IMAQ™

IMAQ Vision for LabVIEW™ Real-Time User Manual

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About This Manual

This manual contains introductory and installation information for your IMAQ Vision for LabVIEW Real-Time (RT) software and describes how to create a real-time vision application using IMAQ Vision for LabVIEW RT.

Conventions

The following conventions appear 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 on 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. This font 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, and code excerpts.
monospace bold	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen. This font also emphasizes lines of code that are different from the other examples.

Related Documentation

The following documents contain information that you may find helpful as you read this manual:

LabVIEW Real-Time Documentation

- *LabVIEW Real-Time User Manual*
- *LabVIEW Real-Time Release Notes*

IMAQ Vision Documentation

- *IMAQ Vision Concepts Manual*
- *IMAQ Vision for LabVIEW User Manual*
- IMAQ Vision online help

IMAQ Vision Builder Documentation

- *IMAQ Vision Builder Tutorial*
- IMAQ Vision Builder online help

Other Documentation

- Your National Instruments IMAQ PXI device user manual
- *Getting Started With Your IMAQ System*
- *NI-IMAQ User Manual*
- *Vision Deployment Engine Note to Users*
- Your National Instruments PXI controller user manual

Welcome to IMAQ Vision for LabVIEW Real-Time

This chapter introduces IMAQ Vision for LabVIEW Real-Time (RT) and describes how you can use its software components to create a machine vision application for a real-time, deterministic, embedded target.

About IMAQ Vision for LabVIEW RT

With IMAQ Vision for LabVIEW RT, you have all the tools you need to develop a complete machine vision application on a reliable, embedded platform. IMAQ Vision for LabVIEW RT features the image acquisition capabilities of IMAQ hardware and NI-IMAQ software, the real-time programming and execution capabilities of LabVIEW RT, the easy-to-use prototyping features of IMAQ Vision Builder, and the image manipulation and analysis tools of IMAQ Vision. Use these features to manage remote-location image acquisition and analysis from your host machine to create a reliable, embedded vision application.

You can develop your vision application with IMAQ Vision for LabVIEW RT, and then download that code to run on a real-time, embedded target. You can also add National Instruments DAQ, Motion Control, CAN, and serial instruments to your LabVIEW RT system, giving you the ability to create complete, integrated, embedded systems.

System Components and Requirements

Your IMAQ Vision for LabVIEW RT system consists of a development system and one or more deployed RT targets. See Figure 1-1 for an illustration of a complete IMAQ Vision for LabVIEW RT system.

Development System

The development system is made up of two components—a Pentium-based host machine using a Windows operating system and a National Instruments PXI chassis housing a PXI controller. Use the host machine to configure your PXI controller as an RT target and to develop your application. Execute the application remotely on the PXI controller.

The two machines communicate with each other over a network connection and use Measurement & Automation Explorer (MAX) to share configuration settings and software. Chapter 2, *Install and Configure Your Development System*, details how to set up each machine and how they interact with each other.

Note   You will need a network connection during development to configure your RT target and download software and code from your host machine. A network connection is optional at runtime.

Pentium-Based Host Computer

Your host machine must meet the following minimum system requirements:

- Windows XP/2000/NT 4.0/Me/9*x*
- At least 233 MHz Pentium-class MMX processor
- 800×600 (or higher) resolution video adapter, using at least 16-bit color
- Minimum of 64 MB RAM (128 MB recommended)
- Minimum of 50 MB of free hard disk space
- LabVIEW 6.1 or higher
- LabVIEW Real-Time Module 6.1 or higher

National Instruments PXI System

Select the PXI controller that best meets the needs of your application. Table 1-1 lists the different controllers you can use with IMAQ Vision for LabVIEW RT.

Table 1-1. National Instruments RT Series PXI Controllers

Device	Functionality
NI 8175 or NI 8176	Supports full functionality
NI 8170 or NI 8156B	Does not support PXI Video Out
NI 8140 RT Series	Does not support PXI Video Out or configuration.

National Instruments recommends the NI 8175 or NI 8176 for use with IMAQ Vision for LabVIEW RT.

Note   The NI 8140 device does not support configuration because it does not boot into Windows, where you use MAX to configure your camera and acquisition device settings. If you choose to use an NI 8140 device as a deployed RT target, you must first use a controller that supports configuration to configure your camera and acquisition device settings, and then transfer those settings to your NI 8140 device as described in Chapter 2, *Install and Configure Your Development System*.

Your PXI system must also meet the following minimum system requirements:

- Windows XP/2000/NT 4.0/Me/9*x*

- Network adapter, floppy disk drive, keyboard and mouse

- National Instruments IMAQ PXI image acquisition device

- Analog or digital camera and associated cables

- LabVIEW RT run-time license

- IMAQ Vision for LabVIEW RT run-time license

Deployed System

Once you have configured your host development system, you can set up and configure additional LabVIEW RT targets for deployment. These deployed systems use the same hardware and software as your development LabVIEW RT target, and do not require Windows for configuration.

Your deployed LabVIEW RT devices may be connected to the same subnet as your host development system, or you may connect them to a different subnet as required by your application. These connections are illustrated in Figure 1-1. Refer to Chapter 5, *Additional Information About IMAQ*

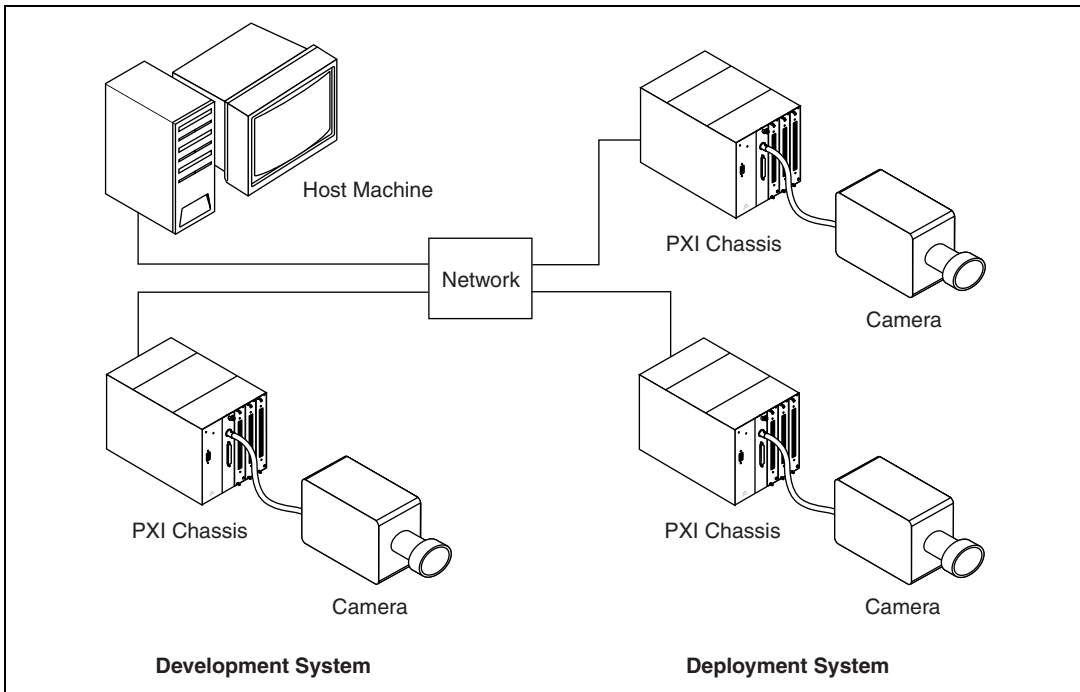*Vision for LabVIEW RT*, for more information about deploying remote systems.

Figure 1-1. IMAQ Vision for LabVIEW RT System Components

Documentation and Examples

In addition to this manual, several documentation resources are available to help you create your vision application:

- *IMAQ Vision for LabVIEW User Manual*—Use this manual as a reference for using IMAQ Vision in LabVIEW.

- *IMAQ Vision Concepts Manual*—If you are new to machine vision and imaging, read this manual to understand the concepts behind IMAQ Vision.

- *IMAQ Vision for LabVIEW* online reference—If you need information about IMAQ Vision palettes or individual IMAQ Vision VIs while creating your application, refer to this help file. Access this file by selecting **Help»IMAQ Vision** from within LabVIEW.

- *NI-IMAQ User Manual*—Use this manual as a reference for using NI-IMAQ to acquire images from your IMAQ hardware.

- Example programs—If you want examples of how to create specific applications, go to `LabVIEW\Examples\Vision`, or see the help file at **Help»Search Vision Examples** from within LabVIEW.

- Application Notes—If you want to know more about advanced IMAQ Vision concepts and applications, refer to the Application Notes located on the National Instruments Web site at `ni.com/appnotes.nsf/`.

- NI Developer Zone (NIDZ)—If you want even more information about developing your vision application, visit the NI Developer Zone at `ni.com/zone`. The NI Developer Zone contains example programs, tutorials, technical presentations, the Instrument Driver Network, a measurement glossary, an online magazine, a product advisor, and a community area where you can share ideas, questions, and source code with vision developers around the world.

Components of IMAQ Vision for LabVIEW RT

IMAQ Vision for LabVIEW RT combines NI-IMAQ driver software, the IMAQ Vision processing library, and the IMAQ Vision Builder prototyping environment. IMAQ Vision for LabVIEW RT provides a comprehensive set of tools and VIs that allow you to quickly and easily create a reliable, embedded machine vision application.

National Instruments IMAQ Devices

National Instruments image acquisition (IMAQ) hardware and Vision software work in a seamless, integrated fashion with National Instruments data acquisition (DAQ) and motion control products. Many IMAQ devices feature the RTSI bus and the PXI trigger bus, which share timing signals across devices to synchronize and correlate images.

NI-IMAQ

NI-IMAQ is a library of routines that work with National Instruments IMAQ devices. NI-IMAQ contains methods for performing tasks ranging from simple device initialization to advanced high-speed image acquisition. The services you need for your application depend on the types of IMAQ devices you have and the complexity of your application.

Note All NI-IMAQ functions are fully supported by IMAQ Vision for LabVIEW RT.

NI-IMAQ also includes a buffer manager that lets you simultaneously acquire and process data. NI-IMAQ uses direct memory access (DMA) to transfer all data to system memory.

NI-IMAQ Functions

NI-IMAQ enhances the performance of National Instruments IMAQ devices by allowing multiple devices to operate at their peak performance, and features both high-level I/O functions for maximum ease of use and low-level I/O functions for maximum flexibility and performance.

NI-IMAQ functions are grouped into three classes: generic, high-level, and low-level. Generic functions include the programming tasks required to set up an acquisition. High-level functions allow you to write programs quickly without having to learn the details of the low-level API and driver. The low-level functions give you greater control over your image acquisition process, but require a more detailed understanding of the API.

Generic Functions—Combine NI-IMAQ Generic functions with high- and low-level functions to perform common activities, such as opening and closing an interface or session.

High-level Functions—Use high-level functions to quickly and easily capture images. If you need more advanced functionality, you can mix high-level functions with low-level functions. The high-level function set supports the following basic types of image acquisition:

- *Snap* acquires a single image to a buffer.
- *Grab* performs an acquisition that loops continually on one buffer; you obtain a copy of the acquisition buffer by *grabbing* a copy to a separate buffer that can be used for analysis.
- *Sequence* performs an acquisition that acquires a specified number of buffers, then stops.

The high-level function set also allows simple triggered acquisitions and the generation of external signals on the trigger lines.

Low-level Functions—Use low-level functions when you require more direct hardware control. The low-level function set supports all acquisition types. You can use low-level functions to perform the following tasks:

- Create and manage your own buffers
- Set session and interface attributes to adjust image quality and size
- Start a synchronous or asynchronous acquisition
- Extract buffers out of a live acquisition for analysis

New Functionality in NI-IMAQ for LabVIEW RT

In addition to supporting all of the functionality of NI-IMAQ in LabVIEW RT, IMAQ Vision for LabVIEW RT introduces a new software utility. IMAQ Hardware Diagnostic, which is included in NI-IMAQ for LabVIEW RT, allows you to remotely run diagnostics on the hardware installed in your PXI chassis. Use IMAQ Hardware Diagnostic to verify your hardware installation as well as your target execution settings. You can also use this utility to test and diagnose your IMAQ devices from your host machine if you experience unexpected hardware errors.

For more information about remotely testing your IMAQ hardware, refer to Chapter 2, *Install and Configure Your Development System*.

IMAQ Vision

IMAQ Vision software provides complete functionality for industrial machine vision and scientific image analysis. IMAQ Vision includes hundreds of functions for gauging and measurement, blob analysis, morphology, edge detection, filtering, image processing, and grayscale and color pattern matching.

IMAQ Vision helps you reduce both the cost and time-to-market of your imaging applications. Transparent memory management and high-level functions built to work together let you develop your application faster, and logically named VIs and parameters make IMAQ Vision easy to use.

IMAQ Vision functions are divided into three categories: Vision Utility, Image Processing, and Machine Vision functions.

Vision Utility Functions—The Vision Utility VIs allow you to create and manipulate images to suit your application's needs. This category of functions includes image management and manipulation VIs, file management VIs, calibration, and region of interest and display VIs.

Image Processing Functions—You can use IMAQ Vision's Image Processing VIs to analyze, filter, and process your images according to the needs of your application. These VIs include functions for analysis, color processing, frequency processing, filtering, morphology, operations, and processing, including the IMAQ Histogram, IMAQ Threshold, and IMAQ Morphology VIs.

Machine Vision Functions—Use the Machine Vision VIs to perform common machine vision inspection tasks, including checking for the presence or absence of parts in an image and measuring the dimensions of

parts to see if they meet specifications. Some examples of machine vision VIs are Caliper VIs and Coordinate System VIs.

✎ **Note**   A small number of IMAQ Vision VIs are not supported under IMAQ Vision for LabVIEW RT. Refer to Appendix A, *Troubleshooting*, for a list of these VIs.

New Functionality in IMAQ Vision for LabVIEW RT

IMAQ Vision for LabVIEW RT introduces two new options for displaying your images: Remote Display and PXI Video Out. These features are accompanied by two new VIs—IMAQ Remote Compression and IMAQ Video Out Display Mode.

IMAQ Remote Compression allows you to configure the method and level of compression for images displayed remotely on your host machine. IMAQ Video Out Display Mode allows you to programmatically set the display mode for the PXI Video Out on your remote LabVIEW RT system.

Refer to Chapter 4, *Display Your Images in IMAQ Vision for LabVIEW RT*, for more information about displaying your images in IMAQ Vision for LabVIEW RT and the new display VIs.

IMAQ Vision Builder

Use IMAQ Vision Builder to acquire your first remote images from your LabVIEW RT system, and then prototype and test image processing applications on those images. To prototype your image processing application, build custom algorithms with the IMAQ Vision Builder scripting feature. The scripting feature records every step of your processing algorithm. After completing the algorithm, you can test it on other images to check its reliability.

Using the LabVIEW VI creation wizard, you can create a LabVIEW VI that implements the prototype you created in IMAQ Vision Builder. You can then run this VI on your host machine or on your remote LabVIEW RT target.

IMAQ Vision Builder makes prototyping easy, with features including a script window where you can record each step in your application and a reference window that houses your original image.

To learn more about prototyping IMAQ Vision applications in IMAQ Vision Builder, refer to the *IMAQ Vision Builder Tutorial*, which contains several interactive examples.

New Functionality in IMAQ Vision Builder for LabVIEW RT

A new remote acquisition module in IMAQ Vision Builder allows you to acquire images from remote LabVIEW RT systems. You can then manipulate those images in IMAQ Vision Builder to prototype applications and solutions.

2

Install and Configure Your Development System

This chapter details each of the steps necessary for setting up your IMAQ Vision for LabVIEW Real-Time (RT) development system. These steps include setting up and configuring your PXI system, preparing your host machine, and downloading software from your host machine to your PXI system. Consult your hardware- and software-specific documentation if you have further installation or functionality questions.

Tip   Before you begin, locate the following documents to use as references during the installation process:

- *LabVIEW User Manual*
- *LabVIEW Real-Time User Manual*
- *LabVIEW Real-Time Release Notes*
- *Your National Instruments IMAQ PXI device user manual*
- *Your National Instruments PXI controller user manual*

What You Need to Get Started

You will need the following items to set up your IMAQ Vision for LabVIEW RT system:

❑   This manual and all related IMAQ and LabVIEW RT documentation

❑   Your Pentium-class host PC with network connections

❑   Your PXI controller with keyboard, mouse, and monitor

❑   Your National Instruments IMAQ PXI device

❑   Camera and associated cables

❑   IMAQ Vision 6.1 Development Module for LabVIEW installation CD

❑   Two floppy disks

❑   CAT-5 crossover cable, if your PXI controller is not connected to a
    network

Table 2-1 illustrates the requirements and components of each part of your
IMAQ Vision for LabVIEW RT system—your host machine and your
remote PXI chassis.

Table 2-1. Host and Remote System Requirements

Requirement	Host	Remote
Hardware	Refer to Chapter 1, *Welcome to IMAQ Vision for LabVIEW Real-Time*, for the minimum system requirements for your host machine.	National Instruments PXI controller (Refer to Table 1-1, *National Instruments RT Series PXI Controllers*, for specific controller information) National Instruments IMAQ PXI image acquisition device Analog or digital camera and associated cables
Operating System	Windows XP/2000/ NT 4.0/Me/9*x*	Windows XP/2000/NT 4.0/Me/9*x* for configuration LabVIEW RT run-time kernel (after booting up from PXI boot disk) for software development and execution
Software	LabVIEW 6.1 or higher LabVIEW Real-Time 6.1 or higher IMAQ Vision for LabVIEW Real-Time	NI-IMAQ 2.5.1 or higher
Licensing	Your IMAQ Vision license is included with your purchase of IMAQ Vision for LabVIEW RT.	You must purchase an IMAQ Vision for LabVIEW RT run-time license and a LabVIEW RT run-time license for your remote RT system and each deployed RT system. Visit ni.com for more information on purchasing run-time licenses.

Set Up Your Host PC

Your host machine serves as the command center for your LabVIEW RT system. Follow these steps to set up and configure your host machine:

1. Install LabVIEW from the LabVIEW installation CD. The installation program, `autorun.exe`, launches automatically when you load the CD.

2. Install LabVIEW RT. The installation program, `autorun.exe`, launches automatically when you load the CD.

Note If you are using a machine running Windows 2000/NT/XP, you must log on as an administrator or as a user with administrator privileges in order to install LabVIEW RT.

3. Insert your Vision installation CD into your CD-ROM drive.

Loading the CD-ROM launches `autorun.exe`, which begins the installation process. Follow the on-screen directions to install all of the components of IMAQ Vision for LabVIEW RT.

Create Your Configuration Disk

Installing IMAQ Vision for LabVIEW RT installs a utility named `ConfigureIMAQRT.exe` on your host machine. The following steps describe how to copy this utility onto a floppy disk for use later in the setup process:

1. Insert one of your blank floppy disks into the `A:\` drive of your host machine.

2. Browse to your `<ni-imaq>\bin` directory.

3. Select `ConfigureIMAQRT.exe`, and copy the file onto your floppy disk.

4. Remove the disk from your floppy drive and label it **Configure IMAQ RT**.

Create Your PXI Boot Disk

You now have all of the necessary components installed on your host machine, and you are ready to create a boot disk that you can use to boot your PXI controller into LabVIEW RT.

1. Close any open Windows Explorer windows.

2. From your host machine, open MAX and select **Tools»Remote Systems»Disk Utilities»Create PXI Boot Disk**.

3. Insert your second blank floppy disk into the A:\ drive of your host machine and click **Make Boot Disk**.

✑ **Note** Do not use the same floppy disk that you used for the **Configure IMAQ RT** utility.

4. Remove the disk from your floppy drive and label it "PXI Boot Disk."

In the next section you will install your IMAQ device.

Prepare Your PXI Chassis for Image Acquisition

The next step in setting up your LabVIEW RT system is to install your IMAQ hardware and prepare your PXI chassis for image acquisition.

You will use Windows on your PXI controller to configure your IMAQ device and camera. When you are ready to develop and execute your application, you will boot your controller into LabVIEW RT using the boot disk you created in the last section.

1. Power on your PXI controller. The system boots into Windows.

✑ **Note** You must boot your PXI controller into Windows in order to configure your device and camera. If Windows is not already installed on your PXI controller, refer to Appendix A, *Troubleshooting*, for more information.

✑ **Note** If you purchased your IMAQ PXI image acquisition device and PXI controller at the same time, your IMAQ image acquisition device and NI-IMAQ software may already be installed on your PXI controller. If you have MAX installed, use MAX to detect whether you have the required version of NI-IMAQ installed by clicking the **Software** folder under **My System**. If MAX detects that you have the required version of NI-IMAQ installed, proceed to the next step: *Check Your Camera Settings With Measurement & Automation Explorer*.

2. Locate the installation CD that was included in your IMAQ hardware shipment, and install NI-IMAQ according to the on-screen directions.

Install Your IMAQ Device

⚠ **Caution**   Make sure that your PXI controller is off and unplugged before beginning your hardware installation.

1. Select an unused PXI 5 V peripheral slot. Install your IMAQ device in a slot that supports bus arbitration or bus-master cards. PXI-compliant chassis must have bus arbitration for all slots.

2. Remove the filler panel for the peripheral slot you have chosen.

3. Touch a metal part on your chassis to discharge any static electricity that might be on your clothes or body.

4. Insert your IMAQ device into the selected 5 V slot. Use the injector/ejector handle to fully inject the device into place.

5. Screw the front panel of your IMAQ device to the front panel mounting rails of the PXI chassis.

6. Visually verify the installation.

7. Replace the power cord and power on your PXI chassis.

8. Connect your camera to your IMAQ device with the appropriate cable.
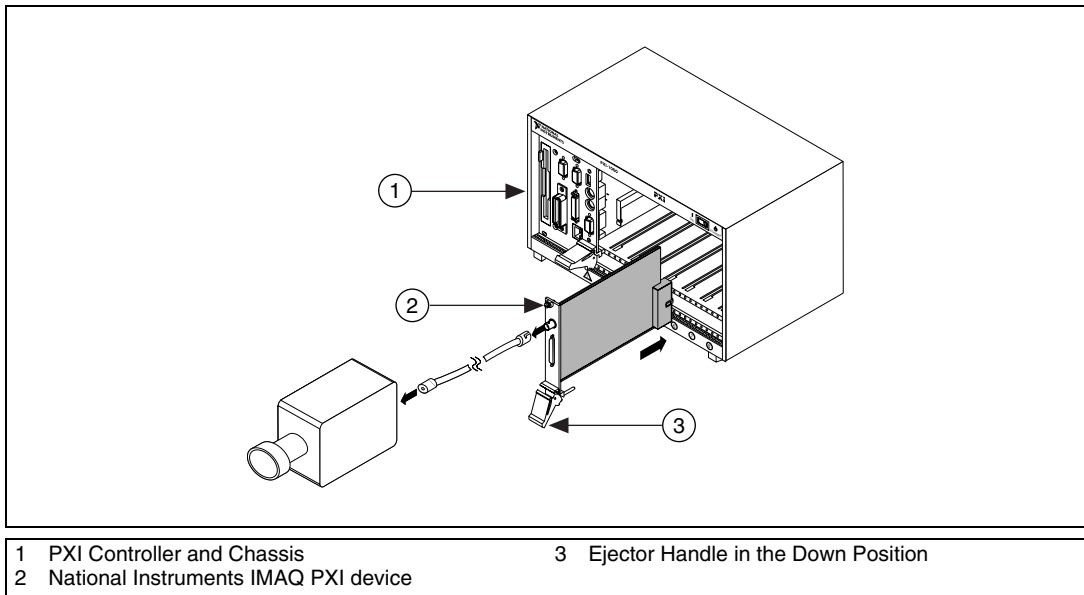

| 1 | PXI Controller and Chassis | 3 | Ejector Handle in the Down Position |
| 2 | National Instruments IMAQ PXI device | | |

Figure 2-1. Installing Your IMAQ Device

Tip For detailed information on installing this device, including unpacking and safety information, see your hardware device-specific documentation.

Your remote system is now equipped for image acquisition.

Check Your Camera Settings With Measurement & Automation Explorer

Use MAX to modify your camera and device properties.

1. Power on your PXI controller. You will modify these properties in Windows.

2. Launch MAX by double-clicking the icon on your desktop.

3. Expand **Devices and Interfaces** to reveal a list of your installed IMAQ devices. Select your IMAQ device from the list.

4. Click the **Diagnostic** button on the toolbar to open the diagnostics window, and click **Run Tests** to run the diagnostics tests on your IMAQ device.

5. Click the **Properties** button on the toolbar to view or modify the configuration.

6. Click the **+** next to your IMAQ device to display a list of the available channels.

7. Right-click on one of the channels to obtain a list of camera types.

8. Choose the appropriate camera type from the list. The types of cameras available vary according to your IMAQ device.
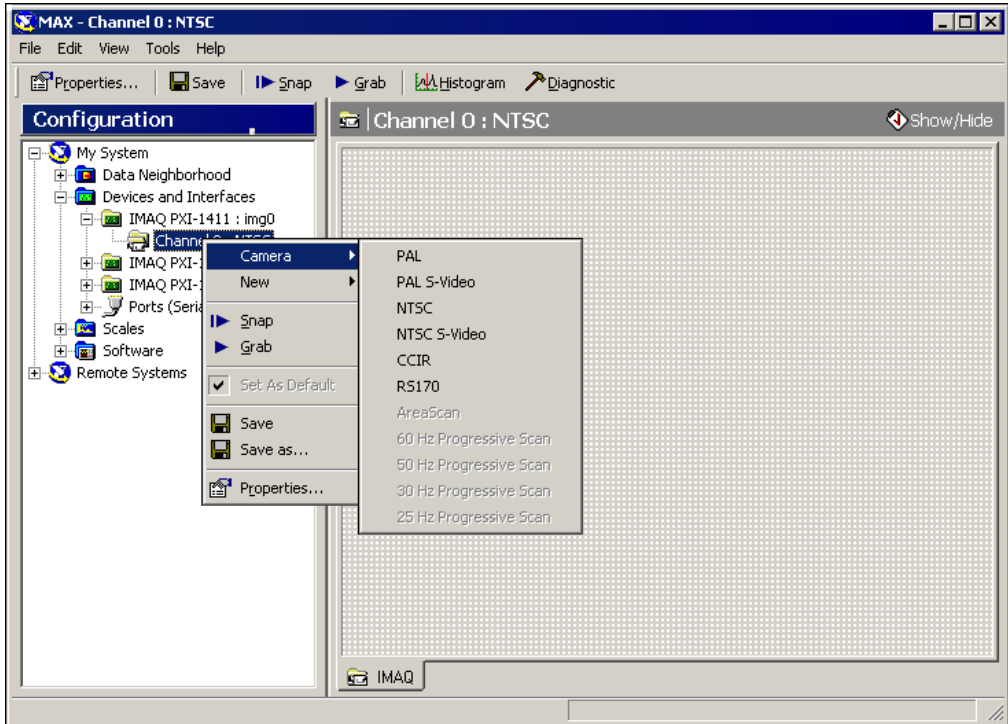
9. Click **Properties** to view or modify the camera files.

✎   **Note** If you are using a digital camera that is not listed in MAX, you must go to `ni.com/cameras` to download the appropriate camera file.

Note the interface name associated with your camera. You will refer to your acquisition device later using this interface name. MAX specifies `img0` as the default interface name.

10. When you are satisfied with your property settings, click **OK** to close the window. You are now ready to perform an acquisition.

11. In MAX, right-click on the channel associated with your camera and select **Grab**.

A live video image opens in your MAX window. Take this opportunity to focus your camera, adjust its position, and set up your lighting. Manipulate each of these options until you achieve satisfactory image conditions.

12. When you are satisfied with your image conditions, click the **Grab** button to stop the acquisition, and exit MAX.

Transfer Your RT Configuration Settings

Now that you have configured your camera settings in MAX, use `Configure IMAQ RT.exe`, which you created earlier in the setup process, to transfer those settings to the RT portion of your system. Refer to the *Configure Your PXI Controller as a Remote Device* section of this chapter for more information about this executable file.

1. Close MAX.

2. Insert the floppy disk labeled "Configure IMAQ RT" into the `A:\` drive of your PXI controller.

3. Copy the file onto your desktop.

4. Double-click the file to run the application.

Note   Whenever you use MAX to change your configuration settings in Windows, you must run this executable again in order to update your RT configuration to reflect those changes.

Configure Your PXI Controller as a Remote Device

This section describes how to boot your PXI controller into RT and how to name and locate the remote device on your network.

LabVIEW RT lets you provide a unique host name and IP address for your remote device. To set up your network configuration, your remote device must be installed on the same network subnet as your host machine.

Note   If your remote device is not installed on the same network subnet as your host machine, use a CAT-5 crossover cable to connect your system.

1. Insert the PXI boot disk into the `A:\` drive.

2. Shut down Windows and reboot the PXI chassis.

The controller boots up into a text screen displaying the IP address of the remote device. Notice that the IP address is currently `0.0.0.0`.

Note   If your controller booted up into Windows, you will need to edit your BIOS boot settings to instruct the controller to boot from your floppy drive. Refer to Appendix A, *Troubleshooting*, for more information.

3. Return to your host machine, and open MAX from your host machine. Double-click **Remote Systems** in the left pane to expand the list of available LabVIEW RT targets.

4. Select your PXI controller, which is listed by its serial number.

5. Click the **Network Settings** tab at the bottom of the right pane.

   The **Device ID and IP Settings** window opens. Use this window to define the host name and IP address for your host system.

6. Specify a unique host name and an IP address.

   You may assign an IP address using one of these methods:

   • Select **Obtain IP Address from DHCP server** to have the DHCP server on your network allocate an IP address to your PXI controller each time the PXI controller is booted.

   • Select **Edit the IP Settings** to enter a predetermined IP address and configure the **Subnet Mask**, **Gateway**, and **DNS Address** network parameters for your PXI controller.

Tip Contact your network administrator if you need additional assistance in configuring your remote device on your network.

7. Click **Apply**. The network settings for your remote device are now saved.

8. Click **Yes** when MAX prompts you to reboot your remote device.

When the remote system reboots, the designated IP address appears in the right pane of MAX. The status message `Connected – No software installed` appears in the bottom right corner of the MAX window, indicating that you have configured your PXI controller correctly and that you are connected to the network.
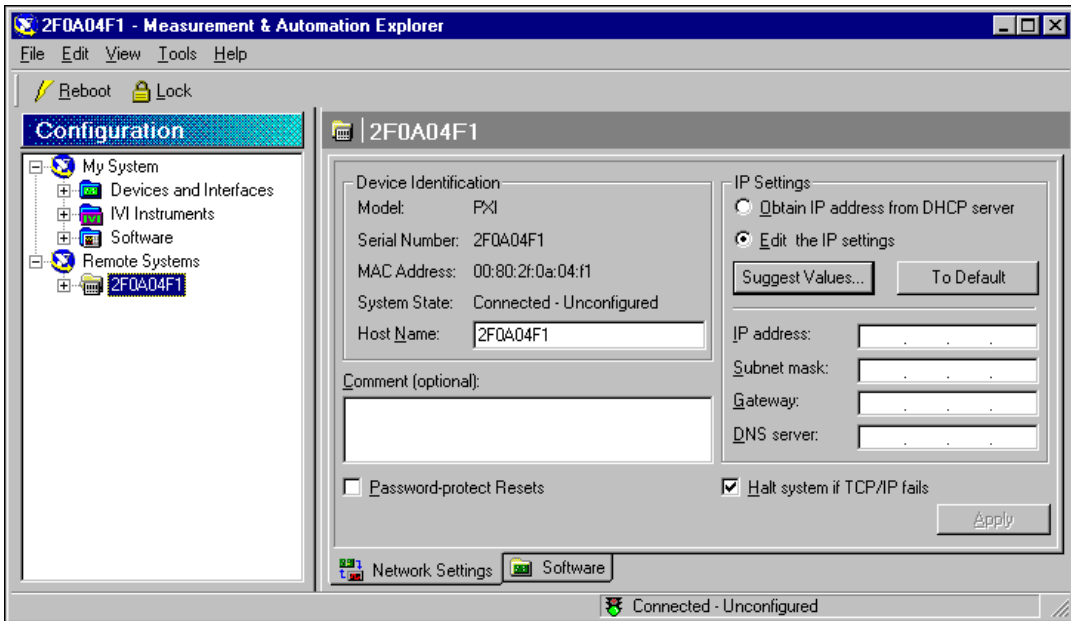
Remotely Install Your IMAQ Vision for LabVIEW RT Software

Use MAX to install NI-IMAQ RT and IMAQ Vision RT from your host machine onto your target system. These components enable your remote device to acquire and analyze images as directed by your host machine.

1. Click the **Software** tab at the bottom of the right pane in MAX.

2. Right-click anywhere in the right pane and select **Install Software**.

   The right pane displays all of the software that is installed on your host machine and remote device, and provides version information for each component. Use this list to select the components that you want to transfer from your host machine to your remote device.
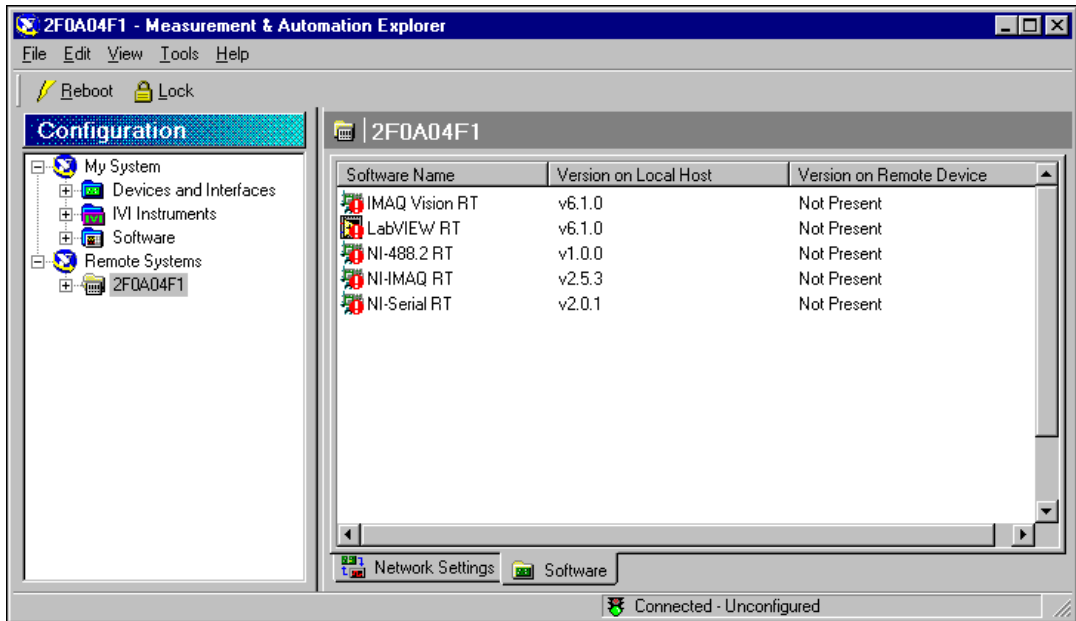
3. Select the following software components—IMAQ Vision RT, LabVIEW RT, and NI-IMAQ RT.

✏ **Note**   If your application requires any additional software components, you may also select them at this time.
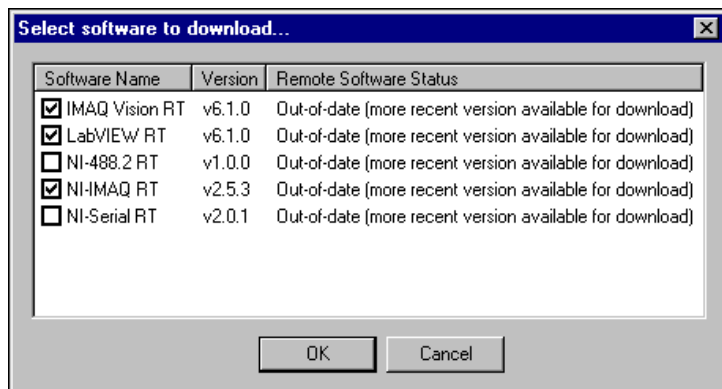
4. Click **OK**.

Note   MAX prompts you that the software updates will overwrite existing software and requests confirmation before beginning the installation. Click **Yes** to proceed.

MAX reboots the PXI controller and installs the software that you selected. You can monitor the progress of the transfer in the dialog box that opens in the center of the MAX window.

Remotely Test Your IMAQ Hardware

Before you begin developing your IMAQ Vision for LabVIEW RT application, you should test the IMAQ hardware you installed in your RT chassis to ensure that all of your devices are installed correctly. This test is also your first test of running a LabVIEW RT-based IMAQ application on your remote system.

1. Launch LabVIEW from your host machine.

2. Select **Switch Execution Target** from the LabVIEW launch screen or select **Operate»Switch Execution Target**. The target platform selection dialog opens.

3. Select **RT Engine on Network** from the drop-down list.

4. Enter the IP address of your remote target.

5. Click **OK**. LabVIEW closes all open VIs and returns to the startup screen.

   The network address of your PXI controller is displayed in the bottom left corner of the LabVIEW RT window. This verifies that the target execution is configured properly.

6. Click **Open VI**.

7. Browse to `<ni-imaq>\bin\imaqdiag.llb\IMAQ Hardware Diagnostic.vi`.

8. Run the VI. Save the VI if prompted. LabVIEW RT indicates that it is downloading the VI and will run the VI when the download is complete.

   The VI detects the hardware installed in your PXI chassis, and displays the results in the **Detected Interfaces** listbox on the front panel.
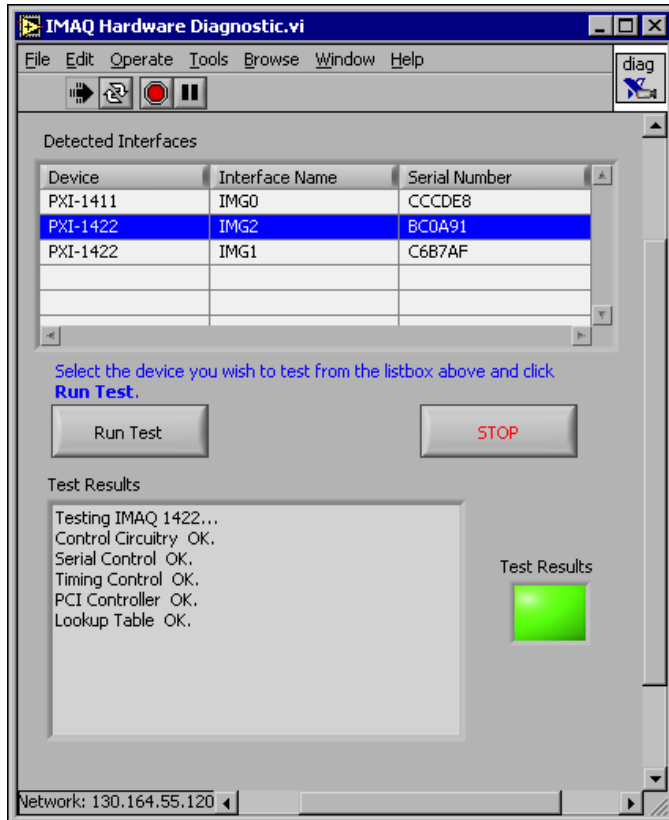
9. Select the name of the device you want to test and click **Run Test**. You can view the results of each test in the **Test Results** dialog box on the front panel.

10. Click **Stop** after you have run diagnostics on each of the hardware devices installed in your PXI chassis.

In the next chapter, you will learn how to perform these IMAQ Vision for LabVIEW RT tasks:

•   Acquire, process, and analyze an image in IMAQ Vision Builder

•   Create a LabVIEW RT VI based on the processing algorithms you used in IMAQ Vision Builder

•   Run your LabVIEW RT VI on your remote system

3

Develop Your IMAQ Vision for LabVIEW RT Application

This chapter describes how you can use IMAQ Vision Builder to acquire images from a remote LabVIEW Real-Time (RT) target device, prototype and test your own image processing algorithms, and then create LabVIEW VIs to run on your LabVIEW RT target device.

IMAQ Vision Builder is a tool for prototyping and testing image processing applications. Build custom algorithms with the IMAQ Vision Builder scripting feature to test your image processing application. The scripting feature records every step of your processing algorithm. After completing the algorithm, you can test it on other images to evaluate its performance.

IMAQ Vision Builder can generate a builder file from your image processing script. Builder files are ASCII text files that list the processing functions and relevant parameters for an algorithm that you prototype in IMAQ Vision Builder. Using the LabVIEW VI Creation Wizard, you can create a LabVIEW VI from that builder file that performs the steps you prototyped in IMAQ Vision Builder. You can then run this LabVIEW VI on your remote LabVIEW RT device, or modify it by adding your own additional functionality.

Launch IMAQ Vision Builder

1. From your host machine, open IMAQ Vision Builder (**Start»Programs»National Instruments IMAQ Vision Builder**).

2. Click **Acquire Image**.

   The **Acquisition Module** drop-down list shows the several different modules you can use to acquire images—the simulation module, the National Instruments IMAQ acquisition module, and the National Instruments IMAQ Remote acquisition module.

3. Select **National Instruments IMAQ Remote** from the Acquisition Module drop-down list.

4. Click the **IMAQ Remote** tab.

5.   Enter the IP address or unique machine name for your remote device in the **Remote Address** field. Use the IP address or machine name that you configured for your remote target in Chapter 2, *Install and Configure Your Development System*.

6.   If the PXI controller is locked, enter the system configuration password.

✎   **Note**   The system configuration password is set in MAX, and is used to lock the configuration and reset of a remote system. (Refer to your *RT Series PXI QuickStart Guide* for details about locking a controller.)

7.   Enter the interface name. Use the same interface name you entered during setup.

You are now ready to acquire your first remote image.

Acquire an Image

Now that you have finalized your remote camera settings and your remote device is configured on your network, you are ready to acquire an image directly into IMAQ Vision Builder.

1.   Click **Acquire Single Image**. The acquired image is displayed in the right window of IMAQ Vision Builder.

2.   Click **Acquire Continuous Image** to acquire a continuous stream of images from your remote RT target.

3.   Click **Acquire Continuous Image** again to stop the acquisition.

The next step explains how to compress your acquired images to improve the transfer time for moving images between your remote target and your host machine.

Configure Your Compression Settings

When you display images that you acquired on your remote machine, LabVIEW must send those images over your network. This transfer can take up a large amount of your network bandwidth, especially for large images. The IMAQ Vision Builder remote acquisition module allows you to compress those images to limit the network bandwidth used by the image acquisition process. You can enable compression and specify your image quality in the **Parameters** tab.

1. Click the **Parameters** tab.

2. Select the **Compression** check box if you want to compress your images for display.

3. Enter an image quality score between 0 and 1000.

   Lower values correspond to images with higher compression but lower image quality due to compression artifacts. Higher values correspond to images with less compression but better image quality due to fewer compression artifacts. Images with a quality of 1000 undergo no compression and have no compression artifacts.

✎ **Note** Your compression settings only affect continuously acquired images that are transferred across your network for display on your host machine. Compression is not enabled for single image acquisition.

4. Click **Acquire Continuous Image** again to acquire images from your remote target.

5. Click **Return** when you have an acceptable image. You will be prompted to store your image in the **Image Browser**. Click **Yes** to accept.

Now use IMAQ Vision Builder to analyze and process your acquired image.

Process Your Image

As you apply various machine vision and image processing functions to your image, each step is saved in a script. You can view the current script in the **Script Window**. You can then create a LabVIEW VI from your script and run that VI on your remote PXI controller.

The following steps demonstrate some of the image processing operations you can perform on your image with IMAQ Vision Builder. See your *IMAQ Vision Builder Tutorial* for more information on using IMAQ Vision Builder.

1. Double-click on your image in the image browser.

   Your image opens in the center of your IMAQ Vision Builder window. This large window is the **Processing Window**. Your original image is displayed in the **Reference Window**. You can return to this original image at any time by clearing your script with the **New Script** button or by clicking **Begin** in the script listbox.

2. Select **Grayscale»Filters**.

Note   If you acquired a color image, the **Filters** menu item is grayed out. For the purposes of this example, convert your image to grayscale by selecting **Color»Extract Color Planes** and selecting **HSL-Luminance Plane** before performing step 2.

Filters can smooth, sharpen, transform, and remove noise from an image so that you can extract the information you need. To sharpen edges, including the edges of any holes inside a particle, and create contrast between the particles and the background, follow these steps:

3. Select **Convolution-Highlight Details** from the **Filters** list.

This function looks for sharp transitions and highlights edge pixels according to a kernel to make gaps more prominent. A kernel is a structure that represents a pixel and its relationship to its neighbors. Refer to your *IMAQ Vision Concepts Manual* for more information about kernels.

You can change the size of the kernel used for the filter in the **Processing Window**, which is located just beneath your image. Try setting your filter size to each of the kernel sizes—3×3, 5×5, and 7×7—to view the different levels of detail you can achieve with this function.

4. When you are satisfied with your filter operation, click **Apply**.

The **Filters: Convolution - Highlight Details** step is now listed in your script. To make changes to any step in the script, double-click on that step.

5. Click **Close**.

Note   Remember that all IMAQ Vision Builder image-processing functions are accessible through the menu bar at the top of the screen.

Create a LabVIEW VI from Your IMAQ Vision Builder Script

Now use IMAQ Vision Builder to automatically create a VI based on your script.

1. Select **Script»Create LabVIEW VI**. The LabVIEW VI Creation Wizard opens.

Tip   See your IMAQ Vision Builder documentation for more information on the LabVIEW VI Creation Wizard.

2. Select **Current Script** as the script you want to use to create your VI. Click **Next**.

3. Select **Image Acquisition Board** as your image source, and **Snap** as your acquisition type. Click **Next**.

   The next screen in the wizard allows you to choose which parameters should appear as controls and indicators on your front panel. If an item in the left column is selected, it appears as a control in LabVIEW. Similarly, if an item is selected from the right column, it appears as an indicator in LabVIEW.

4. Click **Finish** to complete the LabVIEW VI Creation Wizard.

When you click **Finish**, LabVIEW launches and displays the front panel and block diagram of the VI you created in IMAQ Vision Builder.

You can now download and run your VI on your remote LabVIEW RT target.

Run Your VI in LabVIEW RT on Your Remote Target

1. In LabVIEW, select **File»Save** to save the VI you created in IMAQ Vision Builder.

2. Select **Operate»Switch Execution Target**. The target platform selection dialog opens.

3. Select **RT Engine on Network** from the drop-down list.

4. Enter the IP address and machine name of your remote target.

5. Click **OK**. LabVIEW closes all open VIs and returns to the startup screen.

   The network address of your PXI controller is displayed in the bottom left corner of the LABVIEW RT window.

6. Open your saved VI.

✎ **Note**   Ensure that the interface name on your front panel or diagram matches your intended remote interface. IMAQ Vision Builder specifies `img0` by default.

7. Click **Run**. Your VI executes as soon as LabVIEW finishes downloading it to the remote target.

Notice that your image is displayed on your host machine. You will learn more about display options in IMAQ Vision for LabVIEW RT in the next chapter, *Display Your Images in IMAQ Vision for LabVIEW RT*.

4

Display Your Images in
IMAQ Vision for LabVIEW RT

IMAQ Vision for LabVIEW Real-Time (RT) gives you two options for displaying your images: Remote Display and PXI Video Out. Choose the display option that best fits the needs of your application.

Use Remote Display during development and debugging to view your images from your host machine just as you would view the LabVIEW front panels of the VIs running on your RT system. Use PXI Video Out to display your images on a monitor connected to your remote LabVIEW RT system.

Remote Display

IMAQ Vision for LabVIEW RT includes a Remote Display feature that allows you to acquire images on your remote system and view them on your host machine. Remote Display is automatically enabled when you use any of the IMAQ Vision display VIs with IMAQ Vision for LabVIEW RT, such as IMAQ WindDraw, IMAQ ShowTools, and IMAQ Construct ROI.

Remote Display is useful for monitoring and debugging your IMAQ Vision for LabVIEW RT applications. Familiarize yourself with how Remote Display works before using this feature. The following details will help you prepare your application for use with Remote Display:

- Remote Display is a front-panel feature. Therefore, your LabVIEW front-panel must be open for you to see images displayed using Remote Display.

- Remote Display performs best when combined with IMAQ Remote Compression. When you display images on your remote machine, LabVIEW must send those images over your network. This process can take up a large amount of your network bandwidth, especially when transferring large images. IMAQ Remote Compression allows you to specify compression settings for those images to reduce the network bandwidth used by the display process. In addition, compressing images may increase your display rates on slower networks.

- IMAQ Remote Compression uses two types of compression algorithms. The first is a lossy JPEG compression algorithm. This method works best on non-binary images. You can also use a lossless Packed Binary compression algorithm for binary images. See your IMAQ Vision VI Reference help for more information on the IMAQ Remote Compression VI.

Note   JPEG Compression may result in data degradation of the displayed image. There is no degradation of the image during processing. Test various compression settings to find the right balance for your application.

- Using Remote Display can affect the timing performance of your IMAQ Vision VIs. Do not use Remote Display if your program contains a time-critical loop.
- Disconnecting your remote system from your host machine disables Remote Display. Disabled Remote Display VIs do not affect the performance of your application. When you reconnect LabVIEW RT and your host machine, Remote Display is automatically re-enabled.

Tip   Refer to the *Remote Display Errors* section in Appendix A, *Troubleshooting*, for more information about Remote Display.

PXI Video Out

PXI Video Out allows you to display images on a monitor that is connected to your PXI controller. To access this feature, input 15 for the **Window Number** parameter in the IMAQ WindDraw VI.

Note   This feature is only available on PXI controllers that feature the i815 chipset, such as the National Instruments PXI-8175/76 Series controllers.

PXI Video Out also supports overlay functionality. Overlay text is limited to one size and one font.

This display option is not a time-bounded operation. For more information about time-bounded operations, refer to Chapter 5, *Additional Information About IMAQ Vision for LabVIEW RT*.

To programmatically configure your system to use PXI Video Out to display system images, use the IMAQ Video Out Display Mode VI. This VI allows you to set parameters for screen area, color depth, and refresh frequency.

Tip Try the HL Grab (Video Out) or the Video Setup example for a demonstration of interactively setting your PXI Video Out display mode.

IMAQ WindDraw and IMAQ WindClose are the only IMAQ Vision display functions that support PXI Video Out. To use these VIs with PXI Video Out, you must specify Window Number 15.

5

Additional Information About IMAQ Vision for LabVIEW RT

This chapter provides valuable information about using IMAQ Vision for LabVIEW Real-Time (RT) and describes some basic elements of real-time systems, including determinism and time-bounded algorithms.

Determinism

Real-time determinism measures the consistency of a specified time interval between events. Deterministic behavior is often required for control algorithms, which must also be time-bounded. A time-bounded application is a routine that predictably executes within a known amount of time, regardless of initial conditions. A routine is not time-bounded if its execution time depends on input parameters or an initial state.

A real-time operating system, such as the one used to power the embedded RT engine, does not explicitly guarantee completely deterministic applications. However, programming choices and function characteristics can render an application time-bounded.

Determinism in IMAQ Vision for LabVIEW RT

IMAQ Vision for LabVIEW RT VIs can be divided into two categories of determinism—VIs that are never time-bounded and VIs that can be made time-bounded by applying the programming techniques discussed in this chapter.

When designing a LabVIEW RT application with IMAQ Vision for LabVIEW RT, try to use time-bounded image processing routines that execute deterministically to ensure that two calls to the same routine do not vary in overall execution time. In cases where it is not possible to use time-bounded image processing routines, benchmark the performance of

your application on a large set of sample images in order to obtain an approximate execution time. Most applications achieve the necessary level of consistency and reliability by combining the properties of a deterministic operating system with data from the sample set.

Parallel Processing in LabVIEW RT

LabVIEW passes images by reference, meaning that splitting an image wire creates a new reference to an existing image. IMAQ Vision locks images while you are processing them in order to prevent operations on different wires, or reference images, from interfering with each other. IMAQ Vision then waits until the image is available for processing, or "unlocked," before running the function. This feature makes any IMAQ Vision VIs that use images unbounded, since parallel operations may cause these functions to wait for varying amounts of time.

You can avoid this behavior by configuring your application to process images sequentially rather than in parallel.

Memory Allocation in LabVIEW RT

Any operation that must allocate memory is inherently unbounded since the time required to allocate memory is determined by the state of your system. Therefore, any function that must resize image data, such as IMAQ SetImageSize, is unbounded.

Many IMAQ Vision VIs take an optional destination image. Often, these functions resize your destination image to match the size of your source image. For these VIs, pre-allocate the size of the destination image to match that of the source image before reaching the time-critical portion of your application.

Image Size Considerations

Some IMAQ Vision VIs, such as IMAQ Threshold, are time-bounded on the assumption that the image size remains constant throughout the application and that no other operations are using the same image in parallel. Since many of these algorithms process images acquired by a single sensor, the image size is consistent throughout the application.

Acquisition VIs

IMAQ Vision's acquisition VIs are time-bounded when the application meets the following criteria:

- The destination image does not require resizing

- Your camera is connected to your system and is working properly

- No other significant traffic is moving across your PXI bus

File I/O and Display VIs

File I/O and display VIs are inherently unbounded. However, Remote Display VIs become time-bounded when your target device is disconnected from your host machine, since remote display requires a connection with the host. Refer to Chapter 4, *Display Your Images in IMAQ Vision for LabVIEW RT*, for more information about Remote Display functionality.

Data Driven VIs

Image processing VIs that are completely data-driven are never time-bounded. A number of IMAQ Vision algorithms, such as pattern matching, color matching, edge detection, particle analysis, and some morphology operators fall into this category because their execution times depend on the content of the input image. For these algorithms, the execution time varies from image to image.

For example, IMAQ Basic Particle detects binary particles in an image. Its execution time depends on the contents of each image—the number of particles, their sizes, and their relative positions. Because images vary greatly in their contents, these types of VIs cannot be time-bounded.

Image Files

Many applications require you to use external files, such as the template files used by pattern matching and spatial calibration functions. Before running your external application on your remote target, you must use FTP to transfer any external image files from your host machine to your remote target. For more information about using FTP, refer to your *LabVIEW Real-Time User Manual*.

Deployment

Once you have finished developing your IMAQ Vision for LabVIEW RT application, you may want to deploy that application to a number of remote systems. In order to achieve consistent results from your IMAQ Vision for LabVIEW RT application, you must configure these deployed systems with the same settings you used for your development system.

✎ **Note** Each deployed system must have its own RT Series PXI controller and software. Visit ni.com for ordering information.

One configuration option is to boot each deployed system into Windows and configure them manually using MAX in the same manner as you configured your development system. However, this option requires that you have Windows installed on each of your deployed remote targets.

Another configuration option is to use the FTP utility that is built into LabVIEW RT. IMAQ Vision for LabVIEW RT lets you simply copy your configuration settings to your RT controllers using FTP—eliminating the need to individually reconfigure your deployed cameras and IMAQ hardware in Windows.

✎ **Note** You must purchase an IMAQ Vision for LabVIEW RT run-time license and a LabVIEW RT run-time license for each deployed IMAQ Vision for LabVIEW RT system. Refer to ni.com for more information about purchasing run-time licenses.

Use the same installation procedures you used to set up your development target device to set up your deployed systems. For detailed information about each of these steps, refer to Chapter 2, *Install and Configure Your Development System*.

1. Install your IMAQ device.

2. From your host machine, use MAX to install LabVIEW RT, NI-IMAQ RT, and IMAQ Vision RT on each deployed target device.

    You are now ready to copy your configuration settings.

3. From your host machine, use FTP to copy the contents of the C:\ni-imaq\data directory from development RT target to the same folder on your host machine.

4. Use FTP to transfer the contents of this folder from your host machine to the same directory on your deployed target device.

Note   Refer to your *RT Series PXI/Compact PCI User Manual* for more information about using FTP with your PXI controller.

Once your configuration settings are copied to your deployed target device, use LabVIEW RT to download your application to your controller. For more information about this process, refer to your *LabVIEW Real-Time User Manual*.

A

Troubleshooting

This appendix describes solutions and suggestions for common errors in IMAQ Vision for LabVIEW Real-Time (RT).

PXI Controller Errors

What if I don't have a PXI chassis and controller?

Please contact your local NI sales representative.

Why can't Measurement & Automation Explorer find my PXI controller?

Try the following techniques if your PXI controller does not appear in Measurement & Automation Explorer:

- When configuring the PXI controller, ensure that the controller is located on the same subnet of your network as the host PC. If you are unsure of your network configuration, consult your network administrator for assistance.

- If you do not have a keyboard connected to the PXI controller, check the BIOS settings of the controller. The **Halt On** setting must be set to **All, But Keyboard** for the PXI controller to boot without a keyboard connected. You can find the **Halt On** setting in the **Standard CMOS Setup** options. Refer to your PXI controller user manual for more information about BIOS settings.

Why does my PXI controller boot into Windows when I use my PXI boot disk?

Check the BIOS setting for the **Boot Sequence** of your PXI controller. The boot sequence for your PXI controller defined in the BIOS settings must be set to **A,C,...** to boot from a floppy disk. If the **Boot Sequence** setting is set to boot from the C:\ drive before the A:\ drive, the controller only boots into Windows. You can find the **Boot Sequence** setting in the **BIOS Features Setup** settings. Refer to your PXI controller user manual for more information about BIOS settings.

What if Windows is not already installed on my PXI controller?

If you ordered your PXI controller separately from your IMAQ Vision for LabVIEW RT package, your controller may not have Windows pre-installed. Windows is required on your development controller in order to configure your camera and acquisition device. Please contact your local sales representative to have Windows installed on your PXI controller. A complete list of internal offices is included at the back of this manual.

Remote Acquisition Errors

Why am I unable to use the Remote Acquisition Module in IMAQ Vision Builder?

Check to make sure that you have IMAQ Vision for LabVIEW RT installed on your PXI controller. Refer to Chapter 2, *Install and Configure Your Development System*, for more installation information.

If you experience further problems with the Remote Acquisition Module, verify that the following system components are configured correctly:

- **Camera Connection**—Make sure that your camera is properly connected to your IMAQ device. The camera should also be powered according to the camera manufacturer's specifications.

- **Remote IP Address**—Ensure that the Remote IP address is correct. This address is displayed on the **Settings** tab in MAX as well as on your remote system monitor during startup.

- **Interface Name**—Run the remote IMAQ Hardware Diagnostic utility to verify the interface names that are configured on your system. Each detected interface should pass the diagnostic tests.

If you continue to receive errors, contact National Instruments Technical Support. Technical Support information is available in Appendix B, *Technical Support and Professional Services*.

Configuration Errors

Why does `Configure IMAQ RT.exe` tell me that it is unable to configure my interface?

This error occurs when you specify an interface name that contains more than eight characters.

When you defined your configuration settings in MAX, you saved those settings in a file that uses the name of the interface plus the `.iid` extension.

However, because LabVIEW RT only supports files that use the 8.3 naming convention, any configuration files that have an interface name longer than eight characters are rejected when you try to copy them to the target device with `Configure IMAQ RT.exe`.

To correct this error, launch MAX from your RT target. Load your original interface. Right-click on that interface and select **Save As**. Give the interface a new name that uses eight or fewer characters. Once you have saved the new configuration file, you must remove the old one. Browse to your `<ni-imaq>\data` directory and delete the old file. You should now be able to run `Configure IMAQ RT.exe` with no errors.

Remote Display Errors

Why am I unable to display remote images?

The IMAQ Vision Remote Server controls the display of images that are acquired from your remote systems. If you are unable to display your remote images, press <Ctrl-Alt-Del>, which opens the Windows Task Manager, and confirm that `NIVisSvr.exe` is running as an active process. If `NIVisSvr.exe` is not running, close and restart LabVIEW RT and any open IMAQ Vision applications.

If you still experience errors, contact National Instruments Technical Support. Technical Support information is available in Appendix B, *Technical Support and Professional Services*.

Why does my remotely displayed image have low quality?

Try these steps to improve your image quality:

- Ensure that your camera aperture is open to allow the appropriate amount of light for an acquisition.
- Check your compression settings.
- Make sure that your display settings in Windows are set to use at least 24-bit color.

Programming Errors

Why won't my LabVIEW VI run on my LabVIEW RT target?

Your IMAQ Vision VI may not be supported under LabVIEW RT. The following VIs are among those not supported:

- IMAQ Browser Delete

- IMAQ Browser Focus

- IMAQ Browser Focus Setup

- IMAQ Browser Insert

- IMAQ Browser Replace

- IMAQ Browser Setup

- IMAQ Draw

- IMAQ Draw Text

- IMAQ WindGrid

- Other obsoleted VIs. If your program contains a VI that has been updated or replaced to support new functionality, the icon of the obsoleted VI will contain a small black **X**.

If you created a VI in IMAQ Vision Builder, selecting **Image File** for your **Image Source** setting will cause your VI to return a `File Not Found` error in LabVIEW RT. This is because the File Dialog function is not supported in LabVIEW RT. To avoid this error, select **Image Control** or **Image Acquisition Board** as the Image Source.

How can I make my IMAQ Vision for LabVIEW application work on my RT system if it contains IMAQ Draw or IMAQ Draw Text?

IMAQ Draw and IMAQ Draw Text VIs are not supported under LabVIEW RT. However, you can achieve similar functionality by using the IMAQ Overlay VIs, such as IMAQ Overlay Rectangle and IMAQ Overlay Text. You can also use IMAQ Merge Overlay to merge your overlay data into your image.

How can I make my IMAQ Vision for LabVIEW application work on my RT system if it contains IMAQ Browser VIs?

If your application uses any of the IMAQ Browser VIs, use IMAQ Image To Image to embed multiple images within a single image.

Why do I get the error `<IMG_ERR_BINT>` (Bad Interface) when I run my LabVIEW VI?

Be sure that you have selected your PXI system as your target device. A common mistake is to fail to switch your execution target to your remote RT device, accidentally running your IMAQ Vision for LabVIEW RT VI on your host machine. Since your host machine may not have an image acquisition device, LabVIEW RT cannot recognize an interface and sends the Bad Interface error.

Why do I get a `File Not Found` error from my LabVIEW VI when I run it on LabVIEW RT?

When you run your LabVIEW RT application, your VI is downloaded to your remote PXI controller, but your support files, such as images and templates, are not. The File I/O routines in LabVIEW RT and IMAQ Vision always refer to files on the target machine, which in this case, is the remote RT PXI controller. Use FTP to move your image files to the PXI controller.

For more information about transferring files to your RT PXI controller using FTP, refer to your LabVIEW RT documentation.

If you created a VI in IMAQ Vision Builder, selecting **Image File** for your **Image Source** setting will cause your VI to return a `File Not Found` error in LabVIEW RT. This is because the File Dialog function is not supported in LabVIEW RT. To avoid this error, select **Image Control** or **Image Acquisition Board** as the Image Source.

PXI Video Out Errors

Why do I have an invalid Video Out Mode?

To use the PXI Video Out functionality in IMAQ Vision for LabVIEW RT, you must have a PXI controller featuring the i815 graphics chipset. The National Instruments PXI 8175/6 Series controllers use this chipset.

If you are using a controller that does not support PXI Video Out, consider using Remote Display to display your images.

Why can't I see my images when I use PXI Video Out?

Use the IMAQ Video Out VI to configure your video mode before you attempt to display your images. This VI allows you to set your refresh frequency, screen area, and color depth.

Note   If you are using a monitor that does not support high refresh frequencies, your images will not display correctly. Consult your monitor documentation for information on supported refresh frequencies.

You can also run the Video Setup Example from within LabVIEW (**Help»Search IMAQ Examples**). This example allows you to experiment and select the best video mode setting for your application and equipment.

B

Technical Support and Professional Services

Visit the following sections of the National Instruments Web site at `ni.com` for technical support and professional services:

- **Support**—Online technical support resources include the following:

  - **Self-Help Resources**—For immediate answers and solutions, visit our extensive library of technical support resources available in English, Japanese, and Spanish at `ni.com/support`. These resources are available for most products at no cost to registered users and include software drivers and updates, a KnowledgeBase, product manuals, step-by-step troubleshooting wizards, hardware schematics and conformity documentation, example code, tutorials and application notes, instrument drivers, discussion forums, a measurement glossary, and so on.

  - **Assisted Support Options**—Contact NI engineers and other measurement and automation professionals by visiting `ni.com/ask`. Our online system helps you define your question and connects you to the experts by phone, discussion forum, or email.

- **Training**—Visit `ni.com/custed` for self-paced tutorials, videos, and interactive CDs. You also can register for instructor-led, hands-on courses at locations around the world.

- **System Integration**—If you have time constraints, limited in-house technical resources, or other project challenges, NI Alliance Program members can help. To learn more, call your local NI office or visit `ni.com/alliance`.

If you searched `ni.com` and could not find the answers you need, contact your local office or NI corporate headquarters. Phone numbers for our worldwide offices are listed at the front of this manual. You also can visit the Worldwide Offices section of `ni.com/niglobal` to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

Glossary

Prefix	Meaning	Value
m-	milli-	10^{-3}
k-	kilo-	10^{3}

A

A/D   Analog-to-digital.

acquisition window   The image size specific to a video standard or camera resolution.

address   Value that identifies a specific location (or series of locations) in memory.

analog camera   A camera that transforms light into pixels and then translates each pixel's level of light into an analog video signal.

API   Application programming interface.

arithmetic operators   The image operations multiply, divide, add, subtract, and remainder.

B

b   Bit. One binary digit, either 0 or 1.

B   Byte. Eight related bits of data, an eight-bit binary number. Also denotes the amount of memory required to store one byte of data.

binary image   An image in which the objects usually have a pixel intensity of 1 (or 255) and the background has an intensity value of 0.

bit depth   The number of bits (n) used to encode the value of a pixel. For a given n, a pixel can take $2n$ different values. For example, if n equals 8 bits, a pixel can take 256 different values ranging from 0 to 255. If n equals 16 bits, a pxiel can take 65,536 different values, ranging from 0 to 65,535 or –32,768 to 32,767.

blob	Binary large object. A connected region or grouping of pixels in an image in which all pixels have the same intensity level. Blobs are also referred to as objects or particles.
blob analysis	A series of processing operations and analysis functions that produce some information about the objects in an image.
Builder file	IMAQ Vision Builder script file. Builder files are ASCII text files that list the processing functions and relevant parameters for an image processing algorithm created in IMAQ Vision Builder.
bus	A group of conductors that interconnect individual circuitry in a computer, such as the PCI bus; typically the expansion vehicle to which I/O or other devices are connected.

C

caliper	(1) A function in IMAQ Vision Builder that calculates distances, angles, circular fits, and the center of mass based on positions given by edge detection, particle analysis, centroid, and search functions. (2) A measurement function that finds edge pairs along a specified path in the image. This function performs an edge extraction and then finds edge pairs based on specified criteria such as the distance between the leading and trailing edges, edge contrasts, and so forth.

D

DAQ	Data acquisition. (1) Collecting and measuring electrical signals from sensors, transducers, and test probes or fixtures and inputting them to a computer for processing. (2) Collecting and measuring the same kinds of electircal signals with A/D or DIO boards plugged into a computer, and possibly generating control signals with D/A and/or DIO boards in the same computer.
default setting	A default parameter value recorded in the driver. In many cases, the default input of a control is a certain value (often 0).
determinism	Characteristic of a system that describes how reliably it can respond to external events, or perform operations, within a given time limit.
device	Plug-in data or image acquisition board that can contain multiple channels and conversion devices.

digital camera	A camera that transforms light information into pixels and then translates each pixel's level of light into a digital number inside the camera.
DNS	Domain Name Server.
driver	Software that controls a specific hardware device, such as an IMAQ or DAQ device.

E

Ethernet	A high-speed local area network (LAN) which conforms to the IEEE 802.3 standard.

F

ftp	File transfer protocol. Protocol based on TCP/IP to exchange files between computers.

H

hardware	The physical components of a computer system, such as the circuit boards, plug-in boards, chassis, enclosures, peripherals, and cables.
host PC	The computer on which the LabVIEW RT Development System is used to develop and target VIs to RT Series hardware.

I

I/O	Input/output. The transfer of data to/from a computer system, incoling communications channels, operator interface devices, and/or data acquisition and control interfaces.
image processing	Encompasses various processes and analysis functions that you can apply to an image.

L

lossy compression	Compression in which the decompressed image is visually similar but not identical to the original image.

M

MB   Megabyte of memory.

O

operating system   Base-level software that controls a computer, runs programs, interacts with users, and communicates with installed hardware or peripheral devices.

P

pixel depth   The number of bits used to represent the gray level of a pixel.

PXI   PCI eXtensions for Instrumentation. An open specification that builds on the CompactPCI specification by adding instrumentation-specific features.

R

real time   A property of an event of a system in which data is processed as it is acquired instead of being accumulated and processed at a later time.

RT Series PXI controller   National Instruments PXI controller running the RT Engine.

RT Series PXI system   National Instruments PXI chassis with an RT Series PXI controller installed.

S

signal conditioning   The manipulation of signals to prepare them for digitizing.

synchronous   Property or operation that begins an operation and returns control to the program only when the operation is complete.

T

time-bounded   Characterisitic associated with an RT event assuring that the execution time of the event or task is predictable.

V

VI   Virtual Instrument. (1) A combination of hardware and/or software
                    elements, typically used with a PC, that has the functionality of a classic
                    standalone instrument (2) A LabVIEW software module (VI), which
                    consists of a front panel user interface and a block diagram program.

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