Getting Started With VeriStand Hardware-in-the-Loop Software

Overview

VeriStand is a software tool that provides a framework for real-time testing applications such as embedded software validation and real-time control and monitoring of mechanical test cell applications. It contains a wide variety of features to help you get up and running more quickly. Review this article to get started with VeriStand and learn about some of its built-in functionality.

Contents

NATIONAL INSTRUMENTS

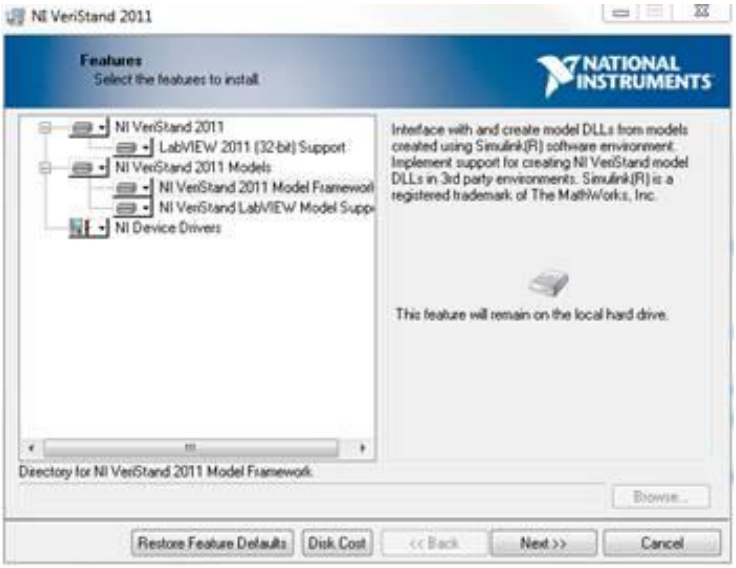
Software Installation

The first step is to install VeriStand software and associated driver software on your Windows computer. Then install VeriStand Engine software on all real-time targets to which you are deploying.

Host PC Software Installation

Install VeriStand by using the VeriStand DVD or downloading it at ni.com/veristand/download. When you run the installer, you have the option to select the components you need for your application.

- LabVIEW support adds a VeriStand palette to LabVIEW for automated control of VeriStand from LabVIEW.
- The VeriStand Model Framework adds support for building simulation models in third-party environments such as The MathWorks, Inc. Simulink® simulation software and ANSI C.
- With VeriStand LabVIEW model support, you can convert a LabVIEW VI into a simulation model that can be used in VeriStand.



Note: The VeriStand Model Framework can be installed independently and licensed free of charge. For machines that do not need the VeriStand environment, select only the VeriStand Model Framework for installation. After you have installed the VeriStand Model Framework, you can license it for free by using the VeriStand Model Generation Activation Utility at http://joule.ni.com/nidu/cds/view/p/id/2466/lang/en.

After you install the necessary VeriStand software components, install **NI Device Drivers** from either the Device Drivers DVD or from ni.com/drivers. Install the following drivers:

- NI-DAQmx
- NI-VISA
- **Optional**: NI-RIO (for CompactRIO or FPGA functionality)
- **Optional**: NI-XNET (for CAN, LIN, or FlexRay functionality)
- **Optional**: NI-Industrial Communications for EtherCAT (for CompactRIO Scan Engine and EtherCAT functionality)

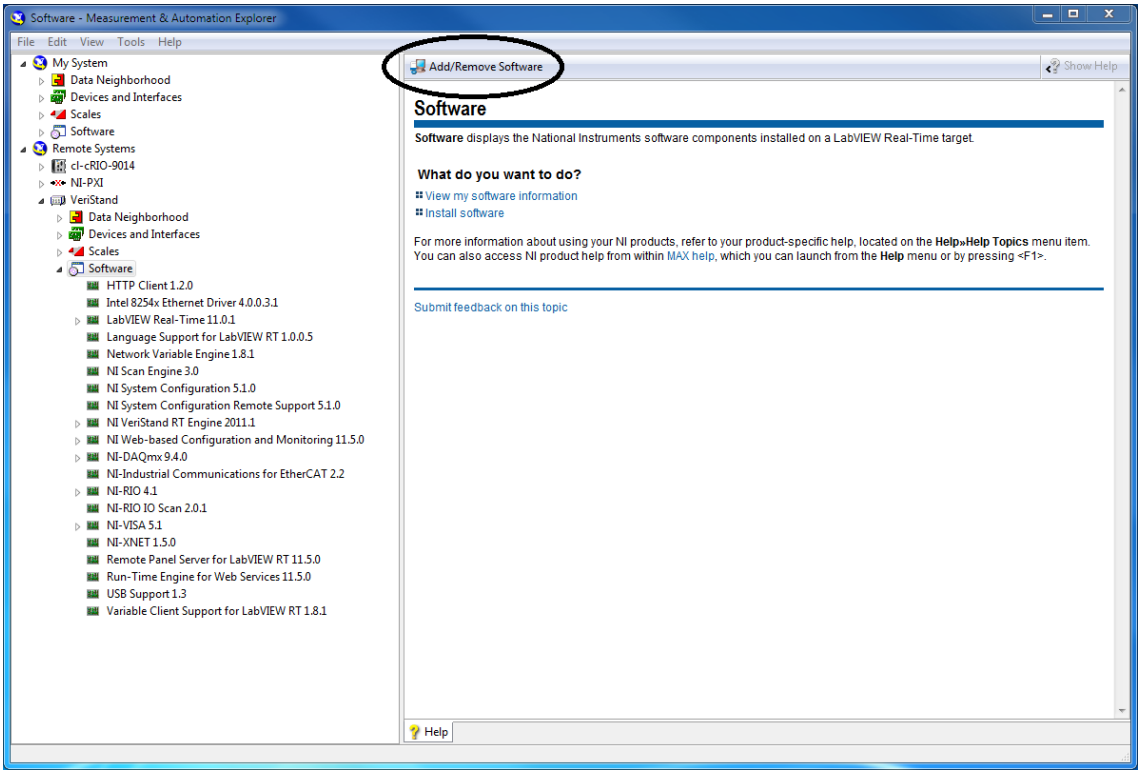
After all installations are complete on the host PC, open **Measurement & Automation Explorer (MAX)** to confirm the installed software by expanding the **My System»Software** item within the tree structure as shown below.

Software Installation on the Real-Time Target

After you have all the necessary software on your host computer, follow the steps below to install software on the real-time target computer.

In MAX, select your VeriStand real-time target under the Remote Systems tree item.

Select the software item for your real-time target and choose **Add/Remove Software**.



For CompactRIO targets only: Select the **Custom Software Installation** option.

Choose to install the VeriStand Engine. This installs the VeriStand Engine as well as the software components required to run it.

Optional: To implement a distributed real-time test system that uses GE reflective memory interfaces, select the GE reflective memory software on the target for installation.

Optional: If you are using a CompactRIO device and want to install the Scan Engine Custom device, select the NI-Industrial Communications for EtherCAT and I/O Variable Remote Configuration Web Service for installation as well.

Complete the software installation process and reboot your real-time target. You can see a list of currently installed software on your target by looking under the **Remote Systems»Real-Time Target»Software** item within the MAX tree structure as highlighted above.

VeriStand Project Setup

Open VeriStand (**Start»Programs»National Instruments»NI VeriStand**) and create a New NI VeriStand Project. A window prompts you to choose your project name and directory path.

Note: NI recommends keeping all project dependencies relative to the project file location and placing them in the same folder or in a subfolder. This includes items such as Workspace files (.nivsscren), System Definition files (.nivssdf), Stimulus Profile files (.nivsstimprof), Real-Time sequence files (.nivsseq), models, and FPGA bitfiles or configuration files.

In the NI VeriStand Project Explorer window, expand the **System Definition File** tree item and open the *.nivssdf file found there by right-clicking on the file and selecting **Launch System Explorer**.

Selecting Deployment Targets

PXI Real-Time and cRIO-908x Targets

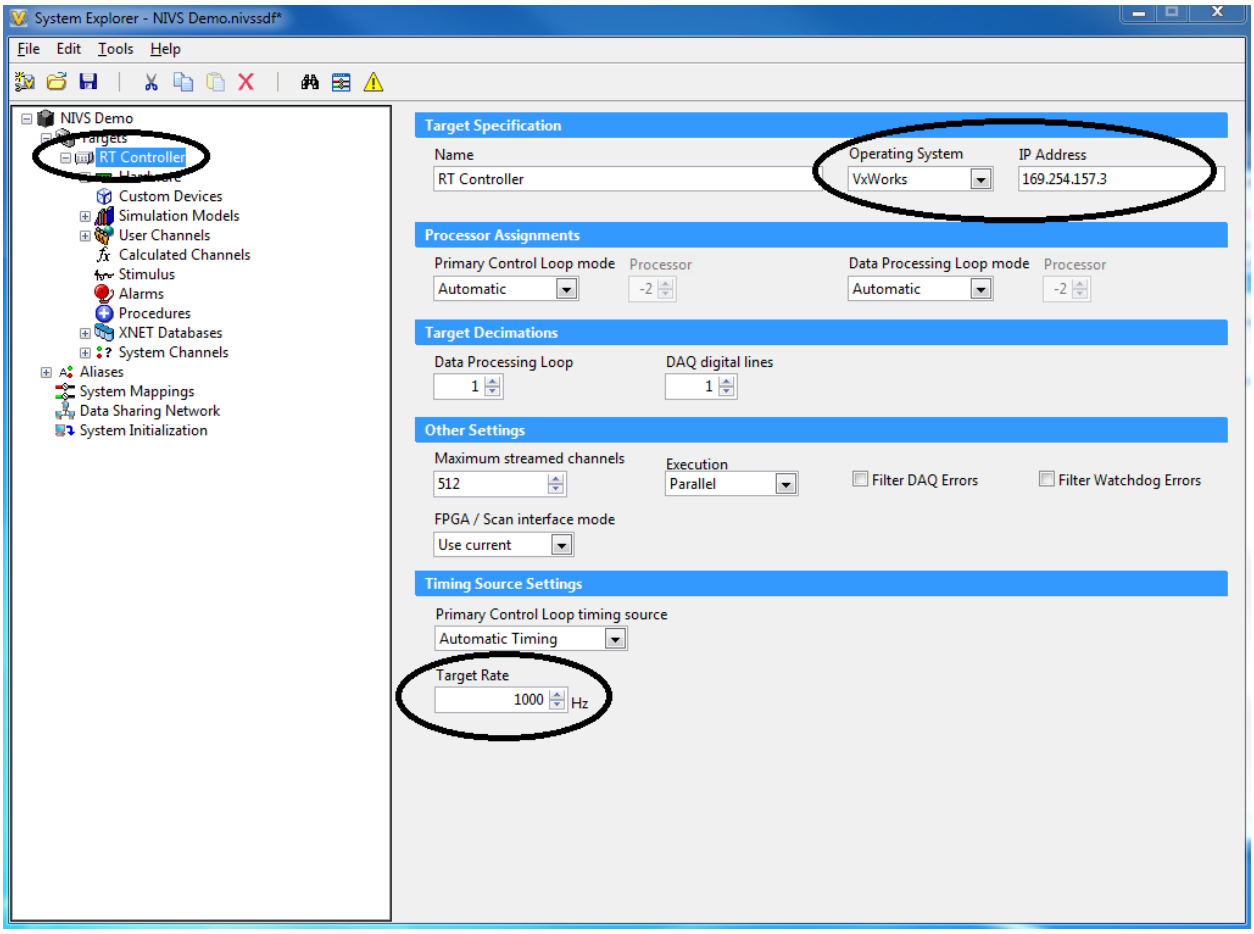
Configure the PXI target by highlighting **Controller** in the tree, selecting **PharLap** for the OS, and using the same IP address displayed for the PXI system in MAX. Rename the controller name to a unique name of your choosing.

All Other CompactRIO Real-Time Targets

Configure the CompactRIO target by highlighting **Controller** in the tree, selecting **VxWorks** for the OS, and using the same IP address displayed for the CompactRIO system in MAX. Rename the controller name to a unique name of your choosing.

Running the VeriStand Engine on the Localhost Windows Computer

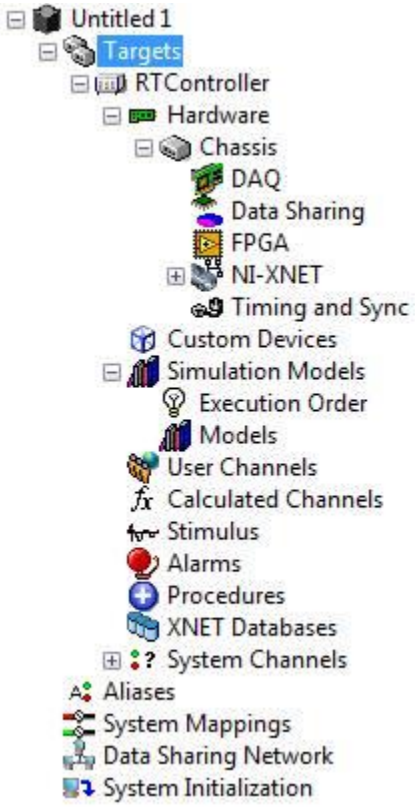
Configure the Windows target by highlighting **Controller** in the tree and selecting Windows for the OS. Note localhost is the automatic selection for IP address, which indicates that the system definition runs on the host PC. Rename the controller name to a unique name of your choosing.



Configuring the VeriStand Engine Using the System Explorer

While in the Controller section, the setting for Target Rate underneath the Timing Source Settings section sets the Primary Control Loop rate on your target. The Primary Control Loop controls the timing for the VeriStand Engine and keeps updated channel values. Find more information on the Primary Control Loop and other individual loops running on the VeriStand Engine in NI VeriStand Engine Architecture.

Expand **Controller** in the tree and note the various items you can add to your system definition.

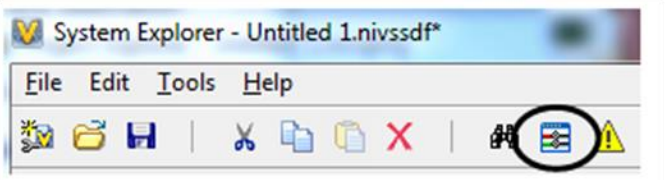


1. **Hardware:** Expand **Hardware** and then **Chassis**. This is where you identify your NI-DAQ, Data Sharing (Reflective Memory), NI-FPGA, NI-XNET, or Timing and Sync devices. You can also add multiple chassis.
2. **Custom Devices:** Customize and extend the out-of-box functionality of VeriStand into a device that you can add to a system definition file and deploy to a real-time target. VeriStand includes three custom devices that you can add here as well as any custom devices you have created yourself. Check the NI VeriStand Add-Ons Community to view other existing custom devices and the NI VeriStand Custom Device Developer's Guide when considering building your own custom device.
3. **Simulation Models:** Expand **Simulation Models**. Add your compiled models from one of the supported modeling environments listed in the document Using Simulation Models With NI VeriStand. If you have multiple models, you also can set the order in which models execute on the VeriStand Engine.
4. **User Channels:** User channels store a single value and can function as variables to be used in other areas of your system definition.
5. **Calculated Channels:** Calculated channels are created to perform calculations on other channels in the system. You can create your own formula or perform built-in operations such as lowpass filter, average, or peak and valley.

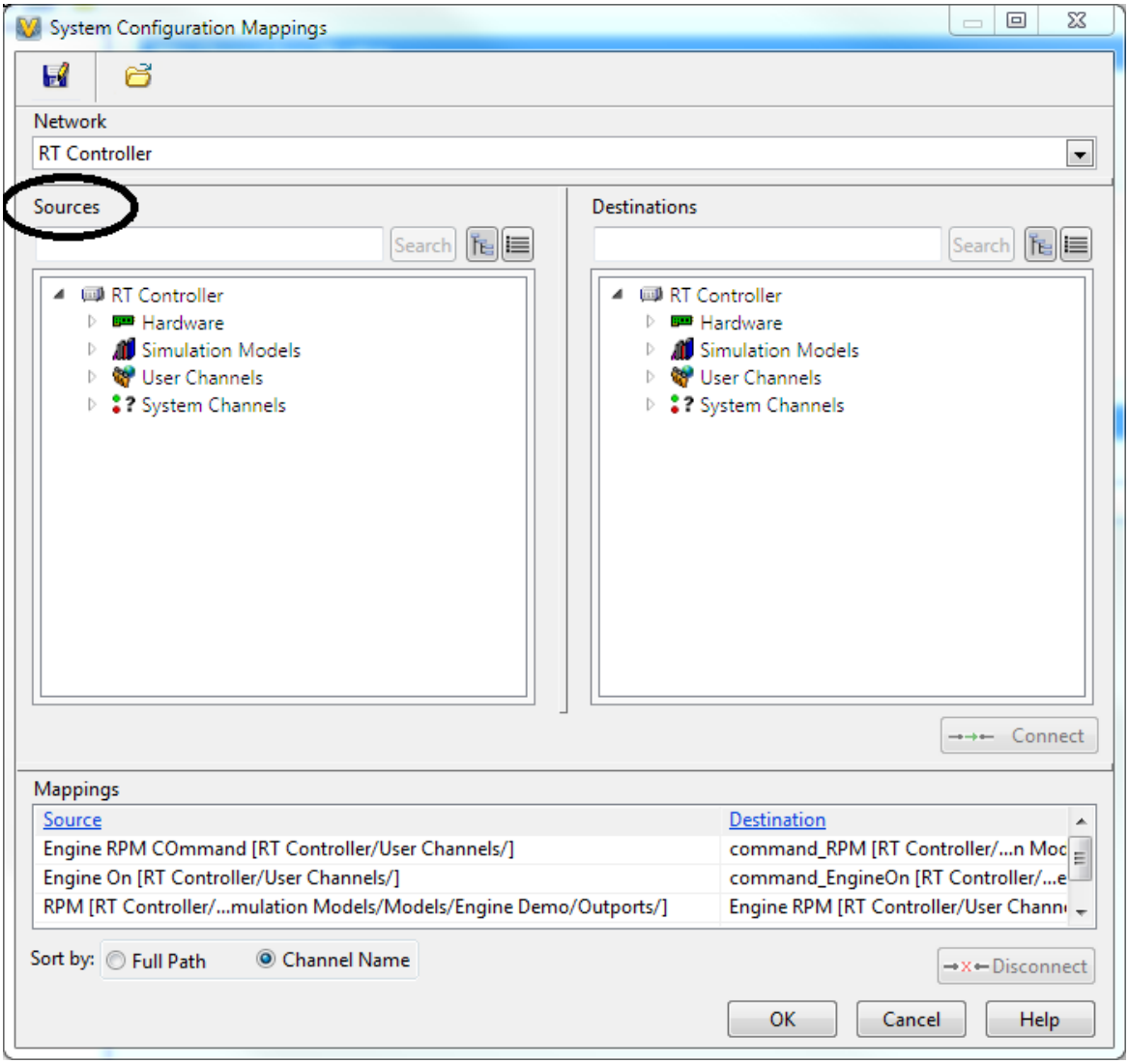
6. **Stimulus:** View and configure the stimulus generators in the Legacy Stimulus Profile Editor, which simulate real-world signals to perform tests on a system. If you're starting a new project without any legacy VeriStand dependencies, ignore this section.
7. **Alarms:** Configure an alarm to warn the user that the value of a channel has gone outside a specified range of values. Alarms can also trigger a procedure to execute.
8. **Procedure:** Configure a procedure to execute a set of actions on the VeriStand Engine. A procedure can be signaled to begin at startup or trigger off an alarm or another procedure.
9. **NI-XNET Databases:** Add any NI-XNET databases to your system. Databases can be CANdb (.dbc), NI-CAN (.ncd), LDF (.ldf), or FIBEX (.xml) files.
10. **System Channels:** Expand **System Channels** to view the channels that monitor the state or condition of various system items. These are often used for troubleshooting system behavior.
11. **System Mappings:** This section displays all defined system mappings, which are connections between source and destination channels. These are configured in the System Configuration Mappings window, which is examined in the next section.
12. **Data Sharing Network:** Add and configure a reflective memory network. To learn more about using reflective memory with VeriStand, go to Creating a Distributed System With NI VeriStand.
13. **System Initialization:** If you have multiple targets, you can use this section to set the order that targets deploy relative to each other and determine target reboot action.
14. **Aliases:** Configure an alias to give a channel or group of channels a unique name in your system definition. Right-click on **Alias** and select **Add Alias**. Type in the alias name and description and then click the **Browse** button next to the channel to select the channel to rename. Aliases are useful for many reasons, including sharing one workspace with multiple system definitions and mapping workspace objects to those aliases. Because of this, you can rename system definition channels within an alias without the workspace losing its mapping.

Mapping System Channels

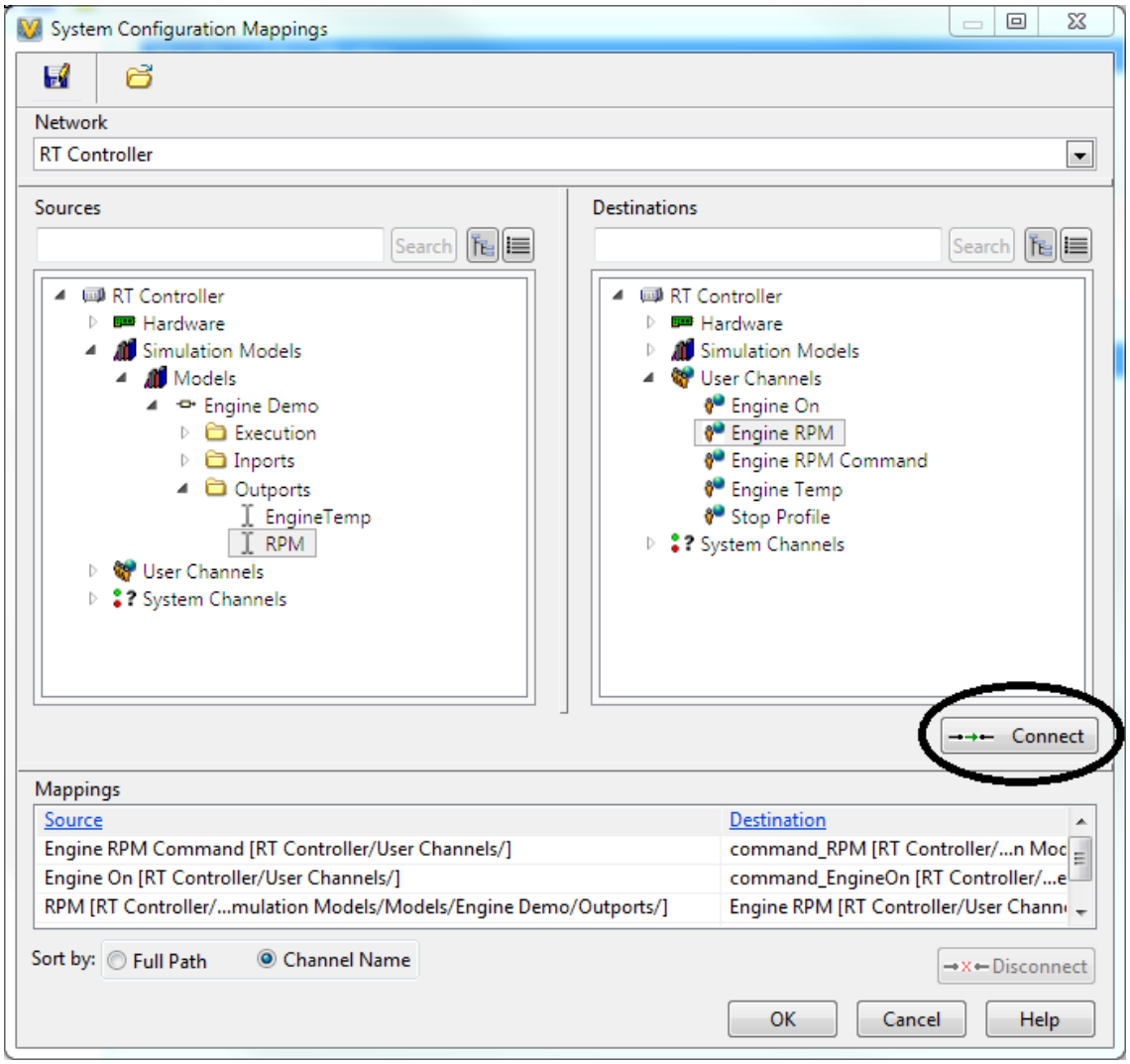
You can easily connect channels to each other in VeriStand using a mapping tool. This tool helps you quickly connect simulation models to physical I/O as well as any other channel in your system. To configure mappings for your VeriStand system, select **Tools»Edit Mappings** or click on the **Configure Mappings** button, shown below, to connect channels to each other such as a model output to a physical channel or a calculated channel to an alias.



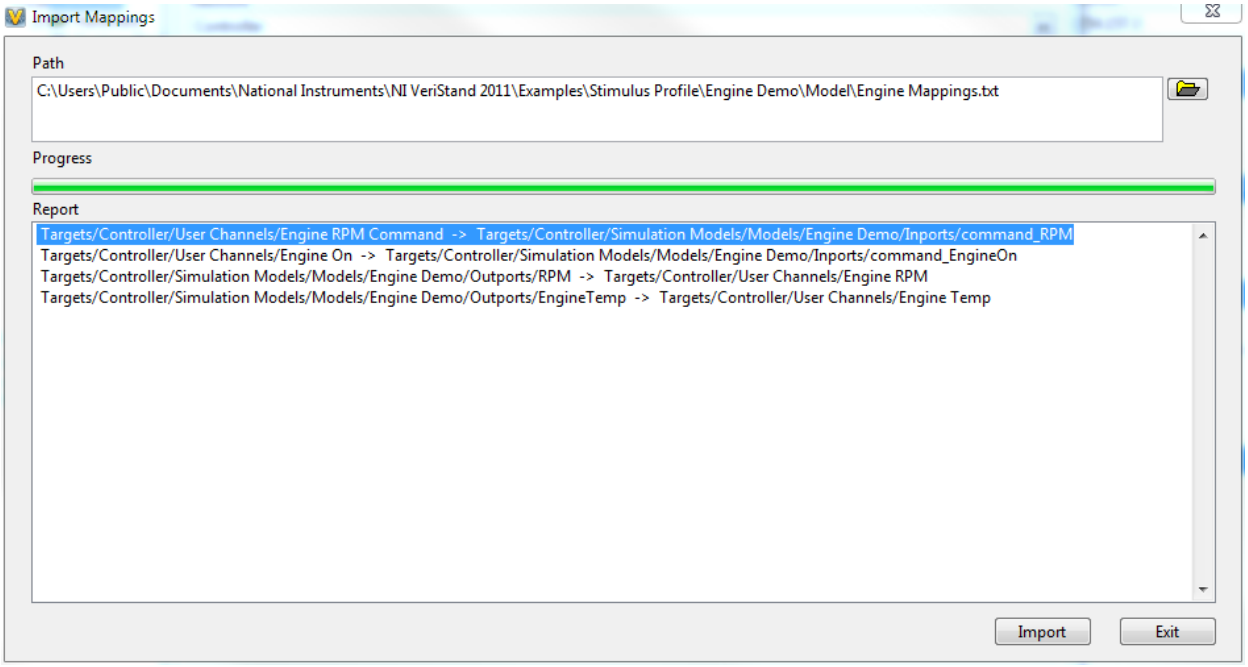
Select a channel in the tree under Sources in the System Configuration Mappings window that just opened.



Select a channel under Destinations and then click **Connect** to map the channels. Note that the Source and Destination channels now appear under Mappings.



System channel mappings can be exported and saved to file. You can then import this file to automate the system mapping process at a later time.



Deploying VeriStand Projects

After you have configured your system definition, save and close the System Explorer. There are two options for running VeriStand projects.

Run: Launches the Workspace window. If you have configured the system to run on a PC, clicking the  button begins running the project. If you have configured the system to run on an real-time target, clicking the Run button deploys the system definition file if one is not already running. If a system definition file already is running on the real-time target, clicking the Run button connects to the target and launches the Workspace window without redeploying the system definition file.

Deploy: Clicking the  button deploys the system definition to the target that you specified in the System Explorer. However, it does not open the Workspace window. If a system definition file already is running on the real-time target, deploying a new system definition will replace the system definition that is currently running.

Building Simulation Models for Use With VeriStand

You can use VeriStand with a wide variety of simulation modeling environments and programming languages. Model subsystems can be built independently and integrated within the VeriStand environment, so you can easily replace simulated components with real components as they become available.

Generating Models From The MathWorks, Inc. Simulink Simulation Software

If you are using an NI real-time target and you don't know which OS is running on the target, view What Operating System Is My Real-Time Controller Running and Why?

- For model deployment on Windows and PharLap-based systems, view Setting Up The MathWorks, Inc. MATLAB® Environment to Work in NI VeriStand.

- For deployment on VxWorks-based CompactRIO systems, go to Developing Shared Libraries for the cRIO-901x and Other VxWorks Targets for Windows XP development computers and Generating Models From The MathWorks, Inc. Simulink Simulation Software for Deployment on VxWorks Systems for Windows Vista and later.

Additional Modeling Environments

For more information on interacting with models from other modeling environments and programming languages in VeriStand, go to Using Simulation Models With NI VeriStand. This document has a complete list of supported modeling environments that have been tested and verified as being able to create compiled models that can be imported in VeriStand.

Using the EtherCAT and Scan Engine Add-On for VeriStand

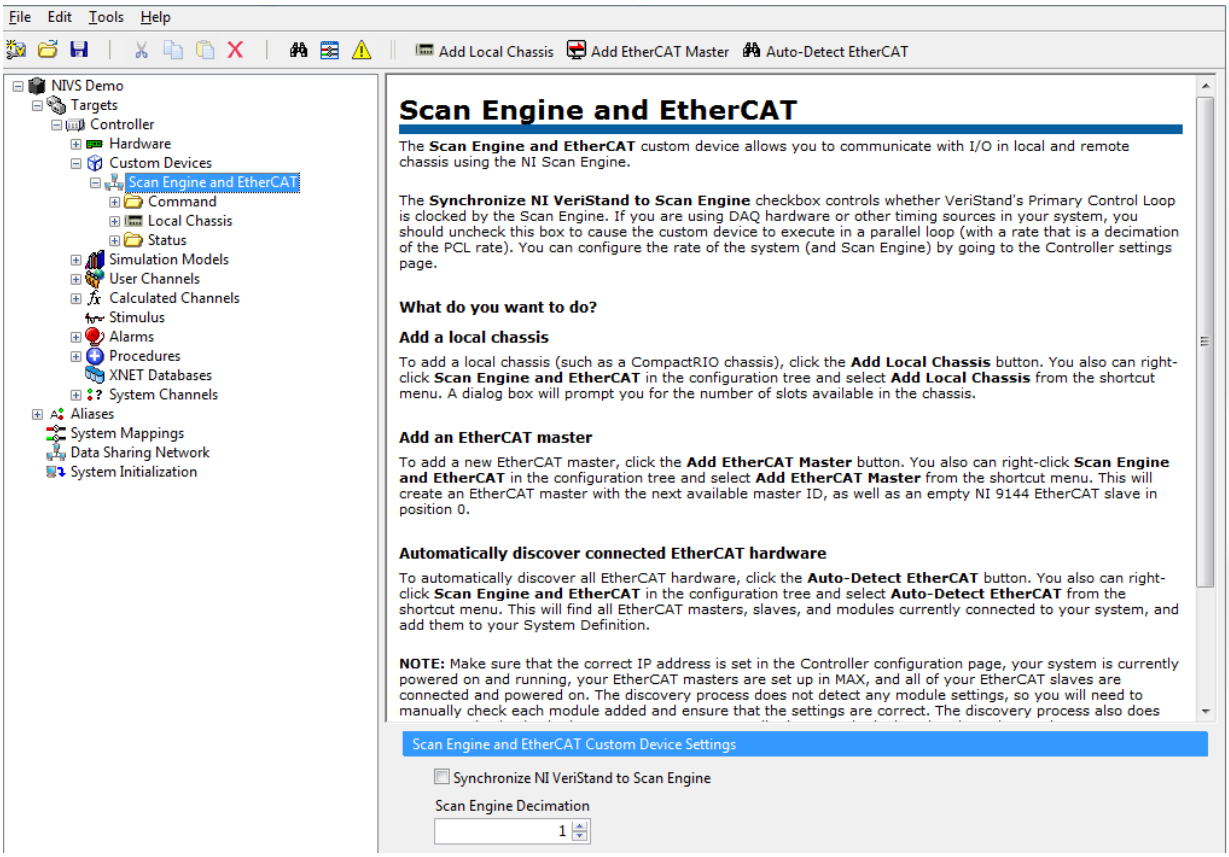
With the Scan Engine and EtherCAT custom device, you can easily read scanned I/O from C Series modules located in a CompactRIO or NI 9144 EtherCAT chassis. The add-on also supports the use of custom FPGA personalities with an NI 9144 chassis.

Note: The EtherCAT and Scan Engine add-on for VeriStand is compatible with CompactRIO targets and the NI 9144 EtherCAT expansion chassis.

Download NI VeriStand Add-On: Scan Engine and EtherCAT custom device from the VeriStand developer community and follow the installation instructions.

To add the **Scan Engine and EtherCAT Custom Device** to your VeriStand system, follow these steps:

1. Open VeriStand and your System Definition.
2. Right-click on **Custom Devices** and select **Scan Engine and EtherCAT**.
3. Select **Auto-Detect Modules** or right-click and select **Add Local Chassis** to use CompactRIO chassis and manually choose the appropriate module for each slot and correct settings for each module.



Next Steps

- VeriStand has many features you can use out of the box without programming. To see video demonstrations of some of these features, visit ni.com/veristand/demos.
- For an in-depth walkthrough of the VeriStand environment, download the VeriStand tutorial.
- To learn more about creating add-ons for VeriStand, watch the VeriStand add-ons webcast.
- For instructor-led training on VeriStand features, take the NI VeriStand Fundamentals training course.