MICROSCAN®

Visionscape® I-PAK®
User's Manual

Rev 3.7.3, May 2012

84-100031-02 Rev A

Tel: +1.425.226.5700 / 800.762.1149
Fax: +1.425.226.8250

ISO 9001 Certified
Issued by TüV USA

Disclaimer

The information and specifications described in this manual are subject to change without notice.

Latest Manual Version

For the latest version of this manual, see the Download Center on our web site at:
www.microscan.com.

Technical Support

For technical support, e-mail: **helpdesk@microscan.com**.

Warranty

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

Microscan Systems, Inc.

United States Corporate Headquarters
+1.425.226.5700 / 800.762.1149

United States Northeast Technology Center
+1.603.598.8400 / 800.468.9503

European Headquarters
+31.172.423360

Asia Pacific Headquarters
+65.6846.1214

Contents

CHAPTER 5 OCV Reference 5-1

PREFACE

Welcome!

Purpose of This Manual

The Visionscape I-PAK User's Manual provides a foundation for successful I-PAK operation. It guides you to apply I-PAK vision tools for training and inspection.

Manual Conventions

The following typographical conventions are used throughout this manual.

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

Validation

Visionscape I-PAK is intended to be the product of choice in the pharmaceutical industry. Microscan has designed the product with just this in mind. To best support the pharmaceutical industry, we know we must be able to provide you with our software development processes. Any software that has to do with production equipment in the pharmaceutical industry is mandated by the FDA to be validated. You may choose to perform your own application validation. We can provide you with our software development details describing how the software is created and tested.

Development Details

Microscan willingly provides the details of its product development to its vision customers in the document Pre-Qualification Manual Software Validation Procedures. You may request a copy of this manual from Microscan by calling (603) 598-8400.

21 CFR Part 11

Visionscape I-PAK is 21 CFR Part 11 technically compliant. Login user names and passwords are set up by the I-PAK Administrator.

The Part 11 user names, their encrypted passwords, and the original time/datestamp when a user was created or last changed his or her password are stored in a data file called ipak.usr.

When you upgrade the I-PAK software, you must manually move the ipak.usr data file to the current version of I-PAK.

A complete 21 CFR Part 11 description can be found in Chapter 3, "21 CFR Part 11," and throughout this User Manual, such as "System Settings" on page 6-76.

I-PAK Distribution Media

The I-PAK SE2 USB drive contains the following:

- Visionscape I-PAK v3.7.3.
- Visionscape v3.7.3.
- Visionscape I-PAK User's Manual — This manual is in PDF format in the i-pak folder. You need Adobe Acrobat Reader (not included) to open the PDF. After you install Adobe Acrobat Reader, double-click Visionscape I-PAK 372 User Manual.pdf to open Acrobat and view the manual.
- Visionscape documentation set.
- Required service packs (if any).

Related Documentation

All Visionscape documentation is provided in PDF format on the USB drive and on the Microscan website. The PDFs are located in the \Vscape\Documentation folder. You need Adobe Acrobat Reader (not included) to open the PDF. After you install Adobe Acrobat Reader. double-click any .pdf to open Acrobat and view a manual.

I-PAK Documentation

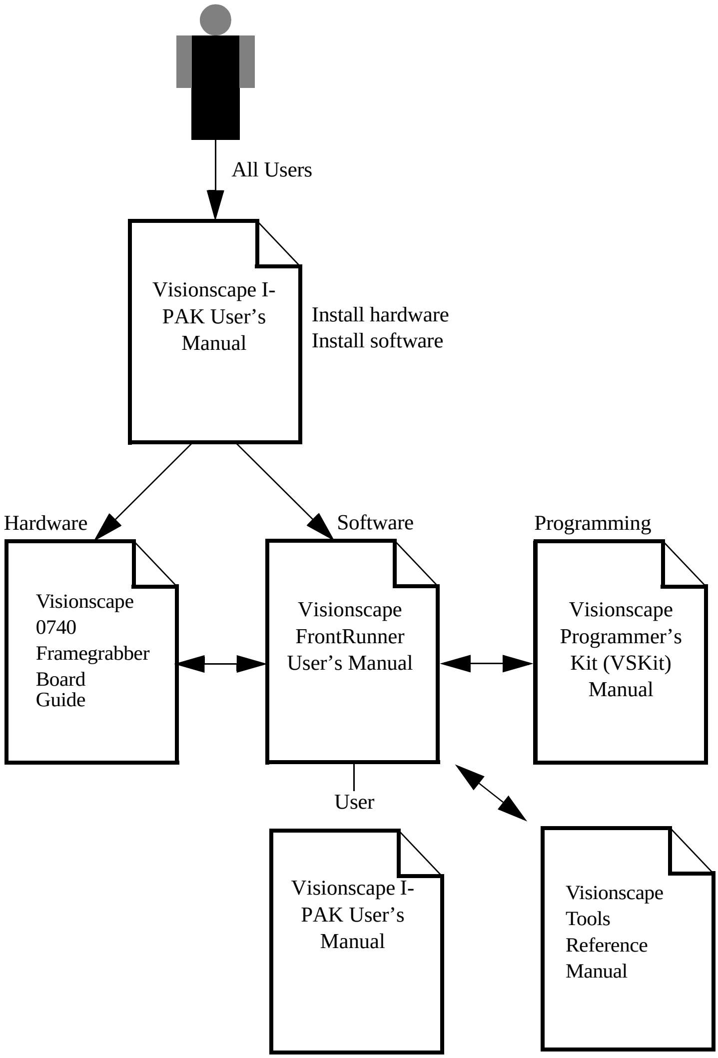
- Visionscape I-PAK V3.7.3 User's Manual (this manual)
- Visionscape I-PAK V3.7.3 ReadMe
- Visionscape I-PAK Enclosure Product Information

Visionscape Documentation

- Getting Started With Visionscape Framegrabber Boards
- Perl Script Custom Tool Programmer's Manual
- Visionscape 0740 Framegrabber Board Guide
- Visionscape V3.7.3 ReadMe

Typically, Visionscape I-PAK comes complete as a system from Microscan. It has all the necessary components installed in the PC. The Visionscape framegrabber documentation suite is shown in Figure 1.

FIGURE 1. **I-PAK Documentation Map**



Terminology

There are many camera options supported by the Visionscape I-PAK, most easily recognized by the term 740 boards.

1

CHAPTER 1

Visionscape I-PAK Inspection

Visionscape I-PAK's primary focus is to inspect, measure, verify position, verify characters, and detect flaws on pharmaceutical packaging. The implementation of I-PAK is flexible, allowing for expansion of I-PAK into the other vision areas of pharmaceutical companies, i.e., medical device manufacturing, diagnostic drugs, glass vials, and laboratory automation. I-PAK is adaptive and can easily be used in many other industries.

Note: You can use IntelliFind® if an IntelliFind® hardware key is installed. For more information about IntelliFind®, see Chapter 7 of the Visionscape Tools Reference (included on the USB drive).

Note: Use of this device other than specified by Microscan is prohibited.

System Specifications

I-PAK interfaces with the Visionscape framegrabber hardware on a system-compatible PC as described in “I-PAK Hardware Components” on page A-1. Ensure that you carefully review the complete system requirements (hardware and software) provided.

I-PAK supports one 0740 framegrabber board in a PC.

Note: The 0740 supports two different camera resolutions. For more information, see Table 1–2 on page 1-7

Each board provides for synchronous and asynchronous operations:

- Synchronous operation allows you to capture images from multiple cameras simultaneously.
- Asynchronous operation involves the support of multiple independent inspections. For example, using I-PAK to inspect parts at two separate locations on the same production line where the inspections are not synchronized and are run at different part rates.

Many other image resolutions are available using the CAM I/O 740 board. All images and inspection results are uploaded from the framegrabber to the host PC for viewing directly on I-PAK’s touchscreen.

For low-resolution applications, ensure that the camera’s field/frame switch is set to FLD.

For high-resolution applications, ensure that the camera’s field/frame switch is set to FRM.

I-PAK allows the programming of 16 programmable I/O points per framegrabber board. You can configure the total number of input and output points within the system. The trigger and strobe I/O are separate I/O points that are not part of the programmable 16. These independent trigger and strobe I/O points are available for each camera.

Communications with I-PAK occur through discrete I/O points, RS-232, TCP/IP or through direct result uploads from the framegrabber to the host PC. Pre-defined user access levels provide security to the programming environment.

Product Specifications

Table 1–1 lists the product specifications for I-PAK.

TABLE 1–1. Visionscape I-PAK Product Specifications

Feature	Description
Hardware	Supports one 0740 framegrabber board.
Trigger	Per framegrabber board, 4 trigger inputs and 4 strobe outputs, which allow separate camera triggering.
I/O	Programmable 16-point I/O scheme (not including triggers and strobes). The default configuration is 2 inputs and 14 outputs when using the Microscan 16 point combination I/O board. When using the Mini I/O board, the following I/O are available: - 2 inputs - 4 outputs - 2 part sensor triggers - 2 strobe outputs
Access Levels	Predefined Operator, Supervisor, and Programmer levels are provided. Predefined: Administrator to create a data file of 21 CFR Part 11 users. 21 CFR Part 11 user name login capability is provided and its users are assigned access levels of Operator, Supervisor or Programmer.
Communications	Digital I/O, RS-232, TCP/IP.
Backup of Statistics and Product Definitions	All Statistics are saved in the PC’s registry. The last run Job’s name is also stored in the PC’s registry. This feature enables the vision counts and product definition to be restored in the event of power interruption and power failure.

In the event of a PC reboot, upon restart of the PC and I-PAK, the last vision product job definition and its statistics are downloaded to the framegrabber and are ready to run, awaiting a trigger.

Functional Specifications

I-PAK resides on the PC in the Windows environment. It is designed to create, manipulate, train, and execute vision tools via a user-friendly program. I-PAK supports both Setup Mode (see Chapter 6, “Setup Mode Reference”) and Run Mode (see Chapter 7, “Run Mode Reference”) in a tri-level access scheme.

Note: Microscan supports Windows XP Professional SP3.

The following is a summary of the I-PAK functional specifications:

- Inspection Program Creation
  - Acquiring an image in the display window. A region of interest (ROI) is defined by established boundaries within the field of view (FOV) where an inspection is performed.
  - Selecting, positioning, and sizing vision tools.
  - Training vision tools.
  - Entering a match string for a Data Matrix, Barcode Tool, Font Tool or OCRTrainable Font Tool.
  - Specifying a font style for training of the Font Tool.
  - Tweaking vision inspection properties.
  - Saving and restoring Inspection Program (Job) definitions.
- Test Inspection Program in Tryout Mode
  - Setting tryout inspection criteria.
  - Performing a tryout inspection on a single vision tool or on all vision tools within a Job.
  - Modifying inspection criteria to retool tryout results.
- Product ChangeOver
  - Quick restoration of pre-programmed Job definitions for ease of batch changeover.

- Automated resetting of Statistics and Failures.
- Connecting to the framegrabber and downloading an I-PAK program to the framegrabber.

• Viewing of the executing inspections in runtime

- Automatic uploading of inspection images and their results from the framegrabber to I-PAK.
- Showing all camera views of product being inspected.
- Enabling and disabling runtime graphics.
- Zooming in and out on inspection images being displayed.
- Updating the video display to show the last inspection failure with its graphics.
- Viewing of the Failure Report of ongoing inspection noting all the failure types and their frequency for this inspection run.

• End of Batch Statistical and Failure information about the inspection

- On-Screen reviewing of Runtime Statistics and Failures.
- Transmitting of Runtime Statistics via RS-232 or TCP/IP to another device.
- Ability to save Runtime Statistics to a file.
- Resetting of Statistical Information.
- Resetting of Failure Information.

• End of Batch Product Data

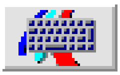
- On-Screen reviewing of Product Data.
- Transmitting of Product Data via RS-232 or TCP/IP to another device.
- Ability to save the Product definition, its Failure Report and Runtime Statistics to a file.

• Customizing of System Settings

  - Ability to set camera triggering method, etc.
  - Ability to define automated functions after Product ChangeOver.
- Support of 21 CFR Part 11 Compliance
  - Login User Name Access with Password Expiration Feature.
  - Configuration File Audit Trail.
  - Login option available when re-training a Data Matrix or Barcode Tool in Match Mode and Training a Font Tool or Runtime Font Tool.

Supported PC

The I-PAK SE2 was tested and is supported by Microscan and this release of I-PAK software. You can open the Touch Input software using the following button:



The button is only available in Windows or dialog boxes where you can enter data. Additionally, in Setup Mode, you can open the Touch Input using
Help > Open Softkeyboard.

Supported Cameras

The following cameras are supported by Microscan and this release of I-PAK software:

- 0740
  - Microscan CM4000/Microscan CM4001
  - Sentech STC-A33A
  - Sentech A152A (No more than three cameras)

User Interface

The UI is English only, and independent of the language setting of the operating system.

Storing Inspection Results

You can store inspection results to a file. If the file does not exist when you store inspection results, it will be created. If the file does exist, inspection results are appended to the end of the file.

Note: Only Supervisor and Programmer can edit or select a file name.

Valid Camera Configurations

TABLE 1–2. 0740 Valid Camera Configurations

Camera - Type 1	Camera - Type 2	Remarks
Single Resolution		
1-4 * CM4000		All the same resolution 640 * 480 or 320 * 240 No mixing of resolution allowed
1-4 * CM4001		All the same resolution 768 * 572 or 384 * 286 No mixing of resolution allowed
1-4 * A33 24 MHz		640 * 494 24 MHz or 640 * 104 24 MHz
1-2 * A33 36 MHz		640 * 494 36 MHz
1-3 * A152		1325 * 1040

TABLE 1–2. 0740 Valid Camera Configurations (continued)

Camera - Type 1	Camera - Type 2	Remarks
Mixed Resolution		
A33/24 MHz (640*494) 1 up to 3	A33/24 MHz (640*494) 1 up to 3	Any combination
A152 1 up to 3	A33/24MHz 640*494 1 up to 3	Any combination
A152 1 up to 3	A33/24MHz 640*140 1 up to 3	Any combination

Moving and Sizing Tools

Table 1–3 lists the keys and key sequences to move and to size tools.

TABLE 1–3. Keys to Move and Size Tools

Key(s)	Resulting Action
Up Arrow	Moves shape up by one pixel
Down Arrow	Moves shape down by one pixel
Right Arrow	Moves shape to the right by one pixel
Left Arrow	Moves shape to the left by one pixel
F	Flips shape by 90° if shape is rotatable
L	Rotates shape one degree to the left (counter clockwise) if shape is rotatable
R	Rotates shape one degree to the right (clockwise) if shape is rotatable
Shift + Up Arrow	Increases the height of the shape by one pixel
Shift + Down Arrow	Decreases the height of the shape by one pixel
Shift + Right Arrow	Increases the width of the shape by one pixel
Shift + Left Arrow	Decreases the width of the shape by one pixel
Control + Up Arrow	Moves shape up by one tenth of a pixel
Control + Down Arrow	Moves shape down by one tenth of a pixel
Control + Right Arrow	Moves shape to the right by one tenth of a pixel
Control + Left Arrow	Moves shape to the left by one tenth of a pixel
Control + F	Flips shape by 180° if shape is rotatable
Control + L	Rotates shape one tenth of a degree to the left (counter clockwise) if shape is rotatable
Control + R	Rotates shape one tenth of a degree to the right (clockwise) if shape is rotatable
Control + 0	Rotates shape to exactly 0°

Modifying AVPSYS Files from Previous Versions

I-PAK V3.7.3 can interpret and modify .avpsys files from previous versions of I-PAK.

A Visionscape I-PAK Product

A Visionscape I-PAK Product is the combination of the tools and steps written by an Application Engineer or Programmer to accomplish your inspection tasks. These Products are also referred to as “Jobs”.

Note: I-PAK 3.7.3 can execute .avp files from previous versions of I-PAK. Avps that handle more than one Visionscape board are rejected.

These product definitions are stored on the PC’s hard drive in a subdirectory where you installed I-PAK software called “\Jobs”. For example, if you install the I-PAK software in C:\Vscape, then, when you first run I-PAK, it automatically creates the Jobs folder as follows:

C:\Vscape\I-Pak\Jobs

I-PAK software performs special functions to make using the Visionscape Inspection device easier. In the case of Font Tools and Data Matrix Tools, where most people are often interested in verifying the inspection strings just read, I-PAK automatically adds steps to your Job to get this information out of I-PAK and back up to the PC user interface.

Scan for Sequence Steps Using Outputs

Another useful automatic feature of I-PAK is “Scan for Sequence Steps Using Outputs”, which checks the logic so that, when a snapshot step fails (e.g., camera unplugged), the outputs used in sequence steps are set to false. This prevents an inspection from passing (when monitoring sequence step outputs) when the snapshot fails.

Compatibility of Products of Previous Versions of I-PAK

If a Job handles more than one Visionscape board, it is rejected.

Behavior for Camera Types Inside Old Jobs

- Visionscape I-PAK V3.7.3 supports the following cameras:
  - Sentech A33A
  - Sentech A152A
  - CM4000
  - CM4001

  Jobs using these cameras will always be opened.
- Visionscape I-PAK V3.7.3 does not support the following cameras:
  - JAI CV-M1
  - KP-M1
  - KP-M1 Field
  - KPF100A
  - Pulnix TM6730
  - Sentech 1100B

  When opening a Job using one these camera types, the following message is displayed:

  Product uses an unsupported camera and will not be opened
- For new unknown cameras, only cameras with the appropriate camera definition file can be selected for a Job.

Software Systems

Note: You cannot mix a Software board and a Hardware board. If you try this, an error message is displayed and I-PAK will be closed.

Software Systems are full featured devices. Software Systems support Load Images from File mode to acquire an image while running in offline mode. Software Systems are not simulators or emulators of a board. Jobs that run on a Software System use the CPU resources and memory of the host PC. A dongle is required to run Jobs on a Software Systems fully; otherwise, the Jobs can be loaded or modified and run on a Software System, but they cannot be saved.

When loading a Job created for a supported device, either board or Smart Camera, the Job is not changed and can be used as is. When loading a Job onto a device, you are prompted to adjust the camera definition if the device is different from the one the Job was created on. Warnings that require user action are shown if the I/O assignments are out of range for the device or if the Job uses IntelliFind® but is loaded on a device that does not support this tool. For more information about IntelliFind®, see Chapter 7 of the Visionscape Tools Reference (included on the USB drive)

Creating Jobs for these Systems is the same as creating Jobs for other physical devices with the following differences:

- No specific camera definitions for a specific device are programmed into the VisionSystemStep camera channels. The default for Software Systems is CM4000. You must change the camera definition in the VisionSystemStep properties page if a different (usually) image size is required, or if your are working offline and plan to load the Job later on a physical device.
- By default, the Acquire Tool is programmed to Load Images from File, as there is no digitizer available on a Software System (Image List is empty originally and must be populated also). When loaded on a physical device, you must change the Acquire mode to Acquire from Camera to enable acquisition from the device CCD sensor.

For complete information about the Acquire and the Vision System step, see Chapter 1 of the Visionscape Tools Reference.

I-PAK Start-up Procedure

Typically, I-PAK is the only program running on the PC. When you start the PC and login to Windows, I-PAK starts because it is in the Windows startup group. The first thing I-PAK does is to reboot the framegrabber board(s), go into Run Mode, reference the PC's registry, and download the last run Job and its counters. Finally, I-PAK refreshes all the camera views and is ready to run awaiting a trigger.

I-PAK Shutdown Procedure

To properly shut down I-PAK, exit Run Mode by entering the Programmer password. Then, close I-PAK by clicking File > Exit. Next, via the PC's Start button, shutdown the PC. When the PC has completed shutting down, turn off the UPS.

2

CHAPTER 2 Visionscape I-PAK Tutorials

This chapter guides you through two tutorials:

- A basic I-PAK tutorial. See “Tutorial 1 — OCVFontless Tool” on page 2-3.
- A more advanced tutorial using font-based Font tools. See “Tutorial 2 — OCVRuntimeTool” on page 2-20.

This chapter serves as a guide. Your results may vary.

Ensure that the Visionscape framegrabber hardware and I-PAK software have been properly installed and configured (see Appendix C, “Software Installation”).

For more information on hardware and software installation and setup, refer to the framegrabber board guides (on the USB drive).

As you go through these tutorials, refer to Chapter 5, “OCV Reference”, Chapter 6, “Setup Mode Reference”, and Chapter 7, “Run Mode Reference” for more information.

Overview

I-PAK incorporates two primary functional categories: Run Mode and Setup Mode. Security access is restricted by the current user access level selected.

Setup Mode

Setup Mode allows a Supervisor to perform a Product ChangeOver, re-train a Job, and view and reset end of batch statistics.

Setup Mode allows a Programmer to create a Job, define I-PAK system parameters such as number of cameras, triggering methods, and so on. This involves setup of all components of the application from positioning the part in the camera's FOV to training the vision tools.

The Run Mode button is grayed out until all tools in the current Job are trained.

Run Mode

Run Mode allows an Operator to view the operation of the framegrabber inspecting product. After a Product ChangeOver or after a new product is defined, the Supervisor downloads the Job to the framegrabber where I-PAK goes On-line and waits for an inspection trigger. When an input trigger is received, the inspection Job executes, the digital outputs are set and inspection images and their results are displayed on the I-PAK monitor. Refer to Chapter 7, "Run Mode Reference" for more information.

Note: The Runtime and Setup screens have the standard Microsoft Windows Minimize button on the upper right corner of the screens when the Minimize option is enabled in the System Settings. When clicked, this button "minimizes" the I-PAK application. When the run screen is minimized, it automatically minimizes the child windows (camera views, runtime stats, etc.).

Tutorial 1 — OCVFontless Tool

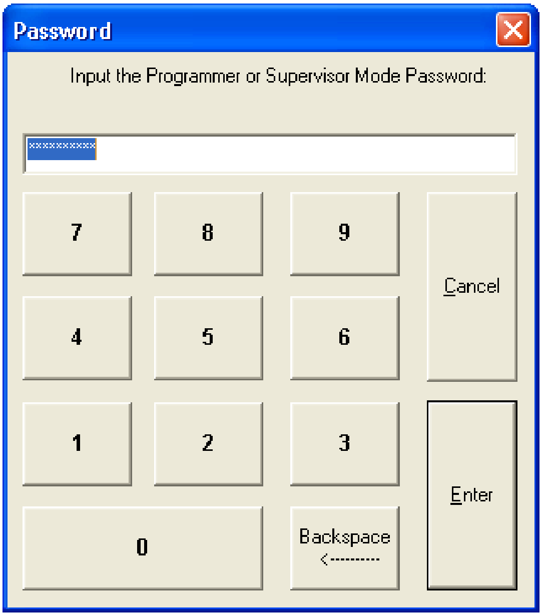
In this tutorial, you will create a simple I-PAK product that uses an OCVFontless Tool. It is assumed that all System Settings are set to their default values. If you have modified any System Settings, the figures and descriptions in this tutorial may vary from the results you experience.

1. From Windows, select Start > Visionscape > Visionscape I-PAK. This activates I-PAK, and the I-PAK Run Mode window is displayed, as shown in Figure 2–1.

FIGURE 2–1. I-PAK Run Mode Window

2. Click the Key icon. This displays the Password dialog box, as shown in Figure 2–2.

FIGURE 2–2. **Password Dialog Box**

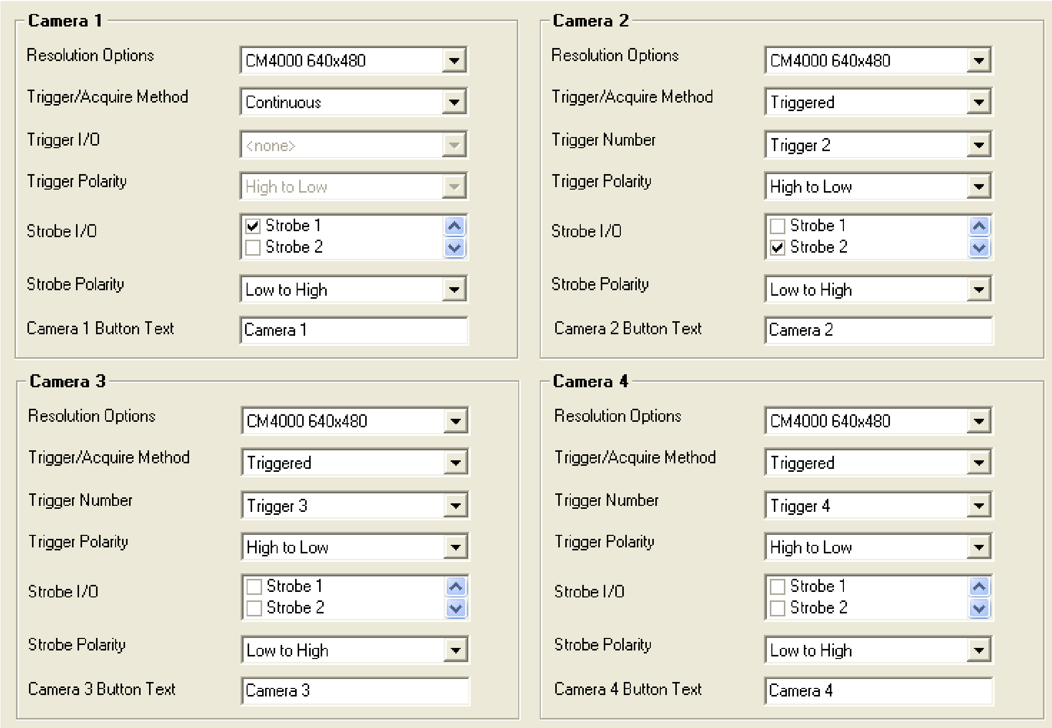


3. Type 0101 and click Enter. This places you in Programmer Mode and displays the Setup Mode window, as shown in Figure 2–3.

FIGURE 2–3. I-PAK Setup Mode Window

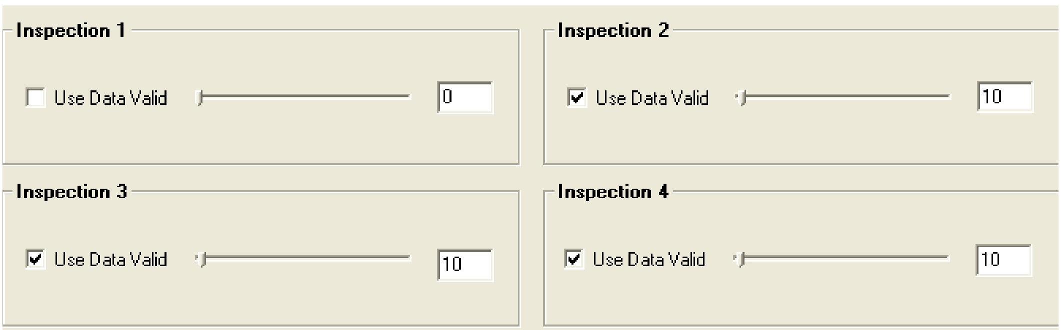
4. Click Advanced Settings.
5. Click Create a Product. This displays the Product Settings dialog box, as shown in Figure 2–4.
6. For Camera 1, change the Resolution Options to match the camera currently connected to Camera 1 on the I-PAK; change Trigger/Acquire Method to Continuous.

FIGURE 2–4. **Product Settings Dialog Box — Cameras Tab**



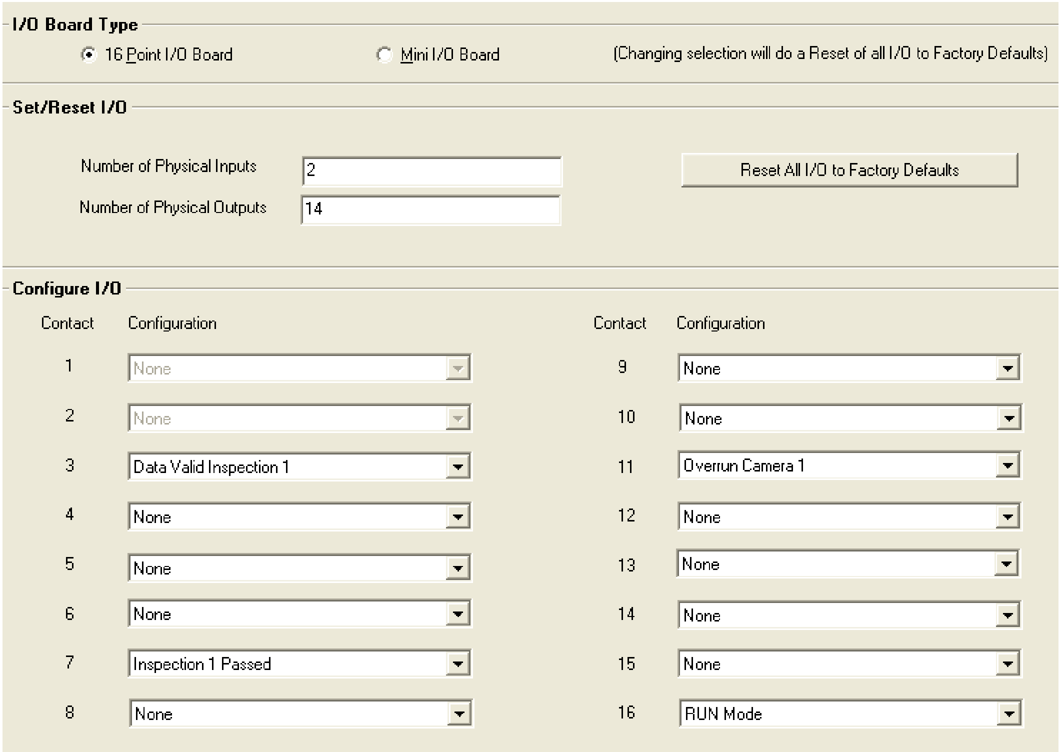
7. Click Next. This displays the Product Settings dialog box, Data Valid tab, as shown in Figure 2–5.

FIGURE 2–5. **Product Settings Dialog Box — Data Valid Tab**



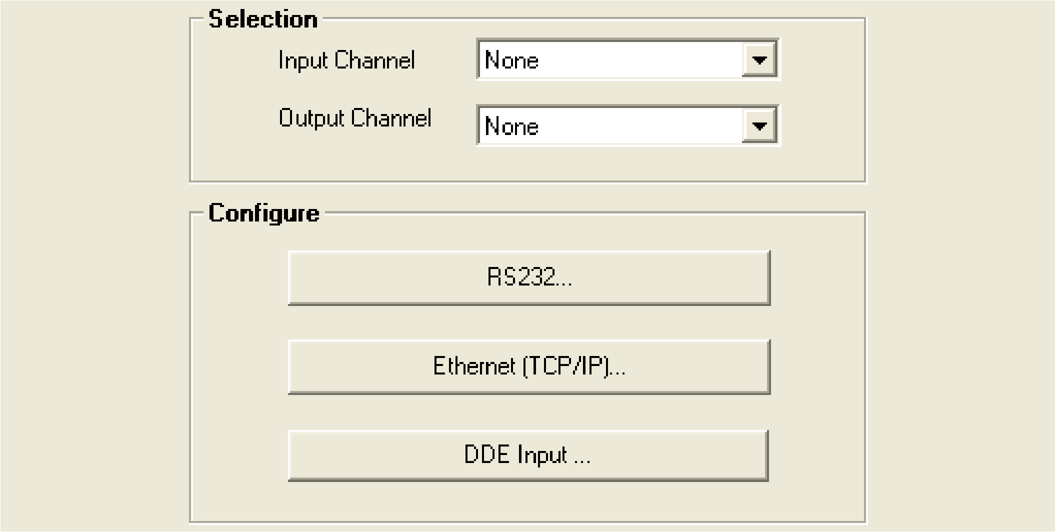
8. Observe the default settings. Click Next. This displays the Product Setting dialog box — I/O tab, as shown in Figure 2–6.

FIGURE 2–6. Product Settings — I/O Tab



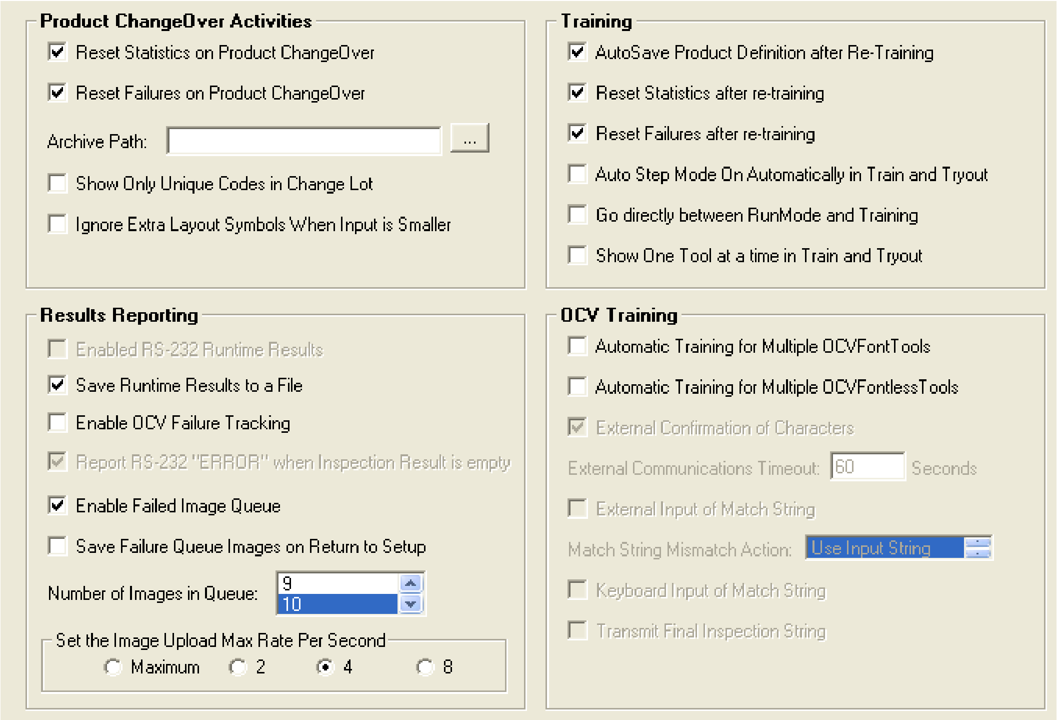
9. Observe the default settings. Click Next. This displays the System Settings dialog box — Communication tab, as shown in Figure 2–7.

FIGURE 2–7. **System Settings Dialog Box — Communication Tab**



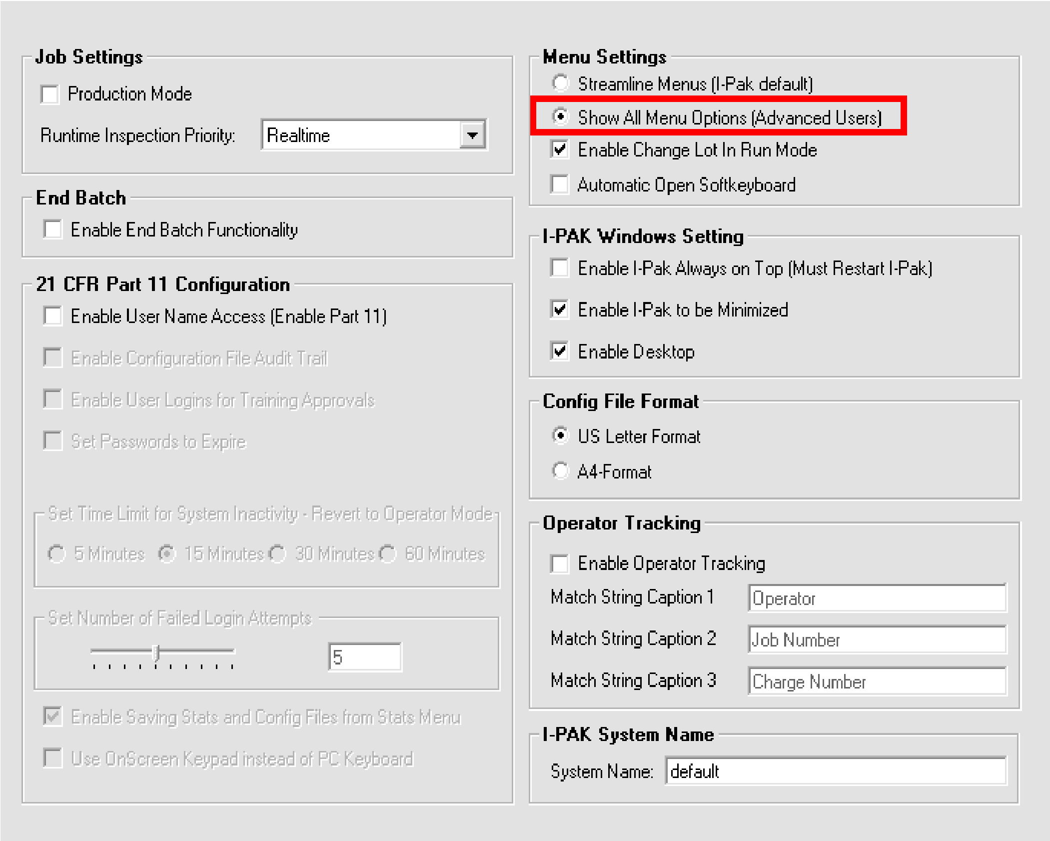
10. Observe the default settings. Click Next. This displays the System Settings dialog box — Training and Results tab, as shown in Figure 2–8.

FIGURE 2–8. **System Settings Dialog Box — Training and Results Tab**



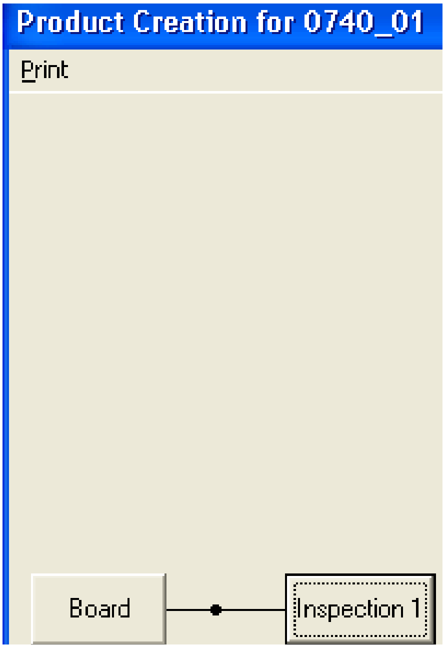
11. Observe the default settings. Click Next. This displays the System Settings dialog box — General tab, as shown in Figure 2–9.

FIGURE 2–9. **System Settings Dialog Box — General Tab**



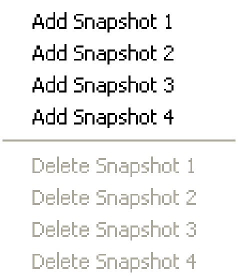
12. Observe the default settings. All menu options must be available for training and tryout during this tutorial. Click (to select) Show All Menu Options (Advanced Users), as shown in Figure 2–9. Click OK. This displays the Product Creation dialog box, as shown in Figure 2–10.

FIGURE 2–10. **Product Creation Dialog Box**



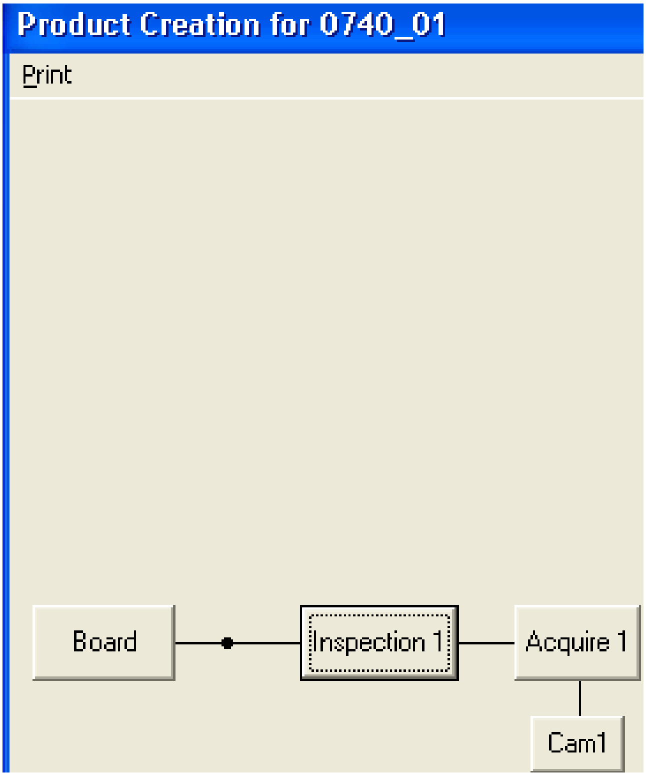
13. Right-click on Inspection 1. This displays the Add/Delete Snapshot box, as shown in Figure 2–11.

FIGURE 2–11. **Add/Delete Snapshot Box**



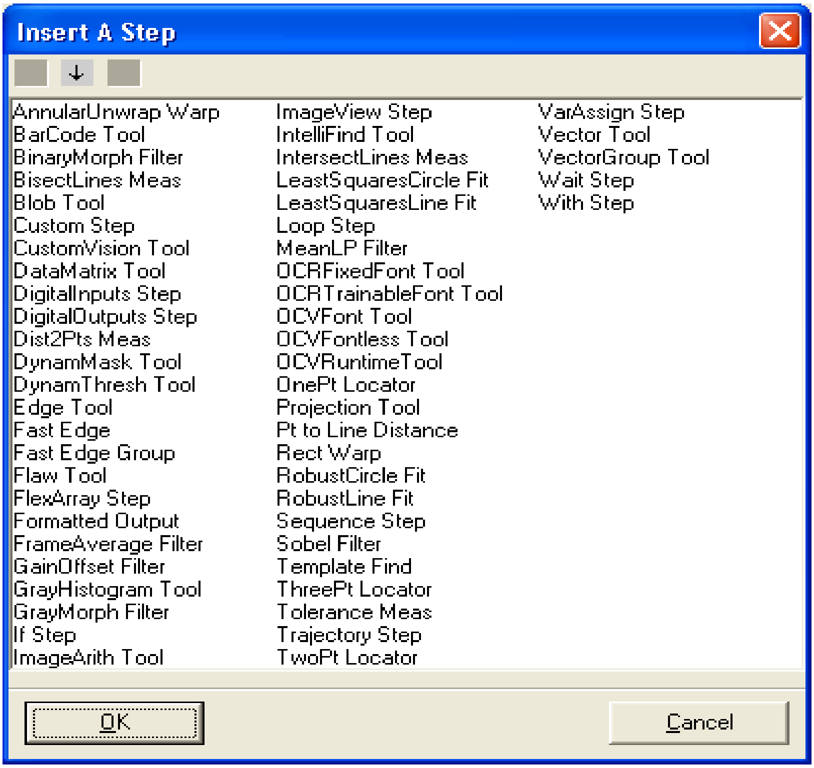
14. Select Add Snapshot 1. This displays the Acquire1 window, as shown in Figure 2–12.

FIGURE 2–12. **Product Creation — Acquire 1**



15. Right-click on Acquire 1. This displays the Insert A Step dialog box, as shown in Figure 2–13.

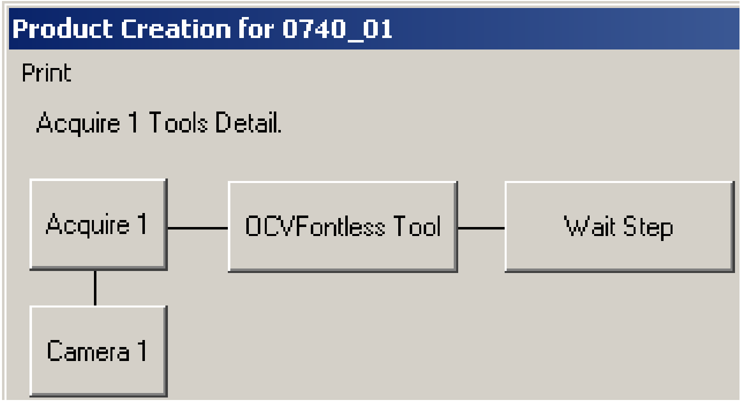
FIGURE 2–13. **Insert A Step Dialog Box**



16. Select OCVFontlessTool and click OK.

17. Right click on Acquire 1, select Wait Step from the list, and click OK. This displays the Product Creation dialog box shown in Figure 2–14.

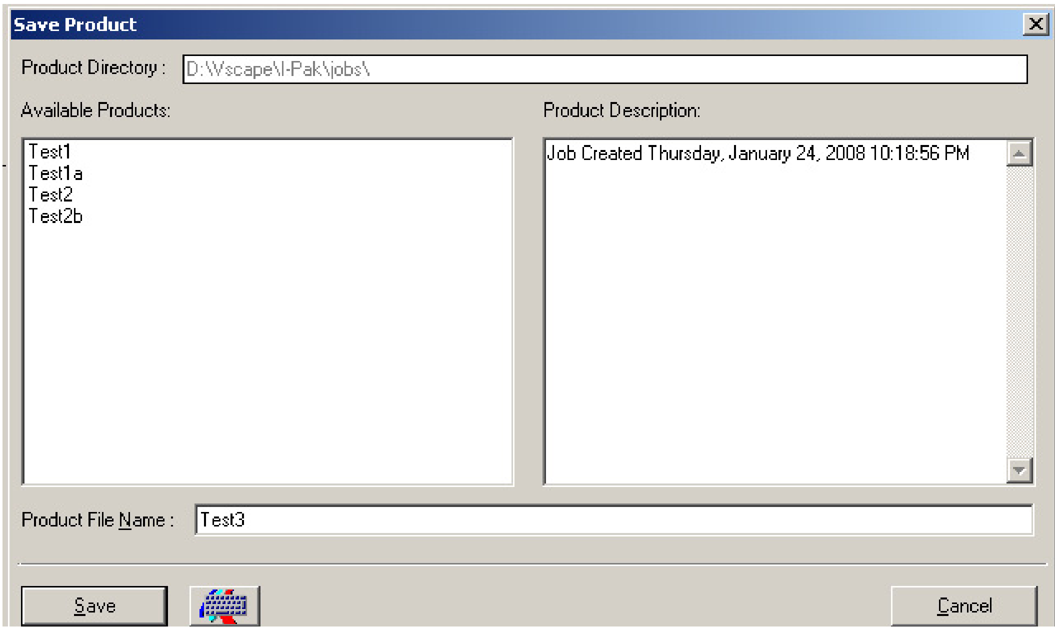
FIGURE 2–14. **Product Creation — OCVFontlessTool**



18. Click OK. This returns you to the dialog box shown in Figure 2–12, “Product Creation — Acquire 1,” on page 2-12.

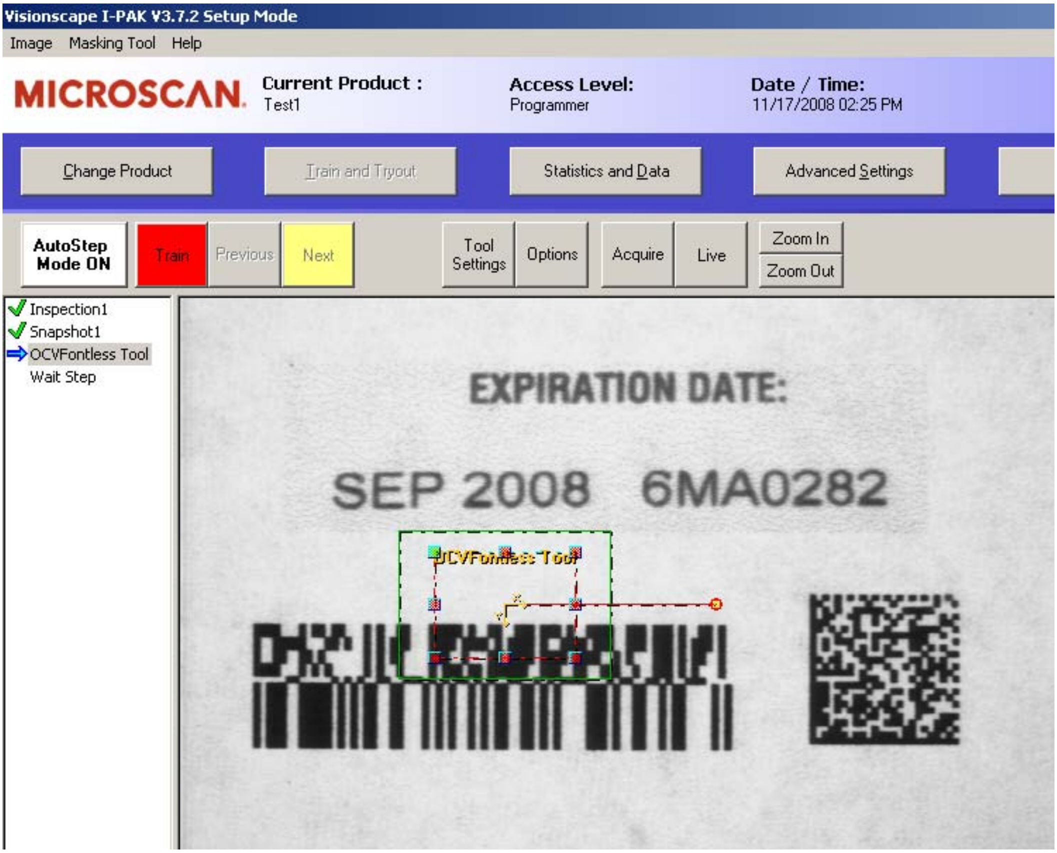
19. Click OK. This displays the Save Product dialog box, as shown in Figure 2–15.

FIGURE 2–15. **Save Product Dialog Box**



20. Type Test1 and click Save. This displays the Setup Mode — Training window, as shown in Figure 2–16.

FIGURE 2–16. Setup Mode — Training



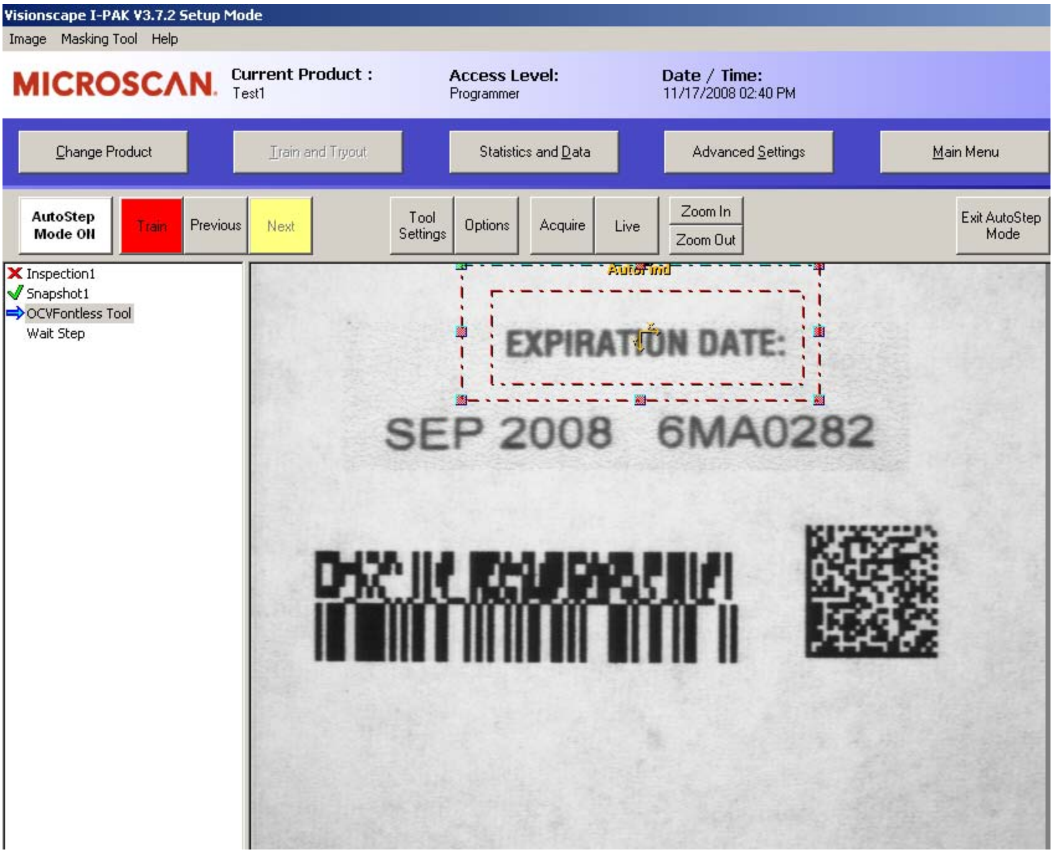
21. Click Live to start a continuous live video loop. Use this to adjust your f-stop and focus your camera.

22. Click Live again to stop live video. Obtain an image that contains some text and/or numerical data. We will use the OCVFontlessTool and your text.

23. The Train button shows red and the OCVFontlessTool is displayed. Drag the tool and place it around the appropriate text, as shown in the

example. Drag the AutoFind Tool and place it around the appropriate text, as shown in Figure 2–17.

FIGURE 2–17. **Fontless FontTool Position**

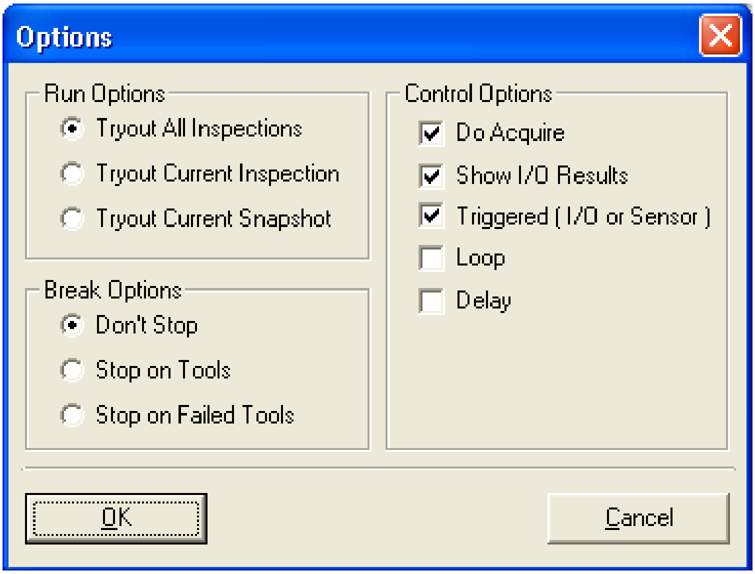


24. Click Train. The Train button shows green. This indicates a successful train.

25. Click Next. The Next button text will change to Finish. Click Finish.

26. Click Options. This displays the Options dialog box, as shown in Figure 2–18.

FIGURE 2–18. **Options Dialog Box**

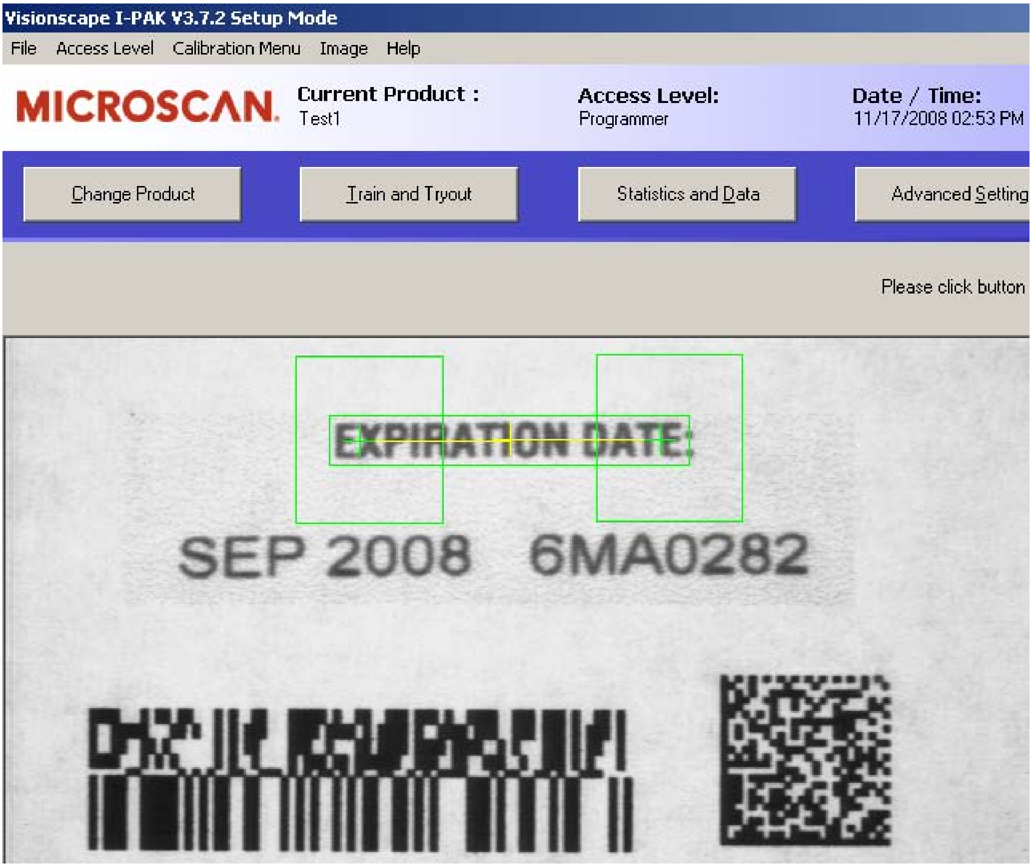


27. Click (to select) Loop, and click OK.

28. Click Try All. This places the Job in a continuous loop allowing you to observe your recently created Job.

29. Click Try Stop, and then click Exit Training to Main Setup. The Stats to Zero dialog boxes and the Failures to Zero dialog boxes are displayed. This returns you to the Setup Mode main window, as shown in Figure 2–19.

FIGURE 2–19. **Setup Mode Main Window**



30. Click Run Mode. This returns you to Operator Mode and displays the Run Mode window, as shown in Figure 2–20.

FIGURE 2–20. **Run Mode Window With Job Running**

Your Job will run in the Camera 1 View window in a continuous mode.

Tutorial 2 — OCVRuntimeTool

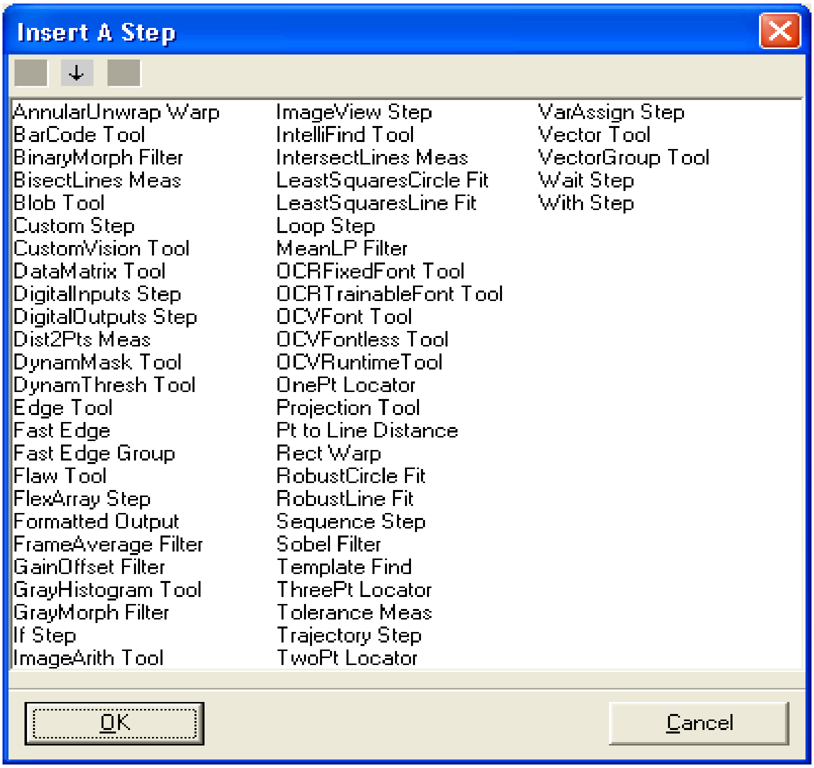
This tutorial takes you through the process of setting up an inspection using OCVRuntimeTool. For more details, refer to “OCVRuntimeTool” on page 5-44.

Note: Tutorial 1 steps 1-13 show additional details for steps 1-4 of Tutorial 2.

Setting Up Tool Set

1. From the main Setup Mode window of I-PAK, click Advanced Settings and Create a Product. This displays the Product Settings dialog box.
2. Select the appropriate settings from this dialog box and click Next.
3. Continue this process until the OK button is displayed. Click OK. This displays the Product Creation screen.
4. Right-click on the Inspection and select Add Snapshot 1 from the drop-down list.
5. Right-click on Acquire 1. The dialog box changes to display the tool details of Acquire 1. This displays the Insert a Step dialog box, as shown in Figure 2–21.

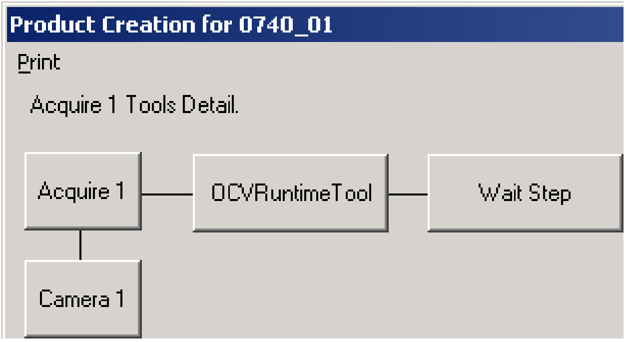
FIGURE 2–21. **Product Creation — Insert A Step Dialog Box**



6. Right-click on Acquire 1 and select OCVRuntimeTool from the list.

7. Right-click on Acquire 1 and select Wait Step from the list. This displays the Product Creation — Acquire 1 Tools Detail dialog box, as shown in Figure 2–22.

FIGURE 2–22. **Product Creation — Acquire 1 Tools Detail**



8. Now you have all the steps required for this tutorial. Click OK twice. Type a name for the Job and click Save.

9. You are shown the Setup Mode Train and Tryout wizard window. If AutoStep Mode is active, click Exit AutoStep Mode.

Font Training

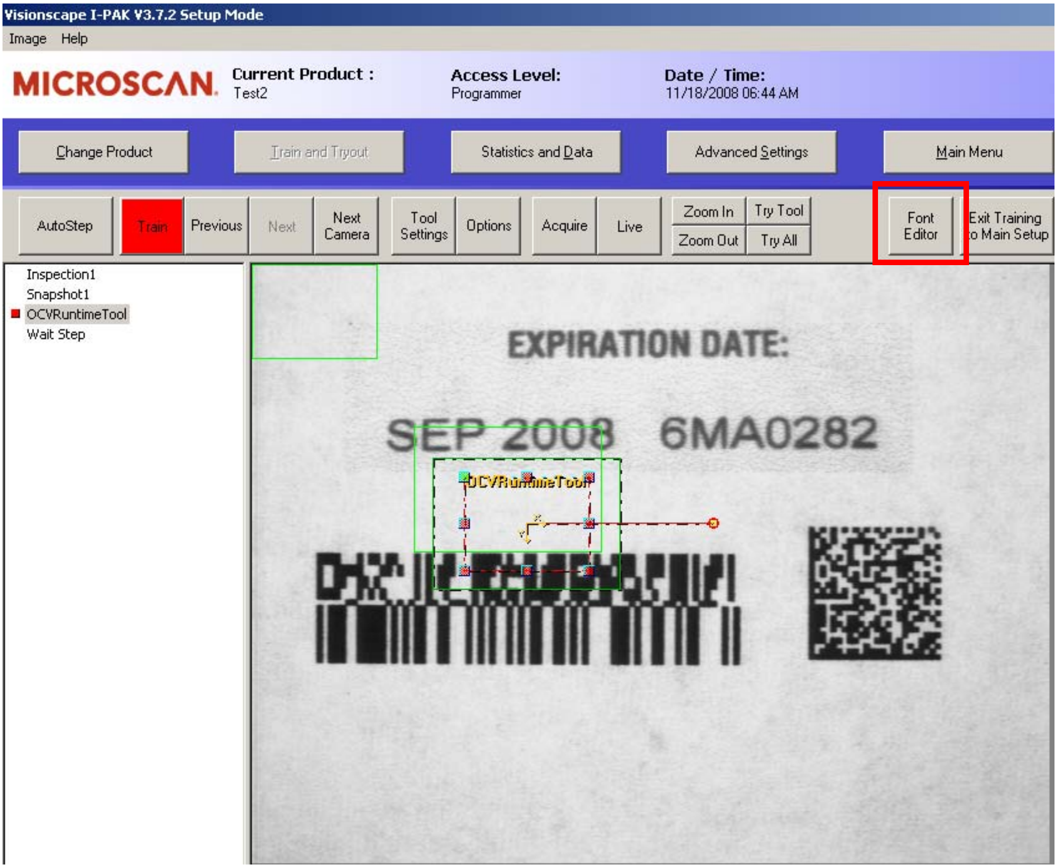
At least one OCVFont is required to use the OCVRuntimeTool. OCVFonts are stored in the Vscape\Jobs\Fonts folder on the hard drive. Also, you will need a good image for training.

1. Place a good example under your camera, click Live, and adjust the camera. Click Live again to stop the picture taking.

2. Click Next. The Current Tool panel at the lower left of the window changes to indicate that the SnapShot step is now selected.

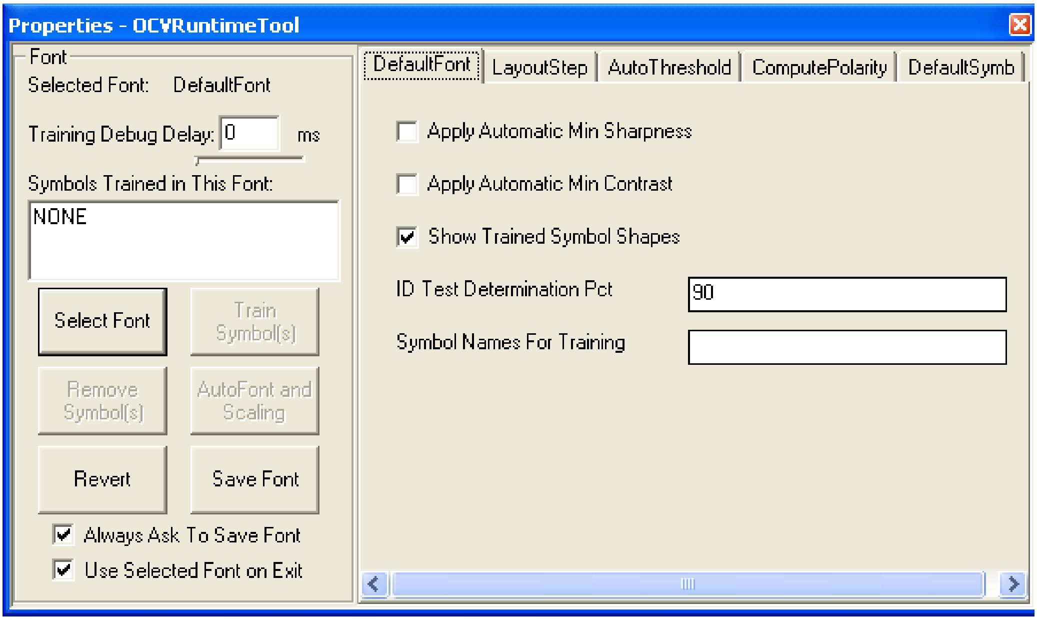
3. Click Next again to display the OCVRuntimeTool. The graphics for the OCVRuntimeTool are displayed and the Current Tool panel shows the OCVRuntimeTool. A Font Editor button is displayed on the Toolbar, as shown in Figure 2–23.

FIGURE 2–23. Font Editor Button on Toolbar



4. Because the OCVRuntimeTool requires a font, click Font Editor to initiate font training. This displays the Custom Properties dialog box, as shown in Figure 2–24.

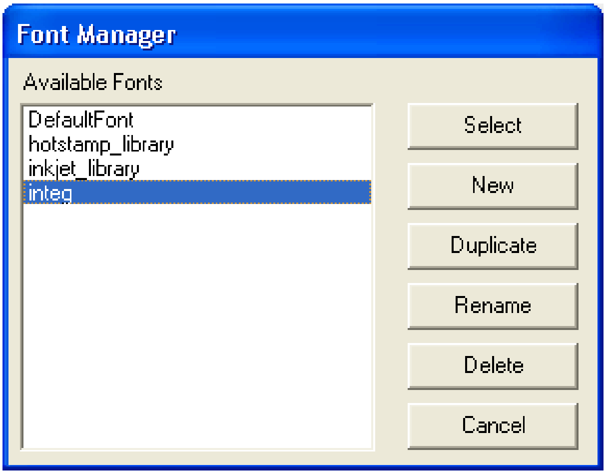
FIGURE 2–24. **Font Selection And Training Dialog Box**



The Custom Properties dialog box allows training of OCVFonts in the current image. The Select Font button allows selecting an OCVFont to train.

5. Click Select Font to bring up the Font Manager dialog box, as shown in Figure 2–25.

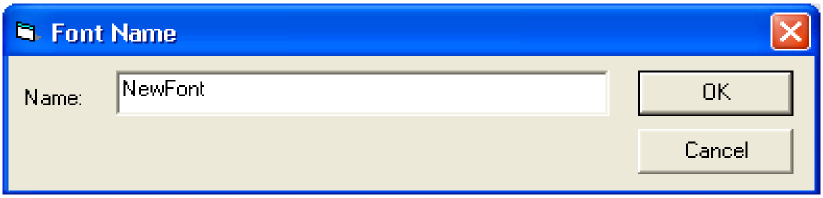
FIGURE 2–25. Font Manager Dialog Box



Any already existing OCVFonts in the Vscape\Jobs\Fonts folder are listed in the “Available Fonts:” list.

6. Click New to display the Font Name dialog box (Figure 2–26), and to create a new OCVFont.

FIGURE 2–26. Font Name Dialog Box



7. Name the font Font1 and then click OK.

8. Click Select to select the new font for training.

   By default, I-PAK OCVFont training does not perform automatic segmentation so that it can better perform Runtime ID Checking. For this tutorial, we will turn automatic segmentation on, so that I-PAK automatically locates and places a box around all characters in the FOV. This makes the tutorial easier.

The tool settings for the selected font are on the right hand side of the Custom Properties dialog box.

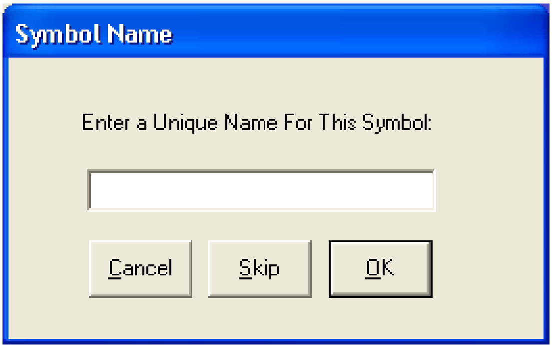
9. Click Layout Step. Click (to select) Automatic Segmentation.

10. Move the Custom Properties dialog box so that you can see the image and the training box.

11. Position the training box in the image over all the characters to be included.

12. Click Train Symbol(s) on the Custom Properties dialog box to start the training process. As each symbol is located, a green box is placed around the character in the image and the Symbol Name dialog box is displayed, prompting you to type a unique name for that symbol, as shown in Figure 2–27.

FIGURE 2–27. **Symbol Name Dialog Box**



13. Enter a name for each symbol and click OK.

14. Now, the symbol is stored as part of the OCVFont. The current box turns red and a green box is placed around the next character in the image, as shown in Figure 2–28. You can click Skip to pass over a character in the case of duplicates, or you can Cancel training at anytime, in which case, no more symbols are added to the OCVFont.

FIGURE 2–28. OCVFont Example

15. When all symbols are trained, click the Save Font button to save the OCVFont and close the Custom Properties dialog box. Now, you are ready to continue with the Setup Mode - Train and Tryout wizard window.

OCVRuntimeTool Training

The OCVRuntimeTool should be selected in the Current Tool panel.

1. Now that the OCVFont has been trained, it needs to be selected for use by this tool. Click Tool Settings (to the right of the Train button). Click the Layout Step tab. Select the font named “Font1” from the “Selected Font” list. Click Close.

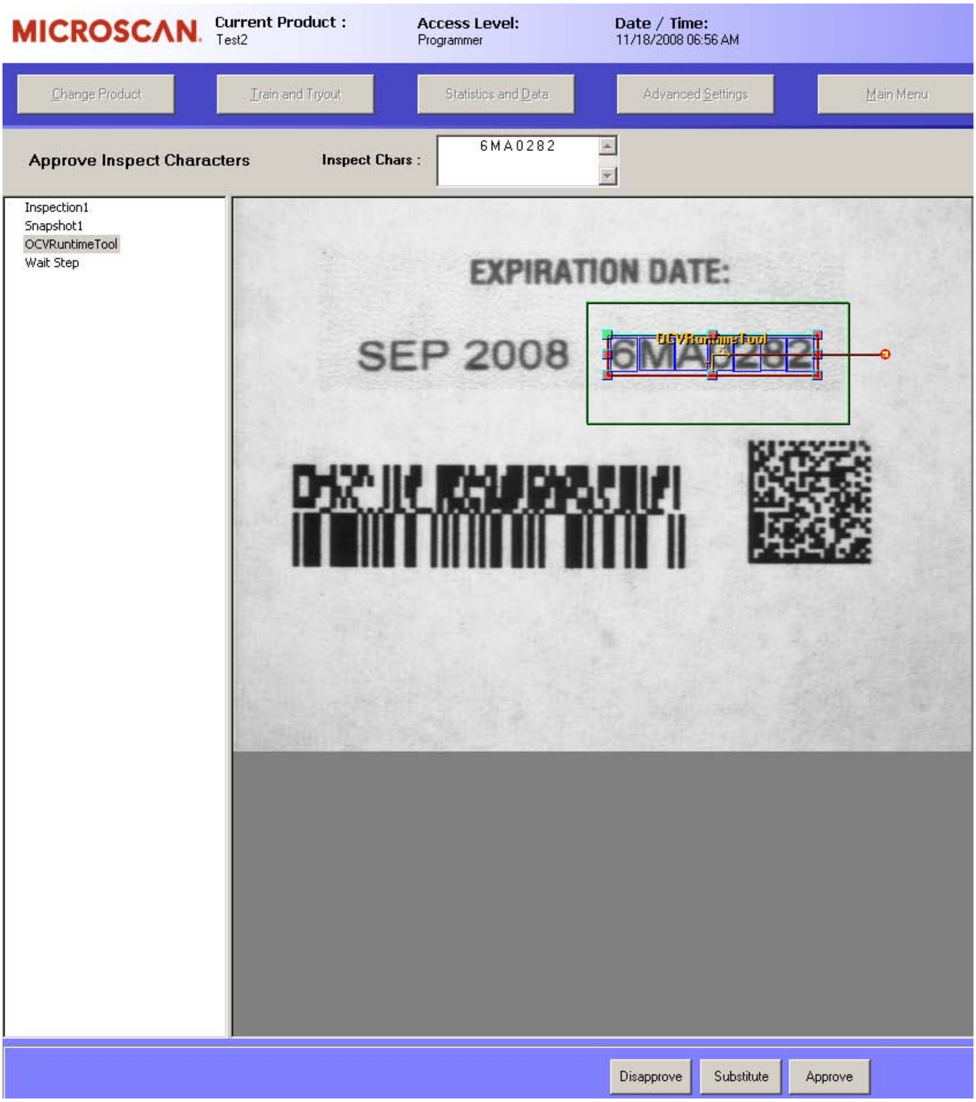
2. Position the OCVRuntimeTool over the characters to be inspected, making the ROI slightly larger than the inspected characters.

3. To start the training process, click Train.

   As symbols in the OCVFont are found in the image, boxes are placed over those positions. When all candidate layout positions are found, any conflicts (two or more symbols found in the same position) are resolved using runtime ID checking information. Each position of the final layout is then trained as a symbol in a new font, the Runtime font.

   The Approve Inspect Characters window is displayed at the end of the Train (learn layout) with the string of Inspect Chars:, as shown in Figure 2–29.

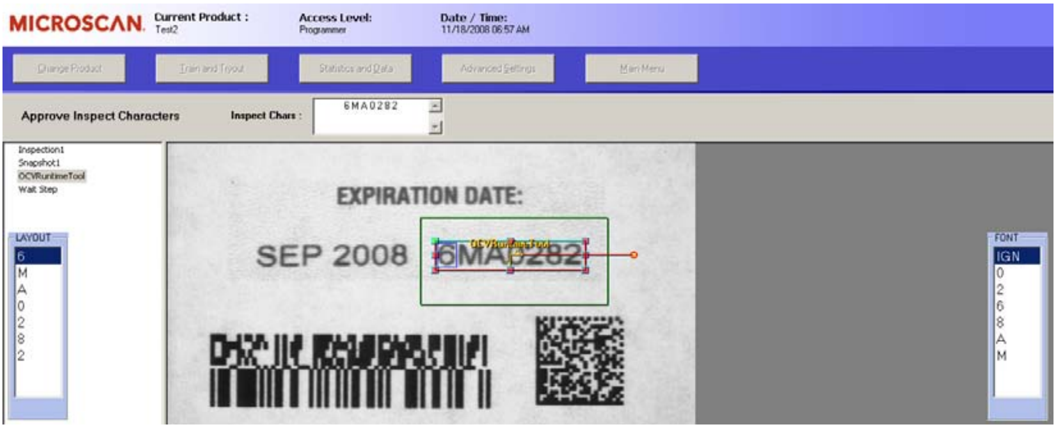
FIGURE 2–29. **Setup Mode — Approve Inspect Characters**



This allows characters to be substituted into the layout or ignored entirely.

4. Click Substitute to display the Layout and Font boxes shown in Figure 2–30.

FIGURE 2–30. Setup Mode — Layout and Font Boxes



The list of symbol names displayed in the Layout box contains the names of all symbols in the layout, in the order in which they appear. The Font box contains the name of all symbols in the selected OCVFont. The first item in the list is IGN, which is used to ignore characters.

5. To substitute one symbol for another, select the character in the Layout box that you want to substitute for. Select the symbol from the Font box that you want to use to replace the layout symbol. Click Substitute. The Layout box and Inspect Chars: are updated.

6. To ignore one of the symbols in the layout (exclude it from being inspected at runtime), select the symbol to be ignored from the Layout box. Select IGN from the Font box. Click Substitute. The symbol is removed from the Layout box and Inspect Chars:.

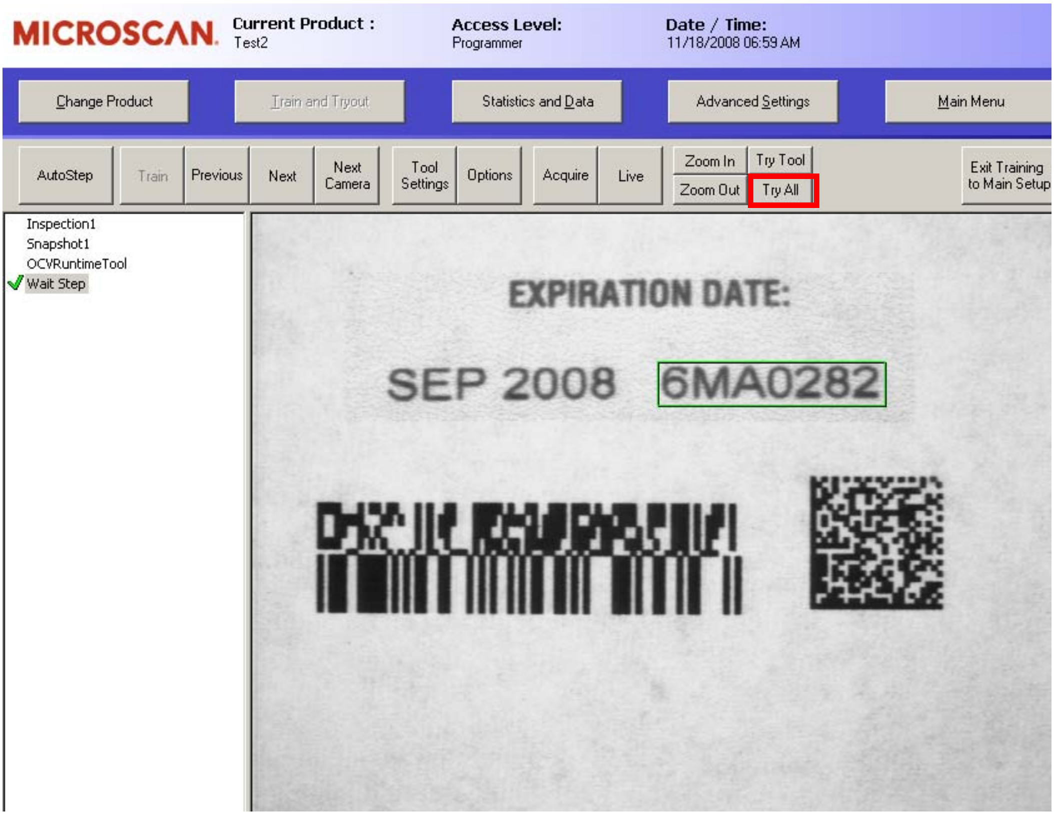
   If you wish to re-train the tool, with the OCVRuntimeTool selected, click Train Tool in the Setup Mode Train window. You can adjust the properties of the tool and re-train until you achieve the desired layout string.

7. Once you are satisfied with the layout shown in the Inspect Chars: string, click Approve to return to the Setup Mode Train and Tryout wizard window.

8. Position the AutoFind box for the OCVRuntimeTool over the area of the image in which the characters are allowed to move/rotate.

9. This completes the training of the OCVRuntimeTool. Click Try all to verify the inspection, as shown in Figure 2–31.

FIGURE 2–31. Setup Mode — Try All



10. This runs the Job once, allowing you to observe your recently created Job. Click Exit Training to Main Setup. The Stats to Zero dialog boxes and Failures to Zero dialog boxes are displayed. This returns you to the Setup Mode main window.

11. Click Run Mode. This returns you to Operator Mode and displays the Run Mode window, as shown in Figure 2–32. Your Job will run in the Camera 1 View window in a continuous mode.

FIGURE 2–32. Run Mode

What’s Next

Congratulations! You have successfully created, set up, and stored an I-PAK program, trained the tools, and executed both a tryout and continuous inspection in runtime.

This tutorial highlights the basic functionality of I-PAK and provides a foundation for properly operating the product. You are ready to go into full operation using I-PAK.

3

CHAPTER 3

21 CFR Part 11

Visionscape® I-PAK is 21 CFR Part 11 technically compliant. This chapter describes the components of our compliancy as well as the customer's responsibilities.

Overview

I-PAK's technical 21 CFR Part 11 compliancy has the following components:

- I-PAK's **Jobs** are stored on the PC as binary files; you cannot edit them except from within I-PAK. These "Jobs" are the vision applications, "recipes" or step-by-step instructions that the vision system follows to inspect product. Typically, you would associate one Job per product being inspected and change or re-train the Date/Lot Code or Expiration date while leaving everything else the same.
- I-PAK's **Audit Trail** is a centralized, chronological, time-stamped journal file of all I-PAK activities: from the automatic start-up of I-PAK as part of the PC Start-Up items noting the version of I-PAK software, through user login attempts, to every button pushed, every re-training action, every new layout string and Data Matrix match strings, every alarm acknowledged and the Statistics entering and exiting Run Mode (Inspection). The Audit File records who makes a change and the reason for the change. It is available for printout using Adobe Acrobat's PDF format - another safeguard to prevent unauthorized

modification of the Audit Trail - from inside I-PAK as part of the Administrator’s role.

- I-PAK’s **Configuration Files** are an ASCII representation of the data contained on I-PAK “Job” files. These are provided for the convenience of our I-PAK customers to provide a readable representation of the logic being used in the inspection. They are stored on the PC as read-only files and are viewable from within I-PAK as part of the Administrator’s role. Additionally, the Administrator can reconcile between two of these files to note detailed changes of all Job settings.
- I-PAK’s **Statistics Files** are an ASCII representation of the last inspection results. These are summaries, and contain the Inspection total, pass and failed as well as the inspection string (when applicable) and the last login name and the timestamp of the last run of the inspection. These are provided for the convenience of our I-PAK customers to provide a readable representation of the data results from the inspection. They are stored on the PC as read-only files and are viewable, printable and exportable from I-PAK as part of the Statistics/Data SubMenu. The data contained within these files is automatically recorded in the Audit Trail.

Access Levels Defined

The ordering of access levels is:

- Programmer (highest access level)
- Supervisor
- Operator (lowest access level)

When the Part 11 option from the System Settings General menu is enabled, the traditional I-PAK Supervisor and Programmer passwords will not be used. Instead, User Login and Passwords will be used. Plus, the concept of an I-PAK Administrator is introduced. An I-PAK Administrator is responsible for creating user accounts and granting access levels to those users.

When an Administrator creates a user account, a listing of user names, encrypted user passwords and access levels will be created. When entering Setup Mode from Run Mode, you will have to enter a user name

and user password via the
I-PAK keyboard or a login dialog box. Based on the user name and password entered, the appropriate access level will be granted during Setup Mode.

At all times, the current access level is clearly displayed. An active user reverts back to Operator mode after the user-defined “no activity” limit is reached.

Anytime there is a login violation, an entry is made to a secuity.log and the Audit Trail files.

21 CFR Part 11 Administrator — Administrator mode allows the defining of valid users, their passwords and their security levels. This Administrator, whose user name is I-PAKAdmin and default password is 999999, is your Configuration Manager. He or she is not a Programmer, a Supervisor nor an Operator.

The Administrator password is stored in the PC’s registry settings and is changeable through the I-PAK interface.

Note: The Administrator should be careful not to forget his or her password, as it is very difficult to recover the Administrator password. You will need to contact Microscan to recover a forgotten Administrator password.

The Administrator should create a user account with the Programmer security level right away so that the Vision System Settings can be adjusted when necessary.

When you create a new user, Supervisor or Programmer, you must specify whether or not that user is authorized to do Re-Training. By default, this setting is disabled - no signature authority. Existing users will be set to NOT have this Signature Authority feature and, therefore, will NOT be able to approve training. Any existing users in your user group must get a new user name and enable this Signature Authority feature to approve training.

The Signature Authority function has been expanded so that, when person #1 trains the OCV tools or match strings for the Barcode or Data Matrix tools, I-PAK checks to make sure that user has “signature authority", in addition to continuing to check for a valid user name, password and security level.

Customer Responsibilities

Microscan has made every attempt to provide an off-the-shelf software solution for your vision needs. Working with I-PAK, you need to provide Standard Operating Procedures (SOPs) at your company to further safeguard your data and comply to 21 CFR Part 11. Microscan has the following suggestions and recommendations.

Starting I-PAK, Using Part 11 and Adding I-PAK Users

1. Determine who in your company will be the I-PAK Administrator. Remember, the Administrator creates user accounts but does not have any “programming” rights (the Administrator is neither an I-PAK Operator, Supervisor nor Programmer). Next, determine who will be a Programmer. Microscan recommends this be a factory-trained I-PAK user. The Programmer will set up the vision Jobs and adjust settings. Then, determine who will be your Supervisors, those who can re-train the vision tools to perhaps train a new lot code and those who can perform a Product ChangeOver to start inspection on another product type. Another decision in your Supervisor Configuration is what access they have to the I-PAK System and whether or not they have the ability to re-train key tools such as a Font Tool. The Programmer can set up the Supervisors Access rights by clicking from the main menu: Access Level > Configure Supervisor Access. The Administrator assigns the right to re-train when they create a user account.

   Note: Create an SOP that defines your users and their access rights.

2. Turn on Part 11 in I-PAK. By default, to provide a generic solution of all our customers, Part 11 is not enabled. As a Programmer, from the Setup Mode, go to the Advanced > System Settings > General > 21 CFR Part 11 Configuration menu and click Enable User Name Access (Enable Part 11); there should be a checkmark inside the box to indicate this setting is enabled. This setting turns on Part 11 and the Audit Trail.

   Note: Create an SOP to never turn this option off.

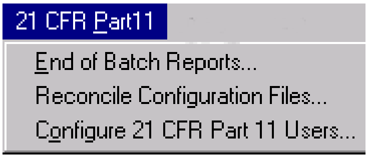
3. Enable any other Advanced > System Settings > General > 21 CFR Part 11 Configuration menu items that you require. These are dependent on your regulations. For example, if you require that passwords expire, set that option, as well as specifying the duration of the password.

   Note: Create an SOP that defines your password expiration duration.

Now, bring in your Administrator to begin assigning login names, passwords, access and re-training rights. Always remember to define a Programmer and at least one Supervisor. Your day-to-day users should be Operators and Supervisors.

When the Enable User Name Access (Enable Part 11) option from the System Settings General menu is enabled, the traditional I-PAK supervision and Programmer passwords will not be used. An additional drop-down menu will appear on the main I-PAK Setup menu, as shown in Figure 3–1.

FIGURE 3–1. Setup Mode — 21 CFR Part11 Menu



When an Administrator creates a user account, a listing of user names, encrypted user passwords and access levels will be created. When entering Setup Mode from Run Mode, you will have to enter a user name and user password via the
I-PAK keyboard or a login dialog box. Based on the user name and password entered, the appropriate access level will be granted during Setup Mode.

Note: A Part 11 System Setting enables an OnScreen Keyboard for entering login and training approval user names and passwords rather than the I-PAK keyboard.

At all times, the current access level is clearly displayed. An active user reverts back to Operator mode after the user-defined “no activity” limit is reached.

Anytime there is a login violation, an entry is made to a secuity.log file. An Administrator can view this file from I-PAK by clicking on Display Login Violation Log.

21 CFR Part 11 Functions

From the main I-PAK menu bar, there is a “21 CFR Part 11” menu item that only shows up on the main I-PAK Setup menu bar when 21 CFR Part 11 is enabled from the System Settings screen. This drop-down menu is accessible for Supervisors, Programmers and the I-PAK Administrator. Operators have no access or visibility into this area of the software.

Typically, at the end of a batch or a run of product, you’ll want to gather your data and record your inspection counts for Part 11 records. These records and this functionality is discussed below.

End of Batch Reports

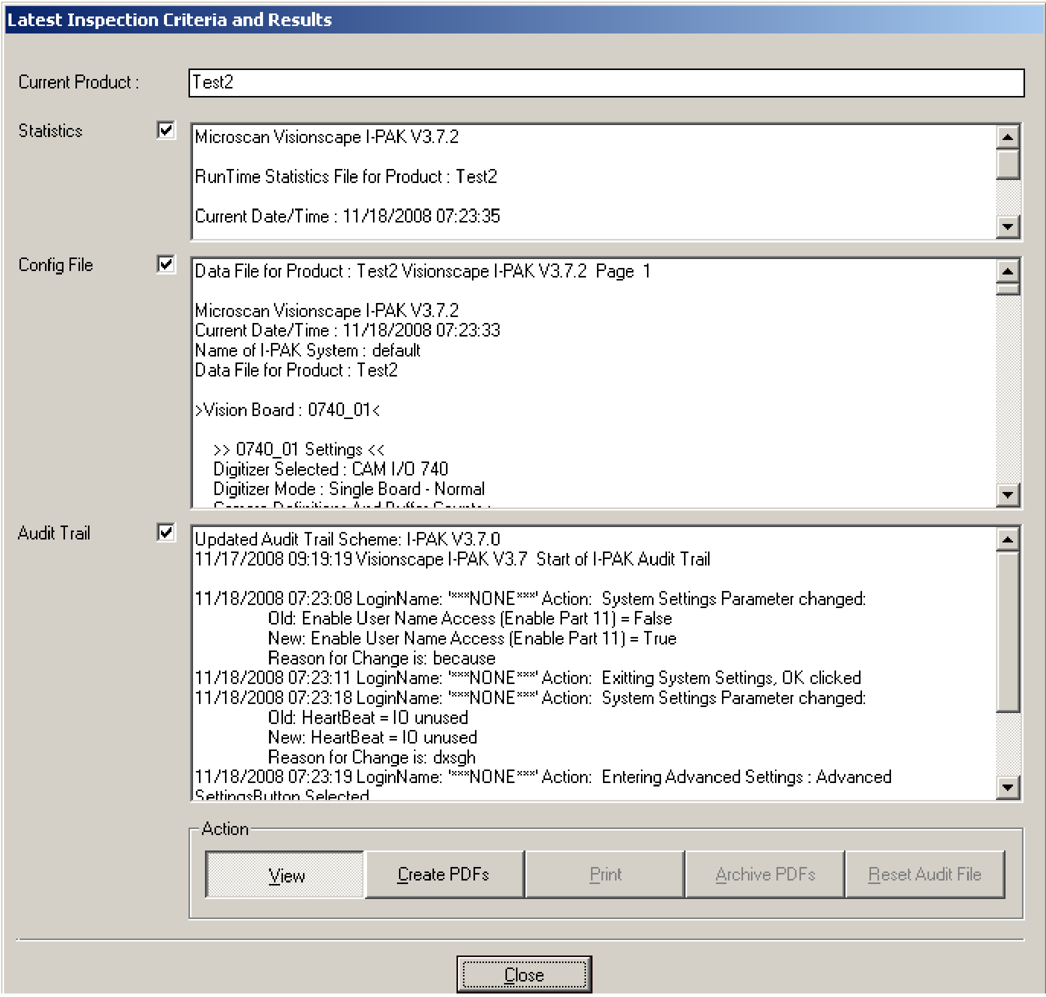
After you have finished running successfully a batch of product, you may need to store the pertinent information about that batch to a secure place for future review and reconciliation. An I-PAK Supervisor, Programmer, or the I-PAK Administrator can view the batch reports, create PDF records of the batch data, print these PDFs, and archive these PDFs to your archive device.

Note: Anytime you write a file to disk or CD, such as when you create a PDF or write that PDF to disk, I-PAK checks to make sure there is room on the device for the files. It will post an error if there is not enough room to write the file.

View

When you click End of Batch Reports…, you will see a dialog box that contains the latest Inspection Results and its support files, as shown in Figure 3–2. By default, you are presented with its “View” option. This shows you the information from the Statistics File, the Configuration File and the decrypted Audit Trail. You can choose to select all or some of these files for the other options.

FIGURE 3–2. **Viewing End of Batch Reports**



PDFs

When you click on Create PDFs, the Reports that are selected (checkboxes to the right of the description and to the left of the display) will translate the latest reports into PDFs for added security. This can include a translation of the encrypted Audit Trail into a human readable PDF of the Audit Trail. PDFs are used because they are difficult to modify and provide a “snapshot” of the batch report details.

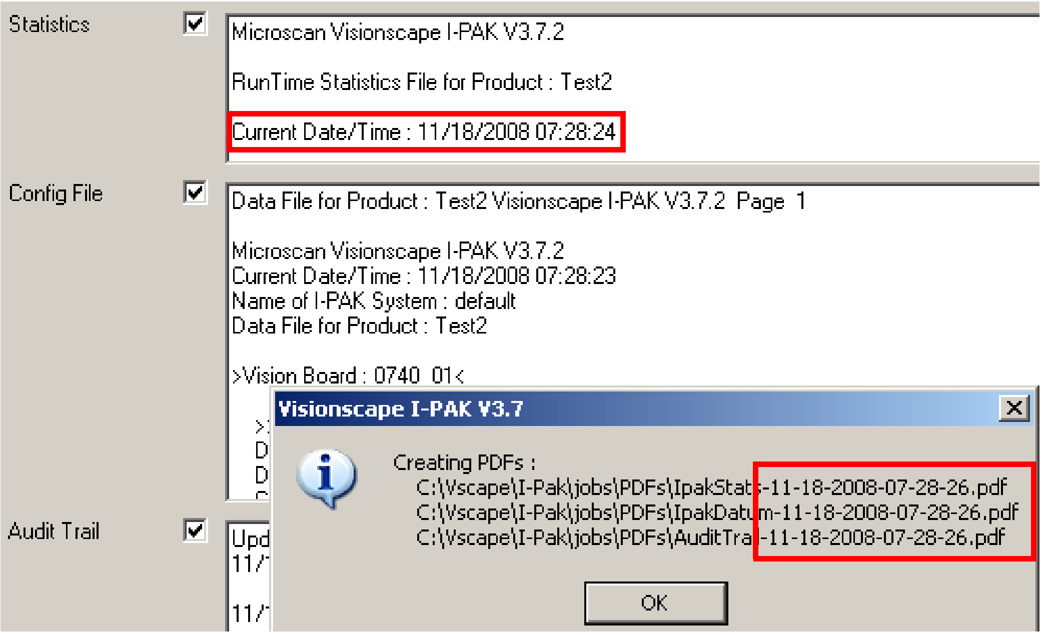
A message box is displayed after the PDFs are created so that you can see the file names and their paths on the hard drive of I-PAK. The folder where these PDFs live is in a subfolder where I-PAK is installed and in their own “PDF” folder. Typically, this is a path like: C:\Vscape\I-Pak\Jobs\PDFs.

Each PDF uses a file name that contains the date/time stamp of when you created these PDF reports and the type of report it is. For example, the Statistics PDF might be called something like:

C:\Vscape\I-Pak\Jobs\PDFs\IpakStats-11-18-2008-07:28_24.pdf

You should be able to use this timestamp to your advantage and verify that the timestamp of the file name is close to the timestamp contained in the file itself. For example, in Figure 3–3, you can see that the Statistics Current Date/Time is 11/18/2008 07:28:24. So, the PDFs were made two seconds after this file was created.

FIGURE 3–3. **Creating PDFs for End of Batch Reports**

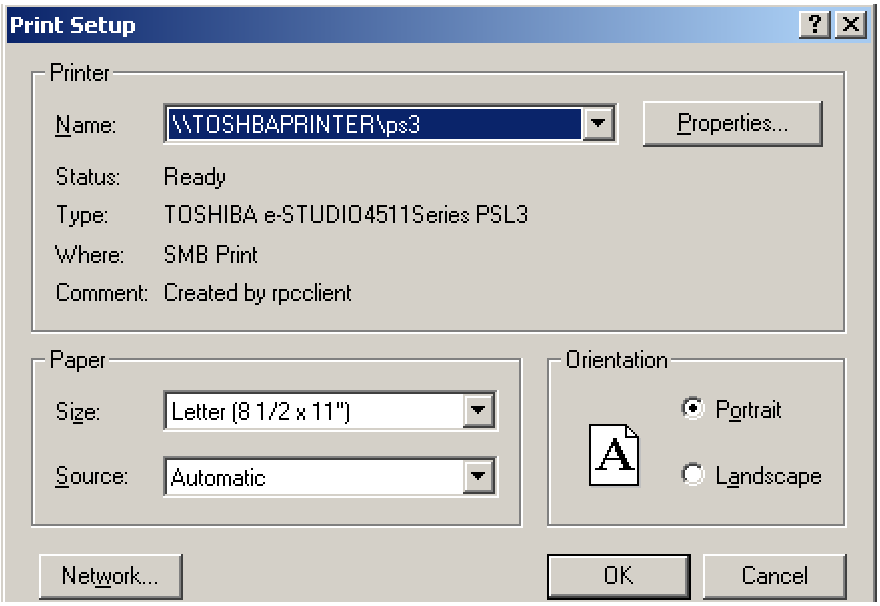


Printing

When you click Print, the Reports that are selected (checkboxes to the right of the description and to the left of the display) will be sent to your printer.

Note: Make sure you have set up previously a network or local printer. I-PAK will look for the printer defined on the system.

FIGURE 3–4. **Printing End of Batch Reports**



Archive PDFs

When you click on Archive PDFs, the Reports that are selected (checkboxes to the right of the description and to the left of the display) and that have PDFs created, will be archived to your archive device. Also, you can archive to every path selected in System Settings independent from the device type. This can also be a USB drive or any device which is connected to the PC and ready to store data.

Microscan strongly suggests you use the optional internal CD R/W device or USB port with removable memory as your archive device and set the path to your local CD R/W or USB drive path.

Note: You need to set up the archive path via the System Settings Menu.

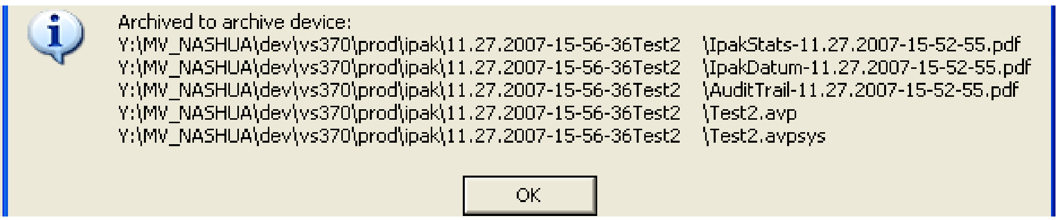
You need to put a blank CD into the CD R/W drive and format it using Direct CD; format it to allow multiple file writes from a program such as Windows Explorer. Format the media before trying to use this feature.

When creating these archives on CD, several things are happening for top security. First, a folder is created on the CD using the current time/date stamp concatenated with the current product's name. The PDFs are written to the CD using the previous names with the time/date stamp. This ensures that the files are not modified, as the file date/times themselves MUST be consistent with the file and folder names. A few seconds differences in these is all that can be expected to be different.

Note: You should create an SOP to verify these date/times on the folder and file names and inside the files themselves to ensure no one is corrupting your data.

A message box is displayed after the PDFs are written so that you can see the file names and their paths on the archive device of I-PAK.

FIGURE 3–5. Archiving PDF End of Batch Reports



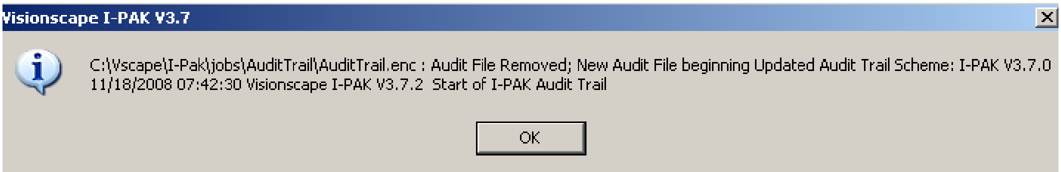
Once the archive is complete, and you click OK on the message box, I-PAK restores this dialog box back to the viewing status of all three files.

Reset Audit Trail

As an Administrator, after creating a PDF of the Audit Trail, which can then be stored onto CD or long term storage device, you can select to reset the Audit Trail. This prevents the PC from having a sluggish response as it updates the Audit Trail file data.

Note: Create an SOP to determine when, if ever, you can reset the Audit Trail.

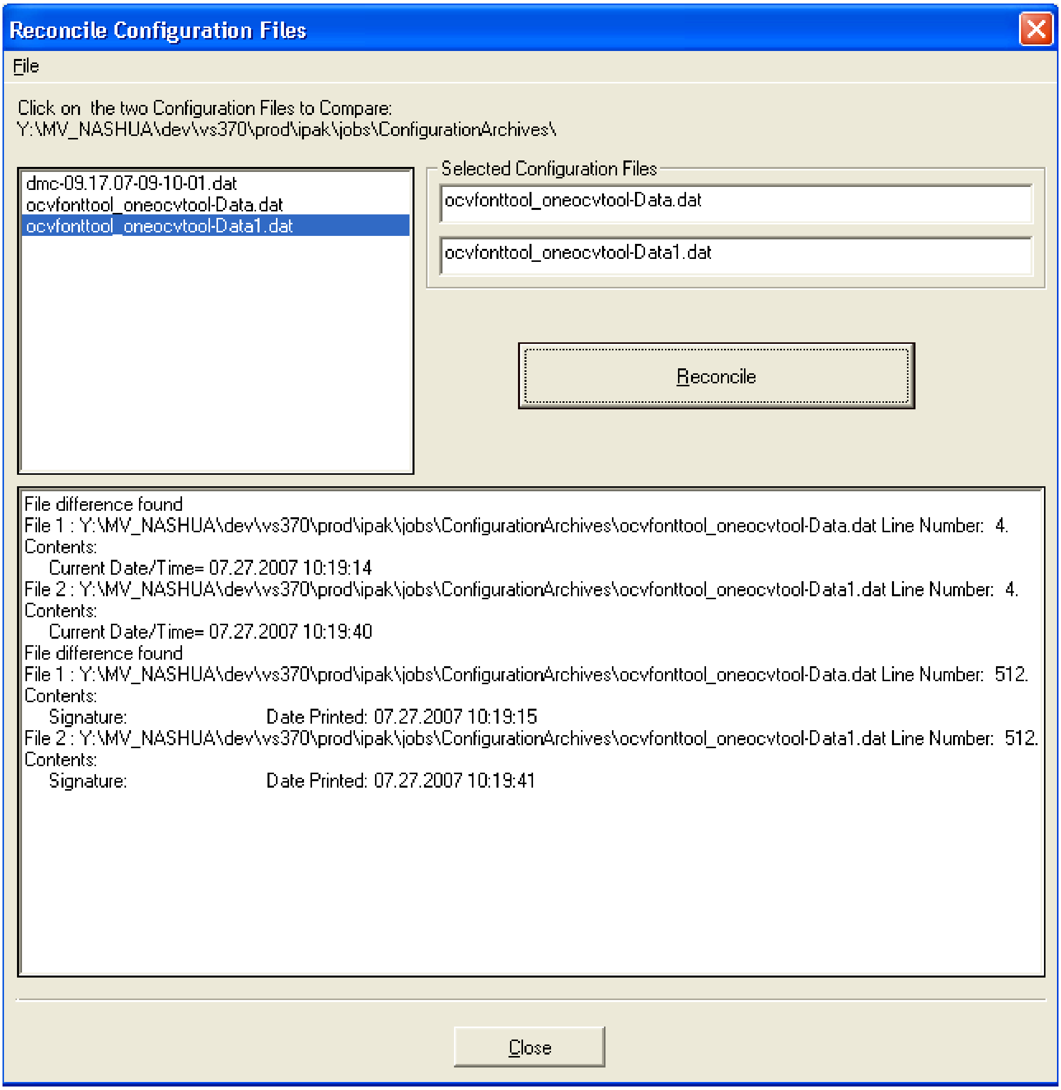
FIGURE 3–6. Reset the Audit Trail as an I-PAK Administrator



Reconciliation of Configuration Files

You can display the file differences between two configuration files. When you click on Reconcile Configuration Files from the main 21 CFR Part 11 task bar, the Reconcile Configuration Files dialog box is displayed, as shown in Figure 3–7.

FIGURE 3–7. Reconcile Configuration Files



The upper left of the display shows you all the files in your I-PAK\Jobs\ConfigurationArchive folder. From here, you select the two files you wish to reconcile (perform a file difference on). When you click Reconcile, the lowest display region will show you the file differences.

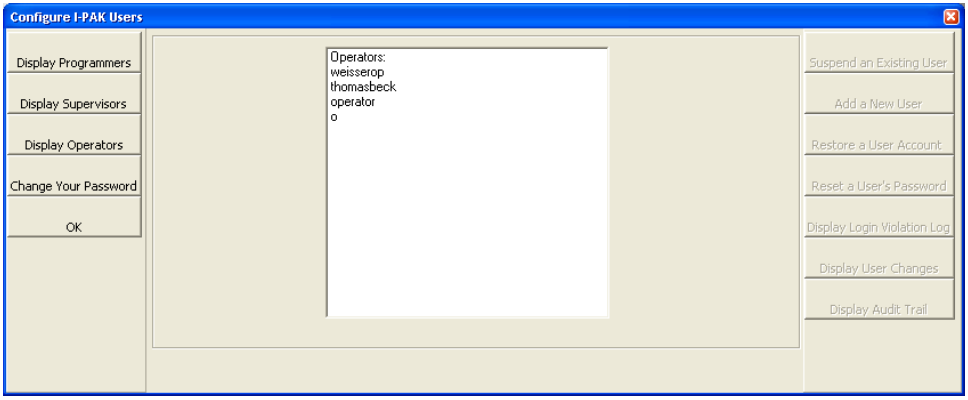
You can view these differences or save them to a file by clicking File > Save As. You can also print these file difference by clicking File > Print.

Configure 21 CFR Part 11 Users

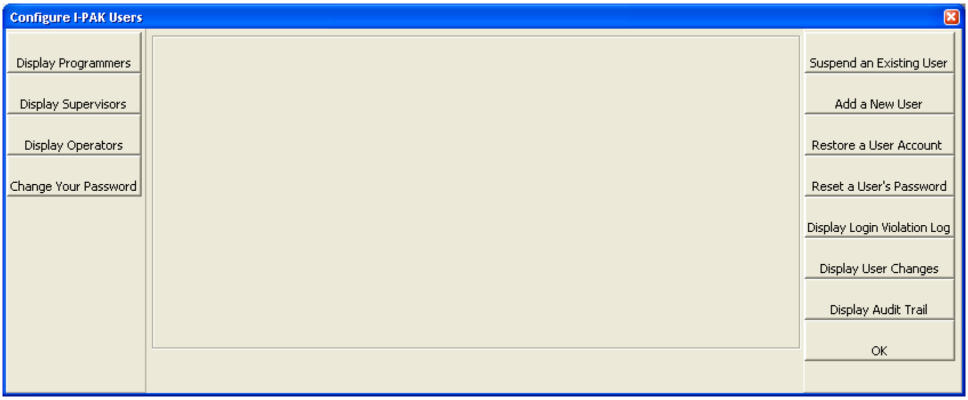
When you click on this, I-PAK brings up the Configure I-PAK Users dialog box, as shown in Figure 3–8.

FIGURE 3–8. Configure 21 CFR Part 11 Users Dialog Boxes

Programmer



Admin



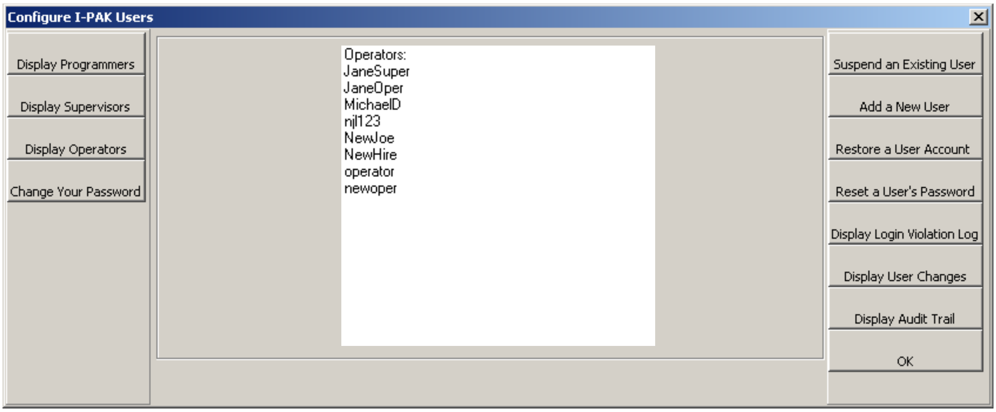
In general, this menu allows the Administrator to create and configure user accounts before users can begin using the feature.

Notes: The Administrator should create a user account with the Programmer security level right away so that the Vision System Settings can be adjusted when necessary.

The buttons on the right-hand side of this display are restricted to the I-PAK Administrator. You must be an Admin to access them.

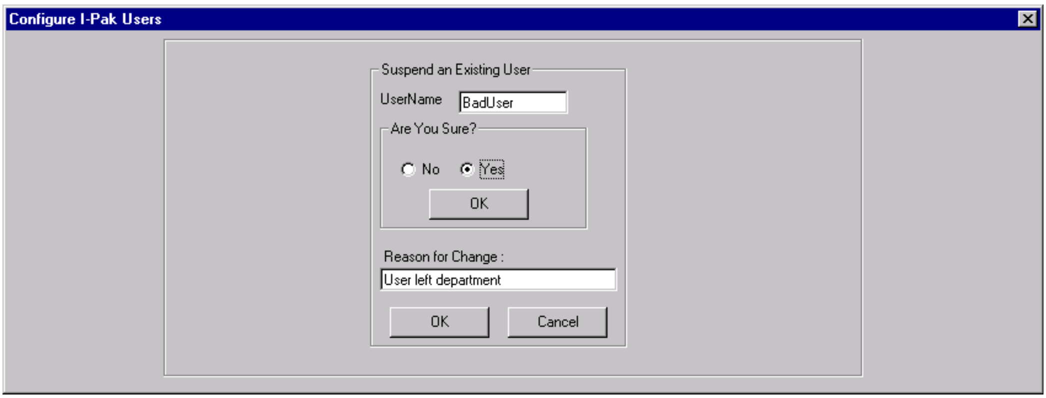
- Display Programmers — This menu option enables the I-PAK Administrator to see all the user accounts that have a security access of Programmer. As a user, you can review this list of already created Programmers as long as you are a Programmer. A Supervisor or Operator cannot access this menu item. You are restricted in viewing the list of other users that are at or below your security level.
- Display Supervisors — This menu option enables the I-PAK Administrator to see all the user accounts that have a security access of Supervisor. As a user, you can review this list of already created Supervisor as long as long as you are a Supervisor or Programmer. An Operator cannot access this menu item. You are restricted in viewing the list of other users that are at or below your security level.
- Display Operators — This menu option enables the I-PAK Administrator to see all the user accounts that have a security access of Operator. As a user, you can review this list of already created Operators as long as you are an Operator.

FIGURE 3–9. **Configure 21 CFR Part 11 Users — Display Operators**



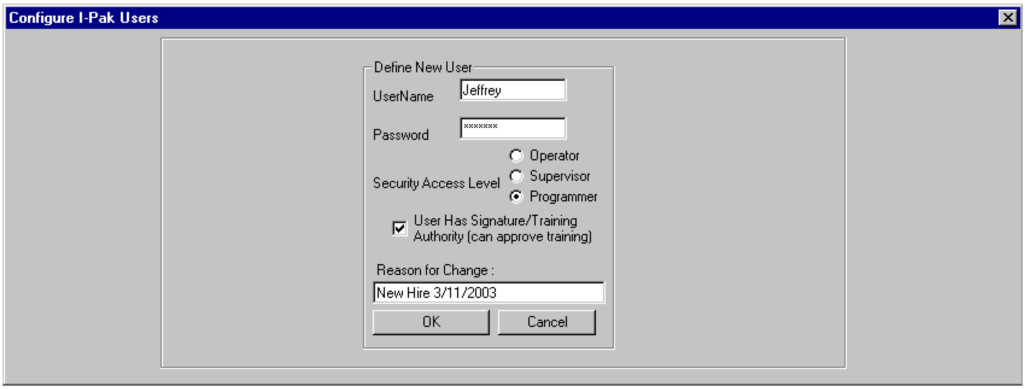
- Change your Password — You can change your own password by clicking this button. You will be asked to enter your password twice to verify that the password is correct. An I-PAK Administrator can also use this menu to Change his or her Administrator password.
- Suspend An Existing User — The I-PAK Administrator can suspend an existing user's account via this dialog box. This might be useful if one of your employees leaves the company.

FIGURE 3–10. **Configure 21 CFR Part 11 Users — Suspend an Existing User**



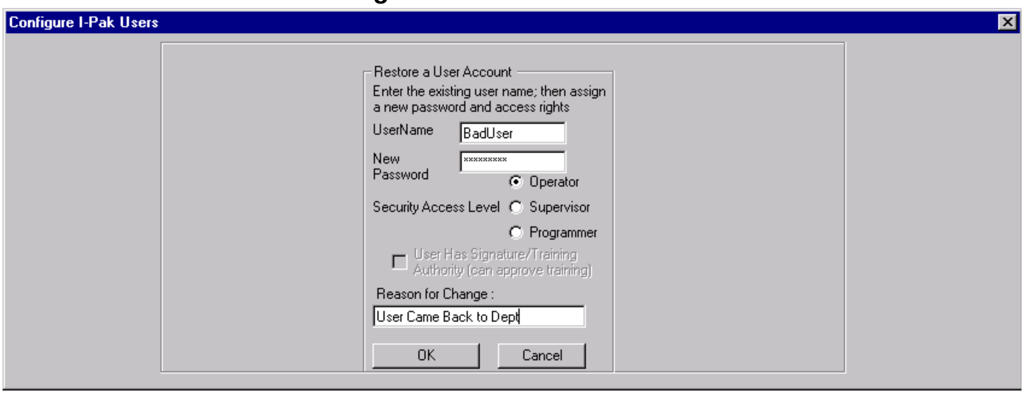
- Add a New User — The I-PAK Administrator can create new accounts. This might be useful when a new employee joins your company.

FIGURE 3–11. **Configure 21 CFR Part 11 Users — Add a New User**



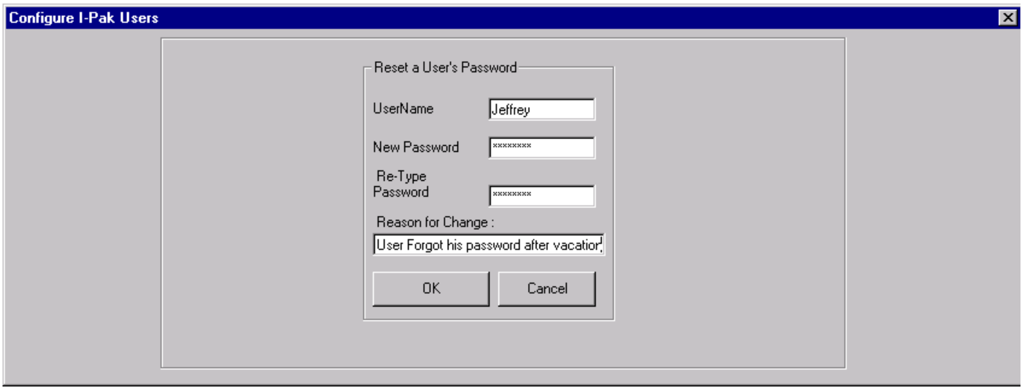
- Restore A User Account — The I-PAK Administrator can restore a suspended user's account via this dialog box. This might be useful if one of your former employees returns to the company.

FIGURE 3–12. **Configure 21 CFR Part 11 Users — Restore a User Account**



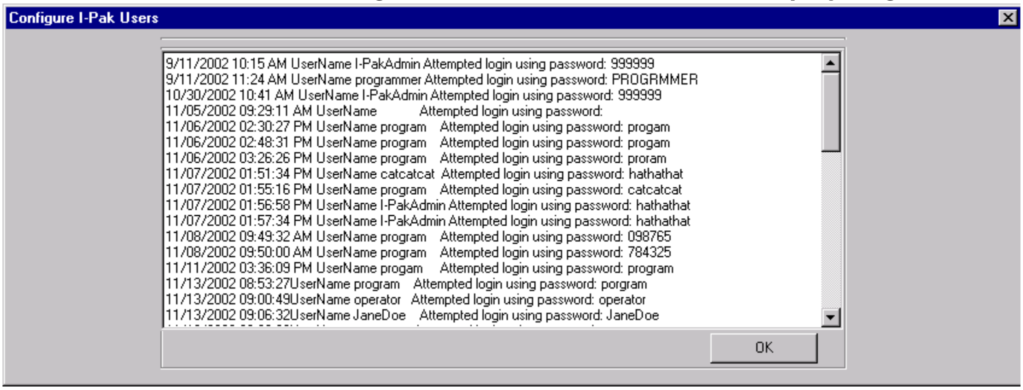
- Reset a User’s Password — The I-PAK Administrator can reset a users’s password via this dialog box. This might be useful if one of your employees forgets his or her password.

FIGURE 3–13. **Configure 21 CFR Part 11 Users — Reset a User’s Password**



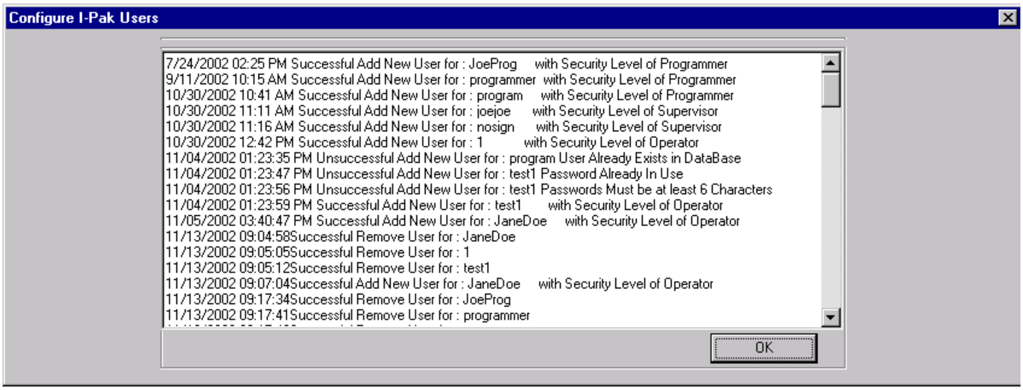
- Display Login Violations — The I-PAK Administrator can review the login violations via this dialog box. This might be useful if one of your employees is constantly logging in incorrectly or you suspect a security breach.

FIGURE 3–14. **Configure 21 CFR Part 11 Users — Display Login Violations**



- Display User Changes — The I-PAK Administrator can review the user changes log via this dialog box. This might be useful if one of your employees is constantly changing his or her password or you suspect a security breach.

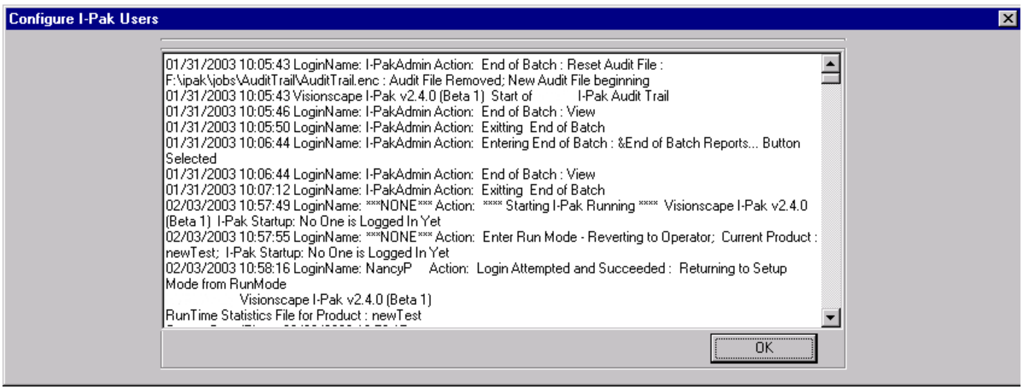
FIGURE 3–15. Configure 21 CFR Part 11 Users — Display User



Changes

- Display Audit Trail — The I-PAK Administrator can review an ASCII translation of the Audit Trail. He or she cannot do much with this data; it is for reference only. If the I-PAK Administrator wanted to archive this data or print this data, he or she should see “End Batch” starting on page 6-109.

FIGURE 3–16. Configure 21 CFR Part 11 Users — Display Audit Trail



Common 21 CFR Part 11 Areas of Concern

From the numerous audits Microscan has hosted through the years, there are certain questions that keep being asked regarding to how I-PAK is technically compliant. Here are some of these questions and our answers.

How is Part 11 activated in the product?

By default, I-PAK does not activate Part 11 functionality as a factory setting. As an off-the-shelf product, not all of our users are required to use Part 11. To enable Part 11, go to Advanced Settings > System Settings > General > Enable User Name Access - (Enable Part 11). The activation state (enabled or disabled) of Part11 is displayed in the status bar of Setup mode.

What are the Password Schemes and Restrictions?

Passwords have restrictions based on the 21 CFR Part 11 guidelines. I-PAK has implemented the following password specific rules:

- Passwords must be at least six characters in length and no longer than 10 characters.
- Passwords are changeable through the Configure Part 11 Users dialog box. You can change your own password only. The I-PAK Administrator can change any user’s password.
- Passwords are encrypted when stored. Passwords are hidden when typed into the login box.
- Microscan recommends that passwords be changed every 30 days. Enforcement of this is left to the end user as your own SOP. You can use System Setting > General > Set Passwords To Expire to aid in this.
- Users entering new passwords are required to enter unique passwords. No two users can have the same password. When changing your password, you cannot change it to what it currently is set to.

- When there is a failed login attempt, the time and date, the user name and the password entered are recorded to a security log and the Audit Trail.
- After a user definable number (1 to 10) of failed login attempts, the user name is suspended from the authorized user list. Only the Administrator is able to Restore a User to restore this user account. The suspension of the user is noted on the security log file.

When you create a new user, Supervisor or Programmer, you must specify whether or not that user is authorized to do Re-Training. By default, this setting is disabled (no signature authority). Existing users will be set to NOT have this Signature Authority feature and, therefore, will NOT be able to approve training. Any existing users in your user group must get a new user name and enable this Signature Authority feature to approve training.

The Signature Authority function has been expanded so that, when person #1 trains the OCV tools or match strings for the Barcode or Data Matrix tools,
I-PAK checks to make sure that user has signature authority, in addition to continuing to check for a valid user name, password and security level.

How can I prevent my users from getting to the desktop?

The System Setting “Enabled Desktop” will allow or prevent users from getting to the desktop. By default, this setting is enabled, meaning you can Alt-Tab and get to the Windows Desktop from I-PAK. For our Part 11 users, this setting should be disabled (unchecked), so that users cannot get to the desktop or taskbar. Disabling the Desktop prevents a user from the following keystrokes: Alt-Tab; Ctrl+Esc (Start Menu and TaskBar); Alt+Esc. This will prevent changes to the System Clock, and will be a deterrent for people who want to use the PC for something other than I-PAK.

How safe is the Audit Trail from being compromised?

The Audit Trail is an encrypted file. You cannot just open it with a common editor and make sense of the data. Further, the Audit Trail can be made into an Acrobat Reader PDF that can be stored on the local drive or archived to another drive, network or CD. The Audit Trail provides a detailed who, what, when log of all I-PAK changes. This Audit Trail is an encrypted file. You can view the translated contents of this file as an authorized user (Administrator, Programmer or Supervisor). Also, you can use the mouse to to select some data to be printed. This could be used to show a single Job's production run from Product ChangeOver to Reconciliation of that Batch records.

How safe are the Jobs files from being compromised?

Since the Jobs are binary files, you can only edit them with I-PAK. If someone tries to edit a Job with, say, Notepad, and saves those changes, the file will be corrupt and I-PAK will not read it in without error. The Jobs are backed up automatically within I-PAK so, even if the file gets corrupted, you can easily recover.

How safe are the Configuration and Statistics files from being compromised?

In addition to the read-only property for the support files (Configuration and Statistics files), I-PAK hides these files. This offers a more secure method of saving support files that will prevent editing records. The data contained in the Statistics file is completely free from editing because it is written into the encrypted Audit Trail. Additionally, these files can be made into Acrobat Reader PDFs that can be stored on the local drive or archived to another drive, network or CD.

Can this data be saved to a non-editable format?

The Audit Trail, the Configuration file and the Statistic file can all be made into Acrobat Reader PDFs that can be stored on the local drive or archived to another drive, network or CD.

How do I know who made the last batch or change?

The Configuration Data and Statistics files are updated to include the last login name and timestamp to the files. This Statistics information is written to the Audit Trail file as well including that login data.

My company wants the number of login failures to be 3 but I-PAK defaults this to 5. What can I do?

There is a System Setting to allow the I-PAK Programmer to define the number of login failure attempts. By default, this value is set to 5. But, it is user definable from 1 to 10. For more information, see Set Number of Failed Logins on page 6–111.

If I get an alarm on I-PAK, how will I know someone saw it?

For Alarms, Overruns, you are required to acknowledge alarms with a login (of Supervisor or higher) to click OK. This transaction is recorded to the Audit Trail file.

What is the date format used inside the Part 11 files?

The date format used inside Part 11 files is mm/dd/yyyy hh:mm:ss -- 24-hour format, with leading zeros added for months/dates less than 10.

All this writing to disk, what if I-PAK runs out of hard drive space?

The availability of disk space is always checked before writing the following to disk: the Job, Audit Trail file, Statistics files, Configuration files, and images.

4

CHAPTER 4

Automatic Identification

4
Automatic Identification

This chapter discusses the following tools for automatic identification:

Barcode Reading

The Barcode Tool reads a barcode and converts the data to a string that can be compared to a known string, or exported. The input to the tool consists of an ROI, which types of barcodes to decode, and the search method. The output of the tool will be the decoded string and a status indicating a match with the known string.

Other Steps Used

None.

Theory of Operation

The Barcode Tool locates and decodes barcodes. It searches the specified ROI for a barcode and attempts to decode it. The Barcode Tool can be trained to set the match string for all types of barcodes. The remaining parameters can only be trained for pharma code and will only affect the reading of pharma codes.

The Barcode Tool will only decode barcodes types that have been enabled in the Enabled Codes selection list. The decoded string is available for output, as well as a status indicating whether the barcode data exactly matches the trained match string.

When reading Pharmacodes, the Pharmacode barcode type must be selected in the enabled code section list.

To train the Barcode Tool, adjust the Barcode Tool ROI so that it contains the barcode to be read. The ROI can be placed just around the barcode or include the entire image. When placing the ROI around the barcode, be sure to leave clean area on all sides of the code.

When training a Pharmacode, both narrow and wide bars must be present in order to train successfully.

If a barcode is located and decoded when the tool is run, the decoded text is displayed at the center of the ROI, as shown in Figure 4–1. The status flag of the tool is set to pass if a barcode is found and decoded and, when the match string is enabled, the decoded string must also match. The output status datum ReadStatus is set true if a barcode is found and decoded regardless of the decoded string.

FIGURE 4–1. **Train VisionBoard1 — Barcode Tool — Match String**

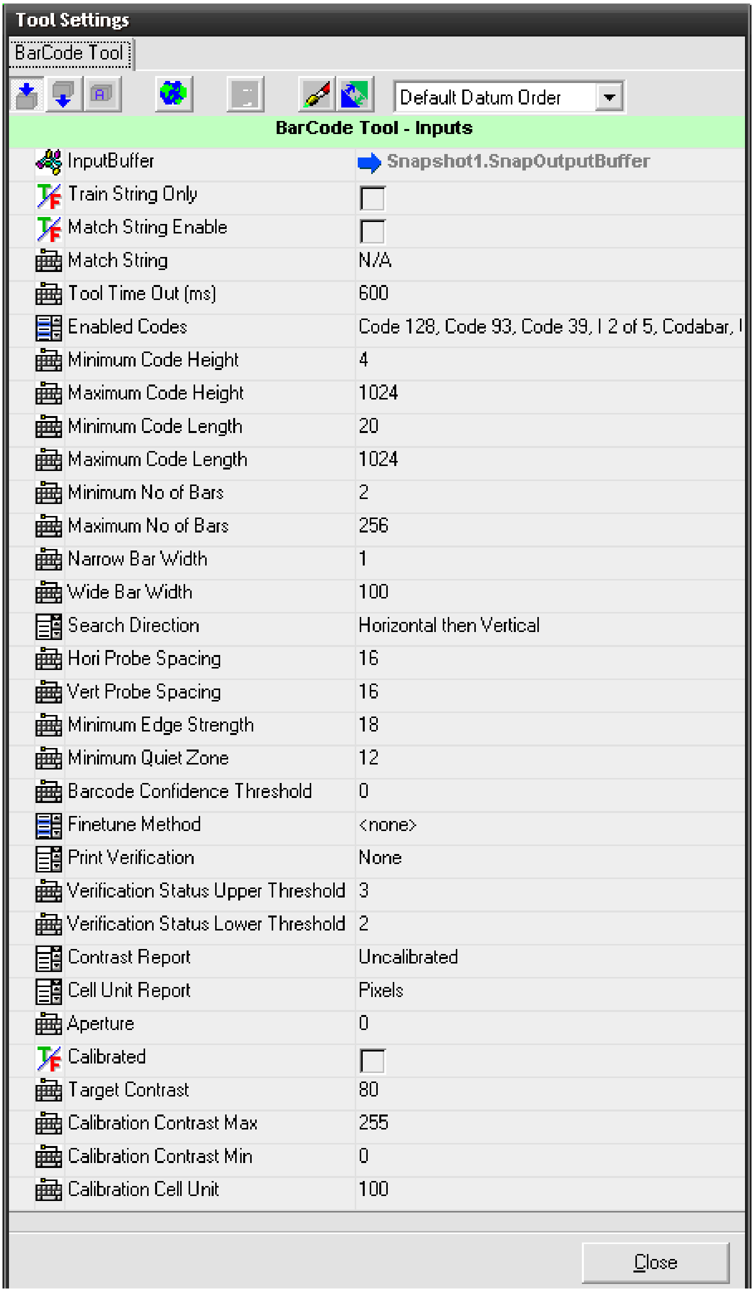
The Barcode Tool is inserted in a Job Tree inside of a Snapshot and an Acquire.

Description

The Barcode Tool allows editing through the Barcode Tool properties page, as shown in Figure 4–2.

Note: Click the A button to display advanced Barcode Tool properties.

FIGURE 4–2. **Barcode Tool Properties Page**



Tool Settings

BarCode Tool

Default Datum Order

BarCode Tool - Inputs	
InputBuffer	Snapshot1.SnapOutputBuffer
Train String Only	☐
Match String Enable	☐
Match String	N/A
Tool Time Out (ms)	600
Enabled Codes	Code 128, Code 93, Code 39, I 2 of 5, Codabar, I
Minimum Code Height	4
Maximum Code Height	1024
Minimum Code Length	20
Maximum Code Length	1024
Minimum No of Bars	2
Maximum No of Bars	256
Narrow Bar Width	1
Wide Bar Width	100
Search Direction	Horizontal then Vertical
Hori Probe Spacing	16
Vert Probe Spacing	16
Minimum Edge Strength	18
Minimum Quiet Zone	12
Barcode Confidence Threshold	0
Finetune Method	<none>
Print Verification	None
Verification Status Upper Threshold	3
Verification Status Lower Threshold	2
Contrast Report	Uncalibrated
Cell Unit Report	Pixels
Aperture	0
Calibrated	☐
Target Contrast	80
Calibration Contrast Max	255
Calibration Contrast Min	0
Calibration Cell Unit	100

Close

TABLE 4–1. Links to Property Descriptions

For Information About...	Go To...
Aperture	page 4–14
Barcode Confidence Threshold	page 4–9
BC412 Check Sum	page 4–10
BC412 Decode Left Right	page 4–10
BC412 Remove Check Sum Display	page 4–10
BC412 Start/Stop	page 4–10
BC412/QR Code Polarity	page 4–10
Calibrated	page 4–14
Calibration Cell Unit	page 4–14
Calibration Contrast Max	page 4–14
Calibration Contrast Min	page 4–14
Cell Unit Report	page 4–14
Code39 Check Sum	page 4–11
Code39 Remove Check Sum Display	page 4–11
Contrast Report	page 4–13
Enabled Codes	page 4–7
Finetune Method	page 4–9
Hori. Probe Spacing	page 4–8
I2of5 Check Sum	page 4–11
I2of5 Remove Check Sum Display	page 4–11
Match String	page 4–6
Match String Enable	page 4–6
Maximum Code Height	page 4–8
Maximum Code Length	page 4–8
Maximum No. of Bars	page 4–8
Minimum Code Height	page 4–8
Minimum Code Length	page 4–8
Minimum Edge Strength	page 4–9
Minimum No. of Bars	page 4–8

TABLE 4–1. Links to Property Descriptions (continued)

For Information About...	Go To...
Minimum Quiet Zone	page 4–9
Narrow Bar Width	page 4–8
Output UPC as EAN	page 4–10
Print Verification	page 4–11
QR Code Finder Pattern Misalignment	page 4–11
Search Direction	page 4–8
Target Contrast	page 4–14
Tool Time Out (ms)	page 4–7
Train String Only	page 4–6
Verification Status Lower Threshold	page 4–13
Verification Status Upper Threshold	page 4–13
Vert. Probe Spacing	page 4–9
Wide Bar Width	page 4–8

Settings

- Train String Only — After configuring the barcode tool and setting its Match String Enabled to enabled, when you select the Train button in Train and Tryout, only the match string field will be updated. None of the other barcode parameters will be modified.
- Match String Enable — When enabled, the match string will be compared against the decoded string of a barcode during a run to determine if the step is run successfully. The result datum will be true if a barcode is successfully decoded and the decoded string matches the match string value when this box is checked. During training, the decoded string from the training barcode will be placed in the Match String Value box only when this property is enabled.
- Match String — The entered string will be compared against each decoded string during each run when Enable Match String is enabled. This datum will be filled in after a successful train only when Enable Match String is enabled while training.

  Default: Empty

- Tool Time Out (ms) — Maximum time to search for a barcode. When a barcode is not found and decoded by this time, this step fails and the program execution continues. After training, if a barcode takes x milliseconds to decode, then the time-out value should be set to more than x milliseconds when Search Direction is Horizontal or Vertical only. The Tool Time Out value should be at least twice x when Horizontal then Vertical or Vertical then Horizontal parameter is used. When x milliseconds is used as the Tool Time Out value when Horizontal then Vertical or Vertical then Horizontal parameter is used, each search pass will time out in half of the x milliseconds.

  Default: 600 milliseconds (0 milliseconds = no time out)

- Enabled Codes — Only enabled codes will be located within the ROI:
  - BC412
  - Codabar
  - Code 128
  - Code 39
  - Code 93
  - Composite
  - I 2 of 5
  - PDF
  - Pharma Code
  - Postnet
  - QR Code
  - RSS 14
  - RSS Expanded
  - RSS Limited
  - RSS Stacked
  - UPC / EAN

  - UPC-E
  - UPC-Supplemental
- Minimum Code Height — Default: 4; Range: 4 to 1024 pixels.
- Maximum Code Height — Default: 1024 pixels; Range: 4 to 1024 pixels.
- Minimum Code Length — The minimum length of the barcode to be decoded.

  Default: 20 pixels
- Maximum Code Length — The maximum length of the barcode to be decoded.

  Default: 1024 pixels
- Minimum No. of Bars — Default: 2; Range: 2 to 256 bars.
- Maximum No. of Bars — Default: 256; Range: 2 to 256 bars.
- Narrow Bar Width — Default: 1; Range: 1 to 100 pixels.
- Wide Bar Width — Default: 100; Range: 1 to 100 pixels.
- Search Direction — Specifies the search method used within the ROI:
  - Horizontal
  - Vertical
  - Horizontal then Vertical — This is the default, and should work best for most cases.
  - Vertical then Horizontal
  - Criss Cross
- Hori. Probe Spacing — Sets the spacing in pixels between two horizontal barcode locating probes. When reading short codes such as postnet, the value should be set to 8.

  Default: 16 pixels
  Range: 8 to 256 pixels

- Vert. Probe Spacing — Similar to the horizontal probe spacing, it sets the spacing in pixels between two vertical barcode locating probes. This value does not apply to postnet or pharma code, which are not designed to be read at more than ± 45^{o}.

  Default: 16 pixels
  Range: 8 to 256 pixels

- Minimum Edge Strength — When the contrast of the barcodes is low, especially for low contrast BC412 images, the edge strength value can be set between 5 and 18 gray scale values. The edge strength can be raised to a higher value when the barcode has very high contrast. With higher edge strength, the tool will ignore most low contrast objects and get to the barcode area more quickly. If the barcode's contrast is unlikely to change (e.g., when a stable lighting source is employed), the level can be raised to 36 to produce the optimum run performance. The value can be set between 5 and 100, with a default of 18.

- Minimum Quiet Zone — If, for any reason, the quiet zone is less in the image due to camera setup restrictions, the Minimum Quiet Zone parameter can be lowered in order for the algorithm to accept shorter space as quiet zone. On the other hand, if the barcode is big in the FOV such that some space between two adjacent bars exceeds the value specified in the Minimum Quiet Zone, then there is a possibility that this space will be detected as possible quiet zone. To avoid this situation, the Minimum Quiet Zone can be increased.

  Default: 12 pixels
  Range: 5 to 100 pixels

- Barcode Confidence Threshold — For barcodes that do not use checksum such as Code 39, I 2 of 5, Codabar, and BC412, the threshold value can help reduce potential misdecode. The value can be set between 0 and 100. The default value is 0, meaning that any possible decode is accepted. When the value is raised, a certain number of decodes must agree before the decode is declared successful. On the other hand, if the value is set too high, then a normally decodable but imperfect barcode may not be decoded.

- Finetune Method — The only method is Decode Near Center; the camera tries to read the symbol that is closest to the center of the FOV.

- Output UPC as EAN — When enabled, a UPC barcode string will be formatted as an EAN barcode. UPC and EAN are overlapping standards. In the one standard, the leading “0” is implied and not output. In the other standard, all of the characters are displayed. Therefore, if a user in Europe had an EAN code that would be a valid UPC, a user in the United States would default to reporting it as a UPC without the leading “0”. However, if the user in the United States wanted it reported with the leading zero, that user must enable Output UPC as EAN, and the leading zero will be sent as part of the decode string.
- BC412/QR Code Polarity — Sets the polarity of a BC412 or QR Code:
  - Auto (Default)
  - Light on Dark
  - Dark on Light
- BC412 Start/Stop — Enable this property to read a SEMI BC412 barcode with a start and stop pattern. The default is disabled, indicating a non-SEMI BC412 barcode without a start and stop pattern.
- BC412 Check Sum — Enable this property to read a SEMI BC412 barcode with a checksum. The default is disabled, indicating a non-SEMI BC412 barcode without a checksum character.
- BC412 Remove Check Sum Display — When this property is enabled, the checksum character will not be displayed. The default is disabled, meaning that the checksum character will be displayed.
- BC412 Decode Left Right — By default, this property is selected, enabling left-to-right decoding of data. When deselected, the data will be decoded from right-to-left. This is only useful when Start/Stop is not selected.

Note: This mode should not be used for a SEMI BC412 barcode that contains both a start and stop pattern and a checksum character.

- I2of5 Check Sum — Enable this property to read an I2of5 barcode with a checksum. The default is disabled, indicating an I2of5 barcode without a checksum character.
- I2of5 Remove Check Sum Display — When this property is enabled, the checksum character will not be displayed. The default is disabled, meaning that the checksum character will be displayed.
- Code39 Check Sum — Enable this property to read an Code 39 barcode with a checksum. The default is disabled, indicating an Code 39 barcode without a checksum character.
- Code39 Remove Check Sum Display — When this property is enabled, the checksum character will not be displayed. The default is disabled, meaning that the checksum character will be displayed.
- QR Code Finder Pattern Misalignment — Sets the QR code finder pattern misalignment parameter.

  Default: 0
  Range: 0 to 6
- Print Verification — Enables Verifier outputs when set to anything other than None:
  - ANSI
  - None (default)

  Print Verification currently supports ANSI Print Verification for Code 128, Code 93, Code 39, I 2 of 5, UPC / EAN, RSS 14, RSS Limited, RSS Expanded, RSS Stacked.

  When Print Verification is set to anything other than None, in addition to decoding the barcode, the BarCode Tool also computes the barcode print quality according to the ANSI guideline. To measure the print quality, a total of 10 scans are made to get 10 scan reflectance profiles of the barcode. The scans are approximately equally spaced within the barcode and are made parallel to the length of the barcode. For each scan reflectance profile, the following parameters are graded: Edge Determination, Minimum Reflectance, Reference Decode, Quiet Zone, Minimum Edge Contrast, Symbol Contrast, Modulation, Defects, and Decodability. Each parameter is given a grade as follows:

– A corresponding to a numeric scale of 4.

– B corresponding to a numeric scale of 3.

– C corresponding to a numeric scale of 2.

– D corresponding to a numeric scale of 1.

– F corresponding to a numeric scale of 0.

The lowest grade received from these parameters is used as the Overall Profile Grade for the scan profile. The Final Symbol Grade is the simple average of all the overall profile grades using the standard weighting 4 = A, 3 = B, 2 = C, 1 = D, and 0 = F. The average is converted to the Final Symbol Grade:

– 3.5 <= A <= 4.0

– 2.5 <= B < 3.5

– 1.5 <= C < 2.5

– 0.5 <= D < 1.5

– F < 0.5

When Print Verification is set to ANSI, the Final Symbol Grade and its corresponding average score, as well as the ten Overall Profile Grades, are available in Results to Upload. They are represented by BarCode Tool.Final Grade, BarCode Tool.Final Grade Score, and BarCode Tool.Scan X Grade, respectively, where X ranges from 0 to 9.

Outputs include (see the ANSI specification for descriptions):

– Code Type

– Erasure Bits

– Error Bits

– Final Grade

– Number Found

– One X Dim

- Ratio [x] (where x is 0 through 2)
- Read Status
- Scan x Grade (where x is 0 through 9)
- Status
- Symbol Height
- Symbol Width
- SymResults
- Text
- Verification Details
- Verification Status

- Verification Status Upper Threshold — Allows you to set the upper threshold at which the printed code is considered good. When the final verification grade is greater than or equal to the value of this datum, the code will be considered to be of good quality. This value should always be greater than or equal to the Verification Status Lower Threshold. If it is equal to the Verification Status Lower Threshold, the resulting status will be good (3) or poor (1), with no fair (2) status defined.

  Valid Values: 4 to 1

- Verification Status Lower Threshold — Allows you to set the lower threshold at which the printed code is considered fair. When the final verification grade is greater than or equal to the value of this datum, the code will be considered to be of fair quality. This value should always be less than or equal to the Verification Status Upper Threshold. If it is equal to the Verification Status Lower Threshold, the resulting status will be good (3) or poor (1), with no fair (2) status defined.

  Valid Values: 3 to 1

- Contrast Report — The units that will be used for the reporting of contrast. These are Uncalibrated, Self Calibrated, and Reflectance Calibrated. Reflectance Calibrated is used if values from a Data

Matrix tool calibration are available to enter into the Calibration Contrast Max and Calibration Contrast Min parameters that correspond to the Target Contrast of the Calibration Standard.

- Cell Unit Report — The units that will be used for the reporting of cell size and symbol height and width. These are Pixels or Mils. Mils may be used if the value from a Data Matrix tool verification is available to enter into the Calibration Cell Unit parameter.
- Aperture — Used to set the synthetic aperture size in mils. The default is 0 for AUTO, with manually set values in the range of 4 - 20.
- Calibrated — Since contrast and pixel to mils calibration are performed with a Data Matrix tool and manually copied to a BarCode tool, this parameter must be manually set to notify the software that it needs to use the calibration parameters.
- Target Contrast— This is the contrast value of the calibration standard used with the Data Matrix tool to generate the calibration parameters.
- Calibration Contrast Max — The value returned from a Data Matrix tool calibration that indicates the pixel brightness that represents white. This must be manually entered for the BarCode tool to report contrast in calibrated units.
- Calibration Contrast Min — The value used by a Data Matrix tool calibration to represent what the camera sees as absolute black. Because the gains and offset of the camera may not yield a value of 0 for black, this must be determined experimentally by blocking the light from the camera and determining the average pixel brightness by moving the cursor across the presented image. This must be manually entered for the BarCode tool to report contrast in calibrated units.
- Calibration Cell Unit — This value is returned from a Data Matrix tool calibration that is the multiplier*100 to convert pixels to mils. This must be manually entered for the BarCode tool to report sizes in calibrated units.

Training

Place the ROI around the barcode to be trained. To train on any barcode other than Postnet or Pharmacode, ensure at least one barcode in the

Enabled Codes is enabled. To train on a Postnet or Pharmacode, each should be specifically enabled in the Enabled Codes. Perform the training by clicking Train. When a barcode is successfully found and decoded and Match String Enable is enabled, the match string will be set from that barcode.

Results

- Status — The BarCode Tool status is true when a barcode is found and decoded, and the decoded string matches the Match String when Match String Enable is enabled.
- Symbol Height — The Symbol Height is reported if Print Verification is set to ANSI and is reported in Pixels if Cell Unit Report is set to Pixels. If Cell Unit Report is set to Mils, Calibrated is set On, and Calibration Cell Unit is set to the results of a Data Matrix tool calibration; Symbol Height will be reported in mils*100.
- Symbol Width — The Symbol Width is reported if Print Verification is set to ANSI and is reported in Pixels if Cell Unit Report is set to Pixels. If Cell Unit Report is set to Mils, Calibrated is set On, and Calibration Cell Unit is set to the results of a Data Matrix tool calibration; Symbol Width will be reported in mils*100.
- Text — String from the decoded barcode.
- Error Bits — Number of code words in error that are not erasure code words used in error correction algorithm.
- Erasure Bits — Number of code words in error that are erasure code words used in error correction algorithm.
- Code Type — Indicates the type of barcode that is decoded. This is useful when multiple barcodes are enabled in Enabled Codes in order

to read different types of barcodes after train. Table 4–2 lists and describes the code types.

TABLE 4–2. Code Types

Code Type	Description
16	PDF
32	Code 128
64	Code 93
128	Code 39
256	I 2 of 5
512	Codabar
1024	UPC / EAN
2048	UPC-E
4096	UPC-Supplemental
8192	BC412
16384	Postnet
32768	Pharma code
65536	RSS 14
131072	RSS Limited
262144	RSS Expanded
524288	RSS Stacked
1048576	Composite
2097152	QR Code

- Number Found — Number of barcodes found, decoded or not.
- ReadStatus — Status indicates true when a barcode is found and decoded, regardless of whether the decoded string matches the match string value.
- VerificationStatus — As defined by Verification Status Upper Threshold and Verification Status Lower Threshold. Grades 4-0 (A-F) are divided into three ranges:
  - Good — Grades above or equal to the Upper Threshold

  - Fair — Grades below the Upper Threshold but greater than or equal to the Lower Threshold
  - Poor — Grades below the Lower Threshold

  VerificationStatus is only available when Print Verification is set to ANSI.

- Scan [0-9] Grade — The overall grade for each of the 10 scans. This is only available when Print Verification is set to ANSI.
- Final Grade — Final composite grade derived from the 10 Scan Grades. This is only available when Print Verification is set to ANSI.
- Final Grade Score — Final score derived from the 10 Scans. This is only available when Print Verification is set to ANSI. Reported value is *10.
- One X Dim — The size of the smallest bar in pixels. This is only available when Print Verification is set to ANSI. Reported value is *10.
- Ratio [0] — The widest bar to 1X dimension. This is only available when Print Verification is set to ANSI.
- Ratio [1] — The next widest bar to 1X dimension. This is only available when Print Verification is set to ANSI.
- Ratio [2] — The smallest widest bar to 1X dimension. This is only available when Print Verification is set to ANSI.
- Verification Details — A summary of the grades and values of all parameters for each of the 10 scans. This is only available when Print Verification is set to ANSI.

Note: The reported Modulation, Defects and Decodability are *100. Min Reflectance reported value is *10.

- Sym Results — A summary of locator and decoder statistics such as angle, roi, and symbol type.

I/O Summary

BarCode Tool provides a I/O summary in the Status Bar located at the bottom of the FrontRunner™ window.

Inputs: N/A

Outputs: N/A

Error Messages:

The least significant digits of reported Error Messages may be interpreted with the information in Table 4–3.

TABLE 4–3. BarCode Error Messages

General Error	Code
IP_NO_EDGE_CANDIDATE_FOUND	127001
IP_FIRST_EDGE_NOT_FOUND_OR_TOO_SMALL	127004
IP_SECOND_EDGE_NOT_FOUND	127005
IP_THIRD_EDGE_NOT_FOUND	127011
IP_FOURTH_EDGE_NOT_FOUND	127012
IP_FOUR_CORNERS_NOT_FOUND	127020
IP_SIZE_TEST_FAILED	127021
IP_ROW_COL_TEST_FAILED	127022
IP_INSPECTION_TIMEOUT	127030
IP_BORDER_MATCH_TEST_FAILED	127033
IP_ECC_UNDECODABLE	127048
IP_CONTRAST_CALIBRATION_FAILURE	127050
IP_CELLUNIT_CALIBRATION_FAILURE	127051
IP_VERIFICATION_PROCESS_ERROR	127100
IP_VERIFICATION_UNSUPPORTED	127101
IP_VERIFICATION_TIMEOUT	127102
IP_ISOV_ECC200_REQUIRED	127110
IP_ISOV_APERTURE_TOO_SMALL	127111
IP_ISOV_APERTURE_TOO_LARGE	127112
IP_ISOV_INSUFFICIENT_SPACE	127113
IP_ISOV_FAIL_RDA_STEP_F_1	127114
IP_ISOV_FAIL_RDA_STEP_F_2	127115
IP_ISOV_FAIL_RDA_STEP_F_3	127116
IP_ISOV_FAIL_RDA_STEP_A_E	127117
QRCODE_DESIGN_UNIMPLEMENTED	128400

TABLE 4–3. BarCode Error Messages (continued)

General Error	Code
QRCODE_IP_GENERAL_ERROR	128401
QRCODE_IP_RATIO_ERROR	128402
QRCODE_IP_FINDER_ERROR	128403
QRCODE_IP_LINE_FIT_ERROR	128404
QRCODE_IP_LINE_INTERSECT_ERROR	128405
QRCODE_IP_CORNER_ERROR	128406
QRCODE_DEC_UNKNOWN_ERROR	128420
QRCODE_RS_LEVEL_INVALID	128421
QRCODE_FORMAT_INFO_FAILED	128422
QRCODE_VERSION_INFO_FAILED	128423
QRCODE_ROWS_COLS_INVALID	128424
QRCODE_DATA_CODEWORD_INVALID	128425
QRCODE_TOTAL_CODEWORD_INVALID	128426
QRCODE_MODE_INDICATOR_INVALID	128427
QRCODE_MODE_UNIMPLEMENT	128428
QRCODE_RS_DECODE_FAILED	128429
QRCODE_BCH15_5_UNDECODABLE	128430
QRCODE_MODEL_INVALID	128431

Data Matrix Tool

This tool reads a Data Matrix symbol and converts the data to a string that can be compared to a known string, or exported. The input to DataMatrix Tool consists of a Data Matrix description, and search criteria. The output of DataMatrix Tool will be the decoded string and status indicating a match with the known string.

Other Steps Used

None.

Theory of Operation

DataMatrix Tool locates and decodes Data Matrix codes. It will search the specified ROI for a Data Matrix and attempt to decode it.

During the training process, a representative Data Matrix is placed in the ROI. After you click Train, the system looks for any type of Data Matrix in the ROI. Based on the first one it finds, it will set the DataMatrix Tool parameters to optimize the reading process for the Data Matrix that it found.

You can run this tool without training. While the untrained speed of locating and decoding a Data Matrix will suffer, the Data Matrix tool will be able to read a much larger range of Data Matrix sizes, shapes, and qualities.

When running the Job, the system will look only for Data Matrices with similar specifications. The decoded string is available for output, and the step's status will indicate the Data Matrix data exactly matches the trained Data Matrix data when Enable Match String is selected.

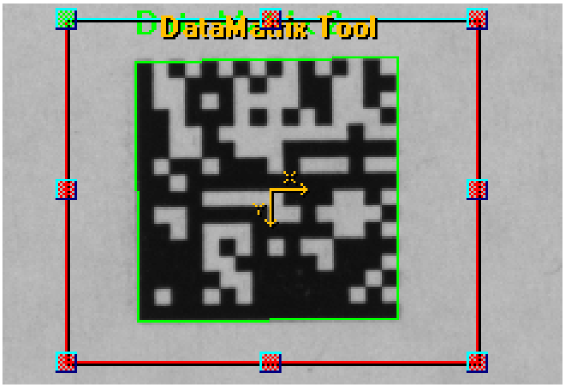
If the Data Matrices being inspected will vary between runs including changing in size, the search criteria can be relaxed. After training on the representative Data Matrix, setting the height, width, rows and columns to 0 will allow the system to find a Data Matrix, regardless of the size. This will slow the search somewhat, so, if the Data Matrix size is constant between runs, the parameters should be set accordingly.

The DataMatrix Tool is inserted in a Job inside of a Snapshot, an NPt Locator, Rect Warp, etc.

To train the DataMatrix Tool, adjust the DataMatrix Tool ROI so that it contains the Data Matrix to be trained, and some clean area around the Data Matrix, as shown in Figure 4–3.

Note: You can be generous with the clean area.

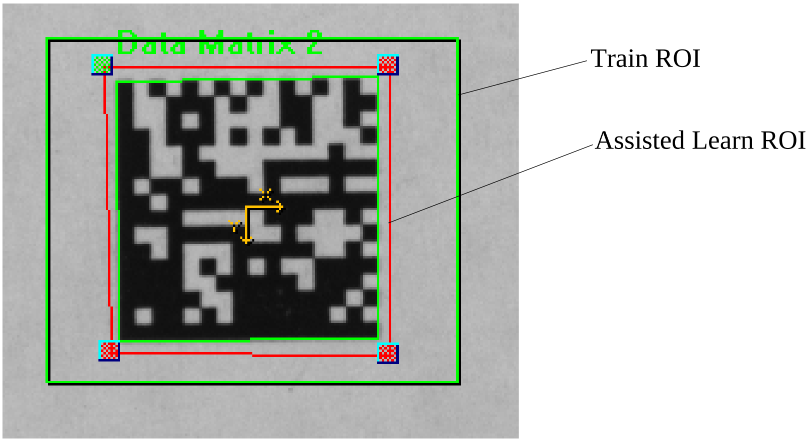
FIGURE 4–3. Data Matrix Tool — Trained



The DataMatrix Tool may fail to train when the ROI contains the full image. In this case, reduce the ROI so that it fits just around the Data Matrix and try to Train again. Once the step has been trained, the ROI can be adjusted without re-training. If the tool still fails to train correctly, try the assisted learn training method. When placing the ROI just around the Data Matrix, be sure to leave some white space around the Data Matrix (usually a little greater than the size of an individual cell).

When Assisted Learn is enabled, a second shape appears (Figure 4–4). This shape defines the shape of the Data Matrix to be trained. Adjust the corners of the assisted learn shape so that they are aligned with the corners of the training Data Matrix. Only the ROI is used during the run of DataMatrix Tool. Assisted Learn shape is used only during the training procedure.

FIGURE 4–4. **Assisted Learn— Data Matrix Tool**



If a Data Matrix is located and decoded from running the DataMatrix Tool, the Data Matrix is outlined and the decoded text displayed above it, as shown in Figure 4–4. The status flag of DataMatrix Tool is set to pass when a Data Matrix is found and decoded and, if the Enable Match String is selected, the decoded string must also match. The output status ReadStatus is set to true when a Data Matrix is found and decoded regardless of the decoded string.

Description

Data Matrix Tool allows editing through the Data Matrix Tool properties page, as shown in Figure 4–5.

FIGURE 4–5. Data Matrix Tool Properties Page

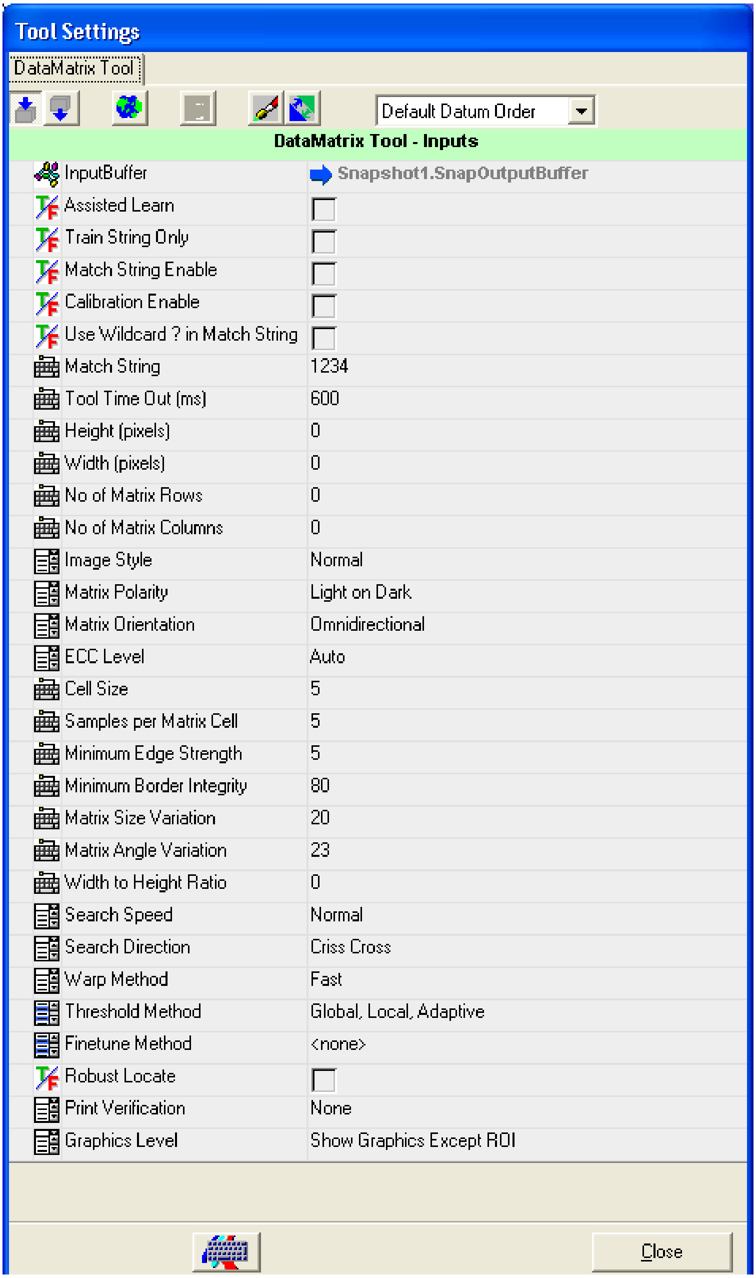


TABLE 4–4. Links to Property Descriptions

For Information About...	Go To...
Aperture	page 4–35
Assisted Learn	page 4–25
Calibrated	page 4–25
Calibration Cell Unit	page 4–35
Calibration Contrast Max	page 4–35
Calibration Contrast Min	page 4–35
Calibration Enable	page 4–25
Cell Size	page 4–27
Cell Unit Report	page 4–35
Contrast Report	page 4–35
ECC Level	page 4–27
Finetune Method	page 4–30
Graphics Level	page 4–35
Height (pixels)	page 4–26
Image Style	page 4–27
Match String	page 4–25
Match String Enable	page 4–25
Matrix Angle Variation	page 4–28
Matrix Orientation	page 4–27
Matrix Polarity	page 4–27
Matrix Size Variation	page 4–28
Minimum Border Integrity	page 4–28
Minimum Edge Strength	page 4–28
No. of Matrix Columns	page 4–27
No. of Matrix Rows	page 4–26
Print Verification	page 4–33
Robust Locate	page 4–33
Samples per Matrix Cell	page 4–28
Search Direction	page 4–29

TABLE 4–4. Links to Property Descriptions (continued)

For Information About...	Go To...
Search Speed	page 4–29
Target Contrast	page 4–35
Threshold Method	page 4–30
Tool Time Out (ms)	page 4–26
Train String Only	page 4–25
Use Wildcard ? in Match String	page 4–26
Warp Method	page 4–29
Width (pixels)	page 4–26
Width to Height Ratio	page 4–29

Settings

- Assisted Learn — Provides an additional shape to place over the Data Matrix to show the system the exact location and size of the Data Matrix. Check to enable.
- Train String Only — After configuring the barcode tool and setting its Match String Enabled to enabled, when you select the Train button in Train and Tryout, only the match string field will be updated. None of the other barcode parameters will be modified.
- Match String Enable — When enabled, the match string will be compared against the decoded string of a Data Matrix during a run to determine if the step is run successfully. The status result parameter will be true if a Data Matrix is successfully decoded and the decoded string matches the match string value when this box is checked. During training, the decoded string from the training Data Matrix will be placed in the Match String Value box only if this box is checked.
- Calibration Enable — This parameter is set On prior to presenting a calibration standard to the camera. When the next read occurs, this parameter will be automatically turned back off.
- Calibrated — If the read of the calibration standard was successful, this flag will be set on and valid Calibration Contrast Max, Calibration Contrast Min, and Calibration Cell Unit values will be created.

- Use Wildcard ? in Match String — When enabled (checked), this can be used in the match string to represent a don't care character, i.e., the character represented by ? can be anything. When disabled, any character ? in the match string is treated as a regular character to be matched.
- Match String — This string will be compared against each decoded string during each run when Match String Enable is selected. This property will be filled in after a successful train only when Match String Enable is selected while training.

  Default: Empty
- Tool Time Out (ms) — Maximum time to search for a Data Matrix. When a Data Matrix is not found and decoded by this time, this step fails and the program execution continues. After training, if a Data Matrix takes x milliseconds to decode, then the time-out value should be set to more than x milliseconds when Search Direction is Horizontal or Vertical only. The Tool Time Out value should be at least twice x when the Horizontal then Vertical or the Vertical then Horizontal parameter is used. When x milliseconds is used as the Tool Time Out value when Horizontal then Vertical or Vertical then Horizontal parameter is used, each search pass will time out in half of the x milliseconds.

  Default: 600 ms (0 = No time out)
- Height (pixels) — The height of the Data Matrix in pixels. This parameter will be filled in after a successful train.

  Default: 0
  Range: 20 to 1024 pixels (0 for Unknown)
- Width (pixels) — The width of the Data Matrix. This property will be filled in after a successful train.

  Default: 0 pixels
  Range: 20 to 1024 pixels (0 for Unknown)
- No. of Matrix Rows — The number of Data Matrix rows including the borders. It will be filled in after a successful train.

  Default: 0
  Range: 8 to 144 (0 for Unknown)

- No. of Matrix Columns — The number of Data Matrix columns, similar to the row parameter.

  Default: 0
  Range: 8 to 144 (0 for Unknown)

- Image Style — Options include:
  - Mirror — The Data Matrix is viewed as a mirror image.
  - Normal — The Data Matrix is viewed as is.
  - Auto — Set by default and will be set to Normal.

- Matrix Polarity — Specifies the border and background color orientation:
  - Auto — Set by default and will be set accordingly after a successful train.
  - Light on Dark — Light cells on a dark background.
  - Dark on Light — Dark cells on a light background.

- Matrix Orientation — Selections are Omnidirectional, 0^o, 90^o, 180^o, 270^o, 45^o, 135^o, 225^o, and 315^o. When the Data Matrix orientation changes from run to run, then Omnidirectional should be used. When the orientation will not change, selecting the correct orientation angle will produce a more robust read. The orientation angle is formed by the x-axis and the bottom of the solid border of the L shape. The angle is positive in a counterclockwise direction. Setting the orientation to a certain degree will not necessarily prevent a Data Matrix of different orientation from being located.

- ECC Level — Specifies the ECC level of the Data Matrix to decode, or Auto for any ECC Level. The default is Auto. The options are ECC 200, ECC 140, ECC 100, ECC 80, ECC 50, ECC 0, ECC 250, and SPEC.

- Cell Size — This is the nominal width and height of a Data Matrix cell in pixels. This value will be set after a successful train.

  Default: 6 pixels
  Range: 3 to 20 pixels

- Samples per Matrix Cell — The width and height of the sample area of a cell. This ranges from 1 to 7 but should not be greater than Cell Size setting.

  Default: 5

- Minimum Edge Strength — This value informs the algorithm to search for the edge of a Data Matrix whose intensity exceeds this value.

  Default: 18
  Range: 5 to 100; a setting of 5 will allow a Data Matrix of low contrast to
  be located.

- Minimum Border Integrity — Percentage of border that must be intact to consider the Data Matrix valid.

  Default: 80
  Range: 55 to 100

- Matrix Size Variation — The size, representing the height and width of a Data Matrix, is set after training. By default, this parameter is set to 20%, which means the Data Matrix size in run can vary up to 10% from the one used in Train. The number can be reduced to speed up the run process. If the variation in size exceeds 20%, both Height and Width should be set to 0 to disable size constraints.

  Default: 20%
  Range: 0 to 25%

- Matrix Angle Variation — The factor is set to up to 23° by default. This means that the Data Matrix, in run mode, can rotate from the orientation specified by the Matrix Orientation parameter (e.g., 0°, 90°, etc.) by up to 23° clockwise or counterclockwise. The range can be reduced to increase the reading speed when appropriate. To read a Data Matrix with significant amount of border damage, train the tool on a good label. Set Matrix Size Variation and Angle Variation to 0 and Matrix Orientation to 0°. This will allow the tool to read a badly damaged Data Matrix label as long as its orientation is approximately 0°.

  Default: 23°
  Range: 0 to 180°

- Width to Height Ratio — Matrix width to Data Matrix height ratio scaled by 10. For a width:height ratio of 1.5, enter 15 in this box. This value will be entered after a successful train. This is useful when a tool reads a Data Matrix whose size varies more than 10% but the Width to Height Ratio does not change. In this case, set this parameter to match the Data Matrix and set the Height and Width properties to 0. When the Data Matrix changes in size and shape, set this property and Height and Width to 0 after the train.

  Default: 10 (1:1 ratio)

- Search Speed — Specifies the method to locate the Data Matrix:
  - Normal (Default) — Changing this may improve the speed (at the cost of robustness).
  - Overdrive — Increase the locating speed by up to 20% from Normal.
  - Turbo — Increase the locating speed by up to 20% from Overdrive.
- Search Direction — Specifies the search method used within the ROI. Changing this parameter requires Tool Time Out to be modified to ensure the best performance:
  - Horizontal — Search for Data Matrix using horizontal probes. The time allowed by Tool Time Out (ms) will be used by horizontal searches.
  - Vertical — Search for Data Matrix using vertical probes. The time allowed by Tool Time Out (ms) will be used by vertical searches.
  - Horizontal then Vertical — Each search direction will be used up to half of the time allowed by Tool Time Out (ms).
  - Vertical then Horizontal — Each search direction will be used up to half of the time allowed by Tool Time Out (ms).
  - Criss Cross (Default) — This setting should work best for most cases. This mode uses diagonal probes to optimize the search.
- Warp Method — Specifies the Data Matrix warping method:

  - Fast (Default) — Increase the reading speed. Uses approximation to reduce the computation time. This may produce a higher error bit rate than Slow.
  - Slow — Enable when receiving a high error bit rate.
- Threshold Method — For dot-peen marks or inkjet printer marks, the spacing between cells may not be accurate. Local or Adaptive cannot replace Global because each is slower and less stable than Global for most of the applications. By default, all three selections are enabled.
  - Adaptive — May produce better decode results when the background of the Data Matrix is uneven due to marking or lighting.
  - Global — A single threshold value determines whether a cell is dark or light for all cells.
  - Local — May yield less error used in the error correction algorithm when Data Matrix rows or columns are not equally spaced.
- Finetune Method — The methods are:
  - Position Enhance — Attempts to locate the four corners of the Data Matrix more precisely and to reduce the number of error correction bits used during decoding.

    Default: Off
  - Intensity Enhance — Overcomes dramatic intensity variation over the Data Matrix border area. For example, certain poorly marked Data Matrix may have some cells that are almost invisible compared to the rest of the cells:
    - When disabled, the system may issue a status code indicating a certain edge cannot be found.
    - When enabled, the option will help read this type of Data Matrix more consistently.

    Default: On
  - No Quiet Zone Clutter (default) — This property attempts to locate a Data Matrix even if the background is noisy and

cluttered. When the Data Matrix is printed on a clean background, enabling this property increases the locating process speed.

Default: Off

- Ignore Single Edges — This property causes the decoder to ignore single edges during the Data Matrix locate process. This speeds up the locate process in the presence of unrelated lines found in the image near the Data Matrix.

  Default: Off

- Finetune — Reserved for future use.

- Allow Steep Angle — In some Data Matrix reading applications, it is not possible to set up the camera such that the focal plane is in parallel with the surface of the Data Matrix label. When the focal plane and the label surface form a steep angle, the Data Matrix in the image will have severe geometrical distortion. Use the following steps to read a severely distorted Data Matrix in any orientation:

  1. Make sure all DataMatrix Tool settings are in their default state.
  2. Select No Quiet Zone Clutter and Allow Steep Angle for the Finetune method.
  3. Select Turbo for the Search Speed.

  The distorted Data Matrix can then be read in Run mode.

  Default: Off

- Allow Severe Damage — Enabling this option will increase the robustness of the software in reading Data Matrices with severe border damage. To use it, first train successfully on a Data Matrix with less damage. Then, enable this option in the Finetune Method to read labels with more damage in Run mode.

  Default: Off

- Ensure Within ROI — Enabling the option ensures that no Data Matrix is located unless it is fully inside the ROI.

  Default: Off

- Allow Outlined Cells — Enabling the option helps the algorithm decode a Data Matrix with outlined cells only. In this case, the On and Off cells have little or no contrast but they are separated by edges of the cells.

Default: Off

– Decode Near Center — The camera tries to read the symbol that is closest to the center of the FOV.

Default: Off

- Robust Locate — When enabled, the system will first look for a Data Matrix matching the given specifications. If it fails to find a Data Matrix, the Data Matrix size parameters will be relaxed and the system will try to find the Data Matrix up to two more times.
- Print Verification — Enables Verifier outputs when set to one of the following:
  - AIM
  - ISO
  - IAQG
  - DPM

Note: For more information, see “Results” starting on page 4-37.

- Enabled DPM Verification Parameters — If DPM verification is enabled in Print Verification, the parameters to be included for the overall verification grade may be selected. This allows you to ignore a parameter if it is not pertinent to their application. The parameters are:
  - Cell Size
  - Center Offset
  - Size Offset
  - Cell Modulation
  - Border Match

- Contrast
- Axial Nonuniformity
- Print Growth
- Unused Error Correction
- Distortion Angle

• Verification Status Upper Threshold — Allows you to set the upper threshold at which the printed code is considered good. When the final verification grade is greater than or equal to the value of this datum, the code will be considered to be of good quality. This value should always be greater than or equal to the Verification Status Lower Threshold. If it is equal to the Verification Status Lower Threshold, the resulting status will be good (3) or poor (1) with no fair (2) status defined.

  Valid Values: 4 to 1

• Verification Status Lower Threshold — Allows you to set the lower threshold at which the printed code is considered fair. When the final verification grade is greater than or equal to the value of this datum, the code will be considered to be of fair quality. This value should always be less than or equal to the Verification Status Upper Threshold. If it is equal to the Verification Status Lower Threshold, the resulting status will be good (3) or poor (1) with no fair (2) status defined.

  Valid Values: 3 to 1

• {parameter} VerStat LoThresh and {parameter} Verstat UpThresh — When DPM verification is enabled in Print Verification, each of the Enabled DPM Verification Parameters will have its own high and low threshold values. The behavior will be the same as for Verification Status Upper Threshold and Verification Status Lower Threshold except applied to classification of the single parameter’s grade. The overall Verification Status for the inspection will be the lowest status of the enable parameters.

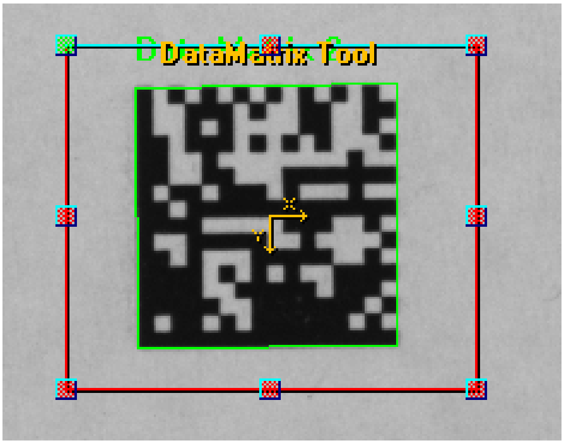
• Target Print Growth — Reserved for future use.

- Graphics Level — Selects the amount of graphics displayed at the completion of step execution:
  - Show None — When enabled, no graphics are drawn.
  - Show Graphics — When enabled, Data Matrix locating graphics and any decoded text will be displayed.
- Contrast Report — The units that will be used for the reporting of contrast. These are Uncalibrated, Self Calibrated, and Reflectance Calibrated. Reflectance Calibrated may be used if values from a Data Matrix tool calibration have been generated by reading a Calibration Standard that corresponds to the entered Target Contrast of the Calibration Standard.
- Calibration Contrast Max — The value returned from a Data Matrix tool calibration that indicates the pixel brightness that represents white.
- Calibration Contrast Min — The value used by a Data Matrix tool calibration to represent what the camera sees as absolute black. Because the gains and offset of the camera may not yield a value of 0 for black, this must be determined experimentally by blocking the light from the camera and determining the average pixel brightness by moving the cursor across the presented image. This must be manually entered for the Data Matrix tool to report contrast in calibrated units and entered before calibration is attempted.
- Cell Unit Report — The Units that will be used for the reporting of cell size and symbol height and width. These are Pixels or Mils. Mils may be used if the value of the Calibration Cell Unit is available following a successful calibration.
- Calibration Cell Unit — This value is returned from a Data Matrix tool calibration that is the multiplier*100 to convert pixels to mils.
- Aperture — Used to set the synthetic aperture size in mils. The default is 0 for AUTO with manually set values in the range of 4 - 20.
- Target Contrast — The contrast value of the calibration standard used with the Data Matrix tool to generate the calibration parameters.

Training

- Normal Training — Place the ROI around the Data Matrix to be trained, and click Train. If a Data Matrix is successfully found and decoded, the trainable set-up parameters (Match String, Height, Width, No. of Matrix Rows, No. of Matrix Columns, Image Style, Matrix Polarity, ECC Level, Cell Size, Minimum Edge Strength, Width to Height Ratio and Threshold Method) will be taken from that Data Matrix, as shown in Figure 4–6. The remainder of the parameters will be set to their defaults to ensure robust reading.

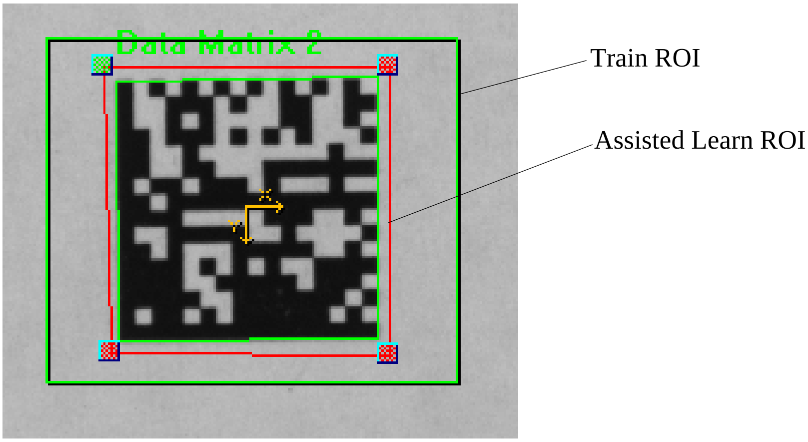
FIGURE 4–6. **Normal Training — DataMatrix Tool**



When the tool is trained successfully, the Train button will turn green and the ROI displays a solid line. When the train fails, the Train button becomes red, and the ROI displays a dashed line.

- Assisted Training — If the normal training method fails to work, enable Assisted Learn on the properties page. Adjust the position of the corners of the DataMatrix Tool shape over the Data Matrix to be trained. No. of Matrix Rows, No. of Matrix Columns and Matrix Polarity must be set correctly before clicking Train, as shown in Figure 4–7. The remainder of the properties should be set to default values.

FIGURE 4–7. **Assisted Training — DataMatrix Tool**



- No Training — The Data Matrix tool can operate without training, which will allow a much wider range of Data Matrix codes to be successfully located and decoded.

Results

- Error Code — Reported errors encountered when locating, decoding, calibrating or verifying (see Table 4–5, “Data Matrix Error Messages,” on page 4-45). The least significant digits of reported Error Messages may be interpreted with the information in the table.
- Status — The DataMatrix Tool status is true when a Data Matrix is found and decoded, and the decoded string matches the Match String when Match String Enable is enabled.
- Text — The decoded string found in the Data Matrix.
- Center Point — X,Y location of the center of the Data Matrix.
- Angle — The rotation of the Data Matrix in degrees.
- Number Found — The number of Data Matrices found, decoded or not.
- Read Status — Status indicates true when a Data Matrix is found and decoded, regardless of whether the decoded string matches the match string value.

- SymResults — Contains detailed Data Matrix results.
- Error Bits — The number of invalid bits in the Data Matrix.
- Decoded Image

If Print Verification is set to anything other than None, the following outputs will be produced regardless of the type of verification being performed:

- Symbol Height — The height of the Data Matrix in pixels if Cell Unit Report is set to Pixels. If Cell Unit Report is set to Mils, Calibrated is set On, and Calibration Cell Unit is set to the results of a Data Matrix tool calibration; Symbol Height will be reported in mils*100.
- Symbol Width — The width of the Data Matrix in pixels if Cell Unit Report is set to Pixels. If Cell Unit Report is set to Mils, Calibrated is set On, and Calibration Cell Unit is set to the results of a Data Matrix tool calibration; Symbol Width will be reported in mils*100.
- Verification Details — Provides a summary of verification results that is specific to the type of verification selected in Print Verification.
- Verification Overall Grade — Selects the overall lowest grade among the graded parameters for this type of verification.
- Verification Status — As defined by Verification Status Upper and Lower Threshold. Grades 4-0 (A-F) are divided into three ranges.
  - Good — Grades above or equal to the Upper Threshold.
  - Fair — Grades below the Upper Threshold but greater than or equal to the Lower Threshold.
  - Poor — Grades below the Lower Threshold are considered Poor.

Note: For DPM verification, Verification Status is the lowest status found in each of the enabled parameters and each enabled parameter has its own set of threshold values.

Print Verification Types

The section discusses the following Print Verification types:

- “AIM” starting on page 4-40
- “ISO” starting on page 4-42
- “IAQG” starting on page 4-43
- “DPM” starting on page 4-43

AIM

When you select AIM, in addition to decoding the Data Matrix, the tool also computes the Data Matrix print quality according to the AIM specification. The DataMatrix Tool computes:

- Axial Nonuniformity
- Contrast
- Print Growth

Each parameter can be graded as follows:

- A corresponding to a numeric value of 4.
- B corresponding to a numeric value of 3.
- C corresponding to a numeric value of 2.
- D corresponding to a numeric value of 1.
- F corresponding to a numeric value of 0.

The overall print quality grade is the lowest of the four grades:

- Axial Nonuniformity — Measures the difference in average spacing between the center of adjacent cells in the horizontal axis versus that of the vertical axis. A square Data Matrix with the same number of rows and columns typically resembles a rectangular Data Matrix when Axial Nonuniformity is significant as measured per the AIM specification. The grading is:

  A when AN <= 0.06
  B when AN <= 0.08
  C when AN <= 0.10
  D when AN <= 0.12
  F when AN > 0.12

  The reported value is *100

- Axial Nonuniformity Grade

- Contrast — Refers to the difference in reflectance between the light and dark cells of the symbol. It is measured according to AIM specification. The Symbol Contrast Grade is given as follows:

  A for 70%+ contrast
  B for 55%+ contrast
  C for 40%+ contrast
  D for 20%+ contrast
  F for less than 20% contrast

- Contrast Grade — The Contrast Grade is the difference in reflectance (measured by grayscale values) between the light and dark cells of the symbol. The arithmetic mean of the darkest 10% of the pixels and that of the lightest 10% pixels within the Data Matrix area are computed. The Symbol Contrast is the difference of the two means divided by the full gray scale range. The Contrast Grade is given as:

  A for 70%+ contrast
  B for 55%+ contrast
  C for 40%+ contrast
  D for 20%+ contrast
  F for less than 20% contrast

- Print Growth Grade — Print growth measures both X (the direction of the bottom “L” solid border) and Y (the direction of the left “L” solid border) direction and picks the worst as the print growth value for determining the print growth grade.

- Print Growth X — Measurement of the direction of the bottom “L” solid border.

- Print Growth Y — Measurement of the direction of the left “L” solid border.

- UEC Grade — A Data Matrix symbol has fixed error correction capacity. When a Data Matrix is decoded, the Error Correction (used) indicates how much of the error correction capacity is consumed in order to decode the symbol. The more the error correction is used, the less the Unused Error Correction is left within the error correction capacity, which corresponding to poorer print quality of the symbol. The grade is:

  A if UEC >= 0.62
  B if UEC >= 0.50
  C if UEC >= 0.37
  D if UEC >= 0.25
  F if UEC < 0.25

ISO

Outputs include:

- Contrast — Data Matrix contrast 0 to 100%.
- Contrast Grade
- Axial Nonuniformity reported as *100
- Axial Nonuniformity Grade
- Print Growth X — Measurement of the direction of the bottom “L” solid border.
- Print Growth Y — Measurement of the direction of the left “L” solid border.
- UEC Grade
- Grid Nonuniformity Grade
- Grid Nonuniformity reported as *100
- Fixed Pattern Damage Grade
- Modulation Grade
- Reference Decode Grade
- Quality 20x Clear Zone

- Cell Size reported as *10

IAQG

Outputs include:

- Cell Fill X
- Cell Fill Y
- Cell Size reported as *10
- Distortion Angle
- Distortion Angle Grade
- Dot Center x (where x is 1 or 2) reported as *10
- Dot Center Grade
- Dot Size x (where x is 1 or 2) reported as *10
- Dot Size Grade

DPM

Outputs include:

- Axial Nonuniformity reported as *100
- Axial Nonuniformity Grade
- Border Match — Border match 0 to 100%.
- Border Match Grade
- Cell Modulation Grade
- Cell Modulation Off
- Cell Modulation On
- Cell Size reported as *10
- Cell Size Grade
- Center Offset reported as *10

- Center Offset Grade
- Contrast — Data Matrix contrast 0 to 100%.
- Contrast Grade
- Distortion Angle
- Distortion Angle Grade
- Print Growth Grade
- Print Growth X — Measurement of the direction of the bottom “L” solid border.
- Print Growth Y — Measurement of the direction of the left “L” solid border.
- Size Offset reported as *10
- Size Offset Grade
- UEC Grade

I/O Summary

DataMatrix Tool provides an I/O summary in the Status Bar located at the bottom of the FrontRunner™ window.

Inputs: Cell Size: aaa TimeOut: bbb Robust: FastWarp:

Where: aaa = datum value - not shown if cell size is zero (unknown)
bbb = inspection timeout in milliseconds - not shown when timeout is set to zero (no timeout)
Robust = displayed only when Robust Locate is selected
FastWarp = displayed only when FastWarp is selected - not shown when SlowWarp is selected

Outputs: Error Bits: cc Contrast: dd

Where: cc = number of error bits detected in the Data Matrix
dd = contrast of the Data Matrix

Error Messages:

The least significant digits of reported Error Messages may be interpreted with the information in Table 4–5.

TABLE 4–5. Data Matrix Error Messages

General Error	Code
IP_NO_EDGE_CANDIDATE_FOUND	127001
IP_FIRST_EDGE_NOT_FOUND_OR_TOO_SMALL	127004
IP_SECOND_EDGE_NOT_FOUND	127005
IP_THIRD_EDGE_NOT_FOUND	127011
IP_FOURTH_EDGE_NOT_FOUND	127012
IP_FOUR_CORNERS_NOT_FOUND	127020
IP_SIZE_TEST_FAILED	127021
IP_ROW_COL_TEST_FAILED	127022
IP_INSPECTION_TIMEOUT	127030
IP_BORDER_MATCH_TEST_FAILED	127033
IP_ECC_UNDECODABLE	127048
IP_CONTRAST_CALIBRATION_FAILURE	127050
IP_CELLUNIT_CALIBRATION_FAILURE	127051
IP_VERIFICATION_PROCESS_ERROR	127100
IP_VERIFICATION_UNSUPPORTED	127101
IP_VERIFICATION_TIMEOUT	127102
IP_ISOV_ECC200_REQUIRED	127110
IP_ISOV_APERTURE_TOO_SMALL	127111
IP_ISOV_APERTURE_TOO_LARGE	127112
IP_ISOV_INSUFFICIENT_SPACE	127113
IP_ISOV_FAIL_RDA_STEP_F_1	127114
IP_ISOV_FAIL_RDA_STEP_F_2	127115
IP_ISOV_FAIL_RDA_STEP_F_3	127116
IP_ISOV_FAIL_RDA_STEP_A_E	127117
QRCODE_DESIGN_UNIMPLEMENTED	128400
QRCODE_IP_GENERAL_ERROR	128401
QRCODE_IP_RATIO_ERROR	128402

TABLE 4–5. **Data Matrix Error Messages (continued)**

General Error	Code
QRCODE_IP_FINDER_ERROR	128403
QRCODE_IP_LINE_FIT_ERROR	128404
QRCODE_IP_LINE_INTERSECT_ERROR	128405
QRCODE_IP_CORNER_ERROR	128406
QRCODE_DEC_UNKNOWN_ERROR	128420
QRCODE_RS_LEVEL_INVALID	128421
QRCODE_FORMAT_INFO_FAILED	128422
QRCODE_VERSION_INFO_FAILED	128423
QRCODE_ROWS_COLS_INVALID	128424
QRCODE_DATA_CODEWORD_INVALID	128425
QRCODE_TOTAL_CODEWORD_INVALID	128426
QRCODE_MODE_INDICATOR_INVALID	128427
QRCODE_MODE_UNIMPLEMENT	128428
QRCODE_RS_DECODE_FAILED	128429
QRCODE_BCH15_5_UNDECODABLE	128430
QRCODE_MODEL_INVALID	128431

DMR Verification

DMR Step Output Datums

- AxialNonuniformity value = DoubleDm*0.01
- CellSizeResult value = DoubleDm*0.1
- CenterOffset value = DoubleDm*0.1
- DotCenter1 value = DoubleDm*0.1
- DotCenter2 value = DoubleDm*0.1
- DotSize1 value = DoubleDm*0.1
- DotSize2 value = DoubleDm*0.1
- GridNonuniformity value = DoubleDm*0.01

- SizeOffset value = DoubleDm*0.1
- SymbolHeight value = DoubleDm*0.01
- SymbolWidth value = DoubleDm*0.01

DMR Step Output Datums

- DoubleDm UnusedErrorCorrection value as a number from 0.00 to 1.00 to go along with the existing UnusedErrorCorrectionGrade
- IntDm OvalityGrade with values of 4 through 0 (A, B, C, D, F) for IAQG Verification
- DoubleDm Ovality value as a number from 0.0 to 100.0 for IAQG Verification
- StringDm ECCLevelResult as the decoded value translated to a string because the value returned by the decoder is more specific than the parameter value provided to the decoder as instructions (e.g. AUTO could be used as setting while the decoded result might be ECC 200).
- StringDm VerificationType to report the selected verification type as a string instead of a number that required a translation.

VerifyDetails

VerifyDetails is a variant array of all verification results necessary to generate verification result reports for any DMR verification type. The contents of this array and the enumerated position of values in the array are provided in Table 4–6.

TABLE 4–6. Contents of VerifyDetails

Offset	Symbolic Offset	Text Name *(italics = output)*	Symbolic Name	Current Type	AIM	IAQG	ISO	ISO AIM	DPM
0	eVerType	VerificationType	VerType	Datum.String.1	X	X	X	X	X
1	eVeriStat	Verification Status	VeriStat	Datum.Int.1	X	X	X	X	X
2	eOverallGrade	Verification Overall Grade	OverallGrade	Datum.Int.1	X	X	X	X	X
3	eSymHeight	Symbol Height	SymHeight	Datum.Double.1	X	X	X	X	X
4	eAngle	Angle **(Note 1)**	Angle	Datum.Angle.1	X	X	X	X	X
5	eSymWidth	Symbol Width	SymWidth	Datum.Double.1	X	X	X	X	X
6	eCellSizeResult	Cell Size	CellSizeResult	Datum.Double.1		X	X	X	X
7	eCont	Contrast	Cont	Datum.Int.1	X		X	X	X
8	eContrGrade	Contrast Grade	ContrGrade	Datum.Int.1	X		X	X	X
9	eAxialNGrade	Axial Nonuniformity Grade	AxialNGrade	Datum.Int.1	X		X	X	X
10	ePrintGX	Print Growth X	PrintGX	Datum.Int.1	X		X	X	X
11	ePrintGY	Print Growth Y	PrintGY	Datum.Int.1	X		X	X	X
12	ePrintGGrade	Print Growth Grade	PrintGGrade	Datum.Int.1	X		X	X	X
13	eUECGrade	UEC Grade	UECGrade	Datum.Int.1	X		X	X	X
14	eGridNUGrade	Grid Nonuniformity Grade	GridNUGrade	Datum.Int.1			X	X	

TABLE 4–6. Contents of VerifyDetails (continued)

Offset	Symbolic Offset	Text Name *(italics = output)*	Symbolic Name	Current Type	AIM	IAQG	ISO	ISO AIM	DPM
15	eGridNU	Grid Nonuniformity	GridNU	Datum.Int.1			X	X	
16	eFixPatDamGrade	Fixed Pattern Damage Grade	FixPatDamGrade	Datum.Int.1			X	X	
17	eModulGrade	Modulation Grade	ModulGrade	Datum.Int.1			X	X	
18	eRefDecGrade	Reference Decode Grade	RefDecGrade	Datum.Int.1			X	X	
19	eQual20Z	Quality 20x Clear Zone	Qual20Z	Datum.Int.1			X	X	
20	eDotSizeGrade	Dot Size Grade	DotSizeGrade	Datum.Int.1		X			
21	eDotSize1	Dot Size 1	DotSize1	Datum.Double.1		X			
22	eDotSize2	Dot Size 2	DotSize2	Datum.Double.1		X			
23	eDotCentGrade	Dot Center Grade	DotCentGrade	Datum.Int.1		X			
24	eDotCent1	Dot Center 1	DotCent1	Datum.Double.1		X			
25	eDotCent2	Dot Center 2	DotCent2	Datum.Double.1		X			
26	eDistAnglGrade	Distortion Angle Grade	DistAnglGrade	Datum.Int.1		X			X
27	eDistAngl	Distortion Angle	DistAngl	Datum.Int.1		X			X
28	eCellFillX	Cell Fill X	CellFillX	Datum.Int.1		X			
29	eCellFillY	Cell Fill Y	CellFillY	Datum.Int.1		X			
30	eCellSizeGrade	Cell Size Grade	CellSizeGrade	Datum.Int.1					X

TABLE 4–6. Contents of VerifyDetails (continued)

Offset	Symbolic Offset	Text Name *(italics = output)*	Symbolic Name	Current Type	AIM	IAQG	ISO	ISO AIM	DPM
31	eCentOffGrade	Center Offset Grade	CentOffGrade	Datum.Int.1					X
32	eCentOff	Center Offset	CentOff	Datum.Double.1					X
33	eSizeOffGrade	Size Offset Grade	SizeOffGrade	Datum.Int.1					X
34	eSizeOff	Size Offset	SizeOff	Datum.Double.1					X
35	eCellModGrade	Cell Modulation Grade	CellModGrade	Datum.Int.1					X
36	eCellModOn	Cell Modulation On	CellModOn	Datum.Int.1					X
37	eCellModOff	Cell Modulation Off	CellModOff	Datum.Int.1					X
38	eBordMatchGrade	Border Match Grade	BordMatchGrade	Datum.Int.1					X
39	eBordMatch	Border Match	BordMatch	Datum.Int.1					X
40	eOvalityGrade	Ovality Grade	OvalityGrade	Datum.Int.1		X			
41	eOvality	Ovality	Ovality	Datum.Double.1		X			
42	eCalibrated	Calibrated	Calibrated	Datum.Status.1	X	X	X	X	X
43	eECCLevelResult	ECC Level Result	ECCLevel Result	Datum.String.1	X	X	X	X	X
44	eVThrUp	Verification Status Upper Threshold	VThrUp	Datum.Int.1	X	X	X	X	X

TABLE 4–6. Contents of VerifyDetails (continued)

Offset	Symbolic Offset	Text Name *(italics = output)*	Symbolic Name	Current Type	AIM	IAQG	ISO	ISO AIM	DPM
45	eVThrLo	Verification Status Lower Threshold	VThrLo	Datum.Int.1	X	X	X	X	X
46	eContRpt	Contrast Report	ContRpt	Datum.Enum.1	X	X	X	X	X
47	eCellUnitRpt	Cell Unit Report	CellUnitRpt	Datum.Enum.1	X	X	X	X	X
48	eAperture	Aperture	Aperture	Datum.Int.1	X	X	X	X	X
49	eTargtCont	Target Contrast	TargtCont	Datum.Int.1	X	X	X	X	X
50	eContMax	Calibration Contrast Max	ContMax	Datum.Int.1	X	X	X	X	X
51	eContMin	Calibration Contrast Min	ContMin	Datum.Int.1	X	X	X	X	X
52	eCellUnit	Calibration Cell Unit	CellUnit	Datum.Int.1	X	X	X	X	X
53	eAxialN	Axial Nonuniformity	AxialN	Datum.Int.1	X				X
54	eCustVer	Enabled DPM Verification Parameters	CustVer	Datum.Enum.1					X
55	eCSVThrUp	Cell Size VerStat UpThresh	CSVThrUp	Datum.Int.1					X
56	eCSVThrLo	Cell Size VerStat LoThresh	CSVThrLo	Datum.Int.1					X
57	eCOVThrUp	Center Offset VerStat UpThresh	COVThrUp	Datum.Int.1					X

4 Automatic Identification

TABLE 4–6. Contents of VerifyDetails (continued)

Offset	Symbolic Offset	Text Name *(italics = output)*	Symbolic Name	Current Type	AIM	IAQG	ISO	ISO AIM	DPM
58	eCOVThrLo	Center Offset VerStat LoThresh	COVThrLo	Datum.Int.1					X
59	eSOVThrUp	Size Offset VerStat UpThresh	SOVThrUp	Datum.Int.1					X
60	eSOVThrLo	Size Offset VerStat LoThresh	SOVThrLo	Datum.Int.1					X
61	eCMVThrUp	Cell Modulation VerStat UpThresh	CMVThrUp	Datum.Int.1					X
62	eCMVThrLo	Cell Modulation VerStat LoThresh	CMVThrLo	Datum.Int.1					X
63	eBMVThrUp	Border Match VerStat UpThresh	BMVThrUp	Datum.Int.1					X
64	eBMVThrLo	Border Match VerStat LoThresh	BMVThrLo	Datum.Int.1					X
65	eSCVThrUp	Symbol Contrast VerStat UpThresh	SCVThrUp	Datum.Int.1					X
66	eSCVThrLo	Symbol Contrast VerStat LoThresh	SCVThrLo	Datum.Int.1					X
67	eANUVThrUp	Axial Nonuniformity VerStat UpThresh	ANUVThrUp	Datum.Int.1					X

TABLE 4–6. Contents of VerifyDetails (continued)

Offset	Symbolic Offset	Text Name *(italics = output)*	Symbolic Name	Current Type	AIM	IAQG	ISO	ISO AIM	DPM
68	eANUVThrLo	Axial Nonuniformity VerStat LoThresh	ANUVThrLo	Datum.Int.1					X
69	ePGVThrUp	Print Growth VerStat UpThresh	PGVThrUp	Datum.Int.1					X
70	ePGVThrLo	Print Growth VerStat LoThresh	PGVThrLo	Datum.Int.1					X
71	eUECVThrUp	Unused Error Correction VerStat UpThresh	UECVThrUp	Datum.Int.1					X
72	eUECVThrLo	Unused Error Correction VerStat LoThresh	UECVThrLo	Datum.Int.1					X
73	eDAVThrUp	Angle of Distortion VerStat UpThresh	DAVThrUp	Datum.Int.1					X
74	eDAVThrLo	Angle of Distortion VerStat LoThresh	DAVThrLo	Datum.Int.1					X
75	eUEC	Unused Error Correction	UEC	Datum.Double.1	X		X	X	X

Note 1: Writing out angle in degrees

4 Automatic Identification

OCRTrainableFont Tool

This tool reads labels and marks and returns string results. Any mark and label symbol can be trained incrementally at the time it is first seen, or offline. Characters and symbols can have any shape or size, as long as they can be mapped to an ASCII character. There are no limits on the number of characters; however, character sets must be combined in groups of at most 45. Each set of 45 characters constitutes a single font. Execution time is proportional to the number of fonts that read the input mark or label.

At the Step level, the OCRTrainableFont Tool encapsulates the user interface elements to configure the Segment Agent, the FeatExtract Agent, the classifier inputs (Font files), and confidence thresholds. It also allows the learning of new fonts.

Font files are stored into text files and will be installed in a “Fonts” directory at install time inside the Vscape\Jobs directory. A font file consists of the following files:

- A fontname.nnd file contains runtime data necessary for OCR to read labels and marks using that Font.
- A fontname.nna file contains the data necessary to incrementally train a font.
- A fontname.nnc file contains the data defining the Font alphabet (ASCII characters) and statistics information necessary to support confidence levels.

By default, a special Font called new (i.e., new.nnd) is always available and is necessary both for creating new fonts and for use at runtime by the OCR tool itself.

The OCRTrainableFont Tool provides both runtime and training capability for the OCR algorithm:

- Runtime — The tool is responsible for reading a mark or label within an ROI using one or more Fonts and reporting results, including the string read and confidence levels for each character read.
- Training — The tool allows the creation of new fonts and allows training and incremental training of existing fonts.

Theory of Operation

When an OCRTrainableFont Tool is inserted into a Visionscape Job, the settings that control the behavior of the Segment Agent and the FeatExtract Agent, as well as the font parameter settings, are available on the tool's property page. From FrontRunner™, when an OCRTrainableFont Tool is present in a Job, a custom interface can edit fonts (for more information, see "OCR Font Training" on page 4-61). The Show Custom Properties for this Step button brings up a user interface that can create a new font or incrementally train an existing font. The settings on the property page can modify the way in which the OCRTrainableFont Tool functions:

- If ROI Contains is set to **Two or More Characters**, see the properties shown in Figure 4–8.
- If ROI Contains is set to **Single Character**, see the properties shown in Figure 4–9.

FIGURE 4–8. **OCRTrainableFont Tool Properties Pages**

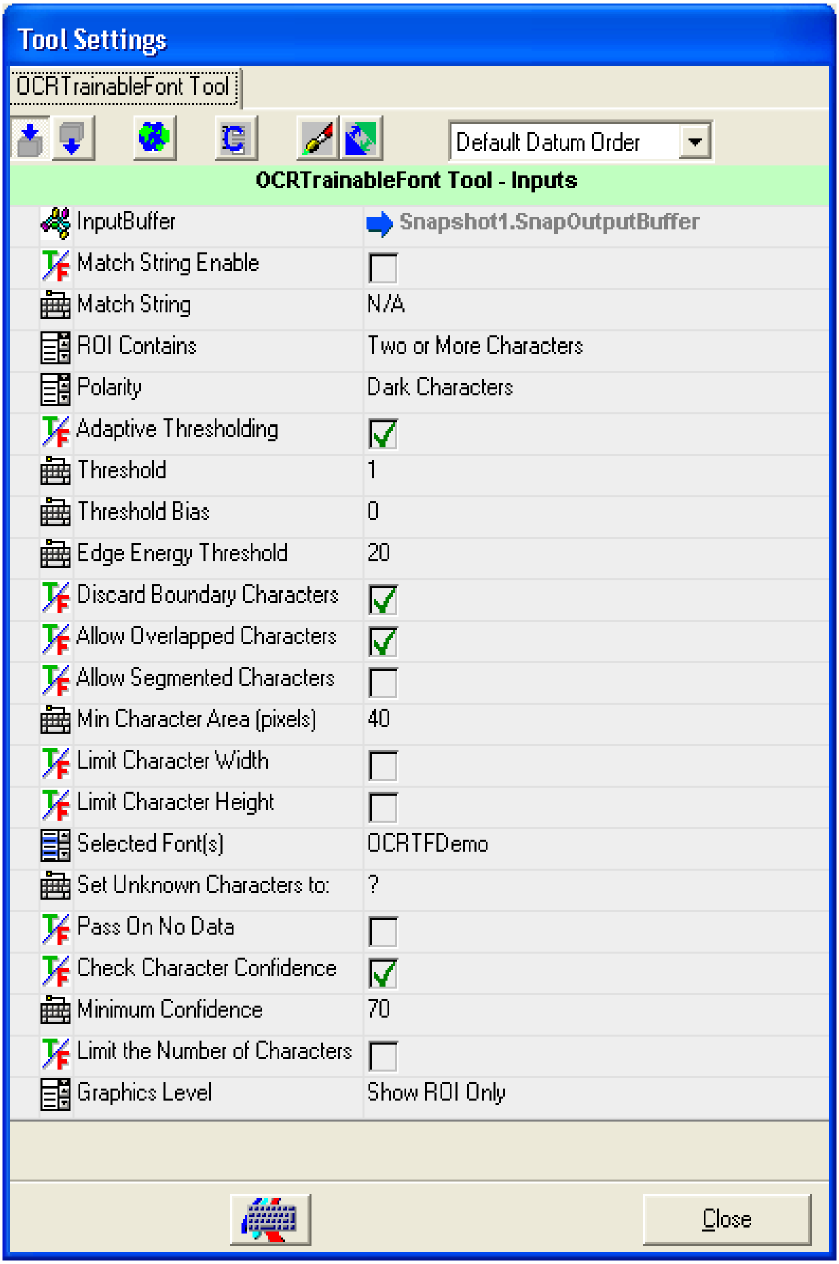


FIGURE 4–9. **OCRTrainableFont Tool Properties Pages**

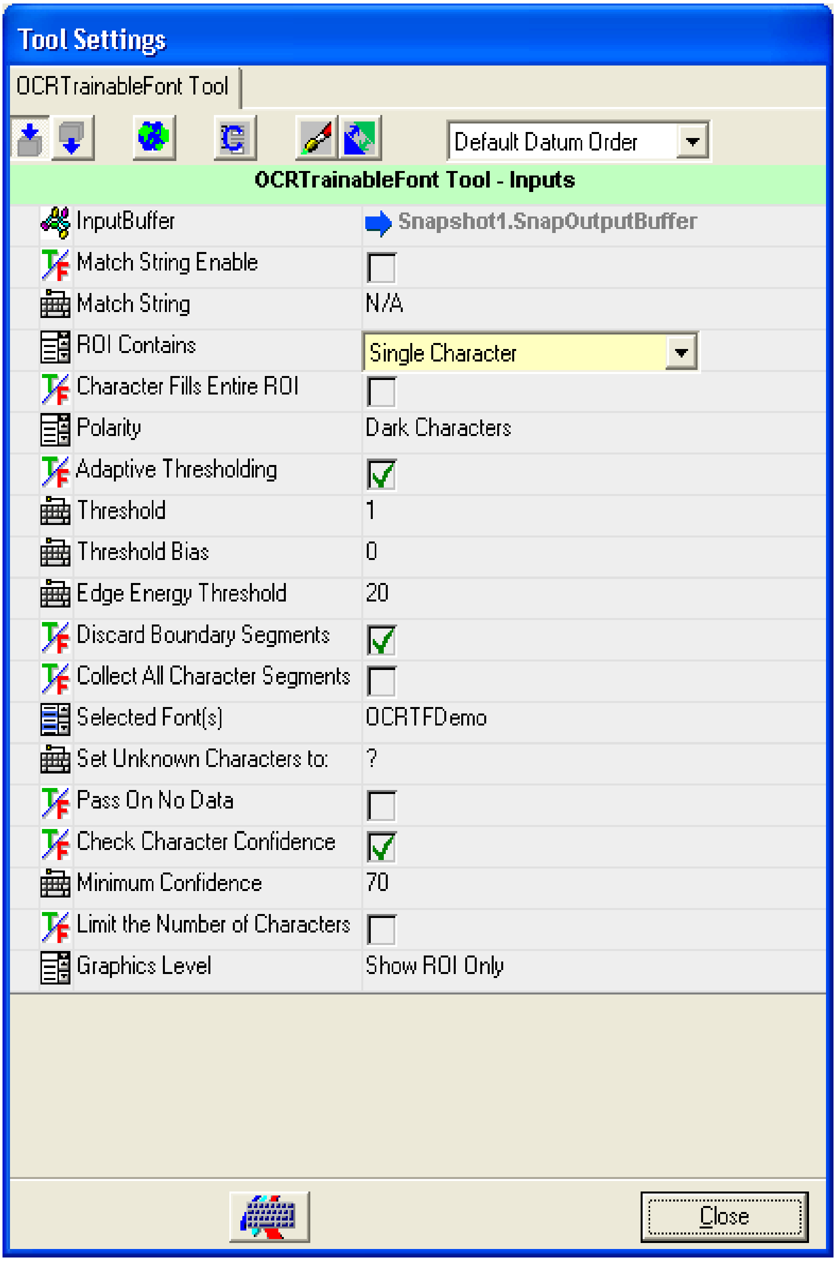


Table 4–7 lists the OCRTrainableFont Tool properties in alphabetical order, and indicates in which property page the property appears (either Single Character or Two or More Characters).

TABLE 4–7. OCRTrainableFont Tool Settings (Alphabetized)

Property	Description
Adaptive Thresholding (Single Character) (Two or More Characters)	When this option is checked, a Sobel operation will be performed within the search area to determine the pixel value that separates a light from a dark pixel. Otherwise, the value given in the Threshold setting is used. By default, adaptive thresholding is enabled.
Allow Overlapped Characters (Two or More Characters)	When this option is checked, the boundaries of the characters found by the tool can overlap. This is useful for fonts that allow the tops of uppercase characters to extend over the next lowercase character in a row. Default: Enabled
Allow Segmented Characters (Two or More Characters)	When this option is checked, the tool will combine adjacent disconnected parts when searching for a character's boundary. This should be enabled when locating dot-matrix characters. Default: Disabled
Character Fills Entire ROI (Single Character)	Uses the ROI perimeter as the character's bounding box. Use this option when two characters touch each other because the tool will not separate contiguous segments. Ensure that the ROI fits tightly around the character. Default: Disabled
Check Character Confidence (Single Character) (Two or More Characters)	When enabled, the confidence level found by the font reading process for each character will be checked against a user input level. (See Minimum Confidence description.) Default: Enabled
Collect All Character Segments (Single Character)	When this option is checked, the tool combines all segments in the ROI into a single character. The ROI can fit loosely around the character, but different characters must not touch. Default: Enabled

TABLE 4–7. OCRTrainableFont Tool Settings (Alphabetized) (continued)

Property	Description
Discard Boundary Characters (Two or More Characters)	When this option is checked, characters found touching the ROI will be discarded. Default: Enabled
Discard Boundary Segments (Single Character)	(This option is displayed only when the Character Fills Entire ROI option is disabled.) When this option is checked, segments of characters found touching the ROI will be discarded. Default: Enabled
Edge Energy Threshold (Single Character) (Two or More Characters)	Defines the pixel value at which a pixel in a Sobel Edge Enhancement is considered to be an edge pixel. This property is only used when Auto Thresholding Enabled is enabled. Range: 0 to 255; Default: 20
Graphics Level (Single Character) (Two or More Characters)	Enables various graphics options at runtime. Default: Show Basic Graphics
InputBuffer (Single Character) (Two or More Characters)	Allows selection of the buffer to work on from the list of currently available buffers. The default buffer will be the output buffer of its originator. This is usually the output buffer of the closest enclosing Snapshot but can also be the buffer of any step that generates an output image.
Limit Character Height (Two or More Characters)	This allows you to specify a minimum and maximum height for the characters found. Default: No height limits
Limit Character Width (Two or More Characters)	This allows you to specify a minimum and maximum width for the characters found. Default: No width limits
Limit the Number of Characters (Single Character) (Two or More Characters)	When enabled, the tool will return only a limited number of characters. The characters with the maximum confidence level up to that limit (see Maximum Number of Characters description) will be returned. Default: Disabled

TABLE 4–7. OCRTrainableFont Tool Settings (Alphabetized) (continued)

Property	Description
Min Character Area (pixels) (Two or More Characters)	(This option is displayed only when you disable the Allow Segmented Characters option.) This setting specifies the minimum size of a character, thereby eliminating segments that are too small to be characters by themselves. Default: 40
Minimum Confidence (Single Character) (Two or More Characters)	(This option is displayed only when the Check Character Confidence property is enabled.) You can enter a confidence level that the tool must find for each character. Any character that cannot be matched to at least this input level will be returned as the unknown character. Default: 70%
Pass On No Data (Single Character) (Two or More Characters)	When enabled, the status will report passed even if a character is not recognized. When disabled, if any character is reported as unknown, the status will be false.
Polarity (Single Character) (Two or More Characters)	Allows selection of the symbol type for which the tool will search. Choices are Dark Characters or Light Characters, with a default of Dark Characters.
ROI Contains (Single Character) (Two or More Characters)	Provides a choice between Single Character and Two or More Characters. When you select the Single Character option, only one character boundary will be found within the search area. The boundaries of the character will be defined so that they tightly enclose all blobs found. Default: The tool searches for multiple characters.

TABLE 4–7. OCRTrainableFont Tool Settings (Alphabetized) (continued)

Property	Description
Selected Font(s) (Single Character) (Two or More Characters)	This is a list box containing the names of all fonts that have been stored on the system. Whenever a new font is created and trained, its name will appear as an option in this list. You can select from this list one or more fonts that are to be used when reading characters from an image.
Set Unknown Characters To (Single Character) (Two or More Characters)	This is a character that will be returned from the font reading process when no match can be made within the selected font. Default: “?”
Threshold (Single Character) (Two or More Characters)	This value is the threshold above which a pixel’s value must be for it to be considered a light pixel. If the Adaptive Thresholding property is enabled, this value is ignored, but the calculated threshold will be displayed. Default: 25
Threshold Bias (Single Character) (Two or More Characters)	This value will be added to the Threshold value before a comparison is made to determine whither a pixel is light or dark. Default: 0

OCR Font Training

1. In FrontRunner, click Editor.
2. Select the OCRTrainableFont tool.
3. When an OCRTrainableFont Tool is present in a Job, select Font Editor (see Figure 4–10); I-PAK displays the font editor interface, as shown in Figure •. This editor is used for all font creation and training.

FIGURE 4–10. **Font Editor Page Button**

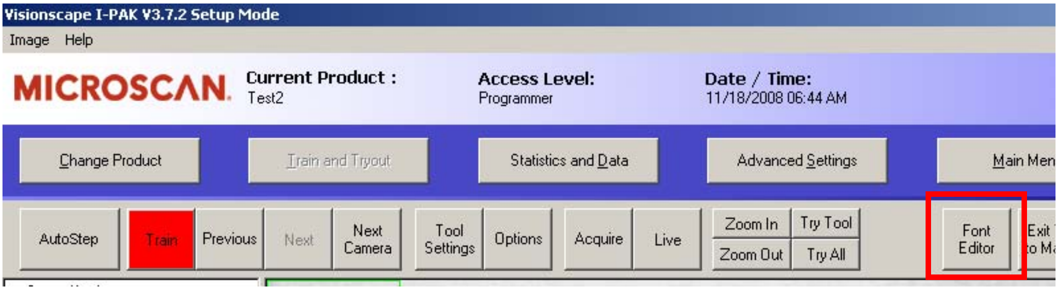
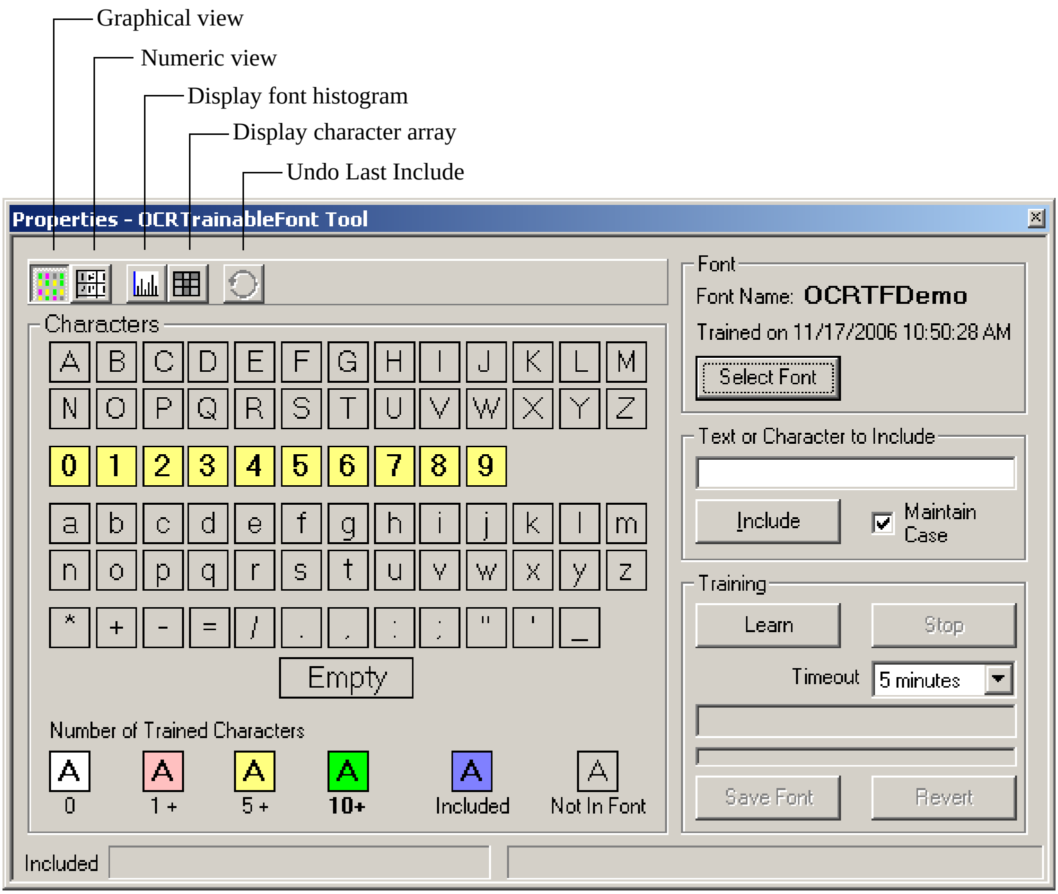


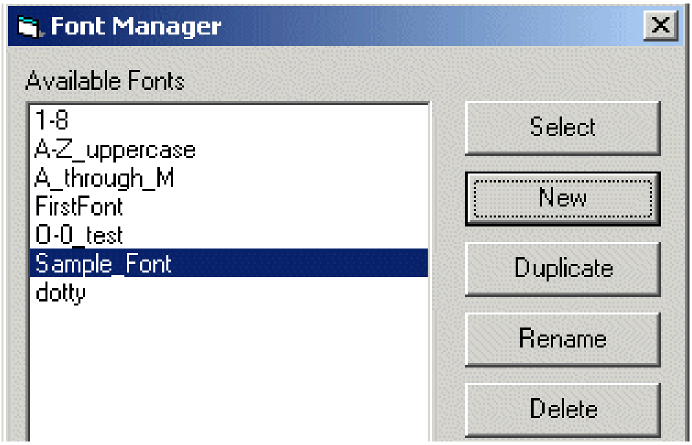
FIGURE 4–11. **Custom Editor**



4. Minimize the FrontRunner Editor (not the custom editor)
5. In the custom editor, click Select Font to select a new font to be trained.

   The Font Manager dialog box is displayed, as shown in Figure 4–12.

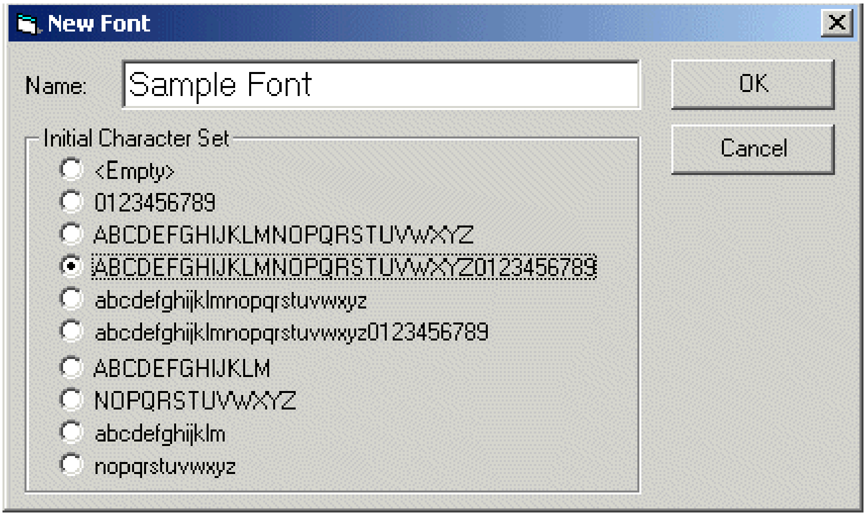
FIGURE 4–12. Font Manager Dialog Box



6. Click New.

   The New Font dialog box is displayed, as shown in Figure 4–13.

FIGURE 4–13. **New Font Dialog Box**



7. Type a name for the new font.

8. Select the initial character set (characters may be deleted or added later).

9. Click OK to close the New Font dialog box.

   The Font Manager is displayed again.

10. Highlight the newly-created font and click Select.

11. In FrontRunner, click Acquire New Image to capture a new image.

    Acquiring a new image clears the image of all overlay graphics.

12. Size the ROI to completely surround the characters to be trained, as shown in Figure 4–14.

FIGURE 4–14. Sizing the ROI

13. In the custom editor, type the characters to be trained into the “Text or Characters to Include” text box (Figure 4–14).

Note: Do not type spaces.

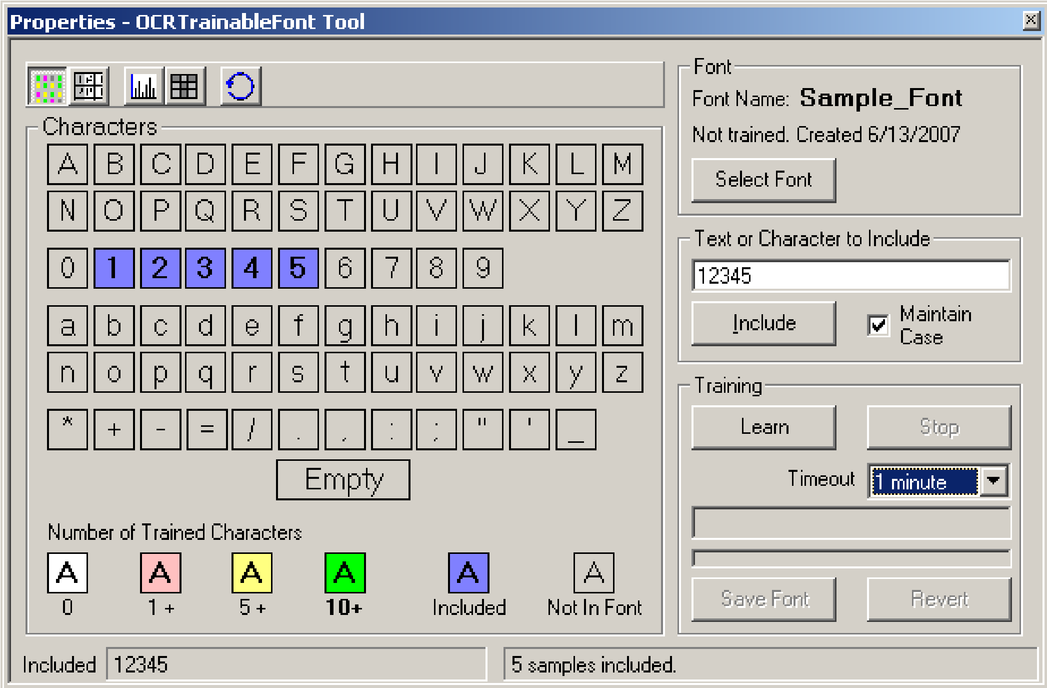
In the image in Figure 4–14, the ROI completely surrounds the characters “12345”. The red lines defining the ROI should not touch the characters to be included.

The Maintain Case checkbox forces the “Text or Character to Include” to uppercase if the font consists of uppercase characters (ABC). For example, if you type “klm”, the characters will be converted to “KLM” when you click the Include button. Maintain Case also forces characters to lowercase if the font consists of lowercase characters (abc).

14. Click Include.

Recently included characters will be highlighted in blue. Characters remain highlighted until the font is trained and saved. The most recently included characters are displayed in the status bar, as shown in Figure 4–15

FIGURE 4–15. Recently Included Characters Highlighted



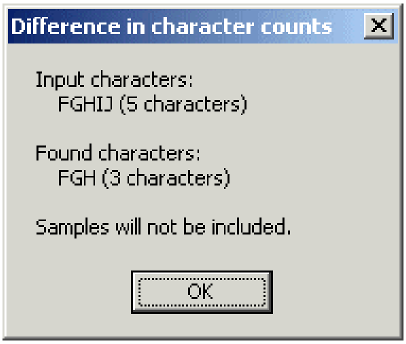
– If the characters do not train well, right click and select Undo Include.

To undo the inclusion of the last set of characters, right click somewhere in the dialog and select the option Undo Include [characters]. There is one level of undo.

Undo is available even after a font is trained.

– If fewer characters than expected are found, a message box appears, as shown in Figure 4–16. Resize the ROI or make adjustments to the OCRTF tool.

FIGURE 4–16. **Fewer Characters Found**

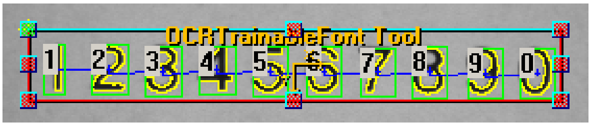


– If more characters are found that expected, only the found characters are included.

15. Repeat steps 11 - 14 to include numerous character samples in the font.

    As characters are included, graphics appear in the image for each character.

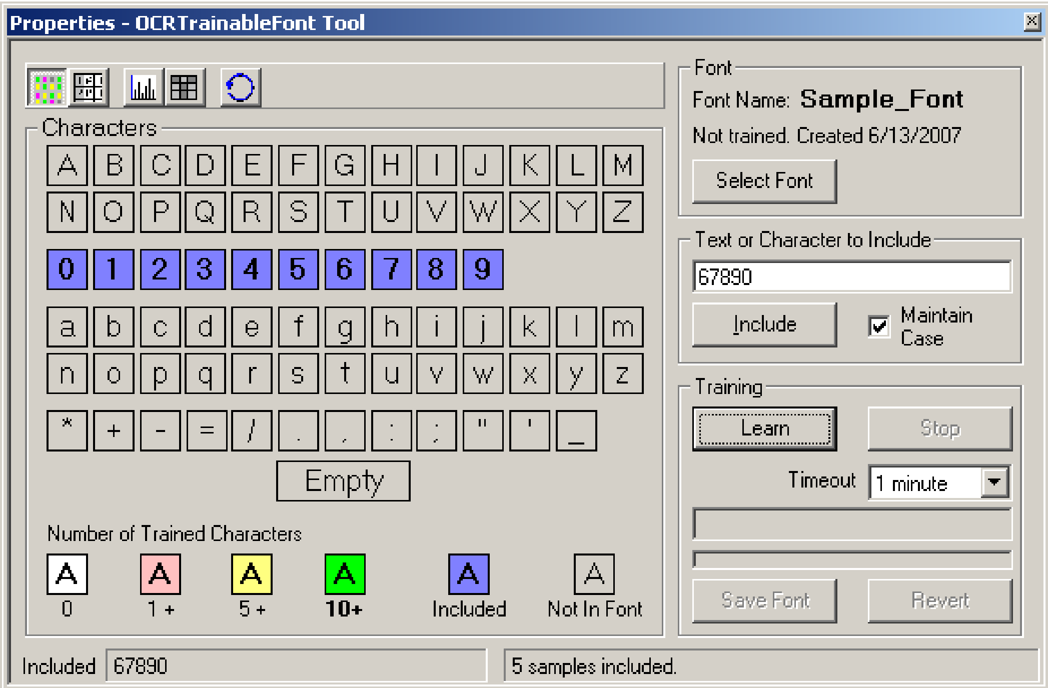
FIGURE 4–17. **Graphics for Each Character**



16. Click Acquire New Image to clear the image graphics.

    The custom editor is updated to indicate all of the included characters, as shown in Figure 4–18.

FIGURE 4–18. **Custom Editor Updated**



17. Click Learn to train the font using the included characters.

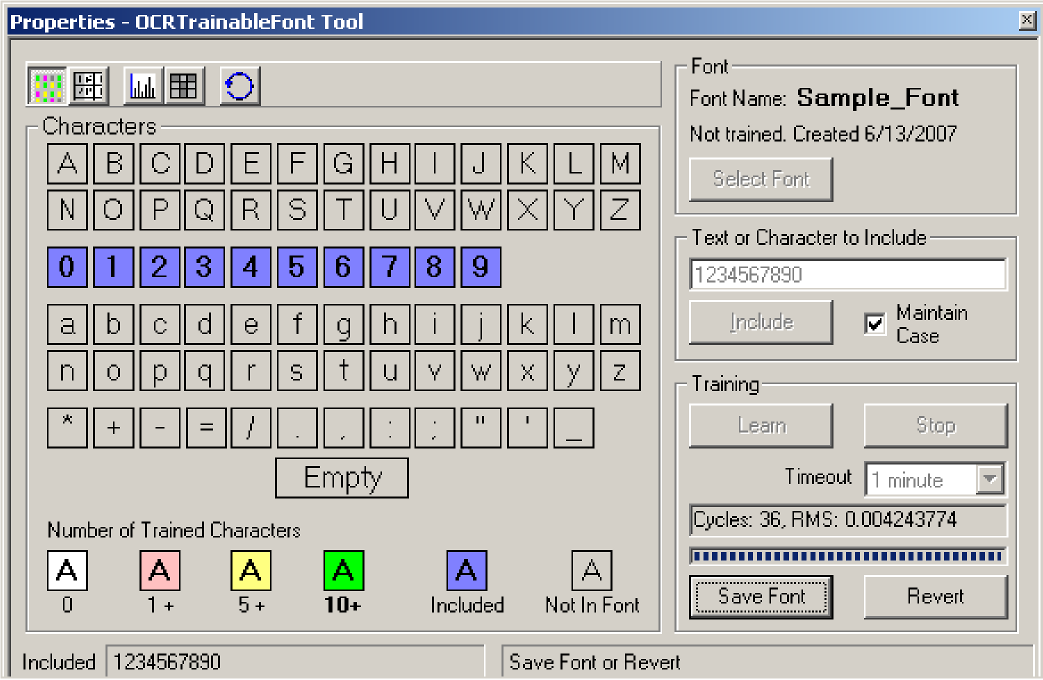
    You may stop training, if desired.

    You may train at any time as you include characters.

18. When training is complete, click Save Font or Revert, as shown in Figure 4–19.

    The time required for training increases as more samples are added. The default timeout is 1 minute; select shorter or longer training periods from the Timeout drop-down list.

FIGURE 4–19. **Click Save Font**



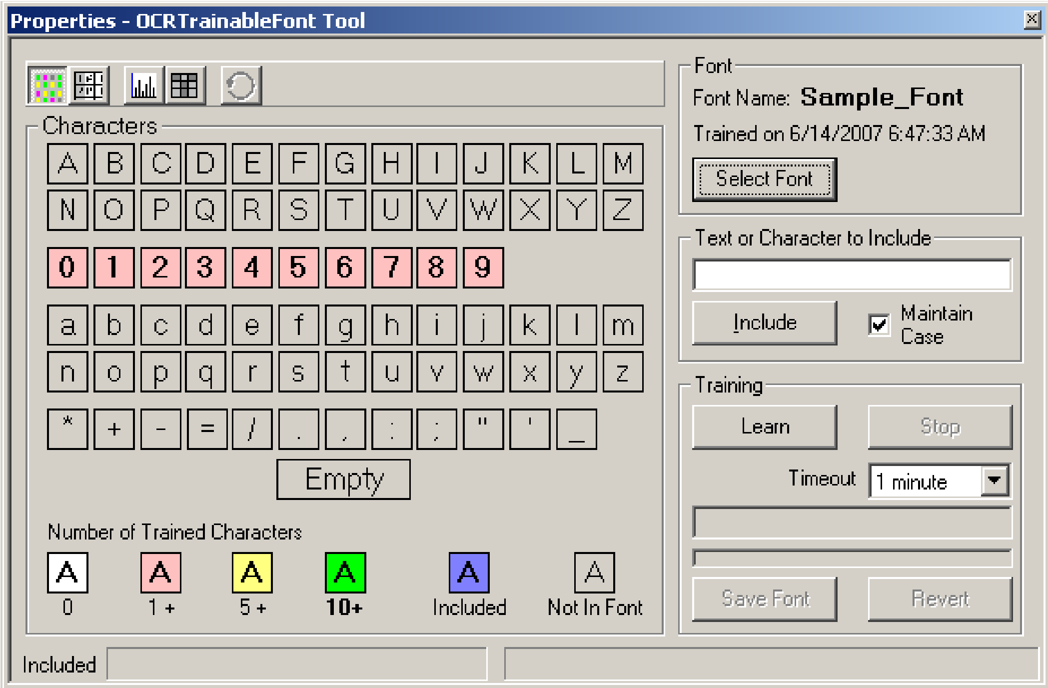
Clicking Save Font saves the new training. The train date and time are displayed beneath the font name, as shown in Figure 4–20.

FIGURE 4–20. **Font Name and Train Date and Time**

Clicking Revert abandons the training. If the font had been trained previously, it will revert to its previous trained state.

After training, characters are highlighted using red, yellow, and green to indicate the number of trained samples for each character.

FIGURE 4–21. **After Training**



When the mouse pointer rests over a character, a tool tip pops up indicating the number of trained samples for the character. In the image above, the tool tip shows that 6 samples have been trained for the character “A”.

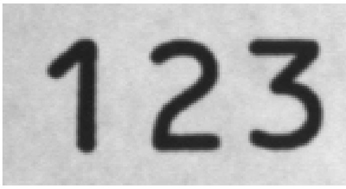
19. Defocus the lens slightly and repeat steps 11 - 18.

A font should be trained using samples that vary in quality. When fewer samples than desired are available, the set of samples can be re-used several times during training.

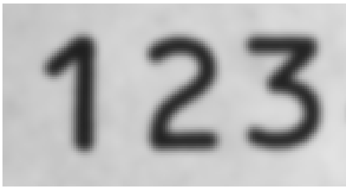
To re-use the character set after the first round of training, defocus the lens slightly to render the characters a bit fuzzy. If the lens is not easily accessible, image processing may be used to change the appearance of the characters.

This method simulates the variability expected in large sample sets of characters.

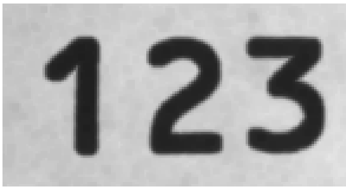
FIGURE 4–22. Defocusing an Image



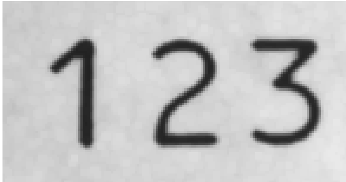
Sharp Focus - Original Image



Defocused - Simulate using MeanLP filter



Thicker Characters - Simulate using GrayMorph-Dilate Dark-1

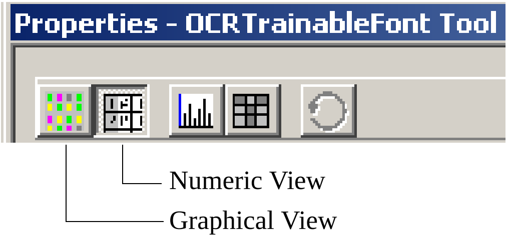


Thinner Characters - Simulate using GrayMorph-Erode Dark-1

Another alternative to image processing is adjusting the Edge Energy datum for the OCRTF step. Changing this parameter is similar to changing focus to produce sharper or softer character edges.

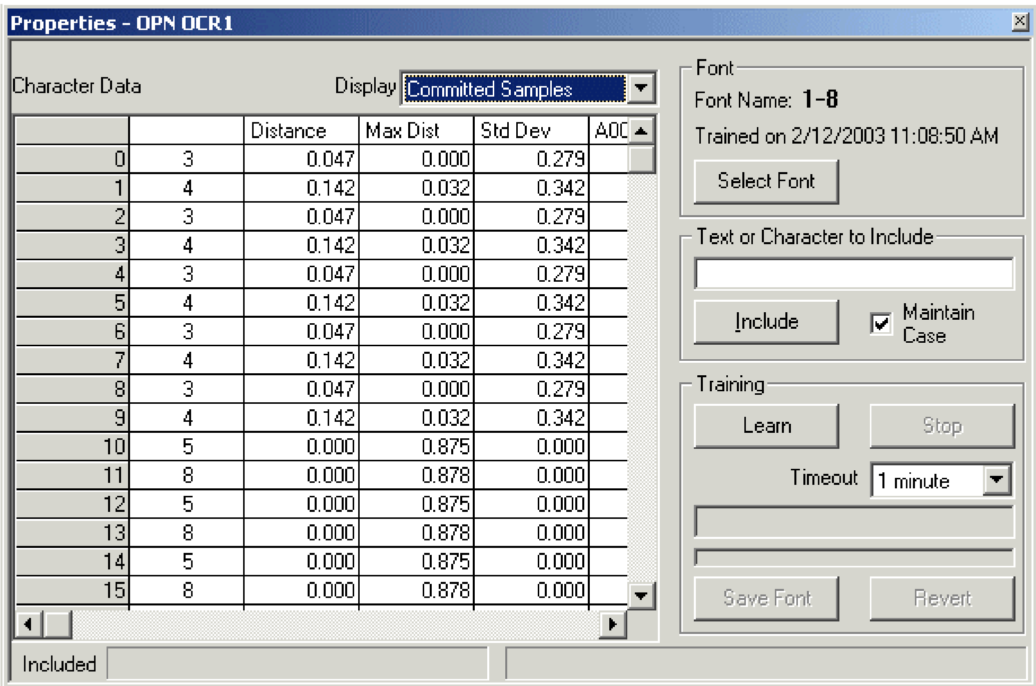
Numeric View

FIGURE 4–23. Numeric View Button



After you click Numeric View, the constants associated with each character sample are displayed in a grid, as shown in Figure 4–24.

FIGURE 4–24. Constants for Character Samples

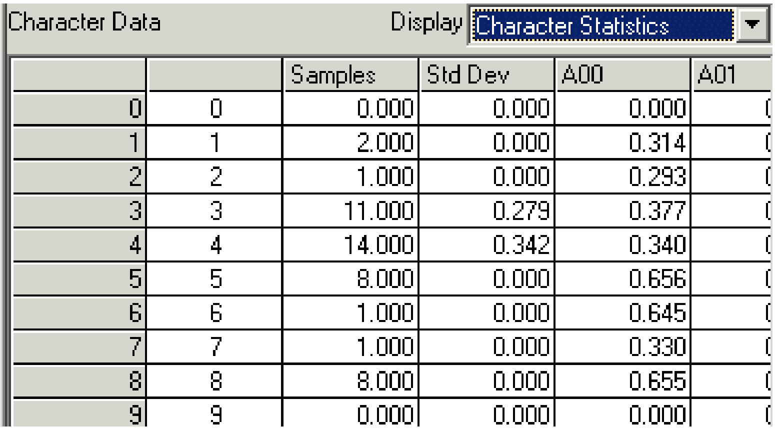


Committed Samples corresponds to included characters.

Individual samples may be deleted from the list by right clicking on the grid and choosing Delete.

Selecting Character Statistics displays the training statistics for all characters in the font, as shown in Figure 4–25.

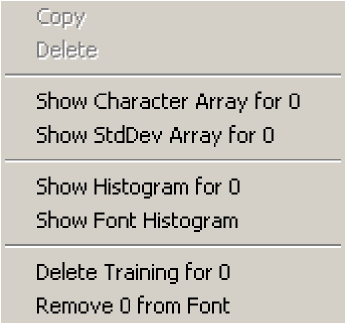
FIGURE 4–25. Training Statistics for All Characters



		Samples	Std Dev	A00	A01
0	0	0.000	0.000	0.000	0
1	1	2.000	0.000	0.314	0
2	2	1.000	0.000	0.293	0
3	3	11.000	0.279	0.377	0
4	4	14.000	0.342	0.340	0
5	5	8.000	0.000	0.656	0
6	6	1.000	0.000	0.645	0
7	7	1.000	0.000	0.330	0
8	8	8.000	0.000	0.655	0
9	9	0.000	0.000	0.000	0

Character-Related Features

FIGURE 4–26. Character Features Menu



This menu is displayed when you right click on a character in the Graphical View.

Show Character Array and Show StdDev Array

You can display constants for each character by selecting Show Character Array or Show StdDev Array, as shown in Figure 4–27. These displays are useful for low-level debugging and font testing only. These displays may not be helpful for an operator.

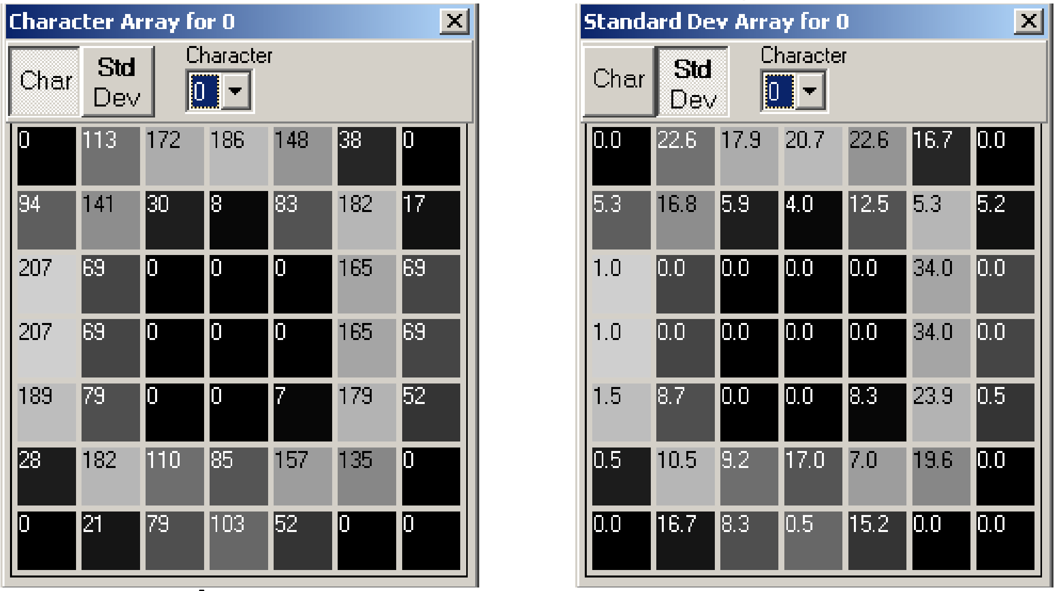


FIGURE 4–27. **Results of Show Character Array and Show StdDev Array**

Show Histogram and Show Font Histogram

You can display a histogram for a character (see Figure 4–28), or show font histogram information (see Figure 4–29).

FIGURE 4–28. Results of Show Histogram for a Character

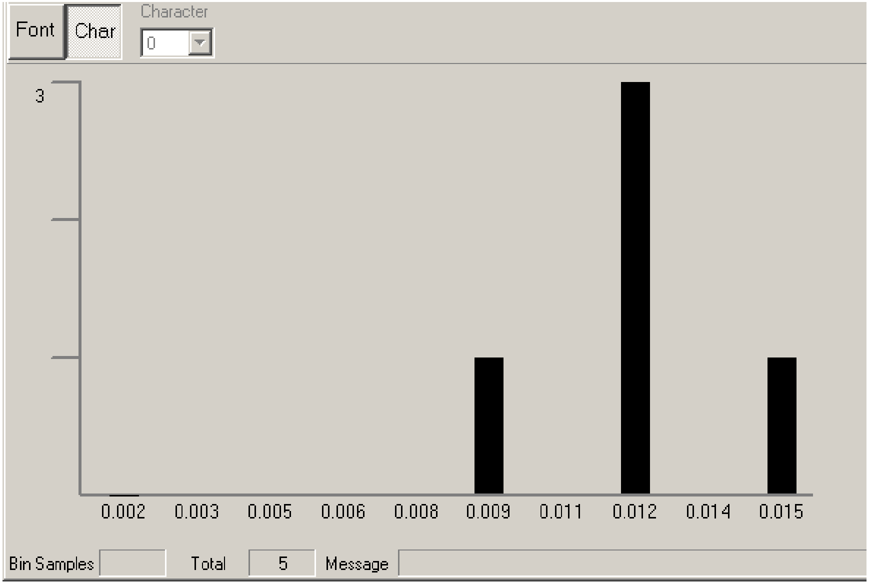
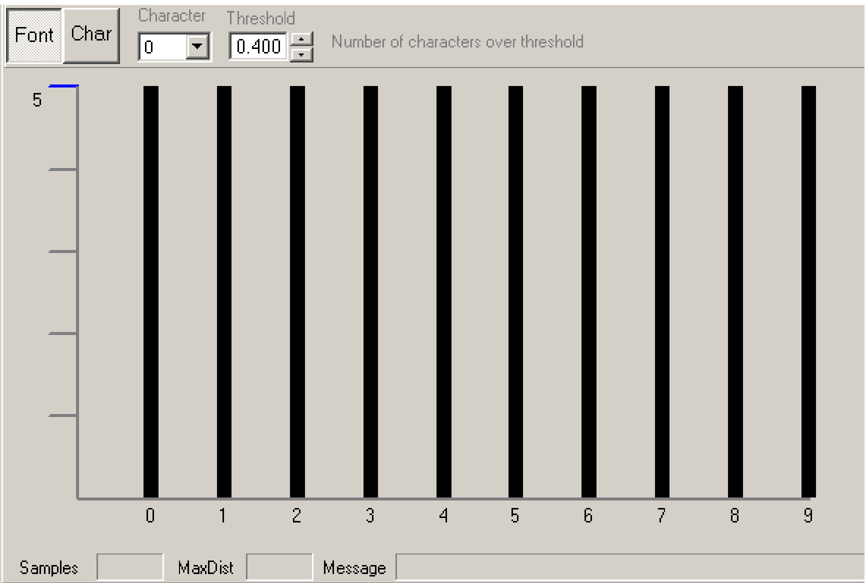


FIGURE 4–29. Results of Show Font Histogram



Delete Training and Remove from Font

The Delete Training feature removes all trained samples for a character from the font. This feature is useful if a particular character should be retrained by itself. You will be prompted regarding deleting all samples for a character.

Remove from Font deletes all training for a character and removes it completely from the font. You will be prompted regarding excluding the character from the font.

Training Tips

- The camera field of view should be configured so that the characters read by the OCRTrainableFont tool have a character width of 25 pixels or larger.
- Given an initial set of sample parts, divided the samples into two subsets. Use one subset for training and the other subset for reading tests.
- For OCRTrainableFont, the image background should be relatively free of noise.
- Be certain to train using samples of varying quality. The samples should be representative of the character print/mark quality expected during production runs of the printed characters.
- Train frequently. A font may be trained at any time.
- If the value of the RMS error increases significantly after a new training cycle, consider deleting recently added samples.
- Changes should be made to the trained font whenever a camera position is moved. If the change in camera position or lens focus is minor, it may be necessary to add no more than a few characters samples.
- Note that certain characters are more prone to be confused for other characters. Examples include B/8, G/6, and numeral 0/ letter O. During testing, confirm that these characters are distinguished from one another accurately.

- If the camera lens is inaccessible for defocusing, use software methods to simulate variations in character quality.
- Note that each OCRTF step can use multiple trained fonts.
- If training takes longer than a minute, try dividing a font into two or more smaller fonts. Click Select Font to display the Font Manager dialog, then click Duplicate to create a copy of the font. Remove characters from the font copy to reduce the size of the character set. A font with characters A - Z can be split into fonts with A - M and N - Z. Make sure all required fonts are selected in the OCRTrainableFont Tool.
- Until Save Font is clicked, font changes may be abandoned. Close the OCRTF training dialog and click the “No” button when prompted to save changes.

Tips for Marking OCR Fonts

- Use either the numeral 0 or the letter O, but not both. If a human operator has trouble distinguishing characters quickly, the vision system will also have difficulty.
- Unlike machine-readable codes such as Data Matrix, OCR does not have built-in error correction. Misreads are possible. For example, “813” may be reported as “B13”. If possible, include a checksum character in the printed text.

Results

- Status — Set to true after a successful execution of the step.
- Number of Characters Found — Total number of character objects found, whether or not they were successfully decoded.
- Output String — The set of characters found within the ROI placed in order from the top left most character and scanning to the right, then down. Characters that are found but not decoded will be represented by the character defined by Set Unknown Characters To.
- Minimum Character Confidence — The lowest match level of the characters successfully decoded.

- Mean Character Confidence — The mean match level of the characters successfully decoded. This excludes the confidence level of any characters that were excluded by the 'Minimum Confidence' parameter.
- Maximum Character Confidence — The highest match level of the characters successfully decoded.
- OCRTF Character Results — Contains a vector of the character confidence values for the successfully decoded characters only. The results are in the order of the characters in the output string skipping unknown characters.

5

CHAPTER 5 OCV Reference

This chapter provides Optical Character Verification tool details.

Overview

Visionscape I-PAK has three options for Optical Character Verification (OCV), each of which has an appropriate use:

- “OCVFontTool” on page 5-36
- “OCVRuntimeTool” on page 5-45
- “OCVFontless Tool” on page 5-54

This chapter outlines each of these tools along with their supporting steps.

5 OCV Reference

OCV Inspection

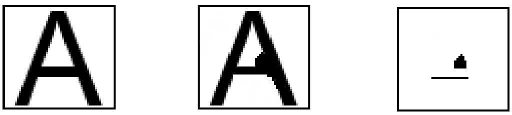
The OCV Tools and their supporting steps inspect codes such as component ID and Date/Lot. The print may be either pre-print or On-line. Individual printed features are referred to as symbols. The OCV inspection methods inspect the quality of the individual printed symbols. Quality checks include:

- Contrast — Contrast refers to the difference between symbol and background. A contrast value is calculated for the symbol and compared to a user-selectable contrast minimum. The symbol fails if the calculated value is less than the minimum.

- Sharpness — Sharpness is an indication of symbol border definition or symbol crispness. A sharpness value is calculated for the symbol and compared to a user-selectable sharpness minimum. The symbol fails if the calculated value is less than the minimum.
- Breaks — The current symbol data is compared to the trained symbol data. If a break appears in the current data that was not in the trained data, the symbol fails.
- Initial Residue — Initial residue of the symbol is basically a count of those pixels that differ between the trained template and the current image. A binary residue template is created that contains On pixels only where a difference occurs between the current image data and the trained symbol template. The sum of the On pixels in this residue template is the initial residue value. If this value is greater than the user-selectable maximum, the symbol fails. Refer to Figure 5–1.

Note: Typically, this test is not used in pharmaceutical applications.

FIGURE 5–1. Initial Residue Examples



Template Symbol Initial Residue

- Final Residue Total Count — After performing a set of morphological operations on the residue image, the final residue is calculated again as the number of On pixels in the residue image. If this value is greater than the user-selectable maximum, the symbol fails. Increasing final residue % accepts symbols of lower quality.
- Final Residue Largest Blob — After performing a set of morphological operations on the residue image, the largest blob is found in the residue image. If the area of this blob is greater than the user-selectable maximum, the symbol fails.

- Runtime ID Checking — (For the font based tools OCVFontTool and OCVRuntimeTool). When a symbol is trained and added to an OCVFont, it is compared to other symbols already in the OCVFont.

  Note: OCVFont boxes must be the same size in order to utilize Runtime ID tests.

  If the two symbols being compared are found to be similar, tests are set up that verify that the correct symbol is present at runtime. If it cannot be determined that the correct symbol is present at runtime, the symbol fails the inspection.

Additional Filters

- Character Expansions are useful when dealing with print from a dot matrix printer or any print that is broken up in segments. The broken print is filtered so that it becomes solid by expanding the segments until they come together. Dilations expand each segment. Then, erosions decrease the size of the character in every direction except the direction in which the segments have connected. Dilations and erosions work together to make the segments solid without making the character fatter.
- Filter Bright Defects is useful when dust or other material settles on the print and appears brighter than the print in the image. This filter eliminates the bright specks and allows proper inspection of the print.

  Note: Typically, this test is not used in pharmaceutical applications.

Brief Descriptions

- OCVFont — An OCVFont step is a container of one or more FontSymbol steps. The OCVFont contains a default FontSymbol that is used only for setting default parameters (parameters that any FontSymbol will inherit when inserted into the OCVFont). One or more OCVFonts are required for font-based OCV. OCVFonts are created and modified using the Custom Properties dialog box of the OCVFontTool or OCVRuntimeTool. OCVFonts are stored separately from the inspection Job file in the Vscape\Jobs\Fonts folder.

- FontSymbol — A FontSymbol is a collection of template images, settings, and tolerances that inspect a character or logo at runtime.
- OCVFontTool — An OCVFontTool uses an OCVFont to learn the layout, and determine which characters from the OCVFont are in which locations in the FOV. Once the layout is learned, the OCVFontTool expects to find these symbols at the same locations during inspection. It uses the data from the FontSymbols in the OCVFont to verify the quality of the characters being inspected.
- OCVRuntimeTool — An OCVRuntimeTool uses an OCVFont (called the Master Font) to learn the layout, and determine which characters from the OCVFont are in which locations in the FOV. Once the layout is learned, the OCVRuntimeTool creates a new OCVFont (called a Runtime Font) by training a new FontSymbol at each layout position, using the current image data. The OCVRuntimeTool expects to find the symbols at the same locations during inspection. It uses the data from the Runtime Font to verify the quality of the characters being inspected. The OCVRuntime Tool compensates for day-to-day changes in On-line print and helps minimize false rejects. The OCVRuntime Tool can be used when inspecting Date/Lot codes.
- OCVFontlessTool — An OCVFontlessTool does not require an OCVFont. Instead, it determines the location of characters in the FOV using a blob-analysis technique. It then stores training data for each character location as an OCVSymbolStep. The OCVFontlessTool expects to find the symbols at the same locations during inspection. It uses the trained data to verify the quality of the characters being inspected. The OCVFontless Tool checks symbol quality and not symbol correctness. The OCVFontless Tool can be used on Date/Lot codes when only symbol quality is a concern. Do not use the OCVFontless Tool to inspect Component ID codes. Table 5–1 contains usage hints.

Note: When placing the ROI around the code to inspect, be sure to leave clean area on either side of the code. This is called a quiet zone.

TABLE 5–1. Usage Hints

Use This Tool...	When You Want To...
OCVFontTool	Inspect for code quality and correctness. Ensure that code quality is always measured against the Font Library created by the Programmer.
OCVFontless	Inspect for code quality only.
OCVRuntime	Inspect for code quality and correctness. Inspect on-line printing.

- AutoFind — An AutoFind can optionally be used by any of the OCV Tools. This step determines the location of the layout at runtime. An AutoFind can be set up to use 1-Pin (no rotation) or 2-Pins (rotation). The Pins can be set up by selecting which layout positions to use.

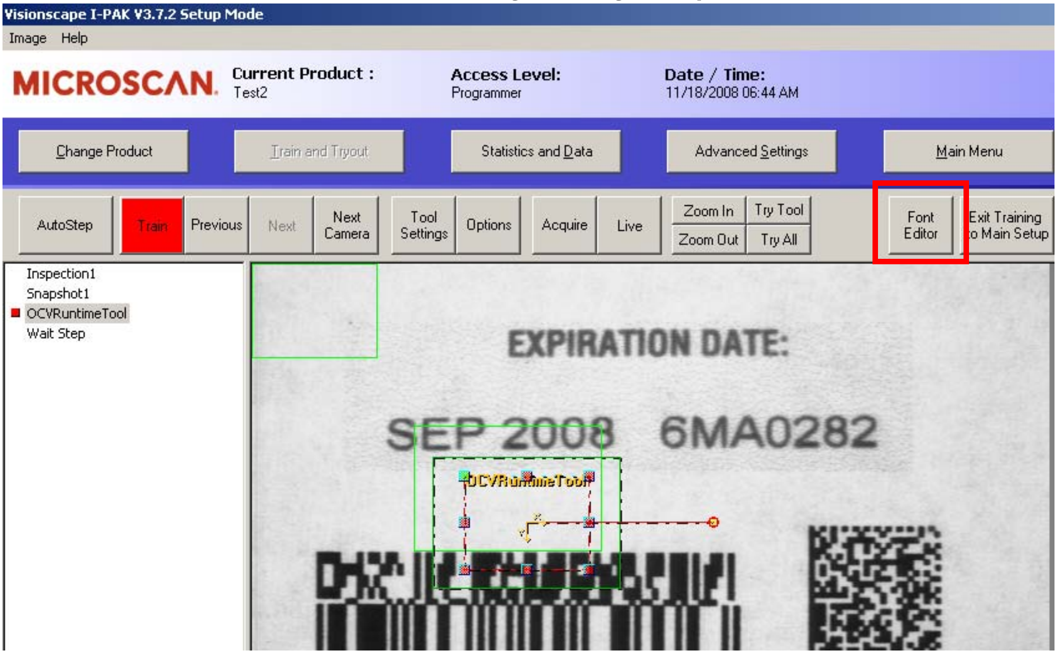
Custom Properties — Create/Modify OCVFonts

When I-PAK is first loaded, there are no fonts on the system. Fonts have to be created in order to perform font based OCV inspection. Fonts are stored in the Vscape\Jobs\Fonts folder. OCVFont files have the extension ".ocv". The location of the stored fonts is not modifiable so that all Visionscape applications can locate the fonts in a single folder.

You can use the LayoutStep of the font based OCV tool to select a font for training and inspection from a list of available fonts on the system.

Custom Settings

FIGURE 5–2. **Custom Settings Dialog Box (accessed via Font Editor**



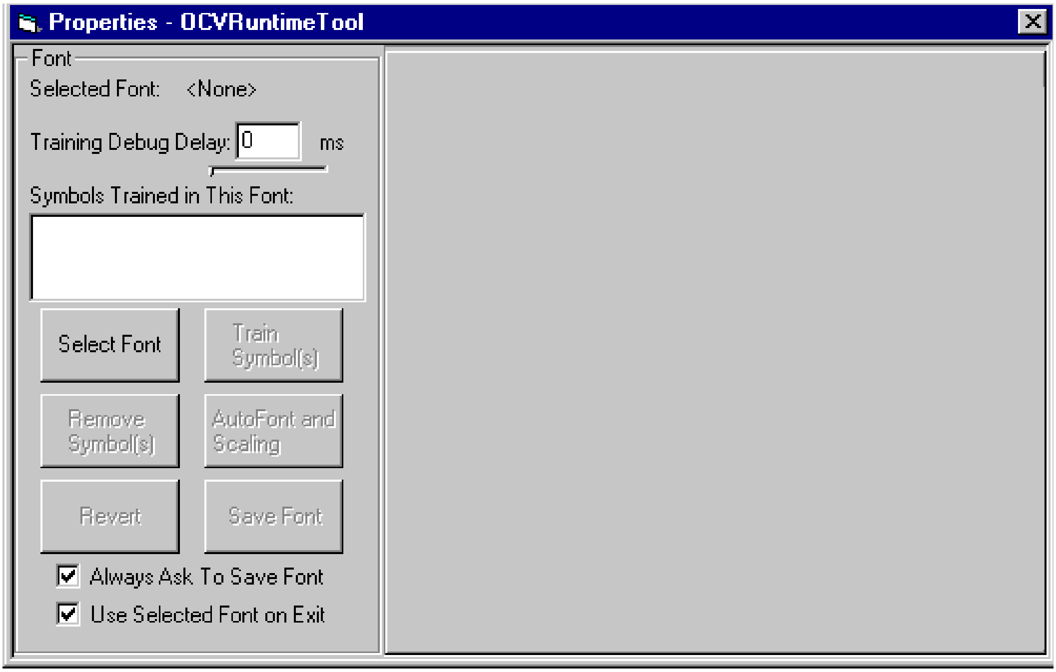
Button)

The Custom Settings dialog box for the font based OCV tool creates and modifies fonts on the system. With a font based OCV tool selected as the current tool from the Train/Tryout screen of I-PAK, clicking on the Font Editor toolbar button brings up the Custom Properties dialog box.

Note: The Font Editor toolbar button does not appear in AutoStep mode because the AutoStep mode is only aware of tools and shapes within the current Setup Manager configuration. “Font Editing” relies on the ability to insert/remove OCVFont steps for training and manipulation. Because these OCVFont steps are inserted/removed dynamically, the AutoStep mode does not know about them and does not allow the shapes to appear in the buffer. Without the shapes, the training of these OCVFonts is not possible.

Main Custom Properties Dialog

FIGURE 5–3. Main Custom Properties Dialog Box



The right side of the Custom Properties dialog box displays the properties for the selected font. When no font is selected, no properties are displayed.

The left side of the Custom Properties dialog box displays the name of the selected font and the names of the symbols currently trained in that font. Setting the “Training Debug Delay” to a non-zero value causes the system to display detailed information during the training and scaling of symbols.

Buttons

- Select Font — Displays the “Font Manager” dialog (see “Font Manager Dialog” on page 5-9) and allows for a font to be selected for training or modification.

- Train Font — Initiates the training of an OCVFont (see “Training Fonts” on page 5-10). This is a change from previous I-PAK versions where the user was required to train the OCVFont using the Train button in I-PAK.
- Remove Symbols — Displays the “Remove Symbols” dialog (see “Remove Symbol Dialog” on page 5-13) and allows for symbols to be easily removed from the selected font.
- AutoFont and Scaling — Instructs I-PAK to determine automatically the best font (from all fonts in the Vscape\Jobs\Fonts folder) for use on the current image (see “Automatic Font Selection and Scaling Dialog” on page 5-14).
- Revert — Reads in the last saved version of the selected font. This allows the user to undo all changes since the last save.
- Save Font — Saves any changes made to the selected font.

By default, the “Always Ask To Save Font” checkbox is checked.

- If this box is **checked** when the custom properties dialog box is closed or Select Font is clicked, the user is asked if any changes should be saved.
- If this box is **not checked**, the user needs to remember to save changes or they will be lost when the dialog box is closed or Select Font is clicked.

By default, the “Use Selected Font on Exit” checkbox is checked.

- If this box is **checked** when the custom properties dialog box is closed, the OCVFont currently active in the custom properties dialog box becomes the selected OCVFont for the font based OCV tool that is being trained in I-PAK.
- If this box is **not checked**, no change is made to the selected OCVFont for the tool being trained in I-PAK.

Font Manager Dialog

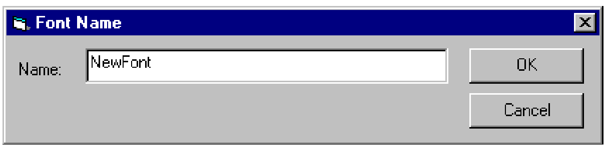
FIGURE 5–4. **Font Manager Dialog Box**

The “Available Fonts” list is the list of all OCVFonts found in the Vscape\Jobs\Fonts folder. OCVFont files have the extension “.ocv”.

Buttons

- Select — When clicked, this button returns the user to the Main Custom Properties dialog box with the font selected in the “Available Fonts” list as the selected font.
- New — When clicked, this button prompts the user to enter a name for the new font.

FIGURE 5–5. **Font Name Dialog Box**

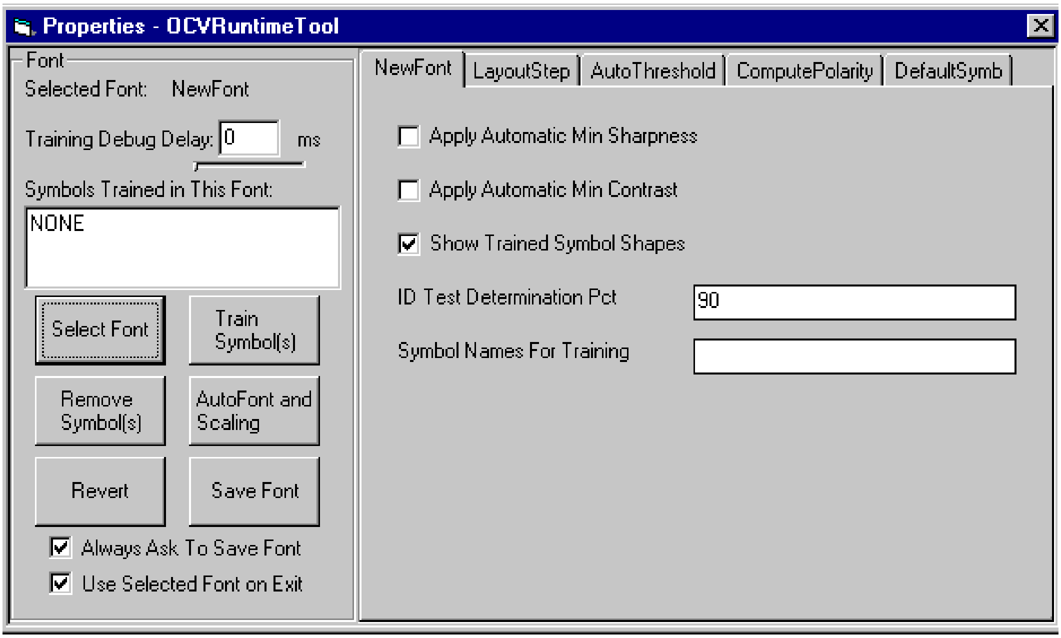


The user must enter a unique name for the new font. If an OCVFont with the name “DefaultFont.ocv” does not exist in the fonts folder, I-PAK will create one and give it the standard default property values. If an OCVFont with the name “DefaultFont.ocv” already exists in the fonts folder, it will not be overwritten. The values of all font properties are copied from “DefaultFont.ocv” to the new font. This allows new fonts to have customized settings based on the user’s requirements.

- Duplicate — When clicked, this button prompts the user for a name for the new font. The user must enter a unique name for the new font. The font that is selected in the “Available Fonts” list is then copied and the copy is given the user provided name.
- Rename — When clicked, this button prompts the user for a name for the new font. The user must enter a unique name for the new font. The font that is selected in the “Available Fonts” list is then renamed with the user provided name.
- Delete — When clicked, this button deletes the font that is selected in the “Available Fonts” lists from the fonts folder.
- Cancel — When clicked, this button returns the user to the Main Custom Properties dialog box with no change to the selected font.

Training Fonts

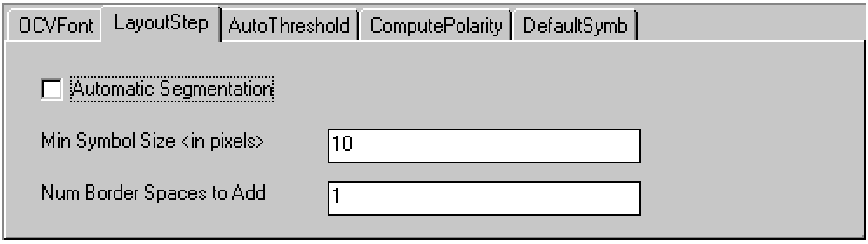
FIGURE 5–6. **OCVFontTool Properties Dialog Box**



When a new font is added and selected for training using the Font Manager dialog, it needs to be trained before it can be used by a font based OCV tool. First, the OCVFont shape needs to be positioned over the symbols to be trained.

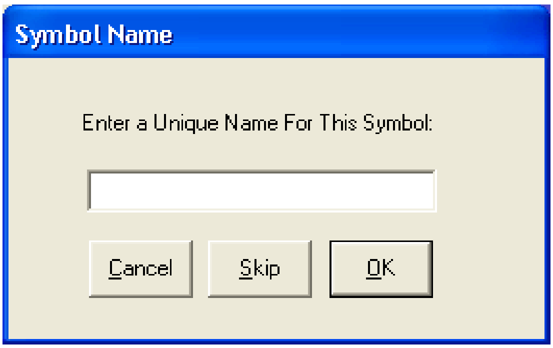
Second, select the LayoutStep tab and enable the Automatic Segmentation option, as shown in Figure 5–5.

FIGURE 5–7. LayoutStep Properties Page



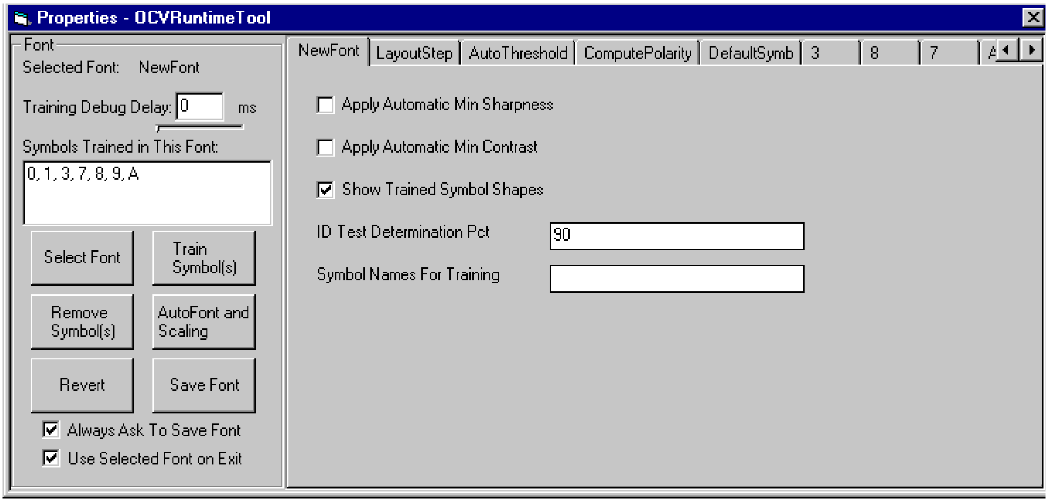
Clicking Train Font on the Custom Properties dialog box initiates the training. The user is prompted to name each symbol found in the train ROI.

FIGURE 5–8. Prompt to Enter Unique Name for the Symbol



When training is complete, the right hand side of the Custom Properties dialog box is modified to contain a tab for each symbol that was added to the OCVFont.

FIGURE 5–9. **Tabs for Each Added Symbol**

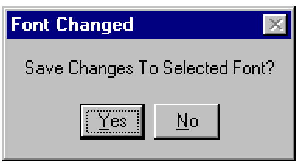


Note: There are many options for training OCVFonts. The example above is the quickest way to train a font. For more details on training OCVFonts and the properties and settings involved, see “OCVFont” on page 5-20.

Training the OCVFontTool

First, to train the OCVFontTool, the Custom Properties dialog box must be closed. If changes have not been saved, the user is asked whether the changes should be saved. Clicking Yes saves the changes; clicking No loses any changes that were made.

FIGURE 5–10. **Prompt to Save Changes**



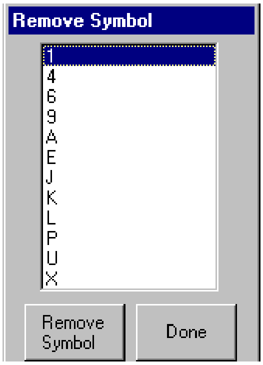
To train the OCVFontTool, place the tool shape around the characters that are going to be inspected.

Click Tool Settings to display the OCVFontTool's datum page. Clicking on the "LayoutStep" tab in the datum page will display all properties for the LayoutStep. Select the correct font from the "Selected Font" datum's list of available fonts.

Clicking Train causes the tool to find all characters within the ROI that are trained as symbols in the selected font. The tool sets up its inspection "Layout" and is then ready to run.

Remove Symbol Dialog

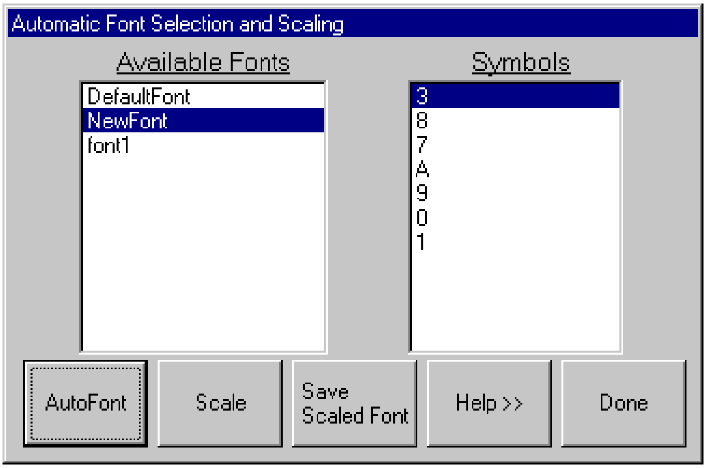
FIGURE 5–11. Remove Symbol Dialog Box



The Remove Symbol dialog box deletes symbols from the Custom Properties selected font. By selecting a symbol name from the list and clicking Remove Symbol, the user is able to remove the selected symbol from the font. Click the Done button to return to the Custom Properties Main dialog box.

Automatic Font Selection and Scaling Dialog

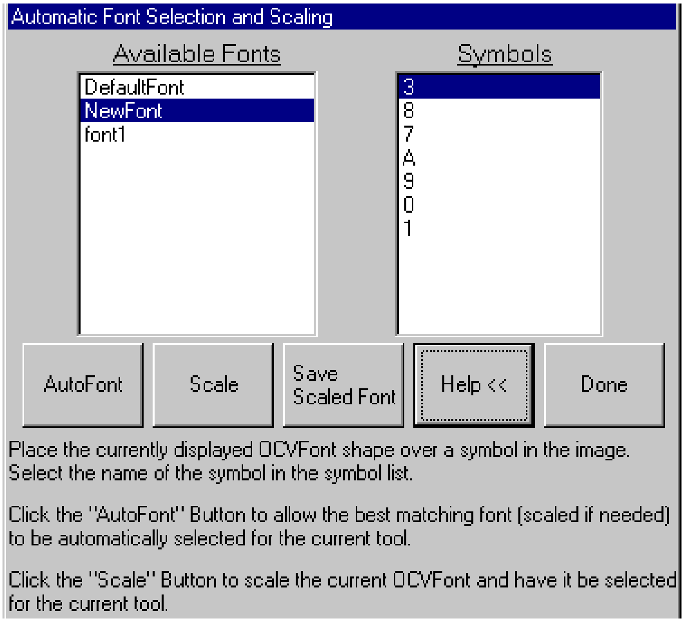
FIGURE 5–12. **Automatic Font Selection and Scaling Dialog Box**



Buttons

- Done — Returns the user to the Custom Properties Main dialog box when the user has finished with AutoFont and Scaling.
- Help — Displays or removes help information from the Automatic Font Selection and Scaling dialog, as shown in Figure 5–13.

FIGURE 5–13. **Help Displayed**



Automatic Font Selection — The AutoFont Button

The automatic font selection and scaling feature allows the system to scan through all of the OCVFonts in the Vscape\Jobs\Fonts folder to determine which one will work best with the current image data. When scaling an OCVFont is required to make it the best match, the system determines the proper scaling factors to use to create a scaled version of the OCVFont. This scaled version of the OCVFont will be created at the end of the automatic selection process. The name of the scaled OCVFont will reflect the change in width and height used to perform the scaling. By default, scaled OCVFonts are stored in the Job file as part of the associated font based tool. These scaled OCVFonts can be stored on the disk using the Save Scaled Font button.

The Automatic Font Selection and Scaling dialog box has two lists:

- The **left hand** list is a font list, containing the names of all the OCVFonts in the Vscape\Jobs\Fonts folder.

- The **right hand** list is a symbol list, containing the names of all the FontSymbols found in the OCVFont that is currently selected in the font list.

Choosing a Symbol

Select a symbol from the symbol list. This symbol will determine the best font. It is important to select a complex, uniquely shaped character. For example, a 5 would be better than a 0 or a 1. The character should appear in the current image and be crisply formed and printed (i.e., no smudges or blurring).

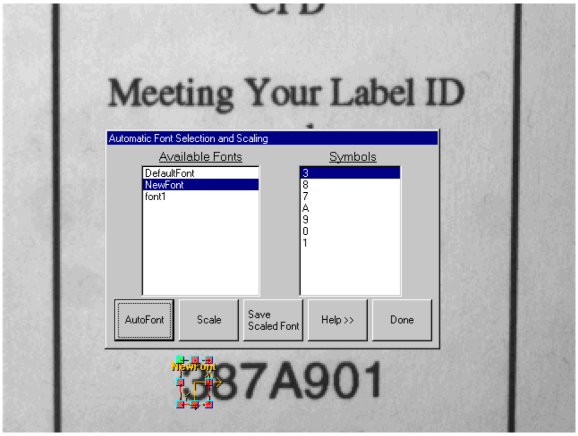
Positioning the OCVFont Shape

The OCVFont shape of the currently selected font sets up the automatic font selection and scaling process. This shape needs to be positioned and sized around a character in the current image that matches the character selected in the symbol list. It is important that the shape be positioned and sized very tightly over the selected character (do not leave any border). This ensures that the system will not mistake any part of other characters as being part of the selected character.

Note: You may find it easier if the trained symbol shapes are not displayed. Click Done and uncheck Show Trained Symbol Shapes (see Figure 5–9, “Tabs for Each Added Symbol,” on page 5-12).

Performing the Automatic Font Selection and Scaling

FIGURE 5–14. Ready to Perform Automatic Font Selection and Scaling



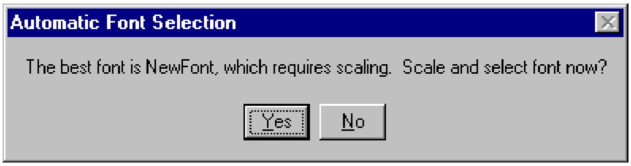
Once a character has been selected and the OCVFont shape has been correctly sized and positioned around that character in the image, the system is ready to perform the automatic font selection and scaling. Click AutoFont to start the process.

During the font selection process, each OCVFont that is in the Vscape\Jobs\Fonts folder is tested. The first part of the test determines if a symbol with the name of the selected character is trained in the OCVFont. If not, the process continues to the next OCVFont. If the symbol is in the font, the system will create several scaled versions of the template based on the size of the symbol in the font and the size of the OCVFont shape. Each scaled template is assigned a score value after it is compared to the actual image data inside the OCVFont Box. If the score value for any scaled template is better than any previous score values, that score value is stored as the BestScore, along with the name of the font that the template originated from and the scaling factors used to derive the scaled template.

When the “Train Debug Delay” property on the Custom Properties Main dialog box is set to a non zero value, the scaled templates and match scores are displayed in the upper left corner of the screen.

After all OCVFonts have been tested, the OCVFont that is associated with the BestScore is considered to be the font that will work best with the current image data. When an OCVFont has been automatically selected, a message box appears to display the name of the best matching OCVFont and whether or not it requires scaling to match the current image.

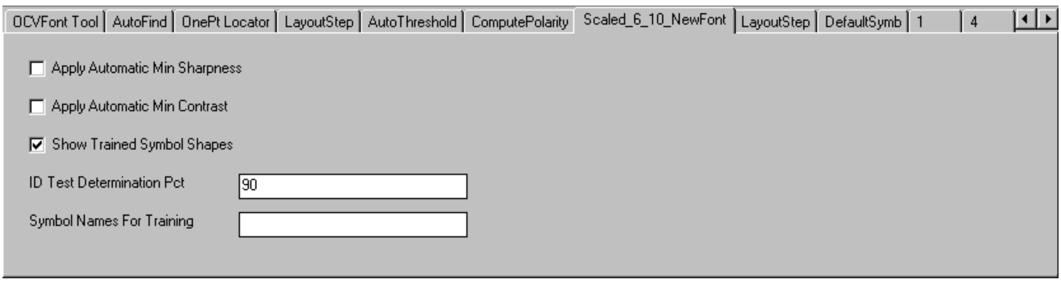
FIGURE 5–15. Name of Best Matching OCVFont



The dialog box also asks if the chosen font should be automatically selected into the current font based OCV Tool.

- Choosing No results in no scaling being done to the best matching OCVFont.
- Choosing Yes results in the OCVFont being scaled and the resulting scaled font will become the selected font of the OCV Tool.

FIGURE 5–16. Scaled_6_10_NewFont Embedded in OCVFontTool



Choosing Yes will cause the scaled font to be created and inserted into the OCV Tool, requiring that the OCV Tool be trained. The scaled OCVFont will now be used when training the OCV Tool.

If none of the OCVFonts were able to match the current image data with at least a 20% score, then no best font is found and an error message is displayed.

Font Scaling — The Scale Button

The font scaling feature is useful when you already know which font needs to be used, but the FOV has changed. Font scaling allows re-sampling of all FontSymbol train data to match the current FOV. A scaled version of the OCVFont will be created and the name of the scaled OCVFont will reflect the change in width and height used to perform the scaling. By default, scaled OCVFonts are stored in the Job file as part of the associated font based tool. These scaled OCVFonts can be stored on the disk using the Save Scaled Font button.

Choosing a Symbol

Choose the OCVFont that needs scaling from the font list. Select a symbol from the symbol list. This symbol will determine the changes in width and height that are needed to perform the font scaling. The character should appear in the current image and be crisply formed and printed (i.e., no smudges or blurring).

Positioning the OCVFont Shape

The OCVFont shape of the currently selected font sets up the font scaling process. This shape needs to be positioned and sized around a character in the current image that matches the character selected in the symbol list. It is important that the shape be positioned and sized very tightly over the selected character (do not leave any border). This ensures that the system will correctly calculate the changes in width and height.

Note: You may find it easier if the trained symbol shapes are not displayed. Click Done and uncheck Show Trained Symbol Shapes (see Figure 5–9, “Tabs for Each Added Symbol,” on page 5-12.

Performing the Font Scaling

Once a character has been selected and the OCVFont shape has been correctly sized and positioned around that character, the system is ready to perform the font scaling. Click Scale to start the process. The system compares the trained width of the selected FontSymbol with the width of the OCVFont box and calculates the required change in width to scale the FontSymbol in X. Then, the system compares the trained height of the selected FontSymbol with the height of the OCVFont box and calculates the required change in height to scale the FontSymbol in Y. Then, a new OCVFont is created and given the name of the source OCVFont with the addition of the change in width and change in height values. For example, OldFont_2_-5 indicates that the OCVFont named “OldFont” was scaled by increasing the width of the symbols by 2 and decreasing the height of the symbols by 5. Each symbol that is in the source OCVFont is then scaled and added to the new OCVFont.

When the “Train Debug Delay” property on the Custom Properties Main dialog box is set to a non zero value, the scaled templates and other FontSymbol training details are displayed in the upper left corner of the screen.

OCVFont

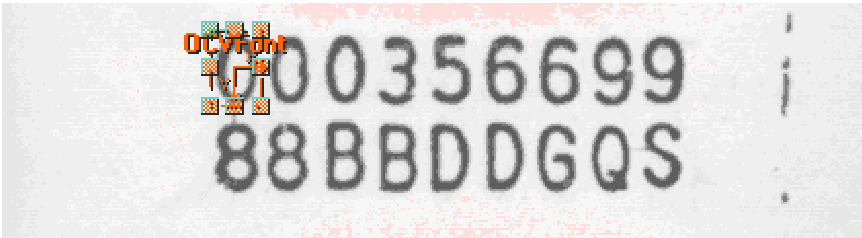
An OCVFont step is a container of one or more FontSymbol steps. It trains and groups a set of characters of a particular font style and size.

The OCVFont contains a default FontSymbol that is used only for setting default parameters (parameters that any FontSymbol inherits when inserted into the OCVFont). One or more OCVFonts are required for font based OCV.

Creating FontSymbols

As a container step, the OCVFont step creates FontSymbol steps. Creating FontSymbol steps can be accomplished by individual training or automatic segmentation using the Custom Properties dialog box of the OCVFontTool or OCVRuntimeTool.

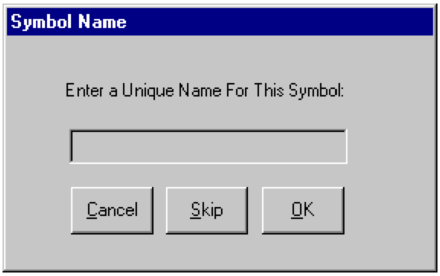
FIGURE 5–17. **OCVFont — Example 1**



By default, I-PAK is designed such that you perform individual training of characters. This is to activate runtime ID checking of special characters like O, 0, B, 8, D, etc. ID checking requires that these symbol boxes be the same size.

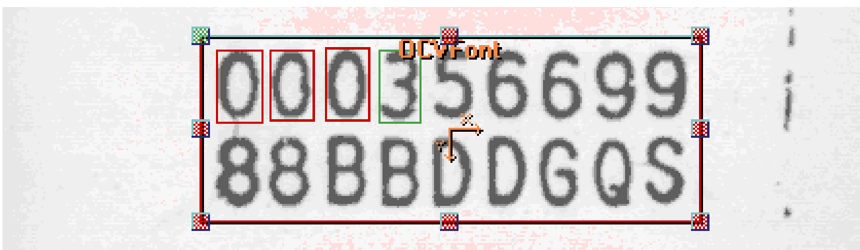
Individual character training requires that the OCVFont box be placed close around a single character in the image, leaving a 1-2 pixel border, as shown in Figure 5–17. This box should not include any portion of the adjacent characters. The minimum recommended character width is 20 pixels. When Train Font is clicked, the Symbol Name dialog box is displayed, asking for a unique name for the symbol, as shown in Figure 5–18.

FIGURE 5–18. **Symbol Name Dialog Box**



Clicking Cancel or Skip aborts the training of this FontSymbol. When a unique name is entered and OK is clicked, a FontSymbol is created, and templates (created from the ROI area of the image) and default parameters are stored in that FontSymbol. The OCVFont shape must be placed around the next character to train it. This process continues until all characters in the image have been trained as FontSymbols and added to the OCVFont, as shown in Figure 5–19. Only one example of a given character needs to be trained.

FIGURE 5–19. **OCVFont — Example 2**



The Automatic Segmentation feature can be enabled from the Custom Properties dialog box. The Automatic Segmentation setting can be found on the Layout Step property tab for the selected font. Automatic segmentation training requires that the OCVFont shape be placed around all the characters in the image that are going to be added as FontSymbols in the OCVFont. Then, when Train Font is clicked, a green box appears in the image over one of the characters. A dialog box is displayed, asking for a unique name for this symbol.

- Clicking Cancel aborts the training of this FontSymbol and ends the automatic segmentation training.
- Clicking Skip aborts the training of this FontSymbol and moves on to the next character in the image.

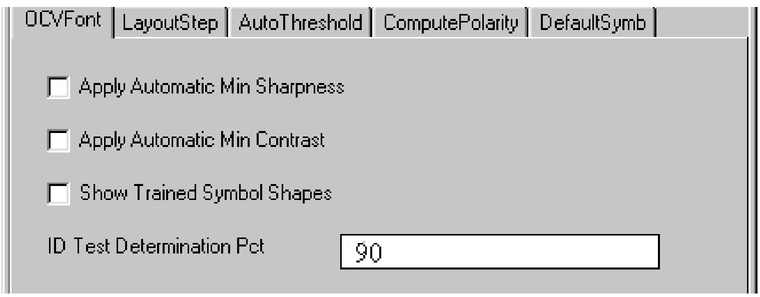
Only one example of a character needs to be trained.

When a unique name is entered and OK is clicked, a FontSymbol is created, and templates (created from the ROI area of the image) and default parameters are stored in that FontSymbol. The green box changes to a red box and a new green box appears over the next character in the image. This process continues until all characters in the image have been trained as FontSymbols and added to the OCVFont or the process is canceled.

OCVFont Tab

When an OCVFont is selected in the Custom Properties dialog box, the OCVFont tab displays the current settings for that OCVFont.

FIGURE 5–20. OCVFont Properties Page



- Apply Automatic Min Sharpness — When enabled, as FontSymbols are trained and added to this OCVFont, a minimum tolerance for sharpness is calculated for the FontSymbol. This value is 65% of the sharpness value calculated using the trained grayscale template of the FontSymbol.

Default: Disabled

- Apply Automatic Min Contrast — When enabled, as FontSymbols are trained and added to this OCVFont, a minimum tolerance for contrast is calculated for the FontSymbol. This value is 50% of the contrast value calculated using the trained grayscale template of the FontSymbol.

  Default: Disabled

- Show Trained Symbol Shapes — When enabled, the shapes of all FontSymbols that are part of this OCVFont are displayed whenever the shape for this OCVFont is selected in the buffer view.

  Default: Enabled

- ID Test Determination Pct — When a FontSymbol is trained as part of an OCVFont, it is compared against all of the FontSymbols already in the OCVFont. When FontSymbols are found to be similar, special tests are set up to check for the presence of the correct symbol at runtime.

  Default: 90%
  Range: 10% to 100%

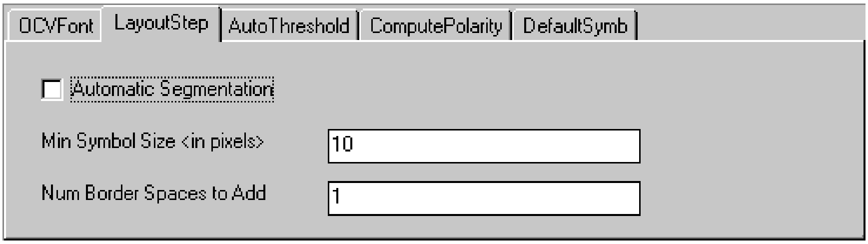
  ID Test Determination Pct adjusts the level at which symbols are similar enough to require special runtime tests. Smaller percentages cause more symbols to be flagged as similar, while larger percentages cause less symbols to be flagged as similar.

  Examples — When two symbols are found to be 75% similar, and the value of this property is 85%, no special tests are set up for runtime ID checking; if two symbols are found to be 90% similar, and the value of the property is 85%, a special test is set up for runtime ID checking.

LayoutStep Tab

The LayoutStep tab of the OCVFont is used for automatic segmentation of the image, when enabled. When an OCVFont is selected in the Custom Properties dialog box, the LayoutStep tab displays the current settings for that OCVFont's LayoutStep.

FIGURE 5–21. **LayoutStep Properties Page**



- Automatic Segmentation — When enabled, the training of the OCVFont causes the image to be segmented using blob analysis. A dialog box is displayed, asking for a unique name to give the FontSymbol before training the FontSymbol for each position found.

  Default: Disabled

- Min Symbol Size <in pixels> — Adjusts the minimum size that a blob must be in order to be considered a symbol.

  Default: 10 pixels
  Range: 5 to 256 pixels

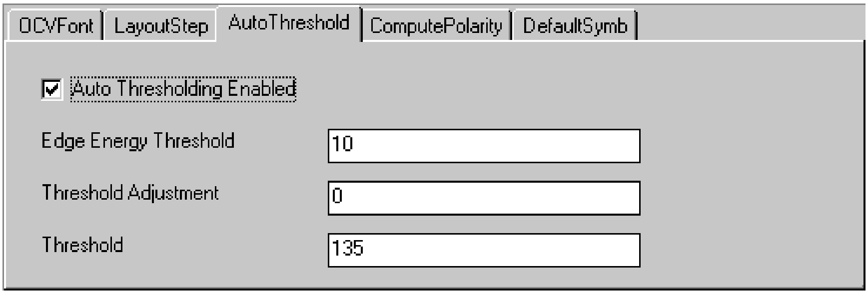
- Num Border Spaces to Add — Determines how many pixels to allow between actual character pixels and the edge of the box that defines the FontSymbol.

  Default: 1 pixel
  Range: 0 to 19 pixels

AutoThreshold Tab

The AutoThreshold tab of the OCVFont is part of the LayoutStep that is used for automatic segmentation of the image, when enabled, as shown in Figure 5–22.

FIGURE 5–22. AutoThreshold Properties Page



- Auto Thresholding Enabled — Enables and disables automatic thresholding.

  When **enabled**, a threshold is calculated using the ROI of the step. This calculation uses edge detection to determine foreground and background information. The calculated threshold is displayed in the Threshold property.

  When **disabled**, no calculation is done. The threshold used by the step is whatever value is in the Threshold property. The Edge Energy Threshold and Threshold Adjustment properties are not used when Auto is disabled.

  Default: Enabled

- Edge Energy Threshold — Defines the pixel value at which a pixel in a Sobel Edge Enhancement is considered to be an edge pixel. This property is only used when Auto Thresholding Enabled is enabled.

  Default: 10
  Range: 0 to 255

- Threshold Adjustment — Offsets or biases the dynamically calculated threshold, when Auto is enabled.

  Default bias: 0
  Range: -64 to 64

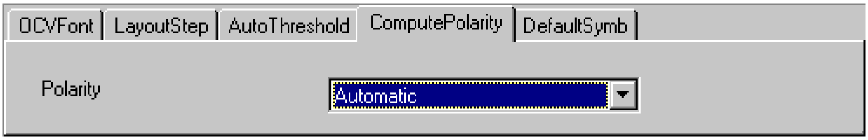
- Threshold — Displays the dynamically calculated threshold when Auto is enabled. When Auto is disabled, the value of this property is the threshold that is used by the step.

Default 135
Range: 0 to 255

ComputePolarity Tab

The ComputePolarity tab of the OCVFont is part of the LayoutStep that is used for automatic segmentation of the image, when enabled, as shown in Figure 5–23.

FIGURE 5–23. ComputePolarity Properties Page



- Polarity — Allows the step to be set up to always return Light_On_Dark, always return Dark_On_Light, or return an automatically determined polarity.

  Default: Automatic

DefaultSymb Tab

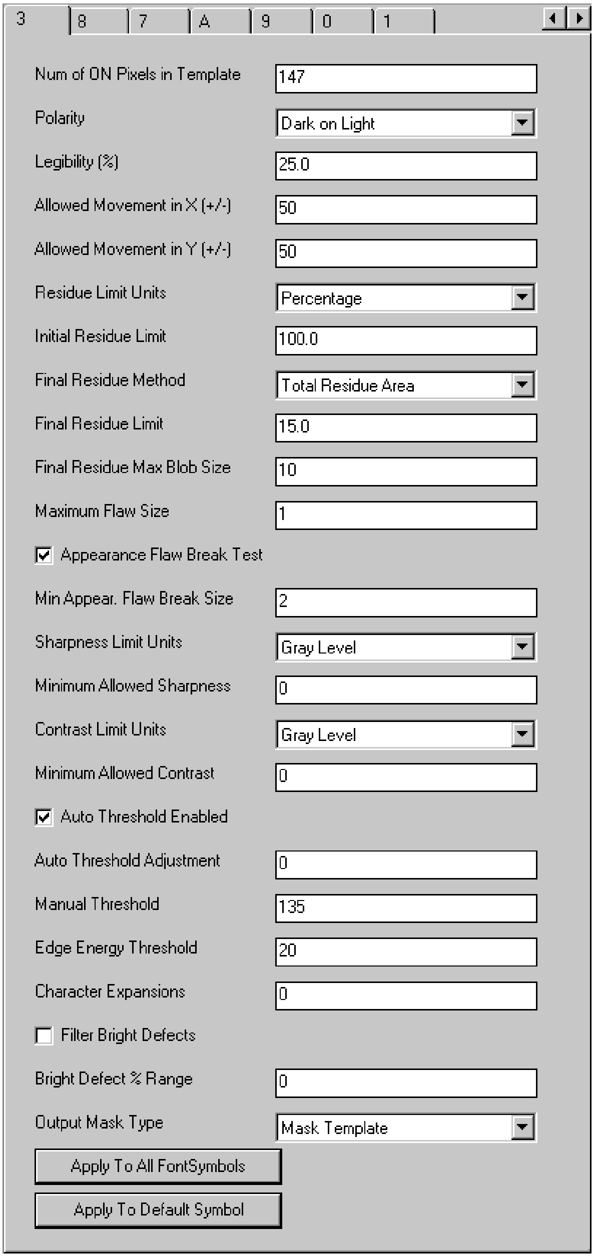
The DefaultSymb tab of the OCVFont sets default parameters that any FontSymbol trained and added to the OCVFont receives.

FontSymbol

A FontSymbol is a collection of template images, settings, and tolerances that inspect a character or logo at runtime. FontSymbols are created during the training of an OCVFont. They are used by the OCVFontTool and OCVRuntimeTool steps to learn the layout at train time and inspect the layout at runtime.

FontSymbols are trained when they are added to an OCVFont.

FIGURE 5–24. FontSymbol Properties Page



- Num of ON Pixels in Template — Displays the number of foreground pixels in the trained binary template.
- Polarity — Allows the step to always train with polarity Light_On_Dark, always train with polarity Dark_On_Light, or train using an automatically calculated polarity.

  Default: Automatic
- Legibility (%) — Passes/fails the symbol based on this minimum correlation percentage. The symbol fails inspection when the correlation percentage is less than this value.

  Default: 25% (typical for pharmaceutical applications)
  Range: 0% to 100%
- Allowed Movement in X (+/-) — Sets the maximum number of pixels that a symbol can move in the X-axis (relative to other symbols) from its trained position.

  Default: 50 pixels (any movement is allowed)
  Range: 0 to 50 pixels. The maximum of 50 pixels comes from the parent OCVTool setting Individual Symbol Search X, which limits the search range in X to a maximum of 50 pixels in either direction.
- Allowed Movement in Y (+/-) — Set the maximum number of pixels that a symbol can move in the Y-axis (relative to other symbols) from its trained position.

  Default: 50 pixels (any movement is allowed)
  Range: 0 to 50 pixels. The maximum of 50 pixels comes from the parent OCVTool setting Individual Symbol Search Y, which limits the search range in Y to a maximum of 50 pixels in either direction.
- Residue Limit Units — Inputs the residue limits in either a maximum pixel count value or a percentage value (percentage value is based on the number of On pixels in the trained template). When the value of this property changes, the values of Initial Residue Limit and Final Residue Limit are changed to match the selected units.

  Default: Percentage

- Initial Residue Limit — Provides a quick check of the character quality and correctness. The initial residue calculation is done before any image processing is performed on the residue image.

  When the system looks at the symbol being inspected, it determines the residue of the symbol, which is a count of those pixels that differ between the trained template and the current image. Based on the value of this property, the system determines if the residue is within tolerances. If it is not within tolerances, the symbol fails. Otherwise, the system continues on with the rest of the inspection procedure.

  When Residue Limit Units is set to Percentage:

    Default: 100.0%
    Range: 0.0% to 100.0%

  The value of this property is the smallest percentage of residue pixels (relative to the trained On pixel count) in the inspected image that will make the symbol fail the inspection.

  When Residue Limit Units is set to Pixels:

    Default: symbol size
    Range: 0 to symbol size

  The value of this property is the smallest count of residue pixels in the inspected image that will make the symbol fail the inspection.

  This property is good for catching smudges that are aesthetically poor, but would pass after all inspection operations are performed on it. A property value of 100% or symbol size means initial residue is ignored.

- Final Residue Method — Selects between three algorithms for final residue analysis.

  – Total Residue Area — This is the **default**. This choice counts all On pixels in the residue image and use the value in Final Residue Limit (pixel or percent) as the tolerance.

  – Max Residue Blob — Only counts the pixels in the largest blob of the residue image and use the value in Final Residue Max Blob Size as the tolerance.

  – Both — Performs both methods.

- Final Residue Limit — Sets the amount of objectionable residue that is to be deemed passable when Final Residue Method is set to Total Residue Area or Both. Final residue calculation is done after the image processing on the residue image that is associated with Maximum Flaw Size.

  An assignment of 0% (residue pixel count = 0) means that no residue is passable. An assignment of 100% (residue pixel count = symbol size) means that objectionable residue as large as the area of the prototype itself is passable.

  When Residue Limit Units is set to Percentage:

  Default: 15.0% (meaning a 15% variation is acceptable)
  Range: 0.0% to 100.0%

  The value of this property is the smallest percentage of residue pixels (relative to the trained On pixel count) in the inspected image that makes the symbol fail the inspection.

  When Residue Limit Units is set to Pixels:

  Default: 15% of the symbol size
  Range: 0 to symbol size

  The value of this property is the smallest count of residue pixels in the inspected image that makes the symbol fail the inspection.

  Note: Determining the proper value for Final Residue Limit is a subjective decision; the higher the quality of the character/symbol desired, the lower the Final Residue Limit should be.

- Final Residue Max Blob Size — Used when Final Residue Method is set to Max Residue Blob or Both. A blob analysis is performed on the residue image and the largest blob is found. If this blob has an area that is greater than the value of this property, the symbol fails the inspection.

  Default: 10
  Range: 1 to 512

- Maximum Flaw Size — Represents the maximum width in pixels that a discrepancy is allowed to be before it is considered objectionable. The larger the number assigned, the larger a discrepancy is allowed before causing the symbol inspection to fail.

  Default: 1 pixels
  Range: 0 to 20 pixels

- Appearance Flaw Break Test — Determines whether the FontSymbol is to inspect for character breaks in the symbol. When enabled, the inspection fails if a break is found in the symbol. When disabled, the inspection ignores breaks in the symbol.

  Default: Enabled

- Min Appear. Flaw Break Size — Is the smallest size break that causes a character break failure.

  Default: 2 pixels
  Range: 1 to 10 pixels

- Sharpness Limit Units — Sets the units for the “Minimum Allowed Sharpness” property. The units can be set to either “Gray Level” or “Percentage”. When set to “Gray Level”, the value of the “Minimum Allowed Sharpness” property is used as an absolute minimum value that the calculated sharpness value must be in order for the inspection to pass. When set to “Percentage”, the value of the “Minimum Allowed Sharpness” is used to calculate a percentage of the trained sharpness value, which is then used as an absolute minimum value that the calculated sharpness value must be in order for the inspection to pass.

  When switched from “Gray Level” to “Percentage”, the “Minimum Allowed Sharpness” property is updated to be the percentage value that corresponds to the gray level value that it previously held. When switched from “Percentage” to “Gray Level”, the “Minimum Allowed Sharpness” property is updated to be the gray level value that corresponds to the percentage value that it previously held.

  Default: “Gray Level”

- Minimum Allowed Sharpness — This value determines how crisp a symbol must be to pass inspection. It is measured by average edge strength over the entire symbol. Typical edge strengths are from 20 to 80 sharpness units.

  Default: 0
  Range: 0 to 256 “Gray Level” or 0 to 100 “Percentage”

- Contrast Limit Units — Sets the units for the “Minimum Allowed Contrast” property. The units can be set to either “Gray Level” or “Percentage”. When set to “Gray Level”, the value of the “Minimum Allowed Contrast” property is used as an absolute minimum value that the calculated contrast value must be in order for the inspection to pass. When set to “Percentage”, the value of the “Minimum Allowed Contrast” is used to calculate a percentage of the trained contrast value, which is then used as an absolute minimum value that the calculated contrast value must be in order for the inspection to pass.

  When switched from “Gray Level” to “Percentage”, the “Minimum Allowed Contrast” property is updated to be the percentage value that corresponds to the gray level value that it previously held. When switched from “Percentage” to “Gray Level”, the “Minimum Allowed Contrast” property is updated to be the gray level value that corresponds to the percentage value that it previously held.

  Default: “Gray Level”

- Minimum Allowed Contrast — The Contrast is the measurement that defines the grayscale foreground to background relationship of the symbol data. To calculate the contrast value, the average gray level value of the background pixels is subtracted from the average gray level of the foreground pixels. Whenever this property has a value of 0, no contrast checks are performed.

  Default: 0
  Range: 0 to 256 “Gray Level” or 0 to 100 “Percentage”

- Auto Threshold Enabled — Enables or disables the automatic calculation of a threshold for binarizing the image at both train and run time. When enabled, the calculated threshold is displayed in the Manual Threshold property. When disabled, no calculation is done. The threshold used for binarizing is whatever value is in the Manual

Threshold property. The Edge Energy Threshold and Threshold Adjustment properties are not used when disabled.

Default: Enabled

- Auto Threshold Adjustment — Offsets or biases the dynamically calculated threshold when Auto Threshold Enabled is enabled.

  Default: 0
  Range: -64 to 64

- Manual Threshold — Displays the dynamically calculated threshold when Auto Threshold Enabled is enabled. When Auto Threshold Enabled is disabled, the value of this property is the threshold that is used for binarizing the image.

  Default: 135
  Range: 0 to 255

- Edge Energy Threshold — Defines the pixel value at which a pixel in a Sobel Edge Enhancement is considered to be an edge pixel. This is only used when Auto Threshold Enabled is enabled.

  Default: 10
  Range: 0 to 255

- Character Expansions — Useful when dealing with print from a dot matrix printer or any print that is broken up in segments. The more sparse the print, the higher the value of this property should be. This allows for the broken print to become solid by expanding the segments until they come together. Dilations expand each segment. Then, erosions decrease the size of the character in every direction except the direction in which the segments have connected. Dilations and erosions work together to make the segments solid without making the character fatter.

  Default: 0
  Range: 0 to 9

- Filter Bright Defects — When enabled, runtime inspection of the symbol includes a pre-processing step for filtering out any bright defects in the image.

  Default: Disabled

- Bright Defect % Range — The value is a percentage that determines the threshold at which the bright defect filter processes. The threshold is calculated by taking this percentage of the range between the binarizing threshold and 255. This means that the binary threshold would be used when Filter Bright Defects is enabled.

  Default: 0
  Range: 0 to 100

- Output Mask Type — Used in conjunction with the DynamicMask step. The selections are:
  - None — Adds nothing to the mask.
  - Mask Template (default) — Only the foreground area of the symbol is added to the mask.
  - Mask ROI — The entire area within the symbol's ROI is added to the mask.
- Apply to All FontSymbols — Sets the properties of all symbols in the OCVFont to the values currently shown on the page.
- Apply to Default Symbol — Sets the properties of the default symbol of the OCVFont to the values currently shown on the page.

The factory default settings work well for most applications. When adjustments to Pass/Fail limits are required, the following settings should be modified first:

- Final Residue Limit
- Maximum Flaw Size

Increasing Final Residue to 20% allows more variations to be accepted. Changing the Final Residue % has a gradual effect on Pass/Fail. Using a high Final Residue %, such as 50%, on small characters such as - can reduce false rejects.

Increasing the Maximum Flaw Size has a pronounced effect on Pass/Fail. Increasing Maximum Flaw Size allows more character variations to be acceptable. For many applications, this value should not be set greater than 2.

AutoFind

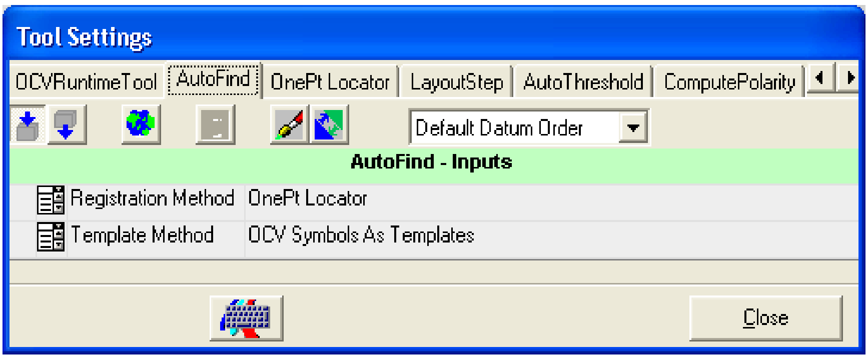
An AutoFind can optionally be used by any of the OCV Tools. This step determines the location of the layout at runtime. An AutoFind can be set up to use 1-Pin (no rotation) or 2-Pins (rotation). The Pins can be set up by selecting which layout positions to use on the OCV Tool properties page.

Training

The AutoFind pin(s) get trained automatically when the OCV Tool is trained. When all characters have been located in the FOV during OCV Tool training, the AutoFind Pin1 Index and AutoFind Pin2 Index properties of the OCV Tool select which characters to use as the find pins. These characters are trained as templates for the pins.

The AutoFindSearchArea box sets up the search regions of the find pins. This box can be moved and sized anywhere in the image, independently of the OCV Tool box. The size of the individual pin search areas is determined by comparing the OCV Tool box to the AutoFindSearchArea box. The position of the individual search areas is determined by the position of the AutoFindSearchArea box.

FIGURE 5–25. **AutoFind Properties Page**



- Registration Method — Selects between a 1-Pin Find and a 2-Pin Find.

  Default: 2-Pin (OCVFontlessTool)
  1-Pin (OCVFontTool and OCVRuntimeTool)

When set to 1-Pin, the locator will not handle any rotation of the characters being inspected. Switching between the registration methods requires
re-training the OCV Tool so that the appropriate templates can be set up.

- Template Method — Sets the method for training the templates used by the Autofind. When set to “OCV Symbols As Templates”, the Autofind uses symbol positions from the OCV tool's trained layout to automatically train templates for the locator. When set to “User Defined Templates”, the user must manually position and size the locator template and search boxes.

  Default: OCV Symbols As Templates

OCVFontTool

An OCVFontTool uses an OCVFont to learn the layout, and determine which characters from the OCVFont are in which locations in the ROI. Once the layout is learned, the OCVFontTool expects to find these symbols at the same locations in the ROI during inspection. It uses the data from the FontSymbols in the OCVFont to verify the quality and correctness of the characters being inspected.

Training

Training of the OCVFontTool involves placing and sizing the OCVFontTool box around the area containing the symbols to be inspected. When Train is clicked, the ROI is scanned for symbol candidates. Symbol candidates are determined by searching for each symbol that is in the selected OCVFont, chosen through the LayoutStep.

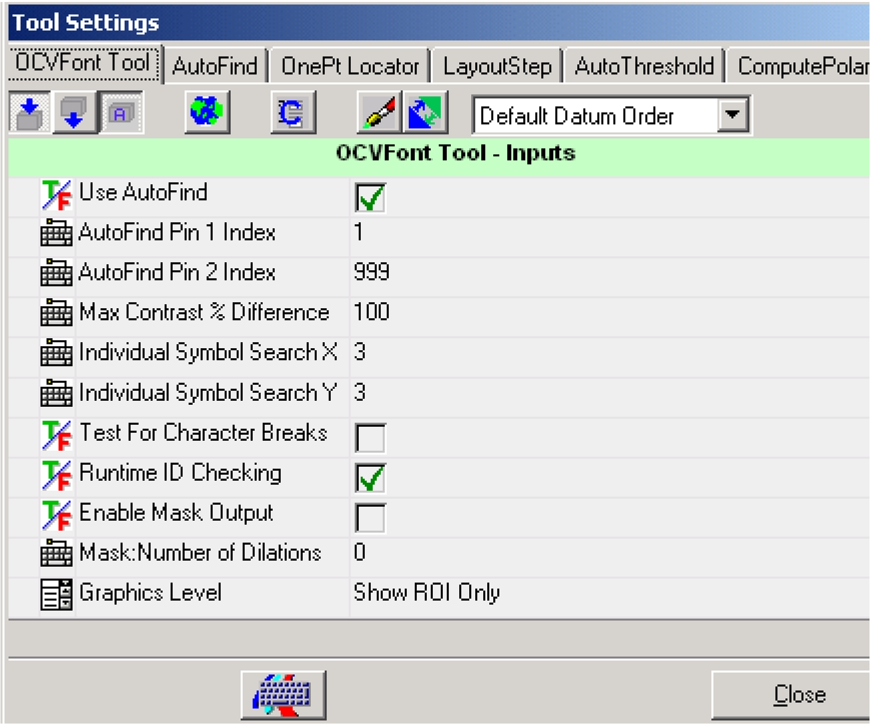
Then, the OCVFontTool box is reset based on the bounding rectangle of all symbols found and the values of the search extra properties. The AutoFind is trained automatically whenever the OCVFontTool is trained. When the AutoFind Search Area Box is moved and/or sized, it is automatically re-trained, without requiring re-training of the OCVFontTool.

Inspection

If AutoFind is enabled, the pins are located and the OCVFontTool box is re-positioned based on the pin locations. Each symbol found during training is expected to be at the same location within the OCVFontTool box at runtime. For each symbol position, there are several ways that an inspection can fail:

- The symbol cannot be located.
- The symbol can fail because the sharpness value is out of tolerance.
- The symbol can fail because the contrast value is out of tolerance.
- The symbol can fail because a break larger than the user-specified size appears in the character.
- The symbol failed an ID Test. It could not be determined that the correct symbol was present.
- The symbol can fail the initial residue check.
- The symbol can fail the final residue check, either or both methods. This residue analysis allows for detection of the following:
  - Symbol has become thicker or thinner
  - Symbol has holes or missing features
  - Symbol holes are filled in
  - Symbol contains additional or stray markings

FIGURE 5–26. **OCVFont Tool Properties Page**



The following are properties of the OCVFontTool:

- Use AutoFind — Enables and disables the locator. Switching between enabled and disabled requires re-training the OCV Tool so that the appropriate templates can be set up.

  Default: Enabled

- AutoFind Pin 1 Index — Allows selection of the symbol position that trains the templates for AutoFind Pin 1. When this property is set to a value less than or equal to 1, the first symbol position is used. When this property is set to a value greater than or equal to the number of trained symbols, the last symbol position is used.

  Default: 1, meaning use the first symbol
  Range: 1 to n, where n is greater than or equal to the number of trained symbols

- AutoFind Pin 2 Index — Allows selection of the symbol position that trains the templates for AutoFind Pin 2 (when the AutoFind is set up as a 2PinFind). When this property is set to a value less than or equal to 1, the first symbol position is used. When this property is set to a value greater than or equal to the number of trained symbols, the last symbol position is used.

  Default: 999 (use the last symbol)
  Range: 1 to n, where n is greater than or equal to the number of trained symbols

- Max Contrast % Difference — Sets the maximum percentage difference between the calculated contrast values for symbols being inspected by the tool. When set to 100%, any contrast difference is acceptable. If no contrast calculations are performed for the inspected symbols, the calculated percent difference is 0. Otherwise, the smallest contrast from the inspected symbols is divided by the largest contrast from the inspected symbols. This value is then subtracted from 1 to get the percentage difference. If the calculated the difference is larger than the value of “Max Contrast % Difference”, the inspection fails.

  Default: 100%
  Range: 0 to 100%

- Individual Symbol Search X — Determines the width of the search area for individual symbols. This number is doubled and added to the symbol width to get the search width.

  Default: 3 pixels
  Range: 0 to 50 pixels

- Individual Symbol Search Y — Determines the height of the search area for individual symbols. This number is doubled and added to the symbol height to get the search height.

  Default: 3 pixels
  Range: 0 to 50 pixels

- Test For Character Breaks — Enables and disables the checks for character break appearance flaws.

  Default: Disabled

- Runtime ID Checking — Enables and disables the tests that determine if the correct symbol is present at runtime.

  During training of an OCVFont, the FontSymbols that are added are checked against each other to determine how similar they are. When FontSymbols are found to be very similar, tests for determining the presence of the correct symbol are set up and stored with the FontSymbols. These tests are only performed at runtime when Runtime ID Checking is enabled.

  Default: Enabled

- Enable Mask Output — Enables and disables the creation and output of a mask at runtime. This property is used in conjunction with the DynamMask Tool to allow the printed characters to be excluded (masked out) from other image processing. Enabling this property increases inspection time.

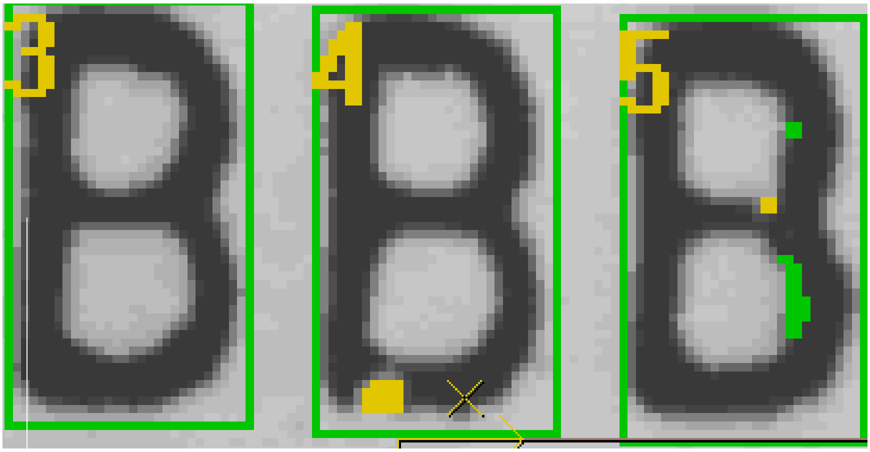
  Default: Disabled

- Mask: Number of Dilations — Sets the number of expansions that are performed on the output mask. This property is used in conjunction with the DynamMask Tool to allow the printed characters to be excluded (masked out) from other image processing.

  Default: 1

- Graphics Level — Sets up different levels of debug graphics at runtime. The default Show ROI Only will only show the ROI boxes associated with the OCVFontTool and the characters being inspected (green for passed, red for failed). When set to Show None, no graphics are shown at runtime. When set to Show Basic Graphics, a number indicating the symbol's position in the layout is shown, along with the ROI boxes.

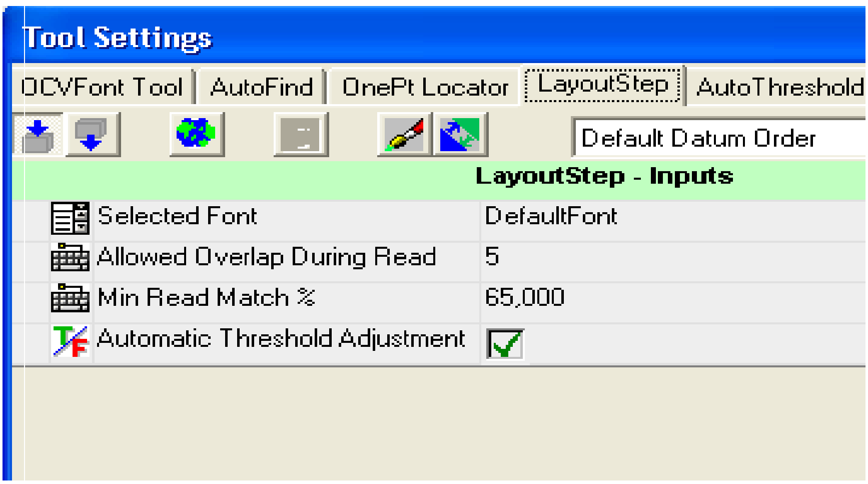
FIGURE 5–27. Graphics Level — Example



When set to Show Details, residue graphics are displayed: green pixels are those that were not there at train time but are in the image at runtime (fills), while yellow pixels are those that were there at train time but are not there at runtime (voids).

The LayoutStep for the OCVFont Tool selects an OCVFont and sets up the learn layout process.

FIGURE 5–28. LayoutStep Properties Page



- Selected Font — Allows selection of an OCVFont to use for training and inspections. This property is a drop-down list containing the names of all OCVFonts that are in the Vscape\Jobs\Fonts folder.
- Allowed Overlap During Read — Used during the learn layout process. The value of this property specifies the amount of symbol candidate ROI overlap that is allowed. When symbol candidates overlap more than the allowed value, tests are performed to determine the best candidate at the overlap position. The other candidate will not become part of the layout. This overlap measurement is in pixels.

  Default: 5 pixels
  Range: 0 to 15 pixels
- Min Read Match % — Is a correlation percentage used as a minimum requirement for a symbol to be considered a candidate during the learn layout process.

  Default: 65%
  Range: 0% to 100%

  Note: When characters are not being read during Learn Layout, decrease this property to 60%. Avoid settings below 55%.
- Automatic Threshold Adjustment — Enables and disables the automatic threshold adjustment feature. When enabled, the best match location during the learn layout process calculates an adjustment to the threshold used to create binary images at runtime. This calculated value is set in the Threshold Adjustment property (AutoThreshold tab).

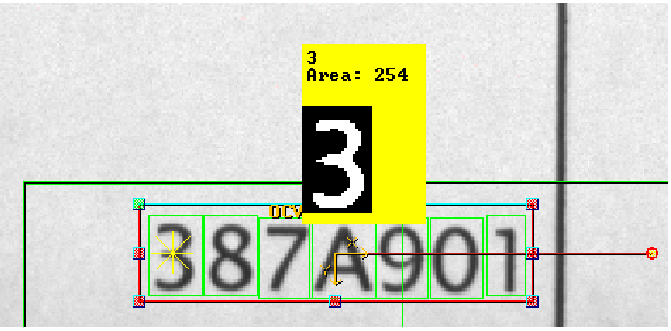
  The AutoThreshold tab of the OCVFontTool belongs to the LayoutStep and is used only at runtime. The only property used is Threshold Adjustment, which serves as a global adjustment for all FontSymbols being inspected. FontSymbols may still make individual adjustments to the thresholds using their own Auto Threshold Adjustment properties.

  The ComputePolarity step of the OCVFontTool belongs to the LayoutStep. It is not used by an OCVFontTool.

Step Tip

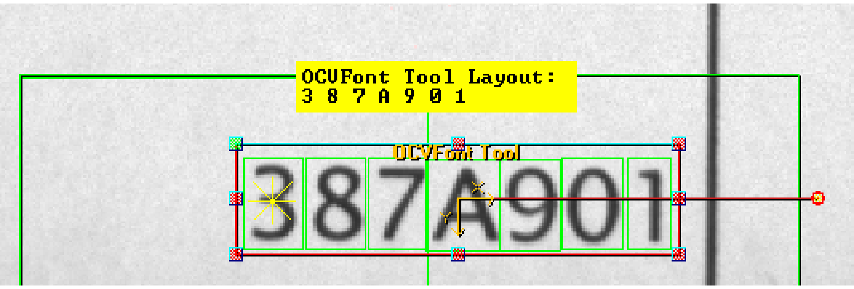
After the OCVFont Tool has been trained, positioning the mouse over the ROI displays a Step Tip. This Step Tip provides information and graphical feedback for individual symbols when the mouse is over a symbol area. Train information includes the Area of the symbol, the number of On pixels in the binary template, and a bitmap representation of the binary template, as shown in Figure 5–29.

FIGURE 5–29. **Step Tip — Example 1**



When the mouse is not positioned over a particular symbol area, the Step Tip displays the currently trained Layout Characters, or just the name of the OCVFont Tool when it is not trained, as shown in Figure 5–30.

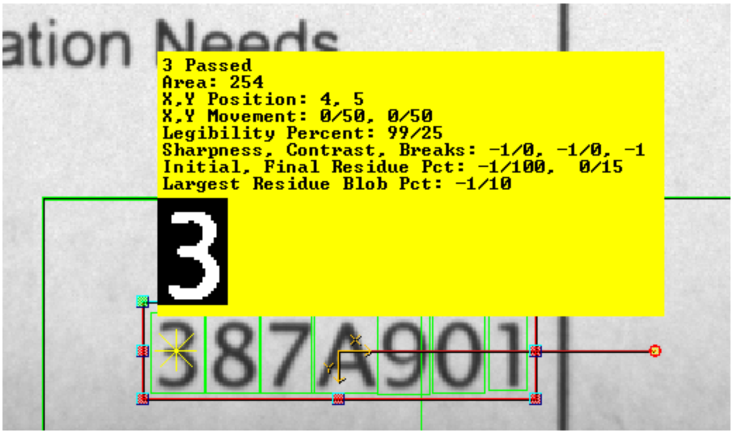
FIGURE 5–30. **Step Tip — Example 2**



When the OCVFont Tool has been run doing a Tryout, additional runtime information is available by holding down the Shift key when the mouse is positioned over the symbol area, as shown in Figure 5–31.

5
OCV Reference

FIGURE 5–31. **Step Tip — Example 3**



Inspection information includes:

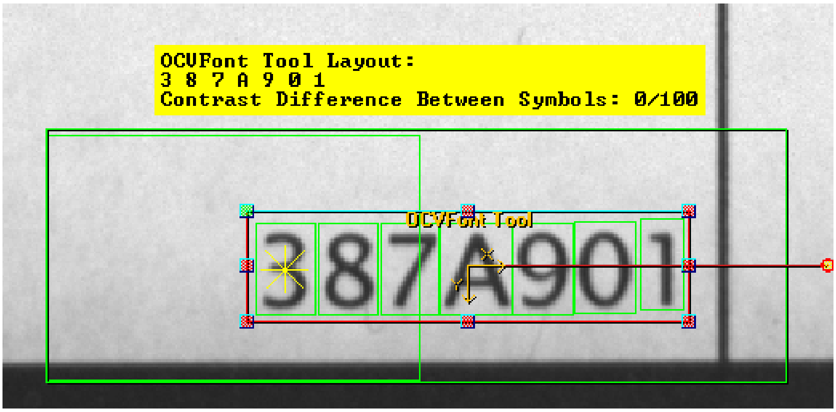
- The Area of the symbol (the number of On pixels in the trained binary template)
- The X and Y position (upper left corner) of the symbol relative to the OCVFontTool shape
- The X and Y allowed movement of the symbol
- The Legibility Percentage and the Legibility Tolerance
- The Sharpness, Contrast and number of Breaks found along with the associated tolerances
- The Initial and Final Residue percentages along with the associated tolerances
- The Largest (Final) Residue Blob Percentage and its associated tolerance

Note: A -1 for any value above, except the X and Y allowed movement, indicates the test is disabled.

- The bitmap representation of the binary runtime symbol area

When the OCVFont Tool has been run doing a Tryout, additional runtime information is available by holding down the Shift key and moving the mouse inside the OCVFont Tool ROI (but not over the symbol area), as shown below.

FIGURE 5–32. Step Tip — Example 4



OCVRuntimeTool

An OCVRuntimeTool uses an OCVFont (called the Master Font) to learn the layout, and determine which characters from the OCVFont are in which locations in the ROI. Once the layout is learned, the OCVRuntimeTool creates a new OCVFont (called a Runtime Font) by training a new FontSymbol at each layout position, using the current image data. The OCVRuntimeTool expects to find the symbols at the same locations during inspection. It uses the data from the Runtime Font to verify the quality and correctness of the characters being inspected. Because the train image creates templates, this code should be of good quality.

Training

Training of the OCVRuntimeTool involves placing and sizing the OCVRuntimeTool box around the area containing the symbols to be inspected. When Train is clicked, the ROI is scanned for symbol candidates. Symbol candidates are determined by searching for each symbol that is in the selected Master OCVFont (chosen through the

LayoutStep). When all candidates have been found, a new OCVFont is created and a new symbol is trained and added to this Runtime Font for each candidate position.

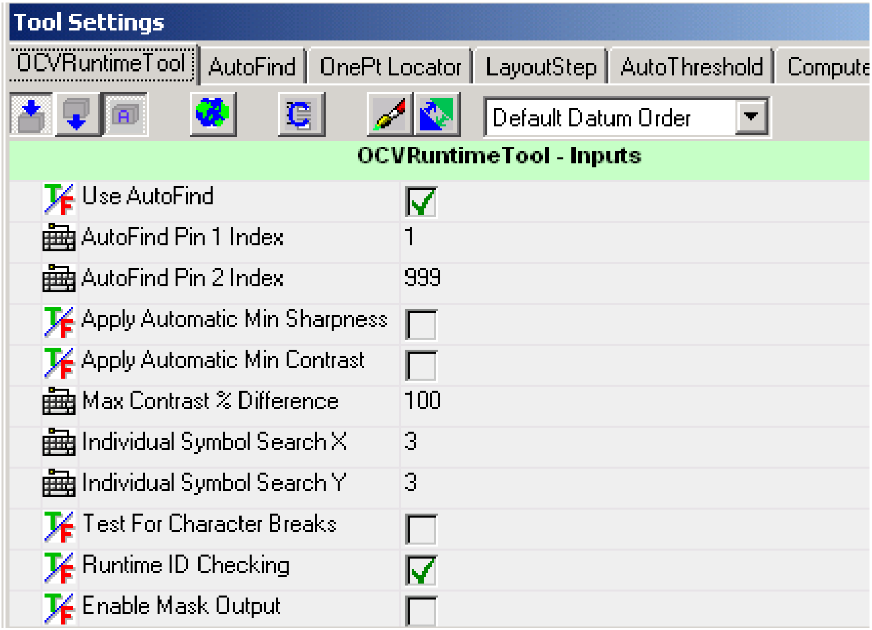
Then, the OCVRuntimeTool box is reset based on the bounding rectangle of all symbols found and the values of the search extra properties. The AutoFind is trained automatically whenever the OCVRuntimeTool is trained. When the AutoFind Search Area Box is moved and/or sized, it is automatically re-trained, without requiring re-training of the OCVRuntimeTool.

Inspection

If AutoFind is enabled, the pins are located and the OCVRuntimeTool box is repositioned based on the pin locations. Each of the symbols found during training is expected to be at the same location within the OCVRuntimeTool box at runtime. For each symbol position, there are several ways that an inspection can fail:

- The symbol cannot be located.
- The symbol can fail because the sharpness value is out of tolerance.
- The symbol can fail because the contrast value is out of tolerance.
- The symbol can fail because a break larger than the user-specified size appears in the character.
- The symbol failed an ID Test. It could not be determined that the correct symbol was present.
- The symbol can fail the initial residue check.
- The symbol can fail the final residue check, either or both methods. This residue analysis allows for detection of the following:
  - Symbol has become thicker or thinner
  - Symbol has holes or missing features
  - Symbol holes are filled in
  - Symbol contains additional or stray markings

FIGURE 5–33. OCVRuntimeTool Properties Page



The following are properties of the OCVRuntimeTool:

- Use AutoFind — Enables and disables the locator. Switching between enabled and disabled requires re-training the OCV Tool so that the appropriate templates can be set up.

  Default: Enabled

- AutoFind Pin 1 Index — Allows selection of the symbol position that trains the templates for AutoFind Pin 1. When set to a value less than or equal to 1, the first symbol position is used. When set to a value greater than or equal to the number of trained symbols, the last symbol position is used.

  Default: 1 (use the first symbol)
  Range: 1 to n, where n is greater than or equal to the number of trained symbols

- AutoFind Pin 2 Index — Allows selection of the symbol position that trains the templates for AutoFind Pin 2 (when the AutoFind is set up as a 2PinFind). When set to a value less than or equal to 1, the first symbol position is used. When set to a value greater than or equal to the number of trained symbols, the last symbol position is used.

Default: 999 (use the last symbol)
Range: 1 to n, where n is greater than or equal to the number of trained symbols

- Apply Automatic Min Sharpness — Allows the FontSymbols trained and added to the Runtime Font to have a sharpness tolerance automatically calculated for them. This automatically calculated tolerance is equal to 65% of the sharpness value calculated using the trained template.

  Default: Disabled

- Apply Automatic Min Contrast — Allows the FontSymbols trained and added to the Runtime Font to have a contrast tolerance automatically calculated for them. This automatically calculated tolerance is equal to 50% of the contrast value calculated using the trained template.

  Default: Disabled

- Max Contrast % Difference — Sets the maximum percentage difference between the calculated contrast values for symbols being inspected by the tool. When set to 100%, any contrast difference is acceptable. If no contrast calculations are performed for the inspected symbols, the calculated percent difference is 0. Otherwise, the smallest contrast from the inspected symbols is divided by the largest contrast from the inspected symbols. This value is then subtracted from 1 to get the percentage difference. If the calculated difference is larger than the value of Max Contrast % Difference, the inspection fails.

  Default: 100%
  Range: 0 to 100%

- Individual Symbol Search X — Determines the width of the search area for individual symbols. This number is doubled and added to the symbol width to get the search width.

  Default: 3 pixels
  Range: 0 to 50 pixels

- Individual Symbol Search Y — Determines the height of the search area for individual symbols. This number is doubled and added to the symbol height to get the search height.

  Default: 3 pixels
  Range: 0 to 50 pixels

- Test For Character Breaks — Enables and disables the checks for character break appearance flaws.

  Default: Disabled

- Runtime ID Checking — Enables and disables the tests that determine if the correct symbol is present at runtime. During training of an OCVFont, the FontSymbols that are added are checked against each other to determine how similar they are. When FontSymbols are found to be very similar, tests for determining the presence of the correct symbol are set up and stored with the FontSymbols. These tests are only performed at runtime when Runtime ID Checking is enabled.

  Note: Microscan highly recommends that you do not use Automatic Segmentation, that is, leave its setting in its default position of off, and carefully use symbol boxes of equal size for all special characters like O, 0, B, 8, D, and so on.

  Default: Enabled

- Enable Mask Output — Enables and disables the creation and output of a mask at runtime. This property is used in conjunction with the DynamMask Tool to allow the printed characters to be excluded (masked out) from other image processing. Enabling this property increases inspection time.

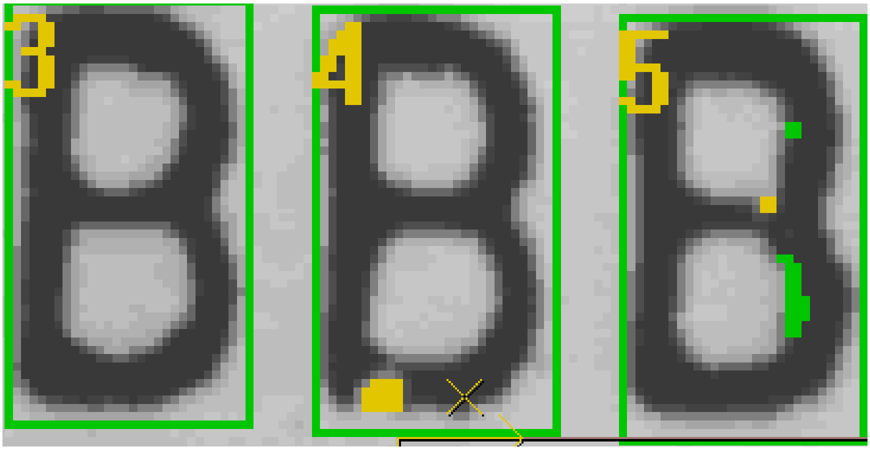
  Default: Disabled

- Mask:Number of Dilations — Sets the number of expansions that are performed on the output mask. This property is used in conjunction with the DynamMask Tool to allow the printed characters to be excluded (masked out) from other image processing.

  Default: 1

- Graphics Level — Sets up different levels of debug graphics at runtime. The default Show ROI Only will only show the ROI boxes associated with the OCVRuntimeTool and the characters being inspected (green for passed, red for failed). When set to Show None, no graphics are shown at runtime. When set to Show Basic Graphics, a number indicating the symbol's position in the layout is shown, along with the ROI boxes, as shown in Figure 5–34.

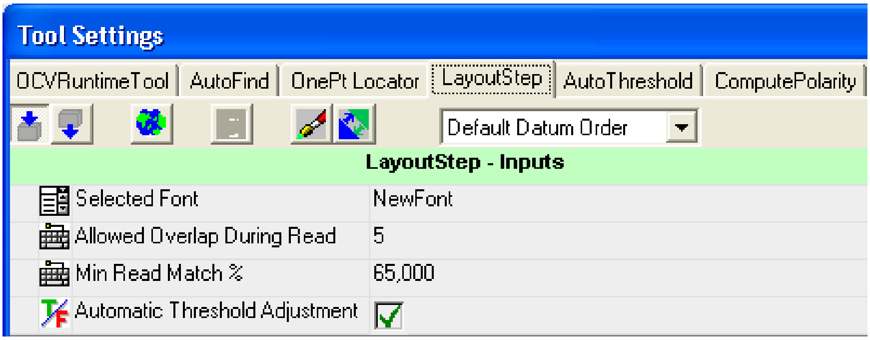
FIGURE 5–34. Graphics Level — Example



When set to Show Details, residue graphics are displayed: green pixels are those that were not there at train time but are in the image at runtime (fills), while yellow pixels are those that were there at train time but are not there at runtime (voids).

The LayoutStep for the OCVRuntimeTool selects a Master OCVFont and set up the learn layout process.

FIGURE 5–35. **LayoutStep Properties Page**



- Selected Font — Allows selection of an OCVFont to use for training and inspections. This property is a drop-down list containing the names of all OCVFonts that are in the Vscape\Jobs\Fonts folder.

- Allowed Overlap During Read — Used during the learn layout process. The value of this property specifies the amount of symbol candidate ROI overlap that is allowed. When symbol candidates overlap more than the allowed value, tests are performed to determine the best candidate at the overlap position. The other candidate will not become part of the layout. This overlap measurement is in pixels.

  Default: 5 pixels
  Range: 0 to 15 pixels

- Min Read Match % — Is a correlation percentage used as a minimum requirement for a symbol to be considered a candidate during the learn layout process.

  Default: 65%
  Range: 0% to 100%

- Automatic Threshold Adjustment — Enables and disables the automatic threshold adjustment feature. When enabled, the best match location during the learn layout process calculates an adjustment to the threshold used to create binary images at runtime. This calculated value is set in the Threshold Adjustment property (AutoThreshold tab).

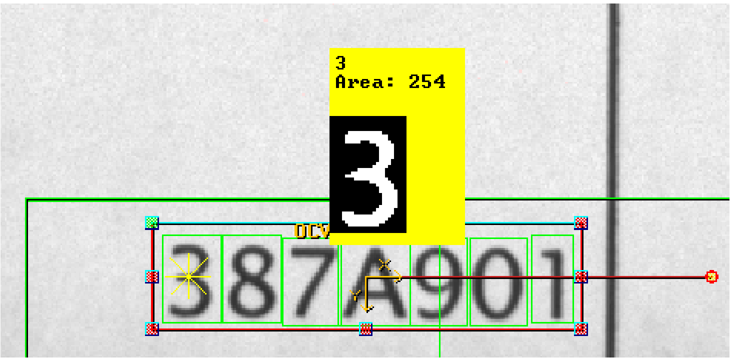
The AutoThreshold tab of the OCVRuntimeTool belongs to the LayoutStep and is used only at runtime. The only property used is the Threshold Adjustment property, which serves as a global adjustment for all FontSymbols being inspected. FontSymbols may still make individual adjustments to the thresholds using their own Auto Threshold Adjustment properties.

The ComputePolarity step of the OCVRuntimeTool belongs to the LayoutStep. It is not used by an OCVFontTool.

Step Tips

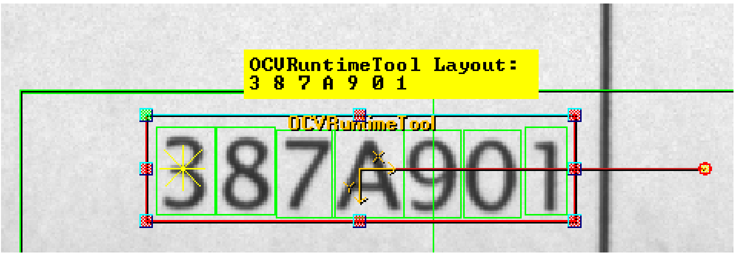
After the OCVRuntimeTool has been trained, positioning the mouse over the ROI displays a Step Tip. This Step Tip provides information and graphical feedback for individual symbols when the mouse is over a symbol area. Train information includes the Area of the symbol, the number of On pixels in the binary template, and a bitmap representation of the binary template, as shown in Figure 5–36.

FIGURE 5–36. **Step Tip — Example 1**



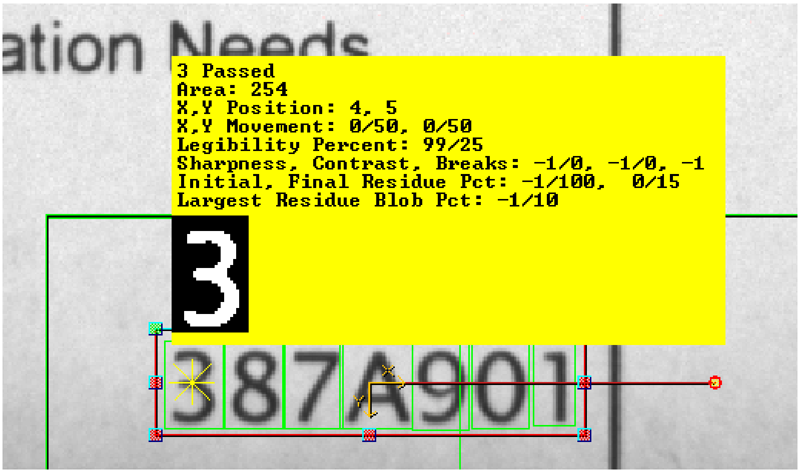
When the mouse is not positioned over a particular symbol area, the Step Tip displays the currently trained Layout Characters, or just the name of the OCVRuntime Tool when it is not trained, as shown in Figure 5–37.

FIGURE 5–37. **Step Tip — Example 2**



When the OCVRuntimeTool has been run using Tryout, additional runtime information is available by holding down the Shift key when the mouse is positioned over the symbol area, as shown in Figure 5–38.

FIGURE 5–38. **Step Tip — Example 3**



Inspection information includes:

- The Area of the symbol, the number of On pixels in the trained binary template
- The X and Y position, upper left corner, of the symbol relative to the OCVRuntimeTool shape
- The X and Y allowed movement of the symbol
- The Legibility Percentage and the Legibility Tolerance

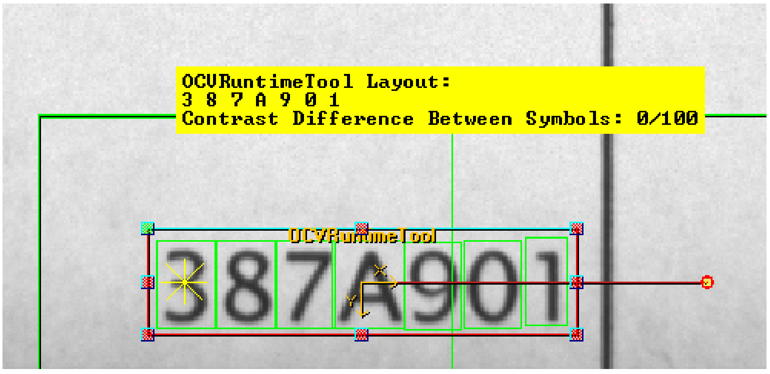
- The Sharpness, Contrast and number of Breaks found along with the associated tolerances
- The Initial and Final Residue percentages along with the associated tolerances
- The Largest (Final) Residue Blob Percentage and its associated tolerance

Note: A -1 for any value above, except the X and Y allowed movement, indicates the test is disabled.

- The bitmap representation of the binary runtime symbol area

When the OCVRuntime Tool has been run doing a Tryout, additional runtime information is available by holding down the Shift key and moving the mouse inside the OCVRuntime Tool ROI (but not over the symbols), as shown in Figure 5–39.

FIGURE 5–39. **Step Tip — Example 4**



OCVFontless Tool

An OCVFontless Tool does not require an OCVFont. Instead, it determines the location of characters in the FOV using a blob-analysis technique. Then, it stores training data for each character location as an OCVSymbolStep. The OCVFontless Tool expects to find the symbols at the same locations during inspection. It uses the trained data to verify the quality of the characters being inspected.

Training

Training the OCVFontless Tool involves placing and sizing the OCVFontless Tool box around the area containing the symbols to be inspected. When Train is clicked, the ROI is scanned for symbol candidates. A symbol candidate is a group of connected pixels that have foreground polarity. Each symbol candidate that contains enough pixels, as defined by the Min Symbol Size in pixels parameter, is trained and stored as an OCVSymbolStep.

Then, the OCVFontless Tool box is reset based on the bounding rectangle of all symbols found and the values of the search extra properties. The AutoFind is trained automatically whenever the OCVFontless Tool is trained. When the AutoFind Search Area Box is moved and/or sized, it is automatically re-trained, without requiring re-training of the OCVFontless Tool.

Inspection

When AutoFind is enabled, the pins are located and the OCVFontless Tool box is re-positioned based on the pin locations. Each symbol found during training is expected to be at the same location within the OCVFontless Tool box at runtime. For each symbol position, there are several ways that an inspection can fail:

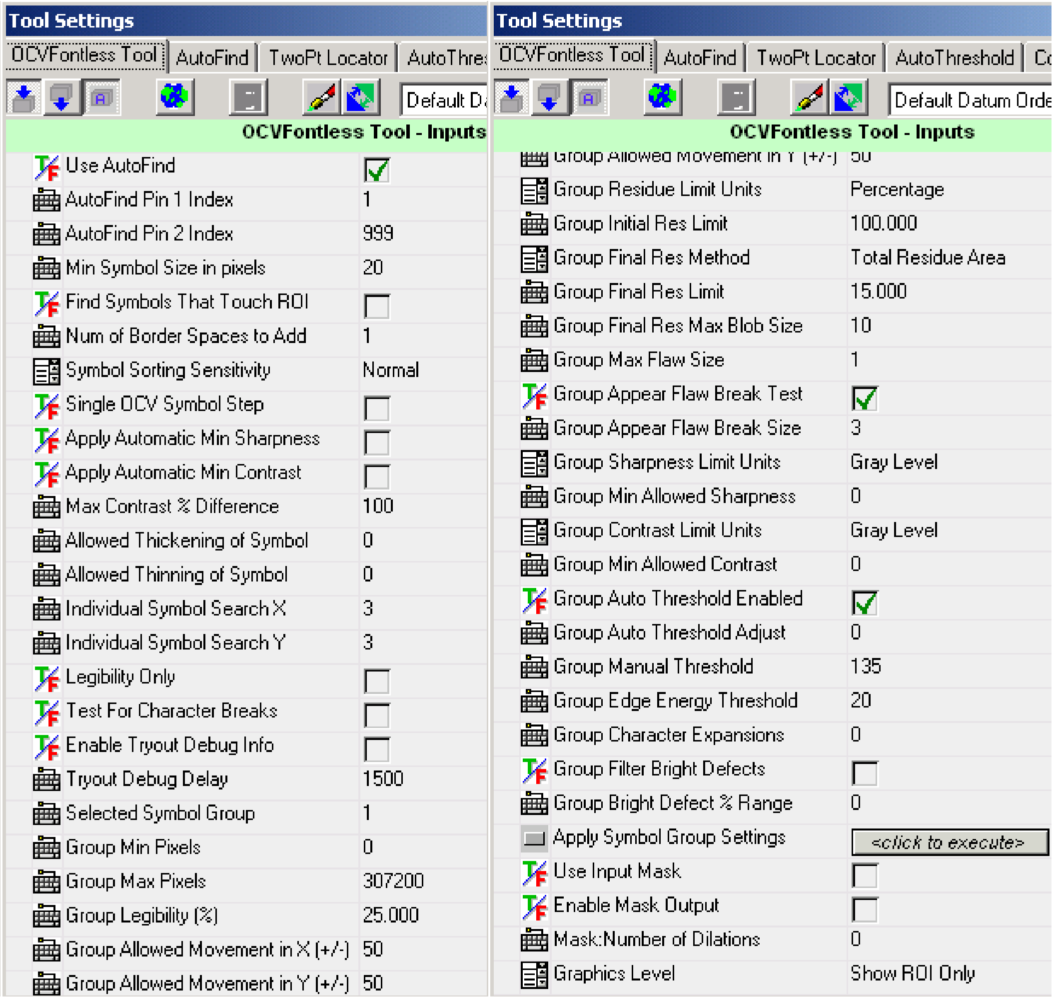
- The symbol cannot be located.
- The symbol can fail because the sharpness value is out of tolerance.
- The symbol can fail because the contrast value is out of tolerance.
- The symbol can fail because a break larger than the user-specified size appears in the character.
- The symbol can fail the initial residue check.
- The symbol can fail the final residue check, either or both methods. This residue analysis allows for detection of the following:
  – Symbol has become thicker or thinner

– Symbol has holes or missing features

– Symbol holes are filled in

– Symbol contains additional or stray markings

FIGURE 5–40. OCVFontless Tool Properties Page



- Use AutoFind — Enables and disables the locator. Switching between enabled and disabled requires re-training the OCV Tool so that the appropriate templates can be set up.

Default: Enabled

- AutoFind Pin 1 Index — Allows selection of the symbol position that trains the templates for AutoFind Pin 1. When set to a value less than or equal to 1, the first symbol position is used. When set to a value greater than or equal to the number of trained symbols, the last symbol position is used.

  Default: 1, meaning use the first symbol
  Range: 1 to n, where n is greater than or equal to the number of trained symbols

- AutoFind Pin 2 Index — Allows selection of the symbol position that trains the templates for AutoFind Pin 2, when the AutoFind is set up as a 2PinFind. When set to a value less than or equal to 1, the first symbol position is used. When set to a value greater than or equal to the number of trained symbols, the last symbol position is used.

  Default: 999, meaning use the last symbol
  Range: 1 to n, where n is greater than or equal to the number of trained symbols

- Min Symbol Size in pixels — Adjusts the minimum size that a blob must be in order to be considered a symbol.

  Default: 20 pixels
  Range: 5 to 256 pixels

- Find Symbols That Touch ROI — When enabled, symbols are trained for blobs that are not fully within the ROI. When disabled, blobs that are not fully within the ROI are ignored.

  Default: Disabled

- Num of Border Spaces to Add — Determines how many pixels to allow between actual character pixels and the edge of the box that defines the OCVSymbolStep.

  Default: 1 pixels
  Range: 0 to 19 pixels

- Symbol Sorting Sensitivity — Adjusts the sensitivity of the sorting of symbols into rows during training. The sorting is based on the positions of the symbols.

TABLE 5–2. Sorting Sensitivity

Level	What It Means
Highest	The allowed separation is decreased to 10% of the average height.
High	The allowed separation is decreased to 25% of the average height.
Normal (Default)	Any two symbols whose top Y positions are separated by more than 50 percent of the average height of all trained symbols will be considered to be on separate rows.
Low	The allowed separation is increased to 75% of the average height.
Lowest	The allowed separation is increased to 90% of the average height.

- Single OCV Symbol Step — When enabled, the OCVFontlessTool trains a single OCVSymbolStep that includes all the symbols of the mark that are within the mark area box. When disabled, the OCVFontlessTool trains an OCVSymbolStep for each symbol of the mark that is located within the mark area box.

  Default: Disabled

- Apply Automatic Min Sharpness — Allows the OCVSymbolSteps trained to have a sharpness tolerance automatically calculated for them. This automatically calculated tolerance is equal to 65% of the sharpness value calculated using the trained template.

  Default: Disabled

- Apply Automatic Min Contrast — Allows the OCVSymbolSteps trained to have a contrast tolerance automatically calculated for them. This automatically calculated tolerance is equal to 50% of the contrast value calculated using the trained template.

  Default: Disabled

- Max Contrast % Difference — Sets the maximum percentage difference between the calculated contrast values for symbols being inspected by the tool. When set to 100%, any contrast difference is acceptable. If no contrast calculations are performed for the inspected symbols, the calculated percent difference is 0. Otherwise,

5

OCV Reference

the smallest contrast from the inspected symbols is divided by the largest contrast from the inspected symbols. This value is then subtracted from 1 to get the percentage difference. If the calculated the difference is larger than the value of Max Contrast % Difference, the inspection fails.

Default: 100%
Range: 0 to 100%

- Allowed Thickening of Symbol — Determines the number of pixels that a symbol is allowed to grow along its perimeter. Residue will be ignored if it is found in the region between the edge of the symbol and the set number of pixels away from the edge, in the direction away from the center of the symbol.

  Default: 0 pixels
  Range: 0 to 10 pixels

- Allowed Thinning of Symbol — Determines the number of pixels that a symbol is allowed to shrink along its perimeter. Residue will be ignored if it is found in the region between the edge of the symbol and the set number of pixels away from the edge, in the direction toward the center of the symbol.

  Default: 0 pixels
  Range: 0 to 10 pixels

- Individual Symbol Search X — Determines the width of the search area for individual symbols. This number is doubled and added to the symbol width to get the search width.

  Default: 3 pixels
  Range: 0 to 50 pixels

- Individual Symbol Search Y — Determines the height of the search area for individual symbols. This number is doubled and added to the symbol height to get the search height.

  Default: 3 pixels
  Range: 0 to 50 pixels

- Test For Character Breaks — Enables and disables the checks for character break appearance flaws.

Default: Disabled

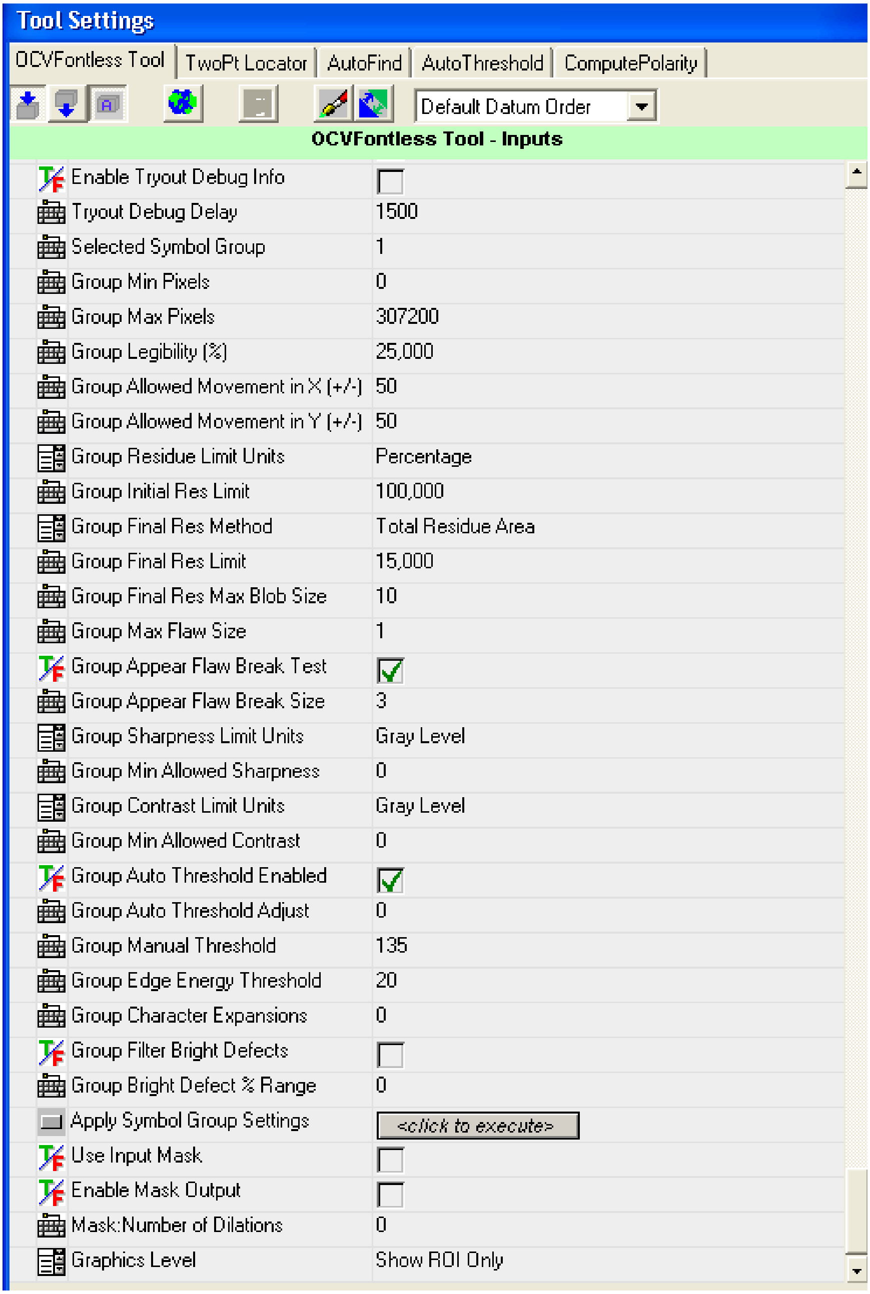
- Enable Tryout Debug Info — Enables and disables the display of debug information during tryout. When enabled, inspection data is displayed on the Output line for each OCVSymbol that is part of the OCVFontlessTool.

  Default: Disabled

- Tryout Debug Delay — Sets a delay that is used during the display of debug information. This delay is the minimum amount of time that the information is displayed.

  Default: 1500 ms

FIGURE 5–41. Symbol Group Settings



- Selected Symbol Group — Selects which symbol group has its symbol properties displayed on the properties page. Changing this value updates the property page to display the correct symbol group properties.

  Symbol groups are defined based on the number of On pixels in the templates of the symbols. The grouping of symbols is accomplished by setting a range of values, Group Min Pixels and Group Max Pixels, for a group. By default, only one symbol group is defined. This group contains all OCVSymbolSteps because the range is automatically set to a minimum of 0 pixels and a maximum of 307200, maximum possible in a 640x480 symbol.

  The groups are defined in order of maximum character pixels, so that group 2's Group Min Pixels property is always equal to group 1's Group Max Pixels property plus one, group 3's Group Min Pixels property is always equal to group 2's Group Max Pixels property plus one, etc. The final group is always defined to have a Group Max Pixels equal to 307200.

  To add a group, change Group Max Pixels of the current group from 307200 to a lower value.

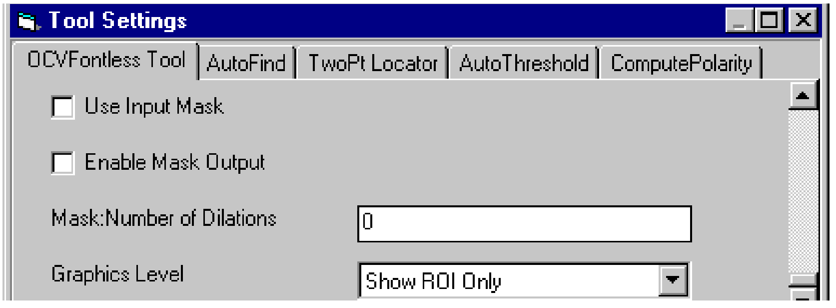
The following properties on the OCVFontlessTool property page can be set on a group basis. Refer to "OCVSymbolStep" on page 5-71 for more information.

- Group Legibility (%)
- Group Allowed Movement in X
- Group Allowed Movement in Y
- Group Residue Limit Units
- Group Initial Res Limit
- Group Final Res Method
- Group Final Res Limit
- Group Final Res Max Blob Size
- Group Max Flaw Size

– Group Appear. Flaw Break Test
– Group Appear. Flaw Break Size
– Group Sharpness Limit Units
– Group Min Allowed Sharpness
– Group Contrast Limit Units
– Group Min Allowed Contrast
– Group Auto Threshold Enabled
– Group Auto Threshold Adjust
– Group Manual Threshold
– Group Edge Energy Threshold
– Group Character Expansions
– Group Filter Bright Defects
– Group Bright Defect % Range

- Apply Symbol Group Settings — Sets the group parameters for the currently selected group to the current values in the group properties.

FIGURE 5–42. **Mask Settings**



- Use Input Mask — This property is applicable only when the OCVFontlessTool has a child step that produces a mask buffer as an output. When such a child step is inserted into the OCVFontlessTool, Use Input Mask is automatically enabled. When enabled, the

OCVFontlessTool must be trained. After it is trained, the mask pixels are highlighted in red. When disabled, this property will allow the OCVFontlessTool to retain the child mask-generating step but does not apply the mask at runtime.

Default: Disabled

- Enable Mask Output — Enables and disables the creation and output of a mask at runtime. This property is used in conjunction with the DynamMask Tool to allow the printed characters to be excluded, masked out, from other image processing.

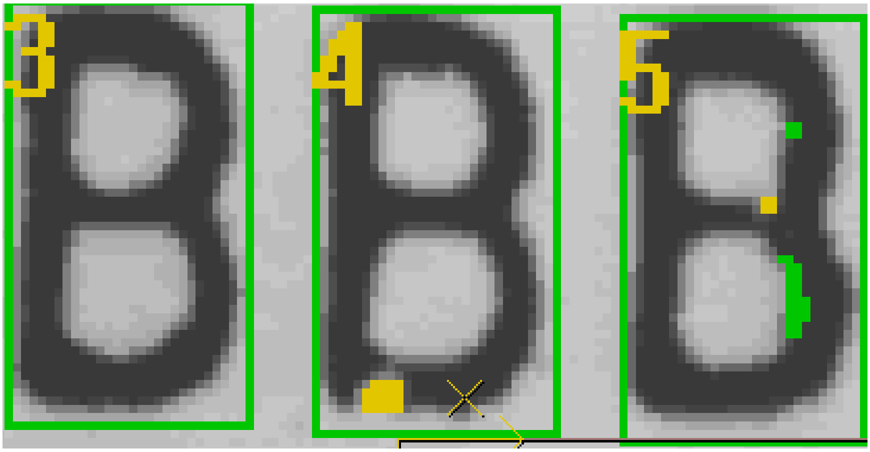
  Default: Disabled

- Mask:Number of Dilations — Sets the number of expansions that are performed on the output mask. This property is used in conjunction with the DynamMask Tool to allow the printed characters to be excluded, masked out, from other image processing.

  Default: Disabled

- Graphics Level — Sets up different levels of debug graphics at runtime. The default Show ROI Only only shows the ROI boxes associated with the OCVFontlessTool and the characters being inspected, green for passed, red for failed. When set to Show None, no graphics are shown at runtime. When set to Show Basic Graphics, a number indicating the symbol's position in the layout is shown, along with the ROI boxes, as shown in Figure 5–43.

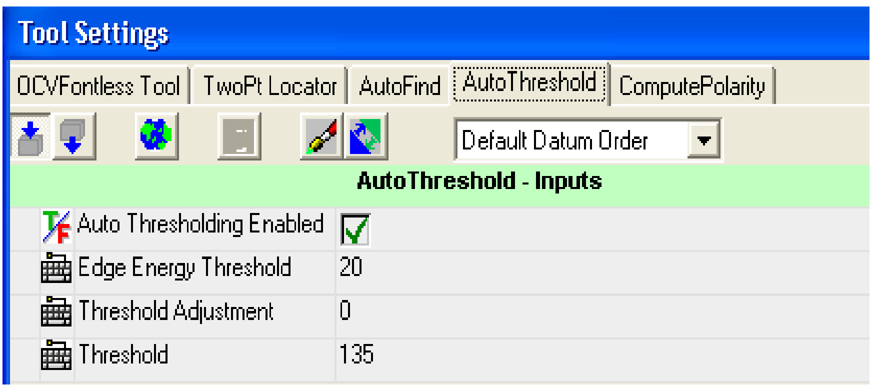
FIGURE 5–43. **Graphics Level — Example**



When set to Show Details, residue graphics are displayed: green pixels are those that were not there at train time but are in the image at runtime (fills), while yellow pixels are those that were there at train time but are not there at runtime (voids). Show Details also displays the blob outline of the characters at train time.

The AutoThreshold properties page of the OCVFontlessTool is used for segmentation of the image during training, as shown in Figure 5–44.

FIGURE 5–44. **AutoThreshold Properties Page**



- Auto Thresholding Enabled — Enables and disables the automatic thresholding. When enabled, a threshold is calculated using the ROI of the step. This calculation uses edge detection to determine foreground and background information. The calculated threshold is displayed in Threshold. Although it is called AutoThreshold, the Auto portion can be disabled. When disabled, no calculation is done. The threshold used by the parent step is whatever value is in the Threshold property. The Edge Energy Threshold and Threshold Adjustment properties are not used when Auto is disabled.

Default: Enabled

- Edge Energy Threshold — Defines the pixel value at which a pixel in a Sobel Edge Enhancement is considered to be an edge pixel. This property is only used when Auto Thresholding Enabled is enabled.

  Default: 10
  Range: 0 to 255

- Threshold Adjustment — Offsets or biases the dynamically calculated threshold, when Auto is enabled.

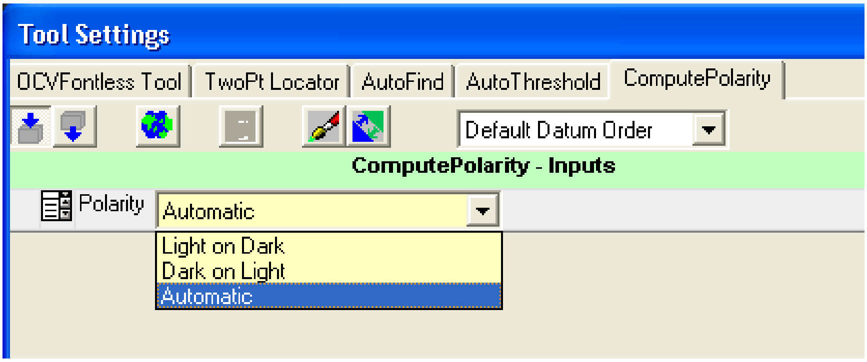
  Default: 0
  Range: -64 to 64

- Threshold — Displays the dynamically calculated threshold when auto is enabled. When auto is disabled, the value of this property is the threshold that is used by the parent step.

  Default: 135
  Range: 0 to 255

The ComputePolarity step of the OCVFontlessTool is used for automatic segmentation of the image during training.

FIGURE 5–45. **ComputePolarity Properties Page**



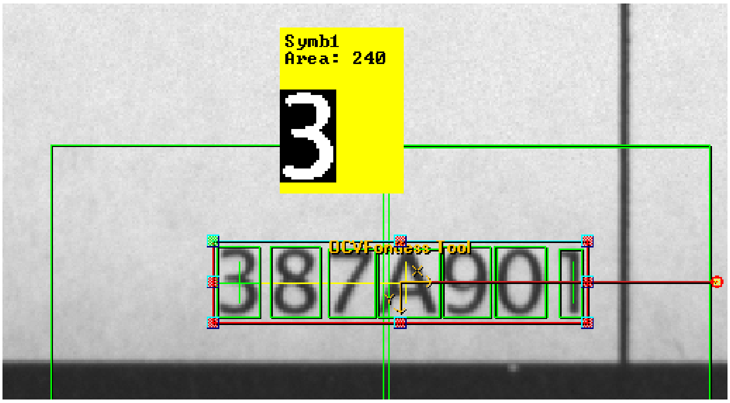
- Polarity — Allows the step to be set up to always return Light_On_Dark, always return Dark_On_Light, or return an automatically determined polarity.

  Default: Automatic

Step Tips

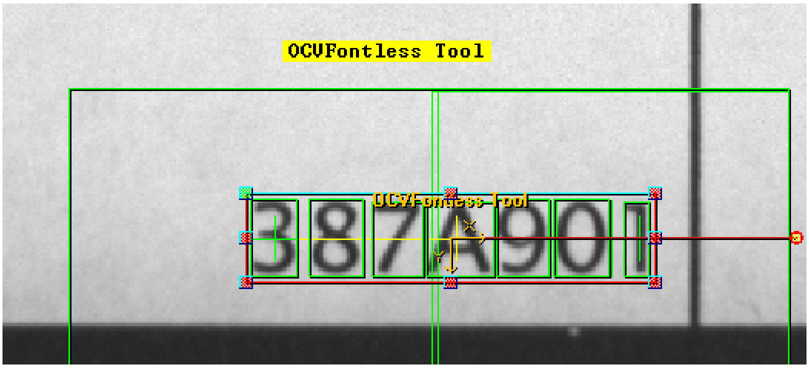
After the OCVFontlessTool has been trained, positioning the mouse over the ROI displays a Step Tip. This Step Tip provides information and graphical feedback for individual symbols when the mouse is over a symbol area. Train information includes the Area of the symbol, the number of On pixels in the binary template, and a bitmap representation of the binary template, as shown in Figure 5–46.

FIGURE 5–46. Step Tip — Example 1



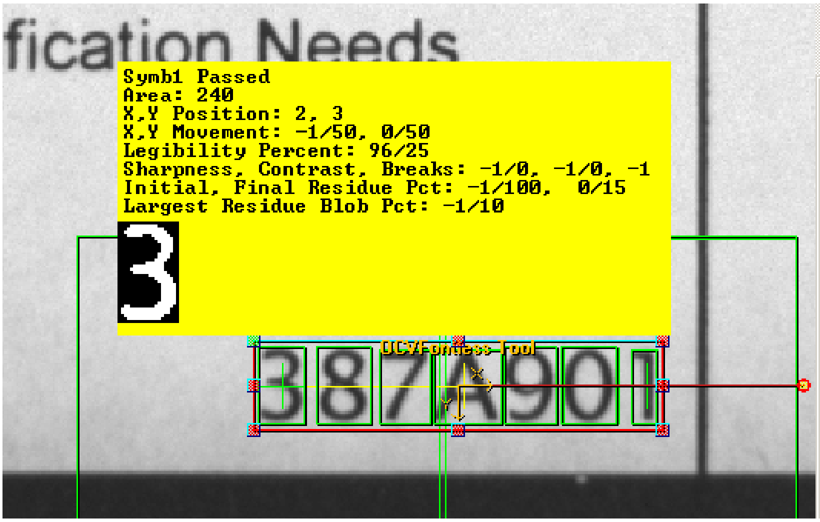
When the mouse is not positioned over a particular symbol area, the Step Tip displays the name of the OCVFontless Tool, as shown in Figure 5–47.

FIGURE 5–47. Step Tip — Example 2



When the OCVFontless Tool has been run, additional runtime information is available by holding down the Shift key when the mouse is positioned over the symbol area, as shown in Figure 5–48.

FIGURE 5–48. **Step Tip — Example 3**



Inspection information includes:

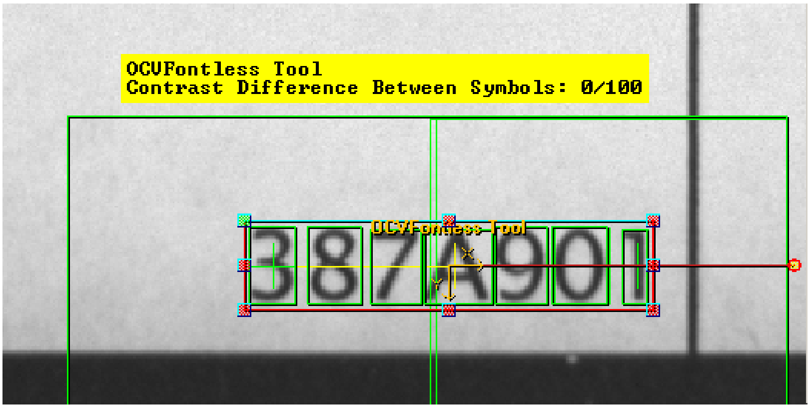
- The Area of the symbol, the number of On pixels in the trained binary template
- The X and Y position, upper left corner, of the symbol relative to the OCVRuntime Tool shape
- The X and Y allowed movement of the symbol
- The Legibility Percentage and the Legibility Tolerance
- The Sharpness, Contrast and number of Breaks found along with the associated tolerances
- The Initial and Final Residue percentages along with the associated tolerances
- The Largest (Final) Residue Blob Percentage and its associated tolerance

Note: A -1 for any value above, except the X and Y allowed movement, indicates the test is disabled.

- The bitmap representation of the binary runtime symbol area

When the OCVFontless Tool has been run doing a Tryout, additional runtime information is available by holding down the Shift key and moving the mouse inside the OCVFontless Tool ROI (but not over the symbols), as shown in Figure 5–49.

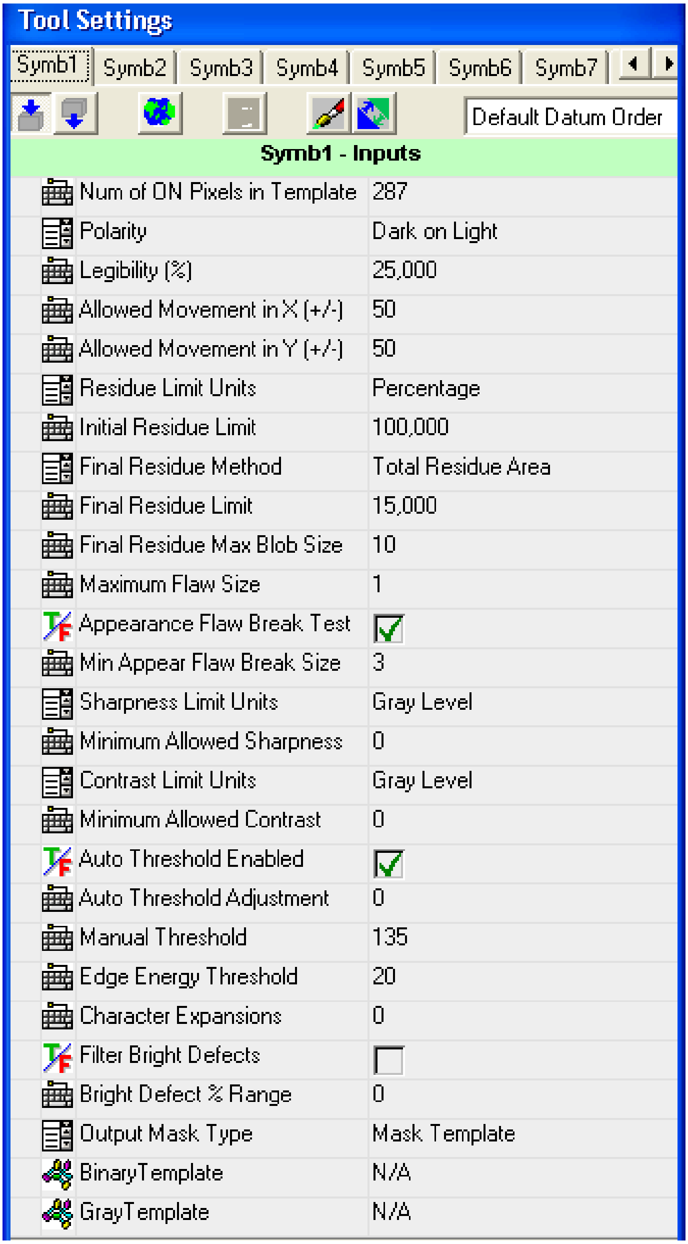
FIGURE 5–49. **Step Tip — Example 4**



OCVSymbolStep

An OCVSymbolStep is a collection of template images, settings and tolerances that inspect a character or logo at runtime. OCVSymbolSteps are created during the training of an OCVFontlessTool. They are used by the OCVFontlessTool to inspect the print at runtime.

FIGURE 5–50. **Symb1 Properties Page**



- Num of ON Pixels in Template — Displays the number of foreground pixels in the trained binary template.
- Polarity — Allows the step to always train with polarity Light_On_Dark, or always train with polarity Dark_On_Light. The default is set by the OCVFontlessTool during training.
- Legibility (%) — Passes/fails the symbol based on this minimum correlation percentage. The symbol will fail inspection when the correlation percentage is less than this value.

  Default: 25%
  Range: 0% to 100%
- Allowed Movement in X (+/-) — Sets the maximum number of pixels that a symbol can move in the X-axis (relative to other symbols) from its trained position.

  Default: 50 pixels (any movement is allowed)
  Range: 0 to 50 pixels. The maximum of 50 pixels comes from the parent OCVTool setting Individual Symbol Search X, which limits the search range in X to a maximum of 50 pixels in either direction.
- Allowed Movement in Y (+/-) — Set the maximum number of pixels that a symbol can move in the Y-axis (relative to other symbols) from its trained position.

  Default: 50 pixels (any movement is allowed)
  Range: 0 to 50 pixels. The maximum of 50 pixels comes from the parent OCVTool setting Individual Symbol Search Y, which limits the search range in Y to a maximum of 50 pixels in either direction.
- Residue Limit Units — Inputs the residue limits in either a maximum pixel count value or a percentage value (percentage value is based on the number of On pixels in the trained template). When the value of this property changes, the values of Initial Residue Limit and Final Residue Limit are changed to match the selected units.

  Default: Percentage
- Initial Residue Limit — Provides a quick check of the character quality and correctness. The initial residue calculation is done before any image processing is done on the residue image. When the system looks at the symbol being inspected, it determines the residue of the

symbol, which is a count of those pixels that differ between the trained template and the current image. Based on the value of this property, the system determines if the residue is within tolerances. If it is not within tolerances, the symbol fails. Otherwise, the system continues on with the rest of the inspection procedure.

When Residue Limit Units is set to Percentage:

Default: 100.0%
Range: 0.0% to 100.0%

The value of this property is the smallest percentage of residue pixels (relative to the trained On pixel count) in the inspected image that makes the symbol fail the inspection.

When Residue Limit Units is set to Pixels:

Default: symbol size
Range: 0 to symbol size

The value of this property is the smallest count of residue pixels in the inspected image that makes the symbol fail the inspection.

This property is good for catching smudges that are aesthetically poor, but would pass after all inspection operations are performed on it. A value of 100% or symbol size means initial residue is ignored.

- Final Residue Method — Selects between three algorithms for final residue analysis:
  - Total Residue Area — This is the default. This choice counts all On pixels in the residue image and use the value in Final Residue Limit, pixel or percent, as the tolerance.
  - Max Residue Blob — Only counts the pixels in the largest blob of the residue image and use the value in Final Residue Max Blob Size as the tolerance.
  - Both — Performs both methods.
- Final Residue Limit — Sets the amount of objectionable residue that is to be deemed passable when Final Residue Method is set to Total Residue Area or Both. Final residue calculation is done after the image processing on the residue image that is associated with Maximum Flaw Size.

If there is little information in a symbol, i.e., a 1 as compared to an L, the percentage variation allowed should be reduced. An assignment of 0% (residue pixel count = 0) means that no residue is passable. An assignment of 100% (residue pixel count = symbol size) means that objectionable residue as large as the area of the prototype itself is passable.

When Residue Limit Units is set to Percentage:

Default: 15.0%, meaning 15% variation is acceptable
Range: 0.0% to 100.0%

The value of this property is the smallest percentage of residue pixels (relative to the trained On pixel count) in the inspected image that makes the symbol fail the inspection.

When Residue Limit Units is set to Pixels:

Default: 15% of the symbol size
Range: 0 to symbol size, and the default is 15% of the symbol size

The value of this property is the smallest count of residue pixels in the inspected image that makes the symbol fail the inspection.

Note: Determining the proper value for Final Residue Limit is a subjective decision; the higher the quality of the character/symbol desired, the lower the Final Residue Limit should be.

- Final Residue Max Blob Size — Used when Final Residue Method is set to Max Residue Blob or Both. A blob analysis is performed on the residue image and the largest blob is found. If this blob has an area that is greater than the value of this property, the symbol will fail the inspection.

  Default: 10
  Range: 1 to 512

- Maximum Flaw Size — Represents the maximum width in pixels that a discrepancy is allowed to be before it is considered objectionable. The larger the number assigned, the larger a discrepancy is allowed before causing the symbol inspection to fail.

Default: 1
Range: 0 to 20

- Appearance Flaw Break Test — Determines whether the OCVSymbolStep is to inspect for character breaks in the symbol. When enabled, the inspection fails if a break is found in the symbol. When disabled, the inspection ignores breaks in the symbol.

  Default: Enabled

- Min Appear. Flaw Break Size — Is the smallest size break that causes a character break failure.

  Default: 2 pixels
  Range: 1 to 10 pixels

- Sharpness Limit Units — Sets the units for the “Minimum Allowed Sharpness” property.

  When set to **Gray Level**, the value of the “Minimum Allowed Sharpness” property is used as an absolute minimum value that the calculated sharpness value must be in order for the inspection to pass.

  When set to **Percentage**, the value of the “Minimum Allowed Sharpness” is used to calculate a percentage of the trained sharpness value, which is then used as an absolute minimum value that the calculated sharpness value must be in order for the inspection to pass.

  When switched from **Gray Level to Percentage**, the Minimum Allowed Sharpness property is updated to be the percentage value that corresponds to the gray level value that it previously held.

  When switched from **Percentage to Gray Level**, the Minimum Allowed Sharpness property is updated to be the gray level value that corresponds to the percentage value that it previously held.

  Default: Gray Level

- Minimum Allowed Sharpness — Determines how crisp a symbol must be to pass inspection. It is measured by average edge strength over the entire symbol. Typical edge strengths are from 20 to 80 sharpness units.

Default: 0
Range: 0 to 256 Gray Level or 0 to 100 Percentage

- Contrast Limit Units — Sets the units for the Minimum Allowed Contrast property.

  When set to **Gray Level**, the value of the Minimum Allowed Contrast property is used as an absolute minimum value that the calculated contrast value must be in order for the inspection to pass.

  When set to **Percentage**, the value of the Minimum Allowed Contrast is used to calculate a percentage of the trained contrast value, which is then used as an absolute minimum value that the calculated contrast value must be in order for the inspection to pass.

  When switched from **Gray Level to Percentage**, the Minimum Allowed Contrast property is updated to be the percentage value that corresponds to the gray level value that it previously held.

  When switched from **Percentage to Gray Level**, the Minimum Allowed Contrast property is updated to be the gray level value that corresponds to the percentage value that it previously held.

  Default: Gray Level

- Minimum Allowed Contrast — The Contrast is the measurement that defines the grayscale foreground to background relationship of the symbol data. To calculate the contrast value, the average gray level value of the background pixels is subtracted from the average gray level of the foreground pixels. Whenever Minimum Allowed Contrast has a value of 0, no contrast checks are performed.

  Default: 0
  Range: 0 to 255 Gray Level or 0 to 100 Percentage

- Auto Threshold Enabled — Enables and disables the automatic calculation of a threshold for binarizing the image at both train and run time.

  When enabled, the calculated threshold is displayed in the Manual Threshold property.

  When disabled, no calculation is done. The threshold used for binarizing is whatever value is in the Manual Threshold property.

Edge Energy Threshold and Threshold Adjustment are not used when this property is disabled.

Default: Enabled

- Auto Threshold Adjustment — Offsets or biases the dynamically calculated threshold, when Auto Threshold Enabled is enabled.

  Default: 0
  Range: -64 to 64

- Manual Threshold — Displays the dynamically calculated threshold when the Auto Threshold Enabled property is enabled. When Auto Threshold Enabled is disabled, Manual Threshold is the threshold that is used for binarizing the image.

  Default: 135
  Range: 0 to 255

- Edge Energy Threshold — Defines the pixel value at which a pixel in a Sobel Edge Enhancement is considered to be an edge pixel. This property is only used when the Auto Threshold Enabled property is enabled.

  Default: 10
  Range: 0 to 255

- Character Expansions — Useful when dealing with print from a dot matrix printer or any print that is broken up in segments. The more sparse the print, the higher the value of this property should be.

  This property allows for the broken print to become solid by expanding the segments until they come together. Dilations expand each segment. Then, erosions decrease the size of the character in every direction except the direction in which the segments have connected. Dilations and erosions work together to make the segments solid without making the character fatter.

  Default: 0
  Range: 0 to 9

- Filter Bright Defects — When enabled, runtime inspection of the symbol includes a pre-processing step for filtering out any bright defects in the image.

  Default: Disabled

- Bright Defect % Range — Percentage that determines the threshold at which the bright defect filter processes. The threshold is calculated by taking this percentage of the range between the binarizing threshold and 255.

  Default: 0 (binary threshold is used if Filter Bright Defects is enabled)
  Range: 0 to 100

- Output Mask Type — Used in conjunction with the DynamicMask step. This property allows three selections:
  - None — Adds nothing the mask.
  - Mask Template — Only the foreground area of the symbol is added to the mask. This is the default.
  - Mask ROI — The entire area within the symbol's ROI is added to the mask.

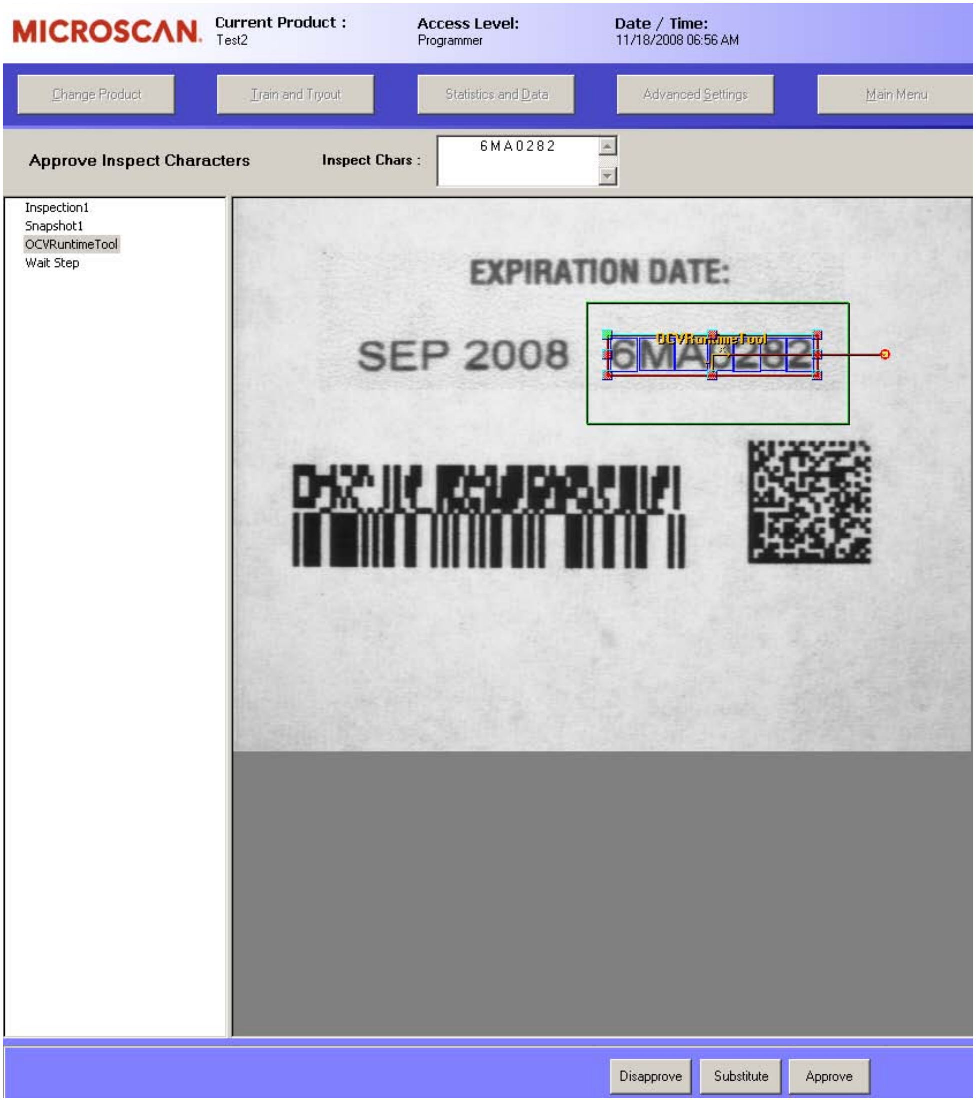
The remainder of this chapter discusses the following:

- “Substitute/Ignore” on page 5-80
- “External Confirmation of Characters” on page 5-83
- “Keyboard Input of Match String” on page 5-88
- “External Input of Match String” on page 5-93
- “Lot ChangeOver — CHANGELAYOUT Command” on page 5-101
- “OCV Tips” on page 5-116
- “Troubleshooting” on page 5-120

Substitute/Ignore

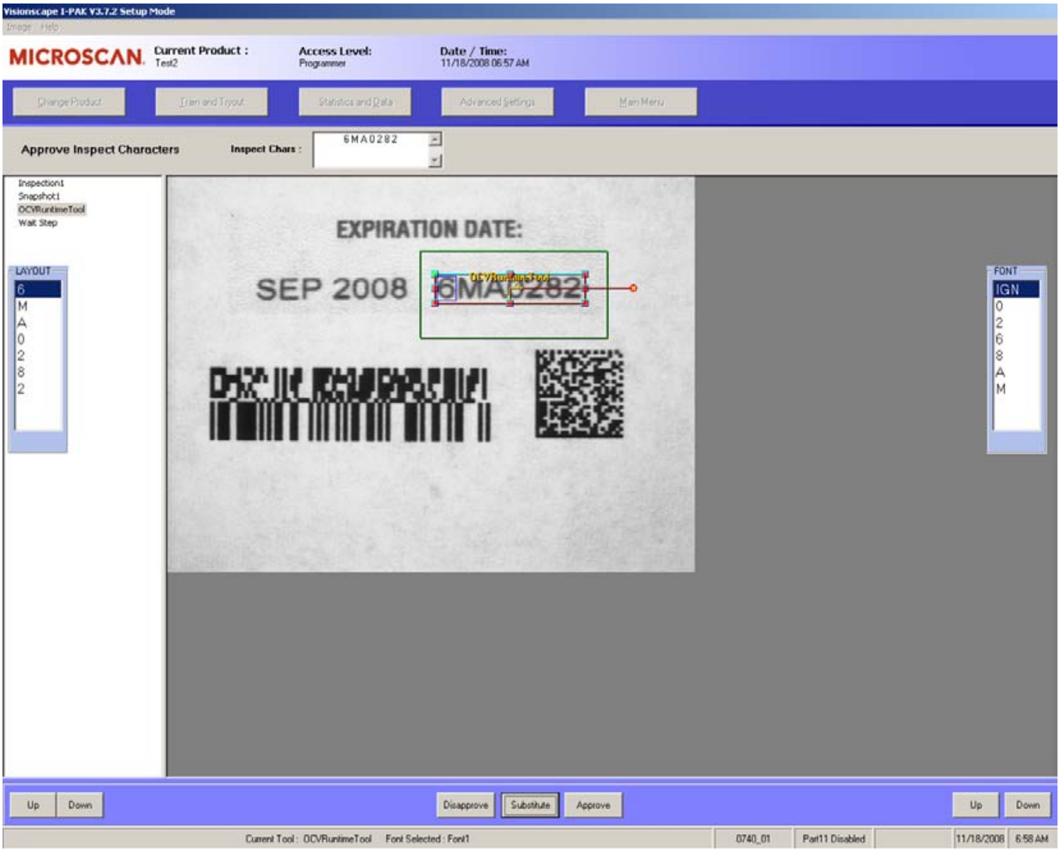
When training either an OCVFontTool or OCVRuntimeTool, the Setup Mode — Approve Inspect Characters dialog box is displayed at the end of the learn layout. The string of layout characters is displayed at the top. This dialog box allows characters to be substituted into the layout or ignored entirely from the layout. Click Disapprove to return to the Setup Mode Train dialog box and re-train the current tool. Click Approve to accept the Inspect Chars: and return to the Setup Mode Train screen to train any remaining tools. Click Substitute to initiate the Substitute/Ignore window and modify the layout string.

FIGURE 5–51. Setup Mode — Approve Inspect Characters Dialog Box



The list of symbol names that is displayed on the left-hand side of the Setup Mode — Approve Inspect Characters dialog box contains the names of all symbols in the layout, in the order in which they appear, as shown in Figure 5–52.

FIGURE 5–52. Setup Mode — Approve Inspect Characters Dialog Box



The Up and Down buttons scroll through the list to select a symbol name. Clicking on a symbol name in the list also selects it. Clicking on the scroll bar to the right of the list scrolls through the list.

The FONT box contains the name of all symbols in the selected OCVFont. The first item in the list is IGN, which ignores characters. The Up and Down buttons scroll through the list to select a symbol name. Clicking on a symbol name in the list also selects it. Clicking on the scroll bar scrolls through the list.

Character Substitution

To substitute one symbol for another, select the layout character in the layout list that you want to replace. Select the symbol from the Font box that you want to use to replace the layout symbol and click Substitute. The layout list will update, as well as the Inspect Chars: string.

Ignoring a Character

To ignore one of the symbols in the layout and exclude it from being inspected at runtime, select the symbol to be ignored from the layout list. Select the IGN symbol from the Font box. Then, click Substitute. The symbol is removed from both the layout list and the Inspect Chars: string.

Finishing Up

If you are not satisfied with the layout and wish to re-train the tool, click Disapprove in the Setup Mode Train window with the OCVRuntimeTool still selected. You can adjust the properties of the tool and re-train until you achieve the desired layout string.

When you are satisfied with the layout shown in the Inspect Chars: string at the top of the window, click Approve to return to the Setup Mode Train window.

External Confirmation of Characters

External Confirmation of Characters allows an external device, computer, etc., to approve or disapprove the result of training an OCVFontTool or OCVRuntimeTool. The learn layout string, string of symbol names for those symbols found during training, is sent from I-PAK to the external device. The external device sends back an approve or disapprove message to I-PAK. An OCVFontTool or OCVRuntimeTool training session is not complete without an approval from the external device.

External Confirmation is accomplished through a communications handshake between I-PAK and the external device. The communications can be accomplished through RS-232 or Ethernet.

Note: The OCVFontlessTool does not support this feature.

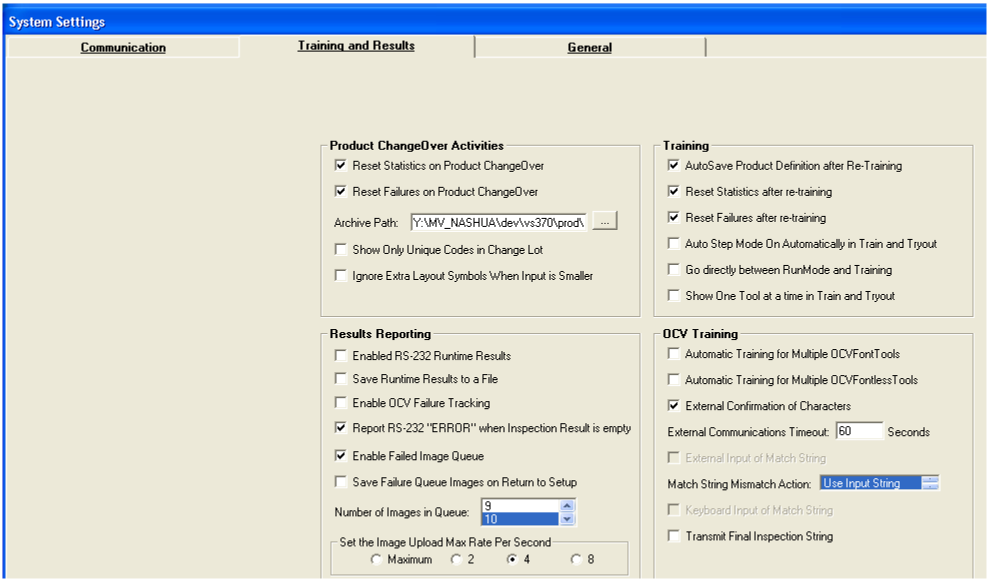
Enabling External Confirmation of Characters

I-PAK software allows the External Confirmation feature to be enabled. The default is disabled.

I-PAK's System Settings Training and Results dialog box has the training options External Confirmation of Characters and External Communications Timeout, as shown in Figure 5–53.

Note: These options are enabled, not greyed out, once you have selected your communications protocol from the System Settings Communications menu. You need to define either RS-232 or Ethernet for both your input and output Communications channel.

FIGURE 5–53. Enabling External Confirmation of Characters



External Confirmation of Characters Checkbox

By default, this checkbox is not checked, meaning that I-PAK expects no external confirmation. When enabled (checked), I-PAK expects an external confirmation whenever an OCVFontTool or OCVRuntimeTool is trained.

External Confirmation of Characters data is transferred using the communication method selected on the System Setting Communications menu. The External Confirmation feature is only active if the communication method is set to either RS-232 or Ethernet.

External Communications Timeout

By default, this is set to 60 seconds. This is the amount of time that I-PAK waits for data from the external device before it displays an error message.

Because they are System Settings, the status of External Confirmation, enabled or disabled, and the timeout value remain the same when a new product is loaded into I-PAK.

OCVFontTool and OCVRuntimeTool Training

The I-PAK OCVFontTool and OCVRuntimeTool use the External Confirmation feature during the training sequence.

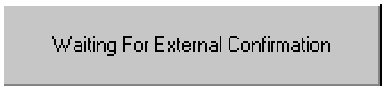
When External Confirmation of Characters mode is enabled, OCVFontTool and OCVRuntimeTool training is unchanged until the Approve Inspect Characters window is displayed. Only two buttons, Substitute and External Confirmation, are displayed.

Clicking Substitute displays the Substitute window. This allows you to manually change the characters in the inspection string.

When External Confirmation is clicked, I-PAK transmits a header line and the inspection string over the selected communication port. The header line is a line of information indicating which tool is requesting confirmation. Following the header information is the inspection string as it is displayed on the Approve Inspect Characters window.

I-PAK displays the Waiting for External Confirmation message box on the user interface, as shown in Figure 5–54.

FIGURE 5–54. **Waiting For External Confirmation Message Box**



If, after the designated timeout expires, no message has been received from the external device, I-PAK displays the External Confirmation Timeout dialog box with the message Communications Timed Out, as shown in Figure 5–55.

FIGURE 5–55. **External Confirmation Timeout Dialog Box**

The Approve Inspect Characters window displays only a Disapprove button.

I-PAK waits for either of two responses from the external device:

- Approve — This is noted by the receipt of the string 0001 through the communication port specified.
- Disapprove — This is noted by the receipt of the string 9999 through the communication device specified.

Upon receipt of the Approve message, I-PAK displays the message External Confirmation Received and continues in the same fashion as when the Approve button is used.

FIGURE 5–56. **External Confirmation Received**

Upon receipt of the Disapprove message, or any message other than Approve, I-PAK displays the message External Confirmation Denied. At this point, the
I-PAK displays only the Disapprove button.

FIGURE 5–57. External Confirmation Denied

Under no conditions will the layout be approved without an Approve message from the external device.

External Confirmation Protocol

The I-PAK OCV Font Tool uses a standard communications protocol in communicating the inspection string to an external device.

Header Line Protocol

The header line of data has the following form:

VisionBoard#, Insp#, Snapshot#, FontTool#<cr><lf>

- VisionBoard# — The # is replaced by the actual board number, such as 1, inside the I-PAK system. This is the symbolic name of the VisionBoard.
- Insp# — The # is replaced by the actual Inspection number from the Job, such as 1. This is the symbolic name of the Inspection.
- Snapshot# — The # is replaced by the actual snapshot number from the Job, such as 1. This is the symbolic name of the snapshot.
- FontTool# — The # is replaced by the actual OCVFontTool number from the Job, such as 1. This is the symbolic name of the OCVFontTool.

Note: OCVRunTool may be present in place of FontTool when the OCVRuntimeTool is used in the inspection.

Inspection String Protocol

The inspection string transmitted has the following form:

1<sp>2<sp>/<sp>2<sp>2<sp>/<sp>0<sp>2 <cr><lf>

This string contains the names of the characters found during training.

- <sp> is a space character separating the names of the symbols.
- <cr> is a decimal 13.
- <lf> is a decimal 10.

Approve String Protocol

The Approve string returned from the external device has the following form:

0001<cr>

Any other string returned is considered a Disapprove.

Keyboard Input of Match String

Keyboard Input of Match String allows you to specify the intended inspection string for an OCVFontTool or OCVRuntimeTool. This is accomplished by displaying an input box into which you can type the necessary information.

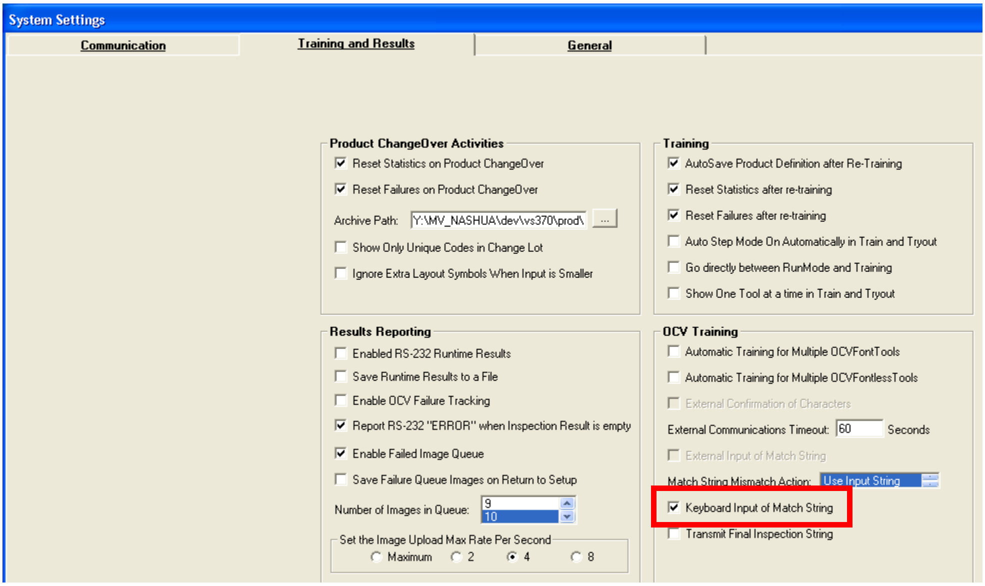
Note: Enabling Keyboard Input of Match String mode automatically disables the ignore and substitute character functionality of I-PAK.

The OCVFontlessTool does not support the Keyboard Input of Match String feature.

Enabling Keyboard Input of Match String

I-PAK’s System Settings Training and Results dialog box has the training option Keyboard Input of Match String. This is a System Settings; even when you do a change product to another Job that contains an OCVFontTool or OCVRuntimeTool, this setting will not change.

FIGURE 5–58. Enabling Keyboard Input of Match String



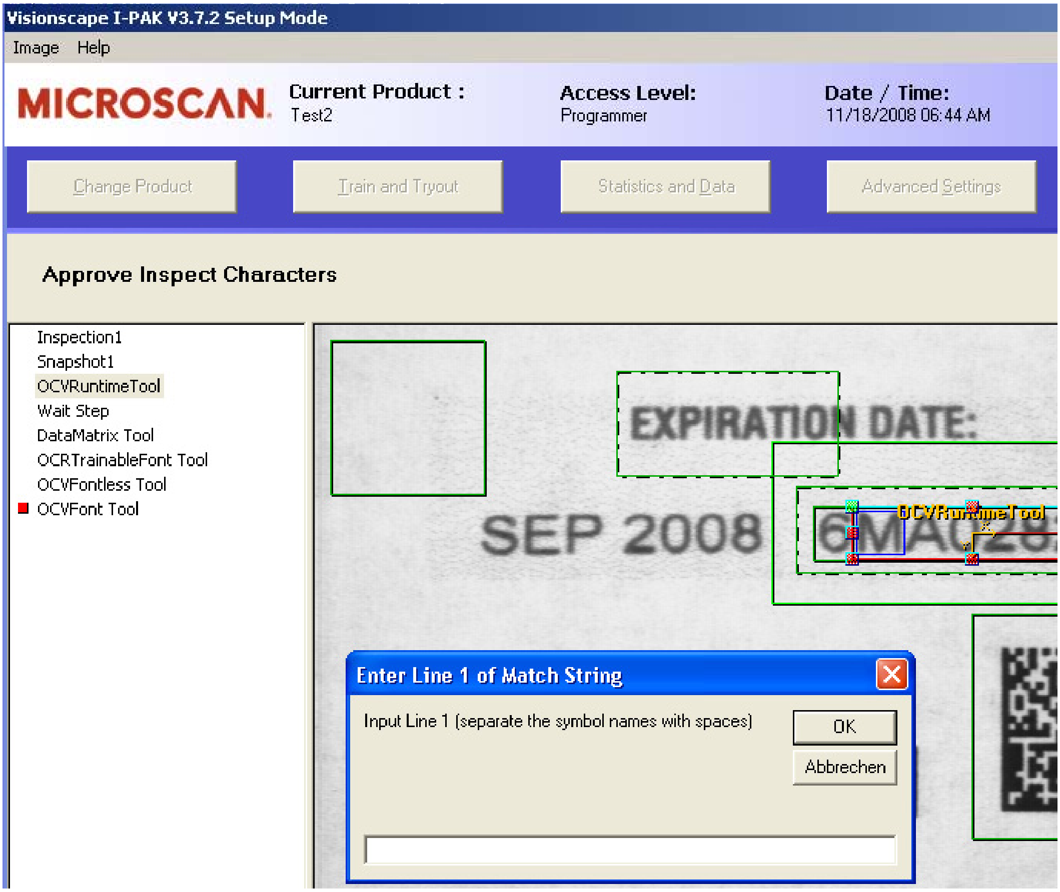
By default, the Keyboard Input of Match String checkbox item is not checked, which means that I-PAK expects no keyboard match string input for the OCVFontTool or OCVRuntimeTool. When enabled (checked), I-PAK expects a match string to be input by the keyboard whenever an OCVFontTool or OCVRuntimeTool is trained.

OCVFontTool and OCVRuntimeTool Training

The I-PAK OCVFontTool and OCVRuntimeTool use the Keyboard Input of Match String, when enabled, in the training sequence.

When Keyboard Input of Match String is enabled, OCVFontTool and OCVRuntimeTool training is unchanged until the Approve Inspect Characters window is displayed, as shown in Figure 5–59.

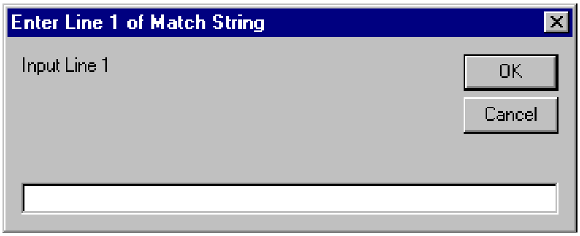
FIGURE 5–59. **Match String Training Dialog Box**



For each line of characters found during training, I-PAK does the following:

- Displays an input box Input Line N message, where N is replaced by the number of the line being waited for.

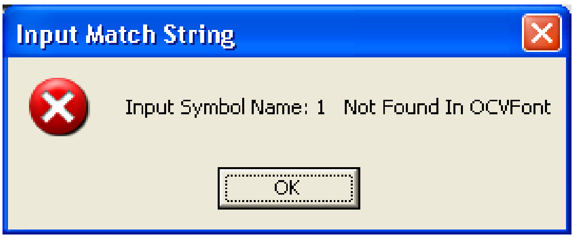
FIGURE 5–60. **Match String Input Prompt**



- Waits for a string to be input.

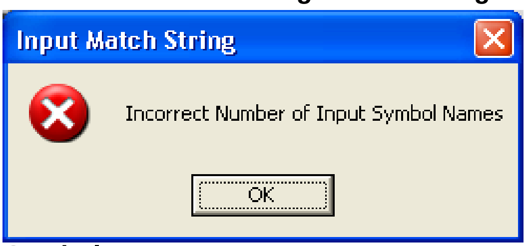
  When a string is input, I-PAK examines it to determine which symbol names are in it. If any of the input symbol names are not found in the OCVFont, I-PAK displays an error message, as shown in Figure 5–61, and forces you to re-train by displaying only the Disapprove button.

FIGURE 5–61. **Match String Error Message — Bad Symbol Name**



- If the number of symbols is not the same in each string, an error message is displayed, as shown in Figure 5–62, and only the Disapprove button is displayed, forcing you to re-train.

FIGURE 5–62. **Match String Error Message — Incorrect Numbers of Symbols**



- If the input string is not the same as the string of characters found during training, an error message is displayed, as shown in Figure 5–63, and only the Disapprove button is displayed, forcing you to re-train.

FIGURE 5–63. **Match String Error Message — Strings Are Different**

If all lines of input are received successfully, I-PAK displays a message, as shown in Figure 5–64.

FIGURE 5–64. **Successful Match String Input Message**

When a string is successfully input, the layout is automatically approved and the training sequence ends.

Keyboard Input Protocol

The I-PAK OCVFontTool and OCVRuntimeTool uses a standard protocol in receiving the inspection string from you.

Inspection String Protocol

The input inspection string is of the following form:

1<sp>2<sp>/<sp>2<sp>2<sp>/<sp>0<sp>2

The <sp> is a space character, which is the separator between symbol names.

External Input of Match String

Match String allows an external device (computer, etc.,) to specify the intended inspection string for an OCVFontTool or OCVRuntimeTool.

External Input of Match String is accomplished by creating a communications handshake between I-PAK and an external device. The necessary information is sent from the external device to I-PAK. The communications can be accomplished through RS-232 or Ethernet.

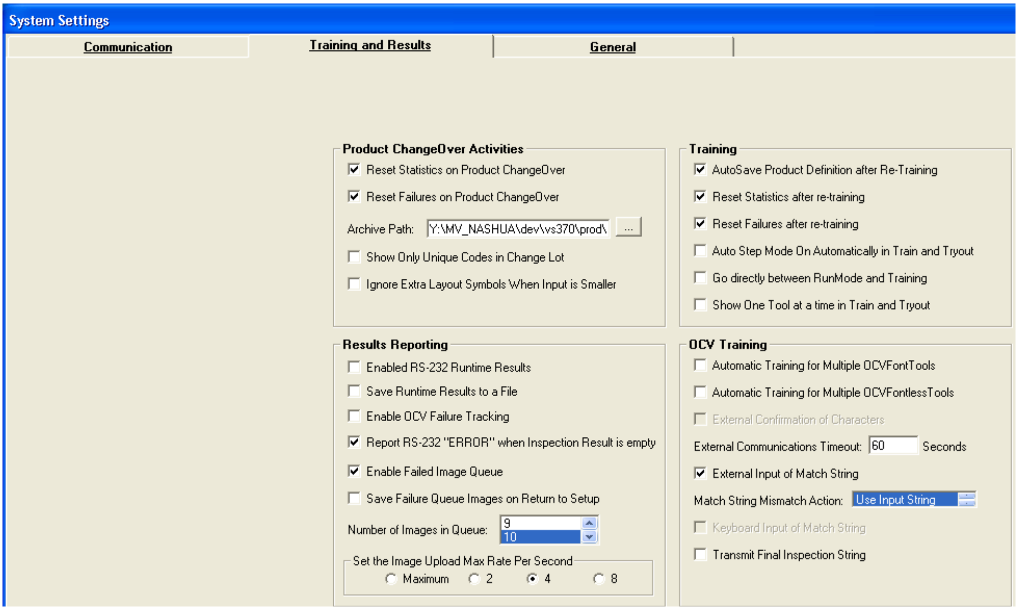
Note: Enabling Match String mode automatically disables the ignore and substitute character functionality of I-PAK.

The OCVFontlessTool does not support the Match String feature.

Enabling External Input of Match String

I-PAK software allows the External Input of Match String feature and related functionality to be enabled. By default, these features are disabled.

FIGURE 5–65. **Enabling External Input Feature**



I-PAK's System Settings Training and Results dialog box has options External Input of Match String, Match String Mismatch Action: and Transmit Final Inspection String. Since these are System Settings, even if you do a change product to another Job that contains an OCVFontTool or OCVRuntimeTool, these settings will not change.

External Input of Match String Checkbox

By default, the External Input of Match String checkbox item is not checked, which means that I-PAK expects no match string input for the OCVFontTool or OCVRuntimeTool. When this option is enabled (checked), I-PAK expects a match string to be input whenever an OCVFontTool or OCVRuntimeTool is trained.

External Input of Match String data is transferred using the communication method selected on the System Setting Communications menu. The External Input of Match String feature is only active if the communication method is set to either RS-232 or Ethernet.

Match String Mismatch Action

I-PAK software allows the Mismatch Action to be selected. By default, the list box is set to Use Input String. This setting defines the action that I-PAK takes in the event that the string input from the external device does not match the string learned when the tool was trained. The possible selections and their meaning are:

- Use Input String — I-PAK uses the input string as the inspection string.
- Use Learned String — I-PAK ignores the input string and sets the string found during training as the inspection string.
- Retry by Learning — I-PAK forces you to re-train the tool and allow the string to be entered again.
- Retry by Input — I-PAK allows the string to be entered again.

The Match Mode Mismatch Action selected is applied to any OCVFontTool or OCVRuntimeTool in the current Job.

Transmit Final Layout String

By default, the Transmit Final Inspection String checkbox item is not checked, which means that I-PAK will not send the inspection string out when training of an OCVFontTool or OCVRuntimeTool is complete. When this option is enabled (checked), I-PAK sends the inspection string out to an external device whenever an OCVFontTool or OCVRuntimeTool is trained successfully.

Transmit Final Inspection String data is transferred using the communication method selected on the System Setting Communications menu. The Transmit Final Inspection String feature is only active if the communication method is set to either RS-232 or Ethernet.

OCVFontTool and OCVRuntimeTool Training

The I-PAK OCVFontTool and OCVRuntimeTool use the External Input of Match String and Transmit Final Inspection String features, when enabled, in the training sequence.

When External Input of Match String and/or Transmit Final Inspection String is enabled, OCVFontTool and OCVRuntimeTool training is unchanged until the Approve Inspect Characters window is displayed. This window displays only one button, Input Match String.

When Input Match String is clicked, I-PAK sends a header line to the external device to indicate which tool needs the inspection string. Then, for each line of characters found during training, I-PAK does the following:

- Displays a Waiting for Input Match String Line N message, where N is replaced by the number of the line being waited for.

FIGURE 5–66. Waiting For Input of Match String Message

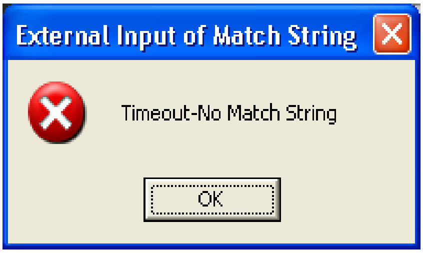
- Prompts the external device for the input string by sending a message with the following format: Input Line N, where N is the line number for the string to be received.

- Waits for a response from the external device.

Note: Strings must be null terminated.

A timeout error occurs if no response is received within the time specified in the System Setting External Communications Timeout.

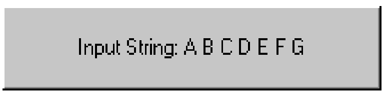
FIGURE 5–67. **External Communications Error Message — Timeout**



If a timeout error occurs, I-PAK displays an error message and only the Disapprove button is displayed, forcing you to re-train the layout.

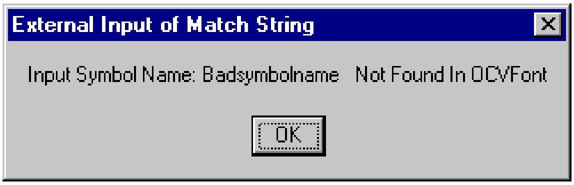
- When a response is received, I-PAK displays the input string.

FIGURE 5–68. **Display of Input String**



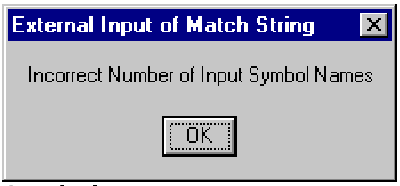
The string is then examined to determine which symbol names are in it. If any of the input symbol names are not found in the OCVFont, I-PAK displays an error message, as shown in Figure 5–69 and forces you to
re-train by displaying only the Disapprove button.

FIGURE 5–69. **Input of Match String Error Message — Symbol Not in Font**



- If all symbols are in the OCVFont, the input string is compared to the string of characters found during training. Any differences in the symbol names are noted. If the number of symbols is not the same in each string, an error message is displayed, as shown in Figure 5–70, and only the Disapprove button is displayed, forcing you to re-train.

FIGURE 5–70. **Match String Error Message — Wrong Number of Symbols**



Once all lines of input are received successfully, I-PAK checks for mismatches in the string, which were noted earlier. In the event of a mismatch, I-PAK displays the message: Mismatch… Strings Are Different, and performs the selected Mismatch Action.

FIGURE 5–71. **Mismatch Error Message**

If the Match String Mismatch Action setting is set to Use Input String, the I-PAK displays the message: Using Input String!, and uses the input string as the inspection string.

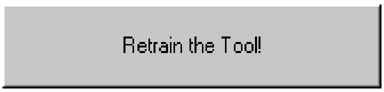
FIGURE 5–72. Mismatch Action — Using Input String Message

If the Match String Mismatch Action setting is set to Use Learned String, the I-PAK displays the message: Using Learned String, and ignores the input string. The string found during training is then set as the inspection string.

FIGURE 5–73. Mismatch Action — Using Learned String Message

If the Match String Mismatch Action setting is set to Retry by Learning, the I-PAK displays the message: Retrain the Tool!, and displays only the Disapprove button. This forces you to re-train the tool and allows the string to be entered again.

FIGURE 5–74. Mismatch Action — Retrain the Tool Message



If the Match String Mismatch Action setting is set to Retry by Input, I-PAK displays the message: Retry Input!, and displays only the Input Match String button. This forces you to try to input the string again.

FIGURE 5–75. Mismatch Action — Retry Input Message

If there are no mismatches, I-PAK sets the inspection string to the learned string and displays a message, Successful Input!

FIGURE 5–76. **Successful Match String Input**

Transmit Final Inspection String

If the Transmit Final Inspection String functionality is enabled, the inspection string is sent to the external device. First, the header line is sent to the device to indicate which tool is sending the string. Then, the line Final Inspection String: is sent, followed by the actual inspection string.

If the tool is an OCVRuntimeTool, the runtime OCVFont is trained based on the inspection string.

When a string is successfully input, the layout is automatically approved and the training sequence ends.

External Input of Match String Protocol

The I-PAK OCVFontTool and OCVRuntimeTool use a standard communications protocol in communicating with an external device.

Header Line Protocol

The header line of data has the following form:

VisionBoard#, Insp#, Snapshot#, FontTool#<cr><lf>

- VisionBoard# — The # is replaced by the actual board number, such as 1 inside the I-PAK system. This is the symbolic name of the VisionBoard.
- Insp# — The # is replaced by the actual Inspection number from the Job, such as 1. This is the symbolic name of the Inspection.
- Snapshot# — The # is replaced by the actual snapshot number from the Job, such as 1. This is the symbolic name of the snapshot.
- FontTool# — The # is replaced by the actual FontTool number from the Job, such as 1. This is the symbolic name of the FontTool.

Note: When OCVRuntimeTool is used, FontTool is replaced with OCVRunTool.

Input Line Protocol

The prompt for input line has the following form:

Input Line N<cr><lf>

where:

– N is the line number for the string to be received.

Input and Output Inspection String Protocol

The input and output inspection string has the following form:

1<sp>2<sp>/<sp>2<sp>2<sp>/<sp>0<sp>2 <cr><lf>

Transmit Final Layout String Protocol

The Transmit Final Layout String first sends the line:

Final Inspection String: <cr><lf>

Then, send the inspection string above.

- <sp> is a space character, which is the separator between symbol names.
- <cr> is a decimal 13.
- <lf> is a decimal 10.

Lot ChangeOver — CHANGELAYOUT Command

An extended feature of the OCVFontTool is the ability to enter a new data string (Layout String) during Run Mode. This allows an automated Lot ChangeOver (CHANGELAYOUT Command) from an external RS-232 device or an external Ethernet device.

After training all the symbols in the OCVFont and training an OCVFontTool, you can send a new string to inspect during Run Mode.

Setup Notes and Precautions

- You must stop triggering before sending a new inspect string.
- You must stop triggering and not re-start it before Runmode IO is active.
- A maximum of one (1) input string is allowed in a single transmission. The new string must have the same number of characters as the original layout string and the character positions must be the same. The characters must all be the same width.
- The character that the AutoFind uses cannot be substituted. This means that there must be at least one character in the string that never changes.

RS-232 Input of Layout String

RS-232 CHANGELAYOUT Usage

The RS-232 CHANGELAYOUT syntax requires user selectable tool names as input rather than symbol tool names.

When there are multiple OCVFontTools, Barcode Tools, Data Matrix Tools, or OCRTrainable Font Tools in the product definition, and one or more of the tools is not inserted directly into the Snapshot step, the RS-232 CHANGELAYOUT Syntax described above may be ambiguous. In order to ensure that I-PAK uses the correct tool for the setting the Layout String or Match String, the tools must be given unique names when the product definition is being created and/or edited.

RS-232 CHANGELAYOUT Syntax

For each FontTool in the Inspection Job, the RS-232 CHANGELAYOUT command can be used to input the Learn Layout string, as shown in Table 5–3. By default, the colon (:) is the string delimiter.

The CHANGELAYOUT command can also be used to change the match string of a Barcode Tool, Data Matrix Tool, or OCRTrainable Font Tool.

TABLE 5–3. RS-232 CHANGELAYOUT Syntax

RS-232 CHANGELAYOUT Syntax	Comment
CHANGELAYOUT: VisionBoard1. Insp1. Snapshot1. FontTool1: 2003/02	Input String for Camera 1's Font Tool #1 {Date}
CHANGELAYOUT: VisionBoard1. Insp1. Snapshot1. FontTool2: 251250430999	Input String for Camera 1's Font Tool #2 {Lot Code}
CHANGELAYOUT: VisionBoard1. Insp2. Snapshot1. FontTool1: 2003/02	Input String for Camera 2's Font Tool #1 {Date}
CHANGELAYOUT: VisionBoard1. Insp2. Snapshot1. FontTool2: 251250430999	Input String for Camera 2's Font Tool #2 {Lot Code}

For each good data string received, I-PAK acknowledges the input with the following:

OK<EOT>

When bad data is received, I-PAK alerts the external RS-232 device with the following:

FAIL<EOT>

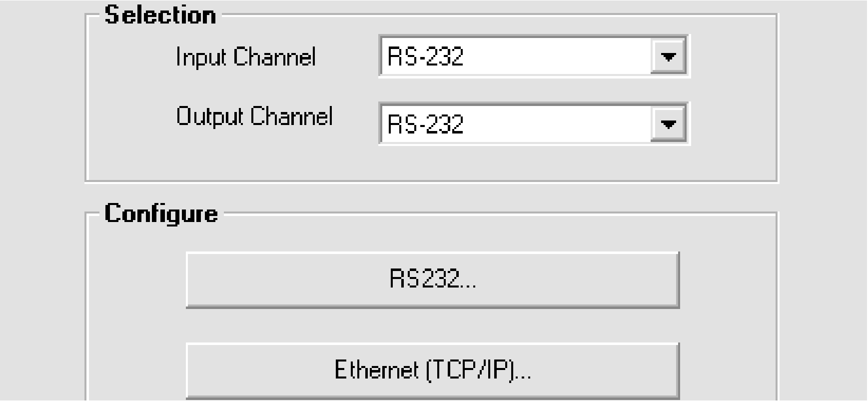
If bad data is received, inspections may not restart. Look at the I-PAK User Interface to see if intervention (clicking on the Cancel button) is required. Then, you can either re-send correct information or go to Setup Mode to manually re-train.

Once data has started to be received, I-PAK exits Run Mode, changes the string, then returns to Run Mode. I/O #16 Run/Setup is asserted once I-PAK is ready to receive triggers. Any errors that occur are displayed in message boxes within
I-PAK.

I-PAK User Interface

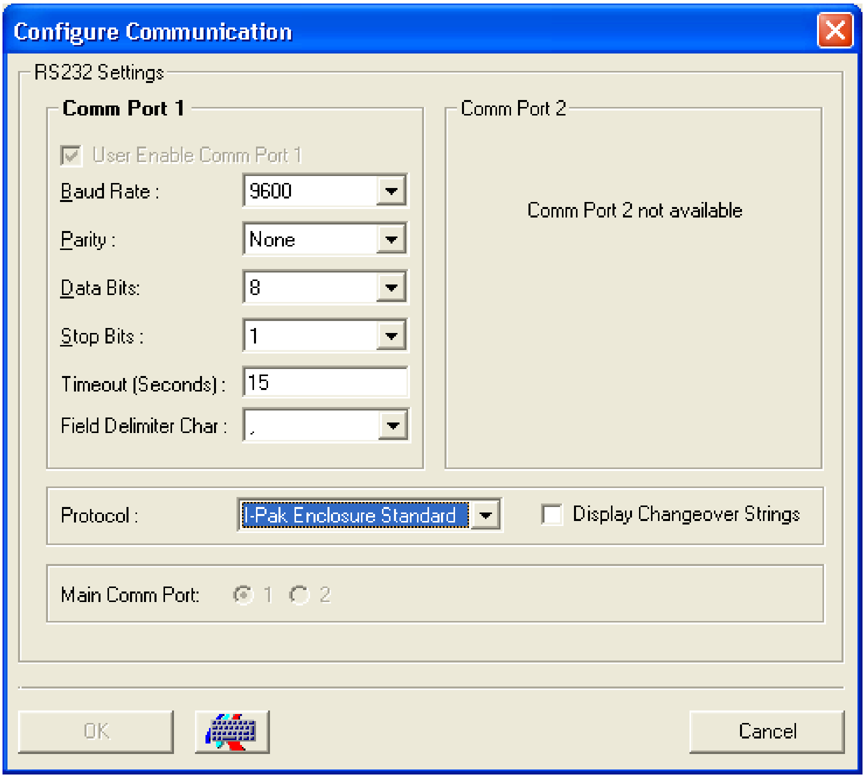
In order to use the RS-232 Input of Layout String, you must set the Input Channel and Output Channel to RS-232 in the System Settings dialog box, as shown in Figure 5–77.

FIGURE 5–77. **System Settings — RS-232**



Clicking on RS-232... brings up the Configure Communications dialog box for RS-232, as shown in Figure 5–78.

FIGURE 5–78. **System Settings — RS-232**



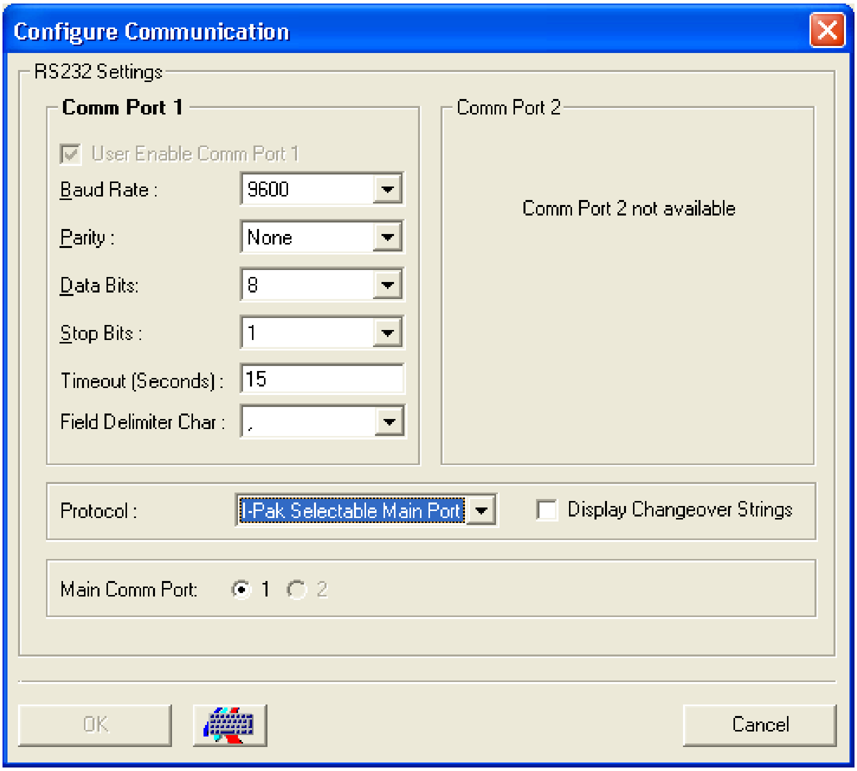
If the selected RS-232 protocol is “I-PAK Enclosure Standard,” RS-232 communications are accomplished through Comm Port 3 of I-PAK. With this protocol, the default RS-232 setting for this Comm Port 3 are:

- Baud Rate — 9600
- Parity — None
- Data Bits — 8
- Stop Bits — 1

These settings may be adjusted to properly configure the communications with the host device.

When the selected RS-232 protocol is “I-PAK Selectable Main Port,” as shown in Figure 5–79, the user can select the Comm Port used by I-PAK for RS-232 communications. The RS-232 settings for the selected port may then be properly configured for communications with the host device.

FIGURE 5–79. **System Settings — RS-232**



RS-232 ChangeLayout Error Debug

Any errors that occur are reported over RS-232 (via a “FAIL” message) to the host device. These errors are also displayed in message boxes within I-PAK. For example, when erroneous data (bad data, symbol not in layout, too many symbols, etc.,) is received over RS-232 from a customer's host machine, the ChangeLayout Dialog box stays on up on the I-PAK Run Mode screen - everything else from Run Mode is Disabled - except for the ChangeLayout Dialog box. It shows you the recently input data-tool name and “new” layout string.

FIGURE 5–80. ChangeLayout RS-232 Error Status: Run Mode

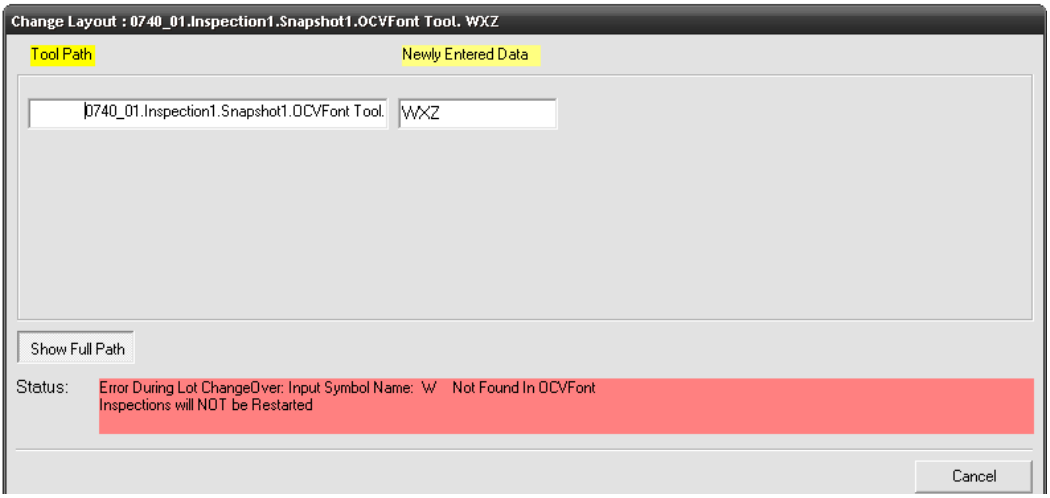
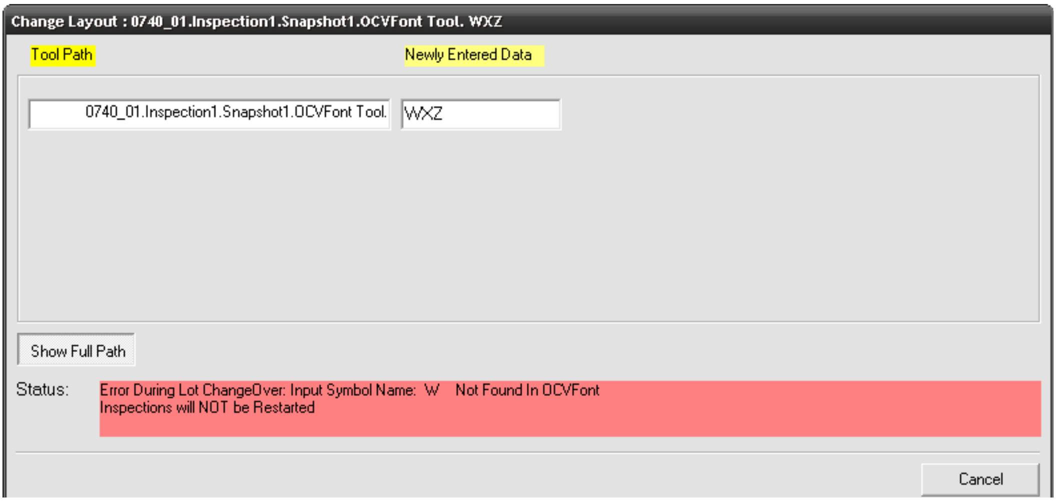


FIGURE 5–81. ChangeLayout RS-232 Error Details



You MUST take action by clicking the Cancel button before I-PAK will "resume". In this bad data sent state, I-PAK is declared "off-line", the error message is displayed along with the exact data input and the tools.

Note: The Cancel button makes you return to Run Mode but still in an Off-Line state - as inspections are NOT restarted because the data was invalid.

You may return to Setup Mode to re-train or try to send another (good) Ethernet ChangeLayout data to I-PAK.

The RS-232 response back is immediate (FAIL).

RS-232 ChangeLayout Success Response

When the Lot Changeover is successful, the RS-232 message "OK" is sent out and a message box is displayed.

For example, on good RS-232 ChangeLayout data, I-PAK will display the ChangeLayout Dialog box for ~5 seconds; I-PAK will make the "mouse" into an hourglass (wait), then control goes back to I-PAK. The RS-232 response back is immediate (OK).

FIGURE 5–82. ChangeLayout RS-232 Success: Run Mode

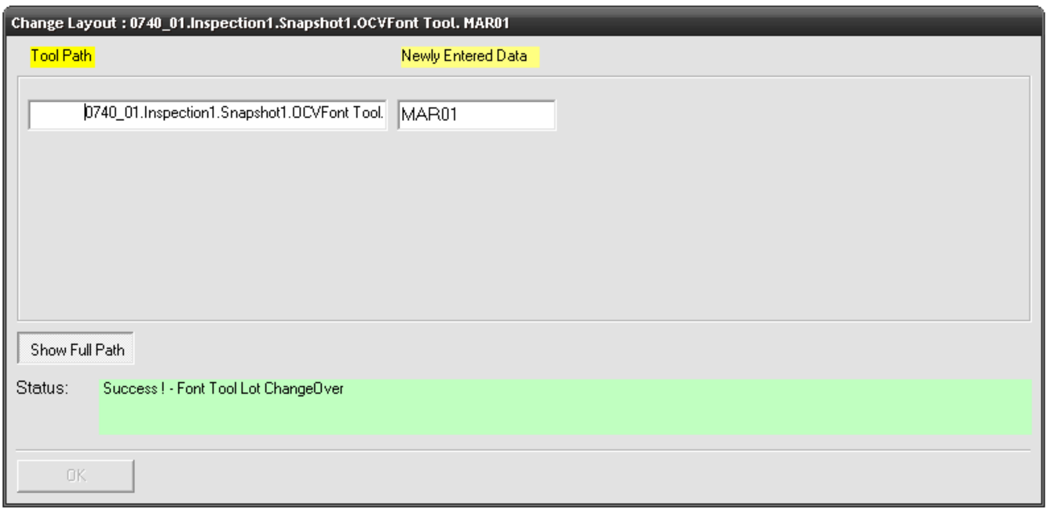
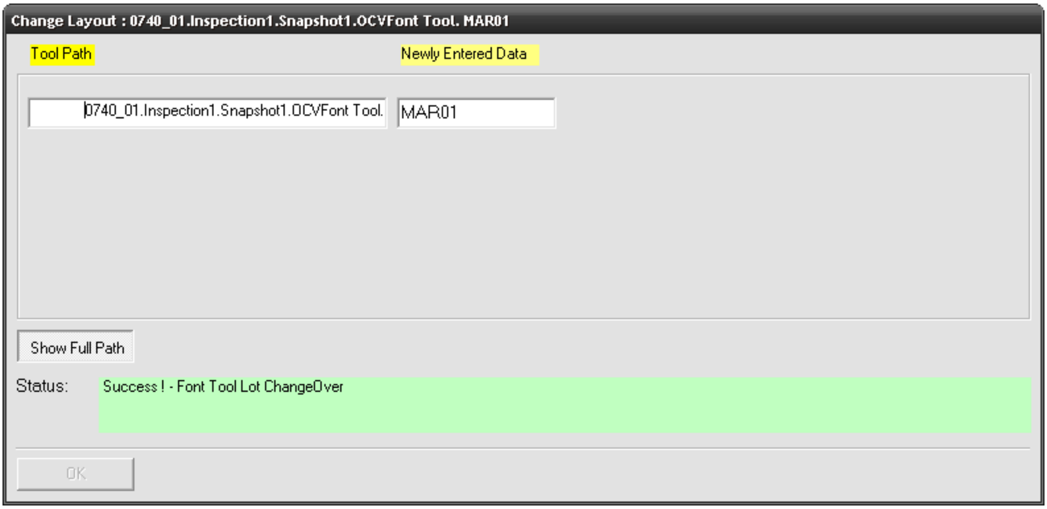


FIGURE 5–83. **ChangeLayout RS-232 Successful Details**



ChangeLayout Debug

Whether good or erroneous data is sent to I-PAK, these “debug” windows help users by providing an RS-232 debugging tool that allows Programmers to verify that string(s) are sent using correct formatting. I-PAK tries to specify the exact syntax error (if any) of the input. I-PAK displays and highlights errors on the I-PAK screen for a longer period of time so that the user knows that a ChangeLayout error has occurred. This causes user intervention to acknowledge the bad data. When I-PAK displays the Change Lot screen, users can clearly see the newly entered strings, to further provide debug assistance.

RS-232 ChangeLayout Error Messages

In the event of data errors, the error messages shown in Table 5–4 are displayed.

TABLE 5–4. RS-232 ChangeLayout Error Messages

Error Message	Meaning
Change Layout Error: Missing the Tool Name or the Layout	The input string did not contain either the name of the OCVFontTool or the new layout string.
Change Layout Error: The Tool name is not in the Job. Check you input syntax.	An OCVFontTool with the given name could not be found in the Job.
Input Symbol Name not found in OCVFont	The new layout string contains a Symbol Name that cannot be found in the selected OCVFont.
Missing 1st colon in layout	The input string could not be parsed because it has an incorrect format.
Missing 2nd colon in layout	The input string could not be parsed because it has an incorrect format.
Number of characters in layout does not match characters sent.	Wrong Number of Symbols: For a given Font Tool, the number of characters in the layout string is different from the inputted number of characters.
Step FontTool Not Found	The FontTool definition is not found in the input string from the host.
Step Inspection Not Found	The Inspection definition is not found in the input string from the host.
Step Snapshot Not Found	The Snapshot definition is not found in the input string from the host.
Step Visionboard Not Found	The Visionboard definition is not found in the input string from the host.
The Font Tool is not trained! Go back to Train/Tryout and train all the tools	The OCVFontTool with the given name is not trained. Lot Changeover requires the tool to have a layout string before changeover can occur.

Ethernet Input of Layout String

Ethernet CHANGELAYOUT Usage

Prior to sending data, the host must ensure there are no inspections taking place or pending.

Ethernet CHANGELAYOUT Syntax

For each FontTool in the Inspection Job, there can be an Ethernet input of the Learn Layout string, as shown in Table 5–5. By default, the colon (:) is the string delimiter.

The CHANGELAYOUT command string must end with the termination character EOT (hex #04).

The CHANGELAYOUT command can also be used to change the match string of a Barcode Tool, Data Matrix Tool, or OCRTrainableFont Tool.

TABLE 5–5. Ethernet Input Syntax

Ethernet Input Syntax	Comment
CHANGELAYOUT: VisionBoard1. Insp1. Snapshot1. FontTool1: 2003/02 <EOT>	Input String for Camera 1's Font Tool #1 {Date}
CHANGELAYOUT: VisionBoard1. Insp1. Snapshot1. FontTool2: 251250430999 <EOT>	Input String for Camera 1's Font Tool #2 {Lot Code}
CHANGELAYOUT: VisionBoard1. Insp2. Snapshot1. FontTool1: 2003/02 <EOT>	Input String for Camera 2's Font Tool #1 {Date}
CHANGELAYOUT: VisionBoard1. Insp2. Snapshot1. FontTool2: 251250430999 <EOT>	Input String for Camera 2's Font Tool #2 {Lot Code}

Note: A maximum of one (1) input string is allowed in a single transmission.

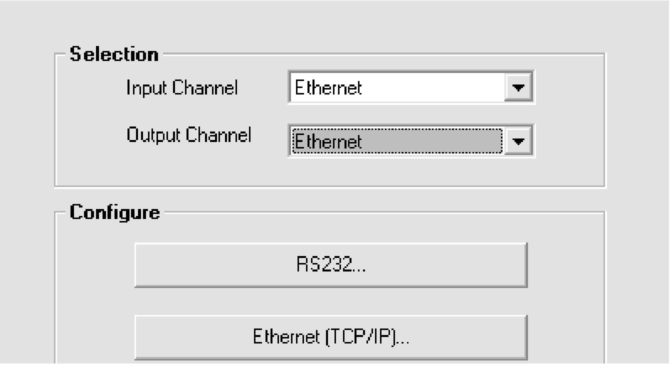
The Ethernet Input Syntax requires user selectable tool names as input rather than symbolic tool names.

When there are multiple OCVFontTools, Barcode Tools, Data Matrix Tools, or OCRTrainableFont Tools in the product definition, and one or more of the tools is not inserted directly into the Snapshot Step, the Ethernet Input Syntax described above may be ambiguous. In order to ensure that I-PAK uses the correct tools for setting the Layout String or Match String, the tools must be given unique names when the product definition is being created or edited.

I-PAK User Interface

In order to use Ethernet Input of Layout String, you must set the Input Channel and Output Channel to Ethernet in the System Settings dialog box, as shown in Figure 5–84.

FIGURE 5–84. System Settings — Ethernet



By default, while in Run Mode, I-PAK listens for input through Ethernet.

Once data has started to be received, I-PAK exits Run Mode, changes the string, then returns to Run Mode. I/O #16 Run/Setup is asserted once I-PAK is ready to receive triggers.

Ethernet ChangeLayout Error Debug

Any errors that occur are reported over Ethernet (via a “FAIL” message) to the host device. These errors are also displayed in message boxes within I-PAK. For example, when erroneous data (bad data, symbol not in layout, too many symbols, etc.,) is received over Ethernet from a user’s host machine, the ChangeLayout dialog box stays up on the I-PAK Run Mode screen - everything else from Run Mode is Disabled - except for the ChangeLayout Dialog box. It shows you the recently input data -tool name and “new” layout string.

FIGURE 5–85. **ChangeLayout Error Status: Run Mode**

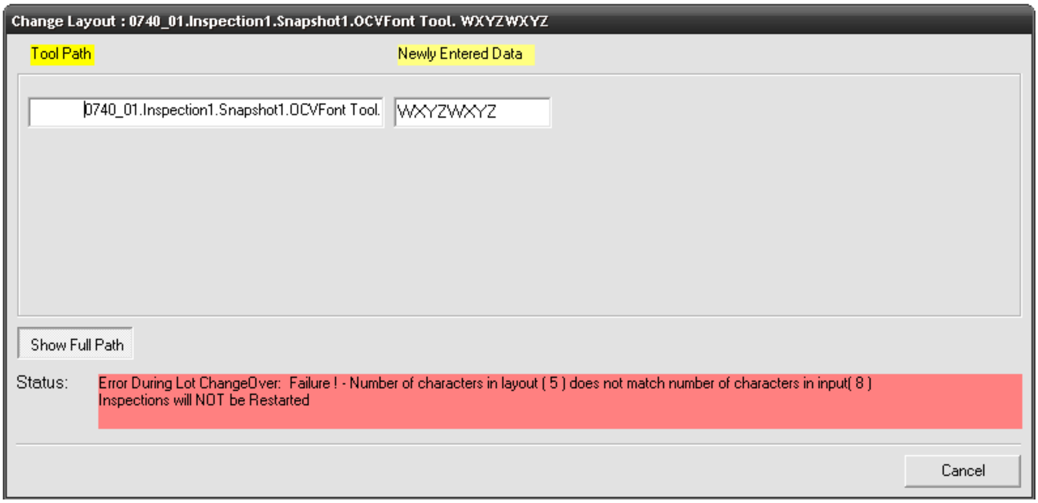
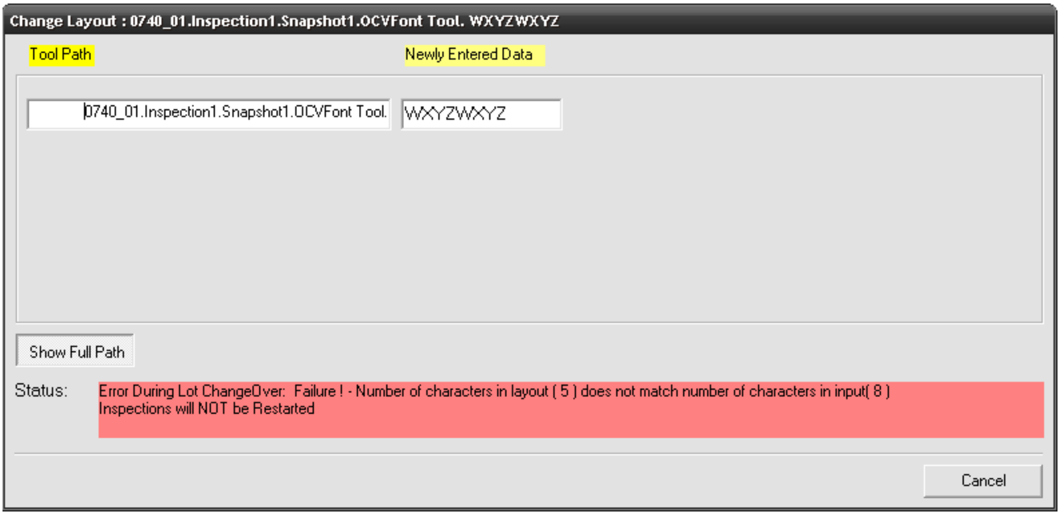


FIGURE 5–86. **ChangeLayout Error Details**



5
OCV Reference

You MUST take action by clicking the Cancel button before I-PAK will “resume”. In this bad data sent state, I-PAK is declared “off-line”. The error message is displayed along with the exact data input and the tools.

Note: The Cancel button makes you return to Run Mode but still in an Off-Line state - as inspections are NOT restarted because the data was invalid.

You may return to Setup Mode to re-train or try to send another (good) Ethernet ChangeLayout data to I-PAK.

The Ethernet response back is immediate (FAIL).

Ethernet ChangeLayout Success Response

When the Lot Changeover is successful, the Ethernet message “OK” is sent out and a message box is displayed.

For example, on good Ethernet ChangeLayout data, I-PAK will display the ChangeLayout Dialog box for ~5 seconds; I-PAK will make the “mouse” into an hourglass (wait), then control goes back to I-PAK. The Ethernet response back is immediate (OK).

FIGURE 5–87. **ChangeLayout Successful**

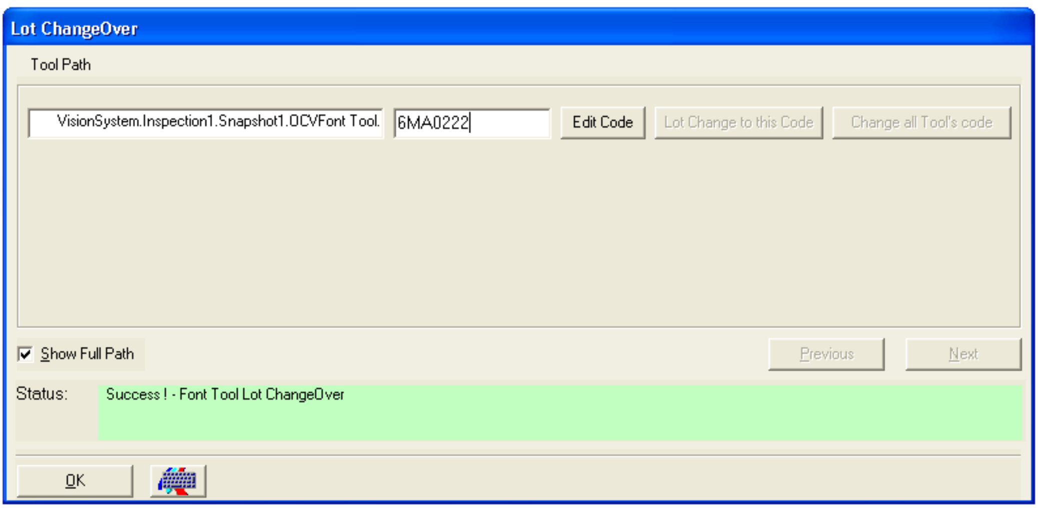
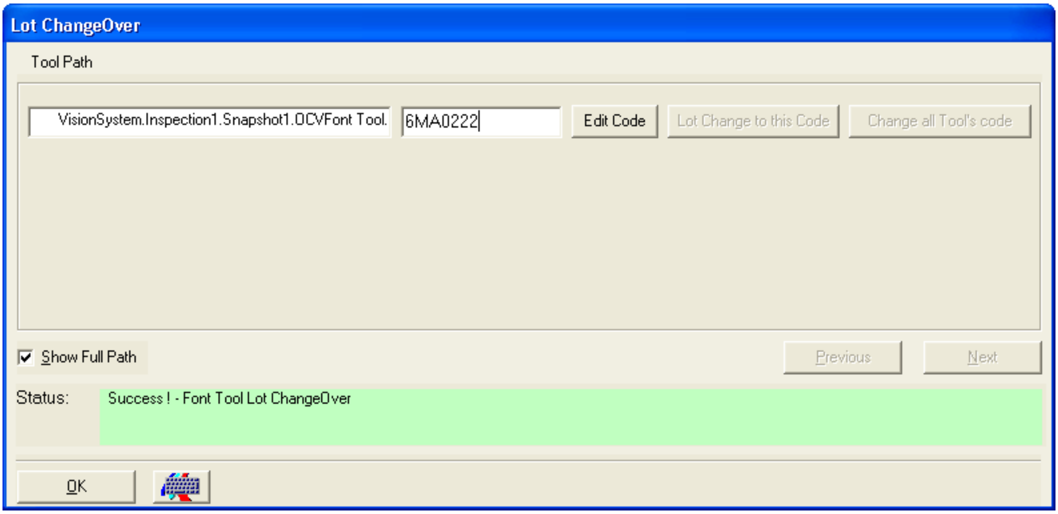


FIGURE 5–88. ChangeLayout Successful Details



ChangeLayout Debug

Whether good or erroneous data is sent to I-PAK, these “debug” windows help users by providing an Ethernet debugging tool that allows Programmers to verify that string(s) are sent using correct formatting. I-PAK tries to specify the exact syntax error (if any) of the input. I-PAK displays and highlight errors on the
I-PAK screen for a longer period of time so that the user knows that a ChangeLayout error has occurred. This causes user intervention to acknowledge the bad data. When I-PAK displays the Change Lot screen, users can clearly see the newly entered strings, to further provide debug assistance.

5

OCV Reference

Ethernet ChangeLayout Error Messages

In the event of data errors, the error messages shown in Table 5–6 are displayed.

TABLE 5–6. Ethernet Error Messages

Error Message	Meaning
Change Layout Error: Missing the Tool Name or the Layout	The input string did not contain either the name of the OCVFontTool or the new layout string
Change Layout Error: The Tool name is not in the Job. Check you input syntax.	An OCVFontTool with the given name could not be found in the Job
Input Symbol Name not found in OCVFont	The new layout string contains a Symbol Name that cannot be found in the selected OCVFont.
Missing 1st colon in layout	The input string could not be parsed because it has an incorrect format.
Missing 2nd colon in layout	The input string could not be parsed because it has an incorrect format.
Number of characters in layout does not match characters sent.	Wrong Number of Symbols: For a given Font Tool, the number of characters in the layout string is different from the inputted number of characters.
Step FontTool Not Found	The FontTool definition is not found in the input string from the host.
Step Inspection Not Found	The Inspection definition is not found in the input string from the host.
Step Snapshot Not Found	The Snapshot definition is not found in the input string from the host.
Step Visionboard Not Found	The Visionboard definition is not found in the input string from the host.
The Font Tool is not trained! Go back to Train/Tryout and train all the tools	The OCVFontTool with the given name is not trained. Lot Changeover requires the tool to have a layout string before changeover can occur.

OCV Tips

The OCV tools found in I-PAK have many settings and adjustments to allow for maximum flexibility. However, most applications require attention to only a few of these settings and adjustments.

OCVFont

- ID Test Determination Pct — Lowering the default value of 85% to 80% or 75% causes more characters to be flagged as similar.

Layout Step

- Automatic Segmentation — By default, this option is off, which allows the font library creation box to be manually sized around each character as it is entered into the library. I-PAK is designed such that you perform this individual training of characters to activate runtime ID checking of special characters like O, 0, B, 8, D, etc. ID checking requires that these symbol boxes be the same size.

  Note: Whenever possible, use the same size box to train all font library characters.

  You can enable the automatic segmentation option, and I-PAK automatically locates and places a box around all characters in the FOV.

DefaultSymbol

- Final Residue Limit — Increasing the default value of 15% to a higher number allows characters to vary more and still be accepted. Increasing this value has a gradual effect.
- Max Flaw Size — Increasing the default value of 1 pixel to a higher value allows characters to vary more and still be accepted. Increasing this value has a rapid effect. This number should not be set greater than 2.

OCVRuntime Tool

The OCVRuntime tool is the vision step that actually performs the inspection of a code. The following settings are found under Tool Settings.

Tool Settings

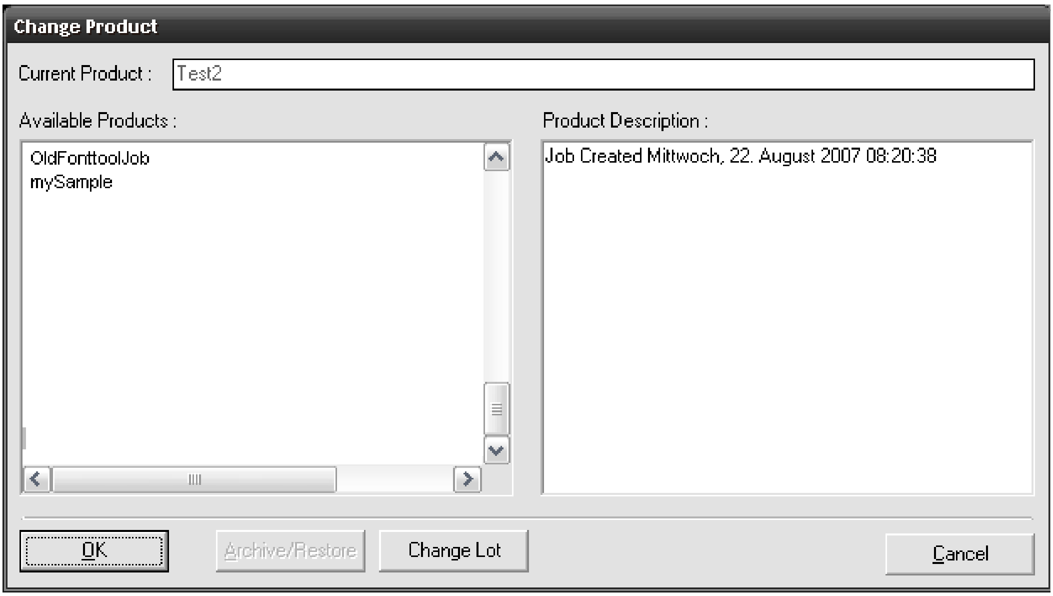
- Individual Symbol Search X — Increasing these values allows individual characters to move more in relation to one another.
- Individual Symbol Search Y — Increasing these values allows individual characters to move more in relation to one another.

Layout Step

- Allowed Overlap During Read — Increasing this value from the default value of 5 allows characters to be identified during the train step when their character boxes overlap.
- Min Read Match % — Decreasing the 65% default value allows characters to be identified at train time when they vary significantly from what was trained into the font library.

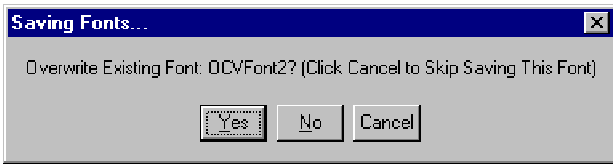
Converting Jobs with Embedded OCVFonts

FIGURE 5–89. **Converting Jobs with Embedded OCVFonts**



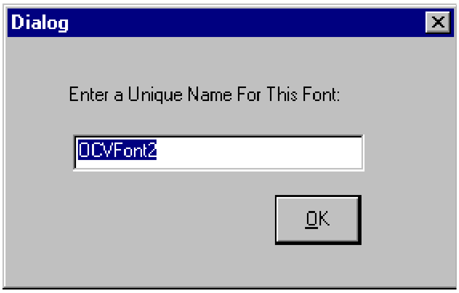
Jobs created with Version 2.3 or earlier that contain font based OCV tools are updated to use the new OCVFont method when those Jobs are read into I-PAK. When the old Job is read in, any OCVFonts found in an existing OCVFontFolder are saved to the Vscape\Jobs\Fonts folder using the font name found in the Job. If a font with that name already exists, the user is asked whether or not to overwrite the existing font.

FIGURE 5–90. **Overwrite Existing Font Dialog Box**



Clicking Cancel causes the font to not be saved. Clicking Yes causes the font being read to overwrite the existing one. Clicking No causes a prompt to appear so that the user can enter a unique name for the font being saved.

FIGURE 5–91. **Enter a Unique Name Dialog Box**



When the old Job is read in, any font based OCV tool found is modified so that the LayoutStep’s “Select Font” datum has the correct font chosen. This allows old Jobs to be loaded and run without requiring a re-train of the font based OCV tools.

Troubleshooting

Training Font Based Tools – Read Match%

To reproduce the behavior, Visionscape V2.5.1.12 was used. We believe that this behavior is consistent across all versions of Visionscape.

The Behavior

1. First, train the OCVFont. In the example given, the “TEXT02.TIF” was used to train characters “L”, “2”, “A”, “0”, “6”, “9”, “3”.
2. Set Read Match % = 80 % on Layout step in the OCV-Run time tool.
3. Train OCV-Run time tool.
4. You will find that the “L” character is not found even though the same “TEXT02.TIF” file is being used.

The Explanation

Training

When a character is trained into an OCVFont, there are several templates stored for the character. One of these templates is a Sobel Edge Enhancement template.

When the OCVRuntimeTool is trained, the ROI being searched for characters is first passed through a Sobel Edge Enhancement. Then, the Sobel Edge Enhancement templates (for each symbol) are used in a correlation to determine where the symbols are within the ROI. The “Read Match%” value is used to accept/reject a found character based on correlation match percentage.

Correct Character Training

When a character is trained, it is important to correctly size the training box around the character. The I-PAK manual describes character training as follows:

> Individual character training requires that the OCVFont box be placed close around a single character in the image, leaving a 1-2 pixel

border. This box should not include any portion of the adjacent characters. The minimum recommended character width is 20 pixels.

The 1 - 2 pixel border is important because it allows room for proper training of templates.

Auto-Segmenting Character Training

When the “Auto-Segment” option is used to train characters, the system locates blobs within the ROI. A bounding box for each blob is used to train the symbols. The “Num Border Spaces to Add” option of the OCVFont’s LayoutStep can be used to increase the size of the box used to train the symbols.

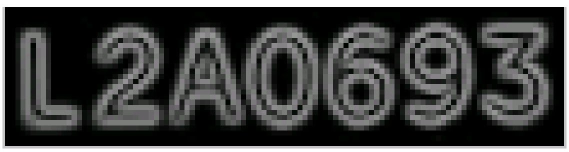
This “Auto-Segment” method of training OCVFonts is not necessarily the optimal method for training characters. In particular, the 1 - 2 pixel border requirement may not be met.

Example with Auto-Segment

Using the “TEXT02.TIF” image, a sample OCVFont was trained using auto-segmentation with all parameters at the default values. The characters “L”, “2”, “A”, “0”, “6”, “9”, “3” were trained into the OCVFont.

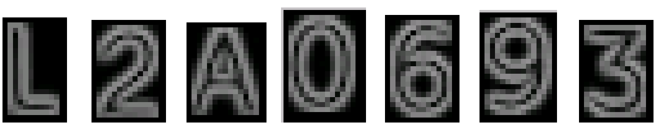
When the OCVRuntimeTool was trained, the Sobel Edge Enhancement search buffer was:

FIGURE 5–92. Contents of Buffer



The Sobel Edge Enhancement templates and the resulting Match% were:

FIGURE 5–93. Resulting Match%



83% 85% 89% 90% 89% 93% 80%

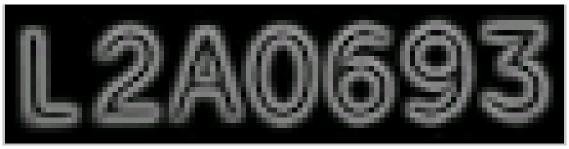
When you look closely at the template images and compare them to the search buffer, you can see that the template images are missing some data. This is because the Auto-Segment boxes were not big enough when the characters were trained. It is this missing data that causes the match % to go down, even when training on the same image.

Example with Manually Trained Characters

Using the “TEXT02.TIF” image, a sample OCVFont was trained by manually placing the training box over the characters. All parameters were at the default values. The characters “L”, “2”, “A”, “0”, “6”, “9”, “3” were trained into the OCVFont.

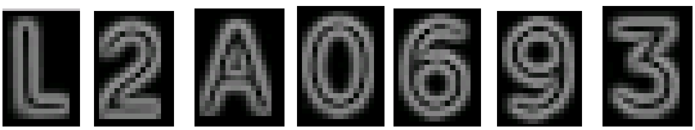
When the OCVRuntimeTool was trained, the Sobel Edge Enhancement search buffer was (the same as above example):

FIGURE 5–94. Contents of Buffer



The Sobel Edge Enhancement templates and the resulting Match% were:

FIGURE 5–95. Resulting Match%



99% 95% 98% 98% 99% 99% 99%

Comparing these templates to the search buffer, you can see that the template characters more closely resemble those in the search area as reflected by the Match % values. By manually positioning the training boxes, we were able to ensure that the proper amount of spacing was available for template training.

Conclusions

- Microscan currently recommends that OCVFont training be performed using manual placement of the training box. This is because the training box should be the same size over symbols that are similar in order for the Runtime ID Checking algorithms to work optimally. The “Auto-Segmentation” cannot assure that the boxes around similar characters are the same size. Using manual placement with the correct 1 - 2 pixel border will also help prevent the behavior described in this document.
- The “Auto-Segmentation” training of OCVFonts is useful for quick demos or to quickly prove out an inspection scenario. While the behavior described may cause confusion at train time when using a frozen image, the Runtime inspections remain intact. The runtime inspections do not use the Sobel Edge Enhancement templates.
- The default value for “Number of Border Spaces to Add” may need to be increased to 2. This would give the Auto-Segmentation characters more border space with which to train the characters. While this would probably help with the Read Match%, increasing the border space may cause some symbol overlap in cases where the symbols are close together. Microscan recommends manual training of the OCVFont.

6

CHAPTER 6

Setup Mode Reference

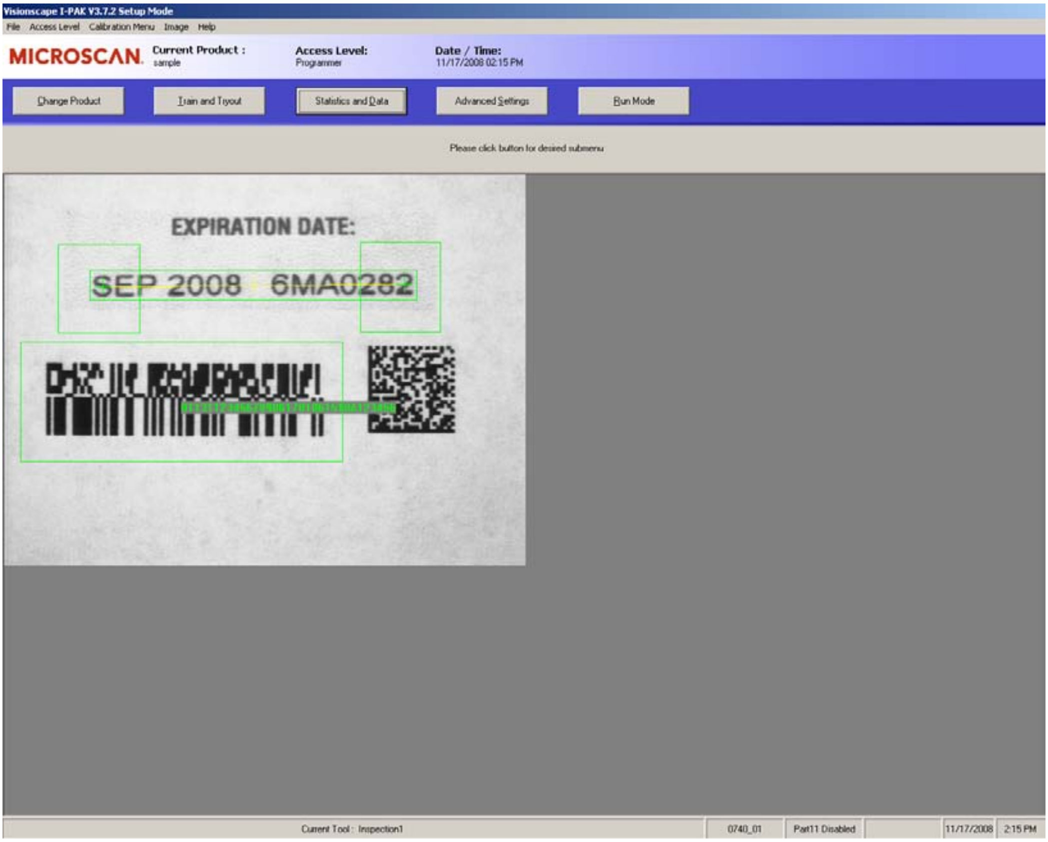
This chapter presents the I-PAK Setup Mode functionality, and describes the following:

Overview

You enter Setup Mode by entering correctly either the Supervisor’s default password (1010) or the Programmer’s default password (0101) from Run Mode. In Setup Mode, you create and program Jobs, re-train tools, and review
end-of-batch results. The Setup Mode window is displayed in Figure 6–1.

Note: These illustrations show the expanded menus in I-PAK. By default, I-PAK appears in “streamline” mode — a system setting. This presents a cleaner operator interface to users. Use the system setting according to your preferences.

FIGURE 6–1. I-PAK Setup Mode



Access level is set depending on which password was entered:

- A Supervisor can perform a product changeOver, re-train tools, perform a tryout, write data out to a file, and reset statistics and failures.
- A Programmer can perform all the Supervisor functions plus create a new product definition, adjust system settings, modify tools in a product definition, adjust tool settings and save a product definition at any time.

There are various dialog boxes, windows, menus, and buttons that are displayed as a result of action taken on the Setup Mode window.

The still picture in the upper right corner indicates Setup Mode status.

The Setup Mode window contains some read-only information, such as the
I-PAK name and version number, the name of the current product, current access level, the date, and the time.

As you go into the I-PAK submenus (Change Product, Train and Tryout, Statistics and Data, and Advanced Settings), you will see the main toolbar as a guide to remind you which submenu you are currently in. The active submenu is grayed out; inactive submenus are not grayed out.

Setup Mode Menus

This section describes the following:

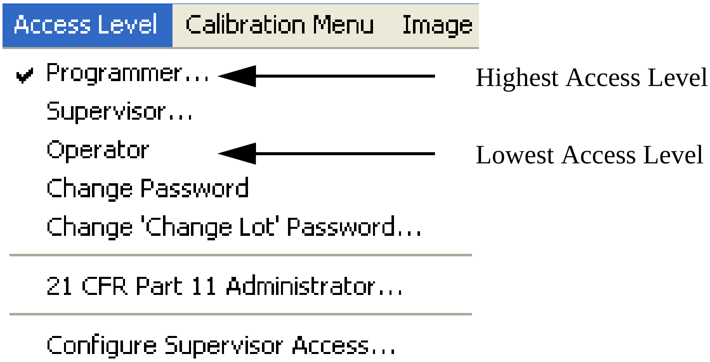
File Menu

FIGURE 6–2. **File Menu**

To exit I-PAK, you must be at the Programmer’s access level. If you are not, you will be prompted to enter the Programmer’s password.

Access Level Menu

FIGURE 6–3. **Setup Mode — Access Level Menu**



The ordering of access levels is Programmer, Supervisor and Operator. If you are at a lower access level and are trying to go up to a higher access level, you will be prompted for a password. If you are trying to go to a lower access level, you will be allowed to go to that lower access level without entering a password.

- Programmer — Displays prompt for the Programmer's password. Successful entry enables Programmer and Supervisor Level Capabilities. The default password for Programmer Access Level is 0101. This data is saved in the PC's registry.
- Supervisor — Displays prompt for the Supervisor's password. Successful entry enables Supervisor Level Capabilities. The default password for Supervisor Access Level is 1010. This data is saved in the PC's registry.
- Operator — Immediately places I-PAK into Operator level.
- Change Password — Displays a dialog box for a new password for the currently enabled access level.

Note: Passwords must use numeric symbols.

- Change 'Change Lot' Password... — Allows the Programmer to change the Change Lot password (default is 1101) to something else.

This is active only if the access level is Programmer. For Supervisor access, Changing Lot at Run Time is activated.

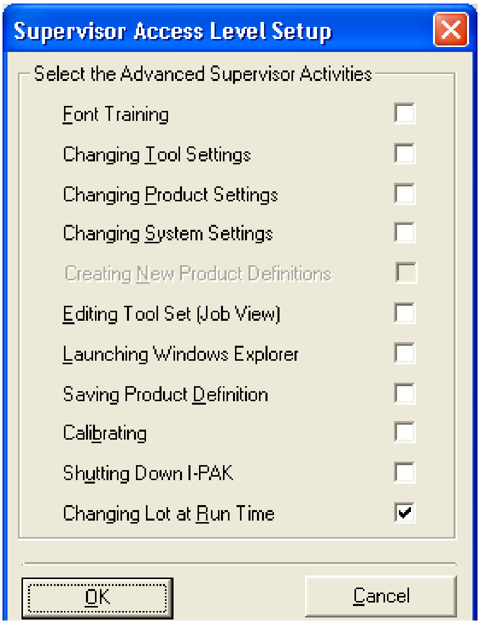
- 21 CFR Part 11 Administrator — When using the 21 CFR Part 11 option, this choice is enabled. The Administrator mode allows the defining of valid users, their passwords and their security levels. This Administrator, whose user name is I-PAKAdmin and default password is 999999, is your Configuration Manager. He or she is not a Programmer, a Supervisor nor an Operator.

  The Administrator password is stored in the PC's registry settings and is changeable through the I-PAK interface.

  Note: The Administrator should be careful not to forget his or her password, as it is very difficult to recover the Administrator password. You will need to contact Microscan to recover a forgotten Administrator password.

- Configure Supervisor Access — This command is available to Programmers to configure the tasks a Supervisor can perform. When you do not have Programmer level access, this menu item is grayed out so that it cannot be selected. When a Programmer selects this item, the Configure Supervisor Access dialog box is displayed, as shown in Figure 6–4.

FIGURE 6–4. **Configure Supervisor Access**



The Programmer can define the following abilities for a Supervisor:

– Allowing access train mode to tool settings, font training and scaling.

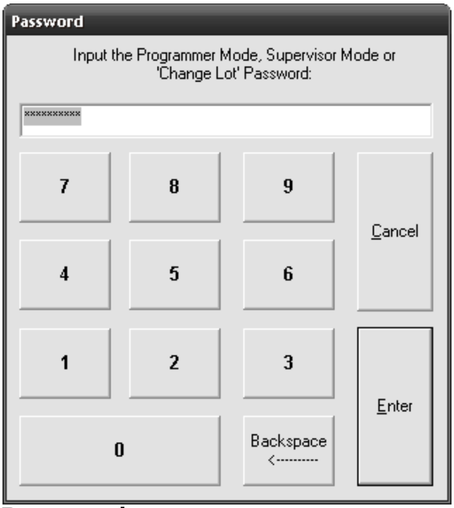
– Changing Product and System settings.

– Editing the Tool Set - Job View.

– Shutting down I-PAK, launching the Windows Explorer, calibration and saving Product definitions.

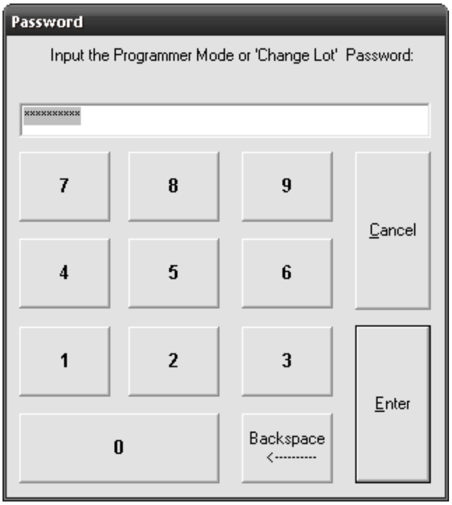
– Changing Lot at Run Time — By default, Changing Lot at Run Time is checked; the Supervisor is allowed to change the lot string using the Change Lot button on the main Run Screen. When the Supervisor clicks Change Lot, he or she is prompted for either the Programmer or Supervisor password, as shown in Figure 6–5:

FIGURE 6–5. **Input Programmer, Supervisor Mode, or Change Lot Password**



When Changing Lot at Run Time is not checked, the Supervisor is not allowed to change the lot string using the Change Lot button on the main Run Screen. When the Supervisor clicks Change Lot, he or she is prompted for the Programmer password:

FIGURE 6–6. **Input Programmer Mode or Change Lot Password**

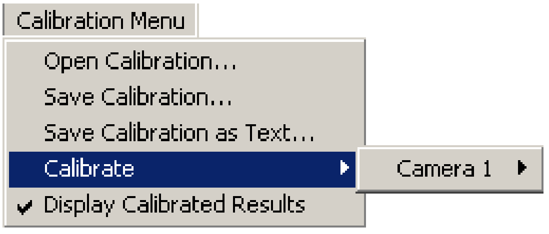


21 CFR Part 11 Menu

For complete information regarding 21 CFR Part 11 and its menu, see Chapter 3, “21 CFR Part 11”.

Calibration Menu

FIGURE 6–7. **Calibration Menu**



This menu allows you to calibrate camera views on any target in the system. Camera views are simply Snapshot Steps on any target in the system, but they are arranged according to the hardware camera on a target system.

- Open Calibration — Reloads calibration data from an existing file. When reloading data, calibration data is read from the file into the corresponding Snapshot on a one to one basis. If the number of Snapshots does not equal the number of calibration data objects in the file, then as many Snapshot steps that can receive calibration data do so.

- Save Calibration — Saves calibration data to a separate file. When saving data, calibration data from each Snapshot Step in every target is saved in one file with a .cal extension.
- Save Calibration as Text — Writes the entire calibration World tree to disk as a text file.
- Calibrate — Starts the calibration process on Snapshot x of Camera y.
- Display Calibrated Results — Enables or disables the display of the calibrated measurement results at Runtime in calibrated units.

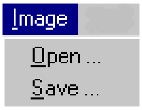
Different Snapshot Steps, which use the same camera, are considered different views of the camera and can be calibrated individually or as a group. The different camera menus under “Calibrate” list the names of each Snapshot in the corresponding target. When you click one of these menus, the Calibration Wizard from the Calibration Manager control is displayed, and you can calibrate the camera view.

When a camera is calibrated, its data is saved in the .avp file. The open/save menu items are a means to extract the calibration data into a file and reload it into a different program.

For further information, please refer to Chapter 2 of the Visionscape Tools Reference. This manual is included on the USB drive in PDF format.

Image Menu

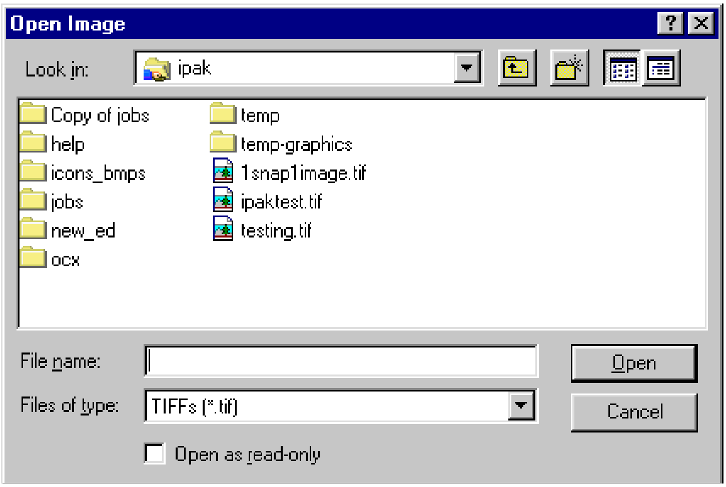
FIGURE 6–8. Image Menu



- Open — When Open is selected, the Open Image dialog box is displayed, as shown in Figure 6–9. You can open a previously saved

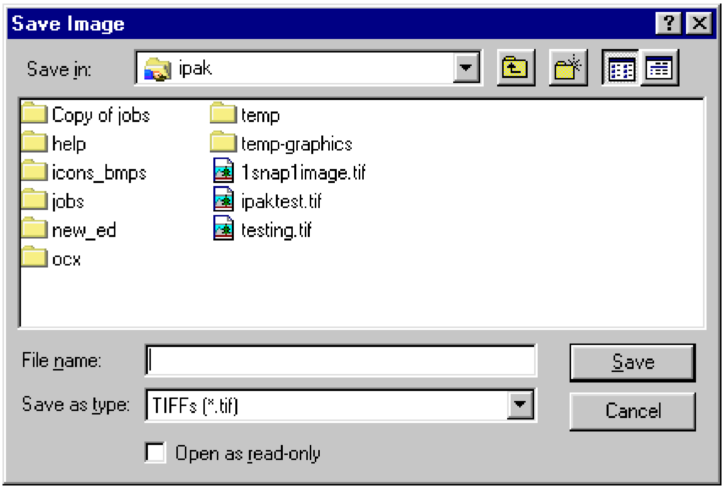
I-PAK image. This may be useful for re-training tools or debugging an application with a frozen image.

FIGURE 6–9. **Open Image Dialog Box**



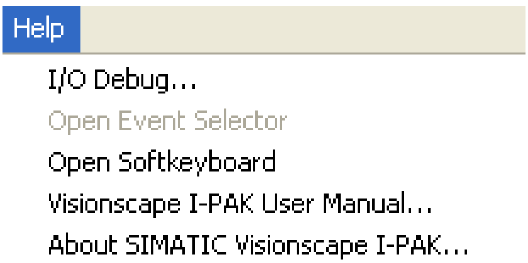
- Save — When Save is selected, the Save Image dialog box is displayed, as shown in Figure 6–10. You can save an I-PAK image to your hard drive. This may be useful in storing a golden training image or for debugging purposes.

FIGURE 6–10. Save Image Dialog Box



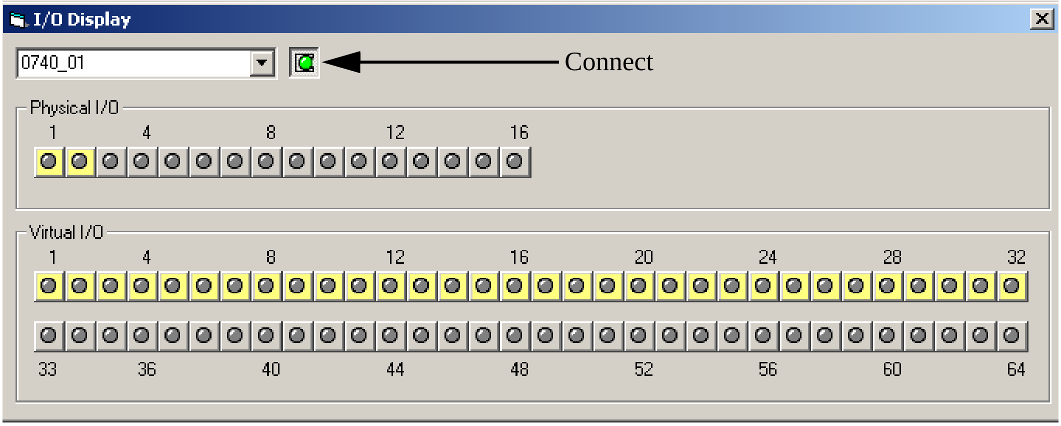
Help Menu

FIGURE 6–11. Help Menu



- I/O Debug... — When I/O Debug... is selected, the I-PAK I/O Debug diagnostic tool is displayed, as shown in Figure 6–12.

FIGURE 6–12. **I/O Debug Diagnostic Display**



A Programmer can access an I/O Diagnostic tool to set and view the state of physical and virtual I/O. This graphical representation is available only in Setup Mode and only at the Programmer access level.

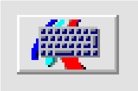
Once the I/O Diagnostic tool is displayed, the Programmer must connect to a Visionscape framegrabber board by selecting the name of the framegrabber board from the drop-down list, and clicking on the Connect button that is to the right of the drop-down list.

The top portion of the window displays the physical I/O; the bottom portion displays the virtual I/O. Inputs are indicated as yellow buttons. Where applicable, you can click the I/O LED and change the state of the given I/O point.

- Open Event Selector — The Event Selector allows the user to change how a touchscreen button press is received. By default, pressing the touchscreen is equivalent to a left mouse click. By pressing the Event Selector, the next touchscreen press will be read as a right mouse click. The Event Selector will show the status of the touchscreen selection based on the button that colored dark blue in its window.

- Open Softkeyboard — The Softkeyboard allows the user to enter text by pressing keys of the keyboard displayed in this program. The text can be entered via left mouse clicks or touching the key on the touchscreen.

If you are working on a Panel PC with an integrated Touch Screen, and no keyboard is connected to the PC, you can open the Touch Input Software using the following button:

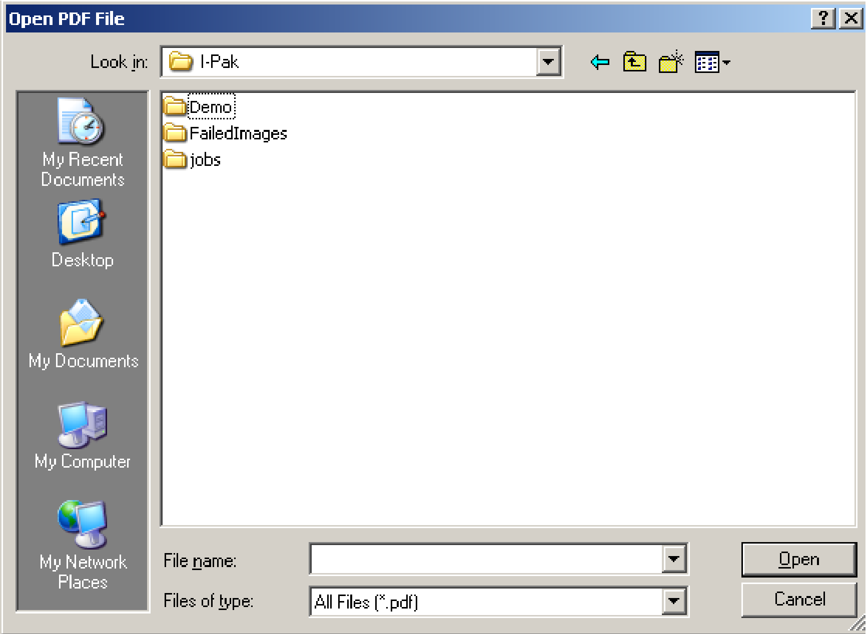


The button is only available in Windows or dialog boxes where it is possible to enter data. You can also open the Touch Input via the Menu entry
Help > Open Softkeyboard in Setup Mode.

If I-PAK is not running on a Panel PC, or the Touch Input Software in not installed on the Panel PC, the button is not available.

- Visionscape I-PAK User Manual — When you select Visionscape I-PAK User Manual, the PDF for the manual is opened immediately. If the PDF cannot be found in the installation path, a dialog box is displayed, as shown in Figure 6–13. Navigate to the I-PAK User Manual PDF and click Open.

FIGURE 6–13. **Open PDF File Dialog Box**



Then, an Acrobat Reader program will launch and you can review the manual. After you go into Run Mode, the Acrobat Reader program will close automatically.

- About Visionscape I-PAK... — Click About Visionscape I-PAK... to display information about the version of I-PAK running on your PC.

Run Mode

Note: For information about PreProduction Mode and Production Mode, see Production Mode on page 6–114.

Use the Run Mode button when you want to leave Setup Mode after performing a Product ChangeOver, configuring or re-training a Job, and return to Run Mode with your Access Level reset to Operator.

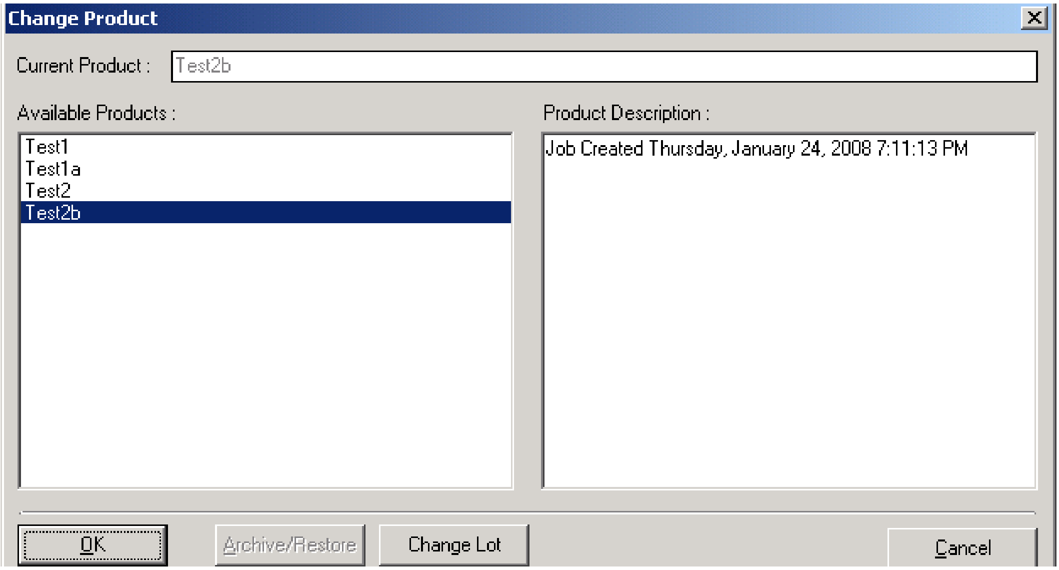
At this time, the inspection Job is downloaded to the framegrabber(s). Windows Registry information is updated with the name of this Job. This provides recovery in the event of a power loss, and enables I-PAK to recover to Run Mode running this last Product. Run Mode can be accessed by any user: Administrator, Programmer, Supervisor or an Operator.

The current product must be fully trained: all tools must be trained before you can run your product in Run Mode. The Run Mode button is grayed out until all tools in the current Job are trained.

Change Product

The Change Product button displays the Change Product dialog box, as shown in Figure 6–14.

FIGURE 6–14. Change Product Dialog Box



The Change Product dialog box displays a listing of pre-existing Jobs from the Jobs directory. The Supervisor can select from these pre-programmed Products by scrolling the list, selecting the Product, and clicking OK.

Once selected, the product is read in from disk, and the new Product name replaces all occurrences of the previously displayed Product name on all windows, menus, and dialog boxes. Any changes to the former Job that were not saved are discarded.

The product description text (up to 1000 characters) is stored with the product definition in the .avpsys file. This allows each product definition to have a unique description.

The Supervisor can perform a Change Lot by clicking Change Lot.

The Supervisor can archive or restore pre-programmed Products from a specified archive path such as a CD-RW or network path by clicking the

Archive/Restore button. Click Cancel to exit without changing the Product.

This remainder of this section describes the following:

- “Change Lot Feature” starting on page 6-17
- “Location of Jobs Folder” starting on page 6-19
- “Advanced Topic: Remote Change Product” starting on page 6-20
- “Archiving and Restoring Products” starting on page 6-20

Change Lot Feature

From the Change Product dialog box, the Supervisor can change:

- The match string for a Barcode Tool, a Data Matrix Tool, and an OCRTrainableFont Tool after the tool has initially been trained using the Change Lot feature.
- The expected Font Tool layout after the tool has been initially trained.

Note: You must ensure that the Font Tool has already been trained, its number of layout characters is not changing, its AutoFind characters are not changing, and its character symbols are well defined in the font library.

I-PAK provides a unique default password for Operators; this password allows Operators to perform a “Change Lot” function, but does not allow them to enter Setup Mode. When 21 CFR Part 11 user control is enabled, Operators can perform a “‘Change Lot” function.

When you click Change Lot, a dialog box is displayed, similar to Figure 6–15 and Figure 6–16. It displays the full path of all tool names and their associated match strings or layouts for the Data Matrix/Barcode and Font Tools, respectively, for all the tools in the Job available for Lot ChangeOver. It will display five strings at a time. Use the Next and Previous buttons to display all the tools in the Job.

FIGURE 6–15. **Lot ChangeOver - Edit Code**

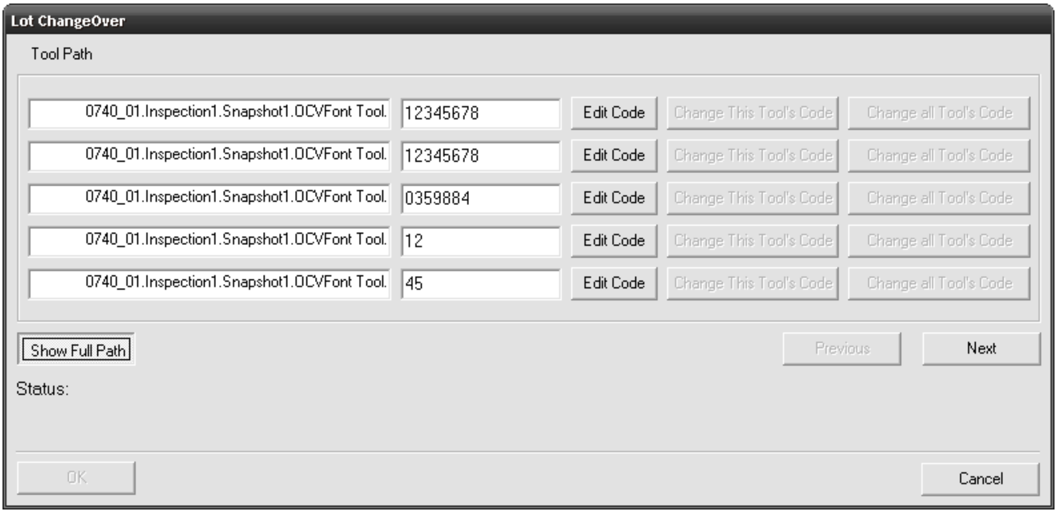
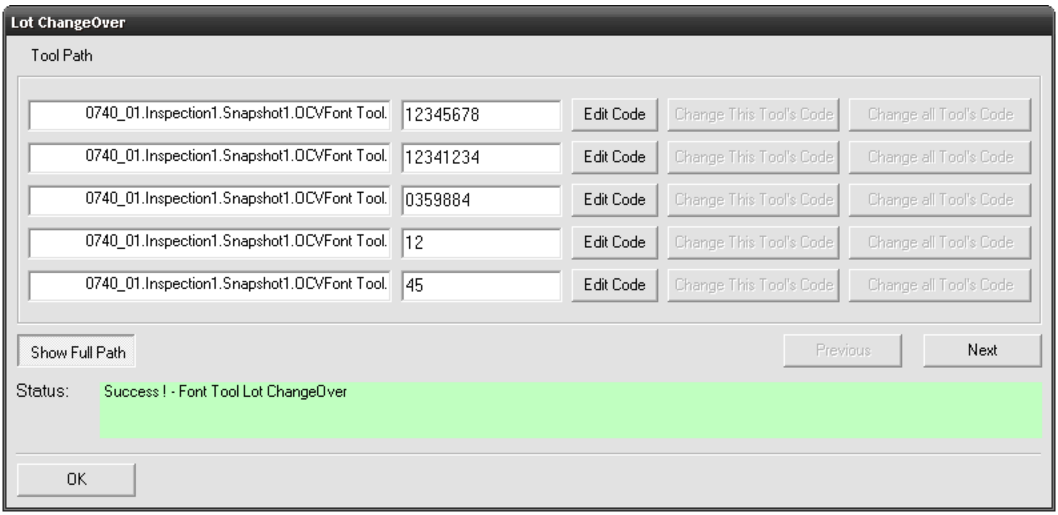


FIGURE 6–16. **Lot ChangeOver - Complete**



If you want to change a Code, simply click Edit Code for the specific tool(s). This allows you to edit the contents of the match or layout string. This also enables the Change this Tool’s Code and the Change all Tool’s Code buttons.

When you want to just change one match or layout string at a time, edit the code and click Change this Tool's Code. This will change the match or layout string to the contents you just specified. I-PAK will display an error message if the number of characters in the new string is not equal to the number of characters in the old string. I-PAK will display a message if any of the characters in the new string are not defined in the OCVFont used by the tool. When no errors are encountered, I-PAK displays a "success" message.

If a Job has multiple tools that have identical match or layout strings, you can change them all at once by editing the code for any one and then clicking Change all Tool's Code. Then, I-PAK will go through the Job and change the match or layout string to the contents you just specified for all tools that had the same code.

Note: The Font Tool IGNORE character "@" and Data Matrix Tool IGNORE character "?" are allowed in this dialog box.

This feature supports up to 99 Font, Data Matrix and Barcode tools total in any one Job.

Location of Jobs Folder

The Jobs folder is created in the directory in which I-PAK was installed and from which you run I-PAK. For example, if you install the I-PAK software in C:\Vscape, then, when you first run I-PAK, it automatically creates the Jobs folder as follows:

C:\Vscape\I-Pak\Jobs

Using Windows Explorer, you can back up your Job definitions to another disk or floppy.

Automatic Backup of Jobs

I-PAK performs an automatic backup of the current product definition to help you recover in the event of a PC disk error. Every time that a product definition is about to be saved, an automatic copy of the Job is created in a directory called JobsBackup that is located within your Jobs directory. For example, this automatic backup directory will be C:\Vscape\I-Pak\Jobs\JobsBackup.

In the event of a PC disk error, you can recover the .avp and .avpsys files for your products short of your last edits. The file is suffixed with a -1 to further designate that these file copies are one revision behind the current product definition.

Advanced Topic: Remote Change Product

You can use an external program to change the product on I-PAK. When an external program downloads a product using a runtime manager, I-PAK recognizes the download and changes the active product to be the one downloaded. This requires that, before the external program downloads the product, it must change the registry setting for I-PAK that indicates the name of the active product.

Note: I-PAK must be in Run Mode operation when the change of product occurs.

Archiving and Restoring Products

Through the I-PAK interface, you can archive and restore products from a CD-RW or any other valid path, such as a directory or across a network. I-PAK Job files are rather large and typically do not fit on a floppy. By using a CD-RW, you can archive your Jobs and restore them safely. The setup of the CD-RW software is necessary before you can use this feature and is described in “CD-RW Support” on page C-10. A system-level I-PAK system has a CD-RW as an optional configuration.

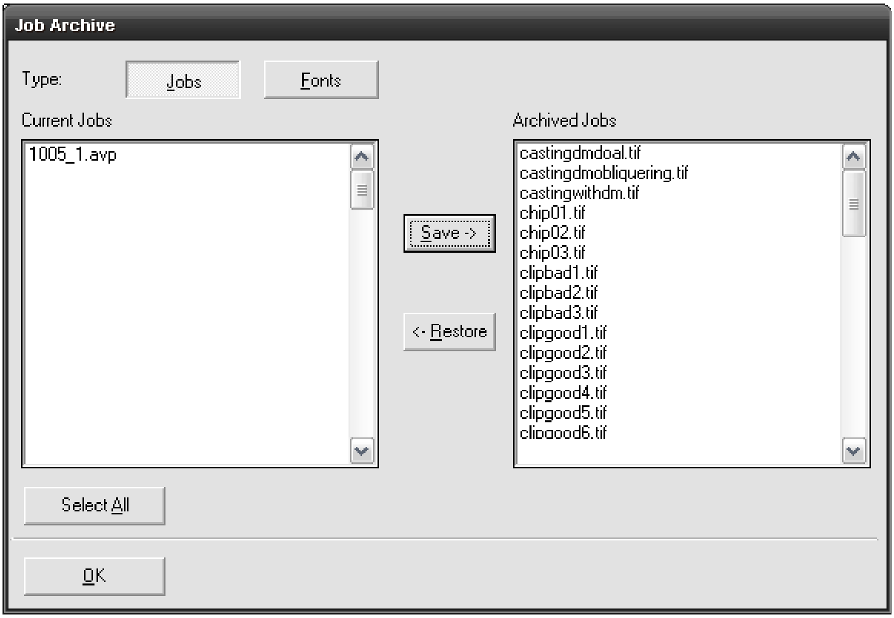
Setting Archival Pathname

In the System Settings menu, in the Product ChangeOver Activities dialog box, you need to specify the path of the archive location. For example, when using a CDR, this path might be D:\.

Archive/Restore Dialog Box

When you go to the Product ChangeOver dialog box, you'll notice the Archive/Restore button. Click this button to display the Job Archive dialog box, as shown in Figure 6–17.

FIGURE 6–17. **Job Archive Dialog Box — Archive Example**



In this Job Archive/Restore dialog box, the left-hand display shows the Jobs from the current I-PAK\Jobs folder, while the right-hand display shows the Jobs from the archival path. In this example, we used a CDR for the archival path.

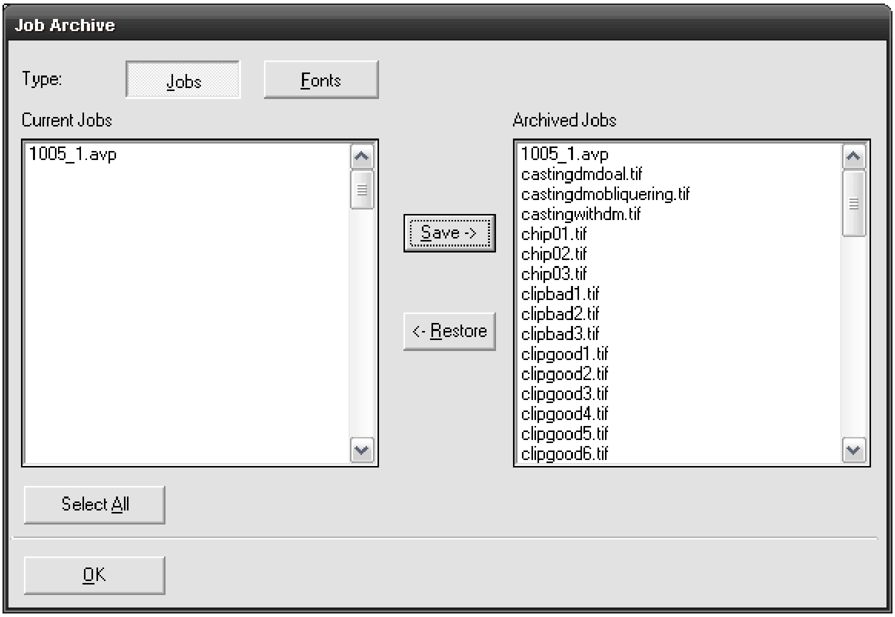
You must ready the CD media before you can begin using it.

You'll always need to archive and restore both the .avp and .avpsys files for a product to run in I-PAK.

To archive a Job from the Current Jobs folder to the Archived Jobs, click on the Job name and its associated .avpsys file from the left-hand list. Then, click on Save-> to copy those files onto the archival path. In this case, it copies the files from the I-PAK\Jobs directory to the CDR.

To select more than one file at a time, hold the Ctrl key while clicking file names.

FIGURE 6–18. **Archive/Restore Dialog Box After Successful Archive**



Likewise, to restore a Job from the Archived Jobs to the Current Jobs folder, simply click on the Job name and its associated .avpsys file from the right-hand list. Then, click on <-Restore to copy those files back to the Current Jobs folder. In this case, it will copy the files from the CDR to the I-PAK\Jobs directory.

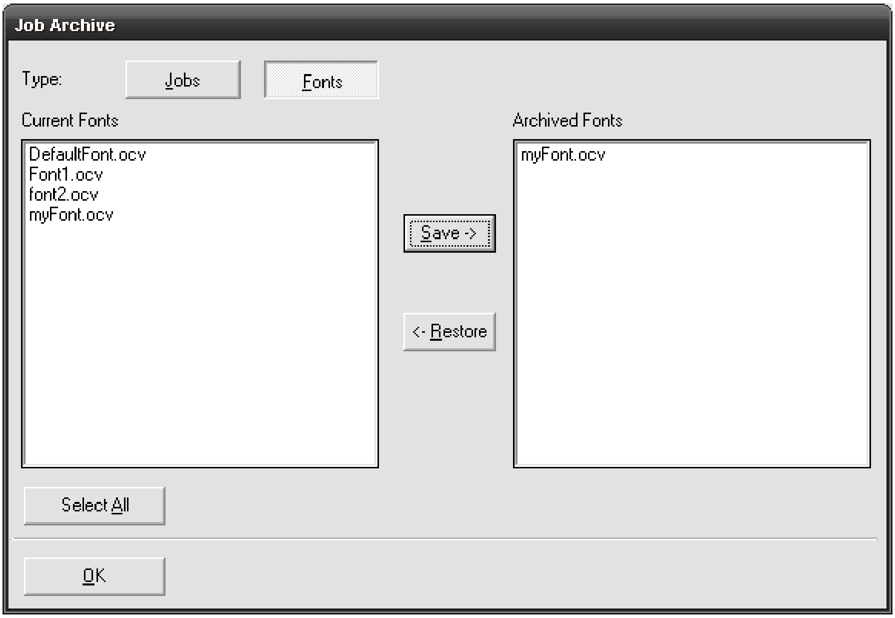
There are error messages and prompts to handle overwriting file names, etc.

Archiving Fonts

I-PAK allows the user to archive OCVFonts. After a valid archive path has been entered on the System Settings screen, the Archive/Restore button on the Product ChangeOver dialog box is enabled. Clicking this button brings up the Job Archive dialog box.

Clicking Fonts allows the user to archive/restore font files and images from/to the Vscape\Jobs\Fonts folder.

FIGURE 6–19. Job Archive Dialog Box — Fonts Button



To archive Fonts from the Current Fonts folder to the Archived Fonts, click on the Font name from the left-hand list. Then, click on Save-> to copy those files onto the archival path.

To select more than one file at a time, hold the Ctrl key while clicking file names.

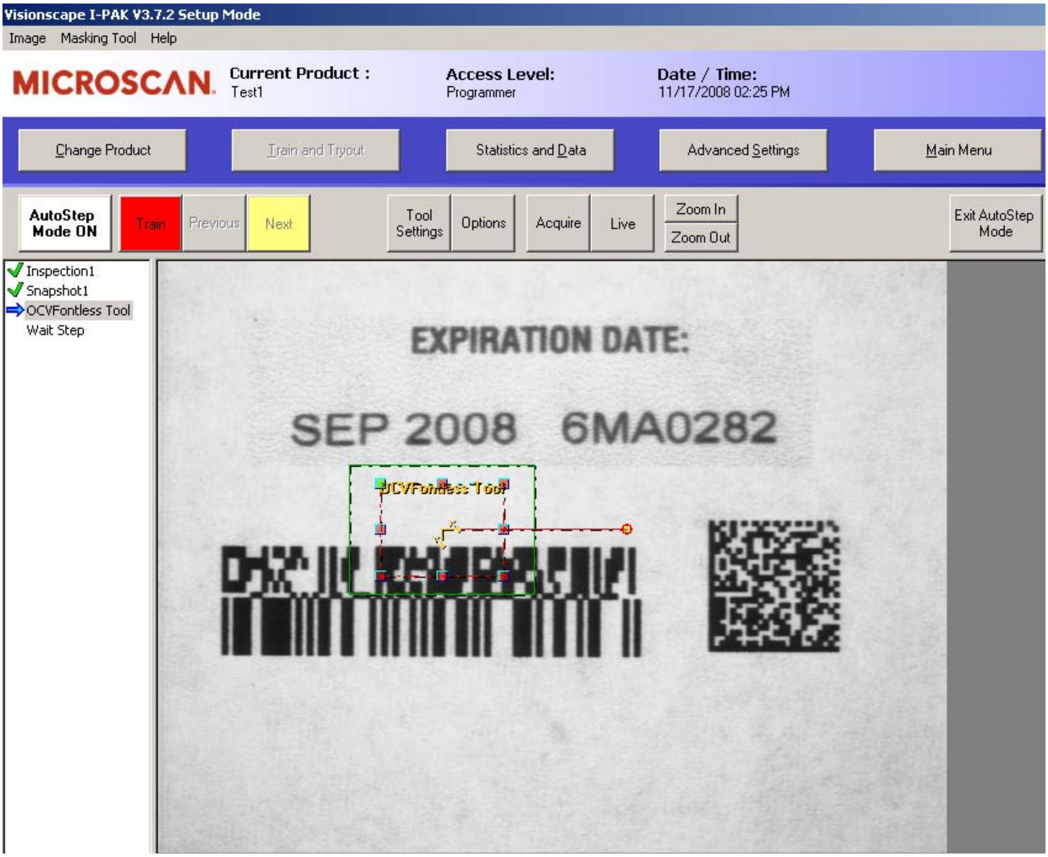
To restore Fonts from the Archived Fonts to the Current Fonts folder, simply click on the Font name from the right-hand list. Then, click on <-Restore to copy that Font back to the Current Fonts folder.

Train and Tryout

Train and Tryout displays the Train and Tryout wizard mode window, as shown in Figure 6–20. The Training and Tryout functions are grouped into one and utilize the same display. The Supervisor/Programmer can train, re-train, and tryout the tools from this display. The concept of wizard mode exists in this menu much like the Create a Product wizard mode.

You want to first train your tools. AutoStep guides you through the training process.

FIGURE 6–20. Train and Tryout Wizard Window



This remainder of this section describes the following:

- “AutoStep or Wizard Training Method” starting on page 6-25
- “AutoStep Off” starting on page 6-27
- “Train and Tryout Mode” starting on page 6-27
- “Train and Tryout Toolbar” starting on page 6-27
- “Automatically Setting Tool Settings” starting on page 6-35
- “Special Training of Tools with I-PAK” starting on page 6-36

AutoStep or Wizard Training Method

The AutoStep or Wizard method of training walks the Supervisor or Programmer through each step of the training sequence. The I-PAK interface uses the term “AutoStep” rather than “Wizard”. By default, AutoStep training is invoked automatically when you first enter this window, but can be changed via a system setting. See the AutoStep Mode On Automatically in Train and Tryout setting on page 6–106.

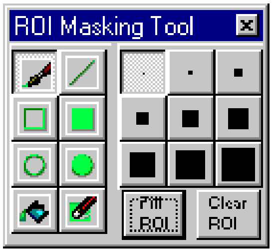
Image

The image will display the last runtime or acquired image associated with that snapshot with the tool graphics superimposed. The Programmer/Supervisor is required to train each tool and then click Next to proceed to the next tool.

Masking Tool

When a vision tool that uses an input mask is selected, the Masking Tool menu option becomes available. Clicking on this menu option brings up the ROI Masking Tool dialog box, as shown in Figure 6–21.

FIGURE 6–21. **ROI Masking Tool Dialog Box**



The dialog box allows a mask to be drawn into the buffer. Then, the associated tool uses this mask at run time. Only tools that have input mask capabilities (in other words, Blob, Flaw, etc.) can use the ROI Masking Tool.

This dialog box allows you to select a pen style and drawing style for drawing a mask directly into the buffer. You can also use the Fill Style or Eraser Style to fill an enclosed area or erase part of the drawn mask.

- Fill ROI — Fills the entire ROI
- Clear ROI — Clears the entire ROI

When editing the mask is complete, you must close the ROI Masking Tool to continue with Train and Tryout activities.

Job View

The data on the left-hand side of the display is your Job. As you successfully train each tool in your Job, a green check mark appears next to each tool name. With AutoStep off, you can click directly on a tool in this view for re-training, or click on its shape in the image window.

Note: Some steps like the Inspection step update its status after all of the tools in that Inspection have completed. This means that the Inspection step could display a red X until the last tool has been trained and then would change to a green check mark.

Completing AutoStep Mode

When all tools have been trained, the Next button on the Toolbar changes to a Finish button. Then, the Programmer/Supervisor clicks on Finish to complete the training process. The Programmer/Supervisor is notified when AutoStep training is complete.

AutoStep Off

The Programmer/Supervisor can manually select the tools to be trained. This method of training may also be called random access training. With AutoStep off, all tools can be graphically displayed in the image window. You can click on a tool to select it. The Programmer/Supervisor can also use the Next and Previous buttons to select a tool. Once selected, the tool can be trained by clicking Train.

By default, upon entering train mode, AutoStep (wizard mode) is on. To exit AutoStep, click Exit AutoStep. This puts you in manual train mode. When in manual train mode, you can click Next Camera or right-click on Next, which allows you to skip to the next snapshot or camera view.

The Programmer/Supervisor can click Exit Training to Main Setup to exit this menu at any time.

Train and Tryout Mode

With AutoStep off, or once all vision tools in a Product have been trained successfully, Train and Tryout Mode allows you to tryout the Job. This mode allows you to monitor the execution of each step in the Product. This allows for debugging and proving the integrity of an inspection before running production mode.

With AutoStep off, Train and Tryout Mode is active and additional buttons are displayed to the right of the Toolbar. Below the Toolbar is an area for image display. Scroll bars are provided to allow you to access all areas of the image. Vision tools are graphically displayed over the image and can be selected by clicking on their graphical representations.

Train and Tryout Toolbar

This toolbar enables you to move through the train and tryout process, acquire images, view live images, and tryout the product. Refer to Figure 6–22 and the descriptions on page 6–28 through page 6–35.

FIGURE 6–22. **Train and Tryout Buttons**

AutoStep

AutoStep enables the Train and Tryout wizard to guide you, tool by tool, through the re-training process. This is a Supervisor level function. The default is based on the System Setting AutoStep Mode On Automatically in Train and Tryout. The default is On. To exit AutoStep, click Exit AutoStep Mode or change the default setting.

Train

Train enables the training of the currently selected tool. Once the tool is trained, you can go to the Next Tool in the Job definition. The Train button is red when the current tool is not trained and turns green once that tool is successfully trained. This is a Supervisor level function.

Previous

Previous enables you to return to the previous tool in the Job definition. This is a Supervisor level function. With AutoStep Off, right-click on Previous to move backward to the previous snapshot in your Job.

Next

Next enables you to go forward to the next tool in the Job definition if the current tool is trained successfully. This is a Supervisor level function. With AutoStep Off, right-click on Next to move forward to the next snapshot in your Job.

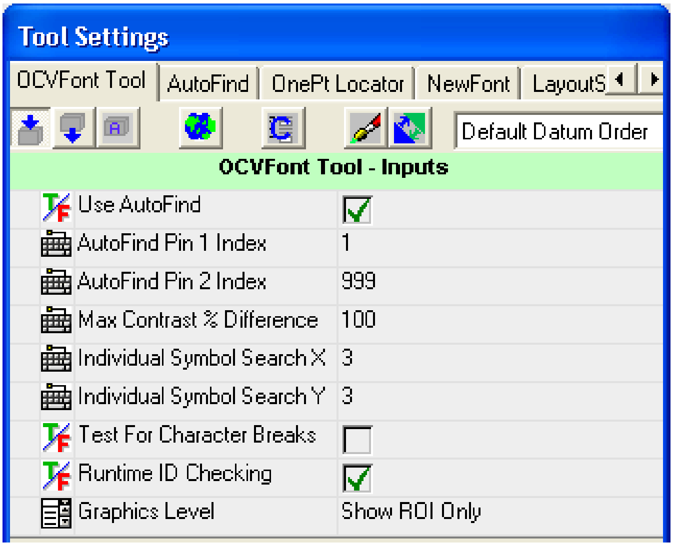
Next Camera

Next Camera is displayed when AutoStep is off. Clicking Next Camera allows you to move ahead to the next camera's view and to its tools in your Job. This is a Supervisor level function.

Tool Settings

Tool Settings displays the Tool Settings dialog box, as shown in Figure 6–23. This shows the training and inspection parameters relative to the selected tool. This is a Programmer's level function.

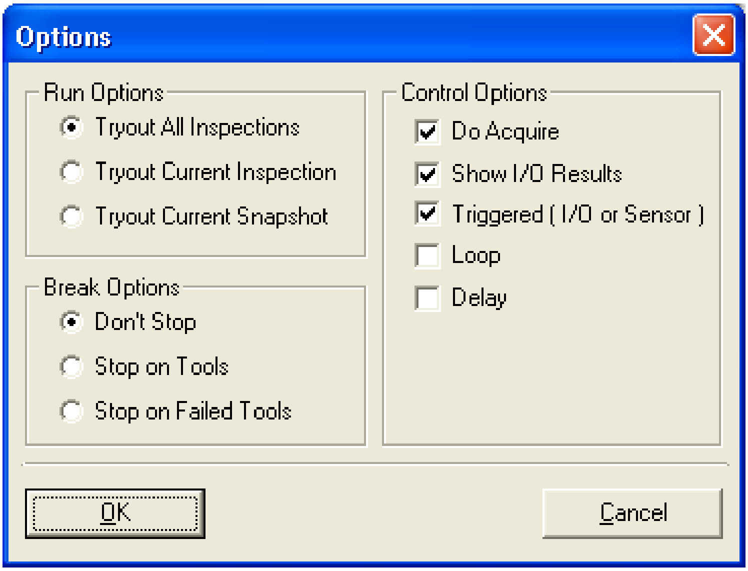
FIGURE 6–23. Tool Settings Dialog Box



Options

Options displays the Tryout Options dialog box, as shown in Figure 6–24. This dialog box allows the Supervisor to temporarily disable the Trigger for Tryout Mode only. These options are grouped by functionality. You can verify that the tool is running properly by viewing the graphics and examining data along the Status Bar. Click OK if you make any changes to this dialog box. This is a Supervisor level function.

FIGURE 6–24. **Options Dialog Box — Tryout**



Run Options — Allows you to set which step to run when executing a tryout:

- Tryout All Inspections — Runs all inspections in Job definition. The default is selected.
- Tryout Current Inspection — Runs the current inspection. The default is not selected.
- Tryout Current Snapshot — Runs the current snapshot. The default is not selected.

Break Options — Allows you to set the circumstances under which the tryout will be stopped:

- Don't Stop — Runs through the entire Job definition without stopping. The default is selected.
- Stop on Tools — Halts inspection on each tool of the Job definition to allow for viewing of results. The default is not selected.

- Stop on Failed Tools — Halts inspection on tools of the Job definition that have failed vision processing to allow for debug viewing of results. The default is not selected.

Control Options — Allows you to set the Tryout operation:

- Do Acquire — During a Tryout, this allows you to make I-PAK acquire an image. Otherwise, it uses the image already shown. The default is selected.
- Show I/O Results — Sets the Opto Outputs as a result of running the Job definition in Tryout. This allows for a near-live simulation. The default is selected.
- Triggered (I/O or Sensor) — During a Tryout, this allows I-PAK to use the trigger mechanism. When you select Trigger in the Trigger/Acquire Method of the Product Setting — Cameras dialog box, this appears checked.

Note: This setting is applicable only when Do Acquire is selected.

- Loop — Allows the system to loop continuously through the Job definition performing a Tryout inspection, rather than running through just once. If selected, the Try All button's text changes to Try Stop. The Supervisor can stop this continuous tryout cycle by then selecting Try Stop. The default is not selected.
- Delay — Allows you to pause briefly between tools to analyze resulting graphics. The default is not selected.

Acquire

Acquire takes an Image using the pre-defined trigger criteria (fire strobe, etc.,) from the Options dialog box. The image is displayed on the display buffer in the lower part of the screen. This is useful when using a strobe, allowing you to view a production image. This is a Supervisor level function.

The image last Acquired is saved by I-PAK. In the Training and Tryout menu, as you go through the Job by clicking Next and Previous, the image displayed is the last runtime image for that camera. If you are on the inspection step, it will show you the first snapshot's image for that inspection.

When you do an Acquire or a Live, I-PAK replaces that stored runtime image with the newly acquired image.

Live

Live takes a live image from the camera and displays it on the display buffer in the lower part of the screen. When you click the button once to activate Live Mode, the button appears depressed. The image area is updated dynamically with live video of the image. Click the button again to exit Live Mode, and the button resumes a normal position. Live Mode does not wait for a trigger. This is a Supervisor level function.

The last image acquired from Live is saved by I-PAK. In the Training and Tryout menu, as you go through the Job by clicking Next and Previous, the image displayed is the last runtime image for that camera. If you are on the inspection step, it will show you the first snapshot's image for that inspection.

When you do an Acquire or a Live, I-PAK replaces that stored runtime image with the newly acquired image.

Zoom In

Zoom In causes the currently displayed image to show more detail.

Zoom Out

Zoom Out causes the currently displayed image to show less detail.

Try Tool

Try Tool causes the currently selected tool to be run. Any tools that the current tool depends on for execution are also run. Runtime debug graphics are displayed over the image. Debug information is displayed in the status bar below the image. This selection uses the triggering mechanism you defined in the Tryout options. Be sure to provide a trigger if one is defined in the product. This is a Supervisor level function.

Try All

Try All causes all tools in the Job definition to be run. Runtime debug graphics are displayed over the image. Debug information is displayed in the Status Bar below the image. Clicking Try All changes the caption to Try Stop. Clicking Try Stop stops the tryout of the program and returns the caption to Try All. This selection uses the triggering mechanism you defined in the Tryout options. Be sure to provide a trigger if one is defined in the product. This is a Supervisor level function.

Custom Settings

The OCVFontTool, OCVRuntimeTool, Trajectory Tool and OCRTrainableFont Tool require a Custom Settings dialog box for proper setup and training. When the Trajectory Tool is selected while in Train/Tryout, the Custom Settings button appears in the toolbar. Figure 6–25 contains the Trajectory Tool Custom Settings window. When the OCRTrainableFont Tool is selected while in Train/Tryout, the Font Folder button appears in the toolbar. Figure 6–26 contains the OCRTrainableFont Tool Custom Settings window.

FIGURE 6–25. **Trajectory Tool Custom Settings Window**

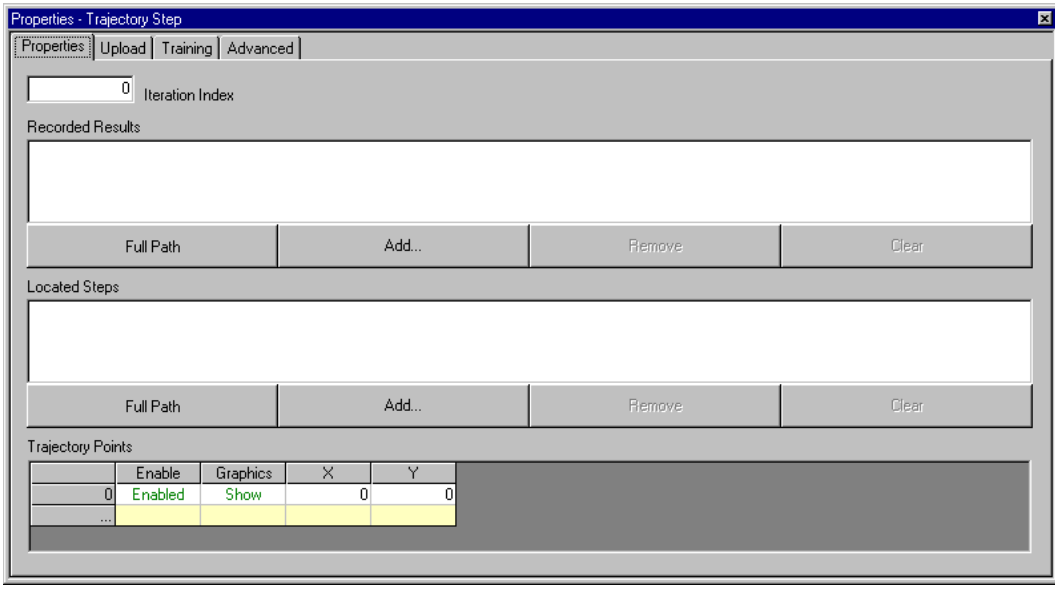
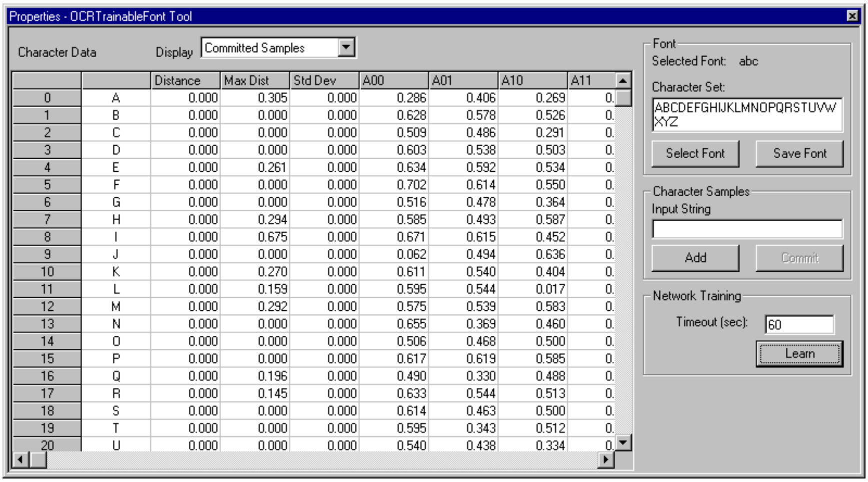


FIGURE 6–26. OCRTrainable Font Tool Custom Settings Window



For more information about using the custom settings for these tools, see the Visionscape Tools Reference.

When either the OCVFontTool or the OCVRuntimeTool are selected while in Train/Tryout, the Font Editor button appears in the toolbar. For more information about using Font Editor, see “Custom Properties — Create/Modify OCVFonts” on page 5-5.

Exit Training to Main Setup

Exit Training to Main Setup allows the Supervisor to leave Train and Tryout Mode and return to the Setup Mode window. All tools should be trained before clicking Exit Training to Main Setup. The Job definition is saved to the hard drive when Exit Training to Main Setup is selected. This is a Supervisor level function.

Automatically Setting Tool Settings

The I-PAK interface automatically sets tool settings that are the most useful for users.

- When inserting a Data Matrix Tool, Barcode Tool, Runtime Font Tool or the OCV Font Tool, I-PAK automatically selects the .text component of each tool in the Inspection step’s Select Results to Upload field. This data is shown on the Results Display dialog box in the String field, Requested Result and Value fields. Only one .text field can be displayed in the String field.

These .text fields are the Font Tool's character string being inspected or the match string for the Data Matrix or Barcode Tool.

- When inserting a Data Matrix Tool, its tool graphics are set to show basic graphics.

Special Training of Tools with I-PAK

The I-PAK interface allows for special training of the Barcode Tool, Data Matrix Tool, and OCRTrainableFont Tool when they are used with the Match String Enable checkbox, as shown in Figure 6–23, "Tool Settings Dialog Box," on page 6-29.

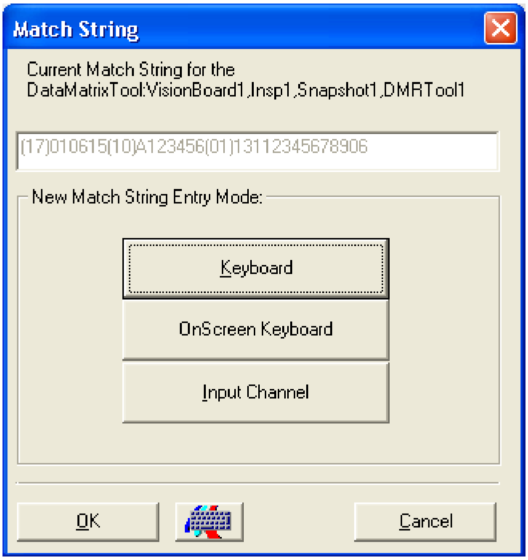
Match String

Typically, these tools perform a read at inspection time, and report these results. Some users want to use a pre-determined code on their product and verify that the string read is what they expect. This concept is known as Match String. With Match String enabled, these tools still perform a read at inspection time and compare it internally against the given Match String to decide if the inspection passed or failed. When the data read is the same as the Match String, this inspection is deemed Pass. If, however, the data read is not the same as the Match String, then this inspection is deemed Fail.

Training Match String Enabled Tools

When training a Barcode Tool, a Data Matrix Tool, or an OCRTrainableFont Tool with the Match String enabled, I-PAK displays a Match String dialog box, as shown in Figure 6–27. This dialog box is displayed immediately after you select one of these tools either by clicking on the tool or by clicking Next or Previous. The dialog box displays the current match string for that tool. When you train the tool, the newly learned string replaces this string.

FIGURE 6–27. **Match String Dialog Box**



Data Matrix Tool Wildcard Match Character

The Data Matrix Tool accepts a wildcard character in the match string. By enabling Use Wildcard ? in Match String on the Data Matrix Tool properties page, wildcard processing occurs. When disabled, no wildcards are allowed in the match string.

When enabled, a "?" character in the match string allows the inspection to pass for any character that appears in the corresponding position of the string read by the Data Matrix Tool. Multiple wildcard characters are allowed in the match string. By default, this setting is disabled.

- Current Match String for the Tool — Displays the current match string for the Barcode, Data Matrix, or OCRTrainableFont tool.
- New Match String Entry Mode — You can enter a new Match String either with the keyboard or by the input channel for remote downloading of the Match String. The Input Channel is configured from the System Settings dialog box to either RS-232 or Ethernet (TCP/IP).
  - Keyboard — To enter the new string with the Keyboard, click Keyboard. Then, type the new string directly into the Match String

dialog box with your keyboard. When you are done, click OK to set the tool's match string. When you click Cancel, the current match string will not change.

– OnScreen Keyboard — To enter data using the OnScreen Keyboard, click OnScreen Keyboard. For touch screen users, this is useful so that you don't have to open up and use the I-PAK Keyboard.

– Input Channel

- RS-232 — To enter the new Match String via RS-232, you need to define the Input Channel on the System Settings menu to be RS-232 and define its RS-232 protocol. For details on how to choose an RS-232 communications port and how to set your I-PAK system's physical communications port, refer to "RS-232" on page 6-83.

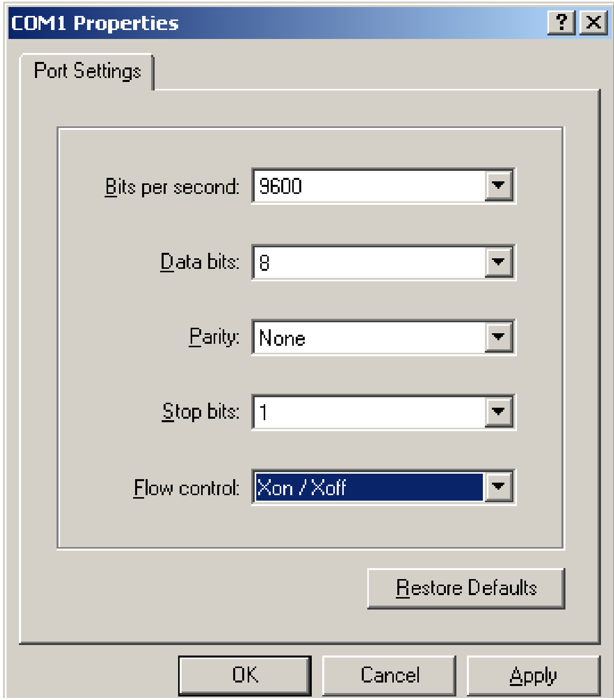
- Once the Match String dialog box is displayed, I-PAK sends out a message on the RS-232 stating it is ready to receive data. "Waiting for RS-232 Input of Match String for Tool: Board, Inspection Number, Snapshot, Toolname <lf><cr>)" is the message sent out. Then, I-PAK begins waiting for the input of the match string.

  When I-PAK does not receive the match string within the specified timeout period, then this transaction times out. I-PAK closes the RS-232 port.

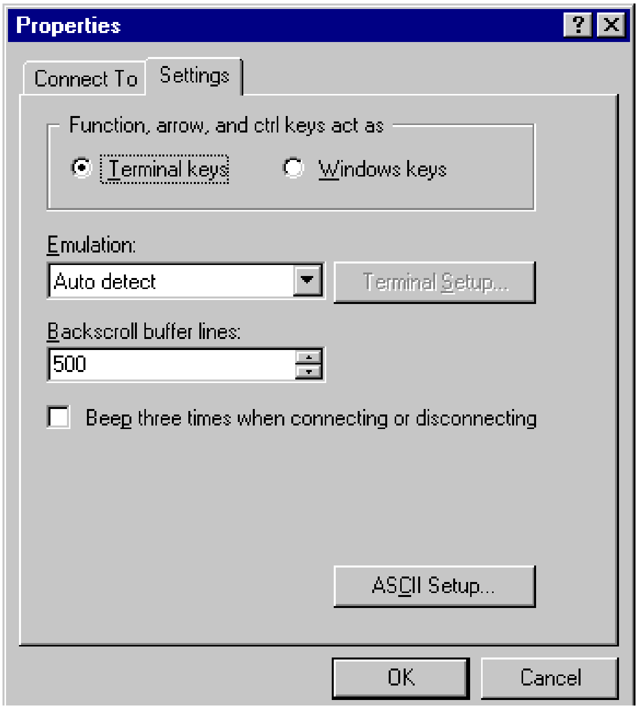
  When I-PAK does receive the match string, the string is displayed in the Match String dialog box. Click OK to accept this new string or Cancel to revert to the old string.

  Note: The RS-232 input of match string must be terminated with either an "Enter" or "Return" character. Once I-PAK receives this termination character, it closes the RS-232 port and ignores anything else sent.

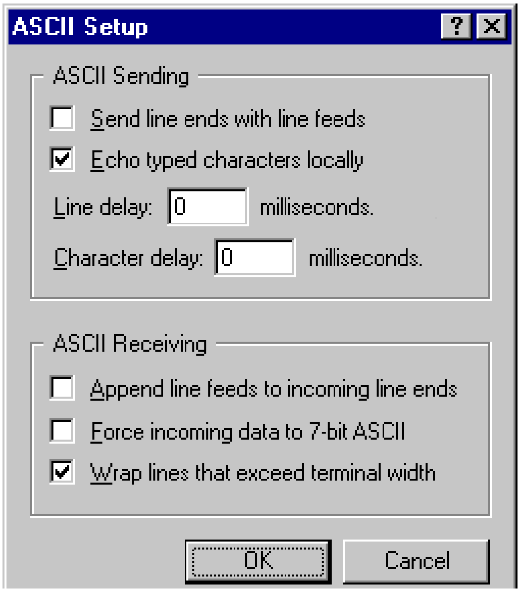
– COM1 Properties — Your RS-232 device settings should be set. This example is from HyperTerminal.



– Properties — Your RS-232 device settings should be set, as shown below. This example is from HyperTerminal.



– ASCII Setup — Your RS-232 device settings should be set, as shown in below. This example is from HyperTerminal.



Note: DO NOT check Send line ends with line feeds. This causes the match string to include this line feed as an actual character in the match string.

- TCP/IP — To enter the new Match String via TCP/IP, you need to define the Input Channel on the System Settings menu to be TCP/IP and define its TCP/IP protocol. Once the Match String dialog box is displayed, you will need to click Input Channel. I-PAK acts as a Server application and is in Listen Mode until the Client machine connects to it.

Before sending data, the client has to request a connection. Once the connection has been made, I-PAK can receive the match string. If the connection is broken, the application resets and places itself in Listen Mode. In this case, the client needs to reconnect. When I-PAK does receive the match string, the string is displayed in the Match String dialog box. Click OK to accept this new string or Cancel to revert to the old string.

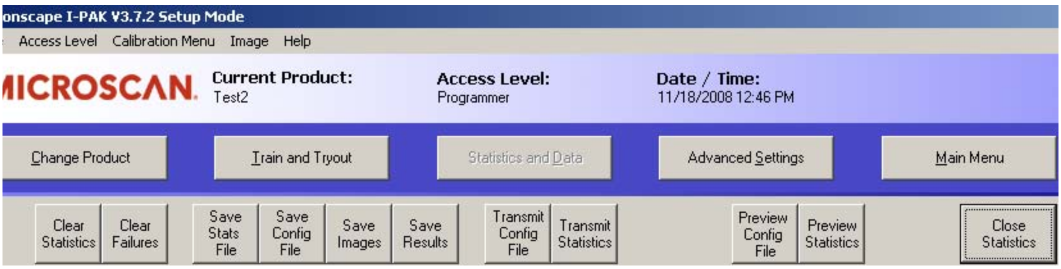
Note: The TCP/IP input of match string must be terminated with a NULL (\0) character.

Note: I-PAK expects the entire match string to be contained within one packet. This means that you cannot type the match string in from a terminal program such as HyperTerminal.

Statistics and Data

The Statistics and Data button displays the Statistics and Data Toolbar, as shown in Figure 6–28. Refer to the descriptions on page 6–43 through page 6–51.

FIGURE 6–28. Statistics and Data Toolbar



This remainder of this section describes the following:

- “Clear Statistics” starting on page 6-43
- “Clear Failures” starting on page 6-43
- “Save Stats File” starting on page 6-43
- “Save Config File” starting on page 6-44
- “Save Images” starting on page 6-44
- “Transmit Config File” starting on page 6-47
- “Transmit Statistics” starting on page 6-47
- “Preview Config File” starting on page 6-50
- “Preview Statistics” starting on page 6-51

- “Close Statistics” starting on page 6-51

Clear Statistics

Clear Statistics resets the Inspect, Pass, and Fail counts to zero (0). It also resets the Failure Counters on the Failure Report to zero (0). At this point, I-PAK clears the counts (sets them to zero) that are stored in the registry. A dialog box is displayed to the Supervisor verifying that statistics have been reset. This is a Supervisor level function.

Note: There are limits on the counters based on display restrictions. For example:

Inspected:10 characters – up to 2, 147, 483, 647
Pass:10 characters – up to 2, 147, 483, 647
Fail:10 characters – up to 2, 147, 483, 647

If another inspection occurs after the counters have reached this limit, then the counter is set to “-2,147,483,647” and stops incrementing. This limit, 2,147,483,647, is based on the size of a VB LONG.

Clear Failures

Clear Failures clears the Failure Report and resets the failure frequencies to zero (0). It does not reset the Inspect, Pass and Fail counts. A dialog box is displayed to the Supervisor verifying that failures have been reset. This is a Supervisor level function.

Save Stats File

Save Stats File saves the last runtime statistics to a file. The data saved includes: Product, date, time, and counters. When Part 11 is enabled, the statistics file is read-only.

Save Config File

Save Config File saves a human-readable version of the current product's Job definition and its essential data to a file. I-PAK prompts for a name. The data saved includes: Product, date/time, counters, Inspected Character String, and Fail Counters. This is a Supervisor level function. When Part 11 is enabled, the configuration file is read-only.

Note: When there is more than one OCVFontTool, OCVRuntimeTool, Barcode Tool, or Data Matrix Tool, only the last inspected tool's string is saved.

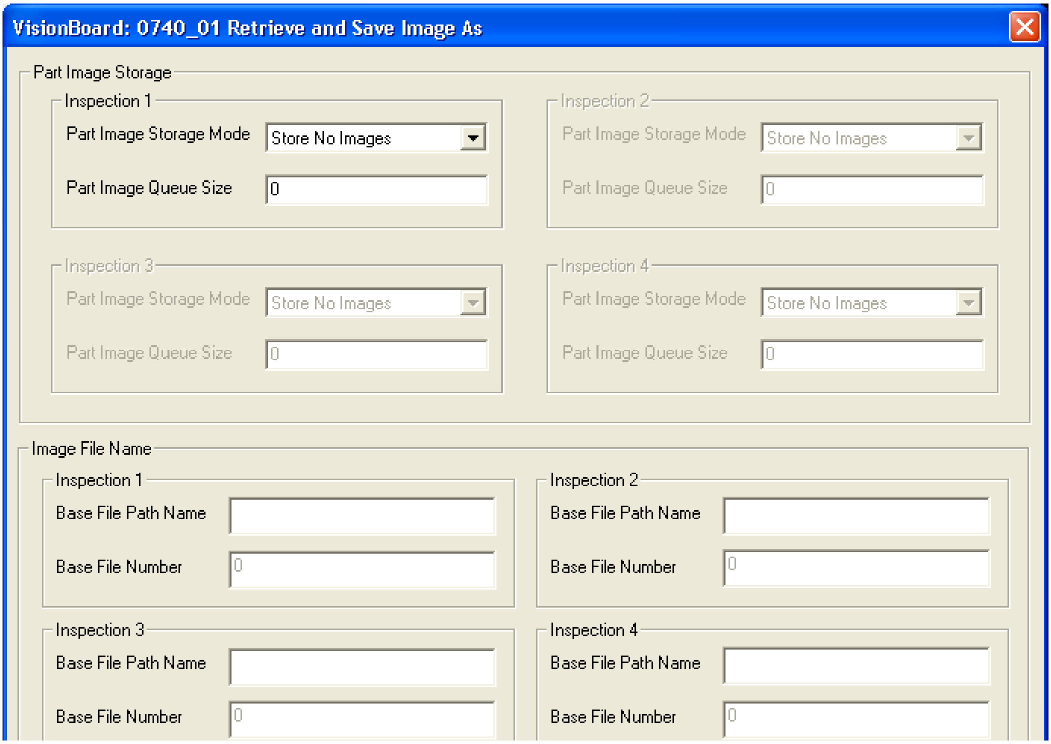
Save Images

Save Images displays the Retrieve and Save Image As dialog box, as shown in Figure 6–29.

Filling in the Retrieve and Save Image As dialog box is a two-step process:

- Fill in the Part Image Storage information (top half) **before** you enter Run Mode.
- Fill in the Image File Name information (bottom half) **after** you exit Run Mode.

FIGURE 6–29. Retrieve and Save Image As Dialog Box



- Part Image Storage Mode — Allows you to select which inspection images are to be stored:
  - Store All Images — Saves all images in the inspection.
  - Store No Images — Saves no images in the inspection. This is the default.
  - Store Failed Images — Saves all images in the inspection whenever a part fails.
  - Store Passed Images — Saves all images in the inspection whenever a part passes.

When an inspection runs and meets the image storage criteria, the Inspection step saves all camera images for that part to memory on the framegrabber; they can be saved to disk at a later time.

- Part Image Queue Size — Allows you to specify the number of images to be stored.

Note: The total number of images **for all inspections** cannot exceed 10.

Based on Part Image Storage Mode, images are stored in a first-in, first-out (FIFO) queue. When the number of images stored reaches the size specified by this parameter, the oldest image in the queue is overwritten so that the queue never expands beyond this size. The default value is 0.

Note: After running your inspection, open the Retrieve and Save Image As dialog box to set up Image File Name. Select the path and file names of the currently stored image files on the vision board. This allows the images to be uploaded and saved on the PC.

- Image File Name — When the Inspection step in the current Job has been set up to store images based on the part pass/fail status, you will specify a file destination to which these images should be stored. When the Product is run in a loop, the Inspection step stores images based on its Part Image Storage Mode setting.

  – Base File Path Name — Takes a base file name.

  – Base File Number — Takes a base file number.

  If the Inspection Step was set up to store the last 10 failed images, you could enter c:\fail for the Base File Path Name and 0 for the Base File Number. Then, the 10 failed images would be saved as:

c:\fail_Snap1_0.tif
c:\fail_Snap1_1.tif
c:\fail_Snap1_2.tif
c:\fail_Snap1_3.tif
c:\fail_Snap1_4.tif
c:\fail_Snap1_5.tif
c:\fail_Snap1_6.tif
c:\fail_Snap1_7.tif
c:\fail_Snap1_8.tif
c:\fail_Snap1_9.tif

When there were two cameras in the inspection, the images would be saved as:

c:\fail_Snap1_0.tif, c:\fail_Snap2_0.tif
c:\fail_Snap1_1.tif, c:\fail_Snap2_1.tif
c:\fail_Snap1_2.tif, c:\fail_Snap2_2.tif
c:\fail_Snap1_3.tif, c:\fail_Snap2_3.tif
c:\fail_Snap1_4.tif, c:\fail_Snap2_4.tif
c:\fail_Snap1_5.tif, c:\fail_Snap2_5.tif
c:\fail_Snap1_6.tif, c:\fail_Snap2_6.tif
c:\fail_Snap1_7.tif, c:\fail_Snap2_7.tif
c:\fail_Snap1_8.tif, c:\fail_Snap2_8.tif
c:\fail_Snap1_9.tif, c:\fail_Snap2_9.tif

In these file names, the “Snap1” indicates the first camera; the “Snap2” indicates the second camera. A similar file naming scheme results from an inspection with three or four cameras. The Base File Number can be greater than zero (0), making it easy to identify stored images from different batch runs.

Transmit Config File

Transmit Config File sends, through user-specified RS-232 or Ethernet, the data file out to another device. This is a Supervisor level function.

Transmit Statistics

Transmit Statistics sends the following statistics to another device through a user-specified RS-232 or Ethernet (TCP/IP) (this is a Supervisor level function):

- Product Name.

- Current date and time.
- Inspected string — When the Match String for the Barcode Tool or Data Matrix Tool is used or when the FontTool.text or OCVRunTool.text is uploaded.
- Last Runtime Statistics.

Transmit Statistics sends this data in the following formats:

- RS-232 Protocol and Syntax — The RS-232 protocol and syntax for a transmission of statistics is as follows:
  - RS-232 Protocol — The RS-232 default baud rate is 9600, No Parity, 8 data bits and 1 stop bit. Any of these can be changed using the System Setting dialog box — Communications tab.
  - RS-232 Syntax for a Single-Camera Job

    Product=product_name<lf><cr>
    Date/Time=mm/dd/yyyy hh:mm:ss <lf><cr>
    Inspected Characters=inspected_characters <lf><cr>
    I=# <lf><cr>
    P=# <lf><cr>
    R=# <lf><cr>
    <eot><lf><cr>

Note: EOT is the end of text character; (chr(4)) or Ctrl-D in HyperTerminal, LF is the LineFeed character (chr(10), CR is the Carriage Return character (chr(13)).

A dialog box is displayed to the Supervisor, indicating statistics have been sent.

If there are no Inspected Characters in the Job, the third line of data will not be present.

  - RS-232 Syntax for a Multi-Camera Job — Each Inspection Step has the following format. Complete data is terminated by the <eot><lf><cr>.

    Product=product_name<lf><cr>
    Date/Time=mm/dd/yyyy hh:mm:ss <lf><cr>

Inspected Characters=inspected_characters1 <lf><cr>
I1=# <lf><cr>
P1=# <lf><cr>
R1=# <lf><cr>
Inspected Characters=inspected_characters2 <lf><cr>
I2=# <lf><cr>
P2=# <lf><cr>
R2=# <lf><cr>
Inspected Characters=inspected_characters3 <lf><cr>
I3=# <lf><cr>
P3=# <lf><cr>
R3=# <lf><cr>
Inspected Characters=inspected_characters4 <lf><cr>
I4=# <lf><cr>
P4=# <lf><cr>
R4=# <lf><cr>
<eot><lf><cr>

A dialog box is displayed to the Supervisor, indicating statistics have been sent.

When there are no Inspected Characters in that inspection, the Inspected Character line of data will not be present.

- TCP/IP Protocol and Syntax — The TCP/IP protocol and syntax for a transmission of statistics is as follows:
  - TCP/IP Protocol — I-PAK is the Server. The TCP/IP default Server Port is 7000. You can change any of these using the System Setting dialog box — Communications tab.
  - TCP/IP Syntax for Single-Camera Job.

Product=product_name<lf>
Date/Time=m/d/yyyy h:mm <lf>
Inspected Characters=inspected_characters <lf>
I=# <lf>
P=# <lf>
R=# <lf>
<cr>

If there are no Inspected Characters in the Job, the third line of data will not be present.

– TCP/IP Syntax for a Multi-Camera Job.

Product=product_name<lf>
Date/Time=m/d/yyyy h:mm <lf>
Inspected Characters=inspected_characters1 <lf>
I1=# <lf>
P1=# <lf>
R1=# <lf>
Inspected Characters=inspected_characters2 <lf>
I2=# <lf>
P2=# <lf>
R2=# <lf>
Inspected Characters=inspected_characters3 <lf>
I3=# <lf>
P3=# <lf>
R3=# <lf>
Inspected Characters=inspected_characters4 <lf>
I4=# <lf>
P4=# <lf>
R4=# <lf>
<cr>

If there are no Inspected Characters in that inspection, the Inspected Character line of data will not be present.

Preview Config File

Preview Config File displays the contents of the current Product's Data File Statistics, as shown in Figure 6–30. This is a Supervisor level function.

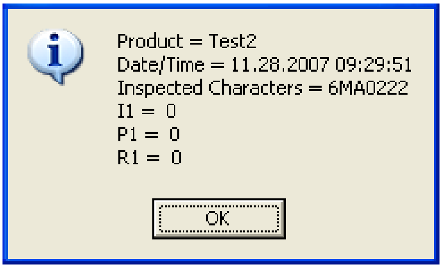
FIGURE 6–30. Preview Config File

```
Current Date/Time : 01/22/2008 07:48:39
Name of I-PAK System : default
Data File for Product : PQ

>Vision Board : 0740_01<

    >> SoftwareBoard Settings <<
    Error Code : 99999
    Status : True
    Board1 :
    Digitizer Selected : CAM I/O 740
    Digitizer Mode : Single Board - Normal
    Camera Definitions And Buffer Counts :
    Number of Image Buffers : 16
```

Preview Statistics

Preview Statistics displays the I-PAK dialog box, as shown in Figure 6–31. This shows the current runtime statistics. This is a Supervisor level function.

FIGURE 6–31. I-PAK Dialog Box — Preview Statistics



Close Statistics

Close Statistics quits this Statistics and Data Toolbar and returns you to the
I-PAK Setup Mode window. This is a Supervisor level function.

Advanced Settings

Advance Settings displays the Advanced Settings Toolbar, as shown in Figure 6–32. The Advanced Settings Toolbar is accessed only via Programmer Mode.

FIGURE 6–32. Advanced Settings Toolbar

This remainder of this section describes the following:

- “Create A Product” starting on page 6-52
- “Save Product” starting on page 6-70
- “Product Settings” starting on page 6-71
- “System Settings” starting on page 6-81
- “Edit Tool Set” starting on page 6-119
- “Tool Settings” starting on page 6-120
- “Windows Explorer” starting on page 6-121
- “Close Advanced” starting on page 6-121

Create A Product

The Create A Product button allows the Programmer to define a new product. The Create A Product wizard is a series of interconnected dialog boxes that navigate the Programmer from the Product Settings to the System Settings to a flowchart-like interface for Step Program Creation.

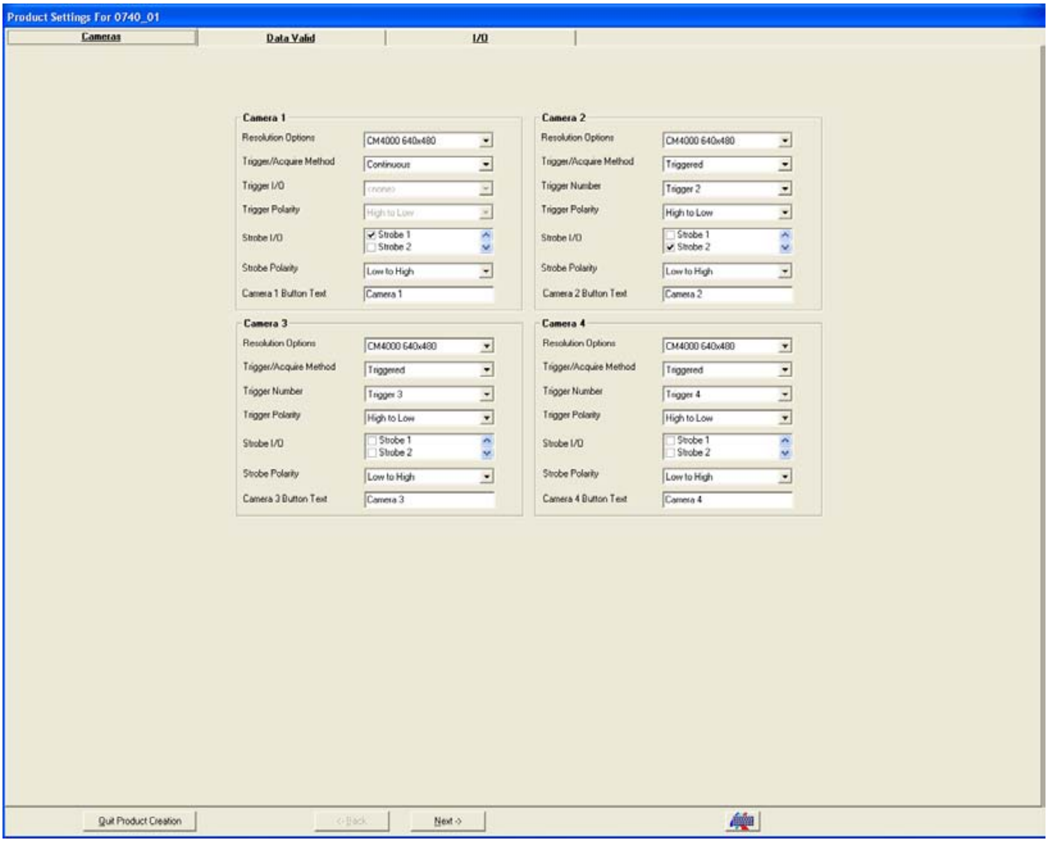
After defining all the tools, the Programmer is taken into Wizard Training mode in order to train the tools. After you successfully train all the tools, you can perform a tryout, in Tryout Mode.

For consistency of menu flow description, all steps and sequences are shown and all general details listed. This is a Programmer level function.

The first series of dialog boxes shown to the Programmer are the Product Settings dialog boxes, as shown in Figure 6–33, Figure 6–34, Figure 6–35. Here, the Programmer defines the camera settings and I/O configuration.

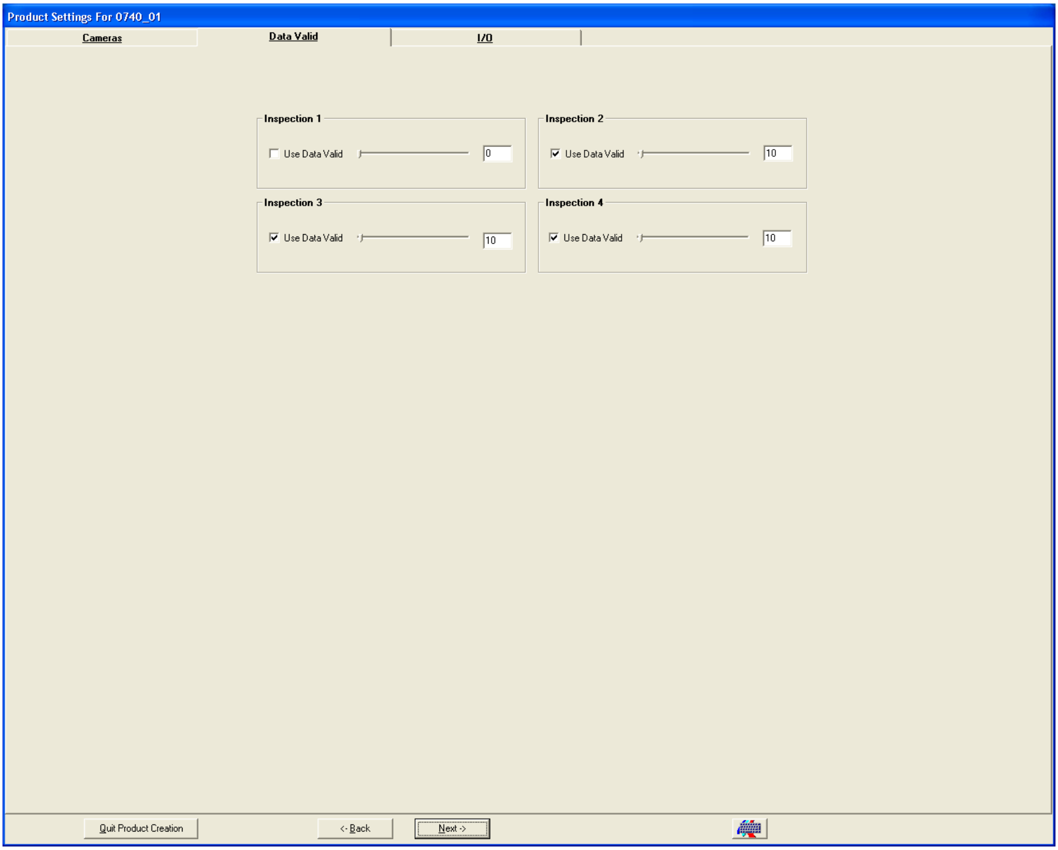
By clicking Next, you can move ahead to the next menu in the Create A Product wizard series.

FIGURE 6–33. **Create a Product — Product Settings Dialog Box —**



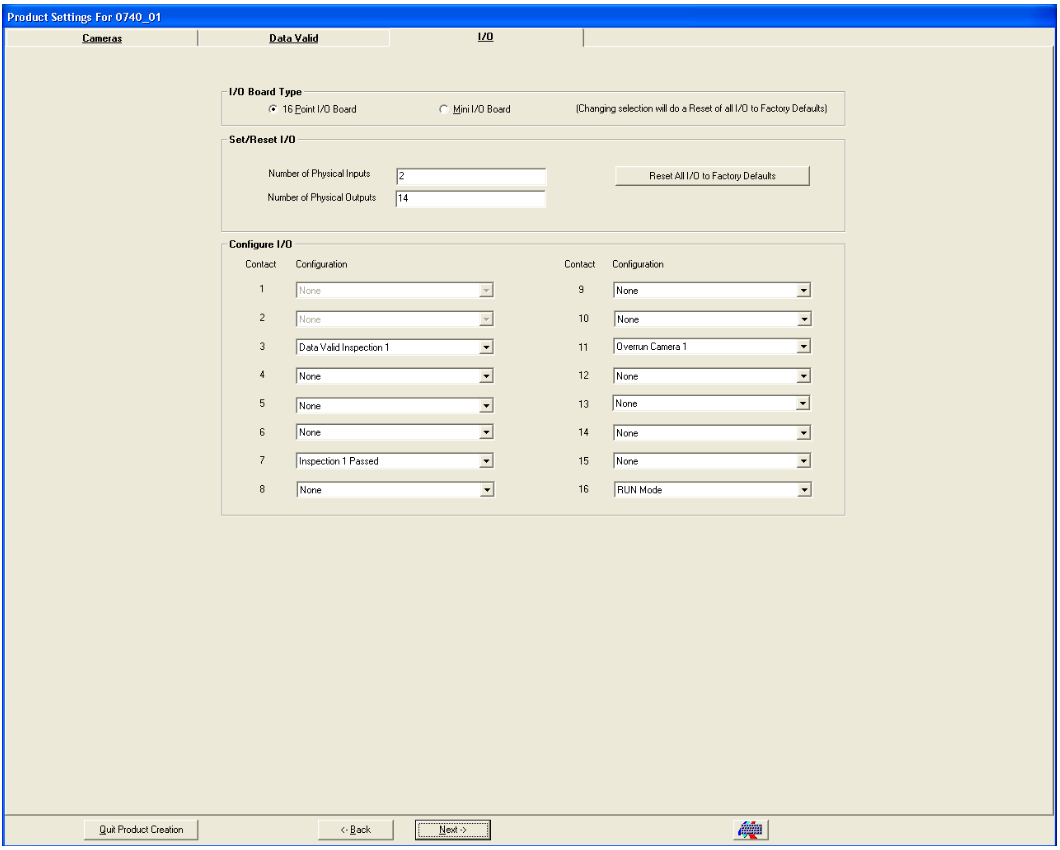
Cameras

FIGURE 6–34. **Create a Product — Product Settings Dialog Box — Data Valid**



6 Setup Mode Reference

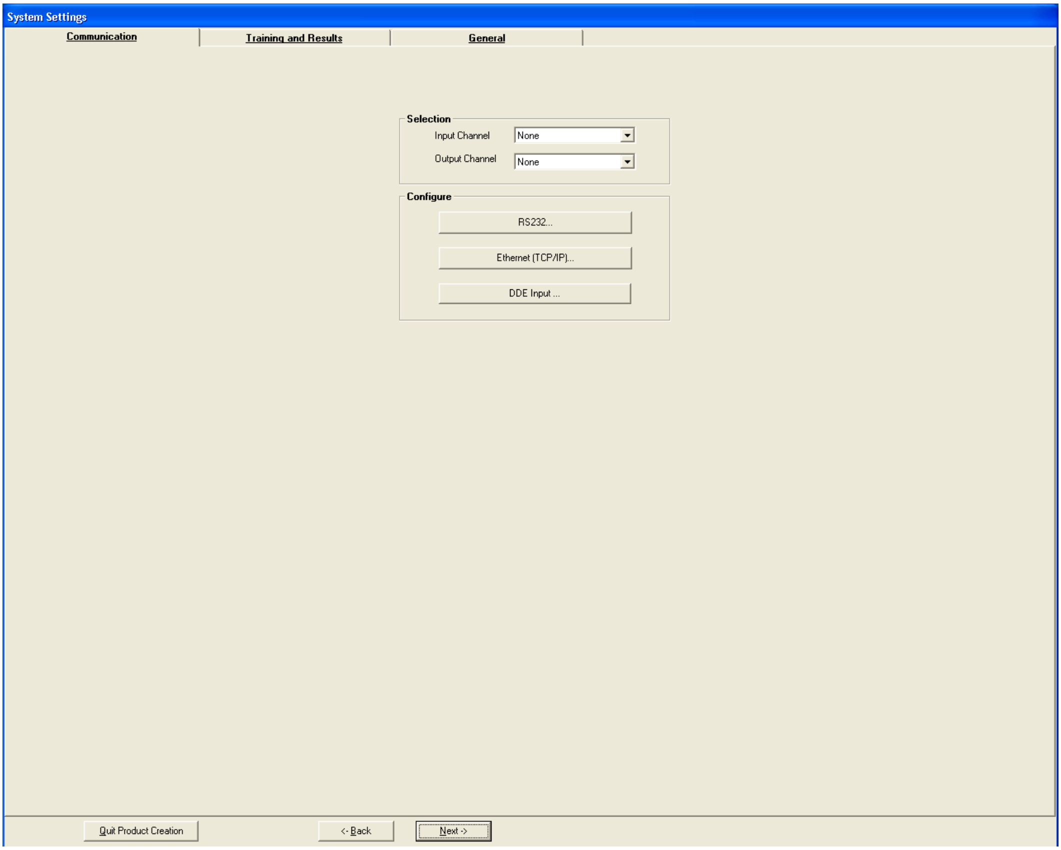
FIGURE 6–35. **Create a Product — Product Settings Menus — I/O**



The next series of dialog boxes provided for the Programmer are the System Settings dialog boxes, as shown in Figure 6–36, Figure 6–37, and Figure 6–38. Here, the Programmer defines the Communication and Reset settings.

Note: When you return to Setup Mode from RunMode, all inspection Passed outputs are set FALSE.

FIGURE 6–36. **Create a Product — System Settings Menu —**



Communication

FIGURE 6–37. **Create a Product - System Settings Menu - Training and Results**

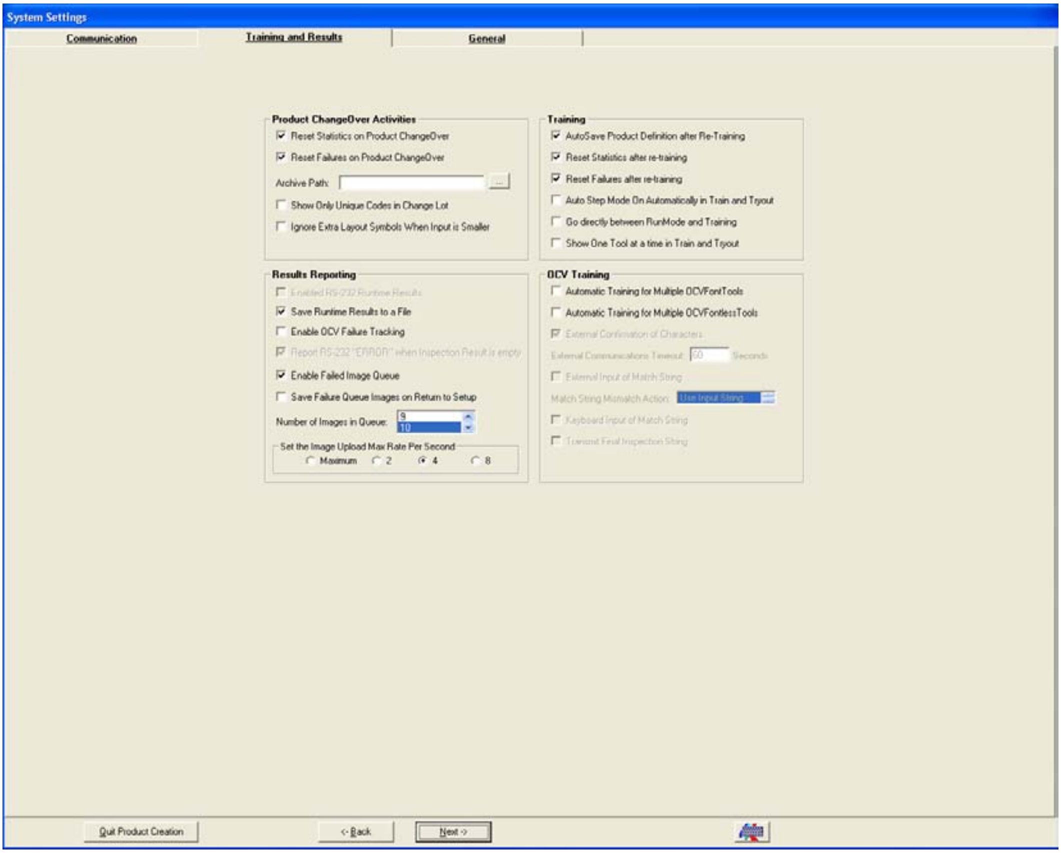
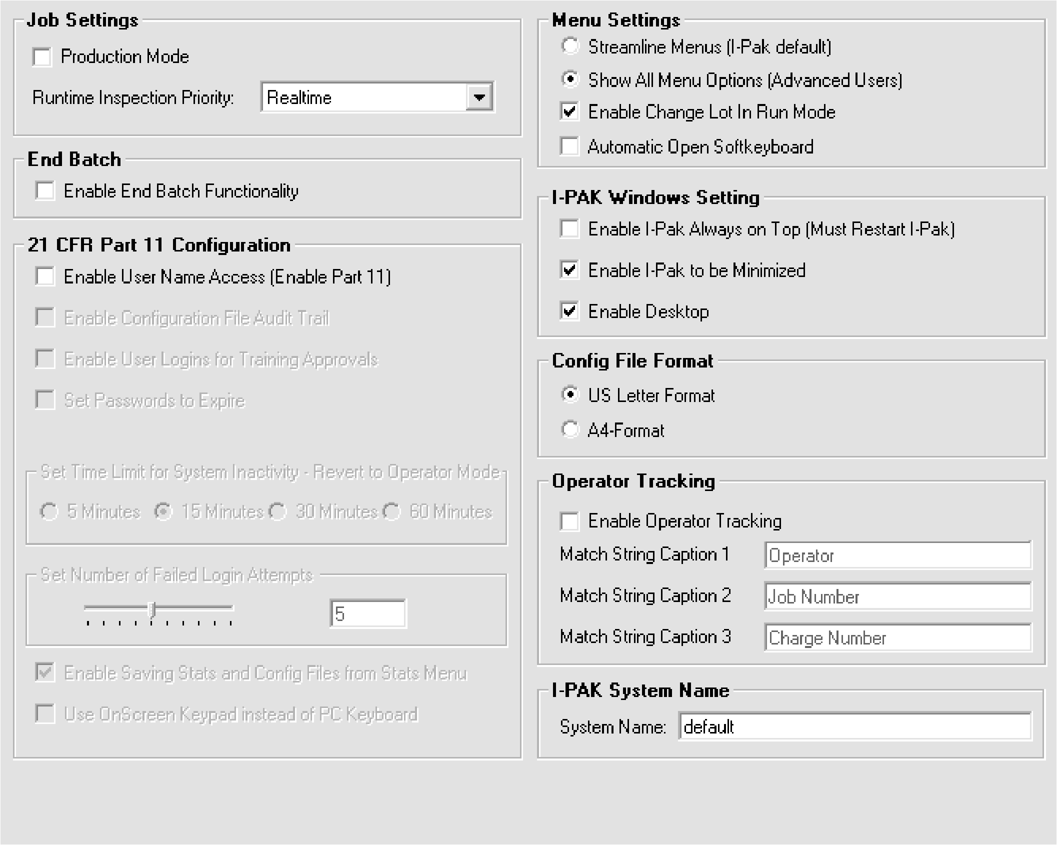


FIGURE 6–38. Create a Product - System Settings Menu - General



Quit Product Creation — Allows you to abort the product creation during Product Settings and System Settings.

The next series of dialog boxes provided for the Programmer are the Step Program Creation dialog boxes, as shown in Figure 6–39, Figure 6–40, and Figure 6–41. This is a visual representation of the tools to be programmed and used in the product definition. A new product definition displays Board, Inspection, and Acquire.

For this window, the glidepoint input device is needed with the touchscreen to support 2-button mouse controls.

FIGURE 6–39. **Create a Product — Step Program Creation — Acquire**

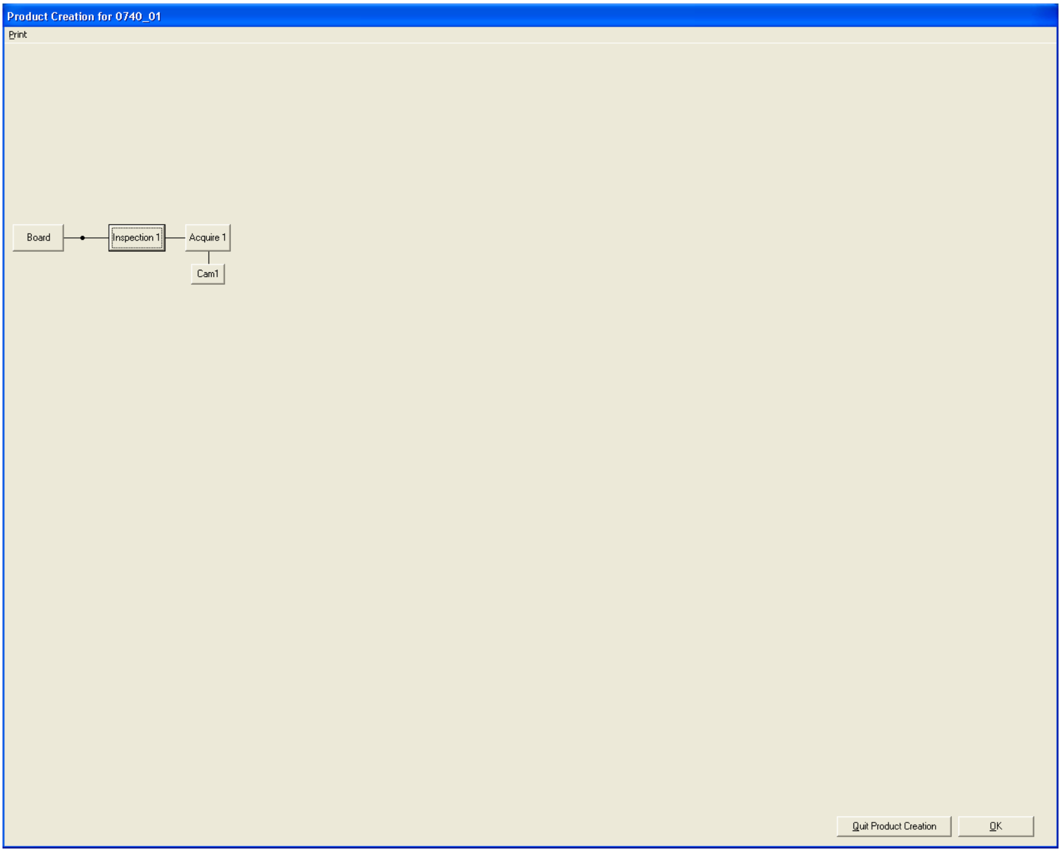


FIGURE 6–40. Create a Product — Step Program Creation — Acquire1 Tool

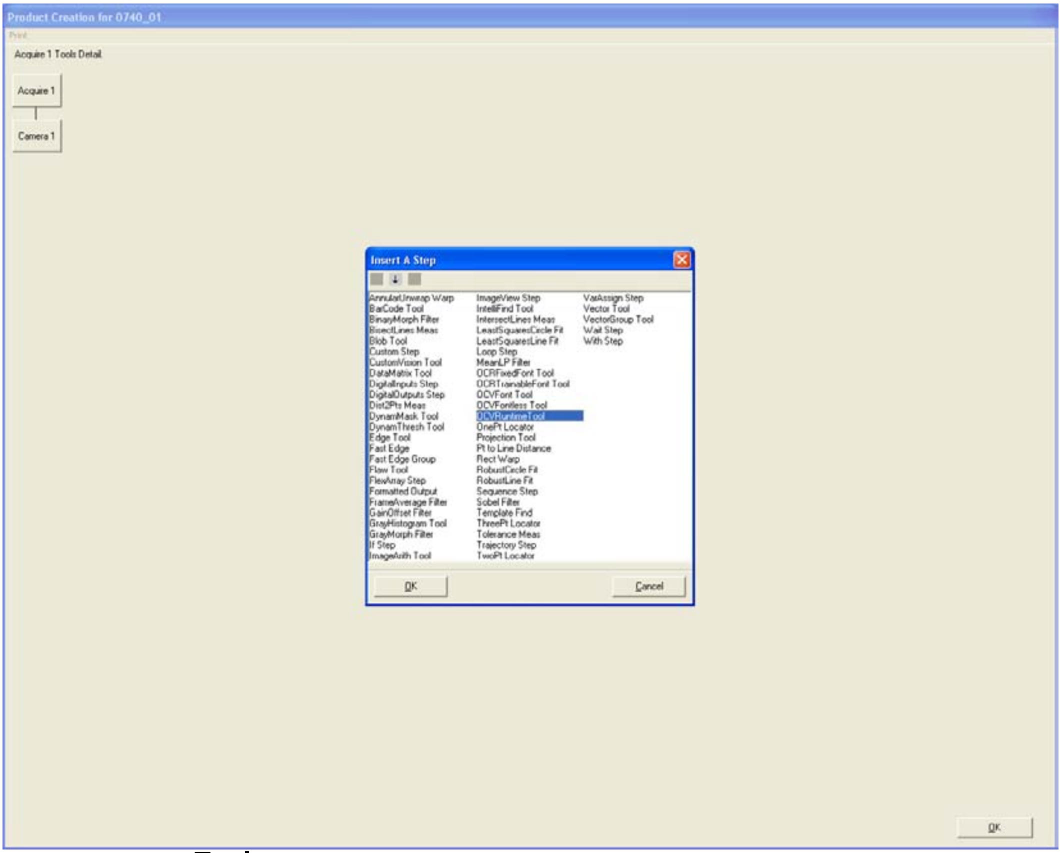
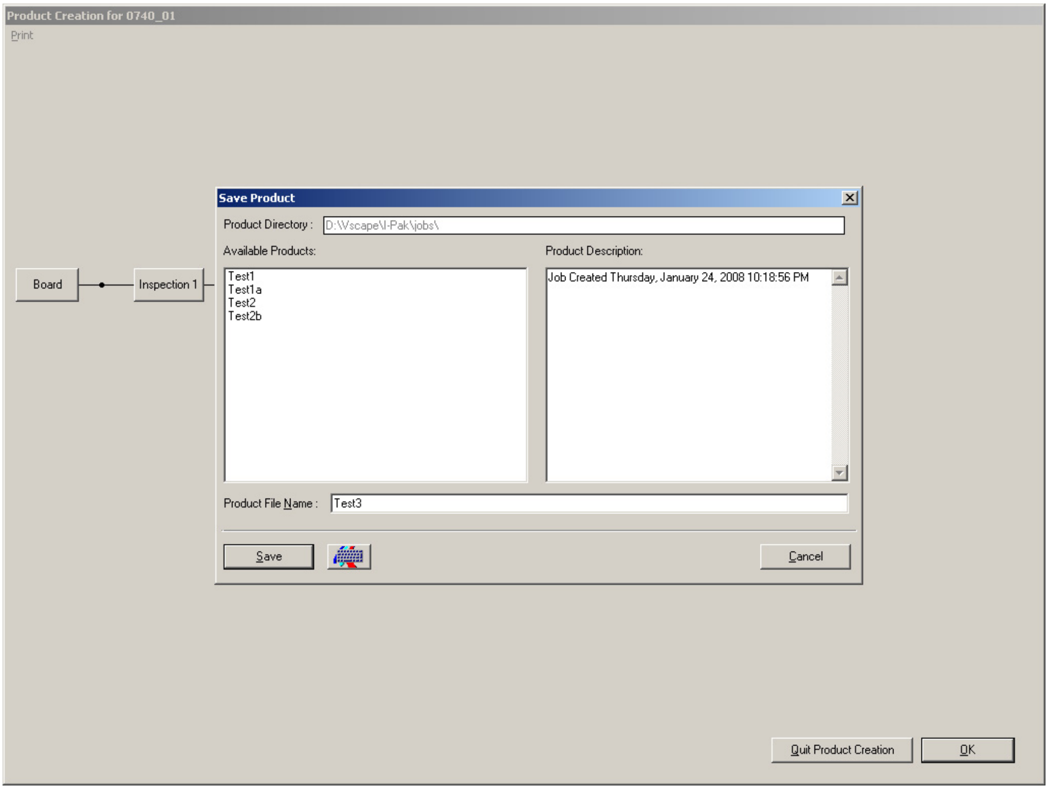


FIGURE 6–41. **Create a Product — Step Program Creation — Save**



Product

The Programmer can add additional Inspections by right-clicking on the Board step. The Programmer can add subsequent Snapshots for this job by right-clicking on the Inspection step.

Right-clicking on the Acquire step results in the Insert A Step dialog box being displayed. This dialog box displays the names of steps that can be inserted into an Acquire step. Once a Board, Inspection, or Snapshot block has been inserted, it can be changed by right-clicking on it. Left-clicking on a primary tool deletes all secondary tools.

Right-clicking on a tool button, such as the Barcode Tool shown in Figure 6–40, displays the Insert A Step dialog box with all possible vision tools. The Programmer selects a tool and clicks on Insert Before, Insert After, or Insert Into. Clicking OK causes an Insert Into action.

Right-clicking on a secondary tool button displays the Insert A Step dialog box with all possible vision tools. The Programmer selects a tool and clicks Insert Before or Insert After. Click OK to cause an Insert After action.

The Programmer can delete any primary or secondary tool at any location by left-clicking on the tool. The Delete Tool/SubTool dialog box is displayed. This will prompt the Programmer to confirm the action. Click OK to delete. Click Cancel to abort this action.

This process continues until the Programmer has completed the selection of tools in this Product build. Click OK. The Programmer is prompted to name the Product. Click OK to save the Product and the Product name associated with this Product.

During Product creation, in the System Settings — General dialog box, if Reset Statistics on Product ChangeOver is checked, the appropriate dialog box is displayed.

Special Features of I-PAK's Tools and Steps in Job Creation

I-PAK uses the Visionscape Toolset as the basis for the I-PAK Toolset. I-PAK has its own rules that are different from Visionscape, and Job creation and implementation are different in I-PAK from FrontRunner. Below are some of these I-PAK unique features and implementation details. Because of these differences, the Programmer should never create a Job using FrontRunner and then try to make I-PAK use it.

FrontRunner uses a Job file that consists of only an .avp file. I-PAK uses an .avp file **and** an .avpsys file, as well, to store many other details about its Job. If the Programmer tries to use a FrontRunner Job in I-PAK, it posts an error message saying that it cannot find the associated .avpsys file.

The tool limit for insertion in the flowchart view of product creation is six primary tools and six secondary tools in each parent tool. If the Programmer needs more than these six tools, he or she can use the Advanced Menu item Edit Tool Set to add more tools.

Note: You can print the Product Creation Flow Chart.

When you insert a tool in I-PAK, a tool specified Fail Counter is automatically inserted into the Job by I-PAK. At Runtime, this Fail Counter tracks and records when that tools fails. When you delete tools in I-PAK, you'll need to delete its associated Fail Counter.

I-PAK allows you to insert Custom Step or CustomVision Tool anywhere in a Product Definition. The Custom Step consists of optional input datums, optional output datums and a script file written in the Perl programming language. The Perl Package Script determines the number and type of inputs and outputs. The Perl Package Script controls the functionality of the Custom Step. Custom Steps cannot perform vision operations because they do not allow for a buffer to be input to the Perl Package Script.

The CustomVision Tool consists of an input image (required), optional input datums, optional output datums and a script file written in the Perl programming language. The Perl Package Script determines the number and type of inputs and outputs. The Perl Package Script controls the functionality of the CustomVision Tool. CustomVision Tools can perform vision operations because they require a buffer to be input to the Perl Package Script.

I-PAK supports a limited set of Perl Language Package Scripts. These scripts allow changing the functionality of a Custom Step or CustomVision Tool by simply selecting a different script.

Note: I-PAK supports the Package Scripts as they are distributed with the I-PAK software. Changing these script files or creating new script files renders them unsupported and non-validated by Microscan.

See Appendix E, "Perl Gems: Tips & Techniques," for full details about Perl.

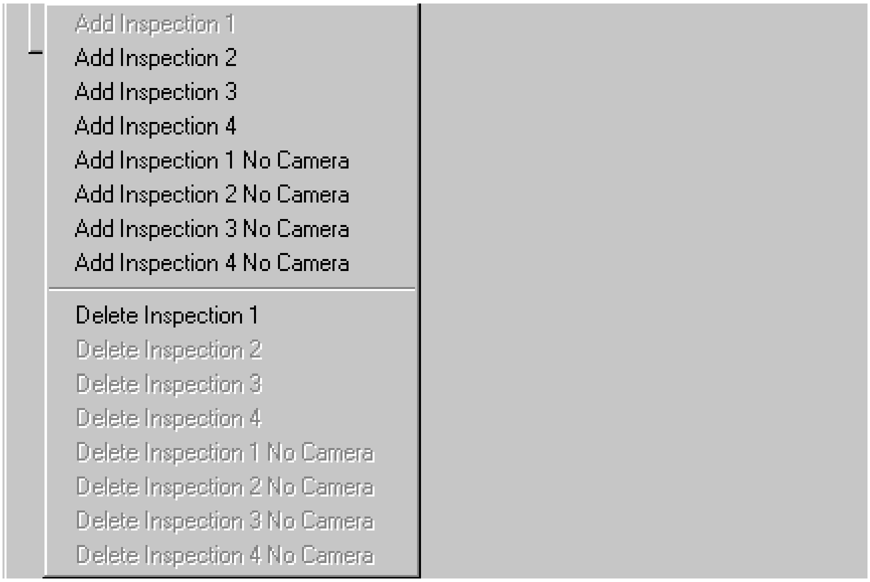
Inspection Steps Without Snapshots

I-PAK allows inspection steps to be used in a product definition even when those inspection steps contain no snapshot child steps.

Product Creation

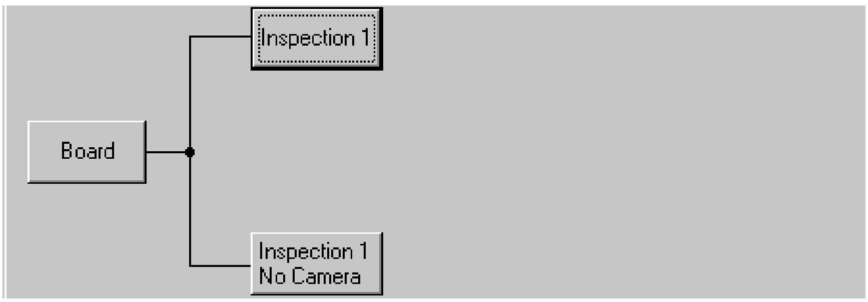
The Job creation flow chart allows the insertion of inspection steps that cannot contain snapshot steps. When you right click Board, menu options add or delete up to four inspection steps that cannot contain snapshot steps.

FIGURE 6–42. Context Menu — New Inspection No Camera Options



When inserted, a button appear to show that the Inspection is part of the product definition, as shown in Figure 6–43.

FIGURE 6–43. Inspection — No Camera Inserted

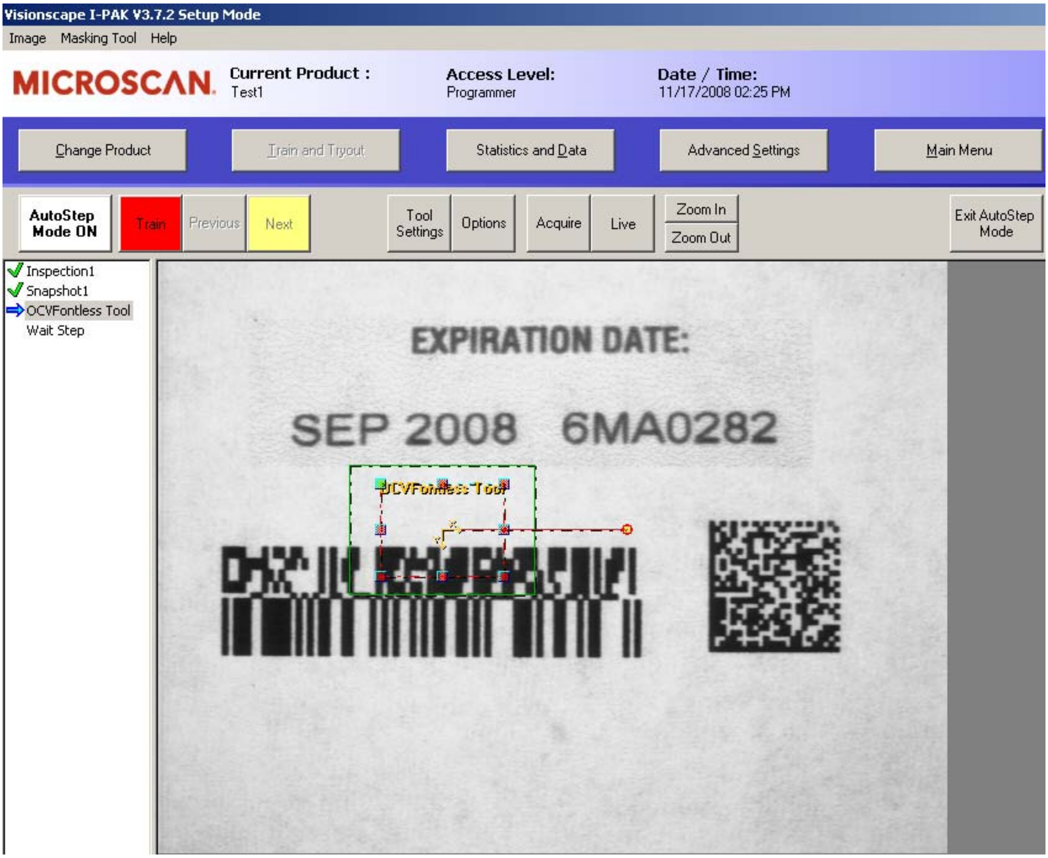


All other aspects of Job creation remain the same. Inserting steps into the inspection is accomplished by right clicking on the associated button.

Train/Tryout

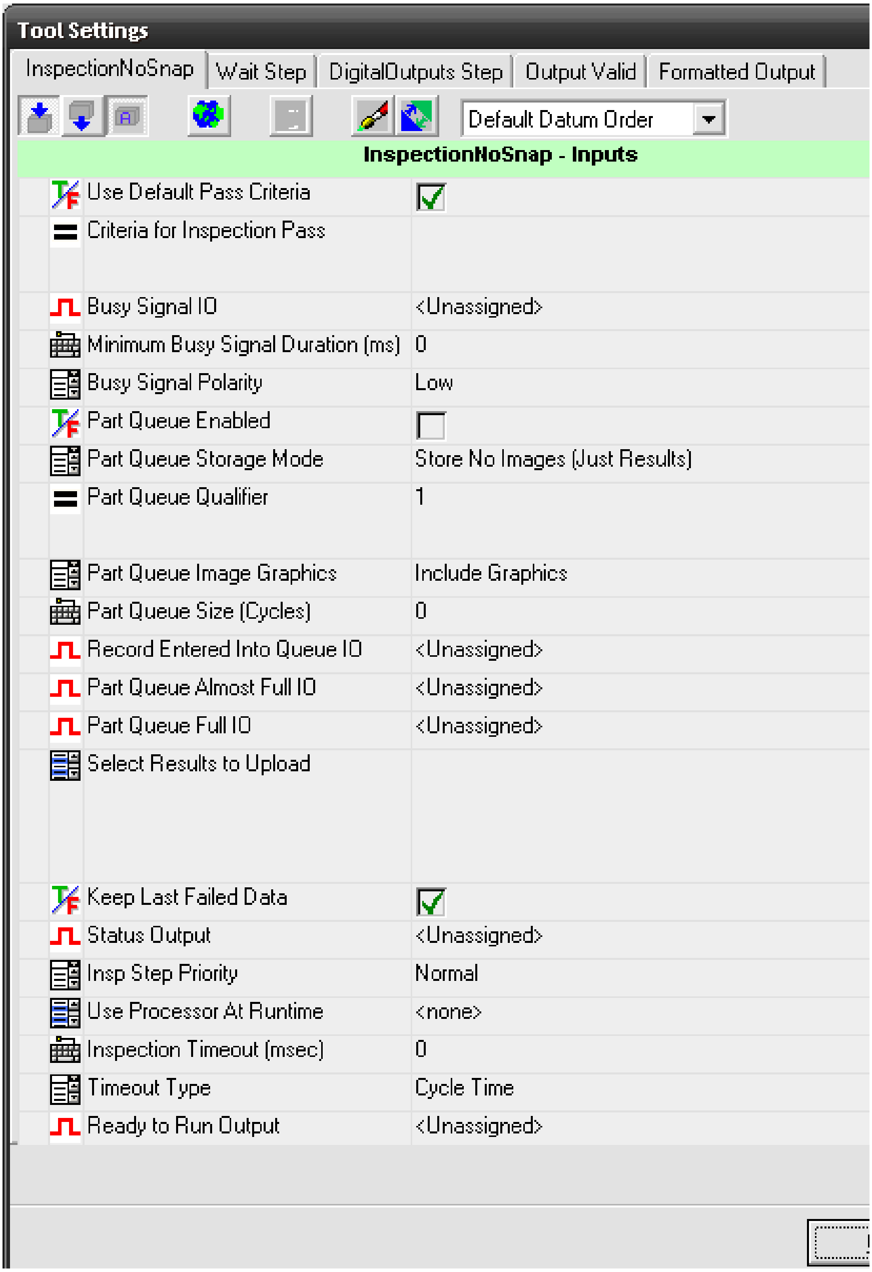
Inspections containing no snapshots are selectable from the item list of the Train/Tryout dialog box, as shown in Figure 6–44.

FIGURE 6–44. **Train and Tryout Dialog Box**



You can select these steps and use the Tool Settings button to modify the settings for these inspection steps and any child steps.

FIGURE 6–45. Tool Settings Dialog Box



Run Mode

Upon entering run mode, all inspections steps are started. Reports are available only for those inspection steps that contain snapshots. Results for inspections that do not contain snapshots are not available for display.

Upon returning to Setup Mode, all inspection steps are stopped.

I/O

I-PAK makes no special provisions for setting up Data Valid or Inspection Passed for inspection steps that do not contain snapshots. If these I/O points are required, they can be set up manually using the Job Editor in Train/Tryout mode.

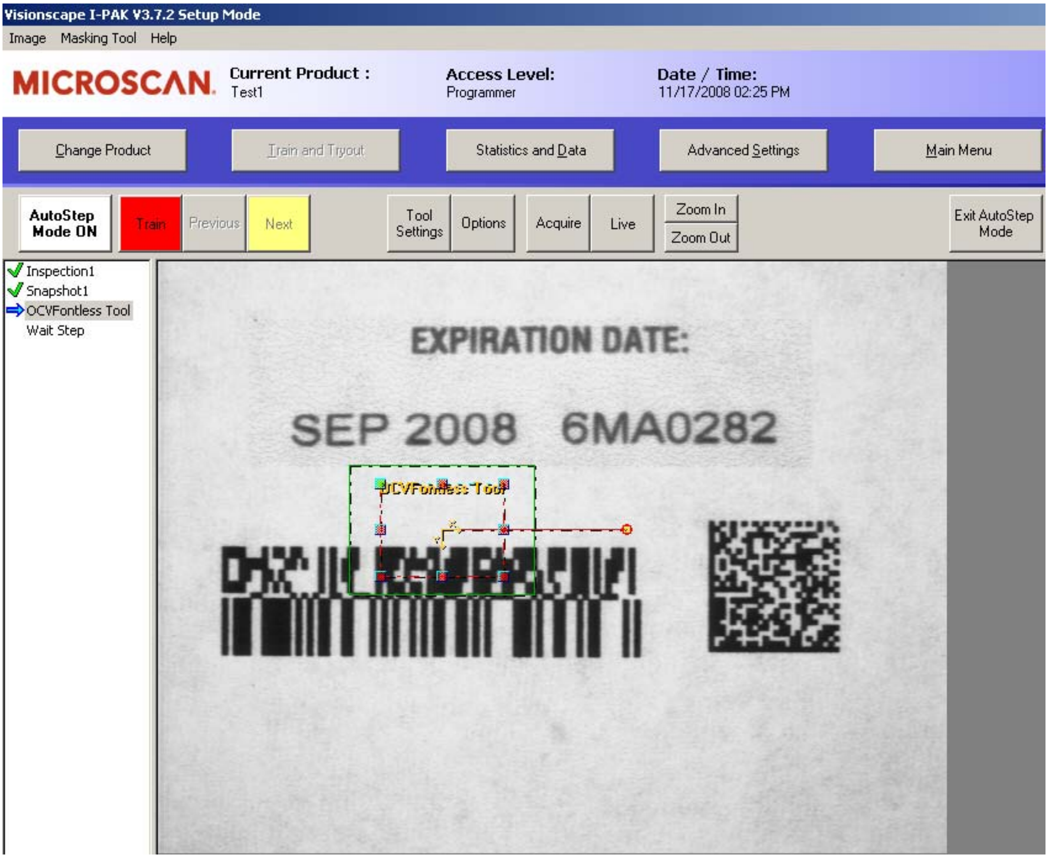
Example of Usage

Inspection steps without snapshots are useful when I/O handling is required outside of the vision inspections. For example, an inspection step could be set up to pulse a virtual I/O point. That virtual I/O point could be used by the vision inspections as a trigger signal.

Continue Product Creation by Training the Tools

After naming the Product, the Programmer will be transferred automatically to the automated training for these vision tools, Wizard Training, as shown in Figure 6–46.

FIGURE 6–46. **Create a Product — Wizard Training**



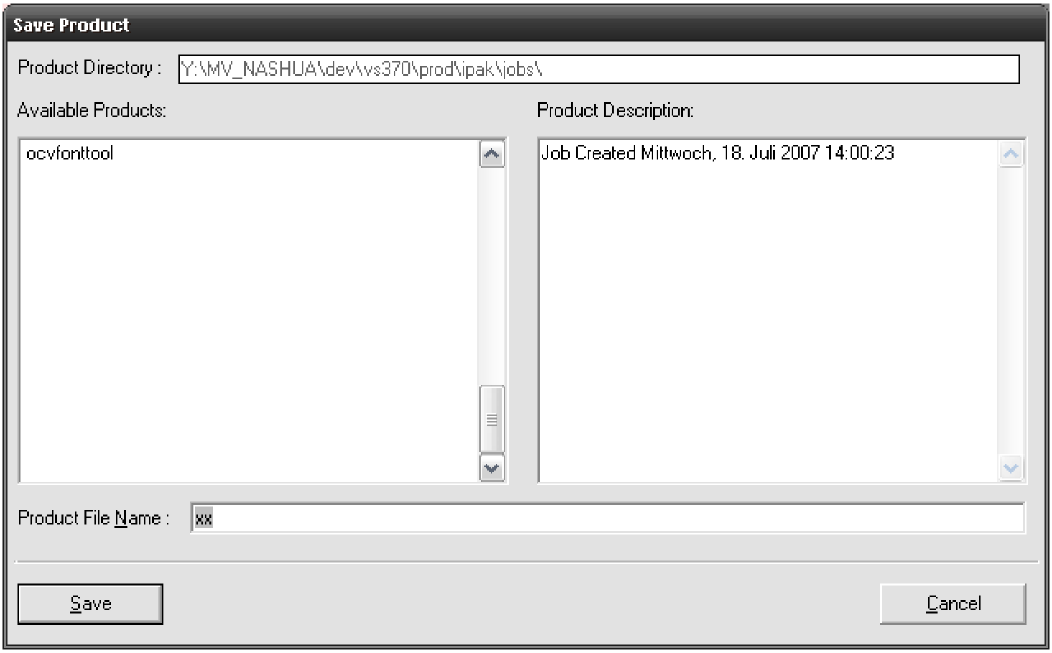
The wizard method of training walks the Programmer through each step of the training sequence. Wizard training is invoked automatically when the Programmer first enters this window. You can disable it via a system setting. See the “System Settings” on page 6-81 for the AutoStep Mode On Automatically in Train and Tryout setting.

Refer to the section of this chapter dedicated to Training for full training and tryout details. See “AutoStep or Wizard Training Method” on page 6-25.

Save Product

Save Product displays the Save Product dialog box, as shown in Figure 6–47.

FIGURE 6–47. Save Product Dialog Box



Type the Product File Name you desire and click Save. I-PAK saves the current product name and Job to disk. This is a Programmer level function. By default, this button is not selected until you click on it.

The product description text can be up to 1000 characters. This allows each product definition to have a unique description.

Note: There is a special I-PAK feature, available for our advanced Programmers, when using the Product Name “ByPass.” When doing a product changeover, the product named “bypass.avp” only appears in the list if the current access level is Programmer. This allows for customer-specific Jobs to be run by Programmers. For example, the “ByPass” product could be set up to bypass the I-PAK vision processing and allow a line to clear old product before beginning the inspection of new product.

Product Settings

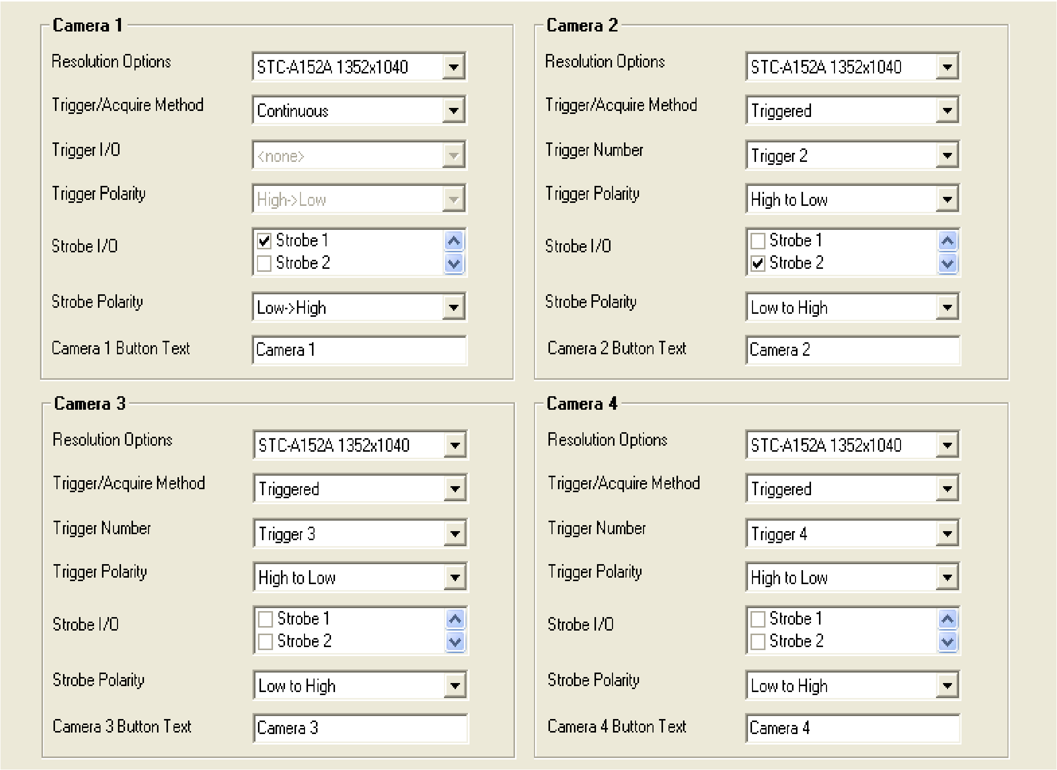
Product Settings displays the Product Settings dialog box, as shown in Figure 6–48, Figure 6–49, and Figure 6–50. The Product Settings dialog box allows the Programmer to define the Triggering Method, Data Valid, Camera button identifiers, and I/O. These are Programmer level functions.

Cameras Tab

This tab allows you to specify, on a per camera basis, the Trigger method, Strobe Settings, and Camera Button Text.

Note: The polarity must be the same for two or more cameras using the same triggers.

FIGURE 6–48. **Product Settings Dialog Box — Cameras Tab**



- Resolution Options — The Programmer can select the camera and resolution to be used by the product.
- Trigger/Acquire Method — The Programmer can select any one of these methods:
  - Triggered — Acquire an image, firing the strobe if connected, and begin inspection when the part sensor detects a part. This trigger is a physical trigger input on the I/O board. The default is selected.

    Note: When Triggered is selected, Trigger Polarity is displayed with a default of High to Low. If Triggered is not selected, Trigger Polarity is grayed out (disabled).
  - I/O Triggered — Acquire an image and begin inspection when the pre-defined inspection Input contact is True. The default is not selected.

    Note: When I/O Triggered is selected, Trigger I/O is displayed with a default of Digital I/O1. When I/O Triggered is no selected, Trigger I/O is grayed out (disabled).
  - Continuous — Acquire an image, firing the strobe if connected, and begin inspection in a continuous loop. For debug purposes only, and never a Production mode setting. The default is not selected. This is the default for Camera 1.
- Trigger Number
  - When the Programmer selects a Trigger/Acquire Method of **Triggered**, the sensor number to be used is designated as the trigger. The Trigger displays Trigger Number.

    Default: Trigger 1
    Range: Trigger 1 through Trigger 4
  - When the Programmer selects a Trigger/Acquire Method of **I/O Triggered**, the I/O is designated to be used as the trigger. The Trigger displays Trigger I/O.

    Default: Digital I/O
    Range: Any valid physical input point

- Trigger Polarity — When the Programmer selects a Trigger/Acquire Method of Triggered or I/O Triggered, Trigger Polarity is designated.

  Default: High to Low

- Strobe I/O — When the Programmer selects a Trigger/Acquire Method of Triggered and is using strobes, the Strobe is designated. The Programmer can select any combination of the four strobe outputs for this camera.

- Strobe Polarity — When the Programmer selects a Trigger/Acquire Method of Triggered and is using strobes, the Strobe Polarity is designated. Microscan supplied strobes require Low to High.

  Default: Low to High

- Camera Button Text — The Programmer can modify the contents of the Camera Button text to better reflect the inspection being done by that camera. The default text is the word “Camera” followed by the camera number (in other words, Camera 1). The maximum length for the camera button text is 30 characters.

Data Valid Tab

This tab allows you to specify, on a per inspection basis, data valid settings.

FIGURE 6–49. **Product Settings Dialog Box — Data Valid Tab**

- Use Data Valid — The Programmer can use Data Valid for each camera’s results. When Data Valid is True, inspection results can be sampled. Data Valid is On for the data valid duration specified and then Off for the data valid duration specified. The On duration of Data Valid is added to the execution time. The Off time is a background task and does not impact execution time.

Default: Enabled (duration of 10ms)

Note: Data Valid is On and Off for the length of time specified. For example, using the default 10 ms, when the inspection is complete and inspection results are available, Data Valid is set TRUE for 10 ms then FALSE for
10 ms. You are to sample the inspection results while data valid is TRUE.

I/O Tab

I-PAK can accept input signals and perform inspections accordingly. I-PAK reports the results of each inspection by setting output points On or Off, and displaying screen messages. There are a total of 16 I/O points on I-PAK.

FIGURE 6–50. **Product Settings Dialog Box — I/O Tab (16 Point I/O Board)**

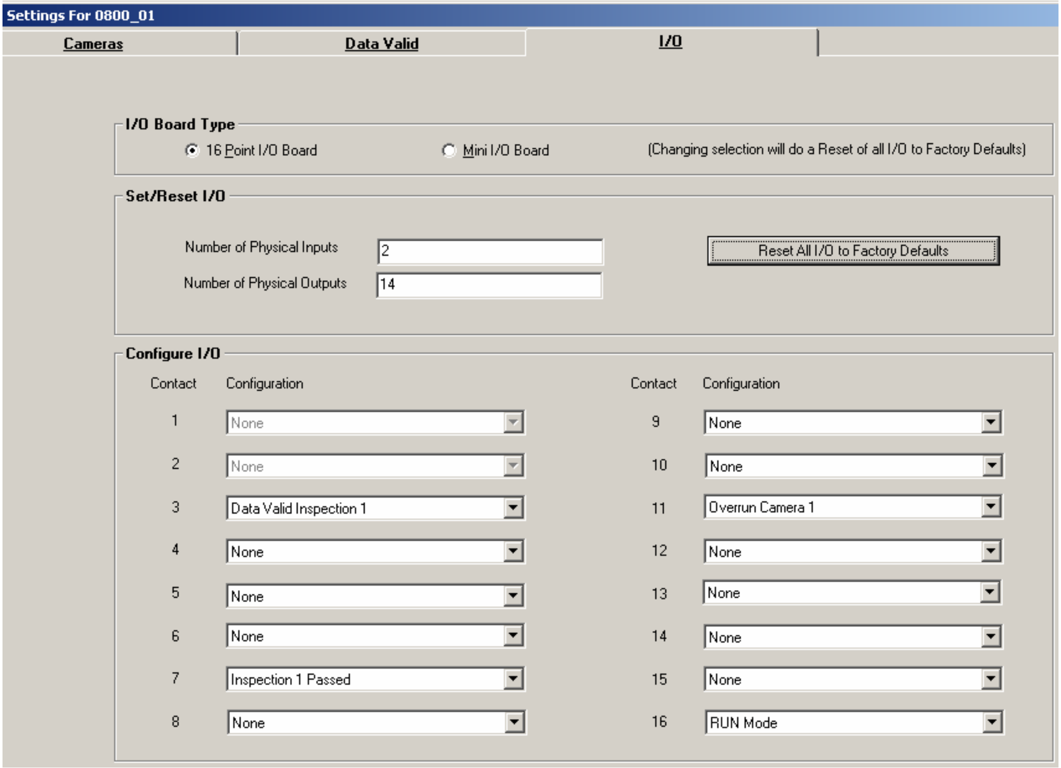
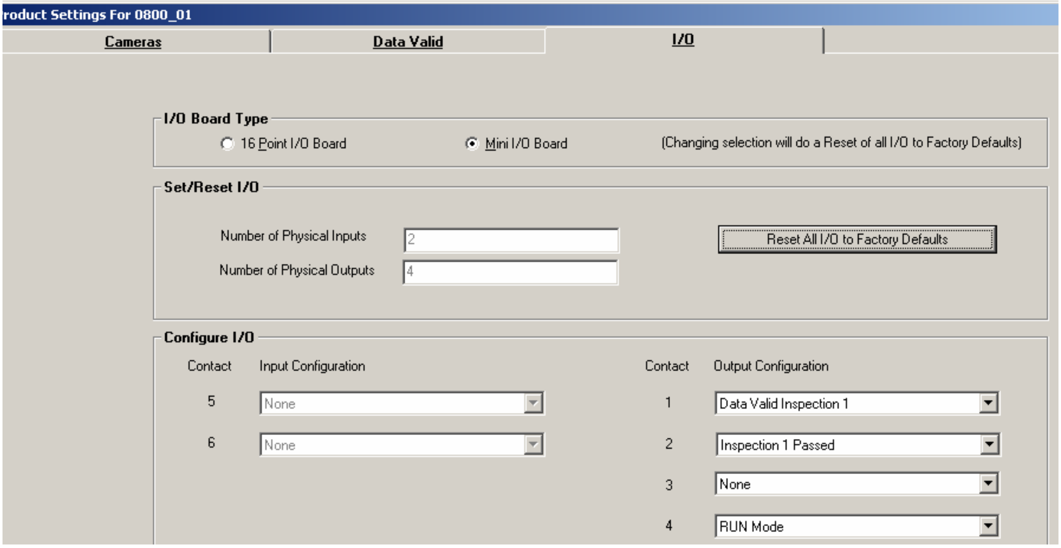


FIGURE 6–51. **Product Settings Dialog Box — I/O Tab (Mini I/O Board)**



- I/O Board Type — Allows you to toggle between “16 Point I/O Board” (Figure 6–50) and “Mini I/O Board” (Figure 6–51).

  Figure 6–51 shows the factory defaults for this kind of I/O board. The number of physical inputs and outputs for a Mini I/O board is fixed to 2 inputs and 4 outputs.

  Note: Do not modify the GPIO Mask within the ToolSet Editor when a Mini I/O board is selected.

  You can only select the I/O board during product creation. If the product has already been created, the I/O board type and Set/Reset I/O cannot be changed.

- Set/Reset I/O

  – Number of Physical Inputs — Set the number of physical inputs in your I-PAK. This is a read-only field on the Product Settings Menu. The Programmer defined this number of inputs when the Job definition was created.

– Number of Physical Outputs — Set the number of physical outputs in your I-PAK. The Programmer defined this number of outputs when the Job definition was created.

- Configure I/O — Allows you to define a value for each physical I/O contact in your I-PAK. Refer to Table 6–1 for single-camera default I/O and to Table 6–2 for four-camera default I/O.

TABLE 6–1. Single Camera Default I/O Scheme

#	I/O	Function	Comment
1	Input	—	—
2	Input	—	—
3	Output	Data Valid — Inspection 1	When TRUE, Inspection 1 Passed output can be sampled.
4	Output	—	—
5	Output	—	—
6	Output	—	—
7	Output	Inspection 1 Passed	TRUE if all Tool passed for Inspection 1.
8	Output	—	—
9	Output	—	—
10	Output	—	—
11	Output	Overrun Camera 1	TRUE if there is an Overrun on Camera 1.
12	Output	—	—
13	Output	—	—
14	Output	—	—
15	Output	—	—
16	Output	Run/Setup	TRUE for Run Mode. FALSE for Setup Mode

TABLE 6–2. Suggested Four Camera Default I/O Scheme

#	I/O	Function	Comment
1	Input	—	—
2	Input	—	—
3	Output	Data Valid — Inspection 1	When TRUE, the *Inspection 1 Passed* output can be sampled.
4	Output	Data Valid — Inspection 2	When TRUE, the *Inspection 2 Passed* output can be sampled.
5	Output	Data Valid — Inspection 3	When TRUE, the *Inspection 3 Passed* output can be sampled.
6	Output	Data Valid — Inspection 4	When TRUE, the *Inspection 4 Passed* output can be sampled.
7	Output	Inspection 1 Passed	TRUE if all Tool passed for Inspection 1.
8	Output	Inspection 2 Passed	TRUE if all Tool passed for Inspection 2
9	Output	Inspection 3 Passed	TRUE if all Tool passed for Inspection 3
10	Output	Inspection 4 Passed	TRUE if all Tool passed for Inspection 4
11	Output	Overrun Camera 1	TRUE if there is an Overrun on Camera 1.
12	Output	Overrun Camera 2	TRUE if there is an Overrun on Camera 2.
13	Output	Overrun Camera 3	TRUE if there is an Overrun on Camera 3.
14	Output	Overrun Camera 4	TRUE if there is an Overrun on Camera 4.
15	Output	—	—
16	Output	Run/Setup	TRUE for Run Mode. FALSE for Setup Mode

I/O Definitions for Table 6–1 and Table 6–2

– Outputs — TRUE when enabled:

- Data Valid is an output that indicates the Inspection Passed output is valid. The duration of Data Valid is user programmable via the Product Setting Menu. Data Valid is TRUE for the duration specified.

  Default: 10ms
  Range: 1 - 500ms

- Overruns — All overruns, underruns, or misses. I-PAK processing is too slow and causes an overrun when it receives an inspect trigger while it is processing the last inspection, as parts are coming in at burst rates. Before I-PAK is finished processing, it receives inspect triggers faster than 16ms.

- Inspection Passed is an output to indicate a good part. The part passed all the inspection criteria set by you.

  Note: When you return to Setup Mode from Run Mode, all inspection Passed outputs are set FALSE.

- Run Mode is an output that indicates that I-PAK is operating in Run Mode and awaiting the next inspection trigger.

- HeartBeat — At system start-up time, the HeartBeat output begins its operation by being set TRUE for 1 second and then FALSE for 1 second, alternatively, to indicate that I-PAK is functional. At this one second interval, the I-PAK software is verifying the operational mode of the framegrabber. If the framegrabber is not operational, the HeartBeat output is set to FALSE and remains FALSE until the framegrabber is again operational. When in Setup Mode and training OCVFont Tools, the timing of HeartBeat may deviate from 1 second True, 1 second False.

– Inputs — Must be set to TRUE to Enable:

- Inspection Trigger is an input that instructs I-PAK to conduct one inspection cycle for each inspection trigger I-PAK receives from an external source.

- You may use an input as a handshake to clear a pass output.

TABLE 6–3. Mini Opto I/O Default Settings (1 Camera)

#	I/O	Function	Comment
1	Output	Data Valid — Inspection 1	When TRUE, Inspection 1 Passed output can be sampled.
2	Output	Inspection 1 Passed	TRUE if all Tool passed for Inspection 1.
3	Output	None	—
4	Output	Run/Setup	TRUE for Run Mode. FALSE for Setup Mode
5	Input	—	—
6	Input	—	—

TABLE 6–4. Mini Opto I/O Suggested 2 Camera Settings

#	I/O	Function	Comment
1	Output	Data Valid — Inspection 1	When TRUE, Inspection 1 Passed output can be sampled.
2	Output	Inspection 1 Passed	TRUE if all Tool passed for Inspection 1.
3	Output	Data Valid — Inspection 2	When TRUE, Inspection 2 Passed output can be sampled.
4	Output	Inspection 2 Passed	TRUE if all Tool passed for Inspection 2.
5	Input	—	—
6	Input	—	—

Outputs

There are a few outputs defined by Microscan for I-PAK, including the System HeartBeat output and the Run/Setup Mode Output.

While in Setup Mode, the System HeartBeat output continues to be set TRUE for 1 second and then FALSE for 1 second, alternatively, to indicate that I-PAK is functional. At this one second interval, the I-PAK software is verifying the operational mode of the framegrabber. If the framegrabber is not operational, the HeartBeat output is set to FALSE and remains FALSE until the framegrabber is again operational.

The HeartBeat output is generated by I-PAK. During periods of heavy PC loading, the HeartBeat Output frequency can change. For example, during a download, the HeartBeat will not pulse, because all resources are downloading the Job to the board(s). PLC monitoring must be written with these scenarios in mind. For example, monitor the HeartBeat every 1 second when the Run Mode output is also asserted.

While in Setup Mode, the Run Mode/Setup Mode Output is set to FALSE. During Run Mode, the Run Mode/Setup Mode Output is set to TRUE. External monitoring of the I/O point indicates when I-PAK is ready to run.

System Settings

The System Settings dialog box allows the Programmer to:

- Define and configure the Input and Output Channels
- Define automatic Product ChangeOver activities:
  - Resetting statistics
  - Resetting failures
  - Setting the archive path
  - Showing only unique codes in change lot
  - Ignoring extra layout symbols
- Define training Session activities:
  - Autosave
  - Resetting statistics
  - Resetting failures
  - AutoStep Mode default on/off in Training
  - Go directly into Training when you exit Run Mode
  - Train Multiple OCV Tools
- Define an End Batch option
- Enable the 21 CFR Part 11 Compliance options:
  - Login capability
  - Configuration Audit trail
  - Login Passwords Expirations
  - Login Prompt on Training Feature

These are Programmer level functions.

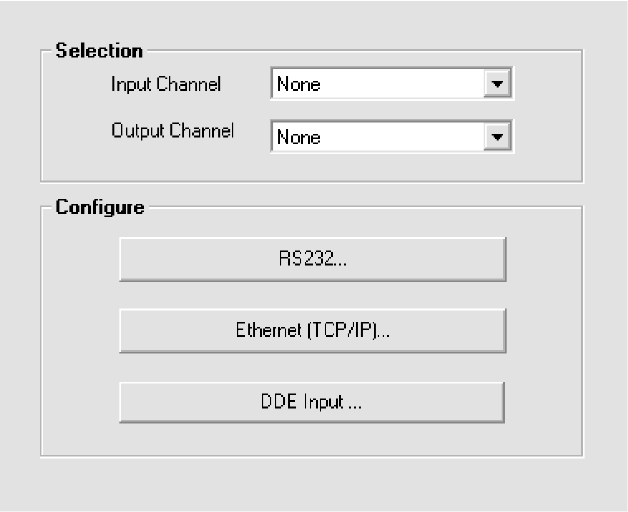
For the System Settings dialog box with **General** tab selected, see "System Settings — General Tab" on page 6-113.

The remainder of this section describes:

- “System Settings — Communication Tab” starting on page 6-82
- “System Settings — Training and Results Tab” starting on page 6-91
- “System Settings — General Tab” starting on page 6-113

System Settings — Communication Tab

FIGURE 6–52. System Settings Dialog Box — Communication Tab



Selection

This section allows you to define the Input and Output Channel to communicate to a host for download of match string and OCV FontTool string.

- Input Channel — Choose from None (default), RS-232, or Ethernet.
- Output Channel — Choose from None (default), RS-232, or Ethernet.

Configure

This section allows you to configure the Input and Output Channel, and contains the following buttons:

- “RS-232” on page 6-83
- “Ethernet (TCP/IP)” on page 6-86

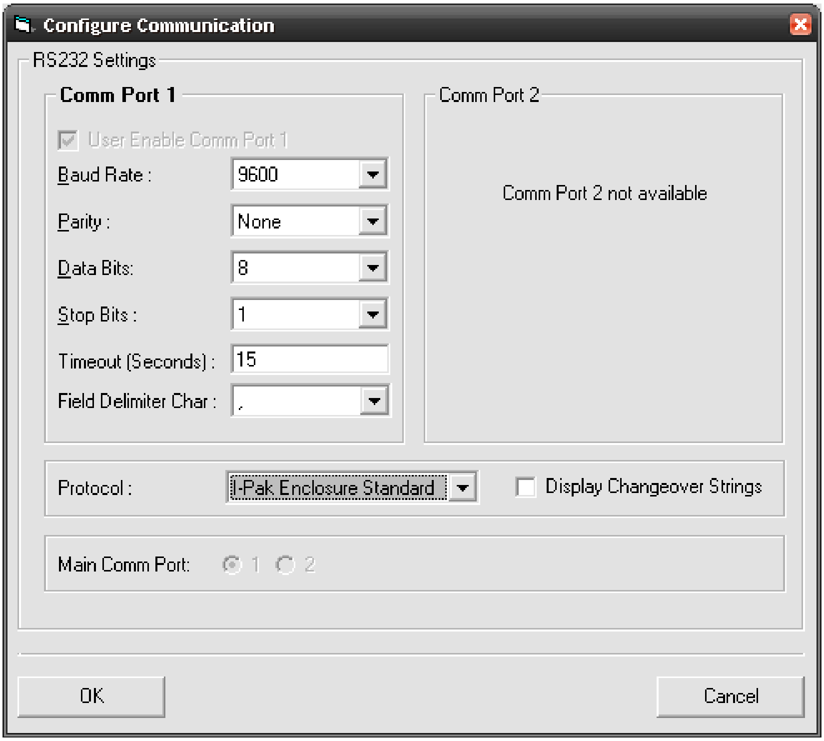
RS-232

After you click on this button, the Configure Communications dialog box is displayed, as shown in Figure 6–53. You can use the defaults or can customize your Communications ports.

I-PAK supports two RS-232 ports. They must be configured as COM1 and COM2.

If a Comm Port is already used by another program, it is displayed inside the frame of the port (“Comm Port x used by another program or not available”) and the Input fields are hidden (see Figure 6–54). If a Comm Port is not available (Hardware), it is displayed inside the frame of the port (“Comm Port x used by another program or not available”) and the Input fields are hidden (see Figure 6–54).

FIGURE 6–53. **Configure Communication Dialog Box — RS-232**



Settings

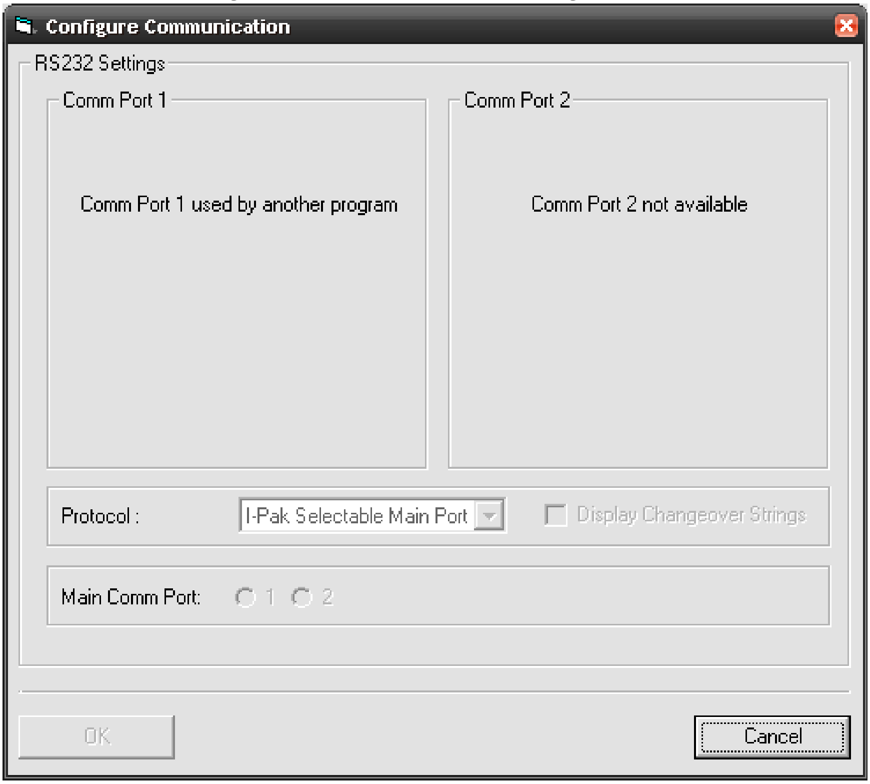
This dialog box is driven by the type of Protocol being used.

- Protocol — Defines which RS-232 protocol scheme is used.
  - I-PAK Enclosure Standard — I-PAK defaults its Protocol as I-PAK Enclosure Standard, which means that RS-232 Comm Port 1 is used for all RS-232 Communications. When this protocol is used, you cannot use the other ports or change their settings.
  - I-PAK Selectable Main Port — I-PAK expects the RS-232 communications to be made through the Comm port indicated by the Main Comm Port item on the RS-232 Configuration screen.
- RS-232 Settings — You can define the RS-232 Settings as follows:
  - Baud Rate — Default of 9600. Range is 110 to 115200.

- Parity — Default of None. Range includes None, Even, Odd.
- Data Bits — Default of 8. Range includes 4, 5, 6, 7, 8.
- Stop Bits — Default of 1. Range includes 1, 1.5, 2.
- Timeout (Seconds) — Default of 15 seconds. Range is 1 to 99.
- Field Delimiter Char — Default of “,”. Range of “,”, “*” and “#”.
- Main Comm Port — This setting selects between the two available Comm ports in I-PAK. This setting can only be selected when the Protocol is set to “I-PAK Selectable Main Port”.

  Default: Comm Port 1
  Range: 1 to 2

FIGURE 6–54. **Configure Communication Dialog Box — RS-232**

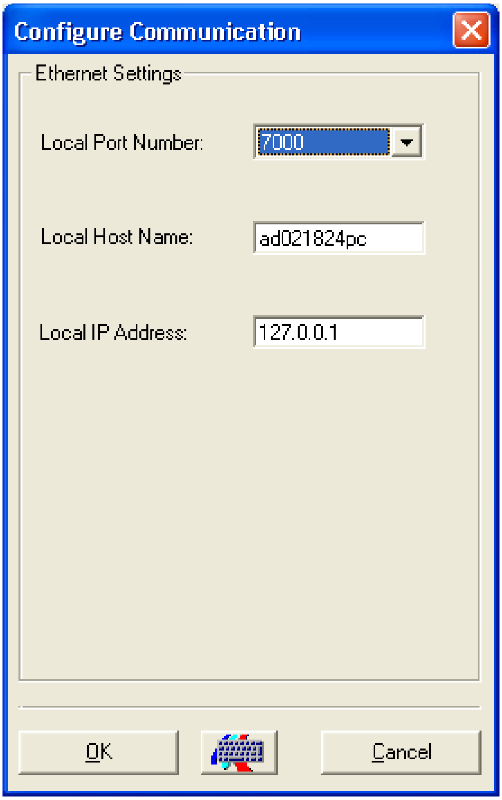


Settings

Ethernet (TCP/IP)

After you click this button, the Configure Communications dialog box is displayed, as shown in Figure 6–55.

FIGURE 6–55. **Configure Communication — Ethernet Settings**



Define the TCP/IP Settings as follows:

- Local Port Number — The default is 7000. The range is 7000 to 7004.
- Local Host Name — Read-only display of the local host.
- Local IP Address — Read-only display of the IP address.

Remote Commands Supported by RS-232 and Ethernet

Remote commands allow an external device or computer to perform a limited set of functions on I-PAK. These functions can be accomplished through either
RS-232 or Ethernet, depending on the selected Input Channel. The commands are accepted by I-PAK in either Run Mode or Setup Mode. Using remote commands, you can clear statistics, retrieve statistics, enter

Setup Mode, enter Run Mode, and change product. The syntax of these commands is:

- Retrieve Statistics: RETRIEVESTATS <EOT>
- Clear Statistics: CLEARSTATISTICS <EOT>
- Go To Setup Mode: ENTERSETUPMODE<EOT>
- Go To Run Mode: ENTERRUNMODE<EOT>
- Change Product: CHANGEPRODUCT<sp>newproductname<EOT>
- Lot Change: CHANGELAYOUT:path:newstring<EOT>

Where:

- The commands themselves are in ALL CAPS.
- <EOT> is an end of text character (chr(4)) or Ctrl-D in HyperTerminal.
- <sp> is a space character.
- newproductname is the name of a valid product definition in the I-PAK Job Folder.
- path is the unique path to the tool.
- newstring is the new layout or match string.

See “Ethernet CHANGELAYOUT Usage” on page 5-105 for details on the Ethernet CHANGELAYOUT command. See “RS-232 CHANGELAYOUT Usage” on page 5-96 for details on the RS-232 CHANGELAYOUT command.

Remote Commands Details and Syntax

Below are the details and syntax for each of the remote commands.

- Retrieve Statistics

  When I-PAK receives this command, the following statistics are sent to the Output Channel specified:

  - Product Name.

– Current Date and Time.

– Inspected string — When the Match String for the Barcode Tool or Data Matrix Tool are used or when the FontTool.text or OCVRunTool.text is uploaded.

– Last Run Time Statistics.

The data is sent in the following format to the RS-232 port as specified in the Output Channel in conjunction with the RS-232 Protocol specified:

– Product=product_name<lf><cr>

– Date/Time=mm/dd/yyyy hh:mm<lf><cr>

– Inspected Characters=inspected_characters<lf><cr>

– I=#<lf><cr>

– P=#<lf><cr>

– R=#<lf><cr>

– <eot><lf><cr>

Where:

– product_name is the name of the currently selected product

– mm is the month (01 - 12)

– dd is the day (01 - 31)

– yyyy is the year (i.e., 2000)

– hh is the hour (01 - 12)

– mm is the minute (00 - 59)

– inspected_characters is a string of the characters inspected by the Job

– # is a number

– <lf> is a line feed character, chr(10)

– <cr> is a carriage return character, chr(13)

– <eot> is an end of text character; (chr(4)) or Ctrl-D in HyperTerminal

---

Note: If there are no Inspected Characters in the Job, the third line of data will not be present. When there is more than one inspection, the “I” “P” and “R” lines indicate the inspection number, such as “I1” “P1” “R1”.

- Clear Statistics — When I-PAK receives this command, the “Inspect”, “Pass”, and “Fail” counts are set to zero.
- Go To Setup Mode — When I-PAK receives this command, the system returns to Setup Mode without requiring a password. If I-PAK is already in Setup Mode, no action is taken.
- Go To Run Mode — When I-PAK receives this command, the system enters Run Mode. If I-PAK is already in Run Mode, no action is taken.
- Change Product — This is the only remote command that requires a parameter (see Protocol on page 6–84). When I-PAK receives this command, the system attempts to load the indicated product. If the product cannot be found or has other problems loading, I-PAK returns a “FAIL” to the Output Channel selected.

  If I-PAK is in Run Mode, inspections stop. The new product is loaded into
  I-PAK and downloaded to the framegrabber board. Then, inspections begin.

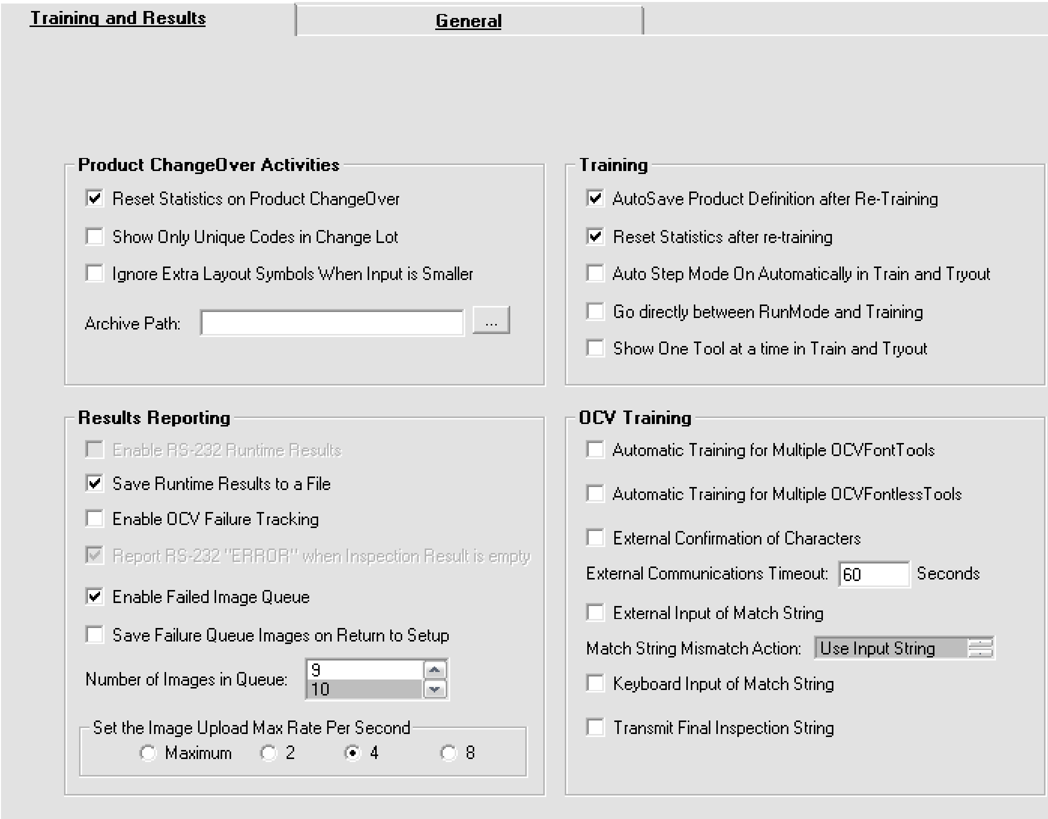
  If I-PAK is in Setup Mode, the new product is loaded into I-PAK.

  I-PAK sends an “OK” message when the command is successfully received and processed. I-PAK sends a “FAIL” message when the command is not successfully received or processed.

Note: When using the CHANGEPRODUCT command, the “OK” response is sent out before the new product is read in. This is because the new product may not have the same Input/Output channel selections.

System Settings — Training and Results Tab

FIGURE 6–56. **System Setting Dialog Box — Training and Results Tab**



The Training and Results Tab window contains the following sections:

- “Product ChangeOver Activities” on page 6-92
- “Results Reporting” on page 6-94
- “Training” on page 6-106
- “OCV Training” on page 6-108

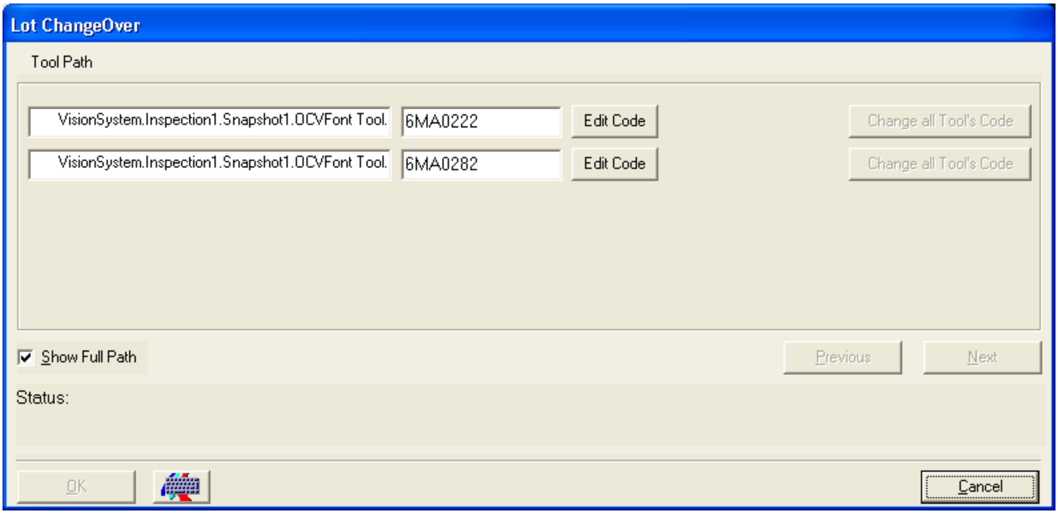
Product ChangeOver Activities

This section allows you to set the automated reset of statistics and failure upon Product ChangeOver.

- Reset Statistics on Product ChangeOver — Enabling this setting automatically resets the Runtime statistics to zero when you perform a Product ChangeOver and when you create a new product. This makes I-PAK ready to go On-line with counters set to zero. The default is selected.
- Archive Path — Enabling this setting enables the Archive/Restore button on the Product ChangeOver dialog box. Through this feature, you can archive and restore products from a CD-RW or any other valid path, such as a directory or across a network. I-PAK Job files are rather large and typically do not fit on a floppy. You'll always need to archive and restore both the .avp and .avpsys files for a product to run in I-PAK. By default, this setting is left blank.

  You can select the Archive Path using a browser by clicking on the ellipsis to the right of the Edit field.
- Show Only Unique Codes in Change Lot Setting — Enables and disables the display of only unique codes in the lot changeover dialog box.

FIGURE 6–57. Lot ChangeOver Dialog Box



With Show Only Unique Codes in Change Lot enabled:

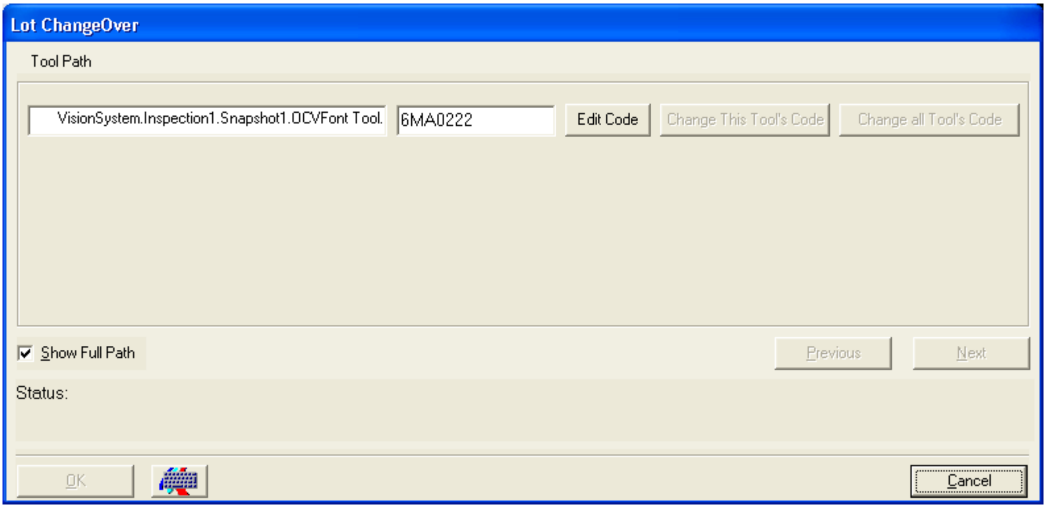
– The list of tools on the Lot ChangeOver dialog box only shows tools with unique codes. When the Job is scanned looking for OCV Tools to display, I-PAK also checks to see if a tool with the same code is already displayed. If a tool with the same code is found, the new tool is not added to the list.

– Clicking Change all Tool's Code initiates a scan of the Job to find all tools with the associated code (using the old code). When a tool is found, it is updated to have the new code.

– The Change This Tool's Code buttons are not displayed. The user is required to change all tools that share the same code.

- Ignore Extra Layout Symbols When Input is Smaller — Enables and disables the automatic ignore feature of lot changeover.

FIGURE 6–58. **Lot ChangeOver Dialog Box**



When the user clicks Change All Tool's Code or Change This Tool's Code, the I-PAK software checks to make sure that the number of symbols input by the user is equal to the number of symbols currently in the OCV Tool's layout. With Ignore Extra Layout Symbols When Input is Smaller enabled, the user is able to enter fewer symbols than the number in the current layout. I-PAK software automatically ignores the extra symbol positions.

Although the OCV Tool ignores the symbols during OCV inspection, the AutoFind still uses those symbol positions as templates if they were assigned as templates when the tool was trained. If the user wishes to completely ignore symbol positions at runtime, the user must ensure that those symbol positions are not used by the AutoFind.

Results Reporting

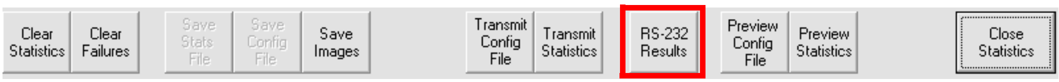
This section allows you to configure I-PAK to output selected inspection results through the RS-232 Communications Port and/or to a file on the PC. This may be useful when you need a matrix match or read string or a Font Tool's string to be communicated to an external device at runtime, in the case of RS-232 Runtime Result, or to log inspection at runtime, in the case of Save Runtime Results to a File.

In either case, the setup is similar. I-PAK presents a list of inspection results to upload as part of the Inspection Step. These are noted as Select Results to Upload on the Inspection Step's property page. I-PAK selects certain results our users are most interested in automatically. These can easily be seen on the Run Mode Display Results window.

To use these features, verify that any inspection results you might need are selected on the Inspection Step's property page in the Select Results to Upload dialog box and enable an RS-232 port on the System Setting Communications Menu.

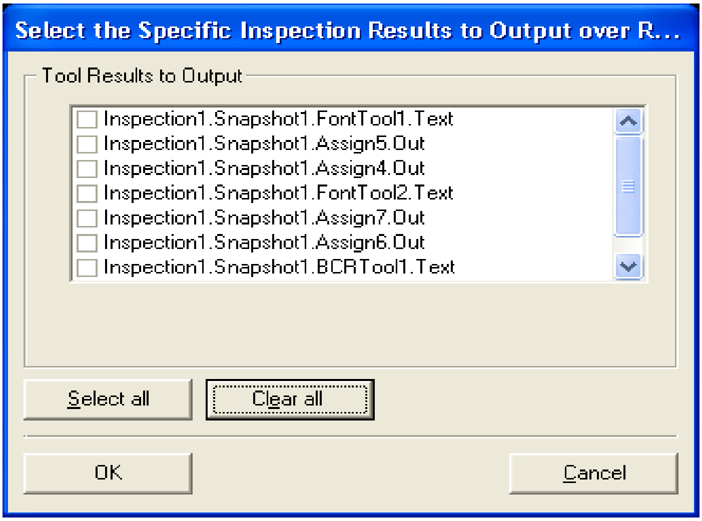
- Enable RS-232 Runtime Results — By default, this selection is disabled until you enable an RS-232 port. Once a port is established, you can select this option. Exit the Advanced SubMenu and go to the Statistics/Data SubMenu. You will notice an additional button available on the Statistics/Data SubMenu called RS-232 Results, as shown in Figure 6–59.

FIGURE 6–59. Updated Statistics SubMenu for RS-232 Results



Click RS-232 Results and go into the dialog box (see Figure 6–60).

FIGURE 6–60. Tool Results to Output



– The Cancel button allows you to discard any modification that was done. Only the OK button will take over the selection.

– The Select all button allows you to select all entries in the list.

You will see a listing of all the selected results from the Inspection Step’s property page in the Select Results to Upload dialog box. Click any of these results to be output via the RS-232 Communications Port. Click OK to exit the dialog box.

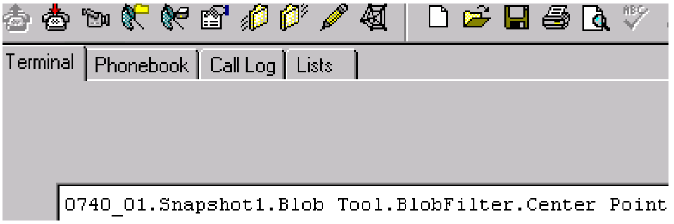
Notes: You may select any or all of these inspection results to be reported at runtime through RS-232. RS-232 result reporting will affect inspection time and system throughput. The fewer items you output, the more efficient
I-PAK will be.

When a tool is not run, any of its results that are selected for RS-232 reporting will contains the string “Error:”.

In the case of a Barcode Tool or Data Matrix Tool, when the tool was unable to successfully read the code, the tool result for RS-232 reporting will contain the string “Error:”.

Once this product's tools are trained, you can go into Run Mode. Using a program such as HyperTerminal, you can verify that the inspection results are being output from I-PAK to the Communications port specified. For example:

FIGURE 6–61. Sample RS-232 Results Output



Each grouping of results is terminated with an EOT.

The format of these inspection results is:

STX symbolic name = result ETX

Where:

STX is Chr(2)

ETX is Chr(3)

EOT is Chr(4)

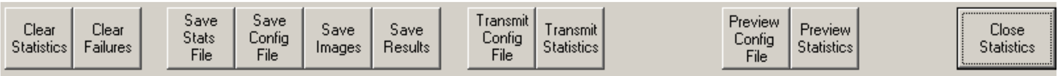
Note: Sometimes, inspection results reported are in the form of arrays or lists. Data will be reported in full; no parsing or interpretation of data results will be done by I-PAK.

- Save Runtime Results to a File — By default, this setting is not selected. Once selected, click OK from the System Settings menu and exit the Advanced SubMenu.

Note: Follow the same setup of I-PAK's inspection results to upload as described above before going into the Save Results dialog box.

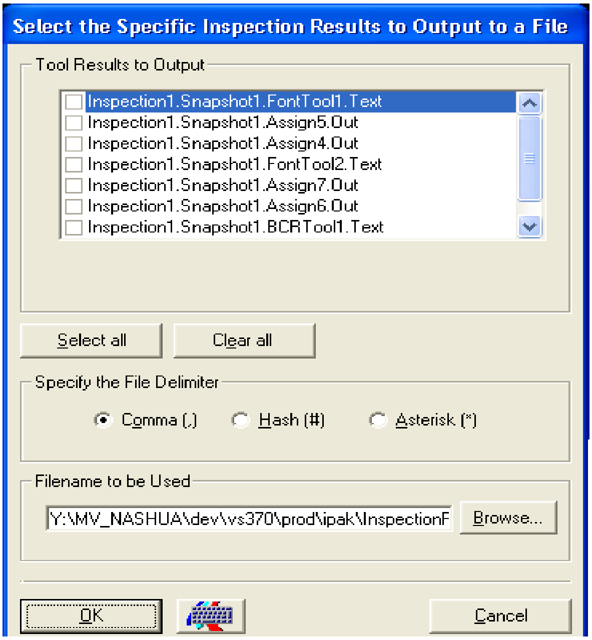
Then, you will notice an additional button available on the Statistics/Data SubMenu called Save Results.

FIGURE 6–62. **Updated Statistics SubMenu for Save Results**



Click Save Results and go into the dialog box.

FIGURE 6–63. **Save Results**

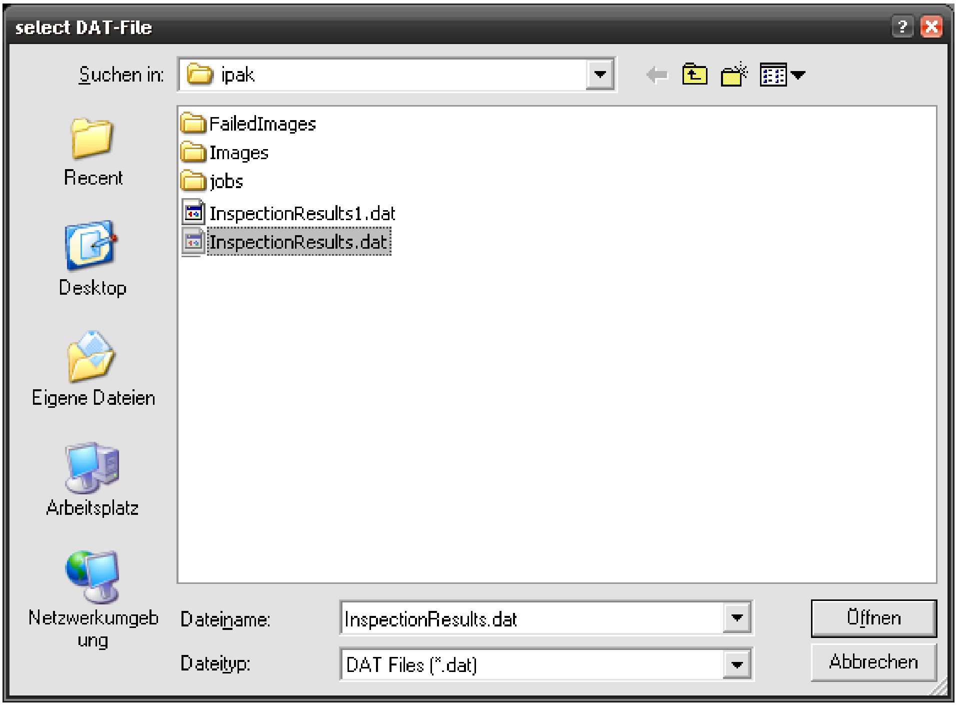


The Cancel button allows you to discard any modification that was done. Only the OK button will take over the selection.

The Select all button allows you to select all entries in the list.

The Browse… button allows you to navigate to the folder and file of the used file. Clicking this button opens the Select DAT File dialog box, as shown in Figure 6–64.

FIGURE 6–64. **Select DAT File Dialog Box**



In this dialog box, the user can select an existing DAT file used for writing the Output data. It is s also possible to write a new filename into the filename field. The file will be created and can be used.

You will see a listing of all the selected results from the Inspection Step's property page in the Select Results to Upload dialog box. Now, you need to click any of these results to be output to a File.

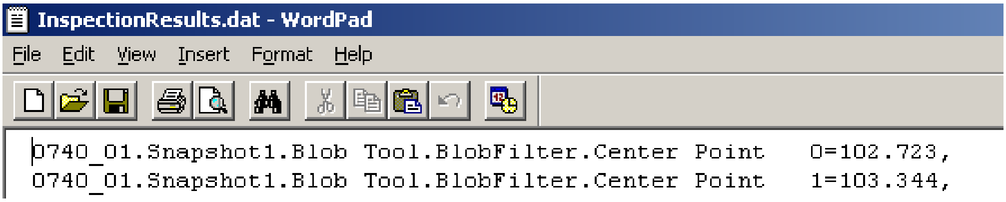
You must also specify the File Delimiter. You can choose between the comma, default or a "#' or a "*".

By default, the File name is "InspectionResults.dat". If you wish to change the file name or its path, specify this data on this dialog box.

Click OK to exit this dialog box.

Once this product's tools are trained, you can then go into Run Mode. Using a program such as Notepad, you can verify the inspection results are being output from I-PAK to the File specified. The example below shows such an exercise.

FIGURE 6–65. Sample Save Results Output



The format of these inspection results is:.

VisionBoard.Snapshot Name.symbolic name = result <delimiter>

Where <Delimiter> is one of these user defined symbols: comma, pound sign, or asterisk.

Each grouping of results is terminated with a <CR> --carriage return.

Note: Sometimes, inspection results reported are in the form of arrays or lists. Data will be reported in full and no parsing or interpretation of data results will be done by I-PAK.

At Runtime, I-PAK will write these inspection results to the file after every results upload. The default file name is: “InspectionResults.dat” and its path is the directory where I-PAK was started.

- Enable OCV Failure Tracking — When checked, enables the failure tracking for every OCV tool in the product definition file.

OCVResultsDm Upload

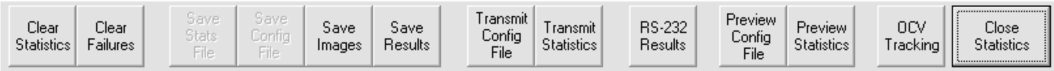
When OCV Failure Tracking is enabled, for each OCV tool in the current product, I-PAK automatically selects the “OCVResultsDm” from the inspection step’s list of results to be uploaded. When OCV Failure Tracking is disabled, I-PAK ensures that this inspection result is not selected for upload.

The OCVResultsDm holds all of the pass/fail information for each symbol in the OCV tool. At runtime, this datum will be parsed in order that a grid of pass/fail counts and failure types for each symbol can be filled. Types of symbol failures are: Correlation Failure, Sharpness Failure, Contrast Failure, Appearance Flaw Break Failure, Initial Residue Failure, Final Residue Failure, Max Blob Residue Failure, B8 ID Test Failure, Quad ID Test Failure, Break ID Test Failure, X Offset Failure, Y Offset Failure.

Setup Mode Viewing of Failures

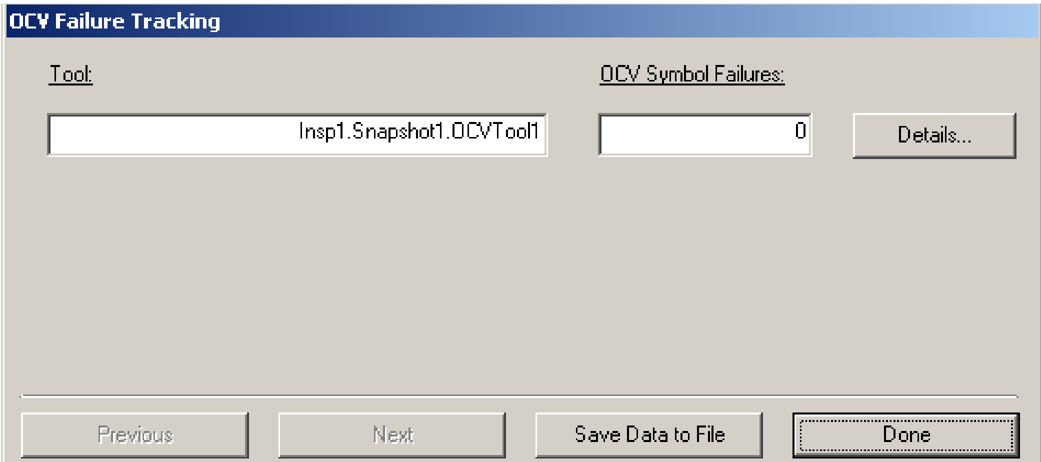
With OCV Failure Tracking enabled, a new button, OCV Tracking, is displayed on the toolbar of the Statistic Screen, as shown in Figure 6–66.

FIGURE 6–66. OCV Tracking Button Displayed



When OCV Tracking is clicked, the OCV Failure Tracking screen is displayed, as shown in Figure 6–67. It lists all of the OCV tools that are in the current product definition.

FIGURE 6–67. OCV Failure Tracking Screen



– The Previous and Next buttons cycle through the available OCV Tools when there are more than four in the product definition.

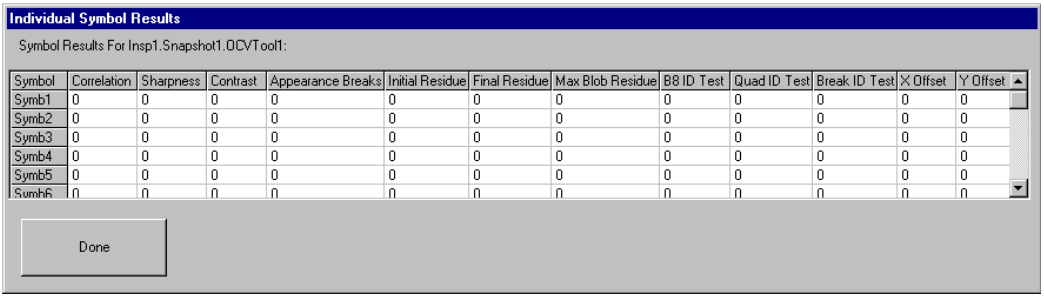
– The Save Data to File button saves all OCV Tracking data to a file. The file is named “SymbolTracking,” concatenated with the current time/date stamp.

– The Done button closes the OCV Failure Tracking dialog box.

The center of the dialog box displays the names of the OCV Tools and the number of failures for the tools. The number of failures is based only on Symbol failures; locator failures will not be included in these counts.

Next to the number of failures is a Details… button. When you click one of the Details… buttons, an Individual Symbol Results dialog box is displayed, as shown in Figure 6–68.

FIGURE 6–68. Individual Symbol Results Dialog Box



This dialog box displays all of the symbols for the associated OCV tool along with the failure counts for each possible type of OCV failure. The information on this dialog box is in a grid format. The grid is filled at runtime.

Run Mode Viewing of Failures

With OCV Failure Tracking enabled, a new button, OCV Result Tracking, is displayed on the Failure Report dialog box, as shown in Figure 6–69.

6

Setup Mode Reference

FIGURE 6–69. **OCV Result Tracking Button Displayed**

When you click this button, the OCV Failure Tracking dialog box is displayed. This dialog box is the same as the Setup Mode dialog box except that it does not allow saving the data to a file (see Figure 6–67, "OCV Failure Tracking Screen," on page 6-100).

Loading New Jobs

When a new Job is loaded and OCV Failure Tracking is enabled, any existing Individual Results dialogs are removed from I-PAK. Then, the Job is scanned for OCV tools. For each OCV tool found, the

OCVResultsDm is selected for upload and an “Individual Results” dialog box is created for the tool. The OCV Tracking screen is updated to reflect the OCV tools that are in the currently loaded Job.

- Report RS-232 ERROR when inspection Result is Empty — I-PAK has a System Setting to enable/disable the RS-232 Error codes from being sent during any tool failure. By default, this setting is enabled and allows I-PAK to report “ERROR” when the RS-232 result data is empty. You can disable this setting so that when the data is empty, I-PAK does not report anything. This only effects data sent our RS-232 not what you see on the I-PAK display.

- Enable Failed Image Queue — When you check Enable Failed Image Queue, the Failed Image Queue button on the Camera View becomes active, and all images from inspections that fail that are displayed in the Camera View are saved to the Failed Image Queue.

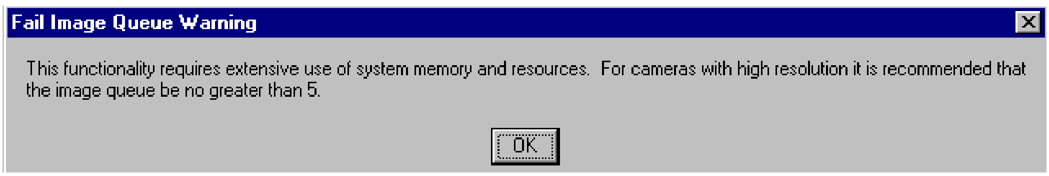
- Save Failure Queue Images on Return to Setup — Enables and disables the saving of the failure queue images when the user returns to Setup Mode. By default, this feature is disabled.

  You can view a queue of the last 1 to 20 failures per camera. When the user-settable maximum number of images is reached, a new failure image overwrites the image in the first image frame.

  Only images that are successfully uploaded to the I-PAK interface from the framegrabber board are entered into the queue. Not all images get uploaded to the I-PAK interface to avoid compromising inspection throughput. For that reason, when failures occur in rapid succession, the failed images may not be entered into the queue.

  When this feature is enabled by the user, a message box is displayed (Figure 6–70) to warn the user about the extensive memory usage that occurs when saving the images.

FIGURE 6–70. **Fail Image Queue Warning Dialog Box**

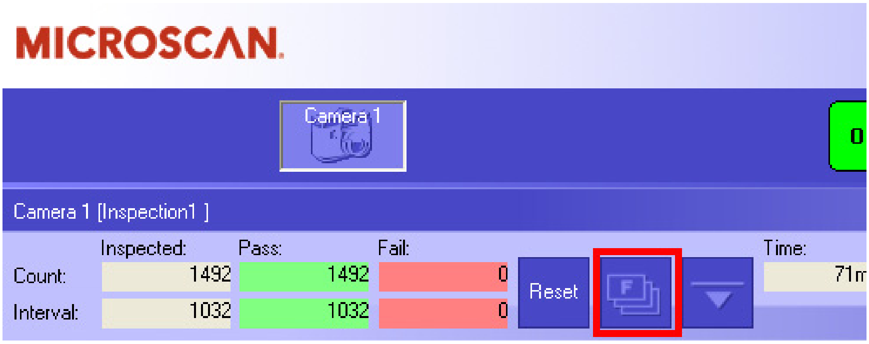


- Number of Images In Queue — Allows the user to input the number of images contained in the failure image queue. By default, I-PAK has room for 10 images in the failure image queue.

Using the Failed Image Queue at Runtime
Failure Image Queue Button

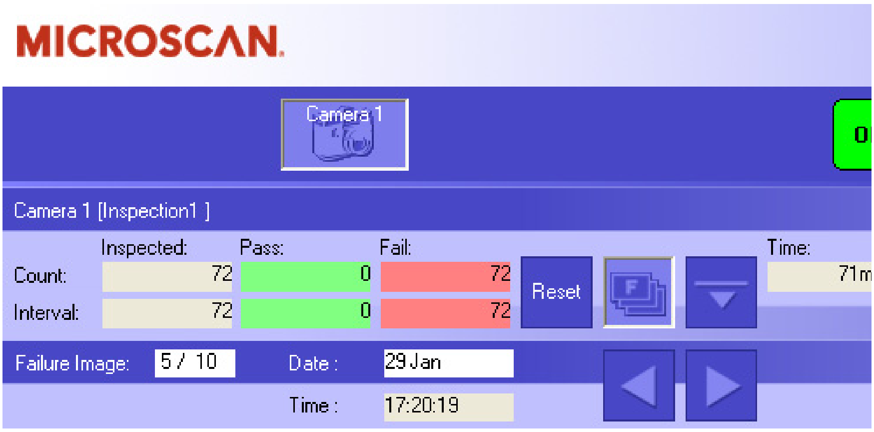
The buttons on the camera view have been rearranged to allow for a new button (Failed Image Queue), as shown in Figure 6–71.

FIGURE 6–71. **Failed Image Queue Button**



When Failed Image Queue is clicked, the display changes to allow cycling through the failed images, as shown in Figure 6–72.

FIGURE 6–72. **Screen to Cycle Through Failed Images**



Clicking the < and > buttons cycles the display through the available image frames. If no failed image has been assigned to a frame, that frame will appear gray. Zoom In and Zoom Out bring the displayed failed image to the desired magnification level.

Saving the Images to Disk

When the Supervisor or Programmer returns to Setup Mode with the Save Failure Queue Images on Return to Setup enabled, the queue of failed images gets saved to the system's hard drive. At startup, the I-PAK software creates the folder I-PAK\FailedImages (if it does not already exist). This is the folder into which the failed images are stored. The images are named Image_bn_cn_fn:

Where:

– bn is the visionboard number

– cn is the camera number

– fn is the failure number

When failed images are written to the hard disk, I-PAK overwrites any images that may already be in the I-PAK\FailedImages folder. It is the Supervisor's (or Programmer's) responsibility to save any images that might be needed for debugging or other purposes at a later time.

Image Upload Maximum Rate

To better I-PAK's CPU usage, there is a System Setting on the General Tab for you to set the Image Upload Maximum Rate. This setting is for the number of images transferred back to the PC per second.

At runtime, the inspected images from the cameras get transferred back from the framegrabber board to the PC and are displayed on the "Camera" views on the I-PAK Run Mode interface. In recent software from Microscan, we had tried to show the most images for users to view. This unfortunately seemed to bog down the PC's CPU - in fact, causing the CPU usage to become high and in some cases causes the CPU usage to "Max out".

By default, this is set to "2". You can increase this to "4", "8" or "Maximum". By increasing this setting, you will enable more images to come back to the PC. But, as you increase this setting, you will also be increasing the CPU usage. By decreasing this setting, you limit the number of images coming back to the PC. Therefore, you may not see “every image” that the framegrabber board processes.

Setting a small number here will result in a “sluggish” update of the camera’s images. Setting a higher number will result in a more “lively” update of runtime images. Microscan can only suggest settings for this field. You need to run your production line at line speeds and judge the best setting for yourself.

Note: You can reliably trust the framegrabber board’s processing - if the framegrabber board reports a Pass signal through the IO, then the part is good. Likewise, a Fail IO signal, should cause the part to be rejected. You may not see all these failed images if you are running at high production rates (Parts per minute) and depending on the Image Upload Rate setting.

Note: When using a Job that is inspecting “frozen” images, or images from disk, set this to “Maximum” for the best runtime user interface response.

Training

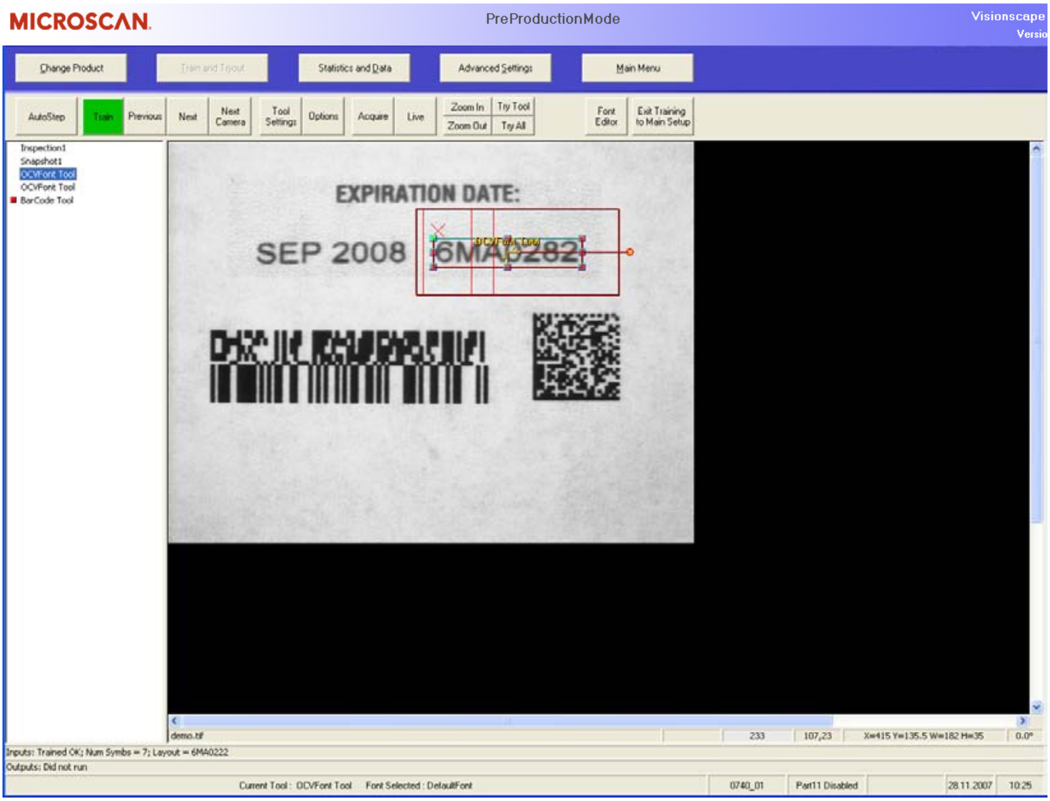
This section allows you to set the automated saving of the product definition every time the Job is re-trained.

- AutoSave Product Definition after Re-Training — Enabling this setting automatically saves the product definition after each re-training of the Job. This prevents changes from being lost. The default is selected.
- Reset Statistics after re-training — Enabling this setting automatically resets the Runtime statistics to zero when you perform a Product ChangeOver and when you create a new product. This makes I-PAK ready to go On-line with counters set to zero. The default is selected.
- AutoStep Mode on Automatically in Train and Tryout — Enabling this setting sets the Train and Tryout menu’s AutoStep (Wizard) Mode on. Some users may want to disable this AutoStep Mode option so they can just go right to the tools they wish to re-train or adjust. By default, this setting is selected.

- Go directly between RunMode and Training — Enabling this setting brings you right into the Train and Tryout menus directly from Run Mode. You will bypass the main Setup Menu. You may find this useful if you usually come out of Run Mode and go directly into Train and Tryout. This saves a mouse click. By default, this setting is not selected.

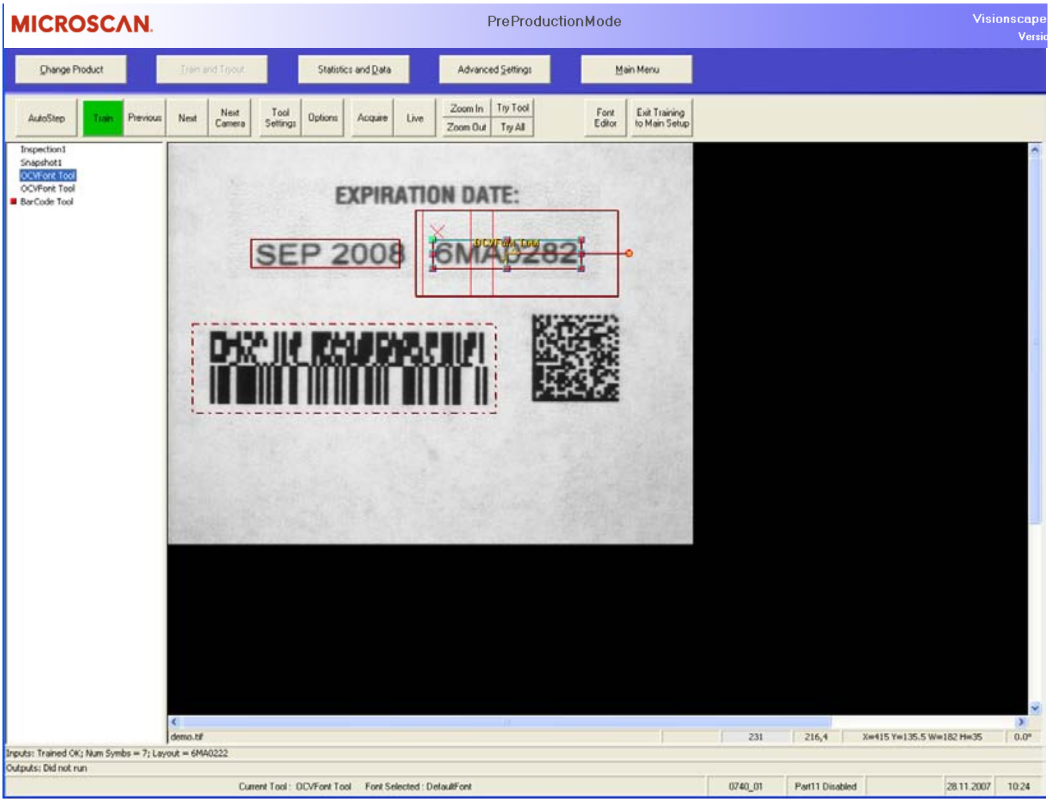
- Show One Tool at a time in Train and Tryout — When enabled, the tool graphics for the selected tool will be the only tool graphics displayed in the buffer on the Train and Tryout screen. Tools can be selected using the list on the left hand side of the screen. See Figure 6–73.

FIGURE 6–73. **Training Screen Showing One Tool at a Time**



When disabled, the tool graphics for all tools will be displayed (unless in AutoStep mode) in the buffer on the Train and Tryout screen. Tools can be selected using the list on the left hand side of the screen or by clicking on the tool graphics for the tool. See Figure 6–74.

FIGURE 6–74. Training Screen Showing All Tools



OCV Training

Automatic training of multiple OCV tools allows a Programmer to quickly train multiple OCVFont Tools, typically, where each tool uses the same OCVFont and has the same layout. It also allows a Programmer to quickly train multiple OCVFontlessTools. Automatic training requires that an image be available for training and that the Programmer train the first tool in the group of the multiple tools. Two menu items on the System Settings menu of I-PAK allow automatic training of multiple OCVFontTools and OCVFontlessTools.

- Automatic Training for Multiple OCV Font Tools — Enabling this setting allows the Automatic Training For Multiple OCVFontTools. By default, this setting is disabled and requires every OCVFontTool to be trained manually.

  With Automatic Training for Multiple OCVFontTools enabled, when an OCVFontTool is trained, the user sees with the Approval Screen. When the layout is approved, the I-PAK software scans the other tools in the snapshot looking for OCVFontTools with the same name or same match criteria as the OCVFontTool that was just approved.

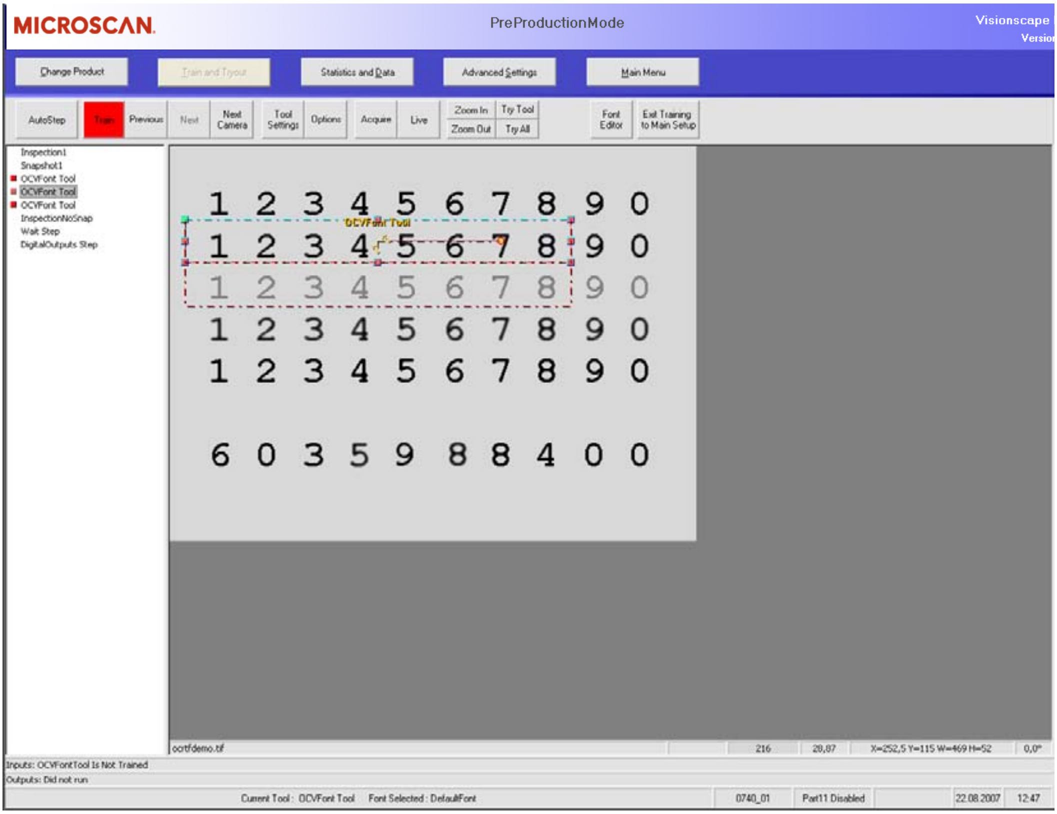
  Match criteria is defined as a string of characters that comes after a " - "(space, dash, space) separator in the tool name. For example, if a tool is named "OCVFontTool - Date Code", the match criteria is "Date Code". After training this tool, when Approval is clicked, I-PAK will scan for and train any OCVFontTools in the snapshot that have the same match criteria (must use the " - " notation to separate tool name from match criteria). If there is no match criteria in the tool name (no "-"), I-PAK will use the entire tool name when searching for tools to train.

- Automatic Training for Multiple OCV Fontless Tools — Enabling this setting allows the Automatic Training For Multiple OCVFontlessTools. By default, this setting is disabled and requires every OCVFontlessTools to be trained manually.

  With Automatic Training for Multiple OCVFontlessTools enabled, when an OCVFontlessTool is trained, the I-PAK software scans the other tools in the snapshot looking for OCVFontlessTools with the same name or same match criteria as the OCVFontlessTool that was just trained.

  Match criteria is defined as a string of characters that comes after a " - " (space, dash, space) separator in the tool name. For example, if a tool is named "OCVFontless Tool - Random Code", the match criteria is "Random Code". After training this tool, when Approval is clicked, I-PAK will scan for and train any OCVFontlessTools in the snapshot that have the same match criteria (must use the " - " notation to separate tool name from match criteria). If there is no match criteria in the tool name (no "-"), I-PAK will use the entire tool name when searching for tools to train.

FIGURE 6–75. **Training Screen from Training Multiple OCV Tools**



- External Confirmation of Characters — Enabling this setting allows an external device (computer, etc.,) to approve or disapprove the result of training an OCVFontTool or OCVRuntimeTool. The learn layout string (string of symbol names for those symbols found during training) is sent from I-PAK to the external device. The external device sends back an approve or disapprove message to I-PAK. An OCVFontTool or OCVRuntimeTool training session is not complete without an approval from the external device.

Note: External Confirmation of Characters is accomplished through a communications handshake between I-PAK and the external device. The communications can be accomplished through RS-232 or Ethernet.

Refer to “External Confirmation of Characters” on page 5-79 for more information.

- External Communications Timeout — Setting this field determines the amount of time that the communications handshake waits.
- External Input of Match String — Enabling this setting allows an external device (computer, etc.,) to specify the intended inspection string for an OCVFontTool or OCVRuntimeTool. This is accomplished by creating a communications handshake between I-PAK and an external device. The necessary information is sent from the external device to I-PAK. External Confirmation is accomplished through a communications handshake between I-PAK and the external device. The communications can be accomplished through RS-232 or Ethernet.

Note: Enabling External Input of Match String mode automatically disables the ignore and substitute character functionality of I-PAK.

Refer to “External Input of Match String Checkbox” on page 5-90 for more information.

- Match String Mismatch Action — Defines the action that I-PAK takes in the event that the string input from the external device does not match the string learned when the tool was trained. By default, the list box is set to Use Input String. The possible selections and their meaning are:
  - Use Input String — I-PAK uses the input string as the inspection string.
  - Use Learned String — I-PAK ignores the input string and set the string found during training as the inspection string.
  - Retry by Learning — I-PAK forces you to re-train the tool and allows the string to be entered again.
  - Retry by Input — I-PAK allows the string to be entered again.

Note: The Match String Mismatch Action selected is applied to any OCVFontTool or OCVRuntimeTool in the current Job.

Refer to “Match String Mismatch Action” on page 5-90 for more information.

- Keyboard Input of Match String — Enabling this setting allows you to specify the intended inspection string for an OCVFontTool or OCVRuntimeTool. This is accomplished by displaying an input box into which you can type the necessary information.

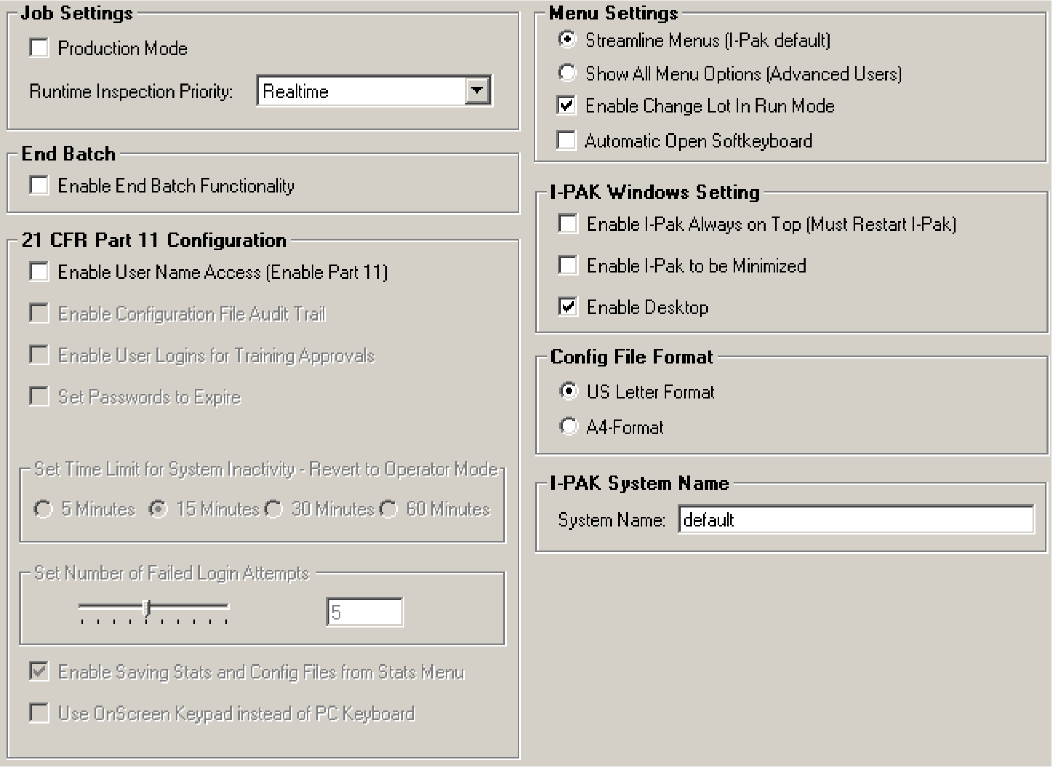
Note: Refer to “Keyboard Input of Match String” on page 5-84 for more information.

- Transmit Final Inspection String — Enabling this setting allows I-PAK to send the final inspection string out after training an OCVFontTool or OCVRuntimeTool.

Note: Refer to “Transmit Final Inspection String” on page 5-94 for more information.

System Settings — General Tab

FIGURE 6–76. **System Settings Dialog Box — General Tab**



The General Tab window contains the following sections:

- “Job Settings” on page 6-114
- “End Batch” on page 6-115
- “21 CFR Part 11 Configuration” on page 6-115
- “Menu Settings” on page 6-117
- “I-PAK Windows Settings” on page 6-118
- “Config File Format” on page 6-118
- “I-PAK System Name” on page 6-119

Job Settings

This section allows you to select or change the following:

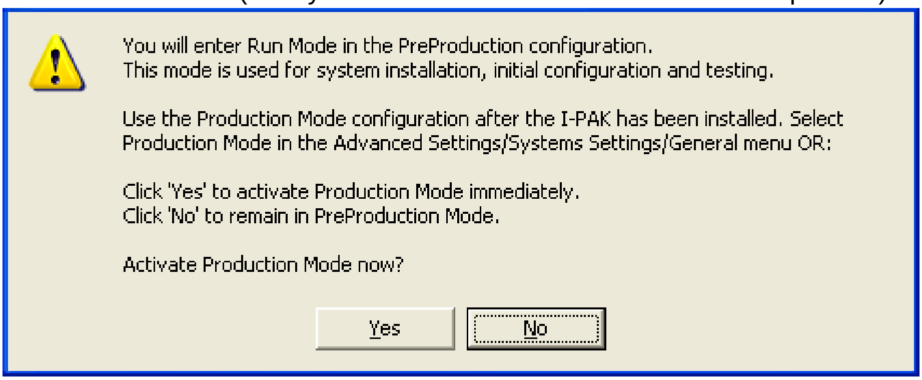
- Production Mode — By default, Production Mode is off, meaning I-PAK is in PreProduction Mode.

  Note: From Setup Mode, you can display the Production Mode checkbox by selecting Advanced Settings > System Settings > General.

  – PreProduction Mode — When you start I-PAK initially, it is in PreProduction Mode. In this mode, you configure and test your Job. When you are ready to run the Job, you want to activate Production Mode.

  – Production Mode — You use this mode AFTER you have configured and tested your Job, and when you are ready to run your Job.

  There are two ways to activate Production Mode; one way is described in the Note above. The other way to activate Production Mode is to click Yes when you see the following screen (after you click the Run Mode button from Setup Mode):



  If you click **Yes**, I-PAK runs in Production Mode.
  If you click **No**, I-PAK runs in PreProduction Mode.

- Runtime Inspection Priority — This is the runtime priority of the current process. The options are Normal, High, and Realtime.

Note: You must have access rights to change the process setting.

End Batch

This section allows you to add the “End Batch” capability when exiting Run Mode, which automatically saves the read-only statistics file to the hard drive and prompt you for a file name. The counters are stored in the PC registry. By default, Enable End Batch Functionality is Off.

21 CFR Part 11 Configuration

This section allows you to set the 21 CFR Part 11 compliance features for user access control (logins) and creating an audit trail.

- Enable User Name Access (Enable Part 11) — Enabling this setting disables the traditional supervision and Programmer modes and replaces it with an Administrator mode. An Administrator then defines valid users, their passwords and their security levels. This Administrator, whose user name is I-PAKAdmin and default password is 999999, is your Configuration Manager. He or she is not a Programmer, a Supervisor nor a Operator. The Administrator must create the valid user accounts before users can begin using the feature. By default, this setting is Off.
- Enable Configuration File Audit Trail — When this setting is enabled, each time the Job definition file is saved to disk, a new read-only configuration file is saved to the archive directory {i.e., C:\Vscape\I-Pak\Jobs\ConfigurationArchives}. This configuration file is marked with the user name, date and time. Old configuration files will not be overwritten. You can determine changes by looking at sequential configuration files. Names for the configuration files are the product name with a date/time identifier. By default, this setting is Off.
- Enable User Logins for Training Approvals — Enabling this option requires your user name/password login when training the following tools:
  - Training a Font Tool or Runtime Font Tool.
  - Entering a keyboard match string entry for a Data Matrix or barcode match.

As you train the tools in a Job, you are prompted to enter your I-PAK Part 11 user name and password for training any FontTool or Runtime Font Tool, and for the Data Matrix and Barcode Tools when in match mode. By default, this setting is Off.

Notes: The System Setting for “Enable User Name Access” must be enabled.

Training a Font Tool or Runtime Font Tool:
When training any font based Font Tool, as you click Train, you are prompted for your user name and password. When you have the system setting for the Font Tool’s “Keyboard Input of Match String” enabled, you are prompted for your user name and password before entering the Font Tool’s match string.

Training a Data Matrix or Barcode Tool in Match Mode:
When training a Data Matrix or Barcode Tool in AutoStep Mode, with the “Match String Enable” option of the tool selected, I-PAK automatically prompts you for your user name and password before entering the Data Matrix or Barcode Tool’s match string. I-PAK also prompts you for your user name and password when you click Train with a Data Matrix or Barcode Tool selected with the “Match String Enable” option selected. I-PAK will not prompt you for the login when just re-training a read mode Data Matrix or Barcode Tool.

When in Part 11 mode, Enable User Logins for Training Approvals affects the Operator:

– When Enable User Logins for Training Approvals is on, Operators cannot change lot in Run Mode.

– When Enable User Logins for Training Approvals is off, Operators can change lot in Run Mode.

- Set Passwords to Expire — Enabling this option makes your password expire after a certain specified time period (15, 30, 60 or 90 days). When this option is selected, a submenu is displayed where you can select the duration. By default, this setting is Off.

Note: The System Setting for “Enable User Name Access” must also be enabled.

When this option is used, as you successfully exit Run Mode using your Part 11 login user name and password, I-PAK checks this user’s password and the current date and time to see if your password has expired. A pop-up message box is displayed if you need to reset your password.

You will not be penalized or lose your account if you do not reset your password. However, you will continue to see these message boxes every time you exit Run Mode or enter your user name and password.

- Set Time Limit for System Inactivity — Setting the time interval to 5, 15, 30 or 60 minutes causes the I-PAK system to revert back to the Operator access level after that period of System Inactivity. The default time interval is 15 minutes.
- Set Number of Failed Logins — Setting the number of failed login attempts to a number between 1 and 10 causes the I-PAK system to suspend a user who has unsuccessfully tried to login X number of times in a row. Only an I-PAK Administrator can restore this suspended account. The default time Number of Failed Logins is 5.
- Enable Saving Stats and Config Files from Stats Menu — Enabling this option makes a more configurable I-PAK user interface. This setting enables and disables the buttons for Save Stats and Save Config Files, saving the Statistics and Configuration files, from the Statistics and Data submenus.
- Use OnScreen Keypad instead of PC Keyboard — Enabling this option causes I-PAK to display an OnScreen Keyboard for entering login and training approval user names and passwords.

Menu Settings

This section allows you to streamline the menus.

- Streamline Menus (I-PAK default) — By default, I-PAK is configured using its streamline menu system. This presents a clean, less cluttered Operator interface.

- Show All Menu Options (Advanced Users) — Select this option to display the menus like they are presented in this user manual.
- Enable Change Lot in Run Mode — When checked, the Change Lot button is visible in Run Mode (meaning Change Lot is possible).
- Automatic Open Softkeyboard — When checked, the Softkeyboard is opened automatically if the selected dialog requires data input. This is available only when I-PAK is running on a Touch panel PC.

I-PAK Windows Settings

This section allows you to configure I-PAK to run with other programs on the PC.

- Enable I-PAK Always On Top (Must Restart I-PAK) — By default, I-PAK is enabled to be Always on Top so that other applications are blocked from view while I-PAK is running. Some users may want to disable this setting so that their other applications can be viewed easily.
- Enable I-PAK to be Minimized — Allows the I-PAK user interface to be minimized while running. Inspections still occur and results are transferred back to the I-PAK interface. By defaults, this setting is disabled.

Note: When you change these settings, you must restart the I-PAK interface, since this is a Windows call that goes into effect at start up of the interface.

- Enable Desktop — Allows the user to show or hide the PC Desktop. When disabled, I-PAK will trap user keys like Ctrl-Esc and the PC's Start button to prevent the Start menu from appearing; Alt-Tab to prevent the user from leaving the I-PAK interface, and Alt-Esc from displaying the TaskBar. I-PAK does not trap or disallow the Ctrl-Alt-Del sequence, as Microsoft recommends against such action as it would interfere with the PC's security. By default, I-PAK enables the desktop.

Config File Format

This section allows you to configure the file format.

- US Letter Format — By default, the file format is set to US Letter (about 66 lines/page).
- A4 Format — Sets the file format to A4 Format (about 72 lines/page).

I-PAK System Name

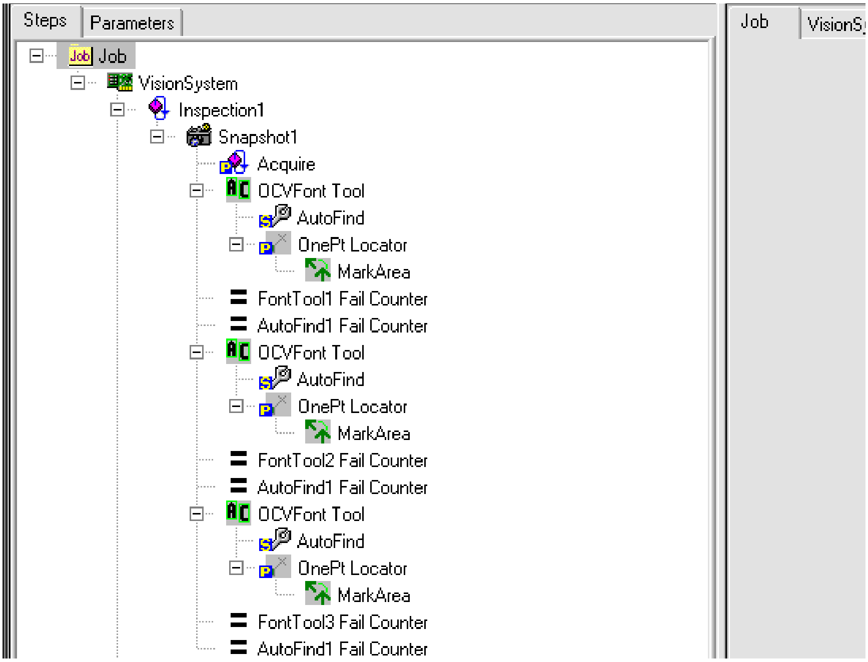
You can name the I-PAK system, which is a useful feature when you have several I-PAK systems dumping Configuration files to a central PC, and you need a way to identify uniquely each I-PAK system.

Edit Tool Set

Edit Tool Set allows the Programmer to add, delete, or edit all the tools in the current product Job definition in a tree-like structure, as shown in Figure 6–77. This is a Programmer level function. You can print the Tree View of your Job, and you can save the Tree View data of the Job to a file.

Note: Edit is intended to give the advanced Programmer a chance to tune an inspection. Some I-PAK settings that you make when you insert steps through edit need to be added manually. For example, if you insert a camera, you must manually set up the virtual I/O for overruns. If you are unsure how to do this, be careful with this feature or you may get unexpected results.

FIGURE 6–77. **Edit Tool Set Menu**

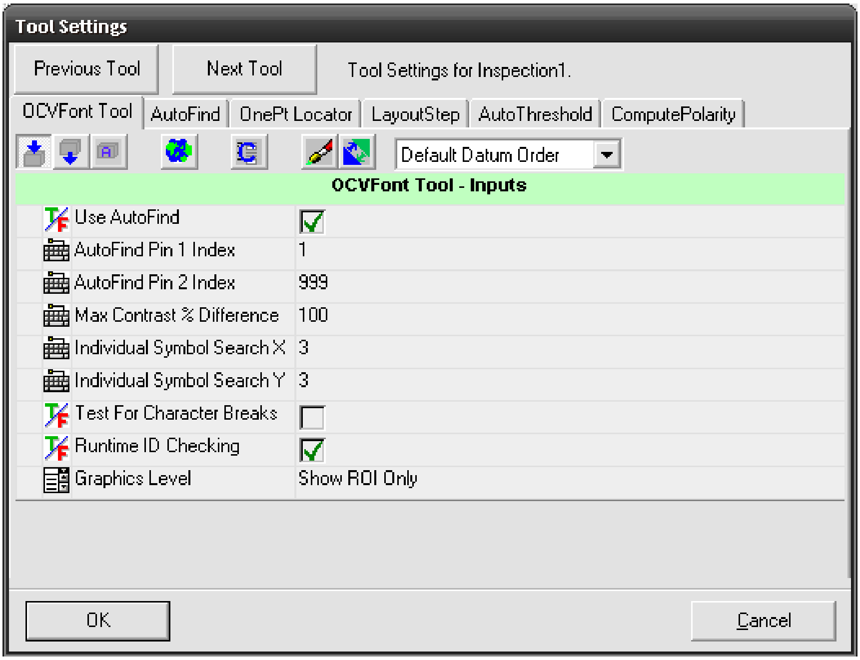


Tool Settings

Tool Settings displays the Tool Settings menu, as shown in Figure 6–78. The Tool Settings dialog box contains training and inspection parameters relative to the selected tool, and allows the Programmer to edit the individual tool settings. This is a Programmer level function.

The Programmer can select Next Tool and Previous Tool to go through all the tools in the product. When complete, close the Tool Settings dialog box. Refer to the Visionscape Tools Reference for complete information on the latest tool settings.

FIGURE 6–78. **Tool Settings Dialog Box**



Windows Explorer

Windows Explorer allows a Programmer to launch a Windows Explorer program for configuration management. Reviewing the read-only configuration files, or moving, copying or deleting files can now occur without leaving the
I-PAK interface. Every time this button is clicked, it launches another Windows Explorer session.

Note: Do not move the Jobs from the I-PAK\Jobs folder while I-PAK is running.

Close Advanced

Close Advanced quits the Advanced Settings Toolbar and returns you to the main I-PAK Setup Mode window. This is a Programmer level function.

Troubleshooting

Shutting Down I-PAK

The I-PAK program should be shut down before disconnecting, connecting or reconfiguring the cameras. If I-PAK is running when the cameras are disconnected and reconnected, setup mode may not properly display images, in which case, it will be necessary to shut down the I-PAK application and then restart it.

7

CHAPTER 7

Run Mode Reference

This chapter describes the Visionscape I-PAK Run Mode functionality.

Notice
It is critical that you use a UPS with your I-PAK to ensure your inspection counts are retained. Inspection counts are written to the system registry on the way out of Run Mode. In the event of power loss, a UPS ensures that your counts are written to the registry and that I-PAK and Windows shutdown gracefully.

Overview

When I-PAK starts up, by default, the Run Mode window is displayed, as shown in Figure 7–1. This is the main user interface for the I-PAK Operator, and allows viewing of the I-PAK inspection Job.

Note: You must let I-PAK fully download your Job and assert the Run Mode output before giving it triggers.

I-PAK runs the last Job downloaded to the Visionscape® framegrabber. All important I-PAK data is saved in the Windows registry. This data includes the last downloaded Job, last statistics and others, as needed.

Initial I-PAK Usage

When you run I-PAK for the first time, a sample Job (Sample.avp) is created and downloaded to the framegrabber. Sample.avp contains a default vision tool setup that includes an Inspection, a Snapshot using camera 1 with a Trigger, and a Fontless Tool. All tools are untrained. I-PAK waits for a system trigger to start inspecting, or allows you to go to Setup Mode.

Outputs

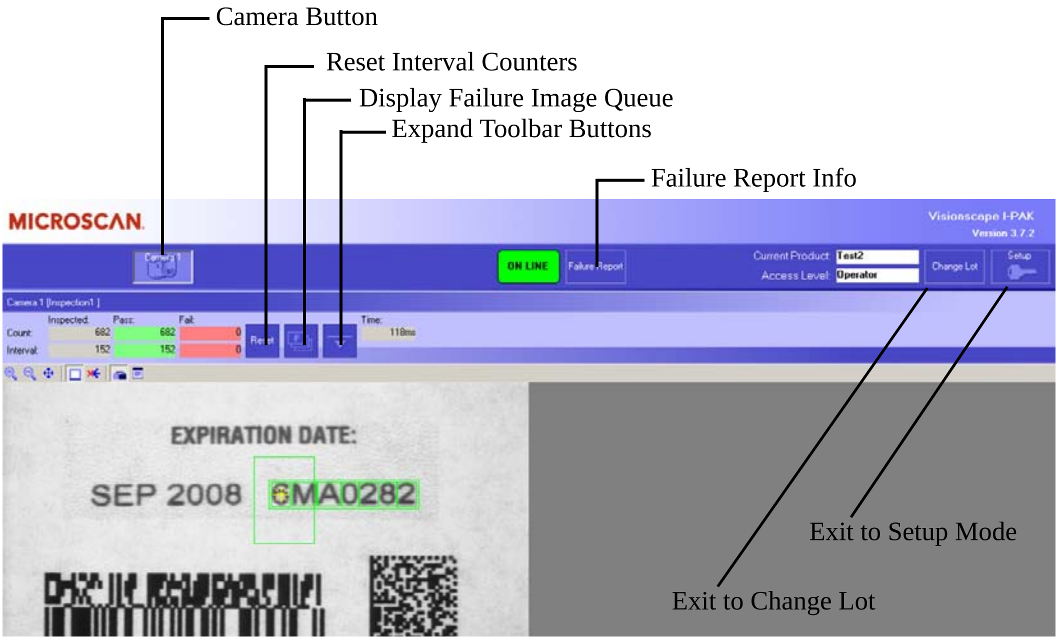
By default, Microscan defines the following outputs for I-PAK:

- Run/Setup Mode Output — During Run Mode, the Run Mode/Setup Mode Output is set TRUE. During Setup Mode, the Run Mode/Setup Mode Output is set FALSE. External monitoring of the I/O point indicates when I-PAK is ready to run.

Run Mode Window

Figure 7–1 shows the I-PAK Run Mode window.

FIGURE 7–1. **I-PAK Run Mode Window**

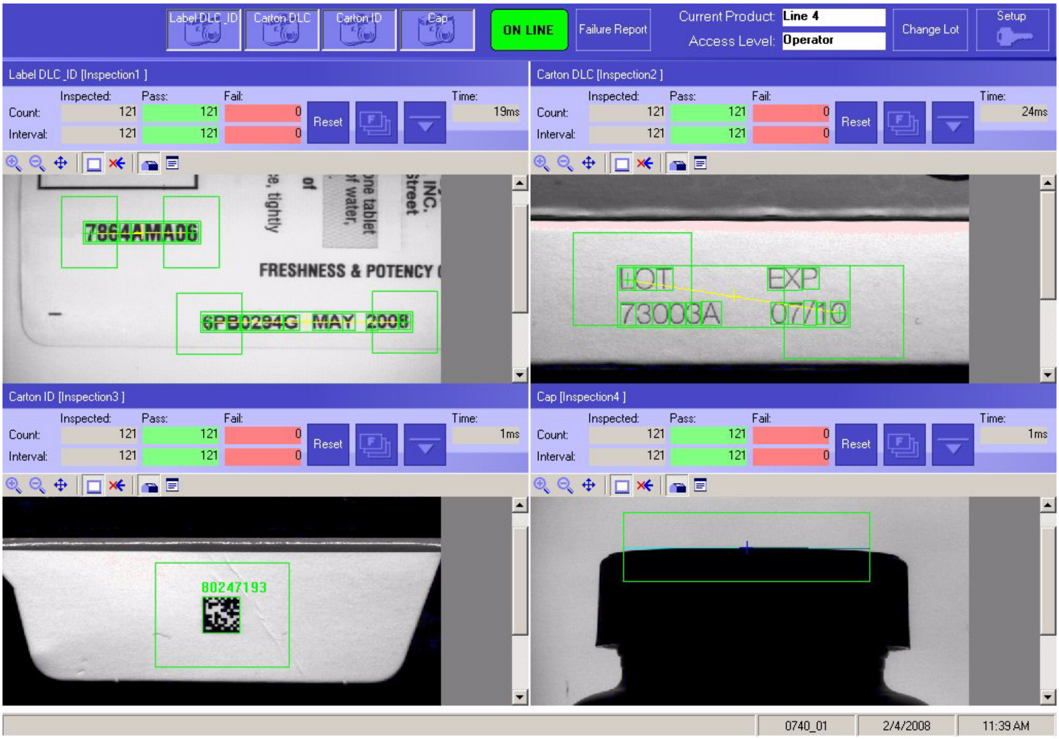


Run Mode Buttons

- Camera x — Displays information about the active camera(s). In a multi-camera Job, you can toggle the display of the active camera by clicking the Camera 1, Camera 2, Camera 3, and Camera 4 buttons. This displays a separate camera view, its toolbar, its statistics and its fail messages.

  Hotkey: ALT+<Number of camera>

FIGURE 7–2. **I-PAK Run Mode (4 Cameras)**



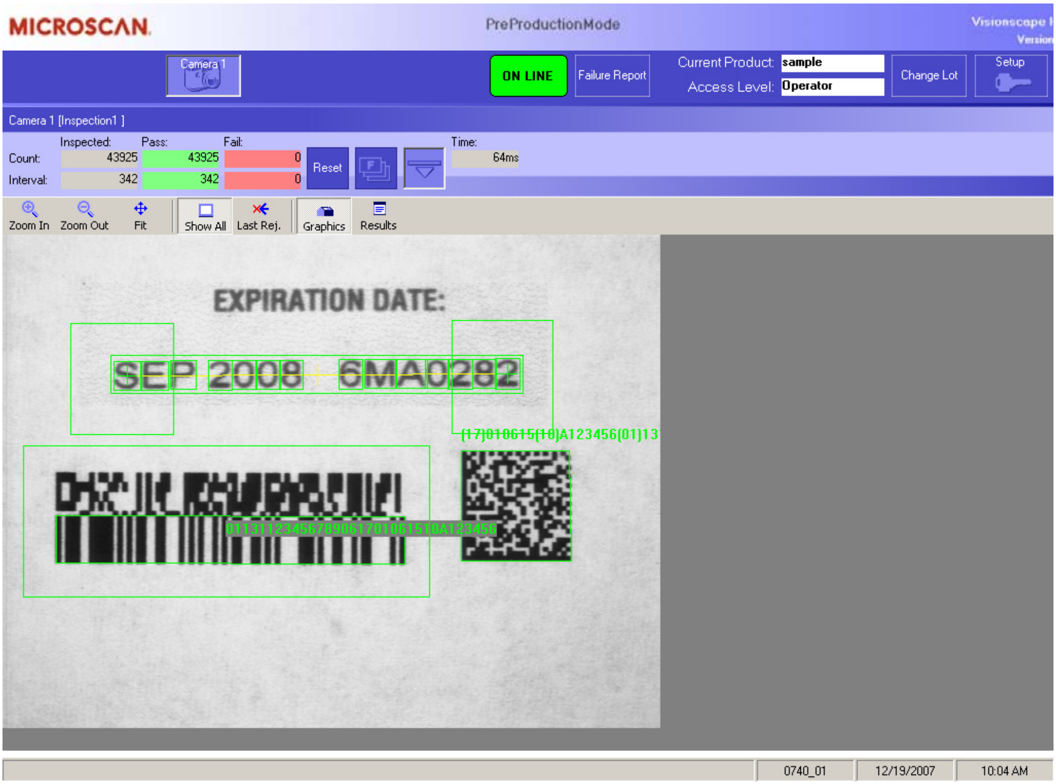
In a system configuration with less than four cameras, those camera buttons are disabled and unavailable for the Operator to view. For example, in a two-camera inspection, only the Camera 1 button and the Camera 2 button are displayed and available for enabling. The buttons for Camera 3 and Camera 4 are not displayed and, thus, rendered unavailable for viewing.

A Programmer can define the text for a button (Advanced Settings > Product Settings > Camera x Button Text). By default, the first camera button reads Camera 1. You might want to specify the text for the camera to best describe the view that is being displayed by that camera. For example, Date/Lot Code might be more meaningful in your application.

This is an Operator level function. Showing all views or no views will not impact the inspection process.

Camera views cannot be moved or resized. You can enable or disable the camera views in any combination. The Operator can relocate camera views.

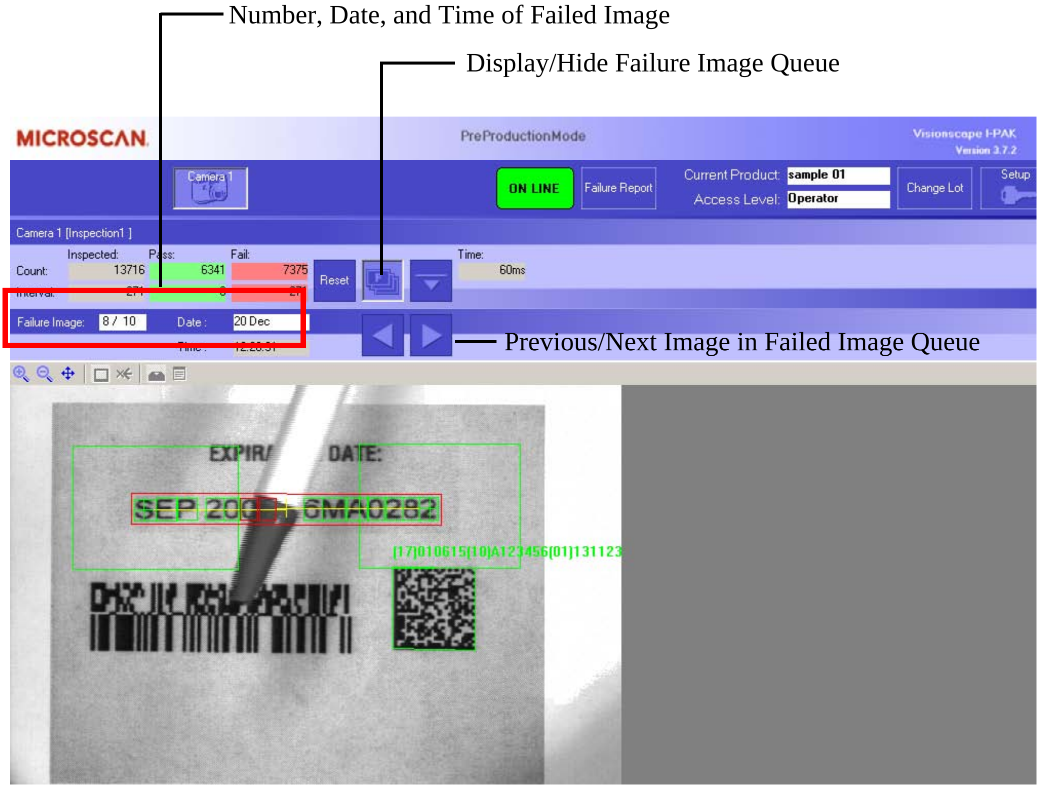
FIGURE 7–3. **Camera View**



- Reset Interval Counters — Click this button to reset the interval counters to zero.
- Display/Hide Failure Image Queue — Click this button to display the Failed Image Queue (Figure 7–4). You can display a queue of up to 20 failed images (default is 10) per camera. Set the number of images in the queue using Advanced Settings > System Settings > Training and Results > Number of Images in Queue. When the queue reaches the maximum number of images, and an additional failure occurs, the first image in the queue gets overwritten by the new failure image. Use the Previous and Next buttons to cycle through the

images in the Failure Image Queue. No images or details appear if there hasn't been a failure yet. Click Display/Hide Failure Image Queue to return to the regular I-PAK Camera display. Zoom In and Zoom Out bring the displayed failed image to the desired magnification level.

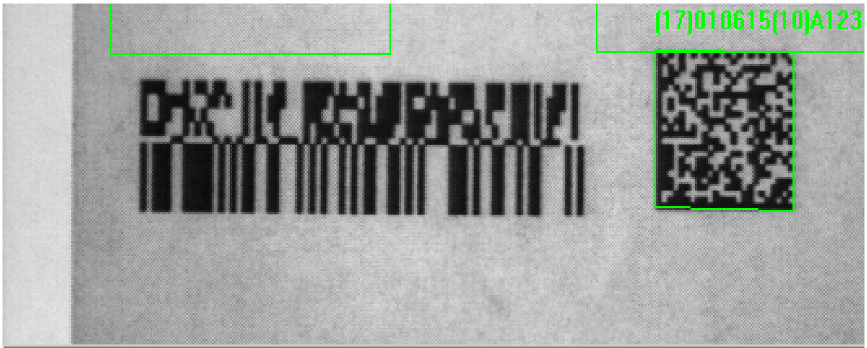
FIGURE 7–4. **Failure Image Queue Displayed**



- Expand Toolbar Buttons — Click this button to display describing text under the toolbar button icons.
- Failure Report — Click this button to display failure information, as shown in Figure 7–5. Advanced Settings > System Settings > General > Show All Menu Options (Advanced Users) must be selected.

  Hotkey: ALT+F

FIGURE 7–5. Failure Report Information



Inspection 1 Failure Type	Frequency
Snapshot1.BCRTool1 Fail Counter	584.000
Snapshot1.DMRTool1 Fail Counter	0.000
Snapshot1.AutoFind1 Fail Counter	0.000
Snapshot1.OCVTool1 Fail Counter	0.000

The Failure Report information box lists Inspection Failures and their occurrences. Failures are generated by Inspection and are displayed by Inspection. The tool's symbolic names are displayed under Failure Type, and the failure counts are displayed under Frequency. The Failure Report information box is displayed below the Camera windows. To close the Failure Report, click Failure Report again.

The FailureReport form will be cleared each time the user goes to Run Mode.

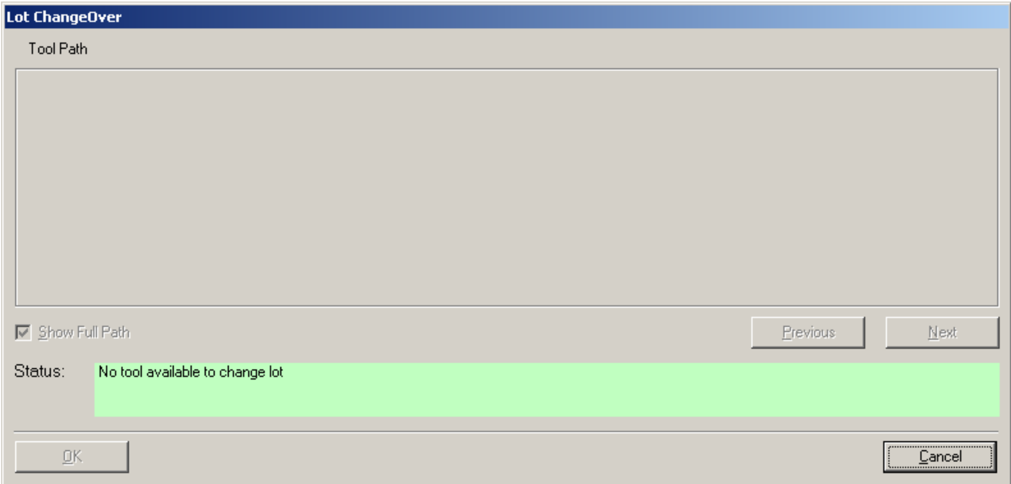
The Supervisor or Programmer can reset these failure types and counts using the Reset Failures button on the Setup Mode's Statistics and Data toolbar.

When Failures are reset, the Job will automatically be downloaded to the framegrabber, while placing the system in Run Mode.

- Exit to Change Lot — Click this button to display the Lot ChangeOver dialog box (you will be prompted to enter a password), as shown in Figure 7–6. Advanced Settings > System Settings > General > Enable Change Lot in Run Mode must be selected.

  Hotkey: ALT+C

FIGURE 7–6. **Lot ChangeOver Dialog Box**



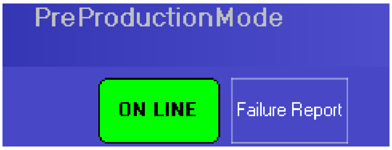
- Exit to Setup Mode — Click this button to exit Run Mode and enter Setup Mode. You will be prompted to enter a password. You need to enter the correct Programmer's or Supervisor's password to get into Setup Mode with that Access Level. This is a Programmer or Supervisor level function.

  Hotkey: ALT+S

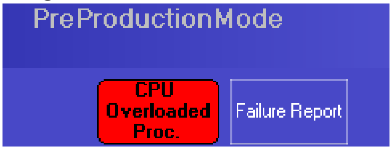
Run Mode Window in PreProduction Mode

There are four potential outputs of the UI when I-PAK is in PreProduction Mode:

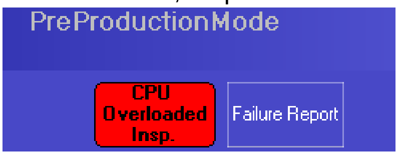
- NO CPU Overload



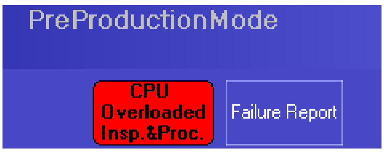
- CPU Overload, Process priorities are lowered and process may no longer be in Realtime



- CPU Overload, Inspection Thread Priorities have been lowered



- CPU Overload and both events have occurred



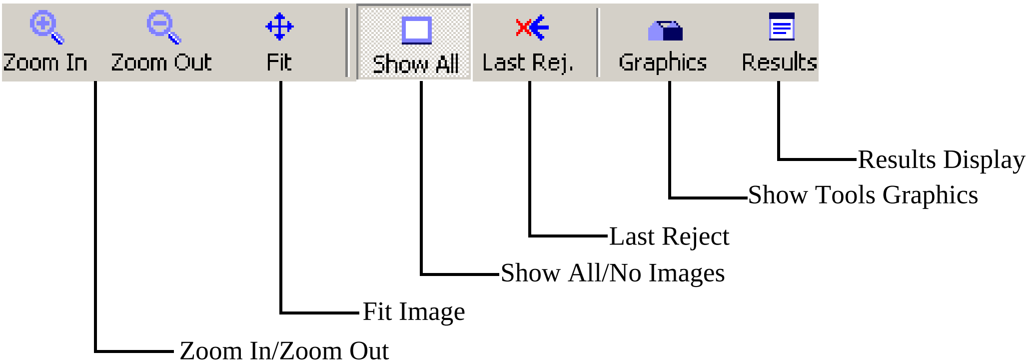
Note: No Trigger or Process Overruns are displayed while a CPU Overload is active.

Note: For detailed information regarding PreProduction Mode and Production Mode, see page 6–108.

For each of these overload states, Visionscape will adjust either process or inspection thread priorities in an attempt to prevent the PC UI from becoming non-responsive. The consequences of this overload state will be that your inspection timing and I/O timing may vary greatly. In other words, do not leave I-PAK running in an overload state.

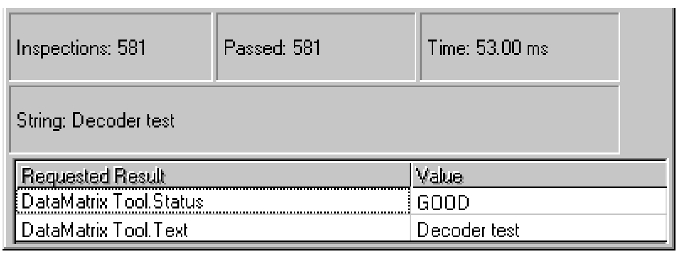
Description of Toolbar Buttons

FIGURE 7–7. **Toolbar Buttons**



- Zoom In/Out — Displays more or less detail for the inspected image. This is useful for examining why a part failed or to get closer to a ROI in the FOV.
- Fit— Re-size the image to fit into the available area.
- Show All — Displays all inspected images, including those that pass the inspection criteria and those that fail the inspection criteria.
- Last Rej. — Displays the last rejected image.
- Graphics — Displays tool graphics
- Results — Toggles the display of the Camera Results information box, as shown in Figure 7–8.

FIGURE 7–8. **Camera Results Information Box**



The Camera Results information box provides inspection result data from a Job. It displays the Requested Result and its Value per inspection. The Camera Results information box appears over the Runtime Window in an always on top mode. The Operator can relocate the Camera Results information box. The default is Off.

To close the Camera Results information box, click Results again.

Camera Results displays updated data from the actively running vision tools, including the following:

– Inspections — Total number of inspections being performed.

– Passed — Total number of passed inspections observed.

– Time — Total inspection time in milliseconds.

– String — The Font Tool's character string being inspected or the match string for the Data Matrix or Barcode Tool.

  Note: When inserting a Data Matrix Tool, Barcode Tool, Runtime Font Tool or the OCV Font Tool, I-PAK automatically selects the .text component of each tool in the Inspection step's Select Results to Upload field. This data shows in the String field and the Requested Result and Value fields. Only one .text field can be displayed in the String field.

– Requested Result — Reports on the items selected at Select Results to Upload in the Inspection properties page.

– Value — Inspection results associated with the Requested Result items described above.

Each camera view contains an image display area showing the camera's FOV. Zoom control and scroll bars are provided to allow you to access all areas of the image. The inspected images appear in the image area with tool graphics optionally overlaid.

Each of the Camera Views contains a toolbar that displays the current Runtime Inspection statistics for that camera. This read-only informational includes: Number of parts Inspected, Number of parts Passed, Number of parts Failed, and the inspection time of the last part inspected. The inspection time does not include image acquisition.

Under this main counter toolbar is another toolbar representing Interval Counters. These provide an inspection-based set of interval counters for: Total Inspected, Passed and Failed. There is also a Reset button on each Inspection window.

At the start of Run Mode, these interval counters are set to zero. Per inspection result, the interval counters are updated. When Reset is clicked, the interval counters are reset to zero.

The maximum value for any counter that can be displayed and retained in the registry is:

- Inspected: 10 characters – up to 2,147,483,648
- Pass: 10 characters – up to 2,147,483,648
- Fail: 10 characters – up to 2,147,483,648

Note: On the way out of Run Mode, counters are written to the PC registry to preserve their values. Therefore, it is imperative that customers use a UPS with an I-PAK system to avoid losing the counters if a power interruption should occur while I-PAK is in Run Mode.

Interval counters are not saved with the Job or to the registry.

Runtime Change Lot

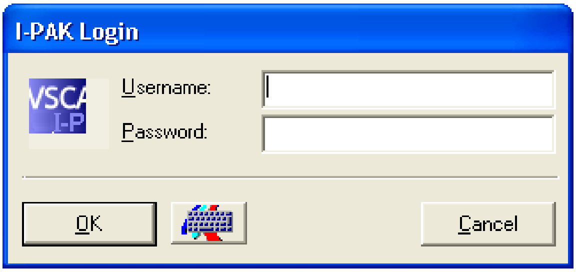
Change Lot functionality allows a Programmer or Supervisor to quickly change the Data Matrix Tool match string, the Barcode Tool match string, the OCRTrainableFont Tool match string, and the OCVFontTool layout string without re-training the tools in the Job.

When you click Change Lot, a prompt for a password is displayed. If a valid password is entered, the Change Lot dialog box is displayed.

Password — 21 CFR Part 11 Access

If 21 CFR Part 11 is active, the user is prompted for user name and password, as shown in Figure 7–9.

FIGURE 7–9. **Prompt for User Name and Password**



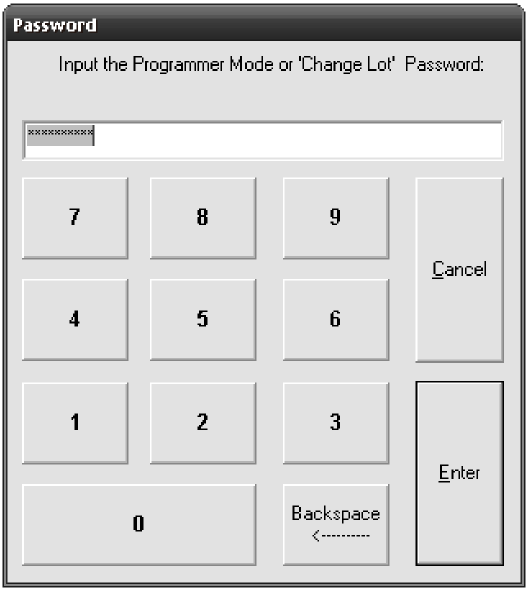
You must enter a valid user name with the correct password to access the Change Lot dialog box. If the Enable User Logins for Training Approvals system setting is enabled, the user name entered must have training authority. User names with “Operator” security level are allowed to perform Change Lot in Run Mode when Enable User Logins for Training Approvals (Systems Settings > General tab) is off. When Enable User Logins for Training Approvals is on, Operators cannot Change Lot in Run Mode.

I-PAK provides a unique default password (1101) that allows a user that does not have supervisor or programmer access to use the Change Lot function. This allows an operator to perform a Change Lot but does not allow the operator to enter Setup Mode.

Password — Standard Access

If 21 CFR Part 11 is not active, the user is prompted to enter either the current Supervisor password or the current Programmer password, as shown in Figure 7–10.

FIGURE 7–10. **Prompt to Enter Password**

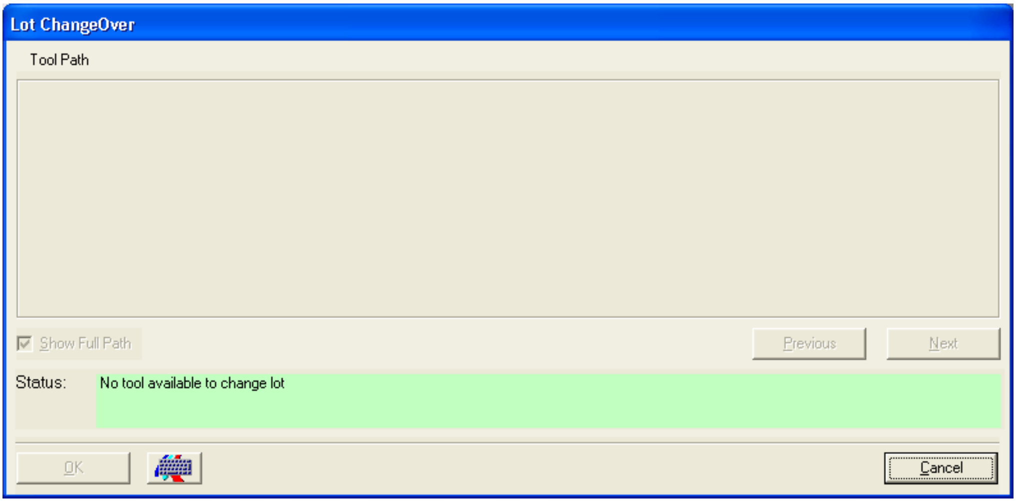


A valid password must be entered in order for the Change Lot dialog box to be accessed.

Change Lot Dialog Box

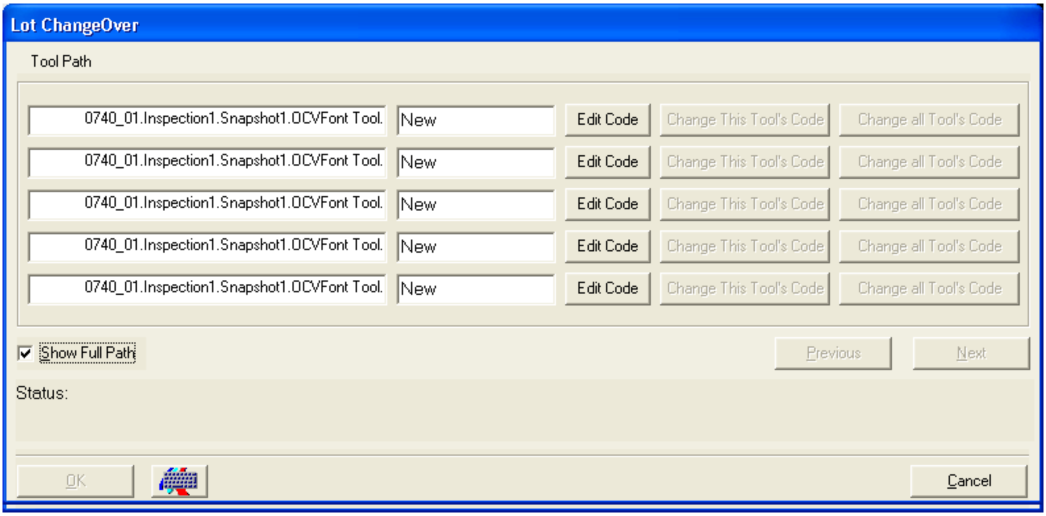
The Change Lot dialog box is the same as the Change Lot dialog box used in Setup Mode. If there are no Data Matrix Tools, Barcode Tools, OCVFontTools, or OCRTrainableFont Tools in the product definition, the Change Lot dialog box is displayed “empty”, with none of the tool or string fields filled in (Figure 7–11). Otherwise, the dialog box displays the tools names and the associated match or layout strings (Figure 7–12).

FIGURE 7–11. **Lot Changeover — Empty**



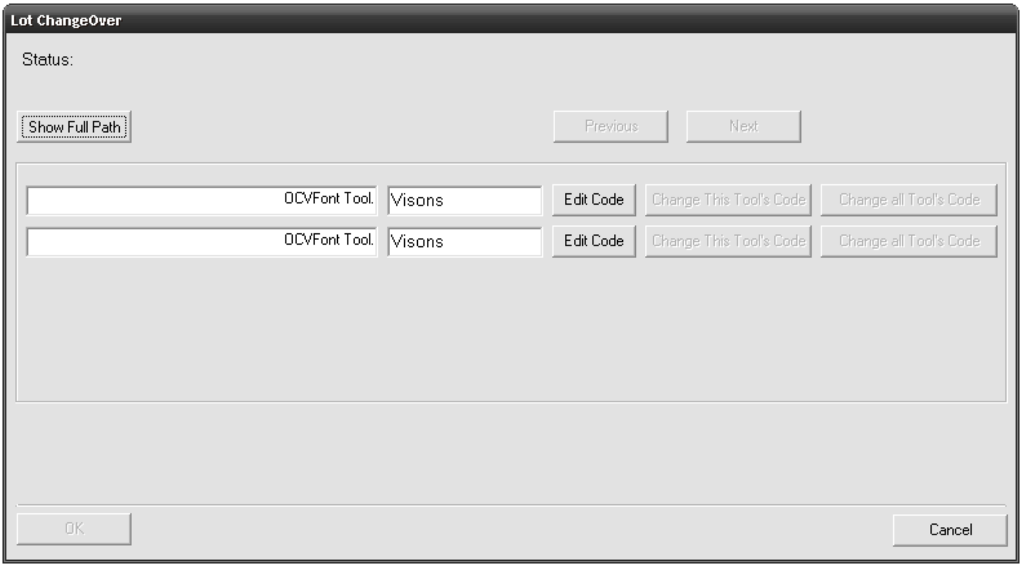
- When Show Full Path is checked, I-PAK displays the full path to the tools, as shown in Figure 7–12:

FIGURE 7–12. **Full Path to Tools Shown**



- If you do not push Show Full Path, I-PAK displays the simple tool name, as shown in Figure 7–13:

FIGURE 7–13. **Simple Tool Names Shown**



Use Previous and Next to display all the tools in the Job.

To change a Code, the user must click on Edit Code for the specific tool. This allows the contents of the match or layout string to be changed. This also enables the Change this Tool's Code and the Change all Tool's Code buttons.

To change one match or layout string at a time, the user edits the code and clicks Change this Tool's Code. This changes the match or layout string to the contents specified. For OCVFontTools, error checking is performed to verify that the same number of characters are in the new string, and to verify that all symbols in the new string are in the OCVFont. A status message is displayed, after trying to change the lot, to indicate status.

If a Job has multiple tools that have identical match or layout strings, the user is able to change them all at once by editing the code for any one and then clicking Change all Tool's Code. I-PAK goes through the Job and changes the match or layout string to the contents you just specified for all tools that had the same code.

Note: The Font Tool IGNORE character “@” and Matrix Tool IGNORE character “?” are allowed in this dialog box.

The Change Lot dialog box can supports up to 99 OCVFontTools, Data Matrix Tools, and Barcode Tools in any one Job.

Overruns

I-PAK monitors Run Mode for process and trigger overruns. If one occurs, the
I-PAK Overrun dialog box is displayed, as shown in Figure 7–14.

FIGURE 7–14. **I-PAK Overrun! Dialog Box**

Note: This should be considered an alarm condition and reported immediately to the Operator’s management. Efforts should be taken to prevent and correct overruns. When using Part 11, alarms must be acknowledged by providing your username and password.

When overruns occur and their dialog box is displayed but not acknowledged by the user, the user will be alerted to these when he or she tries to exit Run Mode and return to SetupMode. The password box will not be displayed until these overrun alarm messages have been acknowledged. Additionally, the timestamp of the overrun will be displayed in the message.

A process overrun occurs when images are not processed fast enough. The I-PAK system has a limited set of image buffers. When images are processed, image buffers are freed for re-use. If the buffers are not freed fast enough because image processing is taking too long, the acquisition process will run out of buffers.

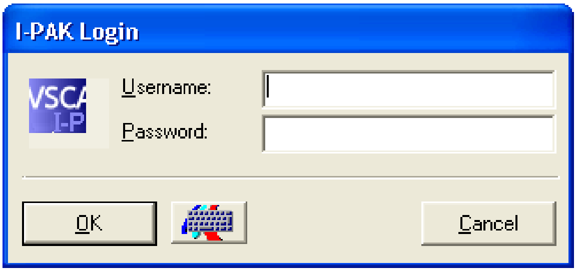
A trigger overrun occurs when triggers arrive too frequently for the acquire to process. In low resolution images, the maximum achievable rate is 60 triggers per second, or not faster than 16.667ms apart. In high resolution images, the maximum achievable rate is 30 triggers per second, or not faster than 33.334ms apart.

Exiting Run Mode

To exit Run Mode, click the Key button located in the upper right corner of the Run Mode window. This is the Return to Setup Mode button. Clicking this button begins the sequence of exiting Run Mode. All camera displays will automatically be closed. All open reports, failure reports, result displays, and extended results will automatically be closed. I-PAK saves the last runtime image for each camera. These images are used in subsequent training sequences. The inspection counters are saved to the registry.

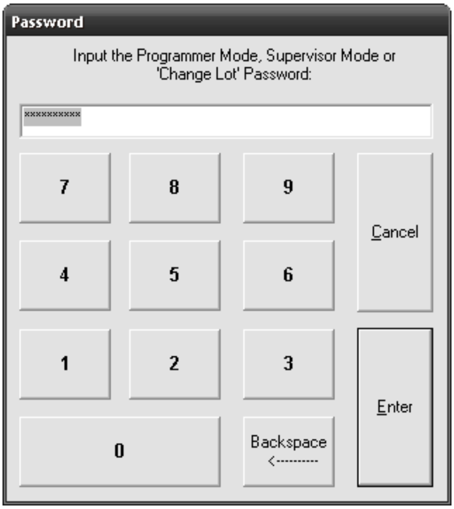
When running with 21 CFR Part 11, Enable User Name Access (Enable Part 11) on, a login dialog box is displayed, as shown in Figure 7–15. Enter your user name and password.

FIGURE 7–15. **I-PAK Login Dialog Box**



Otherwise, you are presented with a keypad to enter your Supervisor’s or Programmer’s password, as shown in Figure 7–16. In either scenario, once your password is successfully entered, your inspection stops running and you are transferred to Setup Mode.

FIGURE 7–16. **Password Dialog Box**



Default Passwords

The default Supervisor password is 1010. The default Programmer password is 0101.

Note: Microscan strongly advises that you change these default passwords in a production environment.

Forgotten Passwords

In the event that you forget your password, Microscan provides a mechanism to reset the password and get into the system **once**. At the password keypad, enter 228489, which spells Acuity on a telephone keypad. A random string then appears on the password keypad.

Note: Make a note of the random string. Then, call Microscan's customer service with the information displayed on the screen.

The Customer Service representative will be able to look up a one-time use password for you to enter.

If you are in Run Mode when you forget your password and contact Microscan, you can exit Run Mode into Setup Mode by using the password provided by Microscan Customer Service. Then, immediately go into the Change Password menu to reset your password.

If you are in Setup Mode when you forget your password, you must go into the Change Password menu after receiving the one-time password from Microscan's Customer Service to reset it.

If you fail to reset your password and you go back to Run Mode, you will either have to remember your original password or call Microscan Customer Service again for a new one-time password.

Forgotten Passwords — Using 21 CFR Part 11

In the event that you have forgotten your password, you'll need to contact your
I-PAK Administrator to suspend your existing user name and create a new user name and password.

End Batch

When running with the End Batch option On, I-PAK prompts you for a response to save the End Batch results. If you answer no, I-PAK just returns to Setup Mode and awaits further action from you. If you answer yes, I-PAK begins to automatically save the read-only statistics file to the hard drive and prompts you for a file name as you return to Setup Mode. Cancelling out of this End Batch saving statistics file option is allowed. Either way, you get an End Batch Successful message and the batch results are stored in the Statistics menus.

A

APPENDIX A

I-PAK Enclosure

Before you install your Visionscape I-PAK, be sure you have all of the necessary I-PAK components. This appendix helps you prepare for a successful installation.

I-PAK Hardware Components

The following lists itemize the contents of the system-level and module-level
I-PAK components:

- System-level I-PAK — To best serve the pharmaceutical market, the I-PAK SE2 product is packaged as a turnkey Windows XP Professional SP3 PC in an Industrial stainless steel enclosure.
  - I-PAK stainless steel enclosure.
  - PC with Windows XP Professional Service Pack 3 or later.
  - One Visionscape 0740 framegrabber board.
  - Standard Floorstand (optional)
  - Microscan’s Combination I/O board and Camera Distribution Cable.

    Notes: After installing the UPS, the installer should add the appropriate labels, in the appropriate language, to the side of the UPS. (Labels are supplied with the UPS.)

The I-PAK installer installs support for the UPS.

The UPS communicates with the PC via RS-232 to initiate a controlled shutdown of the I-PAK application and Windows operating system.

- RS-232 Port 1 available for user input of Match String Characters and output end of batch Runtime Statistics.
- I-PAK Executive Application and Visionscape operating system software on CD-ROM - CD R/W recommended.
- User Manual set including this Visionscape I-PAK User’s Manual and the Visionscape manuals are available on the USB drive.

The I-PAK Stainless Steel Enclosure was designed to meet the needs of the pharmaceutical market and to allow for convenient access to the system components.

- Module-level I-PAK — I-PAK is also available at a module level. Therefore, our customers can build their own enclosure and supply their own PC to build the I-PAK right into their machinery. These customers must configure the equipment as stated in System-level I-PAK.
  - One Visionscape 0740 framegrabber board.
  - Microscan’s Combination I/O board and Camera Distribution Cable
  - I-PAK Executive Application and Visionscape operating system software on CD-ROM - CD R/W recommended.
  - User Manual set including this I-PAK User Manual and the Visionscape manuals are available on the USB drive.

Notice
Microscan imperatively recommends the use of an Uninterruptable Power Supply (UPS) with USB Communication to PC in a I-PAK. In the event of power loss, a UPS will help Windows shut down gracefully and retain important registry information including vision counts and the last Job downloaded.

Note: After installing the UPS, the installer should add the appropriate labels, in the appropriate language, to the side of the UPS (labels are supplied with the UPS).

UPS-to-PC communication is via RS-232.

APPENDIX B

Hardware Installation

This appendix describes the installation of the module-level Visionscape I-PAK into a PC. Refer to the Visionscape FrontRunner User Manual for the minimum PC requirements or “I-PAK Hardware Components” on page A-1.

Basic Setup Procedures

1. Unpack the framegrabber board and Visionscape software.
2. Install the framegrabber board and its IO.
3. Install the Camera Power cable.
4. Mount the camera.
5. Connect all cables and power.
6. Install the Visionscape software, and then the I-PAK software. See Appendix C, “Software Installation,” for more information.
7. Test the system.

General Location Considerations

You can place I-PAK in most pharmaceutical packaging environments without any concern for special enclosures or cabinets. Consider the following when locating the components:

- Ensure that the camera, monitor, strobe, and any other cables are long enough to reach your PC.
- Avoid severe vibrations.
- Locate the components to avoid accidental bumping.
- Protect your PC and components against dust, humidity, extreme temperatures, and extremely harsh environments.

C

APPENDIX C

Software Installation

This appendix guides you through the installation of Visionscape I-PAK and its companion software to support UPS and the CD-ROM.

Installing Software

On system-level I-PAK's, the software is configured and installed from the factory. For module-level I-PAK's, install the Visionscape framegrabber board into your PC before installing the I-PAK software.

This section describes how to install the I-PAK software, its driver, and its support software. The installation is allowed on the Windows XP operating system. Visionscape Studio must be installed before you install I-PAK.

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

The I-PAK USB drive contains the following folders:

- Additional Camera Definition Files — Contains additional camera definition files. **These files have not been tested**.
- i-pak — Contains the Visionscape I-PAK software.
- setup — Contains the Visionscape software.
- vskit — Contains the VSKit software and manual.

Install Visionscape Software

1. To install Visionscape software, place the USB drive into a USB port on your computer.

   If the interface is not displayed automatically, double click setup.html (at the root of the USB drive).

   Note: Visionscape can also be downloaded from the Microscan website.

2. Click Install Visionscape Software. The InstallShield Wizard starts, and displays the following screens:

   – Several messages about Run or Save; click Run.

   – Welcome screen; click Next.

   – License Agreement screen; Select the “I accept...” radio button, and then click Next.

   – Select Destination screen; we suggest you accept the default location (C:\Vscape) and click Next.

   – Start Copying Files screen; click Next.

   – The installer displays the ReadMe.wri file, which you can read as the installer finishes.

   The install process takes a couple of minutes. It may appear that nothing is happening, but that is not the case. Don’t try to do anything until you are prompted to reboot your PC.

   All required components are automatically installed to your hard disk. The default location is:

   C:\Vscape

   Camera definition files are stored under:

   \Vscape\Drivers\Camdefs

3. When the InstallShield Wizard prompts you to reboot your PC, select the Yes, I want to restart my computer now radio button, and then click Finish.

4. Wait for your PC to reboot.
5. Go to the next section to install the I-PAK software.

Install Visionscape I-PAK Software

1. After your PC reboots, double click setup.html (at the root of the USB drive).

   The Visionscape Install screen in is displayed

2. Click Install Visionscape I-PAK Software. The InstallShield Wizard starts, and displays the following screens:
   – Several messages about Run or Save; click Run.
   – Welcome screen; click Next.
   – License Agreement screen; Select the “I accept...” radio button, and then click Next.
   – Select Destination screen; we suggest you accept the default location (Visionscape I-PAK) and click Next.
   – Start Copying Files screen; click Next.
   – The InstallShield Wizard Complete screen; click Finish.
3. Close the web browser

The I-PAK software is installed and ready for you to use.

Software Upgrades — 21 CFR Part 11 Usage

The Part 11 user names, their encrypted passwords, and the original time/datestamp when a user was created or last changed his or her password are stored in a data file called ipak.usr.

When you upgrade the I-PAK software, you must manually move the ipak.usr data file to the current version of I-PAK. These paths can be determined quickly by looking at the Compatibility section of the I-PAK ReadMe file or product information.

Uninstalling I-PAK Software

1. Open the Control Panel and run Add/Remove Programs.
2. Select I-PAK and click Add/Remove to remove the component.
3. Finally, restart the PC.

Starting the I-PAK Program

When you successfully install the Visionscape and I-PAK software, the installer automatically puts an Visionscape I-PAK shortcut into your Start > Visionscape sequence so that I-PAK automatically begins as soon as you have logged on.

As part of the I-PAK startup sequence, a splash screen is displayed and reports the startup sequence, as shown in Figure C–1.

FIGURE C–1. **I-PAK Splash Screen**

After starting the interface, the framegrabber board in the PC is rebooted automatically. Once this is complete, the last run Job is downloaded and transfers control to Run Mode awaiting a trigger (if one is configured).

UPS and UPS Software

Microscan mandates the use of an uninterruptable power supply (UPS), model Smart-UPS SC 420, with the I-PAK system. The UPS provides a safety factor so that your vision inspection system is protected from power outages and brown-outs.

The UPS ensures that I-PAK stays running by providing battery-backup for a user-specified time, then gracefully shutting down the I-PAK program, saving all batch data (Job name, counters, etc.) and, finally, performing a PC shutdown before removing power to the PC.

Note: You may lose inspection counts if you do not use a UPS!

When power is restored, the PC restarts and the I-PAK program starts up, rebooting the framegrabber board, downloading the last run Job, restoring all previous counters and awaiting a trigger (if configured) to continue inspection.

Microscan supplies one of two Uninterruptable Power Supplies depending on the voltage required at the customer site. Depending on availability, actual model numbers may change while functionality remains intact.

- 120 Volt version: APC BP420SUS;
  Microscan Part Number: A1-20918-1
- 240 Volt Version: APC SC420i;
  Microscan Part Number: A1-20919-1

Both of these UPSs are external. They are not inside the I-PAK enclosure due to their form factor.

Note: After installing the UPS, the installer should add the appropriate labels, in the appropriate language, to the side of the UPS.

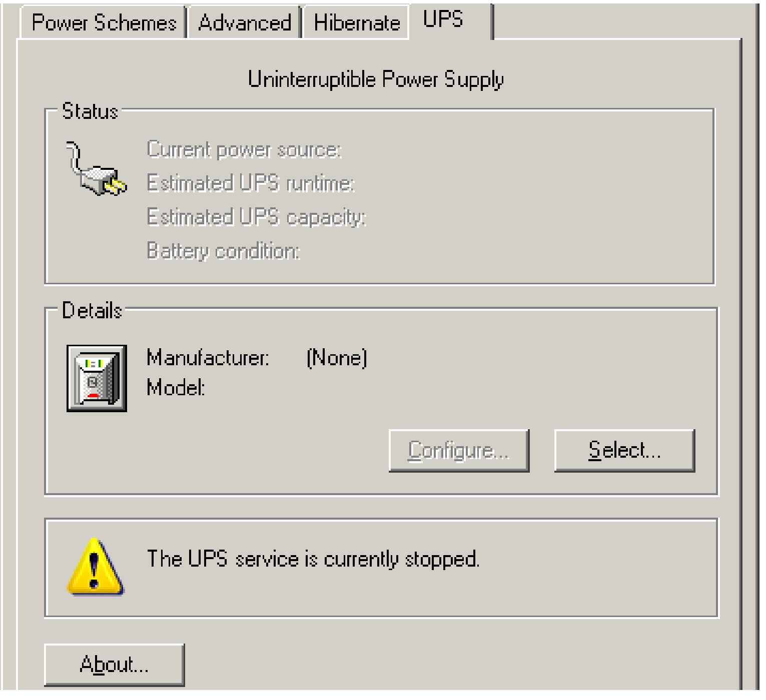
Configuring the UPS Software

I-PAK uses the Windows integrated UPS support. Therefore it's necessary to setup some parameters, e.g. the UPS type, using the Windows Control Panel.

1. Select Start > Settings > Control Panel to open the Windows Control Panel.
2. Double click Power Options.
3. Click on the UPS tab.

   The Uninterruptible Power Supply dialog box is displayed, as shown in Figure C–2.

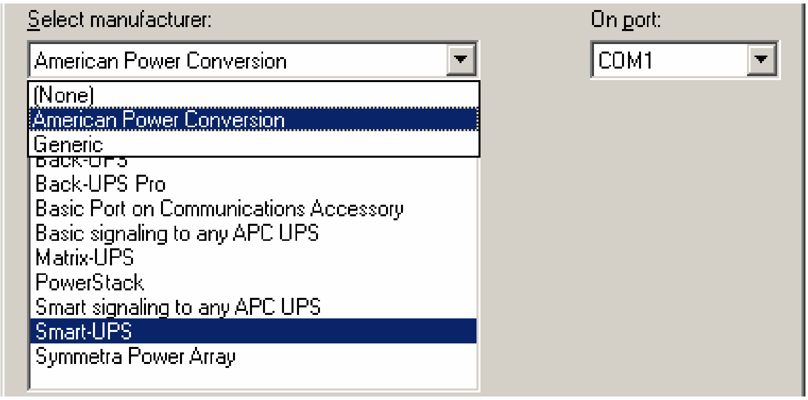
FIGURE C–2. **Power Options Properties — UPS Tab**



4. Click Select....

   The following dialog box is displayed.

FIGURE C–3. Select Manufacturer, Model, and COM Port



5. In the Select manufacturer drop down menu, select American Power Conversion.

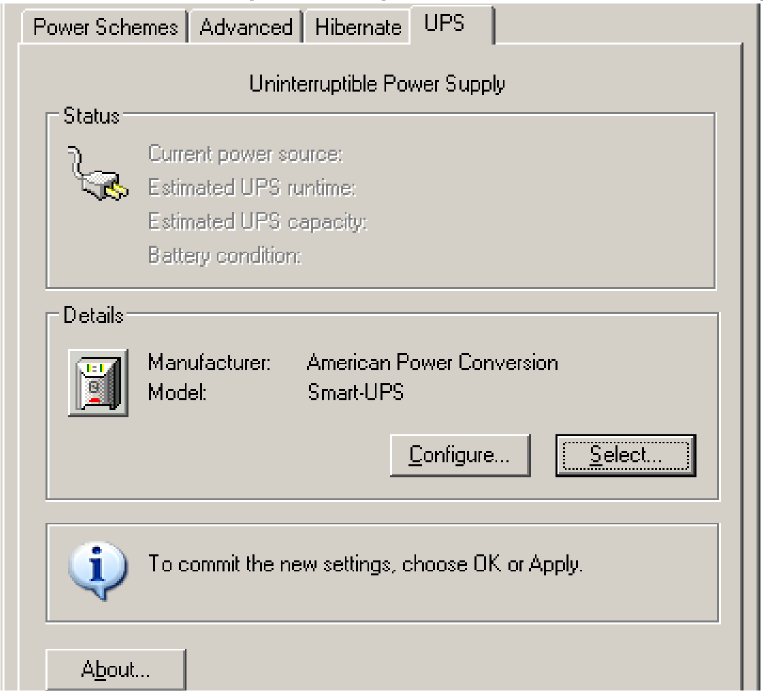
6. In the Select model list, highlight (to select) Smart-UPS.

7. In the On port drop down menu, select the COM port you have chosen to connect the UPS system to your PC.

8. Click Finish to store the selected values.

   The following dialog box is displayed.

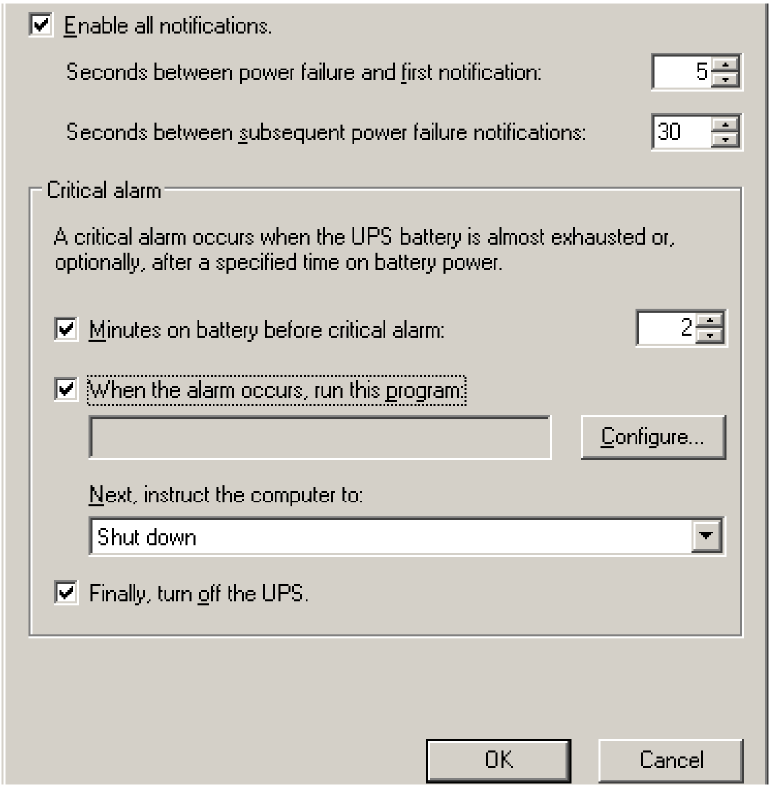
FIGURE C–4. **Power Options Properties — UPS Tab with Configure Enabled**



9. Click Configure.

   The following dialog box is displayed.

FIGURE C–5. UPS Configuration Dialog Box



10. Adjust the values so that they are the same as those shown in Figure C–5.

11. Close the Power Option Properties dialog box.

CD-RW Support

I-PAK supports a CD-RW for the archival and restoration of its product definition files.

To add a CD-RW, install the CD-RW in place of the CD in the I-PAK PC. Installing the CD-RW hardware is not included in this description.

Windows XP

For Windows XP, you can use the integrated burn functionality.

Note: If you use the integrated burn functionality, it is only possible to copy files to a subfolder of the CD drive, and not to the root of the CD drive.

D

APPENDIX D

Demo Mode

Demo Mode allows you to display quickly the capabilities of I-PAK. Demo Mode is password protected. It allows I-PAK to run a saved Job, using saved images, for a pre-set amount of time and then switch to the next desired Job and run it. Demo Mode runs automatically until you manually enter Setup Mode.

Note: You need a Visionscape hardware key to run in Demo Mode.

Note: Disable Failed Image Queue while Demo Mode is active (see Enable Failed Image Queue on page 6–97).

Note: Before starting I-PAK, copy the sample products and the associated images
from C:\Vscape\I-Pak\Demo to C:\Vscape\I-Pak\Jobs.

If you installed I-PAK onto a drive other than drive C:, adjust the image paths of the jobs.

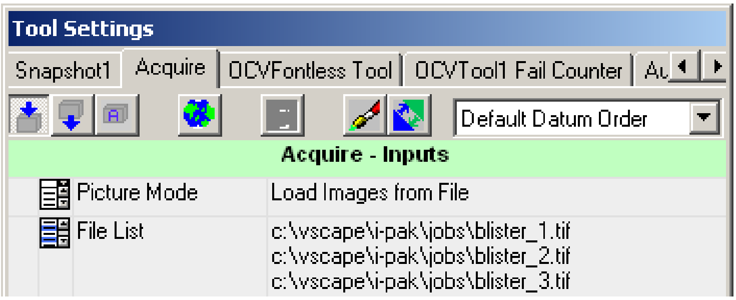
Demo Mode Jobs

Before entering Demo Mode, you can create several products that show the functionality that you want to demonstrate. These products should be configured so that they Load Images from File instead of acquiring the images from a camera. This can be modified when the selected product is trained.

Note: When using Demo Mode, set Image Upload Rate to MAXIMUM.

When the current step is the Snapshot, click Tool Settings and then click the Acquire tab. The dialog box shown in Figure D–1 is displayed, which shows how one of the demo Jobs has been configured.

FIGURE D–1. **Load Images From File**



You can also see that the desired image files have been added to the File List. The products and associated images must be stored in the \Vscape\I-Pak\Jobs directory.

Once the product has been trained using the saved images, it is a good idea to run the Job to make sure that everything has been configured properly and operates as expected. Once all of your products have been tested, Demo Mode can be configured to run the desired products.

Enabling Demo Mode

To access Demo Mode, exit Run Mode using the password 78743366.

Note: 21 CFR Part 11 cannot be used with Demo Mode.

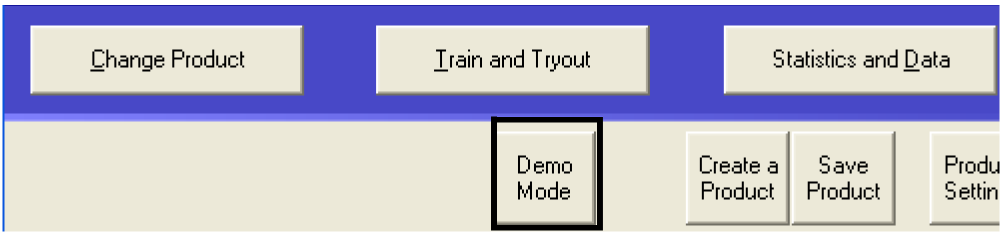
After this password is entered, you enter Setup Mode with the Programmer access level.

To enable Demo Mode:

1. Click Advanced Settings on the I-PAK Setup Menu.

   You will see an additional button called Demo Mode, as shown in Figure D–2.

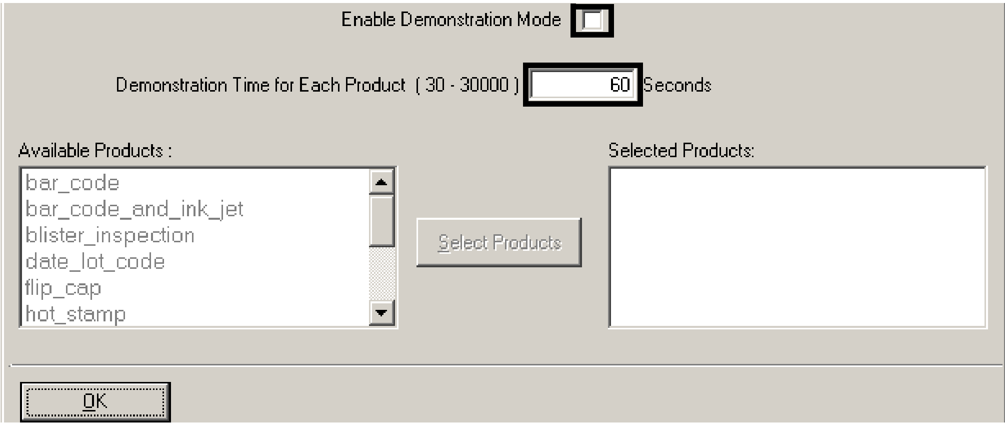
FIGURE D–2. Advanced Menu With Demo Mode Button Enabled



2. Click Demo Mode.

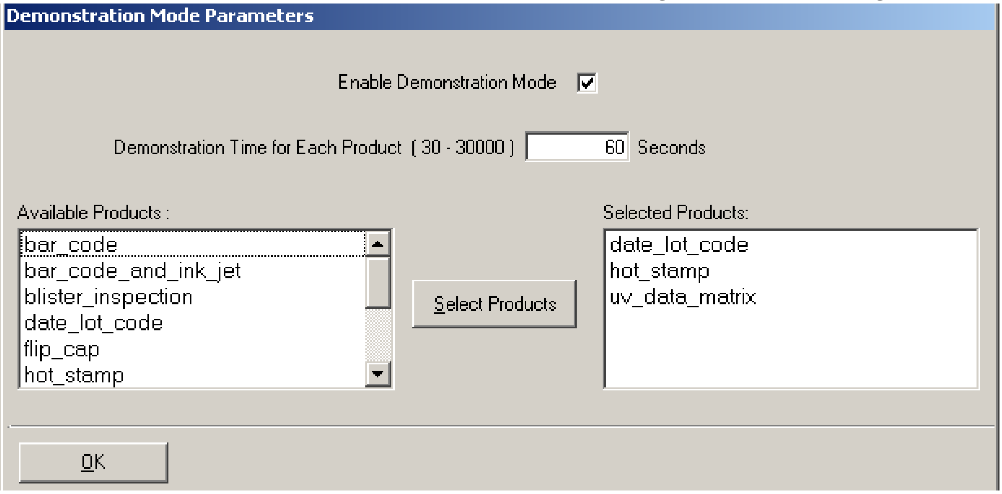
   The Demonstration Mode Parameters dialog box is displayed, as shown in Figure D–3.

FIGURE D–3. **Demo Mode Parameters Dialog Box**



3. Click the Enable Demonstration Mode checkbox.
4. To the right of Demonstration Time for Each Product, specify the amount of time you want each product to run in Demo Mode. The default time is 60 seconds.
5. In the left pane (Available Products), highlight at least two products that you want to run (you can highlight as many as 20 products). Click Select Products, and then click OK.

FIGURE D–4. **Demo Mode Parameters Dialog Box — Selecting Products**



I-PAK checks the number of products selected and makes sure that you did not select too many (more than 20) or too few (less than 2) products. If the Enable Demonstration Mode checkbox is not checked, Demo Mode is disabled.

If Demo Mode is enabled when you return to the main Setup screen, the title bar for I-PAK will also state “Demonstration Mode”. When Run Mode is clicked and “Demonstration Mode” is displayed in the title bar, I-PAK enters Demo Mode. I-PAK loads the first product in the selected product list and runs it for the time set in the Demonstration Mode Parameters dialog box. Once this time limit has been reached, I-PAK automatically stops the product, enters Setup Mode, changes to the next product in the list and returns to Run Mode. This cycle continues indefinitely until you manually exit Run Mode.

Disabling Demo Mode

Each of these methods will disable Demo Mode:

- The first method is to change to a different user mode (User, Supervisor, or Programmer). If any password other than 78743366 is entered, Demo Mode is disabled and the button removed from the Advanced Settings menu.

- The second method can be used if you are in Demo Mode and I-PAK is currently in Setup Mode. In this scenario, you can enter the Advanced Settings menu, click Demo Mode (which displays the Demo Mode Parameters dialog box), and uncheck the Enable Demonstration Mode checkbox. This prevents Demo Mode from being activated when Run Mode is clicked. This option will not remove the Demo Mode button from the Advanced Settings menu. The Demo Mode button is only removed when you change to a different user mode.
- The third method is to close and restart I-PAK.

E

APPENDIX E

Perl Gems: Tips and Techniques

Custom Steps and CustomVision Tools allow new steps and tools to be used in Visionscape using Perl, an interpreted script language. These steps are now available in Visionscape I-PAK, with a limited set of I-PAK supported Perl language Package Scripts. Only the steps illustrated are supported.

Note: I-PAK supports the Package Scripts as they are distributed with the I-PAK software. Changing these script files or creating new script files renders them unsupported and non-validated by I-PAK.

I-PAK Custom Step and CustomVision Tool

I-PAK software allows a Custom Step or CustomVision Tool to be inserted anywhere in a Product Definition. The CustomVision Tool has a built in Input Datum for accessing a buffer (Input Buffer) on which to perform a vision operation. The Custom Step does not support an Input Buffer and can only be used for non-vision operations.

Properties Pages

Each Perl Package Script has a unique Properties Page. You can change the values of the input datums required by the script. Every script results in a minimum set of common properties. These properties are the only properties of the “none” script.

Custom Step

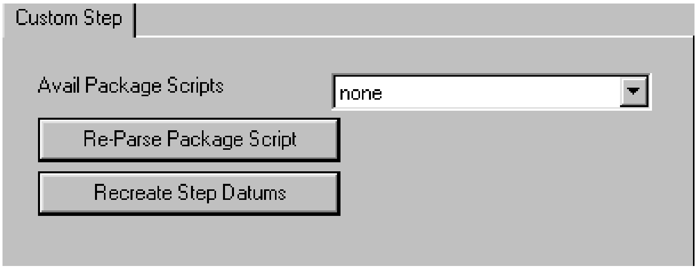
The Custom Step consists of optional input datums, optional output datums and a script file written in the Perl programming language. The Perl Package Script determines the number and type of inputs and outputs. The Perl Package Script controls the functionality of the Custom Step. Custom Steps cannot perform vision operations because they do not allow for a buffer to be input to the Perl Package Script. The Custom Step supports the following scripts:

- “none” on page E-2
- “FailCode” on page E-3

none

The “none” script is the default Perl Package Script used by a Custom Step when inserted into a Job. This script has no functionality.

FIGURE E–1. The “none” Script



- Avail Package Scripts — This property allows selection of a Perl Package Script for the step to use. You can select:
  - none
  - “FailCode” on page E-3
- Re-Parse Package Script — When clicked, this button causes the package script to be parsed. Whenever any changes to the script files are made, this button needs to be clicked to make these changes take effect.

Note: I-PAK supports the Package Scripts as they are distributed with the
I-PAK software. Changing these script files or creating new script files renders them unsupported and non-validated by I-PAK.

- Recreate Step Datums — When clicked, this button causes the input and output datum lists in the step to be re-created. You only need to click this button when a datum is added, removed or changed in the script. If the script is changed, but no input or output datums are changed, then this button does not need to be clicked. Clicking this button also causes all input datums to be set to their default values and to lose their connections to other step results or parameters.

  Datums created by the package script are added to the user interface. Input datums are shown as a box with a drop-down list button. The input datums can be linked to other similar type datums in the Job. Clicking the drop-down list button causes the Job tree to be displayed, allowing you to select the datum to link to the input datum. Resource datums are shown as user-editable boxes that can be set to a value directly. Output datums are not shown in the user interface for this step, but can be seen in the Job tree that comes up when linking an input datum.

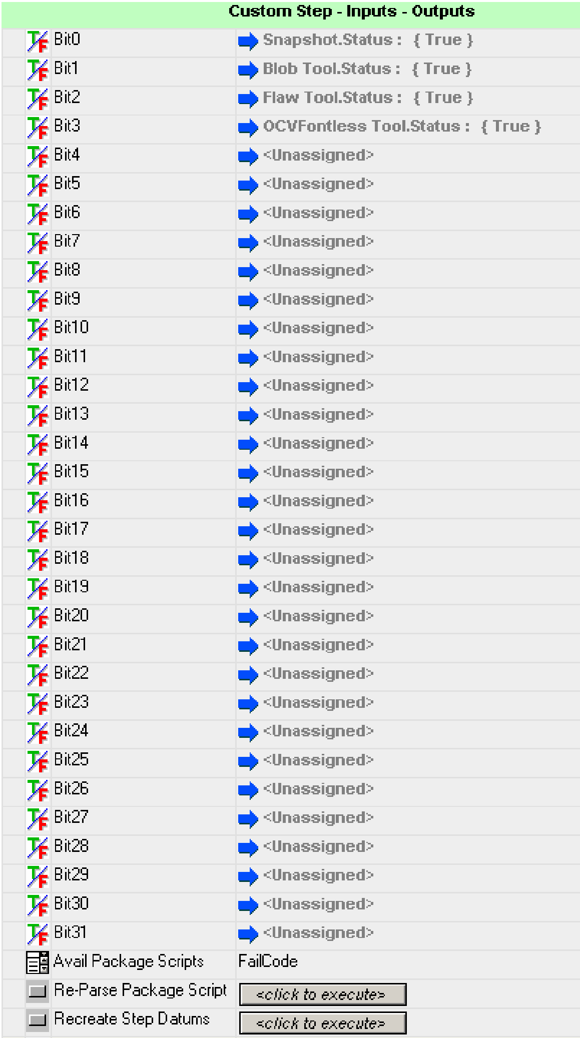
Note: I-PAK supports the Package Scripts as they are distributed with the
I-PAK software. Changing these script files or creating new script files renders them unsupported and non-validated by I-PAK.

FailCode

The FailCode script allows you to encode the failed statuses of various Steps in your Job into a single 32 bit integer value. Typically, this is used when the user wants to cut down on the amount of data that is uploaded from the inspection, but also wants to know the status of a large number of Steps.

When added to your Job, the FailCode script will present you with a list of 32 inputs on the properties page, as shown in Figure E–2:

FIGURE E–2. **FailCode Script**



Custom Step - Inputs - Outputs	
Bit0	Snapshot.Status : { True }
Bit1	Blob Tool.Status : { True }
Bit2	Flaw Tool.Status : { True }
Bit3	OCVFontless Tool.Status : { True }
Bit4	<Unassigned>
Bit5	<Unassigned>
Bit6	<Unassigned>
Bit7	<Unassigned>
Bit8	<Unassigned>
Bit9	<Unassigned>
Bit10	<Unassigned>
Bit11	<Unassigned>
Bit12	<Unassigned>
Bit13	<Unassigned>
Bit14	<Unassigned>
Bit15	<Unassigned>
Bit16	<Unassigned>
Bit17	<Unassigned>
Bit18	<Unassigned>
Bit19	<Unassigned>
Bit20	<Unassigned>
Bit21	<Unassigned>
Bit22	<Unassigned>
Bit23	<Unassigned>
Bit24	<Unassigned>
Bit25	<Unassigned>
Bit26	<Unassigned>
Bit27	<Unassigned>
Bit28	<Unassigned>
Bit29	<Unassigned>
Bit30	<Unassigned>
Bit31	<Unassigned>
Avail Package Scripts	FailCode
Re-Parse Package Script	<click to execute>
Recreate Step Datums	<click to execute>

Each of these inputs can be connected to any Status datum in your job. Typically, you would connect the Statuses of all of the Steps whose pass/fail state you care about. In the example here, we have connected the statuses of the Snapshot step to Bit 0, a Blob Step to Bit 1, a Flaw Tool to Bit 2 and an OCV Fontless Tool to Bit 3. If all of these Steps should pass, the FailCode script will produce an output value of 0. If any of these Steps should fail, the corresponding Bit in the output integer value will be set to a 1. So, for example, if the Blob tool and the OCV Fontless tool should fail, this would mean that bits 1 and 3 would be set to 1, producing an output value of 10. Any Bits that are left “Unassigned” are ignored and will not effect the output value.

Settings

- Bit0 - Bit31 — Each of these input datums can be connected to any Status Datum in the Job. If the Status is False, then the corresponding bit of the output word is set to 1.

Results

- Output Value — This integer value holds the failure code. The bits of this word correspond to the 32 input datum values.

Custom Vision Tool

The CustomVision Tool consists of an input image (required), optional input datums, optional output datums and a script file written in the Perl programming language. The Perl Package Script determines the number and type of inputs and outputs. The Perl Package Script controls the functionality of the CustomVision Tool. CustomVision Tools can perform vision operations because they require a buffer to be input to the Perl Package Script.

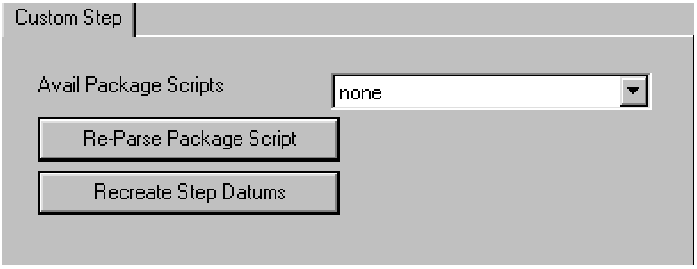
The Custom Vision Tool supports the following scripts:

- “none” on page E-6
- “Cylinder_UnWarp” on page E-7
- “Dynamic_Binarize” on page E-11
- “FailCode” on page E-14
- “FindRotated” on page E-14

none

The “none” script is the default Perl Package Script used by a CustomVision Tool when inserted into a Job. This script has no functionality.

FIGURE E–3. **The “none” Script**



- Avail Package Scripts — This property allows selection of a Perl Package Script for the step to use. You can select:
  - none
  - “Cylinder_UnWarp” on page E-7
  - “Dynamic_Binarize” on page E-11
  - “FailCode” on page E-14
  - “FindRotated” on page E-14
- Re-Parse Package Script — When clicked, this button causes the package script to be parsed. Whenever any changes to the script files are made, this button needs to be clicked to make these changes take effect.

Note: I-PAK supports the Package Scripts as they are distributed with the
I-PAK software. Changing these script files or creating new script files renders them unsupported and non-validated by I-PAK.

- Recreate Step Datums — When clicked, this button causes the input and output datum lists in the step to be re-created. You only need to click this button when a datum is added, removed or changed in the script. If the script is changed, but no input or output datums are changed, then this button does not need to be clicked. Clicking this button also causes all input datums to be set to their default values and to lose their connections to other step results or parameters.

Datums created by the package script are added to the user interface. Input datums are shown as a box with a drop-down list button. The input datums can be linked to other similar type datums in the Job. Clicking the drop-down list button causes the Job tree to be displayed, allowing you to select the datum to link to the input datum. Resource datums are shown as user-editable boxes that can be set to a value directly. Output datums are not shown in the user interface for this step, but can be seen in the Job tree that comes up when linking an input datum.

Note: I-PAK supports the Package Scripts as they are distributed with the
I-PAK software. Changing these script files or creating new script files renders them unsupported and non-validated by I-PAK.

Cylinder_UnWarp

This step is an image-in, image-out operation, and unwraps an image on a cylindrical surface, reducing the distortion caused by the surface.

Theory of Operation

Given a description of the geometry of a cylinder, the CylinderUnwrap step will warp the image on the cylinder in such a way as to unwrap the image onto a flat surface. This reduces the distortion caused by the cylindrical surface.

The geometry of the cylinder is specified using the:

- Radius of the cylinder
- Distance the cylinder is from the camera
- Vertical axis of the cylinder
- Point within the ROI where the image is correct (not distorted)

Cylinder Unwrap ROI

The Cylinder Unwrap ROI is a rotatable rectangle. Typically, the rectangle is rotated to match the angle of the cylinder axis.

Using the Cylinder Unwrap Warp

Typically, other tools and steps are placed in its output image where the image pixels have been unwrapped into a rectangle. This is useful for studying features or text on a cylinder that will be distorted closer to the edges of the cylinder.

The ROI that defines the pixels to warp can be adjusted by moving, sizing and rotating the search area shape associated with a CylinderUnwrap Warp.

Figure E–4 and Figure E–5 show an input image and the corresponding output image for a Cylinder Unwrap Warp. The cylinder axis input is set to the output of a BisectLines Meas step, which is the line which bisects the left and right edges of the cylinder.

FIGURE E–4. Input Image to Cylinder Unwrap Operation Example

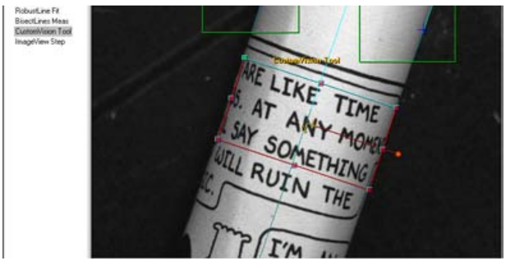
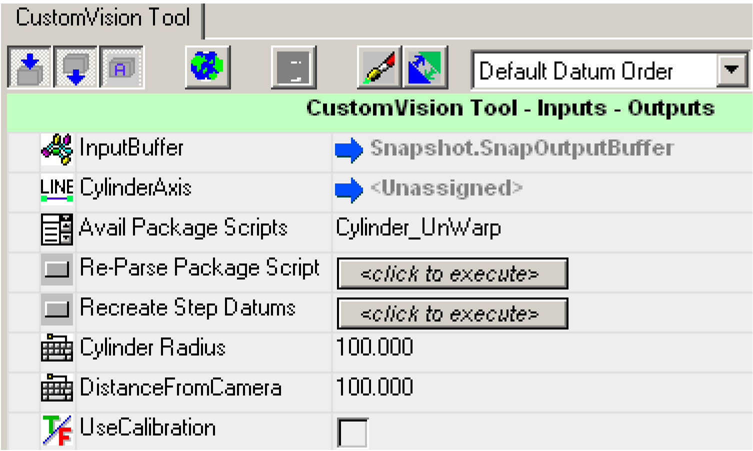


FIGURE E–5. **Output Image to Cylinder Unwrap Operation Example**

Description

CylinderUnwrap Warp allows editing through the CylinderUnwrap Warp properties page, as shown in Figure E–6.

FIGURE E–6. **Cylinder Unwrap Warp Properties Page**



Settings

- Cylinder Axis — An input line datum that is selectable. This input line is usually the bisecting line of the right and left edges of the cylinder. The point within the ROI where the image is correct (i.e., the point of no distortion) should lie along the cylinder axis.
- Re-Parse Package Scripts — This button causes the package script to be parsed when clicked. Whenever any changes to the script are made, this button needs to be clicked to make these changes take effect.

- Recreate Step Datums — This button causes the input and output datum lists in the step to be recreated. This button only needs to be clicked when a datum is either added, removed or changed in the script. If the script is changed, but no input or output datums are changed, then this button does not need to be clicked. Clicking this button also causes all input datums to be set to their default values and lose their connections to other step results or parameters.

  Datums created by the package script are added to the user interface. Input datums are shown as a box with a drop-down list button. The input datums can be linked to other similar type datums in the Job. Clicking the drop-down list button causes the Job Tree to be displayed, allowing you to select the datum to link to the input datum. Resource datums are shown as user-editable boxes that can be set to a value directly. Output datums are not shown in the user interface for this step, but can be seen in the Job Tree that comes up when linking an input datum.

- Cylinder Radius — The radius of the cylinder.
- DistanceFromCamera — The distance from the camera to the cylinder.
- UseCalibration — If the inputs (CylinderRadius, DistanceFromCamera) are specified in calibrated/world coordinates (for example, millimeters), then the UseCalibration checkbox should not be checked. If the inputs are specified in pixel coordinates, then UseCalibration should be checked.

Training

None.

Results

- Status — Set to true after a successful execution of the step.
- CylUnwrapped Image — The modified image.

I/O Summary

None.

Dynamic_Binarize

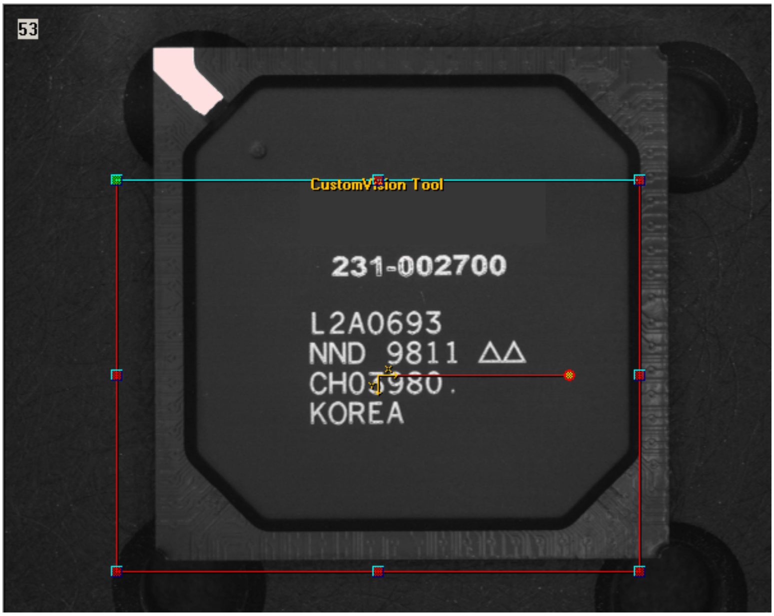
Theory of Operation

The Dynamic Binarize script is used when you want to binarize your image, which means to convert all of the pixels below a threshold to 0 and all those above the threshold to 255. This script will dynamically calculate its binary threshold each time it runs.

Using Dynamic_Binarize

This script provides you with an ROI like any other Vision tool in Visionscape would. You can position and size the ROI over any area of your image, and an output buffer will be created of the same width and height, and containing the binary representation of all of the pixels within the ROI. In Figure E–7 and Figure E–8, we demonstrate how the text on a chip can be binarized:

FIGURE E–7. **Custom Vision Tool Running Dynamic_Binarize Perl**



Script

FIGURE E–8. **Output Buffer produced by Dynamic_Binarize Perl Script**

Description

The Dynamic Binarize script will calculate either the average or median gray value of all the pixels within its ROI, and this value will be used as the binarize threshold. When calculating the average, you can choose to ignore the very lowest and highest gray values. You may also apply an offset to the calculated threshold.

Settings

FIGURE E–9. Dynamic Binarize Script

CustomVision Tool - Inputs	
InputBuffer	Snapshot.SnapOutputBuffer
Avail Package Scripts	Dynamic_Binarize
Re-Parse Package Script	<click to execute>
Recreate Step Datums	<click to execute>
Histogram Low Clip	20
Histogram High Clip	220
Threshold Offset	10
Polarity	Bright
Method	Average

- Histogram Low Clip — Pixels below this gray value will be left out of the calculation of the average or median gray value.
- Histogram High Clip — Pixels above this gray value will be left out of the calculation of the average or median gray value.
- Threshold Offset — An offset that will be applied to the calculated binary threshold.
- Polarity — Determines the polarity of the pixels in the output buffer.
- Method — Selects whether you want the threshold to be based on the average or the median gray value.

Results

- Average — Calculated average gray value.
- RunLoThr — When polarity is set to “Bright”, this will hold the actual threshold that was used to binarize the image; in other words, it will be the average or median gray value + the Offset value. When polarity is set to “Dark”, this will always be 0.
- RunHiThr — When polarity is set to “Dark”, this will hold the actual threshold that was used to binarize the image; in other words, it will be the average or median gray value - the Offset value. When polarity is set to “Bright”, this will always be 255.

- Median — The calculated median gray value.
- ComputedGray — This is the computed gray value that was combined with the offset value to produce the threshold. In other words, if the selected “Method” was “Average”, this will be equivalent to the Average output datum, and if the selected “Method” was “Median”, this will be equivalent to the Median output datum.

FailCode

The FailCode script does not draw any graphics nor does it need an ROI, so it is best used with the Custom Step rather than the Custom Vision Tool. See “FailCode” starting on page E-3.

FindRotated

The FindRotated script allows you to run the correlation algorithm over a range of angles, allowing you to find features that will rotate by more than 5° from the trained orientation. The Template Find step in Visionscape runs the correlation algorithm, but typically can only find features that will rotate by no more than ±5°.

Using FindRotated

FindRotated is used in the same way that the Template Find step is used. You will be provided with two ROIs:

- The first ROI represents the template you wish to train on.
- The second ROI represents the search area (the area within which you will search for the template).

You must train this step before you can use it.

Insert a Custom Vision tool into your Job, and then select the Find Rotated script. You should see two ROIs in your image that look something like the ones in Figure E–10 and Figure E–11:

FIGURE E–10. **Two ROIs**

Unfortunately, the ROIs are not labeled, so it is confusing to understand which of the ROIs is used for the Template, and which is used for the search area. We have labeled the ROIs in Figure E–10. If we wanted to train the tool to find the “KOREA” text in our sample image, we would position the ROIs like the ones in Figure E–11:

FIGURE E–11. **Positioning ROIs to Find KOREA**

Press the Train button to train the template.

Description

The FindRotated script will search for the trained template by searching over a specified range of angles specified by the Maximum Search Angle and Minimum Search Angle datums. It accomplishes this by warping the image contents inside of its ROI. It will start by warping the image contents by the angle specified by the Minimum Search Angle datum, and then it will run correlation on the result. All qualifying match locations are recorded, and then the angle is incremented by an amount equal to the value specified in the Angle Step Size datum, and the image is warped and searched again. It will continue in this fashion until it reaches the angle value specified in the Maximum Search Angle datum, and then it will stop. Then, the script will scan through all of the qualifying template locations, and choose the best one.

Settings

FIGURE E–12. FindRotated Script

CustomVision Tool - Inputs	
InputBuffer	Snapshot1.SnapOutputBuffer
Avail Package Scripts	FindRotated
Re-Parse Package Script	<click to execute>
Recreate Step Datums	<click to execute>
Minimum Search Angle	-15.000
Maximum Search Angle	15.000
Angle Step Size	5.000
Accept Threshold	0.700

- Minimum Search Angle — The minimum warp angle that the step should start searching at.
- Maximum Search Angle — The maximum warp angle that the step should search at.
- Angle Step Size — This is the amount in degrees that the angle should be incremented by for each search iteration.
- Accept Threshold — This is the minimum correlation match percentage.

Results

- Point of Best Match — This is the X,Y location and angle of the best match found.

Index