



# NI Vision Acquisition Express VI Help

June 2008, 372274B-01

This help file describes the NI Vision Acquisition Express VI, and describes the fundamentals of configuring your acquisition settings using an analog, parallel digital, camera link, IEEE 1394 or Gigabit Ethernet (GigE) camera. The NI Vision Acquisition Express VI also supports simulated acquisitions from a folder of images.



**Note** Acquisitions using an IEEE 1394 or GigE camera require you to activate the NI Vision Acquisition Software. Refer to [Activating Your Software](#) for more information.

For more information about this help file, refer to the following topics:

[Using Help](#)

[Related Documentation](#)

[Glossary](#)

[Important Information](#)

[Technical Support and Professional Services](#)

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# Activating Your Software

## How do I activate my software?

Use the NI Activation Wizard to obtain an activation code for your software. You can launch the NI Activation Wizard two ways:

- Launch the product and choose to activate your software from the list of options presented.
- Launch NI License Manager by selecting **Start»All Programs»National Instruments»NI License Manager**. Click the **Activate** button in the toolbar.



**Note** If your software is a part of a Volume License Agreement (VLA), contact your VLA administrator for installation and activation instructions.

## What is activation?

Activation is the process of obtaining an activation code to enable your software to run on your computer. An *activation code* is an alphanumeric string that verifies the software, version, and computer ID to enable features on your computer. Activation codes are unique and are valid on only one computer.

## What is the NI Activation Wizard?

The NI Activation Wizard is a part of NI License Manager that steps you through the process of enabling software to run on your machine.

## What information do I need to activate?

You need your product serial number, user name, and organization. The NI Activation Wizard determines the rest of the information. Certain activation methods may require additional information for delivery. This information is used only to activate your product. Complete disclosure of [National Instruments licensing privacy policy](#) is available at [ni.com/activate/privacy](http://ni.com/activate/privacy). If you optionally choose to register your software, your information is protected under the [National Instruments privacy policy](#), available at [ni.com/privacy](http://ni.com/privacy).

## How do I find my product serial number?

Your serial number uniquely identifies your purchase of NI software. You can find your serial number on the Certificate of Ownership included in

your software kit. If your software kit does not include a Certificate of Ownership, you can find your serial number on the product packing slip or on the shipping label.

If you have installed a previous version using your serial number, you can find the serial number by selecting the **Help»About** menu item within the application or by selecting your product within NI License Manager (**Start»All Programs»National Instruments»NI License Manager**). You can also contact your local National Instruments [branch](#).

### **What is a Computer ID?**

The computer ID contains unique information about your computer. National Instruments requires this information to enable your software. You can find your computer ID through the NI Activation Wizard or by using NI License Manager, as follows:

1. Launch NI License Manager by selecting **Start»All Programs»National Instruments»NI License Manager**.
2. Click the **Display Computer Information** button in the toolbar.

For more information about [product activation and licensing](#) refer to [ni.com/activate](http://ni.com/activate).

## Related Documentation

Most NI Vision Acquisition Software manuals also are available as PDFs. You must have Adobe Reader with Search and Accessibility 5.0.5 or later installed to view the PDFs. Refer to the [Adobe Systems Incorporated Web site](http://www.adobe.com) at [www.adobe.com](http://www.adobe.com) to download Adobe Reader. Refer to the [National Instruments Product Manuals Library](http://ni.com/manuals) at [ni.com/manuals](http://ni.com/manuals) for updated documentation resources.

The following documents contain information that you may find helpful as you use this help file:

- *NI Vision Acquisition Software Release Notes*—Contains information about new functionality, minimum system requirements, and installation instructions for NI-IMAQ, NI-IMAQdx, and NI-IMAQ I/O driver software.
- *Measurement & Automation Explorer Help for NI-IMAQ*—Describes how to configure NI-IMAQ driver software, NI image acquisition devices, and cameras using Measurement & Automation Explorer.
- *Measurement & Automation Explorer Help for NI-IMAQdx*—Describes how to configure NI-IMAQdx driver software, IEEE 1394 cameras, and GigE cameras using Measurement & Automation Explorer.

# Using Help

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# Conventions

This help file uses the following formatting and typographical conventions:

» 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 note, which alerts you to important information.

**bold** Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.

green Underlined text in this color denotes a link to a help topic, help file, or Web address.

*italic* Italic text denotes variables, emphasis, cross-references, or an introduction to a key concept. Italic text also denotes text that is a placeholder for a word or value that you must supply.

monospace Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.

## Navigating Help (Windows Only)

To navigate this help file, use the **Contents**, **Index**, and **Search** tabs to the left of this window or use the following toolbar buttons located above the tabs:

- **Hide**—Hides the navigation pane from view.
- **Locate**—Locates the currently displayed topic in the **Contents** tab, allowing you to view related topics.
- **Back**—Displays the previously viewed topic.
- **Forward**—Displays the topic you viewed before clicking the **Back** button.
- **Options**—Displays a list of commands and viewing options for the help file.



## Searching Help (Windows Only)

Use the **Search** tab to the left of this window to locate content in this help file. If you want to search for words in a certain order, such as "related documentation," add quotation marks around the search words as shown in the example. Searching for terms on the **Search** tab allows you to quickly locate specific information and information in topics that are not included on the **Contents** tab.

## Wildcards

You also can search using asterisk (\*) or question mark (?) wildcards. Use the asterisk wildcard to return topics that contain a certain string. For example, a search for "prog\*" lists topics that contain the words "program," "programmatically," "progress," and so on.

Use the question mark wildcard as a substitute for a single character in a search term. For example, "?ext" lists topics that contain the words "next," "text," and so on.




**Note** Wildcard searching will not work on Simplified Chinese, Traditional Chinese, Japanese, and Korean systems.

## **Nested Expressions**

Use nested expressions to combine searches to further refine a search. You can use Boolean expressions and wildcards in a nested expression. For example, "example AND (program OR VI)" lists topics that contain "example program" or "example VI." You cannot nest expressions more than five levels.

## Boolean Expressions

Click the  button to add Boolean expressions to a search. The following Boolean operators are available:

- **AND** (default)—Returns topics that contain both search terms. You do not need to specify this operator unless you are using nested expressions.
- **OR**—Returns topics that contain either the first or second term.
- **NOT**—Returns topics that contain the first term without the second term.
- **NEAR**—Returns topics that contain both terms within eight words of each other.


## Search Options

Use the following checkboxes on the **Search** tab to customize a search:

- **Search previous results**—Narrows the results from a search that returned too many topics. You must remove the checkmark from this checkbox to search all topics.
- **Match similar words**—Broadens a search to return topics that contain words similar to the search terms. For example, a search for "program" lists topics that include the words "programs," "programming," and so on.
- **Search titles only**—Searches only in the titles of topics.

## Printing Help File Topics (Windows Only)

Complete the following steps to print an entire book from the **Contents** tab:

1. Right-click the book.
2. Select **Print** from the shortcut menu to display the **Print Topics** dialog box.
3. Select the **Print the selected heading and all subtopics** option.  
 **Note** Select **Print the selected topic** if you want to print the single topic you have selected in the **Contents** tab.
4. Click the **OK** button.

## **Printing PDF Documents**

This help file may contain links to PDF documents. To print PDF documents, click the print button located on the Adobe Acrobat Viewer toolbar.

## **NI Vision Acquisition Express VI Overview**

Complete the following steps to launch the Vision Acquisition Express VI:

Launch the NI Vision Acquisition Express VI through LabVIEW by creating a block diagram, opening the Functions palette, and selecting the Vision Acquisition Express VI from the Vision and Motion menu.

Place the NI Vision Acquisition Express VI on the block diagram. This will launch the NI Vision Acquisition Wizard. After you have configured the acquisition, you can double-click the NI Vision Acquisition Express VI to edit the acquisition.



## **Sections**

The NI Vision Acquisition Wizard consists of four main sections:

[Selecting an Acquisition Source](#)







[Selecting an Acquisition Type](#)

[Configuring your Acquisition Settings](#)

[Selecting Controls and Indicators](#)

## Selecting an Acquisition Source

Use the Select Acquisition Source step to select the device to use for an acquisition. Based on the type of device you choose to work with at this step, the settings and options available during the [Configure Acquisition Settings](#) step will vary. Complete the following steps to choose a device to use for an acquisition:

1. Select a device from the list of available devices in the **Acquisition Sources** control.
2. Click the  **Acquire Single Image** button to acquire a single image, or click the  **Acquire Continuous Images** button to acquire images from the selected acquisition device. Use the  **Zoom to Fit**,  **Zoom 1:1**,  **Zoom In**, and  **Zoom Out** controls to adjust the zoom on the acquired image.
3. Click **Next**.

## Acquiring from a Remote Target

The NI Vision Acquisition Express Wizard allows you to acquire images from remote devices. Complete the following steps to configure an acquisition on a remote target.

1. Launch LabVIEW and create a new project.



**Note** To add a remote target to the project, you must have the LabVIEW Real-Time Module installed on your computer.

2. Add a remote target to project. Refer to the *LabVIEW Help* for information about adding RT targets to a LabVIEW project.
3. Right-click the target. Select **New»VI**. This will open a new VI and add it under the remote target to the project.
4. Right-click the block diagram of the new VI to display the **Functions Palette**. Select **Vision and Motion»Vision Express»Vision Acquisition Express VI** and drag it to the block diagram.
5. This will launch the NI Vision Acquisition Express Wizard.
6. All the devices connected to the remote target will appear in the list of devices in the **Acquisition Sources** control on the **NI Vision Acquisition Express Wizard**.
7. Select your device from the list of available devices in the **Acquisition Sources** control.
8. Click **Next**.

## Selecting an Acquisition Type

Use the Select Acquisition Type step to select the type of the acquisition you want to perform. Complete one of the following sets of steps to select the acquisition type.

- **Single Acquisition with Processing**—Acquires a single image.

Complete the following steps to configure a single acquisition with processing:

1. Select **Single Acquisition with Processing** from the available configuration options.
2. Click **Next**.

- **Continuous Acquisition with Inline Processing**—Continuously acquires images until an event stops the acquisition.

Complete the following steps to configure a continuous acquisition with inline processing:

1. Select **Continuous Acquisition with Inline Processing** from the available configuration options.
2. Select an **Acquire Image Type**. The following options are available.

- **Acquire Most Recent Image**—Use this mode to acquire the most recent image. This mode could miss some images, but the image returned will always be the most recent.
- **Acquire Every Image**—Use this mode for applications in which acquiring every image is necessary.



**Note** If the acquisition rate is faster than the average processing rate, the **Acquire Every Image** mode will not be able to keep up and once all the image buffers are filled with unprocessed images, the acquisition will begin to lose images. The number of missed images is an available output of the Express VI that can be used to indicate when this condition occurs. Use a **Finite Acquisition with Inline Processing** acquisition if you need to acquire

every image, and the acquisition rate is faster than the average processing rate.

3. If applicable, specify the **Number of Images to Buffer**.
4. Click **Next**.

- **Finite Acquisition with Inline Processing**—Acquires a specified number of images and returns each image as it is acquired. All images are allocated on the first iteration. Processing can occur while images are acquired without affecting acquisition speeds.

Complete the following steps to configure a finite acquisition with inline processing:

1. Select **Finite Acquisition with Inline Processing** from the available configuration options.
2. Specify the **Number of Images to Acquire**.
3. Click **Next**.

- **Finite Acquisition with Post Processing**—This mode is the same as **Finite Acquisition with Inline Processing**, except the images are only available after they are all acquired.

Complete the following steps to configure a finite acquisition with post processing:

1. Select **Finite Acquisition with Post Processing** from the available configuration options.
2. Specify the **Number of Images to Acquire**.
3. Click **Next**.

# Configuring Acquisition Settings

Use the Configure Acquisition Settings step to configure your acquisition. The configuration settings available in this step will vary based on the type of device you select in the [Select Acquisition Source](#) step of the wizard. The following sections provide information on configuration options based on the type of device you are using:

[NI-IMAQ Devices](#)

[NI-IMAQdx Devices](#)

[Simulated Acquisition](#)

## Controls and Tools

Use the following tools to perform different functions on your images:

- **Image Display**—This control allows users to view the resulting images acquired.
- **Test**—Configures the acquisition using the acquisition type and acquisition settings configured.
- **Stop**—Stops a continuous acquisition once it has started.
- **Image Number**—Allows you to scroll through the acquired images from a finite acquisition.
- **Zoom to Fit**—Scales the image to fit in Image Display window.
- **Zoom 1:1**—Displays the image without any zooming.
- **Zoom In**—Enlarges the image.
- **Zoom Out**—Reduces the size of the image.
- **Acquisition Status String**—Updates information about the status of the acquisition and the acquired image.

## NI-IMAQ Devices

The NI-IMAQ driver software is used for acquiring images from Analog, Parallel Digital, Camera Link and NI Smart Cameras. The NI-IMAQ configuration step can contain the following sections, depending on the features supported by the selected hardware and type of camera:



**Note** Not all NI-IMAQ devices support all of these settings.

[Sensor Tab](#)

[Lighting Tab](#)

[Triggers Tab](#)

[Digital Outputs Tab](#)

[Encoder Tab](#)

[Bayer Tab](#)



**Note** The Error Details control displays information about invalid acquisition settings.



## Sensor Tab



**Note** The **Sensor** tab is only supported by NI 17xx smart cameras.

The **Sensor** tab allows you to view basic information about the NI 17xx smart camera. Refer to *NI 17xx Smart Camera User Manual* for more information on sensor options available for the NI 17xx smart camera.

The following controls are available on the **Sensor** tab:

- **Exposure Time (ms)** specifies the length of time in milliseconds that the camera exposes each image.
- **Gain** specifies the gain for the camera.
- **Partial Scan** specifies the options for partial scan, which is a method of obtaining higher frame rates by reading out only a portion of the image from the sensor. NI 17xx smart cameras support 1/2 scan and 1/4 scan. In 1/2 scan, one half of the image is read out from the center of the sensor and the rest of the image is discarded to enable a faster start of the next frame. In 1/4 scan, only one quarter of the image is read out. Using this mode increases the **Max Frame Rate** of the sensor.
- **Binning** affects the brightness and size of the acquired image by combining pixels. This control allows you to specify the option for binning. Binning allows the image sensor to collect more electrons per pixel, which reduces the amount of required light and exposure time. Binning results in higher frame rates and lower resolution. Using this mode increases the **Max Frame Rate** of the sensor.



**Note** Partial Scan and Binning cannot be used simultaneously.

- **Max Frame Rate** displays the maximum rate of frames per second for the current settings.

## Lighting Tab



**Note** The **Lighting** tab is only supported by NI 17xx smart cameras.

The **Lighting** tab allows you to control the lighting settings for the smart camera. Some features may not be supported for your lighting device. Refer to your device documentation information about the lighting features supported by your device. Refer to *Measurement & Automation Explorer Help for NI-IMAQ* for information on how to change the parameters of the lighthouse on a NI 17xx smart camera. Refer to *NI 17xx Smart Camera User Manual* for more information on the NI 17xx smart camera.


The following controls are available on the **Lighting** tab:

- **Enable Direct Drive** enables the Direct Drive lighting.
  - **Note** Not all smart cameras support Direct Drive.
- **Mode** specifies the lighting mode options. This control can be set to **Continuous** or **Strobed**.
- **Desired Current Level (mA)** specifies the desired current level in milliamperes.
- **Actual Current Level (mA)** displays the actual current level in milliamperes.
- **5V TTL Strobe** and **24V Strobe** display the options for strobe signal generation.
- **Polarity** specifies the polarity for the selected strobe signal generation.

# Triggers Tab


Use a triggered acquisition to synchronize an image acquisition with events external to the computer, such as receiving a pulse from a sensor that indicates the position of an item on an assembly line. The trigger signal must be connected to a trigger input of the image acquisition device. The triggered acquisition settings available in this step will vary based on the type of device you select in the [Select Acquisition Source](#) step and the acquisition type you select in the [Select Acquisition Type](#) step of the wizard. The Trigger Summary Table provides an overview of all the triggers configured for this acquisition.

Complete the following steps to configure a trigger line.

1. Click the  **Add Trigger** button to add a trigger to the **Trigger Summary Table**.



**Tip** Click the  **Remove Trigger** button to remove a trigger from the **Trigger Summary Table**.

2. Select the **Line** to use for the trigger signal.
3. Use the **Action** control to specify the trigger type of the selected **Line**. The following options are available:
  - **Trigger Start of Acquisition**—An acquisition begins when the specified trigger line detects the correct polarity edge.
  - **Trigger Every Image**—Waits until the specified trigger line detects the correct polarity edge to acquire each image.
    -  **Note** The NI 17xx also supports specifying a trigger delay. The delay units are milliseconds or, if quadrature encoders are supported, encoder counts.
  - **Trigger Start of Buffer List**—When the assertion edge of a trigger is received, the buffer list is acquired. The first buffer always waits on a trigger before acquiring. This mode is only supported for the [Continuous Acquisition with Inline Processing](#) with the **Acquire Image Type** set to **Acquire Every Image**.
  - **Trigger Every Line**—Waits to acquire each line from a line scan camera until the specified number of **Skip Triggers** edges have occurred. This mode only applies to line scan

cameras.

- **Trigger End of Acquisition**—Stops the acquisition after **Number of Post Trigger Buffers** has been acquired after a correct polarity edge is detected on the specified trigger line. Returns an array of pre-trigger images and post-trigger images. This mode is only supported for the [Continuous Acquisition with Inline Processing](#) with the **Acquire Image Type** set to **Acquire Every Image**.



**Note** Not all hardware supports this feature.

- **Trigger Height of Acquisition**—Uses the trigger signal level to determine how long to acquire from a line scan camera. While the trigger line is in the active state, each line acquired will be added to the image height. When the trigger line becomes inactive, the resulting image is returned. This mode only applies to line scan cameras and cannot be used at the same time as **Trigger Every Image**.



**Note** The maximum height allowed is determined by the Acquisition Height specified in Measurement & Automation Explorer (MAX).







**Note** Not all hardware supports this feature.

4. Select a **Polarity** to define the active edge of the trigger. The following options are available:
  - Rising Edge
  - Falling Edge
5. Specify a **Timeout**, in milliseconds, to wait for the active edge of a trigger to be received and the image to be captured.

## Digital Outputs Tab

Use the **Digital Outputs** tab to configure the digital output lines to use in an acquisition.

Complete the following steps to configure your digital output settings:

1. Click the  **Add Digital Output** button to add a digital output to the **Digital Outputs Summary Table**.
  -  **Tip** Click the  **Remove Digital Output** button to remove a digital output from the **Digital Outputs Summary Table**.
2. Specify the **Line** to use for the digital output.
3. Specify an **Action** for the selected digital output line.
4. Complete one of the following sets of steps based on the selected **Action**.
  - **Pulse Train, Single Pulse, or Rearmed Pulse**. Refer to [Pulse Types](#) for more information on pulse types.
    - a. Specify a **Polarity** to define the state of the pulse.
    - b. Specify the **Units** to use for the **Pulse Delay** and **Pulse Width** controls. Units can be in milliseconds or Scaled Encoder counts.
      -  **Note** Not all hardware supports scaled encoders.
    - c. Specify a **Pulse Delay** as the desired duration of the first phase of the signal in timebase units. If the timebase units are **Milliseconds**, the **Pulse Delay** must be greater than 0. If the timebase units are scaled encoder, the minimum delay is one cycle.
    - d. Specify a **Pulse Width** as the desired duration of the second phase of the signal in timebase units. If the timebase units are milliseconds, the **Pulse Width** must be greater than 0. If the timebase units are scaled encoder, the minimum delay is one cycle.
    - e. Specify a trigger **Source**. A **Source** can be **Immediate**, a hardware line, or a **Status Signal**. When **Immediate** is selected, the pulse is driven when the acquisition begins. When a hardware line

is selected, the pulse waits for the selected hardware line to have the selected polarity. When **Status Signal** is selected, the pulse waits for the selected status signal to have the selected polarity.



**Note** If the **Source** is **Immediate**, the **Polarity** and **Signal** settings do not apply. If the **Source** is a hardware line, the **Signal** setting does not apply.

- f. Select the **Polarity** of the trigger signal. The following options are available:
  - **Rising Edge**
  - **Falling Edge**
- g. If the **Source** is **Status Signal**, select a **Signal** for the pulse trigger. The following **Status Signals** are supported: Acquisition in Progress, Acquisition Done, Frame Start, and Frame Done.



**Note** Frame Start and Frame Done are only valid for area scan cameras.

- **Drive Status Signal**

- a. Specify a **Polarity** for the status signal.
- b. Specify a **Status Signal** to output. The following status signals are supported: Disabled, Acquisition in Progress, Acquisition Done, Unasserted, Asserted, Frame Start, Frame Done, Vertical Synchronization Signal, Horizontal Synchronization Signal, and Scaled Encoder. Frame Start, Frame Done, and Vertical Synchronization Signal only apply to Area scan cameras.



**Note** Scaled Encoder only applies to NI devices that support scaled encoders.

## Encoder Tab

The **Encoder** tab allows you to configure the encoder settings. Complete the following steps to configure the encoder:



**Note** Not all devices support encoders.

1. Check the **Use Encoder Settings** option.
2. Specify a **Divide Factor** to determine how many encoder pulses to skip before incrementing the Scaled Encoder count.
3. Specify **Phase A Polarity** to determine the polarity of phase A.
4. Specify **Phase B Polarity** to determine the polarity of phase B.
5. Specify **Phase A and B Filter** to determine if signals should be filtered to prevent glitches from being counted as transitions.

## Bayer Tab

The **Bayer** tab allows you to configure Bayer decoding settings. If your camera outputs a Bayer image, you can use this tab to specify the Bayer settings so the resulting image returned is a color image. The **Bayer** tab is only available for monochrome digital area scan cameras.

Complete the following steps to perform Bayer decoding on an acquired image:

1. Select the **Perform Bayer Decoding** check box. If it is checked, the following settings will be used to convert the Bayer image acquired to a color image.
2. Use the radio buttons to select the correct **Pattern** for your image. The four possible variations of the Bayer encoding pattern are available.
3. To select appropriate Red, Green, and Blue gains, acquire an image of a white background, draw a rectangle around the area that is most white, and then click **Auto Balance**.
4. Repeat Steps 2-3 until the image appears correctly.

Refer to the following sections for more information about various aspects of Bayer cameras:

[Bayer Encoding](#)

[Bayer Pattern](#)

[White Level](#)



## Bayer Encoding

**Bayer encoding** is a method you can use to produce color images with a single imaging sensor, rather than using three individual sensors for the red, green, and blue components of light. This technology greatly reduces the cost of cameras. The Bayer color filter array (CFA) is a primary color, mosaic pattern of 50% green, 25% red, and 25% blue pixels. Green pixels comprise half of the total pixels because the human eye receives most of its sharpness information from green light.

Light travels through the camera lens onto an image sensor that provides one value for each sensor cell. The sensor, which is an array of tiny, light-sensitive diodes called photosites, converts light into electrical charges. The sensor is covered by the **Bayer CFA** so that only one color value reaches any given pixel. The raw output is a mosaic of red, green, and blue pixels of different intensity. When the image is captured, the accumulated charge for each cell is read and analog values are converted to digital pixel values using an analog-to-digital (A/D) converter.

## **Bayer Pattern**

**Bayer Pattern**, sometimes referred to as demosaicing, replaces colors in Bayer images. A decoding algorithm determines a value for the RGB components for each pixel in the array by averaging the color values of selected neighboring pixels and producing an estimate of color and intensity. After the interpolation process is complete, the white balancing process further enhances the image by adjusting the red and blue signals to match the green signal in white areas of the image.

## Example

Several decoding algorithms perform color decoding, including nearest neighbor, linear, cubic, and cubic spline interpolations. The following example provides a simple explanation of the interpolation process.

To determine the value of the pixel in the center of the following group:

RGR

GBG

RGR

When the pixels have the following values:

200 50 220

60 100 62

196 58 198

Neighboring pixels will be used to determine the RGB values for the center pixel. The blue component will be taken directly from the pixel value, and the green and red components are the average of the surrounding green and red pixels, respectively.

$$R = (200 + 220 + 196 + 198)/4 = 203.5 \sim 204$$

$$G = (50 + 60 + 62 + 58)/4 = 57.5 \sim 58$$

$$B = 100$$

The final RGB value for the pixel is (204,58,100). This process will be repeated for each pixel in the image.

## White Level

The **White Level** defines the brightness of an image after white balancing. The values for the red, green, and blue gains are determined by dividing the white level by the mean value of each component color. The maximum white level is 255. If the white level is too high or too low, the image will appear too light or too dark. You can adjust the white level to adjust image brightness.

## NI-IMAQdx Devices

Complete the following steps to set the attributes of an NI-IMAQdx device:

1. Specify a **Video Mode** for the camera from the **Video Mode** dropdown menu. This list is based on the video modes the camera supports.



**Note** This option is only available for FireWire® cameras. A GigE camera will display the current settings in this pulldown, but users cannot edit the pulldown. You must use the attributes in the tree to change the resolution or video type.

2. Check the **Show All Attributes** check box to display all the attributes, including acquisition attributes and status information.
3. Select the attribute to change from the attribute tree.
4. Set the value of the attribute using the **Value** control.



**Note** Use the **Reset to Defaults** to set all the attributes to the default values configured in Measurement & Automation Explorer (MAX).

5. Repeat steps 3-4 for all the attributes to change.
6. Click **Next**.

## Simulated Acquisition

Use **Simulated Acquisition** to select a folder of image files, or an **AVI** to simulate an acquisition.



**Note** NI Vision must be installed in the location the Vision Acquisition Express VI will run for the Simulated Acquisition feature to be available.

## Folder of Images

Complete the following steps to configure an acquisition with a folder of image files:

1. Use the **Image Path** control to specify a path to the image to use for a simulated acquisition.
2. If the **Cycle Through Folder of Images** option is checked, the acquisition will acquire additional image files in the same folder as the image file specified by image path.



**Note** This control is not available when the acquisition type is **Single Acquisition with Processing**.

3. Click **Next**.

## AVI Path

Complete the following steps to configure an acquisition with an AVI path:

1. Use the **AVI Path** control to specify a path to the AVI file to use for a simulated acquisition.



**Note** This acquisition type is not available when acquiring on remote targets.

2. Click **Next**.



## Selecting Controls and Indicators

In the Select Controls/Indicators step of the NI Vision Acquisition Express Wizard, specify the controls and indicators that will be available on the Express VI when you exit the Wizard. The controls and indicators displayed depend on the type of acquisition source you selected, the acquisition type, and the acquisition settings. Some controls and indicators are required and cannot be unchecked. When you are done configuring everything, click **Finish** and the Express VI is created with the settings that you configured. If you setup a continuous acquisition or a finite acquisition, looping structures are created the first time the Express VI is configured.

The controls and indicators available will vary based on your device and acquisition settings. Controls and indicators can be required or optional. Controls are also divided into **Setup Settings** and **Acquire Settings** controls. Setup Settings controls are used to configure the acquisition. Setup Settings controls are used during the first iteration of the acquisition. Acquire Settings controls are used to acquire images. Acquire Settings controls can be changed at any point during the acquisition.

## Controls and Indicators Based on Devices

Refer to the following sections for information on the controls and indicators available with different devices:

- [NI 17xx Smart Cameras](#)
- [Analog, Digital and Camera Link Devices](#)
- [IEEE 1394 and GigE Devices](#)
- [Simulated Acquisition](#)

## **Controls/Indicators for NI 17xx Smart Cameras**

In the Select Controls/Indicators step of the NI Vision Acquisition Express Wizard, specify the controls and indicators that will be available on the Express VI based on the type of device used.

## Controls

If you are using an NI 17xx smart camera, the following controls may be available based on your acquisition settings:

Control	Description
<b>Stop (F)</b>	Stops the acquisition. This is a required control when performing a continuous acquisition.
<b>Number of Image Buffers</b>	Specifies the number of internal buffers into which image data will be acquired. This is an optional <b>Setup Settings</b> control that only applies the first time the VI is called.
<b>Pulse Delay</b>	Allows you to set the desired duration of the first phase of the signal in timebase units. This control is available when a pulse is selected as a digital output. This is an optional <b>Setup Settings</b> control that only applies the first time the VI is called.
<b>Pulse Width</b>	Allows you to set the desired duration of the second phase of the signal in timebase units. This is an optional <b>Setup Settings</b> control that only applies the first time the VI is called.
<b>Exposure Time (ms)</b>	Controls how long to expose the sensor in milliseconds. This is an optional <b>Acquire Settings</b> control that is applied every time the Express VI is called.
<b>Gain</b>	Controls the gain of the sensor. This is an optional <b>Acquire Settings</b> control that is applied every time the Express VI is called.
<b>Current Level (mA)</b>	Controls the current level, in milliamps, that the Direct Drive lighting controller will output. This control is available if the option to use the camera's internal lighting is selected. This is an optional <b>Acquire Settings</b> control that is applied every time the Express VI is called.
<b>Pass LED</b>	The green LED located on the smart camera that can be switched on or off. This is an optional <b>Acquire Settings</b> control that is applied every time the Express VI is called.
<b>Fail LED</b>	The red LED located on the smart camera that be switched on or off. This is an optional <b>Acquire Settings</b> control that is

	applied every time the Express VI is called.
<b>Drive Signal</b>	Allows you to select what signal to drive. This control is available when a <b>Drive Status Signal</b> is selected as a digital output. This is an optional <b>Acquire Settings</b> control that is applied every time the Express VI is called.
<b>Drive Polarity</b>	Allows you to select the polarity of the signal to drive. This control is available when <b>Drive Status Signal</b> is selected as a digital output. This is an optional <b>Acquire Settings</b> control that is applied every time the Express VI is called.

## Indicators

If you are using an NI 17xx smart camera, the following indicators may be available based on your acquisition settings:

Indicator	Description
<b>All Image Buffers Out</b>	An array of images allocated by the VI that you can dispose of when the images are no longer in use. This indicator is available when <b>Continuous Acquisition with Acquire Every Image</b> or <b>Finite Acquisition with Inline Processing</b> is selected as the acquisition type. This is a required indicator.
<b>Stopped</b>	This indicator is used to stop a continuous acquisition. It is only available when you are doing a continuous acquisition. This is a required indicator.
<b>Image Out</b>	The reference to the acquired image. This is a required indicator.
<b>Image Number</b>	0-based indicator of how many images have been acquired. This is an optional indicator.
<b>Total Images Transferred</b>	1-based indicator of the total number of images acquired since the beginning of the acquisition. This is an optional indicator.
<b>Lost Image Count</b>	Returns the total number of lost frames in a continuous acquisition. The value increments by 1 each time images are lost. This is an optional indicator.
<b>Frame Rate</b>	The rate of images acquired in frames per second. This is an optional indicator.
<b>Maximum Current Level (mA)</b>	Returns the maximum amount of current, in milliamperes (mA), that can be sourced by the Direct Drive lighting controller under the current configuration. Only available when internal lighting controller is used. This is an optional indicator.
<b>Temperature</b>	Returns the temperature of the smart camera in degrees Celsius (°C). This is an optional indicator.
<b>Encoder Count</b>	Only applies when <b>Use Encoder Settings</b> is selected as a configuration setting. This is an optional indicator.



**Note** This indicator is only available for smart cameras that support quadrature encoders.

## **Controls/Indicators for Analog, Digital, and Camera Link Devices**

In the Select Controls/Indicators step of the NI Vision Acquisition Express Wizard, specify the controls and indicators that will be available on the Express VI based on the type of device used.



## Controls

If you are using an Analog, Digital or Camera Link device, the following controls may be available based on your acquisition settings:


Control	Description
<b>Stop (F)</b>	Stops the acquisition. This is a required control when performing a continuous acquisition.
<b>Number of Image Buffers</b>	Specifies the number of internal buffers into which image data will be acquired. This is an optional <b>Setup Settings</b> control that only applies the first time the VI is called.
<b>Number of Post Trigger Buffers</b>	Indicates the number of images acquired after the <b>Stop Trigger</b> occurs. This control is available when <b>End of Acquisition</b> is selected as a trigger action. This is an optional <b>Setup Settings</b> control that only applies the first time the VI is called.
<b>Pulse Delay</b>	Allows you to set the desired duration of the first phase of the signal in timebase units. This control is available when a pulse is selected as a digital output. This is an optional <b>Setup Settings</b> control that only applies the first time the VI is called.
<b>Pulse Width</b>	Allows you to set the desired duration of the second phase of the signal in timebase units. This is an optional <b>Setup Settings</b> control that only applies the first time the VI is called.
<b>Bayer Settings</b>	Sets the Bayer decoder pattern used to decode the image. This control is available when <b>Perform Bayer Decoding</b> is selected. The <b>Pattern</b> , <b>Red Gain</b> , <b>Green Gain</b> , and <b>Blue Gain</b> can be adjusted. This is a <b>Setup Settings</b> control that only applies the first time the VI is called.
<b>Drive Signal</b>	Allows you to select what signal to drive. This control is available when a <b>Drive Status Signal</b> is selected as a digital output. This is an optional <b>Acquire Settings</b> control that is applied every time the Express VI is called.
<b>Drive Polarity</b>	Allows you to select the polarity of the signal to drive. This control is available when <b>Drive Status Signal</b> is selected as a digital output. This is an optional <b>Acquire Settings</b> control that is applied every time the Express VI is called.

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## Indicators

If you are using an Analog, Digital or Camera Link device, the following indicators may be available based on your acquisition settings:

Indicator	Description
<b>All Image Buffers Out</b>	An array of images allocated by the VI that you can dispose of when the images are no longer in use. This indicator is available when <b>Continuous Acquisition with Acquire Every Image</b> or <b>Finite Acquisition with Inline Processing</b> is selected as the acquisition type. This is a required indicator.
<b>Stopped</b>	This indicator is used to stop a continuous acquisition. It is only available when you are doing a continuous acquisition. This is a required indicator.
<b>Image Out</b>	The reference to the acquired image. This is a required indicator.
<b>Image Number</b>	0-based indicator of how many images have been acquired. This is an optional indicator.
<b>Total Images Transferred</b>	1-based indicator of the total number of images acquired since the beginning of the acquisition. This is an optional indicator.
<b>Lost Image Count</b>	Returns the total number of lost frames in a continuous acquisition. The value increments by 1 each time images are lost. This is an optional indicator.
<b>Frame Rate</b>	The rate of images acquired in frames per second. This is an optional indicator.
<b>Raw Bayer Image Out</b>	This indicator is available when <b>Perform Bayer Decoding</b> is selected. This is an optional indicator.
<b>Image Height</b>	The number of lines acquired per image. This indicator is available when <b>Trigger Height of Acquisition</b> is selected as a trigger action. This is an optional indicator.
<b>Pre Trigger Images</b>	This indicator is available if <b>Trigger End of Acquisition</b> is selected as a trigger action. This is an optional indicator.
<b>Post Trigger</b>	This indicator is available if <b>Trigger End of Acquisition</b> is selected as a trigger action. This is an optional indicator.

<b>Images</b>	
<b>Encoder Count</b>	<p>Only applies when <b>Use Encoder Settings</b> is selected as a configuration setting. This is an optional indicator.</p> <p> <b>Note</b> This indicator is only available for frame grabbers that support quadrature encoders that can be read.</p>

## Controls/Indicators for an IEEE 1394 and GigE Devices

In the Select Controls/Indicators step of the NI Vision Acquisition Express Wizard, specify the controls and indicators that will be available on the Express VI based on the type of device used.



**Note** Refer to the documentation provided by your camera manufacturer for information on specific controls and indicators available with your camera.



## Controls

If you are using a IEEE 1394 or GigE device, the following controls may be available based on your acquisition settings:

<b>Control</b>	<b>Description</b>
<b>Stop (F)</b>	Stops the acquisition. This is a required control when performing a continuous acquisition.
<b>Number of Image Buffers</b>	Specifies the number of internal buffers into which image data will be acquired. This is an optional <b>Setup Settings</b> control that only applies the first time the VI is called.

## Indicators

If you are using an IEEE 1394 or GigE device, the following indicators may be available based on your acquisition settings:

Indicator	Description
<b>All Image Buffers Out</b>	An array of images allocated by the VI that you can dispose of when the images are no longer in use. This indicator is available when <b>Continuous Acquisition with Acquire Every Image</b> or <b>Finite Acquisition with Inline Processing</b> is selected as the acquisition type. This is a required indicator.
<b>Stopped</b>	This indicator is used to stop a continuous acquisition. It is only available when you are doing a continuous acquisition. This is a required indicator.
<b>Image Out</b>	The reference to the image. This is a required indicator.
<b>Image Number</b>	0-based indicator of how many images have been acquired. This is an optional indicator.
<b>Total Images Transferred</b>	1-based indicator of the total number of images acquired since the beginning of the acquisition. This is an optional indicator.
<b>Lost Image Count</b>	Returns the total number of lost frames in a continuous acquisition. The value increments by 1 each time images are lost. This is an optional indicator.
<b>Lost Packet Count</b>	Returns the number of lost packets during an acquisition session. This is an optional indicator.  <b>Note</b> This indicator is only available for GigE cameras.
<b>Requested Resend Packet Count</b>	Returns the number of packets requested to be resent during an acquisition session. This is an optional indicator.  <b>Note</b> This indicator is only available for GigE cameras.
<b>Received Resend Packets</b>	Returns the number of packets that were requested to be resent during an acquisition session and were completed. This is an optional indicator.



**Note** This indicator is only available for GigE cameras.



## **Controls/Indicators for Simulated Acquisition**

In the Select Controls/Indicators step of the NI Vision Acquisition Express Wizard, specify the controls and indicators that will be available on the Express VI based on the type of device used.

## Controls

If you are performing a Simulated Acquisition, the following controls may be available based on your acquisition settings:

Control	Description
<b>Stop (F)</b>	Stops the acquisition. This is a required control when performing a continuous acquisition.
<b>AVI Path</b>	The filepath for the AVI file to read. This control is only available if you select <b>AVI</b> as the simulated acquisition source. This is a <b>Setup Settings</b> control that only applies the first time the VI is called.
<b>Image Path</b>	The complete filepath for the image file. This control is only available if you select <b>Folder of Images</b> as the simulated acquisition source. This is a <b>Setup Settings</b> control that only applies the first time the VI is called.
<b>Cycle Through Folder</b>	Cycles through a folder of images. This is a <b>Setup Settings</b> control that only applies the first time the VI is called and when a folder of images is the acquisition source.
<b>Number of Image Buffers</b>	Specifies the number of internal buffers into which image data will be acquired. This is a <b>Setup Settings</b> control that is only available the first time the VI is called.

## Indicators

If you are performing a Simulated Acquisition, the following indicators may be available based on your acquisition settings:

Indicator	Description
<b>All Image Buffers Out</b>	An array of images allocated by the VI that you can dispose of when the images are no longer in use. This indicator is available when <b>Continuous Acquisition with Acquire Every Image</b> or <b>Finite Acquisition with Inline Processing</b> is selected as the acquisition type. This is a required indicator.
<b>Stopped</b>	This indicator is used to stop a continuous acquisition. It is only available when you are doing a continuous acquisition. This is a required indicator.
<b>Image Out</b>	The reference to the acquired image. This is a required indicator.
<b>Image Number</b>	0-based indicator of how many images have been acquired. This is an optional indicator.
<b>Total Images Transferred</b>	1-based indicator of the total number of images acquired since the beginning of the acquisition. This is an optional indicator.
<b>Lost Image Count</b>	Returns the total number of lost frames in a continuous acquisition. The value increments by 1 each time images are lost. This is an optional indicator.
<b>Frame Rate</b>	The rate of images acquired in frames per second. This is an optional indicator.

# Glossary

A B C D E F G H I L M N O P Q R S T  
U V W Y

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## A

- array            Ordered, indexed set of data elements of the same type.
- aspect ratio    The ratio of a picture or image's width to its height.
- asynchronous (1) Independent in time from any other event. (2) Communication mechanism on the IEEE 1394 bus, which guarantees delivery of the message but does not guarantee timing.

## **B**

**Bayer encoding** Method to produce color images with a single imaging sensor, as opposed to three individual sensors for the red, green, and blue components of light.

**Bayer pattern** Color filter array pattern that can appear in four variations, depending on the current left and top offsets of the acquisition window:

GBGB GRGR BGBG RGRG  
RGRG BGBG GRGR GBGB

**buffer** Temporary storage for acquired data.

## D

default A default parameter value recorded in the driver; in many setting cases, the default input of a control is a certain value (often 0) that means use the current default setting.

## **E**

external trigger    A voltage pulse from an external source that triggers an event such as A/D conversion.



## **F**

frame A complete image; in interlaced formats, a frame is composed of two fields.

## **G**

- gain      Applied value to compensate for discrepancies in the filter for a particular color.
- Gigabit Ethernet      Describes technologies which transmit Ethernet packets at a rate of a gigabit per second.
- GigE Vision      A camera interface standard developed using the Gigabit Ethernet communication protocol.
- 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.
- GUI      Graphical user interface. An intuitive, easy-to-use means of communicating information to and from a computer program by means of graphical screen displays; GUIs can resemble the front panels of instruments or other objects associated with a computer program.

# I

- I/O Input/output. The transfer of data to/from a computer system involving communications channels, operator interface devices, or data acquisition and control interfaces.
- IEEE Institute of Electrical and Electronics Engineers.
- ISO A high voltage isolated trigger.
- Trigger

## L

LUT Lookup table. A selection in Measurement & Automation Explorer (MAX) for Vision that contains formulas that let you implement simple imaging operations such as contrast enhancement, data inversion, gamma manipulation, or other nonlinear transfer functions.

## M

**MAX** Measurement & Automation Explorer. The National Instruments Windows-based graphical configuration utility you can use to configure NI software and hardware, execute system diagnostics, add new channels and interfaces, and view the devices and instruments you have connected to your computer. MAX is installed on the desktop during the National Instruments driver software installation.

memory **See** [buffer](#).

buffer

memory window Continuous blocks of memory that can be accessed quickly by changing addresses on the local processor.

## **N**

NI-IMAQ Driver software for National Instruments image acquisition hardware.

NI-IMAQdx National Instruments driver software for IEEE 1394 and GigE Vision cameras.

**O**

one- Applies to pulse generation and acquisitions. A one-shot pulse  
shot or acquisition happens only once.

## P

- PCI** Peripheral Component Interconnect. A high-performance expansion bus architecture originally developed by Intel to replace ISA and EISA; it is achieving widespread acceptance as a standard for PCs and workstations and offers a theoretical maximum transfer rate of 133 Mbytes/s.
- PCIe** PCI Express. A high-performance expansion bus architecture originally developed by Intel to replace PCI. PCIe offers a theoretical maximum transfer rate that is dependent upon lane width. A x1 link theoretically provides 250 MB/s in each direction—to and from the device. Once overhead is accounted for, a x1 link can provide approximately 200 MB/s of input capability and 200 MB/s of output capability. Increasing the number of lanes in a link increases maximum throughput by approximately the same factor.
- PCLK** Pixel clock signal. Times the sampling of pixels on a video line.
- pixel** Picture element. The smallest division that makes up the video scan line; for display on a computer monitor, a pixel's optimum dimension is square (aspect ratio of 1:1, or the width equal to the height).
- pixel aspect ratio** The ratio between the physical horizontal size and the vertical size of the region covered by the pixel. An acquired pixel should optimally be square, thus the optimal value is 1.0; however, typically it falls between 0.95 and 1.05, depending on camera quality.
- pixel clock** Divides the incoming horizontal video line into pixels.
- pixel count** The total number of pixels between two horizontal sync signals; the pixel count determines the frequency of the pixel clock.



## Q

quadrature encoder An encoding technique for a rotating device where two tracks of information are placed on the device, with the signals on the tracks offset by 90 degrees from each other. The phase difference indicates the position and direction of rotation.

## R

- real time** A property of an event or system in which data is processed as it is acquired instead of being accumulated and processed at a later time.
- resolution** The smallest signal increment that can be detected by a measurement system; resolution can be expressed in bits, in proportions, or in percent of full scale. For example, a system has 12-bit resolution, one part in 4,096 resolution, and 0.0244 percent of full scale.
- RGB** Red, green, and blue. The three primary colors used to represent a color picture. An RGB camera is a camera that delivers three signals, one for each primary.
- ring** Performs an acquisition that loops continually on a specified number of buffers.
- ROI** Region of interest. (1) An area of the image that is graphically selected from a window displaying the image. This area can be used focus further processing; (2) A hardware-programmable rectangular portion of the acquisition window.
- RTSI bus** Real-Time System Integration Bus. The National Instruments timing bus that connects image acquisition and DAQ devices directly, by means of connectors on top of the devices, for precise synchronization of functions.

## S

saturation The richness of a color. A saturation of zero corresponds to no color, that is, a gray pixel. Pink is a red with low saturation.

sequence Performs an acquisition that acquires a specified number of buffers, then stops.

snap Acquires a single frame or field to a buffer.

sync Tells the display where to put a video picture; the horizontal sync indicates the picture's left-to-right placement and the vertical sync indicates top-to-bottom placement.

## T

timeout	Length of time, in milliseconds, that the driver waits for an image from the camera before returning an error
transfer rate	The rate, measured in bytes/s, at which data is moved from source to destination after software initialization and setup operations; the maximum rate at which the hardware can operate.
trigger	Any event that causes or starts some form of data capture.
trigger control and mapping circuitry	Circuitry that routes, monitors, and drives the external and RTSI bus trigger lines; you can configure each of these lines to start or stop acquisition on a rising or falling edge.
TTL	Transistor-transistor logic. A digital circuit composed of bipolar transistors wired in a certain manner. A typical medium-speed digital technology. Nominal TTL logic levels are 0 and 5 V.

## U

user Memory buffer created by the user as a destination for the buffer image. In LabVIEW, this is created with the IMAQ Create VI.

## 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 stand-alone instrument
2. A LabVIEW software module (VI), which consists of a front panel user interface and a block diagram program.

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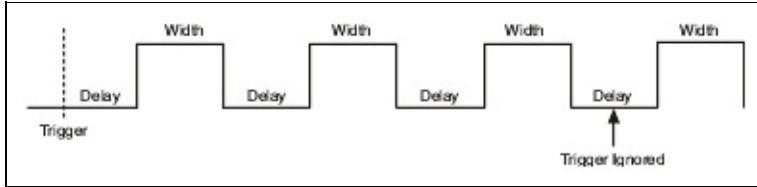
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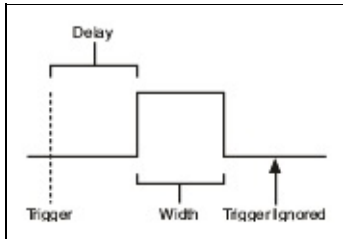
# Pulse Examples

There are three types of Pulses available for the **Type** setting:

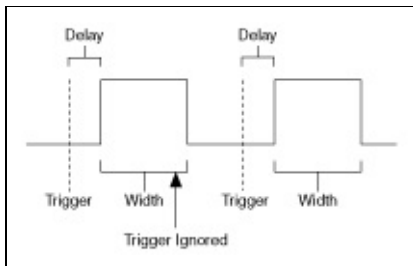
- **Pulse Train** will start generating a continuous pulse train when the pulse trigger occurs, as shown in the following figure:



- **Single Pulse** generates a pulse on the first assertion edge of the selected pulse trigger, as shown in the following figure.



- **Rearmed Pulse** generates a pulse on all assertion edges of the selected pulse trigger, as shown in the following figure.





## Branch Offices

Office	Telephone Number
Australia	1800 300 800
Austria	43 662 457990-0
Belgium	32 (0) 2 757 0020
Brazil	55 11 3262 3599
Canada	800 433 3488
China	86 21 5050 9800
Czech Republic	420 224 235 774
Denmark	45 45 76 26 00
Finland	358 (0) 9 725 72511
France	33 (0) 1 57 66 24 24
Germany	49 89 7413130
India	91 80 41190000
Israel	972 0 3 6393737
Italy	39 02 41309277
Japan	0120-527196 / 81 3 5472 2970
Korea	82 02 3451 3400
Lebanon	961 (0) 1 33 28 28
Malaysia	1800 887710
Mexico	01 800 010 0793
Netherlands	31 (0) 348 433 466
New Zealand	0800 553 322
Norway	47 (0) 66 90 76 60
Poland	48 22 3390150
Portugal	351 210 311 210
Russia	7 495 783 6851
Singapore	1800 226 5886
Slovenia	386 3 425 42 00

South Africa	27 0 11 805 8197
Spain	34 91 640 0085
Sweden	46 (0) 8 587 895 00
Switzerland	41 56 2005151
Taiwan	886 02 2377 2222
Thailand	662 278 6777
Turkey	90 212 279 3031
United Kingdom	44 (0) 1635 523545
United States (Corporate)	512 683 0100