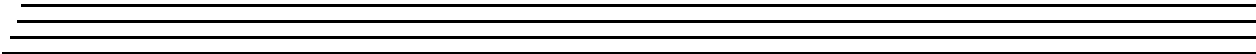
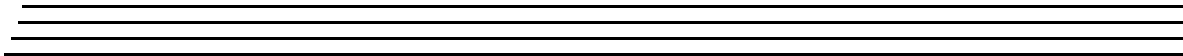
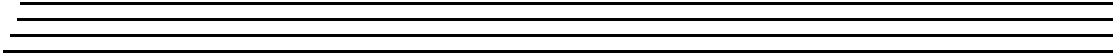




***DT Vision Foundry
User's Manual
(for Windows)***



Fourth Edition
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Data Translation, Inc.
100 Locke Drive
Marlboro, MA 01752-1192
(508) 481-3700

www.datatranslation.com
Fax: (508) 481-8620
E-mail: info@datx.com

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About this Manual

This manual describes how to install DT Vision Foundry™ (for Windows) and how to use the DT Vision Foundry application and machine vision / industrial imaging tools.

Intended Audience

This manual is intended for manufacturers, inspection engineers, and others responsible for creating applications that perform machine vision or other industrial imaging operations. It is assumed that you are familiar with the Windows® 2000 or Windows XP operating environment on the IBM® PC or compatible computer platform, that you are familiar with machine vision principles, and that you have clearly defined your requirements.

What You Should Learn from this Manual

Using this manual, you should be able to successfully install DT Vision Foundry and use the DT Vision Foundry application and tools to perform machine vision and other industrial imaging operations.

Organization of this Manual

This manual is organized as follows:

- [Chapter 1, “Installing DT Vision Foundry,”](#) describes how to install the DT Vision Foundry application and tools.
- [Chapter 2, “Using DT Vision Foundry,”](#) describes how to use the DT Vision Foundry application.
- [Chapter 3, “Using the Arithmetic Tool,”](#) describes how to use the Arithmetic tool.

- [Chapter 4, “Using the AVI Player Tool,”](#) describes how to use the AVI Player tool.
- [Chapter 5, “Using the Barcode Reader Tool,”](#) describes how to use the Barcode Reader tool.
- [Chapter 6, “Using the Blob Analysis Tool,”](#) describes how to use the Blob Analysis tool.
- [Chapter 7, “Using the Calibration Tool,”](#) describes how to use the Calibration tool.
- [Chapter 8, “Using the Color Plane Tool,”](#) describes how to use the Color Plane tool.
- [Chapter 9, “Using the Contour Classifier Tool,”](#) describes how to use the Contour Classifier tool.
- [Chapter 10, “Using the Custom Script Tool,”](#) describes how to use the Custom Script tool.
- [Chapter 11, “Using the Data Matrix Reader Tool,”](#) describes how to use the Data Matrix Reader tool.
- [Chapter 12, “Using the Digital I/O Tool,”](#) describes how to use the Digital I/O tool.
- [Chapter 13, “Using the Display Tool,”](#) describes how to use the Display tool.
- [Chapter 14, “Using the Edge Finder Tool,”](#) describes how to use the Edge Finder tool.
- [Chapter 15, “Using the Export Tool,”](#) describes how to use the Export tool.
- [Chapter 16, “Using the File Manager Tool,”](#) describes how to use the File Manager tool.
- [Chapter 17, “Using the Filter Tool,”](#) describes how to use the Filter tool.
- [Chapter 18, “Using the Gauge Tool,”](#) describes how to use the Gauge tool.

- [Chapter 19, “Using the Histogram Tool,”](#) describes how to use the Histogram tool.
- [Chapter 20, “Using the Image Classifier Tool,”](#) describes how to use the Image Classifier tool.
- [Chapter 21, “Using the Image Manager Tool,”](#) describes how to use the Image Manager tool.
- [Chapter 22, “Using the Image Modifier Tool,”](#) describes how to use the Image Modifier tool.
- [Chapter 23, “Using the Import Tool,”](#) describes how to use the Import tool.
- [Chapter 24, “Using the Line Profile Tool,”](#) describes how to use the Line Profile tool.
- [Chapter 25, “Using the Match Tool,”](#) describes how to use the Match tool.
- [Chapter 26, “Using the Morphology Tool,”](#) describes how to use the Morphology tool.
- [Chapter 27, “Using the Picture Tool,”](#) describes how to use the Picture tool.
- [Chapter 28, “Using the Pixel Change Tool,”](#) describes how to use the Pixel Change tool.
- [Chapter 29, “Using the Point & Click Script Tool,”](#) describes how to use the Point & Click Script tool.
- [Chapter 30, “Using the Polar Unwrap Tool,”](#) describes how to use the Polar Unwrap tool.
- [Chapter 31, “Using the Prompt Tool,”](#) describes how to use the Prompt tool.
- [Chapter 32, “Using the ROI Manager Tool,”](#) describes how to use the ROI Manager tool.
- [Chapter 33, “Using the ROI Shape Fitter Tool,”](#) describes how to use the ROI Shape Fitter tool.

- [Chapter 34, “Using the Search Tool,”](#) describes how to use the Search tool.
- [Chapter 35, “Using the Serial I/O Tool,”](#) describes how to use the Serial I/O tool.
- [Chapter 36, “Using the Sound Tool,”](#) describes how to use the Sound tool.
- [Chapter 37, “Using the Status Tool,”](#) describes how to use the Status tool.
- [Chapter 38, “Using the Text Tool,”](#) describes how to use the Text tool.
- [Chapter 39, “Using the Threshold Tool,”](#) describes how to use the Threshold tool.
- [Chapter 40, “Using the TWAIN Tool,”](#) describes how to use the TWAIN tool.
- [Chapter 41, “Product Support,”](#) describes how to get help if you have trouble using DT Vision Foundry.

An index completes this manual.

Conventions Used in this Manual

The following conventions are used in this manual:

- Notes provide useful information that requires special emphasis, cautions provide information to help you avoid losing data or damaging your equipment, and warnings provide information to help you avoid catastrophic damage to yourself or your equipment.
- Items that you select or type are shown in **bold**. For example, if the instructions tell you to click **OK**, click the OK button found in the DT Vision Foundry window.

- Angle brackets indicate that you must press a key on the keyboard. For example, if the instructions tell you to press **<Spacebar>**, press the space bar key.
- When navigating the screens, an instruction such as **File | Save** means to select “Save” from the drop-down menu under “File.”

Related Information

Refer to the following documentation for more information on using DT Vision Foundry:

- *DT Vision Foundry API Manual*. This manual contains information that allows you to create custom tools and your own machine vision applications using the DT Vision Foundry object-oriented APIs. APIs are included for the DT Vision Foundry application and for most tools.
- DT Vision Foundry online help. This contains all the information included in this manual and in the *DT Vision Foundry API Manual*. Refer to [page 9](#) for information on how to open this help file.
- Documentation for Data Translation® frame grabber boards. Some boards are shipped with a user’s manual and a device driver manual. The user’s manual describes how to install the board, how to get started using the board, and the features of the board. The device driver manual describes how to install the device driver for the board and the capabilities supported by the device driver.

Some boards are shipped with a getting started manual and a user’s manual. The getting started manual describes how to install the board, how to install the device driver for the board, and how to get started using the board. The user’s manual describes the features of the board and the capabilities supported by the device driver for the board.

Where to Get Help

Should you run into problems installing or using DT Vision Foundry, the Technical Support Department is available to provide technical assistance. Refer to [Chapter 41, “Product Support,”](#) for information on how to contact the Technical Support Department. If you are outside the U.S. or Canada, call your local distributor, whose number is listed in your Data Translation product handbook or contact the Data Translation web site (www.datatranslation.com).



Installing DT Vision Foundry

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Introduction

DT Vision Foundry is an object-oriented, machine vision software product that provides the following features:

- Is intuitive and easy to use.
- Can be used as a stand-alone image processing application.
- Allows you to easily add custom tools that you can use with the tools supplied with DT Vision Foundry and with third-party tools.
- Supports a wide range of imaging devices such as imaging boards, NDT equipment, and medical devices.
- Runs under Windows 2000 and Windows XP.

To make DT Vision Foundry powerful, expandable, and still easy to use and understand, the application is segmented into two distinct parts. These two parts can be described by using the familiar idea of a simple workshop. In a workshop, you would have an object that you are working on, for example, a block of wood that you want to turn into a toy boat. In the workshop are several tools, such as screwdrivers, drills, sanders, and a hammer. You use these tools on the block of wood to turn it into the toy boat. In other words, tools are being used on an object.

To relate this to how DT Vision Foundry is designed, think of an image as the object you need to work on. You might need to enhance the image to see a fine detail, to better show a defect, or to take some kind of measurement. In any case, you need some image processing tools to work on the image. These tools might perform a histogram, run a filter, or subtract one image from another. In these cases, you could use the DT Vision Foundry Histogram tool, Filter tool, or Arithmetic tool.

System Requirements

1

The following are the recommended requirements for using DT Vision Foundry:

- Pentium-class/AMD-based processor (or higher).
- Windows 2000 (with Service Pack 1) or Windows XP.
- At least 32 MB of RAM. If you intend to use the Image Classifier tool, it is recommended that you have at least 128 MB of RAM.
- At least 80 MB of available hard disk space.
- CD-ROM drive.
- SVGA monitor.
- Display resolution set to 1024x768 (recommended).
- Imaging device or frame grabber board (optional).
- Sound card (optional).
- Microsoft® Visual C/C++ 6.0 for creating custom tools or applications.

Installing the Software

This section describes how to install DT Vision Foundry. If DT Vision Foundry is already installed in your system, begin with the next section. If DT Vision Foundry is not installed in your system, begin with “[Installing the Main Application,](#)” on [page 6](#).

Notes: When you finish installing DT Vision Foundry, it is recommended that you read the Readme file (Readme.txt). This file contains valuable and up-to-date information concerning DT Vision Foundry. The Readme file is located on the DT Vision Foundry CD-ROM; use any text editor to view this file.

To ensure that you receive technical support and new product information, it is recommended that you register DT Vision Foundry at the Data Translation web site (<http://www.datatranslation.com/registration/>) when you finish the installation.

Preparing to Install the Software

IMPORTANT: If a previous version of DT Vision Foundry is already installed in your system, make sure that you perform the following steps before you install the new version:

1. If you modified any of the sample point & click scripts (*.PCS files), sample images (*.BMP files), or sample Visual C++ source files (*.CPP files) that were installed with DT Vision Foundry, move them to a different directory to ensure that they are preserved.

2. If you modified the DTTOOLS.INI file to customize your toolbars, move this file (located in C:\Program Files\Data Translation\DT Vision Foundry\BIN, by default) to a different directory to ensure that it is preserved.
3. If you used a version of DT Vision Foundry prior to Version 2.5 to create your own custom filters or to modify any of the default filters, refer to the next section before you install DT Vision Foundry to ensure that your custom filters are preserved.
4. Uninstall DT Vision Foundry. You can use either the **Uninstall** option from the DT Measure Foundry program group or the **Add/Remove Programs** option from the Windows Control Panel. Refer to [page 10](#) for more information.
5. If you installed the DTiX Server, uninstall it before installing the new version of DT Vision Foundry. This ensures that the most up-to-date version of DTiX is always installed in your system.

Saving Custom Filters

Versions of DT Vision Foundry prior to Version 2.5 saved only a .ker file. This file contained the kernel information only; it did not contain the gain, offset, divide, or thresholding information. DT Vision Foundry Version 2.5 or higher saves both a .ker file, which contains the kernel information, and a .flt file, which contains the gain, offset, divide, and thresholding information.

If you used a version of DT Vision Foundry prior to Version 2.5 to create your own custom filters or to modify any of the default filters, perform the following steps to ensure that your .ker files are preserved and that the appropriate .flt files are created:

1. Run the old version of DT Vision Foundry and open the Filter tool.
2. For each filter that you created or modified, write down the gain, offset, divide, and thresholding values.

3. Locate the directory where the filter files are stored (C:\Program Files\Data Translation\DT Vision Foundry\Tools\DT_Filtr, by default) and move your custom and modified filter files (*filtername.ker*) to a different directory.
4. Install the new version of DT Vision Foundry. Refer to the next section.
5. When the installation is complete, move your custom and modified filter files (*filtername.ker*) back to the appropriate directory (C:\Program Files\Data Translation\DT Vision Foundry\Tools\DT_Filtr, by default).
6. Run the new version of DT Vision Foundry and open the Filter tool.
7. If the Filter tool encounters a filter for which only a .ker file exists, the tool displays a warning indicating that a .flt file was not found. Click **OK** to create a .flt file with the gain, offset, divide, and thresholding parameters set to their default values.
8. Select one of the custom or modified filters from the filter list.
9. Reset the gain, offset, divide, and thresholding values.
10. Select **Save Kernel** from the File menu to save the filter.
The kernel information is saved in a .ker file; the gain, offset, divide, and thresholding information is saved in a .flt file.
11. Repeat steps 8 to 10 for each custom and modified filter.

Installing the Main Application

Notes: Before you install DT Vision Foundry, make sure that you have installed the latest versions of the device driver and other support software for your device.

You must have Administrator rights on the system on which you are installing DT Vision Foundry.

To install DT Vision Foundry, perform the following steps:

1. Insert the DT Vision Foundry CD into the CD-ROM drive.
*Typically, the software installation procedure starts automatically. If the installation procedure does not start automatically, click **Run** from the Windows Start menu, either enter **x:\SETUP.EXE** (where **x** is the letter of your CD-ROM drive) in the Run dialog box or use the Browse button to locate **SETUP.EXE**, then click **OK**.*
2. From the Welcome screen, click **Next** to continue.
3. Click **Next** to accept the license agreement.
4. To accept the default folder in which to install the software (C:\Program Files\Data Translation\DT Vision Foundry), click **Next**. To specify a different folder, use the Browse button to locate the folder, then click **Next**.
5. If you want to create backup files of existing files, click **Yes**, specify the directory in which to store the backup files, then click **Next**. If you do not want to create backup files, click **No**, then click **Next**.
6. If you do not intend to use DT Vision Foundry with the DTiX Server, uncheck **DTiX**, then click **Next**.
7. To accept the default program group (Data Translation, Inc | DT Vision Foundry), click **Next**. To specify a different program group, either select the program group from the list or enter it in the text box, then click **Next**.
8. Click **Next** to continue.
The installation program copies the DT Vision Foundry application files.
9. After all the files have been copied, click the appropriate radio button to indicate whether you want to start DT Measure Foundry after installation, then click **Finish**.

Installing the DTiX Server

If you selected the **DTiX** checkbox during the installation of the main application (see the previous section), the installation procedure automatically begins installing the DTiX Server.

Note: It is recommended that you continue the installation of DTiX, even if DTiX is already installed on your system. The installation procedure overwrites older files with newer files to ensure that you have the latest version of DTiX.


To continue the installation of DTiX, perform the following steps:

1. From the DTiX Welcome screen, click **Next** to continue.
2. Click **Next** to accept the license agreement.
3. To accept the default folder in which to install the software (C:\Program Files\Data Translation\DTiX), click **Next**. To specify a different folder, use the Browse button to locate the folder, then click **Next**.
4. If you want to create backup files of existing files, click **Yes**, specify the directory in which to store the backup files, then click **Next**. If you do not want to create backup files, click **No**, then click **Next**.
5. To accept the default program group (Data Translation, Inc | DTiX), click **Next**. To specify a different program group, either select the program group from the list or enter it in the text box, then click **Next**.
6. Click **Next** to continue.
The installation program copies the DTiX application files.
7. After all the files have been copied, click the appropriate radio button to indicate whether you want to start DT Measure Foundry after installation, then click **Finish**.

Using the Online Help

1

The online help is accessible while you are using DT Vision Foundry. If no DT Vision Foundry tools are open, click **F1** to open the online help for the main application. If a DT Vision Foundry tool is open, click **F1** to open the online help for that tool.

You can also access the online help from the DT Vision Foundry program group. From the Windows Start menu, click **Programs | Data Translation, Inc | DT Vision Foundry**. Click **Custom Tools**, **DT Vision Foundry API**, or **Main Application**, or click **Tool Help** and then click the help for the appropriate tool. All online help files are represented by the icon .

Removing the Software

If you are having problems with DT Vision Foundry, you may want to remove the software and then reinstall it. In addition, it is highly recommended that you remove previous versions of the software before you install a new version.

The Uninstall option allows you to remove DT Vision Foundry from your hard drive. This option removes the DT Vision Foundry directory and any references to the application in the system files.

To use the Uninstall option to remove DT Vision Foundry, perform the following steps:

1. From the Windows Start menu, click **Programs | Data Translation, Inc | DT Vision Foundry | Uninstall DT Vision Foundry**.
2. It is recommended that you select **Automatic** to automatically remove appropriate files and directories. Select **Custom** to specify which files, directories, .INI entries, and registration keys to remove. Select **Repair** to repair DT Vision Foundry.
3. Click **Finish** to remove DT Vision Foundry.

Note: You can also use the Add/Remove Programs option from the Windows Control Panel to remove the software.



Using DT Vision Foundry

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Introduction

The main application of DT Vision Foundry is the part that shows you the image(s) you are working on. It is easy to use, leaving most of the functionality to the tools. With DT Vision Foundry, you can select the tools you want and replace or upgrade these tools whenever necessary.

The main application contains windows, called viewports, that allow you to view the image you are working on. For more information about viewports, refer to [page 36](#). The main application is responsible for file I/O (refer to [page 54](#)), printing (refer to [page 53](#)), the clipboard (refer to [page 52](#)), and other normal Windows operations.

Attached to the main application (loaded by the main application) are the tools. To use a tool on an image, you click on the tool's icon. For more information about tools, refer to [page 49](#).

A common set of image processing tools is provided with DT Vision Foundry. If you want to use a tool that is not provided by DT Vision Foundry, you can add your own custom tools or obtain third-party tools. All tools that follow the DT Vision Foundry convention can work together.

Starting DT Vision Foundry

To start DT Vision Foundry, perform the following steps:

1. From the Windows Start menu, click **Programs**.
2. Click **Data Translation, Inc\DT Vision Foundry\DT Vision Foundry**.

The Main Application

File Menu Options

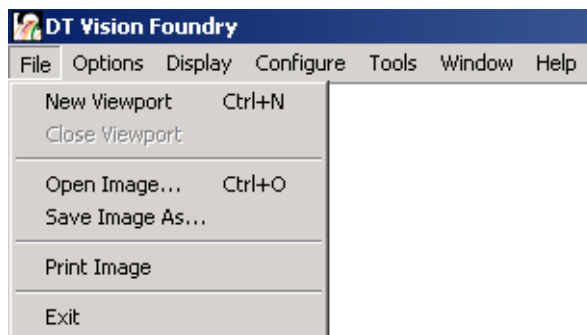


Figure 1: File Menu Options

New Viewport

Select this option to create a new viewport so that you can view an image. The new viewport becomes the active viewport.

Close Viewport

Select this option to close the active viewport and delete any ROIs attached to the viewport.

Open Image

Select this option to open an image from disk. The image must be stored in standard Windows bitmap format (noncompressed). The image can be opened as a binary, 8-bit grayscale, 16-bit grayscale, 32-bit grayscale, floating-point grayscale, 24-bit RGB (Red/Green/Blue) color, or 24-bit HSL (Hue/Saturation/Luminance) color image. By default, the image is opened as an 8-bit grayscale image. To change this, select the desired type under **Options | Image Type**.

Save Image As

Select this option to save the image in the active viewport as a standard Windows bitmap file. If the image is a 16-bit, 32-bit, or floating-point grayscale image, only the displayed 8-bit portion of the image is saved with the bitmap file. The 16-bit, 32-bit, or floating-point data is saved in a separate file in the same directory; this file has the same name with an extension of *.i16 (for 16-bit data), *.i32 (for 32-bit data), or *.flt (for floating-point data).

Print Image

Select this option to print the image exactly as it is seen in the active viewport. Zoomed images print exactly as seen. Images are printed as large as possible while keeping their aspect ratios.

Exit

Select this option to close the application and all open tools. As with most DT Vision Foundry options, the software does not provide any warnings.

Options Menu Options

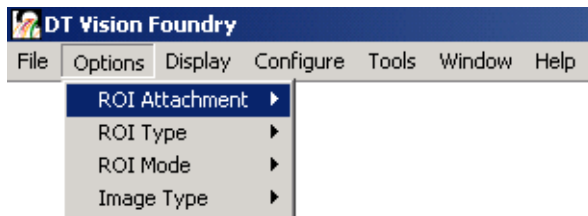
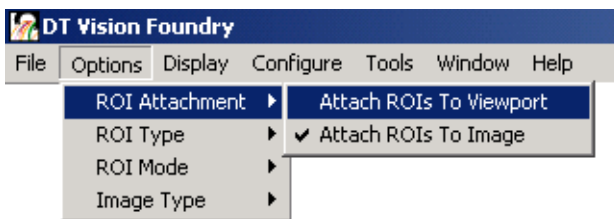


Figure 2: Options Menu Options

ROI Attachment



In DT Vision Foundry, an ROI can be attached to either the viewport or the image itself. The mode you select applies to all the viewports and you can switch back and forth between modes at any time. The **ROI Attachment** option allows you to select one of the following modes:

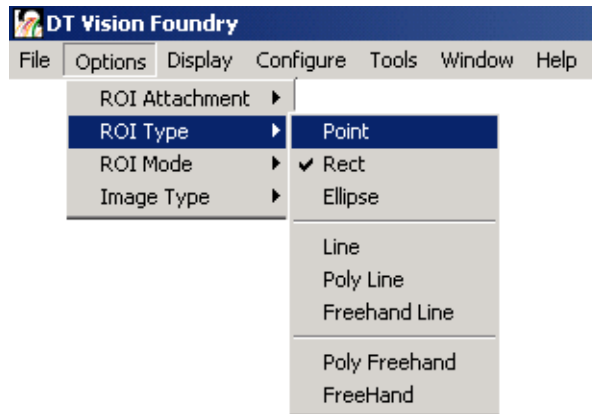
- **Attach ROIs to Viewport** – An advanced user mode in which the ROI attaches itself to the viewport. This mode is useful if you are looking at several different parts made on an assembly line. Since the ROI is attached to the viewport, you can select different images into the same viewport; the ROI references the same area on each image.

For example, assume that you want to inspect a phone made on an assembly line and you put a rectangle ROI around the #3 key on the phone pad. Since the phones are in roughly the same place when the image is captured and since the images are the same size, the ROI is around the #3 key on every phone image.

Using this mode, you can put different images in the same viewport, run a tool on the image, and get some type of result without having to draw an ROI on each image you want to analyze.

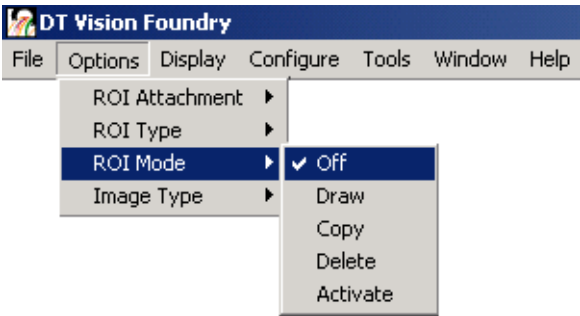
- **Attach ROIs to Image** – The default mode in which the ROI attaches itself to an image. This mode is useful for analyzing a single image displayed differently in multiple viewports. In each viewport displaying the same image, the ROI references the same area. As you move the image to different viewports, the attached ROI moves with the image.

ROI Type



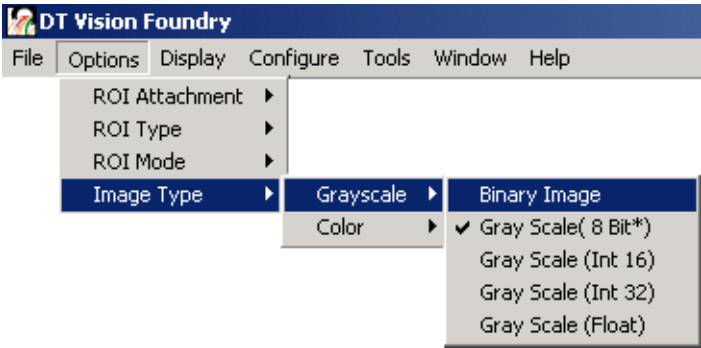
DT Vision Foundry provides eight different types of ROIs. Each ROI is created, moved, copied, selected, used, and deleted in the same way. The ROI type that you select determines the type of ROI that is created. You can also specify the ROI type using the ROI menu bar and the ROI Manager tool. For more information on using ROIs, refer to [page 38](#). For more information on the ROI Manager tool, refer to [Chapter 32, “Using the ROI Manager Tool.”](#)

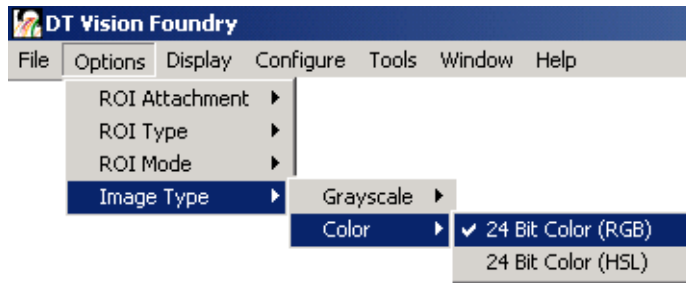
ROI Mode



You can select the action that you want to perform on an ROI. For more information, refer to [page 40](#).

Image Type





The Image Type option allows you to open an image as one of the following grayscale or color image types:

- **Grayscale and Binary** – Allows you to open a supported image as either an 8-bit grayscale, 16-bit grayscale, 32-bit grayscale, floating-point grayscale, or binary image.

In image processing, a process may produce pixel values outside the standard range of 0 to 255. In these cases, you may decide to scale or threshold the output to the range of 0 to 255, discarding very important precision. By using a 32-bit image (or even a floating-point image), you can keep this important precision and use it in your analysis.

Since DT Vision Foundry is an object-oriented application, the use of most tools on an image (regardless of the type) is the same. For example, you could use the Arithmetic tool to take two 8-bit images and add them together, placing the resulting image in a 32-bit image. You could then use the Histogram tool to take a histogram of the output image. The Arithmetic and Histogram tools access the two 8-bit images and the 32-bit image in the same way.

Opening an image as a binary image is useful when you are using a tool, such as the Morphology tool, that works only with binary images.

- **Color** – Allows you to open a supported image as a 24-bit RGB color image or as a 24-bit HSL color image.

Note that at the present time, DT Vision Foundry supports 24-bit RGB and 24-bit HSL color images only. Other color formats may be supported in future releases.

Display Menu Options

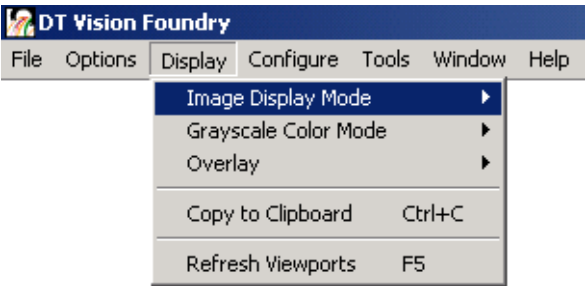
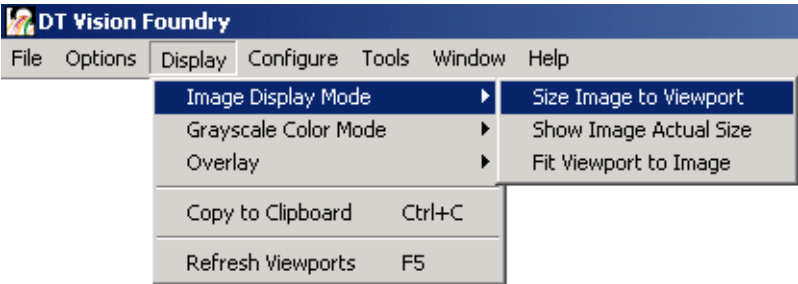


Figure 3: Display Menu Options

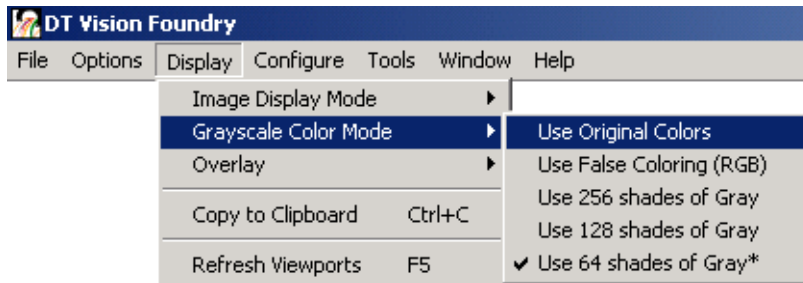
Image Display Mode



The Image Display Mode option allows you to select one of the following modes for determining how a viewport displays its associated image:

- **Size Image to Viewport** – Stretches or shrinks the image so that the entire image fits inside the viewport without resizing the viewport. This mode does not keep the aspect ratio of the image.
- **Show Image Actual Size** – Keeps the aspect ratio and normal size of the image as it is displayed in the current viewport. If the viewport is too small to show the entire image, the software adds scrollbars to the viewport so that you can scroll the image inside the viewport. The viewport does not automatically change size.
- **Fit Viewport to Image** – Resizes the viewport to the size of the entire image while keeping the image's aspect ratio and actual size. If you resize the viewport with the mouse, the software automatically adds scrollbars when necessary.

Grayscale Color Mode



When an image is displayed, the image is passed through an output look-up table (LUT) (also called a color table). The output LUT specifies how the pixel values are displayed. The Grayscale Color Mode option allows you to select one of the following output LUTs:

- **Use Original Colors** – Views images opened from disk showing the image exactly as it is stored in the BMP file. This mode uses the output LUT that came with the image.

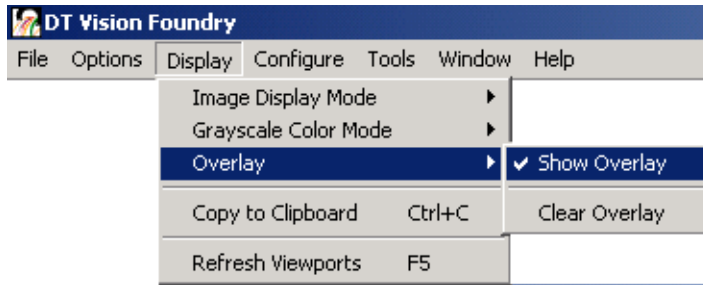
- **Use False Coloring (RGB)** – Shows the image data with a linear RGB output LUT. Use this mode if you want to allow false coloring of grayscale images. By default, an image pixel of value 0 is mapped to a grayscale value of 0, an image pixel of value 1 is mapped to a grayscale value of 1, and so on, up to 255. You can use the Display tool to change this mapping so that a certain group of image pixels map to a certain color. For example, pixel values in the range of 5 to 10 can map to the color blue. For more information on changing the output LUT for an image, refer to [Chapter 13, “Using the Display Tool.”](#)
- **Use shades of Gray (256, 128, 64)** – Always displays the image data as a grayscale image.

The default mode is Use 64 shades of Gray because this mode works with almost all monitors. This mode is also useful for developing algorithms on the PC that are intended to be ported to a different platform with a different display.

For example, if you are using a monitor in 256-color mode and you want to display one image in grayscale, one image with false coloring, and one 24-bit RGB color image, you will run out of colors. In this case, you may want to use only 64 colors to display each grayscale image leaving more colors for the color image. On the other hand, if you are thresholding a grayscale image, you may want to be as exact as possible. In this case, you would most likely use 256 colors to display your grayscale image. These modes have no effect on 24-bit color images.

Note: It is possible to view an image in any combination of these display modes by placing the same image in different viewports (using the Image Manager tool) and selecting a different output LUT for each. Selecting a different output LUT for a grayscale image does not change the image’s data, only how it is displayed.

Overlay



The Overlay option allows you to select one of the following overlay modes:

- **Show Overlay** – Toggles (showing/not showing) the overlay for the image in the active viewport.
- **Clear Overlay** – Clears the overlay for the image in the active viewport.

Copy to Clipboard

Select this option to copy the image in the active viewport to the clipboard. If an active ROI is present, only the ROI portion of the image is copied to the clipboard. If the overlay is showing, the overlay is also copied to the clipboard.

Refresh Viewports

Select this option to redraw the images in the open viewports.

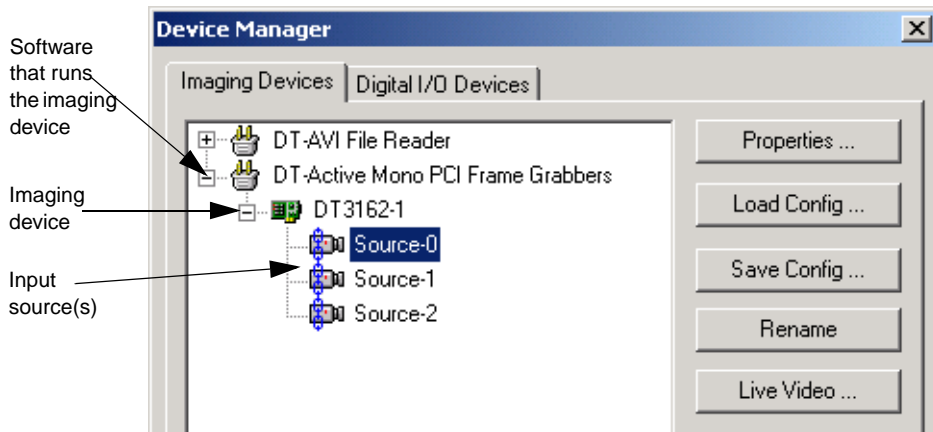
Configure Menu Options



The Configure menu allows you to specify the device you intend to use with DT Vision Foundry and to configure both the input source(s) and the digital input and output settings.

Note: Whenever you save a point & click script, the name of the device you are using, the configuration of the input source(s), and the digital I/O settings are saved with the script. You do not have to use the Device Manager each time you run a script; use it only if you want to change this information.

Select **Device Manager** to open the Device Manager dialog box.



Imaging Devices Tab

The Imaging Devices tab lists all the plug-in software packages installed on your system. The plug-in software allows you to specify settings for your device, such as the video signal type, the pixel clock, and the input look-up table you are using. DT Vision Foundry is shipped with plug-ins for Data Translation PCI frame grabber boards, such as the DT3162, DT3153, and DT3157. It is also shipped with an example Data Translation plug-in (DT-AVI File Reader), which allows you to use DT Vision Foundry without having a real hardware device installed. For information on obtaining the plug-in for another device, contact the manufacturer.

Expand the tree for the plug-in software package associated with your device to display the imaging devices supported by the plug-in and the input source(s) supported by the imaging device. Before you can use any of the buttons on the Imaging Devices tab, you must select an input source.

Note: When multiple input sources are linked (as shown for the DT3162-1 imaging device in the example above), you must configure all the input sources in the same way. You cannot configure the input sources individually.

Properties

Click this button to open the plug-in software used to set up the selected device. For example, if you are using the plug-in software for a Data Translation frame grabber board, the Properties tabs are displayed. For more information on setting up your device, refer to the documentation provided with your plug-in. If you are using a Data Translation frame grabber board, click the **Help** button in the lower-right corner of each Properties tab. Note that only options that are supported by your particular device are available. If an option is not supported by your device, it is grayed out.

Load Configuration

Click this button to load input source settings from an existing configuration file. A Load Source Configuration dialog box is displayed. Locate the appropriate file (with the appropriate extension), then click **Open**. Note that the extension varies depending on your device.

Save Configuration

Click this button to save the current input source settings to a configuration file on disk. A Save Source Configuration dialog box is displayed. Select the directory and enter a file name with the appropriate extension, then click **Save**. Note that the extension varies depending on your device.

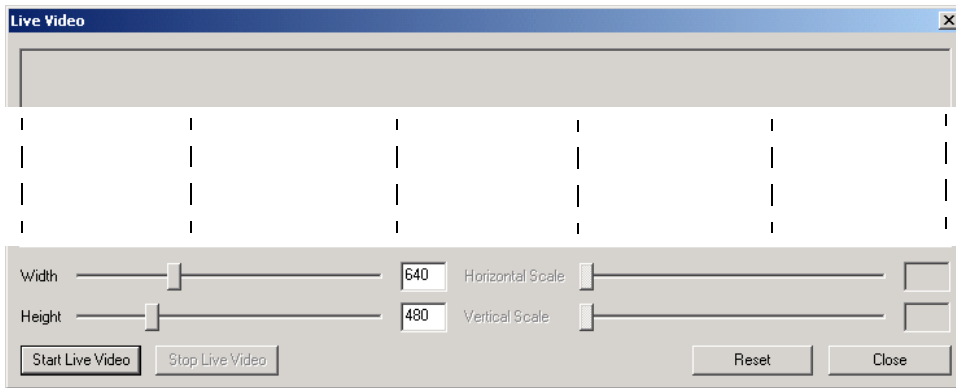
Note that whenever you save a point & click script, the current input source settings are saved with the script.

Rename Source

Click this button to change the name of the selected input source. An edit box is displayed around the current name. Change the name, then press the <Enter> key.

Live Video

Click this button to determine how the acquired images will look. The Live Video dialog box is displayed.



You can set the following options:

- **Width** – Use the slider control to specify the number of pixels to digitize in each line of an image. You can also use the arrow keys to fine-tune the value. If you are scaling the image, enter the number of pixels in the original image, not the number of pixels in the scaled image.
- **Height** – Use the slider control to specify the number of lines in an image to digitize. You can also use the arrow keys to fine-tune the value. If you are scaling the image, enter the number of lines in the original image, not the number of lines in the scaled image.

Note: The values you set for width and height are limited by the maximum number of pixels per image (height x width) supported by your device and by the capabilities of your camera. In addition, the values you set must be consistent with the values set in the plug-in software for width (active line count) and height (active pixel count).

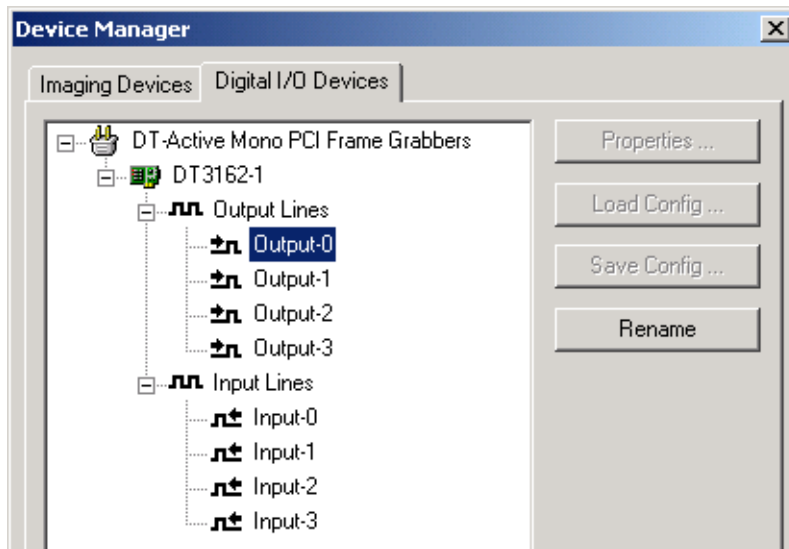
- **Horizontal Scale** – Use the slider control to specify the percentage that you want to scale each image horizontally. You can also use the arrow keys to fine-tune the value.
- **Vertical Scale** – Use the slider control to specify the percentage that you want to scale each image vertically. You can also use the arrow keys to fine-tune the value.

After you specify the appropriate values, click **Start Live Video** to start viewing acquired images. The software displays the acquired images in the center of the Live Video window. If the images are not clear, click **Stop Live Video** to stop the operation, then focus or reposition your camera or adjust the other Live Video settings appropriately, then click **Start Live Video** again. Click **Reset** to return all settings to their default values.

When you are satisfied that your settings are correct, click **Stop Live Video** again, then click **Close** to accept the settings and close the Live Video dialog box.

Note: The settings and ranges available in the Live Video dialog box vary depending on your device.

Digital I/O Devices Tab



The Digital I/O Devices tab allows you to set up your device to perform digital input and output operations.

Properties

Click this button to open the plug-in software used to set up digital I/O operations on the selected device. For more information, refer to the documentation provided with your plug-in. Note that if digital I/O operations are not configurable for your device, this button is grayed out.

Load Configuration

Click this button to load digital I/O settings from an existing configuration file. A Load Digital I/O Device Configuration dialog box is displayed. Locate the appropriate file (with the appropriate extension), then click **Open**. Note that the extension varies depending on your device.

Note that if digital I/O operations are not configurable for your device, this button is grayed out.

Save Configuration

Click this button to save the current digital I/O settings to a configuration file on disk. A Save Digital I/O Device Configuration dialog box is displayed. Select the directory and enter a file name with the appropriate extension, then click **Save**. Note that the extension varies depending on your device.

Note that if digital I/O operations are not configurable for your device, this button is grayed out.

Note that whenever you save a point & click script, the current digital I/O settings are saved with the script.

Rename Line

Click this button to change the name of the selected digital input or digital output line. An edit box is displayed around the current name. Change the name, then press the **<Enter>** key.

Tools Menu Options

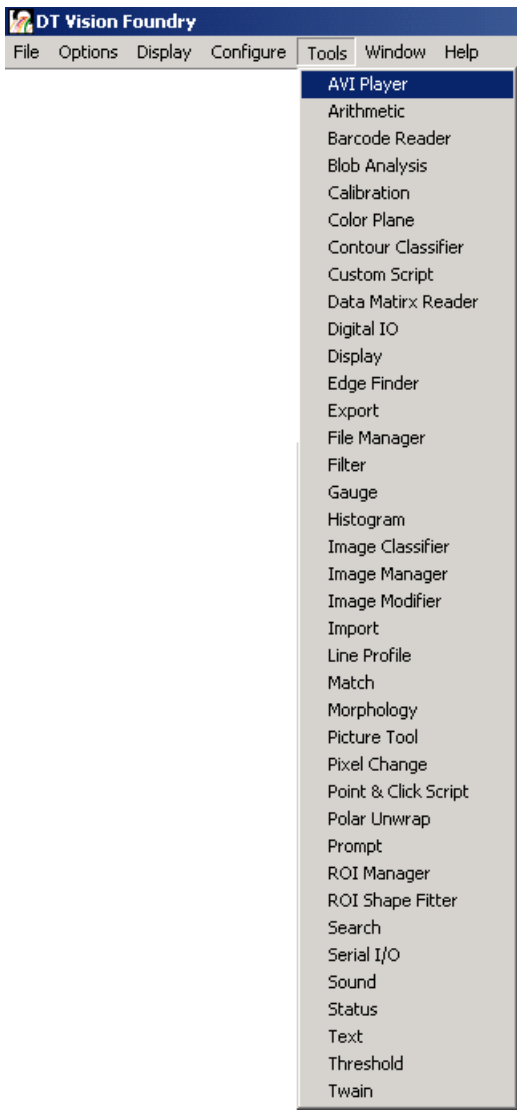


Figure 4: Tools Menu Options

Select the tool that you want to use. The list of tools changes, depending on which tools are loaded by DT Vision Foundry. If you create your own tools or purchase third-party tools, these tools are listed along with the tools supplied by DT Vision Foundry.

Notes: There is no difference between selecting a tool from the Tools menu and selecting a tool from one of the toolbars located along the top and left side of the viewport.

You can use multiple instances of most tools.

Window Menu Options

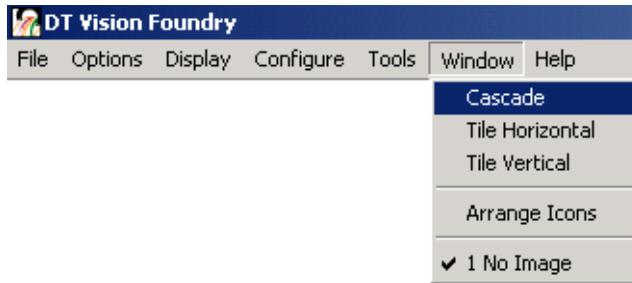


Figure 5: Window Menu Options

Cascade

Select this option to organize all viewports (windows) that are not closed or minimized in a cascading fashion.

Tile Horizontal

Select this option to organize all viewports (windows) that are not closed or minimized in a horizontally tiled fashion.

Tile Vertical

Select this option to organize all viewports (windows) that are not closed or minimized in a vertically tiled fashion.

Arrange Icons

Select this option to arrange all minimized viewports (windows) at the bottom of the main application window.

Names of open viewports

A list of viewport names is added to the end of this menu. If you select one of these names, the software brings the associated viewport to the front.

Action Toolbar



Figure 6: Action Toolbar

The first three buttons on the action toolbar correspond to the following menu options:

- **File | New viewport**
- **File | Open Image...**
- **File | Save Image As...**

The next three buttons on the action toolbar correspond to the following menu options:

- **Window | Tile Vertical**
- **Window | Tile Horizontal**
- **Window | Cascade**

The next three buttons on the action toolbar correspond to the following menu options:

- **Display | Image Display Mode | Size Image to Viewport**
- **Display | Image Display Mode | Show Image Actual Size**
- **Display | Image Display Mode | Fit Viewport to Image**

The last two buttons on the action toolbar correspond to the following:

- **File | Print Image** menu option
- Shows the *About box* for DT Vision Foundry

Status Bar

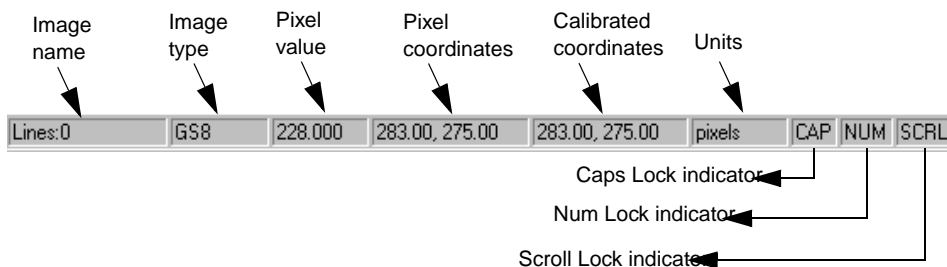


Figure 7: Status Bar

The status bar is displayed in the lower right corner of the main application window. An example status bar is shown in [Figure 7](#). The items shown in the status bar are described as follows:

- **Image name** – the name of the image in the active viewport.
- **Image type** – the type of image in the active viewport (binary, 8-bit grayscale, 16-bit grayscale, 32-bit grayscale, floating-point grayscale, RGB color, or HSL color).
- **Pixel value** – the value of the pixel at the current cursor location. For a color image, the pixel value is based on the current setting of the Color Plane tool (Red plane, Green plane, Blue plane, or Luminance for an RGB color image; Hue, Saturation, or Luminance for an HSL color image). For more information, refer to [Chapter 8, “Using the Color Plane Tool.”](#) The pixel value is displayed with subpixel accuracy.
- **Pixel coordinates** – the location (x, y) of the pixel at the current cursor location, where 0, 0 refers to the lower-left corner of the image.
- **Calibrated coordinates** – the location (x, y) of the pixel at the current cursor location in calibrated units (if the image has an attached calibration object).
- **Units** – the unit of measure that DT Vision Foundry uses to perform its calculations. By default, DT Vision Foundry uses pixel measurements. If the image has an attached calibration object, DT Vision Foundry displays the measurements in calibrated units.
- **Caps Lock indicator** – CAPS indicates that the Caps Lock key is ON (alphabetic characters on the keyboard are shifted to uppercase).
- **Num Lock indicator** – NUM indicates that the Num Lock key is ON (the numeric keypad on the keyboard is activated).
- **Scroll Lock indicator** – SCRL indicates that the Scroll Lock key is ON (the cursor control keys on the keyboard are affected).

Viewports

A viewport is a window in which to view an image. Each viewport contains a view and a title bar. The view portion of the viewport is the portion actually showing you the image. The title bar contains information about the viewport. Viewports also have scrollbars that you can use to move the image around if the image does not fit inside the viewport. [Figure 8](#) shows two open viewports with two instances of the image *Classify*.

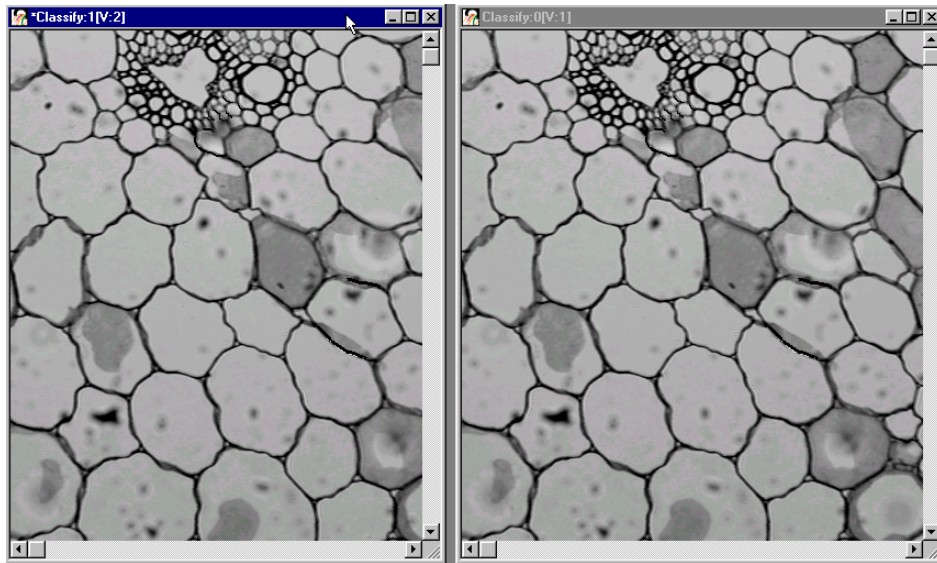


Figure 8: Viewports

The information about the viewport (child window) that is shown in the title bar uses the following convention:

**Image Name:Image Instance[Viewport Number]*

Note that the asterisk (*) is optional; it denotes the active viewport.

Table 1 lists the information provided for each viewport shown in Figure 8.

Table 1: Information in Title Bar of Viewports

Viewport	Information	Meaning
Left: *Classify:1[V:2]	*	This is the active viewport because it contains an asterisk (*) in its title bar.
	Classify	This viewport is displaying the image 'Classify'.
	:1	This viewport is showing you the second instance of the image 'Classify' that is open in the system (the numbering of multiple instances of an image is zero-based).
	[V:2]	This viewport is the second viewport open in the system.
Right: Classify:0[V:1]	Classify	This viewport is displaying the image 'Classify'.
	:0	This viewport is showing you the first instance of the image 'Classify' that is open in the system (the numbering of multiple instances of an image is zero-based).
	[V:1]	This viewport is the first viewport open in the system.

ROIs

An ROI is a region of interest. It is the portion of an image that you want to manipulate. This section contains additional information about ROIs.

ROI Manager Tool

To help you create ROIs, move ROIs, and perform other ROI functions, DT Vision Foundry provides an ROI Manager tool. For more information, refer to [Chapter 32, “Using the ROI Manager Tool.”](#)

ROI Types

You can specify the ROI type by using the ROI type toolbar, the ROI Manager tool, and/or **Options | ROI Type** from the main application. The ROI type toolbar is shown in [Figure 9](#).

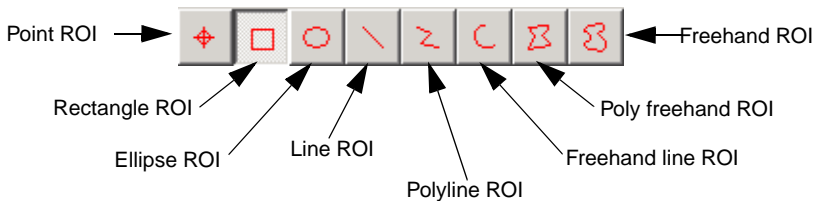


Figure 9: ROI Type Toolbar

DT Vision Foundry supports the following types of ROIs:

- Point
- Rectangle
- Ellipse
- Line
- Polyline – A polyline ROI is composed of several straight line segments. When you release the left mouse button, the first line segment is drawn and you create the second line segment by moving the mouse. Each time you click the left mouse button, you add a line segment. Continue this until the ROI is completely drawn.
- Freehand line – A freehand line ROI is a continuous, user-drawn line. When you release the left mouse button, the line is drawn.
- Poly freehand – A poly freehand ROI is composed of several straight line segments joined together and closed. When you release the left mouse button, the first line segment is drawn and you create the second line segment by moving the mouse. Each time you click the left mouse button, you add a line segment. Continue this until the ROI is almost complete. Then, click the right mouse button to close the ROI by adding a line from the mouse cursor to the beginning the ROI.
- Freehand – A freehand ROI is a continuous, user-drawn line that is closed. When you release the left mouse button, the line is drawn and closed.

Note: When drawing a polyline, freehand line, poly freehand, or freehand ROI, do not cross or touch previously drawn line segments. Although the ROI may appear to be drawn, it may not work as expected.

ROI Modes

You can select the action that you want to perform on an ROI by using the ROI mode toolbar, **Options | ROI Mode** from the main application, and/or a short-cut key method. The ROI mode toolbar is shown in [Figure 10](#).

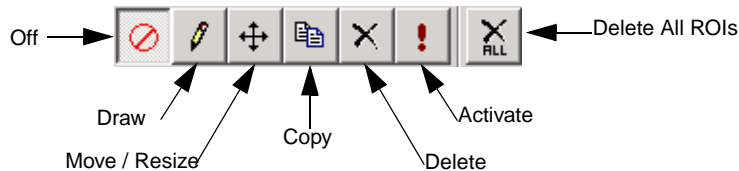


Figure 10: ROI Mode Toolbar

DT Vision Foundry supports the following ROI modes:

- **Off** – Turns off ROI actions. You can still select the ROI type and use the short-cut key methods.
- **Draw** – Continuously draws ROIs of the selected type using the left mouse button. All ROIs are added as inactive ROIs (green). The active ROI is red.

When you finish drawing your ROIs, it is recommended that you select **Off** from ROI actions drop-down list. This ensures that you do not inadvertently create ROIs in the active image.

- **Move / Resize** – When mouse pointer is a 4-sided arrow (inside or on the active ROI), moves the ROI using the left mouse button. When mouse pointer is a 2-sided arrow (over white handles on the active ROI), resizes the ROI using the left mouse button.
- **Copy** – Copies the active ROI using the left mouse button.
- **Delete** – Deletes the active ROI using the left mouse button.

- **Activate** – Activates an ROI using the left mouse button.
- **Delete All ROIs** – If you are running DT Vision Foundry in **Attach ROIs To Viewport** mode, deletes all ROIs in the active viewport. If you are running DT Vision Foundry in **Attach ROIs To Image** mode, deletes all ROIs associated with the image. For more information about ROI attachment modes, refer to [page 16](#). Note that ROIs that have text associated with them are not deleted. For more information, refer to [Chapter 38, “Using the Text Tool.”](#)

Note: To perform operations on ROIs that are close together, select the operation from the ROI actions drop-down list, right-click any ROI in the image, use the <Tab> key to move to the appropriate ROI, and then left-click the ROI to perform the operation.

Short-Cut Key Methods

Drawing an ROI

To draw an ROI, perform the following steps:

1. From the menu or ROI Manager tool, select the type of ROI you want to create.
2. Place the mouse at the position you want to start drawing the ROI.
3. Hold down the <Shift> and <Ctrl> keys. Click and hold down the left mouse button.
4. Drag the mouse until the ROI is the size you want.
5. Release the left mouse button.

Moving an ROI

To move an ROI, perform the following steps:

1. Activate the ROI, if it is not already active, by clicking inside the ROI with the right mouse button.
2. Place the mouse inside or on the ROI.
3. Hold down the <Shift> key. Click and hold the left mouse button.
The cursor changes to a move cursor.
4. While holding down the left mouse button, drag the ROI to the desired location.
5. When you have the ROI at the desired location, release the left mouse button.

Copying an ROI

To copy an ROI, perform the following steps:

1. Activate the ROI, if it is not already active, by clicking inside the ROI with the right mouse button.
2. Place the mouse inside or on the ROI.
3. While holding down the <Ctrl> key, click and hold the left mouse button.
The cursor changes to a copy cursor.
4. While holding down the left mouse button, drag the ROI to the desired location.
5. When you have the ROI at the desired location, release the left mouse button.

Deleting an ROI

To delete an ROI, perform the following steps:

1. Activate the ROI, if it is not already active, by clicking inside the ROI with the right mouse button.
2. Place the mouse inside or on the ROI.
3. While holding down the <Ctrl> key, click the right mouse button.

The Active ROI

An ROI can be either active or inactive. Only one ROI can be active in each viewport and the active ROI is displayed in red. All other ROIs in the viewport are inactive and are displayed in green. Tools working on an image do so with respect to the active ROI. For example, the Histogram tool creates a histogram of all eight ROI types. Activate the ROI you want with the mouse and create a histogram.

You can activate an inactive ROI in one of the following ways:

- Click inside the ROI with the right mouse button. The newly activated ROI turns red and the previously activated ROI turns green.
- Select **Activate** from the ROI actions drop-down list and then click inside the ROI with the left mouse button to activate it.
- Right-click any ROI in the image and then use the <Tab> key until the appropriate ROI is activated (red).

Attaching ROIs

A ROI can be attached to either a viewport or an image. You can select either attachment mode at any time by using **Options | ROI Attachment** from the main application. For more information, refer to [page 16](#).

DT Vision Foundry keeps a list of all ROIs attached to viewports and a list of all ROIs attached to images. When you create (add) an ROI, DT Vision Foundry checks which mode you are in and adds the ROI to the correct list. Therefore, if you run the program in **Attach ROIs To Viewport** mode, the ROI is attached to the view. If you run the program in **Attach ROIs To Image** mode, the ROI is attached to the image.

Attach ROIs To Image is the default attachment mode for the application.

The attachment mode you select applies to the entire application; therefore, you can see and use only one set of ROIs at a time for all viewports.

Using ROIs in Point & Click Scripts

In some cases, ROIs that you create when using a DT Vision Foundry tool are automatically recreated at run-time in your point & click script. Refer to [Appendix A, “Using ROIs in Point & Click Scripts,”](#) for information about the input ROIs that you can create for each tool, the output ROIs that are created by each tool, and the input ROIs that are automatically recreated in your point & click script.

Zoom

DT Vision Foundry allows you to zoom in on your images. Click on the appropriate magnification factor in the zoom drop-down list. Scrollbars are automatically added to the viewport, if needed.

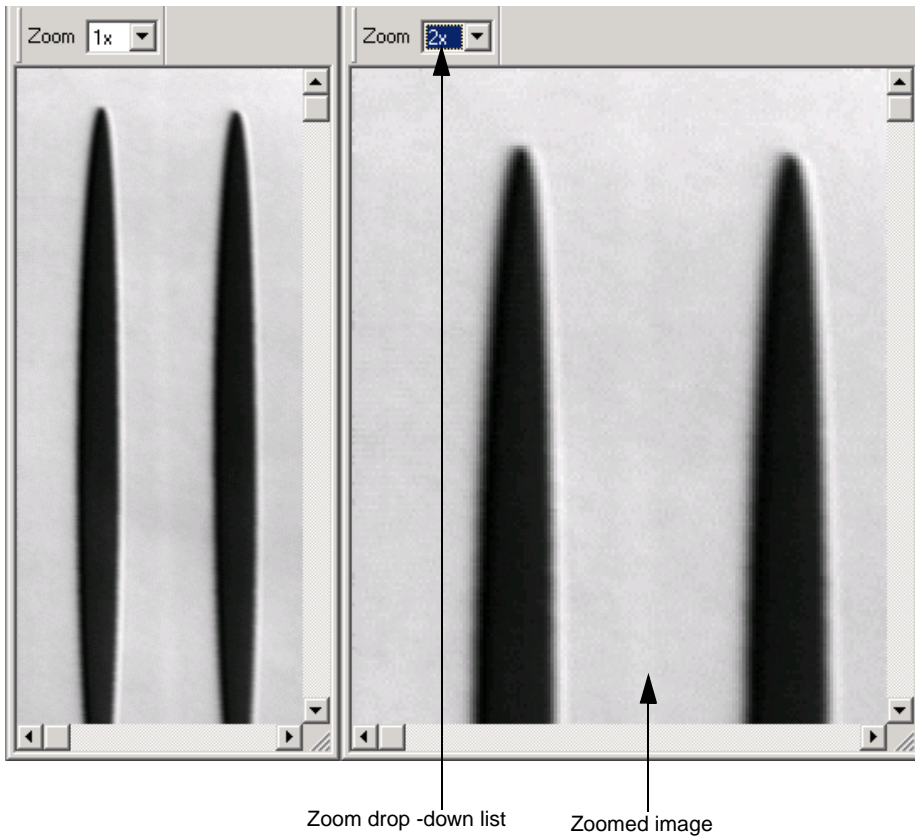
2

Figure 11: Zoom Options

Images

This section provides information about the use of images in DT Vision Foundry.

Image Types

Note: Not all tools support all image types.

DT Vision Foundry supports the following image types:

- **8-bit grayscale** – The value that each pixel can hold ranges from 0 to 255.
- **16-bit grayscale** – The value that each pixel can hold is limited by a 16-bit integer value.
- **32-bit grayscale** – The value that each pixel can hold is limited by a 32-bit integer value.
- **Floating-point grayscale** – The value that each pixel can hold is limited by a floating-point value.

16-bit, 32-bit, and floating-point grayscale images are useful if an imaging process produces pixel values outside the standard range of 0 to 255. Instead of scaling or thresholding the output to the range of 0 to 255, which would discard very important precision, you can use a 16-bit, 32-bit, or floating-point image to keep this important precision and use it in your analysis.

Since DT Vision Foundry is an object-oriented application, the use of most tools on an image (regardless of the type) is the same. For example, you could use the Arithmetic tool to take two 8-bit images and add them together, placing the resulting image in a 32-bit image. You could then use the Histogram tool to take a histogram of the 32-bit output image. The Arithmetic and

Histogram tools access the two 8-bit images and the 32-bit image in the same way.

- **24-bit RGB color** – You access the data for the color image through the red, green, or blue plane.
- **24-bit HSL color** – You access the data for the color image through the hue, saturation, or luminance.
- **The luminance (intensity) of a YIQ image** – Y is the luminance in the YIQ color image space. It is calculated from the RGB values and corresponds to how the human visual system perceives the intensity of a color image. It is calculated as follows:

$$Y = 0.299R + 0.587G + 0.114B.$$

For more information, refer to the following:

- Gonzalez, Rafael C., and Woods, Richard E. [1992]. *Digital Image Processing* Addison-Wesley pp. 225-230.
- Rodriguez, J.J., and Yang, C.C. [1994] “Effects of Luminance Quantization Error on Color Image Processing.” IEEE Transactions on Image Processing, Vol3, No. 6, November 1994.

You can use the Color Plane tool to specify how you want to access a color image through the tools. For more information, refer to [Chapter 8, “Using the Color Plane Tool.”](#)

In addition to the image types provided by DT Vision Foundry, you can use the DT Vision Foundry API to create your own types of images. You can use these image types with all other image types using the tools. For example, you could take two 8-bit images and add them together into a 32-bit image. You could also take a 24-bit color image, run a filter on it, and place the output in a floating-point image. You could then take the 32-bit image and subtract the floating-point image, putting the result in another image.

Managing Images

DT Vision Foundry provides the Image Manager tool, which allows you to load images into viewports, display image information, and delete images. For more information, refer to [Chapter 21, “Using the Image Manager Tool.”](#)

Converting Bitmap Files to .AVI Files

DT Vision Foundry provides the Bitmap-to-AVI Converter utility, which allows you to convert one or more 24-bit RGB color or 8-bit grayscale images to an .AVI file. Note that all bitmap images must be the same size and the same color organization (24-bit RGB color or 8-bit grayscale). The utility (BmpToAvi.exe) is located in C:\Program Files\Data Translation\DT Vision Foundry\Utilities, by default.

To use the Bitmap-to-AVI Converter utility, perform the following steps:

1. From the Windows Start menu, select **Programs\Data Translation, Inc\DT Vision Foundry\Utilities\Data Translation Bitmap to AVI Converter**.
2. Click **Add BMP File** to open the Load BMP File dialog box.
3. Select the bitmap file to add, then click **Open**.
4. Repeat steps 2 and 3 until you have added all the bitmap files that you want to convert.

To remove a bitmap file from the .AVI file, highlight the file and click **Delete BMP File**.

5. Click **Create AVI File**.
6. Enter a name for the new .AVI file in the Save AVI File dialog box, then click **Save**.
7. When you are finished with the utility, click **Close**.

Tools

By default, all DT Vision Foundry tools are grouped into toolbars along the top and left side of the viewport. To use a tool on an image, either click the tool icon in the toolbar or select the tool from the Tools menu.

The toolbars are organized as shown in [Table 2](#).

Table 2: Toolbars


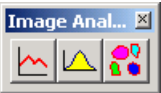





Toolbar	Tools in Toolbar ^a
	Arithmetic Filter Image Modifier Polar Unwrap Morphology Threshold Pixel Change Color Plane
	Line Profile Histogram Blob Analysis
	Search Match Image Classifier Contour Classifier
	Barcode Reader Data Matrix Reader

Table 2: Toolbars (cont.)

Toolbar	Tools in Toolbar ^a
	ROI Manager Gauging Edge Finder ROI Shape Fitter
	Picture AVI Player TWAIN File Manager Export Import Serial I/O Digital I/O
	Calibration Image Manager Custom Script Display Prompt Sound Status Text Point & Click Script

a. The tools are listed from left to right in the toolbar.

To move a toolbar, left-click the bar to the left or on the top of the toolbar, then drag the toolbar to another location.

To specify which toolbars are visible, right-click anywhere around the viewport to display the list of toolbars. Select the checkbox to make the toolbar visible; clear the checkbox to make the toolbar invisible.

Hold the mouse pointer over a tool icon to display the name of the tool.

To customize the arrangement of the tools in the toolbars, you must use the DTTools.ini initialization file. The DTTools.ini file is a standard Windows initialization file that must be located in the same directory as the DT Vision Foundry application (DTVF.exe). Both DTTools.ini and DTVF.exe are located in C:\Program Files\Data Translation\DT Vision Foundry\BIN, by default. Do not put the DTTools.ini initialization file in the Windows system directory.

On startup, DT Vision Foundry loads all the tools specified in the DTTools.ini file, arranged according to the way the tools are listed in the file. If you want to add your own tools or change the toolbar in which the tools are loaded, you must edit this file using any text editor, such as Notepad.

Each tool should have an entry similar to the following:

```
[Tool1]
LOCATION=..\Tools\DT_Arith\DT_Arith.dll
TOOLBAR=Image Processing
AUTOSTART=NO
```

The tool numbers must be unique and sequential starting from 1. The LOCATION is always relative to the location of the DT Vision Foundry application (DTVF.exe). If you do not include a TOOLBAR entry, the tool is placed in the Miscellaneous toolbar. The AUTOSTART entry determines whether you want DT Vision Foundry to automatically start the tool at program startup. If you do not include an AUTOSTART entry, DT Vision Foundry assumes that AUTOSTART=NO.

The Clipboard

Although the standard Windows clipboard supports cut, copy and paste, DT Vision Foundry supports copy only. This allows you to copy images to the clipboard to be used for reports.

If an active ROI is present, only the smallest bounding rectangle is copied to the clipboard. If no active ROI is present, the entire image is copied to the clipboard.

Printing

You can print the entire image exactly as it is seen in the active viewport. The image is printed as large as possible while keeping the image's aspect ratio. For example, if you zoom an image, the image is printed zoomed as seen in the viewport.

2

File I/O

Opening an Image

Use the **File | Open Image** menu option to open a standard Windows bitmap file (*.bmp). For grayscale images, the bitmap file must be a 256 color noncompressed bitmap. The way that the image is opened depends on the image type option selected in **Options | Image Type**.

For example, if you want to open a grayscale image from disk as a 32-bit grayscale image, perform the following steps:

1. Select **Options | Image type | Grayscale | Gray Scale (Int32)**.
2. Activate the desired viewport by selecting it with the mouse.
3. Select **File | Open Image....**
4. Open a grayscale image from disk. The image is opened as a 32-bit image in the active viewport.

Note that after you select **Options | Image type | Grayscale | Gray Scale (Int32)**, all files are opened as 32-bit grayscale images. This applies to all viewports.

Saving an Image

Use the **File | Save Image As** menu option to save the image in the active viewport in its default format. If the image is a 16-bit, 32-bit, or floating-point grayscale image, only the displayed 8-bit portion of the image is saved with the bitmap file. The 16-bit, 32-bit, or floating-point data is saved in a separate file in the same directory; this file has the same name with an extension of *.i16 (for 16-bit data), *.i32 (for 32-bit data), or *.flt (for floating-point data).

If DT Vision Foundry cannot find the 16-bit, 32-bit, or floating-point data when opening an image, DT Vision Foundry uses the 8-bit data.

Drag and Drop

You can open an image (or group of images) by dragging it (them) from the Windows Explorer to an open viewport. A list of the images is added to the Image Manager tool. Note that all the rules for opening a file using **File | Open Image...** still apply.

2

Supported File Types

The main application supports only the standard Windows bitmap file type. If you need to open another file type, refer to [Chapter 16](#), “Using the File Manager Tool.”

Localization File

Several DT Vision Foundry tools, such as the Blob Analysis tool and the Histogram tool, allow you to send selected data to Microsoft Excel so that you can display the data in charts, graphs, and spreadsheets. By default, DT Vision Foundry assumes that you are using the English-language version of Excel. If you are using a different version of Excel, you must update the DTVF.DEF file (located in C:\Program Files\Data Translation\DT Vision Foundry\BIN, by default) to indicate the language you are using.

Using any text editor (such as Notepad), open the DTVF.DEF file. The first line in the file (r%dc%d:r%dc%d) indicates the English-language version of Excel, where "r" stands for "row" and "c" stands for "column." To specify a different language, replace each instance of "r" with the first letter of the word for "row" in the language you are using and replace each instance of "c" with the first letter of the word for "column" in the language you are using. Then, save and close the file.



Using the Arithmetic Tool

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Introduction

The Arithmetic tool is supplied with DT Vision Foundry. It performs arithmetic operations on two input images, placing the result in an output image.

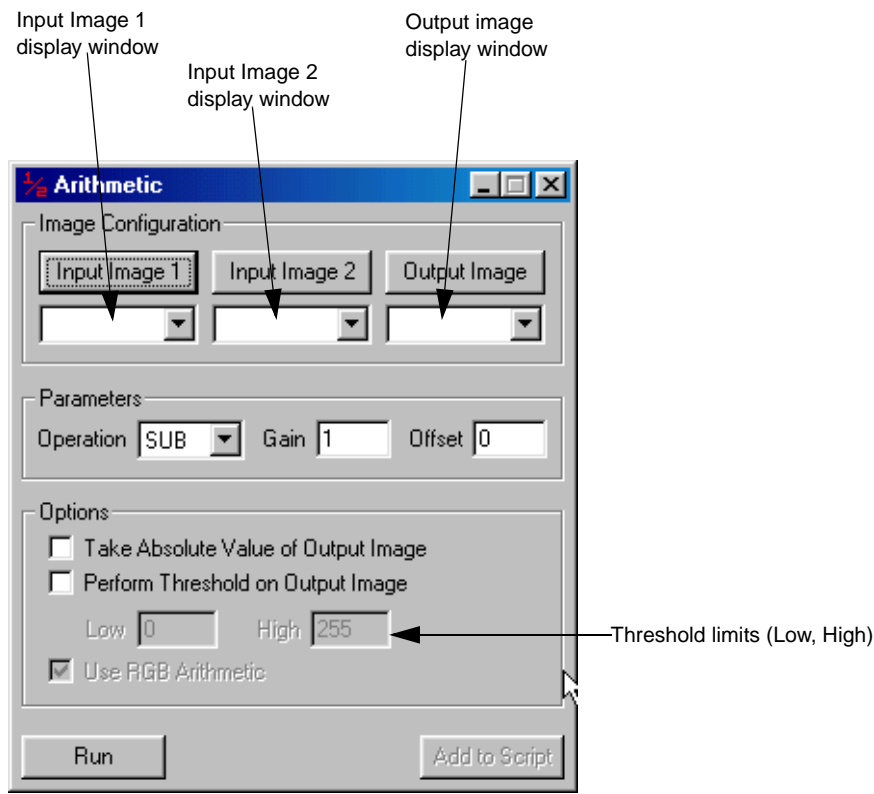


Figure 12: Arithmetic Tool

Table 3 describes the operations that the Arithmetic tool can perform. Note that all operations are performed with respect to the active ROI in input image #1. If no active ROI is present, the whole image is used.


Table 3: Arithmetic Tool Operations

Operation	Description	Calculation
ADD	Adds input image #1 to input image #2, placing the resulting data in the output image.	Image Out = Image #1 + Image #2.
SUB	Subtracts input image #2 from input image #1, placing the resulting data in the output image.	Image Out = Image #1 – Image #2.
MULT	Multiplies input image #1 by input image #2, placing the resulting data in the output image.	Image Out = Image #1 x Image #2
DIV	Divides input image #1 by input image #2, placing the resulting data in the output image.	Image Out = Image #1 / Image #2.
AND	Performs a bitwise logical AND on input image #1 and input image #2, placing the resulting data in the output image. ^a	Image Out = Image #1 AND Image #2
OR	Performs a bitwise logical OR on input image #1 and input image #2, placing the resulting data in the output image. ^a	Image Out = Image #1 OR Image #2
XOR	Performs a bitwise logical exclusive OR on input image #1 and input image #2, placing the resulting data in the output image. ^a	Image Out = Image #1 XOR Image #2

Table 3: Arithmetic Tool Operations (cont.)

Operation	Description	Calculation
COPY	Copies input image #1 to the contents of the output image. Note that Image #2 is not used in this operation.	Image Out = Image #1

a. This operation is typically used with binary images.

To open an Arithmetic tool, select the  icon from the Image Processing toolbar or select **Arithmetic** from the Tools menu.

Notes: The Arithmetic tool is fully compatible with all tools, image types, and ROIs.

You can have up to 100 Arithmetic tools open at the same time.

Description of Arithmetic Tool Options

This section contains a description of the options in the Arithmetic tool dialog box.

Input Image 1

Click this button to load the image in the active viewport as input image #1. The image name is shown in the Input Image 1 display window. You can also select the input image from the list of images currently residing in system memory.

3

Input Image 2

Click this button to load the image in the active viewport as input image #2. The image name is shown in the Input Image 2 display window. You can also select the input image from list of images currently residing in system memory.

Output Image

Click this button to load the image in the active viewport as the output image. The image name is shown in the Output Image display window. You can also select the output image from the list of images currently residing in system memory or enter your own name for the output image in the display window text box.

If you do not select an output image, the Arithmetic tool automatically creates an output image when you perform the operation. Note, however, that if you intend to use multiple output images in a point & click script, it is recommended that you either use the image in the active viewport as the output image or select the output image from the drop-down list. This ensures that each output image in the point & click script has a unique name.

Operation

Select the operation that you want to perform from the drop-down list. For more information, refer to [Table 3](#) on [page 59](#).

Gain and Offset

Specify the gain and offset. The gain is multiplied by the result of the arithmetic calculation. The offset is added to the result of the arithmetic calculation. For example, if you are performing an addition operation, the calculation would be as follows:

$$\text{Output image} = \text{Gain} * (\text{Input Image \#1} + \text{Input Image \#2}) + \text{Offset}$$

Take Absolute Value of Output Image

Select this checkbox if you want to use the absolute value of the output image. This calculation is performed after the gain and offset have been calculated.

Perform Threshold on Output Image

Select this checkbox if you want to threshold the output value of the output image to the specified **High** and **Low** threshold limits. This calculation is performed after the absolute value is performed (if it is performed).

Use RGB Arithmetic/Use HSL Arithmetic

Select this checkbox if you want to perform arithmetic operations on all three color planes (red, green and blue) of a 24-bit RGB color image or on all three color settings of a 24-bit HSL color image.

Clear this checkbox if you want to perform arithmetic operations on only the color plane/color setting that is selected in the Color Plane tool. This allows you to perform operations on each color plane/color setting independently. For example, to add only the red color plane of RGB color images, you can open a Color Plane tool, select the red plane, and then perform the addition. For more information, refer to [Chapter 8, “Using the Color Plane Tool.”](#)

3

Run

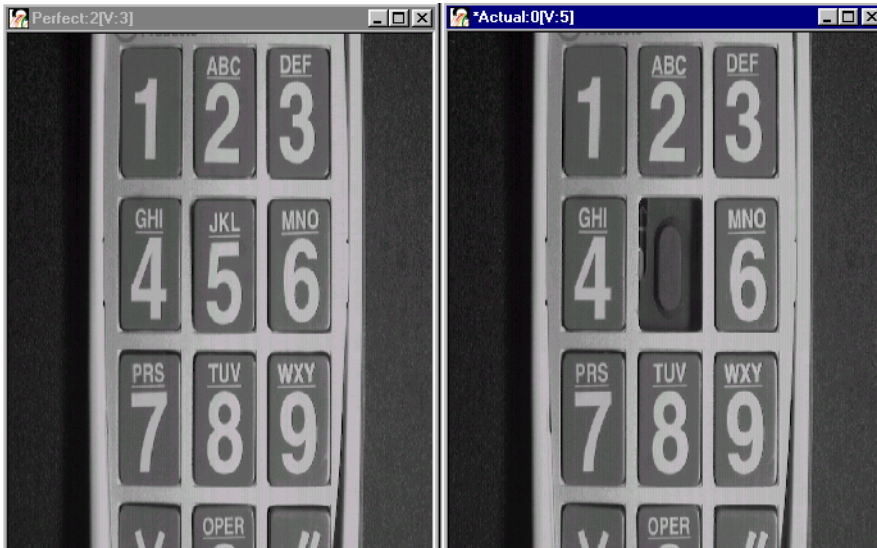
When all options for the tool are set appropriately, click this button to perform the operation.

Add to Script

After you perform the calculation, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the Arithmetic Tool

This example shows how to perform quality control inspections in a manufacturing environment. Using the Arithmetic tool, you can compare the manufactured part (shown in the image Actual) to a known perfect part (shown in the image Perfect) and then display all defects in an output image.

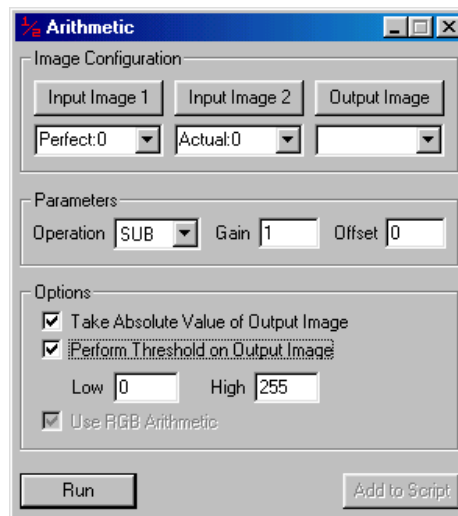


The operation is as follows:

1. Open an Arithmetic tool (if one is not already open).
2. To set input image #1, go to the main application and click in the viewport on the image Perfect.
It is now the active viewport and is denoted with an asterisk.
3. Click **Input Image 1** to load the image Perfect. Note that you can also select the image from the list of images currently residing in system memory.

4. Repeat steps 2 and 3 to set input image #2, using the image Actual.
5. To set the output image, you can select an output image as described in steps 1 and 2, or you can run the operation and let the Arithmetic tool create an output image for you. For this example, the tool automatically creates the output image.
6. Select the options you want to use when performing the arithmetic operation. In this example, set the **Gain** to 1, set the **Offset** to 0, clear the **Take Absolute Value of Output Image** checkbox, and select the **Perform Threshold on Output Image** checkbox.
7. Select the operation you want to perform. In this example, you want to perform a subtraction operation. Therefore, click **SUB** from the drop-down list.

The Arithmetic tool looks as follows:



8. Now that the tool is correctly set up, perform the subtraction by clicking **Run**.

The result is as follows:



The output image contains the result of the subtraction operation (Perfect minus Actual). The Actual part is defective because of the missing 5.

In a manufacturing environment, you can now process your defective part. For example, you could automatically reject and remove the defective part from the assembly line.

Point & Click Script

This section describes the specific use of the Arithmetic tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Arithmetic tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Arithmetic tool to perform the desired function. This includes the input and output images, the arithmetic operation, and the active ROI (if you are using one). Click **Run** to perform the desired operation, then click **Add to Script** to record the desired action in the Point & Click Script tool.

3

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Arithmetic tool is set up exactly as it was when you previously recorded the script item. This includes the input and output images, the desired arithmetic operation, and the active ROI (if an ROI was used). The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved to the point & click script with the new options.




Using the AVI Player Tool

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Introduction

The AVI Player tool is supplied with DT Vision Foundry. It allows you to view a previously captured .AVI video file. You can then select one or more frames from the .AVI file to process using other tools, such as the Blob Analysis tool.

To open an AVI Player tool, select the  icon from the Input-Output toolbar or select **AVI Player** from the Tools menu.

Notes: The AVI Player tool is fully compatible with all tools. It does not use ROIs. It can import frames from 8-bit color, 16-bit color, and 24-bit color .AVI video files, where 24-bit color AVI frames are imported as 24-bit RGB or HSL color images, 16-bit color AVI frames are converted to 24-bit RGB or HSL color images, and 8-bit color AVI frames are imported as 8-bit grayscale images.

You can have two AVI Player tools open at the same time.

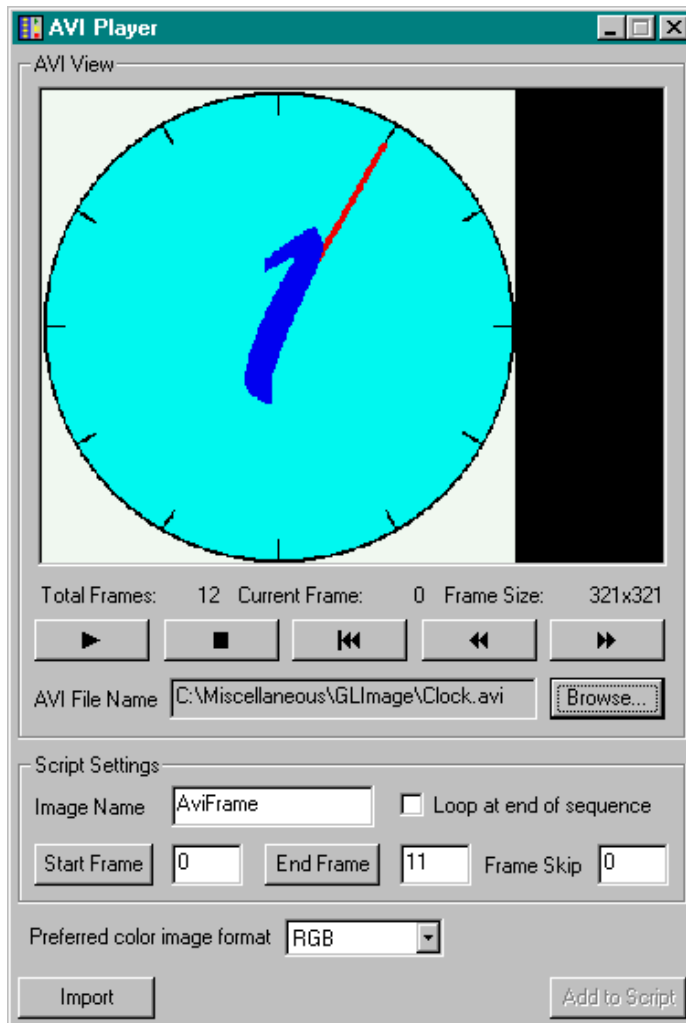


Figure 13: AVI Player Tool

Description of AVI Player Tool Options

This section contains a description of the options in the AVI Player tool dialog box.

AVI File Name

This field displays the name of the current .AVI video file. To open an .AVI file, click the **Browse** button. A Load AVI File dialog box is displayed. Locate the file you want to open, then click **Open**.

Note that the only color images supported by DT Vision Foundry are 24-bit RGB and 24-bit HSL color images. If you open a 16-bit color .AVI file, it is automatically converted to 24-bit RGB or HSL color format, depending on the **Preferred Color Image Format**. If you open an 8-bit color .AVI file, it is interpreted as grayscale. No other file formats are supported.

AVI View

This is the viewing window in which you play the .AVI video file.

Total Frames

This field displays the total number of frames in the .AVI video file.

Current Frame

This field displays the frame within the .AVI video file that is currently displayed in the viewing window.

Frame Size

This field displays the size of the frames in the .AVI video file, in pixels.

Play 

Click this button to play the .AVI video file in the forward direction, beginning at the current frame. After the last frame is played, the tool plays the file again, beginning at the first frame. Play continues until you click the Stop button.

Stop 

Click this button to stop playing the .AVI video file.

Rewind 

Click this button to return to the beginning of the .AVI video file.

Frame Backward 

Click this button to move backward one frame in the .AVI video file and display the frame in the AVI view. If the current frame is the first frame in the file, the tool moves to the last frame in the file.

Frame Forward 

Click this button to move forward one frame in the .AVI video file and display the frame in the AVI view. If the current frame is the last frame in the file, the tool moves to the first frame in the file.

Script Settings

Set the following options if you want to import selected frames from the .AVI file in a point & click script:

- **Image Name** – The name of the image into which the current frame is imported, either when you click **Import** or when an instance of the AVI Player tool imports a frame into a point & click script. Enter the name in the text box.

If an image with the same name already exists in DT Vision Foundry, the current frame replaces the existing image.

- **Loop at end of sequence** – Specifies what the point & click script does when the last frame in the .AVI file has been imported. Select this checkbox if you want the script to import the frames again, starting with **Start Frame**. Clear this checkbox if you want the script to stop importing frames.

Note that if you clear this checkbox, a failure condition (stop light) occurs in the point & click script when the last frame is imported. For more information, refer to [page 513](#).

- **Start Frame** – The first frame in the .AVI file that you want to import into the point & click script. Click the **Start Frame** button to specify the current frame as the start frame, or enter the number of the start frame in the text box. If you enter a frame that is not in the .AVI file, the tool sets the start frame to 0.
- **End Frame** – The last frame in the .AVI file that you want to import into the point & click script. Click the **End Frame** button to specify the current frame as the end frame, or enter the number of the end frame in the text box. If you enter a frame that is not in the .AVI file, the tool sets the end frame to the last frame in the file.
- **Frame Skip** – The number of frames that you want to skip before importing the next frame. Enter the number in the text box. For example, to process every frame in the .AVI file, set **Frame Skip** to 0. To process every tenth frame in the .AVI file, set **Frame Skip** to 9.

Preferred Color Image Format

If you are importing frames from 24-bit or 16-bit color .AVI video files, select the color format you want to use (RGB or HSL) from the drop-down list.

Import

Click this button to import the current frame into the image **Image Name** and display the image in the active viewport.

Add to Script

After you click **Import** and ensure that your image is valid, click this button to add the point & click script settings to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the AVI Player Tool

This example shows how to use the AVI Player tool with the Blob Analysis tool in a point & click script to analyze cells growing in a petri dish.

The operation is as follows:

1. Capture an .AVI file (called celltest.avi) that shows the growth of cells in a petri dish over several hours.
2. Open an AVI Player tool (if one is not already open).
3. Click **Browse** and locate the file celltest.avi.
4. Use the Play, Stop, Rewind, Frame Forward, and Frame Backwards buttons to navigate through the .AVI file to determine which frames you want to analyze.
5. Set the **Image Name** to **Cell Test**.
6. Assume that you want to analyze every 30th frame from frame 30 through frame 300. Navigate to the 30th frame and click **Start Frame**. Navigate to the 300th frame and click **End Frame**. Set **Frame Skip** to **29**.
7. Click **Import** to load the current frame into the active viewport.
8. If the image loaded successfully, click **Add to Script**.
9. Create a loop in the point & click script that uses the Blob Analysis tool to analyze each image and to send the statistics to Microsoft Excel.

Point & Click Script

This section describes the specific use of the AVI Player tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the AVI Player tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the AVI Player tool to perform the desired function. This includes the start frame, the end frame, and the number of frames to skip between processing. Click **Import** to perform the desired operation, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Note: You always provide the absolute path to the .AVI file in the AVI Player tool. If you save the point & click script to the same drive that contains the .AVI file, the tool automatically converts the .AVI file to a path relative to the directory in which you save the script. If you move the script (and the .AVI file) to another directory, the correct .AVI file is opened when you run the script.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the AVI Player tool is set up exactly as it was when you previously recorded the script item. This includes the start frame, the end frame, and the number of frames to skip between processing. The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Barcode Reader Tool

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Introduction

The Barcode Reader tool is supplied with DT Vision Foundry. It allows you to read one-dimensional barcode information located in an image. The tool reads the 128, 3 of 9, 2 of 5, EAN (Version 13), EAN (Version 8), POSTNET (Postal Numeric Encoding Technique), and UPC (Version A) industry-standard barcode formats.

Notes: For reliable barcode reading, the smallest bar/space in a barcode must be at least 5 pixels in width.

This tool is intended for line-based (one-dimensional) barcodes. If you are using module-based (two-dimensional) barcodes, use the Data Matrix Reader tool instead. For more information, refer to [Chapter 11, “Using the Data Matrix Reader Tool.”](#)

The Barcode Reader tool supports the following features:

- Read bidirectionally.
- Perform checksum error checking.
- Perform hard-to-read barcode reading.
- Check for stop pattern.
- Read inverted barcodes.
- Read horizontal or vertical barcodes.

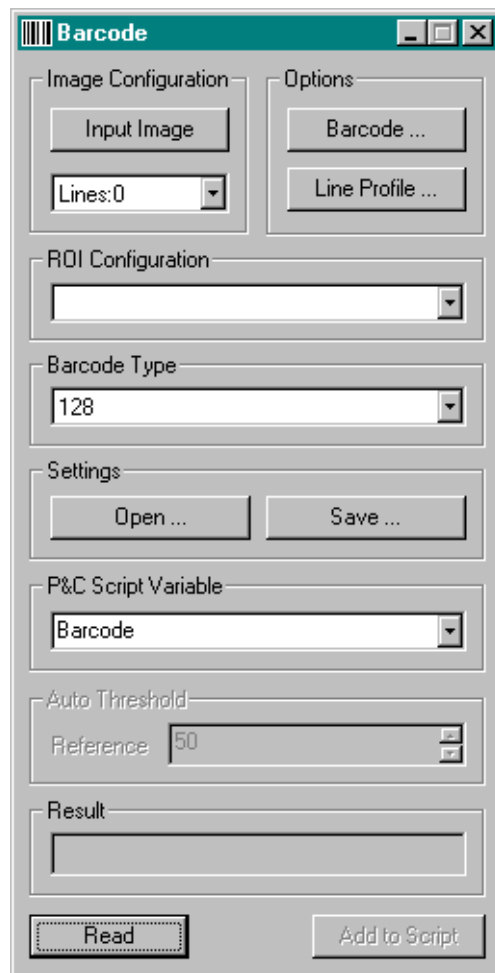



Figure 14: Barcode Reader Tool

To open a Barcode Reader tool, select the  icon from the Barcode toolbar or select **Barcode Reader** from the Tools menu.

Notes: The Barcode Reader tool is compatible with all other DT Vision Foundry tools. It uses a rectangle ROI in the decoding process.

You can have up to 100 Barcode Reader tools open at the same time.

Description of Barcode Reader Tool Options

This section contains a description of the options in the Barcode Reader tool dialog box.

Main Dialog Box Options

Input Image

Click this button to load the image in the active viewport as the input image. The input image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Barcode

Click this button to open the Barcode Options dialog box. For more information, refer to [page 89](#).

Line Profile

Click this button to open the Line Profile Options dialog box. For more information, refer to [page 86](#). Note that the **Line Profile** options are not used for POSTNET barcodes.

ROI Configuration

Select the ROI from the drop-down list. Note that only rectangle ROIs are supported at the present time.

Make sure that you draw the rectangle ROI through the entire barcode. For POSTNET barcodes, make sure that the imaginary line through the middle of the ROI crosses all bars in the barcode.

Barcode Type

Select the type of barcode that you want to read from the drop-down list. The barcode type can be 128, 2 of 5, 3 of 9, EAN (Version 13), EAN (Version 8), POSTNET, or UPC (Version A).

Settings - Open

Click this button to open Barcode Reader tool settings that you have saved. An Open dialog box is displayed. When you open a file (the name must be followed by the extension .hbc), the settings are loaded into the Barcode Reader tool.

Settings - Save

Click this button to save the Barcode Reader tool settings back to disk. A Save As dialog box is displayed. Select the directory and enter the file name with the extension .hbc.

P&C Script Variable

Specify the point & click scripting variable that you want to use to store the barcode text. This is a string variable. After reading a barcode, the tool places the barcode text in this variable for use by other tools. You can manually enter a variable name or select a variable from the drop-down list. If you do not specify a variable, the variable Barcode is used by default.

Auto Threshold

For the POSTNET barcode type only, select an automatic thresholding reference value from the **Reference** spin box. The value can range from 0 to 100%. By default, the reference value is 50%.

The tool uses the difference between the minimum and maximum grayscale values in the selected ROI to automatically threshold the image. If you do not get the results that you expect, try a different reference value.

Result

After you click **Read** to perform the operation, the Result field displays the barcode text.

If the Barcode Reader tool cannot read the barcode text, the tool returns the word **Error**. You can try to enlarge your image (the smallest bar/space in the barcode should be at least 5 pixels in width), or you can try adjusting the settings in the Line Profile Options dialog box (refer to the next section) or the Barcode Options dialog box (refer to [page 89](#)).

Read

After all settings are correct, click this button to read the barcode. The tool displays the barcode text in the **Result** field and places the barcode text in the specified point & click scripting variable, if applicable.

Add to Script

After you click the **Read** button, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29](#), “Using the Point & Click Script Tool.”

Line Profile Options Dialog Box Options

Note: The Line Profile Options dialog box is not used for POSTNET barcodes.

These options determine how the edges of the barcode bars/spaces are found. Typically, you can use the default options. However, if you are not correctly reading a valid barcode and the smallest bar/space width is at least 5 pixels, you can use these options to find the edges of the bars/spaces more accurately. When you are finished, click **OK** to accept the settings.

Note that the lines referred to in this section are the virtual lines created by the Barcode Reader tool within the rectangle ROI that you draw across the barcode image. For more information on how to set up line profiles, refer to [Chapter 24, “Using the Line Profile Tool.”](#)

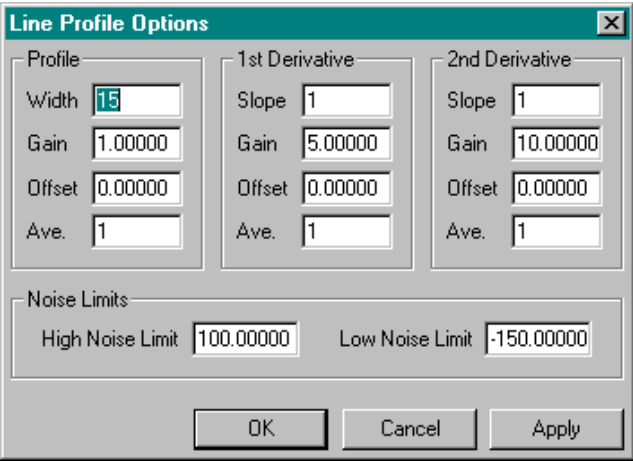


Figure 15: Line Profile Options Dialog Box

Profile Options

Width

Enter the number of pixels that you want the Barcode Reader tool to add to each side of the line when creating a line profile. The pixels are added to each side of the line in a perpendicular fashion. For example, if you enter a value of 1 and the line is a horizontal line, then for each point on the horizontal line, three pixels are averaged: a point on the line, a point just below the line, and a point just above the line. The pixels that are used in the average are always perpendicular to the line.

Gain

Enter the gain value. The gain value, along with the offset value, is applied after the line profile has been created and smoothed using the **Ave.** value.

Offset

Enter the offset value. The offset value, along with the gain value, is applied after the profile has been created and smoothed using the **Ave.** value.

Ave.

Enter the smoothing value (the number of points, on each side of the center point, that you want the Barcode Reader tool to average in with the center point). The smoothing value is applied just after the line profile has been created. For every point in the line profile curve, the smoothing value is averaged in with its neighbors. For example, if you want no smoothing, enter a value of 0. If you want to average 1 point on each side of the center point with the center point, enter a value of 1.

First Derivative Options / Second Derivative Options

Note: The options for the first derivative and the second derivative are the same. The second derivative is typically used to find edges.

Slope

Enter the slope value (the span of points, on each side of the center point, that you want the Barcode Reader tool to take into consideration when calculating the slope of the center point). A value of one (the default) means that the center point and each of its neighbors are included in the calculation. Note that you cannot use a value of 0 for the slope.

Gain

Enter the gain value. The gain value, along with the offset value, is applied to the derivative after the derivative has been created and smoothed using the **Ave.** value.

Offset

Enter the offset value. The offset value, along with the gain value, is applied to the derivative after the derivative has been created and smoothed using the **Ave.** value.

Ave.

Enter the smoothing value (the number of points, on each side of the center point, that you want the Barcode Reader tool to average in with the center point). The smoothing value is applied just after the derivative has been created. For every point in the derivative curve, the smoothing value is averaged with its neighbors. For example, if you want no smoothing, enter a value of 0. If you want to average 1 point on each side of the center point with the center point, enter a value of 1.

Noise Limits Options

Enter the high and low noise limits. Enter limits that factor out the noise but leave the critical data available to find the edges. For more information on how to set noise limits, refer to [Chapter 24, "Using the Line Profile Tool."](#)

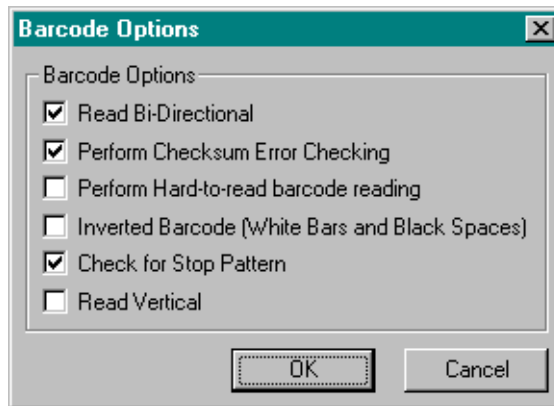
Barcode Options Dialog Box Options

Figure 16: Barcode Options Dialog Box

Read Bi-Directional

Select this checkbox if you want to read barcodes in both directions.
Clear this checkbox if you want to read barcodes from left to right.

Perform Checksum Error Checking

Select this checkbox if you want to perform checksum error checking.
Clear this checkbox if you do not want to perform checksum error checking.

Note that if you are reading a 3 of 9 barcode or other barcodes that do not include error checking (and therefore may not contain a check digit), make sure that this checkbox is cleared.

Perform Hard-to-Read Barcode Reading

Select this checkbox if you are reading barcodes that might have imperfections in the quality of the barcode symbol. In this case, the tool tries to read the barcode using a specialized algorithm that searches throughout the rectangle ROI using different preprogrammed line profiles.

Clear this check box if you are reading barcodes that have no imperfections. In this case, the tool reads the barcode down the center of the rectangle ROI.

Inverted Barcode (White Bars and Black Spaces)

Select this checkbox if you are reading barcodes that are inverted (white bars and black spaces). This is useful when reading etched barcodes on transparent surfaces such as glass.

Check for Stop Pattern

Select this checkbox if you want to check for a stop pattern. Note that if you are reading barcodes that were printed/marked on the part without stop patterns, do not select this checkbox.

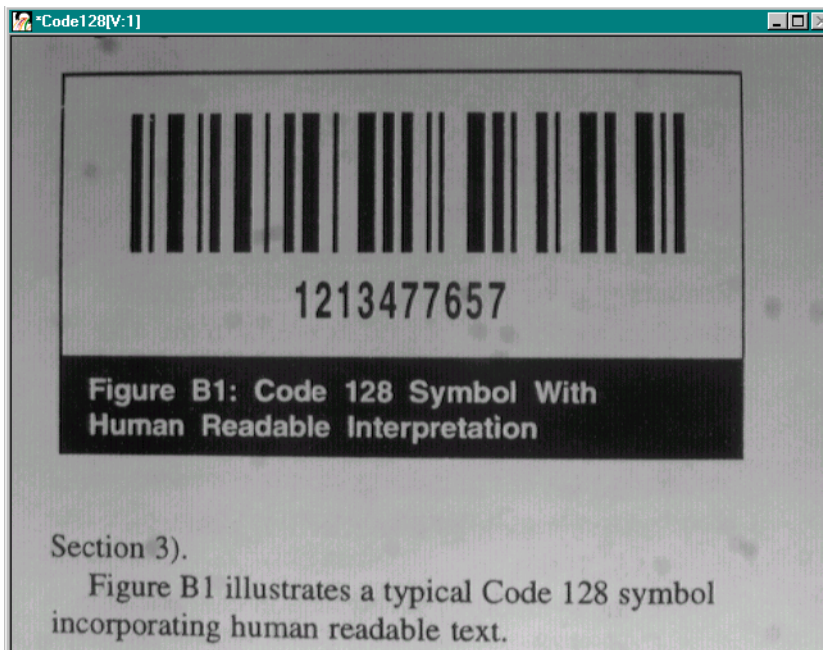
Read Vertical

Select this checkbox if you are reading barcodes that are oriented in a vertical direction. Clear this checkbox if you are reading barcodes that are oriented in a horizontal direction.

Note that barcodes do not have to be perfectly horizontal or vertical. As long as a single horizontal/vertical line comes in contact with all of the bars/spaces of the barcode, the barcode is read successfully.

Example of Using the Barcode Tool

This example shows how to use the Barcode Reader tool to read the barcode symbol located in the image Code128.



The operation is as follows:

1. Open the Barcode Reader tool (if one is not already open).
2. Click on the Code128 image in the viewport in the main application; it becomes the active viewport and is denoted with an asterisk. Now, click **Input Image** in the Barcode Reader tool main dialog box.

Note that when you open a Barcode Reader tool, the image in the active viewport is loaded as the input image by default.

3. Draw a rectangle ROI through the barcode symbol in the image Code128. Make sure that you overlap the symbol completely (the ROI must extend past the symbol on each end).
4. Select the rectangle ROI from the **ROI Configuration** drop-down list.
5. Click **Read**.

*The barcode data is displayed in the **Result** field.*

Point & Click Script

This section describes the specific use of the Barcode Reader tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Barcode Reader tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Barcode Reader tool to perform the desired function. This includes the barcode type and the line profile options. Click the **Read** button to perform the operation, then click the **Add to Script** button to record all the information in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Barcode Reader tool is set up exactly as it was when you previously recorded the script. This includes the barcode type and all option settings. Change the desired options and click **Save**. The new barcode operation is run with the desired options and the new information is saved to the point & click script.



Using the Blob Analysis Tool

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Introduction

The Blob Analysis tool is supplied with DT Vision Foundry. It allows you to perform blob analysis operations on an input image.

Given an input image and a binary mask image, the Blob Analysis tool finds, counts, and measures all blobs within the active rectangle ROI of the input image. If no active ROI is present, the tool finds, counts, and measures all blobs within the whole input image. A blob is defined as a number of connected pixels within a specified threshold range. Pixels are connected if they are horizontally, vertically, or diagonally adjacent.

The Blob Analysis tool finds, counts, and measures all parent blobs and all child blobs. A child blob is defined as a blob within another (parent) blob with a grayscale value outside the grayscale range of the parent blob. Each child blob is considered to be a parent blob and may have child blobs, which in turn may have child blobs, and so on. There is no limit to the number of child blob levels.

All blobs are treated as independent objects, so the same calculations are performed for all blobs, both parent and child. Instead of showing you the outline of a found blob (or one of its children), the Blob Analysis tool creates a freehand ROI for the found blob. This allows you to use other tools on the found blob just as you would with any other ROI.

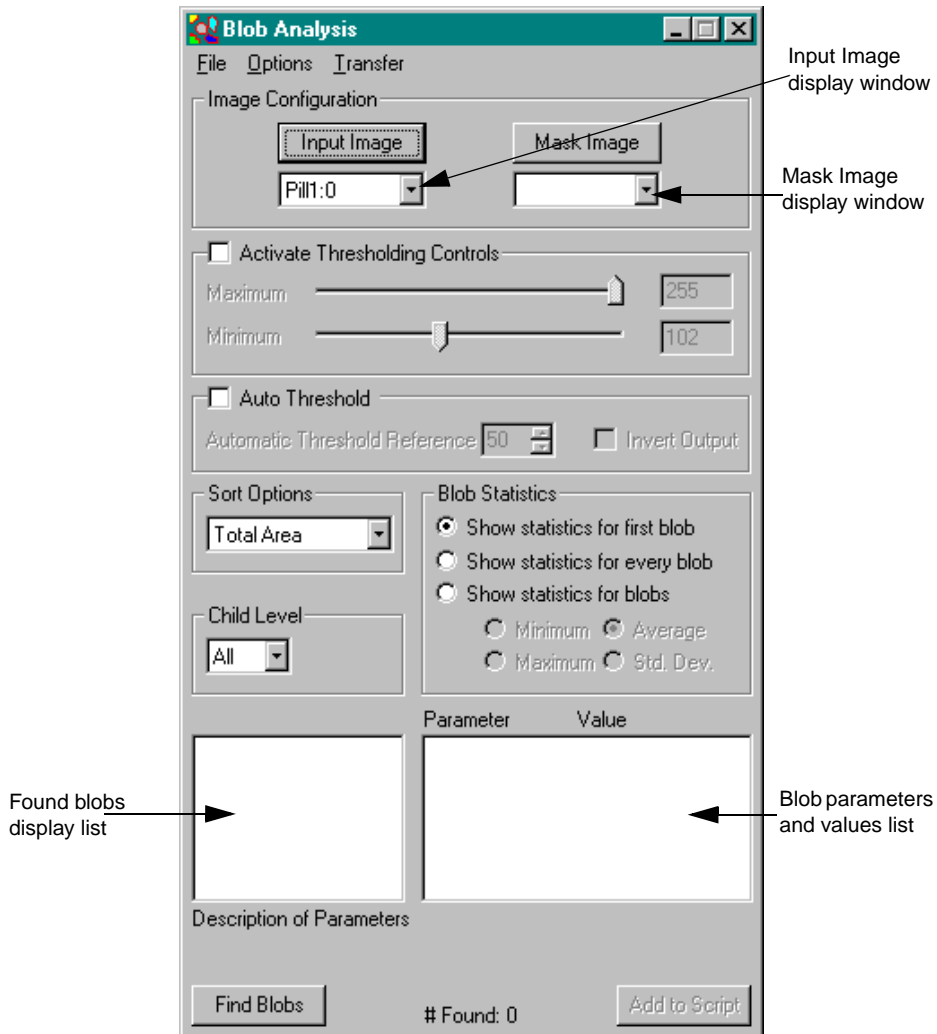


Figure 17: Blob Analysis Tool

Table 4 describes the calculations that the Blob Analysis tool can perform for each blob (parent and child).

Table 4: Blob Analysis Tool Calculations

Blob Option	Description
Parent Area (Calibrated)	The area of the blob, not including any child blobs. If the image has not been calibrated, this is the number of pixels in the parent blob, not including child pixels.
Total Area (Calibrated)	The total area of the parent blob and all child blobs. If the image has not been calibrated, this is the total number of pixels in the parent blob, including child pixels.
Child Area (Calibrated)	The area of all child blobs belonging to the parent blob. This value includes all levels of child blobs of the parent blob.
ROI Area (Calibrated)	The total area of the user-defined rectangle input ROI. If no ROI is present, this is the area of the entire image.
ROI Ratio(P) (Calibrated)	The ratio of the Parent Area to the ROI Area (Parent Area / ROI Area). The value can range from 0 to 1.
ROI Ratio(T) (Calibrated)	The ratio of the Total Area to the ROI Area (Total Area / ROI Area). The value can range from 0 to 1.

Table 4: Blob Analysis Tool Calculations (cont.)

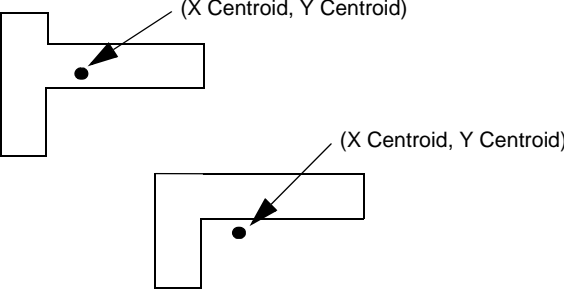
Blob Option	Description
X Centroid(P) (Calibrated)	<p>The x-coordinate of the center of mass of the Parent Area. The origin of the image (0,0) is located at its lower left corner. Note that (X Centroid, Y Centroid) is not necessarily a point within the blob.</p> 
X Centroid(T) (Calibrated)	<p>The x-coordinate of the center of mass of the Total Area. The origin of the image (0,0) is located at its lower left corner. For more information, refer to X Centroid(P).</p>
Y Centroid(P) (Calibrated)	<p>The y-coordinate of the center of mass of the Parent Area. The origin of the image (0,0) is located at its lower left corner. For more information, refer to X Centroid(P).</p>
Y Centroid(T) (Calibrated)	<p>The y-coordinate of the center of mass of the Total Area. The origin of the image (0,0) is located at its lower left corner. For more information, refer to X Centroid(P).</p>
#Children	<p>The total number of child blobs belonging to the parent blob. This includes all levels of child blobs.</p>
Child Ratio (Calibrated)	<p>The ratio of the child area to the total area of the parent blob and all child blobs (Child Area / Total Area). The value can range from 0 to 1.</p>
GrayAverage(P)	<p>The average grayscale value of all pixels within the Parent Area. If you are using a color image, this value is luminance.</p>

Table 4: Blob Analysis Tool Calculations (cont.)

Blob Option	Description
GrayAverage(T)	The average grayscale value of all pixels within the Total Area. If you are using a color image, this value is luminance.
RedAverage(P)	The average red value of all pixels within the Parent Area. If you are not using a color image, this value is not used.
RedAverage(T)	The average red value of all pixels within the Total Area. If you are not using a color image, this value is not used.
GreenAverage(P)	The average green value of all pixels within the Parent Area. If you are not using a color image, this value is not used.
GreenAverage(T)	The average green value of all pixels within the Total Area. If you are not using a color image, this value is not used.
BlueAverage(P)	The average blue value of all pixels within the Parent Area. If you are not using a color image, this value is not used.
BlueAverage(T)	The average blue value of all pixels within the Total Area. If you are not using a color image, this value is not used.
GrayTotal(P)	The total grayscale intensity of the Parent Area, calculated by summing the intensities of each pixel within the blob. If you are using a color image, this value is luminance.
GrayTotal(T)	The total grayscale intensity for the Total Area, calculated by summing the intensities of each pixel within the blob. If you are using a color image, this value is luminance.
RedTotal(P)	The total intensity of the red color plane of the Parent Area. If you are not using a color image, this value is not used.

Table 4: Blob Analysis Tool Calculations (cont.)

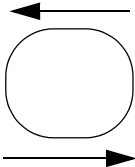
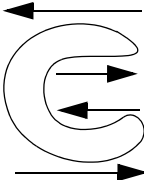
Blob Option	Description
RedTotal(T)	The total intensity of the red color plane of the Total Area. If you are not using a color image, this value is not used.
GreenTotal(P)	The total intensity of the green color plane of the Parent Area. If you are not using a color image, this value is not used.
GreenTotal(T)	The total intensity of the green color plane of the Total Area. If you are not using a color image, this value is not used.
BlueTotal(P)	The total intensity of the blue color plane of the Parent Area. If you are not using a color image, this value is not used.
BlueTotal(T)	The total intensity of the blue color plane of the Total Area. If you are not using a color image, this value is not used.
Perimeter (Calibrated)	The length around the outside edge of the blob. Note that the calculation may be somewhat inaccurate due to pixel quantization errors. A correction term is used to average out the error, resulting in a possible fractional perimeter value.
XPerimeter (Calibrated)	<p>The X component of the perimeter, measured along the x-axis.</p> <div><p>XPerimeter of convex blob</p><p>XPerimeter of concave blob</p></div>

Table 4: Blob Analysis Tool Calculations (cont.)

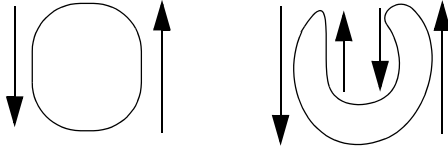
Blob Option	Description
YPerimeter (Calibrated)	<p>The Y component of the perimeter, measured along the y-axis.</p> <div>  <p>YPerimeter of convex blob YPerimeter of concave blob</p> </div>
Roundness (Calibrated)	<p>A measure of roundness that can range from 0 (not round) to 1 (perfectly circular). A circle has a roundness value of 1. The value is calculated as:</p> $\text{Roundness} = 4\pi \times \text{Total Area} / \text{Perimeter}^2$
PPDA (Calibrated)	<p>A common blob value calculated as:</p> $\text{PPDA} = \text{Perimeter}^2 / \text{Total Area}$
SumX(P)	<p>The sum of the x-coordinates of all pixel locations in the Parent Area.</p>
SumX(T)	<p>The sum of the x-coordinates of all pixel locations in the Total Area.</p>
SumXX(P)	<p>The sum of the squared x-coordinates of all pixel locations in the Parent Area.</p>
SumXX(T)	<p>The sum of the squared x-coordinates of all pixel locations in the Total Area.</p>
SumY(P)	<p>The sum of the y-coordinates of all pixel locations in the Parent Area.</p>
SumY(T)	<p>The sum of the y-coordinates of all pixel locations in the Total Area.</p>
SumYY(P)	<p>The sum of the squared y-coordinates of all pixel locations in the Parent Area.</p>

Table 4: Blob Analysis Tool Calculations (cont.)

Blob Option	Description
SumYY(T)	The sum of the squared y-coordinates of all pixel locations in the Total Area.
SumXY(P)	The sum of the XY product (the x-coordinate times the y-coordinate) of all pixel locations in the Parent Area.
SumXY(T)	The sum of the XY product (the x-coordinate times the y-coordinate) of all pixel locations in the Total Area.
MaxX (Calibrated)	The maximum (rightmost) x-coordinate value in the blob.
MaxY (Calibrated)	The maximum (bottommost) y-coordinate value in the blob.
MinX (Calibrated)	The minimum (leftmost) x-coordinate value in the blob.
MinY (Calibrated)	The minimum (topmost) y-coordinate value in the blob.
YatMaxX (Calibrated)	The y-coordinate corresponding to the value of MaxX. If there is more than one, the bottommost is used.
XatMaxY (Calibrated)	The x-coordinate corresponding to the value of MaxY. If there is more than one, the rightmost is used.
YatMinX (Calibrated)	The y-coordinate corresponding to the value of MinX. If there is more than one, the topmost is used.
XatMinY (Calibrated)	The x-coordinate corresponding to the value of MinY. If there is more than one, the leftmost is used.

Table 4: Blob Analysis Tool Calculations (cont.)

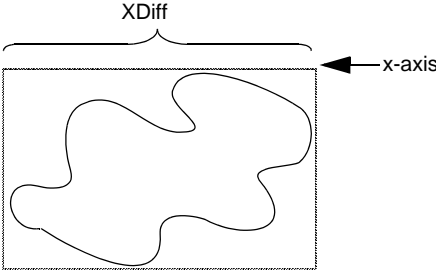
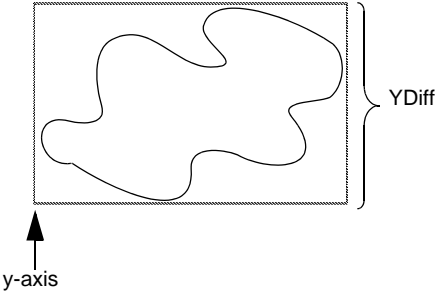
Blob Option	Description
XDiff (Calibrated)	<p>The extent (width) of the blob measured along the x-axis. This is equal to $\text{MaxX} - \text{MinX}$.</p>  <p>The diagram shows an irregular blob shape enclosed within a rectangular bounding box. A horizontal bracket above the box is labeled 'XDiff', indicating the width of the box. An arrow points to the right side of the box, labeled 'x-axis'.</p>
YDiff (Calibrated)	<p>The extent (height) of the blob measured along the y-axis. This is equal to $\text{MaxY} - \text{MinY}$.</p>  <p>The diagram shows the same irregular blob shape within its rectangular bounding box. A vertical bracket to the right of the box is labeled 'YDiff', indicating the height of the box. An arrow points to the bottom side of the box, labeled 'y-axis'.</p>
Box Area (Calibrated)	<p>The area of the smallest bounding box, oriented along the x and y axes, that encompasses the blob. This is equal to $\text{XDiff} \times \text{YDiff}$.</p>
Box Ratio(P) (Calibrated)	<p>The ratio of the Parent Area to the Box Area ($\text{Parent Area} / \text{Box Area}$). The value can range from 0 to 1.</p>
Box Ratio(T) (Calibrated)	<p>The ratio of the Total Area to the Box Area ($\text{Total Area} / \text{Box Area}$). The value can range from 0 to 1.</p>
AvgRadius (Calibrated)	<p>The average radius from the center of the blob (X Centroid, Y Centroid) to the perimeter of the blob.</p>

Table 4: Blob Analysis Tool Calculations (cont.)

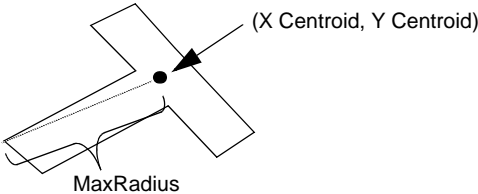
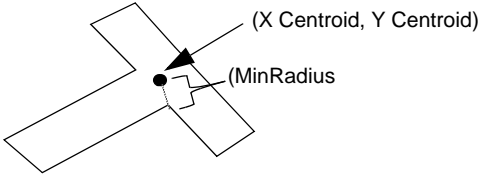
Blob Option	Description
MaxRadius (Calibrated)	<p>The maximum radius from the center of the blob (X Centroid, Y Centroid) to the perimeter of the blob. This is the distance from the centroid of the blob to the farthest point on the blob's perimeter.</p>  <p>The diagram shows a cross-shaped blob with a central black dot representing the centroid, labeled '(X Centroid, Y Centroid)'. A dashed line extends from the centroid to the farthest point on the blob's perimeter. This distance is labeled 'MaxRadius'.</p>
MinRadius (Calibrated)	<p>The minimum radius from the center of the blob (X Centroid, Y Centroid) to the perimeter of the blob. This is the distance from the centroid of the blob to the nearest point on the blob's perimeter.</p>  <p>The diagram shows a cross-shaped blob with a central black dot representing the centroid, labeled '(X Centroid, Y Centroid)'. A dashed line extends from the centroid to the nearest point on the blob's perimeter. This distance is labeled '(MinRadius'.</p>
CDistance (Calibrated)	<p>The distance from the origin (0,0) to the centroid of the blob.</p>

Table 4: Blob Analysis Tool Calculations (cont.)

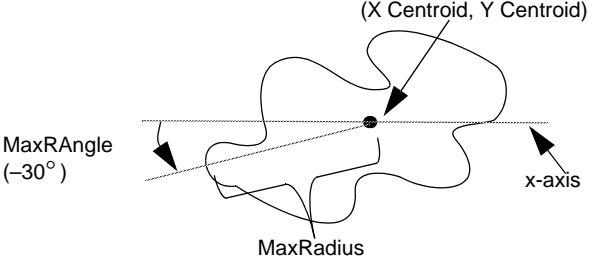
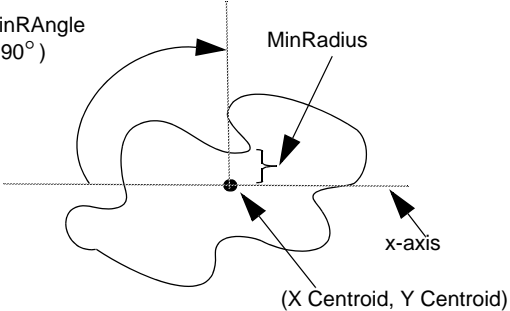
Blob Option	Description
MaxRAngle (Calibrated)	<p>The angle (in degrees) from a horizontal line passing through the centroid of the blob to a line passing through the MaxRadius. The value can range from -90° to $+90^{\circ}$, in a clockwise direction.</p> 
MinRAngle (Calibrated)	<p>The angle (in degrees) from a horizontal line passing through the centroid of the blob to a line passing through the MinRadius. The value can range from -90° to $+90^{\circ}$, in a clockwise direction.</p> 
DiffRAngle (Calibrated)	<p>The difference between the maximum radius angle and the minimum radius angle ($\text{MaxRAngle} - \text{MinRAngle}$).</p>
RRatio (Calibrated)	<p>The ratio of the minimum radius angle to the maximum radius angle ($\text{MinRAngle} / \text{MaxRAngle}$).</p>
# of Pixels(P)	<p>The number of pixels in the Parent Area of the blob.</p>

Table 4: Blob Analysis Tool Calculations (cont.)

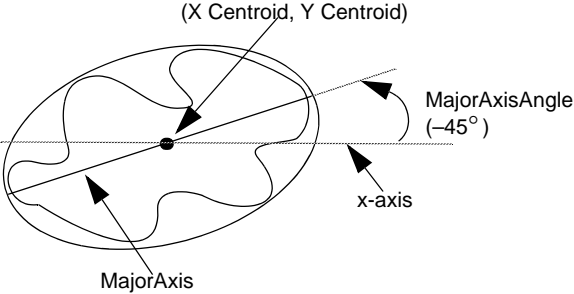
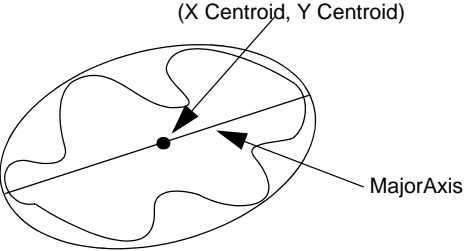
Blob Option	Description
# of Pixels(T)	The number of pixels in the Total Area of the blob.
MajorAxisAngle (Calibrated)	<p>The angle (in degrees) between the x-axis and the MajorAxis. The value can range from -90° to $+90^{\circ}$, in a clockwise direction.</p>  <p>The diagram shows an irregular blob with a central point labeled '(X Centroid, Y Centroid)'. A solid line, labeled 'MajorAxis', passes through the centroid. A horizontal dashed line is labeled 'x-axis'. The angle between the x-axis and the MajorAxis is indicated by a curved arrow and labeled 'MajorAxisAngle (-45°)'.</p>
MajorAxis (Calibrated)	<p>The length of the major axis (the longer of the two axes of symmetry) through the centroid of an ellipse equivalent to the blob.</p>  <p>The diagram shows an irregular blob with a central point labeled '(X Centroid, Y Centroid)'. A solid line, labeled 'MajorAxis', passes through the centroid, representing the longest axis of symmetry.</p>

Table 4: Blob Analysis Tool Calculations (cont.)

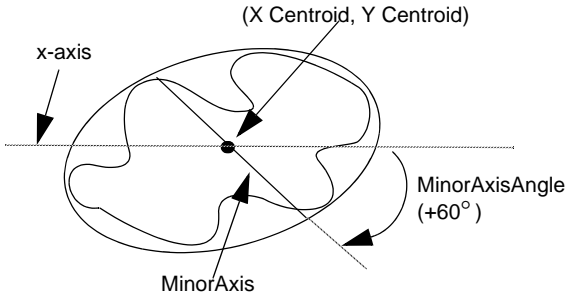
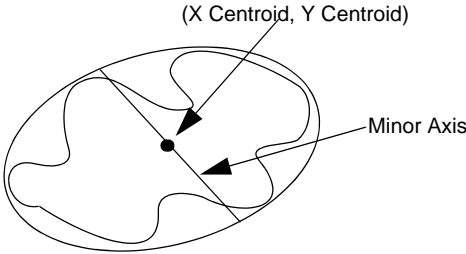

Blob Option	Description
MinorAxisAngle (Calibrated)	<p>The angle (in degrees) between the x-axis and the MinorAxis. The value can range from -90° to $+90^{\circ}$, in a clockwise direction.</p> 
MinorAxis (Calibrated)	<p>The length of the minor axis (the shorter of the two axes of symmetry) through the centroid of an ellipse equivalent to the blob.</p> 
AxisRatio	<p>The ratio of the minor axis to the major axis (MinorAxis / MajorAxis). This value is can range from 0 to 1. Note that if the centroid (total) of the blob does not lie within the blob itself, the MajorAxis and MinorAxis are not calculated. However, the MajorAxisAngle and MinorAxisAngle are always calculated.</p>

Table 4: Blob Analysis Tool Calculations (cont.)

Blob Option	Description
#BlobsFoundTotal ^a	The total number of blobs found during the Find Blobs operation.
#BlobsFoundParent ^a	The number of parent blobs found during the Find Blobs operation.
#BlobsFoundChild ^a	The number of child blobs found during the Find Blobs operation.

a. This calculation is intended to be used only in a point & click script.

To open a Blob Analysis tool, select the  icon from the Image Analysis toolbar or select **Blob Analysis** from the Tools menu.

Notes: The input image can be any grayscale or 24-bit color image. (Although you can open 24-bit HSL color images, HSL statistics are not supported.) The mask image must be a binary image. The Blob Analysis tool can create a binary mask image either by using built-in thresholding (see [page 116](#)) or by using automatic thresholding (see [page 116](#)). You can also create a binary image by using the Threshold tool. For more information, refer to [Chapter 39, “Using the Threshold Tool.”](#) The active ROI on the input image must be a rectangle ROI.

You can have up to 100 Blob Analysis tools open at the same time.

Description of Blob Analysis Tool Options

This section contains a description of the options in the Blob Analysis tool dialog box.

File Menu Options

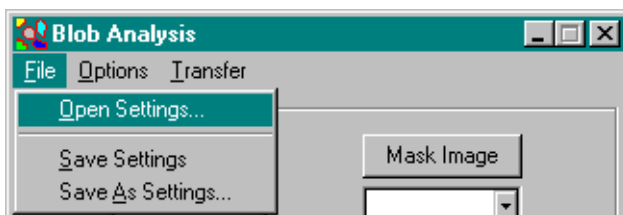


Figure 18: Blob Analysis Tool - File Menu

Open Settings...

Select this option to open Blob Analysis tool settings that you have saved. An Open dialog box is displayed. When you open a file (the name must be followed by the extension .blb), the settings are loaded into the Blob Analysis tool.

Save Settings

Select this option to save the Blob Analysis tool settings back to disk.

Save As Settings...

Select this option to save the Blob Analysis tool settings to a file with a different name. A Save As dialog box is displayed. Select the directory and enter the file name with the extension .blb.

Note that if you save a settings file with the name default.blb, the file will automatically open each time you open a Blob Analysis tool. You must save default.blb in the DT_Blob directory (located in C:\Program Files\Data Translation\DT Vision Foundry\Tools, by default).

Options Menu Options

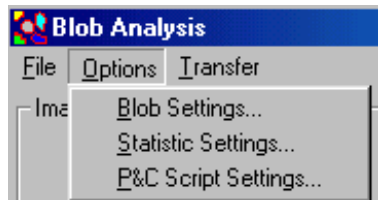


Figure 19: Blob Analysis Tool - Options Menu

Blob Settings...

Select this option if you want to change the default blob settings. The tool opens the Blob Settings dialog box. For more information, refer to [page 120](#).

Statistic Settings...

Select this option to specify how you want to display parameters in the blob parameters and values list in the Blob Analysis tool main dialog box. The tool opens the Statistic Settings dialog box. For more information, refer to [page 124](#).

P&C Script Settings...

Select this option if you want to perform point & click scripting. The tool opens the P&C Script Settings dialog box. For more information, refer to [page 126](#).

Transfer Menu Options

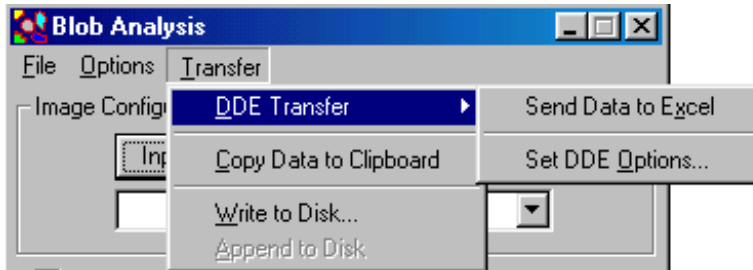


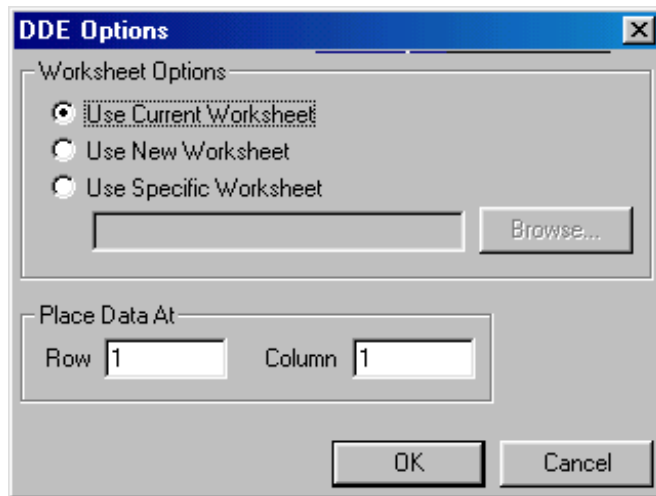
Figure 20: Blob Analysis Tool - Transfer Menu

DDE Transfer

Note: It is recommended that you use the Export tool to send variables and/or images from DT Vision Foundry to Excel. For more information, refer to [Chapter 15, “Using the Export Tool.”](#) The DDE options in the Blob Analysis tool have been retained for backward compatibility.

The DDE Transfer option allows you to select the following options for sending blob data to the spreadsheet program Excel:

- **Send Data to Excel** – Select this option to send all the current blob data (parameters and values) to Excel. Excel automatically opens and loads the data. When the blob data is loaded into Excel, you can display the data in any supported format, such as charts, graphs, and spreadsheets.
- **Set DDE Options...** – Select this option to open the DDE Options dialog box.



Click the appropriate radio button to specify the Excel worksheet you want to use. You can browse for a specific worksheet or enter the name manually. You can place your data at a specific row and/or column in the specified worksheet. When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the DDE Options dialog box without saving your changes.

Note that DT Vision Foundry assumes that you are using the English-language version of Excel. If you are using a different version of Excel, you must update the DTVF.DEF file to indicate the language you are using. For more information, refer to [page 55](#).

Copy Data to Clipboard

Select this option to copy all current blob data to the clipboard. You can then paste from the clipboard to any supported program, such as Word, Excel, or Notepad.

Write to Disk

Select this option to write all current blob data to disk. A Save As dialog box is displayed. Select the appropriate directory and enter the file name, then click **Save**.

Append to Disk

Select this option to add the current blob data to the end of the file you saved using **Write to Disk**.

Main Dialog Box Options

Input Image

Click this button to load the image in the active viewport as the input image. The input image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Mask Image

Click this button to load the image in the active viewport as the binary mask image. Use this button only if you have already created a binary mask image using the Threshold tool. For more information, refer to [Chapter 39, “Using the Threshold Tool.”](#) The mask image name is shown in the Mask Image display window. You can also select the mask image from the list of images currently residing in system memory.

By creating the binary mask image yourself, you can first process the image with other tools such as the Morphology tool. This allows you to remove unwanted particles, to smooth particles, and to separate touching particles. You can also logically AND, OR, or XOR binary images together before finding the blobs contained in the input image.

If you do not require the advanced features of the Threshold tool, you can let the Blob Analysis tool threshold the input image and create a binary mask image using either built-in thresholding (see [page 116](#)) or automatic thresholding ([page 116](#)). After you perform the **Find Blobs** operation, the mask image name (in the format *ImageName.msk:x*) is shown in the Mask Image display window and you can select the mask image from the Mask Image display window drop-down list.

To view a mask image that is created by the Blob Analysis tool, use the Image Manager tool. If you double-click the name of the mask image in the list of images in memory, the tool places the mask image in the active viewport. For more information, refer to [Chapter 21, “Using the Image Manager Tool.”](#)

Activate Thresholding Controls

By default, the Blob Analysis tool uses built-in thresholding to threshold the input image and create a binary mask image using the threshold limits shown in the **Maximum** and **Minimum** text boxes. If you want to change the threshold limits, select the **Activate Thresholding Controls** checkbox. Then, use the **Maximum** and **Minimum** slider controls to adjust the upper and lower limits. You can also enter the limits manually and use the arrow keys to fine-tune the values.

Note that you can perform either built-in thresholding or automatic thresholding. If you select the **Activate Thresholding Controls** checkbox, the **Auto Threshold** checkbox is grayed out.

Auto Threshold

Select this checkbox to enable automatic thresholding. Clear the checkbox to disable automatic thresholding.

If automatic thresholding is enabled, select a reference value from the **Automatic Threshold Reference** spin box. The value can range from 0 to 100%. By default, the reference value is 50%.

The tool uses the difference between the minimum and maximum grayscale values in the selected ROI to automatically threshold the image. If you do not get the results that you expect, try a different reference value.

If automatic thresholding is enabled, you can select the **Invert Output** checkbox to invert the output binary image. The foreground pixels are output as background pixels and the background pixels are output as foreground pixels.

Note that automatic thresholding is not appropriate for all images. It is intended for images with sufficient contrast between the background and the object. If automatic thresholding does not produce the results you expect, try built-in thresholding (see [page 116](#)), or use the Threshold tool to create a binary image. For more information, refer to [Chapter 39, “Using the Threshold Tool.”](#)

Note that you can perform either automatic thresholding or built-in thresholding. If you select the **Auto Threshold** checkbox, the **Activate Thresholding Controls** checkbox is grayed out.

Sort Options

Select the criteria that determines how the found blobs in the found blobs display list are sorted. By default, the tool sorts the list according to the total area of the blob. Other options in the Blob Settings dialog box determine which blobs to display in the list, whether to sort the list in ascending or descending order, and whether to keep the parent-child relationship.

Child Level

Select the level of children that you want to display in the found blobs display list. Although the Blob Analysis tool always finds all levels of children, you can use this control to limit how many levels are displayed.

Blob Statistics

Click one of the following radio buttons to specify which statistics you want to display in the blob parameters and values list and, if you are performing point & click scripting, which statistics you want to send to your point & click script:

- **Show statistics for first blob** – Click this radio button if you want to display/send statistics for the first blob in the found blobs display list. You select the statistics you want to display/send using the Statistic Settings dialog box. For more information, refer to [page 124](#).

If you want to display/send statistics for a blob other than the first blob in the found blobs display list, you must modify the **Sort Options**. For more information, refer to [page 117](#).

Note that the statistics displayed when you click this radio button are the same as the statistics displayed when you click **Show statistics for every blob**. However, when you click this radio button, only statistics for the first blob in the found blobs display list are sent to the point & click script.

- **Show statistics for every blob** – Click this radio button if you want to display/send statistics for all blobs in the found blobs display list. You select the statistics you want to display/send using the Statistic Settings dialog box. For more information, refer to [page 124](#).

Note that the statistics displayed when you click this radio button are the same as the statistics displayed when you click **Show statistics for first blob**. However, when you click this radio button, statistics for all blobs are sent to the point & click script.

- **Show statistics for blobs** – Click this radio button if you want to display/send either the minimum value, the maximum value, the average, or the standard deviation of all blobs in the found blobs display list for each statistic. You select the statistics you want to display/send using the Statistic Settings dialog box. For more information, refer to [page 124](#).

Found Blobs Display List

This field contains all found blobs. If you select (highlight) a blob from the list, the statistics for the blob are shown in the blob parameters and values list. If you right-click a blob from the image itself (as you would select any other ROI), the corresponding blob is highlighted in the list.

Blob Parameters and Values List

For the blob that is highlighted in the found blobs display list, this field contains the parameters specified in the Statistic Settings dialog box and the values (calculations) for that blob. For more information about specifying parameters in the Statistic Settings dialog box, refer to [page 124](#).

Description of Parameters

This field displays a description of the parameter highlighted in the blob parameters and values list.

Find Blobs

Click this button to perform the blob analysis.

Found:

After each execution, this field displays the number of found blobs that the tool finds. Note that this may not equal the total number of blobs in the found blobs display list.

Add to Script

After you perform the blob analysis operation, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Blob Settings Dialog Box Options

The Blob Settings dialog box is opened when you select **Options | Blob Settings**. When you have specified all appropriate values, click **Apply** to save the settings without closing the dialog box. Click **OK** to save the settings and close the dialog box. Click **Cancel** to close the dialog box without saving changes.

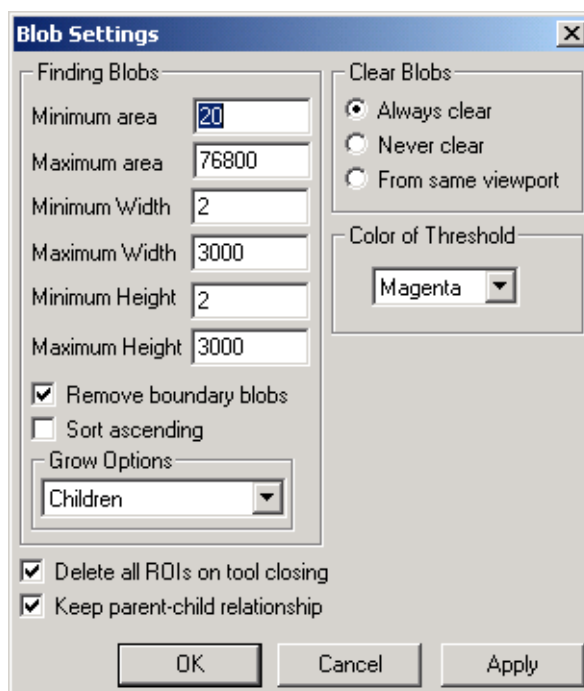


Figure 21: Blob Settings Dialog Box

Minimum Area

Specify the minimum size for a blob in the parent area, in pixels. If the tool finds a blob whose area is smaller than this value, the tool discards the blob. This is useful in noisy images to prevent finding extraneous background blobs in the image. The minimum blob area is 4 pixels.

Note: If there is more than one level of child blobs below the minimum blob size and you do not grow these smaller children, the parameter totals do not include the information contained in the ungrown child blobs. In some cases, this is what is desired; in other cases, it may be an incorrect value.

Maximum Area

Specify the maximum size for a blob in the parent area, in pixels. If the tool finds a blob whose area is larger than this value, the tool discards the blob. This value must be 4 pixels or greater.

Minimum Width

Specify the minimum width for a blob in the parent area, in pixels. If the tool finds a blob whose width is smaller than this value, the tool discards the blob. The minimum blob width is 2 pixels.

Maximum Width

Specify the maximum width for a blob in the parent area, in pixels. If the tool finds a blob whose width is larger than this value, the tool discards the blob. This value must be 2 pixels or greater.

Minimum Height

Specify the minimum height for a blob in the parent area, in pixels. If the tool finds a blob whose height is smaller than this value, the tool discards the blob. The minimum blob height is 2 pixels.

Maximum Height

Specify the maximum height for a blob in the parent area, in pixels. If the tool finds a blob whose height is larger than this value, the tool discards the blob. This value must be 2 pixels or greater.

Remove Boundary Blobs

Select this checkbox if you want the tool to discard a blob that is touching the active ROI. Clear this checkbox if you want the tool to truncate a blob that is touching the active ROI to fit inside the active ROI. If you want only certain blobs discarded, you can find all blobs and then delete the unwanted blobs yourself (just as you would delete any other ROI).

Sort Ascending

Select this checkbox if you want blobs in the found blobs display list to be sorted in ascending order. Clear this checkbox if you want blobs in the found blobs display list to be sorted in descending order.

Grow Options

You can select of the following grow options:

- **Bi-dir with children** –If you select this option, the child blobs are calculated and grown on both sides of the object.
- **Children** –If you select this option, the child blobs are calculated and grown on one side of the object.

- **No Children** –If you select this option, child blobs are not grown or displayed. This option speeds up the overall growing of the blobs. This is useful if only the blob's perimeter ROI is important, if you don't care about child blob information, or if you know that there are no child blobs to be found.

Note: If you select **Bi-dir with children**, the found blobs display list shows levels of child blobs. If you select **Children**, the found blobs display list shows each child as a separate blob.

If more than one level of child blobs exists and you select **No Children**, the parameter totals do not include the information contained in the ungrown child blobs. In some cases, this is what is desired; in other cases, it may be an incorrect value.

Clear Blobs

Click one of the following radio buttons to specify what you want to do with the blobs in the found blobs display list when you push the **Find Blobs** button:

- **Always clear** – Always clear the list when finding new blobs. This is the default.
- **Never clear** – Never clear the list when finding new blobs. This is useful when you want to find blobs in two separate regions either in the same image or in different images.
- **From same viewport** – Delete any blobs in the list that are from the same viewport as the viewport you are currently finding blobs in. Blobs found in other viewports remain in the list.

Color of Threshold

Specify the color that you want to use to display black pixels in the thresholded image.

Delete all ROIs on Tool Closing

Select this checkbox if you want to delete all the freehand ROIs created by the Blob Analysis tool when you close the point & click script or, if the Blob Analysis tool is not in a point & click script, when you close the tool. Clear this checkbox if you want to keep these ROIs when you close the script/tool; this is useful if you want to use these ROIs in other tools.

Keep Parent-Child Relationship

Select this checkbox if you do not want to include child blobs in the sort criteria when sorting the blobs in the found blobs display list. In this case, only the parents are sorted and the children stay attached to their parents.

Clear this checkbox if you do not want to use the parent-child relationship when displaying the blobs in the list. In this case, all blobs (including the children) are considered in the sort criteria when sorting the list. The parent-child relationship still exists, but it is not used when displaying the list.

You can toggle back and forth without having to find the blobs again.

Statistic Settings Dialog Box Options

The Statistic Settings dialog box is opened when you select **Options | Statistic Settings** from the Blob Analysis tool main dialog box. The Statistics Settings dialog box allows you to specify which parameters (calculations) you want to display in the blob parameters and values list in the Blob Analysis tool main dialog box. When you have specified all appropriate values, click **OK** to accept and validate the options. Click **Cancel** to close the Statistic Settings dialog box without saving your changes.

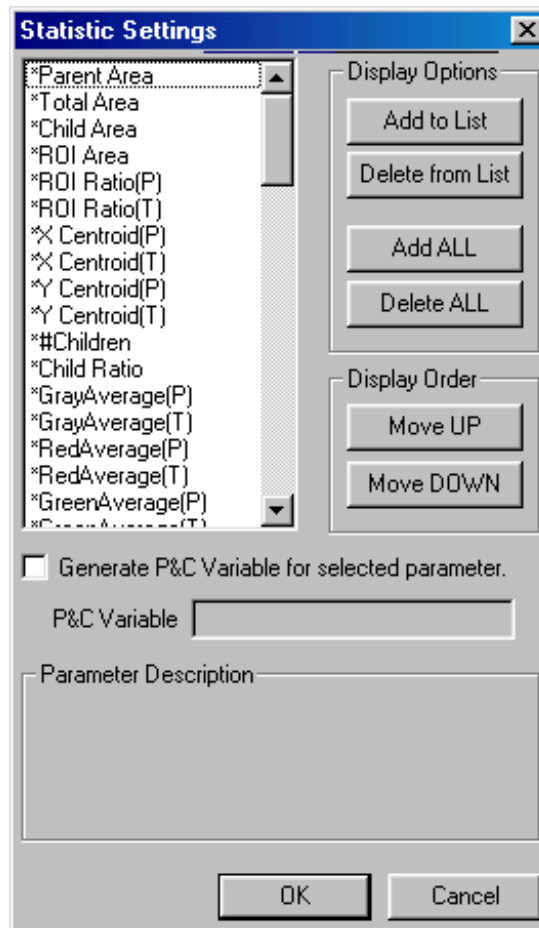


Figure 22: Statistic Settings Dialog Box

Click on a parameter to select (highlight) it. A description of the parameter is displayed in the **Parameter Description** field. If the parameter is a calibrated measurement, the word “Calibrated” is also displayed.

Click **Add to List** to add the selected parameter to the blob parameters and values list, click **Delete from List** to delete the selected parameter from the list, click **Move UP** to move the selected parameter up in the list, or click **Move DOWN** to move the selected parameter down in the list. You can also click **Add ALL** to add all parameters to the list or click **Delete ALL** to delete all parameters from the list. All parameters that will be displayed in the blob parameters and values list are denoted with an asterisk (*).

If you are performing point & click scripting, select the **Generate P&C Variable for selected parameter** checkbox to generate a point & click script variable for the selected parameter. The name of the variable is displayed in the **P&C Variable** field. By default, the name of the variable is the same as the name of the parameter; however, you can change the name, if desired.

P&C Script Settings Dialog Box Options

The P&C Script Settings dialog box is opened when you select **Options | P&C Settings** from the Blob Analysis tool main dialog box. When you have specified all appropriate values, click **OK** to accept and validate the options. Click **Cancel** to close the dialog box without saving your changes.

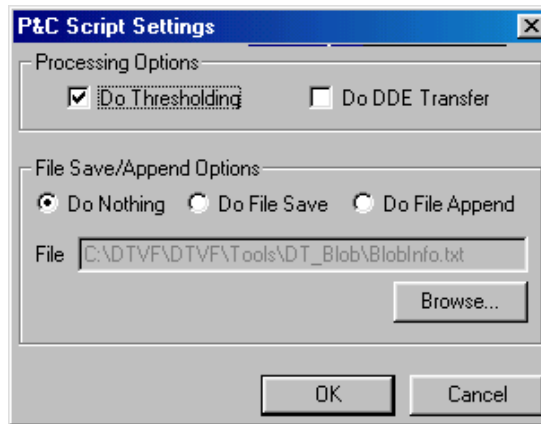


Figure 23: P&C Script Settings Dialog Box

Do Thresholding

Select this checkbox if you want to perform thresholding during point & click scripting. Clear this checkbox if you do not want to perform thresholding.

Note that if you can use the same mask image (the same threshold limits) for each **Find Blobs** operation that you perform, you can improve performance by clearing this checkbox after the first operation. All subsequent operations will use the mask image specified for the first operation.

Do DDE Transfer

Select this checkbox if you want to send the calculations performed by the Blob Analysis tool to the Excel file specified by **File**. The calculations are listed in the Statistic Settings dialog box. For more information, refer to [page 124](#).

File Save/Append Options

Click one of the following radio buttons to specify how you want to save the calculations performed by the Blob Analysis tool:

- **Do Nothing** – Click this radio button if you do not want to save calculations.
- **Do File Save** – Click this radio button if you want to save the calculations in a file. By default, the calculations are saved in the file specified by **File**. If you want to use a different file, either enter the file name in the text box or use the **Browse** button to locate the file. The calculations are listed in the Statistic Settings dialog box. For more information, refer to [page 124](#).
- **Do File Append** – Click this radio button if you want to add the calculations to the end of a file. By default, the calculations are added to the file specified by **File**. If you want to use a different file, either enter the file name in the text box or use the **Browse** button to locate the file. The calculations are listed in the Statistic Settings dialog box. For more information, refer to [page 124](#).

Example of Using the Blob Analysis Tool

This example shows how to find all the blobs inside the active ROI in the image Mixpoll, shown in [Figure 24](#).

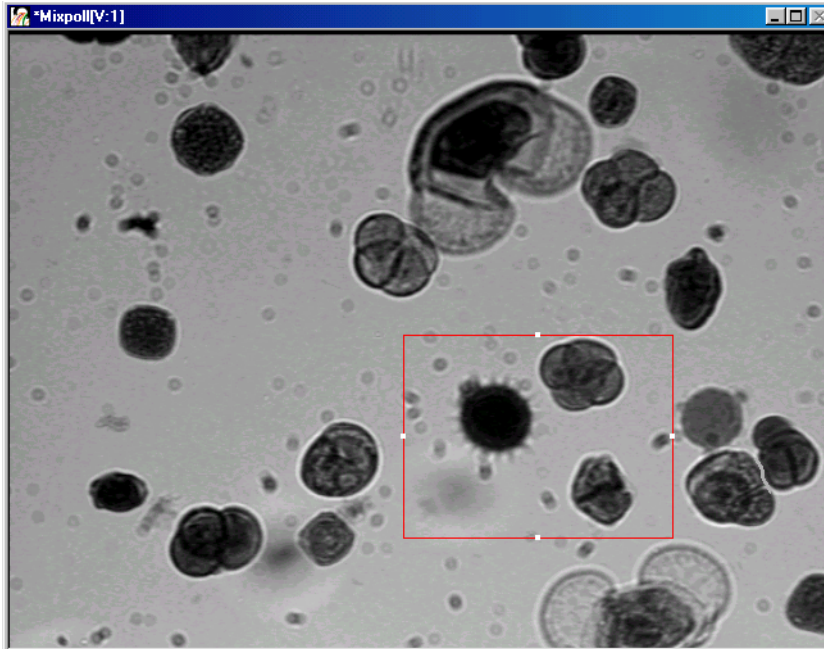


Figure 24: The Image Mixpoll

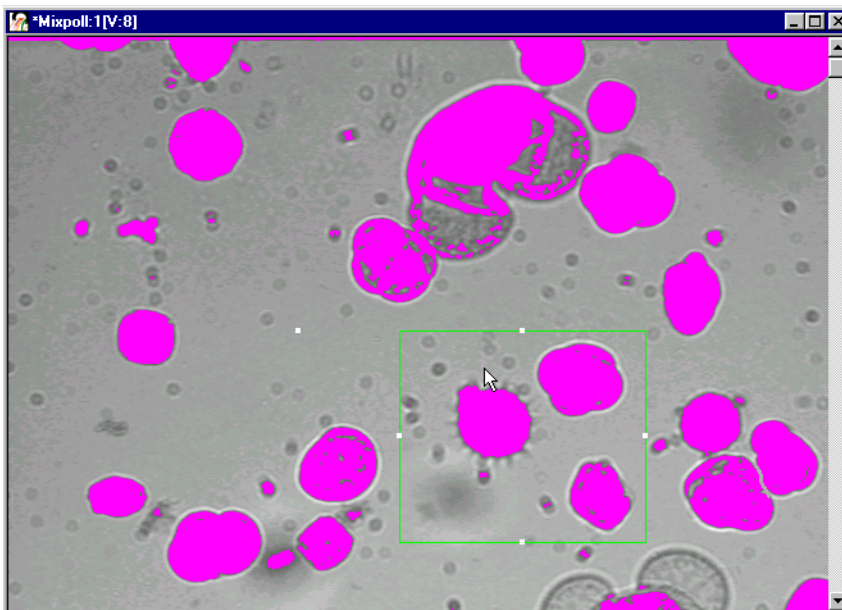
The operation is as follows:

1. Set the input image. Open a Blob Analysis tool (if one is not already open). Click on the image Mixpoll in the viewport in the main application; it becomes the active viewport and is denoted with an asterisk, as shown in [Figure 24](#). Now, click **Input Image** in the Blob Analysis tool main dialog box.

Note that when you open a Blob Analysis tool, the image in the active viewport is loaded as the input image by default.

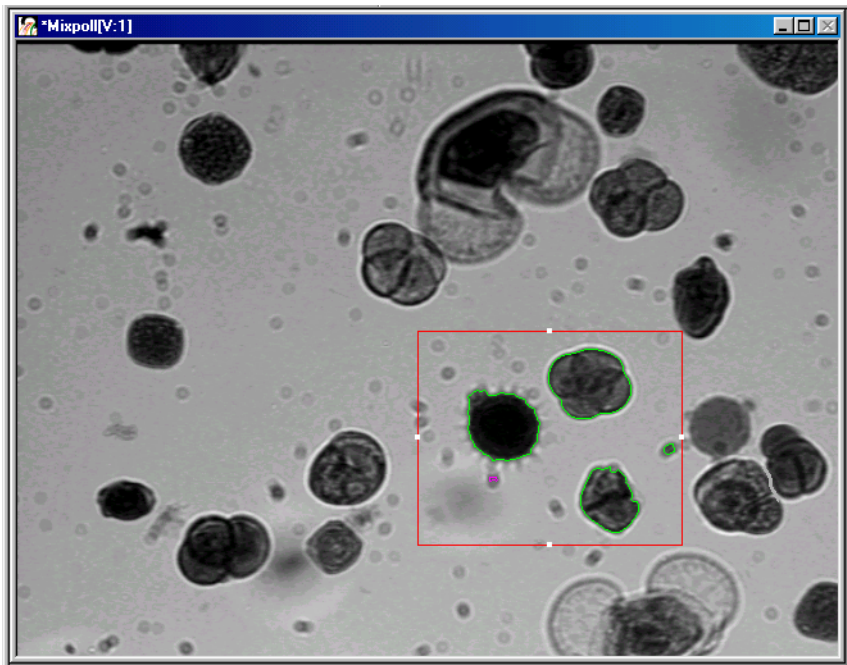
2. Threshold the input image. Click the **Activate Thresholding Controls** checkbox. Set the **Minimum** limit to 0 and the **Maximum** limit to 104 by adjusting the slider controls or entering the values manually. Note that these settings differ for different images.

The image Mixpoll looks as follows:



3. If desired, you can change the way that the Blob Analysis tool finds and displays blobs. Open the Blob Settings dialog box by selecting **Options | Blob Settings**, then change the settings as appropriate.
4. When all options for the tool are set appropriately, click **Find Blobs** to start the blob analysis and list all the found blobs in the found blobs display list.
5. Look at blob statistics. Click on Blob 3 in the found blobs display list. Click on the parameter Parent Area in the blob parameters and values list. Note that for each blob you click, the corresponding blob is highlighted in the image itself and the corresponding statistics are shown in the blob parameters and values list.

The image Mixpoll looks as follows:



6. You can inspect a blob (parent or child) in the following ways:
 - Select a blob from the found blobs display list or activate its associated ROI and view its associated statistics in the blob parameters and values list.
 - Delete a blob or child blob. Since a blob has an associated freehand ROI, you can remove the blob from the found blobs list by deleting its ROI. All blob information is updated to reflect this change.
 - Use other tools on the blob's freehand ROI. For example, you could take a histogram of the blob, run a filter on the blob, or use a custom tool on the blob.
 - Use **Sort Options** and **Child Level** to view the found blobs display list differently.
 - Use the Blob Settings dialog box to view blobs in different colors, to sort the found blobs display list in ascending or descending order, and to detach child blobs from their parents.
 - Change the **Clear Blobs** option in the Blob Settings dialog box to find additional blobs in either another viewport, the same viewport, or both. You can rethreshold or change mask images to find blobs at two (or more) different threshold values for the same or different images. Note that you can use more than one Blob Analysis tool at a time.

Point & Click Script

This section describes the specific use of the Blob Analysis tool's point & click script functionality with respect to adding and editing a point & click script. For more information on scripting options, refer to [page 126](#). For more information about the Point & Script tool, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Blob Analysis tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Blob Analysis tool to perform the desired function. This includes the input and mask images, the sort options, and the active ROI (if you are using one). Click **Find Blobs** to perform the desired operation, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Blob Analysis tool is set up exactly as it was when you previously recorded the script. This includes the input and mask images, the sort options, and the active ROI (if an ROI was used). The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Calibration Tool

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Introduction

The Calibration tool is supplied with DT Vision Foundry. It allows you to calibrate your imaging system to obtain real-world measurement data with subpixel accuracy.

To calibrate your system, you place four calibration points (reference points) in an image containing objects whose measurements are known. The Calibration tool uses these points to create a calibration object that allows the tool to make its calculations.

After you set the calibration points, you enter the corresponding world coordinates. To test the calibration object, you can move the mouse cursor to the calibration point and refer to the status bar in the lower right corner of the main application window. For more information, refer to [page 34](#).

If you want to edit the calibration points, you can move and delete them using the same methods that you would use for an ROI.

Notes: You must set all four calibration points.

Once you have set up the calibration points, you can edit the values, manually, if desired.

You can attach the same calibration object to multiple images. Each image can have only one calibration object attached to it.

[Figure 25](#) shows a viewport containing an image with four calibration points. [Figure 26](#) shows the Calibration tool with the appropriate values set.

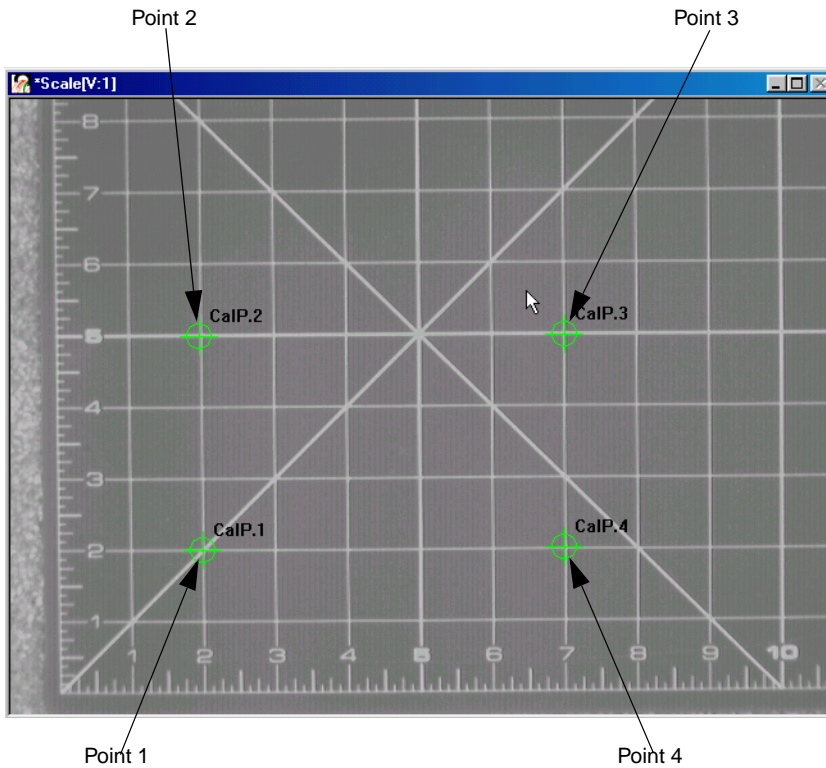


Figure 25: Calibration Image

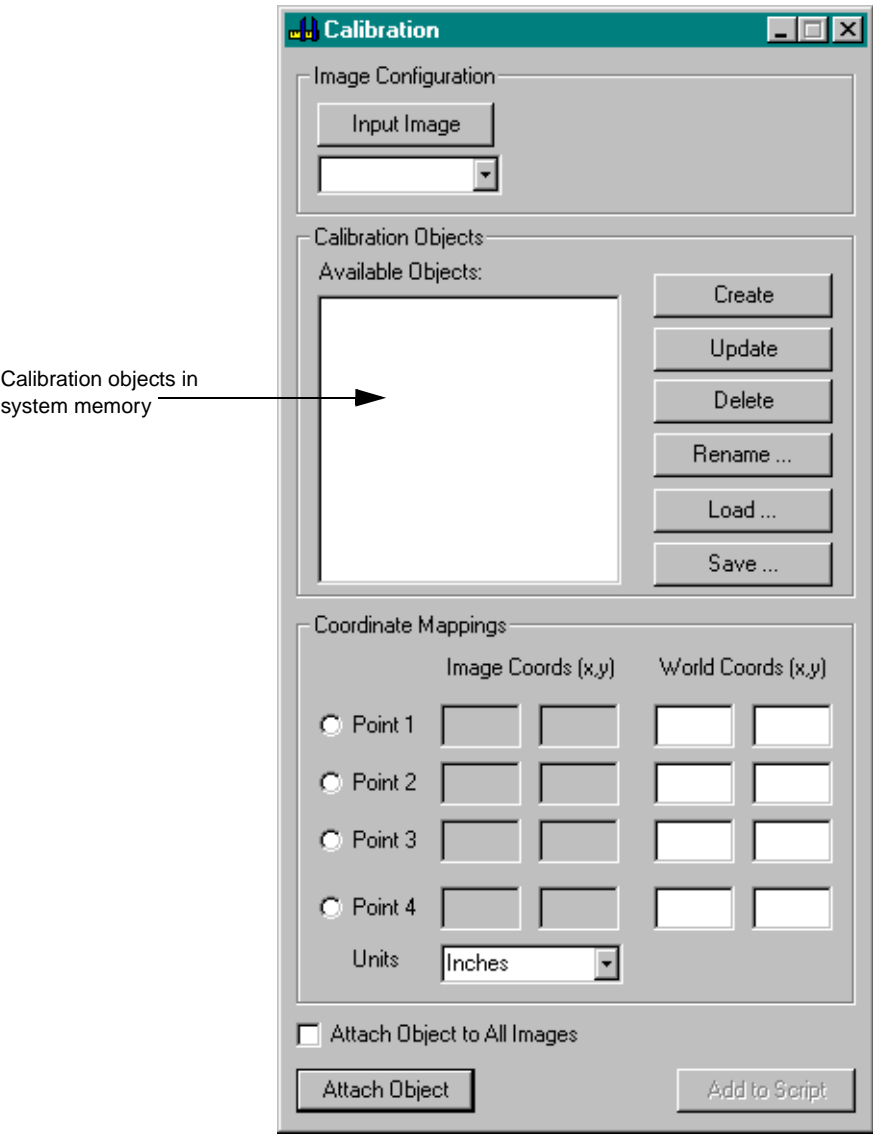



Figure 26: Calibration Tool

To open a Calibration tool, select the  icon from the Miscellaneous toolbar or select **Calibration** from the Tools menu.

Notes: The Calibration tool is fully compatible with all other tools and image types and uses a subpixel point ROI.

You can have only one Calibration tool open at a time.

Description of Calibration Tool Options

This section contains a description of the options in the Calibration tool dialog box.

Input Image

Click this button to load the image in the active viewport as the input image. The input image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Point 1

Select the **Point 1** checkbox to specify the first calibration point. Then, place the mouse cursor on the image at the location where you want to set the first calibration point (lower-left corner, if possible) and click the left mouse button. The calibration point is set and displayed on the image and the **Image Coordinates** fields are automatically filled in. Enter the corresponding **World Coordinates**, based on the image measurement scale and the location of your calibration point.

Point 2

Select the **Point 2** checkbox to specify the second calibration point. Then, place the mouse cursor on the image at the location where you want to set the second calibration point (upper-left corner, if possible) and click the left mouse button. The calibration point is set and displayed on the image and the **Image Coordinates** fields are automatically filled in. Enter the corresponding **World Coordinates**, based on the image measurement scale and the location of your calibration point.

Point 3

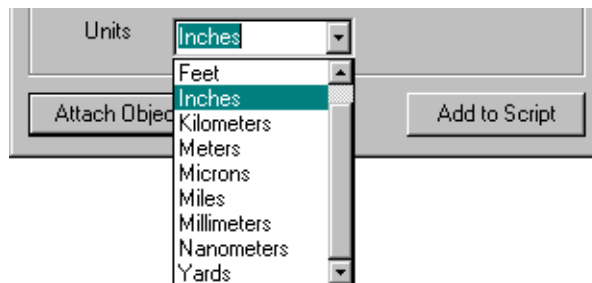
Select the **Point 3** checkbox to specify the third calibration point. Then, place the mouse cursor on the image at the location where you want to set the third calibration point (upper-right corner, if possible) and click the left mouse button. The calibration point is set and displayed on the image and the **Image Coordinates** fields are automatically filled in. Enter the corresponding **World Coordinates**, based on the image measurement scale and the location of your calibration point.

Point 4

Select the **Point 4** checkbox to specify the fourth calibration point. Then, place the mouse cursor on the image at the location where you want to set the fourth calibration point (lower-right corner, if possible) and click the left mouse button. The calibration point is set and displayed on the image and the **Image Coordinates** fields are automatically filled in. Enter the corresponding **World Coordinates**, based on the image measurement scale and the location of your calibration point.

Units

Select the unit of measure from the drop-down list. For example, if your image is scaled in inches, select **Inches**.



If the unit of measure you need is not in the list, you can add it by overwriting the unit in the text box. When you click **Create** to create the new calibration object, the unit you entered is used.

Available Objects

This display window contains all the calibration objects in system memory. The asterisk indicates the calibration object that is currently attached to the selected **Input Image**.

Click on any calibration object to select (highlight) it; the calibration points defined for that calibration object are shown in the selected **Input Image**. Note that selecting a calibration object displays the points on the input image. To use the calibration object, you must attach it to the appropriate image(s) using the **Attach Object** button.

Create

After you have set all calibration points appropriately, click this button to create a new calibration object. The calibration object is added to the Available Objects display window.

Note that clicking the **Create** button only creates the calibration object. To use the calibration object, you must attach it to the appropriate image(s) using the **Attach Object** button.

Update

If you want to change the coordinates of a calibration object, select the calibration object in the Available Objects display window, make the appropriate changes, and then click **Update**.

Delete

Click this button to delete the selected calibration object from the Available Objects display window. Note that this does not delete the calibration object from system memory.

Rename

Click this button if you want to rename the selected calibration object. Enter the new name in the Rename Object dialog box, then click **OK**.

Load

Click this button to open a calibration object that you have saved to disk. An Open dialog box is displayed. Browse to the calibration object, then click **Open**. When you open a calibration object (the file name must be followed by the extension .cal), the object is loaded into system memory.

Save

Click this button to save a calibration object to disk. A Save As dialog box is displayed. Browse to the directory in which you want to store the calibration object, enter the file name with the extension .cal, then click **Save**.

Attach Object to All Images

This option determines which image(s) the calibration object selected in the **Available Objects** display window is attached to when you click the **Attach Object** button. Select this checkbox to attach the selected calibration object to all images in system memory. Clear this checkbox to attach the selected calibration object to the specified **Input Image** only.

When you use a tool that displays measurements (such as the Blob Analysis tool), the attached calibration object is used to calculate the measurements either for all images in system memory (if the checkbox is selected) or for the specified **Input Image** only (if the checkbox is not selected).

Attach Object

Click this button to attach the calibration object selected in the **Available Objects** display window either to all images in system memory or to the specified Input Image only. The image(s) the calibration object is attached to depends on the setting of the **Attach Object to All Images** checkbox.

Add to Script

After you perform an **Attach Object** operation, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the Calibration Tool

This example shows how to create a calibration object using the image Scale, shown in [Figure 27](#).

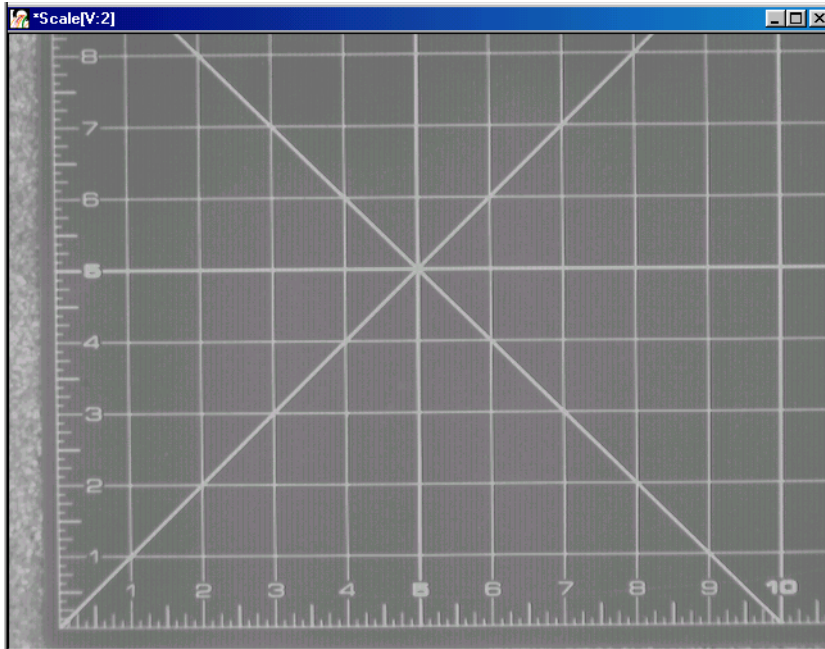


Figure 27: The Image Scale

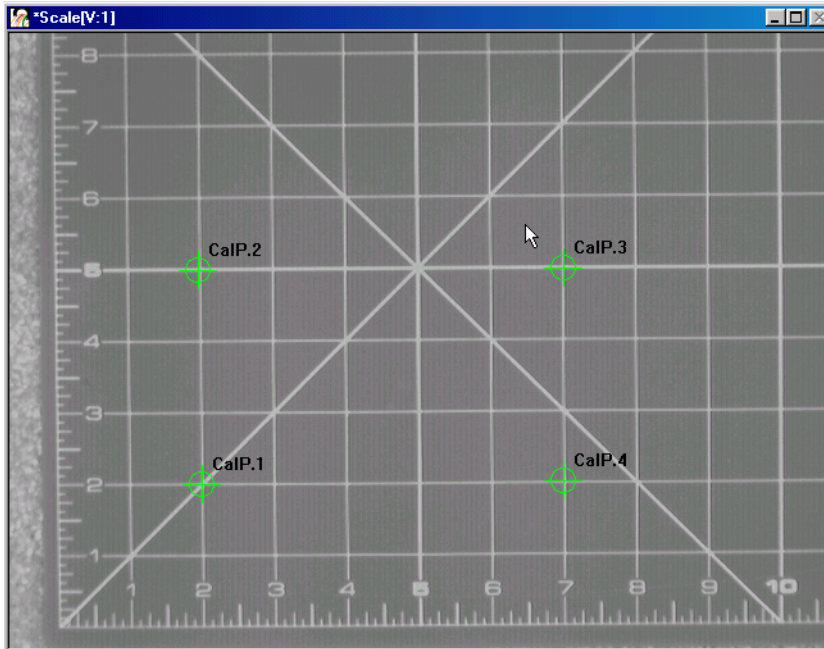
The operation is as follows:

1. Open the Calibration tool (if it is not already open).
2. Click on the image Scale in the viewport in the main application; it becomes the active viewport and is denoted with an asterisk. Now, click **Input Image** in the Calibration tool main dialog box.

Note that when you open a Calibration tool, the image in the active viewport is loaded as the input image by default.

3. Select the **Point 1** radio button. Place the mouse cursor on the image Scale at the location $x = 2, y = 2$. Click the left mouse button. The calibration point is set and displayed on the image. The **Image Coordinates** (pixel locations) are automatically displayed. Enter the corresponding **World Coordinates** (2,2).
4. Select the **Point 2** radio button. Place the mouse cursor on the image Scale at the location $x = 2, y = 5$. Click the left mouse button. The calibration point is set and displayed on the image. The **Image Coordinates** (pixel locations) are automatically displayed. Enter the corresponding **World Coordinates** (2,5).
5. Select the **Point 3** radio button. Place the mouse cursor on the image Scale at the location $x = 7, y = 5$. Click the left mouse button. The calibration point is set and displayed on the image. The **Image Coordinates** (pixel locations) are automatically displayed. Enter the corresponding **World Coordinates** (7,5).
6. Select the **Point 4** radio button. Place the mouse cursor on the image Scale at the location $x = 7, y = 2$. Click the left mouse button. The calibration point is set and displayed on the image. The **Image Coordinates** (pixel locations) are automatically displayed. Enter the corresponding **World Coordinates** (7,2).

The image Scale looks as follows:



7. Set the **Units** to **Inches**.
8. Click **Create** to create a new calibration object. The calibration object is added to the **Available Objects** display window with the name Calibration1.
9. With the calibration object highlighted, click the **Save** button to save the calibration object to disk. Browse to the directory where you want to store the calibration object, then click **Save**.
10. Acquire the images that you want to process. Typically, you would use the Picture tool or the AVI Player tool in a point & click script. For this example, open the image Lines.
11. Click on the image Lines in the viewport in the main application; it becomes the active viewport and is denoted with an asterisk. Now, click **Input Image** in the Calibration tool main dialog box.

12. Click on the calibration object Calibration1.

The calibration points appear on the image Lines.

If the calibration object does not appear in the list of **Available Objects**, click the **Load** button, browse to the calibration object, then click **Open**.

13. Click **Attach Object** to attach the calibration object to the image Lines.

14. If you are acquiring images in a point & click script, click **Add to Script** to add the **Attach Object** operation to the script.

Each image you acquire will be calibrated, and the results of each calibrated measurement you take (for example, using the Blob Analysis tool) will be expressed in inches.

Point & Click Script

This section describes the specific use of the Calibration tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

The Calibration tool can record its **Attach Object** function. To add the Calibration tool's functionality to a point & click script, you must have the Point & Click Script tool open. Select the image(s) that you want to process, and create a calibration object or open an existing calibration object from disk. Click **Attach Object** to attach the calibration object to the image(s), then click **Add to Script** to record the action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Calibration tool is set up exactly as it was when you previously recorded the script item. The **Add to Script** button is changed to an **Update Script** button, indicating that you are editing a point & click script item. Perform the desired action again, then click **Update Script**. The script item is saved back to the point & click script.



Using the Color Plane Tool

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Introduction

The Color Plane tool is supplied with DT Vision Foundry. It allows you to specify how a 24-bit color image's data is accessed.

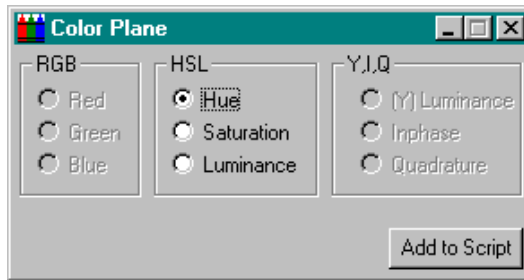


Figure 28: Color Plane Tool

The Color Plane tool allows you to access DT Vision Foundry 24-bit color image data in one of the following ways:

- **RGB color model** – For images opened as 24-bit RGB color images. Red, green, and blue image data reside on separate signals. You can select the particular signal you want to access.
- **HSL color model** – For images opened as 24-bit HSL color images. This color model consists of the following:
 - *Hue* – The color itself. It is represented as a value between 0 and 239, where Red is equal to 0, Green is approximately 70, and Blue is approximately 140.
 - *Saturation* – The depth of color. It is represented as a value between 0 and 240, where 0 is the least depth of color (grayscale) and 240 is the most depth of color.
 - *Luminance* – The brightness. It is represented as a value between 0 and 240, where 0 is pure black and 240 is pure white.


Although the processing time is longer, the HSL color model is more accurate than the RGB color model because you can specify the particular hue you want to access. It is useful if objects of a certain color in your images may undergo a large change in bleaching and brightness due to changing lighting conditions.

- **YIQ color model** – For images opened as 24-bit RGB color images. Y is luminance, I (Inphase) is Red minus Y, and Q (Quadrature) is Blue minus Y.

Only luminance is supported at the present time. The luminance is calculated as follows:

$$Y = 0.299R + 0.587G + 0.114B$$

Note that the luminance in the YIQ color model is different from the luminance in the HSL color model.

To open a Color Plane tool, select the  icon from the Image Processing toolbar or select **Color Plane** from the Tools menu.

Notes: The Color Plane tool works with DT Vision Foundry 24-bit RGB and DT Vision Foundry 24-bit HSL color images and with most DT Vision Foundry tools.

You can have only one Color Plane tool open at a time.

Description of Color Plane Tool Options

This section contains a description of the options in the Color Plane tool dialog box.

Note: The options allow you to specify the access method for color images. You specify the access method for the image in the active viewport only. Other color images in the system are not affected.

RGB

If you are using a 24-bit RGB color image, click the appropriate radio button (Red, Green, Blue) to specify the color plane to use when accessing image data.

HSL

If you are using a 24-bit HSL color image, click the appropriate radio button (Hue, Saturation, Luminance) to specify the color setting to use when accessing image data.

Y,I,Q

If you are using a 24-bit RGB color image, click **(Y) Luminance** to use the luminance (intensity) when accessing image data.

Note that you cannot select Inphase or Quadrature. These are only shown to indicate that the luminance is the luminance from a YIQ color image.

Add to Script

After you set the color, click this button to add the information to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the Color Plane Tool

This example shows how to take a histogram of all four planes of the color image Pill1, shown in [Figure 29](#).



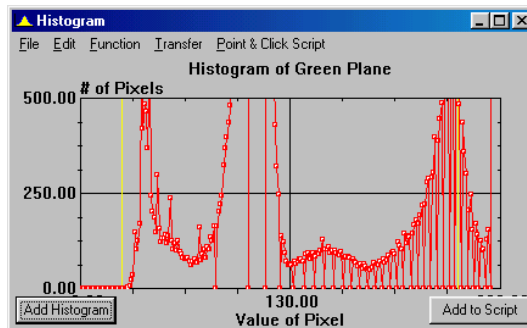
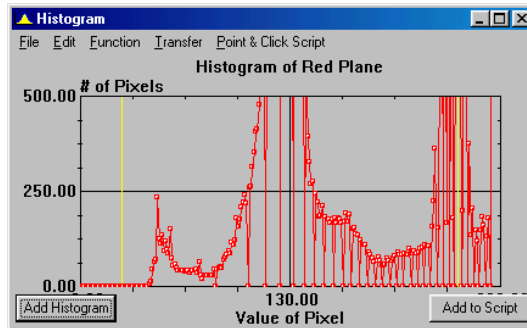
Figure 29: Color Plane Tool Example Image

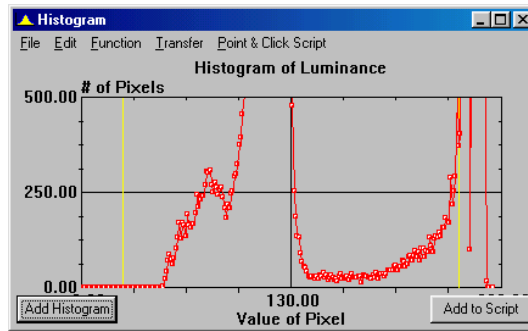
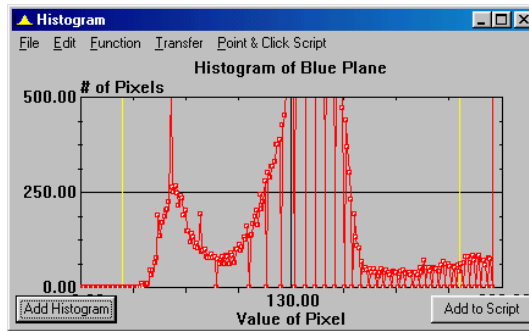
The operation is as follows:

1. Open the Color Plane tool (if it is not already open).
2. Activate the viewport with the image Pill1 by clicking in it with the left mouse button.
3. Make sure that the ROI is active (red) by clicking in it with the right mouse button.

4. Click **Red** in the Color Plane tool.
5. Take a histogram of the image. For more information on how to take a histogram, refer to [Chapter 19, “Using the Histogram Tool.”](#)
6. Repeat steps 3 and 4 for the green plane, blue plane, and luminance of the color image.

The histograms for each color plane and the luminance look as follows:





All histograms were created using the color image Pill1 and the same active ROI. They are shown as four separate histograms. You could also have created the four histogram curves on the same graph using one Histogram tool and then changed the color of each curve to represent the different planes.

Point & Click Script

This section describes the specific use of the Color Plane tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Color Plane tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Select the appropriate color plane for the color image, then click **Add to Script** to record the information in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Color Plane tool is set up exactly as it was when you previously recorded the script item. The **Add to Script** button is changed to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Contour Classifier Tool

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Introduction

The Contour Classifier tool is supplied with DT Vision Foundry. It allows you to classify enclosed shapes, called contours under test, by comparing them to contours that you cataloged previously.

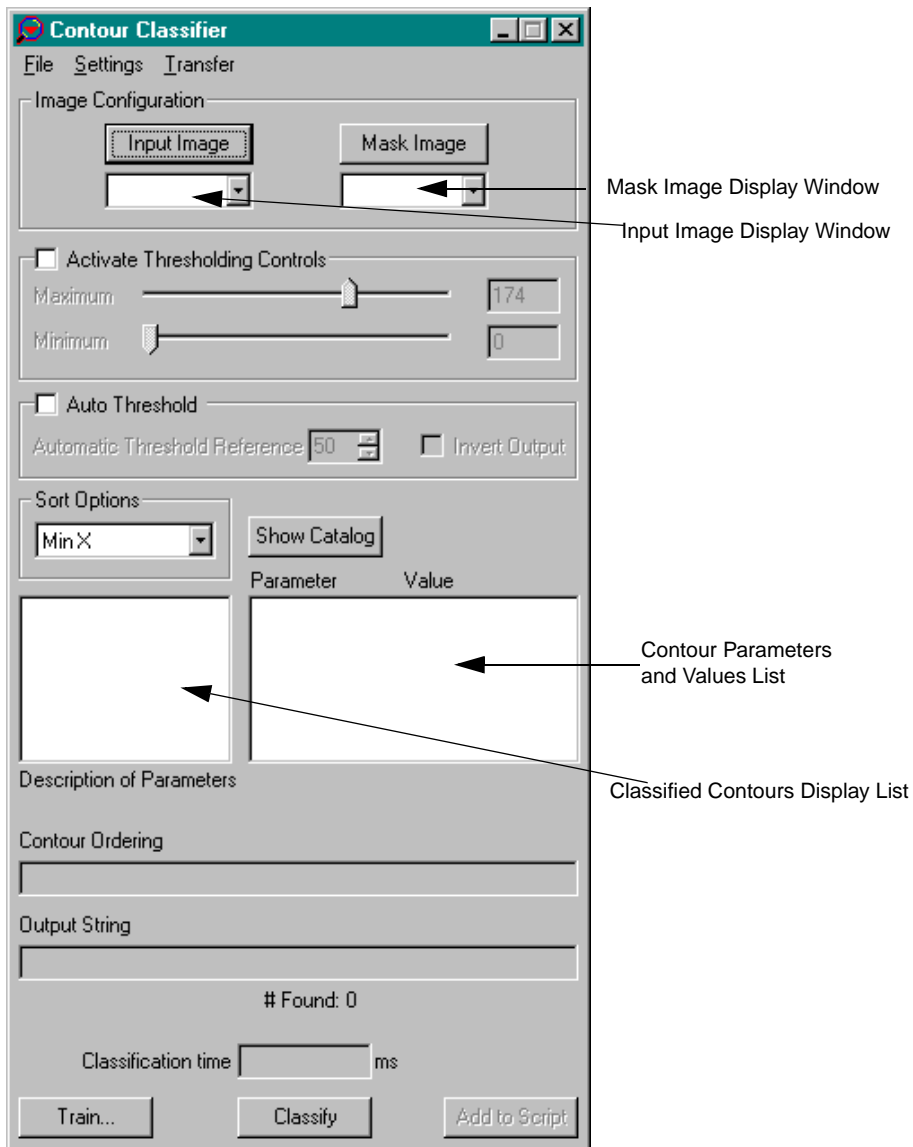


Figure 30: Contour Classifier Tool

The Contour Classifier tool is particularly useful in applications that require optical character recognition, sorting planar objects, positioning objects, or approximating the distance between objects.

To use the Contour Classifier tool, you must first create a binary mask image. You then extract contours from the binary image and add the extracted contours to a catalog and name them.

After you create the catalog, you can compare the contours under test to the contours in the catalog. The Contour Classifier tool produces the following results:

- The name of the catalog element that best matches each contour under test,
- Three Euler angles (alpha, beta, and gamma) that describe the rotation of each contour under test with respect to a contour in the catalog (see [Figure 31](#)), and
- The score, which is a measurement of how good the match is between the contour under test and the contour in the catalog.

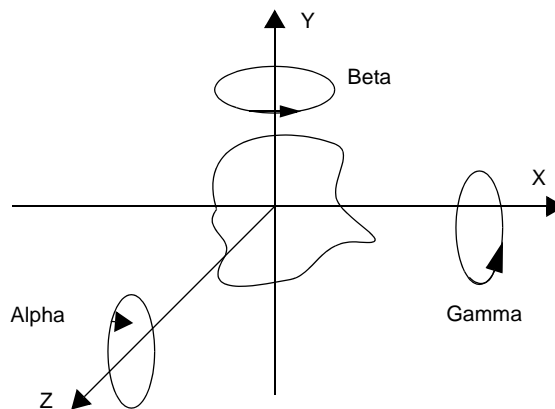


Figure 31: Euler Angles Reported by the Contour Classifier Tool

Notes: The Contour Classifier works only on the outside edges of objects. Therefore, distinguishing the letter “O” from the number “0” is not possible with this tool, unless the outer outlines of these objects are significantly different.

All contours are classified with respect to the active rectangle ROI of the specified input image. If no active ROI is present, the whole input image is used.

[Table 5](#) describes the calculations that the Contour Classifier tool can perform for each contour. All contours are treated as independent objects, so the same calculations are performed for all contours.

Table 5: Contour Classifier Tool Calculations

Contour Option	Description
Match (Not calibrated)	String name of the catalog element that best matches the contour under test.
Score (Not calibrated)	<p>The confidence measure that describes the match between the contour under test and the contour in the catalog. The range varies depending on the classification method that is selected and whether extended processing is selected.</p> <p>When three-dimensional processing is turned off, the score ranges from negative infinity to 0, where 0 represents a perfect match. When three-dimensional processing is turned on, the score ranges from 0 to 1, where 1 represents a perfect match.</p>
Scale (Not calibrated)	The scale factor between the contour under test and the best matching contour from the catalog.
Alpha (Not calibrated)	The rotation of the contour under test in the XY plane (see Figure 31 on page 162).


Table 5: Contour Classifier Tool Calculations (cont.)

Contour Option	Description
Beta (Not calibrated)	The rotation of the contour under test in the ZX plane (see Figure 31 on page 162).
Gamma (Not calibrated)	The rotation of the contour under test in the YZ plane (see Figure 31 on page 162).
Failed (Not calibrated)	A number that indicates whether the contour is below or above the score threshold value. If the score is below the selected threshold, this value is 1; otherwise, this value is 0.
X Centroid (Calibrated)	The center of mass with respect to the x-axis of the image. Note that the origin of the image (0,0) is located at its lower-left corner.
Y Centroid (Calibrated)	The center of mass with respect to the y-axis of the image. Note that the origin of the image (0,0) is located at its lower-left corner.
Max X (Calibrated)	The maximum x value in the contour.
Max Y (Calibrated)	The maximum y value in the contour.
Min X (Calibrated)	The minimum x value in the contour.
Min Y (Calibrated)	The minimum y value in the contour.
Contour Area (Calibrated)	The area of the contour. If the image has not been calibrated, this is the number of pixels in the contour.
Perimeter (Calibrated)	The perimeter of the contour.
Roundness (Calibrated)	A measure of roundness that can range from 0 (not round) to 1 (perfectly circular). A circle has a roundness value of 1. The value is calculated as: $\text{Roundness} = 4\pi \times \text{Total Area} / \text{Perimeter}^2$

Table 5: Contour Classifier Tool Calculations (cont.)

Contour Option	Description
#ContoursFound ^a	The total number of contours that were classified.
Failed String ^a	A number that indicates whether all contours in the entire output string are below or above the score threshold value. If the score is below the selected threshold, this value is 1; otherwise, this value is 0.
String ^a	A string that contains the concatenated names of the contours in the catalog which best match the contours under test. The order in which these elements are concatenated depends on the sorting options selected. Any elements that have a score below the selected threshold are automatically set to the substitution string.

a. This calculation is intended to be used only in a point & click script.

To open a Contour Classifier tool, select the  icon from the Machine Vision toolbar or select **Contour Classifier** from the Tools menu.

Note: The Contour Classifier tool is compatible with all other tools. The input image can be any image type. The mask image must be a binary image. The Contour Classifier tool can create a binary mask image either by using built-in thresholding (see [page 172](#)) or by using automatic thresholding (see [page 173](#)). You can also create a binary image by using the Threshold tool. For more information, refer to [Chapter 39, “Using the Threshold Tool.”](#) The active ROI on the input image must be a rectangle ROI.

You can have 100 Contour Classifier tools open at the same time.

Description of Contour Classifier Options

This section contains a description of the options in the Contour Classifier tool dialog box.

File Menu Options

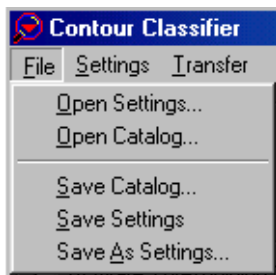


Figure 32: Contour Classifier Tool - File Menu

Open Settings...

Select this option to open Contour Classifier tool settings that you have saved. An Open dialog box is displayed. When you open a file (the name must be followed by the extension .con), the settings are loaded into the Contour Classifier tool.

Open Catalog...

Select this option to open a catalog of contours. An Open dialog box is displayed. When you open a catalog (the name must be followed by the extension .cct), the contours are loaded into the Contour Classifier tool.

Save Catalog...

Select this option to save the catalog to a file. A Save dialog box is displayed. Select the directory and enter the file name with the extension .cct.

Save Settings...

Select this option to save the Contour Classifier tool settings to a file. A Save dialog box is displayed. Select the directory and enter the file name with the extension .con.

Note that if you save a settings file with the name default.con, this file automatically opens each time you open a Contour Classifier tool. You must save default.con in the DT_Contour directory (located in C:\Program Files\Data Translation\DT Vision Foundry\Tools, by default).

Save As Settings...

Select this option to save the Contour Classifier tool settings to a file. A Save As dialog box is displayed. Select the directory and enter the file name with the extension .con.

Note that if you save a settings file with the name default.con, this file automatically opens each time you open a Contour Classifier tool. You must save default.con in the DT_Contour directory (located in C:\Program Files\Data Translation\DT Vision Foundry\Tools, by default).

Settings Menu Options

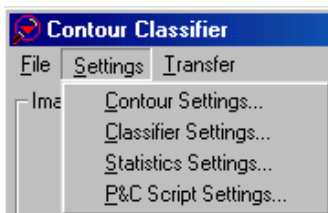


Figure 33: Contour Classifier Tool - Settings Menu

Contour Settings...

Select this option if you want to change the default Contour Settings. The tool opens the Contour Settings dialog box. For more information, refer to [page 177](#).

Classifier Settings...

Select this option if you want to change the default Classifier Settings. The tool opens the Classifier Settings dialog box. For more information, refer to [page 180](#).

Statistics Settings...

Select this option to specify how you want to display parameters in the Contour Parameters & Values List in the Contour Classifier. Tool main dialog box. The tool opens the Statistic Options dialog box. For more information, refer to [page 187](#).

P&C Script Settings...

Select this option if you want to perform point and click scripting. The tool opens the P&C Script Settings dialog box. For more information, refer to [page 185](#).

Transfer Menu Options

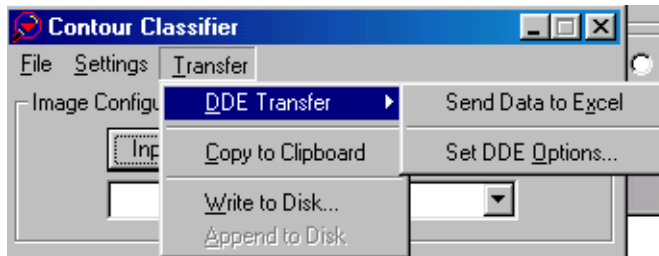


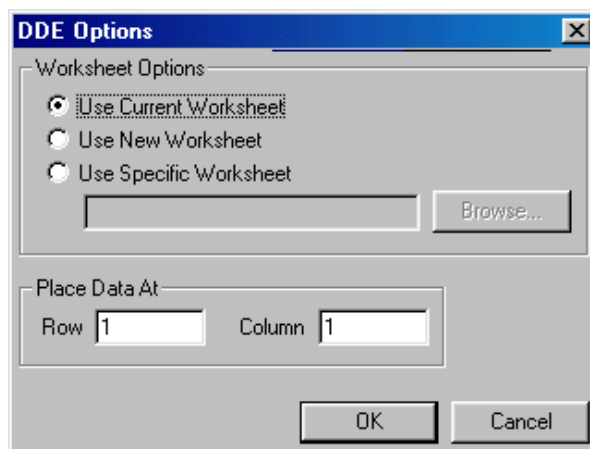
Figure 34: Contour Classifier Tool - Transfer Menu

DDE Transfer

Note: It is recommended that you use the Export tool to send variables and/or images from DT Vision Foundry to Excel. For more information, refer to [Chapter 15, “Using the Export Tool.”](#) The DDE options in the Contour Classifier tool have been retained for backward compatibility.

The DDE Transfer option allows you to select the following options for sending contour data to the spreadsheet program Excel:

- **Send Data to Excel** – Select this option to send all the current contour data (parameters and values) to Excel. Excel automatically opens and loads the data. You can then display the data in any supported format, such as charts, graphs, and spreadsheets.
- **Set DDE Options...** – Select this option to open the DDE Options dialog box.



Click the appropriate radio button to specify the Excel worksheet that you want to use. You can browse for a specific worksheet or enter the name manually. You can place your data at a specific row and/or column in the specified worksheet. When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the DDE Options dialog box without saving your changes.

Note that DT Vision Foundry assumes that you are using the English-language version of Excel. If you are using a different version of Excel, you must update the DTVF.DEF file to indicate the language you are using. For more information, refer to [page 55](#).

Copy to Clipboard

Select this option to copy all current contour data to the clipboard. You can then paste from the clipboard to any supported program, such as Word, Excel, or Notepad.

Write to Disk

Select this option to write all current contour data to disk. A Save As dialog box is displayed. Select the appropriate directory and enter the file name, then click **Save**.

Append to Disk

Select this option to add the current contour data to the end of the file you saved using **Write to Disk**.

Main Dialog Box Options

Input Image

Click this button to load the image in the active viewport as the input image. The image name is shown in the Input Image display window. You can also select the image from the list of images currently residing in system memory.

Mask Image

Click this button to load the image in the active viewport as the binary mask image. Use this button only if you have already created a binary mask image using the Threshold tool. For more information, refer to [Chapter 39, “Using the Threshold Tool.”](#) The mask image name is shown in the **Mask Image** display window. You can also select the mask image from the list of images currently residing in system memory.

By creating the binary mask image yourself, you can first process the image with other tools such as the Morphology tool. This allows you to remove unwanted particles, to smooth particles, and to separate touching particles. You can also logically AND, OR, or XOR binary images together before finding the blobs contained in the input image.

If you do not require the advanced features of the Threshold tool, you can let the Contour Classifier tool threshold the input image and create a binary mask image using either built-in thresholding (see [page 172](#)) or automatic thresholding ([page 173](#)). After you perform the **Train** operation, the mask image name (in the format *ImageName.msk:x*) is shown in the **Mask Image** display window and you can select the mask image from the **Mask Image** display window drop-down list.

To view a mask image that is created by the Contour Classifier tool, use the Image Manager tool. If you double-click the name of the mask image in the list of images in memory, the tool places the image in the active viewport. For more information, refer to [Chapter 21, “Using the Image Manager Tool.”](#)

Note that if you select a binary image as the input image, the input image is also used as the mask image.

Activate Thresholding Controls

By default, the Contour Classifier tool uses built-in thresholding to threshold the input image and create a binary mask image using the threshold limits shown in the **Maximum** and **Minimum** text boxes. If you want to change the threshold limits, select the **Activate Thresholding Controls** checkbox. Then, use the **Maximum** and **Minimum** slider controls to adjust the upper and lower limits. You can also enter the limits manually and use the arrow keys to fine-tune the values.

Note that you can perform either built-in thresholding or automatic thresholding. If you select the **Activate Thresholding Controls** checkbox, the **Auto Threshold** checkbox is grayed out.

Auto Threshold

Select this checkbox if you want to perform automatic thresholding. Clear the checkbox if you do not want to perform automatic thresholding.

If automatic thresholding is enabled, select a reference value from the **Automatic Threshold Reference** spin box. The value can range from 0 to 100%. By default, the reference value is 50%.

The tool uses the difference between the minimum and maximum grayscale values in the selected ROI to automatically threshold the image. If you do not get the results that you expect, try a different reference value.

If automatic thresholding is enabled, you can select the **Invert Output** checkbox to invert the output binary image. The foreground pixels are output as background pixels and the background pixels are output as foreground pixels.

Note that automatic thresholding is not appropriate for all images. It is intended for images with sufficient contrast between the background and the object. If automatic thresholding does not produce the results you expect, try built-in thresholding (see [page 172](#)), or use the Threshold tool to create a binary image. For more information, refer to [Chapter 39, “Using the Threshold Tool.”](#)

Note that you can perform either automatic thresholding or built-in thresholding. If you select the **Auto Threshold** checkbox, the **Activate Thresholding Controls** checkbox is grayed out.

Sort Options

Select the criteria that determines how the contours in the classified contours display list are sorted. By default, the tool sorts the list according to the total area of the contour. Other options in the Contour Settings dialog box determine which contours to display in the list, and whether to sort the list in ascending or descending order.

Show Catalog

Click this button to show the contours that are stored in catalog.

Classified Contours Display List

This field lists all classified contours. You can select (highlight) a contour from the list by clicking on it. If you select a contour from the image itself (as you would select any other ROI), the corresponding contour is highlighted in the list.

Contour Parameters and Values List

This field lists all the parameters and values (calculations) for the contour that is highlighted in the classified contour display list. If you are interested in a specific parameter for multiple contours, you can select the parameter from the contour parameters and values list. The parameter stays selected as you highlight different contours in the classified contours display list.

Description of Parameters

This field displays a description of the parameter highlighted in the contour parameters and values list.

Contour Ordering

This field lists the contours in the order in which they were classified (according to the sort options specified in the Contour Settings dialog box).

Output String

This field lists the name of each classified contour. You assign this name when you train the contours.

Found:

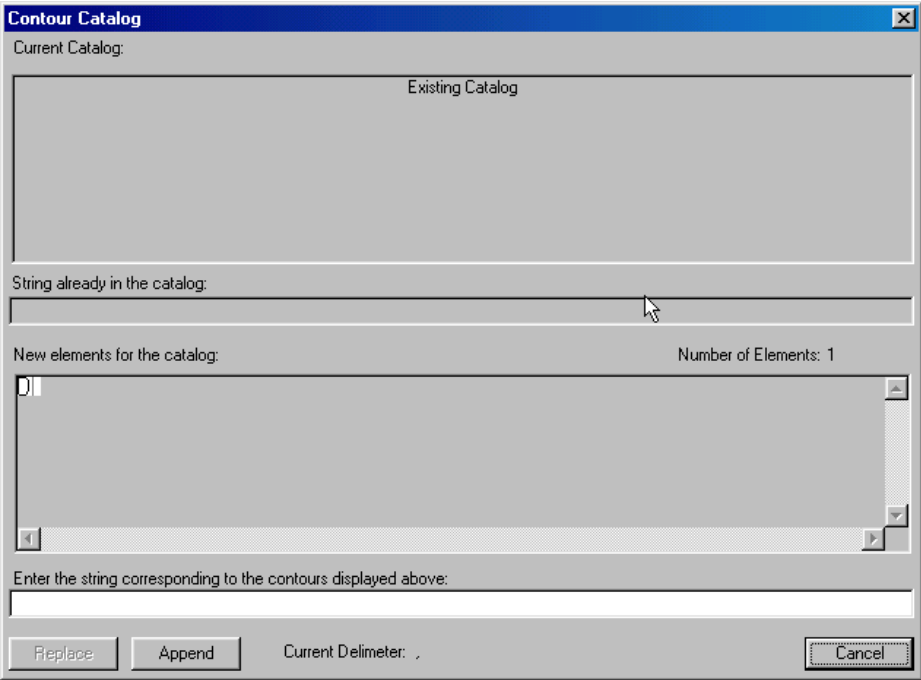
After you perform a **Classify** operation, this field displays the number of contours that the tool classified. Note that this may not equal the total number of contours in the classified contour display list.

Classification Time

After you perform a **Classify** operation, this field displays the time that was required for the tool to classify the contours under test.

Train

Click this button to open the Contour Catalog dialog box. The Contour Catalog dialog box allows you to create a new catalog of contours or to modify an existing catalog of contours.



The top part of the dialog box shows the contours that are already in the catalog, if one exists. The bottom part of the dialog box shows the contours that were extracted.

Name each contour that you want to add to the catalog, separated by the chosen delimiter.

Then, either replace the contours in the existing catalog with the new contours by clicking **Replace**, or add the new contours to the end of the existing catalog by clicking **Append**. Click **Cancel** to close the dialog box without saving changes.

Classify

Click this button to classify a contour under test using an existing catalog of contours. The resulting match information is then shown.

Add to Script

Select this checkbox if you want to perform point & click scripting. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Contour Settings Dialog Box

The Contour Settings dialog box is opened when you select **Settings** | **Contour Settings** from the Contour Classifier tool main dialog box. The Contour Settings dialog box allows you to specify the parameters that are used when matching the contours under test with those stored in the catalog. When you have specified all appropriate values, click **Apply** to accept and validate the options. Click **OK** to save the settings and close the dialog box. Click **Cancel** to close the dialog box without saving changes.

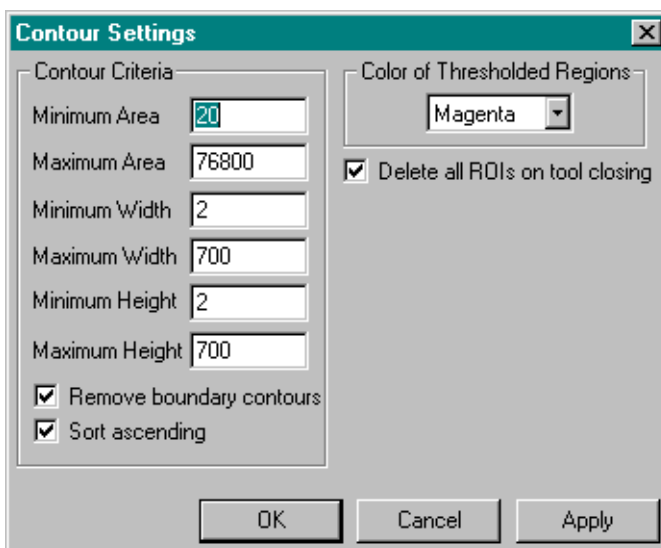


Figure 35: Contour Settings Dialog Box

Minimum Area

Specify the minimum area for the contour, in pixels. If the tool finds a contour that is smaller than this value, the tool discards the contour. The minimum area is 4 pixels.

Maximum Area

Specify the maximum area for the contour, in pixels. If the tool finds a contour that is larger than this value, the tool discards the contour. It must be greater than 20.

Minimum Width

Specify the minimum width for the contour, in pixels. If the tool finds a contour whose width is smaller than this value, the tool discards the contour. The minimum width is 2 pixels.

Maximum Width

Specify the maximum width for the contour, in pixels. If the tool finds a contour that is wider than this value, the tool discards the contour. It must be greater than 20.

Minimum Height

Specify the minimum height for the contour, in pixels. If the tool finds a contour that is smaller than this value, the tool discards the contour. The minimum height is 2 pixels.

Maximum Height

Specify the maximum height for the contour, in pixels. If the tool finds a contour that is larger than this value, the tool discards the contour. It must be greater than 20.

Remove Boundary Contours

Select this checkbox if you want the tool to discard a contour that is touching the active ROI. Clear this checkbox if you want the tool to truncate a contour that is touching the active ROI to fit inside the active ROI. If you want only certain contours discarded, you can find all contours and then delete the unwanted contours yourself (just as you would delete any other ROI).

Sort Ascending

Select this checkbox if you want contours in the classified display list to be sorted in ascending order. Clear this checkbox if you want contours in the found contours display list to be sorted in descending order.

Color of Thresholded Regions

Specify the color that you want to use to display the contours highlighted in the classified contour display list on the image. You can select multiple contours in one color, select a new color, and then select more contours. This is useful for displaying all contours that have certain features in the same color, while displaying other contours in another color. Note that if you perform an action that causes the image to be redrawn, you will lose this coloring.

Delete all ROIs on Tool Closing

Select this checkbox if you want to delete all the freehand ROIs created by the Contour Classifier tool when you close the tool. Clear this checkbox if you want to keep these ROIs when you close the tool; this is useful if you want to use these ROIs in other tools.

Classifier Settings Dialog Box

The Classifier Settings dialog box is opened when you select **Settings | Classifier Settings** from the Contour Classifier tool main dialog box. When you have specified all appropriate values, click **Apply** to accept and validate the options. Click **OK** to save the settings and close the dialog box. Click **Cancel** to close the dialog box without saving changes.

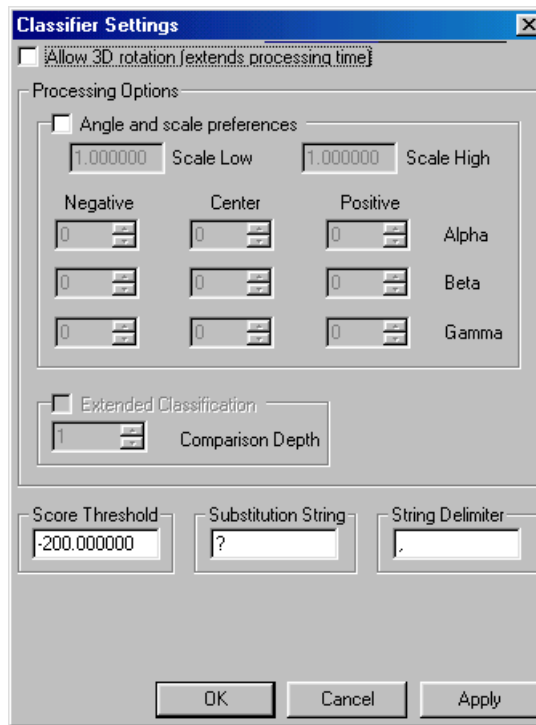


Figure 36: Classifier Settings Dialog Box

Allow 3D Rotation

Select this checkbox if you want to allow three-dimensional rotation of the contours under test. Note that if this checkbox is selected, the processing time will be greater.

Note: Images in three-dimensional space may be misclassified since they will be compared to entries in the catalog that are in two-dimensional space. For example, the side view of the letter “O” in three-dimensional space may resemble the letter “I” in two-dimensional space. Therefore, take care when using this option.

Angle and Scale Preferences

Select this checkbox if you want to restrict the angle and scale parameters that are used when matching the contours under test to the contours in the catalog.

Note: If the tool is unable to match a contour under test to any of the contours in the catalog, the tool will ignore these preferences and return a result that best matches a contour in the catalog.

If this checkbox is selected, you can enter values for the following parameters:

- **Scale Low** –The minimum scale factor between the contour under test and the best contour match in the catalog. For example, if the scale low value is 0.5, the image under test could be half the size of a contour in the catalog to be considered as a match.
- **Scale High** –The maximum scale factor between the contour under test and the best contour match in the catalog. For example, if the scale high value is 2.0, the image under test could be twice the size of a contour in the catalog to be considered as a match.
- **Negative Alpha** –The number of degrees that the contour can rotate in the negative direction (clockwise) in the XY plane. Values range from -180 to 0; 0 is the default.

- **Negative Beta** –The number of degrees that the contour can rotate in the negative direction (clockwise) in the ZX plane. Values range from -180 to 0; 0 is the default. This option is available only if you previously checked the **Allow 3D Rotation** checkbox.
- **Negative Gamma** –The number of degrees that the contour can rotate in the negative direction (clockwise) in the YZ plane. Values range from -180 to 0; 0 is the default. This option is available only if you previously checked the **Allow 3D Rotation** checkbox.
- **Center Alpha** –The number of degrees that the center of the contour can rotate in the XY plane. Values range from -180 to 180; 0 is the default.
- **Center Beta** –The number of degrees that the center of the contour can rotate in the ZX plane. Values range from -180 to 180; 0 is the default. This option is available only if you previously checked the **Allow 3D Rotation** checkbox.
- **Center Gamma** –The number of degrees that the center of the contour can rotate in the YZ plane. Values range from -180 to 180; 0 is the default. This option is available only if you previously checked the **Allow 3D Rotation** checkbox.
- **Positive Alpha** –The number of degrees that the contour can rotate in the positive direction (counterclockwise) in the XY plane. Values range from 0 to 180; 0 is the default.
- **Positive Beta** –The number of degrees that the contour can rotate in the positive direction (counterclockwise) in the ZX plane. Values range from 0 to 180; 0 is the default. This option is available only if you previously checked the **Allow 3D Rotation** checkbox.
- **Positive Gamma** –The number of degrees that the contour can rotate in the positive direction (counterclockwise) in the YZ plane. Values range from 0 to 180; 0 is the default. This option is available only if you previously checked the **Allow 3D Rotation** checkbox.

Extended Classification

Select this checkbox if you want to recheck the best match for the contour under test until a stable score value is returned. In cases where a reliable score is required, it is recommended that you use extended classification.

Comparison Depth

If the Extended Classification checkbox is selected, select the number of additional comparisons that you want the tool to perform. This value can range from 1 to 5; 1 is the default. The higher the number is, the longer the classification takes.

Score Threshold

Specify the lowest match score that the tool will use when determining whether the contour under test matches a contour in the catalog.

When three-dimensional processing is turned off, the score can range from negative infinity to 0, where 0 is a perfect match. When three-dimensional processing is turned on, the score can range from 0 to 1, where 1 is a perfect match.

For example, if you specify a value of 0.5, only matches with match scores greater than or equal to 0.5 are considered to be valid matches.

Substitution String

Specify the string that the tool will display when the contour under test is below the threshold. The default string is "?".

Delimiter

Specify the string that the tool will use to separate the contour strings. The default string is ", ".

P&C Script Settings Dialog Box

The P&C Script Settings dialog box is opened when you select **Settings | P&C Script Settings** from the Contour Classifier tool main dialog box. When you have specified all appropriate values, click **OK** to save the settings and close the dialog box. Click **Cancel** to close the dialog box without saving changes.

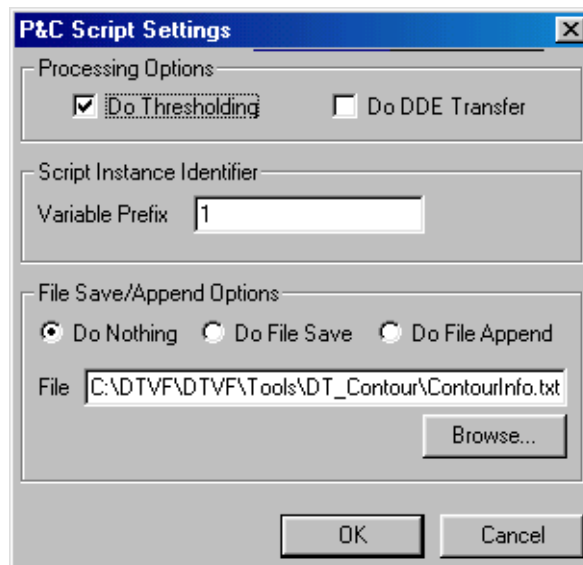


Figure 37: P&C Script Settings Dialog Box

If you are performing point & click scripting, set the following options appropriately:

- **Do Thresholding** – Select this checkbox if you want to perform thresholding during point & click scripting. Clear this checkbox if you do not want to perform thresholding.

Note that if you can use the same mask image (the same threshold limits) for each **Classify** operation you perform, you can improve performance by clearing this checkbox after the first operation. All subsequent operations use the mask image specified for the first operation.

- **Do DDE Transfer** – Select this checkbox if you want to send the calculations performed by the Contour Classifier tool to the Excel file specified by **File**. The calculations are listed in the Statistic Options dialog box. For more information, refer to [page 187](#).
- **Variable Prefix** – Specify the prefix that you want to use for the point & click script variables that are generated by the Contour Classifier tool.
- **File Save\Append Option** - Click one of the following radio buttons to specify how you want to save the calculations performed by the Contour Classifier tool:
 - **Do Nothing** – Select this checkbox if you do not want to save the calculations to a file.
 - **Do File Save** – Select this checkbox if you want to save the calculations performed by the Contour Classifier tool in the file specified by **File**. If you want to use a different file, either enter the file name in the text box or use the Browse button to locate the file. The calculations are listed in the Statistic Options dialog box. For more information, refer to [page 187](#).
 - **Do File Append** – Select this checkbox if you want to add the calculations performed by the Contour Classifier tool to the end of the file specified by **File**. The calculations are listed in the Statistic Options dialog box. For more information, refer to [page 187](#).

Statistics Settings Dialog Box

The Statistics Settings dialog box is opened when you select **Settings** | **Statistics Settings** from the Contour Classifier tool main dialog box. The Statistics Settings dialog box allows you to specify which parameters (calculations) you want to display in the contour parameters and values list in the Contour Classifier tool main dialog box. When you have specified all appropriate values, click **OK** to save the settings and close the dialog box. Click **Cancel** to close the Statistics Settings dialog box without saving your changes.

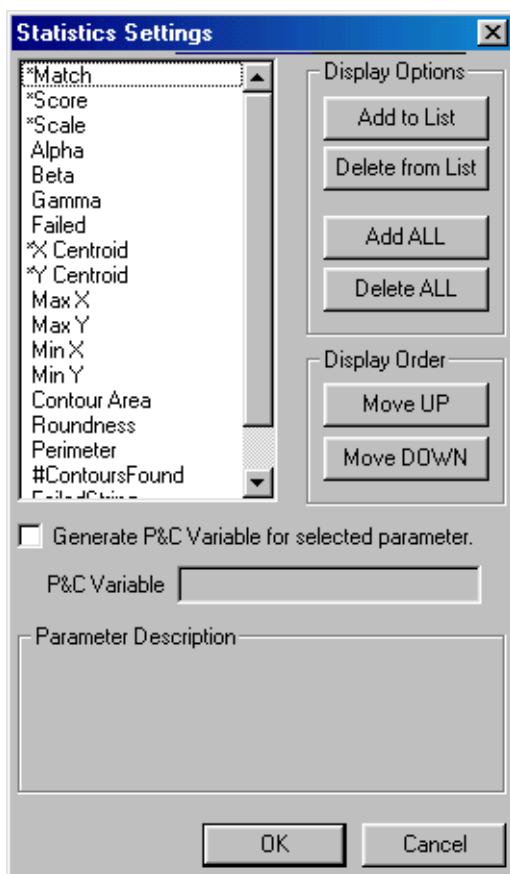


Figure 38: Statistic Options Dialog Box

Click a parameter to select (highlight) it. A description of the parameter is displayed at the bottom of the dialog box. If the parameter is a calibrated measurement, the word “Calibrated” is displayed in the lower left corner of the dialog box.

Click **Add to List** to add the selected parameter to the contour parameters and values list, click **Delete from List** to delete the selected parameter from the list, click **Move UP** to move the selected parameter up in the list, or click **Move DOWN** to move the selected parameter down in the list. You can also click **Add ALL** to add all parameters to the list or click **Delete ALL** to delete all parameters from the list. All parameters that will be displayed in the contour parameters and values list are denoted with an asterisk (*).

If you are performing point & click scripting, select **Generate P&C Variable for selected parameter** to generate a point & click script variable for the selected parameter. The name of the variable is displayed in the **P&C Variable** field. By default, the name of the variable is the same as the name of the parameter; however, you can change the name, if desired.

Example of Using the Contour Classifier Tool

This example shows how to classify different kinds of car keys using the image `keys_image`, shown in [Figure 39](#).

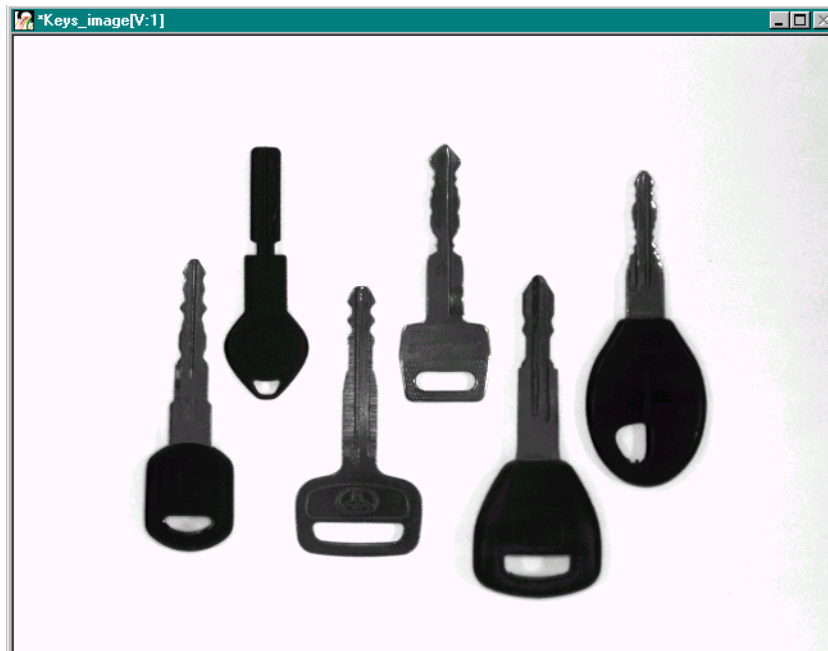


Figure 39: Contour Classifier Tool Example Image

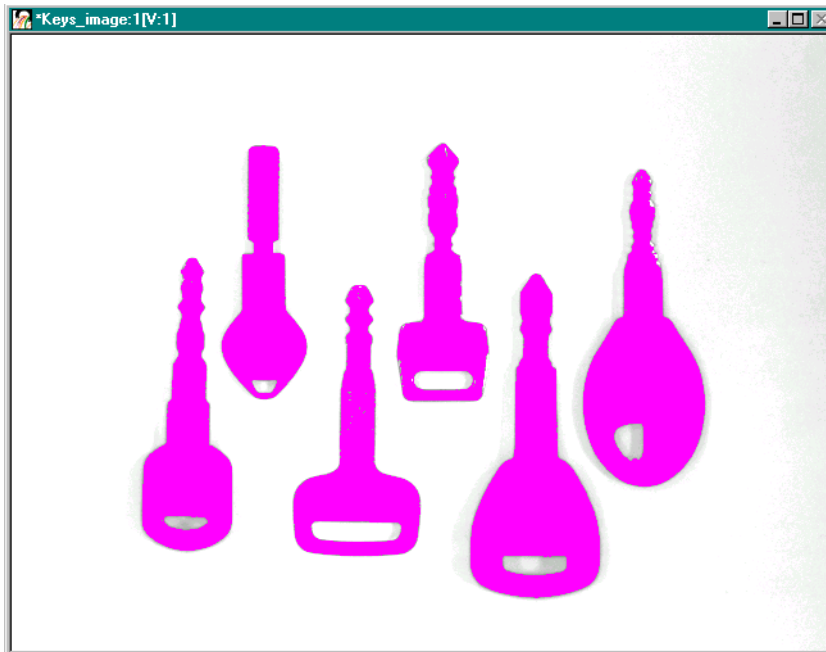
The operation is as follows:

1. Open a Contour Classifier tool (if one is not already open).
2. Click on the image `keys_image` in the viewport in the main application; it becomes the active viewport and is denoted with an asterisk, as shown in [Figure 39](#). Now, click **Input Image** in the Contour Classifier tool main dialog box.

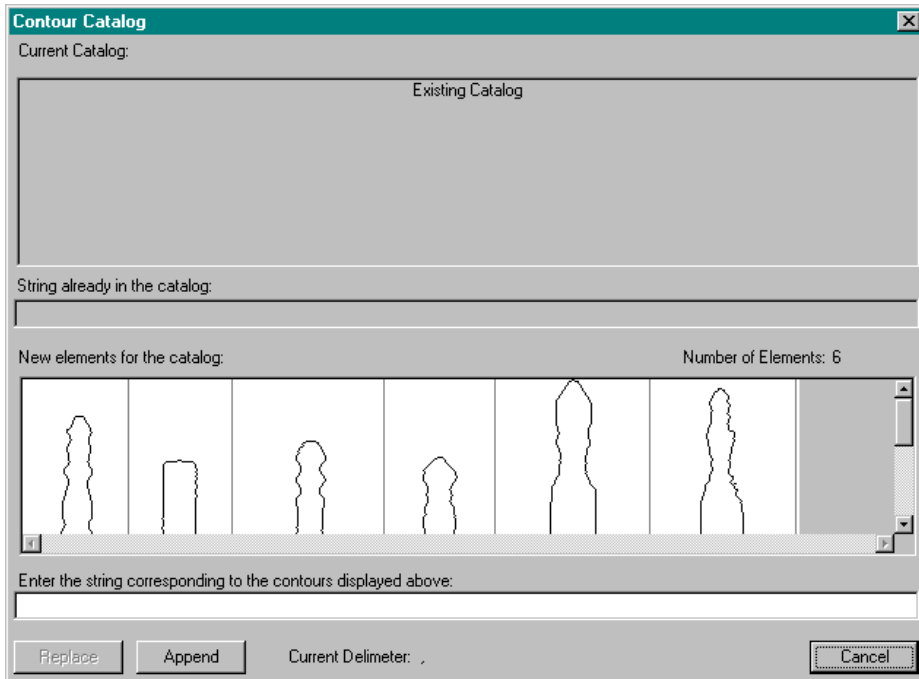
Note that when you open a Contour Classifier tool, the image in the active viewport is loaded as the input image by default.

3. Click the **Activate Thresholding Controls** checkbox. Set the **Minimum** limit to 0 and the **Maximum** limit to 149 by adjusting the slider controls or entering the values manually. Note that these settings differ for different images.

The image `keys_image` looks as follows:



4. Click **Train** to create a catalog of these contours.
The Contour Catalog appears, as follows:



5. In the **Enter the string corresponding to the contours displayed above** text box, name each contour by entering **honda,toyota,gm,nissan,ford,bmw**. Note that a comma (,) is used to separate the names.
6. Since no catalog exists, click **Append** to add the contours to a catalog.
The contours are classified and listed in the classified contours display list. The order of the contours is also shown, as follows:

Parameter	Value
Contour 3	
Contour 1	
Contour 4	
Contour 0	
Contour 5	
Contour 2	

Description of Parameters

Contour Ordering

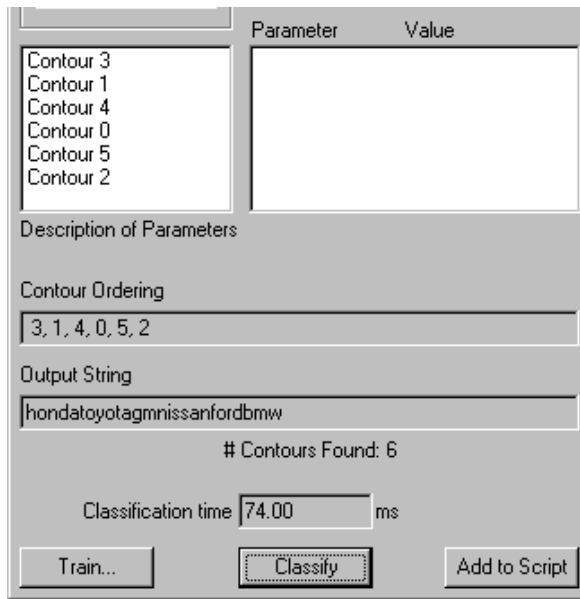
3, 1, 4, 0, 5, 2

Output String

Contours Found: 6

Classification time ms

7. If you want to save the catalog, click **Save Catalog** from the File menu, then name the catalog.
8. If desired, you can change the way that the Contour Classifier tool classifies and displays the contours. Open the Contour Settings dialog box by clicking **Settings | Contour Settings**; open the Classifier Settings dialog box by clicking **Settings | Classifier Settings**. Change the settings as appropriate.
9. If you want to save the settings, click **File | Save Settings**.
10. When all options for the tool are set appropriately, click **Classify**. *The output string that lists the names of the contours and the classification time are shown, as follows:*



11. Click each of the contours in the classified contours display list. Note that the corresponding contour is highlighted in the image itself and the corresponding statistics are shown in the contour parameters and values list.
For example, for Contour 2, the Contour Classifier dialog box appears as follows:

Parameter	Value
Match:	bmw
Score:	1.000000
Scale:	1.000000
X Centroid:	493.000000
Y Centroid:	218.000000

Contour 3
Contour 1
Contour 4
Contour 0
Contour 5
Contour 2

Description of Parameters

Contour Ordering

3, 1, 4, 0, 5, 2

Output String

hondatoyotagmnissanfordbmw

Contours Found: 6

Classification time 74.00 ms

Train... Classify Add to Script

Note: If you get a ?? in the output string, try lowering the score threshold until the question marks are replaced by the name of the key in the catalog that most closely matches it.

12. You can inspect a contour in the following ways:

- Select a contour from the classified contours display list or activate its associated ROI and view its associated statistics in the contour parameters and values list.
- Delete a contour. Since a contour has an associated freehand ROI, you can remove the contour from the classified contours list by deleting its ROI. All contour information is updated to reflect this change.

- Use other tools on the contour's freehand ROI. For example, you could take a histogram of the contour, run a filter on the contour, or use a custom tool on the contour.
- Use the **Sort** options to view the classified contour display list differently.
- Use the Contour Settings and Classify Settings dialog boxes to view contours in different colors or to sort the classified contours display list in ascending or descending order.

Point & Click Script

This section describes the specific use of the Contour Classifier tool's point & click script functionality with respect to adding and editing a point & click script. For more information on scripting options, refer to [page 185](#). For more information about the Point & Script tool, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Note that an example point and click script that uses the Contour Classifier (called `keys.pcs`) is included on the DT Vision Foundry CD.

Adding to the Point & Click Script

To add the Contour Classifier tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Contour Classifier tool to perform the desired function. This includes all input and mask images, all options, and the active ROI (if you are using one). Click the **Classify** button to perform the operation, then click the **Add to Script** button to record all the information in the Point & Click Script tool.

Note: You always provide the absolute path to the catalog file in the Contour Classifier tool. If you save the point & click script to the same drive that contains the catalog file, the tool automatically converts the catalog file to a path relative to the directory in which you save the script. If you move the script (and the catalog file) to another directory, the correct catalog file is opened when you run the script.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Contour Classifier tool is set up exactly as it was when you previously recorded the script. This includes all input and mask images, all options, and the active ROI (if an ROI was used). The **Add to Script** button is changed to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The tool classifies all contours again, using the desired options, and the script item is saved into the point & click script with the new options.

Note: You cannot edit a catalog from within the point & click script. If you want to edit the catalog, open a new Contour Classifier tool, then click **Train** to open the Contour Classifier dialog box. Edit the catalog, click **Replace** or **Append** to update the catalog, then save the catalog. In the point & click script (in edit mode), select **File | Open Catalog** to reload the updated catalog. When you click **Update Script**, the updated catalog is added to the point & click script.



Using the Custom Script Tool

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Introduction

The Custom Script tool is supplied with DT Vision Foundry. It allows you to perform complicated mathematical functions on information derived from an image, using BASIC-like scripting within a point & click script. You can use all point & click script variables inside a custom script and create new point & click script variables from within the custom script.

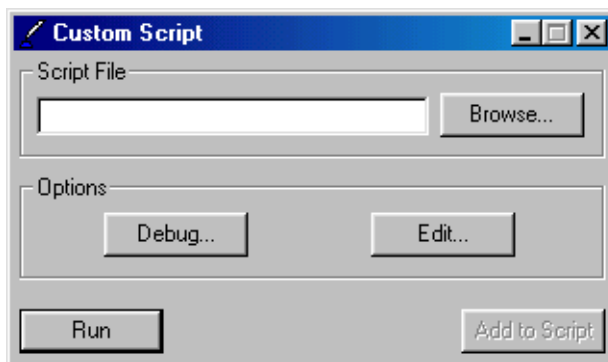



Figure 40: Custom Script Tool

To open a Custom Script tool, select the  icon from the Miscellaneous toolbar or select **Custom Script** from the Tools menu.

Notes: The Custom Script tool is fully compatible with all other tools, image types, and ROIs.

You can have only one Custom Script tool open at a time.

Description of Custom Script Tool Options

10

This section contains a description of the options in the Custom Script tool dialog box.

Script File

Enter the full path to the custom script file that you want to run, edit, or debug. You can also use the **Browse** button to locate the file.

Note that you cannot use spaces in the path name.

Note that you always provide the absolute path to the custom script file. If you save the point & click script to the same drive that contains the custom script file, the tool automatically converts the custom script file to a path relative to the directory in which you save the point & click script. If you move the point & click script (and the custom script file) to another directory, the correct custom script file is opened when you run the point & click script.

Debug

Click this button to start the Custom Script tool's debugger. The entire custom script is displayed and you can view and change any variable while single-stepping through the script.

Edit

Click this button to edit the custom script file specified in the **Script File** text box. If no script is specified in the **Script File** text box, clicking this button allows you to create a new custom script. When you click **Edit**, the tool automatically opens the Windows WordPad text editor. However, you can edit the custom script using any text editor you want.

Run

Click this button to run the custom script file.

Add to Script

Click this button if you want to add your custom script to the current point & click script. You can read, use, change, and create point & click script variables from within a custom script. For more information, refer to the next section.

Using Point & Click Script Variables

You can construct complicated mathematical formulas using point & click script variables from within the Custom Script tool, as follows:

1. Get the value of a point & click script variable.
2. Place the value of the point & click script variable in a custom script variable.
3. Use the custom script variable in a custom script.
4. Use the result of the custom script to set the value of a point & click script variable.

The following functions are available for working with point & click script variables.

GET_PNC_VAR

Syntax `GET_PNC_VAR("PNC_Variable")`

Description Gets the value of a point & click script number variable and places the value in a custom script variable.

Notes None

Example `Min = GET_PNC_VAR("H_Min")`

GET_PNC_STRING

Syntax `GET_PNC_STRING("PNC_Variable")`

Description Gets the value of a point & click script string variable and places the value in a custom script variable.

Notes None

Example `Name$=STRING`

```
Name$ = GET_PNC_STRING  
      ("Name_Variable")
```

SET_PNC_VAR

Syntax `SET_PNC_VAR("PNC_Variable",
 Cscript_Result)`

Description Sets a point & click script number variable to the value of a custom script variable.

Notes If the point & click script variable does not already exist when the custom script is run, this function creates a point & click script variable with the specified name.

Example `Min = GET_PNC_VAR("H_Min")
Max = GET_PNC_VAR("H_Max")`

```
X = Max - Min
```

```
SET_PNC_VAR("Diff", X)
```


SET_PNC_STRING

Syntax `SET_PNC_STRING("PNC_Variable" ,
 Cscript_Result)`

Description Sets a point & click script string variable to the value of a custom script variable.

Notes If the point & click script variable does not already exist when the custom script is run, this function creates a point & click script variable with the specified name.

Example `X$=STRING
Name$=STRING

Name$ = GET_PNC_STRING
 ("Name_Variable")

X$ = "A" + Name$

SET_PNC_STRING("New_Name" , X$)`

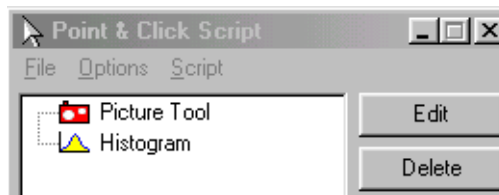
Example of Using the Custom Script Tool

This example shows how to take a picture of an object and then look at the grayscale difference of a region in the image by first calculating a histogram and then subtracting the maximum and minimum values of the histogram. If the difference is larger than 50, a region in the image's overlay is changed to red to indicate a problem.

The operation is as follows:

1. Open the Point & Click Script tool (if it is not already open) and open a Picture tool (if one is not already open). Then, set up the Picture tool as desired and record the Picture Tool script item in the point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool,"](#) and [Chapter 27, "Using the Picture Tool."](#)
2. Open a Histogram tool (if one is not already open). Set up the tool to calculate histogram statistics in the Histogram Script Options dialog box. Use the default names of the script variables (the name of the Maximum script variable is `H_Max` and the name of the Minimum script variable is `H_Min`). For more information, refer to [Chapter 19, "Using the Histogram Tool."](#)

The point & click script looks as follows:



3. Open the Custom Script tool (if it is not already open) and click **Edit**.

WordPad automatically opens.

4. To find the difference between the Maximum and Minimum values in the histogram, enter the following script in WordPad (the Maximum and Minimum values are contained in the point & click script variables `H_Max` and `H_Min` and were calculated by the Histogram tool):

```
Min = GET_PNC_VAR("H_Min")
Max = GET_PNC_VAR("H_Max")

X = Max - Min

SET_PNC_VAR("Diff",X)

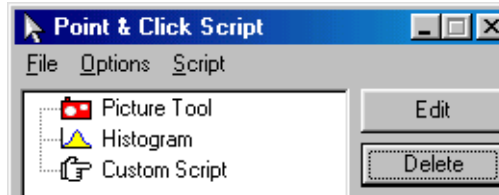
END
EXIT
```

The first line of code gets the value of the point & click script variable `H_Min` and places it in the custom script variable `Min`. The second line gets the value of `H_Max` and places it in `Max`. The third line uses BASIC code to subtract the two values and place the result in the custom script variable `x`. The fourth line takes the value of `x` and creates a point & click variable called `Diff`, which will contain the difference value. You can now use the point & click variable `Diff` in the point & click script.

All custom scripts must end with the keywords `END` and `EXIT`.

5. Save the script with the name `test1.txt` to any directory. Make sure that you save the text as normal text.
6. Load the saved script into the Custom Script tool by clicking **Browse** in the Custom Script tool and selecting the file that you just saved. The custom script is now ready to run, edit, or debug.
7. Add the custom script to the point & click script by clicking **Add to Script** in the Custom Script tool.

The Point & Click Script tool looks as follows:



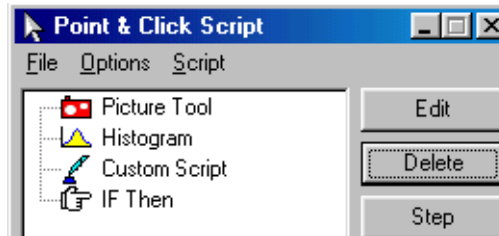
8. Generate the `Diff` variable by either stepping through the custom script item from the Point & Click Script tool or running the custom script from the Custom Script tool.
9. To make a decision based on the new point & click variable `Diff`, click the If-Then button in the Point & Click Script tool and add the statement “If `Diff` is greater than 50”.

The If-Then statement looks as follows:



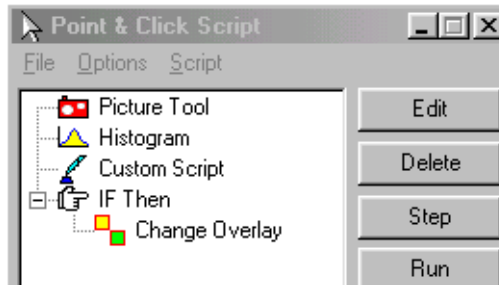
10. Click **OK** in the If-Then box.

The point & click script looks as follows:

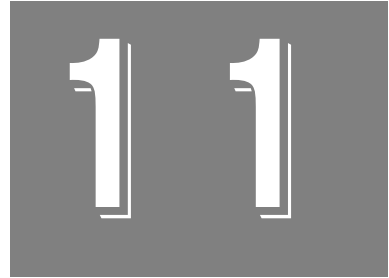


11. Record a point & click script item to change a region to red using the Pixel Change tool and place the script item under the If-Then item. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool,”](#) and [Chapter 28, “Using the Pixel Change Tool.”](#)

The point & click script looks as follows:



For more information on the type of BASIC code that you can use in a custom script, refer to the *DT Vision Foundry API Manual*.



Using the Data Matrix Reader Tool

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Introduction

The Data Matrix Reader tool is supplied with DT Vision Foundry. It allows you to decode ECC200 data matrix symbols located in an image. Data matrix symbols are typically used as barcodes. A data matrix symbol consists of a pattern of two-dimensional square modules, such as those shown in [Figure 41](#).

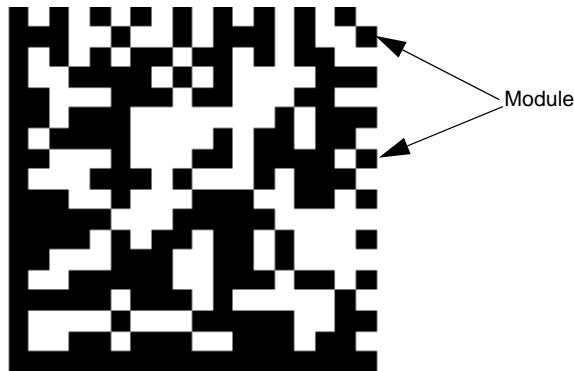


Figure 41: Data Matrix Symbol

Note: The Data Matrix Reader tool is intended for module-based (two-dimensional) data matrix barcodes. If you are using line-based (one-dimensional) barcodes, use the Barcode Reader tool instead. For more information, refer to [Chapter 5, “Using the Barcode Reader Tool.”](#)

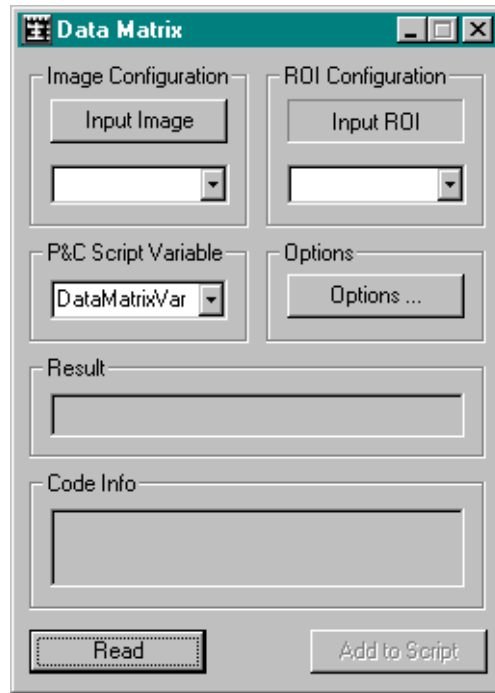



Figure 42: Data Matrix Reader Tool

To open a Data Matrix Reader tool, select the  icon from the Barcode toolbar or select **Data Matrix Reader** from the Tools menu.

Notes: The Data Matrix Reader tool is compatible with all other DT Vision Foundry tools. It uses a rectangle ROI in the decoding process and creates a freehand ROI around the data matrix symbol.

You can have up to 100 Data Matrix Reader tools open at the same time.

Description of Data Matrix Reader Tool Options

This section contains a description of the options in the Data Matrix Reader tool dialog box.

Main Dialog Box Options

Input Image

Click this button to load the image in the active viewport as the input image. The input image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

ROI Configuration

Select an ROI from the drop-down list. Using an ROI can reduce the decoding time and allows you to select a data matrix symbol from an image that contains multiple symbols. The ROI should be at least one module's width larger than the data matrix symbol. If you do not select an ROI, the tool decodes the entire image.

Note that only rectangle ROIs are supported at the present time.

P&C Script Variable

Specify the point & click scripting variable that you want to use to store the text encoded in the data matrix symbol. This is a string variable. After reading a data matrix symbol, the tool places the text in this variable for use by other tools. You can manually enter a variable name or select a variable from the drop-down list. If you do not specify a variable, the variable DataMatrixVar is used by default.

Options

Click this button to open the Data Matrix Options dialog box. For more information, refer to [page 217](#).

Result

After you click **Read** to perform the operation, the **Result** field displays the text encoded in the data matrix symbol.

Code Info

After you click **Read** to perform the operation, the **Code Info** field displays the following information about the data matrix symbol:

- **Matrix Size** - the number of modules in the x-axis by the number of modules in the y-axis.
- **Time to Read** - the amount of time required to decode the data matrix symbol.
- **Centroid** - the x location and the y location of the centroid of the data matrix symbol.
- **Angle** - the number of degrees from the x-axis.
- **Number of Errors Found** - the number of errors found.

The Data Matrix Reader tool uses the ECC200 Reed-Solomon Error Detection and Correction algorithm to correct as many errors as possible. For more information about the algorithm, refer to *International Symbology Specification - Data Matrix*, published by AIM International, Inc.

If the **Read** operation is successful, the tool was able to correct all reported errors. If the **Read** operation returns an error, some errors could not be corrected. In this case, you can try adjusting the data matrix options (refer to the next section) or the lighting conditions.

- **Symbol ID** - one of the symbol IDs listed in [Table 6](#).

Table 6: Symbol IDs

Symbol ID	Header	Description
-1	none	Symbol ID not enabled
1	jd1	ECC200
2	jd2	ECC200, FNC1 1st or 5th position
3	jd3	ECC200, FNC1 2nd or 6th position
4	jd4	ECC200, with ECI protocol
5	jd5	ECC200, FNC1 1st or 5th position with ECI
6	jd6	ECC200, FNC1 2nd or 6th position with ECI

To conform to the International Symbology Specification, the data matrix symbol is decoded as follows:

- The header is added as a prefix to the beginning of the data matrix symbol text.
- An FNC1 (alternate data type identifier) appears in the first or second symbol character position (or in the fifth or sixth data positions of the first symbol of the structured append). A structured append allows files of data to be represented in up to 16 data matrix symbols.
- The ECI (Extended Channel Interpretation) protocol allows the output data stream to have interpretations different from those of the default character set.

For more information, refer to *International Symbology Specification - Data Matrix*, published by AIM International, Inc.

Read

After all settings are correct, click this button to read the data matrix symbol. The tool creates a freehand ROI around the data matrix symbol, displays the text encoded in the data matrix symbol in the **Result** field, stores the text in the specified point & click scripting variable, and displays information about the data matrix symbol in the Code Info field.

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Add to Script

After you click the **Read** button, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29](#), “Using the Point & Click Script Tool.”

Data Matrix Options Dialog Box Options

The Data Matrix Options dialog box is opened when you select the **Options** button from the Data Matrix Reader tool main dialog box. This dialog box allows you to specify values that help you to fine-tune the data matrix symbol decoding process. If you are not getting the results you expect or if you are getting errors, it is recommended that you try various values until you find those that suits the needs of your application. When you have specified all appropriate values, click **OK** to save the settings and close the dialog box. Click **Cancel** to close the dialog box without saving your changes.

Data Matrix Options ✕

Matrix Size (RxC) AutoDetect ▾

Module Size (pixel) 6 ▾

Contrast 20 ▾

Time Out (ms) 1600 ▾

☒ Generate P&C Variable for the number of errors found.
DMNumOfErrors

☒ Generate P&C Variable for the centroid of the Data Matrix Symbol.
DMCentroidX
DMCentroidY

☒ Generate P&C Variable for the angle of the Data Matrix Symbol.
DMAngle

OK Cancel

Matrix Size

Select or enter the data matrix symbol size (the number of modules in the x-axis of the data matrix symbol by the number of modules in the y-axis of the data matrix symbol). For example, the size of the data matrix symbol shown in [Figure 41](#) is 18 x 18. Select **AutoDetect** if you want the tool to use a built-in algorithm to automatically determine the size of the data matrix symbol.

It is recommended that you use the **AutoDetect** option, if possible. Select or enter another value only if auto detection fails.

Module Size

Select or enter the size (width or height) of the smallest data matrix module in the data matrix symbol, in pixels. Any modules smaller than the specified size are ignored during the decoding process, speeding up the search.

Note that modules are always square. Therefore, if you specify a value of 6, the smallest data matrix module in the data matrix symbol is 6 pixels by 6 pixels.

Contrast

Select or enter the contrast value. The contrast value is the difference between the black and white modules in the data matrix symbol. Use a value between 1 and 255. Use lower values for low-contrast images or images with blurry edges. Use higher values for noisy or textured images.

Time Out

Select or enter the timeout value, in milliseconds. If the tool cannot decode the data matrix symbol in the specified amount of time, a timeout error occurs. A timeout value of 500 to 1600 ms is recommended.

Generate P&C Variable

If you are performing point & click scripting, select the appropriate **Generate P&C Variable** checkbox to generate one or more of the following point & click script variables:

- **Errors Found** - Generates a point & click script variable that stores the number of errors found. This is a number variable. By default, the name of the variable is iNumofErrors; however, you can change the name, if desired.
- **Centroid** - Generates two point & click script variables that store the x location and the y location of the centroid of the data matrix symbol. These are number variables. By default, the names of the variables are DMCentroidX and DMCentroidY; however, you can change the names, if desired.
- **Angle** - Generates a point & click script variable that stores the angle (number of degrees from the x-axis) of the data matrix symbol. This is a number variable. By default, the name of the variable is DMAngle; however, you can change the name, if desired.

Example of Using the Data Matrix Reader Tool

This example shows how to decode the data matrix symbol in the image DataMatrix.bmp, shown in [Figure 41](#).

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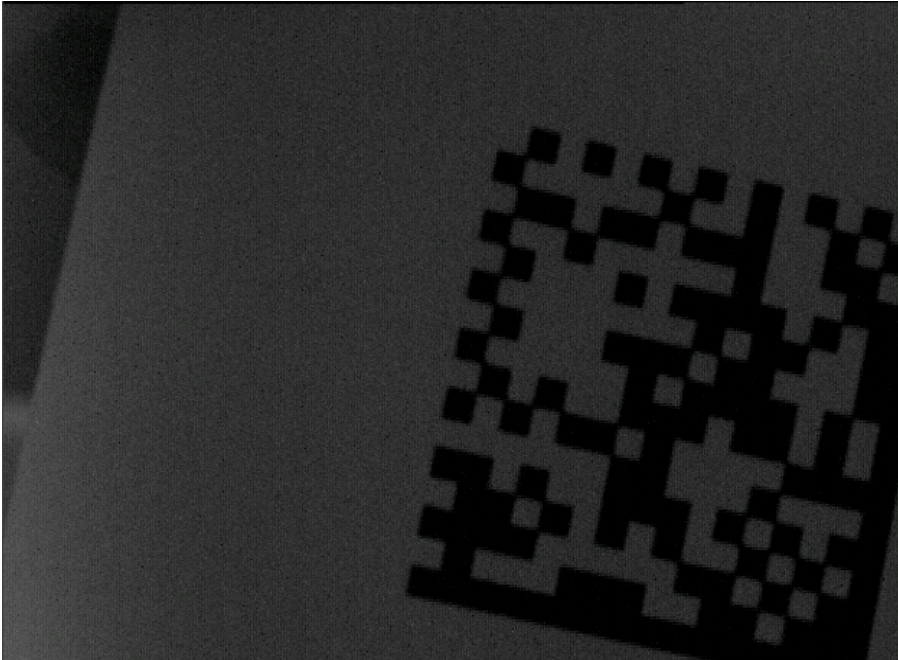


Figure 43: Data Matrix Reader Tool Example Image

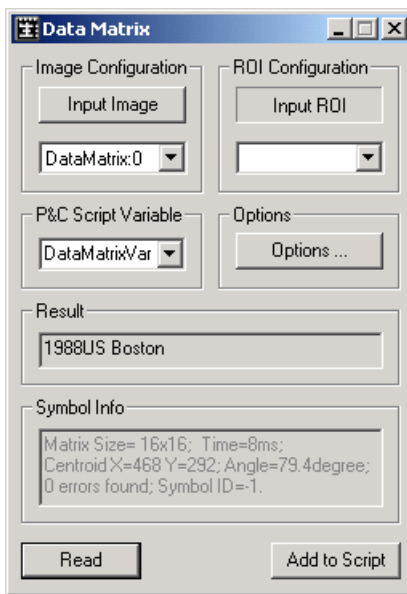
The operation is as follows:

1. Open a Data Matrix Reader tool (if one is not already open).
2. Click on the DataMatrix image in the viewport in the main application; it becomes the active viewport and is denoted with an asterisk. Now, click **Input Image** in the Data Matrix Reader tool main dialog box.

Note that when you open a Data Matrix Reader tool, the image in the active viewport is loaded as the input image by default.

3. Draw a rectangle ROI that is at least one module's width larger than the data matrix symbol. Note that you may have to maximize the image to see the entire data matrix symbol.
4. Select the rectangle ROI from the **ROI Configuration** drop-down list.
5. Click **Read**.

*The data matrix symbol text is displayed in the **Result** field and information about the symbol is displayed in the **Code Info** field.*



Point & Click Script

This section describes the specific use of the Data Matrix Reader tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

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Adding to the Point & Click Script

To add the Data Matrix Reader tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Data Matrix Reader tool to perform the desired function. This includes the input image, the contrast value, and the ROI (if you are using one). Click **Read** to perform the desired operation, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Data Matrix Reader tool is set up exactly as it was when you previously recorded the script item. This includes the input image, the contrast value, and the ROI (if an ROI was used). The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved to the point & click script with the new options.



Using the Digital I/O Tool

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Introduction

The Digital I/O tool is supplied by DT Vision Foundry. It allows you to perform digital input and/or digital output operations on any of the digital I/O sources that are provided by the Device Manager. This is useful for machine vision applications because it allows you to interface to an industrial control, such as a programmable logic controller (PLC).

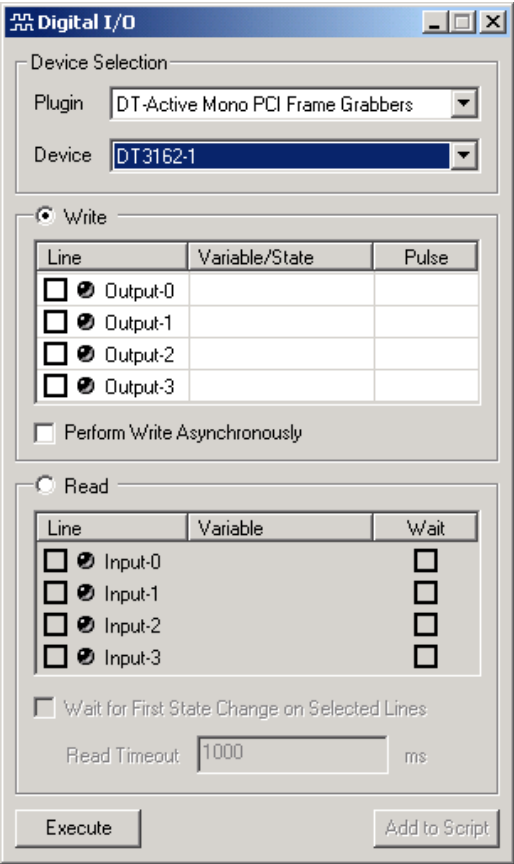


Figure 44: Digital I/O Tool

Notes: Using one instance of the Digital I/O tool, you cannot use both the input lines and the output lines at the same time. If you want to perform input operations and output operations at the same time, use two instances of the Digital I/O tool. Set up one instance of the tool to perform digital input operations; set up the other instance of the tool to perform digital output operations.

This version of the Digital I/O tool supports devices that have WDM device drivers, such as the DT3162 and DT351 boards.


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The Digital I/O tool allows you to perform the following digital output operations:

- Enable or disable a write operation.
- Set an enabled output line to high or to low.
- Generate a high or low square wave pulse (in ms) for an enabled output line.
- Perform all output operations asynchronously or synchronously.

The Digital I/O tool allows you to perform the following digital input operations:

- Enable or disable an input operation.
- Set the activated state of an enabled input line to high or low.
- Perform a wait condition before returning digital input values. You can wait for a read-wait designated input line to change state or you can choose not to wait (just read the input lines and return).

To open a Digital I/O tool, select the  icon from the Input-Output toolbar or select **Digital IO** from the Tools menu.

Notes: The Digital I/O tool is compatible with all other DT Vision Foundry tools. It does not use images or ROIs.

You can open up to 10 Digital I/O tools at a time.

Description of Digital I/O Tool Options

This section contains a description of the options in the Digital I/O tool dialog box.

Device Selection Options

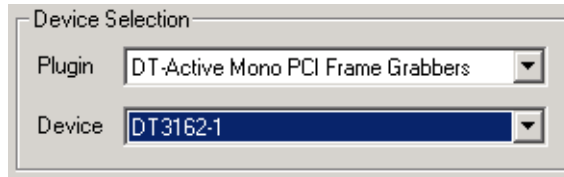


Figure 45: Digital I/O Tool - Device Selection Options

Plugin

This combo box allows you to select a plug-in, such as the DT-Active Mono PCI Frame Grabbers, from a list of plug-ins that are currently loaded in the Device Manager.

Device

When you select a plug-in, the digital I/O devices that are supported by the plug-in are enumerated in this combo box. For example, for the DT-Active Mono PCI Frame Grabbers plug-in, the alias that you specified for the DT3162 board using the DT Imaging Control Panel is listed.

When you select a digital I/O device, a reference to the device is obtained from the Device Manager, and the tool controls are enabled (according to the capabilities of the device) so that you can configure the device for use in a point & click script.

Write Options

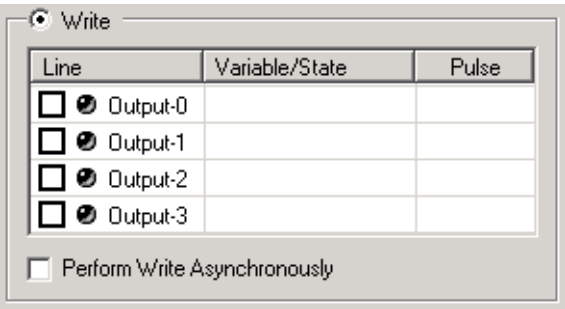


Figure 46: Digital I/O Tool - Write Options

Write Radio Button

When selected, write mode is enabled and the digital output lines that are supported by the device are listed.

Note: When write mode is enabled, read mode is disabled.
Likewise, when read mode is enabled, write mode is disabled.

Line

The output lines that are supported by the selected device are enumerated in the **Line** column. To enable an output line for use in a script, click in the checkbox to the left of the output line name.

Variable/State

The **Variable/State** column allows you to specify the state of each output line as **High Pulse**, as **Low Pulse**, or as the value of a preexisting script number variable.

Pulse

The **Pulse** column allows you to specify the width of the pulse to generate on the output line, in milliseconds. (Note that only one pulse is output on the specified line.) The associated digital output line is set to the specified state for the specified number of milliseconds (rounded to the closest 10 ms) and then set to the opposite state for the same duration. The pulse then stops. A pulse width of 0 forces the line to the state that is specified in the **Variable/State** column.

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Perform Write Asynchronously

Select this checkbox to perform the write operation in asynchronous mode. In asynchronous mode, the Digital I/O tool initiates the write operation and allows script execution to proceed immediately to the next script item.

Clear this checkbox if you want to perform the write operation in synchronous mode. In synchronous mode, the Digital I/O tool waits for the write operation to complete before allowing script execution to continue.

Note: If you are using multiple Digital I/O tools to perform write operations on the same digital I/O device, it is recommended that you do not use asynchronous write operations, since only one tool can write to the same device at a time.

Read Options

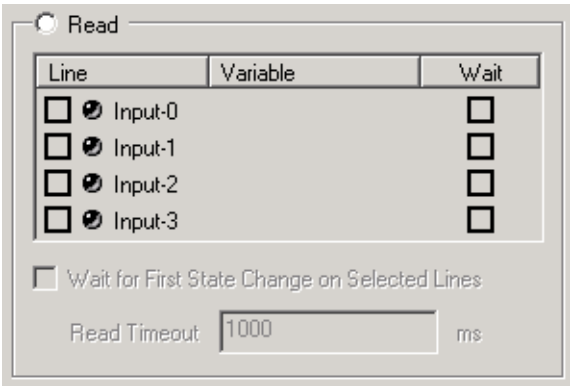


Figure 47: Digital I/O Tool - Read Options

Read Radio Button

When selected, read mode is enabled and the digital input lines that are supported by the device are listed.

Note: When read mode is enabled, write mode is disabled. Likewise, when write mode is enabled, read mode is disabled.

Line

The input lines that are supported by the selected device are enumerated in the **Line** column. To enable an input line for use in a script, click in the checkbox to the left of the input line name.

Variable

The **Variable** column allows you to specify the variable in which the state of an input line is stored once the line has been read. You can select a variable from the list or enter a variable name. Note that you must specify a variable.

Wait

The **Wait** column allows you to select digital input lines to include in a read-wait operation. In a normal read operation, the state of all enabled digital input lines is read immediately when a read is executed (either in a script or by pressing the **Execute** button). In a read-wait operation, the state of the designated read-wait digital input lines is not returned until one of these digital input lines changes state.

Note: This feature is available only if the digital I/O device supports the interrupt-on-change capability.

Wait for First State Change on Selected Lines

Enables or disables read-wait mode for all digital input lines that have checkmarks associated with them in the **Wait** column.

Read Timeout

Specify the timeout value, in milliseconds, to use when the Digital I/O tool is operating in read-wait mode. If the value specified in this box expires before one of the designated read-wait digital input lines changes state, an error is returned.

Main Options

Execute

When the settings for all the lines are configured, click **Execute** to perform the currently configured digital I/O operation. When the selected I/O line goes high, the LED turns green. When the selected I/O line goes low, the LED turns black.

Add to Script

After you click **Execute**, click **Add to Script** to add the current Digital I/O tool configuration to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Note: The **Add to Script** button remains disabled until a single digital I/O operation has been performed successfully.

Example of Using the Digital I/O Tool

This example shows how to use the Digital I/O tool. Note that this example uses a DT3162 board.

The operation is as follows:

1. Open the Digital I/O tool (if it is not already open).
2. For PlugIn, select **DT-Active Mono PCI Frame Grabbers**.
3. For Device, select the alias that you specified for the DT3162 using the DT Imaging Control Panel.
4. Click the **Write** radio button.
5. Click the box to the left of **Output-0**.
6. For **Variable/State**, select **High Pulse**.
7. For **Pulse**, enter a duration of 100 ms.

The Digital I/O tool should now look like the following:

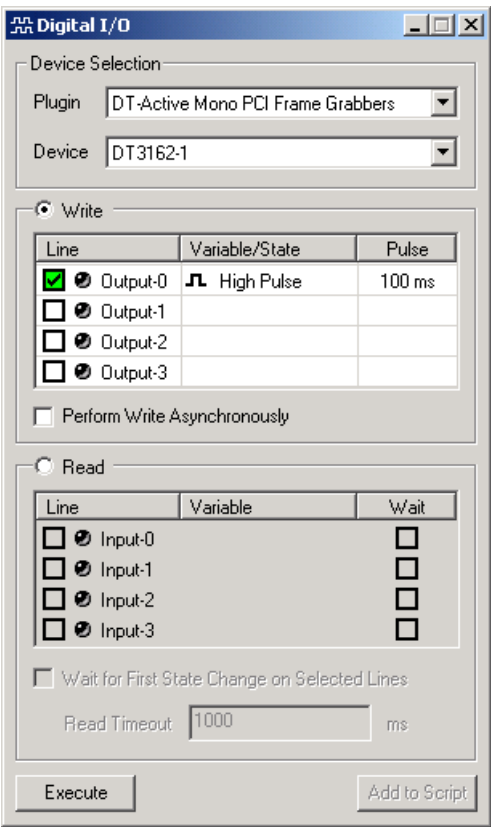


Figure 48: Digital I/O Tool Example

8. Click **Execute**.
- The Digital I/O tool generates a 100 millisecond, high-level square wave pulse from output line 0 on your DT3162 board to your peripheral device. The LED turns green when the output goes high.*

Point & Click Script

This section describes the specific use of the Digital I/O tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Digital I/O tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Digital I/O tool to perform the desired function. Click the **Execute** button to perform the operation, then click the **Add to Script** button to record all the information in the Point & Click Script tool.

12

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Digital I/O tool is set up exactly as it was when you previously recorded the script item. Change the desired options and click **Save** to perform the desired action. The new I/O operation is run with the desired options and the script item and new options are saved to the point & click script.



Using the Display Tool

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Introduction

The Display tool is supplied with DT Vision Foundry. It allows you to specify how to view 8-bit, 16-bit, 32-bit, and floating-point grayscale images.

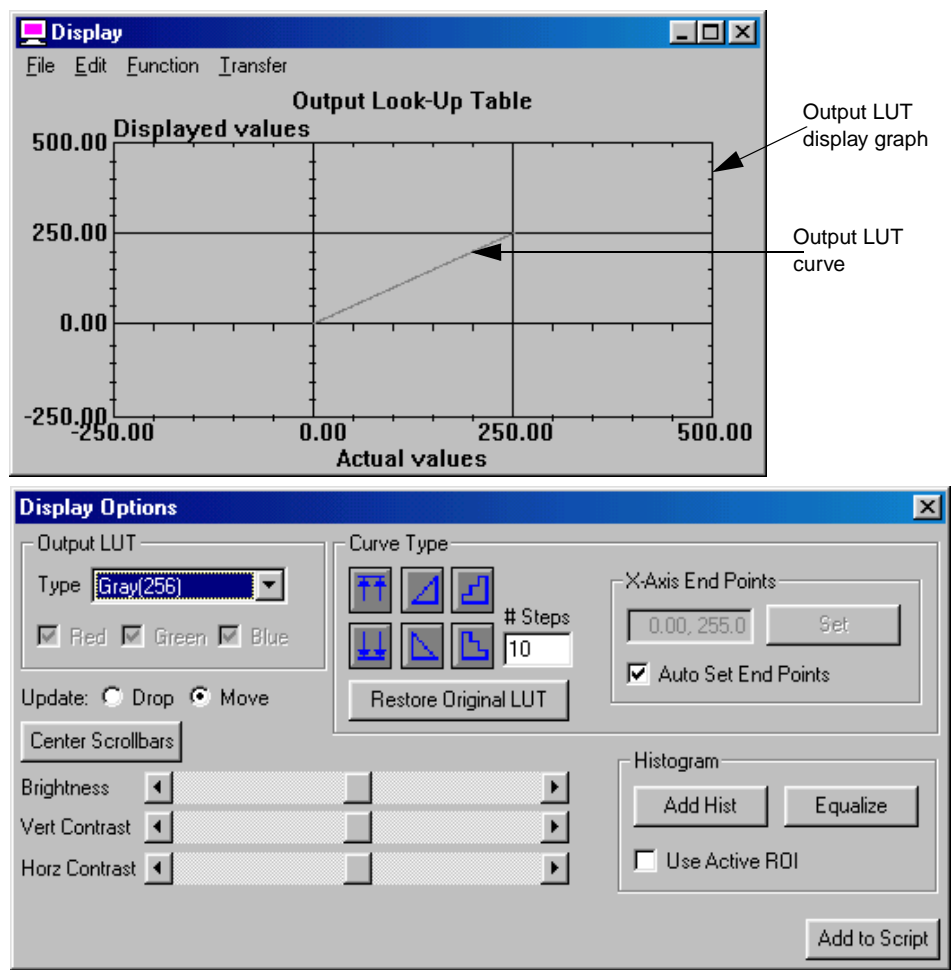


Figure 49: Display Tool


When a grayscale image is displayed, the image is passed through an output look-up table (LUT). The output LUT (also called a color table) specifies how the pixel values are displayed. You view grayscale images using one of five different output LUTs. Select the output LUT in the main application using the **Display | Grayscale Color Mode** menu option.

The Display tool allows you to modify four of the five output LUTs. For more information, refer to [page 249](#). Note that modifying an output LUT does not change the image's data, only how the image is displayed.

The Output Look-Up Table graph, shown on [page 240](#), shows **Actual values** and **Displayed values**. These pixel values are represented on the graph using an output LUT curve. You can select points on the output LUT curve in the following ways:

- **Select a single point** – Click on the point with the left mouse button.
- **Select a continuous group of points** – First, select one of the end points of the group. Then, click on the other end point of the group with the left mouse button while holding down **<Shift>**.
- **Select or deselect another point with other points already selected** – Click on the point with the left mouse button while holding down **<Ctrl>**.

Once selected, you can vertically move the selected points by dragging them with the mouse. You can deselect all points by clicking in any unused area of the graph.

To open a Display tool, select the  icon from the Miscellaneous toolbar or select **Display** from the Tools menu.

Note: The Display tool works with DT Vision Foundry 8-bit grayscale, 16-bit grayscale, 32-bit grayscale, and floating-point grayscale images and with all types of ROIs.

You can have up to 100 Display tools open at the same time.

Description of Display Tool Options

This section contains a description of the options in the Display tool dialog boxes.

File Menu Options

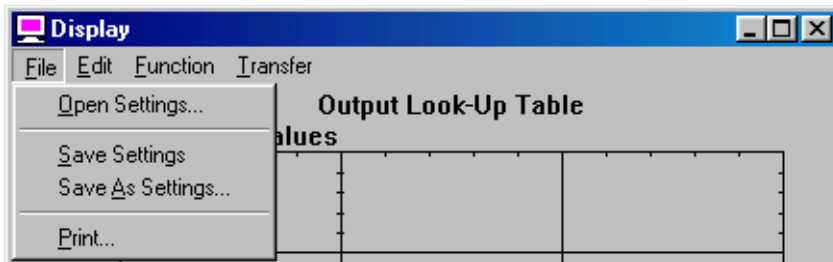


Figure 50: Display Tool - File Menu

Open Settings

Select this option to open a graph configuration from disk. An Open dialog box is displayed. When you open a file (the name must be followed by the extension .dpl), the settings are loaded into the Display tool.

Note that a graph configuration includes x-axis limits, y-axis limits, graph text, and grid markings.

Save Settings

Select this option to save a graph configuration back to disk. The Display tool saves x-axis limits, y-axis limits, graph text, and grid markings.

Save As Settings...

Select this option to save a graph configuration to disk with a different name. A Save As dialog box is displayed. Select the directory and enter the file name with the extension .dpl.

Note that if you save a graph configuration with the name default.dpl, the file will automatically open each time you open a Display tool. You must save default.dpl in the DT_Displ directory (located in C:\Program Files\Data Translation\DT Vision Foundry\Tools, by default).

Print

Select this option to print the graph.

Edit Menu Options

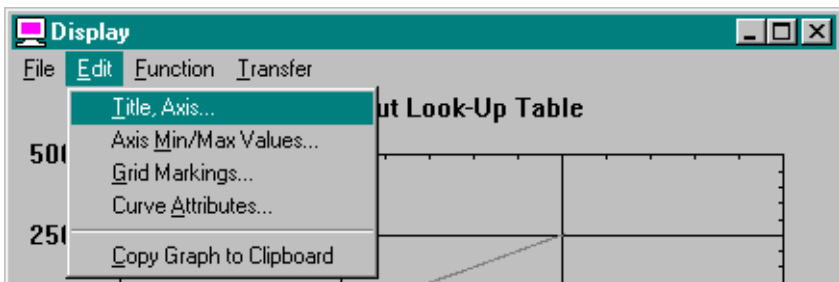


Figure 51: Display Tool - Edit Menu

Title, Axis...

Select this option to change the graph text for the title, x-axis, and y-axis. Enter the appropriate values in the Set Title, X & Y Labels dialog box, then click **OK**.

Axis Min/Max Values...

Select this option to change the minimum and maximum limits for the x-axis and y-axis. Enter the appropriate values in the Axis Min/Max Values dialog box, then click **OK**.

You can also set the minimum and maximum values for the graph by performing the following steps:

1. Move the mouse cursor to the point in the graph at which you want to start drawing the rectangular region.
2. While holding down **<Shift>** and **<Ctrl>** at the same time, click and hold down the left mouse button.
3. Drag the mouse until you complete the rectangular region. While dragging the mouse, the proposed zooming region is shown on the graph.
4. When you have completed the rectangular region, release the left mouse button. The graph now zooms to the desired minimum and maximum axis points.

You can switch back and forth between zoomed and unzoomed modes by double-clicking in the graph with the right mouse button.

Grid Markings...

Select this option to change the grid markings for the x-axis and y-axis. Enter the appropriate values in the Grid Markings dialog box, then click **OK**.

Curve Attributes...

Select this option to change the style and color of the curve selected in the display graph. Click the appropriate radio buttons in the Curve Attributes dialog box, then click **OK**.

Copy Graph to Clipboard

Select this option to copy the display graph of the output LUT to the clipboard.

Function Menu Options

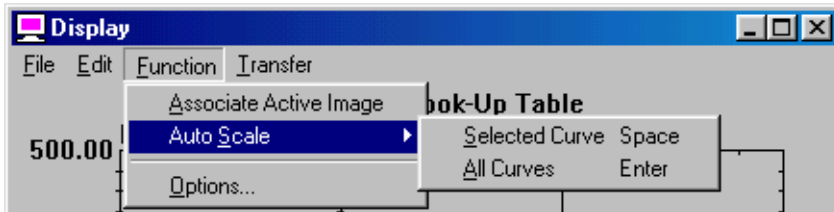


Figure 52: Display Tool - Function Menu

Associate Active Image

Select this option to associate an image with the Display tool. This is required if you want to change the image's output LUT. Note that the active image is automatically associated with the Display tool when you select an output LUT using the **Output LUT Type** option in the Display Options dialog box. For more information, refer to [page 249](#).

Auto Scale

The Auto Scale option allows you to select one of the following options to determine how to scale the x-axis and y-axis:

- **Selected Curve** – Select this option to automatically scale the x-axis and y-axis to best fit the selected curve on the graph.
- **All Curves** – Select this option to automatically scale the x-axis and y-axis to best fit all curves on the graph.

Options

Select this option to open the Display Options dialog box. For more information, refer to [page 249](#).

Transfer Menu Options

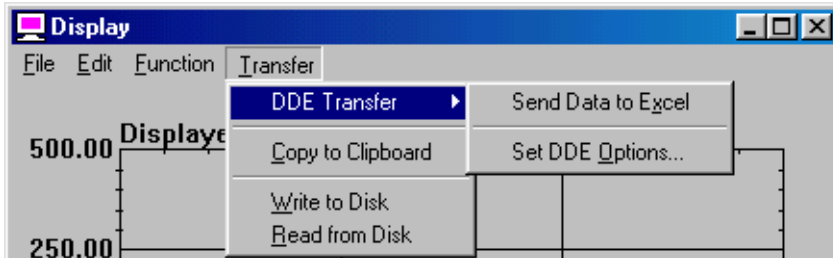


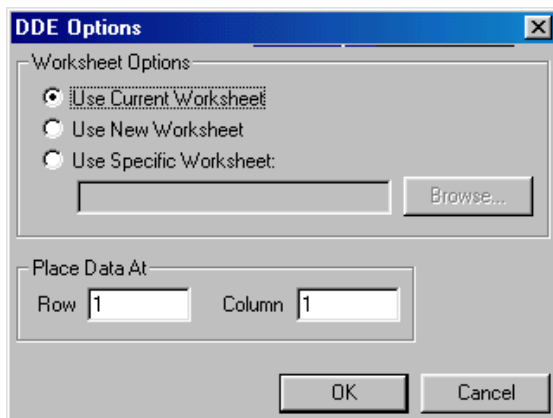
Figure 53: Display Tool - Transfer Menu

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DDE Transfer

The DDE Transfer option allows you to select the following options for sending output LUT settings to the spreadsheet program Excel:

- **Send Data to Excel** – Select this option to send all the current output LUT settings to Excel. Excel automatically opens and loads the data. When the data is loaded into Excel, you can display the data in any supported format, such as charts, graphs, and spreadsheets.
- **Set DDE Options...** – Select this option to open the DDE Options dialog box.



Click the appropriate radio button to specify the Excel worksheet you want to use. You can browse for a specific worksheet or enter the name manually. You can place your data at a specific row and/or column in the specified worksheet. When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the DDE Options dialog box without saving your changes.

Note that DT Vision Foundry assumes that you are using the English-language version of Excel. If you are using a different version of Excel, you must update the DTVF.DEF file to indicate the language you are using. For more information, refer to [page 55](#).

Note that you cannot use the Export tool to send output LUT settings from DT Vision Foundry to Excel.

Copy to Clipboard

Select this option to copy all output LUT settings to the clipboard. You can then paste from the clipboard to any supported program, such as Word or Notepad.

Write to Disk

Select this option to write (save) the selected output LUT settings to disk. A Save As dialog box is displayed. Select the appropriate directory and enter the file name, then click **Save**.

Read from Disk

Select this option to read (open) the previously saved output LUT settings from disk. An Open dialog box is displayed. When you select the appropriate file, the output LUT settings are restored to the associated image.

Display Options Dialog Box Options

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Output LUT Type

Select the output LUT that you want to modify. You can modify the following output LUTs:

- **RGB (256)** – This output LUT is used to produce false coloring of a grayscale image. The grayscale is divided into red, green, and blue planes. Select the box(es) to indicate which color planes you want to update. The Display tool places up to three output LUT curves on the graph, one to represent each color plane.

Note that if any points are selected on any of the curves, the selected points are modified, overriding this selection.

This selection corresponds to the **Display | Grayscale Color Mode | Use False Coloring** option in the main application.

- **Gray (256)** – This output LUT provides 256 grayscale values to map to your image's data. For an 8-bit grayscale image, this corresponds to a 1 to 1 ratio. This means that for each pixel value, you have one grayscale display color.

- **Gray (128)** – This output LUT provides 128 grayscale values to map to your image's data. For an 8-bit grayscale image, this corresponds to a 2 to 1 ratio. This means that for every two pixel values, you have one grayscale display color.
- **Gray (064)** – This output LUT provides 64 grayscale values to map to your image's data. For an 8-bit grayscale image, this corresponds to a 4 to 1 ratio. This means that for every four pixel values, you have one grayscale display color.

For 32-bit grayscale and floating-point grayscale images, the image's data is linearly mapped into the output LUT. For example, assume that you have a 32-bit grayscale image with a minimum pixel value of -237 and a maximum pixel value of 1000. With the highest resolution LUT (Gray (256)), you still have only 256 colors to display all the pixel values. In this case, DT Vision Foundry displays the pixel with the closest color in the selected output LUT corresponding to the pixel's value. It does so based on a linear interpolation of output LUT points.

After you select the output LUT that you want to modify, the Display tool associates the image in the active viewport and displays the image with the output LUT you selected. It then displays the output LUT curve on the graph for you to modify. Note that this also resets the scrollbars for the brightness, vertical contrast, and horizontal contrast controls. You can select the same or a different type of output LUT as many times as you want.

Update

Select **Move** if you want the image redrawn while you are dragging selected points with the mouse. Select **Drop** if you want the image redrawn when you stop dragging the mouse.

When modifying the curve using the controls in the Display Options dialog box, you update the image only if this option is set to **Move**. You can, however, set the option to **Drop**, update the curve, and then reset the option to **Move**. You may want to use this technique if you have a very slow video board.

Center Scrollbars

Click this button to center the scrollbars, allowing you to continue increasing or decreasing the **Brightness**, **Vertical Contrast**, and **Horizontal Contrast** adjustment limits. Note that this does not restore your image's original output LUT.

Brightness

Use this slider control to adjust the brightness of the image. This control moves points on the curve in a vertical direction. If you have selected points on the curve, only the selected points are affected. If no points on the curve are selected, the entire curve is affected. If the curve represents an RGB (256) output LUT, you must select the curves to modify by checking the **Red**, **Green**, and/or **Blue** boxes in the **Output LUT Type** option. Note that if the scrollbar is at either of its limits and you want to increase or decrease the brightness, you can click **Center Scrollbars** and continue to make your adjustments. You can also use the buttons on each end of the scrollbar.

Vertical Contrast



Use this slider control to adjust the vertical contrast of the image. If you have selected points on the curve, only the selected points are affected. If no points on the curve are selected, the entire curve is affected. If the curve represents an RGB (256) output LUT, you must select the curves to modify by checking the **Red**, **Green**, and/or **Blue** boxes in the **Output LUT Type** option. Note that if the scrollbar is at either of its limits and you want to increase or decrease the vertical contrast, you can click **Center Scrollbars** and continue to make your adjustments. You can also use the buttons on each end of the scrollbar.





Horizontal Contrast

Use this slider control to adjust the horizontal contrast of the image. This control moves the points on the curve in a horizontal direction. The entire curve is always used for this control. Make sure that you do not have any points selected when using this control. If the curve represents an RGB (256) output LUT, you must select the curves to modify by checking the **Red**, **Green**, and/or **Blue** boxes in the **Output LUT Type** option. If the scrollbar is at either of its limits and you want to increase or decrease the horizontal contrast, you can click **Center Scrollbars** and continue to make your adjustments. You can also use the buttons on each end of the scrollbar.

Curve Type

This option allows you to select one of the curve types shown in the following table. If the curve represents an RGB (256) output LUT, you must select the curves to modify by checking the **Red**, **Green**, and/or **Blue** boxes in the **Output LUT Type** option.

Curve Type	Description
	Sets points to the highest point. If a curve has selected points, all selected points are set to the value of the highest selected point. If a curve has no selected points, all points in the curve are set to the value of the highest point in the curve.
	Sets points to the lowest point. If a curve has selected points, all selected points are set to the value of the lowest selected point. If a curve has no selected points, all points in the curve are set to the value of the lowest point in the curve.

Curve Type	Description
	Linearly redistributes points from lowest point to highest point. If a curve has selected points, all selected points are redistributed based on the selected points. If a curve has no selected points, all points in the curve are redistributed based on all points in the curve.
	Linearly redistributes points from highest point to lowest point. If a curve has selected points, all selected points are redistributed based on the selected points. If a curve has no selected points, all points in the curve are redistributed based on all points in the curve.
	Linearly redistributes points from lowest point to highest point in step fashion. If a curve has selected points, all selected points are redistributed based on the selected points. If a curve has no selected points, all points in the curve are redistributed based on all points in the curve. Specify the number of steps in the # Steps text box.
	Linearly redistributes points from highest point to lowest point in step fashion. If a curve has selected points, all selected points are redistributed based on the selected points. If a curve has no selected points, all points in the curve are redistributed based on all points in the curve. Specify the number of steps in the # Steps text box.

Restore Original LUT

Click this button to restore the image's original output LUT. This is useful when your image becomes lost or distorted due to over-adjusting.

X-Axis End Points

This option is valid for 32-bit and floating-point grayscale images only.

Select the **Auto Set End Points** checkbox if you want to automatically map all pixel values contained in an image to a value between 0 and 255 for display. For example, if you open an image with pixel values between 0 and 255, the image is displayed as a normal image. If you then change some of the pixels to a value of 1003 and other pixels to a value of -49, the image automatically linearly adjusts all its output LUTs to best show the entire range of pixel values.

Clear the **Auto Set End Points** checkbox if you want to manually specify the maximum and minimum pixel values. For example, assume that you only want to see pixels with a value between 100 and 380. Enter the minimum and maximum values in the text box (in the format *LowLimit, HighLimit*), then click the **Set** button. The image will best display pixels between 100 and 380. Any pixels having a value of 100 or less will show up as black; any pixels having a value of 380 or more will show up as white.

Histogram Options

Click the **Add Hist** button to add a histogram of the attached image to the graph. This is useful in giving you an idea of how to best modify the selected output LUT. Select the **Use Active ROI** checkbox to create the histogram from the active ROI in the attached image. Clear the **Use Active ROI** checkbox to create the histogram from the entire image.

After you have added a histogram, click the **Equalize** button to perform a histogram equalization on the image (show the image in the best possible manner).

For example, to best see a specific portion of an image (defined by a ROI), you could do the following:

1. Create and activate an ROI describing the region.
2. Add a histogram to the graph by clicking **Add Hist** (make sure that the **Use Active ROI** checkbox is selected).
3. Equalize the image by clicking **Equalize**.

You can repeat this procedure as many times as desired with other active ROIs.

Add to Script

Click this button to add the current output LUT settings to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the Display Tool

This example shows how to use the Display tool to increase the vertical contrast of the image Mixpoll, shown in [Figure 54](#). A histogram equalization is also performed on the image with respect to the active ROI A.

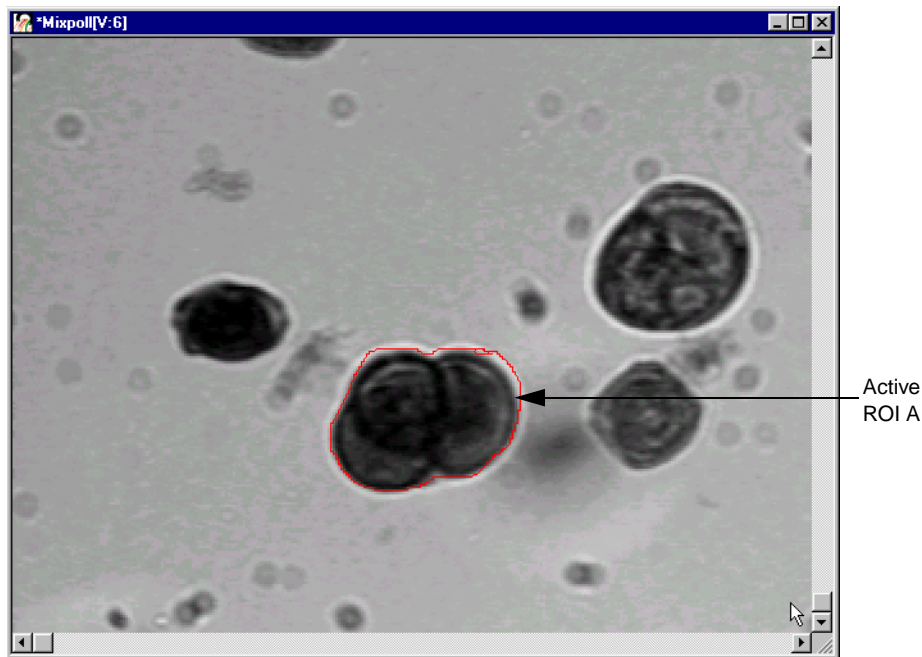
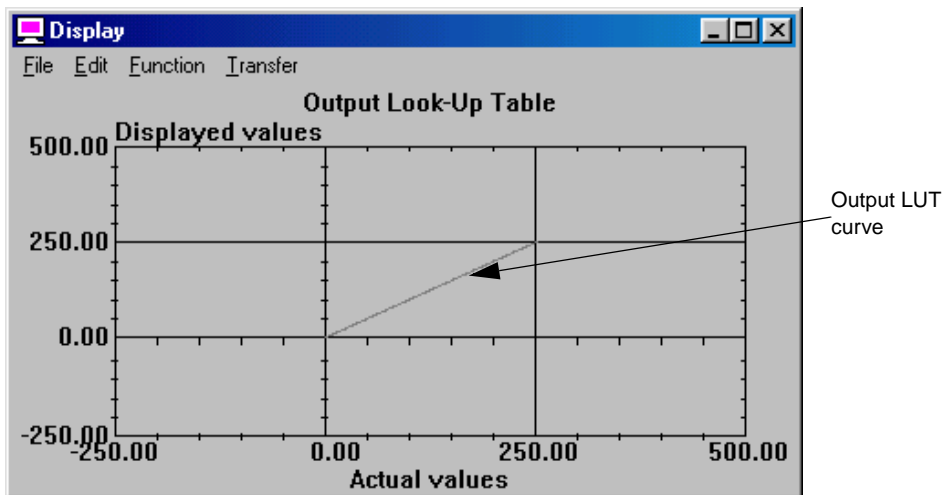


Figure 54: Display Tool Example Image

The operation is as follows:

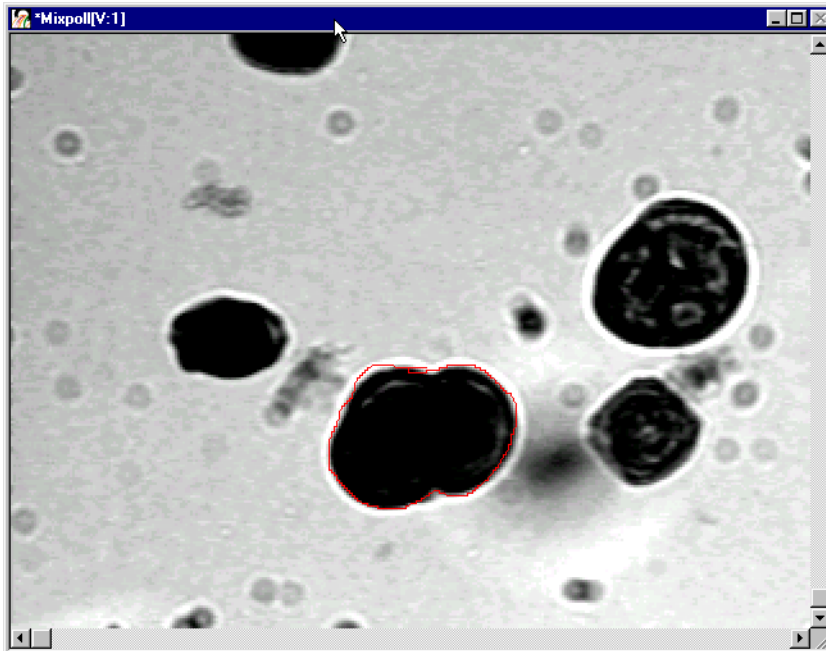
1. Activate the image Mixpoll by clicking in it with the left mouse button.
2. Activate ROI A (red) by clicking in it with the right mouse button. You can create ROI A by using the Blob Analysis tool or by drawing a freehand ROI around the particle.
3. Open a Display tool (if one is not already open). Note that both the output LUT display graph and the Display Options dialog box open.
4. Associate the image Mixpoll (now the active image) by either selecting **Gray (256)** from the **Output LUT Type** drop-down list or selecting the **Function | Associate Active Image** menu option.
5. Click the **Update: Move** radio button to see all changes to the output LUT and the image.

The output LUT display graph looks as follows:

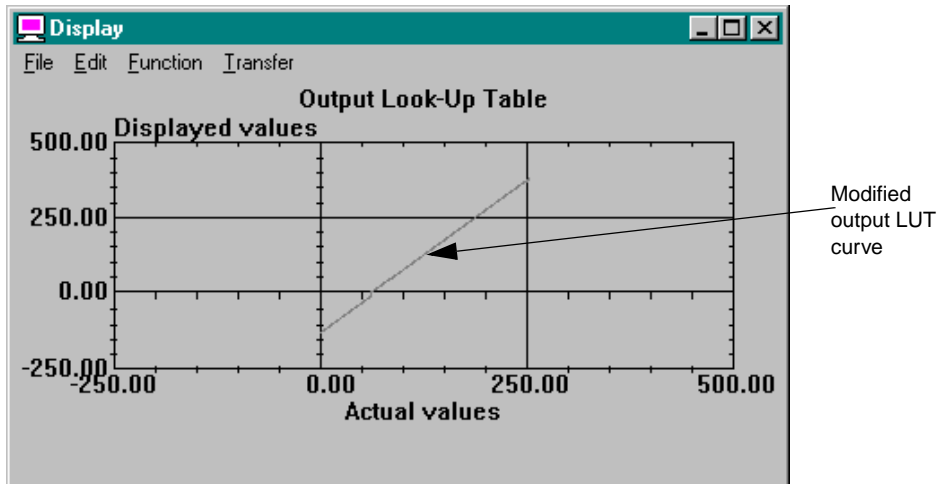


6. Click the **Vert Contrast** scrollbar and drag it to its right-most limit. While doing this, notice that the output LUT curve and the image are updated. You can also use the arrow buttons on each end of the scrollbar to make your adjustments.

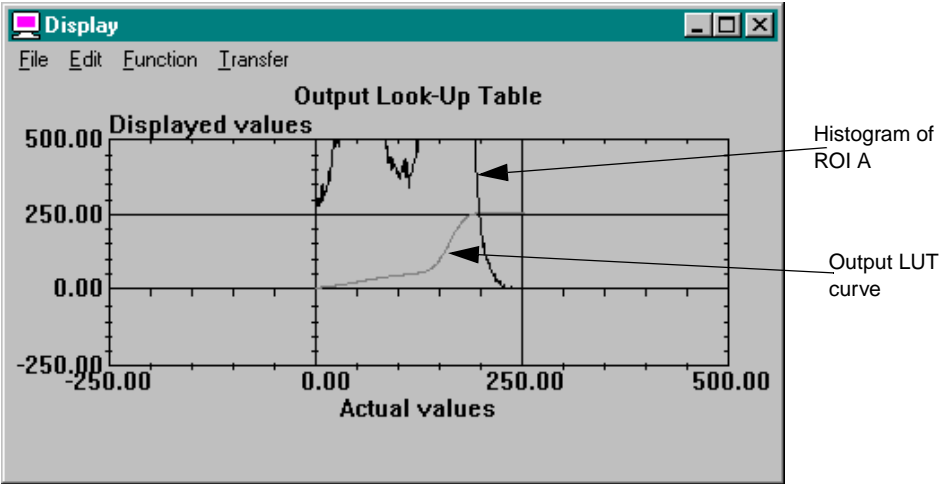
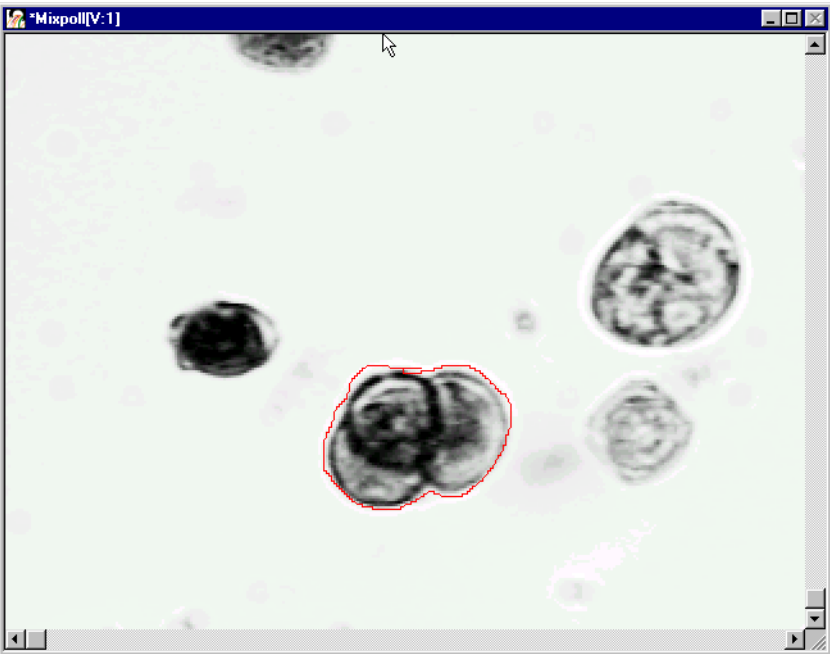
The image has been sharpened by increasing its contrast, as follows.



In addition, the output LUT display graph shows that you have modified the actual pixel values and the displayed pixel values, as follows.



7. Click **Restore Original LUT** to restore the original image's output LUT.
8. Select the **Use Active ROI** checkbox, then click **Add Hist** to add a histogram of ROI A to the Display tool's graph.
9. Click **Equalize** to show the image in the best possible manner.
*The image Mixpoll and the output LUT display graph look as follows.
 Note that you can see inside the area outlined by the ROI with much more detail than before.*



Point & Click Script

This section describes the specific use of the Display tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Display tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, use all the options in the Display tool to set up the desired output LUT. When the image is displayed as desired, click **Add to Script**. The desired settings are recorded in the Point & Click Script tool.

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Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Display tool's output LUT is set up exactly as it was when you previously recorded the script item. The **Add to Script** button changes to a **Update Script** button, indicating that you are editing a point & click script item. Use all the options in the Display tool to set up the new output LUT, then click **Update Script**. The script item is saved back to the point & click script with the new settings.



Using the Edge Finder Tool

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Introduction

The Edge Finder tool is supplied with DT Vision Foundry. It allows you to extract points, edges, or contours from a binary image.

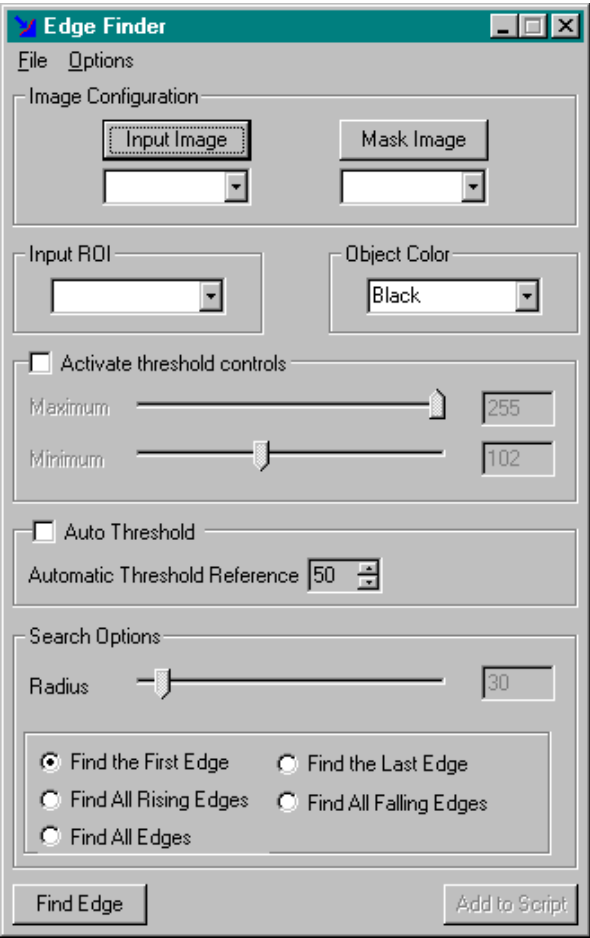


Figure 55: Edge Finder Tool

You start by drawing one of the following:

- A line, ellipse, polyline, freehand line, poly freehand, or freehand ROI that goes through the desired point or edge.
- A rectangle ROI that encloses the desired contour.

From a user-drawn line, ellipse, polyline, freehand line, poly freehand, or freehand ROI, the Edge Finder tool generates one or more point ROIs, freehand line ROIs, or freehand ROIs. From a user-drawn rectangle ROI, the Edge Finder tool generates the largest freehand ROI.

Note: The Edge Finder tool can generate a freehand ROI faster from a line, ellipse, polyline, freehand line, poly freehand, or freehand ROI than from a rectangle ROI.

The tool finds edges that are within the object (black or white), at the transition from black to white or from white to black. [Figure 56](#) illustrates the differences between edges found for black objects and edges found for white objects. Note that for a rectangle ROI, the found edge is not directly on/under the ROI.

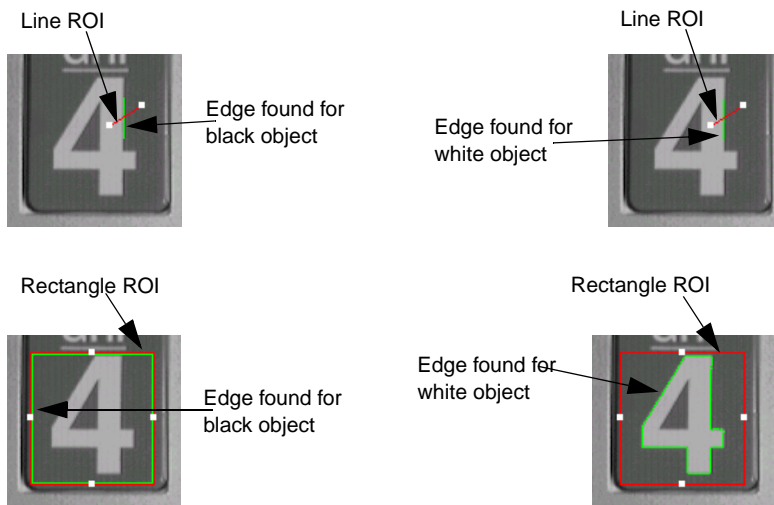



Figure 56: Found Edges

After you find an edge, you can use the generated ROI to perform measurement operations using the Gauge tool. For example, you can measure the area or perimeter of a generated freehand ROI or the x and y coordinates of a point ROI. For more information, refer to [Chapter 18, “Using the Gauge Tool.”](#)

To open an Edge Finder tool, select the  icon from the Gauging toolbar or select **Edge Finder** from the Tools menu.

Notes: The Edge Finder tool is fully compatible with all tools. The input image can be any image type. The mask image must be a binary image. The Edge Finder tool can create a binary mask image either by using built-in thresholding (see [page 273](#)) or by using automatic thresholding (see [page 273](#)). You can also create a binary image using the Threshold tool. For more information, refer to [Chapter 39, “Using the Threshold Tool.”](#) The input ROI can be a rectangle, line, ellipse, polyline, freehand line, poly freehand, or freehand ROI. Point ROIs are not supported.

You can have up to 100 Edge Finder tools open at the same time.

Description of Edge Finder Tool Options

This section contains a description of the options in the Edge Finder tool dialog box.

File Menu Options

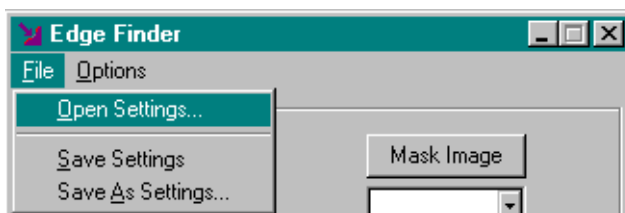


Figure 57: Edge Finder Tool - File Menu

Open Settings...

Select this option to restore Edge Finder tool settings that you previously saved to disk. An Open dialog box is displayed. When you open a file (the name must be followed by the extension .efs), the settings are loaded into the Edge Finder tool.

Save Settings

Select this option to save Edge Finder tool settings back to disk.

Save As Settings...

Select this option to save Edge Finder tool settings to disk with a different name. A Save As dialog box is displayed. Select the directory and enter the file name with the extension .efs.

Note that if you save a settings file with the name default.efs, the file will automatically open each time you open an Edge Finder tool. You must save default.efs in the DT_EdgeFind directory (located in C:\Program Files\Data Translation\DT Vision Foundry\Tools, by default).

Options Menu Options

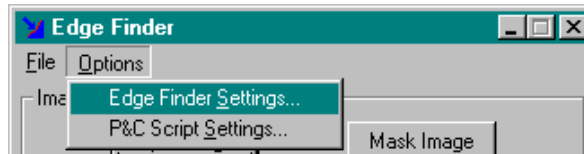
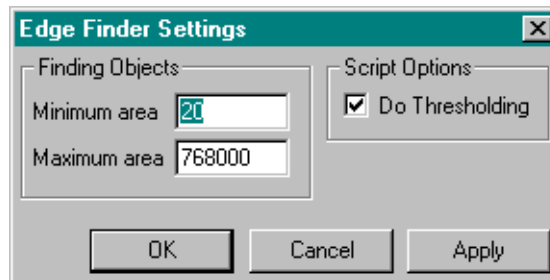


Figure 58: Edge Finder Tool - Options Menu

Edge Finder Settings...

Select this option to open the Edge Finder Settings dialog box. Note that the settings in this dialog box are applicable to rectangle user-drawn ROIs only.



In the **Finding Objects** frame, specify the size of objects for which you want to generate ROIs, in pixels. This is useful if you are forced to enclose more than one object in the user-drawn rectangle ROI.

If the total number of pixels in an object is fewer than the value specified in the **Minimum area** text box, the tool does not generate an ROI for the object. If the total number of pixels in an object is greater than the value specified in the **Maximum area** text box, the tool does not generate an ROI for the object. The values of **Minimum area** and **Maximum area** must be greater than or equal to 4 pixels.

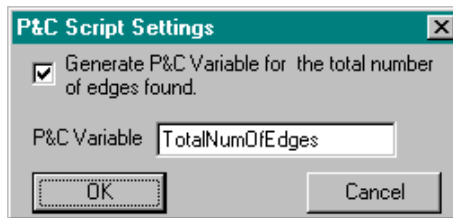
Select the **Do Thresholding** checkbox if you want to perform thresholding during point & click scripting. Clear this checkbox if you do not want to perform thresholding during point & click scripting. For more information about point & click scripting, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Note that if you can use the same mask image (the same threshold limits) for each **Find** operation you perform, you can improve performance by clearing this checkbox after the first operation. All subsequent operations use the mask image specified for the first operation.

When you are finished, click **Apply** to save the settings without closing the dialog box. Click **OK** to save the settings and close the dialog box. Click **Cancel** to close the dialog box without saving your changes.

P&C Script Settings...

Select this option to open the P&C Script Settings dialog box.



Select the checkbox if you want the Edge Finder tool to put the total number of edges found into the specified point & click scripting variable. By default, the name of the scripting variable is TotalNumOfEdges. You can change the name by entering a new name in the text box.

Main Dialog Box Options

Input Image

Click this button to load the image in the active viewport as the input image. The input image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Mask Image

Click this button to load the image in the active viewport as the binary mask image. Use this button only if you created a binary mask image using the Threshold tool. For more information, refer to [Chapter 39, "Using the Threshold Tool."](#) The mask image name is shown in the Mask Image display window. You can also select the mask image from the list of images currently residing in system memory.

If you do not require the advanced features of the Threshold tool, you can let the Edge Finder tool threshold the input image and create a binary mask image using either built-in thresholding (see [page 273](#)) or automatic thresholding ([page 273](#)). After you perform the **Find Edge** operation, the mask image name (in the format *ImageName.msk:x*) is shown in the Mask Image display window and you can select the mask image from the Mask Image display window drop-down list.

To view a mask image that is created by the Edge Finder tool, use the Image Manager tool. If you double-click the name of the mask image in the list of images in memory, the tool places the mask image in the active viewport. For more information, refer to [Chapter 21, “Using the Image Manager Tool.”](#)

Input ROI

Select the ROI that you want to use to generate edges/points/contours. The drop-down list contains all line, rectangle, ellipse, polyline, freehand line, poly freehand, and freehand ROIs in your image.

Note that point ROIs are not supported.

Object Color

Select **Black** if you want to generate ROIs within the black pixels in the point/edge/contour of the user-drawn ROI in the binary mask image. Select **White** if you want to generate ROIs within the white pixels in the point/edge/contour of the user-drawn ROI in the binary mask image.

Note that if you adjusted the threshold limits, black pixels in the input image are displayed as magenta.

Activate Threshold Controls

By default, the Edge Finder tool uses built-in thresholding to threshold the input image and create a binary mask image using the threshold limits shown in the **Maximum** and **Minimum** text boxes. If you want to change the threshold limits, select the **Activate Thresholding Controls** checkbox. Then, use the **Maximum** and **Minimum** slider controls to adjust the upper and lower limits. You can also enter the limits manually and use the arrow keys to fine-tune the values.

Note that when you adjust the threshold limits, the black pixels in the input image are displayed as magenta.

Note that you can perform either built-in thresholding or automatic thresholding. If you select the **Activate Thresholding Controls** checkbox, the **Auto Threshold** checkbox is grayed out.

Auto Threshold

Select the **Auto Threshold** checkbox if you want to perform automatic thresholding. Clear the checkbox if you do not want to perform automatic thresholding.

If automatic thresholding is enabled, select a reference value from the **Automatic Threshold Reference** spin box. The value can range from 0 to 100%. By default, the reference value is 50%.

The tool uses the difference between the minimum and maximum grayscale values in the selected ROI to automatically threshold the image. If you do not get the results that you expect, try a different value.

If automatic thresholding is enabled, you can select the **Invert Output** checkbox to invert the output binary image. The foreground pixels are output as background pixels and the background pixels are output as foreground pixels.

Note that automatic thresholding is not appropriate for all images. It is intended for images with sufficient contrast between the background and the object. If automatic thresholding does not produce the results you expect, try built-in thresholding (see [page 273](#)), or use the Threshold tool to create a binary image. For more information, refer to [Chapter 39, “Using the Threshold Tool.”](#)

Note that you can perform either automatic thresholding or built-in thresholding. If you select the **Auto Threshold** checkbox, the **Activate Thresholding Controls** checkbox is grayed out.

Search Options

The **Search Options** are available for user-drawn line, ellipse, polyline, freehand line, poly freehand, and freehand ROIs only.

Use the **Radius** slider control to specify the number of pixels on either side of the user-drawn ROI to include in the generated ROIs. You can also enter the number of pixels manually or use the arrow keys on your keyboard to fine-tune the value.

The pixels are added to each side of the user-drawn ROI along the edge of the object. For example, if you enter a value of 5, each generated ROI is a freehand line along the edge of the object that is 11 pixels long $((2 \times \text{Search Radius}) + 1)$.

If **Radius** is equal to 0, the tool generates point ROIs. If **Radius** is not equal to 0, but is less than the total number of pixels in the edge of the object, the tool generates freehand line ROIs. If **Radius** is greater than the total number of pixels in the edge of the object, the tool generates freehand ROIs.

Click one of the following radio buttons to specify how many edges to find:

- **Find the First Edge** – The tool finds the leftmost edge only.
- **Find the Last Edge** – The tool finds the rightmost edge only.
- **Find All Rising Edges** – The tool finds rising edges only (transitions from black (0) to white (255)).
- **Find All Falling Edges** – The tool finds falling edges only (transitions from white (255) to black (0)).
- **Find All Edges** – The tool finds all edges.

Find Edge

When all the settings are correct, click this button to generate ROIs for the active user-drawn ROI. For a user-drawn line, ellipse, polyline, freehand line, poly freehand, or freehand ROI, the tool generates one or more point, freehand line, or freehand ROIs. For a user-drawn rectangle ROI, the tool generates the largest freehand ROI. A generated ROI has the same name as the user-drawn ROI with the prefix EF. added. If the tool generated multiple edges, the suffix *n_nn* is also added, where *n* represents the number of the user-drawn ROI and *nn* represents the number of the generated ROI. For example, if you generate four ROIs from the line ROI named Line.1, the generated ROIs are named EF.Line.1_0, EF.Line.1_1, EF.Line.1_2, and EF.Line.1_3.

Note that the Edge Finder tool finds edges that are within the object (black or white), at the transition from black to white or from white to black. For a rectangle ROI, the found edge is not directly on/under the ROI. For more information, refer to [Figure 56](#) on [page 266](#).

If the tool does not return the results that you expect, adjust the options, then click **Find Edge** again.

Add to Script

After you generate the ROI, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the Edge Finder Tool

This example shows how to generate a freehand line ROI along the edges of an object in the image Washer, shown in [Figure 59](#).

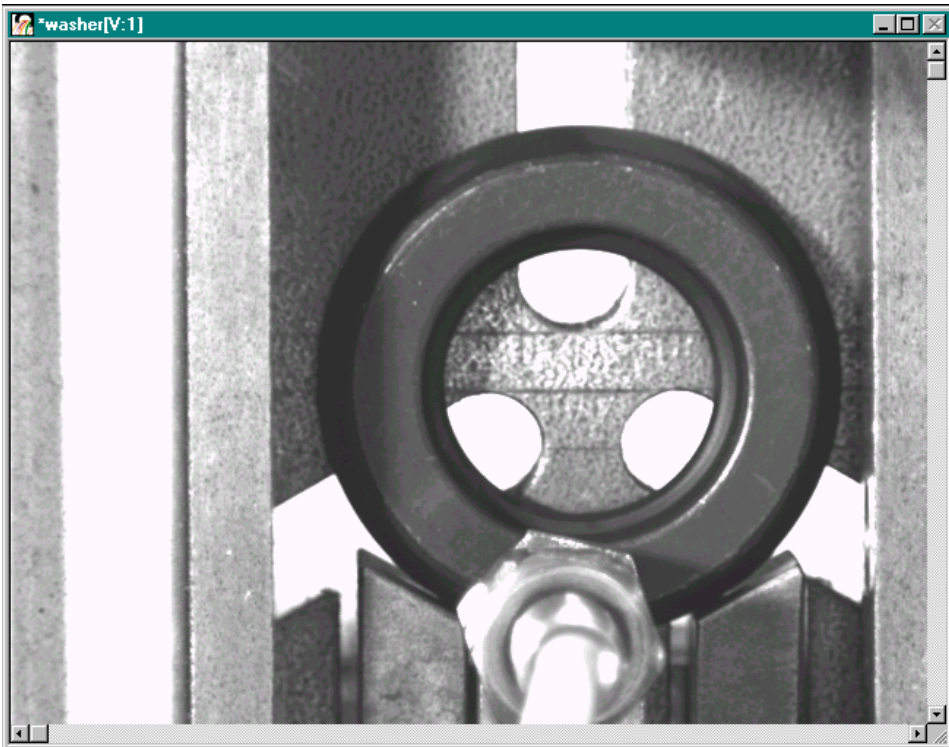


Figure 59: Edge Finder Tool Example Image

The operation is as follows:

1. Open the image Washer.
2. Open an Edge Finder tool (if one is not already open).
3. Click in the viewport on the image Washer with the left mouse button. Washer is now the active viewport and is denoted with an asterisk, as show in [Figure 59](#). Click **Input Image** to load Washer as the input image.
4. Select the **Activate threshold controls** checkbox and then adjust the **Maximum** and **Minimum** slider controls until the transition from black (magenta) to white occurs on the outside edge of the washer. Note that you can also highlight the transition by using automatic thresholding or by creating a binary image with the Threshold tool. For more information, refer to [Chapter 39, “Using the Threshold Tool.”](#)
5. Draw a line ROI across the outside edge of the washer.
*The image looks as follows. The ROI is active (red) and the name of the ROI is displayed in the **Input ROI** text box (Line.1).*



6. Enter **10** in the **Radius** text box to generate a freehand line ROI that is 21 pixels long.
7. Select the **Find the First Edge** radio button.
8. Make sure that the line ROI is still activated (red). If not, click on it with the right mouse button. Note that you can also activate the line ROI by selecting it from the **Input ROI** drop-down list or by using the <**Tab**> key.
9. Click **Find Edge** to extract the edge and generate a freehand line ROI named EF.Line.1.

Point & Click Script

This section describes the specific use of the Edge Finder tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add an Edge Finder tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Edge Finder tool to perform the desired function. This includes the input image and search radius. If you want your thresholding operations to be included in the point & click script, select the **Do Thresholding** checkbox in the Edge Finder Settings dialog box. Click **Find Edge** to perform the desired action, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Note that any input ROIs created for use by the Edge Finder tool are also stored in the point & click script.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Edge Finder tool is set up exactly as it was when you previously recorded the script item. This includes the input image and search radius. The **Add to Script** button is changed to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.

Note that any ROIs required by the Edge Finder tool are recreated, if necessary.



Using the Export Tool

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Introduction

The Export tool is supplied with DT Vision Foundry. It allows you to transfer variables and images from DT Vision Foundry to either the DTiX Variable Server, the DTiX Image Server, a text file, or a Microsoft Excel worksheet.

The DTiX Variable Server and DTiX Image Server are installed when you install DT Vision Foundry. They hold data (variables and images) and provide access to that data to a client application, such as a Visual Basic program or another instance of DT Vision Foundry. The client application accesses the data by using the DTiX Variable Server tools or DTiX Image Server tools. For more information, refer to the online help included with the tools. The online help is located in C:\Program Files\Data Translation\DTiX, by default.

To open an Export tool, select the  icon from the Input-Output toolbar or select **Export** from the Tools menu.

Notes: The Export tool is compatible with all tools and image types. Only line and rectangle ROIs are supported.

You can have up to 100 Export tools open at the same time.

Description of Export Tool Options

This section contains a description of the options in the Export tool dialog box.

Variables Tab Options

The Variables tab allows you to transfer variables from DT Vision Foundry to either the DTiX Variable Server, a text file, or a Microsoft Excel worksheet.

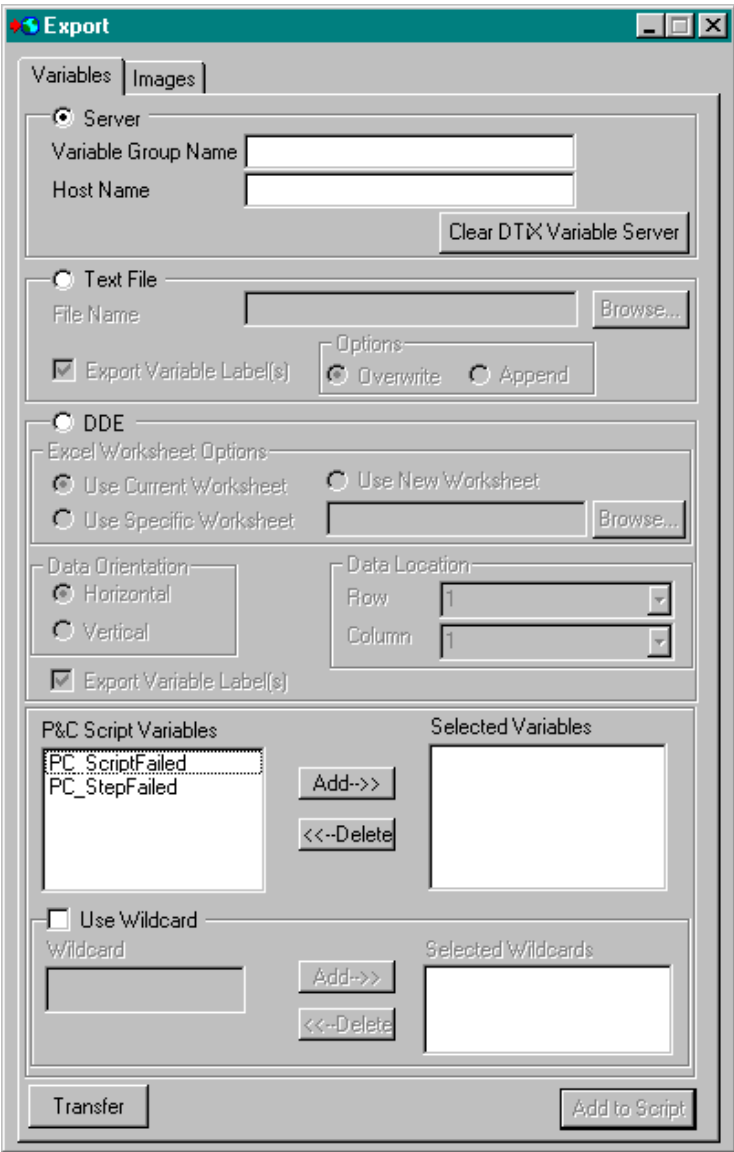


Figure 60: Export Tool - Variable Tab

Server

Click the **Server** radio button if you want to transfer the variables in the **Selected Variables** window to the DTiX Variable Server.

Enter a name in the **Variable Group Name** text box that will identify the variables to the client application. Note that you must enter a variable group name even if you are exporting a single variable.

If the DTiX Variable Server is located on a different computer system, enter the system name in the **Host Name** text box. The host name can be a UNC name (such as `\\server` or `server`) or a DNS name (such as `domain.com`, `example.microsoft.com`, or `135.5.33.19`). If you do not enter a host name, the tool connects to the DTiX Variable Server on your local system.

Note that in order to transfer variables to the DTiX Variable Server on a remote host system, the host system must be turned on, the DTiX Variable Server must be installed on the host system, and you must have permission to access the host system. For more information on assigning permission, refer to the DTiX online help, located in `C:\Program Files\Data Translation\DTiX`, by default.

To remove all the variables on the DTiX Variable Server, click **Clear DTiX Variable Server**.

Text File

Click the **Text File** radio button if you want to transfer the variables in the **Selected Variables** window to a text file (*.txt). Enter the complete path to the file in the **File Name** text box or use the **Browse** button to locate the file. If you enter the name of a file that does not exist, the Export tool automatically creates the file for you either in the specified directory or, if no directory is specified, in the current directory.

Click either the **Overwrite** or the **Append** radio button to specify what you want to do if a file with the specified name already exists.

Select the **Export Variable Label(s)** checkbox if you want to transfer the variable names along with the variable values. Clear the **Export Variable Label(s)** checkbox if you want to transfer only the variable values.

DDE

Click the **DDE** radio button if you want to transfer the variables in the **Selected Variables** window to an Excel worksheet.

Click the appropriate **Excel Worksheet Options** radio button to specify the Excel worksheet that you want to use; you can browse for a specific worksheet or enter the name manually. If you select **Use Current Worksheet**, the Export tool uses the open .xls file; if no .xls file is open, the tool automatically creates a new .xls file. If you select **Use New Worksheet**, the tool automatically creates a new .xls file. If you select **Use Specific Worksheet**, the specified .xls file must already exist; the tool does not create a file for you.

Click the appropriate **Data Orientation** radio button to specify whether you want to store the data horizontally or vertically.

For the **Data Location** option, select the **Row** and **Column** in the specified worksheet at which to place the data. You can enter the number of a specific row/column in the text box or select one of the number variables from the drop-down list. Selecting a number variable is useful if you want to append data to the end of the worksheet, but you are not sure of the exact location. For example, if you want to export variable data from the Blob Analysis tool for each of the found blobs, you can select the #BlobsFoundTotal variable to store new data in the appropriate location.

Select the **Export Variable Label(s)** checkbox if you want to transfer the variable names along with the variable values. Clear the **Export Variable Label(s)** checkbox if you want to transfer only the variable values.

Note that DT Vision Foundry assumes that you are using the English-language version of Excel. If you are using a different version of Excel, you must update the DTVF.DEF file to indicate the language you are using. For more information, refer to [page 55](#).

P&C Script Variables

The **P&C Script Variables** window contains a list of all the variables in your point & click script. For each variable that you want to transfer, click on the variable to select (highlight) it, then click **Add** to add the selected variable to the **Selected Variables** list.

To remove a variable from the **Selected Variables** list, select (highlight) the variable, then click **Delete**.

If you want to use a wildcard to specify the variables that you want to transfer, click the **Use Wildcard** checkbox. Then, enter the variables in the **Wildcard** text box, using either an * (to indicate one or more unspecified characters) or a ? (to indicate a single unspecified character). For example, if you want to transfer both the MajorAxis variable and the MinorAxis variable, enter **M*Axis**. Click **Add** to add the variables to the **Selected Wildcards** list.

To remove a variable from the **Selected Wildcards** list, select (highlight) the variable, then click **Delete**.

Transfer

When all the settings are correct, click this button to export the variables in the **Selected Variables** list to the specified location.

Add to Script

After you transfer the variables, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29](#), “Using the Point & Click Script Tool.”

Images Tab Options

The Images tab allows you to transfer the values of the pixels in an image from DT Vision Foundry to either the DTiX Image Server or a Microsoft Excel worksheet.

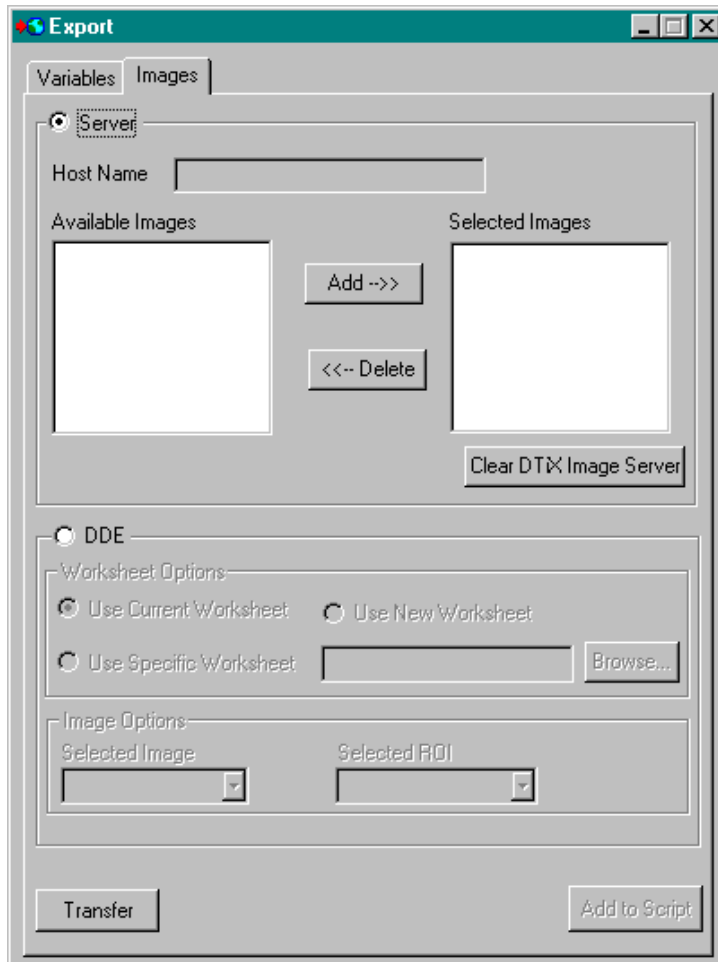


Figure 61: Export Tool - Images Tab

Server

Click the **Server** radio button if you want to transfer the pixel values of the images in the **Selected Images** window to the DTiX Image Server.

If the DTiX Image Server is located on a different computer system, enter the system name in the **Host Name** text box. The host name can be a UNC name (such as \\server or server) or a DNS name (such as domain.com, example.microsoft.com, or 135.5.33.19). If you do not enter a host name, the tool connects to the DTiX Image Server on your local system.

Note that in order to transfer images to the DTiX Image Server on a remote host system, the host system must be turned on, the DTiX Image Server must be installed on the host system, and you must have permission to access the host system. For more information on assigning permission, refer to the DTiX online help, located in C:\Program Files\Data Translation\DTiX, by default.

The **Available Images** window contains a list of all the images that you opened or loaded into DT Vision Foundry. For each image whose pixel values you want to transfer, click on the image to select (highlight) it, then click **Add** to add the selected image to the **Selected Images** list.

To remove an image from the **Selected Images** list, select (highlight) the image, then click **Delete**.

To remove all the images on the DTiX Image Server, click **Clear DTiX Image Server**.

DDE

Click the **DDE** radio button if you want to transfer the pixel values of the **Selected Image** to an Excel worksheet.

Click the appropriate **Worksheet Options** radio button to specify the Excel worksheet that you want to use; you can browse for a specific worksheet or enter the name manually. If you select **Use Current Worksheet**, the Export tool uses the open .xls file; if no .xls file is open, the tool automatically creates a new .xls file. If you select **Use New Worksheet**, the tool automatically creates a new .xls file. If you select **Use Specific Worksheet**, the specified .xls file must already exist; the tool does not create a file for you. Note that the Export tool always overwrites any data in an existing worksheet; excess entries are not deleted.

From the **Selected Image** drop-down list, select the image whose pixel values you want to transfer. If you want to transfer the pixel values of only a portion of the specified image, select the line or rectangle ROI whose pixel values you want to transfer from the **Selected ROI** drop-down list. (Note that only line and rectangle ROIs are supported at the present time.) If you do not select an ROI, the pixel values of the entire image are transferred.

Note that DT Vision Foundry assumes that you are using the English-language version of Excel. If you are using a different version of Excel, you must update the DTVF.DEF file to indicate the language you are using. For more information, refer to [page 55](#).

Transfer

When all the settings are correct, click this button to transfer the pixel values of the **Selected Image(s)/Selected ROI** to the specified location.

For the DTiX Image Server, the Export tool transfers information about the ROIs associated with the images in addition to the values of all the pixels in the image.

For an Excel worksheet, the Export tool transfers pixel values only. If you specified a line ROI, only the pixel values of locations along the line ROI are transferred; if you specified a rectangle ROI, only pixel values within the rectangle ROI are transferred. Data is always stored vertically, starting at Row 1, Column 1. If the width of your image is greater than the number of columns in your Excel worksheet, the tool transfers the first 225 columns, followed by the next 225 columns, and so on.

Add to Script

After you transfer the images, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29](#), “Using the Point & Click Script Tool.”

Example of Using the Export Tool

This example shows how to transfer the pixel values of a line ROI in the image Lines, shown in [Figure 62](#), to an Excel worksheet for further analysis.

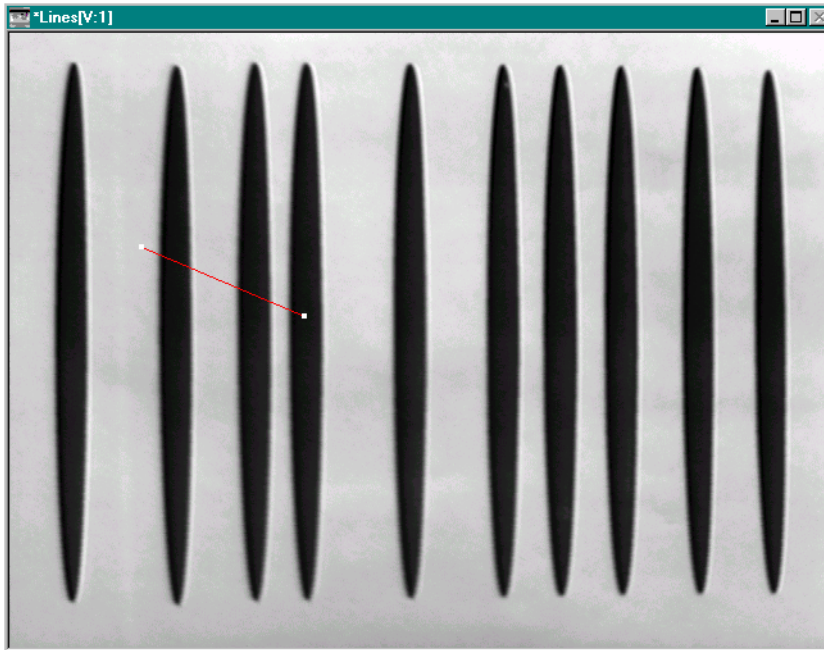
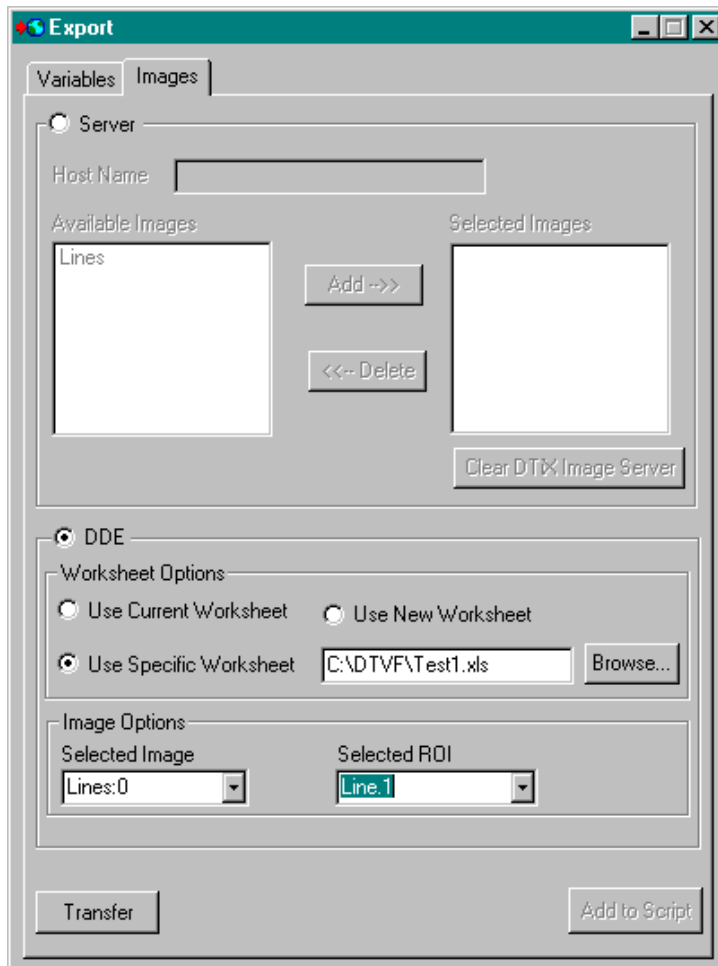


Figure 62: Export Tool Example Image

The operation is as follows:

1. Open Microsoft Excel, then open and save an empty Excel worksheet. For this example, the worksheet (Test1.xls) is located in C:\DTVF.
2. In DT Vision Foundry, open the image Lines into a viewport, then draw a line ROI, as shown in [Figure 62](#).
3. Open an Export tool (if one is not already open).
4. On the Images tab, click **DDE**.
5. Click **Use Specific Worksheet**, then browse to the empty Excel worksheet that you saved.
6. Select the image Lines from the **Selected Image** drop-down list.
7. Select the line ROI from the **Selected ROI** drop-down list.
The Export tool appears as follows.



8. Click **Transfer**.
9. Open the Excel worksheet.
The pixel values for the line ROI are stored vertically, starting at Row 1, Column 1.

Point & Click Script

This section describes the specific use of the Export tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Export tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Export tool to perform the desired function. This includes the location that you want to transfer the variables/images to and the variables/images that you want to transfer. Click **Transfer** to perform the desired operation, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Export tool is set up exactly as it was when you previously recorded the script item. This includes the location that you want to transfer the variables/images to and the variables/images that you want to transfer. The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the File Manager Tool

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Introduction

The File Manager tool is supplied with DT Vision Foundry. It allows you to open many popular file formats. It also lets you open a mixture of color and grayscale images of different image types without being concerned with file conversion.

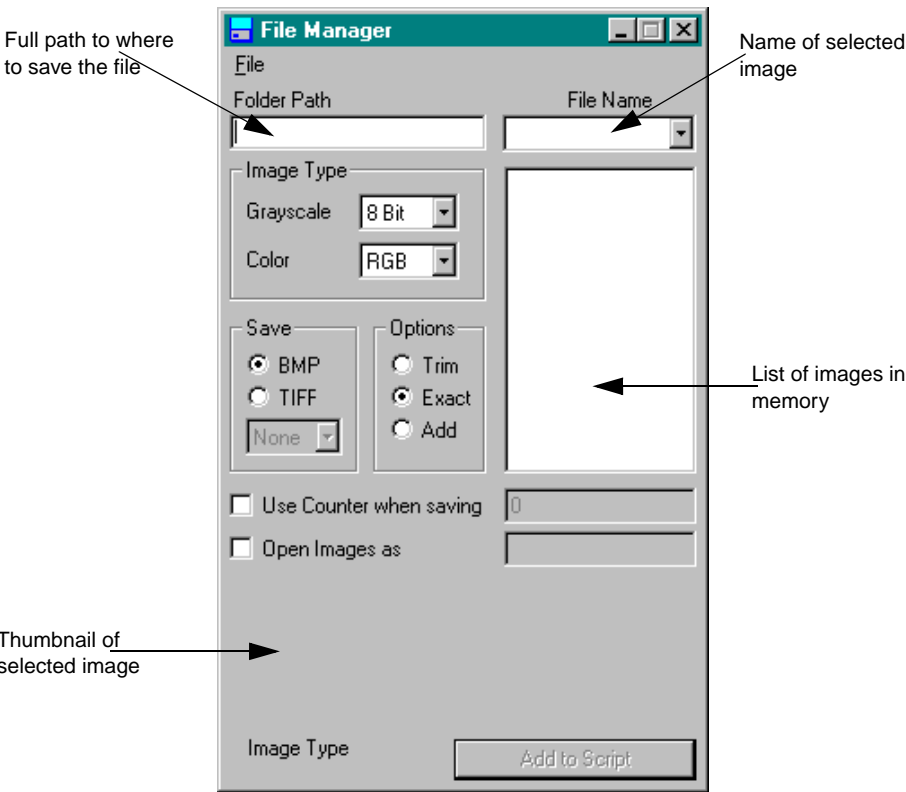


Figure 63: File Manager Tool

Table 7 lists the file formats supported by the File Manager tool.

Table 7: Supported File Types

CMU WM Raster	Faces Project	FBM
G3 FAX	GEM Bit	JPEG
MacPaint	McIDAS areafile	PC Paintbrush (PCX)
Photo CD	Portable Bit Map (PBM, PGM, PPM)	Sun Raster
Targa	TIFF	Utah RLE
Windows and OS/2 BMP	X Bitmap	X Pixmap
X Window Dump		

The File Manager tool can save an image in either a Windows BMP or a TIFF file format.

To open a File Manager tool, select the  icon from the Input-Output toolbar or select **File Manager** from the Tools menu.

Notes: The File Manager tool is fully compatible with all other tools, image types, and ROIs.

You can have up to 100 File Manager tools open at the same time.

Description of File Manager Tool Options

This section contains a description of the options in the File Manager tool dialog box.

File Menu Options

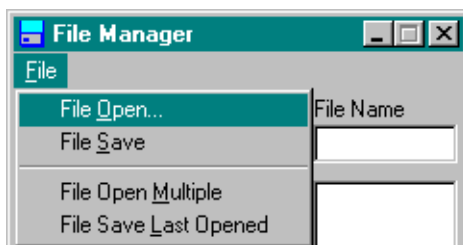


Figure 64: File Manager Tool - File Menu

File Open...

Select this option to open one image at a time. Once an image is opened successfully, the image is included in the list of images in memory and in the Image Manager tool. If an image cannot be loaded, the system beeps. For more information, refer to [Chapter 21](#), “Using the Image Manager Tool.”

File Save

Select this option to save all images highlighted in the list of images in memory to the directory path shown in **Folder Path**. The files are saved according to the selected **Save** radio button.

File Open Multiple

This option is valid only for point & click scripting. For more information, refer to [page 307](#).

File Save Last Opened

This option is valid only for point & click scripting. For more information, refer to [page 307](#).

Dialog Box Options

Folder Path

Enter the full directory path name of the location where you want your files to be saved. The full directory path name must end in a backslash (\). An example of a correct full directory path name would be `C:\DTV\F\IMAGES\COLOR\`.

File Name

If you want to save a single image to disk, highlight the image name in the list of images in memory. The name of the image is displayed in the **File Name** text box. If you want to save an image to disk with a different name, you can enter the new name in the text box.

You can also select one of the string variables from the drop-down list. Selecting a string variable is useful if the images that you want to save vary in your point & click script. For example, assume that you are using the Barcode Reader tool to acquire images of barcodes on items on an assembly line and want to save the images based on the barcode. You can use the Barcode variable to save images with the barcode 12345 with the image name 12345.bmp and images with the barcode 67890 with the image name 67890.bmp.

Image Type

If you are using a grayscale image, select the type of image you want to open from the **Grayscale** drop-down list (8-bit, 16-bit, 32-bit, floating-point).

If you are using a color image, select the type of image you want to open from the **Color** drop-down list (RGB, HSL).

The default image type is 8-bit grayscale images.

Save

Click the appropriate radio button to specify how you want to save the images highlighted in the list of images in memory. If you click **BMP**, all selected files are saved as standard Windows bitmap files. If you click **TIFF**, all selected files are saved as standard TIFF files. If you click **TIFF**, you can also select the TIFF compression method (**None**, **Auto**, **Encoded**).

These options apply to all images regardless of image type. You cannot save binary, 16-bit, 32-bit, or floating-point grayscale images as TIFF. If you try to save these types of images as a TIFF file, the system beeps.

Options

Due to the way that DT Vision Foundry accesses images in memory, the width of DT Vision Foundry images must be divisible by 4 pixels. Click one of the following radio buttons to specify what the tool should do if the image you are opening is not divisible by 4:

- **Trim** – Trim the width of the image so that the width is divisible by 4. For example, if the image is 457 pixels wide, the new width of the image is 456. The extra pixels are discarded. The height of the image is not affected.
- **Exact** – Do not open the image if the width of the image is not divisible by 4.

- **Add** – Add to the width of the image so that the width is divisible by 4. For example, if the image is 457 pixels wide, the new width of the image is 460. The extra pixels added to the width have a value of 0. The height of the image is not affected.

List of Images in Memory

This field lists all images in memory. Select (highlight) all images in the list that you want to save to disk. You can select multiple images and they can be of different types (grayscale and color). The images are saved according to the selected **Save** radio button and the path specified in **Folder Path**.

Use Counter When Saving

Select this checkbox if you want the tool to append a counter number when saving a selected file. This is used primarily for point & click scripting to track different images saved with the same name. The counter is sequential.

Open Images As

Select this checkbox if you want to specify a name for an image that you are opening from disk. Specify the image name in the text box. This is used primarily for point & click scripting.

Thumbnail of Selected Image

This field displays a thumbnail of the image highlighted in the list of images in memory. The image type is shown below the image. If you left-click on the thumbnail image, the image is displayed in the active viewport.

Add to Script

After you open or save a file (or files), click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the File Manager Tool

This example shows how to use the File Manager tool.

Quick Example

1. Open a group of unrelated images using a single drag-and-drop operation from Windows Explorer. The files can be a mixture of color and grayscale and can be in any file format supported by the File Manager tool. For a list of supported formats, refer to [page 299](#). The open files are displayed in a viewport.
2. Save the group of unrelated images using a single save operation to the directory `C:\Temp\Images\`.

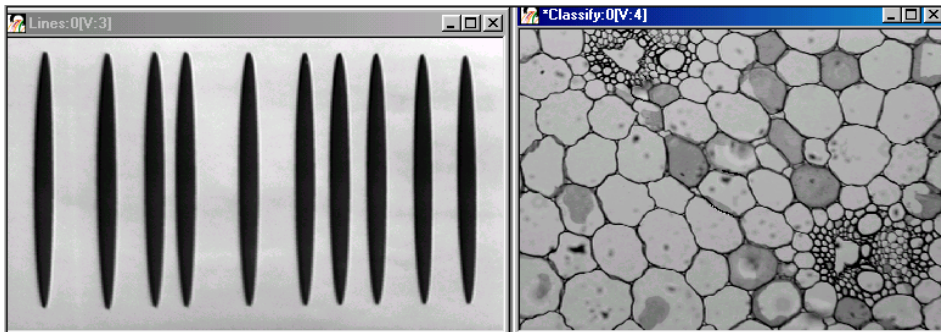
Step-by-Step Example

1. Open a File Manager tool (if one is not already open).
2. Select a group of images in Windows Explorer.
3. Drag the selected files to the File Manager tool and drop them anywhere. Assuming that the **8 Bit Grayscale** radio button is selected, all grayscale images are opened as 8-bit grayscale images.

Notice that the File Manager tool opens all the files regardless of file type or file format and places the path of the images in **Folder Path**. In addition, if you click on an image in the list, the image is displayed in the thumbnail.

4. To place one of the opened images in a viewport, you must open a Image Manager tool. The Image Manager tool contains the same images in its list of memory images as the images shown in the File Manager tool. Double-click an image to place it in the active viewport. For more information, refer to [Chapter 21](#), “Using the Image Manager Tool.”

Assuming that you opened the Lines image and the Classify image, the viewports look as follows:



5. In the File Manager tool, save all the images as compressed TIFF files in the directory `C:\Temp\Images` by placing the path name in **Folder Path** and selecting all the images in the list.
6. Save the selected files by selecting the **File | File Save** menu option. The images are saved in the directory `C:\Temp\Images\` as compressed TIFF files.

Point & Click Script

This section describes the specific use of the File Manager tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

The File Manager tool can perform point & click scripting in one of the following modes of operation:

- **Mode 1: Open and/or Save a Single File** – In this mode, each File Manager tool point & click script item either opens a single file from disk or saves a single image to disk. In this mode, you can have multiple point & click script items in the script at the same time.
- **Mode 2: Open and/or Save Multiple Files** – In this mode, a single File Manager tool point & click script item opens multiple files and another single File Manager tool point & click script item saves each of these opened files back to disk. Each time through the script, the first File Manager tool script item opens one of the files and gives the file a specific image name. Then, other script items (such as a Filter tool script item) can process this image using its specific image name. Later in the script, the second File Manager tool script item saves this processed image back to disk. The data can be saved in any directory (folder). When all the files have been opened, the multiple file save script item fails and this ends the script.

Note: You always provide the absolute path to the image file(s) in the File Manager tool. If you save the point & click script to the same drive that contains the image file(s), the tool automatically converts the image file(s) to a path relative to the directory in which you save the script. If you move the script (and the image file(s)) to another directory, the correct image file(s) are opened when you run the script.

Adding to the Point & Click Script

To add the File Manager tool's functionality (Mode 1 or Mode 2) to a point & click script, you must first have the Point & Click Script tool open.

Adding a Mode 1 File Manager Tool Script Item

To add a file open or file save script item to the script, perform the desired operation. When performing a file open, it is recommended that you select the **Open Images As** checkbox and specify an image name in the text box. This ensures that you know the name of the image once it is opened. You can specify this name in the script items for other tools to process this specific image. Using this mode, you can change the file that is opened without having to change all the other script items that process this image. After you perform the desired action, click **Add to Script** to record the desired action in the Point & Click Script tool.

You can have any number of file open and file save script items in a script and they can be in any order you want.

Adding a Mode 2 File Manager Tool Script Item

To add a multiple file open script item to the script, you must select the **Open Images As** checkbox and specify an image name in the text box. You must also specify a valid path in **Folder Path** and a valid file name in **File Name**. You can use any legal wildcard in the file name (such as *.BMP to open all the BMP files in a given directory). When all the options are set, select **File | File Multiple Open**, then click **Add to Script** to record the desired action in the Point & Click Script tool. Note that the script item is recorded, but it is not performed until the script is run.

After you finish processing the opened images using other tools in the script, you can add the File Manager tool script item that saves the processed file back to disk (if you want to save the processed image). To do so, select **File | File Save Last Opened**, then click **Add to Script** to record the desired action in the Point & Click Script tool. The script item saves the processed image back to disk in the specified directory with the same name it had when it was opened.

You can save the image to a different directory by entering a different directory path in **Folder Path** before selecting **File | File Save Last Opened**. Make sure that you specify the file type so that the correct file extension is used in the file name. You can have only one multiple file open/save combination in a script at one time, and the open script item should be placed before the save script item in the script.

Note: When recording the script, you do not have to perform the script items for the other tools before recording the multiple save script item. You can first record the multiple open and multiple save script items and then record the other tools. Later, you can use drag-and-drop to rearrange the script items as required.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the File Manager tool is set up exactly as it was when you previously recorded the script item. The **Add to Script** button is changed to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Filter Tool

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Introduction

The Filter tool is supplied with DT Vision Foundry. It allows you to apply a filter (perform a convolution) on a given image.

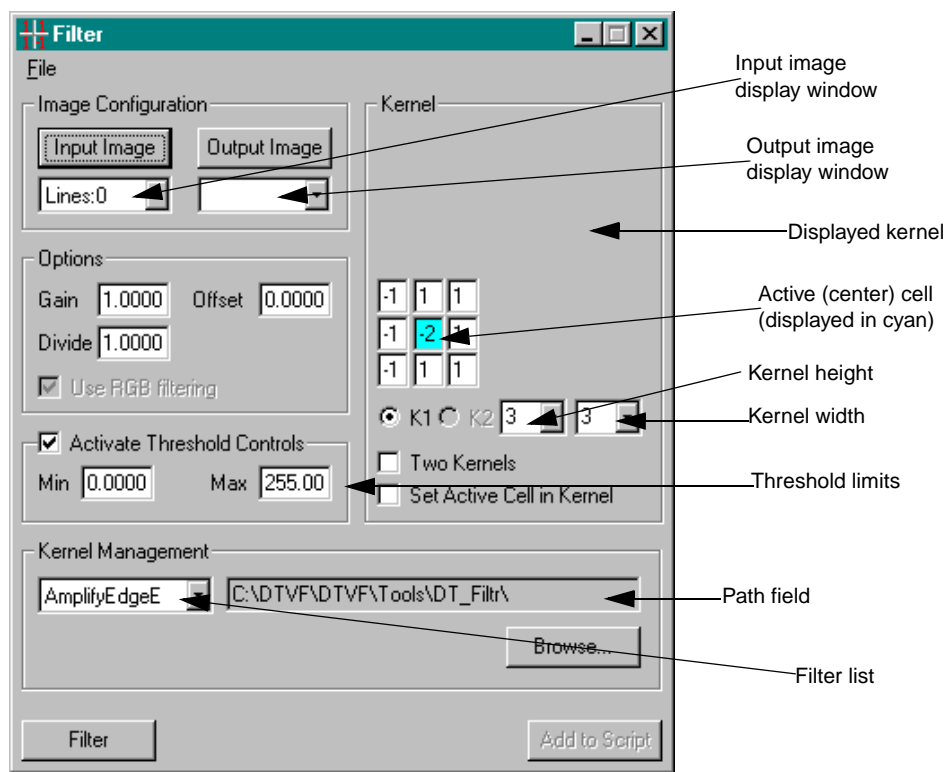



Figure 65: Filter Tool

The Filter tool performs filtering on a specified input image and places the result in an output image. It performs filtering by running a single-kernel or dual-kernel convolution. A set of default filters is provided with the Filter tool. You can also create your own custom filter, if desired. The tool allows you to select the active cell (usually the center cell).

To open a Filter tool, select the  icon from the Image Processing toolbar or select **Filter** from the Tools menu.

Notes: The Filter tool is fully compatible with all other tools, image types, and ROIs.

You can have up to 100 Filter tools open at the same time.

Description of Filter Tool Options

This section contains a description of the options in the Filter tool dialog box.

File Menu Options



Figure 66: Filter Tool - File Menu

Save Kernel

Select this option to save the filter currently selected in the filter list back to disk. The kernel information is saved in a .ker file; the gain, offset, divide, and thresholding information is saved in a .flt file with the same name.

This option is useful if you want to modify an existing filter.

It is recommended that you do not modify the default filters included in the DT Vision Foundry package since these filters represent industry standards. If you want to customize one of the default filters, use the **Save Kernel As** option to save the filter with a different name.

Save Kernel As...

Select this option to save the filter currently selected in the filter list to disk with a different name. A Save Kernel As dialog box is displayed. Select the directory and enter a file name with the extension .ker. The kernel information is saved in the .ker file; the gain, offset, divide, and thresholding information is saved in a .flt file with the same name.

If you save a filter to a new directory, the new directory is displayed in the path field and the filters located in the new directory are displayed in the filter list.

Dialog Box Options

Input Image

Click this button to load the image in the active viewport as the input image. The image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Output Image

Click this button to load the image in the active viewport as the output image. The image name is shown in the Output Image display window. You can also select the output image from the list of images currently residing in system memory or enter your own name for the output image in the display window text box.

If you do not select an output image, the Filter tool automatically creates an output image for you (with the name **Output**). Note, however, that if you intend to use multiple output images in a point & click script, it is recommended that you either use the image in the active viewport as the output image or select the output image from the drop-down list. This ensures that each output image in the point & click script has a unique name.

Gain and Offset Options

Enter the **Gain** and **Offset** values that you want to use in the calculation. The gain and offset are calculated immediately after performing the convolution operation.

If desired, you can enter the value that you want to **Divide** the convolution by. For example, with the mean filter, you must divide the output by the number of pixels in the kernel. Instead of entering 1/9 (0.1111) for the gain, you can enter the value to divide the convolution by in the **Divide** text box.

The entire calculation is as follows:

$$\text{Output pixel} = \text{Gain} * (\text{convolution of input area}) / \text{Divide} + \text{Offset}$$

Use RGB Filtering/Use HSL Filtering

Select this checkbox if you want the Filter tool to filter all three color planes (red, green and blue) of a 24-bit RGB color image or all three color settings of a 24-bit HSL color image.

Clear this checkbox if you want the Filter tool to filter only the color plane/setting that is enabled in the Color Plane tool. This allows you to filter each color plane/setting independently. For example, to filter only the red color plane of an image, open a Color Plane tool, select the red plane, and then perform the filtering. For more information, refer to [Chapter 8, “Using the Color Plane Tool.”](#)

Active Threshold Controls

Select this checkbox if you want to threshold the value of the output pixel to specific threshold limits. Enter the appropriate threshold limits in the **Min** and **Max** text boxes. This calculation is performed after the **Gain**, **Offset**, and **Divide** are applied.

Displayed Kernel Area

A kernel for the current filter is displayed in this area. By default, only one kernel (**K1**) is displayed. If your filter uses two kernels, select the **Two Kernels** checkbox, then click the appropriate radio button to specify whether you want to display the first kernel (**K1**) or the second kernel (**K2**). Note that all filters contain two kernels; however, the second kernel is used only if **Two Kernels** is selected.

The active cell is the cell displayed in cyan (light blue). It is usually the center cell, and it is the cell in which the convolution output is placed. Note that the convolution is performed with respect to the active cell; it is not always performed with respect to the center cell.

If desired, you can create a custom filter in the displayed kernel area. If you want to use two kernels in the convolution, select the **Two Kernels** checkbox. For each kernel, select the height (the number of rows in the kernel) from the kernel height drop-down list and the width (the number of columns in the kernel) from the kernel width drop-down list. Note that if you are creating a two-kernel filter, the two kernels can have different heights and different widths.

In the cells, enter the coefficients that you want to use in the convolution. If you want to select a new active (center) cell, select the **Set Active Cell in Kernel** checkbox, then click the cell in the displayed kernel that you want to be the new active cell. If you are creating a two-kernel filter, the two kernels do not have to have the same active cell.

Filter List

Select the filter that you want to apply to the input image. A filter selection initializes the kernel information for the convolution, the gain, offset, and divide information, and the thresholding information. Note that filtering is performed with respect to the active ROI in the input image. If no active ROI is present, the whole image is used.

By default, the filters provided with the Filter tool are displayed in the drop-down list and the location of the filters is shown in the path field. If you want to use a filter that is stored in a different location, use the **Browse** button to locate the appropriate directory, then click **OK**.

The default filters are described as follows:

- **Mean / Mean1 / Mean2 / Mean3** – These are low-pass filters that smooth the image. They are meant to attenuate the high-frequency (noise) details of the image while leaving the low-frequency content intact.

Note that Mean and Mean1 are exactly the same. Mean is provided for compatibility with previous versions of DT Vision Foundry.

- **Sharpen1 / Sharpen2 / Sharpen3** – These are high-pass filters that sharpen the image. They meant to accentuate the high-frequency details of the image while leaving the low-frequency content intact.
- **Horizontal** – This filter detects horizontal edges.
- **Vertical** – This filter detects vertical edges.
- **Right Diagonal / Left Diagonal / Diamond** – These filters detect edges in a diagonal direction.
- **Sobel / Prewitt** – These filters detects edges in all directions. All pixels not on the detected edges are changed to black. (Note that the usage is the same for both filters, but the algorithms are different.)
- **Laplacian1 / Laplacian2 / Laplacian3** – These filters detect edges in all directions. There are three omnidirectional filters and three bidirectional filters. All pixels not on the detected lines are changed to black.
- **Unsharpen1 / Unsharpen2 / Unsharpen3** – These filters sharpen the edges of an image by subtracting a smoothed version of the image from the original image.

- **Gaussian1 / Gaussian2** – These filters blur the image and remove details and noise.
- **Shift and Difference** – These filters extract the vertical (V), horizontal (H), and diagonal (D) edges in an image. Constant brightness areas become black, while changing brightness areas become highlighted.
- **Amplify Edge** – These are Prewitt gradient-edge enhancement filters. One filter is provided for each of the eight compass directions (E, NE, N, NW, W, SW, S, and SE). The resulting image appears as a directional outline of the objects in the original image. Note that these filters are different from the Prewitt filter.
- **Amplify Line** – These filters enhance and amplify the vertical (V), horizontal (H), left-to-right (LR), or right-to-left (RL) diagonal straight line segments by producing directional outlines of line segments in the original image.
- **Robert Cross** – This is a simple, quick to compute, filter that highlights regions of high spatial frequency that often correspond to edges.

Note: If the default filters do not suit your needs, you can add your own filter by specifying a user-defined kernel in the displayed kernel area or by using one of the many kernels that perform specialized types of filtering.

To delete either one of the default filters or one of your own filters, go to the appropriate directory and make sure that you delete both the .ker file and the .flt file associated with the filter.

Filter

Click this button to apply the current filter to the input image. The result is shown in the output image.

Add to Script

After you apply a filter, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the Filter Tool

This example shows how to perform a Sobel filter on the color image Pill1, shown in [Figure 67](#), with respect to its active ellipse ROI.



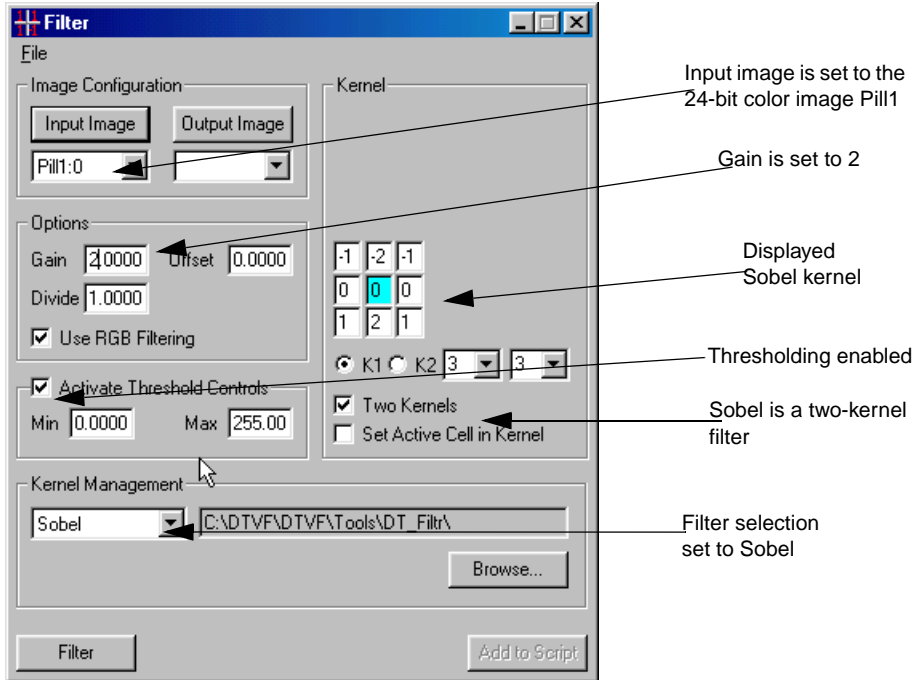
Figure 67: Filter Tool Example Image

The operation is as follows:

1. Open a Filter tool (if one is not already open).
2. Click in the viewport on the image Pill1 with the left mouse button. Pill1 is now the active viewport and is denoted with an asterisk, as show in [Figure 67](#). Click **Input Image** to load Pill1 as the input image.

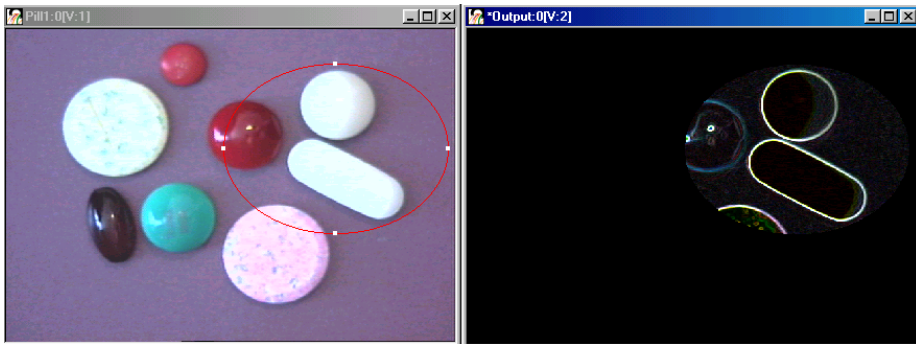
3. Activate (red) the desired ROI within the input image by clicking in it with the right mouse button.
4. Select the Sobel filter from the filter selection list.
5. Set the **Gain** to 2 and select the **Activate Threshold Controls** checkbox.

The Filter tool looks as follows:



6. Click **Filter** to apply the filter.

The result of the Sobel filter is enhanced edges of the image in the output image, as follows.



Point & Click Script

This section describes the specific use of the Filter tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Filter tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Filter tool to perform the desired function. This includes the input and output images, the desired filter, and the active ROI (if you are using one). Click **Filter** to perform the desired action, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Filter tool is set up exactly as it was when you previously recorded the script item. This includes the input and output images, the desired filter, and the active ROI (if an ROI was used). The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Gauge Tool

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Introduction

The Gauge tool is supplied with DT Vision Foundry. It allows you to perform measurement operations on objects (ROIs) in an image. Note that all measurements are taken from center of pixel to center of pixel.

By default, the tool returns results in pixels. If you apply a calibration object to your image, the tool returns results in the specified units of measurement, such as inches or degrees.

You can perform measurement operations on ROIs from up to three images captured from up to three cameras. This is useful if you require increased precision or if you cannot physically set up a single camera to capture your entire image. For example, you can focus one camera on a small component at one end of an object and another camera on a small component at the other end of the object, then measure the distance between the two components. Note that if you are using multiple cameras, you must attach a calibration object to each image you are using.

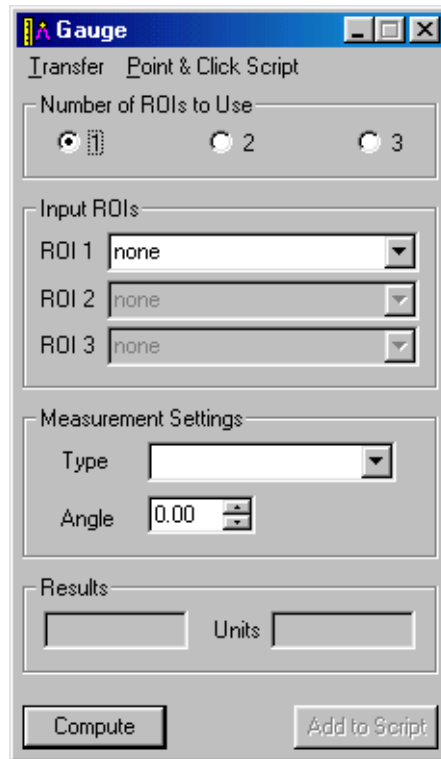



Figure 68: Gauge Tool

To open a Gauge tool, select the  icon from the Gauging toolbar or select **Gauge** from the Tools menu.

Notes: The Gauge tool is fully compatible with all tools, ROIs, and image types.

You can have up to 100 Gauge tools open at the same time.

Description of Gauge Tool Options

This section contains a description of the options in the Gauge tool dialog box.

Transfer Menu Options

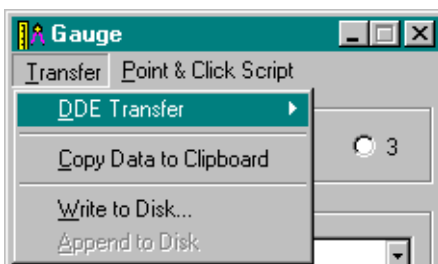


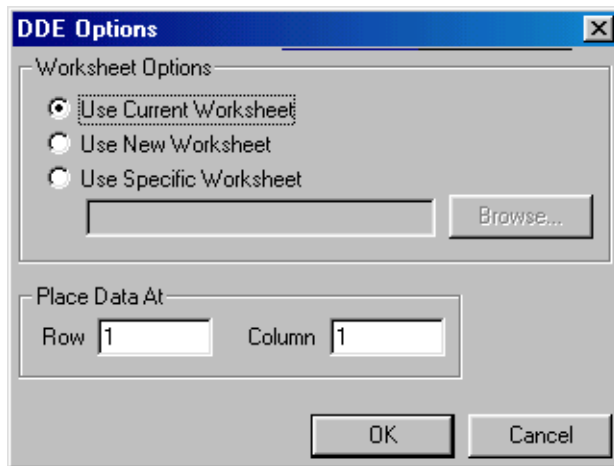
Figure 69: Gauge Tool - Transfer Menu

DDE Transfer

Note: It is recommended that you use the Export tool to send variables and/or images from DT Vision Foundry to Excel. For more information, refer to [Chapter 15, “Using the Export Tool.”](#) The DDE options in the Gauge tool have been retained for backward compatibility.

The DDE Transfer option allows you to select the following options for sending measurement data to the spreadsheet program Excel:

- **Send Data to Excel** – Select this option to send all selected measurement data to Excel. Excel automatically opens and loads the data. You can then display the data in any supported format, such as charts, graphs, and spreadsheets.
- **Set DDE Options...** – Select this option to open the DDE Options dialog box.



Click the appropriate radio button to specify the Excel worksheet that you want to use. You can browse for a specific worksheet or enter the name manually. You can place your data at a specific row and/or column in the specified worksheet. When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the dialog box without saving your changes.

Note that DT Vision Foundry assumes that you are using the English-language version of Excel. If you are using a different version of Excel, you must update the DTVF.DEF file to indicate the language you are using. For more information, refer to [page 55](#).

Copy Data to Clipboard

Select this option to copy all selected measurement data to the clipboard. You can then paste from the clipboard to any supported program, such as Word or Notepad.

Write to Disk...

Select this option to write all selected measurement data to disk. A Save As dialog box is displayed. Select the appropriate directory and enter the file name, then click **Save**. Note that if no measurement is displayed in the **Result** field, an error is returned.

Append to Disk

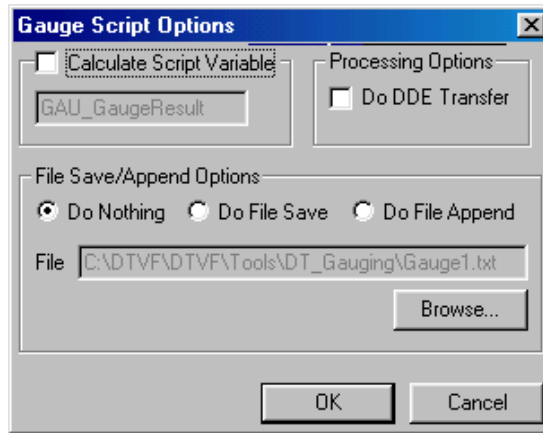
Select this option to add the selected measurement data to the end of the file that you saved using **Write to Disk**.

Point & Click Script Menu Options



Figure 70: Gauge Tool - Point & Click Script Menu

Select the **Options...** option to open the Gauge Script Options dialog box. When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the dialog box without saving your changes.



Calculate Script Variable

Select this checkbox if you want the Gauge tool to put the result of the measurement operation into the specified point & click script variable. Note that if a measurement operation fails, the scripting variable is set to -1.

By default, the name of the scripting variable is GAU_GaugeResult. You can change the name by entering a new name in the text box.

Do DDE Transfer

Select this checkbox if you want to send the measurement result to the spreadsheet program Excel using the options in the DDE Options dialog box. For more information, refer to [page 327](#).

File Save/Append Options

Click one of the following radio buttons to specify how you want to save the calculations performed by the Gauge tool:

- **Do Nothing** – Click this radio button if you do not want to save calculations.

- **Do File Save** – Click this radio button if you want to save the calculations to a file. By default, the calculations are saved in the file specified by **File**. If you want to use a different file, either enter the file name in the text box or use the **Browse** button to locate the file.
- **Do File Append** – Click this radio button if you want to add the calculations to the end of a file. By default, the calculations are added to the file specified by **File**. If you want to use a different file, either enter the file name in the text box or use the **Browse** button to locate the file.

Main Dialog Box Options

Number of ROIs to Use

Click the appropriate radio button to indicate whether you want to take a measurement of a single ROI, take a measurement between two ROIs, or take a measurement among three ROIs. For example, you may want to measure the enclosed area of a single rectangle, you may want to measure the length of a line between the center points of two rectangles, or you may want to measure the angle between two line segments formed by three points.

Input ROIs

Select the appropriate ROIs from the drop-down lists. The drop-down lists contain any user-drawn ROIs in your image and any ROIs generated by other DT Vision Foundry tools, such as the Edge Finder tool, the ROI Shape Fitter tool, or the Blob Analysis tool.

You can also select the ROIs by clicking the appropriate **Number of ROIs to Use** radio button, then using the right mouse button to activate the ROIs in order.

Type

Select the type of measurement you want to take. The measurement types available from the drop-down list depend on the number of ROIs you are using and the particular types of ROI you are using. For example, if you select a single point ROI, you can measure the x-coordinate or the y-coordinate of the ROI. If you select two ROIs (ROI 1 is a point ROI and ROI 2 is a line ROI), you can measure the distance between the ROIs. If you select three point ROIs, you can measure the angle between the vectors that are formed by the ROIs.

Note that if the **Type** drop-down list is empty, no measurement operations using the selected ROIs are supported.

Table 8 contains all supported measurement types, listed alphabetically, and a brief description of each type.

Table 8: Measurement Types

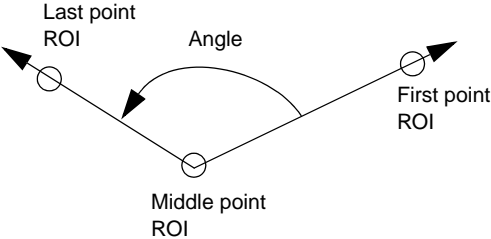
Measurement Type	Description
Angle at middle point	<p>The angle between two vectors formed by three point ROIs. The first vector points from the middle point ROI to the first point ROI; the second vector points from the middle point ROI to the last point ROI. The angle is formed by going in a counter-clockwise direction from the first vector to the second vector and can range from 0 to 360° .</p> 
Angle from x axis	<p>The angle between the x-axis and a line ROI or between the x-axis and a line formed by two point ROIs.</p>

Table 8: Measurement Types (cont.)

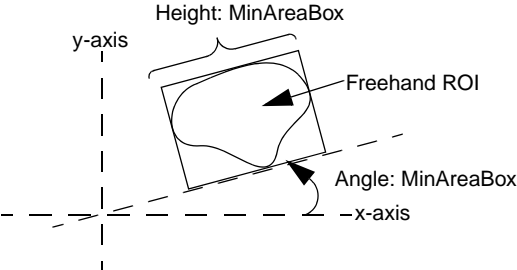
Measurement Type	Description
Angle: MinAreaBox	<p>The angle between Height: MinAreaBox and the x-axis. For more information, refer to the description of Height: MinAreaBox.</p> 
Area	The area of an enclosed ROI.
Average distance	The average distance between two ROIs.
Blue average ^a	The average blue value of all pixels underneath a line ROI or within an enclosed ROI. Note that point ROIs are not supported.
Blue value ^a	The blue value of the pixel underneath a point ROI.

Table 8: Measurement Types (cont.)

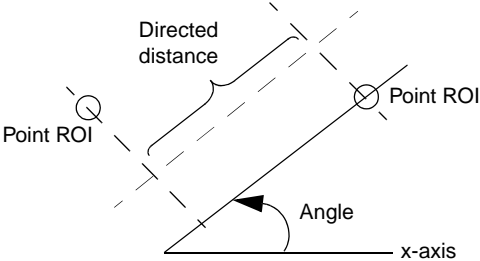
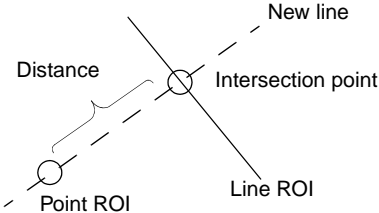
Measurement Type	Description
Directed distance	<p>To compute the directed distance between two point ROIs, the tool creates two parallel lines, both perpendicular to a line at the specified angle, and shifts both lines until each line crosses one of the point ROIs. The tool then creates a third line that is perpendicular to the two parallel lines. The directed distance is the distance between the two parallel lines.</p> 
Distance	<p>The distance between two point ROIs or between a point ROI and a line ROI. To compute the distance between a point ROI and a line ROI, the tool first creates a new line that passes through the point ROI and is perpendicular to the line ROI, extending the line ROI if necessary. The tool then calculates the distance between the point ROI and the intersection point between the line ROI and the new line.</p> 
Green average ^a	<p>The average green value of all pixels underneath a line ROI or within an enclosed ROI. Note that point ROIs are not supported.</p>

Table 8: Measurement Types (cont.)

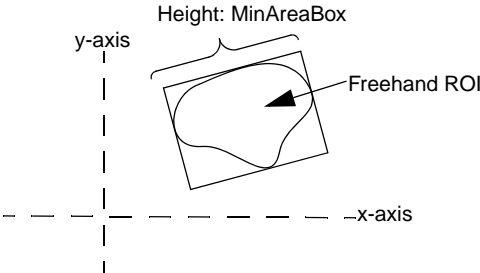
Measurement Type	Description
Green value ^a	The green value of the pixel underneath a point ROI.
Gray average	The average grayscale value of all pixels underneath a line ROI or within an enclosed ROI. Note that point ROIs are not supported.
Gray value	The grayscale value of the pixel underneath a point ROI.
Height	The height (the dimension with respect to the y-axis) of an ellipse or rectangle ROI. For a line, poly freehand, or freehand ROI, the tool returns the height of the bounding box that encompasses the ROI.
Height: MinAreaBox	<p>The longer side of the smallest bounding box (determined by the area of the bounding box) that encompasses a freehand or poly freehand ROI. The bounding box is not necessarily oriented along the x and y axes.</p> 
Hue average ^b	The average hue value of all pixels underneath a line ROI or within an enclosed ROI. Note that point ROIs are not supported.
Hue value ^b	The hue value of the pixel underneath a point ROI.
Intersection angle	The smaller of the two angles formed by the intersection of two line ROIs. The value can range from 0° to 90°.
Line length	The distance between the end points of a line ROI.

Table 8: Measurement Types (cont.)

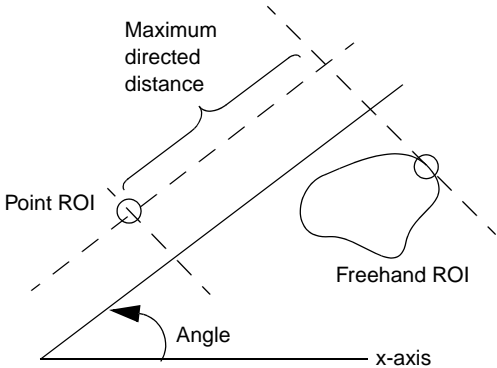
Measurement Type	Description
Luminance average ^b	The average luminance value of all pixels underneath a line ROI or within an enclosed ROI. Note that point ROIs are not supported.
Luminance value ^b	The luminance value of the pixel underneath a point ROI.
Maximum directed distance	<p>The maximum directed distance between two points, each on a different freehand ROI, or the maximum directed distance between a point ROI and a point on a freehand ROI. For more information, refer to the description of directed distance.</p> 
Maximum distance	The distance between two points, each on a different ROI, that are farthest apart from each other.

Table 8: Measurement Types (cont.)

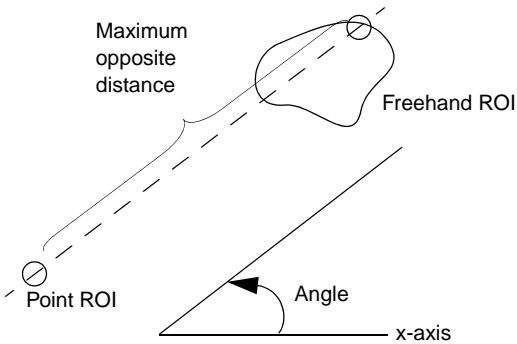
Measurement Type	Description
Maximum opposite distance ^c	<p>To compute the maximum opposite distance between two points, each on a different freehand ROI, or between a point ROI and a point on a freehand ROI, the tool creates a series of lines that are parallel to the specified angle and that cross both ROIs. The tool measures the distance between the intersection points on each line and then returns the maximum distance.</p>  <p>The diagram shows a Point ROI (a small circle with a cross) and a Freehand ROI (an irregular, blob-like shape). A dashed line connects the two ROIs. A series of parallel dashed lines are drawn at an Angle to the x-axis, intersecting both ROIs. The Maximum opposite distance is the distance between the intersection points on the line that is furthest from the x-axis.</p>

Table 8: Measurement Types (cont.)

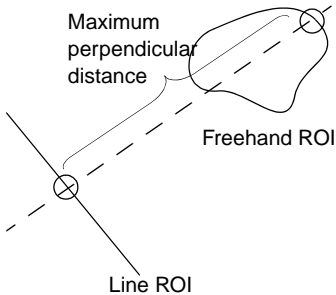
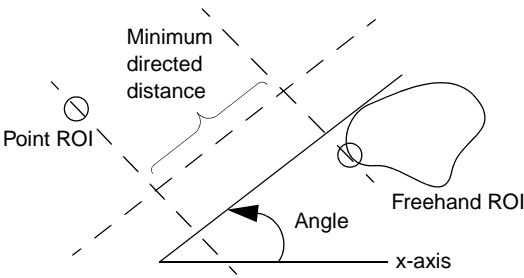
Measurement Type	Description
Maximum perpendicular distance	<p>To compute the maximum perpendicular distance between a line ROI and an ellipse ROI or between a line ROI and a freehand ROI, the tool creates a series of lines that are perpendicular to the line ROI and that cross the ellipse or freehand ROI. The tool measures the distance between the intersection points on each line and then returns the maximum distance.</p> 
Minimum directed distance	<p>The minimum directed distance between two points, each on a different freehand ROI, or the minimum directed distance between a point ROI and a point on a freehand ROI. For more information, refer to the description of directed distance.</p> 
Minimum distance	<p>The distance between two points, each on a different ROI, that are closest to each other.</p>

Table 8: Measurement Types (cont.)

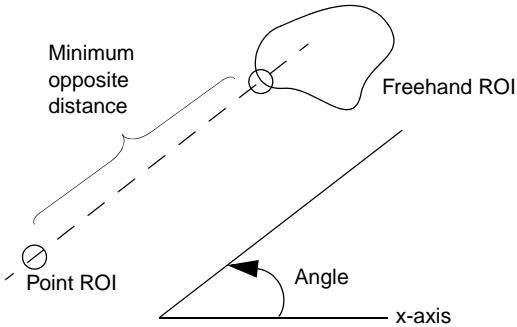
Measurement Type	Description
Minimum opposite distance ^b	<p>To compute the minimum opposite distance between two points, each on a different freehand ROI, or between a point ROI and a point on a freehand ROI, the tool creates a series of lines that are parallel to the specified angle and that cross both ROIs. The tool measures the distance between the intersection points on each line and then returns the minimum distance.</p> 

Table 8: Measurement Types (cont.)

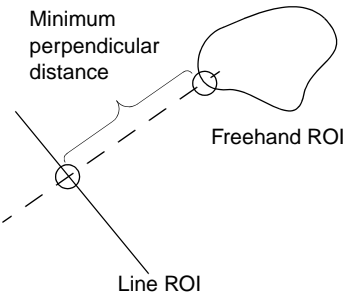
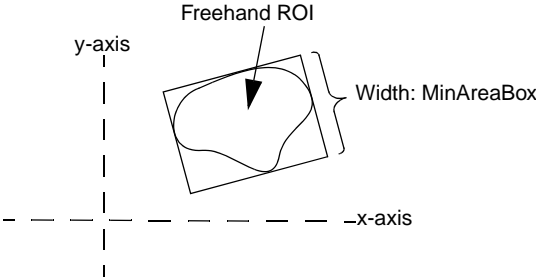
Measurement Type	Description
Minimum perpendicular distance	<p>To compute the minimum perpendicular distance between a line ROI and an ellipse ROI or between a line ROI and a freehand ROI, the tool creates a series of lines that are perpendicular to the line ROI and that cross the ellipse or freehand ROI. The tool measures the distance between the intersection points on each line and then returns the minimum distance.</p> 
Perimeter	The perimeter of an enclosed ROI.
Red average ^a	The average red value of all pixels underneath a line ROI or within an enclosed ROI. Note that point ROIs are not supported.
Red value ^a	The red value of the pixel underneath a point ROI.
Roundness	<p>The degree of roundness of an enclosed ROI. The result of the measurement operation is less than or equal to 1, where a value of 1 indicates that the ROI is perfectly circular. The tool uses the following formula:</p> $\text{Roundness} = \frac{4 \times \pi \times \text{Area}}{\text{Perimeter}^2}$
Saturation average ^b	The average saturation value of all pixels underneath a line ROI or within an enclosed ROI. Note that point ROIs are not supported.

Table 8: Measurement Types (cont.)

Measurement Type	Description
Saturation value ^b	The saturation value of the pixel underneath a point ROI.
Width	The width (the dimension with respect to the x-axis) of an ellipse or rectangle ROI. For a line, poly freehand, or freehand ROI, the tool returns the height of the bounding box that encompasses the ROI.
Width: MinAreaBox	<p>The shorter side of the smallest bounding box (determined by the area of the bounding box) that encompasses a freehand or poly freehand ROI. The bounding box is not necessarily oriented along the x and y axes.</p> 
x coordinate	The x-axis coordinate of a point ROI.
x intersection	The x-axis coordinate of the point at which two line ROIs intersect.
y coordinate	The y-axis coordinate of a point ROI.
y intersection	The y-axis coordinate of the point at which two line ROIs intersect.

- a. Available for 24-bit RGB color images only.
- b. Available for 24-bit HSL color images only.
- c. If the two ROIs are situated so that they cannot cross the same parallel line, the tool cannot perform the measurement and returns **Failed** in the **Result** field.

Angle

Specify the angle that you want to use for directed distance, minimum directed distance, maximum directed distance, minimum opposite distance, and maximum opposite distance measurement operations. Enter the value in the text box or use the up and down arrows to adjust the value.

Results

This field displays the results of the measurement operation, in the specified units of measure.

Note that all measurements are taken from center of pixel to center of pixel.

Units

After you click **Compute**, this field displays the units of measure. By default, the units of measure are pixels. If you have a calibration object attached to your image, the displayed values are in the calibrated units of measure, such as inches or millimeters. For more information about calibration objects, refer to [Chapter 7, "Using the Calibration Tool."](#)

Note that if the default units of measure (pixels) or the calibrated units of measure are not appropriate to the measurement type you are using, the tool uses the appropriate unit of measure instead. For example, if your calibrated units of measure are inches and you are measuring an angle, the tool returns the measurement result in degrees.

Compute

Click this button to perform the measurement operation.

Add to Script

After you perform the measurement operation, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Example of Using the Gauge Tool

This example shows how to use the Gauge tool with the Edge Finder tool and the ROI Shape Fitter tool to find the maximum radius of an object in the image Washer, shown in [Figure 71](#). For more information about the Edge Finder tool, refer to [Chapter 14, “Using the Edge Finder Tool.”](#) For more information about the ROI Shape Fitter tool, refer to [Chapter 33, “Using the ROI Shape Fitter Tool.”](#)

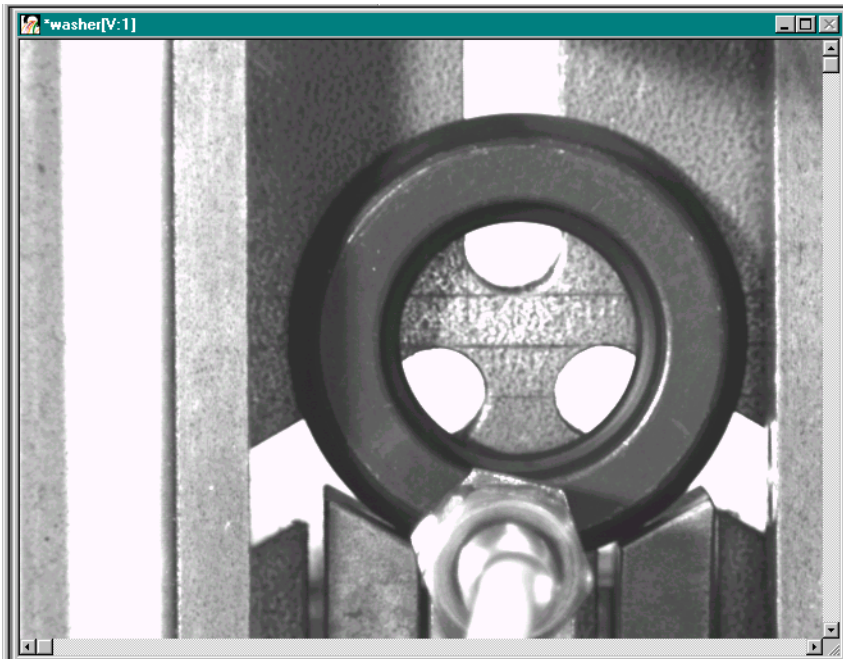
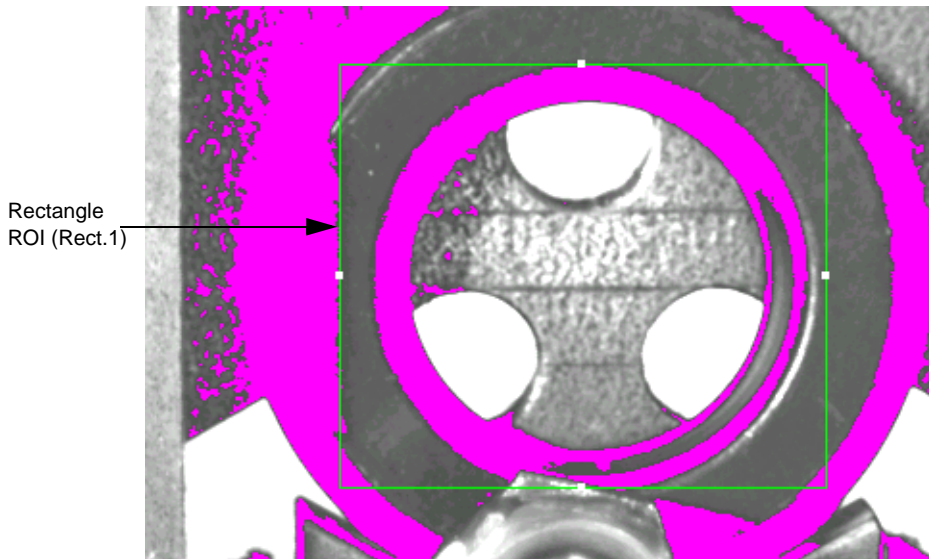


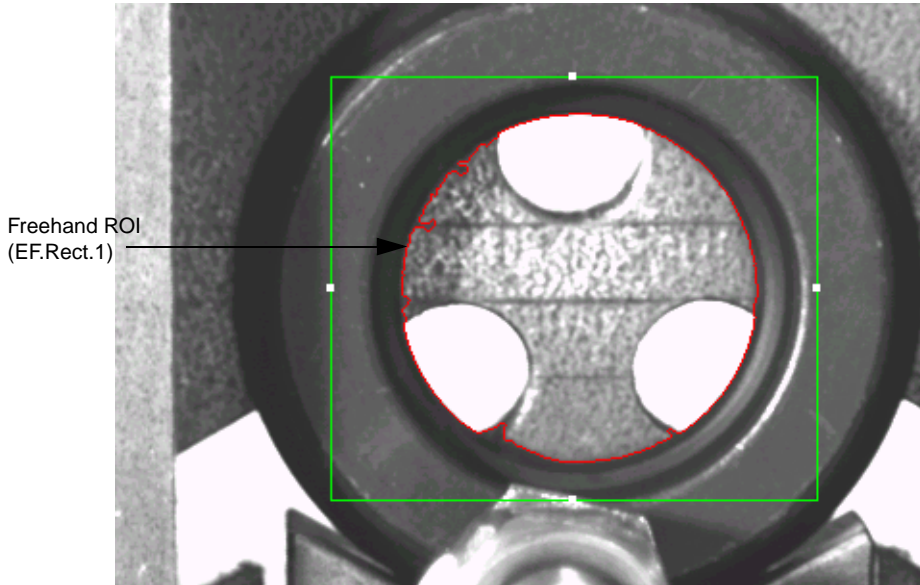
Figure 71: Gauge Tool Example Image

The operation is as follows:

1. Open the image Washer.
2. Click in the viewport on the image Washer with the left mouse button. Washer is now the active viewport and is denoted with an asterisk, as show in [Figure 71](#). Click **Input Image** to load Washer as the input image.
3. Open an Edge Finder tool (if one is not already open).
4. In the Edge Finder tool, select the **Activate threshold controls** checkbox and then adjust the **Maximum** and **Minimum** slider controls until the transition from black (magenta) to white occurs on the inside edge of the washer.
5. Draw a rectangle ROI around the inside edge of the washer.
*The image looks as follows. The name of the ROI is displayed in the **Input ROI** text box in the Edge Finder tool (Rect.1).*

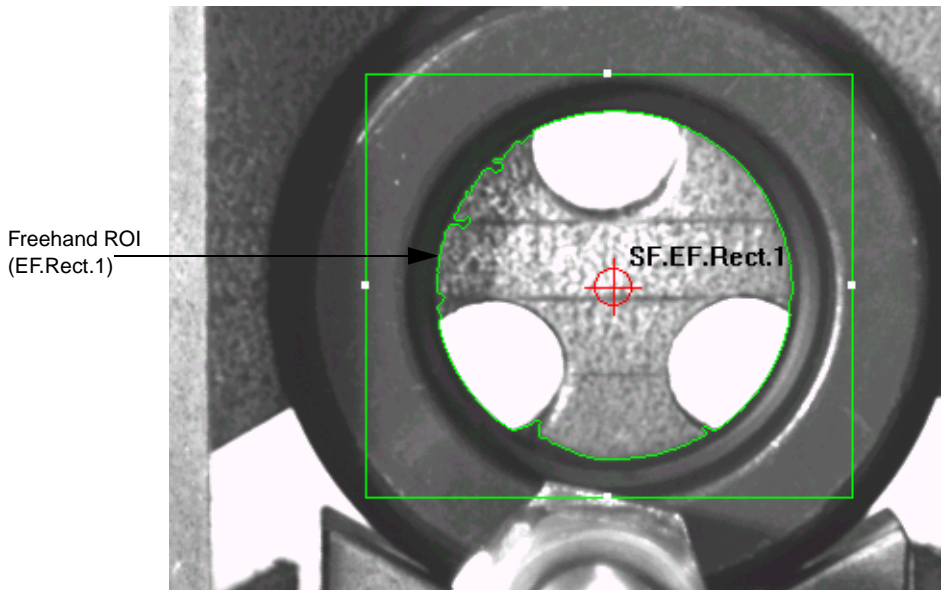


6. Select **White** from the **Object Color** drop-down list to generate the edge within the white pixels.
7. Activate (red) Rect.1 by clicking in it with the right mouse button.
8. Click **Find Edge** in the Edge Finder tool to extract the edge and generate a freehand ROI named EF.Rect.1.
The image looks as follows.



9. Open an ROI Shape Fitter tool.
10. Select **EF.Rect.1** from the **Input ROI** drop-down list.
11. Select **Center Point** from **Output Shape** drop-down list.

12. Click **Fit** in the ROI Shape Fitter tool to find the center point.
The tool generates a point ROI named SF-Point.EF.Rect.1. The image looks as follows:



13. Open a Gauge tool.
14. Click **2** to specify that you want to use two ROIs in your measurement operation (the freehand ROI and the point ROI).
15. Select **EF.Rect.1** from the **ROI 1** drop-down list.
16. Select **SF-Point.EF.Rect.1** from the **ROI 2** drop-down list.
17. Select **Max distance** from the **Measurement type** drop-down list.
18. Click **Compute**.
*The maximum radius measurement is displayed in the **Result** field.*

Point & Click Script

This section describes the specific use of the Gauge tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add a Gauge tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Gauge tool to perform the desired function. This includes the names of the ROIs that you are using and the measurement type. Click **Compute** to perform the desired action, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Gauge tool is set up exactly as it was when you previously recorded the script item. This includes the names of the ROIs you are using and the measurement type. The **Add to Script** button is changed to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Histogram Tool

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Introduction

The Histogram tool is supplied with DT Vision Foundry. It allows you to create histograms of images. You can add up to 100 histograms to the same graph. The histograms can be added from multiple images and from multiple viewports. You can also transfer histogram data directly to the Microsoft Excel worksheet program.

As with all DT Vision Foundry tools that use a graph to display image data, the Histogram tool allows you to do the following:

- Change the minimum and maximum x-axis and y-axis values.
- Change the grid markings for both the x-axis and the y-axis.
- Change the text displayed on the graph (title, x-axis label, and y-axis label).
- Change the color and style of each curve on the graph.
- Zoom to a specified area using the mouse.
- Switch between zoomed and unzoomed modes by double-clicking the right mouse button.
- Resize the graph.
- Print the graph.

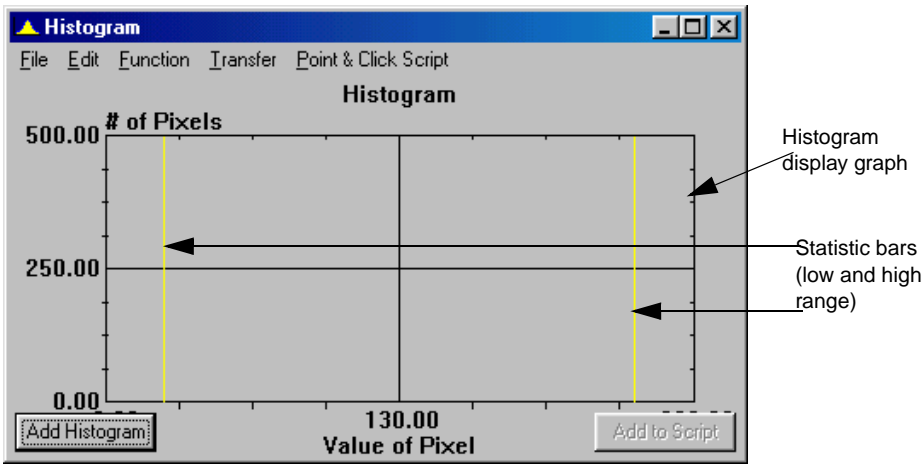



Figure 72: Histogram Tool

To open a Histogram tool, select the  icon from the Image Analysis toolbar or select **Histogram** from the Tools menu.

Notes: The Histogram tool is fully compatible with all other tools, image types, and ROIs.

The histogram is created from the image displayed in the active viewport with respect to its active ROI. If no active ROI is present, the whole image is used.

You can have up to 100 Histogram tools open at the same time.

Description of Histogram Tool Options

This section contains a description of the options in the Histogram tool dialog box.

Dialog Box Options

Histogram Display Graph

The histogram display graph displays all the created histograms. You can resize the graph as needed by dragging the edges.

The statistic bars in the graph allow you to select a range of pixel values in the histogram. You can adjust the low and high range by dragging the vertical bars with the left mouse button. If you cannot locate and/or grab one of the bars, double-click the right mouse button to restore the bars to their original positions.

Add Histogram

Click this button to add a histogram to the graph. The histogram is created from the image displayed in the active viewport with respect to its active ROI. If no active ROI is present, the whole image is used. You can add up to 100 histograms to the graph.

Add to Script

After you add the histogram, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29](#), “Using the Point & Click Script Tool.”

File Menu Options

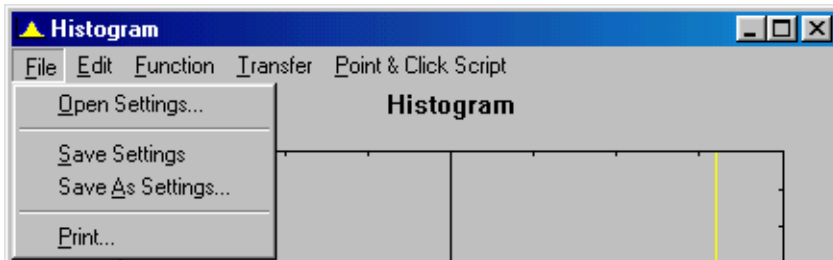


Figure 73: Histogram Tool - File Menu

Open Settings...

Select this option to open a graph configuration from disk. An Open dialog box is displayed. When you open a graph configuration (the file name must be followed by the extension `.hst`), the object is loaded into the Histogram tool.

Note that a graph configuration includes x-axis limits, y-axis limits, graph text, grid markings, and location of statistic bars.

Save Settings

Select this option to save a graph configuration back to disk. The Histogram tool saves x-axis limits, y-axis limits, graph text, grid markings, and location of statistic bars.

Save As Settings...

Select this option to save a graph configuration to disk with a different name. A Save As dialog box is displayed. Select the directory and enter a file name with the extension `.hst`.

Note that if you save a graph configuration with the name default.hst, the file will automatically open each time you open a Histogram tool. You must save default.hst in the DT_Hist directory (located in C:\Program Files\Data Translation\DT Vision Foundry\Tools, by default).

Print

Select this option to print the graph.

Edit Menu Options

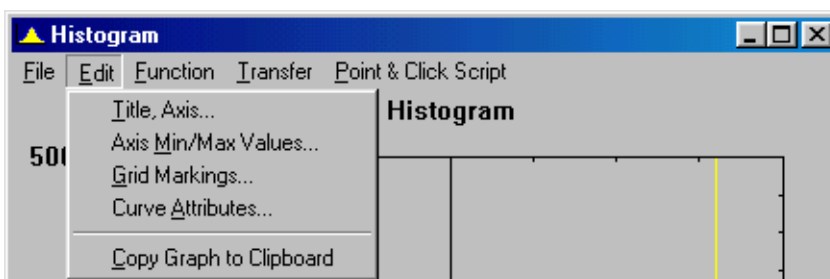


Figure 74: Histogram Tool - Edit Menu

Title, Axis...

Select this option to change the graph text for the title, x-axis, and y-axis. Enter the appropriate values in the Set Title, X & Y Labels dialog box, then click **OK**.

Axis Min/Max Values...

Select this option to change the minimum and maximum limits for the x-axis and y-axis. Enter the appropriate values in the Axis Min/Max Values dialog box, then click **OK**.

You can also set the minimum and maximum values for the graph by performing the following steps:

1. Move the mouse cursor to the point in the graph at which you want to start drawing the rectangular region.
2. While holding down the <Shift> and <Ctrl> keys at the same time, click and hold down the left mouse button.
3. Drag the mouse until you complete the rectangular region. While dragging the mouse, the proposed zooming region is shown on the graph.
4. When you have completed the rectangular region, release the left mouse button. The graph now zooms to the desired minimum and maximum axis points.

You can switch back and forth between zoomed and unzoomed modes by double-clicking in the graph with the right mouse button.

Grid Markings...

Select this option to change the grid markings for the x-axis and y-axis. Enter the appropriate values in the Grid Markings dialog box, then click **OK**.

Curve Attributes...

Select this option to change the style and color of the curve selected in the histogram display graph. Click the appropriate radio buttons in the Curve Attributes dialog box, then click **OK**.

Copy Graph to Clipboard

Select this option to copy the histogram display graph to the clipboard.

Function Menu Options

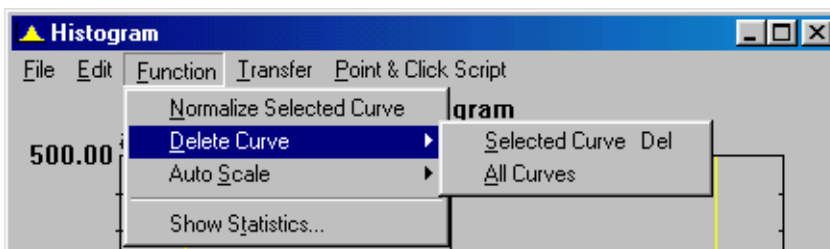


Figure 75: Histogram Tool - Function Menu

Normalize Selected Curve

Select this option to normalize the selected curve.

Delete Curve

The **Delete Curve** option allows you to specify which curves to delete:

- **Selected Curve** – Select this option to delete the selected curve from the graph. You can also delete the selected curve by holding down the <Ctrl> key and clicking on the selected curve with the right mouse button.
- **All Curves** – Select this option to delete all curves from the graph.

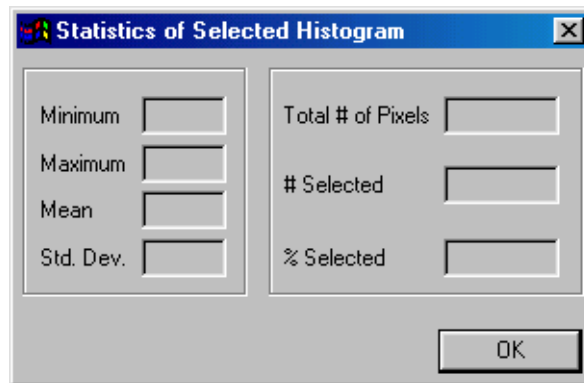
Auto Scale

The **Auto Scale** option allows you to specify how to scale the x-axis and y-axis of the graph:

- **Selected Curve** – Select this option to automatically scale the x-axis and y-axis to best fit the selected curve on the graph.
- **All Curves** – Select this option to automatically scale the x-axis and y-axis to best fit all curves on the graph.

Show Statistics

Select this option to display statistics for the selected curve in the histogram display graph. The Histogram tool opens the Statistics of Selected Histogram dialog box.



The statistics shown are described as follows:

- **Minimum** – The lowest pixel value in the selected range.
- **Maximum** – The highest pixel value in the selected range.
- **Mean** – The average pixel value in the selected range.
- **Standard Deviation** – The standard deviation of the pixel values in the selected range.

- **Total # of Pixels** – The total number of pixels in the full (0 to 255) histogram range.
- **# Selected** – The number of pixels in the selected histogram range.
- **% Selected** – The percent of pixels that fall within the selected range (selected # / total #).

The statistics shown are calculated with regard to the range of pixel values that you set using the statistic bars. You can adjust the low and high range of pixel values by dragging the statistic bars with the left mouse button. To obtain values for the entire range, set the statistic bars to the full range.

Note that you must select a curve and click on the statistic bars in order to display the data.

Transfer Menu Options

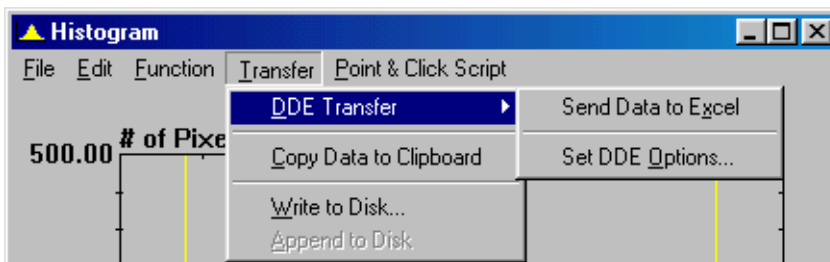


Figure 76: Histogram Tool - Transfer Menu

DDE Transfer

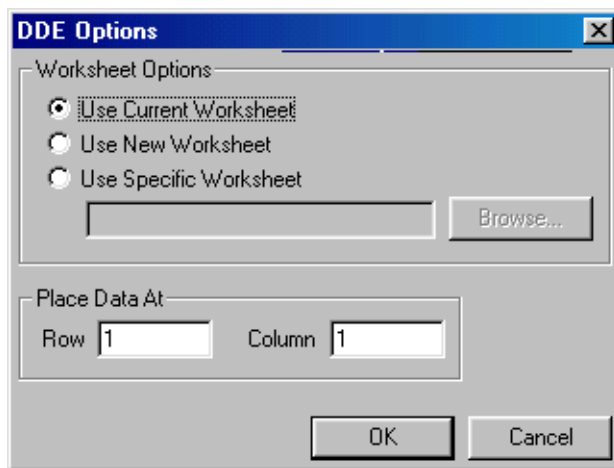
Note: It is recommended that you use the Export tool to send variables and/or images from DT Vision Foundry to Excel. For more information, refer to [Chapter 15, “Using the Export Tool.”](#) The DDE options in the Histogram tool have been retained for backward compatibility.

The **DDE Transfer** option allows you to select the following options for sending histogram data to the spreadsheet program Excel:

- **Send Data to Excel** – Select this option to send all selected histogram data (curve data and statistics data) to Excel. Excel automatically opens and loads the data. When the histogram data is loaded into Excel, you can display the data in any supported format, such as charts, graphs, and spreadsheets.

If multiple histogram curves are on the same graph and no curves are selected, the data for all the curves is loaded into the same worksheet. If a histogram curve is selected, only the data for the selected curve is loaded. Only the current statistics (within the range set by the statistic bars) is transferred.

- **Set DDE Options...** – Select this option to open the DDE Options dialog box.



Click the appropriate radio button to specify the Excel worksheet you want to use. You can browse for a specific worksheet or enter the name manually. You can place your data at a specific row and/or column in the specified worksheet. When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the dialog box without saving your changes.

Note that DT Vision Foundry assumes that you are using the English-language version of Excel. If you are using a different version of Excel, you must update the DTVF.DEF file to indicate the language you are using. For more information, refer to [page 55](#).

Copy Data to Clipboard

Select this option to copy all selected histogram data to the clipboard. You can then paste from the clipboard to any supported program, such as Word or Notepad.

Write to Disk...

Select this option to write all selected histogram data to disk. A Save As dialog box is displayed. Select the appropriate directory and enter the file name, then click **Save**.

Append to Disk

Select this option to add the selected histogram data to the end of the file you saved using **Write to Disk**.

Point & Click Script Menu Options

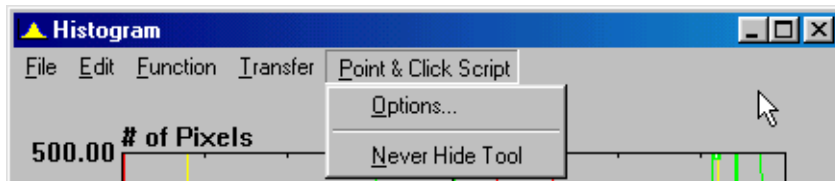


Figure 77: Histogram Tool - Point & Click Script Menu Options

Options

Select this option to open the Histogram Script Options dialog box, shown in [Figure 78](#). When all the settings are correct, click **OK** to accept the settings in the Histogram Script Options dialog box. Click **Cancel** to close the Histogram Script Options dialog box without saving any changes.

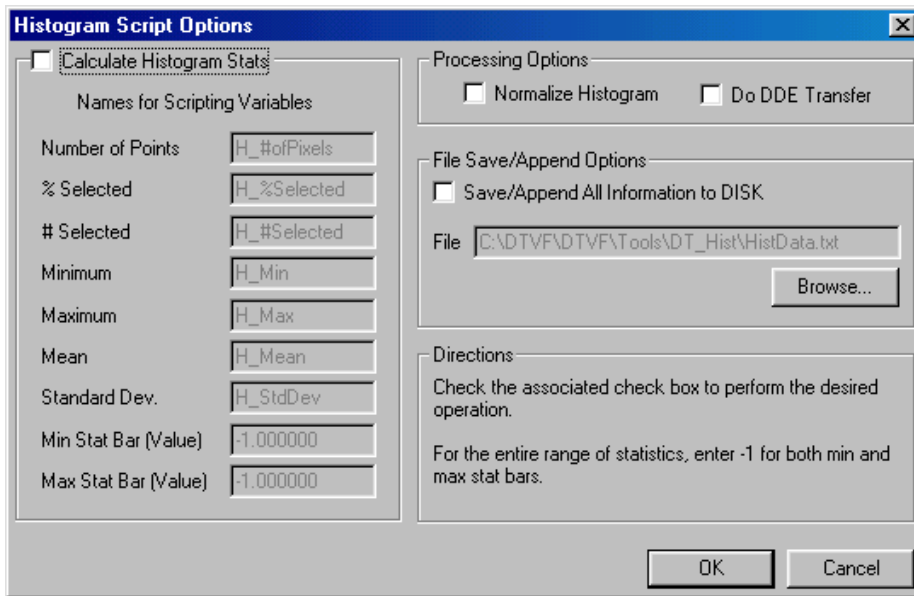


Figure 78: Histogram Script Options Dialog Box

Select the **Calculate Histogram Stats** checkbox if you want the Histogram tool to calculate the histogram statistics and put them into the specified point & click script variables. You can change the names for the scripting variables by entering a new name in the appropriate text box. If the **Min Stat Bar** and **Max Stat Bar** values are set to -1, the statistics are calculated for the entire histogram. If any other values are entered, the statistics are calculated for the area between the given values. For more information about histogram statistics, refer to [page 357](#).

Select the **Normalize Histogram** checkbox if you want to normalize the histogram after you create it.

Select the **Do DDE Transfer** checkbox if you want to send all the calculated information to the spreadsheet program Excel using the options in the DDE Options dialog box. For more information, refer to [page 359](#).

Select the **Save/Append All Information to DISK** checkbox if you want to save all the calculated information to disk. By default, the information is saved in the file specified by **File**. If you want to use a different file, use the **Browse** button to locate the file.

Never Hide Tool

Select this option if you want the Histogram tool to remain visible while you are running a point & click script.

Example of Using the Histogram Tool

This example shows how to compare a histogram of the image Mixpoll and a histogram of the image Pill1 on the same graph. Using these two images, shown in [Figure 79](#), demonstrates that you can take a histogram of any type of image with respect to any type of ROI in different viewports.

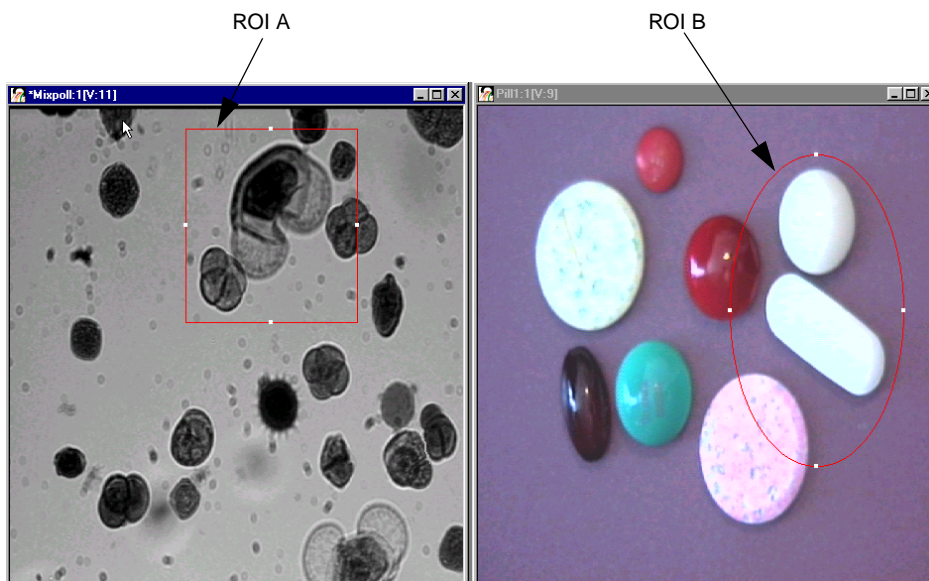
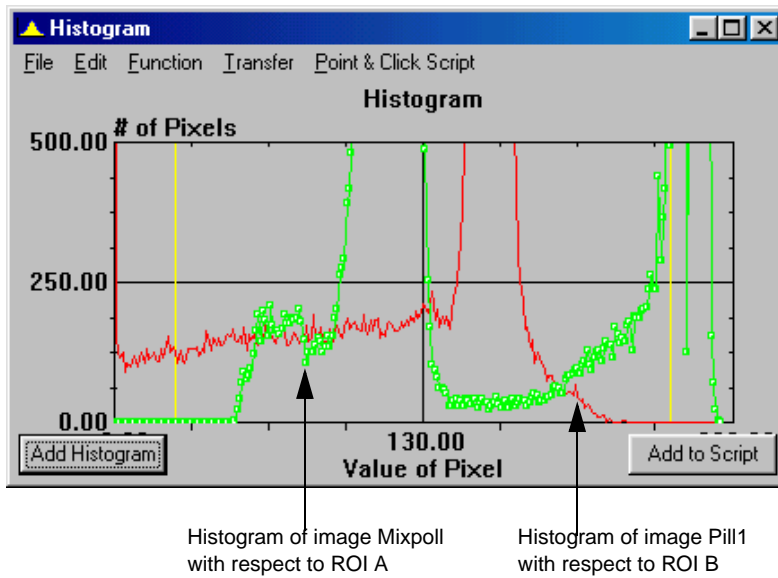


Figure 79: Histogram Tool Example Images

The operation is as follows:

1. Open a Histogram tool (if one is not already open).
2. Activate the image Mixpoll by clicking in it with the left mouse button.
3. Activate ROI A by clicking in it with the right mouse button.

4. Click **Add Histogram**.
5. Repeat steps 2, 3, and 4 for the image Pill1.
The result is as follows.



Point & Click Script

This section describes the specific use of the Histogram tool's point & click script functionality with respect to adding and editing scripting and selecting scripting options. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Histogram tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Histogram tool to perform the desired function. This includes the input image, the script options, and the active ROI (if you are using one). Click **Add Histogram** to perform the desired action, then click **Add to Script** to record the desired action in the Point & Click Script tool. To keep the Histogram tool visible while running a point & click script, select **Point & Click Script | Never Hide Tool**.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Histogram tool is set up exactly as it was when you previously recorded the script item. This includes all histogram options, all script options, and the active ROI (if an ROI was used). The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Image Classifier Tool

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Introduction

The Image Classifier tool is supplied with DT Vision Foundry. It allows you to classify (identify) images by comparing them to images that you cataloged previously.

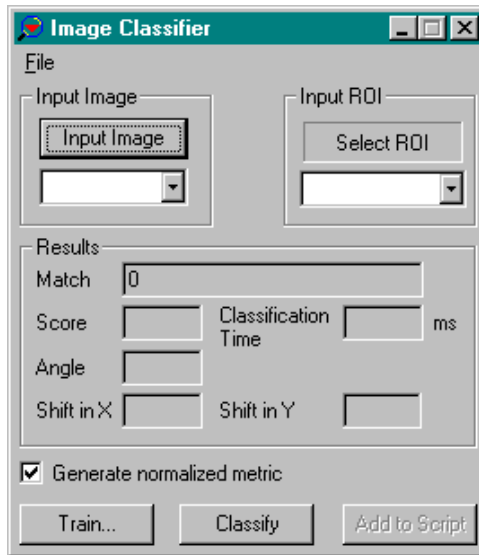


Figure 80: Image Classifier Tool

An example of an application where the Image Classifier tool would be useful is the sorting of three different software packages on CDs that are coming down an assembly line. Since the CDs have different labels, the feature that you will try to identify on each of the CDs is the label.

All the CDs must be in approximately the same position. For example, you may want to attach the CDs to hubs located in the same position on the assembly line. Note, however, that you can program the tool to take slight changes in position (shifting) into account. This is useful if, for example, the labels of some of the CDs were attached slightly lower or slightly higher on the CD.

You can also program the tool to take rotations of the CDs into account. For example, you can program the tool to consider both a Software A label that is right-side up and a Software A label that is upside down as matches for Software A.

Classifying objects requires the following two stages:

- **Training stage** – In the training stage, you build a catalog of images, called training images. If you think that the objects you are trying to identify may shift or rotate during the classification stage, you can program the Image Classifier tool to automatically create additional training images that take this rotation and/or shifting into account.

To create these additional training images, the Image Classifier tool requires a background image as well as a mask image for each of the objects you are trying to identify. These images are described as follows:

- **Background image** – The background image is an image that represents as closely as possible the background on which the features under test will be acquired. When creating additional training images for objects in a rotated or shifted position, the tool replaces the pixels in the original input image with the pixels from the background image.
- **Mask image** – The mask image is a grayscale or binary image that represents the object you are trying to identify. You must create your own mask image. The pixels that you are trying to identify must not equal 0. All pixels in the mask image that are equal to 0 (black) are ignored by the tool and are replaced by pixels from the background image.

If you want to use a binary mask image, you can create it from the input image by using the Threshold tool. For more information, refer to [Chapter 39, “Using the Threshold Tool.”](#) If you want to use a grayscale image, you can create it from the input image by using the Pixel Change tool. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)


Note that the additional training images that the Image Classifier tool creates are in the same plane as the original input image. If you require additional training images that represent other planes, you must create these training images manually.

Note that the more training files the tool must create (based on the number of rotations and/or shifts that you want to allow for) and the more results that you want the tool to report, the longer the tool will take to create the catalog (many hours or several days in some cases) and the more memory the compiled catalog will require.

- **Classification stage** – In the classification stage, a feature under test (an image containing the feature you are trying to identify) is compared to the training images in your catalog. The Image Classifier tool returns information, such as the name of the training image in the catalog that best matches the feature under test, the angle of rotation and/or shift in X and Y direction of the feature under test with respect to the training image, and a score that measures the confidence level of the match. Note that the classifying of images is performed very quickly.

Note: The input images used in a particular classification session must be the same size. The input ROIs (training images, mask images, and features under test) must be the same exact size.

Typically, the Image Classifier tool expects the lighting in the training image to be the same as the lighting in the feature under test. Therefore, it is recommended that you provide appropriate and consistent lighting conditions when using this tool. If you cannot provide appropriate lighting, you can program the tool to tolerate small differences in lighting.

To open an Image Classifier tool, select the  icon from the Machine Vision toolbar or select **Image Classifier** from the Tools menu.

Notes: The input image can be any grayscale or 24-bit color image. The mask image can be a grayscale or binary image. The input ROI must be a rectangle ROI.

You can have multiple Image Classifier tools open at the same time. However, because of the memory requirements of the tool, it is recommended that you open only one Image Classifier tool at a time.

Description of Image Classifier Tool Options

This section contains a description of the options in the Image Classifier tool dialog box.

File Menu Options

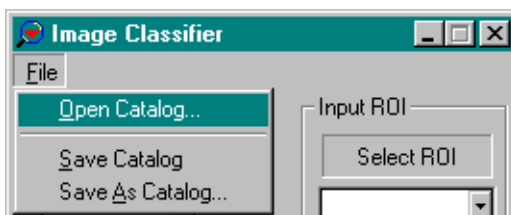


Figure 81: Image Classifier Tool - File Menu

Open Catalog...

Select this option to open an Image Classifier tool catalog that you have saved. An Open dialog box is displayed. When you open a file (the name must be followed by the extension .icl), the input ROI and other settings are loaded into the Image Classifier tool.

The Image Classifier tool catalog is the compiled object file that the tool uses when classifying images. If you want to edit the source file used to design the catalog, select **File | Open Training File...** from the Image Classifier Training dialog box. For more information, refer to [page 379](#).

Save Catalog

Select this option to save the Image Classifier tool catalog to a file on disk. It is strongly recommended that you save the catalog to disk after compiling it.

Save As Catalog...

Select this option to save the Image Classifier tool catalog to a file with a different name. A Save As dialog box is displayed. Select the directory and enter the file name with the extension .icl.

Main Dialog Box Options

Note: The Image Classifier tool main dialog box is used for the classification stage. However, before you perform a classification operation, you must create or open a catalog of training images.

If you have not yet created a catalog of training images when you open the Image Classifier tool, click the **Train** button to open the Image Classifier Training dialog box. This allows you to access the training file (source file) that you will use to design the catalog. For more information, refer to [page 378](#). When you finish compiling your catalog, you can return to the main dialog box to perform the classification operation.

If you want to use a catalog of training images that you have already created, click **File | Open Catalog** to load the existing catalog.

Input Image

Click this button to load the image in the active viewport as the input image for classification. The input image is the image containing the feature you are trying to identify. The image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Input ROI

This field contains the input ROI for classification. The input ROI is the feature that you are trying to identify.

Note that it is not necessary to select an ROI from the **Input ROI** drop-down list. If you do not select an ROI and then click the **Classify** button to identify the feature under test, the tool asks you if you want to use the input ROI for training. Click **Yes** to use the input ROI for training. This ensures that the input ROI for classification is the exact same size as the input ROI for training.

Results

After you click the **Classify** button to identify the feature under test, the Image Classifier tool displays the following information:

- **Match** – The name of the training image in the catalog that best matches the feature you are trying to identify. The tool always returns the best match, even if the match is not very close. To determine the level of confidence that the tool has in the match, refer to the **Score**.
- **Score** – The score assigned to the match. If the **Generate Normalized Metric** checkbox is selected, the value can range from 0.0 to 1.0, where 0.0 is the worst possible match and 1.0 is the best possible match. If the **Generate Normalized Metric** checkbox is cleared, the value can range from 0.0 to negative infinity, where 0.0 is the best possible match and the lower the negative value, the worse the match.

This value is returned if the **Enable Score Calculation** checkbox is enabled in the Image Classifier Training dialog box and if an appropriate option is selected from the **Allow for / Report** drop-down list in the Image Classifier Training dialog box. For more information, refer to [page 378](#).

- **Classification Time** – The length of time the tool required to determine the best match, in milliseconds. The value is returned in increments of 10 ms.
- **Angle** – The number of degrees that the feature under test has rotated with respect to the training image in the catalog with the best match. The value can range from 0° to –180° in the clockwise direction and from 0° to 180° in the counterclockwise direction.

This value is returned only if an appropriate option is selected from the **Allow for / Report** drop-down list in the Image Classifier Training dialog box. For more information, refer to [page 383](#).

- **Shift in X** – The number of pixels that the feature under test has shifted along the X-axis with respect to the training image in the catalog with the best match.

This value is returned only if an appropriate option is selected from the **Allow for / Report** drop-down list in the Image Classifier Training dialog box. For more information, refer to [page 383](#).

- **Shift in Y** – The number of pixels that the feature under test has shifted along the Y-axis with respect to the training image in the catalog with the best match.

This value is returned only if an appropriate option is selected from the **Allow for / Report** drop-down list in the Image Classifier Training dialog box. For more information, refer to [page 383](#).

Generate Normalized Metric

Select this checkbox if you want the **Score** to range from 0.0 to 1.0, where 0.0 is the worst possible match and 1.0 is the best possible match.

Clear this checkbox if you want the **Score** to range from 0.0 to negative infinity, where 0.0 is the best possible match and the lower the negative value, the worse the match. If you clear the checkbox, the tool is more sensitive to differences in lighting and other conditions between the training image and the feature under test.

Train...

Click this button to access the training file (source file) that you will use to design the Image Classifier tool catalog. The tool closes the Image Classifier tool main dialog box and opens the Image Classifier Training dialog box. For more information, refer to [page 378](#).

Classify

After you have specified the image containing the feature you are trying to identify (**Input Image**), click this button to compare the specified feature under test to the training images in your catalog.

Note that it is not necessary to select an ROI from the **Input ROI** drop-down list. If you do not select an ROI, the tool asks you if you want to use the input ROI for training. Click **Yes** to use the input ROI for training. This ensures that your the ROI for classification is the exact same size as the input ROI for training.

When the classification operation is complete, the tool displays information in the **Results** text boxes.

Add to Script

After you click the **Classify** button to identify the feature under test, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Image Classifier Training Dialog Box Options

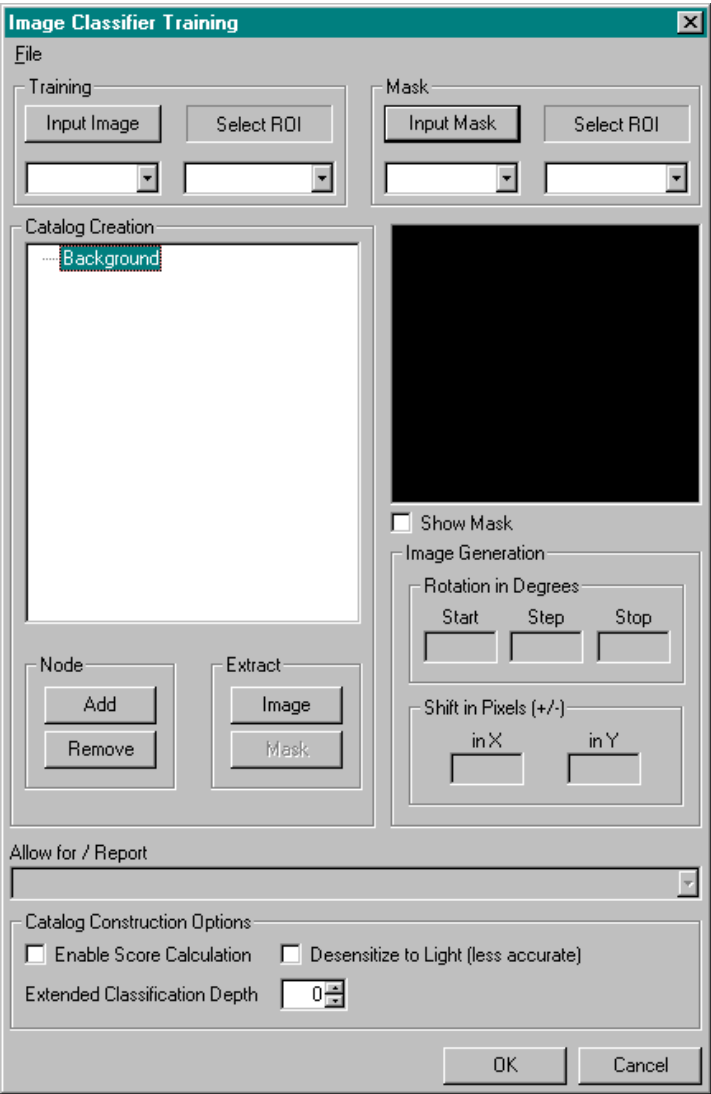
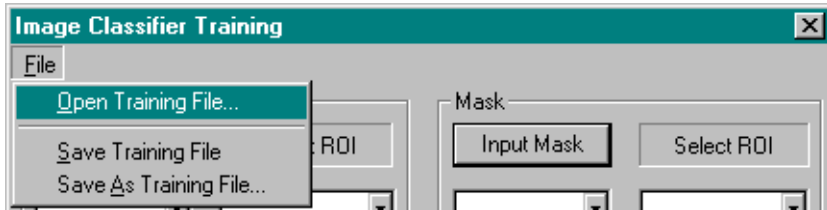


Figure 82: Image Classifier Training Dialog Box

File Menu Options



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The File menu provides the following options:

- **Open Training File...** – Select this option to open a training file. An Open dialog box is displayed. When you open a file (the name must be followed by the extension .trf), the current settings are loaded into the Image Classifier Training dialog box.

The training file is the editable source file that you use to design the Image Classifier tool catalog. If you want to open the compiled object file, select **File | Open Catalog...** from the Image Classifier tool main dialog box. For more information, refer to [page 372](#).

Note that the training file (source file) is much smaller than the catalog (compiled object file). If you have storage limitations, you may want to open the training file (instead of the catalog) and then recompile the training file before each classification operation. Keep in mind, however, that the more training files the tool must create (based on the number of rotations and/or shifts that you want to allow for) and the more results that you want the tool to report, the longer the tool will take to create the catalog (many hours or several days in some cases) and the more memory the compiled catalog will require.

- **Save Training File** – Select this option to save training data to a file on disk.
- **Save As Training File...** – Select this option to save training data to a file with a different name. A Save As dialog box is displayed. Select the directory and enter the file name with the extension .trf.

Training Input Image and ROI

Click **Input Image** to set the image in the active viewport as the input image for training. The input image is the image containing the training image. The image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Select the input ROI for training from the **Select ROI** drop-down list. The input ROI is the training image.

When creating an ROI, keep in mind that the fewer the number of pixels in the ROI, the faster the processing time. This is because the Image Classifier tool checks all pixels in the ROI when performing the classification operation. Therefore, it is recommended that you select the smallest region possible that contains the unique feature you are trying to identify. For best results, make sure that the center of the feature you are trying to identify is located at the center of the ROI.

Mask Input Mask and ROI

Click **Input Mask** to load the image in the active viewport as the input image for specifying a mask. The input image is a grayscale or binary image that contains the mask image. The image name is shown in the Input Mask display window. You can also select the input image from the list of images currently residing in system memory.

The **Select ROI** field contains the input ROI for specifying a mask. The input ROI is the mask image.

Note that it is not necessary to select an ROI from the **Select ROI** drop-down list. If you do not select an ROI and then click the **OK** button to start compiling the Image Classifier tool catalog, the tool asks you if you want to use the input ROI for training. Click **Yes** to use the input ROI for training. This ensures that the input ROI for specifying a mask is the exact same size as the input ROI for training.

Catalog Creation

This field contains the contents of the current training file. The training images are represented as nodes in a tree structure. These nodes include the background image node and nodes for all the training images.

To add the background image to the training file, load the background image into the active viewport, highlight the background image node, and click **Extract - Image**. Note that you must specify a background image and input ROI even if the tool is not creating additional training images.

To add a training image to the training file, click **Node - Add**. The tool displays an entry for Training Image 1. Load the input image into the active viewport, highlight **Training Image 1**, then click **Extract - Image**.

If you want the Image Classifier tool to create additional training images that take rotation and/or shifting of objects into account, load the grayscale or binary mask image into the active viewport, highlight **Training Image 1**, then click **Extract - Mask**.

To delete a node, highlight the training image and click **Node - Remove**. Note that a deleted node cannot be restored. Be sure that you want to delete the node before selecting this option.

By default, the training images are named Training Image 1, Training Image 2, and so on. To change the name of a training image to a more appropriate name, gently left-click the training image name until an edit box appears around the name, then edit the name appropriately.

Image Window

This field displays either the training image or the mask image associated with the selected node. If the **Show Mask** check box is cleared, this field displays the training image. If the **Show Mask** check box is selected, this field displays the mask image.

Image Generation

Use these options if you want the Image Classifier tool to automatically create additional training images that take into account the possible rotation and/or shifting of the training image.

Note that these options are available only if an appropriate option is selected from the **Allow for / Report** drop-down list.

If you want to allow for the rotation of the feature that you are trying to identify, specify the starting angle, the number of degrees between angles, and the ending angle. For example, if **Start** = 0, **Step** = 15, and **Stop** = 90, the tool creates six additional training images, one rotated 15°, one rotated 30°, one rotated 45°, one rotated 60°, one rotated 75°, and one rotated 90°.

If you want to allow for the shifting of the feature that you are trying to identify, specify the number of pixels that the feature can shift in either direction along the X axis and the number of pixels that the feature can shift in either direction along the Y axis. For example, if **in X** = 2 and **in Y** = 2, the tool creates eight additional training images, one shifted one pixel in the negative direction along the X axis, one shifted two pixels in the negative direction along the X axis, one shifted one pixel in the positive direction along the X axis, one shifted two pixels in the positive direction along the X axis, one shifted one pixel in the negative direction along the Y axis, and so on.

You can also allow for both rotation and shifting of the feature that you are trying to identify. In this case, the tool creates one additional training image for each shift for each rotation. Combining the two examples above, the tool creates 48 additional training images, one rotated 15° with a shift of one pixel in the negative direction along the X axis, one rotated 30° with a shift of one pixel in the negative direction along the X axis, and so on.

Allow for / Report Options

These are the rules (conditions) that you want the Image Classifier tool to use when deciding how many additional training images to create and how much information to report about the best match.

Before selecting an option, decide whether you want to take rotations and/or shifts of the feature into account and which results you want the tool to report. Keep in mind that the more training files the tool must create (based on the number of rotations and/or shifts that you want to allow for) and the more results that you want the tool to report, the longer the tool will take to create the catalog (many hours or several days in some cases) and the more memory the compiled catalog will require. It is recommended that you try various options until you find one that suits the needs of your application.

For example, if your feature may rotate around more than one point during classification, it is recommended that you allow for shifts. If your feature always rotates around a single point, if the single point of rotation is in the center of the ROI, and if the feature maintains the same exact position, it is not necessary to allow for shifts.

Select one of the following options from the drop-down list:

- **No rotations or shifts / Image name** – The tool does not take any rotations or shifts into account. The name of the training image with the best match is returned.
- **Rotations only / Image name** – The tool takes rotations only (no shifts) into account. The name of the training image with the best match is returned.
- **Shifts only / Image name** – The tool takes shifts only (no rotations) into account. The name of the training image with the best match is returned.
- **Rotations and shifts / Image name** – The tool takes both rotations and shifts into account. The name of the training image with the best match is returned.

- **Rotations only / Image name and angle** – The tool takes rotations only (no shifts) into account. The name of the training image with the best match and the rotation of the feature image, with respect to the training image, are returned.
- **Shifts only / Image name and shift** – The tool takes shifts only (no rotations) into account. The name of the training image with the best match and the shift of the feature image, with respect to the training image, are returned.
- **Rotations and shifts / Image name and rotation** – The tool takes both rotations and shifts into account. The name of the training image with the best match and the rotation of the feature image, with respect to the training image, are returned.
- **Rotations and shifts / Image name, rotation, and shift** – The tool takes both rotations and shifts into account. The name of the training image with the best match and the both the rotation and shift of the feature image, with respect to the training image, are returned.
- **Rotations and shifts / Image name and shift** – The tool takes both rotations and shifts into account. The name of the training image with the best match and the shift of the feature image, with respect to the training image, are returned.

Enable Score Calculation

Select this checkbox if you want the tool to calculate the score (the degree of confidence that the feature under test matches the training image in the catalog with the best match). Clear this checkbox if you do not want the tool to calculate the score. Since calculating the score can be time-consuming, you can improve performance by clearing this checkbox.

Note that this option is not available if the **Allow for / Report** option is **Rotations only / Image name**, **Shifts only / Image name**, or **Rotations and shifts / Image name**.

Desensitize to Light

Select this checkbox if you want the Image Classifier tool to tolerate small changes in lighting between the training image and the feature under test. Clear this checkbox if the lighting in the training image is well-controlled and is the same as the lighting in the feature under test.

Note that if you select this checkbox, the results of the classification operation may be less accurate in controlled environments.

Extended Classification Depth

Specify the classification depth as a value from 0 to 100. The classification depth is the level of additional processing that you want the tool to perform. If you specify a higher value, the tool takes more data into account in determining the best match, but the processing time is increased.

Note that specifying a higher classification depth is useful when you are trying to identify images that are very similar. It is recommended that you start with a value of 0 (no additional processing) and then try other values until you find one that suits the needs of your application.

OK

When you have finished adding all the training images to the training file, click this button to start compiling the Image Classifier tool catalog. When the catalog has finished compiling, the tool closes the Image Classifier Training dialog box and reopens the Image Classifier tool main dialog box.

Note that the more training files the tool must create (based on the number of rotations and/or shifts that you want to allow for) and the more results that you want the tool to report, the longer the tool will take to create the catalog (many hours or several days in some cases) and the more memory the compiled catalog will require.

Note that the compiled catalog is saved to memory only. It is strongly recommended that you save the compiled catalog to disk by using **File | Save Catalog**. For more information, refer to [page 373](#).

Cancel

Click this button to close the Image Classifier Training dialog box.

Example of Using the Image Classifier Tool

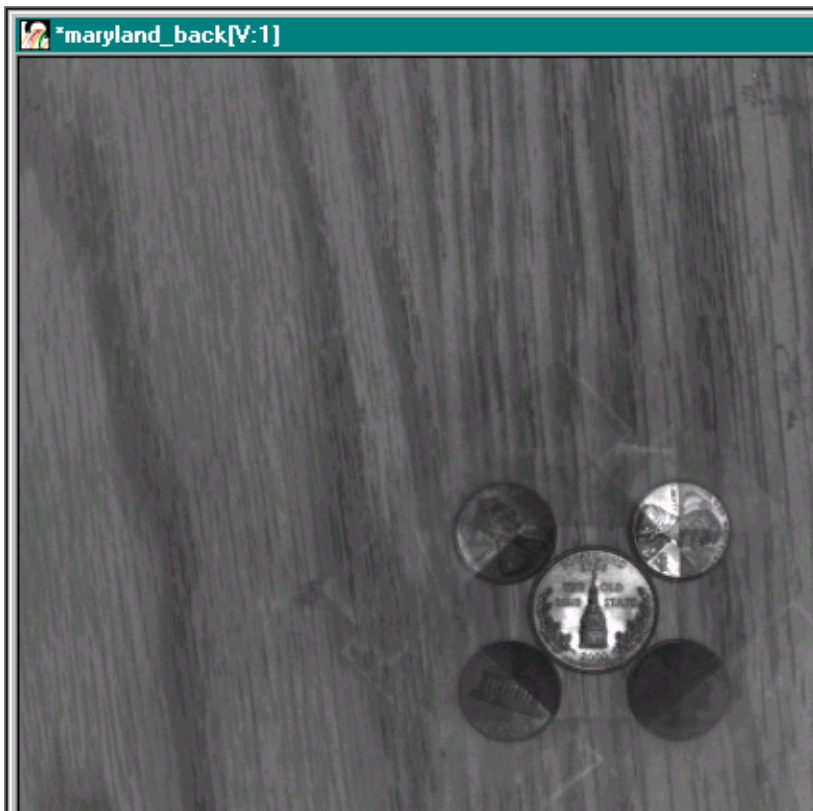
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This example shows how to classify quarters in a sorting machine. It demonstrates how to add training images to a training file, specify a mask image for each of the training images, add a background image to the training file, compile the catalog of training images, and compare features in your input images to the training images in the catalog to find the best match.

Note: The Image Classifier tool requires that you provide consistent lighting conditions. To create appropriate lighting conditions for this example, you could set up the sorting machine in the dark room to prevent any non-polarized light from reaching the quarters and illuminate the quarters with a fluorescent lamp shining through a polarizing glass. Mount a polarizing filter on the lens and adjust the filter to prevent any one-sided reflections/glare. This would ensure that the quarters were illuminated evenly, even after undergoing rotation.

The operation is as follows:

1. Open the Image Classifier tool.
2. Add training images to your training file by performing the following steps:
 - a. Click **Train** to open the Image Classifier Training dialog box.
 - b. In the active viewport, open the first image that contains a feature you will be trying to identify (maryland_back). This image contains the back of the Maryland quarter.



Note that the quarter is secured so that each subsequent quarter will be located in the exact same position.

Note that you can use the Picture tool to capture your training images by including the Picture tool in a point & click script. For more information about the Picture tool, refer to [Chapter 27, “Using the Picture Tool.”](#) For more information about the Point & Click Script tool, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

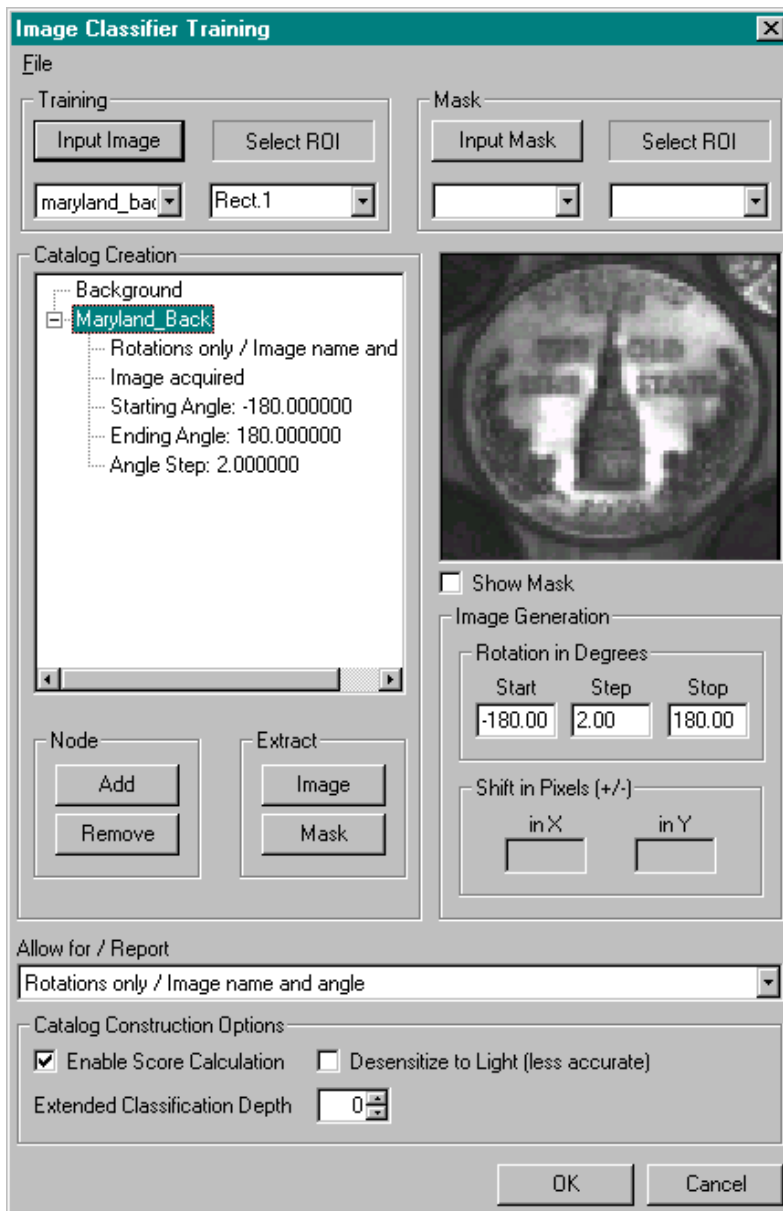
- c. Click **Input Image** in the **Training** frame in the Image Classifier Training dialog box.
The name of the image appears in the drop-down list.

- d. Draw a rectangle ROI that encompasses the quarter as closely as possible. Make sure that the center of the quarter is located at the center of the ROI. This ROI will become the actual training image.



- e. Select the ROI from the **Select ROI** drop-down list in the Training frame of the Image Classifier Training dialog box.
- f. In the Image Classifier Training dialog box, click **Node - Add**.
The tool displays an entry for Training Image 1.

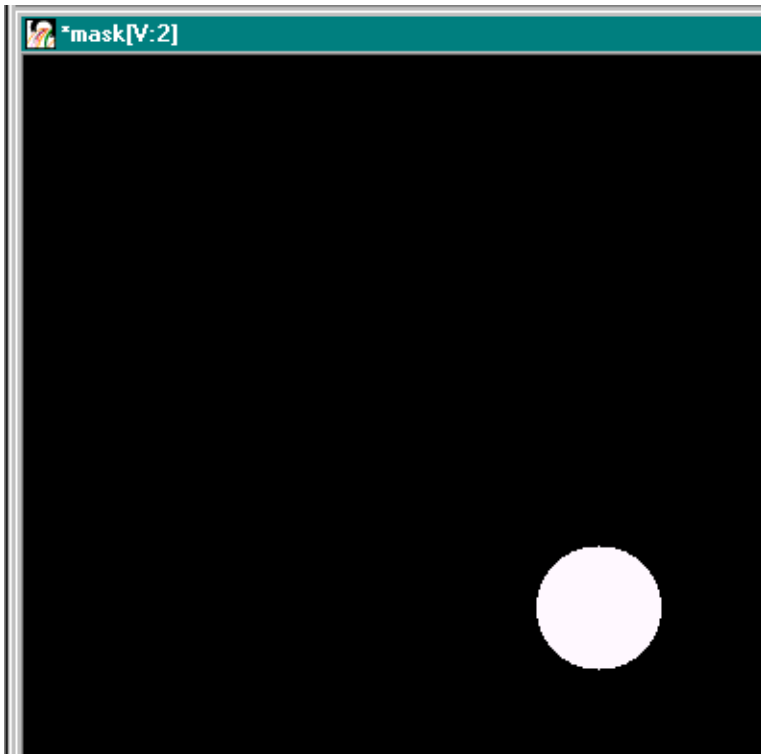
- g. For this example, the quarters may rotate, but because of their secure positioning, they will not shift. Therefore, highlight **Training Image 1** and select **Rotations only / Image name and angle** from the **Allow for / Report** drop-down list.
- h. Assume that you want the tool to create 180 additional training images that show the quarter rotated in 2° increments. In the **Image Generation** frame, set **Start** to -180, set **Step** to 2, and set **Stop** to 180.
- i. To ensure that the tool returns a score for each match, select the **Enable Score Calculation** checkbox.
- j. Highlight **Training Image 1**, then click **Extract - Image**.
The training image is displayed in the image window.
- k. To change the name of the training image to a more appropriate name, gently left-click the training image name until an edit box appears around the name, then change the name to **Maryland_Back**.
The Image Classifier Training dialog box looks as follows.



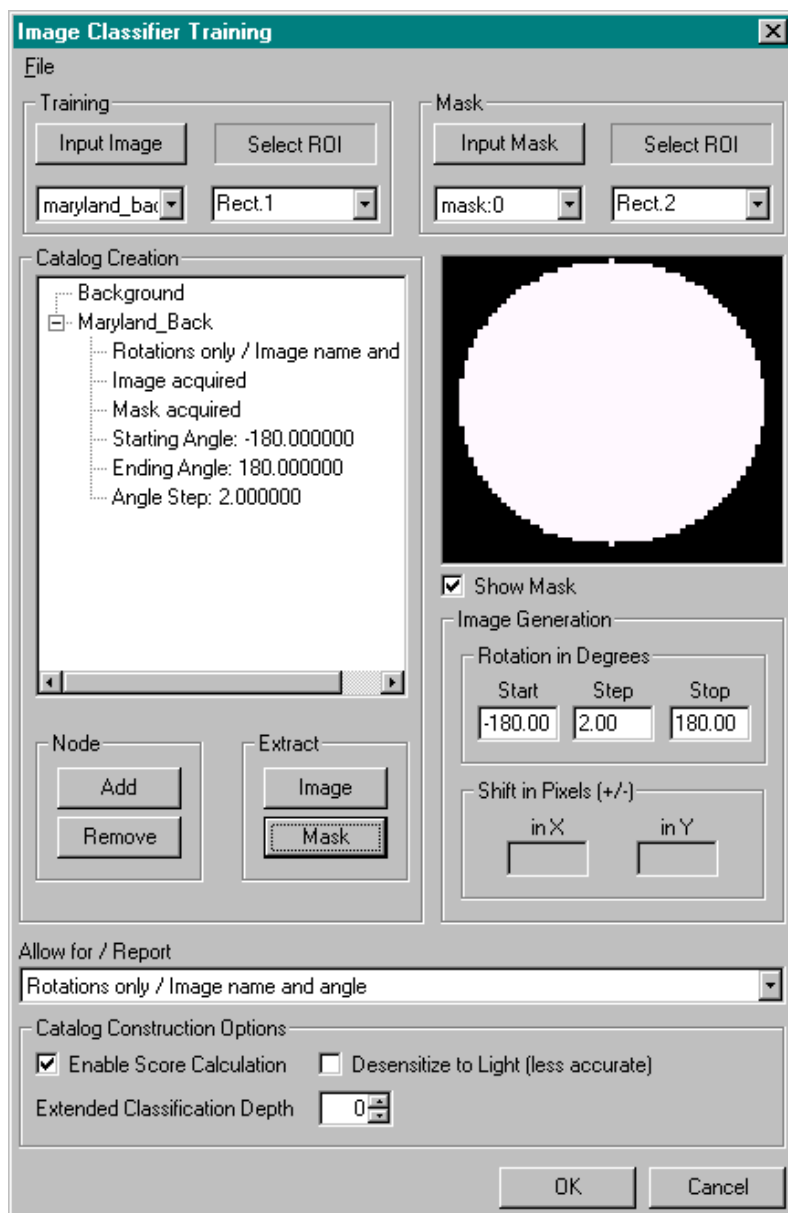
1. Repeat steps b through l until all your training images have been acquired. For example, you might want to create training images for the front of the Maryland quarter, the back of the regular quarter, and the front of the regular quarter.

Note that if you are using a point & click script that draws subsequent training images into the same viewport, it is not necessary to redraw the training ROI.

3. Since the Image Classifier tool will be creating additional training images, create and specify a mask image for each of your training images by performing the following steps:
 - a. In the active viewport, open the first input image (maryland_back).
 - b. Draw an ellipse ROI that encompasses the top of the quarter as closely as possible.
 - c. Use the ROI Manager tool to draw a rectangle ROI around the entire image. For more information about the ROI Manager tool, refer to [Chapter 32, “Using the ROI Manager Tool.”](#)
 - d. Select the rectangle ROI around the entire image and change the contents to black using the Pixel Change tool. For more information about the Pixel Change tool, refer to [Chapter 28, “Using the Pixel Change Tool.”](#)
 - e. Select the ellipse ROI and change the contents to white using the Pixel Change tool. The white area defines the region of the image that will be “dropped” onto the background image.
 - f. Use the **File | Save Image As** option from the main application to save the mask image with the name mask. *The mask image looks as follow.*



- g. Click **Input Mask** in the **Mask** frame in the Image Classifier Training dialog box.
The name of the image appears in the drop-down list.
- h. Highlight the entry for Training Image 1 (Maryland_Back), then click **Extract - Mask**.
If you did not select an ROI, the tool asks if you want to use the training ROI.
- i. Click **Yes**.
The mask image is displayed in the image window and the Image Classifier Training dialog box looks as follows.



- j. Repeat steps a through i until all the mask images have been acquired.

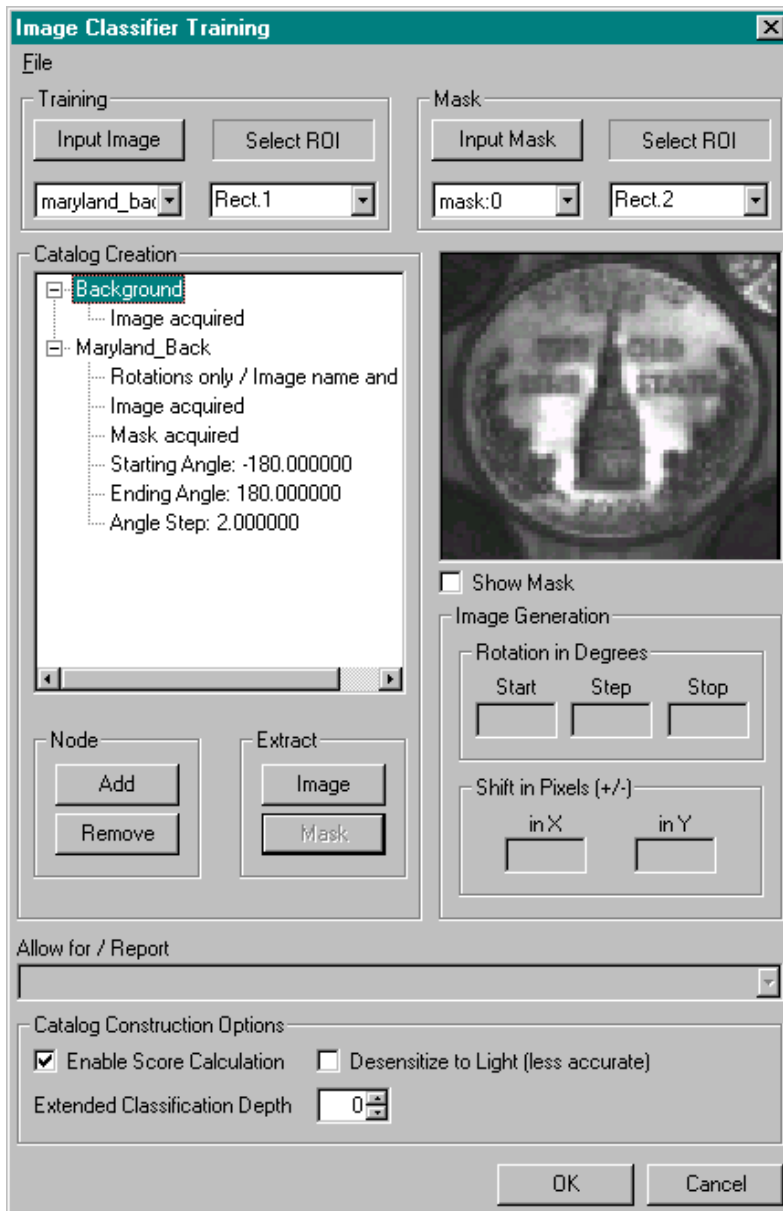
Note that for this example, you can use the same mask image for all your training images.

4. Add the background image to the catalog by performing the following steps:
 - a. Load the background image into the active viewport. Typically, the background image represents as closely as possible the background on which the features under test will be acquired. Following is a background image that you could use with this example.



For this example, because no shifting is allowed, you can use the input image (maryland_back) for the background image.

- b. In the Image Classifier Training dialog box, highlight the **Background** node.
- c. Click **Extract - Image**.
If you did not create an ROI, the tool asks if you want to use the training ROI.
- d. Click **Yes**.
The Image Classifier Training dialog box looks as follows.



5. In the Image Classifier Training dialog box, click **OK** to compile your catalog of training images. When the catalog finishes compiling, the tool closes the Image Classifier Training dialog box and reopens the Image Classifier tool main dialog box.
6. Classify your input images by performing the following steps:
 - a. In the active viewport, open your first input image. Note that you can use the Picture tool to capture your input images by including the Picture tool in a point & click script. For more information about the Picture tool, refer to [Chapter 27, “Using the Picture Tool.”](#) For more information about the Point & Click Script tool, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)
 - b. With the first image in the active viewport, click **Input Image** in the Image Classifier tool main dialog box.
 - c. Click **Classify** to find the best match.
If you did not select an ROI, the tool asks if you want to use the training ROI.
 - d. Click **Yes**.
The results are displayed in Image Classifier tool main dialog box.

Point & Click Script

This section describes the specific use of the Image Classifier tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

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Using Classification Results

Information about the classification operation is stored in point & click script variables, which you can use in a point & click script. To access the match information, perform the following steps:

1. Open the Point & Click Script tool.
2. Select **Options | Show Debug Box**.
The Debug Window is displayed.
3. From one of the drop-down lists, select the point & click script variable whose information you want to access.
The current value of the variable is displayed in the text box to the right of the variable.

The point & click script variables are as follows.

Variable	Type	Description
IC_Match	String	The name of the training image in the catalog that best matches the feature under test.
IC_Score	Number	A number representing the degree of confidence that the feature under test matches the training image in the catalog with the best match. If the Generate Normalized Metric checkbox is selected, the value can range from 0.0 to 1.0, where 0.0 is the worst possible match and 1.0 is the best possible match. If the Generate Normalized Metric checkbox is cleared, the value can range from 0.0 to negative infinity, where 0.0 is the best possible match and the lower the negative value, the worse the match.
IC_Angle	Number	The amount that the feature under test has rotated with respect to the training image in the catalog with the best match, in degrees.
IC_ShiftInX	Number	The amount that the feature under test has shifted along the X-axis with respect to the training image in the catalog with the best match, in pixels.
IC_ShiftInY	Number	The amount that the feature under test has shifted along the Y-axis with respect to the training image in the catalog with the best match, in pixels.

Adding to the Point & Click Script

To add the Image Classifier tool's functionality to a point & click script, you must first have the Point & Click Script tool open. After you have trained and classified the image, click **Add to Script** to record the information in the Point & Click Script tool.

Note: You always provide the absolute path to the catalog file in the Image Classifier tool. If you save the point & click script to the same drive that contains the catalog file, the tool automatically converts the catalog file to a path relative to the directory in which you save the script. If you move the script (and the catalog file) to another directory, the correct catalog file is opened when you run the script.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Image Classifier tool is set up exactly as it was when you previously recorded the script item. The **Add to Script** button is changed to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back into the point & click script with the new options.

Note: You cannot edit a training file from within the point & click script. If you want to edit the training file, open a new Image Classifier tool, click **Train** from the Image Classifier tool to open the Image Classifier Training dialog box, then select **File | Open Training File**. Edit the training file, click **OK** to recompile the catalog, then save the catalog. In the point & click script (in edit mode), select **File | Open Catalog** to reload the updated catalog. When you click **Update Script**, the updated catalog is added to the point & click script.



Using the Image Manager Tool

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Introduction

The Image Manager tool is supplied with DT Vision Foundry. It allows you to manage images in memory. All open images are displayed in a list.

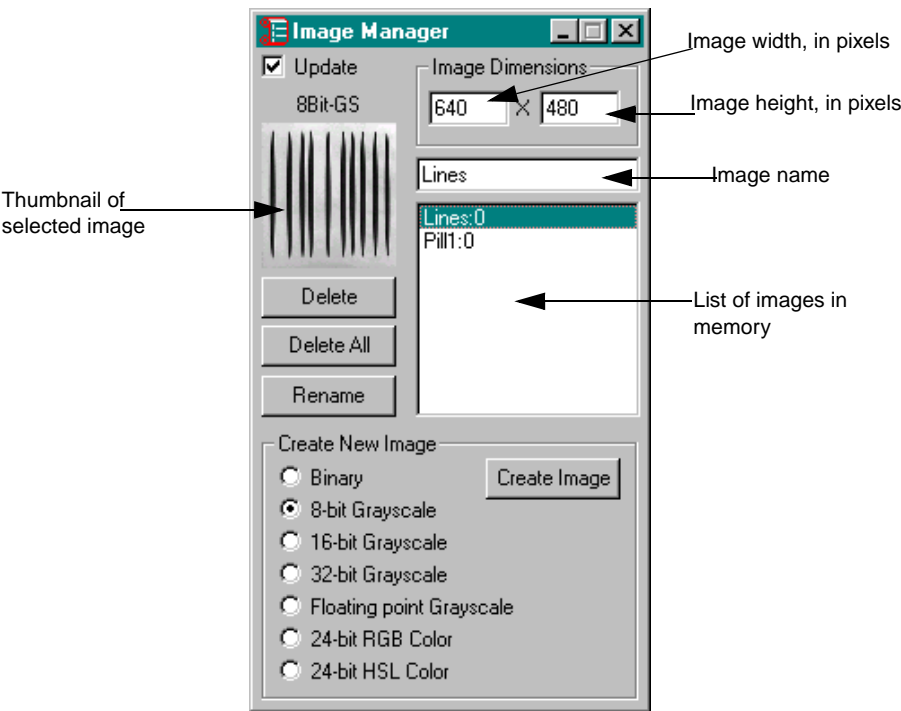



Figure 83: Image Manager Tool

The Image Manager tool allows you to do the following:

- View a list of all images in memory.
- Determine the name, height, width, and type of a specific image.
- View a thumbnail of a specific image.
- Delete a specific image.
- Delete all images in memory.
- Select a specific image into the active viewport.
- Create a new image.
- Rename a specific image.

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To open an Image Manager tool, select the  icon from the Miscellaneous toolbar or select **Image Manager** from the Tools menu.

Notes: The Image Manager tool is fully compatible with all other tools, image types, and ROIs.

You can have up to 100 Image Manager tools open at the same time.

Description of Image Manager Tool Options

This section contains a description of the options in the Image Manager tool dialog box.

Update

Select this checkbox if you want the tool to highlight the image in the active viewport in the list of images in memory and show a thumbnail of the image in the active viewport. As you jump from one active image to another in the main application, the tool updates the list and thumbnail to show you which image in the list is the active image in the main application.

Image Type

This field displays the type of image selected in the list of images in memory.

Thumbnail of Selected Image

This area displays a thumbnail of the image selected in the list of images in memory. To place the thumbnail image in the active viewport, double-click the selection in the list box or click in this area (click on the thumbnail).

Image Dimensions

When you select an image, these fields display the width and height of the selected image. When you are creating a new image, enter the width and height in these text boxes.

Image Name

When you select an image, this field displays the name of the selected image. When you are renaming an image or creating a new image, enter the new name in this text box.

List of Images in Memory

This area displays a list of all images in memory. To place an image in the list into the active viewport, double-click the image name in the list. To view the thumbnail, width, height, and type of an image, single-click the image name in the list.

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Delete

Click this button to delete the selected image. Tools that are using this image are notified that the image has been deleted and unassociate themselves from the deleted image.

Delete All

Click this button to delete all images in memory. Tools that are using a deleted image are notified that the image has been deleted and unassociate themselves from the deleted image.

Rename

Click this button to rename the image selected in the list of images in memory to the name specified in the image name text box. Tools that are using this image are notified and their displays are updated to show the change.

Create New Image

If you want to create a new blank image in memory, click the radio button that specifies the image type, then click the **Create Image** button. A new image is created with the width specified in the image width text box, with the height specified in the image height text box, and with the name specified in the image name text box.

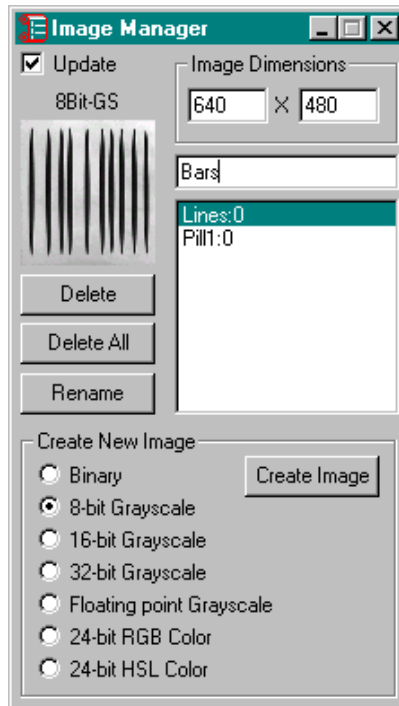
Example of Using the Image Manager Tool

This example shows how to load and rename an image.

The operation is as follows:

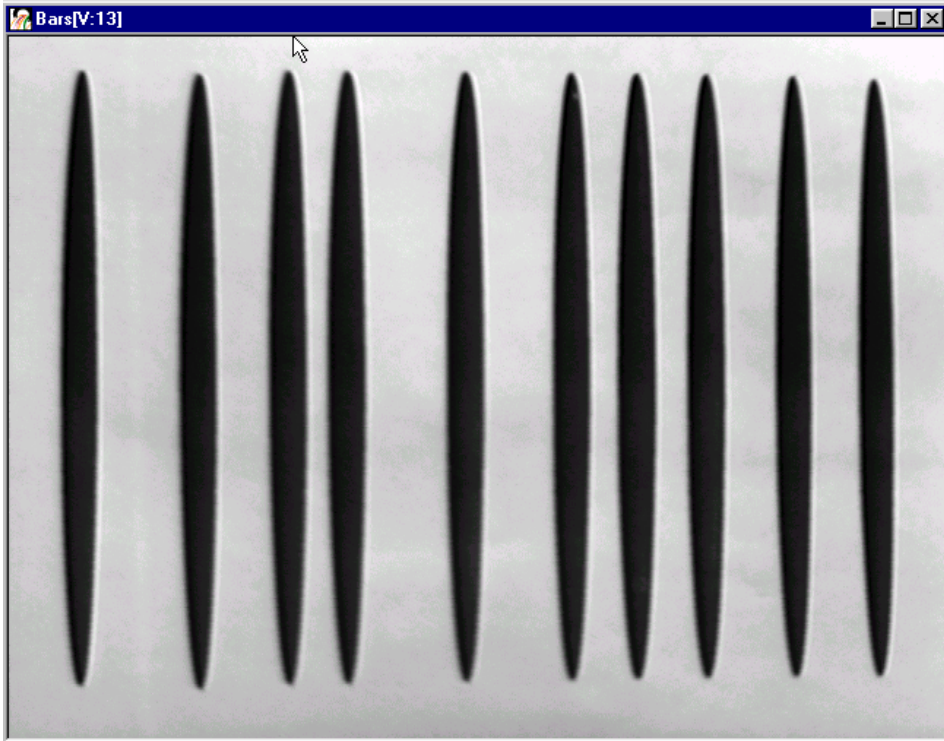
1. Open the image Lines into a viewport.
2. Open an Image Manager tool (if one is not already open).
3. Click on Lines in the list of images in memory.
4. Enter the new name Bars in the image name text box. Leave the width at 640 pixels and the height at 480 pixels.

The Image Manager tool looks as follows:



5. Rename the image by clicking **Rename**.

The viewport and all tools using this image are updated with the new name. The image looks as follows:






Using the Image Modifier Tool

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Introduction

The Image Modifier tool is supplied with DT Vision Foundry. It allows you to crop, rotate, flip, or scale an image.

To open an Image Modifier tool, select the  icon from the Image Processing toolbar or select Image Modifier from the Tools menu.

Note: You can have only one Image Modifier tool open at a time.

Description of Image Modifier Tool Options

This section contains a description of the options in the Image Modifier tool dialog box.

Crop Tab Options

The Crop tab allows you to crop the area inside the specified ROI.

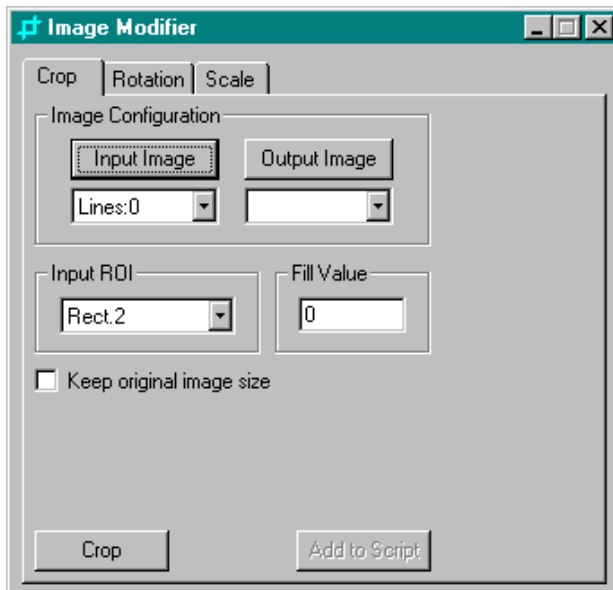


Figure 84: Image Modifier Tool - Crop Tab

Input Image

Click this button to load the image in the active viewport as the input image. The image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Output Image

Click this button to load the image in the active viewport as the output image. The image name is shown in the Output Image display window. You can also select the output image from the list of images currently residing in system memory or enter your own name for the output image in the display window text box.

If you do not select an output image, the Image Modifier tool automatically creates an output image for you (with the name **Output**). Note, however, that if you intend to use multiple output images in a point & click script, it is recommended that you either use the image in the active viewport as the output image or select the output image from the drop-down list. This ensures that each output image in the point & click script has a unique name.

Input ROI

Select the input ROI that represents the area that you want to crop. You can use a rectangle, ellipse, poly freehand, or freehand ROI. Note that rectangle and ellipse ROIs are saved and/or recreated automatically in a script; however, poly freehand and freehand ROIs are not saved or recreated automatically in a script.

Fill Value

Specify the background color of the output image. The value can range from 0 (black) to 255 (white).

Keep Original Image Size

Select this checkbox if you want the output image to be the same size as the input image. The area inside the ROI is cropped and the rest of the image is the color specified by the **Fill Value**.

Clear this checkbox if you want the output image to be the size of the smallest rectangle that surrounds the entire ROI. Any area in the output image that is not inside the ROI is set to the color specified by the **Fill Value**.

Crop

Click this button to perform the Crop operation.

Add to Script

After you set up the parameters, click this button to add the information to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Rotation Tab Options

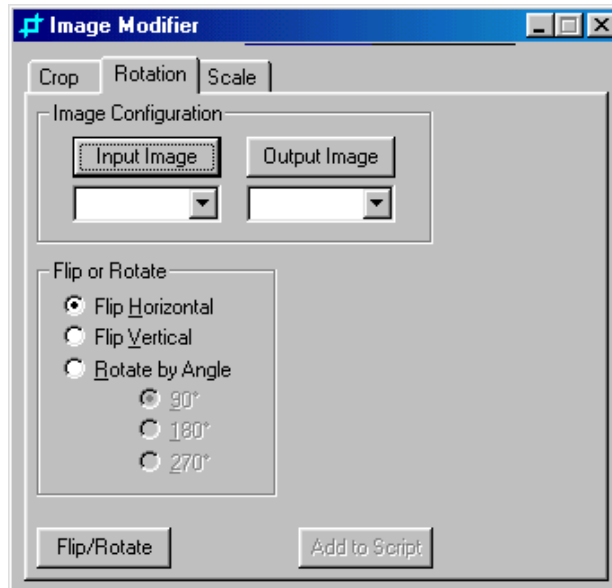


Figure 85: Image Modifier Tool - Rotation Tab

Input Image

Click this button to load the image in the active viewport as the input image. The image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Output Image

Click this button to load the image in the active viewport as the output image. The image name is shown in the Output Image display window. You can also select the output image from the list of images currently residing in system memory or enter your own name for the output image in the display window text box.

If you do not select an output image, the Image Modifier tool automatically creates an output image for you (with the name **Output**). Note, however, that if you intend to use multiple output images in a point & click script, it is recommended that you either use the image in the active viewport as the output image or select the output image from the drop-down list. This ensures that each output image in the point & click script has a unique name.

22

Flip or Rotate

Select one of the following actions:

- **Flip Horizontal** –Flips the image horizontally.
- **Flip Vertical** –Flips the image vertically.
- **Rotate by Angle** –Rotates the image either by 90° (the default), 180°, or 270°.

Flip/Rotate

Click this button to flip or rotate the image.

Add to Script

After you set up the parameters, click this button to add the information to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Scale Tab Options

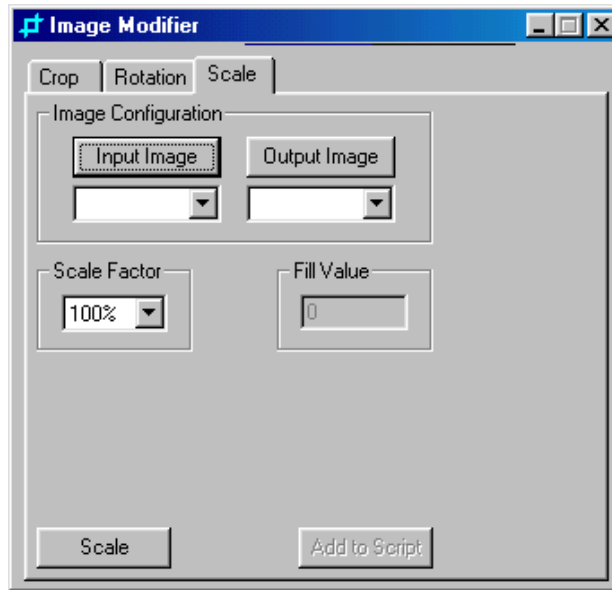


Figure 86: Image Modifier Tool - Scale Tab

Input Image

Click this button to load the image in the active viewport as the input image. The image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Output Image

Click this button to load the image in the active viewport as the output image. The image name is shown in the Output Image display window. You can also select the output image from the list of images currently residing in system memory or enter your own name for the output image in the display window text box.

If you do not select an output image, the Image Modifier tool automatically creates an output image for you (with the name **Output**). Note, however, that if you intend to use multiple output images in a point & click script, it is recommended that you either use the image in the active viewport as the output image or select the output image from the drop-down list. This ensures that each output image in the point & click script has a unique name.

22

Scale Factor

Select the amount by which to scale the image (25%, 50%, 100%, 200%, or 400%).

Fill Value

Specify the background color of the output image. The value can range from 0 (black) to 255 (white). This option is available only if the **Scale Factor** is 25% or 50%.

Scale

Click this button to perform the scale operation.

Add to Script

After you set up the parameters, click this button to add the information to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the Image Modifier Tool

This example shows how to crop, rotate, and scale the image Lines, shown in [Figure 87](#).

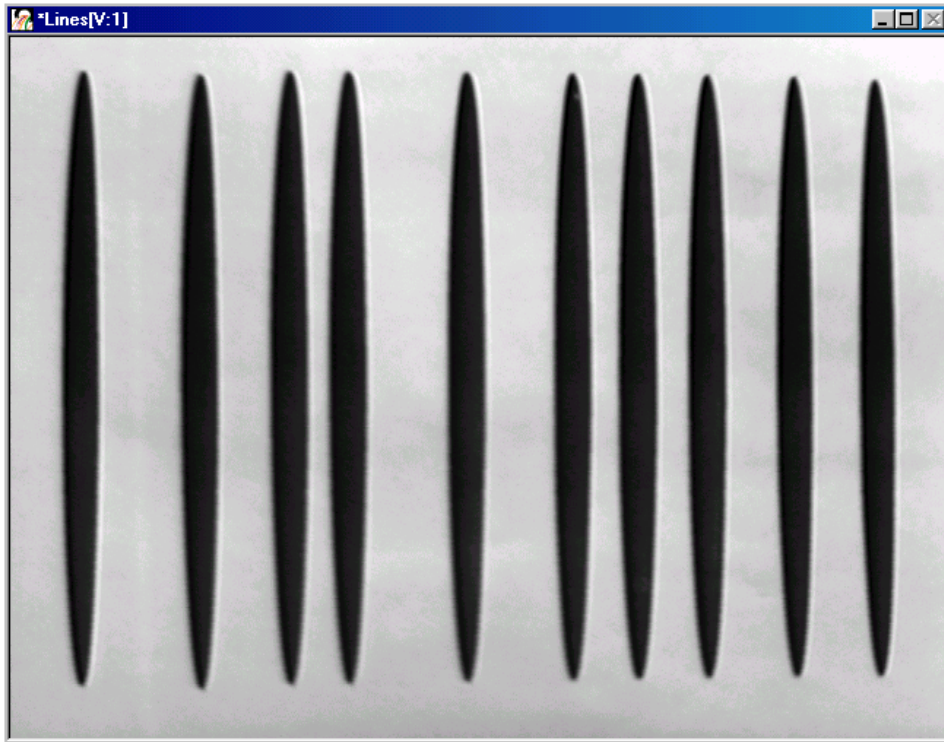
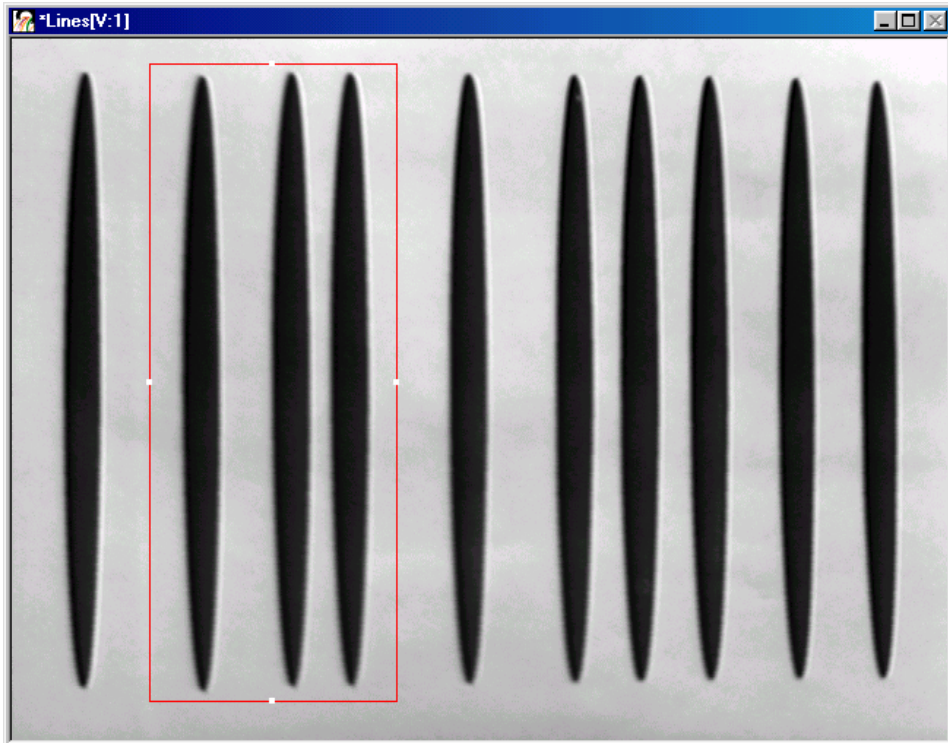


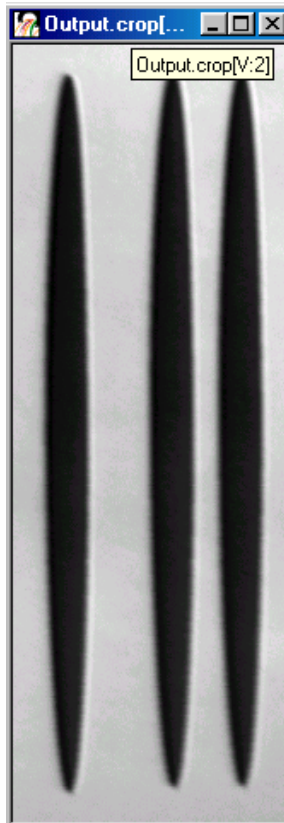
Figure 87: Image Modifier Tool Example Image

The operation is as follows:

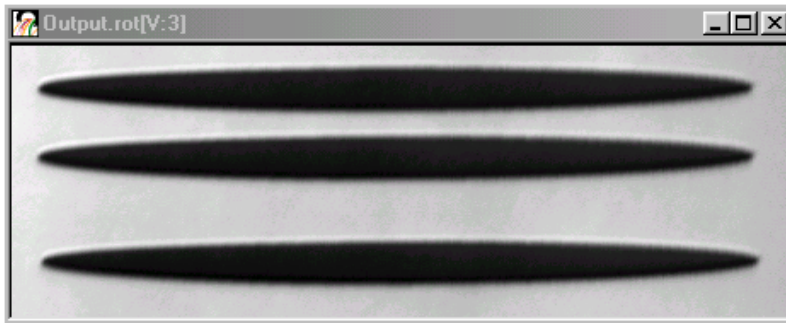
1. Open the Image Modifier tool (if it is not already open).
2. On the Crop tab, select the input image Lines:0, then draw a rectangle ROI around the following lines on the input image:



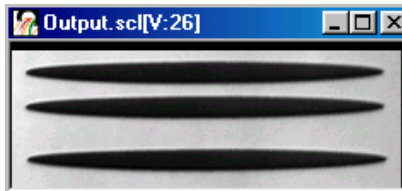
3. Click the **Crop** button.
The resulting image appears as follows:



4. Click the Rotation tab.
5. Select **Output.crop.0** as the input image name.
6. Click **Rotate By Angle**, click **270 degrees**, then click **Flip/Rotate**.
The resulting image appears as follows:



7. Click the Scale tab.
8. Select **Output.rot.0** as the input image name.
9. Enter a scale factor of 50 and a fill value of 0, then click **Scale**.
The resulting image appears as follows:



Notice the black pixels around the scale image. This is because the image was reduced by 50% and the fill value is 0 (black).

Point & Click Script

This section describes the specific use of the Image Modifier tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Image Modifier tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Select the appropriate tab and the image to modify, set up the parameters, then click **Add to Script** to record the information in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Image Modifier tool is set up exactly as it was when you previously recorded the script item. The **Add to Script** button is changed to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Import Tool

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Introduction

The Import tool is supplied with DT Vision Foundry. It allows you to transfer variables and images to the DT Vision Foundry application from either the DTiX Variable Server, the DTiX Image Server, or a text file.

The DTiX Variable Server and DTiX Image Server are installed when you install DT Vision Foundry. They hold data (variables and images) and make that data available to the DT Vision Foundry application. Variables imported into the DT Vision Foundry application are automatically available to all tools that use variables. Images imported into the DT Vision Foundry application are automatically available to all tools that use images.

To open an Import tool, select the  icon from the Input-Output toolbar or select **Import** from the Tools menu.

Notes: The Import tool is fully compatible with all tools, image types, and ROIs.

You can have up to 100 Import tools open at the same time.

Description of Import Tool Options

This section contains a description of the options in the Import tool dialog box.

Variables Tab Options

The Variables tab allows you to transfer variables to DT Vision Foundry from either the DTiX Variable Server or a text file.

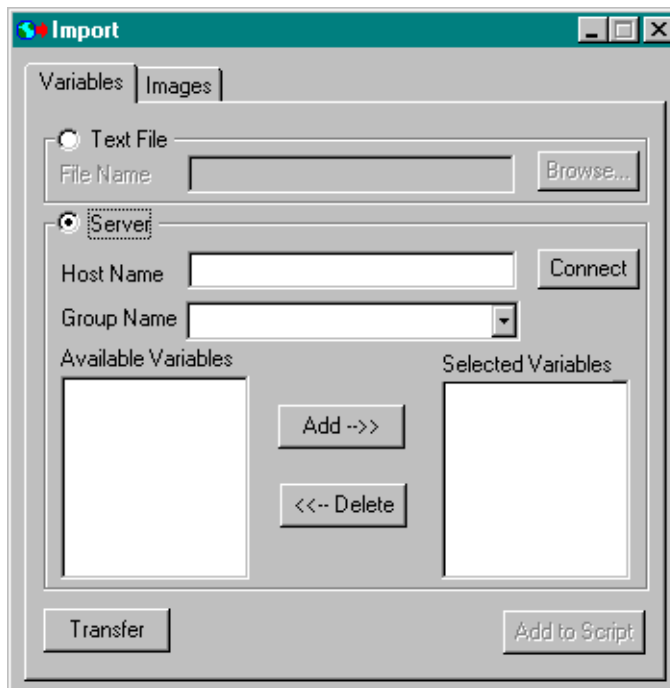


Figure 88: Import Tool - Variables Tab

Text File

Click the **Text File** radio button if you want to transfer all the variables in a text file (*.txt) to DT Vision Foundry. Enter the complete path to the file in the **File Name** text box or use the **Browse** button to locate the file. If you enter the name of a file that does not exist, the Import tool returns an error.

Server

Click the **Server** radio button if you want to transfer the variables in the **Selected Variables** window to DT Vision Foundry.

If the DTiX Variable Server is located on a different computer system, enter the system name in the **Host Name** text box, then click **Connect**. The host name can be a UNC name (such as \\server or server) or a DNS name (such as domain.com, example.microsoft.com, or 135.5.33.19). If you do not enter a host name, the tool connects to the DTiX Variable Server on your local system.

Note that in order to transfer variables from the DTiX Variable Server on a remote host system, the host system must be turned on, the DTiX Variable Server must be installed on the host system, and you must have permission to access the host system. For more information on assigning permission, refer to the DTiX Security online help, located in C:\Program Files\Data Translation\DTiX, by default.

The **Group Name** drop-down list contains all the variable groups located on the DTiX Variable Server. Select the variable group that contains the variables you want to transfer.

The **Available Variables** window contains a list of all the variables in the specified variable group. For each variable that you want to transfer, click on the variable to select (highlight) it, then click **Add** to add the selected variable to the **Selected Variables** list.

To remove a variable from the **Selected Variables** list, select (highlight) the variable, then click **Delete**.

Transfer

When all the settings are correct, click this button to import the specified variables to DT Vision Foundry.

If you are importing variables from a text file, note that variables that contain only numbers are imported as number variables and variables that contain one or more letters are imported as string variables.

Add to Script

After you transfer the variables, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29](#), “Using the Point & Click Script Tool.”

Images Tab Options

The Images tab allows you to transfer images, along with information about the ROIs associated with the images, to DT Vision Foundry from the DTiX Image Server.

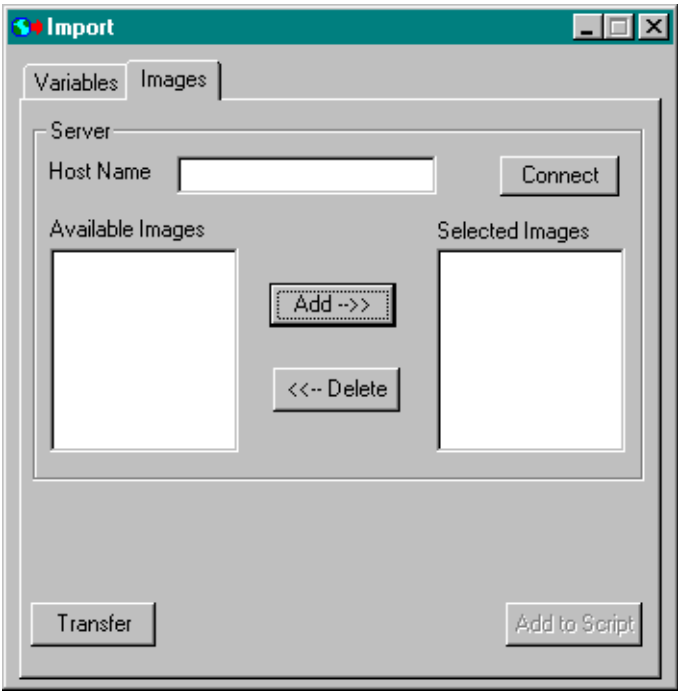


Figure 89: Import Tool - Images Tab

Server

If the DTiX Image Server is located on a different computer system, enter the system name in the **Host Name** text box, then click **Connect**. The host name can be a UNC name (such as \\server or server) or a DNS name (such as domain.com, example.microsoft.com, or 135.5.33.19). If you do not enter a host name, the tool connects to the DTiX Image Server on your local system.

Note that in order to transfer images from the DTiX Image Server on a remote host system, the host system must be turned on, the DTiX Image Server must be installed on the host system, and you must have permission to access the host system. For more information on assigning permission, refer to the DTiX Security online help, located in C:\Program Files\Data Translation\DTiX, by default.

The **Available Images** window contains a list of all the images on the DTiX Image Server. For each image that you want to transfer, click on the image to select (highlight) it, then click **Add** to add the selected image to the **Selected Images** list.

To remove an image from the **Selected Images** list, select (highlight) the image, then click **Delete**.

Transfer

When all the settings are correct, click this button to transfer the **Selected Images** to DT Vision Foundry.

Add to Script

After you transfer the images, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29](#), “Using the Point & Click Script Tool.”

Example of Using the Import Tool

This example shows how to transfer an image (TestImage) that is stored on the DTiX Image Server on your local system to the DT Vision Foundry application and then save the image file to disk.

The operation is as follows:

1. Open an Import tool (if one is not already open).
2. Click the **Images** tab.
3. Leave the **Host Name** text box blank, then click **Connect**.
*A list of all the images on the DTiX Image Server on your local system are displayed in the **Available Images** window.*

If the DTiX Image Server containing the image that you want to transfer is located on a remote system, enter the name of the system in the **Host Name** text box, then click **Connect**.

4. Click **TestImage** to highlight it, then click **Add**.
*The image TestImage is displayed in the **Selected Images** window.*
5. Click **Transfer** to import TestImage to the DT Vision Foundry application.

You can now use the image TestImage in any tool that uses images. For example, if you want to save the image that you transferred, you can use the File Manager tool as follows:

1. Open a File Manager tool (if one is not already open).
The image TestImage is displayed in the list of images in memory.
2. Click **TestImage** to highlight it.
*The image name is displayed in the **File Name** text box.*
3. Enter the complete path to the directory in which you want to save the image in the **Folder Path** text box.
4. Select **File Save** from the File menu.

Point & Click Script

This section describes the specific use of the Import tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Import tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Import tool to perform the desired function. This includes the location from which you want to transfer the variables/images and the variables/images that you want to transfer. Click **Transfer** to perform the desired operation, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Note: You always provide the absolute path to the variable text file in the Import tool. If you save the point & click script to the same drive that contains the variable text file, the tool automatically converts the variable text file to a path relative to the directory in which you save the script. If you move the script (and the variable text file) to another directory, the correct variable text file is opened when you run the script.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Import tool is set up exactly as it was when you previously recorded the script item. This includes the location from which you want to transfer the variables/images and the variables/images that you want to transfer. The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Line Profile Tool

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Introduction

The Line Profile tool is supplied with DT Vision Foundry. It allows you to create and view line profiles of images, find edges, and measure distances along lines. You can add an unlimited number of line profiles to the same graph. This is useful if you want to distinguish some characteristic of one image from another image. You can add line profiles from multiple images and from multiple viewports.

As with all DT Vision Foundry tools that use a graph to display image data, the Line Profile tool allows you to do the following:

- Change the minimum and maximum x-axis and y-axis values.
- Change the grid markings for both the x-axis and y-axis.
- Change the text displayed on the graph (Title, x-axis label, and y-axis label).
- Change the color and style of each curve on the graph.
- Zoom to a specified area using the mouse.
- Switch between zoomed and unzoomed modes by double-clicking the right mouse button.
- Resize the graph.
- Print the graph.

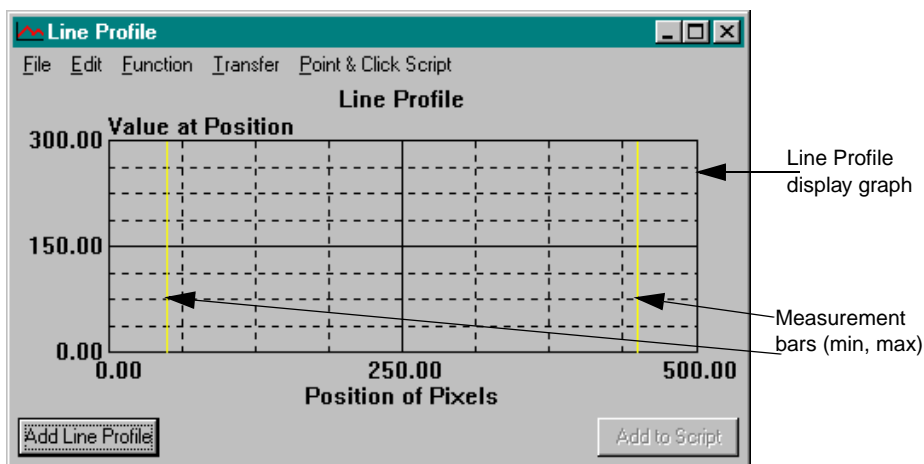



Figure 90: Line Profile Tool

To open a Line Profile tool, select the  icon from the Image Analysis toolbar or select **Line Profile** from the Tools menu.

Notes: The Line Profile tool is fully compatible with all other tools and image types. It works only with line, polyline, and freehand line ROIs.

You can have up to 100 Line Profile tools open at the same time.

Description of Line Profile Tool Options

This section contains a description of the options in the Line Profile tool dialog boxes.

Dialog Box Options

Line Profile Display Graph

The Line Profile display graph shows all the created line profiles and any derivatives taken. A set of vertical measurement bars represent the minimum and maximum measurement values. Displayed measurements are always taken between the minimum and maximum measurement values.

When you are defining and displaying measurement data in the Distances dialog box (see [page 444](#)), you can adjust the minimum and maximum measurement values by grabbing the measurement bars with the left mouse button. When you are finding edges in your images using the Find Edges dialog box (see [page 453](#)), the measurement bars are automatically placed.

Add Line Profile

Click this button to add a line profile to the graph. The line profile is created from the image displayed in the active viewport with respect to its active line ROI (line, polyline, or freehand line). You can add as many line profiles to the graph as you want.

Add to Script

After you add the line profile, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29](#), “Using the Point & Click Script Tool.”

File Menu Options

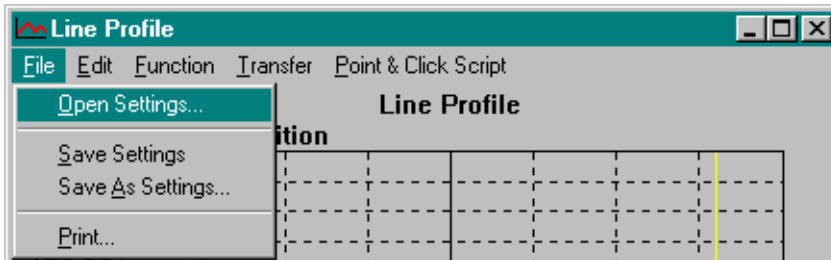


Figure 91: Line Profile Tool - File Menu Options

Open Settings...

Select this option to open a graph configuration from disk. An Open dialog box is displayed. When you open a graph configuration (the file name must be followed by the extension .pro), the object is loaded into the Line Profile tool.

Note that a graph configuration includes x-axis limits, y-axis limits, graph text, and grid markings.

Save Settings

Select this option to save a graph configuration back to disk. The Line Profile tool saves x-axis limits, y-axis limits, graph text, and grid markings.

Save As Settings...

Select this option to save a graph configuration to disk with a different name. A Save As dialog box is displayed. Select the directory and enter a file name with the extension .pro.

Note that if you save a graph configuration with the name default.pro, the file will automatically open each time you open a Line Profile tool. You must save default.pro in the DT_LProf directory (located in C:\Program Files\Data Translation\DT Vision Foundry\Tools, by default).

Print

Select this option to print the graph.

Edit Menu Options

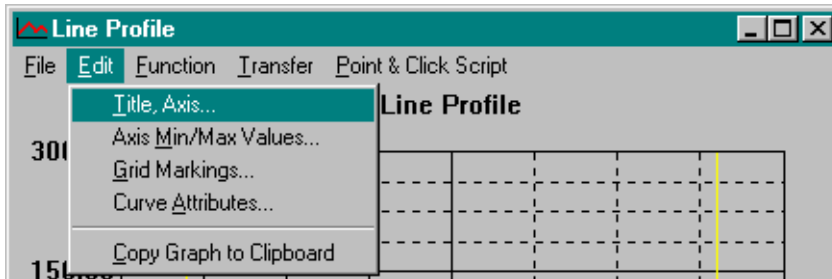


Figure 92: Line Profile Tool - Edit Menu Options

Title, Axis...

Select this option to change the graph text for the title, x-axis, and y-axis. Enter the appropriate values in the Set Title, X & Y Labels dialog box, then click **OK**.

Axis Min/Max Values...

Select this option to change the minimum and maximum limits for the x-axis and y-axis. Enter the appropriate values in the Axis Min/Max Values dialog box, then click **OK**.

You can also set the minimum and maximum values for the graph by performing the following steps:

1. Move the mouse cursor to the point in the graph at which you want to start drawing the rectangular region.
2. While holding down the <Shift> and <Ctrl> keys at the same time, click and hold down the left mouse button.
3. Drag the mouse until you complete the rectangular region. While dragging the mouse, the proposed zooming region is shown on the graph.
4. When you have completed the rectangular region, release the left mouse button. The graph now zooms to the desired minimum and maximum axis points.

You can switch back and forth between zoomed and unzoomed modes by double-clicking in the graph with the right mouse button.

Grid Markings...

Select this option to change the grid markings for the x-axis and y-axis. Enter the appropriate values in the Grid Markings dialog box, then click **OK**.

Curve Attributes...

Select this option to change the style and color of the curve selected in the histogram display graph. Click the appropriate radio buttons in the Curve Attributes dialog box, then click **OK**.

Copy Graph to Clipboard

Select this option to copy the histogram display graph to the clipboard.

Function Menu Options

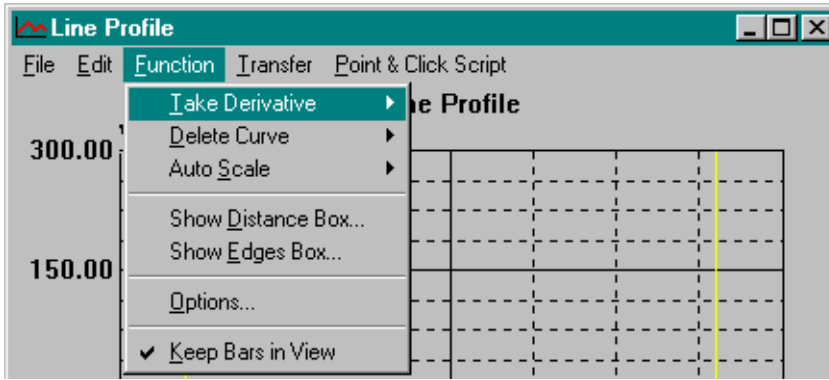


Figure 93: Line Profile Tool - Function Menu Options

Take Derivative

The Take Derivative option allows you to specify whether you want to take a first or second derivative of the selected curve:

- **First** – Select this option to take the first derivative of the selected curve. The Line Profile tool uses the first derivative options specified in the Line Profile Options dialog box; for more information, refer to [page 450](#). The newly created first derivative curve replaces the selected curve.
- **Second** – Select this option to take the second derivative of the selected curve. The Line Profile tool uses the first and second derivative options specified in the Line Profile Options dialog box; for more information, refer to [page 450](#). The newly created second derivative curve replaces the selected curve. Note that the second derivative is typically used to find edges.

Delete Curve

This option allows you to specify which curves to delete:

- **Selected Curve** – Select this option to delete the selected curve from the graph. You can also delete the selected curve by holding down the <Ctrl> key and clicking on the selected curve with the right mouse button.
- **All Curves** – Select this option to delete all curves from the graph.

Auto Scale

The **Auto Scale** option allows you to specify how to scale the x-axis and y-axis of the graph:

- **Selected Curve** – Select this option to automatically scale the x-axis and y-axis to best fit the selected curve on the graph.
- **All Curves** – Select this option to automatically scale the x-axis and y-axis to best fit all curves on the graph.

Show Distance Box...

Select this option to open the Distances dialog box, shown in [Figure 94](#).

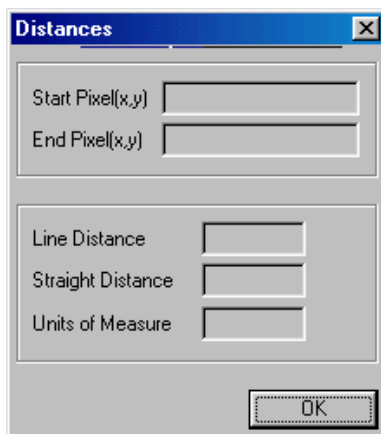


Figure 94: Distance Dialog Box

The Distances dialog box displays measurement data for the selected line profile. The measurements are taken between the measurement bars in the Line Profile display graph.

The measurements displayed are as follows:

- **Start Pixel (x,y)** – Location of the start pixel that correlates with the position of the minimum measurement bar on the display graph. The location values are displayed in x and y coordinates with subpixel accuracy. By default, the displayed values are in pixels. If you have a calibration object attached to your image, the displayed values are in the calibrated units of measure, such as inches or millimeters.
- **End Pixel (x,y)** – Location of the end pixel that correlates with the position of the maximum measurement bar on the display graph. The location values are displayed in x and y coordinates with subpixel accuracy. By default, the displayed values are in pixels. If you have a calibration object attached to your image, the displayed values are in the calibrated units of measure, such as inches or millimeters.

- **Line Distance** – The distance of the line ROI between the minimum and maximum measurement bars on the display graph. The line distance is the summation of the pixel-to-pixel distances along the line, between the measurement bars.
- **Straight Distance** – The shortest distance from end point to end point (Euclidian distance) between the minimum and maximum measurement bars on the display. This distance is the same as the **Line Distance** for a straight line ROI, but is different if you are using a freehand line or polyline ROI.
- **Units of Measure** – The units of measure. By default, the units of measure are pixels. If you have a calibration object attached to your image, the displayed values are in the calibrated units of measure, such as inches or millimeters. For more information about calibration objects, refer to [Chapter 7, “Using the Calibration Tool.”](#)

Note that you must select a line profile curve and click on the measurement bars to display the data.

Click **OK** to close the Distances dialog box.

Show Edges Box...

Select this option to open a Find Edges dialog box. For more information, refer to [page 453](#).

Options...

Select this option to open the Line Profile Options dialog box. For more information, refer to [page 450](#).

Keep Bars in View

Select this option if you always want to keep the measurement bars in view. If you zoom the graph and then double-click the right mouse button to unzoom the graph, the measurement bars are reset or moved. Clear this option if you want the measurement bars to stay set (even though they may go out of view).

Transfer Menu Options

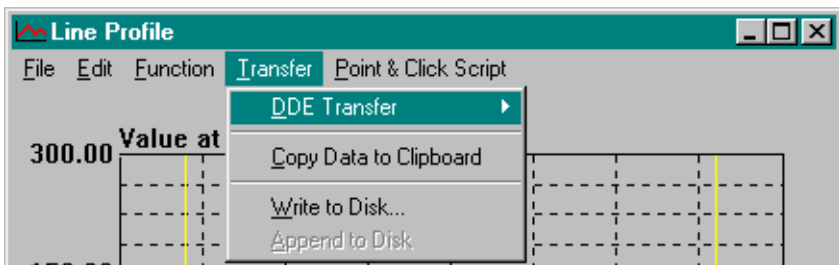


Figure 95: Line Profile Tool - Transfer Menu Options

DDE Transfer

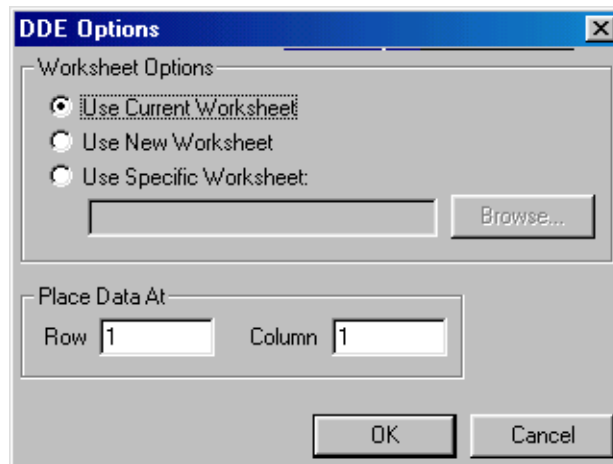
Note: It is recommended that you use the Export tool to send variables and/or images from DT Vision Foundry to Excel. For more information, refer to [Chapter 15, “Using the Export Tool.”](#) The DDE options in the Line Profile tool have been retained for backward compatibility.

The DDE Transfer option allows you to select the following options for sending line profile data to the spreadsheet program Excel:

- **Send Data to Excel** – Select this option to send all selected line profile data to Excel. Excel automatically opens and loads the data. When the line profile data is loaded into Excel, you can display the data in any supported format, such as charts, graphs, and spreadsheets.

If multiple line profile curves are on the same graph and no curves are selected, the data for all the curves is loaded into the same worksheet. If a line profile curve is selected, only the data for the selected curve is loaded.

- **Set DDE Options...** – Select this option to open the DDE Options dialog box.



Click the appropriate radio button to specify the Excel worksheet you want to use. You can browse for a specific worksheet or enter the name manually. You can place your data at a specific row and/or column in the specified worksheet. When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the dialog box without saving your changes.

Note that DT Vision Foundry assumes that you are using the English-language version of Excel. If you are using a different version of Excel, you must update the DTVF.DEF file to indicate the language you are using. For more information, refer to [page 55](#).

Copy Data to Clipboard

Select this option to copy all selected line profile data to the clipboard. You can then paste from the clipboard to any supported program, such as Word or Notepad.

Write to Disk...

Select this option to write all selected line profile data to disk. A Save As dialog box is displayed. Select the appropriate directory and enter the file name, then click **Save**.

Append to Disk

Select this option to add the selected line profile data to the end of the file you saved using **Write to Disk**.

Point & Click Script Menu Options

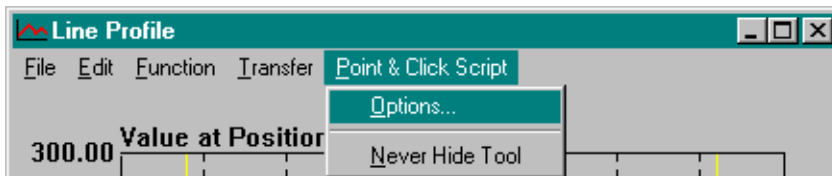


Figure 96: Line Profile Tool - Point & Click Script Menu Options

Options

Select this option to open the Line Profile Script Options dialog box, shown in [Figure 97](#). When all the settings are correct, click **OK** to save the settings and close the dialog box. Click **Cancel** to close the dialog box without saving your changes.

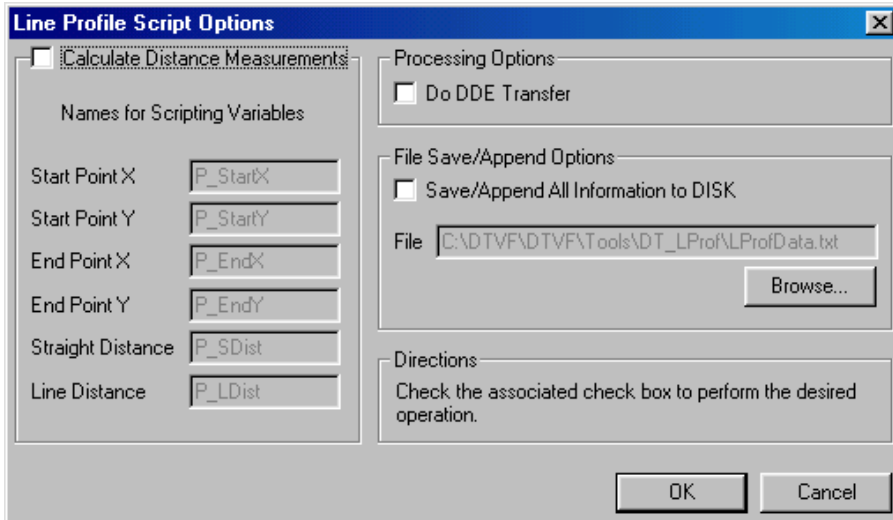


Figure 97: Line Profile Script Options Dialog Box

Select the **Calculate Distance Measurements** checkbox if you want the Line Profile tool to take a second derivative of the line profile, calculate the distance measurements, and put the measurements into the specified point & click script variables. You can change the names for the scripting variables by entering a new name in the appropriate text box. For more information about distance measurements, refer to [page 444](#).

Select the **Do DDE Transfer** checkbox if you want to send all the calculated information to the spreadsheet program Excel using the options in the DDE Options dialog box. For more information, refer to [page 446](#).

Select the **Save/Append All Information to DISK** checkbox if you want to save all the calculated information to disk. By default, the information is saved in the file specified by **File**. If you want to use a different file, use the **Browse** button to locate the file.

Never Hide Tool

Select this option if you want the Line Profile tool to remain visible while you are running a point & click script.

Line Profile Options Dialog Box Options

The Line Profile Options dialog box is opened when you select **Function | Options**. When you have specified all appropriate values, click **Apply** to save the settings without closing the dialog box. Click **OK** to save the settings and close the dialog box. Click **Cancel** to close the dialog box without saving changes.

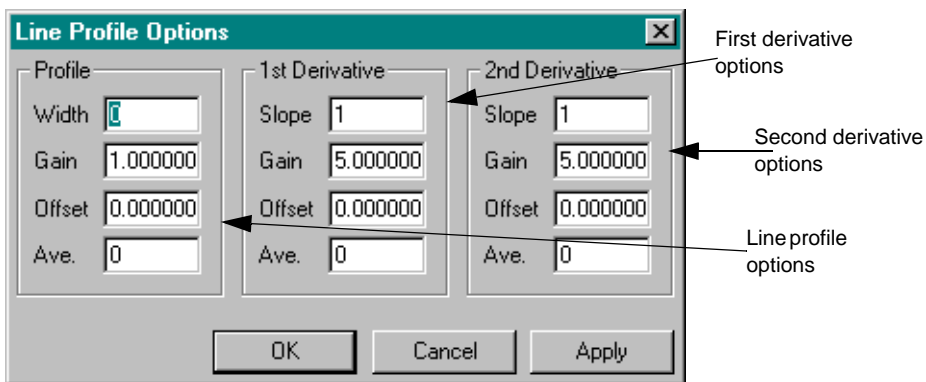


Figure 98: Line Profile Options Dialog Box

Line Profile Options

Width

Enter the number of pixels that you want the Line Profile tool to add to each side of the line when creating the line profile. The pixels are added to each side of the line ROI in a perpendicular fashion. For example, if you enter a value of 1 and the line ROI is a horizontal line, then for each point on the horizontal line ROI, three pixels are averaged: a point on the line ROI, a point just below the line ROI, and a point just above the line ROI. The pixels that are used in the average are always perpendicular to the line ROI.

Gain

Enter the gain value. The gain value, along with the offset value, is applied after the line profile has been created and smoothed using the **Ave.** value.

Offset

Enter the offset value. The offset value, along with the gain value, is applied after the profile has been created and smoothed using the **Ave.** value.

Ave.

Enter the smoothing value (the number of points, on each side of the center point, that you want the Line Profile tool to average in with the center point). The smoothing value is applied just after the line profile has been created. For every point in the line profile curve, the smoothing value is averaged in with its neighbors. For example, if you want no smoothing, enter a value of 0. If you want to average 1 point on each side of the center point with the center point, enter a value of 1.

First Derivative Options / Second Derivative Options

Note: The options for the first derivative and the second derivative are the same. The second derivative is typically used to find edges.

Slope

Enter the slope value (the span of points, on each side of the center point, that you want the Line Profile tool to take into consideration when calculating the slope of the center point). A value of one (the default) means that the center point and each of its neighbors are included in the calculation. Note that you cannot use a value of 0 for the slope.

Gain

Enter the gain value. The gain value, along with the offset value, is applied to the derivative after the derivative has been created and smoothed using the **Ave.** value.

Offset

Enter the offset value. The offset value, along with the gain value, is applied to the derivative after the derivative has been created and smoothed using the **Ave.** value.

Ave.

Enter the smoothing value (the number of points, on each side of the center point, that you want the Line Profile tool to average in with the center point). The smoothing value is applied just after the derivative has been created. For every point in the derivative curve, the smoothing value is averaged with its neighbors. For example, if you want no smoothing, enter a value of 0. If you want to average 1 point on each side of the center point with the center point, enter a value of 1.

Find Edges Dialog Box Options

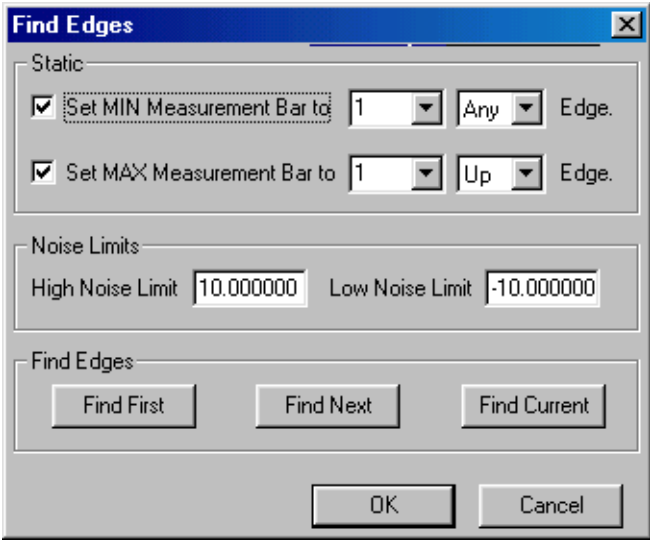


Figure 99: Find Edges Dialog Box

The Find Edges dialog box allows you to find edges in your image, using the second derivative of a line profile. The second derivative crosses the y-axis at zero, where the slope of the original line profile changes rapidly (up or down); this is an edge. You can take the second derivative of a line profile by selecting the line profile, then selecting **Function | Take Derivative | Second**.

The minimum and maximum measurement bars are automatically set to the exact (subpixel) location for the desired edges.

When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the dialog box without saving your changes.

Set MIN Measurement Bar to

Select this checkbox to set the minimum measurement bar to the edge you are seeking. Specify which edge (first edge, second edge, and so on, or best edge) and the type of edge (up, down, or any). For example, [Figure 99](#) indicates that you want to set the minimum measurement bar to the FIRST edge of ANY kind.

An UP edge is where the second derivative line profile crosses the zero y-axis with a positive slope. The curve must start below the low noise limit, cross the zero y-axis, and continue on a constant positive slope until it reaches the high noise limit. A DOWN edge is where the second derivative line profile crosses the zero y-axis with a negative slope. The curve must start above the high noise limit, cross the zero y-axis, and continue on a constant negative slope until it reaches the low noise limit.

Set MAX Measurement Bar to

Select this checkbox to set the maximum measurement bar to the edge you are seeking. Specify which edge (first edge, second edge, and so on, best edge, or last edge) and the type of edge (up, down, or any). For example, [Figure 99](#) indicates that you want to set the maximum measurement bar to the FIRST UP edge.

An UP edge is where the second derivative line profile crosses the zero y-axis with a positive slope. The curve must start below the low noise limit, cross the zero y-axis, and continue on a constant positive slope until it reaches the high noise limit. A DOWN edge is where the second derivative line profile crosses the zero y-axis with a negative slope. The curve must start above the high noise limit, cross the zero y-axis, and continue on a constant negative slope until it reaches the low noise limit.

Noise Limits

Enter the high and low noise limits. Look at the display graph to determine the noise levels on your line profile. Enter limits that factor out the noise but leave the critical data available to find the edges. To help you determine these limits, refer to the next section.

Find First

Click this button to find the first edge in the image, based on the Line Profile Options dialog box settings.

Find Next

Click this button to find the next edge in the image, based on the Line Profile Options dialog box settings.

Find Current

Click this button to find the current edge in the image, based on the Line Profile Options dialog box settings.

Example of Using the Line Profile Tool

This example shows how to use the Line Profile tool to take a line profile of the active line ROI in the image Lines (shown in [Figure 100](#)), take a second derivative of the line profile, and find the edges in the image.

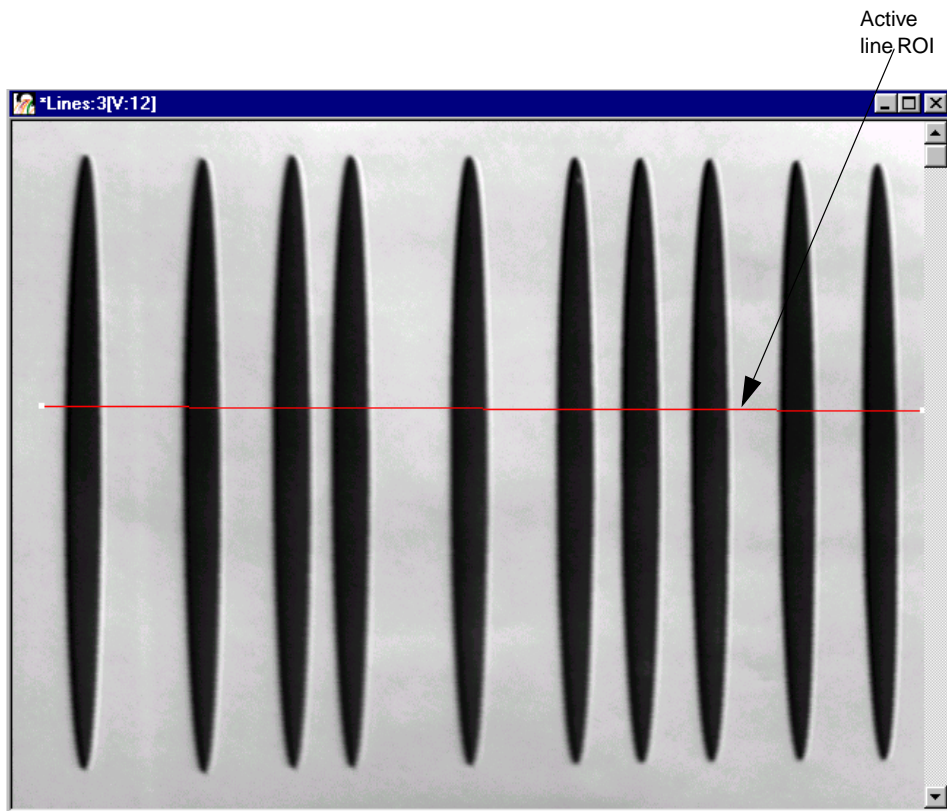
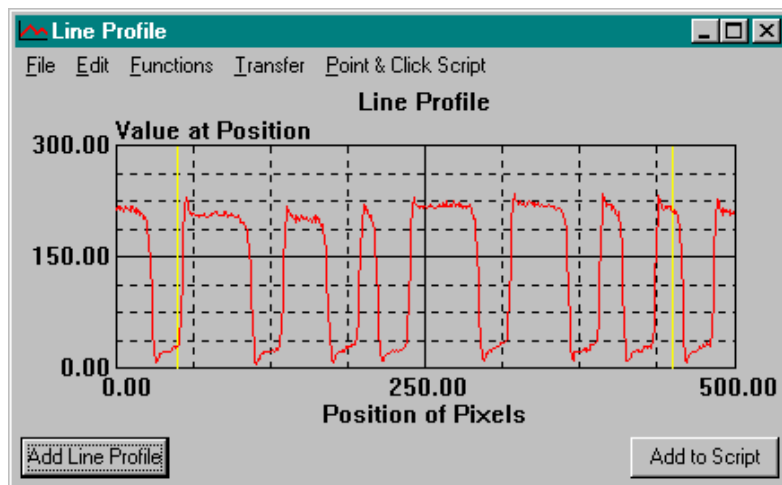


Figure 100: Line Profile Tool Example Image

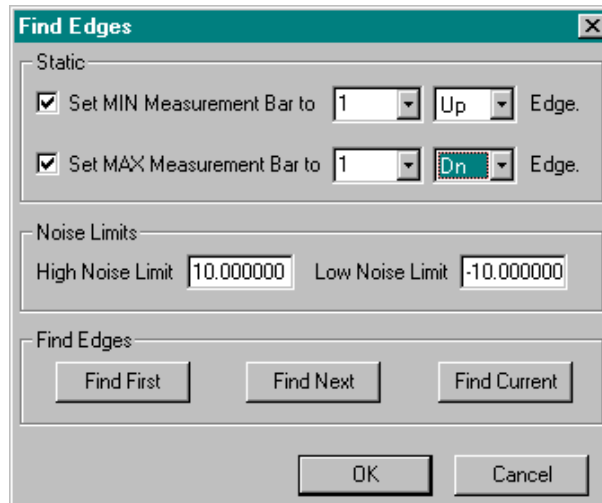
The operation is as follows:

1. Open a Line Profile tool (if one is not already open).
 2. Activate the image Lines by clicking in it with the left mouse button.
 3. Activate (red) the horizontal line ROI by clicking on it with the right mouse button.
 4. Take a line profile of the active ROI by clicking **Add Line Profile**.
- The Line Profile tool looks as follows:*



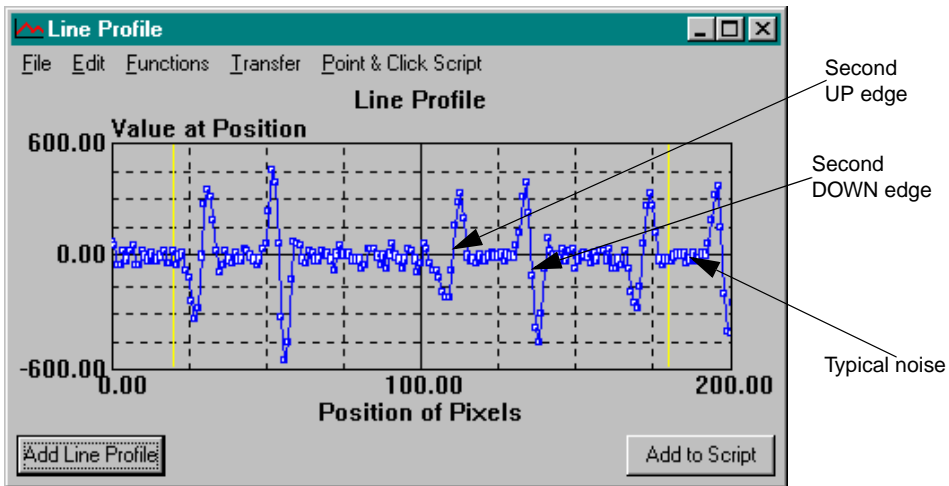
5. Open a Find Edges dialog box by selecting **Function | Show Edges Box**.
6. In the Find Edges dialog box, set the minimum measurement bar to the FIRST UP edge and the maximum measurement bar to the FIRST DOWN edge.

The Find Edges dialog box looks as follows:



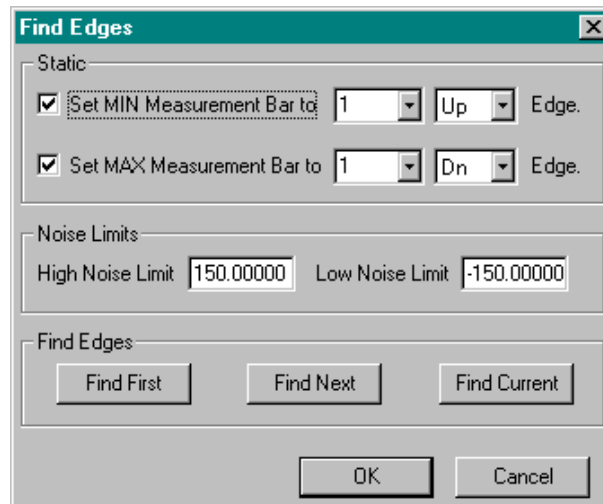
7. Open a Distances dialog box by selecting **Function | Show Distance Box**.
8. Select a curve and click on or move the minimum and/or maximum measurement bars in the Line Profile display graph. Notice how the measurements in the Distances dialog box automatically update.
9. Select the line profile curve by clicking on it with the right mouse button.
The Line Profile display graph shows each point on the curve.
10. Take the second derivative of the line profile by selecting **Function | Take Derivative | Second**. Scale the graph by selecting **Function | Auto Scale**. Select **Edit | Axis Min/Max Values** and adjust the axis so that you can easily see the zero y-axis.

The Line Profile tool looks as follows:



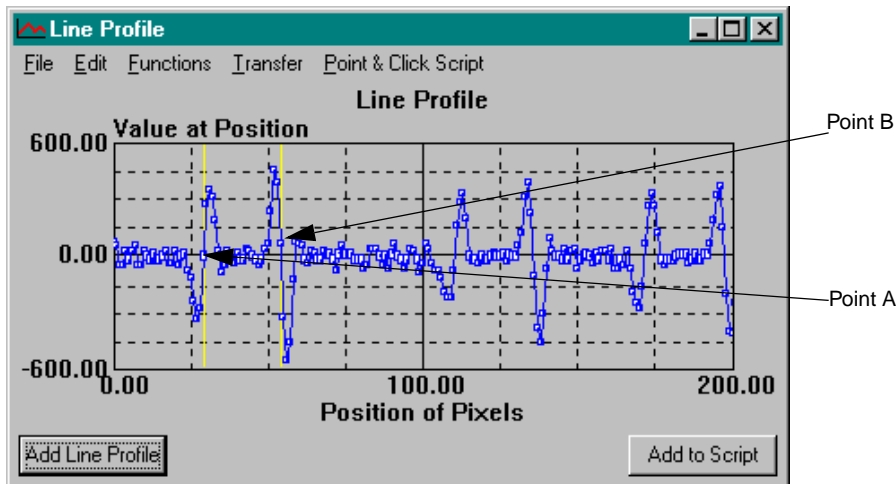
11. Visually inspect the Line Profile display graph to determine how to set the noise limits. In the Find Edges dialog box, set the high noise limit to 150.00 and the low noise limit to -150.00.

The Find Edges dialog box looks as follows:



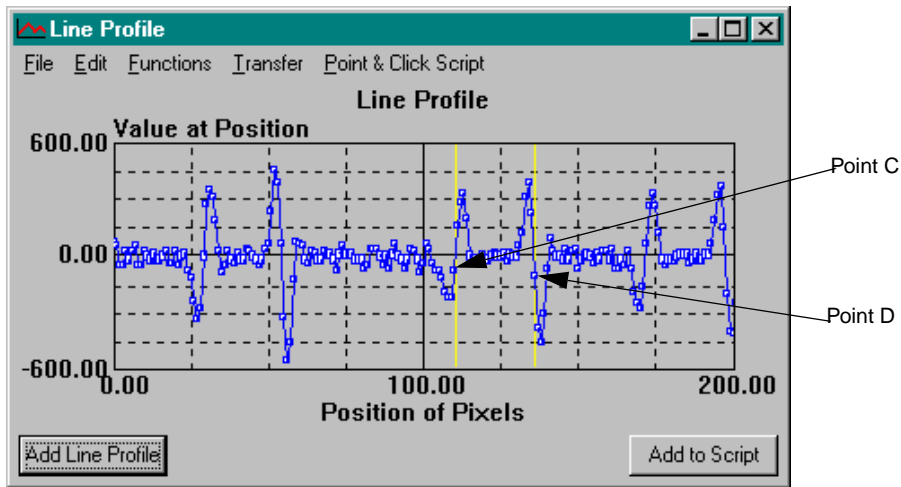
12. Click **Find First** in the Find Edges dialog box to locate the first UP edge and the first DOWN edge of the active ROI in the image Lines. The minimum and maximum measurement bars move to Points A and B on the graph, which are the edges of the first large black vertical line found in the image. The Distances dialog box automatically updates with the corresponding measurements.

The Line Profile tool looks as follows:



13. Click **Find Next** in the Find Edges dialog box to locate the next UP edge and the next DOWN edge of the active ROI in the image Lines. The minimum and maximum measurement bars move to Points C and D on the graph, which are the edges of the second large black vertical line found in the image. The Distances dialog box automatically updates with the corresponding measurements.

The Line Profile tool looks as follows:



14. Hold down the <Ctrl> key and click on various points in the Line Profile display graph with the left mouse button. Notice that the tool shows the exact location on the image Lines that the points correspond to.

Note: Do not use the <Ctrl> key and the right mouse button. If you do, the displayed curve is deleted.

Point & Click Script

This section describes the specific use of the Line Profile tool's point & click script functionality with respect to adding and editing scripting and selecting scripting options. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Line Profile tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Line Profile tool to perform the desired function. This includes the input image, the point & click script options, and the active line ROI. Click **Add Line Profile** to create the line profile and add it to the graph, then click **Add to Script** to record the operation in the Point & Click Script tool. To keep the Line Profile tool visible while running a point & click script, select **Point & Click Script | Never Hide Tool**.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Line Profile tool is set up exactly as it was when you previously recorded the script item. This includes the input image, the point & click script options, and the active line ROI. The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Match Tool

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Introduction

The Match tool is supplied with DT Vision Foundry. It compares two input images, then reports a score that represents the degree of similarity. The two images must be the same size and the same image type.

The score is stored in a point & click script variable so that you can use the information in a point & click script. For more information, refer to [page 469](#).

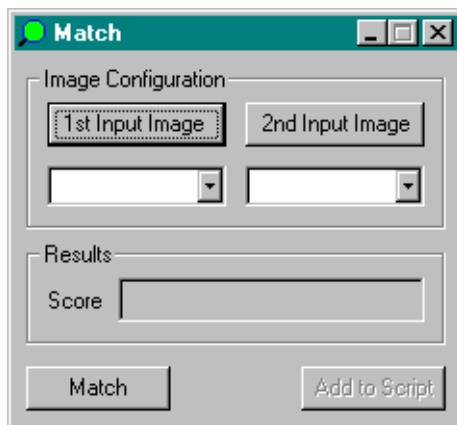



Figure 101: Match Tool

To open a Match tool, select the  icon from the Machine Vision toolbar or select **Match** from the Tools menu.

Notes: The Match tool is fully compatible with all tools and image types. ROIs are not used.

You can have up to 100 Match tools open at the same time.

Description of Match Tool Options

This section contains a description of the options in the Match tool dialog box.

1st Input Image

Click this button to load the image in the active viewport as the first input image. The image name is shown in the 1st Input Image display window. You can also select the input image from the list of images currently residing in system memory.

2nd Input Image

Click this button to load the image in the active viewport as the second input image. The image name is shown in the 2nd Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Results

After you click **Match** to perform the operation, the **Results** field displays the score (degree of similarity). The score can range from 0.00 to 1.00, where scores closer to 1.00 indicate a higher degree of similarity between the images and scores closer to 00.0 indicate a lower degree of similarity.

Match

When all options for the tool are set appropriately, click this button to perform the operation.

Add to Script

After you perform the **Match** operation, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Example of Using the Match Tool

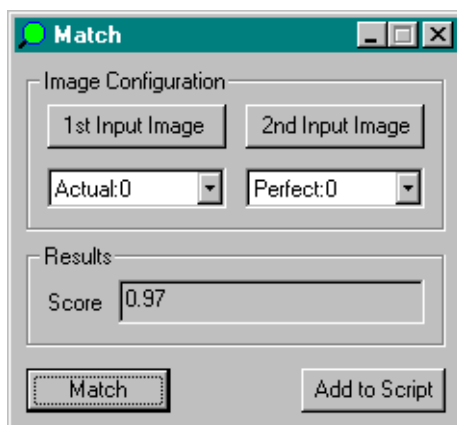
This example shows how to compare a manufactured part (shown in the image Actual) to a known perfect part (shown in the image Perfect).



The operation is as follows:

1. Open a Match tool (if one is not already open).
2. Open the image Perfect, then click in the viewport on the image.
It is now the active viewport and is denoted with an asterisk.
3. Click **1st Input Image** to load the image Perfect. Note that you can also select the image from the list of images currently residing in system memory.
4. Open the image Actual, either in the same viewport or in a different viewport, then click in the viewport on the image.
It is now the active viewport and is denoted with an asterisk.

5. Click **2nd Input Image** to load the image Actual. Note that you can also select the image from the list of images currently residing in system memory.
6. Click **Match** to compare the two images.
The score is displayed in the **Results** field, as follows:



Point & Click Script

This section describes the specific use of the Match tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Using Match Results

The score is stored in a point & click script variable that you can use in a point & click script. The variable is named `Match_Score_n`, where *n* is the instance of the tool in the point & click script. For example, the first instance of the Match tool in a script exports a variable named `Match_Score_1`, the second instance of the Match tool exports a variable named `Match_Score_2`, and so on. To access the score, perform the following steps:

1. Open the Point & Click Script tool.
2. Select **Options | Show Debug Box**.
The Debug Window is displayed.
3. From one of the drop-down lists, select the point & click script variable whose information you want to access.
The current value of the variable is displayed in the text box to the right of the variable.

Adding to the Point & Click Script

To add the Match tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Match tool to perform the desired function. This includes the two input images. Click **Match** to perform the operation, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Match tool is set up exactly as it was when you previously recorded the script item. This includes the two input images. The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved to the point & click script with the new options.



Using the Morphology Tool


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Introduction

The Morphology tool is supplied with DT Vision Foundry. It allows you to perform the following morphological operations on binary images:

- **Erosion** – Erodes a foreground object by removing pixels touching the background. This tends to shrink and smooth foreground particles.
- **Dilation** – Dilates a foreground object by adding onto pixels touching the background. This tends to grow particles and fill small holes in foreground particles. It is the opposite of Erosion.
- **Opening** – Performs an erosion followed by a dilation. This opens up spaces between particles touching one another.
- **Closing** – Performs a dilation followed by an erosion. This tends to join touching particles and fills small holes in foreground particles. It is the opposite of Opening.
- **Skeletonization** – Finds a line replica of the particle.
- **Watershed** – Separates touching or overlapping particles.

For a detailed description of the morphological operations, refer to the literature on morphological image processing, such as the text *An Introduction to Morphological Image Processing* by Edward R. Dougherty, SPIE Press 1992.

To open a Morphology tool, select the  icon from the Image Processing toolbar or select **Morphology** from the Tools menu.

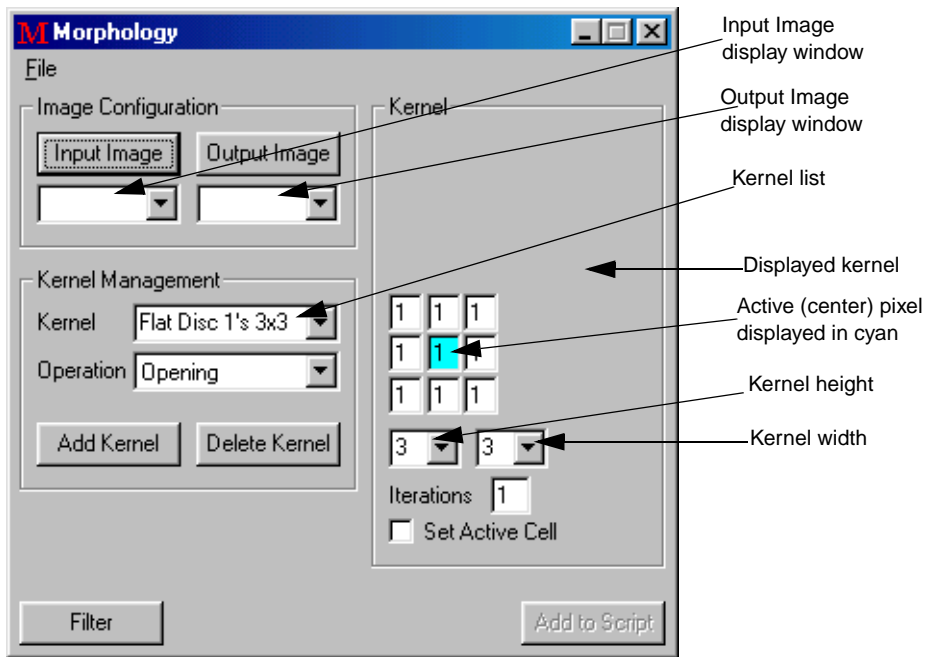


Figure 102: Morphology Tool

Notes: The Morphology tool is fully compatible with all tools and all ROI types. It works only with GLI/2 binary images. To open a binary image, click **Options | Image Type | Grayscale | Binary Image** from the main application. You can also use the Threshold tool to create a binary image.

All operations are performed with respect to the active ROI of the specified input image. If no active ROI is present, the whole image is used.

You can have up to 100 Morphology tools open at the same time.

Description of Morphology Tool Options

This section contains a description of the options in the Morphology tool dialog box.

File Menu Options



Figure 103: Morphology Tool - File Menu

Open Kernel...

Select this option to open stored kernel information from disk and add it to the kernel list. An Open dialog box is displayed. When you open a kernel (the file name must be followed by the extension .ker), the object is loaded into the Morphology tool.

Save Kernel List

Select this option to save the kernel list to disk. All opened Morphology tools use this list.

Save As Kernel...

Select this option to save the current kernel displayed in the kernel list to disk. A Save As dialog box is displayed. Select the directory and enter a file name with the extension .ker.

Dialog Box Options

Input Image

Click this button to load the image in the active viewport as the input image. The image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

The input image must be a binary image. A binary image is an image with all pixel values set to either 1 (foreground/black) or 0 (background/white). You can use the Threshold tool to create a binary image.

Output Image

Click this button to load the image in the active viewport as the output image. The image name is shown in the Output Image display window. You can also select the output image from the list of images currently residing in system memory or enter your own name for the output image in the display window text box.

If you do not select an output image, the Morphology tool automatically creates an output image for you. Note, however, that if you intend to use multiple output images in a point & click script, it is recommended that you either use the image in the active viewport as the output image or select the output image from the drop-down list. This ensures that each output image in the point & click script has a unique name.

Kernel List

Select the kernel (structuring element) that you want to use. This option is valid only for Erosion, Dilation, Opening, and Closing operations.

Operation

Select the morphological operation you want to perform on the input image. For Erosion, Dilation, Opening, and Closing operations, the current kernel is displayed in the displayed kernel area on the tool.

Add Kernel

If you created your own custom kernel in the displayed kernel area, enter a name for the kernel by overwriting one of the kernel names in the kernel list, then click this button to add the kernel to the kernel list.

Delete Kernel

Click this button to delete the current kernel from the kernel list.

Displayed Kernel

For Erosion, Dilation, Opening, and Closing operations, the kernel is displayed in this area. You can change the values of the cells to create a custom kernel, if desired. The only values that you can enter in the cells are the following:

- **1** = Foreground
- **0** = Background
- **X** = Don't Care

Active (Center) Pixel

The active pixel, which is usually the center pixel, is the pixel in which the operation output is placed. The operation is performed with respect to the active pixel; it is not always performed with respect to the center pixel. You can select a new active pixel for the convolution by selecting the **Set Active Cell** checkbox and then clicking on the cell that you want to be the active cell. The active pixel is denoted in cyan (light blue).

Note that the active pixel is also referred to as the origin of the structuring element.

Kernel Height

Specify the height of the displayed kernel.

Kernel Width

Specify the width of the displayed kernel.

Iterations

Specify the number of iterations you want to perform. This option is valid only for Erosion, Dilation, Opening, and Closing operations.

Set Active Cell

Select this checkbox if you want to select a new active pixel for the convolution. Then, click the appropriate cell in the kernel. The active pixel is denoted in cyan (light blue).

Filter

When all options for the tool are set appropriately, click this button to perform the operation.

Add to Script

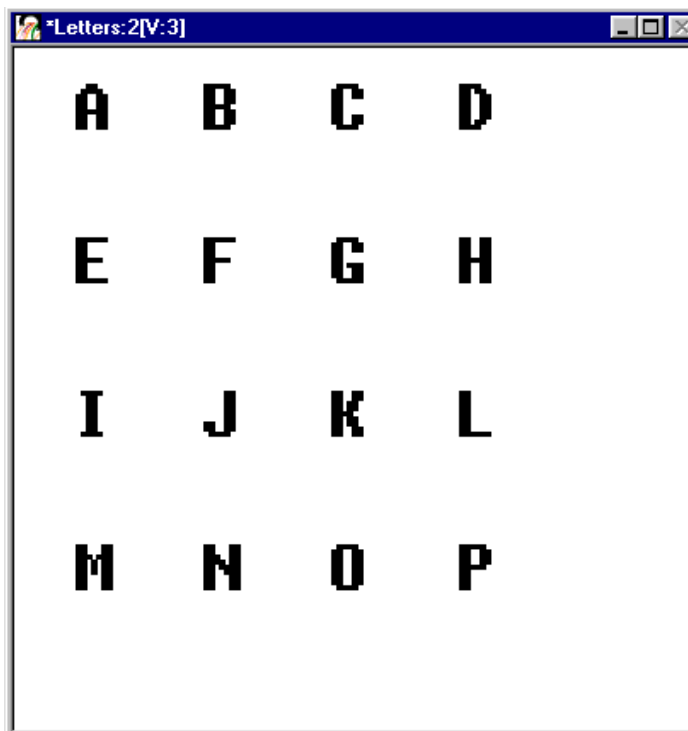
After you perform the operation, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the Morphology Tool

This example shows how to use the Morphology tool to run the morphological operation Dilation on the binary image Letters.

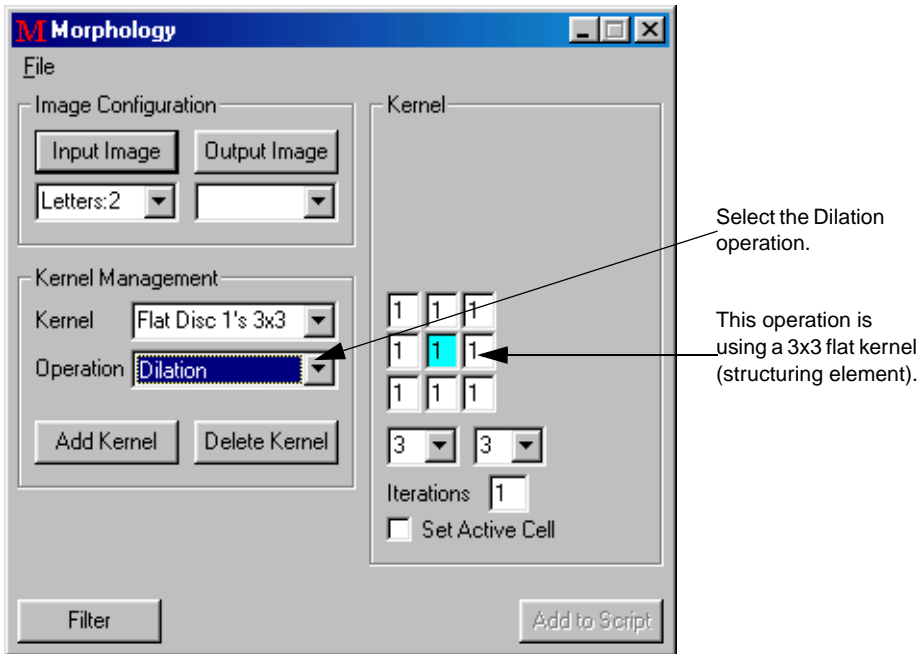
The operation is as follows:

1. From the main application Options menu, select **Image Type | Grayscale | Binary Image**.
2. Open the binary image Letters.

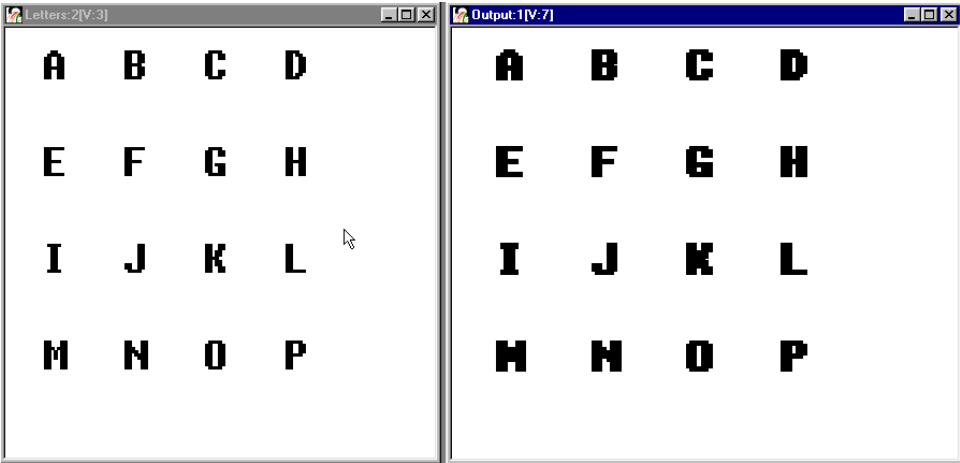


3. Open a Morphology tool (if one is not already open).
4. Activate the binary image Letters by clicking in it with the left mouse button.

5. In the Morphology tool, set Letters as the input image by clicking **Input Image**.
6. You can select an output image or you can let the Morphology tool create an output image for you. For this example, the tool automatically creates the output image.
7. Select **Dilation** from the **Operation** drop-down list.
The Morphology tool looks as follows:



8. Perform the operation by clicking **Filter**.
The output image shows that the letters have been dilated, as follows:



Point & Click Script

This section describes the specific use of the Morphology tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Morphology tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Morphology tool to perform the desired function. This includes the input and output images, the morphological operation, and the active ROI (if you are using one). Click **Filter** to perform the desired operation, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Morphology tool is set up exactly as it was when you previously recorded the script item. This includes the input and output images, the morphological operation, and the active ROI (if an ROI was used). The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired option(s) and click **Update Script**. The script item is performed and saved back to the point & click script with the new options.




Using the Picture Tool

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Introduction

The Picture tool is supplied with DT Vision Foundry. It allows you to acquire images using an imaging device. You can use the Picture tool with any device, as long as you have loaded the appropriate plug-in software from the manufacturer and configured the device using the Device Manager of the main DT Vision Foundry application. For more information, refer to [page 24](#).

To open a Picture tool, select the  icon from the Input-Output toolbar or select **Picture Tool** from the Tools menu.

Note: You can have only one Picture tool open at a time.

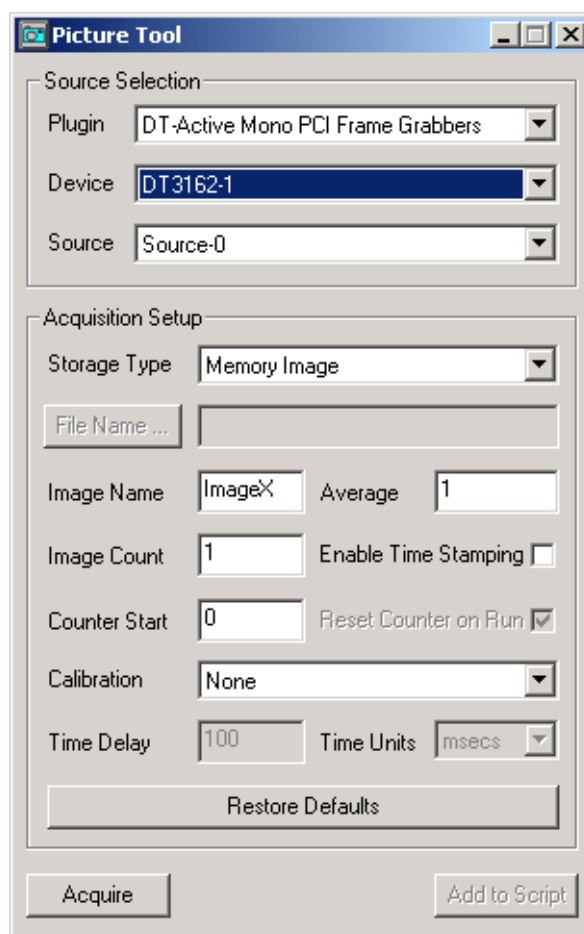


Figure 104: Picture Tool

Description of Picture Tool Options

This section contains a description of the options in the Picture tool dialog box.

Note: Before you can use any of the Picture tool options, you must select a plug-in from the **Plugin** drop-down list and a device from the **Device** drop-down list.

Plugin

Select the plug-in that is associated with your device.

Device

Select the device that you want to use. The drop-down list contains all the devices installed in your system that are supported by the plug-in.

Source

Select the video input source (channel) that is acquiring images from the drop-down list.

Storage Type

Select one of the following options to specify how to store the acquired images:

- **Memory Image** – The images are stored in random access memory (RAM) and are accessible by DT Vision Foundry. You can display them in a viewport, or you can manage them using the Image Manager tool. For more information, refer to [Chapter 21, “Using the Image Manager Tool.”](#) The images are named using the base **Image Name** and the appropriate suffix. If **Image Count** = 1, the image is displayed in the active viewport.
- **Bitmap File** – Each acquired image is stored in a separate .BMP file on disk. Click the **Folder** button, locate the directory in which to store the files in the Browse for Folder dialog box, then click **OK**. The images are named using the base **Image Name** and the appropriate suffix.
- **AVI File (Direct To Disk)** – Multiple images are acquired into RAM. After each image is acquired, it is saved into a single .AVI file on disk. Click the **File Name** button, enter a file name in the Output AVI File dialog box, then click **Save**.
- **AVI File (To Disk Via Memory)** – Multiple images are acquired into RAM. After the number of images specified by **Image Count** have been acquired, they are saved into a single .AVI file on disk. Click the **File Name** button, enter a file name in the Output AVI File dialog box, then click **Save**.

This method is faster than the **AVI File (Direct To Disk)** method; however, the maximum number of images in the .AVI file depends on the RAM memory available.

Note that the **AVI File (Direct To Disk)** and **AVI File (To Disk Via Memory)** options are supported only for 8-bit color, 16-bit color, and 24-bit color .AVI video files, where 24-bit color AVI frames are imported as 24-bit RGB or HSL color images, 16-bit color AVI frames are converted to 24-bit RGB or HSL color images, and 8-bit color AVI frames are imported as 8-bit grayscale images.

Image Name

Enter the name that you want the Picture tool to give to the acquired images. This name is used as the base name for the image. If **Image Count** is greater than 1, the number specified by **Counter Start** is appended to **Image Name** and then incremented with each new image you acquire. This allows you to acquire several images in sequence.

This option is used for memory images and .BMP files only.

Image Count

Enter the number of images that you want to acquire. Note that the maximum number of images that you can acquire depends on the image size and on the RAM memory or disk space available.

Counter Start

Specify the number to append to the first acquired image. This number is then incremented with each new image you acquire.

This option is used for memory images and .BMP files only.

Average

Select the number of acquired images (1 to 9) to average together to create a single image. For example, if **Average** = 3, a single image is created for every three acquired images. If **Average** = 1, no averaging is performed. Note that the higher the value, the longer it takes to acquire images and the less accurate the images are.

Enable Time Stamping

Select this checkbox if you want the date and time of acquisition marked on the lower left corner of each acquired image. Clear this checkbox if you do not want the date and time of acquisition marked on the images.

Reset Counter

Select this checkbox if you want to append the number specified by **Counter Start** to the first acquired image each time you click **Acquire**. Images with the same name are overwritten.

Clear this checkbox if you want to append the next available number to the first acquired image each time you click **Acquire**. This is useful if you are saving multiple images to disk and want to ensure that each image has a unique name.

This option is used for .BMP files only. Memory images are always overwritten.

Calibration

Select the calibration object that you want to attach to every image taken with the Picture tool. The drop-down list contains all the calibration objects in the system (as listed in the Calibration tool). To add a calibration object to the list, refer to [Chapter 7, “Using the Calibration Tool.”](#)

Time Delay

Enter the time delay between each image acquisition, in the measurement units specified by **Time Units**. To disable the time delay, set **Time Delay** to 0.

Time Units

Select the measurement unit to use for the **Time Delay** (milliseconds, seconds, minutes, or hours).

If you do not want to use a calibration object, select **None**.

Restore Defaults

Click this button to return all **Acquisition Setup** options to their default state.

Acquire

Click this button to acquire an image or images. The images are averaged according to the value specified for **Average** and are stored in the format specified by **Output Format**.

Add to Script

After you acquire an image or images, click this button to record the operation in a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the Picture Tool

This example shows how to use the Picture tool to acquire four images.

The operation is as follows:

1. Open the Picture tool (if it is not already open).
2. Select the appropriate plug-in from the **Plugin** drop-down list and select the device you want to use from the **Device** drop-down list. Make sure that you have configured the device using the Device Manager. For more information, refer to [page 24](#).
3. Enter the name MyPict in the **Image Name** text box, set **Image Count** to 4, set **Average** to 1, and set **Counter Start** to zero.
4. Click **Acquire**.
5. Click **Add to Script**.

When you run the point & click script, four images, named MyPict0, MyPict1, MyPict2, and MyPict3, are stored in RAM and are listed in the list of images in memory in the Image Manager tool.

Point & Click Script

This section describes the specific use of the Picture tool's point & click script functionality with respect to adding and editing a point & click script.

Each time you run a point & click script, the Picture tool overwrites the current images; it does not keep making new images. If the images do not exist in the system, they are created.

Adding to the Point & Click Script

To add the Picture tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Picture tool to perform the desired function. This includes the base name of the images and the calibration object that you want to attach to the images. Click **Acquire** to perform the desired action, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Picture tool is set up exactly as it is when you previously recorded the script item. This includes the base name of the images and the calibration object that you want to attach to the images. The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is performed and saved back to the point & click script with the new options.



Using the Pixel Change Tool

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Introduction

The Pixel Change tool is supplied with DT Vision Foundry. It sets the values of pixels in the specified ROI(s) to the specified value. You can change the data in the image buffer (this permanently changes the specified image), or you can create an overlay and change its color (this does not permanently change the specified image).

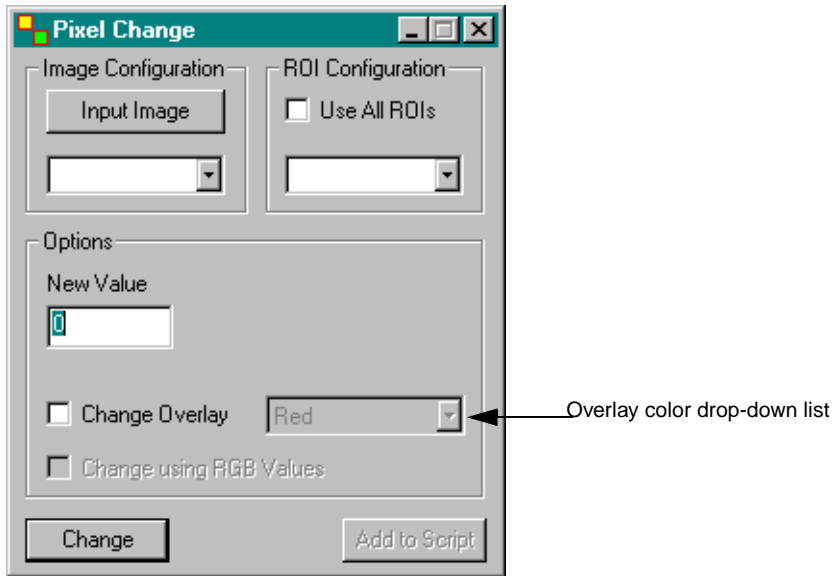



Figure 105: Pixel Change Tool

To open a Pixel Change tool, select the  icon from the Image Processing toolbar or select **Pixel Change** from the Tools menu.

Notes: The Pixel Change tool is fully compatible with all tools and ROIs. It works with all grayscale images and with 24-bit RGB color images. 24-bit HSL color images are not supported.

You can have up to 100 Pixel Change tools open at the same time.

Description of Pixel Change Tool Options

This section contains a description of the options in the Pixel Change tool dialog box.

Input Image

Click this button to load the image in the active viewport as the input image. The input image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

ROI Configuration

Select the **Use All ROIs** checkbox if you want to change the pixels values of all ROIs in the image. Clear the **Use All ROIs** checkbox if you want to specify an ROI whose pixel values you want to change.

If the **Use All ROIs** checkbox is cleared, select the ROI whose pixel values you want to change from the drop-down list.

New Value / New RGB Values

Enter the new value(s) that you want to set all pixels inside the specified ROI(s) to. The value(s) can range from 0 to 255.

Note that if the **Change using RGB Values** checkbox is selected, you can change the pixel values of the red, green, and blue color planes in an RGB color image individually.

Change Overlay

Select this checkbox if you want to create an overlay and change the overlay color, but not change the image itself. Select the overlay color from the overlay color drop-down list. To remove the overlay color, select **Clear** from the overlay color drop-down list.

Change using RGB Values

Select this checkbox if you want to change the pixel values of the red, green, and blue color planes in an RGB color image individually. Enter the new pixel values in the **New RGB Values** text boxes. All pixels inside the specified ROI in the specified image are set to these values.

Change

Click this button to set all the pixels inside the specified ROI in the specified image to the new value(s).

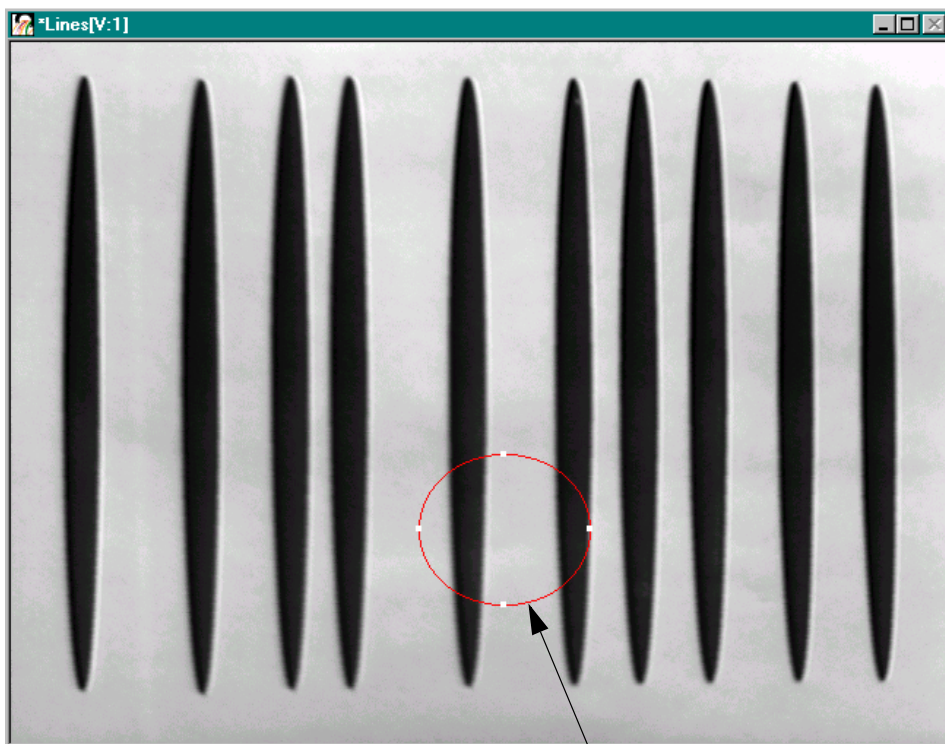
If the **Change Overlay** checkbox is selected, the tool creates an overlay and changes the overlay color, but does not change the image itself. If the **Change Overlay** checkbox is cleared, the tool permanently changes the specified image.

Add to Script

After you perform the pixel change operation, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Example of Using the Pixel Change Tool

This example shows how to set all the pixels inside an ellipse ROI to a value of 100 for the image Lines, shown in [Figure 106](#).



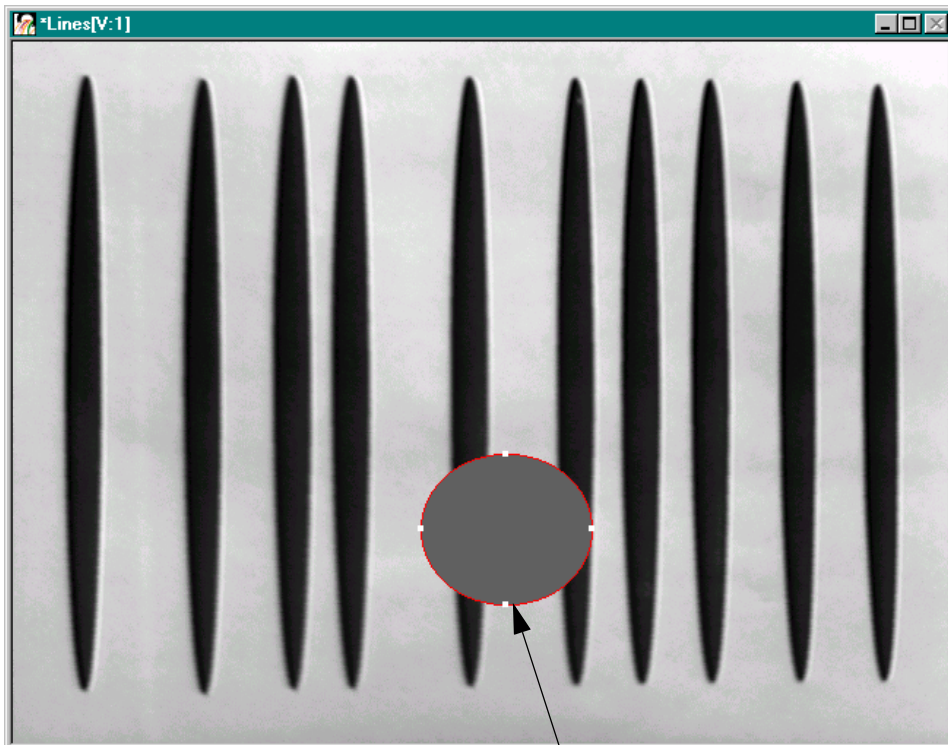
ROI whose pixels you want to change

Figure 106: Pixel Change Tool Example Image

The operation is as follows:

1. Activate the image Lines by clicking in it with the left mouse button.
2. Open a Pixel Change tool (if one is not already open).
3. Set **New Value** to 100.
4. Click **Change**.

All pixels inside the specified ROI in the image Lines have a value of 100, as follows:



Changed area

Point & Click Script

This section describes the specific use of the Pixel Change tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Pixel Change tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Pixel Change tool to perform the desired function. This includes the new value, the overlay color, and the ROI. Click **Change** to perform the desired operation, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Pixel Change tool is set up exactly as it was when you previously recorded the script item. This includes the new value, the overlay color, and the ROI. The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Point & Click Script Tool

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Introduction

The Point & Click Script tool is supplied with DT Vision Foundry. It allows you to perform scripting operations using an easy-to-use point & click / drag-and-drop interface.

The Point & Click Script provides the following functionality:

- If-Then branching conditions
- For-Next loops
- While loops
- Do-While loops
- Assign statements
- Error branching
- Time delays
- Halting mechanism
- Short user-defined description of script item's functionality; the tools automatically fill in the descriptions when recording the script
- Long user-defined description of script item's functionality; the tools automatically fill in the descriptions when recording the script
- Auto-run mechanism
- Failure descriptions
- Debugging information
- Scripting variables
- Drag-and-drop movement of script items
- Step, run, and editing of all script items
- Save and restore options

- Failure options
- Unlimited nesting of looping and branching conditions

Note: The Point & Click Script tool functionality conforms to the associated flow control of any basic programming language. For more information, refer to your programming documentation.

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You can use drag-and-drop to move script items to different locations within the script. If you drag a script item using the left mouse button, the script item is placed **AFTER** the script item you drop it on. All script items can be dragged using the left mouse button. If you drag a script item using the right mouse button, the script item is placed **UNDER** the script item you drop it on. You can drop script items under For-Next loops, Do-While loops, If-Then branches, While loops, and error branches only. You cannot drop one tool's script item on another tool's script item using the right mouse button.

All DT Vision Foundry tools, as well as all third-party tools and custom tools, can be used with the Point & Click Script tool. The Point & Click Script tool can hold up to 10,000 script items.

DT Vision Foundry also provides C/C++ Object Oriented APIs. For more information, refer to the *DT Vision Foundry API Manual*.

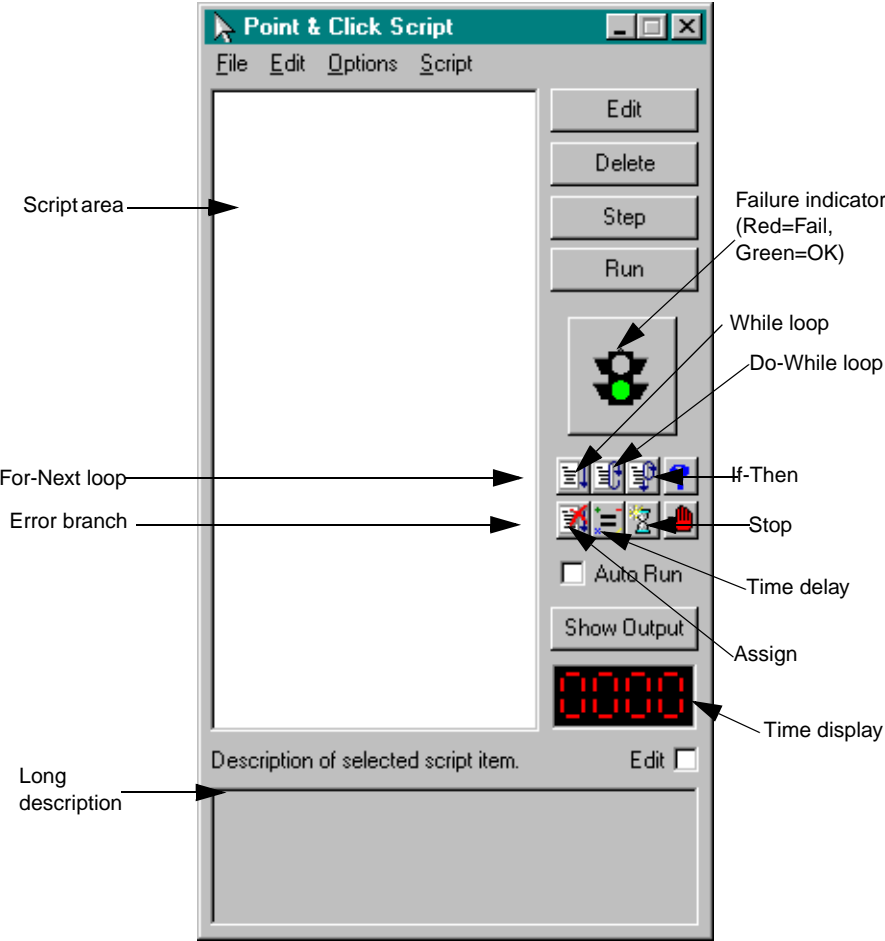



Figure 107: Point & Click Script Tool

To open a Point & Click Script tool, select the  icon from the Miscellaneous toolbar or select **Point & Click Script** from the Tools menu.

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Notes: The Point & Click Script tool is fully compatible with all other tools, image types, and ROIs.

The Point & Click Script tool **MUST** be open when you record a point & click script item.

You can have only one Point & Click Script tool open at a time.

Description of Point & Click Script Tool Options

This section contains a description of the options in the Point & Click Script tool dialog box.

File Menu Options

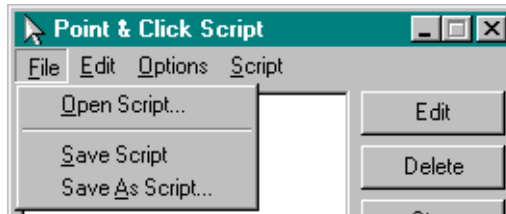


Figure 108: Point & Click Script Tool - File Menu

Open Script...

Select this option to open a saved point & click script from disk. An Open dialog box is displayed. When you open a script (the file name must be followed by the extension .pcs), the object is loaded into the Point & Click Script tool. If the **Auto Run** checkbox was selected when the script was saved, the script automatically runs after opening.

Save Script

Select this option to save the current point & click script back to disk.

Save As Script...

Select this option to save the current point & click script to disk with a different name. A Save As dialog box is displayed. Select the directory and enter a file name with the extension .pcs.

Note that if you save a point & click script with the name default.pcs, the file will automatically open each time you open a Point & Click Script tool. You must save default.pcs in the DT_Pncl directory (located in C:\Program Files\Data Translation\DT Vision Foundry\Tools, by default).

Edit Menu Options

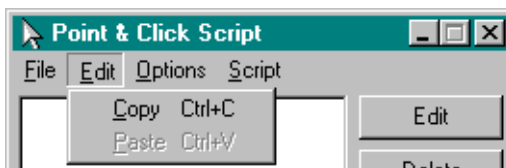


Figure 109: Point & Click Script Tool - Edit Menu

Copy

Select this option to copy the highlighted script item to the clipboard. Note that you can also use <Ctrl>+<C> to copy a script item.

Paste

Select this option to paste the script item in the clipboard below the highlighted script item in the point & click script. Note that you can also use <Ctrl>+<V> to paste a script item.

Options Menu Options

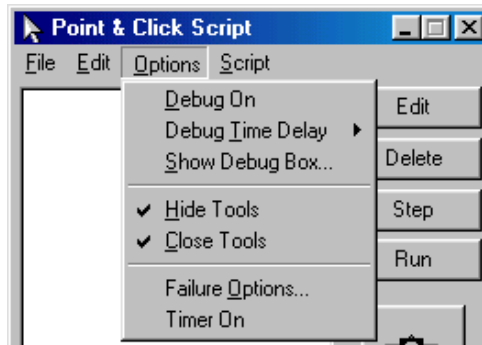


Figure 110: Point & Click Script Tool - Options Menu

Debug On

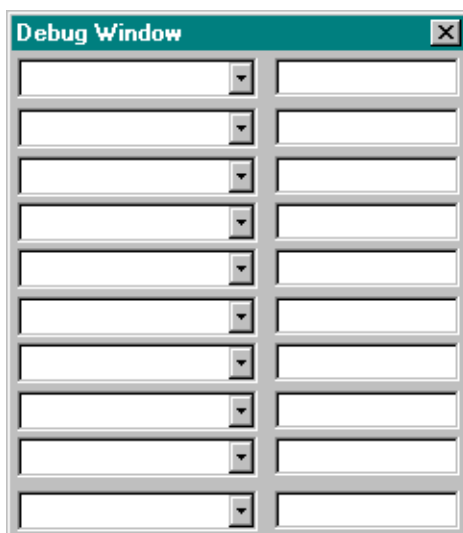
Select this option to debug a script while it is running. If you run a script with this option selected, you will see each script item as it is executed. You can also use the Debug box to examine script variables as the script is running; to open a Debug box, select **Options | Show Debug Box**.

Debug Time Delay

Select the time delay that you want to occur between each script item. This allows you to slow down the script so that you can better examine the script as it runs.

Show Debug Box...

Select this option to open the Debug Window.



The Debug Window allows you to select 10 script variables whose values you want to view during a script run. You can manually change the value of a script variable by entering a new value in the text box next to the variable. You can also use the **Step** button to single-step through the script, watching the script values after each step.

Hide Tools

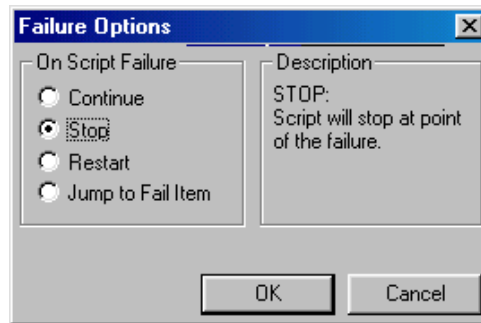
Select this option if you want to keep all tools hidden during a script run; this is useful if too many tools are recorded in a script and the screen becomes cluttered. Clear this option if you want to see all tools during a script run.

Close Tools

Select this option if you want to close all tools used by the script when the Point & Click Script tool is closed. Clear this option if you want to keep all tools open after the Point & Click Script tool is closed. If you decide to keep the tools open, make sure that you unhide the tools (make sure that the **Hide Tools** option is cleared).

Failure Options...

Select this option to open the Failure Options dialog box.



Select one of the following options to determine what happens when an item in a script fails during a script run:

- **Continue** – The script continues, ignoring the failure as if there were no failure.
- **Stop (default)** – The script stops at the point of failure.
- **Restart** – The script stops at the point of failure and restarts from the beginning of the script.
- **Jump to Fail Item** – The script stops at the point of failure, jumps to the error branch, and runs all the items under the error branch. If there is no Stop item in the error branch, the script continues to run all items in the script after the error branch and then loops to the start of the script as normal.

When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the dialog box without saving your changes.

Timer On

Select this option if you want to display the time used to execute each script item in the point & click script, in milliseconds. The tool displays the time to the left of the script item in the format (*current, min, max*), where *current* is the time used in the current execution of the script item, *min* is the minimum time used to execute the script item, and *max* is the maximum time used to execute the script item.

Clear this option if you do not want to display the time.

To determine the time used to execute the entire point & click script, from the first item in the script to the last item in the script, refer to the LED displays in the lower right corner of the Point & Click Script tool dialog box.

Script Menu Options

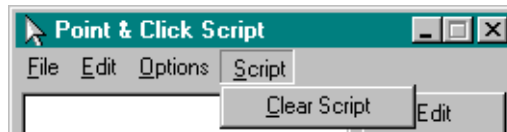


Figure 111: Point & Click Script Tool - Script Menu

Clear Script

Select this option to delete the entire script.

Dialog Box Options

Script Area

This area is where the point & click script is recorded and displayed. You can highlight a script item and move it using drag-and-drop.

A short description of each script item is displayed next to the script item's icon. The tool automatically sets the short description when the item is recorded. To change the short description, perform the following steps:

1. Slowly, click on the description twice (the first time to highlight the description; the second time to display an edit box around the description).
2. Click the **Backspace** key to delete the current description.
3. Enter the new description (up to 20 characters).
4. Click anywhere in the script area.

Note that a long description of the selected script item is displayed at the bottom of the dialog box; for more information, refer to [page 525](#).

Edit

Click this button to edit the highlighted script item. The Point & Click Script tool is grayed out and the tool associated with the highlighted script item is set up exactly as it was when the script was recorded. Use the associated tool to change any desired options. You can then save the script.

Note that you can also double-click a script item to edit it.

Delete

Click this button to delete the highlighted script item. The Point & Click Script tool asks you to confirm that you want to delete the script item. If you delete a looping or branching script item (such as a For-Next script item), you also delete any script items attached to the script item.

Note that you can also delete the highlighted script item by clicking the <Delete> key on your keyboard.

Step

Click this button to execute the highlighted script item. After the Point & Click Script tool executes the script item, it highlights the next script item in the script.

Run

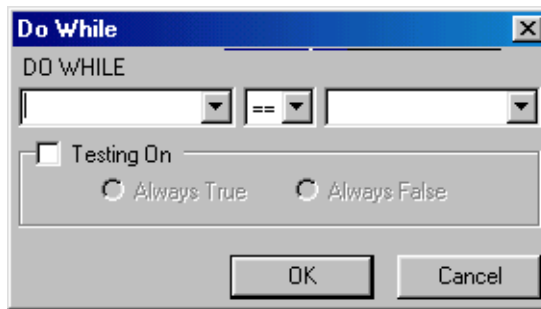
Click this button to run the script. The Point & Click Script tool checks for items that are required to run the script, such as required ROIs and images, and then runs the script. If a required object is not present, the tool stops on the script item that could not run and changes the stop light to Red. Click the stop light (failure indicator) to determine the problem.

Failure Indicator

This icon (stop light) turns red if any problems occur during a script step, run or edit. Click on the stop light to determine the problem. After you click the stop light and read the message, the stop light turns green. Note that you are still responsible for fixing the problem.

Do While Loop

Click this icon to enter a Do-While loop script item into the point & click script. Then, enter the appropriate information in the Do-While box.



The Do-While loop is entered into the point & click script at the selected script item (if one is selected). If the loop is entered in an incorrect location, you can drag-and-drop it to the correct location with the mouse. To enter script items under the new Do-While loop, drag-and-drop them under the new Do-While loop using the right mouse button.

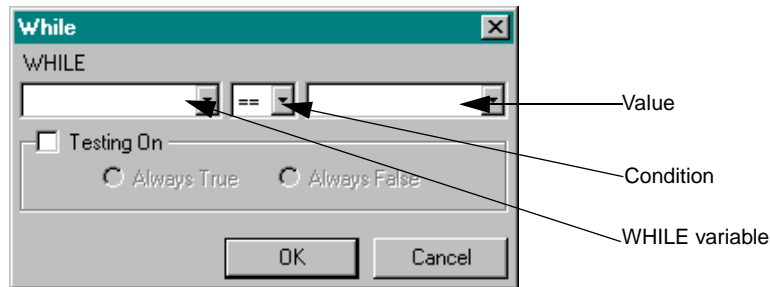
Note that the Do-While loop is identical to the While loop (see [page 515](#)) except that all the script items under a Do-While loop are always run at least once during a single execution of a point & click script.

Select the **Testing On** checkbox if you want to enter a loop or branch for debugging purposes even if the condition is not satisfied. Select the **Always True** radio button if you want to ignore the condition and always enter the loop or branch. Select the **Always False** radio button if you never want to enter the loop or branch.

When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the box without saving your changes.

While Loop

Click this icon to enter a While loop script item into the point & click script. Then, enter the appropriate information in the While box.



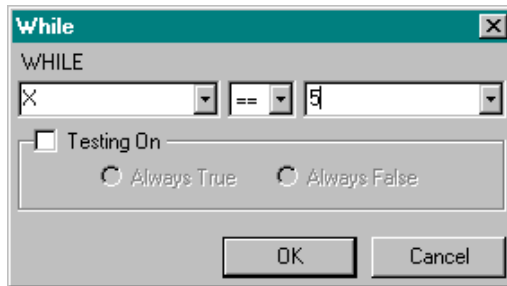
The While box runs all the script items under itself while some condition is true.

Enter a variable name in the WHILE text box or select a script variable from the WHILE variable drop-down list. Then, select one of the following conditions to test for from the condition drop-down list box:

- Equal To (==)
- Not Equal To (!=)
- Greater Than or Equal To (>=)
- Less Than or Equal To (<=)
- Less Than (<)
- Greater Than (>)

Finally, enter a constant, such as 5, in the test box or select a script variable from the value drop-down list.

For example, to keep running all the items under a While loop while X is equal to 5, set the While box as follows:



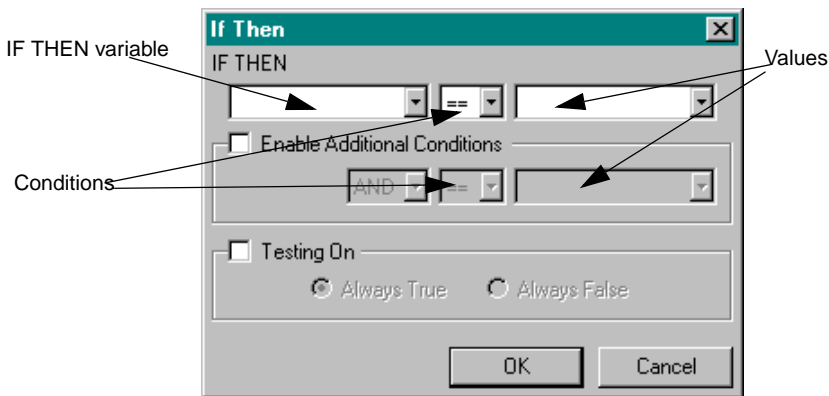
The While loop is entered into the point & click script at the selected script item (if one is selected). If the loop is entered in an incorrect location, you can drag-and-drop it to the correct location with the mouse. To enter script items under the new While loop, drag-and-drop them under the new While loop using the right mouse button.

Select the **Testing On** checkbox if you want to enter a loop or branch for debugging purposes even if the condition is not satisfied. Select the **Always True** radio button if you want to ignore the condition and always enter the loop or branch. Select the **Always False** radio button if you never want to enter the loop or branch.

When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the box without saving your changes.

If Then

Click this icon to enter an If-Then script item into the point & click script. Then, enter the appropriate information in the If-Then box.



The If-Then box tests for one or two conditions. If the conditions are TRUE, the items in the branch under If-Then are run.

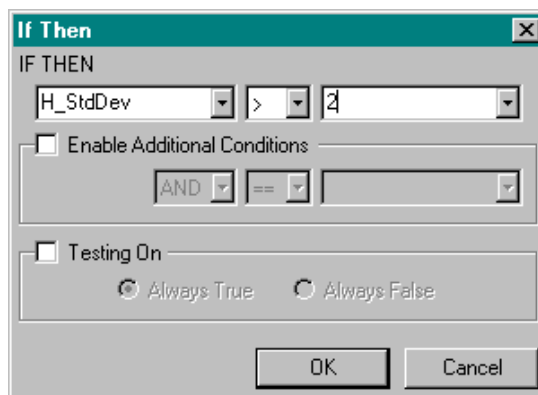
Enter a variable name in the IF THEN text box or select a script variable from the IF THEN variable drop-down list. Then, select one of the following conditions to test for from the condition drop-down list:

- Equal To (==)
- Not Equal To (!=)
- Greater Than or Equal To (>=)
- Less Than or Equal To (<=)
- Less Than (<)
- Greater Than (>)

Finally, enter a constant, such as 5, in the test box or select a script variable from the value drop-down list.

If you want to test the variable in the IF THEN text box for a second condition, select the **Enable Additional Conditions** checkbox. Select **AND** (if both conditions must be true) or **OR** (if either one of the conditions must be true), then, select a condition and constant/variable as above.

For example, if you want to run a set of script items if the H_StdDev script variable is greater than 2, set the If-Then box as follows:



The If-Then statement is entered into the point & click script at the selected script item (if one is selected). If the statement is entered in an incorrect location, you can drag-and-drop it to the correct location with the mouse. To enter script items under the new If-Then statement, drag-and-drop them under the new If-Then statement using the right mouse button.

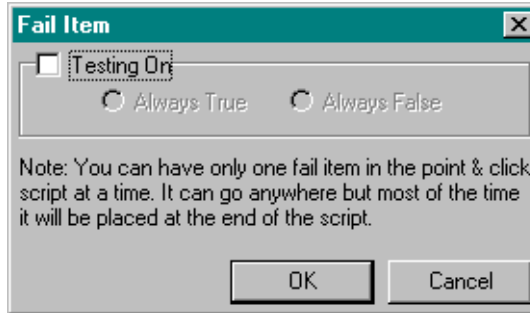
Select the **Testing On** checkbox if you want to enter a loop or branch for debugging purposes even if the condition is not satisfied. Select the **Always True** radio button if you want to ignore the condition and always enter the loop or branch. Select the **Always False** radio button if you never want to enter the loop or branch.

When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the box without saving your changes.

Error Branch

Click this icon to enter an error branch into the point & click script. Then, enter the appropriate information in the Fail Item box.

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The dialog box is titled "Fail Item" and has a close button (X) in the top right corner. It contains a checkbox labeled "Testing On" which is currently unchecked. Below the checkbox are two radio buttons: "Always True" and "Always False", both of which are unselected. A note is displayed below the radio buttons: "Note: You can have only one fail item in the point & click script at a time. It can go anywhere but most of the time it will be placed at the end of the script." At the bottom of the dialog are two buttons: "OK" and "Cancel".

The error branch is a type of If-Then item that is used for error conditions. On any failure, the script, if configured to do so, jumps to the error branch and runs its script items. To configure the script to use the error branch, refer to [page 510](#).

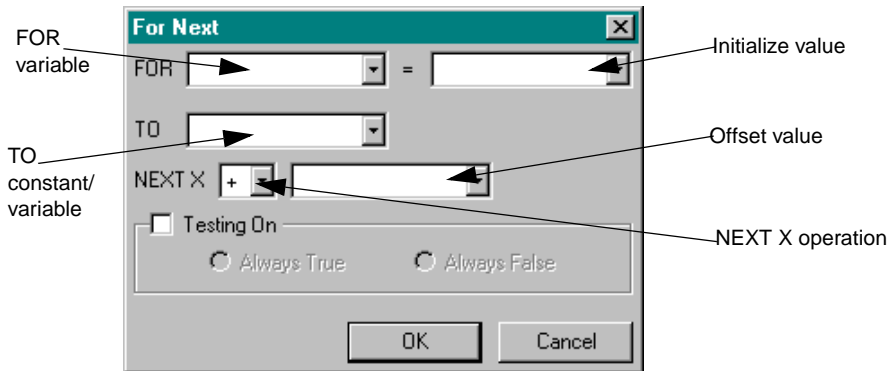
The error branch is entered into the point & click script at the selected script item (if one is selected). Typically, you would position the error branch at the end of the script; however, you can position it any place you want. If the error branch is entered in an incorrect location, you can drag-and-drop it to the correct location with the mouse. To enter script items under the new error branch, drag-and-drop them under the new error branch using the right mouse button.

Select the **Testing On** checkbox if you want to enter a loop or branch for debugging purposes even if the condition is not satisfied. Select the **Always True** radio button if you want to ignore the condition and always enter the loop or branch. Select the **Always False** radio button if you never want to enter the loop or branch.

When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the box without saving your changes.

For Next

Click this icon to enter a For-Next loop script item into the point & click script. Then, enter the appropriate information in the For-Next box.



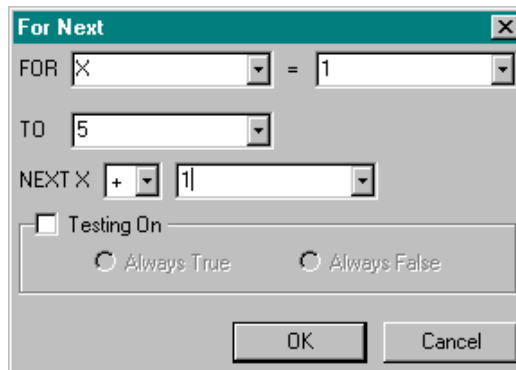
Enter a variable name in the FOR text box or select a script variable from the FOR variable drop-down list. In the initialize box, enter a constant, such as 5, or select a variable from the drop-down list. Enter a constant value or variable name in the TO text box or select a script variable from the TO constant/variable drop-down list.

When the loop starts, the FOR variable is initialized to the value in the initialize value box. The loop continues until the FOR variable is equal to the constant or variable in the TO text box. Each time through the loop, the FOR variable is incremented or decremented by the amount specified in the offset box. If the NEXT X operation is set to +, the value is incremented; if it is set to -, the value is decremented.

For example, to create a simple loop where something would be run five times ($x=1$, $x=2$, $x=3$, $x=4$, and $x=5$), you could use the statement:

```
FOR X=1 TO X=5 NEXT X (X=X+1)
```

To implement this statement, set the For Next box as follows:



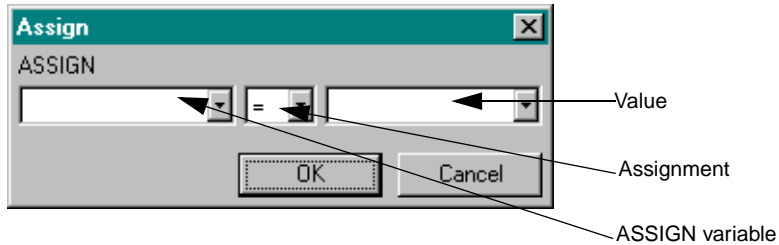
The For-Next loop is entered into the point & click script at the selected script item (if one is selected). If the For-Next statement is entered in an incorrect location, you can drag-and-drop it to the correct location with the mouse. To enter script items under the new For-Next statement, drag-and-drop them under the new For-Next statement using the right mouse button.

Select the **Testing On** checkbox if you want to enter a loop or branch for debugging purposes even if the condition is not satisfied. Select the **Always True** radio button if you want to ignore the condition and always enter the loop or branch. Select the **Always False** radio button if you never want to enter the loop or branch.

When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the box without saving your changes.

Assign

Click this icon to enter an Assign script item into the point & click script. Then, enter the appropriate information in the Assign box.



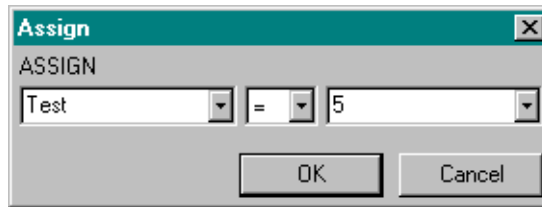
The Assign box assigns a value to a variable.

Enter a variable name in the ASSIGN text box or select a script variable from the ASSIGN variable drop-down list. Then, select one of the following assignments from the assignment drop-down list box:

- Assign (=)
- Add and assign (+=)
- Subtract and assign (-=)
- Multiple and assign (*=)
- Divide and assign (/=)

Finally, enter a constant, such as 5, in the test box or select a script variable from the value drop-down list.

For example, to set the variable Test equal to 5, set the Assign box as follows:



The Assign statement is entered into the point & click script at the selected script item (if one is selected). If the statement is entered in an incorrect location, you can drag-and-drop it to the correct location with the mouse. To enter script items under the new Assign statement, drag-and-drop them under the new Assign statement using the right mouse button.

When all the settings are correct, click **OK** to set your options. Click **Cancel** to close the box without saving your changes.

Time Delay

Click this icon to enter a time delay, in milliseconds, into the script at the selected point.

Stop

Click this icon to enter a stop script item into the script at the selected point. A stop script item stops the script when encountered during a script run and is typically used under an error branch to stop the execution of a script in an error condition. You can place one or more stop items anywhere in a script. If you accidentally enter a stop script item in the wrong location, drag-and-drop it to the correct location.

Auto Run

Select this checkbox to automatically run a script when the script is opened. This is useful for scripts that you want to run on system startup. You can place DT Vision Foundry in the Windows Start menu section so that DT Vision Foundry is run on system startup and, in the Point & Click tool entry in the dttools.ini file, set AUTOSTART to automatically open the Point & Click Script tool when DT Vision Foundry is started. You can then save a script with the name default.pcs. If the **Auto Run** checkbox selected, default.pcs automatically runs on system startup.

For information on editing the dttools.ini file, refer to [page 49](#).

Show Output

Click this button to display the output of the selected script item during a script run. You can toggle the showing of the output by clicking this button again.

Note that showing output takes time and may not be required if no-one is watching.

Time Display

This LED displays the time used to execute the entire point & click script, from the first item in the script to the last item in the script, in milliseconds.

If you want to display the time used to execute each script item in the point & click script, use the **Timer On** option. For more information, refer to [page 511](#).

Long Description

This field displays a long description of the selected script item. The tool automatically sets the long description when the item is recorded. To change the long description, select the **Edit** checkbox and edit the current long description. The long description remains the same even if you edit the script item.

Note that a short description of each script item is displayed in the script area next to the script item's icon. For more information, refer to [page 512](#).

Example of Using the Point & Click Script Tool

This example checks for cracks in a piece of plastic with a constant color such as tan. To check for cracks in an automated system, you would need to do the following:

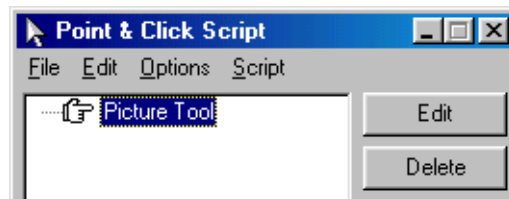
1. Take a picture of the tan plastic with a color or grayscale camera.
2. Run a filter, such as a Sobel filter, on the image to enhance the cracks, if present (optional).
3. Run a histogram of the desired area (or whole image) and look at the standard deviation. If the standard deviation is low, no cracks are present. If it is high, cracks are present.
4. If the part has no cracks, you want to place the text GOOD PART on the image. If the part contains cracks, you want to place the text BAD PART on the image and stop the system.

Note: You might also want to signal other machines using RS-232 or digital I/O, store the bad image and statistics about the image (why it was bad) in a database, and remove the part from the assembly line automatically and continue running the process. However, for ease of understanding the recording and editing of a script, these items will not be covered in this example.

The operation is as follows:

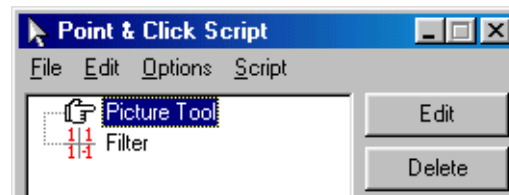
1. Open the Point & Click Script tool (if it is not already open).
2. Open the Picture tool and set it up to take the desired picture. For more information, refer to [Chapter 27, "Using the Picture Tool."](#) When you have all the options set and you are happy with the image from the camera, click **Acquire** to take the picture, then click **Add to Script** to record this step in the Point & Click script. Remember that other tools will find and process the image by the name specified in the Picture tool.

The Point & Click Script tool has a single script item in its script area and looks as follows:



3. Open the Filter tool and set it up to run a Sobel filter on the image you acquired using the Picture tool. You can use an ROI, if desired, or you can process the entire image. For more information, refer to [Chapter 17, "Using the Filter Tool."](#) After setting up the Filter tool to run a Sobel filter on the image, click **Filter** to run the filter, then click **Add to Script** to record the script item.

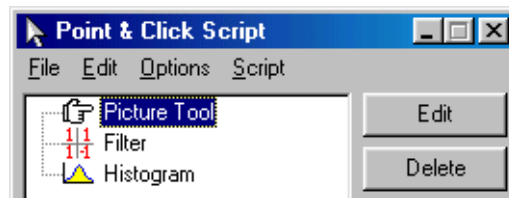
The image is filtered and the script looks as follows:



- Open the Histogram tool to take a histogram of the filtered image. Set up the Histogram tool's scripting options to calculate the histogram statistics, which make statistic scripting variables. For more information, refer to [Chapter 19, "Using the Histogram Tool."](#)

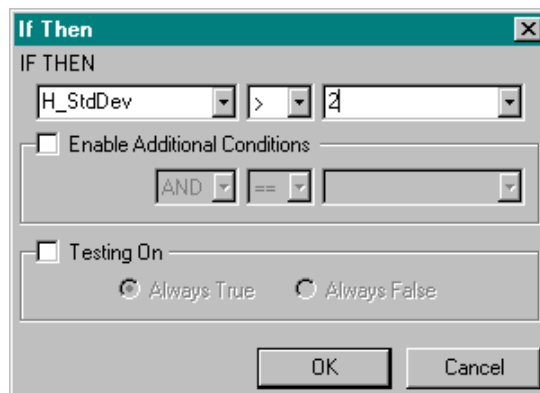
Make sure that your desired ROI is active (if you are using an ROI) and that the filtered image is in the active viewport. Click **Add Histogram** to take a histogram of the image, then click **Add to Script** to record the script item.

The histogram is created and the script looks as follows:



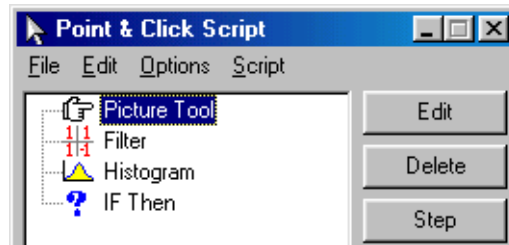
- Create an If-Then branch based on the standard deviation created from the histogram by clicking on the If-Then icon in the Point & Click Script tool. Set the If-Then box so that if the standard deviation is greater than 2, the part is considered to have cracks.

The If-Then box looks as follows:



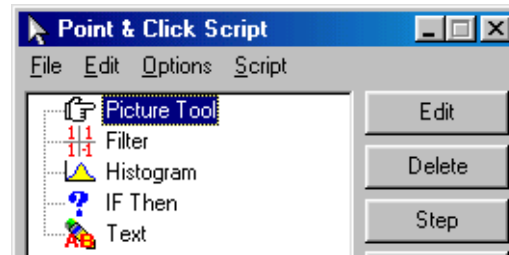
6. Accept the settings by clicking **OK**.

The script looks as follows:



7. Open a Text tool and place the text BAD PART on the filtered image. For more information, refer to [Chapter 38, “Using the Text Tool.”](#) After the text is on the image, click the **Add to Script** button in the Text tool to record this item in the script.

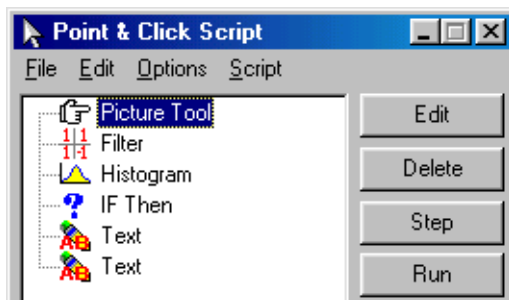
The script looks as follows:



8. Copy the text item using the same text object by using drag-and-drop while holding down the **<Ctrl>** key to drop the text item on the If-Then item (or on any item other than the text item). You now have two text items that use the same text object that both contain the text BAD PART. Edit one of the text items so that it contains the text GOOD PART. To do this, select one of the text objects and click the **Edit** button (or double-click the text item).

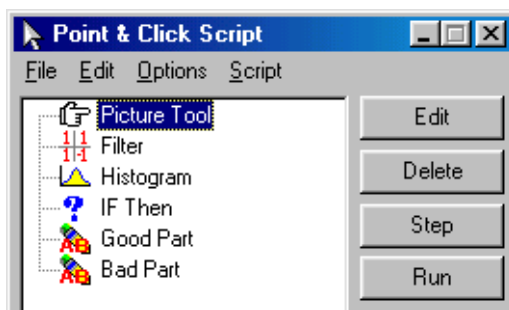
The Text tool is now set up exactly as it was when the script item was recorded (it contains the text BAD PART). Change the text to GOOD PART and click **Update Text** in the Text tool to update the text object. Save the script item by clicking **Update Script** in the Text tool. You now have two text items, one that contains the text BAD PART and one that contains the text GOOD PART.

The script looks as follows:



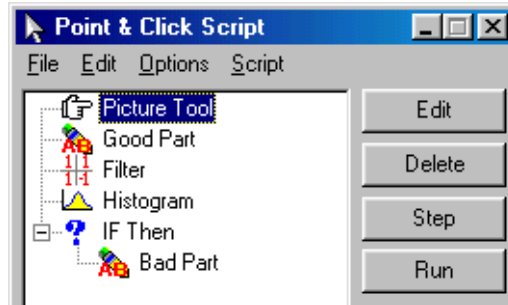
9. To help keep track of the two text items, change the short descriptions to Good Part and Bad Part by slowly clicking on each item twice and then changing its text. When finished, click **Enter**.

The script looks as follows:



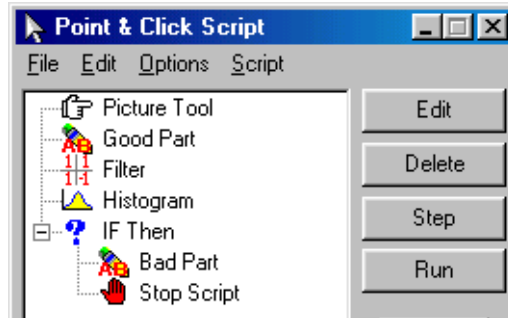
10. Take the mouse and drag the Good Part item to the Picture Tool script item and drop it so that the script starts off displaying Good Part. Then, drag the Bad Part item using the RIGHT mouse button and drop it on the If-Then item.

The script looks as follows:



11. Click the Stop icon in the Point & Click Script tool and position the Stop item under the Bad Part item using drag-and-drop. This allows you to stop the script if you catch a bad part.

The script looks as follows:



12. Either step through the script using the **Step** button or run the script using the **Run** button.

To catch different sized cracks, you may have to adjust the value in the If-Then statement. You can also determine which script items show their output by selecting a script item and clicking the **Show Output** button.

In a real-world application, you may not want to place the text GOOD PART on the image each time. To avoid this, you could put everything in a While loop and place the text on the image once, or you could not place the GOOD PART text on the image at all. For help with logic and programming, refer to any book on programming.



Using the Polar Unwrap Tool

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Introduction

The Polar Unwrap tool is supplied with DT Vision Foundry. It allows you to convert a circular object in an image into a linear object (transform a section of an image from polar to rectangular coordinates). This is useful for straightening curved text for OCR applications or for solving polar-based imaging problems using rectilinear-oriented tools. For example, [Figure 112](#) shows a circular gear, before and after using the Polar Unwrap tool.

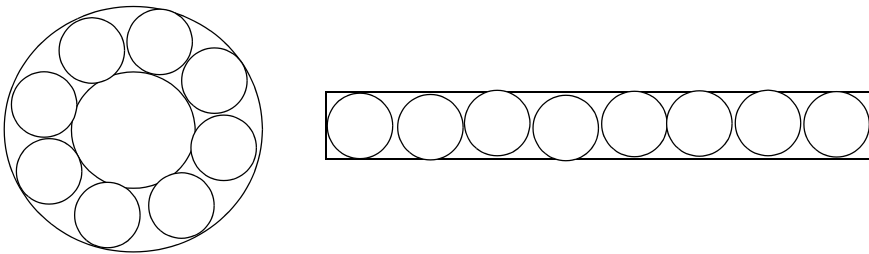


Figure 112: Polar Unwrap Tool Example

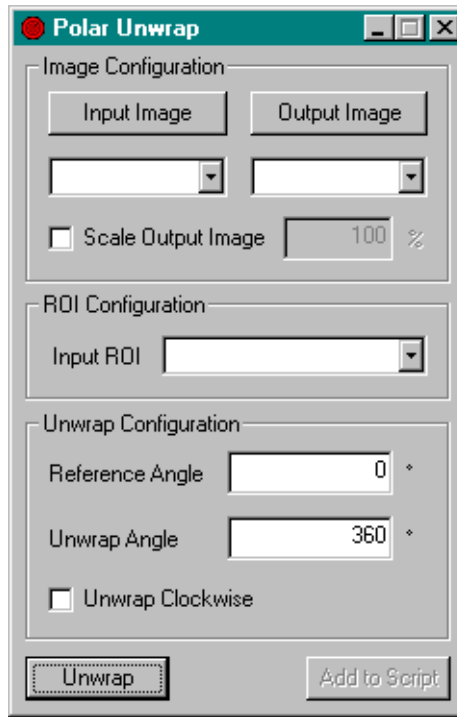


Figure 113: Polar Unwrap Tool

To open a Polar Unwrap tool, select the  icon from the Image Processing toolbar or select **Polar Unwrap** from the Tools menu.

Notes: The Polar Unwrap tool is fully compatible with all tools. At the present time, only 8-bit grayscale images and ellipse ROIs are supported.

You can have up to 100 Polar Unwrap tools open at the same time.

Description of Polar Unwrap Tool Options

This section contains a description of the options in the Polar Unwrap tool dialog box.

Input Image

Click this button to load the image in the active viewport as the input image. The image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Output Image

Click this button to load the image in the active viewport as the output image. The image name is shown in the Output Image display window. You can also select the output image from the list of images currently residing in system memory or enter your own name for the output image in the display window text box.

If you do not select an output image, the Polar Unwrap tool automatically creates an output image when you perform the operation. Note, however, that if you intend to use multiple output images in a point & click script, it is recommended that you either use the image in the active viewport as the output image or select the output image from the drop-down list. This ensures that each output image in the point & click script has a unique name.

Scale Output Image

Select this checkbox if you want to reduce the size of the output image, then enter the percentage that you want to reduce the size of the image (between 10% and 100%). For example, if you enter **90**, the width and height of the output image are multiplied by 0.90.

ROI Configuration

Select an ROI from the drop-down list. The ROI reduces the conversion time and allows you to select the object that you want to unwrap. Note that only ellipse ROIs are supported.

Make sure that you draw the ellipse ROI as close as possible to the circular object that you are unwrapping, leaving some space between the object and the ROI. Make sure that the center of the ellipse ROI is located at the center of the circular object.

Reference Angle

Enter the starting angle, in degrees. The value can range from 0° to 360° . The angle is expressed as a positive offset from the 0° position. For example, to begin unwrapping the image under the selected input ROI at the 90° position, enter the value **90**.

Unwrap Angle

Enter the portion of the image that you want to unwrap, in degrees. The value can range from 0° to 720° . For example, to unwrap the portion of the image from 0° to 180° (quadrants I and IV), specify a **Reference Angle** of 0° and an **Unwrap Angle** of 180° .

Unwrap Clockwise

Select this checkbox if you want to unwrap images in a clockwise direction (negative angular direction). Clear this checkbox if you want to unwrap images in a counter-clockwise direction (positive angular direction).

Unwrap

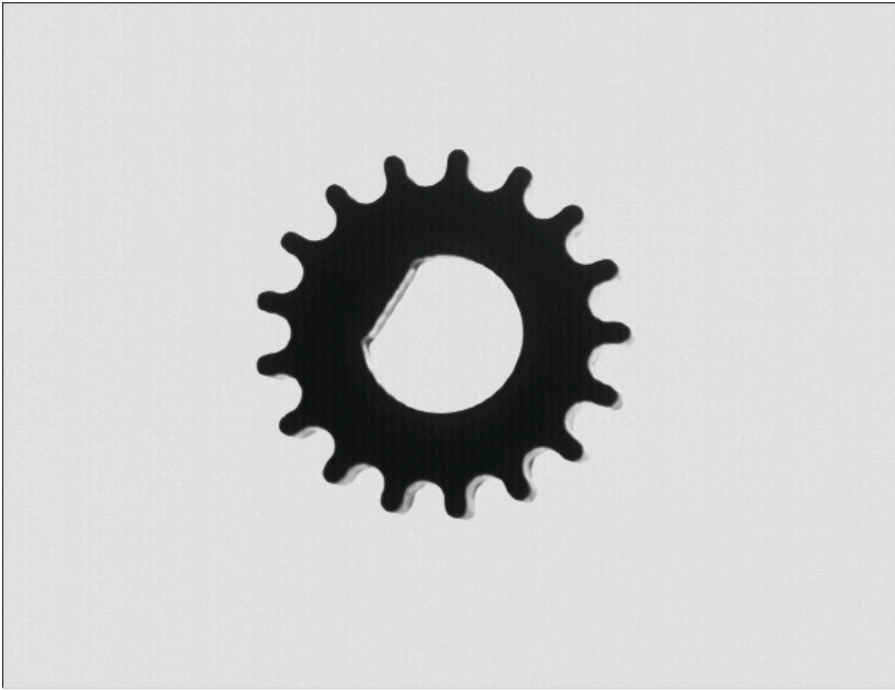
When all options for the tool are set appropriately, click this button to perform the operation.

Add to Script

After you perform the operation, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the Polar Unwrap Tool

This example shows how to convert a gear, such as the one shown in the image Gear.bmp, to a linear object and then use the Edge Finder tool to determine the number of teeth in the gear.



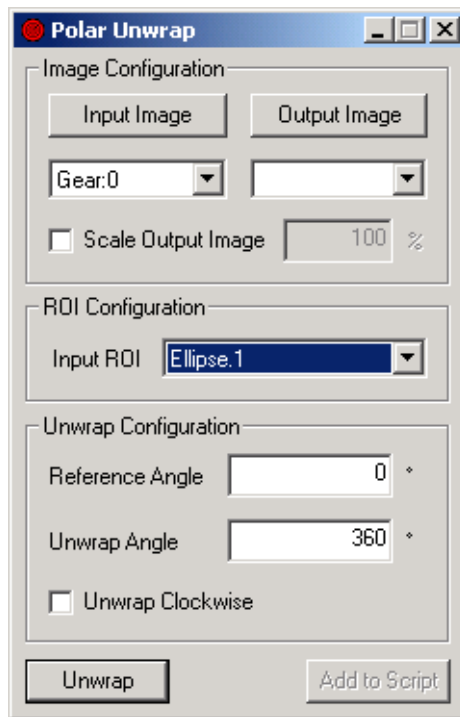
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The operation is as follows:

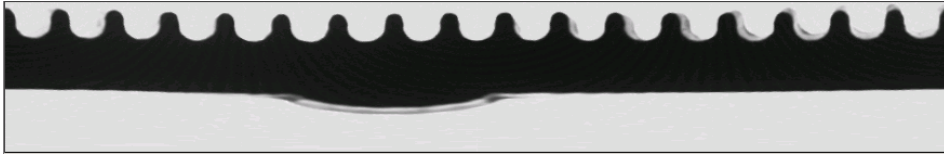
1. Open a Polar Unwrap tool (if one is not already open).
2. Open the image Gear.bmp, then click in the viewport on the image.

It is now the active viewport and is denoted with an asterisk.

3. Click **Input Image** in the Polar Unwrap tool to load the image Gear. Note that you can also select the image from the list of images currently residing in system memory.
4. Draw an ellipse ROI around the gear in the image. Make sure that you overlap the gear completely.
5. Select the ellipse ROI from the **Input ROI** drop-down list.
The Polar Unwrap tool looks as follows.

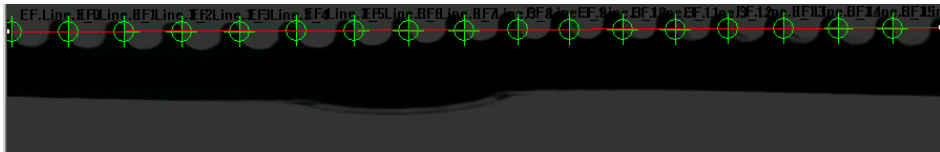


6. Click **Unwrap**.
The Output Image Output is automatically created, as follows.



7. Open an Edge Finder tool (if one is not already open).
8. Click in the viewport on the image Output with the left mouse button. Output is now the active viewport and is denoted with an asterisk. In the Edge Finder tool, click **Input Image** to load Output as the input image.
9. Select the **Auto threshold** checkbox.
10. Draw a line ROI through all the teeth in the gear.
11. Enter 0 in the **Radius** text box to generate point ROIs.
12. Select the **Find All Rising Edges** radio button.
13. Make sure that the line ROI is still activated (red). If not, click on it with the right mouse button. Note that you can also activate the line ROI by selecting it from the **Input ROI** drop-down list or by using the <Tab> key.
14. Click **Find Edge** to extract the edges and generate a series of line ROIs named EF.Line.1_0 through EF.Line.1_16, indicating that there are 17 teeth in the gear.

The image Output appears as follows.



Point & Click Script

This section describes the specific use of the Polar Unwrap tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Polar Unwrap tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Polar Unwrap tool to perform the desired function. This includes the input and output images, the scale value, and the ROI. Click **Unwrap** to perform the desired operation, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Polar Unwrap tool is set up exactly as it was when you previously recorded the script item. This includes the input and output images, the scale value, and the ROI. The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved to the point & click script with the new options.



Using the Prompt Tool

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Introduction

The Prompt tool is supplied with DT Vision Foundry. It allows you to display a prompt to the end-user while a point & click script is running. The end-user can respond to the prompt either by clicking a button or by entering text in a text box.

To open a Prompt tool, select the  icon from the Miscellaneous toolbar or select **Prompt** from the Tools menu.

Notes: The Prompt tool is fully compatible with all tools. Images and ROIs are not used.

You can have up to 100 Prompt tools open at the same time.

Description of Prompt Tool Options

This section contains a description of the options in the Prompt tool dialog box.

Button Tab Options

The Button tab allows you to create a prompt that the end-user responds to by clicking a button. You can provide one or two buttons on the prompt. In addition, the Prompt tool provides a **Stop Script** button that allows the end-user to stop the script, if necessary.

Note that the script stops only if **Stop** (on script failure) is selected in the Failure Options dialog box in the Point & Click Script tool. To access the Failure Options dialog box, select **Options | Failure Options**. For more information, refer to [page 510](#).

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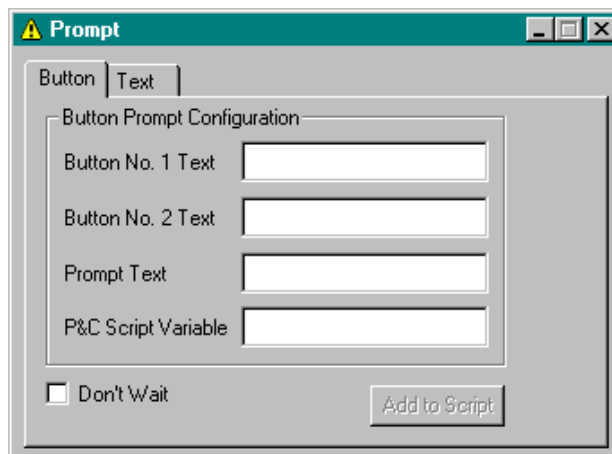


Figure 114: Prompt Tool - Button Tab

An example button prompt is shown in [Figure 115](#).

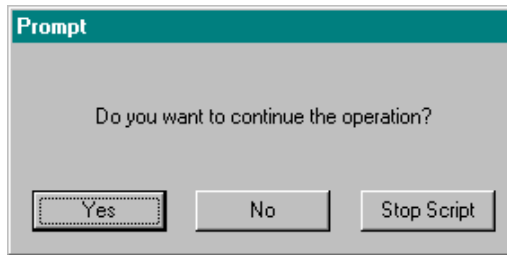


Figure 115: Example Button Prompt

Button No. 1 Text

Enter the text that you want to appear on the first (leftmost) button of the prompt.

Note that only the number of characters that can fit on the button (approximately 14 characters) are displayed. Any additional characters are clipped.

Button No. 2 Text

Enter the text that you want to appear on the second (middle) button of the prompt.

Note that only the number of characters that can fit on the button (approximately 14 characters) are displayed. Any additional characters are clipped.

Prompt Text

Enter the prompt text.

Note that only the number of characters that can fit in the Prompt box (approximately 49 characters) are displayed. Any additional characters are clipped.

P&C Script Variable

Enter the name of the variable that you want to use to keep track of which button the end-user clicks. If the end-user clicks the first button, the variable equals 1; if the end-user clicks the second button, the variable equals 2; if the end-user clicks the **Stop Script** button, the variable equals 3.

You can use this variable in your point & click script to move to a particular point in the script, depending on the button that the end-user clicks.

Don't Wait

Select this checkbox if you want the point & click script to continue running when the prompt is displayed.

Clear this checkbox if you want the point & click script to stop running when the prompt is displayed. This is useful if you want the end-user to be able to do such things as repositioning an object or entering some required information before a particular point in the script is reached. When the end-user clicks one of the buttons, the script automatically continues running.

Add to Script

Once you have specified both a point & click script variable and prompt text, click this button to add a Button Prompt script item to your point & click script. For more information, refer to [Chapter 29](#), “Using the Point & Click Script Tool.”

Text Tab

The Text tab allows you to create a prompt that the end-user responds to by entering text in a text box. The Prompt tool provides a **Stop Script** button that allows the end-user to stop the script, if necessary.

Note that the script stops only if **Stop** (on script failure) is selected in the Failure Options dialog box in the Point & Click Script tool. To access the Failure Options dialog box, select **Options | Failure Options**. For more information, refer to [page 510](#).

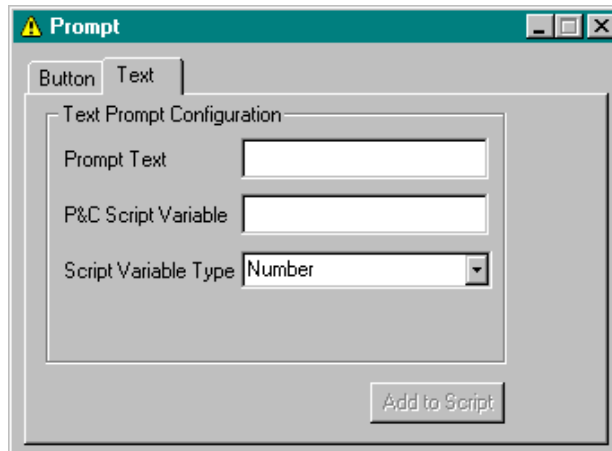


Figure 116: Prompt Tool - Text Tab

An example text prompt is shown in [Figure 117](#).

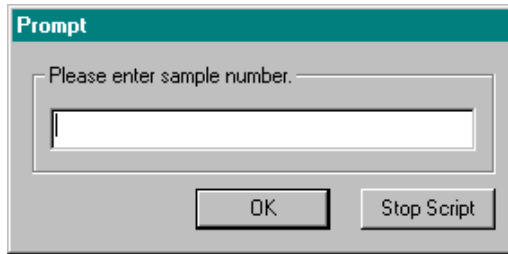


Figure 117: Example Text Prompt

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Note: The point & click script always stops running when a Text prompt is displayed. This allows the end-user to do such things as repositioning an object or entering some required information before a particular point in the script is reached. When the end-user enters text and then clicks **OK**, the script automatically continues running.

Prompt Text

Enter the prompt text.

Note that only the number of characters that can fit in the Prompt box (approximately 49 characters) are displayed. Any additional characters are clipped.

P&C Script Variable

Enter the name of the variable that you want to use to keep track of the text that the end-user enters. You can use this variable in your point & click script to move to a particular point in the script, depending on the text that the end-user enters.

Script Variable Type

Select the type of the point & click script variable (String, Number).

Add to Script

Once you have specified both a point & click script variable and prompt text, click this button to add a Text prompt script item to your point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

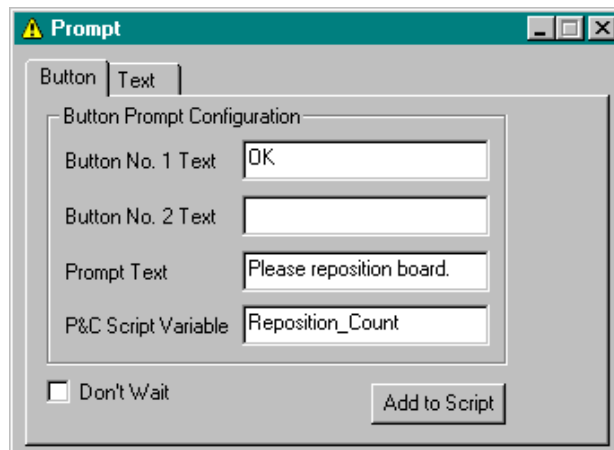
Example of Using the Prompt Tool

This example shows how to create a Button prompt in a point & click script. Assume that you are using the Search tool to find a particular computer chip on images of printed circuit boards moving down an assembly line. If a chip is not found after a specified amount of time, you want to sound an alarm so that someone can reposition the boards and continue the operation.

The operation is as follows:

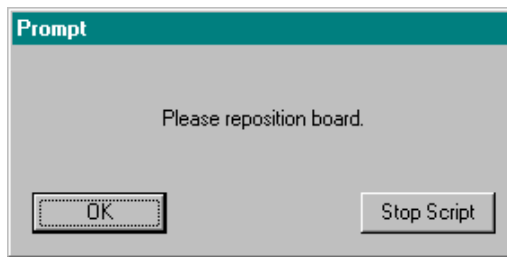
1. Open the Point & Click Script tool (if it is not already open).
2. Open a Prompt tool (if one is not already open).
3. In the Prompt tool, click the Button tab.
4. In the **Button No. 1 Text** text box, enter **OK**.
5. In the **Prompt Text** text box, enter **Please reposition board.**
6. In the **P&C Script Variable** text box, enter **Reposition_Count**.

The Prompt tool looks as follows.



7. Click **Add to Script** to add the Button prompt script item to your point & click script.
8. In the Point & Click Script tool, include the following:
 - Code that sounds an alarm after a specified amount of time if a chip has not been found.
 - Code that runs the Button prompt script item whenever the alarm sounds.

When the end-user checks the computer display, the following Button prompt is displayed:



After the end-user repositions the board and clicks **OK**, the point & click script resumes.

Point & Click Script

This section describes the specific use of the Prompt tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Prompt tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up the Prompt tool to specify the point & click script variable and the prompt text. Click **Add to Script** to record the script item in the Point & Click Script tool.

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Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Prompt tool is set up exactly as it was when you previously recorded the script item. This includes the point & click script variable and the prompt text. The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the ROI Manager Tool

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Introduction

The ROI Manager tool is supplied with DT Vision Foundry. It allows you to do the following:

- Create an ROI (region of interest).
- Create a set of similar ROIs.
- View the coordinates of an ROI.
- Select the type of ROI to be created.
- Enter the coordinates of an ROI to be created.
- Copy an existing ROI from one viewport to another.
- Control the positioning of an ROI using a reference point.

To open an ROI Manager tool, select the  icon from the Gauging toolbar or select **ROI Manager** from the Tools menu.

Note: The ROI Manager tool is fully compatible with all other tools, image types, and ROIs.

You can have only one ROI Manager tool open at a time.

Description of ROI Manager Tool Options

This section contains a description of the options in the ROI Manager tool dialog box.

Draw Tab Options

The Draw tab allows you to create an ROI, change the name of an ROI, save an ROI to disk, open an ROI that was previously saved to disk, or add a series of similar ROIs (auto increment).



Figure 118: ROI Manager Tool - Draw Tab

UL(X,Y)

This field displays the coordinates of a selected point ROI or the coordinates of the upper-left corner of a selected ROI. For a line or ellipse ROI, the values represent a bounding box that encompasses the selected ROI.

If you are creating a line, rectangle, or ellipse ROI, enter the upper-left corner of the ROI in the text box. If you are creating a point ROI, enter the coordinates of the ROI in the text box. Enter the coordinates in the form x, y (for example, enter 10, 10).

You cannot use the ROI Manager tool to create a polyline, freehand line, poly freehand, or freehand ROI; these ROIs must be copied or drawn.

Note that the **UL(X,Y)** values are in image coordinates, where 0, 0 refers to the lower-left corner of the image.

Each time you select, create, move, or delete an ROI in a viewport with the mouse, the tool updates to show the coordinates of the ROI.

LR(X,Y)

This field displays the lower-right corner of a selected rectangle ROI in image coordinates. For a line or ellipse ROI, the values represent a bounding box that encompasses the selected ROI. For a point ROI, this option is not used.

If you are creating a line, rectangle, or ellipse ROI, enter the lower-right corner of the ROI in the text box. Enter the coordinates in the form x, y (for example, enter 10, 10).

You cannot use the ROI Manager tool to create a polyline, freehand line, poly freehand, or freehand ROI; these ROIs must be copied or drawn.

Note that the **LR(X,Y)** values are in image coordinates, where 0,0 refers to the lower-left corner of the image.

Each time you select, create, move, or delete an ROI in a viewport with the mouse, the tool updates to show the coordinates of the ROI.

Width

This field displays the width of the selected or created ROI.

Height

This field displays the height of the selected or created ROI.

Entire Image

Click this button to enter the upper-left and lower-right coordinates of the entire image in the active viewport into the **UL(X,Y)** and **LR(X,Y)** text boxes.

Draw

Click this button to add an ROI of the selected type to the active viewport. For a point, rectangle, line, or ellipse ROI, the tool uses the values specified in the **UL(X,Y)** and **LR(X,Y)** text boxes. For a polyline, freehand line, poly freehand, or freehand ROI, the tool uses an internal copy of the most recently activated ROI of that type. If no internal copy is available, the **Draw** button is grayed out. This option is provided so that you can copy ROIs from one viewport to another.

Auto Increment

Enter the offset value that you want to add to the values specified in the **UL(X,Y)** and **LR(X,Y)** text boxes each time you click **Draw**. This allows you to add sets of similar ROIs to the active viewport quickly.

Note that for a point, polyline, freehand line, poly freehand, or freehand ROI, only the **UL(X,Y)** value is used. This is because these ROIs can only be repositioned; they cannot be resized.

ROI Type

Click the **Point**, **Rect**, **Line**, or **Ellipse** radio button to specify the type of ROI that you want to create. You can then either use the mouse to draw the ROI or specify the image coordinates of the ROI in the **UL(X,Y)** and **LR(X,Y)** text boxes and then click **Draw**.

Note that you cannot use this option to draw a polyline, freehand line, poly freehand, or freehand ROI. If you select one of these ROI types and click **Draw**, the tool uses an internal copy of the most recently activated ROI of that type, if one is available.

Open ROI...

Click this button to open an ROI from disk. An Open dialog box is displayed. When you open an ROI (the file name must be followed by the extension .roi), the object is loaded into the ROI Manager tool.

Save As ROI

Click this button to save the active ROI to disk. A Save As dialog box is displayed. Select the directory and enter a file name with the extension .roi.

If you save the active ROI with a new name and if you want the name of the ROI on disk to match the name of the ROI in the DT Vision Foundry environment, make sure that you also change the name in the **ROI Name** text box.

ROI Name

This field displays the name of the active ROI in the active viewport.

Change

Click this button to change the name of an ROI in the active viewport. Activate the ROI whose name you want to change by clicking in it with the right mouse button or by using the <Tab> key. Enter the new name in the **ROI Name** text box, then click **Change**.

Add to Script

After you open or save an ROI, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29](#), “Using the Point & Click Script Tool.”

Position Tab Options

The Position tab allows you to control the positioning of an ROI by establishing a relationship between the ROI and a reference point. The reference point is a known point, whose x- and y-coordinates are typically provided by another tool, such as the Gauge tool.

Note: The Position tab options are not intended to be used to reposition an ROI on the display. They are intended to provide functionality that is added to a point & click script.

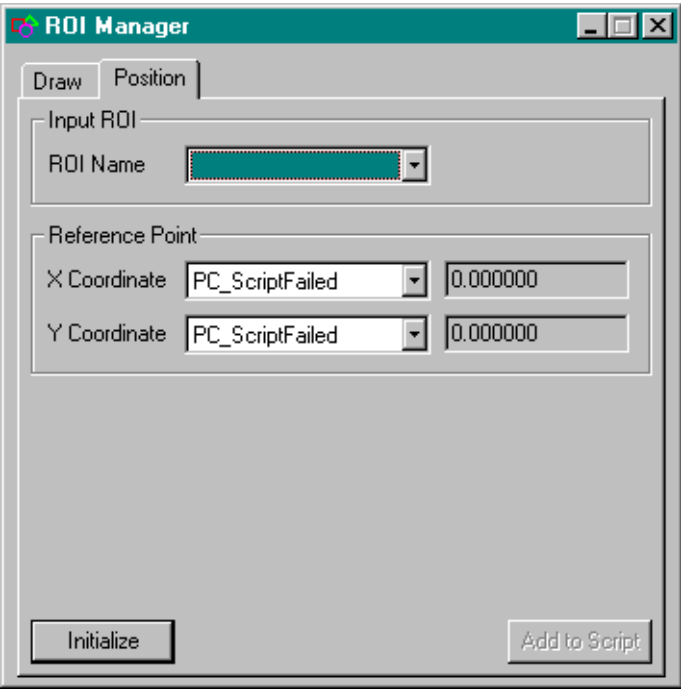


Figure 119: ROI Manager Tool - Position Tab

ROI Name

Select the name of the ROI in the image whose relationship to the reference point you want to establish. You can select the ROI name from the drop-down list, in which case the ROI is activated (red) in the image, or you can right-click or tab to the ROI in the image, in which case the appropriate ROI name is displayed in the drop-down list.

Note that a text object that you created using the Text tool is referred to as **Textx**, not **Rectx**. For more information about the Text tool, refer to [Chapter 38, “Using the Text Tool.”](#)

Reference Point X Coordinate

Select the variable containing the x-coordinate of the reference point from the drop-down list. The x-coordinate value is displayed in the text box.

Reference Point Y Coordinate

Select the variable containing the y-coordinate of the reference point from the drop-down list. The y-coordinate value is displayed in the text box.

Rotation

Select the **Rotation** checkbox if you want the ROI Manager tool to take rotation into account when repositioning a line or point ROI. Then, from the **Angle** drop-down list, select the variable containing the angle at which to rotate the ROI. The angle, in degrees, is displayed in the text box.

Note that the ROI Manager tool does not take rotation into account when repositioning a rectangle, ellipse, polyline, freehand line, poly freehand, or freehand ROI.

Initialize

Click this button to establish the relationship between the ROI specified by **ROI Name** and the reference point specified by **Reference Point X Coordinate** and **Reference Point Y Coordinate**.

Add to Script

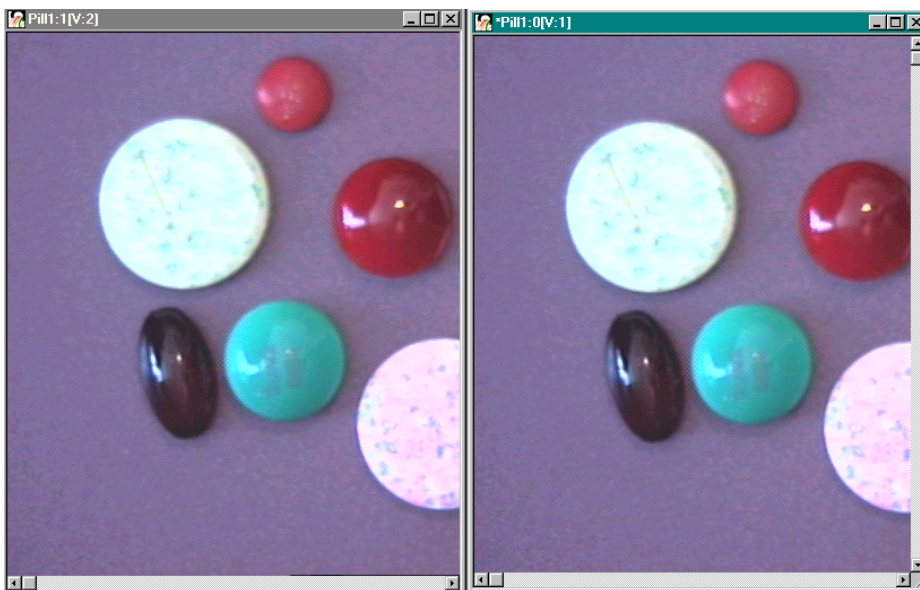
After you establish the relationship between the ROI and the reference point by clicking **Initialize**, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the ROI Manager Tool

This example shows how to add an ellipse ROI around Pill A in the image Pill1:0, how to copy the ellipse ROI to the image Pill1:1, and how to add five rectangle ROIs around the ellipse ROI to the image Pill1:1. Each of the five rectangle ROIs is 10 pixels larger than the last.

The operation is as follows:

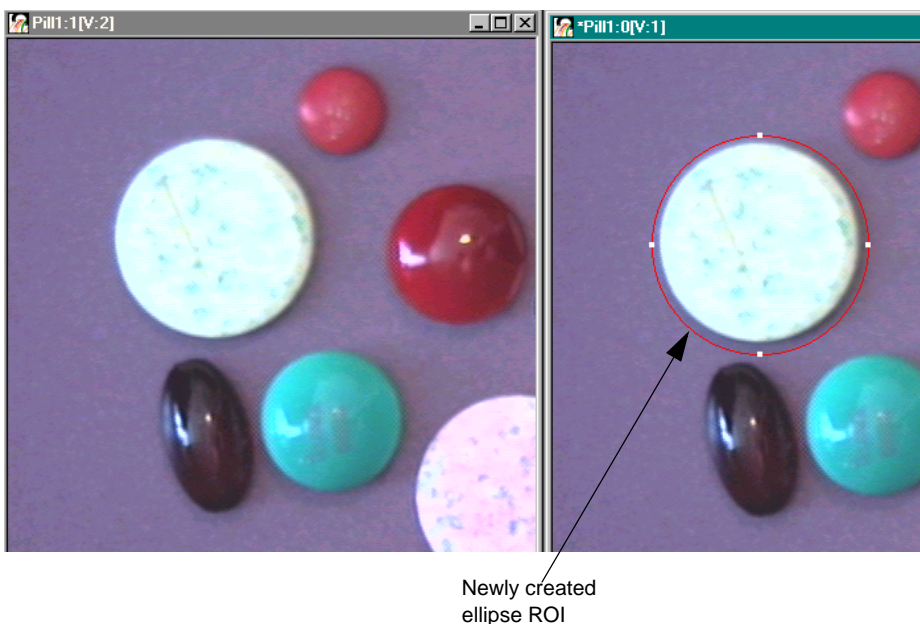
1. Open the image Pill1, open a new viewport, and then open the image Pill1 again. Pill1:0 is the first instance of the image and Pill1:1 is the second instance of the image.



2. Open the ROI Manager tool (if it is not already open).
3. Activate the image Pill1:0 by clicking in it with the left mouse button.

4. Click the **Ellipse** radio button in the ROI Manager tool. Note that you can also specify the ROI type by selecting **Options | ROI Type | Ellipse** from the menu bar in the main application or by selecting the **Ellipse** radio button from the ROI menu bar.
5. Place the mouse cursor over the image Pill1:0 at the upper-left corner of the large white pill at the left of the image. While holding down **<Ctrl>** and **<Shift>** on the keyboard, press the left mouse button. While holding down the left mouse button, drag the mouse to the lower-right corner of the pill. Release the left mouse button.

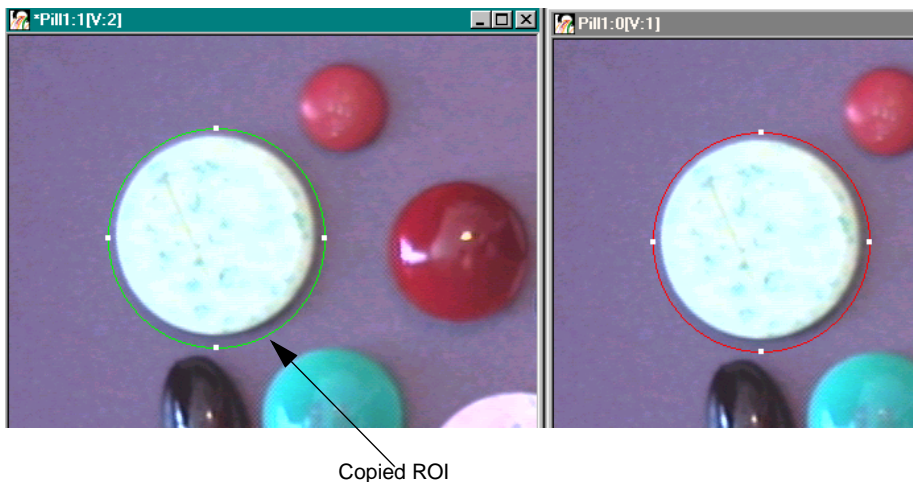
The main application looks as follows:



6. Activate (red) the ROI by clicking in it with the right mouse button. The ROI Manager tool is updated with the coordinates of the ROI.
7. Activate the image Pill1:1 by clicking in it with the left mouse button.

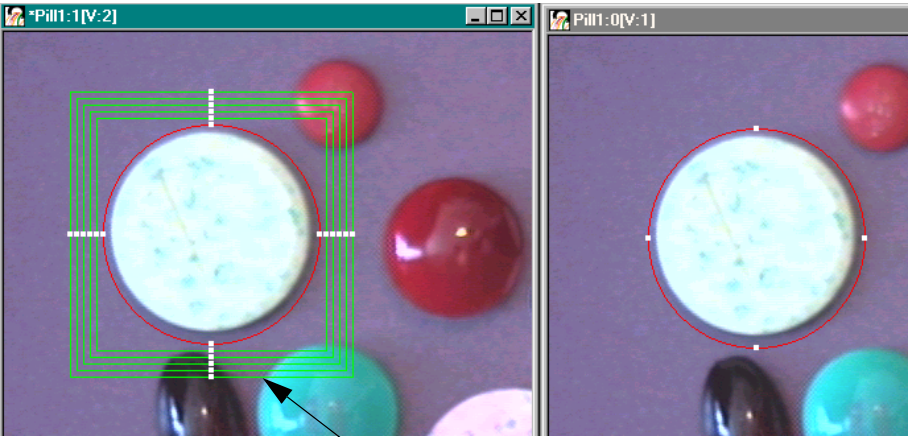
8. Click **Draw** in the ROI Manager tool.

The main application looks as follows:



9. To obtain the coordinates of the ROI that you want to copy and enlarge, activate (red) the ellipse ROI in image Pill1:1 by clicking in it with the right mouse button. The ROI Manager tool is updated with the coordinates of the ROI.
10. Set **Auto Inc** to make the upper-left corner move up and left by five pixels ($-5, 5$) and to make the lower-right corner move down and right by five pixels ($5, -5$).
11. Set the ROI type to **Rect**.
12. Add five new rectangle ROIs to the active image Pill1:1 by clicking **Draw** five times.

The main application looks as follows:



Five new rectangle ROIs (each larger than the last)

Point & Click Script

This section describes the specific use of the ROI Manager tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the ROI Manager tool's functionality to a point & click script, you must first have the Point & Click Script tool open. The only functions from the ROI Manager tool that are scriptable are opening an ROI from disk and saving an ROI to disk (from the **Draw** tab) and setting up the relationship between an ROI and a reference point for positioning purposes (from the **Position** tab). Click **Open ROI**, **Save As ROI**, or **Initialize** to perform the desired action, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Notes: One script item is created for the **Draw** tab and another script item is created for the **Position** tab.

You always provide the absolute path to the ROI file in the ROI Manager tool. If you save the point & click script to the same drive that contains the ROI file, the tool automatically converts the ROI file to a path relative to the directory in which you save the script. If you move the script (and the ROI file) to another directory, the correct ROI file is opened when you run the script.

An ROI can be opened only once from disk, even if the script item that opens the ROI is run multiple times. The point & click script checks to see if an ROI with the same name as the ROI to be opened is attached to the desired image. If the point & click script detects an ROI with the same name, the script does not open another ROI. If the ROI is deleted from the system, the ROI is opened and added to the system when the script item is run.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out. The only functions from the ROI Manager tool that you can edit are opening an ROI from disk and saving an ROI to disk (from the **Draw** tab) and setting up the relationship between an ROI and a reference point for positioning purposes (from the **Position** tab). The **Add to Script** button is changed to a **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the ROI Shape Fitter Tool

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Introduction

The ROI Shape Fitter tool is supplied with DT Vision Foundry. It allows you to fit a straight line into an edge, fit a circle into an arc or an enclosed contour, or locate the center of gravity of an object in your image. The tool does this by transforming an input ROI into an output ROI of another type. This is useful for preprocessing an edge before you perform a measurement operation.

For example, if your image contains an approximately round object, you can start with either a user-drawn ellipse input ROI or a freehand input ROI generated by the Edge Finder tool. Then, use the ROI Shape Fitter tool to locate the center of gravity of the input ROI and create a point ROI. Finally, you can measure the minimum and maximum distance (radius) from this center point to the object's contour using the Gauge tool.

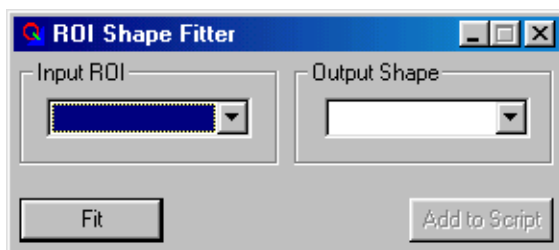



Figure 120: ROI Shape Fitter Tool

To open an ROI Shape Fitter tool, select the  icon from the Gauging toolbar or select **ROI Shape Fitter** from the Tools menu.

Notes: The ROI Shape Fitter tool is fully compatible with all tools. The input ROI can be a line, rectangle, ellipse, freehand line, poly freehand, or freehand ROI; point and polyline ROIs are not supported. The tool does not use images; it processes ROIs only.

The ROI Shape Fitter tool uses least-squares error minimalization techniques.

You can have up to 100 ROI Shape Fitter tools open at the same time.

Description of ROI Shape Fitter Tool Options

This section contains a description of the options in the ROI Shape Fitter tool dialog box.

Input ROI

Select the input ROI that you want to transform. The drop-down list contains the following:

- Any user-drawn line, rectangle, ellipse, freehand line, poly freehand, and freehand ROIs in your image. Point and polyline ROIs are not supported as input ROIs.
- Any ROIs generated by another DT Vision Foundry tool, such as the Edge Finder tool, the ROI Shape Fitter tool, or the Blob Analysis tool.

You can also select the input ROI by right-clicking the ROI in the input image.

Output Shape

Select the type of output shape (ROI) that you want to fit the selected input ROI into. The types of output shapes available from the drop-down list depend on the type of input ROI that you selected, as follows:

Input ROI	Output Shape
Point	Not supported
Rectangle	Center point
Ellipse	Center point
Line	Center point

Input ROI	Output Shape
Polyline	Not supported
Freehand line	Circle Line
Poly freehand	Center point
Freehand	Center point Circle

Fit

When all the settings are finalized, click this button to transform the selected input ROI. The output ROI has the same name as the user-drawn or generated ROI with the prefix SF-Line., SF-Point., or SF-Ellipse., depending on the output ROI type. For example, if you are transforming the generated freehand line ROI named EF.Line.1 into a circle, the output ROI is named SF-Ellipse.EF.Line.1.

Note that if the output shape that you create is a circle (ellipse ROI) or a line (line ROI), the output shape is added to the Input ROI drop-down list and can, itself, be transformed. However, point output shapes (point ROIs) are not supported as input ROIs.

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Add to Script

After you transform the ROI by clicking the **Fit** button, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the ROI Shape Fitter Tool

This example shows how to use the ROI Shape Fitter tool with the Edge Finder tool to determine whether two edges of an object in the image Perfect, shown in [Figure 121](#), are parallel. For more information about the Edge Finder tool, refer to [Chapter 14](#), “Using the Edge Finder Tool.”



Figure 121: ROI Shape Fitter Tool Example Image

The operation is as follows:

1. Open the image Perfect.
2. Click in the viewport on the image Perfect with the left mouse button. Perfect is now the active viewport and is denoted with an asterisk, as show in [Figure 121](#). Click **Input Image** to load Perfect as the input image.
3. Open an Edge Finder tool.
4. Draw two line ROIs, one across the left edge of the #4 button and one across the right edge of the #4 button.

*The image looks as follows. The names of the ROIs are displayed in the **Input ROI** text box in the Edge Finder tool (Line.1 and Line.2).*



5. Activate (red) Line.1 by clicking on it with the right mouse button.
6. Click **Find** in the Edge Finder tool to extract the edge and generate a freehand line ROI named EF.Line.1.
7. Repeat steps 5 and 6 for Line.2.
8. Open an ROI Shape Fitter tool.
9. Select **EF.Line.1** from the **Input ROI** drop-down list.

10. Select **Line** from **Output Shape** drop-down list.
11. Click **Fit** in the ROI Shape Fitter tool to fit a straight line to the edge.
The tool generates a line ROI named SF-Line.EF.Line.1.
12. Repeat steps 9 to 11 for EF.Line.2.
13. Use the Gauge tool to determine the intersection angle between SF-Line.EF.Line.1 and SF-Line.EF.Line.2. If the angle is 0° , the edges are parallel. For more information about the Gauge tool, refer to [Chapter 18, "Using the Gauge Tool."](#)

Point & Click Script

This section describes the specific use of the ROI Shape Fitter tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add an ROI Shape Fitter tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the ROI Shape Fitter tool to perform the desired function. This includes the input ROI and the output shape. Click **Fit** to perform the desired action, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the ROI Shape Fitter tool is set up exactly as it was when you previously recorded the script item. This includes the input ROI and the output shape. The **Add to Script** button is changed to a **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back into the point & click script with the new options.



Using the Search Tool

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Introduction

The Search tool is supplied with DT Vision Foundry. It uses correlation algorithms to find features within an image.

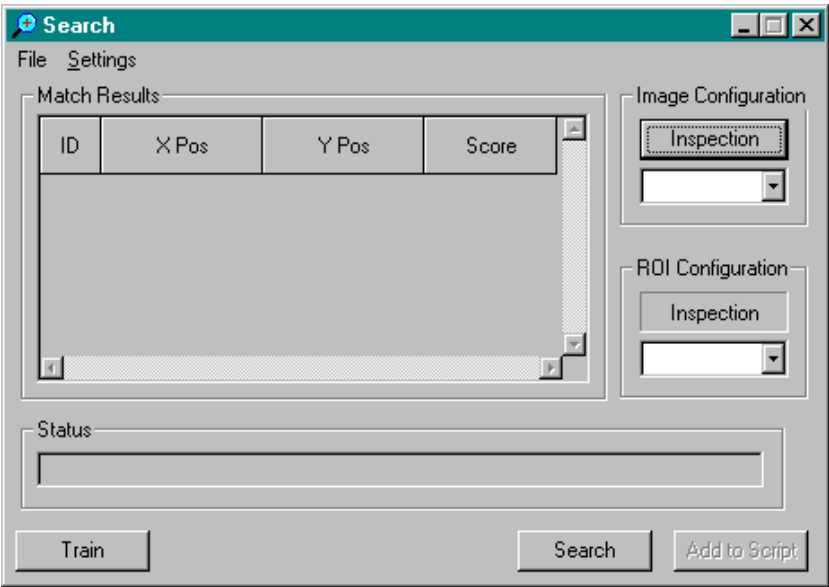


Figure 122: Search Tool

A feature is a pattern or object within a feature image that is identified by a feature ROI; the feature ROI must be a rectangle ROI. The Search tool searches for the feature within an inspection ROI that is defined in an inspection image. The inspection ROI must also be a rectangle ROI.

Before you can perform a search, you must create a catalog. The catalog contains a training image and other settings, such as the search type and the score threshold (the lowest match score that you want the tool to consider a valid match). The training image consists of the pixels within the feature ROI.

Note: When you create a catalog, the Search tool automatically creates a freehand ROI around one of the objects in the training image. If this object represents the feature that you want to search for, you can use the feature to perform a faster search.

After you create the catalog, you must specify the inspection image and the inspection ROI. Then, you can perform the search operation. The Search tool creates new ROIs in the inspection image to indicate where matches were found and returns information about the matches, including the x- and y-coordinates of the feature within the inspection image and the match score.

The match information is stored in point & click script variables so that you can use the information in a point & click script. For more information, refer to [page 599](#).

If the search operation does not return the results you expect, you can fine-tune the search algorithm by specifying such options as the search type that you want to use, the search level, the score threshold, and the number of matches that you want the software to find.

Note: The feature image can contain several feature ROIs, but you can use only one feature ROI in each search operation. Similarly, the inspection image can contain several inspection ROIs, but you can use only one inspection ROI in each search operation.

The search algorithms are not scale-invariant. The size of the feature image (in pixels) does not have to be the same as the size of the inspection image (in pixels). However, the size of the cataloged feature must be the same as the size of the feature within the inspection image.

To open a Search tool, select the  icon from the Machine Vision toolbar or select **Search** from the Tools menu.

Notes: This tool is fully compatible with all tools and ROIs. Only 8-bit grayscale, 24-bit RGB color, and 24-bit HSL color images are supported.

You can have up to 100 Search tools open at the same time.

Description of Search Tool Options

This section contains a description of the options in the Search tool dialog box.

Main Dialog Box Options

Match Results

This field displays information about all the matches found in the most recent search operation, including the following:

- **ID** – The ID of the match. The matches are listed in order from the best match to the worst match (the best match found is given the match ID 0). The IDs of valid matches are shown in green; the IDs of invalid matches are shown in red.
- **XPos** – The x-coordinate of the point ROI or the x-coordinate of the upper left corner of the rectangle ROI that the tool created in the inspection image to reflect where the match was found.

If a calibration object is attached to the inspection image, the tool displays this value in the calibrated units of measure, such as inches or millimeters. You create/save a calibration object using the Calibration tool. For more information, refer to [Chapter 7, “Using the Calibration Tool.”](#)

- **YPos** – The y-coordinate of the point ROI or the y-coordinate of the upper left corner of the rectangle ROI that the tool created in the inspection image to reflect where the match was found.

If a calibration object is attached to the inspection image, the tool displays this value in the calibrated units of measure, such as inches or millimeters. You create/save a calibration object using the Calibration tool. For more information, refer to [Chapter 7, “Using the Calibration Tool,”](#)

- **Score** – The score assigned to the match. The value can range from 0.0 to 1.0, where 0.0 is the worst possible match and 1.0 is the best possible match.

Note that the number of matches displayed in the list always equals the number of matches you specified in **Match Count** in the Search Settings dialog box, whether the match scores are above or below the specified **Score Threshold**. However, only matches with scores greater than or equal to **Score Threshold** are considered to be valid matches (the ID number is shown in green).

Image Configuration

Click the **Inspection** button to load the image in the active viewport as the inspection image. The image name appears in the Inspection display window. You can also select the inspection image from the list of images currently residing in system memory.

ROI Configuration

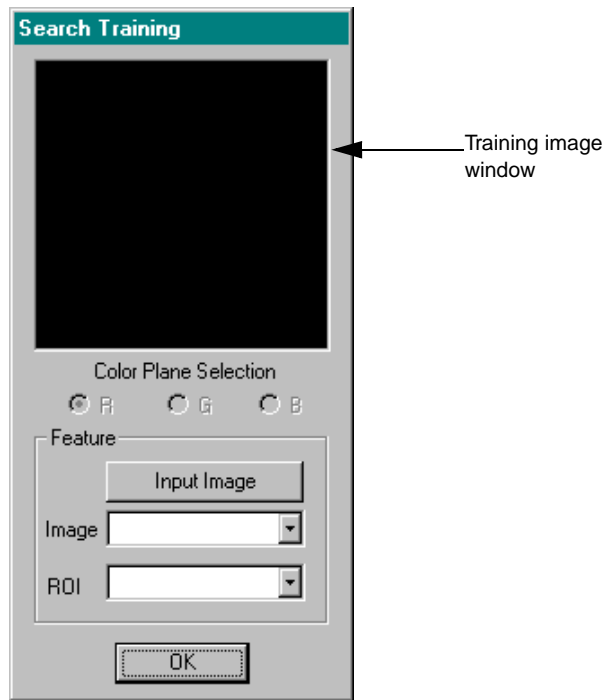
From the **Inspection** drop-down list, select the ROI in the inspection image that reflects the portion of the inspection image that you want to search. Note that only rectangle ROIs are supported at the present time.

Status

This field displays information about the search operation, such as whether the operation is still in progress. After the search operation is completed, the field displays the length of time used for the search operation, in milliseconds.

Train

Click this button to open the Search Training dialog box. The Search Training dialog box allows you to create a new catalog.



Click the **Input Image** button to specify the name of the image in the active viewport as the feature image. The image name appears in the Image display window. You can also select the feature image from the list of images currently residing in system memory.

From the **ROI** drop-down list, select the ROI in the feature image that reflects the feature that you want to search for. Note that only rectangle ROIs are supported at the present time.

If the feature image is a 24-bit color image, use the **Color Plane Selection** option to select the color plane (Red, Green, or Blue for RGB color images) or the color setting (Hue, Saturation, or Luminance for HSL color images) that you want the tool to search in. If you are not sure which plane/setting to select, try different planes/settings until you get satisfactory results.

After you set the appropriate options, the training image appears in the training image window. Note that a freehand ROI is drawn around one of the objects in the training window. If this object represents the feature that you want to search for, you can use the **Feature** search type to perform a faster search. For more information, refer to [page 591](#).

Search

Click this button to perform the search operation using the current settings. After the search operation is completed, the **Status** field displays the length of time used for the search operation, in milliseconds.

Add to Script

After you perform the search operation, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Note that if you have not already saved the current catalog, the Search tool displays a Save As dialog box. Select the directory and enter the file name with the extension .src.

File Menu Options

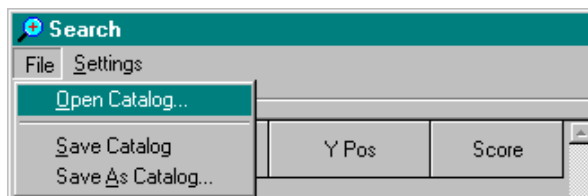


Figure 123: Search Tool - File Menu

Open Catalog...

Select this option to open a Search tool catalog that you have saved. An Open dialog box is displayed. When you open a file (the name must be followed by the extension .src), the feature image and other settings are loaded into the Search tool.

Save Catalog

Select this option to save the Search tool catalog to a file on disk. The tool saves the training image and the following settings: the search type, the score threshold, the search level, the match count, whether you are using subpixel accuracy, and the color plane/setting for color images.

Save As Catalog...

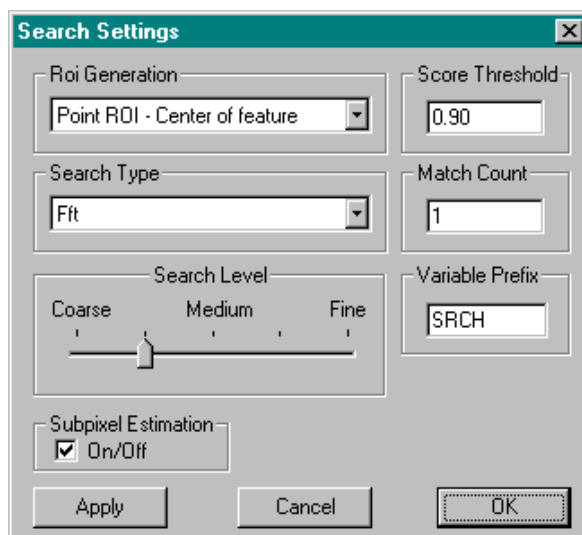
Select this option to save the Search tool catalog to a file with a different name. A Save As dialog box is displayed. Select the directory and enter the file name with the extension .src.

Settings Menu Options



Figure 124: Search Tool - Settings Menu

Click **Search Settings** to open the Search Settings dialog box. When you have specified all appropriate values, click **Apply** to save the settings without closing the dialog box. Click **OK** to save the settings and close the dialog box. Click **Cancel** to close the dialog box without saving changes.



ROI Generation

Select the type of ROI that you want to create in the inspection image to indicate where the matches were found. You can specify a point ROI (located in either the upper left corner, upper right corner, lower left corner, lower right corner, or center of the feature) or a rectangle ROI that is the size of the feature. Point ROIs are labeled SRCH_M x , where with x corresponds to the match ID.

Note that because of the way rectangle ROIs are created in DT Vision Foundry, rectangle ROIs are not labeled in the inspection image. It is recommended that you make a note of the name that the software assigns to the inspection ROI so that you can use it in subsequent search operations.

Search Type

Select the search algorithm that you want the tool to use. The search types include standard correlation algorithms and geometrically enhanced correlation algorithms. Typically, the standard correlation algorithms are applicable for ideal lighting conditions and the geometrically enhanced correlation algorithms are applicable for varying lighting conditions. In addition, the geometrically enhanced correlation algorithms are useful for man-made objects, which tend to have distinct boundaries and simple shapes.

The following search types are supported:

- **Direct** – Standard normalized grayscale search. This search type provides faster results when using coarser search levels (see [page 592](#)), although the results are not as accurate as an FFT (Fast Fourier Transform) search. It is useful if the lighting in the inspection image is similar to the lighting in the feature image.
- **Fft** – Standard normalized grayscale FFT search. This search type provides faster results when using finer search levels (see [page 592](#)), and the results are more accurate than a direct search. It is useful if the lighting in the inspection image is similar to the lighting in the feature image.
- **DirectEx** – Geometrically enhanced normalized grayscale search. This search type provides faster results when using coarser search levels (see [page 592](#)), although the results are not as accurate as an FFT search. It is useful if you do not want changes in lighting conditions to affect the search operation.
- **FftEx** – Geometrically enhanced normalized grayscale FFT search. This search type provides faster results when using finer search levels (see [page 592](#)), and the results are more accurate than a direct search. It is useful if you do not want changes in lighting conditions to affect the search operation.

- **Feature** – Search for the feature within the feature ROI. When you create a catalog, the Search tool automatically creates a freehand ROI around one of the objects in the feature ROI. If this feature is the feature that you want to search for, you can select this option to perform a faster search. This option is useful for small feature ROIs.

Note that some search types provide a faster, but less accurate search. Other search types provide a slower, but more accurate search. It is recommended that you try various options until you find one that suits the needs of your application.

Search Level

Use the slider control to specify one of five search levels (Coarse, Medium Coarse, Medium, Medium Fine, and Fine). The search level determines the depth of the search. If you select **Fine**, the tool looks at every pixel; this provides the highest accuracy and the slowest speed. If you select a lower (coarser) level, the tool averages groups of pixels to reduce the number of values used by the search algorithm; this provides a lower accuracy and a faster speed.

Score Threshold

Specify the lowest match score that you want the tool to consider a valid match. The value can range from 0.0 to 1.0, where 0.0 is the worst possible match score and 1.0 is the best possible match score. For example, if you specify a value of 0.5, only matches with match scores greater than or equal to 0.5 are considered to be valid matches.

Match Count

Specify the total number of matches that you want the Search tool to find in the inspection image. For example, if you specify a value of 10, the tool finds the 10 best matches.

Note that the number of matches displayed in the **Match Results** list in the main dialog box always equals the number of matches you specify for this option, whether the match scores are above or below the specified **Score Threshold**. However, only matches with scores greater than or equal to **Score Threshold** are considered to be valid matches (the ID number is shown in green).

Note that the Search tool does not create ROIs in the inspection image for matches below the **Score Threshold**.

Variable Prefix

Specify the prefix that you want to use for the point & click script variables that are generated by the Search tool and contain information about matches. By default, the variable prefix is SRCH. For more information about using the point & click script variables, refer to [page 599](#).

Subpixel Estimation

Select the **On/Off** checkbox to find the location of the object under test using subpixel accuracy. Note that the search operation may take slightly longer if this checkbox is selected, but the results will be more accurate.

Example of Using the Search Tool

This example shows how to use the Search tool to find a computer chip in the feature image Feature in the inspection image Inspect. The Feature and Inspect images are shown in [Figure 125](#).

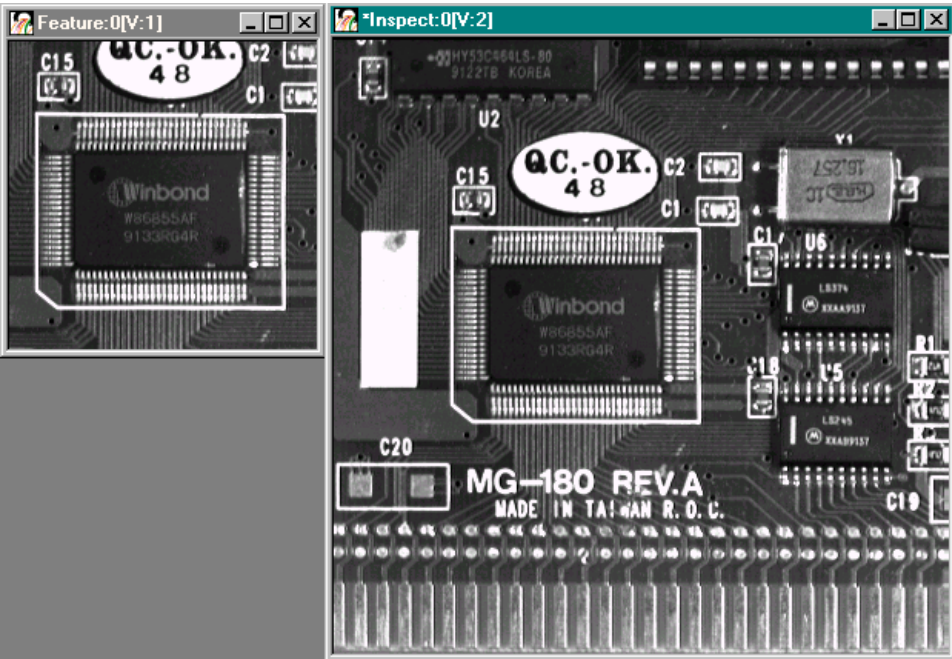


Figure 125: Search Tool Example Image

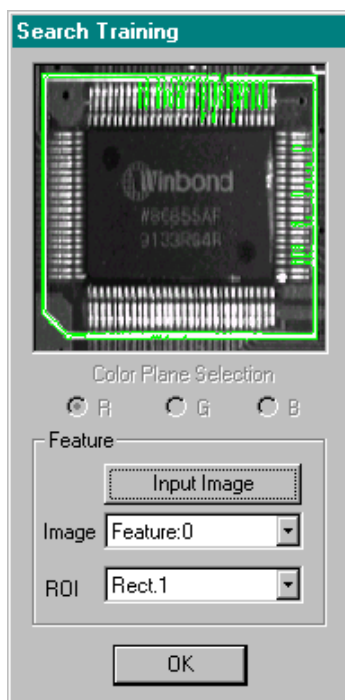
The operation is as follows:

1. Open the image Feature, create a new viewport, and then open the image Inspect.
2. Click in the viewport on the image Feature with the left mouse button. Feature is now the active viewport and is denoted with an asterisk, as show in [Figure 125](#).
3. Draw a rectangle ROI around the computer chip in the image Feature to identify the feature that you want the Search tool to find.
4. Open the ROI Manager tool, then activate the image Inspect by clicking in the viewport with the left mouse button.
5. In the ROI Manager tool, click **Rect**, then click **Entire Image** to import the coordinates of the image Inspect into the tool and to add a rectangle ROI to the image Inspect.

The ROI Manager tool looks as follows:



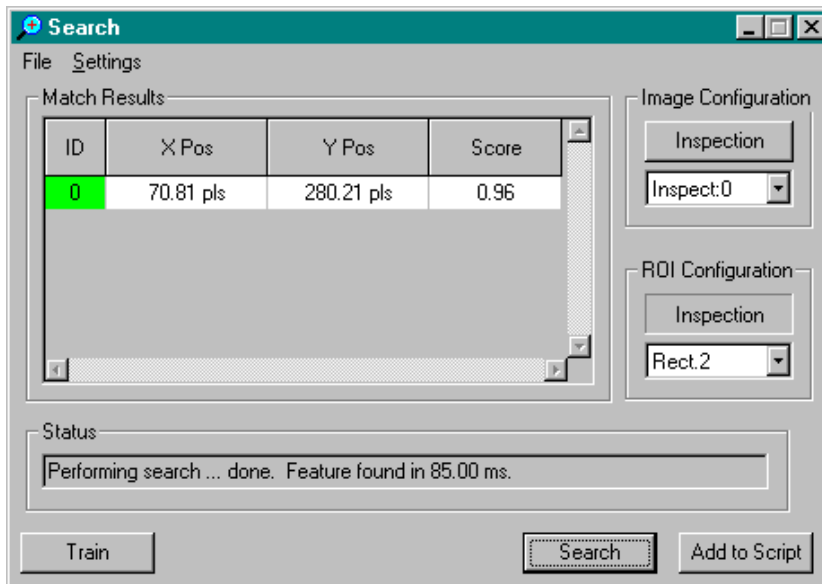
6. Open a Search tool (if one is not already open).
7. Click **Train** to open the Search Training dialog box.
8. Activate the image Feature by clicking in the viewport with the left mouse button, then click **Feature - Input Image** in the Search Training dialog box to specify Feature as the feature image.
9. From the **ROI Configuration - Feature** drop-down list, select **Rect.1**. Rect.1 is the rectangle ROI in the feature image Feature. *The training image is displayed in the training image window, as follows. Note that a freehand ROI is drawn around the computer chip in the training image.*



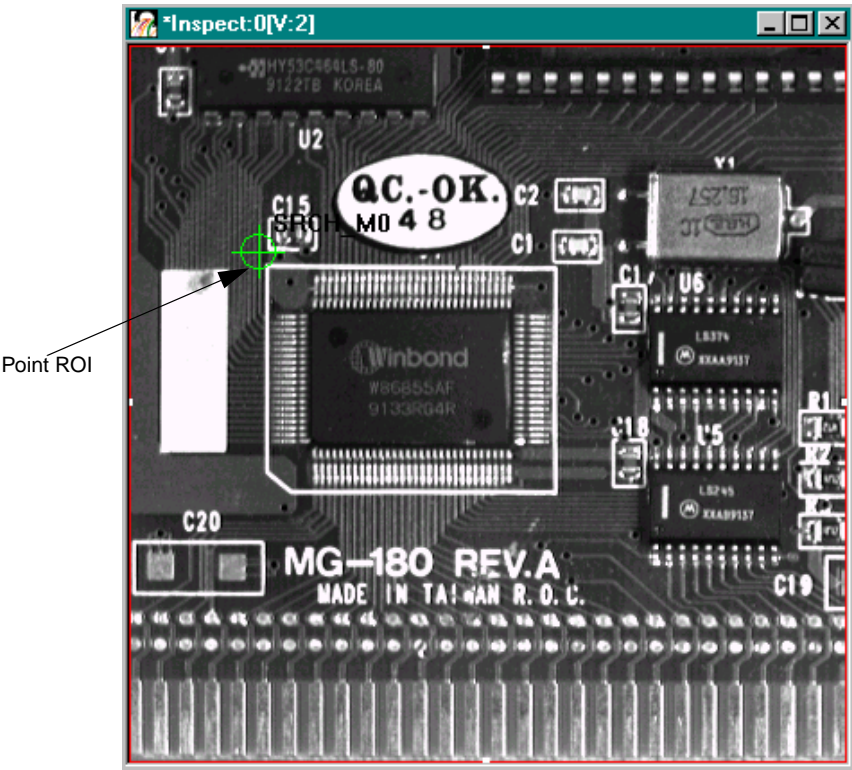
10. Click **OK**.

11. Activate the image Inspect by clicking in the viewport with the left mouse button, then click **Image Configuration - Inspection** in the Search tool dialog box to specify Inspect as the inspection image.
12. From the **ROI Configuration - Inspection** drop-down list, select **Rect.2**. Rect.2 is the rectangle ROI in the inspection image Inspect.
13. Select **Search Settings** from the Settings menu to open the Search Settings dialog box.
14. From the **ROI Generation** drop-down list, select **Point ROI - Upper Left Corner**. Leave the remaining settings at their default values. Click **Apply**, then click **OK** to close the Search Settings dialog box.
15. Click **Search** to perform the search.

*The search results are displayed in the **Match Results** list, as follows:*



In addition, the Search tool creates a point ROI at the upper-left corner of the match it found in the inspection image Inspect, as follows:



Point & Click Script

This section describes the specific use of the Search tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Using Search Results

Information about matches is stored in point & click script variables, which you can use in a point & click script. To access the match information, perform the following steps:

1. Open the Point & Click Script tool.
2. Select **Options | Show Debug Box**.
The Debug Window is displayed.
3. From one of the drop-down lists, select the point & click script variable whose information you want to access.
The current value of the variable is displayed in the text box to the right of the variable.

Assuming that the variable prefix is set to SRCH, the point & click script variables are as follows, where x indicates the match ID.

Variable	Description
SRCH_Mx_Score	This variable indicates the score value.
SRCH_Mx_Valid	This variable equals 1.000 if the match is valid and 0.000 if the match is invalid.
SRCH_Mx_X	<p>This variable indicates the x-coordinate of the point ROI or the x-coordinate of the upper left corner of the rectangle ROI that reflects where the match was found.</p> <p>Note that if a calibration object is attached to the inspection image, the value displayed is in the calibrated units of measure.</p>
SRCH_Mx_Y	<p>This variable indicates the y-coordinate of the point ROI or the y-coordinate of the upper left corner of the rectangle ROI that reflects where the match was found.</p> <p>Note that if a calibration object is attached to the inspection image, the value displayed is in the calibrated units of measure.</p>
SRCH_TotalMatches	This variable indicates the total number of matches.
SRCH_ValidMatches	This variable indicates the number of valid matches.

Adding to the Point & Click Script

To add a Search tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the Search tool to perform the desired function. This includes the feature and inspection images, the search type, and the match count. Select **File | Save Catalog** or **File | Save As Catalog** to save the catalog to disk. Click **Search** to perform the desired action, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Note: You always provide the absolute path to the catalog file in the Search tool. If you save the point & click script to the same drive that contains the catalog file, the tool automatically converts the catalog file to a path relative to the directory in which you save the script. If you move the script (and the catalog file) to another directory, the correct catalog file is opened when you run the script.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Search tool is set up exactly as it was when you previously recorded the script item. This includes the feature and inspection images, the search type, and the match count. The **Add to Script** button is changed to a **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The Search tool closes and the script item is saved back into the point & click script with the new options.



Using the Serial I/O Tool

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Introduction

The Serial I/O tool is supplied with DT Vision Foundry. It allows you to send and receive data through the serial port(s) of your computer so that DT Vision Foundry can interface with peripheral equipment.

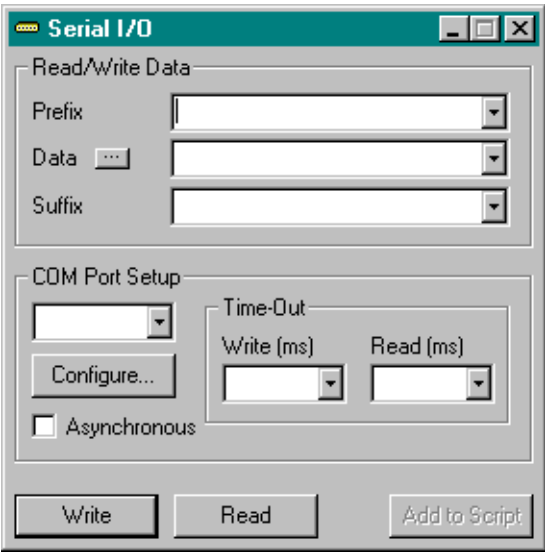



Figure 126: Serial I/O Tool

The Serial I/O tool allows you to do the following:

- Send and receive data using COM ports 1 through 15.
- Use multiple COM ports at the same time.
- Read or write data in synchronous or asynchronous mode.
- Control individual COM port settings, including baud rate, stop bits, and parity.
- Read and write text, string objects, and formatted number objects.
- Provide a prefix and suffix that can be text, string objects, or ASCII control characters.
- Provide separate timeouts for reading and writing.
- Enable a point & click script.

To open a Serial I/O tool, select the  icon from the Input-Output toolbar or select **Serial I/O** from the Tools menu.

Notes: The Serial I/O tool is compatible with all other tools. It does not use images or ROIs.

You can have only one Serial I/O tool open at a time.

Description of Serial I/O Tool Options

This section contains a description of the options in the Serial I/O tool dialog box.

Prefix

Enter the prefix that you want to include when sending data from the serial port or reading data to the serial port. You can specify simple text, a point & click string variable, or ASCII control character(s). When the data is sent from the serial port, the prefix is sent first, then the data, then the suffix.

If you use ASCII control characters, you must use the 0x hex prefix so the tool knows that you are sending ASCII control characters. All control characters must be specified as 2-digit hex values. For example, to send the Control and Line Feed control characters, enter 0x0d0a, where 0d is the Control and 0a is the Line Feed.

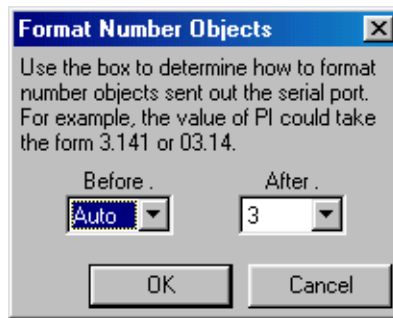
When reading data, the tool waits for the prefix and then begins to capture the data. Any data entering the serial port before the prefix is discarded.

Data

When sending data from the serial port, enter the data in the text box. You can enter simple text, a point & click string variable, or a point & click number variable. You cannot enter ASCII control characters.

When reading data to the serial port, this field contains the data read.

If you are sending/receiving a number variable, click the ... button (next to the **Data** text box) to format the number. The tool opens the Format Number Objects dialog box.



Specify the number of digits before the decimal point from the **Before** drop-down list. Specify the number of digits after the decimal point from the **After** drop-down list.

When the settings are correct, click **OK** to set your options. Click **Cancel** to close the dialog box without saving your changes.

Suffix

Enter the suffix that you want to include when sending data from the serial port or reading data to the serial port. You can specify simple text, a point & click string variable, or ASCII control characters. When the data is sent from the serial port, the prefix is sent first, then the data, then the suffix.

If you use ASCII control characters, you must use the 0x hex prefix so the tool knows that you are sending ASCII control characters. All control characters must be specified as 2-digit hex values. For example, to send the Control and Line Feed control characters, enter 0x0d0a, where 0d is the Control and 0a is the Line Feed.

When reading data, the tool waits for the suffix to enter the serial port before returning.

COM Port Setup

Select the COM port that you want to use from the drop-down list. Only COM ports that are unused, available, and working are listed in the drop-down list.

Asynchronous

Select this checkbox if you want to perform the operation asynchronously.

Configure...

Click this button to set the COM port properties. The tool opens the COM port setup dialog box that is appropriate to your operating system. Use the dialog box to set up the COM port to match the device you are communicating with.

If you are recording a point & click script, make sure that each time you reference a particular COM port, the settings for that COM port are exactly the same. For example, do not use a baud rate of 9600 for COM1 in one script item and a baud rate of 19,200 for COM1 in another script item. For more information, refer to any book on serial communications or refer to the manual that came with the device you are communicating with. Note that you can use different settings for different COM ports.

Time-Out Write

Select the timeout period, in milliseconds, that you want to use when sending data from the serial port. You can select the timeout period from the drop-down list or enter it in the text box. If you do not want to use a timeout period, select **Infinite**.

Time-Out Read

Select the timeout period, in milliseconds, that you want to use when reading data to the serial port. You can select the timeout period from the drop-down list or enter it in the text box. If you do not want to use a timeout period, select **Infinite**.

Write

After you set up the serial port, click this button to output the specified prefix, data, and suffix from the port.

Read

After you set up the serial port, click this button to read data to the port. By default, data entering the port is automatically buffered. The data is read in the following ways:

- If you specified both a prefix and a suffix, the tool waits to read the prefix, then starts collecting data until the suffix is read. Only the data is returned; the prefix and suffix are not returned.
- If you specified only a prefix, the tool waits for the prefix and then reads whatever is stored in the COM port input buffer.
- If you specified only a suffix, the tool reads whatever is stored in the COM port input buffer and continues to read incoming data until the suffix is read.
- If you specified a point & click string variable, the data read from the serial port is stored in this variable.
- If you specified a point & click number variable, the data read from the serial port is converted to a number and stored in this number object. If other than numeric text is read from the serial port, the function fails.
- If you did not select a variable, the data read from the serial port is displayed in the **Data** field.

Add to Script

After you read or write data, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29](#), “Using the Point & Click Script Tool.”

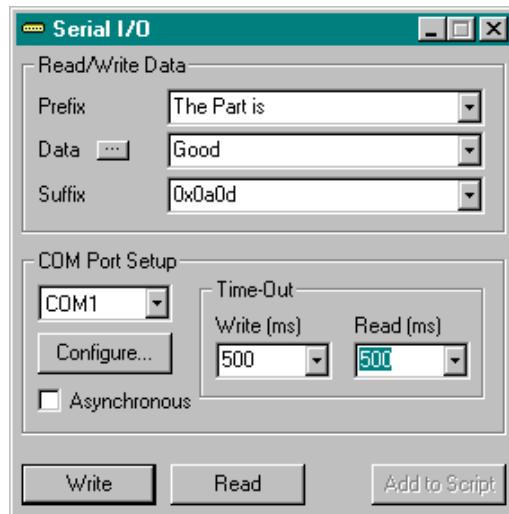
Example of Using the Serial I/O Tool

This example shows how to use the Serial I/O tool.

The operation is as follows:

1. Open the Serial I/O tool (if it is not already open).
2. Enter `The Part is` for the prefix. Enter `Good` for the data. Enter `0x0a0d` for the suffix.
3. From the **COM Port Setup** drop-down list, select COM1.
4. Enter a read/write timeout period of 500 milliseconds.
5. Click **Configure** to open the COM port properties dialog box. Set the port properties to exactly match the settings of the device that you are communicating with.

The Serial I/O tool looks as follows:



6. Click **Write** three times. The Serial I/O tool sends the prefix `The Part is` `Good` from COM1 to the port. The suffix `0x0a0d` tells the port to perform a Control and a Line Feed.

Point & Click Script

This section describes the specific use of the Serial I/O tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Serial I/O tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Set up all the options in the Serial I/O tool to perform the desired function. This includes the COM port setup, the COM port properties, and the format number options. Click **Write** or **Read** to perform the desired action, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Serial I/O tool is set up exactly as it was when you previously recorded the script item. This includes the COM port number and all option settings. The **Add to Script** button is changed to a **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Sound Tool

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Introduction

The Sound tool is supplied with DT Vision Foundry. It allows you to play .WAV sound files using any standard sound card that is configured to support .WAV files. To set the audio device properties, such as volume, tone, and balance, use the standard Windows utilities.

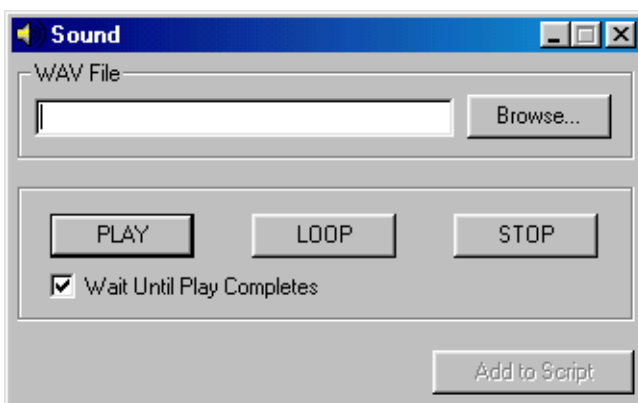


Figure 127: Sound Tool

To open a Sound tool, select the  icon from the Miscellaneous toolbar or select **Sound** from the Tools menu.

Notes: The Sound tool is compatible with all other tools. It does not use images or ROIs.

You can have only one Sound tool open at a time.

Description of Sound Tool Options

This section contains a description of the options in the Sound tool dialog box.

WAV File

Enter the full path to the .WAV audio file that you want to play. You can also use the **Browse** button to locate the file.

PLAY

Click this button to play the specified .WAV file once. The file is played either synchronously or asynchronously depending on whether the **Wait Until Play Completes** checkbox is selected.

LOOP

Click this button to play the specified .WAV file continuously until you click either **Stop** or **Play**. The file is always played asynchronously.

STOP

Click this button to stop any playback that is in progress.

Wait Until Play Completes

Select this checkbox if you want the Sound tool to wait for the sound file to complete before returning its status (synchronous playback). Clear this checkbox if you want the Sound tool to return its status immediately after initiating the playback (asynchronous playback).

For a long .WAV file, it is recommended that you run the Sound tool asynchronously.

Note that if you attempt to play multiple sounds consecutively in asynchronous mode, some of the playbacks may be preempted. You can add a DELAY step to the point & click script to solve this problem.

Add to Script

After you perform the desired operation, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the Sound Tool

This example shows how to use the Sound tool.

The operation is as follows:

1. Open the Sound tool (if it is not already open).
2. Click **Browse** and select a .WAV sound file to play.
3. Click **PLAY** to play the sound file once.
4. Click **LOOP** to play the sound file continuously.
5. Click **STOP**.

Point & Click Script

This section describes the specific use of the Sound tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Sound tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Set up all the options in the Sound tool to perform the desired function. This includes the path name of the .WAV file and the **Wait Until Play Completes** checkbox. Click **PLAY**, **LOOP**, or **STOP** to perform the desired action, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Note: You always provide the absolute path to the .WAV file in the Sound tool. If you save the point & click script to the same drive that contains the .WAV file, the tool automatically converts the .WAV file to a path relative to the directory in which you save the script. If you move the script (and the .WAV file) to another directory, the correct .WAV file is opened when you run the script.

The Sound tool sets point & click script variables as output status. These variables are described in [Table 5](#).

Table 5: Sound Tool Variables

Variable	Status
WAV_OPERATION (number variable)	0 = Stop playback 1 = Asynchronous play 2 = Asynchronous loop 3 = Synchronous play
WAV_PLAY_STATUS (number variable)	0 = Don't know (asynchronous play mode) 1 = Play OK >1 = Error in play

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Sound tool is set up exactly as it was when you previously recorded the script item. This includes the path name of the .WAV file and the synchronous/asynchronous play mode setting. The **Add to Script** button is changed to a **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the Status Tool

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Introduction

The Status tool is supplied with DT Vision Foundry. It allows you to implement a pass/fail/warning screen when you are running a point & click script. In addition to the pass/fail/warning indicator, the Status tool allows you to select the pass/fail warning criteria and provides access to a selection of images and point & click scripts variables that you can output and log. Password protection is also provided to allow you to prevent unauthorized modifications to the main program.

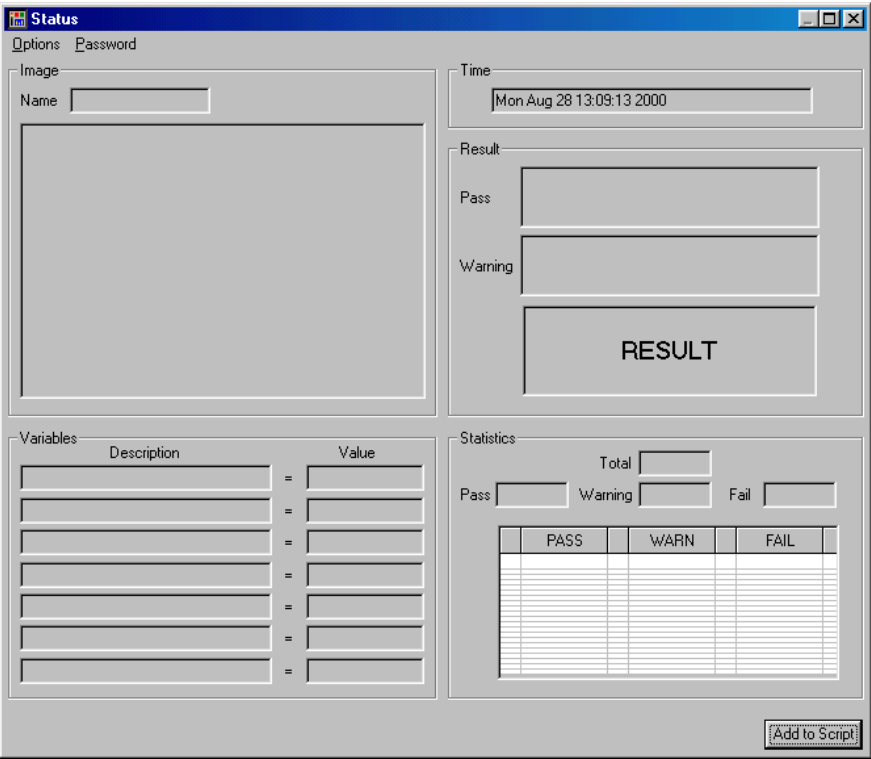


Figure 128: Status Tool

To open a Status tool, select the  icon from the Miscellaneous toolbar or select **Status** from the Tools menu.

Note: You can have only one Status tool open at a time.

Description of Status Tool Options

This section contains a description of the options in the Status tool dialog box.

Options Menu Options

The Options menu allows you to specify the information that is displayed in the main Status dialog box when a point & click script is run. If you are using DT Vision Foundry with a full license key, this menu is always available. If you have the runtime version of DT Vision Foundry, you require a password to access the Options menu. Refer to [page 632](#) for more information on specifying passwords.

Select **Options** | **Options** to open the Options dialog box, shown in [Figure 129](#).

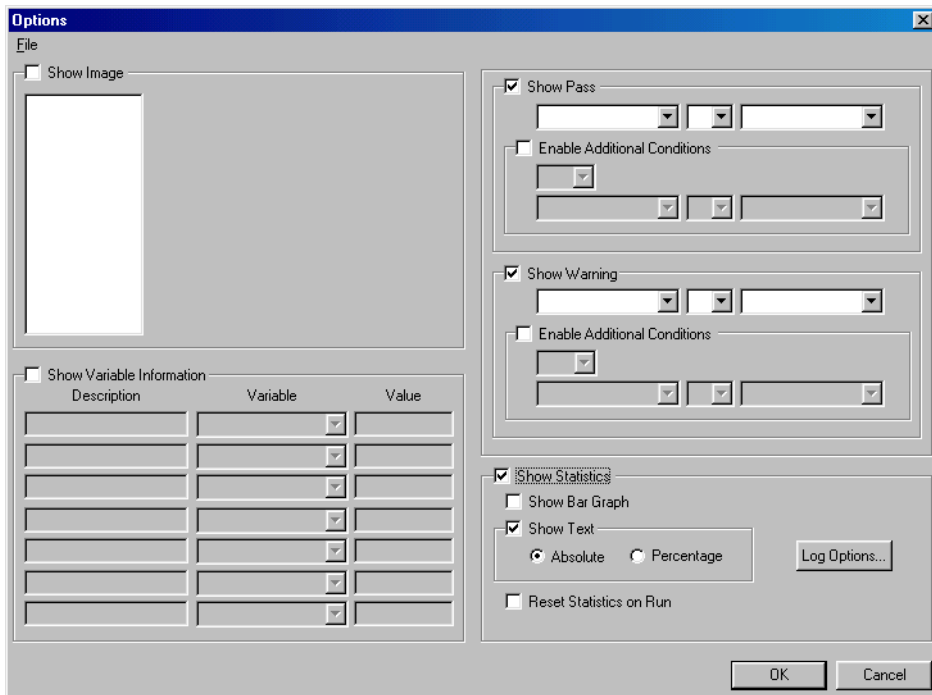


Figure 129: Status Tool - Options Menu

File Menu Options

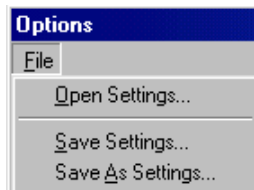


Figure 130: Status Tool - File Menu

Open Settings...

Select this option to open Status tool settings that you have saved. An Open dialog box is displayed. When you open a file (the name must be followed by the extension .sta), the settings are loaded into the Status tool.

Save Settings...

Select this option to save the Status tool settings to a file on disk. A Save dialog box is displayed. Select the directory and enter the file name with the extension .sta.

Save As Settings...

Select this option to save the Status tool settings to a file with a different name. A Save As dialog box is displayed. Select the directory and enter the file name with the extension .sta.

Options Dialog Box Options

Show Image

Select this checkbox if you want to display an image in the main Status dialog box. Select the name of the image to display from the list of images currently in memory. When you select an image from the list, the image is shown in the Show Image window. Both the image and the image name will appear in the main Status dialog box.

Clear this checkbox if you do not want to display an image in the main Status dialog box.

Show Variable Information

Select this checkbox if you want to display values of existing point & click script variables in the main Status dialog box. Select up to seven point & click script variables from the Variable list box. The current value of these variables is displayed in the Value text boxes. You can enter a description for each of the point & click script variables, if desired. The description and value will appear in the main Status dialog box.

Clear this checkbox if you do not want to display the values of the existing point & click script variables in the main Status dialog box.

Show Pass

Select this checkbox if you want to set pass/fail criteria based on the value of a point & click script variable and display the inspection results in the main Status dialog box. Specify the pass/fail criteria as follows:

1. Select the point & click script variable from the first list box.
2. Select one of the following operators from the operators list box:
!=, <, <=, ==, >, >=
3. Select the point & click script variable from the next list box or enter a string or a number.
4. If desired, you can continue the criteria by selecting the **Enable Additional Conditions** checkbox, then by performing steps 5 to 8. If you do not want to specify any additional criteria, skip the rest of these steps.
5. Select AND or OR from the logic list box.
6. Select the point & click script variable from the next list box or enter a string or a number.
7. Select one of the following operators from the next operators list box: !=, <, <=, ==, >, >=

8. Select the point & click script variable from the next list box or enter a string or a number.

If, during inspection, an image meets this criteria, the image has passed. If it has not met this criteria, the image has failed.

Clear the **Show Pass** checkbox if you do not want to set any pass criteria for the Status tool.

Show Warning

Select the Show Warning checkbox if you want to set warning criteria based on the value of a point & click script variable and display the inspection results in the main Status dialog box. Specify the warning criteria as follows:

1. Select the point & click script variable from the first list box.
2. Select one of the following operators from the operators list box:
!=, <, <=, ==, >, >=
3. Select the point & click script variable from the next list box.
4. If desired, you can continue the criteria by selecting the **Enable Additional Conditions** checkbox, then by performing steps 5 to 8. If you do not want to specify any additional criteria, skip the rest of these steps.
5. Select AND or OR from the logic list box.
6. Select the point & click script variable from the next list box or enter a string or a number.
7. Select one of the following operators from the next operators list box: !=, <, <=, ==, >, >=
8. Select the point & click script variable from the next list box or enter a string or a number.

If, during inspection, an image meets this criteria, a warning is generated. If the image has not met this criteria, no warning is generated for the image. Note that the tool looks for a warning first. If no warning exists, the tool then looks for a pass/fail condition.

Clear the **Show Warning** checkbox if you do not want to set any warning criteria for the Status tool.

Log Options

Click this button to specify log options. The Status tool opens the Log Options dialog box, shown in [Figure 131](#). Note that the Log Options button is available only when the Show Pass checkbox is selected.

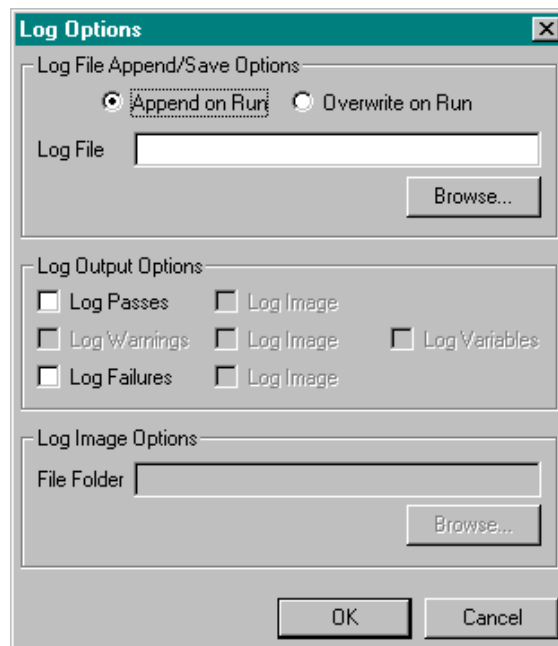


Figure 131: Status Tool - Log Options

The Log Options dialog box options are described as follows:

- **Log File Append/Save Options** – Select the **Append On Run** radio button if you want to add to the log file specified by **Log File**. Select the **Overwrite On Run** radio button if you want to overwrite the log file specified by **Log File**. Either enter the file name in the text box or use the **Browse** button to locate the file.
- **Log Passes/Log Image** – Select the **Log Passes** checkbox to log variable information pertaining to the images that passed inspection. This information was set when you specified the pass/fail criteria. If you select the **Log Image** checkbox that corresponds to this setting, the images that pass are saved to the file specified by **File Folder**. Either enter the file name in the text box or use the **Browse** button to locate the file.

For example, if you specify C:\PassedImage, the first image saved is called PassedImage0.bmp and the third image is called PassedImage2.bmp. All images are located in the C:\ directory. Ensure that the directory you specify already exists.

- **Log Warnings/Log Image** – These checkboxes are available only if the **Show Warning** checkbox is selected in the Options dialog box. Select the **Log Warnings** checkbox to log variable information pertaining to the images that generated a warning during inspection. This information was set when you specified the warning criteria. If you select the **Log Image** checkbox that corresponds to this setting, the images that created a warning are saved to the file specified by **File Folder**. Either enter the file name in the text box or use the **Browse** button to locate the file.

For example, if you specify C:\WarningImage, the first image saved is called WarningImage0.bmp and the third image is called WarningImage2.bmp. All images are located in the C:\ directory. Ensure that the directory you specify already exists.

- **Log Failures/Log Image** – Select the **Log Failures** checkbox to log variable information pertaining to the images that failed inspection. This information was set when you specified the pass/fail criteria. If you select the **Log Image** checkbox that corresponds to this setting, the images that fail are saved to the file specified by **File Folder**. Either enter the file name in the text box or use the **Browse** button to locate the file.

For example, if you specify C:\FailedImage, the first image saved is called FailedImage0.bmp and the third image is called FailedImage2.bmp. All images are located in the C:\ directory. Ensure that the directory you specify already exists.

- **Log Variables** – Select this checkbox if you want to log all the point & click script variables that are selected in the **Show Variables Information** section of the Options dialog box.

Show Statistics

Select this checkbox if you want to show statistical information about the inspection image in the main Status dialog box.

Select the **Show Bar Graph** checkbox if you want to display the data in bar graph form in percentage. The maximum length of each bar in a bar graph is 20 rows, which represents 100%.

Select the **Show Text** checkbox if you want to display values in the **Pass**, **Warning**, and **Fail** text boxes. You can display the statistical units as an absolute value or as a percentage.

Select the **Reset Statistics on Run** checkbox if you want to clear the generated statistics each time the point & click script is run. Note that if this checkbox is cleared, the statistics will include values from previous uses of the Status tool within the script.

If you do not select the **Show Statistics** checkbox, statistical information is not shown on the main Status dialog box.

Password Menu Options

The Password menu allows you to specify passwords to prevent users of the runtime version of DT Vision Foundry to open the Options dialog box of the Status tool and/or to restore the size of the Status tool and stop a point & click script. It is available only if you are using DT Vision Foundry with a full license key.

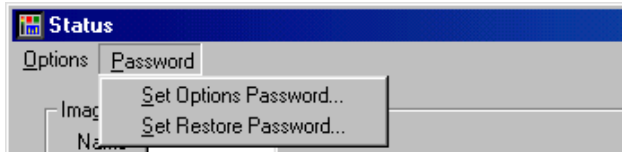


Figure 132: Password Menu - Status Tool

Set Options Password

Select this option to open the Option Password dialog box, shown in [Figure 133](#).



Figure 133: Set Password Options - Status Tool

In the **Password** field, enter the password that users of the runtime version of DT Vision Foundry must use to open the Options dialog box of the Status tool. Reenter the password in the **Confirm Password** field to ensure that you spelled it correctly.

Set Restore Password

Select this option to open the Restore Password dialog box, shown in [Figure 134](#).

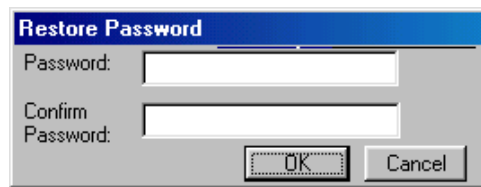


Figure 134: Restore Password Options - Status Tool

In the **Password** field, enter the password that users of the runtime version of DT Vision Foundry must enter before they can restore the size of the Status tool or stop a point & click script. Reenter the password in the **Confirm Password** field to ensure that you spelled it correctly.

Main Dialog Box Options

Image Name

If you selected the **Show Image** checkbox of the Option dialog box and selected an image, the name of the image is shown in this field. See [page 626](#) for more information on specifying an image.

Image Window

If you selected an image to be displayed in the Show Image field of the Option dialog box, the image is displayed in this window. See [page 626](#) for more information on specifying an image.

Variables

If you selected the **Show Variable Information** checkbox in the Option dialog box and entered descriptions for the specified point & click script variables, the description of the variables and their current values are displayed in these fields.

Time

This field contains the current time in 24-hour format.

Result

If you selected the **Show Pass** checkbox and entered criteria for an image to pass/fail inspection, the pass/fail criteria are displayed in the **Pass** field.

If you selected the **Show Warning** checkbox and entered criteria for a warning to be generated during inspection, the warning criteria are displayed in the **Warning** field.

The bottom field shows the result of the inspection as either PASS, FAIL, or WARNING. Refer to [page 627](#) for information on setting the pass/fail parameters and to [page 628](#) for more information on setting the warning parameters.

Statistics

The **Total** field displays the total number of inspections that have been performed since the Status tool was opened.

The **Pass** field displays the number of inspections that have passed since the Status tool was opened. The **Fail** field displays the number of inspections that have failed since the Status tool was opened. The **Warning** field displays the number of inspections that have generated warnings since the Status tool was opened.

If you selected the **Show Bar Graph** checkbox in the Options dialog box (refer to [page 631](#)), the bar graph is shown in the Statistics window. If you selected the **Show Text** checkbox in the Options dialog box (refer to [page 631](#)), the results are shown in text form in this window.

Add to Script

After you perform the desired operation, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

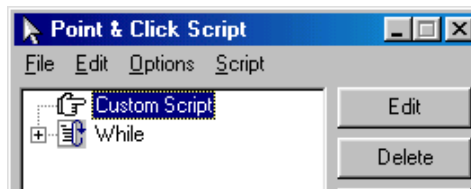
Example of Using the Status Tool

This example shows how to use the Status tool with the example Barcode point & click script to show the results of a barcode operation. For more information about the Point & Click Script tool, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

The operation is as follows:

1. Open the Point & Click Script tool, if it is not already open.
2. From the Point & Click Script tool, open the example point & click script called BarcodeStatus.pcs (located in C:\Program Files\Data Translation\DT Vision Foundry\Scripts\Barcode, by default).

The tool looks as follows:

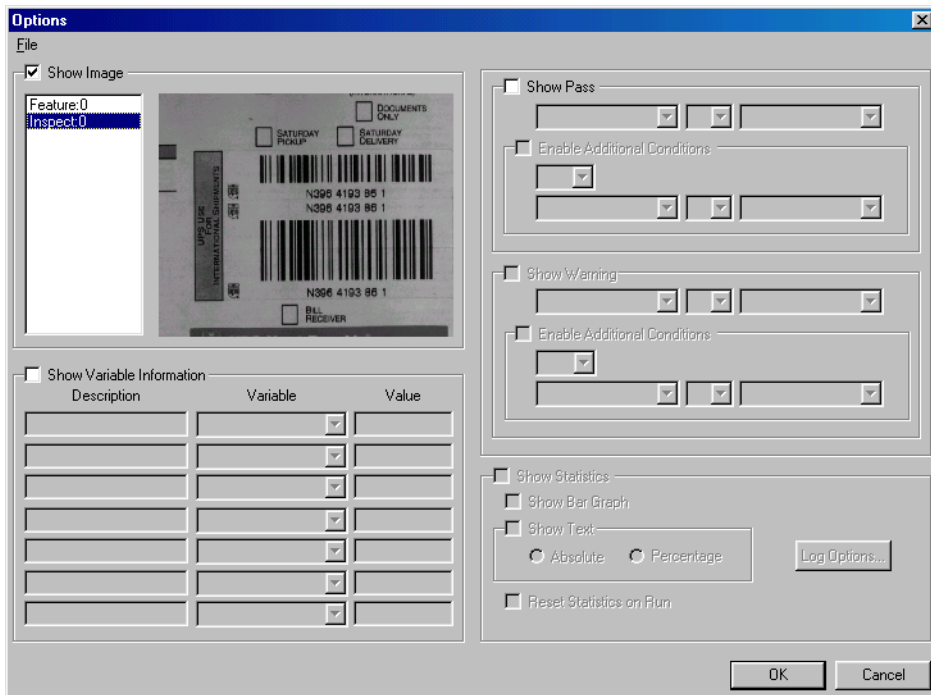


3. Click **Run** to run the Barcode point & click script, then click **Stop**.
4. Open the Status tool.
5. Click **Options...** from the Option menu of the Status tool.
6. Select the **Show Image** checkbox.

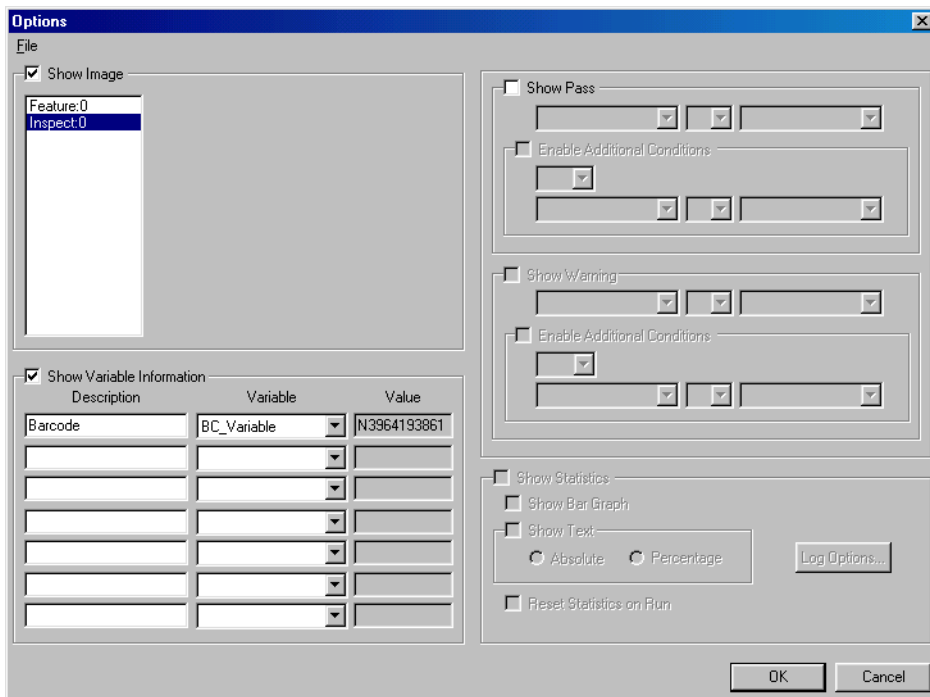
The list of images used in the Barcode point & click script is shown.

7. Select **Inspect:0** from the list of images.

The image is shown in the display window, as follows:

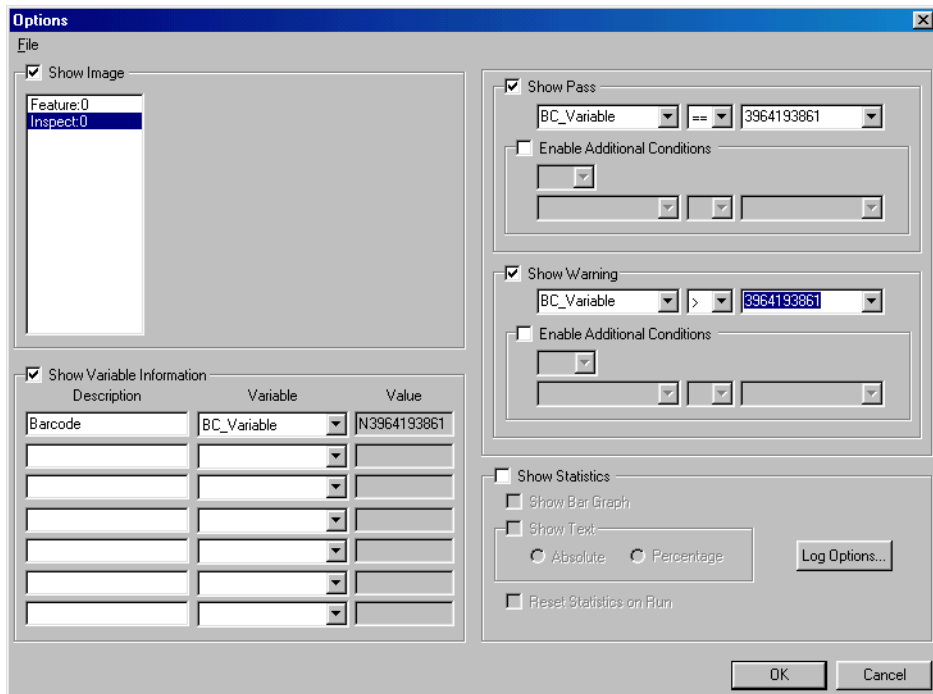


8. Select the **Show Variable Information** checkbox.
The variables in the Barcode point & click script can now be selected from the Variable pull-down lists.
9. Select **BC_Variable** from the Variable pull-down list.
The value of this variable is displayed in the Value text box.
10. In the Description text box, enter **Barcode**.
The Options dialog box looks as follows:

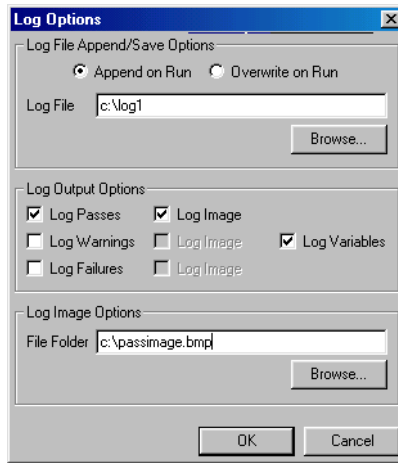


11. Select the **Show Pass** checkbox, then specify the following pass/fail criteria:
 - a. Select the point & click script variable **BC_Variable** from the first list box.
 - b. Select the == operator from the operators list box.
 - c. Enter the following text in the next list box: **N3964193861**
12. Select the **Show Warning** checkbox, then specify the following warning criteria:
 - a. Select the point & click script variable **BC_Variable** from the first list box.
 - b. Select the > operator from the operators list box.

- c. Enter the following text in the next list box: **N3964193861**
The Options dialog box looks as follows:



13. Click **Log Options**, then enter the following Log parameters:
- Select **Append on Run**.
 - Enter the filename **C:\Log1**.
 - Select **Log Passes** and its corresponding **Log Image** checkbox.
 - Select the **Log Variables** checkbox.
 - Enter **C:\Passimage** as the file folder name, where C: is the letter that represents your hard disk.
- The Log Options dialog box looks as follows:*

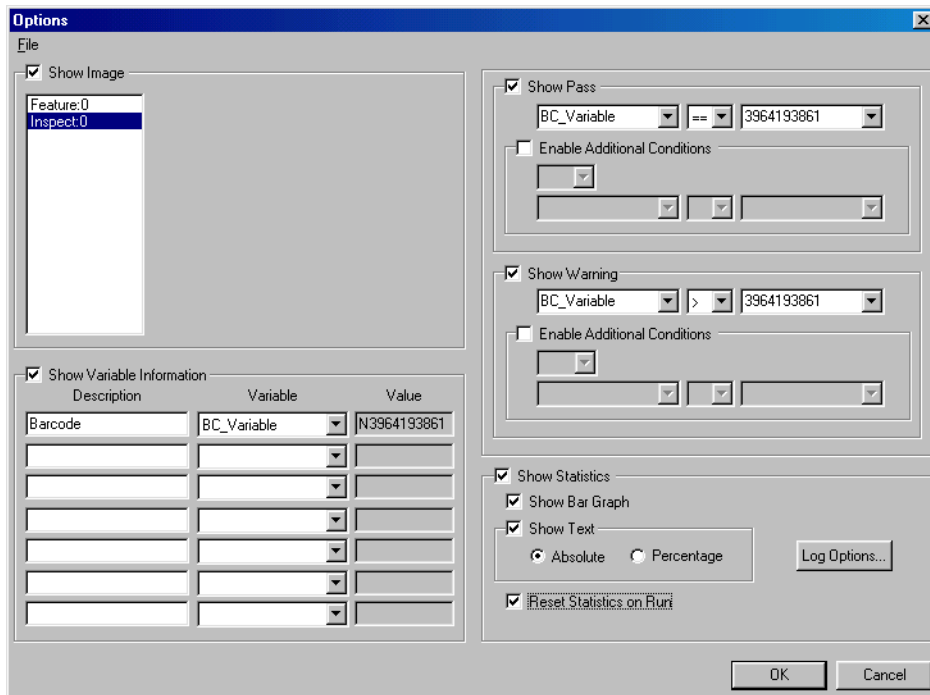


f. Click **OK**.

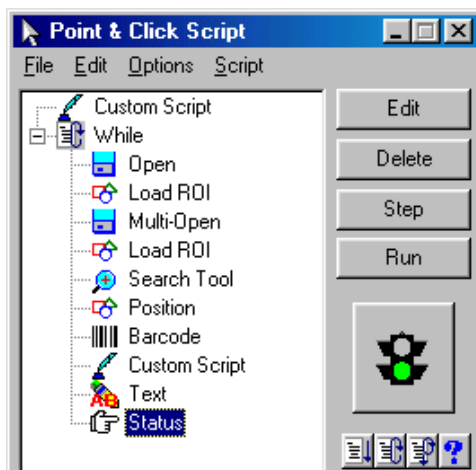
14. Select the **Show Statistics** checkbox and configure the statistics parameters as follows:

- a. Select **Show Bar Graph**.
- b. Select **Show Text**, then select **Absolute**.
- c. Select **Reset Statistics on Run**.

The Options dialog box looks as follows:

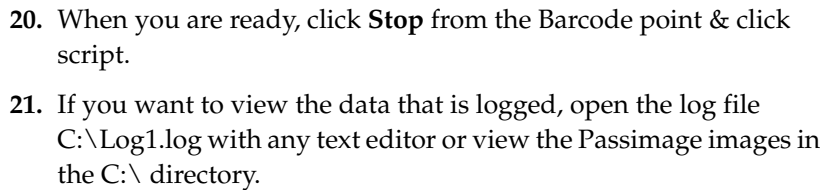


15. Save the settings by selecting **File | Save Settings**, entering a name, such as **Barcode.sta**, and clicking **Save**.
16. Click **OK** to close the Options dialog box.
17. Click **Add to Script** to add the Status tool to the Barcode point & click script.
18. In the Point & Click Script tool, move the Status tool so that it is the last step in the While loop.
The point & click script looks as follows:



19. Click **Run** from the Point & Click Script tool.

The Status tool displays the results of the Barcode point & click script, as follows:



Point & Click Script

This section describes the specific use of the Status tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

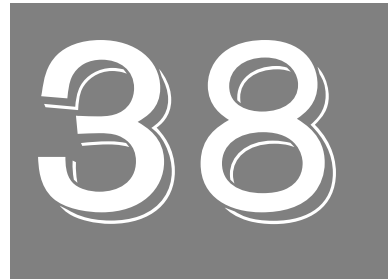
Adding to the Point & Click Script

To add the Status tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Set up all the options in the Status tool to perform the desired function, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Status tool is set up exactly as it was when you previously recorded the script item. The **Add to Script** button is changed to a **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back into the point & click script with the new options.

Note: If you are using a runtime version of DT Vision Foundry, you can edit a Status tool script item, if desired. Since the **Edit** button is unavailable, double-click the script item to open an editable version of the Status tool. The **Add to Script** button changes to an **Update Script** button. Change the desired options and click **Update Script**. You cannot delete a Status tool script item. You cannot save the edited point & click script.



Using the Text Tool

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Introduction

The Text tool is supplied with DT Vision Foundry. It allows you to add text to your images. You can add text directly on the image or add text using a transparent overlay.

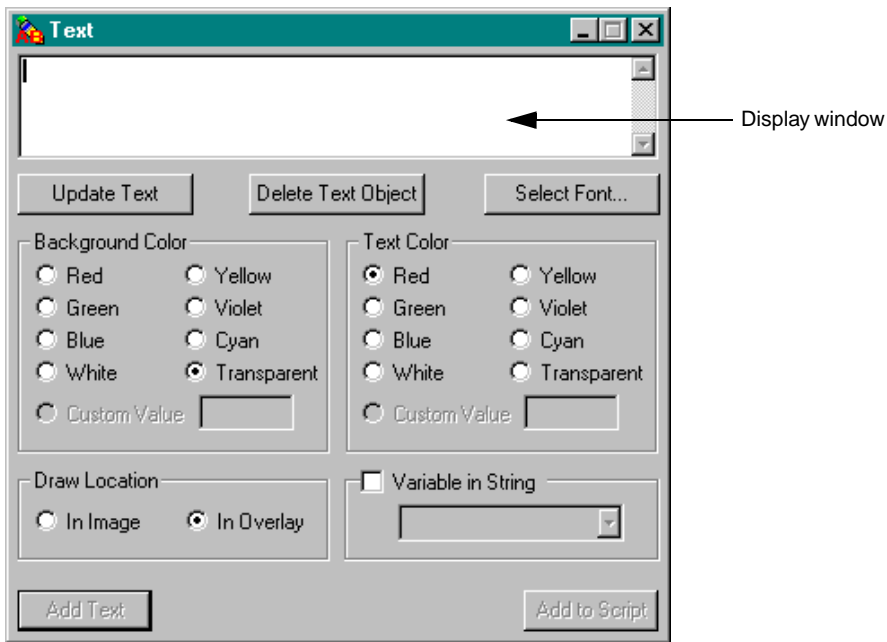


Figure 135: Text Tool

To open a Text tool, select the  icon from the Miscellaneous toolbar or select **Text** from the Tools menu.

Note: The text tool is fully compatible with all other tools, image types, and ROIs.

You can have up to 100 Text tools open at the same time. However, you can place multiple text objects on an image or on different images using the same Text tool.

Description of Text Tool Options

This section contains a description of the options in the Text tool dialog box.

Display Window

Enter the text that you want to add in this field. Each line of text can be up to 100 characters in length and you can have up to 10 lines of text. To move to the next line, press <Enter> on the keyboard.

Note that some versions of Windows require <Ctrl> + <Enter> to move the cursor to the next line.

Update Text

Click this button to modify the text in a text object. Activate the ROI (red) surrounding the text object you want to update, make your changes in the display window, and then click **Update Text**. The text object is now updated with your changes.

Delete Text Object

Click this button to delete a text object. Activate the ROI (red) surrounding the text object that you want to delete, then click **Delete Text Object**. The text object (including wording) is deleted.

Note that if **Draw in Image** is selected and you delete the ROI surrounding the text object, only the ROI is deleted; the associated text is permanently placed in the image and cannot be deleted.

Select Font...

Click this button to select font, font style, and font size.

Background Color

Click the appropriate radio button to specify the background color. If you want to use a custom color, click **Custom Value** and enter the custom color value in the text box. Custom colors are primarily used when adding text to a 32-bit or floating-point image.

Text Color

Click the appropriate radio button to specify the text color. If you want to use a custom color, click **Custom Value** and enter the custom color value in the text box. Custom colors are primarily used when adding text to a 32-bit or floating-point image.

Draw Location

Select the appropriate radio button to determine where to add text.

- **In Image** – Select if you want to add text directly in the image. The text object is added to the image within an ROI.
- **In Overlay** – Select if you want to overlay text on the image. The text object is added to the image within an ROI.

Variable in String

Select this checkbox if you want to use a point & click script variable in a text object. Select the variable from the drop-down list, which contains all the point & click script variables in your script. You can then add the variable %s in a string in the display window. The first %s variable in the string is updated with the value of the selected point & click script variable.

For example, assume that you select the **Variable in String** checkbox and select the variable `PC_ScriptFailed`. If you add the string “**The value of PC_ScriptFailed = %s**” in the display window, the value of the `PC_ScriptFailed` variable replaces %s when the script is run. So, if the value of `PC_ScriptFailed` = 1.0000, the text appears on the image as follows:

The value of PC_ScriptFailed = 1.0000

Note: If you clear this checkbox or if you select this checkbox and do not select a point & click script variable from the list, the %s variables in the strings are not updated.

Add Text

When all the options are set, click this button. Position the mouse cursor on the image location where you want to add the text. Click the left mouse button. The text object is added within an inactive ROI (green). To activate the text object (red), click on it with the right mouse button.

Because the tool adds the text object to the image within an ROI, you can move the text object as you would move any ROI. For more information about ROIs, refer to [page 38](#).

Add to Script

After you add the text, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Example of Using the Text Tool

This example shows how to add text to the image Mixpoll, shown in [Figure 136](#).

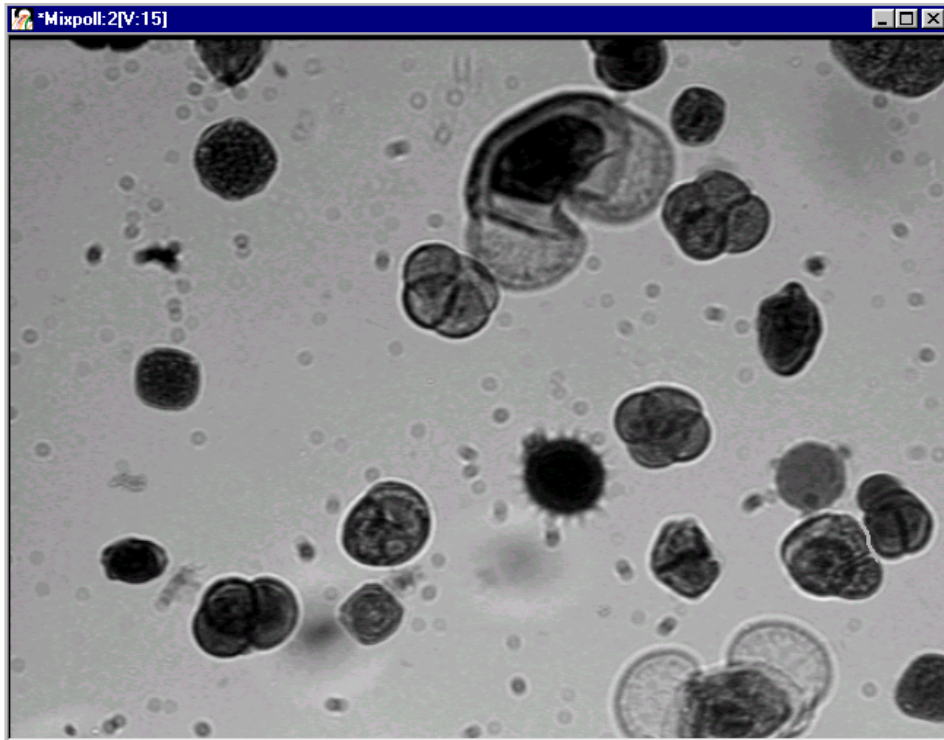
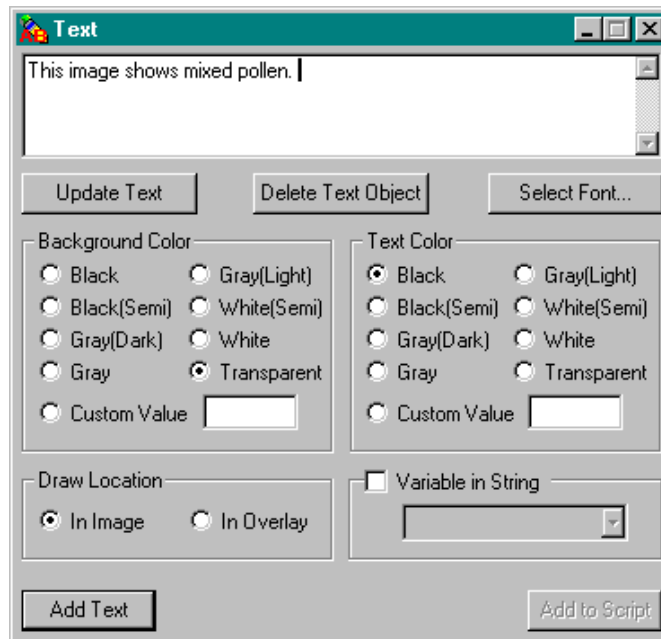


Figure 136: Text Tool Example Image

The operation is as follows:

1. Open a Text tool (if one is not already open).
2. Click **Draw in Image**.
3. In the display window, enter `This image shows mixed pollen.`
4. Select Arial, Bold, and 22 points for the font options.
5. Select Black for the text color.
6. Select Transparent for the background color.

The Text tool looks as follows:



7. Click **Add Text**. Position the mouse cursor on the location in the image where you want to add text. Click the left mouse button. *The text is added to the image within an inactive ROI (green).*
8. Right-click on the ROI surrounding the text object to make it active (red), as follows:



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Point & Click Script

This section describes the specific use of the Text tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Text tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Set up all the options in the Text tool. Click **Add Text** to add the text to the image, then click **Add to Script** to record the operation in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Text tool is set up exactly as it was when you previously recorded the script item. This includes the input image, all options, and the desired text. The **Add to Script** button is changed to a **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options. It is recommended that you click **Update Text** to view the results of your changes before saving the script.



Using the Threshold Tool

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Introduction

The Threshold tool is supplied with DT Vision Foundry. It allows you to threshold an image to create a binary image. A binary image has all pixel values set to either 1 (foreground/black) or 0 (background/white). The Morphology tool requires a binary image. The Blob Analysis, Contour Classifier, and Edge Finder tools require a binary mask image.

You can threshold an image in one of the following ways:

- **Manually** – Manual thresholding is useful when lighting conditions are consistent. You threshold an image manually by specifying the high and low threshold values in the threshold display graph (see [page 659](#)) or in the Threshold Controls dialog box (see [page 664](#)).
- **Automatically** – Automatic thresholding is more reliable if your images may experience changes in lighting conditions. You threshold an image automatically by selecting the **Auto Threshold** checkbox in the Threshold Controls dialog box (see [page 665](#)).

Note that automatic thresholding is not appropriate for all images. It is intended for images with sufficient contrast between the background and the object. If automatic thresholding does not produce the results you expect, use manual thresholding instead.

To open a Threshold tool, select the  icon from the Image Processing toolbar or select **Threshold** from the Tools menu.

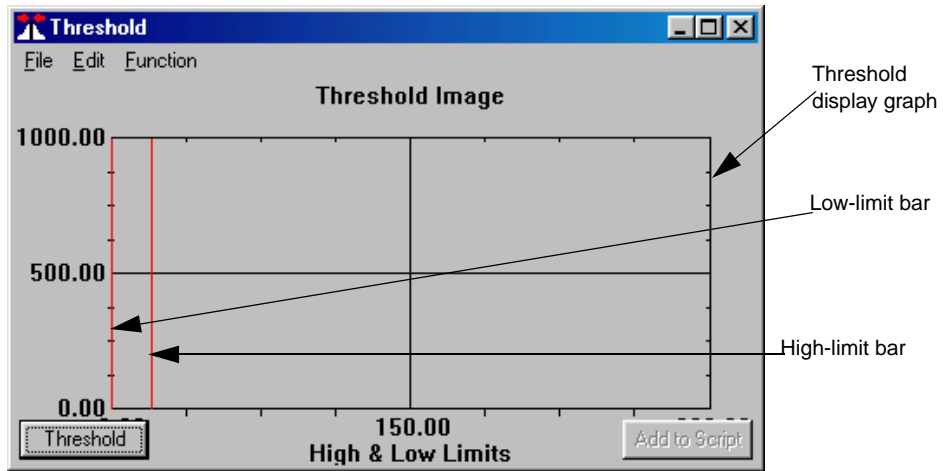


Figure 137: Threshold Display Graph

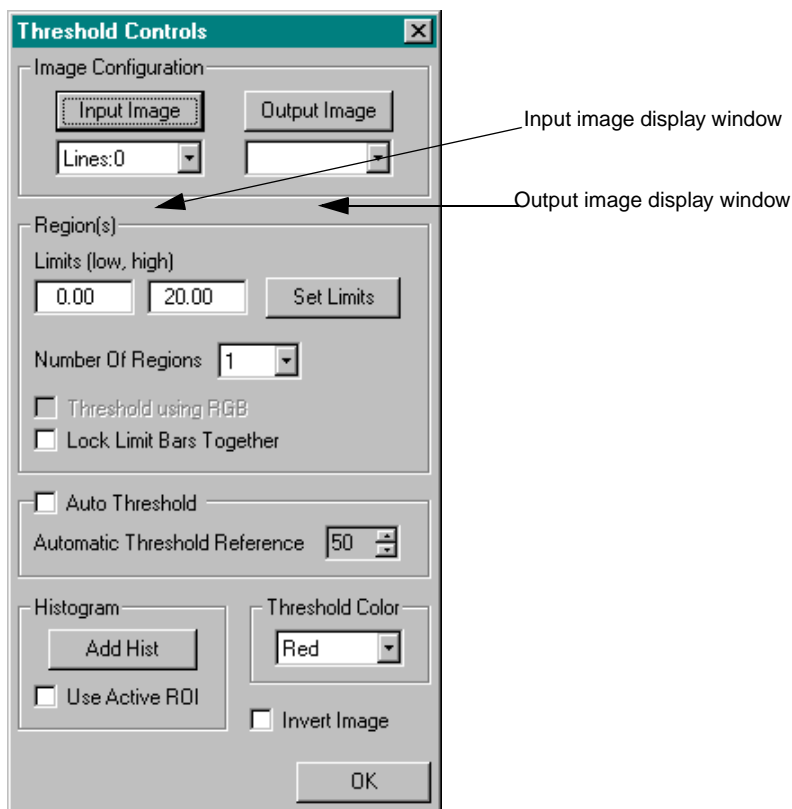


Figure 138: Threshold Controls Dialog Box

Notes: The Threshold tool is fully compatible with all other tools, ROIs, and images.

You can have up to 100 Threshold tools open at the same time.

Description of Threshold Tool Options

This section contains a description of the options in the Threshold tool dialog boxes.

Threshold Display Graph Options

Threshold Display Graph

The threshold display graph shows the low and high threshold limit bars and (if desired) a histogram of the image you are thresholding.

The high-limit and low-limit bars in the graph allow you to select a range of threshold values. You can adjust the low and high range by dragging the vertical bars with the left mouse button. As you drag the bar, the image you are thresholding is updated to show the new limits. You can also view or set the exact value for the high and low limits by using the **Limits (low, high)** text boxes in the Threshold Controls dialog box. For more information, refer to [page 663](#).

Threshold

After you have set the low threshold limit, high threshold limit, and all other options, click this button to threshold the image. If you do not select an output image, the Threshold tool automatically creates an output image for you.

Add to Script

After you threshold the image, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29](#), “Using the Point & Click Script Tool.”

File Menu Options

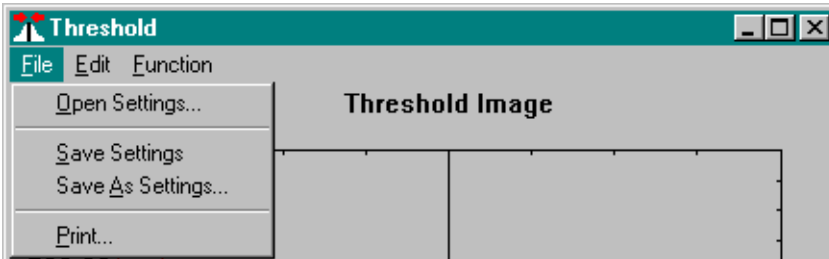


Figure 139: Threshold Tool - File Menu

Open Settings...

Select this option to open a graph configuration from disk. An Open dialog box is displayed. When you open a graph configuration (the file name must be followed by the extension `.ths`), the object is loaded into the Threshold tool.

Note that a graph configuration includes the x-axis and y-axis limits, graph text, and grid markings.

Save Settings

Select this option to save a graph configuration back to disk. The Threshold tool saves x-axis limits, y-axis limits, graph text, and grid markings.

Save As Settings...

Select this option to save a graph configuration to disk with a different name. A Save As dialog box is displayed. Select the directory and enter a file name with the extension `.ths`.

Note that if you save a graph configuration with the name default.ths, the file will automatically open each time you open a Threshold tool. You must save default.ths in the DT_Thrsh directory (located in C:\Program Files\Data Translation\DT Vision Foundry\Tools, by default).

Print...

Select this option to print the graph.

Edit Menu Options

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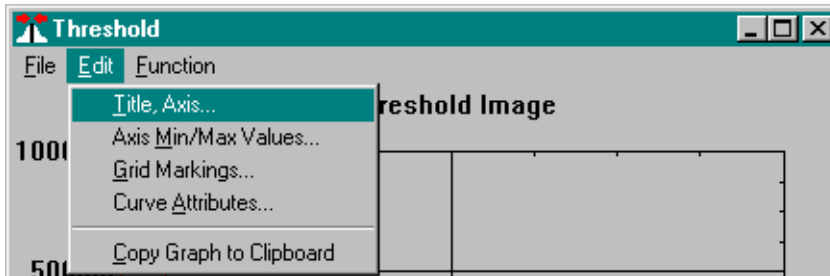


Figure 140: Threshold Tool - Edit Menu

Title, Axis...

Select this option to change the graph text for the title, x-axis, and y-axis. Enter the appropriate values in the Set Title, X & Y Labels dialog box, then click **OK**.

Axis Min/Max Values...

Select this option to change the minimum and maximum limits for the x-axis and y-axis. Enter the appropriate values in the Axis Min/Max Values dialog box, then click **OK**.

You can also set the minimum and maximum values for the graph by performing the following steps:

1. Move the mouse cursor to the point in the graph at which you want to start drawing the rectangular region.
2. While holding down the <Shift> and <Ctrl> keys at the same time, click and hold down the left mouse button.
3. Drag the mouse until you complete the rectangular region. While dragging the mouse, you will see the proposed zooming region on the graph.
4. When you have completed the rectangular region, release the left mouse button. The graph now zooms to the desired minimum and maximum axis points.

You can switch back and forth between zoomed and unzoomed modes by double-clicking in the graph with the right mouse button.

Grid Markings...

Select this option to change the grid markings for the x-axis and y-axis. Enter the appropriate values in the Grid Markings dialog box, then click **OK**.

Curve Attributes...

Select this option to change the style and color of the curve selected in the threshold display graph. Click the appropriate radio buttons in the Curve Attributes dialog box, then click **OK**.

Copy Graph To Clipboard

Select this option to copy the threshold display graph to the clipboard.

Function Menu Options

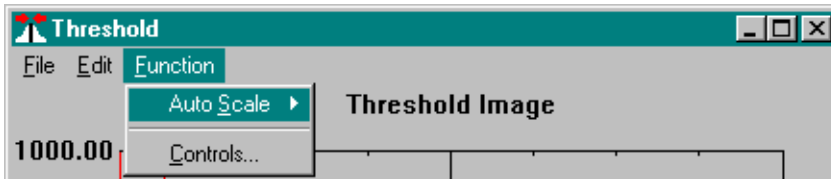


Figure 141: Threshold Tool - Function Menu

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Auto Scale

The **Auto Scale** option allows you to specify how to scale the x-axis and y-axis of the graph:

- **Selected Curve** – Select this option to automatically scale the x-axis and y-axis to best fit the selected curve on the graph.
- **All Curves** – Select this option to automatically scale the x-axis and y-axis to best fit all curves on the graph.

Controls...

Select this option to open the Threshold Controls dialog box. For more information, refer to the following section.

Threshold Controls Dialog Box Options

The Threshold Controls dialog box is automatically opened when you open the Threshold tool. You can also open it by selecting **Function | Controls**. When you have specified all appropriate values, click **OK** to save the settings and close the dialog box.

Input Image

Click this button to load the image in the active viewport as the input image. The image name is shown in the Input Image display window. You can also select the input image from the list of images currently residing in system memory.

Output Image

Click this button to load the image in the active viewport as the output image. The image name is shown in the Output Image display window. You can also select the output image from the list of images currently residing in system memory or enter your own name for the output image in the display window text box.

If you do not select an output image, the Threshold tool automatically creates an output image for you. Note, however, that if you intend to use multiple output images in a point & click script, it is recommended that you either use the image in the active viewport as the output image or select the output image from the drop-down list. This ensures that each output image in the point & click script has a unique name.

Limits (low, high)

Enter the low and high threshold limits in these text boxes, then click **Set Limits**. When you click **Set Limits**, the high-limit and low-limit bars in the threshold display graph and the image are updated to reflect the new values.

When you drag the high-limit and low-limit bars in the threshold display graph with the mouse, the low and high threshold limits are displayed in these fields.

Note that the range between the low threshold limit and the high threshold limit must be at least 1.

Number of Regions

Select the number of regions that you want to work with (maximum of 6) from the drop-down list. The threshold display graph is updated to reflect the number of regions you specify.

Threshold Using RGB/Threshold Using HSL

Select this checkbox if you are thresholding a 24-bit RGB or HSL color image. The Threshold tool automatically sets **Number of Regions** to 3 and adds three sets of limit bars that correspond to the red, green, and blue color planes of an RGB color image or to the hue, saturation, and luminance of an HSL color image.

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Lock Limit Bars Together

Select this checkbox if you want both limit bars to move together whenever you move either of the limit bars with the mouse.

Auto Threshold

Select this checkbox to enable automatic thresholding. Clear the checkbox to disable automatic thresholding.

If automatic thresholding is enabled, select a reference value from the **Automatic Threshold Reference** spin box. The value can range from 0 to 100%. By default, the reference value is 50%.

The tool uses the difference between the minimum and maximum grayscale values in the selected ROI to automatically threshold the image. If you do not get the results that you expect, try a different reference value.

Note that automatic thresholding is not appropriate for all images. It is intended for images with sufficient contrast between the background and the object. If automatic thresholding does not produce the results you expect, try manual thresholding.

Histogram

After you set the input image, click the **Add Hist** button to add a histogram to the graph. The histogram is useful as a visual aid in determining the correct threshold limits. If you are thresholding an RGB/HSL color image and **Threshold using RGB/Threshold using HSL** is selected, a histogram for each color plane (red, green, and blue) or color setting (hue, saturation, and luminance) is added to the graph.

If you select the **Use Active ROI** checkbox, the histogram is created with respect to the active ROI for the input image. If you clear the **Use Active ROI** checkbox, the histogram is created from the entire image.

When you add a histogram to the graph, the **Add Hist** button changes to a **Remove Hist** button. Click **Remove Hist** to remove the histogram from the graph.

Threshold Color

Select the color that you want to display the thresholding in. This serves as a visual aid only.

Invert Image

Select this checkbox to invert the output binary image. The foreground pixels are output as background pixels and the background pixels are output as foreground pixels.

Example of Using the Threshold Tool

The following example shows how to use the Threshold tool to create a binary image from the image Mixpoll, shown in [Figure 142](#).

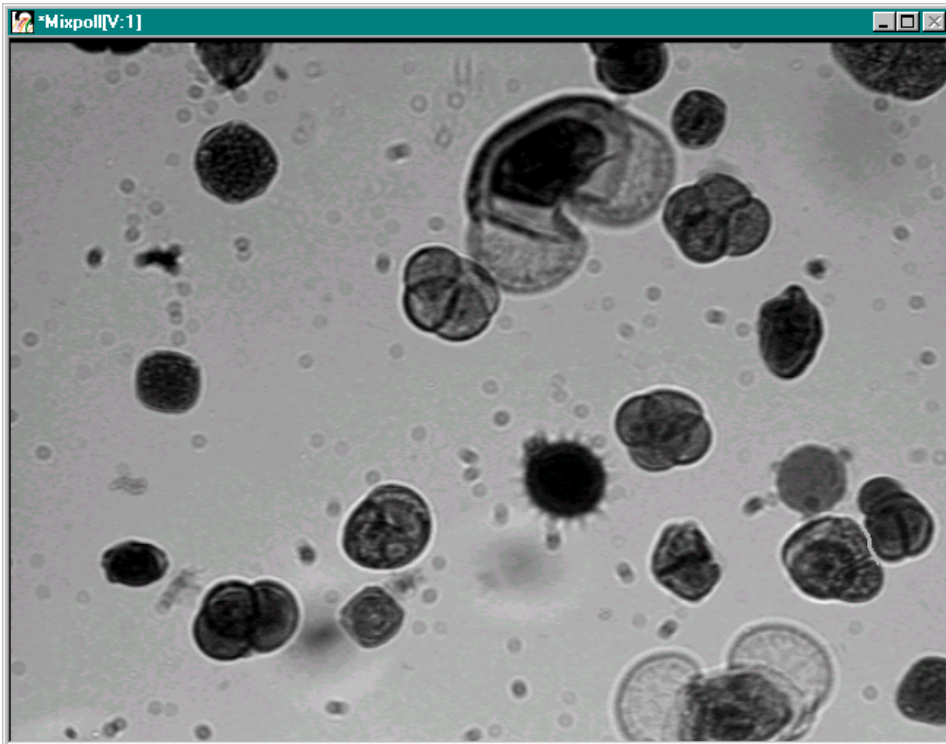
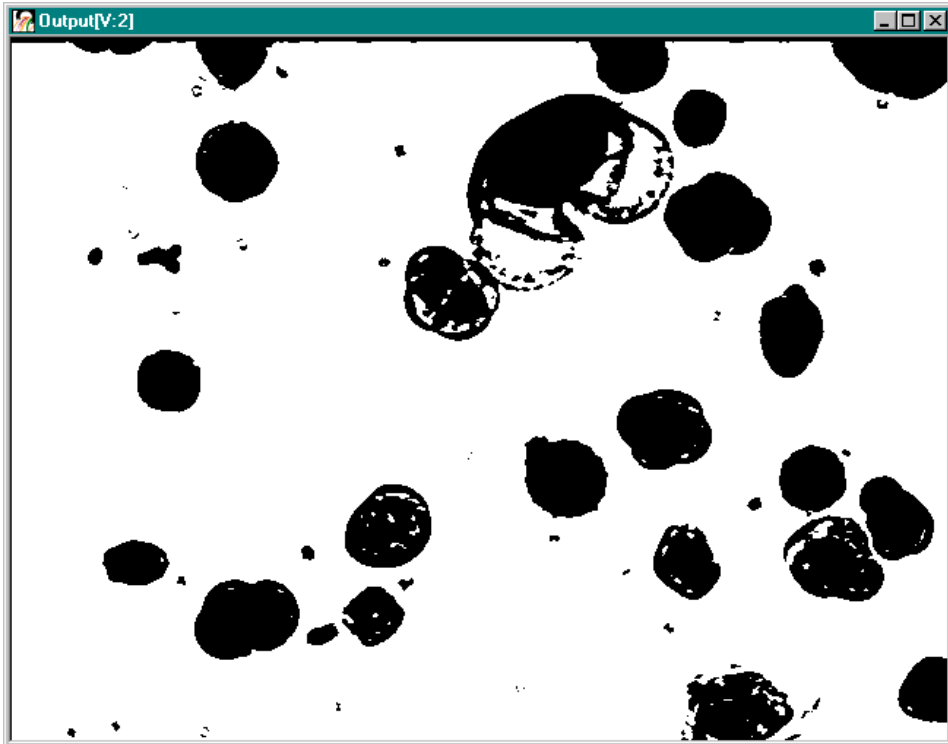


Figure 142: Threshold Tool Example Image

The operation is as follows:

1. Open a Threshold tool (if one is not already open).
2. Click in the viewport on the image Mixpoll with the left mouse button. It is now the active viewport and is denoted with an asterisk. Click **Input Image** to load Mixpoll as the input image.
3. Set the low threshold limit to 0 and the high threshold limit to 105. You can do this either by dragging the limit bars in the threshold display graph or by entering the values in the **Limits (low, high)** text boxes and then clicking **Set Limits**.
4. Click **Threshold** on the Threshold Display graph to threshold the input image.

The input image Mixpoll is thresholded and produces a binary copy of itself. The Threshold tool automatically creates the binary image Output, as follows:



You can use the binary image for anything you want. If you intend to use the binary image with the Blob Analysis tool (as the mask image), you may want to further process (clean) the binary image using the Morphology tool. For more information, refer to [Chapter 26, “Using the Morphology Tool.”](#)

Point & Click Script

This section describes the specific use of the Threshold tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the Threshold tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Set up all the options in the Threshold tool to perform the desired function. This includes the input and output images, the threshold limits, and all other options. Click **Threshold** to perform the desired action, then click **Add to Script** to record the desired action in the Point & Click Script tool.

Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the Threshold tool is set up exactly as it was when you previously recorded the script item. This includes the input and output images, the threshold limits, and all options. The **Add to Script** button is changed to a **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



Using the TWAIN Tool

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Introduction

The TWAIN tool is supplied with DT Vision Foundry. It allows you to acquire 24-bit color or 8-bit grayscale images from devices, such as scanners, that provide TWAIN drivers.

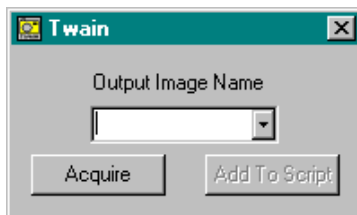


Figure 143: TWAIN Tool

To open a TWAIN tool, select the  icon from the Input-Output toolbar or select **Twain** from the Tools menu.

Notes: The TWAIN tool is fully compatible with all tools. You can acquire 24-bit color and 8-bit grayscale images only. ROIs are not used.

You can have only one TWAIN tool open at a time.

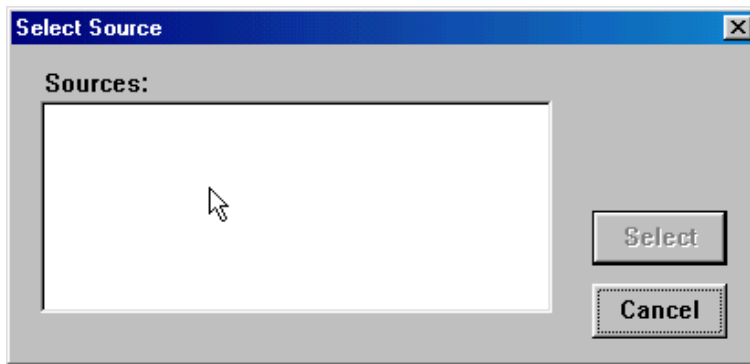
Description of TWAIN Tool Options

Output Image Name

Enter the name that you want to use to identify the image acquired from the TWAIN device in the text box. If you previously acquired an image from a TWAIN device, the name of the image is listed in the drop-down list.

Acquire

After you enter a name for the image, click this button to acquire the image from the TWAIN device. The Select Source dialog box appears.



All available devices with TWAIN drivers are listed in the Sources window.

Click the TWAIN device that you want to use, then click **Select**, or double-click the TWAIN device to select it. The TWAIN manager that is provided by the device's manufacturer is displayed. Use the TWAIN manager to configure the TWAIN device and to acquire an image from the TWAIN device. For information, refer to the documentation provided with the TWAIN device.

Note that when you acquire the image from the TWAIN device, the image is brought into DT Vision Foundry. To save the image, you must save it within DT Vision Foundry.

Once you have acquired an image from the TWAIN device, close the TWAIN manager to return to the Output Image Name dialog box.

Add to Script

After you acquire the image from the TWAIN device, click this button to add the operation to a point & click script. For more information, refer to [Chapter 29, “Using the Point & Click Script Tool.”](#)

Point & Click Script

This section describes the specific use of the TWAIN tool's point & click script functionality with respect to adding and editing a point & click script. For more information, refer to [Chapter 29, "Using the Point & Click Script Tool."](#)

Adding to the Point & Click Script

To add the TWAIN tool's functionality to a point & click script, you must first have the Point & Click Script tool open. Then, set up all the options in the TWAIN tool to perform the desired function. This includes specifying the name of the acquired image and configuring the TWAIN device. Use the TWAIN manager to acquire the image, then click **Add to Script** to record the action in the Point & Click Script tool.

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Editing the Point & Click Script

From within the Point & Click Script tool, double-click the script item that you want to edit, or select the script item and click **Edit**. The Point & Click Script tool is grayed out and the TWAIN tool is set up exactly as it was when you previously recorded the script item. This includes the name of the acquired image and the configuration of the TWAIN device. The **Add to Script** button changes to an **Update Script** button, indicating that you are editing a point & click script item. Change the desired options and click **Update Script**. The script item is saved back to the point & click script with the new options.



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General Checklist

Should you experience problems using DT Vision Foundry, please follow these steps:

1. Read all the appropriate sections of this manual. Make sure that you have added any “Read This First” information to your manual and that you have used this information.
2. Check the DT Vision Foundry CD-ROM for a README file. If present, read this file for the latest installation and usage information.
3. Check that you have installed your software properly. For information, refer to [Chapter 1, “Installing DT Vision Foundry.”](#)
4. Check that you have installed your frame grabber board properly. For information, refer to the documentation supplied with your board.
5. Check that you have installed the device driver for your frame grabber board properly. For information, refer to the documentation supplied with your board.

Note: If you are still having problems, follow the instructions provided in the next section.

Service and Support

If you have difficulty using DT Vision Foundry, the Data Translation Technical Support Department is available to provide technical assistance. Support upgrades, technical information, and software are also available.

All customers can always obtain the support needed. The first 90 days are complimentary, as part of the product's original warranty, to help you get your system running. Customers who call outside of this time frame can either purchase a support contract or pay a nominal fee (charged on a per-incident basis).

For "priority support," purchase a support contract. Support contracts guarantee prompt response and are very affordable; contact your local sales office for details.

Refer to the Data Translation Support Policy located at the end of this manual for a list of services included and excluded in our standard support offering.

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Telephone Technical Support

Telephone support is normally reserved for original warranty and support-contract customers. Support requests from non-contract or out-of-warranty customers are processed after requests from original warranty and support-contract customers.

For the most efficient service, please complete the form on [page 681](#) and be at your computer when you call for technical support. This information helps to identify specific system and configuration-related problems and to replicate the problem in house, if necessary.

You can reach the Technical Support Department by calling (508) 481-3700 x1401.

If you are located outside the USA, call your local distributor. The name and telephone number of your nearest distributor are provided in your Data Translation catalog.

If you are leaving a message to request a support call, please include the following information:

- Your name (please include proper spelling),
- Your company or organization (please include proper spelling),
- A phone number,
- An e-mail address where you can be reached,
- The hardware/software product you need help on,
- A summary of the issue or question you have,
- Your contract number, if applicable, and
- Your product serial number or purchase date.

Omitting any of the above information may delay our ability to resolve your issue.

Information Required for Technical Support

Name: _____ Phone: _____

Contract Number: _____

Address: _____

Data Translation hardware product(s): _____

serial number: _____

configuration: _____

Data Translation device driver - SPO number: _____

version: _____

Data Translation software - SPO number: _____

serial number: _____ version: _____

PC make/model: _____

operating system: _____ version: _____

Windows version: _____

processor: _____ speed: _____

RAM: _____ hard disk space: _____

network/number of users: _____ disk cache: _____

graphics adapter: _____ data bus: _____

I have the following boards and applications installed in my system: _____

I am encountering the following problem(s): _____

and have received the following error messages/codes: _____

I have run the board diagnostics with the following results: _____

You can reproduce the problem by performing these steps:

1. _____

2. _____

3. _____

E-Mail and Fax Support

You can also get technical support by e-mailing or faxing the Technical Support Department:

- **E-mail:** You can reach Technical Support at the following address: tsupport@datx.com

Ensure that you provide the following minimum information:

- Your name,
- Your company or organization,
- A phone number,
- An e-mail address where you can be reached,
- The hardware/software product you need help on,
- A summary of the issue you are experiencing,
- Your contract number, if applicable, and
- Your product serial number or purchase date.

Omitting any of the above information may delay our ability to resolve your issue.

- **Fax:** Please photocopy and complete the form on [page 681](#), then fax Technical Support at the following number: (508) 481-8620.

Support requests from non-contract and out-of-warranty customers are processed with the same priority as telephone support requests.

World-Wide Web

For the latest tips, software fixes, and other product information, you can always access our World-Wide Web site free of charge at the following address: <http://www.datatranslation.com>



Using ROIs in Point & Click Scripts

Table 4 summarizes the input ROIs that you can create for each DT Vision Foundry tool, the output ROIs that are created by each tool, and the input ROIs that are automatically recreated at run-time in your point & click script.

Table 4: DT Vision Foundry ROI Usage

Tool	Input ROIs Used	Output ROIs Created	Automatically Recreates Input ROIs at Run-Time in a Point & Click Script
Arithmetic	All	None	Point, rectangle, ellipse, and line ROIs only. ^a
AVI Player	None	None	N/A
Barcode Reader	Rectangle	None	Yes
Blob Analysis	Rectangle	Freehand	Yes
Calibration	Point	None	No
Color Plane	None	None	N/A
Contour Classifier	Rectangle	Freehand	Yes
Custom Script	None	None	N/A
Data Matrix Reader	Rectangle	Freehand	Yes
Digital I/O	None	None	N/A
Display	All	None	No
Edge Finder	Line	Freehand line, freehand, point	Yes
	Rectangle	Freehand	Yes
	Ellipse Polyline Freehand line Poly freehand Freehand	Freehand line, freehand, point	No

Table 4: DT Vision Foundry ROI Usage (cont.)

Tool	Input ROIs Used	Output ROIs Created	Automatically Recreates Input ROIs at Run-Time in a Point & Click Script
Export	Line Rectangle ^b	None	N/A
File Manager	None	None	N/A
Filter	All	None	Point, rectangle, ellipse, and line ROIs only. ^a
Gauge	All	None	No
Histogram	All	None	Point, rectangle, ellipse, and line ROIs only. ^a
Image Classifier	Rectangle	None	Yes
Image Manager	None	None	N/A
Image Modifier (Crop tab only)	Rectangle	None	Yes
	Ellipse	None	Yes
	Poly freehand	None	No
	Freehand	None	No
Import	None	None	N/A
Line Profile	Line	None	Yes
	Polyline	None	No
	Freehand line	None	No
Match	None	None	N/A
Morphology	All	None	Point, rectangle, ellipse, and line ROIs only. ^a
Picture	None	None	N/A

Table 4: DT Vision Foundry ROI Usage (cont.)

Tool	Input ROIs Used	Output ROIs Created	Automatically Recreates Input ROIs at Run-Time in a Point & Click Script
Pixel Change	All	None	Point, rectangle, ellipse, and line ROIs only. ^a
Point & Click Script	None	None	N/A
Polar Unwrap	Ellipse	None	Yes
Prompt	None	None	N/A
ROI Manager: Draw tab	All	Point Line Ellipse Rectangle	No ^c
ROI Manager: Position tab	All	None	Point, rectangle, ellipse, and line ROIs only. ^a
ROI Shape Fitter	Line	Point	No
	Rectangle	Point	No
	Ellipse	Point	No
	Freehand line	Ellipse, line	No
	Poly freehand	Point	No
	Freehand	Point, ellipse	No
Search	Rectangle	Point Rectangle	Yes
Serial I/O	None	None	N/A
Sound	None	None	N/A
Status	None	None	N/A

Table 4: DT Vision Foundry ROI Usage (cont.)

Tool	Input ROIs Used	Output ROIs Created	Automatically Recreates Input ROIs at Run-Time in a Point & Click Script
Text	None	Rectangle	Yes
Threshold	All	None	Point, rectangle, ellipse, and line ROIs only. ^a
TWAIN	None	None	N/A

- a. Polyline, freehand line, poly freehand, and freehand ROIs are not automatically recreated at run-time in a point & click script.
- b. The line and rectangle ROIs are used by the Export tool, but they are created and recreated by other tools.
- c. If desired, you can use the **Open ROI** option in your point & click script to open an ROI previously saved using the **Save As ROI** option.

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