Getting Started with the LabWindows™/CVI™ Real-Time Module

This document provides an introduction to the LabWindows™/CVI™ Real-Time Module. Refer to this document for installation and configuration instructions and information about creating a real-time (RT) project.

Installing the Real-Time Module Software on a Host Computer

You must first install the Real-Time Module software on a host computer. Then you can configure and install software on the RT target.

To install and use the Real-Time Module software, you must have the following:

- **Free Disk Space**—In addition to the minimum system requirements for LabWindows/CVI, you must have at least 250 MB of free disk space for the Real-Time Module software. Refer to the *LabWindows/CVI Release Notes* for minimum system requirements.

- **RT Target**—The LabWindows/CVI Real-Time Module supports NI RT Series PXI controllers and desktop PCs converted to RT targets. Refer to the *Using Desktop PCs as RT Targets with the Real-Time Module* document for more information about converting a desktop computer to an RT target.

Refer to the *LabWindows/CVI Real-Time Module Readme* for a step-by-step guide to installing the LabWindows/CVI Real-Time Module. You can access the *LabWindows/CVI Real-Time Module Readme* by selecting **Start»All Programs»National Instruments»LabWindows/CVI *version*»LabWindows/CVI Real-Time Module Readme**.

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Configuring the RT Target

After you install LabWindows/CVI and the RT module, you must use NI Measurement & Automation Explorer (MAX) to configure the RT target and to install software and drivers on the RT target. MAX provides access to NI devices and systems and can communicate with networked RT targets, also known as remote systems.

Complete the following steps to configure the RT target. The following sections describe these steps in more detail.

1. Boot the RT target into LabVIEW RT.
2. Configure network settings.
3. Install software on the RT target.
4. Configure system settings.
5. Configure I/O.

Refer to the *Measurement & Automation Explorer Help* for a complete tutorial about configuring the RT target. Select **Help»MAX Help** to access this help file, and then refer to the *MAX Remote Systems Help* section.

> **Tip** The *Measurement & Automation Explorer Help* refers to the LabVIEW Real-Time Module. However, you can apply the same concepts when you use the LabWindows/CVI Real-Time Module.

Booting the RT Target into LabVIEW RT

Many NI RT series PXI targets have a BIOS setting or DIP switch for booting the system into LabVIEW RT. Configure the BIOS setting or DIP switch as appropriate and reboot the system. Refer to your PXI system documentation for details.

If the RT target is a PXI system without a BIOS setting or DIP switch for booting into LabVIEW RT, but the target has a floppy disk drive, you can create a boot disk to boot the system into LabVIEW RT. Complete the following steps to create a boot disk and boot the target into LabVIEW RT:

1. Select **Tools»Real-Time Disk Utilities»Create PXI Boot Disk** in MAX to create a boot disk from the host computer.
2. Click **Yes** in the Measurement & Automation Explorer dialog box and follow the instructions on the screen to create the boot disk.
3. When you finish creating the boot disk, remove the floppy disk from the host computer and insert it into the floppy drive of the PXI controller you are using as an RT target.
4. Power on or reset the controller to boot it into LabVIEW RT.

If you are converting a desktop computer to an RT target, refer to the *Using Desktop PCs as RT Targets with the Real-Time Module* document for information about booting into LabVIEW RT.

Configuring Network Settings

📝 **Note** For the initial configuration, you must connect networked RT targets to the same network subnet as the host computer from which you launch MAX.

1. Connect the RT target to the network and power on the target.
2. Launch MAX and expand the **Remote Systems** item in the MAX configuration tree.
3. Select the RT target from the **Remote Systems** list. Some RT targets will be listed with an automatically configured name or IP address while other targets will be listed as `0.0.0.0`.
4. Specify a network name for the RT target.
5. Configure the IP address settings in the **Network Settings** tab using one of the following options:
   - Select **Obtain an IP address automatically** to obtain an IP address using DHCP.
   - Select the **Use the following IP address** option and specify an IP address. You also can click **Suggest Values** to select an IP address suggested by MAX.
6. Click **Apply** to commit the changes.
7. Click **Yes** to reboot the RT target when prompted.

Installing Software on the RT Target

Use the LabVIEW Real-Time Software Wizard to install software on the RT target. With the LabVIEW Real-Time Software Wizard, you can view the software that is already installed on the target, view the software that is available to install on the target, and change the software that is installed on the target. Click **Help** in the wizard for more information about installing and uninstalling software on the RT target.

1. Expand the RT target under the **Remote Systems** item in the MAX configuration tree, right-click **Software**, and select **Add/Remove Software**.
2. Select the software you want to install on the RT target.

📝 **Note** If you have multiple software versions installed on the host computer, the most recent version is selected by default. You can choose to install another version.

- **Ethernet Drivers**—MAX automatically selects the appropriate Ethernet driver(s) for the RT target when you install the **LabWindows/CVI Run-Time Engine for RT** component.

- **LabVIEW Real Time**—MAX selects this item automatically when you install the **LabWindows/CVI Run-Time Engine for RT** component.

- **NI RT Extensions for SMP (MultiCore Support)**—Install this item to take advantage of parallel processing on a multiple-CPU system.

> **Note** Single-CPU systems perform best without the **NI RT Extensions for SMP**. Also, some applications, such as those that consist mainly of single-point I/O, can achieve lower latency on a multicore system by using a single CPU without the **NI RT Extensions for SMP**.

- **Microsoft Visual Studio 2008 Runtime Support**—Install this item if your application requires additional DLLs built with Visual Studio 2008.

- **LabWindows/CVI Network Variable for RT**—Install this item only if your application uses functions from the Network Variable Library.

- **LabWindows/CVI Run-Time Engine for RT**—Install this item to add support for LabWindows/CVI RT applications on the RT target. This component is required for all LabWindows/CVI RT applications.

- **Language Support for LabVIEW RT**—Install this item if you are using strings in your RT application containing ASCII characters above 127 or multibyte characters. After installing this item on the RT target, you can configure the locale in MAX by selecting the target in the **Remote Systems** item in the MAX configuration tree, selecting the **System Settings** tab, and modifying the **Locale** option.

- **NI Hardware Drivers**—Install the appropriate drivers for any other hardware libraries that you use in your application. For example, install the **NI-DAQmx** component if your application uses functions from the NI-DAQmx Library.

- **Network Variable Engine**—MAX automatically selects this item when you install the **LabWindows/CVI Network Variable for RT** component.

- **USB Support**—Install this item to enable support for accessing USB thumbdrives.

- **Variable Client Support for LabVIEW RT**—MAX automatically selects this item when you install the **LabWindows/CVI Network Variable for RT** component.

Configuring System Settings

1. Select the **System Settings** tab to configure system-level settings for the RT target.

2. Use the **Timezone** option to configure time zone and daylight saving settings for the RT target. You can use this setting with time and date functions to provide accurate time information, relative to the time zone setting.

3. Configure the **Locale** option to match the language you use for strings in your RT application. This option is available only when you install the **Language Support for LabVIEW RT** component on the RT target. This option determines the code page that LabWindows/CVI uses when processing strings containing ASCII characters above 127 or multibyte characters.

Configuring I/O

You must configure any National Instruments I/O devices before you can use them from a LabWindows/CVI RT application. For information about how to correctly configure I/O devices, refer to the documentation for that hardware.

Configuring an RT Project

After you configure the RT target, you can create an RT application on the host computer and then run the application on an RT target. The applications that you create with the LabWindows/CVI Real-Time Module are DLLs.

Complete the following steps to create a DLL and specify an RT target directly from LabWindows/CVI.

1. Create a project in LabWindows/CVI using RTmain instead of main as the entry point function for the program. Select **Edit»Insert Construct» RTmain** to insert the RTmain code into the program source.

2. Select **Build»Configuration»Debug** or **Build»Configuration»Release** to specify the active configuration for the project.

3. Select **Build»Target Type»Dynamic Link Library** to configure the project to generate a DLL.

4. Select **Build»Target Settings** to open the Target Settings dialog box. Select **Real-time only** in the **Run-time support** option. If you specify this option, LabWindows/CVI does not link to the entire set of LabWindows/CVI libraries but instead links to only those libraries supported on an RT system.

5. Click **OK** to exit the dialog box.

6. Select **Build»Create Debuggable Dynamic Link Library** or **Build» Create Release Dynamic Link Library** to create the DLL.

You also can use a project template to create an RT DLL. The project template includes basic settings for RT projects described in the preceding section. To select a project template, select **File»New»Project from Template**. In the New Project from Template dialog box, select **Real-Time Target Application**.

Specifying an RT Target

Complete the following steps to select the RT target on which to run your RT application.

1. Select **Run»Select Execution Target for Debugging** to view a list of previously configured RT targets. Select the RT target you want to use from the list, if it is available.

2. To configure a new RT target, select **Run»Select Execution Target for Debugging»New Execution Target**.

3. In the New Real-Time Execution Target dialog box, enter the computer name or IP address of the RT target in the **Hostname/IP Address** option and click **OK** to exit the dialog box.

Running an RT Application

Select **Run»Debug Project** to run your RT application.

> **Note** If you select **Run»Configuration»Release**, LabWindows/CVI displays a warning message. Click **Continue** to download and run the release DLL on the RT target.

LabWindows/CVI automatically builds the DLL and downloads the DLL and any DLLs that are statically linked to it onto the specified RT target. LabWindows/CVI places the files that it automatically downloads in the NI-RT\CVI\temp folder. LabWindows/CVI empties the folder when you reset the RT device.

While you run your RT application, LabWindows/CVI displays a **<<Running on *target*>>** menu in the upper left corner of the LabWindows/CVI environment. The menu contains the following options, which you can use for debugging and for shutting down the RT application:

- **Toggle Breakpoint**—Turn on or turn off a breakpoint on the selected line when a Source window is active.

- **Break Execution**—Suspend execution of the program.

- **Simulate RT Shutting Down**—End program execution. This option causes the RTIsShuttingDown function to return 1, giving the RT application an opportunity to run any necessary cleanup code and exit. The RT target does not reboot.

- **Abort Execution and Reboot Target**—End program execution and reboot the RT target. The application cleanup code is not guaranteed to finish running before the RT target reboots.

- **Disconnect from RT target**—Disconnect LabWindows/CVI from the RT target while the RT application continues running on the target. Once you disconnect from the RT target, you cannot reconnect LabWindows/CVI to the RT application that is running.

Debugging an RT Application

If you select **Build»Configuration»Debug**, you can debug the DLL from the LabWindows/CVI environment as you would debug any other application. For example, you can set breakpoints and watch expressions, step through code, view and edit variable values, and so on. For more information about debugging in LabWindows/CVI, refer to the *Using LabWindows/CVI» Debugging Tools* section of the *LabWindows/CVI Help*.

Using the Real-Time Execution Trace Toolkit

The LabWindows/CVI Real-Time Module includes a 30-day full-featured evaluation of the Real-Time Execution Trace Toolkit.

Use the Real-Time Execution Trace Toolkit to analyze the timing and execution of an RT application. Use the Execution Trace functions in the Real-Time Utility Library to capture the timing and execution data of functions and threads in an application running on an RT target. The Real-Time Execution Trace Tool displays the timing and event data, or trace session, on the host computer.

In LabWindows/CVI, select **Tools»Real-Time Execution Trace Tool** to launch the Real-Time Execution Trace Tool. Refer to the *LabWindows/CVI Help* for more information about using the Real-Time Execution Trace Toolkit to analyze RT applications.

Deploying an RT Application

When you finish developing your RT application, you can deploy it to an RT target. After you deploy the RT application, the RT application runs automatically every time the RT target reboots.

Select **Run»Install Program to Real-Time Execution Target** to deploy your RT application. This option performs the following actions:

- Checks that the release configuration of the DLL has been built; if not, LabWindows/CVI prompts you to build the DLL or cancel.
- Deploys the release DLL and any statically linked DLLs to the NI-RT\CVI folder on the RT target.
- Sets the release DLL as a startup DLL.
- Displays a dialog box indicating that the DLL was copied and prompting you to reboot the RT target.

If you have additional support files that you need to deploy, complete the following steps:

1. Select **Run»Manage Files on Real-Time Execution Target** to launch the LabWindows/CVI Real-Time File Copy Utility.
2. Click **Add Files** and browse to any support files that your application requires. The utility immediately copies the files to the NI-RT\CVI folder on the RT target.
3. Click **Done** when you finish adding support files.

Where to Go from Here

Refer to the following resources for more information about the LabWindows/CVI Real-Time Module:

- The *LabWindows/CVI Real-Time Module Help* section of the *LabWindows/CVI Help* includes conceptual information about real-time programming techniques, application architectures, and Real-Time Module software features you can use to create real-time applications. Select **Help»Contents** in LabWindows/CVI to access the *LabWindows/CVI Help*.
- Use the NI Example Finder, available by selecting **Help»Find Examples** in LabWindows/CVI, to browse or search for example programs. You also can access the example programs from the samples\CVI samples\realtime directory.