data file will be closed when the specified mover is stopped or function generation stops (including test completion). If the group has multiple movers, WinTest will ask you to select the mover. *NOTE* *If this option is not selected, data acquisition will continue and the data file will remain open as long as the Subsequent Scans conditions are met.*
Export on close	The data file is automatically exported when it is closed, using the export conditions selected in the **Export** window when the file is exported. See "Export Data Files" in "Chapter 9, "Reviewing Test Results," for information about setting export options.
Close on Shutdown/Abort	Closes the data file if a Shutdown or Abort action turns off power during the test. Note that this option does not stop data acquisition if the test runs to completion, unless the **Close file when stopped** option was also selected.

8. Specify the data file name in the **Set filename** box, and specify the destination folder in the **Set destination folder** box. Type the file name and destination or use the **Browse** buttons.

NOTE *If the project file is in the secure workspace, WinTest will direct you to save the data file in the secure workspace, but you can create new folders in the secure workspace to organize your data files.*

WinTest data files carry a date and time stamp that makes the file name for every data file unique.

To use Reverse Data Retention feature, see "Reverse Data Retention" in this chapter for more information.

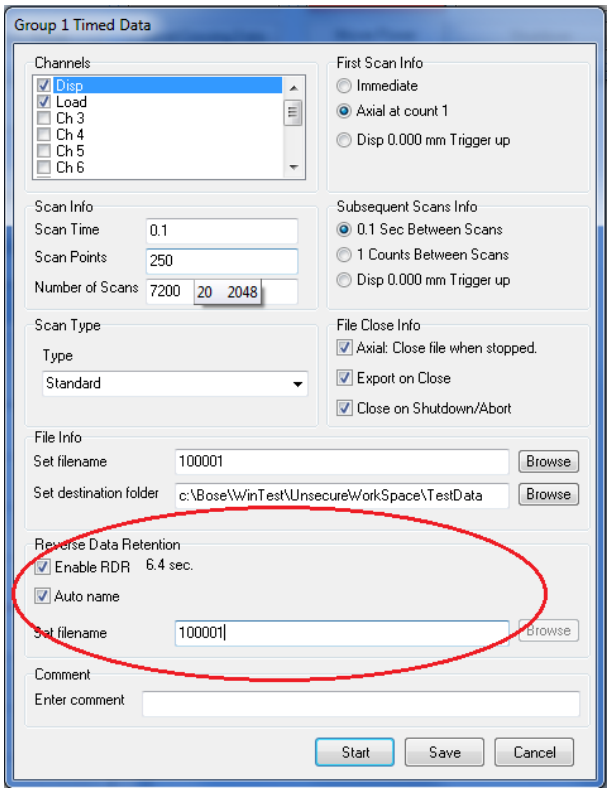
9. **Comment** area: Type a comment to include in the data file (comments are optional).

10. Click one of the following buttons to finish data acquisition setup and close the window.

Button	Description
Start	Starts Timed Data acquisition as defined, saves the setup parameters, and closes the setup window. The **First Scan** parameters determine when to start the first scan.
Save	Saves the data acquisition parameters and closes the setup window, but data acquisition does not start.
Cancel	Discards any changes to setup parameters made since the window was last opened, closes the window, and does not start data acquisition.

Reverse Data Retention

Reverse Data Retention (RDR) lets you automatically collect timed data in a continuous buffer during the last cycles prior to a shutdown. This is very useful to help monitor the changes that test systems or specimens encounter immediately prior to an event, such as specimen failure, that would cause a system shutdown.



RDR saves a continuous history of 64 scans: 62 prior scans plus the current scan plus one full scan. The time interval for the data in the RDR is 64 times the length of time in the **Scan Time** field (**Timed Data** window). Thus, if the scan time is 1.00 seconds, the total time length of data retained in the RDR is 64 seconds. This time is independent of the number of scan points.

RDR works in parallel with Timed Data acquisition. Thus, Timed Data must be set up in order for RDR to work. The RDR file is a normal .tdf file, which can be opened and displayed using WinTest tools. The RDR file will be automatically written at the same time the Timed Data file is closed and written, and the Timed Data file and the RDR file will be exported at the same time if the **Export on Close** check box (**Timed Data** window) is selected.

Like timed data files and saved Scope scan files, you can also use the **Replot** tool in a **Scope** window to display RDR files. See Chapter 9, "Reviewing Test Results," for more information.

Setting up Reverse Data Retention with Timed Data

Set up Reverse Data Retention (RDR) in the **Timed Data** window as follows:

NOTE *RDR must be used with Timed Data acquisition and can be set up only in the* ***Timed Data*** *window.*

---

1. To enable RDR, select the **Enable RDR** check box.

   When RDR is enabled, the **Timed Data** window changes as follows:

   - The total Reverse Data Retention time is displayed next to the **Enable RDR** check box. This number is the scan time multiplied by 64 and is the time interval for the available RDR data. If you change the scan time, this number will change accordingly. If you disable RDR, this number will disappear.
   - In the **File Close Info** area, the **Close file when stopped** check box is automatically selected and is assigned to a mover. If the group has more than one mover, WinTest will ask you to select which mover to use. This ensures that the RDR file is written in parallel with the timed data file when the mover is stopped.

NOTE *If the* ***Close file when stopped*** *check box is not selected, you will have to click the* ***Stop*** *button in the* ***Timed Data*** *window to stop data acquisition in order to write to the RDR file. Clearing this check box while RDR is enabled will generate a request for confirmation.*

---

2. Name the RDR data file.

   Select the **Auto name** check box to use the timed data file name to automatically name the RDR data file (the Timed Data filename is automatically entered). When this option is selected, the RDR file name has the form *timed_data*[RDR].tdf, where *timed_data* is the timed data file name.

   To specify a different RDR file name, clear the **Auto name** check box and type the file name in the **Set filename** box or click the **Browse** button to find and select a file name.

Peak/Valley Data Acquisition Setup

About Peak/Valley Data

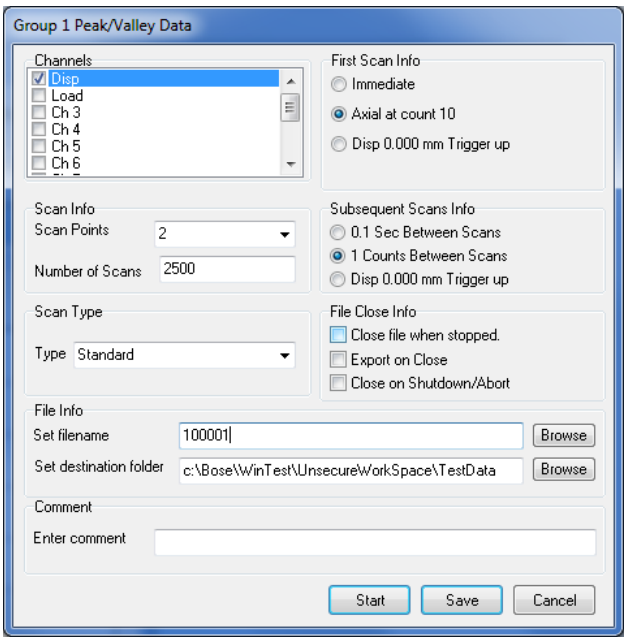
Peak/Valley data acquisition is used with cyclic testing to show that test amplitudes were maintained or to show how cyclic loading also affects channels that are not control channels.

For each Peak/Valley data scan, WinTest reads the current Peak and Valley values in the Peak/Valley buffer for the selected data acquisition channels. To use Peak/Valley data acquisition effectively, the Peak/Valley band for each Peak/Valley data acquisition channel must be set correctly, the number of points in the buffer must be specified, and the Peak/Valley monitoring must be active (State=On). See Chapter 10, "Channel Setup Properties," for more information about the Peak/Valley settings.

Setting Up Peak Valley Data Acquisition

To set up Peak Valley data acquisition for the current group:

1. Click the **Peak Valley Data** button (**Test Setup** window). Alternately, click **Peak Valley Data** on the **Data Acquisition** menu (**Test Setup** window).



2. In the **Channels** list, select or clear check boxes to choose channels for data acquisition.

3. In the **Scan Info** area, define each Peak Valley scan.

Parameter	Description
Scan Points	This value determines the number of Peak/Valley values in each data scan and applies to all acquired channels. Two points equals one Peak and one Valley; four points equals two Peaks and two Valleys, etc. Select the desired number of scan points in the list. If the **Scan Points** value is different than the **Points** value in channel definition for any acquired channel, the channel setup value is reset to match the selected **Scan Points** value when data acquisition begins. See Chapter 10, "Channel Setup Properties," for more information.
Number of Scans	Type the number of scans to collect. (The valid range of Scan Points is displayed when you hold the cursor over this field.)

4. In the **First Scan Info** area, define conditions to start the first data scan. Select an option and enter the parameters.

Option	Description
Immediate	Data acquisition begins when you click the **Start** button in this window.
Mover at count *n*	After clicking **Start** in this window, the first scan begins when the specified mover count is the specified value. WinTest will prompt you to select the mover and enter the cycle count. *NOTES* *Always set this count to 1 or higher to allow WinTest to fill the Peak/Valley buffer.* *If you change this value while running a test, this count value is relative to the current cycle count.*
Trigger at level	After clicking **Start** in this window, the first scan begins when the trigger conditions are satisfied. **Select Channel**: Select a channel from the list. **Select trigger**: Select **Trigger Up** to start the scan if the channel attains the specified level while increasing; select **Trigger Down** to start the scan if the channel attains the specified level while decreasing. **Trigger Level/band**: Type the level the channel must attain to trigger the scan, plus a noise threshold, as a percent of full scale. For example, if the **Trigger Level** for the Disp channel is 2 mm and the band is 1% with **Trigger Up** and full scale is 5 mm, the first scan will begin when Disp attains 1.975 mm while displacement is increasing.

5. In the **Subsequent Scans Info** area, specify when to take additional Peak/Valley data scans after data acquisition begins (up to the number of scans in the **Number of Scans** box). When you select an option, WinTest will prompt you to enter the required parameters.

NOTE *If the Scan Type selection is 1,2,4,8,16,32, the specified time or counts between scans will be multiplied by the next factor for each subsequent scan.*

Option	Description
Time **Sec Between Scans**	Start the next scan after the specified time interval (seconds).
n **Counts Between Scans**	Start the next scan when the mover count has increased by the specified number. For continuous Peak/Valley scans, set this value to 1 and set the **Number of Scans** to equal or exceed the number of test cycles where Peak/Valley data acquisition is required.
Trigger	Start the next scan when the specified trigger conditions are satisfied. **Select Channel**: Select a channel from the list. **Select trigger**: Select **Trigger Up** to trigger data acquisition when the channel level is increasing; select **Trigger Down** to trigger data acquisition when the channel level is decreasing. **Trigger Level/band**: Type the level the channel must attain to trigger the scan plus a noise threshold, as a percent of full scale. For example, if the **Trigger Level** for the Disp 1 channel is 2 mm and the **Band** is 1% with **Trigger Up** and full scale is 5 mm, the next scan will begin when Disp attains 1.975 mm while displacement is increasing.

6. In the **Scan Type** area, click the scan type in the list. This selection determines how to apply the **Subsequent Scans** information.

Scan Type	Description
Standard	Acquires data in evenly spaced intervals as defined in the **Subsequent Scans Info** parameters.
1,2,4,8,16,32,	Acquires data in exponentially increasing intervals by multiplying the **Subsequent Scans Info** parameters by 1, then 2, then 4, then 8, then 16, and so on for each subsequent scan. Use this scan type to collect more data at the beginning of a test and at increasingly less frequent intervals as the test progresses. For example, if you select this scan type and set subsequent scans to occur at 100 counts between scans, the second scan will occur 100 cycles after the first scan, the third scan 200 cycles after that, the fourth scan 400 cycles after that, the fifth scan 800 cycles after that, and so on.

7. In the **File Close Info** area, select or clear check boxes to define options for closing and exporting the data file. You can select multiple options.

Option	Description
Close file when stopped	The data file will be closed when the specified mover is stopped or function generation stops (including test completion). If the group has multiple movers, WinTest will ask you to select the mover. *NOTE* *If this option is not selected, data acquisition will continue and the data file will remain open as long as the Subsequent Scans conditions are met.*
Export on Close	The data file is automatically exported when it is closed, using the export conditions selected in the **Export** window when the file is exported. See "Export Data Files" in Chapter 9, "Reviewing Test Results," for information about setting export options.
Close on Shutdown/Abort	Closes the data file if a Shutdown or Abort action turns off power during the test. Note that this option does not stop data acquisition if the test runs to completion unless the **Close file when stopped** option was also selected.

8. Specify the file name of the data file in the **Set filename** box, and specify the destination folder in the **Set destination folder** box. Type the file name and destination, or click the **Browse** buttons to find and select a file name and destination folder.

NOTE *If the project file is in the Secure Workspace, the data file must be saved in the Secure Workspace. However, you can create new folders in the Secure Workspace folder to organize your data files.*

If the specified file exists, WinTest will ask whether to overwrite the file.

9. In the **Comment** area, type a comment to include in the data file (comments are optional).

10. Click a button to finish setup of Peak/Valley Data acquisition and close the window.

Button	Description
Start	Starts Peak/Valley data acquisition as defined in the window, saves the setup parameters, and closes the setup window.
Save	Saves the setup parameters and closes the setup window, but does not start data acquisition.
Cancel	Discards any changes to setup parameters made since the window was last opened, closes the window, and does not start data acquisition.

Level Crossing Data Acquisition Setup

About Level Crossing Data

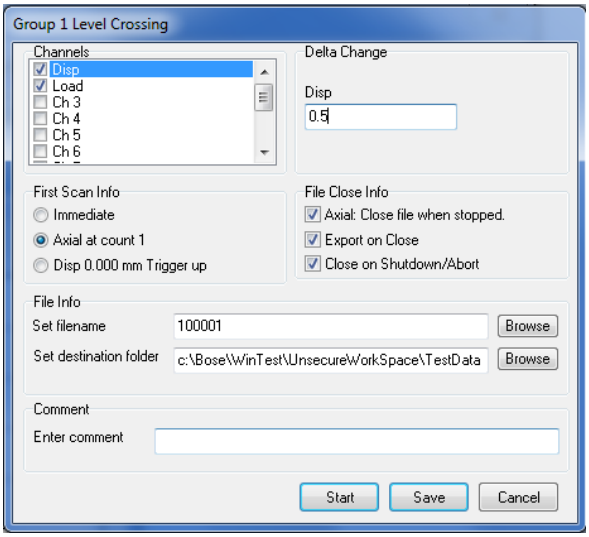
Level Crossing data acquisition is primarily used for tests of long duration where data acquisition is needed only when the level of a channel of interest changes by a specified amount. When any data acquisition channel changes by the specified delta change amount, one point of data for each channel selected for Level Crossing data acquisition is immediately collected for all selected channels.

Setting Up Level Crossing Data Acquisition

To set up level crossing data acquisition for the current group:

1. Click the **Level Crossing Data** button (**Test Setup** window). Alternately, click **Level Crossing Data** on the **Data Acquisition** menu (**Test Setup** window).

2. Select channels for level crossing data acquisition and the **Delta Change** value for each channel.



   a. In the **Channels** list, select or clear check boxes to choose channels for data acquisition.

   b. In the **Delta Change** box, type the amount this channel has to change in order to trigger data acquisition. Units are for the highlighted channel.

   c. Repeat Step 2 for each channel to be acquired.

NOTE *To use one channel to trigger data acquisition but collect data for other channels, set the delta change value for the trigger channel to a small value and the delta change values for the other channels to large values.*

---

3. In the **First Scan Info** area, define conditions to start the first data scan. Click an option and enter the parameters.

Option	Description
Immediate	Data acquisition begins when you click the **Start** button in this window.
Mover at count	After clicking **Start**, data acquisition begins when the specified mover count reaches the specified value. WinTest will prompt you to select the mover and enter the cycle count. *NOTE: If you change this parameter during the test, this count is relative to the current cycle count.*
Trigger at level	After clicking **Start**, data acquisition begins when the trigger conditions are satisfied. WinTest will prompt you to define the trigger conditions. **Select Channel**: Select a channel from the list. **Select trigger**: Select **Trigger Up** to start the scan if the channel reaches the specified level while increasing; select **Trigger Down** to start the scan if the channel reaches the specified level while decreasing. **Trigger Level/band**: Type the level the channel must attain to trigger the scan plus a noise threshold, as a percent of full scale. Example: If the **Trigger Level** for the Disp channel is set to 2 mm and the **Band** is set to 1% with **Trigger Up**, and full scale for the Disp channel is 5 mm, the first scan will begin when the Disp channel attains 1.975 mm while displacement is increasing.

NOTE Subsequent data scans occur when the delta change condition for any channel is satisfied.

4. Specify the file name of the data file in the **Set filename** box, and specify the destination folder in the **Set destination folder** box. Type the file name and destination, or click the **Browse** buttons to find and select a file name and destination folder.

NOTE If the project file is in the Secure Workspace, the data file must be saved in the Secure Workspace. However, you can create new folders in the Secure Workspace folder to organize your data files.

5. In the **Comment** area, type a comment to include in the data file (comments are optional).

6. In the **File Close Info** area, select or clear the check boxes to specify when to close the data file and what to do with it. You can select multiple options.

Option	Description
Close file when stopped	The data file will be closed when the specified mover is stopped or function generation stops (including test completion). If the group has multiple movers, WinTest will ask you to select the mover. *NOTE* *If this option is not selected, data acquisition will continue and the data file will remain open as long as the Subsequent Scans conditions are met.*
Export on close	The data file is automatically exported when it is closed, using the export conditions selected in the **Export** window when the file is exported. See "Export Data Files" in Chapter 9, "Reviewing Test Results," for information about setting export options.
Close on Shutdown/Abort	Closes the data file if a Shutdown or Abort action turns off power during the test. Note that this option does not stop data acquisition if the test runs to completion, unless the **Close file when stopped** check box was also selected.

7. Click a button to finish setup of level crossing data acquisition and close the window.

Button	Description
Start	Starts level crossing data acquisition as defined in the window, saves the setup parameters, and closes the setup window. The First Scan parameters specify when to start the first data scan.
Save	Saves the setup parameters and closes the setup window, but does not start data acquisition.
Cancel	Discards any changes to setup parameters made since the window was last opened, closes the window, and does not start data acquisition.

Block Data Acquisition

About Block Data Acquisition

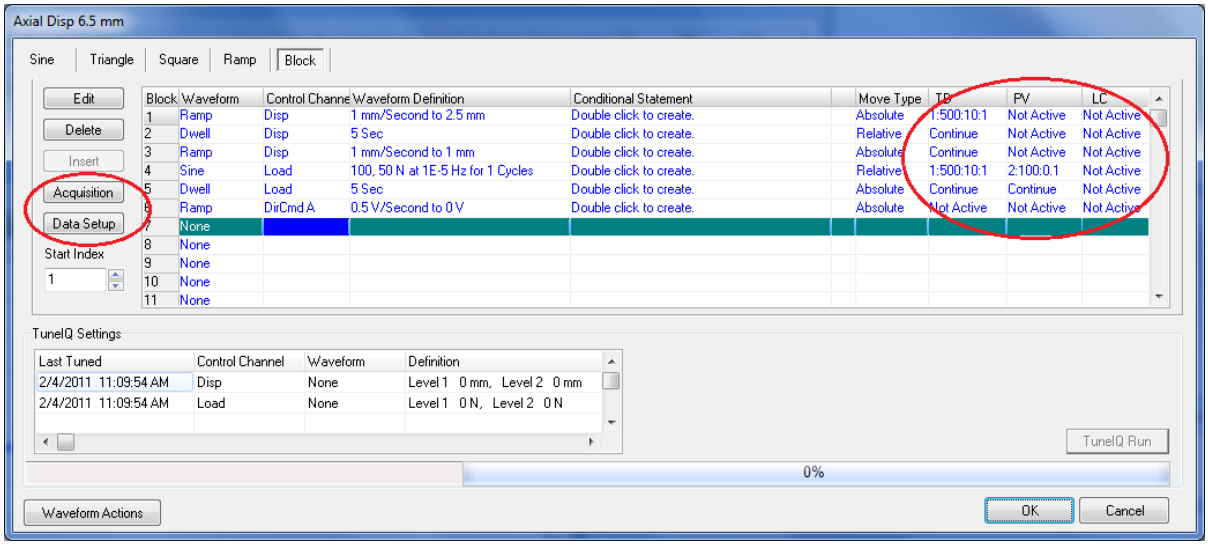
Block data acquisition has two parts:

- Data setup, which selects data acquisition channels, specifies the data files, and selects an export option.
- Acquisition setup for individual block steps. Note that you can use any or all types of data acquisition during any block step.

After running the block waveform test, you will have one data file for each type of data acquisition that you defined in for the data setup. Each file contains the data that was collected for all block steps that were completed.

If the group has multiple movers, you can define block data acquisition for the first mover only. If you open the block waveform setup window for any mover other than the first mover, WinTest will alert you with a displayed message, and the **Acquisition** button will be inactive.

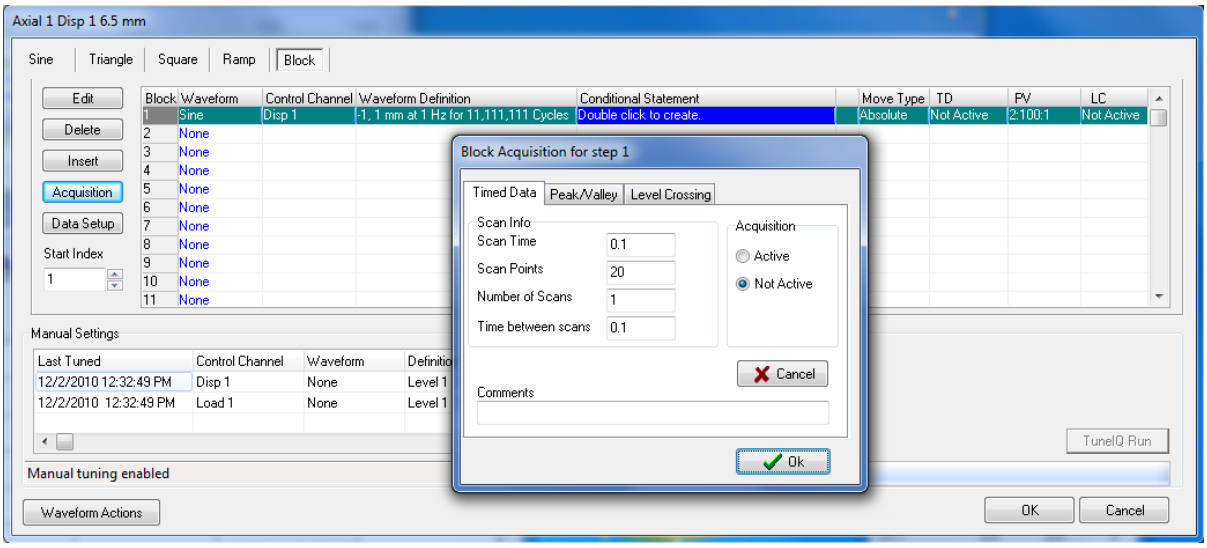
NOTE *You can also set up and use all types of scheduled data acquisition to acquire data while running a block waveform test. The same data acquisition parameters will be used to acquire data for all block steps. Scheduled data acquisition cannot be used together with block data acquisition.*



The TD, PV, and LC columns in the block waveform setup window show what type of data acquisition has been defined for each block step. If data acquisition is active, each column displays the defined parameters.

Click the **Data Setup** button to choose data acquisition channels, to define the data file name and destination for type of data acquisition, and an export option.

Click the **Acquisition** button to define specific data acquisition parameters for each block step. If the same type of data acquisition is defined in the block step above, select **Continue** to continue using the same parameters in this step. Similarly, to use the same parameters from the previous step, you can just double-click in the TD, PV, or LC column and select the Continue option for each applicable data type.



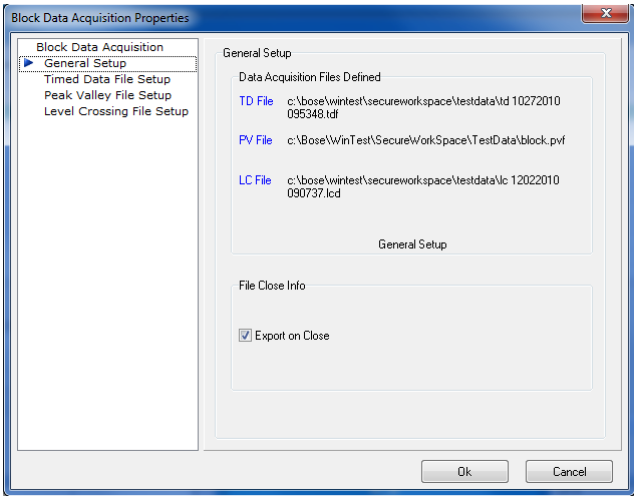
Data Setup for Block Data Acquisition

Data setup selects data acquisition channels and defines data files for all types of block acquisition. It also lets you specify whether to automatically export data files when they are closed and to enter a comment into each data file.

To set up data acquisition for a block waveform:

1. Click the **Data Setup** button (block waveform setup window) to open the **Block Data Acquisition Properties** window.

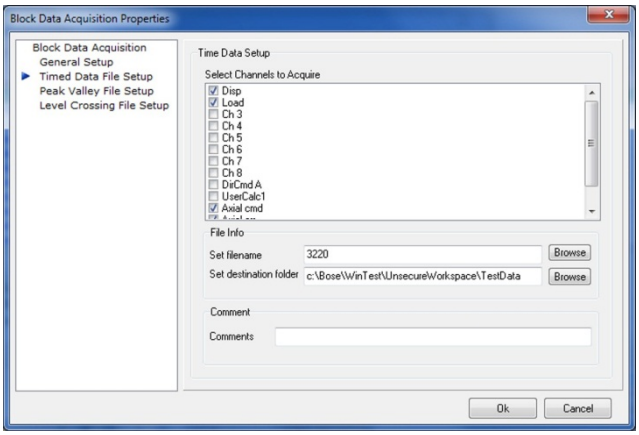
2. Click **General Setup** (**Block Data Acquisition Properties** window). This window lists data file names (if defined) and allows you to select an export option.



3. Select or clear the **Export on Close** check box. When this box is selected, data files are automatically exported when closed with the conditions defined in the **Export** window. See "Export Data Files" in Chapter 9, "Reviewing Test Results," for more information.

4. Set up a data file for each data acquisition type. For example, to set up files for Timed Data, click **Timed Data File Setup**.

5. Select the check box for each channel to acquire for this data acquisition type.



6. Specify the file name of the data file in the **Set filename** box, and specify the destination folder in the **Set destination folder** box. Type the file name and destination, or click the **Browse** buttons to find and select a file name and destination folder.

NOTE *If the project file is in the Secure Workspace, the data file must be saved in the Secure Workspace. However, you can create new folders in the Secure Workspace folder to organize your data files.*

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7. In the **Comments** box, type any comments to include in the data file (optional).
8. Click **Define** in the **Block Data Acquisition Properties** window to define the data file. To remove a data file name, click **Undefine.**
9. Set up the data file for the next data acquisition type (steps 4–8). After you have finished setting up your data acquisition files, click **OK**.

Defining Data Acquisition for Specific Block Steps

Once you have set up your block acquisition data files, you can define data acquisition independently for individual block steps, as follows:

1. In the **Block Waveform Setup** window, select the block to define data acquisition, and then click the **Acquisition** button on the left side of the window. The **Block Acquisition** window opens and shows the block number you selected.
2. For each type of data acquisition you want for this block step:
   a. Click the tab for the type of data acquisition you want to define (Timed Data, Peak/Valley, Level Crossing).
   b. Specify the data acquisition parameters or click **Continue** to copy the parameters from the previous block step. A description of the block data parameters for each type of data acquisition follows this procedure. First scan parameters are not included because the first scan starts immediately when the block step begins.

NOTE *The **Continue** option appears only if this type of data acquisition is active in the previous block step.*

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   c. In the **Comments** box, type any comments to enter in the data acquisition file for this block step.
   d. If you changed or defined data acquisition parameters, select **Active** to collect data as defined, select **Not Active** to save the parameters but collect no scans, or click **Continue** to use the same data acquisition parameters as the previous block step.

NOTE *The **Cancel** button discards changes made to one type of data acquisition only and leaves the **Block Acquisition** window open. WinTest will ask for confirmation before reverting to the previous parameters. To cancel all changes, you have to click **Cancel** for each data acquisition type, and then click **Ok** to close the window.*

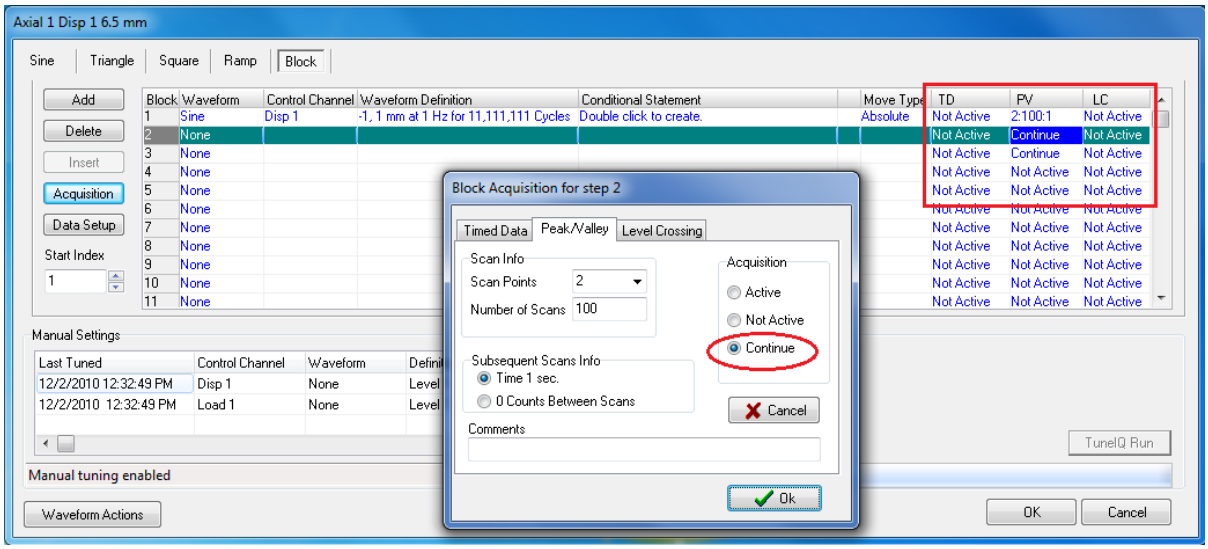
---

e. Repeat step 2 for each type of data acquisition you want to define for this block step.

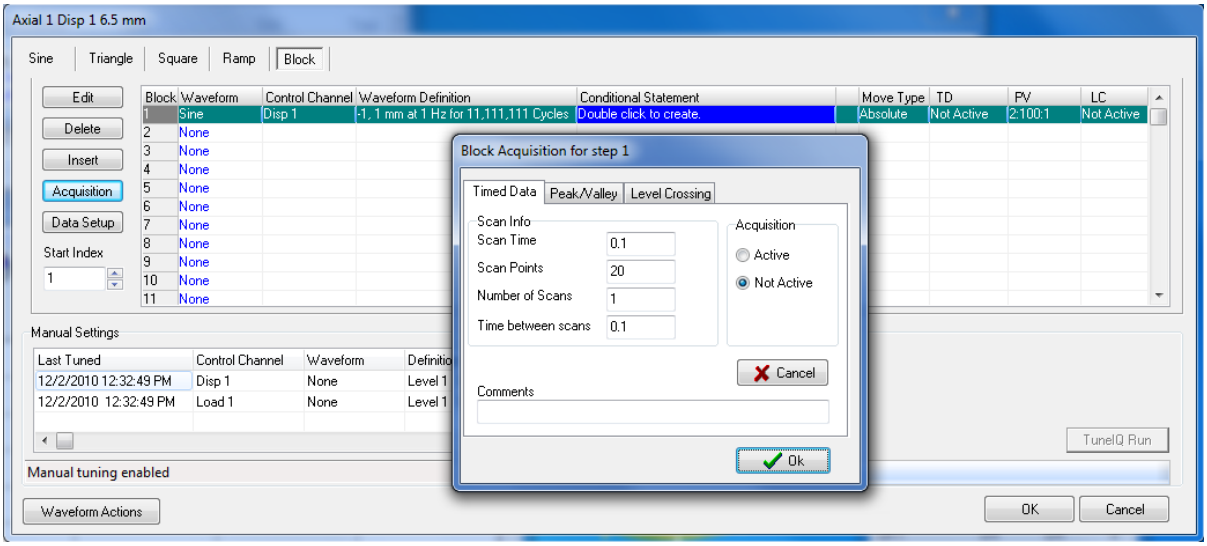
3. When you have finished defining block acquisition for this step, click **OK** to return to the **Block Waveform Setup** window.

   When data acquisition is active, the block step shows the defined parameters in the appropriate column(s).

   When data acquisition is continued from the previous step, the block step shows **Continue** in the appropriate column(s).



Timed Data Block Acquisition parameters



Parameter	Description
Scan Info	
Scan Time	Time interval for each data scan, in seconds.
Scan Points	Number of data points in each scan.
Number of Scans	Number of scans to collect. Enter 1 to collect data for a single event. If you specify multiple scans, the Time Between Scans value determines when the time interval between scans.
Subsequent Scan Info	
Time Between Scans	Specifies the time interval between the start of one scan and the start of the next. For continuous scans during this block step, set this value equal to the scan time. Example: if the scan time is 1 second and the time between scans is 1.5 seconds, is a 0.5 second delay between subsequent scans.

Chapter 8
Running and Managing Tests

Before Running a Test

Before turning on power or running any test, make sure that all of these setup tasks have been completed.

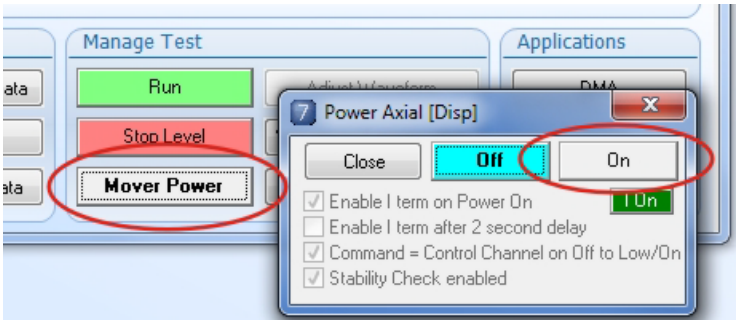
- ✓ To use test parameters from a previously saved test file, click **Open** on the **Test File** menu (**Test Setup** Window) and select the test file to open.
- ✓ Click the **Limits** button to set appropriate limits for installing the specimen. See Chapter 4, "Limits and Actions," for details.
- ✓ Be sure to tare the load cell after mounting the sample but before gripping both sides of the sample. To access the Tare function, right-click in the **Meter** window for the control channel and then click **Properties**.
- ✓ Install the specimen and (if necessary) use the Adjust Mover or Preset function to apply a preload. See your *System Reference Manual* and Chapter 5, "Specimen PreTest Setup."
- ✓ Click the **Limits** button to set appropriate limits for all channels, based on the desired test levels. See Chapter 4, "Limits and Actions."
- ✓ Define test waveform. See Chapter 6, "Waveform Setup."
- ✓ If tuning is necessary (the specimen stiffness is different and/or test conditions have changed), use TuneIQ to optimize the system response. See Chapter 6, "Waveform Setup." If necessary, use manual tuning (for example, if TuneIQ was not successful or for a rotary mover). See Chapter 13, "Manual Tuning."
- ✓ Define and start data acquisition. See Chapter 7, "Data Acquisition Setup."
- ✓ Open and set up the **Meter** windows, the **Scope** windows, the **Test Status** window, and any other windows that are useful for monitoring the test. See Chapter 3, "Display Windows (Show Menus)."
- ✓ Check the filter selection for all channels used for the test. See Chapter 10, "Channel Setup Properties."
- ✓ Check the waveform compensation settings. See "Waveform Compensation" in this chapter.

Running a Test

Before starting this procedure, review the "Before Running a Test" checklist to make sure that all setup tasks have been completed.

1. Systems with multiple groups: Click the appropriate Group tab (**Test Setup** window).

2. Click the **Mover Power** button.



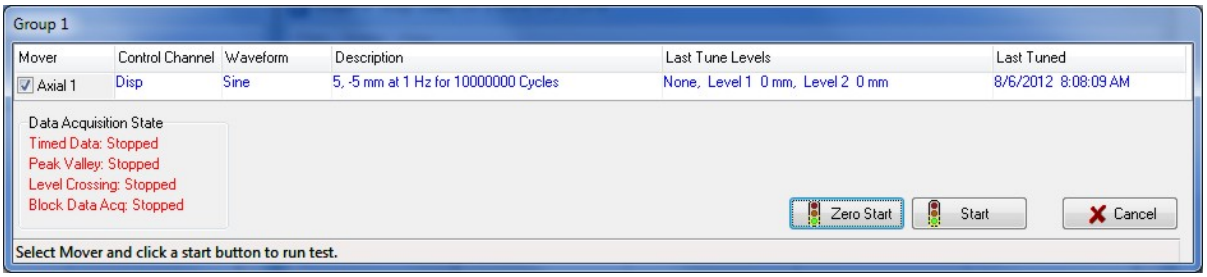
   a. Verify the **Power On** options. If changes are needed, see Chapter 11, "Power Settings and Power On/Off."

Option	Recommended Setting
Enable I term on Power On or Enable I term after 2 second delay	This option is selected for most testing situations. This option is selected for special testing situations if recommended by Bose.
Command = Control Channel on Off to Low/On	Make sure this option is selected to prevent rapid motion of a mover when power is turned on.
Stability Check enabled	This option is selected for most testing situations.

   b. Systems with multiple movers: Select which mover or movers to power on.

   c. Click the **On** button, and then click the **Close** button to close the **Power** window. The **Mover Power** button is green when power is on.

3. Click **Run** (**Test Setup** window) to open the **Run** window for the current group (same as clicking **Run** on the **Run/Stop** menu).



Verify the following information in the **Run** window:

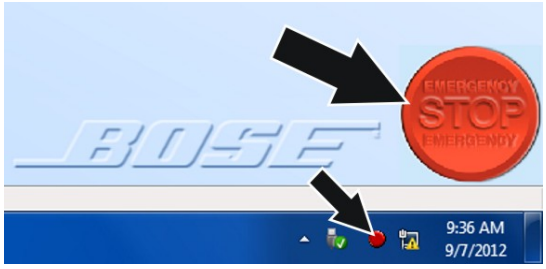
Column	Description
Mover	For multiple movers, select the check box for each mover you want to run.
Control channel	Shows the current control channel. When the test begins, WinTest will automatically switch to the control channel specified in the waveform.
Waveform	Shows the current waveform for each Mover.
Description	Note the waveform description for each mover. If the waveform is not correct, cancel and modify the waveform in the **Waveform Setup** window.
Last Tune Levels	Shows levels used for the Last Tuning.
Last Tune	Note the last tuning date and the waveform properties that were used to set the tuning gains for the test. If the waveform properties for tuning are not appropriate for your test, click **Cancel** and then tune the control channel. See information about TuneIQ in Chapter 6, "Waveform Setup."
Data Acquisition State	Note the data acquisition state for each data acquisition type. If you need to start data acquisition, open the setup window for that data acquisition type and click the **Start** button. *NOTE Even though data acquisition is started, the first scan depends on the **First Scan Info** parameters as defined in the data acquisition setup window for each data acquisition type.*

4. Recheck your limit settings. See Chapter 4, "Limits and Actions," for specific information about limit settings.

5. When you are ready to start the test, click the **Zero Start** or **Start** button in the **Run** window as appropriate (or **Cancel**, to close the window without starting the test). Clicking **Zero Start** or **Start** initiates waveform generation for the test, and the **Run** button changes to **Stop**.

Button	Description
Zero Start	Sets the cycle count to zero and starts running the test waveform.
Start	Starts the test waveform with the cycle count set to the Initial Cycles value in the waveform setup window (sine, triangle, and square waveforms only). If the current cycle count is higher than the Initial Cycles count, WinTest will continue counting from the current cycle count instead of the Initial Cycles value.

6. While the test is running, the following buttons and menu commands are active to stop or pause the test:

Button or Menu Command	Function
Emergency STOP button (red mechanical button) NOTE Three on-screen, red Emergency STOP buttons are also provided.	Press this button in severe or emergency situations for an immediate system shutdown.
WinTest Emergency Stop button (red on-screen button)	This is the large red button located in the lower right corner of the WinTest screen. Left-clicking this button immediately turns off power to all movers (all groups) and triggers an Abort action in WinTest. Right-clicking this button quits WinTest, but only when Mover power is turned off. 
WinTest Emergency Stop button (red on-screen button)	This is the small red button located in the Notification Area, which is typically located on the right-hand end of the Windows Taskbar.

Button or Menu Command	Function
WinTest Emergency Stop button (red on-screen button)	This square red button is located in the **Timeout Login** window. Clicking this button immediately turns off power to all movers (all groups) and triggers an Abort action in the WinTest software.
Shutdown button (**Test Setup** window)	Immediately (no confirmation) turns off power to all movers in the current group. *NOTE Use the Shutdown action with care. In certain situations, turning off power to movers can damage the specimen or the test system.*
Stop button (**Test Setup** window) or **Stop Mover** command (**Run/Stop** menu)	Executes a Stop action. Stops the test waveform, stops data acquisition if this **File Close** option was selected for data acquisition setup, and controls all movers in the group at the current command level. If the command level exceeds the full-scale range, limits, or (for cyclic tests) the requested level, the mover is commanded to the last measured level. Power to movers remains on. Click the **Run** button to restart the test.
Stop Level button (**Test Setup** window) or **Stop level Mover** command (**Run/Stop** menu)	Stops the test waveform, stops data acquisition if selected as a **File Close** option for data acquisition setup, and commands all movers in the group to the Stop Level value defined for each mover in the **Setup Mover** window. The **Stop** button changes to **Run**, and power to movers remains on. Click the **Run** button (or the menu command) to restart the test.
Hold Mover (**Run/Stop** menu)	Pauses the test waveform and holds the current mover at the current command level. If this level exceeds full scale, a limit setting, or (for cyclic tests) the requested level, the mover is instead commanded to the last measured level. Power to movers remains on. To continue the test, click **Resume Mover** on the **Run/Stop** menu (**Test Setup** window).

Button or Menu Command	Function
Hold Group (**Run/Stop** menu)	Pauses the test waveform and holds all movers in the group at the current command level. If this level exceeds full-scale, a limit setting, or (for cyclic tests) the requested level, the mover is instead commanded to the last measured level. Power to movers remains on. To continue the test, click **Resume Group** in the **Run/Stop** menu (**Test Setup** window).
Hold level Mover (**Run/Stop** menu)	Pauses the test waveform and commands the current mover to the Hold Level value defined in the mover settings. Power to movers remains on. To continue the test, click **Resume** on the **Run/Stop** menu.
Hold Level Group (**Run/Stop** menu)	Pauses the test waveform and commands all movers in the group to their Hold Level values as defined in the mover settings. Power to movers remains on. To continue the test, click **Resume Group** on the **Run/Stop** menu.

7. While the test is running, monitor progress in the **Test Status** window, **Scope** window(s), and any other display windows such as the **Meter** or **Peak/Valley** or **Peak Counts** windows.

NOTE *If a limit event occurs during the test, determine the cause, verify that the fixture is intact, and inspect the sample for breakage or creep. If limits were set too close to the test waveform parameters, adjust limit settings accordingly (see Chapter 4, "Limits and Actions").*

NOTE *Watch for Meter windows that have a yellow background, meaning that the channel has reached or exceeded 95% of saturation. See Chapter 3, "Channel Saturation Warning".*

You can also do any of the following during the test:

- Adjust Scope settings (see Chapter 3, "Display Windows (Show Menus),"for more information.
- Save or print Scope scans (see Chapter 3, "Display Windows (Show Menus),"for more information.
- Turn on or adjust waveform compensation (see "Waveform Compensation" in this chapter.
- Adjust the test waveform (see "Adjust Waveform" in this chapter.

- Start and stop data acquisition (see Chapter 7, "Data Acquisition Setup"). If you want to change the data acquisition setup, turn off data acquisition in the setup window, change the setup selections, and start data acquisition again. You can change data acquisition setup while the test continues to run, but data acquisition must be off.

8. When the last cycle or block step of the test waveform is completed, the system does the following:

   - Commands movers to the Finish Level defined in the test waveform or (for a block waveform) to the last commanded level.
   - The Finish Action is executed for all movers that have a Finish Action defined. If a Finish Action is not defined, the waveform definition determines the system status.
   - Depending on the File Close Info parameters in the data acquisition setup, data acquisition stops, the data file is closed, and the data file is exported. See Chapter 7, "Data Acquisition," for specific information.

NOTE *Data files can also be exported manually. See Chapter 9, "Reviewing Test Results," for instructions.*

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9. To end the test and turn off Mover power:

   a. Use a **Preset** button (if defined appropriately) or the **Adjust Mover** window to command the mover in DirCmd to zero volts.

      Be sure to do this for all movers in the group.

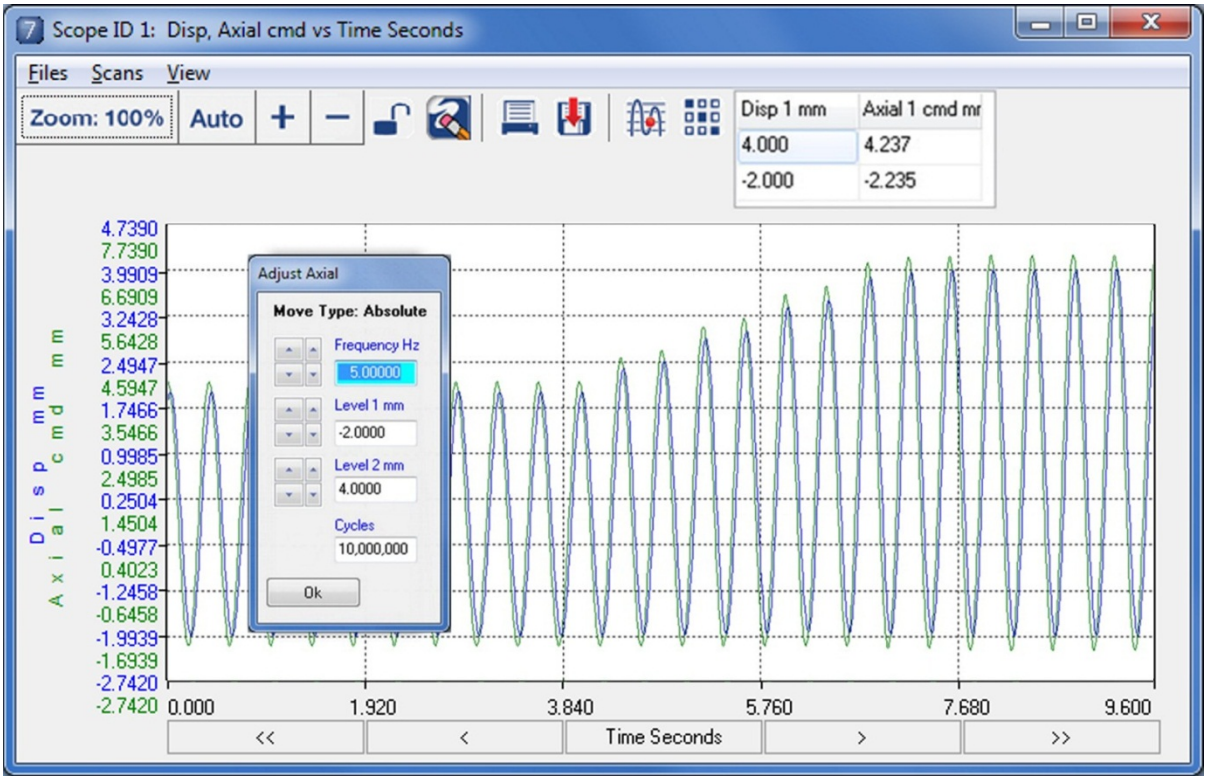
   b. Click the **Mover Power** button (**Test Setup** window) and turn off power to the mover(s).

Adjust Waveform

The **Adjust Waveform** button (**Test Setup** window) allows you to adjust some parameters in the test waveform plus the phase offset while the test is running. These adjustments are entered in the waveform definition and can be seen in the **Waveform Setup** window.

NOTE *Changes made in the **Adjust Waveform** window are applied as soon as you press ENTER or move to a different parameter in the window.*

- If Amplitude Compensation is NOT active: WinTest completes the current command level, then adjusts the command to the new level (s).
- If Amplitude Compensation is active: WinTest gradually adjusts the waveform adjusted over several cycles until the measured control channel achieves the new command level(s). The example below shows the effect of changing Level 2 from 2 mm to 4 mm with Amplitude Compensation enabled.



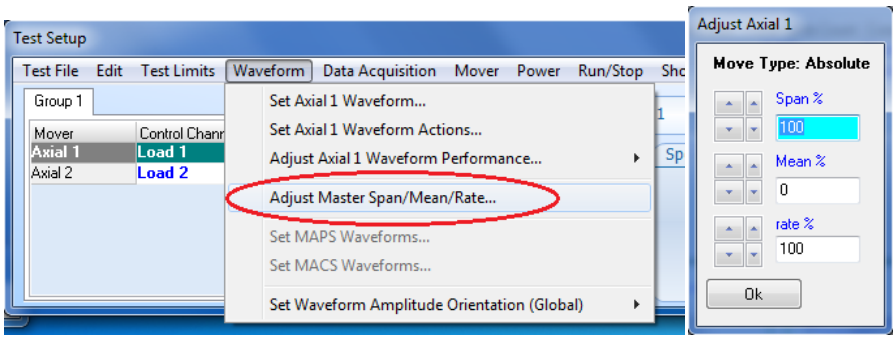
Cyclic waveforms: The following parameters can be adjusted for cyclic waveforms in the **Adjust Waveform** window:

Parameter	Description
Frequency	Frequency of the cyclic waveform.
Level 1 and Level 2	End levels (or mean and peak-to-peak amplitude) values for the test waveform (in channel units).
Cycles	Total number of requested cycles.
Phase Deg.	Sets the phase differential for the mover relative to the defined waveform, in degrees. The **Waveform Compensation** window also provides access to this setting (see also "Phase Compensation" in this chapter).

Block waveforms: The following parameters can be adjusted for block waveforms in the **Adjust Waveform** window, or after you click **Adjust Master Span/Mean/Rate** on the **Waveform** menu (**Test Setup** window). Any adjustments will affect all subsequent block steps that support these settings.

NOTE *To adjust any other characteristics in a block waveform, you have to stop the test, make the adjustments in the **Block Waveform Setup** window, and restart the test, using the **Start Index** parameter to start the test at a specific block (also, do not use **Zero Start** button to restart the test).*

Parameter	Description
Span%	Scales the waveform levels as a percent of the original value. Span 100% means no change from the original levels.
Mean%	Shifts the waveform up or down by a percent of the full scale range. Mean 0% means no change from the original mean.
Rate %	Adjusts the rate by the specified percent of the original value. Rate 100% means no change. Example: for a sine waveform defined as 1 Hz in the waveform setup, Rate 200% increases the frequency from 1 Hz to 2 Hz.



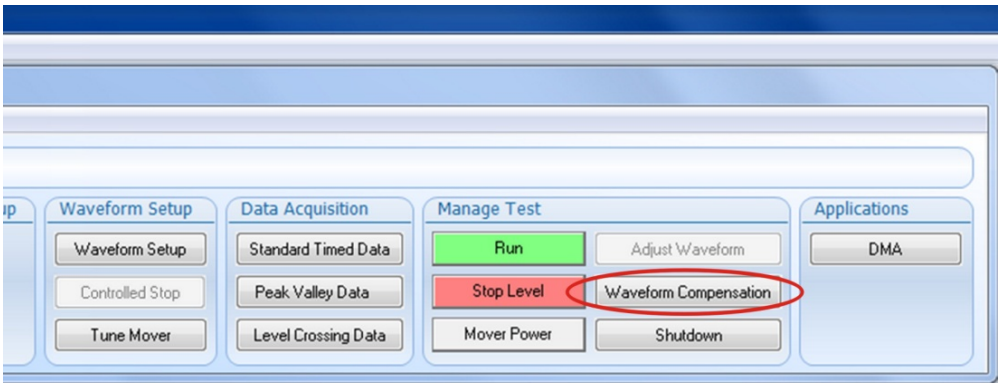
Waveform Compensation

When tuning adjustments are not enough, Waveform Compensation provides a way to dynamically adjust the command waveform so that the system response matches the desired waveform. WinTest provides two kinds of amplitude compensation to adjust the command waveform: Adaptive Peak/Valley compensation and Matrix Peak/Valley compensation. Compensation parameters can also be used to apply a phase offset to a cyclic waveform.

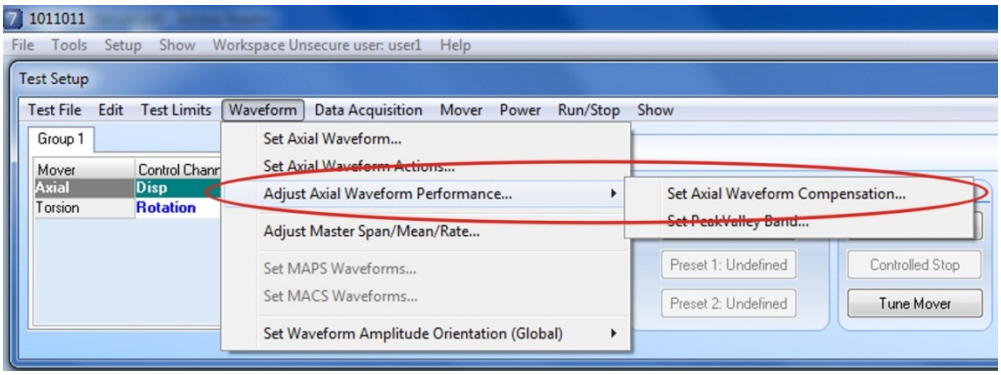
Waveform Compensation settings can be adjusted before the test begins and also during the test.

To access the Waveform Compensation settings in WinTest:

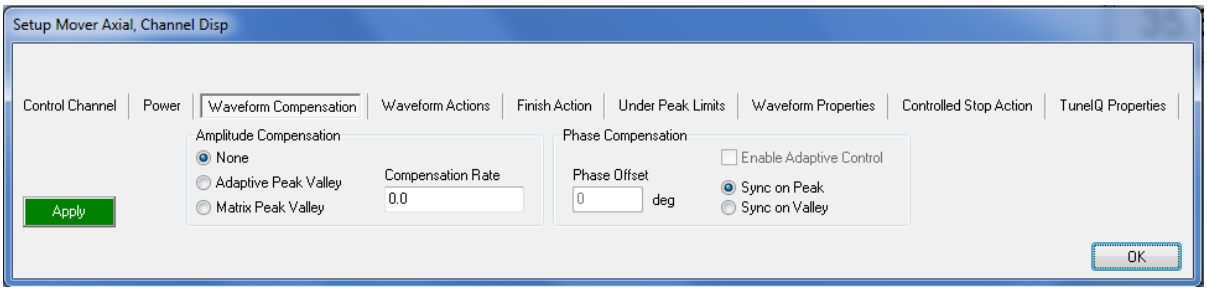
- Click the **Waveform Compensation** button (**Test Setup** window) to access compensation settings for the currently selected mover, or



- Click **Adjust Waveform Performance** on the **Waveform** menu (**Test Setup** window) and then click **Set Waveform Compensation** to access compensation settings for the currently selected mover.



- To access waveform compensation settings for any mover, click **Set Advanced settings** on the **Mover** menu (**Test Setup** window), and then click **Mover Setup**. In the **Setup Mover** window, select the mover (if necessary) and click the **Waveform Compensation** tab.



Amplitude Compensation

Amplitude compensation adjusts the command waveform to help the control channel reach the desired levels. Two types of amplitude compensation are available: Amplitude Control and Correction Matrix. Both methods rely on Peak/Valley measurements, so make sure that the Peak/Valley band is set correctly for the test waveform and the sample characteristics. See Chapter 10, "Channel Setup Properties," for information about setting the Peak/Valley properties.

NOTE *Always turn off Amplitude Compensation (select **None**) while controlling a mover in DirCmd and during the Manual Tuning process.*

To set up or adjust waveform compensation:

1. Select the **Amplitude Compensation** type:

Type	Description
None	No amplitude compensation.
Adaptive Peak Valley	Adaptive Peak Valley compensation is used primarily with repeating sine, triangle, or square waveforms to adjust the amplitude of the command waveform based on the measured control channel response.
Matrix Peak Valley	Matrix Peak Valley compensation is used primarily with block waveforms composed primarily of half sine, dwell, and cycle indirect block steps.

2. In the **Compensation Rate** box, type the maximum incremental change to apply every other cycle (as a percent of full scale). The larger the number, the faster the command waveform will be change to minimize the difference between the desired and the achieved levels.

3. Click **Apply** to apply your changes.

NOTE *For sine, triangle, or square waveforms, the Compensation Rate will automatically decrease as the system response nears the desired end levels.*

Phase Compensation

Phase compensation adjusts the phase of the command waveform by the user-specified offset (-180 to +180 degrees). The phase offset can be set and run, but the phase offset may not be maintained if the sample characteristics change during the test. Alternately, you can enable Adaptive Control to continuously adjust the command signal to achieve the specified phase offset. Adaptive control allows very accurate control of phase differences between movers as long as the movers start at the same time.

Adjust the Phase Compensation parameters as follows:

1. Enter the desired **Phase Offset** value (-180 to +180 degrees).

NOTE *Changes to Phase Compensation settings are applied when you click **Apply** or **OK** in the Compensation window, or when you click **Apply** in the Setup Mover window.*

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2. To continuously control the phase differential, select the **Enable Adaptive Control** check box.

3. Select **Sync on Peak** or **Sync on Valley**, whichever displays the least noise. This selection determines whether Adaptive Control uses Peaks or Valleys to control the desired phase offset.

4. Click **Apply**.

Phase Offset Example for a 2 mover system:

This example shows how to set up Phase Compensation to run a sine wave test at 20 Hz for two movers, with the sine waves 45 degrees apart.

1. Using the **Waveform Setup** window, define the waveform frequency for both movers as 20 Hz.
2. Use the same format to define Peak and Valley levels for both movers. For example, if level 1 is the Peak for mover 1, define level 1 as the Peak for mover 2. (If the level format is not the same for both movers, they will be 180 degrees out of phase even without phase compensation.).
3. Define the same start frequency for both movers.
4. In the **Waveform Compensation** window for the first mover, enter 0.0 in the **Phase Offset** box and select the **Enable Adaptive Control** check box.
5. In the **Waveform Compensation** window for the second mover, enter 45.0 in the **Phase Offset** box and select the **Enable Adaptive Control** check box.
6. Click **Apply**. When you run the test, the waveform for mover 2 will be continuously adjusted to maintain a 45 degree delay relative to mover 1.

Acceleration Compensation

The mass and acceleration of system hardware and the test sample can affect the readings obtained from a sample being tested in the axial direction.

Acceleration Compensation (Accel Comp) is a method of removing that effect, thereby providing more accurate data. Accel Comp provides the most error reduction when a dynamic test is being run (as opposed to a steady force test) and the load cell is mounted on the motor output shaft.

If you have a need to test to ASTM standards (e.g., ASTM-E467), Accel Comp will facilitate this. If not, you can follow the instructions in the following sections.

When testing dynamically with the load cell mounted to the frame, Accel Comp provides benefit. The amount of error reduction is not as significant as a moving load cell, but is frequently enough to reduce the error to the noise levels of the load cell.

In the case of a steady force test, using Accel Comp causes no harm or errors—it just does not provide any benefits.

NOTE *The Accel Comp feature uses three new calculated channels: differentiation, double differentiation, and compensated.*

NOTE *The Accel Comp feature is available on select Bose ESG test instruments. Contact your Bose ESG representative for more information.*

Acceleration Signal Sources

There are two ways to get an acceleration signal:

- High Accuracy Displacement Sensor (HADS)
  - HADS is supplied as part of a standard system
  - Used only with a moving load cell
- Accelerometer
  - This method is an available option for new systems, or to upgrade an older system.
  - Can be used with a fixed-position load cell or with a moving load cell.
  - Used with DMA, when there is a need for high levels of data integrity, or if high amplitude test signals need to be used.

Calculate Accel Comp

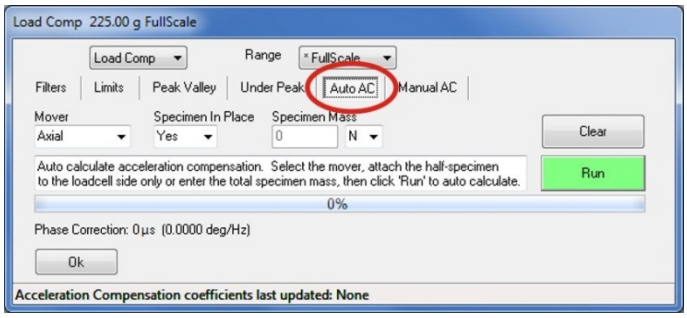
There are two ways to calculate Accel Comp: Automatic and Manual. Both are accessed through the Load Comp channel properties window. Using the automatic method is recommended for most situations and users. Only advanced users should use the manual method.

NOTE TuneIQ should be run before calculating Accel Comp.

Auto-Calculate Accel Comp

1. Access the Load Comp channel properties window.
   - Click **Setup**, and then click **Channels** (Project window). Then choose Load Comp in the list of channels.

     or
   - Right-click in the Load Comp Meter window, and then click **Properties**.



2. Click the **Auto AC** tab.
3. In the **Mover** list, select the mover.
4. Choose whether to calculate Accel Comp with half a specimen in place or to type in values for a whole specimen.
   a. If you are not mounting a half-specimen, select **No** in the **Specimen in Place** list. Then, report the mass of a whole specimen in pounds (lb), grams (g), or Newtons (N) in the **Specimen Mass** box and select the unit of measure from the pull-down list. Go to step 5.

      You can use your load cell to obtain the number to enter into the **Specimen Mass** field. See the procedure "How to use a Load Cell to Calculate the Value for **Specimen Mass**" on the next page
   b. If you have mounted a half-specimen to the load cell side only, select **Yes** in the **Specimen in Place** list.
5. Click the **Run** button to auto calculate Accel Comp. The process takes about one minute to complete.
6. Click **Ok**.

How to use a Load Cell to Calculate the Value for Specimen Mass

Specimen Mass may be calculated in pounds, grams, or Newtons.

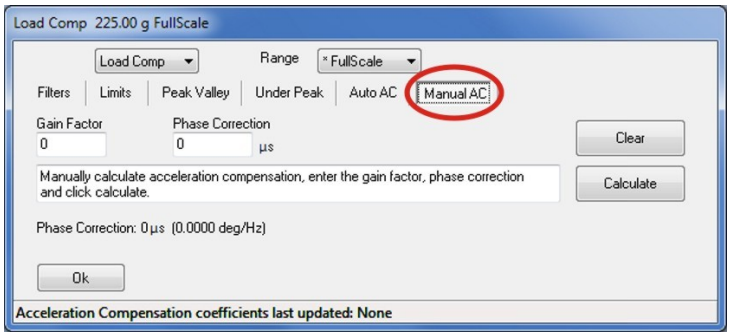
1. Mount the load cell in a fixed position.
2. Take the hardware that is normally attached to your load cell (e.g., platen, grip, etc.) and mount it to the load cell.
3. Tare the load cell.
4. Mount the specimen and record the number from the load cell channel's meter.
5. Enter the number in the **Specimen Mass** field.

Manually Calculate Accel Comp

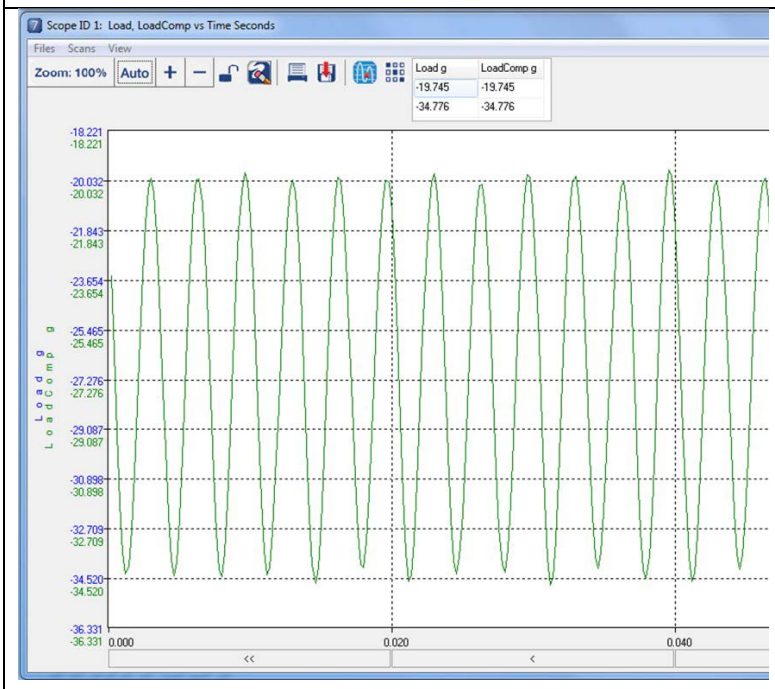
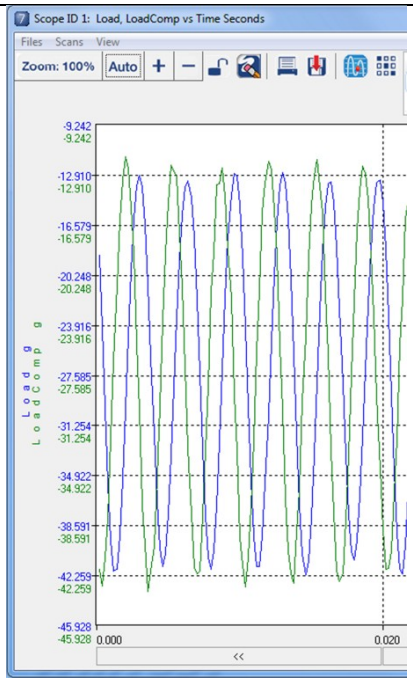
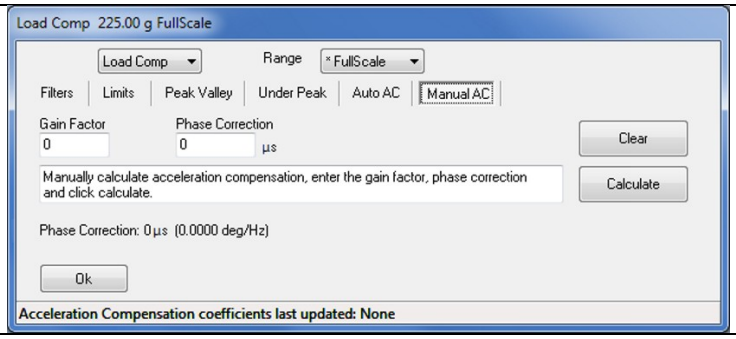
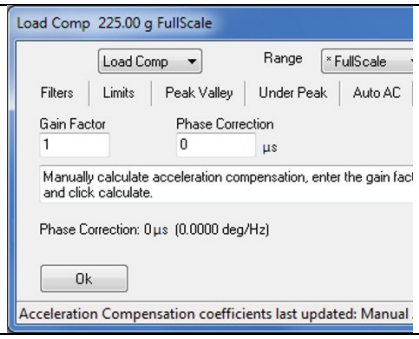
This section is more about how to zero in on good Gain Factor and Phase Correction values, than it is about the values shown in the examples.

In the following example process, the values for Gain Factor and Phase Correction are all positive numbers. In a given situation, the values for Gain Factor and Phase Correction may be positive or negative. The range of values for Phase Correction is -5000 thru +5000, while the Gain Factor does not have a specific range.

1. Set up a waveform and run it in Displacement control, ideally at the frequency at which you will test.
2. Access the Load Comp channel properties window.
   - Click **Setup**, and then click **Channels** (Project window). Then choose Load Comp in the list of channels.
     or
   - Right-click in the Load Comp Meter window, and then click **Properties**.
3. Click the **Manual AC** tab.

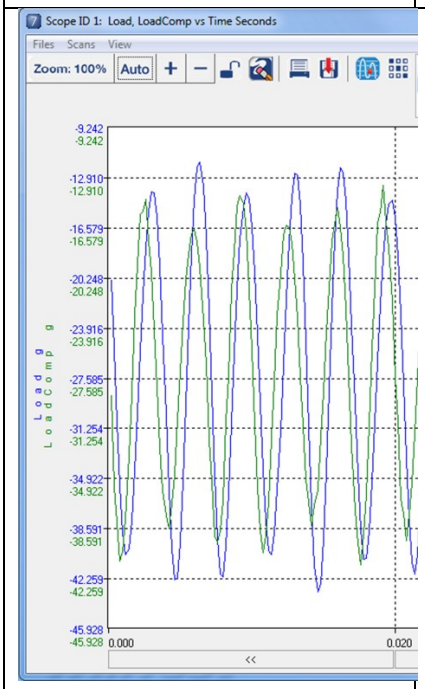


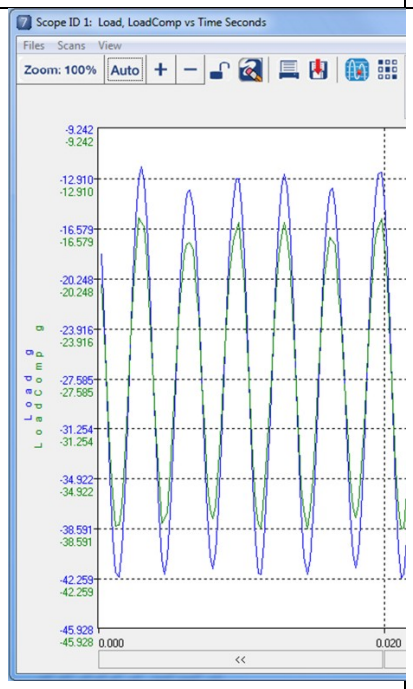
4. Example Process

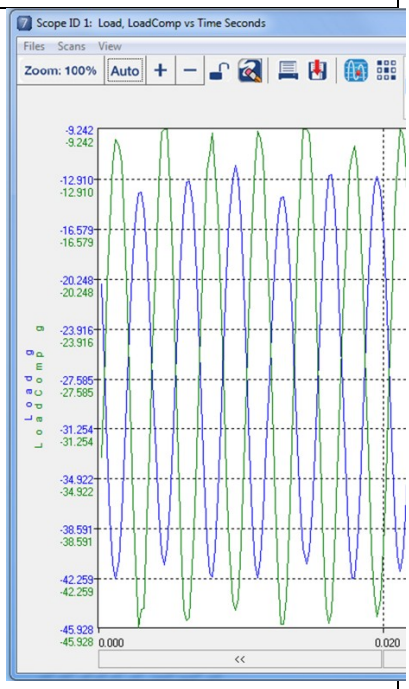
A. Always begin with **Gain Factor** and **Phase Correction** values = 0. These are the initial waveforms. (The Load signal and the LoadComp signals are the same, that is, the LoadComp signal is directly on top of the Load signal, making the Scope window appear to have only one signal.)	B. Enter 1 in **Gain Factor** and then click **Calculate**. The waveforms may go out of phase, but both will become visible. If the waveforms are in phase or are 180° out of phase, go to step E and continue there.
	
	

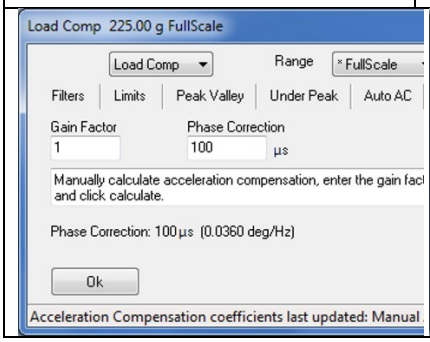
The goal of adjusting the Phase Correction is to get the waveforms either in phase or 180° out of phase. In this example, the waveforms started out of phase and we were able to get the waveforms in phase by adjusting the Phase Correction value.

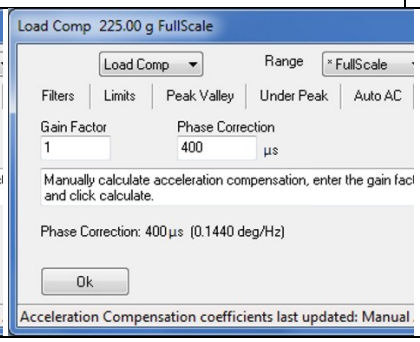
C. Enter 100 in **Phase Correction** and then click **Calculate**. The waveforms become more in phase.	D. Enter 400 in **Phase Correction** and then click **Calculate**. The waveforms become in phase.	NOTE: The waveforms being 180° out of phase is also an acceptable result to adjusting the Phase Correction.







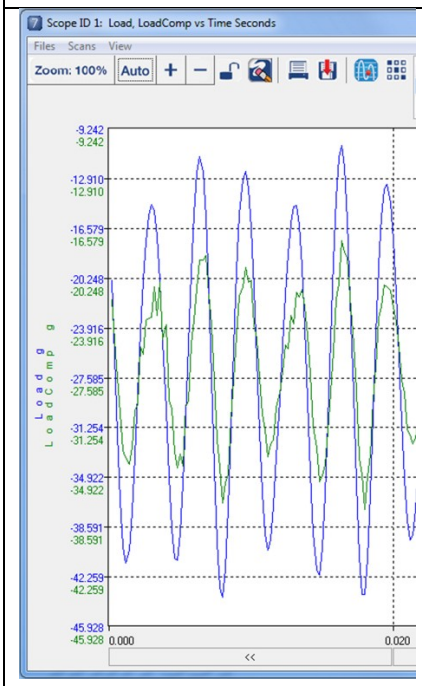
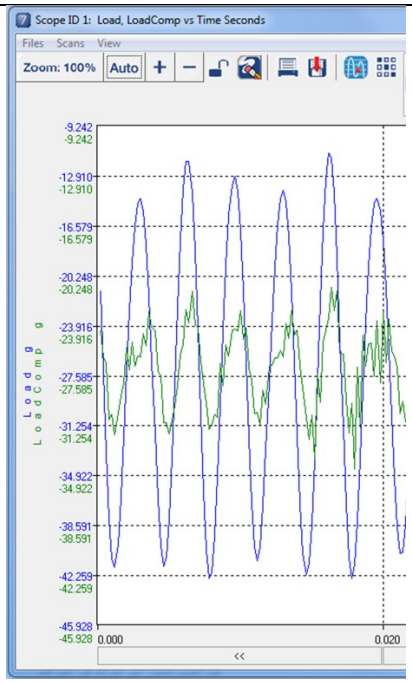
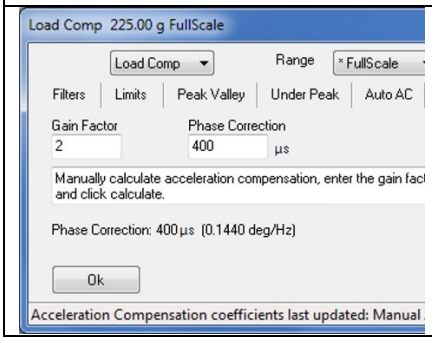
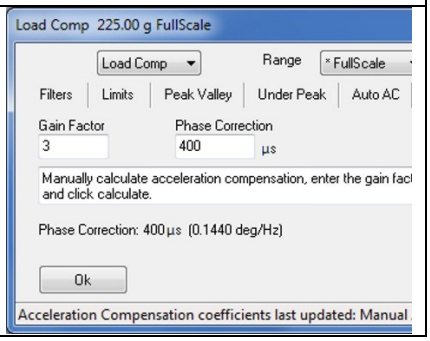




The goal of adjusting the Gain Factor is to reduce the amplitude of the LoadComp signal as much as possible.

The thought process for the adjustments is this: test your system with gain factor values EITHER larger or smaller than the initial value of 1 (negative values are sometimes needed). Then, keep going in the direction that reduces the amplitude of the LoadComp signal.

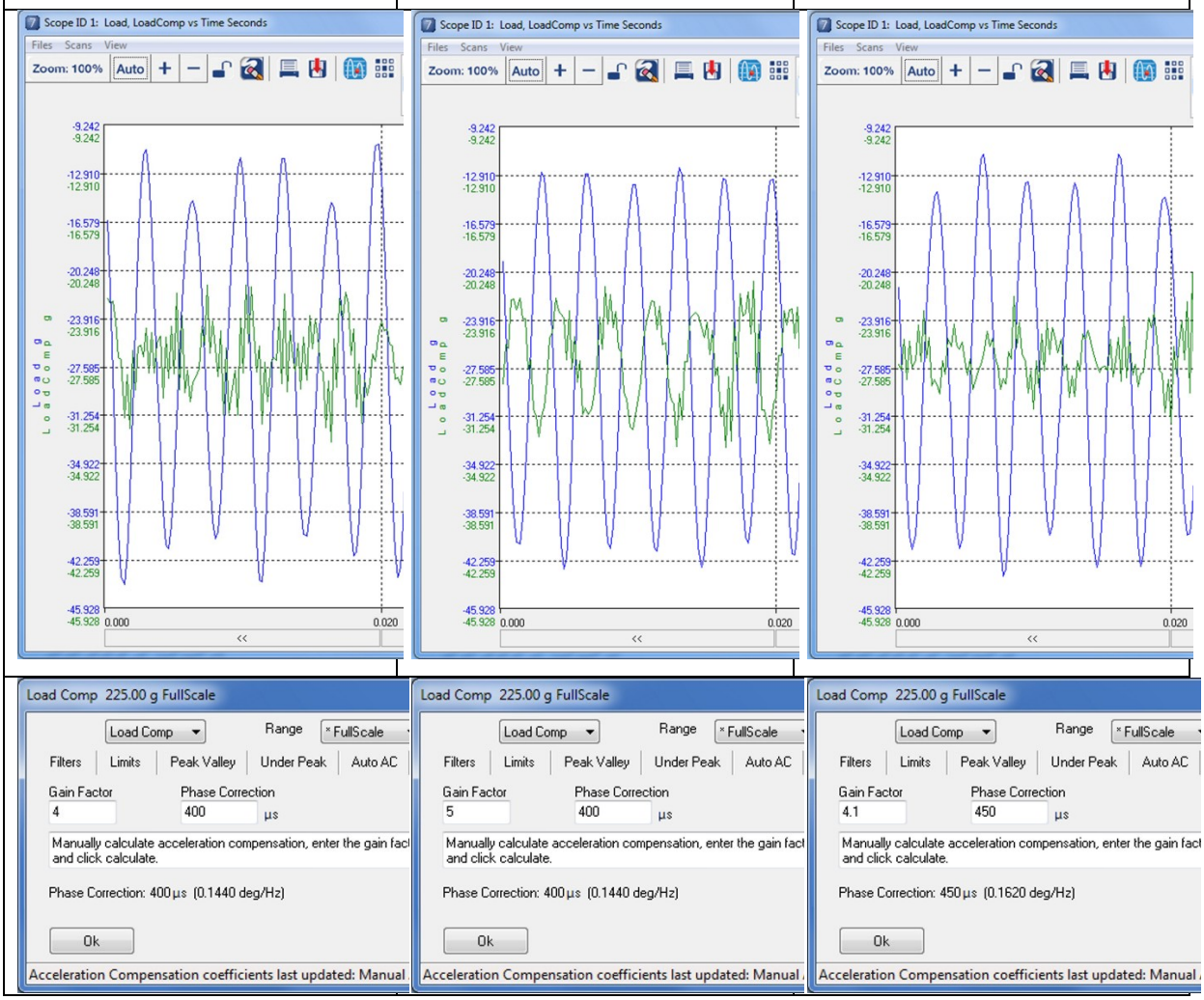
In this example, increasing the Gain Factor in a positive direction with values of 2 and then 3 reduced the amplitude of the LoadComp signal. (If a Gain Factor of 2 had increased the LoadComp amplitude, a next value to try would have been 1.5.)

E. Enter 2 in **Gain Factor** and then click **Calculate**. The amplitude of LoadComp signal was reduced.	F. Enter 3 in Gain Factor and then click **Calculate**. The amplitude of LoadComp signal was reduced.
	
	

Increasing the Gain Factor to 4 continued to reduce the amplitude of the LoadComp signal. Then when Gain factor was set = 5, the amplitude of the LoadComp signal increased. This told us that the Gain Factor needed to be more than 4, but less than 5. Eventually, we found that a Gain Factor of 4.1 reduced the amplitude the most.

Then, very small adjustments were made to Phase Correction. Again the thought process is: increase or decrease the value, observe the results, and then proceed in the direction that reduces the amplitude of the LoadComp signal. In this part of the process, you may also make additional small adjustments to the Gain Factor.

G. Enter a Gain Factor = 4 and then click **Calculate**. The amplitude of LoadComp signal gets smaller.	H. Enter a Gain Factor = 5 and then click **Calculate**. The amplitude of LoadComp signal gets larger.	I. After making very small adjustments to the Gain Factor and the Phase Correction, we found that the amplitude of LoadComp signal was smallest with a Gain Factor of 4.1 and a Phase Correction of 450.



DTL Scripts

Designer Test Language (DTL) is a WinTest feature that lets you create a series of instructions. DTL files are text files and must be compiled before you can run the DTL script in WinTest. The compile process creates a compiled version (*.bin) that can be run in WinTest plus a set of *.con, *.adr, and *.str files that are also necessary to run the script. Once you have compiled a DTL file, you don't have to compile it again unless the DTL file has been modified.

There are several ways to create, edit, and compile a test using DTL:

- If Bose ESG created and supplied a custom DTL script for your test instrument, use the **Edit/Build** window to compile the DTL file so you can run the script.
- Use the Build function in WinTest (click **File→New→New DTL Script** in the **Test Setup** window) to define the sequence of functions in the script. The **Build** window includes a **Build** button, which uses the sequence of functions in the **Build** window to create a DTL file. When the script is compiled and run, the sequence will display windows that request operator input for functions that require input.
- Create a text file containing instructions in the Designer Test Language (DTL). Instructions for using DTL is a WinTest option. The **Edit/Compile** window can be used to create and text file with DTL instructions and to compile (build) these instructions as a DTL (*.dtl) file. Note that if you edit a DTL file in the **Edit/File** window (or anywhere else) you have to compile (build) the edited file before you can run it.

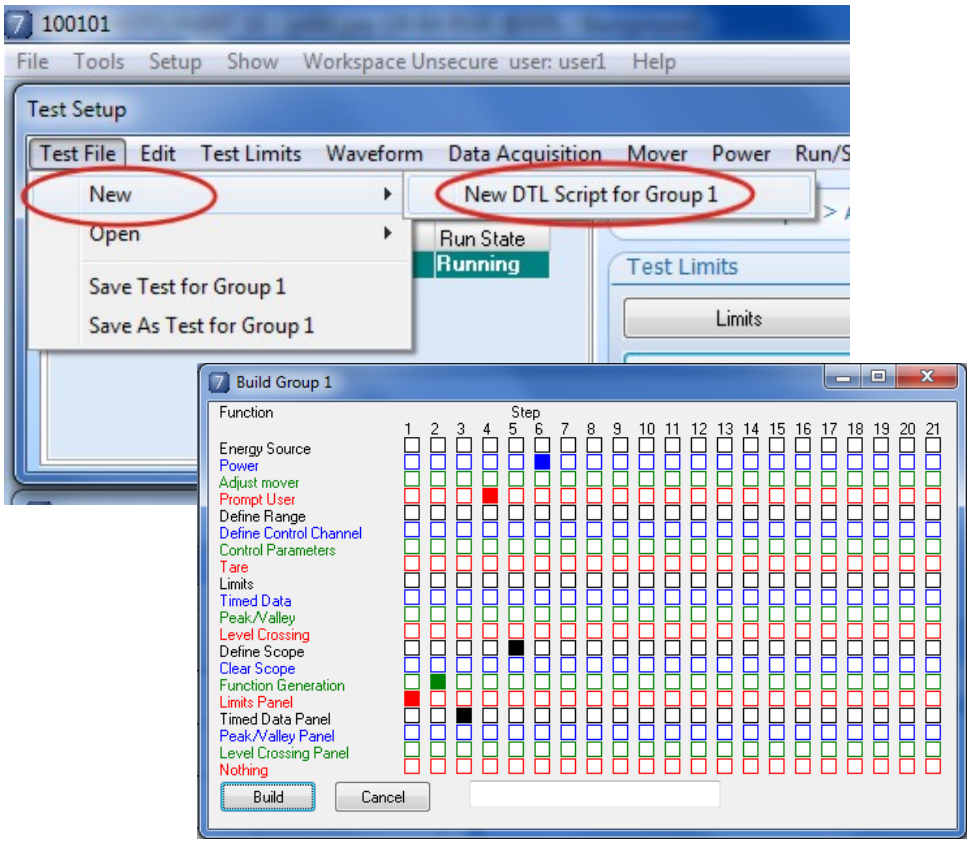
  See Chapter 12, "Additional Setup Functions and Tools," for more information about the **Edit/Compile** window.

Using Build to Create a DTL File

The Build function lets you define a sequence of functions that require user input. When the DTL script is run, the script requests the WinTest user to enter the user-entered parameters that define the test.

To use the Build function to create a DTL script:

1. For systems with multiple groups and movers, click the appropriate Group tab (**Test Setup** window) and mover.
2. Determine the steps for your test procedure. Run these steps manually to verify the test.
3. Now use the Build process to automate these steps. To begin, click **New**, and then click **New DTL Script** on the **Test File** menu (**Test Setup** window).
4. In the **Build** window, select the check box for a function (for example, Power, Adjust mover, Prompt User, etc.) for each step in the test sequence (maximum 21 steps). Select only one function (row) for each step (column).



Build Window Functions	Description
Energy Source	Displays logic for turning on the Energy source (not used for ElectroForce test systems)
Power	Opens the **Power** window, where you can turn mover power on or off.
Adjust Mover	Opens the **Adjust Mover** window, which allows the user to position the mover with power on.
Prompt User	Displays a prompt to the user with instructions for the next step. When you build the DTL file to run it, WinTest will ask you to enter the text for each prompt. WinTest will prompt for each Prompt User function that was selected as a step in the **Build** window.
Define Range	Opens a window to define the range, with logic to check the selection. (Typically not used.)
Define Control Channel	Opens a window to select the control channel, with logic to check the selection.
Control Parameters	Places the currently active tuning settings for the currently selected tuning mode (manual or TuneIQ) in the DTL file. These settings will be used when the DTL file is run.
Tare	Opens a window where the user can tare the transducers.
Limits	Places the current limit settings for all channels in this DTL file.
Timed Data	Places the current Timed Data acquisition settings in this DTL file. WinTest prompt for the data file name and destination when the DTL file is run.
Peak/Valley	Places the current Peak/Valley data acquisition settings in this DTL file. WinTest will prompt for the data file name and destination when the DTL file is run.
Level Crossing	Places the current Level Crossing data acquisition settings in this DTL file. WinTest will prompt for the data file name and destination when the DTL file is run.
Define Scope	Places current Scope setup settings in the DTL file.
Clear Scope	Clears the Scope display.

Build Window Functions	Description
Function Generation	Places the current Waveform Setup information in this DTL file.
Limits Panel	Opens the **Group Limits** window, where the user can adjust the group limit settings.
Timed Data Panel	Allows the user to adjust the Timed Data acquisition settings.
Peak/Valley Panel	Allows the user to adjust the Peak/Valley data acquisition settings.
Level Crossing Panel	Allows the user to adjust the Level Crossing data acquisition settings.
Nothing	Skips this step. Used when a step has been used previously.

5. Click the **Build** button (**Build** window). This creates the DTL file as defined in the **Build** window and compiles the DTL file so the DTL script can be run in WinTest.

6. Enter the file name and destination for this DTL file. Be sure to select the DTL Files (*.DTL) type.

NOTE *If you are working in the SecureWorkspace folder, WinTest will direct you to save the file in the secure workspace. However, you can create new folders in the secure workspace to organize your files.*

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7. If you selected the Prompt User function for any steps, WinTest will display an **Enter Message** window to enter the text to be displayed. Type the text and press the ENTER key. This window will reappear for each Prompt User function that you defined.

NOTE *You must compile the DTL file before you can run it in WinTest. See the description of the **Edit/Compile** window in* *Chapter 12, "Additional Setup Functions and Tools."*

Running a DTL Script

A DTL script can be supplied by Bose as a custom DTL program, created by entering a sequence of DTL commands in the **Edit/Compile** window, or created using the Build function.

NOTE *The DTL file must be compiled before you can run it in WinTest.*

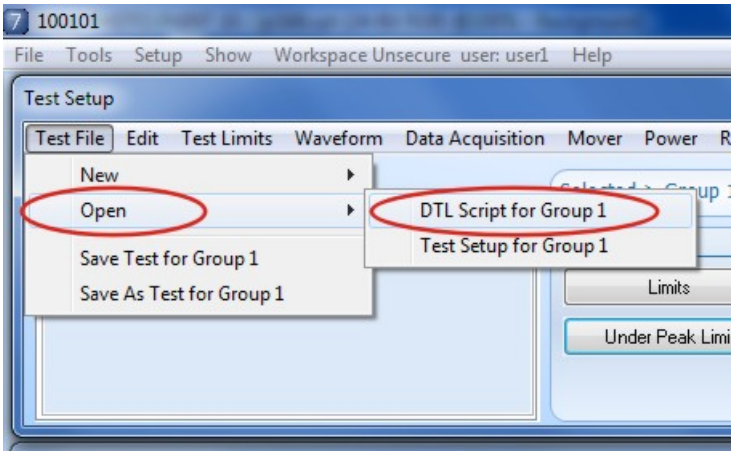
Systems with multiple groups and movers: Select the group and the mover (**Test Setup** window).

There are two ways to run a DTL program in WinTest:

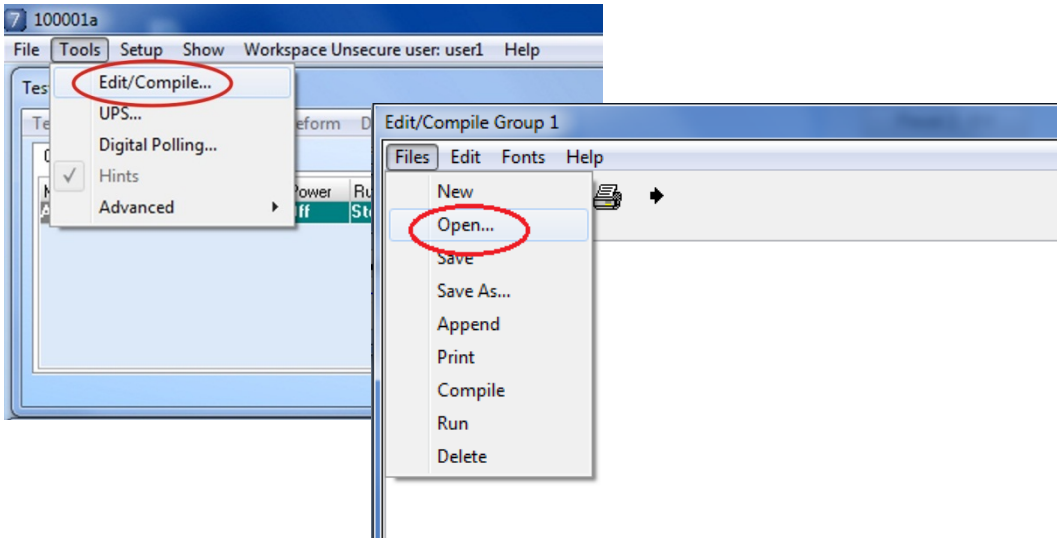
- Click **Open** on the **Test File** menu (**Test Setup** window), and then click **DTL Script**.

  WinTest will ask you to select a DTL file to open. The program sequence defined in the DTL file will begin when you click **Open**.

NOTE *Before selecting a DTL script to run, prepare the test system to run the test (for example, install the specimen, select the group and mover, etc.). See Chapter 8, "Running and Managing Tests," for more information.*



- Click **Edit/Compile** on the **Tools** menu (**Project** window). When the **Edit/Compile** window opens, click **Open** on the **Files** menu.



Select the DTL file to open, and the contents of the DTL file are displayed in the **Edit/Compile** window. You can edit the file in this window, or even create a new file.

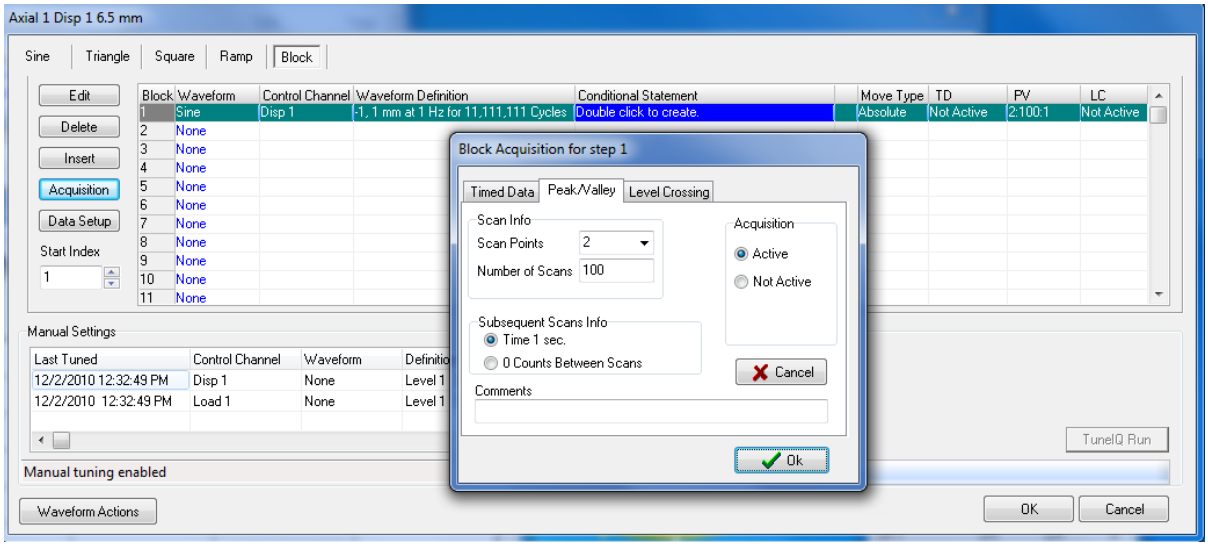
NOTE *If you make any changes to the DTL file, you must recompile the file before you can run it. Use the* ***Compile*** *command on the* ***Files*** *menu (****Edit/Compile*** *window) or the* ➧ *button on the toolbar to compile the modified file.*

NOTE *Before running the DTL file, be sure to prepare the test system to run the test (for example, install the specimen, select the group and mover, set limits, turn on Mover Power, etc.). See Chapter 8, "Running and Managing Tests" for more information.*

To run the DTL file in the **Edit/Compile** window, click **Run** on the **Files** menu or click the ▶ button on the toolbar (**Edit/Compile** window).

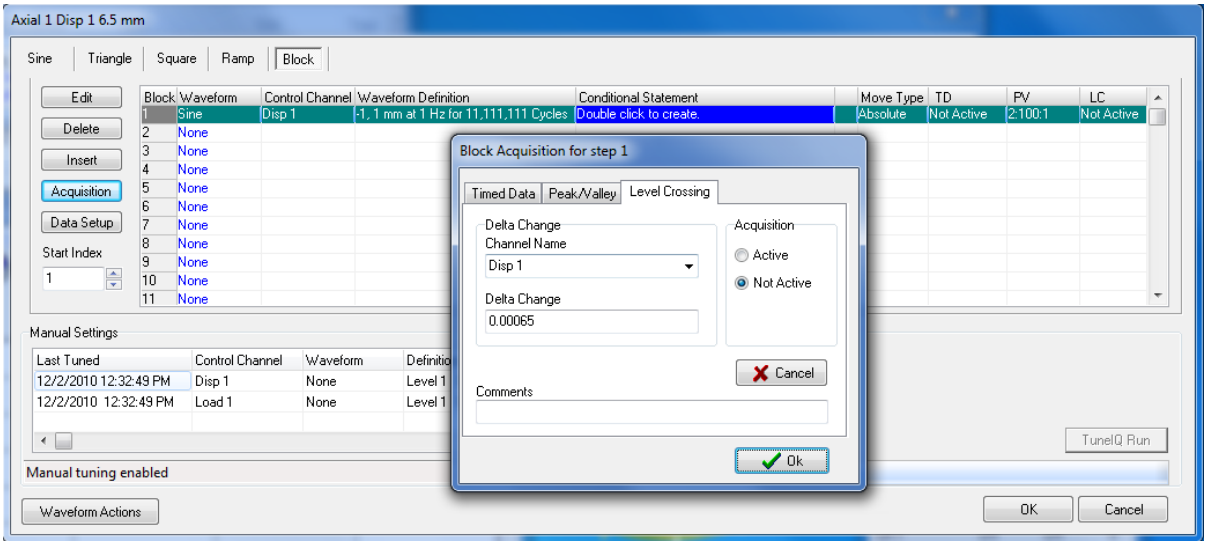
For more information about using the **Edit/Compile** window to view and edit DTL files, see Chapter 12, "Additional Setup Functions and Tools."

Peak/Valley Block Acquisition Parameters:



Parameter	Description
Scan Info	
Scan Points	Select the number of scan points in the list. This number matches the number of scan points for the Peak/Valley buffer defined in the channel setup properties. If the **Scan Points** value here is different than the Points value in the Peak/Valley channel properties, WinTest will change the channel properties value to match.
Number of Scans	Number of scans to collect during this block step. Type 1 to collect data for a single event.
Subsequent Scans Info	
Time	Select this option to collect the next scan after a specified time interval.
Counts between Scans	Select this option to collect the next scan after a given number of counts.

Level Crossing Block Acquisition Parameters:



Parameter	Description
Delta Change	
Channel Name	This list shows all channels that were selected for Level Crossing data acquisition during block data setup. For each channel in the list, click on a channel and then type the Delta Change value for that channel. You must define a Delta Change value for every channel in the list.
Delta Change	Type the amount this channel has to change to trigger data acquisition.

Scope Data Acquisition

The WinTest Scope provides an easy way to graphically view your test conditions and then capture the timed data as a permanent record of your test. You can control when to start and stop saving Scope scans, and scans are written in a file that has the same format as timed data files, but a different file name extension (*.sc*o*). Saved Scope scan files can be exported, either automatically when the file is closed, or manually so you can specify the export conditions for each file. These parameters are set up using the **Scans Setup** command on the **Files** menu (**Scope** window).

Saving and Exporting Scope Scans

See also Chapter 3, "Display Windows (Show Menus),"for more information about saved Scope scans. The general procedure for saving Scope scans in a file:

1. Adjust the Scope settings to optimize the data in each scan.
2. To start saving Scope scans, click the **Save** button on the **Scope** window toolbar or click **Save scans** on the **Files** menu (**Scope** window). Data acquisition starts at the beginning of the next scan.
3. To stop saving scans, click the **Save** button again.
4. If **Export on close** was selected in the **Save Scan Setup** window, the file is automatically exported when the file is closed. The file name is the source file name specified in the **Save Scan Setup** window plus a date and time stamp to make the file name unique. Export conditions are as currently defined in the **Export** window.
5. If **Manual Export** was selected in the **Save Scan Setup** window, the **Export** window opens when the data file is closed. Select the export conditions you want, and then click the **Export** button to export the data file. The default name of the exported file is the saved scan file (which includes the date and time stamp), but you can change the file name and destination when you export the file.

Viewing Saved Scope Scans and Timed Data Files on the Scope

You can also use the **Replot** function to view previously saved Scope scans and timed data files in a **Scope** window. See Chapter 9, "Reviewing Test Results," for specific information.

Chapter 9
Reviewing Test Results

WinTest provides several different ways to review test results after the test is completed:

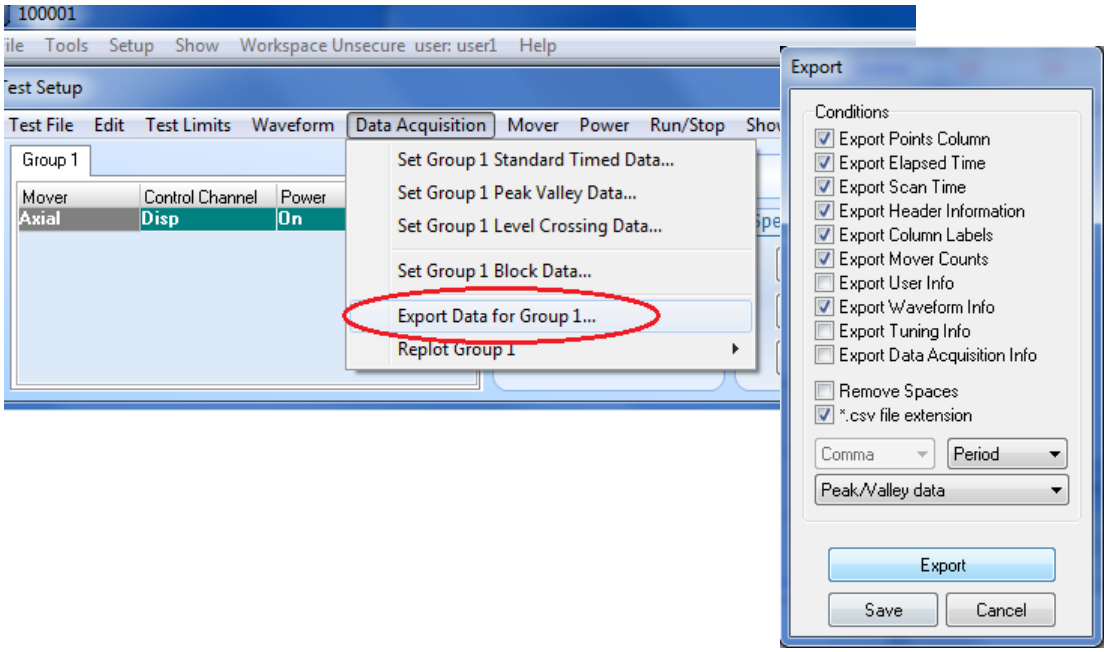
- Use the **Export** function (**Data Acquisition** menu, **Test Setup** window) to export any closed WinTest binary data file to a text format for data analysis with other programs.
- Use the **Replot** function (**Data Acquisition** menu in the **Test Setup** window, or **Files** menu in a **Scope** window) to plot a timed data file or a saved Scope scan file in a **Scope** window. (Replot cannot be used to plot Peak/Valley or level crossing data files.)
- The **History Viewer** window (**Show** menu, **Project** window) allows you to view tracked project activities for traceability or review purposes. WinTest allows you to focus on specific information by filtering what information is displayed.

Export Data File

The Export function converts binary WinTest data files (timed data files, Peak/Valley data files, level crossing data files, and saved Scope scan files) to text format so they can be analyzed in other programs. **Export** window options allow you to specify what to include in the exported file and other formatting options.

WinTest provides three ways to export data files:

- Automatic export on close. A data file will be automatically exported when it is closed if the **Export on Close** option is selected in the data acquisition setup (time data, Peak/Valley, or level crossing data files) or in the save scans setup (Scope scans), using the export conditions as currently defined.
- Manual export. If the **Export on Close** option is not selected for automatic export, you have to export the file manually. Manual export also allows you to set the export conditions and to specify the file name and destination.
- Export saved Scope scans. See Chapter 3, "Display Windows (Show Menus)," for more information.



Setting Export Conditions for Automatic or Manual Export

Use this procedure to manually export a data file, or to set export conditions for automatic export. Once export conditions have been set, files that are automatically exported will use the currently selected conditions.

1. Click **Export Data** on the **Data Acquisition** menu (**Test Setup** window).
2. In the **Export** window, select or clear check boxes to define the export conditions.

NOTE *When exporting a Peak/Valley data file (*.pvf), be sure to clear the **Export Column Labels** and **Export Mover Counts** conditions to avoid placing header and cycle count information before the data for each scan (one scan per cycle).*

Export Condition	Include in the export file when selected:
Export Points Column	Data from the Points column in the binary data file.
Export Elapsed Time	Data from the Elapsed Time column.
Export Scan Time	Data from the Scan Time column (timed data files only).
Export Header Information	File header information (file name, date created, date exported etc.).
Export Column Labels	Labels for column headings.
Export Mover Counts	Mover counts.

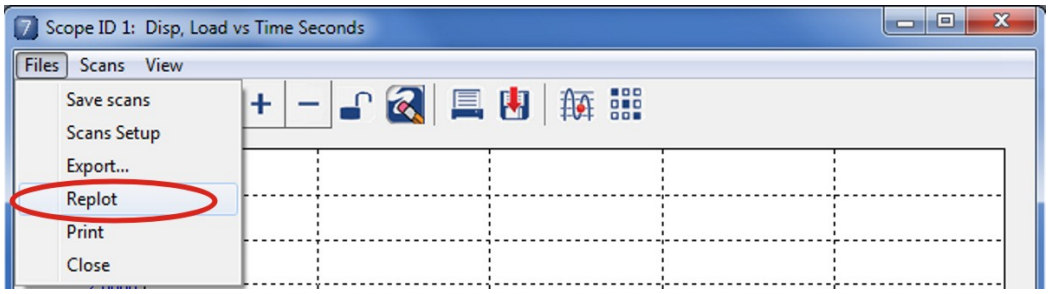
Export Condition	Include in the export file when selected:
Export User Info	WinTest user name.
Export Waveform Info	Waveform definition used to generate the data.
Export Tuning Info	Tuning settings that were applied when the test was run.
Export Data Acquisition Info	Data acquisition setup information used to acquire this data.
Remove Spaces	Removes spaces between columns in the exported file.
*.csv file extension	Exports the file in a comma-delimited file recognized by Microsoft Excel. The exported file has the extension *.csv (when this option is not selected, the export file is a text file with the extension *.txt).

3. Select a character to separate the data fields in the exported file: comma, tab, or space. (This option is disabled if you selected the *.csv file extension.)
4. Select the decimal separator for numerical data: period or comma.
5. Review your selections.
   - If you are defining export conditions for automatic export, click **Save**.
   - To export a file, continue with step 6.
6. Select the type of file to export (timed data, Scope data, Peak/Valley data, or level crossing data).
7. Click the **Export** button.
8. Select the data file to export, then click **Open**.
9. Specify the file name and destination for the exported file. The default file name is the same as the binary file selected for export, and the export conditions specify the extension (*.txt or *.csv). Click **Open** to export the binary file to the specified file name and destination and close the **Export** window.

NOTE *If you are working in the SecureWorkspace folder, WinTest will direct you to export to the same folder. You can create new folders to organize your files when you select the export destination, and you can copy the exported file into the UnsecureWorkspace folder, where you can manage it.*

Replot

The Replot function plots a timed data file or a saved Scope scan file in the **Scope** window. (Replot cannot be used to plot Peak/Valleyor level crossing data files.)



Replotting a Data File or a Scope Scan File

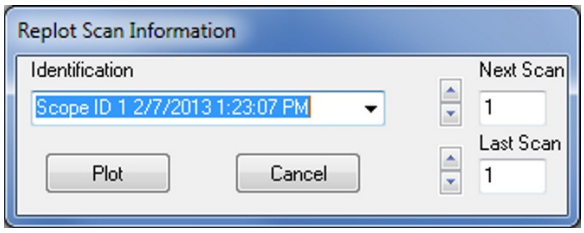
1. Use one of these methods to open the **Replot** window:

   - Click **Replot** on the **Data Acquisition** menu (**Test Setup** window), then select the type of data file to plot on the submenu: **Standard Timed Data** or **Scope Data**.

   - In the **Scope** window, click **Replot** on the **Files** menu.

2. After the **Replot** window opens, click **Open** on the **Files** menu. Select the timed data file or Scope scan file to display in the **Replot** window, and then click **Open**.

3. The **Replot Scan Information** window opens and identifies the file.



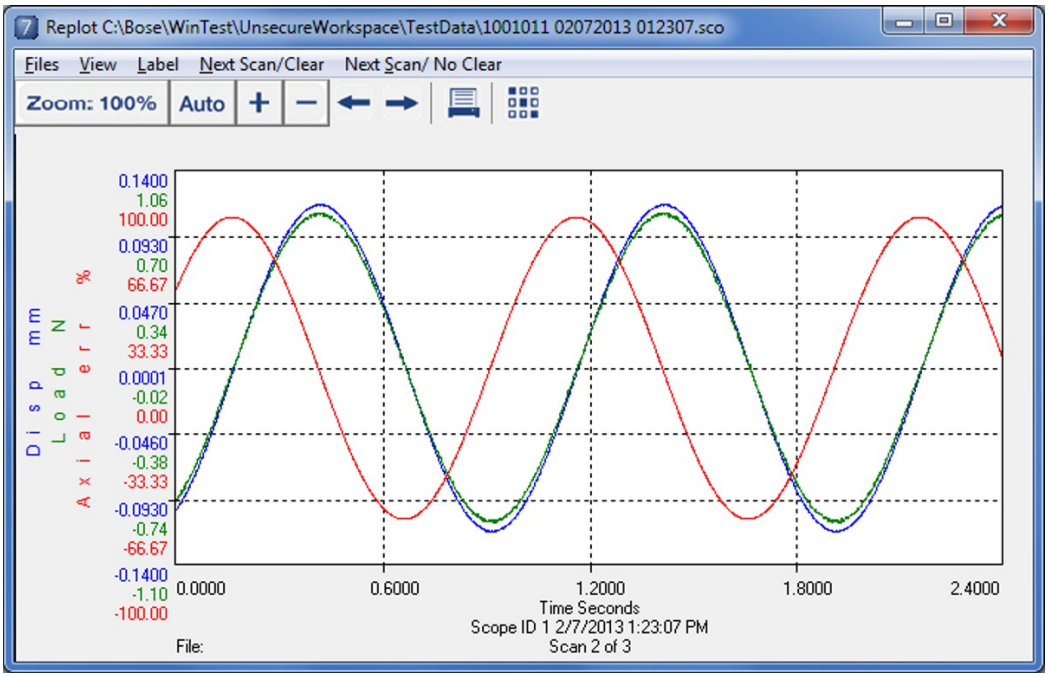
4. Select which scans to plot. The **Next Scan** and **Last Scan** boxes show the first and last scans in the file. To plot a subset of the available scans, enter the first and last scan numbers to plot. To plot just one scan, enter the same scan number in the **Next Scan** and the **Last Scan** boxes.

5. Click **Plot** to display the data in the **Replot** window.

Replot Display Options

The toolbar in the **Replot** window includes some of the same display options as the **Scope** window, with these differences:

- Use the forward arrow button to clear the screen and display the next scan. Use the back arrow button to clear the screen and display the previous scan. The range of scans is defined by the **Next Scan** and **Last Scan** entries, specified before plotting the data. (You can use the **Scan(s)** command on the **View** menu to change the range of displayed scans at any time.)
- To overlay multiple scans, click **Next Scan/No Clear**. The next scan is displayed over the previous scan for comparison.
- Replot scaling functions are similar to the Scope, except that Replot initially plots the data using the full-scale range used to acquire the data. Typically, rescaling is needed to view the data as it appeared during the test (select the axis label for the channel to rescale and select a scaling option). These options are the same as for a **Scope** window. See Chapter 3, "Display Windows (Show Menus)."



Replot View Menu Options

View Menu Option	Description
Scan(s)	Use this option to change the range of scans displayed in the **Replot** window.
Channels	Opens a window where you can select time or a channel for the x-axis and one or more channels to plot on the y-axis. See Selecting Scope Channels in Chapter 3.
Grid	When selected on this menu, displays horizontal and vertical reference lines in the plot area to help interpret the displayed values.
Zero Lines	When selected on this menu, displays a solid horizontal line to identify zero for each displayed channel.

Labels for Replot Scans

The **Replot** window lets you specify a label for your replotted data. This label is centered above the plot area when the scan is displayed or printed. The file name is displayed in the lower left corner, under the plot area.

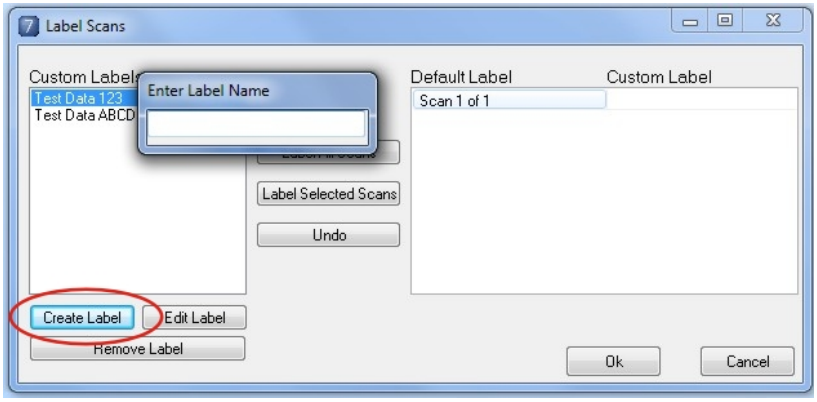
The **Label Scans** command on the **Label** menu (**Replot** window) lets you create custom labels to display or print on scan plots. To label your plots, you only have to define the appropriate labels in the **Custom Labels** list and then apply it either to all scans to selected scans. (See "Creating or Editing Custom Labels for Replot Scans" for specific instructions.)

NOTE *The applied labels are only valid during the current WinTest session. If you exit WinTest and then start another WinTest session, you have to reapply the custom labels if you plot the data again.*

Creating or Editing Custom Labels for Replot Scans

1. Click **Label Scans** on the **Label** menu (**Replot** window).
2. To create a new custom label for the **Custom Labels** list:
   a. Click the **Create Label** button.
   b. Type the label name in the **Enter Label Name** window and then press the ENTER key.
3. To edit an existing label:
   a. Select the label to edit in the **Custom Labels** list.
   b. Click the **Edit Label** button.

c. Type or edit the label name in the **Enter Label Name** window and then press the ENTER key.



4. To remove a label:

   a. Select the label to delete in the **Custom Labels** list.

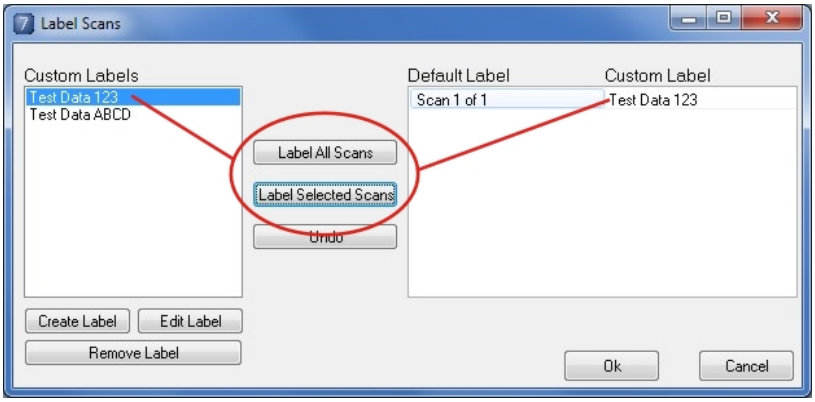
   b. Click the **Remove Label** button (no confirmation).

Applying Custom Labels to Replot Scans

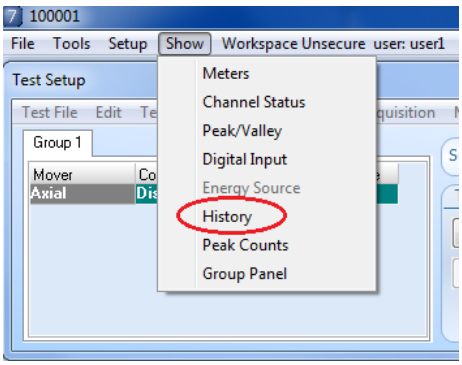
To apply the same label to all scans in the replotted file, select the label name in the **Custom Labels** list and then click **Label All Scans**.

To apply a custom label to one scan or to some scans, select the label name in the **Custom Labels** list, select the scans to which you want to apply this label, and then click **Label Selected Scans**. (Click the **Undo** button to cancel the previous label change.)

Click **Ok** to accept the labels as shown and close the window, or click **Cancel** to discard your changes.



History



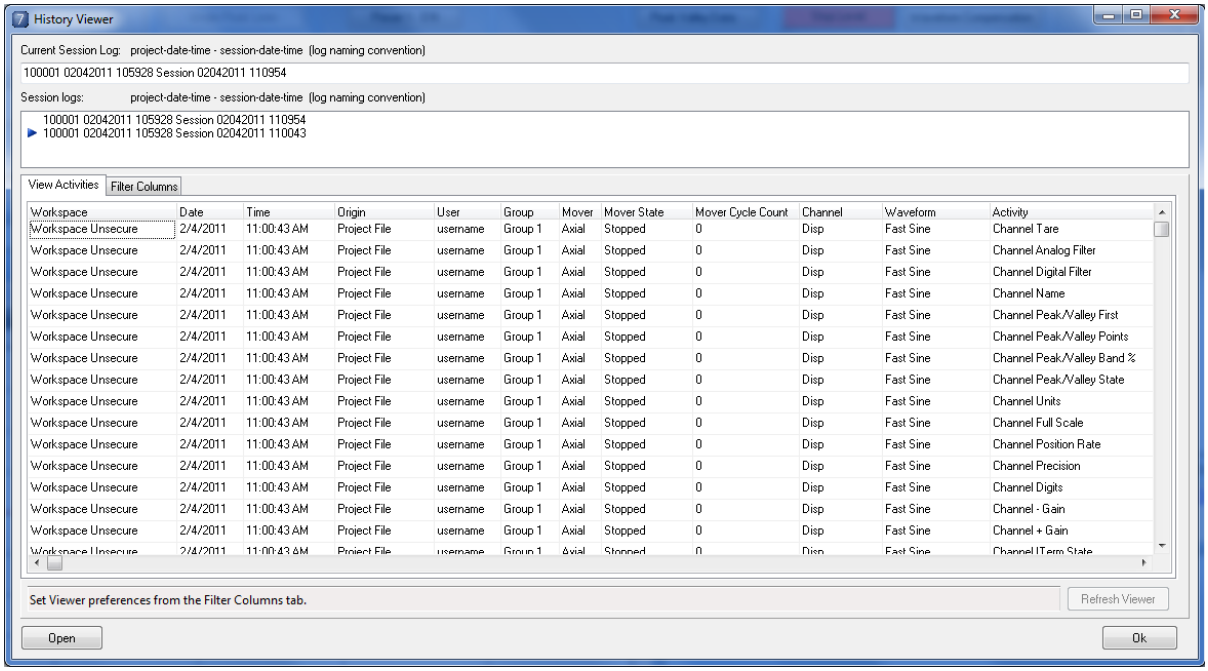
The **History Viewer** window displays the contents of the current session log for the current project. This session log provides a record of activities that affected the project since it was last opened.

For each activity, WinTest records a set of information, including the originator of the activity, the date and time it occurred, and other information that depends on the activity.

To open the **History Viewer** window, click **History** on the **Show** menu (**Project** window). In the **History Viewer** window, use the vertical scroll bars to scroll through the list of activities; use the horizontal scroll bar to scroll through the information items displayed for each activity.

In the **History Viewer** window, you can also do the following:

- Display another project session file.
- Use the **Filter Columns** tab to select columns to display in the **History Viewer** window, and in what order.
- Click the **Refresh Viewer** button to update the contents of the **History Viewer** window. (This button becomes active when a new activity is logged while the **History Viewer** window is open.



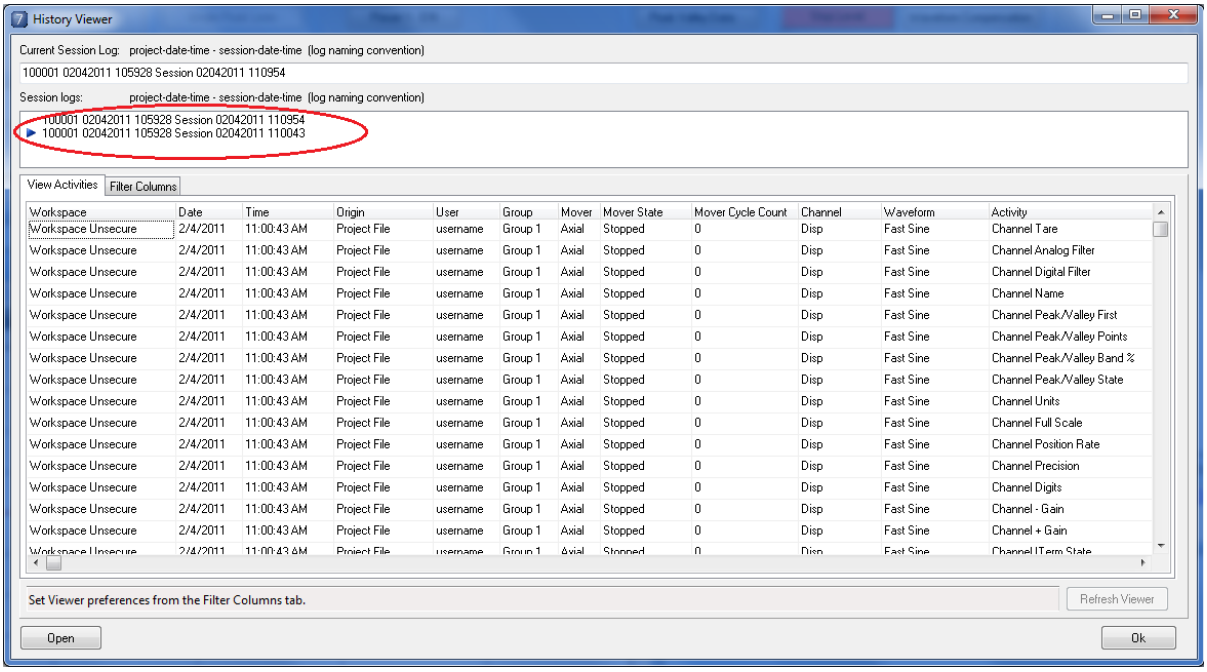
Workspace	Date	Time	Origin	User	Group	Mover	Mover State	Mover Cycle Count	Channel	Waveform	Activity
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Tare
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Analog Filter
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Digital Filter
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Name
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Peak/Valley First
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Peak/Valley Points
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Peak/Valley Band %
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Peak/Valley State
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Units
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Full Scale
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Position Rate
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Precision
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel Digits
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel - Gain
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel + Gain
Workspace Unsecure	2/4/2011	11:00:43 AM	Project File	username	Group 1	Axial	Stopped	0	Disp	Fast Sine	Channel LTerm State

Selecting a Project Session Log to Display

When the **History Viewer** window opens, it displays the activities for the current project session. The **Current Session Log** at the top of the window shows the name of the current project session log file and a key to interpret the elements of the file name.

The **Session logs** panel shows a list of all project session files that are currently open and can be displayed. To display the contents of another project session log file, click on the file name in the list.

To open another project file so that you can display it in the **History Viewer** window, click the **Open** button in the lower left corner of the **History Viewer** window and then select the file to open. Once the file has opened, the file name will appear in the **Session logs** list and the contents of the file will appear in the viewer.



Rows and Columns

Each row in the **History Viewer** window identifies an activity that affected the project, and each column shows information about the activity that was recorded.

For traceability, every project session file records many items of information about each activity that is recorded in the file. You may want to see all of this information, or you may want to focus on some specific items. You can use the **Filter Columns** tab to select which columns to display in the **History Viewer** window, and in what order to display them. (See the "Filtering Information Columns" section later in this chapter for more information.). These selections will persist until you change them, or until you exit WinTest.

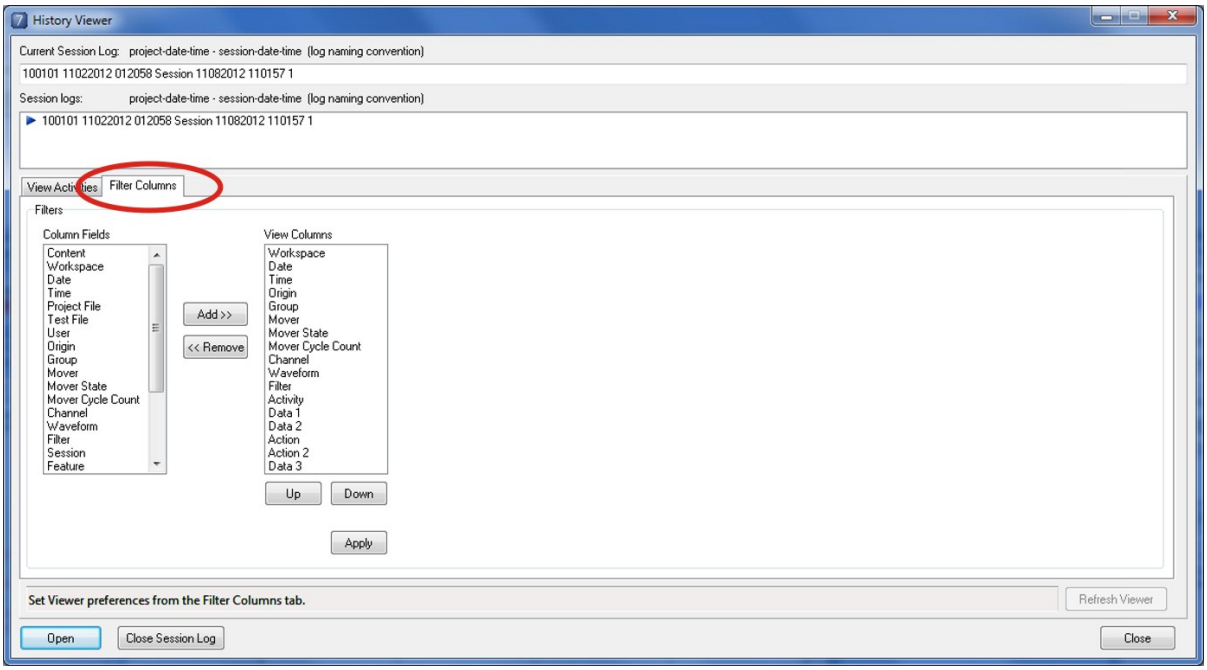
The following table describes the information in each column that can be displayed in the **History Viewer** window:

Column	Description
Content	Not in use
Workspace	Workspace folder for this project file: SecureWorkspace or UnsecureWorkspace
Date	Date the activity was recorded
Time	Time the activity was recorded
Project File	Project file name
Test File	Test file name
User	User ID of the user who made the change.
Origin	Who or what originated the change: Project File, WinTest, or User
Group	Group number, if the change affects a specific group
Mover	Name of the mover affected by the change.
Mover State	State of the mover when the change occurred.
Mover Cycle Count	Mover cycle count when the activity occurred, if applicable.
Channel	Name of the channel affected by the change.
Waveform	Waveform type, if applicable.
Filter	Channel filter, if applicable, or Particle Capture info, if applicable.
Session	Not in use
Feature	Not in use
Activity	A brief description of the change
Data 1	Additional information related to the activity.
Data 2	Additional information related to the activity.
Action	Limit action that was executed, if applicable.
Action 2	Not in use
Data 3	Additional information related to the activity.
Data 4	Additional information related to the activity.
Data	Not in use

Filtering Information Columns

Use the **Filter Columns** tab to select what information columns to display for each activity, and in what order. You can change these selections at any time, to focus on specific types of information. You can also return to the **Filter Columns** tab at any time to change your selections.

NOTE *Filtering the information columns affects only what is displayed in the **History Viewer** window. It has no effect on the contents of the project session file being displayed.*



The **History Viewer** window opens with the default columns selected for display in the viewer. To add or remove columns, and to change their sequence in the **History Viewer** window, do the following:

1. To display more columns, highlight the item or items in the **Activity Fields** list and click the **Add** button.

   - To add multiple items, press and hold the CTRL key and click each of the multiple items to add. Then click the **Add** button to add them all at once.

   - To add a series of items, click the first item you want to add. Then, press and hold the SHIFT key and then click the last item you want to add. Release the SHIFT key, and then click the **Add** button to add them all at once.

2. To remove columns from the **History Viewer** window, highlight the columns to remove in the **View Columns** list and then click the **Remove** button. Select multiple items to remove as described in step 1.

3. Continue adding and removing fields in the **View Columns** list until this list contains all of the information that you want to display for each activity in the **History Viewer** window.

4. The order of items in the **View Columns** list specifies the order of columns that is displayed in the **History Viewer** window. To change the column order, highlight an item in the **View Fields** list and then click the **Up** or **Down** button to move the item up or down in the list.

5. When the **View Columns** list contains all the items you want to display and they are in the desired order, click the **Apply** button

6. Click the **View Activities** tab to return to the **History Viewer** window, which now shows the columns that you selected.

NOTE *These selections are not saved, and they persist only for the current WinTest session.*

Chapter 10
Channel Setup Properties

A channel represents any signal that your system can monitor and read. These include hardware-based transducer signals, digital input and output signals, and calculated channels. This chapter describes the channel setup properties that can be set by WinTest users.

Overview of Channel Properties

These channel setup properties can be specified by WinTest users.

Property	Description
Tare	The tare function defines the zero reference for the transducer reading. An Auto Tare function is also provided to automatically set the current channel reading to zero.
Filter selection	Filter selections allow selection of a digital or an analog filter to attenuate unwanted high frequency noise from the transducer readings.
Limits	Limits define the working boundaries for a channel. If these boundaries are exceeded causes an event, which triggers a user-selectable system response. See Chapter 4, "Limits and Actions," for specific information.
Peak/Valley settings	Peak/Valley settings determine how WinTest measures the reversals that define Peaks and Valleys.
Under Peak limit settings	Under Peak limit settings are used to cause an event when the channel is no longer able to maintain its dynamic amplitude or to detect specimen damage or breakage. See Chapter 4, "Limits and Actions," for specific information.

Access to Channel Setup Properties

WinTest provides multiple accesses to the channel setup properties. Mover power must be off to adjust channel properties.

Property	Description
All properties for individual channels	Right-click in the **Meter** window for the channel and click **Properties** (control channels only). In the **Properties** window, click the appropriate tab. Click **Channels** on the **Setup** menu (**Project** window). In the properties window, select the channel and the appropriate tab.
Limit settings	Group Limits: Click the **Limits** button (**Test Setup** window) or click **Set Group Limits** on the **Limits** menu (**Test Setup** window). All Limits: Click **Limits** on the **Setup** menu (**Project** window) or **Set All Limits** on the **Limits** menu (**Test Setup** window).
Under Peak Limits	Under Peak limits can only be adjusted while a test is running. Group Under Peak Limits: Click the **Under Peak Limits** button (**Test Setup** window) or click **Set Group UnderPeak Limits** on the **Test Limits** menu (**Test Setup** window). All Under Peak Limits: Click **Under Peak Limits** on the Setup menu (**Project** window) or click **Set All UnderPeak Limits** on the **Test Limits** menu (**Test Setup** window).
Peak/Valley settings	All channels: Click **Peak/Valley** on the **Setup** menu (**Project** window).

NOTE *When you exit any window that specifies channel properties, WinTest will always ask whether to save the project file. WinTest will always direct you to save a secure project in the SecureWorkspace folder, but you can create new folders to organize your files.*

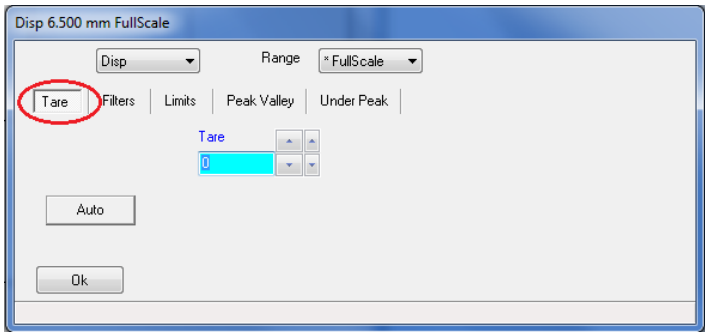
Tare

Taring a transducer changes the transducer's zero reference. The Auto Tare function automatically sets the current channel reading to zero.

Load transducers are typically tared after the fixturing has been added, however, note that the weight of the fixture must be included when setting limits to avoid damage to the load cell. The total force applied to the load cell cannot exceed its capacity or damage may occur.

value for the displacement. If you tare the displacement transducer too far to one end, you may not have sufficient travel to reach your desired levels.

1. Open the properties window (right-click the **Meter** window or clicking **Channels** on the **Setup** menu (**Project** window).
2. Select the channel and the range (as applicable).
3. Click the **Tare** tab.



IMPORTANT *Do not use Auto Tare with a filter frequency lower than 40 Hz. Lower frequency filters can cause the filtered control (feedback) signal to be much smaller than the actual signal, causing limits to not work as expected.*

4. For an automatic tare:
   a. Click the **Filters** tab and verify that the selected filter is 40 Hz or greater.
   b. Click the **Auto** button to reset the channel reading to zero and to automatically enter the offset in the **Tare** box.
5. For a manual tare, adjust the tare value by typing a value in the **Tare** box or by clicking the arrow buttons to change the value. The larger arrow buttons change the value more than the smaller arrow buttons.
6. Click **OK** to close the window.

NOTE *WinTest will always direct you to save a secure project in the SecureWorkspace folder, but you can create new folders to organize your files.*

Filters

A low-pass filter can be used to reduce unwanted high-frequency noise from transducer signals. PCI controllers use only digital filters. The filter selection (or none) is specific to each channel and range (if applicable).

IMPORTANT *Never use Auto Tare with a filter less than 40 Hz, because the low-frequency filter can cause the filtered control signal (feedback) to be smaller than it actually is. In this case, limits may not work as expected.*

Guidelines for Filter Selection

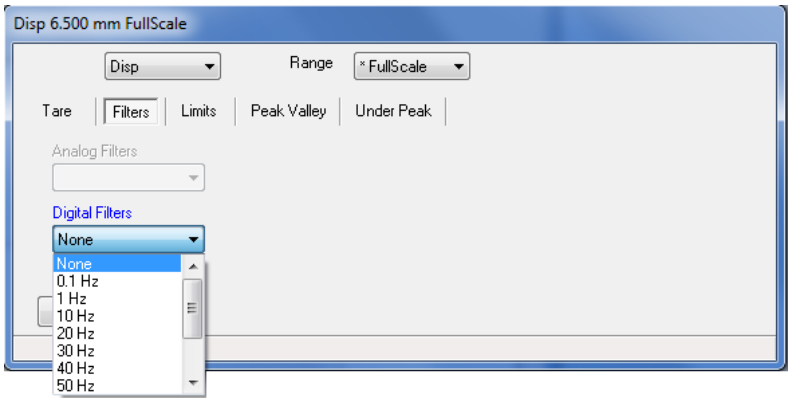
In principle, the selected filter (low pass) should be at least 10 times the frequency of the test waveform. A low-frequency filter can reduce high-frequency noise, but choosing a filter frequency that is too low can eliminate important data or add a phase lag.

IMPORTANT *Even a filter 10 times the frequency of the test waveform can cause significant phase lag. Use filters only when the effect of the filter on the test data is completely understood.*

Viewing and Selecting the Filter

1. Right-click in the **Meter** window for the channel and click **Properties**. Alternately, click **Channel Setup** on the **Setup** menu (**Project** window) and select the appropriate channel.
2. Click the **Filters** tab.
3. Select the appropriate filter (or select **None** for no filtering).
4. Click **OK**. WinTest will ask whether to save the project file.

NOTE *WinTest will always direct you to save a secure project in the SecureWorkspace folder, but you can create new folders to organize your files.*



Peak Valley Settings

Peak/Valley settings determine how WinTest defines a reversal in the direction of motion or loading, which results in a Peak or Valley reading. Other WinTest functions such as Peak/Valley data acquisition, Amplitude Compensation, and Under Peak Limit Detection also rely on accurate Peak/Valley readings.

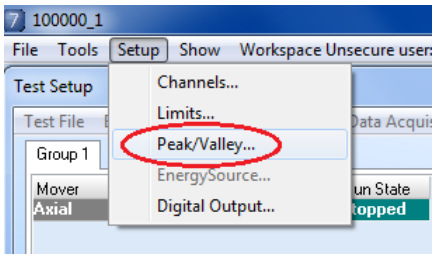
Adjusting Peak/Valley Settings

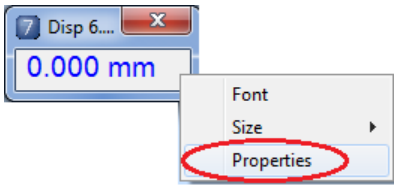
To adjust the Peak/Valley settings for a channel:

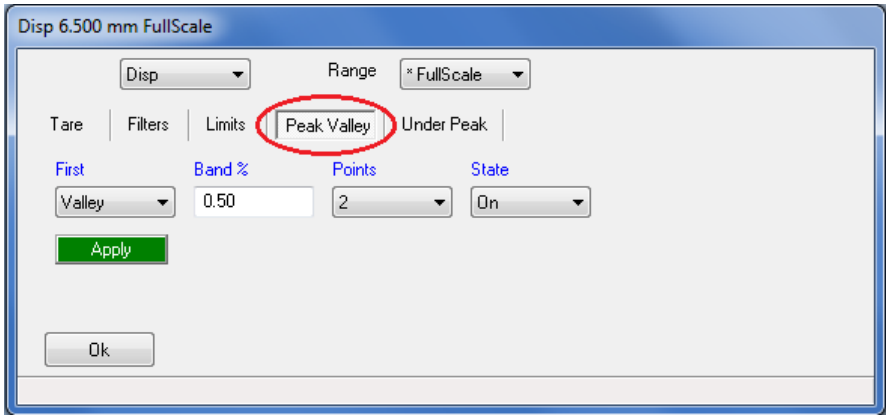
1. Access the Peak/Valley settings for the channel.

   - One channel at a time: Click **Channels** on the **Setup** menu (**Project** window) and then click the **Peak Valley** tab.

   - Right-click in the **Meter** window for the channel and click **Properties** (control channels and calculated channels only).







2. Define the Peak/Valley settings:

Setting	Description
First	Specifies whether WinTest records Peak (maximum) values or Valley (minimum) values first.
Band %	Change in amplitude used to determine whether a reversal has occurred, as a percent of full scale. • If the reversal is less than this amplitude, it is ignored. • If the reversal is greater than this amplitude, the Peak/Valley registered to include the new Peak or Valley value.
Points	Number of Peak and Valley points to store in the Peak/Valley register (always an even number; a multiple of one Peak and one Valley). For example, if Points=8, the register will store the most recent four Peak readings and the last four Valley readings.
State	Select **On** to monitor Peaks and Valleys; select **Off** to ignore Peaks and Valleys.

3. Click **Apply** to apply your changes.
4. Click **Ok** to close the window. WinTest will ask whether to save the project file.

NOTE *WinTest will always direct you to save a secure project in the SecureWorkspace folder, but you can create new folders to organize your files.*

Checking the Accuracy of Peak/Valley Band Settings

If the Peak/Valley band % for a channel is too small, its Peak and Valley data may be based on noise and are not the true Peak and Valley measurements for the channel.

If the Peak/Valley band % is too large, the Peak/Valley points for the channel are not updated in the register, and all values in the register are exactly the same.

WinTest provides two ways to check the accuracy of the Peak/Valley band % setting:

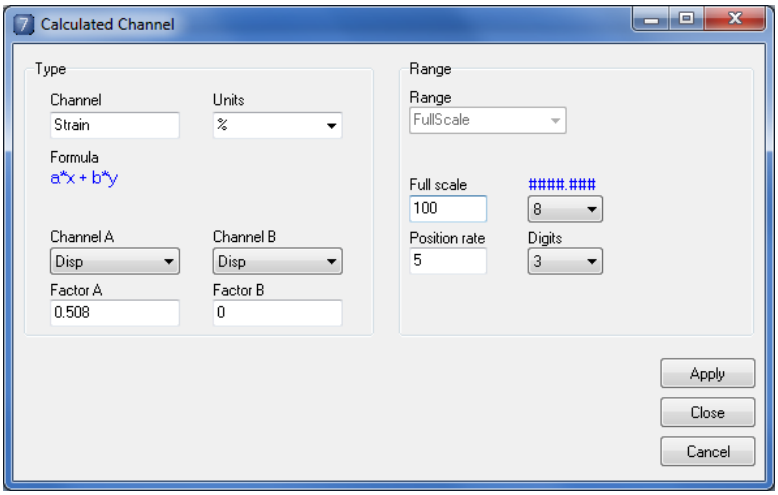
- Compare the Peak/Valley reading for the channel in the **Peak/Valley** window to the Max and Min readings in a **Scope** window. These values should agree within a few percent, and values in the **Peak/Valley** window should be updated on a regular basis. If the displayed Peak/Valley values are not changing, the Peak/Valley band % is too high.

- Compare the channel reading in the **Peak Counts** window to the cycle count in the **Test Status** window. If the Peak Counts reading is greater than the cycle count, the Peak/Valley band% is probably set too low, and Peak/Valley counts are being triggered by noise. If the Peak Counts reading is less than the cycle count, the Peak/Valley band% is probably set too high, and WinTest is not detecting all of the Peaks and Valleys that actually occur.

Calculated Channels

Calculated channels are measurements that multiply and combine readings from one or more channels. For example, calculated channels can be used to sum two load cells, to calculate and monitor stress and strain, to report the average of two control channels, or other test-specific applications. The default WinTest configuration typically has two calculated channels: DirCmd and UserCalc1. A qualified Bose ESG representative can create more calculated channels if needed.

The Acceleration Compensation feature uses three new calculated channels: differentiation, double differentiation, and compensated.



The output of a calculated channel is defined as follows, where Channel A and Channel B can be any channels, including a control channel or another calculated channel.

Calculated channel output = (Factor A x Channel A) + (Factor B x Channel B)

To define a calculated channel:

1. Right-click in the **Meter** window for this channel and click **Calculated**.
2. Enter the following information in the **Calculated Channel** window:

Parameter	Description
Channel	Type the name of the calculated channel here.
Units	Select the calculated channel units from the list or type your own units, if not available in the list.
Range	The default range is the full scale. DO NOT change this value.
Full scale	Enter the desired full scale reading for this calculated channel.
Position rate	Enter the command rate of change.
###.###	Total number of digits used to display values, for this channel, including the leading sign and decimal point.
Digits	Number of digits to display after the decimal point.
Channel A	Select Channel A from the list.
Factor A	For information about calculating Factor A, refer to the examples on the next pages.
Channel B	Select Channel B from the list.
Factor B	For information about calculating Factor B, refer to the examples on the next pages.

3. Click **Apply** to apply your changes, and then click **Ok** to close the window. WinTest will ask whether to save the project file.

NOTE *WinTest will always direct you to save a secure project in the SecureWorkspace folder, but you can create new folders to organize your files.*

How to determine the Factor A and Factor B values

$$\text{Factor A} = \text{scalar}\left(\frac{\text{full scale Channel A}}{\text{full scale calculated channel}}\right)$$

$$\text{Factor B} = \text{scalar}\left(\frac{\text{full scale Channel B}}{\text{full scale calculated channel}}\right)$$

The scalar values used to calculate Factor A and Factor B depend on the test application.

Calculated Channel Examples

Example 1: Sum the output of two different load cells.

Full scale for Load cell 1 = 100 N

Full scale for Load cell 2 = 10 N

Thus, full scale for the calculated channel to sum the two load cells:

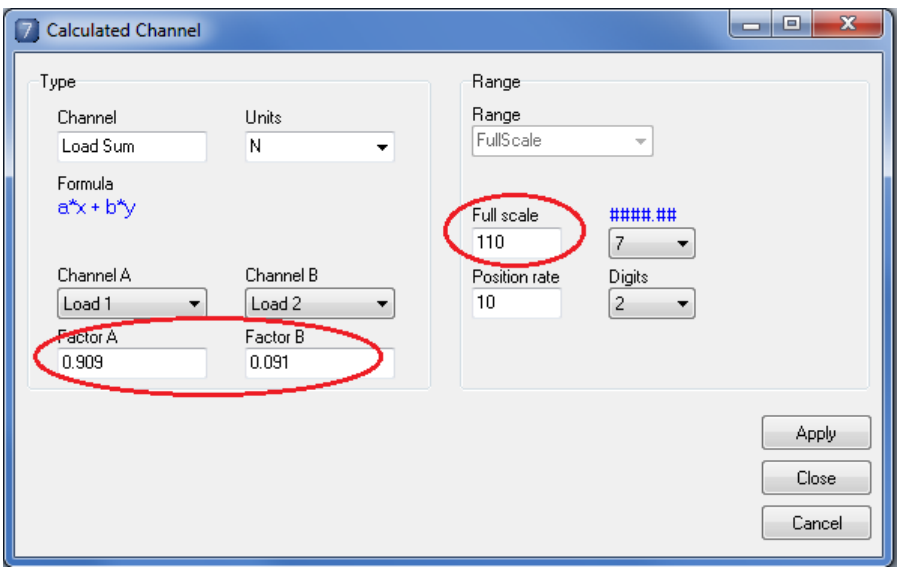
100 + 10 = 110 N

The desired scalar value for both load channels = 1.

Channel A = Load cell 1
Channel B = Load cell 2

$$\text{Factor A} = 1\left(\frac{100}{110}\right) = 0.909$$

$$\text{Factor B} = 1\left(\frac{10}{110}\right) = 0.091$$



Example 2: Define a Strain Calculated Channel

This example shows how to set up a calculated channel for Strain for the 3330 Series II test instrument. Note that Factor B is always zero for strain calculations.

The displacement (Disp) channel measures the difference between the initial length and the new length, ($L - L_0$). Assuming that the Disp reading is 0 mm at the start of the test:

$$\text{Strain\%} = \left(\frac{\text{Disp}}{L_0}\right) \times 100 = \left(\frac{100}{L_0}\right)\text{Disp}$$

Therefore, the desired scalar for the calculated Strain channel is:

$$\text{desired scalar} = \left(\frac{100}{L_0}\right)$$

If L_0 = 25 mm, the desired scalar for this example is 100/25 = 4.

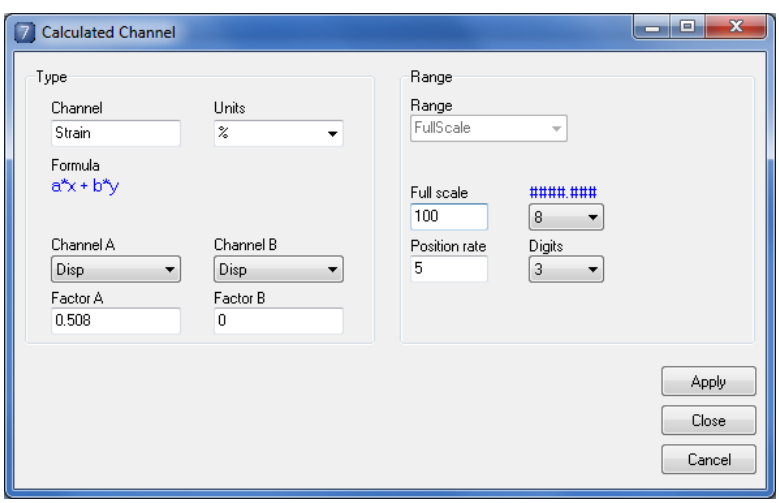
In this example, full scale for the Disp channel = 12.7 mm, and full scale for the calculated Strain channel is 100%. Thus:

$$\text{Factor A} = \left(\frac{100}{L_0}\right) \times \left(\frac{\text{full scale Disp mm}}{\text{full scale Strain \%}}\right)$$

and for this example:

$$\text{Factor A} = 4 \times \left(\frac{12.7}{100}\right) = 0.508$$

Enter this value in the Factor A box in the **Calculated Channel** window.



Example 3: Define a Stress Calculated Channel

This example shows how to set up a Stress calculated channel. Note that Factor B is always zero for stress calculations.

$$\text{Stress (MPa)} = \left(\frac{\text{Force (N)}}{\text{Area (mm}^2)}\right) = \left(\frac{1}{A}\right)\text{Load}$$

Therefore, the scalar = 1/A.

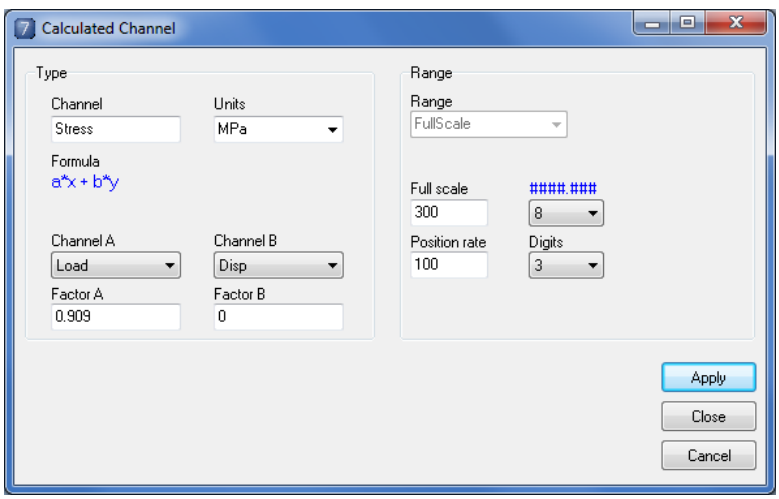
If the full scale of the Load channel is 3000 N, the full scale of the calculated stress channel is 300 MPa, and the initial cross-sectional area (A) of the sample is 11 mm², Factor A for this calculated channel can be calculated as follows:

$$\text{Factor A} = \left(\frac{1}{\text{Area mm}^2}\right) \times \left(\frac{\text{full scale Load N}}{\text{full scale Stress N/mm}^2}\right)$$

Or, for this example:

$$\text{Factor A} = \left(\frac{1}{11\ \text{mm}^2}\right) \times \left(\frac{3000\ \text{N}}{300\ \text{N/mm}^2}\right) = 0.909$$

Enter this value in the **Factor A** box in the **Calculated Channel** window.

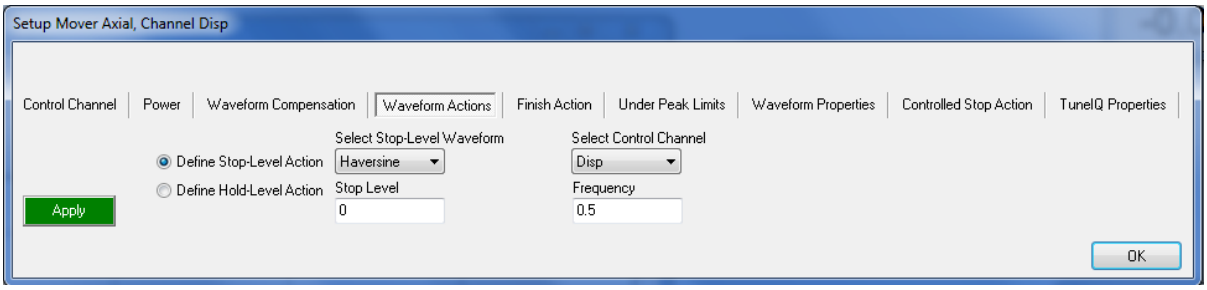


Chapter 11
Mover Settings

Overview of Mover Settings

Mover settings that are accessible to WinTest users are in the **Setup Mover** window. WinTest provides several paths to access this window:

- In the **Setup Waveform** window: Click the **Waveform Actions** button. This window provides access to all tabs except **Control Channel** and **Power** for the current mover only.
- Click **Advanced settings,** then click **Mover Setup** on the **Mover** menu (**Test Setup** window): This window provides access to all mover settings, and a **Select Mover** list also provides access to other movers.



Overview of Mover Settings

Setup Mover Tab	Description
Control Channel	Allows users to select the control channel and the color used to display each control channel in the WinTest screens. See "Set Control Channel" in this chapter.
Power	Allows selection of power-on options and provides a function button to turn power on and off to the mover. See "Power Settings and Power On/Off" in this chapter.
Waveform Actions	These settings define the user-specified parameters for the Stop Level and Hold Level limit actions. See Chapter 6, "Waveform Setup," for specific information.
Finish Action	The Finish action is executed when the last cycle in the test waveform is completed. Selecting a Finish Action is optional. If a Finish Action is not specified for a mover, the test waveform determines its status at the end of a test. See Chapter 6, "Waveform Setup," for specific information.

Setup Mover Tab	Description
Under Peak Limits	Under Peak limit detection can be adjusted only while a test is running. Under Peak detection can be used to cause an event when the monitored channel can no longer maintain its dynamic amplitude, or to help detect specimen damage or failure. See Chapter 4, "Limits and Actions," for specific information.
Waveform Properties	Waveform Properties specify whether to define waveform levels in terms of two levels, or in terms of a mean level and peak-to-peak amplitude around the mean. See Chapter 6, "Waveform Setup," for specific information.
Controlled Stop Action	The Controlled Stop action can be used to send the mover in DirCmd to a predefined Controlled Stop Position in DirCmd and stay there. See Chapter 4, "Limits and Actions," for specific information.
TuneIQ Properties	The TuneIQ properties specify how quickly the mover gets to the mean position of the desired waveform and an amplitude correction percentage for the TuneIQ process. See Chapter 6, "Waveform Setup," for specific information.

Set Control Channel

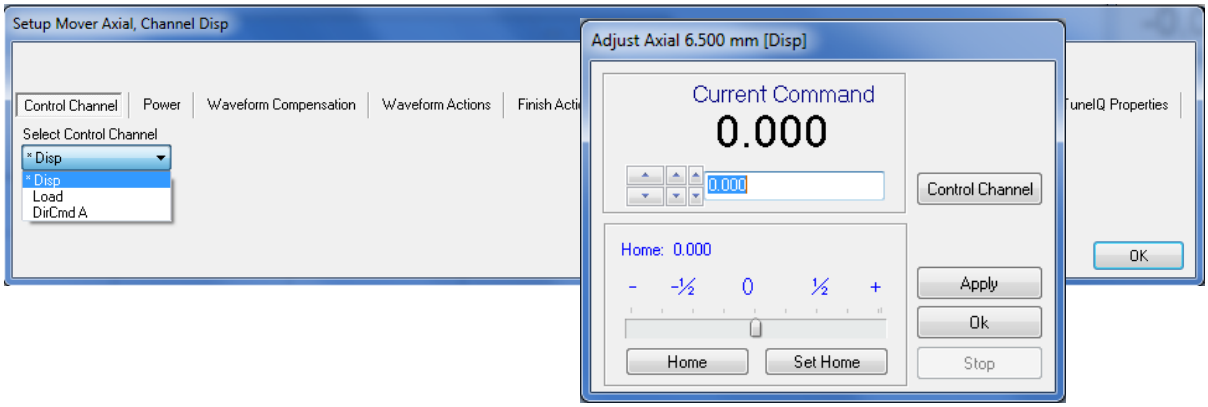
The control channel provides feedback to the control loop in closed-loop (PID) control. Each mover can have only one control channel at any given time.

WinTest provides several different ways to set the control channel for a mover:

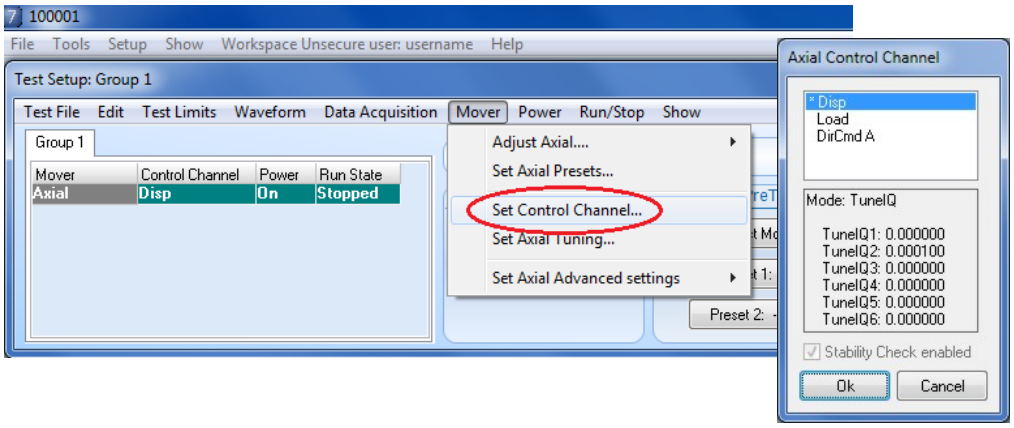
- Run a waveform. Each waveform definition includes the control channel selection. WinTest will automatically select the control channel defined in the waveform when you run the test.

NOTE *When using the External Waveform option, you must set the control channel in WinTest before running the external file (the external file does not set the control channel). Designer Test Language (DTL) files may or may not define the control channel, depending on how they are defined.*

- **Adjust Mover** window: Select the control channel in the **Control Channel** list.
- **Setup Mover** window: Click the **Control Channel** tab and the mover, and then select the control channel for this mover in the **Select Control Channel** list.



- **Mover** menu: Select **Set Control Channel** (**Test Setup** window), then select the control channel in the window that opens. The current control channel is highlighted.



Power Settings and Power On/Off

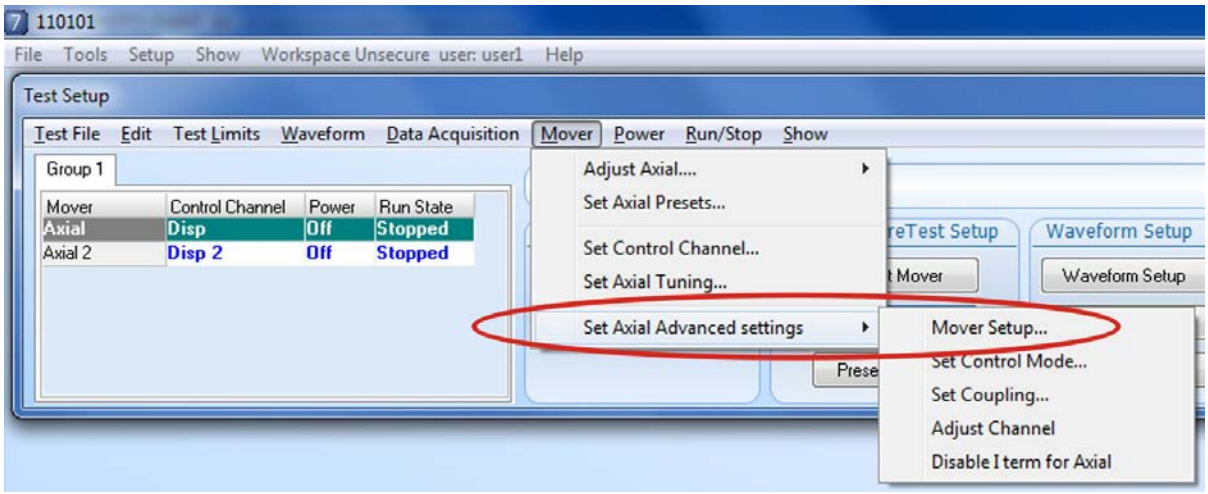
Mover power provides energy to a mover. You can command a mover only when mover power is on.

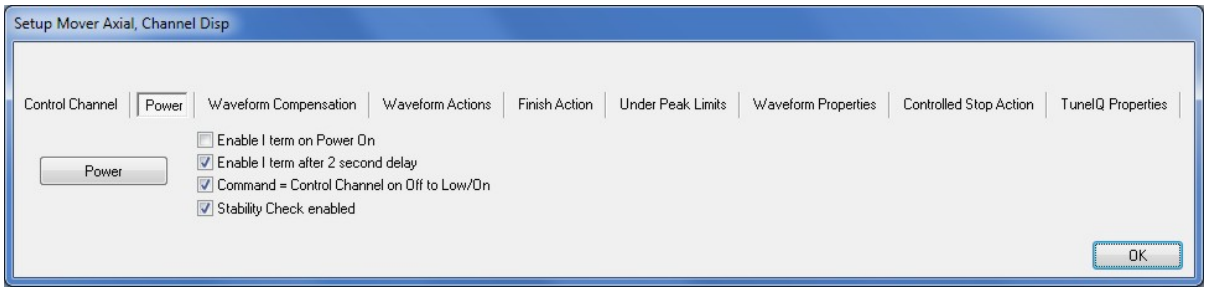
Mover power is different from the energy source in that the energy source makes energy available to the test system in general , while mover power allows you to turn power on and off locally for individual movers. For a servohydraulic test system, the energy source is a hydraulic pump. For a servopneumatic test system, the energy source is an air compressor. For ElectroForce linear motors the concept is somewhat redundant, but the concept still allows WinTest to turn power on and off to multiple movers with the same energy source.

Some types of movers are not configured for mover power (for example, temperature movers).

To access the mover power settings:

1. Click **Set Advanced settings**, then click **Mover Setup** on the **Mover** menu (**Test Setup** window). Click the **Power** tab in the **Setup Mover** window.

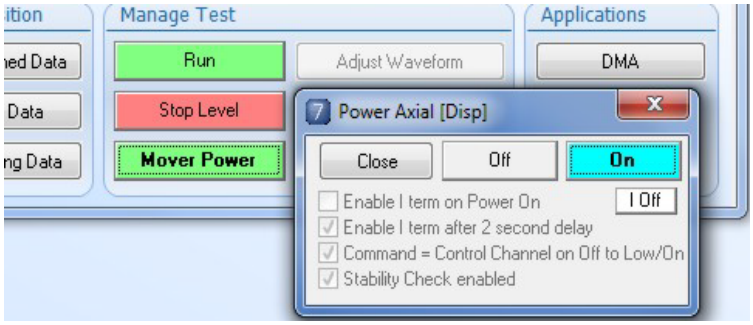




2. Select or clear check boxes to set the power on options. These options are displayed when you turn on power, but they can only be changed in the mover settings.

Option	Description
Select one of these: Enable I term on Power On Enable I after 2 second delay	 Enables I term immediately at power on. Allows the command to adjust for 2 seconds before adding the I term to the control loop. Used for special applications, this option helps prevent rapid movement of the linear motor.
Command = Control Channel on Off to Low/On	Prevents rapid motion at power on by setting command to the measured control channel value when using PID mode.
Stability Check Enabled	When Mover power is turned on or the control channel is changed, this feature tests system stability by applying one full cycle of a small amplitude square wave and small limits to the control channel. If these small Stability check limits are reached, a shutdown is triggered. This prevents unstable (i.e., uncontrolled) motor movement. Once Stability check passes, user-defined limits are restored. When a user turns off Mover power, stability check will switch the control channel to DirCmd and apply a 1 Hz haversine to zero volts. The Mover power is then turned off, after which the control channel is switched back to the user-specified control channel.

3. The **Power** button (**Setup Mover** window) has the same function as the **Mover Power** button (**Test Setup** window).

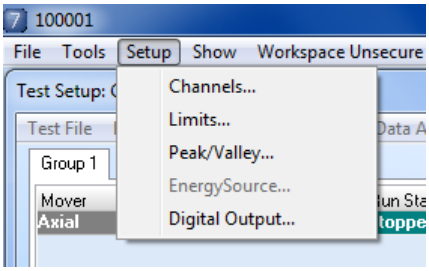


User Notes Area

Chapter 12
Additional Setup Functions and Tools

This chapter provides information about using commands on the **Setup** menu and the **Tools** menu (**Project** window) that are available to WinTest users and not described separately in other chapters.

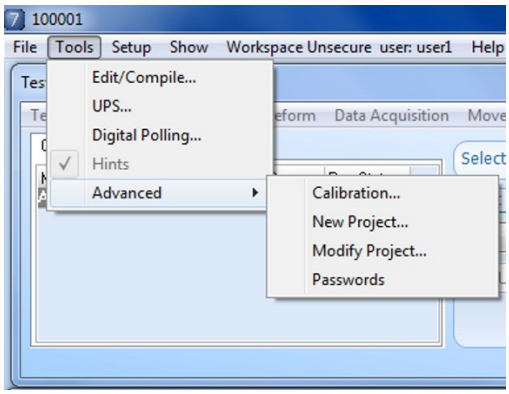
Additional **Setup** menu options are:



- **Energy Source**: Available only if the Energy Source is defined (typically, for hydraulic systems only).
- **Digital Output**: This option allows users to display and/or change the state of digital output lines.

NOTE *See also Chapter 10, "Channel Setup Properties," and Chapter 4, "Limits and Actions."):*

Tools menu commands (**Project** window)



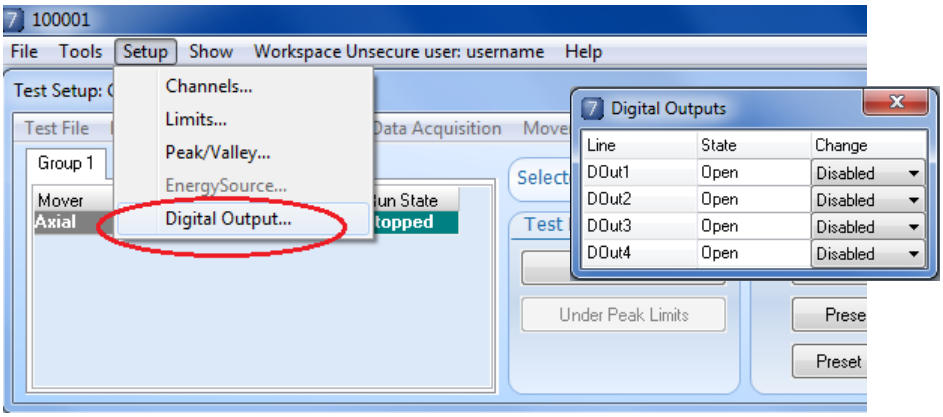
- **Edit/Compile**: This window is used primarily to view, edit, compile, and run Designer Test Language (DTL) files.
- **UPS:** Configures the UPS (uninterruptible power supply).
- **Digital Polling:** Configures events and actions for custom digital inputs.
- **Advanced**:
  - **Calibration:** Adjusts the electronic conditioning of a transducer to agree with a calibration standard.
  - **New Project** and **Modify Project:** *Bose ESG personnel only.*
  - **Passwords:** Sets the access level for WinTest functions and groups and lets you set or change these passwords.

Digital Output Setup

The **Digital Output** window displays the current status of the digital output lines in your system configuration that are not used for power. Refer to the *System Reference Manual* for your test instrument for information about these digital output lines, including their electrical connections and cable requirements.

You can also use the **Digital Outputs** window to set the state (Open or Closed) for specific digital output lines.

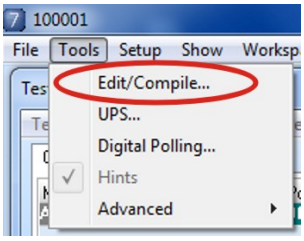
To open this window, click **Digital Output** on the **Setup** menu (**Project** window).



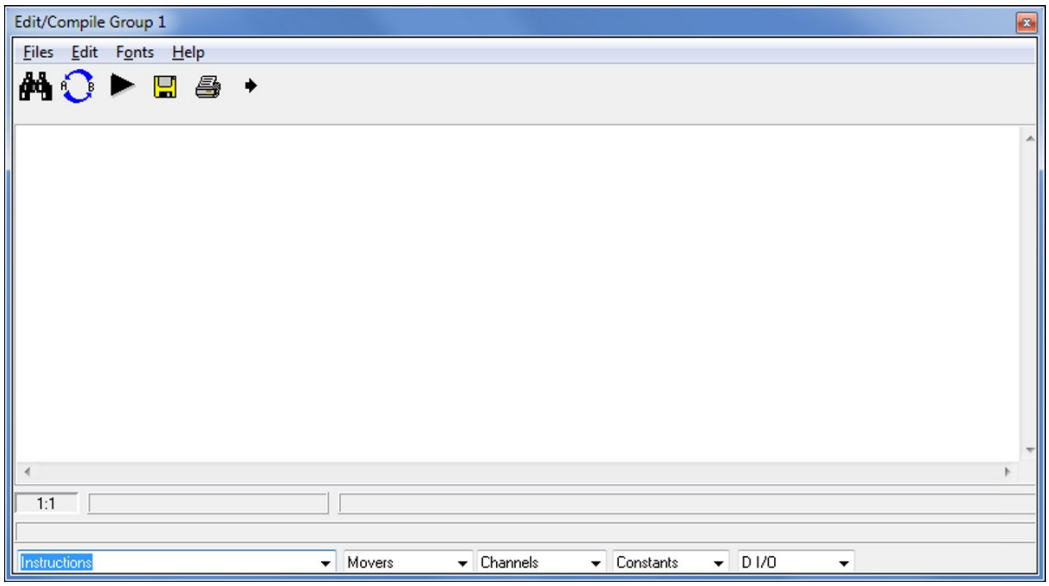
Column	Description
Digital Output Line	Displays a list of each available digital output line.
State	Displays the current state of each digital output line (Open or Closed).
Change	Lets you change the state of a digital output line. To change the state, click **Disabled** (closed) or **Enabled** (open) in the list. The change is immediate, and the **State** column is updated to show the new status.

Tools: Edit/Compile

The **Edit/Compile** window is used primarily to examine and edit DTL (Designer Test Language) files, but it can also be used to examine and edit small data and application programs. See also Chapter 8, "Running and Managing Tests," for information about using the Build function to create a simple DTL file requiring user input and for information about running tests defined with DTL files.



The **Edit/Compile** window also opens when you click **New** and then click **DTL Program** on the **File** menu (**Project** window).

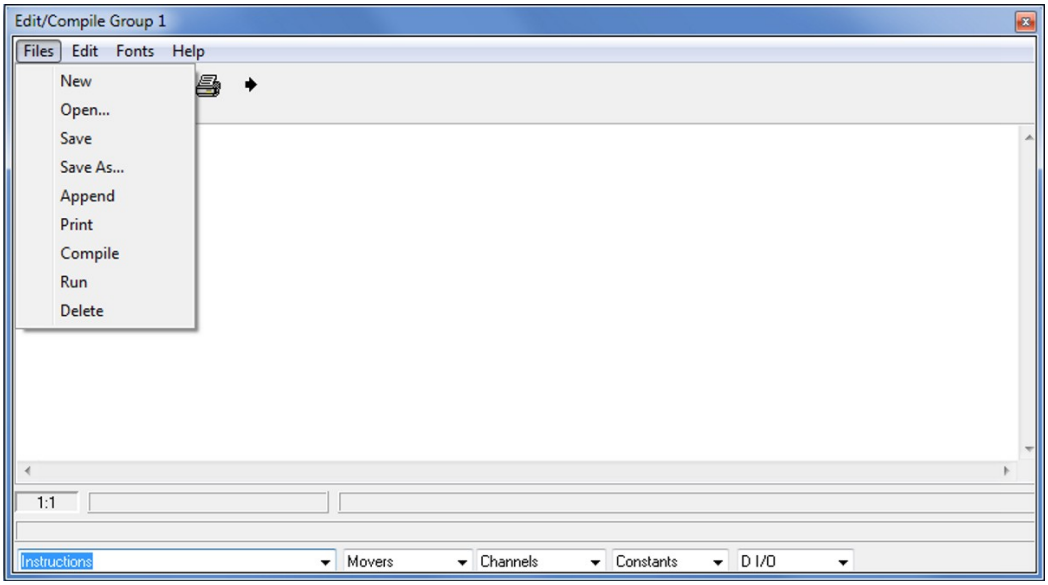


The **Edit/Compile** window has a menu bar and a toolbar.

On the menu bar, there is a **Files** menu, an **Edit** menu, a Fonts command that opens a Font window to change the font of the displayed file, and a **Help** menu.

Selections along the bottom of the window can be used to create or edit the open DTL file by adding DTL instructions and mover names, channel names, digital input names, and constants in the location of the cursor in the displayed file.

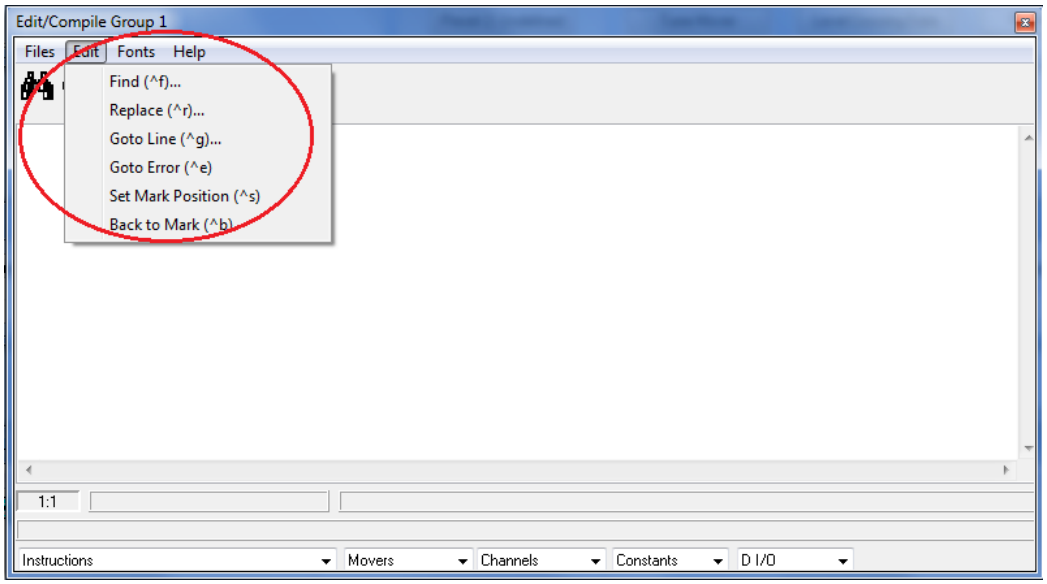
Files menu:



Menu Command	Description
New	Clears the window so you can create a new DTL file.
Open	Opens a window where you can select an existing DTL file to open.
Save	Saves the file with the same file name. Use the **Activity Comment** window to document your changes.
Save As	Saves the file with the specified file name and destination. Use the **Activity Comment** window to document your changes.
Append	Appends the contents of another file at the end of the open file. Select the file to append in the window that opens.
Print	Prints the contents of the open file on the attached printer.
Compile	Compiles (builds) this DTL file so it can run in WinTest.
Run	Lets you select and run a previously compiled DTL file.
Delete	Deletes the selected DTL file.

Edit menu:

Edit menu commands help you edit the contents of the file displayed in the **Edit/Compile** window. Keyboard shortcuts also provide quick execution of each menu command.



Menu Command	Shortcut Key	Description
Find	CTRL+F	Opens a Find window, which lets you find specific text in the open DTL file.
Replace	CTRL+R	Opens a Replace window, which lets you find specific text and replace that text with other text. Commands in the Replace window: Click **Find Text** to find the text; click **Replace** to replace the text. Click **Replace All** to replace all instances of the text in this file with the new text.
Goto Line	CTRL+G	Jumps to a specified line number in the open file.
Goto Error	CTRL+E	Jumps to the next line in the file that contains an error.
Set Mark Position	CTRL+S	Marks the current position of the cursor in the open file so that you can jump back to it quickly.
Back to Mark	CTRL+B	Jumps to the previously marked position in the file.

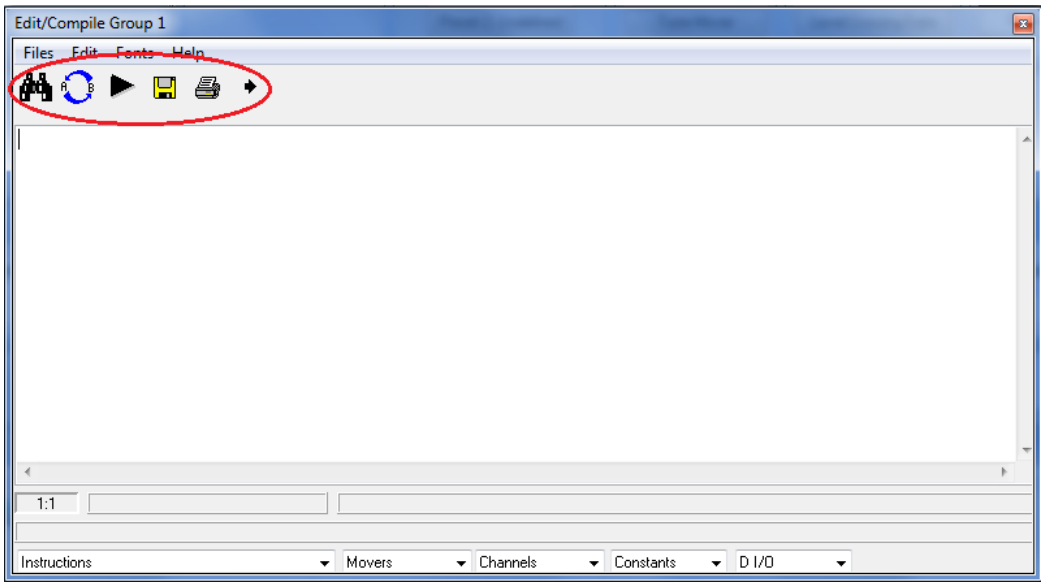
Fonts command:

Opens a **Font** window in which you can select the font type, style, size, and color plus effects for the displayed file.

Help menu:

The **Help** menu provides a link to the Designer Test Language (DTL) Help File, if this WinTest option is installed.

Edit/Compile Toolbar

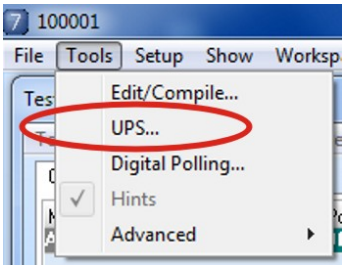


The toolbar in the **Edit/Compile** window includes the following buttons:

Button	Description
	Find text (same as the **Find** command on the **Edit** menu)
	Replace text (same as **Replace** command on the **Edit** menu)
	Open and run a DTL file.
	Specify the file name and destination folder and click **Save** to save the file. If you are working with a secure project, WinTest will direct you to save the file in the SecureWorkspace folder.
	Print the contents of the displayed file on the attached printer (the printer must be attached and configured).
	Open and compile a DTL file. Only a compiled DTL file can be run in WinTest.

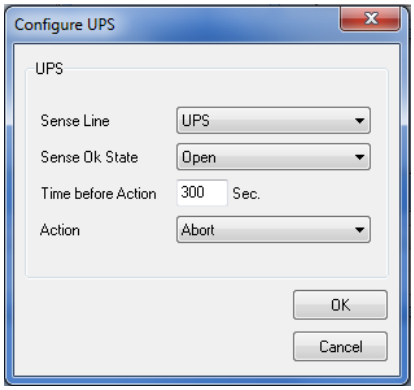
Tools: Configure UPS

Your system may include a UPS (uninterruptible power supply) to provide backup battery power in case of AC power interruptions.



The UPS configuration specifies how the UPS monitors and responds to power loss. These settings, which depend on your system, can be viewed or changed in the **Configure UPS** window.

IMPORTANT *Before attempting to change the UPS configuration, contact Bose ESG Technical Support for assistance.*



To change the UPS configuration, click **UPS** on the **Tools** menu (**Project** window). Set the UPS configuration for your type of UPS as shown in the table, and then click **OK**.

Parameter	Definition	APC UPS	Tripp Lite UPS
Sense Line	Digital input line to monitor.	UPS	UPS
Sense Ok State	Line status for normal electrical power.	Closed	Open
Time before Action	Time interval that the line can be in the trip state before WinTest initiates the specified action.	300 sec	300 sec
Action	The selected action will be executed if the UPS line remains tripped for the specified time. The default action is Abort. As an alternative, you can select the Stop Level action. Be sure to set the Stop Level to an appropriate level.	Abort	Abort

When the UPS senses a power outage that lasts for the specified **Time before Action** interval, WinTest executes the specified action, waits 30 seconds more, and then exits automatically. Before exiting, WinTest closes application programs and data files and also saves the project in a new project file. This file has the file name *projectname*UPS, where *projectname* is the name of the project file when the UPS sensed the power outage.

Tools: Digital Polling

About Digital Polling

Digital polling monitors the status (open or closed) of the digital input lines that are configured for your system. Digital polling can also be set up to cause an event if the status of a digital input line changes. Like other kinds of events, digital polling events can also initiate an action when the event occurs.

Some digital input lines, such as E-Stop, Fault A, etc., are predefined. Your system may also include additional digital input lines, which are system specific, and can be used to configure digital polling events.

IMPORTANT *Although Digital Polling is available to WinTest users, do not change any predefined digital polling settings unless Bose ESG Technical Support has directed you to do so. You may change settings for the DInx digital input lines (for example, DIn5).*

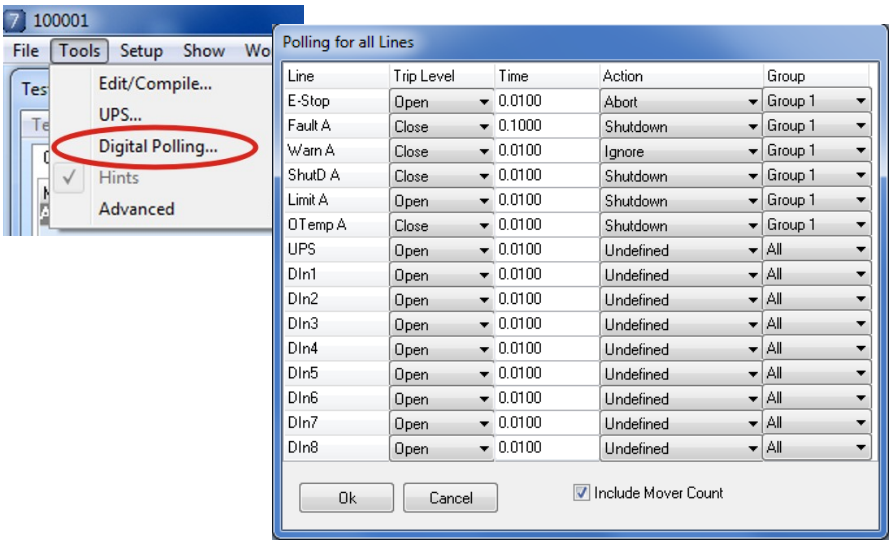
WinTest Digital Input Lines

The following digital input lines are predefined with standard WinTest functions (these vary slightly depending on the type of system):

Line	Condition Monitored
E-Stop	Emergency Stop button was pressed or the PCI box has no voltage.
Fault A	Power supply amplifier fault.
Warn A	The temperature of the motor is approaching an over-temperature condition.
ShutD A	The temperature of the motor has reached an over-temperature condition.
Limit A	Applies only to test systems Model 3300 or greater. LM2 and LM3 over-travel has occurred.
O Temp A	A thermocouple on the motor has opened, or the power cable to the motor is not connected, or the over-temperature board has failed.
UPS	Never change these settings. The UPS is configured in the **Configure UPS** window.

Configuring Digital Polling

To configure digital polling events and actions, click **Digital Polling** on the **Tools** menu (**Project** window).



IMPORTANT *Do not change any predefined digital polling settings unless you have first contacted Bose ESG Technical Support for assistance. You may change settings for the DInx digital input lines (for example, DIn5).*

To configure digital polling for a digital input line:

1. In the **Trip Level** column, click **Open** or **Closed** in the list. The event will occur when the digital input line changes to the selected state.

   Open = No voltage applied to the digital input
   Closed = 5 to 24 volts applied to the digital input

2. In the **Time** column, set the time (seconds) that the **Trip Level** state must persist before an event occurs (use a small, non-zero value if you want WinTest to ignore momentary changes.

3. Select an action to execute if a digital polling event occurs for this line. See Chapter 4, "Limits and Actions," for information about actions.

NOTE *The E-Stop action is always set to "Abort" in the project file. If you change it in this window, it will revert to "Abort" when you start WinTest and open a project file.*

---

4. If your WinTest configuration includes multiple groups, select an option in the Group list to associate a specific group or all groups with this event.

5. Select the **Include Mover Count** box if you want to include the mover count when the event is reported.

Tools: Snap to Grid

In the previous version of WinTest, the **Snap to Grid** option was available.

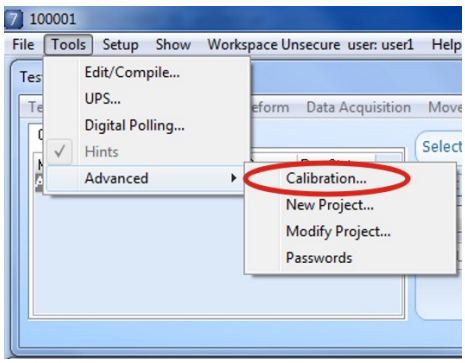
Going forward, the docking Meter windows and Peak Counts windows feature has replaced the **Snap to Grid** option. Go to the "Docking Meter Windows" section in Chapter 3 for more information.

Advanced Tools: Calibration

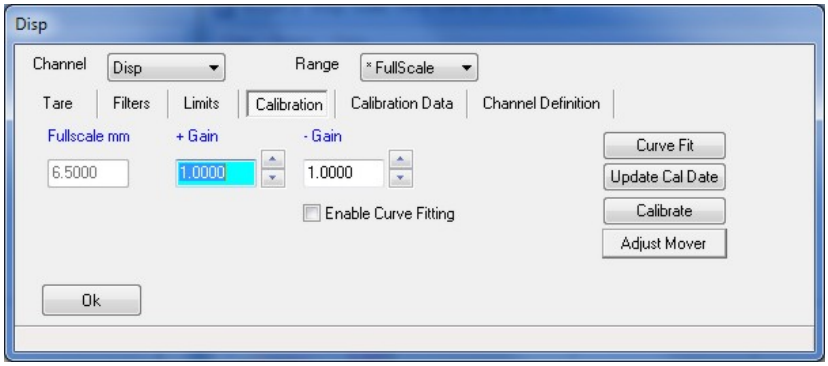
Calibration adjusts the electronic conditioning of transducers so that the value reported by WinTest agrees as closely as possible with the value provided by a calibration standard. The calibration process typically involves comparing transducer readings to the output of a calibration standard at 80% of full scale and adjusting the gain until the transducer reading matches the output from the standard. Other data is also taken at intervals over the full-scale range to make sure that transducer error is acceptable over the range of measurements.

To open the **Calibration** window, click **Advanced** on the **Tools** menu (**Project** window), then click **Calibration,** and then click the **Calibration** tab.

WinTest will ask you save the current project file.



NOTE *If you are working in a secure workspace, WinTest will direct you to save the project in the secure workspace, but you can create new folders to organize your files in the secure workspace.*



Calibration Files

The calibration process in WinTest creates two types of files, which are always saved in the secure Bose\WinTest\Calibration folder to provide backup and traceability for calibration:

- Calibration files (*.cal) store calibration information for a specific channel. This file is a text file and can be printed to record gain values. Starting with WinTest 7.1, the format of the calibration file has changed to include more information.
- Calibration data files (*.dat) contain the calibration measurements, computed error, and other related information. Bose ESG technicians can use this file to generate the calibration report provided to our customers.

Because the Bose\WinTest\Calibration folder is secure, only the WinTest Administrator (or a Bose ESG technician who enters the appropriate password) can modify, delete, or rename files in the Calibration folder.

To limit file naming errors, WinTest has automated the file naming process for files created and saved during calibration. When you save a calibration data or a calibration file, WinTest will automatically generate the file name as follows:

Calibration files: *sysID chan transID techID date*.cal

Calibration data files: *sysID chan transID techID date*.dat

where:

- *sysID* is the system serial number, as defined in the project configuration.
- *chan* is the channel name, as defined in the project configuration.
- *transID* is the serial number of the transducer. This information is entered into the Header Information when saving the *.dat file.
- *techID* are the initials of the person who performed the calibration. This information is entered into the Header Information when saving the *.dat file.
- *date* is the date stamp, when the file was saved.

Linearization Files

Linearization is an optional method of calibration used by Bose ESG technicians to further increase the accuracy of a transducer. The enabling of linearization is done inside a project file.

The linearization process in WinTest creates two files:

- Curve Fit data file (*.txt) contains the calibration measurements and actual values. Bose ESG technicians use this file to generate the ini file used to linearize the channel.
- The Curve Coefficient data file (*.ini) that is applied to linearize a channel

Because the Bose\WinTest\Calibration folder is secure, only the WinTest Administrator (or a Bose ESG technician who enters the appropriate password) can modify, delete, or rename files in the Calibration folder.

To limit file naming errors, WinTest has automated the file naming process for files created and saved during calibration. When you save a calibration data or a calibration file, WinTest will automatically generate the file name as follows:

Linearization files: *sysID chan transID CurveFit techID date.txt*

Linearization initialization files: *sysID chan transID CurveCoef techID date.ini*

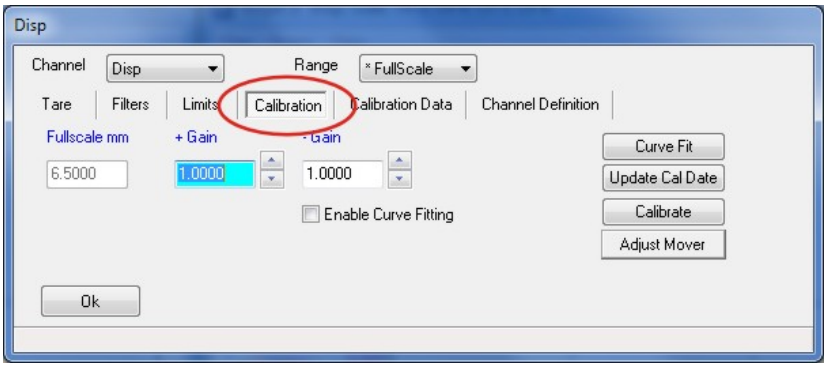
where:

- *sysID* is the system serial number, as defined in the project configuration.
- *chan* is the channel name, as defined in the project configuration.
- *transID* is the serial number of the transducer. This information is entered into the Header Information when saving the *.dat file.
- *CurveFit* identifies the file as Curve Fit data
- *CurveCoef* identifies the file as Curve Coefficient data
- *techID* are the initials of the person who performed the calibration. This information is entered into the Header Information when saving the *.dat file.
- *date* is the date stamp, when the file was saved.

Calibration Tab

The **Calibration** window has the gains for the selected channel and provides access to other calibration windows.

NOTE Do not change the Gain values. Changing them affects calibration.



The **Calibration** window includes these calibration displays and controls:

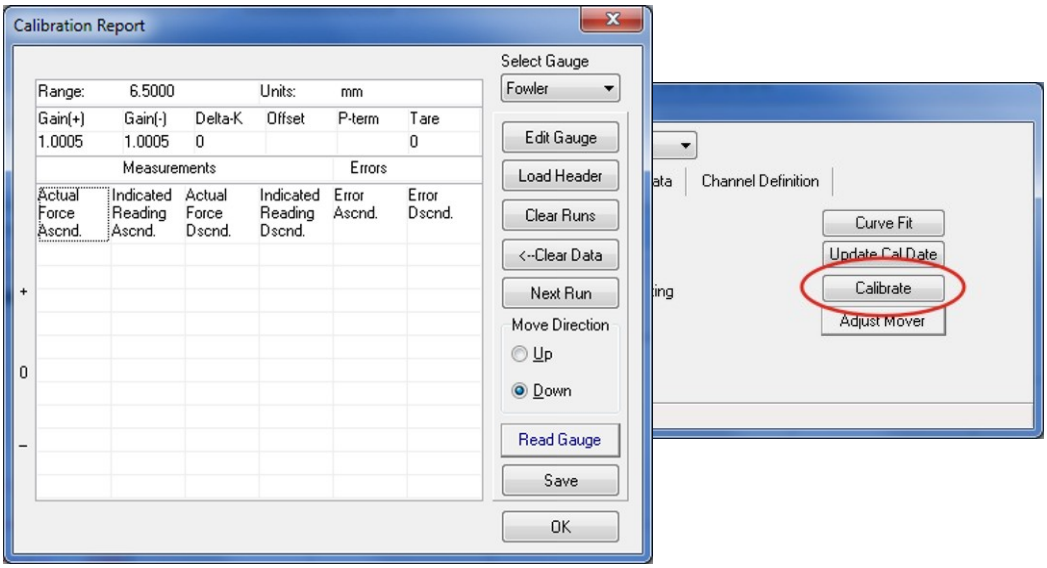
Display or Control	Description
Channel	Select the channel to calibrate from the list.
Range	Select the calibration range for this channel.
Full scale *units*	These settings are configured for the channel at the Bose factory and are not adjustable here. The full-scale value represents the maximum and minimum values that can be displayed for this channel. The full-scale value also represents the range for the calibration resistor for this transducer and is used to set the initial slope for the calibration curve (full scale equals 10 volts).
+ Gain and – Gain boxes	Calibration gains, for positive and negative values. Type any adjustments to the calibration gains here.
Curve Fit button	This button may be seen, depending on your project file. Curve fit is used by a Bose ESG technician to calculate and apply the curve fit parameters needed to linearize the transducer.
Enable Curve Fitting check box	This check box may be seen, depending on your project file. After the curve fit parameters have been calculated and applied, this check box is selected to enable curve fitting.
Update Cal Date button	Click this button to save today's date as the new calibration date in the current calibration (*.cal) file. WinTest will display a message if more than 12 months have passed since the last calibration date. (Typically not used.)

Display or Control	Description
Calibrate button	Click this button to open the **Calibration Report** window, which provides a worksheet for entering calibration measurements and computing calibration errors. These values can be used to create a new calibration data file (*.dat).
Position button	Click this button to open the **Adjust Mover** window, which can be used to adjust the mover while taking calibration readings. See Chapter 5, "Specimen PreTest Setup," for information about this window. The **Adjust Mover** window will close automatically when you exit calibration.
Ok	Exits calibration. WinTest will ask whether to save the project file.

Calibration Report Window

Clicking the **Calibrate** button in the **Calibration** window opens the **Calibration Report** window. This window can serve as a tool to help collect data and compute error during the calibration process. This information can be saved in a calibration data file (*.dat).

Note that a third-party tool such as Excel can also be used to enter calibration data, compute errors, and generate a calibration report.



The worksheet in the **Calibration Report** window provides columns and rows for entering calibration measurements and for displaying the computed errors. Indicated measurements (reference or calibration standard) can be entered by either by typing them in the worksheet or by reading them automatically from an external gauge.

Measurements	Description
Actual Force Ascnd.	Calibration standard reading, taken during calibration steps when the applied condition is ascending (increasing).
Indicated Reading Ascnd.	System transducer reading, taken during calibration steps when the applied condition is ascending.
Actual Force Dscnd	Calibration standard reading, taken during calibration steps when the applied condition is descending (decreasing).
Indicated Reading Dscnd	System transducer reading, taken during calibration steps when the applied condition is descending.

NOTE *Zero readings must be entered in the row marked "0" at the left of the table. Positive readings must be entered in rows above zero (marked "+"), negative readings must be entered in the rows below zero (marked "-")*

The buttons on the right side of the **Calibration Report** window have the following functions:

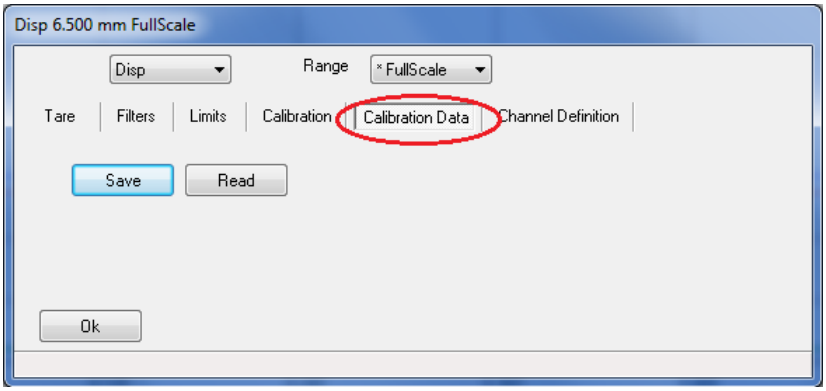
Button or Option	Function
Select Gauge	Select in the list the type of gauge used for this calibration. This is the calibration standard.
Edit Gauge	If the gauge has an RS-232 communication option and communication drivers that are supported by WinTest, click this button to configure the gauge to provide automatic calibration standard readings.
Load Header	Click this button to enter information about the test system, the calibration equipment, the calibration procedure, and other related information to save in the header of the calibration data (*.dat) file and to be used in naming the files.
Clear Runs	When multiple runs have been entered using the **Next Run** button, clicking this button clears data for all runs.
Clear Data	Clears all measurements and error values from the worksheet.
Next Run	When taking multiple sets of calibration data, click this button to start collecting data for the next set.
Move Direction	When automatically entering calibration readings from a gauge, select the **Up** option to enter subsequent readings in the next line above, or select the **Down** option to enter subsequent readings in the next line below.

Button or Option	Function
Read Gauge	When a gauge is being used to read the calibration standard value, click this button to enter the gauge reading and the transducer reading in the worksheet. If the standard gauge is not connected, click this button to enter the transducer reading, then type the value displayed on the gauge in the worksheet.
Save	Click this button to save the calibration data file (*.dat) in the secure Calibration folder. A window will open where you can enter header information to save in the calibration data file. See also "Calibration Files" earlier in this chapter.
OK	Closes the **Calibration Report** window, allows you to save the project file, and exits calibration.

Calibration Data Tab

Click the **Calibration Data** tab to save a calibration file (*.cal) based on the current calibration data or to read calibration information from a previously saved calibration file (*.cal).

Select a channel in the **Channel** list and the range (if applicable).



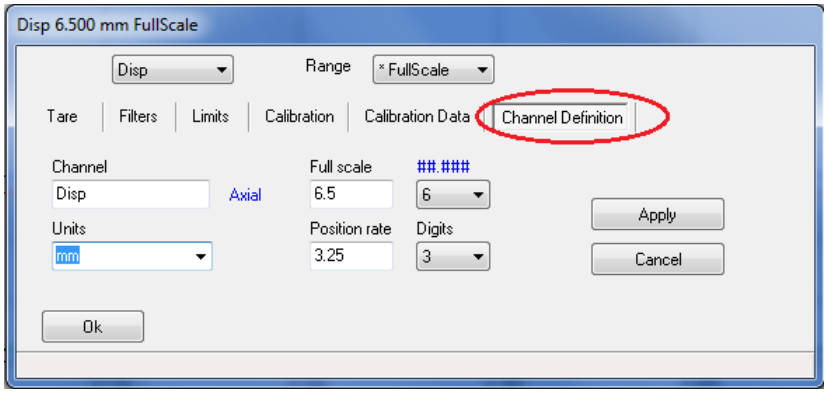
Click **Save** to create a calibration (*.cal) file using the current calibration data. This calibration file includes the gain settings, tare information, and channel definition settings for the selected channel. When you click **Save**, WinTest will default to the same file name as the *.dat file, but you can change the file name before saving the file.

Click **Read** to select a *.cal file (in the secure Calibration folder) and input the calibration information in this file to WinTest. Note that reading the calibration file changes the calibration settings for the selected channel. The new calibration settings will be saved in the project file when you save the project.

IMPORTANT *Be sure to record the gain values and other calibration settings in a notebook for traceability or if you need to verify calibration settings in the future.*

Channel Definition Tab

Use the Channel Definition tab to update channel information for a new transducer during calibration of the new transducer.



Click an input or channel in the **Channel** list to modify. Then verify or change the following channel information as necessary:

Parameter	Description
Channel	Select an input or channel in the list to modify.
Range	Select the range (if applicable).
Channel	Enter or modify the transducer name (as displayed in WinTest)
Units	Select units for this transducer.
Full-scale	Enter the full-scale value for this transducer.
Position rate	Enter the rate of change to be used when commanding the channel to a new level (units per second)
##.###	Total number of digits when displaying values for this channel, including sign and decimal separator
Digits	Number of digits displayed after the decimal separator.

Once you entered the necessary information changes, click **Apply** to save the changes. You can continue working in calibration.

Click **OK** to exit calibration. WinTest will ask whether to save the project file (with the new channel information). To keep the option of using the original transducer again in the future, Bose recommends that you save the project file with a different name.

NOTE *If you change the type of transducer or the full-scale value, you may also have to change the calibration resistor that is integrated into the transducer cable, of you may have to purchase an additional cable from Bose ESG that has the correct resistor. For more information, see the* WinTest PCI Series Controls *section in the* WinTest 7 Controls Administrator Manual.

Advanced Tools: Passwords

About Passwords

The Passwords feature can be used to protect access to specific WinTest functions or to specific groups by requiring a password to access them.

These WinTest functions (including related menus, buttons, etc.) can be password protected:

- Calibration
- Adjust Waveform (during the test)
- Manual tuning properties
- Limits, digital polling, tare, create or modify a project, and channel properties

WinTest can also require a password to access specific groups. Setting a group password can help prevent changes to the wrong group in a multiple group configuration.

WinTest provides several different levels of password protection:

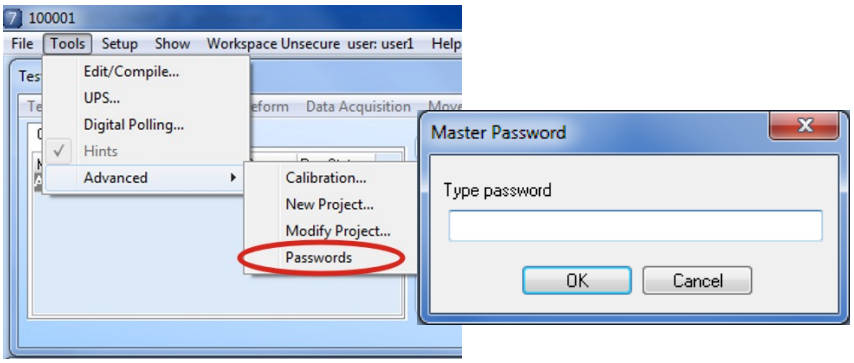
- The master password provides access to functions that set passwords for all other functions. Because this password is required to change any other passwords, it should be changed periodically. It should also be recorded and protected carefully.
- Three levels of passwords (Level 1, Level 2, and Level 3) provide password protection for individual functions.
- "None" means that no password is required.

NOTE *Level 1 is the highest access level; so if WinTest requires the Level 3 password, you can enter either the Level 1 or the Level 2 password to gain access.*

Setting or Changing Passwords

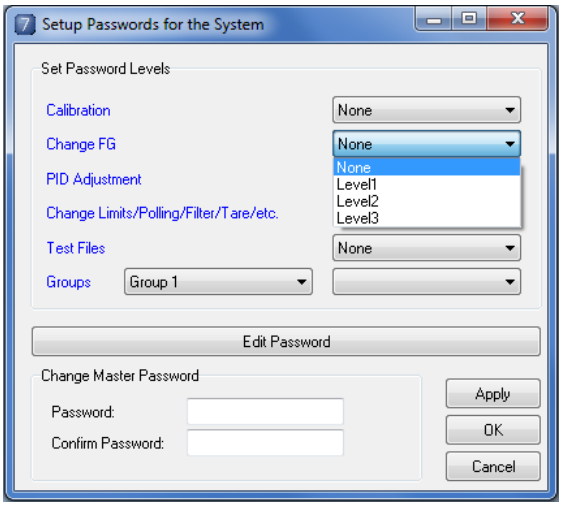
All of these passwords are set in the **Setup Passwords for the System** window. To open this window, click **Advanced** on the **Tools** menu (**Project** window), and then click **Passwords**.

WinTest requires the master password to gain access to this window. The initial master password is "WinTest" (case sensitive). This password should be changed when you start using WinTest to protect access to the WinTest passwords.



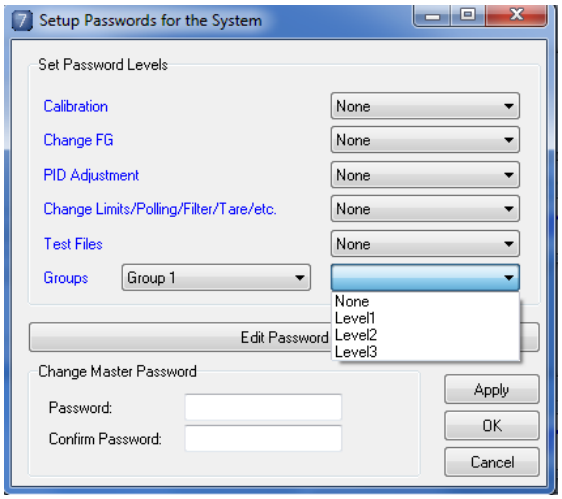
Use the **Setup Passwords for the System** window to set access levels for individual WinTest functions and groups, and to set or change passwords for all levels including the master password. Click **Apply** to apply each change. When you have finished, click **OK** save your changes and close the window.

To set or change the access level for individual functions, select the desired level (Level 1, Level 2, Level 3, or None) from the list for each function.



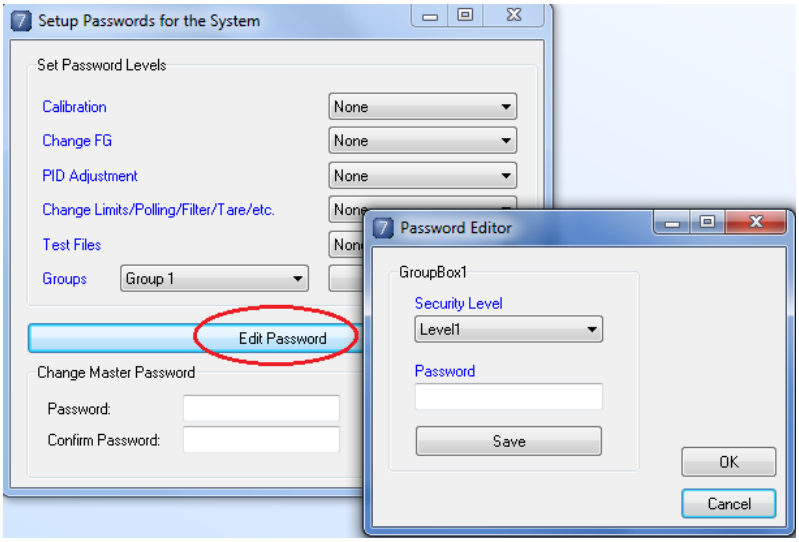
To set or change the access level for individual groups:

1. Select the Group number in the Groups list.
2. Select the password level for this group from the list (Level 1, Level 2, Level 3, or None). Repeat steps 1 and 2 for each group.

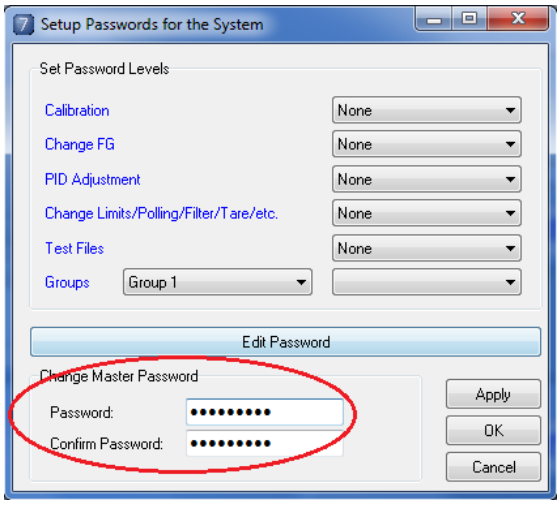


To set or change the password required for level 1, level 2, or level 3 access, do the following:

1. Click the **Edit Password** button.
2. In the **Password Editor** window, select a level to define its password in the **Security Level** list.
3. Type the password for this level in the **Password** box.
4. Repeat steps 2 and 3 for each access level.
5. Click **OK** to apply your changes and close the **Password Editor** window**.** These passwords are now required to access any WinTest function assigned to the corresponding level.



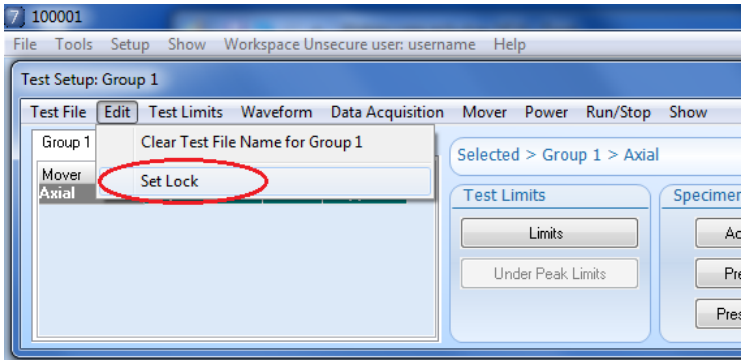
The master password provides access to the WinTest access levels and password configuration defined in the **Setup Passwords for the System** window. To change the master password:



1. Type the new master password in the **Password** box.
2. Enter the new master password again in the **Confirm Password** box.
3. Click **Apply** to apply the change.
4. Record the new master password and keep it in a safe location.

Locking the Screen

Click **Set Lock** on the **Edit** menu (**Test Setup** window) to lock the **Test Setup** window with the access level set in the **Setup Passwords for the System** window. The WinTest user can access the **Test Setup** window only by entering the appropriate password (for the specified level or higher).



User Notes Area

Chapter 13
Manual Tuning

This chapter describes the WinTest windows used in the manual tuning process, information about the Tune Modes, a description of the tuning adjustments available in WinTest and how they affect the system response, and some guidelines for performing manual tuning.

About Manual Tuning

When to Use Manual Tuning

Use TuneIQ for nearly all tuning situations to provide an excellent, automatic system response. However, the following situations require manual tuning:

- Tuning for movers that are not ElectroForce linear motors, such as temperature or torsion.
- Hydraulic systems.
- Rare instances where TuneIQ is not appropriate (for example, the specimen is too soft or the desired amplitude is too small).

IMPORTANT *Changes to manual tuning settings (PIDO terms) can cause the test system to become unstable. Before adjusting any tuning gains or other configuration parameters, make sure that you understand how the adjustments will affect your test system and the specimen.*

Tune Modes

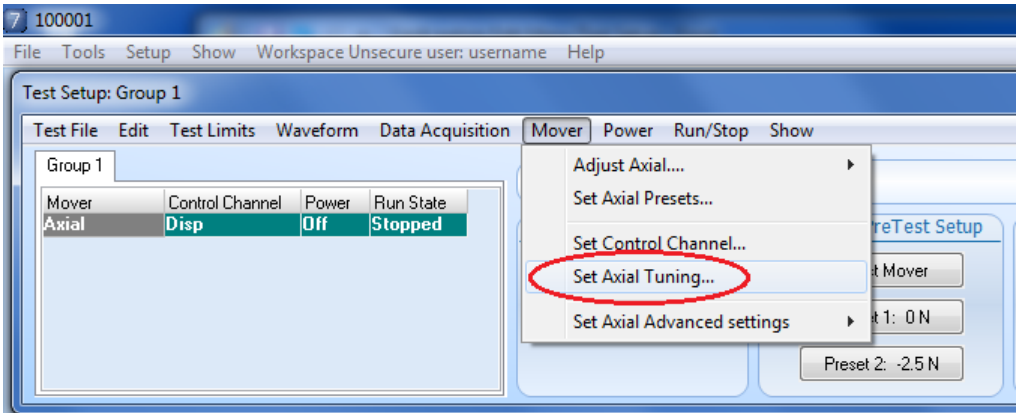
Whenever closed-loop (PIDO) control is being used to control a mover, the control channel is using tuning settings generated from the TuneIQ process or from the Manual Tuning process to optimize the command signal based on the difference between the command signal and the system response.

- When TuneIQ mode is selected for a mover/control channel, the tuning settings that were generated by running TuneIQ are applied to the control loop.
- When Manual Tuning Mode is selected for a mover/control channel, the PIDO tuning settings (and advanced settings, if used) as adjusted during the manual tuning process are applied to the control loop.

Manual Tuning Windows

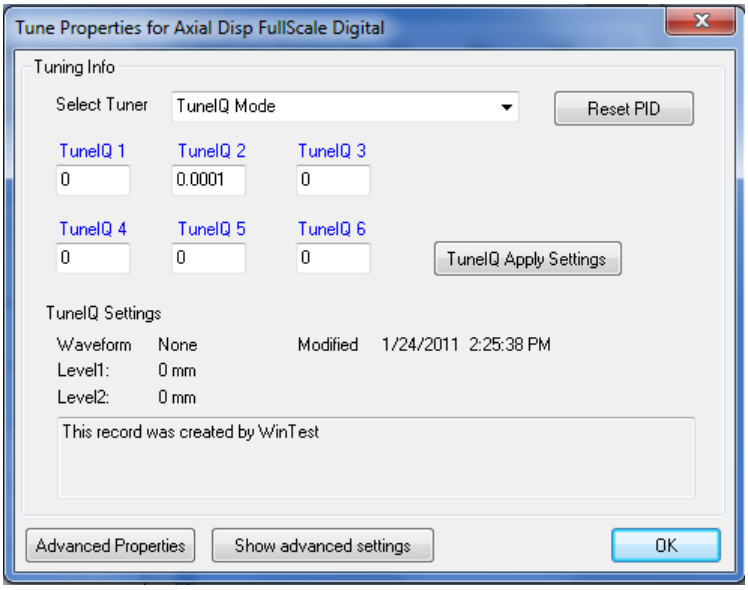
Click **Set Tuning** on the **Mover** menu (**Test Setup** window) to open the **Tune Properties** window. This window displays the tuning mode and current tuning settings for the selected control channel and provides access to additional windows for advanced tuning techniques.

NOTE *If advanced tuning techniques are necessary for your application, contact Bose ESG.*



Tune Properties Window

The **Tune Properties** window is the main window used for manual tuning. This window opens when you click **Set Tuning** on the **Mover** menu (**Test Setup** window). When you open the window, selections and tuning parameters are for the current mover and control channel, for the currently selected tuning mode.



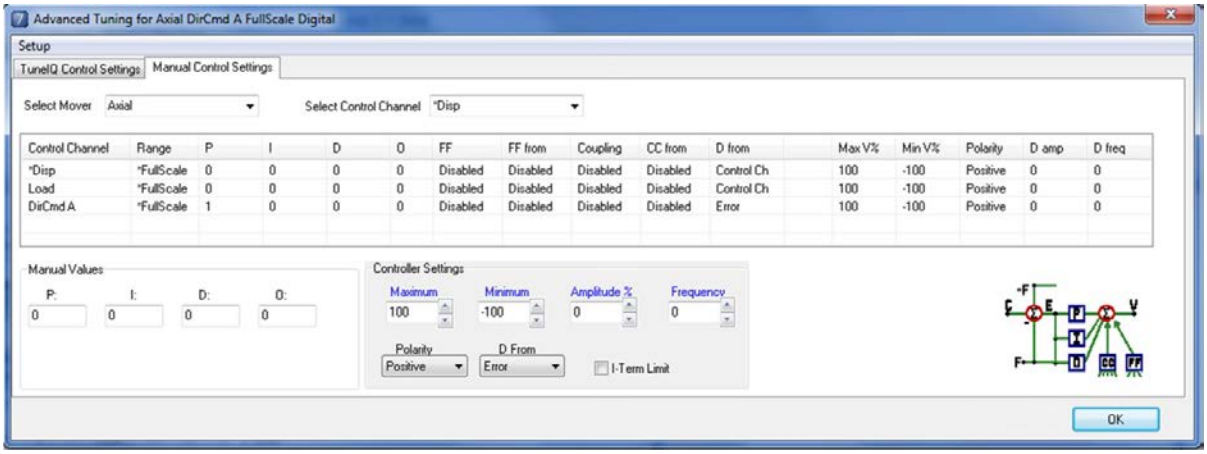
The **Tune Properties** window has the following features:

Feature	Description
Select Tuner	Displays the current Tune Mode. To change the Tune Mode, click **Manual Tune Mode** or **TuneIQ Mode** in the list. • **TuneIQ Mode:** The TuneIQ settings are displayed and are applied to the control loop. • **Manual Tune Mode**: Manual tuning settings (PIDO) are displayed and are applied to the control loop.
Reset PID button	Resets the PIDO values to the system defaults. This also applies to TuneIQ values. Whichever is showing is reset.
TuneIQ Apply Settings button	This button appears only when TuneIQ Mode is selected. If you change any TuneIQ settings in this window, click this button to apply your changes.
Manual/TuneIQ Tune Settings	These values show the type of waveform and levels used to generate the tuning settings as displayed.
Advanced Properties button	Opens the **Advanced Properties** window, where you can view and/or adjust tuning values and controller settings for all control channels and provides access to advanced tuning techniques such as Feed Forward and Cross Coupling.
Show advanced settings button	Allows comparison of TuneIQ and manual tuning parameters and provides access to advanced tuning techniques such as custom filtering for expert Bose personnel. A password is required.

NOTE *If advanced tuning techniques are necessary for your application, contact Bose ESG.*

Advanced Tuning Properties Window

Clicking the **Advanced Properties** button in the **Tune Properties** window opens the **Advanced Tuning** window. This window can be used to display and/or adjust tuning values and controller settings for all control channels in the project configuration.



Feature	Description
Setup tabs	**TuneIQ Control Settings** tab: Click this tab to display tuning values and controller settings for TuneIQ Mode. **Manual Control Settings** tab: Click this tab to display tuning values and controller settings for Manual Tune Mode.
Select Mover	If your system has multiple movers, select the mover from this list.
Select Control Channel	Select the control channel here. The window displays tuning values for all control channels defined for this mover, but adjustable values are for the selected control channel.
Tuning values (TuneIQ or Manual)	Although the display table shows tuning values and controller settings for all control channels, the adjustable values are for selected control channel.
Controller Settings	These fields display and let you adjust the current controller settings. *NOTE Do not adjust these values unless Bose technical support has instructed you to do so.*

Manual Tuning Settings (PIDO)

PIDO tuning is used to optimize the system's response to an input command. The system monitors the control channel response to the command waveform and uses the PIDO parameters to adjust the system response until the desired conditions are met. Each letter in "PIDO" represents an independent adjustment that causes the system to respond differently to the input command based on the system response.

P	Proportional Term (P term)	a multiplier on the error signal
I	Integral term (I term)	a multiplier on the integral of the error signal over time.
D	Derivative Term (D term)	a multiplier on the differential of the error signal (or other signal) with respect to time
O	Offset Term (O term)	adds a fixed offset to the error signal to balance electrical offsets in the test system

IMPORTANT *Changing the PIDO settings can cause system instability and loss of control. Make sure that you understand the PIDO settings and their effects on the system response before attempting to change any tuning parameter.*

Always adjust PIDO settings gradually, starting either with values determined for a similar test specimen or, if the response of the specimen is unknown, with values that are very close or equal to zero.

In general, lower settings for the P and I terms provide a more stable test system over a wider range of specimen properties. Start with more conservative settings and increase them for more aggressive tuning if test conditions demand higher dynamic response or accuracy.

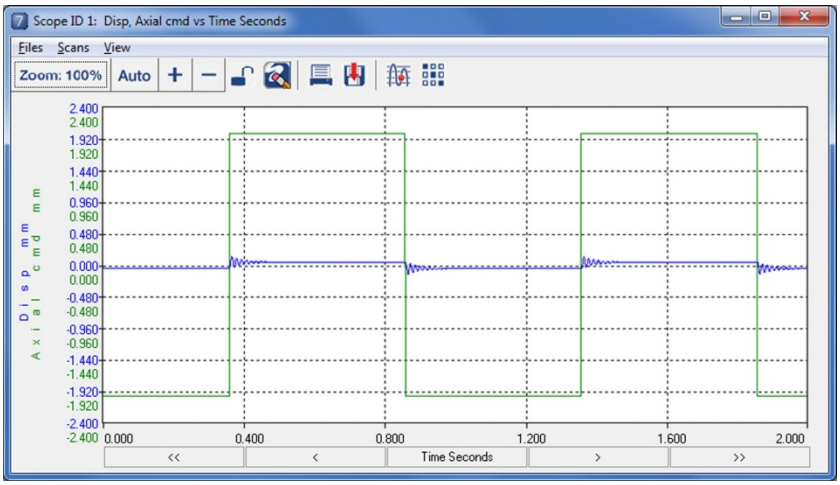
Proportional Term (P term)

The proportional term (P term) is a multiplier on the error signal. Increasing the P term causes the system to respond more quickly to error signals, which provides a faster and stronger control response to reach the desired end levels. During the tuning procedure, the P term is typically increased to get a small amount of instability, and then the D term is negatively increased to eliminate the instability.

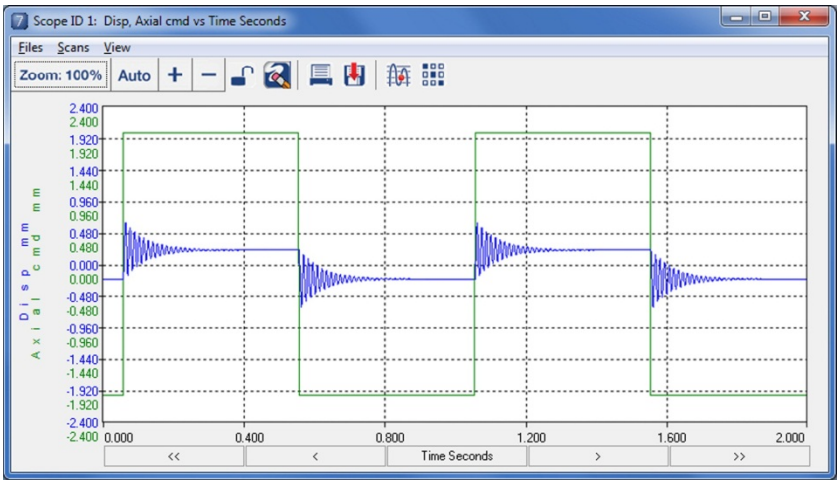
Absolute values for the P term depend on the type of test system (ElectroForce, torsion, servopneumatic, or hydraulic).

P term Value	Description
P term too low	The system does not respond well enough to the error to maintain the desired waveform, and the system cannot achieve the desired response.
P term too high	The system overreacts to the error, causing oscillations or instability in the control loop. The system can potentially oscillate out of control and cause damage to the specimen or to the load cell.

P Term Only and Too Low



P Term Too High

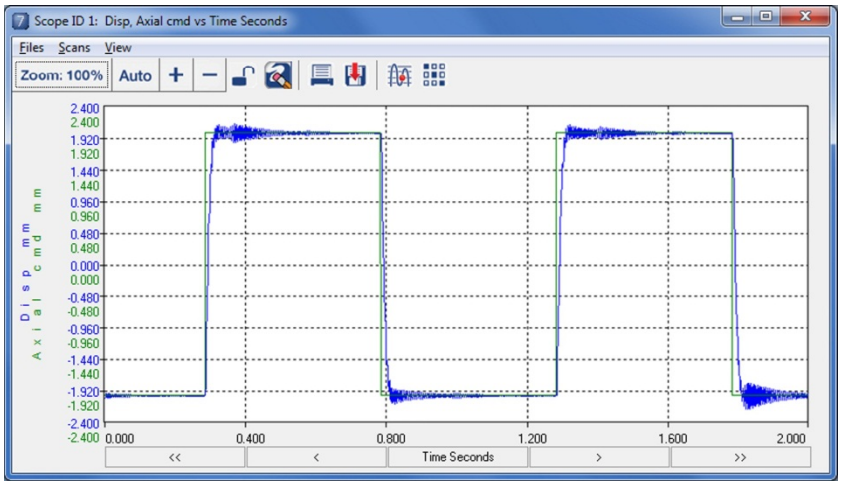


Derivative Term (D term)

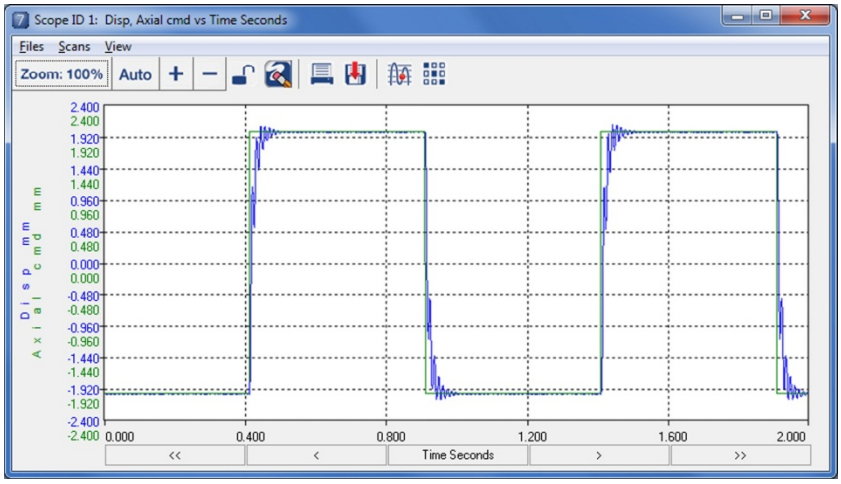
The derivative term (D term) is a multiplier on the differential of the error signal (or other signal) with respect to time. D term adjustments are required in two different situations:

- Negative D term: Adjust negative D term to dampen the system response to a high P term. In this case, the D term is based on the control channel signal.
- Positive D term: Never used in standard testing situations, as it can cause instability. Do NOT use positive D term unless Bose ESG has instructed you to do so.

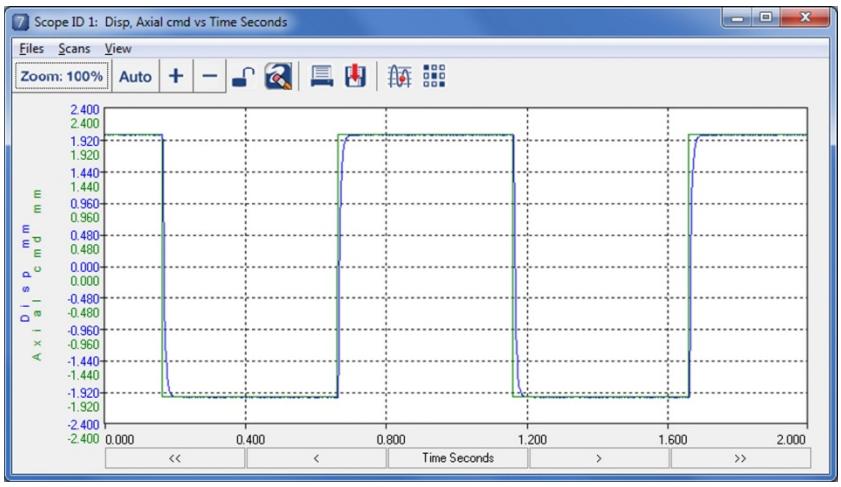
P Term Adjusted, D Term Too Low



P Term Adjusted, D Term Too High



Well Adjusted PID Terms



Integral Term (I term)

The integral term (I term) is a multiplier on the integral of the error signal over time. The I term is useful for improving static accuracy. For some systems, increasing the I term can also provide a more stable "boost" to the system than increasing the P term.

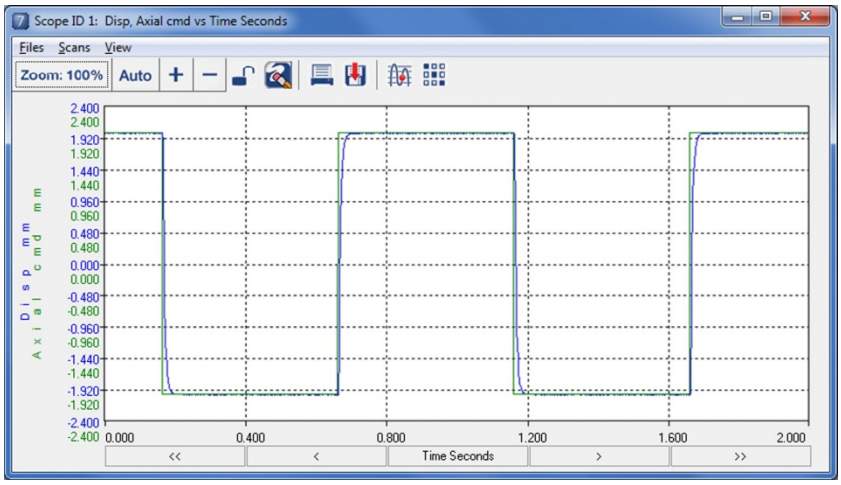
Typically, the I term is adjusted after the P term and D term have been optimized. However, in some cases, especially with an ElectroForce test system and a very stiff specimen, the P term and D term cannot be significantly increased without causing instability. In these cases, I term can be used to achieve the majority of the correction and other techniques such as waveform compensation can be used to optimize the end levels. See Chapter 8, "Running and Managing Tests," for information about waveform compensation.

I term Value	Description
I term too low	If I term is too low, the control channel will not reach the desired end levels for the square waveform.
I term too high	If I term is too high, the system can become unstable. This instability is seen as a distortion in the control channel waveform.

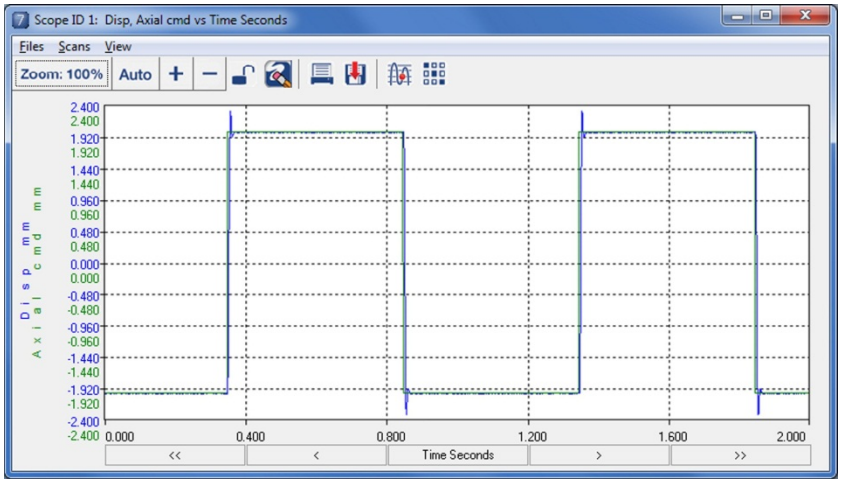
WinTest provides two options to enable the I term when mover power is turned on:

Option	Description
Enable I term at power on	This option should be selected for nearly all testing situations.
Enable I term after 2 second delay	Special application: allows command to adjust before adding I term, which helps prevent rapid movement of the linear motor.

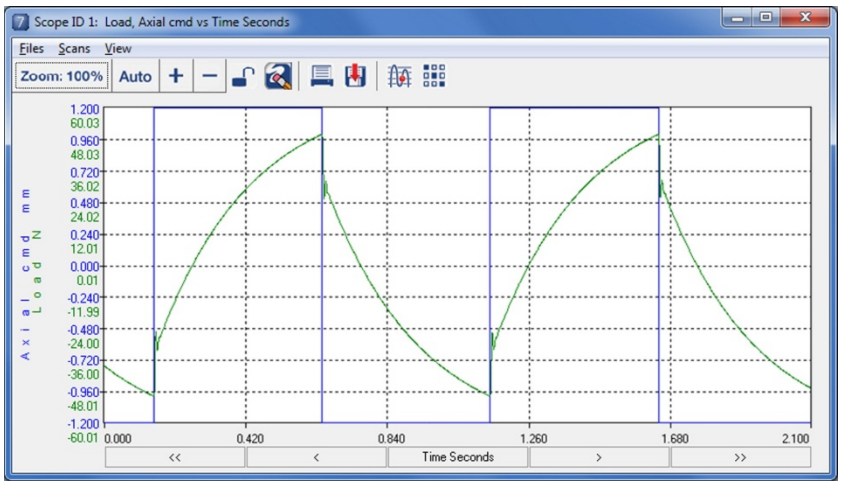
Well Adjusted PID Terms



I Term Too High



I Term Too Low



Offset Term (O term)

The offset term (O term) adds a fixed offset to the error signal to balance electrical offsets in the test system. It is used primarily in static (non-dynamic) situations.

NOTE Never set the O term on the DirCmd channel.

To adjust the O term:

1. With the specimen not installed and mover power off, record the Meter reading for the displacement control channel (for use in step 4 of this procedure.).
2. With the P term and D term well adjusted, set the I term to zero.
3. Turn on mover power.
4. Click the **Adjust Mover** button (**Test Setup** window). Use this window to adjust the command so that it equals the displacement channel reading that you recorded in step 1.
5. Now adjust the O term until the control channel reading and the command channel are equal.
6. To verify that this O term value is correct, select displacement as the control channel and make sure that the **Command = Control Channel on Off to Low/On** option is selected (**Setup Mover** window, **Power** tab). When you turn on Mover Power, there should be little or no movement of the linear motor. If you see any sudden movement, adjust the O term until this movement is eliminated.
7. Use the same O term value for all other transducer channels.

NOTE Never set O term for the DirCmd channel.

Manual Tuning Guidelines

Manual tuning usually consists of running a square (or a triangle) tuning waveform and adjusting the PIDO settings in the **Tuning Properties** window while you observe the system response in a **Scope** window.

IMPORTANT *Changing the PIDO settings can cause system instability and loss of control. Before adjusting any PIDO settings, make sure that you understand the effects of each term on the system response.*

Keep in mind the following guidelines during the manual tuning process:

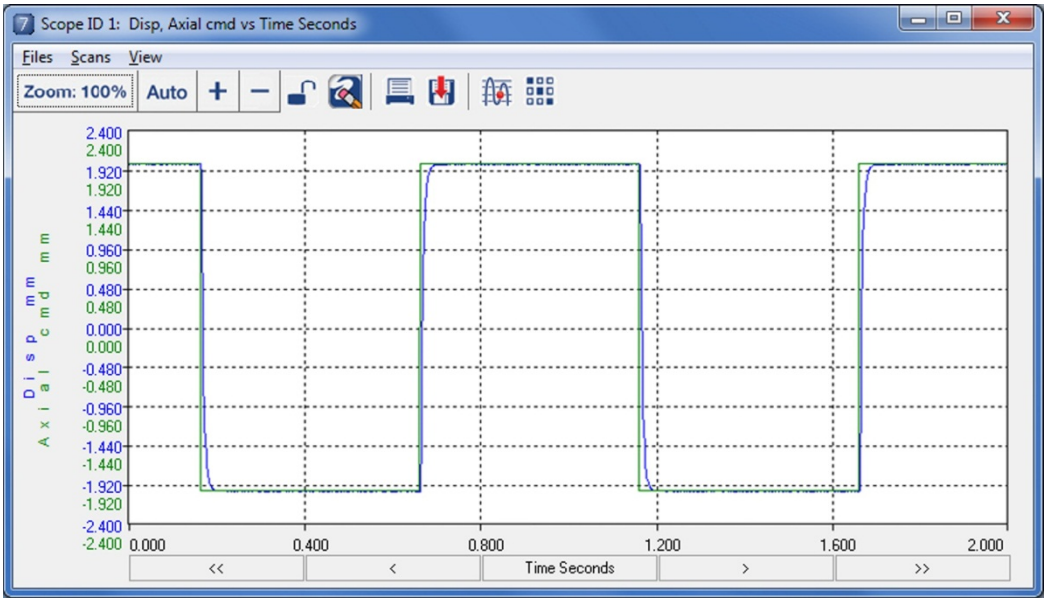
- Use TuneIQ whenever possible. TuneIQ provides fast, excellent optimization for most testing situations, with results that are faster and superior compared to manual tuning.
- Always turn off Amplitude Compensation before starting the manual tuning process.
- When defining the tuning waveform, try to avoid the noise band whenever possible.
- If the system does not respond to a square tuning waveform with good performance, try a triangle waveform. Adjustment of PIDO terms with a triangle tuning waveform is similar to tuning with a square wave.
- Always adjust PIDO settings gradually, starting with values that were previously determined for a similar test specimen in similar test conditions, or (if the system response to the specimen is not known) with PIDO values that are very close or equal to zero.
- When making manual tuning adjustments, increase the P term you see a small amount of instability in the Scope display, then increase the D term in the appropriate direction (positive or negative) to eliminate the instability.

NOTE *D term adjustments for ElectroForce motors and rotary motors are always negative.*

- Continue to iterate these adjustments by increasing P and then D in small increments, up to the maximum values that do not cause instability. Then increase the I term until the command and feedback waveforms agree as closely as possible.

- In general, lower settings for P and I terms will provide a more stable test system over a wider range of specimen properties. Bose recommends starting with conservative settings for general purpose testing and tuning more aggressively with the specific specimen and test conditions for testing that demands higher dynamic response or more accurate control.
- Rotary movers generally require more P term than load or displacement channels.
- When tuning with the specimen installed in the test fixture, it may not be possible (or desirable) to achieve a high-fidelity square wave during the tuning process. If the system becomes unstable, reduce the PID values and rely on Waveform Compensation techniques to optimize the system response. See Chapter 8, "Running and Managing Tests," for information about these waveform compensation techniques.

Well Adjusted PID Terms



Advanced Tuning Techniques

Cross Coupling and Feed Forward are advanced control techniques in WinTest that help the PIDO control loop to anticipate future actions in order to minimize error. The use of these advanced control techniques depends on the testing application, and are normally only for complex, multi-axial systems. If enabled, these settings were adjusted to their proper values during system integration and should be changed only by a WinTest expert.

- Feed Forward is often used in high-speed tests where sudden changes in the command signal are needed to achieve the desired test conditions. To do this, a calculated velocity channel can be defined, scaled, and added to the PIDO loop to boost the command signal. This velocity feed forward technique provides an extra drive boost during the test.
- Cross Coupling is often used in complex multi-axial configurations where the motion of one axis affects the feedback and or control of the other axis.

These advanced tuning settings are displayed in the **Advanced Tuning** window, and Bose ESG experts can also access them here.

NOTE *If advanced tuning techniques are necessary for your application, contact Bose ESG.*

User Notes Area

Chapter 14
WinTest Files

Application Files

The WinTest software uses advanced Windows 7 security features that allow or restrict user access to run applications. If you want to run an application on the WinTest PC that was not installed at the Bose ESG factory, see your system Administrator and/or refer to the *WinTest 7 Controls Administrator Manual* under "Managing Applications," where you will find instructions on how to set up Windows 7 to run your application. These setup tasks require Administrative privileges.

Bose\WinTest Directory Structure

All files pertaining to WinTest are located in the **C:\Bose\WinTest** directory.

WinTest User Files

WinTest user files are stored in either the SecureWorkspace folder or the UnsecureWorkspace folder, depending on how the Administrator set the security configuration for your system. Each of these Workspace folders provides a TestData folder for your data files and a Tests folder for your project files and test files. You can also create new folders within each workspace for organization.

SecureWorkspace\TestData and UnsecureWorkspace\TestData Folders

The TestData folders store data files that are generated by running tests and exporting data files.

File Type	Description
*.tdf	Binary Timed Data files
*.pvf	Binary Peak/Valley data files
*.lcd	Binary Level Crossing data files
*.sco	Binary saved scope scan data. Same file format as Timed Data files
*.sc#	Binary saved scope scan data from an earlier version of WinTest. Same file format as Timed Data files (# is the group number)
*.csv	Comma-delimited file (exported data)
*.txt	Text file (exported data)
*.hdr *.dat	DMA header file (DMA option) DMA data files, one file per condition

The *.tdf, *.pvf, *.lcf, and *.sco files can be exported using the Export function. The *.tdf, *.sco, and *.sc# files can be replotted in the Scope using the Replot function.

Secure Workspace\Tests and UnsecureWorkspace\Tests Folders

Each Tests directory contains files used to define and run tests.

File Type	Description
*.prj	Project files
*.ini	Workspace layout files (automatically created by saving a project file.)
*.gf*x*	Group test files (*x* is the group number)
*.rebuild	Rebuild files, created when using the Rebuild function to export a project file to use with a later version of WinTest.
*.tst *.cyc	DMA test file (DMA option) Condition file, used by the DMA test file to define the DMA test steps.
*.dtl *.bin *.con, *.adr, and *.str	DTL (Designer Test Language) test script (a text file) Compiled version of a DTL test script file Files that are created when the DTL script is compiled and are required to run the compiled *.bin file. All of these files must reside in the same folder under the Bose\WinTest directory.
*.pbp *.dfg	Point by point External Waveform file External waveform (Disk FG) file
.*txt	Text files in the Tests folder include ASCII files used to create external waveforms.

Common\Layout Folder

A workspace layout file (*.ini) contains window information, such as number of windows and their position on the screen, for Scope windows, Meter windows, and Peak Counts windows. When you save a project file, the workspace layout file directly associated with that project file is automatically saved at the same time in either the Secure Workspace\Tests or UnsecureWorkspace\Tests folder.

The Common\Layout folder stores a user-saved *copy* of a workspace layout file that is accessible from Secure and Unsecure workspaces.

File Type	Description
*.ini	Workspace layout files. (manually created by a user.)

Secure Folders for WinTest Resources

Calibration Folder (Secure)

The Calibration folder contains files generated by the calibration process in WinTest.

The Calibration folder is secure, which means that users can create or modify files in this folder only through WinTest, and that only the WinTest Administrator can delete, modify, or rename the folder or the files it contains.

File Type	Description
*.dat	Calibration data file. Bose personnel can use this file to generate a calibration certificate for a transducer.
*.cal	Calibration file, created when a transducer is calibrated. This file contains the board, range, and gain settings for a transducer.

TestActivity Folder (Secure)

The TestActivity folder is secure regardless of the security level set by the WinTest Administrator. This folder contains System Session files and Project Session files that are generated by using WinTest.

The TestActivity folder is secure, which means that users can create or modify files in this folder only through WinTest, and that only the WinTest Administrator can delete, modify, or rename the folder or the files it contains. All files in the TestActivity folder are comma-delimited (*.csv) files, which can be copied and pasted in an unsecure folder to read and manipulate in other programs.

- System session log files: These files provide a record of all log-in attempts, including those that are not successful. System session files have the filename:

  SystemSession *mmddyyyy hhmmss*

  where *mmddyyyy* and *hhmmss* represent the date and time stamp when the file was created.

- Project session log files: These files provide traceability for WinTest projects and allow WinTest users to track events and activities that occur during a WinTest session. A new project session log file is created every time a WinTest user opens a project file. Activities are recorded in the project session log file when the project file is opened (initialization activities, originated by WinTest), when WinTest takes automatic action (for example, in response to an event), and when the user interacts with WinTest. The **History Viewer** window (**Show** menu, in the **Project** window) can be used to view information in the project session files.

Project session log files have the file name

project_name *mmddyyyy hhmmss*

where *mmddyyyy* and *hhmmss* represent the date and time stamp when the file was created.

TuneIQ Folder (Secure)

The TuneIQ folder contains the history of your TuneIQ data files, plus other files required for TuneIQ to function. The TuneIQ folder is secure: users can create or modify files in this folder only through WinTest; only the WinTest Administrator can delete, modify, or rename the folder or delete the files it contains.

Two other folders in the C:\Bose\WinTest directory are also related to TuneIQ: the matlabfunctions_mcr folder and the matlabfunctions_mcr folder.

The TuneIQ folder may also contain data files for the Acceleration Compensation feature. They are located in the ACCdata subfolder.

WinTest System Files

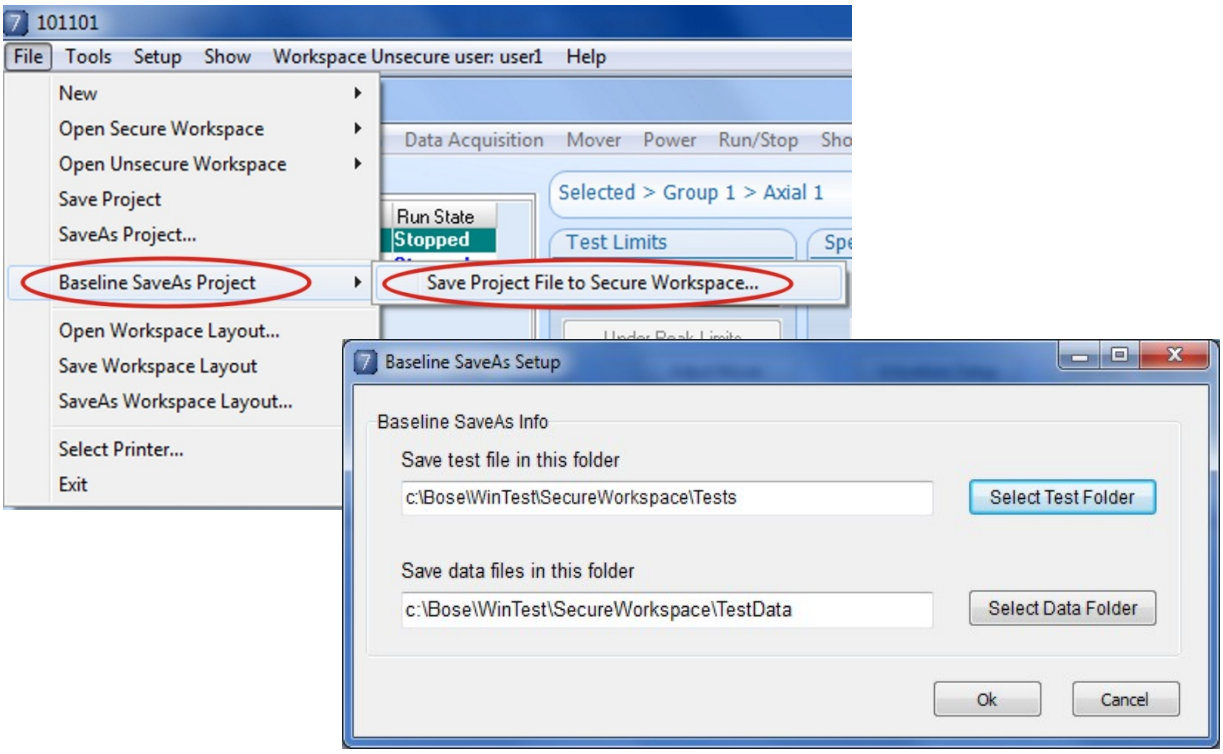
WinTest also includes additional files, stored in the **C:\Bose\WinTest** directory but not within any of the previously mentioned folders. These files are required to configure and run your WinTest software.

IMPORTANT Do not rename, modify, or delete any of these system files.

Using Baseline SaveAs

Using the **Baseline SaveAs Project** command on the **File** menu (**Project** window) is the only way to save an unsecure project into the SecureWorkspace folder. (The new file in the SecureWorkspace folder will be a secure project.) Only authenticated users have access to the **Baseline SaveAs Project** function.

1. Log into WinTest as an authenticated user. (The WinTest Administrator must set the appropriate security level.)
2. Open the unsecure project in WinTest.
3. Click **Baseline SaveAs Project** on the **File** menu (**Project** window).
4. Specify the destination folder for saving this project and any test files created for this project, and the destination folder for data files created for this project. Use the **Select** buttons to browse through each folder and to create new folders within them to organize your files.
5. Click **Ok** to save the project in the SecureWorkspace folder. From now on, this project is secure.



User Notes Area

Chapter 15
Dynamic Mechanical Analysis Option (DMA)

The WinTest DMA (Dynamic Mechanical Analysis) software has been developed to determine the viscoelastic properties of materials or components as a function of a wide range of test conditions. Based on the WinTest software and combined with an ElectroForce test system, the DMA software provides an exceptional range of performance in an easy-to-use, fully automated test system.

The DMA application software applies a sinusoidal excitation to the test specimen, collects timed data (typically force and displacement), and provides viscoelastic analysis of the data based on Fourier analysis techniques. Real-time displays provide essential analysis information to the operator while the test is running. The operator only has to define the test conditions; the DMA software controls all other facets of function generation, test control, and data acquisition required for the test.

The DMA Analysis software makes it easy to plot the data in a wide variety of ways, or you can export the data to a text file for analysis in other third-party tools.

DMA Test Overview

The DMA software makes it easy to define a series of test conditions that are applied systematically to the specimen during the test. DMA lets you define up to two sweep variables to step through a series of conditions that let you explore changes in component or material properties with respect to any controlled parameter, including:

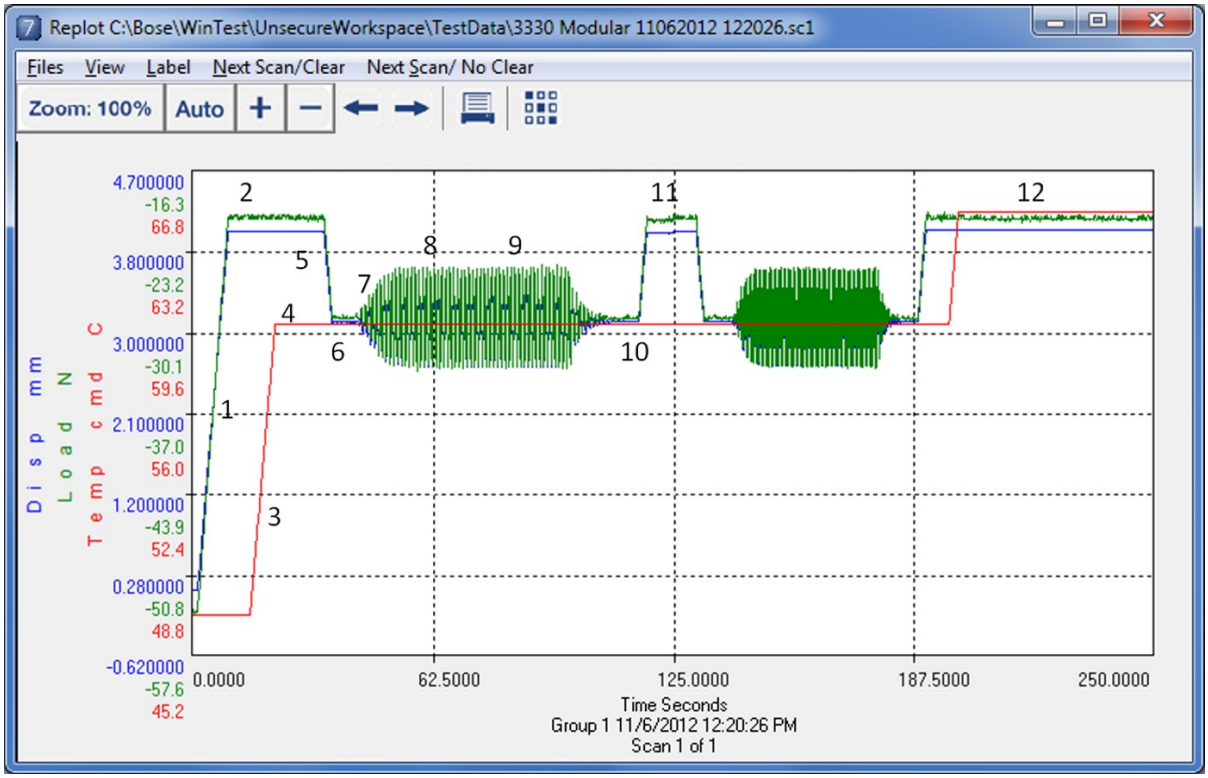
- Frequency
- Temperature
- Dynamic amplitude
- Mean level
- Hold at mean level
- Hold at temperature

The DMA software is designed to intelligently transition through each step of the DMA test. To begin, the system ramps to the specified Hold Value and records the current displacement. This reading is then used as the relative zero position for all subsequent displacement commands and feedback.

- **When the test temperature changes:** The system holds the specified level (typically load) while the temperature change occurs, and the specimen soaks at the new temperature to allow the dimensions of the specimen and the fixtures to change at the new temperature.
- **Ramp to Mean Level:** The system then ramps to the specified Mean Level and is held at that level for a specified time. This allows any creep or relaxation to occur prior to dynamic testing.
- **Dynamic cycling:** When dynamic cycling begins, the amplitude compensation algorithm gradually adjusts the command amplitude at the test frequency until the desired dynamic amplitude is achieved. The specimen is then "precycled" for the specified time interval at the desired amplitude, which allows the specimen to stabilize before data acquisition begins. Next, the dynamic cycles are applied and data is acquired at the optimum rate for the Fourier analysis and the test frequency.
- **End dynamic cycling, next test condition:** When the dynamic cycles are completed, the amplitude compensation algorithm gradually adjusts the command to the original Mean level while data is being saved, generates the real-time plot for the condition, and moves to the Hold level (if specified). The next condition then begins.
- **Last test condition:** When the last test condition is completed, WinTest executes a StopLevel action for all movers, using the StopLevel value that was defined for each mover in WinTest.

IMPORTANT *Before starting the DMA software, be sure to adjust all necessary settings in WinTest. See* *"WinTest Settings for DMA Tests"* *in this chapter for more information.*

The following **Scope** window shows an example DMA test:



Key:

1 Ramp to hold load, first condition
2 Hold at load hold
3 Ramp to temperature
4 Hold at temperature
5 Ramp to mean
6 Hold at mean
7 Amplitude control
8 Precycle
9 Data acquisition
10 End of first condition
11 Ramp to hold load for second condition
12 Second condition

DMA Files

Each DMA test requires two user-defined files:

- The DMA test file (*.tst) stores the WinTest control information and points to a condition file (*.cyc).
- The condition file (*.cyc) defines the details of the DMA test conditions.

Running a DMA test generates two types of data files: one header file (*.hdr) and one data file (*.dat) for each test condition. DMA data files can be also exported as text files for import into third-party analysis programs.

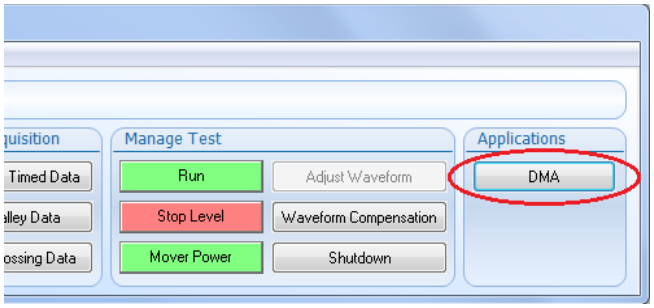
- The header file (*.hdr) contains information about the number of conditions that were run and the test setup information for each condition.
- Each data file (*.dat) contains the timed data for each test condition. Each data file has the same name as the header file, with a number appended to identify the test condition.
- The export file (*.txt or *.csv) saves a standard set of information and the selected variables for each test condition. Optional variables are selected in the **Export Setup** window when the data is exported.

NOTE *If you are working with a secure project, WinTest will direct you to save your DMA files in the SecureWorkspace folder.*

Start DMA and Open a DMA Test File

Before starting the DMA application, read "WinTest Settings for DMA Tests," in this chapter.

1. Click the **DMA** button in the **Applications** panel (**Test Setup** window). If this button is not displayed, contact Bose ESG to find out how you can add the DMA option to your WinTest system.



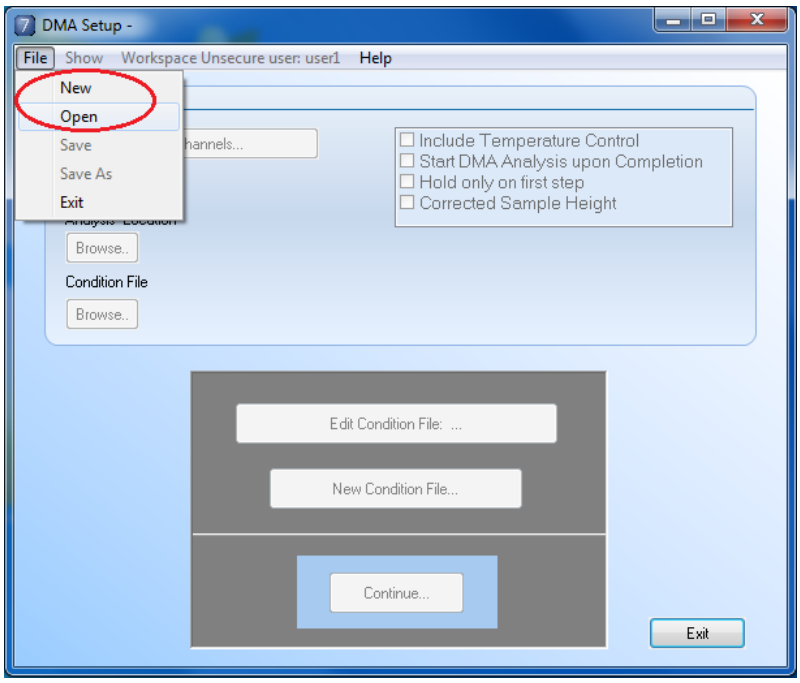
2. Enter your user name and password as required.

3. In the **DMA Setup** window, open an existing DMA test file or create a new one, as follows:

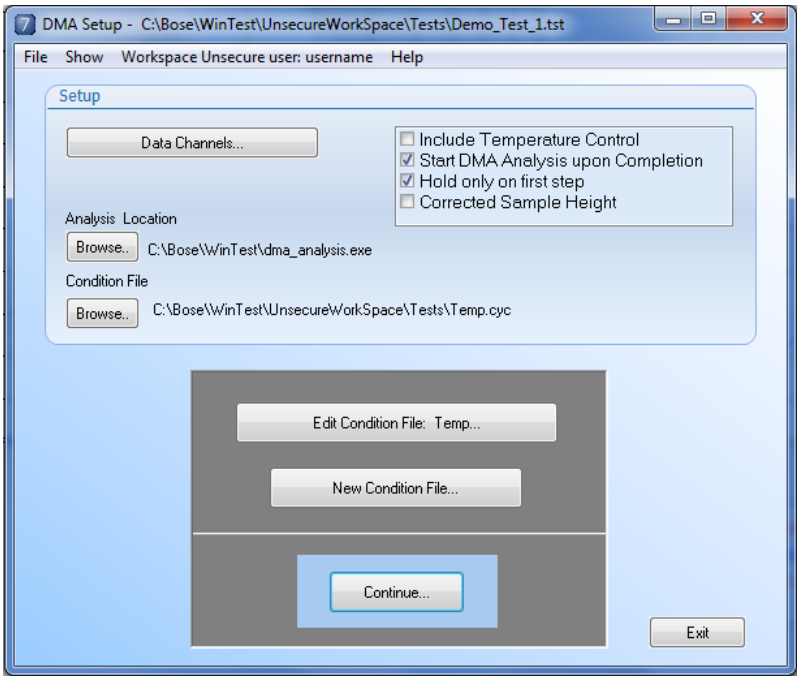
   - Open an existing DMA test: Click **Open** on the **File** menu and select the file to open.

   - Create a new DMA test: Click **New** on the **File** menu and continue with DMA test setup. DMA will ask you to enter the file name and destination for the test when you save the file.

NOTE *As a starting point, Bose provides an initial DMA test file in the Bose folder (Test.tst). This file has all of the information required to create additional DMA tests for your system.*



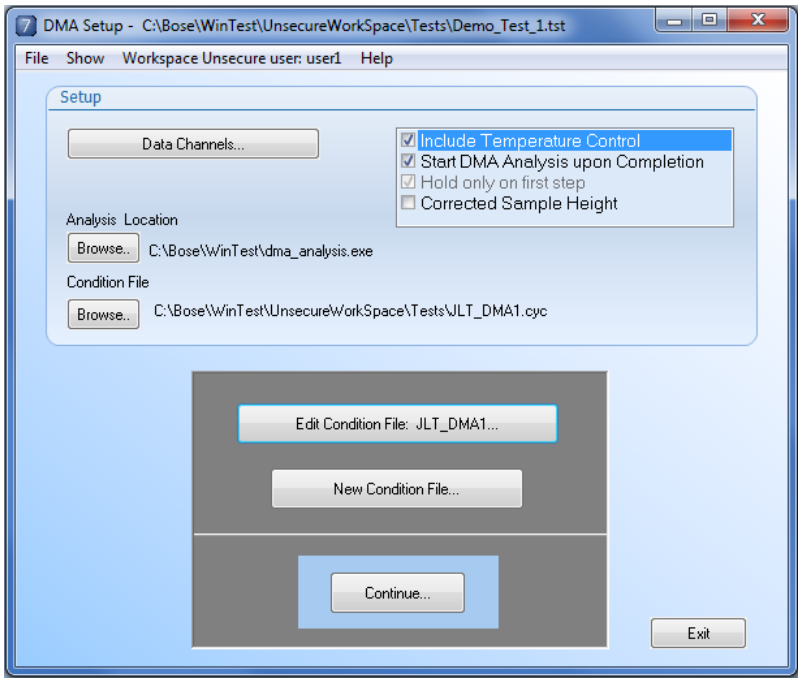
4. Define or modify the DMA test in the **DMA Setup** window. See "DMA Test Setup" in this chapter for instructions.



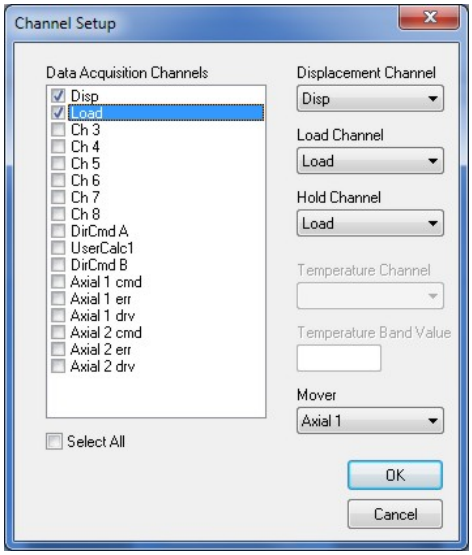
5. When you have finished defining the DMA test, click **Continue** to open the **DMA run/status** window, where you can run the test and use the DMA Analysis.

DMA Test Setup

Use the **DMA Setup** window to create a new DMA test or to modify an existing one. If a test is not open, click **Open** or **New** on the **File** menu.



1. Click the **Data Channels** button. When the **Channel Setup** window opens, select data acquisition channels and set channel definitions as follows:



   a. In the **Data Acquisition Channels** box, select the channels for data acquisition or **Select All**.

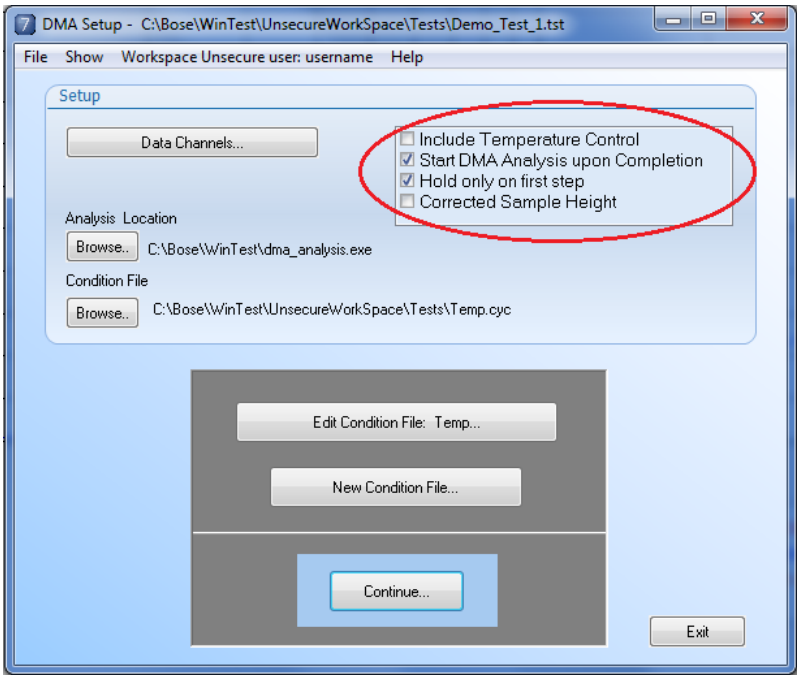
   b. Select the **Displacement Channel,** the **Load Channel**, and the **Hold Channel** (the channel to hold between steps).

   c. Select the **Temperature Channel** and enter the **Temperature Band Value**. These selections are active only if the **Include Temperature Control** option is selected in the **DMA Setup** window. The temperature hold time begins when the difference between the temperature command and the measured temperature equals this value.

   d. Select the **Mover** (typically Axial).

   e. Click **OK** to return to the **DMA Setup** window.

2. Select the DMA test options.



- **Include Temperature Control**: Select this option if you intend to control temperature at any time during this DMA test. When selected, the **Temperature Channel** and the **Temperature Band** fields in the **Channel Setup** window become active.

- **Start DMA Analysis upon Completion:** When this option is selected, the DMA Analysis starts automatically on the successful completion of the test.

- **Hold only on first step:** When this option is selected, the system will ramp to the **Load Hold Value** (specified in the condition file) only on the first step. Thereafter, the system will remain at the mean level after completing the cycles for each step.

  This option is disabled whenever the **Include Temperature Control** option is selected. When temperature is controlled, the system must ramp to the load hold value on each step to minimize specimen loading during temperature changes. The system also determines the "zero" position of the displacement feedback after thermal expansion or contraction.

- **Corrected Sample Height**: If this option is selected, the system will use the LVDT signal to correct for variations in specimen height. For round or rectangular specimens, the algorithm assumes that a zero LVDT reading corresponds to the height of the specimen entered in the **Specimen Shape** window. Non-zero LVDT readings will be added to the specimen height to correct for variations in specimen height or thermal expansion.

  If this option is not selected, the DMA Analysis software will use the height value entered in the **Specimen Shape** window to convert strain to displacement and to convert measured values to strain. No correction is made for shear or bend geometry because the LVDT reading and the height dimension of the sample are not equivalent.

3. In the **Analysis Location** field, specify the path name to the DMA Analysis executable file (if not already displayed). The path name must be specified if you select the **Start DMA Analysis upon Completion** option to automatically start DMA Analysis when the test is completed.

4. In the **Condition File** field, specify the condition file (*.cyc) to use for this DMA test.

   - Click the **Browse** button to select an existing condition file.

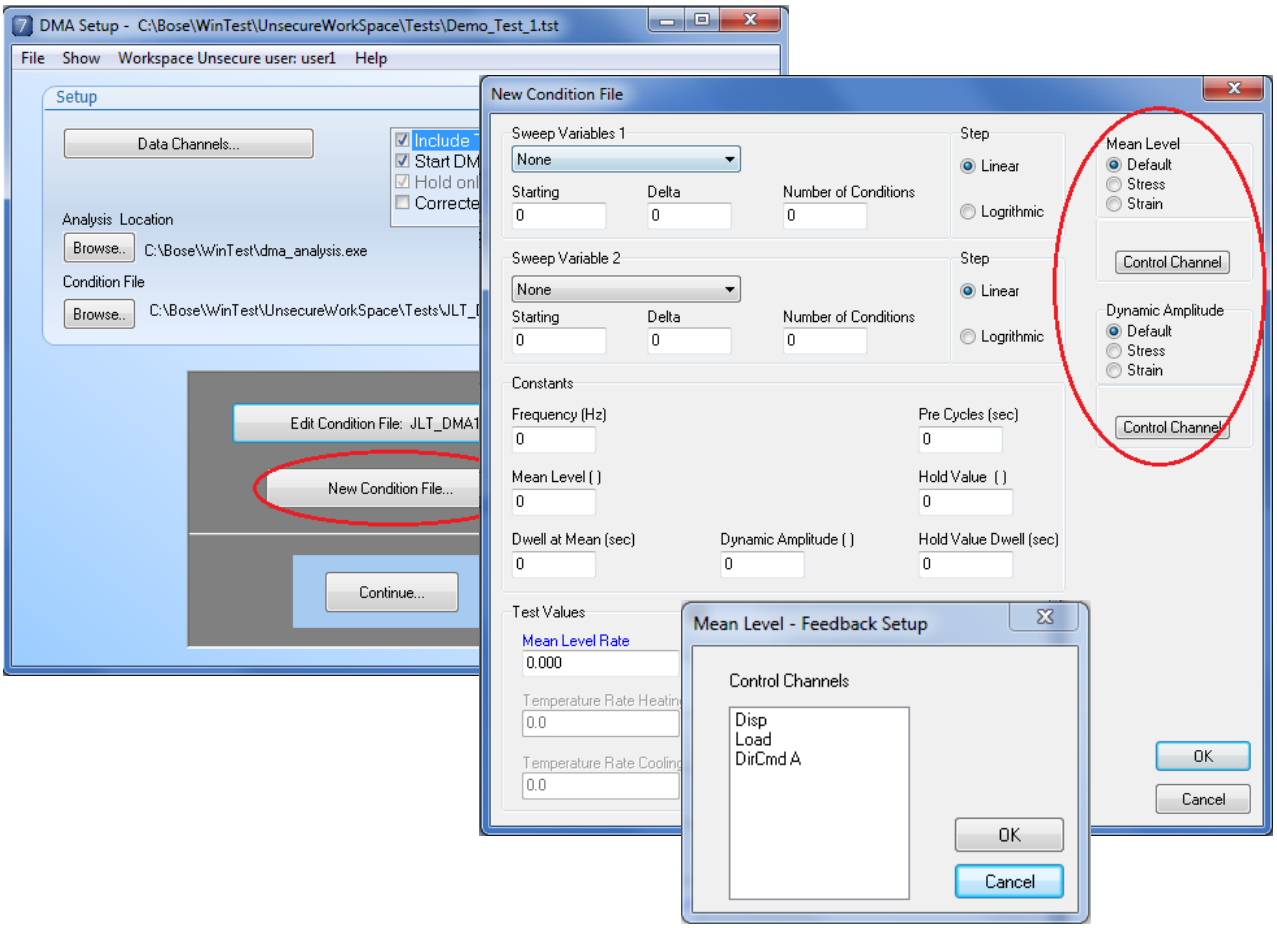
   - To modify the selected condition file, select **Edit Condition File** and modify the file in the **Edit Condition File** window. See "Editing a Condition File" in this chapter for details.

   - To create a new condition file, select **New Condition File** and enter the parameters needed to define the test conditions in the **New Condition File** window. See "Creating a New Condition File" in this chapter for details.

5. When you have finished defining the DMA test and are ready to run the test, click **Continue** to open the **DMA run/status** window. See "Running a DMA Test" in this chapter for details.

Creating a New Condition File

Click the **New Condition File** button in the **DMA Setup** window to create a new condition (*.cyc) file. When you have finished defining test parameters, DMA will return to the **DMA Setup** window.



To define a new condition file (*.cyc): in the **New Condition File** window:

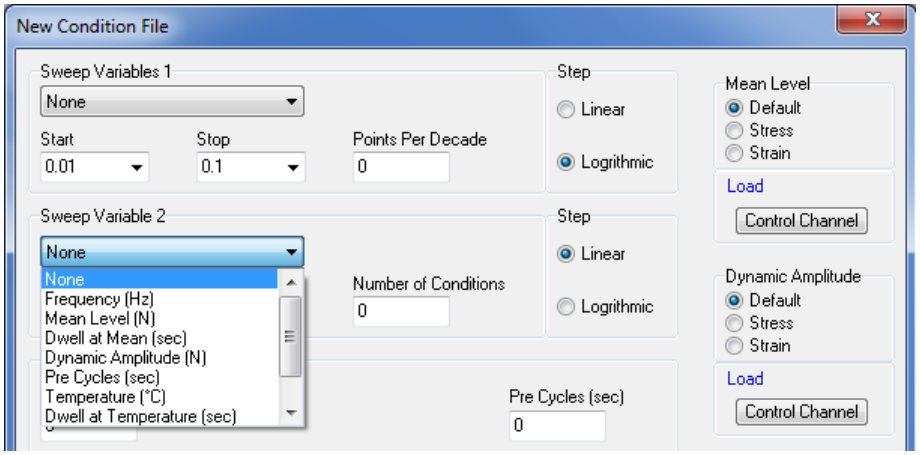
1. Select the control mode for the **Mean Level** and **Dynamic Amplitude** parameters.

   - **Default**: For this option, click the **Control Channel** button and select a control channel.

   - **Stress or Strain**: DMA test conditions are defined in units of stress or % strain, which are converted to load when the test is run, based on the shape and dimensions of the specimen. Selecting **Stress** or **Strain** disables the **Control Channel** selection, and DMA will use the **Displacement Channel** (for strain) and the **Load Channel** (for stress) that were selected using **Data Channels** button in the **DMA Setup** window.

NOTE *If the **Mean Level** or **Dynamic Amplitude** selection in this window is either Stress or Strain, you must enter the **Specimen Shape** information (including dimensions) in the **DMA run/status** window before running the DMA test. The test will not run if either the specimen shape or dimension values are missing.*

2. Select one or two sweep variables and define the sweep parameters. When two sweep variables are defined, Variable 1 is swept while the Variable 2 is held constant. Then Variable 2 is incremented to the second condition and the Variable 1 sweep is repeated. This pattern continues until all conditions for Variable 2 have been applied.



Set the following parameters for each sweep variable that you define:

- **Step** (select **Linear** or **Logarithmic**).

  For linear steps: Type the **Starting** value, the **Delta** value (increment between sweep steps), and the **Number of Conditions** in the sweep.

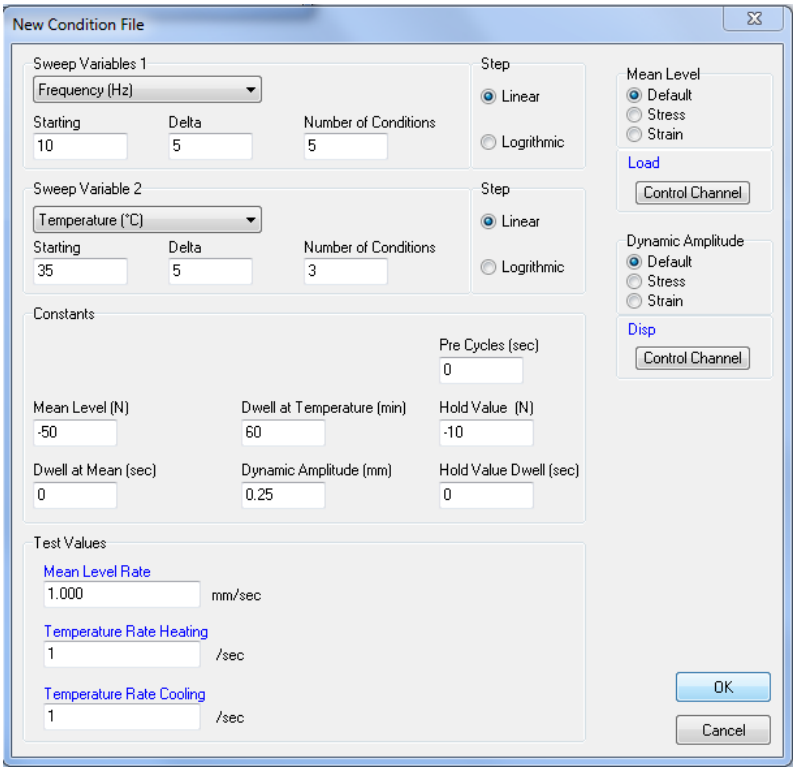
  For logarithmic steps: Select the **Start** decade and the **Stop** decade from each list and type the number of **Points Per Decade**.

- **Stop**: Last value (for linear steps) or last decade (for logarithmic steps) in the sweep for this variable.

- **Number of Conditions** (for linear steps) or **Points per Decade** (for logarithmic steps). These values determine the increment between each step in the sweep.

NOTE *Normally, the DMA test will ramp to the **Hold Value** after the dynamic cycling for the test condition is completed. It will stay at that value if the temperature is changing or it will simply record the measured displacement and continue to ramp to the Mean Level. In displacement control, the amplitude of motion is relative to the value recorded at the Load Hold value. For example, if the control channel reading is 0.5 mm when the Load Hold Value is applied and the Mean Level is 1 mm, the system will ramp to 15 mm to achieve the Mean Level for the test condition.*

3. In the **Constants** panel, specify the conditions to be held constant. Definitions for these parameters are the same as for the Sweep Variables (see step 1). Selecting a Sweep Variable removes that parameter from the **Constants** panel.



4. Define the **Test Values**.

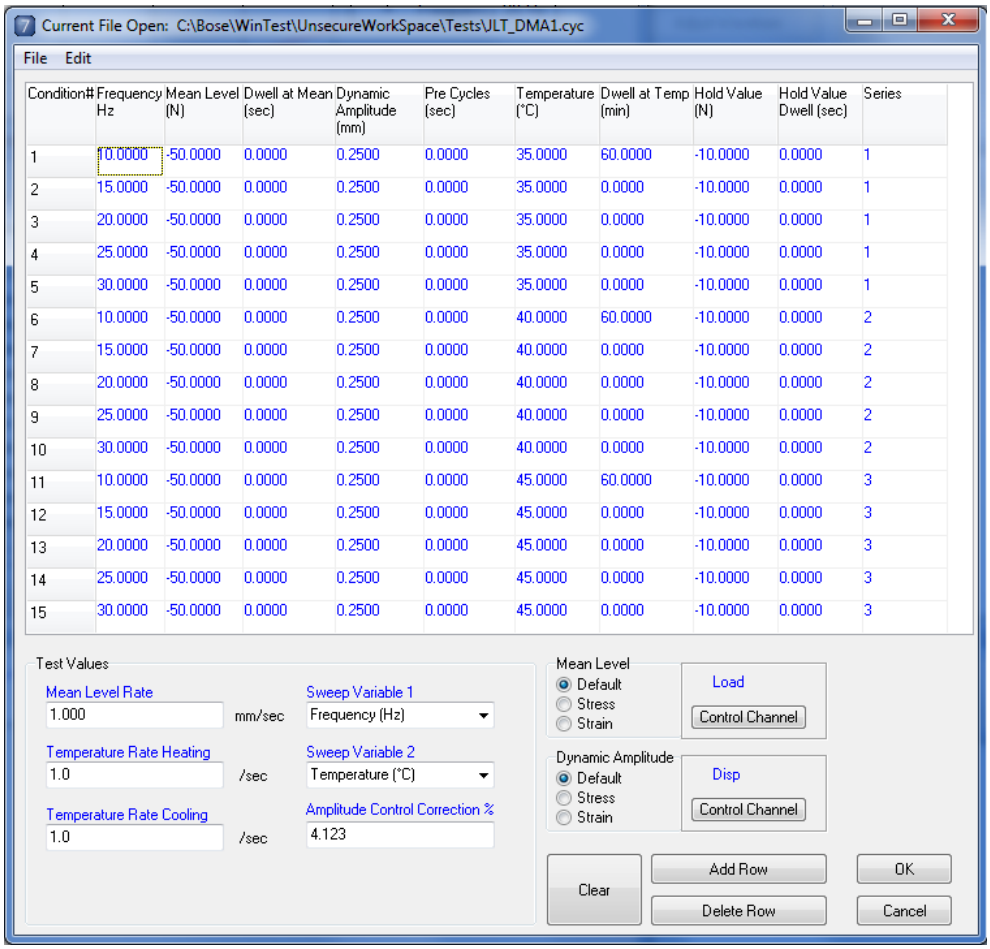
Test Value	Description
Mean Level Rate	DMA uses this rate to achieve the specified Mean Level. Units are as defined for the control channel. Make sure that this value is NOT zero.
Temperature Rate Heating and Temperature Rate Cooling	These fields are active only if **Include Temperature Control** is selected in the **DMA Setup** window. These values determine how quickly the temperature command changes when the required temperature is increasing (heating) or decreasing (cooling). *NOTE* *If you enter a heating or a cooling rate, the **Hold only on first step** option in the **DMA Setup** window is disabled.*

5. When you have finished creating the new condition file, click **OK**. WinTest will ask whether to save the file.

   - If you click **Yes**, specify the file name and location for this *.cyc file and click **OK**. The new condition file is automatically selected for the DMA test.

   - If you click **No**, the condition file will not be saved, and you cannot use it to run the DMA test.

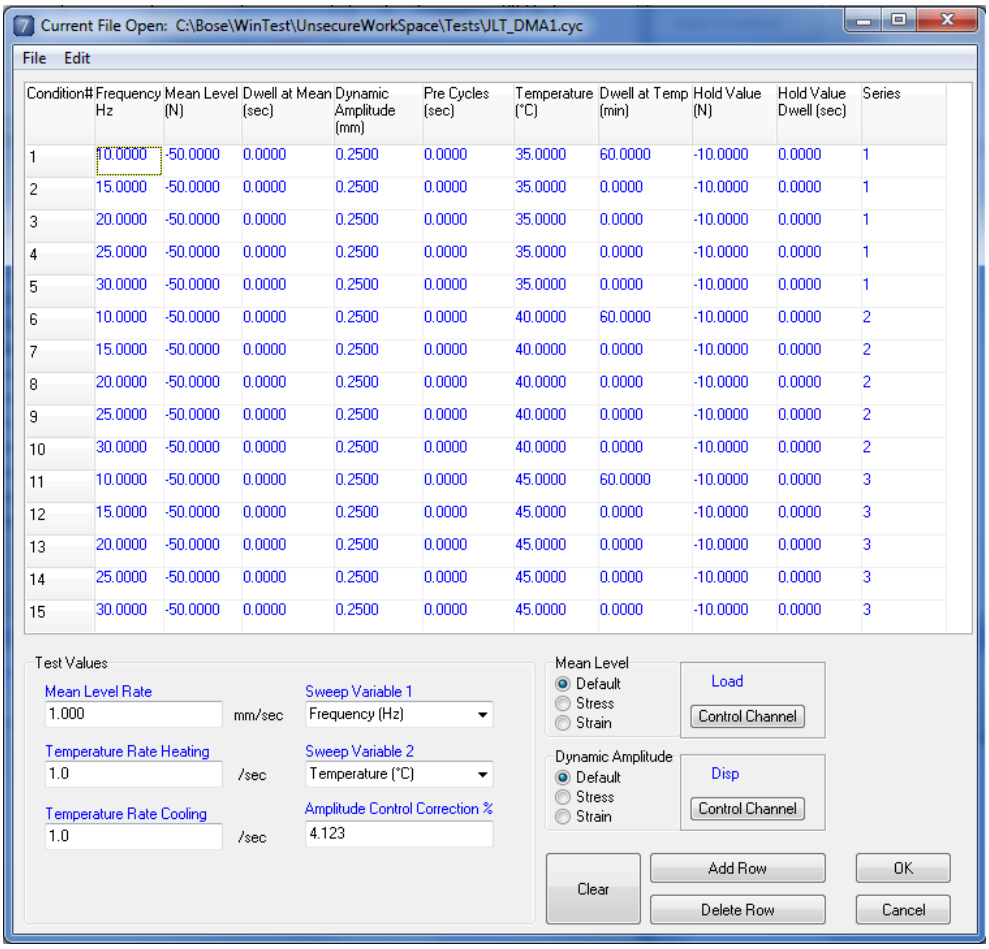
The parameters selected in the **New Condition File** window shown on the previous page generate the test conditions as shown in the **Edit Condition** window below.



Condition#	Frequency Hz	Mean Level (N)	Dwell at Mean (sec)	Dynamic Amplitude (mm)	Pre Cycles (sec)	Temperature (°C)	Dwell at Temp (min)	Hold Value (N)	Hold Value Dwell (sec)	Series
1	10.0000	-50.0000	0.0000	0.2500	0.0000	35.0000	60.0000	-10.0000	0.0000	1
2	15.0000	-50.0000	0.0000	0.2500	0.0000	35.0000	0.0000	-10.0000	0.0000	1
3	20.0000	-50.0000	0.0000	0.2500	0.0000	35.0000	0.0000	-10.0000	0.0000	1
4	25.0000	-50.0000	0.0000	0.2500	0.0000	35.0000	0.0000	-10.0000	0.0000	1
5	30.0000	-50.0000	0.0000	0.2500	0.0000	35.0000	0.0000	-10.0000	0.0000	1
6	10.0000	-50.0000	0.0000	0.2500	0.0000	40.0000	60.0000	-10.0000	0.0000	2
7	15.0000	-50.0000	0.0000	0.2500	0.0000	40.0000	0.0000	-10.0000	0.0000	2
8	20.0000	-50.0000	0.0000	0.2500	0.0000	40.0000	0.0000	-10.0000	0.0000	2
9	25.0000	-50.0000	0.0000	0.2500	0.0000	40.0000	0.0000	-10.0000	0.0000	2
10	30.0000	-50.0000	0.0000	0.2500	0.0000	40.0000	0.0000	-10.0000	0.0000	2
11	10.0000	-50.0000	0.0000	0.2500	0.0000	45.0000	60.0000	-10.0000	0.0000	3
12	15.0000	-50.0000	0.0000	0.2500	0.0000	45.0000	0.0000	-10.0000	0.0000	3
13	20.0000	-50.0000	0.0000	0.2500	0.0000	45.0000	0.0000	-10.0000	0.0000	3
14	25.0000	-50.0000	0.0000	0.2500	0.0000	45.0000	0.0000	-10.0000	0.0000	3
15	30.0000	-50.0000	0.0000	0.2500	0.0000	45.0000	0.0000	-10.0000	0.0000	3

Editing a Condition File

Clicking the **Edit Condition** button in the **DMA Setup** window opens a window where you can make minor changes to an existing condition file (*.cyc). The worksheet area of the window shows values for each test condition, and the lower part of the window displays other test parameters and allows you to change them.



Condition#	Frequency Hz	Mean Level (N)	Dwell at Mean (sec)	Dynamic Amplitude (mm)	Pre Cycles (sec)	Temperature (°C)	Dwell at Temp (min)	Hold Value (N)	Hold Value Dwell (sec)	Series
1	10.0000	-50.0000	0.0000	0.2500	0.0000	35.0000	60.0000	-10.0000	0.0000	1
2	15.0000	-50.0000	0.0000	0.2500	0.0000	35.0000	0.0000	-10.0000	0.0000	1
3	20.0000	-50.0000	0.0000	0.2500	0.0000	35.0000	0.0000	-10.0000	0.0000	1
4	25.0000	-50.0000	0.0000	0.2500	0.0000	35.0000	0.0000	-10.0000	0.0000	1
5	30.0000	-50.0000	0.0000	0.2500	0.0000	35.0000	0.0000	-10.0000	0.0000	1
6	10.0000	-50.0000	0.0000	0.2500	0.0000	40.0000	60.0000	-10.0000	0.0000	2
7	15.0000	-50.0000	0.0000	0.2500	0.0000	40.0000	0.0000	-10.0000	0.0000	2
8	20.0000	-50.0000	0.0000	0.2500	0.0000	40.0000	0.0000	-10.0000	0.0000	2
9	25.0000	-50.0000	0.0000	0.2500	0.0000	40.0000	0.0000	-10.0000	0.0000	2
10	30.0000	-50.0000	0.0000	0.2500	0.0000	40.0000	0.0000	-10.0000	0.0000	2
11	10.0000	-50.0000	0.0000	0.2500	0.0000	45.0000	60.0000	-10.0000	0.0000	3
12	15.0000	-50.0000	0.0000	0.2500	0.0000	45.0000	0.0000	-10.0000	0.0000	3
13	20.0000	-50.0000	0.0000	0.2500	0.0000	45.0000	0.0000	-10.0000	0.0000	3
14	25.0000	-50.0000	0.0000	0.2500	0.0000	45.0000	0.0000	-10.0000	0.0000	3
15	30.0000	-50.0000	0.0000	0.2500	0.0000	45.0000	0.0000	-10.0000	0.0000	3

Worksheet columns: Column 1 is the test condition number. Each remaining column represents a control parameter for the test sequence.

Worksheet buttons: These buttons (lower right in the window) affect the worksheet:

Button	Description
Clear	Clears the worksheet, leaving one blank row for condition 1.
Add Row	Adds a new row at the end of the worksheet.
Delete Row	Deletes the highlighted row.

Test Values: These values can also be entered or modified:

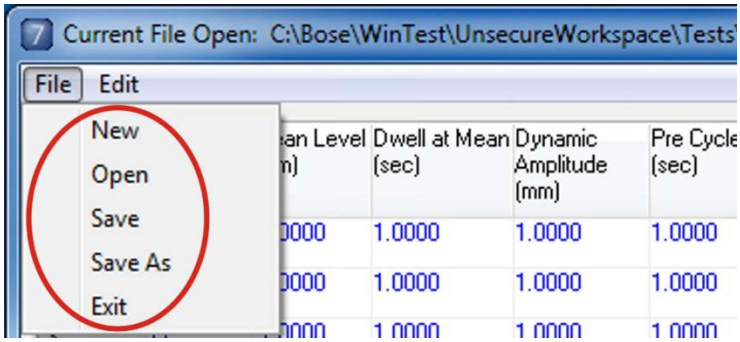
Test Value	Description
Mean Level Rate	The DMA system uses this rate to achieve the specified Mean Level.
Temperature Rate Heating and Temperature Rate Cooling	These fields are active if **Include Temperature Control** is selected in the **DMA Setup** window. These values determine how fast the temperature command changes while increasing (heating) or decreasing (cooling). *NOTE The **Hold only on first step** option in the **DMA Setup** window will be disabled if a nonzero value is entered in either or both of these fields.*
Sweep Variable 1	Allows you to change Sweep Variable 1.
Sweep Variable 2	Allows you to change Sweep Variable 2.
Amplitude Control Correction %	This value adjusts how quickly the system compensates for Mean Amplitude or Dynamic Amplitude error. This value is the percent of the error to apply to the next correction. The larger the value, the faster the control algorithm will approach the correct value. *NOTE Change this value in small increments. If this value is too large, the system can become unstable, which can expose the specimen to excessive force or displacement.* *This value is not saved in the *.cyc file. Instead, it is a global system value that will apply to all tests until it is changed.*

Mean Level and **Dynamic Amplitude:** These control mode selections are normally set in the **New Condition File** window, but you can also change them here.

---

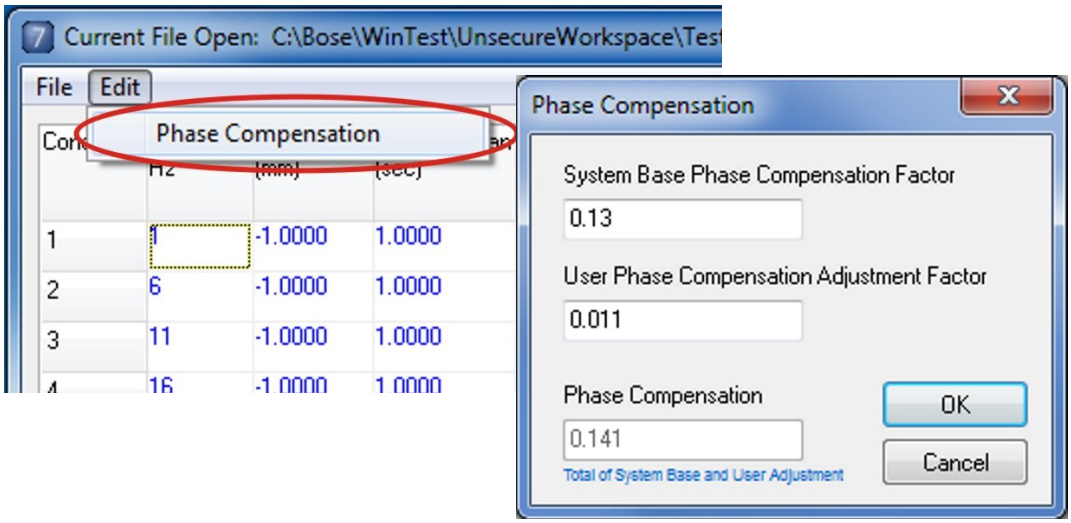
*NOTE Changes to the **Mean Level** and **Dynamic Amplitude** selections do not automatically change the worksheet values. If you change these selections, make sure that the test condition values in the worksheet are still appropriate.*

The DMA Setup window also has a menu bar. You can use commands on the **File** menu to open another condition file to edit, or to create a new condition file using the worksheet format in the editing window. The new or edited file is automatically selected for the DMA test when you click **OK**.



NOTE *Whenever you modify a DMA condition file (*.cyc), it is good practice to use **Save As** on the **File** menu to save the file with a new name. This ensures that you will be able to recreate the original conditions and the modified settings.*

You can use the **Phase Compensation** command on the **Edit** menu to open the **Phase Compensation** window.



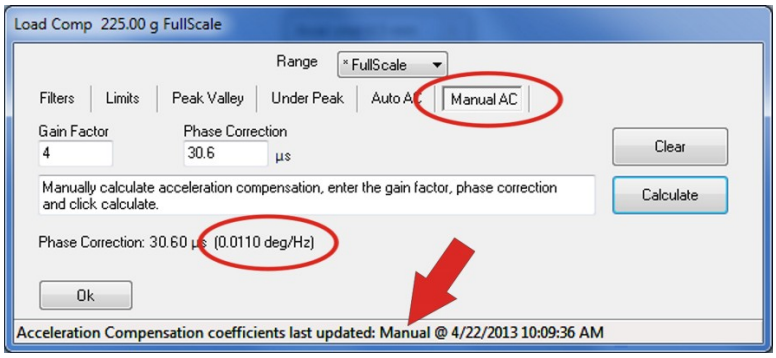
Value	Description
System Base Phase Compensation Factor	This value is system dependent and is set during system calibration at the Bose ESG factory. Do not change this value unless Bose Technical Support has directed you to do so.
User Phase Compensation Adjustment Factor	This value is where the user can add the Accel Comp Phase Correction value to the overall Phase Compensation value.
Phase Compensation	This value is the total of **System Base Phase Compensation Factor** and **User Phase Compensation Adjustment Factor**. It can be changed by adjusting one of the other two values in this window. This value is recorded in the DMA header file (*.hdr) . This value is updated after you click **OK**. *NOTE This value is a global system value that will apply to all tests until it is changed.*

Accel Comp

If you are using the Load Comp channel in Accel Comp as your load channel, you may need to add the Accel Comp Phase Correction value (in deg/Hz) to your existing DMA Phase Compensation value.

Example:

The timestamp at the bottom of the Load Comp window shows the method most recently used to update Accel Comp.



In this example, the method used was “Manual”.

Therefore, the Phase Correction value to use is on the Manual AC tab (0.011 deg/Hz). This value is entered as the **User Phase Compensation Adjustment Factor**. (See previous page.)

WinTest Settings for DMA Tests

Although the DMA application provides a simple interface for conducting DMA tests and the WinTest control software is minimized while DMA is running, the primary application is still WinTest. Many WinTest settings affect the function of the DMA software. This section describes how to set WinTest parameters to work with the DMA software.

To adjust WinTest settings while working in the DMA application, right-click on the WinTest icon at the bottom of the screen. When you have finished adjusting the WinTest settings, be sure to minimize WinTest again.

NOTE *If you opened a **Scope** window from the DMA application and then opened WinTest to adjust settings, you will have to open that **Scope** window again in DMA after minimizing WinTest.*

Peak/Valley Settings

All DMA tests require proper setting of the Peak/Valley band. In general, the Peak/Valley band value should be greater than 0.05%.

- If the Peak/Valley band is too small, the dynamic amplitude will change unexpectedly because the system is measuring signal noise instead of true Peaks and Valleys.
- If the Peak/Valley band is too large, the dynamic amplitude will change unexpectedly because the Peak/Valley readings are not updated with the current waveform.

For more information about setting the Peak/Valley band, see Chapter 10, "Channel Setup Properties."

Stop Level

The DMA application executes the Stop Level action at the end of the test using the Stop Level settings defined for the mover. See Chapter 6, "Waveform Setup," for information about setting the Stop Level parameters.

Test Limits

The Limit settings defined in WinTest for all channels are active during the DMA test. Before starting the DMA application, set limits appropriately to protect the specimen, the test fixture, and the system transducers. However, if these limits are set too conservatively, they may not allow the DMA test to run to completion.

If a message appears during DMA testing to indicate that the test was stopped due to a limit condition, restore WinTest and review and adjust your limit settings as necessary. When you have finished adjusting your limits, minimize WinTest again and continue the DMA test. See Chapter 4, "Limits and Actions," for more information about limits.

Filters

For DMA tests, all channels should specify "None" for the filter setting. Filters affect the dynamic amplitude and phase of the control channel and can cause unusual specimen behavior (excessive phase, negative phase, unusual stiffness), especially as a function of frequency. See Chapter 10, "Channel Setup Properties," for information about verifying and/or changing the filter selection.

DMA data analysis acts as a filter to eliminate all frequency content other than the fundamental frequency used to calculate the phase and stiffness of the specimen. If you decide to use a filter in the channel setup properties, be sure to set the filter for the Reference and Measured channels to the same frequency. If these channels have filters with different frequencies, the measured dynamic properties will be more a function of the filters than of the material properties of the specimen.

Tuning

If the applied test conditions do not change the overall specimen stiffness during the course of the test, use TuneIQ in the desired control mode before starting DMA.

If the stiffness of the specimen expected to change during the course of the test, the Direct Command mode of running DMA is usually the best solution because tuning gains will be optimal only for a given specimen stiffness. Most often, this is encountered in temperature sweeps where the specimen is very stiff at low temperatures and very soft at high temperatures.

Closed-Loop Control vs. Direct Command Mode

Depending on the testing situation, DMA tests can be run with the mover in either closed-loop control or Direct Command control. To set the control mode, select the mover and click **Set Advanced Settings** on the **Mover** menu (**Test Setup** window), and then click **Set Control Mode**. In the **Control Mode** window for the mover, select **PID** (closed-loop control) or **Direct Command**.

DMA Tests in Closed-Loop Control

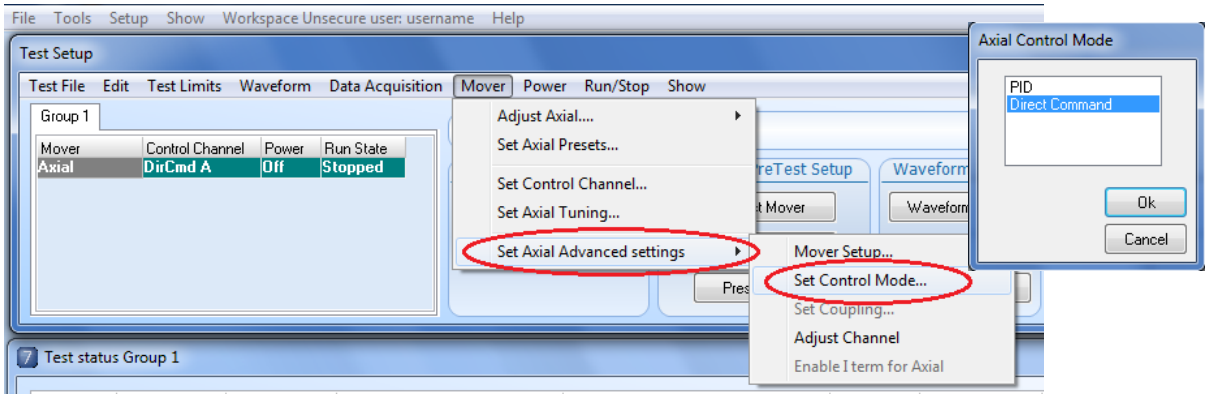
In general, Bose suggests using closed-loop control for DMA testing in situations where the specimen stiffness does not vary significantly during the test sequence, or when the test requires accurate control of the mean and dynamic amplitudes. Tune the system with the specimen in the fixture and rely on DMA's amplitude control algorithm to optimize the command during the test sequence.

NOTE *Tuning the system with the specimen at room temperature can often lead to instability at cold temperatures, where the specimen may have dramatically higher stiffness.*

DMA Tests in Direct Command Control Mode

The Direct Command control mode bypasses WinTest's closed-loop control algorithm and directly translates the commanded value to an electrical current value, which is sent to the ElectroForce linear motor. Because Direct Command is not closed-loop control, tuning is not required, but larger deviations from the desired levels should be expected. In DMA, the application chooses the command voltage required to apply the desired displacement of force to the sample, and the amplitude control algorithm adjusts the command values for errors while the cyclic waveform is running.

The Direct Command control mode is typically used in DMA tests where the stiffness of the specimen changes during the test as a result of the applied test conditions. A good example of this is when the temperature varies widely during the course of the test.



The amplitude control techniques used for other DMA tests also apply to DMA tests run in Direct Command control mode.

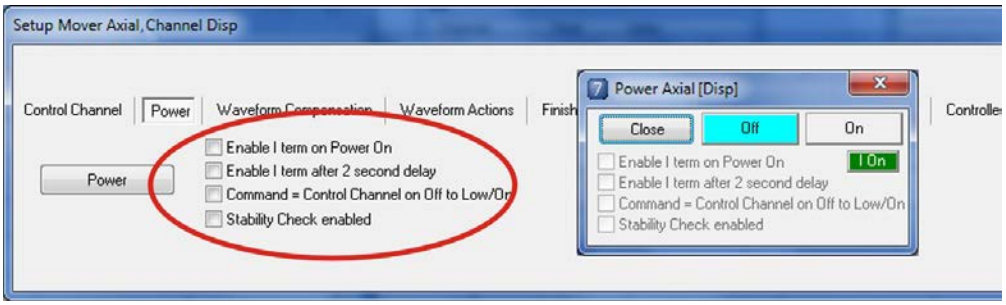
Scaling of commands: When using the Direct Command control mode, the direct command to the linear motor is scaled to the full-scale value for the control channel selected in DMA. For example, if the control channel is Disp (displacement) with a range of 10 mm, a 2 mm command would apply 20% of the available current to the linear motor; a 5 mm command would apply 50% of the available current, and so on.

Correlation between command and applied force: For force-based control modes, there is a fairly close correlation between command and the actual force applied to the specimen. The applied force is proportional to the current applied to the motor.

Correlation between command and applied displacement: For displacement-based testing in the Direct Command control mode, there can be a large error between the compensated command and the applied displacement. If the sample is not in the test fixture, a command equal to 5% of the displacement full scale can create full-scale motion of the linear motor, because there is no resistance. However, this problem occurs only when the operator commands the system manually while in Direct Command control mode. The DMA software will automatically stop the command when the desired value is achieved.

IMPORTANT *Rapid, unexpected motion may occur when using Direct Command mode for DMA testing if the following settings are not configured in WinTest as follows:*

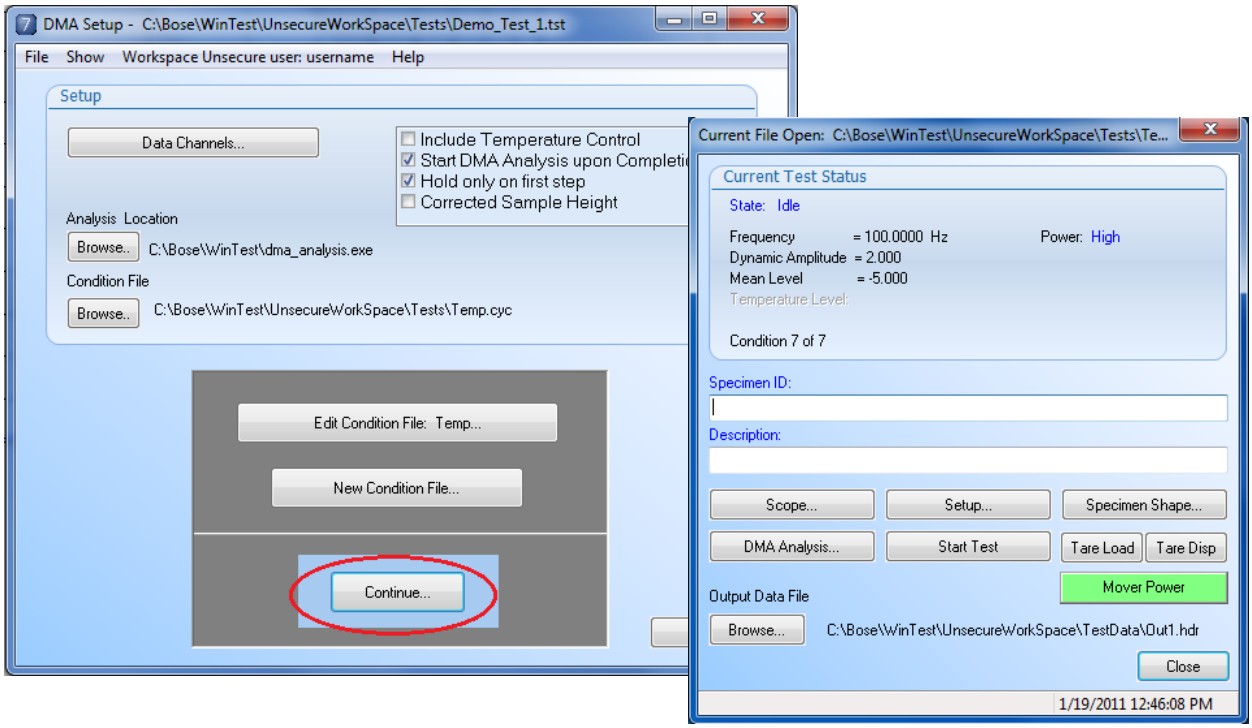
- ***ALWAYS set command to zero (0) before turning on Mover Power**, or unexpected motion may occur when Mover Power is turned on.*
- ***Set the Stop Level to zero (0) for all control channels.** The DMA software commands all movers to the current Stop Level values at the end of the test sequence.*
- ***Mover Power options:** When using the Direct Command control mode for DMA testing, make sure that the **Enable I term** and the **Command = Feedback** check boxes are cleared in the Power settings. For more information, see Chapter 11, "Mover Settings."*
- *Make sure the Stability Check enabled check box is cleared. It is only used for PID closed loop control situations.*



- ***Create and use a separate project file:** Because of these changes, Bose ESG recommends that you use a separate project file for DMA tests that use the Direct Command approach, with the appropriate mover settings.*

Running a DMA Test

When you have finished DMA test setup, click the **Continue** button in the **DMA Setup** window to open the **DMA run/status** window.



Then follow these steps to run a DMA test:

1. Make sure that Peak/Valley settings, the Stop Level parameters, and Test limits are set appropriately in WinTest, because DMA will use them. See "WinTest Settings for DMA Tests" for additional information.

2. Prepare to start the DMA test. The **DMA status** window provides buttons for some tasks that are normally performed in WinTest.

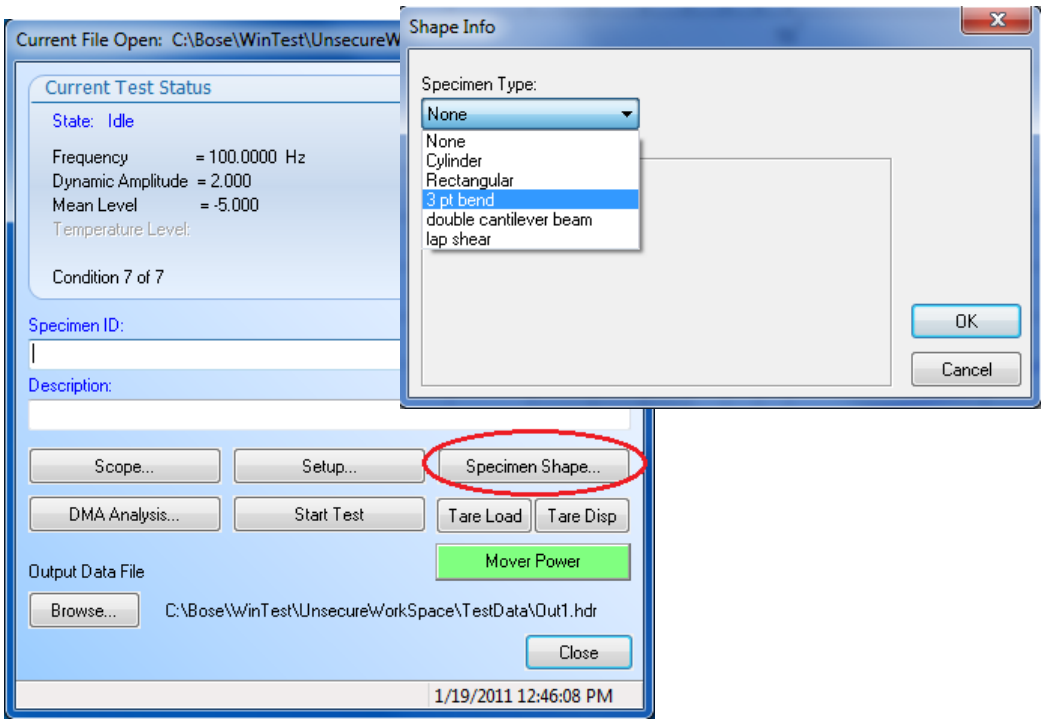
   - Click the **Scope** button to open a **Scope** window and set up a Scope display as appropriate for the test. See Chapter 3, "Display Windows (Show Menus)," for specific information.

   - Click **Tare Load** to tare the load transducer and/or click **Tare Disp** (displacement) to tare the displacement transducer. The tare function sets the reading of the transducer to zero.

   - Click the **Specimen Shape** button, then select the **Specimen Type** (shape) and enter the dimensions. This information will be saved in the DMA test file (*.tst).

NOTE *To ensure that the DMA software applies the correct test conditions, you must select the Specimen Type if the Mean Amplitude or the Dynamic Amplitude is specified as Stress or Strain.*

The shape and dimensions can also be entered during DMA Analysis, but the information will not be saved with the DMA test.



   - Verify the Output Data file name and destination. If necessary, click the **Browse** button and specify another file name and destination.

NOTE *The path name for the DMA data file is saved in the DMA test file (*.tst).*

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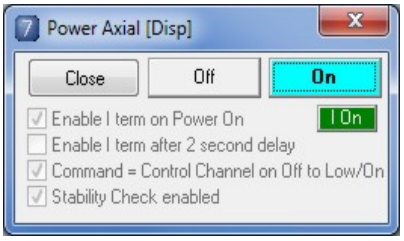
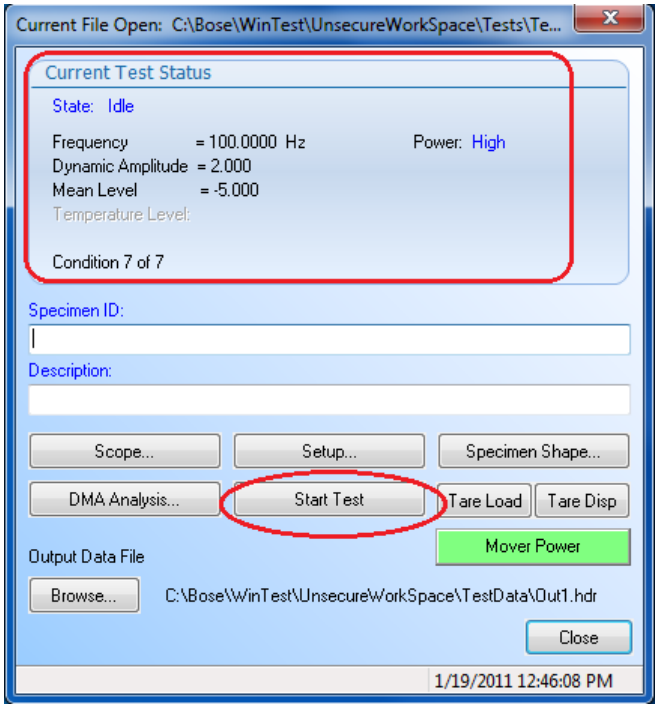
3. Click the **Mover Power** button in the **DMA status** window. In the **Power** window, click **On**.



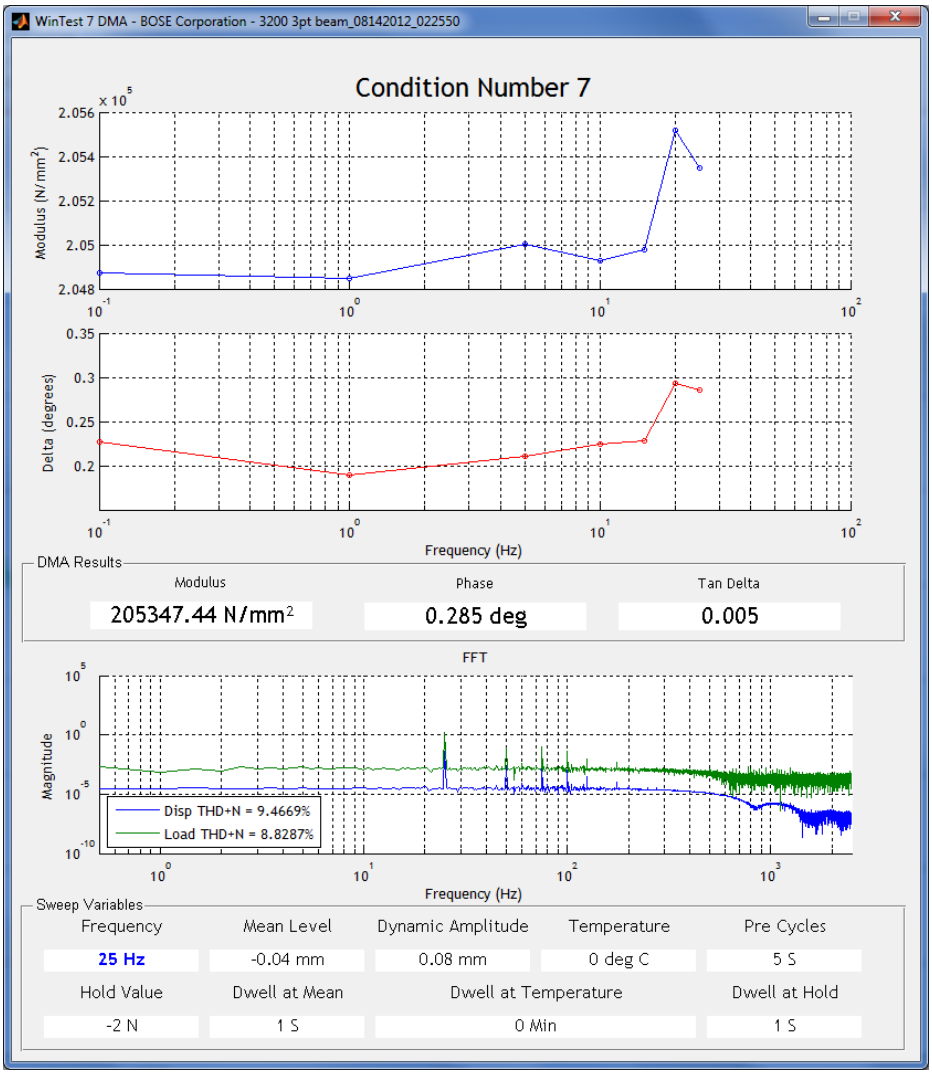
4. Click **Start Test** (**DMA status** window) to start the DMA test.
When the test begins, this button changes to **Stop Test**, which stops the DMA test in progress, resets the condition number to 1, and leaves mover power on.

   While the test is running, the **DMA run/status** window shows the following information:

   - **Current Test Status**: This area shows information about the test conditions being applied the mover power status.
   - **State**: This line displays what the test system is doing (for example, data acquisition, ramp to desired temperature, hold at temperature, remaining hold, etc.).
   - **Condition:** This line displays the current test condition and the total number of test conditions defined for the test (for example, "Condition 7 of 7" is shown in the graphic).



5. When the first test condition is completed, a real-time DMA display appears on the screen. This screen displays information to help you evaluate the test data for each condition, without waiting for the test to run to completion. The real-time display is updated at the end of each condition.



6. When the last condition of the DMA test is completed, the real-time display for the last condition remains on the screen. If the **Start DMA Analysis Upon Completion** option was selected in the **DMA Setup** window, the **DMA Analysis** window will open automatically and display the Time Data view for the first test condition. Otherwise, click the **DMA Analysis** button in the **DMA status** window to open the **Analysis** window for the current DMA data.

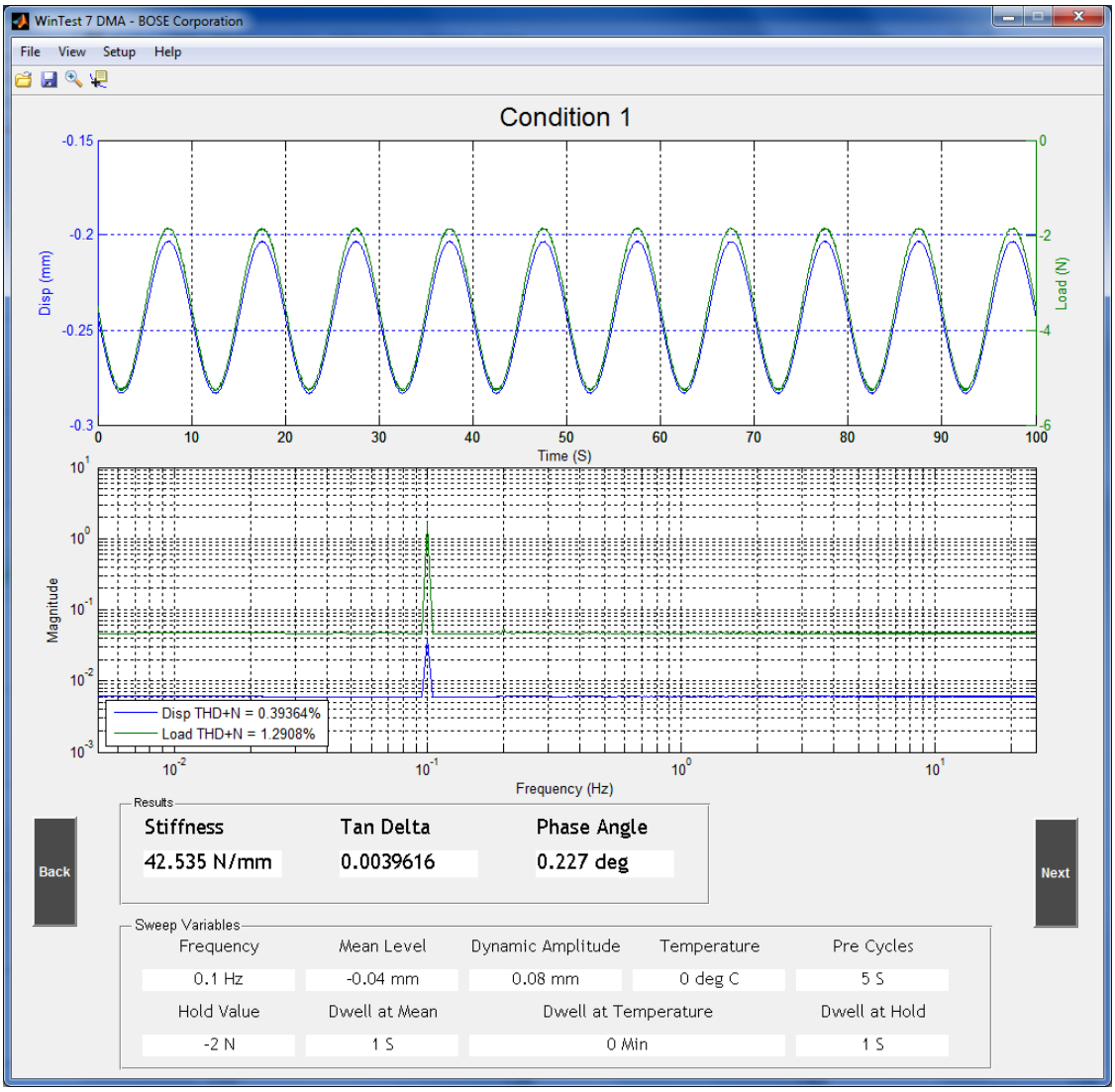
   See "DMA Analysis" later in this chapter for more information about configuring the DMA Analysis views and plot options.

DMA Analysis

DMA Analysis Window

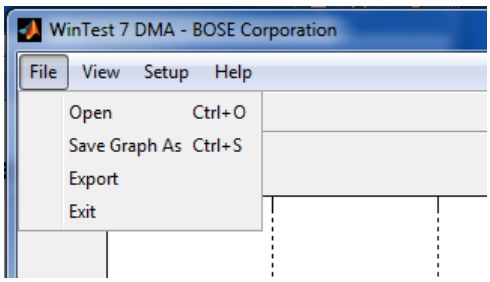
If the **DMA Analysis** window did not open automatically upon completion of the test, click **DMA Analysis** in the **DMA status** window. If the DMA software is not running and you want to view older data files, double-click the DMA shortcut icon on the computer desktop and open the data file to analyze.

NOTE *If DMA displays a black error window and closes when you start the Analysis software, try increasing the test amplitudes and running the test again. If the problem persists, contact Bose ESG Technical Support.*



File Menu

Use the **File** menu (**DMA Analysis** window) to change data files, to save the current plot in a file, to export the DMA data file as a text file, or to close the DMA Analysis software.



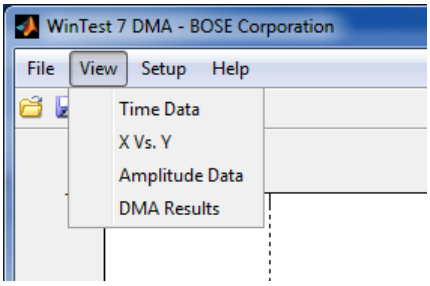
Menu Command	Description
Open	Use this command to open another set of DMA data for analysis.
Save Graph As	Saves the current DMA display in a file. Specify the file name and destination folder.
Export	Exports saves the current DMA data in a comma-delimited text file (*.csv) for easy import into Excel. The exported file includes the requested test conditions, the actual conditions, and the selected calculated specimen properties for all conditions.
Exit	Closes the DMA Analysis application.

NOTE *If you are working in the secure workspace, DMA will direct you to save the graph or the exported file in the secure workspace. After saving the file, you can copy it into the unsecure workspace for analysis with other programs.*

View Menu

Use the **View** menu (**DMA Analysis** window) to display DMA test data in different ways.

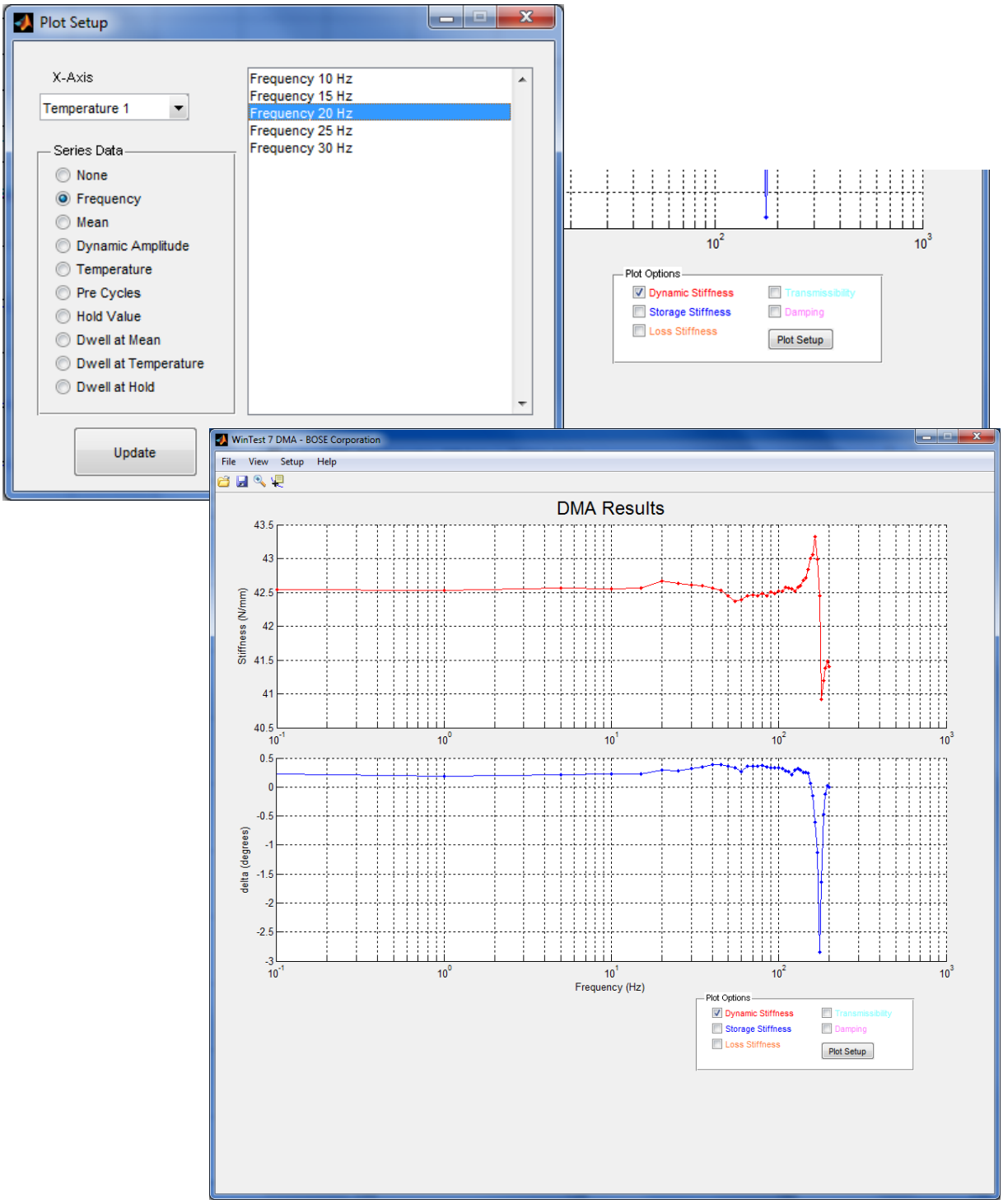
The **Time Data** and **X Vs. Y** plots display data for individual conditions. In these displays, use the **Back** and **Next** buttons to display data for the prior or the next condition. For each condition, the **Time Data** and **X Vs. Y** plots also show the calculated stiffness, tan delta, and phase angle values plus the sweep variables used to apply the test conditions.



Menu Command	Conditions	Description
Time Data	Individual conditions	Displays the Reference channel vs. time and the spectral analysis of the dynamic amplitudes from the Fourier analysis as a function of frequency.
X Vs. Y	Individual conditions	Displays the Reference channel vs. the Measured channel (specified in the channel setup) for an individual condition.
Amplitude Data	All conditions	Displays the mean and dynamic amplitude for each condition (selected as **Plot Options**) as a function of the swept parameter. Use the **Plot Setup** button to select the x-axis and series data for the display.
DMA Results	All conditions	Plots dynamic properties (selected as **Plot Options**) as a function of the swept parameter. Use the **Plot Setup** button to select the x-axis channel and series data for the display.

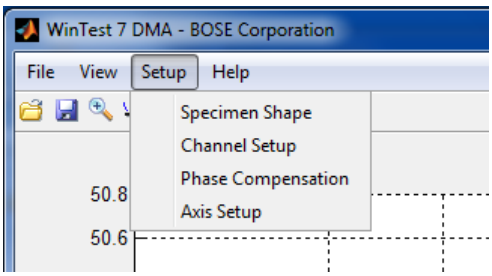
Plot Setup for Amplitude Data and DMA Results

In the Amplitude Data and DMA Results views, click the **Plot Setup** button to select a channel for the x-axis and a test condition for the series data. For variable test conditions, you must also choose a specific condition for the analysis. Then click **Update** to recalculate the analysis and update the display.



Setup Menu

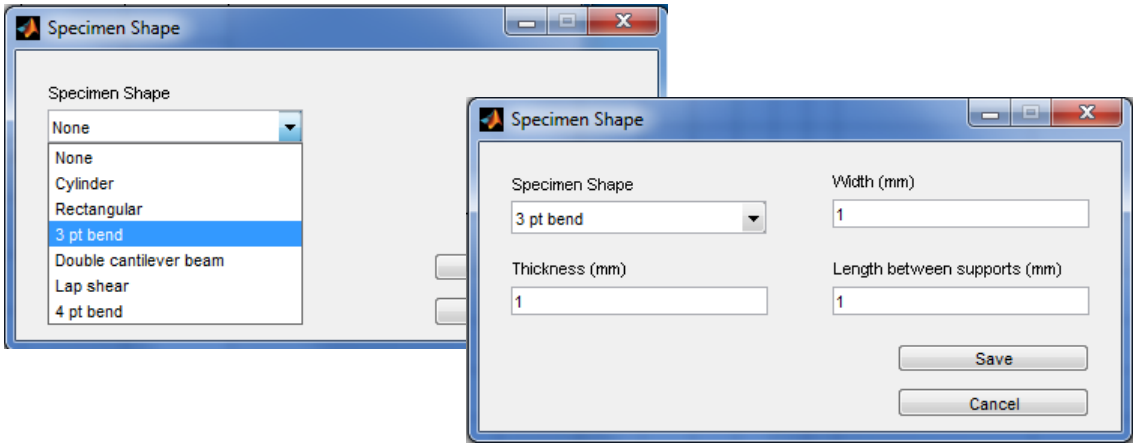
Use commands on the **Setup** menu (**DMA Analysis** window) to enter specimen shape information, to set up channels for DMA calculations and displays, to view or adjust the phase compensation, and to specify linear or logarithmic axes.



Menu Command	Description
Specimen Shape	Selecting a specimen shape converts the stiffness properties to material modulus properties. Normally, the shape information is entered during DMA test setup and is saved in the test file (*.tst). However, you can use this command to enter or adjust shape information for DMA Analysis (this shape information issued for the DMA analysis, but is not saved in the test file).
Channel Setup	Use this command to choose what channels to use in the DMA Analysis displays.
Phase Compensation	This value is the total of the **System Base Phase Compensation Factor** (set during system calibration at the Bose ESG factory) and the **User Phase Compensation Adjustment Factor**.
Axis Setup	Use this command to specify a linear or a logarithmic scale for each plot axis.

Specimen Shape

Selecting a specimen shape converts the stiffness properties to material modulus properties. Select the specimen shape from the list, and then enter the required dimensions, which are displayed for the selected shape. Click **Save** to input this information to the DMA Analysis. Shape and dimension information entered during DMA Analysis is not saved in the DMA test file.



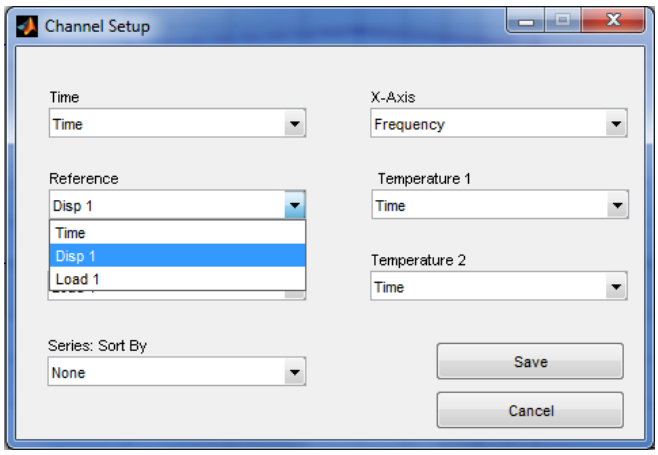
Channel Setup

Use the **Channels** option on the **Setup** menu (**DMA Analysis** window) to select channels for DMA calculations and displays. The **X-Axis** selection determines the x-axis variable for DMA Results (values and plot).

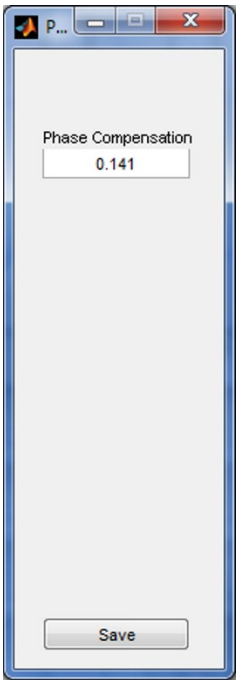
Channel selections for traditional DMA calculations:

- Reference channel: Primary displacement input to the specimen
- Measured channel: Primary force transmitted through the specimen.

NOTE *Alternate channel selections allow analysis of local displacements or resonant behaviors (ratio of input to output force, displacement, or accelerations), but may result in unacceptable units for stiffness or modulus calculations.*



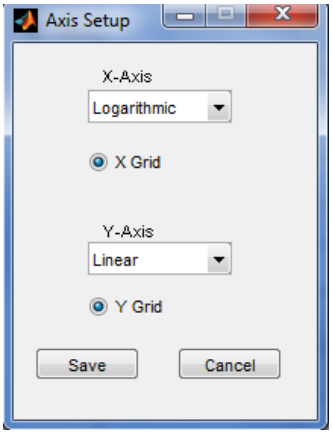
Phase Compensation



This value is the total of the **System Base Phase Compensation Factor** (set during system calibration at the Bose ESG factory) and the **User Phase Compensation Adjustment Factor**. The value is drawn from the header file (*.hdr) generated at the time your output data was collected.

During the course of analyzing your DMA results, you may change this value to adjust the way your results are displayed. However, phase compensation information entered in this window during DMA Analysis is not saved in the DMA test file.

Axis Setup



Use the **Axis Setup** command on the **Setup** menu (**DMA Analysis** window) to define scaling for the **X-Axis** and **Y-Axis** as linear or logarithmic.

Select the **Y Grid** option to include grid lines for scaling on the y-axis in the Amplitude Data and DMA Results plots.

DMA Export Function

Use the **Export** function on the **File** menu to export the DMA data to a comma-delimited text file (*.csv) for easy import into Excel.

Exporting DMA Data

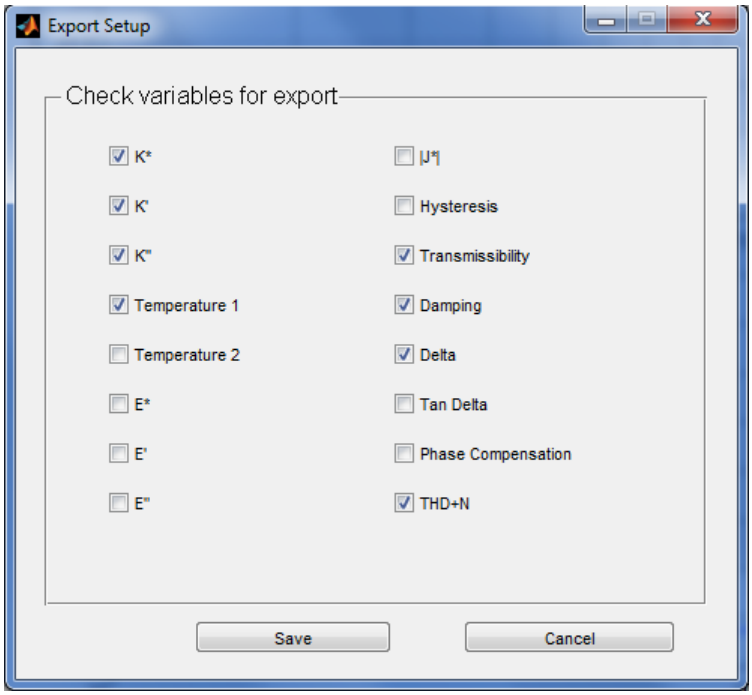
1. Click **Export** on the **File** menu (**DMA Analysis** window) to open the **Export Setup** window. Reference and measured channels are as defined by using the **Channels** option on the **Setup** menu (**DMA Analysis** window).

2. Select all calculated DMA values to include in the export file. Modulus values can be selected if you entered the specimen shape information and dimensions. See "DMA Analysis Calculations" later in this chapter for information about these DMA variables.

3. Click **Save** to export the file.

4. Enter the file name and destination folder for the exported file and click **Save**.

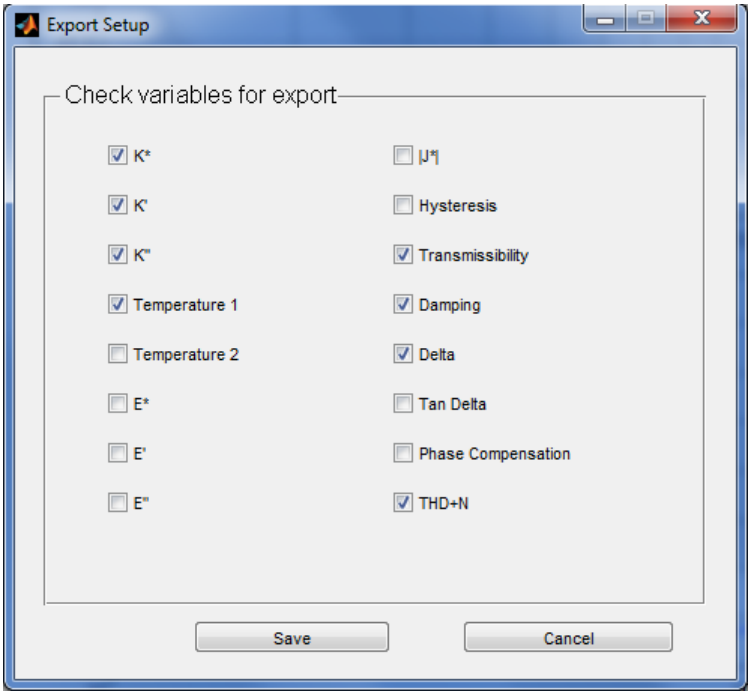
NOTE *If you are working in the secure workspace, DMA will direct you to save the exported file in the secure workspace. After saving the file, you can copy it into the unsecure workspace for analysis with other programs.*



Export File Columns

This section defines the exported DMA data columns, including the source of the data and the variables that influence the values reported in the data file. See "DMA Analysis Calculations" for specific information about how DMA values are calculated.

- Reference and measured channels are as defined by using the **Channels** option on the **Setup** menu (**DMA Analysis** window).
- The specimen shape and dimensions are used for the stress, strain, and modulus calculations.
- Other calculated or measured parameters are the variables that were selected in the **Export Setup** window when the data was exported.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
1	%%%%%%%%%%% Header %%%%%%%%%%%%%%																							
2	########																							
3	Out1_01212011_024410																							
4	0																							
5	Load Hold only on first step:True																							
6	None																							
7	Time	Requeste	Requeste	Requeste	Requeste	Actual Fre	Load Hold	Disp Initia	Actual Ref	Actual Me	Actual Ref	Actual Me	Actual Ter	Actual Ter	K*	K'	K''	E*	E'	E''	Delta	Tan Delta	Damping	Transmiss
8	sec	Hz	N	mm	Sec	Hz	N	mm	mm	N	mm	N	Sec	(N/mm)	(N/mm)	(N/mm)	(N/mm²)	(N/mm²)	(N/mm²)	degree				(mm²/N)
9	60.937	1	2	-5	0	1	-5	1.104	0.040468	2.0119	-0.00011	-4.9989	34.999	34.999	50.1324	50.1323	0.066702	50.1324	50.1323	0.066702	0.076233	0.001331	0.018971	1.0004
10	110.406	2	2	-5	0	2	-5	1.104	0.040666	2.0188	-0.00011	-4.999	29.499	29.499	50.1138	50.1133	0.12298	50.1138	50.1133	0.12298	0.14061	0.002454	0.018139	1.0016
11	153.953	5	2	-5	0	5	-5	1.104	0.040468	2.0051	-0.00037	-5.0127	27.597	27.597	50.1124	50.1091	0.31792	50.1124	50.1091	0.31792	0.3635	0.006344	0.018472	1.0102
12	189.812	10	2	-5	0	10	-5	1.104	0.040468	2.0257	-0.00069	-5.0281	28.7999	28.7999	50.0903	50.0763	0.66044	50.0903	50.0763	0.66044	0.75546	0.013186	0.018858	1.0421
13	245.859	20	2	-5	0	20	-5	1.104	0.040468	2.0325	-1.81E-05	-4.9943	48.1999	48.1999	50.1526	50.0968	1.314	50.1526	50.0968	1.314	1.5013	0.026209	0.01881	1.1905
14	304.203	50	2	-5	0	50	-5	1.104	0.031144	1.5656	1.99E-05	-4.9925	51.1597	51.1597	50.2526	49.9055	3.2764	50.2526	49.9055	3.2764	3.7382	0.065337	0.018769	8.5103
15	361.234	100	2	-5	0	100	-5	1.104	0.011109	0.5562	4.32E-05	-4.9923	49.5999	49.5999	50.7256	49.3223	6.6285	50.7256	49.3223	6.6285	7.5086	0.1318	0.018858	0.33394
16																								
17																								
18																								
19																								
20																								

At the top of the file, the following information is displayed in column A:

Row(s)	Description
2	Date and time stamp when the data was exported.
3 and 4	The text that was entered in the **Specimen ID** and **Description** fields (**DMA status** window) when the test was run.
5	Options that were selected for the DMA test.
6	Identifies the specimen shape and dimension information that was entered prior to running the test.

The following columns are always included regardless of the export selections:

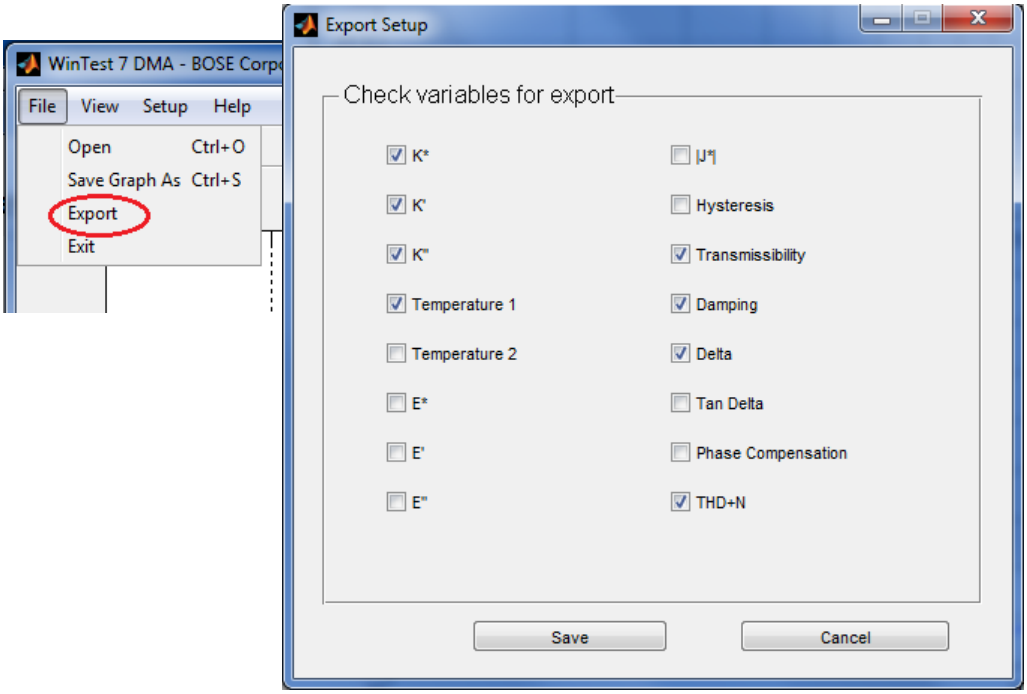
Column	Description
Time (sec)	Elapsed time, in seconds, from the beginning of the test condition (or when the test begin) until data acquisition for this test condition ends.
Requested Frequency, Amplitude, and Mean	These columns report the requested test conditions.
Actual Frequency	Fundamental frequency, returned by the Fourier analysis.
Load Hold Value Requested	For compression tests, the requested force used to establish initial contact. For tensile tests, the requested force used to establish the starting point for the test.

Column	Description
Disp Initial Offset	Displays the displacement transducer reading when the Hold Load value was applied. This value is used to monitor for creep or relaxation during testing or to adjust the length of the sample for strain control testing. Only one value is reported if **Load Hold First Step Only** was selected in the **DMA Setup** window.
Strain Mean	Mean or DC strain level during the test condition, calculated from the shape and the Actual Reference Mean value (also reported). Displayed only if shape information was entered before the file was exported.
Stress Mean	Mean or DC stress level during the test condition, calculated from the shape and the Actual Reference Mean value (also reported). Displayed only if shape information was entered before the file was exported.
Strain Amplitude	Reports the peak-to-peak dynamic strain amplitude during the test condition, calculated from the shape and the Actual Reference Amplitude value (also reported). Displayed only if shape information was entered before the file was exported.
Stress Amplitude	Reports the peak-to-peak dynamic stress amplitude during the test condition, calculated from the shape and the Actual Measured Amplitude value (also reported). Displayed only if shape information was entered before the file was exported.
L0	Length of the sample when the Load Hold value was applied. The value is the height of a rectangular or cylindrical sample. This value is adjusted by the Disp Initial Offset reading if the **Corrected Specimen Height** option is selected in the **DMA Setup** window. For accurate values, the Displacement reading must be zeroed with a gauge block equal to the **Height** value in the **Specimen Info** window (accessed with the **Specimen Shape** button in the **DMA status** window).
Lm	Length of the sample when the mean condition is applied. IT is calculated using L0 plus the Actual Ref. Mean value. The Actual Ref Mean value is negative if the test is run in compression (in this case, the Lm value would be smaller than L0).

Column	Description
Actual Reference Amplitude and Actual Measured Amplitude	These values are based on the 10,000 timed data points acquired for each test condition on the Reference and Measured channels defined at test setup or prior to exporting the data. The DMA Analysis software scans the data to find the maximum and minimum value contained in the array. The Actual Reference Amplitude and the Actual Measured Amplitude values represent the maximum value minus the minimum value of each channel. Max - Min
Actual Reference Mean and Actual Measured Mean	These values are based on the 10,000 timed data points acquired for each test condition on the Reference and Measured channels defined at test setup or prior to exporting the data. The DMA Analysis software scans the data to find the maximum and minimum value contained in the array The Actual Reference Amplitude and the Actual Measured Amplitude values represent the maximum value plus the minimum value of the channel divided by two, respectively. (Max + Min)/2

The following columns are in the exported DMA data file if the corresponding variables were selected in the **Export Setup** window:

Column	Description
Actual Temperature 1 and Actual Temperature 2	Displayed if selected in the **Export Setup** window. These values represent the temperature measured during each test condition. Some systems have both control and a measured temperature channels (option). If Temperature values are selected in the **Export Setup** window but are not available, these values are displayed as 0 seconds.
K*, K′, and K′′ E*, E′, and E′′ Delta Tan delta Damping Transmissibility |J*| (Dynamic Compliance) Hysteresis	Displayed if selected in the **Export Setup** window and calculated as described in the "DMA Analysis Calculations" section. *NOTE* *The Reference Amplitude and Measured Amplitude values reported in earlier columns may be different than the amplitude of the frequency used to compute these values, especially if the data have a small signal-to-noise ratio or are distorted due to specimen nonlinearities.*
THD + N	Total Harmonic Distortion plus Noise, as described in the "DMA Analysis Calculations" section.
Phase Compensation	This value is reported as entered in the **Phase Compensation** window (**Setup** menu, **DMA Analysis** window).



DMA Analysis Calculations

Refer to the following original documents for a complete description of calculations and techniques used in the DMA Analysis software:

- American Society for Testing and Materials (ASTM) D5992-96 Standard Guide for Dynamic Testing of Vulcanized Rubber and Rubber-Like Materials Using Vibratory Methods
- Society of Automotive Engineers (SAE) J1-85 NOV95 Testing Dynamic Properties of Elastomeric Isolators
- American Society for Testing and Materials (ASTM) D790-10 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- American Society for Testing and Materials (ASTM) D6272-03 Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials by Four-Point Bending

The WinTest DMA Analysis software uses a Fourier analysis technique to analyze the timed data of a reference and a measured channel. The Fourier analysis technique models a measured signal as a series of sine functions of varying amplitude and phase. The amplitude and phase behavior of the largest (fundamental) frequency of two channels is used in the analysis to calculate the following:

- Phase relationship between the channels
- Ratio of the measured channel to the reference channel

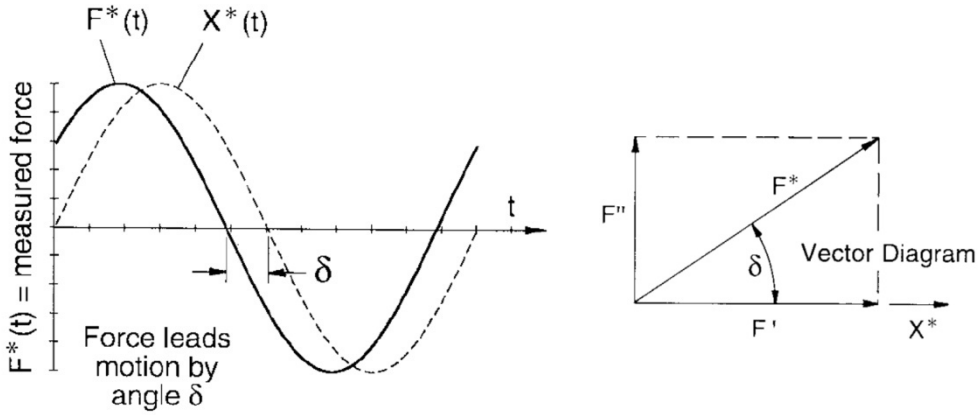
Typically, displacement is chosen as the reference channel and force is chosen as the measured channel. The phase angle then represents the viscous behavior of the sample, and the ratio of the amplitudes represents the stiffness of the sample, which can be converted to a modulus if shape information is available.

The WinTest DMA software optimizes the data acquisition rate, the test frequency, and the number of cycles of data acquired during the test to ensure that the Fourier analysis returns values of phase and stiffness that best represent the test specimen behavior. The DMA software will collect 10,000 data points on a minimum of 2 complete cycles for the Fourier analysis. The number of data cycles over which the 10,000 data points are collected increases with frequency to allow the data to represent complete cycles as much as possible.

The DMA Analysis software uses MATLAB algorithms and commands to convert the timed data acquired in WinTest to the dynamic specimen properties. The data is available in ASCII form in the header file (*.hdr) and in the data files (*.dat) should users want to verify or analyze the DMA calculations using a different technique.

Components

The DMA Analysis software calculates the following parameters for components:



- F* = dynamic peak-to-peak force amplitude
- X* = dynamic peak-to-peak displacement amplitude
- K* (dynamic stiffness) = F*/X* returned by the Fourier analysis as the ratio of the measured channel to the reference channel (force and displacement).
- Phase (δ) is returned by the Fourier analysis as the phase relationship between the measured channel and the reference channel (typically force and displacement).
- K′ = Storage stiffness = K* (cos δ)
- K″ = Loss stiffness = K* (sin δ)
- C = Damping = K* (sin δ)/ω where ω= 2π (frequency)
- Hysteresis = Energy loss per cycle = π F*X* sin δ
- Tr=Transmissibility

$$\sqrt{\frac{\left(C^2\omega^2 + K'^2\right)}{\left(K' - m\omega^2\right)^2 + C^2\omega^2}}$$

Where m = mean mass = measured mean force/gravitational constant

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NOTE *This transmissibility calculation no longer appears in the current version of the J1085 document.*

Materials

For materials, the DMA Analysis software calculates the tangent of the phase angle and uses the specimen shape to convert the stiffness and phase information to provide the following:

Tan Delta = tangent of the phase angle = tan δ

E* or G* for shear = Complex or Dynamic Modulus = K*/shape factor

E′ or G′ for shear = Storage Modulus = K′/shape factor

E″ or G″ for shear = Loss Modulus = K″/shape factor

Shape Factors

The DMA Analysis software uses the following calculations for the selectable shape factors:

Tension/Compression

Cylindrical specimen

Shape factor = $(\pi / \text{Height})\ (\text{Diameter}/2)^2$

$\varepsilon = X^*/\text{Height}$

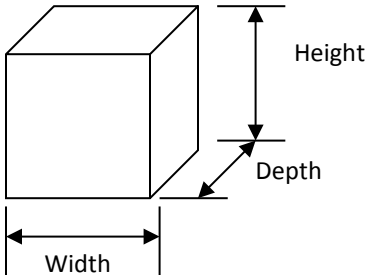
$\sigma = F^*/\ (\pi\ (\text{Diameter}/2)^2)$

Rectangular specimen

Shape factor = (Width x Depth)/Height

$\varepsilon = X^*/\text{Height}$

$\sigma = F^*/\ (\text{Width x Depth})$



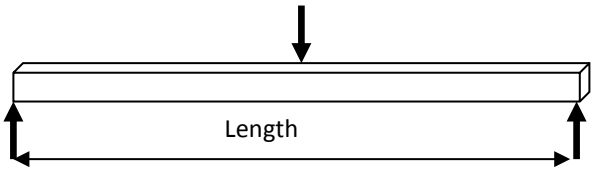
Bending

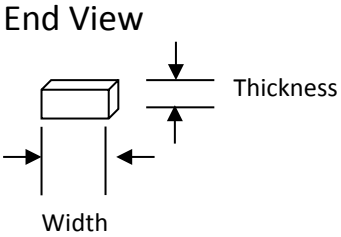
3 Point Bend specimen (free end)

shape factor = 4 Width x $\text{Thickness}^3/\text{Length}^3$

$\varepsilon = 6^*\ X^*\text{Thickness}/\text{Length}^2$

$\sigma = 3\ ^*F^*\text{Length}/(2\ \text{Width x Thickness}^2)$



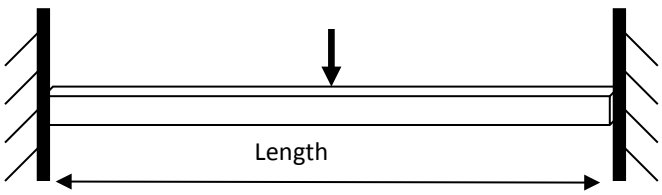


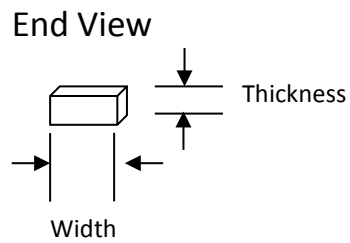
3 Point Bend specimen (double cantilever)

Shape factor = $\frac{2(\text{Width}) \times (\text{Thickness})^3}{(\text{Length})^3}$

$\varepsilon = 12\ X^* \text{ Thickness}/\text{Length}^2$

$\sigma = 3\ F^* \text{ Length}/\ (4 \text{ Width} \times \text{Thickness}^2)$





4 Point Bend specimen

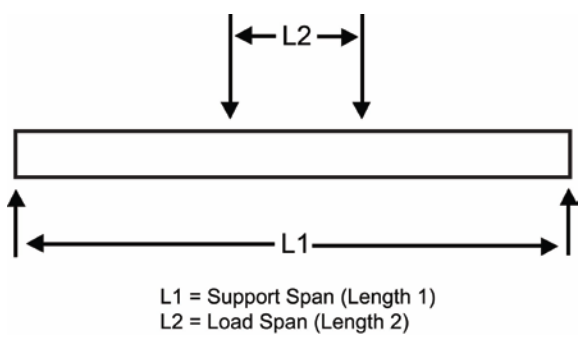
$A = (L1 - L2)/2$

where L1 – Support span and L2 = Load span

Shape factor = $\frac{4 \times \text{Width} \times \text{Thickness}^3}{(3 \times A \times L1^2 - 4 \times A^3)}$

$\varepsilon = 12\ X^* \times \text{Thickness}/3 \times A \times L1^2 - 4xA^3$

$\sigma = 3\ F^* \times A/\ (\text{Width} \times \text{Thickness}^2)$



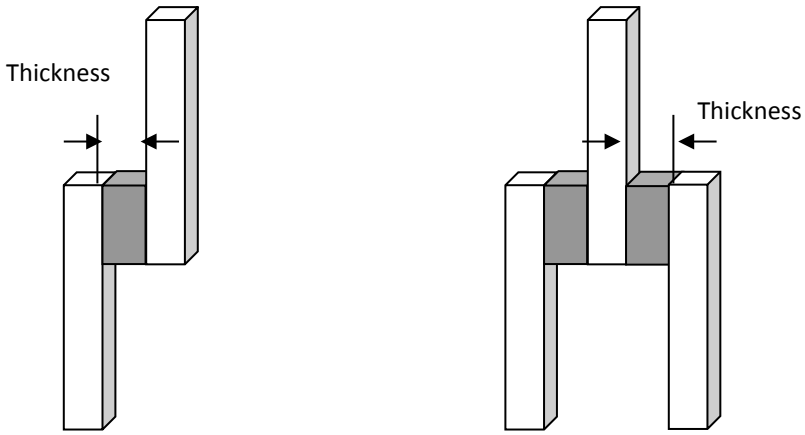
Shear

Single or Double lap

Shape factor = Total Area in Shear / Thickness

ε = X*/Thickness

σ = F*/Total Area in Shear



Total Harmonic Distortion plus Noise (THD + N)

The total harmonic distortion plus noise is defined as the ratio of the sum of the powers of all harmonic components plus the broad band noise power to the power of the fundamental frequency.

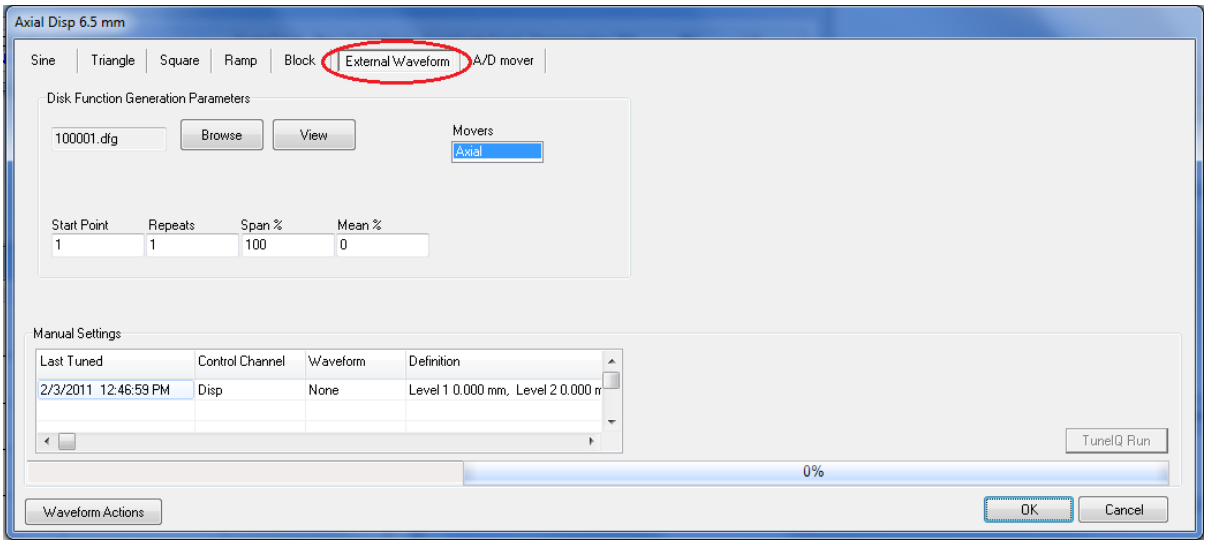
$$THD + N = \sum \text{Harmonic Powers} + \text{Noise Power} / \text{Fundamental Power}$$

THD + N < 10% is considered good performance. If the THD + N value is not as expected although the specimen is mounted correctly in the test fixture, contact Bose ESG Technical Support for assistance.

Chapter 16
External Waveform Option

External Waveform is an optional WinTest feature that allows users to program custom waveforms, time histories, or extended function generation sequences to use in tests where a nonstandard or more complex drive function is required.

When the External Waveform option is installed, the **Waveform Setup** window includes an **External Waveform** tab.



External Waveform File Structure

External waveform files can be constructed in either of two ways: point by point, or by specifying frequency/level end levels.

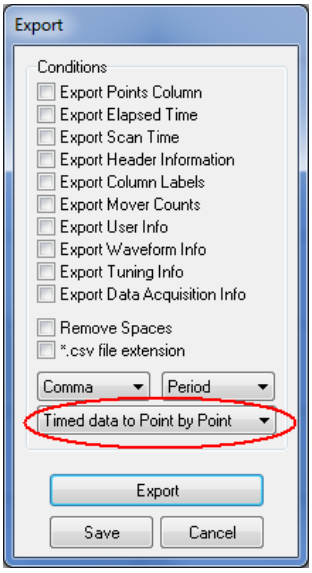
	Point by Point	Frequency/Level
General description	Defines evenly spaced data points (levels) as a function of time.	Defines a group of end levels joined in WinTest with either a half sine or a ramp, with constant or variable time between each level. The resulting file (*.dfg) provides a waveform with a sequence of levels that is similar to a block waveform, but easier to define.
Created by	Exporting a WinTest Timed Data file or an ASCII text file in the appropriate format to a Point by Point file (*.pbp).	Exporting an ASCII file in the appropriate format to an External Waveform (*.dfg) file.
Levels	Levels are connected with steps, so the time between points must be approximate the system update rate to avoid stair-step behavior. Specify end levels as a percent of the control channel full scale.	Levels can be connected with either a half sine or a ramp.
Movers	Single-axis or multi-axis systems.	Single-axis systems only.
Compensation	Not available	Matrix Peak Valley compensation can be used to achieve the desired end levels.

Point by Point External Waveform Files

Point by point external waveform files define evenly spaced data points (levels) as a function of time. This type of external waveform is created by exporting a Timed Data file or a user-defined ASCII file in the appropriate format as a Point by Point (*.pbp) file.

Creating a Point by Point File from a Timed Data File

Use the following steps to create a Point by Point (*.pbp) from a WinTest Timed Data file:



1. Acquire the Timed Data file in WinTest. The data file can include just one cycle or the entire pattern. When the file is used to create the external waveform, each data acquisition channel will be interpreted as a control channel, so choose data acquisition channels appropriately.

2. In WinTest, export the timed data file as a Point by Point (*.pbp) file.

   a. Click **Export** on the **Data Acquisition** menu (**Test Setup** window) to open the **Export** window.

   b. Clear all export conditions. Be sure to select **Timed data to Point by Point**.

   c. Click the **Export** button to start the export process.

   d. Select the timed data file you want to export. To locate the file, it may be necessary to change the **Files of type** setting to "All Files."

   e. In the **Export** window, specify the file name, destination, and file type for the exported file (the extension is not necessary). Be sure to select the **Point by Point (*.pbp)** for the destination file type. Save the exported file.

NOTE *If you are working in a secure workspace, WinTest will direct you to save this file in a secure workspace. However, you can create new folders in the secure workspace to organize your files.*

Creating a Point by Point External Waveform from an ASCII File

Use the following steps to create a Point by Point (*.pbp) external waveform file from a user-defined ASCII file:

1. Create the ASCII file. You can use Excel or any text editor to create the ASCII file, including the **Edit/Compile** window in WinTest.

   The required format for the ASCII file is as shown below, starting at the top of the file. Replace *italicized text* with the appropriate values.

   Drive File Point by Point
   Comment
   Date
   Number of movers
   Time interval between points
   Level 1
   Level2
   Level3
   etc.

```
Drive File Point by Point
Comments
2003-07-22
1
.001
0
0.6506
1.076702
1.139553
0.839139
0.314191
-0.2108
-0.51135
-0.44867
-0.02275
0.627701
1.2782
1.704234
1.767013
```

   Number of movers: In this line, enter the number of movers to be controlled by the waveform. For multiple movers, see "Multi-Axial Point by Point Waveforms" in this chapter for additional information.

   Time interval between points*:* The value in this line is used to scale the waveform frequency. For example, if the external waveform file contains 1,000 points and the time interval between points is 0.001 (as shown in the example file above), each pass through the waveform takes 1 second. Note that the minimum and maximum values for the time interval between points depend on the system update rate, which is typically 0.0002 seconds (per point):

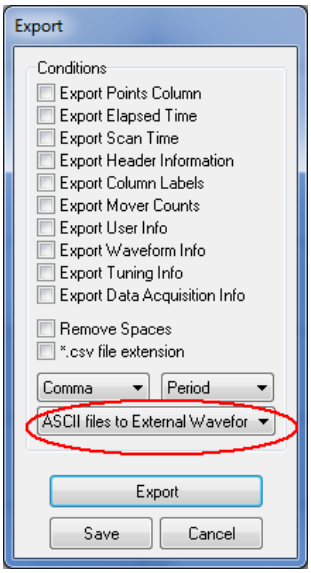
   - Minimum time interval between points = 0.0002
   - Maximum time interval between points = 256 x 0.0002 = 0.0512

   Levels**:** Enter all levels as a percent of the control channel full scale.

2. Save the ASCII file with the Formatted Text (Space Delimited) format in the Bose\WinTest directory. Ignore any warnings about lost information.

3. Close the ASCII file. If the file remains open, you will get a read error when you try to export the file.

4. In WinTest, export the data file as a Point by Point (*.pbp) file.



   a. Click **Export** on the **Data Acquisition** menu (**Test Setup** window) to open the **Export** window.

   b. Clear all export conditions. Be sure to select **ASCII files to External Waveform**.

   c. Click the **Export** button to start the export process.

   d. In the **Select** window, select the Timed data file to export. To locate the file, it may be necessary to change the **Files of type** setting to "All Files."

   e. In the **Export to** window, specify the file name and file type for the exported file. Type the file name (the extension is not necessary) and select or create a destination folder. Be sure to select the **Point by Point (*.pbp)** for the destination file type. Save the exported file.

NOTE *If the project file is secure, WinTest will direct you to save the file in the SecureWorkspace folder, but you can create new folders there to organize your files.*

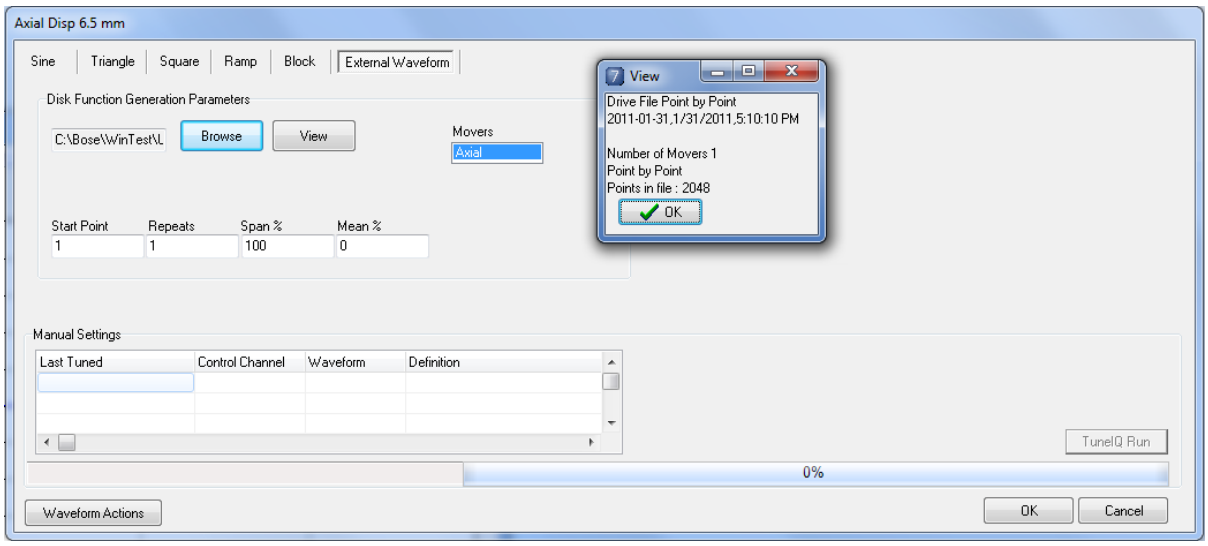
Running a Point by Point External Waveform

NOTE *The External Waveform tab is present only if the External Waveform option is installed. If you need to add the External Waveform option, contact Bose ESG for more information.*

1. Check the current mover in the **Test Setup** window. If necessary, select the appropriate mover for the external waveform.

2. Check the control channel for this mover. If necessary, click **Set Control Channel** on the **Mover** menu (**Test Setup** window). When the **Control Channel** window opens, select the appropriate control channel for the external waveform.

3. Click the **Waveform Setup** button (**Test Setup** window) to open the **Waveform Setup** window. Click the **External Waveform** tab.



4. Click **Browse** to find and select the Disk Point By Point file (*.pbp) that you want to run. Be sure to select the **Disk Point By Point (*.pbp)** file type in the **Open File** window. Click **Open** to open the file.

5. Click the **View** button to view summary information about the selected file, and then click **OK** to close the **View** window.

6. Tune the external waveform as you would a Block waveform: set up a cyclic waveform with levels and frequency that include the highest level and frequency in the block waveform, tune this cyclic waveform, then click the **External Waveform** tab before running the test.

7. Enter the following parameters:

Parameter	Description
Start Point	Point number (sequence) where you want to start the test. Type 1 to start the test at the first point.
Repeats	Number of times to repeat the sequence of points. The number of points is absolute and is independent of the cycle count displayed in the **Test Status** window.
Span %	Percent to scale each point in the waveform, as a percent of the original value. The default is 100%, which does not shift the original values. As an example, Span 200% would double the levels in the external waveform file.
Mean %	Shifts all points of the waveform by this value (as a percent of full scale). The default value is 0%, which does not shift the original values.

NOTE *The **Adjust Waveform** window can be used to modify the **Span %** and **Mean %** settings while the external waveform is running.*

8. Set the waveform actions (Stop Level, Hold Level, Finish Action, etc.) as appropriate for this specimen and test, and then click **OK** to close the **Waveform Setup** window with the External Waveform tab selected.

9. To preview the external waveform before running the test, do the following:

   a. Make sure that Mover Power is off.

   b. Open and set up the Scope display to show the command channel versus time for the appropriate mover(s).

   c. Click the **Run** button (**Test Setup** window) to start the waveform generation.

   d. Make any adjustments to the waveform as needed, save the file, and open the file in the External Waveform tab again.

10. Complete other test setup tasks as required and then start the test. See Chapter 8, "Running and Managing Tests," for more information.

NOTE *Waveform Compensation is not available for point by point external waveforms.*

Multi-Axial Point by Point Waveforms

The point by point method can be used to create waveforms for single-axis or multi-axis test configurations. To define and run a multi-axial (multiple mover) test with an external point by point waveform, follow all of the steps in the "Creating a Point by Point External Waveform from an ASCII File" section, but create and export an ASCII file with multiple columns. Each column represents the desired waveform for each axis (mover).

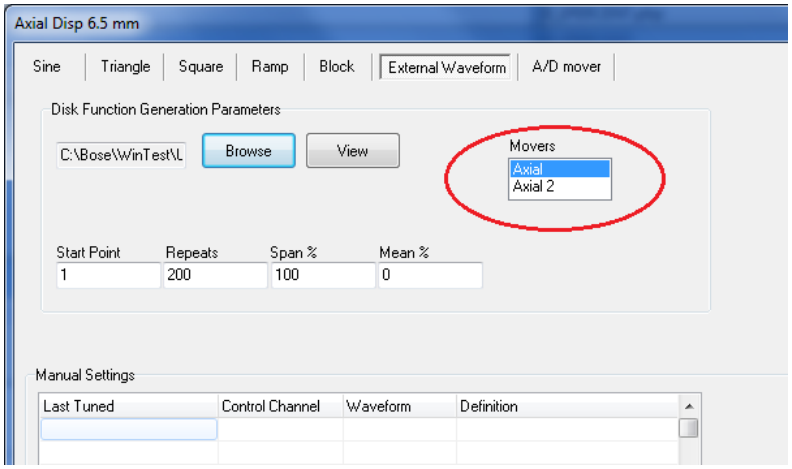
The example shows a two-column ASCII file that can be exported to create a Point by Point external waveform file for a two-mover system. The columns in the ASCII file must be in the same order as movers are listed in the **Test Setup** window.

```
Drive File Point by Point
Comments
2003-07-22
2
.01
0        0
  0.0628  0.0628
  0.1253  0.1253
  0.1874  0.1874
  0.2487  0.2487
  0.3090  0.3090
  0.3681  0.3681
  0.4258  0.4258
  0.4817  0.4817
  0.5358  0.5358
  0.5878  0.5878
  0.6374  0.6374
  0.6845  0.6845
  0.7290  0.7290
  0.7705  0.7705
  0.8090  0.8090
  0.8443  0.8443
  0.8763  0.8763
```

In the **External Waveform** tab (**Waveform Setup** window), make sure that the **Movers** list shows movers in the same order as in the file. Tuning information should be displayed for both control channels. All other functions are the same as for the Point by Point method.

Keep in mind the following when running a multi-axis external waveform file:

- Make sure that both movers have been appropriately tuned.
- Select the first mover before you open the **Waveform Setup** window to open the External Waveform file.
- Turn on power to both movers.
- Be sure to select both movers in the **Run** window when you run the external waveform file.



Frequency/Level External Waveform Files

Frequency/Level external waveform files combine sinusoidal or ramp waveforms to define a series of levels, or steps. The time between levels can be constant, or you can specify the frequency or velocity for each step. This type of external waveform can be used for single-axis (one mover) tests only.

Creating a Constant Frequency/Level External Waveform

This type of external waveform defines a series of end levels at constant frequency. The type of waveform used to connect the end levels (half sine or triangle) and the constant frequency or velocity are specified in the External Waveform tab when you run the test.

Use the following steps to create an external Frequency/Level waveform with constant frequency or velocity from a user-defined ASCII file:

1. Create the ASCII file. Excel or any text editor to create the ASCII file, including the **Edit/Compile** window in WinTest.

   The required format for the ASCII file is as shown below, starting at the top of the file. Replace *italicized text* with appropriate values or information.

   Drive File
   Comments
   Identification
   Date
   Number of movers
   Constant Frequency/Velocity
   Level1
   Level2
   Level3
   etc.

```
Drive File
Comments
7/22/2003
       1
Constant Frequency/Velocity
      15
     -15
```

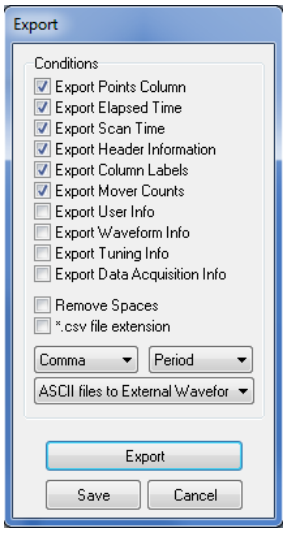
   Number of movers: Always 1 for frequency/level external waveform files

   ***Levels*:** Enter all levels as a percent of full scale.

2. Save the ASCII file with the Formatted Text (Space Delimited) format (*.prn) in the Bose\WinTest directory. If you are working in the Secure Workspace, WinTest will direct you to save this file in the Secure Workspace (you can create new folders to organize files). Ignore any warnings about lost information.

3. Close the ASCII file. If the file remains open, you will get a read error when you try to export the file.

4. In WinTest, export the ASCII file as an External Waveform (*.dfg) file.



   a. Click **Export** on the **Data Acquisition** menu (**Test Setup** window) to open the **Export** window.

   b. Set the export conditions as shown in the example **Export** window. Be sure to select **ASCII files to External Waveform**.

   c. Click the **Export** button to start the export process.

   d. In the **Select** window, select the Timed data file to export. To locate the file, it may be necessary to change the **Files of type** setting to "All Files."

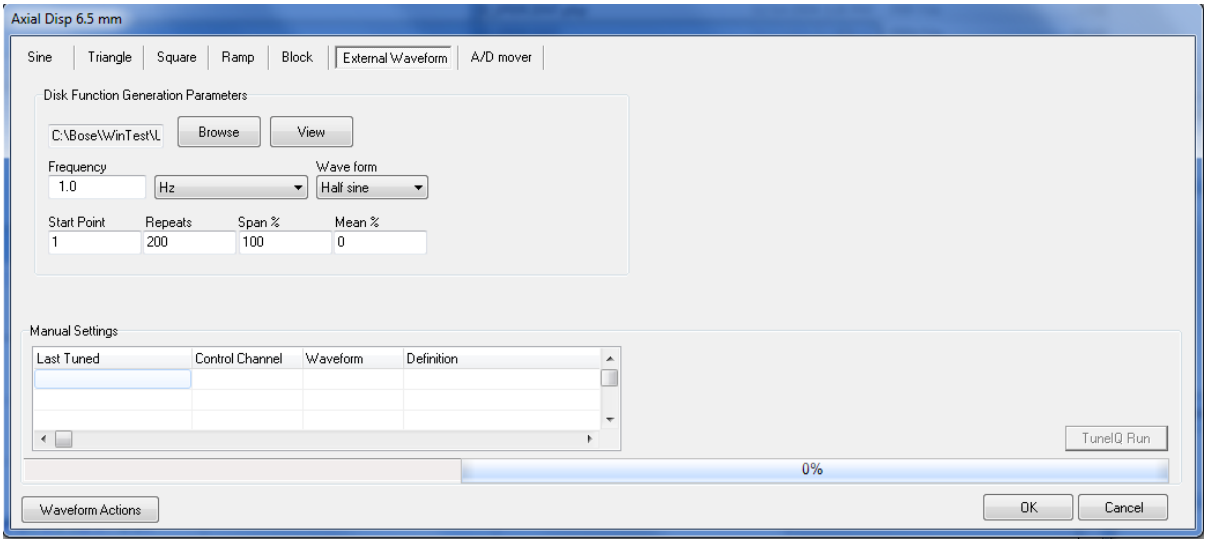
   e. In the **Export to** window, specify the file name and file type for the exported file. Type the file name (the extension is not necessary) and select or create a destination folder. Be sure to select the **Disk Function Generation (*.dfg)** file type. Save the exported file.

NOTE *If you are working in a secure workspace, WinTest will direct you to save this file in the Secure Workspace. However, you can create new folders in the Secure Workspace to organize your files.*

Running a Constant Frequency/Level External Waveform

NOTE *The External Waveform tab is present only if the External Waveform option is installed. If you need to add the External Waveform option, contact Bose ESG for more information.*

1. Check the current mover in the **Test Setup** window. If necessary, select the appropriate mover for the external waveform.
2. Check the control channel for this mover. If necessary, click **Set Control Channel** on the **Mover** menu (**Test Setup** window). When the **Control Channel** window opens, select the appropriate control channel for the external waveform
3. Click the **Waveform Setup** button (**Test Setup** window) to open the **Waveform Setup** window. Click the **External Waveform** tab.
4. Click **Browse** to find and select the Disk Function Generation file (*.dfg) that you want to run, then click **Open**. Be sure to select the Disk Function Generation (*.dfg) file type in the **Open File** window. The **View** window will open. Click **OK** to load the file and close the **View** window. (You can click the View button to view this information again.)
5. Tune the external waveform as you would a Block waveform: set up a cyclic waveform with levels and frequency that include the highest level and frequency in the block waveform, tune this cyclic waveform, then click the **External Waveform** tab before running the test.
6. In the waveform setup window, select **Half sine** or **Half triangle** and enter the desired frequency (Hz) or velocity (units per second).



7. Enter the following parameters:

Parameter	Description
Start Point	Point number (sequence) where you want to start the test. Type 1 to start the test at the first point.
Repeats	Number of times to repeat the sequence of points. The number of points is absolute and is independent of the cycle count displayed in the **Test Status** window.
Span %	Percent to scale each point in the waveform, as a percent of the original value. The default is 100%, which does not shift the original values. As an example, Span 200% would double the original values.
Mean %	Shifts all points of the waveform by this value (as a percent of full scale). The default value is 0%, which does not shift the original values.

8. Set the waveform actions (Stop Level, Hold Level, Finish Action, etc.) as appropriate for this specimen and test, then click **OK** to close the **Waveform Setup** window with the **External Waveform** tab selected.

9. To preview the external waveform before running the test, do the following:

    a. Make sure that Mover Power is off.

    b. Open and set up the Scope display to show the command channel versus time for the appropriate mover(s).

    c. Click the **Run** button (**Test Setup** window) to start the waveform generation.

    d. Make any adjustments to the waveform as needed, export and save the modified file, and use the **Browse** button to open the *.dfg file again.

10. Complete other test setup tasks as required and then start the test. See Chapter 8, "Running and Managing Tests," for more information.

Creating a Variable Frequency/Level External Waveform

Use the following steps to create a Frequency/Level external waveform with variable frequency or velocity between steps.

1. Create the ASCII file. You can use Excel or any text editor to create the ASCII file, including the **Edit/Compile** window in WinTest.

   The required format for the ASCII file is as shown below, starting at the top of the file. Replace *italicized text* with appropriate value or information.

   Drive File
   Comment
   Date
   Number of movers
   Frequency/Level
   Frequency1 *Level1*
   Frequency2 *Level2*
   Frequency3 *Level3*
   etc.

   ```
   Drive File
   Comments
   7/22/2003
   1
   Frequency/Level
   1     15
   1     -15
   0.5   15
   0.5   -15
   ```

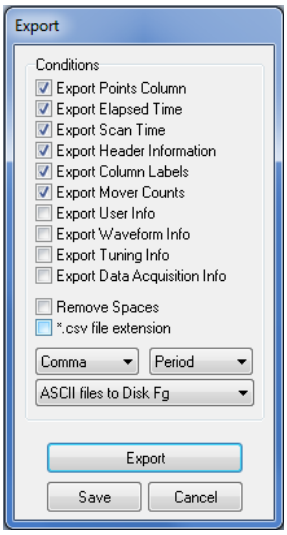
   ***Number of movers*:** Always 1 for frequency/level external waveform files.

   Frequency/Level: Place the frequency/velocity values in column 1 and the level values in column 2. Enter all levels as a percent of full scale.

2. Save the ASCII file with the Formatted Text (Space Delimited) format in the Bose\WinTest directory. Ignore any warnings about lost information.

3. Close the ASCII file. If the file remains open, you will get a read error when you try to export the file.

4. In WinTest, export the ASCII file as an External Waveform (*.dfg) file.



   a. Click **Export** on the **Data Acquisition** menu (**Test Setup** window) to open the **Export** window.

   b. Set the export conditions as shown in the example **Export** window. Be sure to select **ASCII files to External Waveform**.

   c. Click the **Export** button to start the export process.

   d. In the **Select** window, select the Timed data file to export. To locate the file, it may be necessary to change the **Files of type** setting to "All Files."

   e. In the **Export to** window, specify the file name and file type for the exported file. Type the file name (the extension is not necessary) and select or create a destination folder. Be sure to select the **Disk Function Generation (*.dfg)** file type. Save the exported file.

NOTE *If you are working in a secure workspace, WinTest will direct you to save this file in a secure workspace. However, you can create new folders in the secure workspace to organize your files.*

Running a Variable Frequency/Level External Waveform

NOTE *The External Waveform tab is present only if the External Waveform option is installed. If you need to add the External Waveform option, contact Bose ESG for more information.*

1. Check the current mover in the **Test Setup** window. If necessary, select the appropriate mover for the external waveform.
2. Check the control channel for this mover. If necessary, click **Set Control Channel** on the **Mover** menu (**Test Setup** window). When the **Control Channel** window opens, select the appropriate control channel for the external waveform.
3. Click the **Waveform Setup** button (**Test Setup** window) to open the **Waveform Setup** window. Click the **External Waveform** tab.
4. Click the **Browse** button to find and select the *.dfg file to run. Be sure to select the **Disk Function Generation (*.dfg)** file type in the **Open File** window. Click **Open** to open the file. The **View** window displays summary information about the selected file.
5. Tune the external waveform as you would a Block waveform: set up a cyclic waveform with levels and frequency that include the highest level and frequency in the block waveform, tune this cyclic waveform, then click the **External Waveform** tab before running the test.
6. In the **Waveform** list, select **Half sine** if the external waveform file defines variable frequency values; select **Half triangle** if the external waveform file defines variable velocity (rate) values.
7. Enter the following parameters:

Parameter	Description
Start Point	Point number (sequence) where you want to start the test. Type 1 to start the test at the first point.
Repeats	Number of times to repeat the sequence of points. The number of points is absolute and is independent of the cycle count displayed in the **Test Status** window.
Span %	Percent to scale each point in the waveform, as a percent of the original value. The default is 100%, which does not shift the original values. As an example, Span 200% would double all levels in the external waveform file.
Mean %	Shifts all points of the waveform by this value (as a percent of full scale). The default value is 0%, which does not shift the original values.

8. Click the **Waveform Actions** button and set waveform actions (Stop Level, Hold Level, Finish Action, etc.) as appropriate for this specimen and test.

9. Click **OK** in the waveform setup window with the **External Waveform** tab selected.

10. To preview the external waveform before running the test, do the following:

    a. Make sure that mover power is off.

    b. Open and set up the Scope display to show the command channel versus time for the appropriate mover(s).

    c. Click the **Run** button (**Test Setup** window) to start the waveform generation.

    d. Make any adjustments to the waveform as needed, export and save the modified file, and use the **Browse** button to open the *.dfg file again.

Complete other test setup tasks as required and then start the test. See Chapter 8, "Running and Managing Tests," for more information.

Chapter 17
A/D Mover Option

A/D Mover is a WinTest option that lets you connect an external waveform generator to an available channel on the PCI box to command a mover. The external waveform generator provides an input voltage signal (±10 volts), which creates a command value that is proportional to the full scale of the control channel. Example: if the A/D Mover input signal is 7.5 V and controls a Displacement control channel with a full scale of 12.5 mm, the command created is +9.38 mm.

When the A/D Mover option is installed in WinTest, the **Waveform Setup** window includes an A/D Mover tab, as shown below. If the A/D Mover tab is not included, contact Bose ESG for information about adding this WinTest option.

To set up and run a test with A/D Mover:

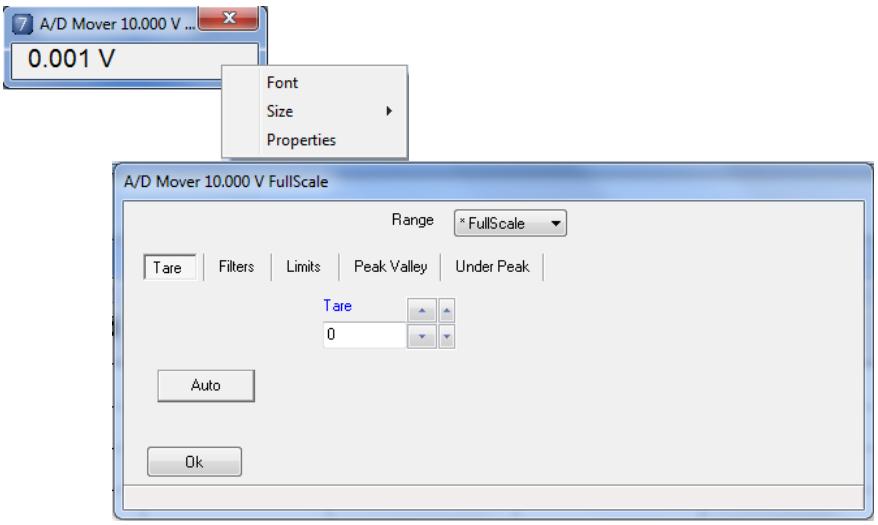
1. Make sure that the A/D Mover channel is defined in the project file. (an easy way to do this is to display the **Meter** window for the A/D Mover channel.)

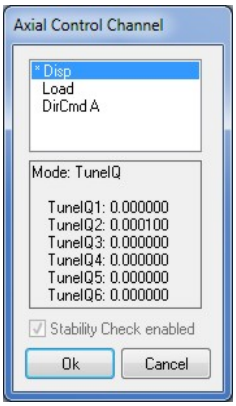
2. Tare the A/D Mover channel.

    a. Make sure that the output from the external waveform generator is 0 V, steady state.

    b. Right-click in the **A/D Mover Meter** window and then click **Properties**.

    c. Click the **Tare** tab in the channel properties window and then click **Auto**. The reading in the **Meter** window for the **A/D Mover channel** window and the output from the external waveform generator should now match.





3. Select the control channel (Load, Disp, Torque, etc.). This is the channel that the A/D mover will actually control. The **Adjust Mover** button (**Test Setup** window) provides an easy way to do this.

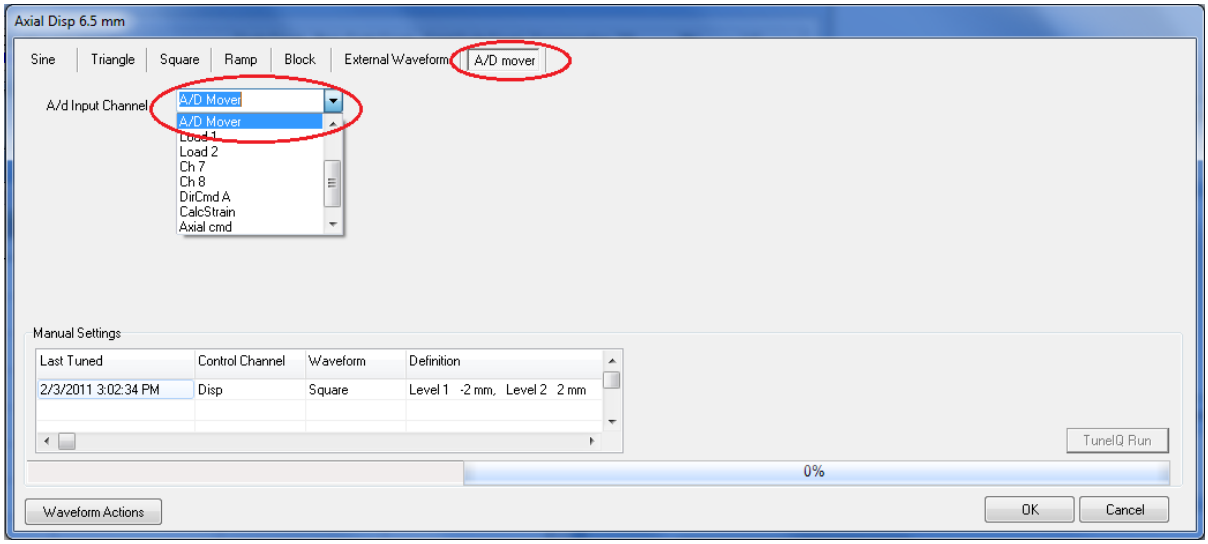
4. Install the fixtures and the specimen (see the *System Reference Manual* for your test instrument).

5. Define all applicable limits based on the target end levels. Remember that the input voltage from the external waveform generator is proportional to the full-scale value for the control channel.

6. Set up the display windows (**Meters**, **Scopes**, etc.) and define data acquisition for the test.

7. Click **Waveform Setup** (**Test Setup** window) and then click the **Sine** tab in the setup window. Define a sine wave with amplitude smaller than the desired A/D Mover amplitude, and then run TuneIQ. If TuneIQ fails, manual tuning may be required.

8. Now click the **A/D Mover** tab in the setup window and select the **A/D Mover** channel from the **A/D/Input Channel** list. Close the setup window with the **A/D Mover** tab selected.



9. Click the **Mover Power** button (**Test Setup** window) and turn on mover power.

10. Click the **Run** button (**Test Setup** window), then click **Zero Start** or **Start** in the window to start the test.

11. Start the external waveform generator to provide the command signal.

Appendix A
Restoring Project Files and Programs

Beginning with WinTest 7, Bose supplies recovery disks for the Windows operating system and WinTest-specific application software. If complete reinstallation is required, you will no longer be able to use the standard Windows settings and then install the necessary software to restore WinTest to functionality.

Administrator privileges are needed to perform most of the tasks required to restore your system to full functionality. Refer to the *WinTest 7 Controls Administrator Manual* for further information.

Bose provides the following backup media for your system:

- Zipped backup files on the hard drive, located in C:\Bose. The typical file name is *1x-xxx*.zip (where *1x-xxx* is your system ID).
- System Repair Disc (a CD)
- System Image Disc (a DVD)

If your project file is no longer functioning, you have two options (try them in the order given):

1. First, use the Rebuild file (*.rebuild) in your Tests folder to recreate the project file (Administrative privileges are not required). Refer to the "Open a Rebuild File and Save as a Project File in WinTest 7" section in Chapter 2 for specific instructions.
2. If step 1 is not successful, locate the *1x-xxx* zipped folder in the C:\Bose folder. Inside the *1x-xxx* folder, navigate to the Backup\Software\v.7.1*x* (*yyy*) folder and extract the *.prj file (*yyy* is the WinTest Build number). Replace your existing project file in the Tests directory with this file. This step requires Administrator privileges if the project is in the Secure Workspace.

If you are having a problem with one of the installed programs relating to WinTest, you also have two options:

1. First, use the Windows Repair function. This function is typically located in the **Control Panel/Programs and Features** directory. Right-click on the desired program, and then click **Repair**.
2. If step 1 is not successful, you will have to reinstall the applications by running the installers from the zipped backup archive located in C:\Bose. For specific instructions, refer to the *WinTest 7 Controls Administrator Manual*.

If none of the preceding options work, we recommend that you contact Bose ESG Technical Support for further assistance. If you decide to restore the computer to the state in which it was originally shipped from the Bose ESG factory, refer to the *WinTest 7 Controls Administrator Manual* for instructions. This procedure requires Administrator privileges.

IMPORTANT! Restoring the computer to its as-shipped state will replace all contents on the hard drive. Be sure to back up all of your data before restoring the WinTest computer.

BEFORE restoring your system to its as-shipped state from the backup discs, be sure to back up all of the following folders:

- C:\Bose\WinTest\Secure Workspace
- C:\Bose\WinTest\Unsecure Workspace
- C:\Bose\WinTest\Calibration
- C:\Bose\WinTest\TestActivity folder (Security and Activity logs)

Contact Bose ESG Technical Support if you have any problems or questions regarding your installation.

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User Notes Area

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