

# **NI TestStand™**

## **Using LabVIEW™ with TestStand**

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# Conventions

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The following conventions are used in this manual:

»

The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.



This icon denotes a note, which alerts you to important information.

**bold**

Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.

*italic*

Italic text denotes variables, emphasis, a cross-reference, or an introduction to a key concept. Italic text also denotes text that is a placeholder for a word or value that you must supply.

`monospace`

Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.

*`monospace italic`*

Italic text in this font denotes text that is a placeholder for a word or value that you must supply.

**Platform**

Text in this font denotes a specific platform and indicates that the text following it applies only to that platform.

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# Role of LabVIEW in a TestStand-Based System

NI TestStand is a test management environment you use to organize and execute code modules written in a variety of languages and application development environments (ADEs), including LabVIEW. TestStand handles core test management functionality, including the definition and execution of the overall testing process, user management, report generation, database logging, and more. TestStand can work in a variety of different testing scenarios and environments because it allows extensive customization of components, such as process models, step types, and user interfaces. You can use LabVIEW in the following ways to accomplish much of this customization:

- Create code modules, such as tests and actions, TestStand can call using the LabVIEW Adapter
- Create custom user interfaces for test systems
- Create custom step types

## Code Modules

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TestStand can call LabVIEW virtual instruments (VIs) with a variety of connector pane configurations. TestStand can call VIs that reside on the same computer as TestStand or on other network computers, including computers running the LabVIEW Real-Time (RT) module.

TestStand can also pass data to the VIs it calls and store the data the VI returns. Additionally, the VIs TestStand calls can access the complete TestStand application programming interface (API) for advanced applications.



## Custom User Interfaces

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You can use the LabVIEW development environment to build custom user interfaces for test systems and for creating custom sequence editors. Typically, custom user interfaces are designed for use in production test systems. With the LabVIEW Full or Professional Development System, you can also create user interfaces using the TestStand User Interface (UI) Controls and the TestStand API. Refer to Chapter 9, *Creating Custom User Interfaces*, of the *NI TestStand Reference Manual* for more information about creating custom user interfaces.

## Custom Step Types

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You can use LabVIEW to create VIs you call from custom step types. These VIs can implement editable dialog boxes and other features of custom step types. Refer to Chapter 13, *Custom Step Types*, of the *NI TestStand Reference Manual* for more information about custom step types.

## LabVIEW Adapter

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The LabVIEW Adapter offers advanced functionality for calling VIs from TestStand. You can use the LabVIEW Adapter to perform the following tasks:

- Call VIs with arbitrary connector panes
- Call VIs on remote computers
- Run VIs in the LabVIEW Run-Time Engine
- Call TestStand VIs from versions of TestStand earlier than 3.0 and LabVIEW Test Executive VIs
- Create and edit VIs from TestStand
- Debug VIs (step in/step out) from TestStand
- Run VIs using the LabVIEW Development System or a LabVIEW executable

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# Calling LabVIEW VIs from TestStand

You can call LabVIEW VIs from TestStand using the LabVIEW Adapter.

## Required LabVIEW Settings

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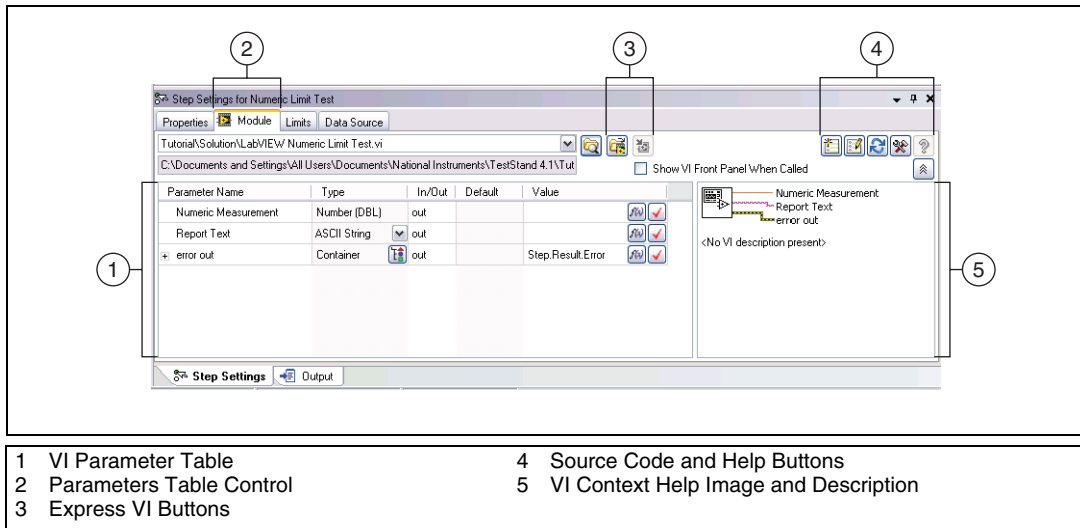
All the tutorials in this manual require that you have the LabVIEW Development System and TestStand installed on the same computer. In addition, you must configure the LabVIEW Adapter to run VIs using the LabVIEW Development System. Refer to Chapter 5, [Configuring the LabVIEW Adapter](#), for more information about configuring these settings for the adapter.

Confirm the following settings in LabVIEW:

- To edit or run a VI from TestStand, you must include the VI in the VI Server: Exported VIs list. By default LabVIEW allows access to all VIs. To view the VI Server: Exported VIs list, select **Tools»Options** and select the **VI Server: Exported VIs** category in the Options dialog box.
- If you use LabVIEW 8.0.1 or earlier, select **Tools»Options»Performance and Disk** to confirm the **Run with multiple threads** checkbox includes a checkmark to avoid errors when running VIs.

## LabVIEW Module Tab

Use the LabVIEW Module tab in the TestStand Sequence Editor to configure calls to LabVIEW VIs. Select a step that uses the LabVIEW Adapter to view the LabVIEW Module tab in the Step Settings pane, as shown in Figure 2-1.



**Figure 2-1. LabVIEW Module Tab**

Use the LabVIEW Module tab in the TestStand Sequence Editor to specify the VI the step executes and to specify if LabVIEW shows the front panel of the VI when TestStand calls the VI. The Module tab includes Source Code buttons for selecting an Express VI and converting an Express VI to a standard VI.

The LabVIEW Module tab also contains the following specific information about the VI to call.

- VI Parameter Table**—Contains the following information about each control and indicator, also called the parameters of the VI, wired to the connector pane of the VI:
  - Parameter Name**—Contains the caption text for the control or indicator. If no caption exists, this field contains the label text.
  - Type**—Contains the LabVIEW data type for the control or indicator. Refer to Chapter 4, *Using LabVIEW Data Types with TestStand*, for more information about how LabVIEW data types map to TestStand data types.

- **In/Out**—Specifies if the parameter is an input (control) or an output (indicator).
- **Default**—Specifies if TestStand uses the default value for the parameter, cluster element, or array element. If the terminal on the VI is marked as Required, this option is not available.
- **Value**—Contains a TestStand expression. For input parameters, TestStand passes the result of this expression to the VI unless you enable the checkbox in the Default column. For output parameters, TestStand stores the data the VI returns in the location this expression specifies.



**Note** Parameters are listed in the VI Parameter Table according to their order in the VI context help image.

- **Source Code and Help Buttons**—Use these buttons to create or edit a VI in LabVIEW, refresh the parameter information for the VI, open the LabVIEW Advanced Settings window, display the help associated with the VI if available, and undock the LabVIEW Help.
- **VI Context Help Image and Description**—Displays the context help image of the VI as shown in the LabVIEW Context Help window and displays the description of the VI from the Documentation page in the LabVIEW VI Properties dialog box. When you click a label or terminal of the VI icon, TestStand highlights the parameter in the VI Parameter Table.

Click the **Help** or **Help Topic** button located on the Help toolbar to access the *NI TestStand Help*, which provides additional information about the LabVIEW Module tab.

## Creating and Configuring a New Step Using the LabVIEW Adapter

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Complete the following steps to insert a new step that uses the LabVIEW Adapter and configure the step to call a test VI.

1. Launch the TestStand Sequence Editor and select the **LabVIEW Adapter** on the Insertion Palette.
2. Open a new Sequence File window if one is not already open.
3. Select **File»Save As** and save the sequence file as <TestStand Public>\Tutorial\Call LabVIEW VI.seq. The <TestStand Public> directory is located at C:\Documents and Settings\

All Users\Documents\National Instruments\  
TestStand x.x on Windows 2000/XP and at C:\Users\Public\  
Documents\National Instruments\TestStand x.x  
on Windows Vista.

4. Insert a Pass/Fail step in the Main step group of the Sequence File window and rename the new step LabVIEW Pass/Fail Test.
5. On the LabVIEW Module tab of the Step Settings pane, click the **Browse for VI** button, select <TestStand Public>\Tutorial\LabVIEW Pass-Fail Test.vi, and click **Open**. TestStand reads the description and connector pane information from the VI and updates the LabVIEW Module tab so you can configure the data to pass to and from the VI.
6. In the VI Parameter Table, enter `Step.Result.PassFail` in the Value column of the **PASS/FAIL Flag** output parameter and enter `Step.Result.ReportText` in the Value column of the **Report Text** output parameter.



**Note** All expression fields support type-ahead and auto-completion with drop-down lists and context-sensitive highlighting. At any point while editing an expression, press <Ctrl-Space> to show a drop-down list of valid expression elements.

When TestStand calls the VI, it places the value the VI returns in the **PASS/FAIL Flag** and **Report Text** indicators into the `Result.PassFail` and `Result.ReportText` properties of the step.

7. Notice that TestStand automatically fills in the Value column of the **error out** output parameter with the `Step.Result.Error` property.



**Note** By default, if a VI uses the standard LabVIEW **error out** cluster as an output parameter, TestStand automatically passes that value into the `Step.Result.Error` property for the step. You can also update the value manually.

8. Select **File>Save** to save the sequence file.
9. Select **Execute>Single Pass** to run the sequence file using the Single Pass Execution entry point.

When the execution completes, the resulting report indicates the step passed. The VI always returns `True` as the Pass/Fail output parameter.

10. Close the Execution window.

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# Creating, Editing, and Debugging LabVIEW VIs from TestStand

You can use the LabVIEW Adapter to create new VIs to call from TestStand and to edit and debug existing VIs.

## Creating a New VI from TestStand

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Complete the following steps to create a new VI from TestStand.

1. Launch the TestStand Sequence Editor and select the **LabVIEW Adapter** on the Insertion Palette.
2. Open <TestStand Public>\Tutorial\Call LabVIEW VI.seq, if it is not already open. You created this sequence file in the [Creating and Configuring a New Step Using the LabVIEW Adapter](#) section of Chapter 2, [Calling LabVIEW VIs from TestStand](#).
3. Insert a Numeric Limit Test step after the LabVIEW Pass/Fail Test step and rename it LabVIEW Numeric Limit Test.
4. Select the LabVIEW Numeric Limit Test step and use the LabVIEW Module tab to complete the following steps.
  - a. Click the **Create VI** button to create a new VI.
  - b. In the File dialog box, browse to the <TestStand Public>\Tutorial directory, enter LabVIEW Numeric Limit Test.vi in the **File Name** control, and click **OK**. TestStand creates a new VI based on the available code templates for the TestStand Numeric Limit Test and opens the VI in LabVIEW.



**Note** The TestStand Numeric Limit Test step type requires code modules to store a measurement value in the `Step.Result.Numeric` property, and the step type performs a comparison operation to determine if the step passes or fails. Code modules can update step properties by passing step properties as parameters to and from the module or by using the TestStand API in the module. If you use a default code template from National Instruments to create a module, TestStand creates the parameters needed to access the step properties for you.

- c. In LabVIEW, select **Window»Show Block Diagram** to open the block diagram.
  - d. Right-click the **Numeric Measurement** indicator terminal, select **Create»Constant** from the context menu, and enter 10.0.
  - e. Save and close the VI.
5. Return to the TestStand Sequence Editor and select the LabVIEW Module tab. Notice that TestStand automatically updates the output parameters for the VI based on the information stored in the code template for the Numeric Limit Test step type.
  6. Save the sequence file as <TestStand Public>\Tutorial\Call LabVIEW VI 2.seq.
  7. Select **Execute»Single Pass** to run the sequence file using the Single Pass Execution entry point. When the execution completes, the resulting report indicates the step passed with a numeric measurement of 10.0.
  8. Leave the sequence file open so you can use it in the next tutorial.

Refer to Chapter 13, *Custom Step Types*, of the *NI TestStand Reference Manual* for more information about step types and code templates.

## Editing an Existing VI from TestStand

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Complete the following steps to edit an existing VI from TestStand.

1. Open <TestStand Public>\Tutorial\Call LabVIEW VI 2.seq, if it is not already open.
2. Right-click the LabVIEW Pass/Fail Test step and select **Edit Code** from the context menu. LabVIEW becomes the active application.
3. Open the block diagram for the VI.
4. Change the **PASS/FAIL Flag** Boolean constant to `False`.
5. Save and close the VI.
6. In the TestStand Sequence Editor, select **Execute»Single Pass** to run the sequence file using the Single Pass Execution entry point. When the execution completes, the resulting report indicates the step failed, and the VI returns `False` in the **PASS/FAIL Flag** indicator.
7. Close the Execution window.

## Debugging a VI

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Complete the following steps to debug a VI you call from TestStand using the LabVIEW Adapter.

1. Open <TestStand Public>\Tutorial\Call LabVIEW VI.seq.
2. Place a breakpoint on the LabVIEW Pass/Fail Test step.
3. Save the sequence file and select **Execute»Run MainSequence** to start an execution of MainSequence.
4. When the execution pauses, click the **Step Into** button on the sequence editor toolbar. LabVIEW becomes the active application, in which the LabVIEW Pass-Fail Test VI is open and in a suspended state.
5. Open the block diagram of the suspended VI.
6. Click the **Step Into** button or the **Step Over** button on the LabVIEW toolbar to begin single-stepping through the VI. You can click the **Continue** button at any time to finish single-stepping through the VI.
7. When you finish single-stepping through the VI, click the **Return to Caller** button on the LabVIEW toolbar to return to TestStand. The execution pauses at the next step in the sequence.
8. Select **Debug»Resume** in TestStand to complete the execution.
9. Close the Execution window.

You can run the VI multiple times before returning to TestStand. However, LabVIEW passes the results only from the last run to TestStand when you finish debugging.



# Using LabVIEW Data Types with TestStand

TestStand provides number, string, Boolean, and object reference built-in data types. TestStand also provides several standard named data types, including Path, Error, LabVIEWAnalogWaveform, and others. You can create container data types that hold any number of other data types. TestStand container data types are analogous to LabVIEW clusters. You can use references to external objects, such as ActiveX (Microsoft ActiveX) objects or VISA sessions, between different types of code modules.

LabVIEW has a greater variety of built-in data types than TestStand, so TestStand converts LabVIEW data types in certain ways when calling VIs. Table 4-1 describes how TestStand handles the various LabVIEW data types.

**Table 4-1.** TestStand Equivalents for LabVIEW Data Types

LabVIEW Data Type	TestStand Data Type
Real number (U8, U16, U32, I8, I16, I32, SGL, DBL, or EXT)	Number  TestStand does not support extended-precision, (EXT) floating-point numbers. TestStand converts any EXT numbers from LabVIEW into double-precision (DBL) numbers.
64-bit Integer Numeric	TestStand does not support calling VIs with 64-bit integer numeric indicators or controls.
Fixed-Point Numeric	TestStand does not support calling VIs with Fixed-Point Numeric indicators or controls.
Complex number (CSG, CDB, or CXT)	Number  TestStand maps each part of the complex number to separate TestStand Number properties. Refer to the previous information about how TestStand converts EXT numbers.

**Table 4-1.** TestStand Equivalents for LabVIEW Data Types (Continued)

LabVIEW Data Type	TestStand Data Type
Enum (U32, U16, or U8)	<p>Number</p> <p>For input parameters, the Value column on the LabVIEW Module tab shows a ring control that contains the items in the LabVIEW enumeration.</p> <p>At edit time, TestStand stores the numeric value and string label value of the enum you select. When you pass an enum value to TestStand at run time, TestStand stores the numeric value only.</p>
String	<p>String</p> <p>Refer to the <a href="#">Calling VIs with String Parameters</a> section of this chapter for more information about using the String data type.</p>
Path	Path or String
ActiveX Control or Automation Refnum	Object reference
.NET Refnum	<p>Object reference</p> <p>You cannot pass references to .NET objects you create outside of LabVIEW, such as with the TestStand .NET Adapter, to LabVIEW VIs. You can store references to .NET objects you create in LabVIEW within TestStand properties and then pass them to other LabVIEW VIs. If you use LabVIEW 7.1.1, the objects must be marshalable by reference.</p>
Waveform	LabVIEWAnalogWaveform
Digital Waveform	LabVIEWDigitalWaveform
Digital Data	LabVIEWDigitalData

**Table 4-1.** TestStand Equivalents for LabVIEW Data Types (Continued)

LabVIEW Data Type	TestStand Data Type
Picture	<p>String</p> <p>You must select <b>Binary String</b> on the LabVIEW Module tab. Refer to the <a href="#">Calling VIs with String Parameters</a> section of this chapter for more information about using the String data type.</p>
Refnum (File I/O, VI, Menu, Queue, TCP connection, and so on)	<p>Number</p> <p>You cannot use references to internal LabVIEW objects inside TestStand or in other types of code modules. You can store only references to LabVIEW objects in TestStand properties and then pass the properties to other VIs.</p>
Timestamp	<p>String</p> <p>Refer to the <a href="#">Calling VIs with String Parameters</a> section of this chapter for more information about using the String data type.</p>
Error I/O	<p>Error</p> <p>If a VI contains the standard <b>error out</b> cluster as an output parameter, TestStand automatically detects it and maps the output to <code>Step.Result.Error</code>.</p>
Array of $x$	Array of TestStand ( $x$ )
Variant	Any TestStand data type
LabVIEW Object	TestStand does not support calling VIs with LabVIEW Object indicators or controls.
Cluster	<p>Container</p> <p>Refer to the <a href="#">Calling VIs with Cluster Parameters</a> section of this chapter for more information about using the Container data type.</p>

**Table 4-1.** TestStand Equivalents for LabVIEW Data Types (Continued)

LabVIEW Data Type	TestStand Data Type
I/O Data Types (DAQmx Task Name, DAQmx Channel Name, VISA Resource Name, IVI Logical Name, FieldPoint IO Point, or Motion Resource)	LabVIEWWIOControl  Refer to the <i>NI TestStand Help</i> for more information about using the DeviceName and SessionNumber properties of the LabVIEWWIOControl data type.
IMAQ Session	Number
Other I/O data types (DAQmx Physical Channel Name, Terminal Name, Analog Trigger Source, Scale Name, Device Name, or Switch Name)	String  Refer to the <i>Calling VIs with String Parameters</i> section of this chapter for more information about using the String data type.

## Calling VIs with String Parameters

When you configure calls to VIs that use strings as parameters, you can specify if TestStand escapes the string data when reading the data from the VI or unescapes the string data when passing the data to the VI. This option is necessary because LabVIEW strings can contain binary data, including NUL characters, but TestStand strings cannot contain NUL characters.

For String parameters, use the ring control in the Type column of the VI Parameter Table on the LabVIEW Module tab to select ASCII String or Binary String. The default value is ASCII String. TestStand does not modify the values of ASCII strings it passes to or from VIs.

Select Binary String in the Type column to store a LabVIEW string that contains binary data in a TestStand property. TestStand escapes the string before storing it and substitutes hexadecimal codes for the unprintable characters, such as the NUL character, in the string.

To pass a string escaped to a LabVIEW VI, select Binary String in the Type column. TestStand unescapes the string before passing it to the VI and substitutes the correct character values for the hexadecimal values in the escaped string.

## Calling VIs with Cluster Parameters

When you configure calls to VIs that use clusters as parameters, you can specify that each cluster element maps to a different TestStand expression or that the entire LabVIEW cluster maps to a TestStand data type.

















You can create a custom data type that matches a LabVIEW cluster. For input parameters, you can pass the default value for the entire cluster or the default values for specific elements of the cluster control on the front panel of the VI.

For output parameters, you can optionally specify where TestStand stores the cluster value or specific elements of the cluster value.

If you are using several VIs with a complex array of clusters that is not used in TestStand, you can use the LabVIEWClusterArray data type, which adapts to the array of clusters as needed. First, use the LabVIEWClusterArray data type as an output expression that TestStand uses to adapt the data type to fit the array of clusters. Then, you can pass the data type to the remaining VIs as an input.

### Specifying Each Cluster Element Individually

To configure each cluster element individually, specify a different TestStand expression for each element of the cluster. Figure 4-1 illustrates a VI Parameter Table in which the data source for the Number element of **Input Cluster** is a local variable. TestStand passes the default value for the String element of **Input Cluster**.

Parameter Name	Type	In/Out	Default	Value	
- Input Cluster	Container	 in	<input type="checkbox"/>		 
Number	Number (DBL)	in	<input type="checkbox"/>	Locals.Numeric	 
String	ASCII String	 in	<input checked="" type="checkbox"/>	""	 
PASS/FAIL Flag	Boolean	out		Step.Result.PassFail	 
Report Text	ASCII String	 out		Step.Result.ReportText	 
+ error out	Container	 out		Step.Result.Error	 

**Figure 4-1.** Input Cluster Data Sources

## Passing Existing TestStand Container Variables to LabVIEW

Instead of passing each cluster element individually, you can create a TestStand custom data type that maps to the entire LabVIEW cluster.

Use the LabVIEW Cluster Passing tab of the Type Properties dialog box for the new custom data type to specify how TestStand maps subproperties to elements in a LabVIEW cluster. Then, when you specify the data to pass for a cluster parameter, use a variable that is an instance of the new custom data type. Refer to the *NI TestStand Help* for more information about the Type Properties dialog box.

Figure 4-2 shows how the data passed to the **Input Cluster** parameter is a local variable called ContainerData with a type of InputData. Figure 4-3 shows the custom InputData data type.

Parameter Name	Type	In/Out	Default	Value
[-] Input Cluster	Container	in	<input type="checkbox"/>	Locals.ContainerData
Number	Number (DBL)	in	<input type="checkbox"/>	Locals.ContainerData.Number
String	ASCII String	in	<input type="checkbox"/>	Locals.ContainerData.String
PASS/FAIL Flag	Boolean	out		
Report Text	ASCII String	out		Step.Result.ReportText
[+] error out	Container	out		Step.Result.Error

Figure 4-2. ContainerData Local Variable

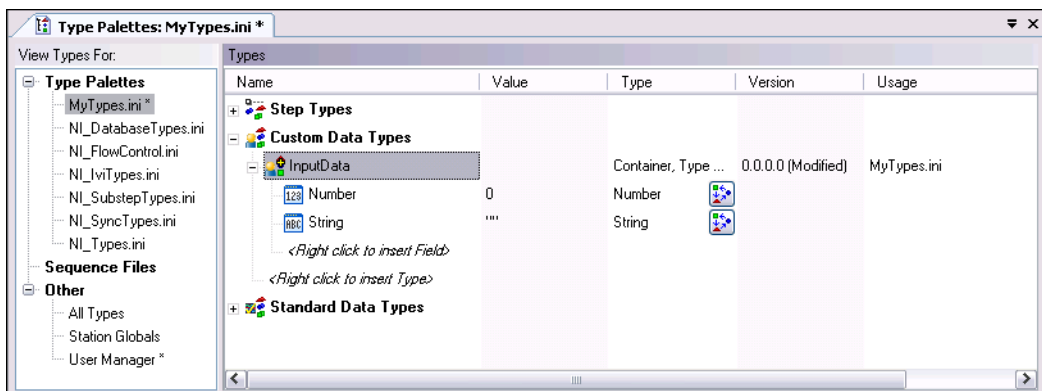
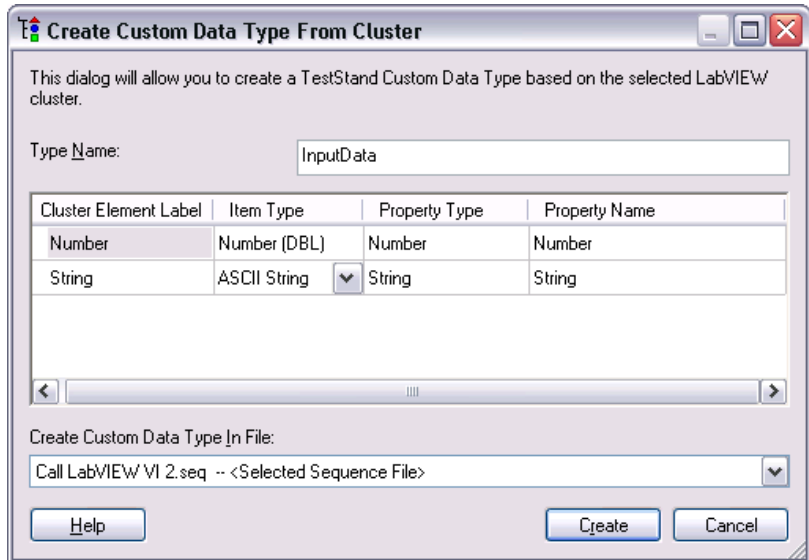


Figure 4-3. TestStand Custom InputData Data Type

## Creating a New Custom Data Type



Use the Create Custom Data Type From Cluster dialog box to create a TestStand custom data type, such as a container, that matches an existing LabVIEW cluster. Click the **Create Custom Data Type** button, shown at left, located in the Type column of the VI Parameter Table on the LabVIEW Module tab to launch the Create Custom Data Type From Cluster dialog box, as shown in Figure 4-4.



**Figure 4-4.** Create Custom Data Type From Cluster Dialog Box

Use the Type Name textbox to specify the name of the TestStand custom data type you want to create. Use the Property Type column to specify the TestStand data type to use for cluster elements that are variants. Use the Property Name column to specify the names of the subproperties that map to the elements of the cluster. Use the Create Custom Data Type In File ring control to specify where TestStand creates the type.

Refer to Chapter 11, *Type Concepts*, of the *NI TestStand Reference Manual* for more information about where TestStand stores custom data types. Refer to Chapter 12, *Standard and Custom Data Types*, of the *NI TestStand Reference Manual* and to the *NI TestStand Help* for more information about custom data types. Refer to the *NI TestStand Help* for more information about the Create Custom Data Type From Cluster dialog box.

## Creating TestStand Data Types from LabVIEW Clusters

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Complete the following steps to create a TestStand data type that matches a LabVIEW cluster.

1. Open <TestStand Public>\Tutorial\  
Call LabVIEW VI 2.seq and select the **LabVIEW Adapter** on the Insertion Palette.
2. Insert a new Pass/Fail Test step in the Main step group of MainSequence after the LabVIEW Numeric Limit Test step and rename the step Pass Container to VI.
3. On the LabVIEW Module tab, click the **Browse for VI** button and select <TestStand Public>\Tutorial\  
VI with Cluster Input.vi. The **Report Text** output parameter of this VI returns a string that contains the number and string elements of the **Input Cluster** parameter.
4. Click the **Create Custom Data Type** button in the Type column of the **Input Cluster** parameter to launch the Create Custom Data Type From Cluster dialog box. TestStand maps the cluster elements to subproperties in a container called Input\_Cluster, which is a new TestStand custom data type. You can rename the data type and subproperties as necessary and specify where TestStand stores the new data type.
5. In the Create Custom Data Type From Cluster dialog box, change the type name to InputData and click the **Create** button to accept the automatically assigned values and to create the data type in the current sequence file.
6. On the LabVIEW Module tab, remove the checkmark from the Default column for the **Input Cluster** input parameter, click the **Expression Browse** button in the Value column to open the Expression Browser dialog box, and complete the following steps.
  - a. Right-click **Locals** in the Variables/Properties tab and select **Insert Types»InputData** to create a local variable of type InputData. Rename the local variable ContainerData.
  - b. Right-click the Number subproperty of ContainerData and select **Properties** from the context menu. Enter 23 in the **Value** field and click **OK**.
  - c. Right-click the String subproperty of ContainerData and select **Properties** from the context menu. Enter My String Data in the **Value** field and click **OK**.



- d. Enter `Locals.ContainerData` in the **Expression** field and click **OK**. The Value column for the **Input Cluster** parameter now contains `Locals.ContainerData`.
7. Enter `Step.Result.ReportText` in the **Value** column for the **ReportText** output parameter. When TestStand calls the VI, it passes the values in the `ContainerData` local variable to the **Input Cluster** control on the VI and returns the **Number** and **String** elements of the **Input Cluster** parameter to the `ReportText` property of the step.
8. Save your changes and select **Execute»Single Pass** to run the sequence file using the Single Pass Execution entry point. When the execution completes, the resulting report shows the text the VI with Cluster Input VI returns.



**Note** By default, the Before Saving Modified Types option on the Preferences tab of the Station Options dialog box is set to Prompt to Increment Version Types. This causes TestStand to launch the Modified Types Warning dialog box when you select **File»Save** and the sequence file or type palette contains types that are marked as modified. Select **Increment Type Versions** and then click **OK** to close the dialog box. Refer to the *NI TestStand Help* for more information about the Modified Types Warning dialog box.

9. Close the Execution window.

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# Configuring the LabVIEW Adapter

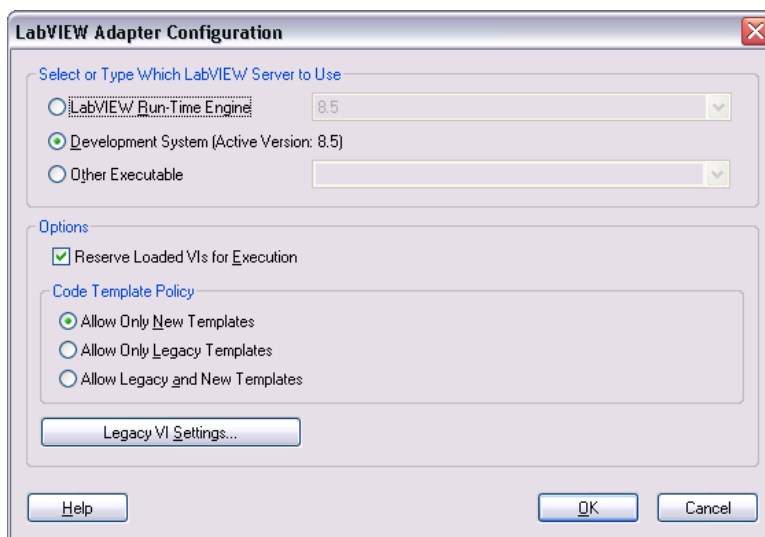
You can configure the TestStand LabVIEW Adapter to select a LabVIEW server, reserve loaded VIs for execution, establish a code template policy, and change legacy VI settings.

## Selecting a LabVIEW Server

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The LabVIEW Adapter can run VIs using the LabVIEW Development System, the LabVIEW Run-Time Engine, or a LabVIEW executable built with an ActiveX server enabled.

Select **Configure»Adapters** to launch the Adapter Configuration dialog box, select **LabVIEW** in the Adapter column, and click the **Configure** button to launch the LabVIEW Adapter Configuration dialog box, in which you can select the server you want TestStand to use, as shown in Figure 5-1.



**Figure 5-1.** LabVIEW Adapter Configuration Dialog Box

- **LabVIEW Run-Time Engine**—Provides optimal performance when calling LabVIEW VIs by running VIs in the same process as TestStand. If you select this option, you cannot create or edit VIs from TestStand or debug VIs TestStand calls. You must install and select the LabVIEW Run-Time Engine version that matches the version of the VIs that TestStand executes.
- **Development System (Active Version: X.X)**—Allows you to create or edit VIs from TestStand and debug VIs TestStand calls in LabVIEW. The VIs execute in the LabVIEW Development System process. You must have the LabVIEW Development System installed on the same computer as TestStand to use this option.
- **Other Executable**—Uses a LabVIEW executable you build with the Build Executable functionality in LabVIEW 8.0 or later or the Build Application or Shared Library (DLL) functionality in LabVIEW 7.1.1. If you select this option, you cannot create or edit VIs from TestStand or debug VIs TestStand calls. The version of LabVIEW that built the executable must match the version of the VIs that TestStand executes.

To use this option, enter the ActiveX server name associated with the LabVIEW executable. The executable must be installed and registered on the same computer as TestStand. Launch the executable once to register it as an ActiveX server. Refer to the <TestStand Public>\Components\RuntimeServers\LabVIEW directory for an example server VI and application build script for LabVIEW 8.0 or later and for LabVIEW 7.1.1.



**Note (Windows Vista)** Windows Vista requires you to log in as a user with administrator privileges in order to register a server. LabVIEW cannot register ActiveX servers on Windows Vista when building executables without elevation. If you are using TestStandLVRTS.exe with Windows Vista to run LabVIEW VIs, you receive an error because the server is not registered. You can register the server by running TestStandLVRTS.exe as an administrator.

## Using a LabVIEW Run-Time Engine or Other Executable Server

If you select LabVIEW Run-Time Engine or Other Executable as a server in the LabVIEW Adapter Configuration dialog box, you must ensure that the server can locate the complete hierarchy of VIs, including any subVIs, that TestStand executes. The version of the VIs that TestStand executes must match the version of the LabVIEW Run-Time Engine or the version of LabVIEW that built the executable. Refer to Chapter 14, *Deploying TestStand Systems*, of the *NI TestStand Reference Manual* for more

information about deploying VIs for use with TestStand and about including a LabVIEW Run-Time Engine in a deployment installer. Refer to Appendix A, *Using LabVIEW 8.x with TestStand*, for more information about calling and deploying LabVIEW 8.x VIs.

If you select the LabVIEW Run-Time Engine as a server on a development system, TestStand might report that it cannot load some VIs in the LabVIEW Run-Time Engine, even though the VIs run using the LabVIEW Development System as the server. This is because TestStand cannot load a subVI that was saved in a different version of LabVIEW than the LabVIEW Run-Time Engine. The most common reason for this discrepancy is when a top-level VI uses a subVI or controls located in the `vi.lib\addons\TestStand` directory, and that subVI was saved in a different version of LabVIEW than the LabVIEW Run-Time Engine. Mass compiling the `vi.lib\addons\TestStand` directory usually resolves the discrepancy. You can also mass compile top-level VIs, which in turn compiles any subVIs.

If you use the TestStand Version Selector to activate a different version of TestStand, TestStand copies new versions of the VIs to the `vi.lib\addons\TestStand` directory. Mass compile the VIs located in this directory after you activate the new version of TestStand.

## Using a LabVIEW Development System Later than 8.5

If you install a version of LabVIEW later than LabVIEW 8.5 and you want to use that version of LabVIEW with TestStand, you must complete the following steps to update `TestStand - Default Values 85.llb` to allow the LabVIEW Adapter to retrieve the default parameter values of the VIs.

1. Create a copy of `TestStand - Default Values 85.llb`.
2. Rename the copy `TestStand - Default Values xx.llb`, where `xx` indicates the version of LabVIEW you want to use with TestStand.
3. Mass compile `TestStand - Default Values xx.llb` using the version of LabVIEW you want to use with TestStand.

## Per-Step Configuration of the LabVIEW Adapter

You can direct TestStand to always use the LabVIEW Run-Time Engine to execute a step. Click the **Advanced Settings** button on the LabVIEW Module tab and select the **Always Run VI in LabVIEW Run-Time Engine** option in the Advanced Settings window.

When you enable the Always Run VI in LabVIEW Run-Time Engine option, TestStand selects the appropriate version of the LabVIEW Run-Time Engine according to the version of LabVIEW in which you last compiled the VI. This setting overrides the global setting in the LabVIEW Adapter Configuration dialog box. Use this option when you do not want the global settings for the adapter to affect the tools and step types you create for use with the LabVIEW Adapter.

## Reserving Loaded VIs for Execution

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Enable the **Reserve Loaded VIs for Execution** option in the LabVIEW Adapter Configuration dialog box to reserve any VIs TestStand loads for calling with the LabVIEW Adapter. Enabling this option reduces the amount of time required for TestStand to call the VIs and makes references you create in a VI you call from TestStand—such as I/O, ActiveX, and synchronization references—persist across calls to other VIs. You can store these references in a TestStand property and pass them to subsequent VIs you call from TestStand.

Although reserving VIs with this option reduces the amount of time required for TestStand to call the VIs, it also blocks other applications from using any VIs TestStand loads, including subVIs of the VIs TestStand calls directly.



If you open a reserved VI in LabVIEW, the Run arrow, shown at left, indicates the VI is reserved, and you cannot edit the VI. To edit a VI TestStand has reserved, click the **Edit Code** button, shown at left, on the LabVIEW Module tab or right-click the step and select **Edit Code** from the context menu to open the VI in TestStand. You can also select **File»Unload All Modules** in the sequence editor before you open the VI in LabVIEW.

You must close any references you create to VIs. If TestStand reserves VIs when it loads the VIs, LabVIEW does not automatically close the references until TestStand unloads the VIs that created the references. Failing to close the references could result in a memory leak in the test system.

# Code Template Policy

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Use the Code Template Policy section in the LabVIEW Adapter Configuration dialog box to specify if TestStand allows the use of old, or legacy, VI templates when you create new test VIs. The legacy VI templates are VIs you can call from previous versions of TestStand. Refer to Appendix D, [Calling Legacy LabVIEW VIs](#), for more information about legacy TestStand VIs.

If you enable the Allow Only New Templates option and create a new VI from the LabVIEW Module tab, TestStand creates a new VI based on the code template for the specified step type. If the step type has multiple code templates available, TestStand launches the Choose Code Template dialog box, in which you can select the code template to use for the new VI.

If you enable the Allow Only Legacy Templates option, TestStand launches the Optional Parameters dialog box, in which you select the optional parameters, such as Input Buffer, Invocation Info, or Sequence Context ActiveX Pointer, you want to include as input parameters for the VI.

If you enable the Allow Legacy and New Templates option, TestStand launches the Choose Code Template dialog box, in which you can select a new template from the list of available templates for the step type. Enable the **Show Legacy Templates in List** option to show the legacy templates. When you select a legacy template, you enable the Optional Parameters for Legacy Templates section of the Choose Code Template dialog box, in which you can select the optional parameters you want to include as input parameters for the VI, as shown in Figure 5-2.

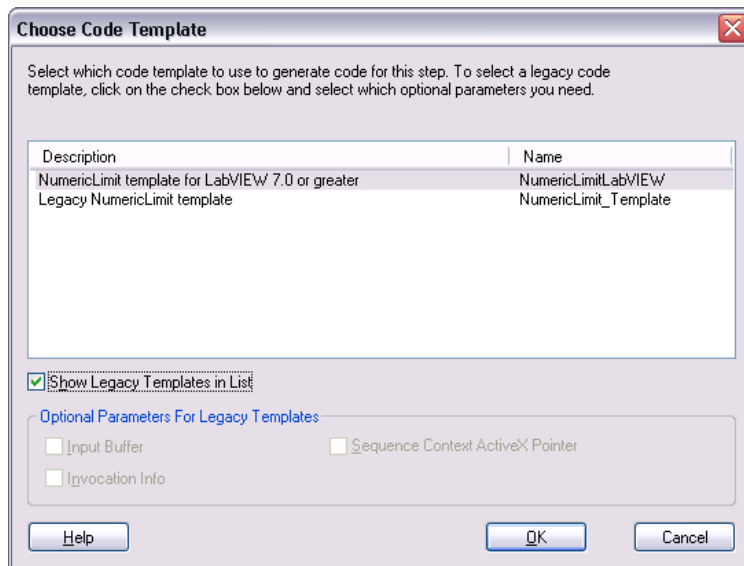


Figure 5-2. Choose Code Template Dialog Box

Refer to the *NI TestStand Help* for more information about the Choose Code Template dialog box.

## Legacy VI Settings

Click the **Legacy VI Settings** button in the LabVIEW Adapter Configuration dialog box to launch the Legacy VI Settings dialog box, in which you can configure settings relevant to calling legacy test VIs. The Legacy VI Settings dialog box contains expressions the LabVIEW Adapter evaluates to generate values to pass to the VI in the various **Invocation Info** cluster fields. Legacy VIs can use the **Invocation Info** cluster as an optional input. Refer to the [Invocation Info Cluster](#) section of Appendix D, [Calling Legacy LabVIEW VIs](#), for more information about the **Invocation Info** cluster.

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# Creating Custom User Interfaces in LabVIEW

You can create custom user interfaces and create user interfaces for other components, such as custom step types. Refer to Chapter 9, *Creating Custom User Interfaces*, of the *NI TestStand Reference Manual* to for information about the TestStand User Interface (UI) Controls.

## TestStand User Interface Controls

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Use the TestStand UI Controls, located on the **Controls»TestStand** palette, to develop a custom user interface application, including custom sequence editors.

When you place the TestStand UI Controls on the front panel of a VI, you can use the LabVIEW ActiveX functionality to program the controls. You can also configure the controls interactively using the LabVIEW Property Browser or control property pages if available. Right-click the control and select **Property Browser** from the context menu to open the LabVIEW Property Browser. Right-click the control and select **Properties** from the context menu to open the property page.

Refer to Appendix C, *Using the TestStand ActiveX APIs in LabVIEW*, for information about programming the TestStand API from LabVIEW.

## TestStand VIs and Functions

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The TestStand VIs and functions, located on the **Functions»TestStand** palette, are the LabVIEW versions of the functions in the TestStand Utility (TSUtil) Functions Library.

Use the TestStand VIs and functions for the following tasks:

- Inserting menu items that automatically execute commands the TestStand UI Controls provide
- Localizing the strings in a user interface



- Making dialog boxes LabVIEW VIs launch modal to TestStand applications
- Checking if an execution that calls a VI has stopped
- Setting and getting the values of TestStand properties and variables

Right-click the VI on the **Functions** palette or on the block diagram and select **Help** from the context menu to access the help for the VI.

## Creating Custom User Interfaces

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User interfaces that use the TestStand UI Controls typically perform the following basic operations:

- Configure connections, commands, and other control settings
- Register to handle events the controls generate
- Start TestStand
- Wait in a main event loop until you close the application
- Shut down TestStand

User interfaces can also include a menu bar that contains non-TestStand items and items that invoke TestStand commands.

Refer to the example user interfaces included with TestStand for more information about creating a TestStand User Interface using the TestStand UI Controls in LabVIEW. Begin with the simple user interface example, `<TestStand>\UserInterfaces\Simple\LabVIEW\TestExec.llb\Simple OI - Top-Level VI.vi`. The `<TestStand>` directory is the location where you installed TestStand. Refer to the full-featured example, `<TestStand>\UserInterfaces\Full-Featured\LabVIEW\TestExec.llb\Full UI - Top-Level VI.vi`, for a more advanced sequence editor example that includes menus and localization options.

TestStand installs the source code files for the default user interfaces in the `<TestStand>\UserInterfaces` and `<TestStand Public>\UserInterfaces` directories. To modify the installed user interfaces or to create new user interfaces, modify the files in the `<TestStand Public>\UserInterfaces` directory. You can use the read-only source files for the default user interfaces in the `<TestStand>\UserInterfaces` directory as a reference. When you modify installed files, rename the files after you modify them if you want to create a separate custom component. You do not have to rename the files

after you modify them if you only want to modify the behavior of an existing component. If you do not rename the files and you use the files in a future version of TestStand, changes National Instruments makes to the component might not be compatible with the modified version of the component. Storing new and customized files in the `<TestStand Public>` directory ensures that new installations of the same version of TestStand do not overwrite the customizations and ensures that uninstalling TestStand does not remove the files you customize.

TestStand no longer includes example user interfaces that use the TestStand API. These examples contained a large amount of complex source code, and they provided less functionality than the simpler examples that use the TestStand UI Controls. National Instruments recommends using the examples that use the TestStand UI Controls as a basis for new development.



**Note** If you place a TestStand UI Control on the front panel of a VI, you must set the Preferred Execution System to **user interface** for the VI. In addition, National Instruments recommends that if a TestStand User Interface performs ActiveX operations that can process messages or performs TestStand operations that can call back into LabVIEW, the application must perform these operations in a LabVIEW execution system other than **user interface**, such as **standard** or **other 2**. Performing these operations in the user interface execution system can result in hang conditions.

## Configuring the TestStand UI Controls

Refer to the following example user interface VIs for examples of configuring connections, commands, and other settings for the TestStand UI Controls:

- Simple OI - Configure Application Manager
- Simple OI - Configure SequenceFileView Manager
- Simple OI - Configure ExecutionView Manager
- Full UI - Configure StatusBar
- Full UI - Configure SequenceFileView Manager
- Full UI - Configure ListBar
- Full UI - Configure ExecutionView Manager

## Enabling Sequence Editing

The TestStand UI Controls support Operator Mode and Editor Mode. Set the `ApplicationMgr.IsEditor` property to `True` for the Application Manager control to allow users to create and edit sequence files. You can also use the `/editor` command-line flag to set the property.

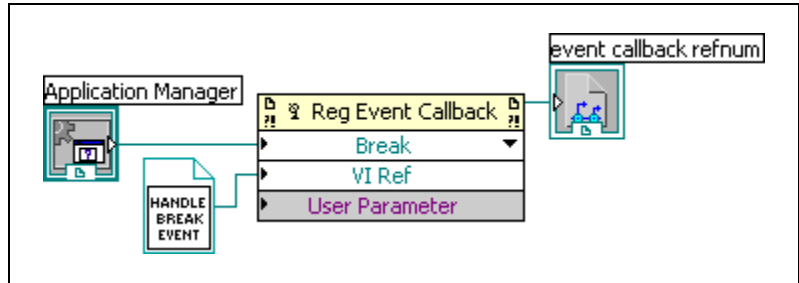
## Handling Events

TestStand UI Controls generate events to notify the application of user input and application events, such as the completion of an execution. To handle an event in LabVIEW, you register a callback VI, which LabVIEW automatically calls when the control generates the event.

Complete the following steps to use the Register Event Callback function, available in the LabVIEW Full or Professional Development System.

1. Wire the reference of the control that sends the event you want to handle to the **Event** input of the Register Event Callback function.
2. Use the **Event** input terminal pull-down menu to select the specific event you want to handle.
3. If you want to pass custom data to the callback VI, wire the custom data to the **User Parameter** input of the Register Event Callback function. The User Parameter input can be any data type.
4. Right-click the **VI Ref** input of the Register Event Callback function and select **Create Callback VI** from the context menu. LabVIEW creates an empty callback VI with the correct input parameters for the particular event, including an input parameter for any custom data you wired to the **User Parameter** input in step 3.
5. Save the new callback VI. The block diagram that contains the Register Event Callback function now shows a Static VI Reference node wired to the **VI Ref** input of the function. This node returns a strictly typed reference to the new callback VI.
6. Complete the block diagram of the callback VI to perform the operation you specify when the control generates the event.
7. When the application finishes handling events for the control, use the Unregister for Events function to close the **event callback refnum** output of the Register Event Callback function.

Figure 6-1 shows how to register a callback VI to handle the Break event for the TestStand Application Manager control.



**Figure 6-1.** Registering a Callback VI for the Break Event

You can resize the Register Event Callback function node to show multiple sets of terminals to handle multiple events. Refer to the following example user interface VIs for examples of registering and handling events from the TestStand UI Controls:

- Simple OI - Configure Event Callbacks
- Full UI - Configure Event Callbacks

You must limit the tasks you perform in a callback VI to ensure that LabVIEW handles the event in a timely manner to allow the front panel to quickly respond to user input and prevent possible hang conditions. If a callback VI performs ActiveX operations that can process messages or performs TestStand operations that can call back into LabVIEW, the application must perform these operations outside of the callback VI. You can define a user event the callback VI generates to defer these types of operations.

The ReDraw user event in the full example user interface shows how callback VIs can defer operations to perform outside of the callback VI. The example user interface performs the following tasks:

- Calls the Full UI - Create LabVIEW Application Events VI to create the ReDraw user event.
- Callback VIs, such as the Full UI - Resized Event Callback VI, generate the ReDraw user event when the user interface must resize and reposition controls on the front panel.
- The ReDraw User Event case in the main event loop of the Full UI - Top-Level VI sets a global variable while processing the current event to prevent callback VIs from generating new ReDraw events. The ReDraw User Event case calls the Full UI - Disable Panel Updates VI

to prevent the front panel from updating, calls the Full UI - ArrangeControls VI to update the position and size of controls on the front panel, and calls the Full UI - Re-enable Panel Updates VI to update the front panel.

## Starting TestStand

Start TestStand by invoking the `ApplicationMgr.Start` method, as shown in the following example user interfaces:

- Simple OI - Top-Level VI
- Full UI - Top-Level VI

## Main Event Loop and Shutting Down TestStand

User interface applications wait in a main event loop after starting TestStand. The main event loop must handle the events that stop the user interface application. The main event loop can also handle other events, such as menu selections and LabVIEW control changes.

Typically, you stop a user interface application by clicking the **Close** box or by executing the **Exit** command through a TestStand menu or a Button control.

When you click the **Close** box, the Event structure in the main event loop handles the Panel Close? event. The block diagram that handles the event invokes the `ApplicationMgr.Shutdown` method and discards the event. When the `ApplicationMgr.Shutdown` method returns `True` to indicate TestStand is ready to shut down, the main event loop stops. When the `ApplicationMgr.Shutdown` method returns `False`, the main event loop waits because TestStand cannot shut down until the executions complete or you unload sequence files. When TestStand is ready, the Application Manager control generates the `ApplicationMgr.ExitApplication` event.

The callback VI for the `ApplicationMgr.ExitApplication` event generates a LabVIEW Quit Application user event, which the example user interface VIs handle, to inform the main event loop to stop.

Refer to the following example user interface VIs for examples of the main event loop and how to shut down TestStand. These VIs also provide examples of creating, generating, and handling the Quit Application event.

- Simple OI - Top-Level VI
- Simple OI - ExitApplication Event Callback

- Full UI - Top-Level VI
- Full UI - Create LabVIEW Application Events
- Full UI - ExitApplication Event Callback

## Menu Bars and Menu Event Handling

The TestStand VIs and functions palette contains the following VIs for creating and handling menu items that execute TestStand UI Control commands:

- TestStand - Insert Commands in Menu
- TestStand - Cleanup Menus
- TestStand - Remove Commands From Menus
- TestStand - Execute Menu Command

Because maintaining the current state of the menu bar can be difficult, National Instruments recommends that you handle the menu bar only when required. The Event structure in a main event loop can include a case to handle the Menu Activation? event to determine when you open a menu or select a shortcut key that might be linked to a menu item. The block diagram that handles this event can then rebuild the menu bar.

The Full UI - Top-Level VI in the example user interface shows how to rebuild the menu bar. The Menu Activation? case in the main event loop of the VI determines which control has focus, if the control is a TestStand UI control, and calls the Full UI - Rebuild Menu Bar VI to rebuild the menu bar. When you click the menu bar, LabVIEW does not automatically return focus to the control after handling a user menu event. The Menu Activation? case in Full UI - Top-Level VI passes a reference for the control with focus to the Menu Selection (User) case so the application can later restore focus to the control.

You can add a Menu Selection (User) case to the Event structure in a main event loop to handle user menu selections but limit the tasks you perform in the Menu Selection (User) case to ensure that LabVIEW handles the menu selection in a timely manner. If the case performs ActiveX operations that can process messages or performs TestStand operations that can call back into LabVIEW, the application must perform these operations in a LabVIEW execution system other than user interface, such as **standard** or **other 2**.

The Full UI - Top-Level VI in the example user interface shows how to process user menu events. The VI uses the standard LabVIEW execution system. The Menu Selection (User) case in the main event loop calls the Full UI - Add To Menu Queue VI to queue the operation for processing the menu outside of the main event loop. The Full UI - Process Menu Queue VI waits for and processes queued operations. For TestStand menu items, the Full UI - Process Menu Queue VI executes the appropriate TestStand command by calling the TestStand - Execute Menu Command VI. For non-TestStand menu items, the VI calls the Full UI - Process User Menus VI, which you can customize to handle user menu selections.

The LabVIEW application menu items for copy, cut, and paste operate on LabVIEW controls only and do not operate on TestStand UI Controls. In addition, the TestStand menu commands operate on TestStand UI Controls only and not on LabVIEW controls. When you rebuild a LabVIEW menu in the Menu Activation? event case and you call the TestStand - Insert Commands in Menu VI to insert `CommandKind_Edit_Copy`, `CommandKind_Edit_Cut`, or `CommandKind_Edit_Paste`, pass `False` to the **TestStand UI Control Has Focus** control and "Edit" to the **Top-Level Menu to Insert Into** control to insert the corresponding LabVIEW application menu items instead of the TestStand menu command.

## Localization

The TestStand UI Controls and TestStand VIs and functions provide tools that localize user interfaces based on the TestStand language setting. Use the following VIs to localize the user interface:

- TestStand - Get Resource String
- TestStand - Localize Menu
- TestStand - Localize Front Panel

Refer to the following example user interface VIs for examples of localizing user interfaces:

- Full UI - Localize Operator Interface
- Full UI - About Box

## Other User Interface Utilities

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You can also launch dialog boxes modal to TestStand application windows and enable VIs to check for stopped executions.

### Making Dialog Boxes Modal to TestStand

The VIs that TestStand calls can launch dialog boxes modal to TestStand application windows, such as the TestStand Sequence Editor or custom user interfaces.

Use the following VIs to make a dialog box modal to TestStand application windows:

- TestStand - Start Modal Dialog
- TestStand - End Modal Dialog

Refer to the `<TestStand Public>\Examples\ModalDialogs\LabVIEW` directory for examples of how to use these VIs.

### Checking for Stopped Executions

The VIs that TestStand calls can launch display dialog boxes or perform other time-consuming operations. In these cases, it can be useful for those VIs to periodically check if TestStand terminated or aborted their parent execution so the VIs can stop gracefully to allow the parent execution to terminate or abort.

Use the following VIs to enable VIs called by TestStand to verify if the execution that called the VI has stopped:

- TestStand - Initialize Termination Monitor
- TestStand - Get Termination Monitor Status
- TestStand - Close Termination Monitor

Refer to the dialog box VIs in the following files to see how to use these VIs:

- `<TestStand Public>\Examples\Demo\LabVIEW\Computer Motherboard Test`
- `<TestStand Public>\Examples\Demo\LabVIEW\Auto`



## Running User Interfaces

---

Consider the following issues when running user interfaces:

- You must close all running LabVIEW User Interfaces before you exit Windows. If you shut down, restart, or log off of Windows while a user interface is running, the user interface cancels the operation and might exit with an error.
- When you run a LabVIEW User Interface in the LabVIEW Development System, you can call remote VIs only if the VI is the same or earlier version as the LabVIEW Development System.
- By default, you can run only one copy of a LabVIEW built executable at a time, which prevents the `TestStand /useexisting` command-line option from working. Add the `"allowmultipleinstances = TRUE"` option to the INI options file in the same directory as the LabVIEW built executable to allow more than one copy to execute at a time.

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# Using LabVIEW 8.x with TestStand

Refer to the LabVIEW documentation for more information about the LabVIEW features included in this appendix.

## Using LabVIEW 8.0

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LabVIEW 8.0 introduced support for many new features, such as projects, project libraries, and DAQmx tasks. As a result of some of these changes, TestStand 3.1 or earlier is not compatible with LabVIEW 8.0. Use TestStand 3.5 or later to use LabVIEW 8.0 with TestStand.

The following sections include the LabVIEW 8.0 features TestStand supports, limitations of the TestStand support, and additional requirements to build a TestStand deployment system that includes LabVIEW 8.0 VIs.

### LabVIEW 8.0 Real-Time Module Incompatibility

TestStand is not compatible with the LabVIEW 8.0 Real-Time (RT) module and cannot download VIs to the LabVIEW 8.0 RT module. Refer to Appendix B, *Calling LabVIEW VIs on Remote Systems*, for more information about executing VIs in the LabVIEW 8.0 RT module.

### Projects

When you run a VI in LabVIEW 8.0, the VI runs inside the application instance for a target in a LabVIEW project or the VI runs without a project in the main application instance. In TestStand, the LabVIEW Adapter always runs a VI in the main application instance, and LabVIEW 8.0 project settings do not apply. TestStand does not support LabVIEW project features or settings unless otherwise noted in the following sections.

## Project Libraries

LabVIEW project libraries are collections of VIs, type definitions, palette menu files, and other files, including other project libraries. In TestStand, you can call public VIs in a project library, but you cannot call private VIs. To call a VI in a project library, you must specify the path to the VI file. TestStand does not use qualified paths that include the project library path and name.

## Network-Published Shared Variables

LabVIEW 8.0 supports network-published shared variables so VIs on distributed systems can share data across the network. LabVIEW identifies shared variables through a network path that includes the computer name (target name), the project library name(s), and the shared variable name.

## Deploying Variables

In LabVIEW, you must deploy a project library that contains the shared variables to which you want to connect from within a VI. LabVIEW automatically deploys shared variables from a library when you execute a VI that reads or writes shared variables and the project library that contains the shared variables is open in the current LabVIEW project.

Because TestStand executes VIs without a project, LabVIEW cannot automatically deploy shared variables. Therefore, you must deploy shared variables to the local computer in one of the following ways:

- Manually deploy the shared variables in the LabVIEW development environment using a project.
- Use the LabVIEW Utility Deploy Library step type in TestStand to deploy a project library that contains shared variables. The project library can contain only shared variables. The project library cannot contain any VI files. Refer to the *NI TestStand Help* for more information about the LabVIEW Utility Deploy Library step type.



**Note** TestStand does not support calling a VI or DLL that programmatically deploys shared variables using the Deploy Library method on a LabVIEW Application reference or using the Deploy Items method on a LabVIEW Project reference. If you programmatically deploy shared variables, the TestStand or LabVIEW application might return an error and terminate. You can use the Deploy Library method from within a standalone executable without adverse effects on TestStand.

## Using an Aliases File

When you deploy a project library or execute a VI in TestStand that accesses a shared variable, LabVIEW must determine how to resolve the target name stored in the network path for the variable. When you configure a target in a LabVIEW project, LabVIEW stores the IP address for the target in an aliases file located in the same directory as the project. The aliases file uses the same base name as the project and a `.aliases` file extension.

The server you configured the LabVIEW Adapter to use in the LabVIEW Adapter Configuration dialog box determines the aliases file LabVIEW uses in the following ways:

- **LabVIEW Run-Time Engine**—LabVIEW looks for an aliases file with the same name and location as the TestStand application. For example, `SeqEdit.aliases` for the TestStand Sequence Editor and `TestExec.aliases` for a user interface. You must quit and restart the TestStand application after you copy the aliases file from the project directory to the application directory.
- **Development System**—LabVIEW looks for an aliases file, `LabVIEW.aliases`, located in the same directory as the LabVIEW Development System executable. You must quit and restart LabVIEW after you copy the aliases file from the project directory to the LabVIEW directory.
- **Other Executable**—LabVIEW looks for an aliases file with the same name and location as the LabVIEW executable server. For example, `TestStandLVRTS.aliases` for `TestStandLVRTS.exe` and `TestExec.aliases` for a user interface. You must quit and restart the executable after you copy the aliases file from the project directory to the executable directory.

## NI-DAQmx Tasks, Channels, and Scales in LabVIEW Projects

TestStand does not support VIs that use NI-DAQmx tasks, channels, and scales defined in a project. You must define NI-DAQmx tasks, channels, and scales in Measurement & Automation Explorer (MAX).

## Conditional Disable Structures and Symbols

LabVIEW 8.0 includes the Conditional Disable Structure, which contains one or more subdiagrams, or cases. Depending on the configuration, LabVIEW uses one of the subdiagrams for the duration of the execution. You can specify conditions for the structure based on custom symbols defined in a project. Because TestStand executes VIs in the main application instance, any conditions that use custom symbols always evaluate to `False`.

## 64-Bit Integer Data Type

TestStand does not support calling VIs that contain terminals connected to 64-bit Integer Numeric indicators or controls.

## XControls

TestStand supports calling VIs that use XControls on Windows systems.

## Remote Execution

To execute VIs on a remote LabVIEW system, TestStand requires Remote Execution Support for NI TestStand for the latest version of LabVIEW on the system. The version of this component must match the version of LabVIEW with which you saved the VIs. LabVIEW installs this component only if TestStand is present. If you install TestStand after you install LabVIEW, TestStand installs a version of the component that might not match the version of LabVIEW on the system. In this case, you might need to rerun the LabVIEW installer.

## Building a TestStand Deployment with LabVIEW 8.0

TestStand 4.0 or later supports deploying LabVIEW 8.0 VIs and VIs from project libraries. However, the following restrictions exist that do not apply to earlier versions of LabVIEW:

- TestStand does not support deploying duplicate project libraries. You receive an error if you attempt to include two project libraries with the same name.
- TestStand no longer supports including two VIs with the same name in a deployment, unless the VIs are in different project libraries.
- National Instruments does not recommend distributing two VIs with the same name to different locations on a target computer. When a VI with the same name from a different location is in memory, LabVIEW uses the VI in memory when attempting to load a subVI. However,

LabVIEW reports an error if you attempt to load a top-level VI with the same name as a VI in memory even if the similarly named VI in memory is an exact copy of the one you want to load.

- TestStand no longer supports distributing duplicate DLLs that VIs call. TestStand 4.0 or later supports, but National Instruments does not recommend, distributing duplicate DLLs that steps in a sequence file call.
- National Instruments does not recommend editing packaged VIs on a deployed system because unexpected errors can occur. TestStand includes only required VIs from a project library in a deployment. If you attempt to add new VIs from a project library to the deployment image, LabVIEW might not be able to find all the VIs it needs when you run the new VIs. National Instruments recommends rebuilding and redeploying the deployment image in this situation. Analysis and instrument drivers are examples of VIs that use project libraries.
- While processing sequence files, the TestStand Deployment Utility automatically includes project library files in the deployment if a LabVIEW Utility Deploy Library step references the project library.
- When you build a TestStand deployment that calls VIs that use shared variables, you must add an aliases file to the deployment. You must also configure the deployment to install the aliases file to the proper location on the destination system so LabVIEW can properly resolve network paths. In addition, you must include the NI Variable Engine component in the installer to ensure that the destination system can deploy the shared variables.
- National Instruments does not recommend deploying LabVIEW VIs that were previously deployed using the TestStand Deployment Utility. When the TestStand Deployment Utility packages LabVIEW VIs, the utility includes all subVIs and creates partial project libraries that contain only the required VIs from the project libraries.

If you attempt to redeploy VIs, the build in the TestStand Deployment Utility can fail when you attempt to include a partial project library and the original complete project library or when you attempt to include two copies of the same VI on the system. If you deploy custom LabVIEW-based step types to a development system and then attempt to include the step types in a new deployment, the build might fail.

To work around this limitation, you must remove the duplicate VIs and partial project libraries from the system and relink the VIs to the original VIs and complete project libraries on the system before you build a new deployment.

Complete the following steps to resolve any duplicate VIs from previously deployed files.

1. Build the deployment and review the VIs the utility reports as duplicates in the status log.
2. Review the SupportVIs LLB or directory in the previously deployed files to determine which VIs and project libraries conflict with VIs located on the development system. Typically, a SupportVIs LLB or directory contains duplicate VIs and project libraries from `vi.lib` and `user.lib`.
3. Remove any duplicate VIs and partial project libraries the Deployment Utility reports and those in a SupportVIs LLB or directory.
4. Load all top-level VIs included in the previously deployed files and resave the VIs. LabVIEW prompts you to browse for any missing subVIs.
5. If the previously deployed files contain sequence files with steps that call Express VIs or any duplicate VI, you must reconfigure the Express VI steps and update the VI pathname for steps that call the VIs.

Select **Tools»Update VI Calls** to run the Update VI Calls tool to update the Express VIs a LabVIEW step instance calls and to check or update a Standard VI call prototype. Use the Update VI Calls tool when you upgrade the LabVIEW version and you want to run the Express VIs a LabVIEW step instance calls in the new version of the LabVIEW Run-Time Engine. Also, use the Update VI Calls tool to update existing Express VI instances with any changes made to the Express VI. Refer to the *NI TestStand Help* for more information about the Update VI Calls tool.

6. Repeat step 1 to determine if duplicate VIs still exist.

## LabVIEW 8.2 Object-Oriented Programming

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LabVIEW 8.2 includes support for Object-Oriented Programming. TestStand cannot directly call a VI that wires a LabVIEW object to its connector pane. However, you can wire the LabVIEW object to the Flatten to String function, return the data string to TestStand as a binary string, and store the flattened LabVIEW object in a string property or variable in TestStand.

You cannot access the properties or invoke the methods on the flattened LabVIEW string object in TestStand. To access the properties or invoke the methods on the LabVIEW object, you must pass the flattened LabVIEW object as a binary string to a VI and wire the string to the Unflatten From String function along with the object constant of the correct type to create the LabVIEW object.



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# Calling LabVIEW VIs on Remote Systems

With TestStand, you can directly call LabVIEW VIs on remote computers, including computers that run the LabVIEW Development System or a LabVIEW executable and PXI controllers that run the LabVIEW Real-Time (RT) module. TestStand supports downloading VIs to systems that run the LabVIEW 7.1.1 RT module but does not support downloading VIs to systems that run the LabVIEW 8.0 or later RT module. To use the LabVIEW 8.0 or later RT module, you must call a VI on the local system and the local VI must then call the VI on the LabVIEW RT module, or you must manually download the VI to the LabVIEW RT module and call the VI by remote path or by name if the VI is already in memory.

Because TestStand uses the LabVIEW VI Server to run VIs remotely, the remote computers can use any operating system LabVIEW supports, including Linux, Solaris (LabVIEW 7.1.1 only), and Mac OS.

To call a VI remotely, you must configure the TestStand step to specify that the call occurs on a remote computer. In addition, you must configure the remote computer to allow TestStand to call VIs located on the computer. You must also configure the computer running TestStand to have network access to the remote computer running the LabVIEW VI Server.

## Configuring a Step to Run Remotely

---

Complete the following steps to configure a step to run remotely. The VI must be present on the local computer so TestStand can configure and run the VI.

1. Click the **Advanced Settings** button on the LabVIEW Module tab to launch the LabVIEW Advanced Settings window, in which you can specify the name, or an expression that evaluates to the name, of the remote computer on which you want to run the VI.
2. If the remote computer is running the LabVIEW Development System or a LabVIEW executable, use the Remote VI Path text box to specify the path to the VI on the remote computer.

If the remote computer is a PXI controller running LabVIEW 7.1.1 RT, TestStand downloads the VI to the remote computer or loads the VI using the Remote VI Path you specified in the LabVIEW Advanced Settings window. TestStand skips this step if the VI is already present in memory on the controller at the time TestStand loads the code module for the step.

If the remote computer is a PXI controller running LabVIEW 8.0 RT or later, TestStand does not download the VI to the remote computer. You can use the LabVIEW 8.0 Development System to download VIs to the PXI controller. You can also use the TestStand FTP Files step type to download files from and upload files to a remote system. Refer to the *NI TestStand Help* for more information about the FTP Files step type.



**Note** Refer to the *Getting Started with the LabVIEW Real-Time Module* manual in the <LabVIEW>\manuals directory for more information about downloading VIs to a PXI controller.

You can also use FTP to download VIs to the PXI controller. Use the LabVIEW Development System to create a Source Distribution with all the VIs to ensure that you include all the dependencies of the VIs to transfer to the hard drive of the LabVIEW RT target. Remove the checkmarks from the options to exclude VIs from `vi.lib`, `instr.lib`, and `user.lib`. Then, you can use FTP to transfer the source distribution output to the hard drive of the LabVIEW RT target.

After you download the VIs to the PXI controller running the LabVIEW 8.0 or greater RT module, you can use the Remote VI Path option in the LabVIEW Advanced Settings window to call the VIs.

## Configuring the LabVIEW VI Server to Run VIs Remotely

The LabVIEW Development System or built executable must be running on the remote computer, and you must configure the development system or built executable to allow VI calls through the TCP/IP protocol of the VI Server.

In LabVIEW 7.1.1, select **Tools»Options** and navigate to the VI Server: Configuration settings to enable the TCP/IP protocol and the VI calls options. You can also specify the TCP/IP port the server uses. The port you specify in LabVIEW must be the same port you specify in TestStand in the LabVIEW Advanced Settings window, which you can access from the LabVIEW Module tab.

Use the VI Server: TCP/IP or Machine Access settings to allow specific computers access to the LabVIEW VI Server. You can also specify certain computers or entire domains that can call VIs on the server machine.

Use the VI Server: Exported VIs settings to configure the VIs you want to call through the LabVIEW VI Server. You must export all VIs you want to call remotely from TestStand. The default setting in LabVIEW is to export all VIs, indicated by an asterisk (\*).

In LabVIEW 8.0 or later, you can make changes to the LabVIEW VI Server settings using LabVIEW Projects. You must enable TCP/IP Protocol and specify the Machine Access, User Access, and Exported VIs settings.

Refer to the *LabVIEW Help* for more information about configuring VI Server options.

## Configuring the LabVIEW RT Server to Run VIs

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You can configure an RT Server to run VIs remotely.

For a LabVIEW 7.1.1 RT Server, launch LabVIEW on the host computer, select the appropriate RT target computer, and select **Tools»RT Target <IP Address/Host Name> Options**. Configure the VI Server settings to specify which computers and VIs can run remotely.

In addition, you must also configure the RT target computer to allow access to the computer running TestStand if you want TestStand to download VIs to the RT target computer.

For a LabVIEW 8.0 or later RT Server, launch LabVIEW on the host computer, select the appropriate RT target in the project, and select **Properties** from the context menu to launch the Real-Time PXI Properties dialog box. Configure the VI Server settings to specify which computers and VIs can run remotely.

When you finish configuring the target computer, untarget the PXI controller before you attempt to use TestStand to call VIs on the target computer.

Refer to the *Configuring Target Properties* section of the *Getting Started with the LabVIEW Real-Time Module* manual in the <LabVIEW>\manuals directory for more information about configuring VI Server settings on a PXI controller.

## User Access to VI Server

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TestStand does not support user-based VI security for executing VIs on remote systems. You must use the VI Server Machine access list to protect a VI server on a remote system.

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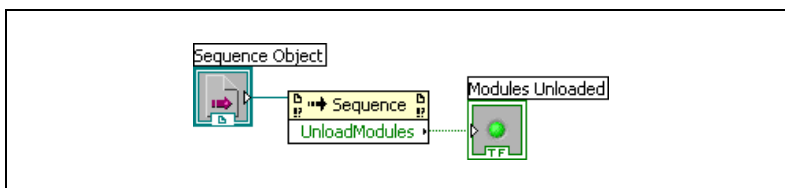
# Using the TestStand ActiveX APIs in LabVIEW

In some cases, you might need to program the TestStand API or TestStand UI Controls from LabVIEW test and user interface VIs. Refer to the LabVIEW documentation for information about ActiveX concepts and how to use LabVIEW as an ActiveX client.

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## Invoking Methods

TestStand objects have methods you invoke in order to perform an operation or function on them. In LabVIEW, use the Invoke Node to invoke methods. The block diagram in Figure C-1 shows how to invoke the `Sequence.UnloadModules` method to unload all code modules in the sequence.



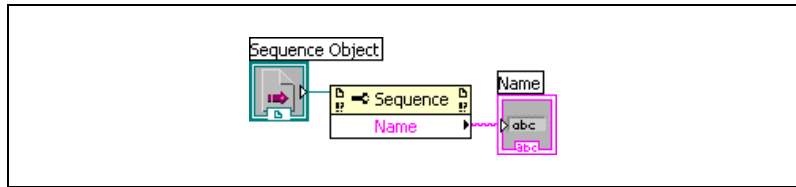
**Figure C-1.** Invoking the UnloadModules Method

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## Accessing Built-In Properties

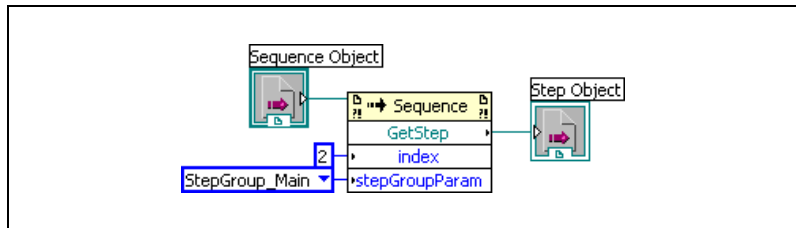
TestStand defines a number of built-in properties that are always present for objects, such as `Step` and `Sequence` objects. Nearly every kind of TestStand object has built-in properties that are static with respect to the TestStand API, which you can use to access the properties in the programming language you specify. Examples of built-in properties are the `Sequence.Name` property and the `SequenceContext.Sequence` property.

In LabVIEW, use the Property Node to access built-in properties. The block diagram in Figure C-2 shows how to obtain the value of the `Sequence.Name` property.



**Figure C-2.** Obtaining the Value of the Name Property from a Sequence Object

The block diagram in Figure C-3 shows how to obtain a reference to a step of a sequence that a Sequence object references.



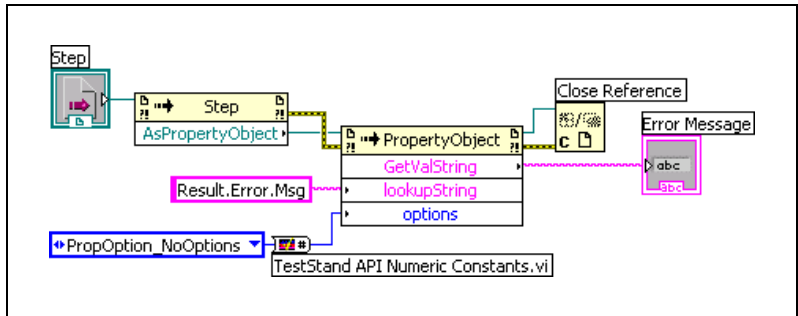
**Figure C-3.** Obtaining a Reference to a Step of a Sequence that a Sequence Object References

## Accessing Dynamic Properties

In TestStand, you can define custom step properties, sequence local variables, sequence file global variables, and station global variables. Because the TestStand API is independent of the variables and custom step properties you define, these variables and properties are dynamic with respect to the TestStand API. The TestStand API provides the `PropertyObject` class so you can access dynamic properties and variables from within code modules. Instead of using defined constants, use lookup strings to identify specific properties by name.

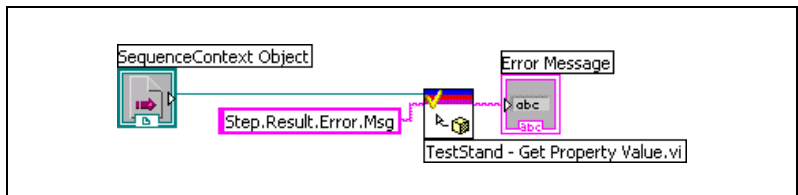
To access dynamic properties of an object, you must first use the `AsPropertyObject` method of the object to convert the specific object reference to a `PropertyObject` reference. Then, use the `PropertyObject` interface to access custom properties of the object by using a lookup string to specify the specific custom property.

The block diagram in Figure C-4 shows how to use the `GetValString` method on the `PropertyObject` interface of a `Step` object to obtain the error message value for the current step.



**Figure C-4.** Using the `GetValString` Method to Obtain the Error Message Value for the Current Step

You can use the `TestStand - Get Property Value VI` or the `TestStand - Set Property Value VI` to access dynamic properties of a `SequenceContext` object. The block diagram in Figure C-5 shows how to use the `TestStand - Get Property Value VI` to obtain the error message value for the current step.



**Figure C-5.** Obtaining the Error Message for the Current Step

## Releasing ActiveX References

When a method or property returns an ActiveX reference, you must use the Automation Close function in LabVIEW to release the reference.



**Note** If you do not release the ActiveX reference, LabVIEW does not release it for you until the VI hierarchy finishes executing. Repeatedly opening large numbers of references without closing them can cause the system to run out of memory.

## Using TestStand API Constants and Enumerations

---

Some TestStand API methods require string and numeric constant input arguments. The acceptable values of these arguments are organized into groups that correspond to different properties and methods. For example, the `PropertyObject.SetValNumber` method has an options input argument that accepts many different numeric constants.

It can be difficult to remember all the available string and numeric constants for the TestStand API properties and methods. To facilitate programming with the TestStand API within LabVIEW VIs, TestStand provides two enumerated constant VIs—the TestStand API String Constants VI and the TestStand API Numeric Constants VI.

Use the TestStand API String Constants VI to locate and select the string constant arguments you can use with TestStand API properties and methods. Use the TestStand API Numeric Constants VI to locate and select the various numeric constant arguments you can use with TestStand API properties and methods. Use both of these VIs in conjunction with the constants that are associated with the TestStand API methods and properties. Refer to the *NI TestStand Help* for more information about using constants with the TestStand methods and properties.

Use the OR function in LabVIEW to combine more than one of the numeric constants. If you need to combine more than two of the constants, use the Compound Arithmetic function and set the mode to OR.

The block diagram in Figure C-4 shows how to use the TestStand API Numeric Constants VI to obtain the value of the `PropOptions_NoOptions` constant.

Some methods in the TestStand API require enumeration input arguments. For these methods, right-click the input parameter on the Invoke Node in LabVIEW, select **Create»Constant** from the context menu to create a LabVIEW ring constant, and select the value you want in the resulting constant.



## Obtaining a Different Interface for a TestStand Object

In some cases, you might need to obtain a different interface for a TestStand object than the interface you currently have. In ActiveX/COM terminology, this action is known as a *QueryInterface*. For example, if you have a `Module` reference to a `LabVIEWModule` object and need to access the `LabVIEWModule` interface instead, perform a *QueryInterface* on the `Module` object to obtain that interface. In LabVIEW, use the *Variant To Data* function with the reference to accomplish this task.

The block diagram in Figure C-6 shows how to obtain the `LabVIEWModule` interface of a `Module` object to get the `VIDescription` property of the object. Notice that you must release the reference the *Variant To Data* function returns when you are finished with it.

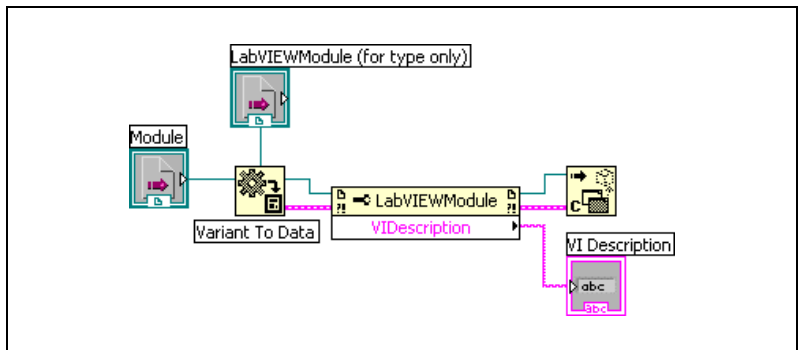
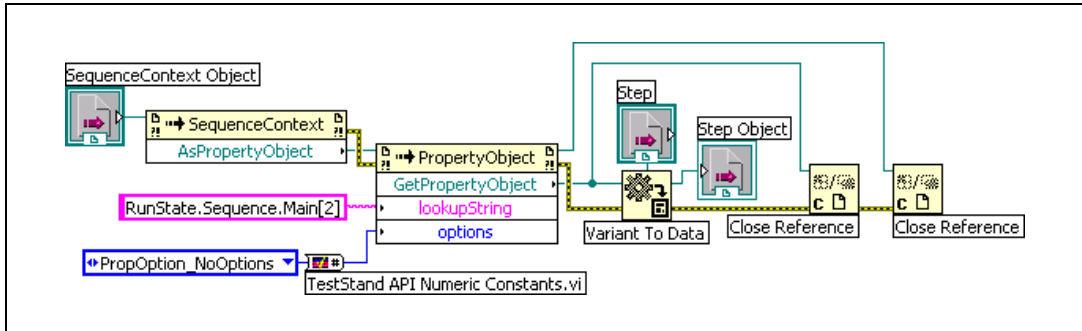


Figure C-6. Converting a Module Reference to the LabVIEWModule Type

## Acquiring a Derived Class from the PropertyObject Class

In some cases, you might need to use the `PropertyObject` class methods to obtain a reference to a TestStand object. You might then want to access one of the static properties of the TestStand object, such as the run mode for the third step in the Main step group of the currently executing sequence. For methods in the `PropertyObject` class that can return objects derived from `PropertyObject`, you must acquire the derived interface for the object to access the built-in properties and methods of the derived class. Use the method described in the *Obtaining a Different Interface for a TestStand Object* section to acquire the derived interface for an object.

The block diagram in Figure C-7 shows how to use a lookup string to obtain a reference to a Step object from a SequenceContext object.



**Figure C-7.** Using a Lookup String to Obtain a Reference to a Step Object from a SequenceContext Object

## Setting the Preferred Execution System for LabVIEW VIs

If the VI calls synchronous methods of the TestStand API, you must correctly set the LabVIEW Preferred Execution System for the VIs. If you call synchronous methods that do not return until the LabVIEW server executes a VI on behalf of TestStand, the VI that calls these methods and the VI that TestStand attempts to run using the LabVIEW VI Server cannot be set to run in the same LabVIEW execution system. If the VIs are set to run in the same execution system, a deadlock occurs because the execution of the synchronous TestStand method consumes the execution system in which the VI needs to run.

Because LabVIEW handles ActiveX communication through its user interface execution system, you cannot set either of the VIs in this scenario to run in the user interface execution system. For example, you can have a LabVIEW code module that calls the `Engine.NewExecution` method followed by the `Engine.WaitForEnd` method, and a new execution that calls LabVIEW code modules. Deadlock can occur if either VI in this scenario uses Same As Caller or User Interface as its preferred execution system. In addition, both VIs in this scenario must use different preferred execution system settings. Use the VI Properties dialog box for each individual VI to configure the LabVIEW execution system.

# Handling Events

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TestStand controls can generate events to notify the application of user input and application events, such as the completion of an execution. To handle events in LabVIEW, use the Register Event Callback function to register a callback VI and then use the Unregister for Events function to close the callback before you close the application.

Refer to Chapter 6, *Creating Custom User Interfaces in LabVIEW*, for more information about handling events that TestStand UI Controls generate.

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# Calling Legacy LabVIEW VIs

In versions of TestStand earlier than 3.0, you could call VIs only with a specific set of controls and indicators. Using TestStand 3.0 or later, you can call VIs with a wide variety of connector panes, including VIs with legacy configurations.

## Format of Legacy VIs

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All legacy-style VIs must include the **Test Data** cluster and **error out** cluster indicators. The **Input Buffer**, **Invocation Info**, and **Sequence Context** controls are optional inputs to legacy VIs, which can contain any combination of these controls.

You must assign each control and indicator of the test VI to a terminal on the connector pane of the test VI. If these assignments do not exist, TestStand returns an error when it attempts to call the test VI. TestStand does not require that you use a particular connector pane pattern, and it does not require that you assign the controls and indicators to specific terminals.

Although you usually create new VIs using the LabVIEW Module tab for steps that use the LabVIEW Adapter, TestStand can also create legacy-style VIs. Refer to Chapter 5, [Configuring the LabVIEW Adapter](#), for information about configuring the LabVIEW Adapter to create new legacy-style VIs.

You can use the following methods to pass data between the code module and TestStand.

- Use the **Test Data** cluster
- Use the sequence context ActiveX reference, which allows you to call the TestStand ActiveX API functions to set the variables used to store the results of the test, such as `Step.Result.PassFail`



**Note** The values the sequence context ActiveX reference sets take precedence over the values the **Test Data** cluster sets. If you use both methods to set the value of the same variable, TestStand recognizes the values the sequence context ActiveX reference sets and ignores the values the **Test Data** cluster sets. You can use the sequence context ActiveX reference and the **Test Data** cluster together in the code module if you do not try to set the

same variable twice. For example, if you use the sequence context ActiveX reference to set the value of `Step.Result.PassFail` and then use the **Test Data** cluster to set the value of `Step.Result.ReportText`, TestStand sets both values correctly.







**Note** The specific control and indicator labels described in this appendix are required. Do not modify them in any way.

# Test Data Cluster

The LabVIEW Adapter uses the **Test Data** cluster to return result data from the VI to TestStand, which then uses the data to make a PASS/FAIL determination.

Table D-1 lists the elements of the **Test Data** cluster, the data type of the cluster element, and descriptions of how the LabVIEW Adapter uses each cluster element.



**Table D-1.** Test Data Cluster Elements

Cluster Element	Data Type	Description
<b>PASS/FAIL Flag</b>		The test VI sets this element to indicate if the test passed. Valid values are <code>True</code> (PASS) or <code>False</code> (FAIL). The adapter copies the value into the <code>Step.Result.PassFail</code> property if the property exists.
<b>Numeric Measurement</b>		Numeric measurement the test VI returns. The adapter copies this value into the <code>Step.Result.Numeric</code> property if the property exists.
<b>String Measurement</b>		String value the test VI returns. The adapter copies this string into the <code>Step.Result.String</code> property if the property exists.
<b>Report Text</b>		Output message to display in the report. The adapter copies this message value into the <code>Step.Result.ReportText</code> property if the property exists.

The LabVIEW Adapter also supports an older version of the **Test Data** cluster from the LabVIEW Test Executive product. The LabVIEW Test Executive **Test Data** cluster does not contain a **Report Text** element but instead contains two string elements, **Comment** and **User Output**.

Table D-2 lists the elements of the older **Test Data** cluster, the data type of the cluster element, and descriptions of how the LabVIEW Adapter uses each cluster element.

**Table D-2.** Old Test Data Cluster Elements from LabVIEW Test Executive




Cluster Element	Data Type	Description
<b>Comment</b>		Output message to display in the report. The adapter copies this message value into the <code>Step.Result.ReportText</code> property if the property exists.
<b>User Output</b>		String value the test VI returns. The adapter dynamically creates the step property <code>Step.Result.UserOutput</code> and copies the string value to the step property.

## Error Out Cluster

TestStand uses the contents of the **error out** cluster to determine if a run-time error occurs and to take appropriate action if necessary. When you create a VI, use the standard LabVIEW **error out** cluster.

Table D-3 lists the elements of the **error out** cluster, the data type of the cluster element, and descriptions of how the LabVIEW Adapter uses each cluster element.

**Table D-3.** Error Out Cluster Elements

Cluster Element	Data Type	Description
<b>status</b>		The test VI must set this element to <code>True</code> if an error occurs. The adapter copies the output value into the <code>Step.Result.Error.Occurred</code> property if the property exists.
<b>code</b>		The test VI can set this element to a non-zero value if an error occurs. The adapter copies the output value into the <code>Step.Result.Error.Code</code> property if the property exists.
<b>source</b>		The test VI can set this element to a descriptive string if an error occurs. The adapter copies the output value into the <code>Step.Result.Error.Msg</code> property if the property exists.

## Input Buffer String Control






Use the **Input Buffer** string control to pass input data directly to the VI. The LabVIEW Adapter automatically copies the `Step.InBuf` property value into the **Input Buffer** string control if the property exists.

## Invocation Info Cluster

Use the **Invocation Info** cluster to pass additional information to the VI.

Table D-4 lists the elements of the **Invocation Info** cluster, the data type of the cluster element, and descriptions of how the LabVIEW Adapter uses each cluster element.

**Table D-4.** Invocation Info Cluster Elements

Cluster Element	Data Type	Description
<b>Test Name</b>		The adapter uses the name of the step that invokes the test VI.
<b>loop #</b>		The adapter uses the loop count if the step that invokes the test VI loops on the step.
<b>Sequence Path</b>		The adapter uses the name and absolute path of the sequence file that runs the test VI.
<b>UUT Info</b>		The adapter uses the value from the <code>RunState.Root.Locals.UUT.SerialNumber</code> property if the property exists. Otherwise, the adapter copies an empty string. Refer to Chapter 5, <a href="#">Configuring the LabVIEW Adapter</a> , for more information about how to configure this setting.
<b>UUT #</b>		The adapter uses the value from the <code>RunState.Root.Locals.UUT.UUTLoopIndex</code> property if the property exists. Otherwise, the adapter copies an empty string. Refer to Chapter 5, <a href="#">Configuring the LabVIEW Adapter</a> , for more information about how to configure this setting.

## Sequence Context Control

Use the **Sequence Context** control to obtain a reference to the TestStand `SequenceContext` object. You can use the sequence context to access all the objects, variables, and properties in the execution. Refer to the *NI TestStand Help* for more information about using the sequence context from a VI.



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