

GETTING STARTED GUIDE

NI Switch Executive

One component of National Instruments (NI) test management software, NI Switch Executive simplifies the management and control of complex switching systems. For validation test and research and development test, NI Switch Executive integrates with LabVIEW and LabWindows™/CVI™ to decrease development time. For production test, NI Switch Executive integrates with TestStand to provide test step ease of use in sequence execution.

With NI Switch Executive, you can perform any of the following tasks:

- Develop multiple device switch systems represented as a single virtual device
- Create end-to-end signal routing
- Make route selections based on signal characteristics and switch capabilities
- Create route groups used to make intelligent resource selections when creating routes
- Create switch routing for end-to-end calibration and maximum execution speed
- Create aliases for channels
- Preconfigure routes and route groups that can be called by name at run-time
- Control NI and IVI-compliant third-party switches
- Generate a report of your switching system
- Create routes graphically with an interactive schematic view of your switch devices
- Configure large and complex switching systems quickly with Excel integration

Refer to the *NI Switch Executive Help* for specific information about the features available in NI Switch Executive.

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Conventions

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 tip, which alerts you to advisory information.



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



This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.

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 and information on hardware labels.

<i>italic</i>	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.
<i>monospace italic</i>	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.

1. Verifying System Requirements

Your system must meet certain requirements to use NI Switch Executive with IVI-compliant switch modules. For more information about minimum system, recommended system, and supported application development environments (ADEs), refer to the *NI Switch Executive Readme*, which is available on the NI Switch Executive CD.



Note After you install NI Switch Executive, you can access the *NI Switch Executive Readme* at **Start»All Programs»National Instruments»Switch Executive»Documentation**.

In addition to the system requirements listed in the *NI Switch Executive Readme*, verify that you have the following items:

- A development or evaluation license for NI Switch Executive
- Interchangeable virtual instruments (IVI-compliant) switches or a simulated IVI switch
- Installed IVI instrument drivers for your physical switches

2. Verifying the Kit Contents

Verify that the kit contains the following items:

- NI Switch Executive case, which contains the following items:
 - NI Switch Executive software CD, which includes the *NI Switch Executive Help* and the *NI Switch Executive Readme*
 - *NI Switch Executive Getting Started Guide*

3. Installing the Software

Complete the following steps to install NI Switch Executive:

1. (Optional) Install an ADE, such as LabVIEW or LabWindows/CVI if you are developing an application or install TestStand if you are developing a test application for the switch system. Always install or upgrade your application software *before* installing the driver. If you install application software after installing NI Switch Executive, you must run the NI Switch Executive installer again to install the correct application software support.



Note If your switch system uses NI switches, you must install NI-SWITCH *before* using them with NI Switch Executive. Refer to the *NI Switch Executive Readme* for NI-SWITCH version information.

2. Insert the NI Switch Executive CD. The NI Switch Executive installer should open automatically. If not, select **Start>Run**, and enter `x:\setup.exe`, where *x* is the letter of the CD drive.
3. Follow the instructions in the installation prompts.
(Windows Vista) Users may see access and security messages during installation. Accept the prompts to complete the installation.

4. Installing the Hardware

NI Switch Executive uses IVI to access both NI and third-party switch devices. For NI switches, install and configure the devices using the *NI Switches Getting Started Guide*.



Note NI Switch Executive automatically creates logical names and other required IVI configuration information for any detected National Instruments switch products.

For third-party switches, install and configure them as specified in the manufacturer-supplied documentation. You must then manually create IVI configuration for these devices using the IVI Drivers section in MAX.

Refer to *Configuring IVI Switches* in the *NI Switch Executive Help* for more information.

5. Configuring an NI Switch Executive Virtual Device

An NI Switch Executive virtual device represents a switching system: it contains the configuration information and definitions of the switches, channels, routes, route groups, hardwires, buses, and exclusions that make up that system. You can use the NI Switch Executive configuration utility in MAX or the configuration API to configure a virtual device.

Configuring in MAX

To configure an NI Switch Executive virtual device in MAX, use the Schematic tab and/or the extended configuration tabs (Channels/Exclusions tab, Hardwires/Buses tab, and Routes/Groups tab).

Commonly used functions are located in the Schematic tab, which is the default starting tab. More advanced functions are located in the extended configuration tabs.

Refer to [Appendix A: Getting Started Exercise](#) for specific instructions about how to configure a virtual device in MAX.

Configuring Programmatically

In addition to the configuration utility in MAX, NI Switch Executive includes a programmatic interface to manage NI Switch Executive virtual device configurations. You can use the configuration API to programmatically create and edit switching devices, channels, hardwires, buses, exclusions, routes, and route groups associated with a virtual device. Refer to *Using the Configuration API* in the *NI Switch Executive Help* for more information about programmatic configuration.

6. Validating an NI Switch Executive Virtual Device

Always validate a virtual device before using and/or deploying it. Validating a virtual device ensures that IVI configurations, routes, and route groups are valid and route group members do not use conflicting resources.

Refer to *Validating a Virtual Device* in the *NI Switch Executive Help* for instructions about validating an NI Switch Executive virtual device.

7. Programming an NI Switch Executive Virtual Device

After you configure and validate a virtual device, you can program the virtual device using an application development environment (ADE) suited to your needs. Because an NI Switch Executive virtual device is recognized as a single instrument, programming time is significantly reduced.

The following steps and figure represent a typical NI Switch Executive programming flow:

1. Open a session.
2. Control the virtual device.
3. Handle errors.
4. Close the session.

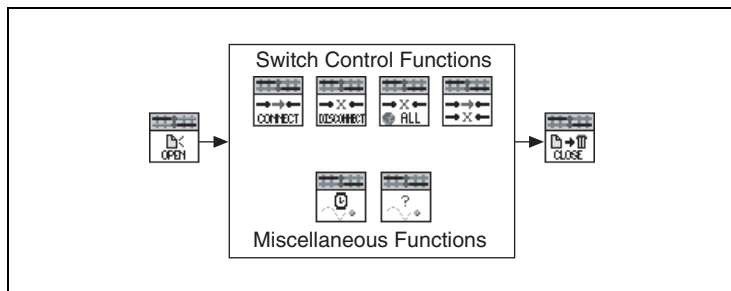


Figure 1. NI Switch Executive Programming Flow

Refer to *Programming with NI Switch Executive* in the *NI Switch Executive Help* for more information about programming an NI Switch Executive virtual device.

8. Deploying an NI Switch Executive Virtual Device (Optional)

If you develop an NI Switch Executive virtual device to use on one or more computers, you can deploy the virtual device to the target machine(s). Complete the following steps to deploy an NI Switch Executive virtual device from a development system to a target system.



Note A development system must be running a licensed development version of NI Switch Executive. Target, or deployment, systems can run either a licensed deployment or a licensed development copy of NI Switch Executive.

Refer to *Deploying a Virtual Device* in the *NI Switch Executive Help* for information about deploying an NI Switch Executive virtual device.

Appendix A: Getting Started Exercise

To acquaint you with the fundamentals of using NI Switch Executive, the following exercise recreates a portion of the virtual device that ships with NI Switch Executive and is available in MAX at **Devices and Interfaces»NI Switch Executive Virtual Devices»SwitchExecutiveExample**. As illustrated in Figure 2, `SwitchExecutiveExample` is composed of two 8×8 matrices that operate as one 8×16 matrix.



Note The following instructions recreate only a portion of `SwitchExecutiveExample` and illustrate how to configure a virtual device using the Schematic tab in MAX. To configure buses, exclusions, and define disabled or reserved for routing channels, you must use the extended configuration tabs in MAX. Refer to *Extended Configuration* in the *NI Switch Executive Help* for more information about extended configuration tabs in MAX.

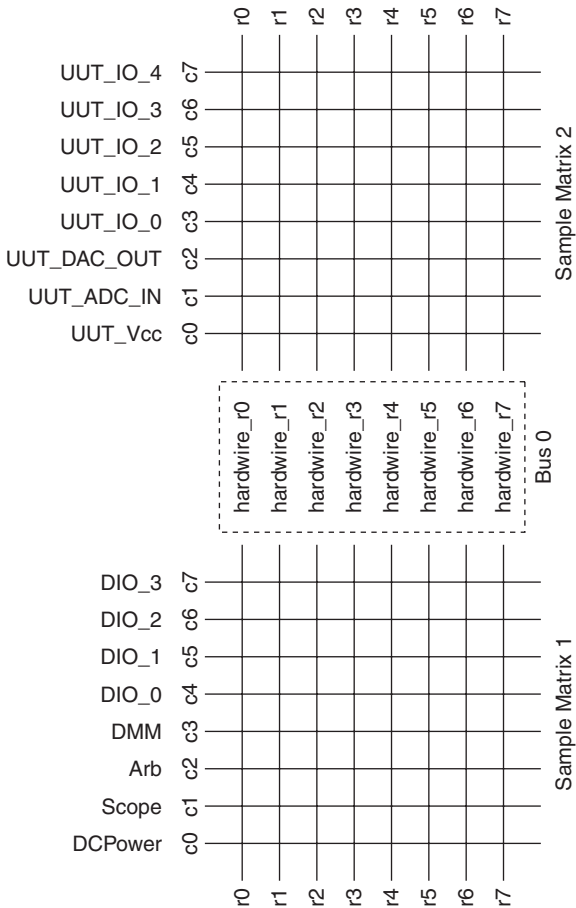


Figure 2. System Architecture for SwitchExecutiveExample

Creating an NI Switch Executive Virtual Device

Complete the following steps to create an NI Switch Executive virtual device:

1. Launch MAX.
2. Expand **Devices and Interfaces**.
3. Right-click **NI Switch Executive Virtual Devices**, and select **Create New**. The **Create New NI Switch Executive Virtual Device** wizard opens.
4. Type `SwitchExecutiveGettingStarted` in the **Virtual Device Name** text box to rename the virtual device. NI Switch Executive references the virtual device by the Virtual Device Name in the API.
5. Select `SampleMatrix1` from the **Available Switches** listbox, and click the right arrow button to add this switch to the **Switches to Add** listbox.
6. Select `SampleMatrix2` from the **Available Switches** listbox, and click the right arrow button to add this switch to the **Switches to Add** listbox.
7. Click **Next**. A progress window displays the status of the virtual device creation.
8. Click **Finish** when the virtual device creation is complete. MAX automatically browses to the NI Switch Executive virtual device.

Configuring Channels and Hardwires

Refer to Figure 2 and complete the following steps to create the channel aliases and hardwires of the virtual device:

1. Verify that `SampleMatrix1` is selected in the **Devices** listbox and its schematic appears in the **Schematic** window.
2. Click a column channel name in the **Schematic** window. The **Edit Alias & Hardwire** dialog box opens.
3. In the **Alias Name** textbox, type an alias for the channel as it appears in Figure 2.



Tip To quickly rename channels with a sequential naming scheme (`DIO_0`, `DIO_1`, `DIO_2`, and so on), you can use the batch rename feature in the extended configuration tabs. Refer to the *NI Switch Executive Help* for more information about batch renaming.

4. Click **OK**. The alias replaces the default channel name in the **Schematic** window.
5. Repeat steps 2 through 4 to create an alias for each column channel of `SampleMatrix1`.
6. Click a row channel name in the **Schematic** window. The **Edit Alias & Hardwire** dialog box opens.
7. Click the **Hardwires** tab.



Note NI Switch Executive creates `Hardware0` by default. If you are associating a row with `Hardware0`, skip to step 9.

8. If necessary, click the **Create New** icon at the top of the **Hardware** listbox to create a new hardware.
9. Click **Associate** *channelName* with *hardwareName* (where *channelName* and *hardwareName* are variable, depending on the channel and hardware you want to associate).
10. Click **OK**. NI Switch Executive denotes the hardware association by appending a superscript *n* (where *n* is a numeric variable that represents the hardware) to the channel name in the **Schematic** window.
11. Repeat steps 6 through 10 to associate a hardware with every row channel of `SampleMatrix1` as listed in Figure 2.
12. Click `SampleMatrix2` in the **Devices** listbox to select the device you want to configure. Its schematic appears in the **Schematic** window.
13. Repeat steps 2 through 4 to create an alias for each column channel of `SampleMatrix2`.
14. Repeat steps 6 through 10 to associate a hardware with every row channel of `SampleMatrix2` as listed in Figure 2.
15. Click the **Save** icon on the NI Switch Executive task bar in MAX to save the configuration.

Configuring Routes and Route Groups

Use route groups to ensure that multiple routes connected at the same time are not using the same resources. If the routes are associated in the same group, NI Switch Executive notifies you of any resource conflicts and attempts to automatically correct those conflicts.

Complete the following steps to create a route group and associated routes:

1. Right-click `RouteGroup0` in the **Route Groups** listbox and select **Edit** to edit the route group name.



Note When you create a new virtual device, NI Switch Executive creates a default route group, `RouteGroup0`, in the **Route Groups** listbox.

2. Type `PowerUUT` to rename the route group.
3. Click `SampleMatrix1` in the **Devices** listbox to select the device you want to configure. Its schematic appears in the **Schematic** window.
4. Click the crosspoint between `DCPower` and `r3` in the **Schematic** window to create a route between the crosspoints. NI Switch Executive displays the route in the **Schematic** window and adds the route to the route group, `PowerUUT`.

5. Click **Show Routes** located under the **Route Groups** listbox.
6. Select the route in the **Route Groups** listbox.
7. Right-click the route and select **Edit** to edit the route name.
8. Type `DCPowerToUUT_Vcc_Leg1` to rename the route.
9. Click `PowerUUT` in the **Route Groups** listbox to select the route group to which you want to add a route.
10. Click the crosspoint between `DMM` and `r2` in the **Schematic** window to create a route between the crosspoints.
11. Select the route in the **Route Groups** listbox.
12. Right-click the route and select **Edit** to edit the route name.
13. Type `DMMToUUT_Vcc_Leg1` to rename the route.
14. Click `PowerUUT` in **Route Groups** listbox to select the route group to which you want to add a route.
15. Click `SampleMatrix2` in the **Devices** listbox to select the device you want to configure. Its schematic appears in the **Schematic** window.
16. Click the crosspoint between `UUT_Vcc` and `r3` in the **Schematic** window to create a route between the crosspoints. NI Switch Executive displays the route in the **Schematic** window and adds the route to the route group, `PowerUUT`.
17. Select the route in the **Route Groups** listbox.
18. Right-click the route and select **Edit** to edit the route name.
19. Type `DCPowerToUUT_Vcc_Leg2` to rename the route.
20. Click `PowerUUT` in the **Route Groups** listbox to select the route group to which you want to add a route.
21. Click the crosspoint between `UUT_Vcc` and `r2` to create a route between the crosspoints.
22. Select the route in the **Route Groups** listbox.
23. Right-click the route and select **Edit** to edit the route name.
24. Type `DMMToUUT_Vcc_Leg2` to rename the route.
25. Validate the route.
 - a. Click the **Validate** icon on the NI Switch Executive task bar in MAX. The Validate NI Switch Executive Configuration wizard opens.
 - b. (Optional) Select **Use Simulation Mode** to simulate connections during validation.



Caution If you do not use simulation mode during the validation process, all routes and route groups are connected on the hardware. If you choose to validate a real system, verify that the hardware can handle switch connections *before* you validate.

- c. Click the items you want to validate—IVI Configurations, Routes, and/or Route Groups.
- d. Click **Next**. A window displays the validation status of the items in your configuration. A message alerts you if the validation passes or fails.
- e. If your validation status includes any errors, correct the configuration, and repeat the preceding validation steps.

When validation is successfully complete, click **Finish**. Now you can program and/or deploy the virtual device.

26. Click the **Save** icon on the NI Switch Executive task bar in MAX to save the configuration.

You have successfully configured the routes of route group `PowerUUT`.

Nesting Route Groups

Route groups can also be useful for categorizing the connections required for a test. There may be cases in your application where you need to create the same connections for different tests. For example, during a frequency response test, you might need to provide power to the UUT and have a DMM monitor voltage on the UUT. For other tests, you must provide power and monitor voltage. In this case, you can create a route group for these connections that can be used in other route groups.

To create the frequency response test that provides power connections, complete the following steps:



Note In the example `SwitchExecutiveExample`, there are greyed routes in the Schematic window, that signify the routes are using reserved for routing channels. Reserved for routing channels are only configurable using the Extending Configuration tabs in MAX. For the purpose of this exercise, you will only recreate the nested route groups.

1. Click the **Create New** button in the **Route Groups** listbox. NI Switch Executive creates a route group, `RouteGroup0`.
1. Select **RouteGroup0** in the **Route Groups** listbox.
2. Right-click the route group and select **Edit** to edit the route group name.
3. Type `FreqResponseTest` to rename the route group.

4. Click **PowerUUT** in the **Route Groups** listbox to select the route group that you want add to `FreqResponseTest`.
5. Using your mouse, drag **PowerUUT** and drop it on `FreqResponseTest`. NI Switch Executive adds the route group **PowerUUT** to the route group `FreqResponseTest`. Notice that the route group **PowerUUT** still exists in the **Routes Groups** listbox. Dissociating a route group from a parent route group only removes the route group from the parent route group. It does not delete the route group from the **Route Groups** listbox.
6. Validate the route group.
 - a. Click the **Validate** icon on the NI Switch Executive task bar in MAX. The Validate NI Switch Executive Configuration wizard opens.
 - b. (Optional) Select **Use Simulation Mode** to simulate connections during validation.



Caution If you do not use simulation mode during the validation process, all routes and route groups are connected on the hardware. If you choose to validate a real system, verify that the hardware can handle switch connections *before* you validate.

- c. Click the items you want to validate—IVI Configurations, Routes, and/or Route Groups.
- d. Click **Next**. A window displays the validation status of the items in your configuration. A message alerts you if the validation passes or fails.
- e. If your validation status includes any errors, correct the configuration, and repeat the preceding validation steps.

When validation is successfully complete, click **Finish**. Now you can program and/or deploy the virtual device.

7. Click the **Save** icon on the NI Switch Executive task bar in MAX to save the configuration.

You have successfully nested the route group `PowerUUT` within the route group `FreqResponseTest`.

Appendix B: Using TestStand with NI Switch Executive

TestStand 2.0.1 and later includes a **Switching** tab on the Step Properties dialog box. Use this feature to use your NI Switch Executive virtual device in TestStand.

Use the **Switching** tab to specify the switching action you want TestStand to perform as a step. Figure 3 shows the **Switching** tab in the step properties dialog box.

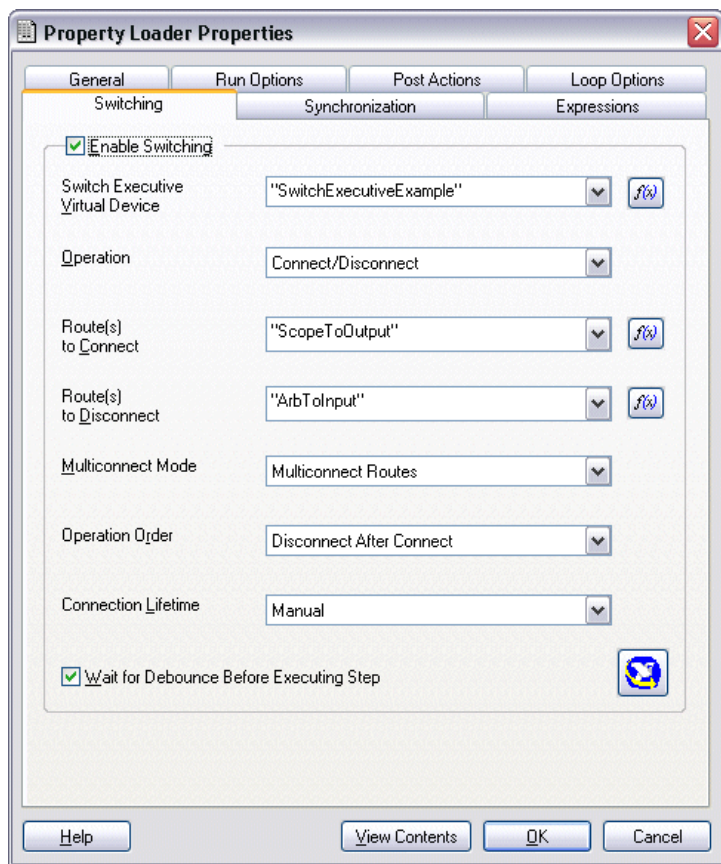


Figure 3. Switching Tab in the TestStand Step Properties Dialog Box

The IVI Switch step type supports not only the IVI class layer but also NI Switch Executive operations.

For general information about TestStand, refer to the TestStand documentation. For specific information about using NI Switch Executive with TestStand, refer to the *NI Switch Executive Help*.

Appendix C: Where to Go for Support

The National Instruments Web site is your complete resource for technical support. At ni.com/support you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world to help address your support needs. For telephone support in the United States, create your service request at ni.com/support and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

Australia 1800 300 800, Austria 43 662 457990-0,
Belgium 32 (0) 2 757 0020, Brazil 55 11 3262 3599, Canada 800 433 3488,
China 86 21 5050 9800, Czech Republic 420 224 235 774,
Denmark 45 45 76 26 00, Finland 358 (0) 9 725 72511,
France 01 57 66 24 24, Germany 49 89 7413130, India 91 80 41190000,
Israel 972 3 6393737, Italy 39 02 41309277, Japan 0120-527196,
Korea 82 02 3451 3400, Lebanon 961 (0) 1 33 28 28,
Malaysia 1800 887710, Mexico 01 800 010 0793,
Netherlands 31 (0) 348 433 466, New Zealand 0800 553 322,
Norway 47 (0) 66 90 76 60, Poland 48 22 3390150,
Portugal 351 210 311 210, Russia 7 495 783 6851,
Singapore 1800 226 5886, Slovenia 386 3 425 42 00,
South Africa 27 0 11 805 8197, Spain 34 91 640 0085,
Sweden 46 (0) 8 587 895 00, Switzerland 41 56 2005151,
Taiwan 886 02 2377 2222, Thailand 662 278 6777,
Turkey 90 212 279 3031, United Kingdom 44 (0) 1635 523545

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