Impact
Reference Guide

Publication # 843-0093 (Rev 11.8.1)

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Telephone: **952-996-9500**
Facsimile: **952-996-9501**
Web site: http://www.datalogic.com
E-Mail: mvsupport@datalogic.com

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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.

T A B L E O F C O N T E N T S

Introduction
Manual Contents Intro-1

Chapter 1: Installation and Quick Setup
Help 1-1
System Requirements 1-1
A30, P-Series, and T4x-Series Camera 1-1
M-Series Processor 1-1
MX-E and MX-U Series Processor 1-2
Installation 1-2
Quick Setup 1-3
Camera cable connection 1-3
Choose a Vision Device or Emulator 1-4
Camera Setup 1-6
Camera Calibration 1-7
Date and Time 1-7
How Impact Software Connecting Works 1-7
A30, P-Series, and T4x-Series 1-7
M-Series and MX-E Series 1-8
MX-U Series 1-9

Chapter 2: System Configuration
Introduction To System Configuration 2-1
Settings Tab 2-1
General 2-1
Camera 2-16
File Camera 2-37
System Log 2-38
File Manager 2-39
Modbus Server 2-42
AB PCCC Server 2-43
OPC Data Access 2-45

Chapter 3: Vision Program Manager
Introduction to VPM 3-1
Start VPM 3-1
VPM - An Overview 3-2
VPM User Interface 3-2
Icons 3-3
Select Camera 3-5
Summary Tab 3-5
Add Vision Device tab 3-6
Main Toolbar-VPM 3-6
Design Mode 3-10
Display Mode 3-26
VPM Linking 3-28
Links Between VPM Tools 3-28
Create a Vision Program 3-30
Create a Task 3-33
VPM Task Configuration 3-34
VPM Tools 3-40
Toolbox Drawers 3-42
Recently Used Drawer 3-43
Image Filtering Drawer 3-44
Average Filter 3-44
Binary Image Filter 3-44
Color Pixel Fill 3-45

Edge Enhancement 3-46
Gaussian Filter 3-47
Image Math 3-48
Light Leveling 3-50
Linear Morphology Close 3-52
Linear Morphology Open 3-53
Median Filter 3-53
Morphology Close 3-54
Morphology Dilate 3-54
Morphology Erode 3-56
Morphology Open 3-57
New Image 3-60
Pixel Fill 3-61
Image Geometry Drawer 3-61
Color Image Sampling 3-61
Color Image Stitching 3-62
Deslant Image 3-66
Image Sampling 3-67
Image Stitching with Origins 3-68
Image Stitching with Points 3-68
Line Profile 3-70
Multiple Image Stitch 3-70
Unwrap 3-74
Undistort Image 3-75
X-Y Projection 3-75
Locating Drawer 3-76
Blob 3-76
Circle Gauge-Locating 3-82
Circular Pattern Find 3-82
Line Find 3-84
Origin Tool 3-90
Pinpoint Pattern Find 3-97
Feature Finding Drawer 3-105
Average Gradient 3-105
Average Intensity 3-106
Blob-Feature 3-109
Blob Filter 3-109
Circle Gauge-Feature 3-112
Color Blob 3-112
Color Checker 3-117
Contrast 3-118
Contrast - Multiple ROI 3-121
Edge Point Find 3-123
Line Find-Feature 3-127
Pattern Sorting 3-127
Spot Find 3-139
Wide Edge Point Find 3-140
Measurement Drawer 3-144
Angle 3-144
Circle Edge Refinement 3-148
Circle Gauge 3-150
Line Find-Measure 3-155
Line Gauge 3-156
Line Gauge Datum Line 3-161
Line Gauge Dual ROI 3-167
Linear Regression 3-173
Midpoint 3-174
Multiple Point to Point Measurements 3-174
Peak Valley Find 3-179

Point Match 3-180
Point to Line Measurement 3-182
Point to Point Measurement 3-185
Subpixel Edge Extractor 3-188
Flaw Detection Drawer 3-190
Adaptive Template 3-190
Average Intensity-Flaw 3-192
Blob-Flaw 3-192
Bump Find 3-192
Color Blob-Flaw 3-194
Contrast-Flaw 3-194
Contrast - Multiple ROI-Flaw 3-194
Extreme Difference 3-194
Greyscale Template 3-196
Polygon Smoothing 3-200
Readers Drawer 3-201
Character Contour Match 3-201
Code Reader 3-205
OCR 3-221
Communication Drawer 3-231
Discrete Input 3-231
Discrete Output 3-232
EtherNet/IP 3-236
EtherNet/IP Explicit Data 3-236
EtherNet/IP Explicit Message 3-237
EtherNet/IP Read Implicit Assembly 3-240
EtherNet/IP Write Implicit Assembly 3-242
Image Archiving 3-243
MC Read 3-246
MC Write 3-248
Send Message 3-249
Wait For Message 3-251
Serial Port Out 3-254
TCP/IP Out 3-255
Logic Drawer 3-260
Basic 3-260
Branch 3-261
Break 3-261
Call Task 3-262
Counted Loop 3-262
Counter 3-262
Data Instance 3-264
Data Set 3-265
Delay 3-265
Event Scheduler 3-265
Group 3-266
List Loop 3-266
List Sorter 3-266
Multiple Branch 3-267
Pass Fail 3-267
Reset 3-269
String Builder 3-269
Switch 3-277
Device Control Drawer 3-282
Camera Trigger 3-282
Device Settings 3-283
Offline 3-285
Online 3-286
Vision Program Load 3-286

Vision Program Save 3-286
Vision Program Unload 3-287
Specialized Drawer 3-287
Change Image Calibration 3-287
Clip ROI 3-288
Data Transfer 3-289
Grid Statistics 3-289
Lead Statistics 3-292
Train 3-292
P-Series Drawer 3-293
Green Red Spot 3-293
PROFINET 3-294
ProfinetIO Read 3-294
ProfinetIO Write 3-295

Chapter 4: Control Panel Manager
Introduction to CPM 4-1
Help CPM 4-1
Start CPM 4-1
CPM - An Overview 4-1
CPM User Interface 4-2
Main Toolbar-CPM 4-2
Task and Panel Toolbar 4-6
Control Palette 4-7
Vision Program Tree 4-7
Control Panel Tree 4-8
Panel and Controls Properties and Tabs 4-9
Control Panel Application 4-9
Control Panel 4-11
CPM and VPM Linking 4-13
Links between CPM and VPM 4-14
Links between CPM controls 4-19
CPM Controls 4-24
Control Palette and Groups 4-24
Images Group 4-25
Histogram 4-26
Image Display 4-28
Arc ROI 4-32
Blob List 4-34
Correlation Model 4-35
Greyscale Template Model 4-36
Line List 4-37
Line ROI 4-38
Origin Control 4-40
Origin List 4-41
Point List 4-42
Rectangle List 4-44
Rectangle ROI 4-45
Shape List 4-46
Input Group 4-48
Button 4-48
Check Box 4-49
Drop List Selector 4-51
Font Library 4-52
Character Contour Library 4-53
Keyboard 4-53
Numeric Entry 4-55
Password 4-57
Pattern Database 4-64

Radio Button ... 4-67
Radio Button Group ... 4-68
Range ... 4-69
Range Scroll ... 4-72
Slider ... 4-73
Table ... 4-75
Text Entry ... 4-79
Toggle Button ... 4-80
Tolerance ... 4-82
Display Group ... 4-86
Chart ... 4-86
Frame ... 4-91
Graphic Display ... 4-92
Indicator Light ... 4-92
Numeric Display ... 4-94
Rich Text ... 4-95
Scrolling Table ... 4-95
Tab ... 4-99
Tab Group ... 4-100
Text Display ... 4-101
XBar-R Chart ... 4-102
XML Table ... 4-105
General Group ... 4-107
Basic Interpreter ... 4-107
Change Log ... 4-108
Execute Command ... 4-111
Impact Connector ... 4-111
Load Image ... 4-117
Load Vision Program ... 4-118
Save Vision Program ... 4-119
Scriptor ... 4-120
TCP-IP Logger ... 4-127
Timer ... 4-128
Camera Calibration Using CPM ... 4-130

Chapter 5: Impact Basic
Basic Editor Window ... 5-1
Type in the Editor Window ... 5-1
General Language Format ... 5-2
Variables ... 5-3
Constants ... 5-3
Expressions ... 5-4
Statement syntax ... 5-5
Loop constructs ... 5-5
Arrays ... 5-6
Data Types ... 5-7
Basic Commands and Functions ... 5-8
Commands and Functions A-D ... 5-9
Commands and Functions E-H ... 5-13
Commands and Functions I-L ... 5-17
Commands and Functions M-Q ... 5-21
Commands and Functions R-V ... 5-24
Commands and Functions W-Y ... 5-30
Basic Program Examples ... 5-31

Chapter 6: Appendix
HTTP Commands ... 6-1
Telnet Commands ... 6-5
TCP/IP Commands ... 6-9

EtherNet/IP 6-12
PROFINET 6-17
Threshold Viewer 6-22
On-Screen Keyboard 6-32
Configure the On-Screen Keyboard 6-32
CPM 6-33
VPM 6-35
Command Line Parameters 6-36
Summary 6-37
Override the program's default system country settings 6-38
Disable moving and sizing the window 6-38
Override the program's default system language settings 6-39
Display an image as the logo on the title bar 6-39
Display an image as a banner in the program window 6-40
Disable the ability to close the program 6-41
Disable the ability to stop the Vision Device programs 6-41
Access a text file of command line options 6-42
Load a control panel application when program starts 6-42
Set the window's location and size 6-43
Run a Scriptor file 6-43
Run a Scriptor file - display a control panel application 6-44
Display a program start and About dialog image 6-44
Display a string in the title bar and About dialog 6-45
Set the amount of memory to be allocated 6-45
Modbus Client Tester 6-47
TCP/IP Settings 6-48
A30, P-Series, and T4x-Series Connection 6-49
IP Address Configuration 6-53
Configure the Client PC or Processor 6-53
Configure the Vision Device or Camera 6-56
Pattern Database Manager 6-59
Start PDM 6-59
Create a new database 6-60
Open an existing database 6-61
Close a Database 6-61
Delete a Database 6-62
Export a Database 6-62
Import a Database 6-63
Add Images to a Database 6-64
View Patterns in a Database 6-66
Train Patterns in a database 6-68
Export a Train File 6-71
How the Code Reader Tool Works 6-72
Camera Calibration Technical Details 6-83
Trouble Diagnosis 6-87
Issue: Bad Image Event 6-87
Issue: System Overrun 6-87
Issue: The Image Display in VPM does not refresh 6-88
Issue: EtherNet/IP Assembly structure changed 6-88
Issue: Need to Back Up Settings, Files, and Programs 6-88
Issue: No Image 6-88
Issue: Buffers Have Not Been Created 6-89
Issue: Connection Problem Dialog 6-89
Issue: Locked for Editing 6-89
Issue: Different Versions 6-90
Issue: "Camera has been powered up..." 6-90
Issue: Could Not Locate Device 6-90
Issue: ImpactSendMessage Tool error in System Log 6-91
Issue: Error Registering Online Callback 6-91

Issue: The camera does not appear in the device list 6-92
Issue: Message is Image is too large. 6-93
Issue: Message is No Camera Connected 6-93
Issue: Could not Start On-screen keyboard 6-93
Issue: Machine does not meet hardware requirements 6-94
Issue: The USB Hardware key is missing or has failed 6-94
Issue: OpenClient ERROR Didn't Find Proxy 6-95

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 the Impact programs which you use to configure the Datalogic Impact camera and view the data collected from your inspections. There are two main programs: Vision Program Manager and Control Panel Manager.

VPM™ (Vision Program Manager™) is used by the inspection programmer or administrator to program inspection tasks that run on the Datalogic Impact camera. A variety of tools furnish the flexibility to program many inspection tasks. The programmer or administrator can also create and call their own general purpose tasks. You can view inspection results in VPM's Summary Table. Settings, which is part of VPM, is used to configure the Datalogic hardware. This includes all Impact cameras.

CPM™ (Control Panel Manager™) is used by the inspection programmer or administrator to create Control Panels. System operators, monitors, and controllers use these panels to view inspection results and control the Impact camera.

There are two additional standalone programs, **Settings** and CPM Runtime Environment (**CPMRE**). The Settings Program is used to configure an Impact camera and CPMRE is used to connect to one or more cameras through user-defined control panels. The Settings program and CPMRE cannot be used to edit vision programs or control panels.

Manual Contents

The Reference guide consists of the following chapters:

- **Chapter 1: Installation and QuickStart Setup**
  Here are installation and basic setup instructions for your Datalogic machine vision system.
- **Chapter 2: Vision Program Manager**
  This chapter describes how to set up an inspection, including descriptions of some of the tools in VPM, including Input and Output ports, linking, data fields, and creating callable tasks.
- **Chapter 3: Settings**
  This chapter explains how to use the VPM Settings tab to configure the camera. It reviews the cameras you can use with Impact Software, 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: Control Panel Manager**
  Here are details about defining the control panels that will provide the interface between operators and inspection tasks.
- **Chapter 5: Impact Basic**
  Here are details about the Basic language used to program VPM's Basic tool. This includes examples you can copy and use in your own applications.
- **Chapter 6: Appendix**
  The appendix contains material about the Threshold Viewer, On-screen Keyboard, Emulator, com-

mand line parameters, and TCP/IP settings for the camera. The Emulator allows you to create and test vision programs without hardware.

CHAPTER 1

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.

NOTE: This manual covers the entire line of Datalogic Impact machine vision cameras. Sections that apply to specific models will be indicated.

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

A30, P-Series, and T4x-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 and Windows 7
- Microsoft® Windows XP, Vista, or Windows 7
- 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 A30, P-Series, and T4x-Series

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

M-Series Processor

Requirements for the M-Series Processor

- Monitor display resolution of 1024 x 768 or greater (for local M-Series programming)
- Keyboard and Mouse (for local M-Series programming)
- If you are connecting to an A30, P-Series, or T4x-Series camera, the processor and camera must have the same version of Impact software installed.
- 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.

Please note that Datalogic cannot guarantee the performance of M-Series systems which have additional software installed on them, including, but not limited to, anti-virus and firewall software. Datalogic recommends that M-Series systems remain disconnected from networks that access the Internet in order to minimize security risks. Datalogic will attempt to support systems with antivirus software installed, but we cannot guarantee system performance.

MX-E and MX-U Series Processor

Requirements for the MX-E and MX-U Series Processor

- Monitor display resolution of 1024 x 768 or greater (for local programming)
- Keyboard and Mouse (for local programming)
- If you are connecting to an A30, P-Series, or T4x-Series camera, the processor and camera must have the same version of Impact software installed.
- 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.

Please note that Datalogic cannot guarantee the performance of MX-E and MX-U Series systems which have additional software installed on them, including, but not limited to, anti-virus and firewall software. Datalogic recommends that these systems remain disconnected from networks that access the Internet in order to minimize security risks. Datalogic will attempt to support systems with antivirus software installed, but we cannot guarantee system performance.

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.

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.

IMPORTANT: Do NOT power off the camera or processor during installation. On the A30, P-Series, and T4X-Series cameras, all five status LEDs are turned ON during the installation process. When all LEDs turn off, the camera will automatically reboot.

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. Insert the Impact Installation CD in the drive.
4. The installation program should start. Select the language you want the install to use, then click OK.
5. Follow the on-screen instructions.
   A30, P-Series, or T4x-Series: If you want to install to an A30, P-Series, or T4x-Series camera, it must be connected to the client PC's network.
   M-Series and MX-U Series: Software is installed only on the processor. You do not need a camera connected to the processor to install the software.
6. When the installation has completed, you can start the VPM 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 1-4.)

Camera cable connection

A30, P-Series, and T4x-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.

M-Series Processor

The M-Series cameras use an Ethernet cable to communicate with the processor. Connect the appropriate cable between the processor's CAM port and the camera. Refer to the M-Series Processor and Camera Guide for connector locations.

MX-E Series Processor

The E-Series cameras use an Ethernet cable to communicate with the processor. Connect the appropriate cable between the processor's CAM port and the camera. Refer to the MX-E Series Processor and Camera Guide for connector locations.

MX-U Series Processor

The U-Series cameras use a USB 3.0 cable to communicate with the processor. Connect the appropriate cable between the processor's USB 3.0 port and the camera. The first time you physically connect a camera to the processor, you must assign that camera to a vision device. See "Assign Tab (USB Cameras Only)" on page 2-29 for details. Refer to the MX-U Series Processor and Camera Guide for connector locations.

Choose a Vision Device or Emulator

Connecting to and choosing a vision device or Emulator works differently on A30, T4x-Series, P-Series, M-Series and MX-U Series systems. For more details about each system works, see “How Impact Software Connecting Works” on page 1-7.

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 first starts

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

No vision device is currently connected

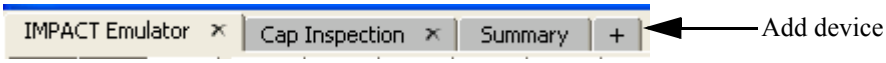


If VPM is not currently connected to a vision device, click the Connect button in the VPM tool bar. A dialog is displayed so you can choose what connection you want to make.The first time you physically connect a camera to the MX-U Series processor, you must assign that camera to a vision device. See “Assign Tab (USB Cameras Only)” on page 2-29.

One or more vision devices are connected



To maintain current connections and connect to an additional vision device or Emulator, click the Add device tab to the right of the Summary tab. Another tab will be added to the row. Select the desired vision device or Emulator from the dialog.

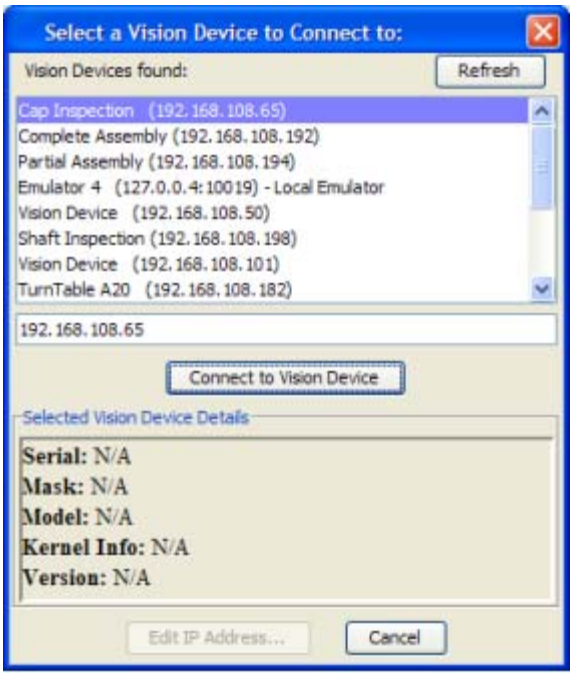


To choose a vision device or Emulator:

1. When the vision device select dialog is displayed, select one or more items from the list (press the Control key while you click to select multiple items). 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 connects with the vision device or Emulator.
3. When the connection has been made, you may see a message that VPM is reading from the newly connected vision device.

- **Vision Devices found**
  This list displays the names and IP addresses of the vision devices and Emulators visible on the network.
- **Connect to Vision Device**
  Click this to connect to the vision devices selected in the list.

NOTE: If another user is already connected to the vision device, a dialog will be displayed indicating that the vision device is in use. See “Editing a vision program from multiple VPM instances” on page 3-6 for more details.

- **Edit IP Address...**
  To change the IP address of the selected vision device, click this button. See “IP Address Configuration” on page 6-53. You cannot change the IP Address of an Emulator.

NOTE for M-Series and MX-U Series: We recommend that you do NOT edit vision programs or control panels on one camera while any other camera on the same processor is online. If you want to edit programs on one camera, make sure all other cameras are offline.

To disconnect from a vision device or Emulator:

1. Select the tab for the vision device you want to disconnect.
2. Click the Disconnect button in the VPM tool bar.

Camera Setup

Note: If you want to use previously captured images for this initial setup, see “File Camera” on page 2-37.

Datalogic Impact cameras contain no hardware switches so all operating parameters must be set from the VPM Settings tab. You can use several different cameras with the M-Series and MX-U Series processors. Refer to the M-Series Processor and Camera Guide (843-0138), MX-E Series Processor and Camera Guide, or MX-U Series Processor and Camera Guide (821003220) for more details.

Plug in a camera

M-Series or E-Series camera:

1. Be sure the Power/Trigger cable is connected to power and the camera. Be sure the appropriate Ethernet cable is connected between the camera and one of the CAM ports on the M-Series processor.
2. Click the Connect button in the VPM tool bar and choose the camera from the list.
3. Click the Settings tab.
4. Click the Camera icon, click the Setup tab, then click the Setup button below the image window.
5. Proceed to “Set up a camera.”

U-Series camera:

1. Be sure a USB camera is plugged into any of the USB 3.0 ports labeled USB1 through USB4 on the MX-U Series processor.
2. Click the Connect button in the VPM tool bar
3. Select one of the IMPACT Devices from the dialog that does not have a camera assigned to it, then click Connect to Vision Device.
4. Click the Settings tab.
5. Click the Camera icon.
6. On the Setup tab, click the Assign tab.
7. From the Select Camera drop down, select the camera you want to use. The list includes camera serial and model numbers. If a camera selection is disabled, the camera is already assigned.
8. Click OK in the Camera Connected dialog. Proceed to “Set up a camera.”

A30, P-Series, or T4x-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 VPM tool bar and choose the camera from the list.
3. Click the Settings tab.
4. Click the Camera icon, click the Setup tab, 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 2-22 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 2-16 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 VPM tools accurately relate to the camera image’s measurements. See “Calibration Panel” on page 2-31 for more details.

Date and Time

(A30, P-Series, and T4x-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 Genera System Object icon.
3. Click the Setup tab.
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 2-7 for details.

The time is also automatically synchronized when a connection is made.

You have now completed the Quick setup.

How Impact Software Connecting Works

A30, P-Series, and T4x-Series

Connecting to a camera

The A30, P-Series, and T4x-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 in VPM, this LAN connection is used to communicate with the camera. Each camera has a unique IP Address. See “IP Address Configuration” on page 6-53 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

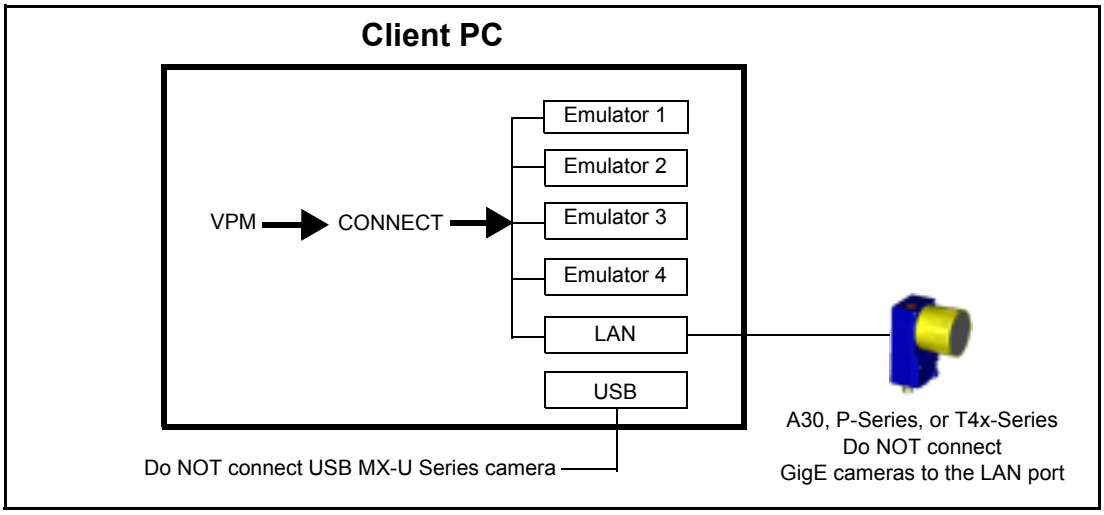
NOTE: When you are using multiple Emulators with ActiveX applications, you can only use the port numbers from 9933 to 10032 in ActiveX.

You can use an emulator with CPM and VPM 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 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.



M-Series and MX-E Series

Connecting to a camera

The M-Series and E-Series cameras physically connect to the processor with an Ethernet cable between the processor's CAM port and the camera. An "interface" software program (called Vision Device) runs on the processor. Each vision device is automatically assigned to a CAM port to provide communication with and control of a camera. If no camera is physically connected to the CAM port, the vision device acts as a Local Emulator.

Click the connect button in VPM to connect to the selected vision device. The number of vision devices (and the processor's camera capacity) is determined by the processor type and number of licenses. Each vision device has a unique IP Address. See "IP Address Configuration" on page 6-53 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, Vision Programs are stored on the processor.

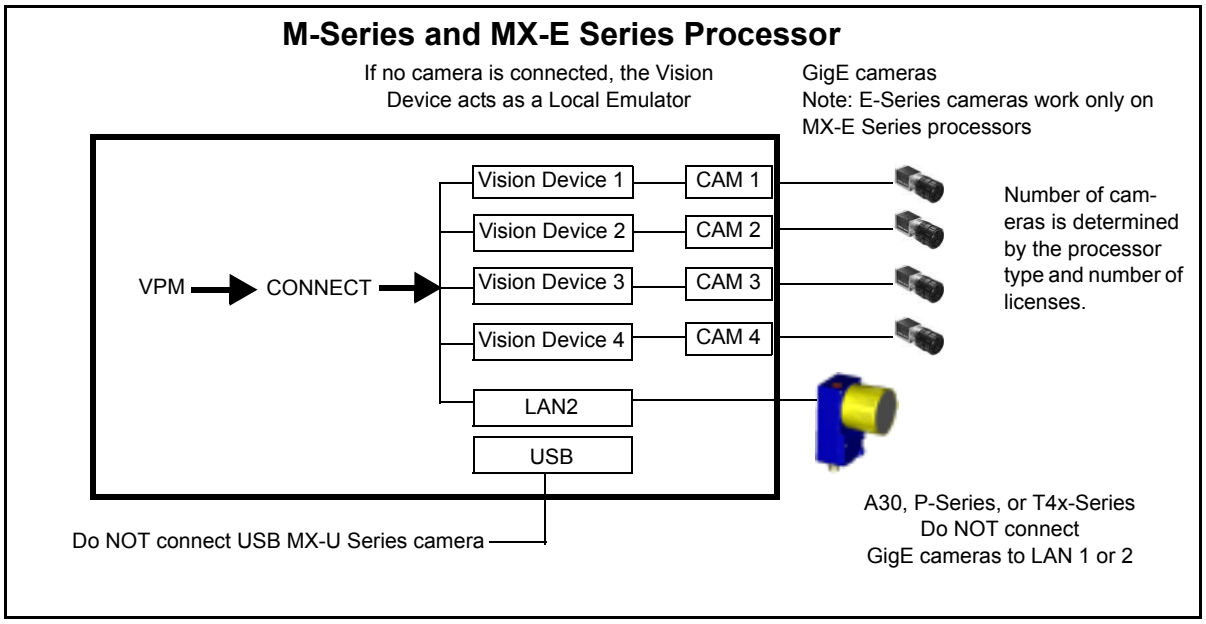
Multiple users can connect to a camera, but only one user at a time can edit programs or change data on the camera.

Connecting to an Emulator

When you connect to a vision device that has no camera connected to its CAM port, the vision device acts as a Local Emulator.

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

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



MX-U Series

Connecting to a camera

The U-Series camera physically connects to the MX-U Series processor using a USB cable between the processor's USB 3.0 port and the camera. An "interface" software program (called Vision Device) runs on the processor and provides communication with and control of a camera. A vision device is not initially associated with a USB port. If no camera is physically connected to the USB port, or assigned to the port, the vision device acts as a Local Emulator. See "Assign Tab (USB Cameras Only)" on page 2-29.

Click the connect button in VPM to connect to the selected vision device. The number of vision devices (and the processor's camera capacity) is determined by the processor type and number of licenses. Each vision device has a unique IP Address. See "IP Address Configuration" on page 6-53 for more details.

When a camera is assigned, 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 processor.

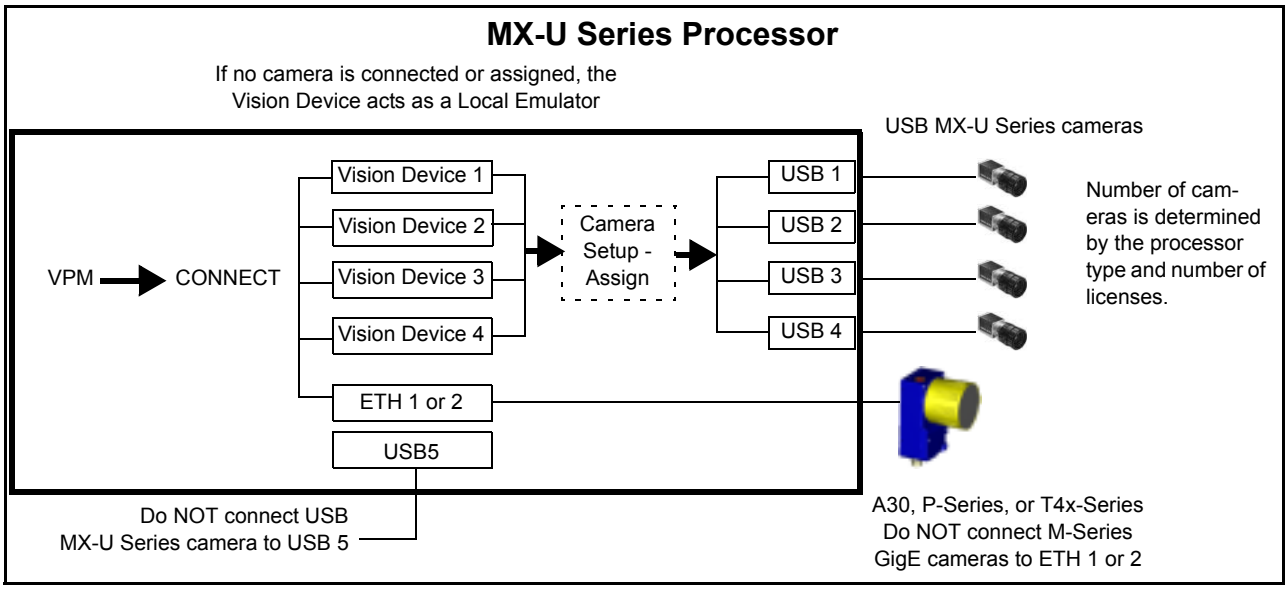
Multiple users can connect to a camera, but only one user at a time can edit programs or change data on the camera.

Connecting to an Emulator

When you connect to a vision device that has no camera connected to, or assigned to, its CAM port, the vision device acts as a Local Emulator.

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

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



CHAPTER 2

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, Vision Device, Emulator, Internet Protocol (IP) Addresses, communications, security, camera calibration, and other areas.

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

Settings Tab



VPM must be connected to a camera, Vision Device, or Emulator to access the Settings tab. See “Choose a Vision Device or Emulator” on page 1-4.

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, Vision Device, or Emulator is online. Access to some Settings functions is limited based on the security access level. See “Impact Vision Device and Camera Security” on page 2-13 for details.

General



The General system object allows access to system parameters on the camera, Vision Device, or Emulator. The General system object’s Properties tab shows some of the parameters. The Setup tab lets you set additional system parameters.

General Properties Tab

Input Name	What it is
Device Name	The Vision Device name. This name appears in the Device Connection dialog.
Device Comment	A comment about the camera or Emulator. This comment appears in the Device Connection dialog.
Task Timeout	See “Enable Timeout” on page 2-7.
TCP/IP Port	See “TCP/IP” on page 2-10.

Input Name	What it is
Serial Port Baud Rate	“TCP/IP” on page 2-10.
Serial Port Parity	“Serial Port” on page 2-10.
Serial Port Data Bits	“Serial Port” on page 2-10.
Serial Port Stop Bits	“Serial Port” on page 2-10.

Output Name	What it is
IP Address	The vision device’s IP Address
IP Mask	The vision device’s IP Mask
System Time	The current time (stored as the number of milliseconds elapsed since the device started). To use the Basic tool to format this value, see “FORMATDATE” on page 5-15.
CPU Temperature	The temperature on the processor board (in degrees C)
Sensor Board Temperature	A30, T4x-Series: The temperature on the sensor board (in degrees C) P-Series: The temperature of the internal illuminator. If not present, -1 is displayed.
Available RAM (kbytes)	The amount of RAM (in kilobytes). This number remains static while the system is online.
Model	The processor model number (M-Series, MX-E Series, and MX-U Series); the internal camera model number (A30, P-Series, and T4x-Series)
Serial Number	The camera serial number (A30, P-Series, and T4x-Series); The Vision Device serial number (M-Series, MX-E Series, and MX-U Series).
Software Version	The Impact software version (Major version.minor version.sub-minor version Build number)
Kernel Version	The operating system software version (Major version.minor version.sub-minor version Build number)
Firmware Version	The firmware version
Board ID	The identification number
HTTP Port	The system port the camera is using for HTTP commands
WatchDog Enabled (P-Series Only)	If True, the WatchDog is enabled. The WatchDog function checks at specific intervals (WatchDog Timeout) that the camera is running normally. If the check reveals a problem, the camera is restarted.
WatchDog timeout (ms) (P-Series Only)	If WatchDog Enabled is True, this is the amount of time delay (in milliseconds) between WatchDog function checks.

General Setup Tab

NOTE: Access to functions on this tab may be limited based on a user's access level and 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, M-Series, MX-E Series, and MX-U Series processer and the Vision Device 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 6-48.)

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 6-53.

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.

A30, P-Series, and T4x-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.

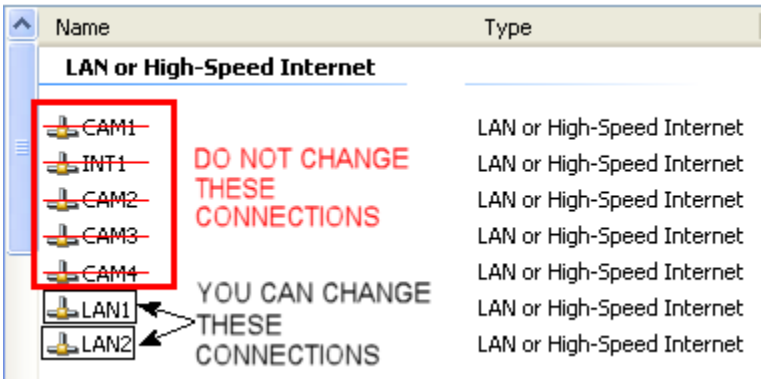
M-Series, MX-E Series, and MX-U Series Processor

Changing the Processor's IP Address (Windows XP)

IMPORTANT NOTE: Change only the Local Area Connection named LAN1 or LAN2. These correspond to Ethernet Ports 1 and 2 on the front of the processor.

DO NOT change any of the other Local Area Connections. Changing any other connection can cause M-Series, MX-E Series, and MX-U Series cameras to stop functioning.

1. In the Start menu, right click on My Network Places and select Properties.
2. Right click Local Area Connection LAN1 or LAN2 and select Properties.
3. On the General tab, select Internet Protocol (TCP/IP) and click Properties.
4. On the General tab, select Use the following IP address.
5. Enter the desired IP address.
6. Click OK to close all the open dialog windows.



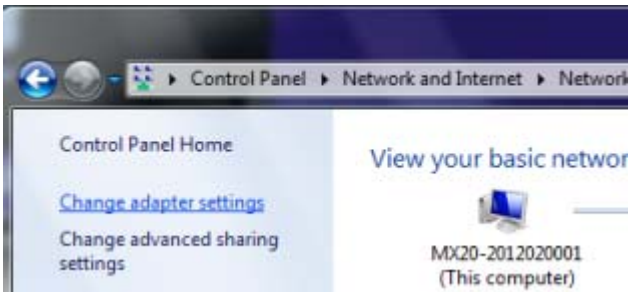
Changing the Processor's IP Address (Windows 7)

IMPORTANT NOTE: Change only the Local Area Connection named LAN1 or LAN2. These correspond to Ethernet Ports 1 and 2 on the front of the processor.

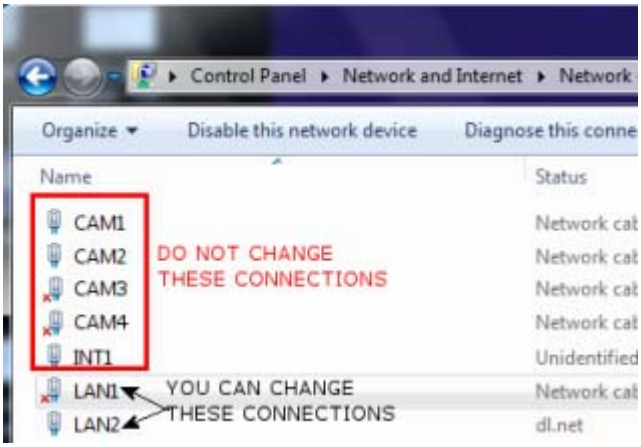
DO NOT change any of the other connections. Changing any other connection can cause the M-Series, MX-E Series, and MX-U Series cameras to stop functioning.

1. In the Start menu, click on Control Panel.
2. Under Network and Internet, click on View Network Status and Tasks.

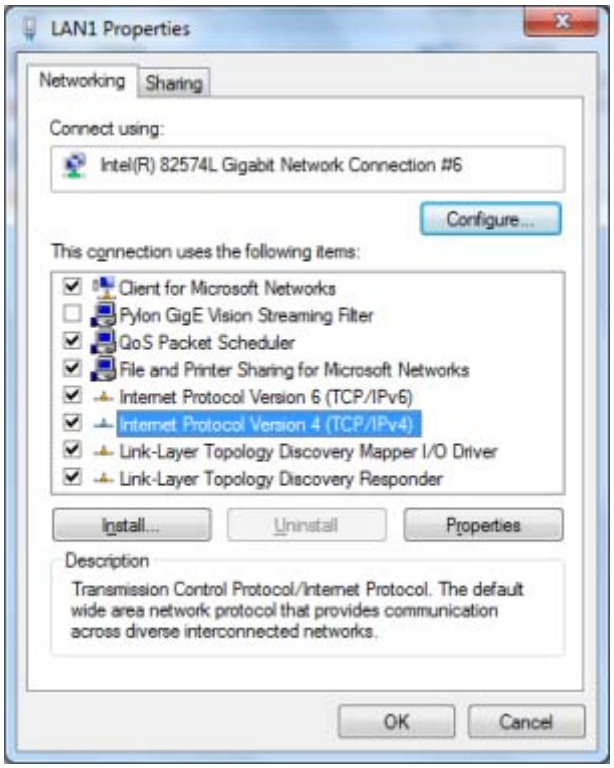
3. On the left side of the screen, click Change Adapter Settings.



4. Right click LAN1 or LAN 2 and select Properties.



5. In the list of items, select Internet Protocol Version 4 (TCP/IPv4), then click Properties.



6. Select Use the following IP address.

7. Enter the desired IP address.
8. Click OK to close all the open dialog windows.

Changing the camera or Vision Device 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 Impact A30, P-Series, and T4x-Series cameras are shipped with a default IP Address of 192.168.0.128 and a default Mask of 255.255.255.0. The M-Series, MX-E Series, and MX-U Series Vision Devices have a default IP Address range from 192.168.0.129 to 192.168.0.132 (The number of Vision Devices is determined by the processor type and number of licenses.)

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**)

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1. A30, P-Series, and T4x-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.
   M-Series, MX-E Series, and MX-U Series: It is not necessary to connect a camera during this process.
2. Connect to the desired Vision Device or camera. See "Choose a Vision Device or Emulator" on page 1-4.
   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 A30, P-Series, and T4x-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, click the Setup tab, 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.



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 tasks that are loaded are executed, based on their trigger parameters. To mark which tasks get loaded when the camera or Emulator starts, see "File Manager Setup Tab" on page 2-39.

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

(A30, P-Series, and T4x-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 date and time, click Synchronize to PC. The time is also automatically synchronized when a VPM connection is made.

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 and the maximum length of time the tool will wait for a response from a control panel.

NOTE: Task Timeout applies only to tasks with the Trigger Event set to Image In Event and 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 Properties" on page 3-32.

  If the task's Trigger Event type is set to "Image In Event," the time starts when the camera trigger is complete, not at the beginning of task execution. For all other Trigger Event settings, the time starts when task execution begins. 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 "VPM Task Configuration" on page 3-34 for more details.
- **Data Transfer Tool**
  When if this property is enabled, the Timeout value indicates the maximum length of time the tool will wait for a control panel response before it stops trying to send data to it. For example, if the timeout is enabled, and the Timeout value is set for 10,000 milliseconds, if the control panel does not respond to the tool's command within 10,000 milliseconds, the transfer is terminated.

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 Vision Device, camera, or Emulator to another (A30, P-Series, and T4x-Series)" on page 2-8.

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 - Setup Tab - 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.
- **OPC Data Access**
  When you click Backup, the OPC data settings displayed on the OPC Data Access 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 2-40 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 2-40 for image and vision program file copying details.

To copy settings files from one Vision Device, camera, or Emulator to another (A30, P-Series, and T4x-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 destination.

To copy settings files from one M-Series, MX-E Series, or MX-U Series to another

1. On the M-Series, MX-E Series, or MX-U Series processor storage device, find the directories C:\installdirectory\IMPACT\Applications\Device\VisionDevice#
(where “installdirectory” is the default install location and “VisionDevice#” is the number of the camera you want to back up)
2. Copy each of the desired directories to the back up device. Each directory contains the information for a specific camera.
3. If you want to duplicate the settings to a different M-Series, MX-E Series, or MX-U Series processor, copy each of the directories from the back up to the appropriate location (in step 1) on the new processor.

Communication Panel

Shift Source

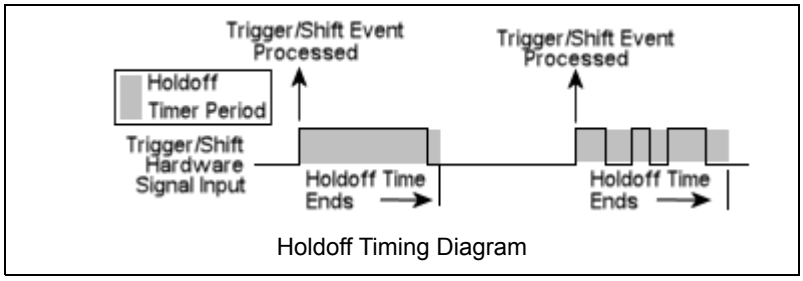
This setting is not used on the A30, T4x-Series, P-Series, M-Series, MX-E Series, and MX-U Series cameras.

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.

NOTE: Third-party cameras have varying Delay and Holdoff Input Debounce settings. Refer to the M-Series Camera and Processor Guide (843-0138) for details.

- **Delay**
This setting is not supported in the M-Series, MX-E Series, and MX-U Series processor. See “Trigger Input Debounce” on page 2-23.
- **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.



Holdoff Timing Diagram

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 OPC/ActiveX Server**
  If this check box is checked, the OPC/ActiveX 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 OPC Data Access (see “OPC Data Access” on page 2-45) or the Impact ActiveX Interface (refer to the Impact ActiveX Reference Guide 843-0119). OPC Server cannot be used on the Datalogic model A30, T4x-Series, or P-Series Smart Cameras.

- **Enable Online/Offline Output Feedback**
  (A30, T4x-Series, 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

- **Server Port**
  This is the camera or Emulator’s Ethernet input port number where the camera or Emulator “listens” for a TCP/IP message or a TCP/IP command.
  When a message is received on this port, the camera or Emulator triggers the TCP/IP event and tasks that have a TCP/IP Task Trigger event are queued to run.
  When a TCP/IP command is received on this port, the command processor evaluates and executes it. You can use other network devices to send commands to this port. The network device should use this same port number. See “TCP/IP Commands” on page 6-9 for more details.
  You can use the TCP/IP Out tool in a task in another camera or Emulator to send messages to this port. The port number used in that TCP/IP Out tool should be the same as this port number. However, as the communication is one-way, the input port number cannot be the same on both cameras or Emulators. See page 3-255 for more details about the TCP/IP Out tool and how to set up TCP/IP communications. See page 3-38 for details about the TCP/IP Input Event.

- **Delimiter**
  A delimiter must be defined. Click the Edit button to change the hex-value delimiter characters that indicate the end of a data string. In the Create Delimiter Sequence dialog, select a character from the list, then click Append, or click Clear to delete the delimiter. Click OK when the sequence is defined.

Serial Port

This section defines the parameters for the camera’s serial port that will be used by VPM’s Serial Port Out and Serial Port In tools. 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 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 3-254). 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.

NOTES for M-Series processors:
The M-Series processor will only accept one delimiter character in the data string.
The MX20 and MX40 processors have two serial ports. Serial port 1 is controlled by Camera 1 (CAM1) and Serial port 2 is controlled by Camera 2 (CAM2).
The Serial Port 1 connector is on the front of the processor box, left of the VGA connector.
The MX80 processor has four serial ports. Each Serial Port is controlled by its respective Camera (e.g port 1 is controlled by Camera 1 (CAM1) and so on).

NOTES for MX-E and MX-U Series processors:
These processors will only accept one delimiter character in the data string.
These processors have one serial port. Serial port 1 is controlled by the camera assigned to Vision Device 1.
The Serial Port 1 connector is on the top of the processor box, next to the Ethernet connectors.

SDK

The System Developers Kit (SDK) provides developer’s a third-party programming language interface to VPM 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 a 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 based on a user’s access level and 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 polls the Impact 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, Emulator, or processor's inputs. (VPM 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.
Event Rate: The signal on the Event Input. A task must be loaded that has the Trigger Event property set to one of the types of Input Event must be loaded.

Reboot Device

Click this button to restart the camera or Vision Device. All tasks stop executing and all vision programs are unloaded. (This has the same effect as pressing the Reset button on the A30, P-Series, or T4x-Series camera.)

When the camera or Vision Device restart has completed, any vision programs set to load on startup are loaded and tasks in those vision programs are queued to execute when they are triggered. See "File Manager Setup Tab" on page 2-39 for setting vision programs to load on startup.

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

Advanced

This button presents a menu of advanced functions.

- **Calibration Editor**
  When you save images in VPM, the lens calibration information is stored with them. You can edit the calibration values, or copy that information to other image files.

- **Memory Meter**
  This utility displays the current memory usage for a camera. The amount of available memory shown is not updated while the camera is online.
- **TCP Tester**
  This utility emulates a camera to test Ethernet communications between the client and a camera.
- **Modbus Client**
  Send commands to and read information directly from the Impact camera Modbus Server using Modbus TCP/IP protocol. (Impact cameras do not support serial Modbus protocol.) See “Modbus Client Tester” on page 6-47 for more details.

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.

Impact Vision Device and Camera Security

Impact security resides in each camera and Vision Device. (Control panel applications and vision programs can be password protected separately. See “Vision Program Security” on page 3-32 and “CPM Security” on page 4-2.) You must connect and log on to a camera or Vision Device to modify security for it. When you attempt to connect to a camera or Vision Device 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. Control Panel designers can check for the user’s security level and allow access to specific functions based on that level.

- **Enable Security**
  Security for each camera or Vision Device resides in it. If the Enable Security check box is checked, security is enabled and the logon screen is displayed whenever a connection attempt is made to the camera or Vision Device. The user cannot gain access to the camera or Vision Device 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 or Vision Device is determined by the access level assigned to each User ID. Access to functions on Control Panels is assigned by the Control Panel creator. 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. Cannot make any changes.
  Operator: Monitor level access plus 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 or Vision Device, 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 2-14 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 2-13.)

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.

Client Directory

The Client directory contains files used by Impact software. It is stored in the default directory on the client computer during installation, but it may be stored in a folder of your choice.

To change the Client directory

1. Type in a directory path and name, or click Browse to locate the desired directory. If the directory is located on a network, be sure all clients have access to it.

Tool Activation

Some VPM 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.

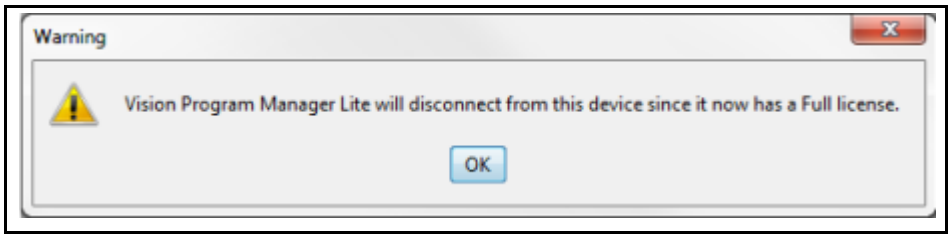
- **Software License Key**: Enter the number provided by Datalogic.
- **License States**: This area lists all the currently active tool and software licenses.
  The tool name is followed by the license state (OCR and Pattern Sort only):
  Full License = The tool is licensed for full use.
  Demo License = The tool can be used in a task but it will return an error every 5th to 7th time it runs.
  Impact License Level indicates how the device is licensed:
  Lite License: The device can only run VPM Lite and the Allowed Tool Weight refers to the total number of tools that can be used in the task. A P-Series camera can be licensed to run either Full VPM or VPM Lite. If it is currently licensed for VPM Lite, the license can be changed to run Full VPM.
  Full License: The device can only run Full VPM.

To change a P-Series Impact License Level

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 P-Series camera power, 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

NOTE: All users have access to this tab regardless of their access level.

When you click the Connect button, VPM automatically scans for cameras on the network, Emulators on the client PC, and Vision Devices and cameras on the processor. It then displays their names, IP addresses, and other information in the selection list. When VPM connects to the camera or Vision Device, 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.
There are sixteen image buffers in the A30, T40, T47, and P-Series smart cameras. The T49 has eight image buffers. M-Series, MX-E Series, and MX-U Series processors have thirty-two image buffers.

Camera Properties Tab

Input Name	What it is
Digital Shift	Non-functional
Gain	Gain adjusts the actual signal intensity from the camera. NOTE: The gain setting for M-Series, MX-E Series, and MX-U Series cameras is the “raw” gain setting, not a percentage gain. The range of values will vary from camera to camera. In all cases the recommended value is the minimum gain, which corresponds to 0dB.
Red Gain	Adjusts the signal intensity of the camera’s red pixels. (Color cameras only)
Blue Gain	Adjusts the signal intensity of the camera’s blue pixels. (Color cameras only)
Offset	Offset adjusts the zero grey-level setting for the camera which causes the entire image to brighten or darken. Images become darker as the offset is increased.
Shutter Speed	Shutter Speed: the amount of time the shutter is open. The higher the number, the longer the shutter is open and the brighter the image.
Next Image Number	This number is appended to the image name which is displayed at the top of the image display window. The number is incremented by one for each subsequent image snapped.
Image Scan Left Edge	Sets the left edge where the camera’s horizontal scan starts. The default value is determined by the camera type. (See *Note below this table)
Image Scan Right Edge	Sets the right edge where the camera’s horizontal scan stops. The default value is determined by the camera type. (See *Note below this table)
Image Scan Top Edge	Sets the top edge where the camera’s vertical scan starts. The default value is determined by the camera type. (See *Note below this table)
Image Scan Bottom Edge	Sets the bottom edge where the camera’s vertical scan stops. The default value is determined by the camera type. (See *Note below this table)
Binning (M-Series, MX-E Series, and MX-U Series only)	The number of adjacent image pixels to combine to produce a brighter, but lower resolution, image. For example, a value of two combines two pixels in the x direction and two pixels in the y direction, resulting in a total of four sensor pixels for each image pixel. If this property value is changed, the camera must be calibrated again. If calibration is not used, then tool ROIs will need to be resized.

Input Name	What it is
Scan Lines to Overlap	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. See “Scan Lines to Overlap” on page 2-24.
Line Trigger Pre-Divider	See “Frequency Converter” on page 2-28.
Line Trigger Multiplier	See “Frequency Converter” on page 2-28.
Line Trigger Divider	See “Frequency Converter” on page 2-28.
Units Per Pixel	Units per Pixel is the scale factor for converting measurements in the image to “real-world” units. See “Units per Pixel” on page 6-84 for details.
Camera Trigger Edge Type	This value sets the Camera Trigger type as follows: 0 = Rising Edge 1 = Falling Edge 2 = Both Edges (See “Frame Trigger Tab” on page 2-22) (Not available on M-Series, MX-E Series, and MX-U Series processors)
Strobe 1 Duration	Strobe 1 pulse length in microseconds
Internal Lighting Mode (P-Series only)	See “Illuminator Tab (P-Series Cameras Only)” on page 2-30
Enable Internal Lighting Chains (P-Series only)	See “Illuminator Tab (P-Series Cameras Only)” on page 2-30
Enable First LED Chain (P-Series only)	If True, the top/left LED chains are enabled.
Enable Second LED Chain (P-Series only)	If True, the bottom/right internal LED chain is enabled.
Enable Third LED Chain (P-Series only)	If True, the top/right internal LED chain is enabled.
Enable Fourth LED Chain (P-Series only)	If True, the bottom/left internal LED chain is enabled.

Input Name	What it is
Calibration Mode	This selection sets the type of calibration to use Circles Hexagon Target: Use a hexagonal target and enter the target pitch Circles Grid Target: Use a grid target and enter the target pitch Checkerboard Target: Use a checkerboard target and enter the target pitch Real World Coordinates: Use user-entered Image point and Real World point coordinates Manual: Use an entered value for Units per Pixel (see “Units per Pixel” on page 6-84) Two Points: Use a Target length and an ROI between two points, or two user-entered point coordinates
Calibration Image	The image used for the previous calibration
Target Pitch (Units)	This is the distance between dots or checkerboard squares on the calibration target. It is independent of the units (e.g. millimeters, inches, centimeters). Used with Circles Hexagon Target, Circles Grid Target, and Checkerboard Calibration Modes.
Image Points	The list of points generated when the Generate Points button is pressed. Used with Real World Coordinate Calibration Mode.
Real World Points	Enter X and Y point coordinates of "Real World" points that correspond to the Image Points. Used with Real World Coordinate Calibration Mode.
Datalogic TCP Image Input Mode	If True, the camera supports input from Datalogic AV6010 cameras.

***NOTE**: If the camera is Online when any Image Scan value is changed, the camera stays Online but camera triggers are temporarily disabled and the image buffer is reallocated based on the new value. The image currently in the image buffer may be overwritten when a new image is acquired based on the new Image Scan value.

Output Name	What it is
Acquisition Time	The amount of time taken to acquire the current image
Number of Buffered Images	The number of images currently in the camera’s image buffers
Buffered Images Maximum	The number of buffers in use when a new image acquisition is started. For example, when the first image is acquired, the value is zero. If another image is acquired before the previous image is released, the value is incremented. This continues until the maximum number of image buffers available is reached. When this happens, it means that all the buffers are occupied at the beginning of an acquisition and a buffer overrun situation may exist. This value is reset to zero when the device is turned on. There are sixteen image buffers in the A30, T40, T47, and P-Series smart cameras. The T49 has eight image buffers. M-Series, MX-E Series, and MX-U Series processors have thirty-two image buffers.

Output Name	What it is
Model	The camera's model
Illuminator Info (P-Series Only)	The model name of the illuminator attached to the camera
Lens Distortion Calibration Enabled	If True, distortion calibration is enabled
Real World Origin	This is the X and Y coordinate location (in pixels), and the rotation angle (in degrees) of the image's upper left corner relative to the upper left corner of the image display.
Serial Number	Not Used in A30, P-Series, and T4x-Series; The camera's internal serial number in the M-Series, MX-E Series, and MX-U Series.
RMS Reprojection Error	Given an image point (in raw pixel space) and its corresponding real world location (in real world units), first the calibration is applied to the real world point to get its estimated position on the raw image plane. Then, the reprojection error is computed as the distance between such point and the corresponding image point. Summing all the squared value of such distances for every point match, then dividing by the number of matches and extracting the square root gives the Root Mean Square (RMS) of the Reprojection Error.
Max Reprojection Error	This is the maximum value of all the reprojection errors computed for every point match.
Calibration Error Code	Any error that occurred during the calibration. See "Calibration Errors" on page 6-85.
Snapped Image	The most recent image snapped by the camera.
Snapped Color Image	The most recent color image snapped by the camera.

Camera Setup Tab

NOTE: Access to functions on this panel may be limited based on a user's access level and 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 VPM Settings Tab - Camera System Object. This section provides details about each of the Camera System Object Setup tab options. (Available options are dependent on camera type.) Some of these options may also be modified dynamically using the Device Settings tool. (See "Device Settings" on page 3-283)

Setup Panel

Note for Line Scan Cameras: When you use the Snap or Live Button with a Line Scan Camera, set the Line Trigger Type to Time-Based and adjust the Trigger Period. Any other Line Trigger Type requires an external hardware line trigger. (See "Line Trigger Type" on page 2-27)

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 button again. 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 per Second

This field indicates the number of frames the camera can capture and process per second (fps). 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.

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 2-30.

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 keeps the strobe off.)

NOTE: Some third-party cameras do not have a Strobe Pulse Length setting. The strobe trigger pulse width coincides with the camera shutter speed open time setting so that it turns on when the exposure starts (shutter opens) and turns off when the exposure ends (shutter closes). Line scan cameras do not have a strobe output.

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.

NOTE: The gain setting for M-Series, MX-E Series, and MX-U Series cameras is the "raw" gain setting. The range of values will vary from camera to camera. In all cases the recommended value is the minimum gain, which corresponds to 0dB. For example, the minimum gain setting for the M200 camera is 320 which corresponds to a gain of 0 dB.

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). (Not available on M-Series, MX-E Series, and MX-U Series processors)

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.

NOTE: Auto-Trigger modes are disabled when VPM is connected to a line scan camera.


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 processing 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 to VPM or CPM. If VPM or CPM is updating very slowly, especially with large images, it might help to increase this delay, although this will slow the trigger rate.

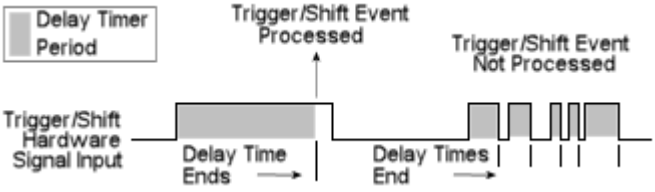
- **Auto-trigger When Online**
  If this is checked, automatic triggers will start when the camera or Emulator goes Online and stop when it goes Offline. The Start/Stop Auto-trigger button is disabled. No other Start/Stop control is available.

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.

NOTE: Third-party cameras have varying Delay and Holdoff Debounce settings. Refer to the M-Series Camera and Processor Guide (843-0138) for details.

- **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.



Delay Timing Diagram

- **Holdoff**: This setting is not supported in the M-Series, MX-E Series, and MX-U Series. See "Input Debounce" on page 2-9.

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.

For line scan cameras, the bottom edge value is the height of the line scan image.

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.

  The feature is primarily intended for use with line scan cameras, however it works with any camera. It works best with line scan cameras because the bottom line of the previous image will be placed directly adjacent to the top line of the current image. 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 is a property of the Camera Object, so it can be linked into your vision program and 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.

Some third-party cameras do not allow partial scanning.

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.

Line Scan Tab

This tab is enabled only when a line scan camera is being used. Refer to the M-Series Processor and Camera Guide for more details about connecting line scan cameras.

Datalogic M5xx cameras

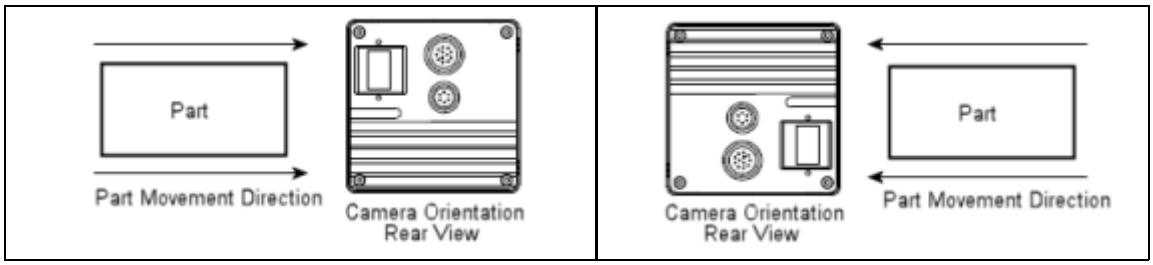
Datalogic's M5xx line scan cameras have a sensor with only one row of pixels and so they acquire one line at a time. The image is formed by moving the part in front of the camera, acquiring multiple lines and stacking them together to form the image. The Acquisition Mode determines when the camera needs to be trig-

gered, e.g. for each line, for a frame, continuously, etc. Line triggers can come from an encoder that ensures that the lines are evenly spaced.

Basler cameras

The sensor used in the Basler color line scan camera has three lines of pixels. The center-to-center distance between each line is 112um. This spacing results in each line having a different field of view on any object that is passing the camera. When an acquisition is triggered, all three lines in the sensor are exposed simultaneously. This means that each line in the sensor acquires a different area on the object for a single acquisition. To ensure that there will be no color banding in the image, it is very important that:

1. The line trigger rate, pre-divider, multiplier, and post-divider settings are set so the image is composed of square pixels (horizontal pixel size = vertical pixel size). See “Frequency Converter” on page 2-28.
2. The camera is correctly oriented for the scan direction. The figure below shows the proper camera orientation relative to part movement direction.



Acquisition Mode

Line scan cameras can operate in several acquisition modes. The continuous modes allow the camera to acquire multiple images without requiring multiple frame triggers. This eliminates any concern about “missing lines” between images when long parts are scanned.

In all the acquisition modes, the number of scan lines needed to create an image is set in the bottom edge value of the Partial Scan tab (see “Partial Scan Tab” on page 2-24). Offline operation, using the Snap or Trigger Once buttons, does not require line triggers since the lines are self-triggered based on shutter time.

Single Frame, Edge Triggered

In this mode, the camera begins to capture a single image beginning with the edge of the frame trigger. To select the frame trigger edge type, see “Frame Trigger Tab” on page 2-22.

Continuous While Online

In this mode, the frame trigger signal is not used. Lines continue to be acquired as long as the camera is online. The signal to begin acquiring a line depends on the Line Trigger Type selected.

The camera will wait as long as necessary to get enough scan lines to fill each image. Since there is nothing to indicate the end of the scan, the last image can wait forever to fill. To flush a partial last image out of the camera and start a new one, the camera must be put Offline. If the camera is not put Offline, when a new image is started the first lines of the new image will contain the left over lines from the end of the previous image.

Continuous While Frame Trigger High

While the frame trigger is held high, the camera will accept line triggers and create images. When the current image is filled with scan lines, the camera sends it and the next image starts with the next line trigger. When the frame trigger goes low, image acquisition is complete and the camera will send the current image regardless of the number of lines acquired. The next image starts with the next line trigger after the frame trigger goes high.

Continuous While Frame Trigger Low

While the frame trigger is held low, the camera will accept line triggers and create images. When the current image is filled with scan lines, the camera sends it and the next image starts with the next line trigger. When the frame trigger goes high, image acquisition is complete and the camera will send the current image regardless of the number of lines acquired. The next image starts with the next line trigger after the frame trigger goes low.

IMPORTANT: The camera can malfunction if the frame trigger goes high or low immediately after the image height is reached and a full buffer has been sent, since this results in a partial image of zero lines. The malfunction may cause the camera to stop operating. If this happens, power the camera off, then on. To avoid this problem, set the image height to be greater than the maximum number of lines that could be acquired during any Frame Trigger time. The image height is set in the bottom edge value in the Partial Scan tab (see “Partial Scan Tab” on page 2-24).

Line Trigger Type

The line trigger signals the camera to start acquiring a line. The acquisition time is determined by the Shutter Open time.

Single Phase

The trigger signal is connected to Input 2 and the line start is triggered on the rising edge of the signal only. There are no debounce settings for Input 2.

Quadrature Forward Only

Use this setting with a quadrature encoder. Phase A is connected to Input 2 and Phase B is connected to Input 3. The line start is triggered on the rising and falling edge of each input as long as Phase A leads Phase B (forward direction). There are no debounce settings for Input 2 and 3.

The camera does not start a line in the backward direction. It counts the trigger pulses until the encoder goes forward again, then it counts the forward pulses until all the backward pulses have been retraced, then it starts triggering. This setting allows the line start to ignore backward jitters.

Quadrature Forward and Back

Use this setting with a quadrature encoder.Phase A is connected to Input 2 and Phase B is connected to Input 3. Line starts are triggered on the rising and falling edge of each input in either direction.

Time-Based

When this setting is selected, an internal trigger signal is generated based on the Trigger Period (microseconds) value and an external trigger source is not required.

Note for Snap and Live Button: When you use the Snap or Live Button with a Line Scan Camera, set the Line Trigger Type to Time-Based and adjust the Trigger Period. Any other Line Trigger Type requires an external hardware line trigger. (See “Snap” on page 2-21.)

Trigger Period (microseconds)

The is the period between internally generated line trigger signals. This field is enabled only when Line Trigger Type is set to Time-Based. The Trigger Period must be greater than the Shutter Open Time.

Shutter Open Time (microseconds)

The Shutter Open Time must be less than the Trigger Period. See “Shutter” on page 2-21.

Line Trigger Input Termination

CAUTION: Maximum Input Voltage is +6 VDC when the termination resistor is in the circuit.

This setting only affects Inputs 2 and 3. Input 1 is not terminated. There are no debounce settings for Inputs 2 and 3. The ability to configure the termination resistor is necessary because Inputs 2 and 3 can accept TTL, RS-422, or RS-644 signal types. If this check box is checked, a termination resistor is present on camera Inputs 2 and 3.

The check box is cleared automatically when the Line Trigger type is set to Single Phase. It is checked automatically when the Line Trigger type is set to either of the Quadrature Line Trigger Types.

You should also check or clear the check box based on the following signal input configurations.

- **RS-422**
  Camera is the end device on the bus: check box must be checked
  Camera is not the end device on the bus: check box must be cleared
- **RS-644**: check box must be checked
- **TTL**: check box must be cleared

Frequency Converter

Because the maximum trigger input rate of the Line Scan camera is 20 MHz, which is faster than the camera's number of lines per second acquisition rate, an internal frequency converter can be configured that will scale the line trigger input rate up or down to create fractional scale factors. This way you can match the x and y resolutions without modifying the encoder frequency. The Frequency Convertor setting can be used with any of the three Line Trigger types.

Refer to the M-Series Processor and Camera Guide (843-0138) for each Line Scan camera's maximum lines per second acquisition rate.

The **Line Trigger Multiplier** and **Line Trigger Dividers** are integer scale factors. They can be combined to create a fractional scale factor. For example, if the trigger input rate is 3000 and the desired lines per second is 2000, then the Multiplier value would be 2 and the Post-Divider would be 3.

3000 * (2/3) = 2000

Pre-Divider

This setting is used to the scale the frequency down to less than 30 KHz, the maximum value for the Multiplier field. For example, if the trigger input rate is 30 KHZ, the pre-divider value would be 10. Using the example above:

30000/10 * (2/3) = 2000

Here is an example using the M565 line scan camera to acquire an image of a cylindrical-shaped object. (For other line scan cameras, substitute the appropriate values.)

The M565 camera has a resolution of 2048 lines. The Field of View (FOV) is 41 mm and the object has a circumference of 73 mm. The encoder produces 2500 pulses per revolution.

The horizontal resolution is calculated by:

FOV/ camera resolution = horizontal resolution
Example: 41 mm/2048 = 0.020 mm/pixel

The vertical resolution is

circumference / encoder frequency = vertical resolution
Example: 73 mm/2500 = 0.029 mm/pixel

Because the horizontal and vertical resolutions are different, the resultant image will appear stretched or compressed. To correct for this, set the Pre-Divider, Multiplier, and Divider to create a fractional scale factor. (First, multiply the horizontal and vertical resolutions by 1000 so the Multiplier and Post-Divider values are integers.)

Example:
Pre-Divider: 1
Multiplier: 0.029*1000 = 29
Post-Divider: 0.020*1000 = 20

You can now use these newly calculated values to adjust the number of lines to acquire (so that the horizontal and vertical resolutions are equal).

Circumference (in pulses per revolution) * Multiplier / Post-Divider = Number of lines
Example: 2500 * 29/20 = 3625
(If this result is greater than 12,228, the resolution must be changed, since the camera's maximum number of lines is 12,228.)

Recalculating the vertical resolution using the new number of lines shows that the vertical and horizontal resolution are equal:

circumference / encoder frequency (Example: 73/3625 = 0.020mm/pixel)

Assign Tab (USB Cameras Only)

Select Camera

Be sure a USB 3.0 camera is plugged into any of the USB 3.0 ports labeled USB1 through USB4 on the MX-U Series processor. Do not connect a USB camera to the port labeled USB5 or any other USB 2.0 port.

If no camera is connected to, or assigned to, a Vision Device, the Vision Device acts as a Local Emulator. (See "MX-U Series" on page 1-9.)

To assign a USB camera to a Vision Device

1. Click the Connect button in the VPM tool bar.
2. Select one of the IMPACT Devices from the dialog that does not have a camera assigned to it, then click Connect to Vision Device.
3. Click the Settings tab.
4. Click the Camera icon.
5. On the Setup tab, click the Assign tab.
6. From the Select Camera drop down, select the camera you want to use. The list includes camera serial and model numbers.
7. The camera selection is disabled if a camera is already assigned or the camera is connected to a USB port that is operating in USB 2.0 mode.
   To reset a camera that is in USB 2.0 mode, disconnect then reconnect the affected camera.
8. Click OK in the Camera Connected dialog.

To remove a USB camera assignment

1. Click the Connect button in the VPM tool bar.
2. Select one of the IMPACT Devices from the dialog that has a camera assigned to it, then click Connect to Vision Device.
3. Click the Settings tab.
4. Click the Camera icon.

5. On the Setup tab, click the Assign tab.
6. From the Select Camera drop down, select None.
7. Click OK in the Camera Disconnected dialog.

Illuminator Tab (P-Series Cameras Only)

Mode

This sets the Internal Illuminator's operating mode. This also affects the permitted Shutter Open Time range.

Mode	Shutter Open Time 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

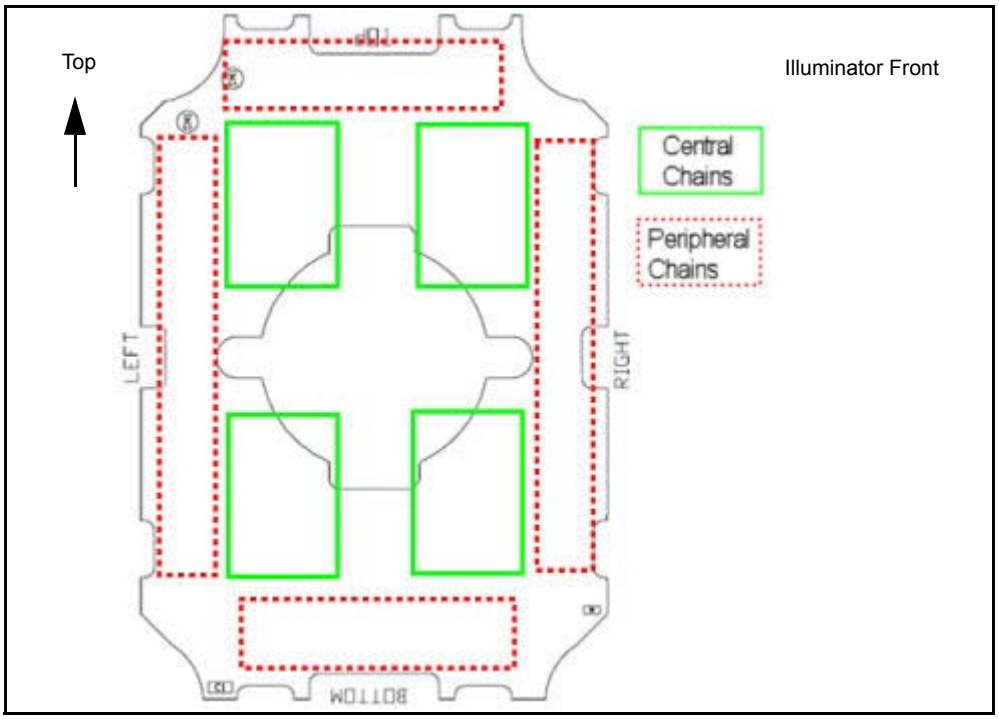
This box contains the model name of the Internal Illuminator mounted on the camera, and the number of Lighting Chains that the Illuminator contains.

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 (and Illuminator type for the P-Series).

Save Image

Click this button to save the displayed image to a file.The image is saved in Portable Networks Graphics (PNG) format.

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 VPM tools accurately relate to 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 6-83.

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 6-84.)

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 6-85.

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 6-85).

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 6-85).

Manual

Use this option when you know the image scale.

Manual Points Settings

- **Units per Pixel**: See “Units per Pixel” on page 6-84.
- **Calibration Error**: See “Calibration Errors” on page 6-85.

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 6-85).

Target

Use this option when you have a calibration target with a hexagonal, grid, or checkerboard pattern. Also see “Target Calibration” on page 6-84.

Target Settings

- **Target Pitch (units)**

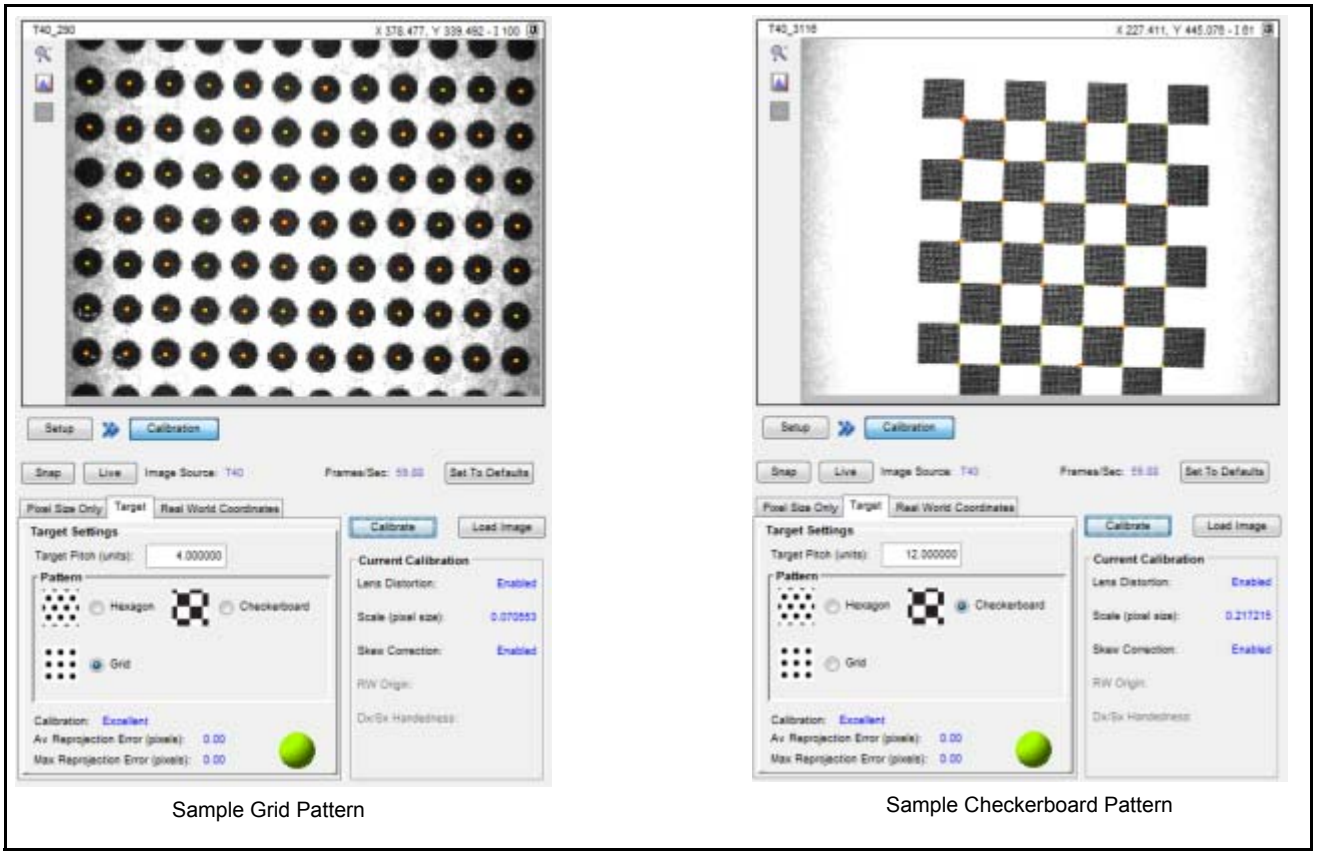
This is the real-world distance between dots on the calibration target. It is independent of the units (e.g. millimeters, inches, centimeters).

- **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
  The image should be high resolution with sharp edges, clear corners, and high contrast. Each square must be a minimum of ten pixels on each side. The 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 6-85.

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 camera

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



Sample Grid Pattern

Sample Checkerboard Pattern

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 (dot or square). 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 6-85).

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.

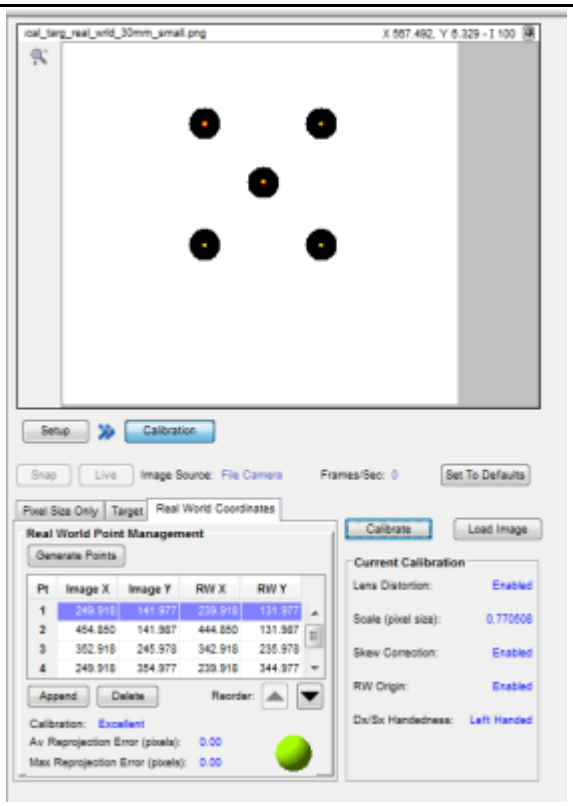
Real World Point Management

- **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.



Sample Real World Coordinate Pattern

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 6-85).

File Camera



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

File Camera Properties Tab

Output Name	What it is
Number of Active Images	The number of images currently in the camera's RAM

File Camera Setup Tab

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 3-11.

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 VPM's 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 VPM Settings Tab or in a VPM 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.

System Log Properties Tab

Input Name	What it is
Log Entry	The most recent log event

System Log Setup Tab

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

Archive Log

On A30, P-Series, and T4x-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. On M-Series, MX-E Series, and MX-U Series Processors, the system log is written to a disk file when the system is closed by using Windows shutdown or when the Vision Device exits. When the system is restarted, the system log is initialized from the saved file.

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 tasks such as online and offline events, system restarts, camera and image acquisition errors, trigger over-runs, tool failures, and other types of system events and failures. See “Trouble Diagnosis” on page 6-87 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 tab 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.

File Manager Properties Tab

Input Name	What it is
Display Mode Program Filter	Programs that contain this name appear on the Display Mode’s File Load drop down list. (See “Filtered Vision Programs” on page 3-27.)

Output Name	What it is
Available Flash	The amount of flash memory on the camera (in bytes)

File Manager Setup Tab

NOTE: Access to functions on this tab may be limited based on a user’s access level and 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.

Refresh

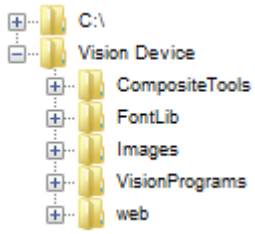
Click to refresh the list of files.

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.
- **FontLib**: OCR tool Font Data files
- **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.
- **Composite Tools**: Composite Tools are created by combining existing tools into new configurations.
- **VisionPrograms**: Datalogic and user-created vision programs
- **Web folder:** User-defined files that can be accessed with a web browser.

To access the files in the Web folder with a browser

1. Open a web browser.
2. In the Address field, type http://123.123.123.123/file/
   where 123.123.123.123 is the IP address of the Impact camera or Emulator.
3. Press Enter. If there is a file in the folder named index.htm or default.htm, the browser will automatically display it. If not, the directory is displayed. To display a different file, enter the file name after the directory name.
   For example: http://123.123.123.123/file/index_help.htm
   IMPORTANT: File names are case sensitive.

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

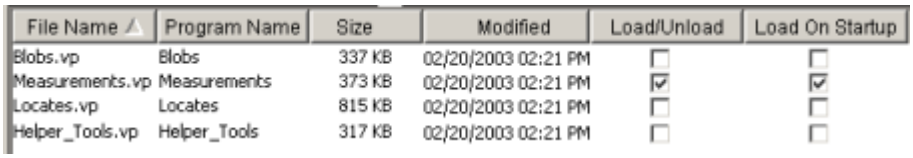
1. Select the desired file(s)
2. Use the Cut or Delete button on the main VPM tool bar.

To Copy and Paste a File

1. Select the desired file(s)
2. Use the Copy and Paste buttons on the main VPM 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	☐	☐
Measurements.vp	Measurements	373 KB	02/20/2003 02:21 PM	☑	☑
Locates.vp	Locates	815 KB	02/20/2003 02:21 PM	☐	☐
Helper_Tools.vp	Helper_Tools	317 KB	02/20/2003 02:21 PM	☐	☐

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.

Modbus Server



The Modbus Server interfaces with other devices that use Modbus TCP/IP protocol. There are brief details of the server's operation after the following table. (Impact processors and cameras do not support serial Modbus protocol.)

All Modbus registers are 16 bit integers. The VPM Modbus server registers (the number in brackets) are used as described here.

NOTE: This System Object is not available while the camera is online.

Modbus Server Properties Tab

Input Name	What it is
Online [0]	If this value is set to one, the camera goes online. If it is set to zero, the camera goes offline.
Trigger [1]	If this value is set to non-zero, the camera is triggered if it is Online. This value is also written to the Trigger Ack register as a trigger acknowledgement.
Gain [2]	The camera's current gain setting
Shutter Speed (x 10us) [3]	The camera's current shutter speed setting in microseconds (divided by ten)
Strobe 1 Duration (ms) [4]	Strobe 1 current duration setting in milliseconds
Strobe 2 Duration (ms) [5]	Strobe 2 current duration setting in milliseconds
Strobe 3 Duration (ms) [6]	Strobe 3 current duration setting in milliseconds
Reserved [7] - [32]	These registers are reserved for future use
Trigger Ack [33]	If the Trigger register value is set to non-zero, the camera or Emulator is triggered and that same value is immediately written to this register as a trigger acknowledgement. This register value is not changed for hardware triggers.
Reserved [34] - [63]	These registers are reserved for future use
Register [64] - [127]	The Modbus client can write to these registers.The value in the register can be linked to VPM tool property values.

How VPM Works With Modbus TCP/IP

The Modbus server runs continuously on the camera or Emulator, listening on the standard Modbus port 502. It does not initiate any communications, but waits for other Modbus devices on the network. To configure a VPM task to run when a Modbus device communicates with the camera or Emulator, select the Modbus Event Trigger Event Type. To run it when Modbus register data changes, select Modbus New Input Data Event Trigger Event Type. (See "Trigger Event Types" on page 3-36).

The server supports only Conformance Class 0 functions — Read Multiple Registers (Function Code - 3 (0x03)) and Write Multiple Registers (Function Code - 16 (0x10)). There is one register address space starting at address 0. All Modbus registers are 16 bit integers and the most-significant bit (at the lowest address) is sent first (known as Big Endian**).**

Read and Write a Modbus Register

Since VPM tool property values cannot be directly linked to a Modbus register, you need to use a Data Set tool to push a value from a tool's property into the register. Register values can be directly linked to a VPM tool property.

How to write to a register

1. Place a Data Set tool in the task.
2. In the Data Set tool, click the create link button on the Destination Port, then select the desired Modbus Register.
3. In the Data Set tool, click the create link button for the Value property, then select the property you want to link from the source tool.
4. When the Data Set tool runs, it pushes the desired value into the Modbus Register.

How to read from a register

1. In the desired tool, select the desired property.
2. Click the create link button.
3. In the Modbus Server system object, select the desired Modbus Register.
4. When the tool runs, it reads the desired value from the Modbus Register.

AB PCCC Server



The AB PCCC Server allows Allen-Bradley®, Rockwell Automation®, and compatible PLC devices to exchange data with cameras using the Programmable Controller Communication Commands (PCCC) protocol encapsulated inside EtherNet/IP commands. The PCCC format is compatible with the Allen-Bradley standard PLC-5 which is supported by a wide variety of their PLCs including the SLC™-5, PLC-5®, and later products. There are brief details of the server's operation after the following table.

No values for the PCCC Server properties are saved in the Vision Program (*.vp) files. If you require initial values, they must be set using explicit Data Set operations in the program when it loads. The VPM PCCC server properties (the number in brackets) are described here.

NOTE: This System Object is not available while the camera is online.

AB PCCC Server Properties Tab

Input Name	What it is
N7-Integer [0] through N7-Integer [63]	64 indexed integer values
F8-Float [0] through F8-Float [63]	64 indexed float values

Input Name	What it is
A9-ASCII [0] through A9-ASCII [63]	64 indexed 1-byte characters
ST10-String [0] through ST10-String [31]	32 indexed string values

How VPM Works With AB PCCC

The AB PCCC server runs continuously on the camera or Emulator. It does not initiate any communications, but waits for other PCCC devices on the network. To configure a VPM task to run when a PLC device communicates with the camera or Emulator, select the AB PCCC Event Trigger Event Type. (See “Trigger Event Types” on page 3-36).

The server supports Typed Read and Typed Write commands. These are standard PCCC commands using command code 15 (0x0F) and functions 104 (0x68) and 103 (0x67) respectively. The PCCC command is placed inside an EtherNet/IP command that targets the EiP object 103 (0x67) and service 75 (0x4B) on the camera or Emulator.

There are four files of data that can be read or written. These are statically-allocated arrays of data analogous to Modbus registers.

File Type	File Name	PCCC Data Type	Depth	Port Names
Integer 16-bit	N7	INT	64	INT [*]
Float 4-byte	F8	REAL	64	REAL [*]
Character 1-byte	A9	SINT	64	SINT [*]
String n-chars	ST10	SINT	32	String SINT [*]

The Integer file is limited to sixteen bits which is the standard for PLC-5 devices and the protocol.

Reals conform to the IEEE 754 standard for representing a real number in four bytes.

The Character file has signed characters. These may be used for characters of other signed one-byte data as well as Boolean values.

The String file entries each contain a variable-length string. The data is passed as the SINT format. Only one string at a time may be read or written as it is already passing an array of data. The other three data types may pass one to n data elements at a time.

To access camera data from a PLC, use Read/Write Message commands with PLC5 as the target device. There are variations in PCCC command implementations across PLC5 product generations. The files must be accessed using the right combination of File Type, File Name, and File Name index as shown in the two tables above. Refer to your PLC documentation for command details. IMPORTANT: File names are case sensitive.

Read and Write PCCC values

Since VPM tool property values cannot be directly linked to a PCCC server property value, you need to use a Data Set tool to push a value from a tool’s property into the server property. Server property values can be directly linked to a VPM tool property.

How to write to a server property value

1. Place a Data Set tool in the task.

2. In the Data Set tool, click the create link button on the Destination Port, then select the desired PCCC property.
3. In the Data Set tool, click the create link button for the Value property, then select the property you want to link from the source tool.
4. When the Data Set tool runs, it pushes the desired value into the PCCC property value.

How to read from a server property value

1. In the desired tool, select the desired property.
2. Click the create link button.
3. In the PCCC Server system object, select the desired property.
4. When the tool runs, it reads the linked value from the server property.

OPC Data Access



The OPC Data Access system object interfaces with the Impact OPC Server. The Server provides OPC capable clients on the network with access to the camera through the OPC Data Access system object. The Server can read and write data to the OPC Data Access properties which are described here.

When you add an input to the OPC Data Access system object, you must restart the OPC Server or the camera to make the new input appear in the Server's input list. Whether you should restart the OPC Server or the camera depends on which would cause the least disruption to your operation. (Also see "Enable OPC/ ActiveX Server" on page 2-10.)

For more details about the OPC Server, refer to the OPC Server Reference (Document 843-0136).

NOTE: OPC Server and OPC Data Access cannot be used on the Datalogic model A30, T4x-Series, or P-Series Smart Cameras.
This System Object is not available while the camera is online.

OPC Data Access Properties Tab

Input Name	What it is
Online	When true, places the camera or Emulator online.
Trigger	When true, a camera trigger event is created in the camera
Gain	The camera gain value
Shutter Speed (x 10 microseconds)	The camera shutter speed
Strobe 1 Duration (ms)	The duration for strobe 1
Strobe 2 Duration (ms)	The duration for strobe 2
Strobe 3 Duration (ms)	The duration for strobe 3

Create Custom OPC Inputs

You can create custom OPC inputs then read and write those input values from other VPM tool properties.

How to create a custom input

1. Click the Add Input button above the properties pane.
2. Click in the new input's name field and rename it. This is the name that the Impact OPC Server will use to read and write the input value. Refer to the OPC Server Reference for more details.

Read and Write OPC values

Since VPM tool property values cannot be directly linked to an OPC Data Access property value, you need to use a Data Set tool to push a value from a tool's property into the Data Access property. Data Access property values can be directly linked to a VPM tool property.

How to write to an OPC Data Access property value

1. Place a Data Set tool in the task.
2. In the Data Set tool, click the create link button on the Destination Port, then select the desired OPC Data Access property.
3. In the Data Set tool, click the create link button for the Value property, then select the property you want to link from the source tool.
4. When the Data Set tool runs, it pushes the desired value into the OPC Data Access property value.

How to read from an OPC Data Access property value

1. In the desired tool, select the desired OPC Data Access property.
2. Click the create link button.
3. In the OPC Data Access system object, select the desired OPC Data Access property.
4. When the tool runs, it reads the linked value from the OPC Data Access property.

CHAPTER 3

Vision Program Manager

Introduction to VPM

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

This chapter introduces VPM and describes how to configure the tools in the Toolbox.

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 Setup Tab” on page 2-20 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 Setup Tab” on page 2-37).

When you have completed the inspection task, you can view the results in VPM Display Mode, or create a custom user interface with CPM.

Start VPM

NOTE: Access to VPM is limited to users with an Administrator or Programmer access level. See “Impact Vision Device and Camera Security” on page 2-13 for details.

To start VPM:

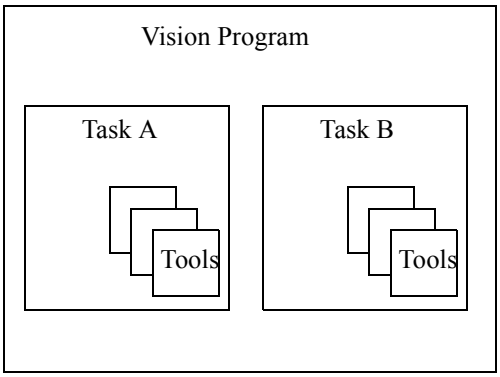
1. Double-click the VPM shortcut on the desktop.
2. When VPM starts, it automatically scans for Impact cameras and Vision Devices on the client’s network and displays the Vision Device Selection list. If the desired camera or Vision Device doesn’t appear in the list, click Refresh. If it still doesn’t 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.
   - **Connect to Vision Device**
     Select the desired Vision Device or Emulator, then click Connect. (See “How Impact Software Connecting Works” on page 1-7.) If security is enabled, the User Logon dialog is displayed. When a valid User ID and password have been entered, VPM tries to connect to the Vision Device or Emulator. If it is unsuccessful, a “connection failed” dialog is displayed. Multiple users can connect to one Vision Device or Emulator, but only one user at a time can edit programs or change data on it.
   - **User Logon dialog**
     Enter a valid User ID and password, then click Log On, to access the selected Vision Device or Emulator. Click Change Password to change a user password from this dialog. (See “To modify a password during logon” on page 2-15 for more details.)
   - **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 2-3 for more details.

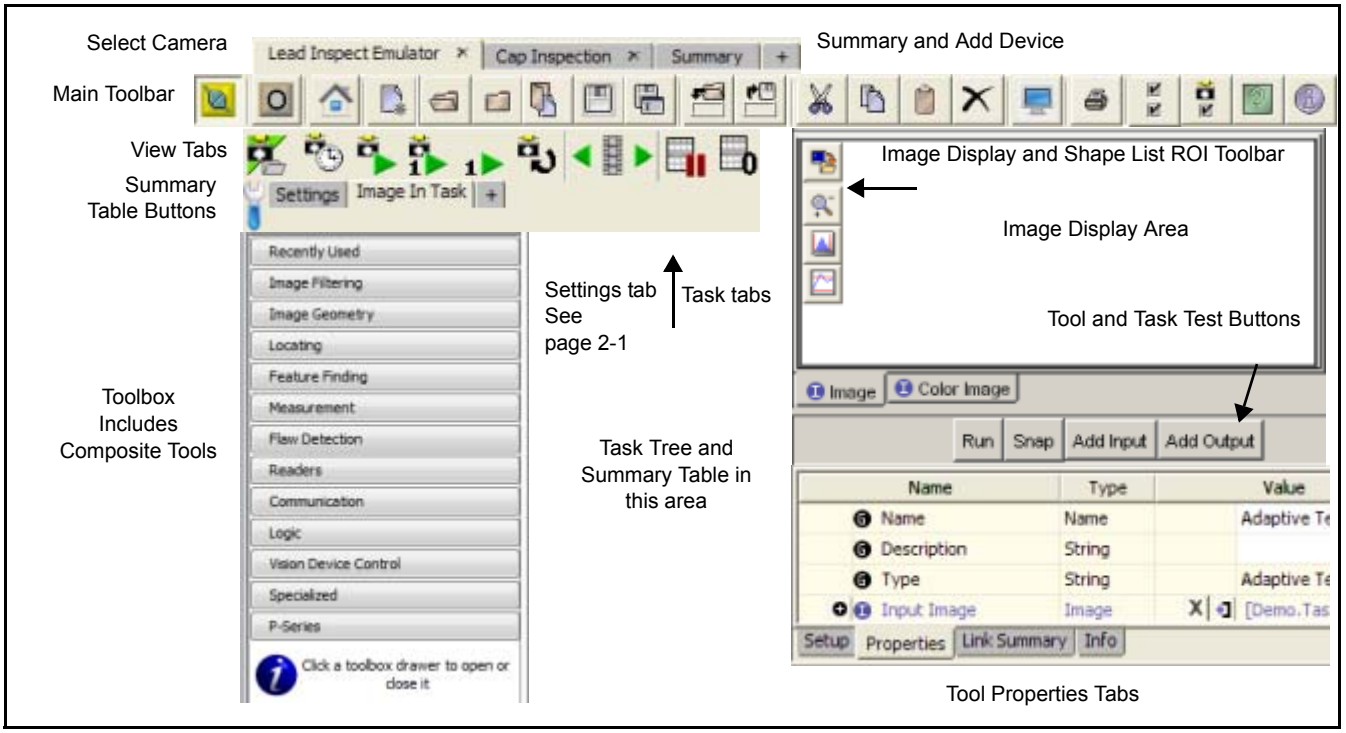
VPM - An Overview

VPM is used to develop vision inspection programs. These programs contain one or more tasks which are built from a variety of tools. Tasks can be developed to produce a certain result, then grouped together and called from other tasks to provide flexibility. This diagram shows the elements of a simple VPM vision program.



VPM User Interface

These are the primary areas in the VPM 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 3-40.


About VPM - See "About VPM" on page 3-10.


Add Template - See "Add a Template" on page 3-8.


Camera Preferences - See "Camera Preferences" on page 3-6 and page 3-9.


Connect to Vision Device - See "Connect to a Vision Device" on page 3-6.


Copy - See "Copy" on page 3-8.


Currently online/offline - See "Online/Offline" on page 3-7.


Currently using File Camera/Camera - This button is disabled when you are connected to an Emulator. See "Camera Setup Tab" on page 2-20 for setting up a camera. See "File Camera Setup Tab" on page 2-37 for setting up a file camera.


Cut - See "Cut" on page 3-8.


Delete (Links) - See "To delete a link" on page 3-30.


Delete Selected Items - See "Delete Selected Items" on page 3-8.


Delete All Character Models - (OCR and Character Contour Match tools) See "Character Contour Match" on page 3-201 or "OCR" on page 3-221.


Delete Character Model - (OCR and Character Contour Match tools) See "Character Contour Match" on page 3-201 or "OCR" on page 3-221.


Design Mode - This switches the view to Design Mode. See "Design Mode" on page 3-27.


Display Mode - This switches the view to Display Mode. See "Display Mode" on page 3-26.


Float Image Display - See "To float the Image Display Area" on page 3-16.


Help - See "Help" on page 3-10.


Histogram - See "Display Area Toolbar" on page 3-17.


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 3-11.


Inspection - See "Create a Vision Program" on page 3-30.


Line Profile - See "Display Area Toolbar" on page 3-17.


Link - (Links) See To Create a Link in "VPM Linking" on page 3-28.


Live Images - See "Live Images" on page 3-11.


Load - See "Load" on page 3-7.


New - See "New" on page 3-7.


Paste - See "Paste" on page 3-8.

 Pause Summary Table - See “Pause Summary Table” on page 3-12.

 Print - (Links) See “Link Summary - Tools” on page 3-25.

 Print Options - See “Print Options” on page 3-8.

 Print Preview - (Links) See “Link Summary - Tools” on page 3-25.

 Print to text file - (Links) See “Link Summary - Tools” on page 3-25.

 Program Preferences - See “Program Preferences” on page 3-9

 Reset Run Counts - See “Reset Run Counts” on page 3-12.

 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 3-11.

 Save - See “Save” on page 3-7.

 Save a Template - See “Save a Template” on page 3-8.

 Save As - See “Save As” on page 3-8.

 Save Image - See “Display Area Toolbar” on page 3-17.

 Select Program - See “Select Program VPM” on page 3-7.

 Show Advanced Browser - (Links) See “Link Summary - Tools” on page 3-25.

 Show/Hide Tools - See “Toolbox” on page 3-11.

 Show ROIs (Summary tab) - See “Summary Tab” on page 3-5

 Show Summary Table buttons - See “Show Tools” on page 3-12.

 Start/Stop Auto-trigger - See “Frame Trigger Tab” on page 2-22.

 Start/Stop Continuous Trigger - See “Start/Stop Continuous Trigger” on page 3-11.

 Task - See “Create a Task” on page 3-33.

 Tip - This icon indicates helpful text or a guide for what to do next.

 Tool branch - See “Branch” on page 3-261, “Group” on page 3-266, “Multiple Branch” on page 3-267, or “Pass Fail” on page 3-267.

 Tool Input property - See “Properties Tab” on page 3-24.

 Tool Method - See “Display panel” on page 3-23.

 Tool Output property - See “Properties Tab” on page 3-24.

 Trigger Once - See “Trigger Once” on page 3-11.

 Unload - See “Unload” on page 3-7.

 View Threshold - See “Threshold Viewer” on page 6-22.

 Zoom Character Models - (OCR and Character Contour Match tools) See “Change Image Calibration” on page 3-287 or “OCR” on page 3-221.

 Zoom Character Models to 100% - (OCR and Character Contour Match tools) See “Change Image Calibration” on page 3-287 or “OCR” on page 3-221.

 Zoom Image - See “Display Area Toolbar” on page 3-17.

 Zoom Image to 100% - See “Display Area Toolbar” on page 3-17.

 Zoom Image to Fit All ROIs - See “Display Area Toolbar” on page 3-17.

 Zoom Image to Fit View Area - See “Display Area Toolbar” on page 3-17.

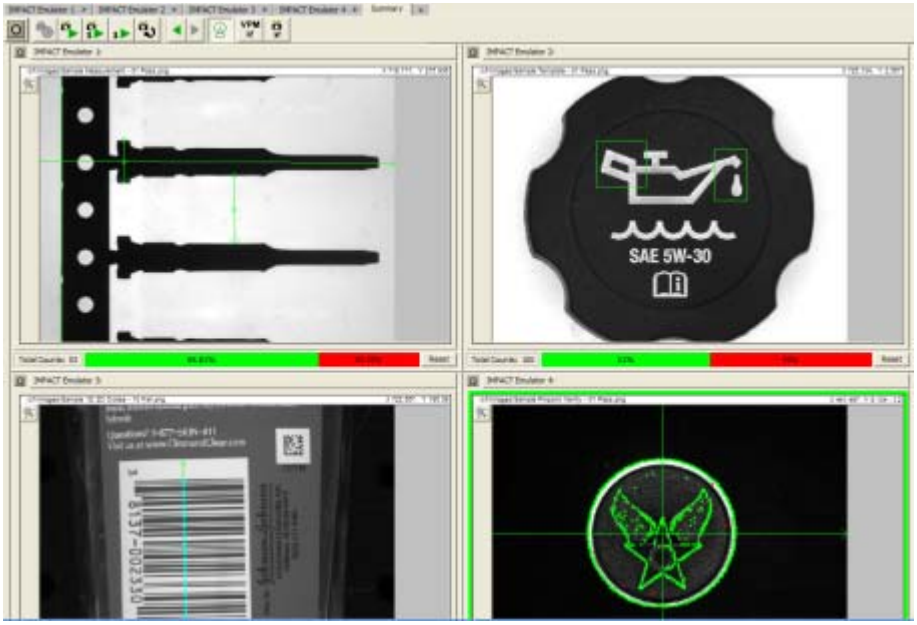
Select Camera

You can connect to multiple Vision Devices or Emulators with VPM. This row of tabs shows those that are connected. Click one of the tabs to select the desired Vision Device or Emulator. Editing a vision program on one Vision Device or Emulator while another one is online and triggering may cause unexpected results. Multiple users can connect to one Vision Device or Emulator, but only one user at a time can edit programs or change data on it.

Summary Tab

Tip: If the Summary and Add Device tabs are not visible, check the “Hide Camera Tabs” setting in Program Preferences (see page 3-9).

The Summary tab provides a summary of the inspection results from all the Vision Devices and Emulators currently connected to VPM.





Show ROIs

The Show ROIs button turns the ROI display on and off for all images on the Summary tab.



Program Preferences

See “Program Preferences” on page 3-9.



Camera Preferences

This dialog indicates the width and height of the current VPM window display in pixels. If the Auto-fit to window check box is checked, VPM automatically adjusts the window display size to the current monitor resolution. If you change the values, VPM adjusts the Summary tab display accordingly.

Total Counts, Pass/Fail bar graph, and Reset

This area displays the pass, fail, percentage, and total counts from the first Pass/Fail tool in the ImageIn task. (You must include a Pass/Fail tool in the task to display this area.) Click the Reset button to set the counts to zero.

Add Vision Device tab



Add Vision Device tab

You can connect to multiple cameras with VPM. If you are already connected to one or more, click the Add Camera tab to add another connection. When you click the tab, a dialog is displayed where you can select the desired camera. See “Choose a Vision Device or Emulator” on page 1-4.

Main Toolbar-VPM

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



Connect to a Vision Device

Click the Connect button to connect VPM to a Vision Device or Emulator. (See “Choose a Vision Device or Emulator” on page 1-4 and “How Impact Software Connecting Works” on page 1-7 for more details.) When you are connected to a Vision Device or Emulator, the button changes to the Disconnect button. If you close VPM while you are connected to a Vision Device or Emulator, you see the following prompt. If you click Yes, VPM automatically reconnects to that Vision Device or Emulator the next time VPM starts. If you click No, the Device Connect dialog is displayed the next time VPM starts.



Editing a vision program from multiple VPM instances

The first VPM instance to connect to a Vision Device or Emulator acquires exclusive editing privileges on it. Other Impact instances can connect to the Vision Device or Emulator and display data (Read Only mode), but they cannot modify its vision programs. (See “Special Case Editing” on page 4-3.) When a second VPM

instance connects to that Vision Device or Emulator, the following dialog is displayed (WORKSTATION2 is the network name of the computer running the currently connected VPM instance).



When the first VPM instance disconnects from the Vision Device or Emulator, another VPM instance can connect to it and edit on it. If that second VPM instance had already connected, it must disconnect from the Vision Device or Emulator, then reconnect.

If Display Mode is selected in the first VPM, Display Mode in the second VPM is enabled and the second VPM can access and modify some values in Display Mode.



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 tasks that are loaded are executed when they are triggered by their selected trigger events. If you try to exit VPM 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), tasks that are loaded remain loaded, but the Vision Device or Emulator does not accept hardware triggers and VPM 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 multiple tasks. See “Create a Vision Program” on page 3-30 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 (A30, P-Series, and T4x-Series), client PC (A30, P-Series, and T4x-Series and Emulator), or processor (M-Series and MX-U Series Vision Device and Emulator). They may also be loaded from Settings - File Manager - Setup.



Unload

This closes the currently selected vision program and unloads it. On the A30, P-Series, and T4x-Series it remains stored in the camera’s memory.



Select Program VPM

Click the button to show the list of vision programs that are currently loaded in. Select a program to view, modify, or run it.



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 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. You can save the file with password protection. See “Vision Program Security” on page 3-32. This button is disabled if the file is password protected.



Add a Template

This loads a previously saved vision program template. This button is disabled if the file is password protected.



Save a Template

This saves the currently selected tool or tools to a template file that you can then load for use in other tasks. This button is disabled if the file is password protected.



Cut

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



Copy

This copies the selected tool to the system clipboard. This button is disabled if the 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 3-29 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 Setup Tab” on page 2-39. This button is disabled if the vision program file is password protected.



Display Mode

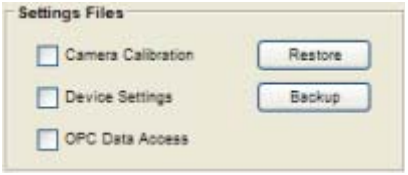
This switches the view to Display Mode. See “Display Mode” on page 3-26



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, Device Settings, and/or OPC Data Access). 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, Device Settings, and/or OPC Data Access). 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 6-32.

- **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 3-28 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 3-29 for more details.
- **Auto-update links**: All tool links are automatically updated when the tool is run or selected. If this is not selected, linked data is not updated unless the Update Links button in a tool is clicked.
- **Use small icons**: Small program and tool icons are displayed.
- **Hide Camera Tabs** - The Select Camera, Summary, and Add Camera tabs are hidden. You can choose this option to save screen space if you are only working with one Vision Device or Emulator.
- **Save compressed vision program files**: Compresses the vision program file into a smaller file when it is saved. Compressed files load and transfer faster. When a file is saved with password protection, it is automatically compressed. See “Vision Program Security” on page 3-32.
- **Show Tool Tips on image**: VPM 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 uses Window’s default text size for all displayed text. If Custom is selected, you can enter the font size you want VPM to use. If you are using VPM 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 ““On-Screen Keyboard” on page 6-32.



Camera Preferences

- **Display Refresh Rate:** The rate at which the Summary Table and Display Mode values are refreshed while VPM 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 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. 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 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 3-12).

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 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 3-22).

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



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

Design Mode

NOTE: The Design Mode button is hidden when the Summary tab is selected.

Toolbox



Show/ Hide toolbox

The toolbox contains all the vision programming tools in VPM. 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 3-40.

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 that has the Trigger Event type set to Image In Event. (See “Trigger Event Types” on page 3-36 for more details.)



File Camera or Camera

Click this button to switch between File Camera and Camera mode. See “File Camera Setup Tab” on page 2-37 for details about the File Camera. See “Camera Setup Tab” on page 2-20 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 2-22.



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 3-14).



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 tasks or tools are run in this mode.

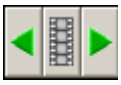
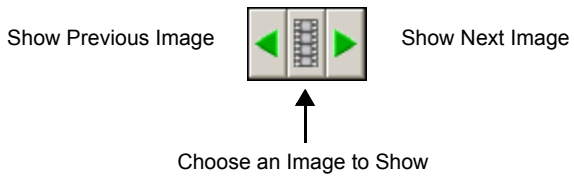


Image History

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 3-9).





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, tasks 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 3-11)



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 a task or the Settings tab. If the number of tasks exceeds the list area, click the left arrow on the Task Chooser to select the first task in the list, or click the down arrow to select any other task.



New Task

When you click this tab, a task is added to the currently selected vision program. (See “Create a Task” on page 3-33) This tab is disabled if the file is password protected. When you add a task, a new task tab is created.

Summary Table

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



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 3-11)

The table refresh rate is determined by the Summary Table Refresh Rate (See “Program Preferences” on page 3-9), 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.

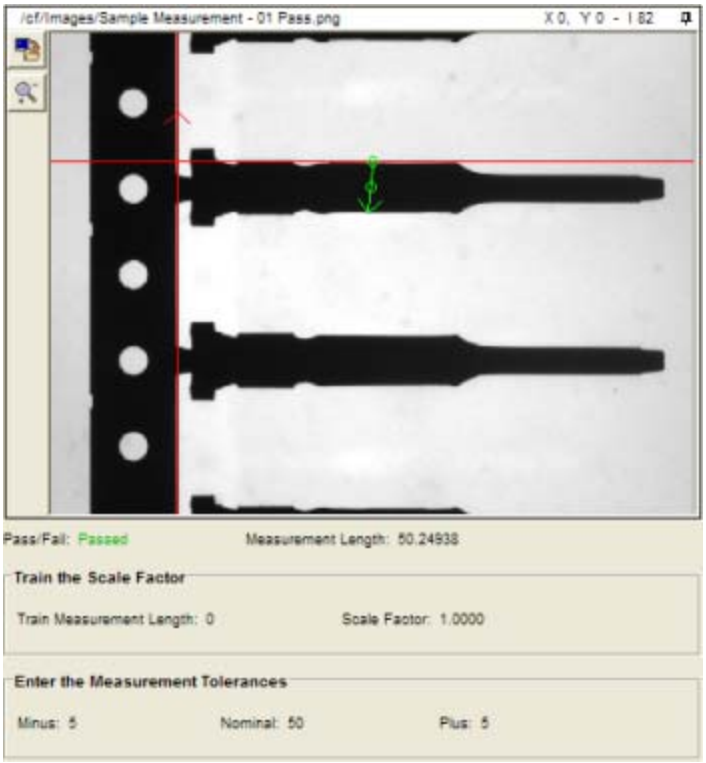
NOTE: The task times listed here are intended only for relative time comparisons between tools and other task settings. The times differ for a Vision Device, Emulator, and camera.

- **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

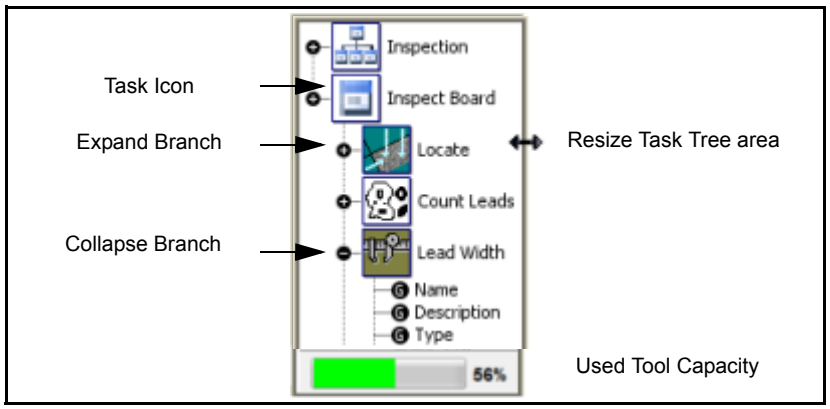
If you click the Start/Stop Continuous Trigger button, the Results Display is shown. This shows a summary of results from a tool or task you select. You cannot modify any tool settings while the Results Display is shown. (See “Start/Stop Continuous Trigger” on page 3-11.)

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.



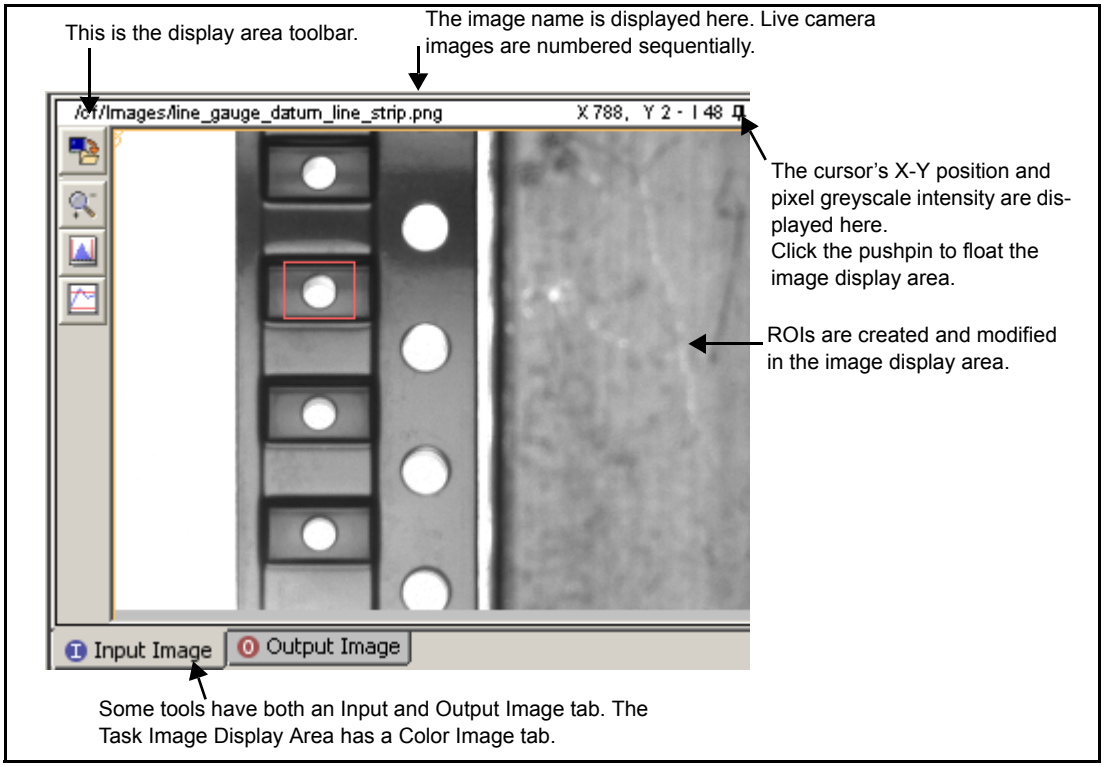
Expand or collapse branches: Some tools, like the Branch tool, have branches that can be expanded and collapsed. Click the Expand or Collapse icon to view the branches.

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. (P-Series camera only.)

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. To reset the image number, see the Next Image Number property on the Camera Properties tab (page 2-17).

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 3-9. To auto-save images, see "Program Preferences" on page 3-9.

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.



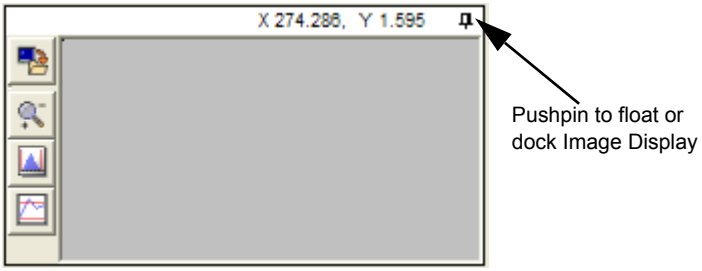
To acquire an image

1. Select the task icon.
2. Click the Setup tab, then click the Options button.
3. Select the Task Type - Triggered By This Event radio button.
4. From the drop-down, select Image In Event if it is not already selected. You should only have one Image In Event task in a program.
5. Click the Trigger Once button in the Summary Table Buttons toolbar. 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 3-11.) Color images are displayed only on the Color Image tab.

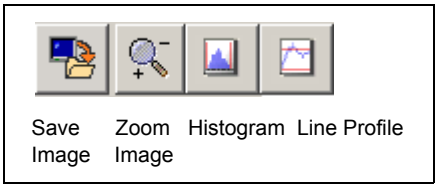
You can "float" the Image Display area to make it larger so you can see it better or move it to a second monitor so you can see it while you create or move ROIs. The float option is not available on the Setup tab.

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.

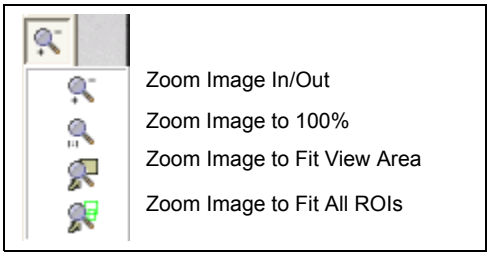
NOTE: In order for the image calibration information to be saved and later used in the File Camera, the image MUST be saved in png format without graphics.



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.



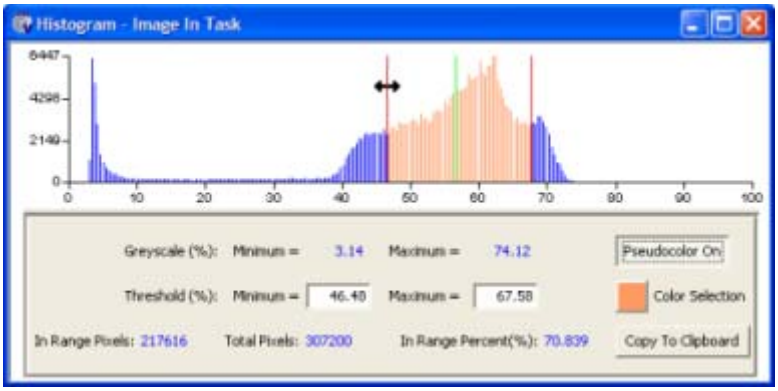
- **Zoom Image In/Out**
  When you click this button, it stays depressed until you click it again. To zoom in (up to 1600:1), left click on the part of the image you want to magnify or roll the mouse wheel button toward you. To zoom out (down to 12.5:1), right click on the part of the image that you 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: The Histogram and Line Profile views are not available for color images. 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 VPM tool “sees” the image (example below). For a detailed explanation of the Threshold Viewer, see “Threshold Viewer” on page 6-22.



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.

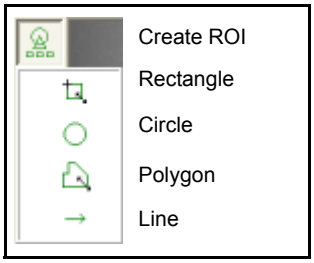
Typically, ListROIs are "locked" by a tool setup so, though many types of ROIs can be displayed to show the results of setting up the tool, editing ROIs is restricted to those ROIs that represent a single tool property.

Shape List ROI Toolbar

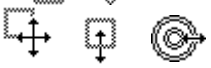


When you select the Shape List input in the list of tool inputs, this toolbar is displayed. These tools are used to create ROIs, cut, copy, paste, and delete selected ROIs, save images, zoom in and out on the image, and view a histogram or line profile. For more details, also see “Display Area Toolbar” on page 3-17.

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 3-17).

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 3-17).

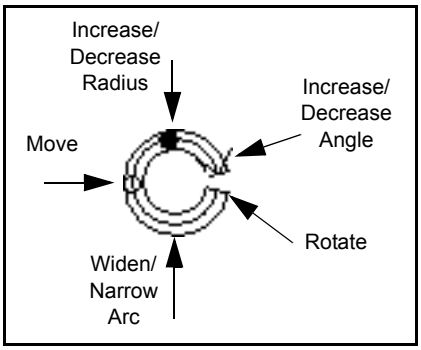
Circular Arc ROIs

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.

Tool and Task Test Buttons

You can use the buttons in this area to run a tool or task, update tool links, and train a tool, depending on the tool type. These buttons are displayed on the Properties tab only.

Run button: When you click this button, the task or tool runs just as it does when the vision program is run, but it runs only one time. (An image must be displayed in the image window.) If Auto-update links is selected in Program Preferences, all values linked to the tool (including the image) are updated before the tool runs. If auto-update links is not selected, you should click the Update Links button before you run the tool. You can also click the Run Once on Current Image button on the Summary Table buttons.

Snap button: This button is displayed only when "Image In Event" is selected as the task Trigger Event type. When you click this button, the camera is triggered and an image is acquired, or a file camera image is loaded. You can also click the Trigger Once button on the Summary Table buttons.

Update Links button: When you click this button, all values linked to the tool are updated, but the tool does not run. (This button is not displayed if the Auto-Update Links check box in Program Preferences is checked.)

Add Input button: This button is only displayed for the task and the Data Transfer tool. Click it to add inputs to the task or the Data Transfer tool (see “Data Transfer” on page 3-289).
When you add an input to the task, that tool property is “promoted” to the task level and becomes a property of the task also. This allows you to “aggregate” only certain properties from multiple tools into the task level.

NOTE: If a tool property with an “Origin” data type and the name “Tool Origin” is promoted to the task level, all other promoted ROIs (including other Origins) are placed on the image relative to that first promoted Origin when viewed from the task level. This may or may not be the Origin that is used by the tool and that is displayed on the image when the tool is selected. This situation does not affect the tool’s ROI when the tool runs.
If you change the name of the first promoted Origin from “Tool Origin” to something else, all the ROIs are placed on the image relative to an origin of (0,0)0 when viewed from the task level.

Add Output button: This button is only displayed for the task. Click it to add outputs to the task. When you add an output to the task, that tool property is "promoted" to the task level and becomes a property of the task, also. This allows you to "aggregate" only certain properties from multiple tools into the task level.

Train button: This button is only displayed for tools that can be trained. Training a tool sets up the necessary variables with a known good image so the tool runs properly.

Synchronize with task button: This button is only displayed for the Call Task tool. If you change the called task, click this button to synchronize the Call Task tool inputs and outputs with the changes in the called task.

Enter Password: This button is only displayed when you load a vision program that is password protected. Click this button to enter the password and open the program for editing, printing, or viewing.

Setup Tab

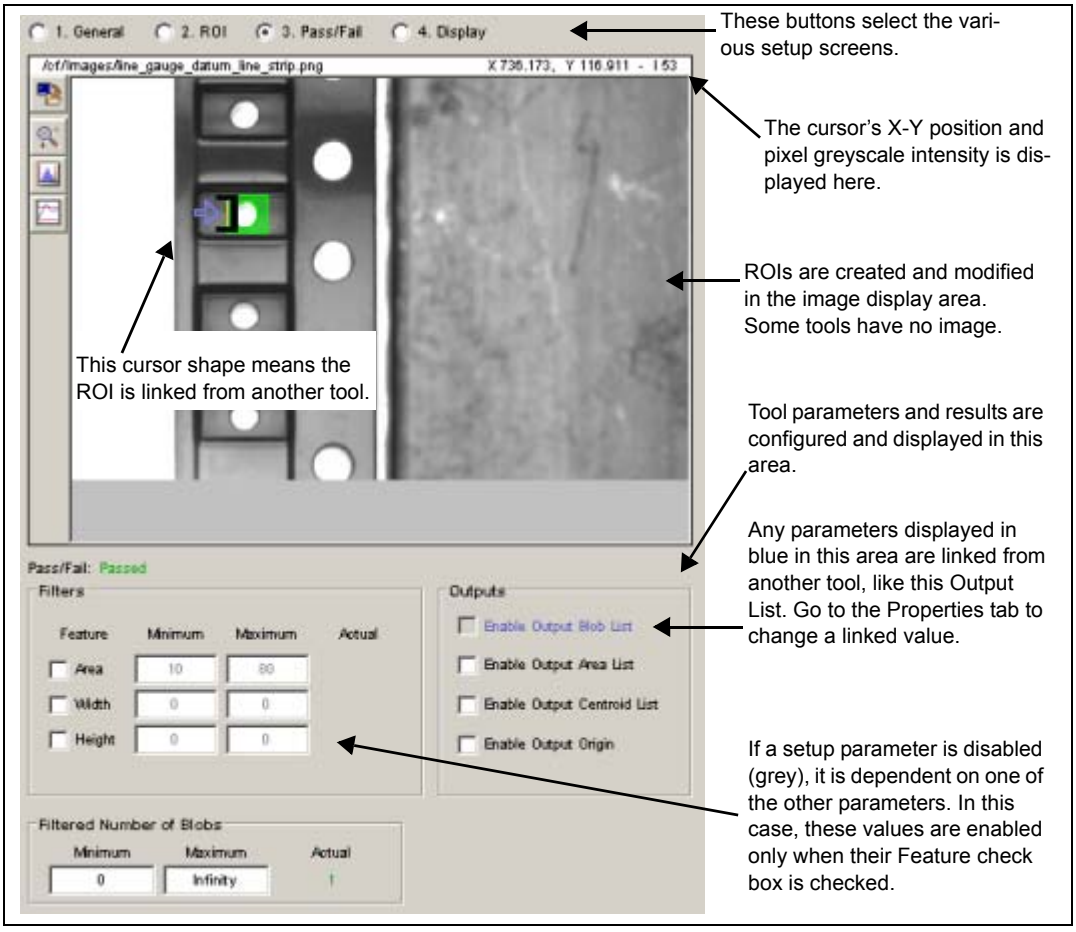
A task or tool’s Setup guides you through the steps necessary to configure the most common properties needed to use the task or tool effectively. You may have to use the Properties tab to configure other properties in the tool or adjust those defined by the Setup to get the tool to work with your specific application.

Each Setup tab has multiple choices (panels) where different parts of the task or tool are configured. If the Setup tab is disabled, another VPM program may be editing the vision program.

As you select different tools, the tab you most recently selected (Setup, Properties, etc) is automatically selected if the tool has a Setup.

NOTE: Some tools have only a General and Display panel. For those tools, you need to click the Properties tab to configure the tool.

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

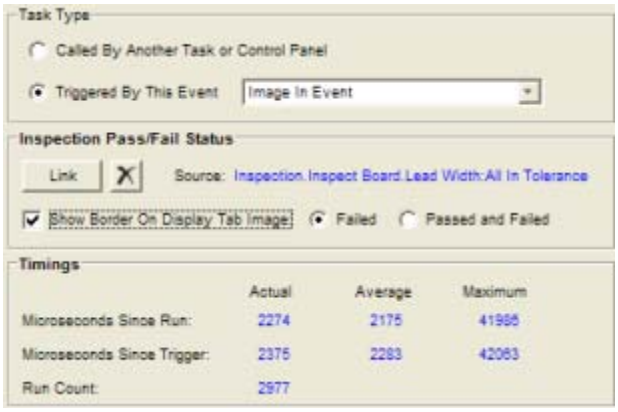


General panel

For tasks and for tool's without a Setup, you can modify the name here. For tool's with a Setup, see each tool's description (starting on page 3-40) for more details.

Options panel

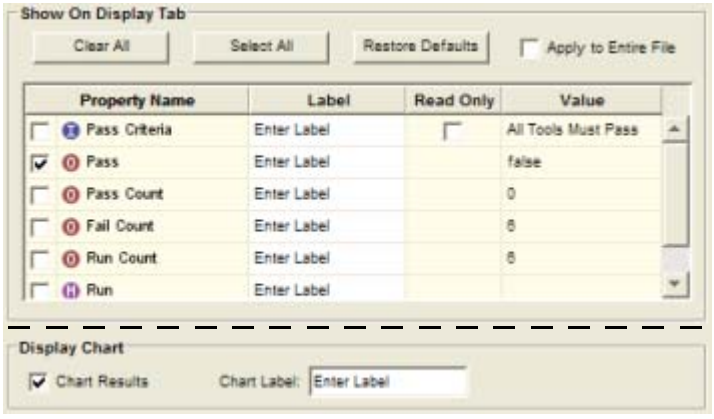
Only tasks have this panel. Here you can define how the task operates.



- **Task Type**
  Called By Another Task or Control Panel: If this task is called by another task or triggered from a Control Panel, choose this option.
  Triggered By This Event: If this task is triggered by an event or hardware trigger in the Vision Device or Emulator, choose this option, then select the Trigger Event type from the drop down list. See “VPM Task Configuration” on page 3-34 for details about Trigger Event types.
- **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 3-9).
- **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** - See the Output table at “VPM Task Configuration” on page 3-34.

Display panel

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



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 tasks 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.

Properties Tab

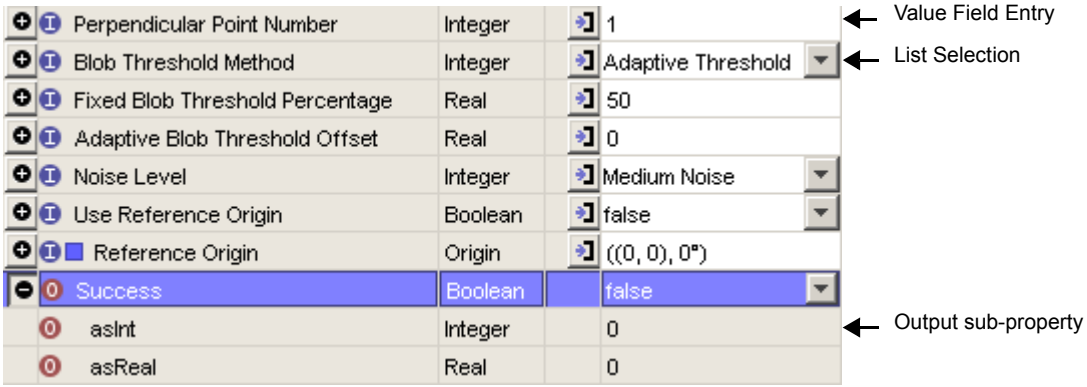


In this area you view and define a tool or task's properties, including its input values. Input properties are configured in different ways, including defining them on the Setup tab, entering them directly into the value field, linking them into the value field, or selecting the values from a list. Details about each tool's properties begins on page 3-40. Task properties begin on page 3-34.

For properties that display or contain real numbers, any number less than 0.001 is displayed in scientific notation. For example, the number 0.00123 is displayed as a fixed point number (0.00123), but the number 0.000123 is displayed in scientific notation (1.23e-4). At least four significant digits are always displayed.

Outputs are also listed on the Properties tab. Data can be linked between outputs and inputs, depending on the data type. Links can be viewed on the Link Summary tab (see "Link Summary - Tools" on page 3-25).

If an input or output has a small plus sign to the left of the name, you can view the sub-properties and all the available data types of those properties. For example, if you click the plus sign of the Success property in the Origin tool (a Boolean data type), other data types for that property are displayed.

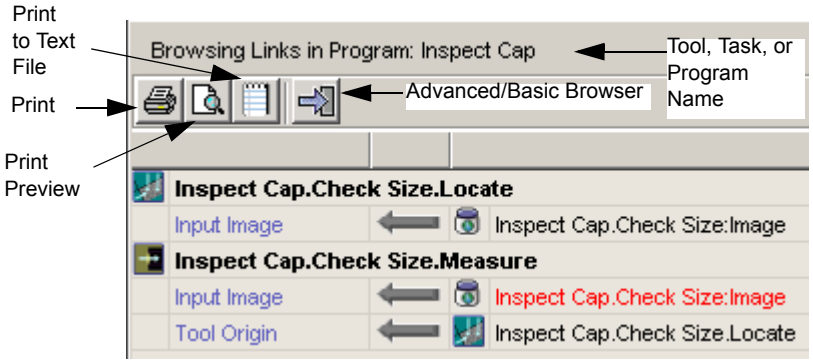


If you select a property or sub-property, then right-click, you can copy the program, task, tool, and property name to the system clipboard. This string can then be used in system commands. For example, see "HTTP Commands" on page 6-1.)

Link Summary - Tools

The Link Summary tab window displays information about links to and from the currently selected tool, task, or program. Click the Advanced Browser button to display the data type and value.

To open the Link Browser window, click the Link tab.



To expand the browser window to include additional fields, click the Advanced Browser button. The link direction arrow points from the source to the destination.

The following fields are displayed in the browser window, from left to right.

- Icon and name of the currently selected program, task, or tool
- Source/Destination value name
- Source/Destination value (advanced browser)
- Link direction arrow
- Icon and name of the Source/Destination tool
- Source/Destination value (advanced browser)
- Source/Destination data type (advanced browser)

The color of the Source/Destination value name indicates the link's status:

- Regular links - blue
- Data Set links - purple
- Unresolved links (due to a program not being loaded) - red
- Broken links - blank

To preview a printed list of all the link information, click the print preview icon. To print the list, click one of the print icons.

To expand any column to the match the length of the data in the column, click the column header. You can also click on the column divider on the column header and drag the column to the desired width.

Info Tab

The Info tab is only available on tools with a Setup. It provides additional information and help on how to configure the tool.

Display Mode

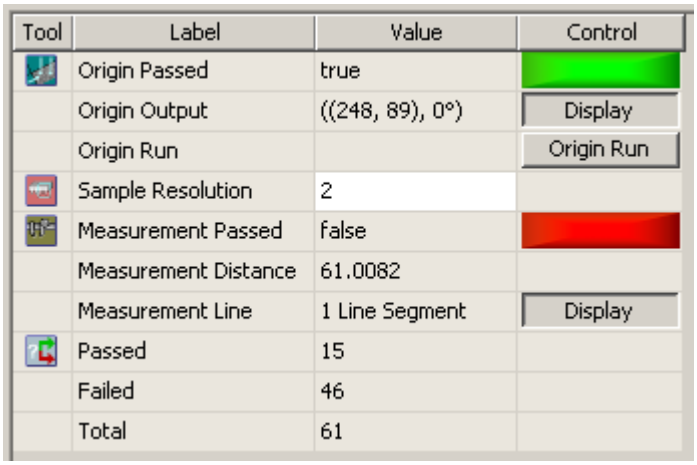
NOTE: The Display Mode button is hidden when the Summary tab is selected.

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 Setup tab, click the Display button, then select the Train method on the Show in Display Mode panel. See “Display panel” on page 3-23.)

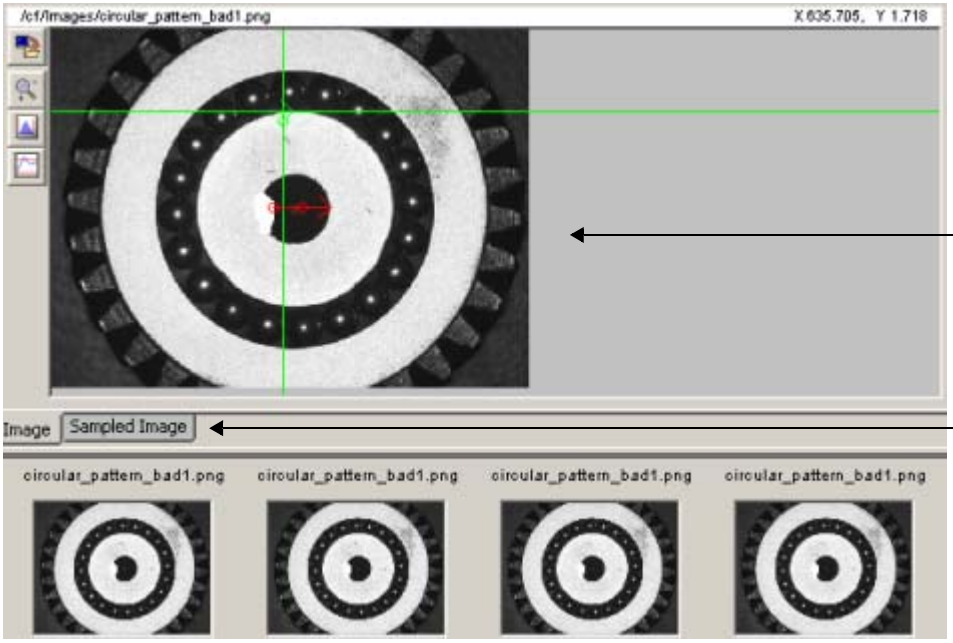
Display Mode provides a runtime display for a program’s tool properties. You can select which properties are shown in Display Mode (see “Display panel” on page 3-23). The following examples show the various parts of Display Mode for a task containing the following tools: Origin, Image Sampling, Line Gauge, and Pass Fail. To save images displayed in Display Mode, see “Program Preferences” on page 3-9.



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 Display panel in the indicated tool’s Setup tab.
- **Label** - This label is defined on the tool Setup tab - 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 3-23). 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.

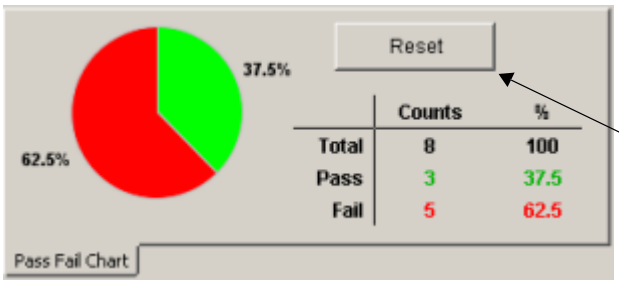


The Image display area (the image float option is not available here)

Current Image

Tabs for tools with image and library outputs

Four most recent images



The Chart display area (to enable, see "Display panel" on page 3-23)

Click Reset to reset the tool's counts

Output Tabs

Some tools, the Binary Image Filter for example, have an Output Image. The OCR and Character Contour Match tools have a character library output. The libraries can be modified here if they have not been marked Read Only (see "Display panel" on page 3-23). These outputs are displayed in the Output tab area.

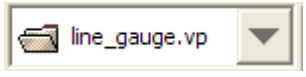


Design Mode

Click this button to switch the view from Display Mode to Design Mode. See "Display Mode" on page 3-26.

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 Setup Tab" on page 2-39. 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. IMPORTANT: File names are case sensitive.

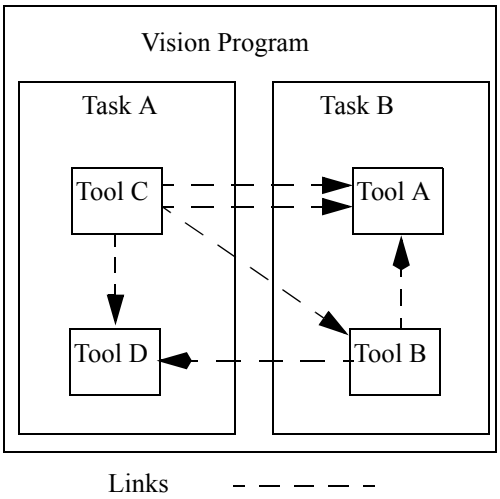
When you select a new Vision Program file from the list, the current Program (and the Vision Program file) is unloaded and the selected one is loaded.

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 3-31 for more details.

VPM Linking



In VPM, links are the data connections between tools and tasks. They are made in the destination tool’s Input and Output tabs. They can only be made between compatible data types. For example, you cannot link an integer data type output directly into a real data type input. Inputs can be linked to inputs or outputs, but outputs can only be linked to inputs (they are source only).

Links Between VPM 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.

1. Task inputs and inputs promoted to the task level of color image or image data types.

2. The tools in the task are searched in execution order until one is found that has an Image data type output. In the case of Data Instance tools, the inputs are searched.

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 in the following order:

1. Inputs or outputs promoted to the task level of origin data types.

2. The tools in the task are searched in execution order until one is found that has an output origin that is not "Relative To Tool." In the case of Data Instance tools, the inputs are searched.

NOTE: Any time the link source is changed, 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 situations may occur.

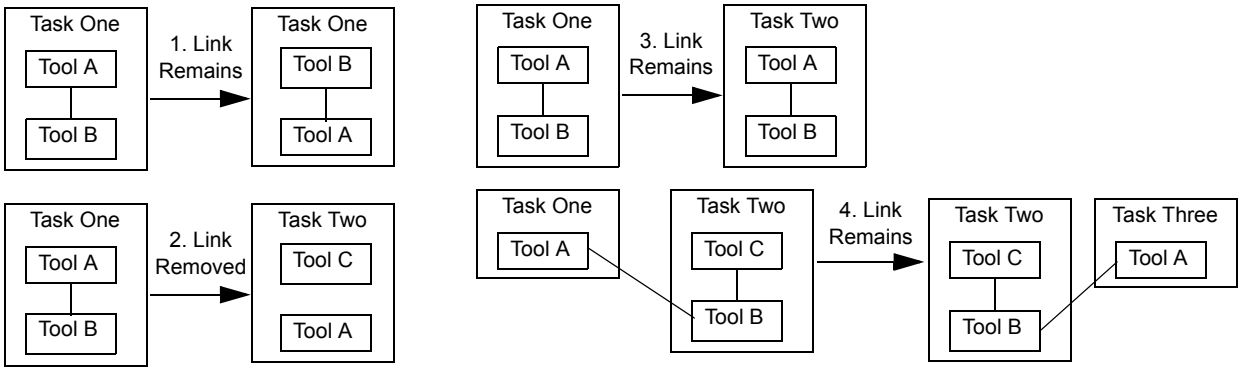
1. Tool A and Tool B are linked to each other in the same program and task. When Tool A is copied or cut, then pasted into the same task, the link remains.

2. Tool A and Tool B are linked to each other in the same program and task. When Tool A is copied or cut, then pasted into a different task or program, the link between them is removed.

3. Tool A and Tool B are linked to each other in the same program and task. When Tool A and Tool B are copied or cut, then pasted together into another task or program, the link between them remains.

4. Tool A is linked to Tool B which is in a different task. When Tool A is cut or copied, then pasted into the same or different task as Tool B, the link remains.

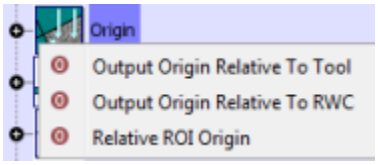
NOTE: If the Program Preferences setting **"**Automatically link tool image input**"** is checked, a new link to the task image is made when a tool with an input image property is pasted, just as if the tool was added from the toolbox.



To create a link


Create 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 access additional properties, click the plus sign to the left of tool. 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


Delete link

1. Click the desired tool in the tool tree.
2. Click the Delete Link button next to the link, or click the Properties tab then 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



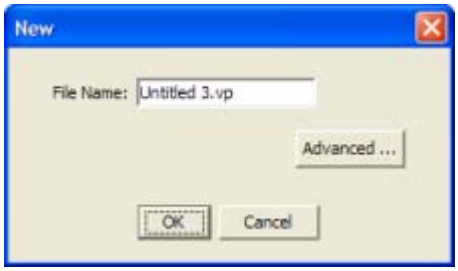
Vision Programs are saved in a Vision Program file (with a ".vp" file extension) which is stored in flash memory (A30, P-Series, and T4x-Series.) or on the hard drive (M-Series and MX-U Series). Each Vision Program file must have a unique name.

Each Vision Program file contains a Program which is a collection of one or more tasks. You can open (or load) multiple Vision Program files in VPM, but each Program name that is loaded must be unique. When

you open a Vision Program file, its Program (which includes the tasks) is loaded into the camera, Vision Device, or Emulator.

To create a vision program

1. Start VPM.
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. To assign a different Program name, click the Advanced button. The program name can be filtered by the Program name entered in Display Mode Program Filter field in the File Manager. See “File Manager Setup Tab” on page 2-39. IMPORTANT: Program names are case sensitive.
3. Click OK to create the Vision Program file.
4. Add and create tasks as desired. (See “Create a Task” on page 3-33.)
5. Click the Save button in the toolbar.

Advanced Vision Programs

You can create Vision Program files that contain supporting Programs. These files are sometimes called recipe files.

To create a supporting file

1. Start VPM.
2. Click the New button in the main toolbar. Enter an Inspection File Name. IMPORTANT: File names are case sensitive.
3. Click the Advanced button in the New File dialog. The following dialog is displayed.



4. Click the Supporting File radio button.

5. Enter a name in the Program Name field. The program name can be filtered by the Program name entered in Display Mode Program Filter field in the File Manager. See “File Manager Setup Tab” on page 2-39.
6. Click OK.
7. Add and create tasks as desired. (See “Create a Task” on page 3-33.)
8. Click the Save button in the toolbar.

Vision Program Security

You can password protect a vision program when you save it. A password protected file is automatically saved in compressed binary format and the program cannot be edited, printed, viewed, or saved.

NOTE: Vision Program security protects the vision program from unauthorized access. Camera security protects the Vision Device or Emulator from unauthorized access. (See page 2-13.)

To password protect a vision program

1. Click the Save As icon in the main toolbar.
2. In the Save As dialog, click the Advanced button.
3. Check the Save With Password Protection check box.
4. Enter and confirm the desired password.
5. Click OK.

To edit, view, or print a password protected vision program

1. Load the password protected program
2. Click Enter Password below the image window.
3. Enter the password and click OK.
4. If you edit the program, then save it, the program is still password protected when you close it.

To remove password protection from a vision program

1. Load the password protected program
2. Click Enter Password below the image window.
3. Click the Save As icon in the main toolbar.
4. In the Save As dialog, click the Advanced button.
5. Clear the Save With Password Protection check box.
6. In the File Name field, enter the existing vision program name, or a new one. IMPORTANT: File names are case sensitive.
7. Click OK.

Vision Program Properties



To access the vision program properties, click on the Vision Program icon, then select the properties tab. To modify a property, click in the value field.

General Properties Name	What it is
Program Name	The name of the Vision Program. This is not the vision program file name (see “To create a vision program” on page 3-31). Names are case sensitive.

General Properties Name	What it is
File Name	The name of the Vision Program file. Names are case sensitive and should end with the vp file extension.
Abort On Error	If True, the program stops running when the Task Timeout value is reached or one of the tools in the task aborts due to an error. If an Abort Task is defined in the task properties, that Abort task is queued to run. If False, then the task keeps running and any remaining tools abort and fail. (See “Enable Timeout” on page 2-7 and “VPM Task Configuration” on page 3-34.) NOTE: This property applies only to tasks in a program that have the Trigger Event type set to Image In Event and is effective only while the Vision Device or Emulator is online and triggering.

Output Name	What it is
File Name	The name of the Vision Program file. Names are case sensitive and should end with the vp file extension.

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. When you call a task (with the Call Task tool), the called task finishes before control is returned to the calling task.

To create a task


Add a task

1. Start VPM and connect to a camera.
2. Open the desired vision program, or create a new one.
3. Click the Add a Task button. A new tab is added below the program list. See page 3-34 for task configuration details.
4. Click the task icon and enter a name for the task, if desired.
5. 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.
6. Continue to add and configure the tools you want in the task to create the desired program. (See page 3-40 for tool configuration details.)
7. To delete a tool, select the tool in the tool tree, then click the Delete tool button in the VPM toolbar.
8. To move a tool in the task tree, click and drag the tool up or down to the desired location.
9. 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 button or 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.

VPM Task Configuration


Task Icon

A task is a collection of tools. It runs based on a user-selected external (hardware) or internal (software) occurrence. Multiple tasks can be combined into a Program. Every task has general properties and common outputs. To access the Sub-properties of each Input property, click the plus sign to the left of the name.

General Property Name	What it is
Name	The name of the task. Names are case sensitive.
Description	A task description
Trigger Event	When the selected Trigger Event occurs, the task is immediately queued to run next. See “Trigger Event Types” on page 3-36.
Abort Task	A task can abort when one of the tools in the task aborts due to an error, or when a Task Timeout occurs. If the task aborts, and Abort on Error is True, the Abort Task named in this property is immediately queued to run. (See “Enable Timeout” on page 2-7 and “Vision Program Properties” on page 3-32.)
Run On Load	If True, this task is queued to run one time immediately after it is loaded (whether the Vision Device or Emulator is online or not). When programs are set to load on startup, all programs are loaded before any tasks that have this property enabled are run. The order of execution of multiple tasks with Run On Load enabled is not specified.

VPM Task Inputs

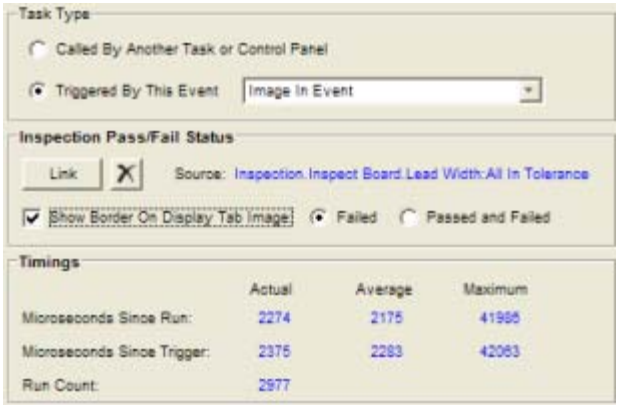
Each trigger event type has unique inputs which are listed in the following pages after each event type.

Output Name	What it is
The task times listed in this table are intended only for relative time comparisons between tools and other task settings. The times differ for a Vision Device, Emulator, and camera.	
UsecsSinceRun (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.
Average UsecsSinceRun	The average of all UsecsSinceRun values since the last count reset
Max UsecsSinceRun	The maximum UsecsSinceRun value since the last count reset

Output Name	What it is
UsecsSinceTrigger (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.
Average UsecsSinceTrigger	The average of all UsecsSinceTrigger values since the last count reset
Max UsecsSinceTrigger	The maximum UsecsSinceTrigger value since the last count reset
Run Count	The total number of times the task has run since the last count reset
Trigger Timestamp Usecs	When a camera trigger or other input event occurs, a Timestamp is recorded and attached to the image or other input data (in microseconds).

How to set up a task

1. Click the task icon.
2. Click the General button on the Setup tab to enter a task name.
3. Click the Options button to define how the task operates.



- **Task Type**
  Called By Another Task or Control Panel: Select this radio button if this task is to run when it is called by a Call Task or from a control panel Run method. There is no Trigger Event for this task.
  Triggered By This Event: Select this radio button if this task is to run when an external hardware or internal software event occurs (for example, an electrical signal or an event from the Scheduled Event tool).
- **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 3-9).
- **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.

Trigger Event Types

To choose a trigger event type, click the drop-down arrow at the right end of the Value field and select the desired event. When the selected event occurs, the task is put into a queue of tasks that are executed in "first in, first out" order.

- None: If this is selected, the task is not queued by any of the listed event types. It is queued only when it is triggered from a control panel or by another task calling it.
- Online Event: When the Vision Device or Emulator goes Online, the task is immediately queued to run.

Input Name	What it is
Name	The name of the Vision Device or Emulator that went online.
onlineState	If True, the Vision Device or Emulator went online.

- Offline Event: When the Vision Device or Emulator goes Offline, the task is immediately queued to run.
- Program Closed Event: The task is queued to run after the program listed in the Program Name property is closed (unloaded) by another task.
- Bad Image Event: The task is queued when an error is generated during image acquisition. This can include communication errors, CRC errors, and out-of-buffer-space errors, among others. This event provides an additional input:

Input Name	What it is
statusBits	The bit map of the image acquisition error message

- Image In Event: The task is queued when an image has been acquired and is ready for processing by the Vision Device or Emulator. This is the default for the first task added when a program is created. If multiple tasks use this event type, they will be queued in alphabetical order. This event provides additional inputs.

Input Name	What it is
Image	The non-color camera or file image used by the task. The image may be acquired with a software or hardware trigger, or when the Snap button is clicked.

TIP: Image In Event must be selected for at least one task in a vision program to be able to snap an image during task edit.

Input Name	What it is
Color Image	The color camera or file image used by the task. The image may be acquired with a software or hardware trigger, or when the Snap button is clicked. Click the plus sign to the left of the property to access non-color versions of the image similar to using a color filter or color light with a non-color camera. Also see “Color Image Sub-Properties” on page 3-40.
Trigger ID	A negative Trigger ID number is automatically assigned if the image is from a camera or the file camera. The Camera Trigger tool can only assign a positive Trigger ID number.

- Image Trigger Event FE and RE: The task is queued by both the rising and falling edges of a hardware trigger on the Impact camera’s Camera trigger input. This option is not available for M-Series and MX-U Series processors or cameras.

- Camera Connected Event: The task is queued when a camera is connected. When the event happens, the device is put online if it was online when a Camera Disconnected event happened. T his option is available only for M-Series and MX-U Series cameras.

- Camera Disconnected Event: The task is queued when a camera is disconnected. If the camera is online when the event happens, the camera is put offline. This option is available only for M-Series and MX-U Series cameras.

- Image Trigger Event FE: The task is queued by the falling edge of a hardware trigger on the Impact camera’s Camera trigger input. This option is not available for M-Series and MX-U Series processors or cameras.

- Image Trigger Event RE: The task is queued by the rising edge of a hardware trigger on the Impact camera’s Camera trigger input. This option is not available for M-Series and MX-U Series processors or cameras.

- Input Event FE and RE: The task is queued by both the rising and falling edges of a hardware trigger on the Impact camera’s Event input.

- Input Event FE: The task is queued by the falling edge of a hardware trigger on the Impact camera’s Event input. (Note: the M-Series and MX-U Series Processors I/O do not signal the FE Input Event.)

- Input Event RE: The task is queued by the rising edge of a hardware trigger on the Impact camera’s Event input. (Note: the M-Series and MX-U Series Processors I/O signal only the RE Input Event.)

- Input 1 Event FE and RE: The task is queued by both the rising and falling edges of a hardware trigger on the Impact camera’s Event 1 input.

- Input 1 Event FE: The task is queued by the falling edge of a hardware trigger on the Impact camera’s Event 1 input. (Note: the M-Series and MX-U Series Processors I/O does not signal the FE Input Event.)

- Input 1 Event RE: The task is queued by the rising edge of a hardware trigger on the Impact camera’s Event 1 input. (Note: the M-Series and MX-U Series Processors I/O signals only the RE Input Event.)

- Input 2 Event FE and RE: The task is queued by both the rising and falling edges of a hardware trigger on the Impact camera’s Event 2 input.

- Input 2 Event FE: The task is queued by the falling edge of a hardware trigger on the Impact camera's Event 2 input. (Note: the M-Series and MX-U Series Processors I/O does not signal the FE Input Event.)

- Input 2 Event RE: The task is queued by the rising edge of a hardware trigger on the Impact camera's Event 2 input. (Note: the M-Series and MX-U Series Processors I/O signals only the RE Input Event.)

- Shift Event FE and RE: The task is queued by both the rising and falling edges of a hardware trigger on the Impact camera's Shift input.

- Shift Event FE: The task is queued by the falling edge of a hardware trigger on the Impact camera's Shift input.

- Shift Event RE: The task is queued by the rising edge of a hardware trigger on the Impact camera's Shift input.

- Camera Button Event: The task is queued when the button on the camera case is pressed. (This option is available only on certain camera models.)

- Scheduled Event: The task is queued when an Event Scheduler tool causes a scheduled event to occur. Use a logic tool to determine what action to take based on the Event ID.

Input Name	What it is
Event ID	The Event ID of the Event Scheduler tool that triggered the event.

- Serial Input: The inputList may contain any character, including NULL. The task is queued when the delimiter character is detected on the Vision Device's or camera's serial port. The delimiter character indicating the end of the data string is defined in Settings Tab - General - Setup - Communication. (see "Serial Port" on page 2-10).

Input Name	What it is
inputString	The data string from the serial port
inputList	The list of integers from the serial port

- TCP/IP Input Event: The task is queued when a message is detected on the Vision Device's or camera's TCP/IP Input Event Port. The event port number and delimiter character (which indicates the end of the data string) are configured in Settings Tab - General - Setup - Communication (see "TCP/IP" on page 2-10. The inputList may contain any character, including NULL. The string or integer list property from the source device is written to both these inputString and inputList properties.

Input Name	What it is
inputString	The data from the source device.
inputList	The list data from the source device.

- EtherNet/IP Explicit Event: The task is queued when an incoming EtherNet/IP command causes an event to occur. Use a logic tool to determine what action to take based on the Event ID.

Input Name	What it is
Event ID	The Event ID of the EtherNet/IP Data tool that triggered the event.

- EtherNet/IP Implicit User Data Event

The task is queued when data changes in the user data area of the Ethernet/IP data assembly. Use the Ethernet/IP Read Implicit Assembly tool to read the data. (See “EtherNet/IP Read Implicit Assembly” on page 3-240.)

- Modbus Event: The task is queued when the Modbus Server receives any Modbus Request from a client.

Input Name	What it is
Function Code	The function code of the Modbus client's request. These are standard Modus function codes. For example, Function Code 16 is a Write Multiple Registers request and Function code 3 is a Read Multiple Registers request.
Start Address	The starting register in the Modbus Request sent by the Modbus Client.
Count	The number of registers the client accessed.

- Modbus New Input Data Event: The task is queued when a Modbus Client writes data in a Modbus Register using the Modbus Write Request function.

Input Name	What it is
Start Address	The starting register in the Modbus Request sent by the Modbus Client.
Count	The number of registers the client accessed.

- AbPc3 Event: The task is queued when an AB PCCC client writes data in a PCCC server property using the PCCC Typed Write command.

Input Name	What it is
File Number	The file type number sent by the PCCC client. See “How VPM Works With AB PCCC” on page 2-44 for file type numbers.
Start Address	The starting server property index in the Typed Write command sent by the PCCC client.
Count	The number of indexes the client accessed.

- OPC New Input Data Event: The task is queued when the OPC Server writes data in an OPC Data Access system object input.

Input Name	What it is
InputName	When data is written to this input, the task is queued. The value contains the name of the OPC Data Access property that changed. See “OPC Data Access” on page 2-45.

- ProfinetIO User Data Event: The task is queued when the Profinet user data area of the assembly is written by a Profinet client. The inputList may contain any character, including NULL. The string or integer list property from the source device is written to both these properties.

Input Name	What it is
inputString	The data from the source device.
inputList	The list data from the source device.

- User Event 1-8: The task is queued when the associated Ethernet/IP or Profinet User Event data area changes from zero to one. (See “EtherNet/IP” on page 6-12 or “PROFINET” on page 3-294.)

Input Name	What it is
Event ID	The ID of the User Event. If the event was originated from a device using EtherNet/IP, the Event ID is -10. If the event was originated from a device using ProfinetIO, the Event ID is -11.

Color Image Sub-Properties

Greyscale images from color cameras are inherently half the resolution (and thus half the accuracy) of the equivalent greyscale camera image. For example, if you use a 640 x 480 pixel color camera and select a greyscale sub-property, the resulting resolution of the image is 320 x 240 pixels.
This is because each pixel of the color image has a different color filter than the adjacent pixel, and the two pixels must be combined to create the greyscale value, which results in half the resolution.

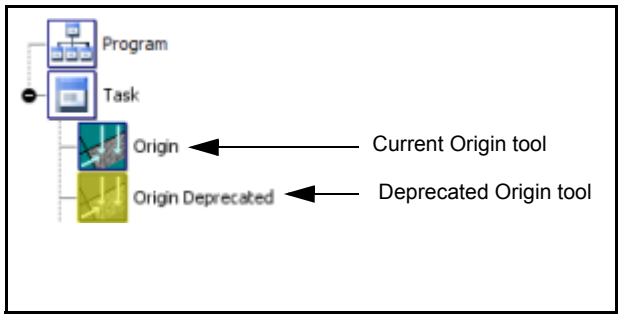
If the two adjacent pixels are not combined, i.e. the value of each raw color pixel is used as the greyscale value, then the resulting image is “grainy.” For example, if the image was a red object, all the red pixels would be bright and all the green and blue pixels would be dark, creating a fine grain checkerboard.

Note that some tools provide sub-pixel options, which can improve the resolution and measurement accuracy of the image.

VPM Tools

VPM 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.



Every tool has the general properties of Name, Description, and Type. Some tools also have inputs and outputs that can be linked between tools. Each tool input and output has a data type.

To run a tool individually, select it in the tree and click the Run button in the Tool Test button area.

Some tools have a Setup tab which is automatically selected to aid you with configuring the tool when you first add one of the tool to a task. (See “Setup Tab” on page 3-21.)

If an input or output has a small plus sign to the left of the name, you can view the sub-properties and all the available data types of those properties. For example, if you click the plus sign of the Success property in the Origin tool (a Boolean data type) the other data types for that property are displayed.



Toolbox Drawers

VPM 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	Vision Device Control	Flaw Detection	Feature Finding	Image Filtering	Image Geometry
Discrete Input 3-231	Camera Trigger 3-282	Adaptive Template 3-190	Average Gradient 3-105	Average Filter 3-44	Color Image Sampling 3-61
Discrete Output 3-232	Device Settings 3-283	Average Intensity 3-192	Average Intensity 3-106	Binary Image Filter 3-44	Color Image Stitching 3-62
Ethernet/IP Data 3-236	Offline 3-285	Blob 3-76	Blob 3-76	Color Pixel Fill 3-45	Deslant Image 3-66
Ethernet/IP Message 3-237	Online 3-286	Bump Find 3-192	Blob Filter 3-109	Edge Enhancement 3-46	Image Sampling 3-67
Ethernet/IP Read Assembly 3-240	Vision Program Load 3-286	Color Blob 3-112	Circle Gauge 3-150	Gaussian Filter 3-47	Image Stitching With Origins 3-68
Ethernet/IP Write Assembly 3-242	Vision Program Save 3-286	Contrast 3-118	Color Blob 3-112	Image Math 3-48	Image Stitching With Points 3-68
Image Archiving 3-243	Vision Program Unload 3-287	Contrast - Multiple ROI 3-121	Color Checker 3-117	Light Leveling 3-50	Line Profile 3-70
MC Read 3-246		Extreme Difference 3-194	Contrast 3-118	Linear Morphology Close 3-52	Multiple Image Stitch 3-70
MC Write 3-248		Greyscale Template 3-196	Contrast - Multiple ROI 3-121	Linear Morphology Open 3-53	Unwrap 3-74
Send Message 3-249		Polygon Smoothing 3-200	Edge Point Find 3-123	Median Filter 3-53	Undistort Image 3-75
Wait For Message 3-251			Line Find 3-127	Morphology Close 3-54	X-Y Projection 3-75
Serial Port Out 3-254			Pattern Sorting page 3-127	Morphology Dilate 3-54	
TCP/IP Out 3-255			Spot Find 3-139	Morphology Erode 3-56	
			Wide Edge Point Find 3-140	Morphology Open 3-57	
				New Image 3-60	
				Pixel Fill 3-61	

Locating	Logic	Measurement	Readers	Specialized	P-Series
Blob 3-76	Basic 3-260	Angle 3-144	Character Contour Match 3-201	Change image Calibration 3-287	ProfinetIO Read page 3-294
Circle Gauge 3-150	Branch 3-261	Circle Edge Refinement 3-148	Code Reader 3-205	Clip ROI 3-288	ProfinetIO Write page 3-295
Circular Pattern Find 3-82	Break 3-261	Circle Gauge 3-150	OCR 3-221	Data Transfer 3-289	Green Red Spot page 3-293
Line Find 3-84	Call Task 3-262	Line Find 3-155		Grid Statistics 3-289	
Origin 3-90	Counted Loop 3-262	Line Gauge 3-156		Lead Statistics 3-292	
Pinpoint Pattern Find™ 3-97	Counter 3-262	Line Gauge Datum Line 3-161		Train 3-292	
	Data Instance 3-264	Line Gauge Dual ROI 3-167			
	Data Set 3-265	Linear Regression 3-173			
	Delay 3-265	Midpoint 3-174			
	Event Scheduler 3-265	Multiple Point to Point Measurements 3-174			
	Group 3-266	Peak Valley Find 3-179			
	List Loop 3-266	Point Match 3-180			
	List Sorter 3-266	Point to Line Measurement 3-182			
	Multiple Branch 3-267	Point to Point Measurement 3-185			
	Pass Fail 3-267	Subpixel Edge Extractor 3-188			
	Reset 3-269				
	String Builder 3-269				
	Switch 3-277				

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

Average Filter

In the Image Filtering Drawer



The Average Filter tool can smooth the average grey level value of the pixels in an image and provide that processed image as an output. The smoothing is done within a defined filter area of pixels which is moved progressively throughout the ROI. Of the three filtering tools (Average, Gaussian and Median), this is the fastest because it weights all pixels within the filter area equally. It is not as precise as the other two, however.

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 search. If no shape is defined, the entire image is processed.
FilterWidth	The width of the area (in pixels) where the smoothing takes place
FilterHeight	The height of the area (in pixels) where the smoothing takes place

Output Name	What it is
Output Image	Filtered Image (may be viewed on the Output Image tab).

Binary Image Filter

In the Image Filtering Drawer



The Binary Image Filter tool creates an output image by applying the standard thresholding methods used in the Contrast and Blob tools. In the output image, In Range pixels are assigned one value, usually 100, and Out of Range pixels are assigned another value, usually 0. This tool is useful if you want to threshold the image before applying another filter, like morphology.

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 search. If no shape is defined, the entire image is processed.
Grey Level Threshold Type	See "Grey Level Threshold Types" on page 3-80
Fixed Threshold Range	The fixed grey level threshold range used when a Fixed Threshold Range Threshold Type is chosen. The parameters are start and end.

Input Name	What it is
In Range Output Pixel Value	If a pixel in the Input Image has a grey level that is within the Threshold Range, this grey level is assigned to it (defaults to 100).
Out of Range Output Pixel Value	If a pixel in the Input Image has a grey level that is outside the Threshold Range, this grey level is assigned to it (defaults to 0).

Output Name	What it is
Output Image	Input Image with the thresholding applied (click the Output Image tab)
Threshold Range Used	The Threshold Range used to modify the image. The parameters are start and end.

Color Pixel Fill

In the Image Filtering Drawer



The Color Pixel Fill tool fills portions of a color image with a specified color value. The Find Shape List defines the area to be filled. The area is filled with the RGB color value specified in the Fill Value property. The filled area appears on the output image. It can be used to fill bad regions of an image before using a Color Blob tool. This is faster than using exclude regions in the Color Blob tool.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Find Shape List	The desired region of the image to fill. If no shape is defined, the entire image is filled.
Shape List ROI Type	Each Shape is separate ROI: Each shape is processed as a separate ROI and the results are combined. This mode is faster than the other mode if the shapes are far apart, but results are duplicated if the shapes overlap. ShapeList is One ROI: The ShapeList is one large rectangular ROI and the shapes are the enabled pixels within the rectangle. The tool may be slow if the shapes are far apart. This setting allows shapes to overlap and form complex shapes without repeating the overlapped pixels and duplicating results. NOTE: The resulting image is the same for either setting.
Fill Value	The percent of each RGB color value used to fill the area.

Output Name	What it is
Output Image	Image with the area filled (may be viewed on the Output Image tab).

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. See “How to Set Up the Edge Enhancement tool” on page 3-46.

Input Name	What it is
Input Image	The image to inspect.
Tool Origin	The tool’s origin relative to the entire image space
Shape List	The desired region of the image to process. If no shape is defined, the entire image is processed.
Enhance 0 Degree Edges	If True, edges at zero degrees rotation are enhanced.
Enhance 45 Degree Edges	If True, edges at 45 degrees rotation are enhanced.
Enhance 90 Degree Edges	If True, edges at 90 degrees rotation are enhanced.
Enhance 135 Degree Edges	If True, edges at 135 degrees rotation are enhanced.
Show Gradient Sign If Single Direction Enabled	If True, then 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 Degree Edges setting is True, this property is not effective.)

Output Name	What it is
Output Image	Enhanced Image (may be viewed on the Output Image tab).

How to Set Up the Edge Enhancement tool

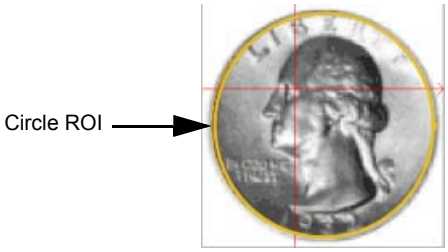
General

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.

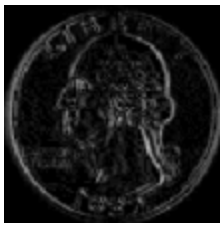


Settings

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 Edges Checked



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 3-23.

Gaussian Filter

In the Image Filtering Drawer



The Gaussian Filter tool performs filtering of pixel grey levels within an ROI to smooth an image. A filter area is defined and used to sequentially process an area that size within the ROI. Pixels at the center of the filter area are weighted more than those further away (a Gaussian curve). This results in more precise smoothing. The effect is similar to changing the camera focus. This tool’s filtering is more precise but slower than the Average Filter tool.

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 search. If no shape is defined, the entire image is processed.
Filter Size	The area size (in pixels square) to include in the smoothing. Smaller numbers provide less smoothing.

Output Name	What it is
Output Image	Smoothed Image within ROI (may be viewed on the Output Image tab).

Image Math

In the Image Filtering Drawer



The Image Math tool performs image math operations on one or more images to produce an output image. Each operation does a pixel by pixel comparison of two images. The result of the math operation on corresponding pixels provides the output image's grey level values.

All operations involve the Input Image and the Secondary Image (except Invert and NOT, which use only the Input Image). The resultant image is displayed on the Output Image tab. Each operation is explained here.

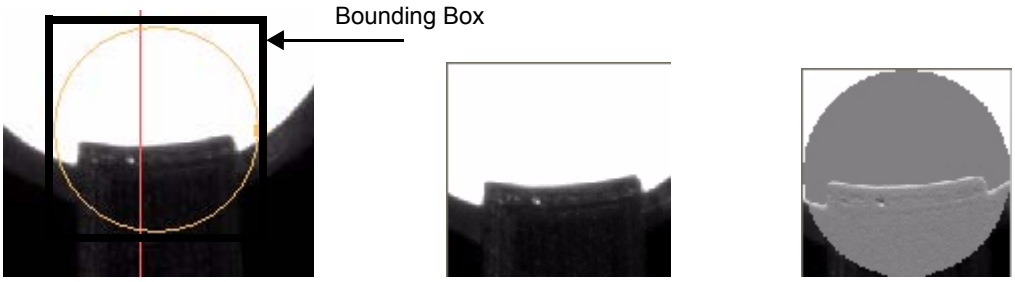
- **Subtract With Offset:**
  This operation subtracts the Secondary image from the Input image and adds fifty to each pixel's grey level value. Resultant values greater than one hundred are clipped at one hundred and values less than zero are clipped at zero. Because negative grey level values cannot be shown in an image, fifty is added to them so that they are shown as values from zero to forty nine.
- **Subtract**
  This operation subtracts the secondary image from the input image. Resultant values less than zero are clipped at zero.
- **Absolute Difference**
  This operation subtracts the Secondary image from the Input image and provides the absolute value of the difference as the result. For example, -1 becomes 1, -2 becomes 2, etc.
- **Min**
  The result of this operation is the minimum value of the corresponding pixel grey levels on the Input image compared to those on the Secondary image.
- **Max**
  The result of this operation is the maximum value of the corresponding pixel grey levels on the Input image compared to those on the Secondary image.
- **AND**
  This operation performs a logical AND of the corresponding Input image and Secondary image pixel grey levels. Pixels on the images are considered logically True if their grey level is greater than zero. Pixels on the Output image are set to one hundred if they are logically True, and zero if they are logically False.
- **OR**
  This operation performs a logical OR of the corresponding Input image and Secondary image pixel grey levels. Pixels on the images are considered logically True if their grey level is greater than zero. Pixels on the Output image are set to one hundred if they are logically True, and zero if they are logically False.
- **XOR**
  This operation performs a logical XOR (exclusive OR) of the corresponding Input image and Secondary image pixel grey levels. Pixels on the images are considered logically True if their grey level is greater than zero. Pixels on the Output image are set to one hundred if they are logically True, and zero if they are logically False.
- **NOT**

This operation performs a logical NOT on the Input image pixels (the Secondary image is not used). The Output image pixel greyscale value is one hundred if the Input image value is zero, and zero if the Input image value is greater than zero.

- **Invert**
  This operation performs inverse greyscale mapping of the pixels on the Input image (the Secondary image is not used). The Output image pixel greyscale level is calculated as 100 minus the input pixel value.
- **Weighted Average**
  This operation is useful for combining multiple images of the same stationary object and averaging the images together to reduce the noise level. See “Weighted Average Calculation” on page 3-50 for details. The input image and secondary image must be the same height and width.

Like other filtering tools, the Output image size is determined by the size of this tool’s Shape List shape and bounding box, based on the following situations. In any case, only the area within the Shape List is used in the operation.

- Pixels in the Input image that are outside the shape, but inside the bounding box, like the corners of a square outside a circle, are copied unchanged from the Input image.



Primary Image with ROI Secondary Image Output Image

- If the Secondary image is the same size as this tool’s Shape List’s bounding box, that image is compared, pixel-by-pixel, with the Input image.
- If the secondary image is larger or smaller than this tool’s Shape List’s bounding box, the Shape List is applied to the Secondary image before the operation.

Input Name	What it is
Input Image	The operation is performed on this image and the Secondary image
Tool Origin	The tool’s origin relative to the entire image space
Shape List	The desired region of the image to process. If no shape is defined, the entire image is processed.
Secondary Image	The operation is performed on this image and the Input image (except for NOT and Invert)
Operation	The operation to perform
Input Image Weight	Used only for the Weighted Average operation. See “Weighted Average Calculation” on page 3-50 for details.
Secondary Image Weight	Used only for the Weighted Average operation. See “Weighted Average Calculation” on page 3-50 for details.

Output Name	What it is
Output Image	The image resulting from the math operation

Weighted Average Calculation

The output image pixel value is calculated as follows:

output pixel = (input image pixel * input image weight + secondary image pixel * secondary image weight) / (input image weight + secondary image weight)

The scaling of the weights and the scaling of the output image is handled automatically by the above formula. For example, the output is the average of the two inputs as long as the input weight and secondary weight are equal, regardless of their actual value (except zero).

The input image and secondary image must be the same height and width. If the secondary image is null (non-existent), the output image is a copy of the input image.

Averaging more than two images
The recommended method (recursive filter) is:

1. Use a counter tool to track the number of images.
2. In the Image Math tool, link the Secondary Image input to the tool's Output Image, so that each input image is combined with the result of averaging all the previous images.
3. In order for all the images to be weighted equally, the weight of the Secondary Image must be increased each time the tool runs, so link the Secondary Image Weight to the Counter tool value.
4. Set the Input Image Weight to 1.

When the first image comes into the tool, the Secondary Image Weight (from the Counter) should be 0, so that the Output Image is just a copy of the input image. When the second image comes in, both weights are 1 and the two images are averaged evenly. When the third image comes in, the Secondary Image (the average of the first two images) now has a weight of 2 and gets weighted twice as much as the Input Image, so that all three images are being given the same weight. In this way any number of images can be averaged by just changing the end value of the Counter tool.

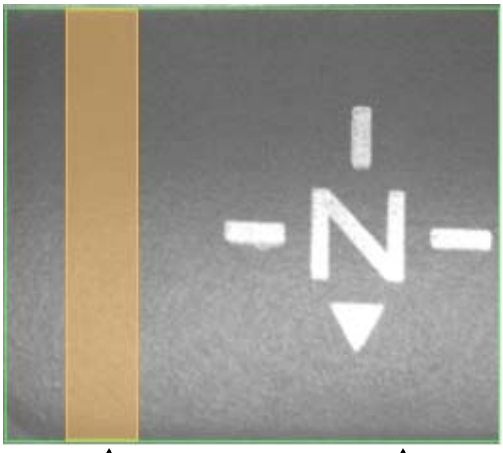
Light Leveling

In the Image Filtering Drawer



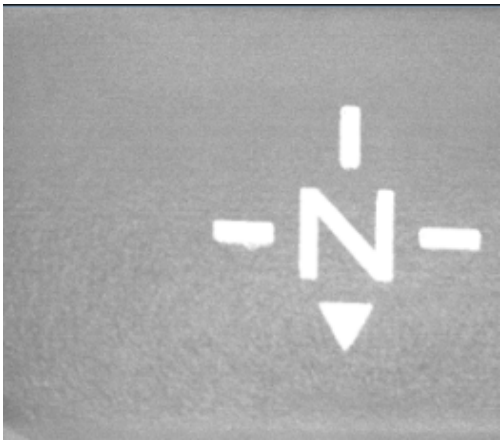
The Light Leveling tool corrects for uneven lighting in an image. Within the Light Sensor Shape List area, the column or row with the highest average grey level is found (based on the Direction To Level input). A scale factor is calculated for all the other columns or rows which brightens them so they have the same average grey level as the brightest column or row. Each column or row's scale factor is then applied to all the pixels in that column or row within the entire Region To Copy.

The light sensor area can be trained or recalculated on each image. The light sensor area is the ROI within which the tool calculates the spatial light distribution in the image, which it then uses to adjust the pixel intensities to be level across the entire image or the Region to Copy.



Light Sensor Shape List

Region To Copy (green rectangle)



Output Image

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Light Sensor Shape List	The region of the image to level. If no shape is defined, the entire image is processed.
Region To Copy	The region of the image to copy to the output image.
Direction To Level	The tool levels the light in this direction (X, Y, or None). If leveling is required in both directions, use two tools in series. If None, no leveling is done.
Training Option	No Training. Recalculate Sensor On Each Image The light sensor is recalculated for each image. Train Light Sensor On This Image Trains the light sensor on the current image and then re-uses that level on every subsequent image. This choice can save processing time on each image if the light distribution within the image is static and repeatable.
Trained Sensor Image	Holds the trained light sensor image. Since the tool levels in X or Y directions only, this image is an X or Y projection of the light sensor ROI, like the output of the X-Y Projection tool.

Input Name	What it is
Target Intensity Selection	Brightest Row/Column Average Is Target Intensity: After projecting the rows/columns of the sensor ROI, the tool finds the brightest row/column and scales all the other row/columns to have that same average intensity. It is automatic self-scaling behavior that preserves greyscale resolution. If the overall input image intensity goes up and down, then the output image intensity also goes up and down, even after it is leveled. Fixed Target Intensity: The rows/columns are scaled so that their average intensity is the Fixed Target Intensity value. This setting helps adjust the image to a fixed average intensity and can help with fixed thresholding in other tools. It takes some adjustment of the Fixed Target Intensity value to keep the image bright and not saturated.
Fixed Target Intensity	The tool levels the pixel intensities to this greyscale value when Target Intensity Selection is set to Fixed Target Intensity.

Output Name	What it is
Output Image	The leveled Region To Copy. Displayed on the Output Image tab.

Linear Morphology Close

In the Image Filtering Drawer



The Linear Morphology Close tool removes small noise in an image, like the Morphology Close tool, but this tool retains thin lines in the image during the process. (See “Morphology” on page 3-58 for more details.)

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 process. If no shape is defined, the entire image is processed.
Number of Iterations	The number of times to perform the operation. If zero is entered, the tool just copies the input image to the output.
Keep 0 Degree Lines	If True, lines in the image that are not rotated remain after processing.
Keep 45 Degree Lines	If True, lines in the image that are rotated 45 degrees remain after processing.
Keep 90 Degree Lines	If True, lines in the image that are rotated 90 degrees remain after processing.
Keep 135 Degree Lines	If True, lines in the image that are rotated 135 degrees remain after processing.

Output Name	What it is
Output Image	The morphed image (viewed on the Output Image tab).

Linear Morphology Open

In the Image Filtering Drawer



The Linear Morphology Open tool removes small noise in an image, like the Morphology Open tool, but this tool keeps thin lines in the image during the process. (See “Morphology” on page 3-58 for more details.)

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 process. If no shape is defined, the entire image is processed.
Number of Iterations	The number of times to perform the operation. If zero is entered, the tool just copies the input image to the output.
Keep 0 Degree Lines	If True, lines in the image that are not rotated remain after processing.
Keep 45 Degree Lines	If True, lines in the image that are rotated 45 degrees remain after processing.
Keep 90 Degree Lines	If True, lines in the image that are rotated 90 degrees remain after processing.
Keep 135 Degree Lines	If True, lines in the image that are rotated 135 degrees remain after processing.

Output Name	What it is
Output Image	The morphed image (viewed on the Output Image tab).

Median Filter

In the Image Filtering Drawer



The Median Filter tool looks for and removes random noise from an image. The edges are not softened like the Gaussian filter. This tool is slower than the Gaussian and Average filters.

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 search.

Input Name	What it is
FilterWidth	This is the width of the area (in pixels) within which the filtering takes place
FilterHeight	This is the height of the area (in pixels) within which the filtering takes place

Output Name	What it is
Output Image	Filtered Image (may be viewed on the Output Image tab).

Morphology Close

In the Image Filtering Drawer



The Morphology Close tool performs a morphological close on the white parts of an image. This makes it useful for removing small black noise from an image, or to connect white areas together. (See “Morphology” on page 3-58 for more details.)

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 search. If no shape is defined, the entire image is processed.
Number of Iterations	The number of times to perform the operation. If zero is entered, the tool just copies the input image to the output.
Morphology Shape	Defines the shape of the neighborhood around each pixel that is searched to find the output pixel value. See “Morphology Shape” on page 3-60.

Output Name	What it is
Output Image	The morphed Image (viewed on the Output Image tab).

Morphology Dilate

In the Image Filtering Drawer



The Morphology Dilate tool performs a standard dilation operation on the white parts of the image. See “How to Set Up the Morphology Dilate tool” on page 3-55. (See “Morphology” on page 3-58 for details.)

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space

Input Name	What it is
Shape List	The desired region of the image to search. If no shape is defined, the entire image is processed.
Number of Iterations	The number of times to perform the operation. If zero is entered, the tool just copies the input image to the output.
Morphology Shape	Defines the shape of the neighborhood around each pixel that is searched to find the output pixel value. See “Morphology Shape” on page 3-60.

Output Name	What it is
Output Image	Morphed Image (may be viewed on the Output Image tab).

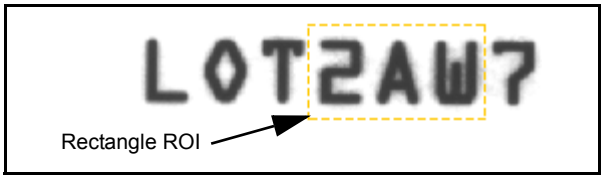
How to Set Up the Morphology Dilate tool

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” on page 3-58” 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 3-60 for details.

Display

See “Display panel” on page 3-23.

Morphology Erode

In the Image Filtering Drawer



The Morphology Erode tool performs a standard erosion on the white parts of an image. See “How to Set Up the Morphology Erode tool” on page 3-56. (See “Morphology” on page 3-58 for details.)

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 search. If no shape is defined, the entire image is processed.
Number of Iterations	The number of times to perform the operation. If zero is entered, the tool just copies the input image to the output.
Morphology Shape	Defines the shape of the neighborhood around each pixel that is searched to find the output pixel value. See “Morphology Shape” on page 3-60.

Output Name	What it is
Output Image	Morphed Image (may be viewed on the Output Image tab).

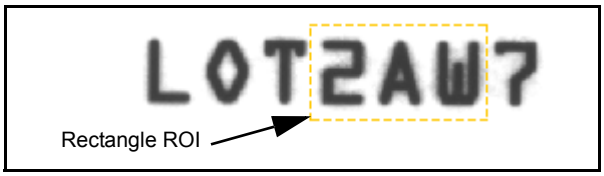
How to Set Up the Morphology Erode tool

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 “Mor-

phology” on page 3-58 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 3-60 for details.

Display

See “Display panel” on page 3-23.

Morphology Open

In the Image Filtering Drawer



The Morphology Open tool performs a morphological open on the white parts of an image. (See “Morphology” on page 3-58 for more details.)

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 search. If no shape is defined, the entire image is processed.
Number of Iterations	The number of times to perform the operation. If zero is entered, the tool just copies the input image to the output.
Morphology Shape	Defines the shape of the neighborhood around each pixel that is searched to find the output pixel value. See “Morphology Shape” on page 3-60.

Output Name	What it is
Output Image	Morphed Image

How to Set Up the Morphology Open tool

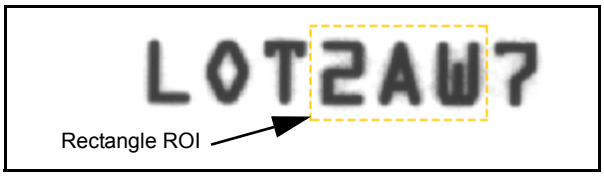
General

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 3-58 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 3-60 for details.

Display

See “Display panel” on page 3-23.

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.

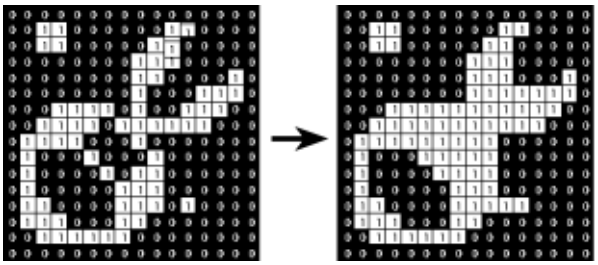
Morphology tools use 3x3 binary analysis. During binary morphology, the tool checks the greyscale values in the image and assigns each pixel an ON or OFF value. The tool then performs the operation (based on the Number of Iterations value), adjusting each pixel's value after comparing its value and the 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

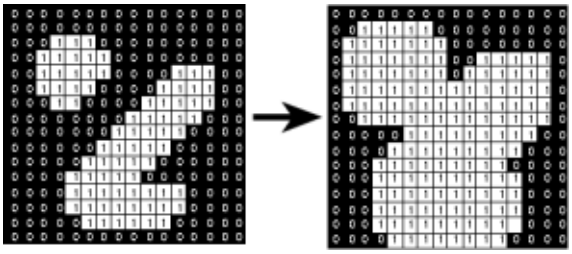
The close operation is similar to dilation in that it tends to enlarge foreground (bright) regions in an image (and shrink background holes), but it affects the original boundary shape less. It is defined as a dilation followed by an erosion.



Results of a close operation

Dilate

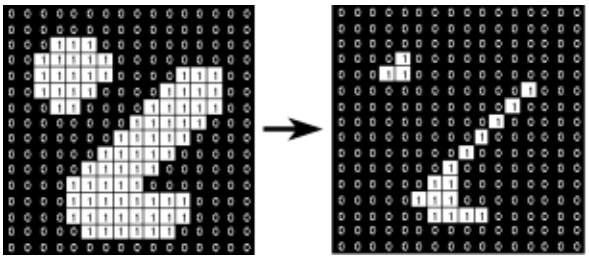
The dilate operation gradually enlarges the boundaries of regions of foreground pixels. Thus areas of foreground pixels grow in size while holes (background pixels) within those regions become smaller.



Results of a dilate operation

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.

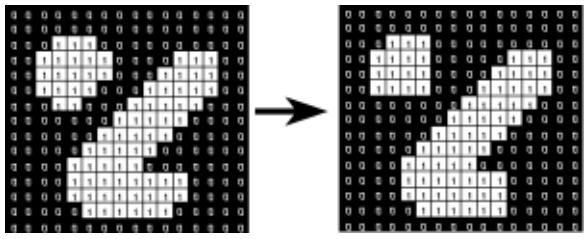


Results of an erode operation

Open

The open operation is similar to erosion in that it tends to remove foreground (bright) regions in an image, but it 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.

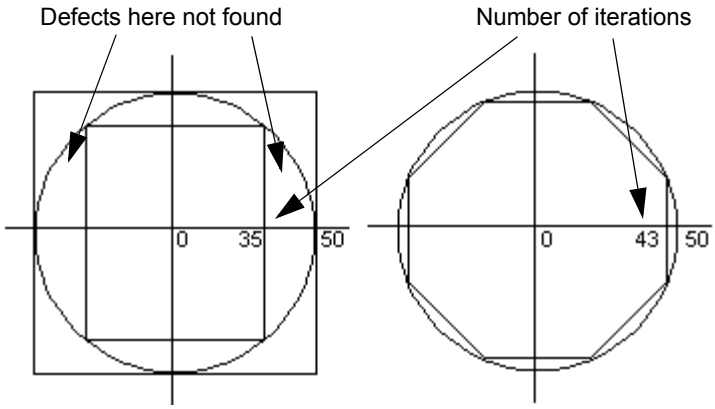


Results of an open operation

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.

New Image

In the Image Filtering Drawer



The New Image tool creates a new image based on the size and width properties each time it runs. The new image is filled with a user-defined greyscale value. The tool does not save the image with the vision program file or alter other images. Its main use is to create a blank image to fill with the Pixel Fill tool.

Input Name	What it is
Width In Pixels	The width of the new image in pixels
Height In Pixels	The height of the new image in pixels

Input Name	What it is
Fill Value	The greyscale value that fills the image (0-100)

Output Name	What it is
Output Image	The filled new image

Pixel Fill

In the Image Filtering Drawer



The Pixel Fill tool fills portions of a greyscale image with a specified grey level. The Find Shape List defines the area to be filled. The area is filled with the grey level from black (zero) to white (100) specified in the Fill Value property. The filled area appears on the output image.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Find Shape List	The desired region of the image to fill. If no shape is defined, the entire image is filled.
Shape List ROI Type	Each Shape is separate ROI: Each shape is processed as a separate ROI and the results are combined. This mode is faster than the other mode if the shapes are far apart, but results are duplicated if the shapes overlap. ShapeList is One ROI: The ShapeList is one large rectangular ROI and the shapes are the enabled pixels within the rectangle. The tool may be slow if the shapes are far apart. This setting allows shapes to overlap and form complex shapes without repeating the overlapped pixels and duplicating results. NOTE: The resulting image is the same for either setting.
Fill Value	The greyscale value to used to fill the area. Zero is black and 100 is white.

Output Name	What it is
Output Image	Image with the area filled (may be viewed on the Output Image tab).

Image Geometry Drawer

Color Image Sampling

In the Image Geometry Drawer



The Color Image Sampling tool provides a reduced resolution color image by sampling a user-defined number of pixels. Impact software uses a 24-bit color system.

Input Name	What it is
Input Image	The Linked Color Image
Region of Interest	The area of the image to sample. (If zero, the entire image is processed.)
Tool Origin	The tool's origin relative to the entire image space.
Sampling Resolution Type	See "How the Color Image Sampling tool works" on page 3-62.
Sampling Resolution	See "How the Color Image Sampling tool works" on page 3-62.
Y Sampling Resolution	See "How the Color Image Sampling tool works" on page 3-62.
Sampling Rotation	The output image is rotated by this angle (0, 90, 180, or 270 degrees).

Output Name	What it is
Output Image	Reduced resolution image (viewed on the Output Image tab).

How the Color Image Sampling tool works

The Color Image Sampling tool provides a reduced resolution output color image by sampling a user-defined number of pixels. For example, if the sampling resolution is 2, the tool samples every other pixel and produces an output image of 1/2 the resolution of the original.

The Sampling Resolution Type property determines whether the tool uses the same sampling resolution in both directions (X and Y) or different sampling for each.

- Use Same Sampling Resolution in X and Y: The Sampling Resolution property is used for sampling in both the X and Y directions.
- Use Different Sampling Resolutions in X and Y: The Sampling Resolution property is used for sampling in the X direction and the Y Sampling Resolution property is used for sampling in the Y direction.

NOTE: If the camera is calibrated, using different sampling resolutions for X and Y results in an output image that is no longer calibrated. Since VPM expects the image pixels to be the same size in both X and Y, the tool will set the X pixel size correctly, but the Y pixel size will be incorrect.

Color Image Stitching

In the Image Geometry Drawer (Available only on the M-Series and MX-U Series processors)



The Color Image Stitching tool combines (stitches) two or more images into a larger image using features in the images as reference points or using a list of images. See “How the Color Image Stitching tool works” on page 3-63. Impact software uses a 24-bit color system.

Input Name	What it is
Stitch Type	Step Between Images: An X and Y offset is added to a source image before it is stitched to the next image. If there are any images in the Image List property, the tool uses this mode by default. Origins of Overlap Feature: The locations (origins) of overlapping features on each image are used to stitch the images. The origins come from another tool.
Image 1	The first color image to stitch (viewed on the Image 1 tab). This image is ignored if the Image List property contains any images.
Overlap Feature Location in Image 1	The origin of the overlapping feature in this image that matches the corresponding feature in Image 2. The two origins are used to align image 1 and image 2 for stitching.This property is ignored if the Image List property contains any images
Image 2	The second color image to stitch (viewed on the Image 2 tab). This image is ignored if the Image List property contains any images.
Overlap Feature Location in Image 2	The origin of the overlapping feature in this image that matches the corresponding feature in Image 1. The two origins are used to align image 1 and image 2 for stitching. This property is ignored if the Image List property contains any images.
Image List	A list of color images to stitch. If there are any images in this list, the tool automatically uses a Stitch Type of "Step Between Images."
Step Between Images	When the Stitch Type property is set to Step Between Images, this is the X and Y offset added to each image before it is stitched to the next image.

Output Name	What it is
Output Image	The stitched image (viewed on the Output Image tab).

How the Color Image Stitching tool works

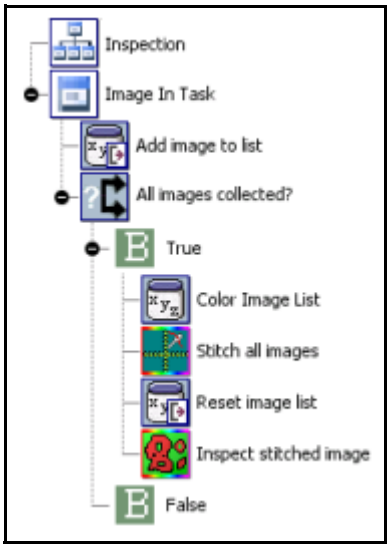
The tool has three modes of operation: Image List Stitching With Step, One At A Time Stitching With Step, and One At A Time Stitching With Overlapped Features. After the tool runs, the stitched image is placed in the Output Image property and can be viewed in the Output Image tab.

Image List Stitching With Step

Use this mode when you know the exact position of one image relative to another and you have more than two images to stitch together.

1. Create a list of the images you want to stitch and link the list to the Image List property. You can use a Data Set tool linked to the Add Element property of a Data Instance tool to create the list.
2. Set the Stitch Type property to Step Between Images.
3. Enter the X and Y offset value in the Step Between Images property. The value specifies the X step and Y step between one image and the next in the list.

For example, if the X value is 50 and the Y value is 20, the first image in the list is placed at 0,0 in the output image.The second image in the list is placed at 50,20 in the output image. The third image in the list is placed at 100,40 in the output image, and so on. Any pixels of the output image that are not covered by a part of the stitched image are filled with black.



Example of Image List Stitching with Step

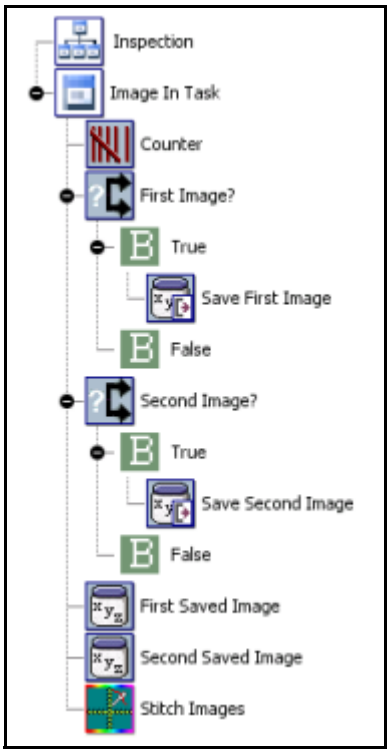
One At A Time Stitching With Step

Use this mode when you know the exact position of one image relative to another and you have two images to stitch together. The Image List property must be empty so that the tool uses the images in the Image 1 and Image 2 properties. Link each of two images you want to stitch into the Image 1 and Image 2 properties.

1. Set the Stitch Type property to Step Between Images.
2. Enter the X and Y offset value in the Step Between Images property. The value specifies the X step and Y step between Image 1 and Image 2.

   For example, if the X value is 50 and the Y value is 20, the Image 1 is placed at 0,0 in the output image.Image 2 is placed at 50,20 in the output image. If there is overlap between the images, Image 1 pixels are on top in the stitched image. Any pixels in the output image that are not covered by Image 1or Image 2 are filled with black.
3. To stitch more images together, link the Output Image from one Color Image Stitching tool into the Image 1 property of a second tool. This method is slower than the Image List mode because intermedi-

ate partial images must be created as each input image is acquired, rather than waiting for all images to be acquired.



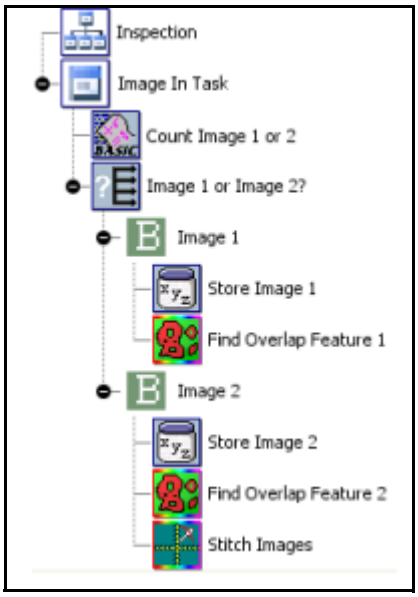
Example of One At A Time Stitching with Step

One At A Time Stitching With Overlapped Features

Use this mode when the relative positions of the images are not known, but can be found by locating a feature that appears in both images because their fields of view overlap. The Image List property must be empty so that the tool uses the images in the Image 1 and Image 2 properties. Link each of two images you want to stitch into the Image 1 and Image 2 properties.

1. Set the Stitch Type property to "Origins of Overlap Feature."
2. Use a locating tool on each image to locate the desired feature
3. Link each origin into the Overlap Feature Location of the respective image. The Step Between Images property is ignored.
4. To stitch more images together, link the Output Image from one Color Image Stitching tool into the Image 1 property of a second tool. This method is slower than the Image List mode because intermedi-

ate partial images must be created as each input image is acquired, rather than waiting for all images to be acquired.



Example of One At A Time Stitching With Overlapped Features

Deslant Image

In the Image Geometry Drawer



The Deslant Image tool corrects the slant frequently seen in printed dot matrix characters.

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 search. If no shape is defined, the entire image is processed.
Slant Angle Type	See "Slant Angle Types" at the end of this table.
Column Slant Angle in Degrees	The character's column slant angle. See details at the end of this table.
Row Slant Angle in Degrees	The character's row slant angle. See details at the end of this table.

Output Name	What it is
Output Image	The straightened image as viewed on the Output Image tab.

Slant Angle Types

Angle to Slant Image

In this mode, the tool slants each character by the angle amounts entered in the Column Slant Angle and Row Slant Angle fields. For example, if a character slants 10 degrees from vertical, enter -10 (degrees) in the Column Slant Angle field to correct the slant. If a row of characters slants 10 degrees from horizontal, enter -10 (degrees) in the Row Slant Angle field to correct the slant.This mode useful if you link the Slant Angle to a scroll bar on the control panel and let the operator dynamically modify the amount of slant.

Measured Angle to Make Square

Note: The Deslant tool and the tool used to measure the edge angle must use the same Tool Origin.

In this mode, the tool calculates the amount of correction necessary to bring each character's columns to vertical (ninety degrees), and their rows to horizontal (zero degrees), based on the Column and Row Slant Angle values. For example, if a character slants 10 degrees from vertical, enter 100 (degrees) in the Column Slant Angle field to correct the slant (100 = 90 + 10). If a row of characters slants 10 degrees from horizontal, enter 10 (degrees) in the Row Slant Angle field to correct the slant (10 - 10 = 0).

You can use an Origin or Linear Regression tool to measure a character's current vertical edge angle (from zero degrees). Link that measured angle into the Column Slant Angle field (using a Data Instance tool to extract the angle). The tool calculates the number of degrees change necessary to correct the vertical edge to make it ninety degrees. The same may be done with a horizontal edge and the Row Slant Angle.

Image Sampling

In the Image Geometry Drawer



The Image Sampling tool provides a reduced resolution image by sampling a user-defined number of pixels.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space.
Region of Interest	The area of the image to sample. (if zero, the entire image is processed)
Sampling Resolution Type	See "How the Image Sampling tool works" on page 3-68.
Sampling Resolution	See "How the Image Sampling tool works" on page 3-68.
Y Sampling Resolution	See "How the Image Sampling tool works" on page 3-68.
Anti Alias Flag	If True, the image is filtered before it is sampled.
Sampling Rotation	The output image is rotated by this angle (0, 90, 180, or 270 degrees).
Mirror	None: The Output Image is not changed. Horizontal: The Output Image is flipped horizontally. Vertical: The Output Image is flipped vertically. Any mirroring takes place after windowing and sampling operations.

Output Name	What it is
Output Image	Reduced resolution image within ROI (viewed on the Output Image tab).

How the Image Sampling tool works

The Image Sampling tool provides a reduced resolution output image by sampling a user-defined number of pixels. For example, if the sampling resolution is 2, the tool samples every other pixel and produces an output image of 1/2 the resolution of the original.

The Sampling Resolution Type property determines whether the tool uses the same sampling resolution in both directions (X and Y) or a different sampling resolution for each.

- Use Same Sampling Resolution in X and Y: The Sampling Resolution property value is used for sampling in both the X and Y directions.
- Use Different Sampling Resolutions in X and Y: The Sampling Resolution property value is used for sampling in the X direction and the Y Sampling Resolution property is used for sampling in the Y direction.

NOTE: If the camera is calibrated, using different sampling resolutions for X and Y results in an output image that is no longer calibrated. Since VPM expects the image pixels to be the same size in both X and Y, the tool will set the X pixel size correctly, but the Y pixel size will be incorrect.

Image Stitching with Origins

In the Image Geometry Drawer



The Image Stitching with Origins tool provides the ability to combine (stitch) several smaller images into one large image using features in the images as reference points for the overlap. For example, you can take several images of sections of a large connector, then stitch them together to inspect the whole connector image.

Input Name	What it is
Image 1	The first image to be stitched
Overlap Feature Location in Image 1	The origin of the feature to be used to indicate the overlap between image 1 and image 2
Image 2	The second image to be stitched
Overlap Feature Location in Image 2	The origin of the feature to be used to indicate the overlap between image 2 and image 1

Output Name	What it is
Output Image	The resulting stitched image (viewed on the Output Image tab). The output image must be less than 32k pixels high or wide with a practical limit of 16 Mpixels total. See “Special Note for Stitched Images with Distortion” on page 3-69.

Image Stitching with Points

In the Image Geometry Drawer



The Image Stitching with Points tool provides the ability to combine (stitch) several smaller images into one large image using points in the images as reference points for the overlap. For example, you can take several

images of sections of a large connector, then stitch them together to produce and inspect the whole connector image. (Also see “Image Stitching and Overlapping ROIs” on page 3-69.)

Input Name	What it is
Image 1	The first image stitch
Overlapping Points in Image 1	The list of points in image 1 used to indicate the overlap between image 1 and image 2
Tool Origin for Image 1 Points	The origin of the overlap reference points in image 1.
Image 2	The second image stitch
Overlapping Points in Image 2	The list of points in image 2 to be used to indicate the overlap between image 1 and image 2
Tool Origin for Image 2 Points	The origin of the overlap reference points in image 2.

Output Name	What it is
Output Image	The image resulting from the stitching operation (viewed on the Output Image tab). The output image must be less than 32k pixels high or wide with a practical limit of 16 Mpixels total. See “Special Note for Stitched Images with Distortion” on page 3-69.

Image Stitching and Overlapping ROIs

To stitch more than two images together, link the output from one stitching tool to the input of another.

Stitched images work fastest and most accurately if each ROI is contained within one of the original images (i.e. they do not completely straddle an overlap area). ROIs that are larger than the overlap areas, including full images, work more slowly and do not have sub-pixel accuracy. If each ROI is kept within one of the images, then all processing is as fast and accurate as non-stitched images. This includes multiple small ROIs.

The stitched image may sometimes give odd-looking, but correct, results in the overlap region. For example, when the stitched image is displayed, the overlap area contains pixels from image one. If an ROI is on image two and includes the overlap area, but not any pixels from image one, then the ROI uses all image two pixels to provide the most accurate results with no seam and with distortion correction. The image display may look odd because the displayed pixels are from image one, but the results are based on image two pixels.

Special Note for Stitched Images with Distortion

If individual images are overly distorted due to lens anomalies, a miscalculated field of view, incorrect lensing, or other conditions, it may appear that the displayed found pixels are offset from the pixels on the resulting stitched image. The tool output data are properly corrected for distortion and any calculations on grid location work correctly.

Distortion correction is applied to individual images before they are stitched to create a virtual image. (Usually distortion should only be found at the edges of an image and is correctable.) After the individual images are stitched, this mathematical information is not available, so when the tool operation is performed, the displayed found pixels may look like they are offset from the object pixels on the image.

The found pixel location calculations are correct, but the image looks distorted in the image display and the pixel locations look misplaced.

In short, the inspection result numbers are good even if the results do not appear correct on the image.

Line Profile

In the Image Geometry Drawer



The Line Profile tool reads the pixel grey level values from a single line segment and outputs them as a list of reals. The pixel values are scaled so the outputs are in the range of zero to one hundred percent.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Line Segment	The line segment that reads the pixel grey level values.
Enable Pixel Value List	If True, the Pixel Value List output is populated.

Output Name	What it is
Pixel Value List	A list of pixel grey levels
Average Pixel Value	The average pixel value in the Line Segment.
Standard Deviation Pixel Value	The standard deviation in the pixel values in the Line Segment.
Minimum Pixel Value	The minimum pixel value in the Line Segment.
Maximum Pixel Value	The maximum pixel value in the Line Segment.

Multiple Image Stitch

In the Image Geometry Drawer



The Multiple Image Stitch tool provides semi-automatic stitching of multiple images into one larger image (up to 8Mb total). (On the M-Series and MX-U Series processor, the output image must be less than 32k pixels high or wide with a total image size limited by the amount of PC memory.) For example, you can take several images of sections of a large part, then stitch them together to inspect the whole part. The tool takes an image list and stitches those images together based on their order in the list and the tool's input settings. The images are stitched into a one or two-dimensional array with a consistent overlap in both the x and y directions. The tool uses correlation pattern matching (based on the Stitching Threshold property) to match the overlap regions and insure accurate stitching.

The Image Motion input values indicate how far the camera or part moves between snaps. These values do not exactly define the image stitching, as they do in the Image Stitching With Origins tool, but they should be within five pixels on each dimension to help the tool find the correct stitching transformation. For a more

detailed explanation of how the images are stitched based on the inputs, see “Stitching Directions” on page 3-72.

Input Name	What it is
Input Images	The list of images to be stitched
Image Count X	The number of images in the list in the X direction
Image Count Y	The number of images in the list in the Y direction
Image Motion X	This is how far the camera or part moves in the x-direction for each successive snap. (This is calculated as the size of the image minus the amount of overlap, within five pixels on left and right.) This would be called the x-pitch if the images were laid onto a rectangular grid. This value is always positive.
Image Motion Y	This is how far the camera or part moves in the y-direction for each successive snap. (This is calculated as the size of the image minus the amount of overlap, within five pixels on left and right.) This would be called the y-pitch if the images were laid onto a rectangular grid. This value is always positive.
Stitching Threshold	This value indicates how well the images must correlate (or match) where they overlap for the stitching to be completed. A higher value means that there must be a greater correlation between the overlapping areas. The value can range from 1 to 100.
Row Major Order	Indicates how the images in the list are presented. If True, the images are presented in rows. If False, the images are presented in columns.
Major Forward	Indicates how the images within the major order (rows or columns) are presented. If True, they are presented left to right for rows and top to bottom for columns. If False, they are presented right to left for rows and bottom to top for columns. For example, if Row Major Order is True, and Major Forward is True, then the images are presented in rows from top to bottom.
Minor Forward	Indicates how the images within the first row or column are presented. If True, they are presented left to right for rows and top to bottom for columns. If False, they are presented right to left for rows and bottom to top for columns. If the Serpentine input is True, this order is alternated for each subsequent row or column.
Serpentine	If True, the image presentation order alternates direction at the end of each row or column, after the first row or column (based on the Minor Forward input). If False, the order does not alternate.

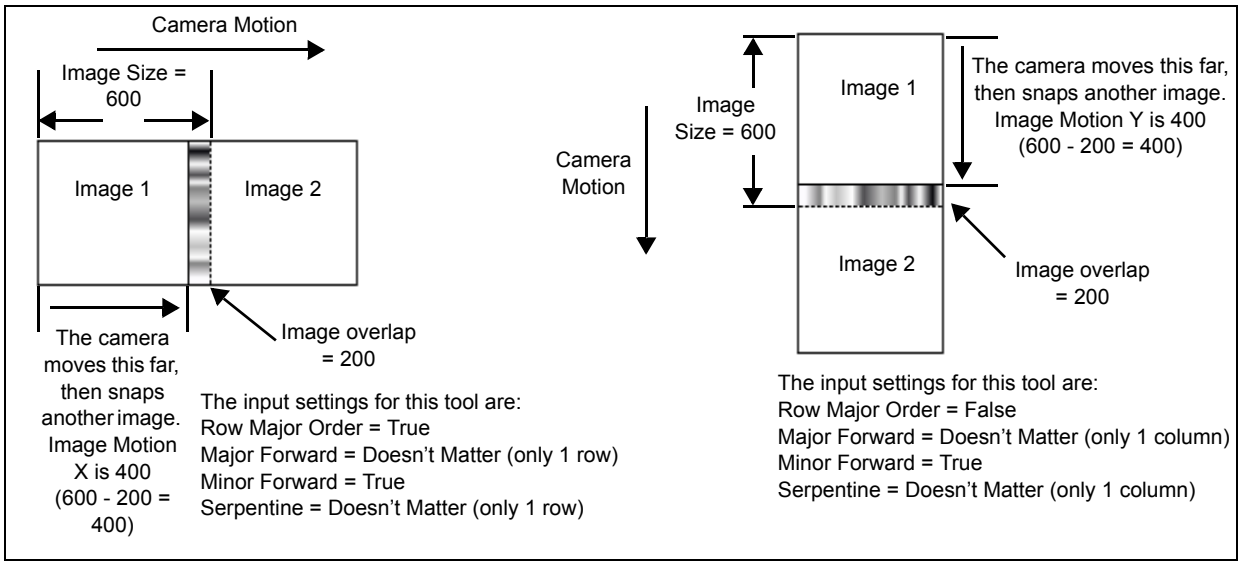
Output Name	What it is
Stitch Successful	If True, the images were stitched successfully.
Stitching Scores	A list of the stitching scores for each stitch in the output image.

Output Name	What it is
Output Image	The image resulting from the stitching operation.

Stitching Directions

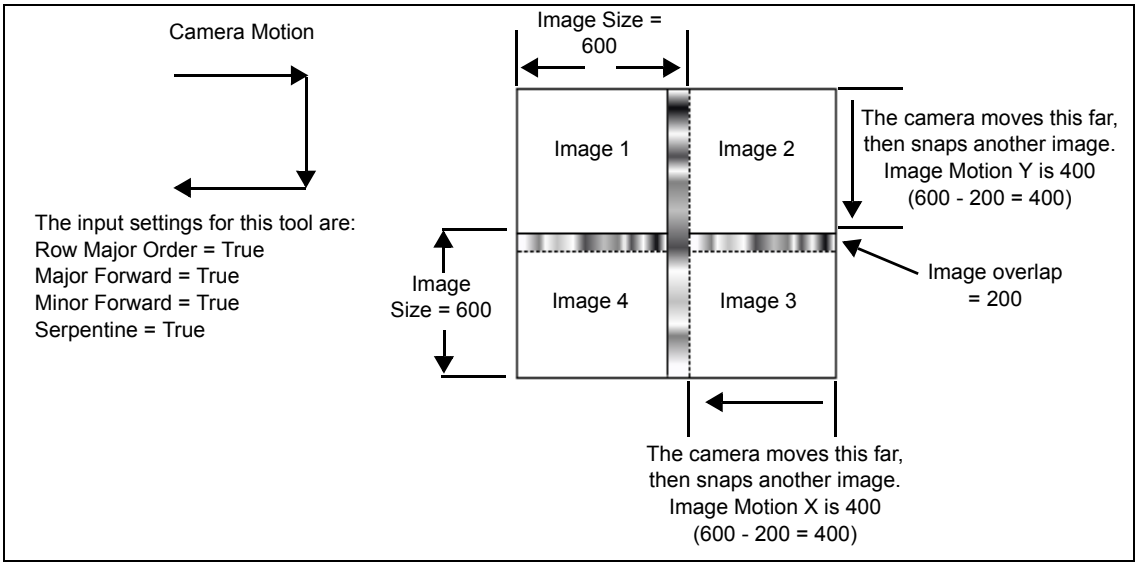
These examples show a part to be inspected that is too large to snap in one image. The camera moves above the part while a series of images are snapped. These images are then combined into an image list and the Multiple Image Stitch tool puts them together. The input settings help the tool recreate the camera or part motion so the input images are stitched together in the correct order.

The first example shows two-image stitches, one in the X and one in the Y direction. The motion arrows show the camera movement direction. The image numbers indicate the order in which they were snapped and their order in the image list. Their order in the final stitched image is determined by the tool's input settings (see "Stitched Image Order Table" on page 3-73).



This figure shows four-image stitching. The camera motion arrows show a serpentine camera movement. The image numbers indicate the order in which they were snapped and their order in the image list. Their

order in the final stitched image is determined by the tool's input settings (see "Stitched Image Order Table" on page 3-73).



Stitched Image Order Table

This table shows an example of how the tool's input settings affects where images are located in a stitched output image. Assume there are four images in the image list numbered 1, 2, 3, and 4. The numbers in the Stitched Image Order column indicate where each image is located in the output image after the tool has run.

Note: To create the desired output image, there does not need to be a single correct set of direction parameters; some settings have no affect on the final stitched image order. For example, for a single row of images the Serpentine input doesn't affect the stitching order.

Row Major Order	Major Forward	Minor Forward	Serpentine	Stitched Image Order
True	True	True	True	1 2 4 3
True	True	True	False	1 2 3 4
True	True	False	False	2 1 3 4
True	True	False	True	2 1 4 3
True	False	True	True	4 3 1 2
True	False	True	False	3 4 1 2
True	False	False	True	3 4 2 1
True	False	False	False	4 3 2 1
False	True	True	True	1 4 2 3

Row Major Order	Major Forward	Minor Forward	Serpentine	Stitched Image Order
False	True	True	False	1 3 2 4
False	True	False	True	2 3 1 4
False	True	False	False	2 4 1 3
False	False	True	True	4 1 3 2
False	False	False	True	3 2 4 1
False	False	True	False	3 1 4 2
False	False	False	False	4 2 3 1

Unwrap

In the Image Geometry Drawer



The Unwrap tool can be used to straighten text in the shape of an arc so it can be analyzed with the OCR tool. A typical application is unwrapping circular text on a coin or other round object.

This tool uses a wide circular ROI to specify the sampled region. The width of the ROI determines the height of the unwrapped image.

A boolean value can be set to indicate whether the sample direction should put the outside or the inside of the arc on top in the resulting image. For example, if you are inspecting text at the top of the coin, set the sample direction so the outside of the arc is on top.

Unwrapped sampling can cause character distortions when the inside arc is stretched and the outside arc is compressed. The distortion is worse for tighter arcs.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space.
Arc Region	The desired region of the image to unwrap. The parameters are x coordinate, y coordinate, radius, start angle, cover angle, and width.
Sample Direction	Indicates whether the outer or inner arc of the Arc Region is on the top of the text.

Output Name	What it is
Output Image	The unwrapped image (may be viewed on the Output Image tab).

Undistort Image

In the Image Geometry Drawer



The Undistort Image tool applies the input image's calibrated distortion mapping to the image to produce an output image that is not distorted. The tool's primary purpose is to "flatten" an image with perspective distortion, so that images look similar at all rotations and translations. It also removes radial lens distortion. Use this tool with the OCR and Greyscale Template tools since they do not work with severe image distortions.

This tool is not normally needed with the Blob, Gauge, and Contrast tools since the calibration process maps edge points to uniform real-world coordinates.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space.
Linear Interpolation	If True, the undistorted pixel values are interpolated, giving a smoother output. If False, the mapping can create some artifacts, especially along the edges, but the operation is much faster.
Shape List	The desired region of the image to search. If no shape is defined, the entire image is processed.

Output Name	What it is
Output Image	The undistorted image (may be viewed on the Output Image tab).

X-Y Projection

In the Image Geometry Drawer



The X-Y Projection tool finds the average intensity of each column (X projection) or row (Y projection) of an area within an ROI and then repeats that average intensity across the column or row to create a new image. This image can then be used by other tools.

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 search. For a single rectangle, the x or y axis is projected. For circles, polygons, doughnuts, etc. the tool origin axes are projected and the row/column average intensity includes the enabled pixels.
Projection Direction	Project on X Axis: Each column is repeated Project on Y Axis: Each row is repeated
Output Image Thickness	The width of the output image in units in the repeated direction. Default is zero which is ten units.
Fixed Threshold Range	The grey level threshold range for the In Range and Out of Range options (in percentage). The parameters are start and end.

Input Name	What it is
Use In Range Value	If True, pixels with a grey level within the Fixed Threshold Range are changed to the In Range Value before the average intensity is calculated. See “Fixed Threshold Range” on page 3-76.
In Range Value	The pixel grey level value to use for the Fixed Threshold Range.
Use Out Of Range Value	If True, pixels with a grey level within the Fixed Threshold Range are changed to the Out Of Range Value before the average intensity is calculated.
Out Of Range Value	The pixel grey level value to use for the Fixed Threshold Range.

Output Name	What it is
Output Image	The image made from the repeated rows or columns (may be viewed on the Output Image tab).

Fixed Threshold Range

If Use In Range Value is true, then the pixels in the Fixed Threshold Range are changed to the In Range Value before pixels in the rows or columns are averaged together. The same is done for Use Out Of Range Value. Use In Range Value and Use Out Of Range Value can be used at the same time.

This feature can be used if the averaging in the projection can cause small high contrast features to have the same intensity in the output image as larger, but lower contrast features. By remapping the lower contrast pixels, high contrast features still stand out in the output image.

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. The output blobs can be filtered with the Blob Filter tool to limit blobs based on size, area, and other parameters, if desired. See “How to Set Up the Blob tool” on page 3-78.

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.

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 search. If no shape is defined, the entire image is processed.

Input Name	What it is
Shape List ROI Type	Each Shape is separate ROI: Each shape is processed as a separate ROI and the results are combined. This mode is faster than the other mode if the shapes are far apart, but results are duplicated if the shapes overlap. ShapeList is One ROI: The ShapeList is one large rectangular ROI and the shapes are the enabled pixels within the rectangle. The tool may be slow if the shapes are far apart. This setting allows shapes to overlap and form complex shapes without repeating the overlapped pixels and duplicating results.
Grey Level Threshold Type	See “Grey Level Threshold Types” on page 3-80 for more details.
Blob Detect Type	Detect Out of Range: detects blobs that are outside the threshold range values Detect In Range: detects blobs that are within the threshold range values
Fixed Threshold Range	The grey level threshold range for Fixed Threshold Range type (in percentage). The parameters are start and end.
Exclude Border Blobs	When true, border blobs are excluded from the output list (see “Border Blobs” on page 3-111)
Fill Blob Holes	If True, any holes in the found blobs are filled to create a single blob. This can save time on images with many extra blobs.
Enable Width Filter	When true, blobs within the Width Range are included in the output list. (Ignored when the Filter Single Blob: First Blob property is selected.)
Width Range	Blob minimum and maximum width
Enable Height Filter	When true, blobs within the Height Range are included in the output list. (Ignored when the Filter Single Blob: First Blob property is selected.)
Height Range	Blob minimum and maximum height
Enable Area Filter	When true, blobs within the Area Range are included in the output list
Area Range	Blob minimum and maximum Area. The minimum value should be set when the Filter Single Bobruisk Blob property is selected. (The Maximum value is then ignored.)
Required Number of Blobs	If the number of found blobs (based on the filter settings) is within this range, the Passed output is set to true
Enable Output Blob List	If True, the filtered blobs are presented in the Blob List output
Enable Output Area List	If True, the filtered blobs areas are presented in the Area list output
Enable Output Centroid List	If True, the filtered blobs centroids are presented in the Centroid list output.

Input Name	What it is
Output Origin Type	Also see “Output Origin” on page 3-82 **Centroid X, Y Only**: The X and Y coordinates of the blob centroid (the angle is ignored) **Centroid X, Y and Major Axis Angle**: The X and Y coordinates of the blob centroid and Major Axis angle in a +/- 90 degree range (useful if blob has an oblong shape). **No Origin**: No origin is presented (tool runs faster) **Centroid X, Y, and Major Axis Angle 360 Range**: The X and Y coordinates of the blob centroid and Major Axis angle in a 360 degree range
Filter Single Blob	This filter is applied after all the other filters Off: Blobs are filtered and output according to all filter settings Centermost Blob: Only the blob closest to the center of each ROI is output First Blob: The tool stops processing when the first blob is found that has an area equal to or larger than the Area Range: Minimum value. (The Width Filter, Height Filter, and Area Range: Maximum filter settings are ignored. Exclude Border Blobs and Fill Blobs are forced to false to save processing time.) Largest Blob: Only the largest blob in each ROI is output Note: If Centermost or Largest blob is selected, only passed blobs are displayed in the image window.

Output Name	What it is
Number of Blobs Found	The number of blobs found
Output Blob List	List of filtered blobs
Output Area List	List of the areas of the filtered blobs
Output Centroid List	List of the X and Y coordinates of the centroid points of the filtered blobs
Passed	If true, the number of blobs in the Output Blob List falls within the range of the Required Number of Blobs
Threshold Range Used	The Fixed Threshold Range input value start and end.
Output Origin Relative to Tool	The found origin (including angle if selected) relative to the Tool Origin, based on filtered blobs. See “Output Origin” on page 3-82
Output Origin Relative To RWC	The found origin (including angle if selected) relative to the entire image space, based on filtered blobs. See “Output Origin” on page 3-82

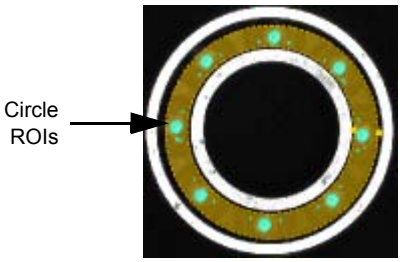
How to Set Up the Blob tool

General

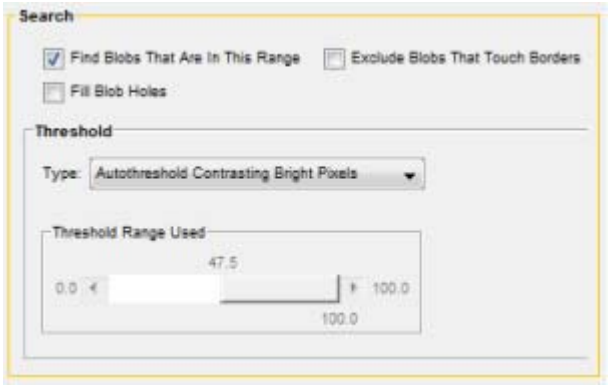
1. **Image**: To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin**: If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link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

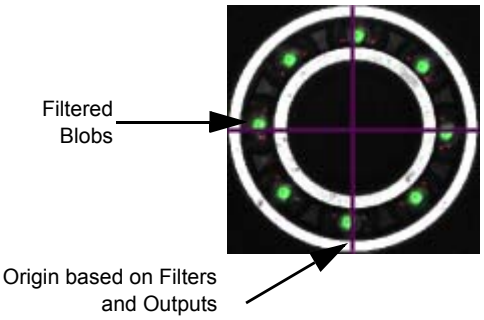


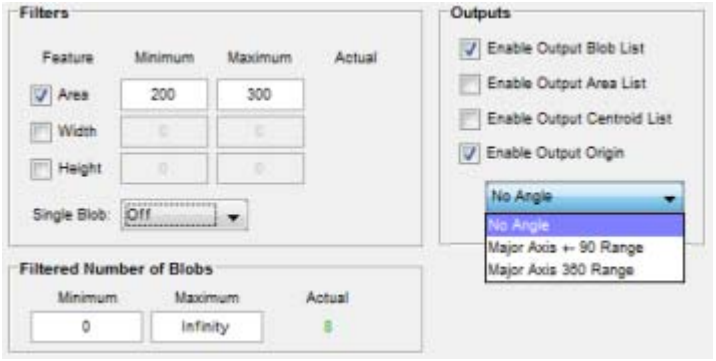
- **Find Blobs That Are in This Range**
  When this is checked, the tool finds blobs that have pixel greyscale values within the threshold range.
- **Exclude Blobs That Touch Borders**
  When this is checked, the tool excludes blobs that touch the ROI.
- **Fill Blobs Holes**
  When this is checked, any 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 3-80 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 3-82.
  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.

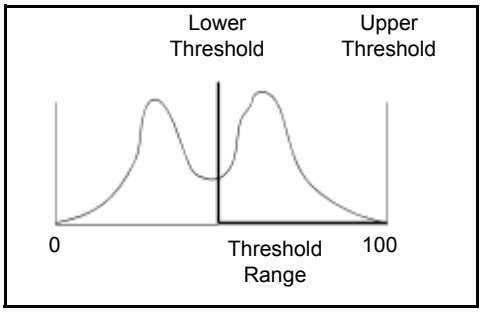
Display

See “Display panel” on page 3-23.

Grey Level Threshold Types

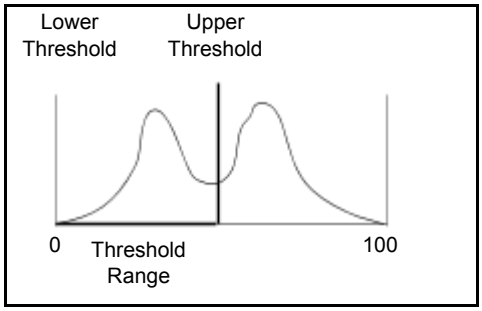
Autothreshold Contrasting Bright Pixels

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%.



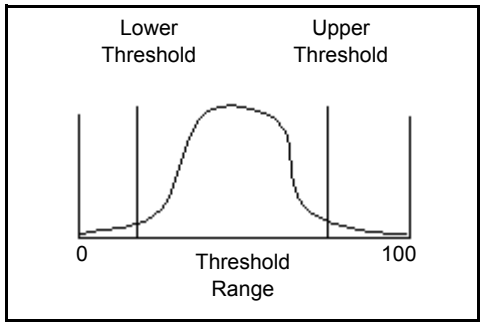
Autothreshold Contrasting Dark Pixels

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%.

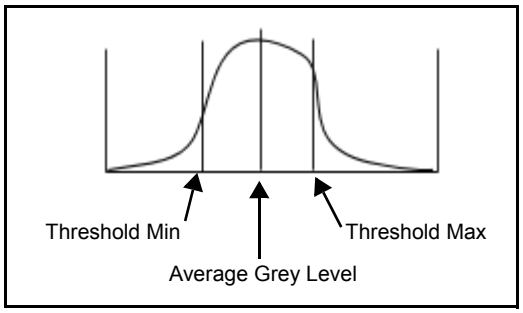


Fixed Threshold Range

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.

Centroid X, Y and Major Axis Angle type: 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.

Centroid X, Y, and Major Axis Angle 360 Range type: 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

In the Feature Finding, Measurement, and Locating Drawers

See “Circle Gauge” on page 3-150.

Circular Pattern Find

In the Locating Drawer



The Circular Pattern Find tool can quickly find the rotational position of rotating objects, such as coins, bottle caps, or snap rings. It uses normalized correlation over a circular arc and outputs an origin centered on the circle. The tool can be trained on and can search part or all of the circular arc. It can find one or several matches around the circular arc.

The tool has one circular arc ROI. To set up the tool, place and size the circular arc ROI over the region to be inspected and click the train button. If necessary, resize the arc length to cover the desired search angles. If the train region is 360 degrees, it is not necessary to resize the arc length. If train region is less than 360 degrees, the ROI length can be resized up to 360 degrees.

To adjust the circular arc ROI move the cursor around the ROI border until the cursor changes to the desired type, then click and drag the cursor to the desired place and size.

- Move 
- Increase Angle 
- Increase Radius 
- Widen Arc 
- Rotate 

Do not change the arc ROI's width between training and running, only the arc length. Generally, a thinner arc executes faster.

The tool can find multiple matches within the search ROI and the best match and a list of all matches are available as outputs.

Note: You cannot see the trained model. That is, after you train and then resize the arc for searching, you can not see the trained arc angle.

Input Name	What it is
Input Image	The image being inspected
Tool Origin	The tool's origin relative to the entire image space
Arc Region	The region of the image used to train the model.
Minimum Match Score	Found Match is false if no pattern is found with a match score larger than this (0 to 100)
Reference Angle Method	Center of Model Arc: The model is trained to report at the center of the arc region. 0 Degrees: The model is trained to report 0 degrees at the trained orientation.
Correlation Model	The model to find, linked from another tool

Output Name	What it is
Found Match	True when a model with a score greater than the Minimum Match Score is found
Output Best Origin	The model's origin relative to the input tool origin
Output Best Origin Relative to RWC	The model's origin in Real World Coordinates. Use this value when the Origin needs to be relative to the image for display or it needs to be linked as another tool's origin
Output Best Score	The best match score greater than the Minimum Match Score (1 to 100)

Output Name	What it is
Output Origin List	List of Origins relative to the input tool origin
Output Origin List Relative to RWC	List of Origins relative to Real World Coordinates
Output Score List	The match scores of origins in the Origin List

Line Find

In the Locating and Feature Finding Drawers



The Line Find tool finds the edge points along an edge or two edges, perform a linear regression on those points, and then create 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. See "How to Set Up the Line Find tool" on page 3-86.

For more details, see "How the Line Find tool works" on page 3-88.

Input Name	What it is
Input Image	The image to be inspected
Tool Origin	The tool's origin relative to the entire image space
Wide Line ROI	The line segment used to find the desired edge.
Line Type	The tool searches in the ROI arrow direction for this type of line (see "How the Line Find tool works" on page 3-88)
Edge Detection Method	Gradient Edges or Grey Level Edges 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. See "Edge Detection Method" on page 3-89.
Edge Detection Sensitivity	The sensitivity level determines the transition level necessary for detection. A higher value detects less well-defined edges.
Fixed Gradient Threshold Percentage	The gradient threshold value for Gradient Edges Detection Method
Fixed Grey Level Threshold Percentage	The grey level threshold value for Grey Level Edges Detection Method
Noise Level	The amount of background noise present in the image. The No Noise setting allows the tool to find edges that are close together since there isn't as much background noise in the image. The Very High Noise 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).

Input Name	What it is
Sampling Percent	The row sampling rate - for example, 100 samples every row, 50 samples every other row, 0 samples a minimum of 2 rows.
Outlier Distance Threshold	Outlying points beyond this distance are not included in the found line
Auto-Select Outlier Distance Threshold	If True, the Outlier Distance Threshold value is automatically calculated for each image. If False, you must click the Train button to calculate the Outlier Threshold.
Max Percentage of Outliers	The tool fails if the percentage of outliers, compared to the total number of edge points, exceeds this value.
Enable Angle Range Check	If True, the Output Origin must lie within the Line Angle Range
Line Angle Range	The maximum angle, in degrees, that the Output Origin may rotate for the tool to pass. The parameters are minus, nominal, plus, include end, and include start.
Enable Line Length Check	If True, the found line's length must lie within the Line Length Tolerance.
Line Length Tolerance	If the found line's length exceeds this value, the tool fails. The parameters are minus, nominal, and plus.
Enable Gap Length Check	If True, the maximum gap length in the found line must be less than the Max Gap Length
Max Gap Length	The maximum allowed gap between fitted points along the line segment, in real world units. 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*Sampling Rate*pixel_size, than the larger value is used instead.
Enable Straightness Check	If True, the found line must have a straightness error less than Max Straightness Error
Max Straightness Error	The maximum deviation allowed from a straight line (0 indicates a straight line)
Subpixel Method	The type of subpixel averaging The grey levels of one or more adjacent pixels (1, 3, 5, 7, or 9) around an edge point are used to interpolate the edge to a fraction of a pixel

Output Name	What it is
Passed	If True, the found line's parameters lie within all the limits
Line Segment	The found line
Output Origin Relative to Tool	The X and Y coordinates of the center point and the angle of the found line relative to the Tool Origin.

Output Name	What it is
Output Origin Relative To RWC	The X and Y coordinates of the center point and the angle of the found line relative to the entire image space.
Edge Points	The points used to create the found line
Outlier Points	The points further from the found line than the Outlier Distance Threshold
Greatest Outlier Distance	The distance of the furthest Outlier Point from the found line
Gap Segments	Line segments of gaps longer than the Max Gap Length
Greatest Gap Length	The length of the longest gap
Straightness Error	The deviation of the found line from a straight line (0 indicates a straight line)

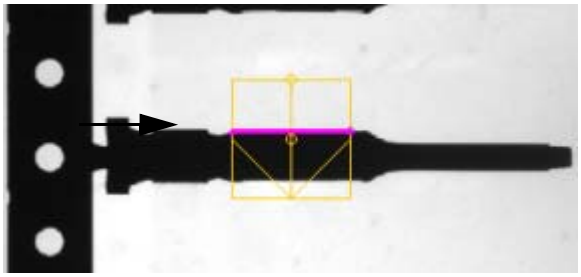
How to Set Up the Line Find tool

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.



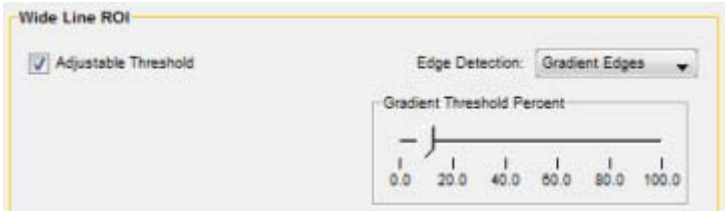
2. Adjust the Wide Line ROI settings to find the desired parts of the image.



For details on Edge Detection methods, see “Edge Detection Method” on page 3-89.

- **Grey Level Edges**

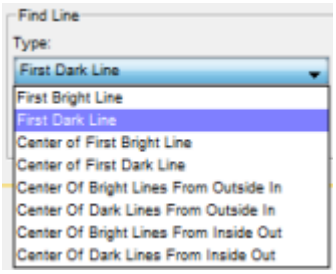
To find edges in the image using grey levels, set Edge Detection to Grey Level Edges. If you want to adjust the Grey Level Threshold manually, check Adjustable Threshold and use the Grey Level Threshold Percent slider to adjust the range that the tool uses.

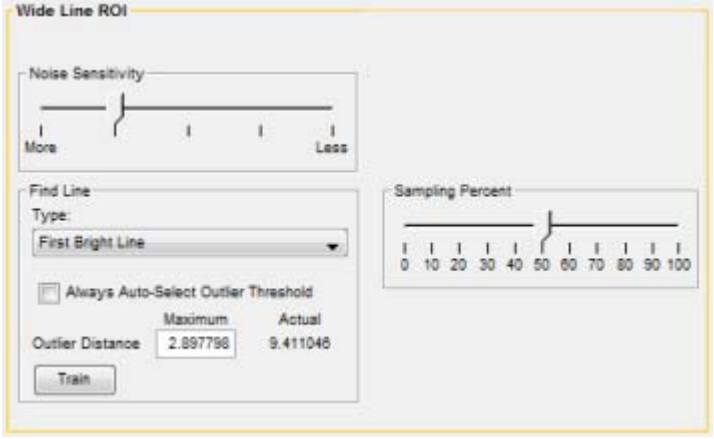


- **Gradient Edges**
  To find edges in the image using a gradient, set Edge Detection to Gradient Edges. If you want to adjust the Gradient Threshold manually, check Adjustable Threshold and use the Gradient Threshold Percent slider to adjust the range that the tool uses.



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.



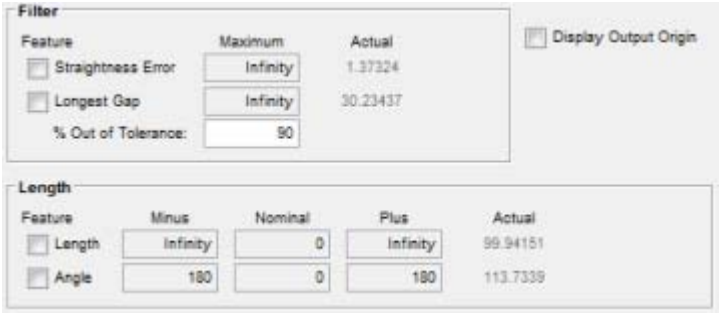


- **Noise Sensitivity**
  This adjusts the tool for the amount of background noise that is present in the image. The More Sensitivity setting allows the tool to find edges that are close together since there isn't as much background noise in the image. The Less Sensitivity setting means there is more 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.
- **Always Auto-Select Outlier Threshold**
  Check this if you want the tool to automatically calculate the Outlier Maximum Distance value for each image. If this is not checked, click the Train button to calculate the distance for the current image.

- **Outlier Distance**
  Outlying points beyond the Maximum Distance from the found line are not included in the line.
- **Train**
  Click the Train button to calculate the Maximum Outlier Distance for the current image. The button is disabled if Always Auto-Select Outlier Threshold is checked.

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.



- **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*Sampling Rate*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. 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.

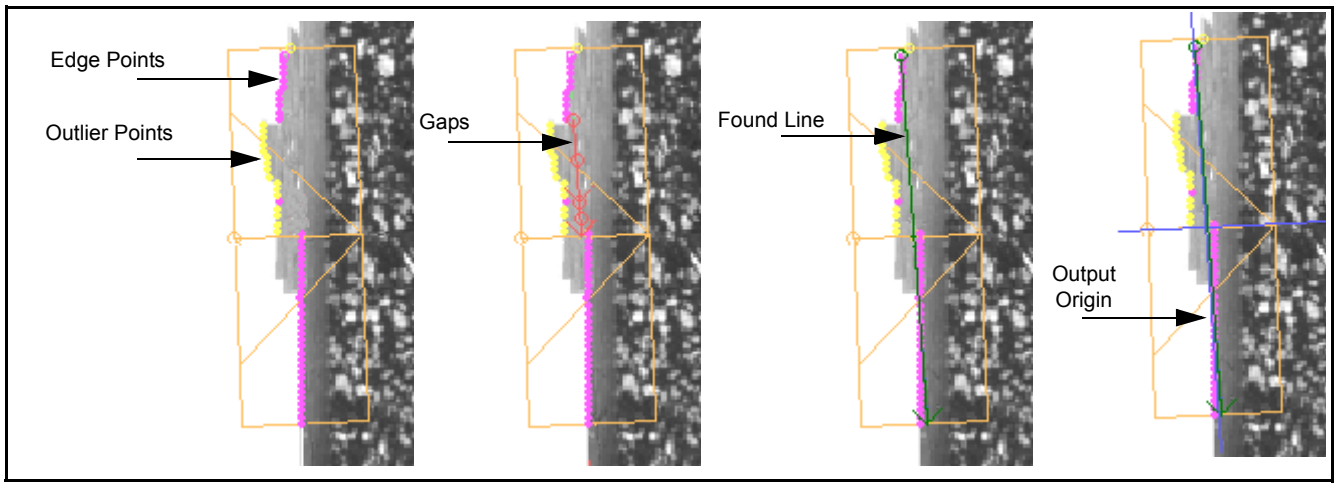
Display

See "Display panel" on page 3-23.

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.

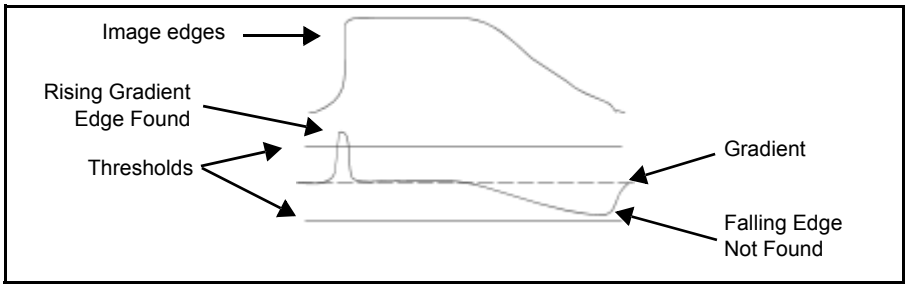
5. The output Origin is centered on the output Line Segment. The Origin is displayed only when the Display Output Origin check box in the Setup Pass/Fail panel is checked.

6. The Straightness Error is the average error of all the non-outlier points.

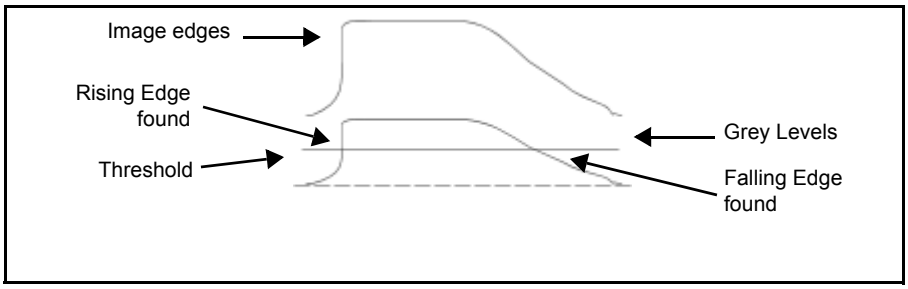
Edge Detection Method

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 property 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.

A Setup is available for this tool, which simplifies tool configuration. Click the Setup tab to use it.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space. Type or link a value into this property if you are trying to find an origin relative to another tool.

Input Name	What it is
Origin Type	One Direction: Primary ROI is used One Direction And Angle: Primary and Secondary ROIs used Two Directions: Primary and Perpendicular ROIs used Two Directions And Angle: Primary, Secondary, and Perpendicular ROIs used
Relative ROI Positioning Method	No Relative ROI Positioning: Each ROI is positioned based on edges found Find Primary Edge, Then Position Perpendicular ROI: When the Primary ROI is positioned, and a point is found, the Perpendicular ROI is positioned relative to the found point Find Perpendicular Edge, Then Position Primary ROI: When the Perpendicular ROI is positioned, and a point is found, the Primary ROI is positioned relative to the found point
Primary ROI	This is the primary locator ROI. Use this ROI alone if you are searching for a single edge in one direction. Place it perpendicular to the edge you want to find.
Primary Object Color to Find	The object color for the Primary ROI to find
Primary Threshold Method	Adaptive or Fixed - See “Threshold Method” on page 3-97 for more details.
Primary Fixed Threshold Percentage	The percentage grey level threshold value used when fixed threshold method is selected
Primary Adaptive Threshold Offset	If Adaptive Threshold Method is selected, this offset is added to the adaptive threshold. This setting allows you to weight the adaptive threshold up or down.
Primary Noise Level	The amount of background noise present in the image. The No Noise setting allows the tool to find edges that are close together since there isn’t as much background noise in the image. The Very High Noise 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).
Primary Centering Method	See “Centering Method” on page 3-97
Primary Point Number	The Primary ROI point used for the origin point, numbered from the start of the Primary ROI. Also see “Centering Method” on page 3-97
Primary Point Number for Centering	See “Centering Method” on page 3-97
Primary Edge Pattern	See “Primary, Secondary, Perpendicular Edge Pattern” on page 96.
Secondary ROI	Use this ROI in addition to the Primary ROI if you want to locate two places along one edge. Draw it parallel to the primary ROI.

Input Name	What it is
Secondary Uses Primary Threshold Settings	If True, the Secondary ROI uses the same threshold property settings as the Primary ROI If False, the Secondary ROI uses its own settings
Secondary Object Color to Find	The object color for the Secondary ROI to find
Secondary Threshold Method	Adaptive or Fixed - See “Threshold Method” on page 3-97 for more details.
Secondary Fixed Threshold Percentage	The percentage grey level threshold value for fixed threshold method
Secondary Adaptive Threshold Offset	If Adaptive Threshold Method is selected, this offset is added to the adaptive threshold. This setting allows you to weight the adaptive threshold up or down.
Secondary Noise Level	See “Primary Noise Level” on page 3-91.
Secondary Centering Method	See “Centering Method” on page 3-97
Secondary Point Number	The Secondary ROI point used for the origin point, numbered from the start of the Secondary ROI. Also see “Centering Method” on page 3-97
Secondary Point Number for Centering	See “Centering Method” on page 3-97
Secondary Edge Pattern	See “Primary, Secondary, Perpendicular Edge Pattern” on page 96.
Perpendicular ROI	Use this ROI in addition to the Primary ROI if you want to locate two edges in two directions. Use it with the Primary and Secondary ROIs if you want locate two places along one edge, with an angle. Draw this ROI perpendicular to the Primary and/or Secondary ROIs.
Perpendicular Uses Primary Threshold Settings	If True, the Perpendicular ROI uses the same threshold property settings as the Primary ROI If False, the Perpendicular ROI uses its own settings
Perpendicular Object Color to Find	The object color for the Perpendicular ROI to find
Perpendicular Threshold Method	Adaptive or Fixed - See “Threshold Method” on page 3-97 for more details.
Perpendicular Fixed Threshold Percentage	The percentage grey level threshold value for fixed threshold method
Perpendicular Adaptive Threshold Offset	If Adaptive Threshold Method is selected, this offset is added to the adaptive threshold. This setting allows you to weight the adaptive threshold up or down.

Input Name	What it is
Perpendicular Noise Level	See “Primary Noise Level” on page 3-91.
Perpendicular Centering Method	See “Centering Method” on page 3-97
Perpendicular Point Number	The Perpendicular ROI point used for the origin point, numbered from the start of the Perpendicular ROI. Also see “Centering Method” on page 3-97
Perpendicular Point Number for Centering	See “Centering Method” on page 3-97
Perpendicular Edge Pattern	See “Primary, Secondary, Perpendicular Edge Pattern” on page 96.
Subpixel Method	The type of subpixel averaging The grey levels of one or more adjacent pixels (3, 5, 7, or 9) around an edge point are used to interpolate the edge to a fraction of a pixel
Subpixel Position	The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-189.
Subpixel Search Distance in Pixels	The maximum distance, in pixels, that the subpixel algorithm searches from the threshold edge for the subpixel edge. See “Subpixel Search Distance” on page 3-161.
Use Reference Origin	If True, the Reference Origin is used to determine the Output origin.
Reference Origin	This is the desired position for the Origin on the displayed image. Move the Reference Origin to the desired position on the image, then press the Train button. The tool calculates the offset between the current found Origin and the Reference Origin, and use that offset for all subsequent found origins.

Output Name	What it is
Success	If True, an origin was found
Output Origin Relative to Tool	The found origin, relative to the Tool Origin, if any.
Output Origin Relative To RWC	The found origin, relative to the entire image space.
Primary Points Found	The point used on the Primary ROI to determine the origin.
Secondary Points Found	The point used on the Secondary ROI to determine the origin
Perpendicular Points Found	The point used on the Perpendicular ROI to determine the origin

Output Name	What it is
Points Found	A list of points found on all ROIs
Relative ROI Origin	The origin based on Relative ROI positioning. (See Relative ROI Positioning Method property)

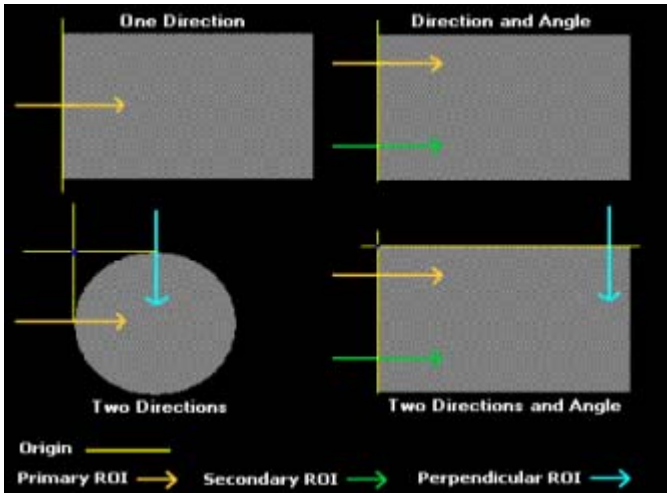
How to Set Up the Origin tool

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

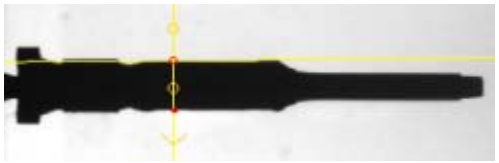
1. On the Method panel, select how the tool should create the origin. Each method uses one or more ROIs (Primary, Secondary, and Perpendicular) to find edges in the image. Use the method that works best for the feature you are trying to find.



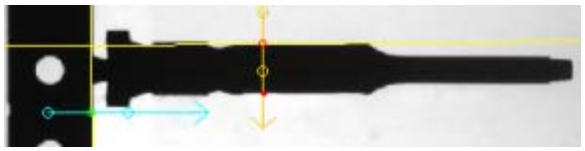
ROI and Pass/Fail

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

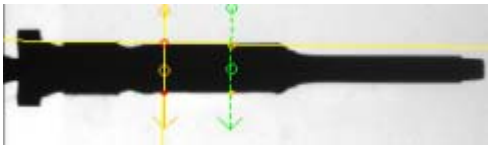
each method and the produced origin are shown.



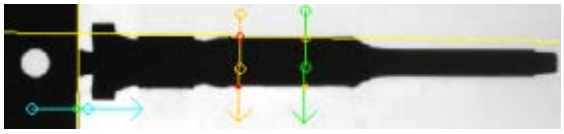
One Direction



Two Directions

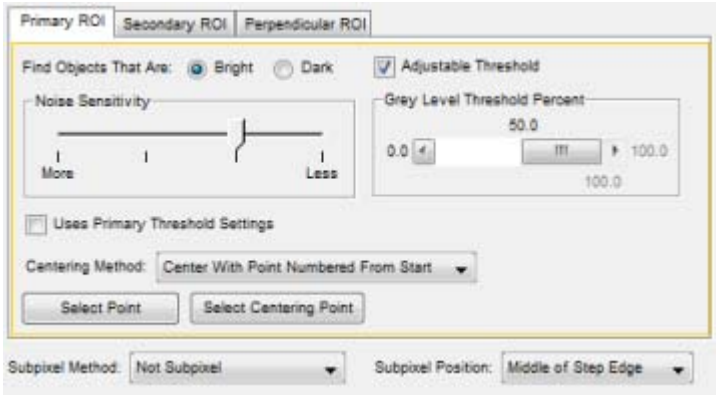


Direction and Angle



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 3-97.
- **Select Point**
  See “Centering Method” on page 3-97.
- **Select Centering Point**
  See “Centering Method” on page 3-97.
- **Subpixel Method**
  See “Subpixel Method” on page 3-161.
- **Subpixel Position**
  The subpixel position for edges that are not well defined. See “Subpixel Position” below.

Display

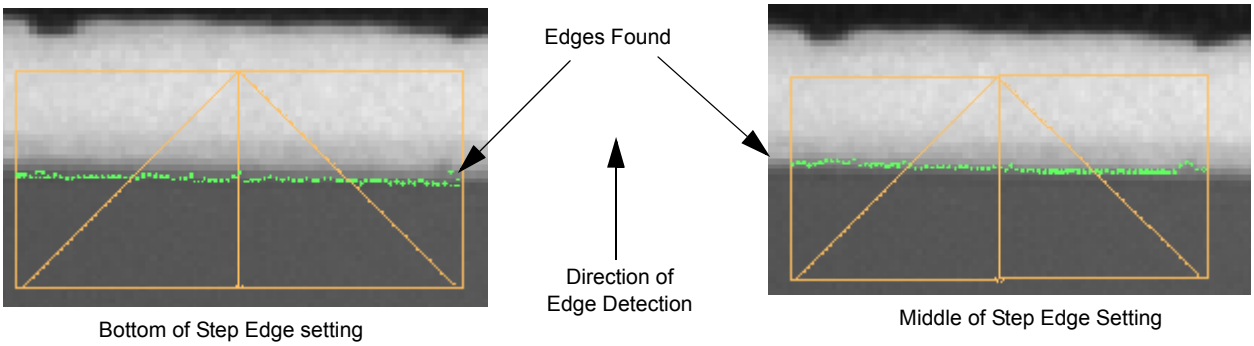
See “Display panel” on page 3-23.

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:

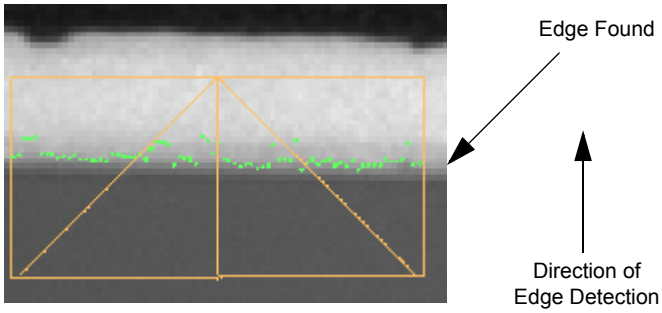
1. Middle of Step Edge: This is the default setting and the correct choice for most cases. The tool finds the steepest part of the edge (the area with the greatest grey level change).
2. Bottom of Ramp Edge: This setting finds the beginning of the edge.
3. Top of Ramp Edge: This setting finds the end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



Bottom of Step Edge setting

Middle of Step Edge Setting



Top of Step Edge Setting

Primary, Secondary, Perpendicular Edge Pattern

The tool ROIs detect patterns of transition from dark to light (rising) or light to dark (falling), depending on this property. For instance, the setting "Rising Only" finds only transitions in the image that change from dark to light. The found pattern is also affected by the "...Object Color to Find" property. The origin is located on the first transition of the selected type.

Alternating Falling/Rising: Detects both dark to light and light to dark transitions

Rising Only: Detects only dark to light transitions

Falling Only: Detects only light to dark transitions

Central Rising Edge: Detects the central point of the dark to light transition

Central Falling Edge: Detects the central point of the light to dark transition

First Rising Edge: Detects the first dark to light transition

First Falling Edge: Detects the first light to dark transition

Automatic: Detects transitions based on the "...Object Color to Find" property 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.

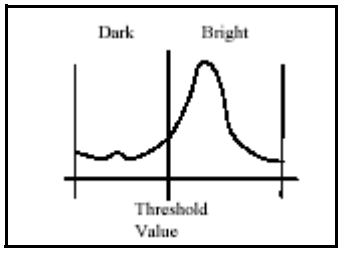
To center the origin between the first and last points on an ROI

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.

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, contour, or edge 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.

See “How to Set Up the Pinpoint Pattern Find tool” on page 3-102.

Input Name	What it is
Input Image	The image being inspected
Tool Origin	The tool’s origin relative to the entire image space
Train Shape List	The region of the image used to train the pattern. You can define multiple shapes and exclude parts of a shape. The train shape must be smaller than the Find Shape.
Find Shape List	The region of the image to search for the trained pattern.You can define multiple shapes and exclude parts of a shape. The Find shape must be larger than the Train Shape. If no Find Shape List is defined, the entire image is searched.
Edge Detection Sensitivity When Training	Controls the edge gradient threshold, which indicates sensitivity to noise in the image, during training. Higher settings detect more weak edges but cause the tool to run slower. If the tool fails, the pattern may include edges that are not reliably seen in all images of the object.
Fixed Edge Threshold When Training	The grey level threshold value to use when Fixed Threshold is selected for Edge Detection Sensitivity When Training. A larger number rejects edges that are not well defined.
Percent Of Train Edge Threshold To Use When Finding	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 Edge Detection Sensitivity When Training property. The tool then takes a percentage of that property value and uses that value for the edge finding threshold when searching. For example, if this property is 75%, the edges on the pattern edges are found if their contrast is 75% of the contrast of the trained pattern. A smaller number causes more edges to be detected, because the calculated gradient threshold is lower.
Optiimization Level	Optimizes tool function for speed or robustness.

Input Name	What it is
Angle Range Pattern	The maximum possible range of rotation of the image in relation to the trained pattern. No Rotation: This is the fastest setting + - A Few Degrees: uses the Angle Range property value 0 And 180 + - A Few Degrees: uses the Angle Range property value plus 180 degrees. For example, if the Angle Range is -5 and 5, the tool searches for patterns rotated from -5 to +5 and 175 to 185 degrees. Full 360 Degree Range: Searches for all rotations. (The Angle Range property does not need to be set.) If a pattern is not found, it could be because the image is rotated beyond this Angle Range.
Angle Range	This is the maximum start and end angle, in degrees, that the tool searches in the image for a match of the trained pattern when the Angle Range Pattern property is set to + - a Few Degrees. Typically this value is -5 and 5, indicating that the image may rotate up to 5 degrees counter-clockwise or clockwise from the trained pattern.
Angle Range Step Type	When searching for rotated patterns, the tool searches at specific rotations within the Angle Range, separated by the Angle Range Step. Fixed Steps: Enter the step value in the Angle Range Step property. Automatic Steps: Angle Range steps are calculated automatically when the pattern is trained. The value is reported in the Actual Angle Range Step output property.
Angle Range Step	The value to use for the Angle Range Step Type property when Fixed Steps is selected. The value is in degrees. If the tool misses patterns at certain rotations, use a smaller value. The tool runs faster with a larger value.
Enable Angle Filter	If True, the Angle Filter Range property is active.
Angle Filter Range	This property is used to filter the match results, so that found matches with an Origin angle outside this range are ignored. You can specify an Angle Range Pattern of Full 360 Degree Range and then specify a smaller range for this property so that the Pass or Fail for each one is based on the filtered angle.
Scale Range Pattern	This property is disabled and has no function.
Scale Range	This property is disabled and has no function.
Scale Range Step Type	This property is disabled and has no function.
Scale Range Step	This property is disabled and has no function.
Edge Match Binning Size	The number of pixels to group with the Edge Match algorithm.
Minimum Match Score	The tool passes if a pattern is found in the Search region that has a match score greater than or equal to this value (0 to 100). This value also determines which found patterns pass or fail.

Input Name	What it is
Model Reference Origin Placement	Train Region Center: The output origin is located in the center of the train region Train Region Upper Left Corner: The output origin is located in the upper left corner of the train region Use Model Reference Origin: The output region is relative to the Model Reference Origin. Drag the Model Reference Origin to the desired point on the image and then retrain the tool.
Model Reference Origin	This origin is used when the Model Reference Origin Placement property is set to Use Model Reference Origin.
Number To Find	This property is a counter, it does not determine whether the tool passes or fails. The tool searches the image for all pattern matches, then reports the location and score of all the found matches, up to the Number to Find property value. 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.
Algorithm Type	See "Algorithm Type" on page 3-105.
Pose Refinement	If Enabled, the Pose Refinement step works by fine tuning the angle and the x and y position (and then the angle again in some cases). When the Contour Match algorithm is used, and Pose Refinement is disabled, the output score is computed using correlation.
Pattern Model	Use this input to link a pattern from another Pinpoint Pattern Find tool for sharing or to modify a pattern during runtime using a Data Set tool.
Maximum Model Memory (MBytes)	The maximum amount of memory to use to create and store the pattern. Patterns can be large if many scale and angle steps are used. If the vision program is running out of memory, try reducing this number. This increases the tool's execution time. The Model Memory Used output contains the amount of memory currently being used.
Position Accuracy	Fast Pixel-Level Accuracy: The tool uses complete pixels to find edges. The tool runs faster with this setting. Subpixel Accuracy: The tool uses subpixel (1/8 pixel) accuracy to find edges. The tool runs more slowly using this setting.
Enable Image Edge Points Output	If True, a list of all the edge points found in the Find ROI are put in the Search Image Edge Points output property. Enabling this input causes the tool to take more time, but it helps when you are debugging problems and configuring edge detection settings.
Enable Tool Time-out	If True, the Tool Timeout property is active.
Tool Timeout (msec)	If active, tool execution will stop when the tool execution time exceeds this value. Any matches found up to that point will be reported.

Output Name	What it is
Passed	When at least one pattern with a score greater than or equal to the Minimum Match Score is found, this property is True.
Output Best Origin	The Output origin, relative to the tool origin input property, calculated from the found pattern with the highest Match Score.
Output Best Origin Relative to RWC	The Output origin, relative to Real World Coordinates, calculated from the found pattern with the highest Match Score. This is the output that should be linked to the tool origin input of other tools to position their regions of interest.
Output Best Scale	The amount of scaling in the found pattern with the highest Match Score.
Output Best Score	The best match score greater than the Minimum Match Score (1 to 100).
Output Origin List	A list of Output origins, relative to the tool origin input property, calculated from the found patterns with passing Match Scores.
Output Origin List Relative to RWC	A list of Output origins, relative to Real World Coordinates, calculated from the found patterns with passing Match Scores.
Output Scale List	A list of the scaling values used in the found patterns with passing Match Scores.
Output Score List	A list of the match scores in the found patterns with passing Match Scores. These scores are calculated as a normalized correlation score of the pattern and image pixels.
Failing Output Origin List	A list of Output origins, relative to the tool origin input property, calculated from the found patterns with failing Match Scores.
Failing Output Origin List Relative to RWC	A list of Output origins, relative to Real World Coordinates, calculated from the found patterns with failing Match Scores.
Failing Output Scale List	A list of the scaling values used in the found patterns with failing Match Scores.
Failing Output Score List	A list of the match scores in the found patterns with failing Match Scores. These scores are calculated as a normalized correlation score of the pattern and image pixels.
Model Display Points	The list of pattern edge points in the current image. If you want to show the pattern on a Control Panel, use this list. The points are relative to the input tool origin. If the pattern is scaled, then the pattern points are correspondingly scaled to line up with the image. If multiple patterns were found in the image, then pattern points are repeated at each location.
Model Display Points State List	The state (passing or failing) of the list of points in the Model Display Points property. When this property is linked to a Control Panel, it displays the Model Points in red and green.
Model Memory Used	The amount of memory used by the trained model, in Megabytes.
Actual Angle Range Step	The value used for the Angle Range Step Type property

Output Name	What it is
Actual Scale Range Step	The value used for the Scale Range Step property
Search Image Edge Points	The list of edge points that were found in the Find Shape List. This list is present only if the input Enable Image Edge Points Output is True.

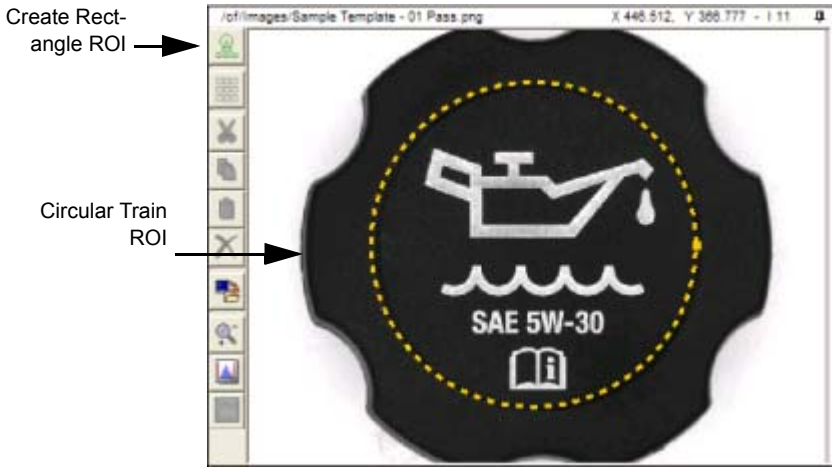
How to Set Up the Pinpoint Pattern Find tool

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. Click the link delete button to delete the link and set the origin to 0,0,0.

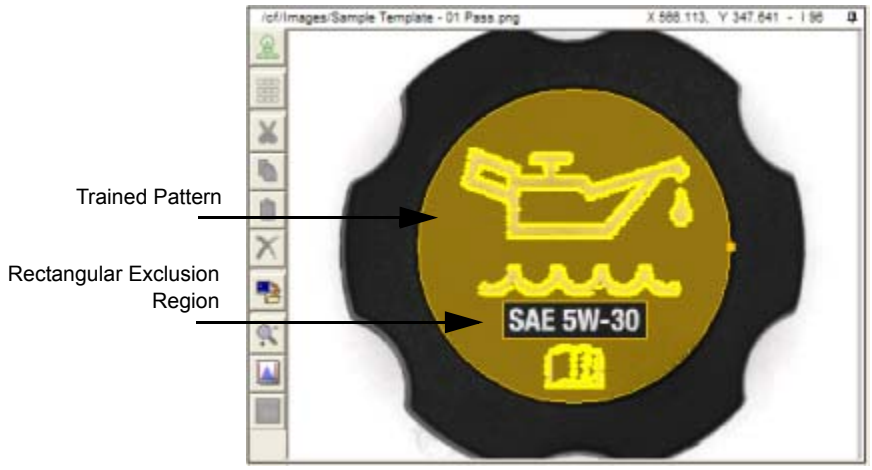
Train ROI

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.

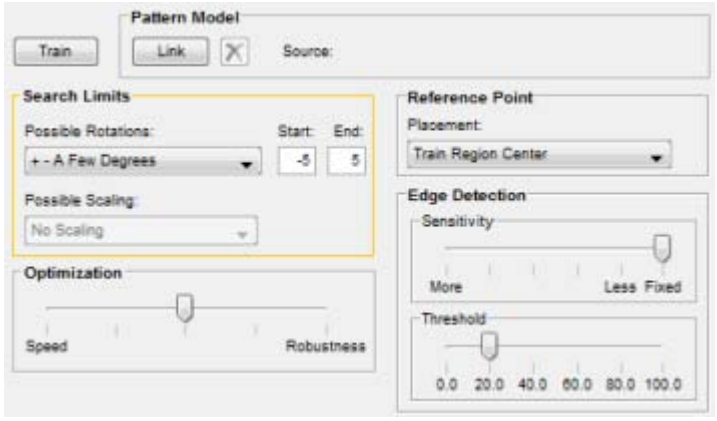


2. **Train**: Click the Train button to train the tool. After you make any changes to the settings or ROIs on this panel, you need to train the pattern. If you try to leave the Train ROI panel without training the tool, a warning is displayed. After the tool is trained, the found pattern is displayed 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.

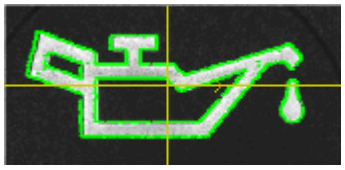


3. **Pattern Model**: The Pattern Model link is disabled.

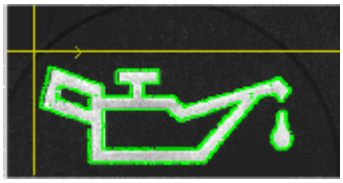


4. **Possible Rotations**: The Possible Rotations setting determines how the tool deals with image rotation. Use the No Rotation option if the image does not rotate. This is the fastest mode as most applications do not involve rotation.
   Use the "+- A Few Degrees" setting if the part can rotate a small 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 scaling setting is disabled since it has no effect.
6. **Optimization**: The tool can be optimized for speed or for robustness. Generally a balance between the two works best. If results are inconsistent, increase the setting toward Robustness.

7. **Reference Point Placement**: The tool's output origin is normally positioned at the center of the Train Shape ROI. You can also place the origin in the upper left corner of the ROI, or position it manually by dragging and rotating the blue Reference Origin. Here are three examples.



Center Reference Point



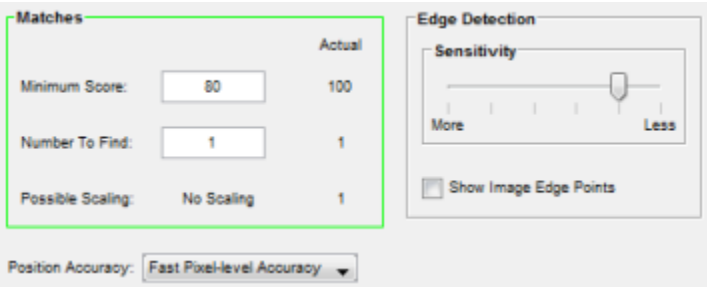
Upper Left Reference Point



Manual Reference Point

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



1. 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.
2. **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.
3. **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.
4. **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.

5. **Possible Scaling**: Scaling is disabled since it has no effect.
6. **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 3-23.

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.

- Correlation: Correlation is used to find candidate match locations in the image. This setting may be useful for patterns that have weak and variable edges or for very small objects.
- Edge Match: Edge matching is fast, especially for rotated objects. Since edges are inherently variable and noise-sensitive features, correlation may work better in some cases. This setting may be useful for patterns that have weak and variable edges or for very small objects.
- Contour Match: This algorithm uses edges for matching, like Edge Match, but it directly matches model and image edge points without searching through all possible rotations and offsets. This means it not necessary for the tool to use angle range steps during processing. Since model data is not stored at each step, the tool uses less memory.

Feature Finding Drawer

Average Gradient

In the Feature Finding Drawer



The Average Gradient tool is used to measure edge point sharpness in the region of interest (ROI). The larger the Average Gradient Result, the more sharply the image edge is focused.

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 search. If no shape is defined, the entire image is processed.
Percent of Strongest Edgels	The number of edge transitions that should be averaged into the result. A lower number includes fewer edges.

Output Name	What it is
Average Gradient Result	Grey level gradient in the ROI (in percentage)

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. See "How to Set Up the Average Intensity tool" on page 3-108.

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 regions of the image to search. If no shapes are defined, the entire image is processed.
Shape List ROI Type	Each Shape is separate ROI: Each shape is processed as a separate ROI. ShapeList is One ROI: The tool calculates average intensity as if there is only one ROI, no matter how many ROIs are used. The tool averages all the pixels from all the ROIs together and produces one Average Intensity and one Passed result. The Average Intensity and Passed Lists are one value long.
Tolerance Type	Use Uniform Tolerance: See the Uniform Tolerance property Use Nominal Intensity List and +- tolerances: See Nominal Intensity List property Use Tolerance List: See Tolerance List property

Input Name	What it is
Uniform Tolerance	If Tolerance Type is Use Uniform Tolerance, this tolerance value is applied to the average intensity of each of the ROIs. Use this value when there is one ROI or all ROIs are expected to have the same intensity. Click Train to set this value to the overall average intensity of all the ROIs. The parameters are minus, nominal, and plus.
Nominal Intensity List	If the Tolerance Type is Use Nominal Intensity List and +- tolerances, this list of values is used as the Nominal Intensity value for each of the ROIs. The Plus and Minus Tolerance values are applied to each Nominal value in the list to set the allowed average intensity for each ROI. Use this mode 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. Click Train to recalculate the values in this list. If this property is linked, training has no effect.
Plus Tolerance	This value is used as the Plus tolerance for all the values in the Nominal Intensity List and the initial Plus tolerance for the values in the Tolerance List.
Minus Tolerance	This value is used as the Minus tolerance for all the values in the Nominal Intensity List and the initial Minus tolerance for the values in the Tolerance List.
Tolerance List	If the Tolerance Type is Use Tolerance List, this list of values, along with the Plus Tolerance and Minus Tolerance values, is used as the Nominal Intensity value for each of the ROIs. Use this mode when you want to set the plus and minus tolerance of each ROI separately. Click Train to recalculate the nominal value of each tolerance in the list. You must adjust the Plus and Minus Tolerance manually. If this property is linked, training has no effect.
Number of ROIs Allowed to Fail	If the number of ROIs that fail is greater than this value, the tool fails.
Intensity Offset	This value is added to the Average Intensity Result for each ROI.
Enable Difference List Out	If True, the Intensity Difference List is generated.

Output Name	What it is
Average Intensity Result	Average grey level intensity of all pixels in all ROIs
Intensity Difference	The positive or negative difference between the Average Intensity Result and the Uniform Tolerance nominal value, regardless of the Tolerance type

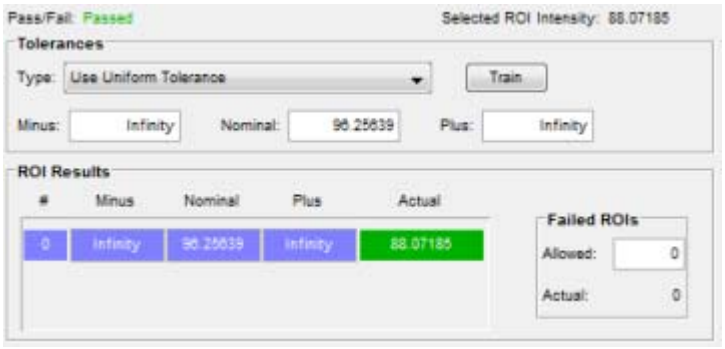
Output Name	What it is
Intensity Offset Output	The negative value of Intensity Difference. This value can be linked to the Intensity Offset input property of another Average Intensity tool to offset light level changes.
Average Intensity List	The calculated Average Intensity of the ROIs
Intensity Difference List	A list of the positive or negative differences between the measured intensity and the Tolerance nominal value for each ROI
Passed	If True, all the ROIs were within tolerance and no error occurred.
Passed List	The Pass or Fail result of each ROI.
Number of Fails	The number of ROIs that failed.

How to Set Up 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



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 3-23.

Blob-Feature

In the Feature Finding, Flaw Detection, and Locating Drawers

See “Blob” on page 3-76.

Blob Filter

In the Feature Finding Drawer



The Blob Filter tool filters the blob’s output list for user-selected features such as size, shape, or whether any part of the blob is filled. The included blobs are put in a filtered list that is available as an output.

Input Name	What it is
Input Image	The image being inspected
Tool Origin	The tool’s origin relative to the entire image space
Input Blob List	List of blobs to filter
Input Shape List	List of Shapes to filter
Exclude Border Blobs	When checked, filter excludes border blobs (see “Border Blobs” on page 3-111)
Enable Width Filter	When checked, filters blobs within Width Range
Width Range	Blob minimum and maximum width
Enable Height Filter	When checked, filters blobs within Height Range
Height Range	Blob minimum and maximum height
Enable Area Filter	When checked, filters blobs within Area Range

Input Name	What it is
Area Range	Blob minimum and maximum Area
Enable Filled Area Filter	When checked, filters blobs within Filled Area Range (see “Filled Blobs” on page 3-111)
Filled Area Range	Blob minimum and maximum Filled Area
Enable Oblong-ness Filter	When checked, filters blobs within Oblongness Range (see “Oblong-ness” on page 3-111)
Oblongness Range	Blob minimum and maximum Oblongness
Enable Filled Oblongness Filter	When checked, filters blobs within Filled Oblongness Range
Filled Oblongness Range	Blob minimum and maximum Filled Oblongness
Enable Convexity Filter	When checked, filters blobs within Convexity Range (see “Convexity” on page 3-111)
Convexity Range	Blob minimum and maximum convexity
Enable Filled Con-vexity Filter	When checked, filters blobs within Filled Convexity Range
Filled Convexity Range	Blob minimum and maximum Filled Convexity
Enable Filled Major Length Filter	When checked, filters blobs within Filled Major Length Range (see “Major Length” on page 3-111)
Filled Major Length Range	Blob minimum and maximum Filled Major Length
Enable Filled Minor Length Filter	When checked, filters blobs within Filled Minor Length Range (see “Minor Length” on page 3-111)
Filled Minor Length Range	Blob minimum and maximum Filled Minor Length
Enable Filled Major Minor Ratio Filter	When checked, filters blobs within Filled Major Minor Ratio Range
Filled Major Minor Ratio Range	Blob minimum and maximum Filled Major Minor Ratio
Rect List Range	The list of rectangles to process
Enable Filled Perimeter Filter	When checked, filters blobs within Filled Perimeter Range
Filled Perimeter Range	Blob minimum and maximum Filled Perimeter

Output Name	What it is
Filtered Blob List	List of filtered blobs, based on input settings

Border Blobs

Border blobs are those blobs that touch the ROI.

Filled Blobs

Filled values are calculated using the entire inside of a blob, including nested blobs. A nested blob is entirely contained inside another blob.

Oblongness

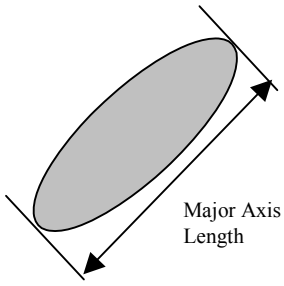
Oblongness is the relationship of the blob's area to its perimeter squared. A perfect circle has a value of approximately 12.5 (4 times pi) with the value increasing as the blob becomes more oblong. This value can be calculated faster than convexity.

Convexity

Convexity is determined by calculating the area of a convex hull drawn around the blob, then dividing that value by the area of the blob. This value increases if there are any concavities in the blob's perimeter.

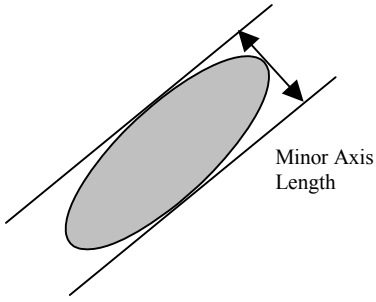
Major Length

The Major Length is the length of the major axis of an ellipse having the same moments of inertia about the major and minor axes as the blob.



Minor Length

The Minor Length is the length of the minor axis of an ellipse having the same moments of inertia about the major and minor axes as the blob.



Circle Gauge-Feature

In the Feature Finding, Measurement, and Locating Drawers

See “Circle Gauge” on page 3-150.

Color Blob

In the Feature Finding Drawer



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.

See “How to Set Up the Color Blob tool” on page 3-114. Also see “How the Color Blob tool works” on page 3-116.

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.
Train Shape List	The region of the image that contains the desired color.
Shape List ROI Type	Each Shape is separate ROI: Each shape is processed as a separate ROI and the results are combined. This mode is faster than the other mode if the shapes are far apart, but results are duplicated if the shapes overlap. ShapeList is One ROI: The ShapeList is one large rectangular ROI and the shapes are the enabled pixels within the rectangle. The tool may be slow if the shapes are far apart. This setting allows shapes to overlap and form complex shapes without repeating the overlapped pixels and duplicating results.
Blob Detect Type	Detect Out of Range: detects blobs that are outside the Maximum Allowed Color Difference Detect In Range: detects blobs that are within the Maximum Allowed Color Difference
Trained Color	The Red, Green, and Blue values of the trained color.
Trained Color List	When Train Mode is set to Add To The Trained Color this contains a list of all the trained colors. Pixels are in range if they are in range for any color in the list.

Input Name	What it is
Train Mode	Train a New Color: trains a new color using the current settings Add To The Trained Color: trains a new color using the current settings and adds it to the Trained Color List. Pixels are in range if they are in range for any color in the list.
Color Difference Method	Color Difference Includes Intensity: the Maximum Allowed Color Difference value uses all 3 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: uses both Maximum Allowed Color Difference and the Intensity Difference Range setting. The intensity and chromaticity (hue and saturation) information is separated. Intensity Difference Range indicates the allowed variation, plus or minus, from the trained intensity. The Maximum Allowed Color Difference indicates only the allowed chromaticity difference. Use Red, Green, and Blue Ranges: uses the Red Range, Green Range, and Blue Range input properties
Maximum Allowed Color Difference	This is the maximum difference allowed between a pixel color in the inspected image area and the Trained Color.
Intensity Difference Range	The allowed variation, plus or minus, from the trained intensity. The parameters are start and end.
Red Range	The range used for red when Color Difference Method is set to Use Red, Green, and Blue Ranges. The parameters are start and end.
Green Range	The range used for green when Color Difference Method is set to Use Red, Green, and Blue Ranges. The parameters are start and end.
Blue Range	The range used for blue when Color Difference Method is set to Use Red, Green, and Blue Ranges. The parameters are start and end.
Exclude Border Blobs	When true, border blobs are excluded from the output list (see “Border Blobs” on page 3-111)
Fill Blob Holes	When true, any holes in the found blobs are filled to create a single blob. This can save time on images with many extra blobs.
Enable Width Filter	When true, blobs within the Width Range are excluded from the output list
Width Range	Blob minimum and maximum width
Enable Height Filter	When true, blobs within the Height Range are excluded from the output list
Height Range	Blob minimum and maximum height. The parameters are start and end.
Enable Area Filter	When true, blobs within the Area Range are excluded from the output list
Area Range	Blob minimum and maximum Area. The parameters are start and end.
Required Number of Blobs	If the number of found blobs (based on the filter settings) is within this range, the Passed output is set to true. The parameters are start and end.

Input Name	What it is
Enable Output Blob List	When true, the filtered blobs are presented in the Blob List output
Enable Output Area List	When true, the filtered blobs areas are presented in the Area list output
Enable Output Centroid List	When true, the filtered blobs centroids are presented in the Centroid list output
Output Origin Type	Also see “Output Origin” on page 3-82 **Centroid X, Y Only**: The X and Y coordinates of the blob centroid (the angle is ignored) **Centroid X, Y and Major Axis Angle**: The X and Y coordinates of the blob centroid and Major Axis angle in a +/- 90 degree range (useful if blob has an oblong shape). **No Origin**: No origin is presented (tool runs faster) **Centroid X, Y, and Major Axis Angle 360 Range**: The X and Y coordinates of the blob centroid and Major Axis angle in a 360 degree range
Filter Single Blob	This filter is applied after all the other filters Off: Blobs are filtered and output according to all filter settings Centermost Blob: Only the blob closest to the center of each ROI is output Largest Blob: Only the largest blob in each ROI is output Note: If Centermost or Largest blob is selected, only passed blobs are displayed in the image window.

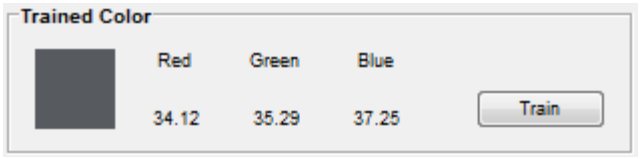
Output Name	What it is
Number of Blobs Found	The number of blobs found
Output Blob List	List of found blobs
Output Area List	List of the areas of the filtered blobs
Output Centroid List	List of the X and Y coordinates of the centroid points of the filtered blobs
Passed	If true, the number of blobs in the Output Blob List falls within the range of the Required Number of Blobs
Output Origin Relative to Tool	The X and Y coordinates and angle of the found origin point relative to the Tool Origin.
Output Origin Relative To RWC	The found origin point (and angle if selected) relative to the entire image space.

How to Set Up 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



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



1. Click the Search ROI button. Position the Search ROI over the area of the image that you want to inspect.

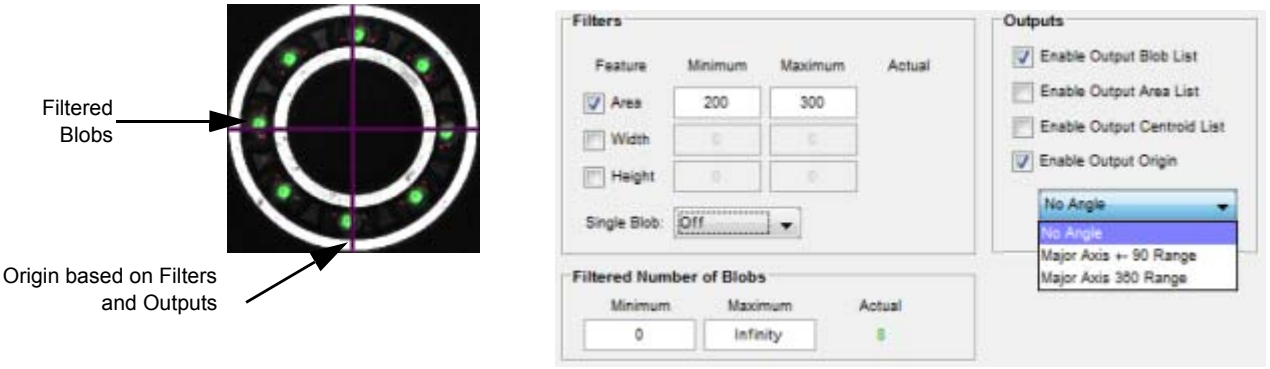
- **Find Blobs That Are In Range**
  If checked, the tool finds color areas that are within the Trained Color space.
- **Exclude Blobs That Touch Borders**
  If checked, found color areas that touch the ROI are not included. See “Border Blobs” on page 3-96.

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.
- **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.

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 3-82.
  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 3-23.

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 Set Up the Color Checker tool” on page 3-117.

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.

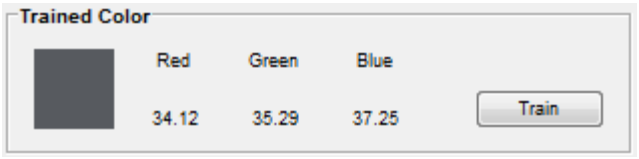
Output Name	What it is
Average Color	The Red, Green, and Blue values of the average color in the Shape List. (0-100)
Actual Color Difference	The difference between the Trained Color and the Average Color, in the RGB color space.
Color In Tolerance	If True, the Actual Color Difference is less than the Maximum Allowed Color Difference.

How to Set Up 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.

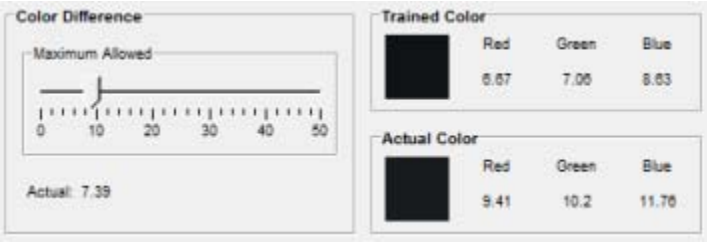
Train ROI



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 3-23.

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

In the Feature Finding and Flaw Detection Drawers



The Contrast tool checks the pixels within an ROI and calculates the percentage or area of pixels that are outside and inside the Threshold Range. If the calculated range or area is inside or outside the user-defined range, the tool passes. The In Range and Out of Range tests are mutually exclusive and the tool always Fails if they are both enabled.

The Contrast tool evaluates all of its ROIs as a total group against a common tolerance and provides combined outputs. “How to Set Up the Contrast tool” on page 3-120.

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 search. If no shape is defined, the entire image is processed.
Grey Level Threshold Type	See “Grey Level Threshold Types” on page 3-80 for more details.
Fixed Threshold Range	The grey level threshold range for Fixed Threshold Range type (in percentage). The parameters are start and end.
Enable In Range Percent Test	The percentage of pixels with a grey level within the Threshold Range is calculated. If that percentage falls within the In Range Percent, the tool passes.
Set In Range Percent	This range is used for the In Range Percent Test.
Enable In Range Area Test	The area of pixels with a grey level within the Threshold Range is calculated. If that area falls within the In Range Area, the tool passes.
Set In Range Area	This range is used for the In Range Area Test.
Enable Out of Range Percent Test	The percentage of pixels with a grey level outside the Threshold Range is calculated. If that percentage falls within the Out of Range Percent, the tool passes.
Set Out of Range Percent	This range is used for the Out of Range Percent Test.
Enable Out of Range Area Test	The area of pixels with a grey level outside the Threshold Range is calculated. If that area falls within the Out of Range Area, the tool passes.
Set Out of Range Area	This range is used for the Out of Range Area Test.

Output Name	What it is
Passed	True if input tests are enabled and the conditions are met.
Percent In Range	Percentage of pixels in the ROI within the designated grey level range (0 to 100 percent)
Percent Out of Range	Percentage of pixels in the ROI outside the designated grey level range (0 to 100 percent)
In Range Area	The total area of all pixels inside the designated grey level range (in square units)
Out of Range Area	The total area of all pixels outside the designated grey level range (in square units)

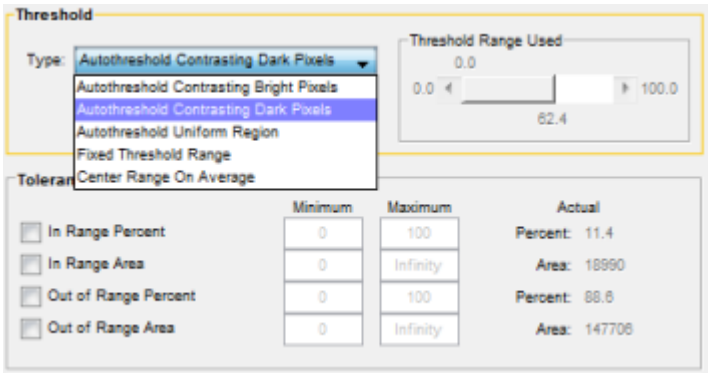
Output Name	What it is
Threshold Range Used	The Fixed Threshold Range input. The parameters are start and end.

How to Set Up the Contrast 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.

ROI Pass/Fail



1. Position the ROI over the area of the image that contains the area you want to inspect. If there is not ROI, the entire images is inspected.

- **Threshold**
  Type: Select the type of thresholding to use. See “Grey Level Threshold Types” on page 3-80 for more details.
  Threshold Range Used: If an Autothreshold type is selected, this is the threshold range used by the tool.
  Fixed Threshold Range: If Fixed Threshold or Center Range On Average is selected, adjust the slider to the desired value.

- **Tolerance**
  In Range Percent: If the box is checked, the percentage of pixels with a grey level within the Threshold Range is calculated. If that percentage falls within the In Range Percent minimum and maximum, the tool passes.
  In Range Area: If the box is checked, the area of pixels with a grey level within the Threshold Range is calculated. If that value falls within the In Range Area minimum and maximum, the tool passes.
  Out of Range Percent: If the box is checked, the percentage of pixels with a grey level outside the Threshold Range is calculated. If that percentage falls within the Out of Range Percent minimum and maximum, the tool passes.
  Out of Range Area: If the box is checked, the area of pixels with a grey level outside the Threshold Range is calculated. If that area falls within the Out of Range Area minimum and maximum, the tool passes.
  Actual: The measured value of each tolerance filter is displayed.

Display

See “Display panel” on page 3-23.

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 Contrast - Multiple ROI tool evaluates each ROI individually, against a common tolerance, and provides a detailed list of outputs. See “How to Set Up the Contrast - Multiple ROI tool” on page 3-122.

Input Name	What it is
Input Image	The image being inspected.
Region of Interest List	The list of regions of interest to process
Tool Origin	The tool’s origin relative to the entire image space
Grey Level Threshold Type	See “Grey Level Threshold Types” on page 3-80 for more details.
Fixed Threshold Value	The grey level threshold range for Fixed Threshold Range type (in percentage).
Fixed Threshold Range	The grey level threshold range for Fixed Threshold Range type (in percentage). The parameters are start and end.
Maximum Percent Out of Range	Maximum percentage of pixels to allow in the ROI outside the designated grey level range (0 to 100 percent)
Create In Range Percent Output List	If True, a list of regions is produced, indicating whether the maximum percent of pixels in those areas were in range
Create In Range Area Output List	If True, a list of regions is produced indicating whether the total area of all pixels is inside the designated grey level range
Create Out of Range Percent Output List	If True, a list of regions is produced, indicating whether the maximum percent of pixels in those areas were out of range
Create Out of Range Area Output List	If True, a list of regions is produced indicating whether the total area of all pixels is outside the designated grey level range
Tolerance Type	Maximum Percentage Out of Range: The tool compares the percent of pixels that are out of range to the Maximum Percent Out of Range Maximum Area Out of Range: The tool compares the area of pixels that are out of range to the Maximum Area Out of Range
Maximum Percent Out of Range	Maximum percentage of pixels to allow in the ROIs outside the designated grey level range (0 to 100 percent)
Maximum Area Out of Range	Maximum area of pixels to allow in the ROIs outside the designated grey level range (0 to 100 percent)

Input Name	What it is
Number of ROIs Allowed To Fail	An ROI fails when the Maximum Area or Maximum Percent Out of Range value is exceeded. If the number of ROIs that fail exceeds this value, the tools's Passed output boolean is set to false.

Output Name	What it is
Percent In Range List	A list of all regions with a percentage of pixels within the designated grey level range
Percent Out of Range List	A list of all regions with a percentage of pixels outside the designated grey level range
In Range Area List	A list of all regions with a total area of pixels within the designated grey level range
Out of Range Area List	A list of all regions with a total area of pixels outside the designated grey level range
Total Percent In Range	The total percentage of all pixels within the designated grey level range
Total Percent Out of Range	The total percentage of all pixels outside the designated grey level range
Total In Range Area	The total area of all pixels within the designated grey level range
Total Out of Range Area	The total area of all pixels outside the designated grey level range
In Tolerance List	A list of all regions that are within the defined parameters
Number of Fails	The number of regions that failed to fall within the defined parameters
Passes	If True, the Number of ROIs Allowed to Fail was not exceeded.

How to Set Up the Contrast - Multiple ROI tool

General

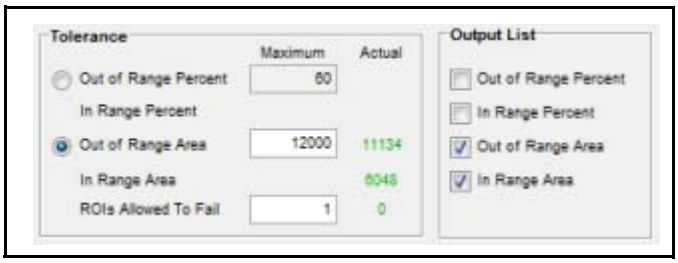
1. **Image**: To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin**: If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link 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 3-80.
   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 6-22)



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 3-23.

Edge Point Find

In the Feature Finding Drawer



The Edge Point Find tool uses an adaptive or a fixed threshold method to find edge points along a single pixel line ROI. See “How to Set Up the Edge Point Find tool” on page 3-125.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space
Line Segment	The x and y coordinates of the beginning and end of the edge-finding line
Line Segment List	A list of all the line segments between edges found

Input Name	What it is
Noise Level	The amount of background noise present in the image. Higher noise means the edges must be farther apart. Lower noise allows edges that are closer together.
Maximum Number Of Edges To Find	Limits the number of edges found to those with the strongest transitions
Edge Pattern	The edge pattern to find (Rising indicates a transition from dark to light; Falling indicates a transition from light to dark) All edges Alternating Rising/Falling Alternating Falling/Rising Rising Only Falling Only Central Rising Edge Central Falling Edge
Edge Detection Method	Gradient Edges or Grey Level Edges 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. See “Edge Detection Method” on page 3-89.
Edge Detection Sensitivity	The sensitivity level Determines the transition level necessary for detection. A higher value detects more edges. The non-fixed uses adaptive threshold selection. See “Threshold Types” on page 3-230. Fixed Threshold uses the Adaptive Grey Level Threshold Offset fixed value.
Fixed Gradient Threshold Percentage	The gradient threshold value for Fixed Threshold Edge Detection Sensitivity (0 to 100 percent)
Fixed Grey Level Threshold Percentage	The grey level threshold value for Fixed Threshold Edge Detection Sensitivity when Grey Level Edge detection is selected (0 to 100 percent)
Adaptive Grey Level Threshold Offset	If one of the adaptive settings is picked from Edge Detection Sensitivity, and Grey Level Edges is selected, then this offset is added to the adaptive threshold. This allows you to weight the adaptive threshold up or down.
Subpixel Method	The type of subpixel averaging The grey levels of adjacent pixels (1, 3, 5, 7, or 9) around an edge point are averaged and used to interpolate the edge to a fraction of a pixel.
Subpixel Position	The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-189.
Subpixel Search Distance in Pixels	The maximum distance, in pixels, from the threshold edge that the subpixel algorithm searches for the subpixel edge. See “Subpixel Search Distance” on page 3-161.

Input Name	What it is
Enable Rise/Fall Output	If True, the Edge Rise/Fall Indicator List output is populated.
Enable Number of Edges Per Segment Output	If True, the Number of Edges Per Segment List output is populated.

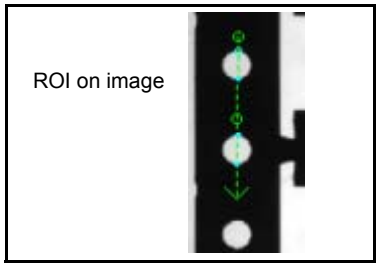
Output Name	What it is
Edge Transitions List	A list of the x and y coordinates of all the edge point found
Edge Rise/Fall Indicator List	A list of edges found, indicating whether the edge is rising or falling True = rising, False = falling
Number of Edges Per Segment List	Lists the number of found edges in each line segment

How to Set Up the Edge Point Find tool

General

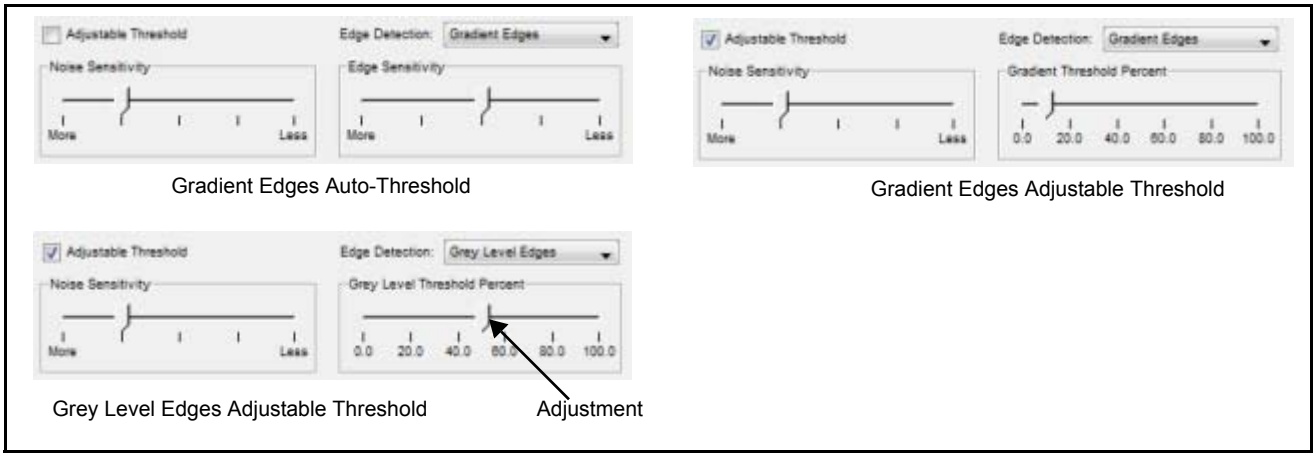
1. **Image**: To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin**: If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link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

ROI

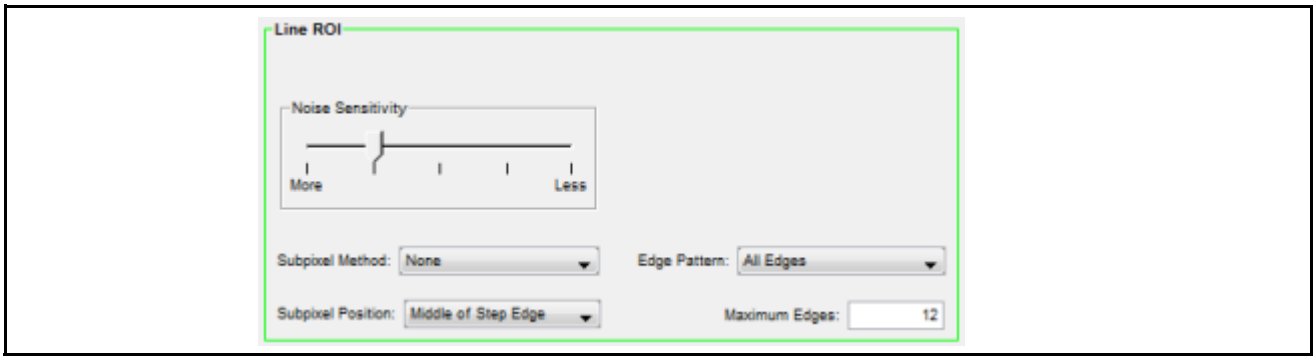


1. Position one or more ROIs over the area of the edges in the image you want to find. You must have at least one ROI.
2. Edge Detection
   Select the type of edge detection the tool should use to find the edges: grey level or gradient. Gradient detection generally provides more consistent results. In 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 3-89.



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 3-89.
   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 3-161.
7. Subpixel Position: The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-189.
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 3-23.

Line Find-Feature

See “Line Find” on page 3-84

Pattern Sorting

In the Locating Drawer (Available on Impact MX40, MX80, MX-U40, and MX-U80 processors only.)



The Pattern Sorting tool works by comparing trained patterns contained in a searchable pattern tree (database) with patterns in the input image. A Setup is available for this tool, which simplifies tool configuration. See “How to Set Up the Pattern Sorting tool” on page 3-136.

Use the Pattern Database Manager (PDM) to create, train, and modify the searchable pattern tree (database) that the Pattern Sorting tool uses for pattern matching. See “Pattern Database Manager” on page 6-59.

Button/Tab Name	What it does
Run	Runs the tool.
Add Image	If a database is loaded, the Input Image is added to a specific PDM queue to be trained for that database. If no database is loaded, the Input Image is added to a general PDM queue to be trained for a new database. Image names are automatically generated, but they can be edited in PDM.
Run Database Manager	The Pattern Database Manager (PDM) is started. PDM is used to create, train, and modify a searchable pattern tree (database) used for pattern matching.
Load Database	Loads the database entered in the Pattern Database Name property in the path entered in the Database Directory Path property. If either property is blank, the database is cleared. If the database does not exist, an error is displayed.
Reset	Resets the Output Counter Num Found Per Pattern and Output Counter Num Found Per Custom Info properties to zero.
Pattern Database Tab	Displays thumbnails of the pattern images contained in the currently loaded database.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space.

Input Name	What it is
Image Collection Mode	If a database is loaded, collected images are added to a PDM queue to be trained for that database. If no database is loaded, collected images are added to a general PDM queue to be trained for a new database. Image names are automatically generated, but they can be edited in PDM. **Manual**: When you click the Add Image button, the Input Image is added to the queue. **Save Failed Images**: The Input Image is added to the queue if the tool fails. Use this option to automatically add untrained patterns to a database. **Save All Images**: The Input Image is added to the queue each time the tool runs.
Database Directory Path	The path to the database to load when the Load Database button is pressed. This path may be to a directory on a network or local drive.
Pattern Database Name	The name of the database currently loaded or that will be loaded when the Load Database button is pressed.
NOTE: For the properties below, a “T” before the property name indicates it is used to detect patterns using the Texture-based algorithm. A “C” indicates it is used to detect patterns using the Contour-based algorithm. See “Pattern Database Manager” on page 6-59.	
(T) Gradient Threshold	The gradient threshold used to extract keypoints. Lower values mean more keypoints, which may lead to increased precision, but increased processing time. Different values can be used while training the pattern and while running the tool. (Min 0, Max 1)
(T) Contrast Threshold	The contrast threshold used to extract keypoints. Lower values mean more keypoints, which may lead to increased precision, but increased processing time. Different values can be used while training the pattern and while running the tool. (Min 0)
(T) Upsample Image	If true, the input image size is increased prior to keypoint extraction, which yields more features.
(T) Max Duplicate Keypoints	The maximum number of duplicate keypoints that can be generated during the extraction phase, when the gradient direction on the keypoint is not unique. A value of two or more yields more features. It is recommended you set the value to one for training and set the value to two or more for running the tool. (Min 0)
(T) Max Number of Keypoints	The maximum number of keypoints to extract. All keypoints are retained if the value is zero. Adjusting this value can increase the performance of the tool when high resolution images are used but it should be done only if the pattern to detect takes up most of the space in the input image or there is no clutter in the image. This is because keypoints are sorted by their strength and an incorrect setting could cause too few keypoints to be extracted.
(C) Number of Scale Levels	The number of scales used for keypoint extraction. Higher numbers yield more keypoints (which increases the robustness of the algorithm, especially in the presence of scale changes) but increase processing time.

Input Name	What it is
(C) Number of Clusters Per Keypoint	The number of clusters built for each keypoint. Possible values are two, three and four. Higher values increase the chance of correctly matching a keypoint, but increase processing time.
(C) Cluster Search Max Check	The precision in the cluster construction. Higher values allow for more precision and therefore better robustness, but increase processing time.
Find Shape List	The desired region of the image to search for a pattern. If no shape is defined, the entire image is filled. Only rectangular un-rotated ROIs are supported. It is possible to draw complex or rotated ROIs but the tool uses the minimum bounding rectangle.
Number to Find Per Pattern	The maximum number of instances of a specific pattern to find in the input image. If the value is zero, there is no limit on the number to find.
Total Number To Find	The total maximum number of all pattern instances to find in the input image. If the value is zero, there is no limit on the total number to find.
Minimum Origin Distance Between Matched Patterns	The minimum distance between the origins of matched patterns. A candidate pattern is discarded if its origin is too close to the origin of another candidate pattern with higher score. The property is useful to avoid false positives when it is known that patterns can't be too close to each other or too much occluded.
Enable Occlusion Check Between Matched Patterns	If true, an occlusion check is applied based on the input “Maximum Allowed Occlusion Percentage Between Matched Patterns.” If objects or obstructions may block or occlude the pattern from being completely visible in the image, set this to true.
Maximum Allowed Occlusion Percentage Between Matched Patterns	If the "Enable Occlusion Check" property is true, this is the maximum allowable percentage of the pattern area that may be occluded.
Minimum Match Score	The Output Best Score output property must greater than this value for the tool to pass. The Match Score is the normalized correlation score of the matched (not occluded) portion of the pattern in the input image. It is not degraded by occlusion. Since matches are sorted by the number of matched keypoints, the tool still reports the best matched pattern even if Filter on Match Score is false.
Minimum Match Confidence	The Match Confidence property must greater than this value for the tool to pass. Match Confidence is the normalized correlation score of the entire pattern in the input image. It is degraded by occlusion. When there are no occlusions, it is possible that Match Score could be slightly lower than Match Confidence, because scores are normalized by the standard deviation of the image. Since matches are sorted by number of matched keypoints, the tool still reports the best matched pattern even if Filter on Match Confidence is false.

Input Name	What it is
Minimum Match Fraction	The Match Fraction property must greater than this value for the tool to pass. Match Fraction is an estimation of how much of the matched model's area is covered by the matching keypoints. Because some parts of the model may not have keypoints, Match fraction is not a precise measure of occlusion. It is computed as the ratio of the convex hull area of the matching features (on the pattern) to the convex hull of the area of all the detected features on the pattern. As the result gets closer to a value of 100, the likelihood of a correct matching model increases because matching keypoints are found throughout the entire area. Since matches are sorted by number of matched keypoints, the tool still reports the best matched pattern even if Filter on Match Fraction is false.
Filter on Match Score	If true, the Minimum Match Score property is enabled.
Filter on Match Confidence	If true, the Minimum Match Confidence property is enabled.
Filter on Match Fraction	If true, the Minimum Match Fraction property is enabled.
Show Output Matched Points	If true, Matched Points are displayed in the Output Matched Points property.
Show Output Display Points	If true, all keypoints (i.e. those with values that pass minimum match filters, including the Matched Points) are displayed on the image. Since this display can increase processing time, it should be used only to configure and optimize the tool.
Show Failing Output Bounding Box	If true, bounding boxes are displayed around patterns in the image that failed to match any trained pattern. Using this option increases processing time.
Estimated Pose Type	This value controls the final transformation to be estimated. If the value is zero, the estimation is "similarity." If the value is one, the estimation is "affine." If no image perspective distortion is expected, set this value to zero so a similarity is estimated. In this case the property “Allowed Match Stretching” has no effect, since the output can never result in stretched bounding boxes. When the Contour-based algorithm is used and clutter and/or occlusions are present, use "similarity" estimation as the affine pose estimation is less stable.
Search Speed	This property defines whether the tool runs primarily based on accuracy, speed, or a balance of the two. To accomplish this, This is done by automatically adjusting the value of the following properties in the tool: Match Max Check, (C) Number of Scale Levels, (C) Number of Clusters Per Keypoint, and (C) Cluster Search Max Check. If clutter or occlusions are present in the image, set this value to "Focus on Accuracy".

Input Name	What it is
Match Max Check	This property defines the keypoint search precision. Higher values provide higher near-neighbors search matches, and therefore generate better robustness on images with cluttered patterns. This option increases processing time. On simple applications with clear, non-overlapping patterns, values of 15 - 100 may offer robust results and faster execution time.
Number of Neighbors during Match	This is the number of nearest neighbors to consider when matching keypoints. Higher numbers yield more matches especially for large trained pattern sets. When the Texture algorithm is used, and this value is larger than 2, then the property "Use Additional Keypoints" should be set to True.
Min Keypoints	This is the minimum number of matched keypoints that should be found for a match to be accepted.
(C) Search Limits	This property defines the allowable positions to search in the image for a match. **Translation**: restricts the pattern searching to only translational searches (X and Y) and does not support rotation or scale changes. **Translation and Rotation**: allows for pattern searching in varying translational and rotational positions (X, Y, angle). **Translation, Rotation and Scale**: No Restriction.
(T) Allow Model Repeats	If true, more than one instance of a pattern is allowed in an image.
(T) Match Gradient Threshold	The gradient of each keypoint is defined when the pattern is trained. However, when the tool is run, the threshold value can be set lower which eliminates more features. Change this value if you want the tool to be more selective during matching.
(T) Allowed Match Stretching	This property controls the amount of stretching allowed. Stretching is defined as the amount the bounding box can be stretched due to out-of-plane rotation or perspective distortion in the image. If no perspective distortion is expected, set this value to 0.9-0.95 to help reject invalid matches. If the "Estimated Pose Type" property is set to "Similarity," then no stretching is allowed and this property is ignored.
(T) Use Forced Residual on Match	For each match, the residual value is computed. The residual is the error between the projected pattern keypoints and the matching keypoints in the image. This value can vary from 0.1 to 8 pixels, depending on how many features are matched and their location. Larger projection errors allow more features to be included in a match and this may result in an incorrect match being reported as the best one. If this property is true, the tool uses Forced Residual Level in Pixel property value which forces all matches to have the same residual value and makes comparison between matches more fair. This is especially useful if there are similar patterns in the database.
(T) Forced Residual Level in Pixel	If Use Forced Residual on Match is true, this value is used as the residual level.

Input Name	What it is
(T) Robust Outlier Multiplier Threshold	A keypoint is considered too "noisy" if its projection error is greater than its residual value multiplied by this threshold value and the keypoint is not used.
(T) Allow Matches to Multiple Patterns	If true, a keypoint can be matched to multiple patterns. This can be useful when there are similar patterns which differ only for a small portion.
(T) Use Additional Keypoints	If true, additional keypoints are allowed so better results are obtained, but matching is slower.
(T) Use All Neighbors If Unique	If you are using a large pattern database, set this property to true.
(T) Min Residual Robust Sigma	This is the minimum value for the estimated variance of the transform residual. If this value is too low, good matching features are treated as outliers and removed.
(T) Max Residual Robust Sigma	This is the maximum value for the estimated variance of the transform residual. If this value is too high, bad matching features are treated as valid matches.
(T) Use Extended Match	If true, final matching results are obtained by doing two recognition iterations, instead of just one. Tool execution time increases. When the tool performs two iterations, the first pass uses relatively loose criteria on the entire pattern set to quickly remove very unlikely matches. The second pass uses the subset of remaining matching patterns, with more stringent criteria, to generate stronger matches. Extended Match is recommended for use with larger databases having thousands of models.
(T) Extended Match Max Check	This property defines the keypoint search precision to use for the Extended Match. Higher values provide more near-neighbors search matches, and therefore generate better robustness on images with cluttered patterns, but processing time is increased.
(T) Number of Neighbors on Extended Match	This value is the number of nearest neighbors to consider for the Extended Match. Higher numbers yield more matches especially for larger databases. If this value is larger than two, then the "Use Additional Keypoints on Extended Match" property should be set to true.
(T) Min Keypoints on Extended Match	This value is the minimum number of matched points that must be present for a match to be accepted in the Extended Match.
(T) Allow Model Repeats on Extended Match	If true, more than one instance of a pattern is allowed in an image in the Extended Match.
(T) Match Gradient Threshold on Extended Match	The gradient of each keypoint is defined when the pattern is trained. However, when the tool runs, the threshold value can be set lower which eliminates more features. Change this value if you want the tool to be more selective during matching in the Extended Match.

Input Name	What it is
(T) Allowed Match Stretching on Extended Match	This property controls the amount of stretching allowed in the Extended Match. Stretching is defined as the amount the bounding box can be stretched due to out-of-plane rotation or perspective distortion in the image. If no perspective distortion is expected, set this value to 0.9-0.95 to help reject invalid matches. If the "Estimated Pose Type" property is set to "Similarity," then no stretching is allowed and this property is ignored.
(T) Use Forced Residual on Match on Extended Match	For each match, the residual value is computed. The residual is the error between the projected pattern keypoints and the matching keypoints in the image. This value can vary from 0.1 to 8 pixels, depending on how many features are matched and their location. Larger projection errors allow more features to be included in a match and this may result in an incorrect match being reported as the best one. If this property is true, the tool uses Forced Residual Level in Pixel property value in the Extended Match which forces all matches to have the same residual value and makes comparison between matches more fair. This is especially useful if there are similar patterns in the database.
(T) Forced Residual Level in Pixel on Extended Match	If Use Forced Residual on Match on Extended Match is true, this value is used as the residual level in the Extended Match.
(T) Robust Outlier Multiplier Thresh on Extended Match	A keypoint is considered too "noisy" if its projection error is greater than its residual value multiplied by this threshold value and the keypoint is not used in the Extended Match.
(T) Allow Matches to Multiple Patterns on Extended Match	If true, a keypoint can be matched to multiple patterns in the Extended Match. This can be useful when there are similar patterns which differ only for a small portion.
(T) Use Additional Keypoints on Extended Match	If true, additional keypoints are allowed in the Extended Match so better results are obtained, but matching is slower.
(T) Use All Neighbors If Unique on Extended Match	If you are using a large pattern database in the Extended Match, set this property to true.
(T) Min Residual Robust Sigma on Extended Match	This is the minimum value for the estimated variance of the transform residual in the Extended Match. If this value is too low, good matching features are treated as outliers and removed.
(T) Max Residual Robust Sigma on Extended Match	This is the maximum value for the estimated variance of the transform residual in the Extended Match. If this value is too high, bad matching features are treated as valid matches.

Output Name	What it is
Pattern Database	The files that contain pattern labels, images, and thumbnails used for display in the tool and for use in the Control Panel Manager Pattern Database control.

Output Name	What it is
Database Creation Date	The date the currently loaded database was trained, in the format year.month.day hour:minute:second
Number of Patterns in Current Database	The total number of trained patterns in the currently loaded database.
Database Label List	A list containing the labels of all the trained patterns in the currently loaded database.
Database Custom Info List	A list containing the Custom Information labels of all the trained patterns in the currently loaded database.
Images Pending for Training	The number of images in the PDM queue waiting to be trained. (See the Image Collection Mode property.)
Search Algorithm	The search algorithm used for training the database and running the tool. See “Pattern Database Manager” on page 6-59.
Found Match	If True, at least one match with a sufficient score was found.
Output Number Found Total	The total number of patterns found in the input image.
Output Number Found Per Pattern	The number of instances found for each pattern in the input image.
Output Counter Num Found Per Pattern	A list containing the number of instances found for each pattern starting from the program load or the most recent counter reset.
Output Counter Num Found Per Custom Info	A list containing the number of instances found for each custom information label starting from the program load or the most recent reset.
Output Label List	A list containing the labels of each found pattern.
Output Index List	The position in the database (starting from zero) of each found pattern.
Output Custom Info List	A list containing the custom information of each found pattern.
Output Origin List	A list containing the output origin of each found pattern.
Output Origin List Relative To RWC	A list containing the output origin in real world coordinates of each found pattern.
Output Scale List	A list containing the scale of each found pattern.
Output Score List	A list containing the Match Score of each found pattern.
Output Match Confidence List	A list containing the Match Confidence of each found pattern.
Output Match Fraction List	A list containing the Match Fraction of each found pattern.

Output Name	What it is
Output Number of Matched Points List	A list containing the number of matched points in each found pattern. The higher the number, the higher the probability of a good match. If new, untrained patterns may appear in the input image, you can enable one or more of the input filter match properties to avoid false positives.
Output Bounding Box List	A list containing the estimated bounding box of each found pattern.
Output Display Points	All the keypoints (including the Matched Points) of the found patterns.
Output Matched Points	A list containing the point location of the matched keypoints of each found pattern.
Output Display Points State List	A list containing all the keypoints (including the Matched Points) of the found patterns.
Output Found Image List	A list containing image thumbnails of each found pattern. This is not the input image.
Output Best Label	The best matched pattern's label (from the database).
Output Best Index	The best matched pattern's position in the database (starting with zero).
Output Best Custom Info	The best matched pattern's Custom Information (from the database).
Output Best Origin	The best matched pattern's Origin.
Output Best Origin Relative to RWC	The best matched pattern's Origin in Real World Coordinates.
Output Best Scale	The best matched pattern's scale.
Output Best Score	The best matched pattern's Match Score.
Output Best Bounding Box	The best matched pattern's estimated bounding box.
Failing Output Number Found Per Pattern	The number of failed matches found for each pattern.
Failing Output Label List	A list containing each failed match's label (from the database).
Failing Output Index List	A list containing each failed match's position in the database (starting with zero).
Failing Output Custom Info List	A list containing each failed match's Custom Information (from the database).
Failing Output Score List	A list containing each failed match's score.
Failing Output Match Confidence LIst	A list containing each failed match's match confidence score.

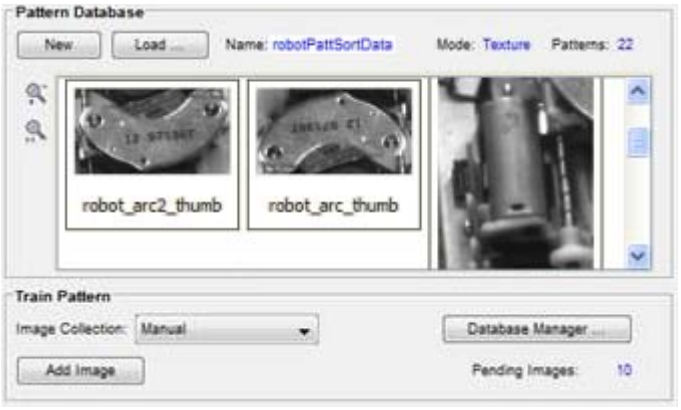
Output Name	What it is
Failing Output Match Fraction List	A list containing each failed match's match fraction.
Failing Output Bounding Box List	A list containing each failed match's estimated bounding box.
Failing Output Number of Matched Points List	A list containing the number of failed match points for each failed match.

How to Set Up the Pattern Sorting tool

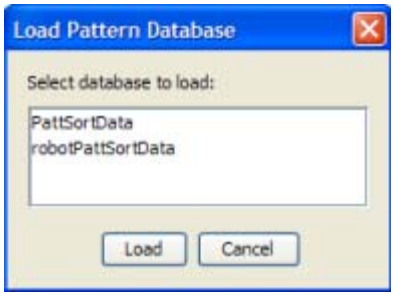
General

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

Database



- **New**: When you click the New button, the following fields are cleared in preparation for creating a new database: Name, viewer images; Mode; and Patterns.
- **Load**: When you click the Load button, a list of available, trained databases is displayed. Select the desired database from the list and click the dialog Load button. If no databases are displayed, check that the database exists in the path indicated by the property named "Database Directory Path." You can also use PDM to import or create a database. See "Pattern Database Manager" on page 6-59.

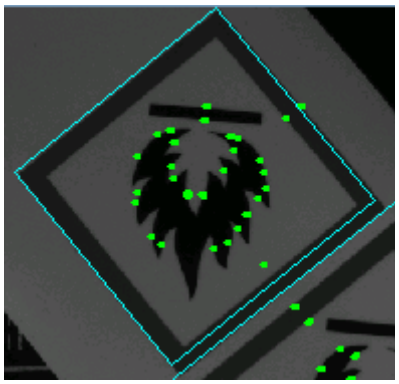


- **Name**: The name of the currently loaded database.

- **Mode**: The method used to train the patterns in the database (texture or contour).
- **Patterns**: The number of patterns in the database.
- **Pattern Viewer**: Thumbnail images of the patterns in the database.
- **Image Collection:**
  Image collection lets you add images to a PDM queue. If a database is loaded, the images are added to a specific queue to be trained for that database. If no database is loaded, the image is added to a general PDM queue to be trained for a new database. Image names are automatically generated, but they can be edited in PDM. When you run PDM, you can select which images to include in the database.
  Manual - The input image is added to the queue when you click the Add Image button.
  Save Failed Images: The input image is added to the queue when the tool fails. Use this option to automatically add untrained patterns to a database.
  Save All Images: The input image is added to the queue each time the tool runs. Use this option to create a new database.
- **Database Manager**
  When you click this button, VPM is suspended and Pattern Database Manager (PDM) is started. An error is displayed if PDM is not installed. You must close PDM to resume editing the vision program.
  See “Pattern Database Manager” on page 6-59.
- **Add Image**
  Click this button to add the input image to the Image Collection queue. This button is enabled only when Manual Image Collection is selected.
- **Pending Images**
  The number of images in the PDM queue that have not been trained for a database.

Search ROI and Pass/Fail

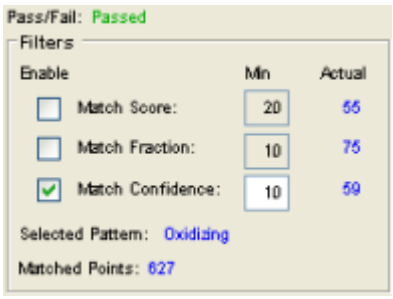
Various ROIs are displayed on the input image, based on the pattern or patterns matched, and the filters and outputs that are enabled. In this example, the Best Match bounding box and Display Points are shown.



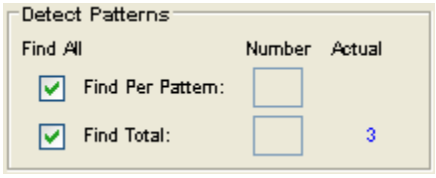
- **Pass/Fail:**
  The tool runs automatically and updates the panel whenever you change any settings on this panel or a new image is acquired. The result is indicated by the Pass/Fail field.
  Depending on which Outputs and Filters are enabled, the result is shown on the image. To display the pattern on a control panel, link to the tool’s Pattern Database property.
- **Match Score**
  If this filter is enabled, a pattern is detected if its Match Score exceeds the Min value. Click on an ROI to display that pattern’s match score value. The selected pattern’s name and number of matched points are displayed.
- **Match Fraction**

If this filter is enabled, a pattern is detected if its Match Fraction exceeds the Min value. Click on an ROI to display that pattern's match fraction value. The selected pattern's name and number of matched points are displayed.

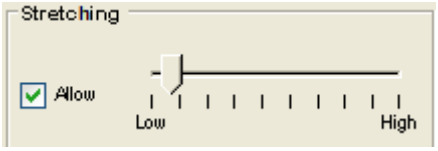
- **Match Confidence**
  If this filter is enabled, a pattern is detected if its Match Confidence exceeds the Min value. Click on an ROI to display that pattern's match confidence value. The selected pattern's name and number of matched points are displayed.



- **Find Per Pattern**
  Enter a value in the Number field to find a specific number of instances of a pattern in the input image. To find all of the instances, check the box under Find All.
  Find Total
  Enter a value in the Number field to specify the total number of instances of all patterns to find in the input image. If the box under Find All is checked, there is no maximum limit.



- **Stretching**
  If the box is checked, stretching is allowed. Stretching indicates how much the pattern bounding box can be stretched due to out-of-plane (perspective) rotations. If no perspective changes are expected, set this to Low to help find valid matches. This option is disabled if the database was trained using a Contour-based search algorithm



- **Search**
  This selection affects settings that determine how the tool searches for patterns in the input image. Settings for the following properties are affected: Match Max Check, Number of Scale Levels, Number of Clusters Per Keypoint, and Cluster Search Max Check. If clutter or occlusions are present in the input images, use the "Favor Accuracy" selection.

- **Outputs**
  Note: Enabling these settings can increase the processing time.
  Enable Matched Points: If enabled, the Output Matched Points ROIs are displayed on the input image.
  Enable All Points: If enabled, all the keypoints found for detected patterns are displayed on the input image.
  Enable Failed Matches: If enabled, bounding box ROIs are drawn around the matches that were found

but failed (matches that did not pass the filter settings).
Display Output Origin: If enabled, the Output Best Origin ROI is displayed on the input image.



Spot Find

In the Feature Finding Drawer



The Spot Find tool is an object or feature location tool. It detects uniformly bright (or dark) objects in an image by finding the maximum (or minimum) average grey-level within a user-defined area. It creates an output point list which contains the center locations of the detected objects. You can link this point list to the Point Match Tool to check actual point locations against ideal locations. This tool is best used to locate objects of a known size, such as balls in Ball Grid Arrays or pins in connectors. See“How to Set Up the Spot Find Tool” on page 3-140.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space. Use this only if you are trying to find an origin relative to another tool.
Find Shape List	This is the tool’s search area.
Shape List ROI Type	Each Shape is separate ROI: Each shape is processed as a separate ROI and the results are combined. This mode is faster than the other mode if the shapes are far apart, but results are duplicated if the shapes overlap. ShapeList is One ROI: The ShapeList is one large rectangular ROI and the shapes are the enabled pixels within the rectangle. The tool may be slow if the shapes are far apart. This setting allows shapes to overlap and form complex shapes without repeating the overlapped pixels and duplicating results.
Spot Size	This defines the spot area to average.
Threshold	Grey-level values above this threshold (for bright objects) or below this threshold (for dark objects) are excluded from the averages.
Spot Type	The type of spot to detect. Find Bright Spots: the maximum average grey-level within the spot is found. Find Dark Spots: the minimum average grey-level within the spot is found.

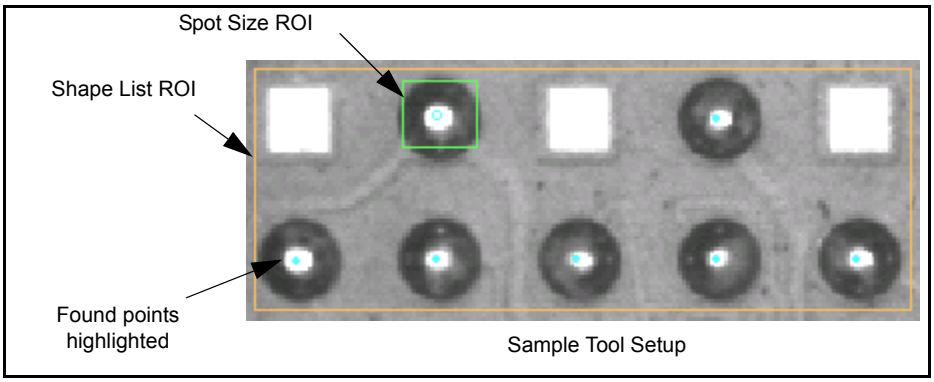
Input Name	What it is
Optimization	Find Spots Accurately: To find spots that are irregular in size and shape. The tool runs more slowly but with better accuracy. Find Spots Quickly: To find spots that are more uniform in size and shape. The tool runs more quickly.

Output Name	What it is
Spot Center List	A list of the spot centers found

How to Set Up the Spot Find Tool

1. Link the desired image into the tool.
2. Use the Find Shape List ROI to define the tool search area, or link in the Shape List. This is the area where the tool applies Maximum/Minimum grey-level averaging to look for objects.
3. Place the Spot Size ROI over an area slightly larger than the area that defines the desired spot to find.
4. Select the desired Spot Type. This indicates the type of spot to detect. If Find Bright Spots is selected, the maximum average grey-level within the spot is found. If Find Dark Spots is selected, the minimum average grey-level within the spot is found.
5. Select the Optimization type. For spots that are irregular in size and shape, select Find Spots Accurately. The tool runs more slowly, but with better accuracy on spots of this type. To find spots that are more uniform in size and shape, select Find Spots Quickly and the tool runs faster.
6. Set the Threshold input value. Grey-level values above this threshold (for bright objects) or below this threshold (for dark objects) are excluded from the averages.

Run the tool. The output point list is generated.



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. See “How to Set Up the Wide Edge Point Find tool” on page 3-142.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space

Input Name	What it is
Wide Line ROI	Points on this ROI are used for finding the edge.
Wide Line ROI List	A list of wide line ROIs used for finding the edge.
Noise Level	The amount of background noise present in the image. Higher noise means the edges must be farther apart. Lower noise allows edges that are closer together.
Maximum Number Of Edges To Find	Limits the number of edges found to those with the strongest transition
Edge Pattern	The edge pattern to find (Rising indicates a transition from dark to light; Falling indicates a transition from light to dark) All edges Alternating Rising/Falling Alternating Falling/Rising Rising Only Falling Only Central Rising Edge Central Falling Edge
Blob Threshold Method	Adaptive Threshold or Fixed Threshold (See “Blob Threshold Method” on page 3-143)
Fixed Blob Threshold Percentage	The Threshold Percentage when Fixed Blob Threshold is selected (see “Blob Threshold Method” on page 3-143)
Adaptive Blob Threshold Offset	If Adaptive Threshold Method is selected, this offset is added to the adaptive threshold. This allows you to weight the adaptive threshold up or down.
Subpixel Method	The type of subpixel averaging. The grey levels of adjacent pixels (3, 5, or 7) around an edge point are averaged and used to interpolate the edge to a fraction of a pixel.
Subpixel Position	The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-189.
Subpixel Search Distance in Pixels	The maximum distance, in pixels, that the subpixel algorithm searches from the threshold edge for the subpixel edge. See “Subpixel Search Distance” on page 3-161.
Blob Color To Find	Bright or Dark objects on the Wide Line ROI
Enable Rise/Fall Output	If True, the Edge Rise/Fall Indicator List output is populated.
Enable Number of Edges Per ROI Output	If True, the Number of Edges Per ROI List output is populated.

Output Name	What it is
Edge Transitions List	A list of the x and y coordinates of all the edge points found

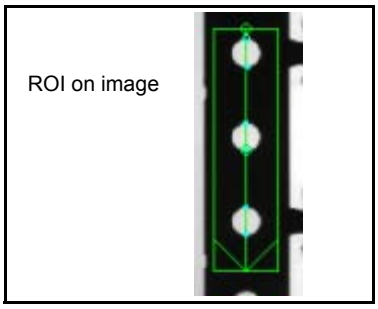
Output Name	What it is
Edge Rise/Fall Indicator List	A list of edges found, indicating whether the edge is rising (True) or falling (False)
Number of Edges Per ROI List	Lists the number of found edges in each ROI

How to Set Up the Wide Edge Point Find tool

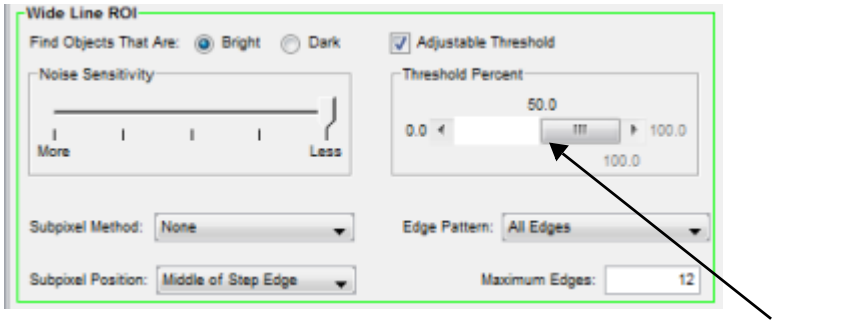
General

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 3-143.



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 3-161.

6. Subpixel Position: The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-189.
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.

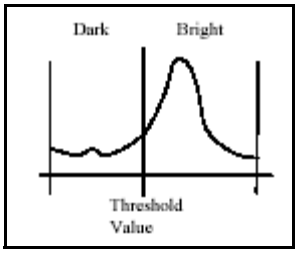
Display

See “Display panel” on page 3-23.

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

Angle

In the Measurement Drawer



The Angle tool measures the angle between two user-specified lines. The lines can be found using the tool's built-in Line Find ROIs or they can be linked from a Pinpoint Pattern Find or Line Find tool as Origins or Line Segments. The angle is always reported as a positive number from 0 to 360. The intersection point is also reported.

See "How to Set Up the Angle tool" on page 3-145.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Line 1 Type	The type of line to find. The choices are using the tool's built-in Line Find or link from another tool.
Wide Line ROI 1	If Line 1 Type is First Bright Line or First Dark Line, move and adjust this ROI to find one of the tool's measurement lines.
Line Segment 1	If Line 1 Type is Link Line Segment, enter a line's parameters, or link a line segment from another tool. This is one of the tool's measurement lines.
Origin 1	If Line 1 Type is Link Origin, enter an origin's parameters, or link an origin from another tool. This is one of the tool's measurement lines.
Rotate Line 1 180	If True, Line 1 is rotated 180 degrees from its original position. You can use this option if the original Line or Origin provides an angle opposite of what you want.
Line 2 Type	The type of line to find. The choices are using the tool's built-in Line Find or to from another tool.
Wide Line ROI 2	If Line 2 Type is First Bright Line or First Dark Line, move and adjust this ROI to find one of the tool's measurement lines.
Line Segment 2	If Line 2 Type is Link Line Segment, enter a line's parameters, or link a line segment from another tool. This is one of the tool's measurement lines.
Origin 2	If Line 2 Type is Link Origin, enter an origin's parameters, or link an origin from another tool. This is one of the tool's measurement lines.
Rotate Line 2 180	If True, Line 2 is rotated 180 degrees from its original position. You can use this option if the original Line or Origin provides an angle opposite of what you want.
Angle Direction	The direction for measuring the angle from one line to the other (Clockwise or Counterclockwise). See "How to Set Up the Angle tool" on page 3-145.

Input Name	What it is
Angle Endpoint	Choose whether or not to consider the direction of the angle's end line when measuring the angle. See "How to Set Up the Angle tool" on page 3-145.
Enable Angle Range Check	If True, the tool will pass if the measured Angle value is within the Angle Range limits.
Angle Range	If Enable Angle Range Check is True, the tool will fail if the measured Angle value falls outside these limits.

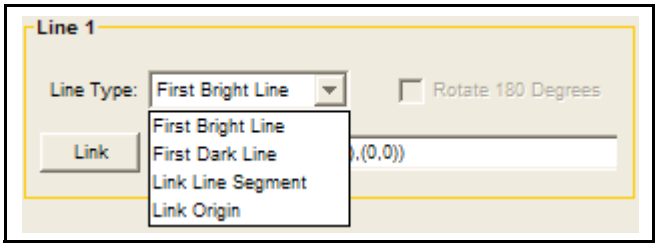
Output Name	What it is
Angle	The measured Angle's value. This is always a positive number from 0 to 360.
Passed	If True, the measured Angle value is within the Angle Range Limits or Enable Angle Range Check is False.
Arc	The measured Angle displayed as a Wide Circular Arc ROI.
Intersection	The intersection point of the Angle's measurement lines, displayed as an Origin aligned with Line 1.
Found Line 1	The line segment found by Wide Line ROI 1, if Line 1 type is Find Bright Line or Find Dark Line. This value is zero if the Line Segment or Origin is linked.
Found Line 2	The line segment found by Wide Line ROI 2, if Line 2 type is Find Bright Line or Find Dark Line. This value is zero if the Line Segment or Origin is linked.

How to Set Up the Angle tool

1. Snap a good image of the desired part, then click the Setup tab.
2. Click the ROI button.

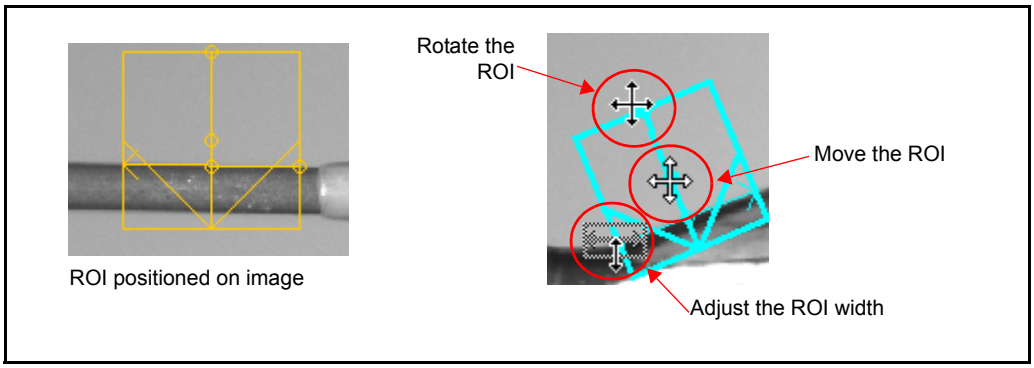
2a. **To use the tool's built-in Line Find ROIs**:

- Select the type of Line 1 or Line 2 you want to find: First Dark Line or First Bright Line.



- Position the Wide Line ROIs for the desired lines on the edges you want to find. Be sure that the ROIs are oriented and aligned as desired. To adjust the ROIs, hold the cursor over an adjustment point until

the cursor changes as shown below, then click and drag.



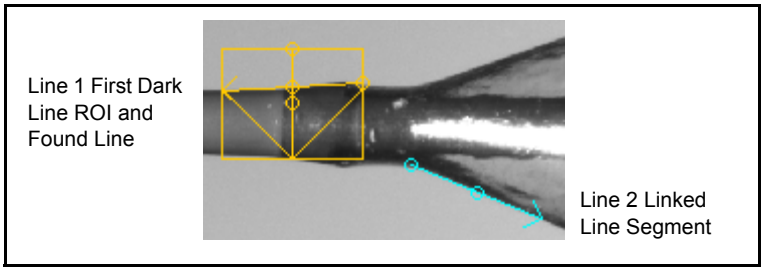
These Wide Line ROIs are the same as those in the Line Find tool with the following settings: Grey level edges, Automatic thresholding, Medium noise level, Sampling of 50%, and Outlier distance of three pixels. If you want to use different settings, add a Line Find tool to the task and link that tool's Line Segment into the Angle tool.

2b. **To link a Line Segment or Origin from another tool**:

- Select the type of ROI you want to link for Line 1 or Line 2: Link Line Segment or Link Origin.
- Type the ROI coordinates into the Source field or click the Link button and link the desired Line Segment or Origin. If the Line is linked, the source is displayed.

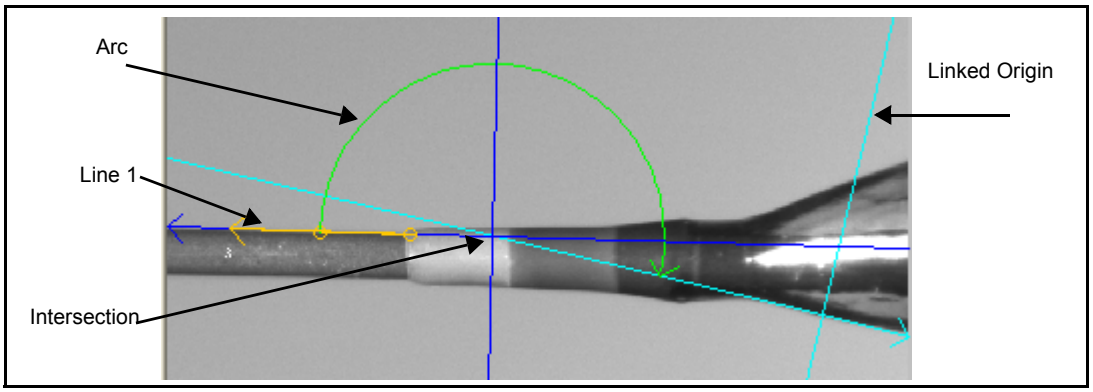


3. Check the Rotate 180 Degrees box if you want the Line to point in the opposite direction. Rotation may not change the reported angle, depending on the Direction and Endpoint selections on the Pass/Fail panel. The Found or Linked Lines are marked on the image.

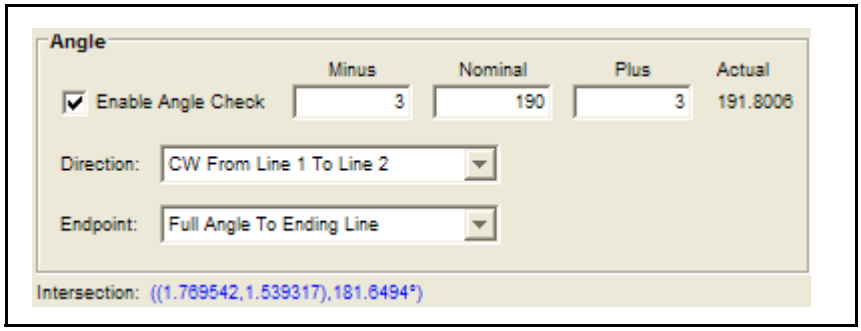


4. Click the Pass/Fail button.

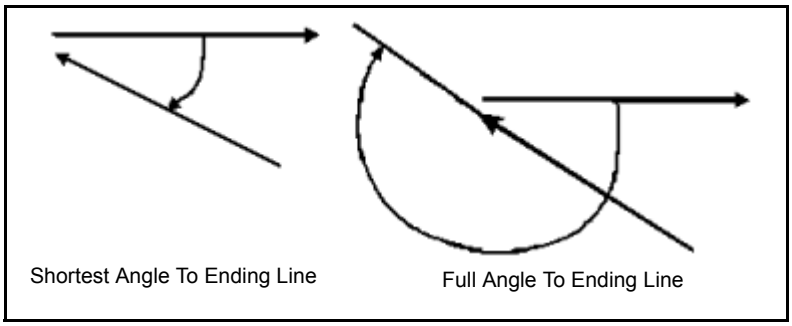
5. The Lines or linked Origin, Found Arc, and Intersection are displayed on the image.



6. If you check the Enable Angle Check check box, the tool will fail if the Actual Angle value is not within the Angle Range limits. Enter the desired values in the Minus, Nominal, and Plus fields.



7. Select the angle Direction from the drop down (Clockwise or Counterclockwise). The selection determines where the angle measurement starts and ends, and the Arc ROI is displayed with the arrowhead pointing in the selected direction. Whether you choose CW or CCW, the measured Angle will always be a positive number from 0 to 360.
8. Select the desired Endpoint. This allows you to choose to whether or not to consider the direction of the ending line when measuring the angle. Sometimes line orientation is ambiguous at 180 degrees rotation. For example, the major axis of a blob does not have 360 degrees of rotation, only 180 degrees. In this case, choose "Shortest Angle to Ending Line" and the tool will ignore 180 degree rotations of the ending line and always measure the shortest angle to the line.



Display

See “Display panel” on page 3-23.

Circle Edge Refinement

In the Measurement Drawer



The Circle Edge Refinement tool refines the center location and diameter of a circle based on an estimated center and the number of segments to search. It indicates if the center and diameter are within an expected range. This tool is primarily used to find the centers of the balls in a ball grid array (BGA).

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Estimated Center List	The list of estimated circle center point locations
Diameter Tolerance	The diameter variation allowed. The parameters are minus, nominal, and plus.
Circle Scan Type	The type of circle and how the tool should find the edge
Circle Edge Detect Type	First Edge, Center Edge, Best Edge: Finds one edge point per ROI, then find fits the circle with least squared error Best Two Edges, Best Three Edges, All Edges: finds multiple edge points per ROI. See "Circle Edge Detect Type" on page 3-150.
Number of Line Segments	How many circle edge segments the tool should use (minimum of 3)
Minimum Number of Points	The least number of edge points the tool should use to refine the circle
Segment Length	The minimum line segment length the tool should use to refine the circle
Outlier Enable	See "Outlier Enable and Outlier Distance Threshold" on page 3-174
Outlier Distance Threshold	See "Outlier Enable and Outlier Distance Threshold" on page 3-174
Edge Detection Method	Gradient Edges or Grey Level Edges 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. See "Edge Detection Method" on page 3-89.
Edge Detection Sensitivity	The sensitivity level determines the transition level necessary for detection. A higher value detects more edges.
Fixed Gradient Threshold Percentage	The gradient threshold value for Gradient Edges Detection Method
Fixed Grey Level Threshold Percentage	The grey level threshold value for Grey Level Edges Detection Method

Input Name	What it is
Adaptive Grey Level Threshold Offset	If one of the adaptive settings is picked from Edge Detection Sensitivity, and Grey Level Edges is selected, then this offset is added to the adaptive threshold. This allows you to weight the adaptive threshold up or down.
Noise Level	The amount of background noise present in the image. Higher noise means the edges must be farther apart. Lower noise allows edges that are closer together.
Motion Blur	The offsetting vector to compensate for blur in the image.
Bounding Circle Enable	The bounding circle is the smallest circle that includes all the points found by the tool. If Outlier Enable is True, the tool first eliminates outliers then get the bounding circle using the remaining points.
Subpixel Method	The type of subpixel averaging The grey levels of adjacent pixels (1, 3, 5, 7, or 9) around an edge point are averaged and used to interpolate the edge to a fraction of a pixel.
Subpixel Position	The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-189.
Arc Angle Range	The tool finds and fit points over this part of the circle. By default the range is 0 to 360 degrees. For arcs of 180 degrees or less, the fitted radius and center point are less accurate than for full circles. The parameters are minus, nominal, plus, include end, and include start.

Output Name	What it is
Valid Circle Found List	A list of true/false indications of valid circles found
Refined Center List	The list of refined circle center point locations
Valid Refined Center List	The list of valid refined circle center point locations
Refined Diameter List	The circles’ refined diameters
Maximum Fit Error List	A list of the measurements that exceeded the maximum fit
All Diameters In Tolerance	If true, none of the diameters were outside the defined tolerance
Diameter in Tolerance List	A list of the diameters that were within tolerance
Edge Point List	A list of the circle’s edge points found
First Circle Line Segment List	A list of the line segments describing the first refined circle
Bounding Circle Center List	If Bounding Circle Enable is True, this is the list of points that describe the Bounding Circles.

Output Name	What it is
Bounding Circle Diameter List	If Bounding Circle Enable is True, this is the list of Bounding Circle diameters.

Circle Edge Detect Type

The first three settings are designed to find one edge point per ROI. The tool will then find fit the circle with least squared error.

The last three settings will find multiple edge points per ROI. In these cases, a least squared error fit is unreliable, so the tool will first do a Hough transform to find the subset of points that are within nominal diameter tolerance, and then do a least squared error fit. The Hough transform step adds time, so it should only be used when you cannot reliably find the correct single edge on the majority of the ROIs.

If there are close concentric circles, then you should set the Diameter Tolerance with limits that separate the circles. For example, if you are finding a circle with diameter 100 and there is also a concentric circle with diameter 110, then you should set the upper limit of the Diameter Tolerance to 105 so that the tool can discriminate between them.

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 tools 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. See “How to Set Up the Circle Gauge tool” on page 3-153.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space
Circle ROI	The desired region of the image to search.
Circle Type	See “How to Set Up the Circle Gauge tool” on page 3-153
Edge Detection Method	Gradient Edges or Grey Level Edges 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. See “Edge Detection Method” on page 3-89.
Edge Detection Sensitivity	The sensitivity level determines the transition level necessary for detection. A higher value detects more edges.

Input Name	What it is
Fixed Gradient Threshold Percentage	The gradient threshold value for Gradient Edges Detection Method when Edge Detection Sensitivity is set to Fixed Threshold
Fixed Grey Level Threshold Percentage	The grey level threshold value for Grey Level Edges Detection Method when Edge Detection Sensitivity is set to Fixed Threshold
Noise Level	The amount of background noise present in the image. Higher noise means the edges must be farther apart. Lower noise allows edges that are closer together.
Sampling Percent	The radial sampling rate - for example, 100 will sample every radial, 50 will sample every other radial, 0 will sample a minimum of 2 radials. Higher numbers increase accuracy, lower numbers increase speed.
Outlier Distance Threshold	Outlying points beyond this distance from the found circle (in units) are excluded.
Auto-Select Outlier Distance Threshold	If True, the Outlier Distance Threshold value is automatically calculated for each image. If False, you must click the Train button to calculate the Outlier Threshold.
Max Fitting Error	The maximum deviation allowed from a straight line (0 indicates a straight line)
Max Percent of Points Out of Tolerance	The tool will fail if the percent of the edge points that are out of tolerance exceeds this value. 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. The current Percent of Points Out of Tolerance is an output.
Enable Radius Check	If this is true, the fitted radius and each edge point is checked against the Inner and Outer Radius tolerance. The tool will fail if the fitted radius exceeds the tolerance. Each edge point is tested against the tolerance. If it exceeds the Outer or Inner Radius tolerance, it is put in the outlier point list and added to the Percent of Points Out of Tolerance.
Outer Radius Tolerance	If Enable Radius Check is true, found points outside this tolerance are excluded from the Outer Edge points. The tool will fail if the Outer Circle radius is greater than this tolerance. (Circle type is Ring.)
Inner Radius Tolerance	If Enable Radius Check is true, found points outside this tolerance are excluded from the Inner Edge points. The tool will fail if the Inner Circle radius is greater than this tolerance.
Enable Roundness Check	If true, the difference is calculated between the greatest radius and least radius of all the points on the circle, including statistical outliers. If Enable Smoothing Filter is true, noise points are excluded to provide more reliable results. If a ring is being gauged, then the roundness error is the larger error of the two circles. The tool fails if this value exceeds the Max Roundness Error.

Input Name	What it is
Max Roundness Error	This is the difference between the greatest radius and least radius of all the points on the circle, including statistical outliers. If a ring is being gauged, then the roundness error is the larger error of the two circles.
Enable Smoothing Filter	If true, the tool removes isolated outlier points (by excluding noise points) for the Roundness and Bounding Circle calculations, since these calculations are sensitive to individual defect points. An isolated outlier is one where both neighbors are not outliers. If two points in a row are beyond outlier distance, they are still considered a defect in Roundness and Bounding Circle calculations. All outlier points are still used in the "Percent of Points Out Of Tolerance" check.
Enable Bounding Circle	If true, the output "Bounding Circle" is calculated. The bounding circle is the smallest circle that includes all the points found. If Enable Smoothing Filter is true, noise points are excluded to provide more reliable results. If the Bounding Circle radius exceeds the Outer Bounding Radius Tolerance, the tool will fail.
Outer Bounding Radius Tolerance	If Enable Bounding Circle is true, and the Bounding Circle radius exceeds this tolerance, the tool will fail.
Enable Inscribed Circle	If True, the Inscribed Circle output is calculated. The Inscribed Circle is the largest circle that can fit inside all the points found.
Inscribed Radius Tolerance	If Enable Inscribed Circle is True, and the Inscribed Circle's radius exceeds this tolerance, the tool will fail.
Enable Ring Thickness Check	If true, the ring's thickness at each radial line is calculated and checked. The tool fails if this value exceeds the Ring Thickness Tolerance. The Ring Thickness is an output. (Circle Type must be a Ring type.) Each individual pair of inner and outer points on a radial line is also checked against the tolerance. If the pair exceeds the tolerance (or either the inner or outer point is missing), it is moved to the outlier list and added to the Percent of Points Out of Tolerance.The ring thickness at each radial line is the "Ring Thickness List" output.
Ring Thickness Tolerance	If Enable Ring Thickness Check is true, and the Ring Thickness exceeds this value, the tool will fail.
Enable Concentricity Check	If true, the ring's concentricity is calculated and checked. The tool fails if this value exceeds the Max Concentricity Error. The Concentricity Error is an output. The concentricity error is the distance, in units, between the inner and outer circle centers. (Circle Type must be a Ring type.)
Max Concentricity Error	If Enable Concentricity Check is true, and the Concentricity Error exceeds this value, the tool will fail.

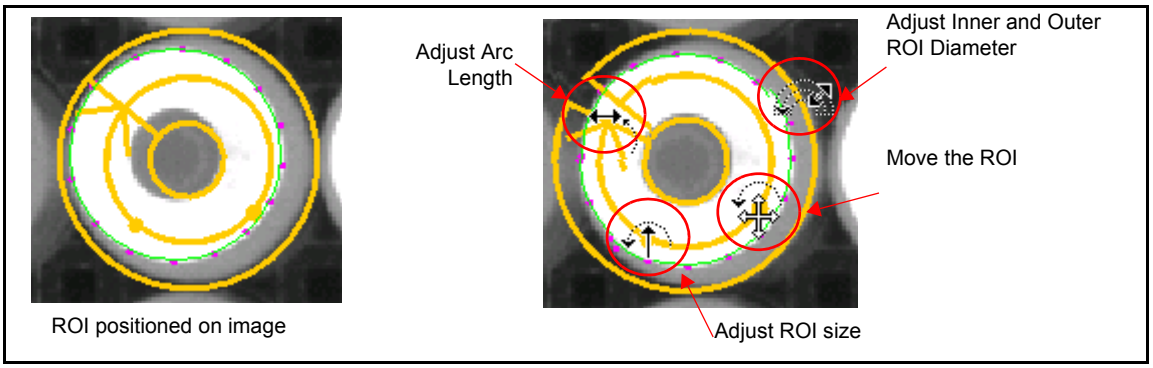
Output Name	What it is
Passed	If True, the found circle's parameters lie within all the limits.
Outer Circle	The found outer circle.
Inner Circle	The found inner circle (Circle type is Ring).

Output Name	What it is
Circle Shapelist	The found outer circle as a Shapelist if Circle type is Circle. The outer circle with an inner circle hole if Circle type is Ring.
Output Origin Relative to Tool	The found origin point, relative to the Tool Origin, if any.The origin is positioned at the circle center if the Circle type is Circle. If Circle type is ring, then it is centered at the average center of the ID and OD.
Output Origin Relative To RWC	The found origin, relative to the entire image space. The origin is positioned at the circle center if the Circle type is Circle. If Circle type is ring, then it is centered at the average center of the ID and OD.
Outer Edge Points	Points used to form the Outer Circle.
Outer Outlier Points	The points further from the Outer Circle than the Outlier Distance Threshold.
Inner Edge Points	Points used to form the Inner Circle. (Circle type is Ring.)
Inner Outlier Points	The points further from the Inner Circle than the Outlier Distance Threshold.
Percent of Points Out of Tolerance	The percent of the edge points that exceed any of the tolerance checks. 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 amount that the circle is out of round. Circle's with a larger value are less round.
Ring Thickness	This is the average ring thickness as measured at each radial line.
Concentricity Error	The tool fails if this value exceeds the Max Concentricity Error. The concentricity error is the distance, in units, between the inner and outer circle centers. (Circle Type must be a Ring type.) Larger values indicate that the circles are less concentric.
Concentricity Line Segment	A line representing the amount and direction of the Concentricity Error.
Bounding Circle	The bounding circle is the smallest circle that includes all the points found. (Enable Bounding Circle must be True.)
Bounding Circle Shapelist	The Bounding Circle as a Shapelist.
Inscribed Circle	The Inscribed Circle is the largest circle that can fit inside all the points found. (Enable Inscribed Circle must be True.)
Inscribed Circle Shapelist	The Inscribed Circle as a shapelist.
Ring Thickness List	The ring thickness at each radial line. (Circle type is Ring.)

How to Set Up the Circle Gauge tool

1. Snap a good image of the desired part, then click the Setup tab.

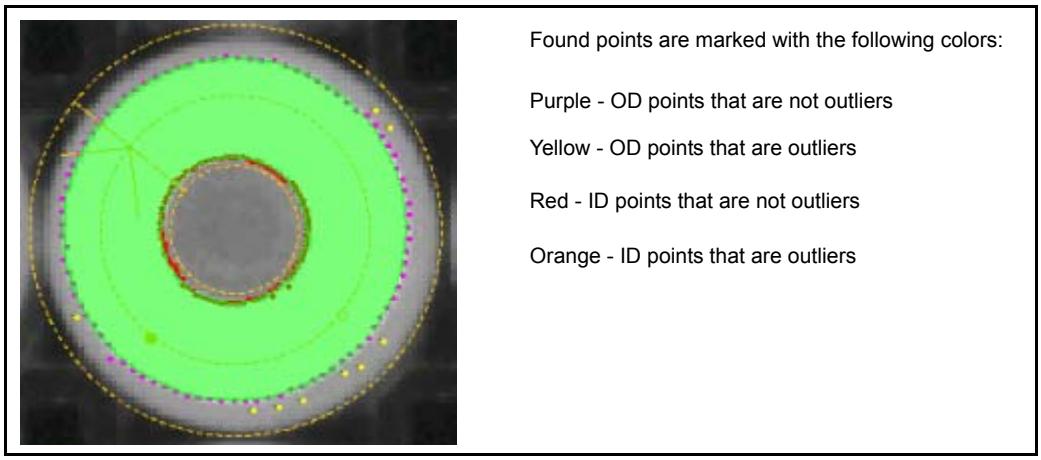
2. Click the ROI button. Position the Circle ROI over the circle or ring you want to find. Be sure that the ROI completely encloses the circle or ring. To adjust the ROI, hold the cursor over an adjustment point until the cursor changes to one shown below, then click and drag.



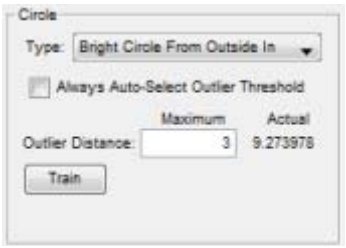
3. Select the "Circle-Type" based on the shape you want to find:
   - Dark Circle from Outside In - Start at the outer edge and search inward for a bright to dark edge
   - Dark Circle from Inside Out - Start at the inner edge and search outward for a bright to dark edge
   - Bright Circle from Outside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

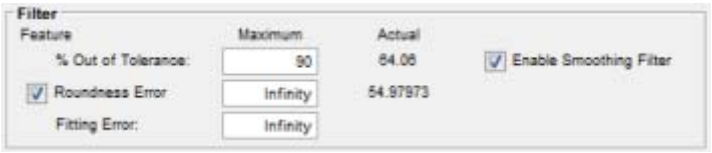
4. The detected edges are displayed on the image.
   Important: Adjust the threshold and sensitivity options in the Circle ROI selection area until all the desired edges are marked in the image.
   Gradient and Grey Level edge detection types are supported. In cases where Gradient edge detection picks up extra edges in a noisy image, Grey Level may offer better results.



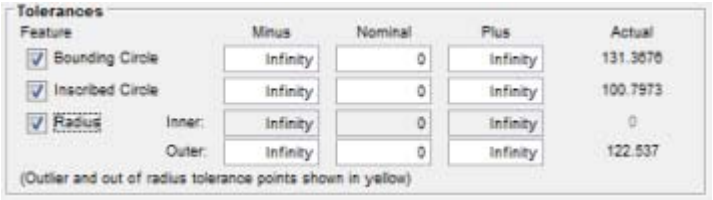
5. **Sampling Percent**: This is the radial sampling rate. For example, 100 will sample every radial, 50 will sample every other radial, 0 will sample a minimum of 2 radials. Higher numbers increase accuracy, lower numbers increase speed.
   Always Auto-Select Outlier Threshold: Check this if you want the tool to automatically calculate the Outlier Maximum Distance value for each image. If this is not checked, click the **Train** button to calculate the distance for the current image.
   Outlier Distance: Outlying points beyond the Maximum Distance from the found line are not included in the line.



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.
   Fitting 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.



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.



Display

See "Display panel" on page 3-23.

Line Find-Measure

See "Line Find" on page 3-84.

Line Gauge

In the Measurement Drawer



The Line Gauge tool finds the distance between two points (the Primary Endpoint Position and the Secondary Endpoint Position) using a single line ROI.

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 tool separately.

See "How to Set Up the Line Gauge tool" on page 3-158.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Wide Line ROI	Points on this ROI are used for measuring. If the ROI goes partly off the image during runtime, it is clipped at the image's edge.
Wide Line ROI List	A list of wide line ROIs used for measuring
Distance Type	Euclidean: direct distance between the points AbsoluteX: the distance between Point One and a line through Point Two's X coordinate and perpendicular to the X axis AbsoluteY: the distance between Point One and a line through Point Two's Y coordinate and perpendicular to the Y axis
Distance Tolerance	If the distance between the beginning and ending measurement points exceeds this value, the tool will fail. The parameters are minus, nominal, and plus.
Primary Endpoint Position	The starting point for measuring, beginning from the tail end of the ROI
Secondary Endpoint Position	The ending point for measuring, beginning from the tail end of the ROI
Primary Use Center	If True, the measurement starting point is half way between the Primary and Secondary Endpoints
Secondary Use Center	If True, the measurement starting point is half way between the Secondary Endpoint and the next point beyond it
Blob Color To Find	Bright, Dark, or both color objects
Blob Threshold Method	See "Grey Level Threshold Types" on page 3-80 for more details.
Fixed Blob Threshold Percentage	The grey level threshold value for fixed single threshold types (in percentage)
Adaptive Blob Threshold Offset	If Adaptive Threshold Method is selected, this offset is added to the adaptive threshold. This allows you to weight the adaptive threshold up or down.

Input Name	What it is
Noise Level	The amount of background noise present in the image. Higher noise means the edges must be farther apart. Lower noise allows edges that are closer together.
Maximum Number of Edges to Find	Limits the number of edges found to those with the strongest transition
Edge Pattern	The edge pattern to find (Rising indicates a transition from dark to light; Falling indicates a transition from light to dark)
Subpixel Method	Indicates how many subpixel points to average when finding the edge points. More points used provides greater accuracy but takes more time. See “Subpixel Method” on page 3-161.
Subpixel Position	The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-189.
Subpixel Search Distance in Pixels	The maximum distance, in pixels, that the subpixel algorithm will search from the threshold edge for the subpixel edge. See “Subpixel Search Distance” on page 3-161.
Number of Steps	Duplicates the Wide Line ROI. Allows multiple measurements that occur at regular intervals across the image with one tool.
Step Distance	The distance between the measurement steps
Step Angle in Degrees	When you enter a value for Number of Steps, the tool will repeat the same measurement "Number of Steps" times. Step Angle is the reference angle for the step segments in relation to the primary Wide Line ROI, in degrees. For purposes of conversion, one radian is equal to 180 divided by pi (approximately 57.296 degrees). One degree is equal to pi divided by 180 (approximately 0.01745 radians)
Scale Factor	The scale factor applied to the output distance. This is applied after any camera calibration. See “Train the Scale Factor” on page 3-160.
Scale Factor Train Distance	When the tool is trained, this scale factor is calculated so that the measured distance is scaled to this value.
Scale Factor List	The list of Scale Factors used when Number of Steps is greater than one.
Scale Factor Train Distance List	The list of Scale Factor Train Distances used when Number of Steps is greater than one.

Output Name	What it is
All in Tolerance	If True, all measurements are within tolerance
In Tolerance List	A list of measurements indicating whether In Tolerance is true or false
Distance List	A list of distances measured
Distance Error List	A list of measured distances minus the nominal

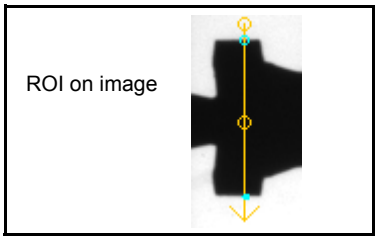
Output Name	What it is
Edge Point List	A list of the found edge point locations
Distance Segment List	A list of the measured line segments
Step Segment List	A list of the step line segments (when Number of Steps is greater than 1)
Number of Edges Per ROI List	The number of edges found on each ROI.

How to Set Up the Line Gauge tool

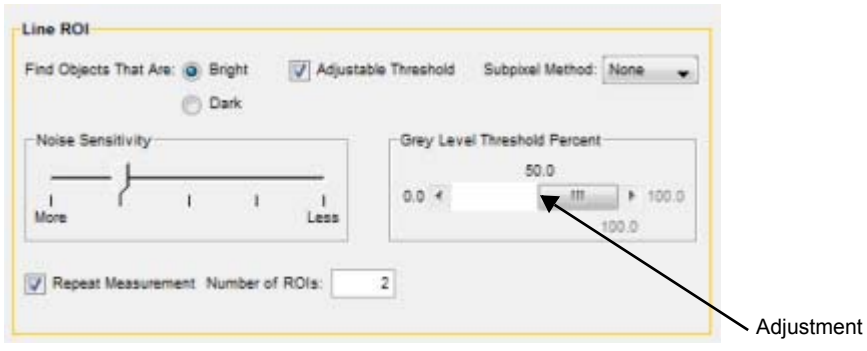
General

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



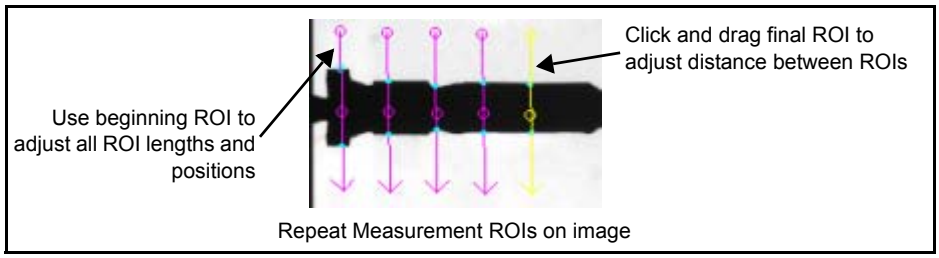
1. Position the ROI over the edges in the image you want to measure. If you want to make multiple measurements, check the Repeat Measurement check box.
2. Find Objects That Are Bright/Dark:
   Select the type of edges the tool should find, Bright (transition is from darker pixels to lighter pixels) or 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 3-143.



Adjustable Threshold

4. Subpixel Method: See “Subpixel Method” on page 3-161.

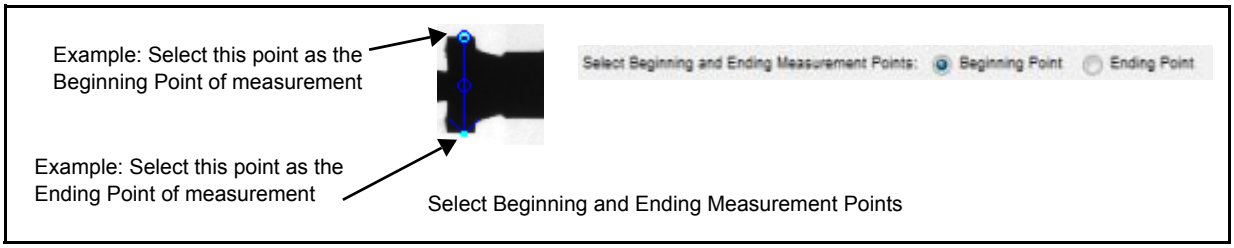
5. Noise Sensitivity: This setting adjusts for background noise in the image. The “more” setting finds edges that are close together when there is less background noise in the image. The “less” setting is used when there is more noise in the image and it is harder to find edges that are close together.
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.



Repeat Measurement ROIs on image

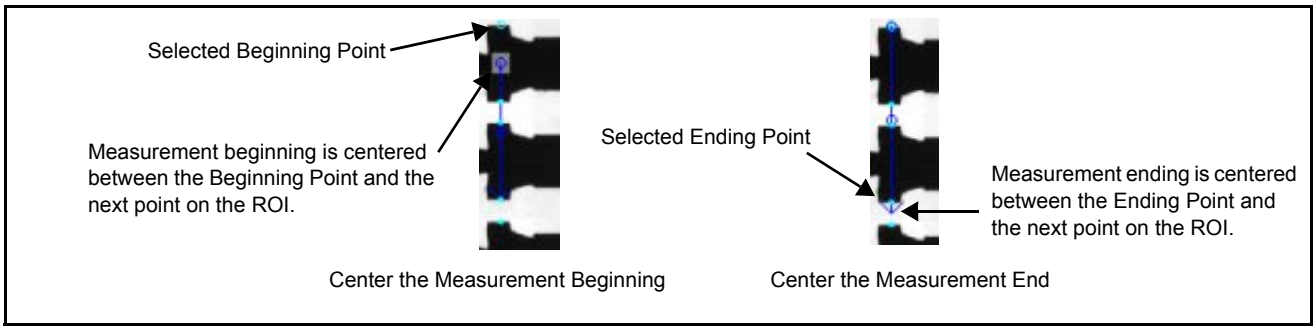
Endpoint & Type

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.



Select Beginning and Ending Measurement Points

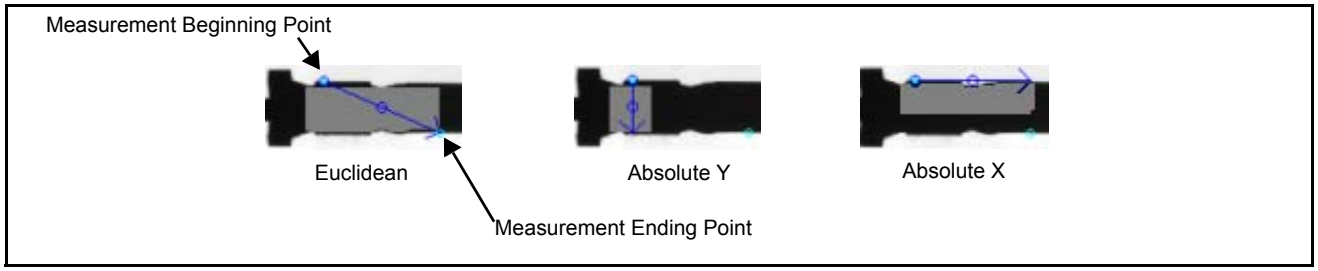
2. Center Measurement
   Center the measurement beginning: When you select this, the measurement beginning is centered between the selected Beginning Point and the next point on the ROI.
   Center the measurement end: When you select this, the measurement end is centered between the selected Ending Point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



Center the Measurement Beginning Center the Measurement End

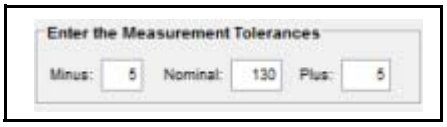
3. Measurement Type
   Euclidean: The tool measures the length of a straight line between the measurement beginning point and ending point.
   Absolute X: The tool measures the length of a straight line between the measurement beginning point and the X axis of the measurement ending point.

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.



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 3-23.

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.

Subpixel Search Distance

This value specifies the maximum distance, in pixels, that the subpixel algorithm will search for the subpixel edge from the edge based on the threshold. In some cases the edge transition from dark to light takes several pixels. This means the subpixel edge could be located several pixels from the non-subpixel (threshold) edge, because the subpixel algorithm is looking for the point of maximum grey level change (slope).

This setting can help prevent the edge location from "jumping" between subpixel positions. For example, if this search distance is set to one (1), the subpixel edge found by the algorithm will never be located more than one (1) pixel from the edge based on the threshold.

Step Angle

When you enter a value for Number of Steps, the tool will repeat the same measurement "Number of Steps" times. Step Angle is the reference angle for the step segments in relation to the primary Wide Line ROI, in degrees.

For purposes of conversion, one radian is equal to 180 divided by pi (approximately 57.296 degrees). One degree is equal to pi divided by 180 (approximately 0.01745 radians)

Line Gauge Datum Line

In the Measurement Drawer



The Line Gauge Datum Line tool finds the distance between a point on a line ROI and either a Datum Line or the X or Y axis of a Datum Origin.

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 tool separately.

See “How to Set Up the Line Gauge Datum Line tool” on page 3-164.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space
Wide Line ROI	A point found on this line is used as one endpoint of the measurement. If the ROI goes partly off the image during runtime, it is clipped at the image’s edge.
Wide Line ROI List	A list of wide line ROIs used for measuring

Input Name	What it is
Datum Line	If Datum Line Type is Datum Line, one endpoint of the measurement is on this line
Datum Origin	If Datum Line Type is Origin X axis or Origin Y axis, one endpoint of the measurement is on the X or Y axis of this origin.
Datum Line Type	The tool measures from the Wide Line ROI point: Absolute Distance to Datum Line: the absolute distance to the Datum Line Signed Distance to Datum Origin X Axis: the signed distance to the Datum Origin's X axis Signed Distance to Datum Origin Y Axis: the signed distance to the Datum Origin's Y axis Absolute Distance to Datum Origin X Axis: the absolute distance to the Datum Origin's X axis Absolute Distance to Datum Origin Y Axis: the absolute distance to the Datum Origin's Y axis Signed Distance to Datum Line: The Datum Line is treated as an origin X axis. If the endpoint is below the datum line, then the reported distance is negative. If the endpoint is above the line, then the reported distance is positive. Signed Distance to Tool Origin X Axis: the signed distance to the tool origin's X axis Signed Distance to Tool Origin Y Axis: the signed distance to the tool origin's Y axis Absolute Distance to Tool Origin X Axis: the absolute distance to the tool origin's X axis Absolute Distance to Tool Origin Y Axis: the absolute distance to the tool origin's X axis
Distance Tolerance	If the distance between the beginning and ending measurement points exceeds this value, the tool will fail. The parameters are minus, nominal, and plus.
Endpoint Position	If Use Center is false, this is the found point to use for measuring (point number one is at the beginning end of the Wide Line ROI)
Use Center	If True, the measurement end point is half way between the Endpoint Position, and the next point beyond it
Blob Color to Find	Bright or Dark objects
Blob Threshold Method	See "Grey Level Threshold Types" on page 3-80 for more details.
Fixed Blob Threshold Percentage	The grey level threshold value for fixed single threshold types (in percentage)
Adaptive Blob Threshold Offset	If Adaptive Threshold Method is selected, this offset is added to the adaptive threshold. This allows you to weight the adaptive threshold up or down.
Noise Level	The amount of background noise present in the image. Higher noise means the edges must be farther apart. Lower noise allows edges that are closer together.

Input Name	What it is
Maximum Number of Edges To Find	Limits the number of edges found to those with the strongest transition
Edge Pattern	The edge pattern to find (Rising indicates a transition from dark to light; Falling indicates a transition from light to dark)
Subpixel Method	The type of subpixel averaging. The grey levels of adjacent pixels (3, 5, or 7) around an edge point are averaged and used to interpolate the edge to a fraction of a pixel. See “Subpixel Method” on page 3-161.
Subpixel Position	The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-189.
Subpixel Search Distance in Pixels	The maximum distance, in pixels, that the subpixel algorithm will search from the threshold edge for the subpixel edge. See “Subpixel Search Distance” on page 3-161.
Number of Steps	Duplicates the primary ROI. Allows multiple measurements with one tool.
Step Distance	The distance between the measurement steps
Step Angle in Degrees	The angle of the secondary ROIs from the primary ROI (see “Step Angle” on page 3-161)
Scale Factor	The scale factor applied to the output distance. This is applied after any camera calibration.
Scale Factor Train Distance	When the tool is trained, this scale factor is calculated so that the measured distance is scaled to this value.
Scale Factor List	The list of Scale Factors used when Number of Steps is greater than one.
Scale Factor Train Distance List	The list of Scale Factor Train Distances used when Number of Steps is greater than one.

Output Name	What it is
All In Tolerance	If True, all measurements are within tolerance
In Tolerance List	A list of measurements indicating whether In Tolerance is true or false
Distance List	A list of distances measured
Distance Error List	A list of measured distances minus the nominal
Edge Point List	A list of the found edge points
Distance Segment List	A list of the measured line segments
Step Segment List	A list of the Wide Line ROIs (when Number of Steps is greater than 1)
Number of Edges Per ROI List	The number of edges found on each ROI.

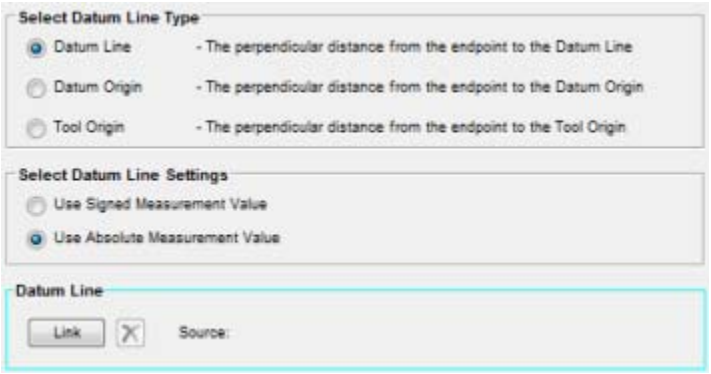
How to Set Up the Line Gauge Datum Line tool

General

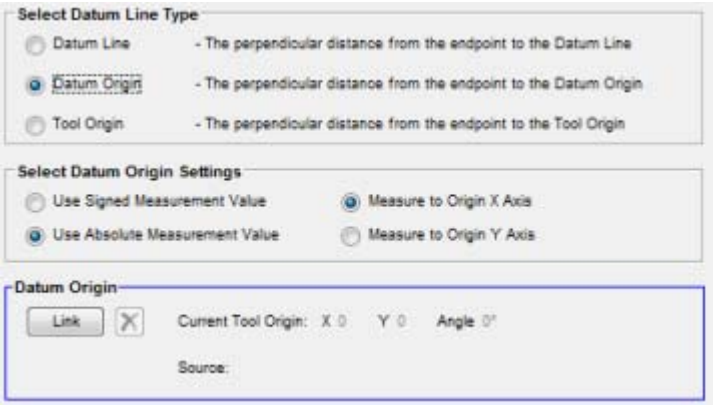
1. **Image**: To use a different image source, click the Link button. The tool works only with greyscale images.
2. **Origin**: If there is a tool with an output origin above this tool in the task tree, an origin may be automatically linked. To delete the link and set the origin to 0,0,0, click the link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

Datum Line

1. Click the Datum Line button to select the type of Datum Line and Measurement.



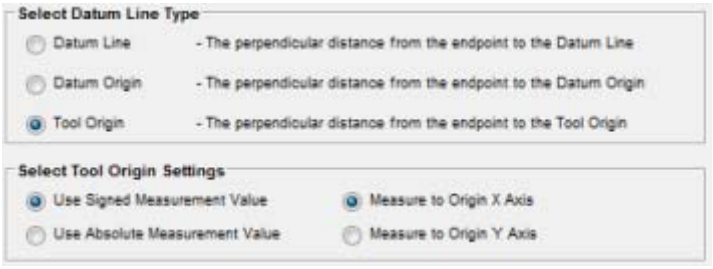
- **Select Datum Line Type - Datum Line**
  Datum Line: The measurement is made from the endpoint perpendicular to the Datum Line.
- **Select Datum Line Settings**
  Use Signed Measurement Value: The Datum Line is treated as an origin X axis. If the endpoint is below the datum line, then the measured distance is negative. If the endpoint is above the line, then the measured distance is positive. (The X coordinate value increases to the right and the Y coordinate value increases downward.)
  Use Absolute Measurement Value: The value is the absolute measured distance.
- **Datum Line**
  Click the link button to use a line from another tool as the Datum Line.



- **Select Datum Line Type - Datum Origin**
  Datum Origin: The measurement is made from the endpoint perpendicular to the Datum Line's X or Y axis.
- **Select Datum Origin Settings**

Use Signed Measurement Value: If the endpoint is below the datum line, then the measured distance is negative. If the endpoint is above the line, then the measured distance is positive. (The X coordinate value increases to the right and the Y coordinate value increases downward.)
Use Absolute Measurement Value: The value is the absolute measured distance.
Measure to Origin X Axis or Origin Y Axis: The distance is measured from the endpoint perpendicular to the selected axis of the Datum Line's origin.

- **Datum Origin**
  Click the link button to use a different origin for the Datum Line than the tool origin.

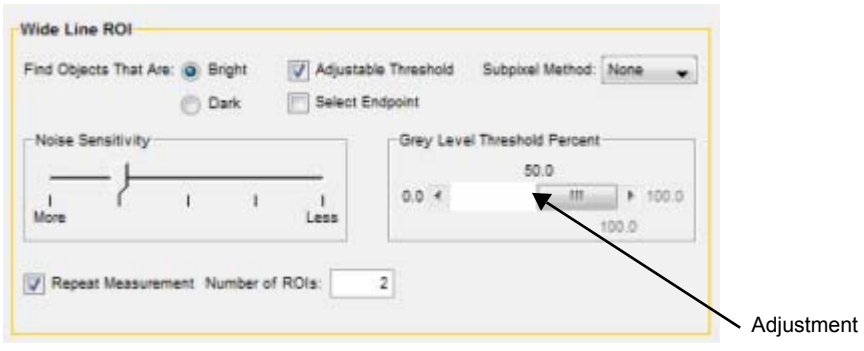


- **Select Datum Line Type - Tool Origin**
  Tool Origin: The measurement is made from the endpoint perpendicular to the tool origin's X or Y axis.
- **Select Tool Origin Settings**
  Use Signed Measurement Value: If the endpoint is below the origin axis, then the measured distance is negative. If the endpoint is above the axis, then the measured distance is positive. (The X coordinate value increases to the right and the Y coordinate value increases downward.)
  Use Absolute Measurement Value: The value is the absolute measured distance.
  Measure to Origin X Axis or Origin Y Axis: The distance is measured from the endpoint perpendicular to the selected axis of the Datum Line's origin.

Endpoint

1. Click the Endpoint button then position the ROI over the edge in the image you want to use as the endpoint. If you want to make multiple measurements, check the Repeat Measurement check box.

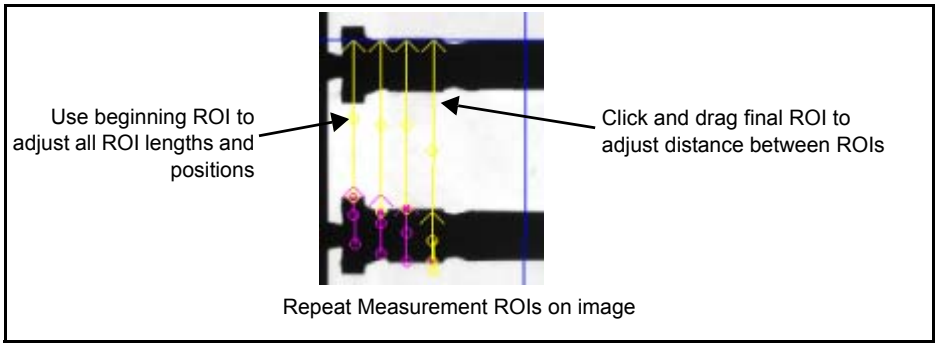
- **Wide Line ROI**
  Find Objects That Are Bright/Dark: Select the type of edge the tool should find, Bright (transition is from darker pixels to lighter pixels) or Dark (transition is from lighter pixels to darker pixels).
  Adjustable Threshold: To adjust the threshold, check the Adjustable Threshold check box. For details see "Blob Threshold Method" on page 3-143.



Adjustable Threshold

Subpixel Method: See "Subpixel Method" on page 3-161.

Select Endpoint: When this box is checked, you can select any found point on the ROI as the measurement Endpoint. After the point is selected, clear the box.
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.



Repeat Measurement ROIs on image

Pass/Fail

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

- **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 130, plus and minus 5.



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

- **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:

1. 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.
2. Check the endpoints found to make sure the desired distance is being measured.
3. Enter the known measurement distance (in real world units, e.g. mm) into the Train Measurement Length.
4. 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:

1. Train the tool's scale factor.

1a. Snap a new image and click the Train button. The tool will average the measured distances and update the scale factor.

1b. Repeat step 1 as needed to average more measurements.

Display

See "Display panel" on page 3-23.

Line Gauge Dual ROI

In the Measurement Drawer



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

The Line Gauge Dual ROI 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 tool separately.

See "How to Set Up the Line Gauge Dual ROI tool" on page 3-170.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Primary Wide LIne ROI	A point found on this ROI is used for the measurement starting point. If the ROI goes partly off the image during runtime, it is clipped at the image's edge.
Primary Wide LIne ROI List	A list of wide line ROIs used as Primary ROIs for measuring
Secondary Wide LIne ROI	A point found on this ROI is used for the measurement ending point
Secondary Wide LIne ROI List	A list of wide line ROIs used as Secondary ROIs for measuring
Distance Type	Euclidean: direct distance between the points AbsoluteX: the distance between Point One and a line through Point Two's X coordinate and perpendicular to the X axis AbsoluteY: the distance between Point One and a line through Point Two's Y coordinate and perpendicular to the Y axis

Input Name	What it is
Distance Tolerance	If the distance between the beginning and ending measurement points exceeds this value, the tool will fail. The parameters are minus, nominal, and plus.
Primary Endpoint Position	The starting point for the measurement, beginning from the tail end of the Primary Wide Line ROI
Primary Use Center	If True, the measurement starting point is half way between the Primary and Secondary Endpoint Positions
Primary Blob Color To Find	Bright, Dark, or both color objects on the Primary Wide Line ROI
Primary Blob Threshold Method	See “Grey Level Threshold Types” on page 3-80 for more details.
Primary Fixed Blob Threshold Percentage	The grey level threshold value for fixed single threshold types (in percentage)
Primary Adaptive Blob Threshold Offset	If Adaptive Threshold Method is selected, this offset is added to the adaptive threshold. This allows you to weight the adaptive threshold up or down.
Primary Noise Level	The amount of background noise present in the image along the Primary Wide Line ROI. Higher noise means the edges must be farther apart. Lower noise allows edges that are closer together.
Primary Maximum Number Of Edges To Find	Limits the number of edges found along the Primary Wide Line ROI to those with the strongest transition
Primary Edge Pattern	The edge pattern to find along the Primary Wide Line ROI (Rising indicates a transition from dark to light; Falling indicates a transition from light to dark)
Primary Subpixel Method	Indicates how many subpixel points to average when finding the edge points along the Primary Wide Line ROI. More points used provides greater accuracy but takes more time. See “Subpixel Method” on page 3-161.
Primary Subpixel Position	The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-189.
Primary Subpixel Search Distance in Pixels	The maximum distance, in pixels, that the subpixel algorithm will search from the threshold edge for the subpixel edge. See “Subpixel Search Distance” on page 3-161.
Secondary Endpoint Position	The ending point for the measurement, beginning from the tail end of the Secondary Wide Line ROI
Secondary Use Center	If True, the measurement starting point is half way between the Primary and Secondary Endpoint Positions
Secondary Blob Color To Find	Bright or Dark objects on the Secondary Wide Line ROI

Input Name	What it is
Secondary Blob Threshold Method	See “Grey Level Threshold Types” on page 3-80 for more details.
Secondary Fixed Blob Threshold Percentage	The grey level threshold value for fixed single threshold types (in percentage)
Secondary Adaptive Blob Threshold Offset	If Adaptive Threshold Method is selected, this offset is added to the adaptive threshold. This allows you to weight the adaptive threshold up or down.
Secondary Noise Level	The amount of background noise present in the image along the Secondary Wide Line ROI. Higher noise means the edges must be farther apart. Lower noise allows edges that are closer together.
Secondary Maximum Number Of Edges To Find	Limits the number of edges found along the Secondary Wide Line ROI to those with the strongest transition
Secondary Edge Pattern	The edge pattern to find along the Secondary Wide Line ROI (Rising indicates a transition from dark to light; Falling indicates a transition from light to dark)
Secondary Subpixel Method	Indicates how many subpixel points to average when finding edge points along the Secondary Wide Line ROI. More points used provides greater accuracy but takes more time. See “Subpixel Method” on page 3-161.
Secondary Subpixel Position	The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-189.
Secondary Subpixel Search Distance in Pixels	The maximum distance, in pixels, that the subpixel algorithm will search from the threshold edge for the subpixel edge. See “Subpixel Search Distance” on page 3-161.
Number of Steps	Duplicates the Primary and Secondary Wide Line ROIs. Allows multiple measurements with one tool.
Step Distance	The distance between the measurement steps
Step Angle in Degrees	The angle of the duplicate ROIs relative the original ROIs (see “Step Angle” on page 3-161)
Scale Factor	The scale factor applied to the output distance. This is applied after any camera calibration.
Scale Factor Train Distance	When the tool is trained, this scale factor is calculated so that the measured distance is scaled to this value.
Scale Factor List	The list of Scale Factors used when Number of Steps is greater than one.
Scale Factor Train Distance List	The list of Scale Factor Train Distances used when Number of Steps is greater than one.

Output Name	What it is
All In Tolerance	If True, all measurements are within tolerance
In Tolerance List	A list of measurements indicating whether In Tolerance is true or false
Distance List	A list of distances measured
Distance Error List	A list of measured distances minus the nominal
Edge Point List	A list of the found edge point locations
Distance Segment List	A list of the measured line segments
Step Segment List	A list of the Wide Line ROIs (when Number of Steps is greater than 1)
Number of Edges Per ROI List	The number of edges found on each ROI.

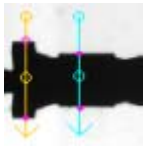
How to Set Up the Line Gauge Dual ROI tool

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

ROIs on image

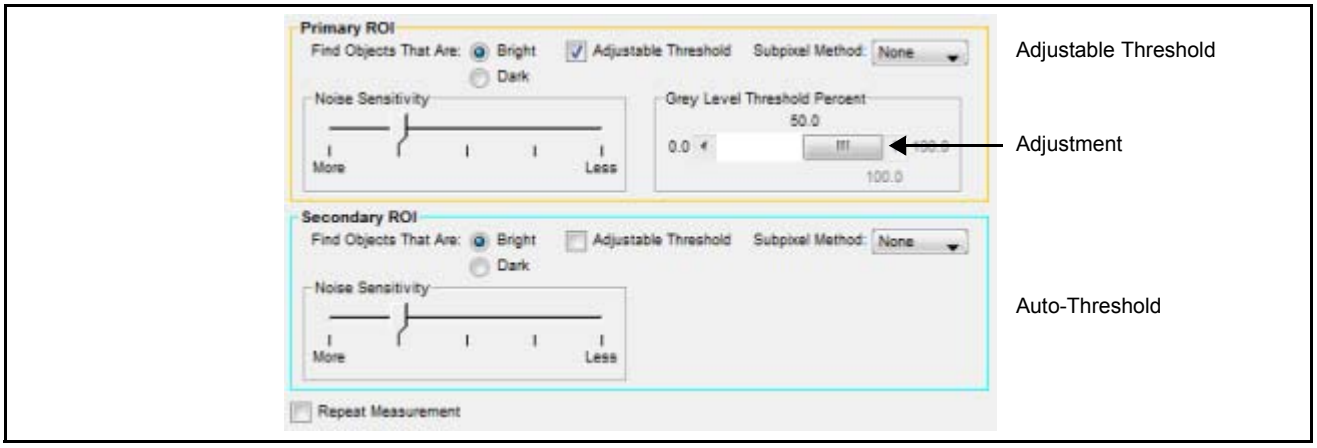


1. Position the ROIs over the edges in the image you want to find. The edge points found by the Primary ROI will be used for the Beginning Measurement point and the points found by the Secondary ROI will be used for the Ending Measurement point. If you want to make multiple measurements, check the Repeat Measurement check box.

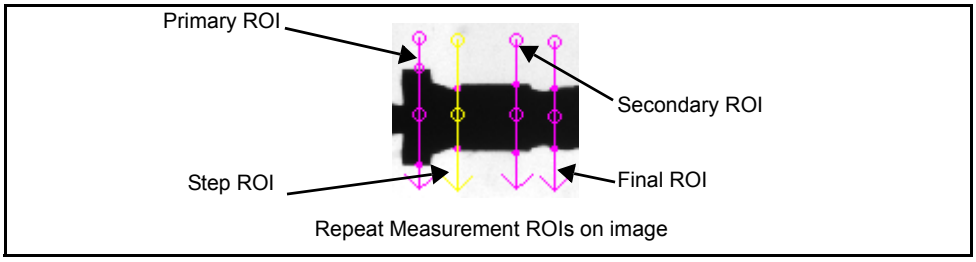
Adjust the settings for both the Primary and Secondary ROIs.

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 “Grey Level Threshold Types” on page 3-80.



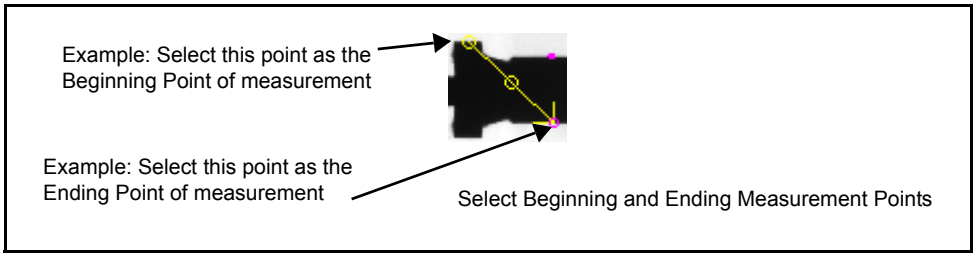
4. Subpixel Method: See “Subpixel Method” on page 3-161.
5. Noise Sensitivity: This setting adjusts for background noise in the image. The “more” setting finds edges that are close together when there is less background noise in the image. The “less” setting is used when there is more noise in the image 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.
   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.



Repeat Measurement ROIs on image

Endpoint & Type

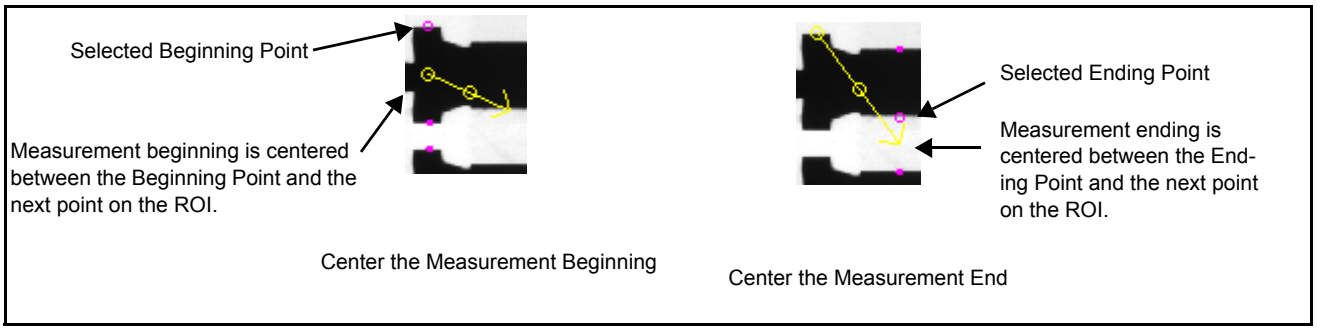
1. Select Beginning and Ending Measurement Points.
   Click the Beginning Point radio button and select the point where the measurement should start. Only the found points on the Primary ROI are displayed. (For Repeat Measurement, only found points on the Primary or Step ROI are displayed.)
   Click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



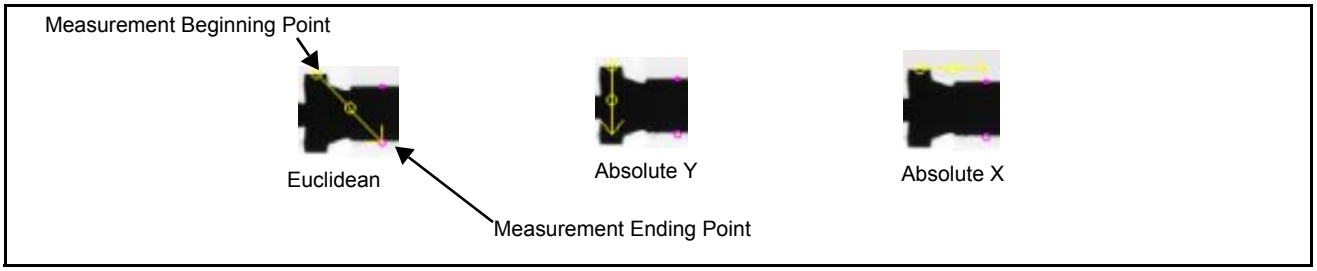
Select Beginning and Ending Measurement Points

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.

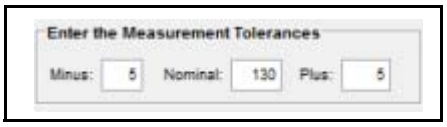


3. Measurement Type
   Euclidean: The tool measures the length of a straight line between the measurement beginning point and ending point.
   Absolute X: The tool measures the length of a straight line between the measurement beginning point and the X coordinate of the measurement ending point and perpendicular 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.



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 3-23.

Linear Regression

In the Measurement Drawer



The Linear Regression tool creates a line from a list of points. You can specify whether to ignore points that lie too far from the created line (outliers).

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Point List	The line is fitted to this list of points
Outlier Enable	See below for details
Outlier Distance Threshold	See below for details

Output Name	What it is
Success Flag	If True, the tool was able to fit a line to the points
Fitted Line	x and y coordinates and the angle of the fitted line
Average Deviation	The average deviation distance of the points from the fitted line
Maximum Deviation	The distance of the furthest point from the fitted line
Maximum Deviation Point	The x and y coordinates of the point furthest from the fitted line

Output Name	What it is
Line Segment	The beginning and ending x and y coordinates of the fitted line

Outlier Enable and Outlier Distance Threshold

The tool first uses all the input points to perform the line fit. At this point, if Outlier Enable is False, the fitting process stops.

If Outlier Enable is true, and the value of Maximum Deviation is larger than the value of Outlier Distance Threshold, then the Maximum Deviation Point is considered an outlier and is excluded from the point list.

The fitting process is repeated while iteratively reducing the weights of points outside of the Outlier Distance Threshold. The tool then recomputes Average and Maximum Deviation using the final fitted line and all the input points.

Midpoint

In the Measurement Drawer



The Midpoint tool calculates the midpoint between two input points and provides its x-y coordinates as an output.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
PointOne	The x and y coordinates of the first point
PointTwo	The x and y coordinates of the second point

Output Name	What it is
Midpoint	The x and y coordinates of the point midway between the two input points

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.

See "How to Set Up the Multiple Point to Point Measurements tool" on page 3-176.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Point List	The distance is calculated between the points in this list, based on the Pairing Type. See "Points" on page 3-176.

Input Name	What it is
Pairing Type	Pair 0-1 2-3 4-5...: calculates measurements between every other point and the one after it in the list. For example, if you have six points, three measurements are created (0-1, 2-3, 4-5). Pair 0-1 1-2 2-3 ...: calculates measurements between the points sequentially as they appear in the list. For example, if you have six points, five measurements are created (0-1, 1-2, 2-3, 3-4, 4-5) User Pairing Indexes: Pair the points using the Pairing Indexes input
Pairing Indexes	The order in which the points in the list should be paired, when Pairing Index Type is selected. The length of this list determines the number of output results, regardless of the length of the Point List property.
Distance Type	Euclidean: direct distance between the points AbsoluteX: the distance between Point One and a line through Point Two's X coordinate and perpendicular to the X axis AbsoluteY: the distance between Point One and a line through Point Two's Y coordinate and perpendicular to the Y axis
Distance Type List	Allows you to specify a different distance type for each point pair. It will override the "Distance Type" value if an integer list is linked here. The allowed values are 0 =Euclidean, 1=AbsoluteX, 2=AbsoluteY.
Tolerance	If the distance between the beginning and ending measurement points exceeds this value, the tool will fail. The parameters are minus, nominal, and plus.
Tolerance List	Allows you to specify a different tolerance for each point pair. If present, this list will override the “Tolerance” value. If the length of this list does not match the number of point list pairs, the tool will fail. The number of output results is based on the length of this list. Tip: To always make a dynamic number of measurements, based on the current length of the point list, use the property panel rather than the tool Setup. Put a Data Set Tool that writes an empty Tolerance List to this input before this tool in the task. That way, if you accidentally enter the tool setup and it configures the Tolerance List, that List is overwritten the next time the task runs.
Scale Factor	A real value that is multiplied by the measured distances. Can be used in place of calibrating the camera. Same as the input in the Line Gauge tools.
Scale Factor List	Allows you to specify a different scale factor for each point pair. It will override the "Scale Factor" value if a list is linked here.
Enable Distance List Out	If True, the Distance List output is populated.
Enable InTolerance List Out	If True, the In Tolerance List output is populated.
Enable Distance Error List Out	If True, the Distance Error List output is populated.
Enable Line Segment List Out	If True, the Line Segment List output is populated.

Output Name	What it is
All In Tolerance	If True, all measurements are within tolerance
Distance List	A list of distances measured
In Tolerance List	A list of measurements indicating whether In Tolerance is true or false
Distance Error List	A list of measured distances minus the nominal
Line Segment List	A list of the measured line segments

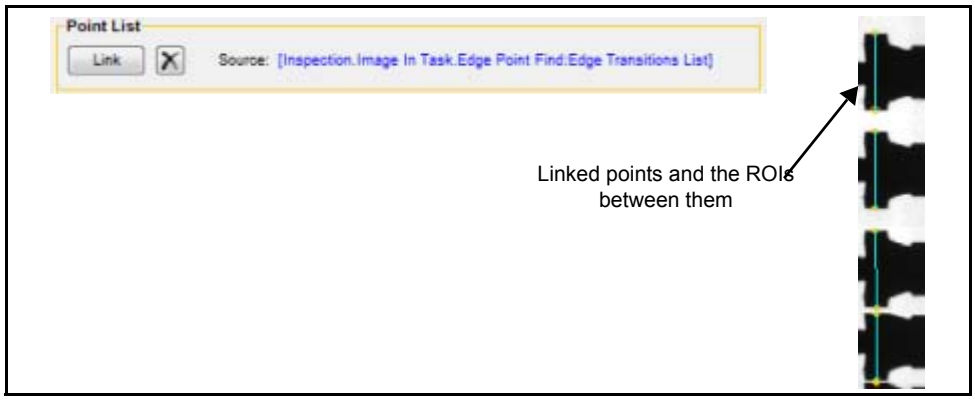
How to Set Up the Multiple Point to Point Measurements tool

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.

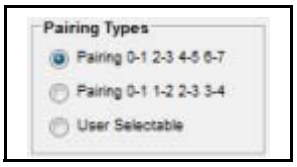
Points

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.

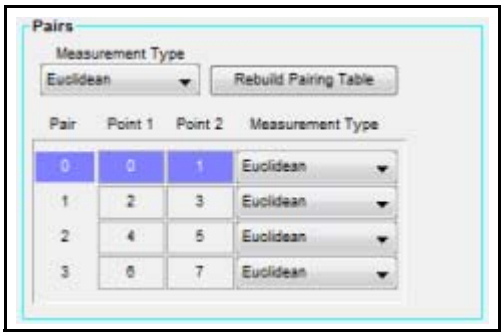


2. Pairing Types
   Pairing 0-1 2-3 4-5 6-7
   If you select this Pairing Type, the tool calculates measurements between every even numbered point (starting with 0) and the next point after it in the Pairs Table. For example, if you have six points, three measurements are created (0-1, 2-3, 4-5).
   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).

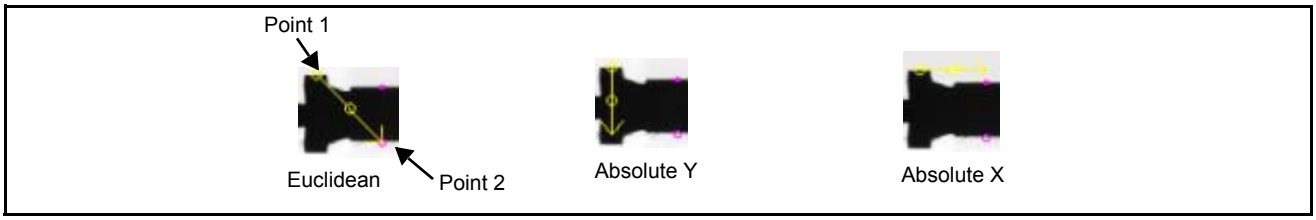
User Selectable
If you select this Pairing Type, you choose the points that the tool uses to build the Pairs Table, then the tool calculates measurements sequentially between those points. The number of measurements is determined by the number of points in the Pairing Table. See “Pairing Table” on page 3-177 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.

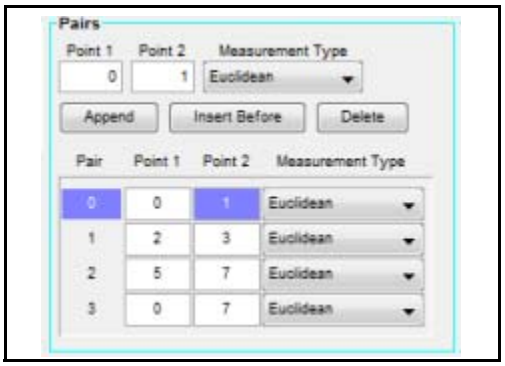


Rebuild Pairing Table
Click the button to match the number of configured measurements to the current point list length.
Pairing Table
Use this table to create measurement segments and set the measurement type. When you select one of the first two Pairing Types, the table is built from the points in the 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:

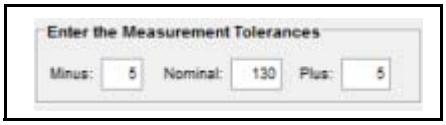
2c. Train the tool's scale factor.

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 3-23.

Peak Valley Find

In the Measurement Drawer



The Peak Valley Find tool is used to find and count maximums and minimums (peaks and valleys) along a given edge direction. A wide line segment is used as a directed ROI to specify the search direction for edges. Starting from the top of the ROI and running in the direction of the line segment, the tool finds edges and detects peaks and valleys along the given direction.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space. Use this only if you are trying to find an origin relative to another tool.
Report Peaks	If True, the Peak List output is populated.
Report Valleys	If True, the Valley List output is populated.
Report Edge Points	If True, the Edge Point List output is populated. Use this primarily for tool setup, since it will slow tool performance.
Wide Line ROI	Points on this ROI are used for finding peaks and valleys along the edge. The ROI direction indicates the edge and amplitude direction.
Edge Strength Range	Specifies the range of percentage difference between detected edge pixels for peak and valley detection.
Minimum Amplitude	The minimum distance, in the direction of the Wide Line ROI, between successive peaks and valleys.

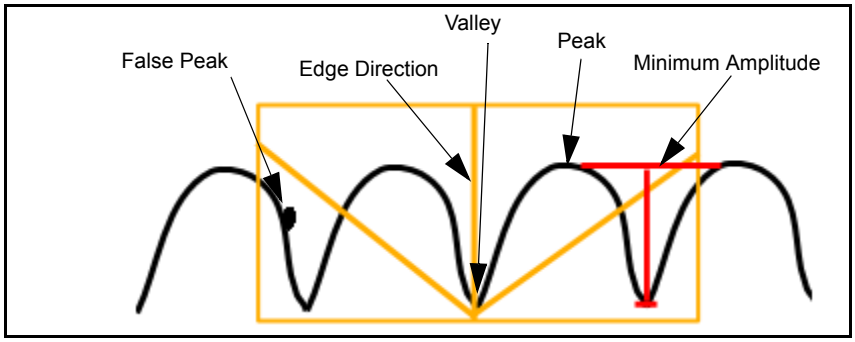
Output Name	What it is
Peak List	A list of peak edge points.

Output Name	What it is
Valley List	A list of valley edge points.
Edge Point List	A list of edge points.
Peak Count	A count of peak points found along the edge.
Valley Count	A count of valley points found along the edge.

Peak Valley Find Tool Details

Edges are chosen as the first edge (either rising or falling), in the direction of the line segment, that is within the given edge strength range. This range value is used to select edges more specifically and filter out image noise.

Peaks and valleys are generated using this list of edges and a minimum amplitude value. The minimum amplitude is used to suppress peaks and valleys which are below the threshold. It specifies the minimal distance (in the direction of the line segment) between the adjacent peaks and valleys. If no edges are further apart than the minimum amplitude, then no peaks or valleys are detected. False peaks and valleys (due to noise or minor deviations) less than the minimum amplitude value are suppressed.



Point Match

In the Measurement Drawer



The Point Match tool compares an ideal point list and an actual point list and finds matches within a given tolerance. The point lists are both assumed to be relative to the same origin, but are not assumed to be in any particular order. The Point Match Tool reports extra points and points that are missing in the actual point list

Since no point correspondence is assumed, two separate lists of Booleans are output to indicate which points in the ideal and actual lists have corresponding points within tolerance. Tolerance checking is based on radial or x-y offset distance (depending on which tolerance is enabled or the largest value if both are enabled).

When you click the Train button, the Actual Points input is copied into the Ideal Points input. This allows you to use a golden part for quick setup of an application. The Ideal Points would ordinarily come from a CAD drawing rather than a golden part, but since that is not always feasible you can use the Train button. The Ideal Points are saved with the vision program file.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space

Input Name	What it is
Ideal Points	A point list generated from an ideal part that is used as a template for comparison. The points can be in any order. See “How Point Matching Works” on page 3-182.
Actual Points	A point list taken from a test part that is used to determine whether the part is defective. The point list is in no particular order relative to the ideal point list.
Tolerance	The maximum distance allowed between corresponding actual and ideal points. Large tolerance values will cause highly ambiguous matching and infinite tolerance values are considered an error.
Match Tolerance	If this value is greater than the tolerance, it is used to match points, but it does not determine whether the point match is In tolerance. If a point is not in tolerance, but you want to know the distance to the "matched" point, use this setting. That is, all points may be within match tolerance, but the inspection is considered a failure if the points are less than the tolerance. The Match Tolerance does not affect the match lists, or the missing or extra points outputs.
Test Extra Points	If True, any extra points found in the actual point list will cause In Tolerance to be False.
Enable XY-Offsets	If True, the X and Y Offset between the actual point and the matching actual point is used to determine point match tolerance. The In Tolerance output is True if all the X and Y Offset values are less than the tolerance.
Enable Radial Offsets	If True, the Radial Offset between the actual point and the matching actual point is used to determine point match tolerance. The In Tolerance output is True if all the Radial Offset values are less than the tolerance.
Enable Tolerance Regions	If True, the Tolerance Regions output is enabled.

Output Name	What it is
In Tolerance	If True, every ideal point has at least one unique matching actual point within the given tolerance. If Test Extra Points is True, then any extra points found will cause In tolerance to be False.
Ideal Point Match	If a value in this list is True, the tool found an actual point within tolerance in the actual points list. If the value is False, the matching point is missing or outside the tolerance.
Actual Point Match	If a value in this list is True, the corresponding actual point found an actual point within tolerance in the actual points list. If a value is false, the corresponding actual point is listed in the extra points output list.
Extra Points	The points in this list were found in the actual points, but had no corresponding actual point within tolerance. Extra points can occur if the actual point is out of tolerance or if multiple points are within tolerance. For multiple points within tolerance, the first point is selected as matching and the rest are considered extra.

Output Name	What it is
Missing Points	The points in this list were found in the ideal point list, but had no matching point within tolerance in the actual point list.
Radial Offsets	A list of radial distances from each ideal point to the corresponding actual point. missing points have a distance of zero.
X-Offsets	A list of distances from each ideal point to the corresponding actual point along the x-axis. Missing points have a distance of zero.
Y-Offsets	A list of distances from each ideal point to the corresponding actual point along the y-axis. Missing points have a distance of zero.
Tolerance Regions	These consist of circles (Radius Offsets) or squares XY-Offsets) centered on the Ideal Points with a radius or length and width equal to the Tolerance input. See “How Tolerance Regions Work” on page 3-182.

How Point Matching Works

Matching begins by selecting successive points in the ideal point list. Each ideal point is matched to an actual point by a tolerance check until the ideal point list is exhausted. Ideal points without a match are added to the missing points list. Actual points which have not been matched to an ideal point are put into the extra points list.
NOTE: If the Tolerance value is too high, missing and extra point locations are reported incorrectly.

How Tolerance Regions Work

There is a Shape List output named “Tolerance Region." These regions consist of circles or squares centered on the Ideal Points with a distance equal to the Tolerance input. For example, if you set Tolerance to fifteen, Enable Tolerance Regions to True, Enable Radial Offsets to True, and press Train; Tolerance Regions are displayed on the image as purple circles fifteen pixels in diameter. The Regions are contained in the Tolerance Regions output in the properties list. The regions are circles because Enable Radial Offsets is true.

Point to Line Measurement

In the Measurement Drawer



The Point to Line Measurement tool measures the distance between a point and a line. See “How to Set Up the Point to Line Measurement tool” on page 3-183.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space
Point	The x and y coordinates of the start measurement point
Line	The x and y coordinates and angle of the end measurement line
Tolerance	If the distance between the point and the line is greater than this value, the tool will fail. The parameters are minus, nominal, and plus.

Output Name	What it is
Distance	The measured distance from the input point to the input line.
In Tolerance	True if the Distance is within the tolerance range
Distance Error	The difference between the Tolerance Nominal and the Distance
Line Segment	A line from the start and end points of the distance. The start point of the line segment will always be the input point.

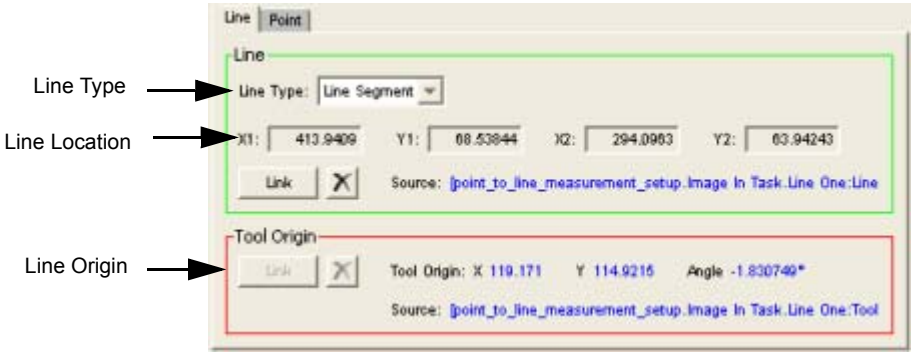
How to Set Up the Point to Line Measurement tool

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 are set 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.



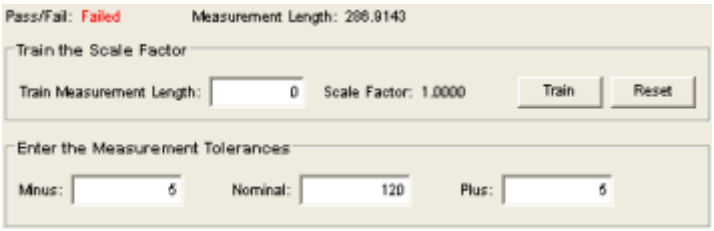
You can also average several images of measurements to create a more accurate scale factor.
To average several images:

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 3-23.

Point to Point Measurement

In the Measurement Drawer



The Point to Point Measurement tool measures the distance between two points. A Setup is available for this tool, which simplifies tool configuration. See “How to Set Up the Point to Point Measurement tool” on page 3-186.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space
Point One	The x and y coordinates of the beginning measurement point
Point Two Origin Source	Use Tool Origin: Select this if Point Two is located on the image relative to the Tool Origin property. Use Point Two Origin: Select this if Point Two is located on the image relative to the Point Two Origin property
Point Two Origin	The origin the tool will use when Point Two Origin Source is set to the value Use Point Two Origin
Point Two	The x and y coordinates of the ending measurement point
Distance Type	Euclidean: Measure direct distance between the points AbsoluteX: Measure the distance between Point One and a line through Point Two's X coordinate and perpendicular to the X axis AbsoluteY: Measure the distance between Point One and a line through Point Two's Y coordinate and perpendicular to the Y axis
Tolerance	If the distance between the two points is greater than this value, the tool will fail. The parameters are minus, nominal, and plus.

Output Name	What it is
Scale Factor	The scale factor applied to the output distance. This is applied after any camera calibration. (See“Train the Scale Factor” on page 3-160.)

Output Name	What it is
Scale Factor Train Distance	When the tool is trained, this scale factor is calculated so that the measured distance is scaled to this value.
Distance	The measured distance between Point One and Point Two
In Tolerance	True if the Distance is within the tolerance range
Distance Error	The difference between the Tolerance Nominal and the Distance
Line Segment	The distance line segment.

How to Set Up 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

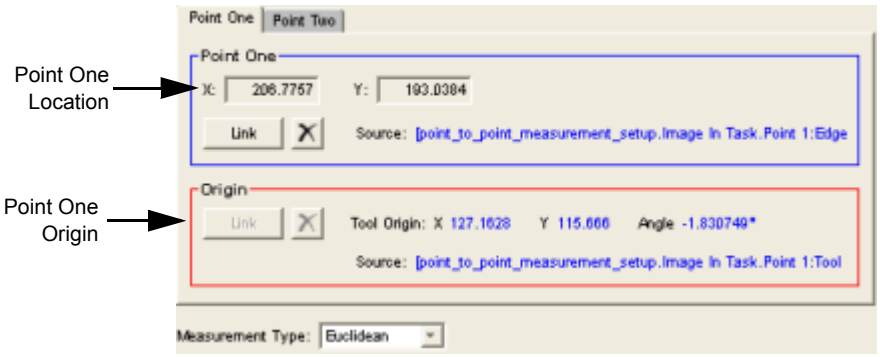
1. **Point One Tab -Point One**: You define the beginning measurement point on the Point One tab. You can manually enter the X and Y coordinates of the point or click the Link button to link a point.
2. **Point One Tab - Origin**: When you link Point One, Setup will complete the Origin location, based 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. **Point One Tab - 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.



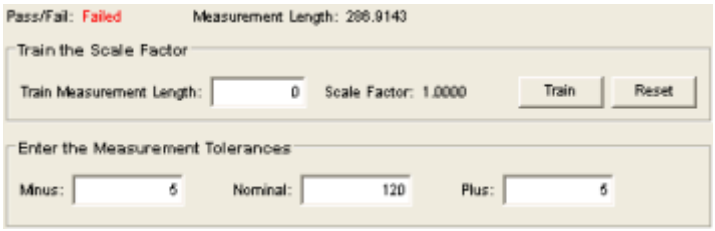
You can also average several images of measurements to create a more accurate scale factor.
To average several images:

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 3-23.

Subpixel Edge Extractor

In the Measurement Drawer



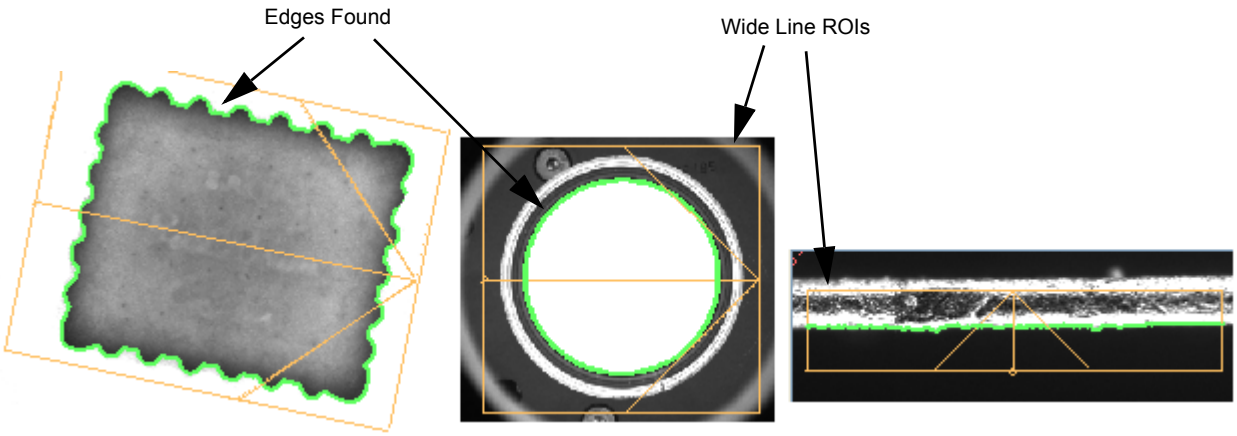
The Subpixel Edge Extractor tool finds the edge points along the edge of an arbitrary shape with subpixel accuracy. See “Edge Extraction Examples” on page 3-189.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space
Wide Line ROI	Indicates the direction and limits of the edge search
Edge Polarity	Search for rising or falling edges
Edge Number To Extract	The edge number to extract.
Maximum Number of Edge Crossings	Limits the number of edges found to those with the strongest transitions.
Edge Detection Method	Gradient Edges or Grey Level Edges 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. See “Edge Detection Method” on page 3-89.
Edge Detection Sensitivity	Determines the transition level necessary for detection. A higher value detects more edges. Non-fixed selections use adaptive threshold selection. Fixed Threshold uses the Fixed Gradient Threshold Percentage value or the Fixed Grey Level Threshold Percentage (depending on the Edge Detection Method)
Fixed Gradient Threshold Percent-age	The threshold value used when Gradient Edge Detection and Fixed Threshold Edge Detection Sensitivity are selected

Input Name	What it is
Fixed Grey Level Threshold Percent-age	The threshold value used when Grey Level Edge Detection and Fixed Threshold Edge Detection Sensitivity are selected
Subpixel Position	The subpixel position for edges that are not well defined. See “Subpixel Position” on page 3-189.

Output Name	What it is
Edge Point List	List of edge points found

Edge Extraction Examples



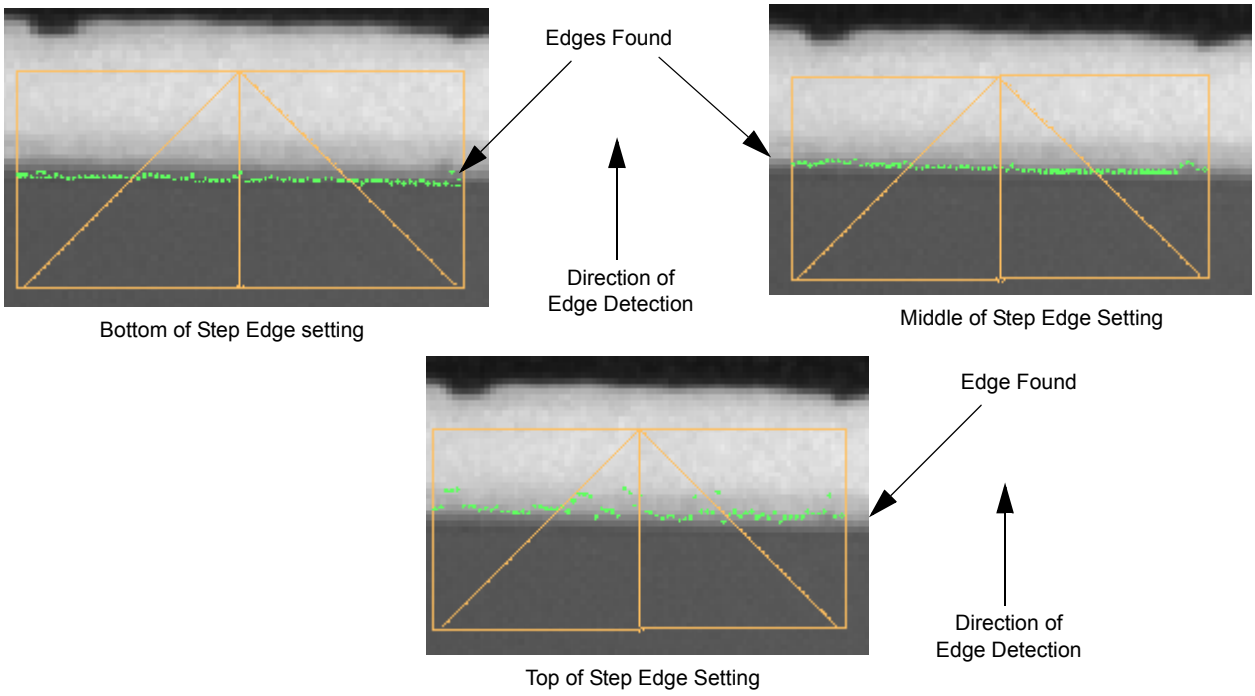
Subpixel Position

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 Wide Line ROI and the Edge Polarity 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 rising 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.



Flaw Detection Drawer

Adaptive Template

In the Flaw Detection Drawer



The Adaptive Template tool performs a gradient match similar to the Greyscale Template tool. However, unlike the Greyscale Template tool, no standoff distance is required since this tool automatically ignores edges while still extracting defects in and around them. This type of search allows the tool to account for minor errors in locating, and also deals with image lighting variations automatically. See “How the Adaptive Template tool Works” on page 3-191.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space
Find Shape List	The desired region of the image to search. If no shape is defined, the entire image is processed.
Trained Image	The Input Image is copied to this input when you train the tool. You should not link an image to here, since it is replaced when you train the tool.
Filter Width	The maximum distance to search in the Input Image for the best gradient match (in pixels).

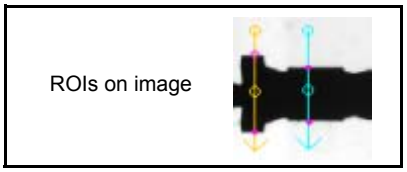
Output Name	What it is
Difference Image	The difference between the Trained and Input images (click the Difference Image tab to view)

How to Set Up the Adaptive 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. Position the ROI over the part of the image you want to adapt.

- **Train ROI**
  Filter Width: The maximum distance to search in the Input Image for the best gradient match (in pixels).

Difference Image

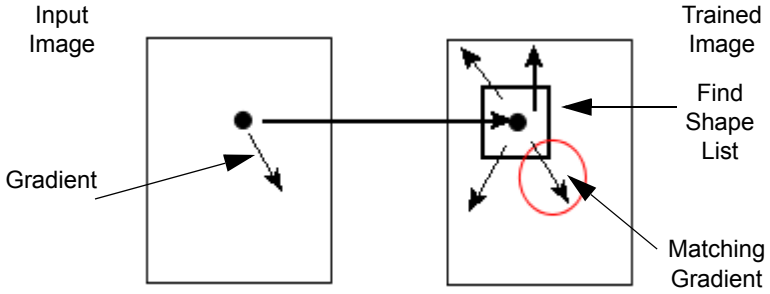
The image produced from all the gradient differences.

Display

See “Display panel” on page 3-23.

How the Adaptive Template tool Works

This tool matches the gradient of the Input image to the best matched gradient in the neighborhood of the corresponding gradient in the Trained image.



In the example above, the tool examines the pixels of the Input image and calculates the gradient at the pixel shown. The pixel location is represented by the dot and the small arrow represents the gradient at that pixel. The large arrow illustrates the mapping from the Input image to the Trained image. The dot in the Trained image is the corresponding pixel and the rectangle is the neighborhood of the pixel where the tool searches for a gradient match (the Filter Width). The four small arrows represent gradients inside the search neighborhood. The red circle in the Trained image is the best match to the gradient in the Input image since it is nearly the same direction and magnitude.

Once the tool determines the best gradient match in the Input image, it uses the difference between the match in the Trained Image and the original gradient from the Input Image. This difference is recorded as a pixel value in the Difference image.

After the tool examines the entire set of pixels, it creates a Difference Image of all the gradient differences. This Difference Image can then be used to perform blob or contrast analysis to find defects.

Average Intensity-Flaw

See “Average Intensity” on page 3-106

Blob-Flaw

See “Blob” on page 3-76

Bump Find

In the Flaw Detection Drawer



The Bump Find Tool analyzes a polygon list for bulges in the boundaries. Use the Polygon Smoothing tool (page 3-200) to smooth the polygon list before you use the Bump Find tool.

The tool distinguishes between a bump or bulge defect and polygon corners or noise based on the input parameters. Smoothing reduces image noise to a low enough level so that edge variability due to noise may be reduced and defects stand out. However, too much smoothing renders defects undetectable.

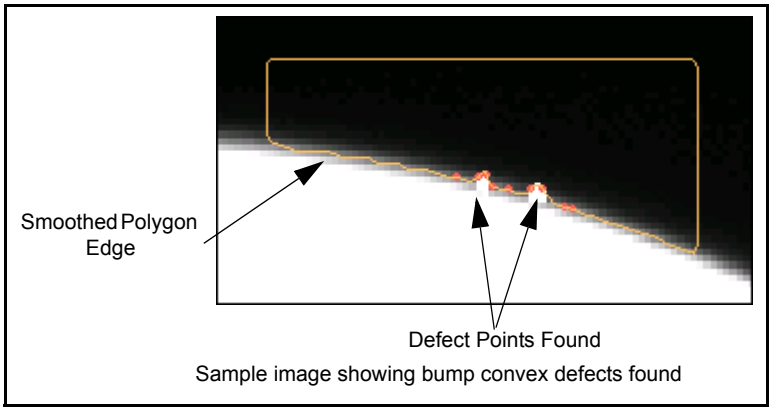
Cumulative turn angle and flatness length settings also help filter noise. Turn angle describes the amount of angle change (in opposite directions) that is needed between boundary edges to indicate the beginning and end of a defect point. The end of a defect is indicated by a stretch of flat boundary. The boundary is considered flat if an edge change does not exceed the minimum turn angle.

Flat areas may exist within a defect, but when the length of that flat area is longer than the flatness value, the defect is considered terminated. The flatness length value should be small enough to terminate defects on any clean edge, but large enough that defects do not terminate prematurely. Note that corners near defects are often considered as part of the defect (since the flatness length is not exceeded in this case) but this should not cause a problem.

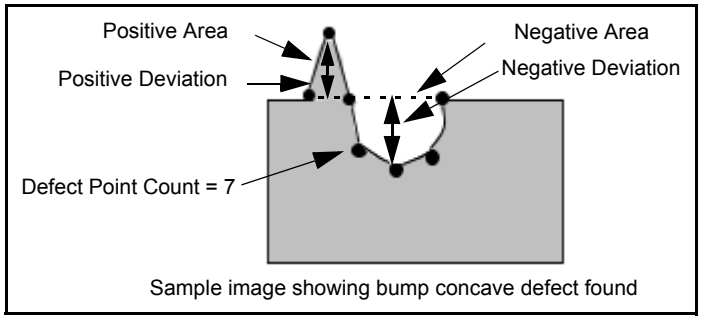
Minimum area is the smallest area within a string of defect points that indicates a defect. If the area range value is not exceeded before the end of a defect, those points are not reported as defects.

The Defect Point Count list indicates how many points are in each defect. This means individual defects can be separated. For example, if the Defect Point Count list contains 3, 4, 5, the first three defect points corre-

spond to the first defect, defect points 4, 5, 6, and 7 (the next four) correspond to the second defect, and the final five points are the third defect.



Sample image showing bump convex defects found



Sample image showing bump concave defect found

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Polygon List	A list of objects to inspect for defect bulges
Window Width	Cumulative turn angles are accumulated over this total length of the curve. Defect points are marked at the middle vertex of the curve.
Flatness Length	The minimum boundary length that declares the end of a defect. If the flatness length is exceeded between defect points, the defect is considered terminated between them.
Cumulative Turn Angle in Degrees	The minimum angle turn needed to signal a defect point. This is called 'cumulative' because it is accumulated over several vertices. Defect points are reported only if there is more than one with opposite turn directions with no flatness termination between them. This criterion makes the tool able to distinguish between corners and defect bumps.
Bump Type	Find Both: The tool finds both concave and convex bumps Find Convex: The tool finds only bumps that protrude outward from the boundary. Find Concave: The tool finds only bumps that are indented into the boundary.

Input Name	What it is
Use Point Count Filter	If True, only defects that exceed the Minimum Point Count value is included in the Defect List
Minimum Point Count	This is the minimum number of points a defect must contain to be included in the Defect List
Use Area Filter	If True, only defects with areas that lie within the Area Range is included in the Defect List
Area Range	A defect's area must lie within this range to be included in the Defect List. This is the area included between the first and last defect point in a defect. Area values within a defect are negative for concave sections and positive for convex sections. The parameters are start and end. The parameters are start and end.
Use Deviation Filter	If True, only defects with a deviation value that lies within the Deviation Range is included in the Defect List.
Deviation Range	The deviation is the maximum distance from a line connecting the first and last defect point in the defect to the defect section's highest or lowest point. Deviation values are negative for concave sections and positive for convex sections. The parameters are start and end.

Output Name	What it is
Defect List	The list of defect points.
Defect Point Counts	A list of the number of points in each defect in the Defect List
Defect Areas	A list of the areas of each defect in the Defect List
Defect Deviations	A list of the deviation values of each defect in the Defect List

Color Blob-Flaw

See "Color Blob" on page 3-112

Contrast-Flaw

See "Contrast" on page 3-118

Contrast - Multiple ROI-Flaw

See "Contrast - Multiple ROI" on page 3-121

Extreme Difference

In the Flaw Detection Drawer

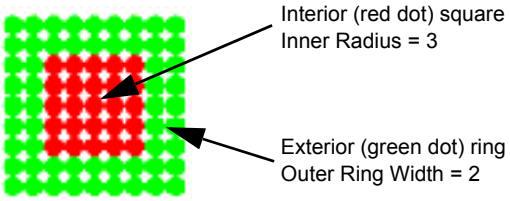


The Extreme Difference tool detects defects indicated by a bright or dark region relative to the background. Similar to the Spot Find Tool, this tool searches the ROI for bright or dark spots. However, since this tool is used for detection instead of location, it uses a relative intensity difference rather than an absolute intensity value. Also, since location is unimportant, non-maximal suppression is not used. Defect points tend to cluster and larger clusters indicate larger defects.

The Extreme Difference tool uses concentric square regions to compare regional extremum (minimums and maximums). For example, if the tool is searching for dark regions, the minimum grey levels for the interior square and the exterior ring are calculated. These two values are compared and marked as a defect if the exterior minimum value minus the interior minimum value exceeds the difference threshold. Extremum values are used, rather than average or median values, so that the tool is insensitive to edges.

The interior region must be large enough to contain any defect that is to be detected. This means that the defect must be completely contained within the inner radius. If the defect is larger than the inner radius, the defect will not be found. This is because, when the defect extends into the outer ring it raises or lowers the outer ring's minimum value, affecting the difference calculation. Also, the tool works more effectively when the defect sizes are consistent.

For example, in this picture the red dots correspond to pixel values used in the interior region and the green dots to the exterior region. The Inner Radius is three and the Outer Ring Width is two.



Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Find Shape List	This is the tool's search area.
Shape List ROI Type	Each Shape is separate ROI: Each shape is processed as a separate ROI and the results are combined. This mode is faster than the other mode if the shapes are far apart, but results are duplicated if the shapes overlap. ShapeList is One ROI: The ShapeList is one large rectangular ROI and the shapes are the enabled pixels within the rectangle. The tool may be slow if the shapes are far apart. This setting allows shapes to overlap and form complex shapes without repeating the overlapped pixels and duplicating results.
Inner Radius	The inner square's radius. The inner square edge size is (2 times the radius) - 1. For example, if the radius is 3, the inner square edge size is 5. The defect must be completely contained in the inner radius in order to be detected. It can not extend into the outer ring.
Outer Ring Width	The width, in pixels, of the outer ring.The outer square edge size is twice the outer ring width plus the inner square edge size.

Input Name	What it is
Difference Threshold	The minimum allowed difference between the inner and outer extreme grey levels (in percent). For dark objects, the difference is the outer minimum minus the inner minimum. For bright objects, it is the inner maximum minus the outer maximum.
Defect Type	Find Bright Defects - finds bright areas Find Dark Defects - finds dark areas Find Both Defects - finds both dark and bright areas

Output Name	What it is
Defect List	The list of points found

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. See "How to Set Up the Greyscale Template tool" on page 3-197.

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 search.
Greyscale Template Model	The model to find, linked from another tool
Greyscale Difference Type	Adaptive or Fixed (see "Greyscale Difference Type" on page 3-200)
Match Sensitivity	Indicates amount of noise in the image. Higher settings allow rougher edges and cause more thorough and longer searching
Train Mode	The template training mode (see "Train Mode" on page 3-199)
Train Noise Level	The amount of background noise present in the image. A larger value erodes the template edges more to eliminate more noise. If the noise level is very high, use the Standoff Distance input to increase the edge erosion.

Input Name	What it is
Train Edge Detection Sensitivity	The sensitivity level determines the transition level necessary for detection. A higher value detects more weaker edges but causes the tool to run slower.
Train Fixed Edge Value	The sensitivity value for Fixed Train Edge Detection Sensitivity type
Train Grey Level Threshold Type	The threshold type when thresholding Train Mode is selected
Train Fixed Threshold Range	The threshold range when Fixed Threshold Range is selected for Train Grey Level Threshold type. The parameters are start and end.
Standoff Distance	The distance to erode the template from the edges. Increase this value if the Train Noise Level setting is not sufficient to accommodate the image noise level.
Min Feature Size Protected From Standoff	The minimum size of features (in units) that should not be subject to Standoff Distance erosion. An Infinity setting means no features are protected.
Perform Blob Analysis	If True, the difference blobs are filtered based on the two following conditions.
Maximum Allowable Blob Size	The maximum size of an individual difference blob
Maximum Allowable Total Blob Size	The maximum total size of all the difference blobs

Output Name	What it is
Difference Image	The difference between the model and the input image (click the Difference Image tab to view)
Blob Sizes In Tolerance	If True, no difference blobs exceeded the maximum allowable sizes (Perform Blob Analysis must be selected)
Maximum Blob Size Found	The size of the largest difference blob found (Perform Blob Analysis must be selected)
Total Blob Size Found	Total size of all difference blobs found (Perform Blob Analysis must be selected)
Defect Blob List	A list of all difference blobs found that failed blob analysis (Perform Blob Analysis must be selected)
Non-Defect Blob List	A list of all difference blobs found that passed Blob Analysis (Perform Blob Analysis must be selected)

How to Set Up the Greyscale Template tool

General

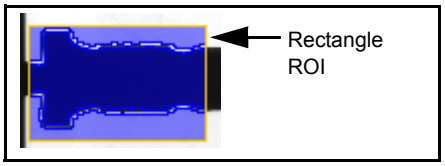
1. **Image**: To use a different image source, click the Link button. The tool works only with greyscale images.

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.

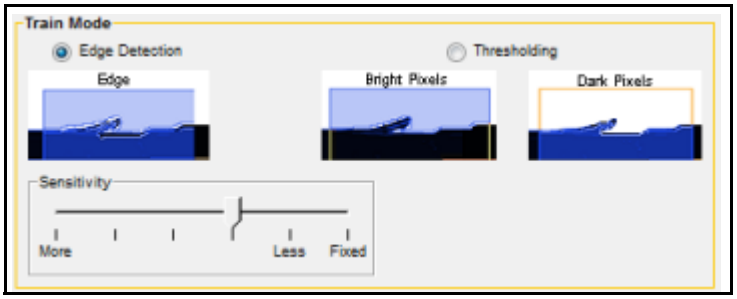
Train ROI

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



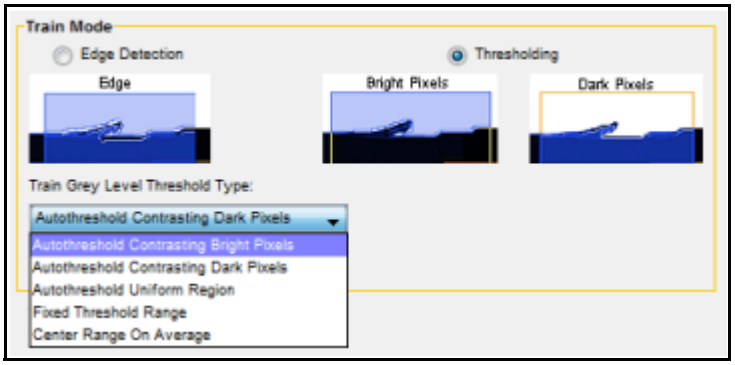
Edge Detection

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 3-80 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.

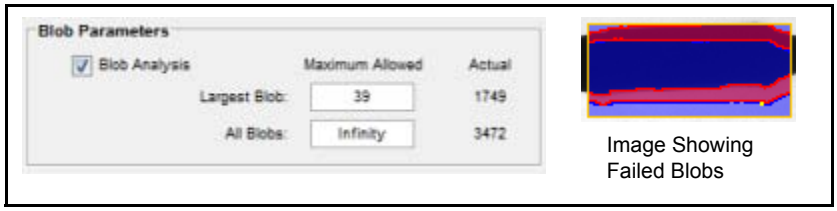
Difference Image

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 3-23.

Train Mode

1. Train New Template With Edge Detection
This mode discards previous training and creates a new model on this image. 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.

2. Add and Train Template With Edge Detection
This mode updates an existing model by adding information from the current image. The model's greyscale image is updated by averaging the current image with the existing model. The model tracks

the number of images that have been added and weights the current image accordingly.
For example, if the current image is the fourth one to be added to the model, the new model pixels are calculated by giving the current image one-fourth weight and the current model three-fourths weight. The mask image is updated by ANDing the non-edge pixels of the current image with the existing model mask. As a result, the model mask includes a pixel only if it was included in ALL of the images that were added. The overall result of adding images to the model is to make the model more generous by incorporating more "do not care" regions, thus accounting for more variations in the inspected part.

3. Train New Template With Thresholding
This mode discards all previous training and creates a new model on this image. 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.

4. Add and Train Template With Thresholding
This mode is the same as Add and Train Template With Edge Detection, except that the model mask is created using thresholding.

Greyscale Difference Type

Adaptive Difference: The tool finds the mean of the grey level differences between the template and the image. It then automatically adjusts the difference image to reflect this mean. This difference type allows the system to ignore small fluctuations in lighting, since the difference mean moves automatically.

Fixed Difference: No adjustment is made to the difference image.

Polygon Smoothing

In the Flaw Detection Drawer



The Polygon Smoothing tool is similar to the image preprocessing performed by the image filtering tools (e.g. the Average Filter and Gaussian Filter tools). This tool preprocesses polygon boundaries for boundary analysis methods. This tool takes a blob list, converts it to a polygon list, and smooths those polygons. Since a polygon that is derived from a blob contains only right angles, some form of smoothing is needed in order to perform a reasonable analysis of the boundary.

Smoothing removes jagged edges caused by pixilation from image noise and blob thresholds. This tool performs convolutions of the polygon vertices with a Gaussian filter to smooth boundary polygons. When a higher smoothing level is selected, a larger filter is used in the convolutions.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool's origin relative to the entire image space
Blob List	These blobs are smoothed
Smoothing Level	The amount of polygon smoothing (the number of convolutions applied to the filter before it is applied to the polygon). A higher value uses a larger filter for greater smoothing.
Input Polygon List	A list of polygons to be smoothed

Output Name	What it is
Smooth Polygon List	The list of smoothed polygons

NOTE: Polygon lists are not currently visible in VPM. To see the smoothed polygon list, use a Data Instance tool with a polygon list data type and link its input to the Polygon Smoothing tool's smooth polygon list output. You can then promote the Data Instance tool's shape list output to a task Output.

Readers Drawer

Character Contour Match

In the Readers Drawer



The Character Contour Match tool measures character defects by comparing the image character to a trained model. The tool only verifies characters, so the tool must be trained on a good character before it runs. To allow for single character verification, define a train and search ROI for each character. If a single train ROI is placed over several characters, all the characters within the ROI are combined and considered a single character when the tool trains.

The Character Contour Match tool calculates the differences between the library characters and the verified characters using boundary length measurements which do not depend on the size of individual letters. This means it is not sensitive to size differences between letters, for example, between the letters 'i' and 'm.' Also, the Character Contour Match tool knows what the string should be, so it only compares each image character to trained models of that character.

This tool "understands" symbols defined as multiple characters similar to the OCR tool. For example, if there is a symbol such as a 'comma' defined in the library and you are trying to verify the string "1,000" you can enter 1"comma"000 as the verification string. Note that quotes are not used in the symbol library, but only in strings used for training or verification.

See "How to Set Up the Character Contour Match tool" on page 3-203.

Input Name	What it is
Input Image	The image being inspected
Tool Origin	The tool's origin relative to the entire image space
Train Character Rectangles	The list of rectangles that contains the contour models for training each individual character of the Train String
Search Character Rectangles	The list of rectangles used to search for characters during verification. Each rectangle corresponds to a character position and should be large enough to account for location error
Train String	The string of characters that defines the characters in the Train Character Rectangles
Verification String	The string of characters to be verified. The characters in the image are compared to model characters in this order.

Input Name	What it is
Match Sensitivity	Indicates how well the edges of the model and image characters must match for success. Higher settings allow rougher edges and causes more thorough and longer searching.
Edge Sensitivity	Indicates sensitivity to edge strength in the image during tool training. Higher settings detect more weaker edges but causes the tool to run slower.
Fixed Edge Threshold	The grey level threshold value used when Fixed Threshold is selected for Edge Sensitivity.
Angle Range	The maximum angle, in degrees, that the tool will search in the image for a match of the trained model. The parameters are minus, nominal, plus, include end, and include start.
Max Defect Size List	A list of the maximum defect size allowed for each character. Each defect size corresponds to a character in the verification string. If there are values in this list, it is used instead of the single Max Defect Size. If the list is too long, the extra values are ignored. If the list is too short, the last value in the list is used to evaluate the remaining characters.
Max Defect Size	The maximum defect size allowed for a single character. The defect size is the total boundary difference between the character to be verified and the trained model.
Min Match Score List	Each each score in this list corresponds to a character in the verification string. If there are values in this list, the list is used instead of the single Min Match Score. If the list is too long, the extra scores are ignored. If the list is too short, the last score in the list is used to evaluate the remaining characters.
Min Match Score	The closeness of the match is assigned a score from 0 to 100. If the match score exceeds this Min Match Score value, and all defect sizes are less than or equal to the maximum defect size, the tool passes.
Train Mode	See “Character Contour Match Train Modes” on page 3-204.
Enable Found Models	If True, the matching polygonal models are displayed in the image window. The model display speed is faster when this is False.
Verification Library	The set of bitmaps and contours that define the characters that have been trained

Output Name	What it is
Success	If True, all the characters in the Verification String were verified with Defect Sizes less than the Max Defect Size
Defect Sizes	A list of the total size difference between each character that was verified and its best matched trained model. For example, if "TEST" is the verification string, then the match error for the second letter is the difference between the second letter in the string and the best matched “E” in the Verification Library.

Output Name	What it is
Character Bounds List	This list of rectangles was replaced by a list of rectangles which give the character bounds. This "Character Bounds List" allows the user to easily determine the width and height of verified characters.A list of the positions of rectangles around verified characters within the Train Character Rectangles. Trained boxes where they are found on the verification image.
Character Success	A list indicating the verification success for each character in the Verification List
Found Models	A list of the character model shapes found during verification.
Trained Models	A list of the character model shapes found during training. This list is emptied when the tool runs.

How to Set Up the Character Contour Match tool

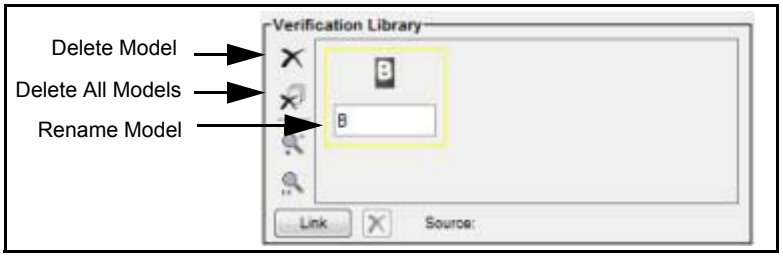
General

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

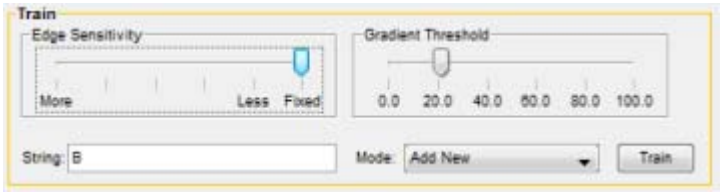
1. Move and size the ROI so it fits closely around the character you want to inspect. Only the character to be trained should be inside the ROI. Try to avoid including parts of the background. To train more than one character at a time, add additional ROIs.

- **Verification Library**
  The Verification Library displays all the characters that the tool has been trained to recognize. To rename a character, select it and type a new name. To delete a character, select it and click the Delete Model icon. To delete all characters, click the Delete All Models icon.
  Link: Click the Link button to link a Verification Library from another tool.



- **Train**
  Edge Sensitivity: This indicates sensitivity to edge strength in the image during tool training. Higher settings detect more weaker edges but causes the tool to run slower.
  Gradient Threshold: When the Edge Sensitivity is set to Fixed, this setting determines the edge transition level necessary for detection. A higher value detects more weaker edges but causes the tool to run slower.
  String: Type the characters to be trained in this field.
  Mode: See “Character Contour Match Train Modes” on page 3-204.

Train: Click the Train button to train characters.

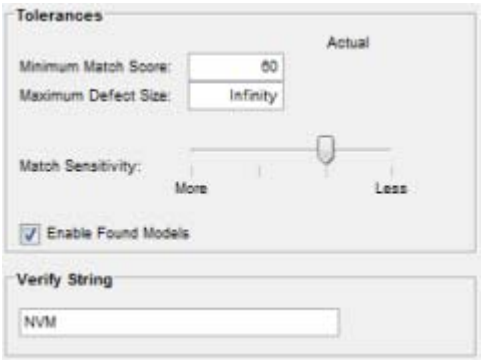


Pass/Fail

1. Click the Pass/Fail button to define the values and tolerances for found characters.
   When the tool runs it reads the characters within the ROIs. If any character can not be read or does not match the Verify String (if there is one), then the tool fails. Adjust the Tolerances if there are too many mismatches or unreadable characters. You can also add unreadable characters to the Verification Library, if necessary.

- **Tolerances**
  Minimum Match Score: The closeness of the match is assigned a score from 0 to 100. If the match score exceeds this Minimum Match Score value, and all defect sizes are less than or equal to the maximum defect size, the tool passes.
  Maximum Defect Size: This is the maximum defect size allowed for a single character. The defect size is the total boundary difference between the character to be verified and the trained model.
  Match Sensitivity: This setting indicates how well the edges of the model and image characters must match for success. The Less setting allows rougher character edges and causes more thorough and longer searching.
  Enable Found Models: If the box is checked, the matching polygonal models for are displayed in the image window. The model display speed is faster when this is unchecked.

- **Verify String**
  This is the string of characters to be verified. The characters found in the image are compared to the model characters in this same order.
  If any character does not match the Verify String, then the tool fails. The Verify String can also be used as a Train string. If a part fails during verification, you train the tool on that image and it will use the Verify String for inspections.



Display

See “Display panel” on page 3-23.

Character Contour Match Train Modes

These train modes update the Verification Library with characters found in the input string, based on the mode selected.

- **Add New**

This mode appends trained characters to the Verification Library if they are not already recognized.

- **Add New and Replace**
  This mode performs the Add New action and removes characters from the existing Library which model the same letter, but are not recognized as such in the trained image.
- **Delete Library and Add**
  This mode removes all characters from the current Verification Library and trains the new string as the Library.

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. See “How to Set Up the Code Reader tool” on page 3-217. Also see “How the Code Reader Tool Works” on page 6-72.

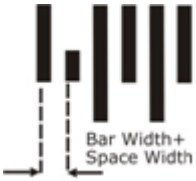
NOTE: Maximum image size is 32768 pixels wide and 8192 pixels high.

The following table defines the Code Reader tool’s inputs and outputs.

Input Name	What it is
Input Image	The image to be inspected. NOTE: Maximum image size is 32768 pixels wide and 8192 pixels high.
Tool Origin	The tool’s origin relative to the entire image space
Region of Interest	This is both the train and search ROI. Position the ROI over the desired part of the image to train and/or search. You can train on one area of an image, then search a different area.
Train Mode	After training, the tool sets the input property of the code types it finds to True. The tool then looks for those code types when it runs. You can also define the code types manually by setting the desired code type’s input property to True. If the input property for a code is True, that code is considered defined. **Add**: When the tool is trained, any new code types trained are added to the list of trained codes (set to True). Any existing code types stay in the list, even if they are not trained in the image again. **Replace**: When the tool is trained, any new code types trained in the image are added to the list of trained codes (set to True) and any existing code types that are not trained are removed from the list (set to False).
Train Type	These are the types of codes the tool will try to find during Training.
Number of Codes to Train	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. Use the smallest number that will train all the desired codes. A maximum of 150 codes (30 on smart cameras) can be read in one image.
Tool Timeout (msec)	The maximum length of time (in milliseconds) that the tool runs before it aborts.

Input Name	What it is
Train Timeout (msec)	The maximum length of time (in milliseconds) that the tool tries to train a code before it aborts.
Delimiter	If multiple codes are read, this character is inserted between the decoded strings in the output labeled Output String.
Code Type Enum	This property has no affect on the tool. It is available so it can be linked to other tools or to a Control Panel.
Image Analysis Subsampling	The number of times to subsample the image during analysis.
Processing Mode	When you Train the tool, the Processing Mode for the best results is automatically selected. Some input properties are only effective when Advanced mode is selected. These properties are labeled “Processing Mode Advanced” (PMA) in this table. See “Code Configuration Processing Modes” on page 6-73. **Standard**: Normally used for most applications. The magnification may be highly variable and the position and orientation of the symbol can be generally unpredictable. **Advanced**: Can be used to increase the decode rate on very small or difficult codes or when the symbol is presented at a fixed magnification and has known properties such as resolution, number of modules, orientation, minimum code height, etc.
Image Mirroring	If True, the tool assumes the external 90 Degree camera mirror accessory is being used.
Reverse Image Polarity	If True, the tool has trained on or will read a code that is printed with white characters on a black background (reverse polarity).
Identical Codes Decoding	If True, identical codes (within the same image) are decoded when the tool runs. A code is considered identical if it has the exact same length, code type, and data string as one already decoded. If you set the 1D Advanced Box Improvement to False, you should also set this property to False to prevent the tool from reading the same code instance multiple times.
Codabar	If True, the tool looks for this code type when it runs.
Code 39	If True, the tool looks for this code type when it runs.
Code 39 Full ASCII	If True, the tool looks for this code type and Code 39 when it runs. This property is not set by Training. It must be set manually.
Code 32	If True, the tool looks for this code type when it runs. (This code type is also included if Code 39 or Code 39 Full ASCII is enabled.)
Code 93	If True, the tool looks for this code type when it runs.
Code 128	If True, the tool looks for this code type when it runs.
GS1 128	If True, the tool looks for this code type when it runs.
GS1 Databar	If True, the tool looks for this code type when it runs.

Input Name	What it is
GS1 Databar Stacked	If True, the tool looks for this code type when it runs.
GS1 Databar Limited	If True, the tool looks for this code type when it runs.
GS1 Databar Expanded	If True, the tool looks for this code type when it runs.
GS1 Databar Expanded Stacked	If True, the tool looks for this code type when it runs.
Interleaved 2 or 5	If True, the tool looks for this code type when it runs.
Standard 2 of 5	If True, the tool looks for this code type when it runs.
MSI	If True, the tool looks for this code type when it runs.
Matrix 2 of 5	If True, the tool looks for this code type when it runs.
EAN/UPC	If True, the tool looks for this code type when it runs.
EAN/UPC Add On 2/5	If True, the tool looks for the 2 and 5 supplemental digits added to the right of the EAN/UPC code when it runs.
Pharmacode (one-track)	If True, the tool looks for this code type when it runs.
PDF417	If True, the tool looks for this code type when it runs.
MicroPDF	If True, the tool looks for this code type when it runs.
Composite Codes	If True, the tool looks for this code type when it runs. See “Composite Codes” on page 3-221
Datamatrix ECC 200, GS1 Datamatrix ECC 200	If True, the tool looks for this code type when it runs.
QR Codes	If True, the tool looks for this code type when it runs.
Micro QR	If True, the tool looks for this code type when it runs.
Aztec	If True, the tool looks for this code type when it runs.
Maxicode	If True, the tool looks for this code type when it runs.
Postal Codes	If True, the tool looks for Postal codes when it runs.
Postal Customer Field Decoding	Select the type of Australia Post Customer Field Decoding from the list of recognized standards. This input is not set during Training; it must be selected on the Properties tab.
Postal Minimum Bar Count (PMA)	If the Postal Code contains fewer than this number of bars, the tool fails.
Postal Maximum Bar Count (PMA)	If the Postal Code contains more than this number of bars, the tool fails.

Input Name	What it is
Postal Bar Edge Spacing (PMA)	 The sum of the Bar Width + Space Width in pixels.
Postal Code Orientation (PMA)	The code's orientation. **Any**: the code can be in any orientation (this setting takes longer to run) **Horizontal & Vertical**: the code is aligned to either the x or y axis (+/- 20°) **Horizontal Only**: the code is aligned to the x axis (+/- 20°) **Vertical Only**: the code is aligned to the y axis (+/- 20°)
Code Quality Verification (PMA)	To enable verification grading, this input must be set to True before Training. ISO/EIC and AIM DPM code quality grades are generated for each found code, where applicable. The grades appear on their respective outputs and on the Setup Grades panel. See "Code Quality Grades" on page 6-78.
2D Code Quality Verification Type	See "Code Quality Grades" on page 6-78
Enable 2D Code Decode Quality Evaluation	If True, this quality type evaluation is enabled.
Enable 2D Code Contrast Quality Evaluation	If True, this quality type evaluation is enabled.
Enable 2D Code UEC Quality Evaluation	If True, this quality type evaluation is enabled.
Enable 2D Code ANU Quality Evaluation	If True, this quality type evaluation is enabled.
Enable 2D Code FDP Quality Evaluation	If True, this quality type evaluation is enabled.
Enable 2D Code GNU Quality Evaluation	If True, this quality type evaluation is enabled.
Enable 2D Code MOD Quality Evaluation	If True, this quality type evaluation is enabled.
Enable 2D Code MinRefl Quality Evaluation	If True, this quality type evaluation is enabled.If True, this quality type evaluation is enabled.

Input Name	What it is
1D Advanced Box Improvement	If True, the tool increases the precision of the decoding ROI around a 1D code when it runs. If this property is False, the tool can run faster, but you should also set the Identical Codes Decoding property to False to prevent the tool from reading the same code instance multiple times.
1D Expand UPC E0-E1 Symbols	If True, the UPC E0 and UPC E1 symbols are expanded in the result string according to the UPC specification
1D EAN/UPC Margin Size	This is the clear margin to require around the code, expressed as a percentage of the narrow linear code module. 200(%) corresponds to an acceptable Margin Size value of 2 modules.
1D Code Orientation (PMA)	The code's orientation. **Any**: the code can be in any orientation (this setting is used during Training) **Horizontal & Vertical**: the code is aligned to either the x or y axis (+/- 20°) **Horizontal Only**: the code is aligned to the x axis (+/- 20°) **Vertical Only**: the code is aligned to the y axis (+/- 20°)
1D Low Code Contrast (PMA)	If True, the tool provides better decoding for low contrast symbols. Low contrast may occur from printing or lighting problems, motion blur, oblique reader angles, etc.
1D Small Codes Improvement (PMA)	If True, the tool improves the reading of physically small dimension linear codes.
1D Minimum Code Height (pixels) (PMA)	If the 1D code is shorter in height than this number of pixels, the tool fails (includes PDF417).
1D Narrow Margins (PMA)	Enables the decoding of codes with substandard length margins (quiet zone). Applies to Code128, Ean128, Code39, Interleaved 2 of 5, MSI, Standard 2 o f5, Matrix 2 of 5, Codabar, and Code 93.
1D Start/Stop Characters TX (PMA)	If True, Start/Stop character transmission is enabled. Applies to Code128, EAN128, and Codabar.
1D Code 128 Characters TX (PMA)	If True, Function character transmission is enabled. Applies to Code128 and EAN128.
1D Check Digit Status (PMA)	If True, the check digit control is enabled to improve decoding safety. The check digit is generally the last digit aligned to the right of the code which verifies the validity of the preceding digits. The calculation technique and number of check digits depends on the code type. The check digit should be used whenever the code contains one. Applies to Code39, Interleaved 2 of 5, MSI, Standard 2 of 5, Matrix 2 of 5, and Codabar

Input Name	What it is
1D MSI Check Digit Status (PMA)	The Check Digit algorithm used depends on the code type. MSI_ChksumDisable: Disable the algorithm MSI_ChksumSingleMod10: Use the SingleMod10 algorithm MSI_ChksumMod11Mod10: Use the Mod 10 + Mod 11algorithm MSI_ChksumTwoMod10: Use the Two Mod 10 algorithm The check digit is generally the last digit aligned to the right of the code which verifies the validity of the preceding digits. The check digit should be used whenever the code contains one.
1D Check Digit Transmission (PMA)	If True, the Check Digit is included in the Output String property. Applies to Code39, MSI, Standard 2 of 5, Matrix 2 of 5, and Codabar.
1D I25 High Decoding Safety	If True, the tool uses a strict control for decoding this code type.
1D I25 Minimum number of characters (PMA)	If the code contains fewer than this number of characters, the tool fails. Applies to Interleaved 2 of 5.
1D Pharmacode Output format (PMA)	The output format for decoded Pharmacodes. The default setting of Binary is not changed during Training. To use the Encoded property it must be manually selected on the Properties tab. **Encoded**: Output is standard numeric format **Binary**: Output is binary format - wide bars correspond to digit 1 and narrow bars correspond to digit 0
1D Pharmacode Decoded Min Value	If the decoded Pharmacode's value is less than this, the tool fails. Valid only when 1D Pharmacode Output format is set to Encoded.
1D Pharmacode Decoded Max Value	If the decoded Pharmacode's value is greater than this, the tool fails. Used only when 1D Pharmacode Output format is set to Encoded.
1D Pharmacode Colored Check bars	If True, a Pharmacode's colored bars are checked.
1D Pharmacode MinBarCount (PMA)	If the Pharmacode contains fewer than this number of bars, the tool fails.
1D Pharmacode MaxBarCount (PMA)	If the Pharmacode contains more than this number of bars, the tool fails.
1D Pharmacode Code Orientation (PMA)	The code's expected orientation. **Horizontal**: the code is aligned to the x axis (+/- 45°) **Vertical**: the code is aligned to the y axis (+/- 45°)

Input Name	What it is
1D Pharmacode Reverse Decoding (PMA)	Indicates whether to read the code in the reverse direction. The default setting of False is not changed during Training. To use the Reverse property it must be manually selected on the Properties tab. **True** (Reverse): Code is read from right to left (Horizontal code) or from bottom to top (Vertical code) **False**: Code is read from left to right (Horizontal code) or from top to bottom (Vertical code)
2D Code Color	The code's foreground/background color combination. Training tries both colors, then sets this property appropriately.
2D Code Contrast	The contrast threshold to be used during the decoding process. Low contrast values for very low contrast symbols may increase the decoding time.
2D DPM Decoding Method	The decoding algorithm to use based on the symbol's printing/marking technique and on the overall printing/marking quality. **True**: Use this setting to improve the decode rate for low quality Direct Part Mark codes and in general for Direct Part Mark codes with dot peening type module shapes. The tool is more aggressive but in general this setting requires longer decoding times. **False**: Use this setting for printed codes or for good quality Direct Part Mark codes. NOTE: Applies only to Datamatrix code types. This property is set to False when the tool is trained.
2D Datamatrix, QR Module Size (pixels) (PMA)	This is the typical resolution of codes to be read (in pixels). Choose the smallest usable value, but the minimum recommended value is 4.
2D Code Aligned (PMA)	The code's orientation. **True**: decodes the code if its finder pattern is aligned to the x and y axes (+/- 20°) **False**: decodes the code regardless of its orientation Applies only to Datamatrix code types.
2D Code Size (PMA)	The number of code modules (rows x columns) to be read. When Processing Mode is set to Standard, and during Training, only the All and All Square values are read. With Processing Mode set to Advanced, all values are read.
2D Datamatrix Operating Mode	Very Fast, Fast, Robust, Very Robust: Choose the mix of speed and robustness the tool uses during the Datamatrix decoding process.
Max Number of Codes to Process	The code search is interrupted when this number of codes has been processed and the rest of the image is ignored. A maximum of 150 codes (30 on smart cameras) can be read in one image.
Pass Fail Wildcard	When this character is used in the Pass Fail Match Code List, it replaces one or more characters to be matched in the decoded string. If you use just the Wildcard (or no characters) in the Pass Fail Match Code, all decoded strings are matched. See "Wildcard and Placeholder Characters" on page 3-220.

Input Name	What it is
Pass Fail Place-holder	When this character is used in the Pass Fail Match Code List, it replaces one character to be matched in the decoded string.See “Wildcard and Placeholder Characters” on page 3-220.
Pass Fail Enable List	See “Using the Pass Fail Filters” on page 3-219.
Pass Fail Code Type List	See “Using the Pass Fail Filters” on page 3-219.
Pass Fail Match Code List	See “Using the Pass Fail Filters” on page 3-219.
Pass Fail Min String Length List	See “Using the Pass Fail Filters” on page 3-219.
Pass Fail Max String Length List	See “Using the Pass Fail Filters” on page 3-219.
Pass Fail Min Over-all Grade	See “Using the Pass Fail Filters” on page 3-219.
Pass Fail Min Num-ber of Codes List	See “Using the Pass Fail Filters” on page 3-219.
Pass Fail Max Number of Codes List	See “Using the Pass Fail Filters” on page 3-219.

Output Name	What it is
Passed	If True, the tool found at least one of the codes it was configured to find. Also, if any Pass Fail Filters are defined, all the found codes passed all their filters. See “Using the Pass Fail Filters” on page 3-219.
Output String	The decoded concatenated strings of all the found codes that passed their filters. Codes are separated by the string defined in the Delimiter input property.
Lowest Overall Grade	The lowest of all the overall code grades. See “Code Quality Grades” on page 6-78
First Code ROI	The ROI of the first found code that passed its filters. The ROI’s location is relative to the Tool Origin. Ideal for single code applications.
First Code ROI Ori-gin	The Origin of the first found code that passed its filters.The Origin’s loca-tion is relative to the Tool Origin. Ideal for single code applications.
First Code Type Found	The Type of the first defined found code that passed its filters. Ideal for single code applications.
First Code String Length	The length of the first defined found code that passed its filters. Ideal for single code applications.
First Code Modules Size (pixels)	The size of the modules in the first found code that passed its filters. Ideal for single code applications.

Output Name	What it is
First 2D Code Size	The size of the first found 2D code that passed its filters. Ideal for single code applications.
First Code Decoding Time (micro sec)	The time required to decode the first found code that passed its filters. Ideal for single code applications.
Code ROI List	A list of the ROIs of each of the found codes that passed their filters. The ROIs' locations are relative to the Tool Origin property.
Code ROI Origin List	A list of the Origins of each of the found codes that passed their filters. The Origins' locations are relative to the Tool Origin property.
Code Type Found List	A list of the Code Types of each of the found codes that passed their filters.
Output String List	A list of the decoded strings from all of the codes that passed their filters.
String Length List	A list of the decoded string lengths of each of the defined codes that passed their filters.
Modules Size (pixels) List	A list of the Modules Sizes of each of the defined codes that passed their filters.
2D Code Size List	A list of the Modules Sizes of each of the defined 2D codes found that passed their filters.
Decoding Time (micro sec) List	A list of the times required to decode each of the defined codes that passed their filters.
Overall Grade	ISO/IEC 15416: This is the average value of ten scan's overall grades, each calculated as the lowest grade achieved for the calculated grading parameters. To calculate the average values, grade A=4, B=3, C=2, D=1 and F=0. Overall Grade ISO/IEC 15415: This is the lowest grade achieved for the calculated grading parameters: A (best value), B, C, D or F (worst value). It is possible to exclude some ISO/IEC 15415 quality parameters from this calculation. AIM DPM: This is the lowest grade achieved for the calculated grading parameters: A (best value), B, C, D or F (worst value).
ISO/IEC 15416 Decode Grade	See "Code Quality Grades" on page 6-78.
ISO/IEC 15416 Symbol Contrast Grade	The difference between the highest and lowest reflectance values in a scan reflectance profile. See "Code Quality Grades" on page 6-78.
ISO/IEC 15416 Minimum Reflectance Grade	Rmin is the lowest reflectance value in the scan reflectance profile. Rmin shall not be higher than 0.5 x Rmax. This parameter is intended to ensure that Rmin shall not be too high, especially when the value of Rmax is high. The value returned is (Rmin/Rmax)*100 so this is consistent with Grade A until it is less than 50. See "Code Quality Grades" on page 6-78.

Output Name	What it is
ISO/IEC 15416 Minimum Edge Contrast Grade	The difference between the Rs (Space Reflectance) and Rb (Bar Reflectance) of adjoining elements including quiet zones. The lowest value of edge contrast found in the scan reflectance profile is the minimum edge contrast, ECmin. See “Code Quality Grades” on page 6-78.
ISO/IEC 15416 Modulation Grade	The ratio of the minimum edge contrast to Symbol Contrast. It can be considered as the quality of the Analog signal related to the printing contrast. See “Code Quality Grades” on page 6-78.
ISO/IEC 15416 Defects Grade	Defects are irregularities found within elements and quiet zones, and are measured in terms of element reflectance non-uniformity. Element reflectance non-uniformity within an individual element or quiet zone is the difference between the reflectance of the highest peak and the reflectance of the lowest valley. Defect measurement is expressed as the ratio of the maximum element Reflectance Non-Uniformity (ERNmax) to Symbol Contrast. See “Code Quality Grades” on page 6-78.
ISO/IEC 15416 Decodability Grade	The decodability of a barcode symbol is a measure of the accuracy of its production in relation to the appropriate reference decode algorithm. See “Code Quality Grades” on page 6-78.
ISO/IEC 15416 Decode Grade Value	This value is used to grade the Decode quality parameter as stated in the ISO/IEC 15416 standard.
ISO/IEC 15416 Contrast Grade Value	This value is used to grade the Symbol Contrast quality parameter as stated in the ISO/IEC 15416 standard.
ISO/IEC 15416 Minimum Reflectance Grade Value	This value is used to grade the Minimum Reflectance quality parameter as stated in the ISO/IEC 15416 standard.
ISO/IEC 15416 Minimum Edge Contrast Grade Value	This value is used to grade the Minimum Edge Contrast quality parameter as stated in the ISO/IEC 15416 standard.
ISO/IEC 15416 Modulation Grade Value	This value is used to grade the Modulation quality parameter as stated in the ISO/IEC 15416 standard.
ISO/IEC 15416 Defects Grade Value	This value is used to grade the Defects quality parameter as stated in the ISO/IEC 15416 standard.
ISO/IEC 15416 Decodability Grade Value	This value is used to grade the Decodability quality parameter as stated in the ISO/IEC 15416 standard.
AIM DPM Decode Grade	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 code type reference decode algorithm, then it receives the failing grade zero. Otherwise, it receives the grade four. See “Code Quality Grades” on page 6-78.

Output Name	What it is
AIM DPM Cell Contrast Grade	Grades the difference between the means of brightest and darkest values of the symbol (instead of determining differences between the brightest and darkest values). See “Code Quality Grades” on page 6-78.
AIM DPM Unused Error Correction 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. See “Code Quality Grades” on page 6-78.
AIM DPM Axial Non Uniformity Grade	Grades the squareness of all modules in the direction of each of the symbol's major axes (X-axis and Y-axis) by applying the decode algorithm to the binarized image. See “Code Quality Grades” on page 6-78.
AIM DPM Fixed Pattern Damage Grade	Similar to Cell Modulation, but it grades the finder pattern and clock pattern, as well as the quiet zone around the code, instead of the data region. See “Code Quality Grades” on page 6-78.
AIM DPM GRID Non Uniformity Grade	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. See “Code Quality Grades” on page 6-78.
AIM DPM Cell Modulation Grade	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. See “Code Quality Grades” on page 6-78.
AIM DPM Min Reflectance Grade	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. See “Code Quality Grades” on page 6-78.
ISO/IEC 15415 Decode Grade	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 code type reference decode algorithm, then it receives the failing grade zero. Otherwise, it receives the grade four. See “Code Quality Grades” on page 6-78.
ISO/IEC 15415 Contrast Grade	Grades the difference between the means of brightest and darkest values of the symbol (instead of determining differences between the brightest and darkest values). See “Code Quality Grades” on page 6-78.
ISO/IEC 15415 Unused Error Correction 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. See “Code Quality Grades” on page 6-78.
ISO/IEC 15415 Axial Non Uniformity Grade	Grades the squareness of all modules in the direction of each of the symbol's major axes (X-axis and Y-axis) by applying the decode algorithm to the binarized image. See “Code Quality Grades” on page 6-78

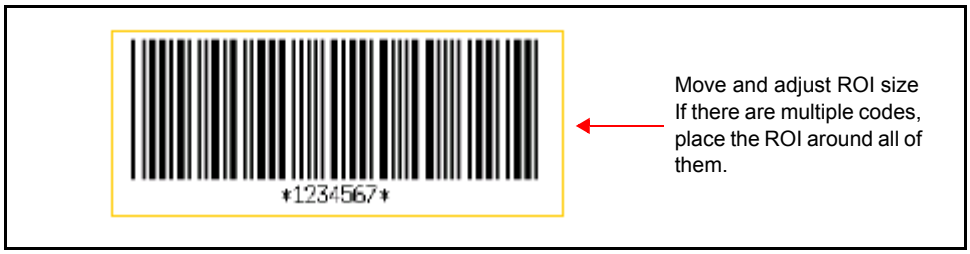
Output Name	What it is
ISO/IEC 15415 Fixed Pattern Damage Grade	Similar to Modulation, but it grades the finder pattern and clock pattern, as well as the quiet zone around the code, instead of the data region. See “Code Quality Grades” on page 6-78.
ISO/IEC 15415 GRID Non Uniformity Grade	Grades the 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. See “Code Quality Grades” on page 6-78.
ISO/IEC 15415 Modulation Grade	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. See “Code Quality Grades” on page 6-78.
Overall Grade Value	This value is used to grade the Overall parameter for both the ISO/IEC 15415 and ISO/IEC 15416 standards.
ISO/IEC 15415 Decode Grade Value	This value is used to grade the Decode quality parameter as stated in the ISO/IEC 15415 standard.
ISO/IEC 15415 Contrast Grade Value	This value is used to grade the Contrast quality parameter as stated in the ISO/IEC 15415 standard.
ISO/IEC 15415 Unused Error Correction Grade Value	This value is used to grade the Unused Error Correction quality parameter as stated in the ISO/IEC 15415 standard.
ISO/IEC 15415 Axial Non Uniformity Grade Value	This value is used to grade the Axial Non Uniformity quality parameter as stated in the ISO/IEC 15415 standard.
ISO/IEC 15415 Fixed Pattern Damage Grade Value	This value is used to grade the Fixed Pattern Damage quality parameter as stated in the ISO/IEC 15415 standard.
ISO/IEC 15415 GRID Non Uniformity Grade Value	This value is used to grade the GRID Non Uniformity quality parameter as stated in the ISO/IEC 15415 standard.
ISO/IEC 15415 Modulation Grade Value	This value is used to grade the Modulation quality parameter as stated in the ISO/IEC 15415 standard.
VL VERSION	The VL Decoding library version for product support use.
Pass Fail Number of Found Codes List	A list of the Actual number of codes found and passed based on the Pass Fail group of Input Property settings. See “Using the Pass Fail Filters” on page 3-219. A maximum of 150 codes (30 on smart cameras) can be read in one image.
Code ROI Corners	A list of the point locations of the Code ROI corners. The points are listed in order beginning with the first found Code.

Output Name	What it is
Unicode Output String	If the found code contains any text with ISO-8859-1 encoding, this string provides it in UTF-8 format.
Unicode Output String List	A list of found ISO-8859-1 encoded text in UTF-8 format.

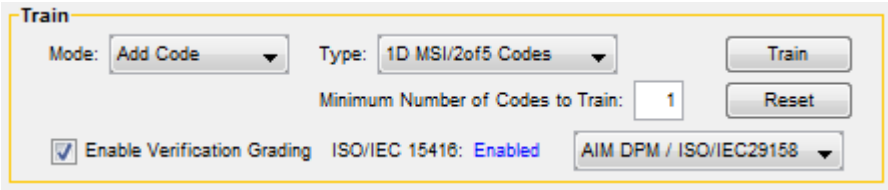
How to Set Up the Code Reader tool

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, then click the Setup tab.
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 3-19.

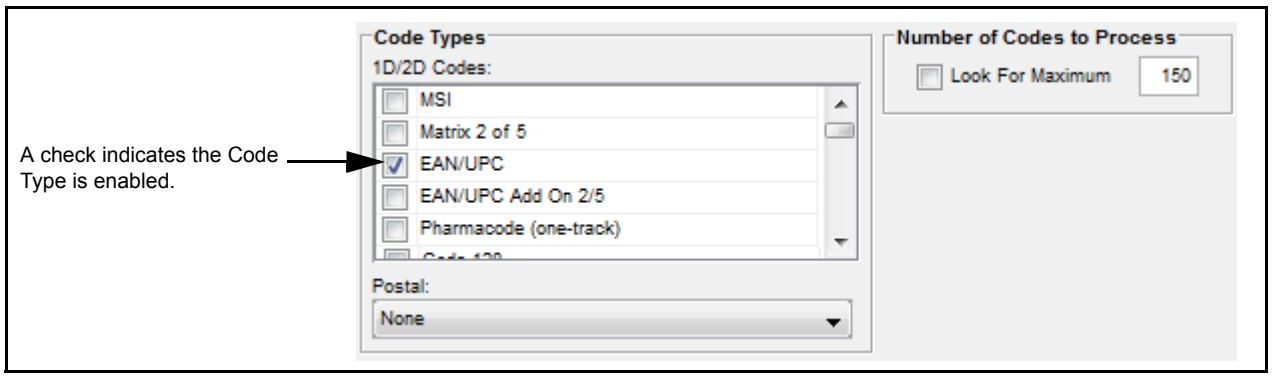


3. Select the Train Mode.
   Add Code: When the tool is trained, any new code types trained are added to the list of trained codes. Any existing code types stay in the list, even if they are not trained in the image again. (Also see “Training Codes from Multiple Images” on page 3-220.)
   Replace Code: 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.

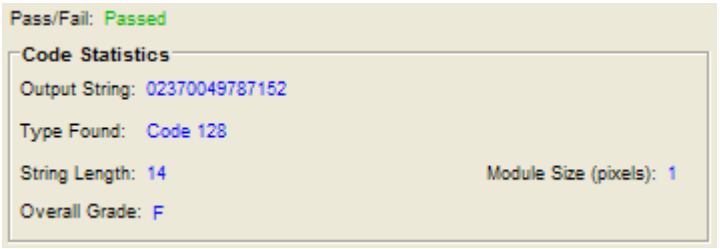


4. Select the Train Type. When the tool is trained, it enables codes of this type that it finds in the image. When the tool runs it looks for and inspects enabled codes. For more details about code types, see “How the Code Reader Tool Works” on page 6-72.
5. Enter the Minimum Number of Codes to Train. This is the minimum number of code configurations the tool uses during training. A configuration includes at least the following parameters: Minimum Number of Codes to Train, Type, whether Verification Grading is enabled, the Mode selected, and the Processing Mode selected.
6. If you want the tool to generate code quality grades for each code found, check the Enable Verification Grading box. The codes are displayed on the Grades panel. ISO/IEC 15416 standards are used to evaluate 1D code quality. 2D code quality is evaluated using the standards selected in the drop down. See “Code Quality Grades” on page 6-78.
7. 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 box is checked, after training the value is replaced by the number of codes found. If the box is not checked, the value is unchanged. A maximum of 150 codes (30 on smart cameras) can be read in one image.

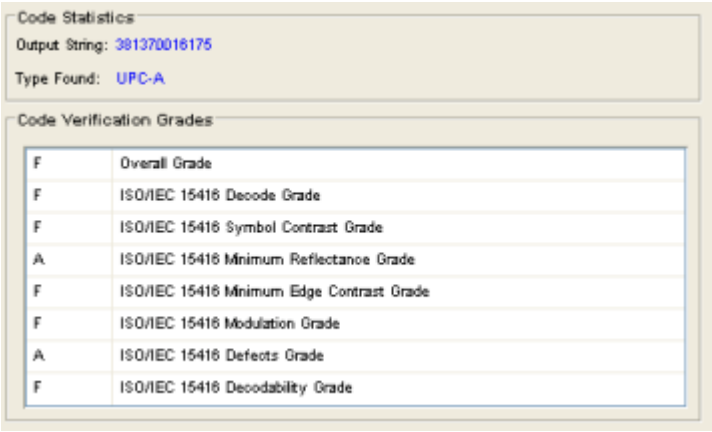
8. Click the Train button. Depending on the configuration and the number of codes in the image, training may take several seconds. When it is complete, an ROI is drawn around each found code, and those codes are enabled in the Code Type window.



9. 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 resets all the train configurations to the default selections.
10. 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.



11. 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.
    For more details see "Using the Pass Fail Filters" on page 3-219.
12. Click the Grades button to view code quality grades that were generated for each found code. (You must have selected the Enable Verification Grading check box in step 5.)

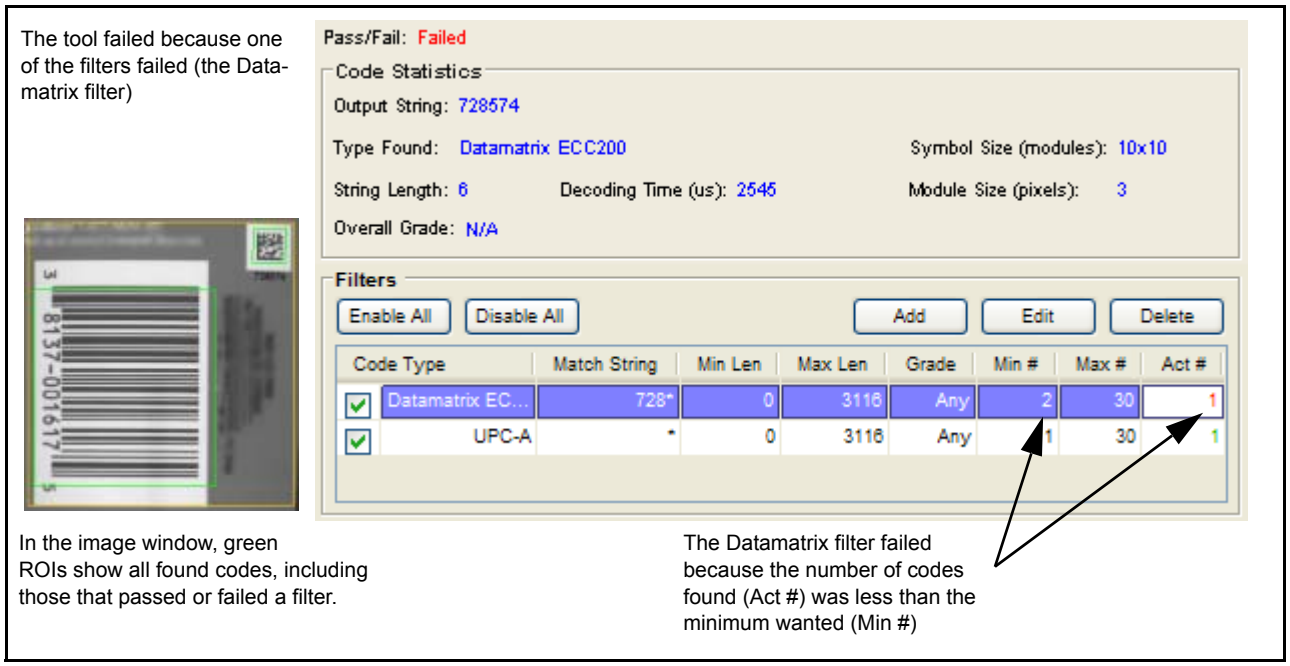


Display

See "Display panel" on page 3-23.

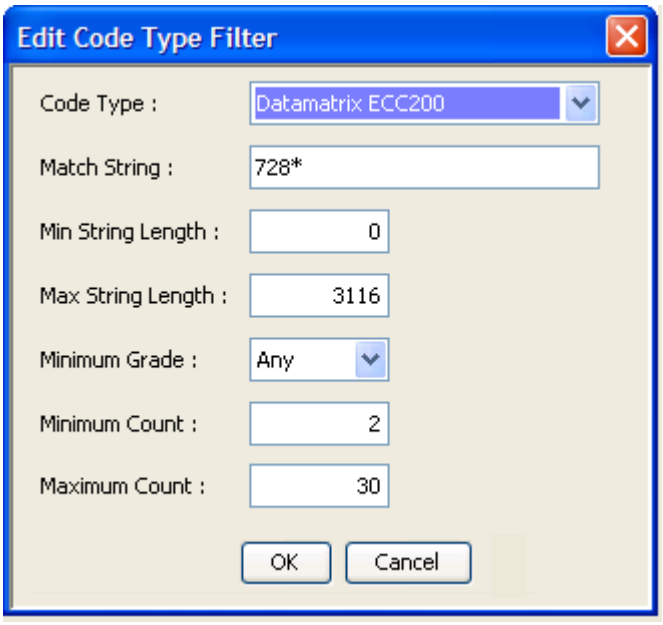
Using the Pass Fail Filters

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.



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. A maximum of 150 codes (30 on smart cameras) can be read in one image.

Act #: This is the actual number of codes of the Code Type in the image. A maximum of 150 codes (30 on smart cameras) can be read in one 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.

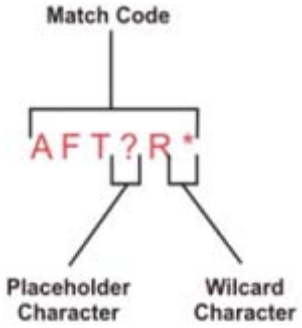
1. Snap a good image of the desired code or codes you want to train, then click the Setup tab.
2. Click the ROI button. Position the ROI over the code or codes. Be sure that the ROI completely encloses the desired codes.
3. Select the Train Mode Add.
4. Select the Code Type.
5. If you want to generate quality grades for any of the codes you are reading, you must leave the Enable Verification Grading box checked.
6. Enter the Minimum Number of Codes to Train.
7. Click the Train button.
8. 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 Composite Code input property is True, 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 Composite Code input property is False, 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 output "Code Type Found" is set according to the following table:

Input: Composite Code Type	Output: 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.

See “How to Set Up the OCR tool” on page 3-225.

This table lists the buttons seen on the Properties tab. The next tables list inputs and outputs.

Button Name	What it does
Run	Runs the tool.
Train	Trains the segmented characters to create the Font Data.
Load Font Library	Loads the .ocr file indicated by the path and name in the Library property.
Save Font Library	Saves the Font Data file to the path and name in the Library property (.ocr extension).
Select Golden Char	(Font Data tab) Marks the selected character as a Golden Character.
Delete All	(Font Data tab) Deletes all characters from Font Data.
Rename	(Font Data tab) Renames the selected character.
Delete	(Font Data tab) Deletes the selected character.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space.
Region of Interest	The area of the image that contains the characters. May contain multiple rows of characters if the Enable Multiple Rows property is True.
Number of Characters to Read	The tool will stop after reading this number of characters, reading from the upper left corner of the ROI to the right, top to bottom.
Use Trained Font Info	If True, the characters’ Min/Max Character Width and Min/Max Character Height are calculated using values from the previously trained font.
Enable Multiple Rows	When checked, the tool will read up to 50 rows of characters in the image.
Row Space	The minimum space between two rows when the Enable Multiple Rows box is checked.
Exclude Characters Touching the ROI	If True, characters that touch the ROI are excluded from the Output String.
Threshold Type	See “Threshold Types” on page 3-230.
Find Spaces	Indicates whether the tool should look for blank spaces between the characters. None: Do not look for spaces Single Space: Multiple contiguous spaces are replaced with a single space Multiple Spaces: All contiguous spaces are found

Input Name	What it is
Fixed Threshold Range	See “Threshold Types” on page 3-230.
Noise Level	The amount of background noise present in the image. Higher noise means the character edges must be farther apart. Lower noise allows character edges that are closer together.
Min/Max Character Width	The minimum and maximum allowable width of each character.
Min/Max Character Height	The minimum and maximum allowable height of each character. Characters should be a minimum of twenty-eight pixels high for best results.
Maximum Horizontal Spacing Within Characters	The maximum horizontal space between two points inside a character such that both are considered to be within a single character.
Maximum Vertical Spacing Within Characters	The maximum vertical space between two points inside a character such that both are considered to be within a single character.
Minimum Spacing Between Characters	The minimum horizontal empty space from the right edge of one segmented character to the left edge of the next. (This property forces a certain amount of space between characters.)
Enable Variable Max Character Width	If True, the Max value of the Min/Max Character Width property is allowed to vary to a lower value when it is used to split merged characters. Enable this setting if characters in the image are very close together, but mostly all the same width, with some small variations due to the printing process. Enter the value of the maximum width of any character in the image into the Max Character Width value. The tool will sense characters narrower than that value and separate them accordingly. If False, the Max value is fixed to the Min/Max Character Width value entered.
Maximum Percent Size Change	The maximum percentage size variation allowed between the read character and the trained one.
Minimum Match Score	If the Match Score is equal to or greater than this value, the character will pass. The Match Score is the correlation value between the character that was read and the most similar character within the trained Font Data. This score is calculated only if the Acceptance Score passes. To display the Actual Match Score, select a character.
Acceptance	The tool examines each character and assigns an Acceptance Score indicating how well the character matches any character in the trained Font Data. If that character's Acceptance Score is equal to or greater than this value, the tool then examines the character to create a Match Score.

Input Name	What it is
Substitution Character	This character is used as a generic place holder, both in the reading and training phases. During reading, all characters that are segmented but not classified are displayed as the substitution character in the output result string. During training, the substitution character causes the tool to skip the indicated segmented position.
Multiple Rows Separator Character	If Enable Multiple Rows is True, this character is placed between the strings from each row.
Train String	The string used for training and segmenting text. (There is a positional relation between the segmented portions of the ROI and the Train String, from left to right). It is possible to train only one row at a time.
Verify String	If this string is present, the tool compares this string to the input string. If all characters in the input string match this string, in order, the Successful Read property is set to True.
Train Mode	Add: The new Train String characters found in the segmented text are added to the Font Data. Delete Library and Add: All characters in the Font Data are removed and the new Train String characters found in the segmented text are added to the Font Data.
Selected Line	The row on which to perform training. The Enable Multiple Rows property must be set to True.
Font Data	The trained font (the collection of trained characters). Linkable only.
Library Name	The path and name of the file (do not include the extension) to be loaded or the destination file in which the Font Data is to be saved. If the path is omitted, the file is saved in the Vision Device\FontLib folder. (see “Folder List” on page 2-40). Click the Load Font Library or Save Font Library buttons to load or save the file.
Minimum Pixels Area	The minimum pixel area of a character.
Maximum Pixels Area	The maximum pixel area of a character.
Enable Split	If True, the tool will segment all the characters using the Min/Max Character Width and Height property value as reference points for automatically finding the beginning and the end of a character.
Discard Undersized	If True, the segmentation phase will discard all the segmented elements with a size smaller than the Min Character Width and Height property values.
Discard Oversized	If True, the segmentation phase will discard all the segmented elements with a size larger than the Max Character Width and Height property values.
Number of Blocks	The number of blocks (ROI divisions) the tool should use when the Threshold Type property is set to Block Adaptive.

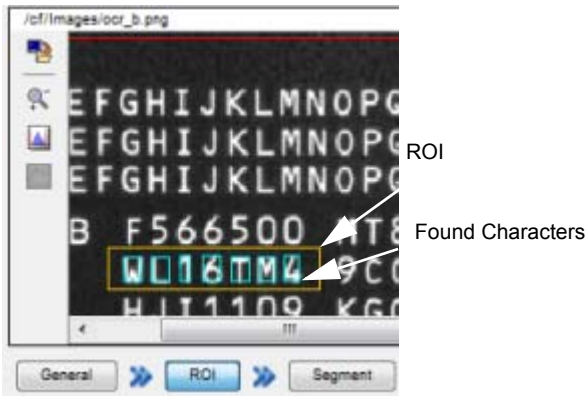
Input Name	What it is
Enable Golden Char	If True, the Golden Character option is enabled. If more than one of the same character is in Font Data, one of them is designated as a Golden Character. The reading score of non-Golden characters is based on the value of correlation with the Golden Character that has the same label, not on the correlation value with the most similar character.
Enable Auto Deslant	If True, the tool will automatically correct the slant frequently seen in printed dot matrix characters when they are trained and read.
Slant Value	If Enable Auto Deslant is False, and this value is greater than zero, it is used to correct slanted characters.
Font Selected Index	The selected character's position in the Font Data.
Select Golden Char	Mark the selected character as Golden.
Delete Font	The number of the font to delete.
Font Rename String	The new name to be assigned to the selected character.

Output Name	What it is
Output String List	A list of all the characters read. Each list element is a row of characters.
Output String	The string of read characters that had at least the match score. Unreadable characters are replaced with the substitution string. Rows are separated by spaces.
Character Boxes	A list of the bounding boxes around individual characters that had at least the match score. Boxes are aligned with the Origin.
Shape List	A list of the bounding boxes around individual characters that had at least the match score. Boxes are aligned with the characters.
Character Success List	A list of each character's match success or failure.
Match Scores	A list of each character's match score.
Number of Rows	The number of rows of character's read.
Successful Read	True if all the characters in the input string are present in the font library. If the Verify String is present, the input string must match it.

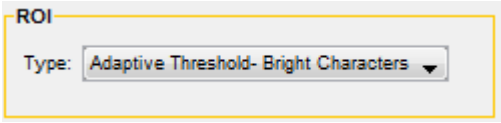
How to Set Up the OCR tool

1. Snap a good image of the desired characters then click the Setup tab.
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 3-230. Generally, the default Adaptive Threshold choice is the most appropriate.



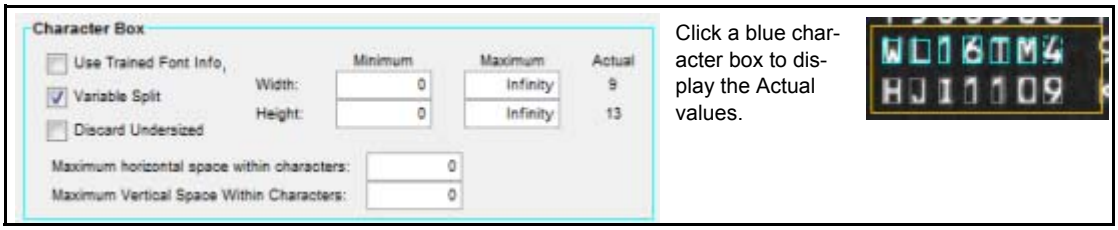
4. Click the Segment button. Use the Train, Options, and Character boxes to set up and train the character string.

- **String**
  Enter the string of characters within the ROI that you want to inspect.
- **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 3-229.
- **Mode**
  Add
  This mode adds any characters that are not recognized in the ROI to Font Data (new or different). 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 3-229.
- **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.
- **Find Space:** Indicates whether the tool should look for blank spaces between the characters.
  None: Ignores spaces.
  Single Space: Single or multiple contiguous spaces are found as a single space.

Multiple Spaces: Multiple contiguous spaces are found as multiple spaces.



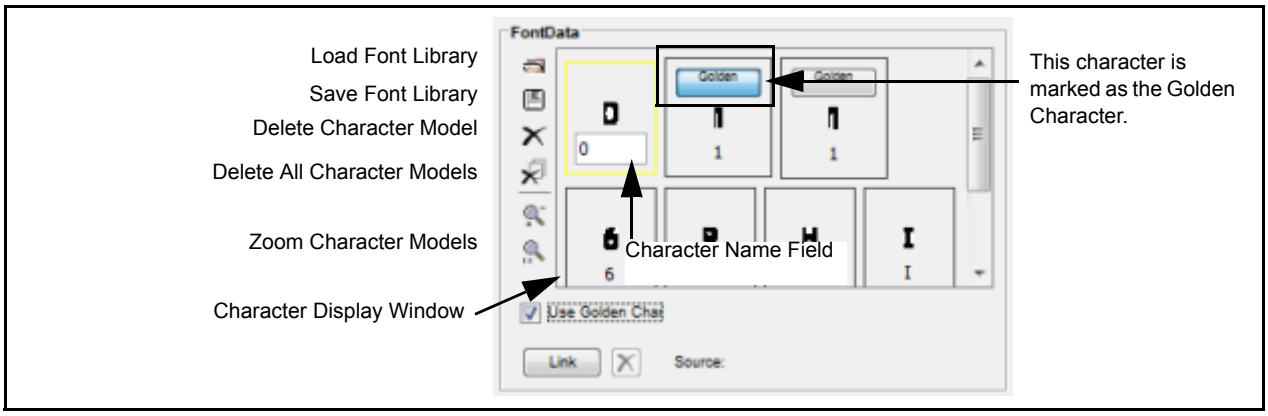
- **Use Trained Font Info**
  If you check this, the tool uses values from the previously trained font data to calculate the Min/Max Character Width and Min/Max Character Height.
- **Variable Split**
  If you check this, the tool segments all the characters using the Min/Max Character Width and Height property values as reference points for automatically finding the beginning and the end of a character.
- **Discard Undersized**
  If you check this, the tool discards all the segmented elements with a size smaller than the Min Character Width and Height property values.
- **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.
- **Height: Minimum, Maximum, Actual**
  Enter the range of acceptable character heights. Characters should be a minimum of twenty-eight units high for best results. 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.



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.

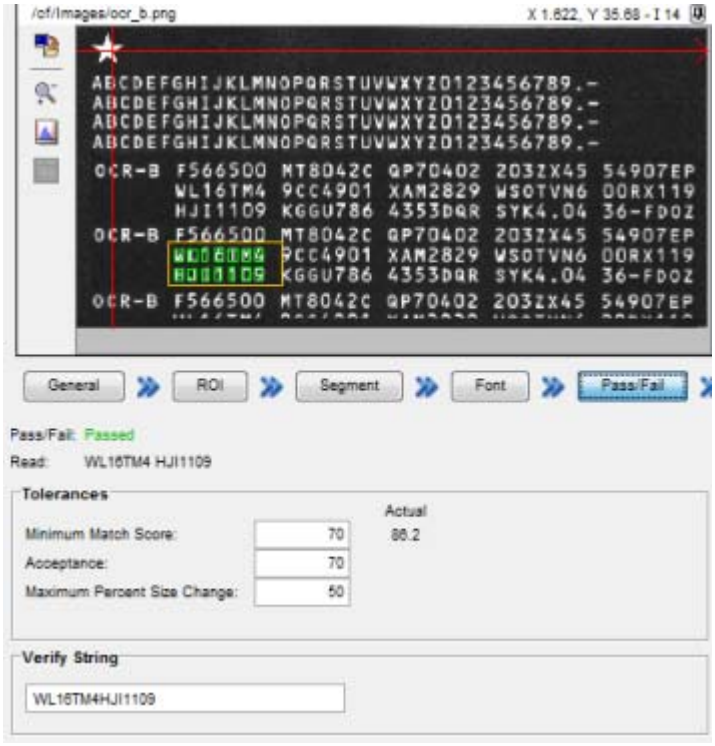
- **Delete All Character Models**
  Click this button to delete all the characters in Font Data.
- **Zoom Character Models**
  Click one of the zoom buttons to increase or decrease the character size in the display window.
- **Character Display Window**
  The trained characters in Font Data are displayed 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.
- **Link**
  Click the Link button to link Font Data from another tool.



6. 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**
  If the Match Score is equal to or greater than this value, the character will pass. The Match Score is the correlation value between the character that was read and the most similar character within the trained Font Data. This score is calculated only if the Acceptance Score passes. To display the Actual Match Score, select a character.
- **Acceptance**
  The tool examines each character and assigns an Acceptance Score indicating how well the character matches any character in the trained Font Data. If that character's Acceptance Score is equal to or greater than this value, the tool then examines the character to create a Match Score.
- **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 3-23.

How to train multiple rows

1. Arrange the ROI so it encloses the entire first row you want to train, then select the appropriate ROI type.
2. Click the Segment button and type the characters within the ROI into the String field.
3. 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 you click Run, the tool will read 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.

Font Data Tab

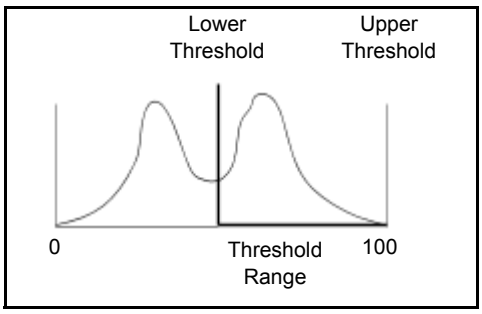


The Font Data tab displays all the characters that the OCR tool has been trained to recognize. Select a character to type a new name for a character, click the Delete button to delete a character, or click the Delete All button to delete all the characters.

Threshold Types

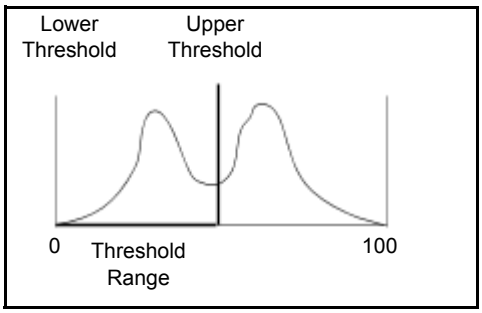
Adaptive Threshold - Bright Characters

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. 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"VPM Task Configuration" on page 3-34).

The state of the inputs (On or Off) can be interpreted as an integer value or as a Binary Coded Decimal (BCD) value. When Interpret as BCD is True, and the four inputs produce an illegal BCD value, the output values associated with the Inputs are still set, but Current State is not updated and BCD Output Valid is set to false.

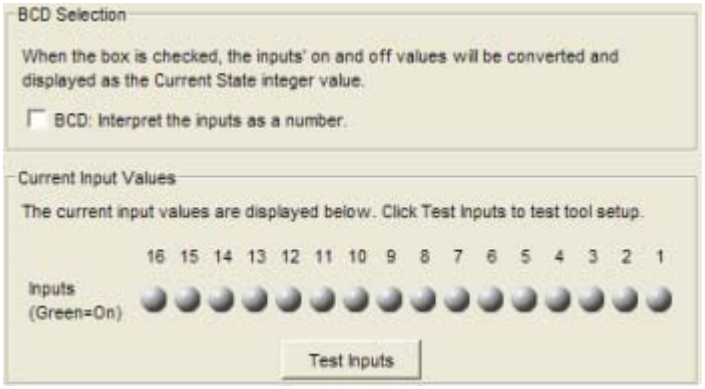
See "How to Set Up the Discrete Input tool" on page 3-231.

Input Name	What it is
Interpret as BCD	If True, the input values are read as Binary Coded Decimal (BCD)

Output Name	What it is
Current State	The binary value of all inputs (displayed as integer)
BCD Output Valid	If True, Interpret as BCD is True and the Input values produced a valid BCD value
Input 1 to maximum	The state of the respective input (The number of inputs is determined by the camera or processor type.)

How to Set Up the Discrete Input tool

1. Click the Setup tab, then click the Setup & Test button.



BCD Selection

You only need to check this box if you want the inputs' on and off values to be converted to a Binary Coded Decimal number. The converted value is displayed on the Properties tab Current State property as an integer value.

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 a voltage is present on the corresponding input. All Emulator inputs always indicate off. The number of inputs is determined by the camera type. Refer to the camera's hardware guide for more details.

Display

See "Display panel" on page 3-23.

Discrete Output

In the Communication Drawer



The Discrete Output tool turns the output lines of the processor or camera on and off. Output values and timings are determined by a combination of Mask and State values, as well as Dwell and Delay timing values.

IMPORTANT: On multiple camera applications with the M-Series and MX-U Series processor, no camera has exclusive control of an output. All cameras share control of all the outputs.

See "How to Set Up the Discrete Output tool" on page 3-235.

Input Name	Data
State	Each bit of this integer value indicates the desired state of the corresponding output when the tool runs (see "Integer to Binary" on page 3-233)
Mask	Each bit of this integer value indicates which output is enabled (see "Integer to Binary" on page 3-233)
Pulse Reset Method	Indicates how each of the outputs should be reset after the tool runs. (Pulsed Output Timing only)

Input Name	Data
Pulse Reset State	Each bit of this integer value indicates the desired state of the corresponding output after the tool runs. This value has the same effect as the State input. Used when Pulse Reset Method is set to Use Pulse Reset State. (see “State” on page 3-233)
Output Timing Method	See Output Timing Method below for details
Delay	The number of milliseconds or event pulses to delay, based on the Output Timing Method (See “Delay and Dwell” on page 3-234.)
Dwell	The number of milliseconds or event pulses to hold the output (based on Output Timing Method) (See “Delay and Dwell” on page 3-234.)
BCD	If True, State sets the outputs after translating its value to Binary Coded Decimal (BCD).

Integer to Binary

NOTE: Each Impact camera type has a different number of outputs. If you enter a value for State, Mask, or Pulse Reset State that exceeds the camera’s number of outputs, a “Value Out of Range” error is displayed.

The Mask and State inputs are integer values, but the Output tool uses the equivalent binary value to set the camera outputs. This table lists some converted values:

Output Number	16	14	12	10	6	5	4	3	2	1
Binary Value	2^{15}	2^{13}	2^{11}	2^{9}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
Integer Value	32,768	8192	2048	512	32	16	8	4	2	1

To select a single output, enter the corresponding integer value. To combine multiple outputs, enter the sum of the integer values for those outputs. For example,
An integer value of 32 selects output number 6
An integer value of 17 (the sum of 16 and 1) selects outputs 5 and 1
An integer value of 36 (the sum of 32 and 4) selects outputs 6 and 3
An integer value of 65,535 (the sum of all the integer values) selects outputs 1 through 16

Mask

An output is enabled when the corresponding bit in its Mask value is set to 1 and disabled when it is set to 0 (zero). If an output is disabled (i.e. its Mask bit is zero), the State value has no effect on that output.

Note: You should only enable those outputs you want to turn on or off. If an output is enabled, and its corresponding State value bit is not set correctly, the output may be in an undesired state after the tool runs.

State

If an output is enabled by its corresponding bit in the Mask value, the State's value determines whether the tool turns an output on or off. If a bit in the State value is 1, the corresponding output is turned on; if the bit is 0 (zero), that output is turned off. The length of the on or off time, and whether the output remains on or off, is determined by the Output Timing Method.

Output Timing Method

Note: Output delay counting (in milliseconds or event pulses) begins with the task execution trigger event. (M-Series and MX-U Series processor outputs do not support event-based timing or queue multiple outputs.)

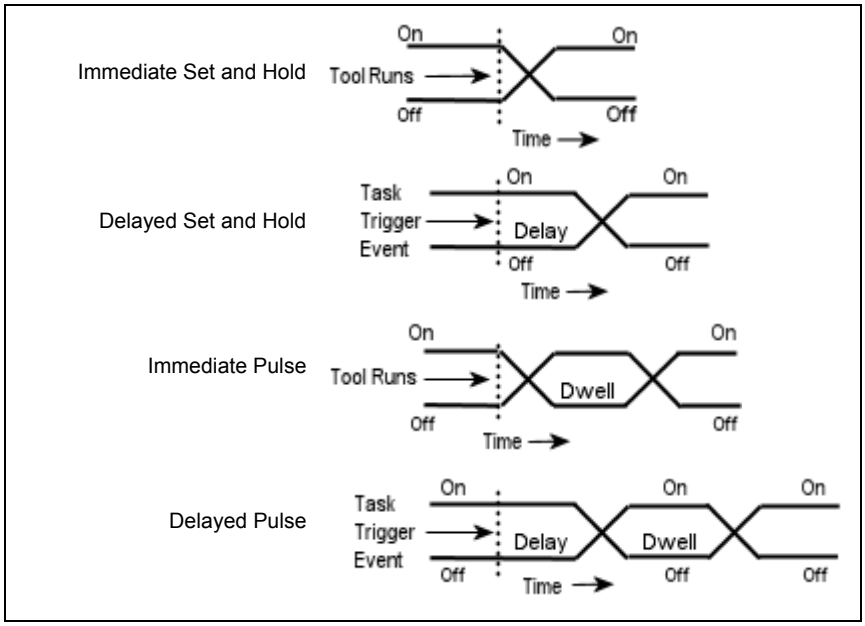
- **Immediate Set and Hold**: Sets the output to the State value immediately and leaves it there.
- **Immediate Event-Based Pulse**: Sets the output immediately to the State value, leaves it there for the "Dwell" number of Camera or Shift events (see "Shift Source" on page 2-9), then sets it to the inverted State or Pulse Reset State, based on the Pulse Reset Method.
- **Immediate MSec-Based Pulse**: Sets the output immediately to the State value and leaves it there for the "Dwell" number of milliseconds, then sets it to the inverted State or Pulse Reset State, based on the Pulse Reset Method.
- **Delayed Event-Based Pulse**: Delays the **"**Delay**"** number of Camera or Shift events (see "Shift Source" on page 2-9), sets the output to the State value, leaves it there for the "Dwell" number of Camera or Shift events, then sets it to the inverted State or Pulse Reset State, based on the Pulse Reset Method.
- **Delayed MSec-Based Pulse**: Delays the "Delay" number of milliseconds, sets the output to the State value, leaves it there for the "Dwell" number of milliseconds, then set sit to the inverted State or Pulse Reset State, based on the Pulse Reset Method. If the delay time is less than the task execution time, it is treated the same as an Immediate Pulse.
- **Delayed Event-Based Set and Hold**: Delays the **"**Delay**"** number of Camera or Shift events (see "Shift Source" on page 2-9), then turns the output to the State value and leaves it there.
- **Delayed MSec-Based Set and Hold**: Delays the "Delay" number of milliseconds, then turns the output to the State value and leaves it there. If the delay time is less than the task execution time, it is treated the same as an Immediate Set and Hold.

Delay and Dwell

Note: M-Series and MX-U Series processor outputs do not support event-based timing or queue multiple outputs.

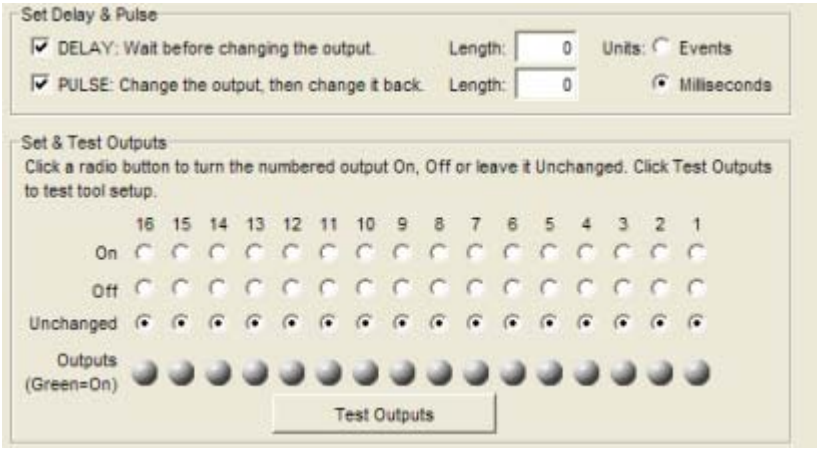
Output delay counting (in milliseconds or event pulses) begins with the task execution trigger event. For Event-based delays; Camera; Event; or Shift hardware triggers must be provided on the Impact camera's corresponding input. See "Shift Source" on page 2-9.

Dwell (in milliseconds or events) determines the length of time the output is on or off. These diagrams show the output pattern based on the Output Timing Pattern setting.



How to Set Up the Discrete Output tool

1. Click the Setup tab, then click the Setup & Test button.



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 there is a voltage 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 Dwell" on page 3-234 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 be turned Off. If you do not check this box, the selected outputs change to the chosen state when the tool runs and remain in that state. See "Delay and Dwell" on page 3-234 for more details.

Set & Test Outputs

This section is where you define what you want an output to do.
Note: The number of outputs shown will vary with the Impact camera type.
On, Off, Unchanged: Click the radio button under the desired output for the desired output state when 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.

Display

See “Display panel” on page 3-23.

EtherNet/IP

VPM provides the following tools that allow the Impact camera to exchange data with other devices on the network using EtherNet/IP protocol. For details about how Ethernet/IP works, see “EtherNet/IP” on page 6-12.

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 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.

The tool has an additional General property - Instance.

- **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.

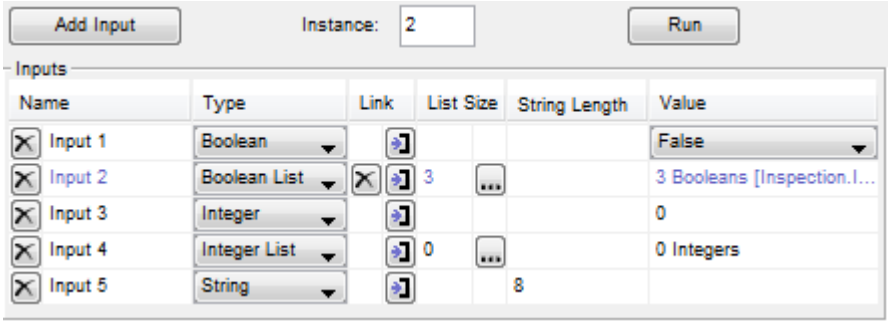
How to Set Up the EtherNet/IP Explicit Data tool

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**

Click to add an input to the Inputs table. Click the delete icon to the left of the 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. 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 3-23.

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.

The following fixed inputs and outputs are available.

Input Name	What it is
Network Path	The IP address of the destination EtherNet/IP device.
Class	The predefined class number for the destination device. The Impact camera class definition is 100 (hexadecimal 64)
Instance	Which function on the device should receive the message.

Input Name	What it is
Service	What the device should do. 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
Attribute	The value for the service function.
Member	The element of the message data structure to access. (See Note 1 below)
Tag String	The name of the user-created request tag for the external device (if needed).

Output Name	What it is
Write Succeeded	If True, the message transfer was successful.

- **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.

How to Set Up the EtherNet/IP Explicit Message tool

General

1. Change the tool name on the General panel, if desired.

Setup

1. Click the Setup button to define data inputs and outputs.

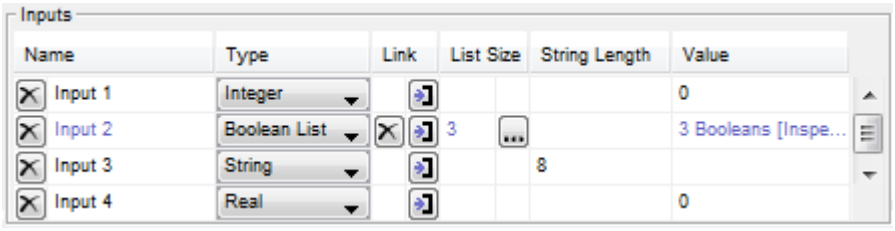
- **Network Path**
  This is the IP address of the destination EtherNet/IP device.
- **Class**

This is the predefined class number for the destination device. The Impact camera class definition is 100 (hexadecimal 64).

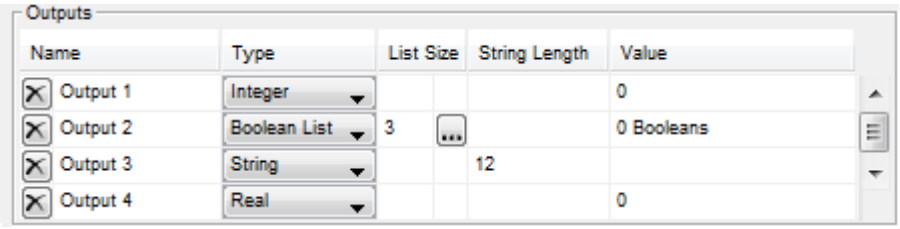
- **Instance**
  This is the function on the destination device that should receive the message.
- **Service**
  This is the destination device command. These Service codes can be used when communicating with an Impact camera (Class 100).
  Get Single Attribute - 100 (See Note 1 below)
  Set Single Attribute - 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



- **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: Click in the field to change the input 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 match in the sending (Write) tool and receiving (Read) tool. 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: Click in the field to change the 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 match in 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 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 3-23.

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. You can define a task trigger event to detect when this occurs. (See “EtherNet/IP Implicit User Data Event” on page 3-38.)

For details about the static assembly, see “EtherNet/IP” on page 6-12.

The tool has an additional General property - Offset.

- **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.

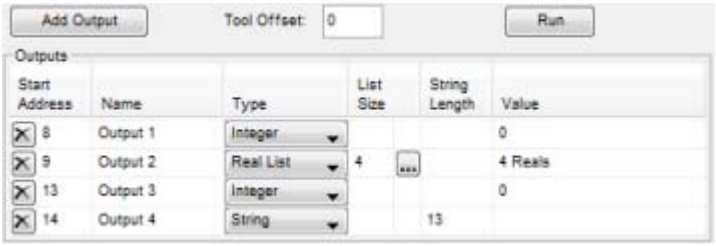
How to Set Up the EtherNet/IP Read Implicit Assembly tool

General

1. Change the tool name on the General panel, if desired.

Outputs

1. Click the Outputs button to define data to be 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.
- **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. 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 be read from the static assembly.
  Value: The value read from the static assembly.

Display

See "Display panel" on page 3-23.

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, see “EtherNet/IP” on page 6-12.

The tool has an additional General property - Offset.

- **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.

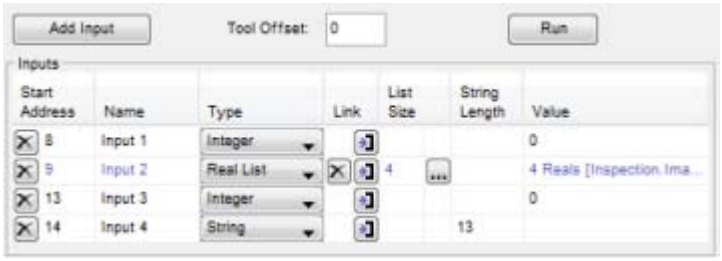
How to Set Up the EtherNet/IP Write Implicit Assembly tool

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.



- **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. 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 static assembly.
  Value: The value to write to the static assembly.

Display

See “Display panel” on page 3-23.

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 Vision Device or Emulator when the tool runs. See “How to Set Up the Image Archiving tool” on page 3-244.

Input Name	What it is
Input Image	The greyscale image to be archived. Each tool can archive a greyscale image or a color image, but not both.
Input Color Image	The color image to be archived. Each tool can archive a greyscale image or a color image, but not both.
FTP Host	The IP Address of the FTP server where the image is to be archived.
FTP User Name	The User Name of the account to use on the FTP server.
FTP Password	The password (if any) for the User Name in the FTP User Name property.
FTP Timeout	The length of time to wait (in seconds) for the FTP server to respond. If the timeout expires, the current image will not be archived.
FTP Passive Mode	If True, the tool initiates both the connection to the FTP server's command port (21) and the connection to the server's data port. If False, after the tool connects to the FTP server's command port, the server initiates a connection back to the tool for passing data. Passive Mode should normally be used.
File Base Name	The name given to the destination file when it is archived. If an incremental number is not added (see the “Rollover Value” property), this file is overwritten every time the tool runs.
Rollover Value	This is the highest value that is appended to the File Base Name, before the value is set back to one. The number of digits in this property is the number of digits in every value appended to the File Base Name. For example, if this property’s value is 999, the first value appended is “001”. If this property’s value is zero, nothing is appended to the Destination File Name. You may choose to set the value to zero if the File Base Name is linked from some other tool.
File Format	This is the format desired for the archived image. (See “How to Set Up the Image Archiving tool” on page 3-244)

Input Name	What it is
Maximum Queue Size	This parameter controls how many images can be waiting for conversion and archiving. If this value is zero, the tool runs synchronously, which means that the image is immediately converted and sent to the FTP server when the tool runs. This mode is not recommended for general use as it may result in long tool and task execution times. If the value is greater than zero, the tool runs asynchronously, which means that the tool queues the image so it can be converted and archived by a separate background process. (See “How Transfer Mode Affects Run, Pass, and Fail Counts” on page 3-246 for more details.)

Output Name	What it is
Passed	If True, and running synchronously, it indicates that conversion and archiving was successful. If running asynchronously, it indicates that the image was successfully queued to the background process. (See “How Transfer Mode Affects Run, Pass, and Fail Counts” on page 3-246 for more details.)
Pass Count	The number of times the tool has passed since the last reset. (See “How Transfer Mode Affects Run, Pass, and Fail Counts” on page 3-246 for more details.)
Fail Count	The number of times that the tool has failed to transfer an image. When the Transfer Mode is Synchronous, the Fail Count is updated immediately. It is updated at a later time if the Transfer Mode is Asynchronous. The tool's Passed output is always updated immediately every time the tool runs. (See “How Transfer Mode Affects Run, Pass, and Fail Counts” on page 3-246 for more details.)
Run Count	The total number of times the tool has run since the last reset. This is calculated by adding the Pass Count, Fail Count, and Current Queue Size. (See “How Transfer Mode Affects Run, Pass, and Fail Counts” on page 3-246 for more details.)
Current Queue Size	The number of images waiting to be archived (see Maximum Queue Size property).
Destination File Name	The full name of the file sent to the FTP server.

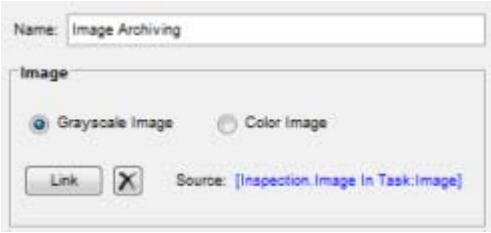
How to Set Up the Image Archiving tool

General

1. Change the tool name on the General panel, if desired.

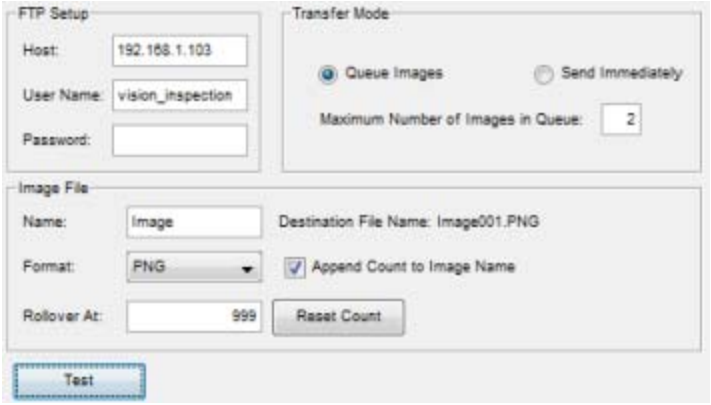
- **Image**
  Grayscale Image: Select this if you are archiving grayscale images.
  Color Image: Select this if you archiving color images.

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 copies the image to memory, then 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. 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 Inspection999JPG 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 3-23.

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 tool's Run Count will always equal the Pass Count plus the Fail Count, and the Current Queue Size will always be 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.

MC Read

In the Communication Drawer



The MC Read tool provides data transfer from a Mitsubishi Programmable Logic Controller (PLC) to a Datalogic vision device. The tool implements the Mitsubishi Electric Sequence Controller (MELSEC) Communication (MC) Protocol Batch Read commands in 3E frames. 3E frames indicates that the communication occurs over an Ethernet (TCP/IP) connection.

Input Name	What it is
PLC Address	See "PLC Address" on page 3-247.
PLC Port	See "PLC Port" on page 3-247.
Network Number	See "Network Number" on page 3-247.
PLC Number	See "PLC Number" on page 3-247.
Timeout	See "Timeout" on page 3-247 below.

Input Name	What it is
Disconnect after each read	See “Disconnect After Each Read/Write” on page 3-247.
Device Code	See “Device Code” on page 3-248.
Start Device	See “Start Device” on page 3-248.
List Data Length	The number of data items to read when the Device Data output property data type is Boolean List, Integer List, Real List, or String. If the Device Data output property data type is Boolean, Integer, or Real, this value is ignored.

Output Name	What it is
Passed	If True, the tool passed.
Pass Count	The number of times the tool has passed since being reset.
Fail Count	The number of times the tool has failed since being reset.
Run Count	The number of times the tool has run since being reset.
Device Data	The data read from the PLC device.

PLC Address

This identifies the IP address of the source or destination PLC. The default is 192.168.3.39, which is a common default address for a Mitsubishi PLC.

PLC Port

This identifies the port number on the source or destination PLC, the default value is 1280. This port must be configured to use the MC protocol using software like Mitsubishi's GX Works2.

Network Number

This is only used when connecting to a plug-in Ethernet module on the PLC. When the tool is connected to the built-in Ethernet port on the PLC, this should be set to 0.

PLC Number

This value can range from 0 to 255. When the tool is connected to the address in the PLC Address property, this value should be set to 255. Other values are used to communicate with other PLCs on the network.

Timeout

This is the timeout value for the TCP socket operations between the tool and the PLC, in milliseconds. The value can range from 0 to 10000. The default is 50. Typical tool execution time is approximately six milliseconds when the Disconnect After Each Read or Disconnect After Each Write property is True.

Disconnect After Each Read/Write

When this is True, the tool opens and closes the PLC connection every time the tool runs. The connection is also closed when the reset method is invoked, the tool is deleted, or the IP Address or port number is modified. If False, the connection is left open and the same connection is used each time the tool runs.

Device Code

The PLC “device” type (register, relay, timer, etc.) to read or write. Types are: Input Relay (X), Output Relay (Y), Internal Relay (M), Latch Relay (L), Annunciator (F), Link Relay (B), Data Register (D), Link Register (W), Timer Contact (TS), Timer Coil (TC), Timer Value (TN), Counter Contact (CS), Counter Coil (CC), Counter Value (CN), Special Link Relay (SB), Special Link Register (SW), and File Register (R).

Note that some of these devices are Bit-type devices and some are Word-type devices. Bit-type devices can be read from or written to one bit at a time and Word-type devices are read from or written to in minimum units of one word or sixteen bits. For detail see “Data Types Supported” on page 3-249.

Start Device

The starting device number to read or write. For example, if the Device Code is Data Register (D), and Start Device is 0, then the tool will read or write starting at Data Register 0, If the Start Device is 4, the tool will read or write starting at Data Register 4.

Note that PLC devices are 16 bits wide, and Impact data types that are larger than 16 bits will be read from or write to consecutive PLC devices, starting at the Start Device. For details see “Data Types Supported” on page 3-249.

MC Write

In the Communication Drawer



The MC Write tool provides data transfer to a Mitsubishi Programmable Logic Controller (PLC) from a Datalogic vision device. The tool implements the Mitsubishi Electric Sequence Controller (MELSEC) Communication (MC) Protocol Batch Write commands in 3E frames. 3E frames indicates that the communication occurs over an Ethernet (TCP/IP) connection.

Input Name	What it is
PLC Address	See “PLC Address” on page 3-247.
PLC Port	See “PLC Port” on page 3-247.
Network Number	See “Network Number” on page 3-247.
PLC Number	See “PLC Number” on page 3-247.
Timeout	See “Timeout” on page 3-247 below.
Disconnect after each write	See “Disconnect After Each Read/Write” on page 3-247.
Device Code	See “Device Code” on page 3-248.
Start Device	See “Start Device” on page 3-248.
Max List Data Length	The maximum number of data items to write when the Device Data property data type is Boolean List, Integer List, Real List, or String. If the property list length is less than this value, the list length is used. If the Device Data property data type is Boolean, Integer, or Real, this value is ignored.
Device Data	The data to write to the PLC device.

Output Name	What it is
Passed	If True, the tool passed.
Pass Count	The number of times the tool has passed since being reset.
Fail Count	The number of times the tool has failed since being reset.
Run Count	The number of times the tool has run since being reset.

Data Types Supported

Impact Data Type	Bit-Type Devices	Word-Type Devices
Boolean	Reads/Writes 1 bit	Reads/Writes 16 bits (1 word)
Boolean List	Reads number of bits defined by Data Length input Writes 1 bit per list element	Reads number of words defined by Data Length input Writes 1 word per list element
Integer	Reads/Writes 16 bits	Reads/Writes 32 bits (2 words)
Integer List	Reads 16 bits x Data Length input Writes 16 bits per list element	Reads 32 bits x Data Length input Writes 32 bits (2 words) per list element
Real	Not allowed, tool fails.	Same as Integer
Real List	Not allowed, tool fails.	Same as Integer List
String	Not allowed, tool fails.	Reads/Writes 2 characters of the String into each 16 bit word

Send Message

In the Communication Drawer



The Send Message tool sends data from one Impact camera to another. Use the Wait For Message tool to receive the data. See “How to Set Up the Send Message tool” on page 3-249.

Input Name	What it is
Address	The IP Address of the camera that will receive the data. The receiving camera must have a program that contains a Wait For Message tool.
Number	The Message number (from 0 to 255). Enter the number of which Wait For Message tool in the other camera will receive this message.
Input ...	Defined inputs are listed.

Output Name	What it is
Passed	If True, the message was sent. This does not imply that the corresponding Wait For Message tool received the message.

How to Set Up the Send Message tool

The Send Message tool sends data to a corresponding Wait For Message tool. You define the data you want to send by adding Inputs on the Message panel. The tool will still work properly if no Inputs are defined. The Message Destination is defined on the Destination panel.

Defining Message Data

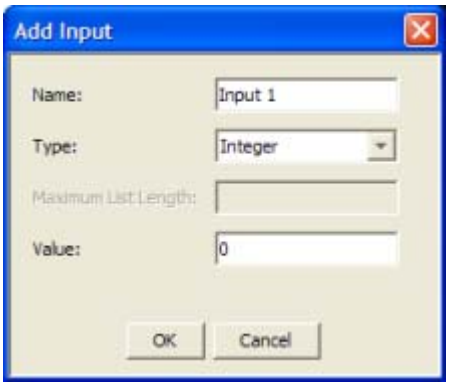
NOTE: The Wait For Message tool that this message is being sent to must contain the same number and type of corresponding Outputs, in the same order, as this tool's Inputs. Image data can be sent only when using M-Series and MX-U Series processors and cameras. The cameras must be connected to the same processor.

To add a tool Input

1. Click the Setup tab, then click the Message button.
2. Click the Add button.



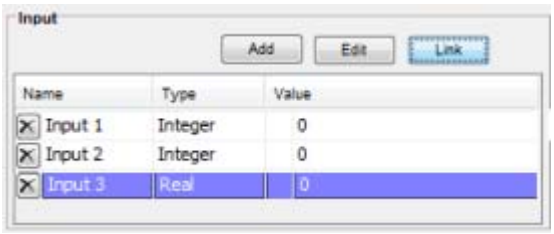
3. When the Add Input dialog is displayed, enter the name for the Input
4. Click the Type drop down and select the type of the data you want to send. For List types, you can enter a Maximum List Length to limit the length.



5. In the Value field, enter the value you want to send.
6. Click OK.

To link a value into an Input

1. Click the desired Input in the Input list.



2. Click the Link button.

3. Select the desired tool and property from the Task tree.

To delete an Input link

1. Click the desired Input in the Input list.
2. Click the "x" on the left side of the Value field (under the Value column).

To delete an Input

1. Click the desired Input in the Input list.
2. Click the "x" on the far left side of the Input entry (under the Name column).

Defining the Message Destination

To send a message, you need to define the Destination camera and the Message Number. The corresponding Wait For Message tool must have the same Message Number.

To define the Destination Camera

1. Click the Setup tab, then click the Destination button.
2. Click the Browse button. When the Select Message Destination dialog is displayed, select the desired Destination Camera from the list.



3. Click OK. The camera's IP Address and name is displayed.
4. Enter the desired Message Number in the Message Number field (from 0 to 255). There should be a Wait For Message tool in a task in the Destination Camera that uses the same Message Number.
5. To test the tool, click the Send button. The Pass/Fail status is True if the message was sent. This does not imply that the corresponding Wait For Message tool received the message.

Display

See "Display panel" on page 3-23.

Wait For Message

In the Communication Drawer



The Wait For Message tool works with the Send Message tool to receive data from another camera. See “How to Set Up the Wait For Message tool” on page 3-252.

Input Name	What it is
Number	The Message number (from 0 to 255). The corresponding Send Message tool must use this number in the Number property.
Maximum Timestamp Difference	See “Enable Maximum Timestamp Difference (ms)” on page 3-253. NOTE: The Timestamp Difference calculation is reliable only for vision devices running on the same processor.
Timeout	See “Timeout” on page 3-253.

Output Name	What it is
Actual Timestamp Difference	See “Actual Timestamp Difference (ms)” on page 3-254. NOTE: The Timestamp Difference calculation is reliable only for vision devices running on the same processor.
Passed	If True, a message number matching the Number property was successfully received.
Output ...	Defined outputs are listed.

How to Set Up the Wait For Message tool

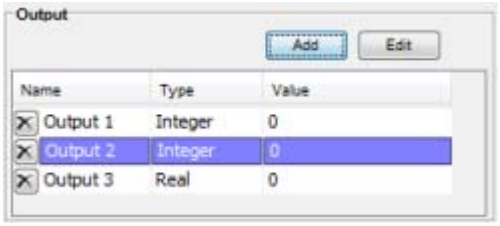
The Wait For Message tool waits to receive data from a corresponding Send Message tool. You define the data you want to receive by adding Outputs on the Message panel. The Message Number is defined on the Receiver panel.

Defining the Received Message Data

NOTE: The Send Message tool that this message is being received from must contain the same number and type of corresponding Inputs, in the same order, as this tool’s Outputs. Image data can be sent only when using M-Series and MX-U Series processors and cameras.

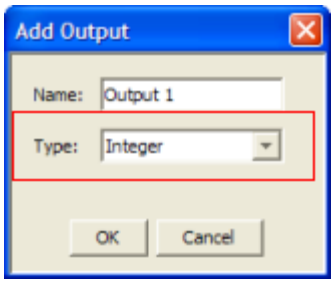
To add a tool Output

1. Click the Setup tab, then click the Message button.
2. Click the Add button.



3. When the Add Output dialog is displayed, enter the name for the Output

4. Click the Type drop down and select the type of the data you want to receive.



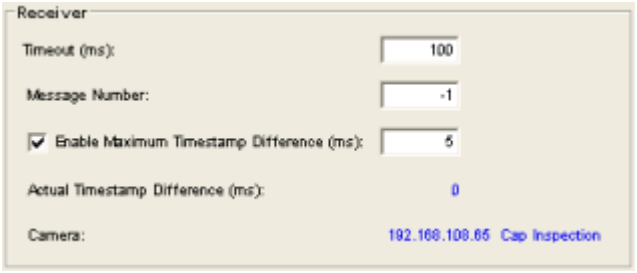
5. Click OK.

Defining the Message Receiver

To receive a message, you need to define the Receiver parameters which include the message number. The corresponding Send Message tool must have the same Message Number.

To define the Receiver

1. Click the Setup tab, then click the Receiver button.



- **Timeout**
  If this value is greater than zero, it is the maximum time (in milliseconds) that the tool will wait for a matching message number. The wait time starts when tool execution starts. If the Timeout value is exceeded, the tool fails and the message data from the Send Message tool is not written to the outputs created in the Message Output panel. The Actual Time Stamp Difference is not displayed.
  If this value is zero, the tool will wait until a message is received. Task execution is suspended while the tool waits.
- **Message Number**
  Enter the desired Message Number in the Message Number field (from 0 to 255). There should be a Send Message tool with the same Message Number in a task running in the Camera shown in the Camera field.

NOTE: The Timestamp Difference calculation is reliable only for vision devices/cameras running on the same processor.

- **Enable Maximum Timestamp Difference (ms)**
  If this box is checked, the Maximum Timestamp Difference value (in milliseconds), is used.
  A Timestamp is generated when a camera hardware trigger or other input event (such as Event 1 or TCP/IP) occurs. When a task's Trigger Event occurs, it is put into a queue of tasks that are executed in "first in, first out" order. (See "Trigger Event Types" on page 3-35.)
  When a task containing a Wait For Message tool runs and receives data from a Send Message tool in another task, the tool compares the Timestamps of the data in the two tools.

If the difference between the two Timestamps is greater than the Maximum Timestamp Difference value, the Wait For Message tool fails. The Actual Timestamp Difference is not displayed.
If the tool passes, the message data received from the Send Message tool is written to the outputs created in the Message Output panel and the Actual Time Stamp Difference displays the difference between the two time stamps.
If this box is not checked, and the Timeout property value is not exceeded, the first message from a Send Message tool with a matching message number is used.

- **Actual Timestamp Difference (ms)**
  This is the difference between the Send Message and Wait For Message Timestamps (in milliseconds). It is not displayed if the Maximum Timestamp Difference is enabled and the value is exceeded. or the Timeout value is exceeded.
- **Camera**
  The IP Address and name of the camera that contains this tool. You can select and copy this information from here, then paste it into the Address property of the Setup's Select Message Destination dialog of the corresponding Send Message tool.

Display

See "Display panel" on page 3-23.

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. To define the Serial Port parameters such as speed, parity, and the delimiter for the receiving device, see "Serial Port" on page 2-10.

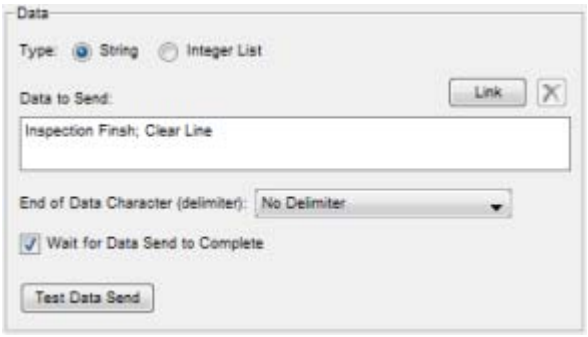
See "How to Set Up the Serial Port Out tool" on page 3-254.

Input Name	What it is
Input String	The string that is sent the serial port when the task runs.
Input List	The integer list that is sent the port when the task runs.
Synchronous	If True, the Impact camera synchronizes the transmission with the receiving device.
Delimiter Type	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. The M-Series and MX-U Series processor can use only a one character delimiter.

NOTE: The MX80 processor provides four serial port connections. CAM 1 controls Serial Port 1 (the connector on the front panel). CAM 2 controls Port 2, CAM 3 controls Port 3, and CAM 4 controls Port 4.

How to Set Up the Serial Port Out tool

1. Click the Setup tab, then 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) The M-Series and MX-U Series processor can use only a one character delimiter.
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 3-23.

TCP/IP Out

In the Communication Drawer



The TCP/IP Out 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.

If an Impact camera has a task with the Trigger Event set to TCP/IP Input, the task is queued to run when the data is received. (See page 2-10 for Input Event Port definition.) The string or integer list from this tool is written to both the InputString and InputList properties of that task.

See "How to Set Up the TCP/IP Out tool" on page 3-257.

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.

Input Name	What it is
Input String	The string that is sent out the Ethernet port when the tool runs. Either the Input String property or the Input List property can contain a value, but NOT both.
Input List	The integer list that is sent out the port when the tool runs. The 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. Either the Input String property or the Input List property can contain a value, but NOT both.
Delimiter Type	This is placed at the end of the Input String when it is written to the port to signify the end of the string.
Connection Type	Server: The tool sends the data to all remote clients that are currently configured to receive data from the camera. See “TCP/IP” on page 2-10 for Server port configuration. Client: The tool sends the data to the device with the IP Address and Port Number defined in the IP Address and Port Number properties.
IP Address	If Connection Type is Client, this is the IP address of the remote Impact camera. If the remote device is a web server, this property can be a domain name such as www.datalogic.com.
Port Number	If Connection Type is Client, this is the remote Impact camera’s input event port number where the device "listens" for a TCP/IP message.
Connect Timeout	The length of time the tool will wait for a connection to the remote device. (10 ms to 10 sec)
Disconnect after each write	If Connection Type is Client and this value is True, the tool disconnects from the port after each time it sends the data. See “Disconnect After Each Send” on page 3-259.
Error Check Delay	If Connection Type is Client, the tool waits this number of milliseconds to test for a successful write.
Number of Retries	This is the number of times the tool will retry sending the data after a timeout or error.
Wait for Response	If True, the tool will wait for a response from the remote device. See “How to Set Up Wait For Response” on page 3-259)
Wait for Response Timeout	The length of time the tool will wait for a response from the remote device.

Output Name	What it is
Write Succeeded	If Connection Type is Server, this value is always True and doesn't relay the number of successful remote client message transmissions. It is the responsibility of the remote client to actively manage the health of the connection. If Connection Type is Client, this value is True when the data was received by the remote device within the time defined in the Error Check Delay property.
Response String	If Wait for response is True, this property contains the string sent by the connected device.
Status String	If Wait for response is True, this property contains the response status, including any errors.

How to Set Up the TCP/IP Out tool

General

1. Change the tool name on the General panel, if desired.

Data

1. 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

1. 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.
Connect Timeout: The length of time the tool will wait for a connection to the remote device.
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.
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 3-259 for details.

- **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 3-23.

Example: Set up two Impact cameras (local and remote) to communicate with each other.

The local Impact camera

1. With VPM, 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. Select the Setup tab. In the Data area, select the data type String.
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 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 Settings Tab - General - Communication 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, 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. Select the Setup tab. In the Data area, select the data type String.
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 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 Settings Tab - General - Communication 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 Set Up 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 a Basic 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 execu-

tion 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

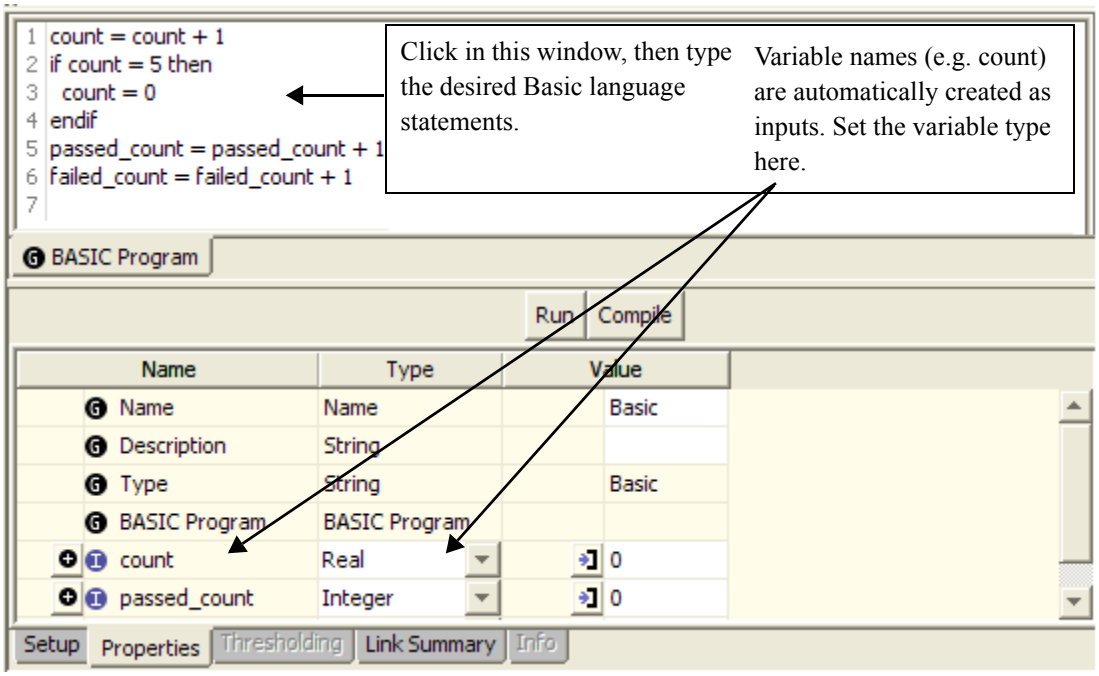
Basic

In the Logic Drawer



The Basic tool performs logical and mathematical calculations based on a set of user-written statements using the Basic programming language. See “Impact Basic” on page 5-1 for more information.

This tool has no standard inputs and no outputs. Basic language statements are typed in the Basic editor window. As variable names are entered, variables are created as inputs in the input list. Click the Compile button to test the validity of your Basic code. The code is also compiled when you select a different tool. When you click the Run button, the Basic program results appear in the properties pane.



In the example above, the variable "count" is incremented each time the tool runs, then reset to zero when it reaches five. When you type the variable name "count," the Basic tool automatically creates an input with that name. You can set the variable’s type in the Type drop-down.

TIP: If the variable’s name has a specific ending, the type is assigned automatically. Variables ending in "real" are assigned type Real, "string" are assigned type String, and "int" are assigned type Integer. For example, count_real is a Real, name_string is a String, and count_int is an Integer.

For more details about entering text in the Editor window, see “Type in the Editor Window” on page 5-1).

Branch

In the Logic Drawer

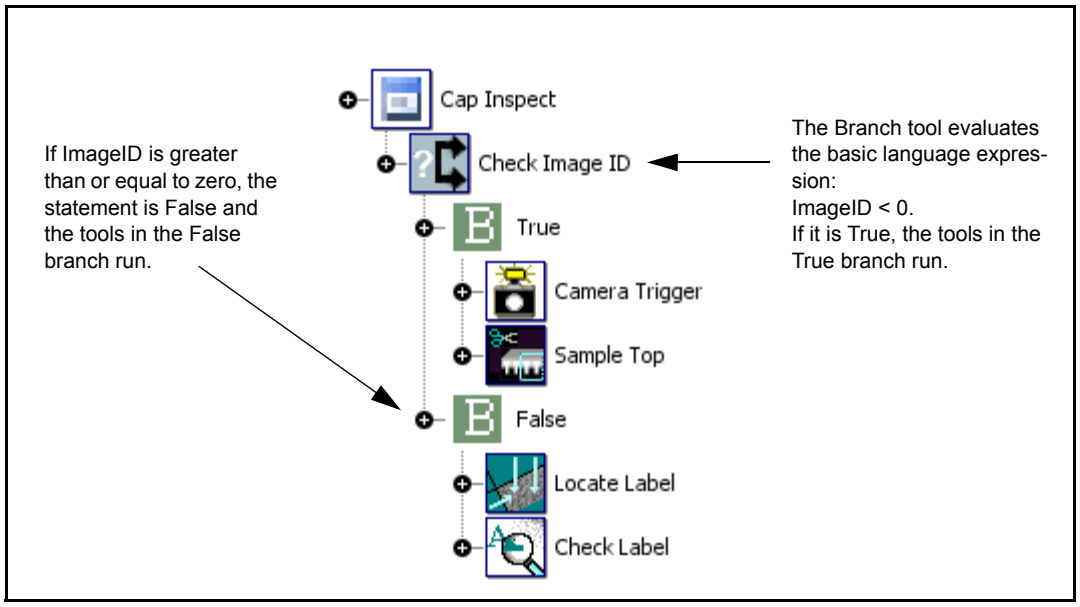


The Branch tool evaluates a user-defined Basic-language expression and executes a task branch based on whether that statement is true or false.

This tool has no standard inputs. A basic language expression is typed in the Basic expression field. As variable names are entered, variables are created as inputs in the input list. The input values can be entered manually or linked from other tools. The expression is evaluated and, based on the result, the Result output is set True or False and that branch is taken. In this example, the basic language expression is

```
ImageID < 0
```

The tools in the False branch are executed if ImageID is greater than or equal to zero.



Input Name	What it is
Basic Expression	A Basic language expression. Each variable in the expression becomes an input that can be entered manually or linked from other tools.

Output Name	What it is
Result	The result of evaluating the Basic Expression. The True or False branch is executed based on this result.

Break

In the Logic Drawer



The Break tool forces an early end to a programming loop tool or the task. When the programming loop ends, the next tool after the loop runs. If there are no tools after the loop, the task ends. If the tool is placed outside a programming loop, the task aborts when the tool runs.

This tool has no inputs or outputs.

Call Task

In the Logic Drawer



The Call Task tool is used to call another task. When the called task ends, control returns to the calling task and the tool after the Call Task tool runs. If there are no tools after the Call Task tool, the calling task ends. The called task must be loaded on the camera, Vision Device, or Emulator.

This tool has no standard inputs or outputs. When you select a task to call, all the inputs and outputs that have been added in the called task become available to the calling task. If you change the called task, click the Synchronize With Task button to synchronize the Call Task tool inputs and outputs with the changes in the called task.

NOTE: The called task should have the Trigger Event Type set to None.

Counted Loop

In the Logic Drawer



The Counted Loop tool loops a user-specified number of times. The starting and step-increment values may also be defined. Any tool may be used within the loop.

Input Name	What it is
repeatCount	The number of times the loop should repeat; if zero, it does not loop
startVal	The starting value for the loop (may be positive or negative)
stepVal	The incremental value of each step in the loop (may be positive or negative)

Output Name	What it is
currentCount	The number of times the loop has repeated
currentValue	currentCount times stepVal plus startVal

Counter

In the Logic Drawer



The Counter tool increments or decrements a counter when it runs. There are several configuration options. See “How to Set Up the Counter tool” on page 3-263.

Input Name	What it is
Count	The current Count
Reset Value	When the Count value equals the Rollover value, the Count value is set to the Reset value and the Success output is set to True.

Input Name	What it is
Rollover Value	When the Count value reaches this value, the Count value is set equal to the Reset value. If the Increment value is negative, this value must also be negative and less than the initial Count value.
Increment	The Count value is increased (or decreased) by this amount each time the tool runs. If this value is negative, the Rollover value must also be negative.
Limit	When the Count value equals the Limit value, the Success output is set to False. If the Increment value is negative, this value should be negative also.

Output Name	What it is
Success	When the Count value equals the Rollover value, this output is set to True. When the Count value equals the Limit value, this output is set to False.

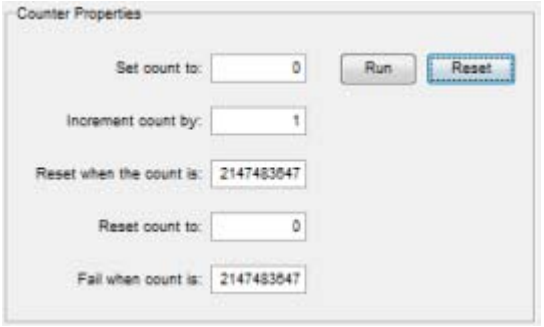
How to Set Up the Counter tool

General

1. Change the Name, if desired.

Pass/Fail

Counter Properties



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 3-23.

The table below shows an example of using the tool a positive “Increment count by” value. 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.

Number of times tool has run	“Set count to” value	Passed	Operation Performed
0	0	True	None
1	1	True	Set count to + Increment count by
2	2	True	Set count to + Increment count by
3	3	True	Set count to + Increment count by
4	4	True	Set count to + Increment count by
5	5	False	Set count to + Increment count by (Set count to = Fail when count is so Passed is set to False)
6	6	False	Set count to + Increment count by
7	0	True	Set count to + Increment count by (Set count to = Reset when the count is so Set count to is set to Reset count to (0) Set count to < Fail when count is so Passed is set to True)

Data Instance

In the Logic Drawer



This tool has no fixed inputs or outputs, but it provides a variety of inputs and outputs that vary, depending on the data type selected. Each data type has a specific set of data elements that can be accessed. You can use the Data Instance tool to access these data elements individually then link them into other tools.

For instance, the Point data type contains the x and y coordinates of a point in the format of (x, y). If you select this data type in the Data Instance tool, the x and y coordinates are provided individually as Real data types on the outputs of the Data Instance tool. These Real values can then be linked individually into another tool, or displayed on a control panel.

Data Set

In the Logic Drawer



The Data Set tool is used to "push" data to another tool. Each data type has a specific set of data elements that can be accessed. The Data Set tool can be used to access these data elements individually then link them into other tools using its general property, Destination. When this tool runs, its data values are "pushed" into the linked tool's values. For example, if you set the data type to Integer, then set the value to zero, the tool can be used to reset other tool values when it runs.

Delay

In the Logic Drawer



The Delay tool delays task processing for a user-specified number of milliseconds. Control panels can still access data from the task during the delay period. The following inputs are available.

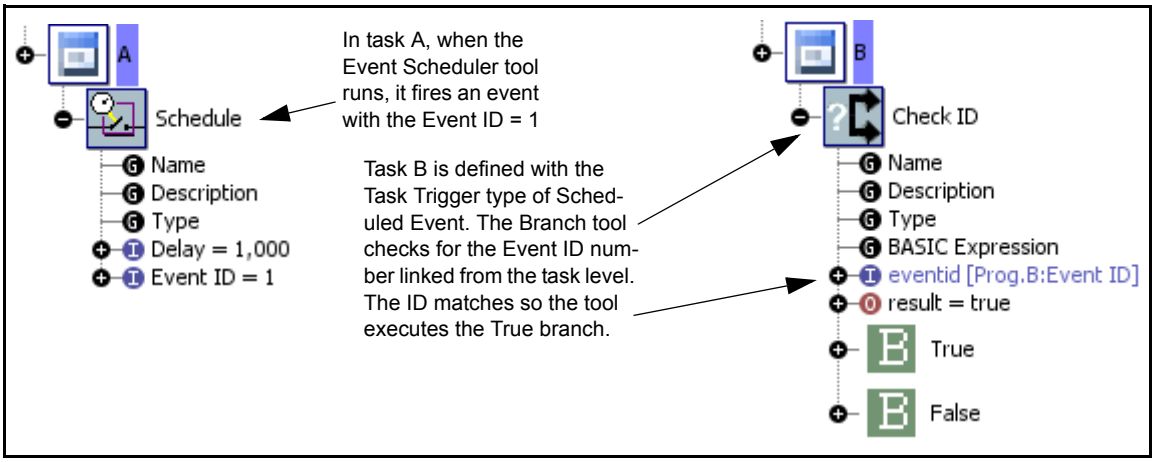
Input Name	What it is
numMilliseconds	The number of milliseconds to delay. Actual maximum delay resolution is four milliseconds.

Event Scheduler

In the Logic Drawer



The Event Scheduler tool "fires" an event and sets the Event ID to the Event ID input property. All tasks that have Scheduled Event selected as the task's Trigger Event type are then queued for processing. **Note**: The camera, Vision Device, or Emulator must be Online for the Scheduled Event to trigger any task.



Input Name	What it is
Delay	The number of milliseconds the system delays between tool execution and when the event is "fired." Actual maximum delay resolution is four milliseconds.
Event ID	The identification number of this event. Use a Branch or Basic tool to test it for selective processing.

Group

In the Logic Drawer

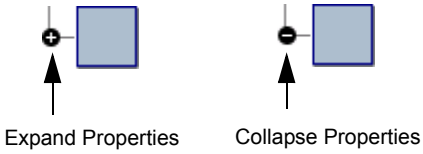


The Group tool provides a way to group and organize tools within the task tree.

To add a tool to a group

1. If necessary, click the Expand Properties icon to the left of the tool.
2. Drag a tool from the tool box and drop it in the desired place under the Group tool.
   To add a tool to the top of the group, drop it on the branch icon.
   To add a tool to the end of the group, drop it on the bottom tool in the group.

To expand the Group tool structure, click the Expand Properties icon to the left of the Group tool icon. To expand individual tool properties, click the Expand Properties icon to the left of the desired tool. To collapse any expanded properties, click the Collapse icon.



This tool has no standard inputs or outputs.

List Loop

In the Logic Drawer



The List Loop tool loops through a list of elements each time it runs, providing access to each element in the list. This tool has as an additional General property, Data Type, which you select to indicate the data type of the list you want to process. Each data type has outputs in addition to those listed in the table.

Input Name	What it is
List	The list of elements

Output Name	What it is
Index	The position, in the list, of the element currently being accessed.
Count	The number of elements in the list
Element	The current element being processed

List Sorter

In the Logic Drawer



The List Sorter tool provides a sorted output list from any list data type input. This tool has an additional General property called Data Type where you select the data type of the list being sorted.

Input Name	What it is
Input List	The list to be sorted

Input Name	What it is
Sort Feature	The feature in the list that determines the sort order.
Sort Order	The order in which to sort the list.

Output Name	What it is
Sorted List	The sorted list.

Multiple Branch

In the Logic Drawer

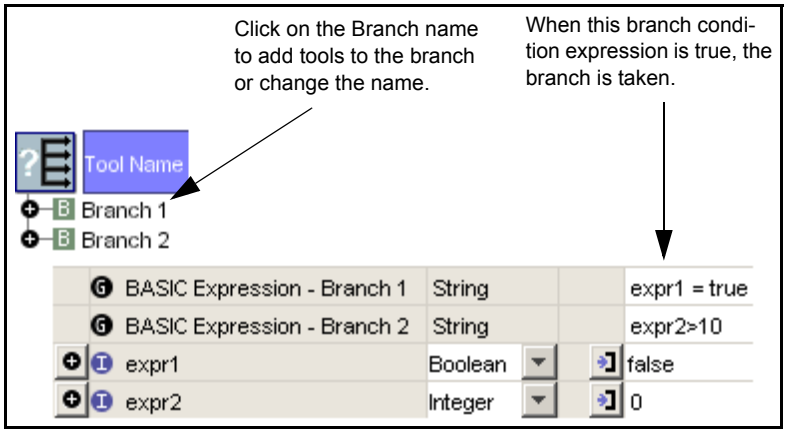


The Multiple Branch tool provides multiple branches based on multiple conditions. When it runs, the tool evaluates user-defined Basic-language expressions. The first branch with an expression that evaluates as True is taken, and the tools in that branch are run. None of the other branches are taken. If none of the expressions are True, none of the branches are taken.

This tool has no standard inputs. As variable names are entered, variables are created as inputs in the input list. The input values can be entered manually or linked from other tools.



Click the Add Branch button to add a branch to the tool. A General BASIC expression line is added for each branch. Type the Basic language expression for that branch in the Value field.



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 output.) After all the input tools are evaluated, the tools in the Pass or Fail branch are run, depending on the Pass Criteria selected. See Figure , “How to Set Up the Pass Fail tool,” on page 268.

Input Name	What it is
Input Image	The image being inspected

Input Name	What it is
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 if any input tool passes.
Input ...	Any inputs that have been added are listed in this section. Click the Add Input button on the Setup tab to add inputs.
Invert Input ...	If true, the input tool's value is inverted or reversed before it is used to determine the Pass Fail tool's status.

Output Name	What it is
Pass	Indicates the pass or fail status of the Pass Fail tool after all the input tools' pass/fail statuses have been evaluated.
Pass Count	The number of times the tool has passed
Fail Count	The number of times the tool has failed
Run Count	The total number of times the tool has run

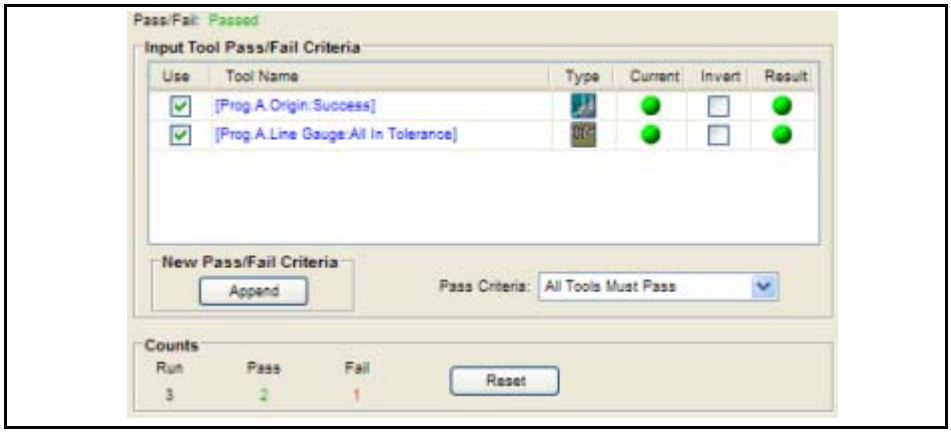
How to Set Up the Pass Fail tool

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 and select the desired task, then select the tool property 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 3-23.
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.



Reset

In the Logic Drawer



When the Reset tool runs, it automatically resets the tool that is linked to the Tool To Reset property. There are no inputs, but there is an additional General property called Tool To Reset.

To select the tool you want to Reset

1. Click the link icon for the Tool To Reset property.
2. Select the desired tool from the task tree. Only tools that can be Reset are highlighted.

String Builder

In the Logic Drawer



The String Builder tool creates an output string by combining a variety of user-defined input data types. See “How to Set Up the String Builder tool” on page 3-270.

Input Name	What it is
Format String for...	The format specifiers shown in each of these properties are applied to the named input property, then combined to create the Output String property. They are similar to the “Printf” format strings in the C programming language.
Leading Text	This fixed text is inserted at the beginning of the Output String property.
Trailing Text	This fixed text is appended to the end of the Output String property.
Input Delimiter	This fixed text is inserted between each named input property in the Output String property. To enter special non-printable ASCII characters, use the Setup. See ““How to Set Up the String Builder tool” on page 3-270.
Terminator	One or more termination characters that are placed at the end of the Output String to signify the end. Select from the drop down.
User-Defined properties	One or more named input properties that are combined to create the Output String. To add an input, click the Add Input button, then select the data type from the drop down. Click the Name field to rename the property. To delete an input, click the “X” button to the left of the name. More options are available in the Setup.

Output Name	What it is
Output String	This string is the result of all the combined User-Defined input property values and other property values.
Passed	If True, the Output String was created successfully.
Pass Count	The number of times the tool has passed since the last reset.
Fail Count	The number of times the tool has failed since the last reset.
Run Count	The total number of times the tool has run since the last reset.

How to Set Up the String Builder tool

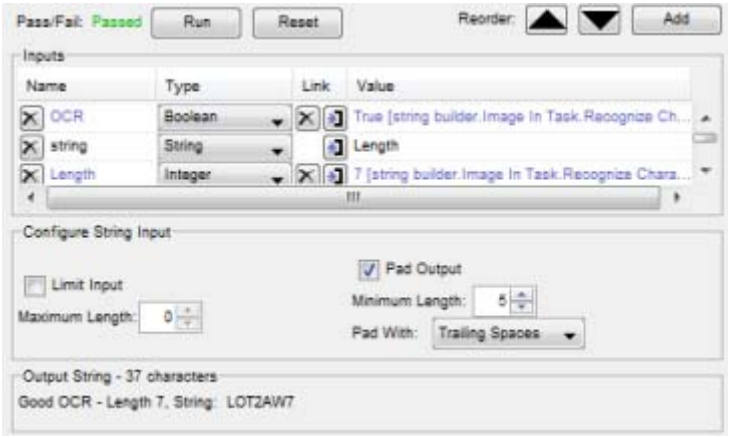
The String Builder tool creates an output string from a variety of user-defined input data types. You can link values from other tools, or directly enter values for some data types.

General

1. Change the tool name on the General panel, if desired.

Inputs

1. On the Inputs panel you define the inputs used to create the Output String.



- **Pass/Fail**
  Indicates if the tool passed or failed.
- **Run**
  Click this button to run the tool and create the Output String.
- **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. See “Configure Inputs” on page 3-272.



- **Link**
  To create a link to the Input Value from another property, click the Link icon. See “To create a link” on page 3-30. 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. See “Configure Inputs” on page 3-272.
- **Output String**
  The string created by the tool is shown here, along with the number of characters in the string.

NOTE: Non-printing ASCII characters in the Fixed Text and Input Delimiter fields are not displayed in the Output String, but they are included in the number of characters count and they are present in the output property.

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 here are based on the input's data type and affect how the input's values appear in the Output String.

Boolean

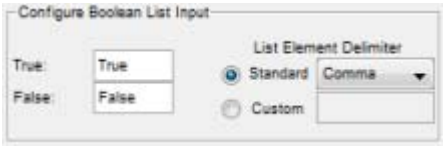
The True or False text (depending on the Input Value) is placed in the Output String.



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.

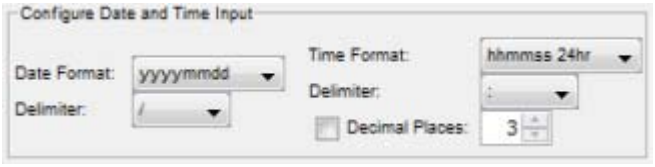


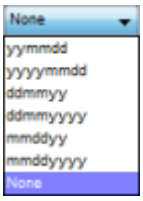


Date and Time

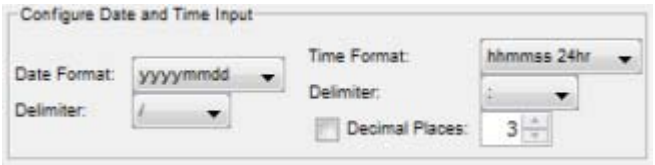
The current Date and Time when the tool runs is formatted then placed in the Output String.

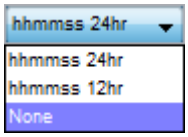
- **Date Format and Delimiter**
  In the format string, m = month, d = day, and y = year. The Delimiter is placed between the date elements. Select None to omit the date. For example, mmddyy with a slash (/) delimiter would yield 09/22/14.





- **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 12 hour time with a colon (:) delimiter and two decimal places would yield 07:58:01.05 PM. Select None to omit the time.



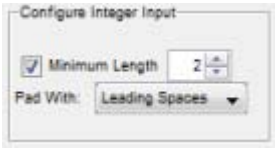


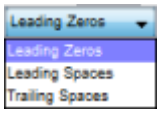
Integer

The Input is configured then placed in the Output String.

- **Minimum Length**

If checked, the Input value is padded with the indicated number of leading or trailing characters selected from the drop down.

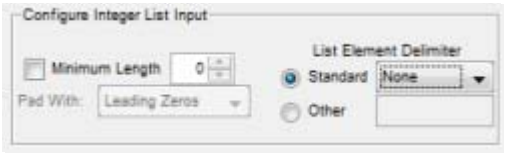




Integer List

Each element of the Input list is configured then placed in the Output String.

- **Minimum Length**
  If 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.

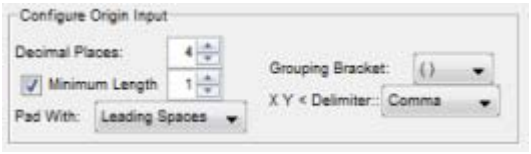


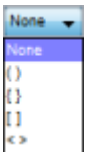


Origin

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 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.





Grouping Bracket



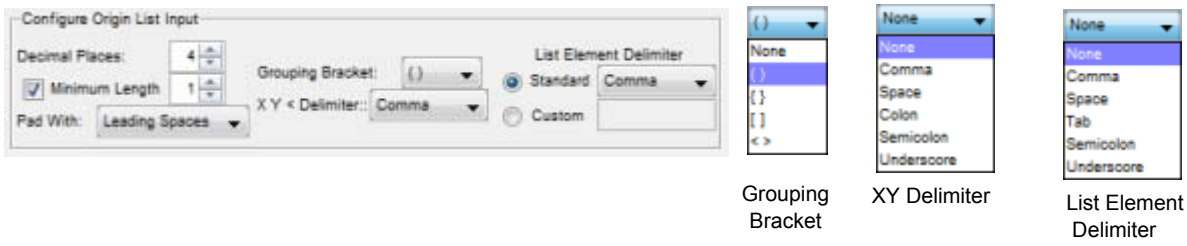
XY Delimiter

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 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 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

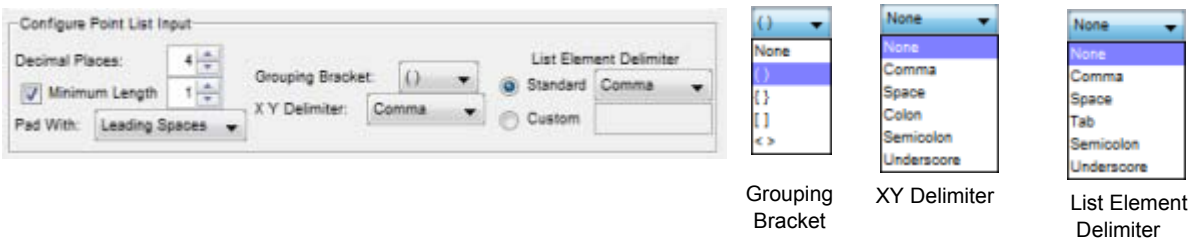
Point List

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 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.

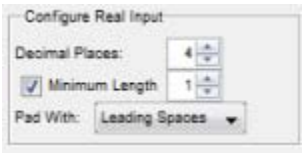


Grouping Bracket | XY Delimiter | List Element Delimiter

Real

The Input is configured then placed in the Output String.

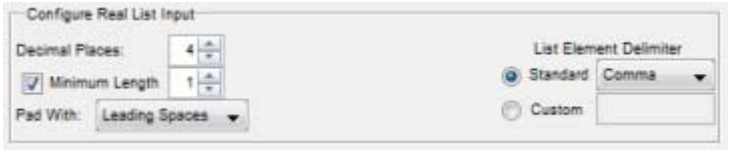
- **Decimal Places**
  This is the number of decimal places to use in the Output String.
- **Minimum Length and Pad With**
  If checked, the Output value is padded with the indicated number of leading spaces or zeros.



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 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.

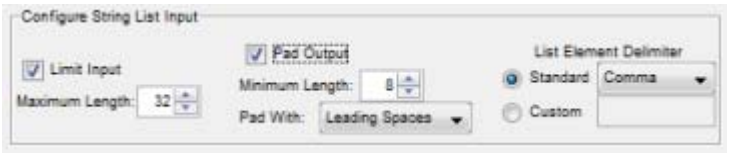
- **Pad Output**
  If checked, the Output value is padded to the Minimum Length with the indicated number of leading or trailing spaces.
- **Minimum Length and Pad With**
  If the Pad Output property is checked, the Output value is padded with the indicated number of leading or trailing spaces.



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 3-23.

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. Place tools that you want to use in the Case branch.

NOTE: The Default Case, which is always listed at the bottom of the Cases table, is only executed if none of the other Cases are executed. It cannot be deleted.

See “How to Set Up the Switch tool” on page 3-278.

Input Name	What it is
Data Type	The type of data to use for the switch condition. The characteristics of the Case statement change depending on this data type. NOTE: When you change this Data Type property, all Case data types are changed and their values are cleared.
Switch Condition	Case branches with a value that match the value of this property are executed. Case statements for Integer and Real Data Types accept an upper and lower value.
Case To Execute	First Matching - only the first Case that matches the Switch Condition is executed. All Matching - all Cases that match the Switch Condition are executed.
Match Substrings	This condition applies only to the string data type and selects which part of the Case value that the Switch Condition string value must match. (The tool searches the Case value for a substring that matches the Switch Condition value.) Exact - the entire Switch Condition string must exactly match the Case string. Beginning- the Switch Condition (sub)string must match the beginning of the Case string. Anywhere - the Switch Condition (sub)string must match any part of the Case string. End- the Switch Condition (sub)string must match the end of the Case string.
String Case Sensitivity	This condition applies only to the string data type. If True, the letter case of the Switch Condition string value and the Case string value must match.
Case 1...n	One or more named evaluation statements that are compared to the Switch Condition. Case statements for Integer and Real Data Types accept a range of values. To add a Case, click the Add button. The Case’s data type automatically matches the Switch Condition. Click the Name field to rename the property. To delete a Case, click the “X” button to the left of the name. More options are available in the Setup.
Default Case	This Case, which is always listed at the bottom of the Cases table, is executed only if none of the other Cases are executed. Its data type is Boolean and its property value is always True. It cannot be deleted.

Output Name	What it is
Passed	If True, at least one Case Statement was evaluated True and its branch executed. If False, all of the Case Statements were evaluated False and only the Default Case branch was executed.

How to Set Up the Switch tool

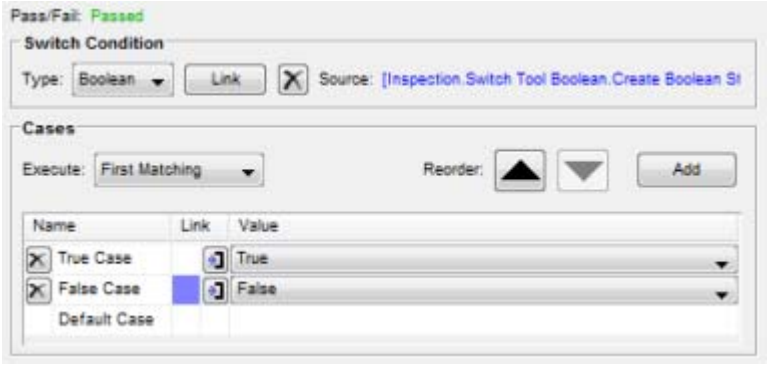
The Switch tool takes a user-defined value (Switch Condition), compares it to one or more values (Case Statement), then executes a branch (Case) based on the outcome. Case statements are executed in their order in the table. Place tools that you want to use in each Case branch. You can define the values 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.



- **Pass/Fail**
  If "Passed," at least one Case Statement (besides 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" below.

Configure Switch Conditions

The choices made here determine the data type and value that will be used for the Case comparison.



- **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 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**
  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

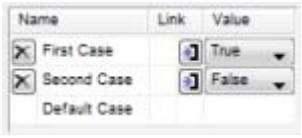
The configuration choices shown here are based on the Switch Condition data type.

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**
  Click in the name field to change the name.

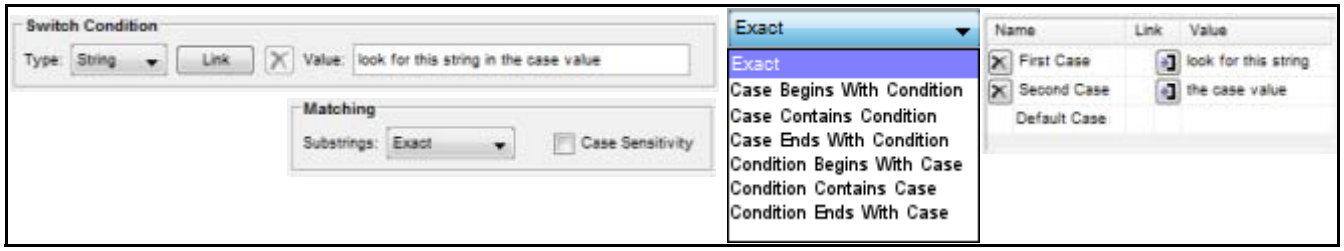
- **Value**
  This value is a range between to integer numbers (including the numbers). Enter two integer values, separated by a comma and surrounded by parentheses, then press Enter.
  Click the link arrow to link a value from another tool. The linked data type must be Range 1D. You cannot directly link an integer value into this field.

Real Case



- **Name**
  Click in the name field to change the name.
- **Value**
  This value is a range between to real 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



- **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 3-23.

Device Control Drawer

Camera Trigger

In the Device Control Drawer



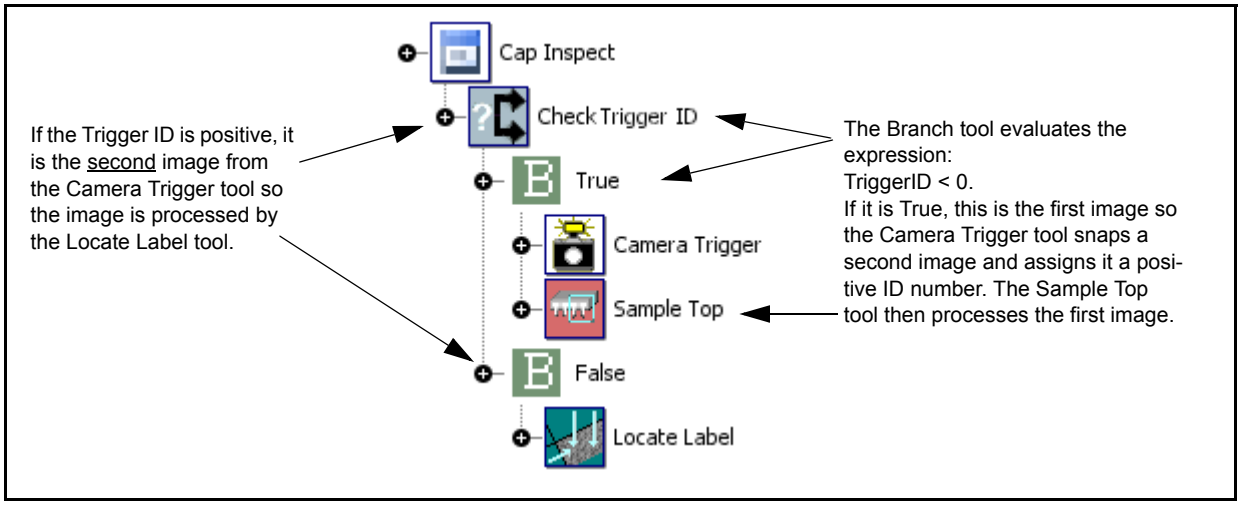
The Camera Trigger tool can force the Vision Device or Emulator to acquire an image without a hardware trigger. It is primarily used to vary the lighting by snapping a second image with different strobe settings.

In the example below, the task is initiated when the Vision Device or Emulator acquires the initial image of the dark areas of a part using the standard strobe settings (the Task Trigger type is ImageIn Event). This first image is automatically assigned a negative TriggerId number by the Vision Device or Emulator and queued to be processed. The Branch tool determines if the TriggerId (linked from the task TriggerId property) is positive or negative. If the TriggerId is negative (it is the first image), the tool is run.

When the tool runs, the Vision Device or Emulator acquires an image of the lighter areas of a part with a shorter strobe settings (less light) which triggers the ImageIn event and queues that image. The tool assigns the image a positive TriggerId number (entered in the tool’s Trigger ID input property). When the task finishes processing the first image, it runs again (because the tool caused an ImageIn event), and the Branch tool takes the True branch so the Sample Top tool processes the second image. In this example, the Branch tool expression is

```
TriggerID < 0
```

The tools in the False branch are executed if TriggerId is greater than zero.



Input Name	What it is
Strobe1Width	The amount of time strobe 1 should be on (microseconds).
Strobe2Width	The amount of time strobe 2 should be on (microseconds).
Strobe3Width	The amount of time strobe 3 should be on (microseconds).

Input Name	What it is
Strobe Update Method	Use System Strobe Settings: The strobe pulse length settings in Settings-Camera-General will control the strobes on time. Use Tool Strobe Settings Once: The Strobe Width settings from this tool inputs will control the strobes “on time” only the first time the tool runs. Change System To Tool Strobe Settings: The Strobe Width settings from this tool permanently change the strobe pulse length settings in Settings-Camera-General. (See “External Strobe - Pulse Length (microseconds)” on page 2-21)
Trigger ID	The number assigned by the tool to the acquired image.

Device Settings

In the Device Control Drawer



The Device Settings tool dynamically changes some of the settings on the Impact camera. Settings made with this tool are retained in the camera until they are changed in the VPM Settings Tab or another Device Settings tool.

Some settings are dependent on the type of camera being used. See “Camera Setup Tab” on page 2-20 for more details about these camera settings. If a setting does not apply to the camera being used, it is ignored.

Changing any of these settings 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 settings are being changed.

Input Name	What it is
Enable Camera Digital Shift	If True, the Camera Digital Shift value is sent to the camera when the tool runs.
Camera Digital Shift	Digital shift provides digital gain for the image.
Enable Camera Gain	If True, the Camera Gain value is sent to the camera when the tool runs.
Camera Gain	Gain adjusts the actual signal intensity of the camera.
Enable Camera Red Gain	If True, the Camera Red Gain value is sent to the camera when the tool runs.
Camera Red Gain	Adjusts the actual red pixel signal intensity of the camera.
Enable Camera Blue Gain	If True, the Camera Blue Gain value is sent to the camera when the tool runs.
Camera Blue Gain	Adjusts the actual blue pixel signal intensity from the camera.
Enable Camera Offset	If True, the Camera Offset value is sent to the camera when the tool runs.
Camera 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.

Input Name	What it is
Enable Camera Shutter Speed	If True, the Camera Shutter Speed value is sent to the camera when the tool runs.
Camera Shutter Speed	Shutter Speed (Open Time) indicates the amount of time the shutter is open. The higher the number, the longer the shutter is open and the brighter the image.
Enable Camera Internal Correction	If True, the camera's internal correction is enabled when the tool runs.
Camera Internal Correction	The camera's internal correction for gain and offset.
Enable Camera Trigger Edge Type	If True, the Camera Trigger Edge Type value is sent to the camera when the tool runs.
Camera Trigger Edge Type	This value sets the Camera Trigger type as follows: 1 = Rising Edge 2 = Falling Edge 3 = Both Edges (See "Frame Trigger Tab" on page 2-22) (Not available on M-Series and MX-U Series processors)
Enable Image Scan Left Edge	If True, the Scan Left Edge value is sent to the camera when the tool runs.
Image Scan Left Edge	This value sets the left edge where the camera's horizontal scan will start. The default value is determined by the camera type. (See *Note below this table)
Enable Image Scan Right Edge	If True, the Scan Right Edge value is sent to the camera when the tool runs.
Image Scan Right Edge	This value sets the right edge where the camera's horizontal scan will stop. The default value is determined by the camera type. (See *Note below this table)
Enable Image Scan Top Edge	If True, the Scan Top Edge value is sent to the camera when the tool runs.
Image Scan Top Edge	This value sets the top edge where the camera's vertical scan will start. The default value is determined by the camera type. (See *Note below this table)
Enable Image Scan Bottom Edge	If True, the Scan Bottom Edge value is sent to the camera when the tool runs.
Image Scan Bottom Edge	This value sets the bottom edge where the camera's vertical scan will stop. The default value is determined by the camera type. (See *Note below this table)
Enable Units Per Pixel	If True, the Units Per Pixel value is sent to the camera when the tool runs.
Units Per Pixel	Units per Pixel is the scale factor for converting measurements in the image to "real world" units.

Input Name	What it is
Enable Strobe 1 Duration	If True, the Strobe 1 Duration value is sent to the camera when the tool runs.
Strobe 1 Duration	Strobe 1 pulse length in microseconds
Enable Internal Lighting Mode	If True, the Internal Lighting Mode value is sent to the camera when the tool runs. See “Illuminator Tab (P-Series Cameras Only)” on page 2-30.
Internal Lighting Mode	The Internal Lighting type (Disabled, Normal, Power) See “Illuminator Tab (P-Series Cameras Only)” on page 2-30.
Enable Internal Lighting Chains	If True, the Internal Lighting Chains value is sent to the camera when the tool runs. See “Illuminator Tab (P-Series Cameras Only)” on page 2-30.
Internal Lighting Chains	The Internal Lighting Chain to enable (Central, Peripheral) See “Illuminator Tab (P-Series Cameras Only)” on page 2-30.
Enable First LED Chain	If True, the First LED Chain value is sent to the camera when the tool runs. See “Illuminator Tab (P-Series Cameras Only)” on page 2-30.
First LED Chain	If True, the First LED chain is turned on. See “Illuminator Tab (P-Series Cameras Only)” on page 2-30.
Enable Second LED Chain	If True, the Second LED Chain value is sent to the camera when the tool runs. See “Illuminator Tab (P-Series Cameras Only)” on page 2-30.
Second LED Chain	If True, the Second LED chain is turned on. See “Illuminator Tab (P-Series Cameras Only)” on page 2-30.
Enable Third LED Chain	If True, the Third LED Chain value is sent to the camera when the tool runs. See “Illuminator Tab (P-Series Cameras Only)” on page 2-30.
Third LED Chain	If True, the Third LED chain is turned on. See “Illuminator Tab (P-Series Cameras Only)” on page 2-30.
Enable Fourth LED Chain	If True, the Fourth LED Chain value is sent to the camera when the tool runs. See “Illuminator Tab (P-Series Cameras Only)” on page 2-30.
Fourth LED Chain	If True, the Fourth LED chain is turned on. See “Illuminator Tab (P-Series Cameras Only)” on page 2-30.

*__NOTE__: If the Impact camera is Online when any Image Scan value is changed, the camera stays Online but camera triggers are temporarily disabled and the image buffer is reallocated based on the new value. The image currently in the image buffer may be overwritten when a new image is acquired based on the new Image Scan value.

Offline

In the Device Control Drawer



The Offline tool places the currently connected Vision Device or Emulator offline when it runs. If the it is already offline, no action is taken. This tool has no inputs or outputs.

Online

In the Device Control Drawer



The Online tool places the currently connected Vision Device or Emulator online when it runs. If it is already online, no action is taken. This tool has no inputs or outputs.

Vision Program Load

In the Device Control Drawer



The Vision Program Load tool loads a vision program file onto the camera, Vision Device, or Emulator. If a file, or a program within the file, with the same name is currently loaded, a “Duplicate Name” error is displayed as the Abort Cause.

Input Name	What it is
Filename	The name of the vision program file to be loaded. The name is case sensitive. If you link the file name as a string, the .vp file extension must be included in the string. You can view the File Name and Program Name on the Settings tab under File Manager (see “File List” on page 2-40). IMPORTANT: File names are case sensitive.

Vision Program Save

In the Device Control Drawer



The Vision Program Save tool saves the current vision program file when it runs. There are no output values.

Input Name	What it is
Filename	The name of the vision program file to be saved, without the file extension (.vp is added by default). If you enter the name of an existing file, that file is overwritten.
Program Name	The name of the program in the vision program file.
File Save Mode	Save as XML: the file is saved in XML format Save Compressed: the file is save in compressed binary format. This format creates smaller files which load faster. All files with password protection are saved in this format.

How to Use the Vision Program Save tool

Use this tool when you want to save the current vision program file. If the file is saved with a new name, the file is saved with the new name, then loaded.

To save the current vision program file with the same name, leave the Filename and Program Name properties blank.

CAUTION: If you enter the name of a vision program file that already exists, the existing file is overwritten without a warning.

To save the current vision program file, but with a different name (Save As), enter the new name in the File-name property. Leave the Program Name property blank. The file is saved with the new name, then loaded.

Vision Program Unload

In the Device Control Drawer



The Vision Program Unload tool unloads the program named "Program Name." If the program is not currently loaded, no action is taken.

Input Name	What it is
Program Name	The name of the program to be unloaded. You can view the Program Name of currently loaded programs on the Settings tab under File Manager (see "File List" on page 2-40).

Specialized Drawer

Change Image Calibration

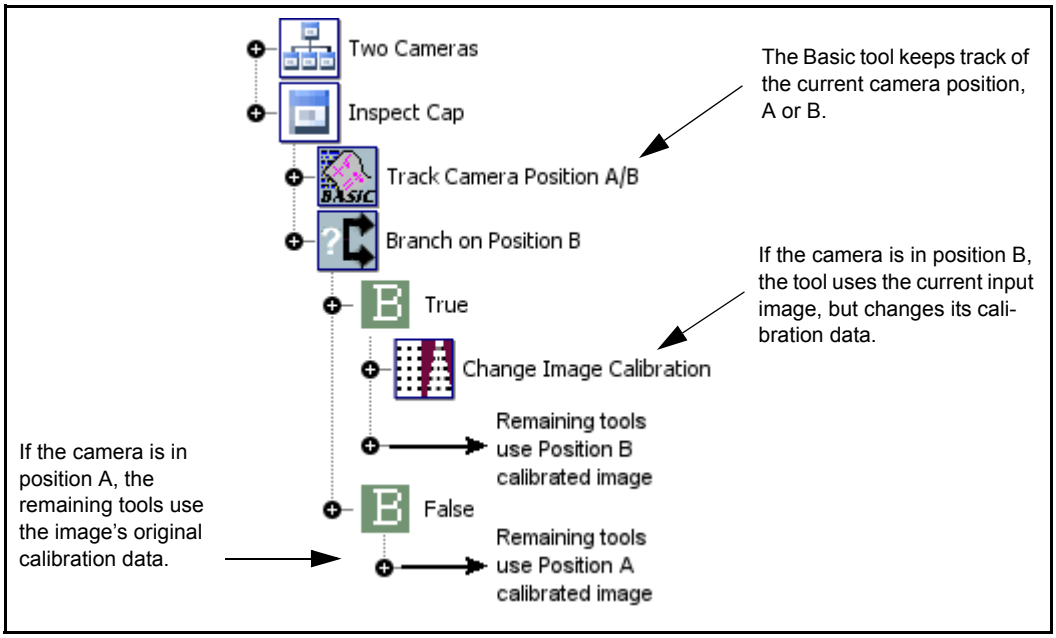
In the Specialized Drawer



The Change Image Calibration tool is intended for use in situations where the camera or part moves to a new position that requires a different calibration between camera snaps. The input image's calibration data are replaced with the calibration data stored in the tool. The camera's calibration is not changed.

This tool has one input, the image, and no outputs.

Here is an example of using the Change Image Calibration tool.



This example assumes that there are two camera positions, A and B, and that the camera moves between positions for each snap.

To set up the Change Image Calibration tool:

1. Create a task with the tools shown in the diagram. Create code in the Basic tool to keep track of the current camera position so that the appropriate branch is taken in the Branch tool.
2. Position the camera and part at position B.
3. Use VPM Settings Tab - Camera - Setup - Calibration to calibrate the camera.
4. In this step, it is important that the Change Image Calibration tool does NOT run when the image is snapped, that is, before it is trained. In VPM, snap the position B image. On the Change Image Calibration tool's Properties tab, click the train button. The tool stores the calibration data for position B in the tool.
5. Position the camera and part in position A.
6. Use VPM Settings Tab - Camera - Setup - Calibration to calibrate the camera again. This will store the calibration data for position A in the Impact camera.
7. Be sure that the input image for all image processing tools (in both branches) is linked to use the task input image. Run the task.

Since the camera is calibrated for position A, all camera images are calibrated for position A by default, and there is no need for a Change Image Calibration tool trained at position A. When the Change Image Calibration tool runs, it will put the stored calibration data for position B into the image. All the tools that follow it will use the image with calibration B, even though they are using the current input image.

Clip ROI

In the Specialized Drawer



The Clip ROI tool clips several types of ROIs to insure that they lie within the Input Image. If an ROI is forced off the screen by part movement, the tool aborts and this may end the task prematurely. The clipped ROI is available as an output.

Input Name	What it is
Input Image	The image being inspected
Tool Origin	The tool's origin relative to the entire image space
Input Rectangle	The rectangular area within which the clipped ROI should stay
Input Wide Line Segment	The wide line area within which the clipped ROI should stay
Input Line Segment	The line area within which the clipped ROI should stay

Output Name	What it is
Success	If True, the ROI was clipped successfully
Clipped Rectangle	The clipped rectangle ROI
Clipped Wide Line Segment	The clipped wide line segment ROI
Clipped Line Segment	The clipped line segment ROI

Data Transfer

In the Specialized Drawer



The Data Transfer tool has one fixed output, and it provides a variety of inputs that vary, depending on the data type selected. Each data type has a specific set of data elements that can be accessed.

To create a new input, click Add Input, then select the data type from the properties drop down.

When this tool executes, the appropriate data values are sent to all the CPM controls that are linked to the tool in all the connected control panels. If Data Transfer Tool Timeout is enabled, and a control panel does not respond within the indicated time, the transfer is terminated. See “Enable Timeout” on page 2-7.

Output Name	What it is
Passed	If False, there is no control panel connected to receive the transferred data, or the transfer failed for some other reason. The Data Transfer Tool Timeout setting does not affect this property.

Grid Statistics

In the Specialized Drawer



The Grid Statistics tool provides extensive statistics about a series of points in a grid pattern. This tool can be used analyze components such as contacts on electrical connectors, Ball Grid Array (BGA) ball spacing, or other components where a grid of found points must be compared to an ideal list.

This Grid Statistics tool matches an Ideal Points list and an Actual Points list within a given set of tolerances. The point lists are both assumed to be relative to the same origin, and MUST be in the same order, i.e. lowest X coordinate to highest X, lowest Y to highest Y (relative to the tool origin).

The Grid Statistics tool is similar to the Point Match tool, with several significant differences:

- The Grid Statistics tool requires that the Ideal Grid Points list and Actual Points list be ordered in the same sequential order, which must be from lowest X to highest X, lowest Y to highest Y (relative to the tool origin).
- The Grid Statistics tool always performs a Best Fit operation on the Ideal Grid Points list relative to the Actual Points list. This is done to correct for locating errors which will minimize the errors that would be associated with incorrectly referencing the Actual Points data to the Ideal Points data.
- The Point Match tool will run noticeably faster than the Grid Statistics tool for large point lists. The difference in execution time is less noticeable on point lists less than 100 points in length.

Input Name	What it is
Input Image	The image being inspected.
Tool Origin	The tool’s origin relative to the entire image space
Ideal Grid Points	A point list representing an ideal part that is used as a template for comparison. The Ideal points MUST be presented in the sequence left to right, top to bottom.
Actual Points	A point list taken from a test part that is used to determine whether the part is defective. This point list MUST be in the same order relative to the Ideal point list (i.e. left to right, top to bottom).

Input Name	What it is
Pitch Calculation Method	Pitch to Next Row/Column: this specifically addresses "staggered" or "hexagonal" grids. Also, The last row and column have a pitch calculated back to the previous row or column, so that every point has x and y pitch values. Pitch to Next Point: the pitch is calculated to the point to the right, for X, and the point below, for Y. This will fit a line to each row and column and calculate the pitch as the distance from the point to the next row or column, even if the next row or column is staggered. This option works best on uniform point grids that have a constant pitch in X and Y across the entire grid.
Minimum X Pitch	The minimum x-coordinate distance allowed between consecutive points or rows
Minimum Y Pitch	The minimum y-coordinate distance allowed between points or rows
Create Pitch Segments	If True, the X pitches and Y pitches between the Ideal points and corresponding Actual points are created as output Line Segment lists. A separate output Line Segment list is provided for the X Pitches and the Y Pitches.
Enable XY Offset	If True, the X Offsets and Y Offsets between the Ideal points and corresponding Actual points are used to check the position of the Actual Points, and the measured X Offset and Y Offset values are created as output real lists.
Maximum X Offset	The Maximum +/- X axis error allowed for an Actual point relative to the corresponding Ideal point. This measurement is independent of all other measurements.
Maximum Y Offset	The Maximum +/- Y-axis error allowed for an Actual point relative to the corresponding Ideal point. This measurement is independent of all other measurements.
Enable Radial Offset	If True, the Radial Offsets between the Ideal points and corresponding Actual points are checked with the Maximum Radial Offset input as the tolerance and the results created as an output real list.
Maximum Radial Offset	The maximum Euclidean distance to allow between corresponding points. Large Radial offset values will cause highly ambiguous matching and infinite tolerance values are considered an error.
Maximum Grid Radial Offset	The maximum Euclidean distance allowed to offset the entire Ideal Grid relative to the Actual Points to minimize errors and optimize the X Offset and Y Offsets to a mean of zero.
Extra Point Test	If True, the extra points in the actual point list will cause the In Tolerance output to be False.

Output Name	What it is
In Tolerance	If True, all of the actual points have exactly one corresponding ideal point that is within the given tolerance and no more points. If the Extra Points Test is True, then extra points will not cause the fit to be outside the tolerance. (i.e. a one to many mapping is allowed)
Results	If a value in this list is true, the corresponding ideal point has a point within tolerance in the actual point list. If the value is false, the matching point is either out of tolerance or missing. Missing points will report all measurement values as zero (X Offset, Y Offset, Radial Offset, X Pitch, Y Pitch).
X Pitches	The Actual X Pitch distances between consecutive points or Columns using the Actual Point list data. The last point in a row or column in the grid will have a pitch value calculated to the previous column or point in the row.
Y Pitches	The Actual Y Pitch distances between consecutive points or Columns using the Actual Point list data. The last point in a column or row in the grid will have a pitch value calculated to the previous row or point in the column.
Pitch Results	A list of the pass/fail status of the X and Y Pitch measurements between sequential Actual Points. If a value in this list is true, the corresponding X Pitch and Y Pitch between consecutive Actual Points is within tolerance. Missing points are reported as false.
Pitches OK	If True, all of the X and Y Pitch results are within tolerance.
X Pitch Segments	A line segment list of the X Pitch distances between consecutive Actual points. The line segment list can be used to display the measurement results graphically in CPM.
X Pitch Results	A list of the pass/fail status of the X Pitch measurements for each Actual Point. If a value in this list is true, the corresponding X Pitch between the current and next Actual Points is within tolerance. Missing points are reported as false.
Y Pitch Segments	A line segment list of the Y Pitch distances between consecutive Actual points. The line segment list can be used to display the measurement results graphically in CPM.
Y Pitch Results	A list of the pass/fail status of the Y Pitch measurements for each Actual Point. If a value in this list is true, the corresponding Y Pitch between consecutive Actual Points is within tolerance. Missing points are reported as false.
X Offsets	A list of the X Offset distances from Ideal points to the corresponding actual points. Missing points have zero distance. Ideal Point (1.0,YI) and Actual Point (1.1,YA) would be reported with an X Offset = XA - XI = 1.1 - 1. 0 = 0.1
Y Offsets	A list of Y Offset distances from ideal points to the corresponding actual points. Missing points have zero distance. Ideal Point (XI,3.0) and Actual Point (XA,3.1,) would be reported with a Y Offset = YA - YI = 3.1 - 3. 0 = + 0.1

Output Name	What it is
Radial Offsets	A list of distances from ideal points to the corresponding actual points. Missing Actual points for an Ideal point result in a zero distance. The Euclidean distance measured between corresponding points. Ideal Point (XI,YI) = (1.0, 3.0) and Actual Point (XA,YA) = (1.1,3.1) would be reported with: Radial Offset = Sqrt [(XA - XI)2 + (YA - YI)2]
Extra Points	A subset of points from the Actual point list that have no corresponding Ideal point within tolerance. If more than 1 Actual point is near a single Ideal Point, then the closest Actual point is used as the Actual point to match with the Ideal Point and the other points are listed as Extra points.
Ideal Points Relative to Tool Origin	A copy of the Ideal point list that have been moved by a distance equal to the Grid Offset coordinate. This is the X Offset, Y Offset, and Angle that the entire grid would be moved to perform the Best Fit alignment of the Ideal point grid to the Actual point grid. The Ideal Points Relative to Tool Origin can be used to show the final test locations of the Ideal point grid after the Best Fit operation is completed.
Grid Offset	The actual X Offset, Y Offset, and rotation angle used to offset the entire Ideal Grid relative to the Actual Points to minimize errors and optimize the X Offset and Y Offsets to a mean of zero. The Grid Offset is given an Origin data type, and the values are applied to the Ideal Grid point list. The results of the Grid Offset operation are available as the Ideal Points Relative to the Tool Origin Point List output.
Grid Radial Offset	The Maximum Euclidian distance for the Ideal point to be offset in order accomplish the Best Fit of the Ideal Grid Points to the Actual Point grid.
Grid Radial Offset OK	If True, the Euclidian distance of the Grid Offset listed in the Grid Radial Offset output is less than the Maximum Grid Radial Offset input.

Lead Statistics

In the Specialized Drawer



The Lead Statistics tool provides extensive statistics about the pitch, width, and length of part leads. This tool is used primarily to test leaded parts.

Train

In the Specialized Drawer



When the Train tool runs, it automatically trains the tool that is linked to the Tool To Retrain property.There are no inputs, but there is an additional General property called Tool To Retrain.

To select the tool you want to Train

1. Click the link icon for the Tool To Train property.
2. Select the desired tool from the task tree. Only tools that can be Trained are highlighted.

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 Communication 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.

Input Name	What it is
Green Spot	If True, the green LED is turned on, then off.
Red Spot	If True, the red LED is turned on, then off.
Delay	The number of milliseconds to delay before turning the LED on.
Dwell	The number of milliseconds to keep the LED on.

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 Dwell" on page 3-234 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 Dwell" on page 3-234 for more details.

Display

See “Display panel” on page 3-23.

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 6-17

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 6-17.

The tool has two additional General properties - Offset and Station Name.

- **Offset** - This value indicates the exchange area location where the tool should begin reading. This allows multiple tools to read from the exchange area.
- **Station Name** - The name for the camera (as an alternative to an IP address) which identifies it on the network. The name can contain any combination of up to 63 letters (a-z), numbers (0-9) and a hyphen (-).

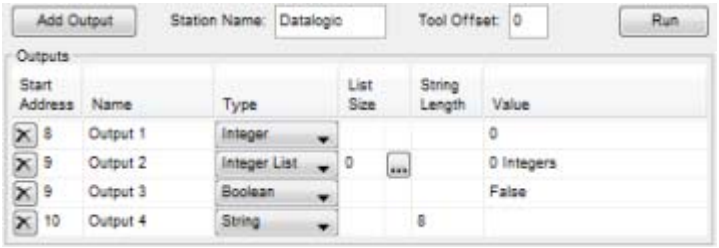
How to Set Up the ProfinetIO Read tool

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.



- **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 3-23.

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 3-294.)

For details about the exchange area, see "PROFINET" on page 6-17.

The tool has two additional General properties - Offset and Station Name.

- **Offset** - This value indicates the exchange area location where the tool should begin writing. This allows multiple tools to write to the exchange area.
- **Station Name** - The name for the camera (as an alternative to an IP address) which identifies it on the network. The name can contain any combination of up to 63 letters (a-z), numbers (0-9) and a hyphen (-).

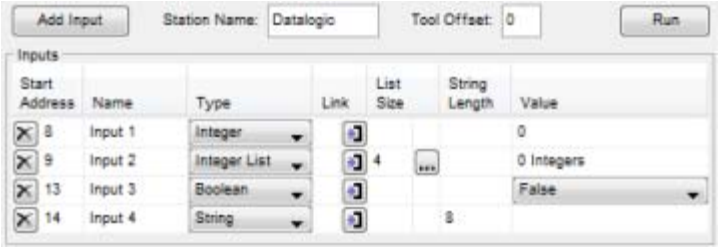
How to Set Up the ProfinetIO Write tool

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.



- **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 3-23.

CHAPTER 4

Control Panel Manager

Introduction to CPM

This section discusses the Control Panel Manager (CPM), the graphical tool for creating Control Panels. The camera, Vision Device, or Emulator can be accessed from any client computer on the network that has the software installed on it.

Help CPM



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.

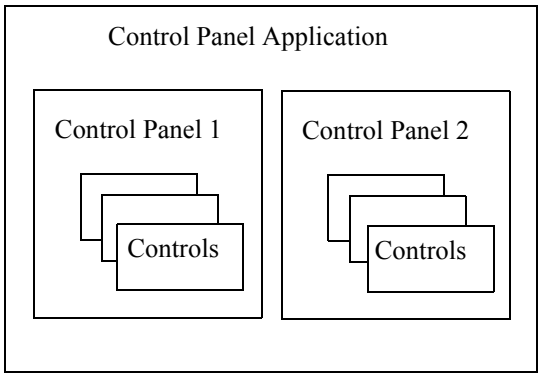
Start CPM

To start Control Panel Manager:

1. Double-click the CPM shortcut on the desktop.

CPM - An Overview

CPM is used to develop Control Panel Applications for vision inspection programs. A Control Panel Application is a collection of Control Panels. The panels contain controls that exchange data with vision inspection programs running on the camera, Vision Device or Emulator. Controls display data on the client computer's monitor for the Control Panel operator to see, and they can provide operator control over the inspection.The vision program you want to control must be loaded on the currently connected device.



Data exchange can be initiated manually (by an operator pressing a button, for example), at a specified time interval, or by another control changing state (an alarm state, for example). Multiple Control Panels can be combined into one Control Panel file.

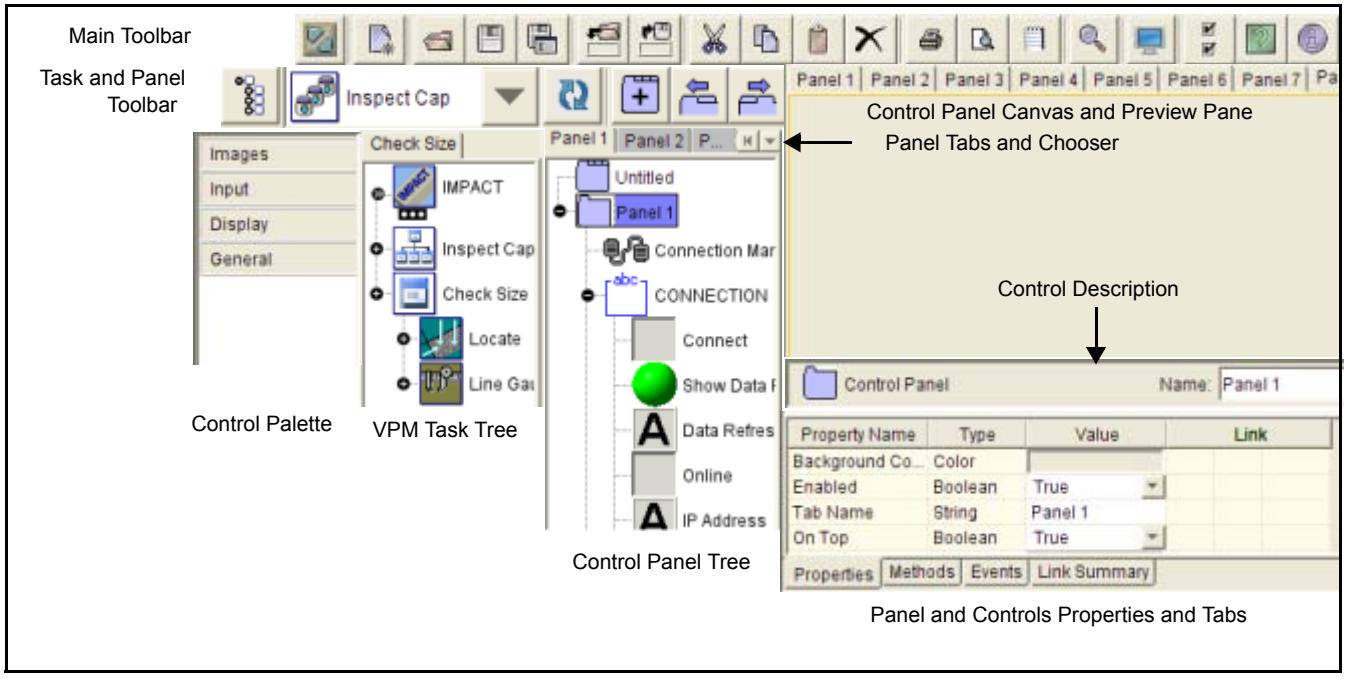
CPM Security

When you open a Control Panel in CPM, the Connector Control may attempt to connect to a camera, Vision Device, or Emulator. If security is enabled, the User LogOn dialog is displayed. You must enter a valid user ID and password to connect the Control Panel. If you do not log on, you can still modify the Control Panel, but you will not be able to update any data or images on the Control Panel.
Note: Camera security is independent of the security enabled by the CPM Password control. (See "Password" on page 4-57 for details about the Password control.)

See "Impact Vision Device and Camera Security" on page 2-13 and "Vision Device Security" on page 4-116 for more details about CPM security.

CPM User Interface

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



Main Toolbar-CPM

Use the main toolbar tools to manipulate controls and Control Panel Applications.



Connect to Vision Device

Click this button to connect CPM to a camera, Vision Device, or Emulator. (See "Choose a Vision Device or Emulator" on page 1-4 for more details.) When CPM is connected, the button changes to the Disconnect button.

This connection is not the same as the one provided by the Connector control. When you connect with this button, CPM is connected to the camera, Vision Device, or Emulator so that the VPM Task(s) can be displayed. You can then make links between the task tool's properties and the Control Panel. Links to VPM cannot be created if this button is disconnected.

When a link is made between the VPM task and a control on the Control Panel, if there is no Connector control for that camera, Vision Device, or Emulator, one is automatically added to the panel and connected. If there is already a Connector control, the link is added and its Connected value set to True. If there are no links between CPM and the displayed task, no Connector control is needed.

In contrast, the Connector control connects the Control Panel to the camera, Vision Device, or Emulator so linked values can be displayed and set. This connection is made when you set the Connector control's Connected property to True.

When you open a Control Panel Application file, you may need to set the Connector control's Connected property to True so data values and images are updated with current VPM values.

The following scenarios may occur while creating links:

Connect Button	Connector Control Exists	Link Added	Result
Connected	No	No	VPM Tree can be displayed
Connected	No	Yes	Connector Control added and connected; link is added; VPM Tree can be displayed
Connected	Yes	No	VPM Tree is displayed; Connector control may or may not be connected
Connected	Yes	Yes	Link is added; VPM Tree can be displayed
Disconnected	Yes	Not Possible	VPM Tree cannot be displayed; Control panel's connected status determined by Connector control
Disconnected	No	Not Possible	VPM Tree cannot be displayed; Control panel is not connected

Sharing a camera with VPM

The first VPM program to connect to a camera, Vision Device, or Emulator acquires exclusive editing privileges on it. When a program is being edited, CPM control panel designers can connect to the camera, Vision Device, or Emulator and create links, but they cannot modify data in vision program properties. (See "Special Case Editing" below.) When the first VPM disconnects from the camera, Vision Device, or Emulator, a CPM control panel can then connect to it.

Special Case Editing

When CPM is running on the same client PC as the VPM program that is editing on the camera, Vision Device, or Emulator, CPM can modify (set data) in vision programs. To use this special case, start VPM and load the program that you want to edit. Then, start CPM and load the control panel you want to edit. You can now modify vision program property values and test the control panel.



New Application

This opens a browser so you can load a Control Panel template to create a new Control Panel Application. Only one Control Panel Application may be open at a time. An application may contain multiple Control Panels. Several templates are provided with CPM, or you can click the Create Empty Application button to create one. You can also create controls or groups of controls, then save them as Control Panel templates.

See “Control Panel Application” on page 4-9 for more details on creating a Control Panel Application.



Open Application

This opens a browser dialog so you can open an existing Control Panel Application.



Save Application

This saves the currently open Control Panel Application. If you save the Control Panel Application while any Connector controls in the Application are connected (the Connected property is True), the Connector controls will try to reconnect to their IP Addresses when the Application is loaded. If any of the connected cameras, Vision Devices, or Emulators have security enabled, you will need to enter a User ID and Password for each when the Application is loaded.



Save Application With A New Name

This saves the currently open Control Panel Application with a new name. You can save the file with password protection. See “Control Panel Application Security” on page 4-10. If the Connector control Connected property is True, CPM will try to connect to the IP Address value when the Control panel is loaded.



Add Template

Control Panel templates are a predefined group of controls that you can insert into your Control Panel. This button opens a browser dialog so you can select an existing template.



Save Template

You can create controls or groups of controls, then save them as Control Panel templates and insert them into a Control Panel. This button opens a browser dialog so you can save the template.



CPM Cut

This button cuts a control to the system clipboard so you can paste it into a different place or Control Panel. The original control is deleted.



CPM Copy

This button copies a control to the system clipboard so you can paste it into a different place or Control Panel.



CPM Paste

This button pastes a control from the system clipboard to a position below the currently selected control in the control tree.



CPM Delete

Use this button to delete a control or a Control Panel. To delete a control, select a single control in the control tree. To delete a Control Panel, select the Control Panel tab. When a control is deleted, if there are no other links to it in the Connector control, the links are removed in the Connector control.

Print Control Panel Tree



Use this button to print a formatted, expanded list of all properties and values in the currently selected application, Control Panel, or control to a chosen printer. (Connector Control Events, Methods, and Links are not listed.)

Control Panel Tree Print Preview



Use this button to preview a formatted, expanded list of all properties and values in the currently selected application, Control Panel, or control.

Control Panel Tree Print To Text File



Use this button to print an expanded list of all properties and values in the currently selected application, Control Panel, or control to a text file.

Full Screen Design Viewing



Use this toggle button to preview the “look and feel” of the Control Panel you are creating in full screen view. The preview pane is expanded and the control tree and palette are closed. You can move, resize, and test controls in this view, but no live data is displayed.

Design/Run Mode



Use this toggle button to put the Control Panel in Run or Design mode. In Run mode you cannot move and resize controls because they are live. If the camera, Vision Device, or Emulator is online, and the linked tools are running, controls will display live data from the vision program. In Design mode you can create, modify, and delete controls.

NOTE: If the Control Panel is connected to a camera, Vision Device, or Emulator, and it is put into Edit mode in VPM, a “Action Blocked” message is displayed because the Control Panel cannot set data or execute methods on the camera, Vision Device, or Emulator while it is locked.

Edit Preferences



This button opens a dialog to set the following parameters:

- **Auto-create Control Panel .bak backup file**: creates a backup file of the Control Panel (with a .bak extension) each time the Control Panel Application file is opened.
- **Remember last Vision Device address entered**: saves the current IP address when the Control Panel Application file is saved.
- **Use small icons**: Small program and tool icons are displayed.
- **Display debugging information**: A window displays each property set or method execution with a time and date stamp. This setting reverts to Off each time CPM is closed.
- **Text Size**: If default is selected, CPM will use Window’s default font size for all displayed text. If Custom is selected, you can enter the font size you want CPM to use.

- **Snap to grid during design**: If this is selected, controls are aligned to a grid during design mode. Enter the grid spacing, in pixels.
- **Use internal on-screen keyboard**: If this is selected, and Enable automatic on-screen keyboard is checked, an internal built-in, on-screen keyboard application is used for entering text and numbers. See “On-Screen Keyboard” on page 6-32 for details.
- **Use External on-screen keyboard**: If this is selected, and Enable automatic on-screen keyboard is checked, an external, third-party, on-screen keyboard is used for entering text and numbers. See “On-Screen Keyboard” on page 6-32 for details.
- **Enable automatic on-screen keyboard**: If this is checked, the on-screen keyboard is enabled.



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 Control Panel Manager

- This displays version and build information about CPM.

Task and Panel Toolbar

Use the task and panel tools to interact with VPM and manipulate Control Panels.

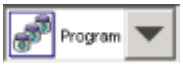


Select Design View Options

When you click this button, a dialog is displayed so you can select whether to show or hide the Control Palette (see “Control Palette” on page 4-7), VPM Task Tree (see “Vision Program Tree” on page 4-7), and Control Panel Tree (see “Control Panel Tree” on page 4-8). In the dialog, click the view you want to display.



Select Program CPM



This list shows all the programs that are loaded on the camera, Vision Device, or Emulator where CPM is currently connected. When you select one, it is displayed in the VPM Task tree. If there are no programs in the list, either CPM is not connected (see “Connect to Vision Device” on page 4-2), or there are no programs loaded on the camera, Vision Device, or Emulator.



Refresh VPM Tree

Click this to refresh the VPM Tree display. The VPM Tree shows the vision program currently selected in the Select Program dropdown. If any changes are made in the VPM program, you need to refresh the display to show the changes.



Add a Control Panel

See “Control Panel” on page 4-11 for more details about adding Control Panels to a Control Panel Application.

Control Palette

Open/Close Control Groups

(Control Palette must be enabled. See “Select Design View Options” above.) Controls are grouped in the palette according to common functions. Click the control group header to open or close the group list. Individual controls are explained in more detail under “CPM Controls” on page 4-24.

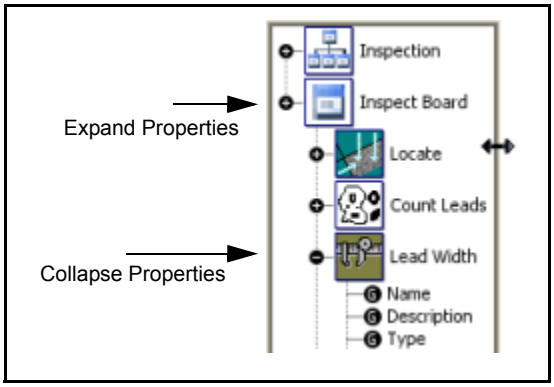
Vision Program Tree

The Vision Program Tree area shows the program currently selected with the Select Program drop down in VPM (the task must be loaded in VPM). From this tree you can link task and tool properties to controls on the Control Panel.

NOTE: You cannot modify the VPM task in this view. You must use VPM to modify the task.

To display the Task Tree, click Select Design View Option, then select Vision Program Tree from the list. (See “Select Design View Options” on page 4-6.)

The Task Tree displays the structure of the vision system programs, tasks, and tools.



Expand or collapse properties: Click the Expand or Collapse Properties icon . While properties are expanded, tool values are visible and you can create links between VPM and a Control Panel.

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.

This is an example of a tool with the properties expanded, showing the Input, Output, and Method properties.



Control Panel Tree

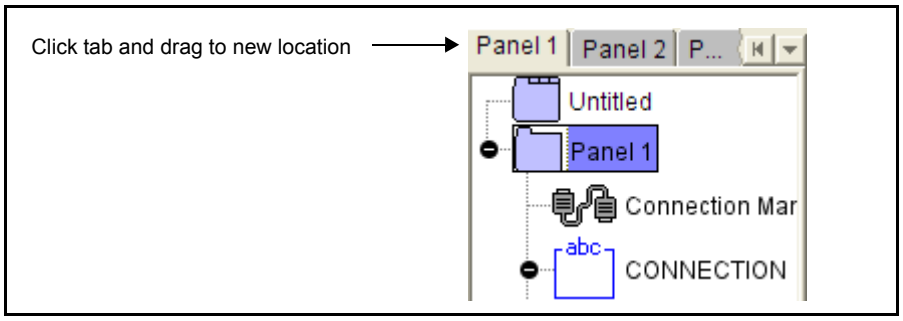
(Control Panel Tree must be enabled. See “Select Design View Options” on page 4-6.)

This is a graphic representation of the controls on the Control Panel Canvas. Controls do not need to be in any particular order. You can add controls here or on the Canvas. As a control is added to the tree, it also appears in the Control Panel Canvas, and vice-versa

NOTE: The following controls are displayed only in the Control Panel Tree, not in the Control Panel Canvas: Basic, Execute Command, Connector, Load Image, Load Vision Program, Save Vision Program, TCP-IP Logger, and Timer. See the individual control descriptions for details.

Panel Tabs and Chooser

Click a tab to display a panel. If the number of panels exceeds the list area, the Panel Chooser is displayed. Click the left arrow on the Panel Chooser to select the leftmost panel, or click the down arrow to select any panel. To rearrange the tabbed panel’s order, click the tab and drag it left or right to the desired location.



Move Up/Down in Tab Order

Controls do not need to be in any particular order in the control tree, but you can rearrange them if desired.

To change the order of controls

1. Select the control you want to move in the Control Tree.
2. Click and drag the control up or down then release it in the desired location.



Control Panel App

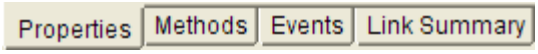
Click this icon to access Control Panel Application properties. See “Control Panel Application” on page 4-9 for details about creating a Control Panel Application and its properties.

Control Panel



Click this icon to access Control Panel properties. See “Control Panel” on page 4-11 for more details about creating a Control Panel Application.

Panel and Controls Properties and Tabs



The tabs in this area allow you to view and define properties, methods, events, and view existing links for a Control Panel and controls. (The Connector control has additional tabs. See “Impact Connector” on page 4-111.)

A **property** is a visible aspect of a control like color, transparency, label, or size. Properties are defined in different ways. Some are typed into the value field, for others you click in the field to select from a list or palette, and some can only be linked to another property or a vision program tool. You can only link a property to a property.

A **method** allows you to affect the behavior of a control based on an event. For example, you can enable, hide, or change the state of controls. You can only link an event to a method.

An **event** occurs when a control property or state changes, for example when a button changes state or a check box is checked. You can only link an event to a method (events are "Source Only.")

The **Link Summary** displays all the links to and from the selected control. See page “Links between CPM controls” on page 4-19 for more details about links.

More information about each control’s properties, methods, and events is listed with the controls starting with “CPM Controls” on page 4-24.

Control Panel Application

A Control Panel Application is a collection of one or more Control Panels. Control panel applications are saved in a Control Panel Application file (with a ".cp" file extension). Each Control Panel Application file must have a unique name, although Control Panels with the same name may be stored in different Control Panel Application files.


New

To create an empty Control Panel Application

1. Click the New Control Panel Application button.
2. Click the Create Empty Application button in the Select Template browser.

3. Add Control Panels as desired. (See “Control Panel” on page 4-11.)

To create a Control Panel Application from a template

1. Click the New Control Panel Application button.
2. Select a template from the Template browser and click Add.
3. Select a location on the Control panel for the template and left-click that location. If you click Cancel, you will create an empty application.


Save

4. Add Control Panels as desired. (See “Control Panel” on page 4-11.)
5. Click the Save Control Panel Application button in the toolbar to save the application.

The following Control Panel Application properties are available.

Property Name	What it is
Filename	The Application’s file name, which must have a ".cp" extension. IMPORTANT: File names are case sensitive.
Panel Tab Font	Selects the display font for all the Control Panel tabs
Panel Tab Height	Sets the tab height for all the Control panels, in pixels. A value of zero automatically adjusts to accommodate the tab font size. A value of -1 hides the tab. In this case, you must provide some other way (such as a toggle button control) to access the tabs
Width of Panels	Sets the width of all the Control panels, in pixels, when CPM is in Full Screen Design Viewing mode or Run mode. Set this value based on the screen resolution of the PC where the application will eventually run.
Height of Panels	Sets the height of all the Control panels, in pixels, when CPM is in Full Screen Design Viewing mode or Run mode. Set this value based on the screen resolution of the PC where the application will eventually run.
Recommended Width/Height of Panels	These dimensions are calculated based on your PC’s current screen resolution setting.
Recommended Height of Panels without Toolbar	Set the Height of Panels value to this value if the application will be run with CPM Runtime with no toolbar displayed.
Control Color	This property controls how some input controls are displayed in a control panel. For more details, see each control’s properties. System: The controls have rounded corners and a "3D" look. The Button Color and Border Painted properties for the Button and Toggle Button are disabled. New control panel applications default to this setting. CPM Classic: The controls have square corners and a "flatter" look. The Button Color and Border Painted properties for the Button and Toggle Button can be modified. Older control panel applications will default to this setting.

Control Panel Application Security

You can password protect a Control Panel Application when you save it. A password protected file is automatically saved in compressed binary format and the application cannot be edited, printed, viewed, or saved.

NOTE: Control panel application security protects the application (all Control Panels) from unauthorized access. Control Panel security protects individual Control Panels from unauthorized access. (See "Password" on page 4-57 for Control Panel security.) Camera security protects the Impact camera from unauthorized access. (See "Impact Vision Device and Camera Security" on page 2-13.)

To password protect a Control Panel Application

1. Click the Save As icon in the main toolbar.
2. In the Save As dialog, click the Advanced button.
3. Check the Save With Password Protection check box.
4. Enter and confirm the desired password.
5. Click OK.

To edit, run, or print a password protected Control Panel Application

1. Click the Open Control Panel Application icon.
2. Select the file to open and click Open.
3. Enter the Password in the Enter Password field of the dialog and click OK.
4. If you edit the application, then save it, it will still be password protected when you close it.

To remove password protection from a Control Panel Application

1. Open the password protected application.
2. Click the Save As icon in the main toolbar.
3. In the Save As dialog, click the Advanced button.
4. Clear the Save With Password Protection check box.
5. In the File Name field, enter the existing application name, or a new one. IMPORTANT: File names are case sensitive.
6. Click OK.

Control Panel

A Control Panel is a collection of controls. You can add controls to the Control Panel Canvas and arrange them as desired, then link the desired properties, methods, and events.

To add a Control Panel to a Control Panel Application



1. Click the Add a Control Panel button.
2. Click the Select Design View button and select the Control Palette option so the Control Palette is displayed.
3. Add controls to the panel as desired. See "Add Controls to a Control Panel" on page 4-12 for more details.

The following Control Panel properties, methods, and events are available.

Property Name	What it is
Background Color	Click in the field to choose the Control Panel's background color.
Enabled	If True, the Control Panel is enabled.
Tab Name	The name that is displayed on the Control Panel's tab.

Property Name	What it is
On Top	If True, the Control Panel is displayed in front of any other Control Panels.
Tab Text Color	Click in the field to choose the text color on the Control Panel's tab.

Method Name	What it does
Disable	Disables the Control Panel; it cannot be selected
Enable	Enables the Control Panel; it can be selected
Bring to Top	Displays the panel in front of other panels

Event Name	When it happens
Loaded from Disk	When this Control Panel is loaded into CPM
Not On Top	When this Control Panel is not displayed in front of any other panels that are present.
On Top	When this panel is displayed in front of any other panels.

Control Panel Display Size

When you create a Control Panel Application, the display size for all its Control Panels is automatically calculated based on the screen resolution setting of your monitor. If you are planning to use the application on a different system, you may change the default values so the Control Panels will display correctly. Test your application on the target system to be sure it works.

NOTE: Since this setting also controls the Preview Pane size, if you place controls on a panel, then change the display size, you may not be able to see the controls in full screen preview or run mode.


Application

To change the Control Panel display size

1. Start CPM.
2. Click the Control Panel Application icon at the top of the control tree.
3. On the Properties tab, enter the desired panel width and height (in pixels). The Recommended values show the calculated width and height based on the current screen resolution. The Recommended Height without toolbar is used when the panel is run in CPM Runtime with no toolbar.

Add Controls to a Control Panel

There are three ways to add Controls to a Control Panel. You can add them to the Control Panel Tree, add them to the Control Panel Canvas, or have them automatically added when you create a link.

To add controls to the Control Panel Tree

1. Click the Select Design View button and select the Control Palette option so the Control Palette is displayed.
2. Click the Select Design View button and select the Control Panel Tree option so the Control Panel Tree is displayed.

3. In the control palette, click the control you want to add, then drag it onto the Control Panel Tree to the desired position. Release the mouse button to add the control. To move and adjust the control you must first select it on the Control Panel Canvas.
4. Link the controls. See “Links between CPM controls” on page 4-19 for more details.
5. When you are ready to save the Control Panel file, click the Save Control Panel Application icon.

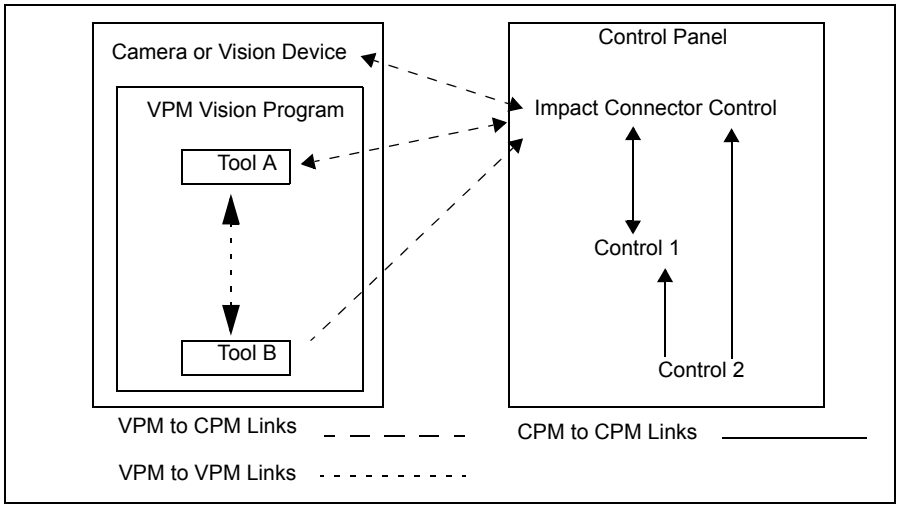
To preview the Control Panel at any time while you are adding controls, click the Full Screen Design Viewing button. To return to edit mode, click the button again.

To add controls to the Control Panel Canvas

1. Click the Select Design View button and select the Control Palette option so the Control Palette is displayed.
2. Click the Select Design View button and clear the Control Panel Tree option so the Control Panel Tree is not displayed.
3. In the control palette, click the control you want to add, then drag it onto the Control Panel Canvas to the desired position. Release the mouse button to add the control. You can move and adjust the control as necessary.
4. Link the controls. See “Links between CPM controls” on page 4-19 for more details.
5. When you are ready to save the Control Panel file, click the Save Control Panel Application icon.

To preview the Control Panel at any time while you are adding controls, click the Full Screen Design Viewing button. To return to edit mode, click the button again.

CPM and VPM Linking





Impact Connector Control

In CPM, links can be made between vision programs and tasks on the camera, Vision Device, or Emulator and Control panels on the host. The links create an information path to the camera, Vision Device, or Emulator through the Impact Connector control. The vision program or task you want to link to must be loaded on the camera, Vision Device, or Emulator, and CPM must be connected to it, before links can be made. (See “Connect to Vision Device” on page 4-2.)

How Impact Connector controls are created

Each Impact Connector control can connect to only one camera, Vision Device, or Emulator at a time, so you need one Connector for each one that the control panel will access. You can put one Connector control on each panel or put multiple controls on one panel.

When you create a link from VPM to CPM, Connector controls are automatically added and connections are made in the following order:

1. If no Impact Connector exists in the application, one is added and the Connector control connection is made to the camera, Vision Device, or Emulator IP address.
2. If a Connector with the current camera, Vision Device, or Emulator IP address exists in the application, that Connector is used. If more than one with that address exists, a list is displayed.
3. If a Connector with a blank IP address exists in the application, the IP address is set and that Connector is used. This happens when a template that contains a Connector is used.

To add additional Impact Connectors, click and drag the control from the palette to the canvas. You will need to manually enter the desired IP address in that Impact Connector's IP Address property, then set the Connected property to True.

NOTES: When you use multiple Impact Connector controls on a control panel, it is possible to unknowingly have controls on the same panel connected to different Impact cameras, Vision Devices, or Emulators. Check the IP Address property value on the Connector controls if some controls are not responding the way you believe they should.

If you delete a control or a Connector on a panel, any Connectors on that control panel that have no links to them are deleted automatically.

Links between CPM and VPM

The following kinds of links can be made between a VPM task or tool and a CPM control:

- **Get Data Link**: a CPM control property receives data from a VPM tool or task property
- **Set Data Link**: a CPM control property sends data to a VPM tool or task property
- **Method Link**: a CPM property sends data to a VPM tool or task method property such as Run or Train
- **Data Transfer Link**: a CPM control property receives data directly from a VPM Data Transfer tool

Create Drag and Drop Links to VPM

There are two ways to create a link between VPM and CPM. You can use left-click drag and drop, or right-click. This section describes how to create drag and drop links. See "Create Right-Click Links to VPM" on page 4-18 for right-click links. When you create a drag and drop link from VPM to CPM, CPM will automatically add a new control if needed, or give you the option to link to the appropriate property type in an existing control. The type of control added, or the property choice shown, depends on the type of data you are linking.

Drag and Drop - Control Added

This section describes the kind of new control that is added to a Control Panel when you create a link to a blank area on the Canvas or the Control Tree.

Get Data

To create a Get Data link, select the desired property in VPM with the left mouse button, then drag and drop it onto an empty spot on the Control Panel Canvas or the Control Panel Tree. This table lists the default control added for a left-click drag and drop Get Data link.

Property Data Type	Get Data Default Control Added - Default Property
Boolean	Indicator Light – Light On
Image	Image Display – Image
Integer	Numeric Display – Integer Value
Real	Numeric Display – Real Value
String	Text Display – Text
Font Library	Font Library – Font Library
Color Image	Image Display – Image
Verification	Character Contour Library – Library

Set Data

To create a Set Data link, hold down the Shift key while you select the property in VPM with the left mouse button, then drag and drop it onto an empty spot on the Control Panel Canvas or the Control Panel Tree. This table lists the control choices for a drag and drop Set Data link.

Property Data Type	Set Data Control Choices - Default Property
Boolean	Check Box - Selected Toggle Button - Selected
Integer	Numeric Entry - Integer Value Slider - Integer Value
Range 1D	Range Scroll
Real	Numeric Entry - Real Value Slider - Integer Value
String	Text Entry - Text
Font Library	Font Library - Font Library
Verification	Character Contour Library – Library

Method

To create a Method link, select the desired property in VPM with the left mouse button, then drag and drop it onto an empty spot on the Control Panel Canvas or the Control Panel Tree. This table lists the default control added for a left-click drag and drop Method link.

Method Property	Default Control Added - Default Property
All Methods	Button – Action Event

Drag and Drop - Existing Control

This section describes the kind of control that is added to a Control Panel when you create a link to an existing control on the Canvas or in the Control Tree and there is only one property of that type to choose. For example, if you drag and drop a Blob List property to an image, the Blob List ROI control is added to the Image Display control automatically and the Blob List property is linked.

Get Data

To create a Get Data link, select the desired property in VPM with the left mouse button, then drag and drop it onto an existing control on the Control Panel Canvas or the Control Panel Tree. This table lists the default controls added for drag and drop Get Data links to an existing control.

Property Data Type	Existing Control	Default Control Added - Default Property
Blob List	Image Display	Blob List ROI - Blob List
Line Segment	Image Display	Line ROI - Line Extents
Line Segment List	Image Display	Line List ROI - Line List
Origin	Image Display	Origin ROI - Origin Extents
Origin List	Image Display	Origin List ROI - Origin List
Point List	Image Display	Point List ROI - Point List
Greyscale Template Model	Image Display	Greyscale Template Model
Shape List	Image Display	Shape List ROI - Shape List
Wide Line Segment	Image Display	Line ROI - Wide Line Extents
Wide Line Segment List	Image Display	Line List ROI - Wide Line List
Wide Circular Arc	Image Display	Arc ROI - Wide Circular Arc
Circle Correlation Model	Image Display	Circle Correlation Model

Set Data

To create a Set Data link, hold down the Shift key while you select the desired property in VPM with the left mouse button, then drag and drop it onto an existing control on the Control Panel Canvas or the Control Panel Tree. This table lists the controls added for drag and drop Set Data links to an existing control.

Property Data Type	Existing Control	Default Control Added - Default Property
Blob List	Image Display	Blob List ROI - Blob List
Line Segment	Image Display	Line ROI - Line Extents
Line Segment List	Image Display	Line List ROI - Line List
Origin	Image Display	Origin ROI - Origin Extents

Property Data Type	Existing Control	Default Control Added - Default Property
Origin List	Image Display	Origin List ROI - Origin List
Point List	Image Display	Point List ROI - Point List
Greyscale Template Model	Image Display	Greyscale Template Model
Shape List	Image Display	Shape List ROI - Shape List
Wide Line Segment	Image Display	Line ROI - Wide Line Extents
Wide Line Segment List	Image Display	Line List ROI - Wide Line List
Wide Circular Arc	Image Display	Arc ROI - Wide Circular Arc
Circle Correlation Model	Image Display	Circle Correlation Model

Method

To create a Method link, select the desired property in VPM with the left mouse button, then drag and drop it onto an empty spot on the Control Panel Canvas or the Control Panel Tree. This table lists the default control added for a left-click drag and drop Method link.

Method Property	Existing Control	Default Control Added - Default Property
All Methods	Button	Button – Action Event

When you click and drag, the cursor will change depending on the action you are trying to complete.



Release to complete link



Cannot complete link

The following sections will explain how to create drag and drop links.

To create a Get Data link using drag and drop

1. Display the Vision Program Tree. If you want to add links to the Control Panel Tree, display it also.
2. Select the desired task from the Select Program dropdown
3. Expand the properties for the tool you want to link. Both Inputs and Outputs can be used to create Get Data links.
4. Left-click on the desired property, drag it to the Control Panel Canvas or the Control Tree, and release it.
   If you drop it on the Control Tree, the new control is added in the Control Tree and in the upper left corner of the Canvas.
5. Repeat step 4 until all links have been made.

To create a Set Data link using drag and drop

1. Display the Vision Program Tree. If you want to add links to the Control Panel Tree, display it also.
2. Select the desired task from the Select Program dropdown

3. Expand the properties for the tool you want to link. Only Inputs can be used to create Set Data links.
4. Hold down the Shift key, then left-click on the desired property, drag it to the Control Panel Canvas or the Control Tree, and release it.
   If you drop it on the Control Tree, the new control is added in the Control Tree and in the upper left corner of the Canvas.
5. Repeat step 4 until all links have been made.

To create a Method link using drag and drop

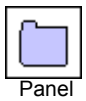
1. Display the Vision Program Tree. If you want to add links to the Control Panel Tree, display it also.
2. Select the desired task from the Select Program drop down
3. Expand the properties for the tool or system object you want to link. Only Methods can be used to create Method links.
4. Left-click on the desired property, drag it to the Control Panel Canvas or the Control Tree, and release it. The new control is added in the Control Tree and in the upper left corner of the Canvas.
5. Repeat step 4 until all links have been made.

Create Right-Click Links to VPM

When you create a right-click link to or from VPM, CPM will always give you choice of what you want to do. You can choose to create a Set or Get Data link, to add a new control, or choose to link to a property type in an existing control. The type of control added, or the property choice shown, depends on the type of data you are linking.

To create a Get Data link using right-click

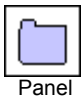
1. Display the Vision Program Tree. If you want to add links using the Control Panel Tree, display it also.
2. Select the desired task from the Select Program dropdown.
3. Expand the properties for the tool you want to link. Inputs and Outputs can be used to create Get Data links.
4. Right-click on the desired property, then left-click on "Get link from here." Some properties will only accept Set Data links.
5. To add the link to an existing control, hold the mouse cursor over the control and right-click. The choices displayed will depend on the VPM property data type and the compatible data types in the control. If the control does not have a compatible data type, no choices are displayed.
   To add the link to a new control, hold the mouse over a blank area on the Canvas, or the Panel icon in the Control Tree, and right-click. Some properties can only be linked to with a Set Data link. If this is the case, no choices are displayed.


Panel Icon

6. Repeat steps 4 and 5 until all links have been made.

To create a Set Data link using right-click

1. Display the Vision Program Tree. If you want to add links to the Control Panel Tree, display it also.
2. Select the desired task from the Select Program dropdown
3. Expand the properties for the tool you want to link. Inputs and Methods can be used to create Set Data links.
4. Right-click on the desired property, then left-click on "Set link to here." Some properties and methods will only accept Get Data links.
5. To add the link to an existing control, hold the mouse cursor over the control and right-click.The choices displayed will depend on the VPM property data type and the compatible data types in the control. If the control does not have a compatible data type, no choices are displayed.


Panel Icon

To add the link to a new control, hold the mouse over a blank area on the Canvas, or the Panel icon in the Control Tree and right-click. Some properties can only be linked to with a Get Data link. If this is the case, no choices are displayed.

6. Repeat steps 4 and 5 until all links have been made.

To create a Method link using right-click

1. Display the Vision Program Tree. If you want to add links to the Control Panel Tree, display it also.
2. Select the desired task from the Select Program drop down
3. Expand the properties for the tool or system object you want to link.
4. Right-click on the desired method, then left-click on "Set link to here."
5. To add the link to an existing control, hold the mouse cursor over the control and right-click.The choices displayed will depend on the compatible data types in the control. If the control does not have a compatible data type, no choices are displayed.
   To add the link to a new control, hold the mouse over a blank area on the Canvas or the Control Tree and right-click.You can only create a button control from a Method link.
6. Repeat steps 4 and 5 until all links have been made.

Delete Links to VPM

You must delete links to VPM through the Impact Connector control.

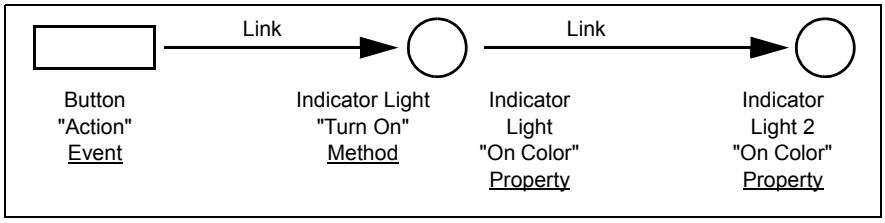
To delete a link


Delete Link

1. Display the Control Panel tree.
2. Click on the Impact Connector control in the Control Panel tree.
3. Depending on the type of link you want to delete, click the Get Data Links, Set Data Links, Method Links, or Links tab.
4. Select the link you want to delete, then click the Delete Link icon.
5. Repeat step 3 until all the desired links are deleted.

Links between CPM controls

Links are the connections between controls (properties, methods, and events). For example, if you want an indicator light control to turn on when the Control Panel operator presses a button control, you can link the button's "Action" event to the indicator light's "Turn On" method. When the button's "action" changes (i.e. it is pressed), the indicator light method that it is linked to (Turn On) is activated. Links can be created from the "source" (the button) control or the "destination" (the indicator light) control, depending on the property data types.



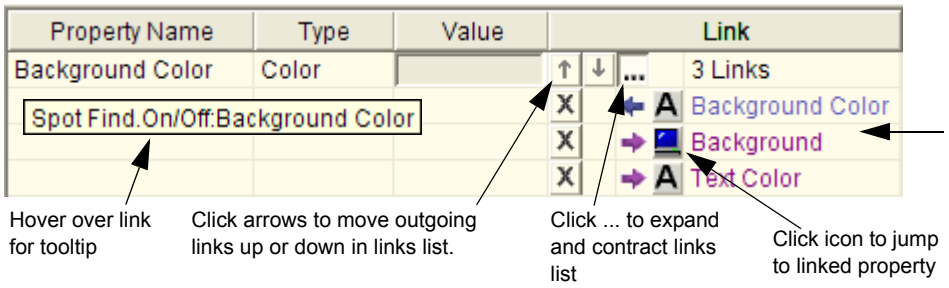
When you link control properties together, they are synchronized. For example, since the "On Color" properties of the two Indicator Lights are linked together, they are the same color when they are On.

In describing links, the following terms are used in this section:

- **Source control:**
  The control's property that provides the value when the link selection is "Get link from here." For example, if you select "Get link from here" on a Toggle Button's property, then link to an Indicator Light's, the Toggle Button is the Source.
- **Beginning control**
  The control that is selected to start the link process. When you create right-click links, the beginning control normally keeps the focus when the link is complete. To shift the focus to the Ending control when the link is complete, hold down the Ctrl key while you right-click on the Ending control.
- **Destination control**
  The control's property that receives the value when the link selection is "Set link to here." For example, if you select "Set link to here" on an Indicator Light's property, then link to a Toggle Button's property, the Indicator Light is the Destination.
- **Ending control**
  The control that is selected to end the link process. When you create right-click links, the beginning control normally keeps the focus when the link is complete. To shift the focus to the Ending control when the link is complete, hold down the Ctrl key while you right-click on the Destination control.

Link Properties

All links are created and displayed on each control's Properties, Methods, or Events tabs, and displayed on the Link Summary tab. This example shows links on a control's Properties tab.

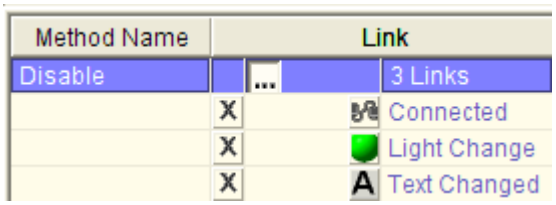


For more details about link colors, see "Link Summary-Controls" on page 4-23

Link Events and Methods

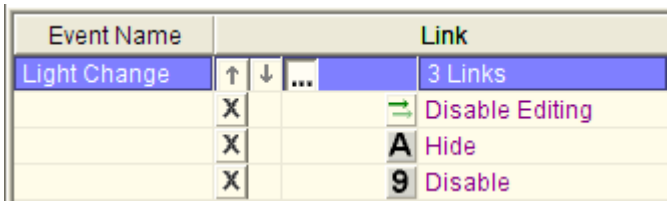
You can only link from one control's event (source) to another control's method (destination), but you can create the link from either control.

If you create links from multiple events to one method, the events are processed in the order that they appear in the method's link display.



Multiple events linked to the one method

If you create links from one event to multiple methods, the methods are processed in the order that they appear in the events's link display.



One event linked to multiple methods

Create Drag and Drop Links in CPM

You can make multiple links between control properties, methods, and events. When the source changes, the destination is updated based on the order in the outgoing links list.

There are two ways to create a link between controls. You can use left-click drag and drop, or right-click. This section describes how to create drag and drop links. See "Create Right-Click Links in CPM" on page 4-21 for right-click links. When you create a drag and drop link, CPM will always give you choice of what destination property, method, or event should get the link. The choice shown depends on the type of source data you are linking.

The following sections will explain how to create drag and drop links.

NOTE: You can only create drag and drop links to and from controls on the same panel. To link controls between panels, see "Create Right-Click Links in CPM" on page 4-21.

To create a link from one control to another using drag and drop

1. Display the Control Panel Tree if you want to use it to add links.
2. Select the desired control from the Canvas or the Control Panel Tree and click the Properties, Methods, or Events tab.
3. Left-click on the desired source property, method, or event, then drag it to the destination control on the Control Panel Canvas or the Control Tree, and release it.
4. Select the property, method, or event in the destination control that is to receive the link.
5. Repeat steps 3 and 4 until all links have been made.

To create a link to one control from another using drag and drop

1. Display the Control Panel Tree if you want to use it to add links.
2. Select the desired control from the Canvas or the Control Panel Tree and click the Properties, Methods, or Events tab.
3. Hold down the Shift key, left-click on the desired source property, method, or event, then drag it to the source control on the Control Panel Canvas or the Control Tree, and release it.
4. Select the property, method, or event in the source control that is to provide the link.
5. Repeat steps 3 and 4 until all links have been made.

Create Right-Click Links in CPM

When you create a right-click link, CPM will always give you choice of whether you want to create a Set or Get Data link. The property choice shown depends on the type of data you are linking.

In describing right-click links, the following terms are used in this section:

- **Source control**
  The control's property that provides the value when the link selection is "Get link from here." For example, if you select "Get link from here" on a Toggle Button's property, then link to an Indicator Light, the Toggle Button is the Source.
- **Beginning control**
  The control that is selected to start the link process. When you create right-click links, the Beginning control normally gets the focus when the link is complete. To shift the focus to the Ending control when the link is complete, hold down the Ctrl key while you left-click on the desired Ending control property.
- **Destination control**
  The control's property that receives the value when the link selection is "Set link to here." For example, if you select "Set link to here" on an Indicator Light's property, then link to a Toggle Button's property, the Indicator Light is the Destination.
- **Ending control**
  The control that is selected to end the link process. When you create right-click links, the Beginning control normally keeps the focus when the link is complete. To shift the focus to the Ending control when the link is complete, hold down the Ctrl key while you left-click on the desired Ending control property.

To create a link from one control (source) to another (destination) using right-click

1. Display the Control Panel Tree if you want to use it to add links.
2. Select the beginning control from the Canvas or the Control Panel Tree and click the Properties, Methods, or Events tab.
3. Right-click on the desired property, method, or event, then left-click on "Get link from here." Some properties and methods will only accept Set Data links.
4. Hold the mouse cursor over the destination control on the Canvas or the Control Tree and right-click. The choices displayed will depend on the source control data type and the compatible data types in the destination. If the destination control does not have a compatible data type, no choices are displayed.
5. Left-click on the desired "Link To" property, method, or event to select it. (When the link is complete, the focus will shift back to the source control. If you want the focus to remain on the destination control, hold the Ctrl key while you left-click on the desired destination control property.)
6. Repeat steps 3, 4, and 5 until all links have been made.

To create a link to one control (destination) from another (source) using right-click

1. Display the Control Panel Tree if you want to use it to add links.
2. Select the beginning control from the Canvas or the Control Panel Tree and click the Properties, Methods, or Events tab.
3. Right-click on the desired property, then left-click on "Set link to here." Some properties and methods will only accept Set Data links.
4. Hold the mouse cursor over the source control on the Canvas or the Control Tree and right-click. The choices displayed will depend on the destination control data type and the compatible data types in the source. If the source control does not have a compatible data type, no choices are displayed.
5. Left-click on the desired "Link From" property, method, or event to select it. (When the link is complete, the focus will shift back to the destination control. If you want the focus to remain on the source control, hold the Ctrl key while you left-click on the desired source control property.)
6. Repeat steps 3, 4, and 5 until all links have been made.

Delete Links in CPM

You must delete links within the appropriate tab in the control.

To delete a link in CPM



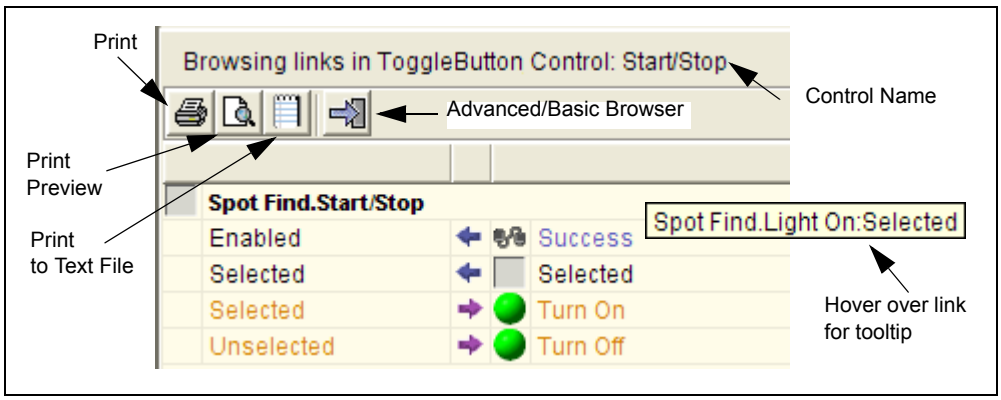
Delete Link

1. Display the Control Panel Tree if you want to use it to delete links.
2. Click on the desired control in the Control Panel Tree or on the Canvas.
3. Depending on the type of link you want to delete, click the Properties, Methods, or Events tab.
4. Select the link you want to delete, then click the Delete Link icon.
5. Repeat step 4 until all the desired links are deleted.

Link Summary-Controls

The Links Summary tab displays links to and from the currently selected control or Control Panel. Click the Advanced Browser button to display the data type and value.

To open the Link Browser window, click the Links tab.



To expand the browser window to include additional fields, click the Advanced Browser button. The link direction arrow points from the source to the destination.

The following fields are displayed in the browser window, from left to right.

- Icon and name of the currently selected control or panel
- Source/Destination property or method name
- Source/Destination value (advanced browser)
- Link direction arrow
- Icon and name of the Source/Destination control
- Source/Destination value (advanced browser)
- Source/Destination data type (advanced browser)

The color of the Source/Destination field name indicates the link's status:

- Blue - link endpoints
- Orange - method and event links
- Red - unresolved links (e.g. due to a vision program not being loaded on the camera, Vision Device, or Emulator)

- Black - property link endpoints

To preview a printed list of all the link information, click the print preview icon. To print the list, click the print icon.

To expand any column to the match the length of the data in the column, click the column header. You can also click on the column divider on the column header and drag the column to the desired width.

CPM Controls

There are several types of CPM controls, including those that receive and display images and other data (including regions of interest), and those that perform output operations (such as sending values to an inspection task and controls to the camera, Vision Device, or Emulator).

Every control has a Name which is displayed on the General tab. Controls also have properties, methods, and events which are shown on their respective tabs. The Impact Connector control also has Get Data, Set Data, Method, and tabs. See “Control Panel” on page 4-11 for details about adding controls to a Control Panel.

NOTE: All distances are in pixels, unless otherwise noted.
All X coordinates are referenced to the left edge of the panel.
All Y coordinates are referenced to the top edge of the panel.

Control Palette and Groups

CPM controls are contained in the palette and grouped within groups based on their general purpose. For control details, refer to the page number in the tables below (displayed in Group, then control, then alphabetical order).

Images	Input	Display	General
Histogram 4-26	Button4-48	Chart 4-86	Basic Interpreter 4-107
Image Display 4-28	Check Box 4-49	Frame 4-91	Change Log 4-108
Arc ROI 4-32	Drop List Selector 4-51	Graphic Display 4-92	Execute Command 4-111
Blob List 4-34	Font Library 4-52	Indicator Light 4-92	Impact Connector 4-111
Correlation Model 4-35	Character Contour Library 4-53	Numeric Display 4-94	Load Image 4-117
Greyscale Template Model 4-36	Keyboard 4-53	Rich Text 4-95	Load Vision Program 4-118
Line List 4-37	Numeric Entry 4-55	Scrolling Table 4-95	Save Vision Program 4-119
Line ROI 4-38	Password 4-57	Tab 4-99	Scriptor 4-120
Origin 4-40	Radio Button 4-67	Tab Group 4-100	TCP-IP Logger 4-127

Images	Input	Display	General
Origin List 4-41	Radio Button Group 4-68	Text Display 4-101	Timer 4-128
Point List 4-42	Range 4-69	XBar-R Chart 4-102	
Rectangle List 4-44	Range Scroll 4-72		
Shape List 4-46	Slider 4-73		
	Table		
	Text Entry		
	Toggle Button		
	Tolerance		

Images Group

Dynamic ROI Tool tips

All controls have a Tooltip Text property. The text in this property is displayed when the cursor is held over the control. Tool tips for Image controls with ROIs can contain special keywords that will be replaced by information about the ROI.

Each type of Image control uses different keywords. Text may be interspersed with keywords, and more than one keyword can be used in a tooltip text property.

For example, if the tooltip text for a Rectangle ROI is
Inspection Area %extents%
the tooltip will display the text "Inspection Area," along with the ROI values, like this:
Inspection Area 100, 100, 90, 200, 200

The Blob List and Greyscale Template Model do not have dynamic tooltips. Tooltips in these controls are displayed for individual elements. For example, a BlobList tooltip is displayed when the cursor is held over each Blob ROI in the list.

ROI Type	Keyword	Properties Displayed
Arc	%extents%	X and Y of center, radius, start angle, arc angle, width
	%location%	X and Y of the arc's start point
	%hints%	description of editing that can be performed
Line List Line	%extents%	X and Y of start point, X and Y of end point, angle
	%location%	X and Y of the line's start point
	%endpoints%	X and Y of start point, X and Y of end point
	%hints%	description of editing that can be performed

ROI Type	Keyword	Properties Displayed
Origin	%extents%	X and Y, angle, radius
	%location%	X and Y
	%hints%	description of editing that can be performed
Point List	%location%	X and Y of the point the cursor is over
Rectangle List Rectangle	%extents%	X and Y, angle, width, height
	%location%	X and Y
	%hints%	description of editing that can be performed
Shape List The same text is applied to all Shapes in the list, but the property displayed depends on the Shape ROI type		
Rectangle		See Rectangle ROI type above
Circle	%extents%	X and Y, radius
	%location%	X and Y
	%hints%	description of editing that can be performed
Polygon	%extents%	X and Y of each polygon vertex
	%location%	X and Y of the vertex "grab region" closest to the mouse
	%vertex%	The number of the vertex with a "grab region" closest to the mouse
	%hints%	description of editing that can be performed

Histogram



The Histogram control displays the histogram of a selected ROI as a bar chart, where each bar represents the greyscale intensity as a percent. The image is linked from a vision program task then this control is linked to the Image Display Connection property on the Image Display control.

Property Name	What it is
Height	The control's height.
Width	The control's width.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Enabled	If True, the control is enabled.

Property Name	What it is
Histogram Entire ROI List	If True, and the selected ROI type is a list ROI, the entire list is displayed in the histogram.
Greyscale Bar Color	Click in the field to select a color for the control's greyscale value bars.
Greyscale Maximum (%)	The maximum greyscale value of the currently displayed histogram.
Greyscale Mean (%)	The mean greyscale value of the currently displayed histogram.
Greyscale Minimum (%)	The minimum greyscale value of the currently displayed histogram.
Image Display Connection	Click in the link field to link to the desired Image Display Connection property.
Axis Color	Click in the field to select a color for the histogram's X and Y axis and their values.
Background Color	Click in the field to select a color for the control's background
Transparent Background	If True, the control's background is transparent. The Background Color property is ignored.
Primary Threshold Midpoint Cursor Color	Click in the field to select a color for Primary Threshold Midpoint Cursor.
Primary Threshold Midpoint Cursor Displayed	If True, a vertical line is displayed at the midpoint between the primary minimum and maximum threshold positions.
Primary Threshold Midpoint Cursor Enabled	If True, the Primary Threshold Midpoint Cursor can be moved. If this value is changed, the Primary Minimum and Maximum Threshold Ranges are recalculated.
Primary Threshold Range Cursor Color	Click in the field to select a color for Primary Threshold Minimum and Maximum Range Cursors.
Primary Threshold Range Cursors Displayed	If True, vertical lines are displayed at the Primary Minimum and Maximum Threshold positions.
Primary Threshold Range Cursors Enabled	If True, the Primary Threshold Minimum and Maximum Range Cursors can be moved.
Primary Threshold Maximum (%)	The histogram's primary maximum threshold value.
Primary Threshold Midpoint (%)	The histogram's primary midpoint threshold value.

Property Name	What it is
Primary Threshold Minimum (%)	The histogram's primary minimum threshold value.
Primary Threshold Width	The primary threshold range (from the minimum to the maximum threshold values).
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Visible	If True, the histogram is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Threshold Range Changed	When either Threshold Range value changes

Image Display



The Image Display control displays an image from a vision program. If Auto Image Save Enabled is true, the displayed image is saved to a file with .png extension. The image is linked to the Impact Connector control from a vision program task then linked to this control.

Property Name	What it is
Background	Click in the field to choose the color displayed behind the image.
Auto Image Save All Name	This is the image file name of all images when Auto Image Save Enabled is true, and Auto Image Save Type is All. This name is combined with an automatically incremented image save number. If there are no files in the folder with this name, the image save number is reset to one. IMPORTANT: File names are case sensitive.
Auto Image Save Enabled	If True, the displayed image is saved to a file with the .png extension. The file name is entered in the Save Image File property. The directory path is entered in the Save Image Path property. IMPORTANT: File names are case sensitive.
Auto Image Save Failed Name	This is the image file name of a Failed image when Auto Image Save Enabled is true, and Auto Image Save Type is Failed or Passed and Failed. This name is combined with an automatically incremented image save number. If there are no files in the folder with this name, the image save number is reset to one. IMPORTANT: File names are case sensitive.

Property Name	What it is
Auto Image Save Passed Name	This is the image file name of a Passed image when Auto Image Save Enabled is true, and Auto Image Save Type is Passed or Passed and Failed. This name is combined with an automatically incremented image save number. If there are no files in the folder with this name, the image save number is reset to one. IMPORTANT: File names are case sensitive.
Auto Image Save Rollover Limit	The maximum number of image files of each image Type (and Image Save Name) that are saved in the directory specified in the Save Image Path property. Once the limit has been reached, the Image file number is reset to one and existing files with the same file name are overwritten. If the Image Save Type is Passed and Failed, files with the same number in the file name are overwritten. For example, if the Rollover Limit is 100, the current image directory will contain a maximum of 100 files with the same file name. If the Image Save Name is unique with each image, the Rollover Limit will never be reached.
Auto Image Save Type	If All is selected, displayed images are saved to the Save Image Path with the name in the Auto Image Save All Name property. If Failed is selected, displayed images with the Image Passed property of false are saved to the Save Image Path with the name in the Auto Image Save Failed Name property. If Passed is selected, displayed images with the Image Passed property of true are saved to the Save Image Path with the name in the Auto Image Save Passed Name property. If Passed and Failed is selected, all images will be saved either as passed (using the "Auto Image Save Passed Name" name) or as failed (using the "Auto Image Save Failed Name" name). If this property is changed, the Image file number is reset to one.
Auto Image Save With ROIs	When true, and the property Auto Image Save Enabled is true, displayed images are saved with any currently displayed ROIs. These images are saved in 24-bit format color and cannot be used as inspection images.
Selected Pixel Color	The color of the pixel beneath the cursor when the mouse is clicked
Selected Pixel Intensity	The intensity of the pixel beneath the cursor when the mouse is clicked
Select Pixel Location	The location of the pixel beneath the cursor when the mouse is clicked
Editing Enabled	If True, ROI controls may be moved and resized.
Height	The image display’s height.
Image	Click in the link field to link the display image. (It must be linked into the Impact Connector tool from a vision program task.)
Image Display Connection	The link source for the Histogram control’s displayed image.

Property Name	What it is
Display Image Name	If True, the image name is displayed at the top of the image frame.
Image Passed	This property indicates the pass or fail status of the currently displayed image so that image can be saved as a Passed or Failed image. This property is typically linked to a Boolean that indicates the final inspection status.
Image Status Border	When None is selected, no border is shown around the image. When Failed is selected, a red border is displayed around images with an Image Passed property of False. When Passed and Failed is selected, a red border is displayed around images with an Image Passed property of False and a green border is displayed around images with an Image Passed property of true.
Maximum Pseudocolor Threshold	The upper threshold for color representation of each pixel's grey level in the image.
Minimum Pseuodocolor Threshold	The lower threshold for color representation of each pixel's grey level in the image.
Display Orientation	Normal: The image is displayed without rotation 90: The image is rotated 90 degrees clockwise. 180: The image is rotated 180 degrees clockwise. 270: The image is rotated 270 degrees clockwise. **Note:** This changes only the image and ROI display orientation, the display coordinates remain the same. For example, if the Display Orientation is 90, the location 0, 0 is in the upper right corner of the display, instead of the upper left corner as it would be with the Normal setting.
Pseuodocolor Color	The color representation of each pixel's grey level in the image.
Pseudocolor Enabled	If True, pseudocoloring is visible.
Save Image File	The file name for saving the image if the saveImage method is called. (The "png" extension is added to the file name and the image is saved in Portable Network Graphics format.) IMPORTANT: File names are case sensitive.
Save Image Path	The path for saving the image if the Save Image or Auto Save methods are invoked. The <IP ADDRESS> is a placeholder for the Image Display control to replace with the IP Address of the device from which the saved image is acquired. An Image Display control may have more than one device saving images through it. This placeholder allows you to append your own sub folders in the path without having to know what the device's IP address is and provides another dimension of organizing images per device.
Show Cursor Value	If True, the cursor's position on the image, with grey level or RGB value, will displayed when it is not over an ROI.
Toolbar Visible	If True, the Zoom toolbar is visible.

Property Name	What it is
Visible	If True, the Image is visible.
Width	The image display's width.
Watermark Color	The watermark's background color. The value of the transparency property adjusts this color.
Watermark Text	This text is drawn repeatedly on the watermark in the same color as the watermark, but 10% more opaque. If this property is empty, only the watermark color is painted on the image.
Watermark Transparency	The watermark color's transparency (a value of 100 is completely transparent, 10 is the minimum so the watermark can never be completely opaque).
Watermark Visible	If True, a transparent layer of text and color is painted over the displayed image. See the Watermark Color, Watermark Text, and Watermark Transparency properties.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Zoom	The zoom factor for the displayed image, with 1.0 as the default. For example, if Zoom is 2.0, the image is displayed twice its size. If you enter a value of -1, the value is automatically adjusted so the image fits the Image control. If you enter a value of -2, the value is automatically adjusted so the image and the ROIs fit the Image control.

Method Name	What it does
Show	Makes the control visible
Reset Auto Save Image File Numbering	If the Auto Image Save Enabled property is true, resets the saved Image file number to one. The file number also reset to one when there are no files in the folder with the Image Save Name, the Image Save Rollover Limit is reached, or the Image Save Type is changed.
Delete Saved Image Files	If the Auto Image Save Enabled property is true, all the .png files in the directory named by the Save Image Path property (concatenated with the IP address) are deleted. If the Auto Image Save Enabled property is false, all the .png files in the directory named by the Save Image Path property are deleted
Save Image	Saves the image being displayed to the file in the Save Image Path with the name Save Image Name

Method Name	What it does
Auto Save Image	This method should be linked to the Impact Connector's Get Data Completed event to ensure that all of the necessary linked properties for the image will have the correct values (such as the Image Passed property) before it is saved. If Auto Image Save Enabled is true, the next Auto Image Save file name is generated and the currently displayed image is saved to that file. Images are saved according to the Auto Image Save properties. If Auto Image Save Enabled is false, the image is NOT saved. IMPORTANT: File names are case sensitive.
Save Image With ROIs	Saves the image being displayed with its ROIs
Hide	Makes the control invisible

Event Name	When it happens
Mouse Click	When the user clicks the mouse on the image. No event is generated if no image is displayed.
Image Saved	When the currently displayed image has been successfully written to the file
Image Displayed	When the image display is complete

Arc ROI



The Arc ROI control displays an Arc ROI on the displayed image. The origin is linked from a vision program tool output. See “ROI Color Properties” on page 4-35 for more ROI color properties information.

Note: You must have an Image Display control in the Control Panel to add this control.

Property Name	What it is
Arc Angle	The ROI’s angle (in radians). One radian is equal, in degrees, to 180 divided by pi. One degree is equal, in radians, to pi divided by 180. This can also be stated as approximately 57.296 degrees per radian or 0.01745 radians per degree.
Arrow Visible	If True, the ROI’s arrow is visible.
True Color	Click in the field to choose the ROI’s True color.
Draw Filled	If True, the ROI is filled with the appropriate True or False Color.
Movable	If True, the ROI can be moved. (The Selectable property must be True.)
Origin	Link the origin from the vision program tool.
Origin Angle	The angle of the linked tool’s origin.
Origin Color	Click in the field to choose the origin’s display color.

Property Name	What it is
Origin Visible	If True, the linked tool's origin is visible.
Origin X	The X coordinate of the linked tool's origin.
Origin Y	The Y coordinate of the linked tool's origin.
Radius	The ROIs radius.
False Color	Click in the field to choose the ROI's False color.
Selectable	If True, ROI can be selected.
Sizable	If True, the ROI can be resized. (The Selectable property must be True.)
Start Angle	The ROIs rotation, in radians.
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Fill Color Transparency	The percentage of fill color transparency.
Use True Color	If True, the ROI is colored in the True Color.
Visible	If True, the ROI is visible.
Width	The ROI's width.
Width Visible	If True, the ROI is drawn the width indicated by the Width property. If False, the ROI is drawn one pixel wide.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.

Method Name	What it does
Disable Editing	Disables the ability to edit the control
Enable Editing	Enables the ability to edit the control
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Extents Edited	When the ROI is modified either with the mouse or by changing one of the extent's properties.
Selected	Enables the ability to edit the control
Unselected	Makes the control invisible

Blob List



The Blob List ROI control displays Blob ROIs on the displayed image. The blob list and origin are linked from a vision program tool output. See “ROI Color Properties” on page 4-35 for more ROI color properties information.

Note: You must have an Image Display control in the Control Panel to add this control.

Property Name	What it is
Blob List	Link the list of blobs that are used to draw the ROI from a vision program tool with the data type Blob List.
Color by States	If True, the ROI is colored with the True or False Color based on its state from the State List.
False Color	Click in the field to choose the ROI’s False color.
False State Visible	If True, the ROI is visible when it’s State is False.
Draw Filled	If True, the ROI is drawn filled with the appropriate True or False Color.
Mouse Over Index	The index of the blob currently under the cursor.
Selected Index	The index of the blob selected.
Origin	Link the origin from the vision program tool.
Origin Angle	The angle of the linked tool’s origin.
Origin Color	Click in the field to choose the tool’s origin color.
Origin Visible	If True, the linked tool’s origin is visible.
Origin X	The X coordinate of the linked tool’s origin.
Origin Y	The Y coordinate of the linked tool’s origin.
Selectable	If True, the ROI can be selected.
State List	Link the boolean list from the vision program tool. This indicates the ROI’s True or False State.
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Fill Color Trans-parency	The ROI’s transparency, from 0 to 100 percent.
True Color	Click in the field to choose the ROI’s True color.
True State Visible	If True, the ROI is visible when it’s State is True.
Use True Color	If True, the ROI is colored in the True Color.
Visible	If True, the control is visible.

Method Name	What it does
Hide	Makes the control invisible

Method Name	What it does
Show	Makes the control visible

ROI Color Properties

All ROIs have the color properties of True Color, False Color, Use True Color, and Visible.

List ROIs have these color properties in addition: State List, False State Visible, True State Visible, and Color By States.

The Color by States property updates automatically based on how you are using the ROI. If you change the Use True Color property to True, all of the ROIs in the list will take on the True Color and the Color by States property are set to False

If you change the Use True Color property to False, all of the ROIs in the list will take on the False Color and the Color by States property will again be set to False.

If you link a boolean list (from a data link in the Impact Connector control) to the State List property, the ROIs in the list will take on True Colors and False Colors corresponding to the True and False values in the State List, and the Color by States property is set to True.

Also, when the value of the State List is updated, the ROIs in the List become visible or invisible, based on the settings of the True State Visible and False State Visible properties. If the Visible property is changed, both the True State Visible and the False State Visible properties are changed to match it.

Correlation Model



The Correlation Model control displays an ROI from a Correlation Pattern Find tool in a vision program. See “ROI Color Properties” on page 4-35 for more ROI color properties information.

Note: You must have an Image Display control in the Control Panel to add this control.

Property Name	What it is
Circle Correlation Model	The Correlation Model linked from a vision program tool.
True Color	Click in the field to choose the ROI’s True display color.
Correlation Model	The Correlation Model linked from a vision program tool.
Origin	Link the origin from the vision program tool.
Origin Angle	The angle of the linked tool’s origin.
Origin Color	Click in the field to choose the origin’s display color.
Origin Visible	If True, the linked tool’s origin is visible.
Origin X	The X coordinate of the linked tool’s origin.
Origin Y	The Y coordinate of the linked tool’s origin.
False Color	Click in the field to choose the ROI’s False display color.

Property Name	What it is
Selectable	If True, the ROI can be selected.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Use True Color	If True, the ROI is colored in the True Color.
Visible	If True, the ROI is visible.

Method Name	What it does
Hide	Makes the control invisible
Show	Makes the control visible

Greyscale Template Model



The Greyscale Template Model control displays an ROI from a Greyscale Template tool in a vision program. See “ROI Color Properties” on page 4-35 for more ROI color properties information.

Note: You must have an Image Display control in the Control Panel to add this control.

Property Name	What it is
True Color	Click in the field to choose the ROI’s True color.
Draw Filled	If True, the ROI is filled with the appropriate True or False Color.
Greyscale Template Model	Link the Greyscale Template Model from a vision program tool.
Origin	Link the origin from the vision program tool.
Origin Angle	The angle of the linked tool’s origin.
Origin Color	Click in the field to choose the tool’s origin color.
Origin Visible	If True, the linked tool’s origin is visible.
Origin X	The X coordinate of the linked tool’s origin.
Origin Y	The Y coordinate of the linked tool’s origin.
False Color	Click in the field to choose the ROI’s False display color.
Selectable	If True, the ROI can be selected.
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Fill Color Transparency	The ROI’s transparency, from 0 to 100 percent.
Use True Color	If True, the ROI is colored in the True Color.
Visible	If True, the control is visible.

Method Name	What it does
Hide	Makes the control invisible
Show	Makes the control visible

Line List



The Line List ROI control displays line ROIs on the displayed image. The line list and origin are linked from a vision program tool output (with the data type Line Segment List). See “ROI Color Properties” on page 4-35 for more ROI color properties information.

Note: You must have an Image Display control in the Control Panel to add this control.

Property Name	What it is
Arrow Visible	If True, the arrows on the ROIs are visible.
Color by States	If True, the ROI is colored with the True or False Color based on its state from the State List.
False Color	Click in the field to choose the display color for failing ROIs (based on the State List property).
False State Visible	If True, failed ROIs are visible.
Mouse Over Index	The index of the line currently under the cursor.
Selected Index	The index of the line selected.
Line List	Link the Line List from a vision program tool’s Line Segment List.
Movable	If True, the ROI can be moved. (The Selectable property must be True.)
Origin	Link the origin from the vision program tool.
Origin Angle	The angle of the linked tool’s origin.
Origin Color	Click in the field to choose the origin’s display color.
Origin Visible	If True, the linked tool’s origin is visible.
Origin X	The X coordinate of the linked tool’s origin.
Origin Y	The Y coordinate of the linked tool’s origin.
State List	Link the In Tolerance List from the vision program tool that contains the Line List.
Selectable	If True, the ROIs can be selected.
Sizable	If True, the ROI can be resized. (The Selectable property must be True.)
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
True Color	Click in the field to choose the ROI’s True color.
True State Visible	If True, the ROI is visible when it’s State is True.

Property Name	What it is
Use True Color	If True, the ROI is colored in the True Color.
Visible	If True, the ROI is visible.
Wide Line List	Link the Wide Line List from a vision program tool's Wide Line Segment List.
Width	The ROI's display width.
Width Visible	If True, ROIs is drawn the width indicated by the Width property. If False, ROIs is drawn one pixel wide.

Method Name	What it does
Disable Editing	Disables the ability to edit the control
Enable Editing	Enables the ability to edit the control
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Extents Edited	When the ROI is modified either with the mouse or by changing one of the extent's properties.
Selected	Enables the ability to edit the control
Unselected	Makes the control invisible

Line ROI



The Line ROI control displays a Line ROI in the Image Display control. The line extents and origin are linked from a vision program tool output (with the data type Line Segment). See "ROI Color Properties" on page 4-35 for more ROI color properties information.

Note: You must have an Image Display control in the Control Panel to add this control.

Property Name	What it is
Angle	The ROI's angle.
Arrow Visible	If True, the ROI's arrow is visible.
True Color	Click in the field to choose the ROI's True color.
Draw to Edge	If True, the ROI is extended to the image's edges
Draw Filled	If True, the ROI is filled with the appropriate True or False Color.
Length	The ROI's length.

Property Name	What it is
Line Extents	Link the Line Segment from a vision program tool's Line Segment List. (Extents are the end's X-Y coordinates.)
Mid Point X	The X coordinate of the ROI's midpoint.
Mid Point Y	The Y coordinate of the ROI's midpoint.
Movable	If True, the ROI can be moved. (The Selectable property must be True.)
Origin	Link the origin from the vision program tool.
Origin Angle	The angle of the linked tool's origin.
Origin Color	Click in the field to choose the origin's display color.
Origin Visible	If True, the linked tool's origin is visible.
Origin X	The X coordinate of the linked tool's origin.
Origin Y	The Y coordinate of the linked tool's origin.
Rectangle Extents	Link the ROI's extents from the vision program tool. (Extents are the corner's X-Y coordinates.)
False Color	Click in the field to choose the ROI's failing display color (pass or fail is based on the State List property).
Selectable	If True, the ROI can be selected.
Sizable	If True, the ROI can be resized. (The Selectable property must be True.)
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Fill Color Transparency	The fill's transparency; a larger number is more transparent (0-100%)
Use True Color	If True, the ROI is colored in the True Color.
Visible	If True, the ROI is visible.
WideLine Extents	Link the Wide Line Segment from a vision program tool's Wide Line Segment List. (Extents are the end's X-Y coordinates.)
Width	The Line ROI's display width.
Width Visible	If True, the ROI is drawn the width indicated by the Width property. If False, the ROI is drawn one pixel wide.

Method Name	What it does
Disable Editing	Disables the ability to edit the control
Enable Editing	Enables the ability to edit the control
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Extents Edited	When the ROI is modified either with the mouse or by changing one of the extent's properties.
Selected	Enables the ability to edit the control
Unselected	Makes the control invisible

Origin Control



The Origin control displays an Origin linked from a vision program tool output. A tool's origin can be linked directly to controls that display an ROI. This control is used primarily to display only the Origin ROI. See "ROI Color Properties" on page 4-35 for more ROI color properties information.

Note: You must have an Image Display control in the Control Panel to add this control.

Property Name	What it is
Angle	The Origin ROI's angle.
Arrow Visible	If True, the ROI's arrow is visible.
True Color	Click in the field to choose the ROI's passing display color.
Draw to Edge	If True, the ROI is extended to the image's edges
Movable	If True, the Origin ROI can be moved. (The Selectable property must be True.)
Origin	Link the origin from the vision program tool.
Origin Angle	The angle of the linked tool's origin.
Origin Color	Click in the field to choose the tool's origin color.
Extents	Link the ROI's extents from the vision program tool. (Extents are the corner's X-Y coordinates.)
Origin Visible	If True, the linked tool's origin is visible.
Origin X	The X coordinate of the linked tool's origin.
Origin Y	The Y coordinate of the linked tool's origin.
Radius	The radius of a circle drawn around the control's ROI, in pixels.
False Color	Click in the field to choose the ROI's failing display color.
Selectable	If True, the Origin ROI can be selected.
Sizable	If True, the Origin ROI can be resized. (The Selectable property must be True.)
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Use True Color	If True, the ROI is colored in the True Color.

Property Name	What it is
Visible	If True, the Origin ROI is visible.
X	The Origin ROI's X coordinate.
Y	The Origin ROI's Y coordinate.

Method Name	What it does
Disable Editing	Disables the ability to edit the control
Enable Editing	Enables the ability to edit the control
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Extents Edited	When the ROI is modified either with the mouse or by changing one of the extent's properties.
Selected	Enables the ability to edit the control
Unselected	Makes the control invisible

Origin List



The Origin List control displays an Origin List linked from a vision program tool output. See "ROI Color Properties" on page 4-35 for more ROI color properties information.

Note: You must have an Image Display control in the Control Panel to add this control.

Property Name	What it is
Arrow Visible	If True, the ROI's arrow is visible.
Color by States	If True, the ROI is colored with the True or False Color based on its state from the State List.
Draw to Edge	If True, the ROI will be drawn only to the image edge. If False, the ROI does not stop at the image edge.
False Color	Click in the field to choose the ROI's False color.
False State Visible	If True, the ROI is visible when it's State is False.
Mouse Over Index	The index of the origin currently under the cursor.
Selected Index	The index of the origin selected.
Movable	If True, the ROI can be moved. (The Selectable property must be True.)
Origin	Link the origin from the vision program tool.

Property Name	What it is
Origin Angle	The angle of the linked tool's origin.
Origin Color	Click in the field to choose the tool's origin color.
Origin List	Link the Origin List from the vision program tool.
Origin Visible	If True, the linked tool's origin is visible.
Origin X	The X coordinate of the linked tool's origin.
Origin Y	The Y coordinate of the linked tool's origin.
Radius	The radius of a circle drawn around the control's ROI, in pixels.
State List	Link the boolean list from the vision program tool. This indicates the ROI's True or False State.
Selectable	If True, the ROI can be selected.
Sizable	If True, the ROI can be resized. (The Selectable property must be True.)
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
True Color	Click in the field to choose the ROI's True color.
True State Visible	If True, the ROI is visible when it's State is True.
Use True Color	If True, the ROI is colored in the True Color.
Visible	If True, the control is visible.

Method Name	What it does
Disable Editing	Disables the ability to edit the control
Enable Editing	Enables the ability to edit the control
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Extents Edited	When the ROI is modified either with the mouse or by changing one of the extent's properties.
Selected	Enables the ability to edit the control
Unselected	Makes the control invisible

Point List



The Point List control displays a point list linked from a vision program tool output. See "ROI Color Properties" on page 4-35 for more ROI color properties information.

Note: You must have an Image Display control in the Control Panel to add this control.

Property Name	What it is
True Color	Click in the field to choose the ROI's passing display color.
Color by States	If True, the ROI is colored with the True or False Color based on its state from the State List.
False Color	Click in the field to choose the ROI's False color.
False State Visible	If True, the ROI is visible when it's State is False.
Origin	Link the origin from the vision program tool.
Origin Angle	The angle of the linked tool's origin.
Origin Color	Click in the field to choose the tool's origin color.
Origin Visible	If True, the linked tool's origin is visible.
Origin X	The X coordinate of the linked tool's origin.
Origin Y	The Y coordinate of the linked tool's origin.
Point List	Link the Point List from the vision program tool.
False Color	Click in the field to choose the ROI's failing display color (pass or fail is based on the State List property).
State List	Link the boolean list from the vision program tool. This indicates the ROI's True or False State.
True Color	Click in the field to choose the ROI's True color.
True State Visible	If True, the ROI is visible when it's State is True.
Use True Color	If True, the ROI is colored in the True Color.
Visible	If True, the ROI is visible.

Method Name	What it does
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Extents Edited	When the ROI is modified either with the mouse or by changing one of the extent's properties.
Selected	Enables the ability to edit the control
Unselected	Makes the control invisible

Rectangle List



The Rectangle List control displays a Rectangle List ROI on the displayed image. The rectangle list and origin are linked from a vision program tool output. See “ROI Color Properties” on page 4-35 for more ROI color properties information.

Note: You must have an Image Display control in the Control Panel to add this control.

Property Name	What it is
Color by States	If True, the ROI is colored with the True or False Color based on its state from the State List.
False Color	Click in the field to choose the ROI’s failing display color.
False State Visible	If True, failing ROIs are displayed in the False Color.
Draw Filled	If True, the ROI is filled with the appropriate True or False Color.
Mouse Over Index	The index of the rectangle currently under the cursor.
Selected Index	The index of the rectangle selected.
Movable	If True, the control can be moved. (The Selectable property must be True.)
Origin	Link the origin from the vision program tool.
Origin Angle	The angle of the linked tool’s origin.
Origin Color	Click in the field to choose the origin color.
Origin Visible	If True, the linked tool’s origin is visible.
Origin X	The X coordinate of the linked tool’s origin.
Origin Y	The Y coordinate of the linked tool’s origin.
Rectangle List	Link the Rectangle List from the vision program tool.
State List	Link the tool’s State List.
Selectable	If True, the ROI can be selected.
Sizable	If True, the ROI can be resized. (The Selectable property must be True.)
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Fill Color Transparency	The fill’s transparency (0-100%)
True Color	Click in the field to choose the ROI’s True color.
True State Visible	If True, the ROI is visible when it’s State is True.
Use True Color	If True, the ROI is colored in the True Color.
Visible	If True, the ROI is visible.

Method Name	What it does
Activate for Editing	Makes the ROI available for editing
Disable Editing	Disables the ability to edit the control
Enable Editing	Enables the ability to edit the control
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Extents Edited	When the ROI is modified either with the mouse or by changing one of the extent's properties.
Selected	Enables the ability to edit the control
Unselected	Makes the control invisible

Rectangle ROI



The Rectangle ROI control displays a Rectangle ROI on the displayed image. The rectangle extents and origin are linked from a vision program tool output. See "ROI Color Properties" on page 4-35 for more ROI color properties information.

Note: You must have an Image Display control in the Control Panel to add this control.

Property Name	What it is
Angle	The ROI's angle.
True Color	Click in the field to choose the ROI's True color.
Draw Filled	If True, the ROI is filled with the appropriate True or False Color.
Height	The ROI's height.
Movable	If True, the ROI can be moved. (The Selectable property must be True.)
Origin	Link the origin from the vision program tool.
Origin Angle	The angle of the linked tool's origin.
Origin Color	Click in the field to choose the origin's display color.
Origin Visible	If True, the linked tool's origin is visible.
Origin X	The X coordinate of the linked tool's origin.
Origin Y	The Y coordinate of the linked tool's origin.
Extents	Link the ROI's extents from the vision program tool. (Extents are the corner's X-Y coordinates.)
False Color	Click in the field to choose the ROI's False color.

Property Name	What it is
Selectable	If True, ROI can be selected.
Sizable	If True, the ROI can be resized. (The Selectable property must be True.)
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Fill Color Trans-parency	The percentage of fill color transparency.
Use True Color	If True, the ROI is colored in the True Color.
Visible	If True, the ROI is visible.
Width	The control's width.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.

Method Name	What it does
Disable Editing	Disables the ability to edit the control
Enable Editing	Enables the ability to edit the control
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Extents Edited	When the ROI is modified either with the mouse or by changing one of the extent's properties.
Selected	Enables the ability to edit the control
Unselected	Makes the control invisible

Shape List



The Shape List control displays a Shape List linked from a vision program tool. Tool's with non-line ROIs use a Shape List. See "ROI Color Properties" on page 4-35 for more ROI color properties information.

Note: You must have an Image Display control in the Control Panel to add this control.

Property Name	What it is
Color by States	If True, the ROI is colored with the True or False Color based on its state from the State List.
False Color	Click in the field to choose the ROI's False color.
False State Visible	If True, the ROI is visible when it's State is False.

Property Name	What it is
Draw Filled	If True, the ROI is drawn filled with the appropriate True or False Color.
Mouse Over Index	The index of the shape currently under the cursor.
Selected Index	The index of the shape selected.
Movable	If True, the ROI can be moved. (The Selectable property must be True.)
Origin	Link the origin from the vision program tool.
Origin Angle	The angle of the linked tool's origin.
Origin Color	Click in the field to choose the tool's origin color.
Origin Visible	If True, the linked tool's origin is visible.
Origin X	The X coordinate of the linked tool's origin.
Origin Y	The Y coordinate of the linked tool's origin.
Selectable	If True, the ROI can be selected.
Shape List	Link the Shape List from the vision program tool.
Sizable	If True, the ROI can be resized. (The Selectable property must be True.)
State List	Link the boolean list from the vision program tool. This indicates the ROI's True or False State.
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Fill Color Trans-parency	The ROI's transparency, from 0 to 100 percent.
True Color	Click in the field to choose the ROI's True color.
True State Visible	If True, the ROI is visible when it's State is True.
Use True Color	If True, the ROI is colored in the True Color.
Visible	If True, the control is visible.

Method Name	What it does
Activate for Editing	Makes the ROI available for editing
Disable Editing	Disables the ability to edit the control
Enable Editing	Enables the ability to edit the control
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Extents Edited	When the ROI is modified either with the mouse or by changing one of the extent's properties.

Event Name	When it happens
Selected	Enables the ability to edit the control
Unselected	Makes the control invisible

Input Group

Button



When the Button control is pressed, it produces an action which can be linked to other controls. This action can be used for many purposes.

Property Name	What it is
Button Color	Click in the field to choose the button's color. (The Visible property must be True to see the button.) If this property value is "System," the operating system display properties color is used. See "Control Color" on page 4-10.
Border Painted	If True, a border is drawn around the button. If this property value is "System," the operating system display properties color is used. See "Control Color" on page 4-10.
Height	The button's height.
Width	The button's width.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Enabled	If True, the button is enabled.
Label Font	Click in the field to choose the button label's font properties.
Label Text Color	Click in the field to choose the button label's text color.
Horizontal Alignment	The button label and icon's horizontal justification.
Horizontal Text Position	The button label's horizontal position relative to the icon.
Icon Height	The icon's height.
Icon Text Gap	The distance between the icon and the button label.
Icon Width	The icon's width.
Keep Icon Aspect Ratio	If True, the icon's height to width ratio is maintained when it is resized.
Button Label	The text displayed on the button. Some special characters will not display in this property. See "Special Characters" on page 4-102.

Property Name	What it is
Left Margin	The distance between the button's left edge and the label text.
Pressed	If True, the button is currently being pressed.
Right Margin	The distance between the button's right edge and the label text.
Size Icon With Button	If True, the icon's size will change when the button is resized.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Icon	Click in the field to place an icon on the button. Icon files may have these extensions: gif, jpg, png, and bmp. The icon file must be on the same disk drive as the Control Panel file.
Vertical Text Position	The button label's vertical alignment relative to the icon.
Visible	If True, the button is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Click	Produces the same effect as clicking the control
Enable	Enables the control so it can be used
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Action	When the button is clicked
Released	When the button is released after it is pressed
Pressed	When the button is pressed

Check Box



The Check Box control allows the Control Panel operator to indicate a selection on the Control Panel. For instance, a control could be enabled or disabled if the operator checks or clears the check box.

Property Name	What it is
Background Color	Click in the field to choose the control's background color. (The Transparent property must be False to see the background.)
Height	The check box's height.
Width	The check box's width.

Property Name	What it is
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Editable	If True, the Selected property can be modified in Run Mode
Enabled	If True, the button is enabled.
Label Font	Click in the field to choose the label font properties.
Label Text Color	Click in the field to choose the label text color.
Label Position	The label's position relative to the check box.
Unselected	True if the check box is currently cleared.
CheckBox Label	The text displayed on the check box. Some special characters will not display in this property. See "Special Characters" on page 4-102.
Selected	If True, the check box is checked.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Transparent	If True, the control's background is transparent.
Visible	If True, the check box is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Unselect	Sets the check box to the Unselected (unchecked) state and fires the Selected and Unselected events.
Select	Sets the check box to the Selected (checked) state and fires the Selected and Unselected events.
Toggle	Sets the check box to the opposite of its current state and fires the Selected and Unselected events.
Enable	Enables the control so it can be used
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Action	When the check box's state changes
Action by User	Only when the check box's state changes from a user's action
Selected	When the check box is checked
Selected by User	Only when the check box is checked by the user
Unselected	When the check box is cleared

Event Name	When it happens
Unselected by User	Only when the check box is cleared by the user

Drop List Selector



The Drop List Selector control allows the Control Panel operator to select an item from a pre-defined list.

Property Name	What it is
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Background Color	Click in the field to choose the list's background color. (The Transparent property must be False to see the background.)
Text Color	Click in the field to choose the list item's text color.
Selection Back-ground Color	Click in the field to choose the selected list item's background color.
Selection Text Color	Click in the field to choose the selected list item's text color.
Font	Click in the field to choose the list item's font properties.
Enabled	If True, the list is enabled.
Visible	If True, the list is visible.
Width	The control's width.
Height	The control's height.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Real Precision	The list items' decimal precision.
List	The control's list of items.
Selected Item	The value of the list item selected.
Selected Index	The list item's position in the list (the first item is index number zero).
Selectable	If True, a selection can be made from the list

Method Name	What it does
Enable	Enables the control so it can be used
Disable	Disables the control; it cannot be used
Show	Makes the control visible
Hide	Makes the control invisible

Event Name	When it happens
Item Selected	When an item is selected
Item Selected by User	Only when an item is selected by a user's action

Font Library



The Font Library control displays the Font Library linked from a tool in a VPM task. Click the delete icons to delete one or more selected characters from the library.



Property Name	What it is
Height	The control's display height.
Width	The control's display width.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Editable	If True, the font library can be edited through the Control Panel.
Font Library	Link the font library from an OCR tool in a VPM task.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Zoom Percent	The font library characters are magnified by this percentage in the display.

Method Name	What it does
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Edited by User	When any font library model is removed
Font Library Changed	When a font library character changes. Changes include any changes to the models or model labels.

Character Contour Library



The Character Contour Library control displays the Character Contour Library linked from a Character Contour Match tool in a VPM task. Click the delete icons to delete one or more selected characters from the library.

Property Name	What it is
Library	Link the Verification Library from a Character Contour Match tool in a VPM task.
Height	The control's display height.
Width	The control's display width.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Editable	If True, the font library can be edited through the Control Panel.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Zoom Percent	The font library characters are magnified by this percentage in the display.

Method Name	What it does
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Edited by User	When any character contour library model is removed
Character Contour Library Changed	When a character contour library character changes. Changes include any changes to the models or model labels.

Keyboard



The Keyboard Control is used in CPM to display a graphical keyboard on the screen for simulated keyboard input through a touchscreen. The Keyboard control and other input controls can display the On-Screen Keyboard (OSK) for use within that control. When you select keys on an OSK, whatever control or general Windows application has the focus will receive the key events. If the OSK is enabled, when the Text Entry control gains focus, the OSK is displayed. When the control loses focus, the OSK stops. (See "On-Screen Keyboard" on page 6-32.)

Property Name	What it is
Button Color	Click in the field to choose the control's color. (The Visible property must be True to see the control.)

Property Name	What it is
Border Painted	If True, a border is drawn around the control.
Height	The control's height.
Width	The control's width.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Enabled	If True, the control is enabled.
Label Font	Click in the field to choose the control label's font properties.
Label Text Color	Click in the field to choose the control label's text color.
Horizontal Alignment	The control label and icon's horizontal justification.
Horizontal Text Position	The control label's horizontal position relative to the icon.
Icon Height	The icon's height.
Icon Text Gap	The distance between the icon and the control label.
Icon Width	The icon's width.
Keep Icon Aspect Ratio	If True, the icon's height to width ratio is maintained when it is resized.
Keyboard Application	The path to the desired On-Screen Keyboard application. You must surround the path string with quotation marks, "C:/Window/System32/osk.exe" for example. This application is displayed whenever the Keyboard button is selected or its "Click" method occurs. (See ""On-Screen Keyboard" on page 6-32.)
Button Label	The text displayed on the control. Some special characters will not display in this property. See "Special Characters" on page 4-102.
Left Margin	The distance between the control's left edge and the label text.
On Screen Keyboard Displayed	If True, the On-Screen Keyboard is currently being displayed. See "On-Screen Keyboard" on page 6-32
Right Margin	The distance between the control's right edge and the label text.
Size Icon With Button	If True, the icon's size will change when the control is resized.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Icon	Click in the field to place an icon on the control. Icon files may have these extensions: gif, jpg, png, and bmp. The icon file must be on the same disk drive as the Control Panel file.
Vertical Text Position	The control label's vertical alignment relative to the icon.

Property Name	What it is
Visible	If True, the control is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Click	Produces the same effect as clicking the control
Enable	Enables the control so it can be used
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Action	When the button is clicked

Numeric Entry



You can use the Numeric Entry control to enter numbers on the Control Panel. The numbers can then be linked to a vision program or other controls. If the On-Screen Keyboard (OSK) is enabled, it is displayed when this control gains focus.

Property Name	What it is
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Minimum Value	The minimum value that may be entered.
Maximum Value	The maximum value that may be entered.
Editable	If True, the number is editable.
Selected Back-ground	The background color of numbers selected in the entry field.
Selected Color	The display color of numbers selected in the entry field.
Disabled Color	The number's display color when the control is disabled.
Caret Color	The cursor color displayed when you enter numbers.
Number Type	The type of number (Real or Integer) that can be entered.
Integer Value	The number's current integer value. (Number Type Integer must be selected)
Display Integer Grouping	If True, the control displays integer values with digit grouping symbols based on Operating System settings
Real Value	The number's current real value. (Number Type Real must be selected)

Property Name	What it is
Suppress Popups	If True, error messages will not be displayed when the value entered was outside the limits set by the Minimum and Maximum value properties. The previously entered value will remain.
Value Error	If True, the value entered was outside the limits set by the Minimum and Maximum value properties
Decimal Precision	The number of decimal places to display for Real numbers.
Tooltip Text	This text is displayed when the cursor is held over the control in Run mode.
Background Color	The number's background color. (The Transparent property must be False to see the background.)
Number Color	The number's display color when the control is enabled.
Transparent	If True, the control's background is transparent.
Font	The number's font properties.
Width	The control's width.
Height	The control's height.
Horizontal Alignment	Sets the number's horizontal justification: Left, Center, or Right
Enabled	If True, the control is enabled.
Visible	If True, the control is visible.
On Screen Keyboard Displayed	If True, the On-Screen Keyboard is currently being displayed. See "On-Screen Keyboard" on page 6-32.

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used
Gain Focus	Puts the cursor into the entry field.
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Action	When the user presses the Enter key while in the control
Focus	When the control loses and gains focus
Action by User	When the text entry field loses focus or the user presses the Enter key
Focus Gained	When the control loses focus
Focus Lost	When the control gains focus

Event Name	When it happens
Value Changed	When the control loses focus or the Enter key is pressed AND the data has changed since the control gained focus

Password



The Password control provides a way to define users, passwords, and access parameters, and control access to one or more controls and control panels.

Note: Security enabled on the Control Panel by this Password control is independent of the security enabled on the camera, Vision Device, or Emulator. See “Impact Vision Device and Camera Security” on page 2-13 for more details about security. This control is also independent of Control Panel Application security (see “CPM Security” on page 4-2).

To define, modify, or delete User IDs and passwords, click the Users property value. See “How the Password control works” on page 4-61. If there are no Users defined, and you select the Password control, its events and properties will be behave as if a Level 1user has logged on.

Property Name	What it is
Border Painted	If True, a bevel border is drawn around the button.
Height	The control’s height.
Width	The control’s width.
X	The X coordinate of the control’s left edge.
Y	The Y coordinate of the control’s top edge.
Disable Prompt Close	If True, standard Windows controls are disabled for dialog prompts: Dialogs cannot be moved or resized Dialogs can only be closed by selecting one of the dialog buttons (not by clicking the title bar X) Dialogs cannot be closed using the Escape key or Alt+F4 keys
Enable Large Data Entry Screens	If True, all of the control's popup dialogs and messages use very large fonts and entry fields for use with touch screen monitors.
Enabled	If True, the button is enabled.
Horizontal Alignment	The Selected/Unselected icon and label’s horizontal justification.
Horizontal Text Position	The label’s horizontal position relative to the Selected/Unselected icon.
Icon Height	The icon’s height. (See Selected/Unselected Icon property.)
Icon Text Gap	The distance, in pixels, between the label and the Selected/Unselected icon.
Icon Width	The Selected/Unselected icon’s width.

Property Name	What it is
Unselected	This value is set to False when a user completes the log in process, and set to True when the user logs off.
Keep Icon Aspect Ratio	If True, the Selected/Unselected icon's height to width ratio is maintained when the control is resized
Left Margin	The distance between the button's left edge and the label.
Level 1 Name	The name associated with the Level 1 user. This user has the highest access (includes access of Levels 1-5).
Level 2 Name	The name associated with the Level 2 user (includes access of Levels 2-5).
Level 3 Name	The name associated with the Level 3 user (includes access of Levels 3-5).
Level 4 Name	The name associated with the Level 4 user (includes access of Levels 4 and 5).
Level 5 Name	The name associated with the Level 5 user. This user has the least access (includes access of 5 only).
Logged On	If True, a user is currently logged on.
Logged On Inactivity Duration	If a user is logged on, and the keyboard/mouse is inactive for this amount of time (in minutes), the user will be automatically logged off.
Logged On Inactivity Enabled	If True, the Logged On Inactivity Duration property is effective.
Logged On Level Name	The name of the currently logged on user's level as defined in the "Level X Name" property.
Logged On Level Number	The number of the currently logged on user's level. If no one is logged on, this value is zero.
Logged On Level 1	If True, a user with Level 1 access is logged on.
Logged On Level 2	If True, a user with Level 1 or Level 2 access is logged on.
Logged On Level 3	If True, a user with Level 1, 2, or 3 access is logged on.
Logged On Level 4	If True, a user with Level 1, 2, 3, or 4 access is logged on.
Logged On Level 5	If True, a user with Level 1, 2, 3, 4, or 5 access is logged on.
Max Failed Logon Attempts	The number of failed logon attempts allowed. If a user reaches this limit, then they are prevented from logging on until the "User Logon Disabled Duration" time has elapsed. The login attempt count is reset when any of the following occurs: The control panel application is loaded The user successfully logs on The "User Logon Disable Duration" time elapses The "Max Failed Logon Attempts Enabled" property is set to False
Max Failed Logon Attempts Enabled	If True, the Max Failed Logon Attempts property is effective.

Property Name	What it is
On Screen Keyboard Displayed	If True, the On-Screen Keyboard is currently being displayed. See “On-Screen Keyboard” on page 6-32.
Password Expiration	The expiration time, in days, for passwords. If a user’s password has expired, they will be required to furnish a new password after they log in. See “Password Expiration” on page 4-63.
Password Expiration Enabled	If True, passwords will expire when the time period defined in the Password Expiration property has elapsed. See “Password Expiration” on page 4-63.
Password Maximum Length	The maximum number of characters that a password can contain (maximum 12).
Password Minimum Length	The minimum number of characters that a password can contain.
Password Required	If True, a password that meets all system requirements must be defined for each user.
Right Margin	The distance between the button’s right edge and the label.
Selected	The value is set to True when a login has been completed. It is set to False when the control is selected while a user is logged on. (The Selected Event occurs even if the login is cancelled.)
Selected Button Color	Click in the field to choose the control’s color when the Selected value is True. (The Visible property must be True to see the control.)
Selected Label Font	Click in the field to choose the label’s font properties when the Selected value is True.
Selected Icon	Click in the field to choose the control’s display icon when Selected value is True.
Selected Label	The label displayed when the Selected value is True. Some special characters will not display in this property. See “Special Characters” on page 4-102.
Selected Label Color	Click in the field to choose the label’s color when the Selected value is True.
Size Icon With Button	If True, the icon’s size will change when the button is resized.
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Unselected Button Color	Click in the field to choose the control’s color when the Unselected value is True. (The Visible property must be True to see the control.)
Unselected Label Font	Click in the field to choose the label’s font properties when the Unselected value is True.
Unselected Icon	Click in the field to choose an icon to display on the control when the Unselected value is True.

Property Name	What it is
Unselected Label	The label displayed when the Unselected value is True. Some special characters will not display in this property. See “Special Characters” on page 4-102.
Unselected Label Color	Click in the field to choose the label’s color when the Unselected value is True.
User ID Text Entry Enabled	If True, the User ID field is displayed as a text entry field. If False, the User ID is displayed as a drop down list which displays all currently defined users. (See "Users" property)
Users	Click in this field to add, modify, or delete users, user levels, and passwords. See “How the Password control works” on page 4-61.
User List Filename	An XML file containing encrypted user information that is stored outside the control panel (cp) file. If this property is blank, information is stored in the cp file. If the file cannot be loaded, the Load User List Failed event is initiated.
Logged On User	The name of the user currently logged on to the control. Blank if no one is logged on.
User Logon Disabled Duration	The length of time, in minutes, that a user must wait to log in after the "Max Failed Logon Attempts" has been exceeded.
User ID Maximum Length	The maximum number of characters that the User ID can contain (maximum 12).
User ID Minimum Length	The minimum number of characters that the User ID can contain
Vertical Text Position	Sets the label’s vertical justification relative to the icon.
Visible	If True, the control is visible.

Method Name	What it does
Display User Editor	Displays the Edit Users dialog
Hide	Makes the control invisible
Disable	Disables the control; it cannot be used
Unselect	Sets the Unselected property to True
Select	Sets the Selected property to True
Show	Makes the control visible
Click	Produces the same effect as clicking the control
Enable	Enables the control so it can be used

Event Name	When it happens
Logged On	If any users are defined, when one of them logs on (a valid User ID and password were entered) If no users are defined, when the Password control is selected by the user or selected by a method or property link
Selected	If any users are defined, when one of them logs on or cancels a log on If no users are defined, when the Password control is selected by the user or by a method or property link If users are defined or not, when the Select Method is invoked
Load User List Failed	If the file listed in the User List Filename property cannot be loaded.
Action	The control's status changes by the user or by a method or property link
Unselected By User	If any users are defined, when one of them logs off If no users are defined, when the Password control is unselected by a user
Logged Off	If any users are defined, when one of them logs off If no users are defined, when the Password control is unselected
Action By User	The control's status changes by a user
Failed Logon Attempt	A user's attempt to log on fails
Selected By User	If any users are defined, when one of them logs on or cancels a log on If no users are defined, when the Password control is selected by the user
Unselected	If any users are defined, when one of them logs off or cancels a log on If no users are defined, when the Password control is unselected by the user or unselected by a method or property link If users are defined or not, when the Unselect Method is invoked

How the Password control works

When you click in the Users property, or initiate the Display User Editor event, the Edit Users dialog is displayed. The options are Add User, Modify User, and Delete User.

Add User



1. **User ID**: The User ID must be unique and can contain alphanumeric characters. Its size is determined by the properties User ID Minimum Length and User ID Maximum Length.
1. **User Description**: A description of the user.
2. **User Level**: User levels range from 1 to 5. Users with level 1 have the most access. When a user with Level 1 access logs on, they have access to all levels (all Logged On Level properties are set to True). Multiple users can have the same User Level.
3. **Level Name**: This is the name defined in the Level "n" Name property (where "n" is the level number).
4. **Password**: The password can contain any alphanumeric characters. Its size is determined by the properties Password Minimum Length and Password Maximum Length. The Password will be masked as you type it.
5. **Confirm Password**: Repeat the Password to verify it was entered correctly. The Password will be masked as you type it.
6. **Password always expires**: If this box is checked, the user's password will expire based on the Password Expiration property. If the box is not checked, the password will never expire and, therefore, cannot be changed by the user.
7. **Force password change at first logon**: If this box is checked, the user will be forced to change their Password after the next time they log on. A prompt is displayed.



Modify User

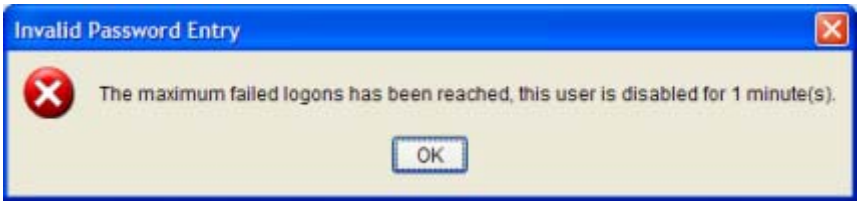
The options in Modify User are the same as Add User, except that users can only modify users that have a higher user level number (less access).

Delete User

To delete a user, select the User ID from the Users list, then click the Delete User button. If there is more than one user defined, you cannot delete the last remaining Level 1 user. You can only delete other users that have a higher user level number (less access).

Failed Logon Attempts

There are several Password control properties and events involved when a user log on fails. The Failed Logon Attempt event fires and the attempt is recorded. If Max Failed Logon Attempt Enabled is True, and the number of attempts exceeds Max Failed Logon Attempts, a countdown is started based on User Logon Disabled Duration. The user will be unable to log on again until the time has elapsed and a warning message is displayed.



The login attempt count is reset when any of the following occurs:

The control panel application is loaded
The user successfully logs on
The "User Logon Disable Duration" time elapses
The "Max Failed Logon Attempts Enabled" property is set to False

Password Expiration

If the Password Expiration Enabled property is False, passwords will never expire and, therefore, cannot be changed by the user. If the Password Expiration Enabled property is True, a user's password will expire after the time defined in the Password Expiration property has elapsed. The start time for each user, which is used to calculate elapsed time after each logon, is reset to the current time when any of the following occurs:

The Password Expiration property is set to True
A password is modified or created using the User Edit dialog
A user changes their password during logon

After the time has elapsed, and a user logs on, a prompt is displayed for the user to change their password. If the user cancels this operation, they will not be able to log on.



Changing an Expired Password

1. Enter your current password in the Old Password field.
2. Enter your new password in the New Password field. The New Password must be different than any previous passwords you have used.

3. Enter your new password in the Confirm Password field.

The system maintains a history for each user based on the following conditions:

- The most recent 24 passwords are maintained. Passwords in the history cannot be reused.
- A password is added to top of the history when the user enters a new one during the logon prompt.
- A password added to top of the history when an administrator changes it.
- A password removed from bottom of the history when the history length reaches 24 and a new password is added.
- All passwords for a user are removed from the history when the user is deleted.

Pattern Database



The Pattern Database Control lets you load, view, and update a pattern database. Pattern databases are used by the VPM Pattern Sorting tool.



This control has sub-controls within it which are automatically created and linked when the Pattern Database control is added to the control panel. Each of the sub-controls have their own property list. See the appropriate section of this chapter for details about each sub-control. Some automatic links are created between the sub-controls' properties and are locked so they cannot be changed or deleted. These are indicated by a lock symbol.

The Pattern Database property of this control must be linked to the Pattern Database Output property of a Pattern Sorting tool. See "How the Pattern Database control works" on page 4-65.

Property Name	What it is
Border Text Align	Sets the border text's position at the top of the border
Border Text Color	Click in the field to choose the border text's color.
Border Text Font	Click in the field to choose the border text's font properties.
Border Type	The border type: Bevel Lowered, Bevel Raised, Etched Lowered, Etched Raised, Line, or None.
Height	The control's height.
Width	The control's width.
X	The control's left edge X coordinate.
Y	The control's top edge Y coordinate.
Device Connection	This property indicates which camera, Vision Device, or Emulator contains the database to load. When you link the Pattern Database property, this link is created to an Impact Connector control automatically. If the control panel contains more than one Connector control, you are prompted to choose one.

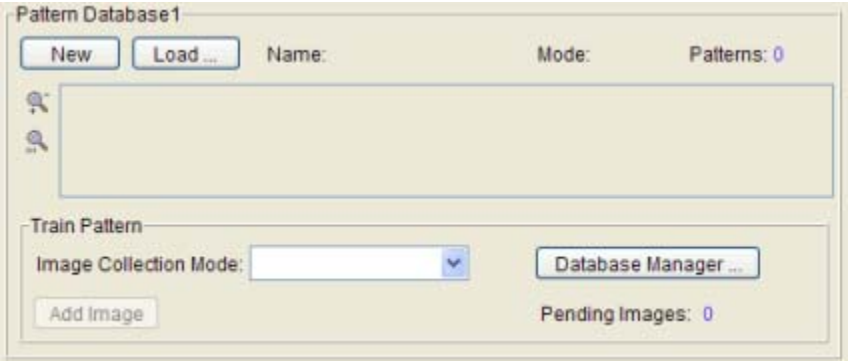
Property Name	What it is
Disable Prompt Close	If True, standard Windows controls are disabled for dialog prompts: Dialogs cannot be moved or resized Dialogs can only be closed by selecting one of the dialog buttons (not by clicking the title bar X) Dialogs cannot be closed using the Escape key or Alt+F4 keys
Enable Large Data Entry Screens	If True, all of the control's popup dialogs and messages use very large fonts and entry fields for use with touch screen monitors.
Enabled	If True, the control is enabled.
Extend Enabled to Contents	If True, this control’s Enabled property is extended to all the controls it contains.
Line Border Color	Click in the field to choose the line border’s color. (This has no effect on other border types.)
Line Border Width	The line border’s width. (This has no effect on other border types.)
Pattern Database	The link to the Pattern Database property in the Pattern Sorting tool.
Border Text	Text displayed when the cursor is held over the control in Run mode.
Visible	If True, the control is visible.
Zoom Percent	The Pattern Database images in the viewer are magnified by this percentage.

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Database Changed	When the Pattern Database changes.

How the Pattern Database control works

When you add the control to a control panel, all of its sub-controls are added. Each sub-control provides a function.



- **New**
  Clicking the new button unloads any currently loaded database and clears the Name, Mode, and Patterns properties and the database viewer panel.

- **Load...**
  NOTE: You must first make a link between the Pattern Database property of this control and the Pattern Database Output property of a Pattern Sort tool before you can load a database.
  When you click the load button, the list of available trained pattern database files is displayed. Select the desired file then click OK. The database file is loaded in the control and in the corresponding Pattern Sorting tool. The Database Filename, Mode, and Number of Patterns in the database are displayed above the viewer. The patterns in the database, along with their labels, are displayed in the viewer. Mode is the type of search algorithm that was used to train the database image.

- **Name**
  This is the name of the currently loaded database.

- **Mode**
  The type of search algorithm used to train the database, either “Texture” or “Contour.”

- **Patterns**
  The number of patterns in the database.

- **Image Collection Mode**
  If a database is loaded, collected images are added to a PDM queue to be trained for that database. If no database is loaded, collected images are added to a general PDM queue to be trained for a new database. Image names are automatically generated, but they can be edited in PDM.
  Manual: When you click the Add Image button, the Input Image is added to the queue.
  Save Failed Images: The Input Image is added to the queue if the tool fails. Use this option to automatically add untrained patterns to a database.
  Save All Images: The Input Image is added to the queue each time the tool runs.

- **Add Image**
  If a database is loaded, the Input Image is added to a specific PDM queue to be trained for that database. If no database is loaded, the Input Image is added to a general PDM queue to be trained for a new database. Image names are automatically generated, but they can be edited in PDM.

- **Database Manager**
  The Pattern Database Manager (PDM) is started. PDM is used to create, train, and modify a searchable pattern tree (database) used for pattern matching. See “Pattern Database Manager” on page 6-59.

Radio Button



The Radio Button control provides exclusive choices on a Control Panel. When two or more radio buttons are in a group, the Selected property is automatically limited to one of the buttons. That is, in Edit mode you can only set the Selected property to True and in Run mode only one of the buttons can be selected at a time.

Note: You must have a Radio Button Group control in the Control Panel to add a Radio Button control.

Property Name	What it is
Background Color	Click in the field to choose the button’s background color. (The Visible property must be True to see the background.)
Border Painted	If True, a bevel border is drawn around the button.
Height	The button’s height.
Width	The button’s width.
X	The X coordinate of the control’s left edge.
Y	The Y coordinate of the control’s top edge.
Enabled	If True, the button is enabled.
Label Font	Click in the field to choose the label’s font properties.
Label Text Color	Click in the field to choose the label’s display color.
Label Position	The label’s position relative to the radio button
Unselected	If True, the button is not selected.
Button Label	The button’s label. Some special characters will not display in this property. See “Special Characters” on page 4-102.
Selected	If True, the button is Selected. Only one button in a group can be set to True, all other buttons in that group are set to False.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Transparent	If True, the control’s background is transparent.
Visible	If True, the button is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Click	Produces the same effect as clicking the control
Enable	Enables the control so it can be used

Method Name	What it does
Hide	Makes the control invisible
Select	Sets the button to the Selected state.
Show	Makes the control visible
Unselect	Sets the button to the Unselected state.

Event Name	When it happens
Unselected	When the Unselected value is set to True by anything but a user's action.
Unselected by User	When the Unselected value is set to True by a user's action.
Selected	When the button's Selected value is set to True by anything but a user's action
Selected by User	When the button's Selected value is set to True by a user's action

Radio Button Group



The Radio Button Group control is used with the Radio Button control to provide two or more exclusive choices on a Control Panel. When two or more radio buttons are in a group, selection is automatically limited to one of the buttons. That is, you can only set the Selected value to True; all other radio buttons in the group automatically have the Selected value set to False.

Note: You must have a Radio Button Group control in the Control Panel to add a Radio Button control.

Property Name	What it is
Border Text Align	Sets the border text's position at the top of the border
Border Text Color	Click in the field to choose the border text's color.
Border Text Font	Click in the field to choose the border text's font properties.
Border Type	The border type: Bevel Lowered, Bevel Raised, Etched Lowered, Etched Raised, Line, or None.
Height	The control's height.
Width	The control's width.
X	The control's left edge X coordinate.
Y	The control's top edge Y coordinate.
Enabled	If True, the control is enabled.
Line Border Color	Click in the field to choose the line border's color. (This has no effect on other border types.)
Line Border Width	The line border's width. (This has no effect on other border types.)

Property Name	What it is
Border Text	The text displayed at the top of the border.
Visible	If True, the control is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Button Selected	When a button's Selected value is set to True
Button Selected by User	Only when a button's Selected value is set to True by a user's action

Range



The Range control is used to display and enter the start and end values of Range1D input type in a VPM tool. You can also link to and enter a Tolerance data type where the minus, nominal, and plus values are calculated from the Range control's start and end values. See "Using the Range Control" on page 4-72.

Property Name	What it is
Background Color	Click in the field to choose the control's background color. (The Visible property must be True to see the background.)
Caret Color	Sets the border text's position at the top of the border
Height	Click in the field to choose the border text's color.
Width	Click in the field to choose the border text's font properties.
X	The border type: Bevel Lowered, Bevel Raised, Etched Lowered, Etched Raised, Line, or None.
Y	The control's height.
Disabled Value Color	The Start and End Value color when the control is disabled.
Enabled	If True, the control is enabled.
End Editable	If True, the End Value is editable. If False, the background color is set to the Background Color property value and the field cannot be changed.
End Value	The current End Value.

Property Name	What it is
End Value Alignment	Where the End Value is aligned in its field.
End Value Background Color	The background color of the End Value field.
End Value Foreground Color	The text color in the End Value field.
End Value Maximum	The maximum value allowed in the End Value field.
End Value Minimum	The minimum value allowed in the End Value field.
Label Color	The Start and End label text color.
Labels Font	The Start and End label text font.
Horizontal Labels Position	The label position when the control's Orientation is horizontal.
Vertical Labels Position	The label position when the control's Orientation is vertical.
Labels Visible	If True, the Start and End labels are visible.
On Screen Keyboard Displayed	If True, the On-Screen Keyboard is currently being displayed. See "On-Screen Keyboard" on page 6-32.
Orientation	The control's orientation, horizontal or vertical.
Decimal Precision	The number of decimal places to display in the Start and End values.
Range	The control's Start and End Values as a Range 1D data type. You can only link this property. It can be linked from the Range1D property of a VPM tool.
Selected Background	The Start and End Value background color when the value is selected.
Selected Color	The Start and End Value text color when the value is selected.
Start Editable	If True, the Start Value field is editable. If False, the background color is set to the Background Color property value and the field cannot be changed.
Start Label Text	The Start Label text.
Start Value	The current Start Value.
Start Value Alignment	Where the Start Value is aligned in its field.
Start Value Background Color	The background color of the Start Value field.

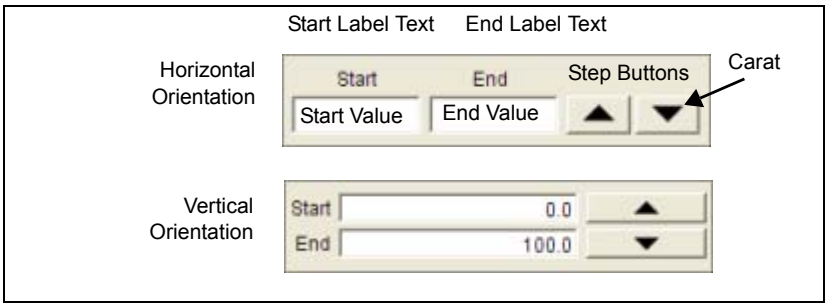
Property Name	What it is
Start Value Foreground Color	The text color in the Start Value field.
Start Value Maximum	The maximum value allowed in the Start Value field.
Start Value Minimum	The minimum value allowed in the Start Value field.
Step Button Value	The amount that the Start or End Value will change each time the Step Button is clicked.
Step Buttons Visible	If True, the Step Buttons are visible on the control.
Tolerance	The control's Tolerance value. Link this property from the Tolerance property of a VPM tool. (Linkable Only)
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Transparent	If True, the control's background is transparent.
Value Font	The font for the Start and End Value field text.
Visible	If True, the control is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
End Gain Focus	Forces the cursor to the End Value field.
Enable	Enables the control so it can be used
Hide	Makes the control invisible
Start Gain Focus	Forces the cursor to the Start Value field.
Show	Makes the control visible

Event Name	When it happens
End Value Action by User	When the End Value field is changed by a user's action
End Value Action	When the End Value field changes
Start Value Action	When the Start Value field changes
Range Action by User	When the Range property is changed by a user's action, i.e. the Start or End Values, or Range property change
Start Value Action By User	When the Start Value field is changed by a user's action
Range Action	When the Range property changes

Event Name	When it happens
Range Lost Focus	When focus is lost from any of the value entry fields

Using the Range Control



To change a value

- Click in the field, enter the value, then press the Enter key.

OR

- Click in the field then click the Up or Down Step Button. The value will change according to the Step Button Value property.

Range Scroll



The Range Scroll control allows you to display and adjust a range of values with a scroll bar. As you slide the bar, the left end adjusts the Range Minimum value. The right end adjusts the Range Maximum value. The middle of the bar adjusts the Range Start and End values within the limits of the Range Minimum and Range Maximum values. Tools that have a data type of Range1D can be linked directly to this control.

Property Name	What it is
Background Color	Click in the field to choose the control's background color. (The Visible property must be True to see the background.)
Height	The control's height.
Width	The control's width.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Enabled	If True, the button is enabled.
Precision	The number of decimal places for the Range values.
Range Maximum	The control's upper limit. This is displayed in the lower right corner of the control.
Range Minimum	The control's lower limit. This is displayed in the lower left corner of the control.

Property Name	What it is
Range End	The control's highest range value. This is displayed in the lower right corner of the range scroll bar. In Run Mode, you can click and drag the upper end of the scroll bar to adjust this value.
Range Start	The control's lowest range value. This is displayed in the upper left corner of the range scroll bar. In Run Mode, you can click and drag the lower end of the scroll bar to adjust this value.
Label Color	Click in the field to choose the label's display color.
Label Font	Click in the field to choose the label's font properties.
Range	The control's Range Start and Range End properties as a Range 1D data type. Link this property to the Range1D property of the desired tool.
Tool Tip	Text displayed when the cursor is held over the control in Run mode.
Visible	If True, the control is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Changed	When the control's value changes
Changed by User	Only when the control's value changes by a user's action.
Change Completed	When the control's range, start, or end, value change is complete (the adjustment stops moving)

Slider



The Slider control varies a value when a slider is moved on the Control Panel. You can define the size, orientation, and major and minor tick spacing for the best presentation.

Property Name	What it is
Background Color	Click in the field to choose the control's background color. (The Transparent property must be False to see the background.)
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Enabled	If True, the slider is enabled.

Property Name	What it is
Real Value	The slider's real value.
Foreground Color	Click in the field to choose the control's foreground color.
Integer Value	The slider's integer value
Invert	If True, the Maximum Value is displayed on the right or bottom of the slider instead of the left or top.
Label Color	The slider's label color.
Label Font	The slider's label font
Major Tick Spacing	The numeric spacing between the slider's major tick marks.
Maximum Value	The maximum slider value (must be greater than the Minimum Value).
Minimum Value	The minimum slider value (must be less than the Maximum Value).
Minor Tick Spacing	The numeric spacing between the slider's minor tick marks.
Number Type	Select the number type to be displayed.
Orientation	choose horizontal or vertical display orientation.
Paint Labels	If True, the Major and Minor Tick Spacing values are displayed.
Paint Ticks	If True, the Major and Minor Tick marks are displayed.
Paint Track	If True, the slider track are displayed.
Decimal Precision	Enter the number of decimal places for the slider's value.
Height	The control's height.
Width	The control's width.
Snap To Ticks	If True, the slider will snap to the nearest tick mark when it is moved.
Thumb Knob Height	The slider knob's height
Thumb Knob Width	The slider knob's width
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Transparent	If True, the control's background is transparent.
Visible	If True, the control is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used

Method Name	What it does
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Change Completed	When the slider's value change is complete (the slider stops moving)
Changed by User	Only when the slider's value changes by a user's action (while the slider is moving)
Change	Each time the slider's value changes (while the slider is moving)

Table



The Table control is provides for flexible data display on a Control Panel. You can define the number of rows and columns, or indicate a dynamic display which adds rows to the table as data is created.

Table Setup	What it is
Style Group (configure overall table styles)	
Table Type	Static: Number of rows and columns is predefined. Dynamic: Data rows are dynamically added to table as needed. If Dynamic is selected, some row property selections are disabled.
Cells Use	Row Properties: All cells use the display properties (e.g. precision, boolean type) defined in the Per Row group; also enables Data Highlighting in the Rows Group Column Properties: All cells use the display properties (e.g. precision, boolean type) defined in the Per Column group; also enables Data Highlighting in the Columns Group
Grid Lines	Vertical visible: when checked the vertical grid lines are visible Horizontal visible: when checked the horizontal grid lines are visible Color: The grid line color.
Rows Group (configure rows)	
Number of Rows	The number of rows in the table. Select a row with the Current Row drop-down. Append: click to add a row at the end of the table Insert Before: click to insert a row above the selected row Delete: click to delete the currently selected row (Buttons are disabled when Dynamic table type is selected)
Current Row	The currently selected row. Click the drop-down to select a row.
Label	The label for the Current Row. Enabled when Visible is checked in the Labels group.

Table Setup	What it is
Apply To All	If checked, all the settings in the All Rows group are applied to all the rows in the table. If unselected, the settings only apply to the Current Row.
Labels Subgroup (configure common row labels)	
Visible	If checked, labels are visible and the Label field for the Current Row is enabled.
Font	The label font properties.
Text Color	The label text color.
Background Color	The label background color.
Per Row/All Rows Subgroup (configure each or all rows) Some choices are enabled only when Cells Use Row Properties is selected. If Apply To All is selected, these settings apply to all rows in the table.	
Real Precision	The number of decimal places to display.
Boolean Cell	Select the display type for cells with Boolean data If Indicator Light is selected, click the True and False color buttons to set the indicator light color.
Editable	If checked, the selected row can be edited in Run mode.
Cell Text Color	The text color for cells
Cell Background Color	The background color for cells
Cell Font	The font properties for cells
Data Highlighting Subgroup (configure row highlighting)	
Enabled	If checked, the selected Cell Text Color and Cell Background Color are applied to the cells.
Column To Monitor	Enter a column number. The state of the cell at the intersection of Column To Monitor and the Current Row is monitored. The selected Cell Text Color and Cell Background Color are used to highlight the Current Row, based on the True or False state of that cell.
Cell Text Color	The display Text Color for highlighted cells.
Cell Background Color	The display Background Color for highlighted cells.
Columns Group (configure columns)	
Number of Columns	The number of columns in the table. Select a column with the Current Column drop-down. Append: click to add a column at the right end of the table Insert Before: click to insert a column to the left of the selected column Delete: click to delete the currently selected column
Current Column	The currently selected column. Click the drop-down to select a column.

Table Setup	What it is
Label	The label for the Current Column. Enabled when Visible is checked in the Labels group.
Apply To All	If checked, all the settings in the All Columns group are applied to all the columns in the table. If unselected, the settings only apply to the Current Column.
Labels Subgroup (configure common column labels)	
Visible	If checked, labels are visible and the Label field for the Current Column is enabled.
Font	The label font properties.
Text Color	The label text color.
Background Color	The label background color.
Per Column/All Columns Subgroup (configure each or all columns) Some choices are enabled only when Cells Use Column Properties is selected. If Apply To All is selected, these settings apply to all columns in the table.	
Real Precision	The number of decimal places to display.
Boolean Cell	Select the display type for cells with Boolean data If Indicator Light is selected, click the True and False color buttons to set the indicator light color.
Editable	If checked, the selected column can be edited in Run mode.
Cell Text Color	The text color for cells
Cell Background Color	The background color for cells
Cell Font	The font properties for cells
Alignment	Sets the data alignment within the column.
Width	Sets the selected column's width (in pixels).
Data Highlighting Subgroup (configure column highlighting)	
Enabled	If checked, the selected Cell Text Color and Cell Background Color are applied to the cells.
Row To Monitor	Enter a row number. The state of the cell at the intersection of Row To Monitor and the Current Column is monitored. The selected Cell Text Color and Cell Background Color are used to highlight the Current Column, based on the True or False state of that cell.
Cell Text Color	The display Text Color for highlighted cells.
Cell Background Color	The display Background Color for highlighted cells.

Property Name	What it is
X	The control's X coordinate.
Y	The control's Y coordinate.
Width	The control's width.
Height	The control's height.
Enabled	If True, the control is enabled.
Visible	If True, the control is visible.
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Background Color	The color displayed behind the table if the Transparent property is False
Transparent	If True, the Control Panel's color shows behind the table If False, the Background Color is displayed
On Screen Keyboard Displayed	If True, the On-Screen Keyboard is currently being displayed. See "On-Screen Keyboard" on page 6-32.
Remaining Properties	The remaining lines in the properties tab define each cell in the table. Property Name contains the Row and Column labels Type sets the cell's data type Value sets the cell's current value (these values persist when the Control Panel is saved)

Method Name	What it does
Update	Updates the control's data values.
Clear	Clears the control's data values.
Show	Makes the control visible
Hide	Makes the control invisible
Enable	Enables the control so it can be used
Disable	Disables the control; it cannot be used

Event Name	When it happens
Updated	When the table's values are updated
Update by User	Only when the table's values are updated by a user's action

Text Entry



The Text Entry control provides text entry on the Control Panel. The entered text can then be linked to a vision program or another Control Panel. If the On-Screen Keyboard is enabled, it is displayed when this control gains focus.

Property Name	What it is
Background Color	Click in the field to choose the control's background color. (The Transparent property must be False to see the background.)
Caret Color	Click in the field to choose the cursor color displayed when you enter numbers.
Check While Entering	If True, the text will be checked for disallowed characters as each character is entered during text entry. (See Characters Disallowed event.)
X	The control's X coordinate.
Y	The control's Y coordinate.
Disabled Color	Click in the field to choose the text's display color when the control is disabled.
Disallowed Characters	If these characters are entered, they will be rejected by the control
Disallowed Characters Entered	Disallowed characters that have been entered in the control
Editable	If True, the text can be edited.
Enabled	If True, the control is enabled.
Font	Click in the field to choose the text's font properties.
Text Color	Click in the field to choose the text's display color.
Horizontal Alignment	Sets the text's horizontal justification: Left, Center, or Right
On Screen Keyboard Displayed	If True, the On-Screen Keyboard is currently being displayed. See "On-Screen Keyboard" on page 6-32.
Selected Color	Click in the field to choose the text's display color when the text field is selected.
Selected Background	Click in the field to choose the text's background color when the text field is selected.
Text	The control's current text value.
Height	The control's height (in pixels)
Width	The control's width (in pixels)
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Transparent	If True, the control's background is transparent.

Property Name	What it is
Visible	If True, the control is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used
Gain Focus	The control gains focus (the cursor is placed in the text entry field).
Hide	Makes the control invisible.
Show	Makes the control visible.

Event Name	When it happens
Action	When the user presses the Enter key while in the control
Focus	When the control loses or gains focus
Action by User	When the text entry field loses focus or the user presses the Enter key
Characters Disallowed	When Disallowed Characters are entered. (See Check While Entering property.)
Focus Gained	When the control gains focus
Focus Lost	When the control loses focus
Value Changed	When the control loses focus or the Enter key is pressed AND the data has changed since the control gained focus

Toggle Button



Each time the Toggle Button control is pressed, it changes state from Selected to Unselected. Its Action event can be used, for many purposes.

Property Name	What it is
Border Painted	If True, a raised bevel border is drawn around the button. If this property value is “System,” the operating system display properties color is used. See “Control Color” on page 4-10.
Height	The control’s height
Width	The control’s width
X	The X coordinate of the control’s left edge.
Y	The Y coordinate of the control’s top edge.
Enabled	If True, the button is enabled.

Property Name	What it is
Horizontal Alignment	Sets the label's justification: Left, Center, or Right
Horizontal Text Position	Sets the label's horizontal justification relative to the icon.
Icon Height	The icon's height.
Icon Text Gap	The distance, in pixels, between the label text and the icon.
Icon Width	The icon's width.
Unselected	If True, the button is currently Unselected.
Keep Icon Aspect Ratio	If True, the icon's height to width ratio is maintained when it is resized.
Left Margin	The distance between the button's left edge and the label text.
Right Margin	The distance between the button's right edge and the label.
Selected	If True, the button is Selected. Changing this property does not fire a "Selected" or an "Unselected" event.
Selected Button Color	Click in the field to choose the control's color when it is in the Selected state. (The Visible property must be True to see the control.)
Selected Label Font	Click in the field to choose the label's font properties when the control is in the Selected state.
Selected Icon	Click in the field to choose an icon to display on the control when it is the Selected state. Icon files may have these extensions: gif, jpg, png, and bmp. The icon file must be on the same disk drive as the Control Panel file.
Selected Label	The displayed label when the button is in the Selected state. Some special characters will not display in this property. See "Special Characters" on page 4-102.
Selected Label Color	Click in the field to choose the label's color when the control is in the Selected state.
Size Icon With Button	If True, the icon's size will change when the button is resized.
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Unselected Button Color	Click in the field to choose the control's color when it is in the Unselected state. (The Visible property must be True to see the control.)
Unselected Label Font	Click in the field to choose the label's font properties when the control is in the Unselected state.
Unselected Icon	Click in the field to choose an icon to display on the control when it is the Unselected state. Icon files may have these extensions: gif, jpg, png, and bmp. The icon file must be on the same disk drive as the Control Panel file.

Property Name	What it is
Unselected Label	The displayed label when the button is in the Unselected state. Some special characters will not display in this property. See “Special Characters” on page 4-102.
Unselected Label Color	Click in the field to choose the label’s color when the control is in the Unselected state.
Vertical Text Position	Sets the label’s vertical justification relative to the icon.
Visible	If True, the control is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Click	Toggles the button state and fires an Action event
Enable	Enables the control so it can be used
Hide	Makes the control invisible
Select	Makes the control Selected
Show	Makes the control visible
Unselect	Makes the control Unselected

Event Name	When it happens
Unselected	When the button is unselected
Unselected by User	Only when the button is unselected by the user
Action	When the button’s state changes
Action by User	Only when the button’s state changes from a user’s action
Selected	When the button is selected
Selected by User	Only when the button is selected by the user

Tolerance



The Tolerance control provides the ability to view and/or adjust the minus, nominal, and plus values of the tolerance property value on a VPM tool. Optional step buttons allow you to increase or decrease the selected tolerance value in user-definable steps.

To change any of the value fields

1. Click in the desired field

2. Click the up or down step button OR
   Enter a value in the field and press the Enter key

Property Name	What it is
Caret Color	Click in the field to choose the cursor color displayed in number entry fields.
Height	The control's height (in pixels)
Width	The control's width (in pixels)
X	The control's X coordinate.
Y	The control's Y coordinate.
Disabled Value Color	Click in the field to choose the value's display color when the control is disabled.
Enabled	If True, the control is enabled.
Labels Font	Click in the field to choose the label's font properties.
Labels Position	The label's position relative to the control.
Labels Visible	If True, the labels are visible.
Minus Label Text	The text displayed for the Minus label.
Minus/Plus Editable	If True, the Minus and Plus values can be edited.
Minus/Plus Label Color	Click in the field to choose the color for the Minus and Plus labels.
Minus/Plus Decimal Precision	The number of displayed decimal places for the Minus and Plus values.
Minus/Plus Step Button Value	The amount of increase or decrease for each click on the indicated Step Button for the Minus and Plus values.
Minus Value	The current Minus value.
Minus Value Alignment	The horizontal alignment for the Minus value.
Minus Value Background Color	Click in the field to choose the Minus value's background color.
Minus Value Foreground Color	Click in the field to choose the Minus value's foreground color.
Minus Value Maximum	The maximum limit for the Minus value.
Minus Value Minimum	The minimum limit for the Minus value.
Nominal Editable	If True, the Nominal value can be edited.

Property Name	What it is
Nominal Label Color	Click in the field to choose the color for the Nominal label.
Nominal Label Text	The text displayed for the Nominal label.
Nominal Decimal Precision	The number of displayed decimal places for the Nominal value.
Nominal Step Button Value	The amount of increase or decrease for each click on the indicated Step Button for the Nominal value.
Nominal Value	The current Nominal value.
Nominal Value Alignment	The horizontal alignment for the Nominal value.
Nominal Value Background Color	Click in the field to choose the Nominal value's background color.
Nominal Value Foreground Color	Click in the field to choose the Nominal value's foreground color.
Nominal Value Maximum	The maximum limit for the Nominal value.
Nominal Value Minimum	The minimum limit for the Nominal value.
On Screen Keyboard Displayed	If True, the On-Screen Keyboard is currently being displayed. See "On-Screen Keyboard" on page 6-32.
Plus Label Text	The text displayed for the Plus label.
Plus Value	The current Plus value.
Plus Value Alignment	The horizontal alignment for the Plus value.
Plus Value Background Color	Click in the field to choose the Plus value's background color.
Plus Value Foreground Color	Click in the field to choose the Plus value's foreground color.
Plus Value Maximum	The maximum limit for the Plus value.
Plus Value Minimum	The minimum limit for the Plus value.
Range	The control's Range Start and Range End. Link this property to the Range1D property of a tool. (Linkable Only)
Selected Background	Click in the field to choose the text's background color when the text field is selected.

Property Name	What it is
Selected Color	Click in the field to choose the text's display color when the text field is selected.
Step Buttons Visible	If True, the step buttons are visible.
Tolerance	The control's Tolerance value. Link this property to the Tolerance property of a tool. (Linkable Only)
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Transparent	If True, the control's background is transparent.
Value Font	The font for all the text entry values.
Visible	If True, the control is visible.

Method Name	What it does
Minus Gain Focus	The Minus value gains focus (the cursor is placed in the text entry field).
Nominal Gain Focus	The Nominal value gains focus (the cursor is placed in the text entry field).
Disable	Disables the control; it cannot be used
Show	Makes the control visible.
Enable	Enables the control so it can be used
Plus Gain Focus	The Plus value gains focus (the cursor is placed in the text entry field).
Hide	Makes the control invisible.

Event Name	When it happens
Plus Action By User	When the Plus entry field is modified by a user's action
Plus Action	Anytime the Plus entry field is modified
Nominal Action	Anytime the Nominal entry field is modified
Minus Action	Anytime the Minus entry field is modified
Tolerance Action By User	When any value entry field is modified by a user's action
Nominal Action By User	When the Nominal entry field is modified by a user's action
Minus Action By User	When the Minus entry field is modified by a user's action
Tolerance Action	When any value entry field is modified

Event Name	When it happens
Tolerance Lost Focus	When any value entry field loses focus

Display Group

Chart



The Chart control presents a graphic display of data from a vision program. Several different types of charts are available and up to five categories of data series can be plotted.

Property Name	What it is
Chart Setup	When you click in the value field, the chart property editor is displayed. (See page “Edit Chart Properties” on page 4-89 for details.)
Series 1 Data	The data to be plotted for this series. The data can be a String, Real list, or Integer list. Values in a String must be separated by the Data Delimiter character defined on the Data Tab in Chart Setup. **NOTE**: For Pie Charts see “Defining a Pie Chart” on page 4-90
Series 1 Name	The name displayed in the legend. The name must be unique among all series. Not used for Pie Chart
Series 1 Category	The first data series category name. Categories are grouped together on the chart. For Vertical Bar charts, you can provide multiple category names for each series separated by a delimiter (comma by default). Each "name+indexNumber" in the category is paired with the corresponding data bar. If there is more data than category names for a series, the remaining data bars will have the index number for a label. For Pie Charts, this is the comma delimited string for the pie slice labels. See “Defining a Pie Chart” on page 4-90
Series 1 Color	Click in the value field to choose the series display color. For Pie Charts, this is the color of the first data value.
Series 2 Data	The data to be plotted for this series. The data can be a String, Real list, or Integer list. Values in a String must be separated by the Data Delimiter character defined on the Data Tab in Chart Setup. Not used for Pie Chart
Series 2 Name	The name displayed in the legend. The name must be unique. Not used for Pie Chart
Series 2 Category	The second data series category name. Categories are grouped together on the chart. Not used for Pie Chart
Series 2 Color	Click in the value field to choose the series display color. For Pie Chart, this is the color of the second data value.

Property Name	What it is
Series 3 Data	The data to be plotted for this series. The data can be a String, Real list, or Integer list. Values in a String must be separated by the Data Delimiter character defined on the Data Tab in Chart Setup. Not used for Pie Chart
Series 3 Name	The name displayed in the legend. The name must be unique. Not used for Pie Chart
Series 3 Category	The third data series category name. Categories are grouped together on the chart. Not used for Pie Chart
Series 3 Color	Click in the value field to choose the series display color. For Pie Chart, this is the color of the third data value.
Series 4 Data	The data to be plotted for this series. The data can be a String, Real list, or Integer list. Values in a String must be separated by the Data Delimiter character defined on the Data Tab in Chart Setup. Not used for Pie Chart
Series 4 Name	The name displayed in the legend. The name must be unique. Not used for Pie Chart
Series 4 Category	The fourth data series category name. Categories are grouped together on the chart. Not used for Pie Chart
Series 4 Color	Click in the value field to choose the series display color. For Pie Chart, this is the color of the fourth data value.
Series 5 Data	The data to be plotted for this series. Data values must be separated by the Data Delimiter character. Not used for Pie Chart
Series 5 Name	The name displayed in the legend. The name must be unique. Not used for Pie Chart
Series 5 Category	The fifth data series category name. Categories are grouped together on the chart. Not used for Pie Chart
Series 5 Color	Click in the value field to choose the series display color. For Pie Chart, this is the color of the fifth data value.
Series 6 Data	The data to be plotted for this series. Data values must be separated by the Data Delimiter character. Not used for Pie Chart
Series 6 Name	The name displayed in the legend. The name must be unique. Not used for Pie Chart
Series 6 Category	The sixth data series category name. Categories are grouped together on the chart. Not used for Pie Chart

Property Name	What it is
Series 6 Color	Click in the value field to choose the series display color. For Pie Chart, this is the color of the sixth data value.
Visible	If True, the control is visible.
Width	The control's width.
Height	The control's height.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Enabled	If True, the control is enabled.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Chart Title	The name displayed at the top of the chart. It may also be edited in the chart property editor.
Y Axis Ticks Visible	If True, tick marks is displayed on the Y axis.
Y Axis Auto Range Enabled	If True, autoranging is enable for Y axis values.
Y Axis Minimum	The minimum value to display on the Y axis.
Y Axis Maximum	The maximum value to display on the Y axis.
Range Marker 1	The value for Range Marker 1.
Range Marker 2	The value for Range Marker 2.
Range Marker 3	The value for Range Marker 3.
Range Marker1 Enabled	If True, Range Marker 1 is shown on the chart.
Range Marker 2 Enabled	If True, Range Marker 2 is shown on the chart.
Range Marker 3 Enabled	If True, Range Marker 3 is shown on the chart.
Run on Data Change	If True, the chart is updated whenever any data value changes.
Spec Range Upper Limit	The Upper Spec color fills the chart from this value to the top of the chart.
Spec Range Lower Limit	The Lower Spec color fills the chart between this value and the bottom of the chart.
Control Range Upper Limit	The Upper Control color fills the chart between this value and the Spec Range Upper Limit value.
Control Range Lower Limit	The Lower Control color fills the chart between this value and the Spec Range Lower Limit value.

Property Name	What it is
Median Value	A line is drawn on the chart at this value.

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used
Hide	Makes the control invisible
Reset	Resets chart to zero (XY Trend only)
Run	Forces the chart to update
Show	Makes the control visible

Event Name	When it happens
Chart Data Change	When any chart data value changes

Edit Chart Properties

The chart property editor lets you define all the chart's properties, split into six tabs.

Chart tab

- Chart Type: When you select a chart type, a sample is displayed in chart plot area. Types include: Vertical Bar, Vertical Line, Pie, X/Y Trend, and Time Trend. (No trend samples are displayed.)
  NOTE: The Pie Chart is a special case. See "Defining a Pie Chart" on page 4-90

- Title: Enter the title to be displayed at top of the chart, then select the title's color and font.

- Background: Choose the color that is displayed around the chart plot area, or select Transparent for the panel's background color to show.

Plot Tab

- Background: Choose the color displayed in the chart plot area, or select Transparent for the panel's background color to show behind the plotted data.

- Range Markers (not applicable for Pie Chart): If enabled, horizontal lines are drawn in the plot area at the field values.

- Range Control Limits (not applicable for Pie Chart): If enabled, shaded areas are drawn on the chart at specified locations. The Upper Spec color fills the chart from the Upper Spec value to the top of the chart. The Lower Spec color fills the chart between the Lower Spec value and the bottom of the chart. The Upper Control color fills the chart between the Upper Control value and the Upper Spec value. The Lower Control color fills the chart between the Lower Spec value and the Lower Control value. Click the Color button to select the desired control limit color. The Median marker is displayed in grey when enabled.

X-Axis Tab

Note: The settings on this tab have no effect for the Pie Chart.

- Visible: If selected, the Label Text field is displayed on the X-axis and the Ticks group is enabled.
- Label: The text in the field is displayed as the X-axis label. You can also choose the color and font for the Label Text. If the vertical check box is checked, the X-axis labels are displayed vertically rather than horizontally.
- Ticks: If Visible is selected, tick marks are drawn on the X/Y Trend chart. You can also choose the color and font for the tick marks.
- Range: For Time Trend charts, this is the chart's time range, in minutes.
- Samples: For X/Y Trend charts, this is the number of samples displayed on the X-axis range.

Y-Axis Tab

Note: The settings on this tab have no effect for the Pie Chart.

- Visible: If selected, the Label Text is displayed on the Y-axis and Ticks and Auto Range are enabled.
- Label: The text in the field is displayed as the Y-axis label. You can also choose the color and font for the Label Text.
- Ticks: If Visible is selected, tick marks are drawn on the X/Y and Time Trend charts. You can also choose the color and font for the tick marks.
- Auto Range: If Enable is selected, the chart range is automatically adjusted to fit the range of Y value data. If it not selected, the chart range will remain static between the Min and Max values.

Legend Tab

Select the where to display (or Hide) the chart legend relative to the chart.

Data Tab

- Data Delimiter: This is the ascii delimiter that appears between data values — Carriage Return, Line Feed, CR and LF (carriage return and line feed), or User Defined. Enter the User Defined value in the field below this selection.
- Out of Range Data Delete (Time Trend Chart only): If True, data is removed from the time series collection when its value is less than the bottom range of time.

Defining a Pie Chart

For Pie Charts, all the data values are defined in the Series 1 Data property. The data can be a String, Real list, or Integer list. Values in a String must be separated by the Data Delimiter character defined on the Data Tab in Chart Setup (with no spaces within the string). A Real list or Integer list must be linked in.

The data values are displayed as percentages. For example, the string 60,20,20 (no spaces within the string) would produce a Pie Chart with three slices of 60%, 20%, and 20%. You can define or link up to five data values for the chart.

NOTE: If you use more than five data values, or the sum of the percentages does not total 100, you will get unpredictable results.

The labels for the pie slices are defined with a comma-delimited string (with no spaces) in the Series 1 Category property. For example, the string value1,value2,value3 would define the labels for three data values. The label font size and color can be changed on the Y-Axis tab in Chart Setup.

The Color property is the only value that is relevant in any of the other Series properties. Each Series Color property sets the color of pie piece for the corresponding data value. For example, the Series 2 Color property determines the color of the pie piece displayed for the second data value.

Frame



The Frame control is used to group controls in the Control Panel. This allows you to move and set some of the properties of all the controls within the Frame at one time.

To place a control in a frame

1. Insert the frame control into the panel.
2. Select the frame control.
3. Select the control to be added.
4. Click the Add Control button.

Property Name	What it is
Border Text Align	Sets the border text's justification: Left, Center, or Right
Border Text Color	The border text's color.
Border Text Font	The border text's font properties.
Border Type	The border type: Bevel Lowered, Bevel Raised, Etched Lowered, Etched Raised, Line, or None.
Height	The frame's height.
Width	The frame's width.
X	The X coordinate of the frame's left edge.
Y	The Y coordinate of the frame's top edge.
Enabled	If True, all controls within the frame are enabled. (Each control can be disabled individually.)
Extend Enabled to Contents	If True, this control's Enabled property is extended to all the controls it contains.
Line Border Color	The line border's display color.
Line Border Width	The line border's width. (This has no effect on other border types.)

Property Name	What it is
Border Text	The control's border text.
Visible	If True, the frame and it's controls are visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used
Hide	Makes the control invisible
Show	Makes the control visible

Graphic Display



The Graphic Display control displays a graphic image on a Control Panel. For instance, you could display a company logo or an icon that represents an operation or machine.

Property Name	What it is
Keep Aspect Ratio	If True, the display's height to width ratio is maintained when the display is resized
Height	The graphic's height.
Width	The graphic's width.
X	The X coordinate of the display's left edge.
Y	The Y coordinate of the display's top edge.
Image	Click in the field to display the file browser to choose the image file. Image files may have these extensions: gif, jpg, and png. The image file must be on the same disk drive as the Control Panel file.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.

Method Name	What it does
Hide	Makes the control invisible
Show	Makes the control visible

Indicator Light



The Indicator Light control gives a color indication of its Light On and Light Off values.

Property Name	What it is
X	The X coordinate of the control's left edge.

Property Name	What it is
Y	The Y coordinate of the control's top edge.
Current Color	The indicator light's current color (either the On or Off color).
Enabled	If True, the control is enabled.
Height	The indicator light's height.
Light On	If True, the indicator displays the On color. If False, the indicator displays the Off color.
Width	The indicator light's width.
Off Blue	The indicator's blue color value when it is off (0-100).
Off Color	Click in the field to choose the control's display color when it is off.
Off Green	The indicator's green color value when it is off (0-100).
Off Red	The indicator's red color value when it is off (0-100).
On Blue	The indicator's blue color value when it is on. (0-100).
On Color	Click in the field to choose the control's display color when it is on.
On Green	The indicator's green color value when it is on (0-100).
On Red	The indicator's red color value when it is on (0-100).
Percent Height	This is the scale factor for the control's display size. A value of 1 indicates 100%. A value of 0.5 indicates 50%.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Visible	If True, the control is visible.

Method Name	What it does
Hide	Makes the control invisible.
Show	Makes the control visible
Toggle	Makes the control switch state.
Turn Off	Makes the control's Light On property False.
Turn On	Makes the control's Light On property True.

Event Name	When it happens
Light Change	When the Indicator Light switches.

Numeric Display



The Numeric Display control displays numbers on the Control Panel.

Property Name	What it is
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Number Type	Choose whether to display Real or Integer numbers.
Integer Value	The integer value to be displayed (Integer Number Type property must be selected).
Display Integer Grouping	If True, the control displays integer values with digit grouping symbols based on Operating System settings
Real Value	The real value to be displayed (Real Number Type property must be selected)
Decimal Precision	Real number decimal places to display.
Tooltip Text	Text displayed when the cursor is held over the control in Run mode.
Number Color	Click in the field to choose the number's display color.
Font	Click in the field to choose the number's display font properties.
Width	The display's width.
Height	The control's height.
Vertical Alignment	Sets the number's vertical justification: Top, Center, or Bottom
Horizontal Alignment	Sets the number's horizontal justification: Left, Center, or Right
Transparent	If True, the control's background is transparent.
Background	Click in the field to choose the control's background color. (The Transparent property must be False to see the background.)
Enabled	If True, the button is enabled.
Visible	If True, the control is visible.
Border Type	The border type: Bevel Lowered, Bevel Raised, Etched Lowered, Etched Raised, Line, or None.
Line Border Color	Click in the field to choose the line border's color. (This has no effect on other border types.)
Line Border Width	The line border's width. (This has no effect on other border types.)

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used

Method Name	What it does
Hide	Makes the control invisible
Show	Makes the control visible

Event Name	When it happens
Value Changed	When the displayed value changes

Rich Text



The Rich Text control displays formatted text on the Control Panel. You can format text (including font type and size), and change the text pane color.

Property Name	What it is
Height	The display's height.
Width	The display's width.
X	The X coordinate of the display's left edge.
Y	The Y coordinate of the display's top edge.
Text	The text to be displayed. The text edit dialog is displayed when you click the field.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Visible	If True, the control is visible.

Method Name	What it does
Hide	Makes the control invisible
Show	Makes the control visible

Scrolling Table



The Scrolling Table control displays other CPM controls in a grid layout. Only one row or column is updated with new data and, when the table is full, old data rows and columns are scrolled off the table. A qualifying control can be added by dragging it from the palette and dropping into the desired table cell. Qualifying controls include Text Display, Numeric Display, Check Box (the Editable property is set to False), Indicator Light, and Drop List Selector (the Selectable property is set to False).

See "How To Set up the Scrolling Table Control" on page 4-97

Property Name	What it is
Auto Resize	If True, the table is automatically resized when a control is added to it
Background	The color displayed behind the table if the Transparent property is False

Property Name	What it is
Border Type	The border type: Bevel Lowered, Bevel Raised, Etched Lowered, Etched Raised, Line, or None
Height	The control's height
Width	The control's width
X	The control's X coordinate
Y	The control's Y coordinate
Enabled	If True, the control is enabled
Grid Line Color	The grid line color if Grid Lines Visible is Both, Vertical, or Horizontal
Grid Lines Visible	Which of the grid lines are visible, Both, Vertical, or Horizontal
Labels Visible	If True, the control labels are visible
Line Border Color	The border color if Line is chosen as Border Type
Line Border Width	The border width, in pixels, if Line is chosen as Border Type
Paused	This property is in effect when CPM is in Run Mode. If True, the table stops updating values. New values are recorded but not shown in the table. If False, all values recorded are displayed in the table, within the Scrolling Limit
Scroll Direction	Up: Rows are added to the bottom of the table and removed from the top when Scrolling Limit is reached. Down: Rows are added to the top of the table and removed from the bottom when Scrolling Limit is reached Left: Columns are added to the right of the table and removed from the left when Scrolling Limit is reached Right: Columns are added to the left of the table and removed from the right when Scrolling Limit is reached
Scrolling Limit	Once the number of rows or columns displayed reaches this limit, they are deleted from the table, according to the Scroll Direction
Tooltip Text	Text displayed when the cursor is held over the control in Run mode
Transparent	If True, the Control Panel's color shows behind the table If False, the Background Color is displayed
Visible	If True, the control is visible
Scroll On Data Change	If True, whenever the Scroll method is called, the table will update if one or more of the cell values has changed. This prevents the table from scrolling if no values have changed. If False, each time the Scroll method is called the table will always update whether any cell values have changed. In this situation, there is a chance of cell values being the same for consecutive updates.

Method Name	What it does
Enable	Enables the table and all the controls within it

Method Name	What it does
Scroll	A row or column of values is appended to the table
Pause	The table stops updating. New values are recorded but not displayed
Hide	Makes the control invisible
Show	Makes the control visible
Disable	Disables the control; it cannot be used
Clear	Clears all the values in all the controls in the table. If CPM is in Design mode, the one active row or column of controls is visible. If CPM is in Run mode, the table is empty until the next "Scroll" method is called.
Resume	Any values that were saved during the pause are displayed in the table and the table values continue to update

Event Name	When it happens
Scrolled	When a row or column is appended to the table

How To Set up the Scrolling Table Control

To set up a Scrolling Table control, you must first add it to the Control Panel, then link the desired values into the table cells.

To add the table to a panel

1. Open the Control palette.
2. Click and drag the Scrolling Table icon to the control panel and drop it on the canvas. A default table display is added. You can click and drag the borders to resize it, however, if Auto Resize is set to True, the table will resize automatically when a control is added to it.
3. Set the desired display options for the table itself, such as the Background Color, Grid Line Color, and Border Type. These settings affect only the table, not the display for each value within the table.
4. Set the desired Scroll Direction and Scrolling Limit. These two settings determine whether the table scrolls up, down, right, or left, and how many rows or columns of values are displayed before they drop off the table.



Default Scrolling Table
No controls added

To display values in the table, you can drop other controls into table cells and then link values into them, or drag properties directly from VPM tools into table cells. If you add controls directly to the table, you can only use qualifying controls. Qualifying controls include Text Display, Numeric Display, Check Box (the

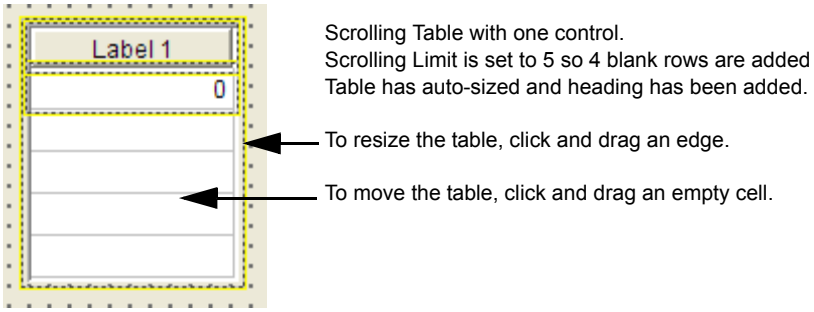
Editable property is set to False), Indicator Light, and Drop List Selector (the Selectable property is set to False).

If you drag and drop a property from a tool, a default qualifying control is added to the table based on the property's data type.

NOTE: When you add a control to a table, it may automatically resize (depending on the Auto Resize property). If you want to modify a Scrolling Table property, you need to click on the outer edge of the Scrolling Table control to select it. To move the Scrolling Table control, you need to click an edge of the table, drag the edge to expand it, then click in an empty table cell and drag the table to the desired location.

To add controls to a table

1. Open the Control palette.
2. Click and drag the desired control, then drop it on top of the Scrolling Table control on the canvas.
3. When you release the control, the Scrolling Table resizes automatically, (if Auto Resize is True) and a default label is added to either the row or column, depending on the Scroll Direction property. The label is a CPM Text Display control so you can select it and modify its properties as needed.
4. To modify the properties of any control in the table cell, select the control in the cell. Its properties, methods, and events are displayed in the property window.



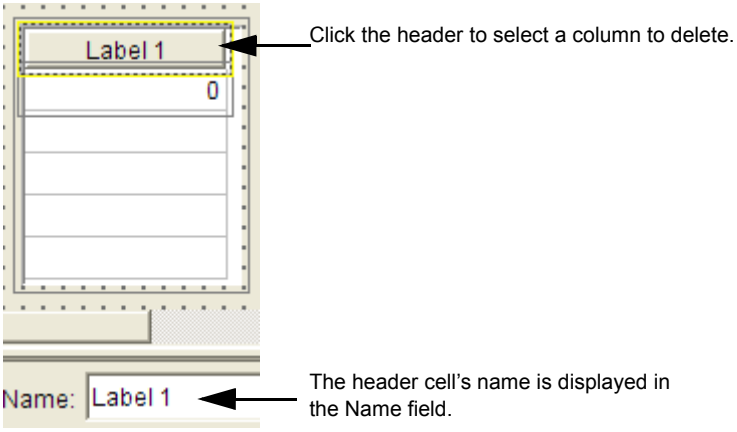
To add tool properties to a table

1. Open the Vision Program Tree.
2. Open the desired tool, click and drag the desired property, then drop it onto the Scrolling Table control. When you release the property, if the data type is compatible with one of the qualifying controls, that control is automatically added to the table. The Scrolling Table resizes automatically based on the Auto Resize and Scrolling Limit properties and a default label is added to either the row or column, depending on the Scroll Direction property. The label is a CPM Text Display control so you can select it and modify its properties as needed.
3. To modify the properties of a control in the table cell, select the control in the cell. Its properties, methods, and events are displayed in the property window.

To delete controls from a table

1. Click on the header of the table row or column you want to delete. Be sure that the name of that header cell is displayed in the property window Name field.

2. Click the Delete button.



Tab

The Tab control lets you group controls within selectable tabbed groups on the Control Panel.

Note: You must have a Tab Group control in the Control Panel to add a Tab control.

Property Name	What it is
Background Color	The control's background color.
Enabled	If True, the control is enabled.
Extend Enabled to Contents	If True, this control's Enabled property is extended to all the controls it contains.
Tab Text Color	The text's display color. (When the control is disabled, the text is grey.)
Icon Height	The icon's display height
Icon	Click in the field to place an icon on the button. Icon files may have these extensions: gif, jpg, png, and bmp. The icon file must be on the same disk drive as the Control Panel file.
Icon Width	The icon's display width
Index	The order of this tab related to other tabs in the Tab Group control.
On Top	If True, the tab is currently in front of any other tab in the Control Panel.
Keep Icon Aspect Ratio	If True, the icon's height to width ratio is maintained when it is resized.
Tab Name	The name displayed on the control's tab.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.

Method Name	What it does
Bring To Top	Puts the tab in front of all other tabs in the group

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used

Event Name	When it happens
Not On Top	When the tab is placed behind all other tabs in the group
On Top	When the tab is placed in front of all other tabs in the group

Tab Group



The Tab Group control lets you group Tab controls on the Control Panel.

Property Name	What it is
Height	The control's height.
Width	The control's width.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Enabled	If True, the control is enabled.
Tab Height	Sets the tab height for all Tab controls in the Tab Group control, in pixels. A value of zero automatically adjusts to accommodate the tab font size. A value of -1 hides the tab. In this case, you must provide some other way (such as a toggle button control) to access the tabs
Tab Layout	Scroll or Wrap the tabs when they are selected
Tab on Top	The index number of the tab currently in front
Tab Placement	Where to place the tab label
Tab Text Font	The tab text's font properties.
Tab Width	Sets the tab width for all Tab controls in the Tab Group control, in pixels. A value of zero automatically adjusts to accommodate the tab font and/or icon size.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Visible	If True, the control is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used
Hide	Makes the control invisible

Method Name	What it does
Show	Makes the control visible

Event Name	When it happens
Tab Selected	When a tab in the group is selected

Text Display



The Text Display control displays text on the Control Panel.

Property Name	What it is
Background Color	The control's background color. (The Transparent property must be False to see the background.)
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Enabled	If True, the control is enabled.
Font	The text's font properties.
Text Color	The text's display color. (When the control is disabled, the text is grey.)
Horizontal Alignment	Sets the text's horizontal justification: Left, Center, or Right
Text	The displayed text. The text will wrap if the display is too narrow. Some special characters will not display in this property. See "Special Characters" on page 4-102.
Line Border Color	The line border's color. (This has no effect on other border types.)
Line Border Width	The line border's width. (This has no effect on other border types.)
Height	The control's height.
Width	The control's width.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Transparent	If True, the control's background is transparent.
Vertical Alignment	Sets the number's vertical justification: Top, Center, or Bottom
Visible	If True, the control is visible.

Method Name	What it does
Disable	Disables the control; it cannot be used
Enable	Enables the control so it can be used
Hide	Makes the control invisible

Method Name	What it does
Show	Makes the control visible

Event Name	When it happens
Text Changed	When the control's displayed text changes

Special Characters

Some special characters will not display on a control unless they are entered along with special characters in the control's property. These control characters are used extensively in web page (HTML) coding. Some common characters, along with the string to enter in the control property, are listed in the table.

Special Character	Meaning	String to Enter
<	less than	<
>	greater than	>
©	copyright	©
®	registered trademark	®
°	degree	°
±	plus or minus	±
µ	micro	µ
≠	not equal	≠
•	bullet	•
™	trademark	™

XBar-R Chart



The XBar-R Chart control graphs statistical information on the Control Panel. It is used to show both the mean value (XBar) and the range (R) of a data set. The XBar portion of the chart shows any changes in the mean value of the process while the R portion shows any changes in the dispersion of the process.

This chart is particularly useful because it shows changes in the mean value and dispersion of the process at the same time, making it a very effective method for checking abnormalities in the process. A data set consists of a minimum, mean, and maximum value, separated by commas. Vertical bars represent the data set's minimum and maximum values. The "XBar" appears as a square at the data set's mean value. When the number of data sets is greater than the visible chart range, the data set at the beginning of the chart is dropped and data set is added at the end of the chart.

Property Name	What it is
Chart Setup	When you click in the value field, the chart setup dialog is displayed. (See "Edit XBar-R Chart Properties" on page 4-104 for details.)

Property Name	What it is
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Width	The control's width.
Height	The control's height.
Enabled	If True, the control is enabled.
Visible	If True, the control is visible.
Chart Title	The name displayed at the top of the chart. It may also be edited in the chart property editor.
Minimum Range Marker	The "R" minimum for the range, shown as a horizontal line.
Maximum Range Marker	The "R" maximum for the range, shown as a horizontal line.
Data	The display data. A data set consists of a minimum, mean, and maximum value. The data can be a String, Real list, or Integer list. Values in a String must be separated by the Data Delimiter character defined on the Data Tab in Chart Setup.
Run on Data Change	If True, the control will run when any data value changes
Mean	Calculated: Mean of all data pair mean values.
Minimum	Calculated: Minimum of all data pair minimum values.
Maximum	Calculated: Maximum of all data pair maximum values.
Deviation of Means	Calculated: Standard deviation of all data pair mean values.
Deviation of Minimums	Calculated: Standard deviation of all data pair minimum values.
Deviation of Maximums	Calculated: Standard deviation of all data pair maximum values.
Upper Control Limit	Calculated: Three times the standard deviation of all the means added to the mean of all means.
Lower Control Limit	Calculated: Three times the standard deviation of all the means subtracted from the mean of all means.
Y Axis Auto Range Enabled	If True, autoranging is enabled for the chart's Y axis.
Y Axis Maximum	The maximum value the Y Axis will display
Y Axis Minimum	The minimum value the Y Axis will display

Method Name	What it does
Enable	Enables the control so it can be used
Disable	Disables the control; it cannot be used
Show	Makes the control visible.
Hide	Makes the control invisible.
Reset	Clears the plot and starts over with the data pairs.
Run	Regenerates the chart with the current properties and data pairs.

Event Name	When it happens
Chart Data Change	When any chart data value changes.
Data Out Of Range	When any data set's minimum or maximum is outside of the values specified in the Minimum and Maximum Range Marker properties.

Edit XBar-R Chart Properties

The chart setup dialog lets you define all the chart's properties on four tabs.

Chart tab

- Title: Enter the title's text, then select its color and font.
- Background: Choose the color that is displayed around the chart plot area, or select Transparent for the panel's background color to show.

Plot Tab

- Background: Choose the color displayed in the chart plot area, or select Transparent for the panel's background color to show behind the plotted data.
- Range Markers: Horizontal lines of the selected color are drawn in the plot area at the Minimum and Maximum Range Marker values.
- Control Limit Markers: Horizontal lines of the selected color are drawn in the plot area at the Upper and Lower Control Limit values.

Y-Axis Tab

- Label: The text in the field is displayed as the Y-axis label. You can also choose the color and font for the Label Text.
- Ticks: The number of decimal places of precision to display. You can also choose the color and font for the tick mark values.
- Auto Range: If Enable is selected, the chart range is automatically adjusted to fit the range of Y value data. If it not selected, the chart range will remain static between the Min and Max values.

Data Tab

- Data Delimiter: This is the ascii delimiter that appears between data values — Carriage Return, Line Feed, CR and LF (carriage return and line feed), or User Defined. Enter the User Defined value in the field.
- XBar-R Sample: Number Displayed is the number of data samples to display on the screen.

XML Table



The XML Table control reads an XML formatted file and displays the information in the file. The XML data must be structured in a specific way, as defined by the control's properties.

Property Name	What it is
Alternating Row Background Color	The Background color for all alternating rows if the Alternating Row Highlight Enabled property is True.
Alternating Row Highlight Enabled	If True, every other row has the Alternating Row Text Color and Alternating Row Background Color properties applied so the table is "striped" for easier viewing. If False, all rows have the Row Text Color and Row Background Color properties applied.
Alternating Row Text Color	The text color for all alternating rows if the Alternating Row Highlight Enabled property is True.
Column Block Tag Name	The XML tag name that indicates the beginning of table columns. Data from this tag to the end of the header block are the column titles in order from left to right.
Column Reordering Enabled	If True, the columns can be moved within the table. The new order is lost when the table is updated. To move a column, click the header then drag the column to the new position. To resize a column, hold the cursor over the border between columns, then click and drag the border to resize it.
Column Sorting Enabled	If True, data in the rows can be sorted in ascending or descending order by clicking the column header.
Height	The control's height.
Width	The control's width.
X	The X coordinate of the control's left edge.
Y	The Y coordinate of the control's top edge.
Data	The entire XML file as a string. This is parsed then used to populate the table. Suggested implementation is to create a Scriptor control that reads an XML file and produces a string for this property.
Data Block Tag Name	The XML tag name that indicates the beginning of the data block. This block contains the report data used to populate table rows.

Property Name	What it is
Enable Large Scroll	If True, all of the control's scroll bars are very large for use with touch screen monitors.
File Path	This is the path and name of the XML file used to populate the table.
Header Text Alignment	The horizontal justification for all column headers.
Header Block Tag Name	The XML tag name that indicates the beginning of the header data block. This block contains the report header, including the column titles.
Header Font	Text font style and size for all column headers.
Header Text Color	Text color for all column headers.
Record Block Tag Name	The XML tag name that indicates the beginning of the record block that corresponds to one row of data. If the record block contains fewer data items than columns, empty values are displayed.
Row Background Color	Background color for all table cells if the Alternating Row Background Color property is False.
Row Font	Text font style and size for all table cell values.
Row Text Alignment	The horizontal justification for all table cell values.
Row Text Color	Text color for all table cell values if the Alternating Row Text Color property is False.
ToolTip Text	Text displayed when the cursor is held over the control in Run mode.
Visible	If True, the control is visible.

Method Name	What it does
Hide	Makes the control invisible.
Update Table	Reads the XML file specified in the "File path" property or parses the string in the Data property, then displays the data in the table according to the record tags.
Show	Makes the control visible.

Event Name	When it happens
Update Failed	When populating the table with data from the XML file or Data property is incomplete. Causes for the failure may include an empty tag property in the XML file or Data property, or the XML file cannot be found.
Update Complete	When the table has been successfully populated with data from the XML file or Data property.

General Group

Basic Interpreter

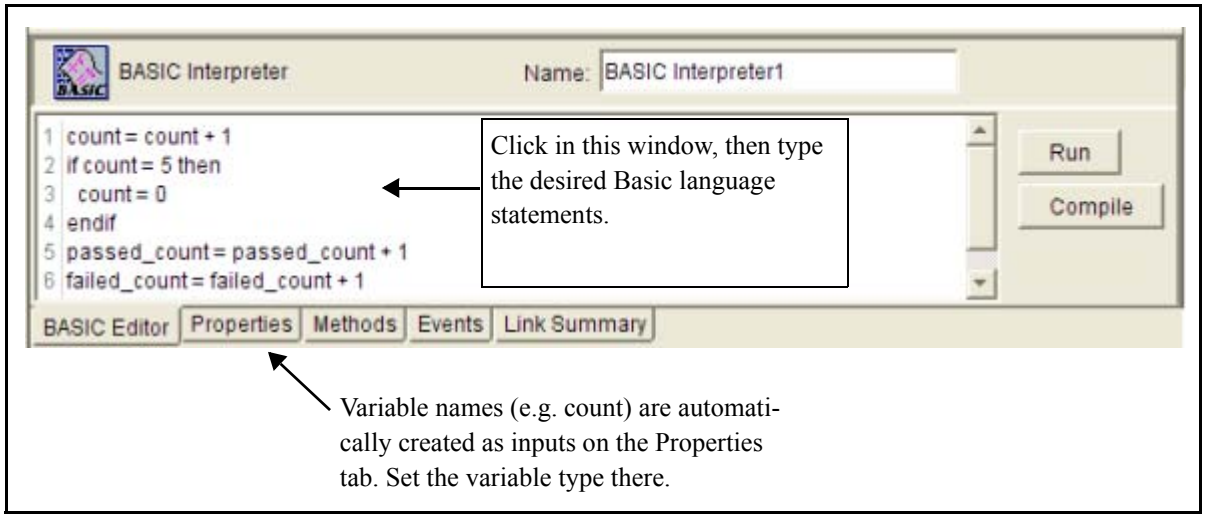


You can use the Basic Interpreter control to write and execute Basic programs. This control is not displayed on the Control Panel Canvas. To see it, click the Select Design View Options button and select Control Panel Tree. See “Select Design View Options” on page 4-6.

Basic Editor Tab

The Basic Interpreter control performs logical and mathematical calculations based on a set of user-written statements using the Basic programming language. See “Impact Basic” on page 5-1 for more information.

Basic language statements are typed in the Basic editor window. As variable names are entered, variables are created as inputs in the input list on the Properties tab. Click the Compile button to test the validity of your Basic code. When you click the Run button, the Basic program results appear in the Properties tab.



In the example above, the variable “count” is incremented each time the tool runs, then reset to zero when it reaches five. When you type the variable name “count,” the Basic tool automatically creates an input with that name. You can set the variable’s type in the Type drop-down. For more details about entering text in the Editor window, see “Type in the Editor Window” on page 5-1).

When CPM is in Run mode, the code is executed when the Run method is called, or when the Run On Variable Change property is True and any of the variables change.

Property Name	What it is
User-defined variables	You can set the data type for each variable defined in the BASIC Editor window.
Run On Variable Change	If True, the Basic code is executed once whenever any of the variables change.

Method Name	What it does
Run	Executes all the Basic code in the Basic Editor window once.

Event Name	When it happens
Run Completed	When all the Basic code has been executed.

Change Log



The Change Log control provides the option to track changes generated by camera, Vision Device, or Emulator changes and user interaction with the control panel application.

The changes are written in a secure Protected Document Format (PDF) or XML file. For more details, see “How the Change Log Control Works” on page 4-109. This control is not displayed on the Control Panel Canvas.

Property Name	What it is
Custom Text	This text is written as a log entry when the Insert Custom Text method is activated.
Custom Text Timestamp Enabled	If True, a timestamp will be added to the custom text.
Last Error Logged	The most recent error entry in the Change Log file. This is not necessarily the most recent entry.
Log File Name	The base name of the Change Log file, without an extension. A number is appended to this base name and incremented when a new file is created. For example, ChangeLog001.pdf. IMPORTANT: File names are case sensitive.
Log File Path	The path to the file in the Log File Name property. See “*Creating the Log File” on page 4-110. IMPORTANT: File names are case sensitive.
Logging Level	Any log event of this level or higher will be logged. If the value is zero, all events will be logged.
Maximum Number of Files	When this number of files has been created, the event "Maximum Number of Files Written" event is activated. The next file created is numbered at 001 and any existing log files with the same name are overwritten.
Maximum Number of Pages	When this number of pages have been written to the log file, a new file is created.
XML File Generation Enabled	If True, the log files are generated in XML format instead of PDF format.

Method Name	What it does
Insert Custom Text	Writes the contents of the Custom Text property as a log entry.

Method Name	What it does
Update File	Writes the cached log entries to the log file.
Start New Log	Increments the log file number and creates a new log file.

Event Name	When it happens
File Update Completed	When the log entries have been written to the log file.
File Update Failed	If the stored log entries do not get written to the log file.
Maximum Number of Files Written	When the number of files indicated in the Maximum Number of Files property has been created.
Error Logged	When an error entry is written to the log file. The entry is available in the Last Error Logged property.

How the Change Log Control Works

Only one Change Log control is allowed in a control panel application.Logging starts when the control panel application enters run mode. Logging stops when the control panel application is closed or enters design mode.

Log File Format

Log files are created in either XML format or password protected PDF format, depending on the property "XML File Generation Enabled."

Log Entry Formatting

The log entries are formatted when they are written to the log file. In general, the entry is formatted based on the entry's data type and the system format settings. A single value is formatted as seen in the VPM properties pane. List values are formatted as single values separated by the system's regional format separator. Fields are separated by four spaces.The following changes are written to the log.

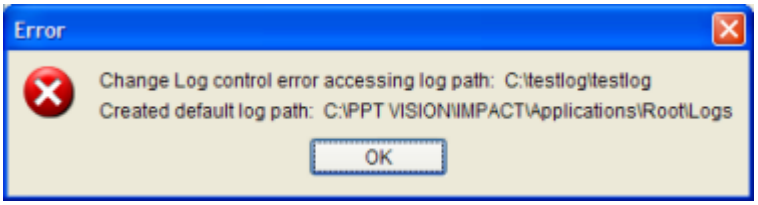
Change Type
Vision Device Connect/Disconnect
Online/Offline State Change
Get Data (after going online)
Set Data
Vision Program Load, Unload, Save
User Password Changed, Level Changed, Description Changed
User Logged On, Logged Off
User Added, Deleted

Change Type
Any of the following VPM tool methods executed from a control panel (Connect, Disconnect, Online, Offline, Run, Retrain, Save file, Reset, Pixel Calibrate, Clear Pixel Calibrate, Start auto trigger, Stop auto trigger, Abort)

*Creating the Log File

When the Change Log control is added, the log file location defaults to the Root/Logs folder of the default CPM installation folder. Click in the Log File Path value field to select a different folder.

If the selected Log File Path doesn't exist when the first log entry is written, an attempt will be made to create the folder. If the folder can't be created, the default folder (based on the installation) is created and an error message is displayed.



A new log file is started when any of the following occurs:

- The Change Log control is created
- The control panel application is loaded
- When the "Start New Log" method is called
- When the Maximum Number of Pages limit is reached

Writing the entries to the Log File

Change Log entries are stored in memory and appended to the current log file when any of the following occurs:

- When fifty entries have been stored in memory
- When the "Update File" method is called
- When the five minutes have elapsed since the entries were last written
- When the control panel application closes
- When CPM goes into Design mode
- When the "Log File Path" property changes while in run mode
- When the "Log File Name" property changes while in run mode

When entries are successfully written or appended to an existing file a "File Update Completed" event occurs. If the write is unsuccessful, a "File Update Failed" event occurs.

Execute Command



The Execute Command control is used to execute a system command or other executable program from the Control Panel. This control is not displayed on the Control Panel Canvas.

Property Name	What it is
Command	The program to be executed, with the full path to the folder that contains the program. If the path contains spaces, it must be enclosed in double quotes. If you want to run a batch file, see “Batch File” below.
Starting Path	Specifies the path to the folder that contains information that the program may or may not access. If the path contains spaces, it must be enclosed in double quotes.

Method Name	What it does
Execute Command	Executes the command.

Event Name	When it happens
Command Executed	When command execution has begun.

Batch File

To execute a batch file, use the following command line in the Command property (where "test.bat" is the name of the batch file to run).

```
cmd.exe /c test.bat
```

When the control runs, the batch file will run to completion, then exit.

If you want to display a Command Prompt window so the user can enter input from the keyboard, use the following command line in the Command property (where "test.bat" is the name of the batch file to run).

```
cmd.exe /c start cmd.exe /c test.bat
```

When the control runs, a Command Prompt window is displayed on top of CPM so the user can enter input from the keyboard. When the batch file completes, the user must close the Command Prompt window.

Impact Connector



The Impact Connector control connects the Control Panel to a camera, Vision Device, or Emulator. Vision programs, tasks, and tool data are linked to this control, then linked to properties, methods, and events in other controls. This control is not displayed on the Control Panel Canvas. To see it, click the Select Design View Options button and select Control Panel Tree (see “Select Design View Options” on page 4-6). When a

control is deleted, if there are no other links to it in the Connector control, the links are removed in the Connector control. Once all links are removed from a Connector control, it is automatically deleted.

Property Name	What it is
Enable IP Address Editing	If True, the Edit IP Address button is enabled on the Device Selector dialog. (See “Choose a Vision Device or Emulator” on page 1-4 for more details.)
Connected	If True, the Control Panel is actively connected with the IP address shown in the IP Address property. See Note at “Connect the Impact Connector Control” on page 4-114.
Device Connection	Used by other controls to determine which camera, Vision Device, or Emulator is currently connected
Action Blocked	True if the camera, Vision Device, or Emulator is currently locked in VPM.
IP Address	Click in the field to choose an IP address.
Internal Get Data Timer Interval	Each time this timer interval has elapsed, the Impact Connector will update all Get Data links. The timer starts after the previous Get Data has completed. The update interval may actually be longer than this if the device is busy.
Disconnected	If True, the Impact Connector is not currently connected to a camera, Vision Device, or Emulator.
Offline	If True, the camera, Vision Device, or Emulator is offline.
Last Command Successful	If True, the last command to the camera, Vision Device, or Emulator was successful (for example, Get Data or Set Data).
Administration Level Enabled	If True, security is enabled and a user with Administrator level security is logged on.
Programmer Level Enabled	If True, security is enabled and a user with Programmer level security is logged on.
Controller Level Enabled	If True, security is enabled and a user with Controller level security is logged on.
Operator Level Enabled	If True, security is enabled and a user with Operator level security is logged on.
Monitor Level Enabled	If True, security is enabled and a user with Monitor level security is logged on.
New IP Address	If this property contains a valid IP Address when the Apply New IP Address/Mask method occurs, the Vision Device IP Address is set to this value. See Warn Before Reboot and New IP Mask properties, and Apply New IP Address/Mask method. The control will try to connect to the new IP address.
New IP Mask	If this property contains a valid IP Mask when the Apply New IP Address/Mask method occurs, the Vision Device IP Mask is set to this value. See Warn Before Reboot and New IP Address properties, and Apply New IP Address/Mask method.

Property Name	What it is
Online	If True, the camera, Vision Device, or Emulator is online. The online method is found on the Execute Method tab.
Link Error	If True, one or more of the links between the Control Panel and the camera, Vision Device, or Emulator have been broken. This may be due to some change in the vision program (e.g. a tool deletion). The links are shown on the Get Data, Set Data, and Execute Method tabs.
Display Device List	If True, the device list is displayed when the connection is made
Suppress Connect Errors	If True, camera connection error dialogs are not displayed when connection with the camera, Vision Device, or Emulator is lost. This allows an unattended reconnect to be attempted by the connector. (Other warning dialogs may be displayed.)
Use Internal Get Data Timer	If True, the Impact Connector will use the Internal Get Data Timer Interval property to update Get Data links.
UserID\Password	If security is enabled, this contains the currently logged on user's User ID and password. See "Vision Device Security" on page 4-116 for more details.
UserID	Works with the Password property. If values are entered into these fields, and they match any defined on the Vision Device, you can connect to the device, and bypass the UserID/Password dialog that is normally displayed during connection. If the fields are blank, the values in the UserID/Password property are used after the connection is made.
Password	See the UserID property.
Warn Before Reboot	If True, a warning dialog will be displayed before the Vision Device is rebooted after the IP Address or Mask is changed. See the New IP Address and New IP Mask properties, and Apply New IP Address/Mask method.

Method Name	What it does
Apply New IP Address/Mask	Changes the Vision Device's IP Address and/or IP Mask. See Warn Before Reboot, New IP Address, and New IP Mask properties.
Run GetData	Updates all the data linked from the camera, Vision Device, or Emulator. Links from the camera can be seen on the Get Data tab.
Connect	Attempts to connect.
Disconnect	Disconnects the Control Panel.
Refresh Set Data	For controls that have Set Data links to tool properties in VPM, reads the current values of those properties from the tools and updates the value in the control property.

Event Name	When it happens
Connected	When the connection is complete
Occurred	Whenever the control has received data through a Link from a tool.
Get Data Completed	When the most recent Get Data has completed. May be from a Run Get-Data Method or elapsed Get Data Timer Interval.
Program Loaded/ Unloaded	After a vision program has completed loading or unloading.

Connect the Impact Connector Control

During normal control panel operation, you will probably create a way for the operator to connect the Control Panel to a camera, Vision Device, or Emulator. During the development process, you can manually connect the Control Panel to it.

NOTE: If you save the Control Panel Application while any Connector controls in the Application are connected (the Connected property is True), the Connector controls will try to reconnect to their IP Addresses when the Application is loaded. If any of the connected cameras have security enabled, you will need to enter a User ID and Password for each camera when the Application is loaded.

To manually connect an Impact Connector control to a camera, Vision Device, or Emulator

1. Select the Properties tab on the desired Impact Connector control.
2. Click in the IP address field and select the desired IP address from the list displayed, then click OK.
3. Select the Connected property, then set the Value to True.
4. If security is enabled, you will need to enter a valid User ID and Password.

Properties Links

Note: If the Control Panel is not connected, you cannot create links.

The Properties tab shows links between the Connector control and other controls in the control panel. The color of the Link field name indicates the link's status:

- Magenta - The property shown is the source property
- Blue - The property shown is the destination property

Methods Links

Note: If the Control Panel is not connected, you cannot create links.

The Methods tab shows links between the Connector control methods and other events from other controls in the control panel. Method Link field names are always blue.

Events Links

Note: If the Control Panel is not connected, you cannot create links.

The Methods tab shows links between the Connector control methods and other events from other controls in the control panel. Method Link field names are always magenta.

Set Data Links

Note: If the Control Panel is not connected, you cannot create links.

Set data links allow you to send data to a tool in a vision program from a control. The link is created between the Impact Connector control and a vision program tool. For example, you can link from the Set Data tab to a Contrast tool's Threshold value, then link from a Slider control to the Set Data tab so the Control Panel operator can adjust the Threshold value from the Control Panel. See "Links between CPM and VPM" on page 4-14 for more details on links.

The color of the Link name indicates the link's status:

- Blue - Normal
- Red - unresolved (e.g. due to no loaded vision program or no connection)
- Black - Links to more than one control

Get Data Links

Note: If the Control Panel is not connected, you cannot create links.

Get Data links allow you to get data from a tool or task in a vision program and display or use it in a control. The link is created between the Impact Connector control and the vision program tool or task. For example, you can link to a Basic tool's calculated value, then link that to a Numeric Display control so the Control Panel operator can see the value on the Control Panel. See "Links between CPM and VPM" on page 4-14 for more details on links.The color of the Link name indicates the link's status:

- Magenta - Normal
- Red - unresolved (e.g. due to no loaded vision program or no connection)
- Black - Links from more than one control

Method Links

Note: If the Control Panel is not connected, you cannot create links.

Method links allow you to create an action in a camera, Vision Device, Emulator, vision program, task, or a tool in a vision program. The link is created between the Impact Connector control and the camera, Vision Device, Emulator, program, task, or tool. For example, you can link to a camera's online state, then link that to a button control's action so the Control Panel operator can change the camera's online status by clicking that button on the Control Panel. See "Links between CPM controls" on page 4-19 for more details on linking.

- Blue - Normal
- Red - unresolved (e.g. due to no loaded vision program or no connection)
- Black - Links to more than one control

Data Transfer Links

Note: If the Control Panel is not connected, you cannot create links.

Data transfer links accept data from a Data Transfer tool in a vision program. See “Links between CPM and VPM” on page 4-14 and “Data Transfer” on page 3-289 for more details.

- Magenta - Normal
- Red - unresolved (e.g. due to no loaded vision program or no connection)
- Black - Links from more than one control

Link Summary-Connector

This tab displays information about links to and from the currently selected Impact Connector control. See“Links between CPM controls” on page 4-19 for more details.When a control is deleted, if there are no other links to it in the Impact Connector control, the links are removed in the control. Once all links are removed from a control, it is automatically deleted.

Vision Device Security

When an Impact Connector control attempts to connect to a camera, Vision Device, or Emulator, and security is enabled, the following occurs:

- If the User ID/Password property is empty, then the User Logon dialog is displayed. The entered User ID and Password are verified. If either is invalid, an error message is displayed, otherwise the Impact Connector is connected.
- If a valid User ID and Password have been linked from the UserID\Password property of another Impact Connector, then the User ID and Password are verified. The User Logon dialog is not displayed. If either the User ID or Password is invalid, an error message is displayed, otherwise the Impact Connector is connected.

If there are multiple Impact Connectors in one Control Panel, and security is enabled on one or more of the cameras, the designer has the option to do one of the following.

- **Camera Connection with Multiple Logon Dialogs**
  If each Impact Connector in the Control Panel Application has a blank User ID/Password property value, then the User Logon dialog is displayed for each Impact Connector prior to connection.
- **Sequential camera Connection with a Single Logon Dialog**
  The designer must create a primary Impact Connector that attempts connection before the other connectors. The UserID\Password property from the secondary Impact Connector(s) can be linked to the primary Impact Connector’s UserID\Password property. This causes only one User Logon prompt to be displayed for the “main” Impact Connector and the other connectors will then receive the logon information via the property links.

What is linked	What it will do
Vision Device	Change the online and offline state of the camera, Vision Device, or Emulator
Vision Program	Save the selected vision program file

What is linked	What it will do
Vision Program Task	Run the selected task
Vision Program Tool	Run or train the selected tool

Load Image



The Load Image control loads an image from a file into it's Image property. You can use this control to load the image into a VPM task, then run the task by linking this control's Load Completed method to the task's Run method.

How to use the Load Image control

1. In CPM, connect to an Image In task loaded in VPM (see "Connect to Vision Device" on page 4-2)
2. Click the Image Path property of this Load Image control and select an image to load. If this property is left blank, you will be able to select an image when the control runs.
3. Make a Set Data link from the Connector control in this control panel to the image property of the VPM Image In task from step one.
4. Link the image property from this Load Image control to the Set Data link created in step three.
5. Make a link from the Load Completed Event of this Load Image control to the Run method of the VPM task from step one.
6. To run the Load Image control, link from a Button or other input control's Event to this control's Load Image method.

This control is not displayed on the Control Panel Canvas. To see it, click the Select Design View Options button and select Control Panel Tree (see "Select Design View Options" on page 4-6).

Property Name	What it is
Image	The image currently loaded into this control.
Image Path	Click in the field to enter the image's file name or browse to choose the image file. Image files may have these extensions: jpg, png, and bmp. The image file must be on the same disk drive as the Interface Panel file. IMPORTANT: File names are case sensitive.

Method Name	What it does
Load Image	Loads the image into this control's Image property.

Event Name	When it happens
Load Completed	When the image has finished loading into this control.

Load Vision Program



The Load Vision Program control loads a vision program file. This control is not displayed on the Control Panel Canvas. To see it, click the Select Design View Options button and select Control Panel Tree (see “Select Design View Options” on page 4-6).

Property Name	What it is
Program Name Filter	Filters the files that are displayed in the file browser based on the vision program names. You can use the asterisk (*) to replace one or more characters in the program name. NOTE: Program names are case sensitive.
Browsing Enabled	If True, the file browser is displayed, which allows you to select and load files from client network folders. If False, only files on the camera, Vision Device, or Emulator root path are displayed.
Device Connection	This property indicates which camera, Vision Device, or Emulator contains the vision program to load. When you add the control to the control panel, this link is created to an Impact Connector control automatically. If the control panel contains more than one Connector control, you are prompted to choose one.
Display Loading Prompt	If True, a prompt is displayed before the program is loaded.
File Path	The path to the file in the File To Load property. To access vision program files camera, Vision Device, or Emulator, use the path: Vision Device/ VisionPrograms. If this field is blank, the file browser is displayed.
File To Load	The name of the vision program file to load. If this field is blank, the file browser is displayed. If multiple files are specified, they must be separated by commas. If you try to load a file with the same program name as an already loaded file, the existing file is unloaded first. IMPORTANT: File names are case sensitive.
Filename Filter	Filters the files that are displayed in the file browser based on the vision program file names. You can use the asterisk (*) to replace one or more characters in the file name. IMPORTANT: File names are case sensitive.
Load Successful	If True, the vision program file was loaded successfully. If multiple files were selected, at least one file was loaded.
Warn On Overwrite	If True, a warning dialog is displayed if the vision program file already exists on the camera, Vision Device, or Emulator. You will have the option to cancel or overwrite the file(s).

Method Name	What it does
Load Program	Loads the vision program.

Event Name	When it happens
Load Completed	When all the vision program files have finished loading into the Impact camera.
Load Started	When the vision program files begin loading.

Save Vision Program



The Save Vision Program control saves one or more vision program files from the camera, Vision Device, or Emulator. Depending on the control's property settings, you can select the files to be saved from a browser, or enter them manually. Also, depending on the control's property settings, you can select where the files will be saved or enter them manually. To select multiple files from a file list, hold the Control key while you click each file. This control is not displayed on the Control Panel Canvas. To see it, click the Select Design View Options button and select Control Panel Tree (see "Select Design View Options" on page 4-6).

Property Name	What it is
Browsing Enabled	If True, a browser is displayed so you can choose where the files will be saved. If there is a valid file path in the File Path property, that path will be displayed in the browser by default. If False, the files will be saved by default to the camera, Vision Device, or Emulator or the last file path entered in the File Path property.
Device Connection	This property indicates the camera, Vision Device, or Emulator that contains the files. When you add the control to the control panel, this link is created to an Impact Connector control automatically. If the control panel contains more than one Connector control, you are prompted to choose one.
Display Saving Prompt	If True, a message is displayed while the file is being saved.
File Path	If this property is blank, and the Browsing Enabled property is False, the file will be saved to the VisionPrograms folder on the camera, Vision Device, or Emulator by default. If a path has ever been entered into this property, the file will be saved to that folder, even if the property is currently blank. If this property is blank, and the Browsing Enabled property is True, a browser is displayed so you can choose where the files will be saved. If this property contains a valid file path, and the Browsing Enabled property is False, the files will be automatically saved to this file path. NOTE: To save files, enter the file path Vision Device/VisionPrograms If this property contains a valid file path, and the Browsing Enabled property is True, this file path will be chosen by default in the browser, but you can navigate to a different file path.

Property Name	What it is
File To Save	If this property contains one or more file names, those files will be saved. Only files that are loaded can be saved. To enter multiple file names, separate them with a comma. IMPORTANT: File names are case sensitive. If this property is blank, a browser is displayed with a list of files that are currently loaded so you can choose which file(s) to save.
Save As	If this property is blank, and the Browsing Enabled property is False, the files will be saved to the VisionPrograms folder by default. If this property is blank, and the Browsing Enabled property is True, a browser is displayed so you can choose where the files will be saved. If this property contains a valid file name, the File to Save property must contain the name of a file that is currently loaded. If the Browsing Enabled property is False, the File to Save will automatically be saved with the Save As name. The existing file (File to Save) is unloaded and the Save As file is loaded. IMPORTANT: File names are case sensitive. If the Browsing Enabled property is True, a browser is displayed so you can choose where the Save As files will be saved.
Save Successful	If True, the file was saved successfully.
Warn On Overwrite	If True, a confirmation dialog is displayed when you try to save a file that already exists.
Warn on Save As	If True, a confirmation dialog is displayed when a file is saved with a different name.
File Format	XML: The file is saved in uncompressed format as XML. Compressed: The file is saved in compressed binary format (resulting in a much smaller file size).

Method Name	What it does
Save Program	Saves the vision program.

Event Name	When it happens
Save Started	When the vision program files begin saving.
Save Completed	When all the vision program files have finished saving.

Scriptor



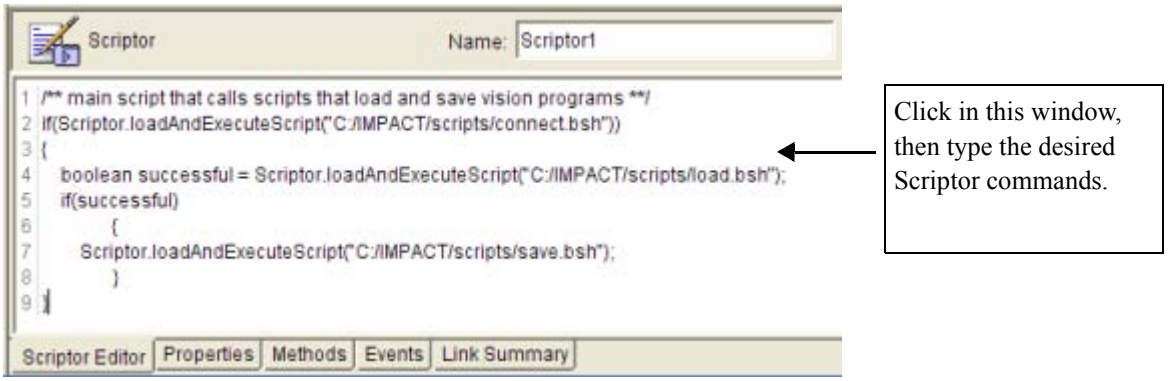
NOTE: Teaching you how to create a Java program is beyond the scope of this manual. This section describes the commands, properties, methods, and events available in the Scriptor control, but not how to implement them in Java code. For more information on Java programming, refer to Java programming guides.

The scriptor only supports string types. You will need to cast them to use them as a different type, for exam-

ple
int myvar = new Integer(Scriptor.getProperty("Full Tool Path")).intValue();

The Scriptor control provides a way to write Java (not JavaScript) Control Panel commands and apply them to a running Control Panel Application. The script can also run when CPM Runtime is started. See “Run a script with CPM Runtime” on page 4-126 for details.

Scriptor Editor Tab



You enter scriptor commands on this tab. See “Script Examples” on page 4-124.

Property Name	What it is
Exit Application Upon Completion	If True, CPM exits when the script has completed executing. If False, the Control Panel Application continues to run.
Run Automatically	If True, the script is executed as soon as the Control Panel Application enters Run mode. If False, the script executes when Run method is called.
Run In Separate Thread	If True, the control runs in a separate thread from CPM (this setting is provided for backward compatibility) If False, then the control runs in the main thread with CPM (this is the recommended setting for improved performance) This property defaults to False since this setting results in improved performance.
Suppress Error Messages	If True, no script execution errors will displayed when the script executes.

Method Name	What it does
Run	Executes the script.

Event Name	When it happens
Run Completed	When all the script commands have been executed.

Scriptor Commands

Error Handling

Scripting errors are displayed as pop-up dialogs during runtime. Command errors, such as not finding the specified control or property, return a False boolean value to the script. It is the script author's responsibility to handle these errors within the script logic.

boolean setProperty(String propertyPath, String value)

This command sets the specified property to the value. If this call is successful, the boolean variable (e.g. successful) is set to True. The parameter format for a non-linked control value is:

```
("Panel Tab Name.Frame Name (if applicable).Property Name","value")
```

The parameter format for a linked control value is:

```
(Panel Tab Name.IMPACT Connector Control Name:Program Name.Task Name.Tool
Name:Property Name", "value")
```

This example sets the IP Address in the Impact Connector control in Panel 1.

```
boolean successful = Scriptor.setProperty("Panel 1.IMPACT Connector.IP
Address","192.168.0.128");
```

This example sets a value in a control that is linked to a tool (Circular Pattern Find) in a VPM task (Task).

```
boolean successful = Scriptor.setProperty("Panel 2.IMPACT Connector5:Indica-
tor.Task.Circular Pattern Find:Minimum Match Score", "50");
```

String getProperty(String propertyPath)

This command gets the specified property from a control and returns it as a String value. If the call is unsuccessful, then a null value is returned to the script.
The parameter format for a non-linked control value is:

```
("Panel Name.Control Name.Property Name")
```

The parameter format for a linked control value is:

```
("Panel Name.IMPACT Connector Control Name:Program Name.Task Name.Tool
Name:Property Name")
```

This example gets the connected status of the Impact Connector control in Panel 1 and returns it as a string (isConnected).

```
String isConnected = Scriptor.getProperty("Panel 1.IMPACT Connector.Connected");
```

This example gets a value from a control that is linked to a tool (Circular Pattern Find) in a VPM task (Task) and returns it as a string (matchScore).

```
string matchScore = Scriptor.getProperty("Panel 2.IMPACT Connector5:Indica-
tor.Task.Circular Pattern Find:Minimum Match Score");
```

boolean executeMethod(String methodPath)

This command calls the specified method. If the call is successful, True is returned to the script. Example:

```
boolean successful = Scriptor.executeMethod("Panel 1.IMPACT Connector.Connect");
```

void sleep(int milliseconds)

This command causes the script to sleep for the indicated time before processing the next script command. Example:

```
Scriptor.sleep(200); // sleep 200 milliseconds
```

void displayPrompt(String message)

This command pops up a modal dialog, displaying the indicated message. When the user clicks the OK button, the dialog is erased and script processing continues. Example:

```
Scriptor.displayPrompt("Error getting connection status");
```

boolean loadAndExecuteScript(String scriptPath)

This command loads and executes the specified script. This lets you execute a script from within another script. If this call is successful, True is returned to the script. Example:

```
if(Scriptor.loadAndExecuteScript("C:/IMPACT/scripts/connect.bsh"))
{
    boolean successful = Scriptor.loadAndExecuteScript("C:/IMPACT/scripts/
load.bsh");
    if(successful)
    {
        Scriptor.loadAndExecuteScript("C:/IMPACT/scripts/save.bsh");
      }
}
```

getDefaultLocale() Method

This command gets the current client's locale based on the operating system's regional options setting and the Application.properties file. Example:

```
import java.util.ResourceBundle;
Locale locale = Scriptor.getDefaultLocale();
```

getResourceBundle() Method

This method retrieves the ResourceBundle instance that applies to the passed in bundle name and Locale. Example:

```
import java.util.ResourceBundle;
Locale locale = Scriptor.getDefaultLocale();
try
{
    localeResources = Scriptor.getResourceBundle("Application", locale);
}
catch(java.util.MissingResourceException mre)
{
    Scriptor.displayPrompt("Could not find resource Application.properties");
}
```

getResourceKey() Method

This method retrieves the localize string associated with passed in bundle name, it's locale, and a desired key. Example:

```
if(localeResources != null)
{
     String propertiesFilename = "Application";
     if(!locale.getLanguage().equals("en")) // not english
   propertiesFilename = "Application_"+locale.getLanguage();
     try
    {
   String titleCompany =
              Scriptor.getResourceKey(propertiesFilename, locale,
"Application_Title_Company");
   Scriptor.setProperty("Main.App Title 1.Text", titleCompany);

   String titleApp = Scriptor.getResourceKey(propertiesFilename, locale,
"Application_Title_App");
```

```
    Scriptor.setProperty("Main.App Title 2.Text", titleApp);
    }
    catch(Exception e)
    {
    Scriptor.displayPrompt("error getting resource key");
    }
```

Script Examples

This section contains examples of scripts using the scriptor commands listed previously.

IMPORTANT: These scripts are examples only. They will not necessarily operate as-is, since they must be modified to fit in your operating environment. Datalogic is not responsible for any malfunctions that may result from the use of this code.

Main script

This is a main script that calls other scripts that connect to a camera, Vision Device, or Emulator, then load and save vision programs.

```
main.bsh
/** main script that calls scripts that load and save vision programs **/
if(Scriptor.loadAndExecuteScript("C:/IMPACT/scripts/connect.bsh"))
{
    boolean successful = Scriptor.loadAndExecuteScript("C:/IMPACT/scripts/
load.bsh");
    if(successful)
    {
        Scriptor.loadAndExecuteScript("C:/IMPACT/scripts/save.bsh");
    }
}
```

Connect script

This is the called script that connects to a camera, Vision Device, or Emulator.

```
connect.bsh
/** This script will connect. **/
boolean successful = Scriptor.setProperty("Panel 1.IMPACT Connector.IP
Address","192.168.0.128");
if(successful)
{
    successful = Scriptor.executeMethod("Panel 1.IMPACT Connector.Connect");
}

if(successful)
{
    String isConnected = "false";
    while(isConnected.equals("false"))
       {
        isConnected = Scriptor.getProperty("Panel 1.IMPACT Connector.Con-
nected");
        Scriptor.sleep(200); // sleep 200 milliseconds
        if(isConnected == null) // couldn't get connected property
        {
            successful = false;
            Scriptor.displayPrompt("Error getting connection status");
            break;
        }
       }
```

```
}
```

Load script

This is the called script that loads the vision programs.

```
load.bsh
/** This script will load the specified vision programs. **/
boolean successful = Scriptor.setProperty("Panel 1.Load Vision Program.Browsing
Enabled","false");
if(successful)
{
    successful = Scriptor.setProperty("Panel 1.Load Vision Program.Warn On Over-
write", "false");
}
if(successful)
{
//        successful = Scriptor.setProperty("Panel 1.Load Vision Program.File
Path", "Vision Device/VisionPrograms");
//        successful = Scriptor.setProperty("Panel 1.Load Vision Program.File
Path", ""); // defaults to camera
    successful = Scriptor.setProperty("Panel 1.Load Vision Program.File Path",
"C:/IMPACT");
}
if(successful)
{
    successful = Scriptor.setProperty("Panel 1.Load Vision Program.File To
Load", "BearingOCR.vp, Locate.vp");
}
if(successful)
{
    successful = Scriptor.executeMethod("Panel 1.Load Vision Program.Load Pro-
gram");
}
if(successful)
{
    // wait for all the loads to complete
    String loadCompleted = "false";
    while(loadCompleted.equals("false"))
    {
        loadCompleted = Scriptor.getProperty("Panel 1.Load Vision Program.Load
Successful");
        Scriptor.sleep(200); // sleep 200 milliseconds
        if(loadCompleted == null) // couldn't get load successful property
        {
            successful = false;
            Scriptor.displayPrompt("Error getting load successful status");
            break;
        }
    }
}
```

Save script

This is the called script that saves the vision programs that were loaded.

```
save.bsh
/** This script will save loaded vision programs onto the client. **/
boolean successful = Scriptor.setProperty("Panel 1.Save Vision Program.Browsing
Enabled","false");
if(successful)
{
```

```
    successful = Scriptor.setProperty("Panel 1.Save Vision Program.Warn On Over-
write", "false");
}
if(successful)
{
    successful = Scriptor.setProperty("Panel 1.Save Vision Program.File Path",
"C:/IMPACT/Backups");
}
if(successful)
{
    successful = Scriptor.setProperty("Panel 1.Save Vision Program.File To
Save", "BearingOCR.vp, Locate.vp");
}
if(successful)
{
    successful = Scriptor.executeMethod("Panel 1.Save Vision Program.Save Pro-
gram");
}
if(successful)
{
    // wait for all the loads to complete
    String saveCompleted = "false";
    while(saveCompleted.equals("false"))
    {
        saveCompleted = Scriptor.getProperty("Panel 1.Save Vision Program.Save
Successful");
        Scriptor.sleep(200); // sleep 200 milliseconds
        if(saveCompleted == null) // couldn't get save successful property
        {
            successful = false;
            Scriptor.displayPrompt("Error getting save successful status");
            break;
        }
    }
}
```

Run a script with CPM Runtime

The script runs when CPM Runtime is started by adding switches to the command line. Once CPM Runtime has opened the specified Control Panel, the specified script file is opened and interpreted. When the script is completed, the loaded Control Panel Application is unloaded and CPM Runtime exits.

To edit the CPM Runtime command line

1. Find the CPM Runtime icon on the desktop.
2. Right click on the icon.
3. Select Properties from the menu.
4. Click the Shortcut tab.
   The CPM Runtime command line appears in the Target field on the Properties dialog. The default command line is:

```
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar"
```

5. These command line options can be added to the end of the default command line to call the script created with the Scriptor control.
   -p "file.cp" (file.cp = path to Control Panel Application)

-scr "file.bsh" (file.bsh = path to user-written script file)
-v (make the CPM Runtime frame visible)

6. When you have finished editing the command line, click OK to close the Properties editor dialog.

TCP-IP Logger



The TCP-IP Logger control receives data from a vision program TCP/IP Out tool and writes it to a text file. This control is not displayed on the Control Panel Canvas. To see it, click the Select Design View Options button and select Control Panel Tree (see “Select Design View Options” on page 4-6). You can display the received data by linking the Last Data Received property to a text display control.

The control finds the Local IP address indicated in the property and connects to it. The address is saved with the Control Panel (cp) file and restored when the file is reloaded providing that the address exists on the client machine that loaded the file. If it does not exist, the control defaults to the first address found.

You can link the Local IP Address property from the control to a VPM tool, for example, through a SetData link to set the IP Address on a TCP/IP Out tool.

Property Name	What it is
Log Filename	The name of the log file. Entered in the Log File property.
Log File Path	The path to the log file. Entered in the Log File property.
Delimiter Type	The delimiter character in the string indicates the end of the current data packet.
Enabled	If True, the control is enabled.
Name	The control’s name.
Last Data Received	The last data received by the control.
Last Write Failed	If True, the control could not write to the log file.
Last Write Successful	If True, the control successfully wrote to the log file.
Listening	If True, the control is currently listening for data on the Listening On Port
Local IP Address	The client computer’s IP address.
Listening on Port	The control is monitoring this port for incoming data.
Max File Size (bytes)	The maximum log file size. Oldest entries are overwritten with the newer ones.
Overwrite Data	If True, only the most recent log entry is saved. The Max File Size property is ignored. If False, when Max File Size is reached, the tool stops logging data.
Log File	Click in the field to enter the log file’s name or browse to choose the file. Log entries are written as text. The line delimiter type is chosen in the TCP/IP Out tool.

Property Name	What it is
Source Disconnects after each Write	If True, the TCP/IP logging camera, Vision Device, or Emulator is set to close its connection each time it logs an entry. If False, it leaves the connection open between each log entry. This setting must match the device's setting. (If you are using the TCP/IP Out tool in VPM, this setting must match the tool's "Disconnect after each Write" property.)
Source Disconnect Timeout	If the source closes its connection, but this control cannot detect it, the control will wait this amount of time then reset the connection. We recommend that you leave this setting at the 5000 (5 second) default.

Method Name	What it does
Enable	Enables the control so it can be used
Delete Log File	Deletes the log file.
Show File Browser	Displays the file browser so the operator can choose a log file.
Disable	Disables the control; it cannot be used

Event Name	When it happens
File Write Failed	When the control cannot write to the log file.
New Data Received	When the control receives new data.

Timer



The Timer control counts elapsed time during Run mode. It can be set to repeat the time interval. This control is not displayed on the Control Panel Canvas. To see it, click the Select Design View Options button and select Control Panel Tree (see "Select Design View Options" on page 4-6).

Property Name	What it is
Enabled	If True, the control is enabled.
Repeating Timer	If True, the timer counts the Time Interval, then starts over.
Timer Running	If True, the timer is currently counting.
Time Interval	The length of time to count (in milliseconds).

Method Name	What it does
Start	Starts or resets the timer.
Stop	Stops the timer.

Event Name	When it happens
Timer Event	When the time interval has elapsed or the timer starts or stops. If the timer is set to Repeating, the Timer Event will occur at the end of every Time Interval.

Camera Calibration Using CPM

This section contains a brief example of how to calibrate a camera using CPM controls. This involves creating a control panel and linking values between the control panel and VPM tools.

This example uses a standard Datalogic five dot grid target for calibration and assumes you are using a monochrome camera. For more details about camera calibration, see “Camera Calibration Technical Details” on page 6-83 and “Calibration Panel” on page 2-31.

NOTE: This manual does not provide detailed operation about Datalogic cameras and processors. It assumes you have some knowledge of how vision programs and Impact tools and tasks are structured, how to access vision program tool and task data in CPM, and that you understand Impact terminology.

For more details about Datalogic cameras, refer to the Datalogic Hardware Guides. For information about camera calibration, see “Camera Calibration Technical Details” on page 6-83 and “Calibration Panel” on page 2-31.

VPM

VPM must be running and connected to a camera with a vision program loaded. The program does not need to contain any tools.

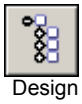
CPM Control Panel

To calibrate with CPM, you must first create a control panel with the appropriate controls. After the control panel is created, you can use it to calibrate the camera.

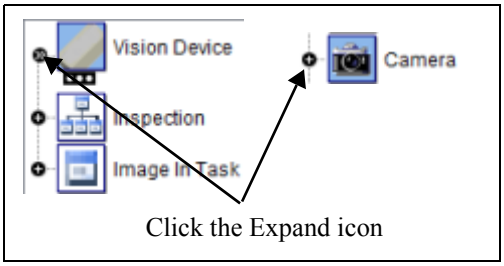
Create a control panel

To create the calibration control panel

1. Start CPM.
2. Click the New Application button.
3. Select the file "Connect Image Display.cpt" from the Template browser window, then click Add.

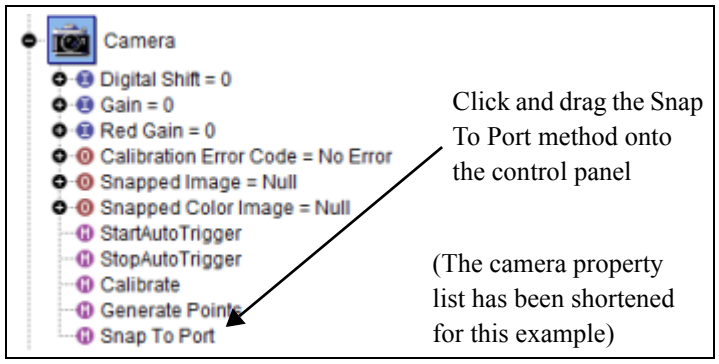

Design View

4. Click the "Connect to Vision Device" button and connect to the camera you are calibrating.
5. Click the Design View button and verify that "Vision Program Tree" is selected.
6. Click the Expand Branch icon next to the Vision Device object.
7. Click the Expand Branch icon next to the Camera System object.

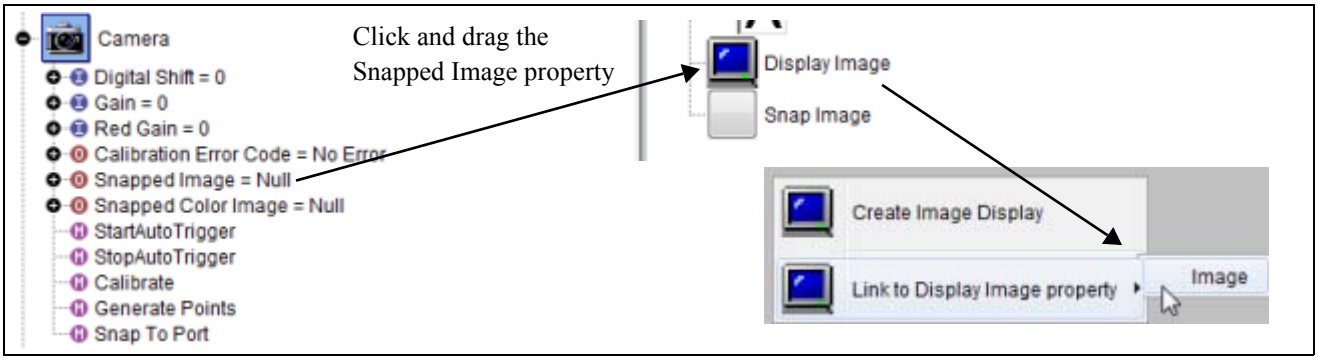


Click the Expand icon

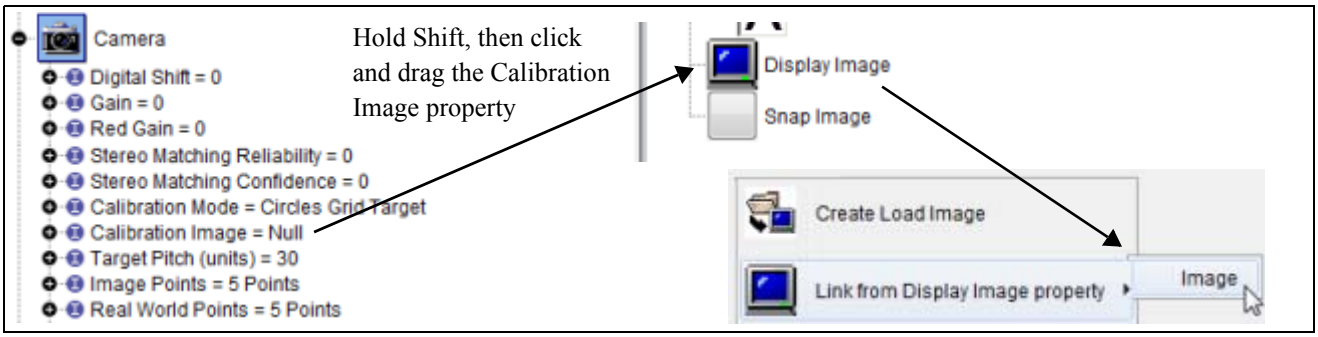
8. Click the "Snap To Port" method, then drag and drop it onto the control panel. A button will be created on the control panel. Rename the button to "Snap Image." When you click this button, an image is snapped and loaded into the "Snapped Image" property.



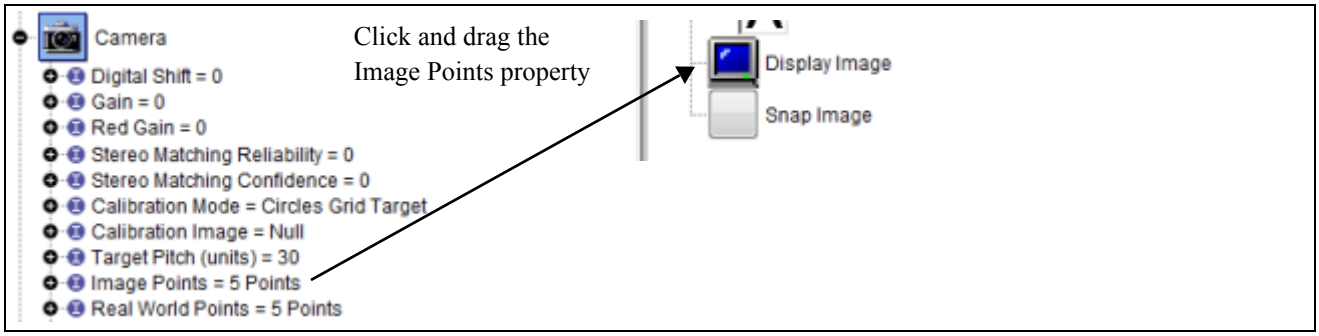
9. Click the "Snapped Image" property, then drag and drop it onto the Image Display control on the control panel. Select "Link to Display Image property" then select "Image." When you snap an image, it will be displayed in the Image Display control.



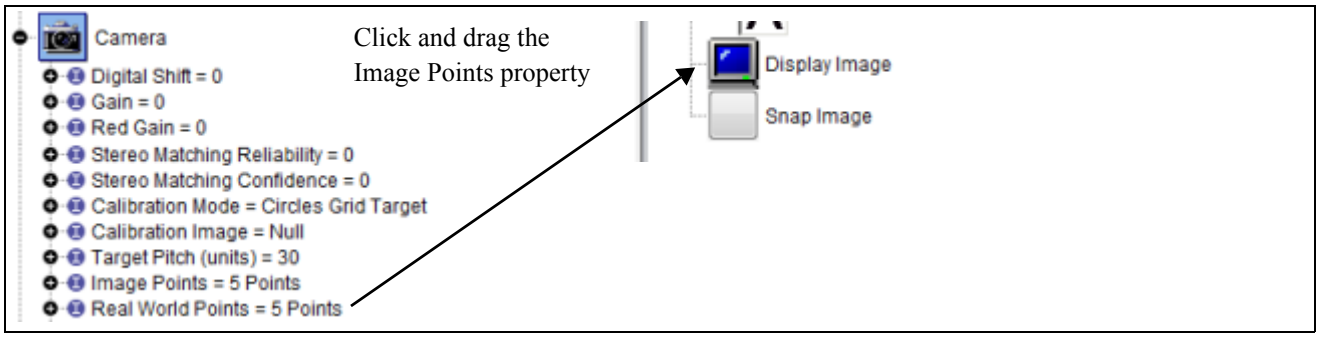
10. Hold down the Shift key while you click and drag the "Calibration Image" property. Drop it onto the Image Display control. Select "Link from Display Image property" then select "Image." This is the image that the camera will use for calibration.



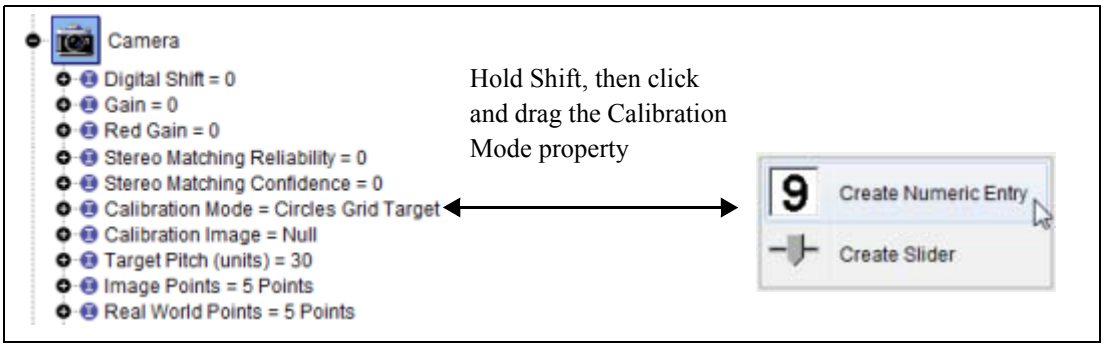
11. Click the "Image Points" property, then drag and drop it onto the Image control. Point ROIs will be added to the image.



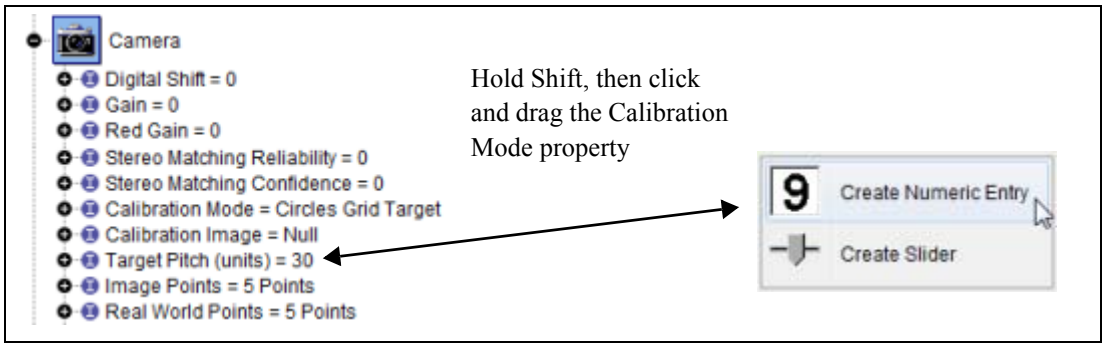
12. Click the "Real World Points" property, then drag and drop it onto the Image control. Point ROIs will be added to the image.



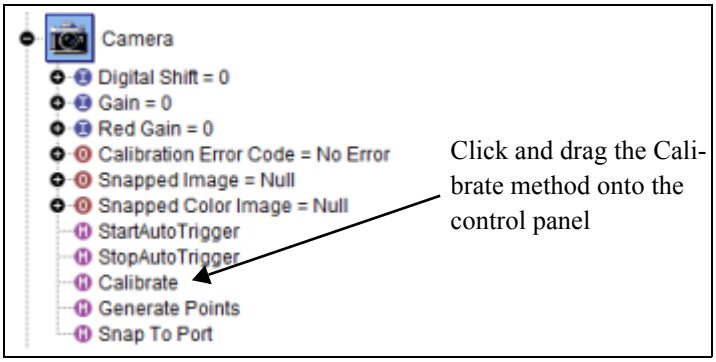
13. Hold down the Shift key while you click and drag the "Calibration Mode" property. Drop it onto the control panel. Select "Create Numeric Entry." This selects Circles Grid Target calibration. You can add a Text Display control for description if desired.



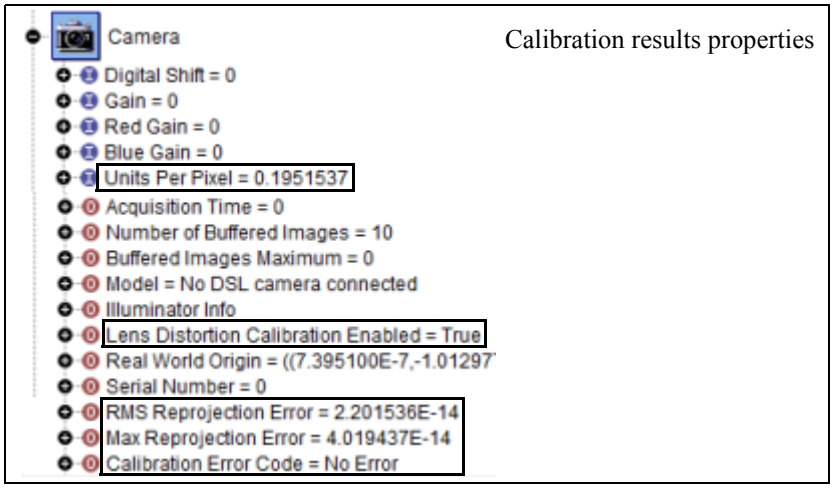
14. Hold down the Shift key while you click and drag the "Target Pitch (units)" property. Drop it onto the control panel. Select "Create Numeric Entry." This allows you to enter the desired Target Pitch for calibration. You can add a Text Display control for description if desired.



15. Click the "Calibrate" method, then drag and drop it onto the control panel. A button will be created on the control panel. Rename the button to "Calibrate." When you click this button, the camera is calibrated using the image in the "Snapped Image" property, and the other properties you have entered.

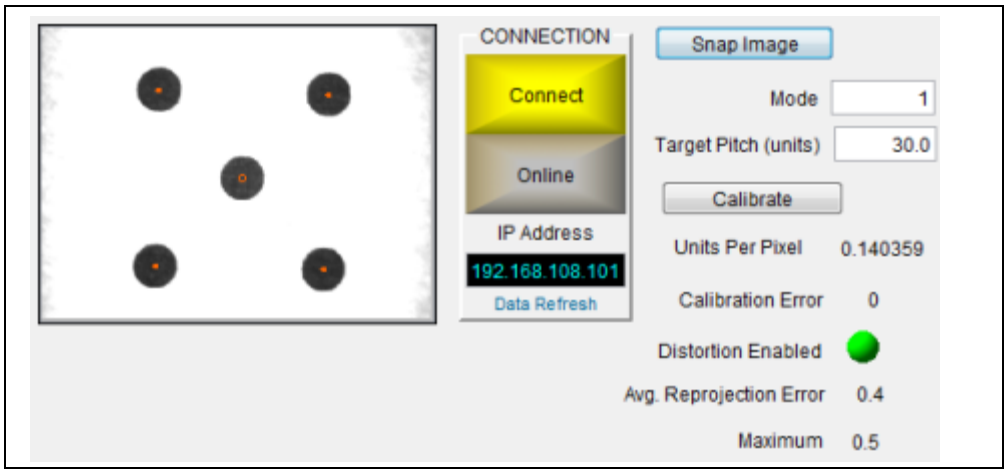


16. If you want, you can drag and drop any of the following calibration results properties to the control panel, then add descriptions:



Completed Control Panel

Your completed control panel, in Run mode, may look similar to this example:



CPM Camera Calibration

Now that the control panel is created, you can use it to calibrate the camera. For more details about camera calibration see “Calibration Panel” on page 2-31.

Calibrate the camera

To calibrate the camera

1. Click the Run mode button in CPM.
2. Enter the camera’s IP address in the IP Address field.
3. Click the Connect button.
4. Place the calibration target in front of the camera and adjust the lighting and focus.
5. Click the Snap Image button. The camera will snap an image of the calibration target.
6. Enter 1 for the Mode.
7. Enter the desired Target Pitch.
8. Click the Calibrate button. The calibration results are displayed in their respective fields.

C H A P T E R 5

Impact Basic



This chapter discusses the Basic language that is used in the Basic tool in VPM and the Basic Interpreter control in CPM. The Basic tool performs logical and mathematical calculations based on a set of user-written statements using the Basic programming language. The program results are available to link to other tools.

Basic Editor Window

Basic language commands are typed in the Basic editor window in the VPM Basic tool and the CPM Basic Interpreter. For more details on the CPM Basic Control, see “Basic Interpreter” on page 4-107. For more details on the VPM Basic tool, see “Basic” on page 3-260.

Compile Button

Click the Compile button to test the validity of your Basic code. Any errors, along with the line numbers, are displayed. Variable names and their calculated variable values are displayed in the properties tab as inputs.

Run Button

Click the Run button to run the tool. Updated values are displayed in the properties tab.

Type in the Editor Window

The Editor window uses standard Windows text editing commands. You enter text by typing in the Editor window. When you reach the end of a line, press Enter to create a new line. To put a blank line between lines, press Enter twice.

To select text

- **Using the mouse**: Move the cursor to the beginning of the text, then click and hold the left mouse button while you drag across the text you want to select.
- **Using the keyboard**: Move the cursor to the beginning of the text, then hold down the Shift key while you move the cursor using the keyboard arrow keys. You can select a word at a time if you hold down the Shift and Control keys while you move the cursor.

To add a new text line

1. Move the cursor to the desired location, then press Enter.
2. Type the new text.

To delete text

Press the Backspace key to delete the character to the left of the cursor. Press the Delete key to delete the character to the right of the cursor. To delete multiple words, letters, or lines, select the desired text, then press the Delete or Backspace key.

To move text

1. Select the desired text, then press Ctrl X.
2. Move the cursor to the new location, then press Ctrl C.

To modify text

1. Select the desired text, then type the new text.

To check the validity of your Basic code

1. Click the Compile button.
2. Any errors are displayed in the Editor window.

Comments

You can make your programs more readable by leaving blank lines between statements, and adding explanatory comment lines.

You can indicate comment lines in one of three ways:

1. Start the line with the letters REM followed by one or more spaces. The spaces after REM are important. If you forget them, the Basic interpreter will interpret your comment as a variable and may display an error message. (See “REM” on page 5-24)
2. Start the line with an apostrophe (‘) character.
3. Start the first line of a multi-line comment with an apostrophe followed by three double-quote marks. The ending line of the multi-line comment must begin with three double-quote marks. Example:

```
 '""" This is the first comment line
      This is the second comment line
 """  This is the ending comment line
```

You cannot put a comment at the end of a statement. Examples:

```
‘This is a comment line
REM This is also a comment line
count = 1 REM This is an illegal comment after a statement
```

Error Messages

If you use incorrect syntax for a command, or enter something that the Basic interpreter doesn’t understand, an error message is displayed at the bottom of the Editor Window. The message will list the offending statement’s line number and a brief explanation of the error.

```
! - No Basic Code.  error &H35:The compiled program contains no executable code.
```

Sample Error Message

General Language Format

Impact Basic is a Basic language and it has the same format as other Basic languages. Some advanced functions and commands are not implemented because they are not used.

In Impact Basic, a Basic program is considered to be all the statements contained in one Basic tool. Basic statements are line oriented and are made up of commands, functions, and assignments. Each statement consists of one line and statements are executed sequentially, based on the program flow.

Variables

Variables are used to store values. Variable names can start with alpha characters, an underscore, a dollar sign, or a colon. They may also contain numbers starting with the second character. The name cannot contain spaces, the last character cannot be a colon, and you cannot use reserved words.

TIP: If the variable's name has a specific ending, the type will be assigned automatically. Variables ending in "real" are assigned type Real, "string" are assigned type String, and "int" are assigned type Integer. For example, count_real is a Real, name_string is a String, and count_int is an Integer.

Examples of valid variable names:

```
myvariable
_variablename
count_real
variable$
```

Examples of invalid variable names:

```
chr$ (this is a reserved word)
variable name (contains a space)
variable:name (cannot use a colon inside the name)
my_variable: (colon as the final character is a GOTO label name)
```

Declaring Variables

Although you don't have to declare variables before you use them, it is good programming practice to do so. You can easily type a variable name wrong so you accidentally create a new variable instead of using an existing one. Declaring variables also prevents losing a variable if you delete a line of code that uses the it.

To require variable declaration, use the statement:

```
declare option DeclareVars
```

Requiring variable declaration means that you must declare them. One way to do this is with the "global" statement. Multiple variables are separated by a comma.

Example of declaring three global variables:

```
global sum_one, product_string, other_real
```

Constants

Constants retain the same value throughout the program and cannot be changed. This allows you to keep constants in one place so they can be easily changed, if necessary. You can create constants by assigning a value to a variable. Example:

```
constant_name = value
const percent = 0.15
tax = purchase * percent
```

Undefined (undef)

Impact Basic uses a special constant named "undef." This constant is undefined in the sense that it has no value (it is not zero or false and it is not any data type). Array elements that have no value assigned to them are undef. If any variables in a mathematical operation are undef, the result of the operation is undef.

Some built-in functions return undef if the operation fails. For example, the function INSTR will return undef if the search string is not found.

If a function's definition indicates that it may return undef, you should include a check for that value in your code. For example:

```
location_int = INSTR ("basestring","ase",1)
IF location_int = undef then
   msg_string = "The string was not found"
ELSE
   msg_string="The string was found"
ENDIF
```

You can also call the function undef to assign the value "undef" to a variable. This example assigns the undefined value to all elements in the array "mylist." Example:

```
undef mylist
```

If a divide by zero operation is performed, the result is "undef" which is displayed as a value of zero in the variable's property.

To make the Basic tool abort with an error on a divide by zero operation, add this code to the tool:

```
Option RaiseMathError 1
```

Expressions

Expressions are used to assign and calculate values. They can contain variables, operators, function calls and parentheses. Operators, unless they are surrounded by parentheses, are evaluated from left to right in the order of precedence listed in the following table, starting with the highest precedence.
Examples:

```
6-3+3 = 6 (3 is subtracted from 6, then 3 is added to 3)
6-(3+3) = 0; (3 is added to 3, the result is subtracted from 6)
6-3/3 = 5; (3 is divided by 3 then subtracted from 6, division has a higher precedence)
```

Operator	Operator Meaning
^	Power: raises the first operand to the power of the second operand (e.g. x = 2^2; result is 4)
*	Multiplication: multiplies the operands
/	Division: divides the left operand by the right operand (the result is undef if the right operand is zero)
%	Modulus: Calculates the remainder of the two operands. The operands are converted to integer value (INT function, not rounded) and the result is integer (e.g. x = 8%3; x is 2). If the second operand is zero, the result is undef.
+	Addition: adds the left operand to the right operand
-	Subtraction: subtracts the right operand from the left operand and the result is the signed difference
=	Equality check: compares operands, if they are equal the result is True (e.g. z = 4>2). If one of the operands is undef, the result is False. If both operators are undef, the result TRUE. NOTE: Be aware of comparing different operand types. For example, comparing a real operand to a string may produce inconsistent results.
<	Less than check: compares the operands, if the left operand is less than the right operand the result is True (e.g. 2<4)* NOTE: Be aware of comparing different operand types. For example, comparing a real operand to a string may produce inconsistent results.

Operator	Operator Meaning
<=	Less than or equal check: compares the operands, if the left operand is less than or equal to the right operand the result is True (e.g. 2<=4)* NOTE: Be aware of comparing different operand types. For example, comparing a real operand to a string may produce inconsistent results.
>	Greater than check: compares the operands, if the left operand is greater than the right operand the result is True (e.g. 4>2)* NOTE: Be aware of comparing different operand types. For example, comparing a real operand to a string may produce inconsistent results.
>=	Greater than or equal check: compares the operands, if the left operand is greater than or equal to the right operand the result is True (e.g. 4>=2)* NOTE: Be aware of comparing different operand types. For example, comparing a real operand to a string may produce inconsistent results.
<>	Not equal check: compares the operands, if the left operand is not equal to the right operand the result is True (e.g. 4<>2) If both operators are undef the result is False. If only one of the operands is undef then the result is True. NOTE: Be aware of comparing different operand types. For example, comparing a real operand to a string may produce inconsistent results.
AND	AND: joins two or more conditional expressions; if both conditional expressions are true, the entire expression is true. If one or none are true, the entire expression is false.
OR	OR: joins two or more conditional expressions; If either or both expressions are true, the entire expression is true. If neither is true, the expression is false.
XOR	Logical and bit-wise: calculates the logical and bit-wise Exclusive OR of the operands
NOT	Logical negation: calculates the logical negation of the operand (e.g. NOT True; the result is False)

*Note: For the compare operators (<, <=, >, >=), the result of the operation is undef if any of the operands is undef.

Statement syntax

Statements consist of assignments, functions, or commands written on a single line. You can leave blank lines between statements for readability. Spacing within a statement is optional. For example, “A=B+C” and “A = B + C” are equivalent. See page 5-31 for some examples of Basic program code.

You should also insert comments in your programs to make them easier to understand. See “Comments” on page 5-2.

Loop constructs

Loops let you process a series of commands a set number of times. The following loop constructs are available.

WARNING: Be careful that you do not create an **“**infinite**”** loop in the Basic tool. For example, if a variable that controls the loop is incorrectly set, the tool may never exit the loop and may run indefinitely. The tool will abort after the Task Timeout time has elapsed only if the task is online and triggering, but not when the Run button is clicked. (See “Enable Timeout” on page 2-7)

Do Until

```
Do Until expression
    REM loop body
Loop
```

This construct repeats the loop body until the expression is True. The expression is evaluated before entering the loop so the loop is not executed if the expression is already True.

Do While

```
Do While expression
    REM loop body
Loop
```

This construct repeats the loop body while the expression is True. The expression is evaluated before entering the loop so the loop is not executed if the expression is already False.

For Next

```
FOR variable = StartValue TO EndValue STEP StepValue
    REM loop body
NEXT
```

This loop construct starts by setting the value of variable equal to StartValue. After the execution of the loop, the variable is increased or decreased by the value of StepValue. The loop is repeated as long as the value of variable is equal to or less than the value of EndValue. If StartValue is already greater than EndValue, the loop is never executed.

The keywords STEP and StepValue are optional. If they are omitted, StepValue is one.

Repeat Until

```
Repeat
    REM loop body
Until expression
```

This construct repeats the loop body until the expression is True. The expression is evaluated after the execution of the loop body so the loop body is always executed at least once.

While

```
While expression
      REM loop body
End
```

This construct repeats the loop body while the expression is True. The expression is evaluated before entering the loop so the loop is not executed if the expression is already False.

Arrays

In the Basic tool, the Boolean List, Integer List, and Real List data types are arrays. Variable values that are not linked into array variables in the tool are preserved between tool executions. If you want to clear an array of all values, assign the "undef" value. For example:

```
    undef mylist
```

assigns an undefined value to all elements in the array "mylist."

To access a list element, use the variable name followed by the list element within brackets.

NOTE: All the list data types are zero based, that is, the first element of the list is zero. For example, if an array contains five elements, the first element is number zero and the final element is number four.

For example, to assign a value to the third element in the mylist variable:

```
mylist[2] = 5.5
```

You can use a loop construct to loop through all the elements in a list variable. For example:

```
For loopcount = 0 to 14
   mylist[loopcount] = True
Next
```

The reserved words "lbound" and "ubound" refer to the lower and upper bounding index of an array. You can use these to process an array of unknown length. For example, to process a Boolean List of unknown length:

```
For loopcount = lbound(mylist) to ubound(mylist)
    if mylist[loopcount] = False then
        sum = sum-1
    endif
Next
```

You can also extend an array by assigning a new value to the upper bounding index value. Array indices can be negative, but if the array is linked into another tool, the index of the first array element will still be zero.

You can define temporary multi-dimensional arrays (the data is not maintained between tool executions). Use the following syntax to access a multi-dimensional array:

```
    mylist [firstdim,seconddim]
```

Data Types

Variables in the Basic tool can be one of the following types: Boolean, Boolean List, Integer, Integer List, Real, Real List, and String. List types can be accessed using array notation. After a variable is defined in the Basic code or as a global variable, click the drop-down arrow next to the variable name in the Tool Properties pane to define its data type.

Boolean and Boolean List

Boolean variables have a value of True (non-zero) or False (zero). You can use any of the comparison operators to compare boolean variables to each other or the constants True and False. You can also assign values to Boolean variables. Individual Boolean List elements can be accessed using array notation. For example, to access the third element of the Boolean List variable Checklist, use the notation Checklist[2].

Here are examples of boolean operations:

```
bvalue = True
bvalue = False
If bvalue = True then
  REM the code to be executed goes here
endif
Checklistlist[2] = False
```

Integer and Integer List

Integer variables can have a whole number value from -2147483647 to 2147483647. You can use any of the comparison operators to compare integer variables to each other or constants. You can also assign values to Integer variables. Individual Integer List elements can be accessed using array notation. For example, to access the third element of the Integer List variable Checkllist, use the notation Checklist[2].

Here are examples of integer operations:

```
value = 1
value = 1+3-99
If value>16 then
  REM the code to be executed goes here
endif
```

```
Checklist[2] = value
```

Real and Real List

Real variables can have a floating number value from -2.147483647E9 to 2.147483647E9. Real variables may use scientific notation. You can use any of the comparison operators to compare real variables to each other or constants. You can also assign values to real variables. Individual Real List elements can be accessed using array notation. For example, to access the third element of the Real List variable Checkllist, use the notation Checklist[2]. Here are examples of real operations:

```
value = 1.5
value = 1.8+3.0-99E6
If value>16.0 then
  REM the code to be executed goes here
endif
Checklist[2] = value
```

String

A string constant is indicated by enclosing a series of letters and/or numbers in double quotes. The following functions and commands are available for string handling.

ASC(), CHR(), &, HEX(), INSTR(), INSTRREV(), ISSTRING(), JOIN(), LCASE(), LEFT(), LEN(), LIKE, LTRIM(), MID(), OCT(), REPLACE(), RIGHT(), RTRIM(), SPACE(), SPLIT, STR(), STRING(), STRREVERSE(), TRIM(), UCASE().

Basic Commands and Functions

Important Note: Some Basic commands and functions are not implemented in Impact software. Some of them may be implemented in future versions.

These commands are implemented only in the CPM Basic control. They will not work in the VPM Basic tool.

- chdir, close, curdir, delete, eod, eof, input, line, open, mkdir, isdirectory, isfile

These commands are not implemented:

- File, directory, network, and screen I/O functions (binmode, delete, eod, eof, line, loc, print, reset, rewind, tcpconnect, textmode, truncate, seek)
- Process spawning (execute, kill, system)
- Command line (environ, command)
- External module access (declare, epreproc)
- Sleep

Impact Basic commands are listed below, in alphabetical order. Commands are shown in upper-case but they may also be written in lower-case.

Commands and Functions A-D

&

Concantenates (joins) two strings. Example:
```
var_string ="first" & "second" yields var_string = "firstsecond"
```

ABS()

Returns the absolute value of the argument. If the argument is undef, the result is undef. Example:
```
x = ABS(-12) yields x = 12
```

ACOS()

This function calculates the arc cosine of the argument (the inverse of the cos function). The result is in radians. If the argument is not between -1.0 and +1.0 the result is undef. Example:
```
x = ACOS(0.54) yields x = 1.000359
```

ADDDAY()

This function takes two arguments and returns a real number representing a date and time. The first argument is a time value, the second argument is the number of days to add to or subtract from it. (See“FORMATDATE” on page 5-15.) Example:
```
tomorrow = ADDDAY(now,1) yields tomorrow = 1.330420E9
```

ADDHOUR()

This function takes two arguments and returns a real number representing a date and time. The first argument is a time value, the second argument is the number of hours to add to or subtract from it. (See“FORMATDATE” on page 5-15.) Example:
```
newtime = ADDHOUR(now,1) yields newtime = 1.330338E9
```

ADDMINUTE()

This function takes two arguments and returns a real number representing a date and time. The first argument is a time value, the second argument is the number of minutes to add to or subtract from it. (See“FORMATDATE” on page 5-15.) Example:
```
newtime = ADDMINUTE(now,1) yields newtime = 1.330334E9
```

ADDMONTH()

This function takes two arguments and returns a real number representing a date and time. The first argument is a time value, the second argument is the number of months to add to or subtract from it. (See“FORMATDATE” on page 5-15.) Example:
```
nextmonth = ADDMONTH(now,1) yields nextmonth = 1.332840E9
```

ADDSECOND()

This function takes two arguments and returns a real number representing a date and time. The first argument is a time value, the second argument is the number of seconds to add to or subtract from it. (See“FORMATDATE” on page 5-15.) Example:
```
nextsecond = ADDSECOND(now,1) yields nextsecond = 1.330334E9
```

ADDWEEK()

This function takes two arguments and returns a real number representing a date and time. The first argument is a time value, the second argument is the number of weeks to add to or subtract from it. (See"FORMATDATE" on page 5-15.) Example:

```
nextweek = ADDWEEK(now,1) yields nextweek = 1.330939E9
```

ADDYEAR()

This function takes two arguments and returns a real number representing a date and time. The first argument is a time value, the second argument is the number of years to add to or subtract from it. (See"FORMATDATE" on page 5-15.) Example:

```
nextyear = ADDYEAR(now,1) yields nextyear = 1.361957E9
```

AMAX(array)

This function returns the maximum value in the argument array. Example:

```
list[0] = 10
list[1] = 2
list[2] = 53
list[3] = 4
listmax =amax (list) yields listmax = 53
```

AMAXI(array)

This function returns the index of the maximum value in the argument array. Example:

```
list[0] = 10
list[1] = 2
list[2] = 53
list[3] = 4
listmaxi =amaxi (list) yields listmaxi = 2
```

AMIN(array)

This function returns the minimum value in the argument array. Example:

```
list[0] = 10
list[1] = 2
list[2] = 53
list[3] = 4
listmin =amin (list) yields listmin = 2
```

AMINI(array)

This function returns the index of the minimum value in the argument array. Example:

```
list[0] = 10
list[1] = 2
list[2] = 53
list[3] = 4
listmini =amini (list) yields listmini = 1
```

ASC()

This function returns the ASCII code of the first character of the argument string. Example:
```
ascii_value = ASC("a") yields ascii_value = 97
```

ASIN()

This function returns the arc sine of the argument (the inverse of the sin function). The result is in radians. If the argument is not between -1.0 and +1.0 the function will fail. Example:
```
x = ASIN(0.5) yields x = 0.5235988
```

ATAN()

This function returns the arc tangent of the argument. The result is in radians. If the argument is undef, the result is undef. This example assigns the value 0.785 to the real variable x.
```
x = ATAN(1) yields x = 0.7853982
```

CALL

This command calls a user-written subroutine and passes optional arguments. Example:
```
CALL mysub (x,y)
```

CHDIR

(CPM Only) This function changes the current directory. This example changes the current directory to the path in the quotes. Note: forward slashes (/) should be used between directories. Example:
```
chdir “C:/Documents/design docs”
```

CHOMP()

This function removes a trailing "newline" character from the string argument. If the last character is not a "newline," then the original string is returned. Example:
```
chr_string = CHOMP(newline_string)
```

CHR()

This function returns the one character string corresponding to the ASCII code in the argument. If the argument is not defined, the result is a string containing a character of code zero. This example would assign the letter "A" to the string variable chr_string. Example:
```
chr_string = CHR(65) yields chr_string = A
```

CLOSE

This function closes a previously successfully opened file. The argument is the file number that was used when the file was opened. If the file number is not associated with a successfully opened file an error is returned. This example closes file number 1.
```
close 1
```

COS()

This function returns the cosine of the argument. The argument is in radians. If the argument is undef, the result is undef.

```
x = COS(0.5) yields x = 0.8775826
```

CURDIR

(CPM Only) This function returns the current directory. This example assigns the current directory name to the string variable current_dir. Note: this function returns a path with back slashes (\) between directories.

```
current_dir = curdir
current_dir = C:\Documents\design docs
```

DAY()

This function returns the number of the day corresponding to the argument. If the argument is empty, the function returns the current day based on the camera time (A30, P-Series, or T4x-Series) or processor time (M-Series and MX-U Series processor). Example:

```
current_day = DAY yields current_day = 27
```

Do

There are two versions of this construct. The first repeats the loop body until the expression following the keyword UNTIL becomes True. The second repeats the loop until the expression following the keyword WHILE becomes False. The expression is evaluated at the end of every loop, so the loop body is always executed at least once.

```
Do
    REM loop body
Loop Until expression

Do
    REM loop body
Loop While expression
```

Do Until

This construct repeats the loop body until the expression is True. The expression is evaluated before entering the loop so the loop is not executed if the expression is already True.

```
Do Until expression
    REM loop body
Loop
```

Do While

This construct repeats the loop body while the expression is True. The expression is evaluated before entering the loop so the loop is not executed if the expression is already False.

```
Do While expression
    REM loop body
Loop
```

Commands and Functions E-H

END SUB

This command declares the end of a subroutine. A subroutine is a piece of code that can be called from the main part of the code or from a function or another subroutine.This command is unnecessary at the end of the main section of code in the VPM Basic tool. Example:

```
SUB MySub(Var1,Var2, Var3)
   REM subroutine code goes here
END SUB
```

EOF()

(CPM Only) This function returns True if the end of the file currently being read has been reached. The argument is an open file number. This example assigns the value True to the variable end when the end of file 1 is reached. Example:

```
end = eof(1)
```

ERROR()

This function returns the error code for the most recent error that occurred. This example would assign the error code to the variable errcode. Example:

```
errcode = ERROR()
```

ERROR n

This command causes the Basic tool to fail with the error code number "n." Example:

```
ERROR 3
```

ERROR$ ()

This function returns a string describing the most recent error. Example:

```
error_string = ERROR$()
```

ERROR$ (n)

This function returns a string describing error number "n." Example:

```
error_string = ERROR$ (10)
```

EVEN()

This function returns a True or False value based on whether the argument is an even or odd number. If the argument is undef, the result is undef. Example:

```
check_it_bool = EVEN(2) yields check_it_bool = True
```

EXIT FUNCTION

This command causes an immediate return from a user-defined function. Any code after the Exit is not executed. Example:

```
FUNCTION MyFunction(var1, var2, var3)
    REM function code goes here
EXIT FUNCTION
    REM This code will not get executed
END FUNCTION
```

EXIT SUB

This command causes an immediate return from a user-defined subroutine. Any code after the Exit command is not executed. Example:

```
SUB MySub(Var1,Var2, Var3)
    REM subroutine code goes here
EXIT SUB
    REM This code will not get executed
END SUB
```

EXP()

This function returns the x-th exponent of the argument. If the argument is undef, the result is undef. Example:

```
z = EXP(0) yields z = 1
```

FALSE

This built-in function has no arguments. It always returns the value False. Example:

```
myresult_bool = FALSE yields myresult_bool = False
```

FFTMAG()

This function computes the Fourier transform of the argument array. The argument is an array of two or more real values. (Ideally the length should be a power of 2, e.g. 4, 8, 16, 64, 256).
After computing the transform, the function computes the magnitude of each complex output value (by multiplying the value by its complex conjugate and taking the square root of the result), and stores the magnitude back in the input array.
The function returns a True value if the transform was calculated successfully. The returned value should be false only if an invalid input argument is passed. Example:

```
list[0] = 10
list[1] = 2
calc_bool = fftmag (list)
```

yields the following result

```
calc_bool = True
list[0] = 12
list[1] = 8
```

FIX()

This function returns the integral (non-decimal) part of the argument. If the argument is a negative non-integer number, it is truncated toward zero (less negative). If the argument is undef, the result is undef. This

function is similar to the INT function. The difference is that INT truncates down while FIX truncates towards zero. The two functions are identical for positive numbers. Examples:

```
x = FIX (3.3) yields x = 3
x = FIX(-3.3) yields x = -3
```

FORMATDATE

This function uses a format string (the first argument) to format a time or date value (the second argument). You can use a comma as a placeholder in the format string. If the second argument is missing or undefined, then the current local time is converted. Example:

```
date_string = FORMATDATE("format",time)
```

This function call:

```
date_string = FORMATDATE ("WEEKDAY-NAME, *MONTH-NAME* DD at 0h:0m:0s pm",NOW)
```

yields

```
date_string = Friday, April 18 at 12:03:03 pm
```

The following format strings will produce the indicated display. Format strings are case sensitive. You may also insert separation characters (such as colons, dashes, and slashes) to make the output more readable.

Format String	Resultant display
YEAR	four digit year
YY	two digit year
MON	three letter abbreviation of the month name
MM	month number
0M	month number with leading zero, if needed
MONTH-NAME	month name
DD	date
0D	date with leading zero, if needed
WD	single digit day of the week starting with Sunday = 0
WEEKDAY-NAME	weekday name
WDN	three letter abbreviation of the weekday name
HH	hour (24 hour notation)
0H	hour with leading zero, if needed (24 hour notation)
hh	hours (12 hour notation)
0h	hours with leading zero, if needed (12 hour notation)
mm	minutes
0m	minutes with leading zero, if needed
ss	seconds
0s	seconds with leading zero, if needed
am or pm	indicate am or pm (12 hour notation)

For Next

This loop construct starts by setting the value of variable equal to StartValue. After the execution of the loop, the variable is increased or decreased by the value of StepValue. The loop is repeated as long as the value of variable is equal to or less than the value of EndValue. If StartValue is already greater than EndValue, the loop is never executed.

The keywords STEP and StepValue are optional. If they are omitted, StepValue is one.

```
FOR variable = StartValue TO EndValue STEP StepValue
    REM loop body
NEXT
```

FRAC()

This function returns the fractional part of the argument. If the argument is an integer, it will return zero. The sign of the argument is retained. If the argument is undef, the result is undef. Example:

```
x = FRAC(1.5) yields x = 0.5
```

FUNCTION

This command declares a function. The function can have arguments, local variables, and local error handling. Example:

```
FUNCTION MyFunction(var1, var2, var3)
    REM function code goes here
END FUNCTION
```

GMTIME

This function returns the camera time (A30, P-Series, or T4x-Series) or processor time (M-Series and MX-U Series processor) converted to Greenwich Mean Time (GMT) as a real number. Example:

```
thistime_string = FORMATDATE ("MM-DD-YY HH:mm:ss",GMTIME) yields
thistime_string = 2-27-12 16:29:15
```

GOSUB

This an alternative to calling a subroutine. Program execution jumps to the line with the label indicated. (A better way to call a subroutine is to use the Call command.) Example:

```
GOSUB mysub
 REM After the RETURN in mysub is executed, program execution
 REM returns here and executes the following code
 x = 3
 REM more code goes here
END
 mysub:
  REM mysub subroutine code is here
 RETURN
```

GOTO

You can use this command to alter the execution order of statements. It causes execution to jump to a program label and continue execution at that statement. The label must be local (i.e. within a program, function,

or subroutine). You cannot jump into or out of a subroutine or function. Labels must be at the start of a line preceding a command and be followed by a colon. Example:

```
looplabel:
count = count+1
IF count > 50 THEN
  GOTO finish
ENDIF
GOTO looplabel
finish:
count = 0
```

In this example, execution will loop until count reaches 50, then the command "goto finish" will cause a jump to the label finish.

HEX()

This function returns the hexadecimal value of the integer argument as a string. Example:
`hex_string = HEX(255) yields hex_string = FF`

HOUR()

This function converts the real argument to an hour value. If there is no argument, it returns the hour in camera time (A30, P-Series, or T4x-Series) or processor time (M-Series and MX-U Series processor). Example:
`thishour = HOUR yields thishour = 10`

Commands and Functions I-L

IF THEN

This command structure provides conditional execution. You can use single or multi-line syntax. If you use a single line, you cannot include an ELSE statement. (Also see “Loop constructs” on page 5-5)

Example of single line statement:

```
IF condition THEN code to execute when condition is true
```

Example of multi-line syntax:

```
IF condition THEN
   Code to execute when condition is TRUE
ENDIF
```

You can use an ELSE command to check for a True and False condition.

Example using an ELSE command:

```
IF condition THEN
   Code to execute when condition is TRUE
ELSE
   Code to execute when condition is FALSE
ENDIF
```

You can only use one ELSE command. To check for multiple conditions, you can use ELSEIF commands. You can use as many ELSEIF commands as you want in a conditional statement.

Example using ELSEIF commands:

```
IF expression1 THEN
   Code to execute when expression1 is TRUE
```

```
ELSEIF expression2 THEN
   Code to execute when expression2 is true
ELSEIF expression3 THEN
   Code to execute when expression3 is true
ELSE
   Code to execute when expression1, expression2, and expression3 are false
ENDIF
```

INPUT

See “LINE INPUT” on page 5-21.

INSTR()

The syntax of this function is
`INSTR(base_string,sub_string[,position])`

The first argument (base_string) is the string to search. The search starts from the beginning of the string. The second argument (sub_string) is the string to find. The third argument is the character location to start the search. The location of the first character of sub_string is returned. If the position argument is missing, the search starts with the first character of base_string. Undef is returned if the sub_string is not found. Example:
`location_int = INSTR ("bases","ase",1) yields location_int = 2`

INSTRREV()

The syntax of this function is
`INSTRREV(base_string,sub_string[,position])`

The first argument (base_string) is the string to search. The search starts from the end of the string. The second argument (sub_string) is the string to find. The third argument is the character location to start the search. The location of the first character of sub_string is returned. If the position argument is missing, the search starts with the last character of base_string. Undef is returned if the sub_string is not found. Example:
`location_int = INSTRREV ("basestring","string") yields location_int = 5`

INT()

This function returns the integral (non-decimal) part of the argument. If the argument is a negative non-integer number, it is truncated down (more negative). If the argument is undef, the result is undef. This function is similar to the FIX function. The difference is that INT truncates down while FIX truncates towards zero. The two functions are identical for positive numbers. Examples:

```
x = INT(3.3) yields x = 3
x = INT (-3.3) yields x = -4
```

ISARRAY()

This function returns True if the argument is an array. Example:

```
list[0] = 1
list[1] = 2
check_bool = isarray(list) yields check_bool = True
```

ISDIRECTORY(name)

(CPM Only) This function returns True if the argument string is a directory name. This example runs the code within the IF statement if the directory "mydirectory" exists.

```
if isdirectory("mydirectory") then
error_text = "no error"
else
error_text = "error: directory does not exist"
endif
```

ISFILE(name)

(CPM Only) This function returns True if the argument string is a file name in the current directory. This example runs the code within the IF statement if the file "myfile" exists. IMPORTANT: File names are case sensitive.

```
if isdirectory("myfile") then
error_text = "no error"
else
error_text = "error: file does not exist"
endif
```

ISEMPTY()

This function returns True if the argument is an empty string (contains zero characters) or undefined (undef). Example:

```
variable_string = ""
check_bool = isempty(variable_string) yields check_bool = True
```

ISINTEGER()

This function returns True if the argument is an integer number. Example:

```
x = 1
check_bool = isinteger(x) yields check_bool = True
```

ISNUMERIC()

This function returns True if the argument is a number (real or integer). Example:

```
x = 1
check_bool = isnumeric(x) yields check_bool = True
```

ISREAL()

This function returns True if the argument is a real number. Example:

```
x = 1.0
check_bool = isreal(x) yields check_bool = True
```

ISSTRING()

This function returns True if the argument is a string. Example:

```
variable_string = "string"
check_bool = isstring(variable_string) yields check_bool = True
```

ISUNDEF()

This function returns True if the argument is undefined (undef). Example:

```
undef x
check_bool = isundef(x) yields check_bool = True
```

JOIN()

This function joins (concantenates) the string arguments using the first argument as the joiner string. Example:

```
var_string = JOIN("and","first", "second", "third") yields
var_string = firstandsecondandthird
```

LBOUND()

This function returns the element number of the lowest occupied index of the argument array. (Also see Arrays on page 5-6.) Example:

```
   for i = 1 to 3
      list[i] = i
   next
   first_element = LBOUND(LIST)
yields
   list[1] = 1
   list [2] = 2
   list [3] = 3
   first_element = 1
```

LCASE()

This function converts the string argument to lower case. If the argument is undef, the result is undef. Example:

```
var_string = LCASE("ALLLOWERCASE") yields var_string = alllowercase
```

LEFT()

This function creates a string from the leftmost characters of the first argument. The second argument is the number of characters to use. Example:

```
var_string = LEFT("This string",4) yields var_string = This
```

LEN()

This function returns an integer value indicating a string's length. If the argument is undef, the result is undef. Example:

```
stringsize = LEN ("This") yields stringsize = 4
```

LIKE

This function compares a string to a string pattern. The pattern can contain a wild-card or joker character. The wild card character * matches multiple characters. The joker character "?" matches a single character. To look for * or ? in the string, use the "~" character as an escape character. Example:

```
   If "Bigstring" like "Big*" then
```

```
     match_bool=True
   endif
yields
   match_bool = True
```

Example:

```
   If "Bigstring" like "Big?tring" then
     match_bool=True
   endif
yields
   match_bool = True
```

Example:

```
   If "Big*string" like "Big~*string" then
     match_bool=True
   endif
yields
   match_bool = True
```

LINE INPUT

(CPM Only) This function reads a record from an open file. This example reads a record from file number 1 and assigns it to the variable in_string.

```
line input #1, in_string
```

LOG()

This function calculates the natural log of the argument. If the argument is less than or equal to zero, the result is undef. Example:

```
x = LOG(2.72) yields x = 1.000632
```

LOG10()

This function calculates the log of the argument. If the argument is less than or equal to zero, the result is undef. Example:

```
x = LOG10(1000) yields x = 3
```

LTRIM()

This function removes any existing spaces from the leftmost part of a string. Example:

```
var_string = LTRIM ("   This") yields var_string = This
```

Commands and Functions M-Q

MID()

The syntax of this function is

```
MID (string, start, [len])
```

The first argument is a string. The second argument indicates where to start the string extraction. The third (optional) argument indicates how many characters to extract. If the third argument is omitted, the entire string is extracted. In this example, the string "middle" is assigned to the variable var_string. Example:

```
var_string = MID("The middle string",5,6) yields
var_string = middle
```

MINUTE()

This function converts the real argument to a minute value. If there is no argument, it returns the current minute in camera time (A30, P-Series, or T4x-Series) or processor time (M-Series and MX-U Series processor). Example:

```
thisminute = MINUTE yields thisminute = 54
```

MKDIR

(CPM Only) This function creates a directory from a string expression. In this example, the directory "mydirectory" is created in the current directory.

```
mkdir "/mydirectory"
```

MOD

Note: The Basic tool does not use this function. Use the % (modulus) operator instead. See “Expressions” on page 5-4.

MONTH

This function converts the real argument to a month value. If there is no argument, it returns the current month in camera time (A30, P-Series, or T4x-Series) or processor time (M-Series and MX-U Series processor). Example:

```
thismonth = MONTH yields thismonth = 2
```

NOW

This function returns the camera time and date (A30, P-Series, or T4x-Series) or processor time and date (M-Series and MX-U Series processor) expressed in seconds. (See“FORMATDATE” on page 5-15.) Example:

```
thistime_string = FORMATDATE ("MM-DD-YY HH:mm:ss",NOW) yields
thistime_string = 2-27-12 11:56:19
```

OCT()

This function returns the octal value of the integer argument as a string. Example:

```
oct_string = OCT(255) yields oct_string = 377
```

ODD()

This function returns a True value if the argument is an odd number. If the argument is undef, the result is undef. Example:

```
mycheck_bool = ODD(3) yields mycheck_bool = True
```

ON ERROR GOTO

This command defines the label for an error handling entry point. If the argument is NULL, error handling is turned off. Example:

```
ON ERROR GOTO mylabel
```

ON ERROR RESUME

If this function is called, when an error occurs the program will try to continue execution at the argument label, or the next statement if the argument is "next." Example:

```
ON ERROR RESUME next
ON ERROR RESUME mylabel
```

OPEN

(CPM Only)

Open - Output

This function opens a file so you can read from or write to it. This example opens a file named myfile.txt for writing in the current directory, assigns the number 1 to it, writes the string “This is the first line” into it, then closes the file. A new file is opened and any existing file with the same name is replaced. IMPORTANT: File names are case sensitive.

```
open "myfile.txt" for output as 1
print#1,"This is the first line\n"
close 1
```

Anytime you refer to the file you need to use the file number assigned when the file is opened. For example, the command Print#1 writes to file number 1 and the command Close 1, closes file number 1.

The "\n" characters at the end of the print command write a "newline" character at the end of the text so that each line written to the file is a separate line. If you don’t use the newline character, the file will be a continuous string.

Open - Append

You can also open an existing file and write (append) additional records to the end of it. This example opens the existing file named yourfile.txt in the current directory and adds the string "Another line" to it. IMPORTANT: File names are case sensitive.

```
open "yourfile.txt" for append as 1
print#1,"Another line\n"
close 1
```

Open - Input

This example opens the myfile.txt file for reading, then assigns the input string to the string variable in_string. If you used the newline character to create your file, you will need a "line input" assignment statement for each line in the file.

```
open "myfile.txt" for input as 1
line input #1, in_string
close 1
```

PI

This function returns the value of the constant pi (the ratio of a circle’s circumference to its diameter). Example:

```
circum_value = pi yields circum_value = 3.141593
```

POW

This function returns the value of 10 to the power of the argument. Example:
```
pow_value = POW(2) yields pow_value = 100
```

PRINT

(CPM Only) This function writes to an open file. The file number must refer to a currently open file. This example opens the file "myfile.txt," writes the string "This is the first line" into it, then closes the file.
```
open "myfile.txt" for output as 1
print#1,"This is the first line\n"
close 1
```

Commands and Functions R-V

REM

You should put comments in your Basic code to make it more understandable. To indicate a comment, put this command at the beginning of a line, followed by one or more spaces. (Also see “Comments” on page 5-2.) You cannot put a comment at the end of a statement. Example:
```
   ‘This is a comment line.
   REM This is a comment also. Here is the energy calculation
        e = m*(c*c)
```

Repeat Until

This construct repeats the loop body until the expression is True. The expression is evaluated after the execution of the loop body so the loop body is always executed at least once.
```
Repeat
    REM loop body
Until expression
```

REPLACE ()

The syntax of this function is
```
REPLACE (base_string, search_string, replace_string [,number_of_replaces]
[,position]).
```

The first argument (base_string) is the string to search.

The second argument (search_string) is the string to find.

The third argument (replace_string) is the string to use as replacement.

The fourth argument (number_of_replaces - optional) is the number of replaces to do. If this argument is missing, then all occurrences of the search_string is replaced.

The fifth argument (position - optional) is the starting character position of the replacement. If this argument is missing, then the operation starts at the string beginning.

Example:
```
var_string = replace ("newxtringx","x","s") yields
var_string = newstrings
```

RESUME

If this function is called, when an error occurs the program will try to continue execution. If the argument is zero it will try to execute the same statement again. If the argument is "next," it will try execute the next statement. If the argument is a statement label, it will try to execute the statement at that label. Examples:

```
RESUME NEXT
RESUME mylabel
```

RETURN

This command causes a return from a GOSUB command. Execution continues at the statement following the GOSUB command when the subroutine returns. Example:

```
GOSUB mysub
  REM When the return in mysub is executed, the program executes
  REM the following line
      x = 3
  REM more code goes here
END
mysub:
  REM mysub subroutine code is here
RETURN
```

RIGHT()

The syntax of this function is

```
RIGHT (string,length)
```

The first argument is the string to extract. The second argument is the number of characters to put into the result. Example:

```
var_string = RIGHT("This string",4) yields var_string = ring
```

RND

This function returns a random number. Example:

```
x = RND yields x = 1016015
```

ROUND()

This function will round the argument to zero decimal places if there is no second argument. The optional second argument indicates the number of places to round. If the first argument is undef, the result is undef. Example:

```
x = ROUND (11.1225,2) yields x = 11.12
```

RTRIM()

This function removes any existing spaces from the rightmost part of a string. In this example, the spaces are removed from the right of the string. Example:

```
var_string = RTRIM ("This  ") yields var_string = This
```

SEC()

This function converts the real argument to a seconds value. If there is no argument, it returns the current seconds in camera time (A30, P-Series, or T4x-Series) or processor time (M-Series and MX-U Series processor). Example:

```
thissecond = SEC() yields thissecond = 13
```

SIN()

This function returns the sine of the argument. The argument is in radians. If the argument is undef, the result is undef. In this example, the value 0.4794255 is assigned to the variable x. Example:

```
x = SIN(0.5) yields x = 0.4794255
```

SPACE()

This function returns a string of spaces. The argument is the number of spaces. Example:

```
var_string = SPACE(6) yields var_string =
```

SPLIT

This function splits "string" into sub-strings (var1, var2, etc) separated by "delimiter." A delimiter at the beginning or end of the expression is ignored.

The syntax of this function is

```
    SPLIT string BY delimiter TO var1, var2...
```

NOTE: You can use the VAL command to convert a string value to a number to perform math operations.

Example (splits the string 10, 11, 12, 13) into four based on the delimiter (the comma). It assigns those values to the string variables sub1, sub2, sub3, and sub4.

```
SPLIT "10,11,12,13" by "," to sub1, sub2, sub3, sub4 yields
sub1 = 10
sub2 = 11
sub3 = 12
sub4 = 13
```

If there are more string variables than sub-strings, the unfilled string variables are undefined. For example,

```
SPLIT "10,11,12" by "," to sub1, sub2, sub3, sub4 yields
sub1 = 10
sub2 = 11
sub3 = 12
(sub4 is undefined)
```

If there are fewer variables than sub-strings, the last string variable will hold the remaining part of the original string and the delimiter. Example,

```
SPLIT "10,11,12" by "," to sub1, sub2 yields
sub1 = 10
sub2 = 11, 12
```

If two delimiters follow each other, the resulting variable is empty. Example:

```
SPLIT "10, ,11" by "," to sub1, sub2, sub3 yields
sub1 = 10
sub3 = 11
(sub2 is empty)
```

All variables are considered strings when they are split. You need to convert those string values into real values using the VAL function if you want to compare them as numbers. If the values are not converted, they are compared as strings and the string "17.32" is evaluated as greater than "115.22." Example:

```
    temp_string = "17.32,115.22"
```

```
SPLIT temp_string by "," to a,b
real_value_of_a = VAL(a)
real_value_of_b = VAL(b)
if real_value_of_a > real_value_of_b then
   greatest = a
else
   greatest = b
end if
```

SPLITA

This function splits "string" into array elements in "array_variable" separated by "delimiter." Delimiters at the beginning or end of the expression are ignored.

The syntax of this function is

SPLITA *string* by *delimiter* to *array_variable*

NOTE: You can use the VAL command to convert a string value to a number to perform math operations.

Example:

```
SPLIT "10, 11, 12" by "," to var_array yields
var_array[0] = 10
var_array[1] = 11
var_array[3] = 12
```

If two delimiters follow each other, the resulting array element is empty.Example,

```
SPLITA "10, ,11" by "," to var_array yields
var_array[0] = 10
var_array[1] =
var_array[3] = 11
```

(the second array element is empty)

SQR

This function returns the square root of the argument. If the argument is undef, the result is undef. Example:
`y = SQR(9.0) yields y = 3`

STOP

This command stops program execution. No further commands are executed. Example:
`STOP`

STR()

This function converts a number to a string. This conversion is done automatically, but you can use this function to insure that a variable is interpreted as a string. Example:

```
a = 6
var_string = STR(a) yields var_string = 6
```

is the same as

```
a = 6
var_string = a yields var_string = 6
```

STRING()

The syntax of this function is
```
STRING (n,code)
```

The first argument (n) is the string length to create. The second argument (code) is the character code to use to create the string.

If the second argument is a string, then the first character of the string is used to fill the result. Otherwise the argument is converted to an integer and the ASCII code is used.

Examples: (the ASCII code 98 is the letter "b")
```
new_string = STRING (16,"a") yields new_string = aaaaaaaaaaaaaaaa
new_string = STRING (16,98) yields new_string = bbbbbbbbbbbbbbbb
```

STRREVERSE()

This function reverses the string argument. Example:
```
var_string = STRREVERSE ("backwards") yields var_string = sdrawkcab
```

SUB()

The syntax of this command is
```
SUB sub (a,b,c)
```

This command declares a subroutine. A subroutine is a piece of code that can be called from the main part of the code or from a function or another subroutine. Example:
```
SUB MySub(Var1,Var2, Var3)
   REM subroutine code goes here
END SUB
```

TAN()

This function returns the tangent of the argument. The result is in radians. If the argument is undef, the result is undef. Example:
```
x = TAN(1) yields x = 1.557408
```

TIMEVALUE()

The syntax of this function is
```
TIMEVALUE (year, month, day, hour, minute, second)
```

This function returns a real number that based on the arguments. If an argument is missing or undefined, the following default values are used:
year = 1970
month = January
day = 1
hour = 0
minute = 0
second = 0
Example:
```
time_var = yearday (TIMEVALUE (2005,12,23)) yields time_var = 356
```

TRIM()

This function removes any leading and trailing spaces from a string. Example:

```
var_string = TRIM (" This ") yields var_string = This
```

TRUE

This function always returns the value True. In this example, the value True is assigned to the variable myresult. Example:

```
myresult = TRUE yields myresult = True
```

TYPE

This function returns the data type of the argument according to the following symbolic constant values:
SbTypeUndef if the argument is undef
SbTypeString if the argument is string.
SbTypeReal if the argument is real.
SbTypeInteger if the argument is integer
SbTypeArray if the argument is an array
Example:

```
the_string = "Welcome"
If TYPE(the_string) = SbTypeString then
  type_is_string = TRUE
Else
  type_is_string = FALSE
Endif
yields type_is_string = True
```

UBOUND()

This function returns the index number of the highest occupied element of the argument array. (Also see Arrays on page 5-6.) Example:

```
for i = 1 to 5
mylist[i] = i
next
last_element = UBOUND(MYLIST)
yields
last_element = 5
```

UCASE()

This function converts the string argument to all upper case. If the argument is undef, the result is undef. In this example, the string "ALL UPPERCASE" is assigned to the variable var_string. Example:

```
var_string = UCASE("All Uppercase") yields var_string = ALL UPPERCASE
```

UNDEF

Impact Basic uses a special constant named "undef." This constant is undefined in the sense that it has no value (it is not zero or false and it is not any data type). Array elements that have no value assigned to them are undef. If any variables in a mathematical operation are undef, the result of the operation is undef.

You can test for undef values with the function ISUNDEF (see page 5-20). This function assigns the value “undef” to a variable. Example:

```
undef my_int yields an undefined value for my_int
```

VAL()

This function converts a string argument to a number. If the argument is undef, the result is undef. Example:
```
var_real = VAL("10.9") yields var_real = 10.9
```

Commands and Functions W-Y

WEEKDAY()

This function converts the real argument to a number corresponding to the day of the week. (Sunday is weekday number zero, Saturday is weekday number six.) If there is no argument, it returns the current weekday number in camera time (A30, P-Series, or T4x-Series) or processor time (M-Series and MX-U Series processor). Example:
```
thisday = WEEKDAY (TIMEVALUE (2005,12,23)) yields thisday = 5
```

While

This construct repeats the loop body while the expression is True. The expression is evaluated before entering the loop, so the loop is not executed if the expression is already False.
```
While expression
   REM loop body
Wend
```

YEAR()

This function converts the argument to a number corresponding to the current year. If there is no argument, it returns the current year in camera time (A30, P-Series, or T4x-Series) or processor time (M-Series and MX-U Series processor). Example:
```
thisyear = YEAR yields thisyear = 2012
```

YEARDAY

This function converts the argument to a number corresponding to the current day of the year. (The first day of the year is number zero.) If there is no argument, it returns the current day of the year in camera time (A30, P-Series, or T4x-Series) or processor time (M-Series and MX-U Series processor). Example:
```
thisyearday = YEARDAY yields thisyearday = 57
```

Basic Program Examples

The following examples of Basic tool code illustrate some simple function calls and shows how to construct Basic statements. Each example is preceded by explanatory text which will help explain its purpose.

This example uses the CHR function to create a string (ab_) with the last character incrementing from ‘a’ to ‘z’ each time the code is run.
```
’ First, initialize the ascii value (the character’s ascii code) for
’ the last character in the string. If it is zero or greater than 121
’ (the value for z), then set it to 96 (the value of a).
   IF ascii_counter = 0 OR ascii_counter > 121 THEN
      ascii_counter = 96
```

```
    END IF
' Now, increment the counter
    ascii_counter = ascii_counter + 1
' This line converts the ascii value to a string value
    char_string = chr(ascii_counter)
' Finally, this line appends the incremented character to the
' fixed string
    name_string = "ab" & char_string
```

This example shows the use of parentheses in calculations which find the intersection point of two line segments. The segments are defined by four points.
The first line segment is defined by points X1,Y1 to X2,Y2
The second line segment is defined by point X3, Y3 to X4, Y4

```
' First, find the slope of the first line segment
    m1 = (y2 - y1) / (x2 - x1)
' Now find its intercept
    b1 = y1 - (m1 * x1)
' This code finds the slope of the second line segment
    m = (y4 - y3) / (x4 - x3)
' Now find its intercept
    b2 = y3 - (m2 * x3)
' Now calculate the x and y coordinates of the intersection of
' the two line segments
    x = (b2 - b1) / (m1 - m2)
    y = (m1 * x) + b1
```

Here are several examples of various functions and assignments.

Example 1

```
' This example assigns an integer value of -35 to the variable
' "cost," then assigns its absolute value to the real variable
' abs_value using the ABS function.
    cost = -35
    abs_value = abs(cost)
```

Example 2

```
' This example uses the ASC function to find the ascii code
' value of the letter "A." It assigns the integer value 65 to the
' variable asc_value.
    asc_value = asc("A")
```

Example 3

```
' This example uses the CHR function to return the letter that
' corresponds to the ascii code assigned in the previous
' example (65). It assigns the string value "A" to the variable
' char_string.
    char_string = chr(asc_value)
```

Example 4

```
' This example uses the HEX function to find the hex value of
' the number assigned to the variable asc_value in the
' previous examples (65). It assigns the string value
' "41" to the variable hex_string.
    hex_string = hex(asc_value)
```

Example 5

```
' This example demonstrates the string concantenation
' function (&). First, it assigns the integer value 5 to the
' string variable blobs_int. It then joins two string constants
' with the integer value inserted between them, and assigns
' that string to the string variable resulting_string.
```

```
    blobs_int = 5
    resulting_string = "Found a total of " & blobs_int & " blobs"
```

Example 6

```
' This example uses the function MID to extract a string from
' the middle of the string variable resulting_string (which
' was created in the previous example). It starts extracting at
' character 7, and continues for 7 characters. It
' assigns the extracted string ("a total") to the string
' variable mid_string.
mid_string = mid(resulting_string,7,7)
```

Example 7

```
' This example uses the function LEN to return the length
' of the variable resulting_string (which was used in the
' previous example). The returned integer (24) is assigned to
' the integer variable length_int.
    length_int = len(resulting_string)
```

Example 8

```
' This example uses the function INSTR to find the beginning
' position of the string constant "a tot" inside the string
' resulting_string (which was used in the previous example).
' The result is the integer 7 (the string starts at character
' position 7). It is assigned to the integer variable num_int.
    num_int = instr(resulting_string,"a tot")
```

Example 9

```
' This example uses the function UCASE to convert the
' string variable resulting_string (which was used in the
' previous example) to all upper case, then assign it to the
' string variable upper_string.
    upper_string = ucase(resulting_string)
```

Example10

```
' This example uses the function LCASE to convert the
' string variable resulting_string (which was used in the
' previous example) to all lower case, then assign it to the
' string variable lower_string.
    lower_string = lcase(resulting_string)
```

Example11

```
' This example uses the function STRREVERSE to reverse
' the string variable resulting_string (which was used in the
' previous example) and assign the result to the string
' variable reverse_string.
    reverse_string = strreverse(resulting_string)
```

This example shows how to format a real value to a specified number of digits.

```
'This is the real value to format
    real_value = 123.1234567890
'Set the number of digits of precision desired
    precision_int = 1
'The Basic function "instr" finds the location of the decimal point in the real
value (4). The function "mid" returns the numbers in the real value beginning at
1 and ending at the location of the decimal point plus the number of digits of
precision (4+1=5). This creates the string formatted_string with a value of
"123.4".
    formatted_string = mid(real_value,1,instr(real_value,".") + precision_int)
'This code creates the same value as the previous line of code, except the string
```

```
is automatically converted to a real value of 123.4 (formatted_value).
   formatted_value = mid(real_value,1,instr(real_value,".") + precision_int)
```

This example shows how to change directories, open a file, write values into it, then read those values.

NOTE: This example works in the CPM Basic control only. It will not work in the VPM Basic tool.

```
'first open the file for write and assign the file number 1, then generate a ran-
dom number to write to the file
   open "myfile.txt" for output as 1
   x = ROUND(rnd)
'now, write the result to the file
   print #1, "This is a first result. x = " & x & "\n"
'repeat for two more records
   x = ROUND(rnd)
   print #1, "This is a second result. x = " & x & "\n"
   x = ROUND(rnd)
   print #1, "This is a third result. x = " & x & "\n"
'close the file
   close 1
'now open the file for reading, read the first record, assign the input string to
the variable thestring, then close the file
   open "myfile.txt" for input as 1
   LINE INPUT #1, thestring
   close 1
'This section of the example, changes the directory to the temp directory,
assigns the directory name to the variable new_dir, opens a file for reading,
reads the first record, then closes the file
   chdir curdir & "/temp"
   new_dir = curdir
   open "myfile2.txt" for input as 2
   LINE INPUT #2, thestring2
   close 2
```

C H A P T E R 6

Appendix

This appendix explains several parts of Impact software 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.Contrast%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:

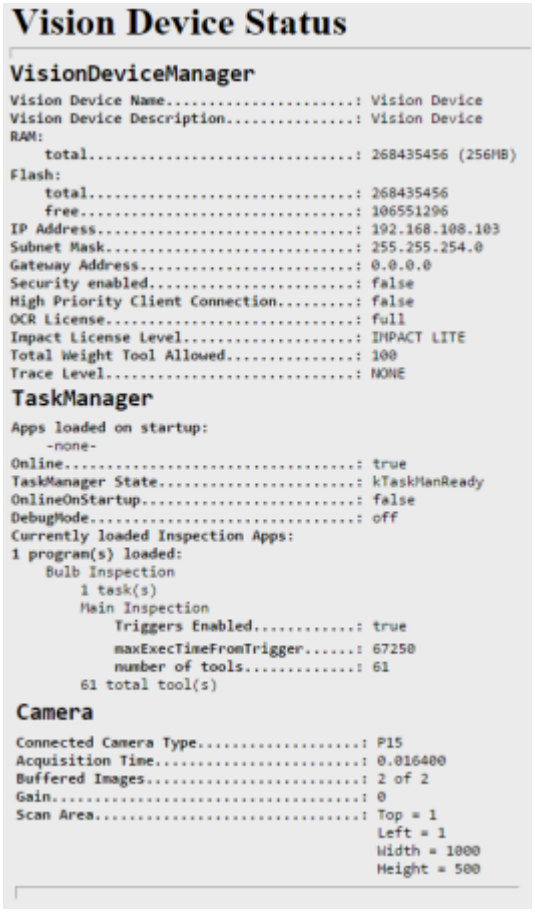
<?xml version=”1.0” encoding=”utf-8” ?>
- < device >
<SyntaxError>Ok</SyntaxError>
<SetDataError>Ok</SetDataError>
</ device >

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
```

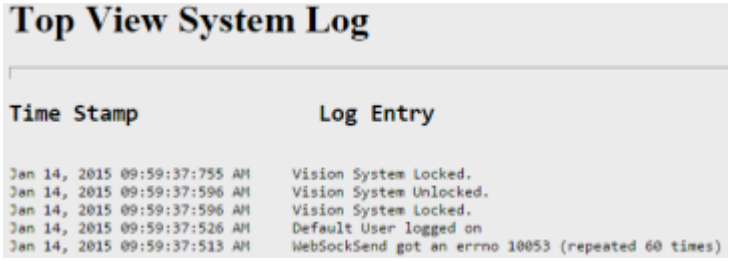
TaskManager

```
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



- 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, MX-E 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, MX-E 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 2-10 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, the 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, MX-E 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, MX-E 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 User Data Event occurs only when data in the User Data area changes.
- Eight User Events that can directly queue a task to run.

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.

EtherNet/IP Implicit Data Mapping

To aid in programming a PLC, the following tables explain the assembly object structure.

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

Word	Name	Data Type	Read/Write	Valid Data	Description
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. -1 .....Program Loading -2 .....Program Load Failed
2	Shutter Time Status	Real	Read	Current Shutter Time Value

Word	Name	Data Type	Read/Write	Description
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.
8-47	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
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

Calibration Command (Word 3)	User Data Words and Values
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
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

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.
- ProfinetIO User Data Event occurs only when a User Data area value changes.
- Eight User Events that can directly queue a task to run.

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).

PROFINET Data Mapping

To aid in programming a PLC, the following tables explain the exchange area structure.

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.

Word	Name	Data Type	Read/Write	Valid Data	Description
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

Word	Name	Data Type	Read/Write	Description
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
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

Calibration Command (Word 3)	User Data Words and Values
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
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

Threshold Viewer

NOTE: The Histogram and Line Profile buttons in the Display Area toolbar are visible only when the Setup tab is selected. To display the Threshold viewer in other tabs, right click on the ROI or image.

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 VPM 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 VPM 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 property is 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 or select a non-ROI property in the Properties tab. If you select a non-ROI property, 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 is in Live mode.

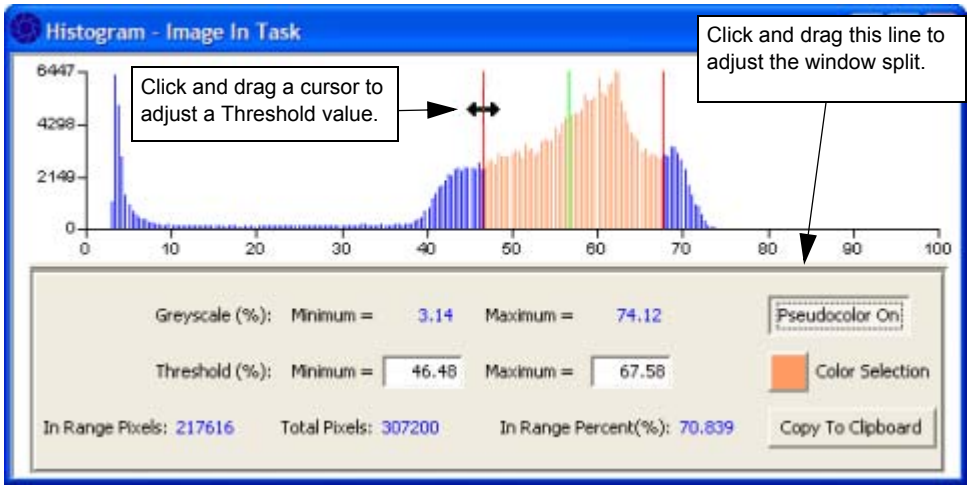
If the Threshold Viewer is already displayed, the Line Profile plot is refreshed when any of the following events happen:

- 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 will close 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 another camera tab.
- You select the Summary tab.
- You click the Online, Continuous Triggers, or Linking button, or you promote a property.
- You leave locked mode in Design Mode.
- You disconnect from the current camera, Vision Device, or Emulator.
- You add a new camera tab.
- You create a new vision program.
- You close the current vision program.
- You select another 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 6-26. 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 property 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 properties when the adjustment stops. The image display is also updated. If you are currently using the tool setup, the tool will run 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 properties, and the image display is updated. If you are currently using the tool setup, the tool will run 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 will adjust the Pseudocolor in the image display, but no values are written to the tool, task, or system object's properties.

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 (In Range Pixels / 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.

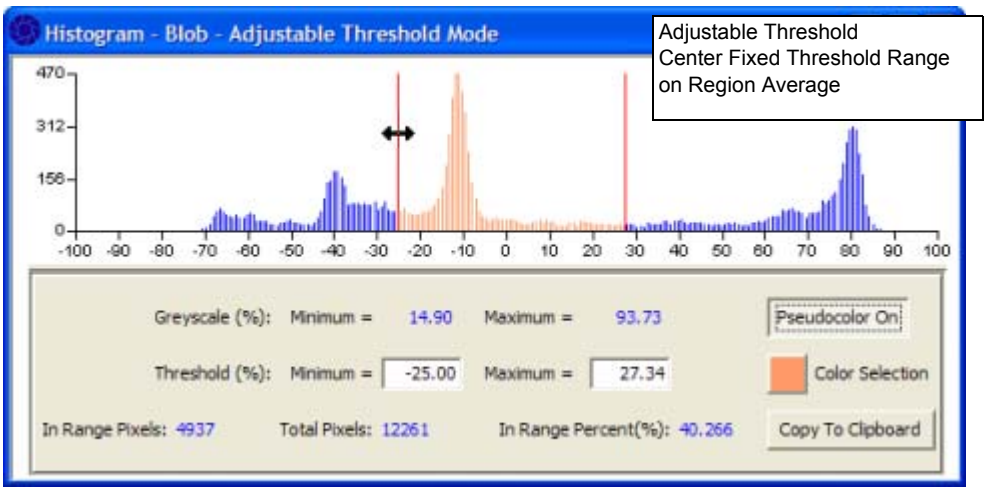
Color Selection

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

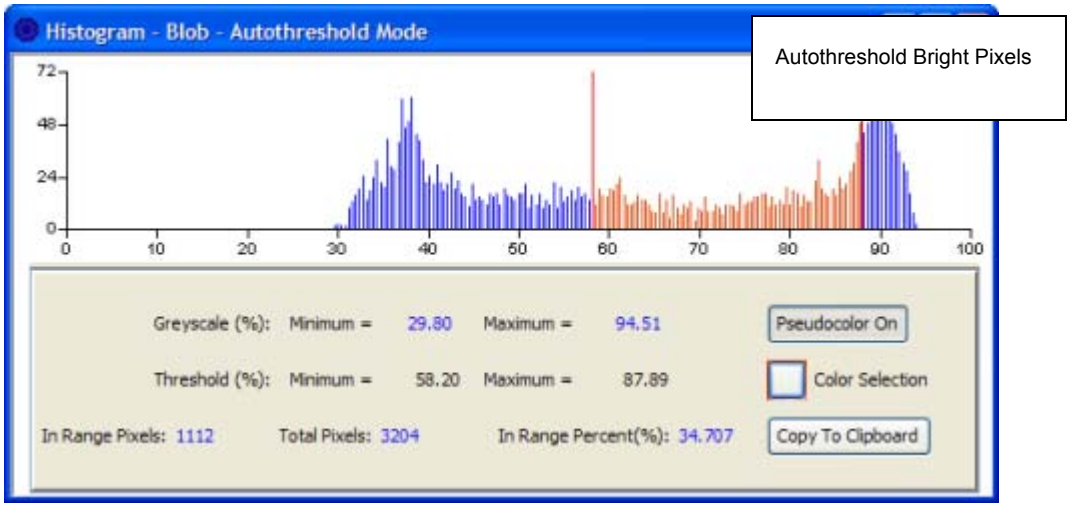
Click this button to create a comma-delimited string of pixel values and write it to the system clipboard. You can paste this information into other applications such as Notepad or Excel.

Center Fixed Threshold Range - Adjustable Threshold



If the tool's threshold type property 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 will move the opposite cursor so that the range is always centered on zero.

Bright and Dark Pixels - Autothreshold



If the tool's threshold type property 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 output property "Threshold Range Used" if it is present in the tool.

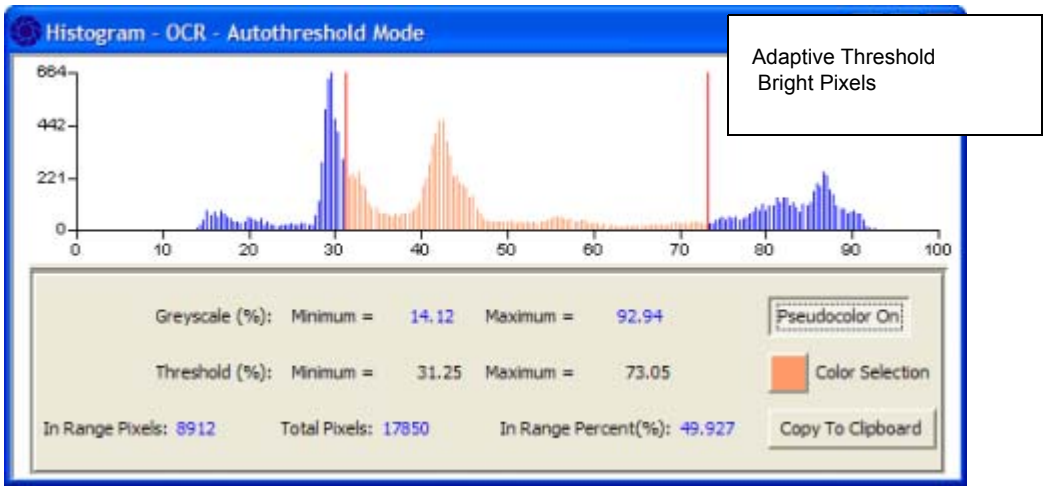
If the tool's threshold type property is set to "Autothreshold Contrasting Dark Pixels," the minimum Threshold (%) is set to 0 and the maximum is set to the maximum value of the tool's output property "Threshold Range Used" if it is present in the tool.

You cannot adjust the Threshold (%) values or cursors in this mode.

NOTE: If there is no "Threshold Range Used" property 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

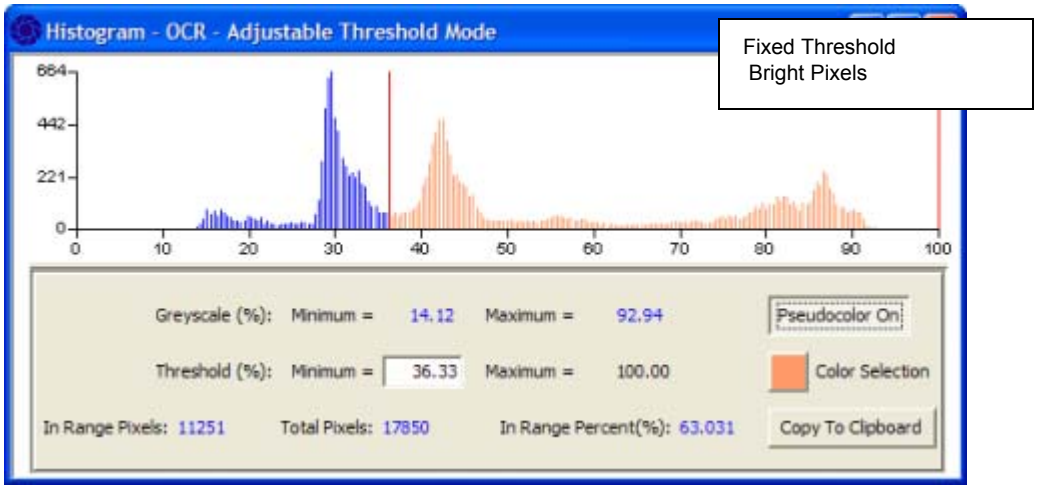


If the tool's threshold type is set to some form of "Adaptive Threshold - Bright," the maximum Threshold (%) is set to 100 and the minimum value is set to the value of the tool's Fixed Threshold Value property.

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 property.

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 property. 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 property. The user can only adjust the Threshold(%) maximum value and cursor in this mode.

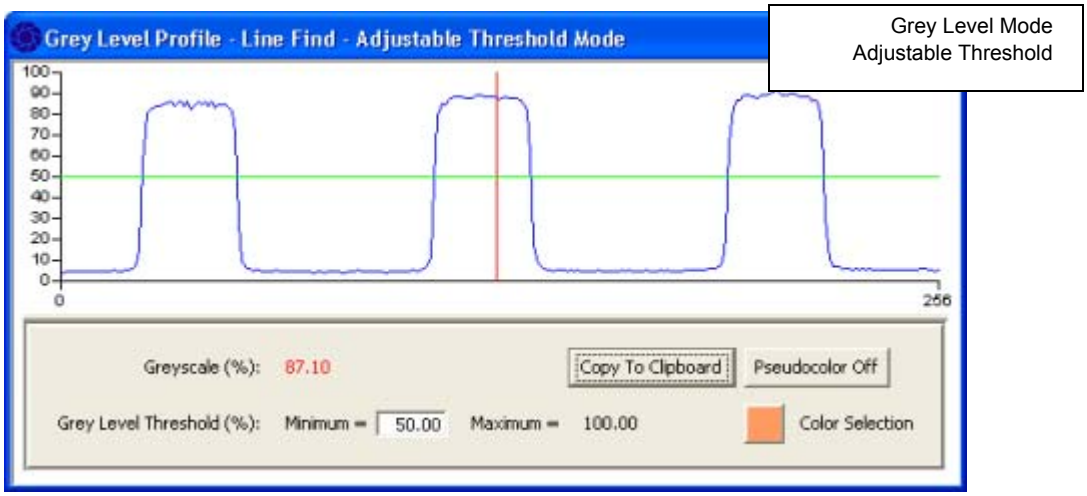
Line Profile - Grey Level Mode

The Threshold Viewer Window will display 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 6-23.

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

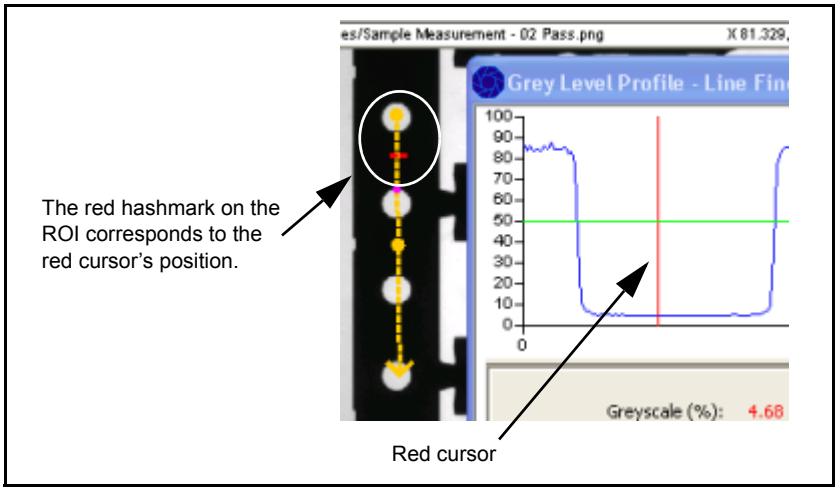


Line Profile Plot

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's property is also adjusted. If Pseudocolor is turned on, adjusting the green cursor will adjust 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 will then only adjust the image display's threshold limits and NOT the tool's property 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" property.

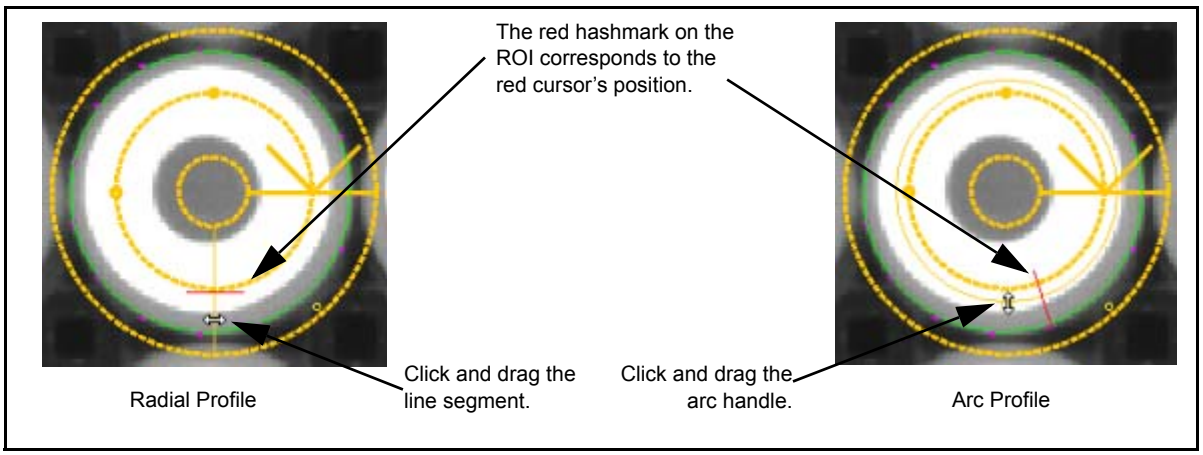
When a Dark Line Type (e.g. First Dark Line) is selected in a tool, the Maximum field is editable and the Minimum field is disabled and displays a fixed value of 0.0. When the green cursor is moved up or down, the Maximum threshold value is adjusted. When you type a value into the Maximum field, the green cursor is adjusted. The Maximum value is reflected in the tool's "Fixed Grey Level Threshold Percentage" property.

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.

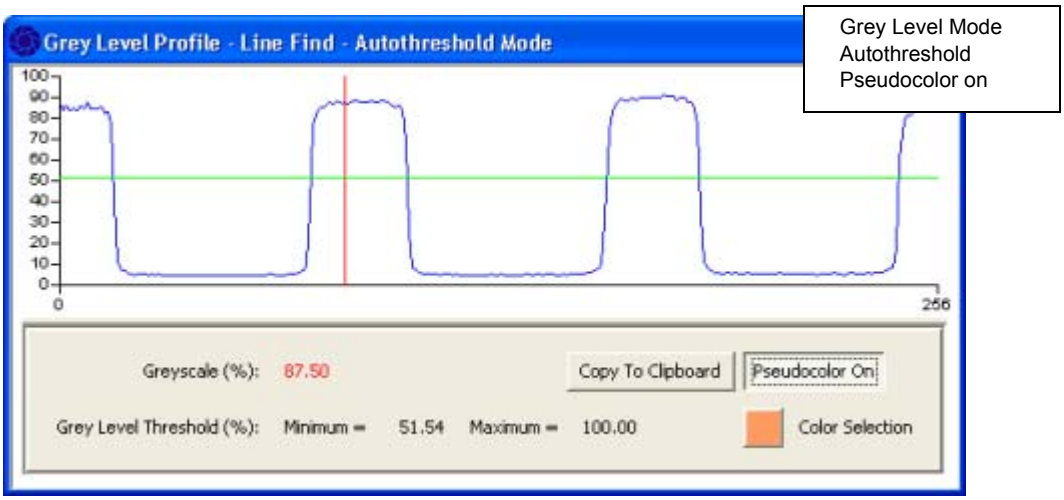
Color Selection

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



Grey Level Mode
Autothreshold
Pseudocolor on

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 properties to read.

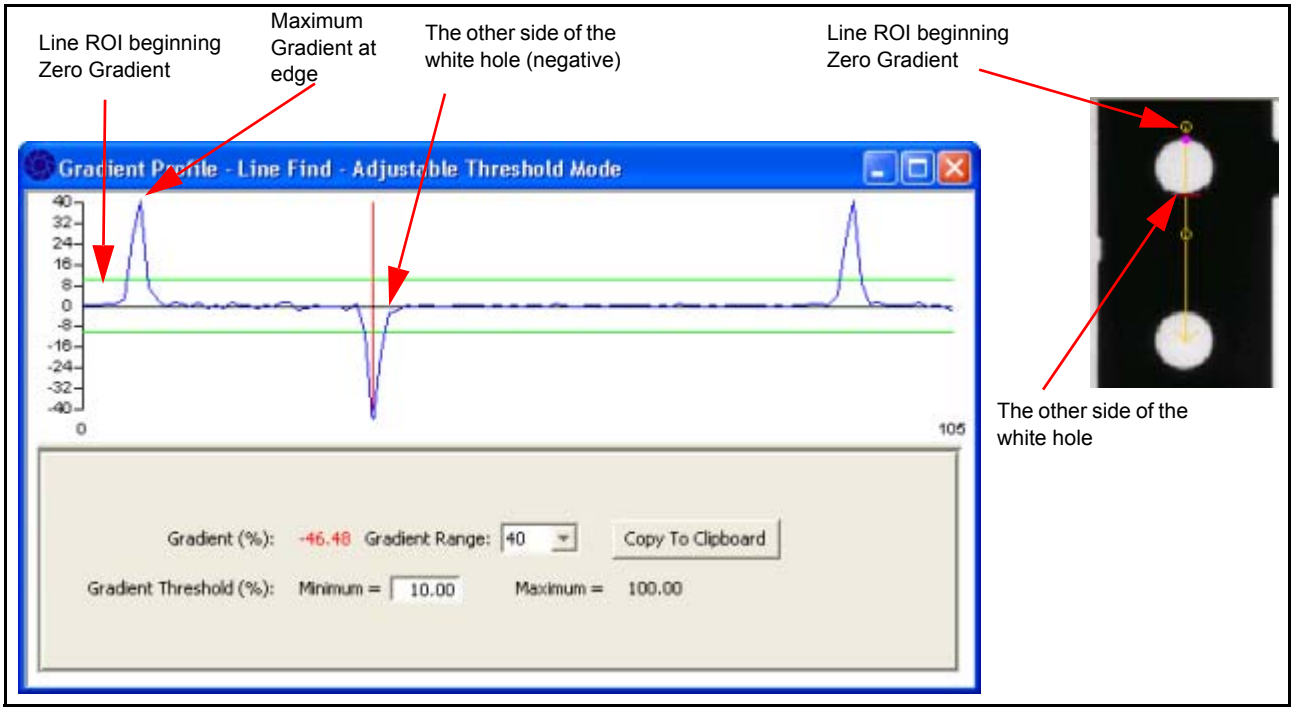
When Pseudocolor is on, a movable horizontal green cursor is displayed. Moving the cursor up or down adjusts either the Threshold % Minimum or Maximum numeric fields and threshold limits in the image display, depending on whether bright or dark line type is selected. In this mode, no values are update in the tool's properties.

Line Profile - Gradient Mode

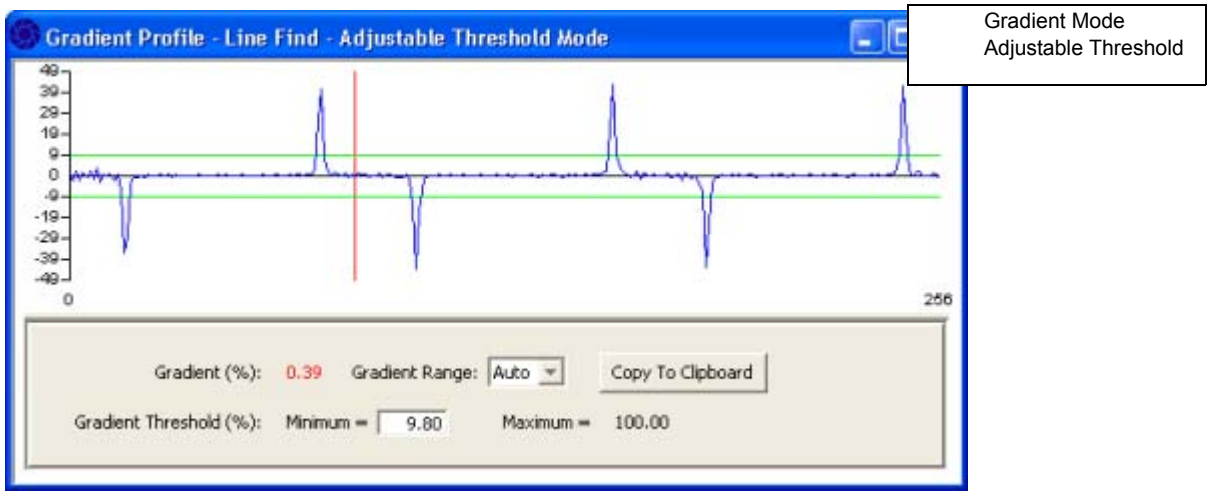
Gradient Introduction

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's property is also adjusted. If the tool is in Auto-threshold 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 6-28.

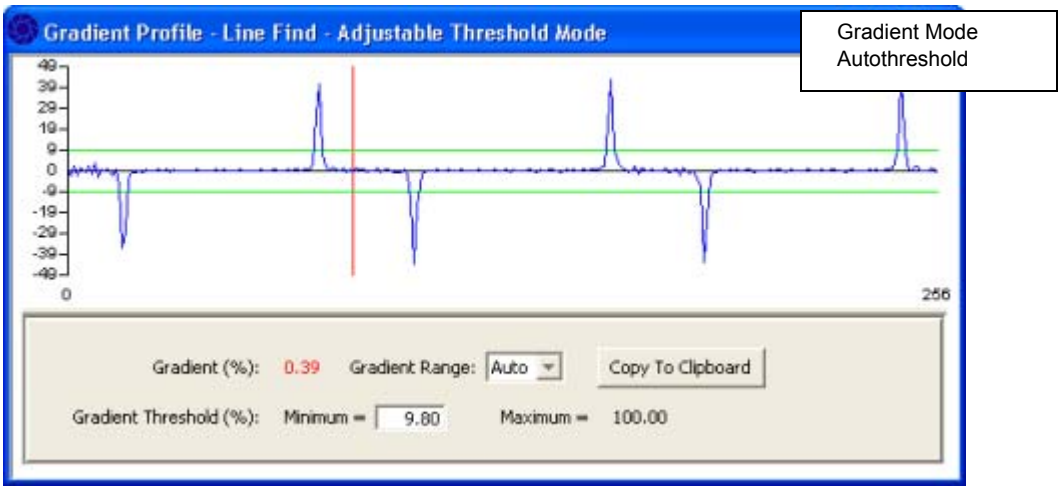
Gradient Threshold (%)

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" property value. As the Minimum percent is adjusted in the text entry or cursor, the tool's property 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 properties in the tool to read.

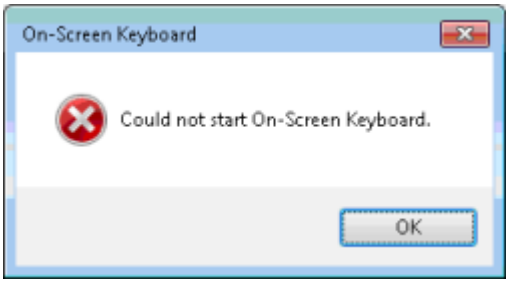
On-Screen Keyboard

Configure the On-Screen Keyboard

Two on-screen keyboards (OSK) are available for entering text and numbers in VPM and CPM using a touchscreen rather than a keyboard. Only the external keyboard is available in VPM. The external and internal OSKs are available in CPM.

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 VPM and CPM 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" and copy it to the folder:
   C:\Datalogic\IMPACT\Applications\OSK

To Change the Default Location in CPM

1. Start CPM and click the Program Preferences button on the main toolbar.
2. In the field labeled "Path to text entry keyboard application," enter the following string (including the quotes):
   "C:\Datalogic\IMPACT\Applications\OSK\osk.exe"
3. Click the OK button.
4. If you are using the Keyboard control in a control panel, click on the Keyboard control.
5. In the control property named "Keyboard Application," click the Value field and enter the following string (including the quotes):
   "C:\Datalogic\IMPACT\Applications\OSK\osk.exe"
6. **NOTE**: You must complete steps 6 and 7 for each Keyboard control in your control panels.

To Change the Default Location in VPM

1. Start VPM 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\IMPACT\Applications\OSK\osk.exe"

4. Click the OK button.

CPM

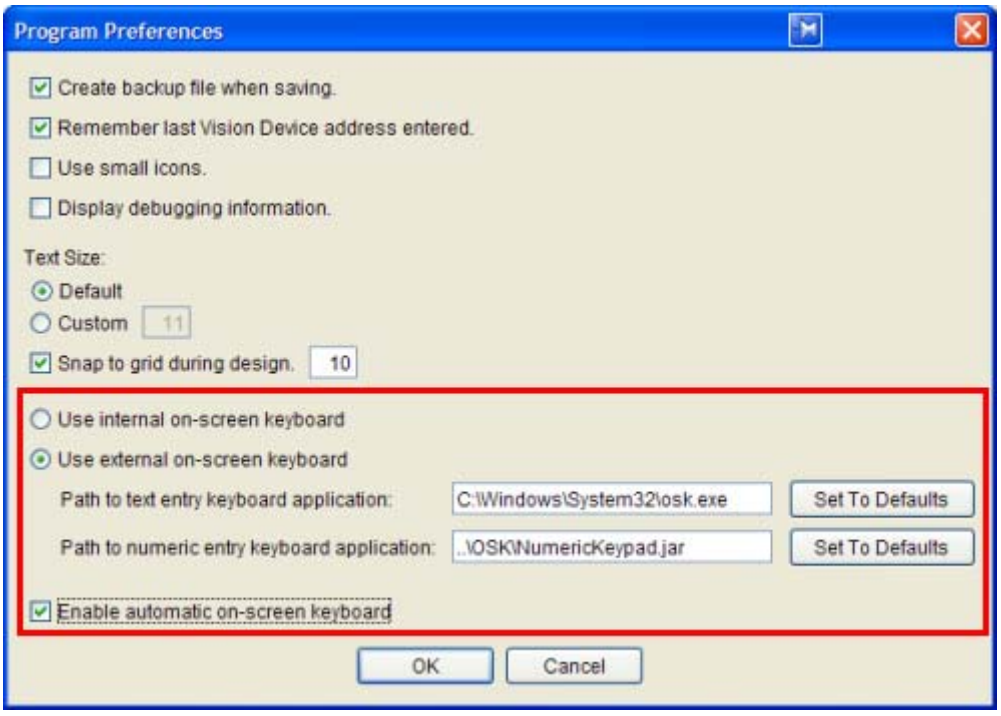
There are three ways to enter information in CPM using a touchscreen: the Keyboard control, the external OSK, and the internal OSK.

The Keyboard Control displays a graphical keyboard on the screen that can be used for keyboard input using a touchscreen. The Keyboard control is placed on a control panel and accessed by clicking it when you want to enter information in a field. For more details see “Keyboard” on page 4-53.

The external OSK is displayed when you select an input field on a control panel. When you press a key, that field will receive the letter or number.

To enable the external OSK

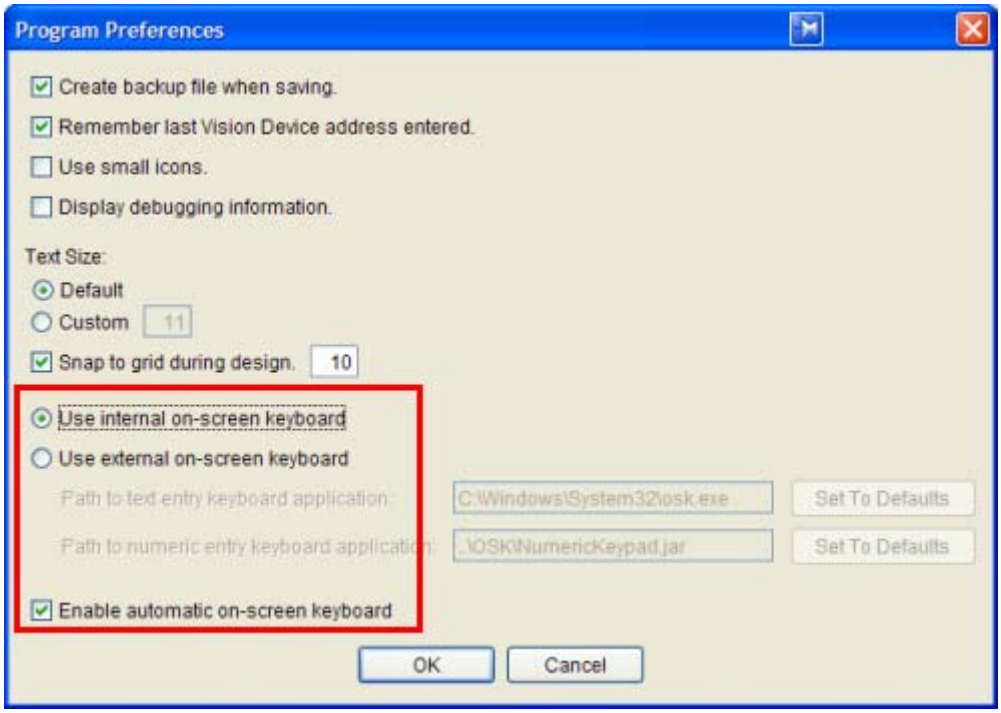
1. Click the Program Preferences button.
2. Click the radio button to select the external OSK. The external OSK requires you to install or otherwise provide a program.
3. In the Program Preferences dialog, check the box labeled "Enable automatic on-screen keyboard."
4. If your text OSK application is 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.



To enable the internal OSK

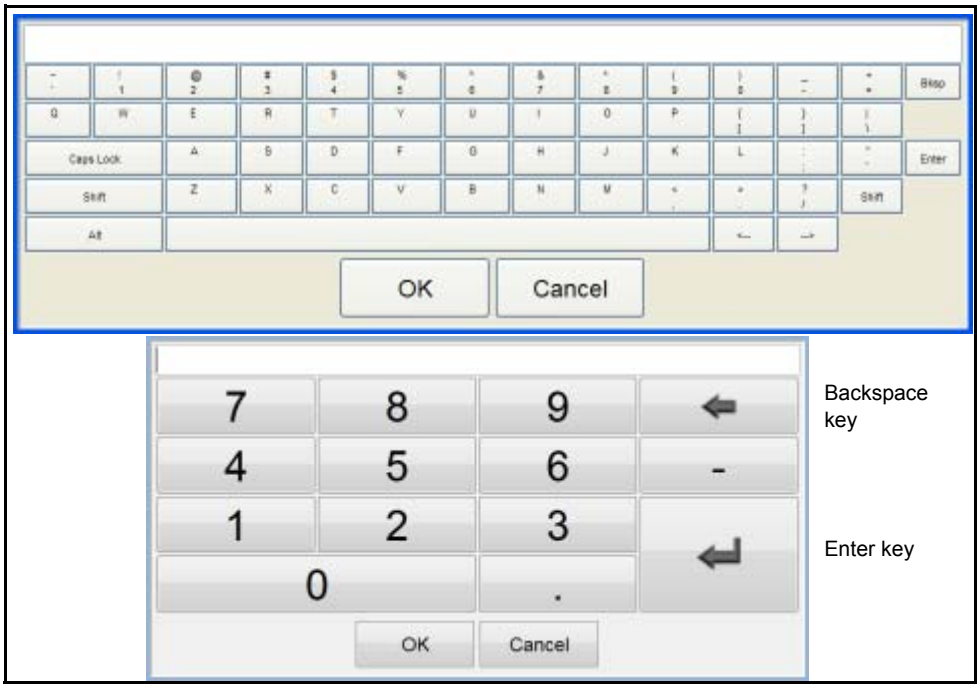
1. Click the Program Preferences button.
2. Click the radio button to select the internal OSK. The internal OSK does not require any external programs.

3. In the Program Preferences dialog, check the box labeled "Enable automatic on-screen keyboard."



Using the internal OSK

The internal OSK is displayed when you select an input field on a control panel. When you press a key, that field will receive the letter or number.



VPM

The external OSK is accessible in VPM 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 will change 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

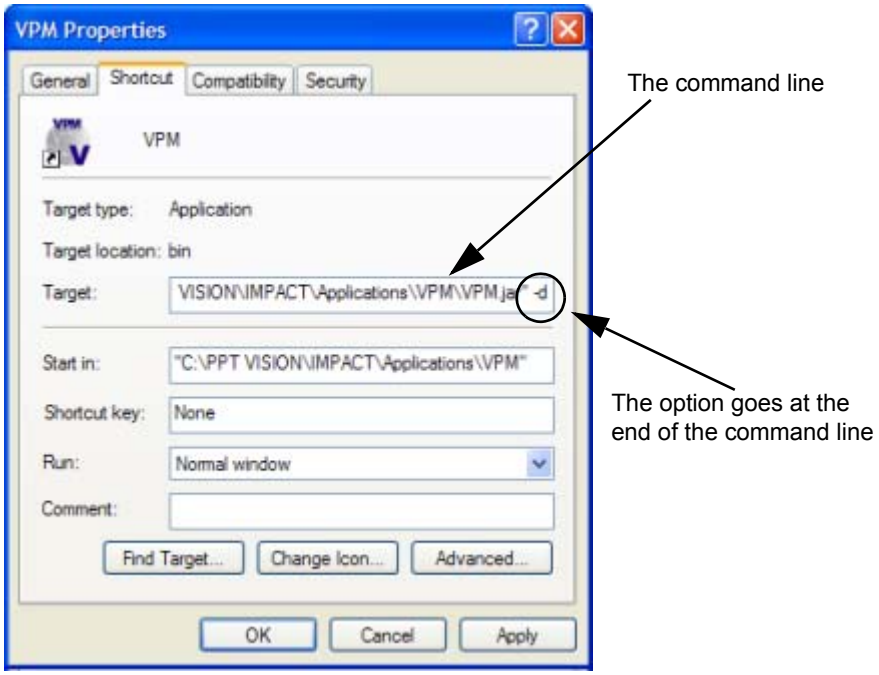
This section describes command line options you can use with Impact software. Some of the options are common to all the programs, and some are unique. Be sure the option you are using is available for the program you are using.

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.



To edit the program command line

1. Find the desired program's shortcut icon on the desktop. This example uses Settings.
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. The default command line varies with the program. For example, here is an example of the VPM program command line:

   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.
   Here is an example of the above command line with the -d option added:

   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 these examples. Only add options at the end of a command line. Do not edit details in a command line.

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 6-42 for an example.

Summary

Here is a summary of all the Command Line parameters, along with the programs that use them.

Access a text file containing command line parameters (-optionfile): CPM, CPMRE, VPM, Settings (page 6-42)

Disable the ability to close the program (-noexit): CPM, CPMRE (page 6-41)

Disable the ability to stop the M-Series, MX-E Series, and MX-U Series Vision Device programs (noExit): VisionDevice.exe (page 6-41)

Disable moving and sizing the window (-d): CPM, CPMRE, VPM, Settings (page 6-38)

Display an image as the logo in the title bar (-logo): CPM, CPMRE, VPM, Settings (page 6-39)

Display an image as a banner in line with the tool bar (-banner): CPM, CPMRE, VPM, Settings (page 6-39)

Display an image at program start and in the About dialog (-splash): CPM, CPMRE, VPM, Settings (page 6-44)

Display a string in the title bar and in the About dialog (-title): CPMRE (page 6-45)

Load a control panel application when the program starts (-p): CPM, CPMRE (page 6-42)

Override the program's default system language settings (-language): CPM, CPMRE, VPM, Settings (page 6-39)

Override the program's default system country settings (-country): CPM, CPMRE, VPM, Settings (page 6-38)

Set the window's starting location and size (-s x y width height): CPMRE (page 6-43)

Run a Scriptor file when the program starts (-scr): CPMRE (page 6-43)

Run a Scriptor file and display a control panel when the program starts (-scr -v): CPMRE (page 6-44)

Set the window's starting location and size (-s x y width height): CPMRE (page 6-43)

Set the amount of program memory space allocated (-Xmx): CPM, CPMRE, VPM, Settings (page 6-45)

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 are example command lines showing the program using the Chinese country settings (the option is in bold):

CPM

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPM.jar" ***-country CN***

CPMRE

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar" ***-country CN***

VPM

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\VPM.jar" ***-country CN***

Settings

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\Settings.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 are example command lines disabling the program window (the option is in bold):

CPM

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPM.jar" ***-d***

CPMRE

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar" ***-d***

VPM

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\VPM.jar" ***-d***

Settings
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\Settings.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 are example command lines overriding the system language setting so the program uses French (the option is in bold):

CPM
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPM.jar" ***-language fr***

CPMRE
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar" -language fr

VPM
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\VPM.jar" -language fr

Settings
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\Settings.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 are example command lines that display an image named "logo.png" located in a folder named "C:\Images" (the option is in bold):

CPM
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPM.jar" -logo "C:\Images\logo.png"

CPMRE
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar" -logo "C:\Images\logo.png"

VPM
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\VPM.jar" -logo "C:\Images\logo.png"

Settings
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\Settings.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 are example command lines that display an image named "banner.png" located in a folder named "C:\Images" (the option is in bold):

CPM
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPM.jar" -banner "C:\Images\banner.png"

CPMRE
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar" -banner "C:\Images\banner.png"

VPM
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\VPM.jar" -banner "C:\Images\banner.png"

Settings
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\Settings.jar" -banner

"C:\Images\banner.png"

Disable the ability to close the program

When this option is used, the program does not display the Windows minimize, maximize/restore down, close or Exit buttons. The "Exit" button is not displayed in the title bar. The window cannot be sized or moved and the program cannot be closed from the program window.

This option must be used with the -d option.

-noexit -d

Here are example command lines that disable the ability to close the program (the option is in bold):

CPM

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPM.jar" ***-noexit -d***

CPMRE

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar" ***-noexit -d***

Disable the ability to stop the Vision Device programs

This option affects the M-Series, MX-E Series, and MX-U Series processors only. You must edit the command file that starts the Vision Device programs to add this option. See "To edit the program command file" on page 6-41.

When this option is used, the Vision Device program (VisionDevice.exe) does not display the Exit button and the exit "X" in the program window is disabled so it cannot be closed from the program window. To close the program you must use the Windows Task Manager.



The switch is case sensitive and must NOT be preceded by a hyphen or dash.

noExit

To edit the program command file

1. Find the command file in the program's installation folder. The default installation location is:
   C:\Datalogic\IMPACT\Applications\Device\IMPACTDevice1.cmd
2. Open the file IMPACTDevice.cmd with a text editor.
3. In this file, locate this line:
   start /MIN ...\IMPACTDevice.exe

4. At the end of that line, add a space followed by the word “noExit” (case sensitive, no quotes, and no hyphen). When you are done, the line should look like this:
   start /MIN ...\IMPACTDevice.exe noExit
5. When you have finished editing the command file, save and close the file.
6. The next time any of the Vision Device programs start, the Exit button will not be displayed.

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 are example command lines that access the text file "options.txt" in the folder named "C:\text folder" (the option is in bold):

CPM
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPM.jar" ***-optionfile "C:\text folder\options.txt"***

CPMRE
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar" ***-optionfile "C:\text folder\options.txt"***

VPM
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\VPM.jar" ***-optionfile "C:\text folder\options.txt"***

Settings
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\Settings.jar" ***-optionfile "C:\text folder\options.txt"***

Load a control panel application when program starts

When this option is used, the specified control panel application is loaded and placed in run mode when the program starts. The window can be sized, moved, and closed. You cannot close the control panel application or open others.

Add the following option to the command line:

-p "control folder\control panel name.cp"

where the folder "control folder" contains "control panel name.cp."

NOTE: The application file path and name must be enclosed in quotes and include the "cp" extension. There is a space between the option and the first quotation mark.

Here are example command lines that opens a control panel application named "inspect.cp" in the folder named "C:\control folder" (the option is in bold):

CPM
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPM.jar"
-p "C:\control folder\inspect.cp"

CPMRE
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar"
-p "C:\control folder\inspect.cp"

Set the window's location and size

When you use this option, the program sizes the window based on the command line option. The window can be sized, moved, and closed. You can close the control panel application or open others.

Add the following option to the command line:
-s x y width height

where

- "x" indicates the distance from the control panel's left edge to the screen's left edge
- "y" indicates the distance from the control panel's top edge to the screen's top edge
- "width" indicates the control panel's width
- "height" indicates the control panel's height

All distances are in pixels. Invalid or missing values may place the control panel off screen. There is a space between each of the option values.

This example command line opens a window and locates it on the screen at 0, 0 with a size of 500 by 500 pixels (the option is in bold):

CPMRE
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar"
-s 0 0 500 500

Run a Scriptor file

When this option is used, CPMRE runs a CPM Scriptor script file when it starts. You must also load the control panel application file that the script file references. IMPORTANT: File names are case sensitive.

Add the following options to the command line:
-scr "script path name\script file name.bsh" -p "cp path name\cp file name.cp"

where "script path name" is the folder that contains the script file named "script file name.bsh" and "cp path name" is the folder that contains the control panel application file named "cp file name.cp."

NOTE: The script file path and name must be enclosed in quotes and include the "bsh" extension. The path name is case sensitive. There is a space between the option and the first quotation mark.

This example command line runs a script named "script.bsh" in the folder named "C:\script folder" and loads the application file named "inspect.cp" in the folder named "C:\control folder" (the option is in bold):

CPMRE
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar"
-scr "C:\script folder\script.bsh" -p "C:\control folder\inspect.cp"

NOTE: This command line may be too long to include in the shortcut. See “Access a text file of command line options” on page 6-42.

Run a Scriptor file - display a control panel application

Use this option to display a control panel application when a Scriptor script file starts and runs. IMPORTANT: File names are case sensitive.

Add the following options to the command line:

-v -scr "script path name\script file name.bsh" -p "cp path name\cp file name.cp"

where "script path name" is the folder that contains the script file named "script file name.bsh" and "cp path name" is the folder that contains the control panel application file named "cp file name.cp."

NOTE: The script file path and name must be enclosed in quotes and include the "bsh" extension. The path name is case sensitive. There is a space between the option and the first quotation mark.

This example command line runs a script named "script.bsh" in the folder named "C:\script folder" and loads the application file named "inspect.cp" in the folder named "C:\control folder" (the option is in bold):

CPMRE
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar" ***-v -scr "C:\script folder\script.bsh" -p "C:\control folder\inspect.cp"***

NOTE: This command line may be too long to include in the shortcut. See “Access a text file of command line options” on page 6-42.

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):

CPM

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" ***-splash:"c:\images\splashfile.png"*** *-XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPM.jar"*

CPMRE
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" ***-splash:"c:\images\splashfile.png"*** *-XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar"*

VPM
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" **-splash:"c:\images\splashfile.png"** *-XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\VPM.jar"*

Settings
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" **-splash:"c:\images\splashfile.png"** *-XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\Settings.jar"*

Display a string in the title bar and About dialog

This option displays a string as the title in the About dialog and on the application title bar (instead of the default title). If the title option is specified without a string, no title is displayed.

Add the following option to the command line:
-title "the string to be displayed"

The string must be enclosed in quotes and there is a space between the option and the first quotation mark. This example command line displays the string “The String” in the About dialog and in the title bar (the option is in bold):

CPMRE
"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC -Xmx400m -Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar"
-title "The String"

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 will be 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 are example command lines that set the amount of memory allocated for each program to 400 MB (the option is in bold):

CPM

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m *-Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPM.jar"*

CPMRE

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m *-Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\CPM\CPMRE.jar"*

VPM

"C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe" -XX:+UseParallelGC
-Xmx400m *-Xms64m -Xrs -jar "C:\Datalogic\IMPACT\Applications\VPM\VPM.jar"*

Settings

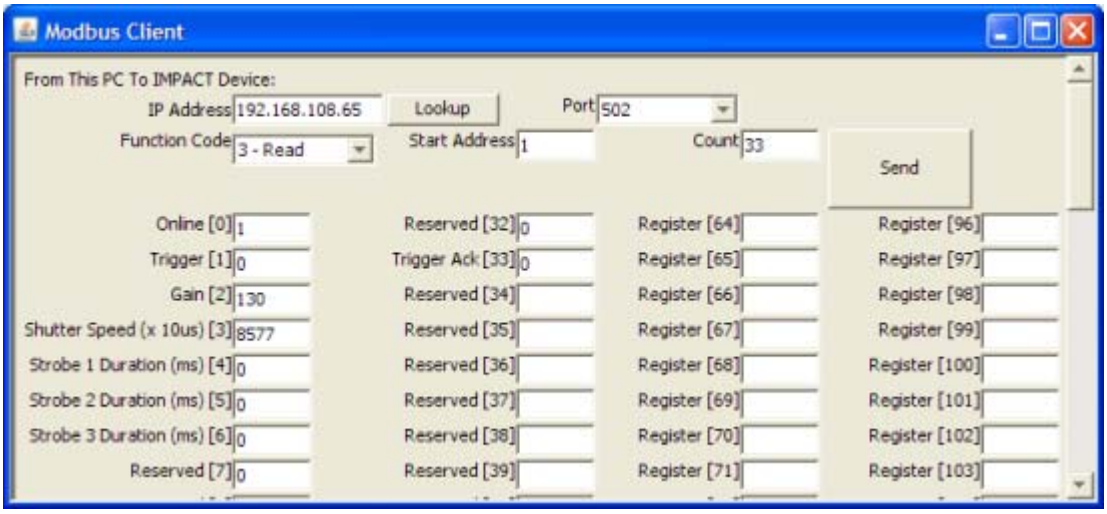
“C:\Datalogic\IMPACT\Applications\jre\bin\javaw.exe” -XX:+UseParallelGC
-Xmx400m *-Xms64m -Xrs -jar “C:\Datalogic\IMPACT\Applications\VPM\Settings.jar”*

Modbus Client Tester

The Modbus Client Tester is used to send function codes and data to the Modbus Server on the Impact camera for testing.

To launch the Modbus Client Tester

1. Start VPM.
2. Select the Settings Tab - General - Diagnostics panel.
3. Click the Advanced button.
4. Select Modbus Client.
5. Click Launch



Field or Button	Purpose
IP Address	The IP address of the Impact camera you want to test
Lookup	Click this to display the Impact camera connect dialog
Port	The standard Modbus communication port is 502
Function Code	The desired operation - read or write
Start Address	The starting register for the selected function (the first register is number zero)
Count	How many registers to read or write
Send	Click this to execute the function
Registers	The Modbus Server registers; For a write function, enter the value you want to send to the camera. For a read function, this is the value read from the camera

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 A30, P-Series, and T4x-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 A30, P-Series, and T4x-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 will assign 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 A30, P-Series, and T4x-Series camera runs an HTTP server that always uses port 80.

The M-Series, MX-E Series, and MX-U Series processors run an HTTP server that uses port 10080.

Impact software uses the following port numbers for communication. Local ports are on the host PC. Remote ports are on the Impact A30, P-Series, and T4x-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 (see “Enable OPC/ ActiveX Server” on page 2-10)
- **Events**
  - Received on local port 7835 from remote port 49153-65534

Impact software (VPM, CPM, CPMRE, CPMREApplets, and the Settings Program)

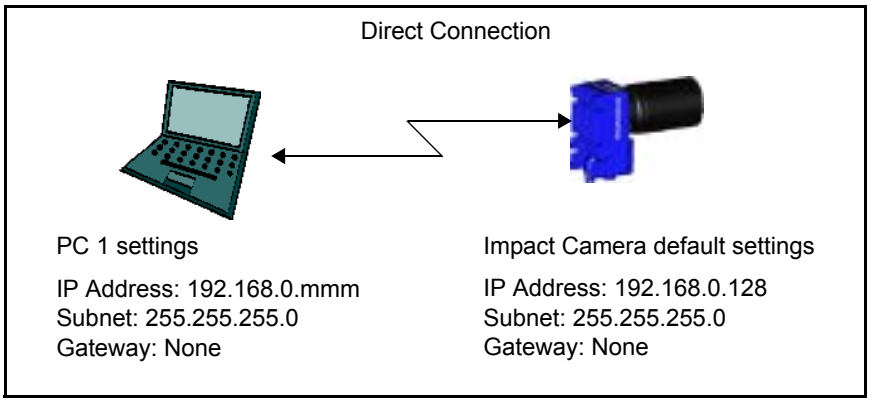
- **Impact Key License**
  - Local port 1947 is used on M-Series, MX-E Series, and MX-U Series systems or other systems that have a Impact License Key installed.
- **Discovery** (finding cameras, Vision Devices, or Emulators)
  - Multicast UDP on address 239.34.56.84, port 52315
  - Replies received 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)
- **SDK Server**

- Uses Port 10001 by default

- **Events**
  - Use the same local and remote port pair established for normal transactions

A30, P-Series, and T4x-Series Connection

Client PC to Camera - Direct Connection



The PC and Impact camera settings must be compatible:

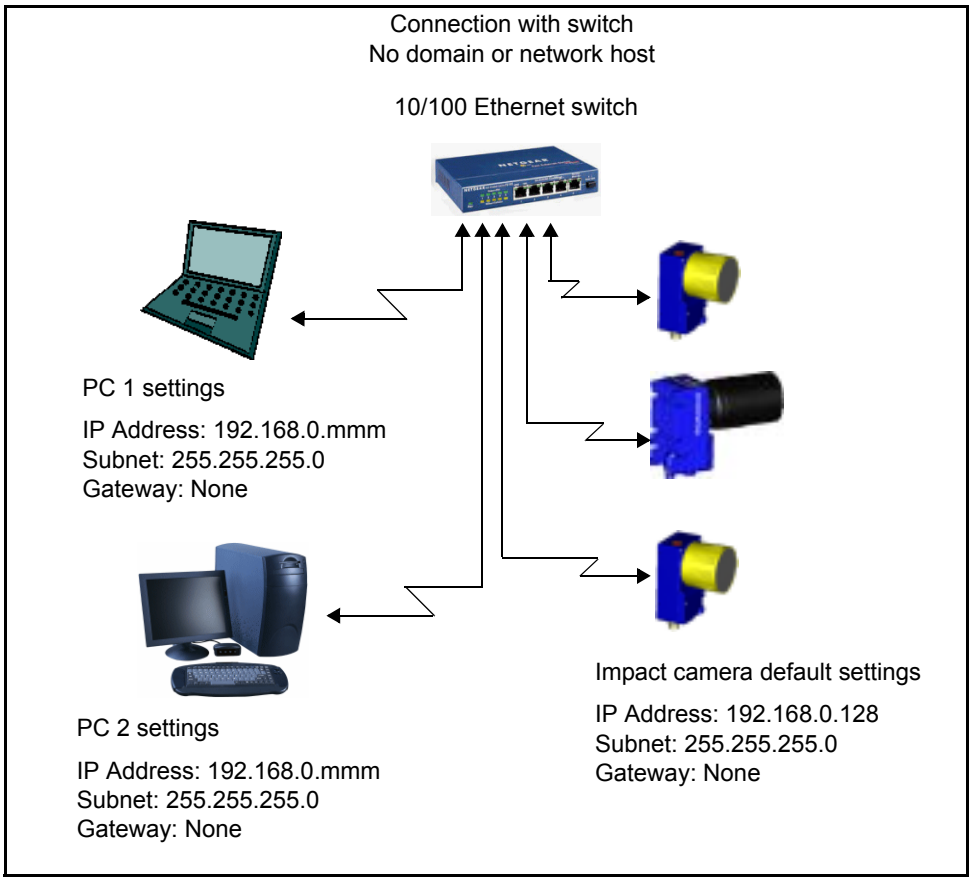
IP Address: AAA.BBB.CCC.nnn
Subnet: 255.255.XXX.0
Gateway: AAA.BBB.CCC.nnn

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:

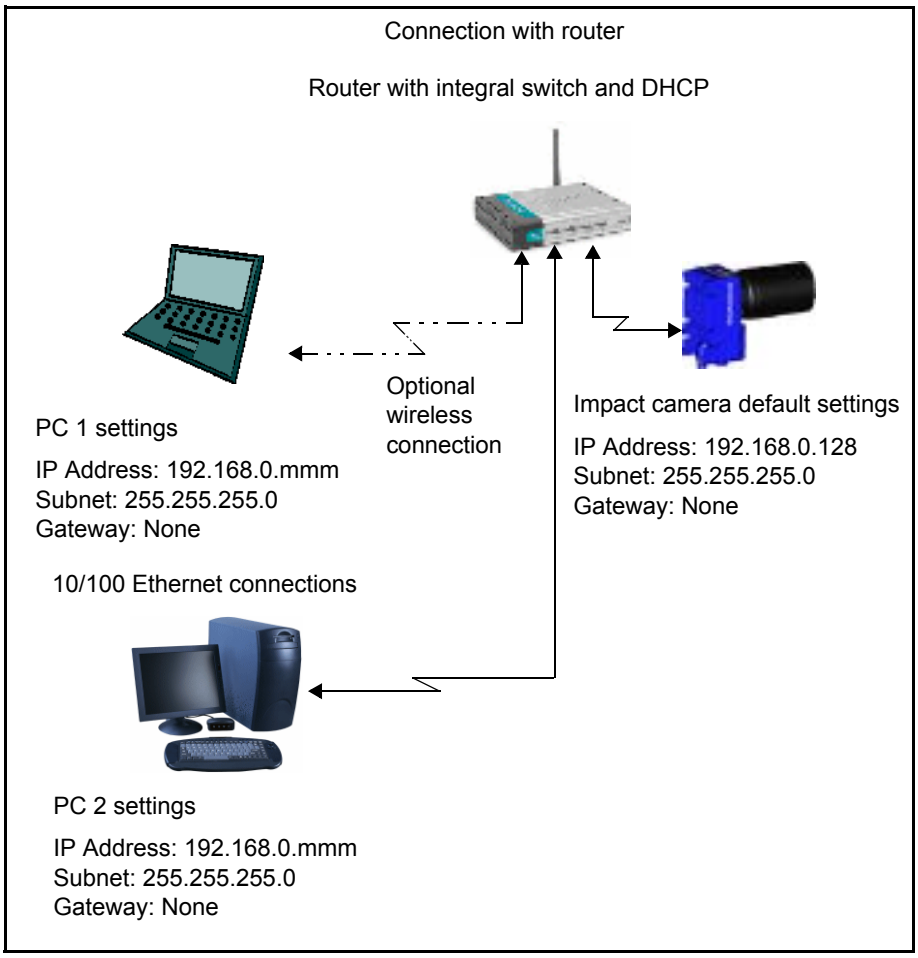
IP Address: AAA.BBB.CCC.nnn
Subnet: 255.255.XXX.0
Gateway: AAA.BBB.CCC.nnn

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.

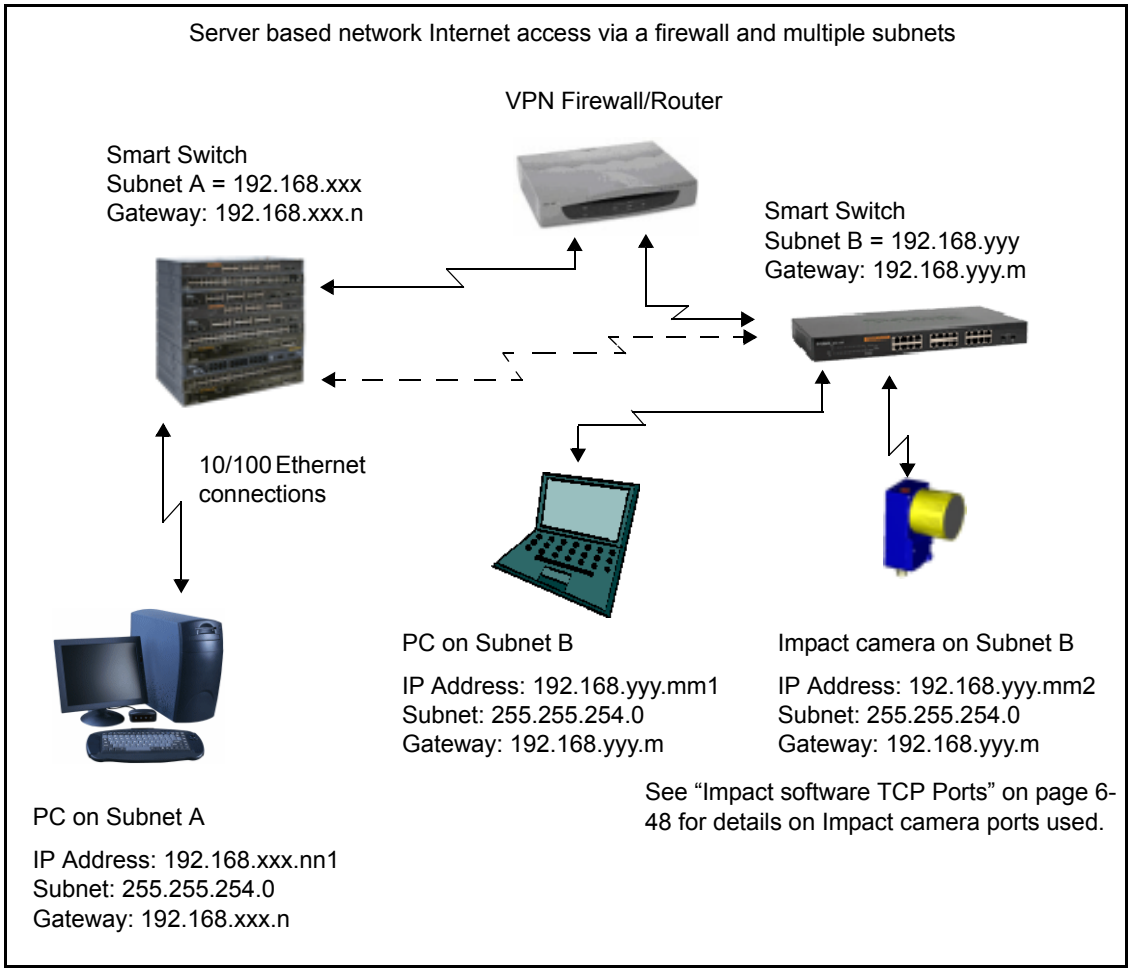
IP Address: AAA.BBB.CCC.nnn
Subnet: 255.255.XXX.0
Gateway: AAA.BBB.CCC.nnn

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 will 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 A30, P-Series, and T4x-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.

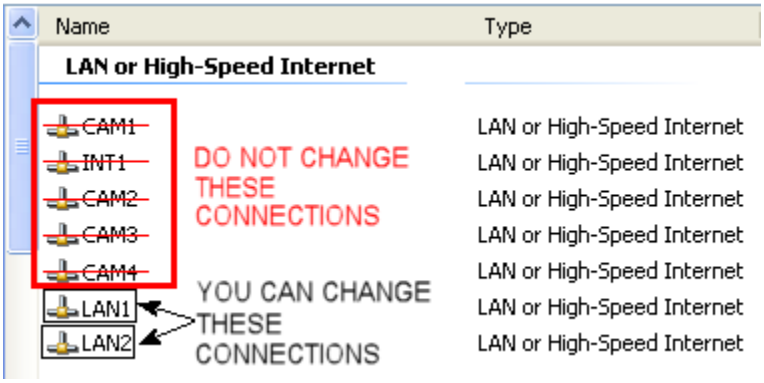
M-Series Processor

Changing the Processor's LAN IP Address (Windows XP)

IMPORTANT NOTE: Change only the Local Area Connection named LAN1 or LAN2. These correspond to Ethernet Ports 1 and 2 on the front of the processor.

DO NOT change any of the other Local Area Connections. Changing any other connection can cause the M-Series, MX-E Series, and MX-U Series cameras to stop functioning.

1. In the Start menu, right click on My Network Places and select Properties.
2. Right click Local Area Connection LAN1 or LAN2 and select Properties.
3. On the General tab, select Internet Protocol (TCP/IP) and click Properties.
4. On the General tab, select Use the following IP address.
5. Enter the desired IP address.
6. Click OK to close all the open dialog windows.



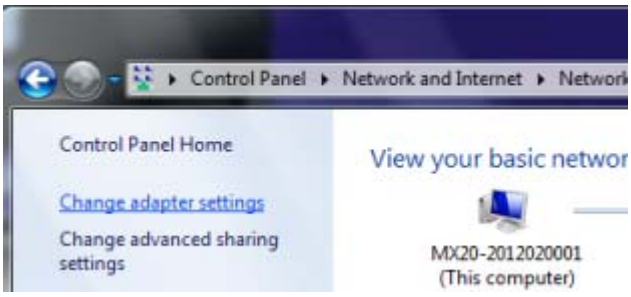
Changing the M-Series, MX-E Series, and MX-U Series Processor's LAN IP Address (Windows 7)

IMPORTANT NOTE: Change only the Local Area Connection named LAN1 or LAN2. These correspond to Ethernet Ports 1 and 2 on the front of the processor.

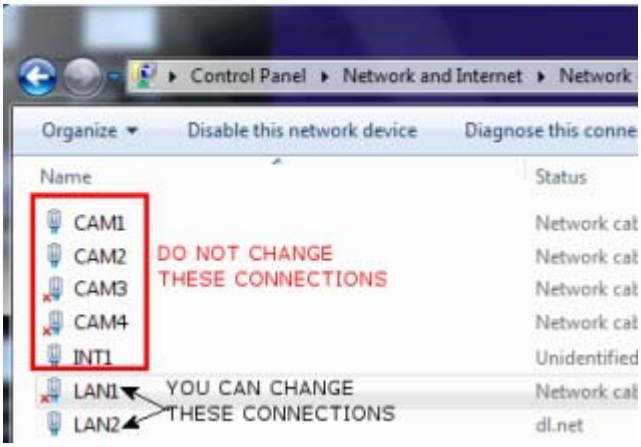
DO NOT change any of the other connections. Changing any other connection can cause the M-Series, MX-E Series, and MX-U Series cameras to stop functioning.

1. In the Start menu, click on Control Panel.

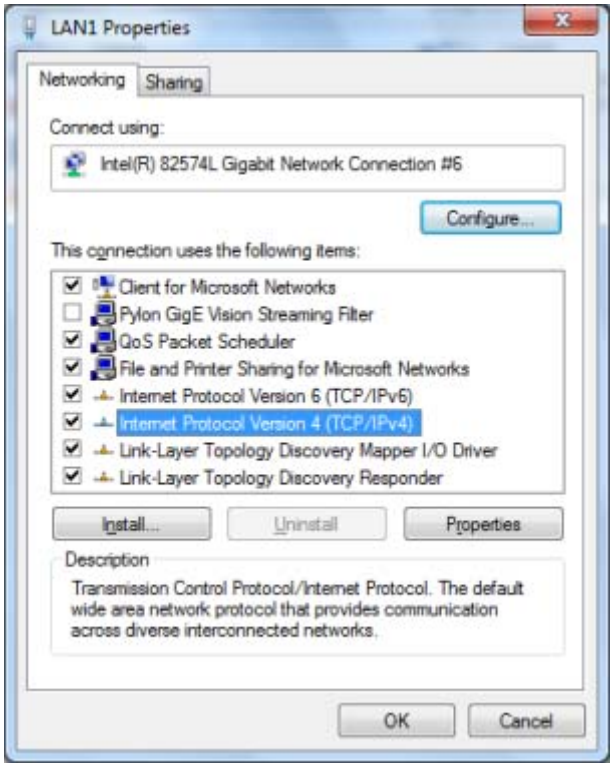
2. Under Network and Internet, click on View Network Status and Tasks.
3. On the left side of the screen, click Change Adapter Settings.



4. Right click LAN1 or LAN 2 and select Properties.



5. In the list of items, select Internet Protocol Version 4 (TCP/IPv4), then click Properties.



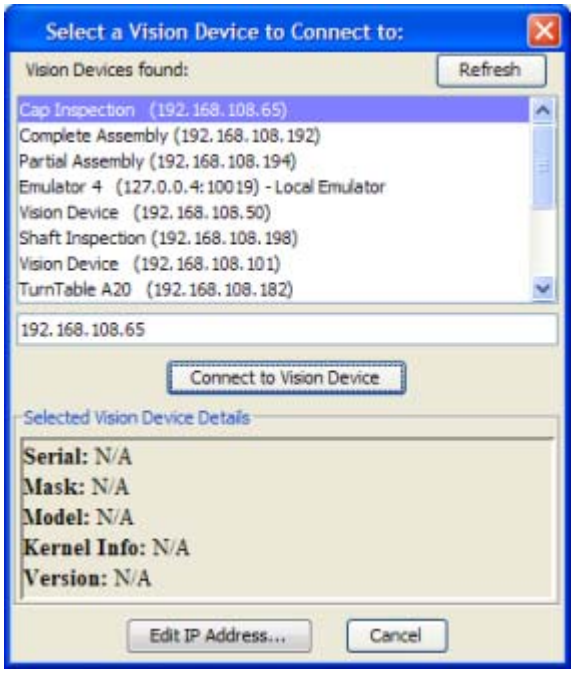
6. Select Use the following IP address.
7. Enter the desired IP address.
8. Click OK to close all the open dialog windows.

Configure the Vision Device or Camera

A30, P-Series, and T4x-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.

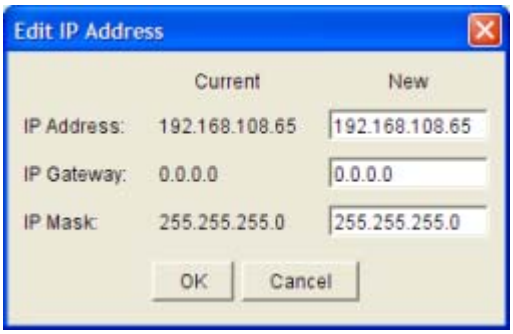
1. Start VPM. When the "Select a Vision Device to Connect to" dialog is displayed, click on the desired camera in the list of Vision Devices found. If the camera is not in the list, be sure the camera power is on and that it is connected to the client computer, then click the Refresh button.



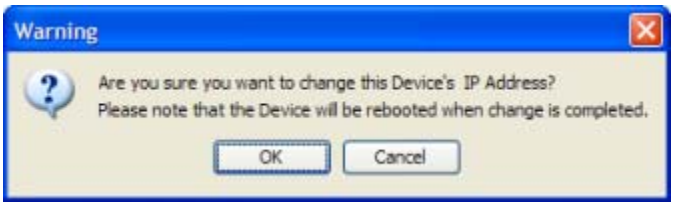
2. Click the Edit IP Address button at the bottom of the dialog.

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.



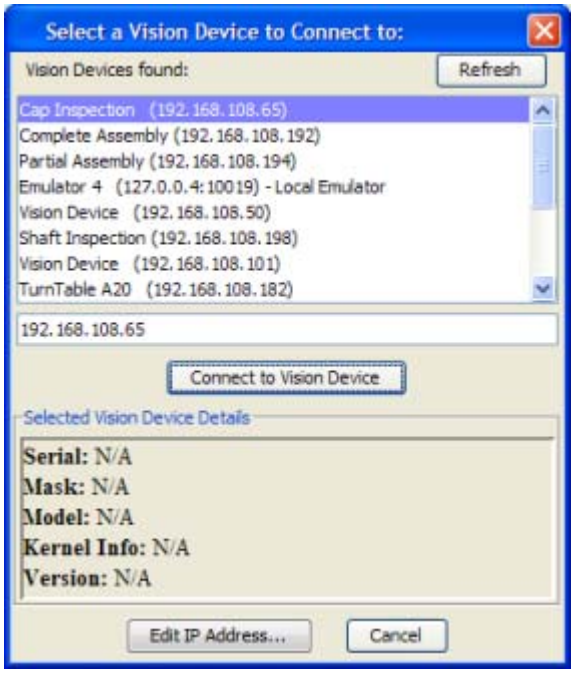
6. Click OK when the Camera is Rebooting dialog is displayed.

M-Series, MX-E Series, and MX-U Series Vision Device

This section explains how to change the vision device's IP address and mask. You do not need to connect a camera to the processor.

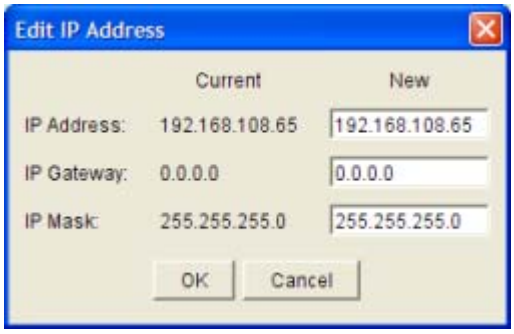
1. Start VPM. When the "Select a Vision Device to Connect to" dialog is displayed, click on the desired

vision device in the list of Vision Devices found.

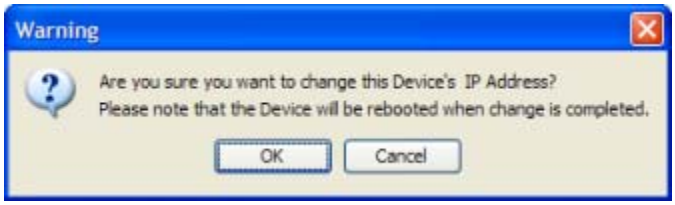


2. Click Connect to Vision Device.
   If security is enabled on the camera, the User Logon dialog is displayed. When a valid User ID and password have been entered, VPM connects with the vision device or Emulator.
3. When the connection has been made, you may see a message that VPM is reading from the newly connected vision device.

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 vision device reboots.



6. Click OK when the Camera is Rebooting dialog is displayed.

Pattern Database Manager

(Available on Impact MX40, MX80, MX-E40, MX-E80, MX-U40, and MX-U80 processors only.)

The Pattern Database Manager (PDM) is used to create, train, and modify a searchable image pattern tree (pattern database) for the Pattern Sorting tool (see “How to Set Up the Pattern Sorting tool” on page 3-136). The tool searches the database to find patterns that match those in its input image.

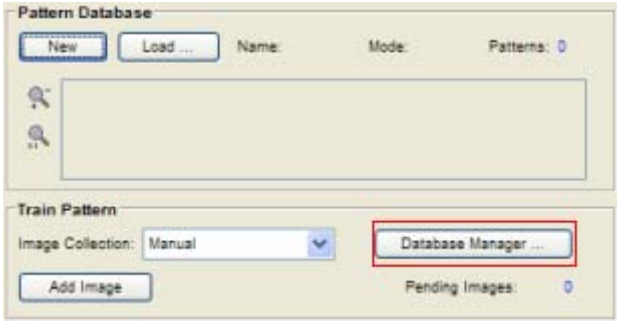
NOTE: While PDM is running, VPM is suspended. To return to VPM, close PDM.

Start PDM

You can access PDM through VPM or by starting PDM directly. While PDM is running, VPM is suspended.

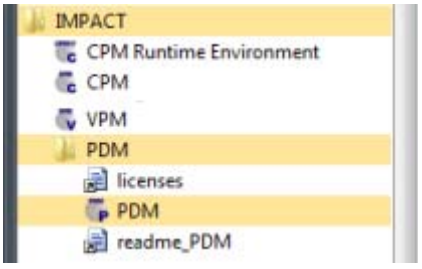
To start PDM through VPM

1. Start VPM. Create a new task and add a Pattern Sorting tool it or open an existing task that contains a Pattern Sorting tool.
2. Select the tool.
3. Select the Setup tab, then click the Database button.
4. Click the Database Manager button in the Train Pattern box.



To start PDM directly

1. In the Start menu, select All Programs - IMPACT - PDM.
2. Click on the PDM icon.



PDM opens with no database loaded.



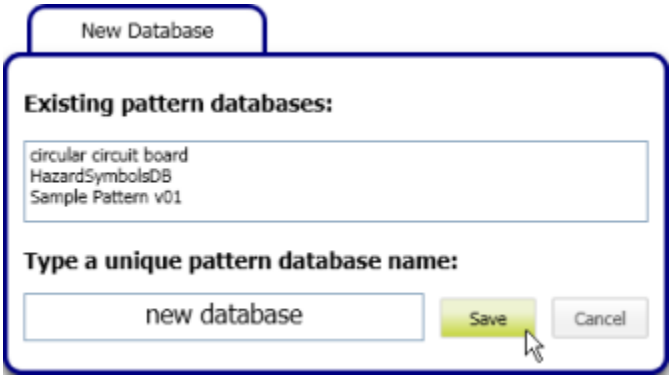
Create a new database

To create a new database

1. Click File - New Database in the title bar menu.



2. In the dialog, enter a name for the new database then click Save.



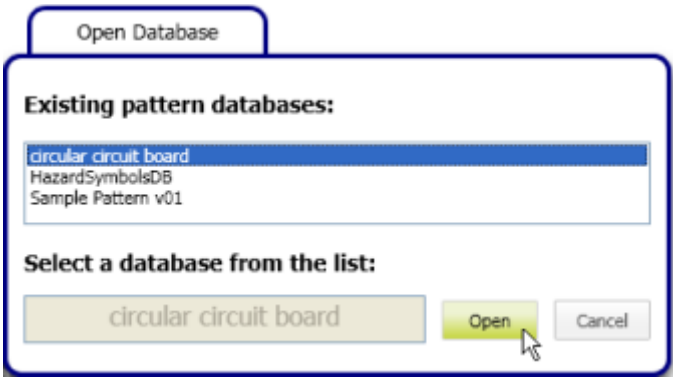
Open an existing database

To open an existing database

1. Click File - Open Database in the title bar menu.



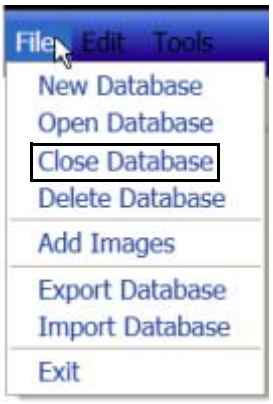
2. In the dialog, click the database name, then click Open.



Close a Database

To close a database

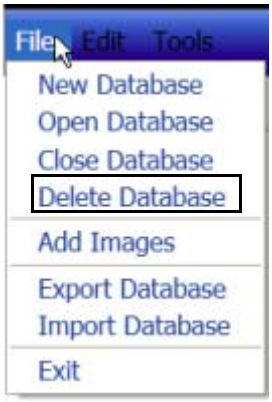
1. Click File - Close Database in the title bar menu.



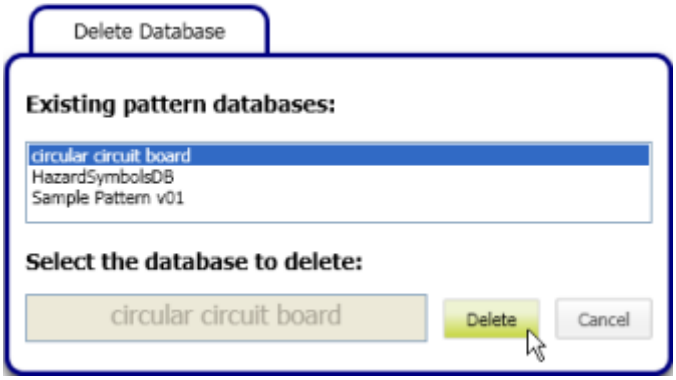
Delete a Database

To delete an existing database

1. Click File - Delete Database in the title bar menu.



2. In the dialog, click the database name, then click Delete.



Export a Database

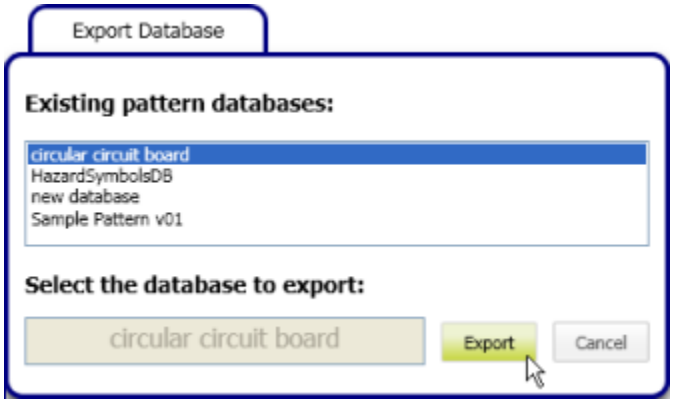
You can export a pattern database so you can easily copy it from one vision system to another. The export function creates a Pattern Database Package file (with a ".pdpkg" extension) that contains the database, thumbnails, and other files.

To export a database

1. Click File - Export Database in the title bar menu.



2. In the dialog, click the database name, then click Export.



3. In the Explorer window, navigate to a location for the database package, enter a name for the package file, then click Save.

Import a Database

You can import a pattern database package (.pdpkg) that you exported previously and then load it into the Pattern Sorting tool. The import function recreates the original directory structure and Pattern Database file from the package.

To import a database

1. Click File - Import Database in the title bar menu.



2. In the Explorer window, navigate to the database package location, select it, then click Open.
3. If the database already exists, you can choose to overwrite it or rename the imported database.
4. When the dialog is displayed, select Yes to open the database, or No to open it later.



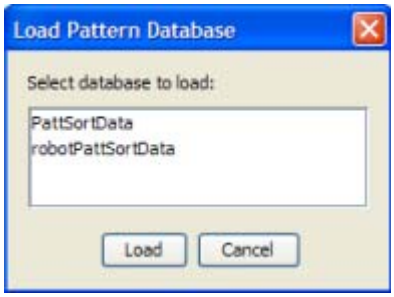
Add Images to a Database

There are two ways to add images to a database: use the Image Collection option in VPM or add images in PDM. When you use VPM, collected images are stored in a queue for later training with PDM.

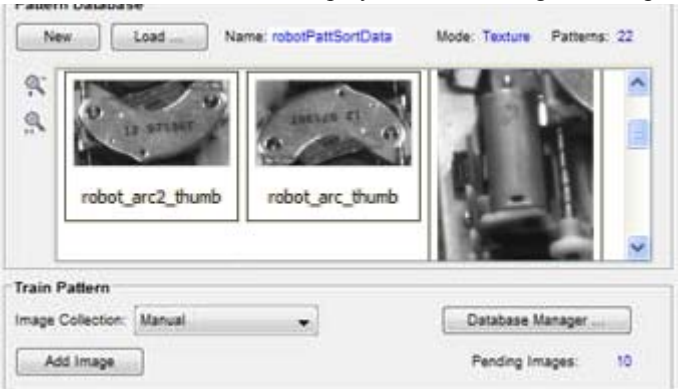
NOTE: After images have been added to the database, they must be trained before the database can be used in the Pattern Sorting tool.

To use VPM to add images to an existing database

1. Start VPM. Create a new task and add a Pattern Sorting tool it or open an existing task that contains a Pattern Sorting tool.
2. Select the tool.
3. Select the Database button on the Setup tab.
4. Click the Load button. A list of available, trained databases is displayed. Select the desired database from the list and click the Load button in the dialog.



5. The tool will load the database and display thumbnail images of the patterns.

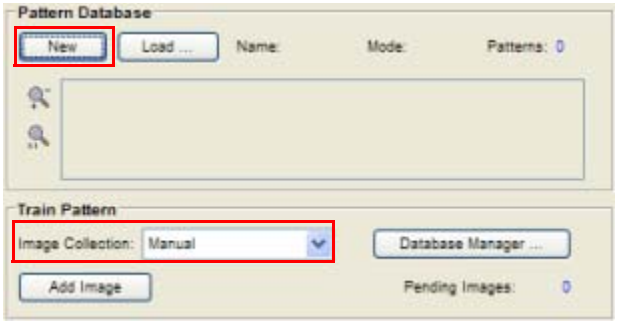


6. From the Image Collection drop down, select the method for adding images (see page 3-137). The pending images are added to a queue for the opened database file.
7. When you have completed collecting images, click the Database Manager button to start PDM.
8. When PDM opens, the collected images are included in the displayed patterns. The new patterns in the database must now be trained. See “Train Patterns in a database” on page 6-68 for details.

To use VPM to add images to a new database

1. Start VPM. Create a new task and add a Pattern Sorting tool it or open an existing task that contains a Pattern Sorting tool.
2. Select the tool.
3. Select the Database button on the Setup tab.

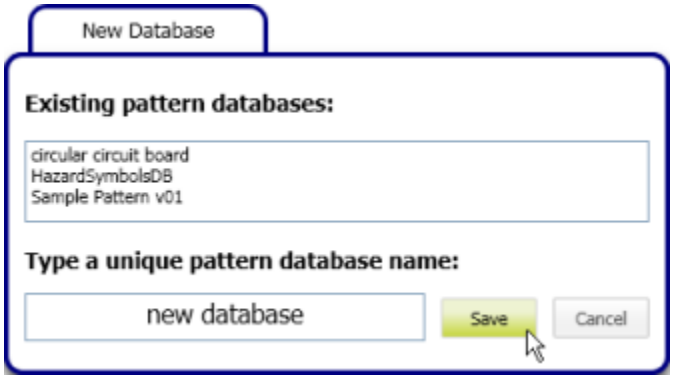
4. Click the New button.



5. From the Image Collection drop down, select the desired method for adding the images to the new database (see page 3-137). As they are collected, the pending images are added to a queue for the new database.
6. When you have completed collecting images, click the Database Manager button to start PDM. When PDM starts, a dialog is displayed indicating that there are images in the queue.
7. Select “Add images into a new database.”



8. In the dialog, enter a name for the new database then click Save.

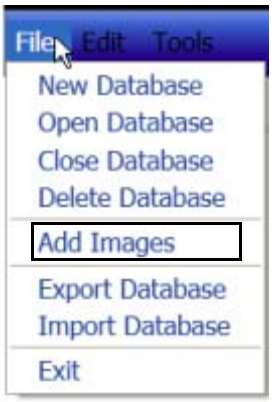


9. The new patterns in the new database must now be trained. See “Train Patterns in a database” on page 6-68 for details.

To use PDM to add images to a database

1. Start PDM and open an existing database or create a new database.

2. Click File - Add Images in the title bar menu.

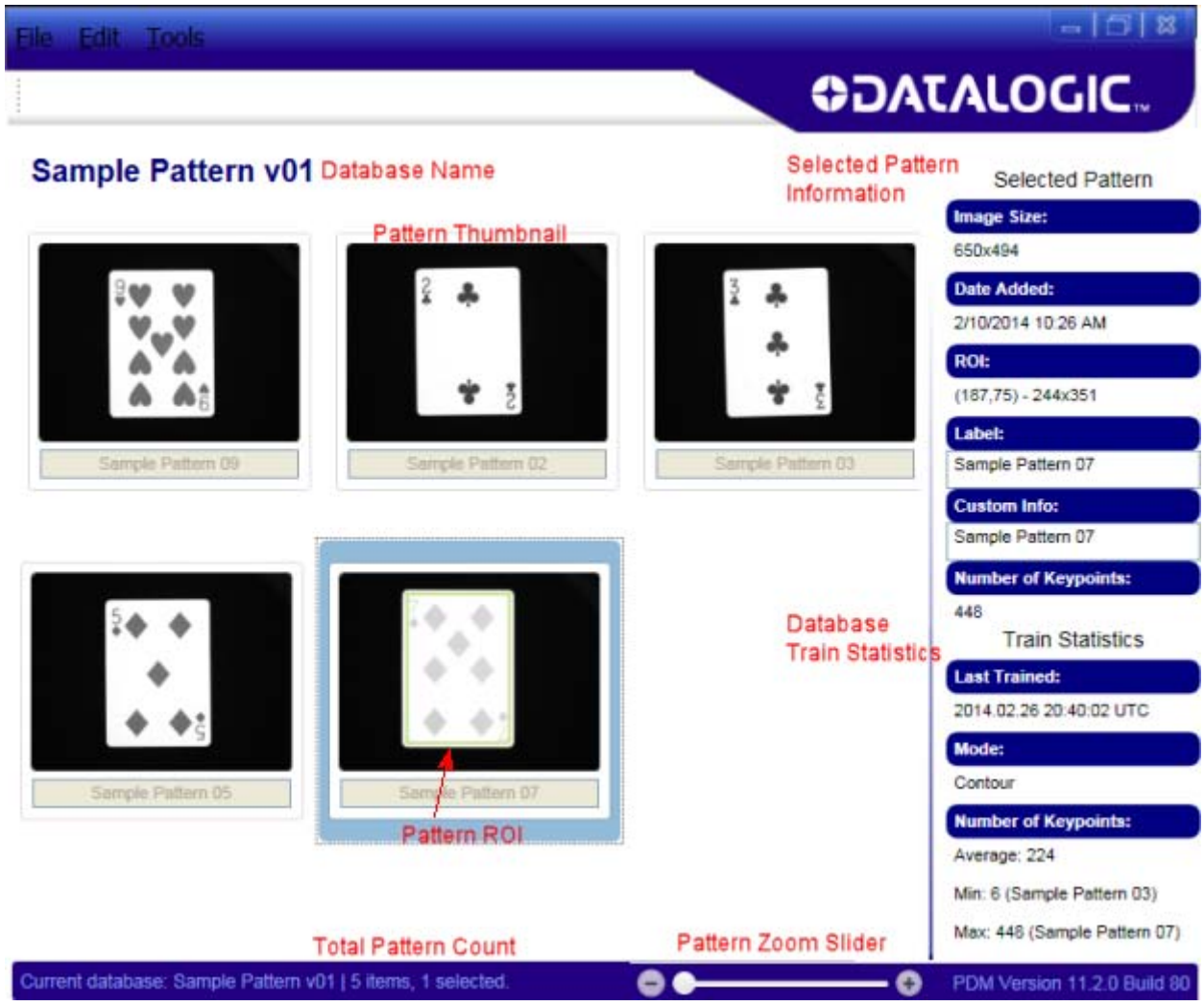


3. In the Explorer window, navigate to the desired folder and select one or more files, then click Open. You can also navigate to the file or files using Windows Explorer, then click and drag the files to the PDM display window.
4. The new patterns in the database must now be trained. See “Train Patterns in a database” on page 6-68 for details.

View Patterns in a Database

After new images are added to a pattern database, they must be trained. Training consists of extracting key-points from each pattern ROI and organizing them in an index structure that is then stored as the pattern database. This is the file that is loaded from the Pattern Sorting Tool setup tab.

When you open PDM, the gallery view displays thumbnails of the pattern collection, information about the patterns, and train statistics.



Selected Pattern Information

- Image size: Size of full pattern image
- Date added: Date the pattern was added to the database.
- ROI: A region of interest can be added to restrict training certain areas of the pattern eliminating clutter.
- Label: A unique alphanumeric identifier associated with each pattern. You can modify this, but it must be unique in the database.
- Custom Info: You may add non-unique information here. For example, it could be used for the product ID when multiple patterns are acquired for the same object.
- Number of Keypoints: The number of keypoints found in the pattern.

Database Train Statistics

- Last Trained: The date and time the database was trained.

- Mode: The search algorithm that was used to train the database (contour-based or texture-based).
- Number of Keypoints: These statistics are useful to quickly understand if enough keypoints are extracted from all patterns.
  - Average: The average number of keypoints extracted from each of the patterns in the database.
  - Min: The minimum number of keypoints extracted among all patterns and the pattern that contains them.
  - Max: The maximum number of keypoints extracted among all patterns and the pattern that contains them.

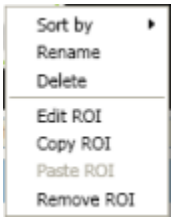
Train Patterns in a database

Before you train patterns in the database, you can optionally add ROIs to exclude areas of clutter or other noise from the trained pattern.

To Add or Modify Pattern properties

1. In the Gallery view, select a pattern.
2. Click Edit in the title bar menu or right-click on the pattern.





Right-click menu

- Sort Patterns by: Sorts patterns in the database by date added or by label
- Rename Pattern: Edit the selected pattern label
- Delete Pattern: Delete the selected pattern
- Edit ROI: Add or Modify the ROI for the selected pattern
- Copy ROI: Copy the ROI from the selected pattern
- Paste ROI: Paste a copied ROI onto the selected patterns
- Remove ROI: Removes the ROI from the selected pattern

ROIs

To Add or Modify ROIs

Training on the full image will not impact the execution time but may hurt robustness if there is clutter around the pattern. If the background is plain, a ROI is probably not necessary. If the background is not plain, train only on the object you want to detect, not on the entire image. Use an ROI just around the pattern you want to detect to exclude the unwanted background.

1. In the Gallery view, select a pattern.
2. Click Edit then Edit ROI in the title bar menu or right-click on the pattern and select Edit ROI.

3. The image is enlarged and Edit ROI buttons are displayed.



Add/ Remove ROIs | Display Keypoints | Beginning Pattern | Previous Pattern | Next Pattern | End Pattern | Return to Main View

Train Database

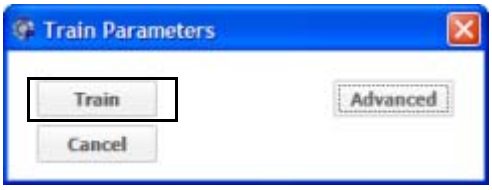
Training consists in extracting keypoints from each pattern and organizing them in an index structure file. This is the database file that can be loaded from the Pattern Sorting Tool Setup tab.

To Train a Pattern Database

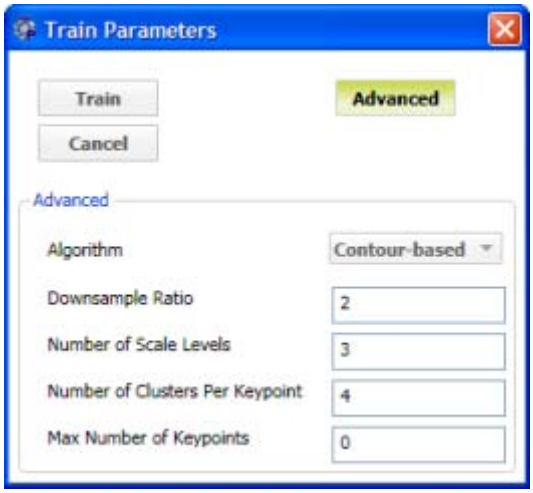
1. Click Tools - Train in the title bar menu.



2. Click the Train button. Depending on the size and complexity of the patterns, training may take several minutes.



3. The search algorithm is set to Auto-Select by default. If you need to manually adjust the parameters that PDM uses to train the patterns, you can click the Advanced button.



Contour-based Parameters

Downsample Ratio

- Defines how much to scale images before extracting keypoints. This also affects runtime, i.e. the Input Image is downsampled by this ratio. Higher values means fewer keypoints and faster computation

time at the cost of robustness. For VGA images, typical values are between 1.0 and 2.0. For higher resolution images higher values may be used.

Number of Scale Levels

- Defines the number of scales used for keypoint extraction. Higher numbers yield more keypoints which increases the robustness of the algorithm, especially in the presence of scale changes, at the cost of increased computation time.

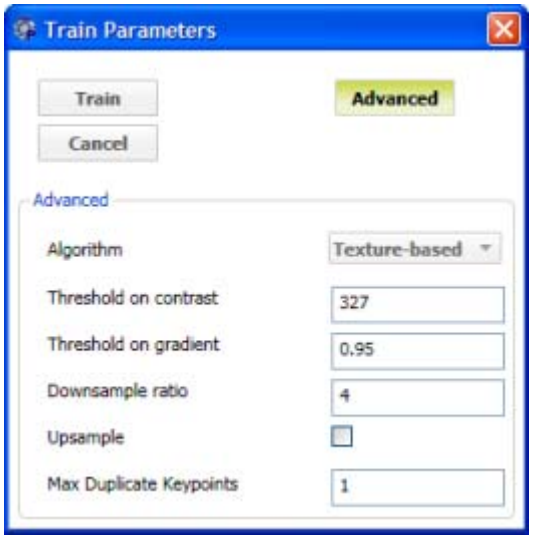
Number of Clusters per Keypoint

- Defines the number of clusters (groups) to take into account when searching for the most similar keypoints. For example, if this is set to 2, two clusters of keypoints are considered, with the second being bigger than the first. If it is set to 3, a third bigger cluster is used. Possible values are 2, 3, and 4. Higher values may make the comparison more robust (increasing the chance of correctly matching a keypoint) with little impact on the processing speed because this affects only the training.

Max Number of Keypoints

- Defines how many keypoints to extract at most. If this is set to zero, all keypoints are retained. It can be useful to increase the performance of the tool, especially when high resolution images are used. This should be modified only if the pattern to detect takes up most of the space in the query image or there is no clutter. This is because keypoints are sorted by their strength and it is not possible to know where they will be removed. As such it is not guaranteed that enough keypoints will be extracted from the pattern in the query image.

Texture-based Parameters



Threshold on Contrast

- Defines the contrast threshold for the keypoint extraction stage. Lower values mean more keypoints, which may lead to increased precision, but at the cost of increased processing time. Different values can be used in training and runtime.

Threshold on Gradient

- Defines the gradient threshold used to extract keypoints. Lower values mean more keypoints, which may lead to increased precision, but at the cost of increased processing time. Different values can be used in training and runtime.

Downsample Ratio

- Defines how much to downsample the pattern images for correlation computation at runtime. Smaller values (i.e. larger image sizes) run slower but too large images may give poor match scores. Higher values (i.e. smaller image sizes) run faster but too small images may always give high match scores. Typical values are 1 to 4.

Upsample

- If checked, the size of the input image is increased prior to keypoint extraction. which yields more features.

Max Duplicate Keypoints

- Defines the maximum number of duplicate keypoints that can be generated during the extraction phase when the gradient direction on the keypoint is not unique. Setting this to 2 or 3 or more yields more features. Usually it is preferable to set this to 1 in training and then set it to 2 or 3 at runtime in the Pattern Sorting Tool properties.

Export a Train File

After you have trained a database, you can export that trained pattern database (pdb) file so it can be used by Pattern Sorting tools in other vision systems. For example, you could place the file on a network so systems throughout the plant could access a common database. In the Pattern Sorting tool you can set the path to the exported train file (see the Database Directory Path property on page 3-128).

To Export a Train File

1. Click Tools - Export Train File in the title bar menu.



2. In the Explorer window, navigate to a location for the database file, enter a name for the file, then click Save.

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 and provides 36 different outputs from the decoded symbols. A maximum of 150 codes (30 on smart cameras) can be read in one image.

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

Input Properties and Affected Code Types

This table lists the interaction between the tool's input properties and the different code types. If a property is not listed, it affects all code types.

Input Property	Affected Code Types
Image Mirroring	2D: Datamatrix, QR, MicroQR Postal: Australian Post
Codabar, Code 39, Code 39 Full ASCII, Code 32, Code 93, Code 128, GS1 128, GS1 Databar, GS1 Databar Stacked, GS1 Databar Limited, GS1 Databar Expanded, GS1 Databar Expanded Stacked, Interleaved 2 of 5, Standard 2 of 5, MSI, Matrix 2 of 5, EAN/UPC, EAN/UPC Add On 2/5, Pharmacode (one-track), PDF417, MicroPDF, Composite Codes	1D
Datamatrix ECC200, GS1 Datamatrix ECC200, QR Codes, Micro QR, Aztec, Maxicode	2D
Postal Codes	Postal Codes
Postal Customer Field Decoding	Postal (Australian Post)

Input Property	Affected Code Types
Postal Minimum Bar Count, Postal Maximum Bar Count, Postal Bar Edge Spacing, Postal Code Orientation	Postal - Processing Mode Advanced (PMA)
Code Quality Verification	1D: Code128, EAN128, Code39, Code93, Codabar, EAN/UPC, Interleaved 2 of 5 2D: Datamatrix ECC200 (PMA)
1D Advanced Box Improvement	1D: Interleaved 2 of 5, Code 39, Codabar, Code128, GS1-128, Code 93, EAN/UPC, Code 32,Matrix 2 of 5, Standard 2 of 5, MSI, PDF417
1D Expand UPC E0-E1 Symbols, 1D EAN/UPC Margin Size	1D Code: EAN UPC
1D Code Orientation, 1D Low Code Contrast, 1D Small Codes Improvement, 1D Code Aspect Ratio, 1D Minimum Code Height (pixels)	1D Codes (PMA)
1D Narrow Margins	1D: Code 128, EAN 128, Code 39, Interleaved 2 of 5, MSI, Code2 of 5 Standard, Code 2 of 5 Matrix, Codabar, Code 93 (PMA)
1D Start/Stop Characters TX	1D: Code 128, Ean128, Codabar (PMA)
1D Code128 Characters TX	1D: Code 128, Ean128 (PMA)
1D Code39 Full Ascii	1D: Code 39 (PMA)
1D Check Digit Status	1D: Code39, Interleaved2of5, MSI, Standard2of5, Matrix2of5, Codabar
1D MSI Check Digit Status	1D: MSI (PMA)
1D Check Digit Transmission	1D: Code 39, MSI, Standard2of5, Matrix2of5, Codabar (PMA)
1D I25 High Decoding Safety, 1D I25 Minimum number of characters	1D: Interleaved2of5 (PMA)
1D Pharmacode Output Format 1D Pharmacode Decoded Min value, 1D Pharmacode Decoded Max Value, 1D Pharmacode Colored Check bars, 1D Pharmacode MinBarCount, 1D Pharmacode MaxBarCount, 1D Pharmacode Code Orientation, 1D Pharmacode Reverse Decoding	Pharmacode (PMA)
2D Code Color, 2D Code Contrast	2D Codes
2D DPM Decoding Method	2D: Datamatrix ECC200, QR Codes
2D Datamatrix, QR Module Size (pixels)	2D: Datamatrix ECC200, QR
2D Code Aligned, 2D Free Size, 2D Code Size	2D: Datamatrix ECC200 (PMA)

Code Configuration Processing Modes

The Processing Mode Input Property affects which Input Properties are used to configure each Code Type. For example, setting the Postal Minimum Bar Count will only have an effect when Processing Mode is set to Advanced.

Code Type	Processing Mode **Standard Settings**	Processing Mode **Advanced Settings**
Australia Post	Image Mirroring Customer Field Decoding Postal Codes	Postal Minimum Bar Count Postal Maximum Bar Count Postal Bar Edge Spacing Postal Code Orientation
Japan Post Royal Mail 4State Swedish Postal KIX Code Intelligent Mail Barcode Planet PostNet PostNet (+BB')	Postal Codes	Postal Minimum Bar Count Postal Maximum Bar Count Postal Bar Edge Spacing Postal Code Orientation
Codabar	Codabar Advanced Box Improvement 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels) 1D Narrow Margins 1D Start/Stop Characters Tx 1D Check Digit Status 1D Check Digit Transmission
Code 39	Code 39 Advanced Box Improvement 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels) 1D Narrow Margins 1D Check Digit Status 1D Check Digit Transmission
Code 39 Full ASCII	Code 39 Full ASCII Advanced Box Improvement 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels) 1D Narrow Margins 1D Check Digit Status 1D Check Digit Transmission
Code 32	Code 32 Advanced Box Improvement 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels) 1D Narrow Margins 1D Check Digit Status 1D Check Digit Transmission
Code 93	Code 93 Advanced Box Improvement 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels) 1D Narrow Margins

Code Type	Processing Mode **Standard Settings**	Processing Mode **Advanced Settings**
Code 128	Code 128 Advanced Box Improvement 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels) 1D Narrow Margins 1D Start/Stop Characters Tx 1D Code128 Characters Tx
GS1 128	GS1 128 Advanced Box Improvement 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels) 1D Narrow Margins 1D Start/Stop Characters Tx 1D Code128 Characters Tx
Code 128 Composite	Code 128 Composite Codes Micro PDF Advanced Box Improvement 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels) 1D Narrow Margins 1D Start/Stop Characters Tx 1D Code128 Characters Tx
GS1 Databar	GS1 Databar Composite Codes Micro PDF 1D Code Orientation	1D Code Orientation 1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
GS1 Databar Stacked	GS1 Databar Stacked 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
GS1 Databar Stacked Composite	GS1 Databar Stacked Composite Codes Micro PDF 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
GS1 Databar LImited	GS1 Databar Limited 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
GS1 Databar Limited Composite	GS1 Databar Limited Composite Codes Micro PDF 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
GS1 Databar Expanded	GS1 Databar Expanded 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
GS1 Databar Expanded Composite	GS1 Databar Expanded Composite Codes Micro PDF 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
GS1 Databar Expanded Stacked	GS1 Databar Expanded Stacked 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)

Code Type	Processing Mode **Standard Settings**	Processing Mode **Advanced Settings**
GS1 Databar Expanded Stacked Composite	GS1 Databar Expanded Stacked Composite Codes Micro PDF 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
Interleaved 2 of 5 (ITF)	Interleaved 2 of 5 (ITF) Advanced Box Improvement 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels) 1D Narrow Margins 1D Check Digit Status 1D I25 Minimum Number of Characters
Standard 2 of 5	Standard 2 of 5 Advanced Box Improvement 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels) 1D Narrow Margins 1D Check Digit Status 1D Check Digit Transmission
MSI	MSI Advanced Box Improvement 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels) 1D Narrow Margins 1D Check Digit Status 1D MSI Check Digit Status 1D Check Digit Transmission
Matrix 2 of 5	Matrix 2 of 5 Advanced Box Improvement 1D Code Orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels) 1D Narrow Margins 1D Check Digit Status 1D Check Digit Transmission
EAN-8 EAN-13 UPC-A	EAN/UPC 1D EAN/UPC Margin Size Advanced Box Improvement 1D Code orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
EAN-8 Add On 2 EAN-8 Add On 5 EAN-13 Add On 2 EAN-13 Add On 5 UPC-A Add On 2 UPC-A Add On 5	EAN/UPC Add On 2/5 1D EAN/UPC Margin Size Advanced Box Improvement 1D Code orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
UPC-E	EAN/UPC 1D EAN/UPC Margin Size Advanced Box Improvement 1D Code orientation 1D Expand UPC E0-E1 Symbols	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
UPC-E Add On 2 UPC-E Add On 5	EAN/UPC Add On 2/5 1D EAN/UPC Margin Size Advanced Box Improvement 1D Code orientation 1D Expand UPC E0-E1 Symbols	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)

Code Type	Processing Mode **Standard Settings**	Processing Mode **Advanced Settings**
Pharmacode (one-track)	N/A	Pharmacode (one-track) 1D Pharmacode Output Format 1D Pharmacode Min Bar Count 1D Pharmacode Max Bar Count 1D Pharmacode Colored Bars Check 1D Pharmacode Decoded Min Value 1D Pharmacode Decoded Max Value 1D Pharmacode Code Orientation 1D Pharmacode Reverse Decoding
PDF417	PDF417 Advanced Box Improvement 1D Code orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
MicroPDF	MicroPDF 1D Code orientation	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
MicroPDF CCA MicroPDF CCB MicroPDF CCC Composite	MicroPDF Composite Codes Code 128 GS1 Databar	1D Low Contrast 1D Small Codes Improvement 1D Minimum Code Height (pixels)
Datamatrix ECC200, GS1 Datamatrix ECC200	Datamatrix ECC200, GS1 Datamatrix ECC200 Image Mirroring 2D Code Color 2D Code Contrast 2D DPM Decoding Method 2D Code Size	2D DPM Decoding Method 2D Datamatrix, QR Module Size (pixels) 2D Code Aligned
QR Codes	QR Codes Image Mirroring 2D Code Color 2D Code Contrast	2D Datamatrix, QR Module Size (pixels)
Micro QR	Micro QR 2D Code Color 2D Code Contrast	
Aztec	Aztec 2D Code Color 2D Code Contrast	
Maxicode	Maxicode 2D Code Color 2D Code Contrast	

Code Quality Grades

If the Code Quality Verification input property is True during Training, code quality grades are generated for each found code, where applicable. The grades appear on their respective outputs and on the Setup Grades panel. This table lists the different code types and the possible grades that they can generate.

Name	Possible Values	Code Types
Overall Grade	A/B/C/D/F	1D: Code128, Ean128, Code39, Code93, Codabar, EAN/UPC, Interleaved2of5 2D: Datamatrix, QR Codes
ISO/IEC 15416 Decode Grade	A/F	1D: Code128, Ean128, Code39, Code93, Codabar, EAN/UPC, Interleaved2of5
ISO/IEC 15416 Symbol Contrast Grade	A/B/C/D/F	1D: Code128, Ean128, Code39, Code93, Codabar, EAN/UPC, Interleaved2of5
ISO/IEC 15416 Minimum Reflectance Grade	A/F	1D: Code128, Ean128, Code39, Code93, Codabar, EAN/UPC, Interleaved2of5
ISO/IEC 15416 Minimum Edge Contrast Grade	A/F	1D: Code128, Ean128, Code39, Code93, Codabar, EAN/UPC, Interleaved2of5
ISO/IEC 15416 Modulation Grade, ISO/IEC 15416 Defects Grade, ISO/IEC 15416 Decodability Grade	A/B/C/D/F	1D: Code128, Ean128, Code39, Code93, Codabar, EAN/UPC, Interleaved2of5
AIM DPM Decode Grade	A/F	2D Datamatrix
AIM DPM Cell Contrast Grade, AIM DPM Unused Error Correction Grade, AIM DPM Axial Non Uniformity Grade, AIM DPM Fixed Pattern Damage Grade, AIM DPM GRID Non Uniformity Grade, AIM DPM Cell Modulation Grade	A/B/C/D/F	2D Datamatrix
AIM DPM Min Reflectance Grade	A/F	2D Datamatrix
ISO/IEC 15415 Decode Grade	A/F	2D Datamatrix, QR Codes
ISO/IEC 15415 Contrast Grade, ISO/IEC 15415 Unused Error Correction Grade, ISO/IEC 15415 Axial Non Uniformity Grade, ISO/IEC 15415 GRID Non Uniformity Grade, ISO/IEC 15415 Fixed Pattern Damage Grade, ISO/IEC 15415 Modulation Grade	A/B/C/D/F	2D Datamatrix, QR Codes
ISO/IEC 15416 Decode Grade Value ISO/IEC 15415 Decode Grade Value	4/0 or -1	-1 when it is meaningless
ISO/IEC 15416 Symbol Contrast Grade Value ISO/IEC 15416 Decodability Grade Value ISO/IEC 15415 Contrast Grade Value	From 0 to 100 or -1	-1 when it is meaningless
ISO/IEC 15416 Minimum Reflectance Grade Value	0 to XXXX	-1 when it is meaningless

Name	Possible Values	Code Types
ISO/IEC 15416 Minimum Edge Contrast Grade Value ISO/IEC 15416 Modulation Grade Value ISO/ IEC 15416 Defects Grade Value ISO/IEC 15415 Unused Error Correction Grade Value ISO/IEC 15415 Axial Non Uniformity Grade Value ISO/IEC 15415 GRID Non Uniformity Grade Value, ISO/IEC 15415 Modulation Grade	From 0,00 to 1,00	-1 when it is meaningless
Overall Grade Value, ISO/IEC 15415 Fixed Pattern Damage Grade	4/3/2/1/0 or -1	-1 when it is meaningless

ISO/IEC 15415 parameters Range

Grade	Decode	Symbol Contrast	Fixed Pattern Damage	Axial Non Uniformity	Grid Non Uniformity	Modulation	Unused Error Correction
A	PASS	>=70%	==4	<=0.06	<=0.38	0.5	>=0.62
B		>=55%	==3	<=0.08	<=0.50	0.4	>=0.50
C		>=40%	==2	<=0.10	<=0.63	0.3	>=0.37
D		>=20%	==1	<=0.12	<=0.75	0.2	>=0.25
F	FAIL	< 20%	==0	> 0.12	> 0.75	0.1	< 0.25

ISO/IEC 15416 parameters Range

Grade	Decode	Min reflectance	MinEdgeContrast	SymbolContrast	Modulation	Defects	Decodability
A	PASS	<=0.5*Rmax	>=15%	>=70%	>=0.70	<=0.15	>=0.62
B				>=55%	>=0.60	<=0.20	>=0.50
C				>=40%	>=0.50	<=0.25	>=0.37
D				>=20%	>=0.40	<=0.30	>=0.25
F	FAIL	>0.5*Rmax	< 15%	< 20%	< 0.40	> 0.30	<0.25

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.

ISO/IEC 15415 2D STANDARD

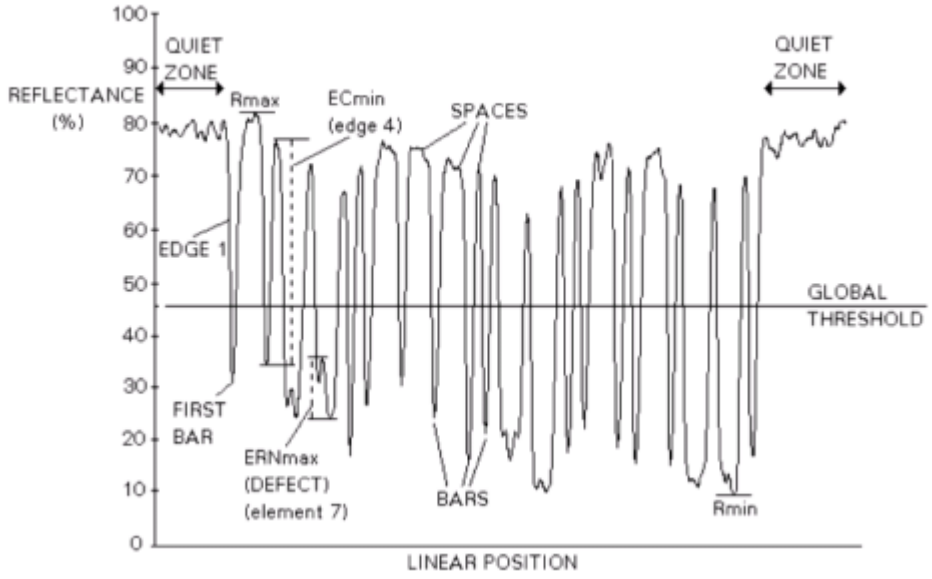
The ISO/IEC 15415 is applicable to the symbol quality assessment of printed Datamatrix and QR Codes.

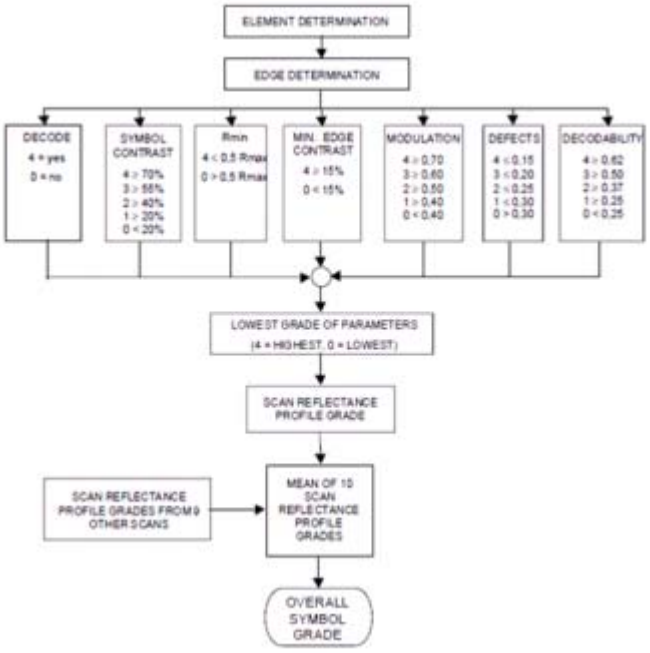
Each quality parameter is measured and a grade on a descending scale of integers from 4 to 0 is allocated to it. The grade 4 (A) represents the highest quality, while the grade 0 (F) represents failure. The Overall symbol grade is the lowest grade achieved for the following seven parameters:

- Decode
- Symbol Contrast
- Modulation

- Fixed Pattern Damage
- Axial Non-Uniformity (ANU)
- Grid Non-Uniformity (GNU)
- Unused Error Correction (UEC)

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

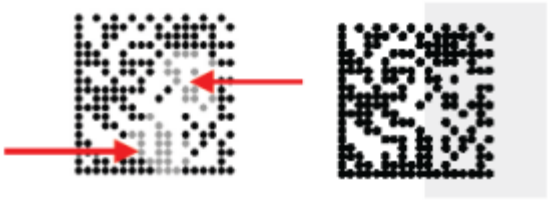
The AIM DPM Quality Guideline is applicable to the symbol quality assessment of direct parts marking performed in using two-dimensional bar code symbols. It defines modifications to the measurement and grading of several symbol quality parameters.

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:

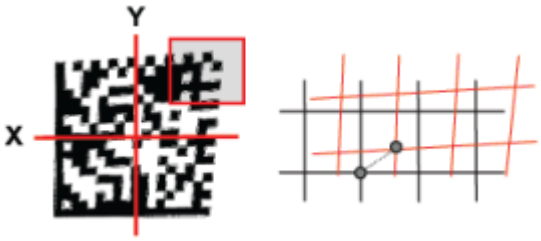
- Decode
  The Decode parameter tests, on a Pass/Fail basis, whether the symbol has all its features sufficiently correct to be readable. If the image cannot be decoded using the symbology reference decode algorithm, then it receives the failing grade 0. Otherwise, it receives the grade 4.
- Cell Contrast (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:

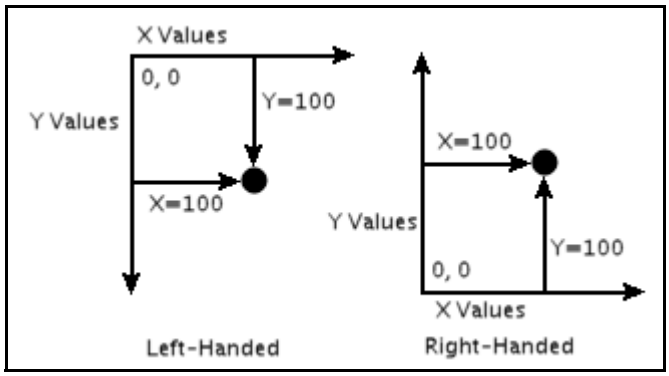
100 millimeters divided by 640 pixels = 0.15625 (or 0.15625 mm per pixel).

This value is used to automatically calibrate measurements in VPM 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.
- Intrinsics 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 Average 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.



Green: Av reprojection error <= 0.2
Yellow: Av reprojection error approximately 1.0
Red: Av reprojection error approximately 5.0

Trouble Diagnosis

Note: There are sixteen image buffers in the A30, T40, T47, and P-Series smart cameras. The T49 has eight image buffers. M-Series, MX-E Series, and MX-U Series processors have thirty two image buffers.

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 (see “Trigger Event Types” on page 3-36).

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 2-9.
- **Bad cabling or interference** – If the trigger cable is bad or there is Electromagnetic Interference (EMI) coupling with the cable, multiple camera triggers can be generated or the acquired image can become corrupted.
  - Replace the 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 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 the A30, T40, T47, and P-Series smart cameras. The T49 has eight image buffers. M-Series, MX-E Series, and MX-U Series processors have thirty two image buffers.

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. If the task branches around image processing tools, the tools that processed the previous image, but do not process the current image, will continue to reference the previous image and keep its buffer 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.

- Check the property "Buffered Images Maximum" in the General-Camera Properties tab to see if the number is equal to the maximum number of buffers in the device. This indicates all the buffers were used during an image acquisition.

Issue: The Image Display in VPM does not refresh

When the system is online and receiving triggers, the image display will freeze 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: Need to Back Up Settings, Files, and Programs

All the settings and program files need to be saved or copied from one M-Series, MX-E Series, and MX-U Series processor to another.

Things to check

- To back up and copy settings, configuration files, and programs:

1. On the M-Series, MX-E Series, and MX-U Series processor storage device, find the directories
   C:\installdirectory\IMPACT\Applications\Device\IMPACTDevice#
   (where "installdirectory" is the default install location and "VisionDevice#" is the number of the camera you want to back up)
2. Copy each of the desired directories to the back up device. Each directory contains the information for a specific camera.
3. If you want to duplicate the settings to a different M-Series, MX-E Series, and MX-U Series processor, copy each of the directories from the back up to the appropriate location (in step 1) on the new processor.

Issue: No Image

No image appears in the image window when you click the Snap, Live, or Trigger buttons in VPM.

Things to check

- File Camera is selected and no images are loaded
  - In VPM, 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 Setup Tab" on page 2-20) 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 Setup Tab” on page 2-20 to adjust camera software settings.
  - Adjust the camera and/or lighting.

Issue: Buffers Have Not Been Created

When you maximize CPM or VPM the following error is displayed:
java.lang.IllegalStateException: Buffers have not been created

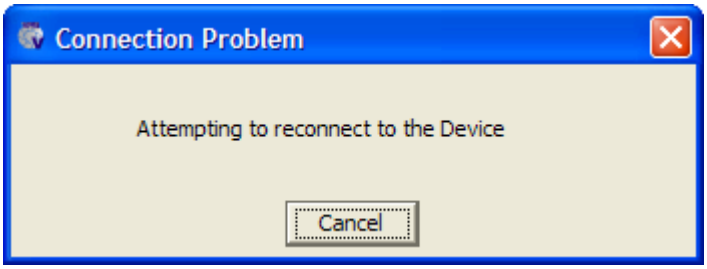
Things to check

- If you are using dual monitors on your PC, and you run VPM or CPM on a remote PC (using Windows Remote Desktop Connection or other remote control program), this error may occur when you maximize VPM or CPM again on the main PC. Restart VPM or CPM to clear the error.

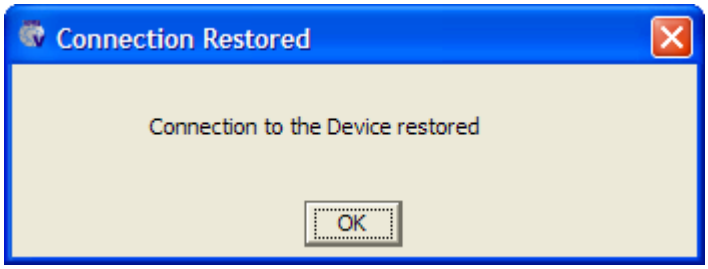
Issue: Connection Problem Dialog

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 will stop 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 program is currently connected and editing files (WORKSTATION2 is the network name of the com-

puter running the currently connected VPM program). When you click OK, the connection will be completed and you will be able to read, but not edit, property values.



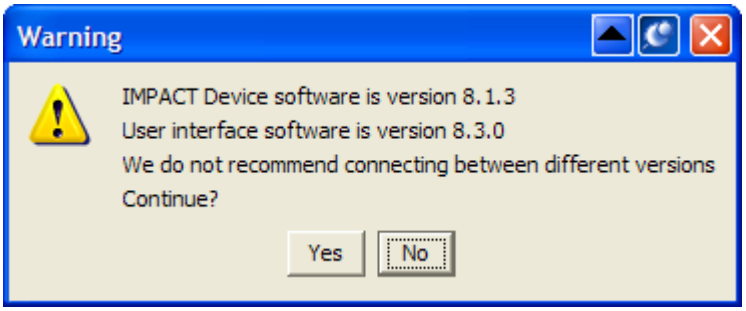
Things to check

- Someone may be connected to the camera, Vision Device, or Emulator for editing
  - Disconnect, disconnect or stop the other VPM 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 e 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: "Camera has been powered up..."

The message “Camera has been powered up for n days n hours n minutes nn seconds” is in the System Log.

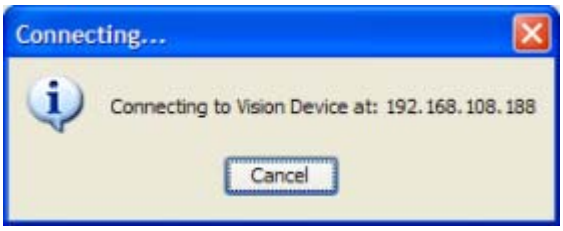
Things to check

- When an M-Series, MX-E Series, or MX-U Series Ethernet connection is established, this message is placed in the System Log. This is to distinguish a communication connection from a power connection. The "powered up" time is reset to zero when power to the camera is interrupted.
  - If this happens frequently or often, check the Ethernet cabling and/or connection between the processor and the camera.

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.



NOTE: In the case of a CPM control panel application with multiple Connector controls, the sequence of dialogs is repeated for each connection attempt.

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: ImpactSendMessage Tool error in System Log

The message "ImpactSendMessageTool:Run - Failure, cannot send Image data type on this platform" is in the System Log.

Things to check

- A vision program file containing Send/Wait tools using the Image data type has been loaded onto a system other than an M-Series, MX-E Series, and MX-U Series processor. The tools will fail to run, and the error is entered into the system log.
  - Load the file onto an M-Series or MX-U Series processor or change the data type in the tools.

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 6-48 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 (A30, P-Series, and T4x-Series only).
  - 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 (A30, P-Series, and T4x-Series)
  - Change the IP address or IP mask on the PC or camera to be compatible (see “TCP/IP Settings” on page 6-48 and “IP Address Configuration” on page 6-53)
- 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 6-48)

  Please note that Datalogic cannot guarantee the performance of M-Series, MX-E Series, and MX-U Series systems which have additional software installed on them, including, but not limited to, anti-virus and firewall software.
  Datalogic recommends that M-Series, MX-E Series, and MX-U Series systems remain disconnected from networks that access the Internet in order to minimize security risks. Datalogic will attempt to support systems with anti-virus software installed, but we cannot guarantee system performance.

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: Message is No Camera Connected

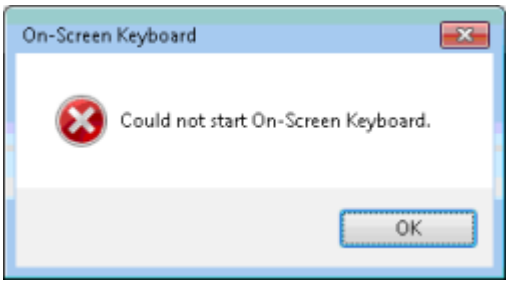
The message “No Camera Connected” is displayed.

Things to check

- The camera is not an Impact or a Datalogic-supported third-party camera. When you look at the system log you will see one of these entries: "GigE Camera: Can not connect to camera. It is not a Datalogic camera" or "GigE Camera: Can not connect to unknown or unlicensed camera."
- The camera is configured with a subnet that happens to be the same subnet used by VisionDevice programs (192.168.0.x). The automatic address re-assignment will fail because there are multiple routes to the camera. This should be rare, because cameras come from Datalogic with 172.31.x subnets.
  - Re-assign the VisionDevice subnets using Settings/General or by editing the NetworkInterface.txt files, then restart VisionDevice. It should successfully re-assign the camera to the CAMx network. Finally, reset the VisionDevice subnet to the original settings.
- M-Series, MX-E Series, and MX-U Series Processor does not have a specific environment variable set.
  - Using the Windows Control Panel System option, set an environment variable named PYLON_SUPPORT_ 3RDPARTY equal to 1.
- The Network connections named CAM1, CAM2, CAM3, and/or CAM4 were changed to something else (M-Series Processor).
  - Change the connection names back to the correct name.

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 VPM and CPM 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 VPM and CPM OSK setup.
  - See “Using the external OSK with Windows 7 (64-bit operating system)” on page 6-32.

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.

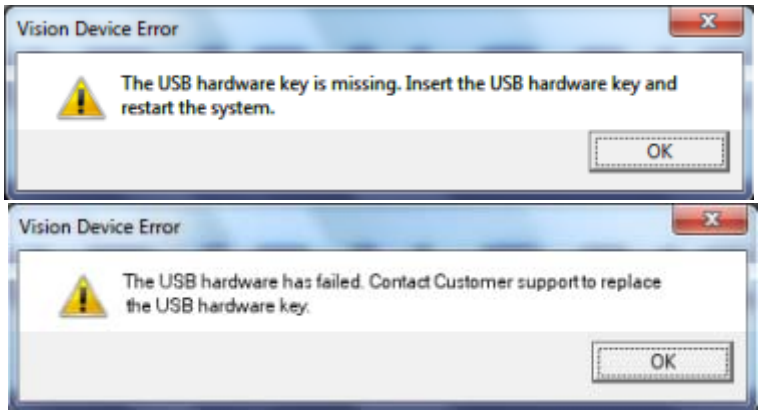
Things to check

- You will need to use a PC that supports the required instruction sets.

Issue: The USB Hardware key is missing or has failed

(M-Series, MX-E Series, or MX-U Series processors only.)

When you start a Vision Device, you may get one of the following errors:



If either of these errors occur, it means that the USB Hardware key that was provided with the processor has not been inserted in the appropriate USB slot, or the key has failed.

Things to check

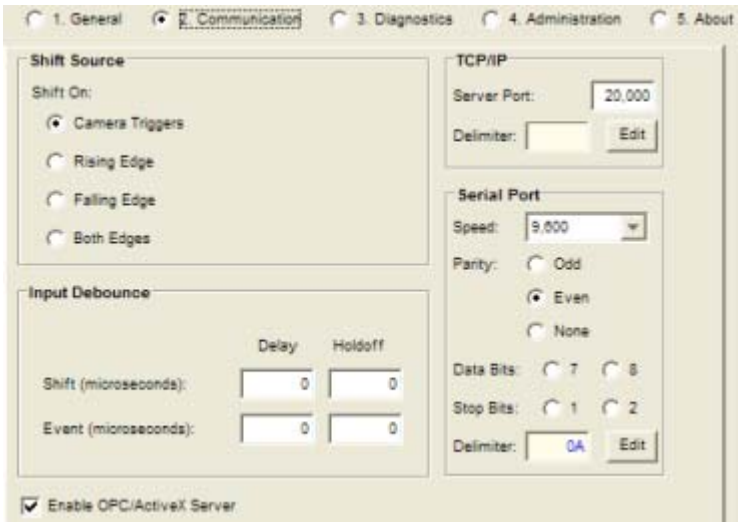
- If the key has failed, contact Datalogic customer support for a replacement key.
- If the key is missing, insert it into the appropriate USB slot. Refer to the processor hardware guide or Quick Start guide for the correct location.

Issue: OpenClient ERROR Didn't Find Proxy

If this error occurs, you are probably trying to use OPC or ActiveX communications with an Impact camera that does not have a DPWS server running. The error should indicate an IP address for the camera.

Things to check

- The DPWS server is not enabled to start when the camera boots.
  NOTE: OPC Server cannot be used on the Datalogic model A30, T4x-Series, or P-Series Smart Cameras
  - Start VPM. Click on the Settings tab, select the General System object, then select the Communication panel. Check the box labeled "Enable OPC/ActiveX Server." You will need to restart the desired Impact camera.



Index

Symbols

@ 4-102
& 5-9
<> 4-102
> 4-102

A

A30
  cable 1-3
  client PC 6-53
  requirements 1-1
  VPM connect 1-7
AB PCCC
  read/write values 2-44
  system object 2-43
  VPM 2-44
Abort on error 2-7, 3-33, 3-34
About
  CPM 4-6
  image 6-44
  panel 2-16
  VPM 3-10
Abs 5-9
Access
  administrator 4-112
  administrator level 2-13
  control panel 2-13
  controller 4-112
  controller level 2-13
  level 2-13
  monitor 4-112
  monitor level 2-13
  operator 4-112
  operator level 2-13
  programmer 4-112
  programmer level 2-13
Acos 5-9
ActiveX server 2-10
Adaptive template tool 3-190
Adaptive threshold 3-230, 6-26
Add
  device 3-5
  input button 3-21
  output button 3-21
  template 3-8
Addday 5-9
Addhour 5-9
Addition operator 5-4
Addminute 5-9
Addmonth 5-9
Addsecond 5-9
Addweek 5-10
Addyear 5-10
Adjustable threshold 6-25
Administration
  panel 2-13
  security 2-13
  setup 2-13
Administrator access 2-13, 4-112
Amax 5-10
Amaxi 5-10
Amin 5-10
Amini 5-10
AND operator 5-5
Angle tool 3-144
Angle types, deslant tool 3-66
Antivirus software 6-91
Appendix 6-1
Arc ROI control 4-32
Archive system log 2-38
Array 5-6
Asc 5-11
Asin 5-11
Assign
  camera 1-9, 2-29, 2-30
Atan 5-11
Auto
  image history 3-10
  image save 3-10
  image saving 4-28
  link input image 3-9
  link tool origin 3-9
  trigger 2-22
  update tool link 3-9
Automatic
  Image Linking 3-28
  Origin Linking 3-29
Autothreshold
  bright 6-25
  uniform region 3-80
Average filter tool 3-44
Average gradient tool 3-105
Average intensity tool 3-106

B

Backup
  control panel 4-5
  files 6-88
  settings 2-7
Bad image event 6-87
Bandwidth
  camera 2-21
Basic
  & 5-9
  abs 5-9
  acos 5-9

addday 5-9
addhour 5-9
addition operator 5-4
addminute 5-9
addmonth 5-9
addsecond 5-9
addweek 5-10
addyear 5-10
amax 5-10
amaxi 5-10
amin 5-10
amini 5-10
AND operator 5-5
asc 5-11
asin 5-11
atan 5-11
call 5-11
chdir 5-11
chomp 5-11
chr 5-11
close 5-11
comment 5-2, 5-5, 5-24
constants 5-3
cos 5-12
curdir 5-12
data type 5-7
day 5-12
division operator 5-4
edit window 5-1
end sub 5-13
EOF 5-13
equality operator 5-4
error 5-13
error messages 5-2
error$ 5-13
even 5-13
exit function 5-14
exit sub 5-14
exp 5-14
expressions 5-4
false 5-14
fftmag 5-14
file example 5-33
fix 5-14
formatdate 5-15
frac 5-16
function 5-16
gmtime 5-16
gosub 5-16
goto 5-17
greater than operator 5-5
greater than or equal operator 5-5
hex 5-17
hour 5-17
if then 5-17
instr 5-18
instrrev 5-18
int 5-18
isarray 5-18
isdirectory 5-19
isempty 5-19
isfile 5-19
isinteger 5-19
isnumeric 5-19
isreal 5-19
isstring 5-20
isundef 5-20
join 5-20
language format 5-2 to 5-8
lbound 5-20
lcase 5-20
left 5-20
len 5-20
less than operator 5-4
less than or equal operator 5-5
like 5-21
line input 5-21
log 5-21
log10 5-21
loop 5-5
ltrim 5-21
mid 5-21
minute 5-22
mkdir 5-22
modulus operator 5-4
month 5-22
multiplication operator 5-4
not equal operator 5-5
NOT operator 5-5
now 5-22
oct 5-22
odd 5-22
on error goto 5-23
on error resume 5-23
open 5-23
operator 5-4
OR operator 5-5
pi 5-24
pow 5-24
power operator 5-4
precedence 5-4
print 5-24
program examples 5-31
REM 5-24
replace 5-24
resume 5-25
return 5-25
right 5-25
rnd 5-25
round 5-25
rtrim 5-25
sec 5-26
sin 5-26
space 5-26
split 5-26
splita 5-27
sqr 5-27
stop 5-27

str 5-27
string 5-8, 5-28
strreverse 5-28
sub 5-28
subtraction operator 5-4
syntax 5-5
tan 5-28
timevalue 5-28
Trim 5-29
true 5-29
type 5-29
ubound 5-29
ucase 5-29
undef 5-3, 5-29
val 5-30
variables 5-3
weekday 5-30
XOR operator 5-5
year 5-30
yearday 5-30
Basic control 4-107
Basic tool 3-260, 5-1
Batch file
execute command 4-111
Binary Coded Decimal (BCD) 3-231
Binary image tool 3-44
Blob filter tool 3-109
Blob list control 4-34
Blob tool 3-76
Boolean data type 5-7
Border blobs 3-111
Branch tool 3-261
Break tool 3-261
Buffer overrun 6-87
Buffers not created 6-89
Bump find tool 3-192
Button
add input 3-21
add output 3-21
connect 3-6, 4-2
enter password 3-21
live 2-21, 2-32
online 3-7
radio 4-67, 4-68
run 3-21
snap 2-21, 2-32
synchronize 3-21, 3-262
tool and task test 3-21
train 3-21
update links 3-21
Button control 4-48

C

Cable
camera 1-3, 1-8
network 6-89
trigger 1-6, 6-87
Calibration
camera 2-31
CPM to Camera 4-130
editor 2-12
manual 2-33
pixel size only 2-32
PLC to camera 6-14, 6-19
real world coordinates 2-35
target 2-33
two points 2-32
Call 5-11
Call task tool 3-262
Camera
and interface versions 6-90
assign 1-9, 2-29, 2-30
backup/restore settings 2-7
bandwidth 2-21
cable connection 1-3
calibration 2-31
connect 1-4, 1-7
date/time 2-7
gain 2-22
gateway 2-3
information 2-16
inputs 2-12
IP address 2-3
line scan tab 2-25
live 2-21, 2-32
locked for editing 6-89
mask 2-3
no camera connected 6-93
no image 6-88
not in list 6-92
not located 6-90
offset 2-22
outputs 2-11
preferences 3-6, 3-9
restart 2-12
security 2-13
select, tab 3-5
setup 1-6, 2-20
shutter open time 2-21
snap 2-21, 2-31
strobes 2-11
system object 2-16
tabs, hide 3-9
trigger 2-22
Camera Trigger tool 3-282
Change image calibration tool 3-287
Change log control 4-108
error 4-110
Character contour library control 4-53
Character contour match tool 3-201
train modes 3-204
Chart
control 4-86
data delimiter 4-90, 4-105
display 3-23
legend 4-90
pie chart 4-90

properties edit 4-89 to 4-90
type 4-89, 4-104
x-axis 4-90
y-axis 4-90, 4-104
Chdir 5-11
Check box control 4-49
Chomp 5-11
Chr 5-11
CIP, control and information protocol 6-12
Circle edge refinement tool 3-148
Circle gauge tool 3-150
Circle ROI 3-19
Circular pattern find tool 3-82
Clear system log 2-39
Client computer
default directory 2-15
Impact camera backup/restore 2-8
Clip ROI tool 3-288
Close 5-11
Code reader
1D codes 6-72
2D codes 6-72
code types 6-72
defined code type 3-205
maximum codes 3-211
postal codes 6-72
processing mode 3-206
processing modes 6-73
quality grades 6-78
standards 6-79
train mode 3-205
Code reader tool 3-205
Collapse task tree 3-14
Color
bilinear interpolation 2-25
image display 3-16
white balance 2-25
Color blob tool 3-112
Color checker tool 3-117
Color image sampling tool 3-61
Color Image Stitching tool 3-62
Color pixel fill tool 3-45
Command line
about image 6-44
access text file 6-42
banner 6-40
country settings 6-38
disable exit Vision Device 6-41
disable program exit 6-41
disable window 6-38
edit 6-36
language settings 6-39
load control panel 6-42, 6-44
memory allocation 6-45
parameters 6-36
run scriptor file 6-43, 6-44
set window location and size 6-43
start image 6-44
title bar logo 6-39
title bar string 6-45
Commands
http 6-1
scriptor 4-121
tcp/ip 6-9
telnet 6-5
Comment 2-6
Basic 5-2, 5-5, 5-24
Communication
panel 2-9
Composite tools 2-40
Compress files 3-9
Concantenate 5-9
Connect
camera 1-4, 1-7
CPM 4-2
Impact connector control 4-114
vision device 1-4, 1-7
VPM 1-7, 3-6
Connection
direct 6-49
internet 6-52
problem 6-89, 6-91
restored 6-89
router 6-51
switch 6-50
Connections
users 2-6
Connector control 4-111
Constants 5-3
Contrast - multiple ROI tool 3-121
Contrast tool 3-118
Control
arc ROI 4-32
basic 4-107
blob list 4-34
button 4-48
change log 4-108
character contour library 4-53
chart 4-86
check box 4-49
copy 4-4
correlation model 4-35
CPM 4-24
cut 4-4
delete 4-4
Display group 4-86
drop list selection 4-51
events 4-9
execute command 4-111
font library 4-52
frame 4-91
graphic display 4-92
greyscale template model 4-36
histogram 4-26
image display 4-28
images 4-25
Impact connector 4-111
indicator light 4-92

line list 4-37
line ROI 4-38
link 4-13, 4-19
load image 4-117
load vision program 4-118
methods 4-9
numeric display 4-94
numeric entry 4-55
origin 4-40
origin list 4-41
palette 4-6, 4-7, 4-24
palette group 4-24
password 4-57
paste 4-4
pattern database 4-64
point list 4-42
properties 4-9
radio button 4-67
radio button group 4-68
range 4-69
range scroll 4-72
rectangle list ROI 4-44
rectangle ROI 4-45
rich text 4-95
save vision program 4-119
scriptor 4-120
scrolling table 4-95
shape list 4-46
slider 4-73
tab 4-99
tab group 4-100
table 4-75
TCP/IP logger 4-127
text display 4-101
text entry 4-79
timer 4-128
toggle button 4-80
tolerance 4-82
XBar-R chart 4-102
XML table 4-105
Control panel
add 4-6
add control 4-12
chooser 4-8
defined 4-1
design view options 4-6
design/run mode 4-5
events 4-9
full screen view 4-5
methods 4-9
move up/down 4-8
new 4-11
print 4-5
properties 4-9
security 2-13, 4-2
template 4-4
toolbar 4-6
tree 4-8
tree select 4-6
Control panel application 4-9
create 4-9
display size 4-12
new 4-3
open 4-4
password protection 4-10
save 4-4
save as 4-4
security 4-10
Control Panel Manager
See CPM
Controller access 2-13, 4-112
Correlation
multiple image stitch 3-70
Correlation Model control 4-35
Cos 5-12
Counted loop tool 3-262
Counter tool 3-262
Country settings 6-38
CPM 4-1
camera calibration 4-130
connect to device 4-2
controls 4-24
editing vision program 4-3
link 4-19
overview 4-1
refresh VPM tree 4-6
start 4-1
toolbar 4-2
user interface 4-2
VPM link 4-13
VPM task tree 4-7
Curdir 5-12
Cut 3-8

D

Data bits 2-10
Data delimiter, chart 4-90, 4-105
Data highlight 4-76, 4-77
Data instance tool 3-264
Data set tool 3-265
Data transfer
link 4-116
timeout 2-7
Data transfer tool 3-289
Data type
Basic 5-7
Boolean 5-7
Boolean List 5-7
Integer 5-7
Integer List 5-7
Real 5-8
Real List 5-8
string 5-8
Date/time
format 5-15
now 5-22
set 2-7

Day 5-9, 5-12
Debounce
input 2-9
Debugging
control panel 4-5
Declaring variables 5-3
Default
IP address 6-53
IP mask 6-53
Defined code type 3-205
Delay
input debounce 2-9
output 3-234
Delay tool 3-265
Delete 3-8
Deprecated
tool 3-40
Design
mode 3-10, 3-27
Design view options 4-6
Design/Run mode 4-5
Deslant tool 3-66
Device
add 3-5
Device settings tool 3-283
Diagnostics
events 2-12
panel 2-11
Disable
exit Vision Device 6-41
program exit 6-41
security 2-13
vision device exit 6-41
window 6-38
Disconnect
VPM 3-6
Discrete input tool 3-231
Discrete output tool 3-232
Display
does not refresh 6-88
mode 3-8, 3-26
refresh rate 3-9
refresh timeout 3-10
setup chart 3-23
setup tab 3-23
Display group, CPM 4-86
Divide by zero 5-4
Division operator 5-4
Do until 5-12
Do while 5-12
Dot pitch 2-34
DPWS server 2-10
Drawer
toolbox 3-11, 3-42
Drop list selection control 4-51
Dwell, output 3-234
Dynamic tooltips 4-25

E

Edge detection method 3-89
Edge Enhancement tool 3-46
Edge point find tool 3-123
Edit
Basic 5-1
EDS 6-12
Electronic data sheet 6-12
Emulator
connect 1-4, 1-7
Enable
security 2-13
End sub 5-13
Enter password button 3-21
EOF
function 5-13
Equality operator 5-4
Error
bad image event 6-87
Basic 5-2
buffers not created 6-89
command 5-13
connection re-established 6-89
could not start OSK 6-32, 6-93
function 5-13
ImpactSendMessage 6-90, 6-91
minimum hardware requirements 6-94
online callback 6-91
openclient 6-95
Error$-function 5-13
Ethernet
client computer 6-53
EtherNet/IP
assembly 6-88
data mapping 6-12
Explicit Data tool 3-236
Explicit Message tool 3-237
introduction 6-12
Read Implicit Assembly tool 3-240
Write Implicit Assembly tool 3-242
Even 5-13
Event
control 4-9
rate diagnostics 2-12
Event scheduler tool 3-265
Event, trigger
AB PCCC event 3-39
Bad Image Event 3-36
camera button 3-38
EtherNet/IP
Explicit Event 3-38
Implicit User Data Event 3-38, 6-12
Image In Event 3-36
Image Trigger Event FE 3-37
Image Trigger Event FE and RE 3-37
Image Trigger Event RE 3-37
Input Event FE 3-37, 3-38
Input Event FE and RE 3-37, 3-38

Input Event RE 3-37, 3-38
Modbus 3-39
Modbus new input data 3-39
None 3-36
offline 3-36
online 3-36
OPC input data event 3-39
ProfinetIO User Data Event 3-39
program closed 3-36
scheduled 3-38
Serial Input Event 3-38
Shift Event FE 3-38
TCP/IP Input Event 3-38
User Event 3-40, 6-12
Events link 4-114
Examples
basic 5-31
Execute command control 4-111
Exit
function 5-14
sub 5-14
Exp 5-14
Expand task tree 3-14
Expressions 5-4
Extreme Difference tool 3-194

F

False 5-14
Fftmag 5-14
Fieldbus 3-294, 6-12, 6-17
File
basic example 5-33
delete 3-8
list 2-40
load vision program 2-41
restore to client 2-41
vision program load 3-286
vision program save 3-286
File camera
no image 6-88
system object 2-37
File manager
file list 2-40
folder list 2-40
images folder 2-40
root directory 2-40
system object 2-39
system object setup 2-39
web folder 2-40
Fix 5-14
Fixed threshold 3-80, 6-23, 6-26
Float image display 3-16
Folder list 2-40
Font data
OCR 3-224, 3-227
Font library
control 4-52
OCR 3-230
OCR tool 3-222
Font size
CPM 4-5
For next 5-16
Format
png image 2-37
Formatdate 5-15
Frac 5-16
Frame control 4-91
Frame Trigger
See Trigger
Frames per second 2-21, 2-32
Full screen view 4-5
Function 5-16

G

Gain, camera 2-22
Gateway
IP 2-3, 2-6
Gaussian filter tool 3-47
General
group, CPM 4-107
system object 2-1
General station descriptor file 6-17
Get data link 4-115
Gmtime 5-16
Golden character
OCR 3-225
Gosub 5-16
Goto 5-17
Gradient 6-29
edges 3-89, 6-29
Graphic display control 4-92
Greater than operator 5-5
Greater than or equal operator 5-5
Green red spot tool 3-293
Grey level
edges 3-89, 6-27
line profile 6-26
Greyscale image resolution 3-40
Greyscale template model control 4-36
Greyscale template tool 3-196
Grid
ROI 3-19
Grid statistics tool 3-289
Group tool 3-266
Group, CPM
display 4-86
general 4-107
images 4-25
input 4-48
GSDML 6-17

H

Hardware key 6-94
Help 1-1
Hex 5-17

Hide camera tabs 3-9
Histogram 3-18, 6-23
Histogram control 4-26
History
image 3-12
Holdoff 2-9
Hour 5-9, 5-17
HTML 4-102
HTTP commands 6-1

I

I/O polling, diagnostics 2-12
Icons
list 3-3
small 3-9, 4-5
yellow 3-40
IF then 5-17
Image
auto save 3-10
auto saving 4-28
automatic link 3-28
color 3-16
color sub-properties 3-40
controls 4-25
display area 3-15
display control 4-28
display refresh 6-88
float display 3-16
format 2-37
history 3-10, 3-12
list - multiple image stitch 3-70
math tool 3-48
not displayed 6-88
sampling tool 3-67
save 2-31, 3-17
stitching multiple images 3-70
stitching with origins tool 3-68
stitching with points tool 3-68
zoom 3-17
Image archiving tool 3-243
Image math
weighted average 3-49
Images group, CPM 4-25
Impact
Basic 5-1
ports 6-48
Impact connector
control 4-111
data transfer 4-116
events 4-114
get data 4-115
link 4-13
method 4-115
methods 4-114
properties 4-114
security 4-116
set data 4-115
ImpactSendMessage error 6-90, 6-91
Indicator light control 4-92
Infinite loop 5-5
Input
debounce 2-9
diagnostics 2-12
event port 2-10
See Line input
Input group, CPM 4-48
Inspection
create 3-30
Installation
software 1-2
Instr 5-18
Instrrev 5-18
Int 5-18
Integer data type 5-7
Integer List data type 5-7
Internet
connection 6-52
IP address 2-3, 6-48
camera, changing 6-53
default 6-53
IP gateway 2-6, 6-48
IP mask 2-3, 6-48
camera, changing 6-53
default 6-53
Isarray 5-18
Isdirectory 5-19
Isempty 5-19
Isfile 5-19
Isinteger 5-19
Isnumeric 5-19
Isreal 5-19
Isstring 5-20
Isundef 5-20

J

Java Runtime 1-2
Join 5-20

L

Label special characters 4-102
Language settings 6-39
Lbound 5-6, 5-20
Lcase 5-20
Lead Statistics tool 3-292
Left 5-20
Legend, chart 4-90
Len 5-20
Less than operator 5-4
Less than or equal operator 5-5
Level, user 2-13
License
key 2-15
Light leveling tool 3-50
Like 5-21
Line find tool 3-84

Line gauge datum line tool 3-161
Line gauge dual ROI tool 3-167
Line gauge tool 3-156
Line input, Basic 5-21
Line list control 4-37
Line profile
gradient 6-29
grey level 6-26
Line profile tool 3-70
Line ROI control 4-38
Line scan
acquisition mode 2-26
camera 2-25
input termination 2-27
line trigger type 2-27
Line trigger type 2-27
Linear morphology close tool 3-52
Linear morphology open tool 3-53
Linear regression tool 3-173
Link
autolink input image 3-9
autolink origin 3-9
automatic image 3-28
automatic origin 3-29
autoupdate 3-9
color 3-25
control 4-13, 4-19
CPM 4-19
create 3-30, 4-14, 4-17, 4-18, 4-21
data transfer 4-116
delete 3-30, 4-19, 4-23
drag and drop 4-14, 4-17, 4-18, 4-21
event 4-20
events 4-114
get data 4-15, 4-16, 4-115
method 4-15, 4-17, 4-20, 4-115
methods 4-114
paste tools 3-29
print 3-25, 4-24
properties 4-20, 4-114
right click 4-18, 4-21
set data 4-15, 4-16, 4-115
status 3-25
summary 3-25, 4-23, 4-116
tools 3-28
List loop tool 3-266
List sorter tool 3-266
Live button 2-21, 2-32
Load
button 3-7
control panel 6-42
file 2-41
Load control panel 6-44
Load image control 4-117
Load vision program control 4-118
Locked
for editing 3-6, 6-89
Log
Basic command 5-21
system 2-12
Log on
VPM 3-1
Log10
Basic command 5-21
Loop
do until 5-5, 5-12
do while 5-5, 5-12
for next 5-5, 5-16
infinite 5-5
repeat until 5-5, 5-24
while 5-5, 5-30
Ltrim 5-21

M

Mask 2-3
discrete output 3-233
Math
image 3-48
MC read tool 3-246
MC write tool 3-248
Median filter tool 3-53
Memory
allocation 6-45
available 2-16
meter 2-12
Method
control 4-9
link 4-115
Methods link 4-114
Mid 5-21
Midpoint tool 3-174
Minimum hardware requirements 6-94
Minute 5-9, 5-22
Mkdir 5-22
Mod
See modulus
Modbus
client tester 6-47
registers 2-43
system object 2-42
VPM 2-42
Mode
design 3-10, 3-27
display 3-8, 3-26
Mode, processing
also see PMA
Modulus operator 5-4
Monitor access 2-13, 4-112
Month 5-9, 5-22
Morphology
close tool 3-54
dilate tool 3-54
erode tool 3-56
open tool 3-57
M-Series
cable 1-3
changing IP Address 2-4, 6-54

VPM connect 1-8
Multiple branch tool 3-267
Multiple image stitch tool 3-70
Multiple point to point measurement tool 3-174
Multiplication operator 5-4
MX-E Series
cable 1-3
changing IP Address 2-4, 6-54
requirements 1-2
VPM connect 1-8
MX-U Series
cable 1-3
changing IP Address 2-4, 6-54
requirements 1-2
VPM connect 1-9

N

New 3-7
New image tool 3-60
New vision program 3-7
No camera connected 6-93
Not equal operator 5-5
NOT operator 5-5
Now 5-22
Numeric display control 4-94
Numeric entry control 4-55

O

OCR tool 3-221
font data 3-224, 3-227
font library 3-222, 3-230
golden character 3-225
Oct 5-22
Odd 5-22
Offline
tool 3-285
Offset, camera 2-22
On error
goto 5-23
resume 5-23
Online
button 3-7
callback problem 6-91
tool 3-286
On-screen keyboard 6-32, 6-93
CPM 4-5
enable 4-5, 6-35
numeric 6-35
VPM 6-35
OPC
backup data 2-8
custom inputs 2-45
data access system object 2-45
server 2-10
Open, Basic command 5-23
OpenClient
error 6-95
Operator access 2-13, 4-112
OR operator 5-5
Origin
automatic link 3-29
Origin control 4-40
Origin list control 4-41
Origin tool 3-90
OSK
See On-screen keyboard
Output
delay 3-234
diagnostics 2-11
dwell 3-234
mask 3-233
state 3-233
timing method 3-234

P

Parity 2-10
Partial scan 2-24
Pass fail tool 3-267
Password 2-14
control panel application 4-10
CPM control 4-57
remove vision program 3-32
Paste linked tools 3-29
Pattern database control 4-64
Pattern Database Manager 6-59
Pattern Sorting tool 3-127, 6-59
PC to camera
direct connection 6-49
internet connection 6-52
router connection 6-51
switch connection 6-50
PDM
See Pattern Database Manager
Peak valley find tool 3-179
Periodic auto-trigger 2-22
Pi 5-24
Pinpoint pattern find tool 3-97
Pitch, calibration 2-34
Pixel fill tool 3-61
Pixel size 6-84
PLC data mapping 6-12, 6-17, 6-88
PMA 3-206
Point list control 4-42
Point match tool 3-180
Point to line measurement tool 3-182
Point to point measurement tool 3-185
Polling rate, diagnostics 2-12
Polygon ROI 3-19
Polygon smoothing tool 3-200
Port
SDK 2-11
serial 2-10
serial input event 3-38
serial out tool 3-254
TCP 6-48

Pow, Basic command 5-24
Power operator, Basic 5-4
Preferences
Camera 3-6, 3-9
program 3-5, 3-9, 4-5
Print 5-24
control panel 4-5
link 3-25, 4-24
options 3-8
Processing Mode
also see PMA
Processing mode
code reader tool 6-73
Profile type 6-28
PROFINET 3-294
data mapping 6-17
exchange 6-17
introduction 6-17
ProfinetIO Read tool 3-294
ProfinetIO Write tool 3-295
User Data 6-17
Program
disable exit 6-41
preferences 3-5, 3-9
vision program unload 3-287
window banner 6-40
Programmer access 2-13, 4-112
Properties
control 4-9
link 3-28, 4-114
tool 3-24
vision program 3-32
P-Series
requirements 1-1
Pseudocolor 6-24, 6-28
Pulse
length 2-21
reset 3-232

Q

Quality grades 6-78
Quick setup 1-3

R

Radio button control 4-67
Radio button group control 4-68
Range control 4-69
Range scroll control 4-72
Read only connection 3-6
Real data type 5-8
Real List data type 5-8
Reboot 2-12
Rectangle list ROI 4-44
Rectangle ROI 3-19
Rectangle ROI control 4-45
Refresh
system log 2-39
Refresh VPM tree, CPM 4-6
Region of Interest
See ROI
REM, Basic command 5-2, 5-24
Repeat until 5-24
Replace 5-24
Requirements
M-Series 1-1
Reset tool 3-269
Restart camera 2-12
Restore
settings 2-7
Resume 5-25
Return 5-25
Rich text control 4-95
Right click link 4-18
Right function 5-25
Rnd 5-25
ROI 3-18
circle 3-19
circular arc 3-20
edit 3-19
grid 3-19
line 3-20
off image 3-16, 3-17, 3-19
polygon 3-19
rectangle 3-19
resize 3-19, 3-83
rotate 3-19, 3-83
shape list 3-19
wide line 3-20
Root directory 2-40
Round 5-25
Router
connection 6-51
RS-232 2-10
Rtrim 5-25
Run button 3-21

S

Save
image 2-31, 3-17
Vision Program 3-7
Save As 3-8
Save template 3-8
Save vision program control 4-119
Scale 6-84
Scan, partial 2-24
Scientific notation 3-24
Script examples
scriptor control 4-124
Scriptor
commands 4-121
editor 4-121
error handling 4-122
run file 6-43, 6-44
script examples 4-124
Scriptor control 4-120

Scrolling table
control 4-95
SDK
port 2-11
server 2-11
Sec 5-26
Second 5-9
Security
Camera 2-13
control panel application 4-10
CPM 4-2
disable 2-13
enable 2-13
Impact connector 4-116
vision device 4-116
vision program 3-21, 3-32
Select Program 3-7
Send Message tool 3-249
setup 3-249
Serial port
settings 2-10
Serial Port Out tool
setup 3-254
Serial port out tool 2-10, 3-254
Server
ActiveX 2-10
OPC 2-10
SDK 2-11
Set data link 4-115
Settings
administration 2-13
camera calibration 2-31
copy 6-88
tab 2-1
Setup
camera 1-6, 2-20
tab 3-21
Shape list control 4-46
Shape list ROI 3-19
Shift source 2-9
Shutter open time 2-21
Sin function 5-26
Slider control 4-73
Snap, camera 2-21, 2-31
Software
installation 1-2
version 3-10, 4-6
Space, Basic command 5-26
Special characters 4-102
Speed, serial 2-10
Split 5-26
Splita 5-27
Spot Find tool 3-139
Sqr 5-27
Start
CPM 4-1
image 6-44
VPM 3-1
Stitched image 3-68
Stop bits 2-10
Stop, Basic command 5-27
Storage 2-16
Str function 5-27
String Builder tool 3-269, 3-277
String data type 5-8
String, Basic command 5-28
Strobe
diagnostics 2-11
pulse length 2-21
Strreverse 5-28
Sub 5-28
Sub-pixel edge extraction tool 3-188
Subtraction operator 5-4
Summary
link 3-25
tab 3-5
table 3-12
table buttons 3-11
table colors 3-13
table values 3-13
Switch connection 6-50
Synchronize
with task button 3-21, 3-262
Syntax, Basic 5-5
System log
system object 2-38
trace 2-12
System object
AB PCCC 2-43
camera 2-16
file camera 2-37
file manager 2-39
general 2-1
Modbus server 2-42
OPC data access 2-45
system log 2-38
System requirements
A30, T4x-Series, P-Series 1-1
M-Series 1-1
MX-E Series 1-2
MX-U Series 1-2

T

T4x-Series
cable 1-3
client PC 6-53
requirements 1-1
VPM connect 1-7
Tab
camera select 3-5
control 4-99
group control 4-100
line scan 2-25
settings 2-1
summary 3-5
Table
configure column 4-76

configure data highlight 4-76, 4-77
configure labels 4-76, 4-77
configure row 4-75
control 4-75
dynamic 4-75
set cell data type 4-78
setup 4-75
static 4-75
summary 3-12
Tan 5-28
Target
calibration 2-34
Task
call 3-33
configuration 3-34
create 3-33
delete 3-8
test buttons 3-21
timeout 2-7
tree, collapse 3-14
tree, CPM 4-6
tree, expand 3-14
tree, VPM 4-6
trigger event types 3-36
TCP/IP
commands 6-9
direct connection 6-49
Impact ports 6-48
input event port 2-10
internet connection 6-52
logger control 4-127
out tool 3-255
router connection 6-51
settings 6-48
switch connection 6-50
tester 2-12
Telnet commands 6-5
Template, control panel 4-4
Text display control 4-101
Text entry control 4-79
Text entry special characters 4-102
Text file, command line 6-42
Text size
VPM 3-9
Threshold
adaptive 3-230, 6-26
adjustable 6-25
block adaptive 3-230
center fixed 3-80
fixed 3-230, 6-23, 6-26
grey level 3-80, 6-28
percent 6-23
profile type 6-28
viewer 6-22
Time
gmtime 5-16
Timeout
data transfer 2-7, 3-289
task 2-7
Timer control 4-128
Timevalue 5-28
Timing method 3-234
Title bar
logo 6-39
string 6-45
Toggle button control 4-80
Tolerance control 4-82
Tool
activation 2-15
delete 3-8
deprecated 3-40
link 3-28
properties 3-24
reset 3-269
setup 3-21
test buttons 3-21
tips 4-25
to retrain 3-292
VPM 3-40
Toolbar
CPM 4-2
shape list 3-19
task and panel 4-6
VPM 3-6
Toolbox
drawer 3-42
VPM 3-11
Tooltips
show on image 3-9
Tool-VPM
adaptive template 3-190
angle 3-144
average filter 3-44
average gradient 3-105
average intensity 3-106
basic 3-260
binary image 3-44
blob 3-76
blob filter 3-109
branch 3-261
break 3-261
bump find 3-192
call task 3-262
camera trigger 3-282
change image calibration 3-287
character contour match 3-201
circle edge refinement 3-148
circle gauge 3-150
circular pattern find 3-82
clip ROI 3-288
code reader 3-205
color blob 3-112
color checker 3-117
color image sampling 3-61
color image stitching 3-62
color pixel fill 3-45
contrast - multiple ROI 3-121
contrast tool 3-118

counted loop 3-262
counter 3-262
data instance 3-264
data set 3-265
data transfer 3-289
delay 3-265
deslant 3-66
device settings 3-283
discrete input 3-231
discrete output 3-232
edge enhancement 3-46
edge point find 3-123
EtherNet/IP Explicit Data 3-236
EtherNet/IP Explicit Message 3-237
EtherNet/IP Read Implicit Assembly 3-240
EtherNet/IP Write Implicit Assembly 3-242
event scheduler 3-265
extreme difference 3-194
gaussian filter 3-47
green red spot 3-293
greyscale template 3-196
grid statistics 3-289
group 3-266
Image archiving 3-243
image math 3-48
image sampling 3-67
image stitching with origins 3-68
image stitching with points 3-68
lead statistics 3-292
light leveling 3-50
line find 3-84
line gauge 3-156
line gauge datum line 3-161
line gauge dual ROI 3-167
line profile 3-70
linear morphology close 3-52
linear morphology open 3-53
linear regression 3-173
list loop 3-266
list sorter 3-266
MC read 3-246
MC write 3-248
median filter 3-53
midpoint 3-174
morphology close 3-54
morphology dilate 3-54
morphology erode 3-56, 3-200
morphology open 3-57
multiple branch 3-267
multiple image stitch 3-70
multiple point to point measurement 3-174
new image 3-60
OCR 3-221
offline 3-285
online 3-286
origin 3-90
pass fail 3-267
pattern sorting 3-127
peak valley find 3-179
pinpoint pattern find 3-97
pixel fill 3-61
point match 3-180
point to line measurement 3-182
point to point measurement 3-185
ProfinetIO Read 3-294
ProfinetIO Write 3-295
reset 3-269
Send message 3-249
serial port out 3-254
spot find 3-139
string builder 3-269, 3-277
sub-pixel edge extraction 3-188
TCP/IP out 3-255
train 3-292
undistort image 3-75
unwrap image 3-74
vision program load 3-286
vision program save 3-286
vision program unload 3-287
Wait for message 3-251
wide edge point find 3-140
x-y projection 3-75
Trace
system log 2-12
Train
button 3-21
character contour match tool 3-204
OCR tool 3-222, 3-226
Train tool 3-292
Trigger
auto 2-22
camera 2-22
edge 2-22
overrun 6-87
periodic 2-22
rate 2-12
Trigger event
bad image 3-36
camera button 3-38
EtherNet/IP 3-38
image in 3-36
image trigger 3-37
input 3-37, 3-38
modbus 3-39
none 3-36
OPC new input data 3-39
pccc 3-39
ProfinetIO User Data 3-39
program closed 3-36
scheduled 3-38
serial input 3-38
shift 3-38
task offline 3-36
task online 3-36
TCP/IP input 3-38
User 3-40, 6-12
Trim 5-29
Trouble Diagnosis 6-87

True 5-29
Type 5-29

U

Ubound 5-6, 5-29
Ucase 5-29
Undef 5-29
  array 5-6
  constant 5-3
Undistort image tool 3-75
Units per pixel 6-84
Unload
  button 3-7
  vision program 2-41
Unwrap tool 3-74
Update links button 3-21
USB camera
  assign 1-9, 2-29, 2-30
USB Hardware key 6-94
User
  add 2-13
  connections 2-6
  delete 2-14
  ID 2-13
  level 2-13
  modify 2-14
  multiple cameras 2-14
  password 2-14
User interface
  CPM 4-2
  VPM 3-2

V

Val 5-30
Variables 5-3
  declaring 5-3
Version
  checking 6-90
  software 3-10, 4-6, 6-90
Viewer
  threshold 6-22
Vision Device
  connect 1-4, 1-7
  date/time 2-7
  disable exit 6-41
  information 2-16
  locked 3-6
  security 4-116
Vision program
  compress files 3-9
  create 3-30
  security 3-32
Vision program load
  tool 3-286
Vision Program Manager
  See VPM
Vision program save tool 3-286
Vision program unload tool 3-287
VPM 3-1
  CPM link 4-13
  create a link 3-30
  delete a link 3-30
  image display 3-15
  link 3-28
  overview 3-2
  settings tab 2-1
  start 3-1
  task configuration 3-34
  task tree 3-14, 4-7
  tool properties 3-24
  toolbar 3-6
  toolbox 3-11
  tools 3-40
  user interface 3-2

W

Wait for Message tool 3-251
Web folder
  access 2-40
Week 5-10
Weekday 5-30
Weighted average 3-49
While 5-30
White balance 2-25
Wide edge point find tool 3-140
Window
  disable 6-38
  set location and size 6-43

X

X-axis, chart 4-90
XBar-R chart control 4-102
XML table control 4-105
XOR operator 5-5
X-Y projection tool 3-75

Y

Y-axis, chart 4-90, 4-104
Year 5-10, 5-30
Yearday 5-30
Yellow icons 3-40

Z

Zero, divide by 5-4
Zoom 3-17