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Getting Started with Visionscape GigE Cameras

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Disclaimer

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Latest Manual Version

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For current warranty information, see: **www.microscan.com/warranty**.

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PREFACE

Welcome

Purpose of This Guide

This guide is designed to get your Visionscape GigE Camera up and running quickly.

The following topics are covered in this guide:

- Instructions on how to set up and connect Visionscape GigE Camera(s) to a network.
- Instructions on how to install Visionscape software for use with your Visionscape GigE Camera in a Windows 10 or 7-equipped PC.

Conventions

The following typographical conventions are used throughout this guide:

- Items emphasizing important information are **bolded**.
- Menu selections, menu items and entries in screen images are indicated as: Run (triggered), Modify..., etc.

Preface

CHAPTER 1 Before You Begin

Before you connect and set up the Visionscape GigE Camera(s), be sure you have all of the necessary components. This section helps you prepare for a successful installation. Chapter 2, Setting Up the GigE Camera, describes the actual installation process.

Visionscape Hardware

Visionscape can run with several types of devices:

Visionscape GigE Cameras — These are imaging devices that connect to the PC via a Gigabit Ethernet connection. All vision processing is performed on the PC.

Visionscape Software System — Visionscape can mimic a hardware system by software emulation. The software system may be used for application development using stored images and allows full operation for a limited duration without a software key.

Figure 1–1 shows supported Visionscape hardware. All smart cameras and Visionscape GigE Cameras are supported by the same application environment.

FIGURE 1–1. Visionscape GigE Camera

Visionscape GigE Camera

Package Contents

Unpack your components and check them against the System Configuration Sheet. If any item is missing or damaged, contact your Omron Microscan distributor.

Important: Keep the system configuration sheet. You will need to refer to the part numbers and descriptions during system installation. After the installation, keep the system configuration sheet for future reference.

Components

In addition to your Vision System, you may need the following items, which can be ordered directly from Omron Microscan:

- Lenses
- Lighting Components
- Strobe/Trigger, Power, and Network Cables
- Network Components such as Switches and NIC (Network) Cards
- PCIe I/O Kits

PC Requirements

The Minimum requirements for a PC running Visionscape are as follows:

Supported Operating Systems:

- Microsoft Windows 10 (64-bit)
- Microsoft Windows 7 (32-bit and 64-bit)

Hardware Specs:

- Minimum of 2GB memory for Windows 10 and 7
- 1 Gigabit Ethernet port reserved for use with Visionscape GigE Cameras
- If I/O is required: one open PCIe slot for the available Digital I/O board

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CHAPTER 2

Setting Up the GigE Camera

This chapter describes the process of connecting Visionscape GigE cameras to your PC. After reading this chapter you will be able to acquire images with your cameras and use them in vision applications.

Install Visionscape Software

Before installing, be sure you are logged into the computer with an account that has administrator privileges. Also, be sure to disable any virus protection software you are running.

Note: By default, Visionscape is installed to C:\Vscape. The software will not function correctly if it is saved to a location other than N:\Vscape, where N is the selected drive.

Install Visionscape software by inserting the Omron Microscan Tools Drive into your Windows 10 or Windows 7 PC. Navigate to the page shown here:

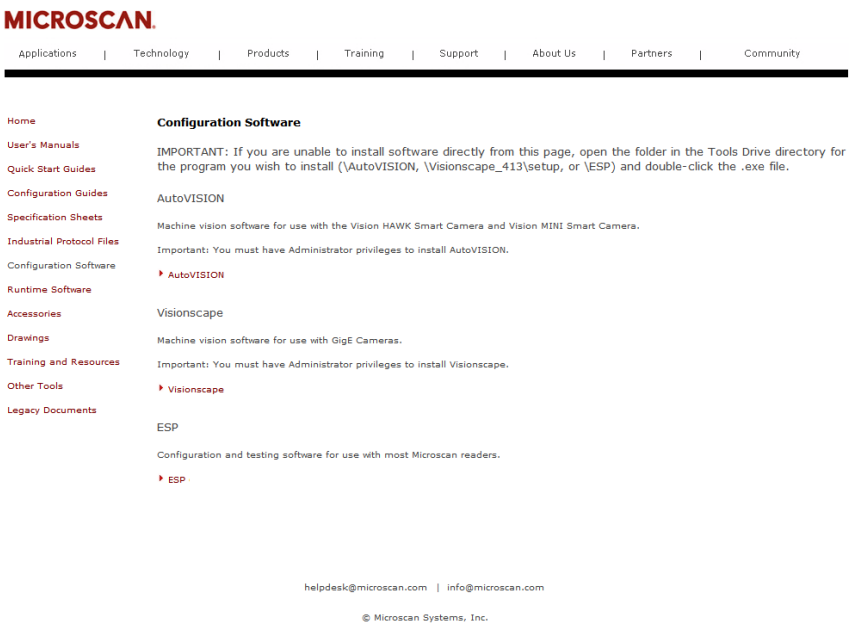


FIGURE 2–1. Configuration Software Screen

Click the “AutoVISION” link and follow the installation prompts to install the most recent version of Visionscape. Note that the most recent version of Visionscape is installed simultaneously with the most recent version of AutoVISION.

The installation will create the C:\Vscape folder on your hard drive if necessary and will install the Visionscape software into a version specific folder. For example, version 6.0.1.10 would be installed in the folder 601_10.

The installation creates a Program Group named “Omron Microscan Visionscape” in your Start Menu, and icons for FrontRunner and AppRunner are added to your desktop. Tutorial Jobs and Images are installed in:

c:\vscape\tutorials & samples\...

Plug In Your USB License Key

Once Visionscape is installed and you have rebooted your PC, you should plug in your Visionscape USB license key.

Configure Gigabit Ethernet Adapter(s) In Your PC to Use Static IP

To maximize the speed and reliability of your GigE system, we recommend that you set up a private network using Static IP addresses on the Gigabit Ethernet ports in your PC that will be connected to GigE cameras. In this section we will explain how to do this.

Open the “Network Connections” window

Go to the Windows Control Panel, and double-click on the “Network Connections” option.

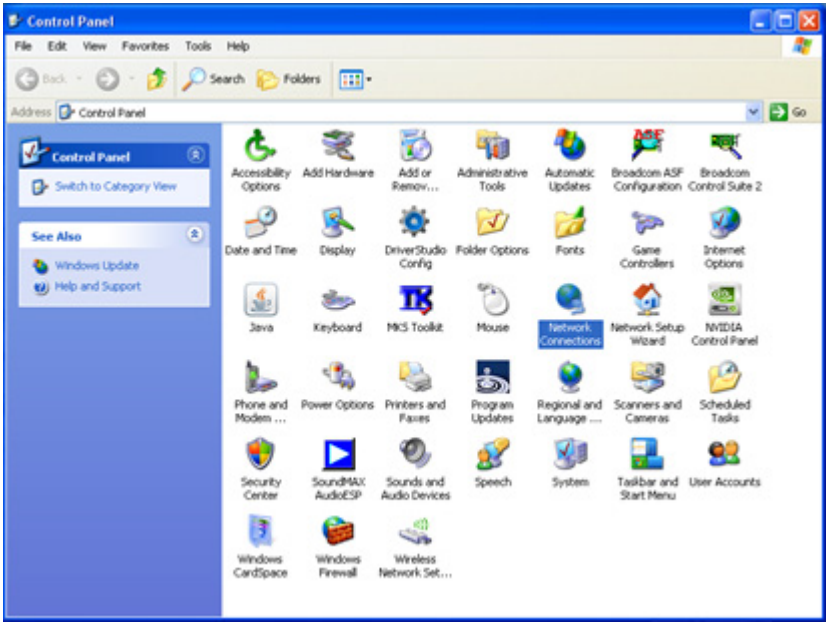


FIGURE 2–2. Control Panel View

The following example shows what the Network Connections window might look like if you have a 4-port Gigabit Ethernet adapter installed in your PC.

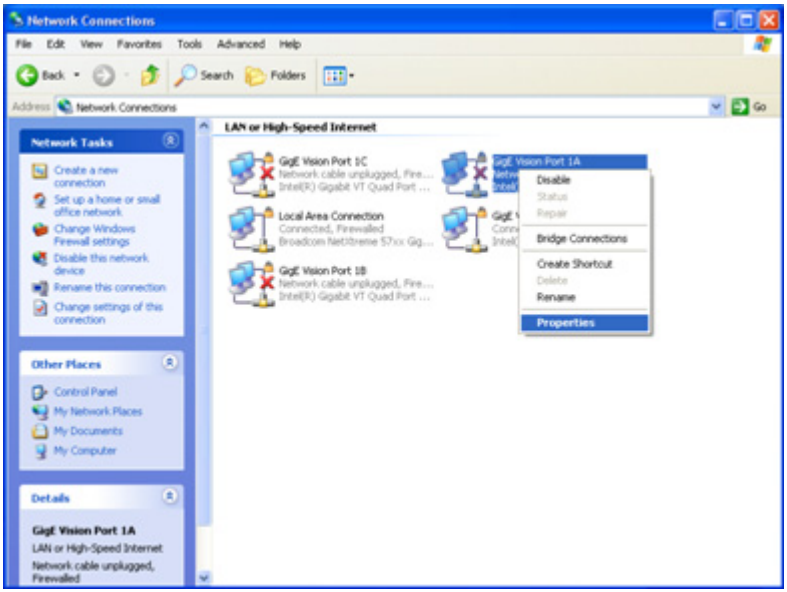


FIGURE 2–3. Network Port Properties

Right-click on one of the Gigabit Ethernet ports (e.g. GigE Vision Port 1A, as shown above) and select Properties.

Configure Network Properties

In the properties window, select Internet Protocol (TCP/IP) and then click the Properties button.

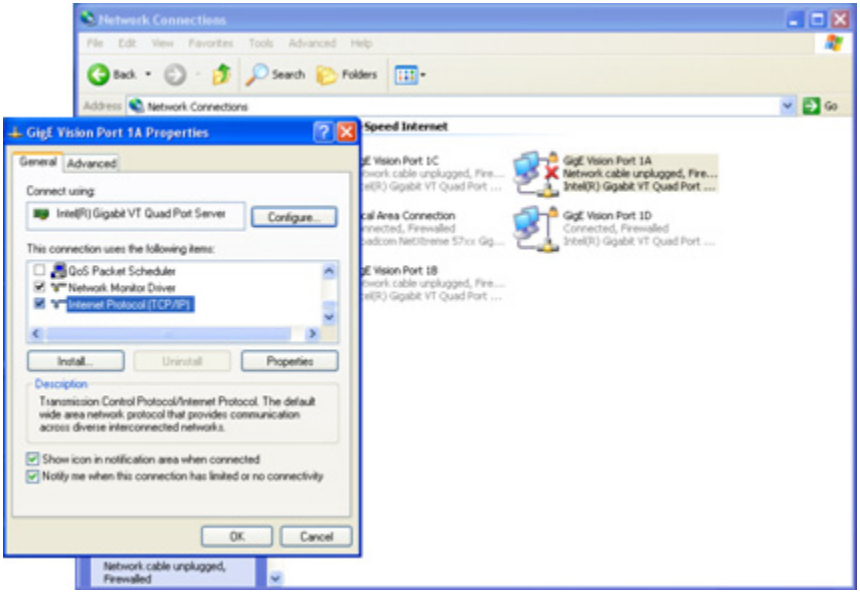


FIGURE 2–4. Network Properties Page

On the General Tab select “Use the following IP address” radio button and enter the IP address as 192.168.XXX.2 where XXX can be from 1 to 254. 192.168.XXX.UUU is a local private Class B network. The Subnet Mask is set for a Class C Network and the Default gateway is set to the same class C network with a host ID of 1.

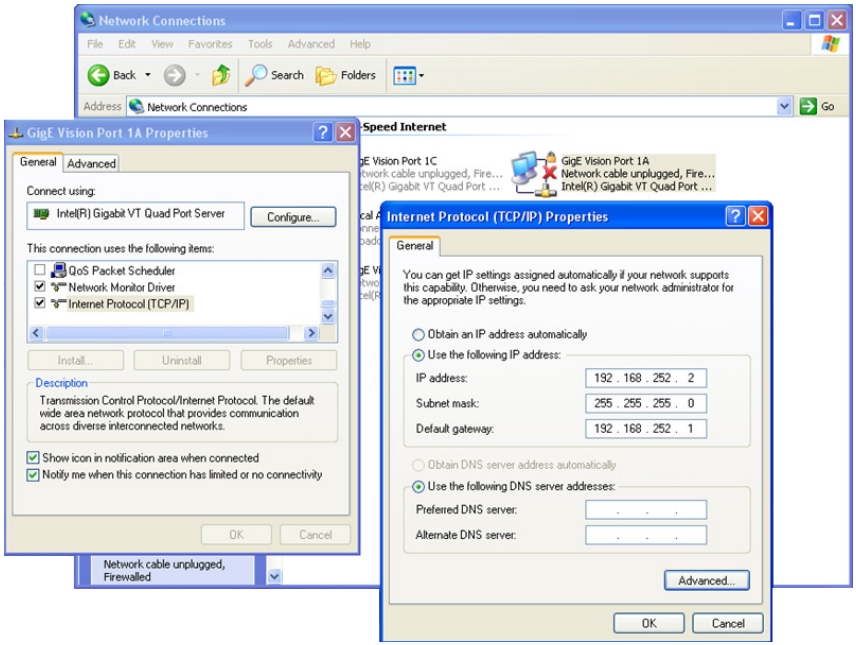


FIGURE 2–5. TCP/IP Property Page

The setup of your network adapter is now complete. Visionscape software will automatically configure your Omron Microscan GigE cameras to be on the same network.

Connect Cables to Your GigE Camera(s)

Connect the included power and Ethernet cables to the back of your Omron Microscan GigE camera.

FIGURE 2–6. Omron Microscan GigE Camera Connectors

Note: If you choose not to use the Ethernet cable supplied with your Omron Microscan GigE camera, be sure to use a CAT6 cable. DO NOT USE CAT5 CABLES – they are not rated for GigE speeds.

Connect the GigE Camera(s) to Your PC

For maximum performance, we recommend that you connect your GigE cameras directly to your PC, and not to your company network. You can do this in one of two ways:

1. Point to Point connection. You will connect your Ethernet cables directly to the ports of the Gigabit Ethernet adapter(s) in your PC. If you choose this approach, and you are using multiple cameras, you will either need to install multiple Gigabit Ethernet adapters in your PC, or use a multi-port adapter.

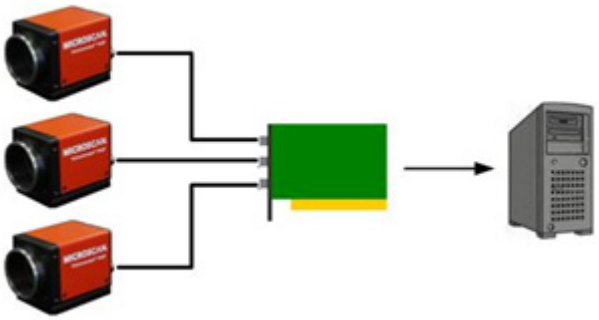


FIGURE 2–7. Point-to-Point Connection

2. Gigabit Ethernet Switch. Use this configuration when you only have one Gigabit Ethernet port in your PC and you wish to use multiple cameras. Connect your cameras and your PC to the switch. Be sure to use a Gigabit Ethernet switch, such as Omron Microscan part number 98-000131-01.

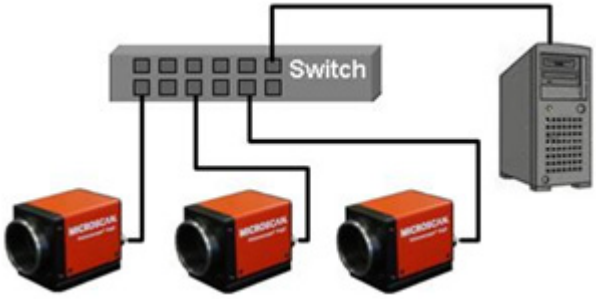


FIGURE 2–8. Gigabit Ethernet Switch

Take Your First Picture

You are now ready to start taking pictures with your Visionscape GigE cameras. Visionscape provides a program called FrontRunner which acts as the engineering interface. You will use this application to create and test your vision application, as well as to check your camera setup. When you launch FrontRunner for the first time, your GigE cameras will be automatically discovered and configured on the private network set up in the previous step.

Start FrontRunner

Start up FrontRunner by going to the Windows Start Menu > All Programs > Omron Microscan Visionscape > Visionscape FrontRunner. Assuming your license key is plugged in and your cameras have been detected, the FrontRunner screen should display the GigE Software System icon in the Device Toolbar.

FIGURE 2–9. FrontRunner Screen

Select the GigE System

FrontRunner provides a Device Toolbar at the top of the main window that lists all of the available Visionscape devices. A single GigE device, named “GigEVision1”, is created to provide access to all of your GigE cameras. Before we can do anything, we must tell FrontRunner that we want to work with the GigE Device by selecting it on the toolbar.

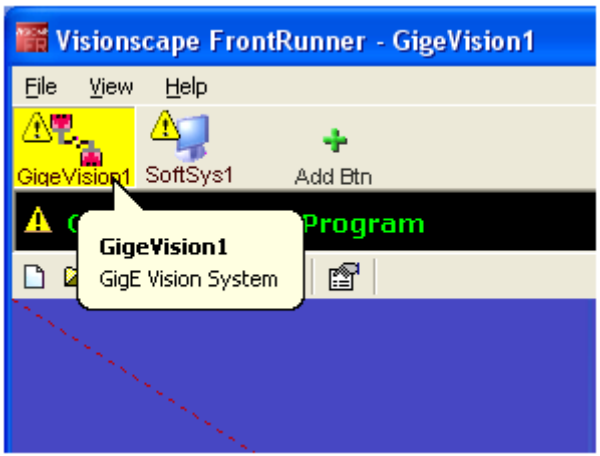


FIGURE 2–10. Select GigE System

Create a New Job for Your GigE System

Before we can take pictures with our GigE cameras, we must create a new vision Job to run on our GigE device. Do this by clicking on the “Create New Program” icon on the toolbar.

FIGURE 2–11. Create New Job

This will create a default job that contains a single Inspection that contains a single Snapshot Step. The Snapshot Step is responsible for taking pictures. Refer to the FrontRunner manual and the Visionscape Tools Manual for more details on creating applications with Visionscape Step programs.

Take a Picture

Now that we have a Job loaded, FrontRunner should look like this:

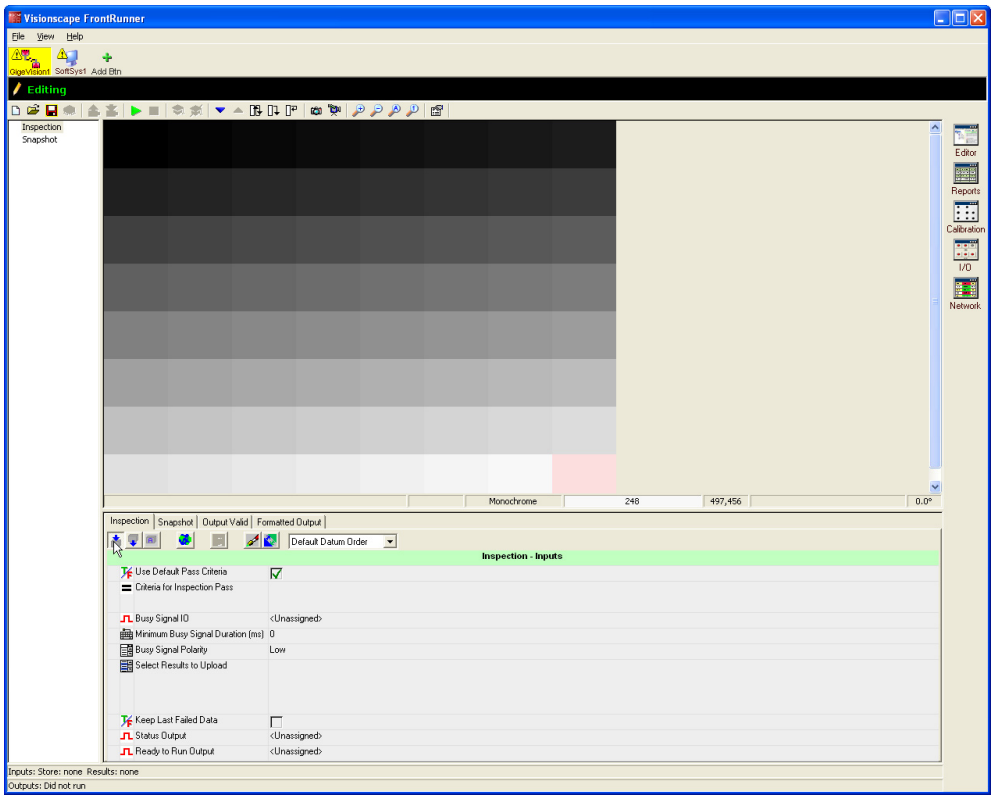


FIGURE 2–12. FrontRunner with Job Loaded

You can now take a single picture with your first GigE camera by simply clicking on the Acquire icon on the Setup toolbar:

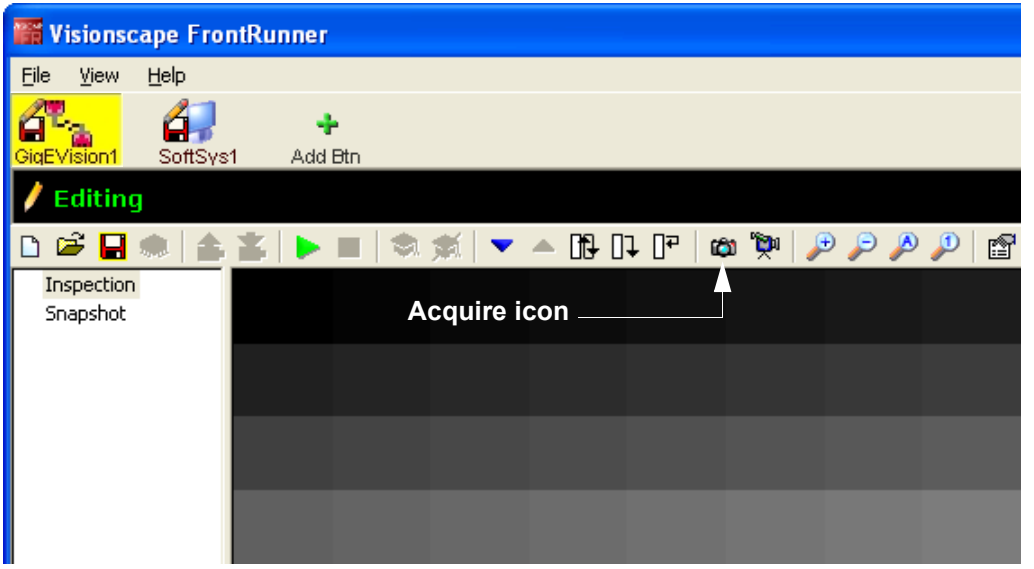


FIGURE 2–13. Acquire

Or you can activate Live Video mode by clicking on the Live Video button:

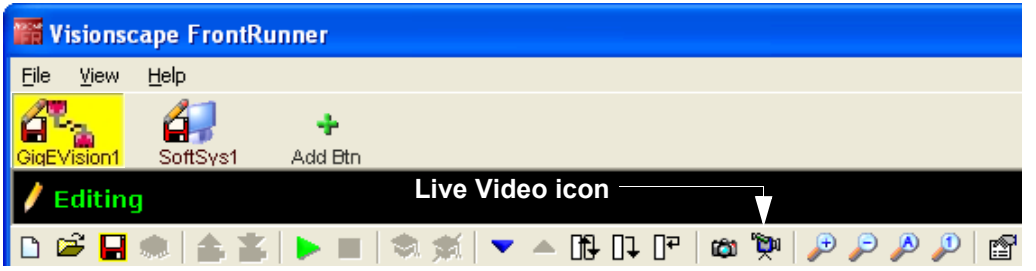


FIGURE 2–14. Live Video

Picture Taking Notifications

If camera hardware trigger is being used, PicExpose and PicDone are unreliable. Equivalent logic can be implemented in the job using Digital Output Steps.

Change the Selected Camera

In the previous steps we showed how to acquire single images or live video from your first GigE camera. If you are using more than one camera, and want to check images from additional cameras, you have two options:

1. Add additional Snapshot Steps to your Job, and configure each to connect to your other cameras.
2. Simply reconfigure the current Snapshot step to use a different camera.

Option # 1 goes beyond the scope of a “Getting Started” manual, please refer to the Visionscape Tools Reference Manual for more information on building Step programs. We will explain option 2 here.

Select the snapshot step in the “Job List” window on the left side of the main window:

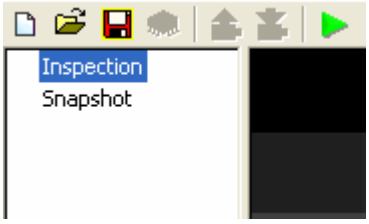


FIGURE 2–15. Change Selected Camera

When you select a Step in the Job List, all of its parameters are displayed in the properties window at the bottom of the main window. Click on the “Acquire” tab at the top of the properties pane, as shown here:

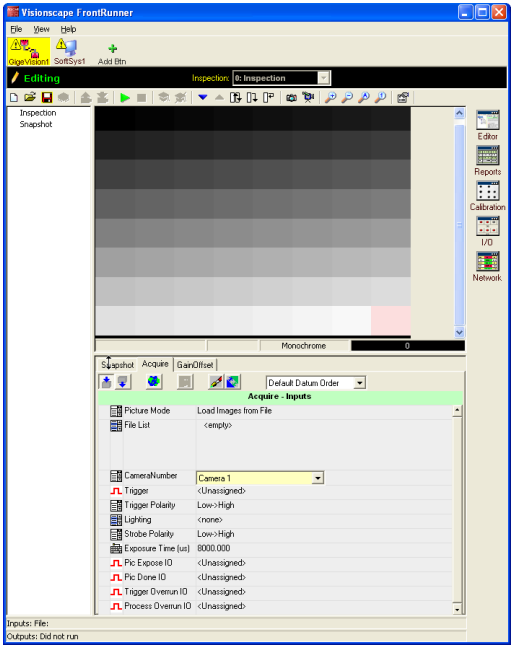


FIGURE 2–16. Select a Step in the Job List

If you look at the “Camera Number” parameter, you will see that “Camera1” is currently selected. This corresponds to the first GigE camera that was discovered when you started FrontRunner for the first time. Change the selection to “Camera 2” by clicking on the parameter and using the combo box that pops up.

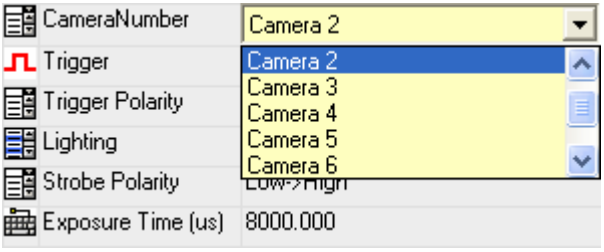


FIGURE 2–17. Change Camera Number

General Location Considerations

You can place the Visionscape GigE cameras in most environments without any concern for special enclosures or cabinets. Consider the following when locating the cameras and their associated components:

- Ensure that the camera, strobe, and any other cables are long enough to reach your PC.
- The Ethernet cable can be affected by interference from an electrical transformer or heavy machinery. In these circumstances make sure the cable is properly shielded.
- Avoid severe vibrations.
- Locate the components to avoid accidental bumping.
- Protect your PC and components against dust, humidity, extreme temperatures, and extremely harsh environments.
- Protect the viewing area from excess ambient light.

Environmental Requirements

The environment of your PC is important for maintaining a reliable system. You should consider the humidity, temperature, foot traffic, and fresh air flow before permanently mounting your system. Refer to the following manuals for specific information regarding environmental requirements:

- Visionscape GigE Camera Guide

CHAPTER 3 Advanced Tool Tutorials

These tutorials provide you with a basic functional understanding of Visionscape. They progress in difficulty., and they will teach the first time user to build a Job, run the Job, and observe the results. The tutorial avps are installed under \\Vscape\Tutorials & Samples on your PC's hard disk.

Visionscape is a very powerful, complex, and infinitely configurable tool. As a result of this flexibility, it is not possible to explain and document every possible scenario of creating a Job without the aid of a factory qualified training class. These tutorials are not meant to replace a training class; rather, they are provided as a companion to the training class. The tutorials are:

Tutorial 1 — Defect Detection with Flaw Tool

FrontRunner Job:

Start > Visionscape > Visionscape Tutorials & Samples > Tutorials > GigE Systems > Defect Detection with Flaw Tool > tutorial_flawtool.avp

Flaws are described as chips, pits, scratches, texture variations, finishing abnormalities, burrs, bumps, inclusions, dents, dings, and general imperfections.

Flaw detection, inspecting for flaws, is being able to detect and then quantify a flaw. Detection of flaws requires proper lighting and a processing algorithm.

This tutorial shows you how to use the Flaw Tool to inspect flaws on ICs. All images used in the tutorial have the same text as the foreground. We will be inspecting for flaws in the background of the images. To inspect the background, we use a masking tool to mask out (hide) the mask in the foreground and apply the Flaw Tool algorithm on the background. The tools we use to solve this inspection problem are a Flaw Tool, a StaticMask Tool and a ThreePt Locator. The ThreePt Locator locates, or finds, the mask on the IC in the image. The part coordinates make sure the vision tools are run at the correct locations on the part. This is called Dynamic Location. Visionscape re-samples the image and moves the relevant section into place to accomplish this.

1. Start FrontRunner by selecting Start > Visionscape > Visionscape FrontRunner. FrontRunner displays its main window.
2. Select a Visionscape Device on the FrontRunner Device Toolbar.
3. Start creating a new Job by clicking  .
4. To display the Job Tree and Step Tree Editor, click 

.

This allows you to view your Job as you create it.

Note: Maximize or minimize the Editor as needed to accomplish the steps in this procedure.

---

5. Highlight Acquire in the Step Tree (left pane). FrontRunner displays the Acquire properties page.

Note: You may have to click the Acquire tab in the properties window.

6. Adjust the following settings:

   – Picture Mode — Set to Load Images from File.

   – File List — Click <empty>, and then Add... to display the Open dialog box. Browse for the file, text02.tif, from Windows. It is located at: C:\Vscape\Tutorials & Samples\Tutorials\GigE Systems\Defect Detection with Flaw Tool\. Select text02.tif and click Open.

     Note: This file was installed when you installed Visionscape. If you installed Visionscape to a location other than C:\Vscape, replace it with the appropriate drive and directory designation.

7. In the Setup window, to view text02.tif, click  .

Inspection Snapshot

FIGURE 3–1. text02.tif

8. Maximize or open the Editor window by clicking 

.

9. Right click Snapshot in the Step Tree (left pane) and select Insert Into to display the Insert Step window. Click the Analysis Tools tab. Double click on ThreePt Locator to insert it into the Snapshot.

10. Right click ThreePt Locator, select Insert Into, and click the Image/PreProcessing tab. Double click Rect Warp to insert it into the ThreePt Locator. The Rect Warp and ThreePt Locator dynamically relocate the region to be inspected.

11. Right click Rect Warp, select Insert Into, and click the Analysis Tools tab. Double click on Flaw Tool to insert it into the Rect Warp.

12. Highlight Flaw Tool in the Step Tree (left pane).

13. Adjust the following parameters for the Flaw Tool:

    – Tool Method — Count Pixels within Range of Intensities.

    – Min Intensity Value to Include — 135.

    – Max Intensity Value to Include — 255. These numbers may be adjusted after we have learned about our parts.

    – Graphics Level — Show Details and Mask.

14. Right click Flaw Tool, select Insert Into, and click the Image/PreProcessing tab. Double click on StaticMask Tool to insert it into the Flaw Tool. StaticMask Tool eliminates the foreground text in the image.

15. Highlight StaticMask Tool and adjust the following parameter:

    – Number of Adjustments — 2.

16. The Job you created should look like the example shown in Figure 3–2.

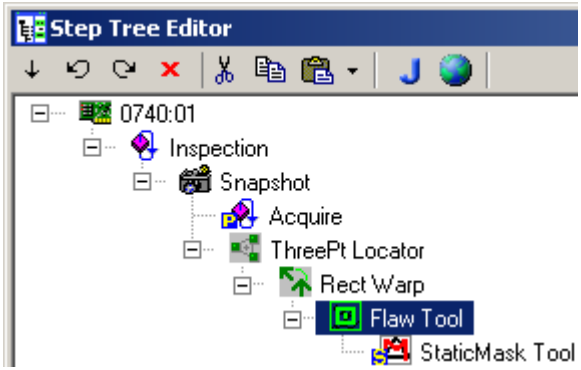


FIGURE 3–2. Defect Detection Flaw Tool Job Tree

 allows you to step through your Job as you set up and train each tool. A green check mark will appear next to each tool when you click this button.

17. Minimize the Editor.

18. Highlight Snapshot (left pane).

19. Click  .

    Snapshot acquires the image and displays it in the Setup Window.

20. Highlight ThreePt Locator (left pane).

21. To set up the ThreePt Locator, you will move and size Find Pin 1, Find Pin 2, and Find Pin 3 (Figure 3–3). The outer box is the Find Pin ROI. The inner box is the Template Find Pin.

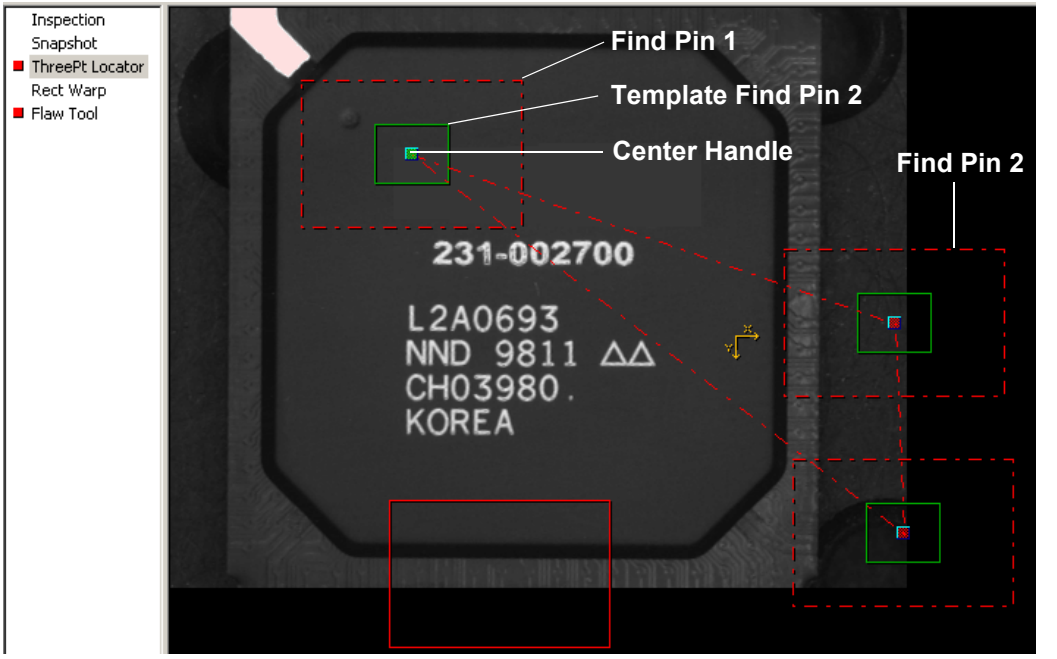


FIGURE 3–3. Find Pin Locations

22. Move and size the Find Pin ROI for the three Points. Your setup for ThreePt Locator should appear as shown in Figure 3–4.

FIGURE 3–4. Setting Up the Three Pt. Locator

The ThreePt Locator step and the Train button will display a red box until you have trained the tool. Also, the boxes around the untrained tool will remain dotted lines until trained.

23. Train the ThreePt Locator by clicking  .

A trained ThreePt Locator will appear as shown in Figure 3–5.

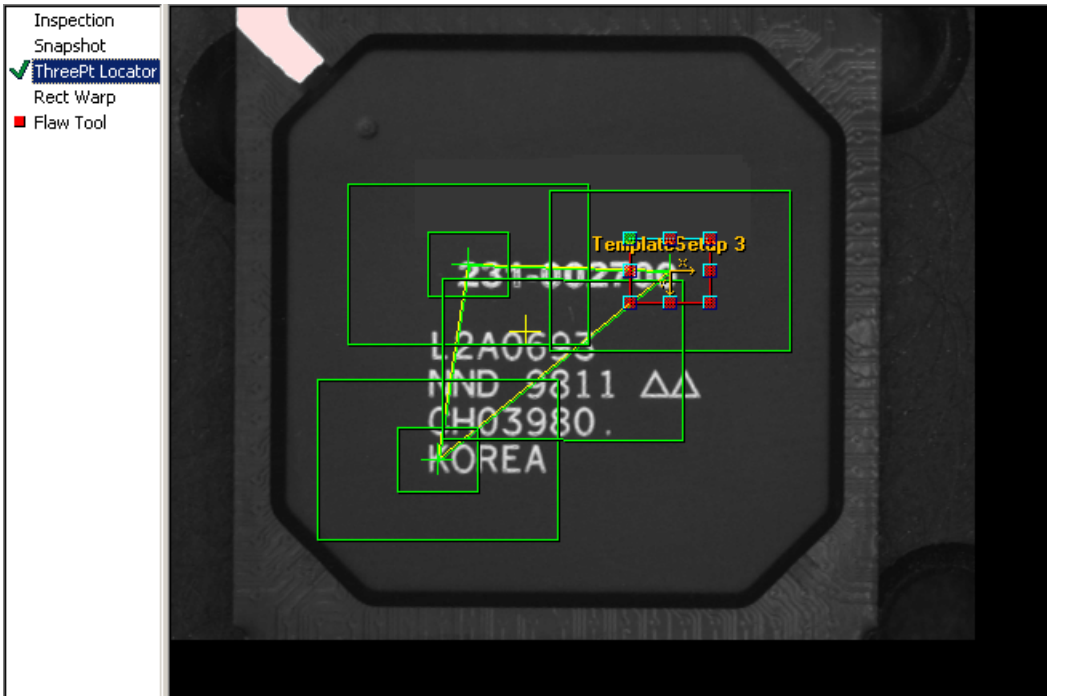


FIGURE 3–5. Three Pt. Locator — Trained

Observe that the ThreePt Locator has a green check mark in front of it, indicating that it has been trained successfully.

24. Highlight Rect Warp (left pane).

25. Move and size the Rect Warp ROI so that it encloses the area to be inspected, as shown in Figure 3–6.

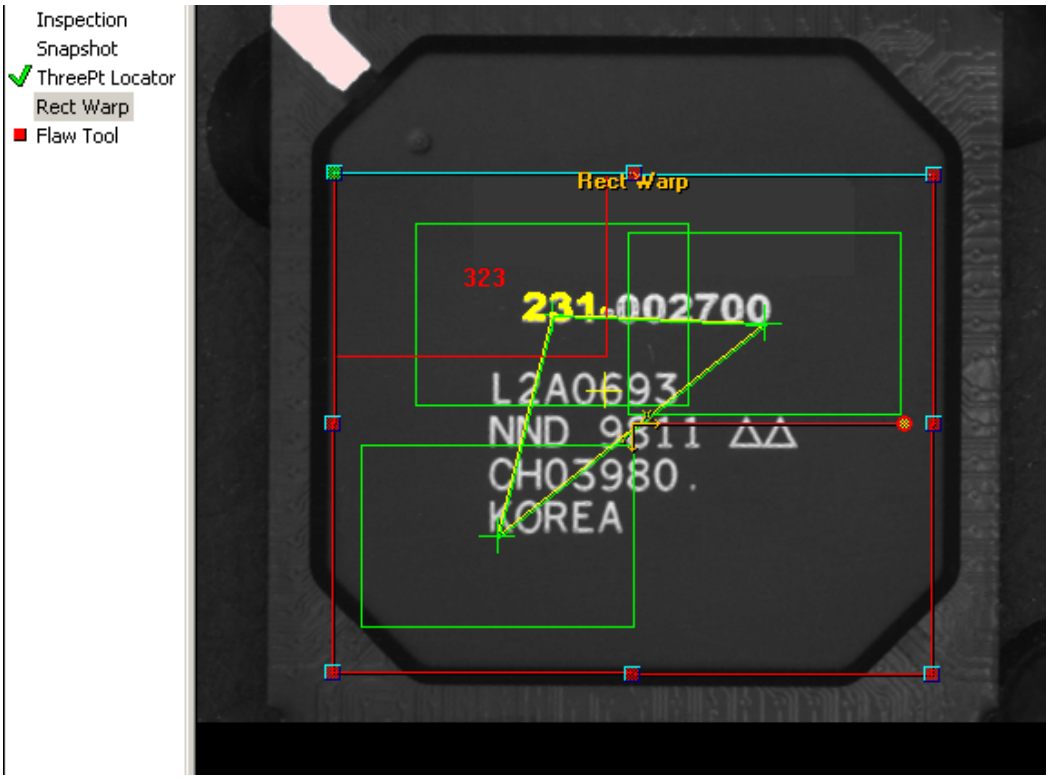


FIGURE 3–6. Rect Warp ROI Positioned

26. Click  .

Observe that Rect Warp has a green check mark in front of it, indicating that it has been trained successfully.

27. Highlight Flaw Tool (left pane), as shown in Figure 3–7.

FIGURE 3–7. Flaw Tool ROI

28. The text02.tif image is reduced to the size of the of the Rect Warp ROI. The Flaw Tool is not a trainable tool. However, it becomes trainable when the StaticMask Tool is inserted into it. Move and size the Flaw Tool ROI to enclose the area shown in Figure 3–8.

Note: You can also right click in the image and select Maximize ROI.

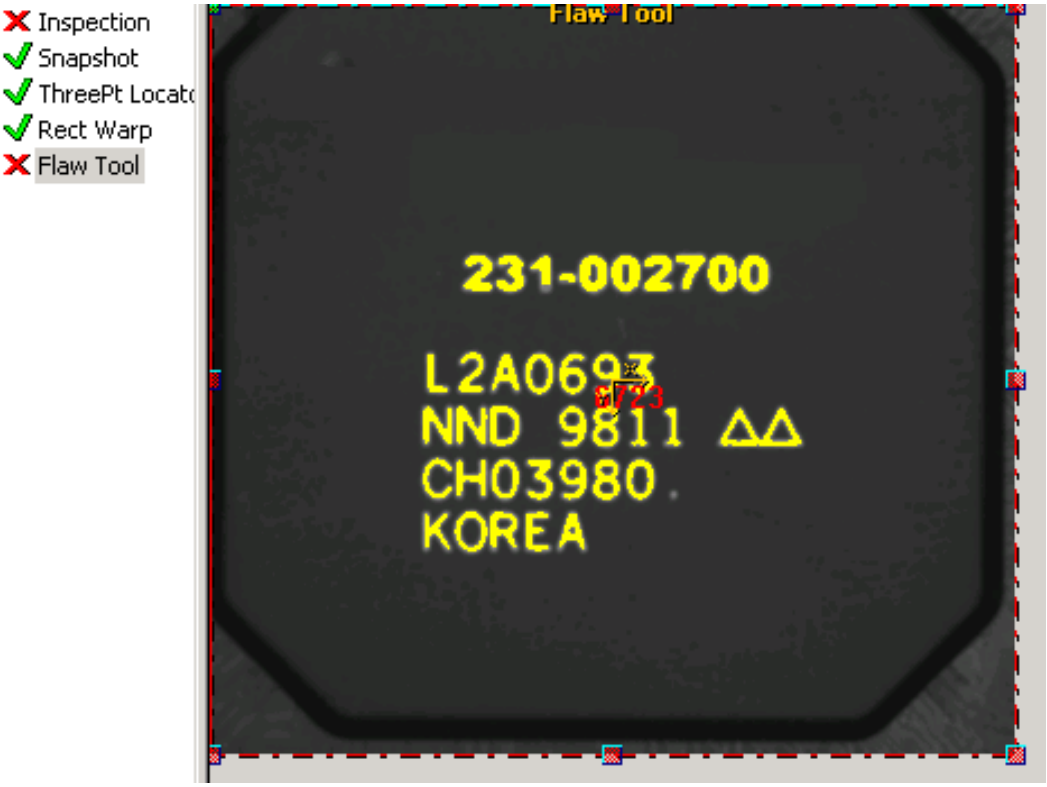


FIGURE 3–8. Flaw Tool ROI Sized

29. Click  .

    Notice that the foreground, the text, which is the mask pixels, will be green, then yellow, as shown Figure 3–8.

30. Click  to complete your Job.

    The masked parts will be red and then yellow.

31. To run the program once and then stop, click  .

This will run your Job once to verify your setup and settings. The inspection should pass. This is indicated by a green check mark next to the inspection.

Now is the time to add more images to the inspection. The images text02.tif and text03.tif are good (pass). The image text06.tif is bad (fail). This tutorial is designed to catch bad parts. This will enable you to see the bad image that the inspection failed because it was outside of the limits that were set.

32. Maximize or open the Editor window by clicking 

.
33. Highlight Acquire in the Step Tree (left pane).
34. Adjust the following setting:
    - File List — Click to the right of File List, and then click Add... This displays the Open window. Browse for the files text03.tif and text06.tif from Windows. They are located at: C:\Vscape\Tutorials & Samples\Tutorials\GigE Systems\Defect Detection with Flaw Tool\. Hold down the Ctrl key and select text03.tif and text06.tif and click Open.

      Note: These files were installed when you installed Visionscape. If you installed Visionscape to a location other than C:\Vscape, replace it with the appropriate drive and directory designation.
35. Minimize or close the Editor window.
36. To run the program on the PC in a continuous loop, click 
.

    This will run a continuous loop of all the images and display a red square next to the steps that fail.

    You can also click  to run each image, one at a time, to view results.

Tutorial 2 — OCV Fontless Tool

FrontRunner Job:

Start > Visionscape > Visionscape Tutorials & Samples > Tutorials > GigE Systems > OCV Fontless Tool > tutorial_ocvfontless.avp

The OCV Fontless Tool is very useful in detecting font discrepancies.

1. Start FrontRunner by selecting Start > Visionscape > Visionscape FrontRunner. FrontRunner displays its main window.
2. Select a Visionscape Device on the FrontRunner Device toolbar.
3. Start creating a new Job by clicking  .
4. To display the Job Tree and Step Tree, click 

.

   This allows you to view your Job as you create it.

   Note: Maximize or minimize the Editor as needed to accomplish the steps in this procedure.

5. Highlight Acquire in the Step Tree (left pane). FrontRunner displays the Acquire properties page.

   Note: You may have to click the Acquire tab in the properties window.

6. Adjust the following settings:
   - Picture Mode — Set to Load Images from File.
   - File List — Click <empty>, and then Add... This displays the Open window. Browse for the file, ocv1.tif, from Windows. It is located at: C:\Vscape\Tutorials & Samples\Tutorials\GigE Systems\OCV Fontless Tool\. Select ocv1.tif and click Open. This will load the file and its path into the File List.

     Note: This file was installed when you installed Visionscape. If you installed Visionscape to a location other than C:\Vscape, replace it with the appropriate drive and directory designation.

7. On the Setup window, to view ocv1.tif, click .

FIGURE 3–9. OCV1.tif

8. Right click Snapshot in the Step Tree (left pane) and select Insert Into to display the Insert Step window. Click the Analysis Tools tab. Double click OCVFontless Tool to insert it into the Snapshot.

   Before the OCV Fontless Tool is trained, the characters in the image should be the proper size. The average character width for the characters should be approximately 20 pixels in width.

The Job you created should look like the example shown in Figure 3–10.

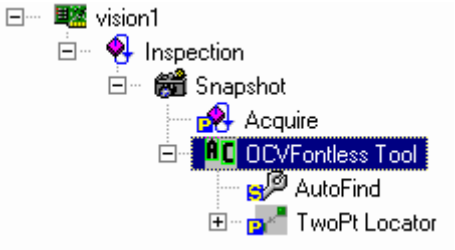


FIGURE 3–10. OCV Fontless Tool Job Tree

9. Minimize the Editor window.

10. Highlight OCVFontless Tool (left pane).

    The OCVFontless Tool has two boxes. The outer box is the AutoFind. The inner box is the OCV Fontless Tool.

11. Move and size the OCV Fontless Tool (inner box) around the characters to be inspected (L2A0693).

    Note: If preferred, zoom the image to make it easier to adjust the box.

    After sizing the OCV Fontless tool, select the AutoFind box (larger box). This box graphically shows you where the system will search for the code in the image. Move and size this box so that the inspected characters will stay inside this box when the inspection is run. After

both boxes are adjusted, the OCV Fontless Tool will look similar to the graphic shown in Figure 3–11.

FIGURE 3–11. OCV Fontless Tool

12. To train the OCV Fontless tool, click  .

The symbol boxes are placed around the characters based on the space between the characters. If any characters are touching, the characters will be grouped in one symbol box. The trained tool will be displayed as shown in Figure 3–12.

FIGURE 3–12. OCV Fontless Tool — Trained

13. Test the inspection by clicking  .

The inspection graphics for the OCV Fontless tool are shown in Figure 3–13.

FIGURE 3–13. OCV Fontless Tool — Inspection Graphics

The two large green boxes represent the AutoFind search area. Once the AutoFind has located the code, the character verification boxes are placed over each of the characters in the code. When the tool passes, the box will turn green. When the tool fails, the box will turn red.

14. After the Job has been tested and saved, you can run it.

Debugging Techniques

The OCV Fontless tool has debug capabilities that can be used in the Edit window. After the OCV Fontless tool has been run, you can view the inspection graphics. When you move the mouse over an inspected character in the code, the original template of the character is displayed, as shown in Figure 3–14.

FIGURE 3–14. OCV Fontless Tool — Inspected Character Code

When the shift key is held and the mouse is moved over an inspected character in the code, the inspection results for that character are displayed, as shown in Figure 3–15.

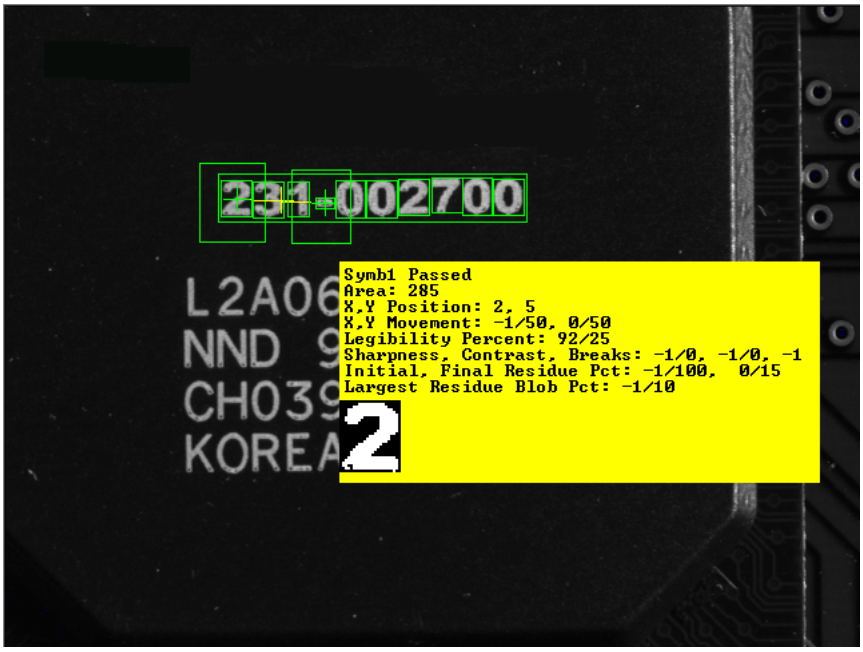


FIGURE 3–15. OCV Fontless Tool — Inspection Results

This Inspection Results Window displays the current values for the character and the tolerances set for the character. With this information, the tolerances can be set in the OCV Fontless tool to detect the types of failures you require. The readings take the form value/tolerance. If the value exceeds the tolerance, then that test has failed. A negative one (-1) means individual tests are disabled in the OCV Fontless datum page.

Properties Settings

To display the OCVFontless tool properties page, click 

.

Some of the most commonly used parameters in the OCVFontless Tool are:

- Apply Automatic Min Sharpness — When enabled, verifies that the inspected characters are clear and in focus. By default, the tolerance for this inspection is determined to be 65% of the trained character.
- Apply Automatic Min Contrast — When enabled, verifies that the inspected characters have the proper contrast. When disabled, the OCVFontless Tool will still pass even if the characters are very dark. By default, the tolerance for this inspection is determined to be 50% of the trained character.
- Group Final Res Limit — The primary setting for the OCVFontless Tool. When this is set higher, it allows the characters to have more variation from the trained characters and still pass the inspection. You must click Apply Symbol Group Settings before these changes are made to the previously trained symbols. This button is located at the bottom of the properties page.

Tutorial 3 — Data Matrix Tool

FrontRunner Job:

Start > Visionscape > Visionscape Tutorials & Samples > Tutorials > GigE Systems > Data Matrix Tool > tutorial_dmr.avp

This tutorial uses a saved image to demonstrate Data Matrix tool utilization. The goal is to set the image so the Data Matrix Tool sees the matrix with five pixels per matrix cell. This optimizes the Data Matrix reading process.

1. Start FrontRunner by selecting Start > Visionscape > Visionscape FrontRunner. FrontRunner displays its main window.
2. Select a Visionscape Device on the FrontRunner Device toolbar.
3. Start creating a new Job by clicking  .
4. To display the Job Tree and Step Tree, click 

.

   This allows you to view your Job as you create it.

   Note: Maximize or minimize the Editor as needed to accomplish the steps in this procedure.

5. Right click Snapshot in the Step Tree (left pane) and select Insert Into to display the Insert Step window. Click the Imaging/PreProcessing tab. Double click Rect Warp to insert it into the Snapshot.
6. Right click Rect Warp, select Insert Into, click the Analysis Tools tab, and double click Data Matrix Tool to add it to the Job.

The Job Tree should look similar to the one displayed in Figure 3–16.

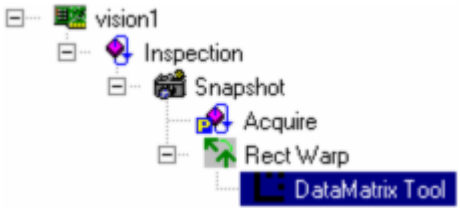


FIGURE 3–16. Data Matrix Job Tree

7. Highlight Acquire in the Step Tree (left pane). FrontRunner displays the Acquire properties page.

   You may have to click the Acquire tab in the properties window.

8. Adjust the following settings:

   – Picture Mode — Set to Load Images from File.

   – File List — Click <empty>, and then Add... This displays the Open window. Browse for the file, dm01.tif, from Windows. It is located at: C:\Vscape\Tutorials & Samples\Tutorials\GigE Systems\Data Matrix Tool\. Select dm01.tif and click Open. This will load the file and its path into the File List.

     Note: This file was installed when you installed Visionscape. If you installed Visionscape to a location other than C:\Vscape, replace it with the appropriate drive and directory designation.

9. To display dm01.tif, click  .

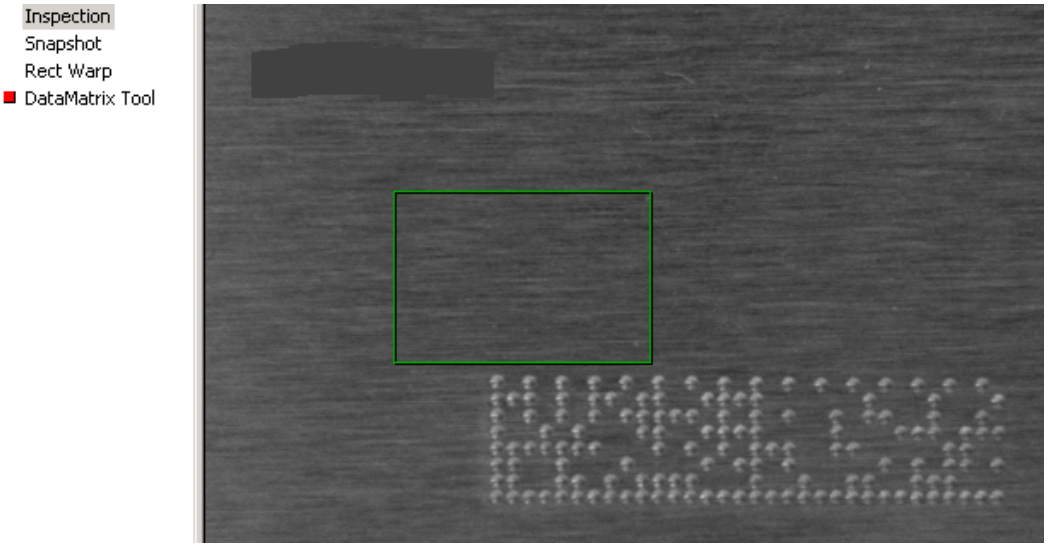


FIGURE 3–17. Data Matrix Displayed

10. Highlight Rect Warp (left pane).

11. Size the Rect Warp ROI to enclose the entire Data Matrix, as shown in Figure 3–18.

Note: Leave plenty of space between the ROI and the Data Matrix.

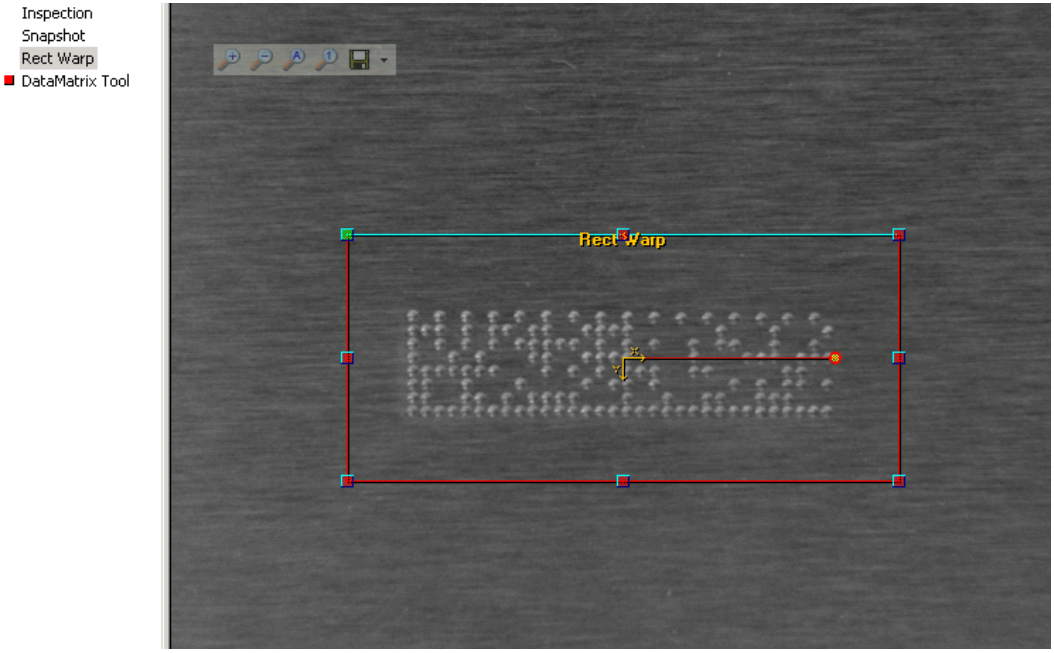


FIGURE 3–18. Size Rect Warp ROI

12. In the Properties (right pane), set the following scaling parameters for the Rect Warp:
    - X ScaleFactor — 60.
    - Y ScaleFactor — 60.
13. To highlight the DataMatrix Tool and green check mark the Rect Warp, click  .
14. Highlight DataMatrix Tool (left pane). Notice that the image has reduced in scale factor to 60% of the original size.
15. Zoom in to enlarge the image before proceeding with this tutorial.

16. Right click and select Maximize ROI. You should see a screen similar to the screen shown in Figure 3–19.

Note: Leave plenty of space around the Data Matrix for a quiet zone.

FIGURE 3–19. Sizing Data Matrix Tool

17. Click  .

If the DataMatrix Tool fails to train, perform the alphabetic steps below. Otherwise, go to Step 19.

a. If the DataMatrix Tool did not train, as indicated by the red square placed next to the tool, display the DataMatrix Tool properties page.

b. Enable (check) Assisted Learn. This displays a green ROI box.

c. Click on this ROI box and size it as close to the DataMatrix as possible, as shown in Figure 3–19. Zoom in to enlarge the image if you need to. This will help when sizing the ROI box.

d. Click  to train the DataMatrix Tool.

The Train button box will turn green when trained. In case the DataMatrix Tool does not train, scroll down the DataMatrix Tool properties page and set the following parameters:

- No. of Matrix Rows — 8.
- No. of Matrix Columns — 32.
- Matrix Polarity — Light on Dark.

18. Zoom so that you can see the entire image area.

19. To try the program on the PC once and then stop, click  .

    This will display the Data Matrix code read and place a green check mark next to all of the successfully trained and run tools, as shown in Figure 3–20.

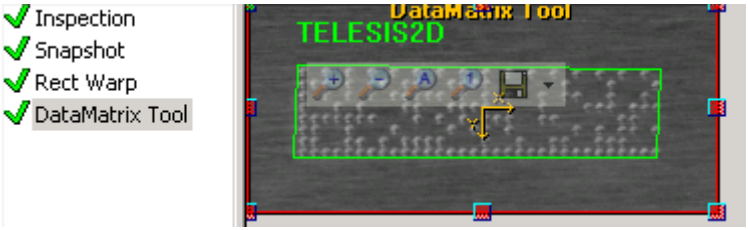


FIGURE 3–20. Run Once Successfully

20. To run your Job, click  .

The differences between this tutorial Job and a typical real application are:

- Real world applications are usually triggered by real world inputs.
- Most applications are strobed.

The important properties on the DataMatrix Tool properties page to consider are described below.

General

- Cell Size — For optimal performance, the calculated value should be set to five upon a successful learn.
- Tool Time Out (ms) — This value is the time the tool will use to process. If you set Search Direction to Horizontal, Vertical, Horizontal then Vertical or Vertical then Horizontal, the time used by each probe direction will be half the time set by this parameter. Furthermore, when Robust Locate is enabled (checked), the system may use up to three times the timeout value before timing out.

Optimizations for Speed

- Minimum Edge Strength — Increasing this parameter may speed performance if the image contains edges of less strength than the Data Matrix edges.
- Samples per Matrix Cell — This will be set to the lower of five or the number of pixels per cell. Lowering this number will speed the algorithm processing.
- Search Speed — This parameter can be increased to Turbo to increase algorithm speed. Typically, this will adversely affect robustness.
- Warp Method — If the Data Matrix is perpendicular to the camera and there is little optical distortion, then the Fast option may be safely selected here without affecting robustness.

Optimization for Robustness

- Finetune Method
  - Selecting Intensity Enhance will increase robustness for matrices of very low (<40 gray scales between foreground and background) contrast.
  - Selecting No Quiet Zone Clutter will enhance the performance of the tool should there be little quiet zone around the matrix.
  - Selecting Position Enhance is advisable for matrices created by ink jet or dot peen where the center of the matrix varies greatly from the ideal center location.
- Robust Locate — When enabled, this algorithm will retry up to two additional times with slightly different parameters. This will generally increase the time the algorithm runs and may cause the tool to run longer than the timeout value.
- Threshold Method — Selecting all three threshold methods will generally increase the robustness of the matrix readings and will typically only marginally affect speed.

Tutorial 4 — Using Measurement Tools in an Inspection

FrontRunner Job:

Start > Visionscape > Visionscape Tutorials & Samples > Tutorials > GigE Systems > Using Measurement Tools in an Inspection > tutorial_meastool.avp

This tutorial guides you through solving an inspection problem using Visionscape measurement tools.

The inspection checks that all good parts maintain the relative positions among the tips of the two prongs and the center of the circular shape, and maintain the radius of the circular portion of the part.

1. Start FrontRunner by selecting Start > Visionscape > Visionscape FrontRunner. FrontRunner displays its main window.
2. Select a Visionscape Device on the FrontRunner Device toolbar.
3. Start creating a new Job by clicking  .
4. To display the Job Tree and Step Tree, click 

   This allows you to view your Job as you create it.

   Note: Maximize or minimize the Editor as needed to accomplish the steps in this procedure.

5. Highlight Acquire in the Step Tree (left pane). FrontRunner displays the Acquire properties page.

   Note: You may have to click the Acquire tab in the properties window.

6. Adjust the following settings:

   – Picture Mode — Set to Load Images from File.

   – File List — Click <empty>, and then Add... This displays the Open window. Browse for the file, clipgood1.tif, from Windows. It is located at: C:\Vscape\Tutorials & Samples\Tutorials\GigE Systems\Using Measurement Tools in an Inspection\. Select

clipgood1.tif and click Open. This will load the file and its path into the File List.

Note: This file was installed when you installed Visionscape. If you installed Visionscape to a location other than C:\Vscape, replace it with the appropriate drive and directory designation.

7. Right click Snapshot in the Step Tree (left pane) and select Insert Into to display the Insert Step window. Click on the Analysis Tools tab. Double click TwoPt Locator to add it to the Job. The TwoPt Locator tool locates the tips of the two prongs on the part.

8. Right click TwoPt Locator and select Insert Into to display the Insert Step window. Double click Edge Tool to add it to the Job. The Edge Tool locates edge points that will fit the circle shape on the part.

9. Right click Edge Tool and select Insert Into. Click the Measurements tab. Double click LeastSquaresCircle Fit to add it to the Job.

10. Right click LeastSquaresCircle Fit and select Insert Into. Double click Tolerance Meas to add it to the Job.

    Rename Tolerance Meas to Circle Radius tolerance. To rename the step, place the cursor on Tolerance Meas and right-click. This displays the Step Context Menu. Select Rename and type Circle Radius tolerance.

11. Right click TwoPt Locator and select Insert Into. Click the Measurements tab. Double click Dist2Pts Meas to add it to the Job.

    Rename Dist2Pt Meas to Pin to Pin Distance. This will identify the proper use of the tool to measure the distance between the tips of the prongs.

12. Right click Pin to Pin Distance and select Insert Into. Click the Measurements tab. Double click Tolerance Meas to add it to the Job.

    Rename Tolerance Meas to Pin to Pin Distance tolerance. This will be used to tolerance the measured pin-to-pin distance.

13. Right click TwoPt Locator and select Insert Into. Click the Measurements tab. Double click Dist2Pts Meas to add it to the Job.

    Rename Dist2Pts Meas to Left to Center. This will measure the distance between the tip of the left prong and the center of the circle.

14. Right click Left to Center and select Insert Into. Click the Measurements tab. Double click Tolerance Meas to add it to the Job.

    Rename Tolerance Meas to Left Pin to Center Distance tolerance.

15. Right click TwoPt Locator and select Insert Into. Click the Measurement tab. Double click Dist2Pts Meas to add it to the Job.

    Rename Dist2Pts Meas to Right to Center. This will measure the distance between the tip of the right prong and the center of the circle.

16. Right click Right to Center and select Insert Into. Click the Measurements tab. Double click Tolerance Meas to add it to the Job.

    Rename Tolerance Meas to Right Pin to Center Distance tolerance.

17. The Job you created should appear similar to the example shown in Figure 3–21.

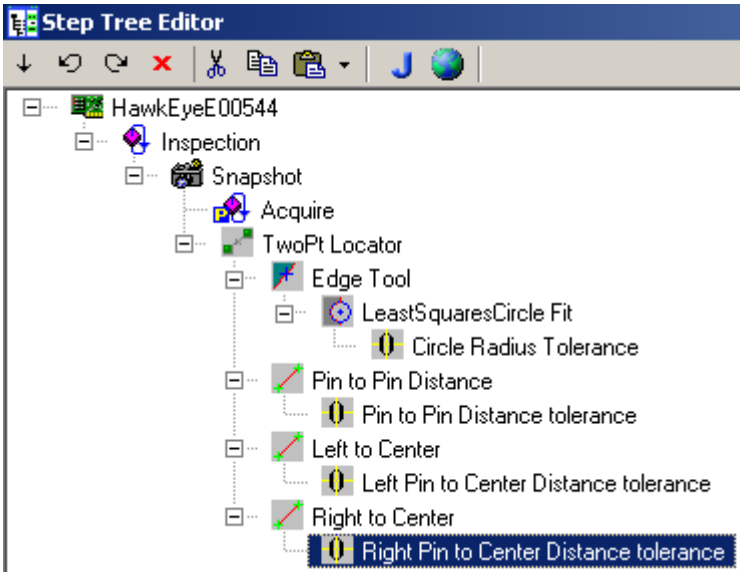


FIGURE 3–21. Using Measurement Tools in an Inspection Job Tree

During the setup,  will run the currently highlighted tool/step and move on to the next tool/step. A green check mark will appear next to the tool successfully tried when you click this button.

18. Minimize the Step Tree Editor.
19. Click  .
20. Highlight Snapshot and click  . This will place a green check mark next to Snapshot.
21. Highlight TwoPt Locator and click  .
22. To set up the TwoPt Locator, enlarge the search areas Find Pin 1 (left boxes) and Find Pin 2 (right boxes) so that the tips of the prongs will always fall into them respectively for all images. The outer box of each Find Pin is its search area; the inner box is the template pin. Click on the Template Find Pin 1 box and place its center at the tip of the left prong. Place the center of the Pin2 template at the tip of the right prong. Your setup for Two Pt Locator should appear as shown in Figure 3–22.

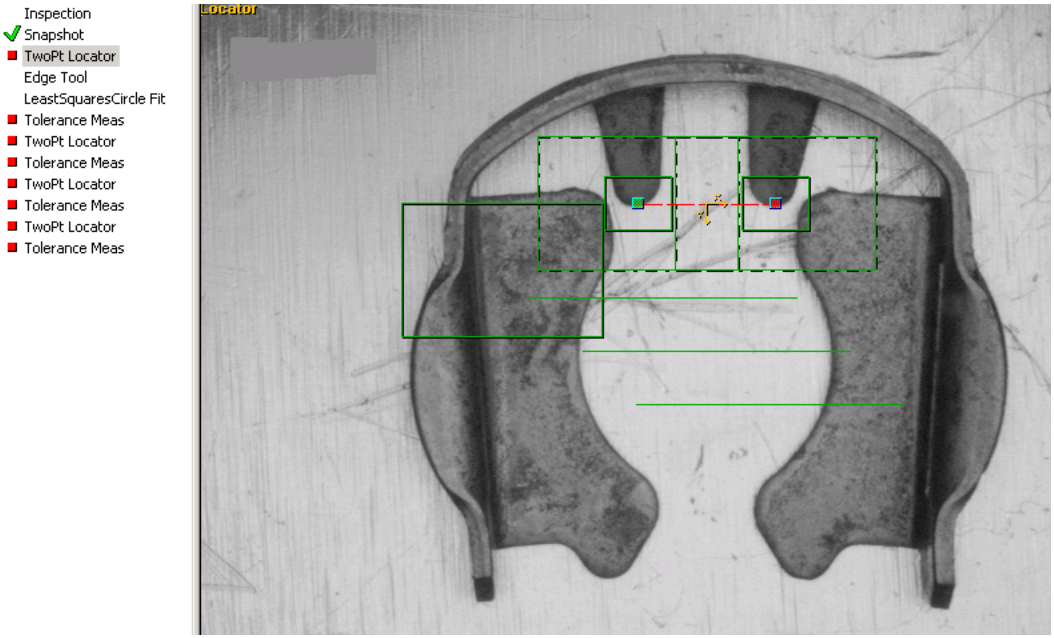


FIGURE 3–22. Find Pin Setup

Two Pt Locator and the Train button will display a red box until you have trained the tool. Also, the boxes around the untrained tool will remain dotted lines until trained.

23. Train the Two Pt Locator by clicking  . A trained Two Pt Locator will appear, as shown in Figure 3–23.

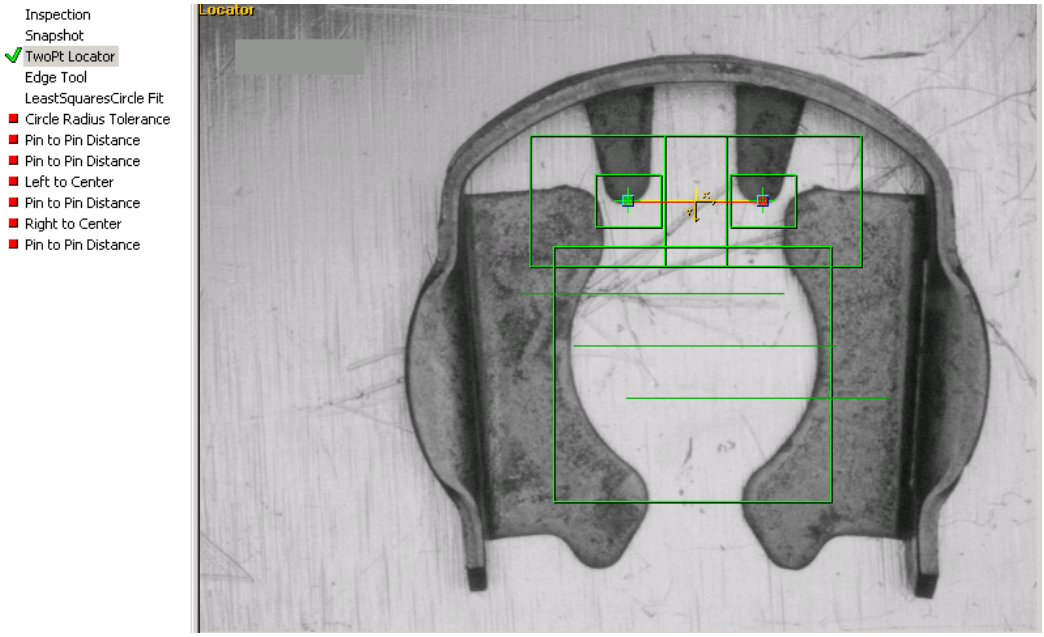


FIGURE 3–23. Two Pt Locator — Trained

24. Highlight Edge Tool (left pane).

25. In the Properties pane, set the following Edge Tool parameters:

- EdgeSign — Any settings.
- PointType — Maximum Transition on Line.
- Minimum Gradient — 48.
- Maximum Gradient — 255.
- Gradient Sparseness — Sharp Edges.
- Projection Width — 3 (click the Show Advanced Datums button to display the Projection Width property).
- Graphics Level — Show Details.

26. Minimize the Step Tree Editor.

27. Size and place the Edge Tool ROI to enclose the curved edges, as shown in Figure 3–24.

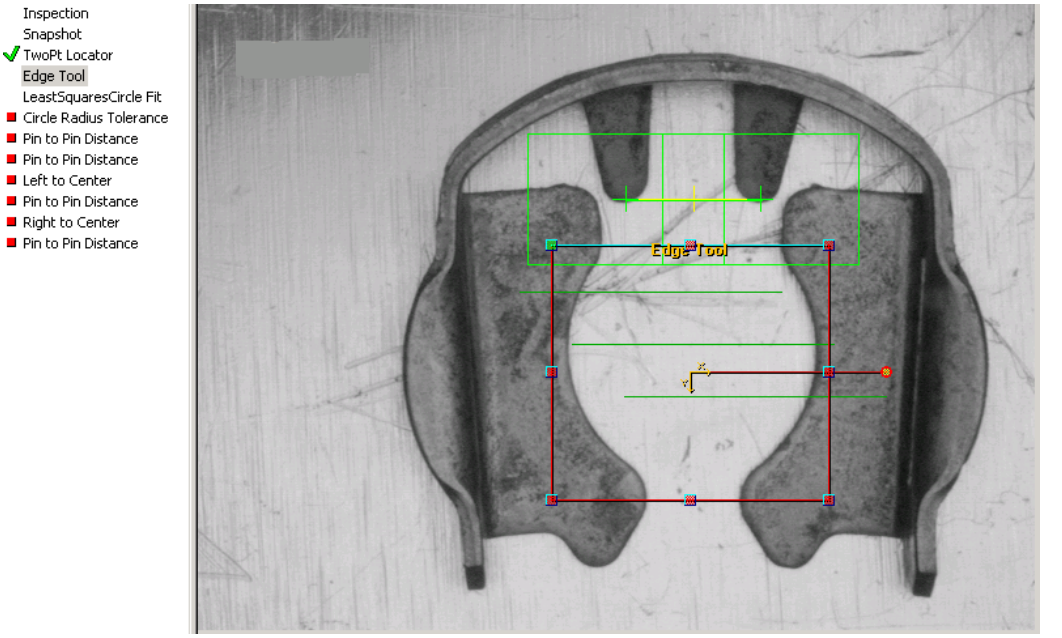


FIGURE 3–24. Edge Tool Setup

28. Click  .

    Observe that the Edge Tool has been run successfully, as is indicated by the green check mark.

29. Highlight LeastSquaresCircle Fit (left pane).

30. Click  .

    Observe that LeastSquaresCircle Fit has been run successfully, as indicated by the green check mark. Observe also that a circle fitted from the edge points has been displayed on the buffer.

31. Highlight Circle Radius Tolerance (left pane).

32. In the Properties pane, set the following Circle Radius Tolerance parameters:
    - Input Datum — LeastSquaresCircleFit.Radius
    - With Tolerance — 5% Nominal
33. Minimize the Step Tree Editor.
34. Click  .

    On the properties page, observe that the Nominal Distance is set to be the radius value calculated by the LeastSquaresCircle Fit step. The Tolerance +/- is set to the value that is 5% of the Nominal Distance. This is because the parameter With Tolerance is set at 5% Nominal.
35. Minimize the Step Tree Editor.
36. Highlight Pin to Pin Distance.
37. Click  .

    Observe that Pin to Pin Distance is highlighted and Circle Radius tolerance has run successfully, as indicated by the green check mark.
38. In the Properties (Figure 3–25), set Graphics Level to Show Graphics.

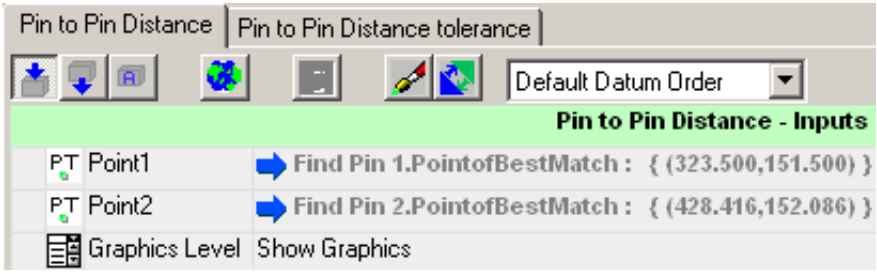


FIGURE 3–25. Select Reference Button

39. To select the reference for Point1, click in the area to the right of the blue arrow (Figure 3–25), and click on the three dots, which displays the Select Reference window, as shown in Figure 3–26.

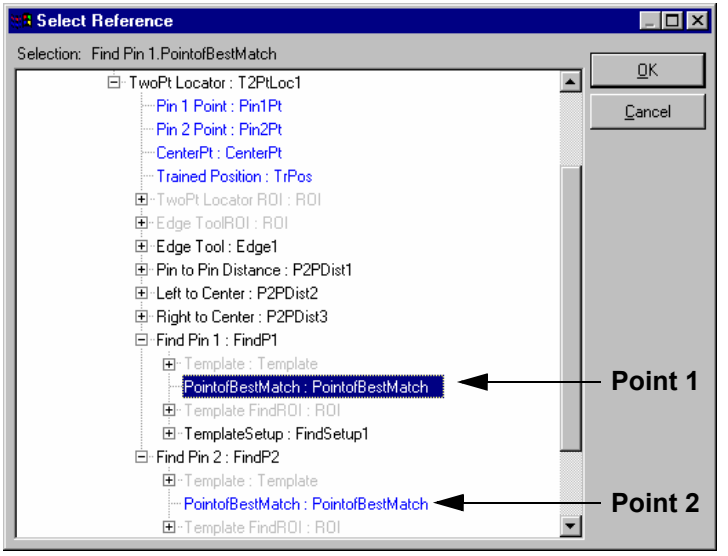


FIGURE 3–26. Select Reference Window

40. Click on the check mark to the left of FindPin 1:FindP1 to expand the tree view. Select PointofBestMatch:PointofBestMatch and click OK (Figure 3–26).

41. To select the reference for Point2, click in the area to the right of the blue arrow (Figure 3–25), and click on the three dots, which displays the Select Reference window, as shown in Figure 3–26.

42. Click on the check mark to the left of FindPin 2:FindP2 to expand the tree view. Select PointofBestMatch:PointofBestMatch and click OK (Figure 3–26).

43. Minimize the Step Tree Editor.

44. Click  .

    Observe that Pin to Pin Distance tolerance is highlighted and Pin to Pin Distance has been green check marked.

45. Highlight Pin to Pin Distance tolerance (left pane).
46. In the Properties pane, set the following Pin to Pin Distance tolerance parameters:
    - Input Datum — Pin to Pin Distance.Pt-Pt Distance
    - With Tolerance — 5% Nominal
47. Minimize the Step Tree Editor.
48. Click  .

    On the properties page, observe that the Nominal Distance is set to the output value of the above Pin to Pin Distance, the Tolerance+/- is set to be the value that is 5% of the Nominal Distance.
49. Minimize the Step Tree Editor.
50. Highlight Left to Center and click  .
51. In the Properties (Figure 3–27), set Graphics Level to Show Graphics.

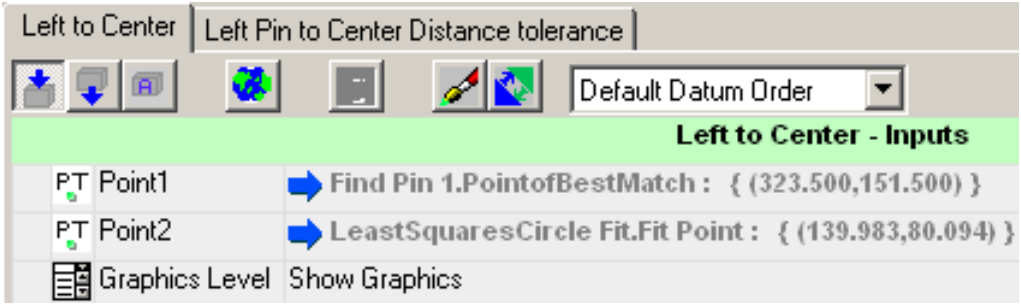


FIGURE 3–27. Select Reference Button

52. To select the reference for Point1, click in the area to the right of the blue arrow (Figure 3–27), and click on the three dots, which displays the Select Reference window, as shown in Figure 3–28.

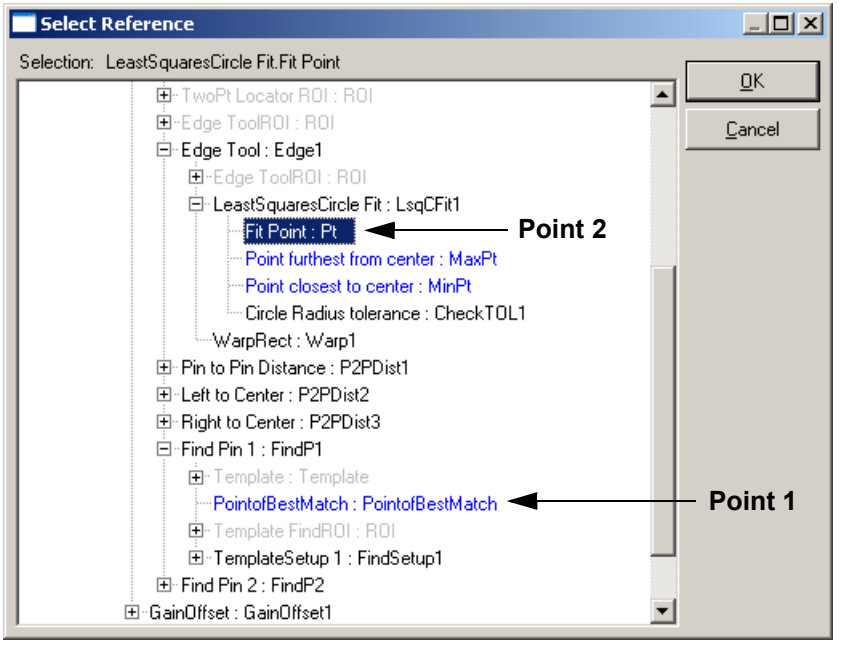


FIGURE 3–28. Select Reference Window

53. Click on the check mark to the left of FindPin 1:FindP1 to expand the tree view. Select PointofBestMatch:PointofBestMatch and click OK (Figure 3–28).

54. To select the reference for Point2, click in the area to the right of the blue arrow (Figure 3–27), and click on the three dots, which displays the Select Reference window, as shown in Figure 3–28.

55. Click on the check mark to the left of LeastSquaresCircle Fit:LsqCFit1 to expand the tree view. Select Fit Point:Pt and click OK (Figure 3–28).

56. Minimize the Step Tree Editor.

57. Click  .

On the properties page, observe that the Nominal Distance is set to the output value of the above Pin to Pin Distance, the Tolerance+/- is set to be the value that is 5% of the Nominal Distance.

58. Highlight Left Pin to Center Distance tolerance (left pane).

59. In the Properties pane, set the following Left Pin to Center Distance tolerance parameters:

    – Input Datum — Left to Center.Pt-Pt Distance

    – With Tolerance — 5% Nominal

60. Minimize the Step Tree Editor.

61. Click  .

    On the properties page, observe that the Nominal Distance is set to the output value of the above Left Pin to Center Distance, the Tolerance+/- is set to be the value that is 5% of the Nominal Distance.

62. Highlight Right to Center and click  .

63. In the Properties (Figure 3–29), set Graphics Level to Show Graphics.

64. To select the reference for Point1, click in the area to the right of the blue arrow (Figure 3–29), and click on the three dots, which displays the Select Reference window, as shown in Figure 3–30.

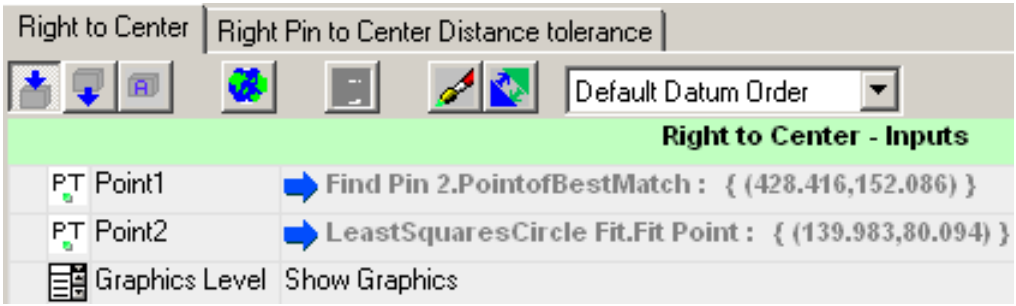


FIGURE 3–29. Select Reference Button

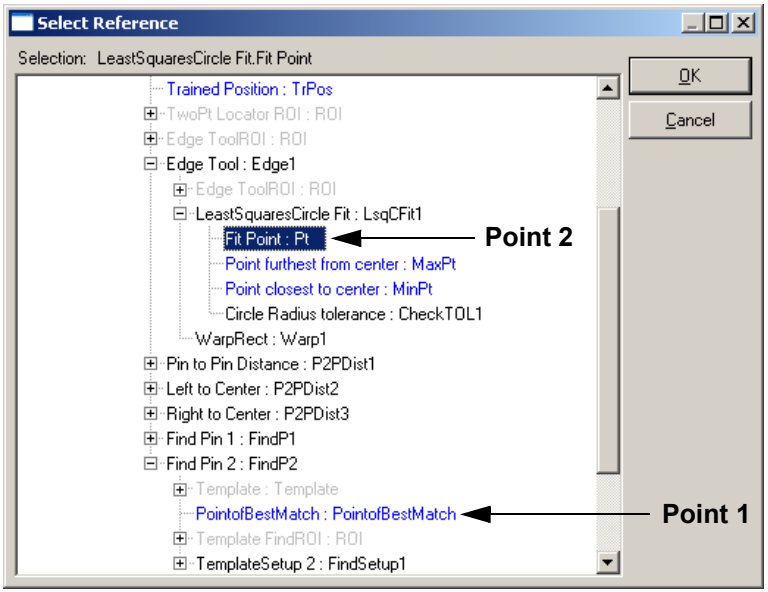


FIGURE 3–30. Select Reference Window

65. Click on the check mark to the left of FindPin 2:FindP2 to expand the tree view. Select PointofBestMatch:PointofBestMatch and click OK (Figure 3–30).

66. To select the reference for Point2, click in the area to the right of the blue arrow (Figure 3–29), and click on the three dots, which displays the Select Reference window, as shown in Figure 3–30.

67. Click on the check mark to the left of LeastSquaresCircle Fit:LsqCFit1 to expand the tree view. Select Fit Point:Pt and click OK (Figure 3–30).

68. Minimize the Step Tree Editor.

69. Click  .

    Observe that Right Pin to Center Distance tolerance is highlighted and Right Pin to Center Distance has been green check marked.

70. Highlight Right Pin to Center Distance tolerance (left pane).

71. In the Properties, set the following Pin to Pin Distance tolerance parameters:

    – Input Datum — Right to Center.Pt-Pt Distance

    – With Tolerance — 5% Nominal

72. Minimize the Step Tree Editor.

73. Click  .

    On that properties page, observe that the Nominal Distance is set to the output value of the above Pin to Pin Distance, the Tolerance+/- is set to be the value that is 5% of the Nominal Distance.

74. Click  .

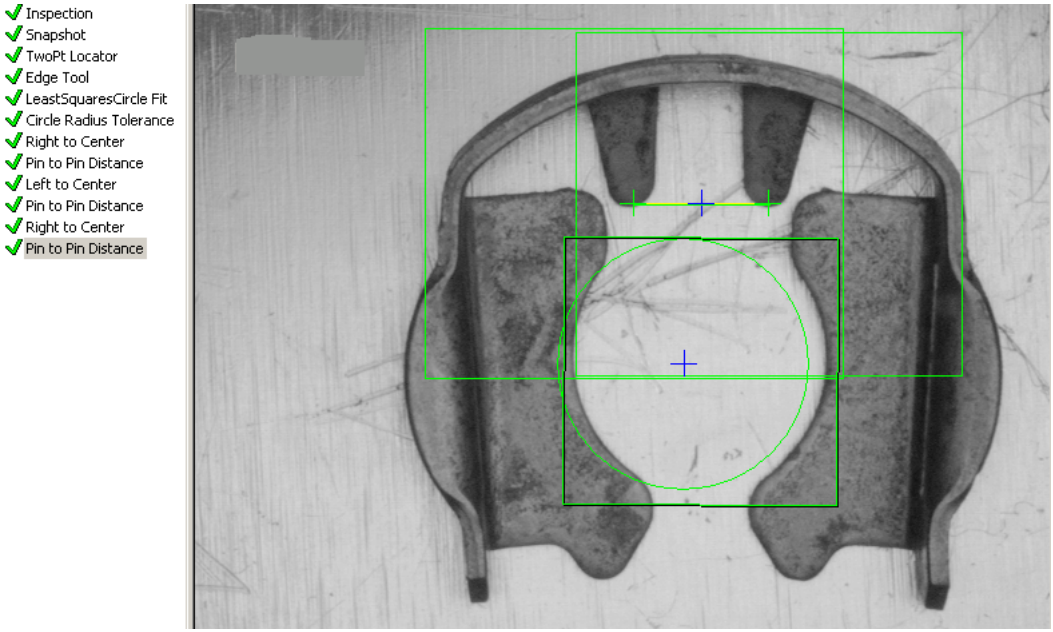


FIGURE 3–31. Setup and Training Complete

75. Click  to run your Job once to verify your setup and settings.
76. In the Step Tree (left pane), highlight Acquire.
77. Add the image file clipbad3.tif to the File List of the Acquire properties pages.
78. Minimize the Step Tree Editor.
79. Click  .

    This will run the Job repeatedly until you click Stop. For any step/tool that fails, a red X is displayed next to it.

    You can also click  to run on each image, one at a time, to view their results.

80. Select results to be uploaded at runtime.
    a. Click 

to display the Inspection properties page.
    b. Scroll down to view the Select Results to Upload parameter.
    c. Click to the right of Select Results to Upload to display listings.
    d. Click Add and scroll through the listing and select any datums that you would like to view at runtime; for example:
        - Snapshot.Status
        - GainOffset.Status
        - TwoPt Locator.Status
        - Find Pin 1.Status
        - Find Pin 2.Status
    e. Click Close.
81. To run you Job, click  .

Tutorial 5 — Using the Trajectory Step

FrontRunner Job:

Start > Visionscape > Visionscape Tutorials & Samples > Tutorials > GigE Systems > Using the Trajectory Step > tutorial_trajectory.avp

This tutorial shows you how to use the Trajectory Step to inspect a grid of parts.

1. Start FrontRunner by selecting Start > Visionscape > Visionscape FrontRunner. FrontRunner displays its main window.
2. Select a Visionscape Device on the FrontRunner Device toolbar.
3. Start creating a new Job by clicking .
4. To display the Job Tree and Step Tree Editor, click 

.

   This allows you to view your Job as you create it.

   Note: Maximize or minimize the Editor as needed to accomplish the steps in this procedure.

5. Highlight Acquire in the Step Tree (left pane). FrontRunner displays the Acquire properties page.

   Note: You may have to click the Acquire tab in the properties window.

6. Adjust the following settings:
   - Picture Mode — Set to Load Images from File.
   - File List — Click <empty>, and then Add... This displays the Open window. Browse for the file TrajectoryTutorial.tif from Windows. It is located at: C:\Vscape\Tutorials & Samples\Tutorials\GigE Systems\Using the Trajectory Step\. Select TrajectoryTutorial.tif and click Open. This will load the file and its path into the File List.

Note: This file was installed when you installed Visionscape. If you installed Visionscape to a location other than C:\Vscape, replace it with the appropriate drive and directory designation.

7. Right click Snapshot in the Step Tree (left pane) and select Insert Into. FrontRunner displays the Insert Step window. Click the Program Control tab. Double click Trajectory Step to add it to the Job.

Note: FrontRunner automatically inserts the Data Array, With, If, and One Point Locator steps into the Trajectory Step.

---

8. Right click Trajectory Step and select Insert Into. FrontRunner displays the Insert Step window. Click the Analysis Tools tab. Double click Blob Tool to add it to the Job.

Note: FrontRunner will automatically insert the Blob Tool into the One Point Locator of the Trajectory Step.

---

9. Right click Trajectory Step and select Insert Into. FrontRunner displays the Insert Step window. Click the Program Control tab. Double click Trajectory Grid Setup to add it to the Job.

   The Job you created should look like the Job displayed in Figure 3–32.

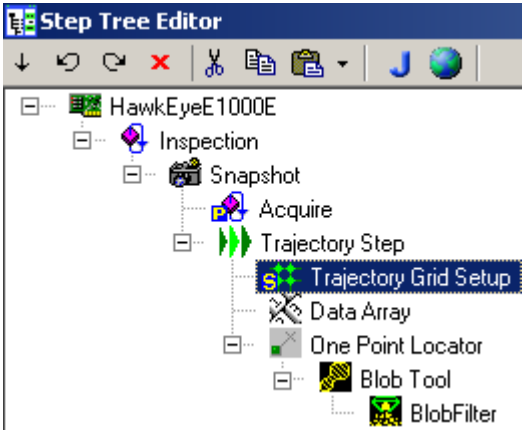


FIGURE 3–32. Trajectory Tool Job Tree

10. Highlight Trajectory Step in the Step Tree (left pane).

11. Click to the right of Result Selector, as shown in Figure 3–33.

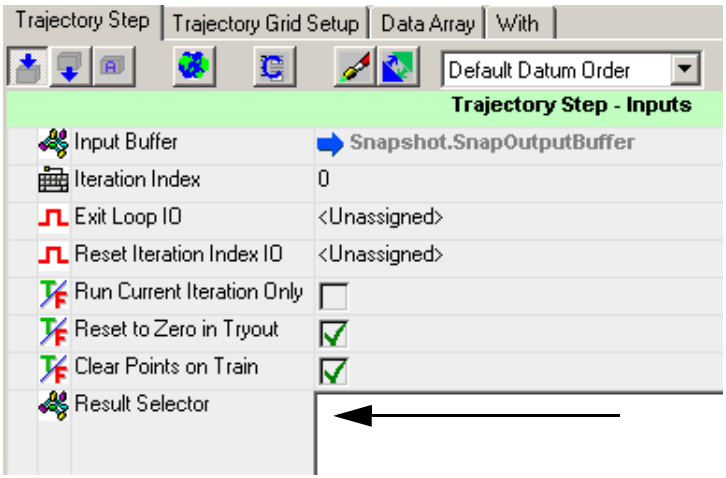


FIGURE 3–33. Result Selector — Add

12. Click Add.

    The Select Datums for Report dialog box is displayed, as shown in Figure 3–34.

13. In the left pane, navigate down the tree to the Blob Tool, and highlight it.

14. In the right pane, highlight (to select) Status and Number of Blobs as datums for the report, as shown in Figure 3–34. Click Close.

Note: Blob Tool is in the One Point Locator. Once selected in the Trajectory Step, the results are automatically enabled in the Inspection Step results list.

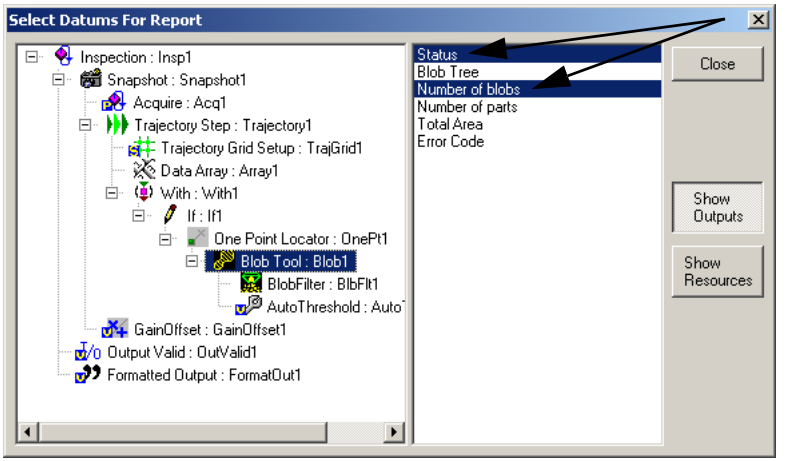


FIGURE 3–34. Select Datums for Report

15. Highlight Trajectory Grid Setup in the Step Tree (left pane). FrontRunner displays the Trajectory Grid Setup properties page.

    The Trajectory Grid Setup step tells the system the locations of the devices in the field of view. Specify the following:

    – In Number of Rows, type 3.

    – In Number of Columns, type 4.

The position of the upper left hand device is determined by the X Offset and Y Offset parameters. Specify the following:

– In X Offset, type 95.

– In Y Offset, type 90.

Vertical Spacing and Horizontal Spacing define the distance between devices and are measured in pixels. Specify the following:

– In Horizontal Spacing, type 150.

– In Vertical Spacing, type 150.

16. Highlight Blob Tool in the Step Tree (left pane). FrontRunner displays the Blob Tool properties page, as shown in Figure 3–35.

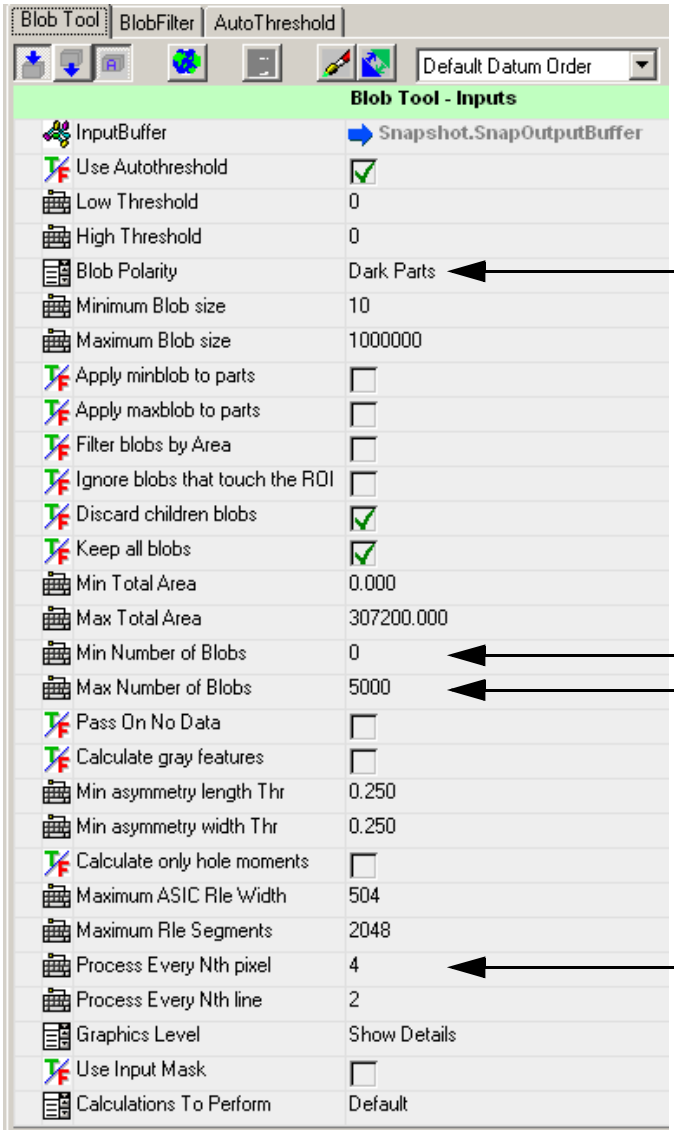


FIGURE 3–35. Blob Tool Properties Page

Specify the following:

- In Blob Polarity, select Light Parts.
- In Min Number of Blobs, type 100. This instructs the Blob Tool to find 100 blobs, no more and no less, or else it should fail.
- In Max Number of Blobs, type 100. This instructs the Blob Tool to find 100 blobs, no more and no less, or else it should fail.
- In Advanced Datums, set Process Every nth pixel to 2 (the default is 4).

17. Minimize the Editor.
18. Click  .
19. Set up the initial location of the Blob ROI. Move the ROI to surround the top left hand device, as shown in Figure 3–36.

Note: Zooming in once will help you when surrounding the device.

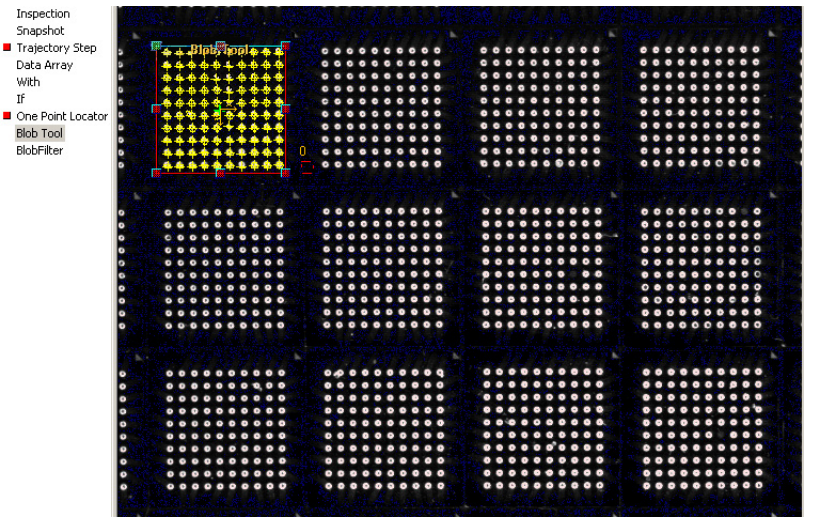


FIGURE 3–36. Setup Window — ROI Move

20. Highlight Trajectory Step in the Step Tree (left pane).

21. Click  .

    Trajectory Step will display a red box and Train will be red until you train the tool.

22. Click  to train the Trajectory Step.

    The trajectory ROI changes to a zig-zag pattern across all the devices with nodes at each device location, as shown in Figure 3–37. This represents the order in which the devices will be inspected. This order is English reading order.

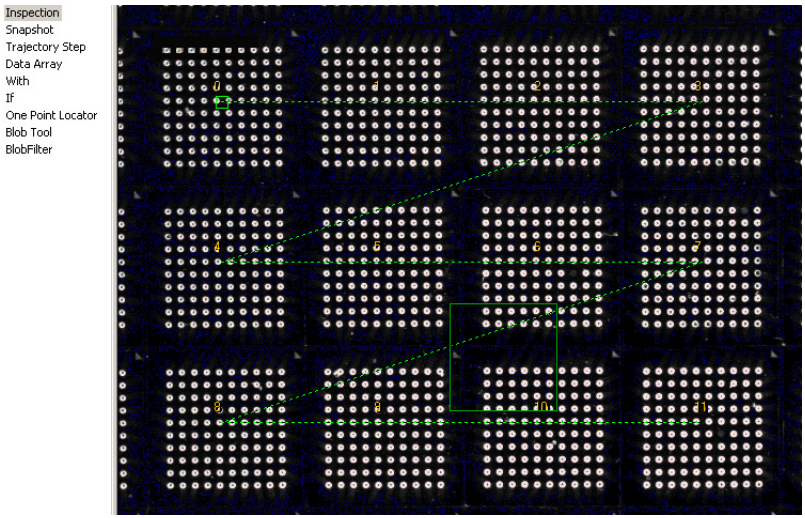


FIGURE 3–37. Train the Trajectory Step

23. Run the inspection by clicking  .

    The inspection proceeds by moving the Blob to each location defined by the Trajectory Step and running it there. Notice that the parts that

pass have green boxes around them, and that the parts that fail have red boxes, as shown in Figure 3–38.

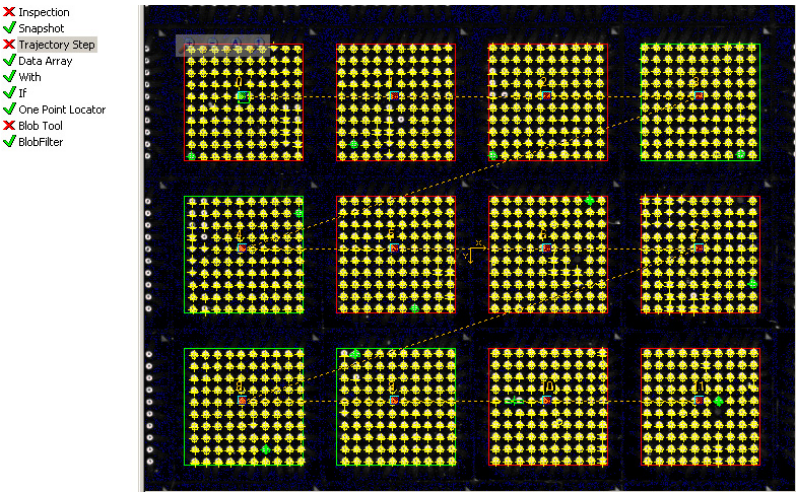


FIGURE 3–38. Start Test and Test Results

24. To run your Job, click  .

25. To display the Report information that you specified previously, click on the button shown in Figure 3–39. Results are shown in Figure 3–40.

FIGURE 3–39. Displaying Report Information

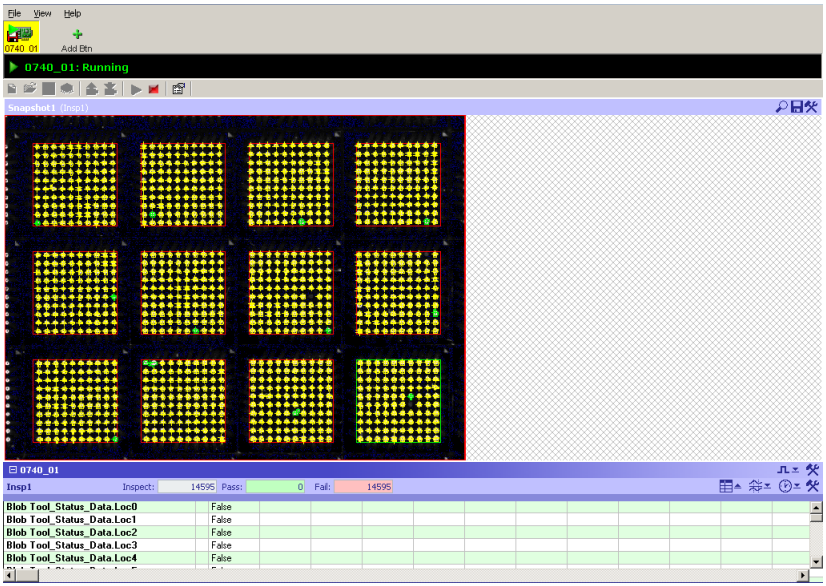


FIGURE 3–40. Trajectory Tutorial Results

APPENDIX A GigE Network Configuration

This section contains information about Visionscape GigE network configuration.

Configuring Your Network Adapter for GigE Visionscape

GigE cameras need GigE NICs (network interface controllers). NICs can come built-in to a PC on the motherboard or as PCI or PCIe cards and there are also some USB-to-Ethernet adapters available.

Omron Microscan recommends the use of NICs that make use of the Intel Pro/1000 chipsets.

Normally, when you put a NIC into a PC it will be recognized as a network adapter and will inherit all the usual network protocols. These usually include the following:

Client for Microsoft Networks

File and Printer Sharing for Microsoft Networks

QoS Packet Scheduler

Internet Protocol (TCP/IP)

Some systems split internet protocol into two separate entries: TCP/IP Rev 4 and Rev 6. All Omron Microscan cameras use TCP/IP Rev 4.

There may also be anti-virus filters such as “McAfee NDIS Intermediate Filter”.

GigE cameras should be on their own dedicated network. This has nothing to do with Microsoft or with sharing. Visionscape installs a dedicated driver for GigE cameras that is called JAI GigE Vision Filter Driver. This filter driver recognizes GigE vision packets and filters them so that the CPU doesn’t have to deal with sorting them out. This lowers the CPU load, freeing it up for other things.

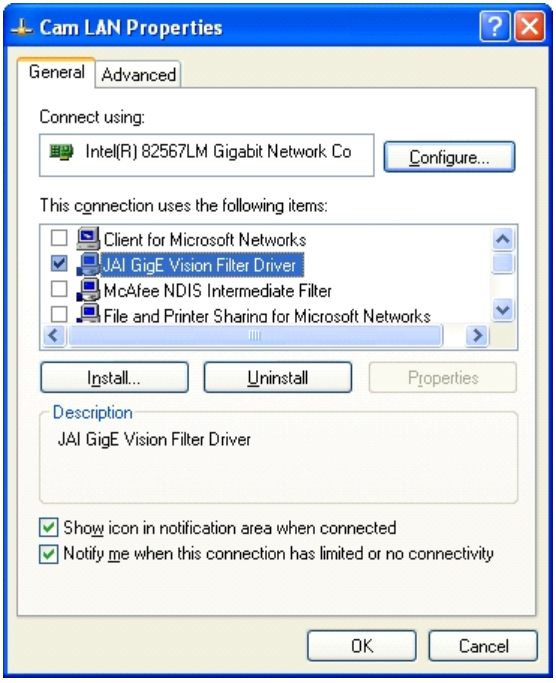
A GigE vision NIC only needs two items:

JAI GigE Vision Filter Driver

Internet Protocol (TCP/IP) (or TCP/IP Rev 4)

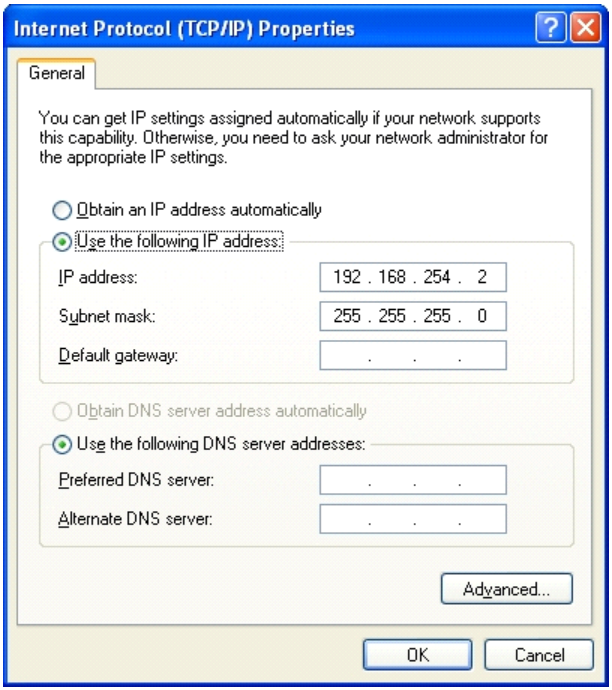
Uncheck all other items from the NIC you want to use for cameras if it will only be used for cameras. (If you use it for cameras one day and regular networking the next, leave everything on.)

Important: If you are using a third-party camera and you have installed that manufacturer's control software make sure that you disable it in the Properties dialog below. It will almost certainly conflict with the JAI software that Visionscape uses to receive images from the cameras.



In the example above, note the two check boxes at the bottom of the dialog box. If you have these checked then you will see a small icon for each NIC in the task bar. This is a useful visual indicator of network status.

The filter driver requires no setup whatsoever. Clicking on the TCP/IP Properties button will bring up the following dialog:



There is usually no need for cameras to be on a DHCP network, so choose a static address that starts with 192.168.x.x. 192.168 is reserved for private networks. In the picture above the address is set to 192.168.254.2 with the subnet mask set to 255.255.255.0. The mask means that all devices connected to the NIC should have addresses that start with 192.168.254.x. It is recommended that you steer clear of using any address that ends with .1 (for instance 192.168.254.1) as this is sometimes used by networks for gateways (devices that convert one sort of protocol to another).

In addition, you should not use any address like 192.168.x.254 because the GigE driver looks at the last number (254) and enumerates all cameras on the NIC with addresses above that. In the case of the NIC ending in 254 the first camera would end in 255, which will not work.

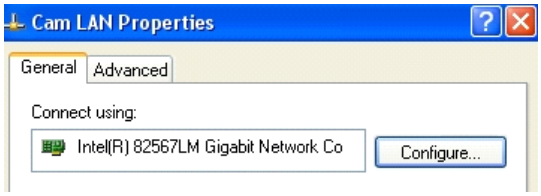
Omron Microscan recommends that you set your NIC to end in .2. For instance 192.168.2.2. If you have more than one camera NIC then set the second one to 192.168.3.2, and so on.

Optimizing the Network Adapter for Use with GigE Cameras

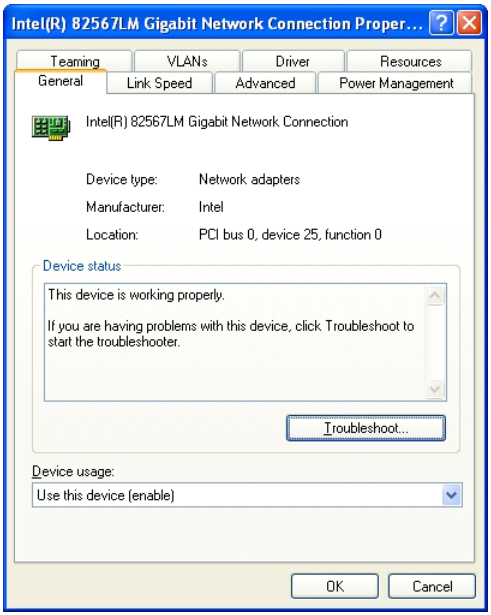
To reduce the load on the PC to a minimum you need to optimize the NIC. Visionscape does not perform this optimization because every installation has different requirements and every NIC has different limitations.

Optimization is performed as follows:

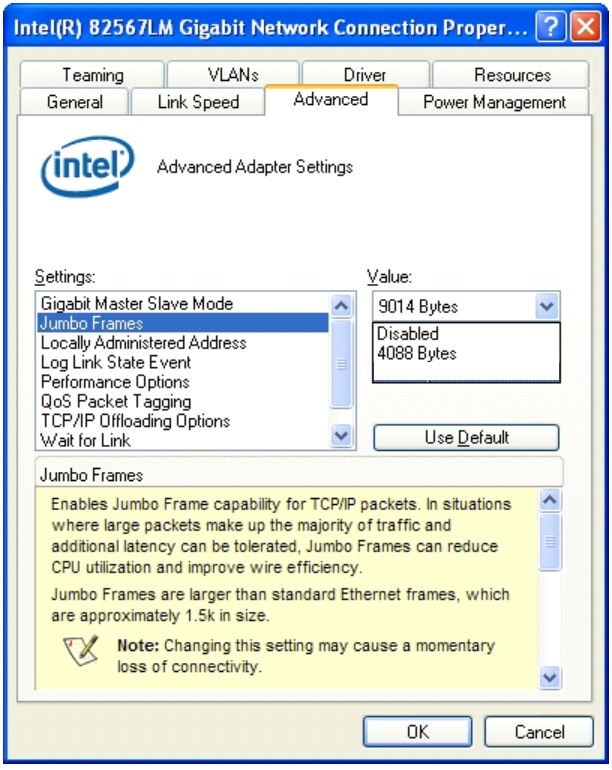
Navigate to the network adapter properties and click on the **Configure** button next to the network card description:



Clicking the **Configure** button should bring up the following dialog:

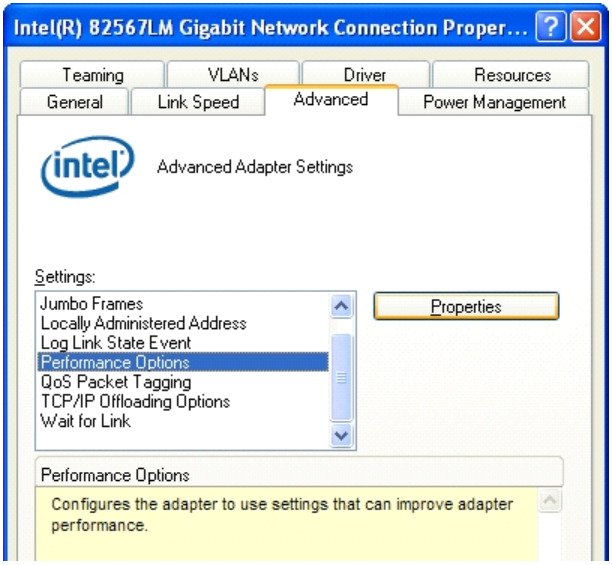


Next, click on the Advanced tab and you should see a list of parameters that can be tuned by the user.

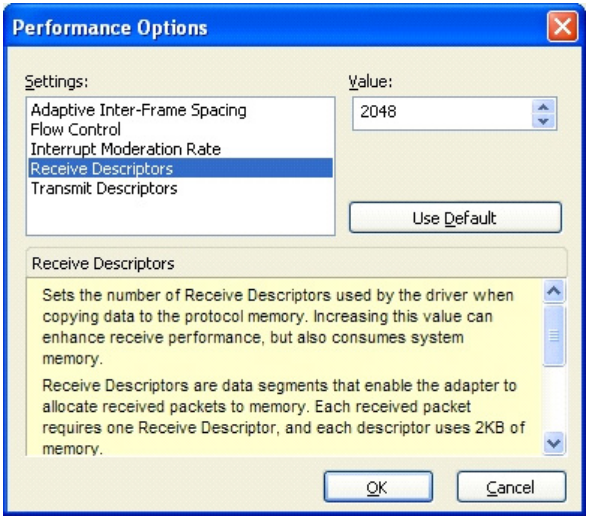


Look for Jumbo Frames (sometimes called Jumbo Packets). Set this to the maximum available – typically **8192** bytes but only 4k or 5k on some NICs.

Then select Receive Descriptors (if available). This is sometimes grouped within Performance Options:



Click on the Properties button to bring up this view:



The default value for receive descriptors is 256. Set this to the maximum available - typically 2048.

Save changes by clicking **OK**.

The NIC is now enabled to handle larger packets. This means that, instead of sending image data from the camera in chunks of 1500 bytes they can now come in chunks of 8192. That means about 6 times fewer packets for each image.

Increasing the number of receive descriptors enables the NIC to handle more packets at any one time. If the processor is busy when an image arrives, the NIC may not be able to send on the data immediately but data is still coming in from the camera. These receive descriptors buffer the system against this. (It is almost essential when using a CMG50 camera).

Attaching and Configuring the Camera(s)

Once you have done all this you can connect your camera directly or plug in a switch and then connect cameras to that switch. As they come out of the box the cameras should now assign themselves addresses in the 192.168.254.x range. They are still receiving information about the network from outside in order to make this choice. You can simplify things still further by assigning each camera its own persistent IP address.

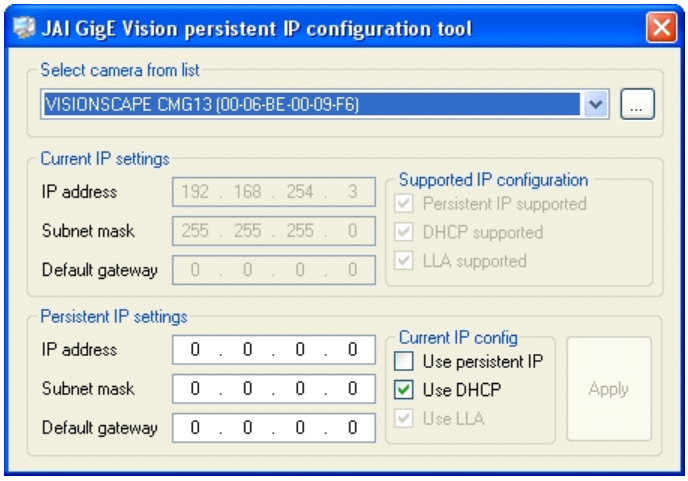
When you install Visionscape, this folder is placed on your C: drive:

C:\Microscan\Vscape\Drivers\GigE\JAI

Navigate to that folder and double-click on **JAI SDK 1.4.0.exe** or **JAI SDK x64 Version 1.4.0.exe** (depending on whether you're running a 32-bit or 64-bit system) to install the **JAI GigE Vision Persistent IP Configuration Tool**.

Once the tool is installed, navigate to **Start Menu > All Programs > JAI SDK > Tools** and click on **Persistent IP Configuration Tool** to open it.

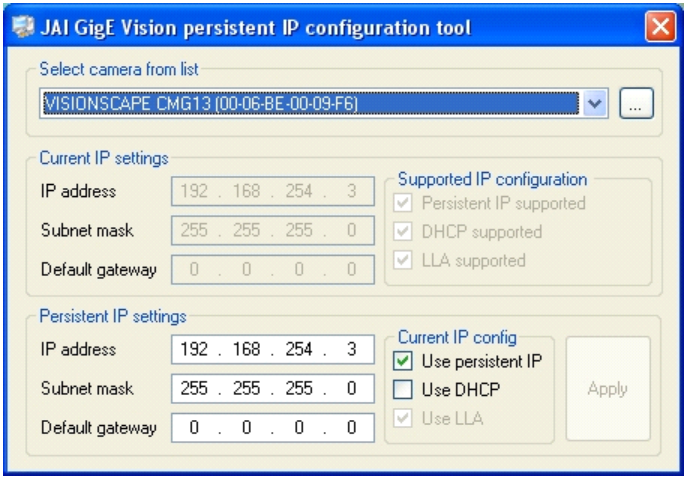
When you open the tool you will see a dialog similar to this:



The camera here is set to use DHCP and the address is 192.168.254.3. However, a persistent IP address is preferable.

Check the “Use persistent IP” box and uncheck the “Use DHCP” box. Enter 192.168.254.3 in the lower IP address box and 255.255.255.0. Click **Apply**. You will be prompted to reboot the camera as follows:

Cycle power to the camera. The config tool will now show the following:



Now, every time the camera is rebooted it will automatically set this IP address so it will not have to search the network to determine what IP address to use.

This is ideal in fixed industrial setups. However, it does mean that you cannot swap cameras from NIC to NIC or even change the address of the NIC without setting the camera too.

Now the NIC is set correctly and you need to adjust the way the software sends the data from the camera to the PC. The NIC “allows” the use of jumbo packets now but it does not enforce their use. You have to tell Visionscape to use them. This is done as follows:

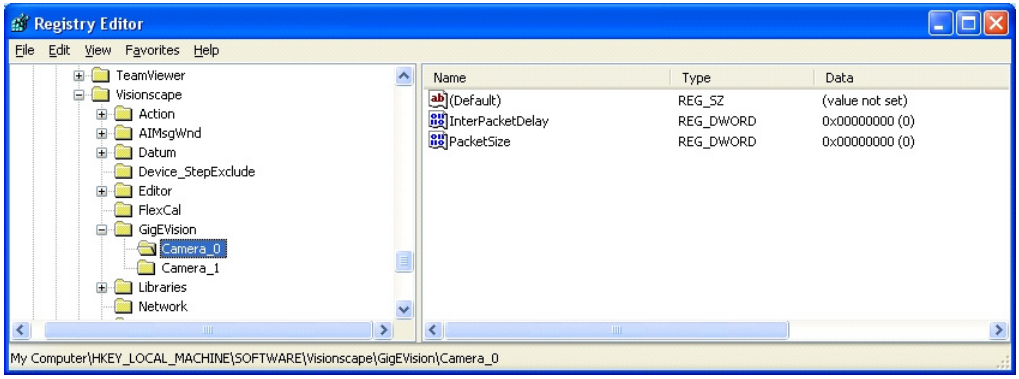
Make sure that the **dm.config** file (C:\Vscape\DM\dm.config) is deleted. This will give you a clean start. Now boot FrontRunner. This will create a new dm.config file and populate the Windows registry with default values.

The camera is going to use the default 1500 byte packet size that Visionscape uses out-of-the-box. You need to change this before going any further. These values are stored in the registry. From the Start menu select **Run…** and type:

Regedit

Then go to:

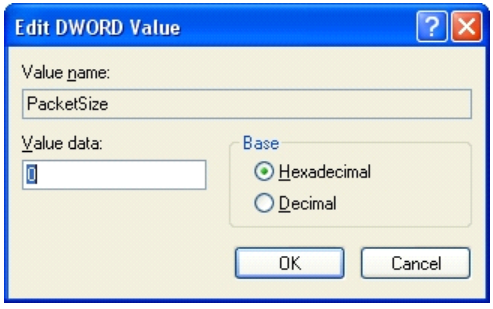
My Computer\HKEY_LOCAL_MACHINE\SOFTWARE\Visionscape\GigEVision\Camera_0



Note: In newer builds of Visionscape there are more entries in these directories.

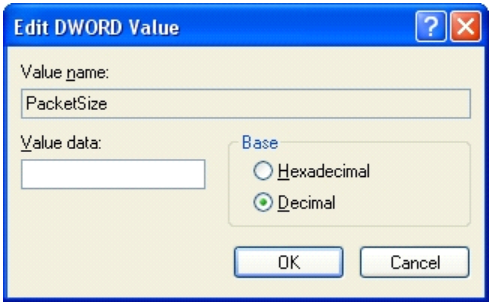
Depending on how many cameras you have connected you may have Camera_0, Camera_1, Camera_2 and Camera_3 directories – these all have the same things inside. You'll need to repeat the procedure for Camera_0 on all 4 cameras.

The two parameters InterPacketDelay and PacketSize are both set to 0, which tells Visionscape to use its default values. The first thing you need to do is set the PacketSize to 8192. Right-click on PacketSize (the actual word) and select Modify. You'll see the following:



Change **Base** to **Decimal**:

Now enter 8192 in the Value Data text box:



Click on OK and you are done for setting the packet size.

You've told Visionscape to use jumbo packets but the camera is still going to be sending data at the same rate – as fast as possible.

Setting the Inter-Packet Delay

There is no reason to have a camera capable of sending data at 90 frames per second if your particular application only runs at 30 frames per second. It makes a lot more sense (and puts a lot less stress on the PC) to slow the camera down to the point where it is still fast enough to run faster than the inspection requirements but not much faster. Let's give the application 10% headroom and say that for our 30 frames per second application we feel safe with the camera running at 33 frames per second.

In other words, we need to slow down the camera to make sure that the PC can handle the throughput. This is not an issue on PCs with dedicated PCIe x16 graphics cards but it most certainly is on slower devices.

The inter-packet delay is the parameter that will allow us to control the rate of data from the camera.

Let's assume that we are using a CMG03c camera transmitting bayer data. This camera is capable of running at 91 fps with an 8 millisecond exposure time. With a 9000 byte packet size one frame of data (656 x 494 = 324,064 bytes + a small overhead) can be transmitted in 38 packets.

The actual data from the camera will be sent over the network at the clock rate which, for gigabit Ethernet, is 125MHz. This is 8 nanoseconds per clock. Assuming no overhead and no delays between packets our frame of data from the CMG03c would take 324,064 clocks, which is 2.59 milliseconds. There is nothing we can do to change this time to transfer the data.

With the InterPacketDelay (IPD) set to zero the camera sends one packet of data and then immediately sends the next (actually there is a minimum delay of approximately 96 nanoseconds). This process repeats until all the packets that make up an image have been transmitted. Increasing the IPD tells the camera to take a short break between sending each packet, which might give other devices a chance to send some of their data.

We can put a delay between each packet. The inter-packet delay is set in "ticks", where there are 31,250,000 ticks in one second. From this we know that 1 tick is 32 nanoseconds.

Let's assume that we want our camera to run at 33 fps. In this case 1 frame is equal to 30.3 milliseconds. We can take off the fixed data transmission time of 2.59 milliseconds and that leaves us 27.71 milliseconds. With 38 packets per image that means that every packet needs to take 729 microseconds.

Dividing 729,000 nanoseconds by 32 nanoseconds gives us a tick count of 22,781. This is the inter-packet delay we need to put in the Visionscape registry entry.

The following calculations show how this works in reverse:

- 22,781 ticks is 729 microseconds.
- A 2MB image is approximately 38 9k packets.
- 38 * 729 microseconds = 27.71 milliseconds.

- Add in the 2.59 milliseconds to actually send the data. 2.59 + 27.71 = 30.3 milliseconds per frame.
- The camera could run at 33 fps.
- Set the inter-packet delay in the registry in exactly the same way as you set the packet size.

Note: The Visionscape GigE Camera Control Tool includes a tool to calculate the inter-packet delay. Feel free to use this only when you understand the material presented here!

FrontRunner Live Video

When you go into Live Video in FrontRunner with the zoom set to 1, a frame rate is displayed on the top left corner of the picture. For instance, it might say 30.1 fps. This means that Visionscape is displaying images at 30.1 fps. It does not mean that the camera is running at this rate and, in fact, it means that the camera is running *at least* twice as fast as that. This is due to the way FrontRunner handles live video from the camera.

Imagine that you are using a CMG03c, a VGA camera that can output data at slightly more than 90 fps. The display on the PC can probably only manage 60 fps. FrontRunner works as follows:

The camera is put into a continuous acquisition mode. If the inter-packet delay is negligible it will indeed be acquiring frames at 90 fps. FrontRunner will take a frame and then process it before displaying it on-screen. This process is sequential and FrontRunner will not take another frame until it has finished with the image display. It is not “pipelining” the process the way it does when acquiring images at runtime with triggers.

The sequential nature of the capture-draw-capture-draw process means that the best FrontRunner can ever do is 50% of the camera frame rate. This also depends on how fast the memory is, how fast the CPU itself is, and how fast the drawing operations are. It may in fact take more than the frame time to complete the drawing in which case FrontRunner will only show one in three frames.

Experiments on a Core2Duo workstation with a dedicated graphics card and an Intel Pro/1000 NIC connected to a CMG03c camera showed that the maximum frame rate for live video in FrontRunner was 36.9 frames

per second. Furthermore, this was not when the packet size was minimized but when it was set to 9000.

The rate shown in FrontRunner is the display rate. The camera itself is running at least twice as fast. The rate displayed on-screen when in live video is meaningless in terms of the application runtime performance.

Dropped or Missing Packets Message

Live video does however stress the PC more than the runtime. If you have reduced the camera frame rate using packet size and inter-packet delay to the rate at which you absolutely must run and you get “Dropped Packets” messages when running in live video, then your PC is not capable of running the application and you should find a faster PC. The usual reason for this is the graphics adapter. Any onboard adapter that uses shared memory is going to have problems.

The “Dropped Packets” message means that the NIC could not send data to the system memory in time because the memory or data bus was too busy. As mentioned above, an onboard or integrated graphics adapter using shared memory uses the bus extensively. A dedicated graphics adapter is given the data it needs to display and handles all manipulations required within its own memory space, thus freeing the system memory bus.

How to Modify the dm.config File to Change Camera and System Assignments

Explaining and Modifying the dm.config file

The first time you plug an Omron Microscan GigE camera into a PC and start FrontRunner, a new file is created. This file is called **dm.config** and it can be found in the **C:\Vscape\DM** directory. DM stands for Device Manager, and this file is intended to manage all GigE devices attached to the PC.

Assuming you have a single GigE camera, the dm.config file will look similar to that shown below:

```
<?xml version="1.0" encoding="utf-8"?>
<DMConfiguration xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <Settings>
    <servicePort>8899</servicePort>
    <serviceBase>http://localhost</serviceBase>
    <path>DM</path>
    <enableLogging>true</enableLogging>
<engineExePath>C:\dev\EngineSolution\EngineProcess\bin\Debug\Vision
scape.EngineProcess.exe</engineExePath>
  </Settings>
  <Devices>
    <Device name="GigEVision1" devClass="GigE">
      <Assignments>
        <Assignment type="ACQ" uid="94d2afa3-95bb-4e6d-83bd-
098e5ed439d2" />
      </Assignments>
    </Device>
    <Device name="SoftSys1" devClass="Software" />
  </Devices>
  <Resources>
    <Resource uid="94d2afa3-95bb-4e6d-83bd-098e5ed439d2"
type="GigE_Camera" MACAddress="00-06-BE-00-09-4A">
      <gige>
        <CameraID>TL=&gt;GevTL , INT=&gt;FD::MAC-&gt;00-1B-21-0A-0C-
72::National Instruments GigE Vision Adapter - Packet Scheduler
Miniport , DEV=&gt;::MAC-&gt;00-06-BE-00-09-4A::Baumer
Optronic::VISIONSCAPE CMG20</CameraID>
        <IPAddress>192.168.254.3</IPAddress>
        <MACAddress>00-06-BE-00-09-4A</MACAddress>
        <VendorName>Microscan</VendorName>
        <ResolutionX>1624</ResolutionX>
        <ResolutionY>1236</ResolutionY>
        <ModelName>VISIONSCAPE CMG20</ModelName>
      </gige>
    </Resource>
  </Resources>
</DMConfig
```

This file, in XML format, has three main sections. The first section, settings, can be ignored. The second section, which starts with the **<Devices>** line, outlines all the devices (other than smart cameras) that will be listed in the FrontRunner device bar. In the example above, there are two devices – **GigE Vision1** and **SoftSys1**.

The third section, starting with the **<Resources>** line, lists all the GigE cameras attached to the network cards. Note that only cameras that are connected via gigabit ethernet will be listed. Omron Microscan not recommend or allow 100baseT networks with GigE cameras.
If you look closely, you'll notice that the assignment uid listed in the device section is the same as that shown for the resource uid for the attached camera.

If you open the **Visionscape Backplane** debug window, you will see the same information again:

```
10:41:37 QuerySWRights: GigE license rights detected, features:
Visionscape GigE (x8): YES / IntelliFind: YES / Third Party GigE
Cameras: 0 allowed
10:41:39 CreateSystemsFromConfigFile: found 2 devices in dm.config
file
10:41:39     Creating GigE System 1: GigEVision1
10:41:39          Channel 0 (Filter Driver): Microscan VISIONSCAPE
CMG20 (1624x1236) MAC="00-06-BE-00-09-4A" IP="192.168.254.3"
Connected

10:41:39     Creating SW System 1: SoftSys1
10:41:40     Creating IO Server for System GigEVision1
10:41:41     Creating IO Server for System SoftSys1
```

Now let's quit FrontRunner and the Backplane and add a second camera to our network. Once the second cameras is plugged in, the network card will take a little while to recognize and configure it, so don't start FrontRunner immediately.

If you look at the dm.config file now you will see that it looks similar to this:

```
<?xml version="1.0" encoding="utf-8"?>
<DMConfiguration xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <Settings>
    <servicePort>8899</servicePort>
    <serviceBase>http://localhost</serviceBase>
    <path>DM</path>
    <enableLogging>true</enableLogging>

<engineExePath>C:\dev\EngineSolution\EngineProcess\bin\Debug\Vision
scape.EngineProcess.exe</engineExePath>
  </Settings>
```

```
  <Devices>
    <Device name="GigEVision1" devClass="GigE">
      <Assignments>
        <Assignment type="ACQ" uid="94d2afa3-95bb-4e6d-83bd-
098e5ed439d2" />
        <Assignment type="ACQ" uid="189b1b90-624b-4eec-b282-
839558dc0f6c" />
      </Assignments>
    </Device>
    <Device name="SoftSys1" devClass="Software" />
  </Devices>
  <Resources>
    <Resource uid="94d2afa3-95bb-4e6d-83bd-098e5ed439d2"
type="GigE_Camera" MACAddress="00-06-BE-00-09-4A">
      <gige>
       <CameraID>TL=&gt;GevTL , INT=&gt;FD::MAC-&gt;00-1B-21-0A-0C-
72::National Instruments GigE Vision Adapter - Packet Scheduler
Miniport , DEV=&gt;::MAC-&gt;00-06-BE-00-09-4A::Baumer
Optronic::VISIONSCAPE CMG20</CameraID>
        <IPAddress>192.168.254.3</IPAddress>
        <MACAddress>00-06-BE-00-09-4A</MACAddress>
        <VendorName>Microscan</VendorName>
        <ResolutionX>1624</ResolutionX>
        <ResolutionY>1236</ResolutionY>
        <ModelName>VISIONSCAPE CMG20</ModelName>
      </gige>
    </Resource>
    <Resource uid="189b1b90-624b-4eec-b282-839558dc0f6c"
type="GigE_Camera" MACAddress="00-06-BE-00-09-4B">
      <gige>
       <CameraID>TL=&gt;GevTL , INT=&gt;FD::MAC-&gt;00-1B-21-0A-0C-
72::National Instruments GigE Vision Adapter - Packet Scheduler
Miniport , DEV=&gt;::MAC-&gt;00-06-BE-00-09-4B::Baumer
Optronic::VISIONSCAPE CMG20</CameraID>
        <IPAddress>192.168.254.2</IPAddress>
            <MACAddress>00-06-BE-00-09-4B</MACAddress>
            <VendorName>Microscan</VendorName>
            <ResolutionX>1624</ResolutionX>
            <ResolutionY>1236</ResolutionY>
            <ModelName>VISIONSCAPE CMG20</ModelName>
          </gige>
        </Resource>
      </Resources>
    </DMConfiguration>
```

The GigEVision1 system now contains two assignments and there is a second camera resource at the bottom of the file.

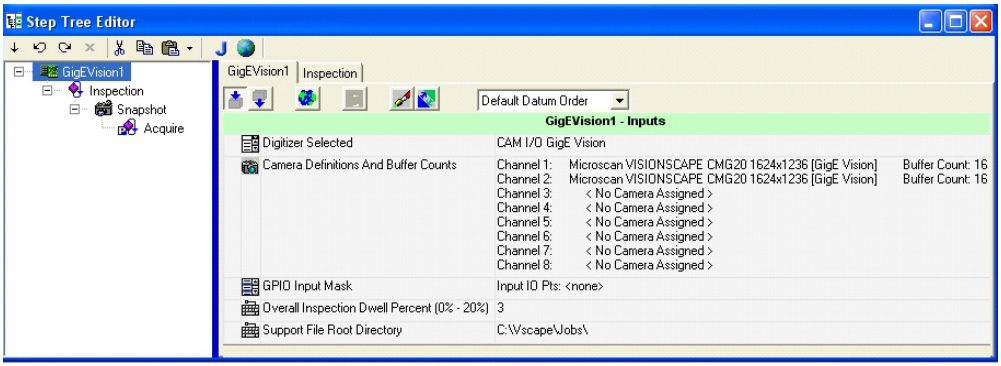
The debug window now shows two cameras on GigEVision1:

```
11:19:11 QuerySWRights: GigE license rights detected, features:
Visionscape GigE (x8): YES / IntelliFind: YES / Third Party GigE
Cameras: 0 allowed
11:19:13 CreateSystemsFromConfigFile: found 2 devices in dm.config
file
11:19:13     Creating GigE System 1: GigEVision1
```

```
11:19:13          Channel 0 (Filter Driver): Microscan VISIONSCAPE
CMG20 (1624x1236) MAC="00-06-BE-00-09-4A" IP="192.168.254.3"
Connected
11:19:13          Channel 1 (Filter Driver): Microscan VISIONSCAPE
CMG20 (1624x1236) MAC="00-06-BE-00-09-4B" IP="192.168.254.2"
Connected
11:19:13     Creating SW System 1: SoftSys1
11:19:15     Creating IO Server for System GigEVision1
11:19:16     Creating IO Server for System SoftSys1
```

If you look at the FrontRunner device bar you will see that there is still only one GigE device listed:

Create a new job and bring up the editor. Click on the vision system step on the left and you will see something similar to that shown below:



There are the two cameras both now available for use in the new job.

Suppose you want to break your cameras down so that, instead of all being part of one big system, they are on separate systems. Why might you want to do this? Maybe it makes more sense to your physical layout this way. For example, if you have one Visionscape system with four cameras each monitoring a process on four separate lines, then you might want to stop one line and change the job being run while still

running the other three lines. This is theoretically possible with multiple GigE systems.

How do you do this? By making some relatively simple changes to the dm.config file. Start by quitting FrontRunner and the Backplane.

Taking our two camera file as a starting point, we are going to duplicate the GigEVision1 device as follows. (Only the device part of the file is shown here):

```
  <Devices>
    <Device name="GigEVision1" devClass="GigE">
      <Assignments>
        <Assignment type="ACQ" uid="94d2afa3-95bb-4e6d-83bd-
098e5ed439d2" />
        <Assignment type="ACQ" uid="189b1b90-624b-4eec-b282-
839558dc0f6c" />
      </Assignments>
    </Device>
    <Device name="SoftSys1" devClass="Software" />
  </Devices>
```

Copy everything for the first device and paste it immediately above the SoftSys1 device as follows:

```
  <Devices>
    <Device name="GigEVision1" devClass="GigE">
      <Assignments>
        <Assignment type="ACQ" uid="94d2afa3-95bb-4e6d-83bd-
098e5ed439d2" />
        <Assignment type="ACQ" uid="189b1b90-624b-4eec-b282-
839558dc0f6c" />
      </Assignments>
    </Device>
    <Device name="GigEVision1" devClass="GigE">
      <Assignments>
        <Assignment type="ACQ" uid="94d2afa3-95bb-4e6d-83bd-
098e5ed439d2" />
        <Assignment type="ACQ" uid="189b1b90-624b-4eec-b282-
839558dc0f6c" />
      </Assignments>
    </Device>
    <Device name="SoftSys1" devClass="Software" />
  </Devices>
```

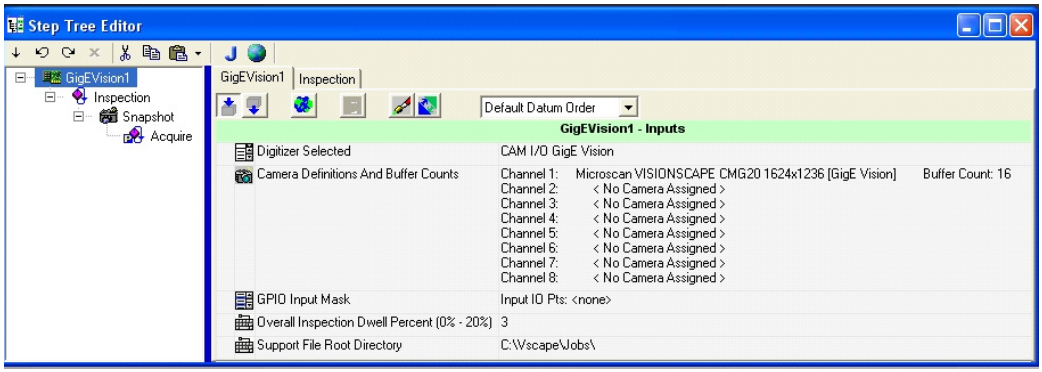
Now delete one uid from each of the two devices and rename the second one:

```
  <Devices>
    <Device name="GigEVision1" devClass="GigE">
      <Assignments>
        <Assignment type="ACQ" uid="94d2afa3-95bb-4e6d-83bd-
098e5ed439d2" />
      </Assignments>
```

```
    </Device>
    <Device name="GigEVision2" devClass="GigE">
      <Assignments>
        <Assignment type="ACQ" uid="189b1b90-624b-4eec-b282-
839558dc0f6c" />
      </Assignments>
    </Device>
    <Device name="SoftSys1" devClass="Software" />
  </Devices>
```

Bring up FrontRunner again and you should see the following in the device bar:

Two GigE systems are available, each with one camera.



The Backplane debug window also shows the change:

```
14:01:47 QuerySWRights: GigE license rights detected, features:
Visionscape GigE (x8): YES / IntelliFind: YES / Third Party GigE
Cameras: 0 allowed
14:01:49 CreateSystemsFromConfigFile: found 3 devices in dm.config
file
14:01:49     Creating GigE System 1: GigEVision1
14:01:49          Channel 0 (Filter Driver): Microscan VISIONSCAPE
CMG20 (1624x618) MAC="00-06-BE-00-09-4A" IP="192.168.254.3"
Connected
14:01:49     Creating GigE System 2: GigEVision2
```

```
14:01:49          Channel 0 (Filter Driver): Microscan VISIONSCAPE
CMG20 (1624x618) MAC="00-06-BE-00-09-4B" IP="192.168.254.2"
Connected
14:01:49     Creating SW System 1: SoftSys1
14:01:50     Creating IO Server for System GigEVision1
14:01:51     Creating IO Server for System GigEVision2
14:01:52     Creating IO Server for System SoftSys1
```

You can now use the two cameras and systems independently. You could load the same job on both systems.

Remember that, if using the Visionscape PCIe digital IO card, all systems share this resource. Make sure that you're not trying to use the same output line for two or more things.

Switching Out a Camera

Imagine you have a production system with several cameras. All is working well but then someone manages to break one of the cameras. A spare camera is procured and put on the network in place of the damaged device. Will Visionscape automatically detect this change for you?

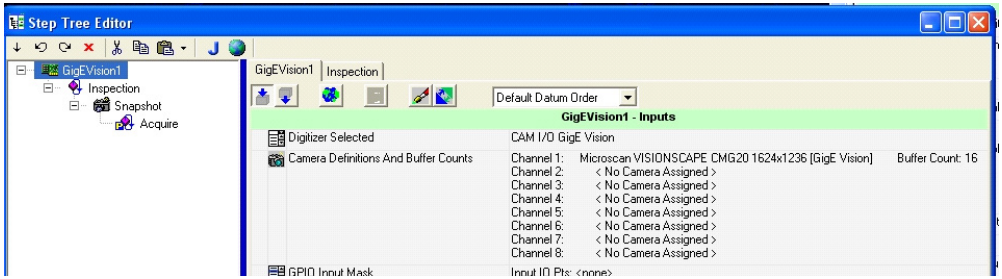
The answer is no, not in the current version of Visionscape. What will happen is that the new camera will be added to the end of the resources list in the dm.config file. The uid for the new camera will be automatically added to the end of the GigEVision1 list. This probably isn't what you want. In addition, the original, broken camera will still have entries in the dm.config file – the software doesn't know it is broken.

Let's go back to our original dm.config file. We have one camera attached as shown in the listing below:

```
<?xml version="1.0" encoding="utf-8"?>
<DMConfiguration xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <Settings>
    <servicePort>8899</servicePort>
    <serviceBase>http://localhost</serviceBase>
    <path>DM</path>
    <enableLogging>true</enableLogging>
<engineExePath>C:\dev\EngineSolution\EngineProcess\bin\Debug\Vision
scape.EngineProcess.exe</engineExePath>
  </Settings>
  <Devices>
    <Device name="GigEVision1" devClass="GigE">
      <Assignments>
        <Assignment type="ACQ" uid="2ca5cfd1-14c2-45dd-b692-
9a2948d18361" />
      </Assignments>
```

```
    </Device>
    <Device name="SoftSys1" devClass="Software" />
  </Devices>
  <Resources>
    <Resource uid="2ca5cfd1-14c2-45dd-b692-9a2948d18361"
type="GigE_Camera" MACAddress="00-06-BE-00-09-4B">
      <gige>
        <CameraID>TL=&gt;GevTL , INT=&gt;FD::MAC-&gt;00-1B-21-0A-0C-
72::National Instruments GigE Vision Adapter - Packet Scheduler
Miniport , DEV=&gt;::MAC-&gt;00-06-BE-00-09-4B::Baumer
Optronic::VISIONSCAPE CMG20</CameraID>
        <IPAddress>192.168.254.2</IPAddress>
        <MACAddress>00-06-BE-00-09-4B</MACAddress>
        <VendorName>Microscan</VendorName>
        <ResolutionX>1624</ResolutionX>
        <ResolutionY>618</ResolutionY>
        <ModelName>VISIONSCAPE CMG20</ModelName>
      </gige>
    </Resource>
  </Resources>
</DMConfiguration>
```

The vision system step shows this one camera as being available for use. Everything is as it should be.



Now we are going to shut Visionscape down and change the camera to another one. This camera is then added to the dm.config list.

```
<?xml version="1.0" encoding="utf-8"?>
<DMConfiguration xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema">
  <Settings>
    <servicePort>8899</servicePort>
    <serviceBase>http://localhost</serviceBase>
    <path>DM</path>
    <enableLogging>true</enableLogging>
<engineExePath>C:\dev\EngineSolution\EngineProcess\bin\Debug\Vision
scape.EngineProcess.exe</engineExePath>
  </Settings>
  <Devices>
    <Device name="GigEVision1" devClass="GigE">
      <Assignments>
        <Assignment type="ACQ" uid="2ca5cfd1-14c2-45dd-b692-
9a2948d18361" />
```

```
        <Assignment type="ACQ" uid="07a05837-f79e-4827-8773-
399c72bb1d63" />
      </Assignments>
    </Device>
    <Device name="SoftSys1" devClass="Software" />
  </Devices>
  <Resources>
    <Resource uid="2ca5cfd1-14c2-45dd-b692-9a2948d18361"
type="GigE_Camera" MACAddress="00-06-BE-00-09-4B">
      <gige>
       <CameraID>TL=&gt;GevTL , INT=&gt;FD::MAC-&gt;00-1B-21-0A-0C-
72::National Instruments GigE Vision Adapter - Packet Scheduler
Miniport , DEV=&gt;::MAC-&gt;00-06-BE-00-09-4B::Baumer
Optronic::VISIONSCAPE CMG20</CameraID>
        <IPAddress>192.168.254.2</IPAddress>
        <MACAddress>00-06-BE-00-09-4B</MACAddress>
        <VendorName>Microscan</VendorName>
        <ResolutionX>1624</ResolutionX>
        <ResolutionY>618</ResolutionY>
        <ModelName>VISIONSCAPE CMG20</ModelName>
      </gige>
    </Resource>
    <Resource uid="07a05837-f79e-4827-8773-399c72bb1d63"
type="GigE_Camera" MACAddress="00-06-BE-00-09-4A">
      <gige>
       <CameraID>TL=&gt;GevTL , INT=&gt;FD::MAC-&gt;00-1B-21-0A-0C-
72::National Instruments GigE Vision Adapter - Packet Scheduler
Miniport , DEV=&gt;::MAC-&gt;00-06-BE-00-09-4A::Baumer
Optronic::VISIONSCAPE CMG20</CameraID>
        <IPAddress>192.168.254.2</IPAddress>
        <MACAddress>00-06-BE-00-09-4A</MACAddress>
        <VendorName>Microscan</VendorName>
        <ResolutionX>0</ResolutionX>
        <ResolutionY>0</ResolutionY>
        <ModelName>VISIONSCAPE CMG20</ModelName>
      </gige>
    </Resource>
  </Resources>
</DMConfiguration>
```

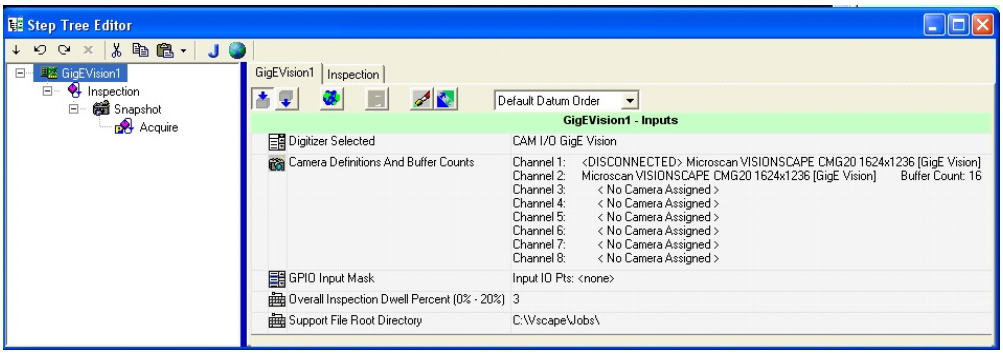
The original camera is still in the file and the new one has been added to GigEVision1 below it.

The debug window also noted the change – it lets you know that the original camera couldn't be found.

```
16:23:58 QuerySWRights: GigE license rights detected, features:
Visionscape GigE (x8): YES / IntelliFind: YES / Third Party GigE
Cameras: 0 allowed
16:24:05 CreateSystemsFromConfigFile: found 2 devices in dm.config
file
16:24:05     Creating GigE System 1: GigEVision1
16:24:05          Channel 0 (Filter Driver): Microscan VISIONSCAPE
CMG20 (1624x618) MAC="00-06-BE-00-09-4B" IP="192.168.254.2" Not
connected
16:24:05          Channel 1 (Filter Driver): Microscan VISIONSCAPE
CMG20 (0x0) MAC="00-06-BE-00-09-4A" IP="192.168.254.2" Connected
```

```
16:24:05     Creating SW System 1: SoftSys1
16:24:10     Creating IO Server for System GigEVision1
16:24:11     Creating IO Server for System SoftSys1
```

In this state, FrontRunner comes up and, although you only have the one camera connected, there are two cameras in the vision system step list:



The original camera is still camera 1 although it is noted as being disconnected. Any job that we were using before would still keep the same camera channel assignments, so if they were using camera 1 before they will still try to use camera 1 even though it is not there.

We opened a job that had been saved for the first camera and tried to take a picture. It failed and output the red error bar below the buffer in FrontRunner. The debug window also informed us that this was not going to work:

```
16:31:33 GigeVision1: No Acquisition control! There is no control
connection for Camera 1
16:31:33 GigEVision1: Camera 1 Not Detected -- Check the camera,
camera power, and cable !
```

Live video will still start but won't do anything.

Warning: If you are using a slow laptop then it could also be hard to stop.

We need to get back to where the same jobs will load in the same way as before but will use the new camera instead. We need to edit the dm.config file. Again, be sure to quit FrontRunner and the Backplane before attempting this.

If the original camera is no longer required, delete it by erasing the first line in the GigEVision1 assignments as follows:

Before

```
  <Devices>
    <Device name="GigEVision1" devClass="GigE">
      <Assignments>
        <Assignment type="ACQ" uid="2ca5cfd1-14c2-45dd-b692-
9a2948d18361" />
        <Assignment type="ACQ" uid="07a05837-f79e-4827-8773-
399c72bb1d63" />
      </Assignments>
    </Device>
    <Device name="SoftSys1" devClass="Software" />
  </Devices>
```

After

```
 <Devices>
    <Device name="GigEVision1" devClass="GigE">
      <Assignments>
        <Assignment type="ACQ" uid="07a05837-f79e-4827-8773-
399c72bb1d63" />
      </Assignments>
    </Device>
    <Device name="SoftSys1" devClass="Software" />
  </Devices>
```

You could leave the resources entry in the file but it is cleaner to delete it (make sure you delete the correct one – use the uid from the original camera from the line you just deleted).

Before

```
  <Resources>
    <Resource uid="2ca5cfd1-14c2-45dd-b692-9a2948d18361"
type="GigE_Camera" MACAddress="00-06-BE-00-09-4B">
      <gige>
        <CameraID>TL=&gt;GevTL , INT=&gt;FD::MAC-&gt;00-1B-21-0A-0C-
72::National Instruments GigE Vision Adapter - Packet Scheduler
Miniport , DEV=&gt;::MAC-&gt;00-06-BE-00-09-4B::Baumer
Optronic::VISIONSCAPE CMG20</CameraID>
        <IPAddress>192.168.254.2</IPAddress>
        <MACAddress>00-06-BE-00-09-4B</MACAddress>
        <VendorName>Microscan</VendorName>
        <ResolutionX>1624</ResolutionX>
        <ResolutionY>618</ResolutionY>
        <ModelName>VISIONSCAPE CMG20</ModelName>
      </gige>
    </Resource>
    <Resource uid="07a05837-f79e-4827-8773-399c72bb1d63"
type="GigE_Camera" MACAddress="00-06-BE-00-09-4A">
      <gige>
        <CameraID>TL=&gt;GevTL , INT=&gt;FD::MAC-&gt;00-1B-21-0A-0C-
72::National Instruments GigE Vision Adapter - Packet Scheduler
```

```
Miniport , DEV=&gt;::MAC-&gt;00-06-BE-00-09-4A::Baumer
Optronic::VISIONSCAPE CMG20</CameraID>
        <IPAddress>192.168.254.2</IPAddress>
        <MACAddress>00-06-BE-00-09-4A</MACAddress>
        <VendorName>Microscan</VendorName>
        <ResolutionX>0</ResolutionX>
        <ResolutionY>0</ResolutionY>
        <ModelName>VISIONSCAPE CMG20</ModelName>
      </gige>
    </Resource>
  </Resources>
```

After

```
  <Resources>
    <Resource uid="07a05837-f79e-4827-8773-399c72bb1d63"
type="GigE_Camera" MACAddress="00-06-BE-00-09-4A">
      <gige>
        <CameraID>TL=&gt;GevTL , INT=&gt;FD::MAC-&gt;00-1B-21-0A-0C-
72::National Instruments GigE Vision Adapter - Packet Scheduler
Miniport , DEV=&gt;::MAC-&gt;00-06-BE-00-09-4A::Baumer
Optronic::VISIONSCAPE CMG20</CameraID>
        <IPAddress>192.168.254.2</IPAddress>
        <MACAddress>00-06-BE-00-09-4A</MACAddress>
        <VendorName>Microscan</VendorName>
        <ResolutionX>0</ResolutionX>
        <ResolutionY>0</ResolutionY>
        <ModelName>VISIONSCAPE CMG20</ModelName>
      </gige>
    </Resource>
  </Resources>
```

We should now be able to bring up FrontRunner again and only see the one camera. We should also be able to run jobs from our original camera on this new device (assuming they are the same type of camera).

Everything looks fine in the debug window:

```
16:41:54 QuerySWRights: GigE license rights detected, features:
Visionscape GigE (x8): YES / IntelliFind: YES / Third Party GigE
Cameras: 0 allowed
16:41:56 CreateSystemsFromConfigFile: found 2 devices in dm.config
file
16:41:56     Creating GigE System 1: GigEVision1
16:41:56          Channel 0 (Filter Driver): Microscan VISIONSCAPE
CMG20 (1624x1236) MAC="00-06-BE-00-09-4A" IP="192.168.254.2"
Connected
16:41:56     Creating SW System 1: SoftSys1
16:41:57     Creating IO Server for System GigEVision1
16:41:58     Creating IO Server for System SoftSys1
```

This is certainly not as simple as it was when all you had to do to replace a camera was unplug the old one and plug in the replacement – but it's not rocket science either.

If you find yourself running demonstrations from a laptop for customers or other users and you have more than one GigE camera, be sure to follow the guidelines from the last few pages. If you don't, you won't be able to demonstrate the software as cleanly as you would otherwise. Omron Microscan recommends that you delete the dm.config file before running a GigE demonstration. The file will be created correctly the first time you start up FrontRunner. If you really don't want to delete it then give it a new name so you can go back to it later.

Partial Scan Acquisition

All of the new Visionscape GigE cameras support partial scan mode. This is easy to use if you don’t mind “getting your hands dirty” modifying the camera definition file. Here’s how to do it.

Imagine you’re using a CMG03. The camdef file is in the **C:\Vscape\Drivers\CamDefs** directory and it’s called:

microscan_visionscape_cmg03_656x494_gigevision.cam

Open this file with the text editor of your choice (Notepad, for example). It looks like this:

```
Camera Name Microscan VISIONSCAPE CMG03 656x494
Digitizer Type 1073741824  // GigeVision
Camera Help File
Stride 656
Rows 494
X Offset 0
Y Offset 0
Bits Per Pixel 8
Pixel Type 0
Image Structure 1
Vertical Binning 1
Horizontal Binning 1
Async Control 1       // 1=async, 0=continuous (formerly "shutter
type")
Usecs Per Frame 33333
Usecs Per Line x 10 674
Sensors 1
Strobes 1
GPIO Edit Mask 0x0
GPIO Defaults 0x0
GPIO Count 0
GPIO Inputs 0
GPIO Outputs 0
```

If you only want to use the middle 100 lines you would change this as follows:

```
Camera Name Microscan VISIONSCAPE CMG03 656x100
Digitizer Type 1073741824  // GigeVision
Camera Help File
Stride 656
Rows 100
X Offset 0
Y Offset 197
Bits Per Pixel 8
Pixel Type 0
Image Structure 1
Vertical Binning 1
Horizontal Binning 1
Async Control 1       // 1=async, 0=continuous (formerly "shutter
type")
Usecs Per Frame 33333
Usecs Per Line x 10 674
Sensors 1
Strobes 1
GPIO Edit Mask 0x0
GPIO Defaults 0x0
GPIO Count 0
GPIO Inputs 0
GPIO Outputs 0
```

Setting the Y Offset to 197 because 494-100 = 394. 394/2 = 197. 197 lines to ignore, take 100 lines and ignore the rest. Save this file, making sure that you do not save it as a text file (Save as Type… All Files).

Load FrontRunner and you should now be able to select this new camdef for your camera.

How to Set Up a Multiple-Camera System the Easy Way

Imagine that a customer wants to use four CMG20 cameras in a single inspection. The cameras will be connected to a single NIC through a GigE switch.

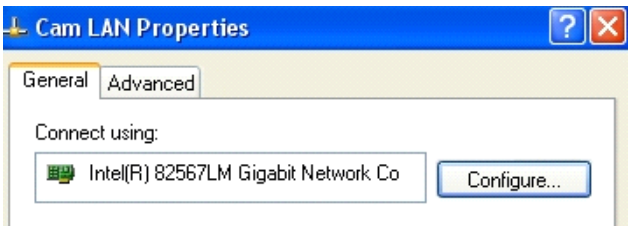
If they just plug in all four cameras and turn them on, two things will happen:

- The order of the four cameras may not be what the customer wants;
- They won't work taking simultaneous images because the overall bandwidth of these four cameras is too high (the CMG20 can do 16 fps. At 2MB per image, this is 32MB per second per camera. 4

cameras give 128MB per second which is more than the 1000Base/T link can handle).

The Correct Procedure

The first thing to do is to make sure that the NIC is configured correctly. Hopefully this is an Intel Pro/1000 NIC card. If so, go to the network adapter properties and click on the **Configure** button next to the network card description:



Next, click on the Advanced tab and you should see a list of parameters that can be tuned by the user.

Look for **Jumbo Frames** (sometimes called **Jumbo Packets**) and **Receive Descriptors** (sometimes called **Receive Buffers**). On some drivers these may be buried inside **Performance Options**.

Jumbo Frames: Make sure this is set to the maximum available – typically 8192 bytes but only 5k on some NICs.

Receive Descriptors: Set this to the maximum – typically 2048.

Save the changes.

You have just enabled the NIC to handle larger packets. This means that, instead of sending image data from the camera in chunks of 1500 bytes they can now come in chunks of 8192. That means about six times fewer packets for each image.

Increasing the number of receive descriptors enables the NIC to handle more packets at any one time. If the processor is busy when an image arrives, the NIC may not be able to send on the data immediately, but data is still coming in from the camera. These receive descriptor buffer the system against this. (It is almost essential when using a CMG50 camera).

Now that the NIC is all set up to handle cameras in the most efficient way possible we can start working with the cameras.

1. Connect the switch to the NIC and turn it on.
2. Connect the camera you want to be camera 1 to the NIC.
3. Bring up FrontRunner or just the Backplane. (Just the Backplane is much faster). As this is the first time that you have booted the Visionscape software, a new file, **C:\Vscape\DM\dm.config**, will be created.

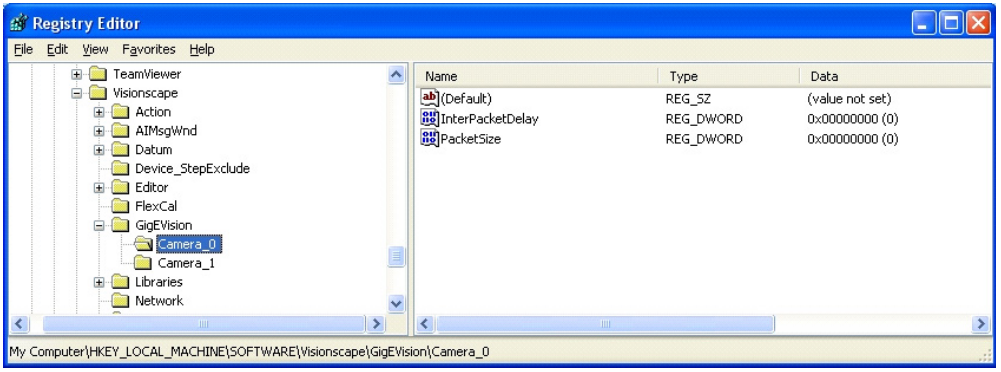
   [If this wasn't the first time you have run FrontRunner then quit FrontRunner and the Backplane and delete dm.config before going back to step 1].
4. Close the Backplane – you can do this by right-clicking on the icon in the taskbar.
5. Connect the second camera and repeat steps 3 and 4.
6. Repeat step 5 for cameras 3 and 4.

You have now attached all four cameras to the switch and the Visionscape software saw them each in order. This will have made the dm.config file remember the order.

The four cameras are still not quite ready to use. They are still going to use the default 1500 byte packet size that Visionscape uses out-of-the-box. We need to change this before going any further. These values are stored in the registry. From the **Start** menu select **Run…** and type:

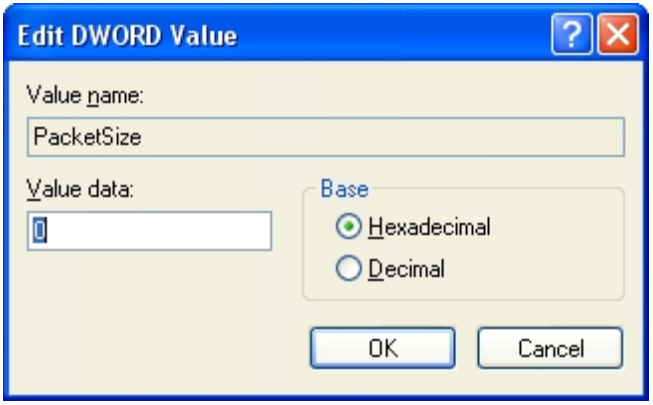
Regedit

Go to **My Computer\HKEY_LOCAL_MACHINE\SOFTWARE \Visionscape\GigEVision\Camera_0**

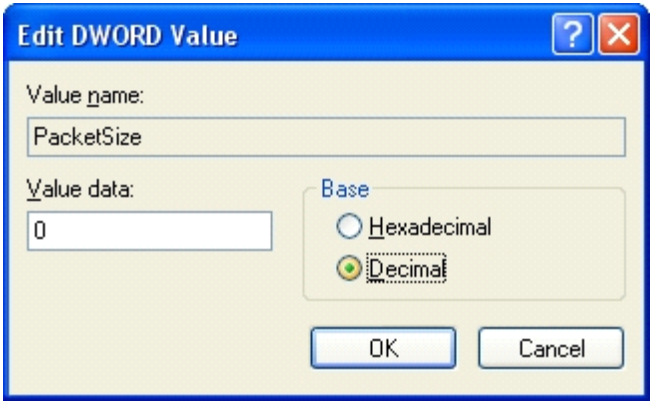


You will actually have Camera_0, Camera_1, Camera_2 and Camera_3 directories – these all have the same things inside. You'll need to repeat the procedure for Camera_0 on all 4 cameras.

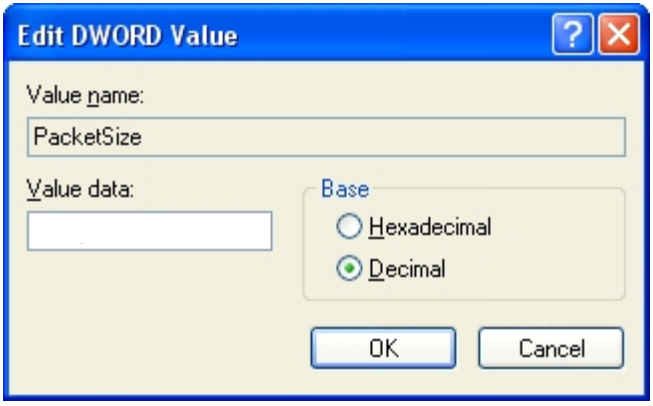
The two parameters **InterPacketDelay** and **PacketSize** are both set to 0, which tells Visionscape to use its default values. The first thing you need to do is set the PacketSize to 8192. To do this, right-click on **PacketSize** and select **Modify**. You'll see the following:



Change to Decimal in the Base group:



Now enter 8192 in the Value Data text box:



Click **OK** and you are done setting the packet size. Repeat this for all four cameras.

We've told Visionscape to use jumbo packets but the four cameras are still going to be sending data at the same rate (128MB per second overall). What this means is that one camera will start sending a solid stream of data, another camera will try to do the same thing but find that the network is completely snarled and the result will be that image data will be lost.

We need to slow down the cameras now so that they'll work nicely together – this is what InterPacketDelay is for.

With the InterPacketDelay (IPD) set to zero the camera sends one packet of data and then immediately sends the next (actually there is a minimum delay of approximately 96 nanoseconds). This process repeats until all the packets that make up an image have been transmitted. Increasing the IPD tells the camera to take a short break between sending each packet which might give other devices a chance to send some of their data.

The IPD is a multiple of ticks. For GigE, 1 tick is 16 nanoseconds. To run 4 CMG20 cameras at a maximum of 5 frames per second setting the IPD to 15000 works. This is a delay of 240 microseconds between each packet.

The following calculations show how this works:

- 15,000 ticks is 240 microseconds.
- 2MB image is approximately 222 9k packets.
- 222 * 240 microseconds = 53 milliseconds.
- The camera could run at 16 fps, which is 62 milliseconds per frame.
- We have just increased the overall time per frame from 62 milliseconds to 62 + 53 = 115 milliseconds. This is more than 5 frames per second so we should be all set (depending on exposure time).

The final step is to shut down the Backplane (if it is running) and cycle power to all the cameras. When Visionscape comes up the next time with jumbo packets enabled in the registry and the NIC, it will be able to tell the cameras to use jumbo packets too.

Now you can use the cameras without any missing packets or dropped frames.

NIC Parameters

GigE cameras need GigE NICs (network interface controllers). NICs can come built-in to a PC on the motherboard or as PCI or PCIe cards and there are also some USB-to-Ethernet adapters available.

Omron Microscan recommends the use of NICs that make use of the Intel Pro/1000 chipsets.

Normally, when you put a NIC into a PC it will be recognized as a network adapter and will inherit all the usual network protocols. These usually include the following:

Client for Microsoft Networks

File and Printer Sharing for Microsoft Networks

QoS Packet Scheduler

Internet Protocol (TCP/IP)

Some systems split internet protocol into two separate entries: TCP/IP Rev 4 and Rev 6. All Omron Microscan cameras use TCP/IP Rev 4.

There may also be anti-virus filters such as “McAfee NDIS Intermediate Filter”.

GigE cameras should be on their own dedicated network. This has nothing to do with Microsoft or with sharing. Visionscape installs a dedicated driver for GigE cameras that is called JAI GigE Vision Filter Driver. This filter driver recognizes GigE vision packets and filters them so that the CPU doesn’t have to deal with sorting them out. This lowers the CPU load, freeing it up for other things.

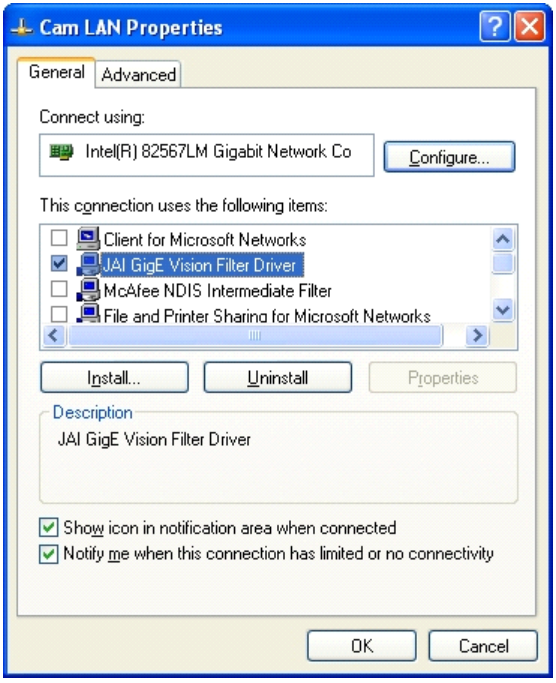
A GigE vision NIC only needs two items:

JAI GigE Vision Filter Driver

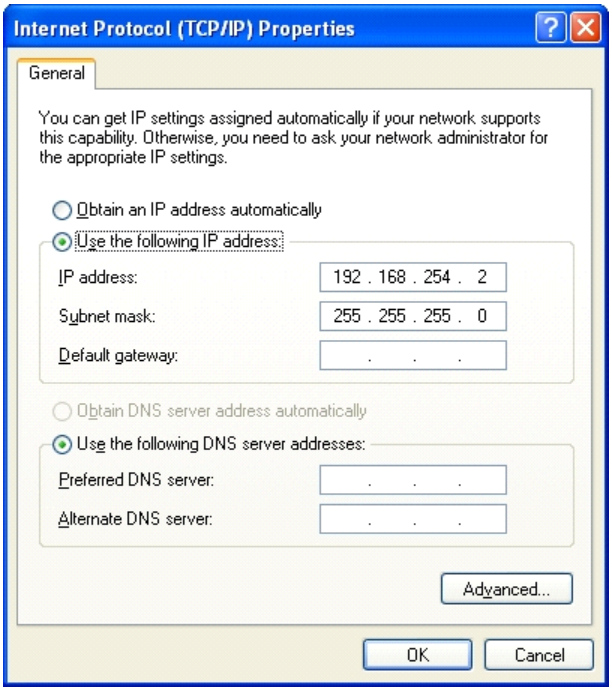
Internet Protocol (TCP/IP) (or TCP/IP Rev 4)

Uncheck all other items from the NIC you want to use for cameras if it will only be used for cameras. (If you use it for cameras one day and regular networking the next, leave everything on.)

In the example below, note the two check boxes at the bottom of the dialog box. If you have these checked then you will see a small icon for each NIC in the task bar. This is a useful visual indicator of network status.



The filter driver requires no setup whatsoever. Clicking on the TCP/IP Properties button will bring up the following dialog:



There is usually no need for cameras to be on a DHCP network, so choose a static address that starts with 192.168.x.x. 192.168 is reserved for private networks. In the picture above the address is set to 192.168.254.2 with the subnet mask set to 255.255.255.0. The mask means that all devices connected to the NIC should have addresses that start with 192.168.254.x. It is recommended that you steer clear of using any address that ends with .1 (for instance 192.168.254.1) as this is sometimes used by networks for gateways (devices that convert one sort of protocol to another).

You should also optimize the NIC. **How to Set Up a Multiple-Camera System** covered setting up the advanced parameters for the NIC (jumbo packets, receive descriptors, etc.). Make sure you do this for best performance.

Once you have done all this you can connect your camera directly or plug in a switch and then connect cameras to that switch. As they come out of

the box the cameras should now assign themselves addresses in the 192.168.254.x range. They are still receiving information about the network from outside in order to make this choice. You can simplify things still further by assigning each camera its own persistent IP address.

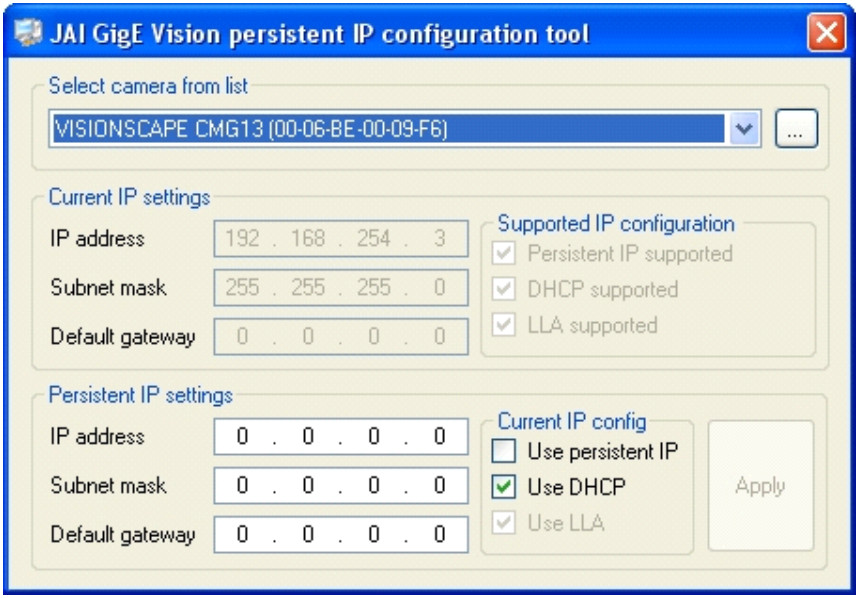
When you install Visionscape, this folder is placed on your C: drive:

C:\Microscan\Vscape\Drivers\GigE\JAI

Navigate to that folder and double-click on **JAI SDK 1.4.0.exe** or **JAI SDK x64 Version 1.4.0.exe** (depending on whether you're running a 32-bit or 64-bit system) to install the **JAI GigE Vision Persistent IP Configuration Tool**.

Once the tool is installed, navigate to **Start Menu > All Programs > JAI SDK > Tools** and click on **Persistent IP Configuration Tool** to open it.

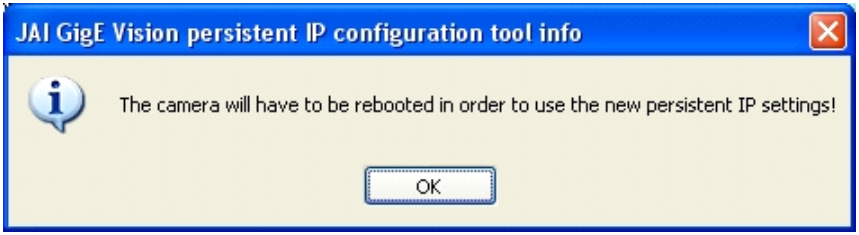
When you open the tool you will see a dialog similar to this:



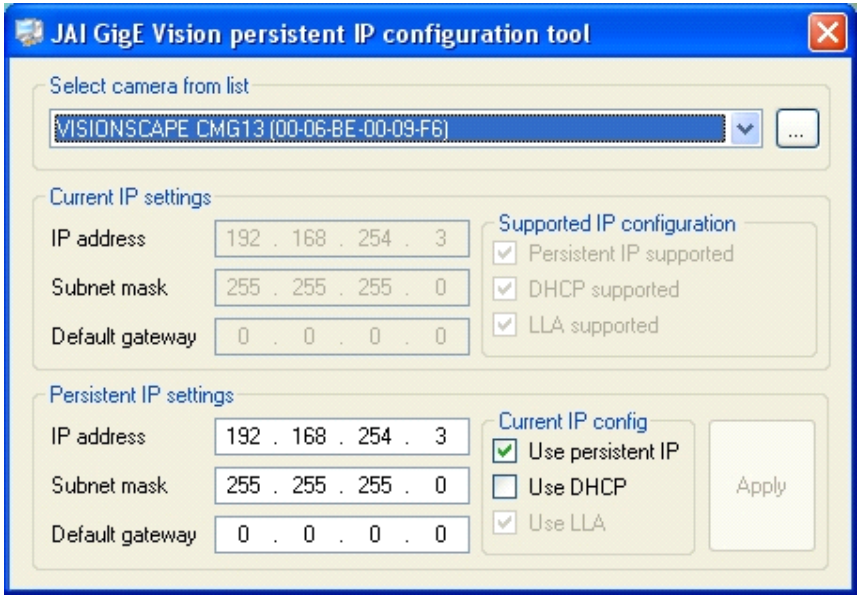
The camera here is set to use DHCP and its address is **192.168.254.3**. However, a persistent IP address is preferable.

Check the **Use persistent IP** box and uncheck the **Use DHCP** box. Enter **192.168.254.3** in the lower IP address box and **255.255.255.0** for the

Subnet mask. Click **Apply**. You will be prompted to reboot the camera as follows:



Cycle power to the camera and you are ready. The config tool will now show the following:



Now, every time the camera is rebooted it will automatically set this IP address so it will not have to search the network to determine what IP address to use.

This is ideal in fixed industrial setups. However, it does mean that you cannot simply swap cameras from NIC to NIC or even change the address of the NIC without having to reconfigure the camera address.

What To Do When Visionscape Is Not Working Within Normal Operational Parameters

Sometimes when you install or upgrade Visionscape (or install something after Visionscape) things start to work incorrectly. This can be caused by registration problems. All of the components used for Visionscape are in the **C:\Vscape\610_10\Dll** directory.

To ensure that they are all registered you should first make sure that no Visionscape applications are running (including the AVP Backplane).

Then do the following:

1. Open a command prompt window (type **CMD** in the **Run…** box).
2. Navigate to the directory shown above. You can do this by whatever means you prefer, but a step-by-step way would be to type:
   a. cd ..
   b. cd ..
   c. cd Vscape
   d. cd 610_10
   e. cd dll
3. Type aregsvr *
4. This will register all the Visionscape components again.

Another problem that some customers have encountered seems to be related to the installation process, although this affects the dm.config file. The error seen in the Visionscape debug window looks like this:

```
CAvpBackplane:: CreateAll From Config file cannot access config file
Exception thrown
```

One possible fix for this is:

1. Open the command prompt and navigate to the same folder as above.
2. Type the following:

regasm visionscape.configuration.dll /tlb

Again, be sure that all Visionscape components are shut down before doing this.

For additional assistance, contact Microscan's help desk at:

helpdesk@microscan.com.

Visionscape GigE Network Configuration

Visionscape GigE cameras should be configured on private networks in the manner described in Section 2 of this manual. Cameras may either be connected directly to a PC network “Ethernet” port or wired indirectly through a GigE switch such as PN 98-000131-01.

The Visionscape GigE is configured by default with network parameters governing packet size and the intervals between packets that allow single GigE cameras of all sensor sizes to operate at full rated speed. The automatically selected parameters will also allow multiple (up to 4) standard resolution (VGA) cameras such as the 98-000115-01 (CMG03) to operate at full speed in a direct connect or wired through a switch configuration.

If multiple high resolution cameras (such as the CMG20 or CMG50) are used in applications with high trigger rates, Omron Microscan recommends that each camera is connected directly to its own PC network port.

If a switch must be used then the available network bandwidth will be restricted to that of the link between the switch and the PC network port. In these circumstances the trigger rate should be restricted to limit the overall pixel rate to approximately 80 Mpixels/sec and network parameters should be adjusted to override the default Packet Size and Inter-Packet Delay parameters.

This is done by entering appropriate values in the Windows registry.

To make these changes the user should run the “regedit” program that is supplied with Microsoft Windows.

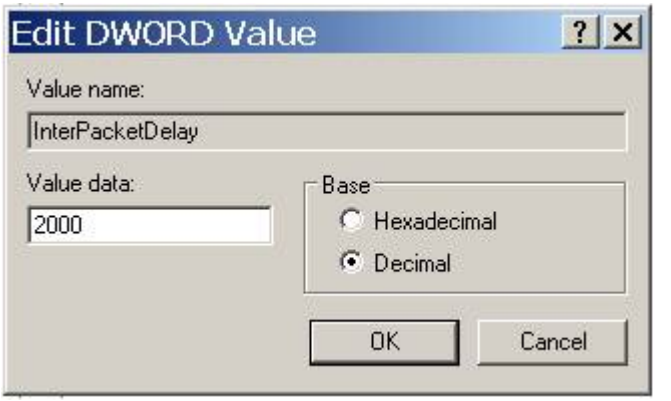
Important: Since unintended registry changes can render a PC inoperable it is recommended that registry changes are only made by those with suitable training or experience. **Proceed with the following only if you meet these criteria or have access to expert assistance. In any case a registry backup should be made before any changes are made to the system registry.**

---

1. Run regedit;
2. Navigate to:

3. Select InterPacketDelay;

4. Select Decimal and enter desired values.



Recommended Values for InterPacketDelay (IPD) and Maximum Frames per Second (FPS)

		2 Cameras on a Single Port	3 Cameras on a Single Port	4 Cameras on a Single Port
CMG20 Camera	**IPD**	261	48	133
	FPS	16	16	10
CMG50 Camera	**IPD**	206	167	133
	FPS	7	5	4