



Impact VPM Lite Reference Guide

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Technical Support

If you have technical questions about the operation of any Datalogic product, contact your distributor or Datalogic. Please have the following information available before you call:

- The model and serial number of the camera, located on the unit. The version number of the Impact software you are running, found in the title bar of the software.
- The type and version number of the operating system software you are running on the client computer.

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Introduction

Thank you for purchasing a Datalogic Impact machine vision system. *Please read the instructions in this document before starting your system setup.* The machine vision system is flexible, compact, and configurable.

This manual documents Vision Program Manager™ Lite (VPM Lite), the Impact program which you use to configure the Datalogic Impact camera and view the data collected from your inspections.

VPM™ Lite is used by the inspection programmer or administrator to create inspection programs that run on the Datalogic P-Series Impact camera. A variety of tools furnish the flexibility to program the inspection and configure the Datalogic hardware. You can view inspection results in VPM's Summary Table.

Manual Contents

The Reference guide consists of the following chapters:

- **Chapter 1: Installation and Quick Setup**
Here are installation and basic setup instructions for your Datalogic machine vision system.
- **Chapter 2: System Configuration**
This chapter describes how to set up an inspection, including descriptions of some of the tools in VPM Lite, linking, and data fields.
- **Chapter 3: Vision Program Manager Lite**
This chapter explains the user interface and how to use VPM Lite to configure the camera, including proper setup and calibration in the client computer, and lighting adjustments. There are also details about administering the camera user interface, including file management, user names and passwords, defining camera IP addresses and names, and file camera use.
- **Chapter 4: Appendix**
The appendix contains material about the Threshold Viewer, On-screen Keyboard, Emulator, command line parameters, and TCP/IP settings for the camera. The Emulator allows you to create and test vision programs without hardware.

Installation and Quick Setup

This chapter discusses installing Impact software and provides a quick setup guide for connecting to a camera and acquiring an image.

The machine vision cameras can be accessed from any client computer with an Ethernet connection that has Impact software installed on it.

Help



To access online Help, press the F1 key, or click the Help icon in the tool bar. Click the desired topic in the Table of Contents in the left pane of the Help window or type a topic in the search field.

System Requirements

P-Series Camera

Requirements for the Client Computer

- Intel®, AMD®, or VIA® x86-class processor -minimum 1.2 GHz; 64-bit processors are supported with Windows Vista, Windows 7, and Windows 8.1
- Microsoft® Windows Vista, Windows 7, and Windows 8.1
- 1 GB or more of RAM, 2 GB recommended
- 800MB or more of available hard disk space
- 10/100 Mbps Ethernet connection
- Monitor display resolution of 1024 x 768 or greater
- A program capable of reading Portable Document Format (PDF) files
- CD-ROM Drive

Requirements for the P-Series

- The camera and client computer must have the same version of Impact software installed.

Installation

The install program copies all the application files to their appropriate places. This includes the files for the Java™ Runtime software, which Impact software requires. Please note that the instructions vary slightly depending on the type of system you are using. For full installation instructions, refer to the Readme file.

IMPORTANT: Do NOT power off the camera during installation. All five status LEDs are turned ON during the installation process. When all LEDs turn off, the camera will automatically reboot.

Note: If security is enabled on the camera, you cannot install new software on it. You must disable security on the camera before you start the install.

To install Impact software:

1. You may need to turn off automatic virus checking during the install if it causes installation problems.
2. You must log in to an operating system account that has administrative privileges in order to install or run Impact software on a Windows operating system.
3. Download the installation program from the Datalogic web site, then double-click on the saved file.
4. The installation program should start. Select the language you want the install to use, then click OK.
5. Follow the on-screen instructions.
P-Series: If you want to install to a P-Series camera, it must be connected to the client PC's network.
6. When the installation has completed, you can start the VPM Lite and complete the Quick Setup procedure.

Quick Setup

This section explains the basic steps to get a system configured so you can start using it. A more detailed explanation can be found in later chapters of this manual.

NOTE: If you want to begin creating vision programs and control panels without using a Datalogic Impact camera, you can use the Emulator. (See “Choose a Vision Device or Emulator” on page 1-2.)

Camera cable connection

P-Series

These cameras use an Ethernet cable to communicate with the client PC. Connect the appropriate cable between the Impact camera's Ethernet port and the client PC's LAN port. Refer to the camera's hardware manual for connector locations.

Choose a Vision Device or Emulator

For more details about connecting to a camera, see “How Impact Software Connecting Works” on page 1-5.

CAUTION: Any program on a camera that controls outputs that are connected to and control external mechanical equipment can cause that equipment to operate when the program runs.

When VPM Lite first starts

When VPM Lite first starts, a dialog is displayed so you can choose a camera or Emulator.



No camera is currently connected

If VPM Lite is not currently connected to a camera, click the Connect button in the tool bar. A dialog is displayed so you can choose what connection you want to make.

A camera is connected

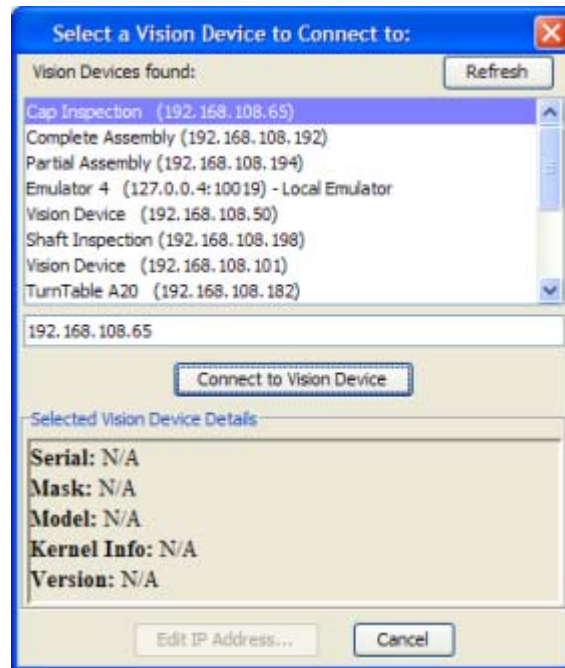


You can connect to only one camera at a time. If a camera is already currently connected, click the Disconnect button in the tool bar to disconnect from the camera. Click the button again to connect to a camera.

To choose a camera or Emulator:

1. When the vision device select dialog is displayed, select a camera from the list. An Emulator appears in the list with Local Emulator as part of its name.

TIP: Details about a device selected in the list are displayed at the bottom of the dialog.



2. Click Connect to Vision Device.
If security is enabled on the camera, the User Logon dialog is displayed. When a valid User ID and password have been entered, VPM Lite connects with the camera or Emulator.
 3. When the connection has been made, you may see a message that VPM Lite is reading from the newly connected camera.
- **Vision Devices found**
This list displays the names and IP addresses of the vision devices/cameras and Emulators visible on the network.
 - **Connect to Vision Device**
Click this to connect to the vision devices/cameras selected in the list.

NOTE: If another user is already connected to the camera, a dialog will be displayed indicating that the camera is in use. See “Editing a vision program from multiple VPM Lite instances” on page 3-5 for more details.

- **Edit IP Address...**
To change the IP address of the selected camera, click this button. See “IP Address Configuration” on page 4-44. You cannot change the IP Address of an Emulator.

To disconnect from a camera or Emulator:

1. Click the Disconnect button in the tool bar.

Camera Setup

Note: If you want to use previously captured images for this initial setup, see “File Camera” on page 2-23.

Datalogic Impact cameras contain no hardware switches so all operating parameters must be set from the Settings tab.

Plug in a camera**P-Series camera:**

1. Be sure the Ethernet and power cables are connected to the camera and that the power is on. The Power LED lamp on the camera should be on.
2. Click the Connect button in the tool bar and choose the camera from the list.
3. Click the Settings tab.
4. Click the Camera icon then click the Setup button below the image window.

Set up a camera

1. Click the Frame Trigger tab. Set the following values.
 - Select the Self-paced Auto-trigger radio button. This will let you run the camera without wiring a trigger signal. See “Frame Trigger Tab” on page 2-13 for more details.
2. Click the General tab. Set the following values. (Some options are not available on all cameras.) Leave the remaining values at their default.
 - Gain: Default
 - Offset: 0
 - Shutter Open Time: 10,000 microseconds
 - Strobe Pulse Length: 30 microseconds
3. Click the Live button. If you do not see the image or object in the image window, adjust the camera focus, shutter open time, and strobe length until a clear, well defined image is displayed. See “Camera” on page 2-11 for more details about how each of the settings affects the image.
4. You may need to move the camera toward or away from the object until it fills most of the camera’s field of view.

Camera Calibration

For this Quick Setup, you can leave the camera uncalibrated. A camera requires calibration the first time you use it and when the camera-to-subject distance is changed. Calibration insures that the measurements indicated in tools accurately relate to the camera image’s measurements. See “Calibration Panel” on page 2-17 for more details.

Date and Time

(P-Series only)

In this step of the Quick Setup procedure you will set the date and time on the camera. Leave the other parameters at their default setting.



General Panel - Vision Device Date/Time

1. Click the Settings tab.
2. Click the General System Object icon.
3. Click the General button.
4. In the panel section labeled “Vision Device Date/Time,” click Synchronize to PC. This sets the camera date and time to match the client computer. See “Vision Device Date/Time” on page 2-3 for details.

You have now completed the Quick setup. More details about using the Settings Tab to configure the camera can be found in Chapter 4. The camera should now be ready for defining an inspection task, which is described in Chapter 2.

How Impact Software Connecting Works

P-Series

Connecting to a camera

The P-Series camera physically connects to the client PC with an Ethernet cable between the client PC's Local Area Network (LAN) port and the camera. When you click the connect button, this LAN connection is used to communicate with the camera. Each camera has a unique IP Address. See “IP Address Configuration” on page 4-44 for more details.

When you connect to a camera, you can work with either live images or previously captured images (File Camera). When the camera is set to File camera mode, images and Vision Programs are stored on the camera.

Multiple users can connect to a camera, but only one user at a time can edit programs or change data on the camera.

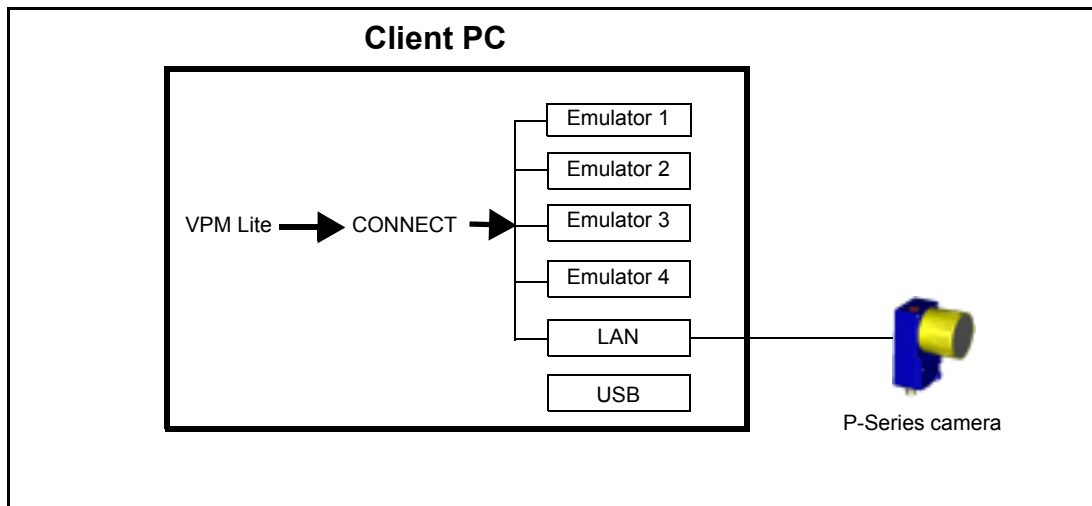
Connecting to an Emulator

You can use an emulator to create and test vision programs without a camera connected to the client PC. The Emulator uses the PC to emulate a camera.

When you connect to a Local Emulator, if it is not already running it is started automatically on the client PC. VPM Lite then uses an internal software connection to communicate with it. Up to four Emulators can be running and connected at a time. The IP Addresses 127.0.0.1 through 127.0.0.3 are associated with the Local Emulators.

You must already have suitable images saved in order to use the Emulator since it is intended for creating vision programs without a camera. Emulator images and Vision Programs are stored on the client PC.

Multiple users can connect to one Emulator, but only one user at a time can edit programs or change data on the Emulator.



System Configuration

Introduction To System Configuration

This chapter explains options on the Settings Tab. It is used for general system configuration including the Impact camera, Emulator, Internet Protocol (IP) Addresses, communications, security, camera calibration, and other areas.

Some options are available based on whether VPM Lite is connected to a camera or Emulator, as well as the type of camera.

Settings Tab



VPM Lite must be connected to a camera or Emulator to access the Settings tab. See “Choose a Vision Device or Emulator” on page 1-2.

You can access properties through the system objects on the Settings Tab shown in Design Mode. Every object has the general properties of Name, Description, and Type. Some system objects have inputs and outputs that can be set directly or linked between tools. Most system objects have both a Setup and a Properties tab.

NOTE: Some tabs, panels, and fields may be disabled when the camera or Emulator is online.

General



The General system object allows access to system parameters on the camera or Emulator.

NOTE: Access to functions on this panel may be limited while the camera or Emulator is online.

General Panel

Name

The name can contain any combination of letters or numbers up to 25 characters in length. There may be multiple cameras or Emulators on the network with the same name, although this may cause confusion.

IP Address, IP Gateway, and IP Mask

Note: Usually you will not need to use the IP Gateway address. Do not change it.

IMPORTANT: Do NOT include a leading zero in an IP Address group (for example 192.168.108.**065**)

The IP Mask and Address on the client and P-Series work together so data can be exchanged. The IP Mask is network dependent, but it is the same for each Vision Device on a particular network. The IP Address must be unique to each Vision Device if there is more than one on a network. (For a detailed discussion of network configurations see page 4-39.)

You may need to change the client computer's mask and address to match the desired camera's IP Address. See "IP Address Configuration" on page 4-44.

Note: Do not attempt to change the IP Address or Mask without the authorization of your network administrator; doing so could disrupt your network connection.

P-Series

To be able to communicate with the camera, a client computer's IP Mask and Address must be configured correctly. During address configuration, we recommend that the client computer and the camera be connected directly to each other and not through a network server.

Changing the client computer's addresses: Windows 7

1. In the Start Menu, select Computer, Network, then click Network and Sharing Center.
2. Under "View Your Active Networks," click Local Area Connection.
3. Click Internet Protocol Version 4 in the list, then click Properties.
4. On the Alternate Configuration tab, select User Configured.
5. Enter the desired IP address and Subnet Mask. Remember, to be able to communicate with the camera, a client computer's Subnet mask must correspond correctly to the camera's IP mask, and the address must match the camera's address in the first three sets of numbers.
6. Click OK, then close all the open dialog windows.

Changing the client's mask and address: Windows XP

1. In the Start menu, right click on My Network Places and select Properties.
2. Right click on Local Area Connections and select Properties.
3. On the General tab, select Internet Protocol (TCP/IP) and click Properties.
4. On the Alternate Configuration tab, select User Configured.
5. Enter the IP Address 192.168.0.1 and the Subnet Mask 255.255.255.0, then click OK to close all the dialog windows.

Changing the camera Mask and Address

To change the IP Mask and Address, you must know the current IP Address and Mask so you can configure the client correctly. The P-Series cameras are shipped with a default IP Address of 192.168.0.128 and a default Mask of 255.255.255.0.

IMPORTANT: If you change a camera or Vision Device's Mask or Address, be sure to record the change. **IMPORTANT:** Do NOT include a leading zero in an IP Address group (for example 192.168.108.**065**)

1. P-Series: Be sure that the client computer's IP Address and Mask are set correctly. Connect the client computer and camera's Ethernet ports directly using an Ethernet cable and turn on power to the camera.
2. Connect to the desired Vision Device or camera. See "Choose a Vision Device or Emulator" on page 1-2.

IMPORTANT NOTE: If you intend to change **both** the IP Address and the IP Mask, do not Reboot

until you have changed them both. After you change the IP Address, you will see a message that states you must reboot for the changes to take effect. Do not reboot until after you have changed both the Mask and the Address. On P-Series cameras, you need to cycle power for the changes to take effect.

3. When the connection has been made, click the General System Object then click the General button. Enter the new IP Mask and/or IP Address in the appropriate field(s). Record the new value (along with the serial number) and store it where you can find it again.

A screenshot of a web interface for configuring IP settings. It features two input fields stacked vertically. The top field is labeled 'IP Address:' and the bottom field is labeled 'IP Mask:'. Both fields are empty and have a light gray border.

4. Click the Diagnostics button, then click the Reboot Device button. You must reboot to make the changes take effect in the camera or Vision Device.

IP Gateway

The IP Gateway address is used when you want to access an IP Address through a router. You will ordinarily leave this field unchanged.

Comment

The comment can contain notes about the camera or Emulator, such as its function, the physical location, what it is inspecting, or when it was put into service. This comment is displayed on the Device Information panel.

Go Online At Startup

Check this box if you want the camera or Emulator to go Online when it starts. Any task that is loaded is executed, based on its trigger parameters. To mark which task gets loaded when the camera or Emulator starts, see “File Manager” on page 2-25.

Connections

- **Maximum**

The maximum number of users at each level (1 to 100) that can be connected to this camera or Emulator at one time. Multiple users can connect to one camera or Emulator, but only one user at a time can edit programs or change data on the camera or Emulator.

- **Current**

The number of users at each level currently connected to the camera or Emulator.

Vision Device Date/Time

(P-Series only) This displays the current date and time stored on the camera. To set the camera date and time to match the client computer's, click Synchronize to PC.

NOTE: The camera does not automatically adjust for daylight savings time changes. You will need to manually synchronize it.

Enable Timeout

Here you can define the maximum length of time a task may take to execute.

NOTE: Task Timeout is effective only while the camera or Emulator is online and triggering.

- **Task**

When this property is enabled, the Task Timeout value determines how much time the task is allowed to complete execution before it aborts. See “Vision Program Panel” on page 3-24.

The time starts when the camera trigger is complete, not at the beginning of task execution. The timing accuracy depends on the tools in the task, but it is generally accurate to within a few milliseconds.

For example, if Task Timeout is enabled, and the Timeout value is set for 10,000 milliseconds, a task will run until it completes or 10,000 milliseconds has elapsed, whichever comes first. If the Task Timeout occurs first, and Abort On Error is True, the Abort Task runs, if one is defined. If Abort On Error is False, then the task keeps running and any remaining tools immediately fail. See “Task Configuration” on page 3-24 for more details.

Settings Files

This section lets you select what camera or Emulator settings are saved and printed. Both is selected by default. To copy settings files from one camera or Emulator to another, see “To copy settings files from one camera or Emulator to another (P-Series)” on page 2-5.

IMPORTANT NOTE: Settings files contain information about which vision programs should be loaded when the camera or Emulator starts. Since vision program files *are not copied* to the camera or Emulator when you backup and restore the settings file, some vision programs may not get loaded when the it starts. It is the system programmers responsibility to insure that the proper vision program files are copied to the camera or Emulator.

- **Camera Calibration**

When you click Backup, the settings displayed on the Camera System Object - Calibration panel are saved to the client. Restore sends the calibrations from the client’s file to the camera or Emulator. Calibration settings are also saved whenever the calibration is changed.

- **Vision Device Settings**

When you click Backup, the settings displayed on the General System Object are saved to the client. Restore sends the camera or Emulator settings from the client’s file to the camera or Emulator.

IMPORTANT NOTE: Restore will overwrite any existing settings on the Vision Device, camera, or Emulator with those currently on the computer. If more than one computer is connected, the most recently restored settings are kept.

- **Restore**

The Restore button sends Vision Device, camera, or Emulator settings currently saved on the computer. Vision program files are *not* copied. See “Folder List” on page 2-25 for image file copying details.

IMPORTANT NOTE: The computer will backup the settings for only one Vision Device, camera, or Emulator at a time. Only those currently connected are backed up. Any previously saved settings are overwritten.

- **Backup**

The Backup button saves the selected settings from the Vision Device, camera, or Emulator to the computer. Vision program files are *not* copied. See “File List” on page 2-25 for image and vision program file copying details.

To copy settings files from one camera or Emulator to another (P-Series)

1. Connect to the source (where you are copying from).
2. Click the Settings Tab - General - Setup - General panel
3. In the Settings Files group, select the Vision Device Settings check box.
4. Click Backup.
5. Disconnect from the source.
6. Connect to the destination (where you are copying to).
7. Click the Settings Tab - General - Setup - General panel
8. In the Settings Files group, select the Vision Device Settings check box.
9. Click Restore.
10. Disconnect from the destination.
11. Repeat steps 6 through 9 to copy the files to other destinations.

Communication Panel

Shift Source

This setting is not used on the P-Series cameras.

Input Debounce

Here you define the debounce time for event trigger signals. Debounce determines the maximum trigger rate the system will allow (basically like a governor on an engine) to help prevent negative effects from noise and high frequency bursts. The debounce setting must be able to filter out noise while not introducing any unnecessary delays.

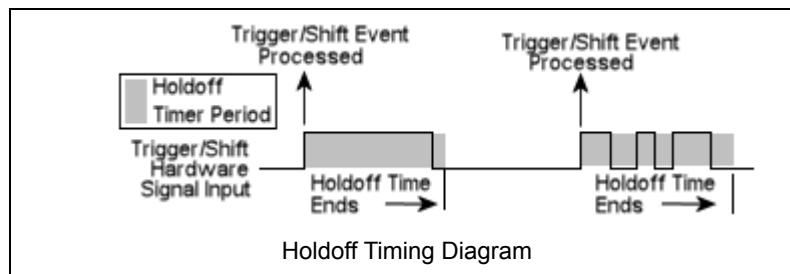
- **Delay**

See “Trigger Input Debounce” on page 2-14.

- **Holdoff**

The event is triggered when the signal's active edge is detected, but another active edge will not trigger the input until the Holdoff time has elapsed.

Holdoff is good for noise on the signal's leading edge and it is not speed-dependent, but it is susceptible to random noise on the input signal. Use a Holdoff time long enough to reject leading edge noise, but not so long that the inspection rate is limited.



Output Type

(P-Series only) Select the type of electrical configuration for each of the outputs depending on the type of external load. This setting is ignored if the camera is connected to a CBX 500 or CBX 800. Refer to the P-Series Reference Manual for details.

Miscellaneous

- **Enable Online/Offline Output Feedback**
(P-Series only) If this check box is checked, the selected output is turned on when the device goes online and stays on while the device is online or until a Discrete Output tool turns the output off. The output state may also be affected if Output 3 is used as a strobe output.

TCP/IP

This is the camera or Emulator's Ethernet input port number where the camera or Emulator "listens" for a TCP/IP message. When a TCP/IP command is received on this port, the command processor evaluates and executes it.

- **Server Port**
You can use Telnet or another network device to send messages to this port. The port number on the other device should be the same as this port number. See "TCP/IP Out" on page 3-99 for more details about the TCP/IP Out tool and how to set up TCP/IP communications.
- **Delimiter**
A delimiter must be defined. This delimiter is used only for TCP/IP communication.

To create the Delimiter

1. Click the Edit button next to the Delimiter field.
2. In the Create Delimiter Sequence dialog, select a character from the list.
3. Click Append.
4. Repeat steps 2 and 3 until the delimiter is defined.
5. Click OK.

Serial Port

This section defines the parameters for the camera's serial port that will be used by the Serial Port Out tool. Consult the documentation for the requirements of the device you are connecting to the camera's serial port, then set these values accordingly. The serial port does not support hardware (CTS/RTS) or software (Xon/Xoff) data flow control. Datalogic Impact cameras support only RS-232 communication protocol. RS-485 is not supported. The Emulator has no serial port.

- **Speed**
The camera's data transmission rate. Speeds supported: 300; 2,400; 9,600; 19,200; 38,400; and 115,200. VPM Lite defaults to 115,200 when it is installed.
- **Parity**
The number of parity bits used.
- **Data Bits**
The number of data bits used.
- **Stop Bits**
The number of stop bits used.
- **Delimiter**
(This Delimiter character is used only by the Serial Port In tool. Also see "Serial Port Out" on page 3-98). The delimiter is placed at the end of the input string when it is transmitted. The receiving camera's Serial Port Delimiter must match this setting.
When the camera detects a delimiter in the data string, it creates a Serial Input task trigger event. If no delimiter is defined, an event is created after every character in the data.

To create the Delimiter

1. Click the Edit button next to the Delimiter field.

2. In the Create Delimiter Sequence dialog, select a character from the list.
3. Click Append.
4. Repeat steps 2 and 3 until the delimiter is defined.
5. Click OK.

SDK

The System Developers Kit (SDK) provides developer's a third-party programming language interface to VPM Lite tools and controls. For more details, refer to the SDK Reference Manual.

- **SDK Port**
This is the camera or Emulator's SDK input port number where the camera or Emulator "listens" for an Impact SDK command.
- **Enable SDK Server**
If this check box is checked, the SDK Server on the camera or Emulator will be started each time the camera or Emulator starts. This server must be running if you are using the Impact Vision SDK to access the camera or Emulator.

Diagnostics Panel

NOTE: Access to functions on this tab may be limited while the camera or Emulator is online.

The Diagnostics tab lets you run diagnostic tests on various functions of the camera.

Outputs

Click a button to turn the indicated output on and off. The indicator is green when the output is on.

Strobe

Use this function to test your strobe output. When you click the Fire button, the output will pulse for 30 microseconds.

Options

- **I/O Polling Rate**
Enter a number from 50 to 10,000 milliseconds. VPM Lite polls the camera or Emulator at this rate and updates all the indicators on the Diagnostics tab.

NOTE: Enable System Log Trace only when you need to trace all system events. For instance, if you are having trouble tracking down an intermittent problem with a vision program. The system log can quickly become filled with entries and system performance can be affected, depending on the program's complexity.

- **Enable System Log Trace**
When this is checked, all system events that occur on the camera or Emulator are entered in the system log. This includes events, task and tool run completion, and many other occurrences that would not ordinarily get logged.

Inputs

This section shows the current state of each camera or Emulators' inputs. (VPM Lite polls at the I/O Polling Rate shown.) The indicator is green when the input is On. If the input change rate is too fast, the indicator may not switch quickly enough to indicate the true current state.

To test a camera or processor input, connect a “loopback” between an output and the input. The input’s state will change when the output changes.

Events

This section shows the hardware signal frequency on the camera’s trigger or event inputs (in Hz). These values are inactive if the camera is not online and receiving hardware trigger signals. The appropriate Trigger Event property must also be set.

Trigger Rate: The signal on the Trigger Input. A task that has the Trigger Event property set to one of the Image Trigger Event types must be loaded.

Shift Rate: This signal is not functional.

Reboot Device

Click this button to restart the camera or Vision Device. The task stops executing and all vision programs are unloaded. (This has the same effect as pressing the Reset button on the P-Series camera.)

When the camera restart has completed, any vision program set to load on startup is loaded and the task in that vision program is queued to execute when it is triggered. See “File Manager” on page 2-25 for setting vision programs to load on startup.

IMPORTANT NOTE: The camera must completely reboot before you can connect to it.

Administration Panel

NOTE: Access to this tab is limited to users with an Administrator access level. Some options are unavailable while the camera is online.

Device Security

Impact security resides in each camera. You must connect and log on to a camera to modify security for it. When you attempt to connect to a camera that has security enabled, you will have to enter a valid User ID and password. The User ID will determine your security level. Some functions are limited based on the user’s security level.

- **Enable Security**

If the Enable Security check box is checked, camera security is enabled and the logon screen is displayed whenever a connection attempt is made to the camera. The user cannot gain access to the camera until a valid User ID and password have been entered. There must be at least one Administration level user defined to enable security.

- **Users**

User ID and Level: All currently defined users and their access levels are displayed in this list. Access to a camera is determined by the access level assigned to each User ID. The following access levels can be assigned, with Administrator level having full access to all functions.

Monitor: View inspection results, view images, and view vision program parameters, but cannot make any changes.

Operator: Monitor level access plus view images, adjust some inspection settings, and put the camera or Emulator online and offline.

Controller: Monitor and Operator level access plus modify some vision program parameters.

Programmer: Monitor, Operator and Controller level access plus adjust all inspection settings, modify all vision program parameters, modify camera and program preferences, create and edit vision programs, and change camera or Emulator settings.

Administrator: Monitor, Operator, Controller, and Programmer level access plus modify system security, including defining and modifying users levels and passwords.

Note: Before you can enable security on the camera, there must be at least one Administration level user defined.

To add a User

1. Click the Add User button.
2. Enter a User ID. It may contain any letter or number. For example, this may be a name, a shift designation, or some other unique identifier. The User ID is case sensitive.
3. Select the access level from the drop-down list.
4. Enter a password in the Password field. See page 2-9 for more about passwords. Asterisks are displayed for the password. The password is case sensitive.
5. Enter the same password again in the Confirm Password field. Asterisks are displayed for the password.
6. If you want the user's password to expire after a fixed time period, check the Number of days before password expires check box and enter the number of days. Administrator level passwords never expire.
7. If you want anyone (including Administrators) to be able to change this password, check the Can Change Password check box.
8. Click the OK button.

To modify a User

1. Select the User ID you want to modify.
2. Click the Modify User button.
3. Change the desired field. If you change the password, you will have to enter the new password again in the Confirm Password field.
4. Click the OK button.

To delete a User

1. Select the User ID you want to delete.
2. Click the Delete User button.
3. Click the Yes button to confirm the deletion.

- **Install Users on Multiple Cameras or Emulators**

You can copy the User IDs and passwords from the connected camera or Emulator to another camera or Emulator.

To install Users on multiple cameras or Emulators

1. Click Install, then select the target cameras or Emulators for the User IDs and passwords.
NOTE: Any existing User IDs and passwords on the selected cameras or Emulators are overwritten.
2. Click OK.

- **Passwords**

Passwords are case sensitive, can contain any ASCII character (except CR or LF), and must be at least as long as the Minimum Character Length defined in the Passwords group. They are displayed as asterisks in entry fields. The Minimum Character Length and Password Reuse values apply to all passwords.

Minimum Character Length

Specifies the minimum number of characters all newly defined system passwords must contain. Existing passwords are not affected.

Password Reuse

Number of Passwords: If Password Expires is enabled, this is the minimum number of new passwords that must be used before an old password can be used again. A zero indicates passwords can

be reused immediately.

Minimum Days: If Password Expires is enabled, this is the minimum number of days that must pass before a password that has already been used can be used again. A zero indicates passwords can be reused immediately.

You can also modify a password during logon.

To modify a password during logon

A user cannot change their password unless the “Can Change Password” check box is checked. (See “To add a User” on page 2-9.)

1. Click the Connect button, select a camera or Emulator from the Device Selection list, then click OK.
2. When the User Logon dialog is displayed, click Change Password.
3. Enter the User ID and the Old Password for that User ID.
4. Enter the New Password and type the same password in the Confirm Password field.
5. Click Log On.

Tool Activation

Some tools require a Software License Key to be activated before you can use them. The Tool Activation dialog displays the current status of activated tools, and lets you enter the Software License Key for new tools.

- **Software License Key:** Enter the number provided by Datalogic.
- **License States:** This area lists all the currently active licenses. The Impact License Level refers to the number of tools available for use.

A P-Series camera can be licensed to run either VPM or VPM Lite. If the camera is currently licensed for VPM Lite, the license can be changed so the camera can use VPM.

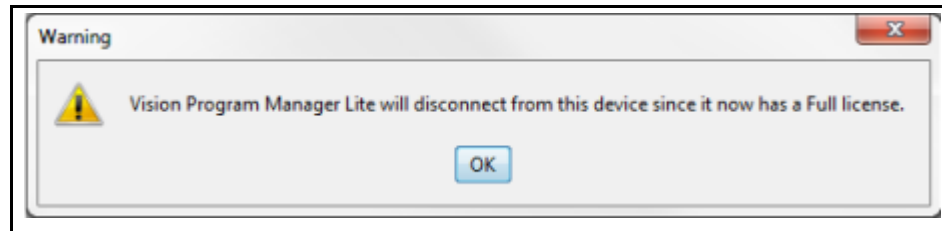
To change a P-Series camera license

1. Open VPM Lite and connect to the P-Series camera.
2. In VPM Lite, select Settings-General-Administration.
3. Enter the license key provided by Datalogic into the Software License Key field.



4. Press Enter.

5. A Warning dialog is displayed. The camera is now licensed for VPM so it will disconnect from VPM Lite.



6. Click OK.
7. Turn off power to the P-Series camera, wait ten seconds, then turn on camera power. The camera will complete the restart in approximately 1 minute.
8. You can now connect to the camera using VPM.

About Panel

When you click the Connect button, VPM Lite automatically scans for cameras and Vision Devices on the network and Emulators on the client PC. It then displays their names, IP addresses, and other information in the selection list. When VPM Lite connects to the camera, it determines the hardware configuration and current status then displays it on this panel. None of the information on this tab can be modified.

Storage

Storage is the Impact camera memory used to store the camera's operating system software and firmware and user-defined vision programs.

Memory

Memory is the Impact camera memory that stores dynamic vision program data. The amount of available memory shown is not updated while the camera is online.

Vision Device Information

This information is for display only. Technical support personnel may ask you for this information if you call for assistance.

Camera Information

This Impact camera information is for display only. Technical support personnel may ask you for this information if you call for assistance.

Camera



The Camera system object accesses and sets some of the Impact camera and Emulator's parameters.

NOTES: The range of acceptable values for each input is determined by the camera type. Changing any of these properties while the camera is being triggered and acquiring images can cause the images to be corrupted. The camera should be offline or triggers should be stopped while these properties are being changed.

Setup Panel

NOTE: Access to functions on this panel may be limited while the camera is online. Some functions are available only with a camera connected.

Datalogic's digital cameras contain no hardware switches so all operating parameters must be set from the Settings Tab - Camera System Object. This section provides details about each of the Camera System Object options. (Available options are dependent on camera type.)

Snap

Click the Snap button to acquire and display an image in the image window. You can use this to see how camera settings affect the image, or to position objects within the camera's field of view. The acquired image is also displayed in the image display area of the Design and Display modes.

Live

Click the Live button to continuously acquire images and display images in the image window until you click the Snap or Live buttons. You can use this to see how camera settings affect the image, or to position objects within the camera's field of view. The acquired image is also displayed in the image display area of the Design and Display modes.

Image Source

The type of camera that is currently acquiring images.

Frames/Sec

This field indicates the number of frames the camera can capture and process per second. It is calculated based on the current Shutter Open Time, Partial Scan line, and Half Resolution Mode settings.

General Tab

Shutter

Shutter Open Time indicates the amount of time the shutter will be open. The longer the shutter is open (a higher number), the brighter the image. A shutter open time that is too low can cause the inspected image to be too dark. Higher shutter open times will decrease the number of frames per second acquired and may blur the image. You can enter the value in the field or use the slider. The range of acceptable values is determined by the camera type.

(P-Series Only) The Illuminator Mode settings affect the shutter range limits. See "Illuminator Tab (P-Series Cameras Only)" on page 2-16.

External Strobe - Pulse Length (microseconds)

Enter the number of microseconds that you want the strobe to be on. The strobe pulse length must be coordinated with the shutter open time to provide optimum image capture and eliminate image blur. (The range of acceptable values is determined by the camera type. A zero value turns the strobe off.)

Advanced Button

Strobe Trigger

Select the type of trigger that the strobe you are using requires.

Rising - The output is normally off and a positive going signal is generated for the camera's strobe.

Falling - The output is normally on and a negative going signal is generated for the camera's strobe.

Gain

Gain adjusts the actual signal intensity from the camera. Doubling the gain value has the same effect as opening the camera lens aperture approximately one f-stop. The range of acceptable values is determined by the camera type.

Offset

Offset adjusts the zero grey-level setting for the camera. Adjusting the offset causes the entire image to brighten or darken. Images become darker as the offset is increased.

Frame Trigger Tab

Trigger On

This setting determines how the camera responds to the hardware signal as an active input on the camera trigger input or how the camera or Emulator is triggered automatically. Refer to the camera's hardware guide for appropriate trigger voltage levels. The camera or Emulator must be Online to respond to a hardware trigger input signal or to automatic triggers.

NOTE: When it is triggered while in File Camera mode, the camera will acquire the next File Camera image, not a live camera image. When connected to the Emulator, the next File Camera image is always acquired.

- **Rising Edge** - An input signal is indicated by a trigger input voltage increase.
- **Falling Edge** - An input signal is indicated by a trigger input voltage decrease.
- **Both Edges** - An input signal is indicated by a trigger input voltage increase *and* decrease (two triggers per input cycle).

NOTE: While either Auto-trigger or Periodic Auto-trigger mode is active, the camera will ignore any hardware trigger signals. Select one of the above modes if you want to use hardware triggers.



Start/Stop
Auto-
Trigger

- **Periodic Auto-trigger**
This is a fixed-pace auto-trigger mode. The camera or Emulator is automatically triggered and ImageIn task execution begins after the image is acquired. After the Delay period expires, the camera or Emulator is triggered and the next image acquisition begins, even if the previous image's processing is incomplete. If the image acquire time plus the delay value is less than the ImageIn task execution time, triggering is too fast and the image buffers will be overrun. This is a software-generated trigger and does not require a hardware trigger connection. Periodic Auto-Trigger mode is activated using the same methods as the Self-Paced Auto-Trigger mode.

Delay (milliseconds)

(for Periodic Auto-trigger mode) This is the delay time between camera or Emulator triggers. This value should be larger than the longest ImageIn task execution time so there is time for all images to be processed.

- **Self-Paced Auto-trigger**
Self-paced means that the camera or Emulator is automatically triggered at the fastest rate possible without overrunning image buffers. The trigger interval is the sum of either the acquire time or the ImageIn task's execution time (whichever is greater), plus the Delay time. Each time the camera or Emulator starts processing an image, it triggers the next image, so that the acquisition and process-

ing happen in parallel. This means that the acquire rate adapts to the processing rate so that the image buffers cannot be overrun.

How to activate Self-Paced Auto-Trigger mode

- a) Auto-trigger When Online check box is checked: automatic triggers will start when the camera or Emulator goes Online and stop when it goes Offline. The Start/Stop Auto-trigger button is disabled. No other Start/Stop control is available.
- b) Auto-trigger When Online check box is NOT checked: the camera or Emulator must be Online to enable the Start/Stop Auto-trigger button. Automatic triggers will start when the Start/Stop Auto-trigger button is clicked on and stop when it is clicked off.

How Self-Paced Auto-trigger mode works

After an image is acquired and the ImageIn task begins, the next image acquisition is started. When the task is complete, processing is delayed the number of milliseconds entered in the Delay field, then the task begins processing the next image and another image acquisition begins. This is a software-generated trigger and does not require a hardware trigger connection.

This mode is especially useful in applications that use a fast tool to sense part presence then branch to a full inspection when the part is present. The camera or Emulator triggers quickly when it is just running the fast tool. When the part is present, the camera or Emulator will not trigger again until the inspection task is done, so the inspection is self-pacing. Also, if the task execution time changes, the trigger rate does not need to be changed.

Delay (milliseconds)

(for Self-Paced Auto-trigger mode) This is the delay time between the end of processing one image in the ImageIn task and beginning to process the next image. The value can be between 1 and 100 milliseconds. Without the delay, the camera or Emulator may stay too busy to send data. If VPM Lite is updating very slowly, especially with large images, it might help to increase this delay, although this will slow the trigger rate.

- **Auto-trigger When Online**

If this is checked, automatic triggers will start when the camera or Emulator goes Online and stop when it goes Offline. The Start/Stop Auto-trigger button is disabled. No other Start/Stop control is available.

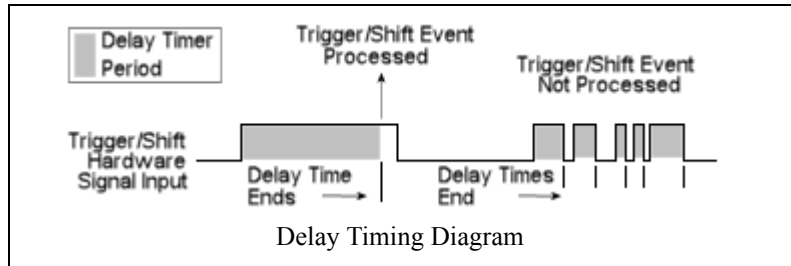
Trigger Input Debounce

Here you can define the debounce time for the camera trigger signal. Debounce determines the maximum trigger rate the system will allow (basically like a governor on an engine) to help prevent negative effects from noise and high frequency bursts. The debounce setting must be able to filter out noise while not introducing any unnecessary delays.

- **Delay**

The debounce timer starts when the signal's active edge is detected, and stops when the opposite edge is detected. The input must remain active for the delay amount of time for the event to be triggered. Delay is good for filtering random noise on the input, but delay makes the time between the input signal's edge and system triggering speed-dependent, especially on high-speed inspections. Use a Delay

time that is long enough to filter out the worst expected noise, but short enough to accommodate your fastest inspection times.



- **Holdoff:** See “Input Debounce” on page 2-5.

Partial Scan Tab

The values for the left, right, top, and bottom edges control the maximum vertical and horizontal line numbers scanned by the camera. Use this setting to decrease the image area scanned and increase the inspection speed. The range of acceptable values is determined by the camera type.

If you want to use partial scanning on an image, you should calibrate the entire image first and then set the partial scan parameters.

For partial scan images, the image coordinates of 0,0 correspond to the sensor pixel coordinates 0,0. This means that, when the image is partially scanned from the left or top, the upper left image pixel coordinate becomes the top left partial scan setting. The image above and to the left of the partial scan setting will not be displayed in the image window.

- **Scan Lines to Overlap**

This property indicates the number of scan lines to copy from the bottom of the previous image and add to the top of the current image. As a result of the overlap, the resultant image is this number of lines taller than the Partial Scan setting used by the camera.

For example, if a camera with 480 lines has an Overlap value of 100, the resultant image delivered to the vision program will be 580 lines, with the top 100 lines copied from the previous image and the remaining 480 lines from the camera sensor.

One primary application is inspection of a moving part, such as a web, that requires multiple images. If an interesting object, such as a defect, falls in the area where one image ends and the next image begins, the object can not be fully seen in either image. By setting the overlap setting to the maximum height of the object of interest, the entire object at the top of the second image will be visible.

This property can be used when analyzing results. For example, smaller objects may get duplicated at the bottom of the previous image and the top of the current image, so you can recognize that the position of the object is in the overlap and avoid counting it twice.

The maximum value for this property is equal to the height of the camera image.

The overlap area is expressed in scan lines, not calibrated units.

The overlap feature only works for vertical overlap, not horizontal overlap.

The overlap feature is not currently compatible with lens distortion calibration. It is compatible with pixel size calibration.

Color Tab

This tab is enabled only when a color camera is being used. Impact software uses a 3x3 bilinear interpolation to convert the incomplete color imager output to a usable color image.

White Balance

If you are using a color camera, you can apply automatic white balance correction which calculates the proper red and blue pixel gains needed to provide an accurate color image, or you can manually enter values for the red and blue pixel gains. Default gain settings are determined by the camera type (and Illuminator type for the P-Series).

To automatically adjust the white balance:

1. Point the camera at a uniformly white or grey object or image. Be sure the image is well-lit and not too bright. Errors are returned if any of the color channels are saturated (the gain is greater than 100%).
2. Adjust the purple rectangular ROI so that it covers only a white or grey area of the image.
3. Click "Auto." The camera automatically calculates the proper red and blue gain values to bring all three colors into balance.

How White Balance Works

Datalogic's color cameras have two stages of gain, the overall gain (set with the Gain slider on the General tab), and a gain for the red and blue pixels.

When you click the Auto button, the average value is calculated for the red, green, and blue pixels. The red gain is computed as the average green pixel value divided by the average red pixel value. The blue gain is computed as the average green pixel value divided by the average blue pixel value. Errors are returned if any of the color channels are saturated (the gain is greater than 100%) or if the computed red or blue gain is outside of the range supported by the camera.

The red and blue gain values are applied to the camera after they are entered manually or calculated by clicking the Auto button.

First, the overall gain is applied to all pixels, then the red gain is applied to the red pixels and, finally, the blue gain is applied to the blue pixels. This means that only the overall gain is applied to the green pixels. Red pixel gain is overall gain times the red gain and blue pixels gain is overall gain times the blue gain. In all cases 100% gain equals unity gain.

Illuminator Tab (P-Series Cameras Only)

Mode

The Mode sets the Internal Illuminator's permitted Shutter Speed range and enables or disables the Lighting Chain settings.

| Mode | Shutter Speed Range (microseconds) |
|----------|------------------------------------|
| Disabled | 10, 1000000 |
| Normal | 100, 3300 |
| Power | 1, 500 |

Shutter

This is the amount of time the shutter is open. The higher the number, the longer the shutter is open and the brighter the image. The Mode type affects the Shutter range limits.

Model

This box contains the model number of the Internal Illuminator mounted on the camera, and the number of Lighting Chains that the Illuminator contains.

Lighting Chains

If the Illuminator contains multiple chains, this box configures the number of LEDs that will be enabled.

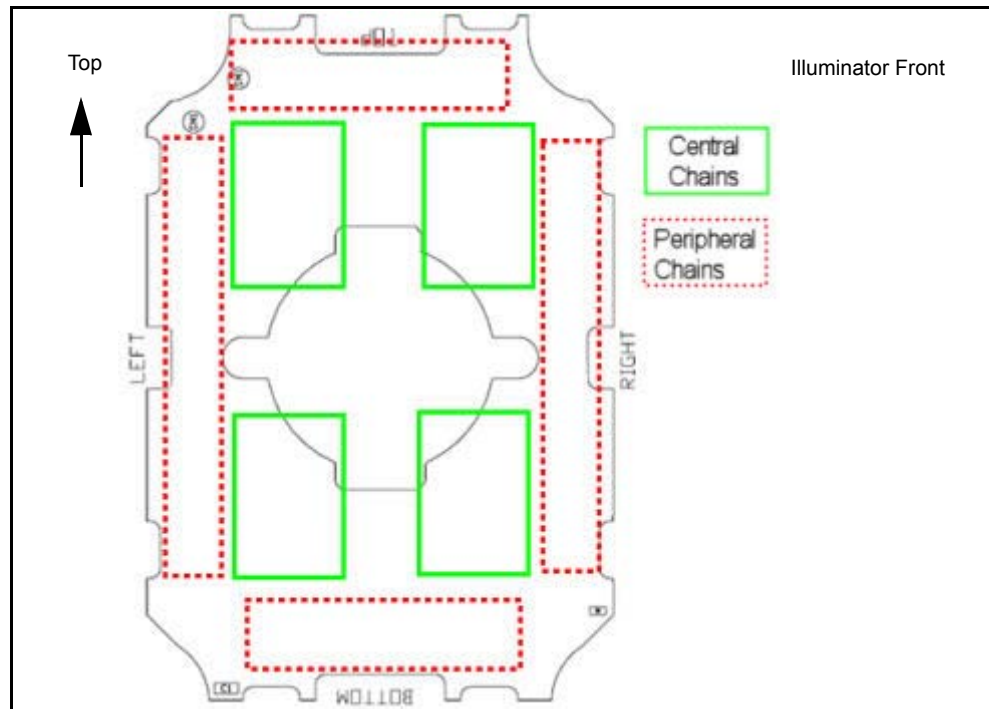
- **Chains Enabled**

Peripheral: The four LEDs around the edge of the Illuminator can be enabled (top, bottom, left, right).

Central: The four LEDs in the central part of the Illuminator can be enabled (top/left, top/right, bottom/left, bottom/right).

- **LEDs Enabled**

If a check box is checked, the LEDs in those areas of the illuminator will fire when the camera is triggered. The choices are based on the Chains Enabled setting.



Set to Defaults Button

Clicking this button restores all camera settings to their factory defaults. Default settings are determined by the camera type.

Calibration Panel

NOTE: Access to functions on this tab may be limited based on the user's access level and while the camera is online.

A camera will require calibration the very first time you use it, when the camera-to-subject distance is changed, when a new camera is connected, or if the lens is changed. Calibration insures that the measurements indicated in tools accurately relate the inspected object's measurements. You may calibrate a camera using a calibrated target or enter the camera's units-per-pixel factor manually.

If you want to use partial scanning on an image, you must calibrate the entire image first and then set the partial scan parameters.

NOTE: For details about how to set up calibration and how it works, see “Camera Calibration Technical Details” on page 4-51.

Snap

Click the Snap button to acquire and display an image in the image window. You can use this to see how camera settings affect the image, or to position objects within the camera’s field of view. The acquired image is also displayed in the image display area of the Design and Display Modes.

NOTE: Clicking the Trigger Once button in the Summary Table buttons toolbar will not acquire a new image for this image display.

Live

Click the Live button to continuously acquire images and display images in the image window until you click the Snap or Live buttons. You can use this to see how camera settings affect the image, or to position objects within the camera’s field of view. The acquired image is also displayed in the image display area of the Design and Display Modes.

NOTE: Clicking the Trigger Continuously button in the Summary Table buttons toolbar will not acquire a new image for this image display.

Image Source

The type of camera currently acquiring images.

Frames per Second

This field indicates the number of frames the camera can capture and process per second. It is calculated based on the current Shutter Open Time, Partial Scan line and Half Resolution Mode settings.

(MX-U Series Only) The total processor-to-camera bandwidth is 600 Megapixels per second. Each connected camera shares this bandwidth. For example, if two cameras are connected, each camera can use up to a maximum of 300 Megapixels per second. For four cameras, each camera can use up to a maximum of 150 Megapixels per second. This means that both the camera resolution and the number of connected cameras can affect the fps value for each connected camera.

Set To Defaults

Click this button to restore all camera settings to their factory defaults.

Calibrate

Click this button to calibrate the camera when the desired image is displayed in the image window and all calibration settings are complete. You can use the Snap button or Load Image button to acquire an image.

Load Image

Click this button to load a file image into the image display window. You can calibrate the camera using this image and the image is displayed in the task image window.

Pixel Size Only

Use the distance between two points on the image to calculate the image scale, or enter the scale value. This type of calibration does not correct lens or perspective distortion. (See “Units per Pixel” on page 4-52.)

Two Points

Calibration with two points provides an ROI you can position to indicate beginning and ending calibration points on the image, or you can manually enter the point coordinates.

Two Points Settings

- **Target Length (units):** The distance in real-world units between the points into the Target Length field (e.g. if the distance is 100 mm, enter 100 in the field).
- **Points Table:** This table contains the X and Y coordinates of the beginning and ending points of the line ROI drawn in the image.
- **Calibration Error:** See “Calibration Errors” on page 4-53.

To calibrate with Two Points using the ROI

1. Select the Pixel Size Only tab.
2. Select the Two Points radio button.
3. Snap the desired image so it appears in the image window. A line ROI is placed on the image. Move and size the line until it stretches between two points with a known distance between them.
4. Enter a value in the Target Length field.
5. Click the Calibrate button. The calibration results are displayed at the bottom of the Settings and the Current Calibration areas (see page 4-52).

To calibrate with Two Points using entered coordinates

1. Select the Pixel Size Only tab.
2. Select the Two Points radio button.
3. Double-click on a field in the endpoint coordinates table and enter the X and Y endpoint coordinate for each of the two points.
4. Enter a value in the Target Length field.
5. Click the Calibrate button. The calibration results are displayed at the bottom of the Settings and the Current Calibration areas (see page 4-52).

Manual

Use this option when you know the image scale.

Manual Points Settings

- **Units per Pixel:** See “Units per Pixel” on page 4-52.
- **Calibration Error:** See “Calibration Errors” on page 4-53.

To calibrate manually

1. Select the Pixel Size Only tab.
2. Select the Manual radio button.
3. Click in the Units per Pixel field and enter the value.
4. Click the Calibrate button. The calibration results are displayed at the bottom of the Settings and the Current Calibration areas (see page 4-52).

Target

Use this option when you have a calibration target with a hexagonal, grid, or checkerboard pattern. Also see “Target Calibration” on page 4-52.

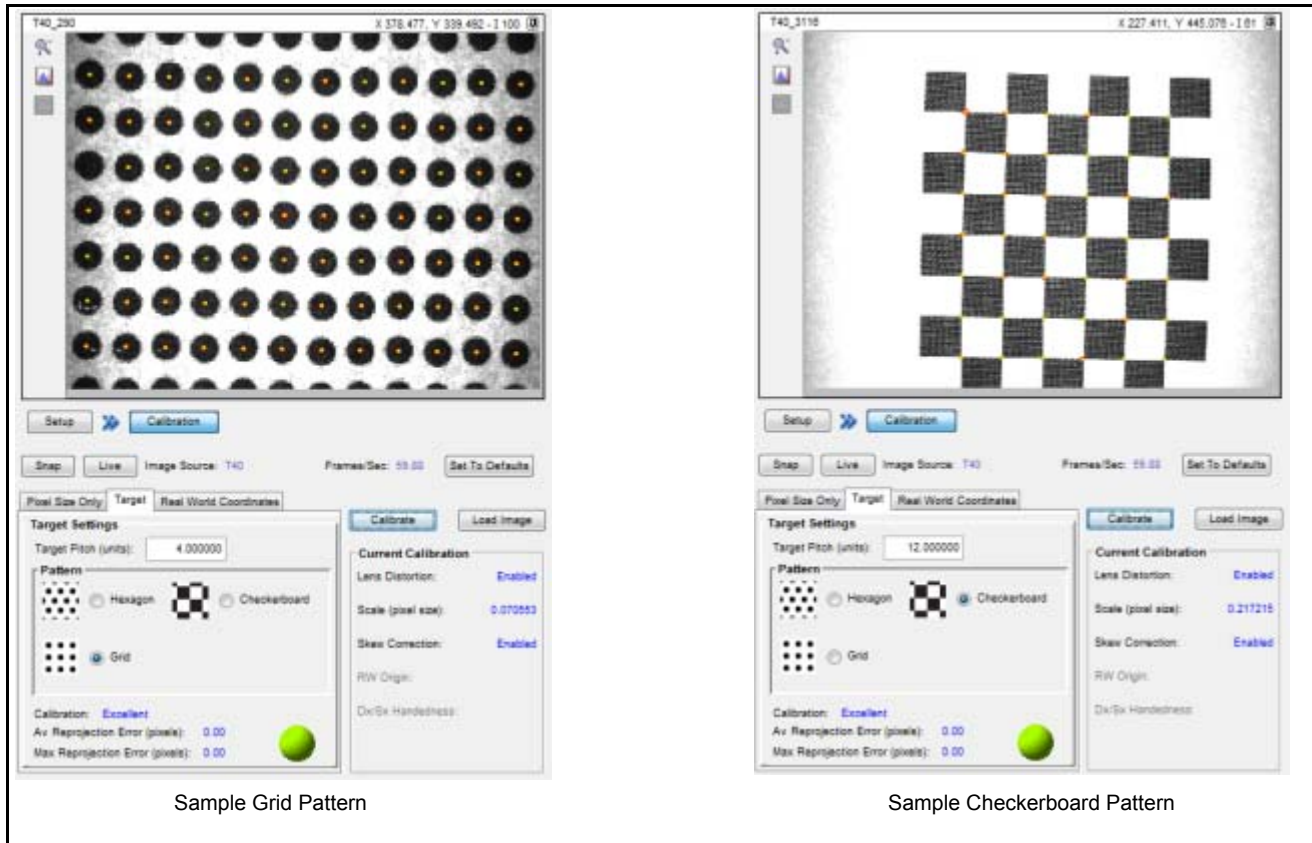
Target Settings

- **Target Pitch (units)**
This is the real-world distance between dots on the calibration target. It is independent of the units (e.g. millimeters, inches, centimeters).
- **Pattern**
You can use a target that is laid out in a hexagonal, grid, or checkerboard pattern. The small sample images show the different types. For Hexagon and Grid targets, the dots must be a minimum of twenty pixels in diameter spaced twenty pixels apart.
Checkerboard Pattern
Each square must be a minimum of fifteen pixels. The black squares must touch each other at one corner point, with no overlapping. The pattern must be at least four columns by four rows.
- **Calibration Error:** See “Calibration Errors” on page 4-53.

To Calibrate from a target

1. Select the Target tab.
2. Select the desired target radio button.
3. Place the calibration target in front of the camera.
4. Click the Live button. Move the target so that the center of the image corresponds to the center of the lens (optical axis) as much as possible.
5. **Hexagon or Grid Pattern**
Be sure that the target is well-lit but not saturated. Place the target in the camera’s field of view (FOV). Focus the camera so that the target dots are clear and sharp.
Checkerboard Pattern
Be sure that the target is well-lit. Place the target in the camera’s field of view (FOV). Focus the cam-

era so that the squares are clear and sharp with high contrast. Increase the exposure so that the white squares are saturated.



6. Click the Snap button.
7. Type the pitch measurement into the Target Pitch (units) field. The pitch is the distance between each calibration object. Calibration targets have a known pitch.
8. Click the Calibrate button. The calibration results are displayed at the bottom of the Target Settings area and in the Current Calibration area (see page 4-52).

Real World Coordinates

Use this option when you have a calibration target with at least four points. You can generate points from the target, then enter corresponding real-world point coordinates to transform left-handed or right-handed coordinate systems.

Real World Point Management

- **Generate Points**

Click this button to generate point coordinates to fill the Image X and Image Y sections of the point table.

- **Point Table**

The Image X and Image Y coordinates are generated when the Generate Points button is clicked. The coordinates are derived from the centroid of blobs found on the image.

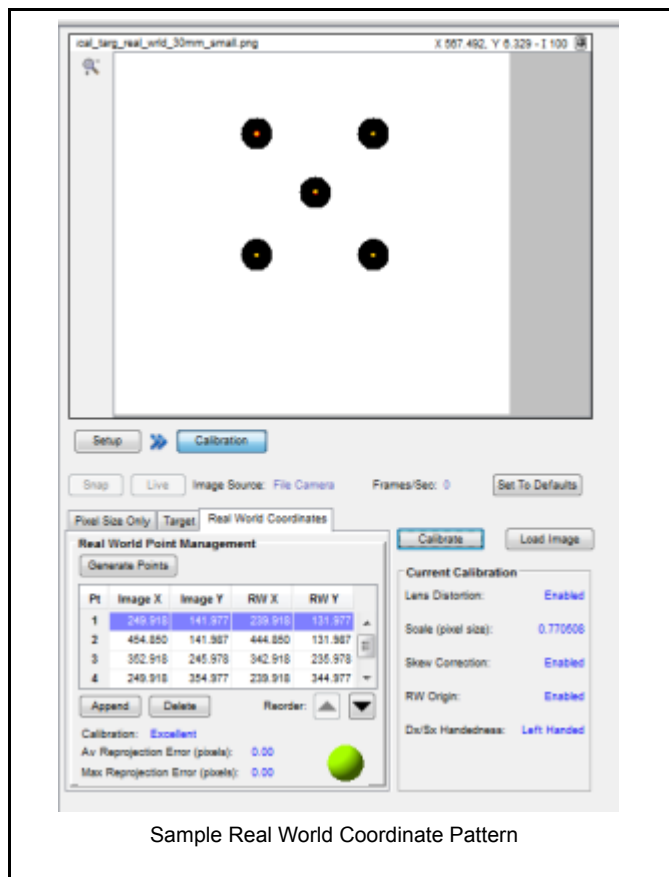
- **Append**

Click to append a pair of points to the point table.

- **Delete**
Click to delete a pair of points from the point table.
- **Reorder**
Select a row from the point table, then click the appropriate arrow to move the row up or down. This operation only reorders the Image X and Image Y coordinates.

To Calibrate using Real World Coordinates

1. Select the Real World Coordinates tab.
2. Place the calibration target in front of the camera. The target must contain at least four points.
3. Click the Live button. Move the target so that the center of the image corresponds to the center of the lens (optical axis) as much as possible.
4. Be sure that the target is well-lit but not saturated. Place the target in the camera's field of view (FOV). Focus the camera so that the target dots are clear and sharp.



5. Click the Snap button.
6. Click the Generate Points button. The coordinates of centroid points of blobs found on the image are automatically entered in the Image X and Image Y columns of the table.
7. In the RW X and RW Y columns, enter the real-world coordinates of the corresponding Image X and Image Y coordinates.
8. Click the Calibrate button. The points indicated by the RW X and RW y coordinates are drawn on the image.
9. The calibration results are displayed at the bottom of the Real World Point Management area and in the Current Calibration area (see page 4-52).

File Camera



The File Camera system object accesses the camera's system memory where file images are stored.

NOTE: Access to functions on this tab may be limited based on a user's access level and while the camera is online.

This panel lets you configure a camera to work with saved images. Previously captured images in PNG format can be selected in the File Camera tab, then the Active selected images are displayed in the image window when the camera is triggered. The following section describes each of the tab parameters in detail.

File Camera mode and the Emulator function the same, except that images are stored on the client PC when you use the Emulator. In File Camera mode, images are stored in the camera's compact flash memory.

When File Camera mode is enabled, the camera will not acquire live images, but it will use the images in the RAM Images Active list as though they were acquired live. To enable File Camera mode, click the File Camera/Camera button. See "File Camera or Camera" on page 3-8.

Available File Images

The images listed in the Available list are stored in the camera's compact flash memory and are available to be copied to the Active Images list. When you select an image in the list, it is displayed in the Image Window.

To add an image to the Available list:

1. Click Add.
2. In the Locate Image dialog, navigate to the directory that contains the image you want to use and select it. Images with a name greater than 44 characters cannot be added to the list.

Tip: If you select an image format other than .png, it is automatically converted to png format when it is added to the list.

3. Click Add. (Images are saved, by default, in the Root/Images folder in the default installation location.) The image is also automatically added to the Active list in RAM Images.

To remove an image from the Available list:

1. Select the desired image.
2. Click Remove.

Tip: To save images from the camera to the client PC, click the File Manager system object, open the camera's Root folder, open the Images folder, then copy the desired images to a client folder. To save a displayed image, click the Save Image button in the image display area.

Active Images

Images listed in the Active list are in the camera's RAM and available for processing. These images are displayed in a repeating list in order from top to bottom when the camera is triggered or when the Snap or Live button is pressed on anywhere in the Settings Tab or in a tool. When you select an image in the list, it is displayed in the Image Window.

To add an image to the Active list

1. Select the desired image in the Compact Flash Images Available list.

2. Click the Activate arrow in the space between the lists.
3. To change the order of the image in the list, if necessary, click the Reorder arrows below the list.

To remove an image from the list

1. Select the desired image in the list.
2. Click the Deactivate arrow in the space between the lists.

System Log



The System Log system object is used to view and save the System Log. Events in the System log are time and date stamped and stored on the camera or Emulator. This object has an additional General property named Log Entries that is a String List containing all the system log events.

NOTE: Access to functions on this tab may be limited while the camera is online.

Archive Log

On P-Series cameras, the System Log is stored on the camera. If the camera loses power for an extended period of time, existing system log events are lost unless you archive them first.

To Archive System Log Events:

Overwrite an Existing File

1. Click Archive Log to archive System Log Events to the default file displayed in the File field. An existing file with the same name can be overwritten.

Archive to a new file

1. Click Browse.
2. Navigate to the desired folder.
3. Enter a new file name. IMPORTANT: File names are case sensitive.
4. Click Open.
5. Click Archive Log.

Event

The events are sorted in ascending time order and contain information about the camera or Emulator and the task such as system events and failures. See “Trouble Diagnosis” on page 4-55 for more details about system errors.

Clear

Click Clear to clear all the events in the system log.

Refresh

Click Refresh to update the list of events.

File Manager



The File Manager lists and manipulates files that are in the camera's flash memory or the Emulator. You can use this tab to copy files between cameras and other network devices, including client computers.

NOTE: Access to functions on this tab may be limited while the camera is online.

Display Mode Program Filter

Programs that contain this name appear on the Display Modes's File Load drop down list. See "Filtered Vision Programs" on page 3-21.

Refresh

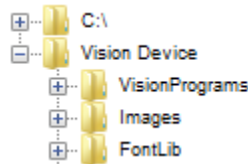
Click to refresh the list of files.

Select All

Click to select all the files listed.

Folder List

The left pane of the tab shows the folders on the client computer and the camera or Emulator.



WARNING: The files in the camera or Emulator's Root folder are important system files. The camera or Emulator may fail to operate correctly if these files are modified or deleted.

- **Vision Device:** The camera or Emulator's operating system and firmware files. Do not put more than thirty two files in the root directory or the install may fail.
- **VisionPrograms:** Datalogic and user-created vision programs
- **Images:** contains images stored on the camera or on the Emulator PC. To backup images, copy them from this folder to a folder on the client PC. To add images, copy them into this folder using the File Manager. Images with a name greater than 44 characters cannot be used by the file camera.
- **FontLib:** OCR tool Font Data files

File List

To select a file from the list, click on the file name in the list. To select multiple files, hold down the Ctrl key and click each file. If a file that is pasted into the Vision Programs folder is already loaded on the Impact camera or Emulator, the new file is automatically loaded in place of it.

Cut or Delete a File

1. Select the desired file(s)
2. Use the Cut or Delete button on the main tool bar.

To Copy and Paste a File

1. Select the desired file(s)
2. Use the Copy and Paste buttons on the main tool bar or click the file and drag it to the desired folder.

The right pane of the tab shows the files in the folder that is selected in the left pane. Click on the respective header to sort the files by name, size, or date modified. The small arrow on the header indicates the sort order. Not all headers are displayed for all folders.

- **File Name**

Vision program files have a .vp extension. Each vision program file must have a unique name. **IMPORTANT:** File names are case sensitive.

- **Vision Program Name**

This column is displayed only when the Vision Programs folder is selected. It shows the name of the vision program within the vision program file. Vision Programs are created with Vision Program Manager. Multiple vision programs can have the same name. Links are made from control panels to a vision program. **IMPORTANT:** Program names are case sensitive.

- **Size, Modified**

Shows the size in kilobytes and the date the file was modified.

- **Load/Unload**

This column is displayed only when the Vision Programs folder is selected. When this box is checked, the indicated vision program is immediately loaded in the camera or Emulator. When the box is unchecked, the file is unloaded. Loaded programs can be edited in Vision Program Manager and are queued to run if they are triggered when the camera or Emulator is online.

- **Load On Startup**

This column is displayed only when the Vision Programs folder is selected. When this box is checked, the indicated vision program is loaded into the camera or Emulator when it restarts. Loaded programs can be edited in Vision Program Manager and can run when the camera or Emulator is online.

| File Name ▲ | Program Name | Size | Modified | Load/Unload | Load On Startup |
|-----------------|--------------|--------|---------------------|-------------------------------------|-------------------------------------|
| Blobs.vp | Blobs | 337 KB | 02/20/2003 02:21 PM | <input type="checkbox"/> | <input type="checkbox"/> |
| Measurements.vp | Measurements | 373 KB | 02/20/2003 02:21 PM | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Locates.vp | Locates | 815 KB | 02/20/2003 02:21 PM | <input type="checkbox"/> | <input type="checkbox"/> |
| Helper_Tools.vp | Helper_Tools | 317 KB | 02/20/2003 02:21 PM | <input type="checkbox"/> | <input type="checkbox"/> |

Restoring vision program files

To restore vision program files from the client to the camera or Emulator:

1. Connect to the desired camera or Emulator.
2. Click Settings Tab - File Manager - Setup.
3. Open the folder on the client drive that contains the file to be restored.
4. Click the file to be restored to select it.
5. Click the Copy button.
6. Click the plus sign to the left of the Vision Device folder to open it.
7. Click the VisionPrograms folder.
8. Click the Paste button.
9. The file is pasted into the VisionPrograms folder.
10. If you want the file to be loaded on the camera or Emulator, check the Load/Unload check box.

Vision Program Manager Lite

Introduction

This chapter describes how to set up an inspection task, including an overview of Vision Program Manager Lite (VPM Lite) tools and how to configure them.

If you are using a camera, it should be calibrated before you set up an inspection task so that inspection measurements are accurate. See “Camera” on page 2-11 for camera calibration details. Also be sure that the camera and lighting are connected and adjusted appropriately. The client computer must be connected to the Impact camera with both powered on. If you are using the file camera or Emulator, be sure the desired images are active in RAM (see “File Camera” on page 2-23).

When you have completed the inspection task, you can view the results in the Display Mode.

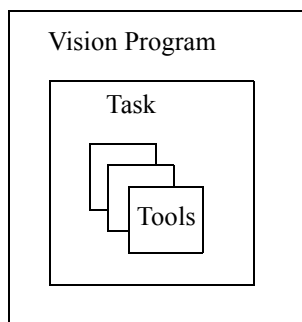
Start VPM Lite

To start VPM Lite:

1. Double-click the VPM Lite shortcut on the desktop.
 2. When VPM Lite starts, it automatically scans for Impact cameras and Vision Devices on the client’s network and displays the Vision Device Selection list. VPM Lite will connect only to P-Series cameras. If the desired camera or Vision Device doesn’t appear in the list, click Refresh. If it still doesn’t appear, check the camera’s power and Ethernet connections.
- **Vision Devices found**
This list displays the names, IP addresses, and other information about the cameras and Vision Devices connected to the client network. Click the Refresh button to update the list. Cameras other than the P-Series will display as “Not Supported.”
 - **Connect to Vision Device**
Select the desired camera or Emulator, then click Connect. (See “How Impact Software Connecting Works” on page 1-5.) If security is enabled, the User Logon dialog is displayed. When a valid User ID and password have been entered, VPM Lite tries to connect to the camera or Emulator. If it is unsuccessful, a “connection failed” dialog is displayed. Multiple users can connect to one camera or Emulator, but only one user at a time can edit programs or change data on it.
 - **Edit IP Address...**
To change the IP address of the selected camera or Vision Device click this button. When the Edit IP Address dialog is displayed, enter the new IP Address, and Mask. See “IP Address, IP Gateway, and IP Mask” on page 2-1 for more details.

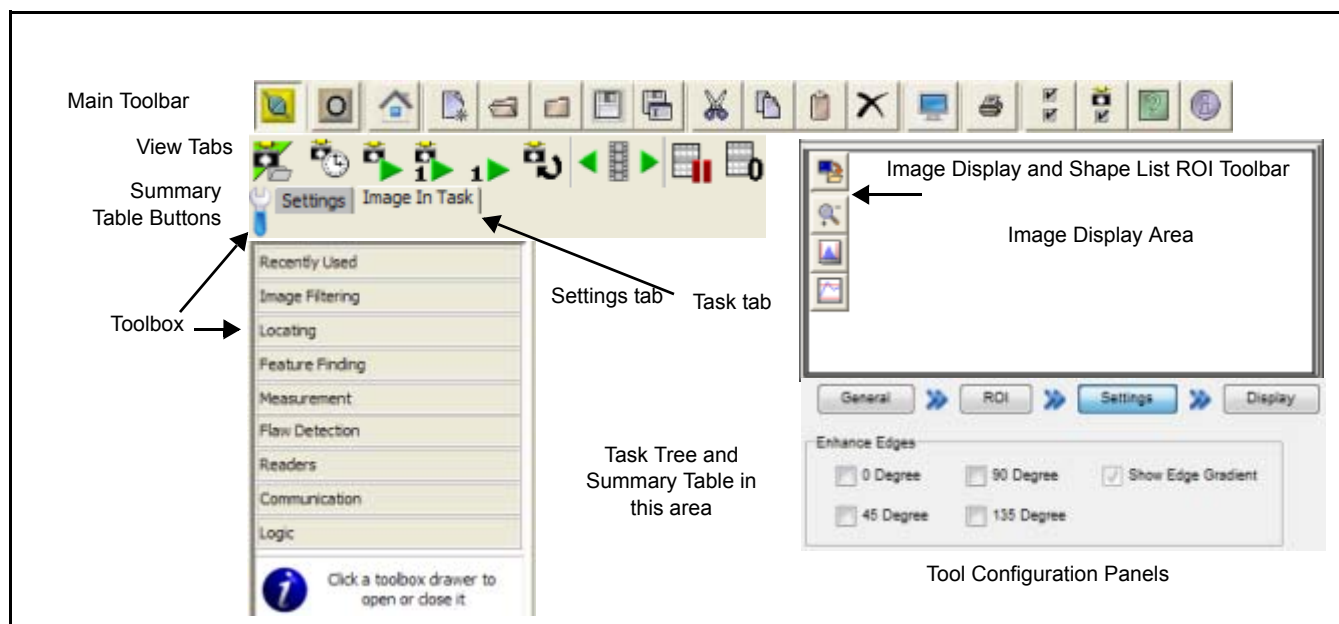
An Overview

VPM Lite is used to develop vision inspection programs. These programs can contain one task which is built from a variety of tools. This diagram shows the elements of a simple vision program.



User Interface

These are the primary areas in the interface. Each of these areas is explained in the following sections.



Icons






























Icons are used throughout Impact software. In some cases the icon is informative, in others it indicates a button that performs an action when you click it. This list of icons (sorted alphabetically by tool tip) shows the tool tip and a cross reference to the icon's meaning. Each tool and system object also has a tool tip. Tools are explained starting on page 3-25.





















About VPM Lite - See "About VPM Lite" on page 3-8.



Camera Preferences - See "Camera Preferences" on page 3-7.

-  Connect to Vision Device - See “Connect to a Vision Device” on page 3-4.
-  Copy - See “Copy” on page 3-6.
-  Currently online/offline - See “Online/Offline” on page 3-5.
-  Currently using File Camera/Camera - This button is disabled when you are connected to an Emulator. See “Camera” on page 2-11 for setting up a camera. See “File Camera” on page 2-23 for setting up a file camera.
-  Cut - See “Cut” on page 3-6.
-  Delete (Links) - See “To delete a link” on page 3-23.
-  Delete Selected Items - See “Delete Selected Items” on page 3-6.
-  Delete All Character Models - (OCR tool) See “OCR” on page 3-84.
-  Delete Character Model - (OCR tool) See “OCR” on page 3-84.
-  Design Mode - This switches the view to Design Mode. See “Design Mode” on page 3-21.
-  Display Mode - This switches the view to Display Mode. See “Display Mode” on page 3-19.
-  Float Image Display - See “To float the Image Display Area” on page 3-13.
-  Help - See “Help” on page 3-8.
-  Histogram - See “Display Area Toolbar” on page 3-14.
-  Home - Returns focus to the Settings tab in Design Mode. See “Settings Tab” on page 2-1.
-  Image History - See “Summary Table Buttons” on page 3-8.
-  Inspection - See “Create a Vision Program” on page 3-23.
-  Line Profile - See “Display Area Toolbar” on page 3-14.
-  Link - (Links) See “Linking” on page 3-21.
-  Live Images - See “Live Images” on page 3-9.
-  Load - See “Load” on page 3-5.
-  New - See “New” on page 3-5.
-  Paste - See “Paste” on page 3-6.
-  Pause Summary Table - See “Pause Summary Table” on page 3-9.
-  Print Options - See “Print Options” on page 3-6.
-  Program Preferences - See “Program Preferences” on page 3-6.
-  Reset Run Counts - See “Reset Run Counts” on page 3-9.
-  ROI property colors - For any tool with an ROI, these colors next to the Input or Output property indicate the color of the ROI on the image display. Click the property to select the ROI.
-  Run Once on Current Image - See “Run Once on Current Image” on page 3-9.
-  Save - See “Save” on page 3-5.
-  Save As - See “Save As” on page 3-5.

-  Save Image - See “Display Area Toolbar” on page 3-14.
-  Show/Hide Tools - See “Toolbox” on page 3-8.
-  Show Summary Table buttons - See “Show Tools” on page 3-9.
-  Start/Stop Auto-trigger - See “Frame Trigger Tab” on page 2-13.
-  Start/Stop Continuous Trigger - See “Start/Stop Continuous Trigger” on page 3-9.
-  Task - See “Create a Task” on page 3-24.
-  Tip - This icon indicates helpful text or a guide for what to do next.
-  Tool branch - See “Pass Fail” on page 3-104.
-  Tool Case - See “String Builder” on page 3-105.
-  Trigger Once - See “Trigger Once” on page 3-9.
-  Unload - See “Unload” on page 3-5.
-  View Threshold - See “Threshold Viewer” on page 4-22.
-  Zoom Character Models - (OCR tool) See “OCR” on page 3-84.
-  Zoom Character Models to 100% - (OCR tool) See “OCR” on page 3-84.
-  Zoom Image - See “Display Area Toolbar” on page 3-14.
-  Zoom Image to 100% - See “Display Area Toolbar” on page 3-14.
-  Zoom Image to Fit All ROIs - See “Display Area Toolbar” on page 3-14.
-  Zoom Image to Fit View Area - See “Display Area Toolbar” on page 3-14.

Main Toolbar

Use the main toolbar tools to work with vision programs, tools, the task, and Vision Devices.



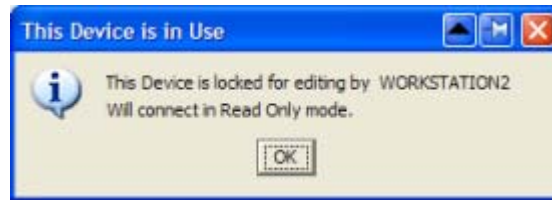
Connect to a Vision Device

Click the Connect button to connect to a Vision Device or Emulator. (See “Choose a Vision Device or Emulator” on page 1-2 and “How Impact Software Connecting Works” on page 1-5 for more details.) When you are connected to a Vision Device or Emulator, the button changes to the Disconnect button. If you close VPM Lite while you are connected to a Vision Device or Emulator, you see the following prompt. If you click Yes, VPM Lite automatically reconnects to that Vision Device or Emulator the next time VPM Lite starts. If you click No, the Device Connect dialog is displayed the next time VPM Lite starts.



Editing a vision program from multiple VPM Lite instances

The first VPM Lite instance to connect to a Vision Device or Emulator acquires exclusive editing privileges on it. When a second VPM Lite instance connects to that Vision Device or Emulator, it automatically enters Display mode and cannot modify any vision programs. The following dialog is displayed. (WORKSTATION2 is the network name of the computer running the currently connected VPM Lite instance.)



Online/Offline

Click this button to toggle the Vision Device or Emulator online and offline. When the Vision Device or Emulator is online (the switch is labeled “1” and is colored yellow), it accepts triggers. Any task that is loaded is executed when it is triggered by its selected trigger events. If you try to exit VPM Lite while the Vision Device or Emulator is online, and there are unsaved changes in the vision program file, a warning dialog is displayed.

When the Vision Device or Emulator is offline (the switch is labeled “0” and is colored grey), the task that is loaded remains loaded, but the Vision Device or Emulator does not accept hardware triggers and VPM Lite stops generating software triggers.



Home

Returns focus to the Settings tab in Design Mode. See “Settings Tab” on page 2-1.



New

This creates a new vision program and adds it to the vision program list. A vision program may contain only one task. See “Create a Vision Program” on page 3-23 for details.



Load

This opens a browser dialog so you can open (load) an existing vision program and make it ready to edit or run. Vision programs are stored on the camera (P-Series) or client PC (Emulator). They may also be loaded from Settings - File Manager - Setup.



Unload

This closes the currently selected vision program and unloads it. It remains stored in the camera’s memory.



Save

This saves the currently open vision program while it remains loaded. You can see a list of all the vision programs (loaded and unloaded) from Settings Tab - File Manager - Setup. This button is disabled if the file is password protected. If you try to exit VPM Lite while the Vision Device or Emulator is online and there are unsaved changes in the vision program file, a warning dialog is displayed.



Save As

This saves the currently open vision program with a new name.



Cut

This cuts the selected tool or file to the system clipboard. The selected tool or file is deleted. This button is disabled if the vision program file is password protected.



Copy

This copies the selected tool or file to the system clipboard. This button is disabled if the vision program file is password protected.



Paste

This pastes a tool or file from the system clipboard. A tool is pasted to a position below the currently selected tool in the task tree. A file is pasted into the selected directory. See “Paste Linked Tools” on page 3-22 for information about pasting linked tools. This button is disabled if the vision program file is password protected.



Delete Selected Items

This deletes the selected tool, file, or task. To delete a vision program file, see “File Manager” on page 2-25.



Display Mode

This switches the view to Display Mode. See “Display Mode” on page 3-19



Print Options

- **Print**
This prints a formatted, expanded list of all properties and values in the currently selected vision program, task, or tool. This button is disabled if the file is password protected.
- **Print preview**
This displays a preview of a formatted, expanded list of all properties and values in the currently selected vision program, task, or tool. This button is disabled if the file is password protected.
- **Print to text file**
This prints an expanded list of all properties and values in the currently selected vision program, task, or tool to a text file. This button is disabled if the file is password protected.



- **Print Settings Files**
(displayed only when Settings-General-General Panel is selected) This prints the values in the Settings Files currently selected in the Settings Files dialog (Camera Calibration and/or Device Settings). This button is disabled if the file is password protected.
- **Print Settings Files Preview**
(displayed only when Settings-General-General Panel is selected) This displays a preview of the values in the Settings Files currently selected in the Settings Files dialog (Camera Calibration and/or Device Settings). This button is disabled if the file is password protected.



Program Preferences

NOTE: There are additional preference settings when you are in Display Mode. See “On-Screen Keyboard” on page 4-32.

- **Automatically link tool image input:** When new tools are added to the vision tree, that tool's input image is automatically linked to the task's image. See "Automatic Image Linking" on page 3-22 for more details.
- **Automatically link tool origin input:** When new tools are added to the vision tree, that tool's origin is automatically linked to the output of the closest tool above it in the task tree that has an Origin output. See "Automatic Origin Linking" on page 3-22 for more details.
- **Use small icons:** Small program and tool icons are displayed.
- **Save compressed vision program files:** Compresses the vision program file into a smaller file when it is saved. Compressed files load and transfer faster.
- **Show Tool Tips on image:** VPM Lite displays tooltips when the mouse is held over the image (e.g. x, y position; ROI position and angle).
- **Text Size:** If default is selected, VPM Lite uses Window's default text size for all displayed text. If Custom is selected, you can enter the font size you want to use. If you are using VPM Lite with a non-English translation file, we recommend that you use the default size (11).
- **Enable On-screen Keyboard** (Note: this setting is only available when you select Display Mode.) If this is selected, an on-screen keyboard is made available for entering text and numbers. See "Configure the On-Screen Keyboard" on page 4-32.



Camera Preferences

- **Display Refresh Rate:** The rate at which the Summary Table and Display Mode values are refreshed while VPM Lite is in Start/Stop Continuous Trigger mode or online. If the system is online, this setting affects only the refresh rate, not the trigger rate.
- **Display Refresh Timeout:** Occasionally communication timeouts can cause VPM Lite to stop refreshing the Summary Table and Display Mode values. The timeout value can be too short for the amount of information being gathered for display and/or the Impact camera is being triggered at a rate that does not allow it to return information to VPM Lite. If a timeout occurs after three consecutive attempts, a warning is displayed indicating that you should increase this setting. You should adjust this timeout value only after you have received this warning.
The timeout can be adjusted from one to thirty seconds; each mark on the scale represents approximately three seconds.
- **Auto Image History:**

NOTE: In high speed applications, some images may not be saved if saving them delays task execution. Determining factors can include the VPM Lite update rate, the camera's trigger rate, inspection speed, and task execution time.

In PC Memory: Images are stored in PC memory and can be accessed using the Image History button (see "Image History" on page 3-9).

Type: Select the type of image you want to save. Depending on the inspection speed and task processing time, some images may not be saved if saving them delays task execution.

Maximum Images: Enter the number of images to save (from two to twenty images depending on the image size and the amount of available PC memory).

IMPORTANT NOTE: You must use Continuous Trigger or the camera must be online and getting triggers for the Save to File function to save images.

Save to File: Images of the selected Type from the currently selected tool or task are saved when Start/Stop Continuous Trigger is selected or the Vision Device or Emulator is online and getting triggers.

Enable: If checked, VPM Lite saves the selected type of image to the indicated path. Images are saved as png file type. **NOTE:** You must also link the task's Pass/Fail status on the Task display panel (see

“Options panel” on page 3-18).

Type: Select the type of image you want to save. Depending on the inspection speed and task processing time, some images may not be saved if saving them delays task execution.

Path: You can use the default path, enter a different path, or click Browse to find a folder. The IP address of the currently selected Vision Device or Emulator is shown in the path field as the text <IP ADDRESS>.

For example, if you enter the path c:\image_directory\<IP ADDRESS>, the images are saved in the folder c:\image_directory\192.168.108.65 A folder is created if it does not exist.

Name/Passed Name/Failed Name: The name, with an appended image number count, is used as the saved image’s file name. **IMPORTANT:** File names are case sensitive.

Rollover at: Previously saved images are overwritten after this number of images has been saved.

Help



To access online Help, press the F1 key, or click the Help icon in the tool bar. Click the desired topic in the Table of Contents in the left pane of the Help window or type a topic in the search field.

About VPM Lite



Click this to display version, build, and translation file information about VPM Lite. Additional information may be displayed depending on the product.

Design Mode

Toolbox



Show/
Hide
toolbox

The toolbox contains all the vision programming tools. To show or hide the toolbox, click the toolbox Show/Hide button. To resize the toolbox, point to the right-side border then click and drag the border when the pointer becomes a double-headed arrow.

Tools are grouped in the Drawers according to common functions. To open or close a Toolbox Drawer (group), click the toolbox label. Choose the tool you want, then click and drag it to the Task Tree to add it. Only one Toolbox Drawer can be open at a time. Any Composite Tools you have added are displayed in self-named Drawers at the bottom of the Toolbox. The Recently Used Drawer contains the ten tools most recently used.

Details about each tool begin on page 3-25.

Summary Table Buttons

The Summary Table buttons control File Camera or Camera mode, task testing functions, and the Summary Table display.

The trigger buttons (except for Live Images) acquire an image which queues the task to run.



File Camera or Camera

Click this button to switch between File Camera and Camera mode. See “File Camera” on page 2-23 for details about the File Camera. See “Camera” on page 2-11 for details about Camera setup.

Start/Stop Auto-Trigger



Click this button to start and stop automatic triggers. When auto-triggering is on, software automatically triggers the camera or Emulator without hardware signals. For details about configuring Auto-triggering, see “Trigger On” on page 2-13.



Start/Stop Continuous Trigger

Click this button once to turn it on, click it again to turn it off. While it is on, images are acquired and the task with the Trigger Event type set to Image In Event runs continuously, based on the refresh rate set by the Summary Table Refresh Rate setting in Preferences. This button is disabled when the system is online, when you are promoting inputs and outputs, or when you are linking properties. When you click this button, the view automatically switches to Summary Table view and the Results Display replaces the Tool Properties tabs (see “Results Display” on page 3-11).



Trigger Once

Each time this button is clicked, an image is acquired and the task with the Trigger Event type set to Image In Event runs once. This button is disabled when the system is online, when you are promoting inputs and outputs, or when you are linking properties. When you click this button, the view automatically switches to Summary Table view.



Run Once on Current Image

When this button is clicked, the task that has its Image In Event set as its Trigger Event type runs once on the image currently in the image buffer. A new image is not acquired. This button is disabled when the system is online, when you are promoting inputs and outputs, or when you are linking properties.



Live Images

When this button is clicked, images are displayed as rapidly as possible. If a camera is connected to the Vision Device, images are acquired and displayed. If an Emulator is connected, or File Camera is selected, all the images in the file camera are displayed, one at a time. No task or tools are run in this mode.



Image History

You can save from two to twenty of the most recently acquired images in Image History (depending on the image size and the amount of available PC memory), then display them like any other acquired image. When you click the Run Once on Current Image button, the task runs on the historical image displayed. The number of images to save is set in Camera Preferences (see “Camera Preferences” on page 3-7).

Show Previous Image



Show Next Image

Choose an Image to Show



Pause Summary Table

Click this button to pause Summary Table value updates, including the image. If the system is online or the Start/Stop Continuous Trigger button is depressed, the task continues to run. This button is enabled only when the Start/Stop Continuous Trigger button is depressed or the system is online. (See “Start/Stop Continuous Trigger” on page 3-9)



Reset Run Counts

Click this button to set the values in the Summary Table’s Run Counts, Process Time, and Total Time columns to zero.



Show Tools

When the Image Display Window is resized, the row of Summary Table buttons is resized and some of the buttons can become hidden. Click this down arrow to display the hidden buttons.

Task Tabs



Display Task List

Click a tab to select the task or the Setting tab.

Summary Table

The Summary Table shows the results of all the tools that ran in the task.

| | Run Counts | Process Time | Total Time | Abort Cause |
|---------------|------------|--------------|------------|-------------|
| Inspection | | | | |
| Inspect Board | 2,182 | 1,920 | 2,063 | |
| Locate | 2,183 | 461 | | |
| Count Leads | 2,189 | 796 | | |
| Lead Width | 2,200 | 605 | | |

When the Vision Device or Emulator is online and triggering, or the Start/Stop Continuous Trigger button is pressed, the tool results are updated continuously in the table values area. When the Vision Device or Emulator stops triggering, or the Pause Summary Table button is pressed, the most recent tool results are shown. (See “Start/Stop Continuous Trigger” on page 3-9)

The table refresh rate is determined by the Summary Table Refresh Rate (See “Program Preferences” on page 3-6), the tools in the task, and the task size. Larger tasks, and more complex tools, take longer to run.

To adjust the width of each table column, click and drag the separator bar in the heading.

Summary Table Values

This area of the Summary Table shows the results of the task and each tool when it ran. If the outputs are not visible, click on the plus sign to the left of the tool or task.

The tool’s run status is indicated by different colors in the tool row.

- Yellow:** If a tool fails to complete execution, for example, it aborts because an ROI is off the image, the row is yellow. The reason for the failure is listed in the Abort Cause column.
- Red:** If a tool fails (its pass/fail output is false), the row is red.
- Grey:** If a tool runs with normal results, the row is grey.

NOTE: The task times listed here are intended only for relative time comparisons between tools and other task settings. The times differ for a Vision Device, Emulator, and camera.

- Run Counts**
This is the number of times the tool or task has run since the program was loaded or the Reset Task Run Count button was clicked.
- Process Time**

The time since the task or tool started running (in microseconds). This is a “live” value during the run because it is read during the run and updated to the current time. Once the task or tool finishes running, this time is locked to the time at which it finished. For the task, this is the time it took to run the all the tools in the task with some time added for data aggregation and evaluation at the task level.

- **Total Time**

The time since the hardware trigger at the camera started the image acquisition process (in microseconds). This is the “trigger to done” time, which includes exposure, acquire, image transfer to the PC, etc. This is a “live” value during the task run as it is read during the task run and updated to the current time. Once the task finishes running, this time is locked to the time at which the task finished. Note that the Process Time and Total Time are not necessarily equal, since there is some “overhead” time included in the Total Time.

- **Abort Cause**

If the tool aborts before completing its run, for example, if an ROI is off image, this column displays the reason.

Results Display

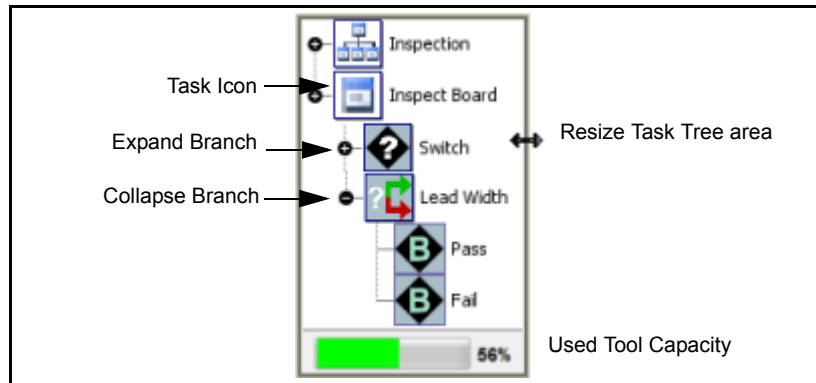
If you click the Start/Stop Continuous Trigger button, the Results Display is shown. This shows a summary of results from a tool or task you select. You cannot modify any tool settings while the Results Display is shown. (See “Start/Stop Continuous Trigger” on page 3-9.)

The Results Display for a Line Gauge tool is shown here.



Task Tree

The Task Tree shows the tools in the order they run when the task runs. If you link data between tools, be sure the data you are using originates in a tool that runs before the destination tool runs.



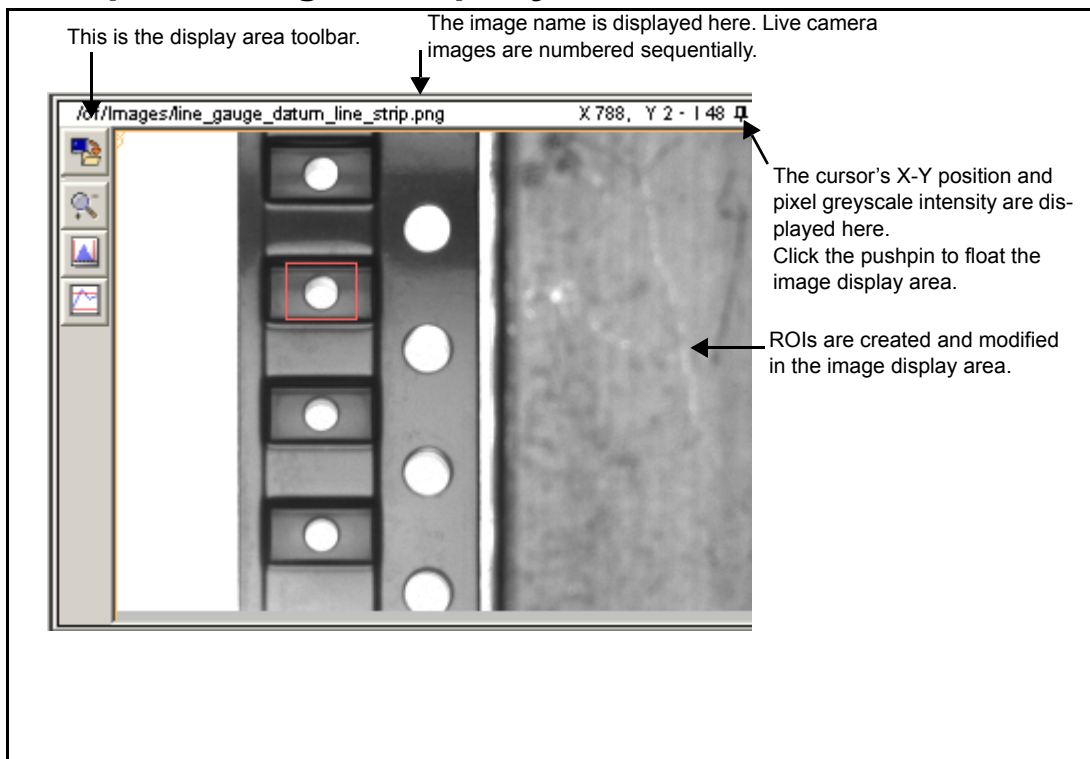
Expand or collapse branches: Some tools, like the Switch tool, have branches that can be expanded and collapsed. Click the Expand or Collapse icon to view the branches.

Resize the task tree area: Point the cursor to the right-side border. When the pointer becomes a double-headed arrow, click and drag the border.

Used Tool Capacity: This meter indicates the remaining amount of tools that can be used in this task. Each tool uses a different percentage of capacity. The meter will change color as the limit is reached.

Reorder tools in the task tree: To move a tool in the task tree, click and drag the tool up or down to the desired location.

Input Image Display Area



The currently acquired image is displayed in this area. The name of the image is displayed at the top of the area. If you are using the File Camera or an Emulator, this is the image file name. If you are using a live camera, this is the camera type followed by a unique number.

This image display area is where you configure Regions of Interest (ROI) and other tool parameters. To enable automatic image linking when new tools are added to the task, see “Program Preferences” on page 3-6. To auto-save images, see “Program Preferences” on page 3-6.

If you are using an image processing tool with an ROI, the tool does not work correctly if all or part of the ROI extends past the edge of the image. If this happens, an “ROI Off Image” watermark is displayed over the image display area for five seconds or until you move the ROI back onto the image.



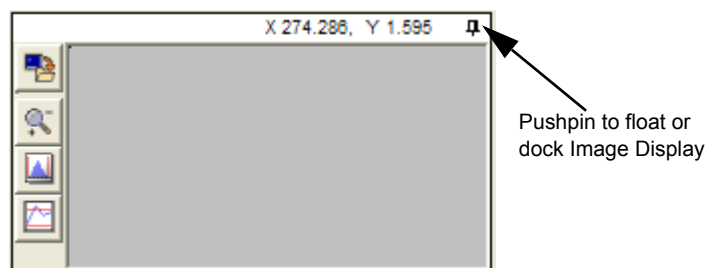
To acquire an image

1. Click the Trigger Once button in the Summary Table button area. If a camera is connected, the camera image is displayed. If the camera is in File Camera mode, an image from File Camera folder is displayed. (For File Camera mode see “File Camera or Camera” on page 3-8.)

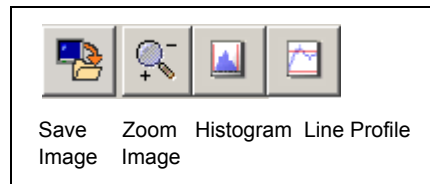
You can “float” the Image Display area to make it larger so you can see it better or move it to a second monitor so you can see it while you create or move ROIs.

To float the Image Display Area

1. Click the pushpin in the upper right corner of the Image Display Area (next to the cursor location value).
2. Click the title bar to drag the Image Display. Click the corners or edges to resize the display.
3. To return the Image Display Area to its normal position, you can click the pushpin in the corner of the floating Image Display area, or the permanent display area.



Display Area Toolbar



Save Image

When you click the Save Image button, two buttons are displayed.

- **Save Image Button**
This saves the image only
- **Save Image with Graphics Button**
This saves the image all ROIs that are on the image and Pseudocoloring (if enabled). Note that images saved with graphics are saved in 24-bit format color and cannot be used as inspection images. You are prompted to choose the path and name for the saved file.

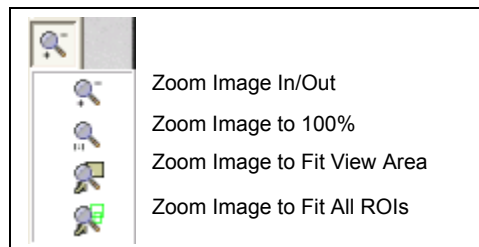
NOTE: In order for the image calibration information to be saved and later used in the File Camera, the image MUST be saved in png format without graphics.



Zoom Image

Note: These buttons magnify or shrink the image size in the image window, but the inspected image size is not affected.

When you click the Zoom Image button, four buttons are displayed.



- **Zoom Image In/Out**
When you click this button, it stays depressed until you click it again. To zoom in (up to 1600:1), left click on the part of the image you want to magnify or roll the mouse wheel button toward you. To zoom out (down to 12.5:1), right click on the part of the image that you want to see in the center of the image display or roll the mouse wheel button away from you.
- **Zoom Image to 100%**
The image is displayed at 100% its size (1:1).
- **Zoom Image to Fit View Area**
The image size is automatically scaled so you can see the entire image in the image display.
- **Zoom Image to Fit All ROIs**

The image size is automatically scaled so that all ROIs on the image can be seen and you can move them back onto the image if necessary. If an ROI goes off the screen during editing and running a tool, an “ROI Off Image” watermark is displayed over the image and the display switches to this mode.

Histogram and Line Profile

NOTE: To display the Threshold Viewer, you can also right click on the ROI or the image.

The floating Threshold Viewer displays a histogram or line profile, depending on the area of the image or ROI selected. The viewer graphically represents each pixel's grey level to show how a tool “sees” the image (example below). For a detailed explanation of the Threshold Viewer, see “Threshold Viewer” on page 4-22.



Region Of Interest

A region of interest (ROI) is a marked area on the video image. During an inspection, the vision system only examines pixels within an ROI. Each image inspection tool has its own set of ROIs.

Several different ROI types are available: line, wide line, rectangle, circle, and polygon. The rectangle, circle, and polygon are used with tools that have a Shape List data type. A Grid ROI places multiple ROIs based on a user-selected pattern.

NOTE: If an ROI is linked from another tool, you cannot move or reshape the ROI in the tool to which it is linked.

You can select ROIs using keyboard keys while you are using the ROI Editor. The Tab key selects the next ROI, Shift-Tab selects the previous ROI, Ctrl-Tab extends the selection to the next ROI, Shift-Ctrl-Tab extends the selection to the previous ROI. Ctrl-A selects all ROIs.

Both the Tab select and the Select All methods operate on all ROIs that are visible and selectable in the ROI Editor, unless a ListROI is selected and “locked.” In that case, the methods operate only on the ROIs in that particular ListROI.

Typically, ListROIs are “locked” by a tool setup so, though many types of ROIs can be displayed to show the results of setting up the tool, editing ROIs is restricted to those ROIs that represent a single tool property.

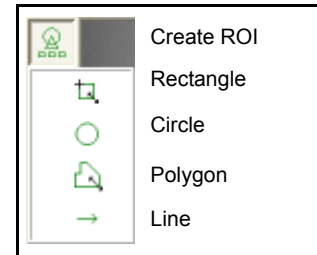
Shape List ROI Toolbar



When you select the Shape List input in the list of tool inputs, this toolbar is displayed. These tools are used to create ROIs, cut, copy, paste, and delete selected ROIs, save images, zoom in and out on the image, and view a histogram or line profile. For more details, also see “Display Area Toolbar” on page 3-14.

To place a Rectangle, Circle, or Polygon Shape List ROI

1. In the tool input properties, select Shape List.
2. On the toolbar, click the Create ROI button.
3. From the drop down, select the ROI type you want to place.
4. Click on the image where you want to place the ROI. To resize, move, or rotate the ROI, move the cursor around the ROI border (the cursor changes to one of these types), then click and drag the cursor to the desired place or size.



- Move -
- Resize -
- Rotate -
- Polygon Add Edit Point -

To delete an Edit Point, click and drag the point you want to delete over an adjacent edit point and release the mouse button. The edit point must touch the point you want to delete.

NOTE: If an ROI moves outside the image window, an “ROI Off Image” watermark is displayed over the image and the display switches to Zoom to Fit All ROIs mode. You can also click the button on the Display Area toolbar (see “Display Area Toolbar” on page 3-14).




To create a Grid Shape List ROI

1. Select Create ROI.
2. On the toolbar, select the ROI type you want to place.
3. On the toolbar, click the Create Grid of ROIs button.
4. From the drop down, select the type of grid you want to create:
 - **Step and Repeat:** Creates a grid of ROIs based on a single start point, a number of rows and columns, x and y pitch, and a step angle. Position the Start Location ROI, then enter the number of desired rows and columns, the x and y pitch, and the step angle. Rows and columns of ROIs are created x and y distance apart at the step angle beginning at the starting location.
 - **Grid:** Creates a grid of ROIs based on a starting ROI, an ending column position, an ending row position, and row and column values. Position the Start Location ROI at the desired row 1 column 1 of the grid. Position the End Column ROI at the final column position of the grid. Position the End Row ROI at the final row position of the grid. Enter the number of desired rows and columns. A grid of ROIs is created based on the number of rows and columns defined.
 - **Area:** Creates a grid of ROIs based on a Size ROI, an Area ROI, and an x and y offset. Position the Size ROI on the desired part of the image, place the Area ROI around the desired grid area, then enter the desired x and y offset values. The defined area is filled with ROIs, based on the Size ROI and the offset values.
5. Individual ROIs can be selected and adjusted as desired.
6. When all the ROIs are in the desired place, click Create to create the grid of ROIs, Reset to reset all values and start over, or Done to exit the grid dialog.

Line and Wide Line ROIs

To create a Line or Wide Line ROI

1. Select the desired tool, then click the desired Line ROI Property (depending on the tool).
2. On the toolbar, click the Create ROI button.
3. From the drop down, select the Line ROI.
4. Click on the image where you want to place the ROI.
5. To resize, move, or rotate the ROI, move the cursor along the ROI (the cursor changes to one of these types), then click and drag the cursor to the desired place or size.

- Move 
- Resize / Rotate 
- Widen 






NOTE: If an ROI moves outside the image window, click the Zoom to Fit All ROIs button on the Display Area toolbar (page 3-14).

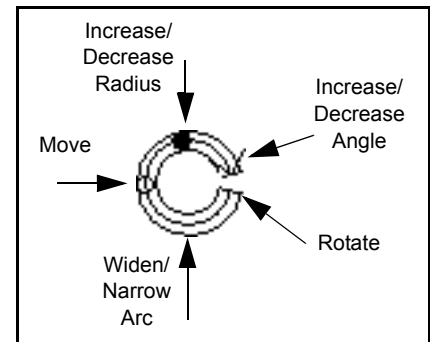
Circular Arc ROIs

Circular Arc ROIs are used in the Circular Pattern Find, Circle Gauge, and Unwrap tools.

To adjust a Circular Arc ROI

1. To adjust a Circular arc ROI, move the cursor around the ROI border to the point where the cursor changes to the desired type, then click and drag the cursor to the desired place and/or size.

- Move 
- Increase / Decrease Angle 
- Increase / Decrease Radius 
- Rotate 
- Widen / Narrow Arc 



Cut, Copy, Paste, Delete ROIs

To cut, copy, paste, or delete ROIs

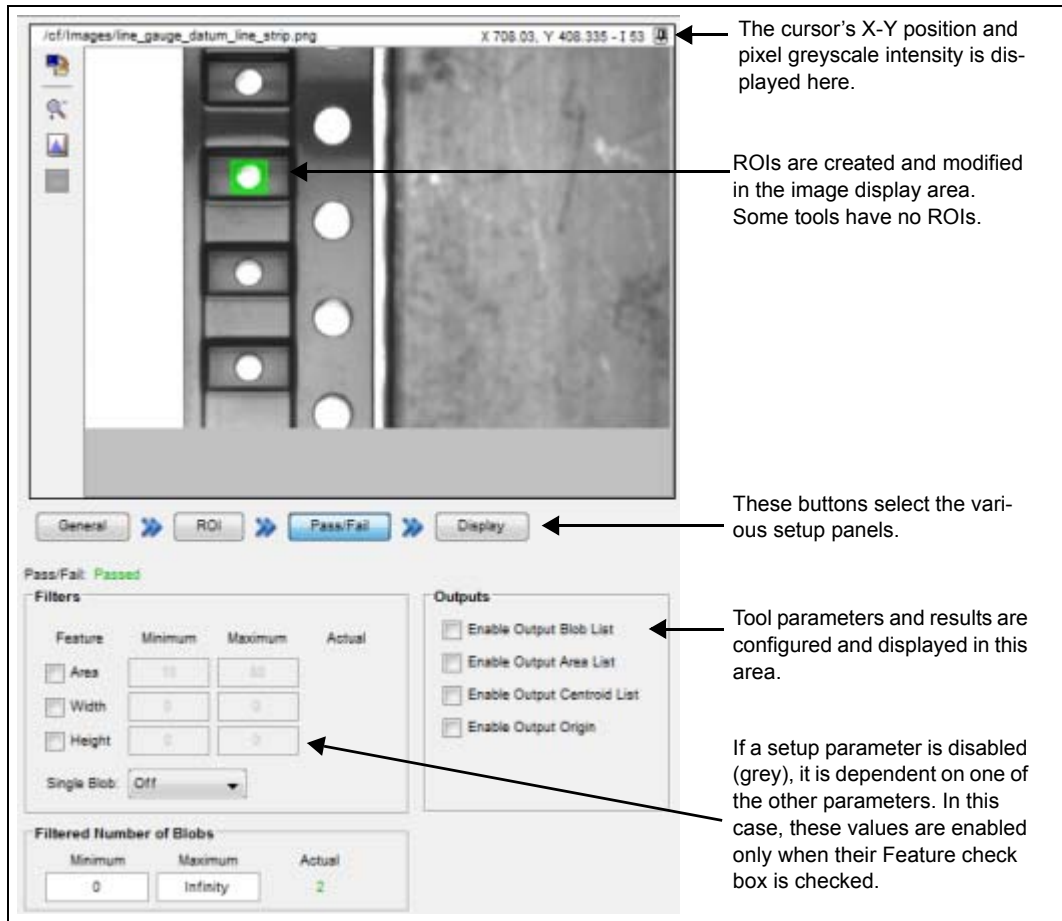
1. Select the desired ROI, then click the appropriate button. Some tools do not allow more than one ROI to be created or allow the only remaining ROI to be deleted.

Setup

A task or tool's Setup guides you through the steps necessary to configure the most common properties needed to use the task or tool effectively.

Each Setup panel has multiple choices where different parts of the task or tool are configured.

This example shows the Pass/Fail panel in the Setup for the Blob tool.



General panel

You can link an image and origin as well as modify the name here. See each tool's description (starting on page 3-25) for more details.

Options panel

Only the task has this panel. Here you can define how the task operates. See "How to set up the task" on page 3-24 for details.

Inspection Pass/Fail Status

Link: ☒ Source: [Inspection.Image In Task.Pass Fail.Pass]

☒ Show Border On Display Mode Image: ☒ Failed ☐ Passed and Failed

Timings

| | Actual | Average | Maximum |
|-----------------------------|--------|---------|---------|
| Microseconds Since Run: | 252 | 38881 | 77510 |
| Microseconds Since Trigger: | 250 | 38908 | 77563 |
| Run Count: | 2 | | |

Display panel

The Display panel for tools and the task lets you select the properties that are displayed in Display Mode. This example shows the Display panel for the Pass Fail tool.

| Property Name | Label | Read Only | Value |
|--|-------------|--------------------------|---------------------|
| <input type="checkbox"/> I Pass Criteria | Enter Label | <input type="checkbox"/> | All Tools Must Pass |
| <input checked="" type="checkbox"/> O Pass | Enter Label | | False |
| <input type="checkbox"/> O Pass Count | Enter Label | | 0 |
| <input type="checkbox"/> O Fail Count | Enter Label | | 0 |
| <input type="checkbox"/> O Run Count | Enter Label | | 0 |

Display Chart

☒ Chart Results Chart Label:

This section is displayed only on the Pass Fail tool.

- **Clear All** - Clears all the property selections.
- **Select All** - Selects all the properties.
- **Restore Defaults** - Each tool and task has some properties that are selected by default. This restores all of the default selections.
- **Apply to Entire File** - If this check box is checked, the Clear, Select, or Restore Defaults operation are applied to the property selections in all the tools and the task in the currently selected vision program file.
- **Property Name** - If the check box to the left of the name is checked, the property value are displayed in Display Mode. The letter signifies the property type: I = Input, O = Output, M = Method.
- **Label** - This label is shown in Display Mode. Click in the label field to modify it.
- **Read Only** - If this is checked, the property cannot be modified in Display Mode.
- **Value** - The property's current value.
- **Display Chart** - This selection appears only on the Pass Fail tool. If Chart Results is checked, a chart showing cumulative pass and fail results is displayed in Display Mode. Click in the Chart Label field to modify it.

Display Mode









Display Areas

NOTES: When you switch to Display Mode from another tab, the task does not run automatically. You can click the Run Once on Current Image button to insure that the tab displays the most current values.

If a tool has a Train function (e.g. the Origin tool), and you move an ROI, you must use the Train method to update the display. (Click the tool, click the Display button, then select the Train method on the Show in Display Mode panel. See "Display panel" on page 3-19.)

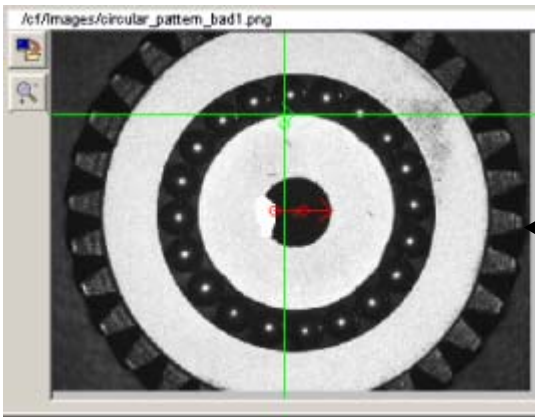
Display Mode provides a runtime display for a program's tool properties. You can select which properties are shown in Display Mode (see "Display panel" on page 3-19). The following examples show the various

parts of Display Mode for a task containing the following tools: Origin, Image Sampling, Line Gauge, and Pass Fail. To save images displayed in Display Mode, see “Program Preferences” on page 3-6.

| Tool | Label | Value | Control |
|---|----------------------|-----------------|---|
|  | Origin Passed | true |  |
| | Origin Output | ((248, 89), 0°) | Display |
| | Origin Run | | Origin Run |
|  | Sample Resolution | 2 | |
|  | Measurement Passed | false |  |
| | Measurement Distance | 61.0082 | |
| | Measurement Line | 1 Line Segment | Display |
|  | Passed | 15 | |
| | Failed | 46 | |
| | Total | 61 | |

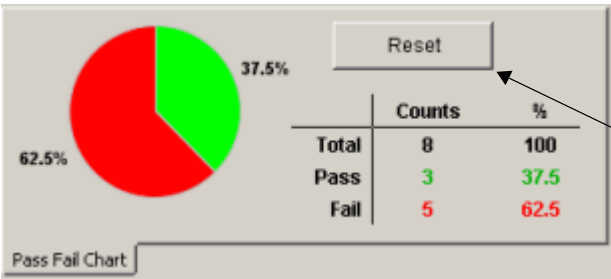
The Tool Property display area

- **Tool** - Click on the tool icon to switch to the indicated tool’s Display panel.
- **Label** - This label is defined on the tool Display panel. The default is Tool Name:Property Name.
- **Value** - This is the property’s current value. If this is an input value, it can be modified here if it has not been marked Read Only (see “Display panel” on page 3-19). If it is an input ROI, you can click on the ROI on the image display to move or resize it.
- **Control** - This column varies depending on the type of property being displayed.
Boolean Output - Green for Pass, Red for Fail
ROI - Click Display button to toggle the ROI display on the Image
Method - Click the button to the initiate the action listed. For example, Train trains the tool.



The Image display area (the image float option is not available here)

Current Image



The Chart display area (to enable, see “Display panel” on page 3-19)

Click Reset to reset the tool’s counts

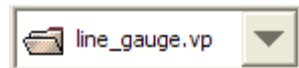


Design Mode

Click this button to switch the view from Display Mode to Design Mode. See “Display Mode” on page 3-19.

Filtered Vision Programs

The file names listed here are filtered by the Program name entered in the Display Mode Program Filter field. See “File Manager” on page 2-25. You can use this feature so the operator can change between multiple pre-programmed inspections if you define multiple Programs. For example, in applications that use recipe files, you can define a Vision Program file for each “recipe” and give them the same Program name. Then, enter that Program name in the Display Mode Program Filter. When you want to change the recipe, choose the desired Vision Program file from the Filtered Vision Programs list.



Files that have the same Program name are “exclusively” loaded. This means that only one Vision Program file with a specified Program name can be loaded on the Vision Device or Emulator at a time.

The currently loaded Vision Program file name is shown in the title bar at the top of VPM Lite. IMPORTANT: File names are case sensitive.

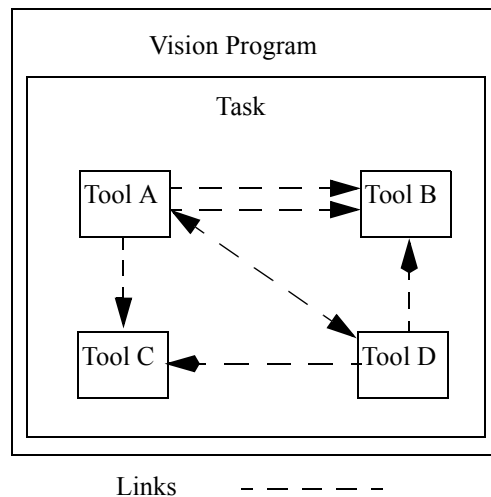
When you select a new Vision Program file from the list, the current Program (and the Vision Program file) is unloaded and the selected one is loaded.

Program files with names other than the Filter names can be loaded and unloaded through the Settings Tab - File Manager - Setup.

If no loaded Program names match those in the Filter, then the drop-down current selection is blank.

See “To create a vision program” on page 3-23 for more details.

Linking



Links are the data connections between tools. They are made by clicking the Link button in the destination tool. They can only be made between compatible data types. For example, you cannot link an integer data type directly into a real data type.

Links Between Tools

Automatic Image Linking

When a tool with an image input is added to a task, the image input for that tool is linked to the same image that was last used as an image source for other tools in that task. If that input is empty, automatic linking searches for a suitable link in the following order:

1. The task Image property.
2. The tools in the task are searched in execution order until one is found that has an Image data type output.
3. If no suitable default is found, a link is not automatically made. You can still make a manual link.

NOTE: Any time an input image link is modified on a tool in a task, that new link source becomes the default for tools added to that task. For example, if you delete the image link in any tool in a task, the next time you add a tool to that task, the task's image are NOT automatically linked.

The automatic linking applies whether the tool was added from the toolbox or the clipboard.

The link source information is validated each time before using. If the a link source no longer exists, it is set to uninitialized and reverts to the value specified in the list above. If the link source does exist, but it occurs later in execution order in the task, it is not used. However, it remains as the default link source, and is used if and when you drop a tool in after that point in the task execution. If the link source refers to a tool in a different task or program, execution order is not checked.

Automatic Origin Linking

When a tool with an origin input is added to a task, the origin input for that tool is linked to the same origin that was last used as an origin source for other tools in that task. If that input is empty, automatic linking searches for a suitable default by searching the tools in the task in execution order until one is found that has an output origin that is not "Relative To Tool."

NOTE: Any time the link source is changed from a tool, it becomes the new default link source. For example, if you delete the origin link in any tool in a task, the next time you add a tool anywhere in that task, the origin is NOT automatically linked.

The automatic linking applies whether the tool added from the toolbox or the clipboard.

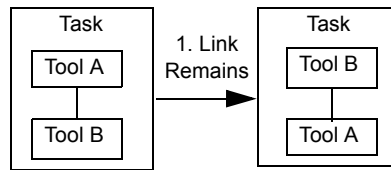
The link source information is validated each time before being used. If a link source no longer exists, it is set to uninitialized, and reverts to the value specified in the list above. If the link source does exist but it occurs later in execution order in the task, it is not used. However, it remains as the default link source, and is used if and when you drop a tool in after that point in the task execution. If the link source refers to a tool in a different task or program, execution order is not checked.

Paste Linked Tools

When you cut or copy a tool that is linked to another tool, links may be broken when it is pasted, depending on where the tool is pasted. The following situation may occur.

1. Tool A and Tool B are linked to each other in the same program. When Tool A is copied or cut, then pasted, the link remains.

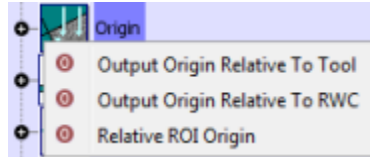
NOTE: If the Program Preferences setting “Automatically link tool image input” is checked, a new link to the task image is made when a tool with an input image is pasted, just as if the tool was added from the tool-box.



To create a link



1. Click the destination tool in the tool tree. Click the Link button, or click the small “create link” icon on the left end of the Value field.
2. Click the desired source tool in the Task Tree. (Only tools that have a property with a matching data type are enabled for linking.) Output values that correspond to the data type of the destination field are listed automatically. To complete the link, click the desired value name. Linked values are displayed in blue in the tool’s value field.



3. To cancel the linking operation, press the ESC key or click the “create link” icon again without selecting a value name.
4. Repeat steps 1 and 2 for additional links.

To delete a link



1. Click the desired tool in the tool tree.
2. Click the Delete Link button next to the link, or click the small “delete link” icon next to the link you want to delete (on the left end of the Value field). Linked values are displayed in blue in the tool’s value field.

Create a Vision Program

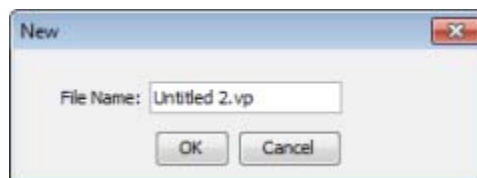


Vision Programs are saved in a Vision Program file (with a “.vp” file extension) which is stored in flash memory. Each Vision Program file must have a unique name.

Each Vision Program file contains a Program which contains a task. When you open a Vision Program file, its Program (which includes the task) is loaded into the camera or Emulator.

To create a vision program

1. Start VPM Lite.
2. Click the New button in the toolbar. The following dialog is displayed.



Enter a name for the Vision Program file in the File Name field. This must be a unique name and

names are case sensitive. The Program name “Inspection” is assigned by default. See “File Manager” on page 2-25. **IMPORTANT:** Program names are case sensitive.

3. Click OK to create the Vision Program file.
4. A vision program can contain only one task. (See “Create a Task” on page 3-24.)
5. Click the Save button in the toolbar.

Vision Program Panel



To access the vision program name, click on the Vision Program icon.

Create a Task

A task is a collection of one or more vision system tools connected in the tool tree. When you run the task, tools are executed in order from top to bottom. A vision program can contain only one task.

To create a task

1. Start VPM Lite and connect to a camera.
2. Create a new vision program.
3. Click the task icon and enter a name for the task, if desired.
4. In the toolbox, click on the tool you want to add to the task, then drag the tool to the task tree and drop it in the desired place.
To add a tool after an existing tool, drop it on the existing tool.
To add a tool to the branch of a tool, drop it on the branch icon.
To move a tool in the task tree, click and drag the tool up or down to the desired location.
5. Continue to add and configure the tools you want in the task to create the desired program. (See page 3-25 for tool configuration details.)
6. To delete a tool, select the tool in the tool tree, then click the Delete tool button in the toolbar.
7. To move a tool in the task tree, click and drag the tool up or down to the desired location.
8. When you are ready to save your work, click the Save button.

To test a task



Task
Icon

1. Select the desired task icon in the task tree.
2. Be sure that the Auto-update links check box is checked in Program Preferences.
3. Click the Run Once on Current Image button on the Summary Table buttons. The task runs one time, executing all the tools in the execution path, then stops.

Task Configuration



Task
Icon

A task is a collection of tools that run when an image is acquired.

How to set up the task

1. Click the General button to enter a name for the task.

- Click the Options button. Here you can define how the task operates.

| | Actual | Average | Maximum |
|-----------------------------|--------|---------|---------|
| Microseconds Since Run: | 252 | 38881 | 77510 |
| Microseconds Since Trigger: | 250 | 38908 | 77563 |
| Run Count: | 2 | | |

- Inspection Pass/Fail Status**

Link: Click this button to link a Pass/Fail status from a tool in the task. This status determines the Image Border color and whether the border is displayed. To automatically save passed or failed images, you must link a status here (see “Program Preferences” on page 3-6).

- Show Border On Display Mode Image** - When the linked Pass/Fail status is equal to the following chosen status, the image border is displayed in red or green.
- Failed / Passed and Failed** - Choose the status that determines whether the Image Border is displayed.
- Timings**

Microseconds Since Run: The time since the task started running (in microseconds). This is a “live” value during the task run because it is read during the task run and updated to the current time. Once the task finishes running, this time is locked to the time at which the task finished.

Microseconds Since Trigger: The time since the hardware trigger at the camera started the image acquisition process (in microseconds). This is the “trigger to done” time, which includes exposure, acquire, image transfer to the PC, etc. This is a “live” value during the task run as it is read during the task run and updated to the current time. Once the task finishes running, this time is locked to the time at which the task finished. Note that UsecsSinceRun and UsecsSinceTrigger are not necessarily equal, since there is some “overhead” time included in the UsecsSinceTrigger.

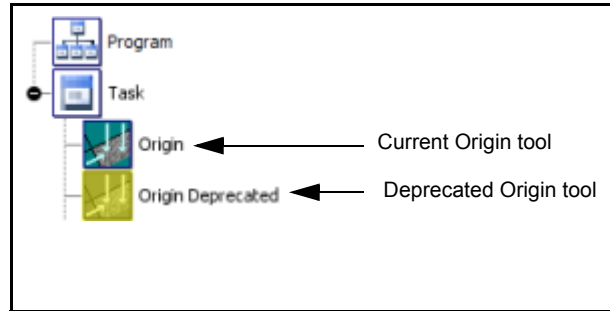
Run Count: The total number of times the task has run since the last count reset.

Tools

Tools are divided by function within toolbox drawers. The tool icon helps you identify the tool within the task tree and the drawer. Sometimes, in order to enhance a tool’s function or properties, the old version of a tool is “deprecated” or made unavailable and replaced with a new version or a different tool.

Deprecated tools are displayed in yellow in the task tree. They continue to function, but they do not appear in the Toolbox and cannot be added to new Vision Program files. You can replace the older tool with an up-

to-date tool or its replacement. If you do replace the tool, you may need to redefine the tool's inspection properties. When you save the vision program file, the deprecated tool is saved the same as other tools.



Toolbox Drawers

Tools are contained in the toolbox and grouped within drawers based on their general purpose. Some tools appear in more than one drawer because they have multiple purposes. A brief tool tip is displayed when you hover the cursor over the tool icon in the toolbox. For tool details, refer to the page number in the tables below (displayed in alphabetical order by toolbox then by tool name).

| Communication | Flaw Detection | Feature Finding | Image Filtering | Locating | Logic |
|---|------------------------------|------------------------------|------------------------|-----------------------------|---------------------------|
| Discrete Input 3-89 | Average Intensity 3-49 | Average Intensity 3-49 | Edge Enhancement 3-28 | Blob 3-32 | Counter 3-102 |
| Discrete Output 3-90 | Blob 3-32 | Blob 3-32 | Morphology Dilate 3-29 | Circle Gauge 3-61 | Pass Fail 3-104 |
| Ethernet/IP Explicit Data page 3-91 | Contrast - Multiple ROI 3-55 | Circle Gauge 3-61 | Morphology Erode 3-32 | Line Find 3-37 | String Builder page 3-105 |
| Ethernet/IP Explicit Message page 3-92 | Greyscale Template 3-78 | Color Blob page 3-51 | | Origin 3-41 | Switch page 3-105 |
| Ethernet/IP Read Implicit Assembly page 3-94 | | Color Checker page 3-53 | | Pinpoint Pattern Find™ 3-45 | |
| Ethernet/IP Write Implicit Assembly page 3-95 | | Contrast - Multiple ROI 3-55 | | | |
| Image Archiving 3-96 | | Edge Point Find 3-56 | | | |
| Serial Port Out 3-98 | | Line Find 3-58 | | | |
| TCP/IP Out 3-99 | | Wide Edge Point Find 3-58 | | | |

| Measurement | P-Series | Readers |
|---|-----------------------------|------------------|
| Circle Gauge 3-61 | Green Red Spot page 3-116 | Code Reader 3-80 |
| Line Find 3-37 | ProfinetIO Read page 3-117 | OCR 3-84 |
| Line Gauge 3-63 | ProfinetIO Write page 3-118 | |
| Line Gauge Dual ROI 3-66 | | |
| Multiple Point to Point Measurements 3-69 | | |
| Point to Line Measurement page 3-72 | | |
| Point to Point Measurement page 3-75 | | |

Recently Used Drawer

This drawer contains the ten tools that have been used most recently, with the most recent at the top.

Image Filtering Drawer

Edge Enhancement

In the Image Filtering Drawer



The Edge Enhancement tool produces an output image with its edges enhanced. The settings control the direction of the edge enhancement.

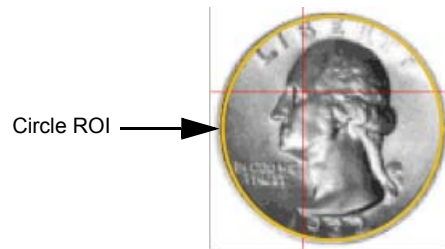
How to use the Edge Enhancement tool

General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

ROI

1. On the ROI panel, move and adjust the ROI so that it encloses the part of the pattern you want to find in the image. The default shape list is a rectangle that you can move and size. You can also create complex shapes by using circles, polygons, and exclusion regions. In this example, the ROI includes the entire center portion of the image.

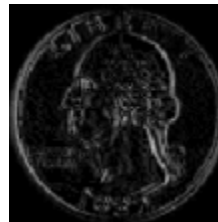


Settings

1. Select one or more check boxes to provide the enhanced image you want. These images show examples of the results from various settings.



All four Enhance
Edge settings true



Enhance 90
Degree Edges



Enhance 90 Degree Edges
with Show Gradient

Show Edge Gradient: If checked, bright to dark edge gradients in the direction of the enhancement are shown as black, and dark to bright edge gradients are shown as white. This can give the image an embossed look. (If more than one Enhance Edges setting is checked, this is disabled.)

Display

See “Display panel” on page 3-19.

Morphology Dilate

In the Image Filtering Drawer



The Morphology Dilate tool performs a standard dilation operation on the white parts of the image. (See “Morphology” on page 3-30 for more details.)

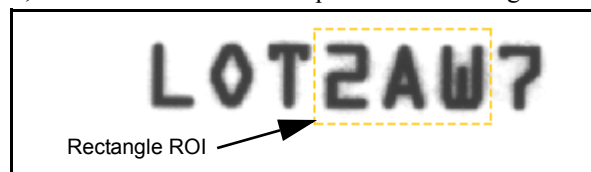
How to use the Morphology Dilate tool

General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

ROI

1. On the ROI panel, move and adjust the ROI so that it encloses the part of the pattern you want to find in the image. To use the entire image, delete the ROI. The default shape list is a rectangle that you can move and size. You can also create complex shapes by using circles, polygons, and exclusion regions. In this example, the ROI includes a center portion of the image.



Settings

1. Slide the slider to select the Number of Iterations to provide the dilated image you want. See “Morphology” below for details. This image shows an example of the results of two iterations.



2. Select the Morphology Shape to use. See “Morphology Shape” on page 3-32 for details.

Display

See “Display panel” on page 3-19.

Morphology Erode

In the Image Filtering Drawer



The Morphology Erode tool performs a standard erosion on the white parts of an image. (See “Morphology” on page 3-30 for more details.)

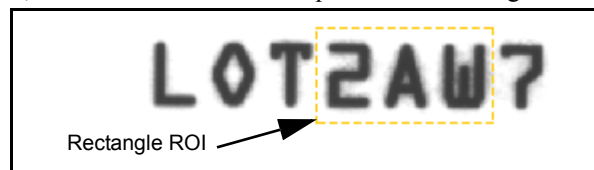
How to use the Morphology Erode tool

General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

ROI

1. On the ROI panel, move and adjust the ROI so that it encloses the part of the pattern you want to find in the image. To use the entire image, delete the ROI. The default shape list is a rectangle that you can move and size. You can also create complex shapes by using circles, polygons, and exclusion regions. In this example, the ROI includes a center portion of the image.



Settings

1. Slide the slider to select the Number of Iterations to provide the eroded image you want. See “Morphology” on page 3-30 below for details. This image shows an example of the results of two Iterations.



2. Select the Morphology Shape to use. See “Morphology Shape” on page 3-32 for details.

Display

See “Display panel” on page 3-19.

Morphology

Morphology is the act of warping an image according to mathematically defined relationships. It can eliminate noise, smooth edges, join narrow gaps, and fill small holes on each image. Morphological operations are non-linear and irreversible. There is no inverse operation to undo what was done by the last operation. Thus, each operation loses some information about the original image.

Morphology tools use 3x3 binary analysis. During binary morphology, the tool checks the greyscale values in the image and assigns each pixel an ON or OFF value. The tool then performs the operation (based on the

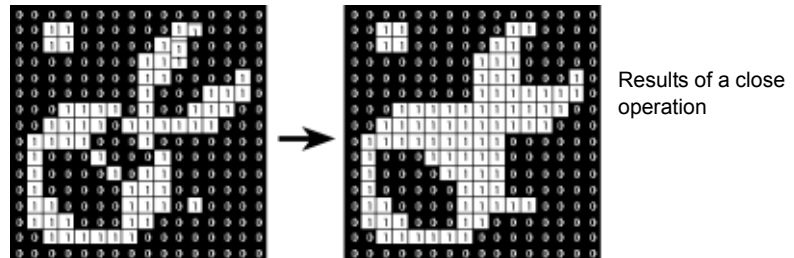
Number of Iterations value), adjusting each pixel's value after comparing its value and the values of surrounding pixels in a 3x3 pixel neighborhood.

During pixel analysis, the tool first groups pixels. A group consists of any foreground or background pixels that are connected, or touching. The tools use the eight-connected rule to group pixels into foreground blobs. The eight-connected rule states that two foreground pixels are connected if they are directly side by side, top to bottom, or if their corners touch. In this example, the white pixels A, B, C, F, H, and X are connected.

| | | |
|---|---|---|
| A | B | C |
| D | X | E |
| F | G | H |

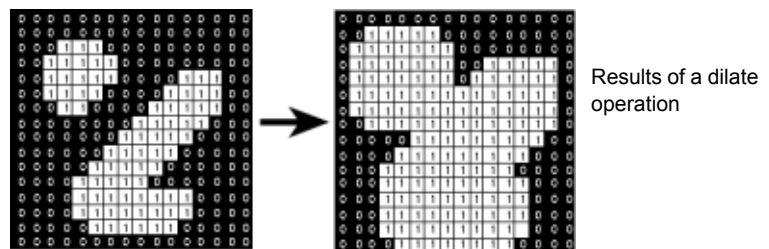
Close

The close operation is similar to dilation in that it tends to enlarge foreground (bright) regions in an image (and shrink background holes), but it affects the original boundary shape less. It is defined as a dilation followed by an erosion.



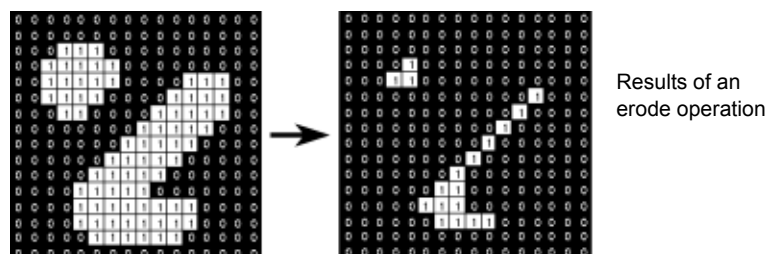
Dilate

The dilate operation gradually enlarges the boundaries of regions of foreground pixels. Thus areas of foreground pixels grow in size while holes (background pixels) within those regions become smaller.



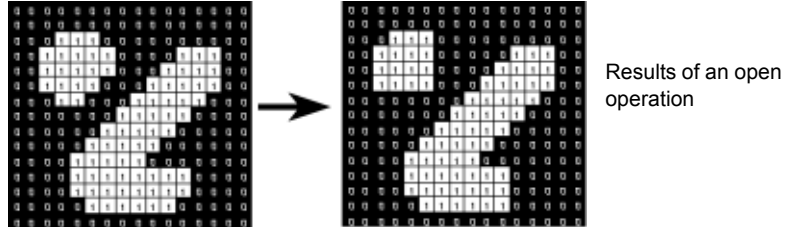
Erode

The erode operation erodes away the boundaries of regions of foreground pixels. Thus areas of foreground pixels shrink in size, and holes within those areas become larger.



Open

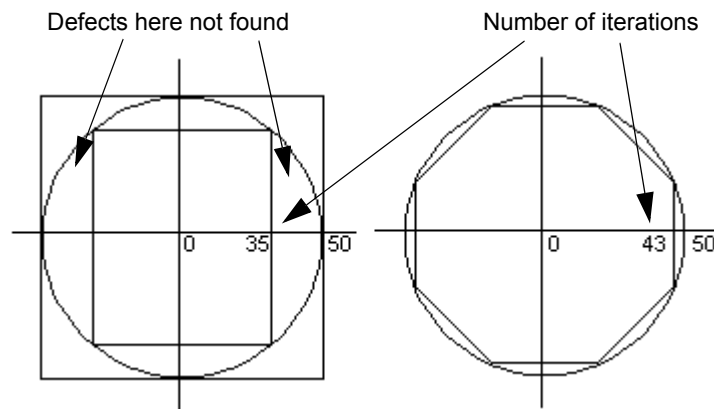
The open operation is similar to erosion in that it tends to remove foreground (bright) regions in an image, but it is less destructive than erosion in general. The effect is to preserve foreground regions that have a similar shape while eliminating all other regions of foreground pixels. It is defined as an erosion followed by a dilation.



Morphology Shape

Morphology Shape defines the shape of the neighborhood around each pixel that is searched to find the output pixel value. It is sometimes referred to as structuring element, filter mask, or filter kernel. The choices are Square and Octagon.

A square morphology shape is the fastest to process, but has the disadvantage of working better in the diagonal directions than in the horizontal and vertical directions. In the example shown below (the figure on the left), a Morphology Erode tool is used to test the size of a fifty-pixel radius circular hole. With a square morphology shape, the tool tests all pixels in a 100x100 square, centered on the hole. However, the number of iterations is limited to 35 along the x and y axes so that the square shape's corners fit inside the circle. Defects at the top, bottom, left, and right may not be found.



Using a circle shape would solve this problem, but a perfect circle is slow to process, so an octagonal shape is used. (The figure on the right.) The execution time is only 40% greater to accomplish the required 43 iterations within the octagon than within a square.

Locating Drawer

Blob

In the Feature Finding, Flaw Detection, and Locating Drawers



The Blob tool uses an Autothreshold or Fixed threshold method to find randomly oriented or amorphously shaped objects within the ROI.

NOTE: The tool's execution time is affected by the image resolution, a rotated tool origin, and ROIs with an exclude area. Very high resolution images may take a long time.

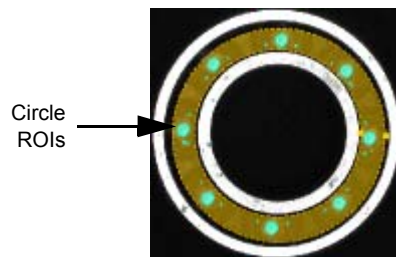
How to use the Blob tool

General

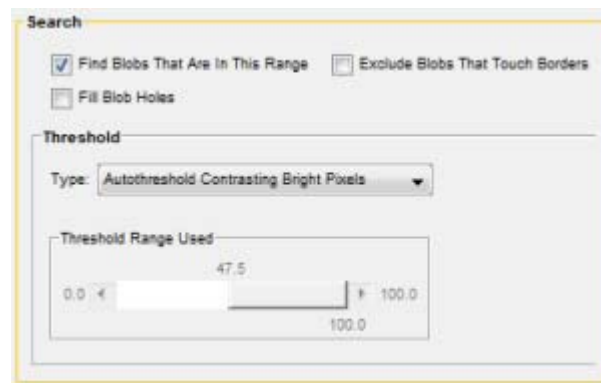
1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

ROI

1. On the ROI panel, move and adjust the ROI so that it encloses the part of the pattern you want to find in the image. To use the entire image, delete the ROI. The default shape list is a rectangle that you can move and size. You can also create complex shapes by using circles, polygons, and exclusion regions. In this example, two ROIs include just the center portion of the image.



2. Adjust the Search and Threshold settings to find the desired parts of the image.



- **Find Blobs That Are in This Range**
When this is checked, the tool finds blobs that have pixel greyscale values within the threshold range.
- **Exclude Blobs That Touch Borders**
When this is checked, the tool excludes blobs that touch the ROI.
- **Fill Blobs Holes**
When this is checked, any holes in the found blobs are filled to create a single blob. This can save time on images with many extra blobs.
- **Threshold Type**

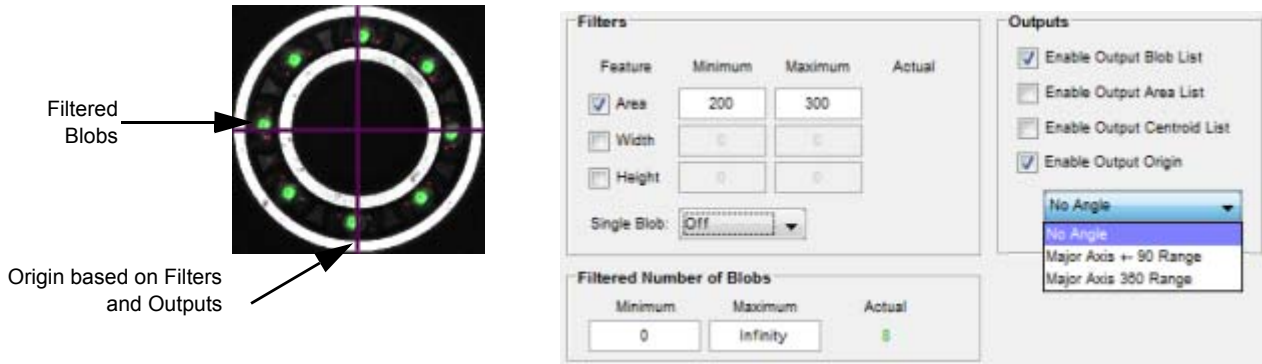
Select the type of threshold range the tool should use to find blobs. See “Grey Level Threshold Types” on page 3-35 for details.

- **Threshold Range Used**

This is the threshold range the tool used to find blobs. It will vary based on the Threshold Type selected.

Pass/Fail

1. On the Pass/Fail panel, adjust the Filters, Outputs, and Filtered Number of Blobs settings to filter the found blobs and provide the desired output. The tool will pass or fail based on these settings and the found blobs.



- **Filters: Feature**

Area, Width, Height: Enter values to filter the found blobs based on their minimum and maximum measurements. If you click on a blob in the image, the Actual measurements of that blob are displayed.

- **Filters: Single Blob**

This filter is applied after all the other filters. If Centermost or Largest blob is selected, only passed blobs are displayed in the image window.

Off: Blobs are filtered according to all the other filter settings

Centermost Blob: Only the blob closest to the center of each ROI is used.

First Blob: The tool stops processing when the first blob is found that has an area equal to or larger than the Area Minimum value. (The Width, Height, and Area Maximum filter values are ignored. The Exclude Blobs That Touch Borders value and Fill Blob Holes value are set to false.)

Largest Blob: Only the largest blob in each ROI is used.

- **Outputs**

Enable Output Blob List: A list of the found blobs is produced. This list can be used in other tools.

Enable Output Area List: A list of the areas of the found blobs is produced. This list can be used in other tools.

Enable Output Centroid List: A list of the center points of the found blobs is produced. This list can be used in other tools.

Enable Output Origin: The origin produced from the found blobs is displayed. This origin can be used in other tools. The tool runs faster if the Output Origin is not enabled. Also see “Output Origin” on page 3-36.

Major Axis:

No Angle: The origin is the X and Y coordinates of the blob centroid (the angle is ignored).

Major Axis +/- 90 Range: The origin is the X and Y coordinates of the blob centroid and the Major Axis angle in a +/- 90 degree range (useful if blob has an oblong shape).

Major Axis 360 Range: The origin is the X and Y coordinates of the blob centroid and the Major Axis angle in a 360 degree range.

- **Filtered Number of Blobs**

This is the Minimum and Maximum number of filtered blobs allowed. If this range is exceeded, the tool will fail.

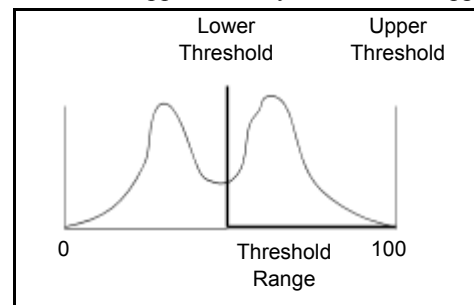
Display

See “Display panel” on page 3-19.

Grey Level Threshold Types

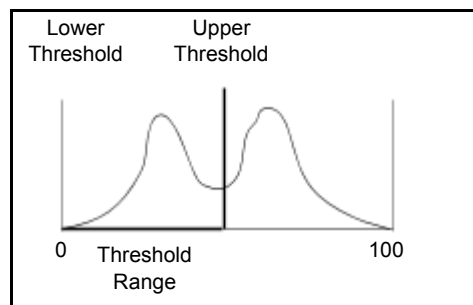
Autothreshold Contrasting Bright Pixels

This sets the upper and lower thresholds automatically based on all the grey levels in the ROI. The lower threshold is set to a value somewhere in the valley between the bright pixel and the dark pixel peaks. The exact value depends on the statistics of the two peaks. The upper threshold is set to 100%. Bright pixels are thus considered in-range. This setting is best used when looking for a bright part of an image with non-uniform grey levels. In this example, the lower threshold is approximately 50% and the upper threshold 100%.



Autothreshold Contrasting Dark Pixels

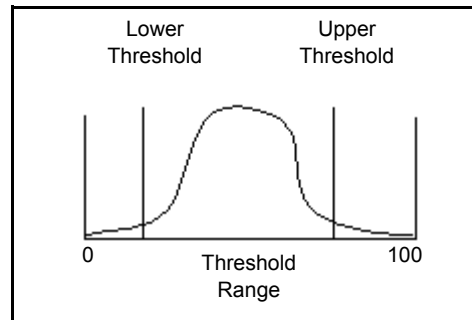
This sets the upper and lower thresholds automatically based on all the grey levels in the ROI. The lower threshold is set to 0%, and the upper threshold is set to a value somewhere in the valley between the bright pixel and the dark pixel peaks. The exact value depends on the statistics of the two peaks. Dark pixels are thus considered in-range. This setting is best used when looking for a bright part of an image with non-uniform grey levels. In this example, the lower threshold is 0% and the upper threshold approximately 50%.



Autothreshold Uniform Region

This sets the upper and lower thresholds automatically based on a uniform region of grey levels in the ROI. The lower threshold is set to the low end of the grey level values and the upper threshold is set high end of the grey level values. Pixels outside the thresholds are thus considered out-of-range. This setting can be used

for flaw detection which looks for non-uniform areas in the image. In this example, the lower threshold is approximately 20% and the upper threshold approximately 80%.

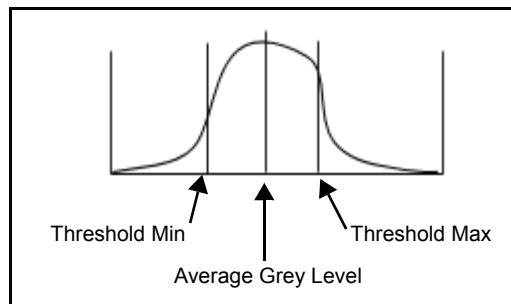


Fixed Threshold Range

This sets the upper and lower thresholds based on the Fixed Threshold Range input value. Pixels with grey level values between the thresholds are considered in-range. This setting is best used for an image with uniform grey levels.

Center Fixed Threshold Range On Region Average

The average of all grey levels within the Region of Interest is calculated. The Fixed Threshold Range (i.e. the difference between the Min and Max values) is centered on the average grey level. Pixels with grey levels within that range are considered in-range of the inspection. For example, if the Fixed Threshold Range is 20 to 40, the range is 20. If the average grey level is 70, the center of the grey level is 35. All pixels with grey levels between 25 and 45 ($35 - 10$ and $35 + 10$) are considered in-range.



Output Origin

The output origin is located based on the centroid of the filtered blobs. This means that the found output origin is based on the blobs that pass based on the filter settings. If there are multiple blobs, then the origin is located based on their combined centroid. In most cases you want to filter all but one blob. If that blob is not found, then set the tool to fail based on a minimum blob count of one. In other cases, you want to set the filters so that all the blobs pass and base the output origin on their combined centroid, especially if the blobs may break up.

Major Axis +/- 90 Range: The origin angle is the Major Axis of the blob, and, because the major axis is a line with two directions, the tool chooses the angle between -90 and 90 degrees.

Major Axis 360 Range: The origin angle is the Major Axis of the blob, and, because the major axis is a line with two directions, the tool chooses the angle on the side of the blob that extends furthest from the centroid (the longer side).

Circle Gauge-Locating

See “Circle Gauge” on page 3-61.

Line Find

In the Locating and Feature Finding Drawers



The Line Find tool finds the edge points along an edge or two edges, performs a linear regression on those points, and then creates a fitted line segment along the edge (or between two edges) and an origin as an output. It can find the center line between two found lines. It also checks for the maximum gap length in the line, the maximum distance of outlying points from the line, and the line's straightness. For more details, see “How the Line Find tool works” on page 3-39.

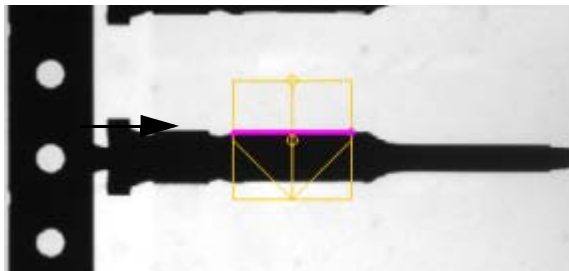
How to use the Line Find tool

General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

ROI

1. On the ROI panel, move and adjust the ROI so that it covers the part of the pattern you want to find in the image. The default shape list is a wide line ROI that you can move and size. In this example, the ROI includes the part of the edge to measure.



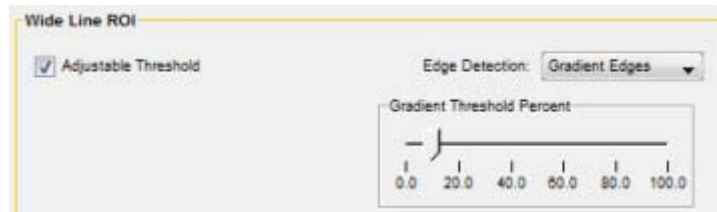
2. Adjust the Wide Line ROI settings to find the desired parts of the image.



For details on Edge Detection methods, see “Edge Detection Method” on page 3-40.

- **Grey Level Edges**

To find edges in the image using grey levels, set Edge Detection to Grey Level Edges. If you want to adjust the Grey Level Threshold manually, check Adjustable Threshold and use the Grey Level Threshold Percent slider to adjust the range that the tool uses.

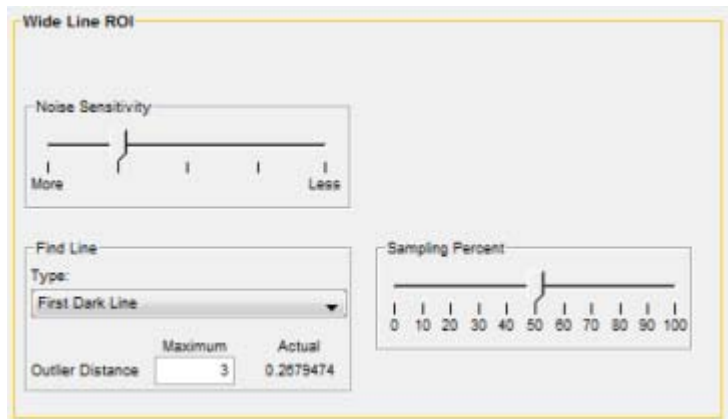
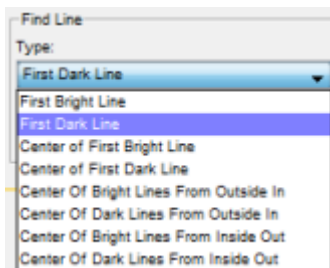


- **Gradient Edges**

To find edges in the image using a gradient, set Edge Detection to Gradient Edges. If you want to adjust the Gradient Threshold manually, check Adjustable Threshold and use the Gradient Threshold Percent slider to adjust the range that the tool uses.



If you want the tool to adjust the Gradient Threshold automatically, clear the Adjustable Threshold check box. You can then adjust the Gradient Edge Sensitivity using the Edge Sensitivity slider.



- **Noise Sensitivity**

This adjusts the tool for the amount of background noise that is present in the image. The More Sensitivity setting allows the tool to find edges that are close together since there isn't as much background noise in the image. The Less Sensitivity setting means there is more noise in the image so it's harder for the tool to find edges that are close together (edges along the ROI must be farther apart).

- **Find Line**

Select the type of line the tool should find. Line position is relative to the ROI direction.

- **Sampling Percent**

This the percentage of rows to sample. For example a setting of 100 samples every row, 50 samples every other row, 0 samples a minimum of 2 rows.

- **Outlier Distance**

Outlying points beyond this distance from the found line are not included in the line.

Pass/Fail

1. On the Pass/Fail panel, adjust the Filters, Outputs, and desired Feature settings to provide the desired output. The tool will pass or fail based on these settings.

The screenshot shows the Pass/Fail panel with two main sections: Filter and Length.

Filter Section:

| Feature | Maximum | Actual |
|---|----------|----------|
| <input type="checkbox"/> Straightness Error | Infinity | 1.37324 |
| <input type="checkbox"/> Longest Gap | Infinity | 30.23437 |

% Out of Tolerance: 90

☐ Display Output Origin

Length Section:

| Feature | Minus | Nominal | Plus | Actual |
|---------------------------------|----------|---------|----------|----------|
| <input type="checkbox"/> Length | Infinity | 0 | Infinity | 99.94151 |
| <input type="checkbox"/> Angle | 180 | 0 | 180 | 113.7339 |

- **Filter: Feature**

Straightness Error: This is the maximum amount the found line can deviate from a straight line (0 indicates a straight line).

Longest Gap: This is the maximum gap allowed between fitted points along the found line. Gaps are formed by missing edge points or outliers caused by bumps or breaks in the edge. Gaps must exceed this max length to be detected. If any gaps are detected, then the tool fails. If this value is less than $1.5 * \text{Sampling Rate} * \text{pixel_size}$, then the larger value is used instead.

% Out of Tolerance: The percent of the edge points that can be out of tolerance. A point is out of tolerance if it is not found or it is an outlier.

- **Display Output Origin:**

The origin produced from the found line is displayed. This origin can be used in other tools. The tool runs faster if Display Output Origin is not enabled.

- **Length: Feature**

Length: If the found line's length exceeds this value, the tool fails. The parameters are minus, nominal, and plus.

Angle: If the found line's Output Origin exceeds this angle, in degrees, the tool fails. The parameters are minus, nominal, plus, include end, and include start.

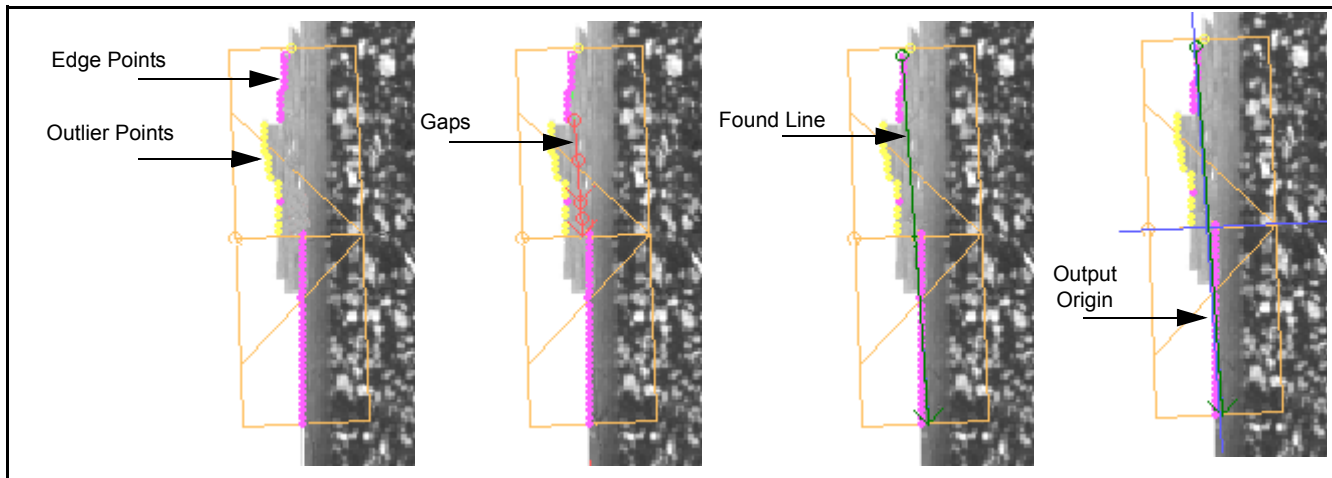
Display

See "Display panel" on page 3-19.

How the Line Find tool works

This tool can find a line by locating multiple points on an edge and fitting them; find two lines and report the center line between them; and pass or fail based on the length, angle, straightness error (average fitting

error), and maximum gap length of the found line. It can only find one line or one pair of leading and trailing lines.



Above is an example of an image after the tool has run (some features have been removed in each example for clarity). The magenta dots are the edge points, the yellow dots are the outlier edge points, and the green line is an output that lies on the fitted line and extends from the first fitted point to the last fitted point, as they are projected to the fitted line. The output origin is centered on the fitted line and at the same angle.

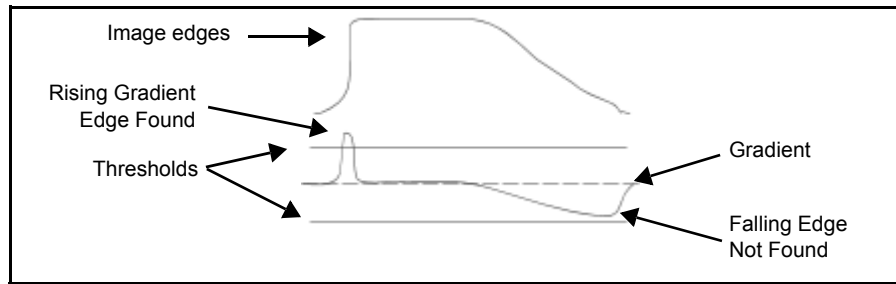
When the tool runs it performs the following operations:

1. Runs an Edge Point Find tool algorithm on each row of the wide line ROI and then does a linear regression on the points that are found.
2. For Dark Line type it finds the First Falling edge. For Bright Line type it finds the First Rising edge. For Center of Dark Line type it finds the strongest Falling/Rising pair. For Center of Bright Line type it finds the strongest Rising/Falling pair.
3. The regression algorithm fits all the found edge points to a line and then iteratively reduces the weights of points outside the Outlier Distance Threshold. For Center type finds, it fits the rising points to one line and the falling points to another and then averages the two lines to create the output Line Segment.
4. The output Line Segment and Gaps are found by projecting the non-outlier points to the fitted line and sorting along the line. The output line segment extends from the first to the last points on the fitted line. The gaps are the distance between adjacent points on the fitted line.
5. The output Origin is centered on the output Line Segment. The Origin is displayed only when the Display Output Origin check box in the Setup Pass/Fail panel is checked.
6. The Straightness Error is the average error of all the non-outlier points.

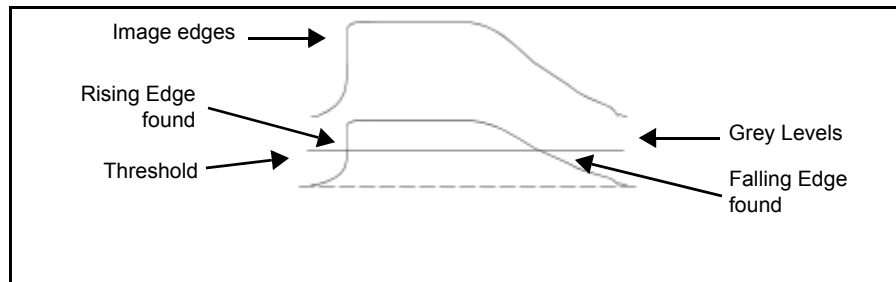
Edge Detection Method

Gradient Edges: Grey Levels in an image range from 0 to 100 percent (0 to 255 grey levels). A gradient indicates a rate of change. When you choose this setting, the tool compares the value of each pixel along the edge to its neighbor. A greater value indicates a positive gradient (dark to bright). A lesser value indicates a negative gradient (bright to dark). The difference between the two values indicates the steepness of the gradient (no difference indicates no gradient). The Fixed Gradient Threshold Percentage or Edge Detection Sensitivity input property determines the minimum steepness of the edge the tool should find. A larger threshold number or higher sensitivity means the tool only finds edges with a steeper gradient. In some cases Gradient Edge detection can find extra edges in the flat parts of a noisy image where Grey Level detection

offers better control. However, if there is extra noise in the edge you are trying to find, this method probably provides more consistent results.



Grey Level Edges: Grey Levels in an image range from 0 to 100 percent (0 to 255 grey levels). When you choose this setting, the tool measures the grey level of each pixel along the edge. The Fixed Grey Level Threshold Percentage or Edge Detection Sensitivity input property determines the grey level value at which edges are found. For example, if one pixel's grey level is less than the threshold and the next pixel's grey level is greater than the threshold, then a rising edge is detected. The threshold value is related to the difference in brightness or darkness of the object rather than the steepness of the edge. This setting works somewhat better than Gradient Edges when the edge is a gradual slope, the flat parts of the image are noisy, or you are trying to find more subtle edges.



Origin Tool

In the Locating Drawer



The Origin tool uses from one to three line ROIs to locate image edges. These edges provide an origin point and angle for other tools to use as a reference point to locate the parts of the image you want to inspect. Use this tool when the parts of the image to be inspected may move within the image window. After the tool is trained and run, the Output Origin can be linked into the Tool Origin of other tools.

Notes: When a tool with a Tool Origin input property is put in a task, that input property value is linked to the same value that was last used by other tools in the task.

The Origin tool, unlike other tools, clips ROIs that fall partially off the image. Since it is a locating tool and its ROIs can dynamically position relative to each other, ROI off-image situations can happen and not be errors.

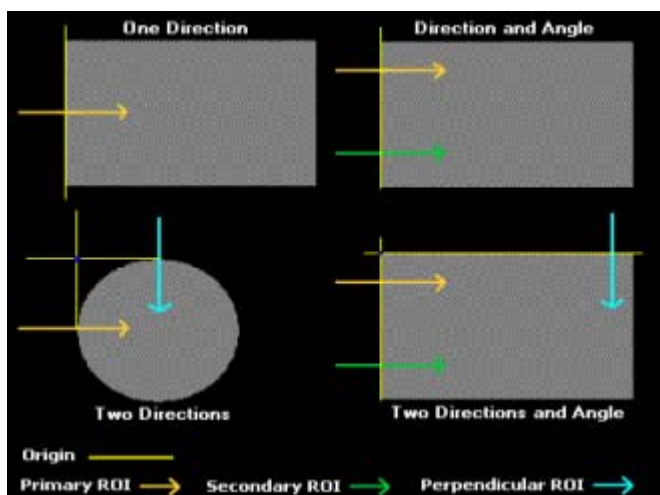
How to use the Origin tool

General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

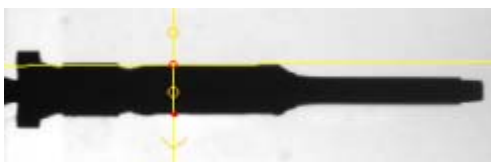
Method

1. On the Method panel, select how the tool should create the origin. Each method uses one or more ROIs (Primary, Secondary, and Perpendicular) to find edges in the image. Use the method that works best for the feature you are trying to find.

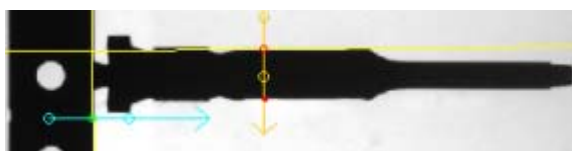


ROI and Pass/Fail

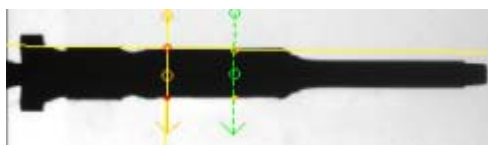
1. On the ROI panel, move and adjust each of the ROIs so that they cross the parts of the image you want to find. To adjust the settings for each ROI, select the appropriate tab. In these examples, the ROIs for each method and the produced origin are shown.



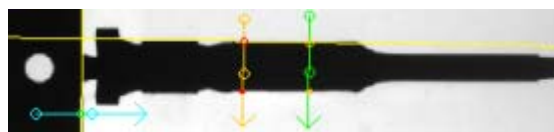
One Direction



Two Directions



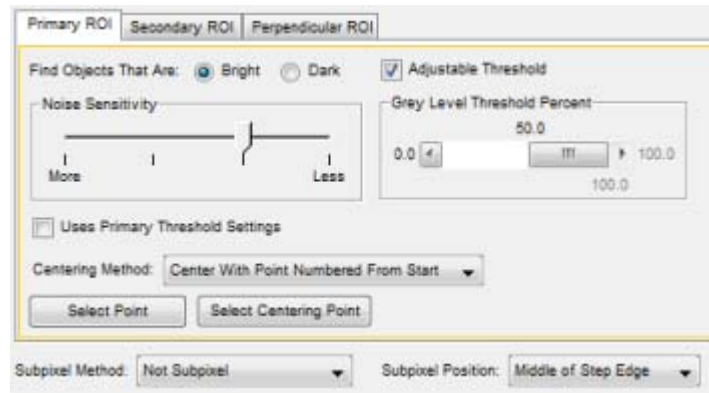
Direction and Angle



Two Directions and Angle

2. Primary, Secondary, and Perpendicular ROI

The Primary ROI is colored orange in the image window. This is the only ROI used for the One Direction method.



- **Find Objects That Are Bright/Dark**
Select the type of edge transition that you want the ROI to find.
- **Grey Level Edges**
The tool uses grey levels to find edges. If you want to adjust the Grey Level Threshold manually, check Adjustable Threshold and use the Grey Level Threshold Percent slider to adjust the range that the tool uses.
- **Uses Primary Threshold Settings**
Secondary and Perpendicular ROIs only.
When this box is checked, these ROIs use the same Threshold Settings as the Primary ROI.
- **Centering Method**
See “Centering Method” on page 3-44.
- **Select Point**
See “Centering Method” on page 3-44.
- **Select Centering Point**
See “Centering Method” on page 3-44.
- **Subpixel Method**
See “Subpixel Method” on page 3-66.
- **Subpixel Position**
The subpixel position for edges that are not well defined. See “Subpixel Position” below.

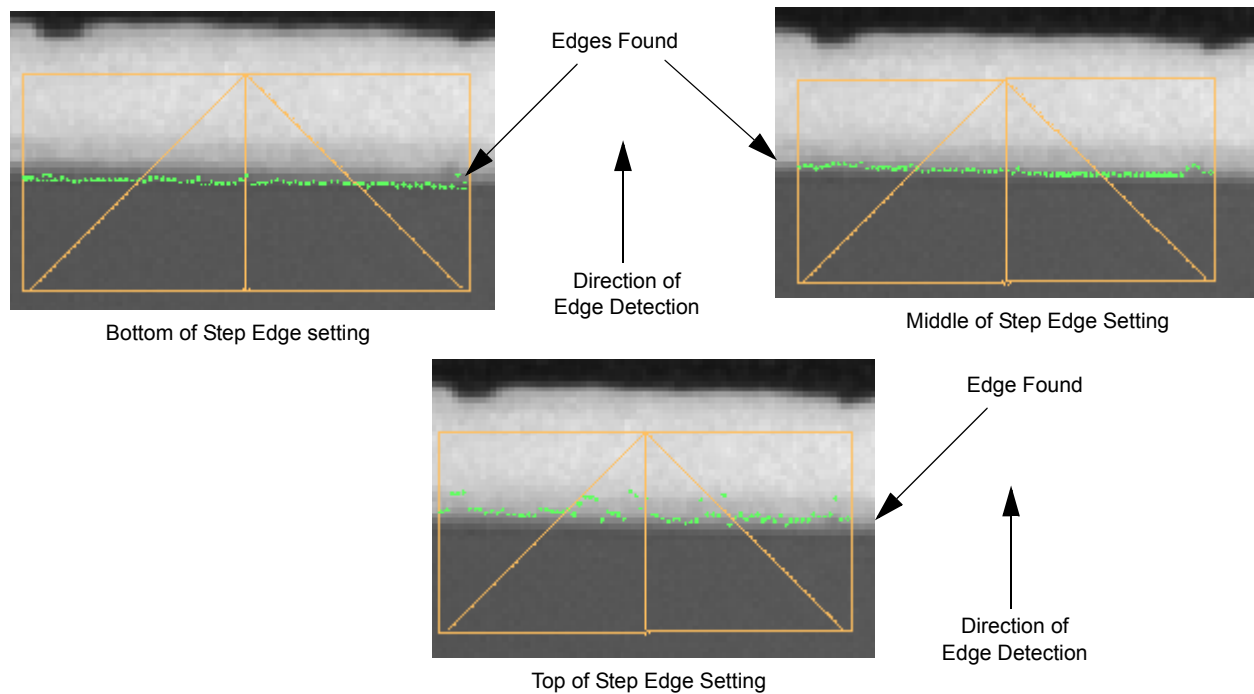
Subpixel Position

The subpixel position gives you greater control over subpixel position for edges that are not well defined. The bottom, middle, and top of the edge are determined by the direction of the ROI and the Subpixel Position setting. (See the examples below.) There are three settings:

1. Middle of Step Edge: This is the default setting and the correct choice for most cases. The tool finds the steepest part of the edge (the area with the greatest grey level change).
2. Bottom of Ramp Edge: This setting finds the beginning of the edge.
3. Top of Ramp Edge: This setting finds the end of the edge.

In the following examples, the edge of the part is not well defined because it is rounded and therefore becomes darker near the edge. The Middle of Step Edge setting finds the steepest part of the edge which actually occurs inside the part in this case. The Bottom of Ramp Edge setting finds the beginning of the ris-

ing edge, which is the desired edge in this case. The Top of Ramp Edge setting finds the end of the rising edge, which is quite poorly defined in this case. The bottom, middle, and top of the edge are determined by the direction of the Wide Line ROI and the Edge Polarity setting.



Centering Method

Points found on the ROI are counted from the beginning of the ROI. The first point found on the ROI is number one.

No Centering: The first found point is used to determine the origin on the ROI.

Center With Point Numbered From Start: The Select point is used to determine the starting point for centering. The tool uses the Select Centering Point to determine the ending point for centering. For example, if the Select Point is point one and the Select Centering Point is point twenty, the origin is centered between point one, counting from the beginning of the ROI, and point twenty, also counting from the beginning of the ROI.

Center With Point Numbered From End: The Select point is used to determine the ending point for centering. The tool uses the Select Centering Point to determine the beginning point for centering. For example, if the Select Point is point one and the Select Centering Point is point five, the origin is centered between the point one, counting from the end of the ROI, and point five, counting from the beginning of the ROI.

To center the origin between the first and last points on an ROI

1. For Centering Method, select Center With Point Numbered From Start.
2. Click Select Point and select the first found point on the ROI.
3. Click Select Centering Point and select the last found point on the ROI.

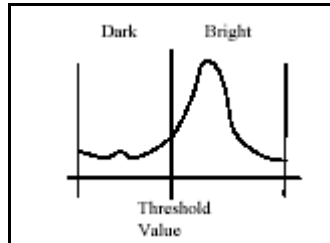
Display

See "Display panel" on page 3-19.

Threshold Method

Adaptive Threshold: The tool finds the peak grey level and automatically sets the threshold between the dark and bright areas of the image depending on the statistics of the two areas. It then checks where pixels fall within that range of grey levels to find edges. You can also apply a threshold offset to weight the adaptive threshold up or down. This threshold type allows the system to ignore small fluctuations in lighting, since the threshold moves automatically.

Fixed Threshold: The threshold is fixed at the Fixed Threshold Percentage value.



Pinpoint Pattern Find

In the Locating Drawer



The Pinpoint Pattern Find™ tool uses a train region to create a pattern (or model) from part of an image. When the tool runs, it uses correlation and contour matching routines to find one or more matches to the trained pattern. It then calculates best-match scores and provides those scores and the x-y coordinates of the found patterns as one or more origin outputs.

This tool does not automatically find pattern matches in "mirrored" images.

How to use the Pinpoint Pattern Find tool

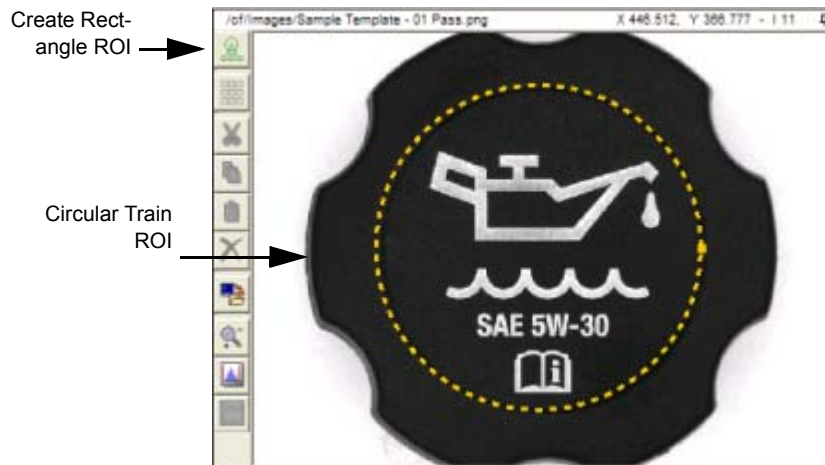
General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** Since this is primarily a locating tool, the tool origin should usually be 0,0,0. If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

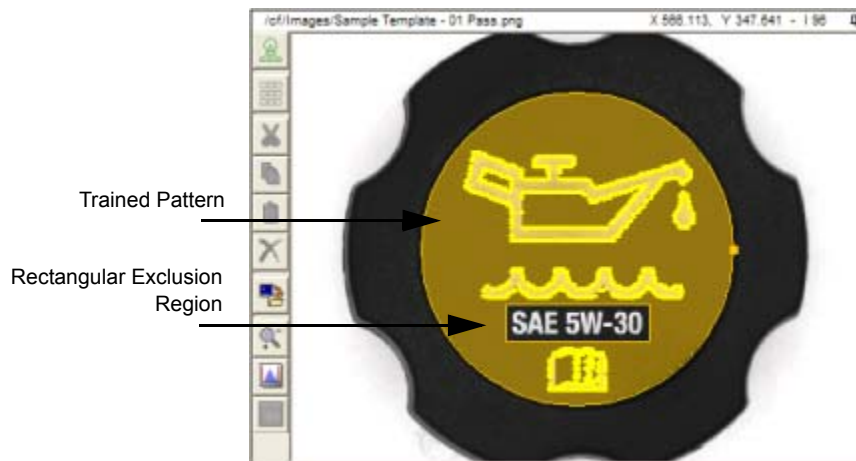
Train ROI

1. **ROI:** On the Train ROI panel, move and adjust the Train ROI so that it encloses the part of the pattern you want to find in the image. The default shape list is a rectangle that you can move and size. You can also create complex shapes by using circles, polygons, and exclusion regions. In this example, the Train ROI includes the entire center portion of the image. You can also create exclusion regions within an ROI. For example, if the text is not part of the image to inspect, click the Create Rectangle ROI icon

on the left side of the image window to create an exclusion region.

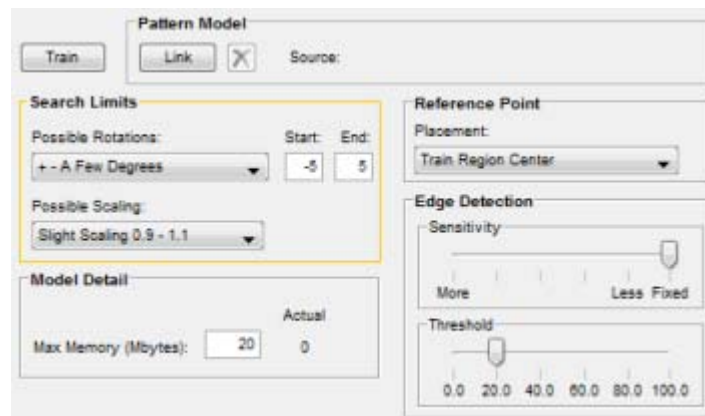


2. **Train:** Click the Train button to train the tool. After you make any changes to the settings or ROIs on this panel, you need to train the pattern. If you try to leave the Train ROI panel without training the tool, a warning is displayed. After the tool is trained, the found pattern is displayed as edge points overlaid on the image. In the example below, the entire center portion of the image inside the Train ROI, minus the text, is the trained pattern. The pattern's edge points may have gaps in them. These are a normal feature of the tool caused by a statistical data reduction process that increases execution speed.



3. **Pattern Model:** The model from another Pinpoint Pattern Find tool can be linked to this tool, rather than training the model in this tool. You can do this, for example, if you want to search for the same

model using a different Search ROI or different Search settings. All Train settings are disabled if a Pattern Model is linked here.



NOTE: Searching for both Possible Rotations and Possible Scaling can add a large amount of execution time and memory usage to the tool.

4. **Possible Rotations:** The Possible Rotations setting determines how the tool deals with image rotation. Use the No Rotation option if the image does not rotate. This is the fastest mode as most applications do not involve rotation. Use the "+ - A Few Degrees" setting if the part can rotate a small amount. The tool searches for patterns rotated from -5 to +5 degrees. You can change the Start and End rotation if necessary. Use the "0 And 180 +- A Few Degrees" option if some parts can be oriented two ways – as trained or rotated 180 degrees. The tool searches for patterns rotated from -5 to 5 degrees and 175 to 185 degrees. Use the "Full 360 Degree Range" setting for fully rotating parts. You should only use this option for parts that can be oriented at any angle. This option takes longest to execute and there is a greater risk of false matches if the search range is too large.
5. **Possible Scaling:** The Possible Scaling selection determines how the tool deals with scale variations (size changes) in the pattern. The setting "No Scaling" is the fastest setting as most applications do not involve any scale variation. If the pattern size varies a little, and the tool is failing to find these patterns, use the setting "Slight Scaling 0.9 - 1.1." This allows up to plus or minus 10% variation from the trained pattern size. The "Large Scaling 0.5 - 2.0" setting can deal with very large scale variation of 1/2 size to double size.
6. **Model Detail Max Memory:** The tool can potentially use a large amount of Impact camera memory. If the vision program is running out of memory, set the maximum amount of memory the tool uses for the pattern. The Actual value is the current amount of memory used for the pattern. If you enter a value that is less than the current Actual value, and then retrain the tool, the pattern is retrained to use less memory. However restricting memory usage adds to the tool's execution time.
7. **Reference Point Placement:** The tool's output origin is positioned at the center of the Train ROI by default. You can also have it placed in the upper left corner, or manually drag and rotate the blue Reference Origin to place it anywhere on the image. Here are three examples.



Train Region Center



Train Region Upper Left Corner



Where Placed On Image

8. **Edge Detection:** This is an automatic adaptive threshold setting that adjusts to the content of the currently trained image. The More setting makes the tool more sensitive so that it detects more edges. The

Fixed setting enables the Threshold slider. With this slider you can set a fixed gradient threshold value for detecting edges. For example, a value of 20 means that edges that have a contrast of 20% of the range between black and white are found. The Fixed setting gives you greater control, but may require further manual adjustment when you train on a different image or change lighting.

Search ROI and Pass/Fail

- After the pattern is trained, click the Search ROI and Pass/Fail button to configure the Search ROI. By default, the ROI is a large rectangle that includes nearly the entire image because the Search ROI must be larger than the Train ROI.
The tool execution time is fastest when you use a rectangular Search ROI that is parallel to the image. You can use any shape for the Search ROI including polygons, circles, and exclusion regions. If no Search ROI is defined, the entire image is searched.
- Pass/Fail Result:** The tool runs automatically and updates the panel whenever you change the Search ROI, any settings on this panel, or a new image is acquired. The result is indicated by the Pass/Fail field just below the image.
The Pass/Fail result of each found pattern is shown on the image with green or red edge points. If multiple patterns are found, those with a match score greater than or equal to the Minimum Match Score are shown in green. Patterns with a match score less than the Minimum Match Score are shown in red. The Origin is displayed only for the pattern with the highest match score. To display the pattern on a control panel, use the tool's Model Display Points property.
- Matches: Minimum Score:** The match score is a normalized correlation of the found pattern and the image at the pattern's location. The Actual value shows the match score for the pattern with the highest score.
The Minimum Score is the lowest match score possible for a pattern to pass. If there are no patterns found with a passing score, the patterns are displayed, but the tool fails. Use the failing pattern and Actual score to adjust the Minimum Score to get a passing result. If the Number To Find is greater than one, then the highest score is shown in the Actual value.
- Matches: Number To Find:** This property is a counter, not a pass/fail property. By default, the tool reports just one instance of the pattern with a match score greater than the Minimum Match Score. To report multiple instances, enter the desired number in this field.
The tool searches the image for all pattern matches, then displays the patterns for all the found matches, up to the value of this property. When multiple matches are found, they are listed in the corresponding passing or failing output property. The tool passes if it finds at least one pattern with a match score greater than the Minimum Match Score.
Increasing this value can increase the tool's execution time.
- Matches: Possible Scaling:** The first field shown is the Possible Scaling setting from the Train ROI panel. The second field is the actual scaling used on the pattern. You can use the Actual Scale value as feedback to adjust the Possible Scaling settings on the Train ROI panel. You cannot adjust the Possible Scaling setting on the Search ROI and Pass/Fail panel because the tool needs to be retrained after the setting is changed.
- Position Accuracy:** Choose whether to find the pattern location to pixel level accuracy or subpixel accuracy. The tool runs faster using pixel level accuracy.

7. **Edge Detection Sensitivity:** This setting is used to calculate the gradient threshold for edge finding when the tool searches for the pattern. To save time, the threshold is calculated once for each image using the setting on the Train ROI panel called Edge Detection Sensitivity. The tool then uses a percentage of that value for the edge finding threshold when searching.
A setting toward the More end causes more edges to be detected because the calculated gradient threshold is lower.
8. **Show Image Edge Points:** When you check this box, all the edge points found in the Search ROI are displayed in the image. This causes the tool to take more time, but it helps when you are configuring edge detection settings and debugging pattern find problems.
NOTE: Because this setting affects the tool's speed, it is only enabled while this Setup panel is displayed. When you leave Setup, the setting is turned off.

Display

See "Display panel" on page 3-19.

Algorithm Type

When the tool runs, it uses edge detection and edge matching to find candidate match locations, followed by correlation based final placement and scoring. The model contains both edge point lists and greyscale correlation models to support both stages of the search. Edge matching is the default first stage operation because it is fast, especially for rotated objects. However, edges are inherently variable and noise-sensitive features, so the edge matching is complemented with correlation in the final match stages to give robust final placement and scoring results.

If the Algorithm Type property is set to Edge Match, edge matching is used only for the first stage of the search. Correlation matching is always used for the final placement and scoring. This setting may be useful for patterns that have weak and variable edges or for very small objects.

Feature Finding Drawer

Average Intensity

In the Feature Finding Drawer



The Average Intensity tool calculates the average grey level intensity of pixels in one or more ROIs, calculates whether that intensity is within a user-specified tolerance, then passes or fails each ROI, and the tool, based on that calculation.

How to use the Average Intensity tool

General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

ROI & Pass/Fail

Pass/Fail: Passed Selected ROI Intensity: 88.07185

Tolerances

Type: Use Uniform Tolerance Train

Minus: Infinity Nominal: 90.25639 Plus: Infinity

ROI Results

| # | Minus | Nominal | Plus | Actual |
|---|----------|----------|----------|----------|
| 0 | Infinity | 90.25639 | Infinity | 88.07185 |

Failed ROIs

Allowed: 0

Actual: 0

1. Position one or more ROIs over the area of the image you want to inspect. If you want to calculate the average intensity of the entire image, delete any existing ROIs.
2. Tolerances

- **Type**

Use Uniform Tolerance: Use this when there is one ROI or all ROIs are expected to have the same intensity, or there are no ROIs and you want to calculate the average intensity of the entire image.

Use Nominal Intensity List and +/- tolerances: Use this when each ROI is expected to have a different intensity, but you want Plus and Minus Tolerances that apply to all ROIs, even as you add them.

Use Tolerance List: Use this when you want to set the plus and minus tolerance of each ROI separately.

- **Train**

Click this to generate a list of the ROIs and their average intensity values, along with Minus, Plus, and Nominal values in the ROI Results table. If you have any ROIs selected, only those ROI values may be recalculated, depending on the Tolerance type.

- **Tolerance Range**

Depending on the Tolerance Type you chose, adjust the Minus, Plus, and Nominal values, if necessary. To adjust a value, select the desired table row, then enter the values as follows:

Use Uniform Tolerance: adjust values in the Tolerances box fields

Use Nominal Intensity List and +/- tolerances: adjust the Nominal value in the table Nominal cell, adjust the Minus and Plus values in the Tolerances box Minus and Plus fields

Use Tolerance List: adjust all values in the Tolerances box or in the table cell

Tip: To select multiple rows, hold down the Ctrl key while you select a table row.

When you change a value, the tool runs and recalculates the results.

- **ROI Results**

The range and average intensity is listed for all the defined ROIs. Click on an ROI in the image to select its entry in the table.

- **Failed ROIs**

If the actual number of ROIs that fail is greater than the allowed number, the tool fails.

Display

See “Display panel” on page 3-19.

Blob-Feature

In the Feature Finding, Flaw Detection, and Locating Drawers

See “Blob” on page 3-32.

Circle Gauge-Feature

In the Feature Finding, Locating, and Measurement Drawers

See “Circle Gauge” on page 3-61.

Color Blob

In the Feature Finding and Flaw Detection Drawers



The Color Blob tool finds areas within an ROI based on the Trained Color. If it is set to find Out Of Range areas, it finds areas that vary from the Trained Color. If it is set to find In Range areas, it finds areas that match the Trained Color. Impact software uses a 24-bit color system.

This tool does not use L*a*b colors like the Color Checker does because it is unreasonably slow to calculate L*a*b color differences for every pixel.


The tool's execution time depends on the image resolution. Very high resolution images may take a long time.

How to use the Color Blob tool

General

1. **Image:** To use a different image source, click the Link button. The tool works only with color images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

Train ROI

| Trained Color | | | |
|---|-------|-------|-------|
|  | Red | Green | Blue |
| | 34.12 | 35.29 | 37.25 |
| <button>Train</button> | | | |

1. Position an ROI over the area of the image that contains the color you want to train. The Red, Green, and Blue components and color are displayed. When the desired area is covered, click the Train button.

Search ROI

☒ Find Blobs That Are In This Range ☐ Exclude Blobs That Touch Borders

Color or Intensity Differences

Color Difference Method: Separate Color And Intensity Differences

Maximum Allowed Color: 0 10 20 30 40 50 60 70 80 90 100

Intensity Range: -85.0 -10.0 10.0 100.0

1. Click the Search ROI button. Position the Search ROI over the area of the image that you want to inspect.
 - **Find Blobs That Are In Range**
If checked, the tool finds color areas that are within the Trained Color space.
 - **Exclude Blobs That Touch Borders**

If checked, found color areas that touch the ROI are not included. See “Border Blobs” on page 3-96.

2. Color or Intensity Differences

• Color Difference Method

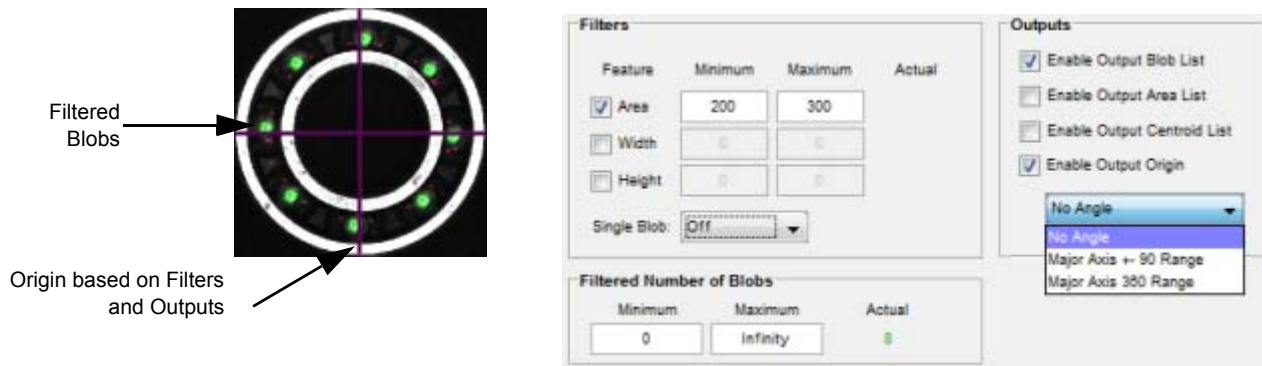
Color Difference Includes Intensity: The Maximum Allowed Color value uses all three dimensions of color and therefore includes intensity differences. This setting is faster and works well when the lighting is controlled.

Separate Color and Intensity Differences: The tool uses both Maximum Allowed Color and the Intensity Range settings. The intensity and chromaticity (hue and saturation) information is separated. Intensity Range indicates the allowed variation, plus or minus, from the trained intensity. The Maximum Allowed Color indicates only the allowed chromaticity difference.

Use Red, Green, and Blue Ranges: Adjust each of the ranges to find the desired color. The component values are listed on the Train ROI panel.

Pass/Fail

1. Click the Pass/Fail button. The tool will pass or fail based on these settings and the found blobs.



• Filters: Feature

Area, Width, Height: Enter values to filter the found blobs based on their minimum and maximum measurements. If you click on a blob in the image, the Actual measurements of that blob are displayed.

• Filters: Single Blob

This filter is applied after all the other filters. If Centermost or Largest blob is selected, only passed blobs are displayed in the image window.

Off: Blobs are filtered according to all the other filter settings

Centermost Blob: Only the blob closest to the center of each ROI is used.

First Blob: The tool stops processing when the first blob is found that has an area equal to or larger than the Area Minimum value. (The Width, Height, and Area Maximum filter values are ignored. The Exclude Blobs That Touch Borders value and Fill Blob Holes value are set to false.)

Largest Blob: Only the largest blob in each ROI is used.

• Outputs

Enable Output Blob List: A list of the found blobs is produced. This list can be used in other tools.

Enable Output Area List: A list of the areas of the found blobs is produced. This list can be used in other tools.

Enable Output Centroid List: A list of the center points of the found blobs is produced. This list can be used in other tools.

Enable Output Origin: The origin produced from the found blobs is displayed. This origin can be used in other tools. The tool runs faster if the Output Origin is not enabled. Also see “Output Origin” on page 3-36.

Major Axis:

No Angle: The origin is the X and Y coordinates of the blob centroid (the angle is ignored).

Major Axis +/- 90 Range: The origin is the X and Y coordinates of the blob centroid and the Major Axis angle in a +/- 90 degree range (useful if blob has an oblong shape).

Major Axis 360 Range: The origin is the X and Y coordinates of the blob centroid and the Major Axis angle in a 360 degree range.

- **Filtered Number of Blobs**

This is the Minimum and Maximum number of filtered blobs allowed. If this range is exceeded, the tool will fail.

Display

See “Display panel” on page 3-19.

How the Color Blob tool works

Where the Blob tool has a minimum and maximum threshold range, the Color Blob tool has a Trained Color and a Maximum Allowed Color Difference from the Trained Color.

Wherever the Trained Color is located in the RGB color space, the Maximum Allowed Color Difference is the radius of a sphere around that color. If the tool is set to detect Out Of Range, a pixel in an image is considered out of range when it is further from the Trained Color than the Maximum Allowed Color Difference (i.e. it is outside that sphere). If there are multiple colors in the training region, the color with the most pixels is trained. The other colors are ignored and do not affect the trained color. The Color Blob tool calculates the color difference of every pixel versus the trained color and needs a simple formula for speeds sake, so it uses the Euclidean difference.

The units are greyscale steps from 0 to 100, just like the monochrome Blob tool threshold range, so values of 5 to 10 are typical settings.

Note: This tool does not use L*a*b colors like the Color Checker does because it is unreasonably slow to calculate L*a*b color differences for every pixel.

Color Checker

In the Feature Finding Drawer



The Color Checker tool compares a known, trained color with the average color within an ROI of an input image. Impact software uses a 24-bit color system. See “How to use the Color Checker tool” on page 3-54.

| Input Name | What it is |
|----------------------------------|---|
| Input Image | The image being inspected. |
| Tool Origin | The tool's origin relative to the entire image space. |
| Shape List | The desired region of the image to check. |
| Trained Color | The Red, Green, and Blue values of the trained color. (0-100) |
| Maximum Allowed Color Difference | This is the maximum difference allowed between the Average Color in the inspected image area and the Trained Color. |

| Output Name | What it is |
|---------------|---|
| Average Color | The Red, Green, and Blue values of the average color in the Shape List. (0-100) |

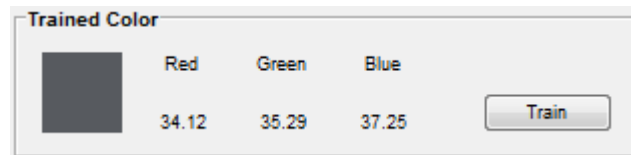
| Output Name | What it is |
|-------------------------|---|
| Actual Color Difference | The difference between the Trained Color and the Average Color, in the RGB color space. |
| Color In Tolerance | If True, the Actual Color Difference is less than the Maximum Allowed Color Difference. |

How to use the Color Checker tool

General

1. **Image:** To use a different image source, click the Link button. The tool works only with color images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

Train ROI



1. Position an ROI over the area of the image that contains the color you want to train. The Red, Green, and Blue components and color are displayed. If you are looking for out of range blobs in a solid color area, you can delete the Train ROI. The tool determines that there is no Train ROI and uses the Search ROI to calculate the Trained Color value.
2. When the desired area is covered, click the Train button.

Pass/Fail

1. Click the Pass/Fail button. The tool will pass or fail based on these settings.



- **Color Difference**
Maximum Allowed: This is the maximum difference allowed between the Average Color in the inspected image area and the Trained Color. The actual color difference is displayed.
- **Trained Color, Actual Color**
The Trained and Actual colors.

Display

See "Display panel" on page 3-19.

How the Color Checker tool works

Wherever the Trained Color is located in the RGB color space, the Maximum Allowed Color Difference is the radius of a sphere around that color. A pixel in an image is considered out of tolerance when it is further from the Trained Color than the Maximum Allowed Color Difference (i.e. it is outside that sphere). The

value is calculated using the CMC Color Difference. The CMC color difference is a complex formula that attempts to compensate for variation in human eye sensitivity across the RGB color space. It maps RGB differences into “just perceptible color differences.” The Color Checker tool averages the color in an area and calculates the CMC difference just once versus the trained color.

Contrast - Multiple ROI

In the Feature Finding and Flaw Detection Drawers



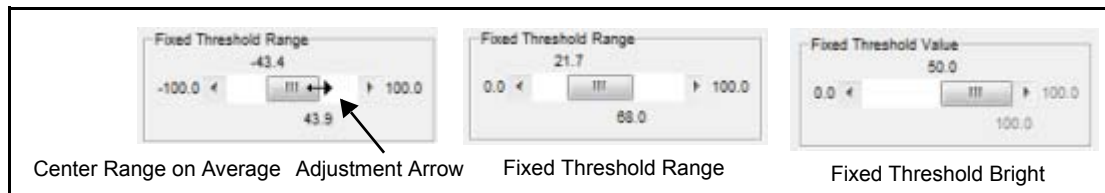
The Contrast - Multiple ROI tool checks the pixels within multiple ROIs and provides the percentage or area of pixels that are outside and inside a range that is based on user-defined parameters. The tool evaluates each ROI individually, against a common tolerance, and provides a detailed list of results.

How to use the Contrast - Multiple ROI tool

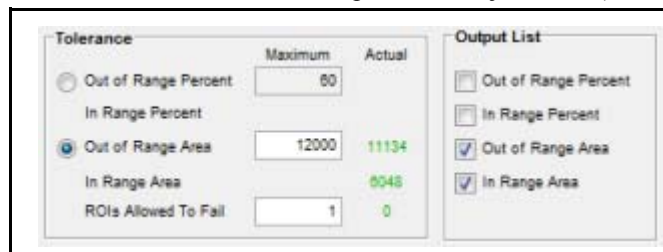
General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

ROI & Pass/Fail



1. Position one or more ROIs over the area of the image you want to inspect. You must have at least one ROI. Select an ROI to see its in/out of range values.
2. Threshold Type
Select the type of threshold the tool should use to determine contrast grey levels. For details see “Grey Level Threshold Types” on page 3-35.
For some threshold types you can adjust a slider to limit the pixel grey levels that are considered “in range” and “out of range.” To move the slider, hover the cursor over a slider’s free end, then click and drag the slider.
You can use the threshold viewer to help with the adjustment. (See “Threshold Viewer” on page 4-22)



3. Tolerance
Select the type of contrast failure you want to check, area or percent of pixels.

- **Out of Range**

The tool counts the total number of pixels in an ROI. It then finds the number of pixels in that ROI that are within the grey level determined by the Threshold Type and setting. It calculates the percentage of pixels outside that range and, if that value is greater than the Maximum tolerance value, that ROI fails.

- **Out of Range/In Range Area**

The tool calculates the total area of an ROI. It then finds the number of pixels in that area that are within the grey level determined by the Threshold Type and setting. It calculates the area of pixels outside that range and, if that value is greater than the Maximum tolerance value, that ROI fails.

- **ROIs Allowed to Fail**

An ROI fails when the Maximum Area or Percent Out of Range tolerance is exceeded. Enter the maximum number of ROIs that can fail. If the number of failing ROIs exceed this number, the tool fails.

4. **Output List**

Select the type or types of list(s) you want the tool to generate.

Display

See “Display panel” on page 3-19.

Edge Point Find

In the Feature Finding Drawer



The Edge Point Find tool finds edge points along a single pixel line ROI. It can use an adaptive or a fixed threshold method and gradient or grey level edge detection.

How to use the Edge Point Find tool

General

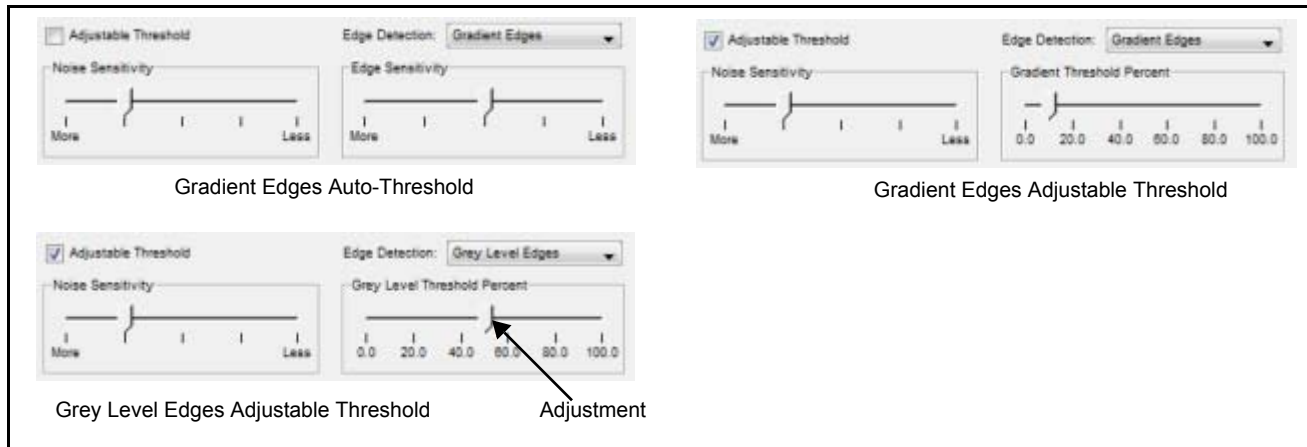
1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

ROI

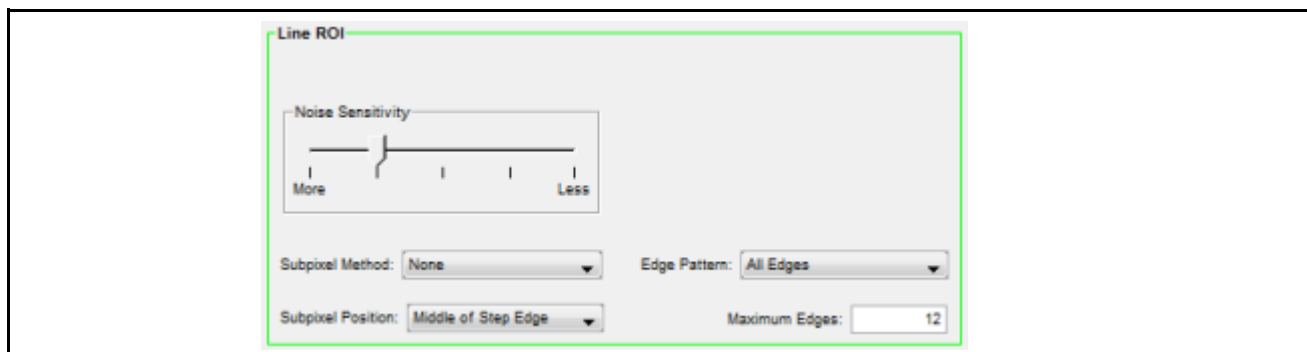


1. Position one or more ROIs over the area of the edges in the image you want to find. You must have at least one ROI.
2. **Edge Detection**
Select the type of edge detection the tool should use to find the edges: grey level or gradient. Gradient detection generally provides more consistent results. In some cases Gradient detection can pick up

extra edges in a noisy image and Grey Level detection may offer better control. For details see “Edge Detection Method” on page 3-40.



3. Gradient Edges - Edge Sensitivity: This setting determines the transition level necessary for detecting the edge. A “more” value is more sensitive and detects more edges.
4. Adjustable Threshold
Adjust the slider to set the pixel grey levels or gradient threshold for edge detection.
Gradient Threshold Percent: This setting determines the minimum steepness of the edge the tool should find. A larger threshold number or higher sensitivity means the tool finds edges with a steeper gradient. See “Edge Detection Method” on page 3-40.
Grey Level Threshold Percent: This setting determines the grey level value at which edges are found. For example, if one pixel’s grey level is less than the threshold and the next pixel’s grey level is greater than the threshold, then a rising edge is detected.



5. Noise Sensitivity: This setting adjusts for background noise in the image. The “more” setting finds edges that are close together when there is less background noise in the image. The “less” setting is used when there is more noise in the image and it is harder to find edges that are close together.
6. Subpixel Method: See “Subpixel Method” on page 3-66.
7. Subpixel Position: The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-43.
8. Edge Pattern: This is the edge pattern the tool should find (Rising indicates a transition from dark to light; Falling indicates a transition from light to dark.)
9. Maximum Edges: This limits the number of edges found to those with the strongest transitions.

Display

See “Display panel” on page 3-19.

Line Find-Feature

In the Locating, Feature Finding, and Measurement Drawer

See “Line Find” on page 3-37

Wide Edge Point Find

In the Feature Finding Drawer



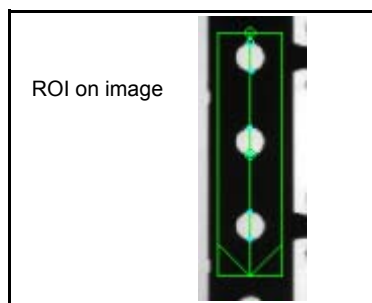
The Wide Edge Point Find tool uses an adaptive or fixed threshold method to find edge points along a wide line ROI.

How to use the Wide Edge Point Find tool

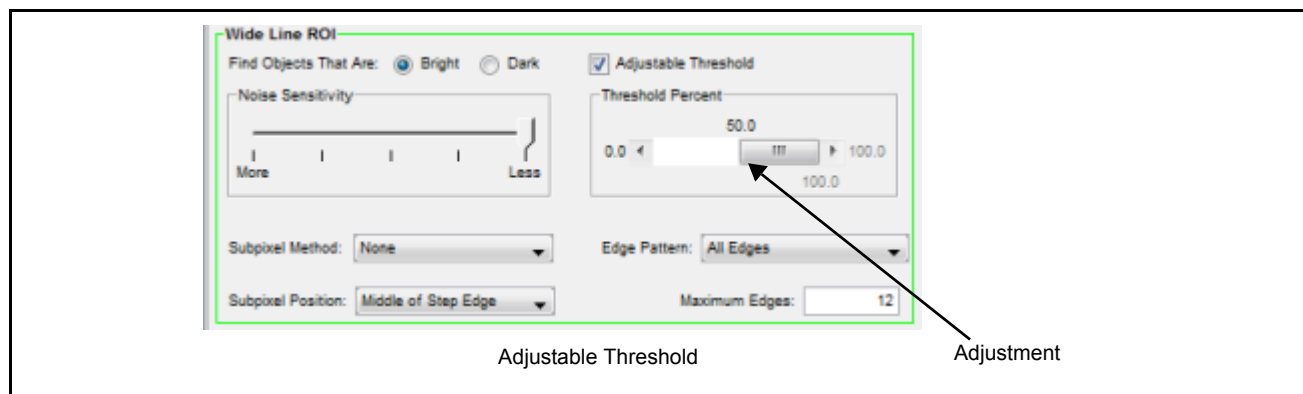
General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

ROI



1. Position one or more Wide Line ROIs over the area of the edges in the image you want to find. You must have at least one ROI.
2. Find Objects That Are:
Select the type of objects the tool should find: Bright or Dark objects.
3. Adjustable Threshold
To adjust the threshold, check the Adjustable Threshold check box. For details see “Blob Threshold Method” on page 3-59.



4. Noise Sensitivity: This setting adjusts for background noise in the image. The “more” setting finds edges that are close together when there is less background noise in the image. The “less” setting is used when there is more noise in the image and it is harder to find edges that are close together.
5. Subpixel Method: See “Subpixel Method” on page 3-66.
6. Subpixel Position: The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-43.
7. Edge Pattern: This is the edge pattern the tool should find (Rising indicates a transition from dark to light; Falling indicates a transition from light to dark.)
8. Maximum Edges: This limits the number of edges found to those with the strongest transitions.

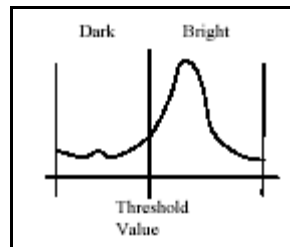
Display

See “Display panel” on page 3-19.

Blob Threshold Method

Adaptive Threshold: The tool finds the peak grey level and automatically sets the threshold between the dark and bright areas of the image depending on the statistics of the two areas. It then checks where pixels fall within that range of grey levels to find edges. You can also apply a threshold offset to weight the adaptive threshold up or down. This threshold type allows the system to ignore small fluctuations in lighting, since the threshold moves automatically.

Adjustable Threshold: The threshold is fixed at the slider value.



Measurement Drawer

Circle Gauge

In the Feature Finding, Locating, and Measurement Drawers



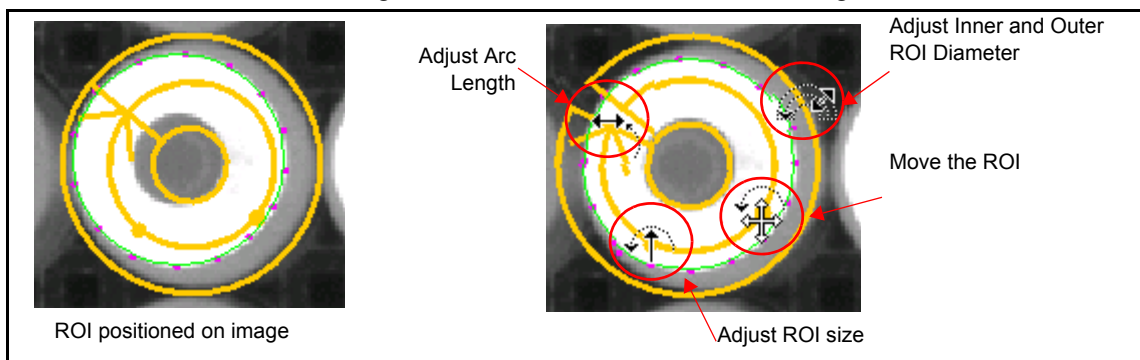
The Circle Gauge tool radially searches for edge points within the ROI, then finds the best fit circle to the found points. The tool can be set to find either a circle or a ring. It will output an origin placed at the circle or ring center.

If the tool is set to find a circle, the pass or fail can be based on the average radius, as well as the percentage of the radial lines that contain found points and that fit the radius tolerance.

If the tool is set to find a ring (two circles that make up the Inner Diameter (ID) and the Outer Diameter (OD) of the ring), the pass or fail can be based on the fitted radius of the ID and OD; the thickness and concentricity of the ring; and the percentage of radial lines that contain found points on both rings and fit the radius and ring thickness tolerances.

How to Use the Circle Gauge tool

1. Snap a good image of the desired part.
2. Click the ROI button. Position the Circle ROI over the circle or ring you want to find. Be sure that the ROI completely encloses the circle or ring. To adjust the ROI, hold the cursor over an adjustment point until the cursor changes to one shown below, then click and drag.



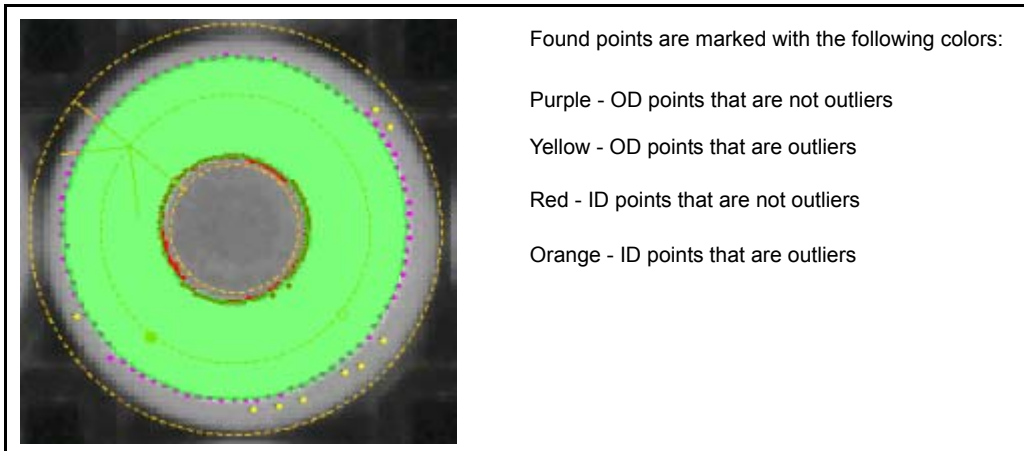
3. Select the "Circle-Type" based on the shape you want to find:
 - Dark Circle from Outside In - Start at the outer edge and search inward for a bright to dark edge
 - Dark Circle from Inside Out - Start at the inner edge and search outward for a bright to dark edge
 - Bright Circle from Outside In - Start at the outer edge and search inward for a dark to bright edge
 - Bright Circle from Inside Out - Start at the inner edge and search outward for a dark to bright edge
 - Dark Ring from Outside In - Do both Outside In and Inside Out searches for bright to dark edges
 - Dark Ring from Inside Out - Start at the ROI mid-Diameter and search outward and inward for dark to bright edges
 - Bright Ring from Outside In - Do both Outside In and Inside Out searches for dark to bright edges
 - Bright Ring from Inside Out - Start at the ROI mid-Diameter and search outward and inward for bright to dark edges

The Inside Out Ring types will only work if the ROI mid-Diameter is located on the ring, since the search starts at the mid-Diameter.

4. The detected edges are displayed on the image.

Important: Adjust the threshold and sensitivity options in the Circle ROI selection area until all the desired edges are marked in the image.

Gradient and Grey Level edge detection types are supported. In cases where Gradient edge detection picks up extra edges in a noisy image, Grey Level may offer better results.



5. Adjust the Outlier Distance and Sampling Percent until all the desired points are found.
6. Click the Pass/Fail button. Adjust the settings in the Filter Area to define which image features you want to check.
- % Out of Tolerance** - The percent of the edge points that can be out of tolerance. A point is out of tolerance if it is not found, is an outlier, is out of radius tolerance, or is out of ring thickness tolerance.
- Roundness Error** - The difference between the greatest radius and least radius of all the points on the circle, including outliers.
- Concentricity Error** - (Ring Only) The concentricity error is the distance, in units, between the inner and outer circle centers. Larger values indicate that the circles are less concentric.
- Smoothing Filter** - Removes isolated outlier points (both neighbors are not outliers) for the Roundness and Bounding Circle calculations.

| Filter | | | |
|---|----------|-----------|---|
| Feature | Maximum | Actual | |
| % Out of Tolerance: | 10 | 7.69 | <input checked="" type="checkbox"/> Enable Smoothing Filter |
| <input checked="" type="checkbox"/> Roundness Error | Infinity | 0.100189 | |
| <input checked="" type="checkbox"/> Concentricity Error | Infinity | 0.0118831 | |

7. Adjust the settings in the Tolerances Area to further refine the image features you want to check.
- Bounding Circle** - The size of the smallest circle that includes all the points found.
- Inscribed Circle** - The largest circle that can fit inside all the points found.

Radius - The fitted radius and each edge point is checked against the Inner and Outer Radius tolerance.

Ring Thickness - (Ring Only) The ring's thickness at each radial line is calculated and checked.

| Tolerances | | | | |
|--|----------|----------|----------|----------|
| Feature | Minus | Nominal | Plus | Actual |
| <input checked="" type="checkbox"/> Bounding Circle | Infinity | 0 | Infinity | 182.998 |
| <input checked="" type="checkbox"/> Inscribed Circle | Infinity | 0 | Infinity | 151.5162 |
| <input checked="" type="checkbox"/> Radius | Inner: | Infinity | 0 | Infinity |
| | Outer: | Infinity | 0 | Infinity |
| <input checked="" type="checkbox"/> Ring Thickness | Infinity | 0 | Infinity | 20.52721 |

(Outlier and out of radius tolerance points shown in yellow)

Display

See “Display panel” on page 3-19.

Line Find-Measure

See “Line Find” on page 3-37.

Line Gauge

In the Measurement Drawer



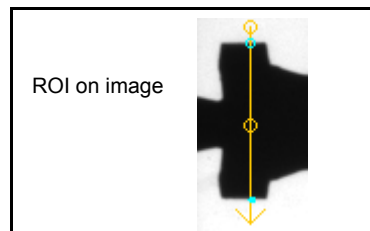
The Line Gauge tool finds the distance between two points using a single line ROI.

How to use the Line Gauge tool

General

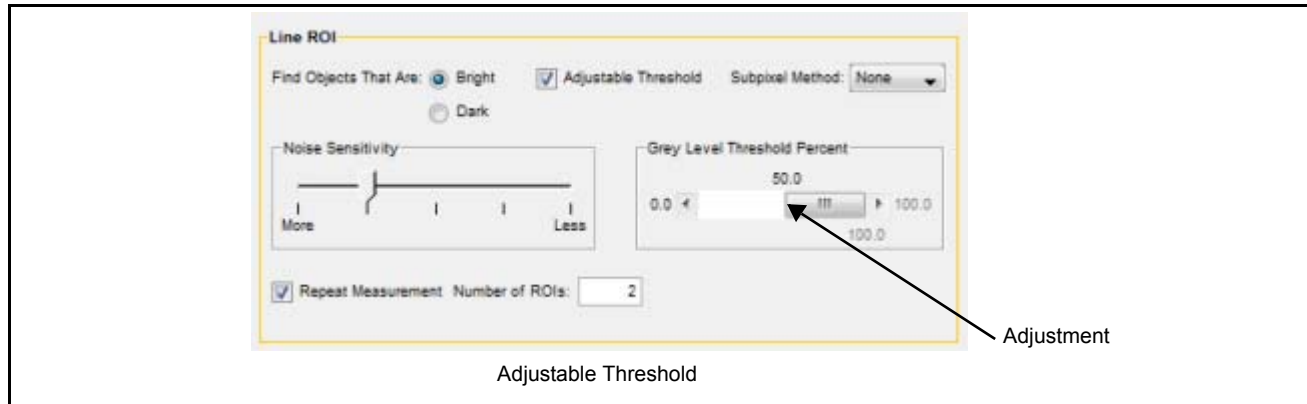
1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

ROI

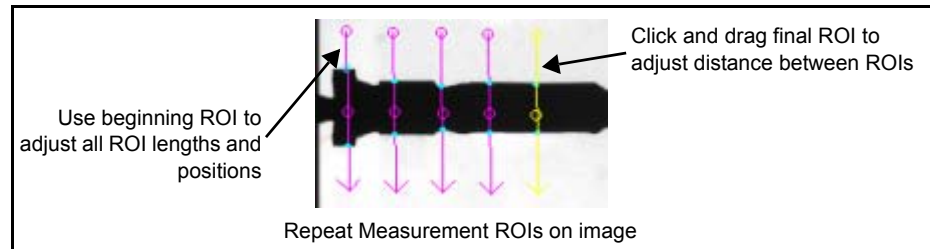


1. Position the ROI over the edges in the image you want to measure. If you want to make multiple measurements, check the Repeat Measurement check box.
2. Find Objects That Are Bright/Dark:
Select the type of edges the tool should find, Bright (transition is from darker pixels to lighter pixels) or Dark (transition is from lighter pixels to darker pixels).
3. Adjustable Threshold

To adjust the threshold, check the Adjustable Threshold check box. For details see “Blob Threshold Method” on page 3-59.



4. Subpixel Method: See “Subpixel Method” on page 3-66.
5. Noise Sensitivity: This setting adjusts for background noise in the image. The “more” setting finds edges that are close together when there is less background noise in the image. The “less” setting is used when there is more noise in the image and it is harder to find edges that are close together.
6. Repeat Measurement: Check this to create multiple ROIs so you can make multiple measurements with a single tool. Enter the number of ROIs you want the tool to use.



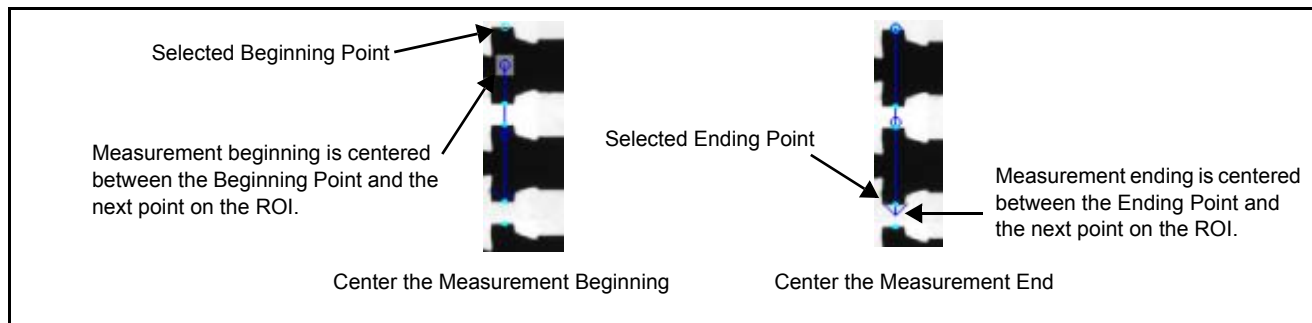
Endpoint & Type

1. Select Beginning and Ending Measurement Points
Click the Beginning Point radio button and select the point where the measurement should start. Then click the Ending Point radio button and select the point where the measurement should end. If there are multiple ROIs, the measurement direction will be the same for all of them.



2. Center Measurement
Center the measurement beginning: When you select this, the measurement beginning is centered between the selected Beginning Point and the next point on the ROI.

Center the measurement end: When you select this, the measurement end is centered between the selected Ending Point and the next point on the ROI.

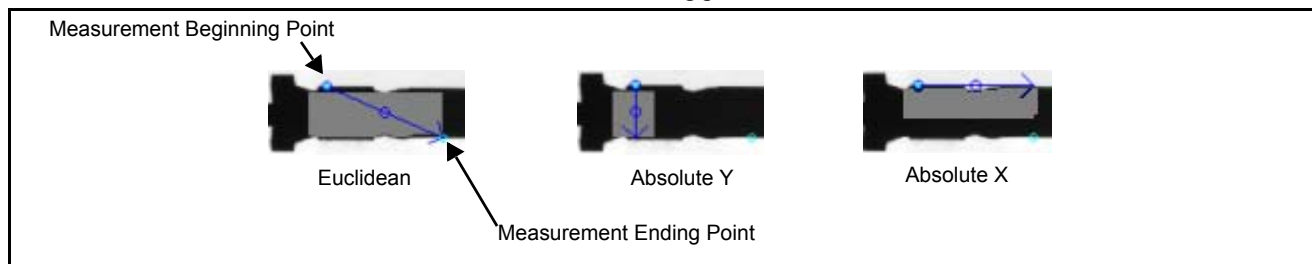


3. Measurement Type

Euclidean: The tool measures the length of a straight line between the measurement beginning point and ending point.

Absolute X: The tool measures the length of a straight line between the measurement beginning point and the X axis of the measurement ending point.

Absolute Y: The tool measures the length of a straight line between the measurement beginning point and the Y axis of the measurement ending point.



Pass/Fail

1. Pass/Fail: Indicates whether the measurement was within the measurement tolerances.

2. Enter the Measurement Tolerances

The ideal measurement range is the nominal value, plus and minus the tolerance values. For instance, in the example below, the ideal measurement is from 125 to 135.

The screenshot shows a dialog box titled 'Enter the Measurement Tolerances'. It contains three input fields: 'Minus:' with the value '5', 'Nominal:' with the value '130', and 'Plus:' with the value '5'.

NOTE: Train the Scale Factor ONLY when the tool measurement calibration is different from the camera image calibration.

3. Train the Scale Factor

The tool can be calibrated so that the distance measured in pixels on the image relates correctly to the measurement's real-world units. You can calibrate the tool and/or the camera. For example, you can calibrate the tool on a sample part as well as calibrate the camera for all parts. If you have multiple measurements and are concerned with lens distortion or multiple image planes, you can calibrate each measurement tool separately.

- **To train the tool's scale factor:**

3a. Place the ROI across the distance to be measured and select the Endpoints and Type. If the ROI goes partly off the image during runtime, it is clipped at the image's edge.

- 3b. Check the endpoints found to make sure the desired distance is being measured.
Enter the known measurement distance (in real world units, e.g. mm) into the Train Measurement Length.
- 3c. Click the Train button.
The tool will calculate the scale factor required to scale the measured distance in pixels to the Train Measurement Length value. This factor is applied after any camera calibration factor.



You can also average several images of measurements to create a more accurate scale factor.

- **To average several images:**
4. Train the tool's scale factor.
 - 4a. Snap a new image and click the Train button. The tool will average the measured distances and update the scale factor.
 - 4b. Repeat step 2 as needed to average more measurements.

Display

See "Display panel" on page 3-19.

Subpixel Method

Subpixel method "None" means that edges are located to pixel resolution. However, if the tool calculates Euclidean distances and the endpoints are not on the same row or column, then edges are located to fractions of pixels. This is a natural result of the ROI taking a slanted path across the pixel grid, even when it starts and ends on pixel boundaries. Integral distances are displayed if Subpixel Method is "None" AND the Distance Type is AbsoluteX or AbsoluteY (or the endpoints are on the same row or column) AND the image is not calibrated.

Line Gauge Dual ROI

In the Measurement Drawer



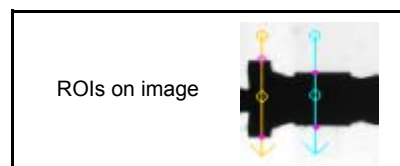
The Line Gauge Dual ROI tool finds the distance between two points using two line ROIs.

How to use the Line Gauge Dual ROI tool

General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

ROIs

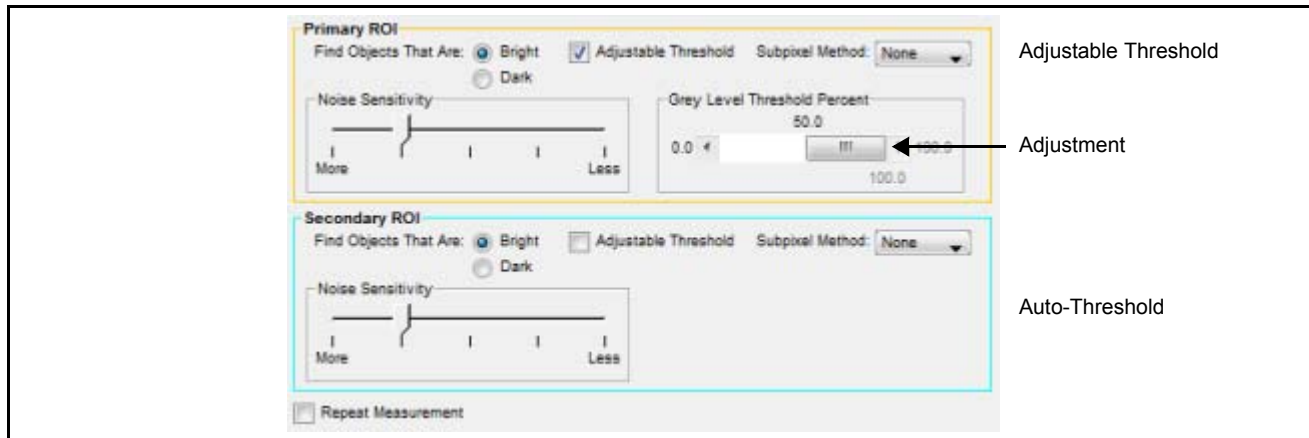


1. Position the ROIs over the edges in the image you want to find. The edge points found by the Primary

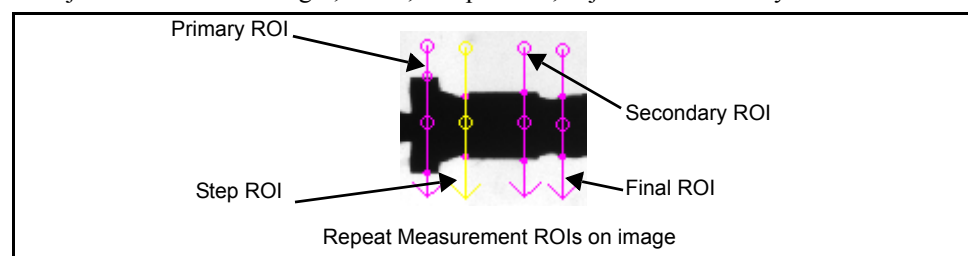
ROI will be used for the Beginning Measurement point and the points found by the Secondary ROI will be used for the Ending Measurement point. If you want to make multiple measurements, check the Repeat Measurement check box.

Adjust the settings for both the Primary and Secondary ROIs.

- Find Objects That Are Bright/Dark:
Select the type of edges the tool should find, Bright (transition is from darker pixels to lighter pixels) or Dark (transition is from lighter pixels to darker pixels).
- Adjustable Threshold
To adjust the threshold, check the Adjustable Threshold check box. For details see “Blob Threshold Method” on page 3-59.



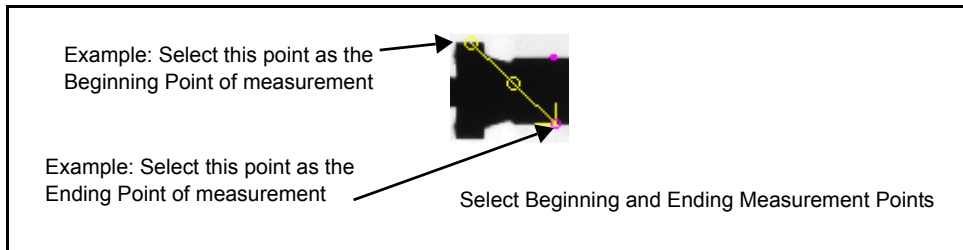
- Subpixel Method: See “Subpixel Method” on page 3-66.
- Noise Sensitivity: This setting adjusts for background noise in the image. The “more” setting finds edges that are close together when there is less background noise in the image. The “less” setting is used when there is more noise in the image and it is harder to find edges that are close together.
- Repeat Measurement: Check this to create multiple ROIs so you can make multiple measurements with a single tool. Enter the number of ROIs you want the tool to use.
To adjust the Step ROI length and width, adjust the Primary ROI
To adjust the distance between the Secondary and final ROIs, adjust the Step ROI.
To adjust the Final ROI length, width, and position, adjust the Secondary ROI.



Endpoint & Type

- Select Beginning and Ending Measurement Points.
Click the Beginning Point radio button and select the point where the measurement should start. Only the found points on the Primary ROI are displayed. (For Repeat Measurement, only found points on the Primary or Step ROI are displayed.)

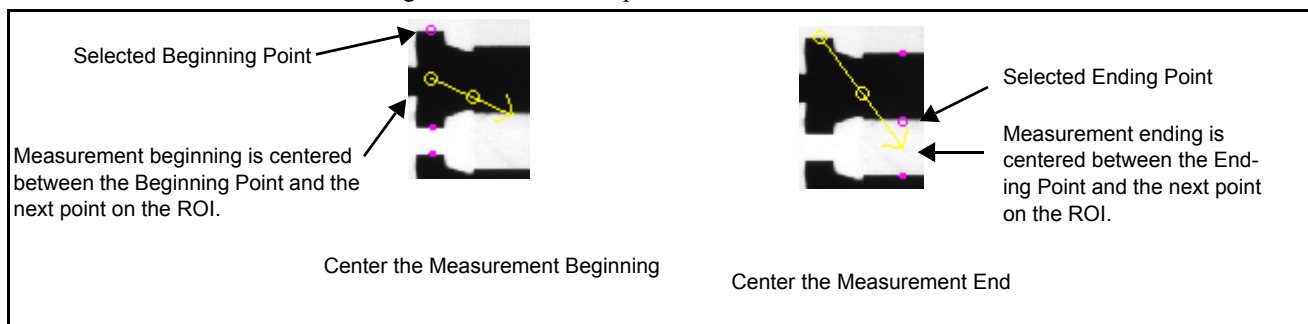
Click the Ending Point radio button and select the point where the measurement should end. For Repeat Measurement, the measurement direction is the same for all of them.



2. Center Measurement

Center the measurement beginning: When you select this, the measurement beginning is centered between the selected Beginning Point and the next point on the ROI.

Center the measurement end: When you select this, the measurement end is centered between the selected Ending Point and the next point on the ROI.

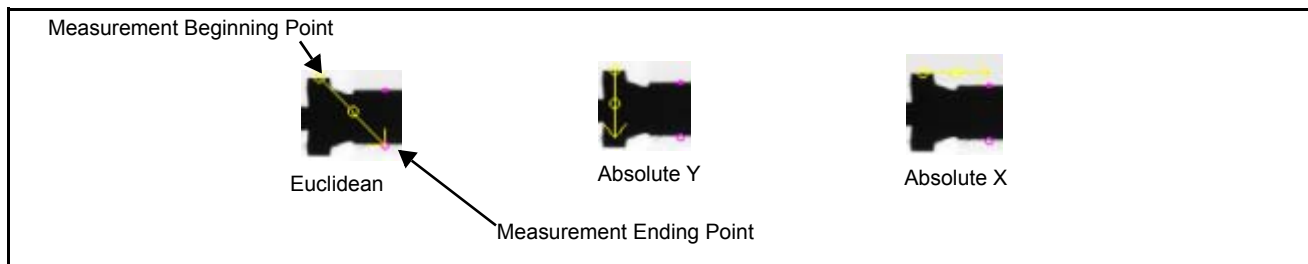


3. Measurement Type

Euclidean: The tool measures the length of a straight line between the measurement beginning point and ending point.

Absolute X: The tool measures the length of a straight line between the measurement beginning point and the X coordinate of the measurement ending point and perpendicular to the X axis.

Absolute Y: The tool measures the length of a straight line between the measurement beginning point and the Y coordinate of the measurement ending point and perpendicular to the Y axis.



Pass/Fail

1. Pass/Fail: Indicates whether the measurement was within the measurement tolerances.

2. Enter the Measurement Tolerances

The ideal measurement range is the nominal value, plus and minus the tolerance values. For instance, in the example below, the ideal measurement is from 125 to 135.

Enter the Measurement Tolerances

Minus: 5 Nominal: 130 Plus: 5

NOTE: Train the Scale Factor **ONLY** when the tool measurement calibration is different from the camera image calibration.

3. Train the Scale Factor

The tool can be calibrated so that the distance measured in pixels on the image relates correctly to the measurement's real-world units. You can calibrate the tool and/or the camera. For example, you can calibrate the tool on a sample part as well as calibrate the camera for all parts. If you have multiple measurements and are concerned with lens distortion or multiple image planes, you can calibrate each measurement tool separately.

- **To train the tool's scale factor:**

3a. Place the ROI across the distance to be measured. If the ROI goes partly off the image during run-time, it is clipped at the image's edge.

3b. Press the Train button. Check the endpoints found to make sure the desired distance is being measured.

Type the known measurement distance into the Train Measurement Length.

3c. Click the Train button.

The tool will calculate the scale factor required to scale the measured distance in pixels to the Scale Factor Train Distance value. This factor is applied after any camera calibration factor.



You can also average several images of measurements to create a more accurate scale factor.

To average several images:

3d. Train the tool's scale factor.

3e. Snap a new image and click the Train button. The tool will average the measured distances and update the scale factor.

3f. Repeat step 2 as needed to average more measurements.

Display

See "Display panel" on page 3-19.

Multiple Point to Point Measurements

In the Measurement Drawer



The Multiple Point to Point Measurements tool measures the distance between multiple points in a point list. The points may be paired sequentially, as they appear in the list, or using a user-defined index.

How to use the Multiple Point to Point Measurements tool

General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

Points

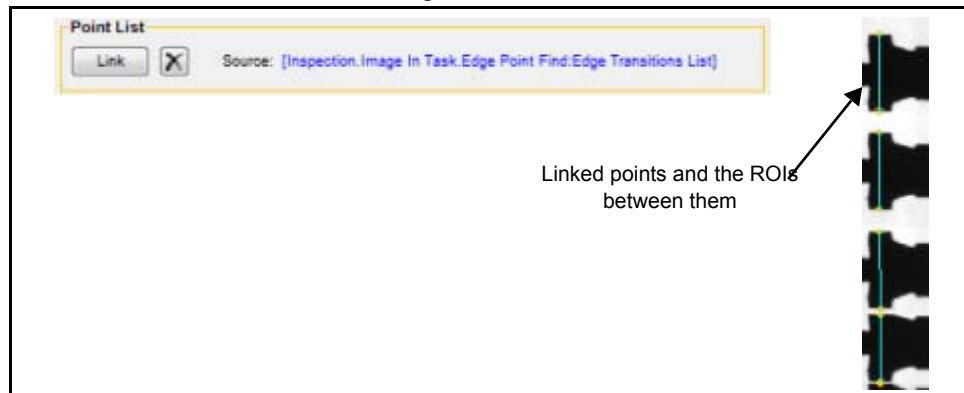
1. Point List

Click the Link button to link the list of points to use for measurements. When you link a points list, the tool checks the correspondence between the source tool's Tool Origin and this tool's Origin to insure the measurement is made on points with the desired reference. The check is based on the following order:

If the Points List link source tool does NOT have a Tool Origin property (e.g. the Data Instance tool), the link is made without a warning.

If the Points List link source tool contains "RWC" in the name (it uses Real World Coordinates), and this tool's Tool Origin is 0,0,0, the link is made without a warning.

If the Points List link source tool has a Tool Origin property, and this tool's Tool Origin matches it's value, the link is made without a warning.



2. Pairing Types

Pairing 0-1 2-3 4-5 6-7

If you select this Pairing Type, the tool calculates measurements between every even numbered point (starting with 0) and the next point after it in the Pairs Table. For example, if you have six points, three measurements are created (0-1, 2-3, 4-5).

Pairing 0-1 1-2 2-3 3-4

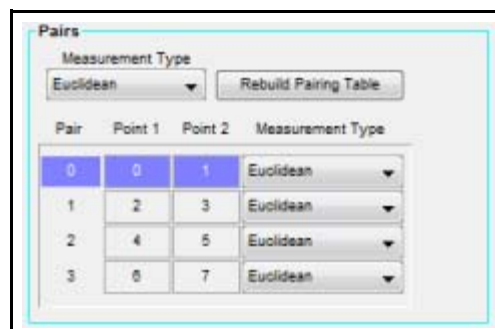
If you select this Pairing Type, the tool calculates measurements sequentially between the points as they appear in the Pairs Table. For example, if you have six points, five measurements are created (0-1, 1-2, 2-3, 3-4, 4-5).

User Selectable

If you select this Pairing Type, you choose the points that the tool uses to build the Pairs Table, then the tool calculates measurements sequentially between those points. The number of measurements is determined by the number of points in the Pairing Table. See "Pairing Table" on page 3-71 for more details.



3. Pairs

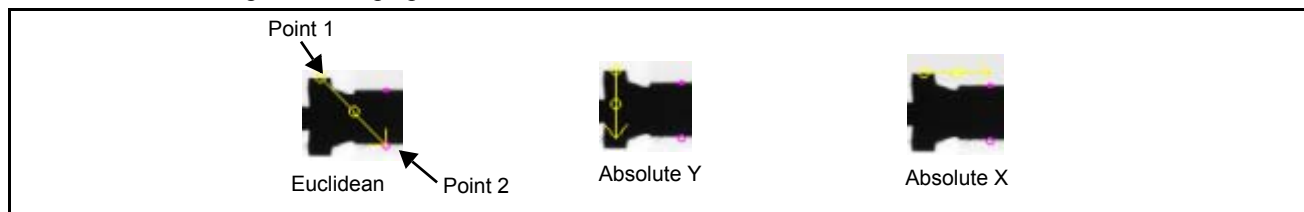


Measurement Type

Euclidean: The tool measures the length of a straight line between point 1 and point 2 of the pair selected in the table.

Absolute X: The tool measures the length of a straight line between point 1 and the X coordinate of point 2 and perpendicular to the X axis.

Absolute Y: The tool measures the length of a straight line between point 1 and the Y coordinate of point 2 and perpendicular to the Y axis.

Rebuild Pairing Table

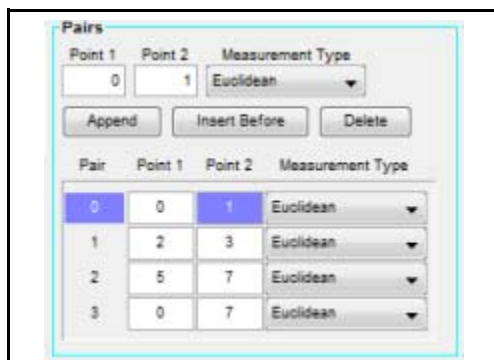
Click the button to rebuild the pairing table whenever necessary.

Pairing Table

Use this table to create measurement segments and set the measurement type. When you select one of the first two Pairing Types, the table is built from the points in the Point List. To change the Measurement Type for a segment, select the pair in the table or the segment in the image window. When you select "User Selectable," you can create the Pairing Table with your point selections.

To create a User Selectable Pairing Table

1. Click in the Point 1 field. In the image window, click on the beginning point for the measurement segment or enter the point number.
2. Click in the Point 2 field. In the image window, click on the ending point for the measurement segment or enter the point number.
3. Click the Measurement Type drop down to select the type for the measurement segment.
4. Click the Append button.
5. Repeat steps 1 through 4 to create additional segments.
6. To insert a new measurement segment before the selected segment, click the Insert button.
7. To delete the selected segment, click the Delete button.

**Pass/Fail**

1. Pass/Fail: Indicates whether all segment measurements were within the measurement tolerances.

NOTE: Train the Scale Factor ONLY when the tool measurement calibration is different from the camera image calibration.

2. Train the Scale Factor

The tool can be calibrated so that the distance measured in pixels on the image relates correctly to the measurement's real-world units. You can calibrate the tool and/or the camera. For example, you can calibrate the tool on a sample part as well as calibrate the camera for all parts. If you have multiple measurements and are concerned with lens distortion or multiple image planes, you can calibrate each measurement tool separately.

- **To train the tool's scale factor:**

2a. Select the desired measurement segment. Check the endpoints found to make sure the desired distance is being measured.

Type the known measurement distance into the Train Measurement Length.

2b. Click the Train button.

The tool will calculate the scale factor required to scale the measured distance in pixels to the Scale Factor Train Distance value. This factor is applied after any camera calibration factor.



You can also average several images of measurements to create a more accurate scale factor.

To average several images:

2c. Train the tool's scale factor.

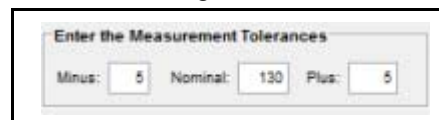
2d. Snap a new image and click the Train button. The tool will average the measured distances and update the scale factor.

2e. Repeat step 2 as needed to average more measurements.

3. Enter the Measurement Tolerances

The ideal measurement range is the nominal value, plus and minus the tolerance values. For instance, in the example below, the ideal measurement is from 125 to 135.

Select the desired measurement segment, then enter the desired values.



4. Measurements

The Measurements table shows the measurements for each segment.

#

Indicates the Pair Number from the Pairs table on the Points panel.

Scale Factor

The result of the Train the Scale Factor step.

Minus, Nominal, Plus

The measurement limits for the selected segment.

Actual

The actual measurement of the selected segment. This reflects any optional Scale Factor.

Display

See "Display panel" on page 3-19.

Point to Line Measurement

In the Measurement Drawer



The Point to Line Measurement tool measures the distance between a point and a line.

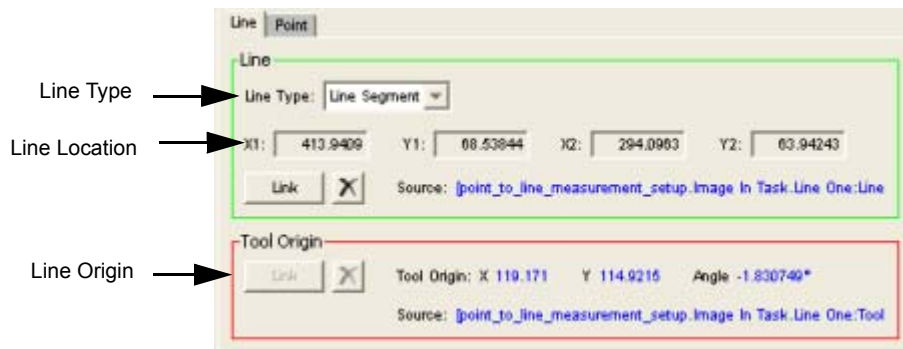
How to use the Point to Line Measurement tool

General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.

ROI

1. **Line Tab - Line Type:** Select the type of line you want to use for the line measurement location.
Line Segment: Select this to use a Line Segment.
Origin: Select this to use the X-axis line of the origin shown in the Tool Origin area. The X, Y, and Angle fields default to zero.
X1, Y1, X2, Y2: If the Line Segment is not linked, enter the coordinates in these fields
X, Y, Angle: If the Origin is not linked, enter the coordinates in these fields. The measurement Origin is offset from the Tool Origin by this amount.
2. **Line Tab - Tool Origin:**
Line Segment: Setup uses the link source tool's Tool Origin property. If the link source tool does NOT have a Tool Origin property (e.g. the Data Instance tool), the Origin is left unchanged and the Origin Link button is enabled
Origin: Setup uses the link source tool's Tool Origin property. This tool's Tool Origin values are set to zero and the link button is disabled. If the link source tool does NOT have a Tool Origin property (e.g. the Data Instance tool), the Origin is left unchanged and the Origin Link button is enabled.



3. **Point Tab - Point:** You define the point measurement location on the Point tab. Manually enter the X and Y coordinates of the point or click the Link button to link a point.
4. **Origin:** When you link the Point, Setup completes the Origin location, based on the following order:
 - 4a. If the Point's link source property contains "RWC" (it uses Real World Coordinates), the Origin is set to (0, 0, 0) since Point Two's location is relative to those coordinates. The Origin Link button is disabled.
 - 4b. If the Point's link source tool has a Tool Origin property, the Origin is linked to it. The Origin Link button is disabled.

- 4c. If the Point's link source tool does NOT have a Tool Origin property (e.g. the Data Instance tool), the Origin is left unchanged. The Origin Link button is enabled. Click the Link button to link an Origin for Point Two.



Pass/Fail

1. Click the Pass/Fail button.

NOTE: Train the Scale Factor ONLY when the tool measurement calibration is different from the camera image calibration.

2. Train the Scale Factor

The tool can be calibrated so that the distance measured in pixels on the image relates correctly to the measurement's real-world units. You can calibrate the tool and/or the camera. For example, you can calibrate the tool on a sample part as well as calibrate the camera for all parts. If you have multiple measurements and are concerned with lens distortion or multiple image planes, you can calibrate each measurement tool separately.

- **To train the tool's scale factor:**

- 2a. Select the desired measurement segment. Check the endpoints found to make sure the desired distance is being measured.

Type the known measurement distance into the Train Measurement Length.

- 2b. Click the Train button.

The tool will calculate the scale factor required to scale the measured distance in pixels to the Scale Factor Train Distance value. This factor is applied after any camera calibration factor.



You can also average several images of measurements to create a more accurate scale factor.

To average several images:

- 2c. Train the tool's scale factor.
- 2d. Snap a new image and click the Train button. The tool will average the measured distances and update the scale factor.
- 2e. Repeat step 2 as needed to average more measurements.

3. **Enter the Measurement Tolerances:** In the Nominal field, enter the correct measurement length, then enter the tolerances in the Minus and Plus fields.

Display

See “Display panel” on page 3-19.

Point to Point Measurement

In the Measurement Drawer



The Point to Point Measurement tool measures the distance between two points.

How to use the Point to Point Measurement tool

Click the Setup tab to use the setup for this tool.

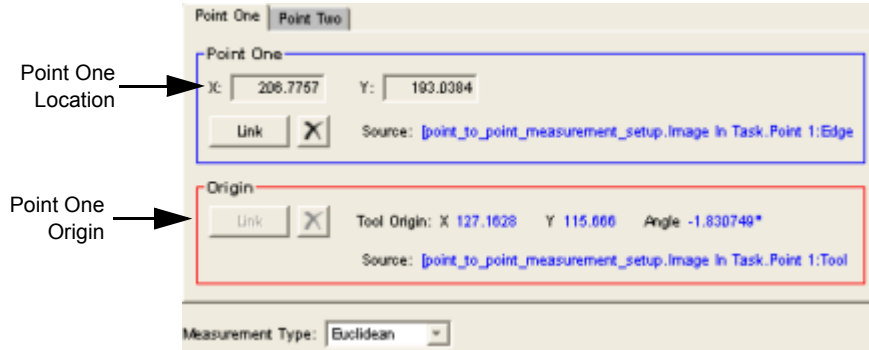
General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.

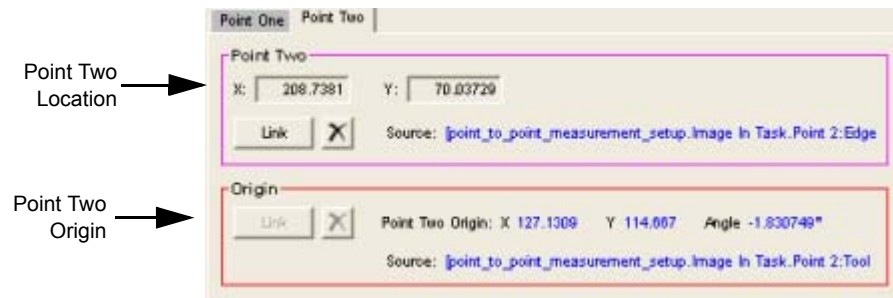
Points

1. **Point One Tab -Point One:** You define the beginning measurement point on the Point One tab. You can manually enter the X and Y coordinates of the point or click the Link button to link a point.
2. **Point One Tab - Origin:** When you link Point One, Setup will complete the Origin location, based on the following order:
 - 2a. If Point One’s link source property contains “RWC” (it uses Real World Coordinates), the Origin is set to (0, 0, 0) since Point One’s location is relative to those coordinates. The Origin Link button is disabled.
 - 2b. If Point One’s link source tool has a Tool Origin property, the Origin is linked to it. The Origin Link button is disabled.
 - 2c. If Point One’s link source tool does NOT have a Tool Origin property (e.g. the Data Instance tool), the Origin is left unchanged. The Origin Link button is enabled. Click the Link button to link an Origin for Point One.
3. **Measurement Type:** Select how you want the tool to measure the distance between the points.
 - Euclidean:** Measures the direct distance between the points
 - AbsoluteX:** Measures the distance between Point One and a line that runs through Point Two's X coordinate and is perpendicular to the X axis

AbsoluteY: Measures the distance between Point One and a line that runs through Point Two's Y coordinate and is perpendicular to the Y axis



4. **Point Two Tab - Point Two:** You define the ending measurement point on Point Two tab. Manually enter the X and Y coordinates of the point or click the Link button to link a point.
5. **Point Two Tab - Origin:** When you link Point Two, Setup will complete the Origin location, based on the following order:
 - 5a. If Point Two's link source property contains "RWC" (it uses Real World Coordinates), the Origin is set to (0, 0, 0) since Point Two's location is relative to those coordinates. The Origin Link button is disabled.
 - 5b. If Point Two's link source tool has a Tool Origin property, the Origin is linked to it. The Origin Link button is disabled.
 - 5c. If Point Two's link source tool does NOT have a Tool Origin property (e.g. the Data Instance tool), the Origin is left unchanged. The Origin Link button is enabled. Click the Link button to link an Origin for Point Two.



Pass/Fail

1. Click the Pass/Fail button.
2. Train the Scale Factor

The tool can be calibrated so that the distance measured in pixels on the image relates correctly to the measurement's real-world units. You can calibrate the tool and/or the camera. For example, you can calibrate the tool on a sample part as well as calibrate the camera for all parts. If you have multiple measurements and are concerned with lens distortion or multiple image planes, you can calibrate each measurement tool separately.

 - **To train the tool's scale factor:**
 - 2a. Select the desired measurement segment. Check the endpoints found to make sure the desired distance is being measured.
Type the known measurement distance into the Train Measurement Length.
 - 2b. Click the Train button.

The tool will calculate the scale factor required to scale the measured distance in pixels to the Scale Factor Train Distance value. This factor is applied after any camera calibration factor.



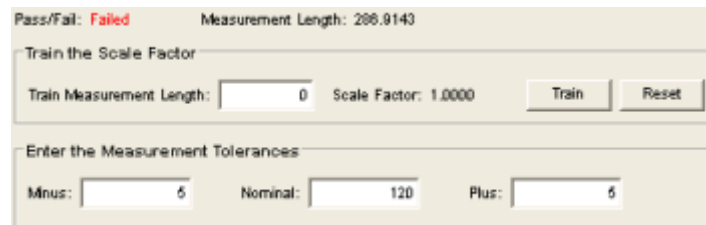
Train the Scale Factor

Train Measurement Length: Scale Factor: 1.0000

You can also average several images of measurements to create a more accurate scale factor.

To average several images:

- 2c. Train the tool's scale factor.
- 2d. Snap a new image and click the Train button. The tool will average the measured distances and update the scale factor.
- 2e. Repeat step 2 as needed to average more measurements.
3. **Enter the Measurement Tolerances:** In the Nominal field, enter the correct measurement length, then enter the tolerances in the Minus and Plus fields.



Pass/Fail: **Failed** Measurement Length: 288.9143

Train the Scale Factor

Train Measurement Length: Scale Factor: 1.0000

Enter the Measurement Tolerances

Minus: Nominal: Plus:

Display

See "Display panel" on page 3-19.

Flaw Detection Drawer

Average Intensity-Flaw

See "Average Intensity" on page 3-49

Blob-Flaw

See "Blob" on page 3-32

Color Blob-Flaw

See "Color Blob" on page 3-51

Contrast - Multiple ROI-Flaw

See "Contrast - Multiple ROI" on page 3-55

Greyscale Template

In the Flaw Detection Drawer



The Greyscale Template tool creates a template of an image when the tool is trained and that template is compared to the input image. A "difference blob" is created of the differences between the template and the inspected image. The difference image can be linked to other tools.

A greyscale template model consists of two parts; a greyscale image that is subtracted from the test image to find areas of difference, and a binary mask image that indicates which pixels in the rectangular model area should be used and which should be ignored. The mask image is needed because edges in the greyscale image generate large differences from the test image with even a slight misalignment. The mask image indicates <don't care> near image edges. The size of the <don't care> areas around edges is twice the standoff distance.

How to use the Greyscale Template tool

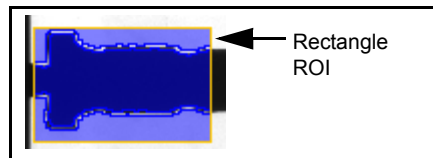
General

1. **Image:** To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin:** If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link delete button.

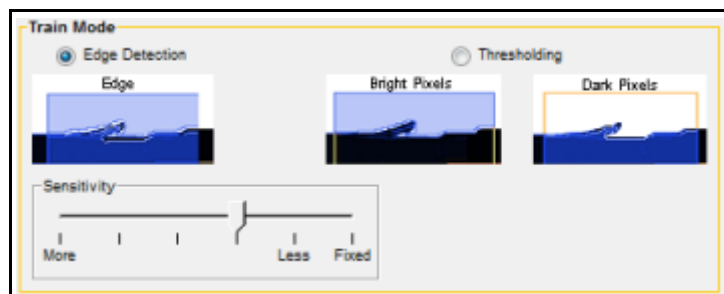
Train ROI

1. ROI

On the Train ROI panel, move and adjust the Train ROI so that it encloses the part of the pattern you want to find in the image. The default shape list is a rectangle that you can move and size. You can also create complex shapes by using circles or polygons.



2. Train Mode



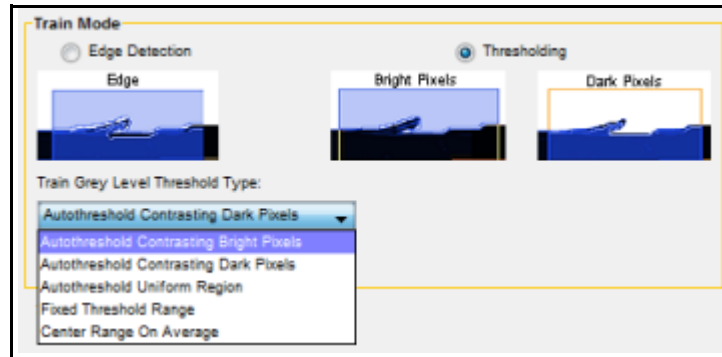
Edge Detection

The ROI is trained and a new model is created on this image using edge detection. The model greyscale image is a copy of the training region. The model mask image is created by detecting non-edge pixels and then eroding them by the standoff distance.

IMPORTANT: Templates made with edge detection have pixels of all intensities and only exclude pixels near edges. For example, a model of text includes the black pixels inside the characters and the white pixels in the background and excludes pixels near the edges of the characters.

Sensitivity

The sensitivity level determines the transition level necessary for detection. A more sensitive value detects more weak edges but causes the tool to run slower.



Thresholding

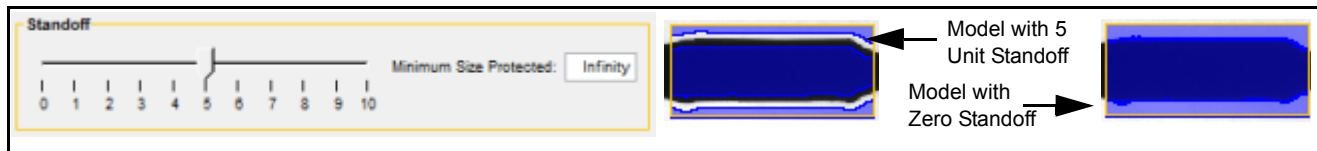
The ROI is trained and a new model is created on this image using thresholding. The model greyscale image is a copy of the training region. The model mask image is created by thresholding the image and then eroding it by the standoff distance.

IMPORTANT: Templates made with thresholding only include pixels within the threshold range. For example, a model of text would include only the black pixels inside the characters OR only the white pixels in the background, not both.

Train Grey Level Threshold Type

This indicates the thresholding type to use. See “Grey Level Threshold Types” on page 3-35 for details.

3. Standoff



The distance (in units) to erode the template from the edges. Increase this value to eliminate more noise or other unwanted features from the template edges.

Minimum Size Protected

This is the minimum size (in units) of features that should not be subject to Standoff Distance erosion. An Infinity setting means no features are protected.

Difference Image

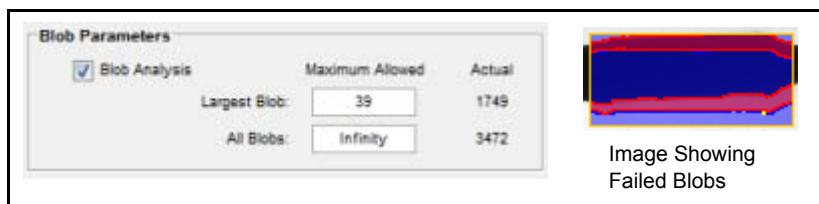
1. The image produced from the difference between the trained model and the current image is displayed in the image window.

Match Sensitivity

This setting indicates the amount of noise in the image. A more sensitive setting allows rougher edges and causes more thorough and longer searching.

Pass/Fail

1. Blob Parameters



Blob Analysis

When this box is checked, the tool analyzes the blobs present in the Difference Image and calculates the areas of the Largest Blob and All Blobs. If values are entered in the Maximum Allowed field, the tool will fail if any of the found blobs exceed those values. The Actual calculated values are shown and the failed blobs are highlighted in the image window.

Display

See “Display panel” on page 3-19.

Readers Drawer

Code Reader

In the Readers Drawer



The Code Reader tool reads 1D, 2D, Postal, Pharmacode, and MSI/2of5 symbols and provides thirty-six different outputs from the decoded symbols.

NOTE: The Code Reader tool will only read images with a darker code on a lighter background.

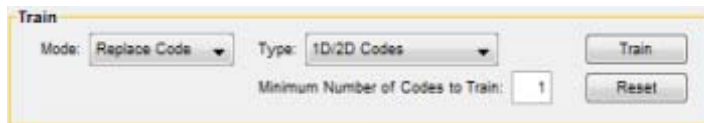
How to use the Code Reader tool

NOTE: The Code Reader tool will only read images with a darker code on a lighter background.

1. Snap a good image of the desired code or codes you want to read.
2. Click the ROI button. Position the ROI over the code or codes. Be sure that the ROI completely encloses the desired codes. See “Shape List ROI Toolbar” on page 3-15.

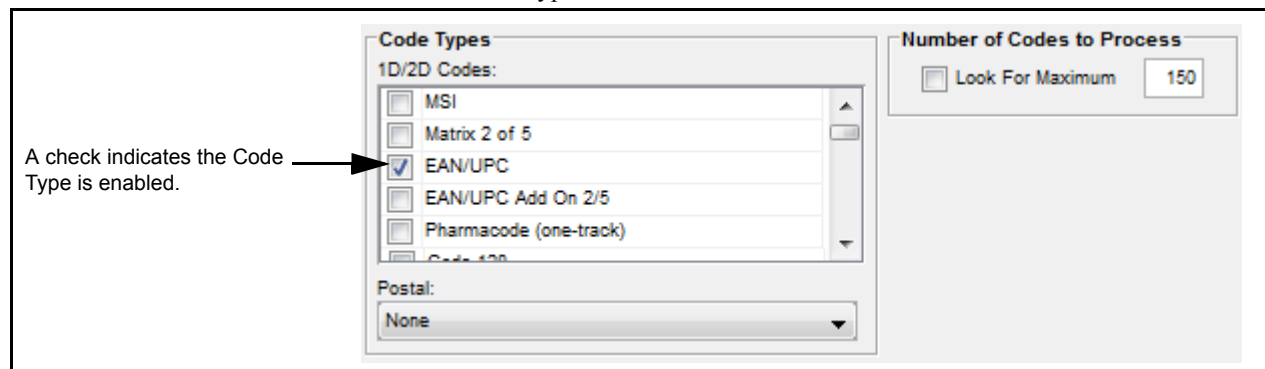


3. Select the Train Mode.
Add Code: When the tool is trained, any new code types trained are added to the list of trained codes. Any existing code types stay in the list, even if they are not trained in the image again. (Also see “Training Codes from Multiple Images” on page 3-83.)
Replace Code: When the tool is trained, any new code types trained in the image are added to the list of trained codes and any existing code types that are not trained are removed from the list.



4. Select the Train Type. When the tool is trained, it enables codes of this type that it finds in the image. When the tool runs it looks for and inspects enabled codes. For more details about code types, see “How the Code Reader Tool Works” on page 4-47.

5. Enter the Minimum Number of Codes to Train. This is the minimum number of code configurations the tool uses during training. The tool stops training after it tries this number of configurations, though it may find more than this number of individual code instances. A configuration includes at least the following parameters: Minimum Number of Codes to Train, Type, the Mode selected, and the Processing Mode selected.
6. Enter the Number of Codes to Process. The tool searches the image for codes, then stops processing when it finds all of them or the number in the value field. If the Look For Maximum box is checked, the value is replaced by the number of codes found after training. If the box is not checked, the value is unchanged.
7. Click the Train button. Depending on the configuration and the number of codes in the image, training may take several seconds. When it is complete, an ROI is drawn around each found code, and those codes are enabled in the Code Types window.



8. If you need to restart the Train process, click the Reset button and begin again with step 2. Reset will clear all the enabled codes and reset all the train configurations to the default selections.
9. Click the Pass/Fail button. The tool's Pass/Fail status and statistics about found codes are displayed. If there are multiple codes in the image, select an ROI to display that code's statistics.




10. You can define filters to look for one or more code characteristics. If those characteristics match a found code, it is decoded and output. If all the filters pass, the tool passes. If any one of the filters fail, the tool fails. If no filters are defined or enabled, all the defined codes found in the image are output and the tool passes. If the tool has not been trained to find a code type, any filters defined for it will automatically fail and the tool will fail.

Using the Pass Fail Filters

The following example shows two filters. The first one will pass only if the image contains two Datamatrix ECC200 codes (Min # = 2) that start with the string "728" (Match String = 728*). The second filter will pass if the image contains any UPC-A code (Match String = *). The first filter fails because the image contains

only one Datamatrix ECC200 code (Act # = 1) that has a string that starts with “728.” Because the first filter fails, the tool fails.

The tool failed because one of the filters failed (the Data-matrix filter)



In the image window, green ROIs show all found codes, including those that passed or failed a filter.

Pass/Fail: **Failed**

Code Statistics

Output String: 728574

Type Found: Datamatrix ECC200 Symbol Size (modules): 10x10

String Length: 6 Decoding Time (us): 1183 Module Size (pixels): 3

Overall Grade: N/A

Filters

Enable All Disable All Add Edit Delete

| Code Type | Match String | Min Len | Max Len | Min # | Max # | Act # |
|---|--------------|---------|---------|-------|-------|-------|
| <input checked="" type="checkbox"/> Datamatrix ECC200 | 728* | 0 | 3116 | 2 | 30 | 1 |
| <input checked="" type="checkbox"/> UPC-A | * | 0 | 3116 | | 30 | 1 |

The Datamatrix filter failed because the number of codes found (Act #) was less than the minimum wanted (Min #)

You can define one or more filters to test the characteristics of the defined codes found in the image. If a code's characteristics match its enabled filter parameters, that code is read and output. If no filters are defined or enabled, all the defined codes found in the image are output.

The tool's pass/fail condition is based on whether the found codes in the image pass all the filter parameters defined for them. If ALL the enabled filters pass, or no filters are enabled, the codes are considered valid and the tool passes. If any code does not pass its enabled filter, the tool fails.

Filters

Enable All: Enables all the filters. The tool will pass if all the conditions in all the filters are met.

Disable All: Disables all the filters. The tool will always pass if a defined code type is in the image.

Add and Edit: Click Add, or select a filter and click Edit. The Edit Filter dialog is displayed.

Delete: Select the filter you want to delete, then click Delete.

Code Type Check Box: If the box is checked, the corresponding filter is enabled. If no filters are defined or enabled, all codes pass.

Code Type: If this code type is not present in the image, the filter fails.

Match String: If the decoded string does not match this string, the filter fails. (You can use Wildcard and Placeholder characters.)

Min Len: If the decoded string contains fewer than this number of characters, the filter fails.

Max Len: If the decoded string contains more than this number of characters, the filter fails.

Min #: If the image contains fewer than this number of codes of the Code Type, the filter fails.

Max #: If the image contains more than this number of codes of the Code Type, the filter fails.

Act #: This is the actual number of codes of the Code Type in the image.

Training Codes from Multiple Images

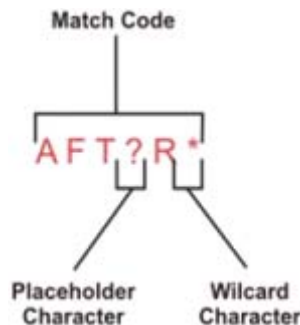
If you want to find different code types, and they are not all in one image, you can train the tool using multiple images.

1. Snap a good image of the desired code or codes you want to train.
2. Click the ROI button. Position the ROI over the code or codes. Be sure that the ROI completely encloses the desired codes.
3. Select the Train Mode Add.
4. Select the Code Type.
5. Enter the Minimum Number of Codes to Train.
6. Click the Train button.
7. For any additional code types you want to train, repeat steps 1 through 7.

Wildcard and Placeholder Characters

The Pass Fail Wildcard and Pass Fail Placeholder can be used when you define a Pass Fail Match Code. The Wildcard matches one or more characters and the Placeholder matches a single character. In the example below, all codes starting with the characters "AFT" are considered a match, if

- any single character occurs between the "T" and "R" characters (using the "?" Placeholder character)
- one or more characters follow the "R" character (using the "*" Wildcard character).



If you include only the Wildcard in the Pass Fail Match Code, all decoded strings are matched.

Composite Codes

If the Code Type Composite Codes is selected, the tool decodes two different code types:

- The first code is one of these 1D codes: GS1 128, Code 128, GS1 Databar, GS1 Databar Stacked, GS1 Databar Limited, GS1 Databar Expanded, or GS1 Databar Expanded Stacked.
- The second code is a 1D MicroPDF code.

If the Code Type Composite Codes is not selected, only the linear code in the Composite code is decoded and its type is indicated. MicroPDF is a stacked code but is still considered linear.

When the two 1D codes are linked by the composite rule, the Code Type Found is set according to the following table:

| Composite Code Type | Code Type Found |
|---------------------|-------------------|
| GS1 128 | Code128 Composite |
| Code 128 | Code128 Composite |

| | |
|------------------------------|--|
| GS1 Databar | GS1 Databar Composite |
| GS1 Databar Stacked | GS1 Databar Stacked Composite |
| GS1 Databar Limited | GS1 Databar Limited Composite |
| GS1 Databar Expanded | GS1 Databar Expanded Composite |
| GS1 Databar Expanded Stacked | GS1 Databar Expanded Stacked Composite |
| MicroPDF | MicroPDF CCA Composite MicroPDF CCB Composite MicroPDF CCC Composite |

OCR

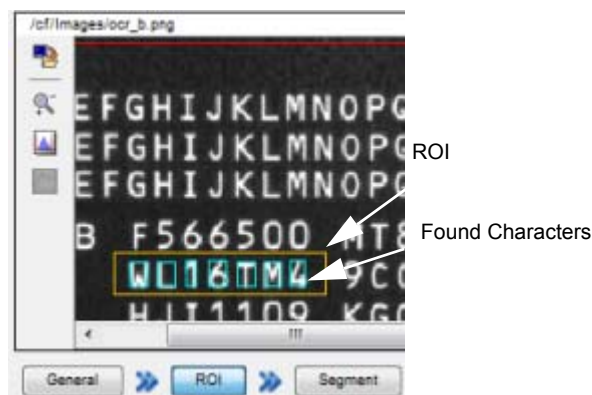
In the Readers Drawer



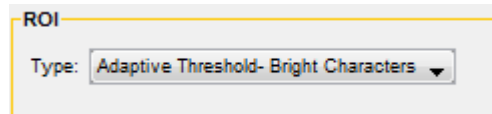
The OCR tool (Optical Character Recognition) detects and reads character strings to find matches with trained characters and verifies those strings. Characters are read by finding the best matching character from a trained library or string, within a minimum match score. If the tool finds no matching character, it uses a substitution character instead. Several different text segmentation techniques can be chosen.

How to set up the OCR tool

1. Snap a good image of the desired characters.
2. Click the ROI button. Move and size the ROI so it fits closely around all the characters you want to inspect. Only the characters to be verified should be inside the ROI so try to avoid including parts of the background. Multiple rows of characters can be contained within the ROI. The tool will place a character box around each character it finds.

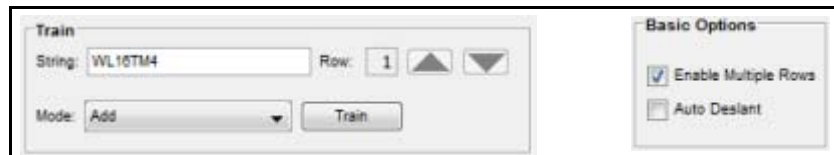


3. Select an ROI Type, based on the character and background contrast. See “Threshold Types” on page 3-88. Generally, the default Adaptive Threshold choice is the most appropriate.



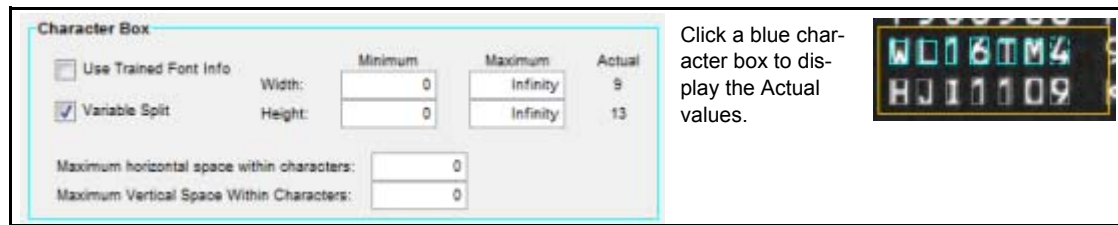
4. Click the Segment button. Use the Train, Options and Character boxes to set up and train the character string.
 - **String**
Enter the string of characters that you want to inspect that are within the ROI.

- **Row**
Click the up and down arrows to move the training focus from one row to another. See “How to train multiple rows” on page 3-87.
- **Mode**
Add New
This mode adds any characters that are not recognized (new or different) in the ROI to Font Data. For example, if there is an “N” in the characters that is different from an “N” in Font Data, it is added with the same name. Totally new characters are also added.
Delete Library and Add
This mode deletes all the characters in Font Data then adds any characters it finds in the ROI to Font Data. This mode is the same as Add New, except it deletes the existing Font Data before adding characters.
- **Train Button**
After you have defined all the training parameters, click the Train button to add the characters to Font Data.
- **Enable Multiple Rows**
Check this box if you want to train and inspect more than one row of characters in the image. See “How to train multiple rows” on page 3-87.
- **Auto Deslant**
If this box is checked, during training and reading the tool will automatically correct the text slant frequently seen in printed dot matrix characters.



- **Use Trained Font Info**
If this box is checked, the tool uses values from the previously trained font data to calculate the Minimum and Maximum Character Width and Height.
- **Variable Split**
If you check this, the tool segments all the characters using the Min/Max Character Width and Height property values as reference points for automatically finding the beginning and the end of a character.
- **Width: Minimum, Maximum, Actual**
Enter the range of acceptable character widths. When you click a character box in the image, the Actual width is displayed. These values are references to help find and segment the characters. To use these values as strong constraints, enable the properties Discard Oversized and Discard Undersized on the properties tab.
- **Height: Minimum, Maximum, Actual**
Enter the range of acceptable character heights. When you click a character box in the image, the Actual height is displayed.
- **Maximum Horizontal Space Within Characters**
The maximum horizontal space between two points inside a character so that both are to be considered within a single character.
- **Maximum Vertical Space Within Characters**

The maximum vertical space between two points inside a character so that both are to be considered within a single character.



Click a blue character box to display the Actual values.

5. Click the Font button. Font Data is configured here. You can also save and load a Font Library.

- **Load Font Library**

A Font Library is a collection of trained characters (Font Data) saved in a file. You can load a previously saved Font Library and use it instead of creating Font Data by training characters.

- **Save Font Library**

Click this button to save the characters in Font Data to a file. The file is saved by default with an “ocr” extension in the Vision Device\FontLib folder. (see “Folder List” on page 2-38).

- **Delete Character Model**

To delete a character from Font Data, select the character in the Display Window, then click this button to delete it.

- **Delete All Character Models**

Click this button to delete all the characters in Font Data.

- **Zoom Character Models**

Click one of the zoom buttons to increase or decrease the character size in the display window.

- **Character Display Window**

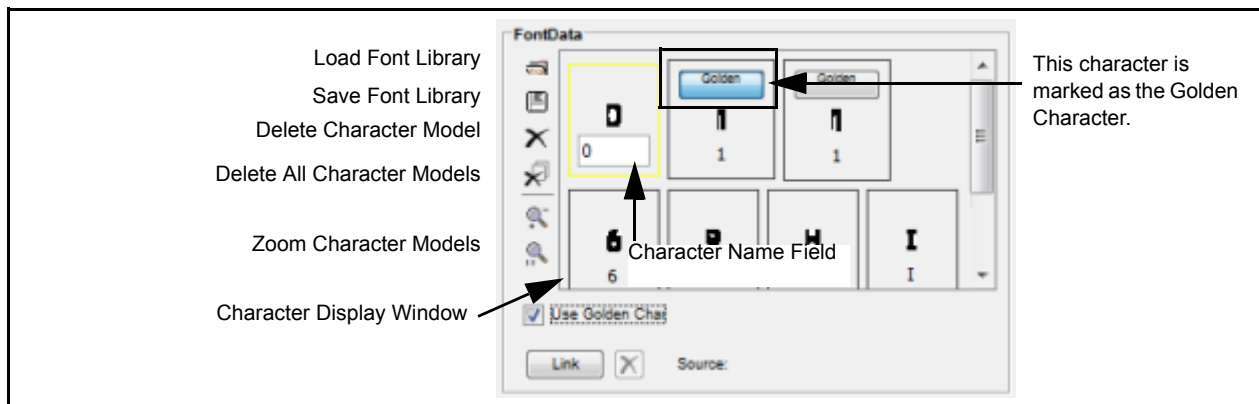
The trained characters in Font Data are displayed in the Character Display window. To rename a character, select it, then type the new name in the Character Name Field.

- **Use Golden Char**

If this is checked, the Golden Character option is enabled. If more than one of the same character is in Font Data, one of them is designated as a Golden Character. The reading score of non-Golden characters is based on the value of correlation with the Golden Character that has the same label, not on the correlation value with the most similar character or other characters with the same label. To select the Golden Character, click the Golden button.

- **Link**

Click the Link button to link Font Data from another tool.



- Click the Pass/Fail button after you have finished finding and training all the characters you want. This panel shows the results of the inspection. In this example, the correct string is read in the image so the tool passes.

- Read**

The characters in the string that were read. Unrecognized characters are replaced with a question mark (?).

- Minimum Match Score**

The minimum match score value required to label a read character as a successful read. If you select a character, the Actual Match Score is displayed.

- Acceptance**

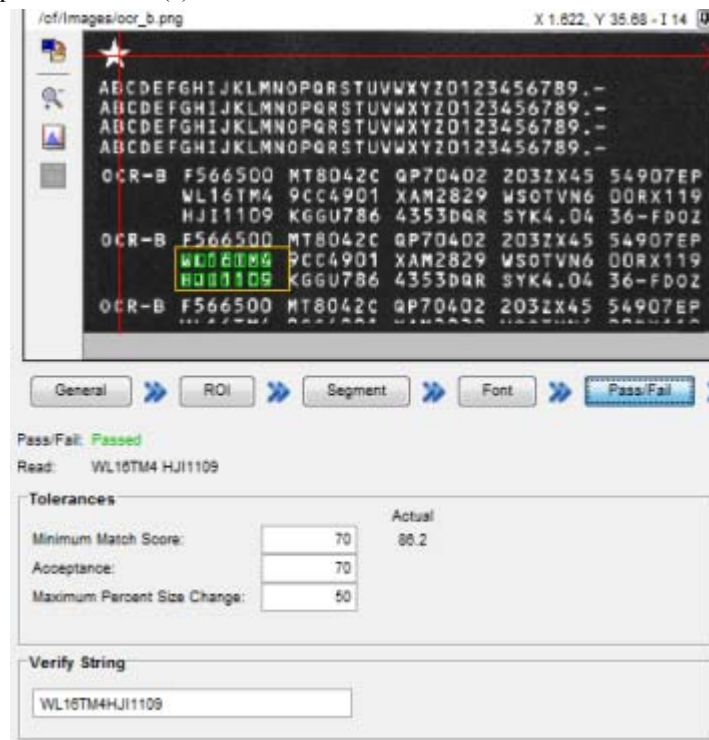
This is the minimum score value required to classify a read character as being in the trained Font Data.

- Maximum Percent Size Change**

The maximum percentage size variation allowed between the read character and the trained one.

- Verify String**

If you want to verify that the image contains a specific string, enter that string here. The tool compares this string to the characters. If all characters match this string, in order, the tool passes. You can enter one or more question marks (?) as individual character substitutions.



Display

See “Display panel” on page 3-19.

How to train multiple rows

- Arrange the ROI so it encloses the entire first row you want to train, then select the appropriate ROI type.
- Click the Segment button and type the characters within the ROI into the String field.
- Select the Add mode, then click the Train button.

4. Select the Enable Multiple Rows check box.
5. Select the Use Trained Font check box.
6. Extend the ROI so it encloses any additional rows of characters.
7. Click the Row down arrow to select the next row.
8. Type the characters within the selected row into the String field.
9. Click the Train button.
10. Repeat steps 7 through 9 for each additional row.
11. If necessary, click the Font button to access the Font Data and make adjustments.
12. Click the Pass/Fail button to see if the characters passed. If necessary, adjust the Tolerances or enter a Verify String.

Reading Characters

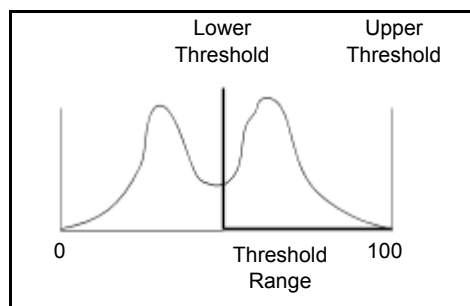
When the tool runs it reads the characters within the ROI. Any unread characters show up as the Substitution Character in the output string. If any character cannot be read or does not match the verification string (if there is one), then the tool fails. You can adjust the input parameters if you get too many mismatches or unreadable characters. You can also add unreadable characters to the Font Library, if desired.

As the tool verifies each output character against the verification string, it searches toward the right in the verification string until it finds a match. If it finds a match, it reports the character as successfully read in the “Character Success List” output. This allows it to skip over missing characters in the image and still verify the remaining characters. If it reaches the end of the verification string without finding a match, then it treats the character as an extra character by reporting it as a failure in the “Character Success List” output and skips over it in the matching process so that the next character in the output string can still match the next character in the verification string.

Threshold Types

Adaptive Threshold - Bright Characters

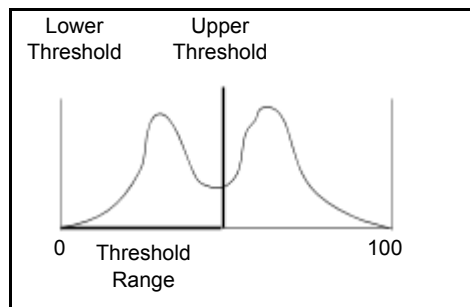
This sets the upper and lower thresholds automatically based on all the grey levels in the ROI. The lower threshold is set to a value somewhere in the valley between the bright pixel and the dark pixel peaks. The exact value depends on the statistics of the two peaks. The upper threshold is set to 100%. Bright pixels are thus considered in-range. This setting is best used when looking for a bright part of an image with non-uniform grey levels. In this example, the lower threshold would be approximately 50% and the upper threshold 100%.



Adaptive Threshold - Dark Characters

This sets the upper and lower thresholds automatically based on all the grey levels in the ROI. The lower threshold is set to 0%, and the upper threshold is set to a value somewhere in the valley between the bright pixel and the dark pixel peaks. The exact value depends on the statistics of the two peaks. Dark pixels are thus considered in-range. This setting is best used when looking for a bright part of an image with non-uniform grey levels.

form grey levels. In this example, the lower threshold would be 0% and the upper threshold approximately 50%.



Block Adaptive Threshold

The tool breaks the ROI into a user-defined number of blocks from left to right and calculates a separate threshold in each block using the Adaptive Threshold method.

Fixed Threshold - Dark or Light Characters

This sets the upper and lower thresholds based on the Fixed Threshold Range input value. Pixels with grey level values between the thresholds are considered in-range. This setting is best used for an image with uniform grey levels.

Communication Drawer

Discrete Input

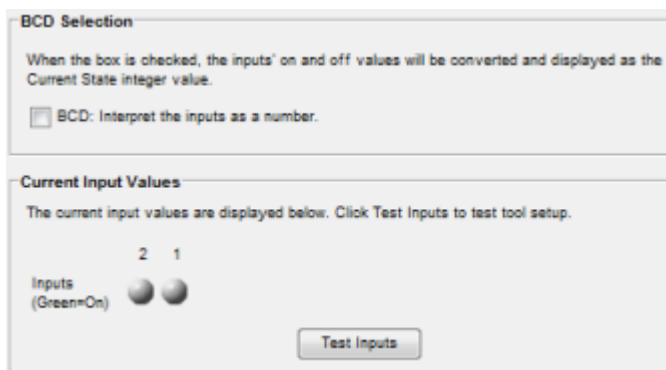
In the Communication Drawer



The Discrete Input tool reads the camera's polled input lines. The input lines are read only when the tool executes. Event inputs are configured in the Events list in the main task section (see "Task Configuration" on page 3-24).

How to set up the Discrete Input tool

1. Click the Setup & Test button.



2. **BCD Selection:** The state of an input can be interpreted as an integer value or as a Binary Coded Decimal (BCD) value. If this box is checked, the input values are converted to BCD and displayed in the Current Input Values area as an integer value labeled "BCD Current State." If the inputs produce an illegal BCD value, the BCD Current State is not updated.

3. **Current Input Values:** When you click the Test Inputs button, the tool reads the camera's inputs and updates the status lights. If a light is on, it indicates that the input voltage is present on the corresponding input. All Emulator inputs always indicate off. Refer to the camera's hardware guide for more details.

Display

See "Display panel" on page 3-19.

Discrete Output

In the Communication Drawer



The Discrete Output tool turns the output lines of the camera on and off.

How to set up the Discrete Output tool

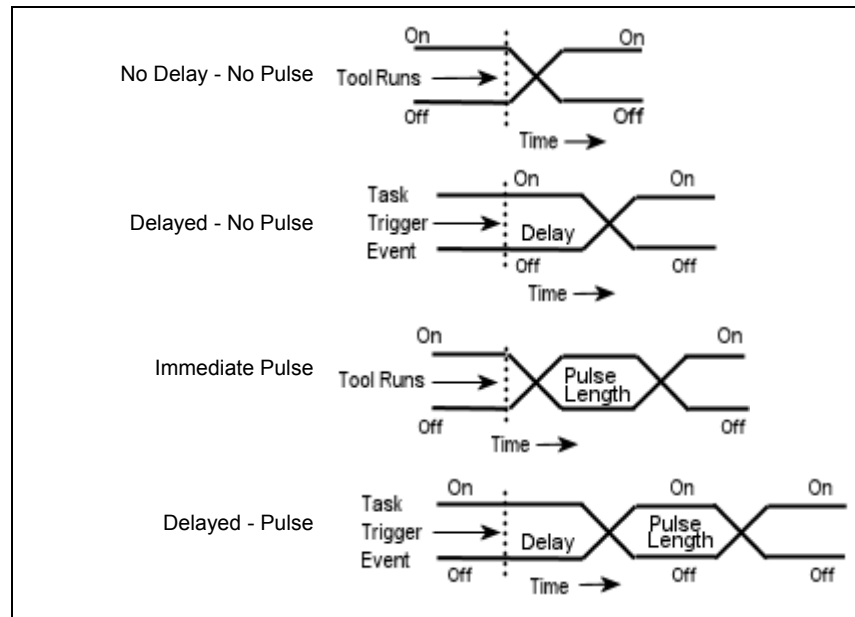
1. Click the Setup & Test button.

2. **Set Delay & Pulse:** This section is where you define any output delays and whether you want the selected outputs to pulse (On to Off or Off to On).
Delay: If you define a delay, the tool waits the indicated number of events or milliseconds (the length field) before switching the outputs to the state (On or Off) defined in the Set & Test Outputs section. An event occurs when the correct voltage is present on the Impact camera's Event Input. Refer to the camera's hardware guide for details. Note that the delay begins with the task execution trigger event (e.g. Image In Event or Offline Event). See "Delay and Pulse Length" on page 3-90 for more details.
Pulse: If you check this box, the selected outputs change to the chosen state for the indicated number of events or milliseconds (the length field) then back to the other state. For example, if the Set Output is On, and the pulse length is 10, the output is pulsed on for 10 milliseconds then turned Off. If you do not check this box, the selected outputs change to the chosen state and remain in that state. See "Delay and Pulse Length" on page 3-90 for more details.
3. **Set & Test Outputs:** This section is where you define what you want an output to do.
On, Off, Unchanged: Click the radio button under the output for that output's desired state after the tool runs. If the output is already in that state, the tool does not change it, unless a pulse was defined. Unchanged means that the tool does not change the output when it runs, even if a pulse is defined.
Test Outputs: Click this button to run the tool and view the resultant output state.

Delay and Pulse Length

Output delay counting (in milliseconds or event pulses) begins with the task execution trigger event. For Event-based delays; Camera; Event; or Shift hardware triggers must be provided on the Impact camera's corresponding input. See "Shift Source" on page 2-5.

Pulse Length (in milliseconds or events) determines the length of time the output is on or off. These diagrams show the output based on the Delay and Pulse settings.



Display

See “Display panel” on page 3-19.

EtherNet/IP Introduction

The Impact camera is EtherNet/IP compatible. EtherNet/IP is an industrialized extension of Ethernet TCP/IP communications. The Control and Information Protocol (CIP) is a communications protocol for transferring automation data and control between network devices.

In CIP, every network device represents itself as a series of objects. Each object is simply a grouping of the related data values in a device. The Impact camera’s class definition is 100 (hexadecimal 64). Datalogic’s vendor ID for Impact is 921.

The EtherNet/IP Read Assembly and Write Assembly tools use implicit I/O (the data format is not in the message but is implied by the pre-defined assembly object) and a UDP/IP connection.

VPM Lite provides the following two tools that allow the Impact camera to exchange data with other devices on the network using EtherNet/IP protocol.

Datalogic provides an EtherNet/IP Electronic Data Sheet file. See “Using an Electronic Data Sheet (EDS) file” on page 4-16.

EtherNet/IP Explicit Data

In the Communication Drawer



The EtherNet/IP Explicit Data tool provides a way to receive explicit messages from other devices that communicate via EtherNet/IP protocol. It has no fixed inputs, but inputs can be added to provide six standard data types. These inputs define the layout of the incoming data packet.

How to Use the EtherNet/IP Explicit Data tool

General

1. Change the tool name on the General panel, if desired.

Inputs

1. Click the Inputs button to define data to be read from the static assembly.

Add Input

Instance: 2

Run

| Inputs | | | | | |
|----------------------------------|--------------|------|-----------|---------------|-----------------------------|
| Name | Type | Link | List Size | String Length | Value |
| <input type="checkbox"/> Input 1 | Boolean | | | | False |
| <input type="checkbox"/> Input 2 | Boolean List | | 3 | | 3 Booleans [Inspection.I... |
| <input type="checkbox"/> Input 3 | Integer | | | | 0 |
| <input type="checkbox"/> Input 4 | Integer List | | 0 | | 0 Integers |
| <input type="checkbox"/> Input 5 | String | | | 8 | |

- **Add Input**
Click to add an input to the Inputs table. Click the delete icon next to an input to delete it.
- **Instance**
An EtherNet/IP device sends a data packet which contains an Instance number and other data. If this tool's Instance number matches that of the incoming packet, the data is available in this tool's inputs.
- **Run**
Click to run the tool and read the values from the static assembly.
- **Inputs**
Name: Click in the field to change the input name.
Type: Click the drop down to select the data type.
List Size: If a list data type is selected, enter the number of values in the list. This value must match in the sending (Write) tool and receiving (Read) tool. Linked lists with a different length are padded with zeroes or truncated.
String Length: The length of the string to be read from the static assembly.
Value: The value read from the static assembly.

Display

See “Display panel” on page 3-19.

EtherNet/IP Explicit Message

In the Communication Drawer



The EtherNet/IP Explicit Message tool creates a message for setting or requesting data on another Ethernet/IP device. The tool's fixed inputs define the required parts of the message.

Additional inputs and outputs can be added. Data values in the added inputs are sent with the message, while values in the added outputs are filled in when the message from another device is received. You can use an EtherNet/IP device's data sheet to provide the appropriate values for each input and output. The Impact camera's class definition is 100 (hexadecimal 64). Datalogic's vendor ID for Impact is 921.

To create a new input or output, click the appropriate Add button, then select the data type from the type properties drop down.

How to Use the EtherNet/IP Explicit Message tool

General

1. Change the tool name on the General panel, if desired.

Setup

2. Click the Setup button to define data inputs and outputs.

- **Network Path**

This is the IP address of the destination EtherNet/IP device.

- **Class**

This is the predefined class number for the destination device. The Impact camera class definition is 100 (hexadecimal 64).

- **Instance**

This is the function on the destination device that should receive the message.

- **Service**

This is the destination device command. These Service codes can be used when communicating with an Impact camera (Class 100).

Get Single Attribute - 100 (See Note 1 below)

Set Single Attribute - 101 (See Note 1 below)

Get All Attributes - 102

Set All Attributes - 103

Cause EtherNet/IP Event - 104

Set Online State - 105 (Attribute value of 0 = offline; non-zero = online)

These Service codes can be used when communicating with any device with the Class 100.

Get_Attributes_All - 1

Set_Attributes_All - 2

Get_Attribute_Single - 14

Set_Attribute_Single - 16

Network Path: 192.168.0.128 Class: 100 Instance: 1 Service: 100
 Tag String: Attribute: 14 Member: 1
 Add Input Add Output Run Write Succeeded: False

- **Tag String**

The name of the user-created request tag for the external device (if needed).

- **Attribute**

The value for the service function.

- **Member**

The element of the message data structure to access. (See Note 1 below.)

Note 1: How the Member property is used with Get Single Attribute and Set Single Attribute

Set Single Attribute (101)

The value of the first input in the Explicit Message tool is the only value used for setting.

Member is the index of the input to set on the Explicit Data tool. If Member is zero or one, the tool will set the value to the first input. If Member is two, the tool will set the value to the second input, etc.










Get Single Attribute (100)

The first output in the Explicit Message tool is the only output that will have a new value assigned to it.

Member is the index of the input value to get from the Explicit Data tool. If Member is zero or one, the tool will get the value from the first input. If Member is two, the tool will get the value from the second input, etc.

- **Add Input**

Click to add an input to the Inputs table. Click the delete icon next to an input to delete it.

| Inputs | | | | | |
|---|--------------|---|-----------|---------------|----------------------|
| Name | Type | Link | List Size | String Length | Value |
|  Input 1 | Integer |  | | | 0 |
|  Input 2 | Boolean List |   | 3 | ... | 3 Booleans [Inspe... |
|  Input 3 | String |  | | 8 | |
|  Input 4 | Real |  | | | 0 |

- **Inputs**

Name: Click in the field to change the input name.

Type: Click the drop down to select the data type.





List Size: If a list data type is selected, enter the number of values in the list. This value must match in the sending (Write) tool and receiving (Read) tool. Linked lists with a different length are padded with zeroes or truncated.

String Length: The length of the string to be read from the static assembly.

Value: The value read from the static assembly.

- **Add Output**

Click to add an output to the Outputs table. Click the delete icon next to an output to delete it.

| Outputs | | | | | |
|--|--------------|-----------|---------------|------------|--|
| Name | Type | List Size | String Length | Value | |
|  Output 1 | Integer | | | 0 | |
|  Output 2 | Boolean List | 3 | ... | 0 Booleans | |
|  Output 3 | String | | 12 | | |
|  Output 4 | Real | | | 0 | |

- **Outputs**

Name: Click in the field to change the name.

Type: Click the drop down to select the data type.

List Size: If a list data type is selected, enter the number of values in the list. This value must match in the sending (Write) tool and receiving (Read) tool.

String Length: The length of the string to be written to the static assembly.

Value: The value to write to the static assembly.

- **Run**

Click to run the tool and set or get the defined data.

- **Write Succeeded**

This is true if the message transfer was successful.

Display

See “Display panel” on page 3-19.

EtherNet/IP Read Implicit Assembly

In the Communication Drawer



The EtherNet/IP Read Implicit Assembly tool provides a method for reading a reserved data area (called a static assembly) on the Impact camera. Other EtherNet/IP devices can write data to this area. Additional outputs, which are appended to the static assembly, can be added.

For details about the static assembly, “EtherNet/IP” on page 4-12.

How to Use the EtherNet/IP Read Implicit Assembly tool

General

1. Change the tool name on the General panel, if desired.

Outputs

1. Click the Outputs button to define data types to be read from the static assembly.

| Start Address | Name | Type | List Size | String Length | Value |
|---------------|----------|-----------|-----------|---------------|---------|
| 8 | Output 1 | Integer | | | 0 |
| 9 | Output 2 | Real List | 4 | | 4 Reals |
| 13 | Output 3 | Integer | | | 0 |
| 14 | Output 4 | String | | 13 | |

- **Add Output**

Click to add an output to the Outputs table. Click the delete icon next to an output to delete it.

- **Tool Offset**

This value indicates the static assembly location where the tool should begin reading. If the value is zero, the tool starts reading at User Data In location zero. This allows multiple tools to read from the static assembly.

- **Run**

Click to run the tool and read the values from the static assembly.

- **Outputs**

Start Address: This is the output's starting address in the static assembly.

Name: Click in the field to change the output's name.

Type: Click the drop down to select the data type.

List Size: If a list data type is selected, enter the number of values in the list. This value must be set in both the sending (Write) tool and receiving (Read) tool.

String Length: The length of the string to be read from the static assembly.

Value: The value read from the static assembly.

Display

See "Display panel" on page 3-19.

EtherNet/IP Write Implicit Assembly

In the Communication Drawer



The EtherNet/IP Write Implicit Assembly tool provides a method for writing to a reserved data area (called a static assembly) on the Impact camera. Other EtherNet/IP devices can read data from this area. Additional inputs, which are appended to the static assembly, can be added.

For details about the static assembly, "EtherNet/IP" on page 4-12.

How to Use the EtherNet/IP Write Implicit Assembly tool

General

1. Change the tool name on the General panel, if desired.

Inputs

1. Click the Inputs button to define data types to be read from the static assembly.

| Start Address | Name | Type | Link | List Size | String Length | Value |
|---------------|---------|-----------|------|-----------|---------------|-----------------------------|
| 8 | Input 1 | Integer | | | | 0 |
| 9 | Input 2 | Real List | | 4 | | 4 Reals [Inspection, Ima... |
| 13 | Input 3 | Integer | | | | 0 |
| 14 | Input 4 | String | | | 13 | |

- **Add Input**

Click to add an input to the Inputs table. Click the delete icon next to an input to delete it.

- **Tool Offset**

This value indicates the static assembly location where the tool should begin writing. If the value is zero, the tool starts writing at User Data Out location zero. This allows multiple tools to write to the static assembly.

- **Run**

Click to run the tool and write the values to the static assembly.

- **Inputs**

Start Address: This is the input's starting address in the static assembly.

Name: Click in the field to change the input's name.

Type: Click the drop down to select the data type.

Link: Click the link icon to link a value from another tool. Click the delete link icon to delete an existing link.

List Size: If a list data type is selected, enter the number of values in the list. This value must be set in both the sending (Write) tool and receiving (Read) tool. Linked lists with a different length are padded with zeroes or truncated.

String Length: The length of the string to write to the static assembly.

Value: The value to write to the static assembly.

Display

See "Display panel" on page 3-19.

Image Archiving

In the Communication Drawer



The Image Archiving tool transfers an image to an FTP server using FTP protocol. The server is separate and must be running and accessible by the camera or Emulator when the tool runs.

How to Use the Image Archiving tool

General

1. Change the tool name on the General panel, if desired.

- **Image**

Grayscale Image: Select this if you archiving grayscale images.

Color Image: Select this if you archiving color images.

Link: Click this button to change the linked image source.

Destination

1. Click the Destination button to define where the image is to be archived.

- **FTP Setup**

Host: Enter the IP Address of the FTP server where the image is to be archived. The server must be running and available on the network (or the local PC).

User Name: This is the User Name defined for the account on the FTP Server.

Password: This is the Password, if any, defined for the account on the FTP Server.

- **Transfer Mode**

Queue Images: In this mode, the tool runs asynchronously, which means that the tool queues the image so it can be converted and sent to the FTP server by a separate background process. If the tool tries to queue more images than the value of "Maximum Number of Images in Queue," it will fail and the image will not be archived. The tool run time includes only the time required to hand off the image to the separate background process.

Send Immediately: In this mode, the tool runs synchronously, which means that the image is immediately converted and sent to the FTP server when the tool runs. The tool run time includes the time required to convert and send the image to the FTP server. This mode is not recommended for general use as it may result in long tool and task execution times.

Maximum Number of Images in Queue: If the tool tries to queue more images than this value, it will fail. If the FTP transfers occasionally do not complete before the next task trigger, you may want to increase this value so the queue does not overflow.

NOTE: The images in the queue use input image buffer space. If the queue size is too large, image buffer overrun errors may occur. The average time required for the FTP transfer must fit within the camera/task trigger rate.

- **Image File**

Name: This is the base name, which is the name given to the destination file when it is archived. If an incremental number is not added ("Append Count to Image Name" is not checked), the archived file is overwritten every time the tool runs.

Destination File Name: This is the name of the file saved on the FTP server, including any incremental number. For example, if the file base name is Inspection, the Format is JPG, and the Rollover At value is 999, files with names Inspection001.JPG through Inspection999.JPG are archived.

Format: Select the desired file format for the archived image. BMP, JPG, and PNG are supported. The JPG format generates the smallest files, but the compression may cause some loss of image information. The BMP and PNG conversions do not cause information loss. Only the PNG format also saves the image's calibration information so the image can be used later in the File Camera mode. File format, image resolution (size), and image contents will affect the conversion and transfer time. No ROIs or other image overlays are archived with the image.

Append Count to Image Name: If this box is checked, an incremental number is appended to the file base name so the saved images have incremental file names. Enter a value in the "Rollover At" field.

Rollover At: When the incremental file count number reaches this value, it is reset to zero.

Reset Count: Click to reset the incremental file number.

- **Test**

Click this button to test the FTP connection and the file archiving operation.

Display

See "Display panel" on page 3-19.

How Transfer Mode Affects Run, Pass, and Fail Counts

When the tool is configured to run in synchronous mode:

The tool's run completes when the image has been converted to the desired format and transferred to the FTP server. This mode of operation is not recommended, however, it can be useful for observing the actual time required for the entire conversion and transfer. In this mode, the Run Count always equals the Pass Count plus the Fail Count, and the Current Queue Size is always zero.

When the tool is configured to run in asynchronous mode:

If the Current Queue Size is less than the Maximum Queue Size:

The image is put into the queue for the background process. The tool Passes and the Run Count and Current Queue Size values are incremented. After the image transfer has completed, the Pass Count, Fail Count, and Current Queue Size values are updated.

If the Current Queue Size is equal to or greater than the Maximum Queue Size:

When the tool runs, it Fails and the Run Count and Fail Counts are incremented.

Serial Port Out

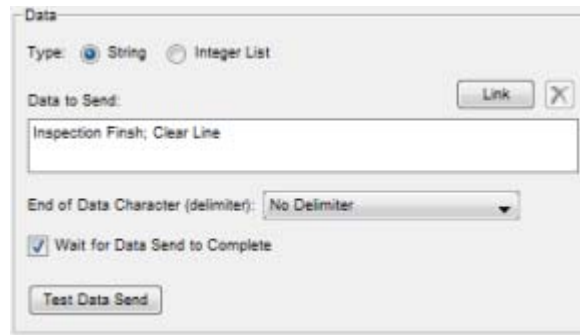
In the Communication Drawer



The Serial Port Out tool sends a string or integer list out the Impact camera's serial port. Impact cameras support only RS-232 communication protocol. RS-485 is not supported. See "Serial Port" on page 2-6 to define the Serial Port parameters such as speed, parity, and the delimiter for the receiving device.

How to Use the Serial Port Out tool

1. Click the Setup button.



2. Select the type of data the tool will send - a string or an Integer List.
String - You can type a string directly into the Data to Send field, or create a link.
Integer List - can contain any valid integer value but, since each value is translated into a 1-byte character, any value outside the range -128 to +127 is truncated before it is sent. You can use a Basic tool to unpack, translate, and repack larger integer values, if necessary. You must create a link to an Integer List, you cannot type it directly into the Data to Send field.
3. Click the drop down arrow to select an End of Data Character. The delimiter is placed at the end of the input string when it is transmitted. The receiving camera's Serial Port Delimiter must match this setting. (See "Serial Port" on page 2-10)
4. If you check the box labeled "Wait for Data Send to Complete," the tool will wait for verification from the receiving device that the data has been received.
5. If you want to test the setup at any time, you can click the Test Data Send button.

Display

See "Display panel" on page 3-19.

TCP/IP Out

In the Communication Drawer



The TCP/IP tool sends a message consisting of a string or integer list out the Impact camera's Ethernet port. The tool can act as either a Server or a Client. In Server mode it uses the existing local server connections and sends the data to all remote clients when it runs. Any device on the network receives the message. In Client mode, the tool connects to the remote device with the defined IP Address and Port Number and sends that device the data.

NOTE: Either the Input String property or the Input List property can contain a value, but NOT both. An error will occur if both properties contain a value.

Since TCP communication is one-way, you cannot send and receive on the same port number in an Impact camera.

General

1. Change the tool name on the General panel, if desired.

Data

- On the Data panel you define the type of data the tool will send - a string or an Integer List.

- Data**

String: Type a string directly into the Data to Send field or create a link.

Integer List: This can contain any valid integer value. You must create a link to an Integer List, you cannot type it directly into the Data to Send field.

Data to Send: Contains the data that the tool sends when it runs.

Destination

- On the Destination panel you define the devices to receive the data.

- Destination**

Connection Type: Server

The currently configured Server IP Address and Port Number are displayed. (See “TCP/IP” on page 2-9 for configuration.) The data is sent to all currently connected clients (devices).

Connection Type: Client

The data is sent to the remote device indicated by the IP Address and Port Number.

IP Address: Enter the IP Address of the remote (receiving) device.

Port Number: Enter the Port Number on the remote (receiving) device. This is the port on the receiving device where the tool sends the message. For an Impact camera, this number should match the remote Impact camera’s TCP/IP Input Event port number. Since TCP communication is one-way, you cannot send and receive on the same port number in a camera.

Disconnect After Each Send: If this box is checked, the tool disconnects from the remote device after the data send is complete. See “Disconnect After Each Send” on page 3-102 for details.

Check for Successful Send after Delay: Enter the number of milliseconds that the tool should wait between the data send and a check for success.

End of Data Character (delimiter): The receiving device may require that a special character (delimiter) be appended to the data it receives. If so, select the appropriate character from the drop down.

Test Data Send: Click to test the tool configuration.

Display

See “Display panel” on page 3-19.

Example: Set up two Impact cameras (local and remote) to communicate with each other.

The local Impact camera

- With VPM Lite, connect to the local Impact camera.

2. In Design Mode, open the Communication Drawer and add the TCP/IP Out tool to the task.
3. Click the Data button and select String as the data type.
4. Type two or three words in the Data to Send text area.
5. Select the Destination button.
6. Select Client in the Connection Type drop down.
7. Enter the IP Address of the remote Impact camera.
8. Enter the Port Number 10000. This is the port on the remote camera where the tool sends the message.
9. Check the check box labeled "Disconnect After Each Send."
10. In the field labeled "Check for Successful Send after Delay," enter the number 10.
11. In the drop down labeled "End of Data Character (delimiter)," select No Delimiter.
12. Select the VPM Lite Settings Tab - General - Trigger Events panel.
13. In the TCP/IP section, be sure the TCP/IP Input Event Port number is 20,000. This is the port number where the local Impact camera listens for messages.
14. Add a task and set the Trigger By This Event to "TCP/IP Input."
15. Put the local Impact camera Online.
16. Disconnect from the local Impact camera.

The remote Impact camera

1. With VPM Lite, connect to the remote Impact camera.
2. In Design Mode, open the Communication Drawer and add the TCP/IP Out tool to the task.
3. Click the Data button and select String as the data type.
4. Type two or three words in the Data to Send text area.
5. Select the Destination button.
6. Select Client in the Connection Type drop down.
7. Enter the IP Address of the local Impact camera.
8. Enter the Port Number 20000. This is the port on the local Impact camera where the tool sends the message. (Step 13 in the local Impact camera configuration.)
9. Check the check box labeled "Disconnect After Each Send."
10. In the field labeled "Check for Successful Send after Delay," enter the number 10.
11. In the drop down labeled "End of Data Character (delimiter)," select No Delimiter.
12. Select the VPM Lite Settings Tab - General - Trigger Events panel.
13. In the TCP/IP section, be sure the TCP/IP Input Event Port number is 10,000. This is the port number where the local Impact camera listens for messages. (Step 8 in the local Impact camera configuration.)
14. Click the Test Data Send button. The data you entered in step 4 should have been sent to the local Impact camera.

How to Use Wait For Response

The TCP/IP Output tool can optionally wait for a response string from the receiving program or server. The response is an application level message. It can be an acknowledgement or contain data or command strings to be used in other tools. The receiving/responding program can be a user-written DOTNET program or a web server.

If the Wait For Response property is False, the tool sends the data and immediately moves on to then next tool in the vision program without waiting and the Response String output is always empty.

How to Send to a Web Server

When you send a message to a web server, it is important to format the sent data correctly as an HTTP URL. For example, this message to the web server of an A30 camera (at address 192.168.108.98) will put the camera online.

```
GET /Online/ HTTP/1.1\r\nHost: 192.168.108.98\r\n\r\n
```

Where `\r` is a carriage return command and `\n` is a line feed command.

The command string can be created in the String Builder tool so the carriage return and newline characters are created correctly.

These property settings are also important when sending to a web server:

- Connection Type = Client
- Port Number = 80
- Delimiter Type = No Delimiter
- IP Address = web server address (this is the same address as Host in the example command string above. HTTP requires this address in both places.)
- Wait For Response = True

When the tool runs it sends the Input String, including the command, to the web server, waits for the response web page, and puts the page in the Response String output port.

Disconnect After Each Send

This setting should be determined primarily by the reliability of the system network and the speed of the inspection. Factors includes the total tool execution time needed, the consistency of tool execution time needed, robustness in the face of network error, and compatibility with the receiving device's implementation. Disconnecting after each write provides a way to asynchronously handle connection errors and changes. Set up on first execution adds time to the first execution, and may add time to a subsequent execution if a disconnect or error must be handled. This adds significant random variability into the tool's execution time in the face of delivery errors, although the overhead is much less on average except in a very error-prone environment.

If the network is robust (i.e. few transmission errors) and the total task execution time is low, then the setting can be False. If the network is relatively more error prone, or the task execution time is faster, the setting should be True. The tool's default setting is True.

Logic Drawer

Counter

In the Logic Drawer



The Counter tool increments or decrements a count each time it runs. When the Fail when count is value is reached, the tool fails.

How to Use the Counter tool

General

1. Change the Name, if desired.

Pass/Fail

Counter Properties

The image shows a 'Counter Properties' dialog box with the following fields and buttons:

- Set count to:** 0
- Increment count by:** 1
- Reset when the count is:** 2147483647
- Reset count to:** 0
- Fail when count is:** 2147483647
- Buttons:** Run, Reset

1. **Set count to**
This is both the initial count, and the current count. When the tool runs the first time after a reset, this is the initial count. Each time the tool runs, the Increment count by value is added to this count. If this value is set to a value less than the Fail when count is value with a Reset tool or by other means, the tool immediately passes.
2. **Increment count by**
This value is added to the Set count to value each time the tool runs. If this value is negative, the Reset when the count is and Fail when count is values must also be negative.
3. **Reset when the count is**
The tool values are reset when the Set count to value equals this value. If you want the tool to fail, this value must be greater than the Fail when count is value.
4. **Reset count to**
When the Set count to equals the Reset when the count is value, or when the Reset button is clicked, the Set count to value is reset to this value.
5. **Fail when count is**
When the Set Count To value is equal to this value, the tool fails. If you want the tool to fail, this value must be less than the Reset when the count is value.
6. **Run**
When this button is clicked, the tool runs and all the values are adjusted.
7. **Reset**
When this button is clicked, the Set count to value is set to the Reset count to value.

Display

See “Display panel” on page 3-19.

The table below shows an example.

Starting values: Set count to = 0, Increment count by = 1, Reset count to = 0, Reset when the count is = 7, and Fail when count is = 5.

| Tool Run Count | <u>Set count to</u> value | Pass/Fail | Operation Performed |
|----------------|---------------------------|-----------|---|
| 0 | 0 | Passed | None |
| 1 | 1 | Passed | <u>Set count to</u> + <u>Increment count by</u> |
| 2 | 2 | Passed | <u>Set count to</u> + <u>Increment count by</u> |
| 3 | 3 | Passed | <u>Set count to</u> + <u>Increment count by</u> |

| | | | |
|---|---|--------|---|
| 4 | 4 | Passed | <u>Set count to</u> + <u>Increment count by</u> |
| 5 | 5 | Failed | <u>Set count to</u> + <u>Increment count by</u> Passed is set to False (because <u>Set count to</u> = <u>Fail when count is</u>) |
| 6 | 6 | Failed | <u>Set count to</u> + <u>Increment count by</u> |
| 7 | 0 | Passed | <u>Set count to</u> + <u>Increment count by</u> <u>Set count to</u> is set to <u>Reset count to</u> (because <u>Set count to</u> reached <u>Reset when the count is</u>) Passed is set to True (because <u>Set count to</u> is less than <u>Fail when count is</u>) |

Pass Fail

In the Logic Drawer



When the Pass Fail tool runs, it evaluates the pass and fail status of each Input Tool in its Tool Name list. (Not all tools have a pass/fail status.) After all the Input Tools are evaluated, the tools in the Pass or Fail branch are run, depending on the Pass Criteria selected.

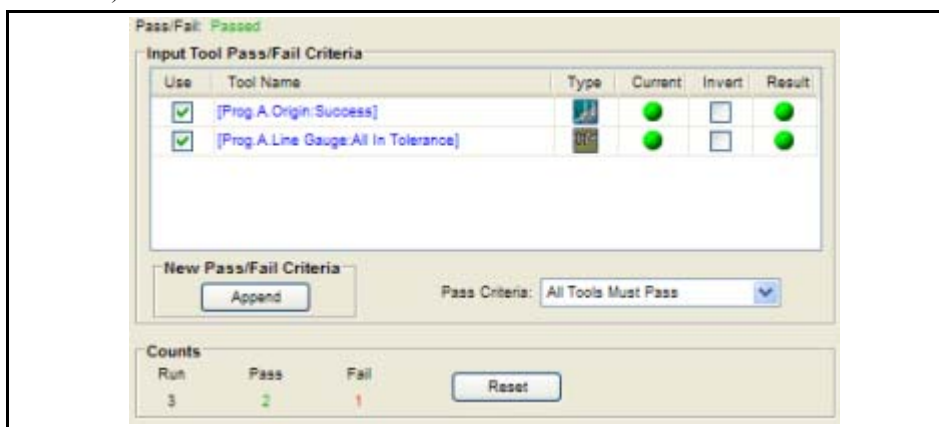
How to Use the Pass Fail tool

General

1. Change the Name, if desired.

Pass/Fail

1. Click the Pass/Fail button to define which tools to use as criteria. When you add the Pass Fail tool, it automatically creates a list of the tools above it in the task tree that have a pass/fail status (the input tools).



- **Pass/Fail**

This is the pass or fail status of the Pass Fail tool. After all the input tools' pass/fail statuses have been evaluated, this LED is green if the Pass Fail tool passed and red if it failed. If the Pass Fail tool passed, the Pass branch is run. If the tool failed, the Fail branch is run.

- **Input Tool Pass/Fail Criteria**



Use: When this box is checked, the pass/fail status of that input tool is used to determine the Pass Fail tool's status when it runs. If there is a delete icon in this column, it means the input tool is linked from a task outside the current task. Click the icon to delete the link. If no inputs are defined, the tool always fails.

Tool Name: The input tool name.

Type: The input tool type.

Current: If the input tool's current pass/fail status is pass, the LED color in this column is green. If the pass/fail status is fail, the color is red.

Invert: If this box is checked, the input tool's Current status is inverted or reversed before it is used to determine the Pass Fail tool's status.

Result: This is the result of the Invert operation on the Current status. If the result is pass, the LED color is green. If the result is fail, the color is red. This status is used to evaluate the pass or fail status of the Pass Fail tool, based on the Pass Criteria.

- **New Pass/Fail Criteria**

Append: If you want the Pass Fail tool to evaluate an additional tool, click the Append button then select the tool output to use.

- **Pass Criteria:**

All Tools Must Pass: If this option is selected, the Pass Fail tool passes only when all the input tools pass.

At Least One Tool Must Pass: If this option is selected, the Pass Fail tool passes when any of the input tools pass.

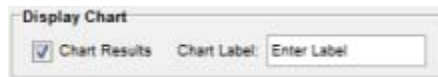
- **Counts:**

Run, Pass, Fail: The number of times the tool has Run, Passed, and Failed since the last Reset.

Display

See "Display panel" on page 3-19.

Display Chart: If Chart Results is checked, a chart showing cumulative pass and fail results is shown in Display mode. To change the label, click in the Chart Label field.



String Builder

In the Logic Drawer



The String Builder tool creates an output string by combining a variety of user-defined input data types.

How to Use the String Builder tool

The String Builder tool creates an output string from a variety of user-defined input data types. You can link values from other tools, or directly enter values for some data types.

General

1. Change the tool name on the General panel, if desired.

Inputs

- On the Inputs panel you define the inputs used to create the Output String.

- **Pass/Fail**
If Passed, the Output String was created successfully.
- **Run**
Click this button to run the tool and create the Output String for testing.
- **Reset**
Click this button to clear the Output String and reset the Pass, Fail, and Run counts.
- **Reorder**
Select an input from the table, then click the up and down arrows to rearrange its order in the table.
- **Add**
Click this button to add an input to the table. The new input is added below the currently selected input.
- **Delete**
To delete an input from the table, click the X to the left of the name.
- **Name**
To change the Name, click in the Name field.
- **Type**
Select the data type for the input from the drop down. The data type will affect the Output String configuration choices. You cannot change the Type if the Value is linked. For details about each data type, see “Configure Inputs” on page 3-107.
- **Link**
To create a link to the Input Value from another property, click the Link icon. See “To create a link” on page 3-23. To delete a link, click the X in the link column.
- **Value**
A value can be entered in the Value field for some data types. Other types require a linked value.
- **Scroll Bar**
If there are too many inputs to fit in the display list, click the up and down scroll bar.
- **Configure ... Input**
The data type selected from the Type drop down will affect the Input Configuration choices. For details about each data type, see “Configure Inputs” on page 3-107.
- **Output String**

This string is the result of all the combined input values. The number of characters in the string, is also shown here.

NOTE: Non-printing ASCII characters defined in the Fixed Text and Input Delimiter sections are not displayed in the Output String, but they are present and they are included in the characters count.

Format

- 1. On the Format panel you define text and other constants that are combined with the inputs to create the Output String.



- **Fixed Text: Leading Text**
This text is placed at the beginning of the Output String. To add non-printing ASCII characters to the text, click the ellipses button. To delete non-printing ASCII characters, select and delete them in the text field.
- **Fixed Text: Trailing Text**
This text is placed at the end of the Output String (before the Terminator). To add non-printing ASCII characters to the text, click the ellipses button.
- **Fixed Text: Terminator**
The selected Terminator characters are placed at the end of the Output String (after the Trailing Text).
- **Input Delimiter: Standard**
The selected Standard Delimiter is placed between Inputs, when the tool has more than one Input.



- **Input Delimiter: Custom**
You can enter text into the Custom field along with non-printing ASCII characters (click the ellipses button).

| ASCII Table | | | | | |
|-------------|-------|------|-------|------|-------|
| Hex | ASCII | Hex | ASCII | Hex | ASCII |
| 0x00 | NUL | 0x20 | SP | 0x40 | @ |
| 0x01 | SOH | 0x21 | ! | 0x41 | A |
| 0x02 | STX | 0x22 | " | 0x42 | B |
| 0x03 | ETX | 0x23 | # | 0x43 | C |
| 0x04 | EOT | 0x24 | \$ | 0x44 | D |
| 0x05 | ENQ | 0x25 | % | 0x45 | E |
| 0x06 | ACK | 0x26 | & | 0x46 | F |
| 0x07 | BEL | 0x27 | ' | 0x47 | G |
| 0x08 | BS | 0x28 | (| 0x48 | H |

Some of the characters in the ASCII Table

Configure Inputs

The configuration choices shown in this section are based on the input’s data type and they affect how the input’s values appear in the Output String.

Boolean

The True or False text (depending on the Input Value) is placed in the Output String.

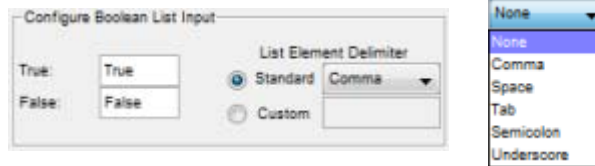


Boolean List

The True or False text (depending on the Input Value) is placed in the Output String for each element in the Input list.

- **List Element Delimiter: Standard or Custom**

The List Element Delimiter selected from the Standard drop down or the text in the Custom field is added between elements in the input list.

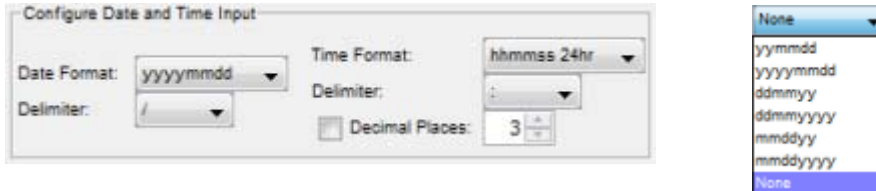


Date and Time

The current Date and Time when the tool runs is formatted then placed in the Output String.

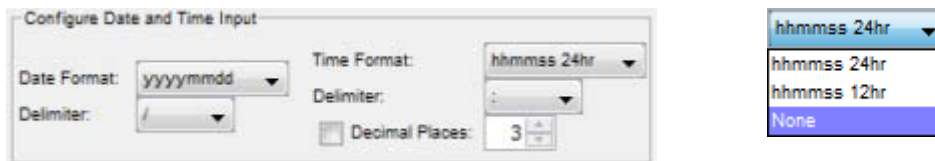
- **Date Format and Delimiter**

In the format string, m = month, d = day, and y = year. The Delimiter is placed between the date elements. Select None to omit the date. For example, yyymmdd with a slash (/) delimiter would yield 2015/22/14.



- **Time Format, Delimiter, and Decimal Places**

In the format string, h = hour, m = minute, and s = second. The Delimiter is placed between the time elements. Decimal Places controls the display of fractional second values. For example, the 24 hour time with a colon (:) delimiter and two decimal places would yield 07:58:01.05 PM. Select None to omit the time.



Integer

The Input is configured then placed in the Output String.

- **Minimum Length and Pad With**

If Minimum Length is checked, the Input value is padded with the indicated number of leading or trailing characters selected from the drop down.



Integer List

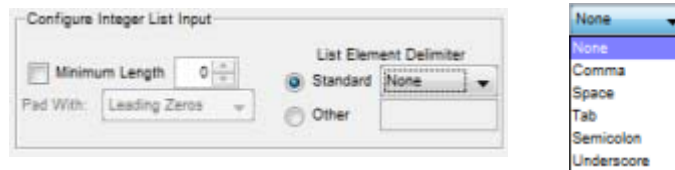
Each element of the Input list is configured then placed in the Output String.

- **Minimum Length and Pad With**

If Minimum Length is checked, each Input element is padded with the indicated number of leading or trailing characters selected from the drop down.

- **List Element Delimiter: Standard or Custom**

The List Element Delimiter selected from the Standard drop down or the text in the Custom field is added between elements in the input list.



Origin

The Input is configured then placed in the Output String.

- **Decimal Places**

This is the number of decimal places to use in the origin's X, Y, and Angle values.

- **Minimum Length and Pad With**

If Minimum Length is checked, the Origin is padded with the indicated number of leading spaces or zeros.

- **Grouping Bracket**

The selected character is placed around the entire Origin value as well as the individual X, Y, and Angle elements. For example, using the {} characters would yield {{227.000,259.000},0.000}.

- **X Y < Delimiter**

The Delimiter is placed between the Origin X, Y, and Angle elements. For example, using a comma (,) separator would yield 227.000,259.000,0.000.



Origin List

Each element of the Input list is configured then placed in the Output String.

- **Decimal Places**

This is the number of decimal places to use in each element's X, Y, and Angle values.

- **Minimum Length and Pad With**

If Minimum Length is checked, each element value is padded with the indicated number of leading spaces or zeros.

- **Grouping Bracket**

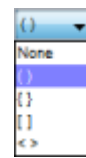
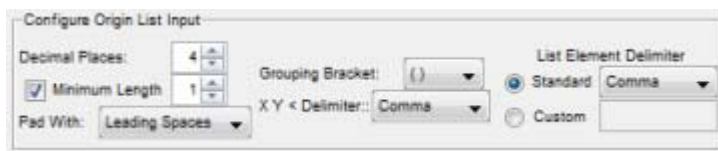
The selected character is placed around each element as well as each element's individual X, Y, and Angle values. For example, using the {} characters would yield {{227.000,259.000},0.000}.

- **X Y < Delimiter**

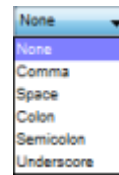
The Delimiter is placed between the X, Y, and Angle elements. For example, using a comma (,) separator would yield 227.000,259.000,0.000.

- **List Element Delimiter: Standard or Custom**

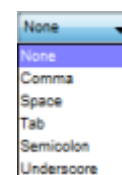
The List Element Delimiter selected from the Standard drop down or the text in the Custom field is added between elements in the input list.



Grouping Bracket



XY Delimiter



List Element Delimiter

Point

The Input is configured then placed in the Output String.

- **Decimal Places**

This is the number of decimal places to use in the Point's X and Y values.

- **Minimum Length and Pad With**

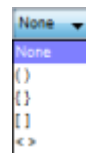
If Minimum Length is checked, the Point value is padded with the indicated number of leading spaces or zeros.

- **Grouping Bracket**

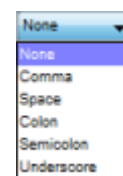
The selected character is placed around the entire Point value. For example, using the {} characters would yield {227.000,259.000}.

- **X Y < Delimiter**

The Delimiter is placed between the Point's X and Y coordinate values. For example, using a comma (,) separator would yield 227.000,259.000,0.000.



Grouping Bracket



XY Delimiter

Point List

Each element of the Input list is configured then placed in the Output String.

- **Decimal Places**

This is the number of decimal places to use in each element's X and Y values.

- **Minimum Length and Pad With**

If Minimum Length is checked, each element value is padded with the indicated number of leading spaces or zeros.

- **Grouping Bracket**

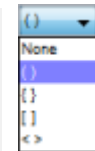
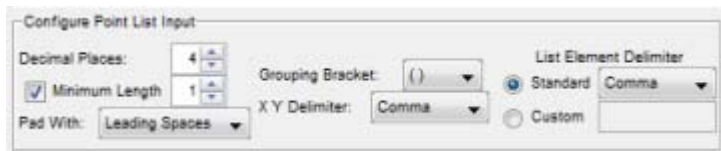
The selected character is placed around each element's X and Y coordinate values. For example, using the {} characters would yield {-53.9976-28.6744}{-53.3414-26.6537}.

- **X Y < Delimiter**

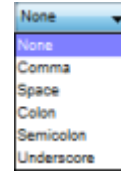
The Delimiter is placed between each element's X and Y coordinate values. For example, using a comma (,) separator would yield -53.9976,-28.6744-53.3414,-26.6537.

- **List Element Delimiter: Standard or Custom**

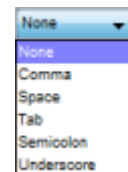
The List Element Delimiter selected from the Standard drop down or the text in the Custom field is added between elements in the input list.



Grouping
Bracket



XY Delimiter



List Element
Delimiter

Real

The Input is configured then placed in the Output String.

- **Decimal Places**

This is the number of decimal places to use in the Output String.

- **Minimum Length and Pad With**

If Minimum Length is checked, the Output value is padded with the indicated number of leading spaces or zeros.



Real List

Each element of the Input list is configured then placed in the Output String.

- **Decimal Places**

This is the number of decimal places to use for each element in the Output String.

- **Minimum Length and Pad With**

If Minimum Length is checked, the Output value is padded with the indicated number of leading spaces or zeros for each element.

- **List Element Delimiter: Standard or Custom**

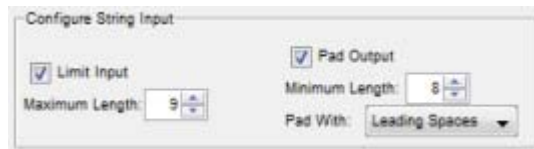
The List Element Delimiter selected from the Standard drop down or the text in the Custom field is added between elements in the input list.



String

The Input is configured then placed in the Output String.

- **Limit Input**
If checked, the right end of the input string is truncated to the number of characters selected in the Maximum Length property.
- **Maximum Length**
The maximum number of characters to allow in the input string.
- **Pad Output**
If checked, the Output value is padded to the Minimum Length with the indicated number of leading or trailing spaces.
- **Minimum Length and Pad With**
If the Pad Output property is checked, the Output value is padded with the indicated number of leading or trailing spaces.



String List

Each Input is configured then placed in the Output String.

- **Limit Input**
If checked, the right end of each input string element is truncated to the number of characters selected in the Maximum Length property.
- **Maximum Length**
The maximum number of characters to allow in each input string element.
- **Pad Output**
If checked, the Output value for each input string element is padded to the Minimum Length with the indicated number of leading or trailing spaces.
- **Minimum Length and Pad With**
If the Pad Output property is checked, the Output value for each input string element is padded with the indicated number of leading or trailing spaces.
- **List Element Delimiter: Standard or Custom**
The List Element Delimiter selected from the Standard drop down or the text in the Custom field is added between elements in the input list.



Display

See “Display panel” on page 3-19.

Switch

In the Logic Drawer



The Switch tool takes a user-defined input (Switch Condition), compares it to one or more values (Case Statement), then executes a branch (Case) based on the outcome. Tools can be placed in a Case branch.

NOTE: The Default Case, which is always listed at the bottom of the Cases table, is executed only if none of the other Cases are executed. The Default Case cannot be deleted.

How to Use the Switch tool

The Switch tool takes a user-defined value (Switch Condition), compares it to one or more values (Case Statement), then executes a branch (Case) based on the outcome. Case statements are executed in their order in the table. Place tools that you want to use in each Case branch. You can define the values and Case statements in the tool Setup.

General

1. Change the tool name on the General panel, if desired.

Pass/Fail

1. On the Pass/Fail panel you define the values and comparison statements that determine the Case to be executed.

| Name | Link | Value |
|--|-------------------------------------|-------|
| <input checked="" type="checkbox"/> True Case | <input checked="" type="checkbox"/> | True |
| <input checked="" type="checkbox"/> False Case | <input checked="" type="checkbox"/> | False |
| Default Case | | |

- **Pass/Fail**

If “Passed,” at least one Case Statement (not the Default Case) was evaluated True and its branch executed. If “Failed,” only the Default Case branch was executed.

- **Switch Condition**

See "Configure Switch Conditions" below.

- **Cases**

See “Configure Cases” on page 3-114.

Configure Switch Conditions

The choices made here determine the data type and value that will be used for the Case comparison.

| Type | Link | Value |
|---------|-------------------------------------|-------|
| Boolean | <input checked="" type="checkbox"/> | True |
| String | <input checked="" type="checkbox"/> | |
| Integer | <input checked="" type="checkbox"/> | 0 |
| Real | <input checked="" type="checkbox"/> | 0.0 |

- **Type**

There are four data types available but only one data type can be used in each Switch tool. This data is used to evaluate all Switch tool conditions. Select a type from the drop down. The Case properties for each type are explained in the "Configure Cases" section below.

IMPORTANT NOTE: When you change this Type, all Case data types are changed and all Case links and values are cleared.



- **Link**

Click the link button to link another tool's value. Click the "X" icon to remove an existing link.

- **Source or Value**

This is the source of the Switch Condition value if it is linked. If the value is not linked, type a value in the field and press Enter, or choose one of the radio buttons, depending on the data type.

Configure Cases

The configuration choices shown here are based on the Switch Condition data type.

NOTE: The Default Case, which is always listed at the bottom of the Cases table, is executed only if none of the other Cases are executed. It cannot be deleted.

- **Execute:**

First Matching: The first Case that matches the Switch Condition will be executed. This is similar to the logical "OR" operator. Case statements are executed in their order in the table.

All Matching: All Cases that match the Switch Condition will be executed. This is similar to the logical "AND" operator.

- **Reorder**

Select a Case from the table, then click the up and down arrows to rearrange its order in the table. The Default Case cannot be moved.

- **Add**

Click this button to add a Case to the table. The new Case is added after the final Case and before the Default Case.

- **Default Case**

The Default Case, which is always listed at the bottom of the Cases table, is executed only if none of the other Cases are executed. It cannot be deleted.

Boolean Case

- **Name**

Click in the name field to change the name. The Boolean Case must always have at least three Case statements, including the Default.



- **Value**

Select True or False from the drop down if the value is not linked.

Click the link arrow to link a value from another tool. The linked data type must be Boolean.

Integer Case

| Name | Link | Value |
|---|------|----------|
| <input checked="" type="checkbox"/> First Case | | (10,100) |
| <input checked="" type="checkbox"/> Second Case | | (0,0) |
| Default Case | | |

- **Name**
Click in the name field to change the name.

- **Value**
This value is a range between two integer numbers (the range includes the numbers). Enter two integer values, separated by a comma and surrounded by parentheses, then press Enter.
Click the link arrow to link a value from another tool. The linked data type must be Range 1D. You cannot directly link an integer value into this field.

Real Case

| Name | Link | Value |
|---|------|--------------|
| <input checked="" type="checkbox"/> First Case | | (10.5,100.9) |
| <input checked="" type="checkbox"/> Second Case | | (0,0) |
| Default Case | | |

- **Name**
Click in the name field to change the name.

- **Value**
This value is a range between two real numbers (the range includes the numbers). Enter two real values, separated by a comma and surrounded by parentheses, then press Enter.
Click the link arrow to link a value from another tool. The linked data type must be Range 1D. You cannot directly link a real value into this field.

String Case

| Switch Condition Type: String <input type="button" value="Link"/> <input checked="" type="checkbox"/> Value: look for this string in the case value | | <table> <tr> <th>Name</th><th>Link</th><th>Value</th></tr> <tr> <td><input checked="" type="checkbox"/> First Case</td><td></td><td>look for this string</td></tr> <tr> <td><input checked="" type="checkbox"/> Second Case</td><td></td><td>the case value</td></tr> <tr> <td>Default Case</td><td></td><td></td></tr> </table> | Name | Link | Value | <input checked="" type="checkbox"/> First Case | | look for this string | <input checked="" type="checkbox"/> Second Case | | the case value | Default Case | | |
|--|------|--|-------|------|-------|--|--|----------------------|---|--|----------------|--------------|--|--|
| Name | Link | | Value | | | | | | | | | | | |
| <input checked="" type="checkbox"/> First Case | | look for this string | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> Second Case | | the case value | | | | | | | | | | | | |
| Default Case | | | | | | | | | | | | | | |
| Matching Substrings: Exact <input type="checkbox"/> Case Sensitivity | | | | | | | | | | | | | | |

- **Name**
Click in the name field to change the name.
- **Matching Substrings**
Select the desired type of substring matching from the drop down. This determines which part of the Case and Switch Condition strings must match, and in which direction the match is attempted. If both strings are empty, they are considered a match.
Exact: The entire Switch Condition string and Case string must match exactly. If both strings are empty, they are considered a match.
Case Begins With Condition: The Switch Condition string matches the beginning of the Case string.
Case Contains Condition: The Switch Condition string is contained inside the Case string.
Case Ends With Condition: The Switch Condition string matches the end of the Case string.
Condition Begins With Case: The Case string matches the beginning of the Switch Condition string.
Condition Contains Case: The Case string is contained inside the Switch Condition string.

Condition Ends With Case: The Case string matches the end of the Switch Condition string.

- **Case Sensitivity**

If checked, the letter case of any matching Switch Condition and Case values must also match.



- **Value**

This value is a string (without quote marks). Enter a string, then press Enter. You can enter one or more question marks (?) to substitute for individual characters.

Click the link arrow to link a value from another tool. The linked data type must be String.

Display

See “Display panel” on page 3-19.

P-Series Drawer

This tool drawer appears only when the device is connected to an Emulator or a P-Series camera. Tasks that contain these tools can only be loaded on P-Series cameras.

Green Red Spot

In the P-Series Drawer (P-Series Camera Only)



The Green Red Spot tool appears in the toolbox only when VPM is connected to a P-Series camera. The tool operates the integral red and green LEDs in the camera's illuminator.

How to Set Up the Green Red Spot tool

General

1. Change the tool name on the General panel, if desired.

Setup

1. Click the Setup tab, then click the Setup button.

- **Set Green & Red Spot parameters**

Enable GREEN SPOT

If this check box is checked, the tool turns the green indicator LED on, then off.

Enable RED SPOT

If this check box is checked, the tool turns the red indicator LED on, then off.

Dwell

If the Dwell value is greater than zero, the tool turns the LED on for the indicated number of milliseconds. For example, if the value is 10, the LED is turned on for 10 milliseconds, then turned off. See “Delay and Pulse Length” on page 3-90 for more details.

Delay

If the Delay value is greater than zero, the tool waits the indicated number of milliseconds before switching the LED on and off. Note that the delay begins with the task execution trigger event (e.g. Image In Event or Offline Event). See “Delay and Pulse Length” on page 3-90 for more details.

Display

See “Display panel” on page 3-19.

PROFINET

VPM provides the following two tools that allow the P-Series camera to use an exchange area to communicate with other devices on the network using PROFINET protocol. For details about how PROFINET works, see “PROFINET” on page 6-17.

Datalogic also provides a PROFINET GSDML file which provides device-specific specifications for communication. See “Using a General Station Descriptor (GSDML) file” on page 4-21.

ProfinetIO Read

In the P-Series Drawer (P-Series Camera Only)



The ProfinetIO Read tool receives messages by reading the exchange area.

The tool has no fixed inputs or outputs, but inputs can be added to provide six standard data types. These inputs define the layout of the incoming data packet. To create a new input, click Add Input, then select the data type from the type properties drop down.

For details about the exchange area, see “PROFINET” on page 4-17.

How to Set Up the ProfinetIO Read tool

General

- 1. Change the tool name on the General panel, if desired.

Outputs

- 1. Click the Outputs button to define data to be read from the exchange area by the tool.

| Start Address | Name | Type | List Size | String Length | Value |
|---------------|----------|--------------|-----------|---------------|------------|
| 8 | Output 1 | Integer | | | 0 |
| 9 | Output 2 | Integer List | 0 | ... | 0 Integers |
| 9 | Output 3 | Boolean | | | False |
| 10 | Output 4 | String | | 8 | |

- **Add Output**
Click to add an output to the Outputs table. Click the delete icon next to an output to delete it.
- **Station Name**
The name for the camera which identifies it on the network as an alternative to an IP address. The name can contain any combination of up to 63 letters (a-z), numbers (0-9) and a hyphen (-).
- **Tool Offset**
This value indicates the exchange area location where the tool should begin reading. This allows multiple tools to read from the exchange area.

- **Run**
Click to run the tool and read the values from the exchange area.
- **Outputs**
Start Address: This is the output's starting address in the exchange area.
Name: Click in the field to change the output's name.
Type: Click the drop down to select the data type. For string data, one address (word) is always reserved.
List Size: If a list data type is selected, enter the number of values in the list. This value must be set in both the sending (Write) tool and receiving (Read) tool. Lists with a different length are padded with zeroes or truncated (strings are padded with NULL).
String Length: The length of the string to read from the exchange area.
Value: The value read from the exchange area.

Display

See "Display panel" on page 3-19.

ProfinetIO Write

In the P-Series Drawer (P-Series Camera Only)



The ProfinetIO Write tool sends messages by writing to the exchange area on the Impact camera. Other PROFINET devices can then read data from this area. (See "PROFINET" on page 3-117.)

For details about the exchange area, see "PROFINET" on page 4-17.

How to Set Up the ProfinetIO Write tool

General

1. Change the tool name on the General panel, if desired.

Inputs

1. Click the Inputs button to define data types to be written to the exchange area by the tool.

| Start Address | Name | Type | Link | List Size | String Length | Value |
|---------------|---------|--------------|------|-----------|---------------|------------|
| 8 | Input 1 | Integer | | | | 0 |
| 9 | Input 2 | Integer List | | 4 | | 0 Integers |
| 13 | Input 3 | Boolean | | | | False |
| 14 | Input 4 | String | | | 8 | |

- **Add Input**
Click to add an input to the Inputs table. Click the delete icon next to an input to delete it.
- **Station Name**
The name for the camera which identifies it on the network as an alternative to an IP address. The name can contain any combination of up to 63 letters (a-z), numbers (0-9) and a hyphen (-).
- **Tool Offset**
This value indicates the exchange area location where the tool should begin writing. This allows multiple tools to write to the exchange area.
- **Run**
Click to run the tool and write the values to the exchange area.

- **Inputs**

Start Address: This is the input's starting address in the exchange area.

Name: Click in the field to change the input's name.

Type: Click the drop down to select the data type. For string data, one address (word) is always reserved.

Link: Click the link icon to link a value from another tool. Click the delete link icon to delete an existing link.

List Size: If a list data type is selected, enter the number of values in the list. This value must be set in both the sending (Write) tool and receiving (Read) tool. Lists with a different length are padded with zeroes or truncated (strings are padded with NULL).

String Length: The length of the string to write to the exchange area.

Value: The value to write to the exchange area.

Display

See "Display panel" on page 3-19.

Appendix

This appendix explains several parts of VPM Lite in more detail.

HTTP Commands

This section describes HTTP commands that can be sent to a camera, Vision Device, or Emulator over a local area network. These commands can be sent to the camera using a standard Internet browser.

NOTES: In this section, “camera” will be used to refer to the camera, Vision Device, and Emulator. All HTTP commands are case sensitive. Filenames are case sensitive for commands that require them.

To send commands to the camera

1. Start a web browser
2. In the browser's address field, type the IP Address followed by a forward slash. For example:
`http://192.168.0.128/`
3. Immediately following the address and slash, type one of the commands, then press Enter.
4. When the command has completed, the camera will return a response.

For example, to find out if the camera is currently online, the command would be
`http://192.168.0.128/IsOnline`

Command examples and responses are listed below the table.

| HTTP Command | What it does |
|--------------|--|
| getData | Reads the data in the command from the camera's tool or system object properties. The getData command format for tool data is getData/Program Name.Task Name.Tool Name:Property Name and the command format for system object data is getData/Vision System.Object:Property Name Tip: In VPM, click a tool's Properties tab, select the desired property, then right-click to copy the tool or object's property text to the system clipboard. |
| IsOnline | Displays True if the camera is currently online |
| Online | Puts the camera online if it is offline |
| Offline | Puts the camera offline if it is online |
| setData | Writes the data in the command to the camera's tool or system object properties. The setData command format is setData/Program Name.Task Name.Tool Name:Property Name=(datatype)value and the command format for system object data is setData/Vision System.Object:Property Name Tip: In VPM, click a tool's Properties tab, select the desired property, then right-click to copy the tool or object's property text to the system clipboard. |

| | |
|------------------|---|
| status | Displays the camera's current status, including model number, software version, settings and other information. |
| syslog/count=nnn | Displays the most recent "nnn" entries from the System Log in reverse date order |
| trigger | Triggers the camera to acquire an image. The camera must be online to trigger. |
| trigger/id=n | Triggers the camera to acquire an image. The id number "n" is assigned to the TriggerID property of the task set to run on an Image In event. The camera must be online to trigger. |
| unlock | Unlocks the camera if it is in "read only" mode |

Command Examples and Responses

- **getData**

The **getData** command format for tool data is

getData/ProgramName.TaskName.ToolName:PropertyName

This example gets the value of the program "Inspection," the task "Image In Task," the tool "Contrast 1," and the boolean property "Enable In Range Area Test."

getData/Inspection.Image In Task.Contrast 1:Enable In Range Area Test

If the command was successful, the following response is displayed:

```
<Datalogic>
<Boolean portname="Enable In Range Area Test">false</Boolean>
</Datalogic>
```

If the command was not successful, an error message is displayed:

```
Failed to find data "\Inspection.Image%20In%20Task.Con-
trast%201:Enable%20In%20Range%20Area%20"
```

You can also get properties from a system object like the camera.

The **getData** command format for system object data is

getData/Vision System.Object:Property Name

This example gets the Shutter Speed from the system object "Camera."

getData/Vision System.Camera:Shutter Speed

If the command was successful, the following response is displayed:

```
<Datalogic>
<Integer portname="Shutter Speed">
<ver>2</ver>
<val>196</val>
<min>1</min>
<max>500</max>
</Integer>
</Datalogic>
```

If the command was not successful, an error message is displayed:

```
Failed to find data "/Vision%20System.Camera:Shutter%20speed"
```

- **IsOnline**

False

- **Offline**

System Offline!

- **Online**

System Online!

- **setData**

The **setData** command format for tool data is

setData/ProgramName.TaskName.ToolName:PropertyName=(datatype)value

This example sets the program "Inspection," the task "Image In Task," the tool "Contrast 1," and the boolean property "Enable In Range Area Test" to True.

setData/Inspection.Image In Task.Contrast 1:Enable In Range Area Test=(boolean>true

You can also set properties in a system object like the camera.

The setData command format for system object data is

setData/Vision System.Object:Property Name=(datatype)value

This example sets the system object "Camera," integer property "Shutter Speed" to 1000.

setData/Vision System.Camera:Shutter Speed=(integer)1000

If the command was successful, the following response is displayed:

```
<?xml version="1.0" encoding="utf-8" ?>
```

```
- < device >
```

```
<SyntaxError>Ok</SyntaxError>
```

```
<SetDataError>Ok</SetDataError>
```

```
</ device >
```

If the command was not successful, an error message is displayed:

```
<?xml version="1.0" encoding="utf-8" ?>
```

```
- < device >
```

```
<SyntaxError>Possible unknown port or type mismatch</SyntaxError>
```

```
<SetDataError>Invalid Parameter</SetDataError>
```

```
</ device >
```

- status

(This sample status report has been shortened.)

```

Vision Device Status

VisionDeviceManager
Vision Device Name.....: Vision Device
Vision Device Description.....: Vision Device
RAM:
  total.....: 268435456 (256MB)
Flash:
  total.....: 268435456
  free.....: 106551296
IP Address.....: 192.168.108.103
Subnet Mask.....: 255.255.254.0
Gateway Address.....: 0.0.0.0
Security enabled.....: false
High Priority Client Connection.....: false
OCR License.....: Full
Impact License Level.....: IMPACT LITE
Total Weight Tool Allowed.....: 100
Trace Level.....: NONE

TaskManager
Apps loaded on startup:
  -none-
Online.....: true
TaskManager State.....: kTaskManReady
OnlineOnStartup.....: false
DebugMode.....: off
Currently loaded Inspection Apps:
1 program(s) loaded:
  Bulb Inspection
    1 task(s)
    Main Inspection
      Triggers Enabled.....: true
      maxExecTimeFromTrigger.....: 67250
      number of tools.....: 61
    61 total tool(s)

Camera
Connected Camera Type.....: P15
Acquisition Time.....: 0.016400
Buffered Images.....: 2 of 2
Gain.....: 0
Scan Area.....: Top = 1
                  Left = 1
                  Width = 1000
                  Height = 500

```

- syslog/count=5

| Top View System Log | |
|------------------------------|--|
| Time Stamp | Log Entry |
| Jan 14, 2015 09:59:37:755 AM | Vision System Locked. |
| Jan 14, 2015 09:59:37:596 AM | Vision System Unlocked. |
| Jan 14, 2015 09:59:37:596 AM | Vision System Locked. |
| Jan 14, 2015 09:59:37:526 AM | Default User logged on |
| Jan 14, 2015 09:59:37:513 AM | WebSockSend got an errno 10053 (repeated 60 times) |

- trigger
 - <Datalogic>
 - <Error>Must be online!</Error>
 - </Datalogic>
- Online
 - System Online!
- trigger
 - <Datalogic>
 - <Error>Ok</Error>
 - </Datalogic>
- trigger/id=1
 - <Datalogic>
 - <Error>Ok</Error>
 - </Datalogic>
- unlock
 - Vision Device is now unlocked.

Telnet Commands

This section describes Telnet commands that can be sent to a camera, Vision Device, or Emulator over a local area network.

NOTE: In this section, “camera” will be used to refer to the camera, Vision Device, and Emulator.

The commands can be sent to using standard Telnet Client software or an external PLC. A Telnet client is provided with the Windows operating system.

To send commands to the camera

1. Start the Telnet client.
2. Connect to the camera. Only one client can be connected to the camera at the same time.
3. The camera will prompt for a user name and password.
If device security is not enabled, any user name and password is valid.
If device security is enabled, you must enter the user name and password of a valid user that has an access level of Programmer or Administrator.
4. When the logon is complete, the camera will return the prompt:
/\$
5. At the prompt, type one of the commands from the table below, then press Enter
6. When the command has completed, the camera will return a response.

For example, to find out if the camera is currently online, type
/\$IsOnline

NOTE: Commands are not case sensitive, however filenames are case sensitive for commands that require them.

Command examples and responses are listed below the table. To list the commands shown in the table, type:
Help

| Command | What it does |
|--------------------|--|
| ApiVersion | Displays the version number of the VisionDevice API |
| Exit | Logs off the Telnet server |
| Help | Displays commands supported by the camera |
| IsOnline | Displays True if the camera is online |
| ListAllVPFiles | Displays the number, and names of, all of the vision program (VP) files in the VisionPrograms folder on the camera |
| ListLoadedPrograms | Displays the number, and names of, all of the Vision Programs loaded into memory and executable |
| ListLoadedVPFiles | Displays the number, and names of, all of the VP files loaded into memory and executable. |
| LoadVPFile | Loads the named VP file into camera memory |
| Offline | Puts the camera offline |

| Command | What it does |
|-----------------------|--|
| Online | Puts the camera online |
| Reboot | Restarts the camera |
| Revs | Displays the software and hardware revision numbers |
| SaveProgram | Saves the named vision program in the vision programs folder. The program to be saved must be currently loaded. By default, the program is saved in binary mode. To save it in XML format, add ".XML" after the program name. Do not put a space between the program name and the ".XML" flag. |
| SetData | Writes the data in the command to the camera's tool or system object properties. The SetData command format for tool data is SetData ProgramName.TaskName.ToolName:PropertyName=(datatype)value and the command format for system object data is SetData Vision System.Object:Property Name Tip: In VPM, click a tool's Properties tab, select the desired property, then right-click to copy the tool or object's property text to the system clipboard. |
| SetIPAddress | Sets the camera's IP Address |
| SetIPMask | Sets the camera's IP Mask address |
| Temp | Displays the camera's temperature in Celsius |
| Trigger | Triggers the camera to acquire an image. The camera must be online to trigger. |
| Trigger/id=n | Triggers the camera to acquire an image. The id number "n" is assigned to the TriggerID property of the task set to run on an Image In event. The camera must be online to trigger. |
| Trigger/file=filepath | NOTE: This command is available only on M-Series and MX-U Series processors. The camera must be online to trigger. It creates a "camera" image from the .jpg or .png file indicated in "filepath," then generates an ImageIn Event. Any vision program task with the Task Trigger type set to ImageIn Event will run using that image. |
| UnloadAllPrograms | Unloads all the currently loaded vision programs from camera memory. This command unloads programs by their name, rather than by the name of their VP file. |
| UnloadProgram | Unloads the named vision program from camera memory. This command unloads programs by their name, rather than by the name of their VP file. |
| UnloadVPFile | Unloads the named VP file from camera memory. It remains in the VisionPrograms folder. |

Command Examples and Responses

- ApiVersion
74
- Revs
Kernel: 11.4.0, build 73
Board: 8
- Online
System Online!

- Offline
System Offline!
- IsOnline
False
- Trigger
Must be online!
- Trigger
Ok
- Trigger/id=1
Ok
- Trigger/file=filepath (NOTE: This command is available only on M-Series and MX-U Series processors. The camera must be online to trigger. This trigger/file example uses the file "sample" in the folder "C:\images" to create a "camera" image and generate an ImageIn event.)
Trigger/file=C:\images\sample.png
Ok
- SaveProgram Inspection
Save successful
- SaveProgram Inspection:XML
Save successful
- SetIPAddress 192.168.0.210
System must be rebooted before change will take effect.
- SetIPMask 255.255.255.0
System must be rebooted before change will take effect.
- Reboot
Are you sure?
System rebooting, user session will be terminated.
- ListAllVPFiles
5
Sample Bulb v04.vp
IATest.vp
Sample Code Reader v01.vp
Sample Color v01.vp
Sample Measurement v01.vp
- ListLoadedVPFiles
0
- LoadVPFile Test.vp
Load successful
- ListLoadedVpFiles
1
Test.vp
- UnloadVPFile Test.vp
Unload successful
- ListLoadedPrograms
3
Inspection
Support

Robot Calibration

- UnloadProgram Support
Unload successful

The SetData command format for tool data is

SetData ProgramName.TaskName.ToolName:PropertyName=(datatype)value

This example sets the "Enable In Range Area Test" boolean property in the program "Inspection," the task "Image In Task," and the tool "Contrast 1" to True.

- SetData Inspection.Image In Task.Contrast 1:Enable In Range Area Test=(boolean>true
Ok

You can also set properties in a system object like the camera.

The SetData command format for system object data is

SetData Vision System.Object:Property Name=(datatype)value

This example sets the system object "Camera," and the integer property "Shutter Speed" to 1000.

- SetData Vision System.Camera:Shutter Speed=(integer)1000
Ok

TCP/IP Commands

This section describes TCP/IP commands that can be sent to a camera, Vision Device, or Emulator over a local area network.

NOTE: In this section, “camera” will be used to refer to the camera, Vision Device, and Emulator.

The TCP/IP server runs on all Datalogic cameras and is configured in the Settings - General - Communication panel. See “TCP/IP” on page 2-6 for more details. The server checks incoming data for any of the TCP/IP commands listed below. If the data does not contain the “cmd” command indicator, the server ignores it.

The commands can be sent using standard terminal software or an external device. Terminal software is provided with the Windows operating system. The TCP/IP communication is one-directional, there is no response from the server.

To set up the TCP/IP server in the camera

1. Go to the Settings - General - Communication panel in VPM Lite.
2. Set the Server Port in the TCP/IP section of the Communication panel. This port number must match the port number used by the external device.
3. Set one or more Delimiter characters in the TCP/IP section of the Communication panel. The Delimiter character(s) must be set and must match the Delimiter character(s) set in the external device.

To send commands to the camera

1. Start the terminal software client.
2. Connect to the camera. Multiple clients can be connected to the camera at the same time, but they must all be configured to send the same Delimiter character(s).
3. When the connection is complete, enter one of the commands from the table below, then press Enter.
4. There is no response when the command is completed.

For example, to put the camera online, type
cmd online

There must be a space between “cmd” and the command. Command examples are listed below the table.

NOTE: Commands are not case sensitive, however filenames are case sensitive.

| Command | What it does |
|-----------------|--|
| cmd loadvpfile | Loads the named VP file into camera memory |
| cmd offline | Puts the camera offline |
| cmd online | Puts the camera online |
| cmd saveprogram | Saves the named vision program in the vision programs folder. The program to be saved must have previously been loaded into working memory. By default, the program is saved in binary mode. To save it in XML format, add “:XML” after the program name. Do not put a space between the program name and the “:XML” flag. |

| Command | What it does |
|---------------------------|---|
| cmd SetData | Writes the data in the command to the camera's tool or system object properties. (See example below table.) The SetData command format for tool data is SetData ProgramName.TaskName.ToolName:PropertyName=(datatype)value and the command format for system object data is SetData Vision System.Object:Property Name Tip: In VPM, click a tool's Properties tab, select the desired property, then right-click to copy the tool or object's property text to the system clipboard. |
| cmd trigger | Triggers the camera to acquire an image. The camera must be online to trigger. |
| cmd trigger/id=n | Triggers the camera to acquire an image. The id number "n" will be assigned to the TriggerID property of the task set to run on an Image In event. The camera must be online to trigger. |
| cmd trigger/file=filepath | NOTE: This command is available only on M-Series and MX-U Series processors. The camera must be online to trigger. It creates a "camera" image from the .jpg or .png file indicated in "filepath," then generates an ImageIn Event. Any vision program task with the Task Trigger type set to ImageIn Event will run using that image. |
| cmd unloadallprograms | Unloads all the currently loaded vision programs from camera memory. This command unloads programs by their name, rather than by the name of their VP file. |
| cmd unloadprogram | Unloads the named vision program from camera memory. This command unloads programs by their name, rather than by the name of their VP file. |
| cmd unloadvpfile | Unloads the named VP file from camera memory. It remains in the VisionPrograms folder |

The TCP/IP communication is one-directional, there is no response from the server when the command is completed.

Command Examples

- cmd loadvpfile Test.vp
- cmd offline
- cmd online
- cmd saveprogram Inspection
- cmd saveprogram Inspection:XML
- cmd setData

The command format is

setData ProgramName.TaskName.ToolName:PropertyName=(datatype)value

This example sets the program "Inspection," the task "Image In Task," the tool "Contrast 1," and the boolean property "Enable In Range Area Test" to True.

cmd setData Inspection.Image In Task.Contrast 1:Enable In Range Area Test=(boolean>true

You can also set properties in a system object like the camera.

The command format is

setData Vision System.Object:Property Name=(datatype)value

This example sets the system object "Camera," and the integer property "Shutter Speed" to 1000.

cmd setData Vision System.Camera:Shutter Speed=(integer)1000

- cmd trigger

- `cmd trigger/id=1`
- `cmd trigger/file=filepath`
NOTE: This command is available only on M-Series and MX-U Series processors. The camera must be online to trigger.
This trigger/file example uses the file "sample" in the folder "C:\images" to create a "camera" image and generate an ImageIn event.
cmd trigger/file=C:\images\sample.png
- `cmd unloadallprograms`
- `cmd unloadprogram Support`
- `cmd unloadvpfile Test.vp`

EtherNet/IP

The Impact camera is EtherNet/IP compatible. EtherNet/IP is an industrialized extension of Ethernet TCP/IP communications. The Common Industrial Protocol (CIP) is a communications protocol for transferring automation data and control between network devices. In CIP, every network device represents itself as a series of objects. Each object is simply a grouping of the related data values in a device.

The EtherNet/IP Explicit Data and EtherNet/IP Explicit Message tools use explicit messaging (the data format is explicitly defined in the message) which implements a Client/Server relationship and requires a TCP/IP connection. The EtherNet/IP Explicit Data tool receives messages and the EtherNet/IP Explicit Message tool sends messages.

Implicit Assembly Functionality

The EtherNet/IP Read Implicit Assembly and EtherNet/IP Write Implicit Assembly tools use implicit I/O (the data format is not in the message but is implied by the pre-defined assembly object) and a UDP/IP connection.

EtherNet/IP Implicit communications features include:

- 48 REAL words IN (32-bit floating point).
- 48 REAL words OUT (32-bit floating point).
- The first eight IN and OUT words are reserved for dedicated Vision Device control and status, for example Trigger control, Shutter control, and file loading.
- The remaining 40 words IN and 40 words OUT are User Data.

EtherNet/IP Implicit Data Mapping

To aid in programming a PLC, the following tables explain the assembly object structure.

NOTE: User Events (e.g. User Event 1) are not accessible in VPM Lite.

INPUT WORDS (Command)

| Word | Name | Data Type | Read/Write | Valid Data | Description |
|------|---------------------|----------------------|------------|----------------------|--|
| 0 | Input Control Word | Real | Write | | See bit description table below |
| 1 | Load Program Number | Real | Write | 0000-9999 | Load the .vp file which starts with the 4 digit number (e.g. 0001_file.vp). Overwrite existing duplicate inspection names. Zero is no operation. Device must be Online |
| 2 | Shutter Time | Real | Write | Varies by camera | Set shutter time to this value. Zero is no operation. Device must be Online. |
| 3 | Calibration Command | Real | Write | 0-9 | Start device calibration using the mode defined by this value. (See the Calibration Commands table below.) |
| 4 | Not Used | Real | Write | | |
| 5 | Not Used | Real | Write | | |
| 6 | Not Used | Real | Write | | |
| 7 | Not Used | Real | Write | | |
| 8-47 | User Data In (0-39) | Real/Bool/Int/String | Write | Real/Bool/Int/String | Used with Ethernet/IP Read Implicit Assembly Tool (Offset 0-39) and Calibration Command |

INPUT CONTROL WORD BITS (Command)

| Bit | Name | Data Type | Read/Write | Valid Data | Description |
|-------|----------------|-----------|------------|------------|---|
| 0 | Online Control | Boolean | Write | 0, 1 | 0 - Set Vision Device Offline, 1 - Set Vision Device Online. |
| 1 | Trigger | Boolean | Write | 0, 1 | Change of value from 0 to 1 fires Camera Trigger (Trigger ID = -10) |
| 2 | User Event 1 | Boolean | Write | 0, 1 | Change value from 0 to 1 fires User Event 1 (Event ID = -10) |
| 3 | User Event 2 | Boolean | Write | 0, 1 | Change value from 0 to 1 fires User Event 2 (Event ID = -10) |
| 4 | User Event 3 | Boolean | Write | 0, 1 | Change value from 0 to 1 fires User Event 3 (Event ID = -10) |
| 5 | User Event 4 | Boolean | Write | 0, 1 | Change value from 0 to 1 fires User Event 4 (Event ID = -10) |
| 6 | User Event 5 | Boolean | Write | 0, 1 | Change value from 0 to 1 fires User Event 5 (Event ID = -10) |
| 7 | User Event 6 | Boolean | Write | 0, 1 | Change value from 0 to 1 fires User Event 6 (Event ID = -10) |
| 8 | User Event 7 | Boolean | Write | 0, 1 | Change value from 0 to 1 fires User Event 7 (Event ID = -10) |
| 9 | User Event 8 | Boolean | Write | 0, 1 | Change value from 0 to 1 fires User Event 8 (Event ID = -10) |
| 10-31 | Not Used | Boolean | Write | | |

OUTPUT WORDS (Status)

| Word | Name | Data Type | Read/Write | Description |
|------|-------------------------|----------------------|------------|--|
| 0 | Output Control Word | Real | Read | See Output Control Word Bitsdescription table below |
| 1 | Load Program Status | Real | Read | nnnn .Program number nnnn successfully loaded. -1Program Loading -2Program Load Failed |
| 2 | Shutter Time Status | Real | Read | Current Shutter Time Value |
| 3 | Calibration Status | Real | Read | 0Calibration Succeeded 1Unexpected Error 2No image found 3A valid target was not found in the image 4Too few points were entered or found 5The Image Point List and Real-World Point List are different lengths 6The pitch or units per pixel are not greater than zero 7Estimation of pixel pitch, image center, and distortion parameters failed 8Estimation of real-world coordinates failed 9The Calibration Command Word value is out of range |
| 4 | Not Used | Real | Read | |
| 5 | Not Used | Real | Read | |
| 6 | Buffered Images Maximum | Real | Read | The number of buffers in use when a new image acquisition is started. This value is reset to zero when the camera is turned on. |
| 7 | Image Number | Real | Read | Current image number. |
| 8-47 | User Data Out (0-39) | Real/Bool/Int/String | Read | Used with Ethernet/IP Write Implicit Assembly Tool (Offset 0-39) |

OUTPUT CONTROL WORD BITS (Status)

| Bit | Name | Data Type | Read/Write | Description |
|-------|----------------------|-----------|------------|--|
| 0 | Online Status | Boolean | Read | Current status 0 = Offline 1 = Online |
| 1 | Trigger Status | Boolean | Read | Mirrors bit 1 of Input Control Word |
| 2 | User Event 1 Status | Boolean | Read | Mirrors bit 2 of Input Control Word |
| 3 | User Event 2 Status | Boolean | Read | Mirrors bit 3 of Input Control Word |
| 4 | User Event 3 Status | Boolean | Read | Mirrors bit 4 of Input Control Word |
| 5 | User Event 4 Status | Boolean | Read | Mirrors bit 5 of Input Control Word |
| 6 | User Event 5 Status | Boolean | Read | Mirrors bit 6 of Input Control Word |
| 7 | User Event 6 Status | Boolean | Read | Mirrors bit 7 of Input Control Word |
| 8 | User Event 7 Status | Boolean | Read | Mirrors bit 8 of Input Control Word |
| 9 | User Event 8 Status | Boolean | Read | Mirrors bit 9 of Input Control Word |
| 10 | Camera Connected | Boolean | Read | 0 = Not Connected, 1 = Connected |
| 11 | Image In task active | Boolean | Read | True = the Image In task or any task called by the Image In task is running |
| 12 | Any task active | Boolean | Read | True = any task is running (including the Image In task or any task called by the Image In task) |
| 13 | Abort Active | Boolean | Read | True = the abort task ran |
| 14 | Trigger Overrun | Boolean | Read | True = the trigger rate exceeded the camera's frames per second capability |
| 15 | Image Buffer Overrun | Boolean | Read | True = the trigger rate exceeded VPM's ability to process images or image buffers were not being released by a processing task |
| 16 | Bad Image In | Boolean | Read | True = a partial or corrupt image was acquired |
| 17-31 | Not Used | Boolean | Read | |

CALIBRATION COMMANDS

Input Word 3 should contain the calibration command which determines the calibration mode. The camera will use the User Data Words values listed in the table below for the calibration. See Settings - Camera - Calibration for more details.

For example, if Word 3 contains the value of 1, the camera is calibrated using Calibrate From Target with a Hexagonal Pattern. User Data Word 8 must contain the target pitch as a real value.

| Calibration Command (Word 3) | User Data Words and Values |
|---|--|
| 0 No Calibration | N/A |
| 1 Calibrate From Target (Hexagonal Pattern) | Word 8..... Target Pitch |
| 2 Calibrate From Target (Grid Pattern) | Word 8..... Target Pitch |
| 3 Calibrate From Target (Checkerboard Pattern) | Word 8..... Target Pitch |
| 4 Calibrate Pixel Size Only (Manual) | Word 8..... Units per Pixel |
| 5 Calibrate Pixel Size Only (Two Points) | Word 8..... Target Length Word 9..... Point 1, X value Word 10..... Point 1, Y value Word 11..... Point 2, X value Word 12..... Point 2, Y value |

| Calibration Command (Word 3) | User Data Words and Values |
|---|--|
| 6 Reserved for Future Use | |
| 7 Calibrate Real World Units (From 4 Entered Points) | Word 8..... Point 1, Image X value Word 9..... Point 1, Image Y value Word 10..... Point 1, Real World X value Word 11..... Point 1, Real World Y value Word 12..... Point 2, Image X value Word 13..... Point 2, Image Y value Word 14..... Point 2, Real World X value Word 15..... Point 2, Real World Y value Word 16..... Point 3, Image X value Word 17..... Point 3, Image Y value Word 18..... Point 3, Real World X value Word 19..... Point 3, Real World Y value Word 20..... Point 4, Image X value Word 21..... Point 4, Image Y value Word 22..... Point 4, Real World X value Word 23..... Point 4, Real World Y value |
| 8 Calibrate Real World Units (From 5 Entered Points) | Word 8..... Point 1, Image X value Word 9..... Point 1, Image Y value Word 10..... Point 1, Real World X value Word 11..... Point 1, Real World Y value Word 12..... Point 2, Image X value Word 13..... Point 2, Image Y value Word 14..... Point 2, Real World X value Word 15..... Point 2, Real World Y value Word 16..... Point 3, Image X value Word 17..... Point 3, Image Y value Word 18..... Point 3, Real World X value Word 19..... Point 3, Real World Y value Word 20..... Point 4, Image X value Word 21..... Point 4, Image Y value Word 22..... Point 4, Real World X value Word 23..... Point 4, Real World Y value Word 24..... Point 5, Image X value Word 25..... Point 5, Image Y value Word 26..... Point 5, Real World X value Word 27..... Point 5, Real World Y value |

| Calibration Command (Word 3) | User Data Words and Values |
|---|--|
| 9 Calibrate Real World Units (From 6 Entered Points) | Word 8..... Point 1, Image X value Word 9..... Point 1, Image Y value Word 10..... Point 1, Real World X value Word 11..... Point 1, Real World Y value Word 12..... Point 2, Image X value Word 13..... Point 2, Image Y value Word 14..... Point 2, Real World X value Word 15..... Point 2, Real World Y value Word 16..... Point 3, Image X value Word 17..... Point 3, Image Y value Word 18..... Point 3, Real World X value Word 19..... Point 3, Real World Y value Word 20..... Point 4, Image X value Word 21..... Point 4, Image Y value Word 22..... Point 4, Real World X value Word 23..... Point 4, Real World Y value Word 24..... Point 5, Image X value Word 25..... Point 5, Image Y value Word 26..... Point 5, Real World X value Word 27..... Point 5, Real World Y value Word 28..... Point 6, Image X value Word 29..... Point 6, Image Y value Word 30..... Point 6, Real World X value Word 31..... Point 6, Real World Y value |

Using an Electronic Data Sheet (EDS) file

An EDS file can be downloaded from the Datalogic web site. This file configures an IMPACT Ethernet I/O device within the PLC software. An Add-On-Instruction (AOI) file specifically for Rockwell RSLogix5000 PLC software is also available. Installation and use instructions are included in the download package.

- The device has 48 words In, and 48 words OUT.
- When creating an Ethernet Device, the data MUST be defined as 32 bit REAL.
- The device utilizes a configurable polled update rate.
- The Impact Vision Device must be Online to respond to any Input Commands with the exception of Online and Offline Command and Status.

PROFINET

There are two exchange areas in memory used by the ProfinetIO Read and ProfinetIO Write tools, one for reading and one for writing. Each exchange area consists of 128 bytes of memory divided into 32-bit registers. The User Available Registers are defined in the tool setup.

Exchange Area Functionality

PROFINET is the communication standard for automation of PROFIBUS & PROFINET International (PI). Standardized in IEC 61158 and IEC 61784, it represents an open standard for industrial Ethernet. PROFINET satisfies all requirements for automation technology: it is 100% Ethernet compatible according to IEEE standards, it allows data-intensive parameter assignment and extremely fast I/O data transmission. In addition, PROFINET provides a direct interface to the IT level (TCP/IP).

PROFINET communications features include:

- 32 words IN (32-bits each).
- 32 words OUT (32-bits each).
- The first eight IN and OUT words are reserved for dedicated Vision Device control and status, for example Trigger control, Shutter control, and file loading.
- The remaining 24 words IN and 24 words OUT are User Data.

PROFINET Data Mapping

To aid in programming a PLC, the following tables explain the exchange area structure.

NOTE: User Events (e.g. User Event 1) are not accessible in VPM Lite.

INPUT WORDS (Command)

| Word | Name | Data Type | Read/Write | Valid Data | Description |
|------|---------------------|----------------------|------------|----------------------|--|
| 0 | Input Control Word | Real | Write | | See bit description table below |
| 1 | Load Program Number | Real | Write | 0000-9999 | Load the .vp file which starts with the 4 digit number (e.g. 0001_file.vp). Overwrite existing duplicate inspection names. Zero is no operation. Device must be Online |
| 2 | Shutter Time | Real | Write | Varies by camera | Set shutter time to this value. Zero is no operation. Device must be Online. |
| 3 | Calibration Command | Real | Write | 0-9 | Start device calibration using the mode defined by this value. (See Calibration Commands table below) |
| 4 | Not Used | Real | Write | | |
| 5 | Not Used | Real | Write | | |
| 6 | Not Used | Real | Write | | |
| 7 | Not Used | Real | Write | | |
| 8-31 | User Data In (0-23) | Real/Bool/Int/String | Write | Real/Bool/Int/String | Used with ProfinetIO Read Tool (Offset 0-23) and Calibration Command |

INPUT CONTROL WORD BITS (Command)

| Bit | Name | Data Type | Read/Write | Valid Data | Description |
|-------|----------------|-----------|------------|------------|---|
| 0 | Online Control | Boolean | Write | 0 or 1 | 0 - Set Offline, 1 - Set Online. |
| 1 | Trigger | Boolean | Write | 0 or 1 | Change of value from 0 to 1 fires Camera Trigger (Trigger ID = -11) |
| 2 | User Event 1 | Boolean | Write | 0 or 1 | Change value from 0 to 1 fires User Event 1 (Event ID = -11) |
| 3 | User Event 2 | Boolean | Write | 0 or 1 | Change value from 0 to 1 fires User Event 2 (Event ID = -11) |
| 4 | User Event 3 | Boolean | Write | 0 or 1 | Change value from 0 to 1 fires User Event 3 (Event ID = -11) |
| 5 | User Event 4 | Boolean | Write | 0 or 1 | Change value from 0 to 1 fires User Event 4 (Event ID = -11) |
| 6 | User Event 5 | Boolean | Write | 0 or 1 | Change value from 0 to 1 fires User Event 5 (Event ID = -11) |
| 7 | User Event 6 | Boolean | Write | 0 or 1 | Change value from 0 to 1 fires User Event 6 (Event ID = -11) |
| 8 | User Event 7 | Boolean | Write | 0 or 1 | Change value from 0 to 1 fires User Event 7 (Event ID = -11) |
| 9 | User Event 8 | Boolean | Write | 0 or 1 | Change value from 0 to 1 fires User Event 8 (Event ID = -11) |
| 10-31 | Not Used | Boolean | Write | | |

OUTPUT WORDS (Status)

| Word | Name | Data Type | Read/Write | Description |
|------|-------------------------|----------------------|------------|--|
| 0 | Output Control Word | Real | Read | See Output Control Word Bits description table below |
| 1 | Load Program Status | Real | Read | nnnn. Program number nnnn successfully loaded. -1 Program Loading -2 Program Load Failed |
| 2 | Shutter Time Status | Real | Read | Current Shutter Time Value |
| 3 | Calibration Status | Real | Read | 0..... Calibration Succeeded 1..... Unexpected Error 2..... No image found 3..... A valid target was not found in the image 4..... Too few points were entered or found 5..... The Image Point List and Real-World Point List are different lengths 6..... The pitch or units per pixel are not greater than zero 7..... Estimation of pixel pitch, image center, and distortion parameters failed 8..... Estimation of real-world coordinates failed 9..... The Calibration Command Word value is out of range |
| 4 | Not Used | Real | Read | |
| 5 | Not Used | Real | Read | |
| 6 | Buffered Images Maximum | Real | Read | The number of buffers in use when a new image acquisition is started. This value is reset to zero when the camera is turned on. |
| 7 | Image Number | Real | Read | Current image number. |
| 8-31 | User Data Out (0-23) | Real/Bool/Int/String | Read | Used with ProfinetIO Write Tool (Offset 0-23) |

OUTPUT CONTROL WORD BITS (Status)

| Bit | Name | Data Type | Read/Write | Description |
|-------|----------------------|-----------|------------|--|
| 0 | Online Status | Boolean | Read | Current status 0 = Offline 1 = Online |
| 1 | Trigger Status | Boolean | Read | Mirrors bit 1 of Input Control Word |
| 2 | User Event 1 Status | Boolean | Read | Mirrors bit 2 of Input Control Word |
| 3 | User Event 2 Status | Boolean | Read | Mirrors bit 3 of Input Control Word |
| 4 | User Event 3 Status | Boolean | Read | Mirrors bit 4 of Input Control Word |
| 5 | User Event 4 Status | Boolean | Read | Mirrors bit 5 of Input Control Word |
| 6 | User Event 5 Status | Boolean | Read | Mirrors bit 6 of Input Control Word |
| 7 | User Event 6 Status | Boolean | Read | Mirrors bit 7 of Input Control Word |
| 8 | User Event 7 Status | Boolean | Read | Mirrors bit 8 of Input Control Word |
| 9 | User Event 8 Status | Boolean | Read | Mirrors bit 9 of Input Control Word |
| 10 | Camera Connected | Boolean | Read | 0 = Not Connected, 1 = Connected |
| 11 | Image In task active | Boolean | Read | True = the Image In task or any task called by the Image In task is running |
| 12 | Any task active | Boolean | Read | True = any task is running (including the Image In task or any task called by the Image In task) |
| 13 | Abort Active | Boolean | Read | True = the abort task ran |
| 14 | Trigger Overrun | Boolean | Read | True = the trigger rate exceeded the camera's frames per second capability |
| 15 | Image Buffer Overrun | Boolean | Read | True = the trigger rate exceeded VPM's ability to process images or image buffers were not being released by a processing task |
| 16 | Bad Image In | Boolean | Read | True = a partial or corrupt image was acquired |
| 17-31 | Not Used | Boolean | Read | |

CALIBRATION COMMANDS

Input Word 3 should contain the calibration command which determines the calibration mode. The camera will use the User Data Words values listed in the table below for the calibration. See Settings - Camera - Calibration for more details.

For example, if Word 3 contains the value of 1, the camera is calibrated using Calibrate From Target with a Hexagonal Pattern. User Data Word 8 must contain the target pitch as a real value.

| Calibration Command (Word 3) | User Data Words and Values |
|---|--|
| 0 No Calibration | N/A |
| 1 Calibrate From Target (Hexagonal Pattern) | Word 8..... Target Pitch |
| 2 Calibrate From Target (Grid Pattern) | Word 8..... Target Pitch |
| 3 Calibrate From Target (Checkerboard Pattern) | Word 8..... Target Pitch |
| 4 Calibrate Pixel Size Only (Manual) | Word 8..... Units per Pixel |
| 5 Calibrate Pixel Size Only (Two Points) | Word 8..... Target Length Word 9..... Point 1, X value Word 10..... Point 1, Y value Word 11..... Point 2, X value Word 12..... Point 2, Y value |

| Calibration Command (Word 3) | User Data Words and Values |
|---|--|
| 6 Reserved for Future Use | |
| 7 Calibrate Real World Units (From 4 Entered Points) | Word 8..... Point 1, Image X value Word 9..... Point 1, Image Y value Word 10..... Point 1, Real World X value Word 11..... Point 1, Real World Y value Word 12..... Point 2, Image X value Word 13..... Point 2, Image Y value Word 14..... Point 2, Real World X value Word 15..... Point 2, Real World Y value Word 16..... Point 3, Image X value Word 17..... Point 3, Image Y value Word 18..... Point 3, Real World X value Word 19..... Point 3, Real World Y value Word 20..... Point 4, Image X value Word 21..... Point 4, Image Y value Word 22..... Point 4, Real World X value Word 23..... Point 4, Real World Y value |
| 8 Calibrate Real World Units (From 5 Entered Points) | Word 8..... Point 1, Image X value Word 9..... Point 1, Image Y value Word 10..... Point 1, Real World X value Word 11..... Point 1, Real World Y value Word 12..... Point 2, Image X value Word 13..... Point 2, Image Y value Word 14..... Point 2, Real World X value Word 15..... Point 2, Real World Y value Word 16..... Point 3, Image X value Word 17..... Point 3, Image Y value Word 18..... Point 3, Real World X value Word 19..... Point 3, Real World Y value Word 20..... Point 4, Image X value Word 21..... Point 4, Image Y value Word 22..... Point 4, Real World X value Word 23..... Point 4, Real World Y value Word 24..... Point 5, Image X value Word 25..... Point 5, Image Y value Word 26..... Point 5, Real World X value Word 27..... Point 5, Real World Y value |

| Calibration Command (Word 3) | User Data Words and Values |
|---|--|
| 9 Calibrate Real World Units (From 6 Entered Points) | Word 8..... Point 1, Image X value Word 9..... Point 1, Image Y value Word 10..... Point 1, Real World X value Word 11..... Point 1, Real World Y value Word 12..... Point 2, Image X value Word 13..... Point 2, Image Y value Word 14..... Point 2, Real World X value Word 15..... Point 2, Real World Y value Word 16..... Point 3, Image X value Word 17..... Point 3, Image Y value Word 18..... Point 3, Real World X value Word 19..... Point 3, Real World Y value Word 20..... Point 4, Image X value Word 21..... Point 4, Image Y value Word 22..... Point 4, Real World X value Word 23..... Point 4, Real World Y value Word 24..... Point 5, Image X value Word 25..... Point 5, Image Y value Word 26..... Point 5, Real World X value Word 27..... Point 5, Real World Y value Word 28..... Point 6, Image X value Word 29..... Point 6, Image Y value Word 30..... Point 6, Real World X value Word 31..... Point 6, Real World Y value |

Using a General Station Descriptor (GSDML) file

The GSDML file is a readable, ASCII text file in XML format for PROFINET. It contains both general and device-specific specifications for communication. Each of the entries describes a feature that is supported by a device. For example, the name, vendor identifier, device identifier, number, and size of input/output exchange areas (called modules).

By means of keywords, a configuration tool reads the device identification, the adjustable parameters, the corresponding data type, and the permitted limit values for the configuration of the device from the file.

Datalogic provides a GSDML file which can be downloaded from the Datalogic web site (www.datalogic.com).

Threshold Viewer

NOTE: To display the Threshold viewer, click the Histogram button or right click on the image window.



The floating Threshold viewer shows a Histogram or Line Profile, depending on the area of the image or type of ROI selected. The Histogram or Line Profile graphically represents each pixel's grey level within the ROI or image. This shows how the tools "see" images.

The Threshold view varies depending on the type of ROI and which tool is being configured. This is explained in more detail below. These types of ROIs, and whole images, display a Histogram: Blob, Blob List, Circle, Polygon, Rectangle, Rectangle List, Shape, and Shape List. These types of ROIs display a Line Profile: Arc, Line, and Wide Line. The Wide Circular Arc and Wide Line Segment ROI types also display a choice of Radial or Arc Profile types.

General Features

When the Threshold Viewer window is open, it always remains on top of the window. A horizontal splitter bar between the plot and options let you adjust the window split. The plot resizes when the window is resized.

When the selected value List ROI, all the ROI's in the list are represented in the Histogram. If no ROI is selected, the entire image is represented in the Histogram.

If the Threshold Viewer is already displayed, the Histogram plot is refreshed when any of the following events happen:

- A new ROI is selected.
- The selected ROI is unselected, for example, when you left-click on the image. If you select a non-ROI, the entire image's Histogram is displayed.
- A new image is displayed.
- A new tool is selected in the task tree.
- You move to or from Settings-Camera or Settings-File Camera setups.
- VPM Lite is in Live mode.

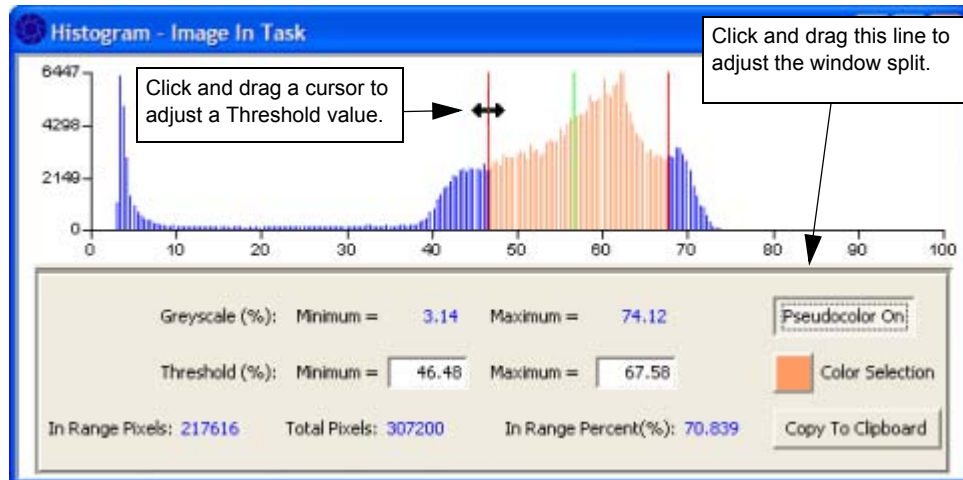
If the Threshold Viewer is already displayed, the Line Profile plot is refreshed when any of the following events happen:

- A new ROI is selected.
- A new tool that has a Line ROI is selected in the task tree.

If the Threshold Viewer window is displayed, it closes when any of the following events happen:

- You click the "X" button in the upper right corner of the Threshold Viewer window.
- You select Display Mode.
- You select the Settings tab and the Camera or File Camera are NOT selected.
- The Camera or File Camera in the Settings tab is selected and you select another system object that is NOT the Camera or File Camera.
- You select Camera or File Camera and there is NO image displayed.
- You select the Summary tab.

- You click the Online, Continuous Triggers, or Linking button.
- You leave locked mode in Design Mode.
- You disconnect from the current camera, Vision Device, or Emulator.
- You close the current vision program.



Histogram View

Image In Task and Fixed Threshold

For details about the Line Profile Threshold Window, see “Line Profile - Grey Level Mode” on page 4-26. Depending on the type of threshold mode a particular tool uses, or when displaying an image, various fields and lines within the Histogram window are enabled or disabled. All tools and images have the following features.

Title

The window title displays the Tool or Task name and the current threshold mode being used.

Histogram Plot

The Histogram plot is displayed as a bar chart where each vertical bar represents the greyscale intensity of a pixel in the image. The Y-Axis is the scale for the number of pixels of each intensity. The X-Axis shows the range of grey levels for the pixels from zero percent (black) to 100 percent (white).

Greyscale %

The minimum and maximum grey levels, as shown graphically in the plot, are displayed here as numbers.

Threshold (%)

The Histogram window displays the selected tool’s or image’s current values and new values are updated in the tool as they are changed in the window.

The movable vertical red cursors (lines) let you set the tool’s desired threshold range on the Histogram. The current red cursor locations are displayed in the window as Threshold (%) Minimum and Maximum.

The movable vertical green cursor is always positioned at the middle of the threshold range. You can move the entire range (both red cursors) by moving the green line.

When you move the red cursors, the new minimum and maximum threshold values are written to the entry fields and are sent to the corresponding tool when the adjustment stops. The image display is also updated. The tool runs after the values are updated.

When you change the values in the minimum entry fields, the red and green vertical cursors are adjusted, the values are sent to the corresponding tool, and the image display is updated. The tool runs after the values are updated.

NOTE: If the Histogram window is displayed and the current tool, task, or system object (e.g. camera or file camera) does NOT have Threshold options, the Minimum and Maximum Threshold (%) values are set to 25 and 75. Adjusting these values adjusts the Pseudocolor in the image display, but no values are written to the tool, task, or system object.

In Range Pixels, Total Pixels, and In Range Percent (%)

In Range Pixels: The number of pixels within the threshold range (between the red vertical cursors).

Total Pixels: The number of pixels in the entire image.

In Range Percent: The percentage of pixels in the entire image with a grey level that fall between the red cursors ($\text{In Range Pixels} / \text{Total Pixels} * 100$).

Pseudocolor

When Pseudocolor is turned on, pixels in the image with a greyscale intensity that falls within the threshold range are colored. The vertical plot lines in the Histogram are also colored. To select the color, click the Color Selection button.

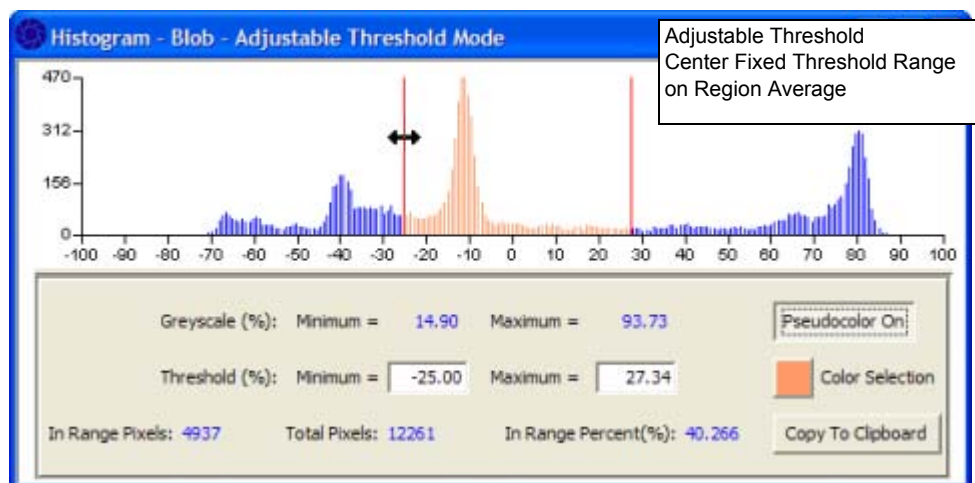
Color Selection

This button displays the current Pseudocolor color. Click this button select the color from a color palette. Each camera, Vision Device, or Emulator stores its own Pseudocolor.

Copy to Clipboard

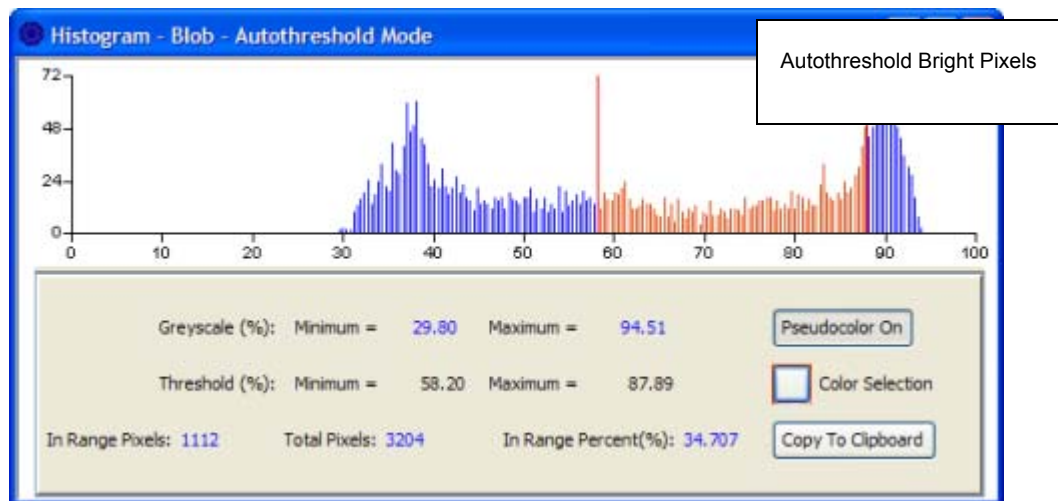
Click this button to create a comma-delimited string of pixel values and write it to the system clipboard. You can paste this information into other applications such as Notepad or Excel.

Center Fixed Threshold Range - Adjustable Threshold



If the tool's threshold type is set to “Center Fixed Threshold on Region Average,” the X-Axis is displayed as -100 to 100 and the centered red cursor is not shown. Moving either the Minimum or Maximum cursor moves the opposite cursor so that the range is always centered on zero.

Bright and Dark Pixels - Autothreshold



If the tool's threshold type is set to “Autothreshold Contrasting Bright (or Dark) Pixels,” the maximum Threshold (%) is set to 100 and the minimum is set to the minimum value of the tool’s “Threshold Range Used” if it is present in the tool.

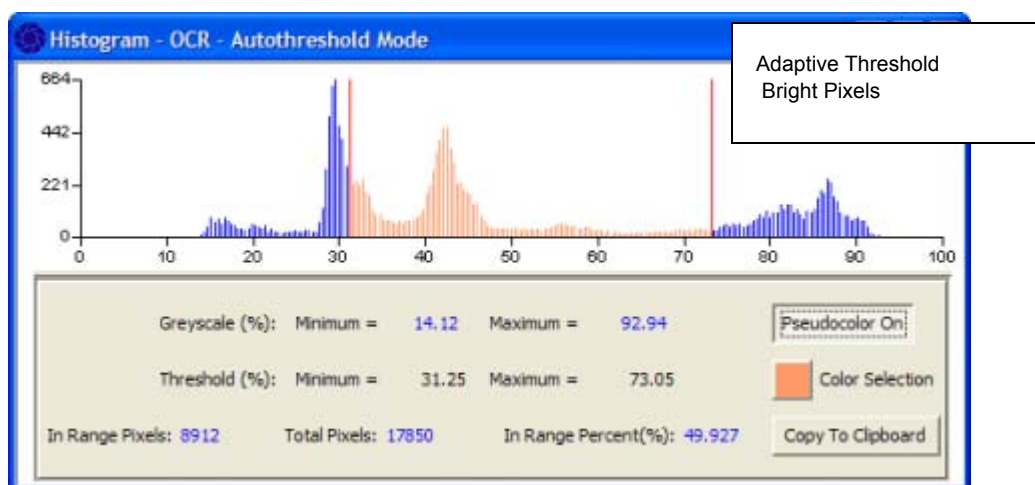
If the tool's threshold type is set to “Autothreshold Contrasting Dark Pixels,” the minimum Threshold (%) is set to 0 and the maximum is set to the maximum value of the tool’s “Threshold Range Used” if it is present in the tool.

You cannot adjust the Threshold (%) values or cursors in this mode.

NOTE: If there is no “Threshold Range Used” in the tool, then the cursors are not shown and the Threshold (%) Minimum and Maximum values are set to zero.

The Autothreshold Contrasting Bright (or Dark) Pixels setting works well when the histogram has a bimodal distribution (i.e. it has two distinct data groupings as in the image above). When the histogram is single mode (i.e. the grey levels are grouped together around one common average), it is better to use the Center Fixed Threshold on Region Average or calculate a threshold value using the appropriate tool.

Bright and Dark Pixels - Adaptive Threshold

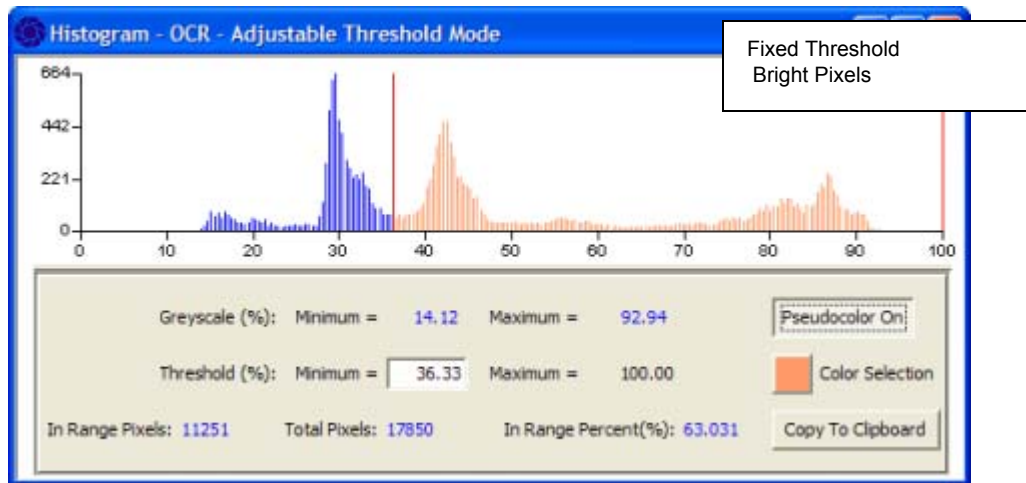


If the tool's threshold type is set to some form of “Adaptive Threshold - Bright,” the maximum Threshold (%) is set to 100 and the minimum value is set to the value of the tool's Fixed Threshold Value.

If the tool's threshold type is set to some form of “Adaptive Threshold - Dark,” the minimum Threshold (%) is set to 0 and the maximum value is set to the value of the tool's Fixed Threshold Value.

You can only adjust the Threshold(%) minimum value and cursor in this mode.

Bright and Dark Pixels - Fixed Threshold



If the selected tool's Threshold type is set to some form of “Fixed Threshold - Bright,” the maximum Threshold (%) is set to 100 and the minimum value is set to the minimum value of the tool's Fixed Threshold Range. You can only adjust the Threshold(%) minimum value and cursor in this mode.

If the selected tool's Threshold type is set to some form of “Fixed Threshold - Dark,” the minimum Threshold (%) is set to 0 and the maximum value is set to the maximum value of the tool's Fixed Threshold Range. The user can only adjust the Threshold(%) maximum value and cursor in this mode.

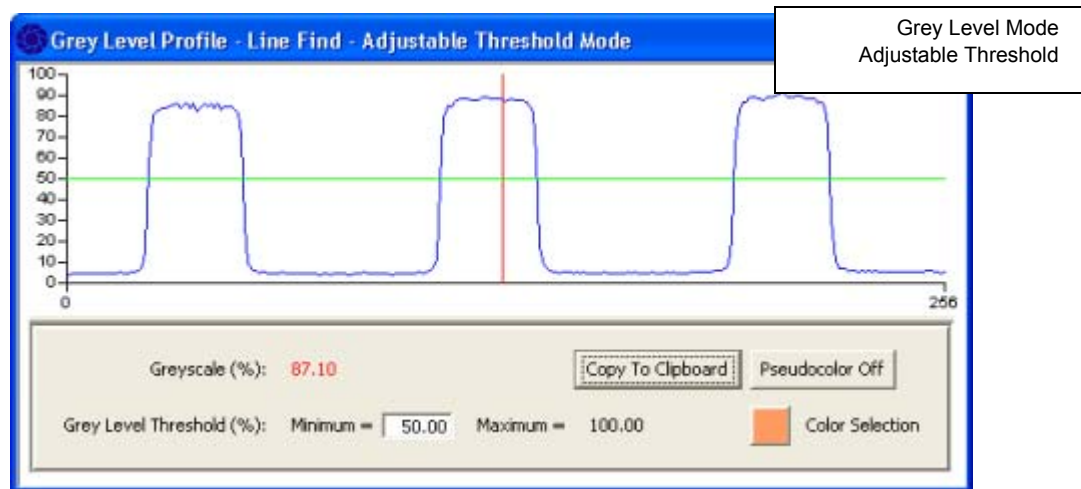
Line Profile - Grey Level Mode

The Threshold Viewer Window displays a grey level or gradient Line Profile, depending on the mode chosen in the tool, for these ROI types: Arc, Line, and Wide Line. For details about the Histogram window, see “Histogram View” on page 4-23.

Title

The window title displays the current Profile Mode (Grey Level or Gradient), the Tool or Task name, and the current threshold mode being used (when applicable).

Grey Level Mode - Adjustable Threshold

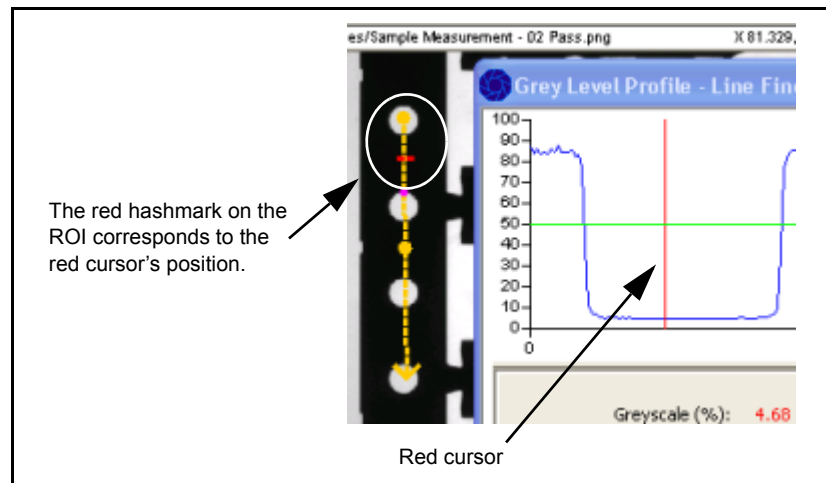


Line Profile Plot

The grey level Line Profile is displayed as a line plotted on a graph where the X-Axis represents the length of the selected line ROI and the Y-Axis represents the line's grey level percent from zero percent (black) to 100 percent (white).

The horizontal green cursor represents the tool's Grey Level Threshold Minimum or Maximum percent (based on bright or dark line type). When the green cursor is adjusted, the threshold percent in the tool is also adjusted. If Pseudocolor is turned on, adjusting the green cursor adjusts the threshold limits on the image display. If the tool is in Autothreshold mode, the green cursor is only displayed when the Pseudocolor is ON, it then only adjusts the image display's threshold limits and NOT the tool's values.

The vertical red cursor is movable and shows the Greyscale or Gradient value at its location. A red hash mark on the selected Line ROI follows the position of the red cursor on the plot.



Greyscale %

The percent greyscale, as shown graphically in the plot, at the red vertical line (cursor).

Grey Level Threshold (%)

The Grey Level Threshold (%) Minimum and Maximum fields work as follows:

When a Bright Line Type (e.g. First Bright Line) is selected in a tool, the Minimum field is editable and the Maximum field is disabled and displays a fixed value of 100.0. When the green horizontal line (cursor) is moved up or down, the Minimum threshold value is adjusted. When you type a value into the Minimum field, the green cursor is adjusted. The Minimum value is reflected in the tool's "Fixed Grey Level Threshold Percentage".

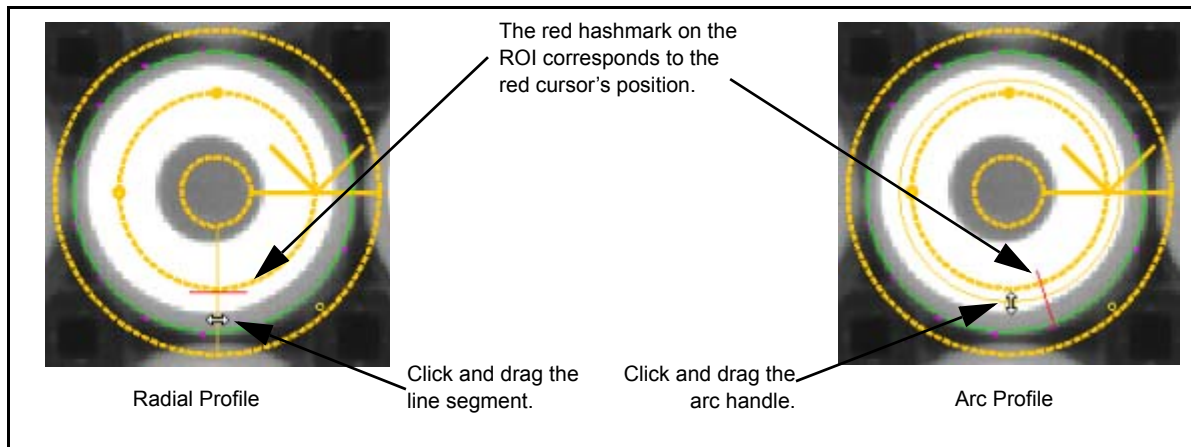
When a Dark Line Type (e.g. First Dark Line) is selected in a tool, the Maximum field is editable and the Minimum field is disabled and displays a fixed value of 0.0. When the green cursor is moved up or down, the Maximum threshold value is adjusted. When you type a value into the Maximum field, the green cursor is adjusted. The Maximum value is reflected in the tool's "Fixed Grey Level Threshold Percentage".

Profile Type

Wide Circle Arc ROIs have an additional Profile Type selection: Radial and Arc

Radial Profile: When Radial Profile is selected, a radial line segment is shown on the ROI. Click and drag the line segment to move it around the circle. The profile viewer shows the pixel values under the line segment.

Arc: When Arc Profile is selected, an arc with a line segment is displayed on the ROI. You can click and drag the arc handle to contract and expand it and move the line segment. The profile viewer shows the pixel values under the line segment.



Pseudocolor

When Pseudocolor is turned on, pixels in the image with a grey level intensity that falls within the threshold range are colored. To select the color, click the Color Selection button.

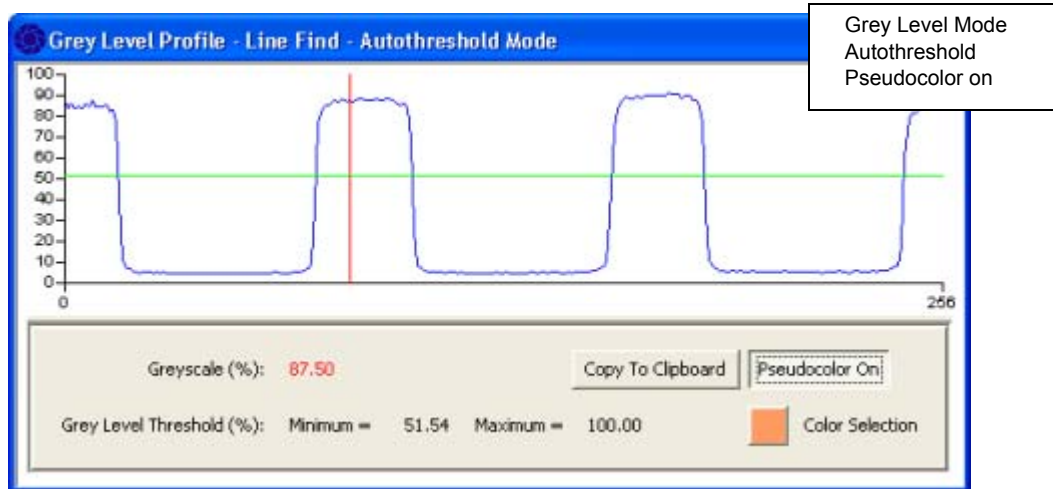
Color Selection

This button displays the current Pseudocolor color. Click this button select the color from a color palette. Each camera, Vision Device, or Emulator stores its own Pseudocolor.

Copy to Clipboard

When clicked, this button creates a comma-delimited string of pixel values and writes it to the system clipboard. You can paste this information into another application such as Notepad or Excel.

Grey Level Mode - Autothreshold



When the tool is in Autothreshold mode and Pseudocolor is off, the horizontal green cursor is not displayed and the Grey Level Threshold % fields are set to zero and disabled since there are no Threshold Used values to read.

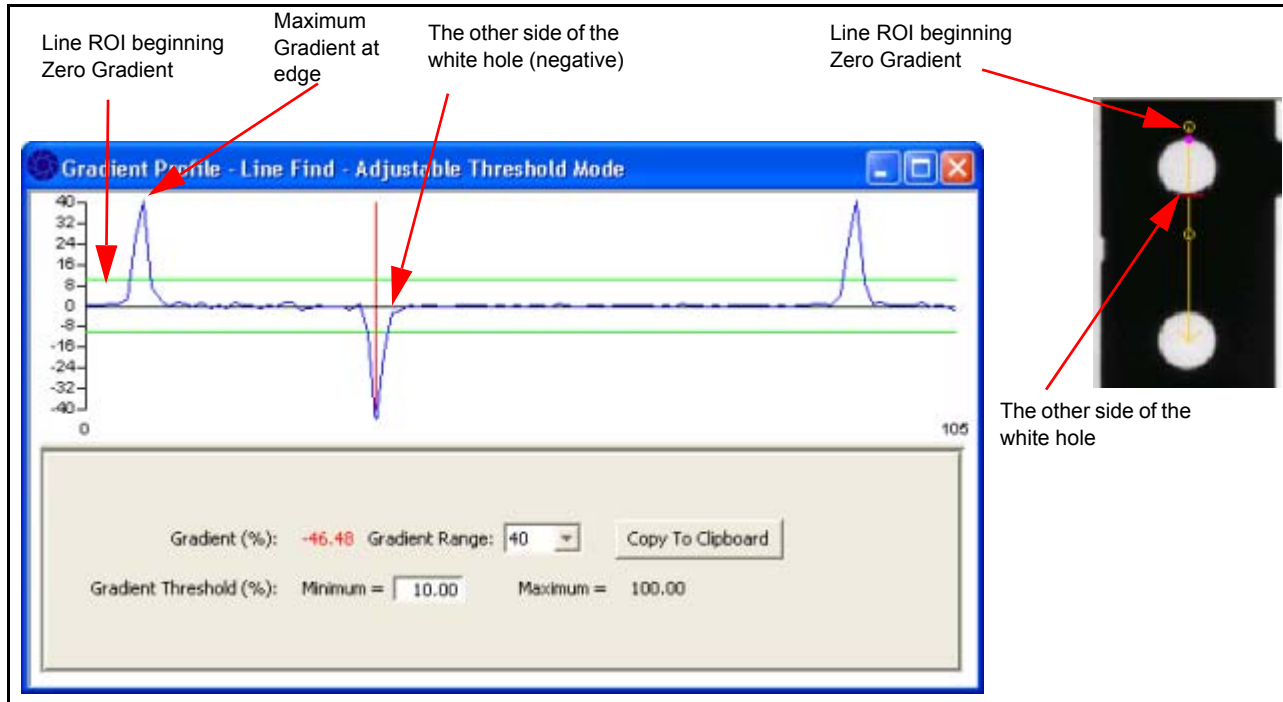
When Pseudocolor is on, a movable horizontal green cursor is displayed. Moving the cursor up or down adjusts either the Threshold % Minimum or Maximum numeric fields and threshold limits in the image display, depending on whether bright or dark line type is selected. In this mode, no values are update in the tool.

Line Profile - Gradient Mode

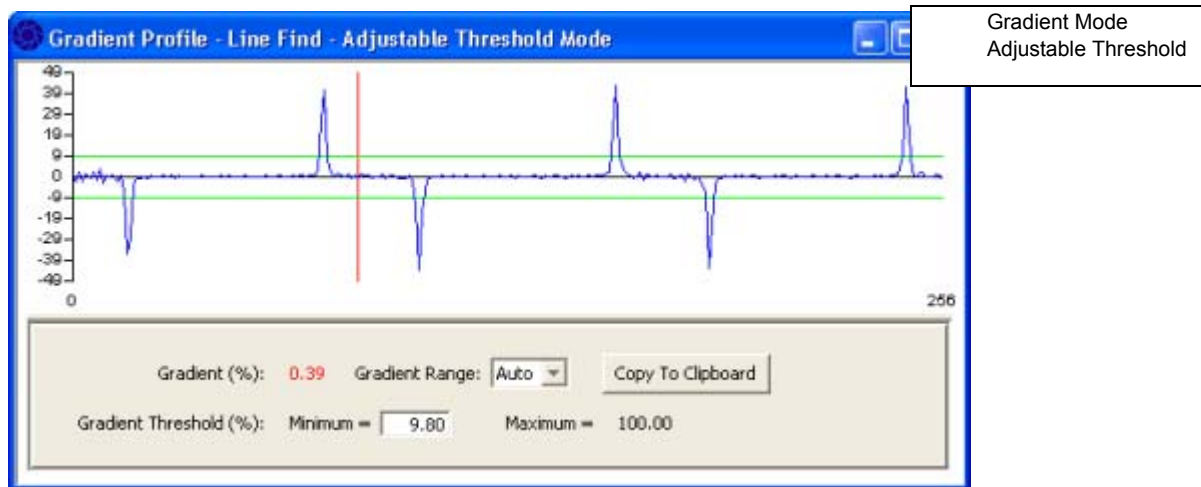
Gradient Introduction

The term gradient refers to how quickly an image's grey level intensity changes. For example, the Line Profile below is from the Line ROI in the image at the right. The image is black from the beginning of the line to the first circle so there is zero gradient at the beginning of the profile. As the intensity changes from black to white, the gradient increases in a positive direction, reaches a maximum at the edge, then returns to zero where the image is white. On the other side of the hole, the intensity changes from white to black and the

gradient increases in a negative (black) direction. The red cursor has been moved so that the red hashmark on the image is directly over the black edge of the hole, which has a maximum gradient of -46.48.



Gradient Mode - Adjustable Threshold



Line Profile Plot

The gradient Line Profile is displayed as a line plotted on a graph where the X-Axis represents the length of the selected line ROI and the Y-Axis represents the gradient percent range. The maximum range value is based on the currently selected Gradient Range.

The top horizontal green cursor represents the tool's Gradient Threshold Minimum percent. When the green cursor is adjusted, the gradient threshold percent in the tool is also adjusted. If the tool is in Autothreshold mode, the green cursor is not displayed.

Gradient (%)

The Gradient (%) value is shown in red text and displays the percent at the current location of the red vertical cursor.

Gradient Range

The Gradient Range drop down provides custom Y-Axis scaling options. If you select "Auto", the Y-Axis is adjusted so that the maximum range value is 10% larger than the highest gradient percent. If you select any other option, the Y-Axis is set to that value.

Profile Type

Wide Circle Arc ROIs have an additional Profile Type selection: Radial and Arc. See "Profile Type" on page 4-28.

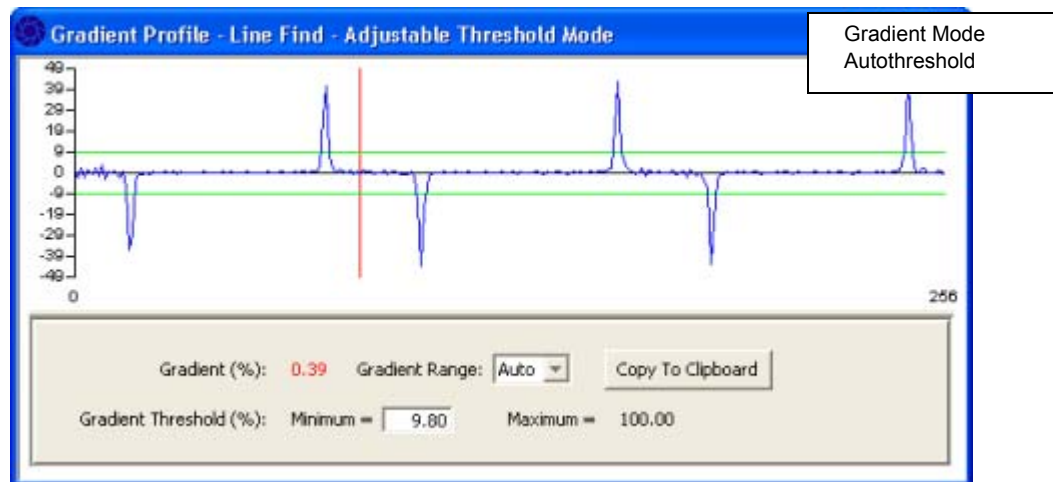
Gradient Threshold (%)

The Gradient Threshold (%) Maximum is always set to 100.0. The Minimum field and top green cursor reflect the tool's "Fixed Gradient Threshold Percentage" value. As the Minimum percent is adjusted in the text entry or cursor, the tool is updated.

Copy to Clipboard

When clicked, this button creates a comma-delimited string of pixel values and writes it to the system clipboard. You can paste this information into another application such as Notepad or Excel.

Gradient Mode - Autothreshold



When the tool is in Autothreshold mode, no horizontal green cursors are displayed and the Threshold % fields are set to zero since there are no Threshold Used values in the tool to read.

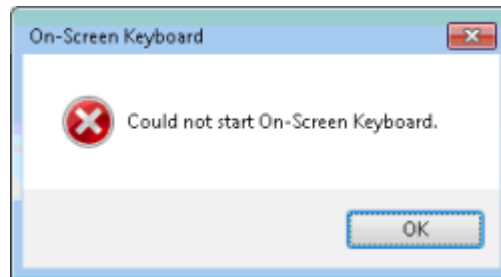
On-Screen Keyboard

Configure the On-Screen Keyboard

An external keyboard (OSK) is available for entering text and numbers using a touchscreen rather than a keyboard.

Using the external OSK with Windows 7 (64-bit operating system)

When you use the external OSK on a Windows 7 64-bit operating system, you may get the following error:



If this error occurs, you are probably trying to use the default OSK program location as it is defined in the OSK setup. You must copy the program file from its current location to another folder and change its default location.

To Copy the OSK program

1. Using Windows Explorer, navigate to the folder:
C:/Windows/System32/
2. Locate the file named "osk.exe"
3. Copy the file to the folder:
C:\Datalogic\ImpactLite\Applications\OSK

To Change the Default Location



1. Start VPM Lite and click the Display Mode button. You can only change this setting from Display Mode.
2. Click the Program Preferences button on the main Display toolbar.
3. In the field labeled "Path to text entry keyboard application," enter the following string (including the quotes):
"C:\Datalogic\ImpactLite\Applications\OSK\osk.exe"
4. Click the OK button.

Display Mode

The external OSK is accessible only when you are using Display Mode. If the OSK is enabled, the text entry OSK pops up when an editable text cell gains focus. The numeric OSK application is executed when an editable integer or real cell gains focus. The OSK application stops when either the table loses focus or you press the "Enter" key. If a table has various data types within it, the OSK changes depending what cell gains focus.



To enable the external OSK

1. Click the Display Mode button.
2. Click the Program Preferences button.
3. In the Program Preferences dialog, check the box labeled "Enable on-screen keyboard."
4. If your text OSK application is in a different folder than the folder shown, enter the path and application name in the first field.
5. If your numeric OSK application is in a different folder than the folder shown, enter the path and application name in the second field.

External Numeric OSK

The numeric keypad application is provided by Datalogic. It uses displays standard numbers and uses a numeric keypad layout.



The keyboard can be resized and moved.

The Font and Icon size are adjusted based on the keypad size, but there is no external font setting.

The slider at the bottom of the keypad adjusts its transparency, increasing from left to right.

The decimal point key is localized based on the current operating system language.

Keyboard settings are stored between uses.

Command Line Parameters

This section describes command line options you can use. Some of the options are common to all the programs, and some are unique. Be sure the option you are using is available for the program you are using.

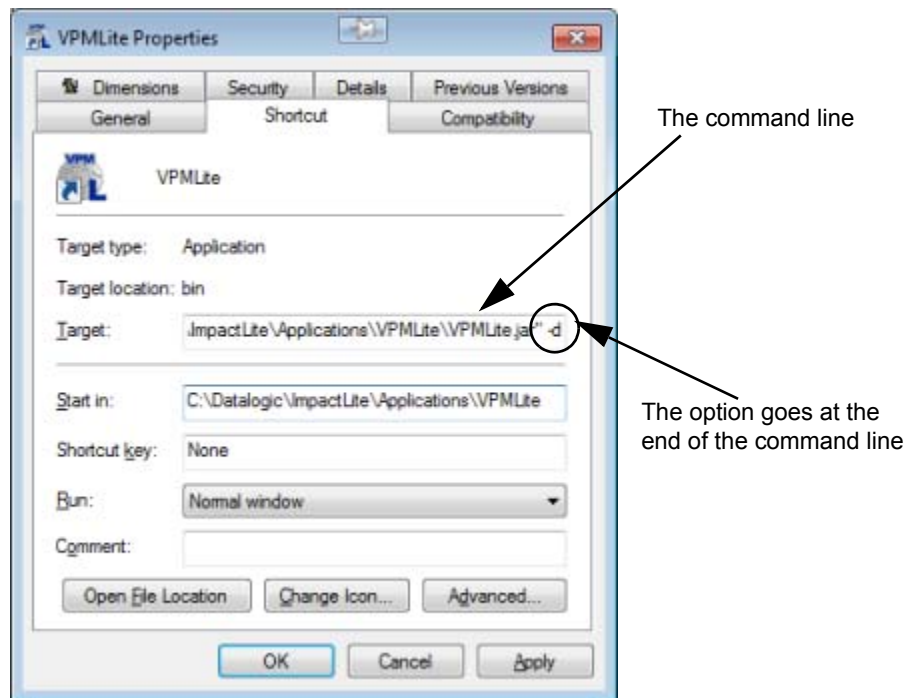
You must edit the program command line to add parameters. The command line is in the program's shortcut. To add multiple options to a single command line, put a space between each option.

Program Shortcut Icon



To edit the program command line

1. Find the program's shortcut icon on the desktop.
2. Right click on the icon.
3. Select Properties from the menu.
4. Click the Shortcut tab.
5. The command line appears in the Target field on the Properties dialog.
Command line options must be added to the end of the default command line. After the final quotation mark, add a space, then add the option exactly as indicated in each description below.
6. When you have finished editing the command line, click OK to close the Properties editor dialog.



IMPORTANT: The command line on your system may not contain exactly the same information as this example.

Tip: The Target field on the Properties dialog can contain a maximum of 255 characters. If the options cause the command line to exceed this length, you can create a text file containing the options, then use the “optionfile” command line. See “Access a text file of command line options” on page 4-37 for an example.

Summary

Here is a summary of all the Command Line parameters.

Access a text file containing command line parameters (-optionfile): (page 4-37)

Disable moving and sizing the window (-d): (page 4-35)

Display an image as the logo in the title bar (-logo): (page 4-36)

Display an image as a banner in line with the tool bar (-banner): (page 4-36)

Display an image at program start and in the About dialog (-splash): (page 4-37)

Override the program’s default system language settings (-language): (page 4-36)

Override the program’s default system country settings (-country): (page 4-35)

Set the amount of program memory space allocated (-Xmx): (page 4-38)

Override the program’s default system country settings

When this option is used, the program uses the country setting specified in the command line instead of the default system setting. The country argument is one of the valid upper-case two-letter ISO Country codes as defined by ISO-3166. For example, here is a list of codes for a few countries.

| Country | Code | Country | Code | Country | Code | Country | Code |
|---------------|------|---------|------|---------|------|---------|------|
| United States | US | China | CN | Spain | ES | Germany | DE |

Add the following option to the command line:

-country

Here is an example command line showing the program using the Chinese country settings (the option is in bold):

“C:\Datalogic\ImpactLite\Applications\jre\bin\javaw.exe” -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar “C:\Datalogic\ImpactLite\Applications\VPMLite\VPMLite.jar”
-country CN

Disable moving and sizing the window



With this option, the program does not display the minimize, restore/down, or close buttons in the title bar. The “Exit” button is added so the program can be closed.

Add the following option to the command line:

-d

Here is an example command line disabling the program window (the option is in bold):

VPM Lite

“C:\Datalogic\ImpactLite\Applications\jre\bin\javaw.exe” -XX:+UseParallelGC

```
-Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\ImpactLite\Applications\VPMLite\VPMLite.jar" -d
```

Override the program's default system language settings

When this option is used, the program uses the translation file language setting specified in the command line instead of the default system setting. The language argument is one of the valid lower-case two-letter ISO Country codes as defined by ISO-639. For example, here is a list of the codes for a few languages.

| Language | Code | Language | Code | Language | Code | Language | Code |
|----------|------|----------|------|----------|------|----------|------|
| English | en | Chinese | zh | French | fr | German | de |
| Hindi | hi | Italian | it | Japanese | ja | Korean | ko |

For more details about how to create and use a translation file, refer to the Datalogic publication "How to Use Impact Translations."

Add the following option to the command line:

-language

Here is an example command line overriding the system language setting so the program uses French (the option is in bold):

VPM Lite

```
"C:\Datalogic\ImpactLite\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\ImpactLite\Applications\VPMLite\VPMLite.jar" -language fr
```

Display an image as the logo on the title bar

This option displays an image file as a small icon just left of the title on the application title bar. This image is also displayed on the right end of the toolbar if the **-banner** option is not used. The image file must be type jpg, gif, or png and should be no more than 40 pixels high. If the image is not found in the designated folder, or no file name is specified, no image is displayed in the title or toolbar. IMPORTANT: File names are case sensitive.

Add the following option to the command line:

-logo "images/image name.ext"

where the folder "images" contains "image name.ext."

NOTE: The file path and name must be enclosed in quotes and include the file extension. There is a space between the option and the first quotation mark.

Here is an example command line that displays an image named "logo.png" located in a folder named "C:\Images" (the option is in bold):

VPM Lite

```
"C:\Datalogic\ImpactLite\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\ImpactLite\Applications\VPMLite\VPMLite.jar" -logo
"C:\Images\logo.png"
```

Display an image as a banner in the program window

This option displays an image file as a small icon on the right end of the toolbar, replacing the Datalogic logo. The image file must be type jpg, gif, or png and should be no more than 40 pixels high. If the image is

not found in the designated folder, or no file name is specified, no image is displayed at the right end of the toolbar. IMPORTANT: File names are case sensitive.

Add the following option to the command line:

-banner "images/image name.ext"

where the folder "images" contains the image to be displayed named "image name.ext."

NOTE: The file path and name must be enclosed in quotes and include the file extension. There is a space between the option and the first quotation mark.

Here is an example command line that displays an image named "banner.png" located in a folder named "C:\Images" (the option is in bold):

VPM Lite

```
"C:\Datalogic\ImpactLite\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\ImpactLite\Applications\VPMLite\VPMLite.jar" -banner
"C:\Images\banner.png"
```

Access a text file of command line options

This option specifies that the program should read a text file that contains a list of command line options to use. The file should only contain valid program options, all other text is ignored. Do not include the actual command line in the file, just the option. IMPORTANT: File names are case sensitive.

Add the following option to the command line:

-optionfile "text folder\text file name.txt"

where the folder "text folder" contains "file name.txt."

NOTE: The file path and name must be enclosed in quotes and include the file extension. The path and file name are case sensitive. There is a space between the option and the first quotation mark.

The options are easier to read if you list only one option per line in the text file. For example:

```
-noexit -d
-language fr
-logo "C:\Images\logo.png"
```

Here is an example command line that accesses the text file "options.txt" in the folder named "C:\text folder" (the option is in bold):

VPM Lite

```
"C:\Datalogic\ImpactLite\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\ImpactLite\Applications\VPMLite\VPMLite.jar"
-optionfile "C:\text folder\options.txt"
```

Display a program start and About dialog image

NOTE: The text for this option is different and it is placed within the command line, not at the end.

This option displays the indicated image when the program starts and in the About dialog when you click the About icon in the tool bar. If no image file is specified, no image is displayed. IMPORTANT: File names are case sensitive.

Add the following option in the command line:

-splash "image path name\image file name.ext"

where "image path name" is the folder that contains the image named "image file name.ext."

The string must be enclosed in quotes and there is a colon (not a space) between the option and the first quotation mark. Here are example command lines containing the option. The image file is named "splash-file.png" and is in the folder named "C:\images" (the option is in bold):

VPM Lite

```
"C:\Datalogic\ImpactLite\Applications\jre\bin\javaw.exe" -splash:"c:\images\splashfile.png" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\ImpactLite\Applications\VPMLite\VPMLite.jar"
```

Set the amount of memory to be allocated

IMPORTANT NOTE: This option is placed within the command line, not at the end. This option already exists in the program command line. Change the existing value only, do not add a new value to the end of the command line.

This option sets the amount of memory space to be allocated for the program to run. If the program exceeds its default allocated memory space, it is terminated.

This option must be set on all applicable program shortcuts used on your computer.

The number following the -Xmx parameter in the command line sets the amount of memory to allocate. This number should not exceed the maximum recommended value which is calculated as 40% of the memory size of your computer, in megabytes (MB).

For example, if your computer has 1 Gigabyte (1 GB) of memory, the maximum recommended value is 1,000,000,000 x .40 = 400,000,000 (400 MB).

Change the following option in the command line, where nnn is the amount of memory to allocate (note the letter "m" at the end):

-Xmxnnnm

Here is an example command line that sets the amount of memory allocated for each program to 400 MB (the option is in bold):

VPM Lite

```
"C:\Datalogic\ImpactLite\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC  
-Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\ImpactLite\Applications\VPMLite\VPMLite.jar"
```

TCP/IP Settings

This section describes different types of Impact camera and PC connections and the TCP/IP settings for those connections. If you need help configuring the network or the client computer, you should seek professional advice. Network configuration is beyond the scope of this manual.

Impact software TCP Ports

Impact software uses an ephemeral port number to connect to Impact P-Series cameras.

Ephemeral ports are temporary ports assigned by the operating system from a designated range of ports used for this purpose. When the connection between the client PC and the P-Series camera terminates, the ephemeral port is available for reuse, although usually the port number is not reused until the entire pool of ephemeral ports has been exhausted. This means that the client PC assigns a different ephemeral port number for the new connection. Microsoft Windows uses the range of port numbers 1024 through 5000 for its ephemeral port range.

The P-Series camera runs an HTTP server that always uses port 80.

Impact software uses the following port numbers for communication. Local ports are on the host PC. Remote ports are on the Impact P-Series camera.

Impact ActiveX API

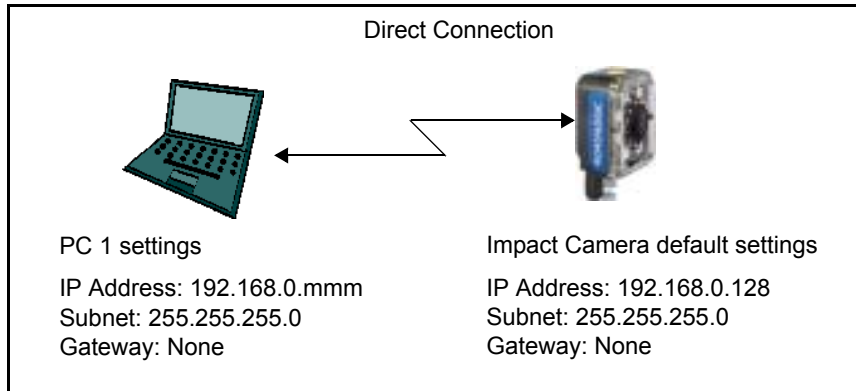
- **Discovery** (finding Impact cameras)
 - Multicast UDP on address 239.255.255.250, port 3702
 - Replies received on local port 1024-5000 from remote port 49153-65534
- **Normal transactions**
 - Local port 1024-5000, the ActiveX server always uses remote port 9977
- **Events**
 - Received on local port 7835 from remote port 49153-65534

Impact software

- **Telnet Server**
 - Local port 23 is used for Telnet commands.
- **Impact Key License**
 - Local port 1947 is used on systems that have an Impact License Key installed.
- **Discovery** (finding cameras, Vision Devices, or Emulators)
 - Multicast UDP on address 239.34.56.84, port 52315
 - Replies received on local port 52315 from remote port 52315
- **Normal transactions**
 - Port 1024-5000, the CORBA server always uses remote port 7994
 - Port 49400+, used by the Send Message and Wait For Message tools to transfer image type data (the actual port number is 49400 + the tool message number)
 - Port 10012, used by the Send Message and Wait For Message tools to transfer non-image type data (UDP datagrams)
- **Events**
 - Use the same local and remote port pair established for normal transactions

P-Series Connection

Client PC to Camera - Direct Connection



The PC and Impact camera settings must be compatible:

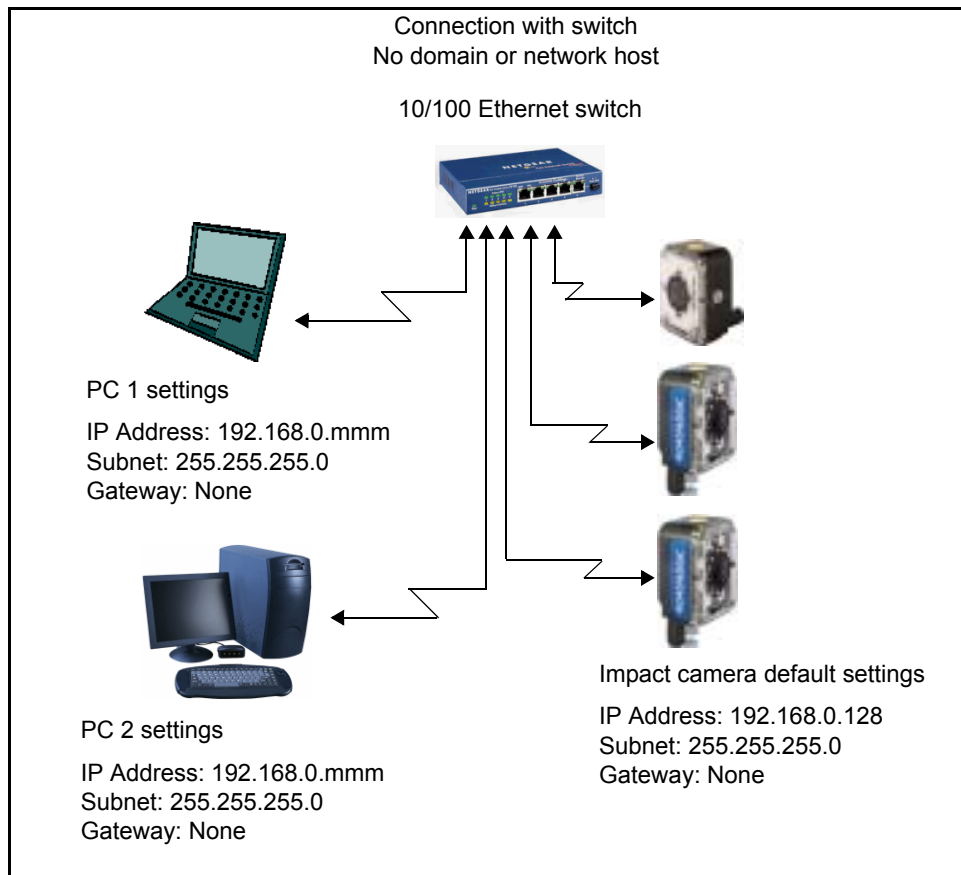
IP Address: AAA.BBB.CCC.nnn
Subnet: 255.255.XXX.0
Gateway: AAA.BBB.CCC.nnn

The first 3 fields of the IP address (AAA.BBB.CCC) must match exactly on both the PC and Impact camera.
The last field 'nnn' must be unique and in the range of 1 to 254.

The Subnet address on the PC and the Impact camera must match exactly.

The Gateway address is not used and should be left unchanged on all the cameras and PCs.

PC to Camera - Switch Connection



The PC and Impact camera settings must be compatible:

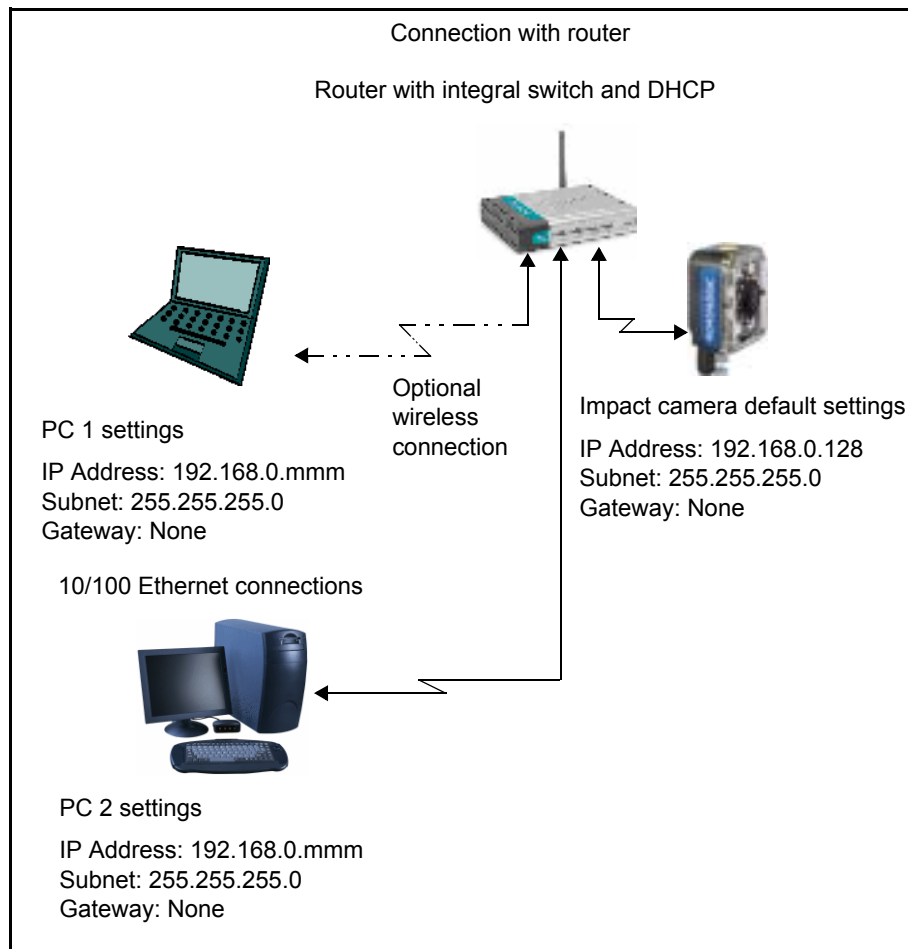
IP Address: AAA.BBB.CCC.nnn
Subnet: 255.255.XXX.0
Gateway: AAA.BBB.CCC.nnn

The first 3 fields of the IP address (AAA.BBB.CCC) must match exactly on both the PC and Impact camera.
The last field 'nnn' must be unique and in the range of 1 to 254.

The Subnet addresses on the PCs and the Impact cameras must match exactly.

The Gateway address is not used and should be left unchanged on all the cameras and PCs.

PC to Camera - Router Connection



The router is normally configured to assign TCP/IP settings automatically to all network devices. Configure the router to exclude a range of IP addresses from the DHCP server that is used by the Impact cameras. The camera must be manually configured with unique IP data that is compatible with the router settings.

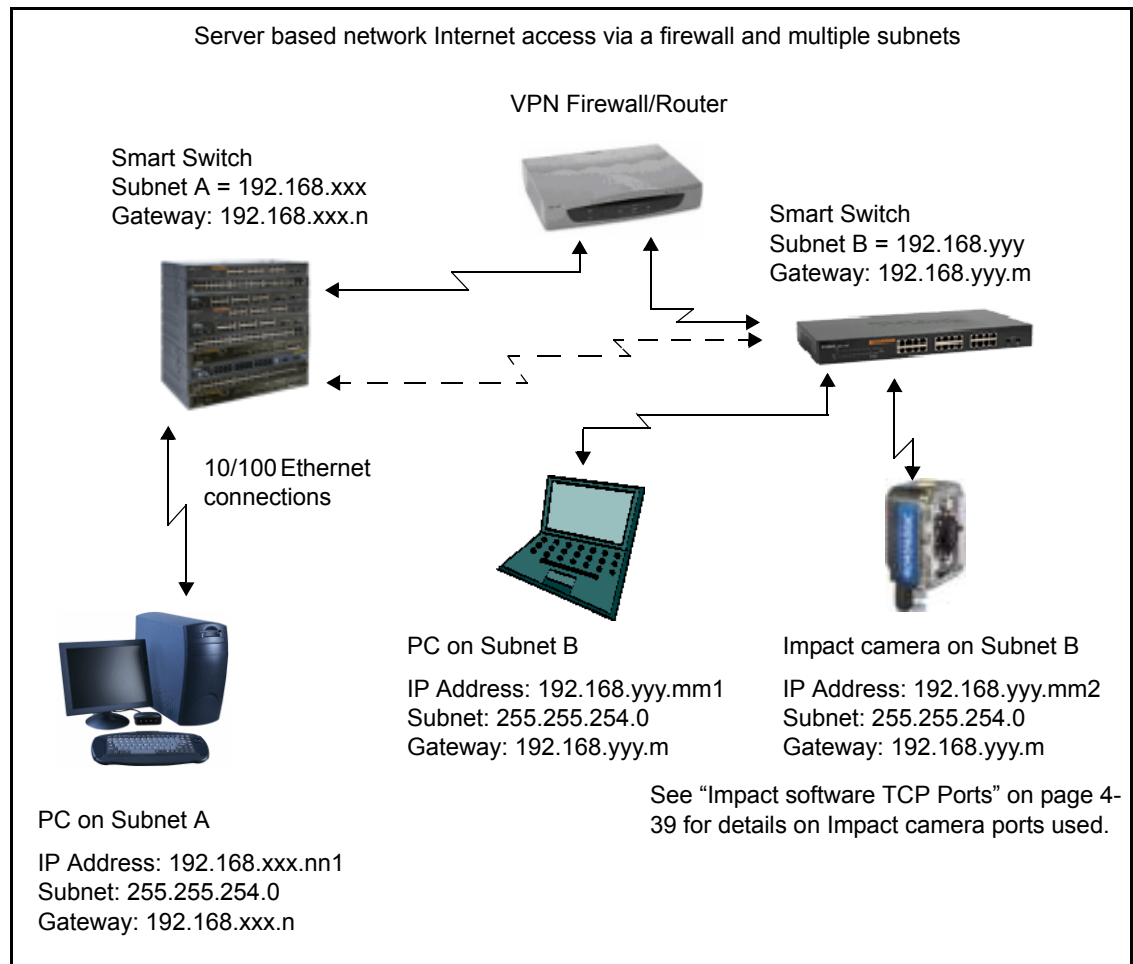
IP Address: AAA.BBB.CCC.nnn
 Subnet: 255.255.XXX.0
 Gateway: AAA.BBB.CCC.nnn

The first 3 fields of the IP address (AAA.BBB.CCC) must match exactly on both the PC and Impact cameras. The last field 'nnn' must be unique and in the range of 1 to 254.

The Subnet must match exactly on the PCs and Impact cameras.

The Gateway address is not used for direct connection and should be left unchanged on all devices.

PC to Camera - Internet connection



The two smart switches should be able to ping one another. For "discovery" to work, multicast must be enabled. It is disabled by default on most routers.

Broadcasts are data packets sent to all nodes on a subnet and every node hears them. These broadcast packets can never cross routers.

Multicast packets are special. They are only heard by nodes that are configured to hear them. Multicast receivers (nodes) 'tune in' to listen to specific multicast packets. This is similar to tuning to a radio station.

IP Address Configuration

An IP (or Subnet) mask specifies which bits of the Internet Protocol (IP) address are significant. The IP mask is network dependent, but it is the same for each Impact camera on a particular network. The IP address indicates the address of each camera. If there is more than one camera on a network, each camera's address must be different. The network administrator is probably responsible for determining the IP mask and address.

To work with the camera, the client computer's Ethernet port must be connected to the camera's Ethernet connector directly or through a correctly configured network.

During address configuration, we recommend that the client computer and the camera be connected directly to each other and not through a network router, switch, or server.

IMPORTANT NOTE: If you need help configuring the network or the client computer, you should seek professional advice. Network configuration is beyond the scope of this manual.

Do not attempt to change the IP address or mask without the authorization of your network administrator as doing so could disrupt your network connection. The following procedures require technical knowledge and should not be attempted unless you understand the terminology used.

IP addresses and masks consist of from one to four sets of numbers separated by periods. The camera is shipped with a default IP address of 192.168.0.128 and a default mask of 255.255.255.0. To be able to communicate with the camera, a client computer's IP mask must correspond correctly to the camera's mask, and the address must match the camera's address in the first three sets of numbers.

A default IP mask and address were assigned to the camera at the factory. If these values work for your installation, you do not need to change them. However, if you do change the default IP mask, you also need to change the default IP address.

You do not need to know the camera's IP mask and address to change them. However, if you change them, you may also need to change the client computer's IP mask and address so the camera and client can communicate.

Configure the Client PC or Processor

Client PC for P-Series

To be able to communicate with the camera, a client computer's IP Mask and Address must be configured correctly. During address configuration, we recommend that the client computer and the camera be connected directly to each other and not through a network server.

Changing the client computer's addresses: Windows 7

1. In the Start Menu, select Computer, Network, then click Network and Sharing Center.
2. Under "View Your Active Networks," click Local Area Connection.
3. Click Internet Protocol Version 4 in the list, then click Properties.
4. On the Alternate Configuration tab, select User Configured.
5. Enter the desired IP address and Subnet Mask. Remember, to be able to communicate with the camera, a client computer's Subnet mask must correspond correctly to the camera's IP mask, and the address must match the camera's address in the first three sets of numbers.

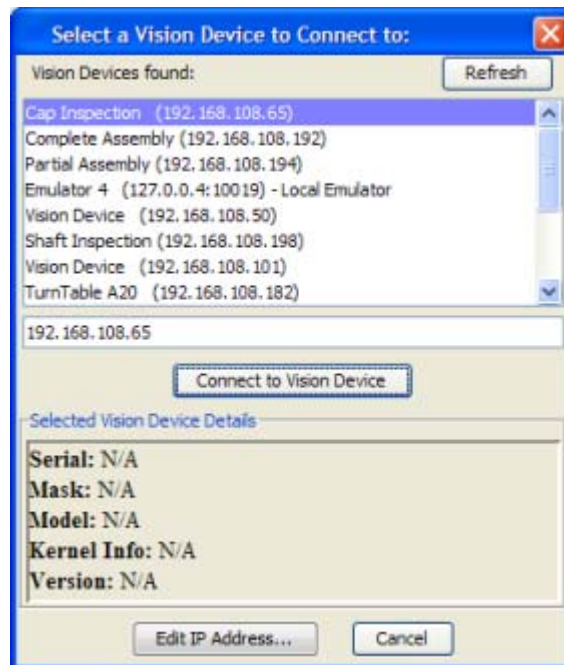
6. Click OK, then close all the open dialog windows.

Configure the Vision Device or Camera

P-Series Camera

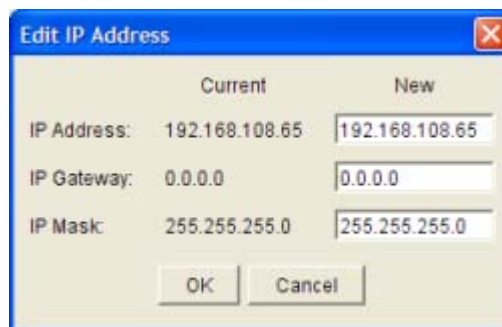
This section explains how to change the camera's IP address and mask. Be sure the client computer and camera are directly connected with an Ethernet cable.

1. Start VPM Lite. When the "Select a Vision Device to Connect to" dialog is displayed, click on the desired camera in the list of Vision Devices found. If the camera is not in the list, be sure the camera power is on and that it is connected to the client computer, then click the Refresh button.

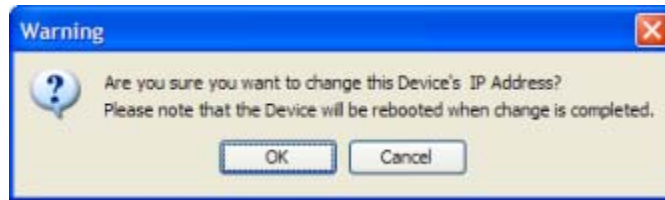


2. Click the Edit IP Address button at the bottom of the dialog.
3. In the "Edit IP Address dialog," enter the desired IP address and IP mask. Leave the IP Gateway unchanged.

IMPORTANT: Do NOT include a leading zero in an IP Address group (for example 192.168.108.**065**)



4. Click OK.
5. When the warning dialog is displayed, click OK. After the change is complete, the camera reboots.



6. Click OK when the Camera is Rebooting dialog is displayed.

How the Code Reader Tool Works

This section explains some of the more specialized Code Reader tool functions and parameters, and provides some details about how the tool works. The tool reads the following types of 1D, 2D, and Postal symbols.

1D Codes

| | | |
|--------------------|--|------------------------|
| Codabar | GS1 Databar (RSS) | MicroPDF CCA Composite |
| Code 39 | GS1 Databar Composite | MicroPDF CCB Composite |
| Code 39 Full ASCII | GS1 Databar Stacked (RSS) | MicroPDF CCC Composite |
| Code 32 | GS1 Databar Stacked Composite | Pharmacode (one-track) |
| Code 93 | GS1 Databar Limited (RSS) | PDF417 |
| Code 128 | GS1 Databar Limited Composite | Standard 2 of 5 |
| Code128 Composite | GS1 Databar Expanded (RSS) | UPC-A |
| EAN-8 | GS1 Databar Expanded Composite | UPC-A Add On 2 |
| EAN-8 Add On 2 | GS1 Databar Expanded Stacked (RSS) | UPC-A Add On 5 |
| EAN-8 Add On 5 | GS1 Databar Expanded Stacked Composite | UPC-E |
| EAN-13 | Interleaved 2 of 5 (ITF) | UPC-E Add On 2 |
| EAN-13 Add On 2 | MSI | UPC-E Add On 5 |
| EAN-13 Add On 5 | Matrix 2 of 5 | |
| GS1 128 | MicroPDF | |

2D Codes

| | | |
|-----------------------|----------|----------|
| Datamatrix ECC200 | QR Codes | Aztec |
| GS1 Datamatrix ECC200 | MicroQR | Maxicode |

Postal Codes

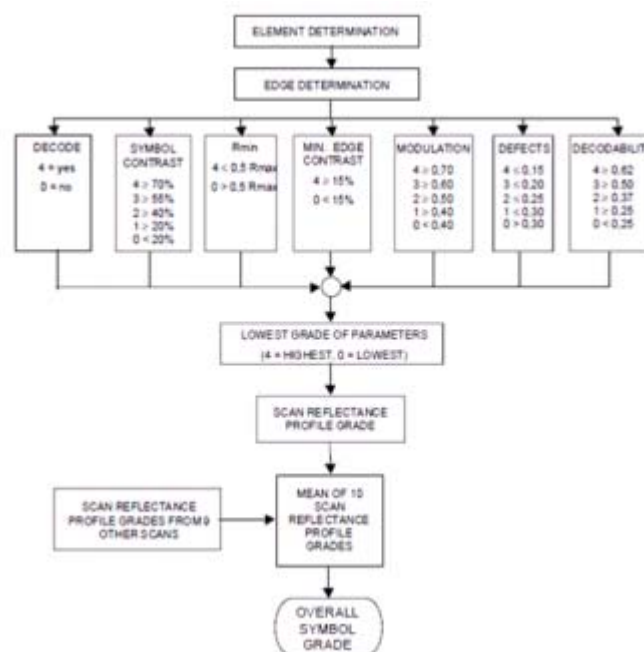
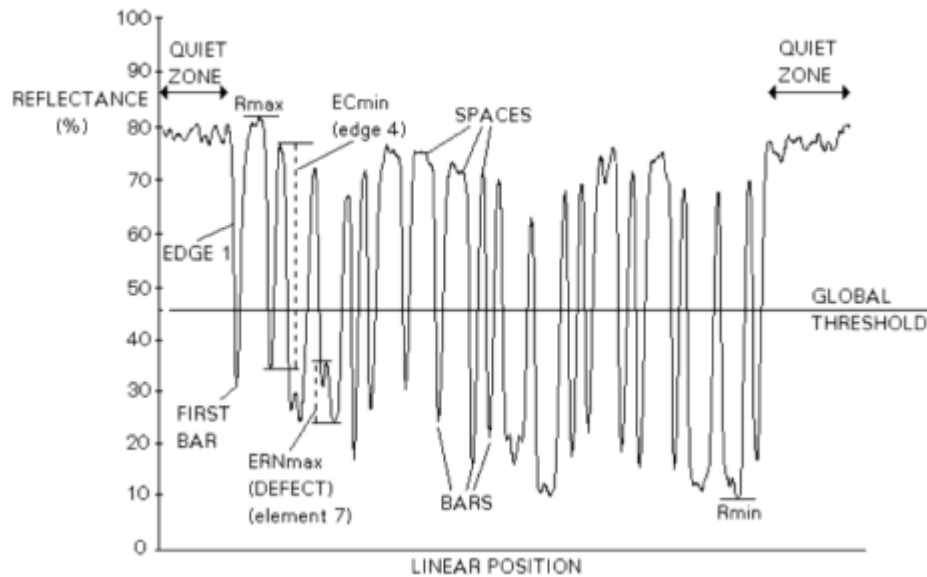
| | | |
|-------------------|----------------|--------------------------|
| Australia Post | Swedish Postal | Intelligent Mail Barcode |
| Japan Post | KIX Code | Planet |
| Royal Mail 4State | | PostNet |

ISO/IEC 15416 1D STANDARD

The ISO-IEC 15416 Standard specifies the methodologies for the measurement of specific attributes of linear bar code symbols, and methods for evaluating and grading these measurements and deriving an overall assessment of symbol quality.

The ISO/IEC 15416 Verification applies only to the following 1D Codes: Code128, Ean128, Code39, Code93, Codabar, EAN/UPC, Interleaved2of5.

Bar code symbol quality assessment is based on an analysis of the Scan Reflectance profiles. The scan reflectance profile is a record of the Reflectance values measured on a single line across the entire width of the barcode.



Symbol Quality grading is used to derive a relative measure of symbol quality under the measurement conditions used. Each scan reflectance profile is analyzed and a grade on a descending scale of integers from four to zero is allocated to each of the parameters evaluated.

The Scan Reflectance Profile Grade is the lowest grade of the following:

- Decode

- ▶ Symbol Contrast (SC)
- ▶ Minimum Reflectance (Rmin)
- ▶ Minimum Edge Contrast (ECmin)
- ▶ Modulation (MOD)
- ▶ Defects
- ▶ Decodability (V)

The Overall Symbol grade is calculated using the mean of the ten scan grades.

AIM DPM QUALITY GUIDELINE

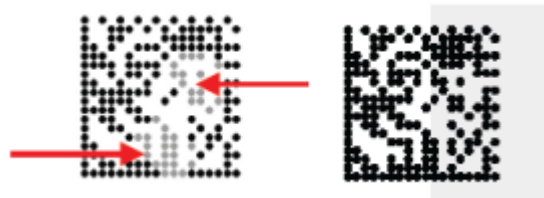
The AIM DPM Quality Guideline is applicable to the symbol quality assessment of direct parts marking performed in using two-dimensional bar code symbols. It defines modifications to the measurement and grading of several symbol quality parameters.

The marking processes covered by this guideline are as follows: Dot Peening, Ink Jet, Laser Etching and Electrochemical Etching.

Each quality parameter is measured and a grade on a descending scale of integers from 4 to 0 is allocated to it. The grade 4 (A) represents the highest quality, while the grade 0 (F) represents failure.

The Overall symbol grade is the lowest grade achieved for the following seven parameters:

- Decode
The Decode parameter tests, on a Pass/Fail basis, whether the symbol has all its features sufficiently correct to be readable. If the image cannot be decoded using the symbology reference decode algorithm, then it receives the failing grade 0. Otherwise, it receives the grade 4.
- Cell Contrast (CC)
- Cell Modulation (CM)
Cell modulation analyzes the grid center points within the data region to determine the reflectance uniformity of light and dark elements after considering the amount of error correction available in the code.

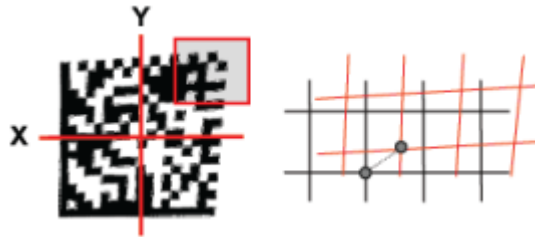


- Fixed Pattern Damage
This metric is similar to Cell Modulation, but it analyzes the finder pattern and clock pattern as well as the quiet zone around the code, instead of the data region.



- Axial Non-Uniformity (ANU)
- Grid Non-Uniformity (GNU)
Measures and grades the largest vector deviation of the grid intersections, determined by the reference decode algorithm from the binarized image of a given symbol, from their “ideal” theoretical position.

Assuming a grid on which the ideal angle of intersection is 90° , any angle deviation from 90° constitutes Grid Non-Uniformity.



- **Minimum Reflectance (MR)**
The image brightness is adjusted on a reference part, after which this calibrated value is compared with the reflectance of that part. Minimum Reflectance is the ratio of the parts reflectance to the calibrated reflectance.
- **Unused Error Correction (UEC)**
This parameter tests and grade the extent to which regional or spot damage in the symbol has eroded the information redundancy margin that error correction provides. 100% Unused Error Correction Capacity is the ideal condition.



Non Graded Parameter:

- **Print Growth**
Measures the deviation of actual elements dimension from the expected element dimension due to printing problems (i.e. overprint or underprint).



Camera Calibration Technical Details

Color Cameras

A color camera has half the measurement accuracy (twice the error) of a greyscale camera with the same number of pixels. The resolution rules-of-thumb for greyscale and color cameras are as follows:

| | Greyscale | Color |
|----------------------------|------------|------------|
| Smallest Detectable Defect | 2x2 pixels | 3x3 pixels |
| Gauging resolution | 1/4 pixel | 1/2 pixel |

The Bayer filter mosaic halves the effective resolution of the color cameras because each pixel detects either red, green, or blue. The smallest detectable defect corresponds to the smallest size defect that always fills at least one pixel. This is a theoretical lower limit. In most applications the defect will need to be larger.

Note that some tools provide sub-pixel options, which can improve the resolution and measurement accuracy of the image.

Determining the calibration type

The type of calibration to use is determined by the camera and lens characteristics. The following table illustrates some characteristics that can be mitigated by calibrating.

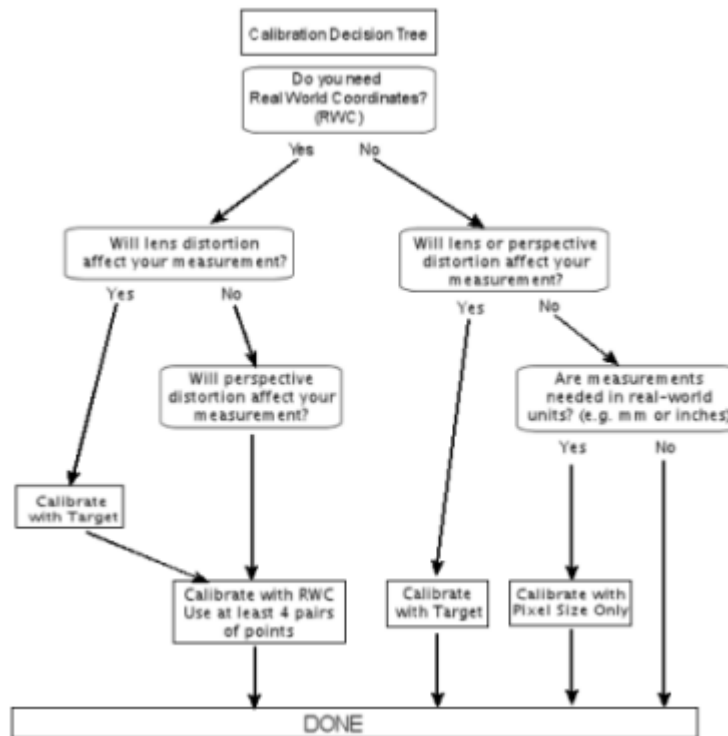
| Calibration Type | Lens Distortion | Pixel Size | Perspective Distortion (Skew) | Left/Right Handedness | Real World Origin |
|-------------------------------------|-----------------|------------|-------------------------------|-----------------------|-------------------|
| Target | Yes | Yes | Yes | Default Value | Default Value |
| RWC* with 4 or more pairs of points | No (See Note 1) | Yes | Yes | Yes | Yes |
| Pixel Size Only | No (See Note 2) | Yes | No | No | No |

*RWC = Real World Coordinates

Note 1: Does not remove existing lens distortion correction

Note 2: Removes existing lens distortion correction

The following diagram can help you determine the optimal calibration steps.



Target Calibration

It is best practice to have the dot target cover all parts of the field of view (FOV) where any inspection measurements will be made. Larger dots provide a more accurate calibration because the dot centers can be more accurately located. The dots must be a minimum of twenty pixels in diameter spaced twenty pixels apart. The minimum blob size is nine pixels. The calibration algorithm works best when the target's dot pattern fills the camera's (FOV). Any areas outside of the dot target are extrapolated.

Lens distortion is a radial phenomenon (a function of the distance from the center of the lens), so the extrapolation will not be as accurate as the calibration.

It is not critical to center the calibration target in the FOV. It is important, however, that the center of the image you use corresponds to the center of the lens (optical axis). The calibration algorithm assumes that the center of the calibration image is the center of the lens. It accounts for partial scanning of the run-time image, and cropped and sampled images from the Image Sampling tool. It does not account for the case where the calibration image is offset from the optical axis due to partial scanning. If you want to use partial scanning on an image, you should calibrate the entire image first and then set the partial scan parameters.

Units per Pixel

Units per Pixel (also called Scale or pixel size) is the factor used to convert measurements in the image into "real-world" units. This calculates the Units per Pixel for an object that measures 100 millimeters, and is 640 pixels in the image:

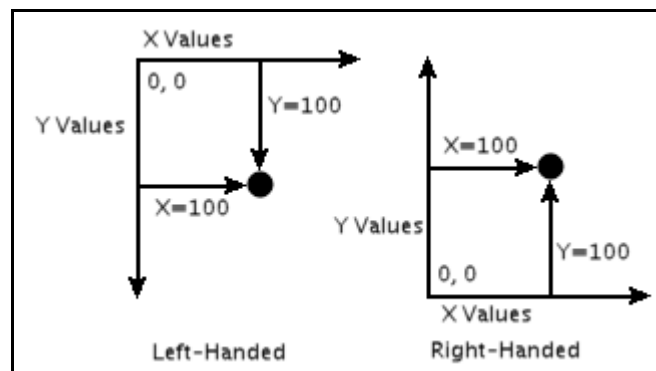
100 millimeters divided by 640 pixels = 0.15625 (or 0.15625 mm per pixel).

This value is used to automatically calibrate measurements in tools with the physical dimensions of the image.

Current Calibration

This section indicates the values after calibration is complete.

- **Lens Distortion:** When a camera is calibrated, the calibration process can account for the natural distortion present in the camera lens. When an image is saved, the distortion information can be stored with it.
- **Scale (pixel size):** This is the number of units represented by one pixel in the displayed image. When calculated by the calibration operation, this value can be reliably used only if there is very low lens distortion and low skew, otherwise it is only a reference.
- **Perspective Correction:** If enabled, correction for perspective was applied to the calibration. Perspective distortion is due to an angle between the image plane and the working plane.
- **RW Origin:** If enabled, an origin in real world coordinates was calculated.
- **Dx/Sx Handedness:** Indicates whether the real world coordinates are left or right handed. "Left-Handed" means that the origin (0,0) is in the upper-left corner of the image so that the X coordinate value increases to the right and the Y coordinate value increases downward. "Right-Handed" means that the X coordinate value increases to the right and the Y coordinate value increases upward.



Calibration Errors

Calibration errors are displayed on their respective calibration tabs.

- For Target and RWC calibration methods: if there is no calibration error, the accuracy of the calibration is displayed, based on the Reprojection Error (Excellent, Good, Fair, Poor, Very Poor).
- Unexpected Error: An unknown error occurred.
- No image found: There was no image in the image window.
- Target Not Found: A valid target was not found in the image. Try increasing the image contrast. If you are using a checkerboard target, adjust the gain or exposure so the white squares are saturated. Also, make sure that the corners of the squares touch each other and don't overlap.
- Too few points were entered or found: There were too few points in a target. Dot targets require at least seven points, checkerboard targets must have at least four rows and columns, and real-world targets need four points minimum.
- The Image Point List and Real-World Point List are different lengths.
- Intrinsic Estimation Failed: The basic input value checks have passed but the calibration routine from target has failed. This could be related to poor localization of the image points or numerical issues.
- The pitch or units per pixel are not greater than zero.
- Estimation of pixel pitch, image center, and distortion parameters failed.
- Real World Estimation Failed: This may happen when correcting for the skew of the working plane (in Calibrate From Target) or when computing the real-world units. This error is also shown when you enter three collinear point pairs.

Reprojection Errors

RMS or Av Reprojection Error

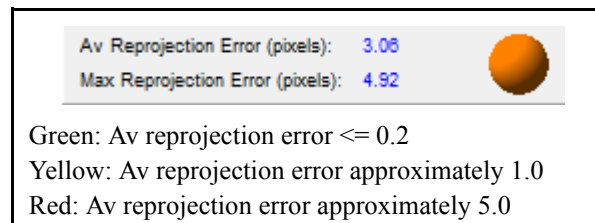
The reprojection error is the distance, in pixels, between an image point extracted from the image (drawn in red on the image), and the corresponding real world point projected onto the image plane (drawn in orange) according to the estimated calibration.

To calculate the Av Reprojection Error, square each reprojection error distance and find the sum of all these results, then divide this sum by the number of point pairs. Find the square root of this result. If a calibration has not been performed, the value is -1.

Max Reprojection Error

This is the maximum value of all the reprojection errors computed for every point match. If a calibration has not been performed, the value is -1.

Each calibration panel contains a visual display of the relative reprojection error.



Trouble Diagnosis

Note: There are sixteen image buffers in P-Series smart cameras.

Issue: Bad Image Event

A Bad Image Event generates a System Log entry with details of the detected error. It also generates a Bad Image Event Trigger.

Things to check

- **Buffer Overrun** – This results from triggering the camera so fast that images are acquired more quickly than the task can process them. That is, the task processing time is consistently longer than the time between camera triggers. This situation will eventually cause the camera to run out of image buffers.
 - Slow down the triggering rate
 - Decrease task execution time by optimizing the inspection
- **Trigger Overrun** – This results from triggering the camera to acquire an image while it is still in the process of acquiring the previous image. This can be the result of a “bouncy” or noisy trigger signal.
 - Use a cleaner trigger signal source
 - Adjust the Input Debounce time. See “Input Debounce” on page 2-5.
- **Bad cabling or interference** – If the DSL cable is bad or there is Electromagnetic Interference (EMI) coupling with the DSL cable, multiple camera triggers can be generated or the acquired image can become corrupted.
 - Replace the DSL cable
 - Remove the EMI source
 - Be sure all electrical grounds are securely connected
- **Noisy power** – A noisy power supply to the camera could generate extra triggers or degrade the DSL connection.
 - Replace the power supply
 - Be sure all electrical grounds are securely connected

Issue: System Overrun

A System Log entry “System overrun: out of image buffers” is displayed.

Note: There are sixteen image buffers in P-Series smart cameras.

Things to check

- This results from images occupying multiple image buffers and not releasing them.
 - The inspection task may contain image processing tools that do not process the current image. That is, if the task branches around image processing tools that have processed the previous image and continue to reference that image the buffer continues to be occupied. If this happens for many tools, i.e. holding references to several previous images because there are tools that have not run for several triggers, several buffers can remain occupied.

Issue: The Image Display does not refresh

When the system is online and receiving triggers, the image display freezes and the current images are not displayed.

Things to check

- This results from triggering the camera so fast that images are acquired more quickly than they can be displayed. That is, the task processing time is consistently longer than the time between camera triggers.
 - ▶ Slow down the triggering rate
 - ▶ Decrease task execution time by optimizing the inspection

Issue: EtherNet/IP Assembly structure changed

A System Log entry "Ethernet/IP Implicit Data tools have changed. PLC data mapping and data type may need to be adjusted to allow for a new eight-word reserved offset" is displayed.

Things to check

- This results from opening a vision program that was created in a release prior to 11.7.0 if the program contains an EtherNet/IP Read Implicit Assembly or EtherNet/IP Write Implicit Assembly tool. The static assembly structure for EtherNet/IP changed in 11.7.0. The first eight words of the structure are now reserved, so the user data area has shifted.
 - ▶ Any PLC programs that access the structure must be adjusted to account for the offset.

Issue: No Image

No image appears in the image window when you click the Snap, Live, or Trigger buttons.

Things to check

- File Camera is selected and no images are loaded
 - ▶ Be sure the File Camera is selected. Click the File/Camera button in Design Mode.
 - ▶ Be sure that image file names appear in the File Camera Images list. (See "Camera" on page 2-11) IMPORTANT: File names are case sensitive.
- The camera or ethernet connection is bad
 - ▶ Check the Ethernet connection on the camera and processor.
- The camera software settings are adjusted incorrectly, the camera f-stop is too low, or the lighting is too dim.
 - ▶ See "Camera" on page 2-11 to adjust camera software settings.
 - ▶ Adjust the camera and/or lighting.

Issue: Buffers Have Not Been Created

When you maximize VPM Lite the following error is displayed:
java.lang.IllegalStateException: Buffers have not been created

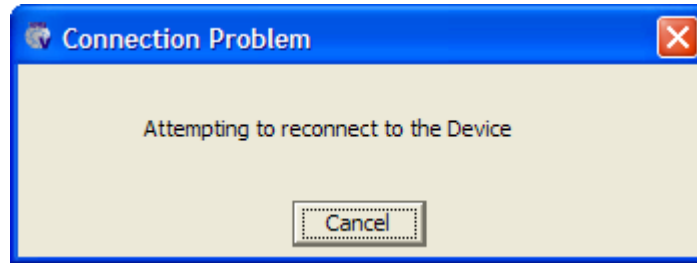
Things to check

- If you are using dual monitors on your PC, and you run VPM Lite on a remote PC (using Windows Remote Desktop Connection or other remote control program), this error may occur when you maximize VPM Lite again on the main PC.

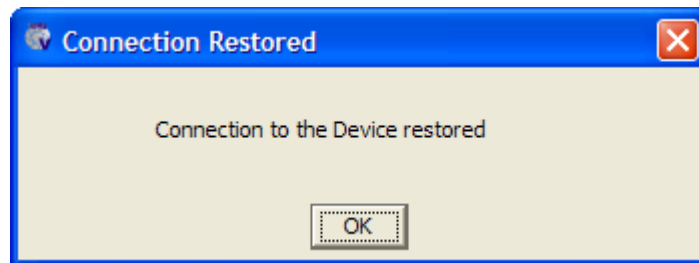
Issue: Connection Problem Dialog

There is a "Connection re-established by client after error" message in the System Log. A "Connection Problem" or "Connection Restored" dialog is displayed.

When communication with a camera, Vision Device, or Emulator is lost or temporarily interrupted, the connected program regularly tries to re-establish communication. During this attempt, this dialog is displayed. If you click Cancel, the program stops trying to re-establish communication.



When communication is restored, this dialog is displayed:



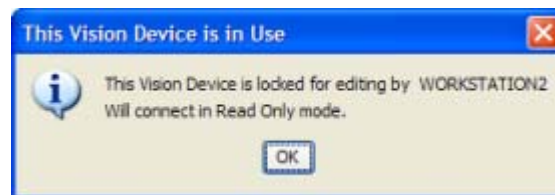
Things to check

- The network connection is bad. Power to the camera has been turned off.
 - Check the network cable and connection
 - Check power to the camera

Issue: Locked for Editing

A dialog is displayed indicating "This Vision Device is in Use."

If you try to connect to a camera, Vision Device, or Emulator and this dialog is displayed, it means that a VPM Lite program is currently connected and editing files (WORKSTATION2 is the network name of the computer running the currently connected VPM Lite program). When you click OK, the connection is completed and you can read, but not edit, values.



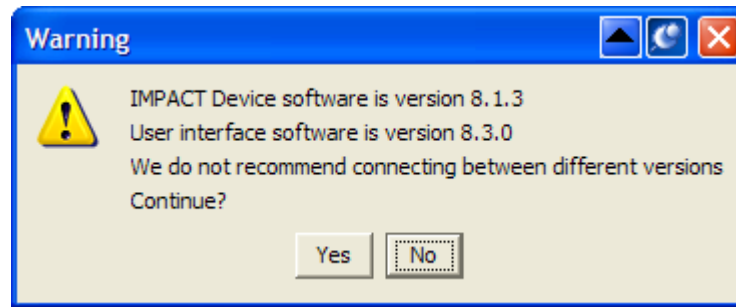
Things to check

- Someone may be connected to the camera, Vision Device, or Emulator for editing
 - Disconnect, disconnect or stop the other VPM Lite program, then reconnect.

Issue: Different Versions

A dialog is displayed indicating that the camera, Vision Device, or Emulator and the software interface are different versions.

If you try to connect to a device that has an Impact software version different from the PC, this dialog is displayed.



You should click No to abandon the attempted connection. If you click Yes, the connection is completed, but you should not try to edit any vision programs or change any settings. If you do, you may corrupt the vision program files or put the camera into an undesirable state of operation.

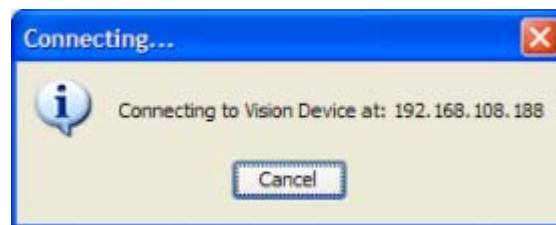
Things to check

- The camera, Vision Device, or Emulator and PC Impact software versions are different
 - ▶ Install the appropriate version of software on either the camera or PC

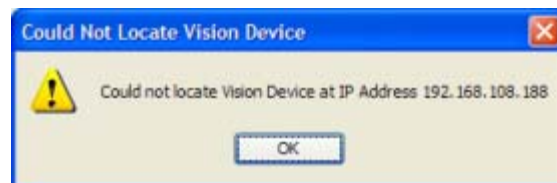
Issue: Could Not Locate Device

A dialog is displayed indicating that the camera, Vision Device, or Emulator could not be located.

When you try to connect, this dialog is displayed. Ordinarily the camera, Vision Device, or Emulator responds immediately and the connection is completed. If it does not respond, the dialog is displayed for approximately twenty seconds. To cancel the connection attempt, click the Cancel button.



If it does not respond during the time-out period, and you do not cancel the connection attempt, this dialog is displayed. Click OK to close the dialog.



Things to check

- The camera, Vision Device, or Emulator is not connected to the network
 - ▶ Connect the camera or start the Vision Device.
- The camera is powered off.
 - ▶ Turn on the camera's power
- The IP Address is incorrect
 - ▶ Enter the correct IP Address

Issue: Error Registering Online Callback

An error message is displayed indicating an “Error registering online callback” when you try to connect.

**Things to check**

- Restrictive settings in antivirus or anti-malware software on the PC can block communication ports that Impact software uses. Some antivirus programs interpret normal communications as a computer virus.
 - Install Impact software release 8.3.0 or greater
 - Adjust the antivirus or anti-malware software settings so they don't block normal communications. See “Impact software TCP Ports” on page 4-39 for more details.

Issue: The camera does not appear in the device list

When you try to connect or install to an Impact camera, the name and IP Address of the camera do not appear in the list. There are several possible causes for this issue.

Things to check

- There is no power to the Impact camera.
 - Check the power cable and be sure the wires to the power connector are secure
 - Be sure the camera power supply is working
- There is no power to the switches used for connecting the PC to the camera.
 - Connect the power cable to the switches
 - Plug in the switch power supply
- An Ethernet cable is disconnected or faulty
 - Reconnect or replace the cable
 - Check the camera's status light for the appropriate signal
- The IP addresses and/or IP masks for the PC and camera are incompatible.
 - Change the IP address or IP mask on the PC or camera to be compatible (see “TCP/IP Settings” on page 4-39 and “IP Address Configuration” on page 4-44)
- The camera does not respond to a “ping” from the PC
 - Check power to the camera
 - Check the cable connections
 - Temporarily connect a different camera to the same cable and try the "ping" again
- Firewall exceptions for the Impact Java bin directory and the emulator directory are not defined
 - Define the exceptions as described in the Configure PC Firewall section of the Readme file
- The camera or the PC has an older version of Impact software installed
 - Install the most recent version

- When antivirus software and the firewall on the PC are temporarily disabled, the camera appears in the device connection list
 - Adjust the firewall or antivirus software settings to allow the Impact camera ports to be used (see “Impact software TCP Ports” on page 4-39)

Issue: Message is Image is too large.

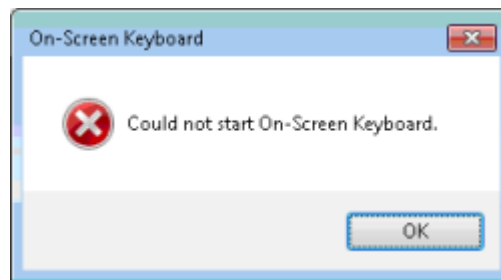
The message “Image is too large. See system log for details.” is displayed.

Things to check

- The Code Reader is trying to read an image that is too large. The maximum image size the Code Reader can read is 32768 pixels wide and 8192 pixels high.

Issue: Could not Start On-screen keyboard

When you use the On-screen keyboard (OSK) on a Windows 7 64-bit operating system, you may get the following error:



If this error occurs, you are probably trying to use the default OSK program location as it is defined in the OSK setup. You must copy the program file from its current location to another folder and change its default location.

Things to check

- The default OSK program location as it is defined in the OSK setup.
 - See “Using the external OSK with Windows 7 (64-bit operating system)” on page 4-32.

Issue: Machine does not meet hardware requirements

When you start VPM Lite, you may get the following error:



If this error occurs, it means the processor in the PC you are using does not support the minimum hardware requirement of the x86 enhanced instruction sets used in some of the functions and tools in VPM.

Things to check

- You will need to use a PC that supports the required instruction sets.

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