LabVIEW NXG SystemDesigner

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SystemDesigner

SystemDesigner provides a visual representation of the hardware in a system and the software targeted to specific devices in the system. Use SystemDesigner to view your connected hardware, design a system using real and simulated hardware, and target software components to specific devices in the system.

Whether you must develop a standalone software application on a development machine or create a complex application with multiple systems, you should use SystemDesigner to manage your project's hardware configuration.

To help you manage your system, SystemDesigner includes two views:

- Live view—Displays your connected hardware and enables you to validate and debug your devices with measurement panels.
- Design view—Provides a canvas for you to design and document your hardware system, regardless of whether you have access to the physical hardware.

You can use one or both views depending on your programming goal as you validate, design, and configure a system. Refer to the following table to learn about the uses for each view.

SystemDesigner view	Uses
Live view	• View connected hardware devices in software • Add a device to your system that SystemDesigner does not discover • Validate and debug your hardware with measurement panels
Design view	• Design a system with or without access to physical hardware • Add software to a target device, such as a PC or FPGA

SystemDesigner view	Uses
	• Test or debug a project using a subset of the required hardware • Annotate a system • Include a hardware configuration in a distribution • Generate a report of your system configuration to retain, share, or deploy

Related concepts:

- Live View: A Visual Representation of Hardware in Your System
- Design View: A Canvas for Designing and Documenting a Hardware System

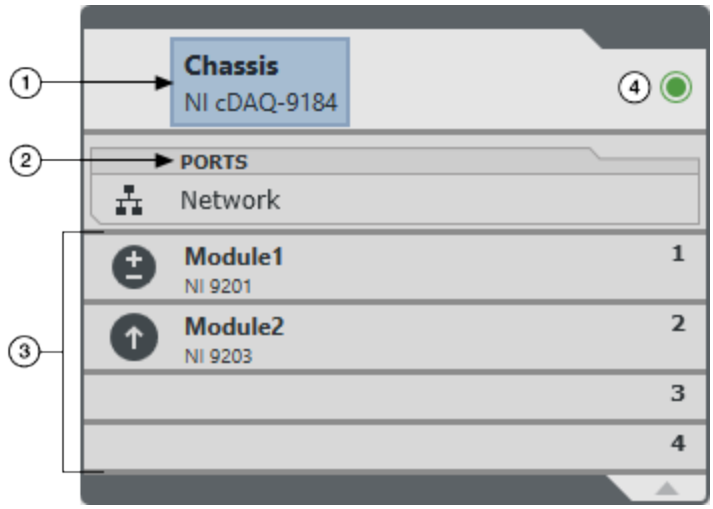
Related tasks:

- Navigating SystemDesigner

Live View: A Visual Representation of Hardware in Your System

The Live view displays all of the hardware that SystemDesigner can discover in your system. Each device on the Live diagram represents the configuration of a real or simulated device in your system.

Refer to the following image for an example of a device on the Live diagram.



1. Label and sub-label—Information about the device, such as the device name, hostname, model, product family, and serial number.
2. Ports—Connections between devices in your system.
3. Device slots—Controllers, modules, and empty slots.

> **Note** Only some devices support controllers, such as PCs and PXI chassis. If a device does support controllers, the only slot compatible with a controller is the first slot.

4. Hardware detection type—Glyph that indicates how SystemDesigner discovers the device.

Hardware Detection Type	Icon	Behavior
Auto-discovered	◉	• The device automatically appears on the Live diagram. • Changes to the live device instantly appear on the Live diagram representation of the device. • When the device is unplugged, powered down, or is no-longer reachable, it automatically disappears from the Live diagram.
Manually identified	○	• The device may automatically appear on the Live diagram, or you may need to add it. On the document toolbar, click **Add Hardware**.

Hardware Detection Type	Icon	Behavior
		• Changes to the live device may automatically appear on the Live diagram. If a change does not appear, you may need to use one of the following methods to view the change in SystemDesigner: ◦ Select the device and click **Refresh** under the **Advanced** section on the Item tab. ◦ Click **Identify Instruments** to re-scan for GPIB instruments. • When the device is removed from the system, you must manually remove it from the Live diagram.
User declared		• The device does not appear on the Live diagram until you add it manually. • Changes to the live device do not apply to the Live diagram device representation. You must manually specify changes in SystemDesigner. • To remove the device from the system, you must manually remove it from the Live diagram.

Related concepts:

- Design View: A Canvas for Designing and Documenting a Hardware System

Related tasks:

- Verifying Your Hardware Appears in the Live View
- Manually Adding Hardware to the Live View of SystemDesigner
- Validating Your Hardware with Measurement Panels

Design View: A Canvas for Designing and Documenting a Hardware System

The Design view enables you to create and annotate the hardware system your project requires.

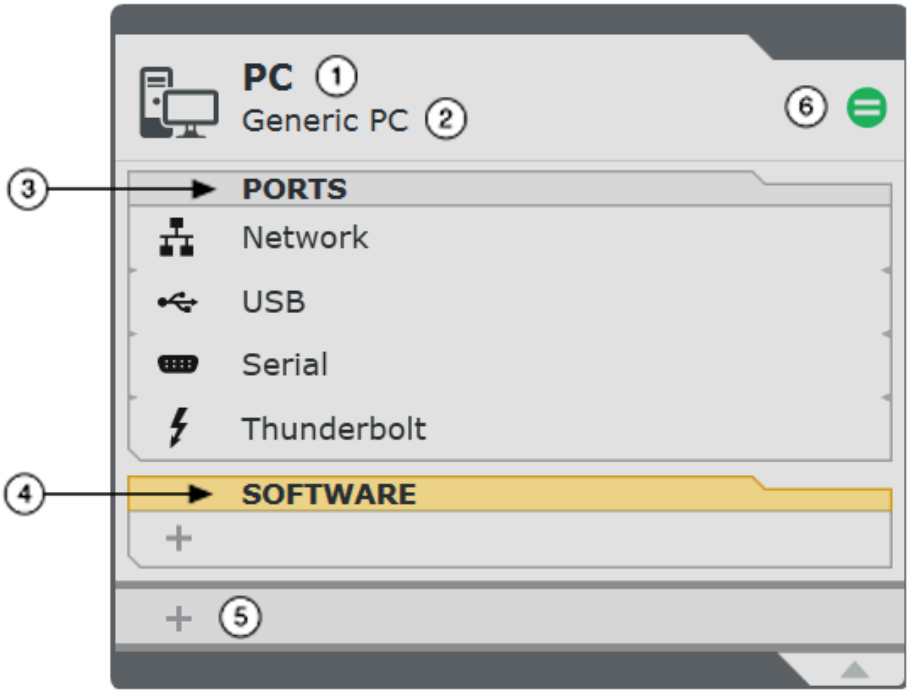
SystemDesigner does not automatically populate your live hardware system in the Design view. Instead, the Design view is a blank diagram, or canvas. The Design

diagram is where you add devices and connect them to configure your hardware system.

The Design view palette contains supported devices from the NI product line and your live hardware. You use these devices to design your system.

> **Note** If your system requires third-party devices, you must install the required drivers to find the devices in Design view palette. After you install the drivers, restart LabVIEW NXG.

A device on the Design diagram contains several configurable features.



1. Label—Name of the device product family.
2. Sub-label—Additional information about the device, such as the device name, hostname, model, or product family.
3. Ports—Connections between devices in your system.
4. Software—Applications that execute on the device and libraries that contain reusable source files.
5. Device slots—Controllers, modules, and empty slots.

6. Match status—Type of device match between the live device and the device added to the Design view.

Related concepts:

- Live View: A Visual Representation of Hardware in Your System

Related tasks:

- Designing a Hardware System in the Design View
- Adding Software to a Target in the Design View

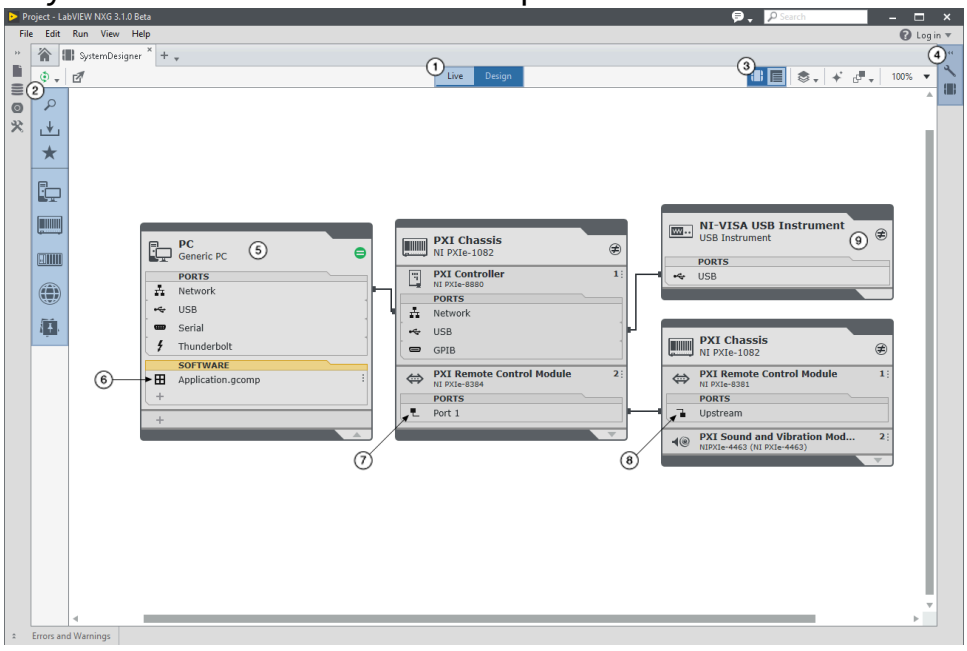
Related information:

- NI Driver Downloads

Navigating SystemDesigner

Visualize and design a hardware system with the SystemDesigner editor.

The following image highlights parts of the SystemDesigner editor you use to configure a system and view the relationship between hardware and software in a system.



1. Editor selector— View all live hardware currently connected to your system on the

Live view, or create a system of devices on the Design view.
2. Palette— Use the palettes to find unplaced live hardware, browse the hardware catalog for devices you want to explore, or create documentation for the system you design.
3. View selector—Explore your hardware visually as a system-level diagram that displays the relationship between devices in your project, or as a table of devices, software, and device resources.
4. Configuration pane—Configure devices and resources in your project using context-sensitive options. You can expand the pane when you want to make configurations.
5. Host device—Configure the host, such as a PC or embedded controller, to control the child devices to send commands and obtain data.
6. Software—Applications that execute on the target device and libraries that contain reusable source files.
7. Downstream port—Send commands down the system towards the intended device.
8. Upstream port—Send data up the system towards the parent device.
9. Child device—Use the child device to perform measurement tasks and obtain data to process.

Related concepts:

- SystemDesigner
- Live View: A Visual Representation of Hardware in Your System
- Design View: A Canvas for Designing and Documenting a Hardware System

Verifying Your Hardware Appears in the Live View

Use the Live view of SystemDesigner to see all hardware available for use in your application.

Depending on your device and connection type, most devices automatically appear on the Live view after you plug them into your local machine.

1. If you have not done so already, plug your devices into your local machine.
2. Navigate to the Live view of SystemDesigner.
3. Verify your hardware devices are visible on the Live diagram.

> **Note** Even if you do not have access to physical hardware, you should see your local machine on the Live diagram. SystemDesigner automatically labels your local machine This Computer to help you determine the difference between the computer running LabVIEW NXG—that is, This Computer—and any other PC target you create on the Design view.

If a device in your system does not automatically appear in the Live view, you can manually add the device to the Live diagram.

Related concepts:

- Live View: A Visual Representation of Hardware in Your System

Related tasks:

- Manually Adding Hardware to the Live View of SystemDesigner
- Validating Your Hardware with Measurement Panels

Manually Adding Hardware to the Live View of SystemDesigner

Manually add hardware devices that do not automatically appear on the Live diagram.

1. Navigate to the Live view of SystemDesigner.
2. On the document toolbar, click **Add Hardware**.
3. Follow the instructions for the appropriate device category:

Device Category	Instructions
Network Resources	Select the resource on the Add Hardware dialog box and click **Add**.
Missing SystemDesigner Support	Click **Find Support** to install required instrument drivers with NI Package Manager. **Note** If you install SystemDesigner support for a device, you may need to restart LabVIEW NXG before the

Device Category	Instructions
	device appears on the Live diagram.
Non-Discoverable Devices	Click **Launch NI MAX** to find and add the device to the Live diagram manually.
Device with known IP address or hostname	Click the **Add hardware by address** tab and enter the IP address or hostname of the device to which you want to connect, then click **Connect**.

Note A device category only appears when a device in your system meets the criteria for the category.

4. If the device requires login credentials, enter a valid password.
5. Click **Add** and verify that the device appears on the Live diagram.

Note If your device still doesn't appear on the Live diagram, refer to your hardware and driver manuals for troubleshooting help.

Learn More

Complete the ***Getting Started with Instrument Control*** lesson in software to learn more about setting up your devices in the Live view.

Related concepts:

- Live View: A Visual Representation of Hardware in Your System

Related tasks:

- Verifying Your Hardware Appears in the Live View
- Validating Your Hardware with Measurement Panels

Validating Your Hardware with Measurement Panels

Launch a measurement panel from SystemDesigner to validate your hardware, specify measurement inputs and outputs, and configure tasks.

Tip It is helpful to think of measurement panels as the same as test panels and tasks in NI MAX or interactive soft front panels available in driver software.

Before you launch a measurement panel from SystemDesigner, you must complete the following tasks:

- Install the drivers your local machine needs to communicate with and control the hardware.
- Verify SystemDesigner detects your hardware in the Live view.

1. Navigate to Live view of SystemDesigner.

   Note If a device match exists on the Design view, you can also launch a measurement panel for the matched device from the Design view.

2. Locate the device you want to validate and configure to acquire measurement data.
3. Click the device on the diagram.
4. On the Item tab, expand Use hardware section.
5. Click Create measurement panel to launch a measurement panel.

After you validate and configure your hardware with measurement panels, you can acquire and analyze your measurement data.

Related concepts:

- Live View: A Visual Representation of Hardware in Your System

Related tasks:

- Verifying Your Hardware Appears in the Live View
- Manually Adding Hardware to the Live View of SystemDesigner

Designing a Hardware System in the Design View

Use the Design view to design and document a virtual hardware system using hardware you do and do not own.

The Design view enables you to design a new hardware system, modify an existing hardware system, and document the system to retain or share with others.

There are many ways you can design or modify a hardware system in the Design view, depending on the hardware available to you, the instrument drivers installed, and your system needs:

- Design a system using your current system as a template—Create a new system using the hardware connected to your local machine by removing, modifying, or adding devices.
- Design a new system—Create a new system by adding virtual hardware devices and wiring them together.
- Swap device models—Switch out one device for another device to better meet your system needs.
- Manage visible device ports—Hide unused device ports on devices to remove clutter from the Design diagram.
- Configure a Device Match in SystemDesigner—Enable hardware matching to apply changes to a live hardware device from the Design view.

Designing a New System Using Your Live Hardware as a Template

To create a new system, you can use a connected hardware system as a template to modify or add devices to in the Design view of SystemDesigner.

1. Navigate to the Design view.
2. On the palette, click **Unplaced Live Hardware**.

Note The devices on the Unplaced Live Hardware palette have same configuration as the matching device on the Live diagram. However, devices on the Design diagram do not change when modifications occur to a matching device on the Live diagram. Additionally, SystemDesigner

> does not remove a device from the Design diagram after you remove the matching device from the Live diagram.

3. Select **All** to add all discovered hardware devices to the Design diagram.
4. **Optional:** Considering your system requirements, customize the system in any of the following ways:
   - From the palette, add hardware devices to the Design diagram.
   - Wire the compatible device ports together based on the port configurations of the device. For example, downstream device ports connect to upstream device ports.

     > **Note** If a wire appears broken, the connected devices are not compatible. In the Item tab, select **Documentation** » **Manual** to review device specifications.

   - Rename the device names to something more useful or identifiable for you and your team.
   - Add comments and images to the Design diagram to include notes about the system. Refer to Annotating the Design View for more information.
5. After you complete your system design, click **File** » **Save SystemDesigner**.
6. On the document toolbar, click **Create SystemDesigner Report** to capture the system for you to share or retain as a CSV file.

Related tasks:

- Designing a New System
- Managing Visible Device Ports
- Swapping Device Models in a System
- Configuring a Device Match in SystemDesigner

Designing a New System

Design a system to your exact specifications using virtual hardware in the Design view.

1. Navigate to the Design view.
2. Considering your system requirements, customize the system in any of the following ways:

- Add your target to the Design diagram. Refer to the table below for instructions on how to add a target to the Design diagram, depending on the system you need to create.

I want to create a PC system	I want to create a PXI system
On the palette, select **PC** » **PC** to add a generic computer to the Design diagram.	a. On the palette, select **PXI** » **PXI chassis** to select the chassis model your system needs and add it to the Design diagram. b. On the PXI chassis, click **Add device** on the first port. c. Select the product family of the controller you need and then select the controller.

- From the palette, add hardware devices to the Design diagram.
- Wire the compatible device ports together based on the port configurations of the device. For example, downstream device ports connect to upstream device ports.

> **Note** If a wire appears broken, the connected devices are not compatible. In the Item tab, select **Documentation** » **Manual** to review device specifications.

- Rename the device names to something more useful or identifiable for you and your team.
- Add comments and images to the Design diagram to include notes about the system. Refer to Annotating the Design View for more information.

3. After you complete your system design, click **File** » **Save SystemDesigner**.
4. On the document toolbar, click **Create SystemDesigner Report** to capture the system for you to share or retain as a CSV file.

Related tasks:

- Designing a New System Using Your Live Hardware as a Template
- Managing Visible Device Ports
- Swapping Device Models in a System
- Configuring a Device Match in SystemDesigner

Swapping Device Models in a System

Quickly replace one device model with another in the Design view.

1. Navigate to the Design view.
2. Select the device you want to swap for another device.
3. On the **Item** tab, select a new device from the **Model** drop-down menu.

> **Note** Not all devices support the **Model** drop-down menu. Complete the following tasks if the device you want to change doesn't have a **Model** drop-down menu:
>
> - Delete the device model you no longer want to use and add the desired device model from the palette.
> - (VISA) If the VISA device is not matched to a device in the Live view, type the device you want into either the Vendor or Model field. If your VISA device is matched to a device in the Live view, you must disable hardware matching before you can replace the device on the Design view. On the document toolbar, click **Sync** » **Disable hardware matching** to stop matching devices between the SystemDesigner views.

4. **Optional:** Delete broken wires and wire compatible devices together.
5. **Optional:** Repeat steps 2-4 to replace another device model for a new one.

Related tasks:

- Designing a Hardware System in the Design View
- Managing Visible Device Ports
- Configuring a Device Match in SystemDesigner

Managing Visible Device Ports

Show or hide device ports of PCs and remote controllers in the Design view to organize the system you create.

1. In the **Ports** section of the device you want to organize, right-click a port and select **Manage Ports** to open the Manage Ports dialog and view the device ports you can

display.

2. Select each device port you want to display.

   Consider the following behaviors when choosing device ports to display:

   - Connecting a visible port to a hidden port on a separate device causes the hidden port to become visible.

     Tip To connect to a hidden port on a device, wire a visible port terminal to the terminal next to the **Manage Ports** button on the device.

   - Hiding a wired port causes the existing wire to break. You cannot hide wired ports on the Live diagram.
   - Displaying a port may rearrange the display order of the device ports, depending on the alphabetical order of the port names.
   - Saving a project only preserves visible port designations on the Design diagram.

   After you close the **Manage Ports** dialog, SystemDesigner updates the device port display on the diagram.
3. To hide a device port, right-click the port and select **Hide Port** or deselect the port in the Manage Ports pop-up.

Related tasks:

- Swapping Device Models in a System
- Designing a Hardware System in the Design View
- Configuring a Device Match in SystemDesigner

Configuring a Device Match in SystemDesigner

Use device matching to apply updates to your live hardware configuration based on changes you make in the Design view.

If SystemDesigner finds a matching device on the Design diagram, it automatically applies updates to the matching live device in your project.

1. Navigate to the Design view.
2. Ensure that **Sync** is set to **Enable hardware matching**.
   The Sync setting determines if you can apply changes in your project to matching live hardware in your system. Sync is set to Enable hardware matching when you open SystemDesigner for the first time.
3. On the Design diagram, find the device you want to match with your live hardware. If the device is not already on the Design diagram, find it on the palette and place it on the diagram.

   Tip Any device on the Live diagram that does not have a match on the Design diagram appears in the Unplaced Live Hardware palette.

4. Verify the match status of the device.
   SystemDesigner assigns a PC, chassis, or network device one of the following match status icons to inform you whether a device matches with live hardware.

Match Status	Icon	Description
Hardware matching disabled		When **Sync** is set to **Disable hardware matching**, SystemDesigner prevents changes to devices in the Design view from applying to matching live hardware.
Not Matched		SystemDesigner does not identify a corresponding device on the Live diagram.
Partially Matched		SystemDesigner identifies a potential match on the Live and Design diagrams. Click **Update modules in chassis** to update the device on the Design diagram to match the configuration of the device on the Live diagram.
Matched		SystemDesigner identifies a corresponding device on the Live diagram.

5. If the device does not have a match, configure the device on the Design diagram to match the device configuration on the Live diagram.
   The following device characteristics must match on both the Design view and Live view for SystemDesigner to identify a match.

Matching Criteria	Tasks
Device model	Search for the correct model on the Design view palette and the **Model** drop-

Matching Criteria	Tasks
	down menu in the **Identity** section of the Item tab.
Device name	Use the **Device name** field in the **Identity** section of the Item tab to change the name of a device on the Design diagram.
Order of controllers and modules inside a chassis	If a device is partially matched, click **Update modules in chassis** on the Item tab to update the order of the modules in the chassis to match the corresponding live chassis. This button only appears when **Sync** is set to **Enable hardware matching**.
Device port connections	Ensure port connections are identical to those of the device on the Live diagram.

After you enable hardware matching and configure the device on the Design diagram to match the configuration of the live hardware, SystemDesigner automatically matches the devices.

Related tasks:

- Designing a Hardware System in the Design View
- Swapping Device Models in a System
- Managing Visible Device Ports

Software on SystemDesigner Devices

Adding software to a target device on the Design view specifies where the software executes at run time. Targeting software to a specific device also provides information about the hardware configuration of the target where the software executes.

You can add two types of software components directly to a device in SystemDesigner:

- **Application**—A program designed to perform a group of coordinated functions, tasks, or activities.
- **Library**—A collection of source files, such as VIs, G Types, palette files, and other files.

You can add an application or library to a specific target by clicking **Add software** on

the device on the Design view, or by dragging a component from the Project Files pane onto a device.

If a file or component is not on a specific target device, it executes on the development system, which SystemDesigner labels This Computer in the Live view. This is the same as a VI running normally in a project on your computer using the live hardware in your system.

Note To view every target device in your system and the software on each target, select **Software** from the **Table** view drop-down menu.

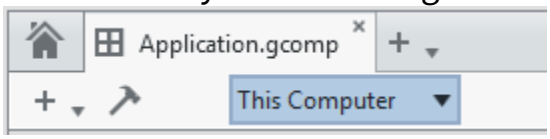
Related tasks:

- Adding Software to a Target in the Design View
- Navigating SystemDesigner

Adding Software to a Target in the Design View

Add an application to a device, or target, in the Design view to specify where the software executes at run time.

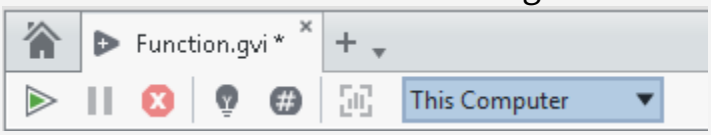
1. On the Design diagram, locate the device to which you want to add software.
2. **Optional:** If an application already exists in your project, drag it from the **Project Files** tab to the **Software** section of the target.
3. **Optional:** If you don't have an existing application, create a new application and add a VI to it.
   a. On the target, click **Add Software** » **Application** and then click **OK**.
   On the Application document toolbar, notice how the target selector is automatically set to the target.



   b. In the Application document, add a VI to the Application folder in one of the following ways:
      - Drag an existing VI from the Project Files tabs to the Application document.
      - Click **New** (+) to create a new VI.

When you add files to the Application and open them, those software files open in the context for the target device you selected. Therefore, you can interactively edit and run the program on the target device from the VI.

Note When you open a VI from the **Project Files** tab, the target of that VI can vary depending on whether it is targeted to run on multiple devices in SystemDesigner. You can use the target selector, shown in the following image, to verify the target or switch between instances of the VI on different targets.



c. If you create a new VI, create whatever code you want to run on the target.

Note You can use example code installed with your drivers to quickly start programming. To use example code, navigate to the Lobby in LabVIEW NXG and select **Learning** » **Examples** to launch an example and copy the code to your VI.

d. Click **File** » **Save all** to save your project.
e. Navigate back to the Design view of SystemDesigner.

You can now see software on your target.

Related concepts:

- Software on SystemDesigner Devices

Related tasks:

- Navigating SystemDesigner

Annotating the Design View

Use comments and lines from the Annotations palette to explain design decisions and document your system.

When you select a comment on the Design diagram, you can customize it on the Item tab in the following ways.

Item Tab Action	Additional Information
Add a comment label, sub-label and inline notes.	You can type the text a comment displays on the Item tab.
Adjust the visual style of the comment.	You can visually group a set of annotations by styling them the same way. Edit the comment fill color, as well as border color, style and thickness, on the Item tab.
Set an image to display inside the comment.	Images appear at the bottom of a comment on the Design diagram. The image scales proportionately with the size of the comment. If you enable **Fixed image padding**, you may need to resize the comment in order to avoid image cropping.
Provide additional information about the comment in the **Context help description** field.	Text you enter appears in the context help for the comment.
Enter a URL or path in the **More help link** field to provide additional information.	The more help link appears in the context help for the comment.

Related tasks:

- Documenting a System Design
- Exporting the Hardware Configuration of a Target

Capturing the Hardware Configuration of a System

Capture the hardware configuration of a system to save, share, or deploy.

Record hardware in one of the following ways:

- Create a report of a system design—Record the hardware setup and device requirements of your system as a CSV file.
- Export the hardware configuration of your system to another machine—Capture

the hardware dependencies of your project as an NI Hardware Configuration file (`.nihwcfg`) to deploy to another machine.

Related tasks:

- Designing a Hardware System in the Design View

Documenting a System Design

Create a report of the hardware setup and device requirements of your system from either the Live view or Design view.

The report records the location, label, product family, model, vendor, device name, and serial number of the devices in your system as a comma-separated value (CSV) file.

1. Navigate to the view which possesses the system you want to capture.
2. On the document toolbar, click **Export** » **SystemDesigner Report (.csv)** to produce a report.
3. Select the location to save the report on your local machine and click **Save**.

Related concepts:

- Annotating the Design View

Related tasks:

- Exporting the Hardware Configuration of a Target

Exporting the Hardware Configuration of a Target

Export the hardware configuration of your system as an NI Hardware Configuration file (`.nihwcfg`) to capture hardware dependencies.

1. Navigate to either the Live view or Design view, depending on where your target's hardware configuration is in the project.
2. On the document toolbar, select **Export** » **NI Hardware Configuration file (.nihwcfg)**.
3. If the SystemDesigner view you have open contains more than one target, select

the target whose hardware configuration you want to export.

> **Note** In the Live view, the only supported system is This Computer.

4. Select or deselect the hardware configuration you need to include for your project and click **OK**.
5. Select the location to save the NI Hardware Configuration file on your local machine and click **OK**.
6. Navigate to where you saved the NI Hardware Configuration file and send a copy of it to the system that will use it.

After you export the NI Hardware Configuration file, double-click the file to launch the NI Hardware Configuration Importer to apply the hardware dependencies.

> **Note** To successfully import hardware dependencies, verify the appropriate drivers and NI System Configuration are installed.

Related concepts:

- Annotating the Design View

Related tasks:

- Documenting a System Design