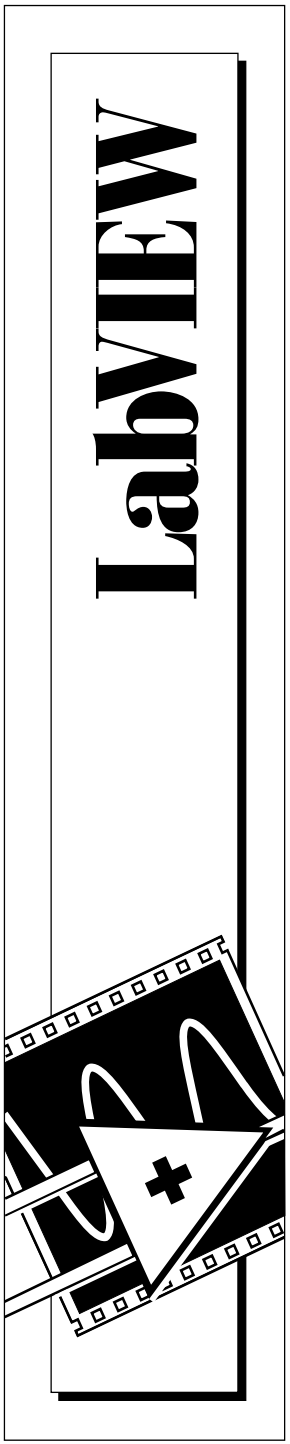

LabVIEW® Test Executive Reference Manual

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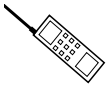

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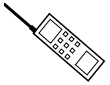

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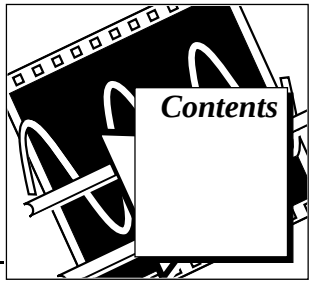

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Chapter 3
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Chapter 4
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Chapter 5
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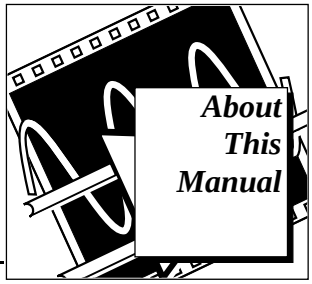


This manual describes the LabVIEW Test Executive 5.0 package. You can use this add-on package for automated sequencing of test programs in LabVIEW 4.*x*.

Organization of This Manual

This manual is organized as follows:

- Chapter 1, *Introduction*, lists the main features of the Test Executive, explains its execution model, and describes its three operating levels.
- Chapter 2, *Getting Started*, introduces the basic concepts of Test Executive operation and test sequence development.
- Chapter 3, *Operating the Test Executive*, describes the operation of the main Test Executive front panel—the controls, indicators, and operator dialog boxes.
- Chapter 4, *Creating Tests and Test Sequences*, describes the process of creating new test programs and test sequences for execution by the Test Executive.
- Chapter 5, *Modifying the Test Executive*, describes the architecture of the Test Executive and explains how to make modifications to it.
- Chapter 6, *Deploying the Test Executive*, describes how to deploy a LabVIEW Test Executive Run-Time System on a test stand computer.
- Appendix A, *Common Questions*, includes a list of common questions you may have when using the Test Executive.
- Appendix B, *Sequence Conversion Notes*, describes the steps for converting a test sequence created with Version 4.0 of the Test Executive to Version 5.0.
- Appendix C, *Customer Communication*, contains forms you can use to request help from National Instruments or to comment on our products and manuals.

- The *Glossary* contains an alphabetical list and description of terms used in this manual, including abbreviations, acronyms, metric prefixes, mnemonics, and symbols.
- The *Index* contains an alphabetical list of key terms and topics in this manual, including the page where you can find each one.

Conventions Used in This Manual

The following conventions are used in this manual:

bold	Bold text denotes a parameter, menu name, palette name, menu item, return value, function panel item, or dialog box button or option.
bold monospace	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen.
italic	Italic text denotes mathematical variables, emphasis, a cross reference, or an introduction to a key concept.
bold italic	Bold italic text denotes an activity objective, note, caution, or warning.
monospace	Text in this font denotes text or characters that you should literally enter from the keyboard. Sections of code, programming examples, and syntax examples also appear in this font. This font also is used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, variables, filenames, and extensions, and for statements and comments taken from program code.
< >	Angle brackets enclose the name of a key on the keyboard—for example, <PageDown>.
-	A hyphen between two or more key names enclosed in angle brackets denotes that you should simultaneously press the named keys—for example, <Control-Alt-Delete>.
<Control>	Key names are capitalized.
»	The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options»Substitute Fonts** directs you to pull down the **File** menu, select the **Page Setup** item, select **Options**, and finally select the **Substitute Fonts** option from the last dialog box.
paths	Paths in this manual are denoted using backslashes (\) to separate drive names, directories, and files, as in `C:\dir1name\dir2name\filename`.

☞ This icon to the left of bold italicized text denotes a note, which alerts you to important information.

Data Types Each VI description gives a data type picture for each input and output parameter, as illustrated in the following table.

Control	Indicator	Data Type
		Signed 8-bit integer
		Signed 16-bit integer
		Signed 32-bit integer
		Unsigned 8-bit integer
		Unsigned 16-bit integer
		Unsigned 32-bit integer
		Single-precision floating-point number
		Double-precision floating-point number
		Extended-precision floating-point number
		String
		Boolean
		Array of signed 32-bit integers
		Cluster
		File Refnum

Abbreviations, acronyms, metric prefixes, mnemonics, symbols, and terms are listed in the *Glossary*.

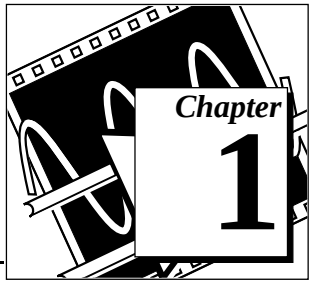
Related Documentation

The following documents contain information that you might find helpful as you read this manual:

- *LabVIEW Function and VI Reference Manual*
- *LabVIEW QuickStart Guide*
- *LabVIEW Test Executive Installation and Release Notes*
- *LabVIEW Tutorial*
- *LabVIEW User Manual*

Customer Communication

National Instruments wants to receive your comments on our products and manuals. We are interested in the applications you develop with our products, and we want to help if you have problems with them. To make it easy for you to contact us, this manual contains comment and technical support forms for you to complete. These forms are in Appendix C, *Customer Communication*, at the end of this manual.



Introduction

This chapter lists the main features of the Test Executive, explains its execution model, and describes its three operating levels.

Overview

A Test Executive is an application you can use to develop and execute test sequences. A test sequence consists of a series of test programs, combined with flow control statements, that you use to test a Unit Under Test (UUT). The LabVIEW Test Executive 5.0 can call test programs written using both the G and C (Windows NT/95 and UNIX only) programming languages.

The Test Executive includes a powerful Test Executive engine for performing test sequencing and sequence editing operations, an operator interface virtual instrument (VI), and a set of callback VIs for handling various interface and data-logging tasks. The operator interface and callback VIs are provided with G source code, allowing users to change and/or expand the functionality of the LabVIEW Test Executive 5.0.

Features

Some of the main features of the Test Executive are as follows.

- Hierarchical test sequences
- Calls test programs written in either LabVIEW's G programming language or in C (Windows NT/95 and UNIX only).
- Test sequencing based on PASS/FAIL states and advanced dependencies
- Test report logging to either an ASCII file or SQL-compliant database (in conjunction with the LabVIEW SQL Toolkit).
- Run-time interfacing, including the ability to prompt for operator and UUT serial numbers, to display PASS/FAIL banners, and to perform run-time error notification

- Generates ASCII sequence reports to files
- Contains continuous testing in Test UUT mode

Available Packages

The Test Executive is available in two versions.

Development System

The LabVIEW Test Executive 5.0 Development System is designed to run under the LabVIEW development environment. It consists of the Test Executive engine, an operator interface VI, a library of callback VIs, and a library of LabVIEW type definitions for use when developing LabVIEW tests and custom callback VIs. Example test programs and test sequences are also included with the Development System.

Run-Time System

The LabVIEW Test Executive 5.0 Run-Time System is a stand-alone executable designed to be run independently of the LabVIEW development environment. It consists of a single application program that uses external operator interface and callback VIs to form a complete test executive. With the Run-Time System, you can distribute the LabVIEW Test Executive to many test stations without incurring the expense of outfitting each station with the LabVIEW Development System.

Test Executive Architecture

The Test Executive includes an engine, an operator interface VI, and a set of *callback VIs* (LabVIEW VIs designed for specific interface and data-logging operations). The engine handles tasks such as the creation, editing, loading, saving, and execution of test sequences. The engine uses the operator interface VI and the callback VIs to handle tasks such as the operator interface, user login, report generation, and datalogging.

The following illustration shows the relationship between the Test Executive engine, the operator interface VI, and the callback VIs.

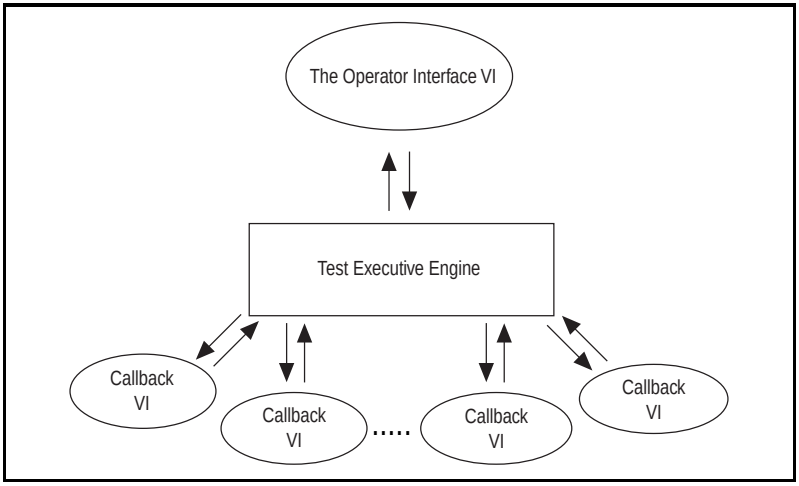


Figure 1-1. Architecture of the Test Executive

You can customize the Test Executive by modifying or replacing the operator interface VI or the callback VIs. The operator interface VI is the main panel of the Test Executive. With the main panel, you can issue commands to the Test Executive engine and see the results of those commands. The Test Executive engine works with 17 different callback VIs, which are divided into *system* and *sequence* callback VIs. For information on modifying the operator interface VI, the system callback VIs, or the sequence callback VIs, refer to Chapter 5, *Modifying the Test Executive*.

System Callback VIs

The Test Executive works with the following system callback VIs:

- Login
- Select Sequence
- Open Sequence
- Save Sequence
- Close Sequence
- Sequence Report
- Exit

The Login callback VI identifies the Test Executive operator and sets the operating level. The Select Sequence callback VI prompts the operator to choose a test sequence to open. The Open, Save, and Close Sequence callback VIs are called when the operator opens, saves, or closes a test sequence. The Sequence Report callback VI generates an ASCII report file describing the currently loaded test sequence. The Exit callback VI is called when the user exits the Test Executive.

Sequence Callback VIs

The Test Executive works with the following sequence callback VIs:

- Pre-UUT Loop
- Pre-UUT
- Post-UUT
- Post-UUT Loop
- Pre-Step
- Post-Step
- Test Report
- Post Run-Loop Test
- Test Failure
- Open Test VI

The next section discusses the sequence callback VIs in more detail.

Execution Model

The Test Executive can execute a sequence in one of four modes—Test UUT, Single Pass, Run Step(s), or Loop Step(s). Test UUT, invoked when the user clicks on the **Test UUT** button, executes a test sequence repetitively. This mode is the production operating mode for testing multiple UUTs. In Single Pass mode, the test sequence executes only once. Single Pass mode is primarily for use during development and may also be useful for diagnostic purposes. Run Step(s) mode, invoked when the user clicks on the **Run Step(s)** button, executes the steps currently selected in the Sequence Display. Loop Step(s) mode, invoked when the user clicks on the Loop Step(s) button, executes the step currently selected in the Sequence Display a specified number of times (or, if only a single step is selected, until that step fails.) Both Run Step(s) and Loop Step(s) modes are intended primarily for diagnostic purposes.

Every test sequence has a set of sequence callback VIs that handle certain run-time or edit-time events. When you create a new test sequence, the Test Executive gives it a default set of sequence callback VIs. You can override these default callback VIs to change the way the Test Executive executes or edits a test sequence. The Sequence Editor also calls these VIs when you want to edit a test VI. The following illustration shows a test sequence and its associated callback VIs:

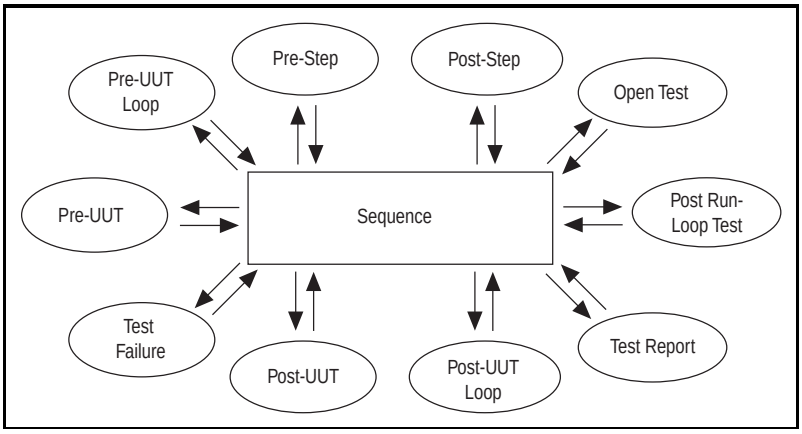


Figure 1-2. Test Sequence Callback VIs

For a typical test sequence in Test UUT mode, the Test Executive engine calls the Pre-UUT Loop callback VI before testing the first UUT. The Pre-UUT Loop callback VI performs user-specified setup or datalogging operations. Then, before testing each new UUT, the Test Executive calls the Pre-UUT callback VI, which by default, prompts the operator for UUT information.

After testing a UUT, the Test Executive calls the Post-UUT callback VI, which by default, displays a PASS/FAIL banner. After testing the last UUT, the Test Executive calls the Post-UUT Loop callback VI for user-specified cleanup or data-logging operations. Then, the Test Executive engine calls the Test Report callback VI, which by default, generates a spreadsheet-style ASCII report detailing the test results for each UUT

that was tested. The following illustration shows the overall flow of execution in Test UUT mode.

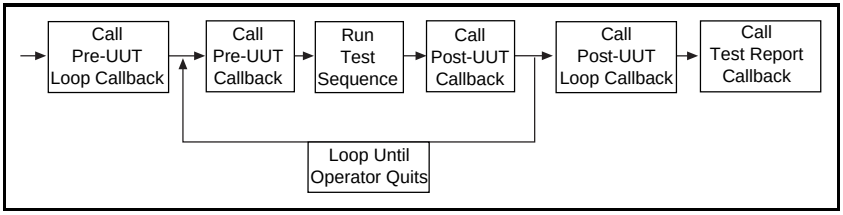


Figure 1-3. Flow of Execution in Test UUT Mode

In Single Pass mode, the Test Executive engine does not call the Pre-UUT Loop, Pre-UUT, Post-UUT, or Post-UUT Loop callback VIs. The following illustration shows the overall flow of execution in Single Pass mode.

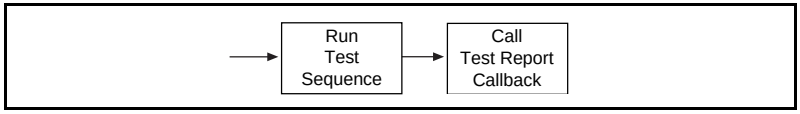


Figure 1-4. Flow of Execution in Single Pass Mode

When a step with a FAIL Action of `Callback` fails, the Test Executive engine calls the Test Failure callback VI to determine what action it should take.

After you press the **Run Step(s)** or **Loop Step(s)** button to run or loop the individual steps selected in the Sequence Display, the Test Executive engine calls the Post Run-Loop Test callback VI.

In all execution modes, the Pre-Step and Post-Step callbacks are called before and after each test step, respectively.

In contrast to the other sequence callback VIs, which are called by the Test Executive engine, the Sequence Editor calls the Open Test VI callback when you press the **Edit Test VI** button. The default Open Test VI callback opens the front panel of the current LabVIEW test.

Operating Levels

The Test Executive has three operating levels—Developer, Technician, and Operator. The following table summarizes the capabilities available in each operating level.

Table 1-1. Operating Level Capabilities

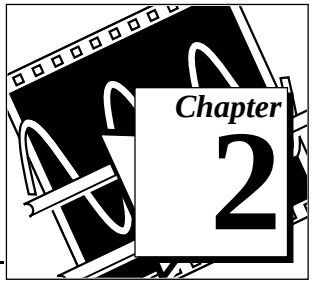
Level	UUT Test	Single Pass/ Run Step(s)/Loop Step(s)	Edit Sequences
Developer	Yes	Yes	Yes
Technician	Yes	Yes	No
Operator	Yes	No	No

At the Developer level, you have access to all capabilities of the Test Executive.

At the Technician level, you can run individual steps, but you cannot edit sequences. You can also run a sequence in Single Pass mode. The Technician level gives you the flexibility to execute steps for diagnosing a UUT.

The Operator level is the most restrictive. At this level, you can execute test sequences only in Test UUT mode by selecting the **Test UUT** button.

The Login callback VI determines the initial operating level. When you first load the Test Executive, the default Login callback VI displays a dialog box that prompts you for a password, which sets the operating level. To change the operating level when running the Test Executive, you can re-open the Login dialog box by pressing the **Login** button on the main panel of the Test Executive.



Getting Started

This chapter introduces the basic concepts of Test Executive operation and test sequence development, and contains the following examples.

- Running a Test Sequence
- Examining a Test Program
- Editing a Test Sequence

You should go through these examples in the order they are presented. The first example, *Running a Test Sequence*, is relevant to anyone who operates the Test Executive. The second two examples, *Examining a Test Program* and *Editing a Test Sequence*, are for users who write test programs and create test sequences.

The Test Executive comes with four test sequence examples, which are described at the end of this chapter.

This chapter assumes that you are running the Test Executive Development System. If you are executing the Test Executive Run-Time System, you cannot run the *Examining a Test Program* example.

Running a Test Sequence

This section shows you how to run a test sequence.

Starting the Test Executive

Perform the following steps to start the Test Executive.

1. Launch LabVIEW.
2. Open the default operator interface VI. The setup program installs the default operator interface VI for the Test Executive in `LVEXEC50\OPERATOR.LLB`.

The default operator interface VI begins running when you open it. When the Test Executive begins running, it loads the callback VIs into memory. After loading the system callback VIs, it calls the Login callback VI, which displays the Login dialog box.

3. Type your name and password into the Login dialog box, as shown in the following illustration. Use the <Tab> key to move from the Name to the Password box.

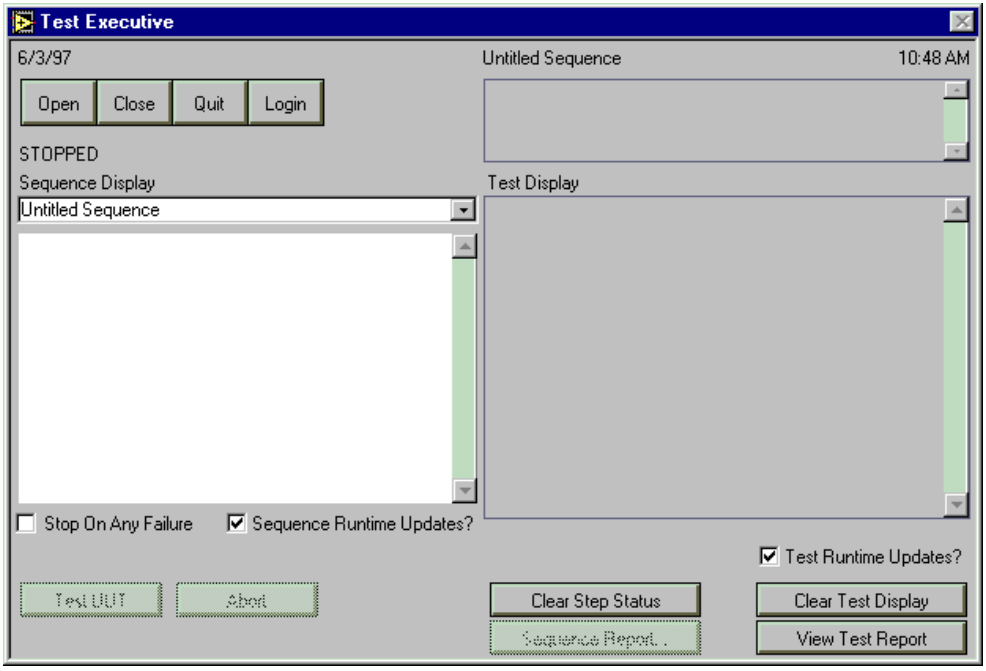
The default Login callback VI uses the password you enter to set the operating level. It then passes this operating level to the Test Executive, which configures itself accordingly. In this session, you run the Test Executive at the Operator level. You access the Operator level by typing any text in the Password field.

☞ **Note:** ***To access the other operating levels, you must type*** `technician` ***for the Technician level and*** `developer` ***for the Developer level.***

4. Press <Enter> (<return>, <Return>) or click on **OK** to confirm your entries.

On the Test Executive front panel, notice the word **STOPPED** that appears directly above the Sequence Display. This field is the Status indicator. A flag of `STOPPED` indicates that no test sequence is currently

running. The following illustration shows the Test Executive operator interface panel.



Opening and Running a Test Sequence

Perform the following steps to open and run a test sequence.

1. Press the **Open** button in the upper left corner of the operator interface panel.
2. Select the file `COMPUTER.SEQ`, which is located in the `LVEXEC50\EXAMPLES` directory.

A short delay occurs while the Test Executive loads into memory the VIs that the sequence requires. After you load `COMPUTER.SEQ`, notice that the test sequence appears in the Sequence Display. Also, the name of the test sequence and the sequence description appear at the top of the Test Executive front panel.

Patching Test VI Paths

COMPUTER.SEQ, contains steps that have associated LabVIEW Tests (VIs). The Test Executive install program installed these associated VIs in the LVEXEC50\TEST_VIS.LLB VI library. When you first open COMPUTER.SEQ, the VI paths may be invalid. If this is the case, the Test Executive prompts you to find the first VI for COMPUTER.SEQ. Using the file dialog box, locate the missing VIs in the LVEXEC50\TEST_VIS.LLB VI library. The Test Executive patches the invalid VI path with the new VI path. Then, it prompts you to choose whether you want to add the selected VI library or directory to the search path. If you press **Yes**, the Test Executive automatically searches that VI library or directory to patch the missing paths for any other VIs.

☞ **Note:** ***When the Test Executive patches a VI path, it marks the path as modified.***

3. Click on the **Test UUT** button located beneath the Sequence Display to execute the test sequence. The Test Executive calls the default Pre-UUT callback VI, which prompts you for the serial number of the UUT.
4. Type any value for the serial number and press <Enter> (<return>, <Return>) or click on the **OK** button.

As the sequence executes, notice the following activities on your screen.

- The Status indicator displays **RUNNING**.
- As each step runs, the word **RUNNING** appears next to the name of the active step in the Sequence Display.
- After each step runs, the PASS/FAIL status of the step appears next to the name of the step in the Sequence Display, and the step result appears in the Test Display.

When the sequence execution completes, the Test Executive calls the default Post-UUT callback VI, which displays a PASS/FAIL banner.

5. Click on the **OK** button in the PASS/FAIL banner. The Test Executive begins the next test cycle by calling the default Pre-UUT callback VI again. The Test Executive continues to cycle to the next UUT until you click on **Stop** in the UUT Information dialog box. At that point, the Test Executive exits the Test UUT loop and calls the Test Report callback VI to generate the test report.

6. To view the test report after execution completes, click on the **View Test Report** button. The report appears in the Test Display string indicator.

The Test Report includes the name and description of the sequence, the date and time that testing ended, the name of the user, and the results of testing for each UUT.

Changing to Technician Level

Perform the following steps to change from Operator level to Technician level and to see the more flexible execution capabilities at the Technician level.

1. Click on the **Login** button on the Test Executive front panel.
2. In the Login dialog box, type the word `technician` in the Password field and click on the **OK** button. The **Single Pass**, **Run Step(s)**, and **Loop Step(s)** buttons appear in the lower left corner of the Test Executive front panel.
3. If you do not see these buttons, click on the **Login** button again and retype the word `technician` in the Password field.

Executing Individual Steps and Using Single Pass Mode

To run an individual step, click on the name of the desired step in the Sequence Display and click on the **Run Step(s)** button. Notice that only the selected step runs. You can select multiple steps to run in Run Step(s) mode by Shift-clicking on them in the Sequence Display. Run Step(s) mode selectively runs individual steps for diagnosis and troubleshooting. The status of each step appears next to the step names in the Sequence Display. You can click on the **Loop Step(s)** button to execute steps repeatedly.

Now, click on the **Single Pass** button. Clicking on this button runs the entire test sequence one time. When running in Single Pass mode, the Test Executive skips all sequence callback VIs except for the Test Report callback VI. Notice that the sequence executes one time and then stops. When you click on the **View Test Report** button, the Test Executive displays the Test Report as it did at the Operator level.

Quitting the Test Executive

Click on the **Quit** button to stop execution of the Test Executive. When the Test Executive stops running, LabVIEW automatically quits if you are logged in at the Operator or Technician levels. Launch the LabVIEW full development system before proceeding to the next examples.

Examining a Test Program

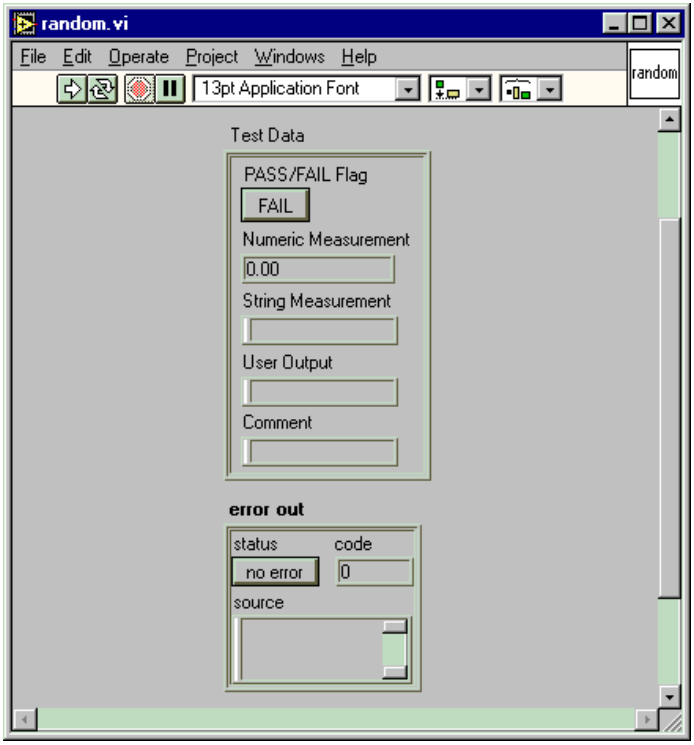
In this section, you examine a sample test program written in LabVIEW's G programming language. You only need this information if you plan to write LabVIEW tests and incorporate them into test sequences. This section requires you to be familiar with the LabVIEW full development environment. For more detailed information on the topics in this section, see Chapter 4, *Creating Tests and Test Sequences*.

Perform the following steps to learn how to build a LabVIEW test.

1. Launch LabVIEW if you have not already done so.
2. Find and open the VI called `random.vi`, located in `LVEXEC50\TEST_VIS.LLB`.

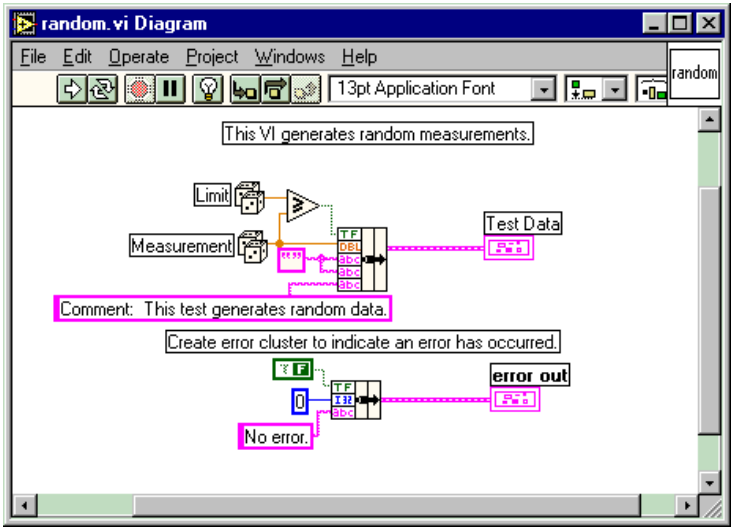
This VI illustrates the basic structure of a LabVIEW test that the Test Executive runs. The front panel of the VI contains two clusters: the Test

Data cluster and the Error cluster, which are shown in the following illustration.



The Test Data cluster transmits information about the result of the test. The error out cluster transmits information the Test Executive uses for run-time error handling. In this example, use `random.vi` as if it were a new test VI to step through the test sequence creation process.

3. Open the diagram of `random.vi` by selecting **Windows»Show Diagram** from the menu on the front panel. The diagram appears as shown in the following illustration.



This VI generates two random numbers, Limit and Measurement. The VI compares Limit to Measurement, setting the PASS/FAIL flag in the Test Data cluster to the result of the comparison. This VI also passes one of the random numbers and a comment as the Numeric Measurement and Comment elements of the Test Data cluster. The Test Executive uses these elements when you create a test sequence that calls this VI.

4. Close `random.vi`. Do not save any changes.

Editing a Test Sequence

This section shows you how to set up and edit a test sequence.

Starting the Test Executive

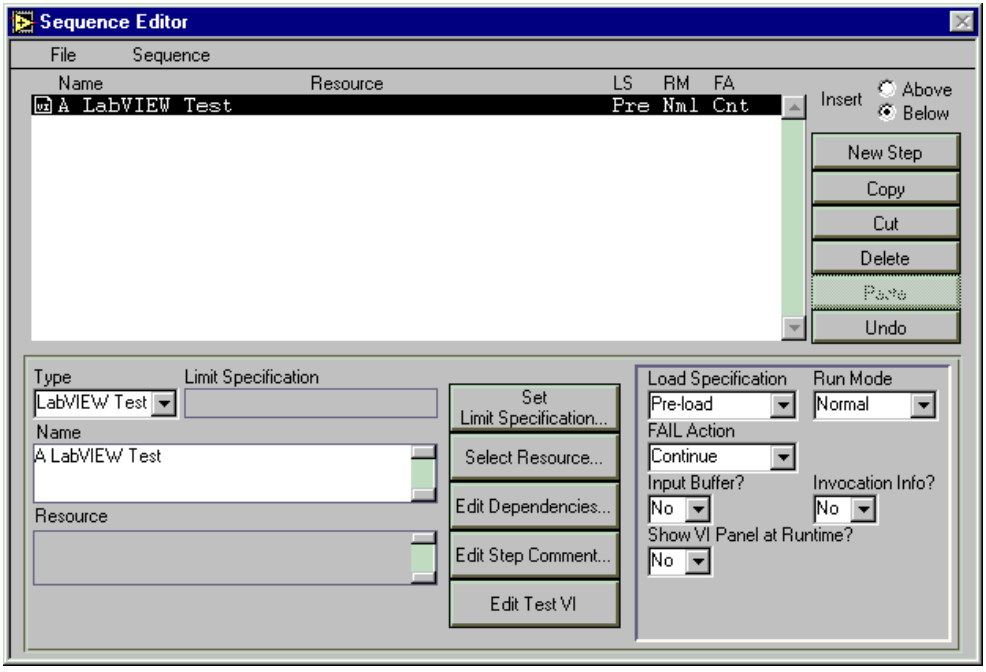
1. Launch LabVIEW if you have not already done so.
2. Open the default operator interface VI. The setup program installs the default operator interface VI for the Test Executive in `LVEXEC50\OPERATOR.LLB`. Type the word `developer` in the Password field of the Login dialog box and click on the **OK** button. A row of six buttons appears in the upper left corner of the operator

interface front panel. If you do not see six buttons, click on the **Login** button and make sure that you type `developer` as the password. Remember that the password is case sensitive.

Editing a Sequence

3. Click on the **Edit** button to invoke the Sequence Editor.

The first time that you invoke the Sequence Editor, there is a delay while the Test Executive loads the editor. This loading delay occurs only the first time that you open the Sequence Editor. Notice that the list box at the top of the Sequence Editor panel is empty. This list box, called the *sequence list*, shows the steps that are defined for the current sequence. With the Sequence Editor, you input all of the specifications required to define a test sequence.



Creating a Step

Complete the following steps to add `random.vi` to the sequence.

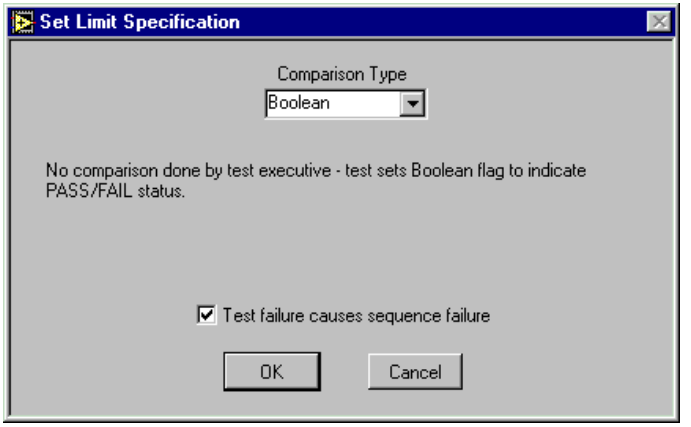
4. Click on the **New Step** button to add a new, untitled step to the top of the sequence list. Notice that the edit controls are displayed and that the edit control named Name is automatically selected. Also notice that the ring control named Type is set to LabVIEW Test. Because this example involves only LabVIEW-based test programs, do not change the Type setting.
5. Type the name `Random-Boolean` into the Name control and press <Enter> (<return>, <Return>). Notice that `Random-Boolean` now appears in the sequence list.
6. Click on the **Select Resource...** button to choose the VI that you want to run for this step. For this example, select `random.vi`. Notice that the Resource control is automatically filled with the VI path you selected.

Configuring the Limit Specification

To determine if a step passes or fails, the Test Executive must have a limit specification. The Test Executive looks at the Test Data cluster of the test VI and applies the limit checking you specify in the Sequence Editor to that data. The Test Data cluster contains a Boolean flag, a numeric measurement, and a string measurement. You can use any of these elements to determine if the VI passes.

7. Click on the **Set Limit Specification** button to view the Set Limit Specification dialog box. Click on the Comparison Type ring control to see the available types of checking. If you choose a numeric comparison, you must enter the numeric limits used for the comparison. If you choose a string comparison, you must enter a reference string to be used for the comparison. For this example, set

Comparison Type to `Boolean`. Your Set Limit Specification dialog box should look like the following illustration.



Selecting Boolean comparison sets the Test Executive to use the PASS/FAIL flag in the Test Data cluster to determine if the step passed or failed.

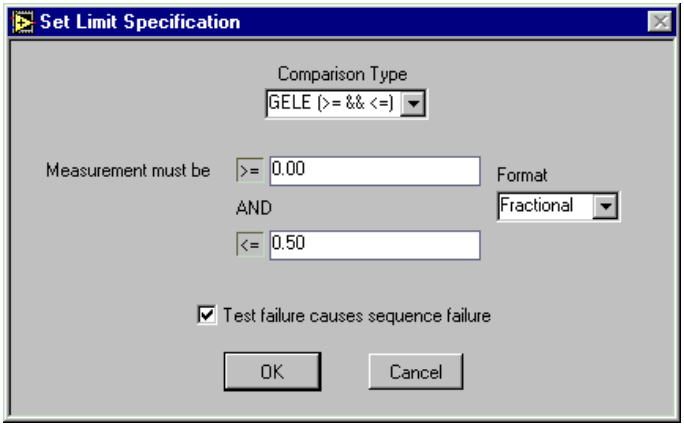
8. Click on the **OK** button to confirm the limit specification. Notice that the Limit Specification control now contains the text `{BOOL}`.

Adding Another Step

Now, perform the following steps to add another step below Random-Boolean and change the limit specification to numeric.

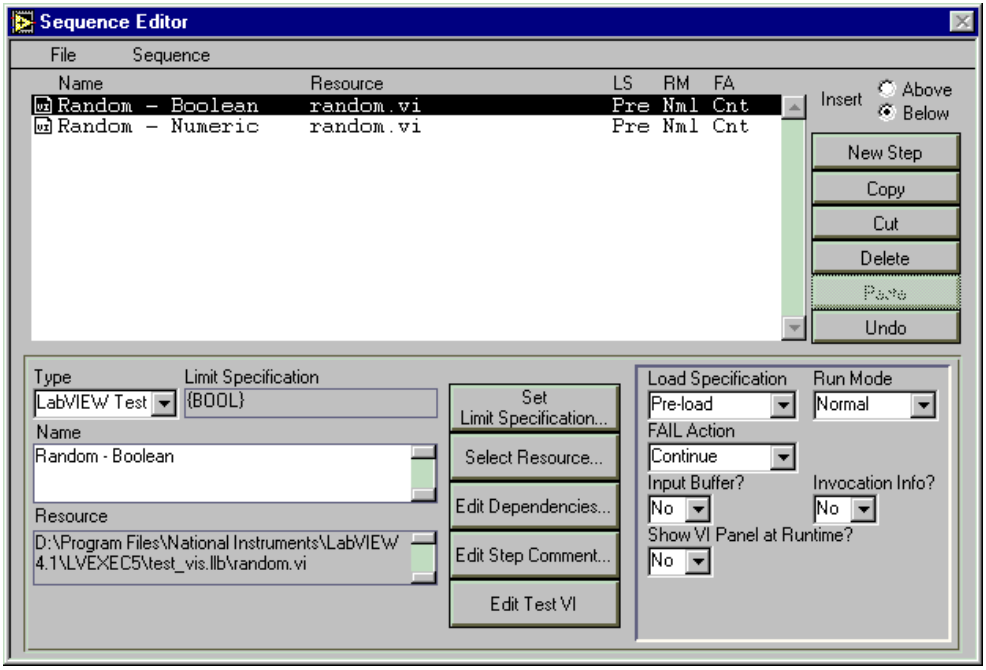
9. Make sure that the Insert control is set to `below` and press the **New Step** button. The new step appears below the currently selected step in the sequence list. Name the new step `Random-Numeric`.
10. Click on the **Select Resource...** button and again select `random.vi`. Then, click on the **Set Limit Specification** button and set the Comparison Type to numeric comparison, `GELE (>= && <=)`, which means the numeric value returned by the test VI must be greater than or equal to a lower limit *and* less than or equal to an

upper limit. Set the lower limit to `0.00` and the upper limit to `0.50`, as shown in the following illustration.



With the Format control, you set the numeric limits to fractional, scientific, decimal, hexadecimal, octal, or binary notation. For this example, use fractional notation.

11. Click on the **OK** button to accept the limit specifications. Your completed test sequence should appear in the sequence list as the following illustration shows.

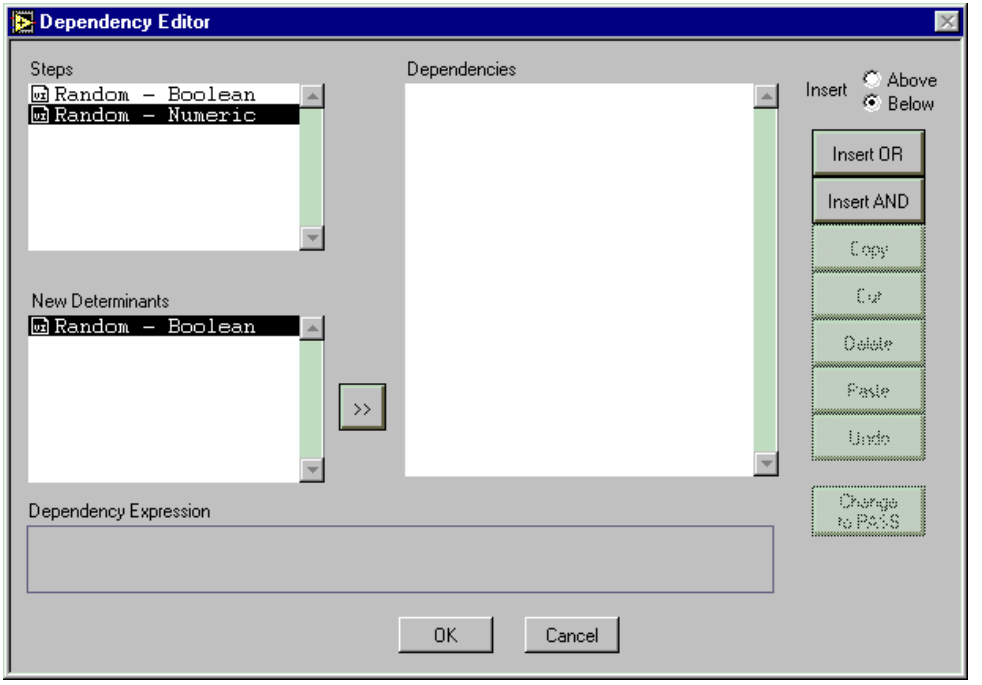


12. To modify the definition of a step, click on the step you want to modify in the sequence list. The specifications of the step appear in the edit fields. Make any changes to these edit fields and the Test Executive automatically applies the changes to the step.

Setting Dependencies

Next, set up a dependency between the two steps in your sequence.

13. Click on the **Edit Dependencies** button, which opens the Dependency Editor.



14. To set up a dependency between the two steps, you must specify that Random-Boolean must pass for Random-Numeric to execute. If Random-Numeric is not selected in the step list box, select it. Notice that the Dependencies list box is empty, indicating that Random-Numeric has no dependencies.
15. To add the desired dependency, select Random-Boolean in the New Determinants list box and click the **»** button. This adds a FAIL dependency on Random-Boolean to the Dependency list for Random-Numeric. (Double-clicking on Random-Boolean also allows you to add this FAIL dependency.) Change the FAIL dependency to a PASS dependency by clicking on the **Change to PASS** button. (Double-clicking on the FAIL dependency also allows you to change this dependency from FAIL to PASS.)
16. Click on the **OK** button to keep the new dependencies and return to the Sequence Editor.

Running the Sequence

You are now ready to run your test sequence.

17. Return to the main Test Executive front panel by selecting **File»Exit**. After saving the new sequence it appears in the Sequence Display.
18. Click on the **Test UUT** button to run the sequence. The Test Executive automatically determines the PASS/FAIL status based on the values placed in the Test Data cluster. Perform the following steps to view your specification.
    a. After you have tested several UUTs, click on the **Stop** button in the UUT Information dialog box.
    b. To see the data generated by `random.vi` for each test, click on the **View Test Report** button.

Quitting the Test Executive from the Developer Level

19. Click on the **Quit** button to quit the Test Executive. The Test Executive prompts you to confirm or cancel the Quit operation. Proceed with the operation, and the Test Executive automatically prompts you to save the sequence you created.

Because you are running the Test Executive at the Developer level, the application stays in memory after it finishes executing.

If you followed the examples presented in this chapter, you now know how to operate the Test Executive, develop test programs using LabVIEW, and use the Sequence Editor to create sequences that use these VIs. These are the fundamental steps required to create test sequences that run in the Test Executive. The remaining chapters of this manual describe the capabilities of the Test Executive in greater detail.

Example Sequences

The Test Executive package includes nine test sequence examples located in the EXAMPLES subdirectory of the Test Executive. If you quit the Test Executive from the Operator or Technician level, you need to restart the Test Executive to see these examples. The sequences, COMMENT.SEQ, COMPUTER.SEQ, RTERROR.SEQ, UNDEFINE.SEQ, comp_new.seq, computer_cvi.seq, cpu_cvi.seq, cpu_diag.seq, and cpu_lv.seq, demonstrate different aspects of the Test Executive.

COMMENT.SEQ executes tests that use the Comment field to log test results in a customized format. When you run COMMENT.SEQ, notice that test results in the Test Report contain multiple, custom-formatted lines rather than the standard formatted lines.

COMPUTER.SEQ contains a sequence that includes Pre-run and Post-run VIs (VIs that run before or after a test sequence), multiple dependencies, and tests that use a variety of comparison types.

RTERROR.SEQ contains the same tests as COMPUTER.SEQ, but generates a run-time error during the test to illustrate the Run-time Error dialog boxes.

UNDEFINE.SEQ demonstrates how the Test Executive handles sequence files containing invalid information. This condition is called a parsing error. The Parsing Error dialog box opens when you try to load UNDEFINE.SEQ.

comp_new.seq contains a sequence which calls subsequences.

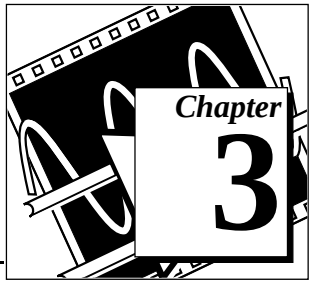
cpu_lv.seq contains a sequence which is called by comp_new.seq.

cpu_diag.seq contains a sequence which is called by comp_new.seq.

computer_cvi.seq (Windows NT/95 and UNIX only) contains a sequence which calls tests developed in LabWindows/CVI.

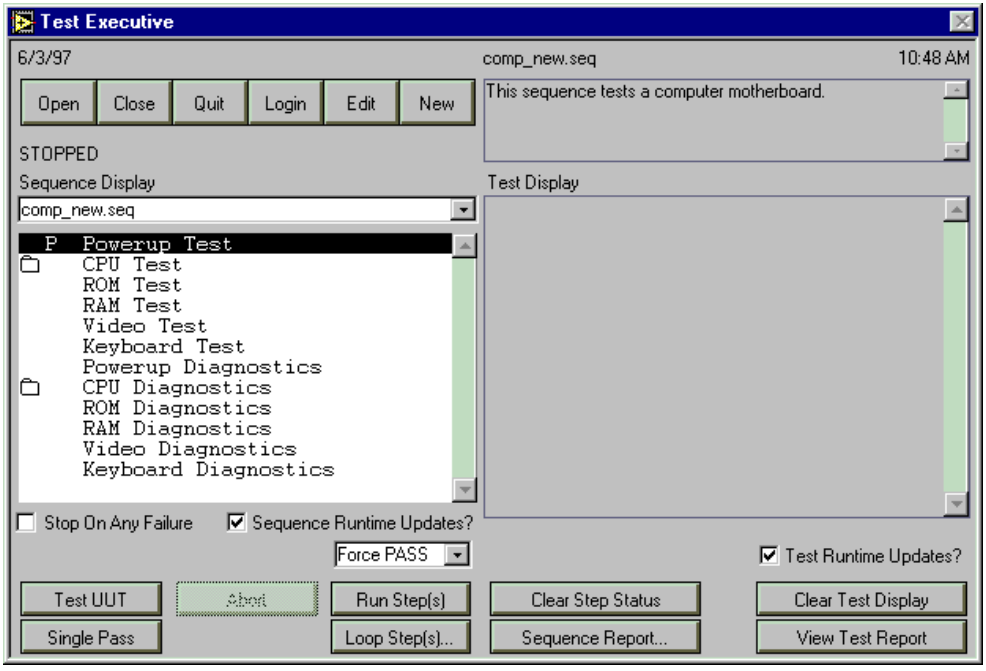
cpu_cvi.seq contains a sequence which is called by computer_cvi.seq.

☞ **Note:** UNDEFINE.SEQ ***is not meant to run; its purpose is to show how the Test Executive handles a parsing error.***



Operating the Test Executive

This chapter describes the operation of the main Test Executive front panel—the controls, indicators, and operator dialog boxes. The main front panel is the user interface for both development and run-time operation. The following illustration shows the Test Executive front panel when you are at the Developer level. When at the Technician and Operator levels, the Test Executive disables some of the buttons.



Controls

The controls on the Test Executive front panel access the following three areas of operation.

- Sequence file operations and login
- Execution
- Display

The rest of this section describes the purpose of each control, grouping them according to their areas of operation.

Open

<F2>

The **Open** button invokes the Select Sequence callback VI for selecting a test sequence to load into memory from a file. Selecting a valid sequence file opens the sequence, loading the step resource and sequence callback VIs into memory. A delay occurs proportional to the number and size of the step resources being loaded. The **Open** button is visible at all operating levels. The default key assignment for Open is <F2>.

Close

<F3>

The **Close** button closes the current sequence visible in the Sequence Display, unloading the step resources and the sequence callback VIs from memory. A delay occurs proportional to the number and size of the step resources being unloaded. The **Close** button is visible at all operating levels. The default key assignment for Close is <F3>.

Quit

<F10>

The **Quit** button causes the Test Executive to stop execution. After you press the **Quit** button, the Test Executive prompts you to confirm or cancel the Quit operation. The default key assignment for Quit is <F10>.

☞ **Note:** ***If the Test Executive is at the Operator or Technician operating level, clicking on the* Quit *button stops the Test Executive and quits LabVIEW.***

Login

<F4>

The **Login** button calls the Login callback VI. The default Login callback VI displays a Login dialog box for entering your name and/or password. The **Login** button is visible at all operating levels. The default key assignment for Login is <F4>.

Edit

<F5>

The **Edit** button invokes the Sequence Editor. There is a short loading delay when you first open the Sequence Editor. The **Edit** button is visible only when the Test Executive is running at the Developer operating level. The default key assignment for Edit is <F5>.

New

<F6>

The **New** button loads a new Untitled sequence, displaying it in the Sequence Display. The **New** button is visible only when the Test Executive is at the Developer operating level. The default key assignment for New is <F6>.

☞ **Note:** ***You can have only one Untitled sequence loaded at a time.***

Test UUT

<Shift-F1>

The **Test UUT** button initiates repetitive execution of the currently visible test sequence for UUT testing. (See the *Execution Model* section of Chapter 1, *Introduction*, for information about the Test UUT mode of execution.) The **Test UUT** button is visible at all operating levels. The default key assignment for Test UUT is <Shift-F1>.

Single Pass

<Shift-F2>

The **Single Pass** button initiates a single execution of the currently visible test sequence. (See the *Execution Model* section of Chapter 1, *Introduction*, for information about the Single Pass mode of execution.) The **Single Pass** button is visible only at the Developer and Technician operating levels. The default key assignment for Single Pass is <Shift-F2>.

Abort

<Shift-F10>

The **Abort** button stops sequence execution after the currently executing step completes. If you press the **Abort** button while in Test UUT mode, the Test Executive stops testing on the current UUT and proceeds to the next UUT. The default Post-UUT callback VI displays an ABORT banner when you abort testing. The **Abort** button is visible at all operating levels, but is active only when a test is running. The default key assignment for Abort is <Shift-F10>.

Abort Loop

<Shift-F9>

The **Abort Loop** button appears only when the Test Executive loops on a failing step. Clicking on the **Abort Loop** button stops the loop execution. Test sequence execution then continues with the next step. The **Abort Loop** button appears at all operating levels. The default key assignment for Abort Loop is <Shift-F9>.

Run Step(s)

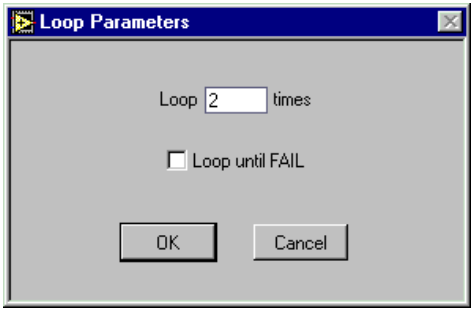
<Shift-F3>

The **Run Step(s)** button executes the steps currently selected in the Sequence Display. After the step runs, the Test Executive calls the Post Run-Loop Test Callback VI. The **Run Step(s)** button is visible only at the Developer and Technician operating levels. The default key assignment for Run Step(s) is <Shift-F3>.

Loop Step(s)

<Shift-F4>

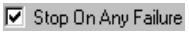
The **Loop Step(s)** button initiates repetitive execution of the step currently selected in the Sequence Display. The **Loop Step(s)** button is visible only at the Developer and Technician operating levels. When you select **Loop Step(s)**, the following dialog box appears.



With the Loop Parameters dialog box, you can either execute a specific number of iterations or loop until a step fails (if you have selected only one step for execution). To specify a number of iterations, make sure the **Loop until FAIL** control is not checked and enter the number of iterations in the **Loop** count control. To loop until a step fails, click on the Loop until FAIL checkbox. To confirm your inputs, click on the **OK** button. To cancel, click on **Cancel**. After the steps finish looping, the Test Executive calls the Post-Run Loop Test callback VI. The default key assignment for Loop Step(s) is <Shift-F4>.

☞ **Note:** ***When you run steps using the Run Step(s) or Loop Step(s) button, the Test Executive disregards the Run Mode setting for the selected step and forces the step to run normally. In contrast, if the Run Mode setting of a test is Skip, Force PASS, or Force FAIL in Test UUT or Single Pass mode, the Test Executive does not run the step. Instead, it generates a step result of Skip, PASS, or FAIL.***

Stop On Any Failure



<Shift-F5>

If you check the Stop On Any Failure checkbox, the Test Executive stops executing the current sequence whenever a step in that sequence fails. When you uncheck this box, the Test Executive runs the current sequence as normal. Changes to this box do not affect the default sequence setting for Stop On Any Failure. You must change this default setting in the Sequence Editor. The Stop On Any Failure box is visible at all operating levels. The default key assignment for Stop On Any Failure is <Shift-F5>.

Sequence Runtime Updates?

<Shift-F6>

When you check the Sequence Runtime Updates? checkbox, the Test Executive updates the Sequence Display whenever a new step starts running, finishes running, or another test sequence runs. When you uncheck this box, the Test Executive does not update the Sequence Display. To make the Test Executive run as fast as possible, disable Sequence Display updates by unchecking this box. The Sequence Runtime Updates? checkbox is visible at all operating levels. The default key assignment for Sequence Runtime Updates? is <Shift-F6>.

Run Mode

<Shift-F7>

The Run Mode ring control displays the run mode setting for the currently selected step. You also use this control to change the run mode of a step for diagnostic purposes. Changes made to any step's run mode using this control do not affect the step's default run mode. You must change the default value in the Sequence Editor. The Run Mode control is visible only at the Developer and Technician operating levels. The default key assignment for Run Mode is <Shift-F7>.

Clear Step Status

<Ctrl-F1>

The **Clear Step Status** button clears the Step Status/Result field for each step in the Sequence Display. The **Clear Step Status** button is visible at all operating levels. The default key assignment for Clear Step Status is <Ctrl-F1> (<command-F1>, <meta-F1>, <Alt-F1>).

Clear Test Display

<Ctrl-F2>

The **Clear Test Display** button clears the contents of the Test Display. The **Clear Test Display** button is visible at all operating levels. The default key assignment for Clear Test Display is <Ctrl-F2> (<command-F2>, <meta-F2>, <Alt-F2>).

View Test Report

<Ctrl-F3>

The **View Test Report** button displays the current Test Report in the Test Display. The **View Test Report** button is visible at all operating levels. The default key assignment for View Test Report is <Ctrl-F3> (<command-F3>, <meta-F3>, <Alt-F3>).

Sequence Report

<Ctrl-F4>

The **Sequence Report** button invokes the Sequence Report callback VI. The default Sequence Report callback VI generates a formatted ASCII report for the current sequence and displays a Save dialog box that prompts you to save the report. The **Sequence Report** button is visible at all operating levels. The default key assignment for Sequence Report is <Ctrl-F4> (<command-F4>, <meta-F4>, <Alt-F4>).

Test Runtime Updates?

<Ctrl-F5>

When you check the Test Runtime Updates? checkbox, the Test Executive updates the Test Display each time a step finishes running. When you uncheck this box, the Test Executive does not update the Test Display during sequence execution. To make the Test Executive run as fast as possible, disable Test Display updates by unchecking this box. The Test Runtime Updates? checkbox is visible at all operating levels. The default key assignment for Test Runtime Updates? is <Ctrl-F5> (<command-F5>, <meta-F5>, <Alt-F5>).

Operator Interface Key Assignments

To summarize, the following table lists the default key assignments for each operator interface control.

Table 3-1. Default Operator Interface Key Assignments

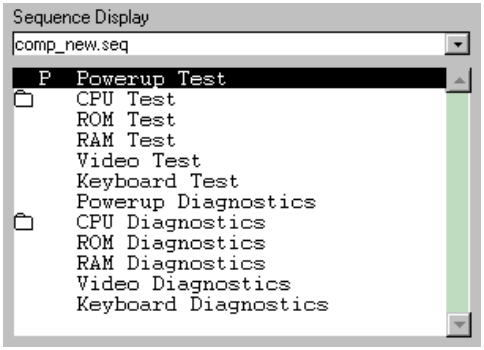
Control	Default Key Assignment
Open	<F2>
Close	<F3>
Login	<F4>
Edit	<F5>
New	<F6>
Quit	<F10>
Test UUT	<Shift-F1>
Single Pass	<Shift-F2>
Run Step(s)	<Shift-F3>
Loop Step(s)	<Shift-F4>
Stop On Any Failure	<Shift-F5>
Sequence Runtime Updates?	<Shift-F6>
Run Mode	<Shift-F7>
Abort Loop	<Shift-F9>
Abort	<Shift-F10>
Clear Step Status	<Ctrl-F1> (<command-F1>, <meta-F1>, <Alt-F1>)
Clear Test Display	<Ctrl-F2> (<command-F2>, <meta-F2>, <Alt-F2>)
View Test Report	<Ctrl-F3> (<command-F3>, <meta-F3>, <Alt-F3>)
Sequence Report	<Ctrl-F4> (<command-F4>, <meta-F4>, <Alt-F4>)
Test Runtime Updates?	<Ctrl-F5> (<command-F5>, <meta-F5>, <Alt-F5>)

Indicators

This section describes the displays and indicators on the Test Executive's front panel.

Sequence Display

The **Sequence Display** is really a control. The Sequence Display contains two parts. The first is a ring control that allows the user to select the sequence currently visible in the second part, a multiple-selection listbox. During sequence execution, the ring control also indicates the file name of the current sequence visible in the listbox.



Each line in the listbox portion of the display has three fields. From left to right, the fields are Run Mode, Step Name, and Step Status/Result. In addition, steps which are sequences are marked with the closed-folder glyph.

☞ **Note:** ***The fields in the Sequence Display are not labeled, so take special notice of what occurs in each field.***

The Run Mode field indicates the setting of the Run Mode parameter for the step. The following table shows the possible Run Mode field values and their meanings.

Table 3-2. Run Mode Field Values

Value	Meaning
blank (no symbol)	Step runs normally.
S	Step is skipped.
P	Step is skipped with a forced PASS result.
F	Step is skipped with a forced FAIL result.

The Step Name field shows the name of the step.

The Step Status/Result field is set to `RUNNING` during the step execution to indicate the active step. After the step completes, the field is set to reflect the result of the step. The following table shows the possible Step Status/Result field values and their meanings.

Table 3-3. Step Status/Result Field Values

Value	Meaning
SKIP	Step did not execute.
PASS	Step result satisfied limit specification.
FAIL	Step result did not satisfy limit specification.
NONE	Step data was logged but no comparison was made because the limit specification was set to Log only.
UNKNOWN	No step data was logged, and no comparison was made because the limit specification was left blank.
ERROR	Run-time error occurred during step execution.

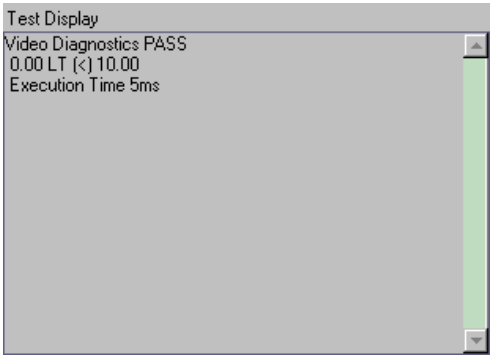
Notice the difference between NONE and UNKNOWN. If the limit specification for a step is set to `Log only`, the Test Executive has been explicitly instructed to log the step data but not make a comparison. The step result is `NONE` because there is no result. If the limit specification for a step is left blank, however, the Test Executive takes no action other than to run the step. Because there is no limit specification, the Test Executive has not been instructed on what to do with the step data, so the step result is `UNKNOWN`.

Test Display

The Test Display shows three types of information.

- Result of each step (If Test Run-Time Updates? is enabled.)
- Error messages
- Test report

The following illustration shows how the Test Display appears.



Result of Each Step

After a step executes, the Test Display shows the complete result of that step. The format of a step result is as follows.

Step name	Result	
	Comment (optional, might be multiple lines)	
	Measurement Comparison	Lower Limit Upper Limit or String Limit
	Execution Time	Time (in ms)

Notice that the number of lines that comprise the step result varies, depending on the type of comparison made and whether a step logs a comment. A step result always contains at least one line listing the name and result of the step. The result is the same value shown in the Step Status/Result field of the Sequence Display.

The format and content of the Comment line(s) is determined by the step that logged the comment. The Measurement field shows the measured value returned by the step. Comparison shows the type of limit checking used to determine if the step passed. Lower and Upper Limits are the numeric limit values used for PASS/FAIL determination. String Limit is the string value used for PASS/FAIL determination. The following table describes the possible values of Comparison and their relation to the limits (Condition for Step to Pass).

Table 3-4. Comparison Values and Relative Limits

Value	Condition for Step to Pass
EQ (==)	Numeric Measurement = Lower Limit
NE (!=)	Numeric Measurement!= Lower Limit
GT (>)	Numeric Measurement > Lower Limit
LT (<)	Numeric Measurement < Lower Limit
GE (>=)	Numeric Measurement >= Lower Limit
LE (<=)	Numeric Measurement <= Lower Limit
GTLT (> && <)	Numeric Measurement > Lower Limit and < Upper Limit
GTLE (> && <=)	Numeric Measurement > Lower Limit and <= Upper Limit
GELT (>= && <)	Numeric Measurement >= Lower Limit and < Upper Limit
GELE (>= && <=)	Numeric Measurement >= Lower Limit and <= Upper Limit
STRCMP	String Measurement = String Limit

The Execution Time line shows the execution time of the step resource in ms, if the step was executed.

Error Messages

Error messages also appear in the Test Display. One of two types of error messages can appear. The first is a parsing error. If a test sequence references an undefined resource or contains an invalid limit or dependency, a description of the error appears in the Test Display.

The second type of error message displays run-time errors. When the Test Executive detects a run-time error, it displays a description of the error in the Test Display.

The Test Report

You also view the Test Report in the Test Display. The Test Report is a record of the testing results for the most recent execution of a test sequence. The following illustration shows the format of a Test Report.

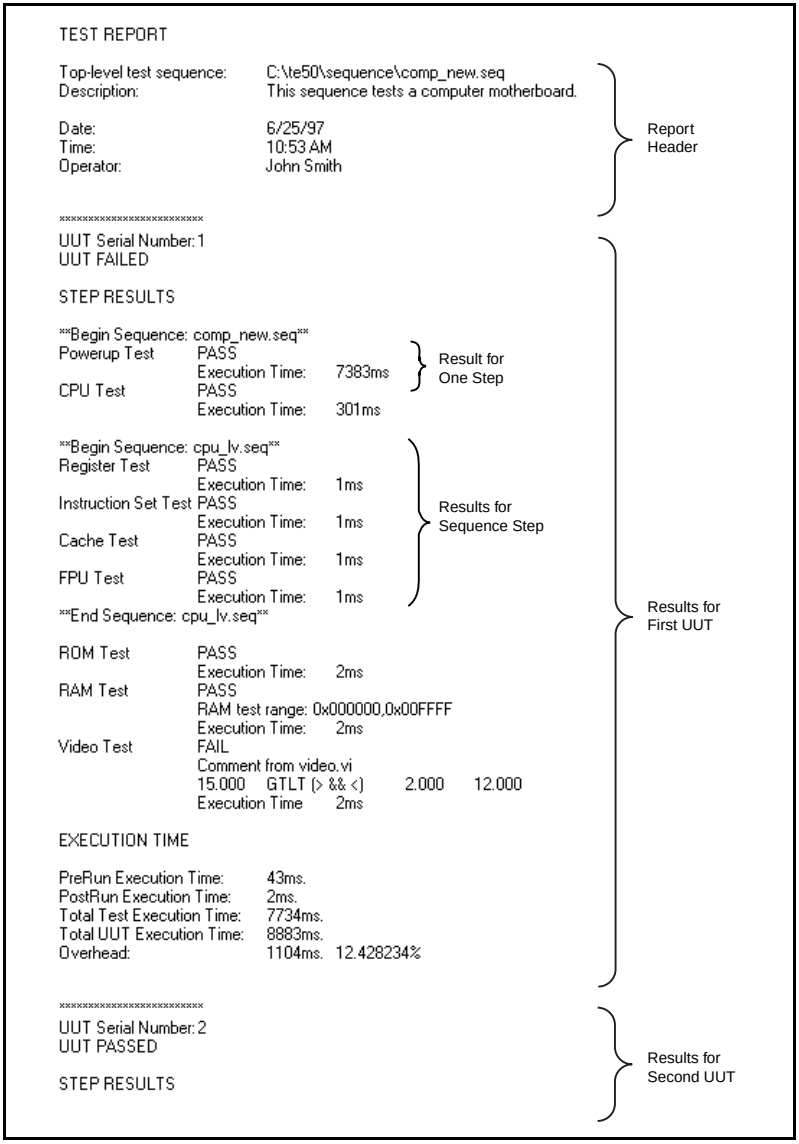


Figure 3-1. Sample Test Report

Status

The Status indicator appears directly above the Sequence Display. This indicator shows the current operating status of the Test Executive. Table 3-5, *Status Indicator Values*, lists the possible values of the Status indicator and their meanings.

Table 3-5. Status Indicator Values

Value	Meaning
STOPPED	No test sequence currently running.
RUNNING	Test sequence is running.
LOOPING [n]	Test sequencing is looping on a step and is in the *n*th iteration.
QUIT	Test Executive has stopped executing.

Sequence Name

The Sequence Name indicator appears above the Sequence Information box. If no sequence is loaded, or if the current sequence has not yet been saved, this indicator displays **`Untitled Sequence`**. When a named sequence is displayed, the Sequence Name indicator displays the filename of the test sequence. During sequence execution, the Sequence Name indicator always displays the name of the top-level sequence.

Sequence Information

The Sequence Information indicator appears above the Test Display and below the Sequence Name. When a sequence is displayed, the Test Executive updates this box to display user-defined information. By default, the Sequence Information box displays the sequence description. During sequence execution, the Sequence Information indicator always displays the information for the top-level sequence.

Operator Dialog Boxes

During operation of the Test Executive, several dialog boxes appear that require user action. This section describes these dialog boxes and the action that each dialog box requires.

Default Login Dialog Box

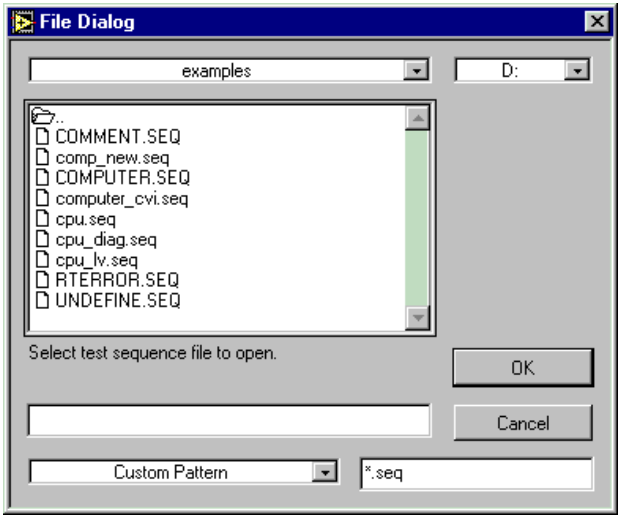
The default Login dialog box, shown in the following illustration, prompts you to enter your Name and Password.

The Password sets the operating level of the Test Executive. This dialog box appears when the Test Executive first starts running and when you click on the **Login** button. In the dialog box, use the <Tab> key to move between the Name and Password fields. Click on the **OK** button or press <Enter> (<return>, <Return>) to confirm the entries made in the Name and Password inputs. Click on the **Cancel** button to remove the dialog box without making any changes to the existing name and password. If you click on the **Cancel** button when the Test Executive first starts running, the Test Executive runs at the Operator level.

For information on modifying the Default Login dialog box, refer to Chapter 5, *Modifying the Test Executive*.

Default Select Sequence Dialog Box

The default Select Sequence file dialog box, shown in the following illustration, prompts you to select a test sequence file to open.

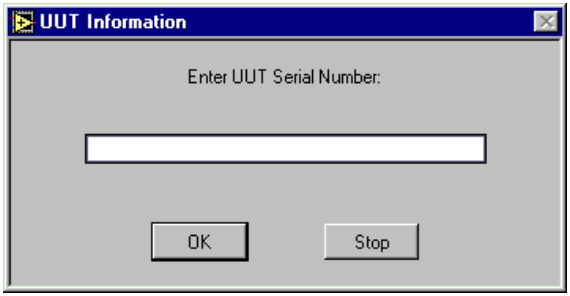


The default Select Sequence file dialog box appears when you press the **Open** button on the operator interface panel. This dialog box is the standard LabVIEW file dialog box, which is initially configured to show only those files ending with an `SEQ` extension. If you select a valid test sequence file and press **OK**, the Test Executive opens the selected test sequence. If you press the **Cancel** button, the Test Executive closes the Select Sequence file dialog box and performs no operation.

For information on modifying the default select sequence File dialog box, refer to Chapter 5, *Modifying the Test Executive*.

Default UUT Information Dialog Box

The default UUT Information dialog box prompts you to enter a serial number for the device to be tested on the next execution of the test sequence.

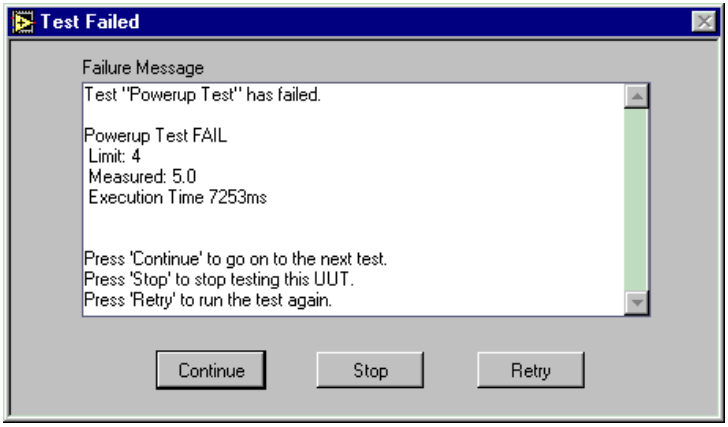


The default UUT Information dialog box appears only when you press the **Test UUT** button. The Test Executive accepts any ASCII string as a valid serial number. Click on the **OK** button or press <Enter> (<return>, <Return>) to confirm the serial number. Click on the **Stop** button to stop UUT testing.

For information on modifying the default UUT Information dialog box, refer to Chapter 5, *Modifying the Test Executive*.

Default Test Failed Dialog Box

The default Test Failed dialog box, shown in the following illustration, appears when a step fails and the step's FAIL Action is set to `Callback`. The dialog box prompts you to select an action.



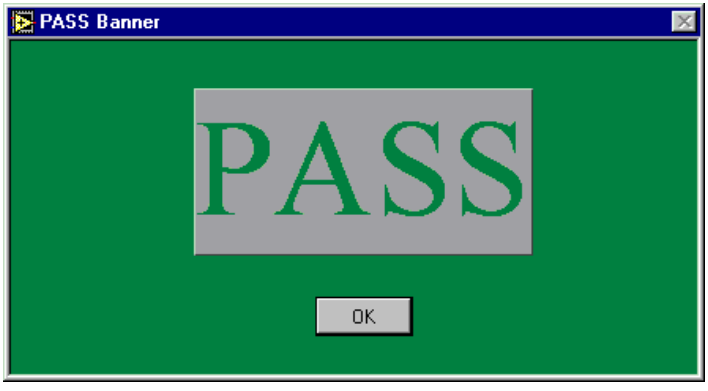
If you press the **Continue** button, the Test Executive logs the step failure and continues with the next step in the sequence. If you press **Stop**, the Test Executive stops testing the UUT. If you press **Retry**, the Test Executive runs the failed step again.

For information on modifying the default Test Failed dialog box, refer to Chapter 5, *Modifying the Test Executive*.

Default PASS/FAIL/ABORT Banners

The default PASS/FAIL/ABORT banners, shown in the following illustrations, indicate whether the current UUT passed, failed, or was aborted. In Test UUT mode, one of these banners appears at the end of test sequence execution for each UUT. The default PASS/FAIL/ABORT banners do not appear in Single Pass mode. Click on the **OK** button or press <Enter> (<return>, <Return>) to acknowledge a banner and continue testing.

For information on modifying the PASS/FAIL/ABORT banners, refer to Chapter 5, *Modifying the Test Executive*.

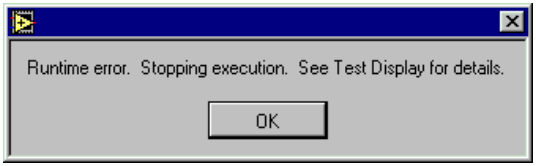

PASS Banner
PASS
OK


FAIL Banner
FAIL
OK

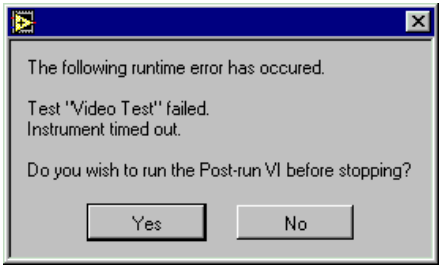

ABORT Banner
ABORT
OK

Run-Time Error Warning Dialog Box

A Run-Time Error dialog box appears when a step reports an error. There are two types of Run-Time Error dialog boxes that appear. The following illustration shows the general Run-Time Error dialog box.



The dialog box shown in the following illustration appears when a run-time error occurs and you have specified a Post-Run VI for the test sequence. This prompt appears, which allows you to choose whether to run the Post-Run VI.



Parsing Error Dialog Box

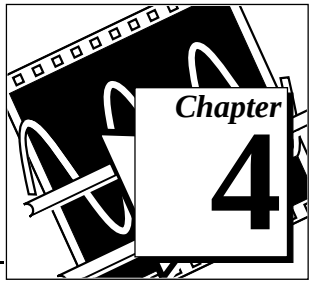
The Parsing Error dialog box appears when the Test Executive detects that a test sequence contains one of the following errors.

- Invalid step resource
- Invalid step name
- Invalid step type
- Invalid limit specification
- Invalid dependency expression
- Invalid GOTO destination

The following illustration shows the Parsing Error dialog box.

After pressing **OK** in the Parsing Error dialog box, you can use the Sequence Errors dialog box to find and fix the errors in the test sequence. To show the Sequence Errors dialog box, select **Sequence»Sequence Error** in the Sequence Editor. For more details on the Sequence Errors dialog box, see Chapter 4, *Creating Tests and Test Sequences*.

Creating Tests and Test Sequences



This chapter describes the process of creating new test programs and test sequences for execution by the Test Executive. The Test Executive can call two different types of test programs: LabVIEW VIs and C functions (Windows NT/95 and UNIX).

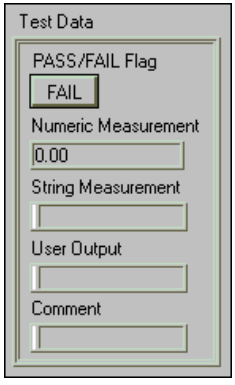
Writing LabVIEW Tests

LabVIEW-based tests, which can be called by the Test Executive are VIs with a specific structure. In particular, a test VI must contain the following two indicators on its front panel and connector pane.

- Test Data cluster
- error out cluster

Test Data Cluster

A test VI uses the Test Data cluster for transmitting result data needed by the Test Executive to make a PASS/FAIL determination. The following illustration shows the Test Data cluster.



The Test Data cluster contains the following elements.

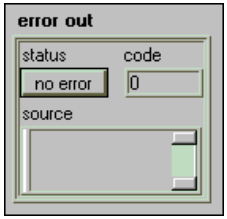
Table 4-1. Test Data Cluster Elements

Name	Type	Meaning
PASS/FAIL Flag	TF	Set by test VI to indicate whether test passed or failed (This flag is used if the limit specification of the test is Boolean.)
Numeric Measurement	DBL	Numeric measurement value used by Test Executive for Pass/Fail evaluation
String Measurement	abc	String value used by Test Executive for Pass/Fail evaluation
User Output	abc	String used to hold test-specific output data. Output data of any type can be flattened to string and passed out in this buffer.
Comment	abc	Comment from VI that is included in the Test Report

When you create a test VI, use the Test Executive typedef `TYPEDEF-Test Data.ctl` for result information. For more details on Test Executive typedefs, see Chapter 5, *Modifying the Test Executive*.

Error Cluster

A test VI must output an error out cluster as shown in the following illustration.



The error out cluster contains the following elements.

Table 4-2. Error Cluster Elements

Name	Type	Meaning
Status	TF	True if an error occurred, False otherwise
Code	I32	0 if no error, non-0 to indicate specific error
Source	abc	Name of the VI that caused the error and text description of the error

The Test Executive uses the contents of the error out cluster to determine if a run-time error has occurred and takes appropriate action if necessary. When you create a test VI, use the standard LabVIEW error out cluster for error information.

Optional Inputs

Input Buffer

A test VI may optionally have a string control on its front panel that serves as an input buffer. This input buffer allows your test sequence to specify input data for the test VI. The Test Executive does not define the meaning or content of the input buffer. It is a general-purpose mechanism for passing any data into a test VI. The test VI defines the meaning and content of this buffer. To add an Input Buffer control to your test VI, use the Test Executive typedef `TYPEDEF-Input Buffer.ctl`. For more details on Test Executive typedefs, see Chapter 5, *Modifying the Test Executive.*

Invocation Information

A test VI may have an Invocation Information cluster on its front panel to receive run-time calling information from the Test Executive. The Invocation Information cluster contains information about the sequence that is being run, the UUT that is being tested, and the name and loop count of the current step. To add an Invocation Information control to your test VI, use the Test Executive typedef `TYPEDEF-Invocation`

Information.ctl. For more details on Test Executive typedefs, see Chapter 5, *Modifying the Test Executive*.

Writing C Tests (Windows NT/95 and UNIX)

C-based tests that can be called by the Test Executive are functions in a 32-bit DLL (Windows NT/95) or shared library (UNIX) with a specific functional prototype. These test functions are equivalent to the functions called by the LabWindows/CVI Test Executive 2.0 but can be created using any compiler capable of creating standard DLLs or shared libraries.

Test functions should have the following prototype:

```
void SampleTest(tTestData *data, tTestError *error);
```

Test Data Structure

A test function uses the tTestData structure to transmit data results that the Test Executive uses to determine if a test passed or failed. The tTestData structure is defined in the following way:

```
typedef struct {
   int32  result;
   double measurement;
   char   *inBuffer;
   char   *outBuffer;
   char   *modPath;
   char   *modFile;
   void   *hook;
   int32  hookSize
   void   *mallocFuncPtr;
   void   *freeFuncPtr;
   } tTestData;
```

The `tTestData` structure contains the elements named in the following table.

Name	Type	Meaning
result	32-bit signed integer	Set by test function to indicate whether test passed (result=1) or failed (result=0). This flag is observed only if the test has been set to pass or fail based upon a Boolean comparison.
measurement	64-bit floating-point number	Measurement value used for Test Executive Pass/Fail evaluation.
inBuffer	string pointer	String passed in by the Test Executive.
outBuffer	string pointer	String passed out by the Test Executive.
modPath	string pointer	Directory path of file containing test function.
modFile	string pointer	File name of file containing test function.
hook	generic pointer	Not used by the LabVIEW Test Executive.
hookSize	32-bit signed integer	Not used by the LabVIEW Test Executive.
mallocFuncPtr	generic pointer	Function pointer to malloc() function used to allocate outBuffer and errorMessage in Test Error structure.
freeFuncPtr	generic pointer	Function pointer to free() function pointer to be used in conjunction with the malloc() function pointed to by mallocFuncPtr.

The Test Executive allocates and frees an input buffer when one is specified for the test. The test function must allocate the **outBuffer** if needed (using the malloc() function pointed to by **mallocFuncPtr**), but the Test Executive frees it. If your test function needs access to another file in its directory (such as a LabWindows/CVI `.uir` file), you can use the **modPath** and **modFile** fields to construct the file name. These fields help you avoid problems if you later move the module containing the test.

Test Error Structure

A test function reports errors with the `tTestError` structure. The `tTestError` structure is defined in the following way.

```
typedef struct {
   int32 errorFlag;
   int32 errorLocation;
   int32 errorCode;
   char  *errorMessage;
   } tTestError;
```

The `tTestError` structure contains the following elements.

Name	Type	Meaning
errorFlag	32-bit signed integer	errorFlag = 1 if an error occurred, errorFlag = 0 otherwise.
errorLocation	32-bit signed integer	Not used by the LabVIEW Test Executive.
errorCode	32-bit signed integer	errorCode = 0 for no error, non-zero to indicate a specific error.
errorMessage	string pointer	Text description of error (allocated with mallocFuncPtr).

The Test Executive uses the contents of the `tTestError` structure to determine if a run-time error occurred and takes appropriate action.

Compiling Test Functions

Test functions should be compiled using C calling conventions using any compiler that can produce standard 32-bit DLLs (Windows NT/95) or shared libraries (Solaris 1.x, 2.x, and HP-UX).

Creating Pre-Run and Post-Run VIs

Pre-run and Post-run VIs are special VIs that run at the beginning and end of each test sequence. They are used for test system configuration, such as turning on a vacuum pump or shutting down power supplies, as opposed to making measurements for a specific test. In general, the Pre-run and Post-run VIs always execute, regardless of the status of any test. If the Pre-run or Post-run VI encounters a situation that prevents the test sequence from executing, it indicates the condition as a run-time error. Pre-run and Post-run VIs do not log data; they simply return run-time error information.

Like standard LabVIEW tests, Pre-run and Post-run VIs must have the clusters Test Data and error out on their front panels.

What is a Test Sequence?

A test sequence consists of a collection of data that describes the flow of test execution. The main components of a test sequence are as follows.

- List of steps
- Pre-run VI (optional)
- Post-run VI (optional)
- Set of sequence callback VIs (optional)
- Dependencies for flow control based upon PASS/FAIL results
- Global flag for stopping testing on any failure
- Test report file information
- Description of the sequence
- Sequence load specification

The following sections explain each of these components.

What is a Step?

A step consists of a combination of specifications that tell the Test Executive how to perform a single execution element in the testing process. Steps can be of four different types: LabVIEW Test, C Test, GOTO, or Sequence. For LabVIEW Test, C Test, or Sequence steps, the specifications are as follows.

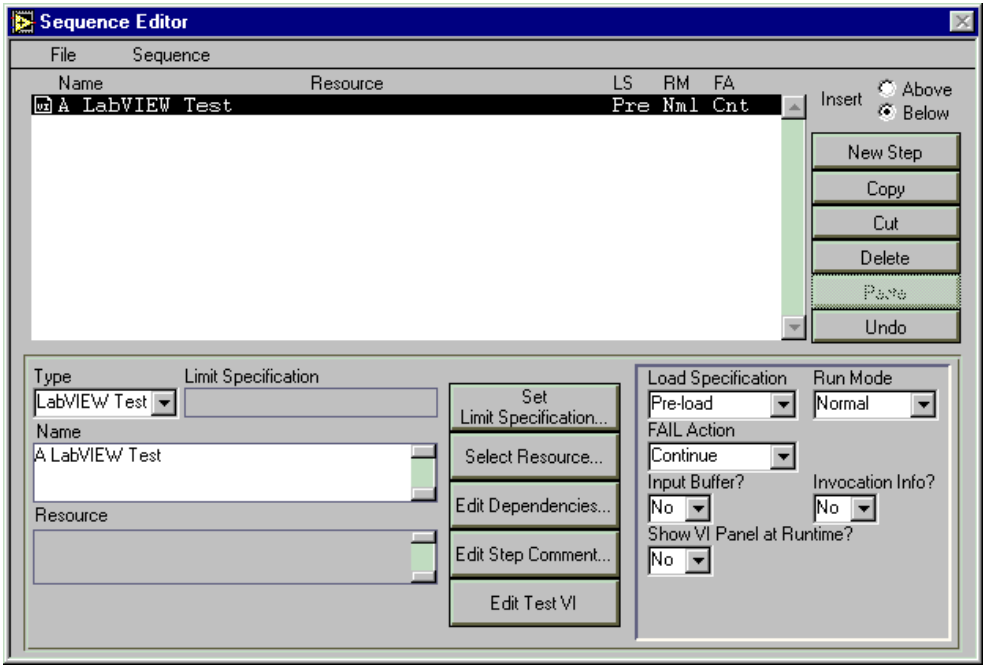
- Name
- Resource file (LabVIEW VI, DLL/shared library, or Test Executive sequence file)
- Function name (for C Tests only)
- Limit Specification for determining PASS/FAIL status of step (LabVIEW Tests and C Tests only)
- Dependency expression
- Load specification indicating whether the step resource should be pre-loaded or loaded dynamically
- Run Mode specifying whether step executes normally
- FAIL Action (and maximum loop count if applicable)
- Optional input specifiers (Input Buffer - LabVIEW Tests and C Tests only, Invocation Information - LabVIEW Tests only)
- Panel Display specifier to indicate whether the test VI should show its panel at run time (for LabVIEW Tests only)

For GOTO steps the specifications are as follows.

- GOTO target
- Dependency expression

Creating or Editing a Test Sequence

To create or edit a test sequence, you must invoke the Sequence Editor when the Test Executive is at the Developer operating level. This section describes the operation of the Sequence Editor. The following illustration shows the Sequence Editor.



Step Editing Elements

Insert

Use the **above** and **below** radio buttons to indicate where new steps are inserted or pasted into the sequence list. If you select the **above** button, new steps are inserted or pasted above the currently selected element in the sequence list. If you select the **below** button, new elements are inserted or pasted below the currently selected element. If you selected more than one element in the sequence list, the Test Executive inserts or pastes the new elements either above or below the first or last element in your selection.

New Step

When you press the **New Step** button, the Sequence Editor inserts a new step into the sequence list. Use the **above** and **below** radio buttons to determine where the new step is inserted.

Copy, Cut, Delete, Paste, and Undo

When you press the **Copy** or **Cut** button, the Sequence Editor copies or cuts the currently selected sequence steps, including groups of steps, to the Sequence Editor clipboard.

When you press the **Delete** button, the Sequence Editor deletes the currently selected steps.

When you press the **Paste** button, the Sequence Editor inserts the contents of the Sequence Editor clipboard into the sequence list according to the setting of the Insert switch. When the Sequence Editor clipboard is empty, the **Paste** button is disabled.

When you press the **Undo** button, the Sequence Editor reverses the last edit action. If you have not made any changes or have just reversed an action, the **Undo** button is disabled.

☞ **Note:** ***For a list of Element Editing Control key shortcuts, see the*** *Sequence Editor Control Key Assignments* ***section in this chapter.***

Using the Editing Elements

Adding a New Step

The Test Executive allows you to insert a new step either above or below an existing step in the sequence list. Perform the following operations to add a new step to a sequence.

1. Select the existing step in the sequence list and set the insert position to `above` or `below`, as desired. The insert position is set using the radio button control in the upper right corner of the Sequence Editor panel.
2. Click on the **New Step** button. Notice that clicking on this button adds a new, untitled step to the sequence list and selects the Name control, which allows you to name the new step.
3. Enter or select the desired values in the step editor controls. Notice that the Test Executive automatically applies the new values to the step.

Modifying a Step

Perform the following operations to modify a step.

1. Click on the step you want to edit in the sequence list. Notice that the settings for the selected step appear in the step editing area.
2. Enter or select the desired values in the step editor controls. Notice that the Test Executive automatically applies the new values to the step.

Copying a Step

To copy a step, perform the following operations.

1. Click on the step you want to copy in the sequence list.
2. Click on the **Copy** button to copy the selected step to the Sequence Editor clipboard.
3. To insert the step above an existing step, select the step and set the insert position to `above`. To insert the step below an existing step, select the step and set the insert position to `below`.
4. Click on the **Paste** button. The Sequence Editor then inserts the contents of the clipboard in the desired location in the sequence list.

Deleting a Step

To delete a step, perform the following operations.

1. Click on the step you want to delete in the sequence list.
2. Click on the **Delete** button.

Mass Editing

The Sequence Editor allows you to edit more than one step at a time. This feature is useful when you need to make the same modifications to several steps. To mass edit a group of steps, perform the following operations.

1. Select the steps you want to edit by <Shift>-clicking on them in the sequence list.

☞ **Note:** ***To add or remove steps from the current selection, <Shift>-click on the step. To add or remove a group of adjacent steps to the selection, hold down the <Shift> key, click on the first step in the group, and drag the mouse pointer to the last step in the group.***

2. Enter or select the desired values in the step editor controls. The Sequence Editor automatically applies the changes to every step in the selection.
3. To exit mass edit mode, select a single step in the sequence list.

Step Editor Controls

This section describes the step editor controls and indicators. You use these controls, such as the Select Resource and the Set Limit Specification, to modify the definition of any step in the sequence.

Type

Use the Type ring control to choose the type of the selected step. The available step types are: LabVIEW Test, C Test, GOTO, and Sequence. Depending on the type selected, other editor controls will be either shown or hidden.

Name (LabVIEW Test, C Test, Sequence)

Type any ASCII string in the Name control. The name appears in the Sequence Display of the main Test Executive front panel when the sequence is loaded. Each step in a sequence must have a unique name. The Sequence Editor warns you if a step is not properly named when you try to quit the editor.

Resource (LabVIEW Test, C Test, Sequence)

The Resource indicator contains the path to the resource that the step executes. For LabVIEW tests, the resource is a valid test VI. For C tests, the resource is a DLL or shared library containing a valid test function. For Sequence steps, the resource is a Test Executive 5.0 sequence file. To set or change the resource, click on the **Select Resource…** button. From the dialog box that appears, select a valid resource file from the file system (either local or network). The path to the resource file you select appears in the Resource indicator.

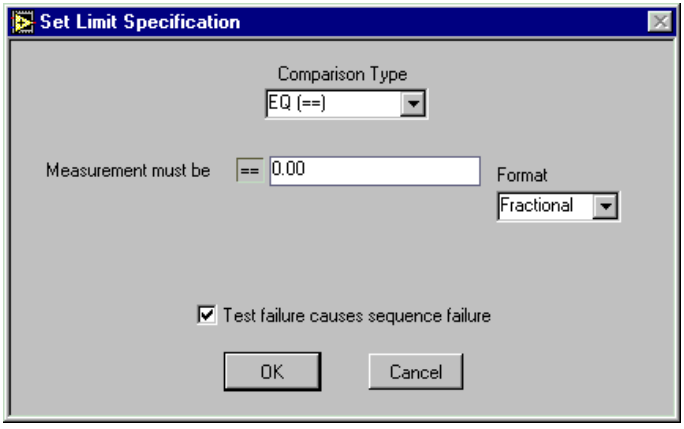
Function (C Test)

Type the name of the function found with the DLL or shared library specified in the Resource indicator. This function must be a valid C test function.

Limit Specification (LabVIEW Test, C Test)

The Limit Specification indicator specifies the type of limit checking the Test Executive uses to determine if a step passes. You cannot type directly into the Limit Specification indicator. To specify a limit, click on the **Set Limit Specification…** button next to the indicator. Then use the ring control to set the comparison type and the string controls to set

the measurement. The following illustration shows the Set Limit Specification dialog box.



Comparison Type specifies the type of comparison to perform, if any, to determine if a step passed. Select the desired limit type from the Comparison Type ring control. The meaning of each value of Comparison Type is as follows.

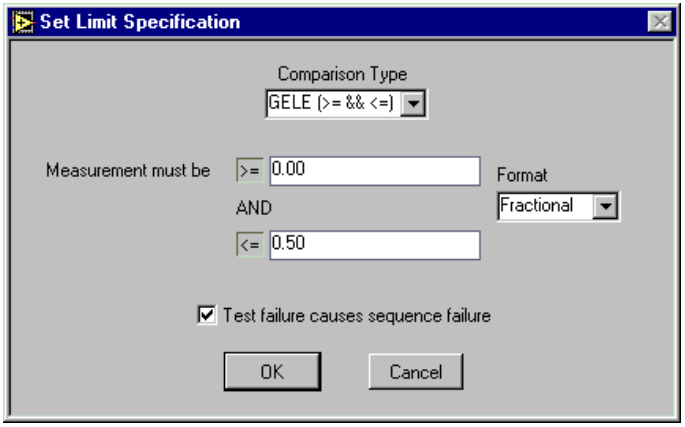
Table 4-3. Comparison Type Values

Type	Condition for Test to Pass
EQ (==)	Numeric Measurement = Lower Limit
NE (!=)	Numeric Measurement != Lower Limit
GT (>)	Numeric Measurement > Lower Limit
LT (<)	Numeric Measurement < Lower Limit
GE (>=)	Numeric Measurement >= Lower Limit
LE (<=)	Numeric Measurement <= Lower Limit
GTLT (> && <)	Numeric Measurement > Lower Limit and < Upper Limit
GTLE (> && <=)	Numeric Measurement > Lower Limit and <= Upper Limit
GELT (>= && <)	Numeric Measurement >= Lower Limit and < Upper Limit
GELE (>= && =<)	Numeric Measurement >= Lower Limit and <= Upper Limit

Table 4-3. Comparison Type Values (Continued)

Type	Condition for Test to Pass
Boolean	PASS/FAIL Flag = TRUE
String	String Measurement = String Limit
Log only	No PASS/FAIL determination–measurement is logged
None	No PASS/FAIL determination or data logging

Depending on the setting of Comparison Type, zero, one-limit, or two-limit entry controls appear in the Set Limit Specification dialog box. A one-limit value appears for Comparison Types of `EQ (==)`, `NE (!=)`, `GT (>)`, `LT (<)`, `GE (>=)`, or `LE (<=)`. Two-limit values, a lower and upper limit, appear for Comparison Types of `GTLT (> && <)`, `GELE (>= && <)`, `GELT (>= && <)`, or `GTLE (> && <=)`, as the following illustration shows.



When the Comparison Type is `String`, the string limit control appears. The Test Executive compares the string value with the string measurement that the step calculates. There are no limits for Comparison Types of `Boolean`, `Log only`, or `None`.

For numeric comparisons, you use the Format control to view the numeric limits in fractional, scientific, decimal, hexadecimal, octal, or binary format. For string comparisons, you use the Display control to view the string limit in normal, hex, or '\' codes mode.

Load Specification (LabVIEW Test, C Test, Sequence)

Load Specification determines whether the step resource loads when the sequence loads (*pre-load*) or loads upon demand when the step executes (*dynamic-load*). Pre-load steps run much faster because the Test Executive does not need to load them during the test sequence. The Test Executive loads dynamic-load steps just before running them, and unloads them immediately after running them.

Run Mode (LabVIEW Test, C Test, Sequence)

Run Mode specifies how the step executes. The options for Run Mode and their meanings are as follows.

Table 4-4. Run Mode Options

Run Mode	Meaning
Normal	Execute step normally.
Skip	Do not execute the step, set result to `SKIP`.
Force PASS	Do not execute the step, set result to `PASS`.
Force FAIL	Do not execute the step, set result to `FAIL`.

FAIL Action (LabVIEW Test, C Test, Sequence)

FAIL Action specifies an action to take if the step fails. The options for FAIL Action and their meanings are as follows.

Table 4-5. FAIL Action Options

FAIL Action	Meaning
Continue	Continue execution with next step.
Stop	Stop execution of sequence.
Callback	Call the Test Failure sequence callback VI to determine whether to continue, stop, or retry the step.
Loop	Repeat execution of the step.

Max Loop Count

The Max Loop Count control appears only when FAIL Action is set to `Loop`. Max Loop Count specifies the maximum number of loop iterations to perform when the FAIL Action is set to `Loop`, and the step fails. Setting the loop count to `-1` causes the step to loop until the operator clicks on either the **Abort Loop** or **Abort** button, or the step passes.

Input Buffer? (LabVIEW Test, C Test)

The Input Buffer? control specifies whether the Test Executive should pass a buffer of input data to the test VI or function when it executes the step. If you uncheck this box, the Test Executive does not pass any input data. If you check this box, the Input Buffer string control appears, which allows you to enter the input data. To pass input data to a test VI, the test VI must have an Input Buffer string control on its front panel. Otherwise, the Test Executive cannot execute the step. For more details on the Input Buffer? control, see the *Test Executive Typedef Controls* section in Chapter 5, *Modifying the Test Executive*. No additional operations are necessary to pass input data to a C test function.

Invocation Info? (LabVIEW Test)

The Invocation Info? control specifies whether the Test Executive should pass run-time call information to the test VI when it executes the step. If you uncheck this box, the Test Executive does not pass run-time call information to the test VI. If you check this box, the Invocation Info? control appears, which allows you to enter the run-time call information. To pass invocation information to a test VI, the test VI must have an Invocation Information cluster control on its front panel. Otherwise, the Test Executive cannot execute the step. For more details on the Invocation Info? control, see the *Test Executive Typedef Controls* section in Chapter 5, *Modifying the Test Executive*.

Show Test VI Panel at Runtime? (LabVIEW Test)

The Show Test VI Panel at Runtime? control determines whether the test VI shows its panel at run time. If you select this checkbox, the test VI panel shows at run time. Otherwise, the test VI panel remains closed.

Edit Test VI (LabVIEW Test)

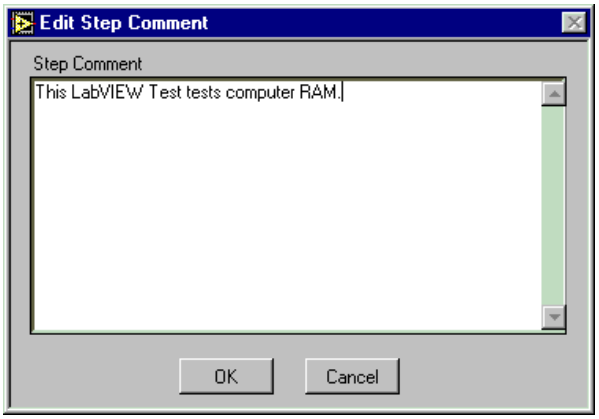
The **Edit Test VI** button is linked to a callback VI. The default Open Test VI callback opens the test VI panel for the current step. If the test VI is not defined or is invalid, the callback VI cannot open the panel and displays an error message. You use the **Edit Test VI** button to edit test VIs from within the Sequence Editor. Modifying or replacing the Open Test VI callback VI makes the **Edit Test VI** button perform different functions. For more details, see the *Advanced Modifications* section in Chapter 5, *Modifying the Test Executive*.

Edit Dependencies

The **Edit Dependencies…** button invokes the Dependency Editor, allowing you to examine or modify the dependencies for the current step. For more details, see the *Editing Dependencies* section of this chapter.

Edit Step Comment (LabVIEW Test, C Test, GOTO, Sequence)

With the **Edit Step Comment…** button, you can edit the comment field for the step. The Sequence Report Callback VI can access this comment. If you press the **Edit Step Comment…** button, the following dialog box appears.



GOTO Target (GOTO)

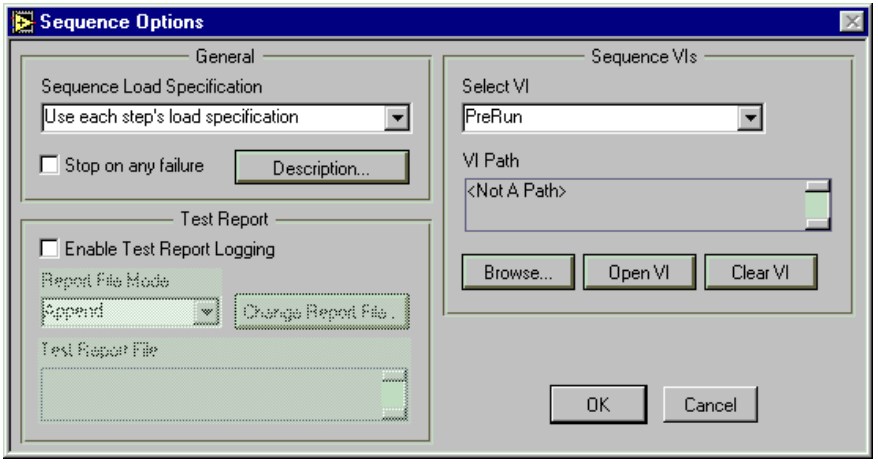
Enter the name of a step in the GOTO Target control. If the Test Executive executes this step, sequence execution will skip to the GOTO Target. Within the Test Executive, step names are case-sensitive.

GOTO Conditions (GOTO)

The **GOTO Conditions…** button invokes the Dependency Editor, allowing you to examine or modify the dependencies for the current GOTO step. For more details, see the *Editing Dependencies* section later in this chapter.

Sequence Options

To view or set the Sequence Options, select **Sequence»Sequence Options…**. The following dialog box appears.



Sequence Load Specification

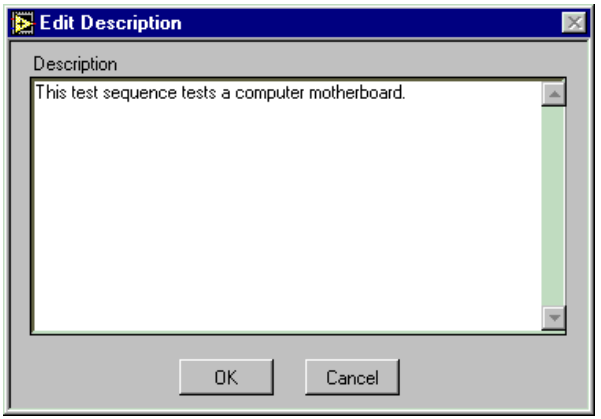
You use the Sequence Load Specification control to override the individual load settings for every step in the sequence. The default setting is `Use each step's load specification`, which means that when the Test Executive loads the sequence, it uses each step's load specification to determine whether to pre-load or dynamically load step resources. If you set the Sequence Load Specification to `Pre-load all steps`, the Test Executive pre-loads every step resource in the sequence regardless of the step's load specification. If you set the Sequence Load Specification `Dynamic-load all steps`, the Test Executive dynamically calls each step resource, regardless of the step's load specification. When all step resources are pre-loaded, the Test Executive runs faster, but it also uses more memory. When step resources are dynamically loaded, the Test Executive runs more slowly, but uses less memory.

Stop on Any Failure

If set, the Stop on Any Failure checkbox stops sequence execution immediately after any step fails. This setting overrides the FAIL Action of any individual step.

Description

The **Description** button allows you to edit the description of the test sequence. If you press the **Description** button, the following Edit Description dialog box appears. The description you create in this dialog box appears in the Test Report that the Test Executive generates at the end of test sequence execution.



Enable Test Report Logging

If set, the Test Executive will log the Test Report to the file specified (if any) in the Test Report File indicator.

Report File Mode

The Report File Mode control specifies the Test Executive response when a file already exists with the name in the Test Report File control. If you set Report File Mode to `Overwrite`, the new report replaces any existing file contents. If you set Report File Mode to `Append`, the Test Executive appends the new report to the existing file. If the file does not exist, the Test Executive creates a file, regardless of the mode.

Change Report File

The **Change Report File** button specifies the path name for the ASCII Test Report file generated at the end of test sequence execution. The path to the file you specify appears in the Test Report File indicator.

Sequence VIs

The term *sequence VIs* refers to the PreRun VI, PostRun VI, and sequence callback VIs for a particular sequence.

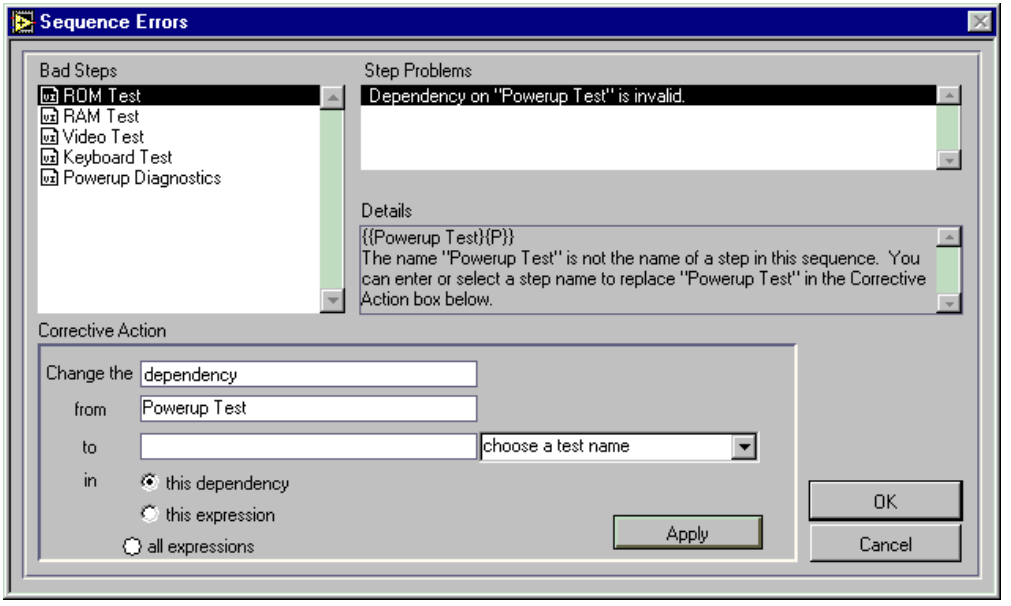
You use the Select VI control to choose any one of the sequence VIs. Then, you change the path for that VI in the VI Path control. Alternately, pressing the **Browse** button activates a file dialog box, so you can browse for a new sequence VI. If you select a new sequence VI and press **OK**, the path to that VI is stored in the VI Path control.

To open the front panel of the current sequence VI, press the **Open VI** button. You can then examine or edit the VI. If the VI Path for the current sequence VI is empty or invalid, the Sequence Editor is not able to open the panel, and displays an error message.

To clear the current sequence VI, press the **Clear VI** button. To save the changes that you make in the Sequence Options dialog box, press the **OK** button. To discard the changes, press the **Cancel** button.

Sequence Errors

When you select **Sequence»Sequence Errors…**, the Sequence Editor checks the test sequence for errors. If the Sequence Editor finds no errors in the sequence, it displays the message **`No Sequence Errors`**. If it finds errors in the sequence, the Sequence Editor displays the following Sequence Errors dialog box.



The Sequence Errors dialog box lists steps that have errors in the Bad Steps list box. When you select a step from the Bad Steps list box, the errors for the selected step appear in the Step Problems list box. If you select an error in the Step Problems list box, an explanation of the selected error appears in the Details list box.

For some errors, the Sequence Errors dialog box displays a Corrective Action. For example, if a step has an empty name, the Sequence Errors dialog box displays a Corrective Action of changing the step's name. However, if the error is that the step does not have a resource, the Sequence Errors dialog box does not display a Corrective Action. Instead, it suggests that you assign a resource to the step in the

Sequence Editor. The following table lists the errors that the Sequence Editor detects and the corresponding Corrective Actions.

Table 4-6. Possible Errors and Corrective Actions in the Sequence Errors Dialog Box

Error	Corrective Action
Step with no name	Change selected step name
Step with duplicate name	Change selected step name
Step with invalid resource	None
Step with invalid limit specification	None
GOTO step with invalid target	Change GOTO target in selected GOTO or all GOTOs
Step with error in dependency	None
Step dependent on invalid step	Change step name in selected dependency, selected expression, or all expressions
Step with invalid dependency condition	None

If you enter a Corrective Action, you must press the **Apply** button to apply that corrective action to the sequence. After you press **Apply**, the Sequence Errors dialog box updates to reflect the application of the Corrective Action. When you fix the last error in the sequence, the message `There are no sequence errors.` appears in the Details list box.

Clicking on the **OK** button in the Sequence Errors dialog box returns you to the Sequence Editor and updates any changes you made. Clicking on the **Cancel** button returns you to the Sequence Editor and discards any changes you made.

Sequence Editor Control Key Assignments

Use the following keyboard shortcuts for the Sequence Editor controls.

Table 4-7. Key Assignments for Sequence Editor Controls

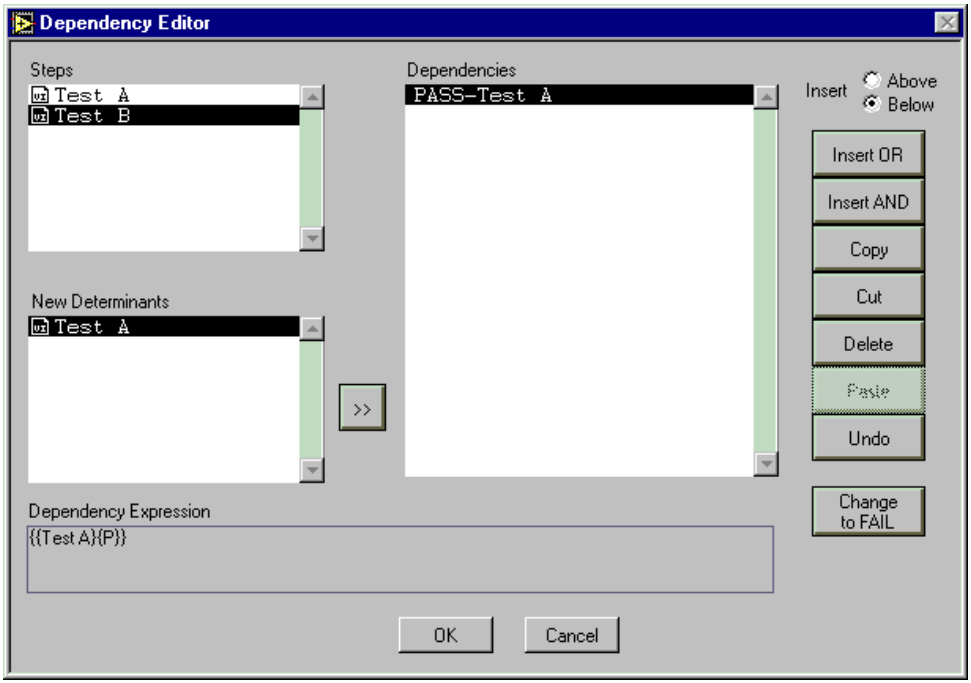
Control	Key Assignment
File Menu	<F1>
Sequence Menu	<F2>
Sequence List	<F3>
Insert	<F4>
New Step	<F5>
Copy	<F6>
Cut	<F7>
Delete	<F8>
Paste	<F9>
Undo	<F10>
Type	<Shift-F1>
Name	<Shift-F2>
Function	<Shift-F3>
Set Limit Specification...	<Shift-F4>
Select Resource…	<Shift-F5>
Edit Dependencies	<Shift-F6>
Edit Step Comment	<Shift-F7>
Edit Test VI	<Shift-F8>
GOTO Target	<Shift-F9>

Table 4-7. Key Assignments for Sequence Editor Controls (Continued)

Control	Key Assignment
GOTO Condition	<Shift-F10>
Load Specification	<Ctrl-F1>
Run Mode	<Ctrl-F2> (<command-F2>, <meta-F2>, <Alt-F2>)
FAIL Action	<Ctrl-F3> (<command-F3>, <meta-F3>, <Alt-F3>)
Max Loop Count	<Ctrl-F4> (<command-F4>, <meta-F4>, <Alt-F4>)
Input buffer?	<Ctrl-F5>
Invocation Info?	<Ctrl-F6>
Show VI Panel at Runtime?	<Ctrl-F7>
Input Buffer	<Ctrl-F8>

Editing Dependencies

Conditional execution of one step based on the result of another is called a *dependency*. Use the Dependency Editor, shown in the following illustration, to define dependencies for steps.



The Dependency Editor shows the dependencies for all steps in the sequence. The name of each step appears in the Steps list box in the top-left corner of the Dependency Editor. To see the dependencies for any step in the sequence, select that step in the Steps list box. The Dependency Editor then displays the dependencies for that step in the Dependencies list box. At the same time, the Dependency Editor updates the New Determinants list box to show the list of steps that can be added to the dependencies. If you select a GOTO step in the Steps list box, the New Determinants list includes every step in the sequence. If you select a step, the New Determinants list includes every step in the sequence except for that step. (A step cannot be dependent upon itself.)

Perform the following operations to make a step dependent on the outcome of another step.

1. Select the dependent step in the Steps list box.
2. Select the determinant step in the New Determinants list box and press the **»** button to add it to the Dependencies list box. This adds a FAIL dependency for the determinant step to the Dependencies list box. Double-clicking on the determinant step also adds the dependency. The FAIL dependency means that the dependent step only executes if the determinant step fails.
3. To change the dependency to a PASS dependency, click on the **Change to PASS** button to the right of the Dependencies list box. Double-clicking on the FAIL dependency also changes it to a PASS dependency.

Notice the Dependency Expression indicator at the bottom of the Dependency Editor panel. This indicator displays the same information as the Dependencies list box, but in a different notation. The Test Executive uses this notation to store the dependencies for any given step.

☞ **Note:** ***It is possible to make a step A dependent on the outcome of a step B even if step B comes after step A in the sequence list. Through the use of GOTOS, step B may execute before step A. If step B does not execute before step A, the result for step B is UNKNOWN. In such a case, any PASS/FAIL dependency that step A has upon step B evaluates to FALSE.***

AND and OR Expressions

When a step has more than one determinant step, an AND or an OR expression must define the relationship between the determinants. For example, suppose Test C is dependent on Tests A and B. If Test C is dependent upon Test A passing and Test B failing, then Test C has an AND dependency expression on Tests A and B. If Test C is dependent upon Test A passing or Test B failing, then Test C has an OR dependency expression on Tests A and B.

Perform the following operations to add an AND dependency expression for a step.

1. Select the desired dependent step in the Steps list box.
2. Click on the **Insert AND** button to the right of the Dependencies list box. This action adds a new, empty AND expression. Click on the `BEGIN AND` statement and set the Insert switch to `below`.
3. Add the desired determinant steps as described in the previous section.

When the Test Executive evaluates the AND expression, it evaluates each element between the `BEGIN AND` and `END AND` statements. The AND expression only evaluates to TRUE if every element inside it is TRUE.

OR expressions are similar to AND expressions in that they contain several elements within a `BEGIN OR` and an `END OR` statement. An OR expression, however, evaluates TRUE if any one of the elements inside it is TRUE. You add a new OR expression to the dependencies for any step or GOTO statement by pressing the **Insert OR** button. You add determinant steps to the OR expression in the same way that you add them to an AND expression.

You can change any AND expression to an OR expression, or an OR expression to an AND expression, by selecting the `BEGIN` or `END` statement of the expression and pressing the **Change to PASS** button. You can also change an expression by double-clicking on its `BEGIN` or `END` statement.

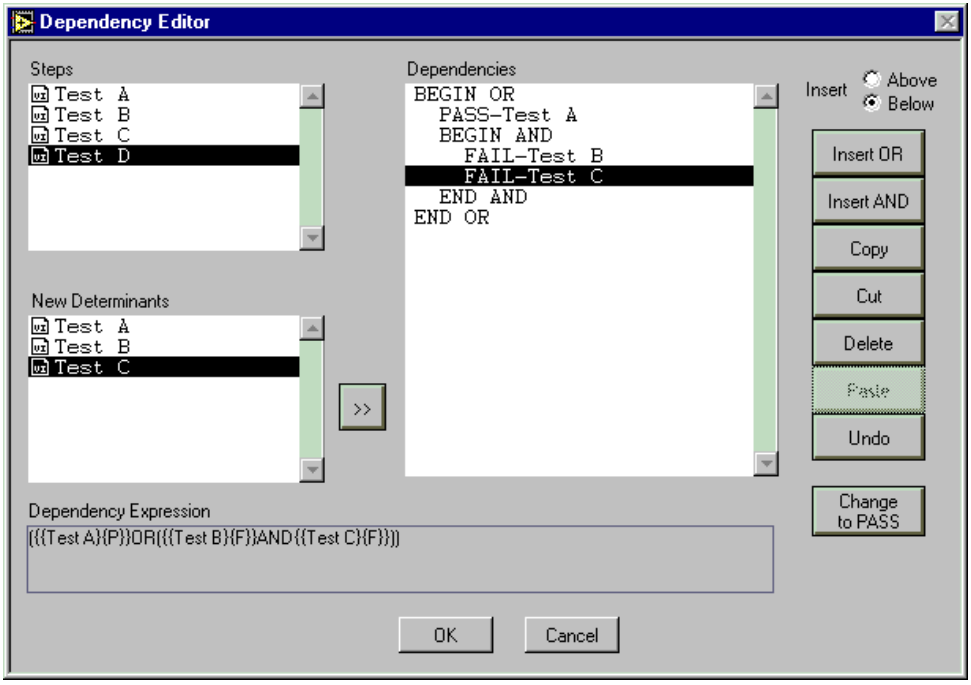
Complex Dependencies

You create complex dependency expressions by nesting AND and OR expressions inside each other. For example, suppose that Test D should only execute if Test A passes or if Tests B and C fail. To define such a dependency in the Dependency Editor, perform the following operations.

1. Select `Test D` in the Steps list box.
2. Click on the **Insert OR** button. After inserting the OR expression, select the `BEGIN OR` statement and set the Insert switch to `below`.
3. Select `Test A` in the New Determinants list box and add it to the Dependencies list box. Use the **Change to PASS** button or double-click on the FAIL dependency to change it to a PASS dependency.

4. Click on the **Insert AND** button to nest an AND expression inside the OR expression. After inserting the AND expression, click on the `BEGIN AND` statement and set the Insert switch to `below`.
5. Add FAIL dependencies for Tests B and C by selecting them in the New Determinants list box and clicking on the **»** button.

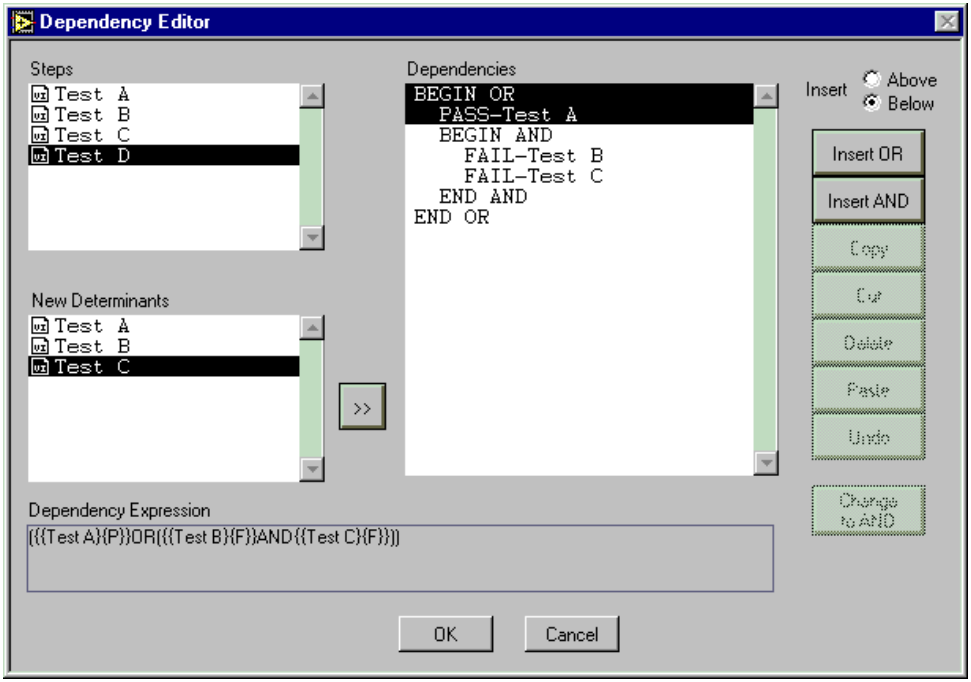
When you finish, the Dependency Editor should look like the following illustration.



Copy, Cut, Delete, Paste, and Undo

The Dependency Editor features cut, copy, paste, delete, and undo capabilities. You cut, copy, or delete statements from the dependencies of any step by selecting the statements in the Dependencies list box and pressing the **Copy**, **Cut**, or **Delete** buttons. You paste statements into the dependencies of any other step by pressing the **Paste** button. When the Dependency Editor clipboard is empty, the **Paste** button is disabled.

Note: ***It is possible to copy, cut, or delete individual statements or entire AND and OR expressions in the Dependency Editor. However, you cannot cut, copy, or delete partial expressions. When you select a partial expression, the* Copy, Cut, *and* Delete *buttons are disabled, as the following illustration shows.***



The Dependency Editor features one level of undo. You reverse any edit action by pressing the **Undo** button. When you have not made changes or have just reversed an action, the **Undo** button is disabled.

Dependency Editing Rules

You cannot insert or paste elements outside the top-level dependency expression in the Dependency Editor. If you attempt to insert or paste elements outside the top-level expression, the Dependency Editor inserts the elements inside the expression.

OK

The **OK** button saves any changes you make to the sequence dependencies and returns you to the Sequence Editor.

☞ **Note:** ***Clicking on the* OK *button only saves to memory. You must select* File» Save *or* File»Save As… *on the Test Executive front panel to save changes to disk.***

Cancel

The **Cancel** button discards any changes made to the sequence dependencies and returns you to the Sequence Editor.

Dependency Editor Key Assignments

The following Dependency Editor controls are followed by their keyboard shortcuts.

Table 4-8. Dependency Editor Key Assignments

Control	Key Assignment
Sequence Elements	<F2>
New Determinants	<F3>
»	<F4>
Dependencies	<F5>
Insert	<F6>
Insert OR	<Shift-F1>
Insert AND	<Shift-F2>
Copy	<Shift-F3>
Cut	<Shift-F4>
Delete	<Shift-F5>
Paste	<Shift-F6>

Table 4-8. Dependency Editor Key Assignments (Continued)

Control	Key Assignment
Undo	<Shift-F7>
Change to PASS	<Shift-F8>

Relationship between Dependencies, Run Mode, and Test Flow

The dependencies and run mode for each step determine the flow of execution for a test sequence. The Test Executive performs the following steps to determine whether to execute a given step.

1. The Test Executive evaluates the dependencies for the step. For a step to execute, the dependency expression for that step must evaluate to TRUE. If the Test Executive determines that the current step should be skipped, the step result is set to `SKIP`.
2. If the dependencies indicate that the step should execute, the Test Executive evaluates the Run Mode of the step. If the Run Mode is `Normal`, the step executes. If Run Mode is set to any value other than `Normal`, the step does not execute. The following table shows the corresponding step results for each Run Mode value.

Table 4-9. Run Mode Step Result Values

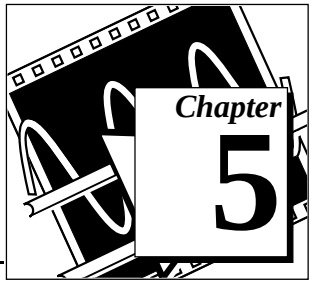
Run Mode	Test Result
Skip	SKIP
Normal	PASS/FAIL
Force PASS	PASS
Force FAIL	FAIL

When evaluating dependencies, the Test Executive does not distinguish between a real PASS/FAIL result—where the step actually executed—and a forced PASS/FAIL result.

File Menu

Selecting **File»Save…** saves the current sequence. If the sequence has not yet been saved, a dialog box prompts you for a path or file name. Selecting **Save As…** prompts you for a file name and then saves the current sequence under that name. Selecting **Exit** returns you to the main Test Executive front panel, prompting you to save if any changes were made. If you made changes to the sequence or saved it under a different name, the Test Executive unloads the old sequence hierarchy and reloads the new, saved hierarchy.

When you select **Save…** or **Save As…**, the Sequence Editor scans the test sequence for errors. If any errors are found, you are prompted to fix them. If you choose to fix the sequence errors, the Sequence Error dialog box appears. Selecting **Save…** or **Save As…** without fixing sequence errors will save a sequence which cannot be executed by the Test Executive until the errors are fixed.



Modifying the Test Executive

This chapter describes the architecture of the Test Executive and explains how to make modifications to it. If you do not plan to modify the Test Executive, you do not need to read this chapter. The chapter covers the following topics.

- The system configuration file, `testexec.ini`
- The operator interface VI
- The callback VIs
- The Test Executive typedef controls
- Common modifications
- Advanced modifications

The System Configuration File, testexec.ini

The system configuration file, `testexec.ini`, is an ASCII file that defines the names and locations of the Test Executive operator interface VI, callback VIs, and preference values. The Test Executive install program creates a default system configuration file with paths to the default operator interface VI, default callback VIs, and initial preference values. The installer puts this file in the `LVEXEC50` directory, where the Test Executive is installed.

The system configuration file is divided into three sections. The first section, `[Callback Paths]`, identifies the locations of all default callback VIs. The second section, `[Operator Interface Path]`, identifies the location of the default operator interface VI. The third section, `[Preferences]`, lists the preference values that the Test Executive uses.

[Callback Paths] Section

Each time you launch the Test Executive, it loads the appropriate callback VIs by first reading the `[Callback Paths]` section of the `testexec.ini` file. The entries in this section have the following format.

```
VI_id="VI_path"
```

`VI_id` specifies one of the Test Executive callback VIs. The system configuration file must have an entry for each of the following `VI_id` string values.

- Login
- Select_Sequence
- Open_Sequence
- Save_Sequence
- Close_Sequence
- Exit
- Sequence_Report
- Default_PreUUT_Loop
- Default_PreUUT
- Default_PostUUT_Loop
- Default_PostUUT
- Default_PreStep
- Default_PostStep
- Default_Test_Report
- Default_Post_Run-Loop_Test
- Default_Test_Failure
- Default_Edit_Test_VI

`VI_path` specifies the absolute file path to the callback VI. You must enclose `VI_path` in double quotes and make sure that it contains no extra leading or trailing spaces. The following code shows a sample entry in `testexec.ini` for the Login callback VI.

```
Login="C:\LV41\LVEXEC50\CALLBACK.LLB\Login Callback.vi"
```

Patching Callback Paths

As described in the previous section, when you launch the Test Executive, it loads the appropriate callback VIs by reading their paths from the `testexec.ini` file. If the path to a particular callback VI is invalid, the Test Executive prompts you to find the callback VI. This happens, for example, if you deploy the Test Executive to a different machine and do not update the callback paths in the system configuration file.

After you locate the missing callback VI, the Test Executive patches the invalid callback VI path with the new path. Then, it prompts you to add the selected VI library or directory to the search path. If you press **Yes**, the Test Executive automatically searches that VI library or directory to patch the missing paths for any other callback VIs. This search path is a temporary path that is deleted after you launch the Test Executive.

☞ **Note:** ***When the Test Executive patches a callback VI path, it marks the path as modified. If you try to close the Test Executive with patched callback VI paths, the Test Executive prompts you to save changes to*** `testexec.ini`***. If you press*** `Yes`***, the Test Executive saves the patched callback VI paths to*** `testexec.ini`***. Then, the next time you launch the Test Executive, it does not need to search for the callback VIs.***

[Operator Interface Path] Section

When you launch the Test Executive Run-Time System, it loads the appropriate operator interface VI by first reading the `[Operator Interface Path]` section of the `testexec.ini` file. The entries in this section have the same format as those in the `[Callback Paths]` section. The system configuration file must have an entry for the following `VI_id` string value.

- Operator_Interface

For more information on the Test Executive Run-Time System, please refer to Chapter 6, *Deploying the Test Executive*.

[Preferences] Section

The [Preferences] section of the testexec.ini file holds additional information the Test Executive uses to define certain values. The entries in this section have the following format.

```
preference_name=value
```

preference_name specifies the particular preference. The only preference the default testexec.ini file specifies is TestNameDisplayLength, which is set to a default value of 21. The TestNameDisplayLength preference specifies how long the step names shown in the Test Executive Sequence Display can be before they are truncated. If you would like to display longer step names, simply increase this preference's value in testexec.ini and grow the Sequence Display listbox to accommodate the longer names.

Operator Interface VI

The operator interface VI is the main panel of the Test Executive. It is responsible for accepting commands from the operator and passing them to the Test Executive engine. It is also responsible for receiving information from the Test Executive engine and displaying that information to the user.

The Test Executive package includes a default operator interface VI, called Test Executive. It is installed in the LVEXEC50\OPERATOR.LLB VI Library. The Test Executive also allows you to customize the name, appearance, and/or behavior of the default operator interface VI.

Modifying the Default VI

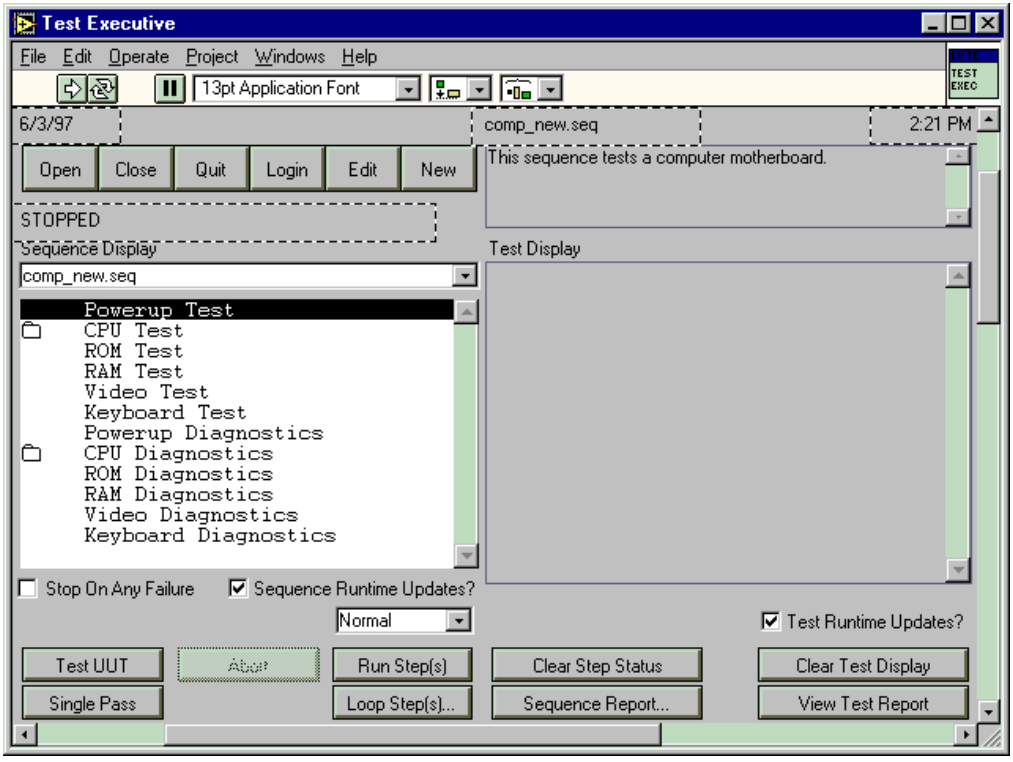
Before you modify the default operator interface VI, you should make a backup copy of it.

Front Panel

You open and examine the front panel of the default operator interface VI by performing the following steps.

1. Launch the LabVIEW FDS (Full Development System).
2. Select **File»Open** from the menu on the front panel and choose the Test Executive VI in the `LVEXEC50\OPERATOR.LLB` VI Library. A Login dialog box appears, because the Test Executive automatically configures the default operator interface VI to run when opened.
3. Log in as a developer and quit the Test Executive.

The following illustration shows the front panel of the default operator interface VI in edit mode.



In addition to the visible controls and indicators, the operator interface panel also contains some transparent string indicators. Dashed outlines mark the locations of the transparent string indicators.

You make cosmetic modifications to the operator interface VI panel, such as resizing buttons, changing function key assignments, or pasting in a logo or other imported graphics, without editing the operator interface's block diagram. However, to add new controls to the panel or change the behavior of existing controls, you must edit the block diagram.

Block Diagram

To open and examine the block diagram of the operator interface VI, select **Windows»Show Diagram** from the menu on the front panel.

Notice that the operator interface diagram consists of a command loop and a clock loop. When you run the operator interface VI, it simultaneously runs the command loop and the clock loop until you quit the Test Executive. Notice also that the operator interface VI communicates with the Test Executive engine through subVI calls. The Test Executive allows you to open the front panel of any of these subVIs, but you cannot modify them or look at their block diagrams. The engine subVIs are shipped without their block diagrams.

Command Loop

The command loop of the operator interface VI is a state machine construct described in the Spring 1996 issue of the *LabVIEW Technical Resource*. It continuously scans all active controls on the operator interface panel for changes in state. When a control changes state, the corresponding case in the command loop executes.

If you add a new control to the front panel of the operator interface, you must edit the command loop so that it monitors and handles state changes in the new control. Perform the following steps to edit the command loop.

1. At the left side of the command loop diagram and in the No Event Case structure, turn the state change of your new control into a Boolean value—TRUE if the state has changed and FALSE if it has not. The default command loop contains examples of Boolean controls and numeric controls.

2. In the No Event Case structure, add an input to the bottom of the Build Array function and wire the state change value into the new input.
3. On the front panel of the operator interface, add an item to the Event List enumerated type representing your new event. Always add new events immediately before the Update Display event. Set the Event List back to No Event after adding the new event.
4. Add a case before the Update Display case in the Command Handler Case structure and place the code to handle your new command in the new case.

☞ **Note:** ***If you create a new subVI and call it from your operator interface block diagram, make sure to store that new subVI in*** `OPERATOR.LLB`***, so the operator interface VI finds the subVI when it is loaded.***

Callback VIs

When you install the Test Executive, the installer places a complete set of default callback VIs in the `LVEXEC50\CALLBACK.LLB` VI Library. In addition, it installs a set of typedef controls for creating your own callback VIs in the `USER.LIB\LVEXEC50.LLB` VI Library.

By creating your own callback VIs, you customize certain operations in the Test Executive, such as user login, prompting for UUT information, displaying PASS/FAIL banners, logging UUT Test results, and generating Test and Sequence reports. The Test Executive engine then handles these operations by calling your callback VIs.

The callback VIs for different operations have different calling interfaces. The calling interface specifies a set of required inputs and outputs for the front panel of the callback VI. In order for the Test Executive to successfully call a callback VI, the callback VI must have all required inputs and outputs. The Test Executive ignores any additional controls or indicators that might be on the front panel.

You use the typedef controls for the correct definitions for some of the required callback inputs and outputs. These controls are available from the **Controls** menu of the LabVIEW FDS after you install the Test Executive development system. For a detailed examination of these typedef controls, see the *Test Executive Typedef Controls* section later in this chapter.

Test Executive Callback VI Calling Interface

The Test Executive calling interface includes system callback VIs and sequence callback VIs.

System Callbacks

The Test Executive includes the following system callback VIs:

- Login
- Select Sequence
- Open Sequence
- Close Sequence
- Save Sequence
- Sequence Report
- Exit

The system callback VIs are not associated with the execution of any particular sequence. Each time you launch the Test Executive, it loads the appropriate system callback VIs by first reading the entries in the system configuration file, `testexec.ini`. If the Test Executive cannot find the system configuration file, it prompts you to find it. When you quit the Test Executive, it unloads the system callback VIs.

The rest of this section contains a detailed description of the calling interface for each system callback VI.

☞ **Note:** ***In the parameter tables that follow, the type of some inputs and outputs is listed as*** `TYPEDEF-xxx.ctl`***. This value indicates that the input or output is a Test Executive typedef control. For a detailed examination of these typedef controls, see the*** *Test Executive Typedef Controls* ***section of this chapter.***

Login

The Test Executive calls the Login callback VI upon startup and whenever the user presses the **Login** button on the operator interface panel. The Test Executive installs the default `Login Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.
Output	**New Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the new user.

The default Login callback VI performs no action with its inputs. It sets a warning in the error out control if the user cancels the Login dialog box. If the login is successful, the default callback VI sets error out to `no error` and puts the name, password, and privilege level (Developer, Technician, or Operator) of the new user into the New Login Info control. If the Login callback VI returns an error or warning, the Test Executive does not change the current login information and displays the error or warning in the Test Display.

You customize the Login callback VI to work with custom login information in the following manner. You should first create a custom Login Info typedef to contain the custom login information. Then, when the login callback VI logs in a new user, it fills in the custom Login Info typedef with the custom login information, flatten the contents of the typedef to a string, and pass the flattened string out in the User Info output of the New Login Info cluster. If any other callback VI needs to access this custom login information, it uses the Unflatten From String function on the custom Login Info typedef.

Select Sequence

The Test Executive calls the Select Sequence callback VI when the operator presses the **Open** button on the main operator interface panel to open a new test sequence. With the Select Sequence callback VI, the operator chooses the path to the new test sequence file. The Test Executive installs the default `Select Sequence Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Current Sequence Info**	`TYPEDEF-Sequence.ctl`	Contains information about the test sequence currently shown in the Sequence Display.
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.
Output	**Sequence Path**	`TYPEDEF-String`	Contains the path to the selected test sequence file.
Output	**Cancelled?**	`TYPEDEF-Boolean`	This output is TRUE if the operator cancelled the Select Sequence operation, FALSE otherwise.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.

The default Select Sequence callback VI opens the standard LabVIEW File Dialog box and prompts the operator to choose a sequence file. The default callback VI returns the path to the selected file in the Sequence Path control, returns `TRUE` in Cancelled? if the operator cancels the dialog box, and always returns `no error` in the error out control. If the Select Sequence callback VI returns `TRUE` in Cancelled?, the Test Executive cancels the operation and keeps the currently loaded sequence. If the callback VI returns an error in the error out control, the Test Executive cancels the operation and displays the error in the Test Display. To use a custom Open Sequence dialog box or to restrict access to sequences based upon the users privilege level, modify the default Select Sequence callback VI.

Open Sequence

The Test Executive calls the Open Sequence callback VI just after it opens a new sequence. The Test Executive installs the default `Open Sequence Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Sequence Info**	`TYPEDEF-Sequence.ctl`	Contains information about the test sequence that was opened.
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.
Output	**Sequence Info String**	`TYPEDEF-String`	Contains a string that appears in the Sequence Info box on the operator interface panel. This string contains a description of the sequence or instructions to the operator.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.

The default Open Sequence callback VI performs no action. If the operation is successful, the default callback VI returns the sequence description in the Sequence Info String control and returns `no error` in the error out control. If the Open Sequence callback VI returns an error or warning to the Test Executive, the error appears in the Test Display. The string returned in Sequence Info String appears in the Sequence Info box on the operator interface panel. You may want to modify this VI to perform initialization functions or to log sequence file usage.

Close Sequence

The Test Executive calls the Close Sequence callback VI just before it closes a sequence. The Test Executive installs the default `Close Sequence Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Sequence Info**	`TYPEDEF-Sequence.ctl`	Contains information about the test sequence that is being closed.
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.

The default Close Sequence callback VI performs no action. If the close operation is successful, it returns `no error` in the error out control. If the callback VI returns an error to the Test Executive, the error appears in the Test Display. You modify this callback VI to perform cleanup functions or to log sequence file usage.

Save Sequence

The Test Executive calls the Save Sequence callback VI just after it saves a sequence. The Test Executive installs the default `Save Sequence Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following the calling interface.

Type	Name	Typedef	Description
Input	**Sequence Info**	`TYPEDEF-Sequence.ctl`	Contains information about the test sequence that was saved.
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.

The default Save Sequence callback VI performs no action. If the save operation was successful, it returns `no error` in the error out control. If the callback VI returns an error to the Test Executive, the error appears in the Test Display. You modify this callback VI to log sequence file modifications.

Sequence Report

The Test Executive calls the Sequence Report callback VI when you press the **Sequence Report** button on the operator interface panel. The Test Executive installs the default `Sequence Report Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Sequence Info**	`TYPEDEF-Sequence.ctl`	Contains information about the test sequence currently shown in the Sequence Display.

The default Sequence Report callback VI generates an ASCII, spreadsheet-style report of the contents of the currently loaded sequence and prompts you to save the report to disk. You modify this callback VI to customize the contents of the Sequence Report ASCII file to meet your needs.

Exit

The Test Executive calls the Exit callback VI when you quit the Test Executive. If there is an open test sequence, the Test Executive closes it prior to calling the Exit callback VI. The Test Executive installs the default `Exit Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.

You modify the Exit callback VI to work with the Login callback VI to log usage of the Test Executive.

Sequence Callbacks

The Test Executive includes the following sequence callback VIs:

- Pre-UUT Loop
- Pre-UUT
- Post-UUT
- Post-UUT Loop
- Pre-Step
- Post-Step
- Test Report
- Post Run-Loop Test
- Test Failure
- Open Test VI

Each time you launch the Test Executive, it loads the appropriate sequence callback VIs by first reading the entries in the system configuration file, `testexec.ini`. If the Test Executive cannot find the system configuration file, it prompts you to find it. When you quit the Test Executive, it unloads the sequence callback VIs.

Although the Test Executive contains a default set of sequence callback VIs, each sequence has its own custom set of sequence callback VIs. If a sequence uses a custom callback VI, the Test Executive loads the VI when it opens the sequence and unloads it when it closes the sequence. While the sequence is open, the custom callback VIs override the corresponding default callback VIs. You specify custom callback VIs for a sequence by selecting **Sequence Options…** in the Sequence Editor. For more details, see Chapter 4, *Creating Tests and Test Sequences*.

The Test Executive calls the first seven sequence callback VIs—Pre-UUT Loop, Pre-UUT, Post-UUT, Post-UUT Loop, Pre-Step, Post-Step, and Test Report—during the execution of a test sequence.

The following illustration shows how the Test Executive calls these callback VIs during a UUT Test loop.

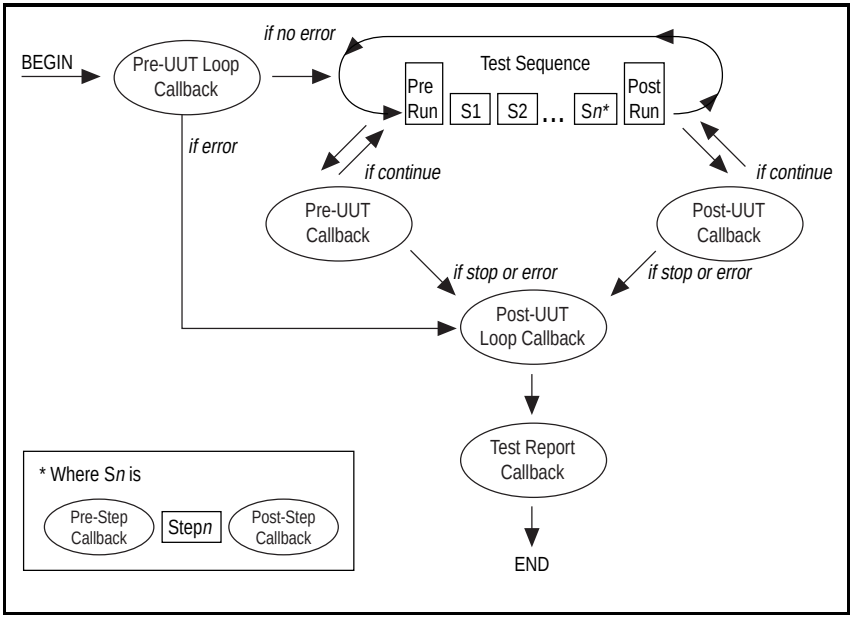


Figure 5-1. Flow of Sequence Callback VIs in a UUT Test Loop

The sequence callback VIs handle operations such as putting up a UUT Information dialog box at the start of a UUT Test, putting up a PASS/FAIL banner at the end of a UUT Test, and generating an ASCII Test Report at the end of a UUT Test Loop. By modifying these default sequence callback VIs or by specifying custom sequence callback VIs, you create customized UUT Information dialog boxes, customized PASS/FAIL banners, or customized Test Reports.

When a step with a FAIL Action of `Callback` fails, the Test Executive engine calls the Test Failure callback VI to determine what action it should take. After the user presses the **Run Step(s)** or **Loop Step(s)** button to run or loop an individual step, the Test Executive engine calls the Post Run-Loop Test callback VI and passes the step results to it.

The Sequence Editor calls the last sequence callback VI, Open Test VI, when you press the **Edit Test VI** button or double-click on a LabVIEW test in the sequence list. The default Open Test VI callback opens the front panel of the selected LabVIEW Test, so you can edit it. You replace this default callback VI with one that automatically configures

the call to the test VI or performs other LabVIEW Test editing operations.

The rest of this section contains a detailed description of the calling interface for each sequence callback VI.

☞ **Note:** ***In the parameter tables that follow, the type of some inputs and outputs is listed as*** `TYPEDEF-xxx.ctl`***. This value indicates that the input or output is a Test Executive typedef control. For a detailed examination of these typedef controls, see the*** *Test Executive Typedef Controls* ***section of this chapter.***

Pre-UUT Loop

The Test Executive calls the Pre-UUT Loop callback VI before it tests the first UUT in a UUT Test Loop. You initiate a UUT Test Loop by pressing the **Test UUT** button. The Test Executive installs the default `Pre-UUT Loop Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Sequence Info**	`TYPEDEF-Sequence.ctl`	Contains information about the top-level test sequence in the hierarchy being executed.
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.

The default Pre-UUT Loop callback VI performs no action and returns `no error` in the error out control. If the Pre-UUT Loop callback VI returns an error to the Test Executive, it terminates the UUT Test Loop and displays the error in the Test Display. You modify this callback VI to perform appropriate initialization before a UUT Test Loop begins.

Pre-UUT

The Test Executive calls the Pre-UUT callback VI just before calling the PreRun VI at the beginning of each cycle of a UUT Test Loop. You initiate a UUT Test Loop by pressing the **Test UUT** button. The Test Executive installs the default `Pre-UUT Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Sequence Info**	`TYPEDEF-Sequence.ctl`	Contains information about the top-level sequence in the hierarchy being executed.
Input	**Previous UUT Info**	`TYPEDEF-String`	Contains the UUT information for the last UUT that was tested. This input is empty for the first UUT in a UUT Test loop.
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.
Input	**UUT#**	`TYPEDEF-Integer`	Indicates how many UUTs have been tested in the current UUT Test Loop.
Output	**Continue?**	`TYPEDEF-Boolean`	Indicates whether to continue the UUT Test Loop.
Output	**UUT Info**	`TYPEDEF-String`	Contains user-supplied information about the next UUT to be tested.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.

The default Pre-UUT callback VI pops up a UUT Info dialog box that prompts you to enter a serial number for the UUT about to be tested. If you press the **Stop** button on the default UUT Info dialog box, the callback VI sets the Continue? Boolean to FALSE and returns `no error` in the error out control. Otherwise, the callback VI copies the serial number into the UUT Info control, sets Continue? to TRUE, and returns

no error in the error out control. The Test Executive ends the UUT Test Loop if the Pre-UUT callback VI returns a FALSE in the Continue? control. If the callback VI returns an error to the Test Executive, it terminates the UUT Test Loop and displays the error in the Test Display.

Similar to defining custom login information in the Login callback VI, you can also define custom UUT information in the Pre-UUT callback VI. For more details, see the *Login* section earlier in this chapter.

Post-UUT

The Test Executive calls the Post-UUT callback VI just after calling the PostRun VI at the end of each cycle of a UUT Test Loop. You initiate a UUT Test Loop by pressing the **Test UUT** button. The Test Executive installs the default Post-UUT Callback.vi in the LVEXEC50\CALLBACK.LLB VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Sequence Info**	TYPEDEF-Sequence.ctl	Contains information about the top-level sequence in the hierarchy being executed.
Input	**UUT Results**	TYPEDEF-UUT Results.ctl	Contains user-supplied UUT information and raw UUT test results.
Input	**Current Login Info**	TYPEDEF-Login Info.ctl	Contains login information for the current user.
Input	**UUT#**	TYPEDEF-Integer	Indicates how many UUTs have been tested in the current UUT Test Loop.
Output	**Continue?**	TYPEDEF-Boolean	Indicates whether to continue the UUT Test Loop.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.

If testing for the UUT is successful, the default Post-UUT callback VI pops up a PASS/FAIL banner. It either pops up a PASS banner if all the steps in the sequence passed or a FAIL banner if any step in the sequence failed and its Step Fail = Seq. Fail? flag was set to TRUE. If you abort testing for the UUT, the default Post-UUT callback VI pops up an ABORT banner. The default Post-UUT callback VI always returns a TRUE in the Continue? control. If the Post-UUT callback VI returns a FALSE in the Continue? control, the Test Executive ends the UUT Test Loop, just as it does when the Pre-UUT callback VI returns a FALSE in Continue? If the Post-UUT callback VI returns an error in the error out control, the Test Executive terminates the UUT Test Loop and displays the error in the Test Display.

You modify the Post-UUT callback VI to perform custom actions, such as logging result data on a per-UUT basis to a file or a database.

Post-UUT Loop

The Test Executive calls the Post-UUT Loop callback VI when you terminate a UUT Test Loop. You initiate a UUT Test Loop by pressing the **Test UUT** button. The Test Executive installs the default `Post-UUT Loop Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Sequence Info**	`TYPEDEF-Sequence.ctl`	Contains information about the current test sequence.
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.

The default Post-UUT Loop callback VI performs no action and returns `no error` in the error out control. If the callback VI returns an error to the Test Executive, it displays the error in the Test Display. You modify the Post-UUT Loop callback VI to perform appropriate cleanup after a UUT Test Loop ends.

Pre-Step and Post-Step Callbacks

Pre-Step and Post-Step are sequence callbacks which execute before and after each test step, respectively. The Test Executive installs the default `Pre-Step Callback.vi` and `Post-Step Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library.

The Pre-Step Callback uses the following calling interface.

Type	Name	Typedef	Description
Input	**Execution Mode**	`TYPEDEF-Execution Mode.ctl`	Specifies the execution mode under which the callback is being run.
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.
Input	**Invocation Info**	`TYPEDEF-Invocation Info.ctl`	Contains the invocation information used for the associated test step
Input	**Runtime Status In**	`TYPEDEF-Runtime Status.ctl`	Contains runtime information like resource path, function name (for C functions), etc. for the associated test step.
Output	**Runtime Status Out**	`TYPEDEF-Runtime Status.ctl`	Contains runtime information like resource path, function name (for C functions), etc. for the associated test step.
Output	**error out**	Standard LabVIEW error output cluster	Indicates whether an error or warning occurred in the callback VI.

The default Pre-Step Callback performs no action and returns `no error` in the error out control.

The Post-Step Callback uses the following calling interface.

Type	Name	Typedef	Description
Input	**Execution Mode**	`TYPEDEF-Execution Mode.ctl`	Specifies the execution mode under which the callback is being run.
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.
Input	**Invocation Info**	`TYPEDEF-Invocation Info.ctl`	Contains the invocation information used for the associated test step
Input	**Runtime Status In**	`TYPEDEF-Runtime Status.ctl`	Contains runtime information like resource path, function name (for C functions), etc. for the associated test step.
Output	**Test Result**	`TYPEDEF-Test Result.ctl`	Contains the result information from the associated test step.
Output	**Runtime Status Out**	`TYPEDEF-Runtime Status.ctl`	Contains runtime information like resource path, function name (for C functions), etc. for the associated test step.
Output	**error out**	Standard LabVIEW error output cluster	Indicates whether an error or warning occurred in the callback VI.

The default Post-Step Callback performs no action and returns `no error` in the error out control.

Test Report

The Test Executive calls the Test Report callback VI after calling the Post-UUT Loop callback VI at the end of a UUT Test Loop. You initiate a UUT Test Loop by pressing the **Test UUT** button. The Test Executive also calls this callback VI at the end of a Single Pass Test, which you initiate by pressing the **Single Pass** button. The Test Executive installs the default `Test Report Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Sequence Info**	`TYPEDEF-Sequence.ctl`	Contains information about the sequence that is being executed.
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.
Input	**Single Pass?**	`TYPEDEF-Boolean`	TRUE if called from a Single Pass UUT Test, FALSE otherwise.
Output	**Test Report**	`TYPEDEF-String`	Contains a report string detailing the test results for each UUT that was tested.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.

The default Test Report callback VI generates a formatted, spreadsheet-style report string and returns it in the Test Report control. If the sequence has a report file, the Test Report callback VI appends or overwrites the report file, depending on the Report File Mode. You view the report string on the operator interface panel by pressing the **View Test Report** button. You modify the Test Report callback VI to generate the report string in a different format or to perform other actions, such as logging result data to a database.

The default Test Report Callback VI uses the following VIs to access the test results from a temporary file, which the Test Executive maintains. These VIs can be found in LVEXEC50\CALLBACK.LLB.

- Open UUT Results File.vi
- Read UUT Results File.vi
- Close UUT Results File.vi

Post Run-Loop Test

The Test Executive calls the Post Run-Loop Test callback VI when you press the **Run Step(s)** or **Loop Step(s)** buttons on the main operator interface panel. The Test Executive installs the default Post Run-Loop Test Callback.vi in the LVEXEC50\CALLBACK.LLB VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Test #**	TYPEDEF-Integer	Contains the index of the run or looped test in the sequence.
Input	**Sequence Info**	TYPEDEF-Sequence.ctl	Contains information about the currently loaded test sequence.
Input	**Current Login Info**	TYPEDEF-Login Info.ctl	Contains login information for the current user.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.

The default Post Run-Loop Test callback VI does nothing and returns no error in the error out control. You modify this callback VI to log or process the results of the step that was run or looped. You can use the same VIs used in the default Test Report Callback VI to access the results for the testing operation.

Test Failure

The Test Executive calls the Test Failure callback VI when a step with a FAIL Action of `Callback` fails. The Test Failure callback VI allows you to choose the failure action. The Test Executive installs the default `Test Failure Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Failed Test Result**	`TYPEDEF-Test Result.ctl`	Contains the test result for the failed test.
Input	**Test #**	`TYPEDEF-Integer`	Contains the index of the failed test in the sequence.
Input	**Sequence Info**	`TYPEDEF-Sequence.ctl`	Contains information about the currently loaded test sequence.
Input	**Current Login Info**	`TYPEDEF-Login Info.ctl`	Contains login information for the current user.
Output	**Action**	`TYPEDEF-Integer`	Indicates a continue, stop, or retry action.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.

The default Test Failure callback VI opens a dialog box that prompts you to choose one of three actions: Continue, Stop, or Retry. When you press a button on this dialog box, the default callback VI returns the selected action in the Action control. The only values for Action are 0 (Continue), 1 (Stop), and 2 (Retry). When the Test Failure callback VI returns `Continue`, the Test Executive logs the step failure and continues to run the next test in the sequence. When the callback VI returns `Stop`, the Test Executive stops testing the current UUT. When the callback returns `Retry`, the Test Executive runs the failed step again. If the Test Failure callback returns an error in the error out control, the Test Executive stops running the test sequence and displays the error in the Test Display. The default Test Failure callback VI always returns `no error` in the error out control.

You modify the default Test Failure callback VI if you want to use a custom dialog box, to handle the failure automatically, or to handle the failure differently depending on your privilege level.

Open Test VI

The Sequence Editor calls the Open Test VI callback VI when you press the **Edit Test VI** button in the Sequence Editor. The Test Executive installs the default `Open Test VI Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library and uses the following calling interface.

Type	Name	Typedef	Description
Input	**Sequence Path**	`TYPEDEF-File Path`	Contains the absolute path to the sequence file for the sequence that is being edited. If the sequence has not been saved, this input is empty.
Input	**Test**	`TYPEDEF-Sequence Element.ctl`	Contains information about the test that is being edited.
Output	**Test Input**	`TYPEDEF-String`	If filled, the Sequence Editor copies the string into the Input Buffer for the test that is being edited. If empty, the Sequence Editor ignores this output.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the callback VI.

The default Open Test VI callback opens the front panel of the LabVIEW test for the test that is being edited. This way, you can edit the LabVIEW test from within the Sequence Editor. The default Open Test VI callback returns the empty string in the Test Input control and returns `no error` in the error out control. If the Open Test VI callback returns an error to the Test Executive, it displays the error in a message box.

You modify the Open Test VI callback if you to generate input data for the LabVIEW test that is being edited. For a demonstration of this technique, see the *Advanced Modifications* section of this chapter.

Test Executive Typedef Controls

The Test Executive install program installs a set of typedef controls in the `USER.LIB\LVEXEC50.LLB` VI Library, allowing you to create callbacks and test VIs more easily. These typedef controls define some of the required callback VI inputs and outputs and all of the required and optional test VI inputs and outputs. The Test Executive typedef controls are available from the **Controls** palette of the LabVIEW FDS after you install the Test Executive development version.

When creating or modifying a callback VI or LabVIEW test, you should remember that the Test Executive calls these VIs by name. Therefore, every required input or output on the called VI must match in name, type, and data direction with what the Test Executive expects. For example, if the Test Executive expects a callback VI to have a Boolean input control named “abc” on its front panel, the call to the VI fails if the control’s name is not “abc”, if the type is not Boolean, or if it is not a control. Note that control name comparisons are case sensitive, so “ABC” does not match “abc”. Also, make sure that the required control and indicator names do not have any extra spaces.

Typedefs for Callback VIs

To help make sure that your callback VI inputs and outputs have the right name, type, and data direction, use the following Test Executive typedef controls when you create or modify these VIs.

TYPEDEF - Login Info.ctl

`TYPEDEF-Login Info.ctl` contains user login information. The elements of this cluster are Operating level and User Info.

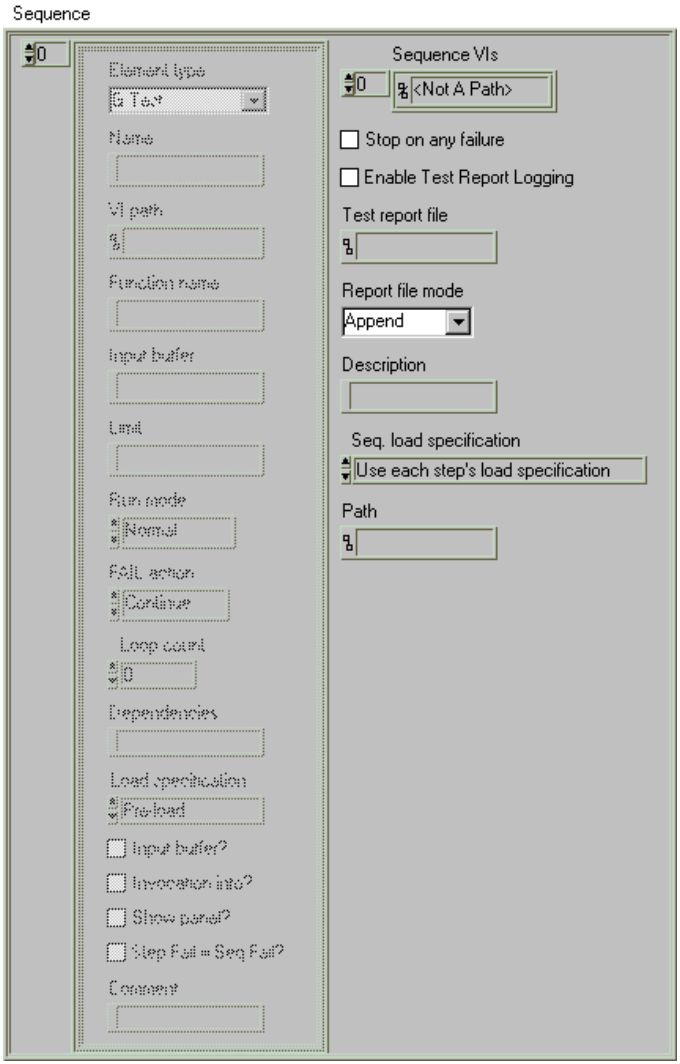
Operating level is an enum with the three privilege levels of the Test Executive: Developer, Technician, and Operator.

User Info is a string that contains information about the current Test Executive user. The default Login callback VI stores the name and password of the current operator in the User Info control.

TYPEDEF - Sequence.ctl

`TYPEDEF-Sequence.ctl` contains all the specifications for a sequence. The elements of this cluster are Elements, Sequence VIs, Stop on any

failure, Enable Test Report Logging, Test report file, Report file mode, Description, Seq. load specification, and Path.



Elements is an array of `TYPEDEF-Sequence Element.ctl` typedefs. This array contains the definitions for all the steps in the sequence. For more details, see the *TYPEDEF - Sequence Element.ctl* section.

Sequence VIs is an array of file paths. This array contains the paths to the following sequence VIs in the following order.

index	VI
0	PreRun
1	PostRun
2	Pre-Step Callback VI
3	Post-Step Callback VI
4	Pre-UUT Loop Callback VI
5	Pre-UUT Callback VI
6	Post-UUT Loop Callback VI
7	Post-UUT Callback VI
8	Test Report Callback VI
9	Edit Test VI Callback VI
10	Post Run-Loop Test Callback VI
11	Test Failure Callback VI

Stop on any failure is a Boolean flag. If Stop on any failure is TRUE, the Test Executive stops the sequence execution whenever any test fails.

Enable Test Report Logging is a Boolean flag. If Enable Test Report Logging is TRUE, the default Test Report Callback VI logs the ASCII text report to the file specified in the Test report file.

Test report file is a file path that stores the path to the test report file.

Report file mode is a text ring that indicates how results should be stored to file, if Enable Test Report Logging is TRUE. You can set Report file mode to `append` or `overwrite`.

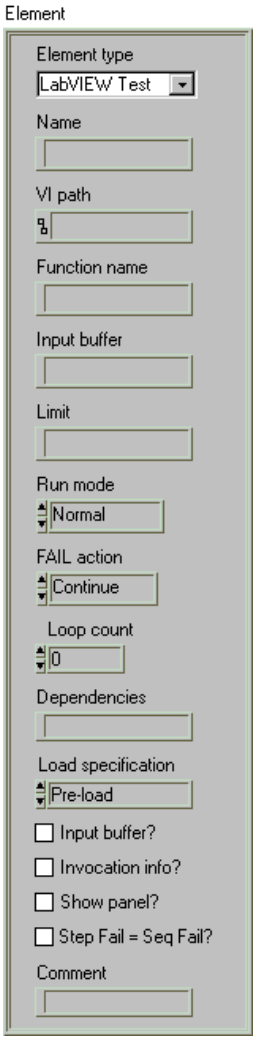
Description is a string containing a description of the test sequence.

Seq. load specification is a text ring that determines how the Test Executive loads the step resources for the sequence. This allows you to set Seq. load specification to `Use each step's load spec.`, `Pre-load all steps`, or `Dynamic-load all steps`.

Path is a file path that stores the path to the sequence file. If the sequence has not been saved, Path is empty.

TYPEDEF - Sequence Element.ctl

`TYPEDEF-Sequence Element.ctl` contains all the specifications for a single step. The elements of this cluster are Element type, Name, VI path, Function name, Input buffer, Limit, Run mode, FAIL action, Loop count, Dependencies, Load specification, Input buffer?, Invocation info?, Show Panel?, Step Fail = Seq. Fail?, and Comment.



Element type is a text ring with four items: LabVIEW Test, C Test, GOTO, and Sequence. The setting of this ring indicates the type of the step.

Name is a string that specifies either the name of a step or the target for a GOTO step. No two steps in a sequence can have the same name. Before executing a sequence, the Test Executive parses the target of each GOTO step. If the Test Executive finds a GOTO target that does not match any step name in the sequence, it stops parsing and displays an error to the user.

VI path is a file path that specifies the resource for the step.

Function name is the name of the function found in the DLL or shared library identified in VI path to call for C tests.

Input buffer is a string. If Input buffer? is TRUE, the Test Executive passes the string data in Input buffer to the LabVIEW Test or C Test at run time.

Limit is a string that specifies a type of comparison. The Test Executive applies this comparison to the measurements returned by the LabVIEW Test or C Test to make a PASS/FAIL determination.

Run mode is a text ring with four items: Normal, Skip, Force PASS, and Force FAIL. If you set a step's Run mode to `Normal`, the Test Executive runs the step's resource and applies the step's limit comparison to the results. If you set the step's Run mode to `Skip`, `Force PASS`, or `Force FAIL`, the Test Executive does not run the step, and it sets the result for the step to `SKIPPED`, `PASS`, or `FAIL`, respectively.

FAIL action is a text ring with four items: Continue, Stop, Loop, and Callback. If you set a step's FAIL action to `Continue`, the Test Executive continues to the next step in the sequence when the step fails. Setting the FAIL action to `Stop` causes the Test Executive to stop testing the current UUT when the step fails. If you set the FAIL action to `Loop`, the Test Executive enters a failure loop, which means that the Test Executive continues to execute the step until it passes or the maximum loop count for the step is reached. If you set the FAIL action to `Callback`, the Test Executive calls the Test Failure callback VI to determine whether it should continue to the next step, stop testing the UUT, or run the failed step again.

Loop count is an integer that specifies the maximum number of times that the Test Executive should run the step inside a failure loop.

Dependencies is a string that specifies either the dependency expression of a step. Before executing a sequence, the Test Executive parses the dependencies of each step in the sequence. If the Test Executive finds an invalid step name in any dependency expression, it stops parsing and displays an error to the operator.

Load specification is a text ring with two items: Pre-load and Dynamic-load. When the Test Executive opens a test sequence, it loads the resources for all steps with a Pre-load Load specification. The Test Executive does not load the resources for Dynamic-load steps until they are called during the execution of the test sequence.

Input buffer? is a Boolean flag. If Input buffer? is TRUE, the Test Executive passes the string data in Input buffer to the LabVIEW test or C test at run time. If Input buffer? is FALSE, the Test Executive does not pass Input buffer data to the LabVIEW test or C test.

Invocation info? is a Boolean flag. If Invocation info? is TRUE, the Test Executive passes invocation information to the LabVIEW test at run time. If Invocation info? is FALSE, the Test Executive does not pass invocation information to the LabVIEW test.

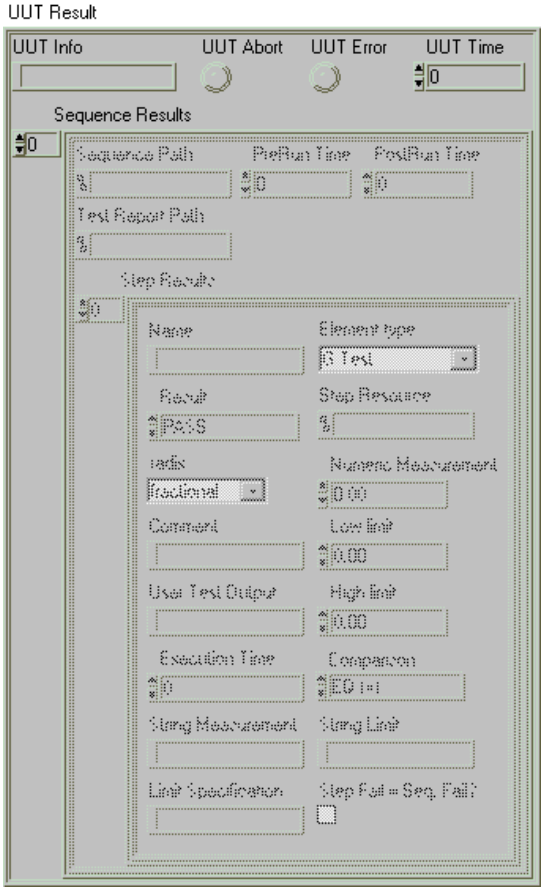
Show Panel? is a Boolean flag. If Show Panel? is TRUE, the Test Executive shows the panel of the LabVIEW test before running it and closes the panel afterwards. If Show Panel? is FALSE, the Test Executive does not show the panel of the LabVIEW test while running it.

Step Fail = Seq. Fail? is a Boolean flag. If Step Fail = Seq. Fail? is TRUE, the sequence will fail if the step fails. If Step Fail = Seq. Fail? is FALSE, the result of the step does not affect the result of the sequence.

Comment is a string containing a comment for the step.

TYPEDEF - UUT Results.ctl

`TYPEDEF-UUT Result.ctl` contains all the UUT ID information and sequence result information for a particular UUT. The elements of this cluster are UUT Info, UUT Abort, UUT Error, UUT Time, and Sequence Results.



UUT Info is a string that contains the UUT Information supplied by the user in the Pre-UUT Callback VI.

UUT Abort is a Boolean flag. If UUT Abort is TRUE, the user aborted testing on this UUT. If UUT Abort is FALSE, the user did not abort testing.

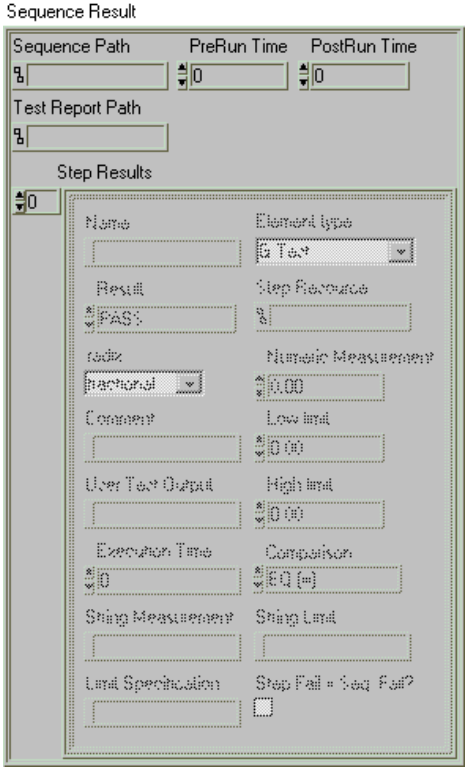
UUT Error is a Boolean flag. If UUT Error is TRUE, an error occurred during the testing of this UUT that caused the Test Executive to abort the UUT Test Loop. If UUT Error is FALSE, no error occurred during the testing of this UUT.

UUT Time is an integer that gives the total execution time for the UUT Test in milliseconds. The UUT Execution timer starts just before the PreRun VI starts and stops just after the PostRun VI stops. The timer resolution of your computer affects the accuracy of the timing information.

Sequence Results is an array of `TYPEDEF-Sequence Result.ctl` typedefs. This array contains the results for each sequence that was run during the testing process. The order of the results is the order in which the sequences were executed. The first element in the array is the result for the top-level sequence executed. For more information, see the *TYPEDEF - Sequence Result.ctl* section of this chapter.

TYPEDEF - Sequence Result.ctl

TYPEDEF-Sequence Result.ctl contains all the step result information for a particular sequence. The elements of this cluster are Sequence Path, Pre Run Time, Post Run Time, Test Report Path, and Step Results.



Sequence Path is a path that contains the path to the sequence file.

PreRun Time is an integer that gives the execution time of the PreRun VI in milliseconds.

PostRun Time is an integer that gives the execution time for the PostRun VI in milliseconds.

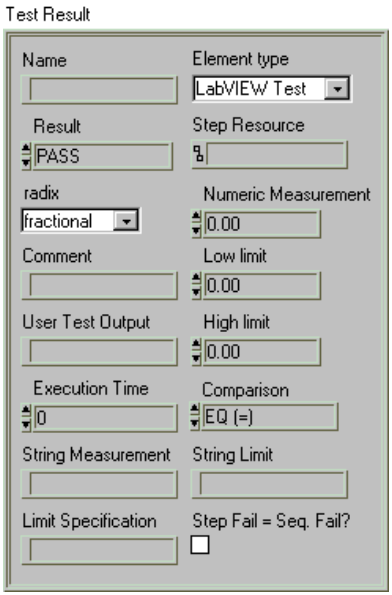
Test Report Path is a path that contains the path to the test report file.

Step Results is an array of TYPEDEF-Test Result.ctl typedefs. This array contains the results for each step (excluding GOTO steps) that

was run during the testing process. For more information, see the *TYPEDEF - Test Result.ctl* section of this chapter.

TYPEDEF - Test Result.ctl

`TYPEDEF-Test Result.ctl` contains all the specifications for a single step result. The elements of this cluster are Element Type, Name, Result, Step Resource, Comment, User Test Output, Execution Time, String Measurement, Numeric Measurement, radix, Low Limit, High Limit, Comparison, String Limit, Limit Specification, and Step Fail = Seq. Fail?.



Element Type is a text ring with four items: LabVIEW Test, C Test, GOTO, and Sequence. The setting of this ring indicates the type of the step.

Name is the step name of the step that produced the result.

Result is an enum with five items: PASS, FAIL, None, Skipped, and Unknown. PASS and FAIL mean that the step passed or failed, respectively. None means that the step's comparison type was `Log only`, and therefore, no PASS/FAIL determination was made for the step. Skipped indicates that the step did not execute, and Unknown indicates that the Test Executive could not determine if the step passed or failed because the step has no limit specification.

Comment is a string containing a comment generated by the LabVIEW test.

User Test Output is a string containing data generated by the LabVIEW test or C test.

Execution Time is an integer that gives the execution time for the step resource in milliseconds.

String Measurement is a string measurement that is transmitted by the LabVIEW test.

Numeric Measurement is a double-precision, floating-point measurement that is transmitted by the LabVIEW test or C test.

radix is a text ring with six values: fractional, scientific, decimal, hex, octal, and binary. The setting of radix indicates whether Numeric Measurement, Low Limit, and High Limit should appear in fractional, scientific, decimal, hexadecimal, octal, or binary notation, respectively.

Low Limit is a double-precision, floating-point number that the Test Executive compares with Numeric Measurement to make a PASS/FAIL determination for the step.

High Limit is a double-precision, floating-point number that the Test Executive compares with Low Limit and Numeric Measurement to make a PASS/FAIL determination for the step.

Comparison is an enum with fourteen items: EQ (==), NE (!=), GT (>), LT (<), GE (>=), LE (<=), GTLT (> && <), GTLE (> && <=) GELT (>= && <), GELE (>= && <=), Boolean, String, Log only, and None. If Comparison is EQ, NE, GT, LT, GE, or LE, the Test Executive applies the indicated comparison to Numeric Measurement and Low Limit and sets Result accordingly. If Comparison is GTLT, GTLE, GELT, or GELE, the Test Executive applies the indicated range comparison to Numeric Measurement, Low Limit, and High Limit, and sets Result accordingly. If Comparison is Boolean, the Test Executive sets Result to PASS or FAIL based on the Boolean result transmitted by the LabVIEW test or C test. If Comparison is String, the Test Executive sets Result to PASS if String Measurement equals String Limit, and sets Result to FAIL otherwise. This string comparison is case sensitive. If Comparison is Log only, the Test Executive sets Result to None, logs Numeric Measurement and String Measurement, and applies no comparison. If Comparison is None, the Test Executive sets Result to None, logs no measurement, and applies no comparison.

String Limit is a string that the Test Executive compares with String Measurement to make a PASS/FAIL determination for the LabVIEW test.

Limit Specification is a string used to store the complete limit specification for the step.

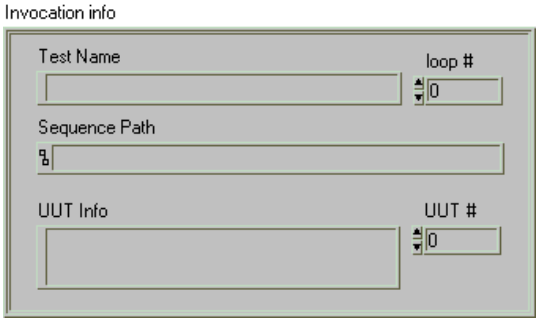
Step Fail = Seq. Fail? is a Boolean flag. If Step Fail = Seq. Fail? is TRUE, the sequence will fail if the step fails. If Step Fail = Seq. Fail? is FALSE, the result of the step does not affect the result of the sequence.

Typedefs for LabVIEW Tests

To help make sure that your LabVIEW test inputs and outputs have the right name, type, and data direction, use the following Test Executive typedef controls when you create or modify these VIs.

TYPEDEF - Invocation Info.ctl

`TYPEDEF-Invocation Info.ctl` contains run time information that passes from the Test Executive to the LabVIEW test. The elements of this cluster are Test Name, Sequence Path, UUT Info, loop #, and UUT #.



Test Name is the name of the step that is currently running.

Sequence Path contains the absolute file path to the sequence file that is currently executing.

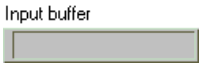
UUT Info is a string that contains the UUT Information supplied by the user in the Pre-UUT callback VI.

loop # is the number of times that this step has run within a failure loop. In a failure loop, the Test Executive repeatedly executes the step until it passes or the maximum loop count for the step is reached. loop # is `0` for the first run of the step, `1` for the second, and so on.

UUT # is an integer that identifies how many UUTs have been tested in this UUT Test Loop. UUT # is `0` for the first UUT, `1` for the second, and so on.

TYPEDEF - Input buffer.ctl

`TYPEDEF-Input buffer.ctl` consists of a string containing test-specific input data that passes from the Test Executive to the LabVIEW test at run time.

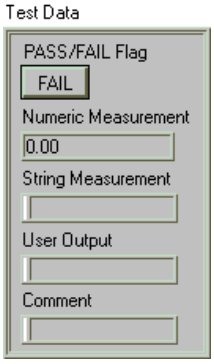


TYPEDEF - Mode.ctl

`TYPEDEF-Mode.ctl` consists of a test ring containing two items, run and config, that you use on the front panel of LabVIEW test shells. The Test Executive identifies the call mode of LabVIEW test shells and passes the appropriate input value, run or config, to `Mode.ctl`. For more information on LabVIEW test shells, see the *Advanced Modifications* section of this chapter.

TYPEDEF - Test Data.ctl

`TYPEDEF-Test Data.ctl` contains result information that is transmitted from the LabVIEW test to the Test Executive. The elements of this cluster are PASS/FAIL Flag, Numeric Measurement, String Measurement, User Output, and Comment.



PASS/FAIL Flag is set by the LabVIEW test to indicate whether the step passed or failed. When the limit specification for a step is Boolean, the Test Executive uses this element to make a PASS/FAIL determination.

Numeric Measurement is a double-precision, floating-point number. When the limit specification for a test is EQ (==), NE (!=), GT (>), LT (<), GE (>=), LE (<=), GTLT (> && <), GTLE (> && <=) GELT (>= && <), GELE (>= && <=), the Test Executive uses this element to make a PASS/FAIL determination. The value that the LabVIEW test passes out in Numeric Measurement is stored in the step's Test Result cluster.

String Measurement is a string. When the limit specification for a step is String, the Test Executive uses this element to make a PASS/FAIL determination. The value that the LabVIEW test passes out in String Measurement is stored in the step's Test Result cluster.

User Output is a string. The LabVIEW test stores data of any kind in this string by using the Flatten to String function. The data that the LabVIEW test passes out in User Output is stored in the step's Test Result cluster.

Comment is a string. The value that the LabVIEW test passes out in Comment is stored in the step's Test Result cluster. Use the Comment option for storing comments that you want to include in the test report.

Common Modifications

The following sections describe common modifications that you may want to make to the Test Executive. You learn how to make these modifications by editing the default callback VIs in the LVEXEC50\CALLBACK.LLB VI library. Before modifying any of the default callback VIs, you should make a backup copy of CALLBACK.LLB.

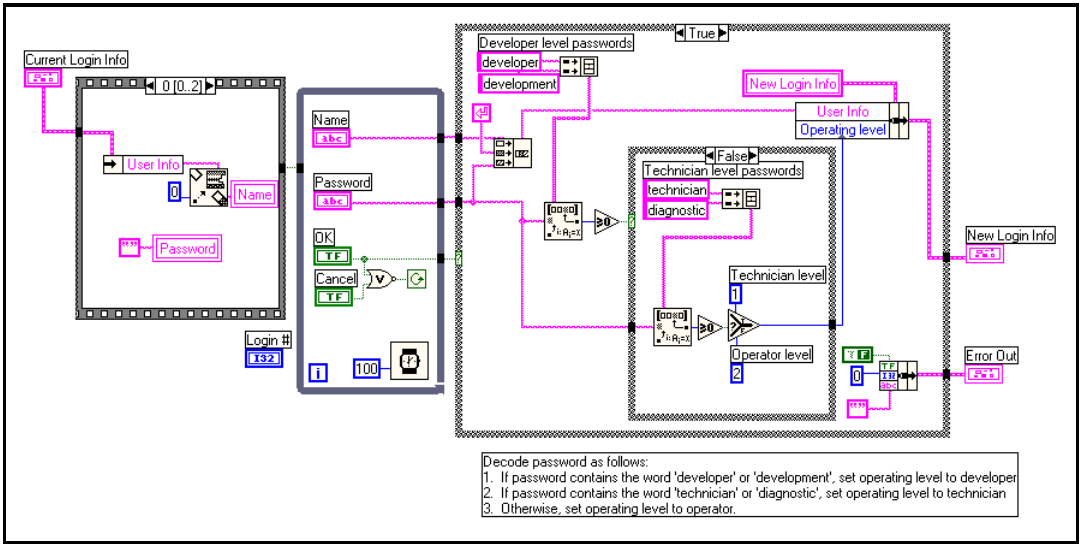
This section covers the following areas.

- Passwords
- PASS/FAIL/ABORT banners
- UUT Serial Number prompt
- Test report

Changing Passwords

You can change the passwords that determine the Test Executive operating level (Developer, Technician, or Operator) by modifying the default Login callback VI in LVEXEC50\CALLBACK.LLB. (See the *Operating Levels* section in Chapter 1, *Introduction*, for a description of the operating modes.) To modify the default Login callback VI, open Login Callback.vi in LVEXEC50\CALLBACK.LLB. Notice that Login Callback.vi has the required Login callback inputs and outputs on its front panel. This VI makes a subVI call to the Login VI. To examine the front panel of the Login VI, show the diagram of Login Callback.vi,

pop up on the subVI call to Login, and select **Open Front Panel**. The following illustration shows the diagram of the Login callback VI.



To set the password that specifies Developer level, examine the True case of the larger Case structure. Find the string constant, labeled `Developer Level Password`, which is wired into the Match Pattern primitive. Replace the string constant with the password you want to use to specify the Developer level. Subsequently, any password typed in that contains this sequence of characters sets the Test Executive to Developer level.

To set the password specifying Technician level, find the string constant labeled `Technician Level Password` inside the False case of the smaller Case structure. Replace this string constant with the password you want to use to specify Technician level. If the password entered at the prompt contains the character sequence in this string constant, the Test Executive sets the level to Technician. If a match is not found for either Developer or Technician passwords, the level defaults to Operator.

☞ **Note:** ***The password comparison is case sensitive.***

Changing PASS/FAIL/ABORT Banners

You change the PASS, FAIL, and/or ABORT Banner VIs, which display the result of a UUT Test, to show a custom screen. To do so, you need to modify the default Post-UUT callback VI. To modify this VI, open `Post-UUT Callback.vi` in `LVEXEC50\CALLBACK.LLB`. Notice that `Post-UUT Callback.vi` has the required Post-UUT callback VI inputs and outputs on its front panel. This VI makes subVI calls to PASS Banner, FAIL Banner, or ABORT Banner, depending on the UUT Test Results. On a color monitor, the PASS, FAIL, and ABORT banners have a colored background (green for pass, red for fail and abort), an OK button, and a free label in a large font containing the word PASS, FAIL, or ABORT.

You change the appearance of these banners by either revising the existing VIs (changing the message, colors, adding graphics, and so forth) or by replacing the PASS, FAIL, and/or ABORT Banner VIs with your own VIs. Notice that the execution palette and menus have been hidden in the Banner VIs.

Changing the UUT Serial Number Prompt

You customize the prompt that asks for the UUT serial number by modifying the default Pre-UUT callback VI. To modify this VI, open `Pre-UUT Callback.vi` in `LVEXEC50\CALLBACK.LLB`. Notice that `Pre-UUT Callback.vi` has the required Pre-UUT callback VI inputs and outputs on its front panel. This VI makes a subVI call to the UUT Information VI. To examine the front panel of the UUT Information VI, show the diagram of `Pre-UUT Callback.vi`, pop up on the subVI call to UUT Information, and select **Open Front Panel**. The front panel of this VI consists of a string control, its label (which prompts the user to Enter UUT Serial Number), and two buttons, **OK** and **STOP**.

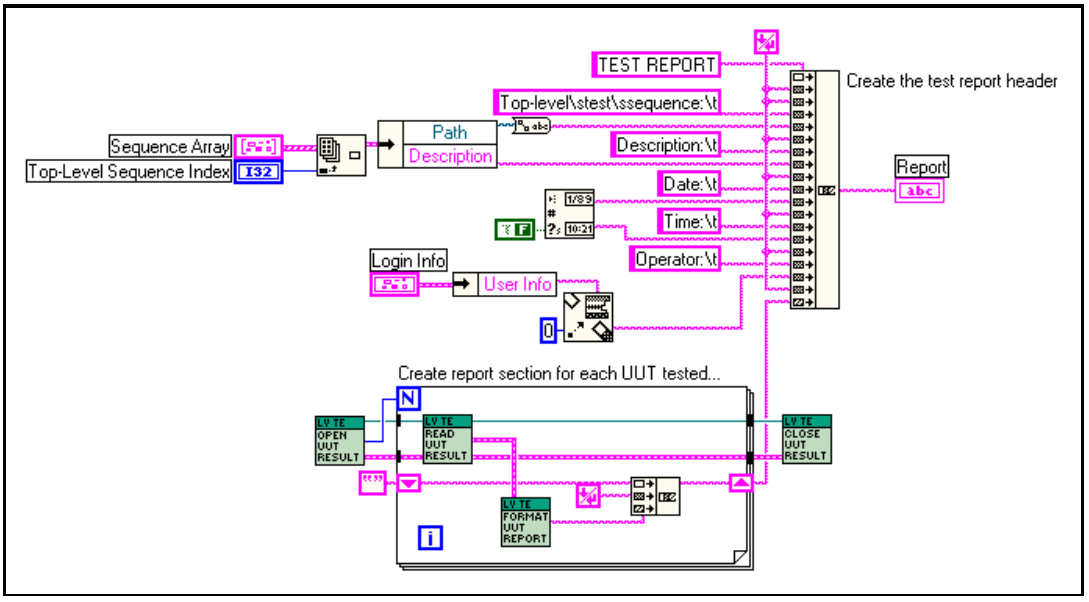
To change the UUT serial number prompt message, retype the label on the front panel using the Labeling tool.

You also make other modifications to the serial number prompt, such as adding a routine that reads the serial number from a bar code reader via an RS-232 port, by editing the Pre-UUT callback VI.

Changing the Test Report

The Test Report is generated by the default Test Report callback VI and its subVIs. You can modify the test format of the Test Report to suit your needs.

To modify the default Test Report callback VI, open `Test Report Callback.vi` in `LVEXEC50\CALLBACK.LLB`. Notice that `Test Report Callback.vi` has the required Test Report callback inputs and outputs on its front panel. This VI calls two subVIs, Format Test Report and File Report, and then institutes error checking procedures. The File Report VI sends the completed Test Report to a specified file and does not need to be changed to modify report format. Make any modifications in the Format Test Report VI block diagram (shown in the following illustration) or its main subVI, `Format UUT.vi`.



To change the Test Report header information, make the desired changes to the large Concatenate Strings function and its inputs in the Format Test Report VI. For example, you might want to include more information in the header. Stretch the Concatenate Strings function and add the desired string to an input. Another common change might be to add seconds to the time display. To do this, change the Boolean constant input to the Get Date/Time String VI from FALSE to TRUE.

The UUT Test results are generated in the For Loop of the Format Test Report VI. This VI converts the data read from a Test Executive temporary file to ASCII strings for inclusion in the Test Report.

Using Another Application for Report Generation

The format of a standard Test Report allows other applications to easily import the report. For example, because the Test Report uses tabs to delimit fields in a test result, each of these fields appears in a separate cell when you load the Test Report into a spreadsheet. Saving the Test Report to a file provides a simple mechanism for transferring the report to another application for further formatting of test results.

You may also want to use an interapplication communication mechanism to have the Test Executive automatically pass the Test Report to another application. You can use the network VIs in LabVIEW for OLE automation in Microsoft Windows, Apple Events on the Macintosh, or TCP/IP and UDP on all platforms. Using interapplication communication requires that you be familiar with the particular protocols and data formats the recipient application expects.

Advanced Modifications

This section describes advanced modifications that you can make to the Test Executive. The section covers the following areas.

- Result Logging Alternatives
- Using LabVIEW Test Shells

Result Logging Alternatives

By default, the Test Executive logs the results for an entire UUT Test Loop to file. The default Test Report callback VI writes the Test Report string to the Report File as determined by the Report File Mode. This section discusses two result logging alternatives.

- Logging step results on a per-UUT basis
- Logging step results to a database

Logging Test Results on a Per-UUT Basis

As soon as a UUT completes testing it is possible to modify the Test Executive to log UUT step results on a per-UUT basis. To set up this method, substitute a VI named `Per-UUT Logger Callback.vi` for your Post-UUT callback VI and `Test String Callback.vi` for your Test Report callback VI. Both of these callback VIs are in the `LVEXEC50\CALLBACK.LLB` VI Library.

Per-UUT Logger Callback.vi

In addition to showing the PASS, FAIL, or ABORT banner, `Per-UUT Logger Callback.vi` creates a report string for the current UUT. If the current UUT is the first in the UUT Test Loop, `Per-UUT Logger Callback.vi` appends a report header to the report string and then, depending on the Report File Mode, either overwrites or appends this string to the report file. If the current UUT is not the first in the UUT Test Loop, `Per-UUT Logger Callback.vi` simply appends the report string to the Report File.

Test String Callback.vi

`Test String Callback.vi` creates the Test Report string from the UUT Test Loop results, but it does not write this Test Report string to the Report File.

Using the Edit Sequence Callbacks dialog box in the Sequence Editor, allows you to make `Per-UUT Logger Callback.vi` and `Test String Callback.vi` the Post-UUT and Test Report callbacks for any sequence. Alternately, it is possible to edit the Test Executive system configuration file, `testexec.ini`, and make these callback VIs the default Post-UUT and Test Report callbacks for all sequences. When you run a sequence that uses these two callback VIs, the Test Executive logs UUT Test results to file on a per-UUT basis.

Logging Test Results to a Database

See the *LabVIEW Test Executive Installation and Release Notes* for information on logging test results to a database using the SQL Toolkit for G.

Using LabVIEW Test Shells

The Test Executive allows your end-users to use LabVIEW Test shells to design test sequences using instrument drivers without doing any LabVIEW programming. A LabVIEW Test shell consists of a special kind of test VI that runs in two modes, config mode and run mode. A LabVIEW Test shell has the following calling interface.

Type	Name	Typedef	Description
Input	**mode**	`TYPEDEF-mode.ctl`	Determines the mode in which the LabVIEW Test shell runs.
Input	**Input buffer**	`TYPEDEF-Input buffer.ctl`	Receives input data.
Output	**Test Data**	`TYPEDEF-`Test Data.ctl	Transmits data to its caller.
Output	**error out**	Standard LabVIEW error out cluster	Indicates whether an error or warning occurred in the Test VI shell.

Each LabVIEW Test shell must have these required inputs and outputs on its front panel. Like any other test VI, a LabVIEW Test shell can also contain additional controls and indicators on its front panel, as long as the names of those controls and indicators are different from the names of the required inputs and outputs. Notice that the two required outputs for a LabVIEW Test shell, Test Data and error, are the same as the two required outputs for a test VI. Also notice that the Input buffer input, which is optional for test VIs, is required for a LabVIEW Test shell.

In run mode, the LabVIEW Test shell executes just like a test VI and transmits result and error information in Test Data and error. In run mode, the shell VI assumes that Input buffer contains a flattened cluster of input values and uses the Unflatten From String function to retrieve the input values.

In config mode, the LabVIEW Test shell acts like a dialog VI and allows the user to set the values of various input controls. In this mode, the user presses an **OK** button after setting the control values. Then, the LabVIEW Test shell bundles the control values into a cluster, flattens the cluster to a string, and returns the string in the User Output element of Test Data.

If you create a LabVIEW Test shell, use the Test Executive typedef controls. For more information on these controls, see the *Test Executive Typedef Controls* section earlier in this chapter.

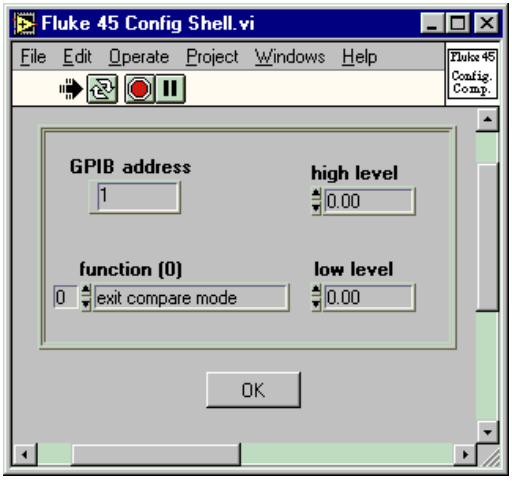
☞ **Note:** ***Any step which uses a LabVIEW Test shell must have a load specification of Dynamic load.***

Example Sequence Using LabVIEW Test Shells

When using LabVIEW Test shells to implement sequences, the sequence developer can configure instrument drivers without doing any LabVIEW programming. In a no-programming sequence, you must use an auto-configure Open Test VI callback and LabVIEW Test shells for every step. A sequence developer creates the sequence by using the Sequence Editor to add steps to the sequence, selecting LabVIEW Test shells for the steps, and configuring the LabVIEW Test shells by calling them in config mode. As an example of this process, perform the following operations.

1. Run the Test Executive and log in as a developer.
2. Press the **Edit** button to invoke the Sequence Editor.
3. Select **Sequence»Sequence Options…**to select an auto-configure Open Test VI callback for this sequence. In the Sequence VIs section, select the Open Test VI callback from the callback ring. Press the **Browse** button and choose the auto-configure callback VI named `Configure Test VI Callback.vi` in the `LVEXEC50\CALLBACK.LLB` VI Library. Press the **OK** button to confirm your changes.
4. Back in the Sequence Editor, press the **New Step** button and enter `Fluke 45 Config` for the step name. Press the **Select Resource** button and select the LabVIEW Test shell named `Fluke 45 Config Shell.vi` in the `LVEXEC50\TEST_VIS.LLB` VI Library.
5. To configure this LabVIEW Test shell, press the **Edit Test VI** button. This calls the auto-configure callback `Configure Test VI Callback.vi`, which in turn calls the Test VI shell `Fluke 45 Config Shell.vi` in config mode. When this happens, the front panel of `Fluke 45 Config Shell.vi` appears and allows you to set

the values of the four input controls on the panel. Your front panel should look like the following illustration.



6. When you have finished entering values, press the **OK** button. The `Fluke 45 Config Shell.vi` flattens the values to a string and pass them back to the auto-configure callback VI. The auto-configure callback VI passes the same flattened string back to the Sequence Editor, which stores the string in Fluke 45 Config's input buffer.
7. If you press the **Edit Test VI** button again, it repeats the process, allowing you to examine or modify the input values you have entered.
8. Set the load specification for the step to Dynamic load.
9. Press the **OK** button on the Sequence Editor panel to confirm the changes you have made and return to the Test Executive.

The LabVIEW Test shell `Fluke 45 Config Shell.vi` makes a subVI call to the test VI `Fluke 45 Config.vi` in `LVEXEC50\TEST_VIS.LLB`. This subVI call has been configured to `Suspend when called`, so you can see the values that are passed to the test VI by the LabVIEW Test shell at run time.

10. Press the **Single Pass** button to run the test sequence once. The Test Executive executes the `Fluke 45 Config Shell.vi` in run mode, passing it the flattened input string in the Input buffer. `Fluke 45 Config Shell.vi` unflattens the Input buffer string and passes the input values to the LabVIEW Test `Fluke 45 Config.vi`. `Fluke 45 Config.vi` suspends when called, showing its front panel so you

can examine the input values. Notice that the values are the same as those you entered when you configured the test in the Sequence Editor.

11. Press the **run** button to run the suspended test VI `Fluke 45 Config.vi`. Press the **return to caller** button to terminate the test VI.
12. Save this example sequence under the name `NPROGRAM.SEQ`.

If you examine the auto-configure callback `Configure Test VI Callback.vi`, you see that it calls the LabVIEW Test shell in config mode and passes it the current contents of Input buffer. This way, the shell VI displays the most recent user settings for the input controls. You can use this method to create no-programming sequences of any length. The following illustration shows the configuration and execution mechanisms for LabVIEW Test shells.

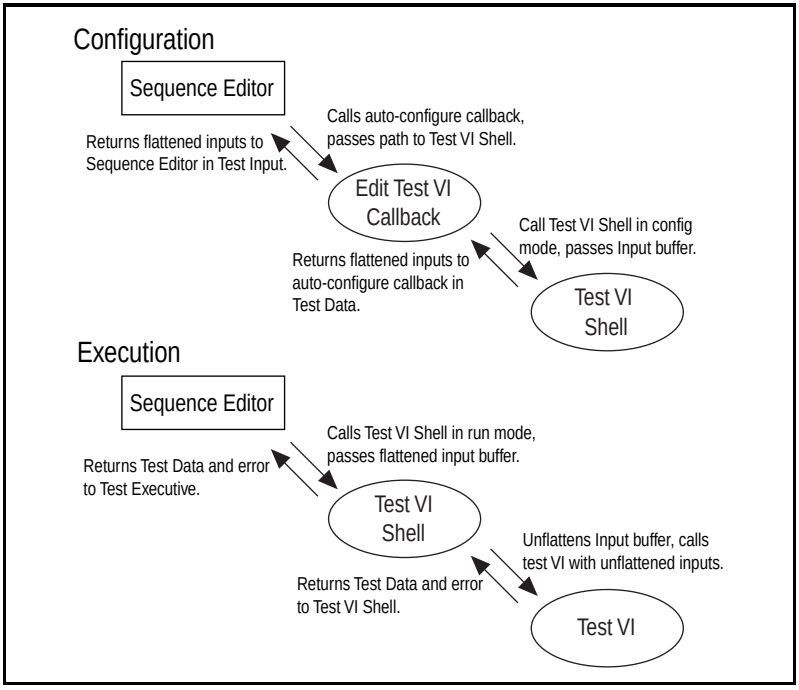
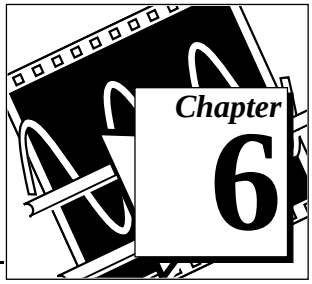


Figure 5-2. Test VI Shell Configuration and Execution



Deploying the Test Executive

This chapter explains how to deploy a LabVIEW Test Executive 5.0 Run-Time System on a test stand computer.

LabVIEW Test Executive 5.0 Run-Time System

The LabVIEW Test Executive 5.0 Run-Time System is an executable version of the Test Executive Engine. It allows the distribution of the Test Executive to a test stand computer without an accompanying LabVIEW installation, saving both money and installation space. When you purchase the LabVIEW Test Executive 5.0, you receive one copy of the Run-Time System. Please contact National Instruments for additional licenses.

For Run-Time System installation instructions, refer to the *LabVIEW Test Executive 5.0 Installation and Upgrade Notes*.

The Run-Time System installation includes an executable version of the Test Executive Engine only. After installing this executable, the user is then responsible for providing the following customizable components to create a complete Test Executive installation.

- Operator Interface VI
- Callback VIs
- `testexec.ini` file

In addition to these Test Executive components, the user also must provide test sequences and resources (VIs and/or shared libraries).

The following sections describe how to prepare each of these components for distribution to a test stand computer which has no LabVIEW development system installed.

The testexec.ini File

The `testexec.ini` file tells the engine where to find all of the external components of the Test Executive. It must reside in the same directory as the Run-Time System executable file and provides the following information to the Test Executive Engine. (Refer to Chapter 5, *Customizing the Test Executive*, for information on the format of the `testexec.ini` file.)

- The location of the Operator Interface VI
- The location of all system callback VIs
- The location of all default sequence callback VIs
- Preference values

All path values must be valid for the test stand computer and can be either paths to local files or files on a shared network volume.

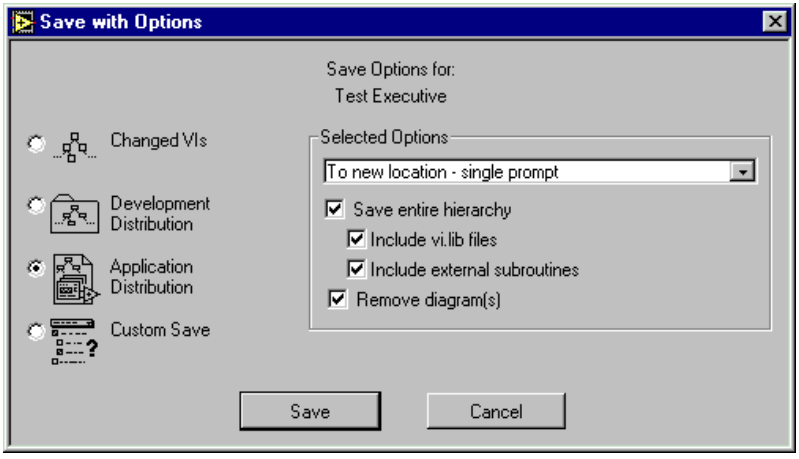
The Operator Interface VI

The Operator Interface VI is the main interface for the Test Executive. The engine uses the `testexec.ini` file to determine what VI to run as the operator interface after the executable is launched.

To save an Operator Interface VI for deployment to a test stand computer, use the following steps.

1. Open the Operator Interface VI in the LabVIEW development system.
2. Log in to the Test Executive as `developer`.
3. Quit the Test Executive.
4. Select **File»Save with Options…**.

5. Select **Custom Save** with the following **Selected Options** (see figure below).
   a. To new location - single prompt
   b. Save entire hierarchy
   c. Include `vi.lib` files
   d. Include external subroutines
   e. Remove diagrams (this selection is optional)
6. In the file dialog that follows, enter the name of the VI library you would like to use for this distribution of the operator interface VI.
7. Select **Project»Test Executive 5.0»Prepare Test Executive Library for Distribution…** and run the utility on the library named in step 6. This utility will remove any VIs from the new library that are already included as part of the Test Executive engine.

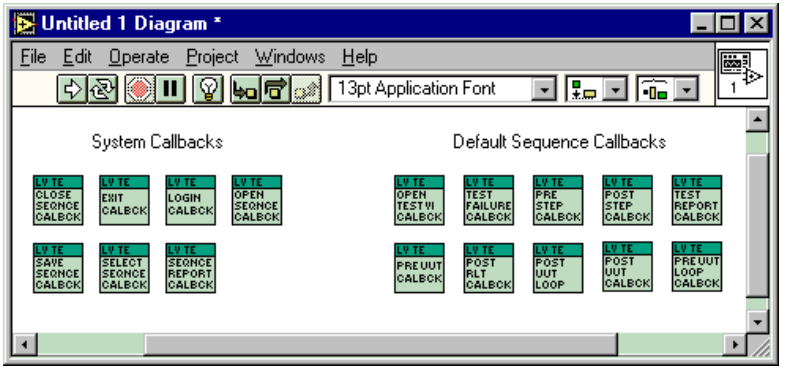


The operator interface is now ready for distribution to a test stand computer. While removing the diagrams from your VIs (step 5e) is not necessary, it does save space.

Callback VIs

To save the Callback VIs for deployment, use the following steps.

1. Create a new Untitled VI in the LabVIEW development system.
2. Place the icons for the following VIs on the new VI's block diagram (see figure below).
   a. All System Callback VIs (see Chapter 1, *Introduction*, for a list of these callbacks)
   b. All Default Sequence Callback VIs (see Chapter 1, *Introduction*, for a list of these callbacks)
   c. All non-default Sequence Callback VIs used by sequences to be run with the Run-Time System, including Pre-Run and Post-Run VIs



3. Select **File»Save with Options…**.
4. Select **Custom Save** with the following **Selected Options**.
   a. To new location - single prompt
   b. Save entire hierarchy
   c. Include `vi.lib` files
   d. Include external subroutines
   e. Remove diagrams (this selection is optional)
5. In the file dialog that follows, enter the name of the VI library you would like to use for this distribution of the callback VIs.

Test Sequences

You can copy test sequences to the test stand computer, but you must use the Run-Time System to update the paths to all the necessary test resources and non-default callback VIs, including Pre-Run and Post-Run VIs.

Test Resources

LabVIEW Tests

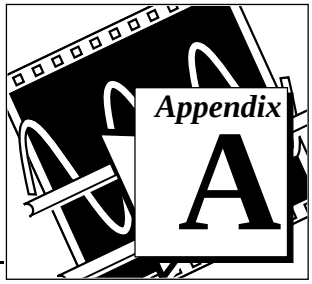
For VI resources, follow the same steps as for callback VIs.

C Tests

For shared library resources, distribute the DLL or shared library along with any run-time libraries required by that DLL or shared library.

Sequences

See the *Test Sequences* section earlier in this chapter.



Common Questions

This appendix includes a list of common questions you may have when using the Test Executive.

How easy is it to incorporate my existing LabVIEW tests into the Test Executive?

You will need to add two clusters to your existing LabVIEW VIs to pass status information from the subVIs. The Test Executive does not require any other modifications. Chapter 4, *Creating Tests and Test Sequences*, explains in detail how to add a LabVIEW test to the Test Executive.

How can I have individual steps displayed as they are executing?

In the Sequence Editor, select **Yes** in the **Show VI Panel at Run-Time** ring control for the step . For more information, refer to Chapter 4, *Creating Tests and Test Sequences*.

Is it easy to modify the Test Executive to fit my own needs?

The Test Executive uses a modifiable operator interface VI and modifiable callback VIs to implement much of its functionality. To change the behavior of the Test Executive, you can edit or replace any of these VIs. For more information on modifying these VIs, refer to Chapter 5, *Modifying the Test Executive*.

I have a test sequence that contains many, many step resources. How can I keep the Test Executive from loading all of the step resources into memory when I open the sequence? Is there a way to load a step resource into memory only when it is needed?

Normally, when the Test Executive opens a test sequence, it loads all the step resources that the sequence needs into memory. This process is called *pre-loading* the resoources. If you do not want the Test Executive to pre-load a resource, use the Sequence Editor to set the load specification field for that step to `dynamic-load`. For more information, refer to Chapter 4, *Creating Tests and Test Sequences*.

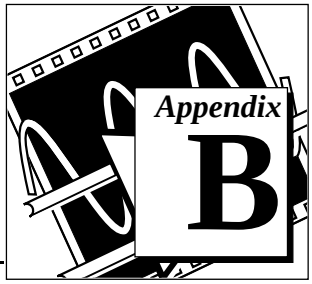
How can an operator or technician specify a filename to log test results?

Normally in the Test Executive, only the developer can modify the filename of the test report. This modification is typically made in the Sequence Editor. For the operator or technician to specify a file, you must first place a path control on the Test Executive front panel. Next, modify the block diagram of the operator interface VI to copy the path in this control to a global variable. Finally, modify the callback VI that logs test results (Post-UUT, Post-UUT Loop, or Test Report) to use the path in the global variable instead of the report file path. For more information on modifying the operator interface VI and the callback VIs, refer to Chapter 5, *Modifying the Test Executive*.

How can you build a filename from the Serial Number of the UUT?

The default Pre-UUT callback VI prompts the user for the serial number and passes it back to the Test Executive in the UUT Info output. The Test Executive stores this information in the UUT Results and passes it out to the Post-UUT, Post-UUT Loop, and Test Report callback VIs. You can modify any one of these callback VIs to retrieve the serial number, build the file path, and store the result data to file.

Sequence Conversion Notes



This sequence describes the steps for converting a test sequence created with Version 4.0 of the Test Executive to Version 5.0. It also describes how to convert a test sequence created with Version 3.0 of the Test Executive to Version 4.0. Users with Version 3.0 sequences should convert them to Version 4.0 and then convert those sequences to Version 5.0.

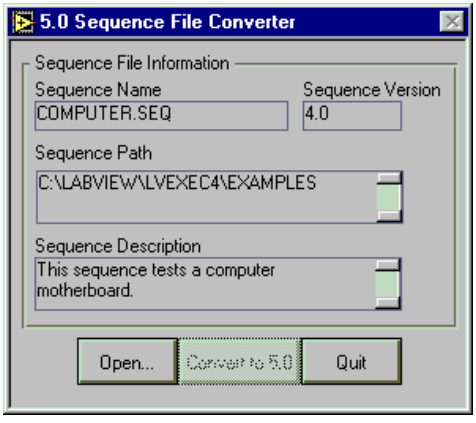
Version 4.0 to Version 5.0 Conversion

Perform the following steps to convert sequence files from Version 4.0 to Version 5.0.

1. Use the 5.0 Sequence File Converter to convert your sequence files to the new format.
2. Use LabVIEW to compile all Version 4.0 test VIs with the new Version 5.0 typedef controls.

Step 1—Use the 5.0 Sequence File Converter

The 5.0 Sequence File Converter is a LabVIEW VI that converts your Version 4.0 sequence files to Version 5.0. The following illustration shows the front panel of the 5.0 Sequence File Converter.



To load the 5.0 Sequence File Converter, perform the following steps.

1. Launch the LabVIEW FDS (Full Development System)
2. Open the 5.0 Sequence File Converter VI in the `LVEXEC50\CONVERT.LLB` library. The 5.0 Sequence File Converter VI automatically runs when you open it.

With the 5.0 Sequence File Converter, you can open any 4.0 sequence file and convert it to 5.0. The following section explains the controls and indicators on the 5.0 Sequence File Converter panel.

Controls

Open…

The **Open…** button pops up a dialog box that prompts you to select a 4.0 sequence file. You can only select 4.0 sequence files from this dialog box.

Convert to 5.0…

When you press this button, the 5.0 Sequence File Converter converts the currently loaded 4.0 sequence file to 5.0. It then pops up a dialog box that prompts you to enter a name and location for the new 5.0 sequence file. When no 4.0 sequence file is loaded in the 5.0 Sequence File Converter, this button is disabled.

Quit

The **Quit** button stops the 5.0 Sequence File Converter operation.

Indicators

Sequence Name

The Sequence Name indicator displays the filename of the currently loaded sequence.

Sequence Version

The Sequence Version indicator displays the version of the currently loaded sequence.

Sequence File Path

The Sequence File Path indicator shows the complete file path of the currently loaded sequence.

Sequence Description

The Sequence Description indicator displays the sequence description for the currently loaded sequence. If no description has been entered for the sequence, this indicator will be empty.

Step 2—Compile Your Test VIs

To make sure that all your test VIs use the new Test Executive 5.0 typedef controls, you must compile those VIs with the LabVIEW FDS after installing the Test Executive 5.0. To compile your test VIs, you must either.

1. Open each test VI in LabVIEW and save the changes to it.
2. Use LabVIEW's mass compile operation (**File»Mass Compile…**) to compile an entire directory or library of VIs.

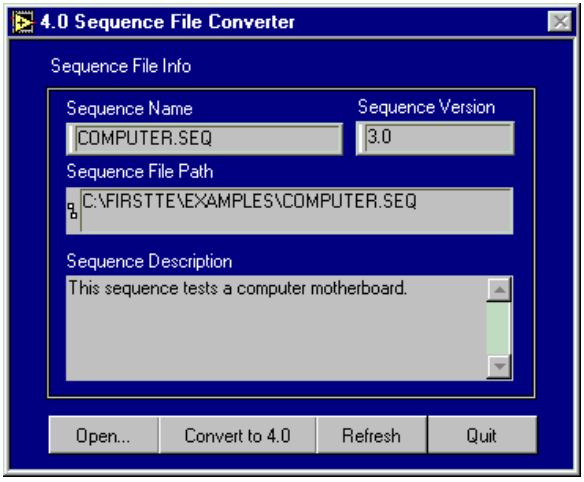
Version 3.0 to Version 4.0 Conversion

Perform the following steps to convert Version 3.0 to the new version.

1. Use the 4.0 Sequence File Converter to convert your SEQ files to the new file format.
2. Use the Test Executive typedef controls to convert each test VI's front panel.

Step 1—Use the 4.0 Sequence File Converter

The 4.0 Sequence File Converter is a LabVIEW application that converts your Version 3.0 SEQ files to Version 4.0 files. The following illustration shows the front panel of the 4.0 Sequence File Converter.



To load the 4.0 Sequence File Converter, perform the following steps.

1. Launch the LabVIEW FDS (Full Development System).
2. In LabVIEW, open the `All Tests.vi` that you created for the 3.0 Test Executive.

☞ **Note:** ***When the Test Executive converts a 3.0 sequence file to 4.0, it makes changes to the sequence. When you try to close the converted sequence file, the Sequence File Converter prompts you to save changes. If you save the changes, the saved sequence file will become a 4.0 file and the 3.0 Test Executive will not be able to open it. If you did not make a backup copy of the 3.0 Test Executive sequences before installing the 4.0 Test Executive, you should do so before saving any changes to the*** `All Tests.vi`***.***

3. After opening the `All Tests.vi`, open the 4.0 Sequence File Converter VI in the `LVEXEC50\CONVERT.LLB` library. The Sequence File Converter VI automatically runs when you open it.

With the 4.0 Sequence File Converter, you can open any 3.0 sequence file and convert it to 4.0. The following section explains the controls and indicators on the Sequence File Converter panel.

Controls

Open

The **Open…** button pops up a dialog box that prompts you to select a 3.0 sequence file. You can only select 3.0 sequence files from this dialog box.

Convert to 4.0

When you press this button, the 4.0 Sequence File Converter converts the currently loaded 3.0 sequence file to 4.0. It then pops up a dialog box that prompts you to enter a name and location for the new 4.0 sequence file. When no 3.0 sequence file is loaded in the Sequence File Converter, this button is disabled.

Refresh

When you first run the 4.0 Sequence File Converter, it creates a list of all VIs currently in memory. If you have multiple versions of the `All Tests.vi`, you should press the **Refresh** button to switch between the versions. When you press the **Refresh** button, the Sequence File Converter updates its list of currently loaded VIs.

Quit

The **Quit** button stops the Sequence File Converter execution.

Indicators

Sequence Name

The Sequence Name indicator displays the filename of the currently loaded 3.0 sequence.

Sequence Version

The Sequence Version indicator displays the version of the currently loaded sequence. The indicator should always read `3.0`.

Sequence File Path

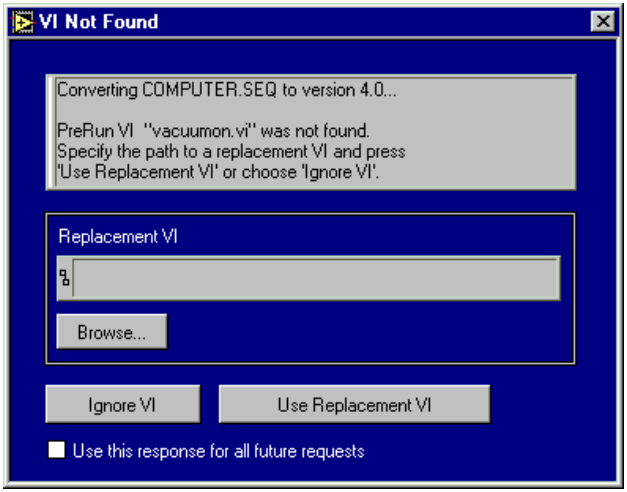
The Sequence File Path indicator shows the complete file path of the currently loaded 3.0 sequence.

Sequence Description

The Sequence Description indicator displays the sequence description for the currently loaded 3.0 sequence. If no description has been entered for the 3.0 sequence, this indicator will be empty.

Using the Sequence File Converter

While the 3.0 Test Executive references test VIs by name, the 4.0 Test Executive references them by file path. The Sequence File Converter attempts to convert 3.0 tests to 4.0 tests by replacing test VI names with test VI paths. When the 3.0 Sequence Editor adds a test VI to a test, it copies the test VI name from the VI LIST on the diagram of `All Tests.vi` into the test. If the names in VI LIST exactly match the names of the corresponding test VIs in VI CONTAINER, then the Sequence File Converter is able to automatically convert the 3.0 test VI names into test VI paths. If the names in VI LIST do not match the names of the test VIs in VI CONTAINER, then the Sequence File Converter is not able to automatically convert all 3.0 test VI names to test VI paths. When the 4.0 Sequence File Converter finds a 3.0 test VI name that does not match, it opens a VI Not Found dialog box, like the one shown below, prompting you to select a test VI for the test.



☞ **Note:** ***If you have modified the definition of the Sequence cluster or the Test typedef in the 3.0 Test Executive, the Sequence File Converter will not be able to recognize your 3.0 sequence files. Consequently, these modified 3.0 sequence files will not be listed in the Sequence File Converter's Open File dialog box. To convert modified 3.0 sequence files to 4.0, you need to modify the 4.0 Sequence File Converter VI itself.***

When you have finished converting `SEQ` files, quit the Sequence File Converter and close the `All Tests.vi`.

Step 2—Use the 4.0 Typedef Controls

Similar to the 3.0 Test Executive, the 4.0 Test Executive requires that each test VI produce two outputs, a Test Data cluster and an Error cluster. Also in both versions, any test VI can receive an input through the Input Buffer. The 4.0 Test Executive, however, refers to these inputs and outputs by the following pre-defined names. The control names in each test VI must match these pre-defined names.

- Test Data cluster—*Test Data*
- Error cluster—*error*
- (optional) Input Buffer—*Input buffer*
- (optional) Invocation Information—*Invocation info* (For more information about the Invocation Information input, see Chapter 4, *Creating Tests and Test Sequences*.)

The Test Executive cannot run a test VI that does not have the correct names for its input and output controls.

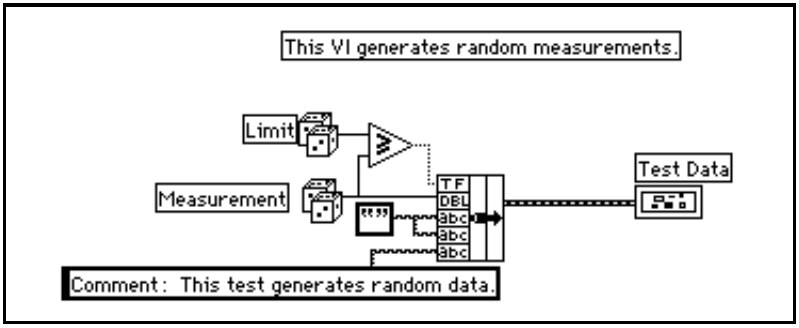
To help test developers use the correct names and types for these test VI controls, the 5.0 Test Executive package includes a set of typedef controls. The 5.0 Test Executive install program installs these controls in the `LabVIEW` directory in the `USER.LIB\CONTROLS.LLB` VI library. After installation, these typedef controls are available in the **Controls»Test Executive** menu of the LabVIEW FDS.

To convert a 3.0 test VI to 4.0, open its front panel and delete the 3.0 Test Data, Error, and Input Buffer controls. Then, place the 4.0 versions of the Test Data, Error, and Input Buffer controls on the front panel and wire them.

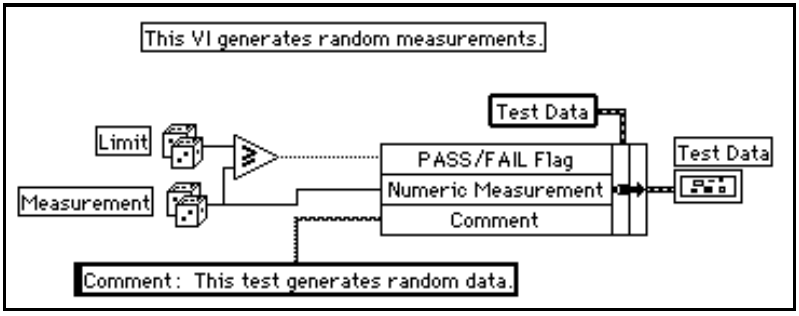
☞ **Note:** ***You should delete the 3.0 controls rather than popping up on the 3.0 controls and replacing them with the 4.0 controls. Popping up on the control and choosing* Replace *from the menu replaces the control instead of replacing the name. If the name of the 3.0 control is preserved, the Test Executive may not be able to call the test VI because the replaced control name may not be correct.***

The Error and Input Buffer controls have not changed type from 3.0 to 4.0, so you should be able to rewire these controls without any problem. The 4.0 Test Data control, however, has two new string elements named String Measurement and User Output. When you rewire this output, you will still have a broken wire because the old Test Data output had only three elements and the new Test Data output has five. To fix the broken

wire, stretch the Bundle function on the test VI block diagram to five elements instead of three. You can then wire an empty string into the two new elements, as shown below.

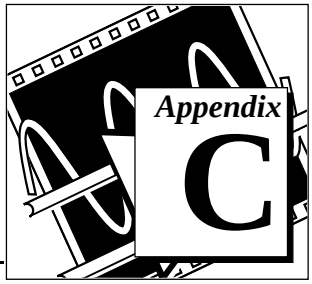


You can also use the Bundle By Name function to supply the three original elements and ignore the two new elements, as shown below.



For more information on using the new Test Data cluster, see Chapter 4, *Creating Tests and Test Sequences*.

☞ **Note:** ***A convenient way to convert all the test VIs for a particular sequence is to edit the sequence in the 4.0 Test Executive. With the 4.0 Sequence Editor, you can open any test VI panel by selecting the test and pressing the* Edit Test VI *button or by double-clicking on the test in the sequence list. After you open the test VI panel, you can convert the test VI controls, save the changes, and close the test VI. Repeat this process for every test VI in the sequence. Before saving any changes to the test VI, make sure that you have fixed all the VI's errors. The Test Executive cannot run a broken test VI.***



Customer Communication

For your convenience, this appendix contains forms to help you gather the information necessary to help us solve your technical problems and a form you can use to comment on the product documentation. When you contact us, we need the information on the Technical Support Form and the configuration form, if your manual contains one, about your system configuration to answer your questions as quickly as possible.

National Instruments has technical assistance through electronic, fax, and telephone systems to quickly provide the information you need. Our electronic services include a bulletin board service, an FTP site, a fax-on-demand system, and e-mail support. If you have a hardware or software problem, first try the electronic support systems. If the information available on these systems does not answer your questions, we offer fax and telephone support through our technical support centers, which are staffed by applications engineers.

Electronic Services

Bulletin Board Support

National Instruments has BBS and FTP sites dedicated for 24-hour support with a collection of files and documents to answer most common customer questions. From these sites, you can also download the latest instrument drivers, updates, and example programs. For recorded instructions on how to use the bulletin board and FTP services and for BBS automated information, call (512) 795-6990. You can access these services at:

United States: (512) 794-5422
Up to 14,400 baud, 8 data bits, 1 stop bit, no parity

United Kingdom: 01635 551422
Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

France: 01 48 65 15 59
Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

FTP Support

To access our FTP site, log on to our Internet host, `ftp.natinst.com`, as `anonymous` and use your Internet address, such as `joesmith@anywhere.com`, as your password. The support files and documents are located in the `/support` directories.

Fax-on-Demand Support

Fax-on-Demand is a 24-hour information retrieval system containing a library of documents on a wide range of technical information. You can access Fax-on-Demand from a touch-tone telephone at (512) 418-1111.

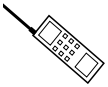
E-Mail Support (currently U.S. only)

You can submit technical support questions to the applications engineering team through e-mail at the Internet address listed below. Remember to include your name, address, and phone number so we can contact you with solutions and suggestions.

support@natinst.com

Telephone and Fax Support

National Instruments has branch offices all over the world. Use the list below to find the technical support number for your country. If there is no National Instruments office in your country, contact the source from which you purchased your software to obtain support.

	 Telephone	 Fax
Australia	03 9879 5166	03 9879 6277
Austria	0662 45 79 90 0	0662 45 79 90 19
Belgium	02 757 00 20	02 757 03 11
Canada (Ontario)	905 785 0085	905 785 0086
Canada (Quebec)	514 694 8521	514 694 4399
Denmark	45 76 26 00	45 76 26 02
Finland	09 725 725 11	09 725 725 55
France	01 48 14 24 24	01 48 14 24 14
Germany	089 741 31 30	089 714 60 35
Hong Kong	2645 3186	2686 8505
Israel	03 5734815	03 5734816
Italy	02 413091	02 41309215
Japan	03 5472 2970	03 5472 2977
Korea	02 596 7456	02 596 7455
Mexico	5 520 2635	5 520 3282
Netherlands	0348 433466	0348 430673
Norway	32 84 84 00	32 84 86 00
Singapore	2265886	2265887
Spain	91 640 0085	91 640 0533
Sweden	08 730 49 70	08 730 43 70
Switzerland	056 200 51 51	056 200 51 55
Taiwan	02 377 1200	02 737 4644
U.K.	01635 523545	01635 523154

Technical Support Form

Photocopy this form and update it each time you make changes to your software or hardware, and use the completed copy of this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

If you are using any National Instruments hardware or software products related to this problem, include the configuration forms from their user manuals. Include additional pages if necessary.

Name _____

Company _____

Address _____

_____

Fax (___)_____ Phone (___) _____

Computer brand _____ Model _____ Processor_____

Operating system (include version number) _____

Clock speed _____MHz RAM _____MB Display adapter _____

Mouse ___yes ___no Other adapters installed _____

Hard disk capacity _____MB Brand _____

Instruments used _____

_____

National Instruments hardware product model _____ Revision _____

Configuration _____

National Instruments software product _____ Version _____

Configuration _____

The problem is: _____

_____

_____

_____

_____

List any error messages: _____

_____

_____

The following steps reproduce the problem:_____

_____

_____

_____

_____

LabVIEW Test Executive Hardware and Software Configuration Form

Record the settings and revisions of your hardware and software on the line to the right of each item. Complete a new copy of this form each time you revise your software or hardware configuration, and use this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

National Instruments Products

DAQ hardware _____

Interrupt level of hardware _____

DMA channels of hardware _____

Base I/O address of hardware _____

Programming choice _____

HiQ, NI-DAQ, LabVIEW, or LabWindows version _____

Other boards in system _____

Base I/O address of other boards _____

DMA channels of other boards _____

Interrupt level of other boards _____

Other Products

Computer make and model _____

Microprocessor _____

Clock frequency or speed _____

Type of video board installed _____

Operating system version _____

Operating system mode _____

Programming language _____

Programming language version _____

Other boards in system _____

Base I/O address of other boards _____

DMA channels of other boards _____

Interrupt level of other boards _____

Documentation Comment Form

National Instruments encourages you to comment on the documentation supplied with our products. This information helps us provide quality products to meet your needs.

Title: *LabVIEW® Test Executive Reference Manual*

Edition Date: August 1997

Part Number: 320599C-01

Please comment on the completeness, clarity, and organization of the manual.

_____

_____

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If you find errors in the manual, please record the page numbers and describe the errors.

_____

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Thank you for your help.

Name _____

Title _____

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Austin, TX 78730-5039

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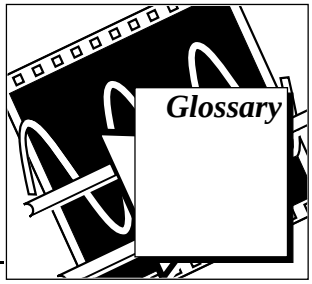


A

ASCII	American Standard Code for Information Interchange.
attribute nodes	A special LabVIEW feature with which you can programmatically change or read certain attributes or values of LabVIEW controls. For example, you can use attribute nodes to set options of a ring control, to set the color of a control, or to set the visibility of a control programmatically. The attributes available vary according to the control type.

B

block diagram	Pictorial description or representation of a program or algorithm. In LabVIEW, the block diagram, which consists of executable icons called nodes and wires that carry data between the nodes, is the source code for the VI. The block diagram resides in the Diagram window of the VI.
Boolean controls and indicators	Front panel objects used to manipulate and display input and output Boolean (TRUE or FALSE) data. Several styles are available, such as switches, buttons, and LEDs.
broken VI	VI that cannot be compiled or run; signified by a broken arrow in the Run button.

C

callback VIs	VIs designed for specific interface and data-logging operations. In the Test Executive, the system callback VIs handle interface operations, such as login and sequence opening and closing, while the sequence callback VIs handle run-time and edit-time events.
case	One subdiagram of a Case structure.

Case structure	Conditional branching control structure, which executes one and only one of its subdiagrams based on its input. It is the combination of the IF, THEN, ELSE, and CASE statements in control flow languages.
cluster	A set of ordered, unindexed data elements of any data type including numeric, Boolean, string, array, or cluster. The elements must be all controls or all indicators.
cluster shell	Front panel object that contains the elements of a cluster.
compile	Process that converts high-level code to machine-executable code. LabVIEW automatically compiles VIs before they run for the first time after creation or alteration.
connector	Part of the VI or function node that contains its input and output terminals, through which data passes to and from the node.
control	Front panel object for entering data to a VI interactively or to a subVI programmatically.
control flow	Programming system in which the sequential order of instructions determines execution order. Most conventional text-based programming languages, such as C, Pascal, and BASIC, are control flow languages.
Controls menu	Menu of controls and indicators.
current VI	VI whose Panel window, Diagram window, or Icon Editor window is the active window.

D

data flow	Programming system consisting of executable nodes in which nodes execute only when they have received all required input data and produce output automatically when they have executed. LabVIEW is a dataflow system.
data logging	Generally, to acquire data and simultaneously store it in a disk file. LabVIEW file I/O functions can log data.

datalog file	File that stores data as a sequence of records of a single, arbitrary data type that you specify when you create the file. While all the records in a datalog file must be of a single type, that type can be complex; for instance, you can specify that each record is a cluster containing a string, a number, and an array.
Description box	Online documentation for a LabVIEW object.
Diagram window	VI window that contains the block diagram code.
dialog box	An interactive screen with prompts in which you specify additional information needed to complete a command.

E

edit mode	The mode in which you create or edit a VI.
enumerations	Type controls and constants that are similar to ring controls and constants except in the way they display data. When an enumeration is wired to a Case structure, cases are named according to the enumeration's mnemonics rather than traditional numeric values.

F

front panel	The interactive user interface of a VI. Modeled from the front panel of physical instruments, it is composed of switches, slides, meters, graphs, charts, gauges, LEDs, and other controls and indicators.
function	Built-in execution element, comparable to an operator, function, or statement in a conventional language.

G

Global variable	A built-in LabVIEW object you use to easily access a given set of values throughout your LabVIEW application. A global variable is a special kind of VI with front panel controls that define the data type of the global variable.

H

Help window	Special window that displays the names and locations of the terminals for a function or subVI, the description of controls and indicators, the values of universal constants, and descriptions and data types of control attributes.

I

indicator	Front panel object that displays output.
I/O	Input/Output. The transfer of data to or from a computer system involving communications channels, operator input devices, and/or data acquisition and control interfaces.

L

label	Text object used to name or describe other objects or regions on the front panel or block diagram.
Labeling tool	Tool used to create labels and enter text into text windows.
LabVIEW	Laboratory Virtual Instrument Engineering Workbench.
Local variable	A variable assigned to a front panel control or indicator on a VI. Once set up, a local variable always reads from or writes to the front panel control or indicator. You can use a local variable to read from an indicator or write to a control and in effect create an input-output control that LabVIEW does not normally have.

M

MB	Megabytes of memory.
menu bar	Horizontal bar that contains names of main menus.

N

numeric controls and indicators	Front panel objects used to manipulate and display or input and output numeric data.

O

object	Generic term for any item on the front panel or block diagram, including controls, nodes, wires, and imported pictures.
Operating tool	Tool used to enter data into controls as well as operate them. Resembles a pointing finger.

P

palette menu	Menu that displays a palette of pictures that represent possible options.
Panel window	VI window that contains the front panel, the execution palette and the icon/connector pane.
platform	Computer and operating system.
pop up	To call up a special menu by clicking on an object with the mouse. (In Windows, click on the right mouse button to pop up.)
pop-up menus	Menus accessed by clicking on an object. Menu options pertain to that object specifically.
Positioning tool	Tool used to move and resize objects.
pull-down menus	Menus accessed from a menu bar. Pull-down menu options are usually general in nature.

R

ring control	Special numeric control that associates 32-bit integers, starting at 0 and increasing sequentially, with a series of text labels or graphics.
run mode	The mode in which you execute a VI.

S

string controls and indicators	Front panel objects used to manipulate and display or input and output text.
structure	Program control element, such as a Sequence, Case, For Loop, or While Loop.
subdiagram	Block diagram within the border of a structure.
subVI	VI used in the block diagram of another VI; comparable to a subroutine.

T

terminal	Object or region on a node through which data passes.
tool	Special LabVIEW cursor you can use to perform specific operations.
top-level VI	VI at the top of the VI hierarchy. This term distinguishes the VI from its subVIs.
Type definition (typedef)	A master copy of a control. If you use a custom control, you can save it as a type definition, and use that type definition in all your VIs. If you need to change that control, you can update the single type definition file instead of updating the control in every VI that uses it. A *strict* type definition can force everything about the control to be identical *everywhere* it is used, not just its data type.

U

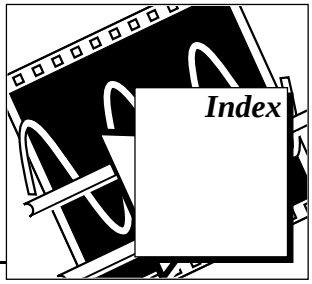
UUT	Unit Under Test

V

VI	Virtual instrument.
VI library	Special file that contains a collection of related VIs for a specific use.

W

While Loop	Post-iterative test loop structure that repeats a section of code until a condition is met. Comparable to a Do loop or a Repeat-Until loop in conventional programming languages.
wire	Data path between nodes.
Wiring tool	Tool used to define data paths between source and sink terminals.



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