

DT Vision Foundry Training Notes

Data Translation's machine vision software package, DT Vision Foundry, is a high-tech analysis tool for checking the quality of certain products being used on production lines. Although the software is very powerful, it is also very simple to program and to debug if problems do arise. This training will show you how DT Vision Foundry works as a solution for your application.

The philosophy behind DT Vision Foundry is that if the package is simple to use and to program, then people will not only become confident using the system but they will also enjoy using and extending to its full potential. Whether you are searching for components on a PCB to verify that the correct components are located accurately down to microns, or if you are just verifying that the correct color of a product is being used, you can use DT Vision Foundry. This training will not only show you how to write Point and Click Scripts," it will also show you how to debug the system and change the parameters of the variables to any specifications that you or your customer may require.

The training consists of four parts:

1. The three stages of machine vision.
2. The major components of DT Vision Foundry.
3. Acquiring an image in DT Vision Foundry using a Data Translation frame grabber.
4. Basic description of each tool and its usage in applications.

PART I. MACHINE VISION

Machine Vision is normally thought of in three main stages:

1. Image Acquisition
2. Analysis
3. Decision Making

If you think of machine vision in this way, then you will understand the thought process and approaching the application will be much easier.

Image Acquisition

This is the first stage of any machine vision project. You will need to take an image from a camera through a frame grabber, a bitmap (or any other kind of single image) or from an AVI. The difference is that you can only view live video through the frame grabber. Many applications engineers complete studies on bitmap images rather than live images just so they can get the process correct before implementing the script on the live images.

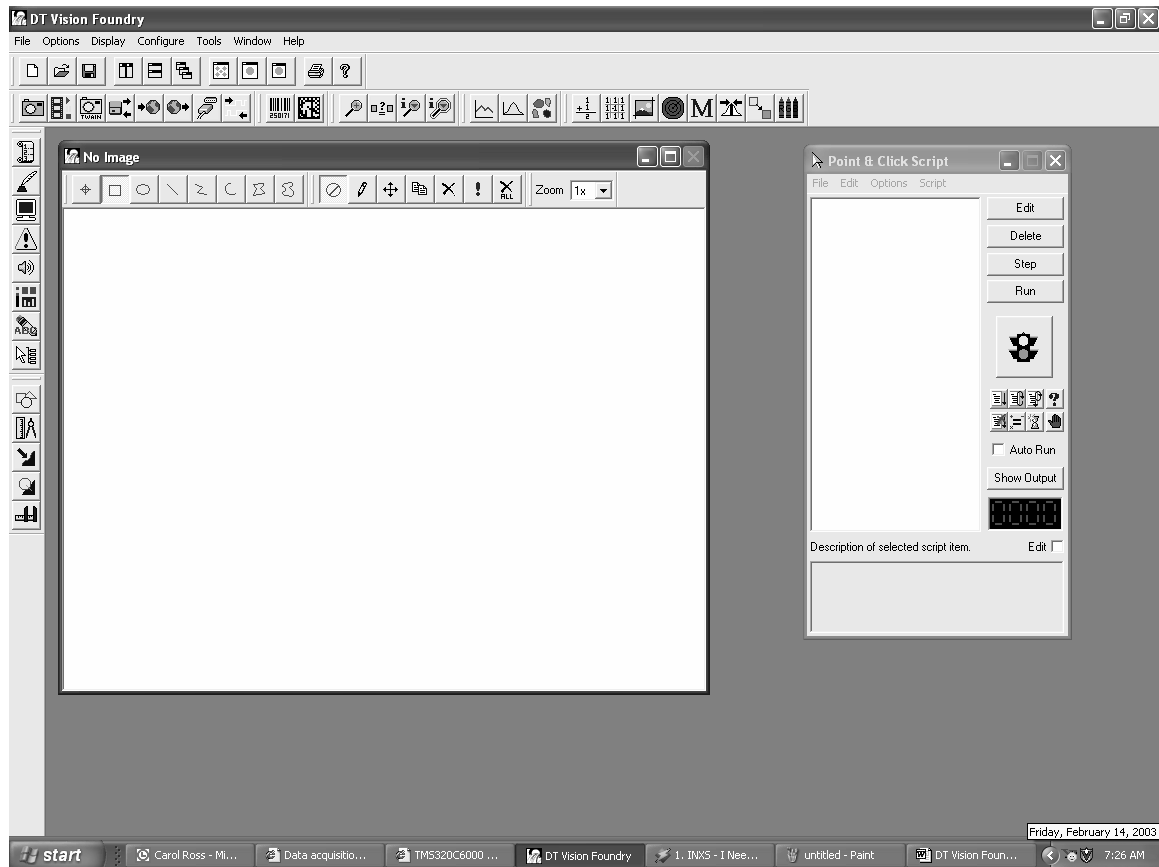
Analysis

Analysis is the main stage of machine vision. Once you have your images, you then need to decide what you wish to do with them. You can examine the results of image acquisition through measurement and other forms of analysis. Whether it's a simple search and measurement or more in-depth testing of products, if you break it up into sections, it is very simple.

Decision-Making

The decision-making part of machine vision is based on the customer's specifications. Does he want to signal a PLC through Digital I/O for a failure mechanism to reject a failed product? Does he want to stop the production line when there's a failure? Does he just want to take in the data and store the statistics?

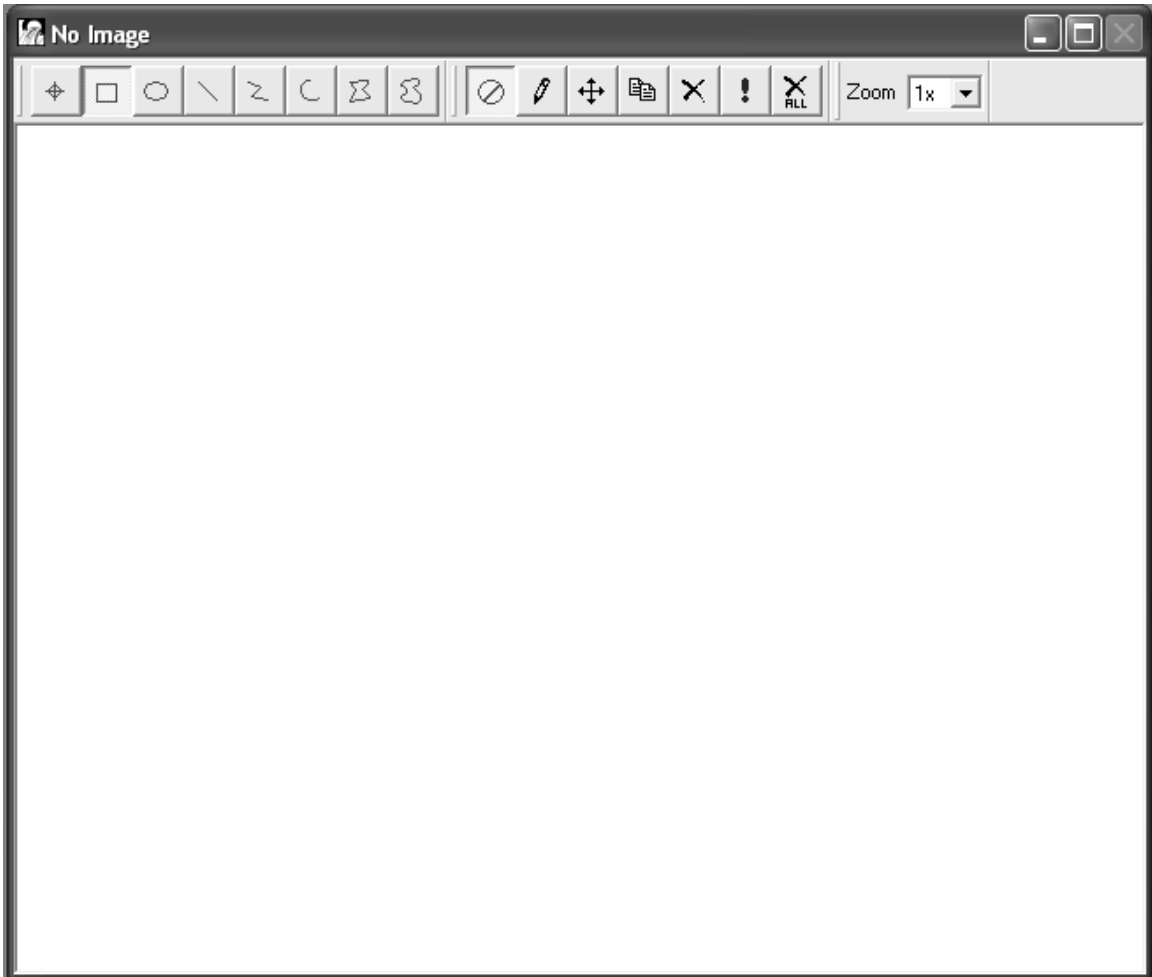
PART II. MAJOR COMPONENTS OF DT VISION FOUNDRY



DT Vision Foundry – Full Screen

DT Vision Foundry has three main parts:

1. Viewports – These contain either the images that you are analyzing or the images which you are using for comparison, i.e. “gold” images. The viewports hold all the ROI’s (Regions of Interest) which are used for measurement and analysis. You can have as many viewports open as you wish; however, you should keep it down to a minimum to avoid confusion.



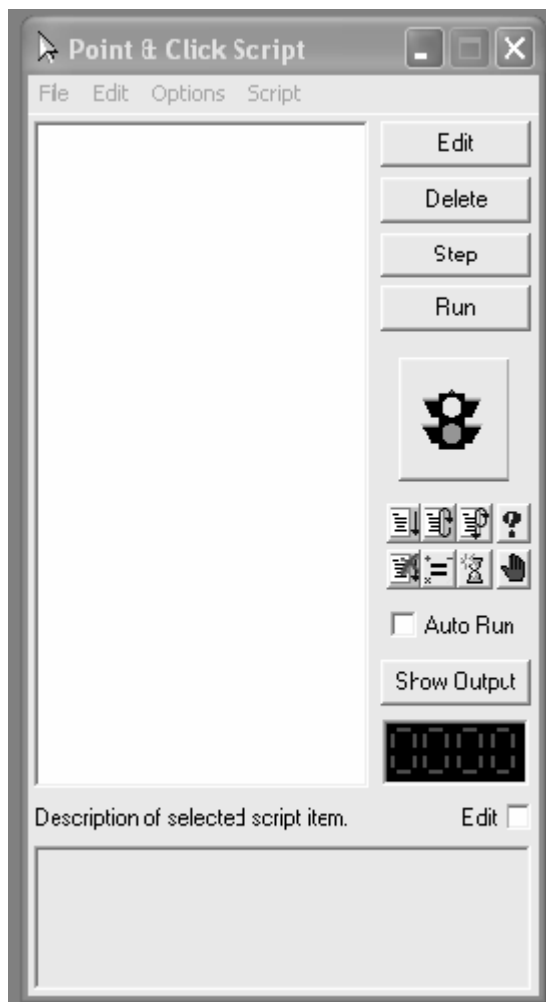
Viewport

2. Docking Tool Bars – All the DT Vision Foundry ready-to-run tools are contained in the tool bars. You select the tool you wish to use and fill in the parameters and settings with regards to the active viewport that you are using. The majority of tools use the ROI's to measure/gauge /characterize/count or even read the image. However, you don't need to use ROI's as you can use the whole image if you wish.



Docking Tool Bars

3. Point and Click Script – When you have set the parameters for the tools you want to use, you then click “Add to Script”, and each tool is placed in the Point and Click Script window. You can easily edit the tools after they have been added.



Point and Click Script

Common Machine Vision Terms

ROI – Region of Interest. A region of interest is a portion of an image that you want to manipulate. There are eight different types of ROI's contained in DT Vision Foundry. Each can be used with the majority of tools. You will be allowed to move, delete, draw and perform many more functions when using ROI's.

Viewports – The image window that contains the image that is either under inspection or is used in a portion of the program being written.

Grey Level – The grey level of any product is a level of light and dark. The stronger the light, then the higher the grey level (white light being 255), and the darker the lighting, then the lower the grey level (dark being 0).

PART III. ACQUIRING AN IMAGE

You can acquire an image in DT Vision Foundry with the AVI Player Tool. You can string a variety of bitmaps together to form an AVI file. Through the AVI Player, you can view it and complete a study on these images.

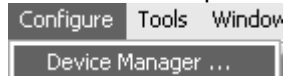
The most common way to get an image, however, is with a Data Translation frame grabber. This is done through the Device Manager and the Picture Tool.

Here is a list of DT Vision Foundry-compatible PCI frame grabbers:

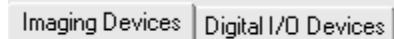
DT3120, DT3131, DT3132, DT3133, DT3152, DT3153, DT3154, DT3155, DT3157, DT3162 and the new CameraLink frame grabber, the DT3145. DT Vision Foundry does NOT support any ISA boards.

To take an image you need to follow these steps:

1. Make sure your frame grabber is properly installed in the PC. Please reference the installation instructions on the latest Imaging Omni-CD for further details.
2. Open DT Vision Foundry.
3. Go to the Top of the VF screen to the CONFIGURE – DEVICE MANAGER.

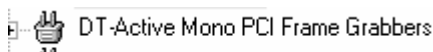


4. This will open up the “Central Nervous System” of the image acquisition and digital I/O configurations.
5. From here you can configure any frame grabber or digital I/O board.

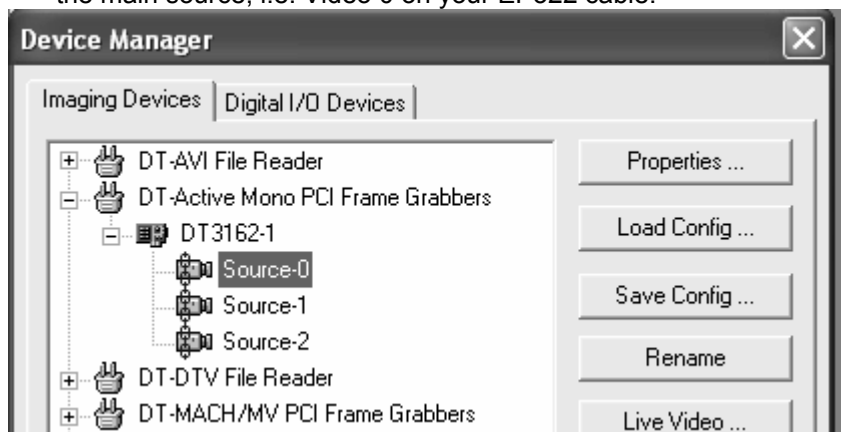


6. You will be working with the Imaging Devices. These devices will range from the frame grabbers that you have installed, to the AVI file Reader to the Video for Windows (USB) image devices. You will have a separate plug-in for each board. You will notice that the boards are called “DT-Active Mono PCI Frame Grabbers” (for the DT3162) and the “DT-MACH/MV PCI Frame Grabbers” (or the Mach 1 Series frame grabbers).

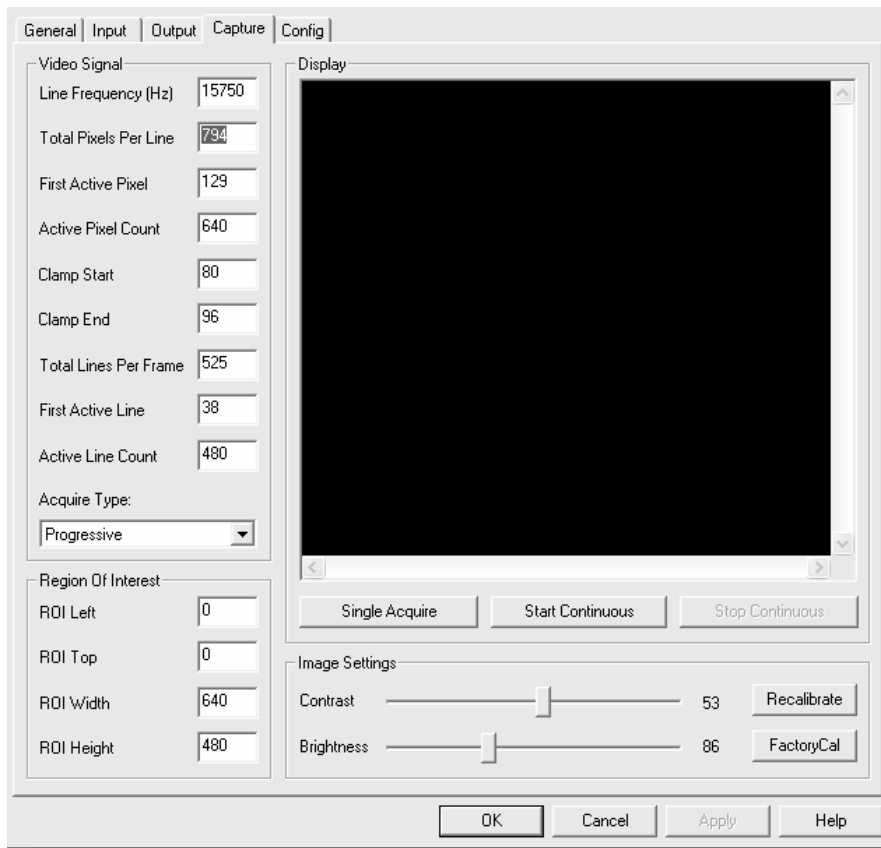
You will see the following screen in front of you if you have a DT3162 frame grabber installed correctly.



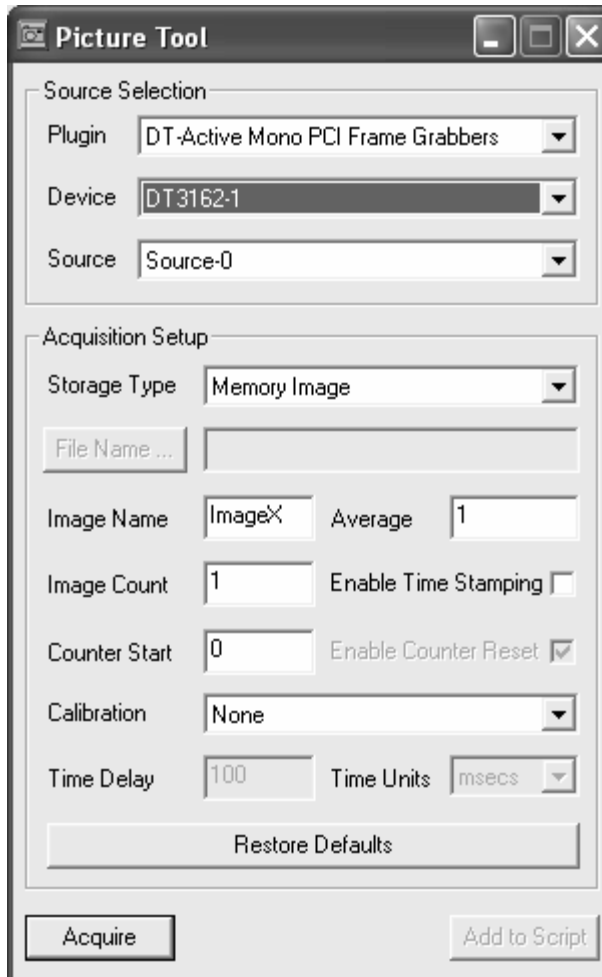
7. Open the + on the frame grabber and select the DT3162. Then select Source 0. This is the main source, i.e. Video 0 on your EP322 cable.



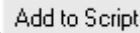
8. You will then click on PROPERTIES to open up the settings in order to decide on which video format and other properties you are going to use. In this example, the DT3162 is a progressive-scan frame grabber, but it will take interlaced as well.
9. You will see the property pages of the DT3162 with several tabs. In most cases, you really only want to worry about the CAPTURE tab. Please note that most frame grabbers will display these property pages, including the DT3145.

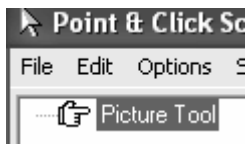


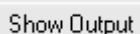
10. Select progressive scan or interlaced under Acquire Type. The click SINGLE ACQUIRE or START CONTINUOUS. This will display live images and show you that the frame grabber is working. Once you have done this, click Apply, then OK. Then close the Device Manager. You have now set up your frame grabber. Now you need to use the Picture Tool to take the image and put it into the Point and Click Script.
11. Open the Picture Tool and select the correct settings as shown below:



You can select the device (frame grabber), the correct channel source and the image type that you want.

12. Click Acquire – You should now see an image come up on your viewport. You now need to ADD TO SCRIPT . This will add all the settings to the Point and Click Script (see below).



13. Now you can close the Picture Tool. Once you have saved the script (at the top of Point and Click Script, click on File, Save Script As) you will need to display the output from the Picture Tool. To do this, you will need to click on the Picture Tool in the Point and Click Script with your left mouse button to highlight it BLUE. You will then need to click on SHOW OUTPUT, in the Point and Click Script window - . This will display the output from the tools that you have highlighted. Normally, it would be the Picture Tool or the last visual tool that you have used.

14. To see live video you now need to click RUN, which is in a group of four tools located in the Point and Click Script window.



These tools will allow you to EDIT the tools which you have added to the script, to DELETE the tools which are in the script, and to STEP the program so that you can debug it if you feel that there are problems, or even if you wish to view the program slowly and see every step throughout the process. To practice you should open the scripts which ship with the software (located in C:\Program Files\Data Translation\DT Vision Foundry\Scripts). You can step through these programs just to view the samples and learn from them. You can then RUN the program which will show you your progress.

Now you have managed to view the live images which your program will be written to analyze. The following sections will cover writing a program for the AVI file that I will give you to practice on.

Note: If you want more information on the Picture Tool or any other tool in DT Vision Foundry, click on F1 when you have the tool open and the online help will take you through the properties and features of the tool. There is also a step-by-step example of each tool.

PART IV. INDIVIDUAL TOOLS AND SETTINGS

This section will go through each tool so that you understand how they work, what properties they have and in which applications they should be used. For more information on any of these tools, open the tool and click F1 for online help and examples.

Below is a list of all DT Vision Foundry Tools:

1. AVI Player
2. Arithmetic
3. Barcode Reader
4. Blob Analysis
5. Calibration
6. Color Plane
7. Contour Classifier
8. Custom Script
9. Data Matrix Barcode Reader
10. Digital I/O
11. Display
12. Edge Finder
13. Export Tool
14. File Manager
15. Filter Tool
16. Gauge Tool
17. Histogram Tool
18. Image Classifier
19. Image Manager
20. Image Modifier
21. Import Tool
22. Line Profile
23. Match Tool
24. Morphology Tool
25. Picture Tool
26. Pixel Change Tool
27. Point and Click Script
28. Polar Unwrap
29. Prompt Tool
30. ROI Manager
31. ROI Shape Fitter
32. Search Tool
33. Serial I/O Tool
34. Sound Tool
35. Status Tool
36. Text Tool
37. Threshold Tool
38. Twain Tool

AVI Player

This tool is the equivalent of the Picture Tool; however, it plays AVI files which can be used to prototype a program or a script. You can bring the AVI file in through the Device Manager as a plug-in and use it through the Picture Tool or you can view it through the AVI Player in a script. The advantage of using the AVI Player is so that you can string together a variety of customer bitmaps and convert them into an AVI (Start – Programs – Data Translation – DT Vision Foundry – DMP to AVI Converter) and use it as a live image coming through the script.

Arithmetic Tool

The Arithmetic Tool checks for any discrepancies between a saved bitmap of the image you will be processing and a moving image that will be taken through the Picture Tool.

Subtraction is the most commonly used feature. This works by taking a saved image and subtracting the input image (taken from the Picture Tool). The output will show if there are any discrepancies between the original perfect image and the production line input image.

If there any differences between the images, the output image will show that the image is black with various white pixels. This means that there are extra pixels in the image and therefore it is classified as a failure.

Barcode Reader

The Barcode Reader Tool simply reads the barcode indicated by the specified Region of Interest. The reader can handle different types of barcodes.

Blob Analysis

The Blob Analysis Tool is a very powerful tool which can be used for a number of scenarios, including looking for variables which can be analyzed for the purpose of evaluation and decision-making.

The Blob Analysis Tool has approximately 70 different statistics which can be used as variables; for example, number of blobs found, area, number of pixels, roundness, etc. Each statistic has a description, which fully highlights the reasoning behind the usage. Each statistic can be used in the “If Then” statements which can determine whether the product under evaluation is a pass or a fail.

The .dll which runs the tool can be altered to suit the user. Custom tools are very common and if the user feels that the tools would have more added value with differing statistics then a custom tool can be created.

For example, in a program written for checking whether a certain number of pens are running on a production line, the tool will not only pick up the pens by thresholding (to within the lighting requirements) but it will also fail items which are not within certain specifications, i.e. roundness, radius and circumference. If the pens fail the criteria, then the system will indicate that there is a failure and that the batch needs to be checked.

Calibration Tool



This is the tool which will help you receive accurate dimensions and measurements in your required units (pixels, millimeters, etc). This tool can be calibrated to a specific given unit if it has been given specific “world co-ordinates”. Once the tool has been given the image co-ordinates and the world co-ordinates, the algorithm then evaluates the differences between these co-ordinates and calibrates them against the other. You can then add this calibration file to each image or just a single image.

Color Plane Tool



This tool will give the script the access to the color sections of this program. You can specify the color HSL or YiQ or even the RGB of the image.

Contour Classifier



The Contour Classifier Tool can be used in many projects to solve a wide variety of problems. It is one of the most flexible tools that DT Vision Foundry has. It can be used for OCR, measurement, counting, categorization, identification and verification of many objects or products.

The way that this tool works is that an object is placed under the camera and then the tool is then “trained” on the object, finding the contour of the shape and storing it in a library. The user gives that specific contour a name and certain statistics are brought up about that contour. It uses scale invariance and rotation. The more you teach this tool, then the more catalogues it has of this object and its contours and the more accurate the results.

For example, it can distinguish between different keys for cars (see example on CD called “C:\Program Files\Data Translation\DT Vision Foundry\Scripts\ Measurement\KeyContours”). This example demonstrates that it can be used for classification of different objects at high speeds. If you wish to see an OCR example, then please look at “C:\Program Files\Data Translation\DT Vision Foundry\Scripts\Ocr\ClosedContour”. This will show you OCR reading through the Contour Classifier.

Custom Script



The Custom Script Tool allows you to use a BASIC-like script within a Point and Click Script. If you want to perform complicated mathematical functions on this derived information, you can use the BASIC language scripting provided by the Custom Script Tool. You can use all the point and click variables inside a BASIC script and create new point and click script variables from within the BASIC script.

The Custom Script Tool lets you debug the BASIC program that you have written and it will step through the lines with you to indicate whether or not the script is correct.

Data Matrix Barcode Reader



This tool locates the barcode within the image and reads the ECC200 code and gives you a number of outputs if specified in the property pages:

- Variable – i.e. Result from the Barcode Read
- Centroid co-ords for X and for Y
- Angle of the Barcode

This is a single function barcode reader and does not do multiple reads. In other words, if you want to read four barcodes on the same image, then you need four 2D Data Matrix Readers in the script. If you don't specify the ROI in the property pages, then the tool will scan the ENTIRE image for a barcode to read. In the property pages, you have various parameters ranging from contrast of image to module size. This tool features an auto-detect matrix size and a Solomon Auto-correction algorithm to indicate to the user when a barcode has failed.

Digital I/O Tool

The Digital I/O Tool will communicate with Data Translation's DT351 Digital I/O board and any Data Translation PCI frame grabbers which support onboard Digital I/O. The property page of this tool is accessible through the Device Manager. You have full Read and Write functions of supported I/O's. The tool functions are below:

- State a unique Line Name
- Variable or State of Line
- Pulse width (ms)
- Read Timeout
- Graphical display of your I/O triggering

You will use this tool if you are communicating with a PLC for a failure or rejection mechanism.

Display Tool

The Display Tool will be used to change the brightness and contrast of the image. This is basically changing the onboard LUT (Look-up Table).

Edge Finder Tool

This tool is another tool which relies on light-dependent thresholding to obtain an edge of an object. The Edge Finder allows you to extract points, edges, or contours from a binary image. You will draw a horizontal line across a product and you can threshold (even automatically threshold) the image to find the most accurate lines or points to measure from. This tool is very flexible and can be used with all ROI types. The tool finds edges that are within the object (black or white), at the transition from black to white or from white to black.

Export Tool

The Export Tool allows you to transfer variables and images from DT Vision Foundry to 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. These servers store data (variables and images) and provide access to that data to a client application, such as a Visual Basic program or another DT Vision Foundry application. The client application accesses the data by using the DTiX Variable Server tools and DTiX Image Server tools.

The Variables tab allows you to export variables from DT Vision Foundry to the DTiX Variable Server, a text file, or a Microsoft Excel worksheet. The Images tab allows you to export the values of the pixels in an image from DT Vision Foundry to either the DTiX Image Server or a Microsoft Excel worksheet.

This tool can be used to complete any SPC which the user may want to accomplish with Microsoft Excel. All the variables created in DT Vision Foundry can be exported to Excel for later analysis.

File Manager

The File Manager Tool is the most widely used tool when composing a point and click script to evaluate a product. The main function of this tool is to open reference images for the script to run against.

As mentioned earlier, the File Manager can also be used to open multiple images. This function is mainly for feasibility studies to make sure that the program that has been written works properly and will work with a variety of images. The tool opens a number of images that are written in the check box. Normally the bitmaps are called Image*.bmp as there needs to be a number of images and the * can be any number, i.e. Image1.bmp, Image2.bmp, Image3.bmp. They will all open as the Image*.bmp is a part of the name.

Filter Tool

The Filter Tool performs filtering on a given input image, placing the result in an output image. It performs filtering by running a single or dual kernel convolution. The tool provides default filters and allows you to add your own filters to its list by specifying user-defined kernels. Each kernel can be any size. The tool allows you to select the active cell (usually the center cell).

This tool can be used to filter out any spurious lighting which the user may not wish to be in the image for the analysis part of the project. This will eliminate errors.

Note: The Filter Tool performs filtering with respect to the active ROI of the input image. If no active ROI is present, the Filter Tool uses the whole image.

Gauge Tool

The Gauge Tool is a very complex device but is very simple to program and to use when certain objects need to be measured with regards to area, grey level average analysis, perimeter, etc. This tool will work with up to three ROI's to find the results.

Pick the two points that you would like to analyze and then suggest which parameter you would like the tool to check. For example, if it is the distance between two objects, the tool will calculate the distance on a number of variances (i.e. maximum distance, minimum distance, etc.). This point can be calculated in any units that you specify (from pixels to miles) using the Calibration Tool.

The Gauge Tool becomes very valuable when you need to check for writing on a product to verify that all the characters are present. The Gauge Tool will analyse the average grey to check whether or not all the characters match the original. The tool will pick up any changes from the set parameters by one pixel (if necessary).

Histogram Tool



The Histogram Tool 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 Microsoft Excel.

As with all DT Vision Foundry tools that use a graph to display data, the Histogram tool allows you to do the following:

- Change the min and max 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, labels etc)
- Change the colour and style of each curve on the graph.
- Zoom to a specified area using the mouse
- Switch between zoomed and non-zoomed modes by double-clicking the right mouse button.
- Re-size the graph.
- Print the graph.

Histograms are 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.

Image Classifier



The Image Classifier Tool allows you to classify (identify) images by comparing them to images that you catalogued previously. This tool is very similar to the Contour Classifier; however, this tool uses the entire pixel image rather than just the contour of the product. This tool can be used in many situations where identification and differentiation is required.

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.

An example of imaging classifying:

For classifying playing cards, you would need the cards to be in the correct position every single time (if this is not possible, you can use the Search Tool in co-operation with this tool so that you can find the card wherever it is in the image). You can then train the tool to recognize the 52 different cards. Take an image, give it a name and train it. All of this information is then kept in a catalogue which is created when you have finished training. You can then add this tool to your Point and Click Script. With a triggering camera, you can then capture an image of each card and the image classifier will determine which card is which. It will tell the difference between the two of clubs and the three of clubs.

Note: The input images used in a particular classification session must be the same size. The input ROI's (training images, mask images, and features under test) must be the same size.

Image Manager



The Image Manager is a tool which stores all the images that have been opened during the active project. The purpose of the Image Manager Tool is to manage images in memory. All open images are displayed in a list. Using this tool, you can 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 in the active viewport.
- Create a new image.
- Rename a specific image.

Image Modifier

This tool is a basic image manipulation tool. It will crop, rotate, or scale a specific ROI.

Note: If no ROI is specified, then the complete image will be identified as a default image for manipulation. The output image can be used for further analysis.

Import Tool

The Import Tool is the inverse of the previously mentioned Export Tool. It allows you to transfer variables and images into the DT Vision Foundry application from 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. These servers store 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.

The Variables tab allows you to import variables to DT Vision Foundry from either the DTiX Variable Server or a text file. The Images tab allows you to import images, along with information about the ROI's associated with the images, to DT Vision Foundry from the DTiX Image Server.

Line Profile Tool

This tool is very simple in principle and can be used in many projects. The Line Profile Tool lets you create and view line profiles of images. It allows you to add an unlimited number of line profiles to the same graph. You can add line profiles from multiple images and from multiple viewports. This tool allows you to measure distances and performs edge detection on your images.

Quite often in image processing, you need to compare two or more line profiles to distinguish some characteristic of one image from another image. To do this easily, you need the two line profile curves displayed on the same graph. Using this tool, you can easily compare two or more line profiles. As with all DT Vision Foundry tools that use a graph to display image data, you can do the following:

- Change the minimum and maximum x- and y-axis values.
- Change the grid markings for both the x- 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.

Match Tool

This tool's main purpose is to compare two images against each other and evaluate the correlation score. The score is the degree of similarity, with 1.00 being a perfect match and 0.00 being the worst match possible.

Morphology Tool

The Morphology Tool lets you perform binary morphology operations on binary images. It provides the following morphological operations:

- Erosion: Erodes a foreground object by removing pixels that touch the background. This tends to shrink and smooth foreground particles.
- Dilation: Dilates a foreground object by adding onto pixels that touch the background. This tends to grow particles and fill small holes in foreground particles. It is the opposite of erosion.
- Opening: An erosion followed by a dilation. It opens up spaces between particles that touch one another.
- Closing: A dilation followed by an erosion. It is the opposite of opening. It tends to join touching particles and fills small holes in foreground particles.
- Skeletonization: A process that finds a line replica of the particle.
- Watershed: A process of separating touching or overlapping particles.

Picture Tool

The Picture Tool lets you acquire images through your Data Translation frame grabber. The Picture Tool does not vary with the frame grabber that you have installed, as it can work with any Data Translation PCI frame grabber. All the settings are automatically brought up when the specific frame grabber that you are using is selected. This saves time when writing a Point and Click Script.

The Picture Tool offers a variety of options:

- Plug-in
- Device to be used
- Source number
- Storage Type
- Image Name
- Average
- Image Count
- Enable Time Stamping
- Calibration

The Picture Tool can produce 8-bit greyscale, 16-bit greyscale (digital) and 24-bit color images.

The Picture Tool is the anchor point for the Point and Click Script writing process. Nearly every program written in DT Vision Foundry will require the Picture Tool to take the image for the software to analyze.

Pixel Change Tool

The general purpose of this tool is when an active ROI has been found or created this tool allows you to actively change the color or overlay to highlight the ROI's found and if needed to be used for further analysis. This tool allows you to select either certain specific ROI's or every ROI within an image.

Point and Click Script

The Point and Click Script Tool is the main tool used in DT Vision Foundry. It contains all of the tools you are using in an application, along with their specified properties. All .pcs files are opened through this tool. The flow of the program is controlled by the order in which you drag and drop the tool icons. It includes the following functions:

- Edit – This edits the program (i.e. individual tools)
- Delete – Lets you delete tools.
- Step – This will step through the program tool by tool. This is helpful when debugging the program.
- Run/Stop – This will let you run or stop the program.

Other functions contained in this tool are:

- While Loop
- Do While Loop
- For Next Loop
- If Then
- Failure Item
- Assign
- Delay
- Stop

There are built-in traffic lights which will show you if something is wrong with the program. In the Options section there are a variety of settings that can be changed to control the flow and speed of your script.

Polar Unwrap Tool

This tool will unwrap polar co-ordinates and transpose them into linear co-ordinates. For example, it will take a round bottle top saying "Coca-Cola" and unwrap it so that the words are linear and not round. This will make it easier for measurements and OCR, if your OCR tool is not 360 degrees.

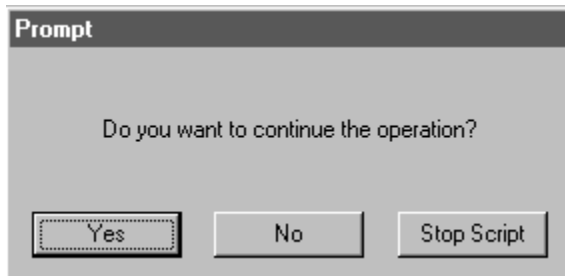
Prompt Tool

The Prompt Tool allows you to display one of the following types of prompt to the end-user while a Point & Click Script is running:

Button prompt – A prompt that the 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 user to stop the script, if necessary. You can also specify whether or not you want the Point & Click Script to continue running when a Button prompt is displayed.

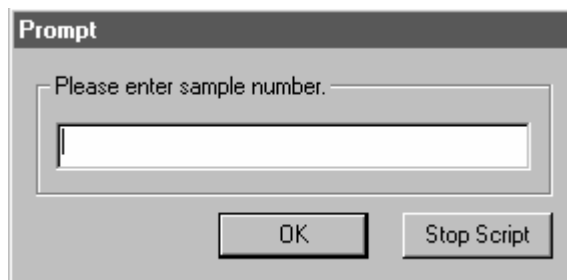
Note that the script stops only if Stop (on script failure) is selected in the Failure Options dialog box in the Point & Click Script Tool. To access the Failure Options dialog box, select Options /Failure Options.

An example button prompt is shown below.



Text prompt – A prompt that the user responds to by entering text in a text box. The Prompt Tool provides a Stop Script button that allows the 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.

An example text prompt is shown below.



Note that the Point & Click Script always stops running when a text prompt is displayed. This allows the 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 user enters text and then clicks OK, the script automatically continues running.

ROI Manager

The ROI Manager is a very useful tool for when you have to accurately position any number of ROI's. The ROI Manager also works very well with the Search Tool. When the Search tool has positioned its new co-ordinates, then the ROI Manager can verify that the ROI's that you have added into the tool will follow the new co-ordinates that the Search Tool has generated. The ROI Manager positions the ROI's wherever the programmer specifies. The tool remembers where the position is when the ROI is saved as a file and attaches it as part of the program. As many ROI's can be positioned as the user requires.

ROI Shape Fitter



This tool 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.

Search Tool



When a vision system is running automatically and the product passing under the camera does not always arrive in the same position each time, the system may not function as required. The Search Tool actually finds a certain point on the image no matter where it may be on the screen. This tool will also work with varying lighting conditions. The better the consistency of the lighting, the greater the efficiency of the tool. The Search Tool can be used in a variety of conditions, however. Many options can be selected so that the lighting does not contribute as a failure factor (for example, fft, direct ex and mmx).

If the position of the article changes every single time and you would like the regions of interest to move as well then you can position the ROI's to follow. You can use the ROI Manager to do this.

Serial I/O Tool



This is another communications tool which will allow you to send more than just a TTL level signal to a PLC. This tool will send information, co-ordinates, and variables you require to another computer. The Serial I/O Tool allows you to send and receive data through the serial ports of your computer. This allows you to interface DT Vision Foundry to peripheral equipment.

The Serial I/O Tool allows you to perform 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 objects, string objects, and formatted number objects.
- The tool provides a prefix and a suffix that can be a text object, string object, or ASCII control characters.
- Provides separate timeout values for reading and writing data.
- Enables point & click scripting.

Sound Tool



This tool will simply play a .wav file on demand. This is useful when the user wishes to have a siren or alarm play when a product has failed a test or has not met certain criteria set out in the Point and Click Script. You can have as many sound tools as you wish in the script. They are normally inside of an IF Then statement.

Status Tool

This is the front interface when the program is running. It displays pass/fail criteria and numbers so that it is easier to view the percentage of good throughput on the screen. This tool will also do the following:

- Save Pass/Fail images
- Save Pass/Fail variables with a time and date stamp
- Show warnings
- Show variables

Text Tool

The Text Tool is a visual aid for the passing and the failing of the products being tested using the Point and Click Script. Any alphanumeric text can be entered into the tool and placed anywhere on the image that is being processed. It can be triggered by using the IF Then function of the Point and Click Script. When the IF Then statement becomes true, then the text will be displayed.

For example, when you need to pass or fail products, the Text Tool is used to display the result. This is done by typing PASS or FAIL into the Text Tool and setting the message to fire whenever the statements become true.

Threshold Tool

The Threshold Tool supplied with DT Vision Foundry allows you to threshold an image to create a binary image. A binary image has all pixels values set to either 1 (foreground/black) or 0 (background/white). The Blob Analysis Tool and Binary Morphology Tool requires binary images.

The Threshold Tool is completely compatible with all other tools, ROI's and images.

Twain Tool

This simple tool allows the user to acquire 24-bit color or 8-bit greyscale from any Twain Device such as scanners.