Related Documentation

Most NI Vision 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 <u>Adobe Systems Incorporated Web site</u> at www.adobe.com to download Adobe Reader. Refer to the <u>National Instruments Product Manuals Library</u> at 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 Concepts Manual—Describes the basic concepts of image analysis, image processing, and machine vision. This manual also contains in-depth discussions about imaging functions for advanced users.
- *NI Vision for LabVIEW VI Reference Help*—Contains reference information about NI Vision for LabVIEW palettes and VIs.
- NI Vision for LabWindows/CVI Function Reference Help—Contains reference information about NI Vision for LabWindows/CVI functions.
- NI Vision for Visual Basic Reference Help—Contains reference information about NI Vision for Visual Basic objects and their associated properties, methods, and events.
- *NI Vision Assistant Help*—Contains descriptions of the NI Vision Assistant features and functions and provides and instructions for using them.
- NI Vision Builder for Automated Inspection: Configuration Help— Contains information about using the Vision Builder for Automated Inspection Configuration Interface to create a machine vision application.
- NI Vision Builder for Automated Inspection: Inspection Help— Contains information about running applications created with Vision Builder for Automated Inspection (Vision Builder AI) in the Vision Builder AI Interface.
- NI Vision Builder for Automated Inspection Tutorial—Describes Vision Builder for Automated Inspection and provides step-by-step instructions for solving common visual inspection tasks, such as inspection, gauging, part presence, guidance, and counting.

• NI Vision Builder for Automated Inspection Release Notes— Contains information about the minimum system requirements, installation instructions, device support, and known issues for Vision Builder for Automated Inspection.

Using Help

Conventions

Navigating Help

Searching Help

Printing Help File Topics

Conventions

This help file uses the following formatting and typographical conventions:

- [] Information that specifically applies to the NI Vision Template Editor wizard accessed from Vision Assistant is provided in square brackets.
- 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.
- **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, emphasis, or an introduction to a key concept.
- green Underlined text in this color denotes a link to a help topic, help file, or Web address.
- italic Italic text denotes variables or cross references. 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.

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

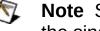
Use the following checkboxes on the **Search** tab to customize a search:

- **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.

Accessing the NI Vision Template Editor

You can access the NI Vision Template Editor from the **Start** menu or from within NI Vision Builder for Automated Inspection (Vision Builder AI) or NI Vision Assistant. You can use the NI Vision Template Editor to perform **Pattern Matching**, **Geometric Matching**, or **Golden Template Comparison** on your template.

From the Start Menu

Complete the following steps to launch the NI Vision Template Editor from the **Start** menu and open an image from which you want to create a template.

- 1. Click Start»All Programs»National Instruments»Vision»Template Editor.
- 2. Complete the instructions in **Selecting the Template Type**.

From Vision Assistant

The NI Vision Template Editor opens from Vision Assistant in a wizard to guide you through the creation of a new template. Complete the following steps to launch the NI Vision Template Editor wizard from Vision Assistant.

- 1. Click **File»Open Image**, and navigate to the image file from which you want to create a template.
- 2. Click **Open** or double-click the image file name to open the file.
- 3. Click the step you want to use in the **Machine Vision** tab of the Processing Functions palette to access the Setup window for the step you selected.
- 4. Click **New Template** in the **Template** tab of the Setup window.

From Vision Builder Al

The NI Vision Template Editor opens from Vision Builder AI in a wizard to guide you through the creation of a new template. Complete the following steps to launch the NI Vision Template Editor wizard in Vision Builder AI.

- 1. Acquire, or simulate the acquisition of, an image from which you want to create a template. Refer to the *Vision Builder for Automated Inspection: Configuration Help* for information about acquiring images or simulating acquisitions.
- 2. Click the step you want to use in the **Check for Presence** tab of the Inspection Steps palette to access the Setup panel for the step you selected.
- 3. Click **New Template** in the **Template** tab of the setup panel. This launches the NI Vision Template Editor.

How to Create a Template

Selecting the Template Type

Selecting the Template Region

Defining a Pattern Matching Mask

Defining the Template Curves

Customizing the Scoring

Specifying the Match Offset

Defining a Golden Template Mask

Selecting the Template Type

You can create pattern matching, geometric matching, and golden template comparison templates using the NI Vision Template Editor. Complete the following steps to define the type of template you want to create and to select an image from which you want to create a template.

1. Select **File»New Template**. The following dialog box opens.



- 2. Select the type of template you want to create. You can select more than one type.
- 3. Browse to the image from which you want to extract the template, and click **Open**.
- 4. Click **OK** to create the template.

Only the tabs corresponding to the type of template you selected are enabled in the main interface of the template editor.

Template Type	Available Tabs
Pattern Matching Template	Select Template Region, Define Pattern Matching Mask
Geometric Matching Template	Select Template Region, Define Curves, Customize Scoring, Specify Match Offset
Golden Template	Select Template Region, Define Golden Template Mask

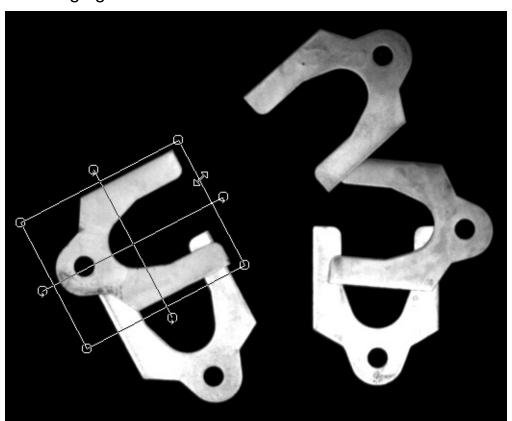
You can add information of another type by selecting **Edit»Add Pattern Matching Information**, **Edit»Add Geometric Matching Information**, or

Edit»Add Golden Template Information.

Selecting the Template Region

By default, the NI Vision Template Editor defines the entire image as the template region. Complete the following steps within the **Select Template Region** tab to define a smaller area of the image as the template region.

- 1. Select a rectangular selection tool from the toolbar located to the right of the image.
- 2. Draw a region of interest (ROI) around the area of the image that contains the part you want to learn as a template, as shown in the following figure.



3. Select the next available tab to complete the selection of the template region.



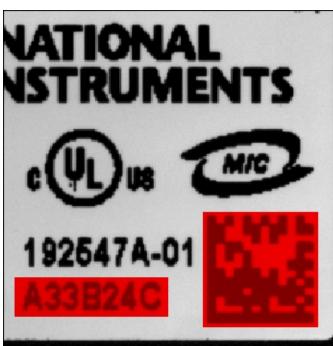
Note You can save the template at any point after you select the template region and verify the resulting curves. Click **File»Save Template** to save the template. If you did not specify parameter values before saving the template, the NI Vision Template Editor creates the template using the default values.

Defining a Pattern Matching Mask

Complete the following steps within the **Define Pattern Matching Mask** tab to define the pattern matching template mask on an image.

- 1. Draw regions to ignore using the **Draw Template Regions to Ignore** tools. Select a tool, and draw template regions to ignore in the image. The regions to ignore are shown in red on the template.
- 2. If necessary, use the Erase Area tool to erase customizations at specific locations of the template. Click **Clear All Regions to Ignore** to erase all regions to ignore. Press <Ctrl-Z> to undo the last customization. Press <Ctrl-Shift-Z> to redo the last customization that you undid.

The following image demonstrates how you can use a pattern matching mask to ignore regions of a template that change from image to image. When the pattern matching algorithm learns the template, it will ignore the serial number and the 2D barcode that change from image to image.



Defining the Template Curves

Complete the following steps within the **Define Curves** tab to define the template curves.

1. Adjust the curve parameters to ensure that the green highlighted curves accurately reflect the part of the image you want to learn.



Note When you adjust curve parameters, the NI Vision Template Editor automatically computes new curves and overlays the results on the image in green.

2. Enable the **View Resulting Curves** control to verify the curves that you want the geometric matching algorithm to learn.



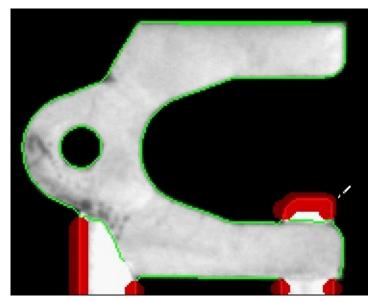
Note If the **View Resulting Curves** control is enabled, you cannot adjust the parameter values. If necessary, disable the control to readjust the parameter values before proceeding to the next tab.

 Customize the curves using Draw Regions to Ignore and Draw Additional Curves. Enable the View Resulting Curves control after each customization to verify changes to the template.
 Disable the View Resulting Curves control to continue customizing the template.

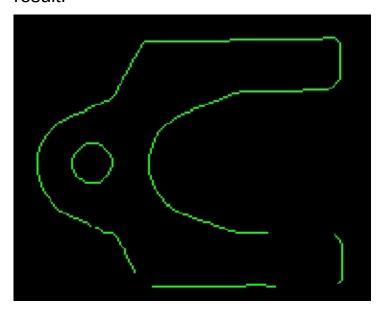


Note You can use **Erase Customization** to erase customizations at specific locations of the template. Click **Clear All Customization** to erase all customization of the template. Press <Ctrl-Z> to undo the last customization. Press <Shift-Ctrl-Z> to redo the last customization that you undid.

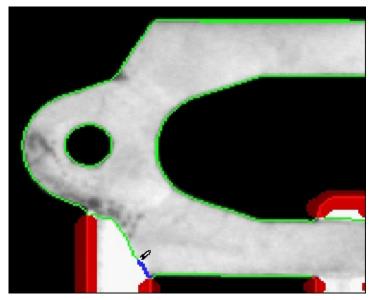
a. Select **Draw Regions to Ignore**. Use the pen tool to specify regions of the image that contain superfluous curves that may have been introduced by shadows, glares, or overlapping parts. The algorithm ignores these regions during the learning process.



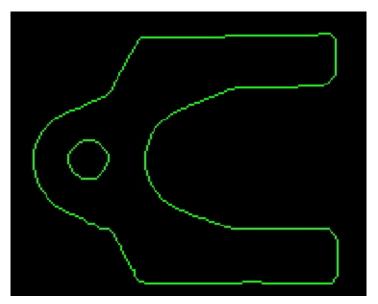
b. Enable the **View Resulting Curves** control to verify the result.



c. Select **Draw Additional Curves**. Use the pen tool to specify curves on the image that may have been hidden by foreign objects, glares, or shadows. The algorithm looks for these added curves during the learning process.



d. Enable the **View Resulting Curves** control to verify the result.

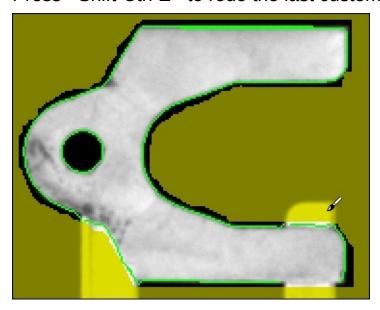


- 4. Verify that the final result only includes the curves you want the algorithm to learn. If necessary, disable the **View Resulting Curves** control and readjust the curve parameters and the curve customization until all of the curves that you want to include in the template are highlighted.
- 5. Select the **Customize Scoring** tab to complete the definition of template curves.

Customizing the Scoring

By default, the geometric matching algorithm uses the entire template to compute the correlation score. Complete the following steps within the **Customize Scoring** tab to specify regions of the image that you want the geometric matching algorithm to ignore when computing the correlation score.

- 1. Select **Draw Regions to Ignore**. Use the pen tool to specify the regions on the image you want the algorithm to ignore.
- If necessary, use Erase Customization to erase customizations at specific locations of the template.
 Click Clear All Customization to erase all customization of the template. Press <Ctrl-Z> to undo the last customization.
 Press <Shift-Ctrl-Z> to redo the last customization that you undid.



3. Select the **Specify Match Offset** tab to complete the customization.

Specifying the Match Offset

By default, the geometric matching algorithm references the center of the template when returning the location of a valid match. To offset this reference, within the **Specify Match Offset** tab, click a point on the template or enter a **Match Offset** value, in pixels.

Click **File»Save Template** to apply your customizations and save the template.

Defining a Golden Template Mask

Complete the following steps within the **Define Golden Template Mask** tab to define the golden template mask on an image of a label under inspection.

1. Adjust the **Edge Threshold** and **Edge Thickness** to ensure that the red highlighted curves accurately reflect the part of the image you want to ignore.



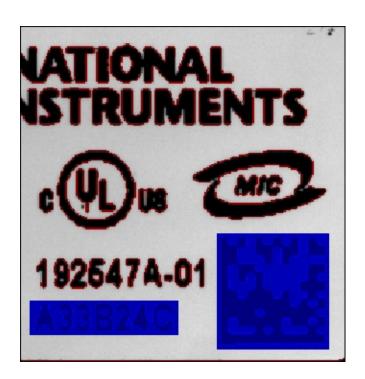
Note When you adjust the Ignore Edge Region parameters, the template editor automatically computes new edge regions and overlays the results on the image in red.



Note Edge Thickness is a run-time parameter. The modification of this parameter in the training interface is for display purposes. The Golden Template is always saved with an edge thickness of 1.

- 2. Customize the regions to ignore using the **Draw Additional Regions to Ignore** tools. Select a tool, and draw additional regions to ignore in the image. The additional regions to ignore are shown in blue on the template.
- 3. If necessary, use the Erase Area tool to erase customizations at specific locations of the template. Click **Clear All Additional Regions** to erase additional regions to ignore. Press <Ctrl-Z> to undo the last customization. Press <Ctrl-Shift-Z> to redo the last customization that you undid.

The following image demonstrates how you can use a golden template mask to ignore regions of a template that change from image to image. When the golden template algorithm learns the template, it will ignore the serial number and the 2D barcode that change from image to image.



Control Descriptions

Use the following controls to create a template using the NI Vision Template Editor.

New Template Dialog

- Select the type of template to create.
 - **Pattern Matching Template**—Creates a pattern matching template.
 - Geometric Matching Template—Creates a geometric matching template.
 - **Golden Template**—Creates a golden template.
 - **Tip** You can select more than one type.
- Select an image to extract the template from—Specifies the path to the image from which you want to create a template.

Select Template Region

- **Zoom Tool**—Enlarges a region in the image.
- **Rectangle Tool**—Selects a rectangular region in the image. Use this selection tool when the main axis of an object is aligned with the horizontal axis of the image.
- **Rotated Rectangle Tool**—Selects a rectangular region in the image. Use this selection tool when the main axis of an object is *not* aligned with the horizontal axis of the image.

Define Pattern Matching Mask

- **Draw Template Regions to Ignore**—Controls that allow you to draw template regions to ignore when the pattern matching algorithm learns the template.
 - **Pen Tool**—Manually draws any shape areas using this tool. You can set the width of the pen with the **Pen Width** control.
 - **Rectangle Tool**—Draws a rectangular region to ignore.
 - **Oval Tool**—Draws an oval to ignore.
 - Polygon Tool—Draws a polygon to ignore. Click to add polygon vertices. Double-click to add the last vertex and close the polygon.
 - **Free Hand Tool**—Draws a closed shape to ignore.
 - Eraser—Erases customization at specific locations of the template.
- **Pen Width**—Specifies the width of the Pen or Eraser tools.
- Clear All Regions to Ignore—Erases all customization.
- **Template Regions to Ignore**—Indicates the color used to highlight template regions to ignore by the pattern matching algorithm.

Define Curves

Specify Curve Parameters

- Extraction Mode—Specifies how the algorithm identifies curves in the image.
 - Normal—Makes no assumptions about the uniformity of objects in the image or the image background.
 - Uniform Regions—Assumes that either the objects in the image or the image background consist of uniform pixel values. Use this mode to calculate the external curves of the objects with greater accuracy.
- **Edge Threshold**—Specifies the minimum contrast an edge pixel must have to be considered part of a curve. This value can range from 0 to 255. The default value is 75.
- Edge Filter Size—Specifies the kernel size to use for computing the edges in the image. The options are **Normal** and **Fine**. The default value is **Normal**.
- **Minimum Length**—Specifies the length, in pixels, of the smallest curve you want to extract. The default value is 25.
- Row Search Step Size—Specifies the distance, in the y direction, between the image rows that the algorithm inspects for <u>curve seed points</u>. Valid values range from 1 to 255. The default value is 15.
- Column Search Step Size—Specifies the distance, in the x direction, between the image columns that the algorithm inspects for <u>curve seed points</u>. Valid values range from 1 to 255. The default value is 15.

Customize Curves

 Initial Curves—Indicates the color used to highlight the curves found by the algorithm in the image using the current **Specify Curve Parameters** settings.

- **Draw Regions to Ignore**—When enabled, you can select regions of the image that you want the algorithm to ignore during matching.
- **Draw Additional Curves**—When enabled, you can add curves that may be missing in the template.
- **Erase Customization**—Erases customization at specific locations of the template.
- Pen Width—Specifies the width of the drawing tool in the Draw Regions to Ignore or Erase Customization modes.
- Clear All Customization—Erases all curve customization.

Customize Scoring

- **Draw Regions to Ignore**—When enabled, you can select regions of the image that you want the algorithm to ignore when computing the correlation score.
- **Erase Customization**—Removes specific locations of the template from the computation of the correlation score.
- **Pen Width**—Specifies the width of the drawing tool in the **Draw Regions to Ignore** mode.
- Clear All Customization—Erases all customization of correlation scoring.

Specify Match Offset

• Match Offset—Specifies the number of pixels from the center of the template to shift the location of the match returned by the algorithm.

Define Golden Template Mask

• Edge Threshold—The NI Vision Template Editor uses a Sobel algorithm to find the edges of objects in the template. Edge Threshold is the threshold value applied to the grayscale Sobel image. The threshold results in a binary image containing only the object edges. This binary image is used to mask the edges you want to ignore during golden template comparison.



Note If the inspection image exhibits little contrast between edges and the background, the image resulting from the Sobel algorithm can be dark. Dark Sobel images require a low value for Edge Threshold. The default value is 15.

• Edge Thickness—Specifies the thickness of the edges to ignore.



Note Edge Thickness is a run-time parameter. The modification of this parameter in the training interface is for display purposes. The Golden Template is always saved with an edge thickness of 1.

- Draw Additional Regions to Ignore—Controls that allow you to draw additional regions to ignore by the golden template comparison algorithm.
 - Pen Tool—Manually draws any shape areas using this tool.
 You can set the width of the pen with the Pen Width control.
 - Rectangle Tool—Draws a rectangular region to ignore.
 - **Oval Tool**—Draws an oval to ignore.
 - Polygon Tool—Draws a polygon to ignore. Click to add polygon vertices. Double-click to add the last vertex and close the polygon.
 - **Free Hand Tool**—Draws a closed shape to ignore.
 - Eraser—Erases customization at specific locations of the template.

- Pen Width—Specifies the width of the Pen or Eraser tools.
- Clear All Additional Regions—Erases all customization.
- Edge Regions to Ignore—Indicates the color used to highlight the edges of the objects in the image using the current Edge Threshold and Edge Thickness settings.
- Additional Regions to Ignore—Indicates the color used to highlight additional regions to ignore by the golden template comparison algorithm.

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 - Standard Service Program Membership—This program entitles members to direct access to NI Applications
 Engineers via phone and email for one-to-one technical support, as well as exclusive access to on demand training modules via the <u>Services Resource Center</u>. NI offers complementary membership for a full year after purchase, after which you may renew to continue your benefits.

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- <u>Training and Certification</u>—Visit ni.com/training for self-paced training, eLearning virtual classrooms, interactive CDs, and Certification program information. 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, National Instruments Alliance Partner 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 <u>local office</u> or NI corporate headquarters. You also can visit the <u>Worldwide Offices</u> 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.

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
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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
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Switzerland	41 56 2005151
Taiwan	886 02 2377 2222
Thailand	662 278 6777
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United States (Corporate) 512 683 0100	