REFERENCE MANUAL

> Impact+Object Detector™

DATALOGIC

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Impact+ Object Detector Reference Manual
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REFERENCES

Conventions

This manual uses the following conventions:

"User" refers to anyone using Impact+ Object Detector.
"Camera" refers to the camera that provides the product image.
"You" refers to the System Administrator or Technical Support person using this manual to install, configure, operate, maintain, or troubleshoot Impact+ Object Detector.

Reference Documentation

Other reference documentation may be available on the Datalogic web site (www.datalogic.com).

Support Through The Website

Datalogic provides several services as well as technical support through its website. Log on to www.datalogic.com and click on the SUPPORT > Machine Vision category link. From this page you can select your product model from the dropdown list which gives you access to:

- Downloads including Data Sheets, Manuals, Software & Utilities, and Drawings;
- Repair Program for On-Line Return Material Authorizations (RMAs) plus Repair Center contact information;
- Service Program containing details about Maintenance Agreements;
- Technical Support through email or phone.

Patents

This product is covered by one or more of the following patents:
U.S. patents: 6,512,218 B1; 6,616,039 B1; 6,808,114 B1; 6,997,385 B2; 7,102,116 B2; 7,282,688 B2
European patents: 999,514 B1; 1,014,292 B1; 1,128,315 B1.
Additional patents pending.

COMPLIANCE

For installation, use, and maintenance, it is not necessary to open the camera. Opening the camera will void the warranty.

Connect Ethernet and dataport connections to a network which has routing only within the plant or building and no routing outside the plant or building.

EMC Compliance

In order to meet the EMC requirements:

- connect the camera chassis to the plant earth ground by means of a flat copper braid shorter than 100 mm.
- for CBX connections, connect the terminal "Earth" to a good Earth Ground.
- for direct connections, connect the main interface cable shield to Chassis.

Power Supply

ATTENTION: READ THIS INFORMATION BEFORE INSTALLING THE PRODUCT

This product is intended to be installed by Qualified Personnel only. Refer to the P-Series Impact+ Object Detector Camera Quick Reference Guide for more information.

CE Compliance

CE marking states the compliance of the product with essential requirements listed in the applicable European directive. Since the directives and applicable standards are subject to continuous updates, and since Datalogic promptly adopts these updates, therefore the EU declaration of conformity is a living document. The EU declaration of conformity is available for competent authorities and customers through Datalogic commercial reference contacts. Since April 20th, 2016 the main European directives applicable to Datalogic products require inclusion of an adequate analysis and assessment of the risk(s). This evaluation was carried out in relation to the applicable points of the standards listed in the Declaration of Conformity. Datalogic S.r.l. products are mainly designed for integration purposes into more complex systems. For this reason it is under the responsibility of the system integrator to do a new risk assessment regarding the final installation.

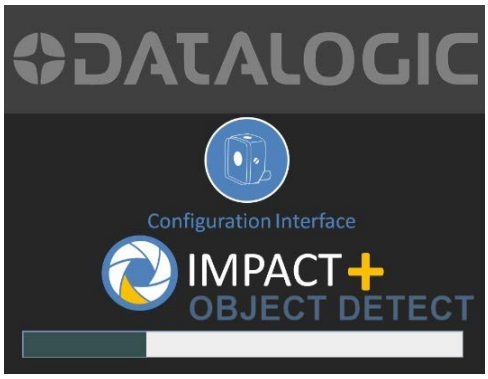
Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

STARTING THE OBJECT DETECTOR

To start the Object Detector

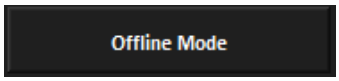
1. Find the Configuration Object Detector button that was installed on your desktop.
2. Double-click the button.
   The Configuration Interface loading screen is displayed while the program is loading.



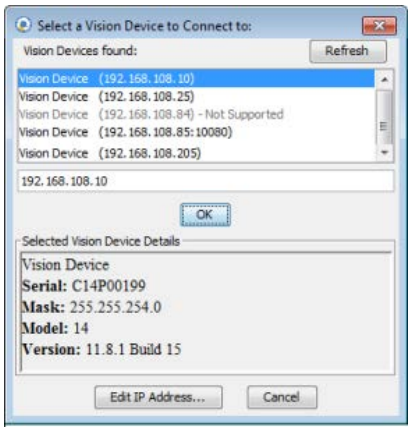
To Connect to a camera

1. When the interface has finished loading, the “Device Connection” screen is displayed.

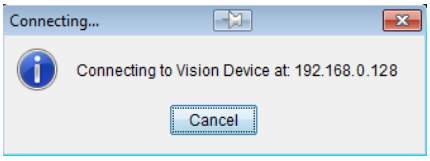
2. If you want to use the PC without a camera, click the Offline Mode button to work offline. A camera Emulator is started.



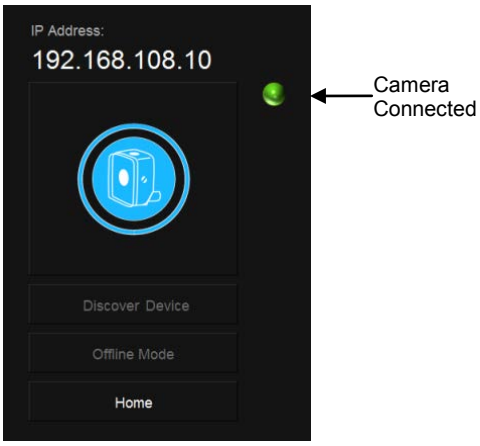
3. If you want to use a camera that is connected to the PC, click the Discover Device button to display a list of cameras in the “Device Selection” dialog.
   A. When the “Device Selection” dialog is displayed, click a camera in the list to select it. Click the OK button to connect to it.



4. During camera or Emulator connection, several “Connecting” messages are displayed.



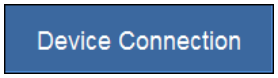
5. When all the connections are complete, the “Device Connection” screen is displayed with the green Camera Connected light blinking and the Home button enabled. Click the Home button.



Home Button Enabled

To Disconnect from a camera

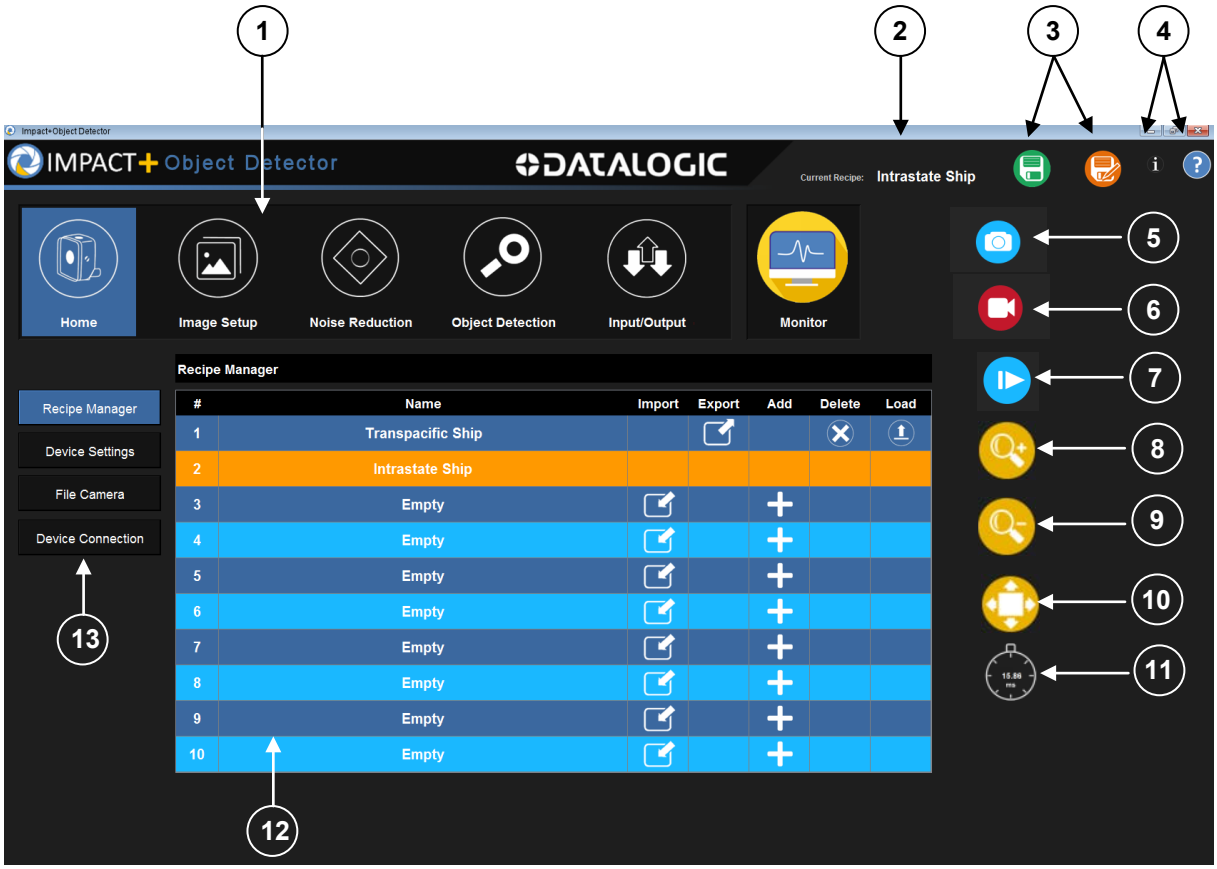
1. On the Home Screen, click the Device Connection button.



2. When the “Device Connection” screen is displayed, click the Camera Connection button.

CONFIGURATION INTERFACE

The Configuration Interface gives you access to all the functions available in the Object Detector application. When the Configuration Interface is started, the system monitor's resolution is detected and the scale and position of the screens is automatically calculated. As a result, the layout of some of the screens depicted here may vary. The minimum monitor resolution supported is 1024 x 768. Other resolutions may distort or limit the Configuration Interface.



Note: Not all buttons and functions appear on all screens

1. Main Menu — Click a button in the menu to select a function.
2. Current Recipe — Displays the name of the currently loaded recipe.
3. Save or Save As — Click the appropriate button to Save the currently loaded recipe.
4. About Impact+ Object Detector or Online Help — Click one of these buttons to display the current software version and camera IP Address or this manual.
5. Capture a single image — Click this button to capture one image.
6. Capture images continuously — Click this button to continuously capture images. Click again to stop capturing. Uses "software" triggers so hardware triggers are not required.
7. Go Online — Click this button to put the camera Online and capture images. Requires hardware triggers (except in File Camera mode).
8. Zoom In (magnify) — Click this button to increase image magnification. Use the scroll bars to view different areas of the image.
9. Zoom Out — Click this button to reduce image magnification.
10. Zoom to fit the image to the window — Click this button to increase or decrease image

magnification to fit in the image window.

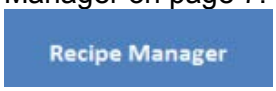
11. Processing Time — Includes the amount of time it takes for the camera to capture and inspect the image.
12. Recipe Select Area, Setup, and Image Display — This area includes the recipe select area on the Recipe Manager screen and the image display and tool setup on other screens.
13. Select Function — Function choices are available on the Home and Input/Output screens.

HOME OVERVIEW

The Home button displays the Home screen.

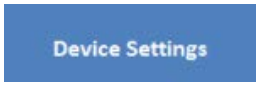
RECIPE MANAGER

The Recipe Manager lets you define custom-made vision inspections. Each recipe combines the settings from the Noise Reduction, Object Detection, and Input/Output sections. See Recipe Manager on page 7.



DEVICE SETTINGS

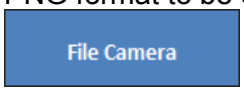
Device Settings lets you automatically save images, enable the on-screen (virtual) keyboard, load recipes when the camera starts, set the camera to Go Online when it starts, and enable File Camera Mode. See Device Settings on page 8.



FILE CAMERA

The File Camera is enabled on the Home Screen (see page 10) or when in Offline Mode (see To Connect to a camera on page 1).

File Camera lets you work with saved images. You can select previously captured images in PNG format to be displayed in the image window when the camera is triggered. See page 10.



DEVICE CONNECTION

Click this button to display the camera connection dialog. See “To Disconnect from a camera” on page 2.

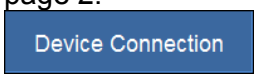


IMAGE SETUP OVERVIEW

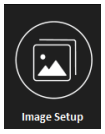
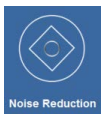


Image Setup is disabled if the Configuration Interface is in Offline Mode.

The Image Setup button lets you configure the hardware Trigger, Shutter Open Time, Offset, Gain, and Strobe lighting settings. See page 12.

NOISE REDUCTION OVERVIEW



The Noise Reduction button displays the morphology setup. Morphology lets you reduce the amount of noise (unwanted bright or dark spots) from the image.

OBJECT DETECTION OVERVIEW

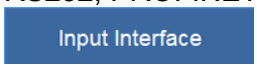
Click the Object Detection button to define Regions Of Interest (ROIs). These ROIs find bright or dark points in the image which indicate if there is an object in the image.

INPUT/OUTPUT OVERVIEW

The Input/Output button lets you configure the system inputs and outputs. You can enable various communication protocols and define messages that are sent to other devices on the network. Digital outputs can control external equipment. See page 23.

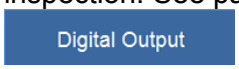
INPUT INTERFACE

The Input Interface section lets you enable and define communication protocols for TCP/IP, RS232, PROFINET, and EtherNet/IP. See page 23.



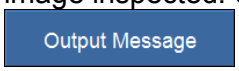
DIGITAL OUTPUT

In the Digital Output section, you define how the camera's digital outputs operate during the inspection. See page 26.



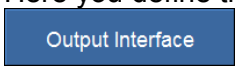
OUTPUT MESSAGE

In the Message Output section, you define a message to send to an external device for each image inspected. See page 26.



OUTPUT INTERFACE

Here you define the communication message protocols. See page 29.



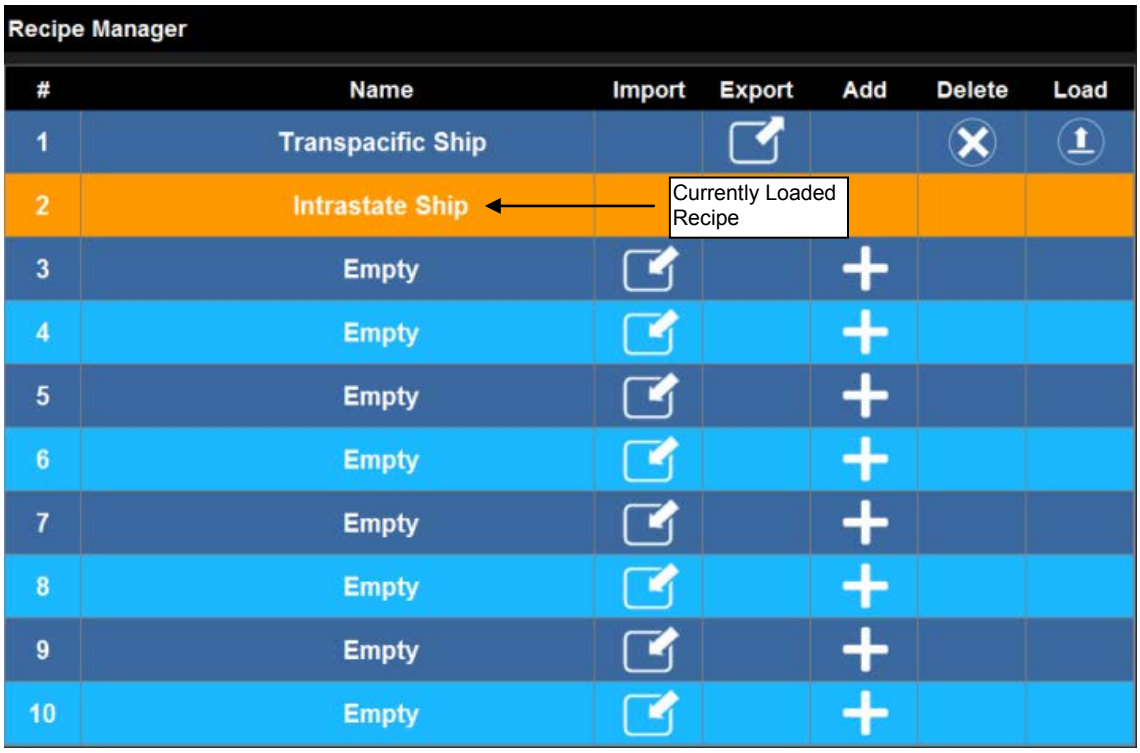
MONITOR OVERVIEW

The Monitor button lets you view inspection results and statistics. See page 30.

HOME SCREEN

RECIPE MANAGER

A recipe is a collection of settings that reside on the camera, including Noise Reduction, Object Detection, and Input/Output settings. The Recipe Manager screen lets you create, load, and delete recipes. The currently loaded recipe line is colored orange.

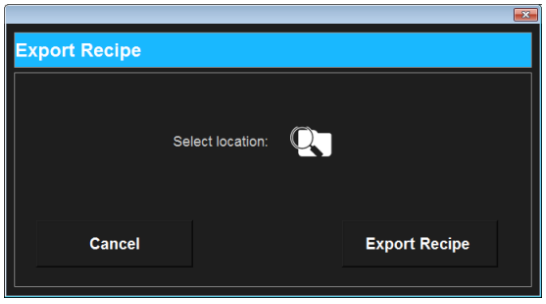


Recipe Manager

To Export an Existing Recipe

You cannot export the currently loaded recipe.

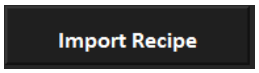
1. Click the Export Recipe button on the desired recipe.



2. Click the Select location button.
3. In the Save dialog, navigate to the desired folder, then click Save.
4. Click the Export Recipe button.

To Import a Recipe

You can import only to an empty recipe.

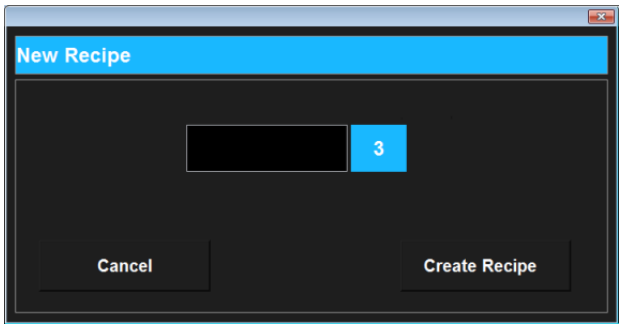
1. Click the Import Recipe button for the desired recipe.
2. Click the Select file button.
3. In the Open dialog, navigate to the desired folder, select the desired recipe file, then click Open.
4. Click the Import Recipe button. 

To Load an Existing Recipe

1. Click the Load Recipe button for the desired recipe.

To Create a New Recipe

1. Click the New Recipe button in the desired new recipe slot.
2. Enter the recipe name in the name field.
3. Click the Create Recipe button.



New Recipe

Be sure to Save the recipe after you make changes.

To Delete an Existing Recipe

You cannot delete the currently loaded recipe.

1. Click the Delete Recipe button for the desired recipe.

DEVICE SETTINGS

This section contains settings that control how the camera saves the images it inspects, whether the on-screen (virtual) keyboard is available, and whether the File Camera is enabled.

Image Saving

This section contains the function to save inspected images to the host PC.

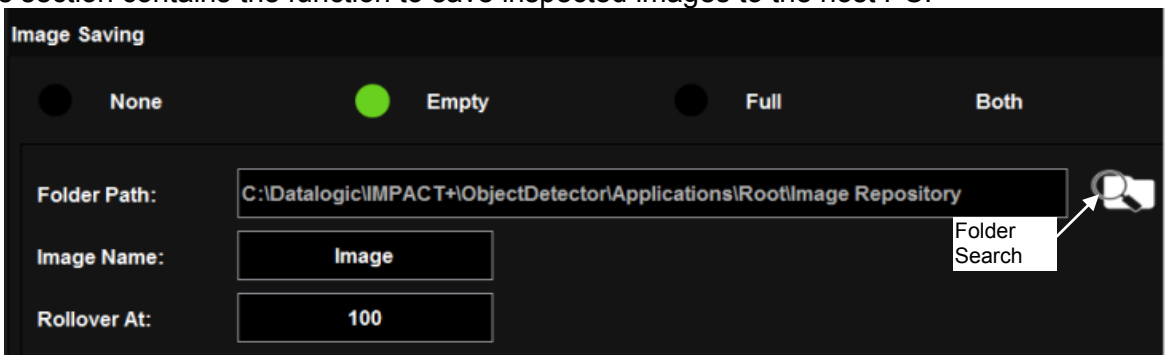


Image Saving Options

Image Type

Select an image type to enable automatic image saving. You can choose to automatically save images based on their Empty or Full inspection results, or save Both. When you change the Image Type, the saved image's name count restarts at "1."

Select None to disable automatic image saving.

Folder Path

Click the Folder Search button to navigate to the folder where you want the images to be saved.

Image Name

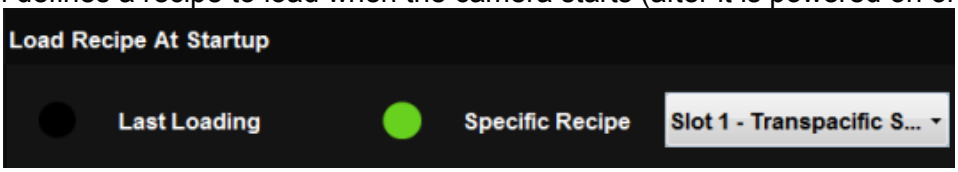
This is the first part of the name assigned to the saved image. The second part of the name is an incremental number ranging from one to the "Rollover at:" value. For example, if Image Name is "Image," and the "Rollover at" value is 999, the saved image's names will range from "Image001.png" to "Image999.png." Any existing image with the same name is overwritten.

Rollover at

This is the maximum number of images to save. When this count is reached, the value is reset to one. Any existing image with the same name is overwritten. This value also determines the number of digits in the image name. For example, if the Rollover at value is 10, the image names will range from "Image01.png" to "Image10.png."

Load Recipe At Startup

This section defines a recipe to load when the camera starts (after it is powered on or reset).



Last Loading

If Last Loading is selected, the recipe that was loaded when the camera was powered off or reset is loaded when it starts.

Specific Recipe

You can select an existing recipe to be loaded when the camera is powered on or reset.

To select a specific recipe to be loaded

1. Click the Specific Recipe radio button.
2. From the drop down, select the recipe you want the camera to load when it starts.

Online At Startup

When the camera is Online, it will capture an image when it receives a trigger signal (see Trigger On at page 12). If Online At Startup is selected, the camera will Go Online when it is powered on or reset.

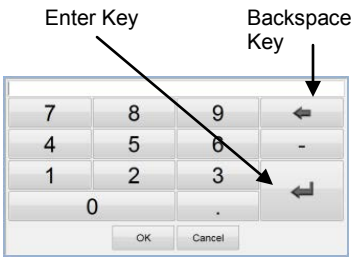
To put the camera Online when it starts

1. Click the On switch for Online At Startup.

Virtual Keyboard

This section turns on or off the on-screen (virtual) keyboard.

If the virtual keyboard is On, a numeric or alphanumeric keyboard is displayed when you select an input field, depending on the field type. When you click or press a key, that field receives the letter or number.



Alphanumeric Keyboard **Numeric Keyboard**

File Camera Mode

This section enables or disables File Camera Mode (see the next section). File Camera Mode is always enabled when the Configuration Interface is in Offline Mode, and this choice is not visible.

FILE CAMERA

The File Camera is enabled on the Home Screen – Device Settings (see page 10) or when in Offline Mode (see To Connect to a camera on page 1).

This section contains the functions to load images that are stored on the host PC. These images are displayed in the image window when the camera is triggered. This provides an easy way to define recipes with known good parts, then test the recipes with bad parts. The recipes can be exported, then imported to the camera.

File Camera

Add Images

Click to add up to two hundred images to the File Camera. Navigate to the images on the host PC using the file directory. Images must be greyscale in PNG format and exactly 1280 pixels wide by 1024 pixels high. Once they are added, thumbnails of the images are shown to the left of the File Camera image window. The images are “captured” and presented for inspection in thumbnail order.

Remove All

Click to remove all the images from the File Camera. The images are only removed from the File Camera, not from the source directory.

Remove

Select one or more images from the thumbnails to the left of the file camera image window. Click this button to remove the selected images from the File Camera.

Move Up/Down

The images are “captured” and presented for inspection in thumbnail order. To move an image up or down in order, select the image from the list, then click the Move Up or Move Down button.

DEVICE CONNECTION

Click this button to display the camera connection dialog. See “To Disconnect from a camera” on page 2.

IMAGE SETUP SCREEN

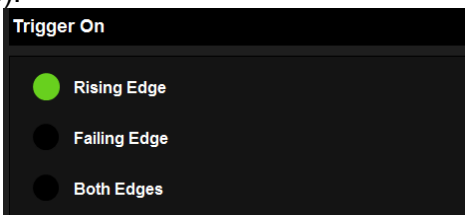
Image Setup is disabled if the Configuration Interface is in Offline Mode.

Trigger On

The camera must be triggered to make it capture an image. A “hardware” trigger, is an electrical signal wired to the camera’s trigger input. Refer to the P-Series Impact+ Object Detector Quick Start Guide for wiring information.
The Trigger On type determines how the camera responds to hardware Trigger input signals.

NOTE: The camera must be “Online” to respond to the Trigger input signals

- 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).



General

The Offset, Shutter, and Gain are displayed in the General area. Adjust the settings as necessary to provide a clear, well-illuminated image for inspection. These settings are saved with the recipe.

Offset

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

Gain

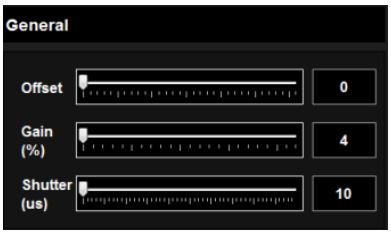
Gain adjusts the actual signal intensity from the camera. The recommended value is the minimum gain, which corresponds to 0% (0dB).

Shutter

The amount of time the shutter is open in microseconds (101-100,000). The higher the number, the longer the shutter is open and the brighter the image. This value is changed when the Lighting Pulse Value is changed (Pulse Value + 100; see Pulse on page 13).

To adjust the settings

1. Place the object to be inspected in front of the camera.
2. Click the Trigger Continuously button. The camera will continuously capture images of the object.
3. Type a value in each setting’s entry field, or slide the slider to the desired position.
4. Click the Stop button to stop continuous image capture.



Offset, Gain, and Shutter Adjustments

Lighting

If you need external inspection lighting that is controlled by the camera, connect it to Output 3 on the camera using an optional Datalogic CBX500 or CBX800 connection box, or a user-provided external cable and connector. See Mechanical Alignment on page 42 for mounting, alignment, and connection details.

Pulse

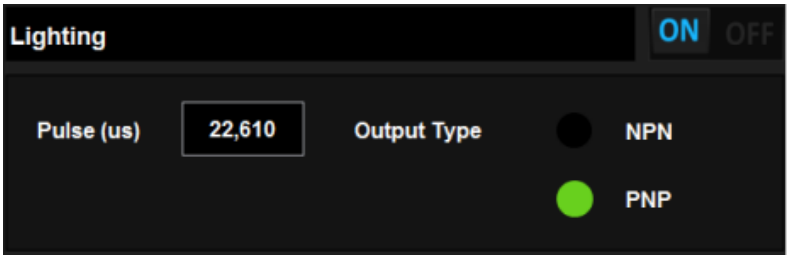
This determines how long (in microseconds) the external light should stay on (1-99,900). This value is changed when the Shutter Time value is changed (see Shutter on page 12).

Output Type

This determines the type of hardware output signal the external light needs - NPN (sinking) or PNP (sourcing). See Mechanical Alignment on page 42 for connection details.

To set up Lighting

1. Click the On switch for Lighting.
2. Enter a value for how long (in microseconds) the external light should stay on.
3. Select the type of hardware output signal the external light needs.



FOCUSING THE CAMERA

You may need to focus the camera in order to capture a clear, detectable image. You will need a stationary object in the camera's field of view.

To focus the camera

1. Place the object to be inspected in front of the camera at the desired distance.
2. Click the Trigger Continuously button. The camera will continuously capture images of the object.
3. Move the object or camera until the area you want to inspect is centered and approximately in focus. Secure the object and camera.
4. Turn the focus adjustment on the side of the camera until the image is focused.
5. Click the Stop button to stop continuous image capture.

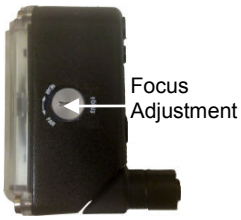


Image Capture Buttons

Capture Image
When you click the Capture Image button, one image is captured and displayed.

Trigger Image Continuously
When the Trigger Image Continuously button is active, the camera provides “software” triggers. This causes the camera to capture one image approximately every half-second without a hardware trigger input signal.

Pause Trigger Image Continuously
Click the Pause Trigger Image Continuously button to stop capturing images

A hardware trigger input signal should not be active while the Trigger Image Continuously button is active.

Go Online
When the Go Online button is active, the camera captures an image when a hardware trigger signal is received. To Go Online when the camera starts, see Online At Startup on page 9.

Pause Online
Click the Pause Online button to put the camera offline and stop capturing images.

NOISE REDUCTION SCREEN

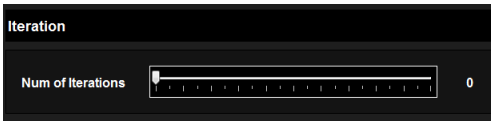
On this screen you can reduce the amount of noise (unwanted bright or dark spots) from the image using morphology. Morphology is the act of warping an image according to mathematically defined relationships. It can eliminate noise, smooth edges, join narrow gaps, and fill small holes on an image.

Iteration

This setting determines how many times (iterations) that the tool performs the operation on the image. Each iteration removes more noise from the image, but too many iterations can make the image impossible to inspect.

To adjust Number of Iterations

1. Click on the slider and drag it to the desired number or click on the mark for the desired setting on the scale.



Number of Iterations slider

Here is an example of an image with bright noise on a dark background with the noise reduced.

Image before Noise Reduction

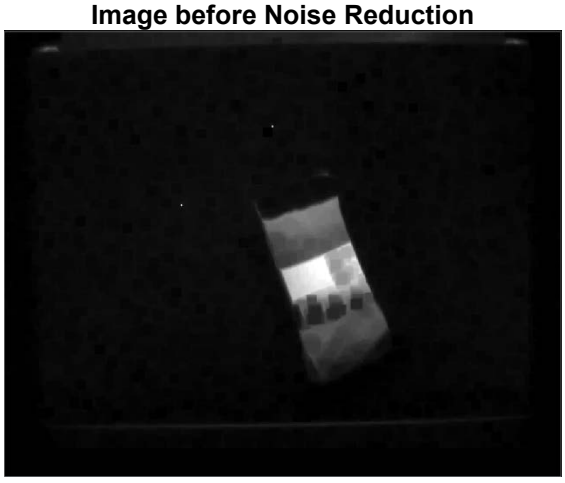
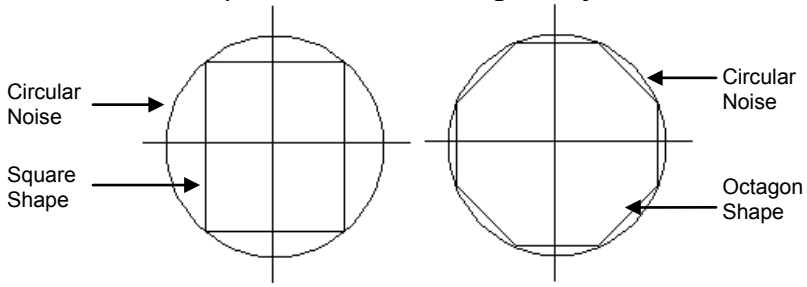


Image after five Iterations

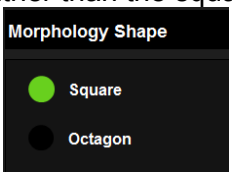
Morphology Shape

Morphology Shape defines the shape of the neighborhood around each pixel that is searched to reduce the noise. The choices are Square or 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), the Noise Reduction tool operates on a circular noise spot. With a square morphology shape, the tool tests all pixels in a square, centered on the hole. However, the number of iterations is limited 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.



An octagonal shape (the figure on the right.) will find those defects since it covers more of the area within the circular noise spot. The processing time is only slightly greater to accomplish the required iterations within the octagon rather than the square.



Be sure to save the recipe after you make changes.

Image Capture Buttons

Go Online

When the Go Online button is active, the camera captures an image when a hardware trigger signal is received. To Go Online when the camera starts, see Online At Startup on page 9.

Pause Online

Click the Pause Online button to put the camera offline and stop capturing images.

Capture Image

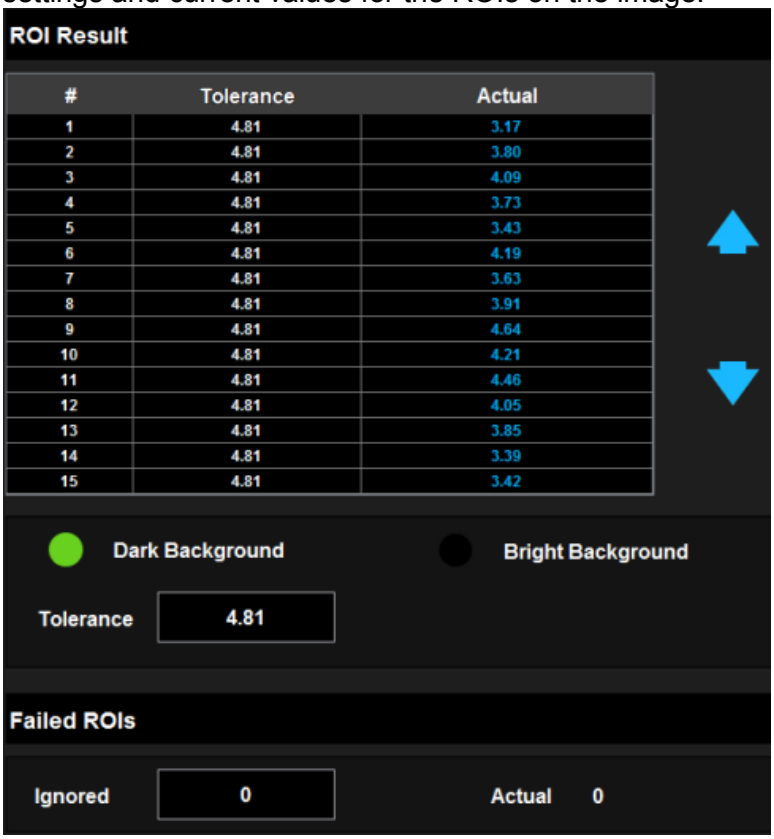
When you click the Capture Image button, one image is captured and displayed.

OBJECT DETECTION SCREEN

On this screen you define how objects are detected. Regions Of Interest (ROI) are created with a threshold so the tool can determine if any object is present. A “Full” ROI indicates an object was detected. If one or more objects are detected, the image is considered Full. If no objects are detected, the image is considered Empty.

ROI Result

This table lists the settings and current values for the ROIs on the image.



#

This is the ROI number in the image. ROIs are numbered in sequence on the image from left to right, top to bottom. You can select the ROI in the table or on the image. To scroll up or down in the table, click the up and down arrows to the right of the table.

Dark Background

If the background is darker than the object you are trying to find, select Dark Background.

Bright Background

If the background is brighter than the object you are trying to find, select Bright Background.

Tolerance

An ROI’s Actual value compared to the Tolerance value indicates whether an object was detected. On a Dark Background, an Actual value greater than or equal to the Tolerance value indicates a detected object. On a Bright Background, an Actual value less than or equal to the Tolerance value indicates a detected object. For example, on a Dark Background, with a Tolerance value of 10, any ROI with an Actual value greater than or equal to 10 will show as red (Full), indicating that it exceeded the Tolerance and an object is detected.

Failed ROIs

This table lists the settings and current values for the ROIs on the image. An ROI is considered Failed (Full) if its Actual value exceeds the Tolerance. One or more Failed ROIs in the image causes a Full Result.

Ignored

This is the number of Full ROIs in the image that should be ignored. When a Full ROI is ignored, it does not contribute to a Full Result. For example, if the Actual Full ROI value is 1 and the Ignored value is 1 or greater, the Result is Empty.

Actual

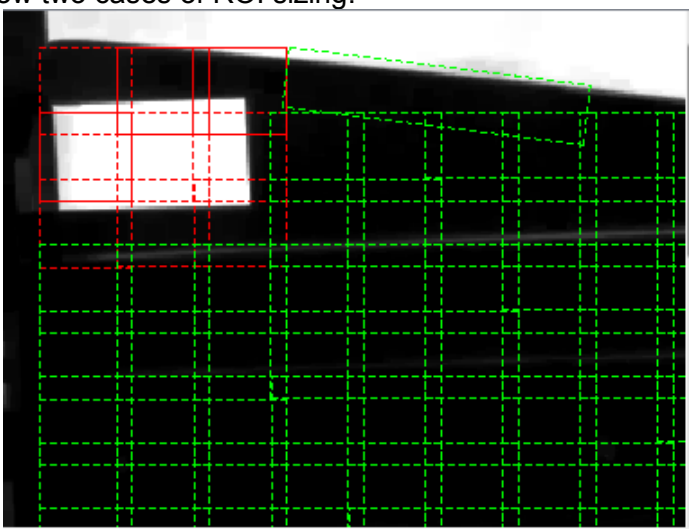
This is the number of ROIs with an Actual value that exceeded the Tolerance.

Creating ROIs

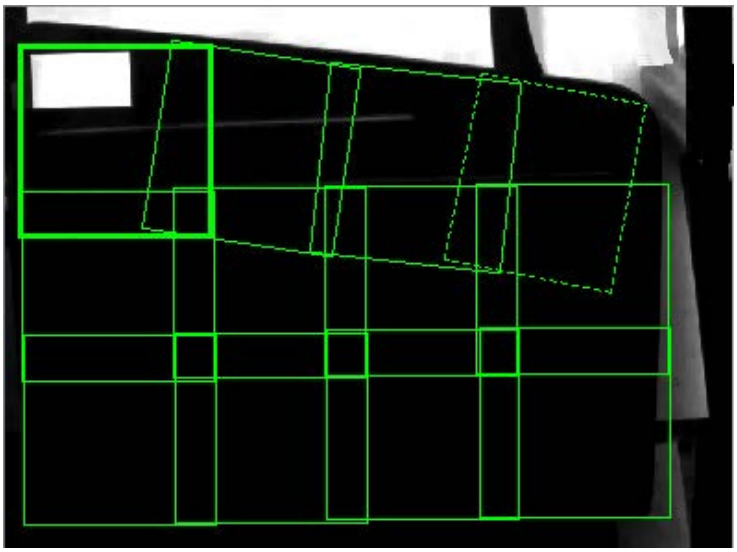
ROIs are created on the image in a grid pattern. Best results are obtained if ROIs are created using the following general rules.

- The ROI size should be about the size of the smallest object that is to be detected. Object detection is more sensitive with smaller ROIs.
- If ROIs are too small, they may cause false detection by detecting unwanted noise.
- If ROIs are too large, small objects may not be detected because the Actual value of pixel brightness within the ROI is lower, due to more background pixels in the average.
- ROIs should be overlapped about 10-20%.

The images below show two cases of ROI sizing.



Here the ROIs are correctly sized and overlapped for the object

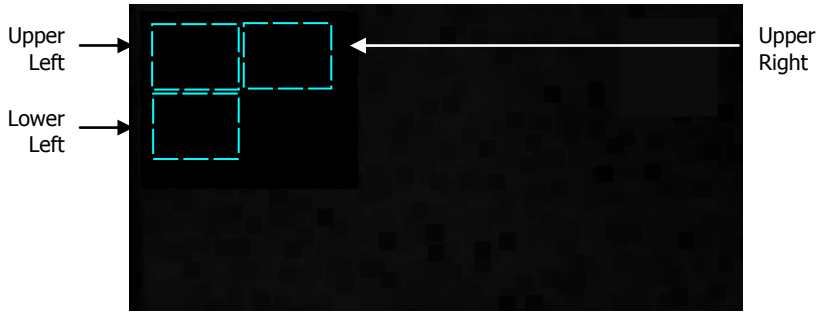


Here the ROIs are too large to detect the object

Important Note: The tray surface must be kept clean and free of debris for the Object Detector to function correctly. Bright objects (such as labels and other paper) that are left in the tray can cause false results. Keep the surface clean.

To create ROIs

1. In the image window, display an image with the desired Dark or Bright Background (an empty tray, for example). There should be no objects in the image.
2. Click the Create Grid of ROIs button. The Image window is displayed with three “Placement” ROIs. These ROIs are used to locate the extents of the ROI grid: upper-left, upper-right, and lower-left.

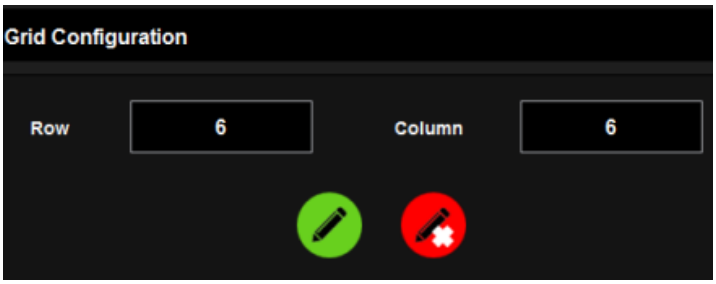


Dark Background image with initial Placement ROIs

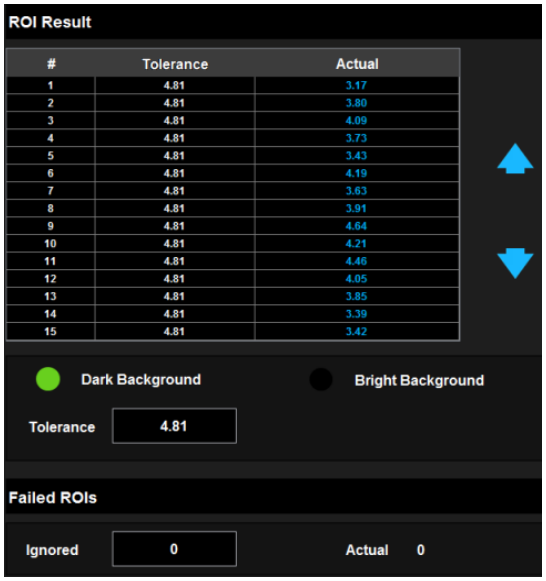
3. Move the Placement ROIs to their desired locations and size them. See To adjust the ROI on page 22. Remember that you can zoom in on the image to see greater detail.

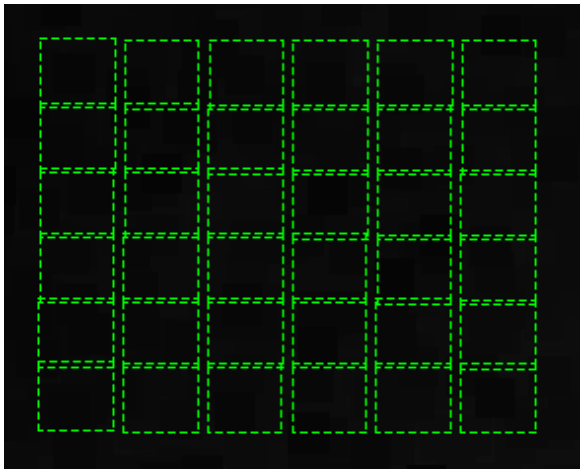
Dark Background image with arranged Placement ROIs

4. In the Grid Configuration dialog, enter the number of rows and columns of ROIs that you want to create on the image. This example shows six rows and six columns.



5. Click the Draw a Grid button. (To cancel drawing the grid, click the Cancel Draw a Grid button.)
   A grid of ROIs is drawn on the screen based on the location, size, and orientation of the Placement ROIs. This example shows six rows and six columns.





ROI Result table **ROI grid on the image**

6. Click the radio button to select the type of tray being used, Dark or Bright.

   B. Dark Background: If the tray is darker than the object you are trying to find in the tray, select Dark Background.

C. Bright Background: If the tray is brighter than the object you are trying to find in the tray, select Bright Background.

7. The ROI Result table is filled with the order number of the created ROIs and their Actual brightness or darkness (depending on the background type).
8. The Tolerance value is calculated automatically based on the selected background type and the its brightness. You can adjust the Tolerance value, if needed, to detect more or fewer objects. The value is common to all the ROIs. See ROI Result on page 17.
9. You can move or resize the ROIs to detect more or fewer objects, if needed. See To adjust the ROI on page 22.

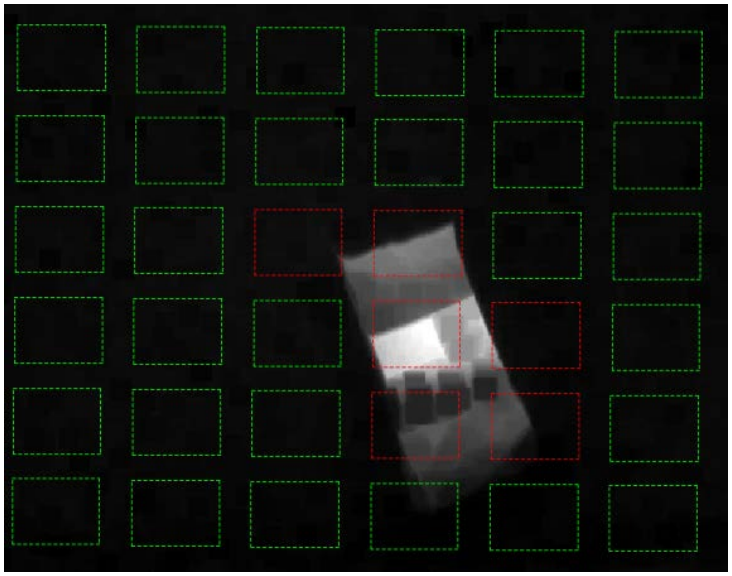


Image showing object detected

Be sure to save the recipe after you make changes.

Warning: If there are no ROIs selected when the Delete ROI button is clicked, ALL ROIs are deleted.

To delete one ROI

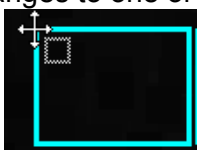
1. Select the desired ROI in the image window or in the ROI Result table. The selected ROI is displayed as a dashed line.
2. Click the Delete ROIs button.

To delete all ROIs

1. Click anywhere in the image window without selecting an ROI. There should be no ROIs selected.
2. Click the Delete ROIs button.

To adjust the ROI

To resize, move, or rotate the ROI, move the cursor around the ROI border. When the cursor changes to one of these types, click and drag the cursor and ROI to the desired place or size.



Move	Resize	Rotate

ROI selected with Move cursor

Image Capture Buttons

Capture Image

When you click the Capture Image button, one image is captured and displayed.

Trigger Image Continuously

When the Trigger Image Continuously button is active, the camera provides “software” triggers. This causes the camera to capture one image approximately every half-second without a hardware trigger input signal.

Pause Trigger Image Continuously

Click the Pause Trigger Image Continuously button to stop capturing images.

A hardware trigger input signal should not be active while the Trigger Continuously button is active.

Go Online

When the Go Online button is active, the camera captures an image when a hardware trigger signal is received. To Go Online when the camera starts, see Online At Startup on page 9.

Pause Online

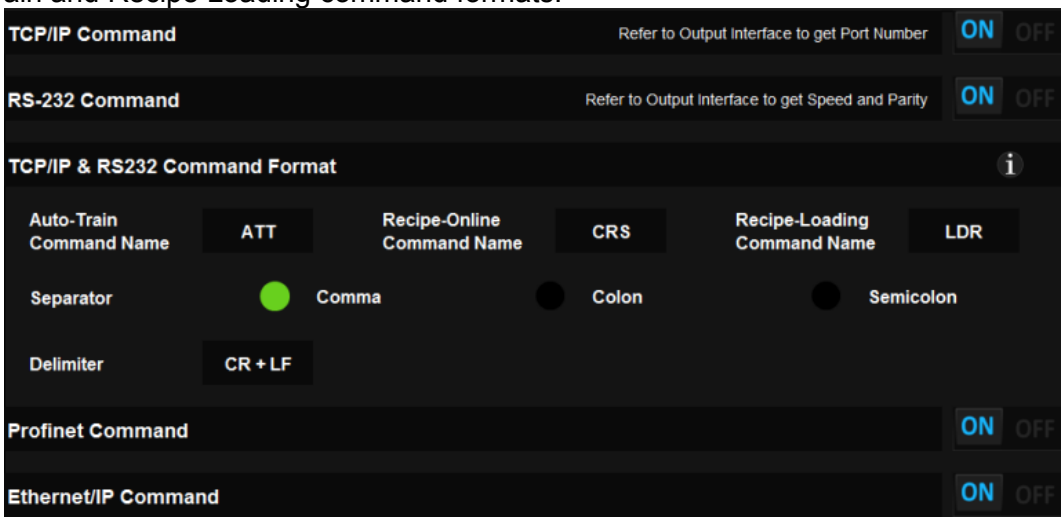
Click the Pause Online button to put the camera offline and stop capturing images.

INPUT/OUTPUT SCREEN

This screen lets you enable an Auto-Train function input and define a message to be sent over TCP/IP and Serial outputs for each image inspected. A number that represents the inspection result is always included in the message.

INPUT INTERFACE

You can enable TCP/IP, RS232, PROFINET, and EtherNet/IP input commands and define the Auto-Train and Recipe Loading command formats.



TCP/IP Command

If this option is enabled, the camera can send and receive commands that use TCP/IP protocol. Configure the TCP/IP port on the Output Interface screen (see page 29).

RS232 Command

If this option is enabled, the camera can send and receive commands that use RS232 protocol. Configure the RS232 port on the Output Interface screen (see page 29).

TCP/IP & RS232 Command Format

If the TCP/IP or RS232 Command option is enabled, this section defines the command format for the Auto-Train and Recipe-Loading commands for TCP/IP and RS232.

Auto-Train Command Name

The default string “ATT” cannot be changed. During Auto-Train, the camera captures images and calculates the maximum (for Dark Background) or minimum (for Bright Background) Tolerance value for each ROI based on the Actual value. When Auto-Train is complete, the recipe is automatically saved.

Recipe-Online Command Name

The default string “CRS” cannot be changed. The Recipe-Online command causes the camera to go Online or Offline.

Recipe-Loading Command Name

The default string “LDR” cannot be changed. The Recipe-Loading command causes the camera to load the specified recipe when the command is received from an external device.

Separator

Select the Separator character. This character is inserted in the command between the message parts.

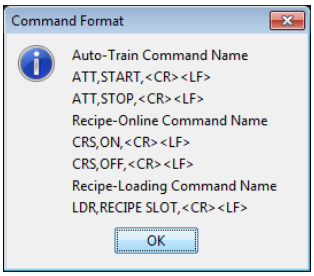
Delimiter

The delimiter characters are the ASCII characters “CR” and “LF” and cannot be changed.

To set up Auto-Train for TCP/IP and/or RS232

1. Click the On switch for TCP/IP Command or RS232 Command.

2. Select the Separator character.
3. The Command Name is fixed as “ATT” and the Delimiter is fixed as the ASCII characters “CR” (hexadecimal 0D) and “LF” (hexadecimal 0A).
4. The message from the external device must contain the appropriate command to start or stop training as represented by the text “START” or “STOP” (without quotes) in the Command Format (click the information icon to the right).



Command Format

TCP/IP and RS232 Auto-Train Command Structure

Header	Separator	Body	Separator	Delimiter
Fixed	Choose One	Starts or Stops Auto-Train		Fixed
ATT	Comma	The text START or STOP	Comma	(CR)(LF)
	Semicolon		Semicolon	
	Colon		Colon	

For example, this command starts the Auto-Train function:
ATT,START,(CR)(LF)

Auto-Train Error Messages

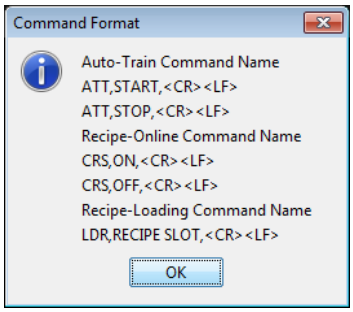
When the Auto-Train command is received by the camera, one of the following acknowledgment responses is returned.

- OK: The correct command was received.
- ERR1: [Auto-Train] The parameters is invalid.
- ERR2: [Auto-Train] Couldn't run the auto-train because of no any ROI in Object Detection tab.
- ERR9: The command line is wrong format.
- ERR10:TCP/IP or RS232 Serial Port communication protocol is OFF.

To set up Recipe-Online for TCP/IP and/or RS232

1. Click the On switch for TCP/IP Command or RS232 Command.

2. Select the Separator character.
3. The Command Name is fixed as “CRS” and the Delimiter is fixed as the ASCII characters “CR” (hexadecimal 0D) and “LF” (hexadecimal 0A).
4. The message from the external device must contain the appropriate command to put the camera Online or Offline as represented by the text “ON” or “OFF” (without quotes) in the Command Format (click the information icon to the right).



Command Format

TCP/IP and RS232 Recipe-Online Command Structure

Header	Separator	Body	Separator	Delimiter
Fixed	Choose One	Puts the camera Online or Offline.		Fixed
CRS	Comma	The text ON or OFF	Comma	(CR)(LF)
	Semicolon		Semicolon	
	Colon		Colon	

For example, this command puts the camera Online.
CRS,ON,(CR)(LF)

Recipe-Online Error Messages

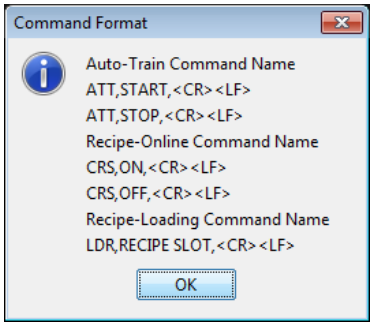
When the Recipe-Online command is received by the camera, one of the following acknowledgment responses is returned.

- OK: The correct command was received.
- ERR7: [Recipe-Status] Couldn't go online because of no any ROI in Object Detection tab
- ERR8: [Recipe-Status] The parameter is invalid.
- ERR9: The command line is wrong format.
- ERR10:TCP/IP or RS232 Serial Port communication protocol is OFF.

To set up Recipe-Loading for TCP/IP and/or RS232

1. Click the On switch for TCP/IP Command or RS232 Command.

2. Select the Separator character.
3. The Command Name is fixed as “LDR” and the Delimiter is fixed as the ASCII characters “CR” (hexadecimal 0D) and “LF” (hexadecimal 0A).
4. The message from the external device must contain the appropriate recipe number as represented by the text “Recipe Slot” in the Command Format (click the information icon to the right).



Command Format

TCP/IP and RS232 Recipe-Loading Command Structure

Header	Separator	Body	Separator	Delimiter
Fixed	Choose One	Loads recipe in the slot number specified by this integer.		Fixed

LDR	Comma Semicolon Colon	Integer number from 1 to 10	Comma Semicolon Colon	(CR)(LF)

For example, this command loads the first recipe in the recipe list (slot number 1).
LDR,1,(CR)(LF)

Recipe-Loading Error Messages

When the Recipe-Loading command is received by the camera, one of the following acknowledgment responses is returned.

- OK: The correct command was received.
- ERR3: [Recipe-Loading] Invalid slot, it must be in range [1, 10]
- ERR4: [Recipe-Loading] Invalid slot, it is an empty.
- ERR5: [Recipe-Loading] The recipe has been loaded already.
- ERR9: The command line is wrong format.
- ERR10:TCP/IP or RS232 Serial Port communication protocol is OFF.

PROFINET Command

If this option is enabled, the camera can send and receive commands that use PROFINET protocol.

To set up Auto-Train for PROFINET

1. Click the On switch for PROFINET Command.

2. To start Auto-Train, configure the PLC to write the value “1” to the 4th User Data area in the assembly object structure. See page 32.
3. To stop Auto-Train, configure the PLC to write the value “2” to the 4th User Data area in the assembly object structure. See page 32.

To set up Recipe-Online for PROFINET

1. Click the On switch for PROFINET Command.

2. To put the camera Online, configure the PLC to write the value “1” to the 5th User Data area in the assembly object structure. See page 32.
3. To put the camera Offline, configure the PLC to write the value “2” to the 5th User Data area in the assembly object structure. See page 32.

To set up Recipe Loading for PROFINET

4. Click the On switch for PROFINET Command.

5. Configure the PLC to write the desired Recipe Slot Number to the 3rd User Data area in the assembly object structure. See page 32.

EtherNet/IP Command

If this option is enabled, the camera can send and receive commands that use EtherNet/IP protocol.

To set up Auto-Train for EtherNet/IP

1. Click the On switch for EtherNet/IP Command.

2. Configure the PLC to write the value “1” to the 4th User Data area in the assembly object structure to start Auto-Train. See page 32.
3. Configure the PLC to write the value “2” to the 4th User Data area in the assembly object structure to stop Auto-Train. See page 32.

To set up Recipe-Online for EtherNet/IP

1. Click the On switch for EtherNet/IP Command.

2. To put the camera Online, configure the PLC to write the value “1” to the 5th User Data area in the assembly object structure. See page 32.
3. To put the camera Offline, configure the PLC to write the value “2” to the 5th User Data area in the assembly object structure. See page 32.

To set up Recipe Loading for EtherNet/IP

1. Click the On switch for EtherNet/IP Command.

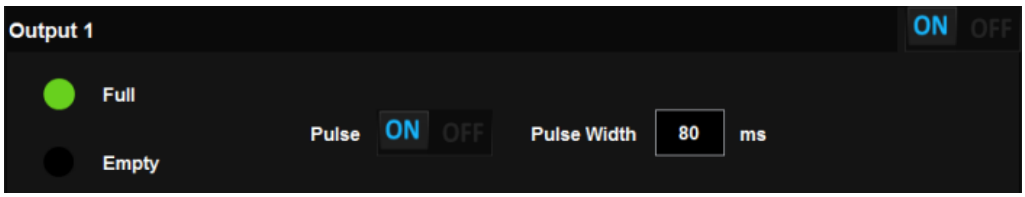
2. Configure the PLC to write the desired Recipe Slot Number to the 3rd User Data area in the assembly object structure. See page 32.

DIGITAL OUTPUT

Here you can enable the camera outputs to turn on, turn off, or pulse.

To set up Output 1

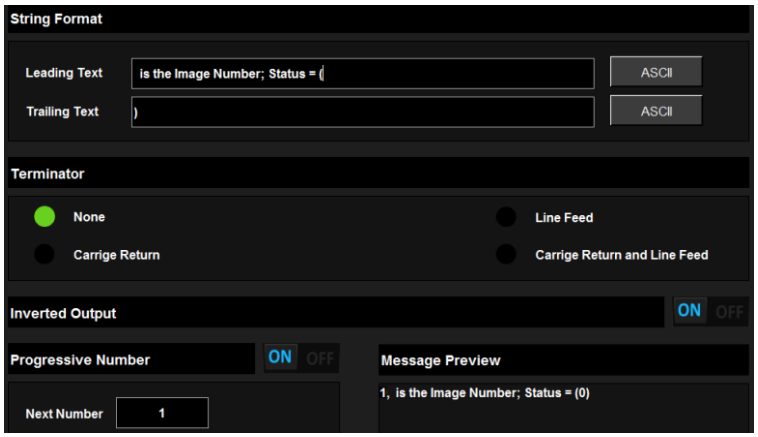
1. Click the On switch for Output 1.
2. Select the condition, Full or Empty, for when the output should turn on or pulse. For instance, if you select Full, the output will turn on or pulse when an object is detected. The output will turn off when the next inspection starts, if pulse is not turned on.
3. If you want the output to pulse on, then off, turn on the Pulse switch and enter a value in the Pulse Width field. The value indicates how long (in milliseconds) Output 1 will stay on.



To set up Output 2

1. Click the On switch for Output 2.
2. This output will turn on and off based on the selected state of the camera.
   D. Toggle: The output turns on during one inspection and off during the next inspection.
   E. Busy: The output turns on while the camera is busy capturing an image and inspecting it. (The opposite of Ready.)
   F. Ready: The output turns on when the camera is ready to capture an image. (The opposite of Busy.)
   G. Alive: The output turns off during a system reboot. It turns on after the reboot is complete and remains on until the next reboot.

OUTPUT MESSAGE



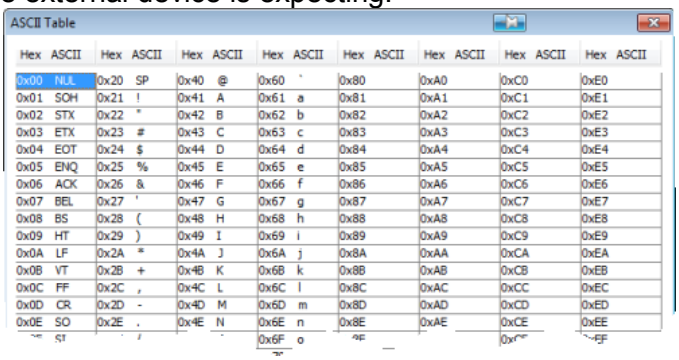
String Format

Leading Text

Enter the text to add at the beginning of the output message before the inspection result, if desired.

ASCII

Click the ASCII button, then select the type of delimiter character(s) to add to the end of the Leading Text. A character is added each time you select it. The delimiter must match the type of delimiter the external device is expecting.



Trailing Text

Enter the text to add at the end of the output message after the inspection result, if desired.

ASCII

Click the ASCII button, then select the type of delimiter character(s) to add to the end of the Trailing Text. A character is added each time you select it. The delimiter must match the type of delimiter the external device is expecting.

Terminator

Select the ASCII character(s) to add to the end of the message. This can be None, the ASCII character “Carriage Return” (hexadecimal 0D), the ASCII character “Line Feed” (hexadecimal 0A), or both “Carriage Return” and “Line Feed”. The Terminator must match the type of Terminator the external device is expecting.

Inverted Output

When the Inverted Output is turned on, the inspection result number is inverted before it is displayed in the output message. For example, when Inverted Output is turned off, and the inspection result is Full, the number “0” is displayed in the output message. When Inverted Output is turned on, and the inspection result is Full , the number “1” is displayed in the output message. This setting has no effect on the inspection’s Full or Empty result as displayed on the Monitor Screen.

Progressive Number

After the inspection is complete, the number in the Number field is incremented then inserted (followed by a comma) in the Output Message before the Trailing Text.

Message Preview

The fully assembled message is displayed here, in the following order, based on the previous selections:

“Progressive Number,” “Leading Text” “ASCII” “Inspection Result” “Trailing Text” “ASCII” “Terminator”

OUTPUT INTERFACE

TCP/IP Output

Port Number

When the TCP/IP Output is turned on, this is the camera Ethernet port number where the camera “listens” for a TCP/IP command. When a command is received on this port, the command processor evaluates and executes it.

RS232 Output

Speed

This sets the camera’s data transmission rate for serial communication.

Parity

This sets the camera’s data transmission parity type for serial communication.

PROFINET Output

When the PROFINET Output is turned on, the camera “listens” for a PROFINET command. When a command is received, the command processor evaluates and executes it.

Station Name

This sets the camera’s name for PROFINET communications.

EtherNet/IP Output

When the EtherNet/IP Output is turned on, the camera “listens” for a TCP/IP command. When a command is received, the command processor evaluates and executes it.

MONITOR SCREEN

This screen provides an overview of the inspection results.

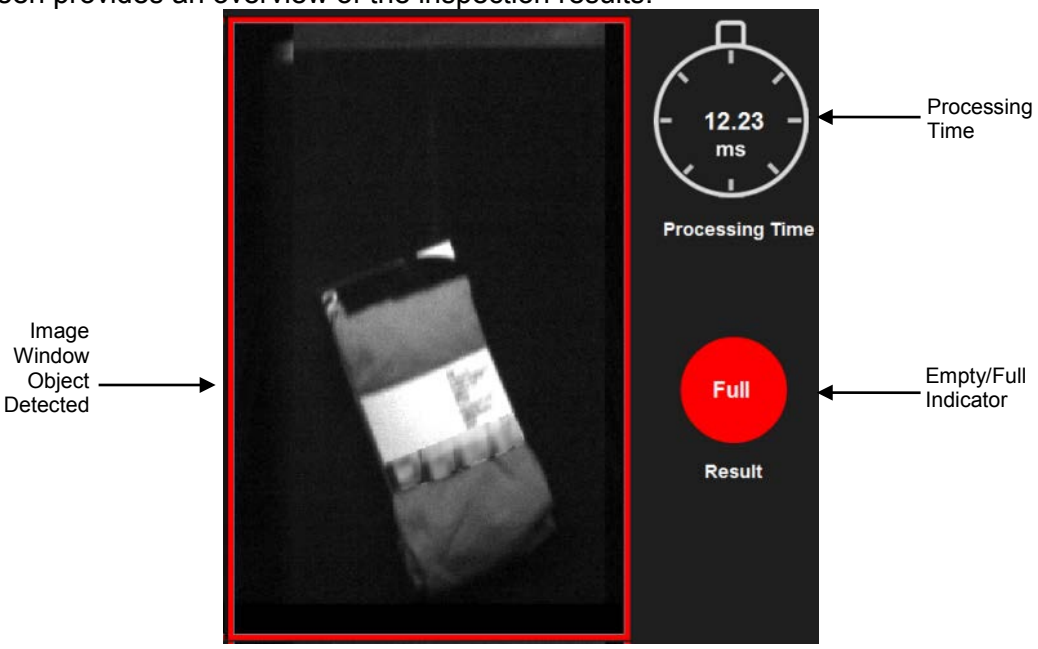


Image Window

The Image window displays the image currently being inspected.

Empty/Full Indicator

If an object is detected, the Empty/Full Indicator is displayed in red with the text “Full.” If no object is detected, it is displayed in green with the text “Empty.”

Processing Time

Processing time includes the amount of time it takes for the camera to capture and inspect the image.

Go Online

File Camera Mode

In File Camera Mode, when the Go Online button is active, the camera provides “software” triggers. This causes the camera to capture one image approximately every half-second without a hardware trigger input signal.

Live Mode

In Live Mode, when the Go Online button is active, the camera captures an image when a hardware trigger signal is received. To Go Online when the camera starts, see Online At Startup on page 9.

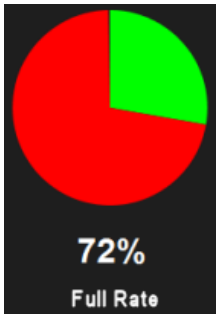
Pause Online

Click the Pause Online button to stop capturing images.

Statistic Data

Full Rate

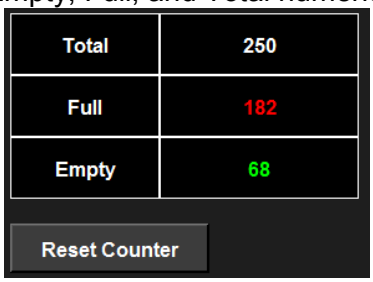
The Full Rate is the percentage of Full tray inspections out of Total inspections since the last time the counter was reset or the current recipe was loaded. The inspection result is Full if any object is detected in the tray.



Full Rate

Numerical Display

The numerical display shows an Empty, Full, and Total numerical count.



Numerical Display

RESET COUNTER

Click Reset Counter to reset all counter values to zero.

Message Out

The Message Out window shows the message that was defined on the Input/Output screen (see page 23).

ETHERNET/IP AND PROFINET ASSEMBLY OBJECT STRUCTURE

Impact+ Object Detector is EtherNet/IP and PROFINET compatible. EtherNet/IP is an industrialized extension of Ethernet TCP/IP communications. It is used for transferring automation data and control between network devices. Every network device represents itself as a series of objects. Each object is simply a grouping of the related data values in a device.
PROFINET is the communication standard for automation of PROFIBUS & PROFINET International (PI). It represents an open standard for industrial Ethernet.
Impact+ Object Detector uses explicit messaging (the data format is explicitly defined in the message) which implements a Client/Server relationship and requires a TCP/ IP connection.

Implicit Assembly Functionality

Impact+ Object Detector uses 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 and PROFINET 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 Input Control Word Bits description table below
1	Reserved	Reserved	Reserved	Reserved	Reserved
2	Shutter Time	Real	Write	100-100000	Set shutter time to this value. Zero is no operation. Camera must be Online.
3-9	Reserved	Reserved	Reserved	Reserved	Reserved
10	Load Recipe Number	Real	Write	1-10 (slot must contain a defined recipe)	Loads the recipe which resides in the indicated slot number. (e.g. the value 4 loads the recipe from slot number 4). Loads only when data changes. Camera must be Online
11	Auto-Train	Real	Write	0, 1, 2	0 - No Operation 1- Start Auto-Train 2 - Stop Auto Train Camera must be Online
12	Recipe-Online	Real	Write	0, 1, 2	0 – No Operation 1 – Put Camera Online 2 – Put Camera Offline

Input Control Word Bits (Command)

Bit	Name	Data Type	Read/Write	Valid Data	Description
0	Online Control	Boolean	Write	0, 1	0 - Set camera Offline, 1 - Set Camera Online.
1	Trigger	Boolean	Write	0, 1	Change of value from 0 to 1 fires Camera Trigger
Remaining Bits	Reserved	Reserved	Reserved	Reserved	Reserved

Output Words (Status)

Bit	Name	Data Type	Read/Write	Description

Bit	Name	Data Type	Read/Write	Description
0	Output Control Word	Real	Read	See Output Control Word Bits description table below
1	Reserved	Reserved	Reserved	Reserved
2	Shutter Time Status	Real	Read	Current Shutter Time Value
3-9	Reserved	Reserved	Reserved	Reserved
10	Load Recipe Status	Real	Read	n - Recipe Slot Loaded Successfully -1 - Recipe Slot Loading -2 - Recipe Load Failed
11	Auto-Train	Real	Read	1 - Auto-Train Active 2 - Auto-Train Inactive
12	Recipe-Online	Real	Read	1 – Camera Online 2 – Camera Offline

Output Control Word Bits (Command)

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
2-9	Reserved	Reserved	Reserved	Reserved
10	Camera Connected	Boolean	Read	0 = Not Connected, 1 = Connected
11-13	Reserved	Reserved	Reserved	Reserved
14	Trigger Overrun	Boolean	Read	True = the trigger rate exceeded the camera's frames per second capability

CAMERA NOT RESPONDING

Occasionally the Configuration Interface may display this message. This can occur when one of the following conditions exist.

- The camera trigger rate is close to or exceeds the inspection processing time.
- The camera cable has become disconnected.
- The camera power has been turned off.

HARDWARE INSTALLATION AND CONFIGURATION

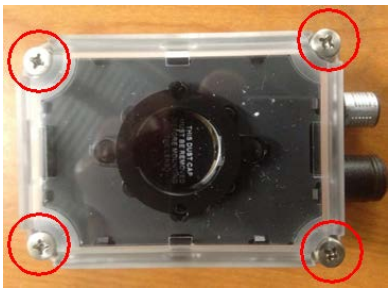
This section contains details for installing and configuring the camera, mounting, lighting, and other hardware for the Object Detector.

IMPORTANT: Disconnect power from the camera before removing the cover.

P14 Camera Setup

Installing the P14 camera lens

1. Remove the four lens cover screws and carefully remove the cover. Be sure the sealing gasket stays with the cover. (Caution: these are not captive screws.)



2. Carefully remove the dust cover from the lens access port.

3. The lens assembly and filter housing can be found in a separate box from the camera. Discard the filter housing that is included with the lens. A different housing will be used.

Discard this filter housing

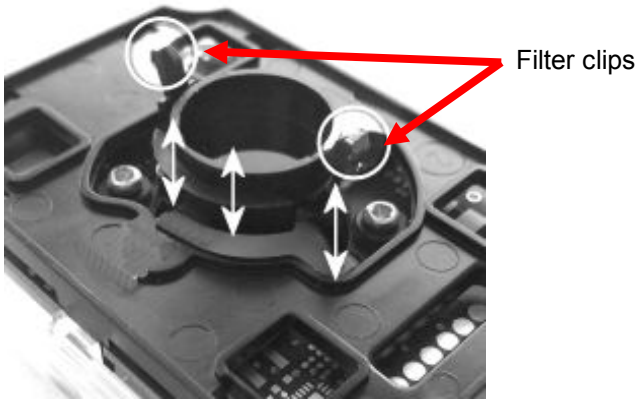
Lens Assembly

4. Install the lens in the camera.
   A. Align the tabs on the lens with the notches in the lens housing.
   B. Grasp the lens firmly, then press in until the lens stops moving.
   C. Turn the lens 90º clockwise.
   D. Release the lens.
   E. When the lens is mounted correctly, it should not turn in the housing.

5. Find the band pass filter. The filter can be found in a separate box from the lens assembly.

Band pass filter

6. Install the band pass filter.
   A. Line up the clips on the filter with the notches in the cover.
   B. Gently squeeze the clips on each side of the filter while you gently press straight down on the filter.

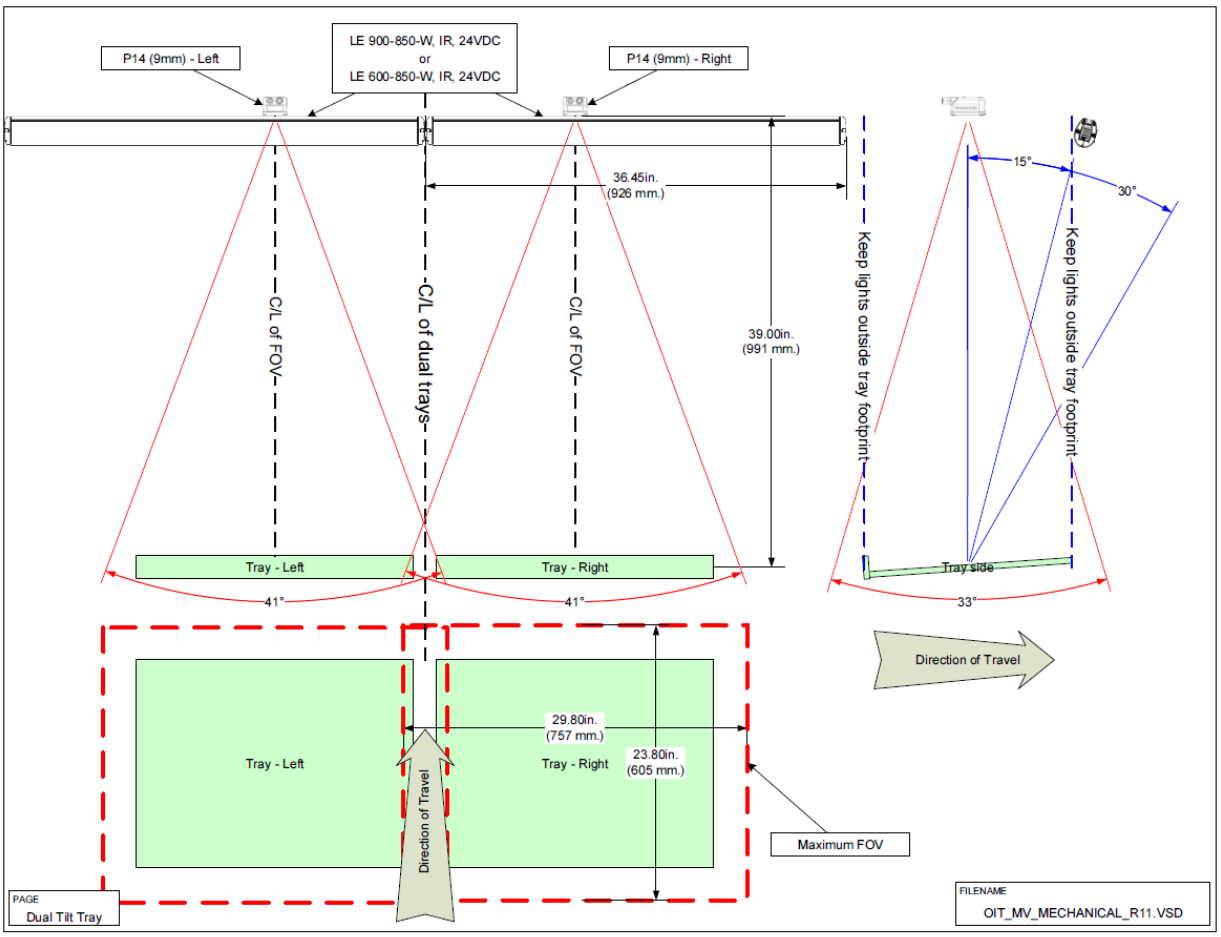


Tilt-Tray Machine Vision Equipment Mounting Positions

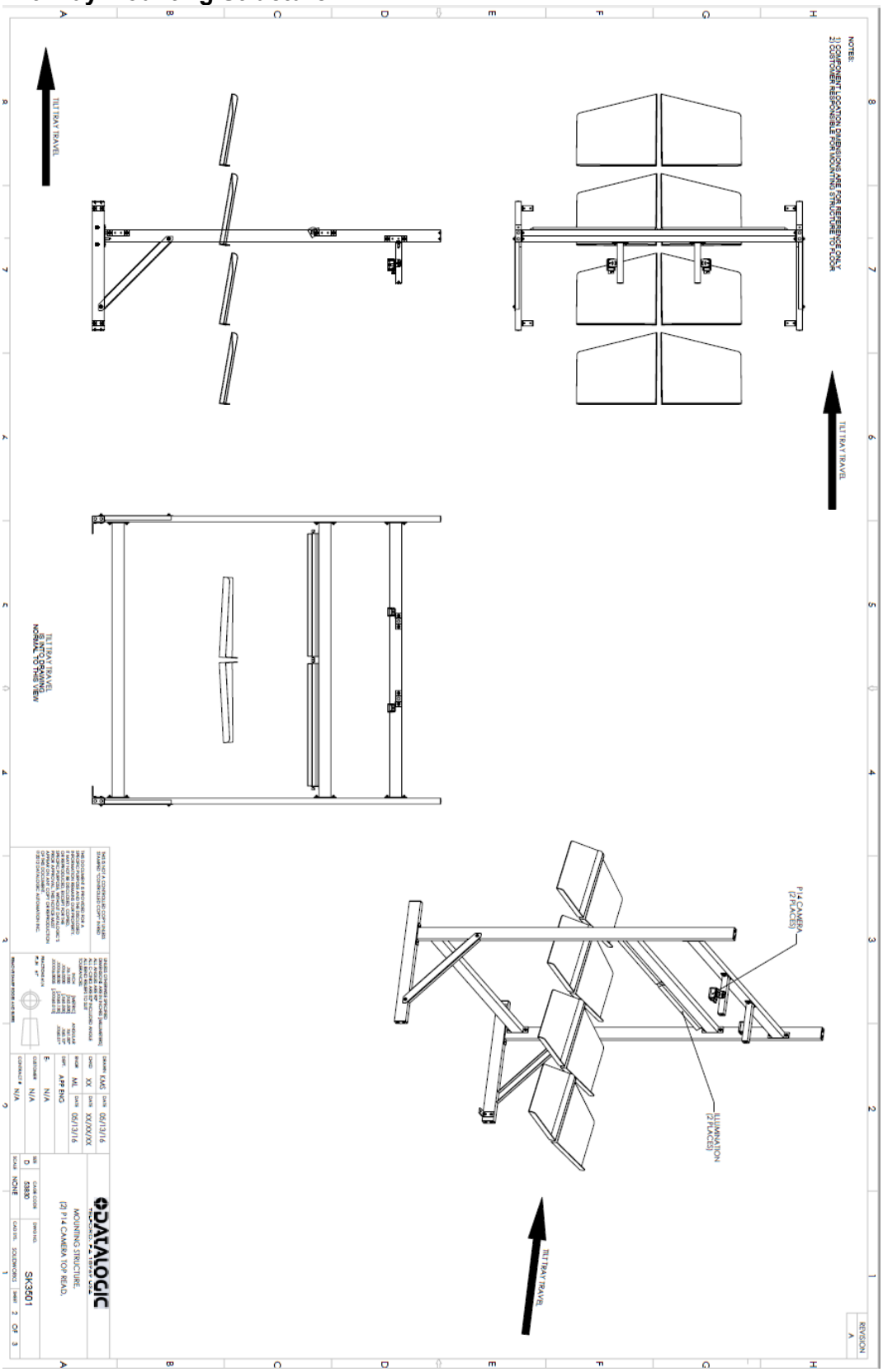
The drawings below illustrate the typical mounting dimensions and locations for the P14 camera(s) and the Infrared illuminator light assembly(s) for the given Field Of View (FOV) on Tilt-Tray equipment.

This is a starting point. The final mounting position of the machine vision equipment may be affected by many variables including the ambient light in the environment, the available conveyor space, the sorting equipment surface finish, etc…

Datalogic's Optics Calculator (available for download from the web site) can be used to determine the correct FOV or Working Distance (WD). When you enter values in the calculator, add 50 millimeters (2 inches) to the Field of View (X) dimension to insure complete FOV coverage.



Tilt-Tray Mounting Structure

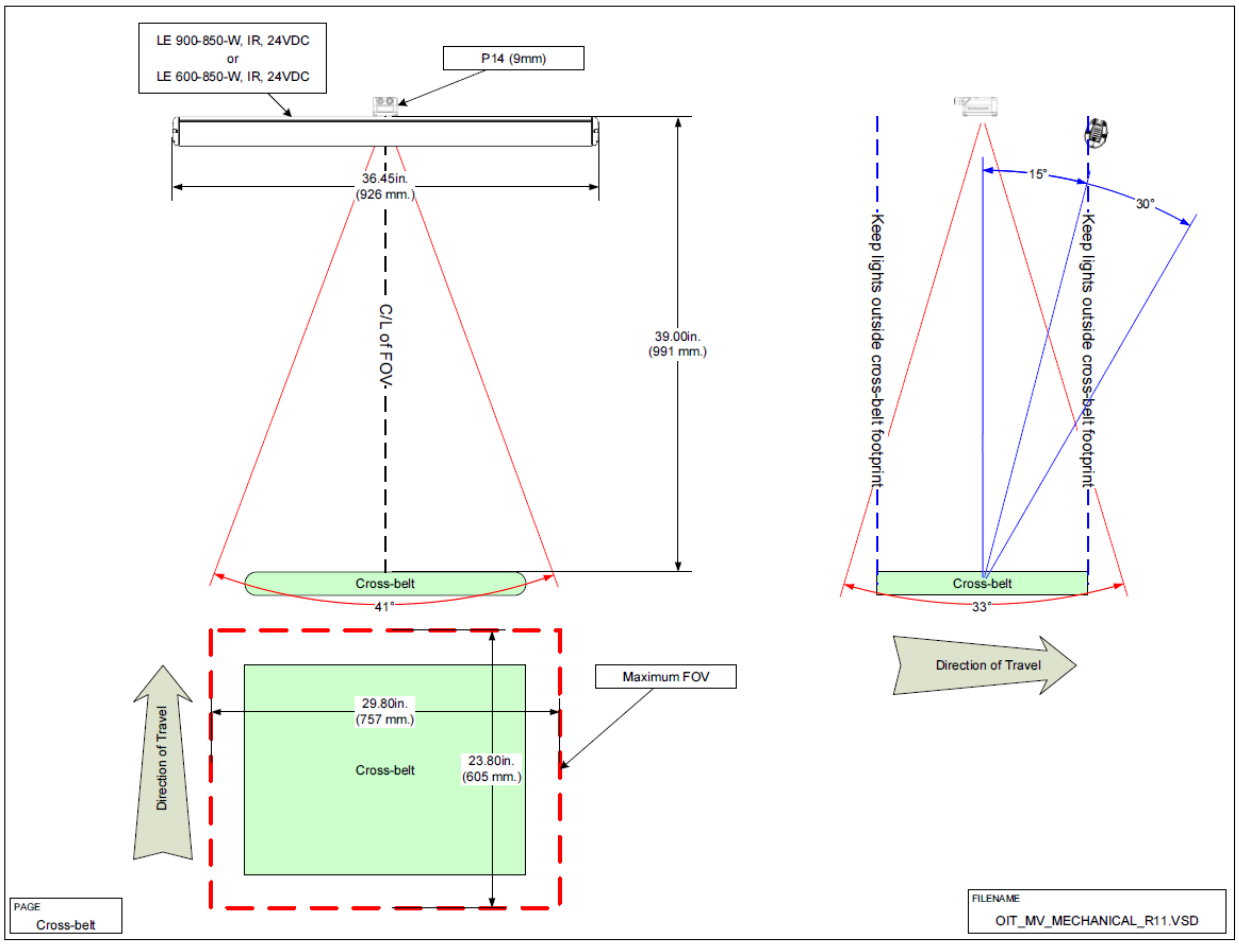


Cross-Belt Machine Vision Equipment Mounting Positions

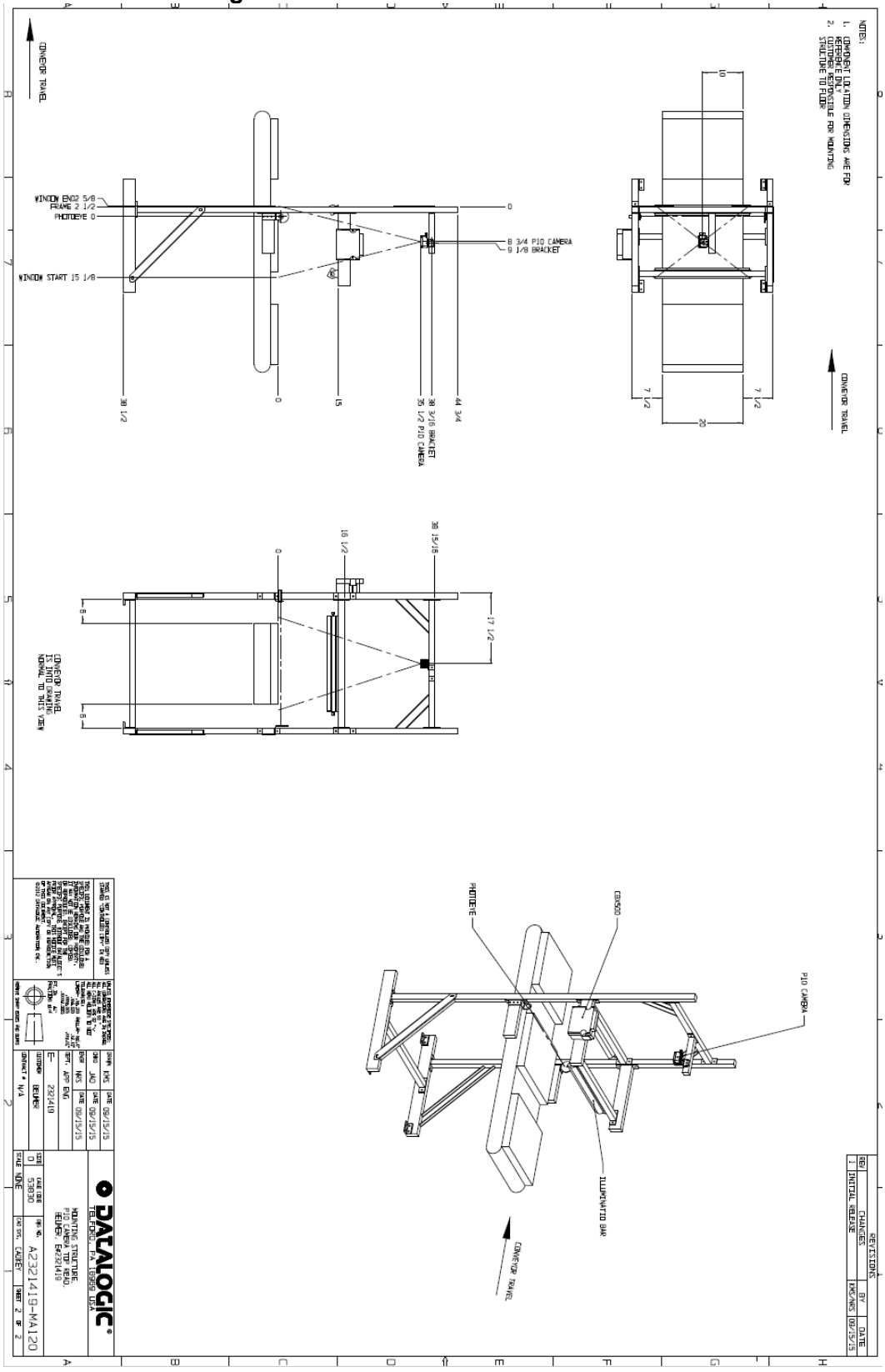
The drawings below illustrate the typical mounting dimensions and locations for the P14 camera(s) and the Infrared illuminator light assembly(s) for the given Field Of View (FOV) on Cross-Belt equipment.

This is a starting point. The final mounting position of the machine vision equipment may be affected by many variables including the ambient light in the environment, the available conveyor space, the sorting equipment surface finish, etc…

Datalogic's Optics Calculator (available for download from the web site) can be used to determine the correct FOV or Working Distance (WD). When you enter values in the calculator, add 50 millimeters (2 inches) to the Field of View (X) dimension to insure complete FOV coverage.

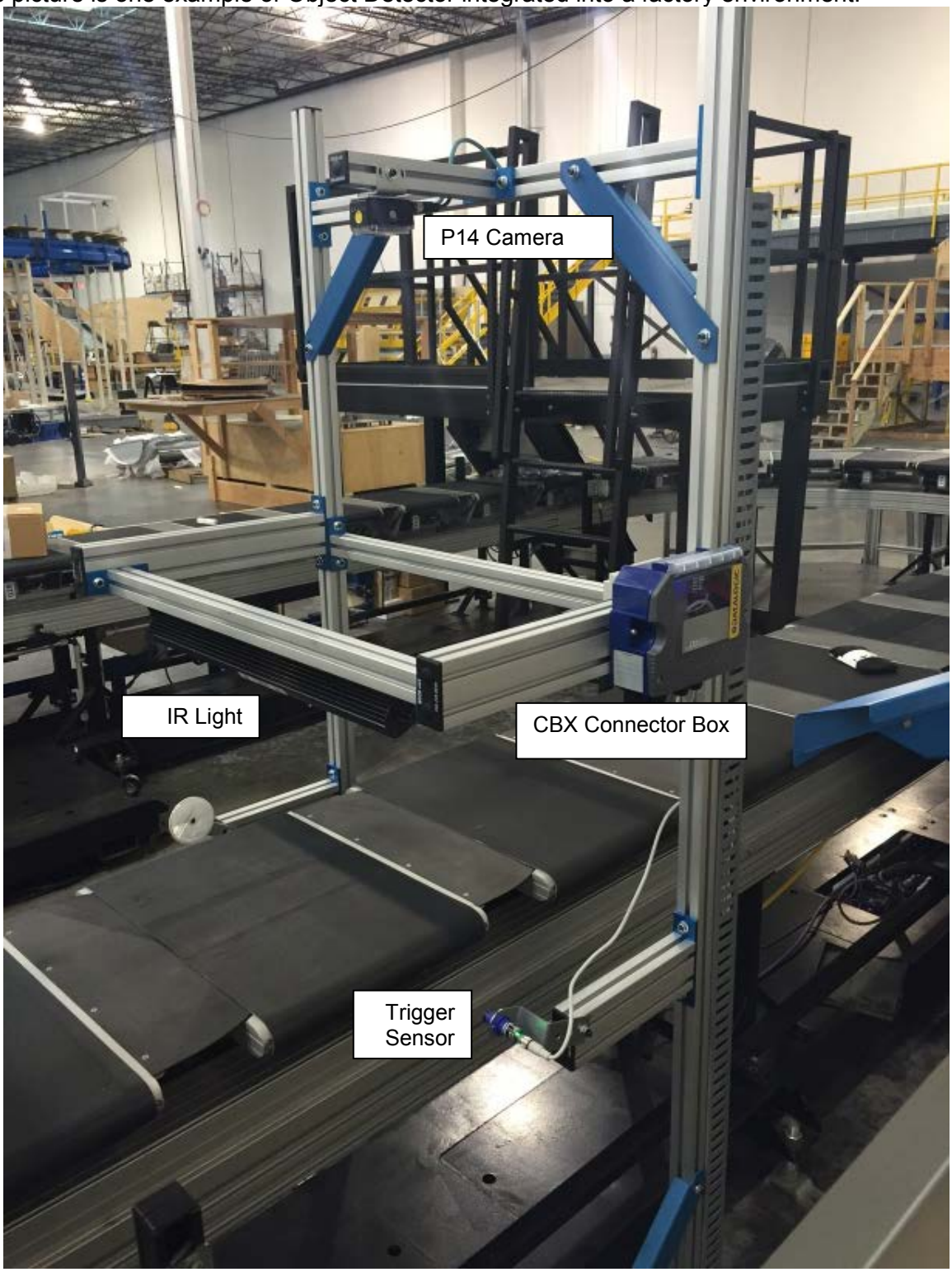


Cross-Belt Mounting Structure



Example of a Cross-Belt Installation

This picture is one example of Object Detector integrated into a factory environment.



MECHANICAL ALIGNMENT

Equipment Mounting

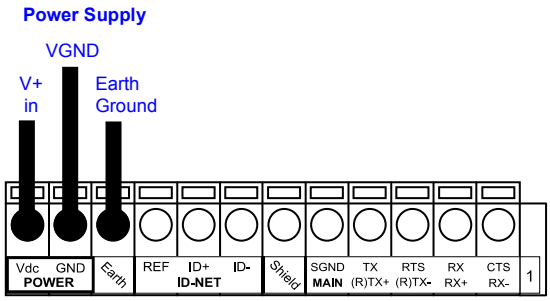
Mount the camera, IR light, and trigger sensor based on your application.

Electrical Connections

The following diagrams show connections to the CBX500 or CBX800 for power, the IR illumination light, and the trigger sensor.

Power

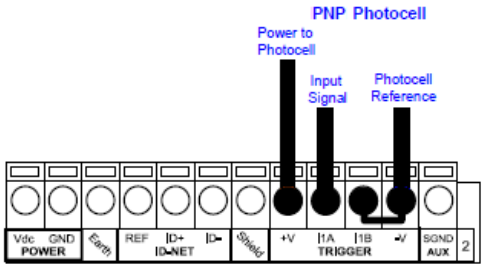
The power must be between 10 and 30 Vdc only.



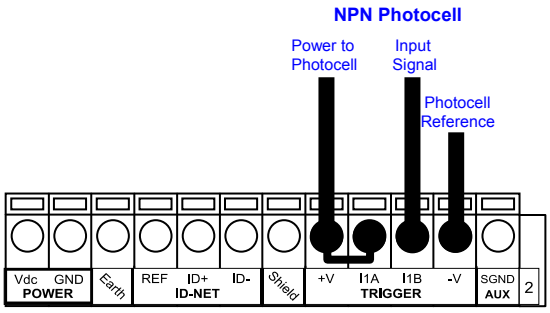
Power Supply Connections

External Trigger with a photocell

There are many types of sensors that can be used for triggering the camera. This diagram shows the connections to the CBX box for a typical photocell sensor. Your application may be different.



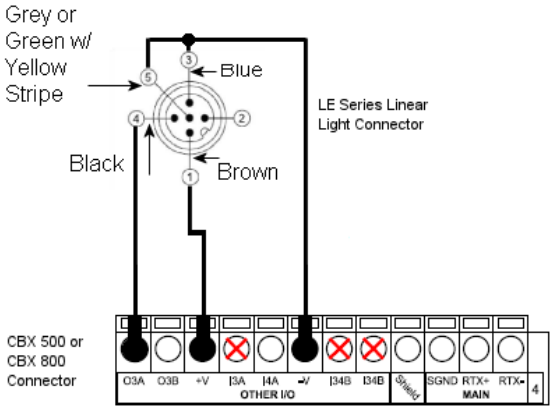
External Trigger Using PNP photocell



External Trigger Using NPN photocell

External IR Illumination

There are many different lighting solutions that can be used with Object Detector. This diagram shows the connections to the CBX box for a Smart Vision® LE Series Linear Light. Your application may be different.



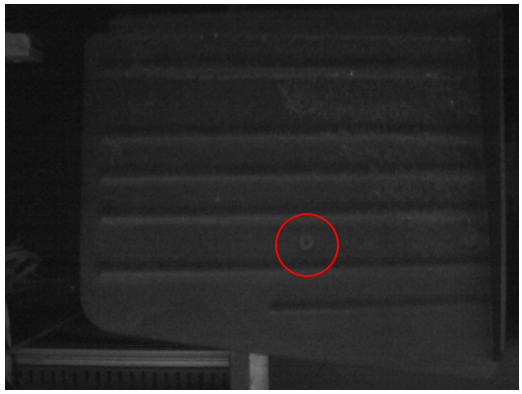
Pin	Function	Signal	Wire Color
1	Power In	+24VDC	BROWN
2	N/C	N/C	WHITE
3	GND	Ground	BLUE
4	PNP	Sourcing Signal	BLACK
5	OverDrive Signal	Ground	GREY

Important Note: The tray surface must be kept clean and free of debris for the Object Detector to function correctly. Bright objects (such as labels and other paper) that are left in the tray can cause false results. Keep the surface clean.

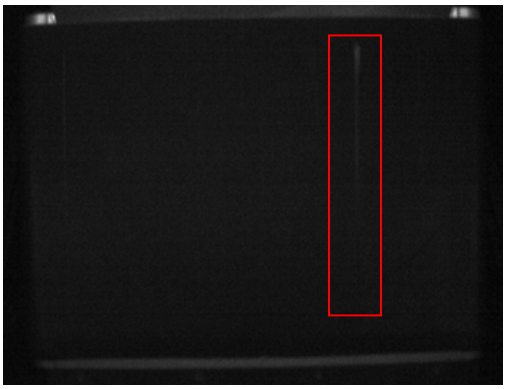
P14 Camera Alignment

To align the camera

1. Start the Object Detector software and connect to the camera.
2. Add (Create) a recipe, then click the Image Setup button.
3. Start the conveyor and click the Go Online button.
4. Adjust the mounting angle of the P14 camera and the photo-eye trigger sensor position until the entire Tilt-Tray or Cross-Belt is visible in the image.
5. Proceed to Illuminator Alignment on page 44.



Tilt-Tray FOV Image (note screw in FOV)



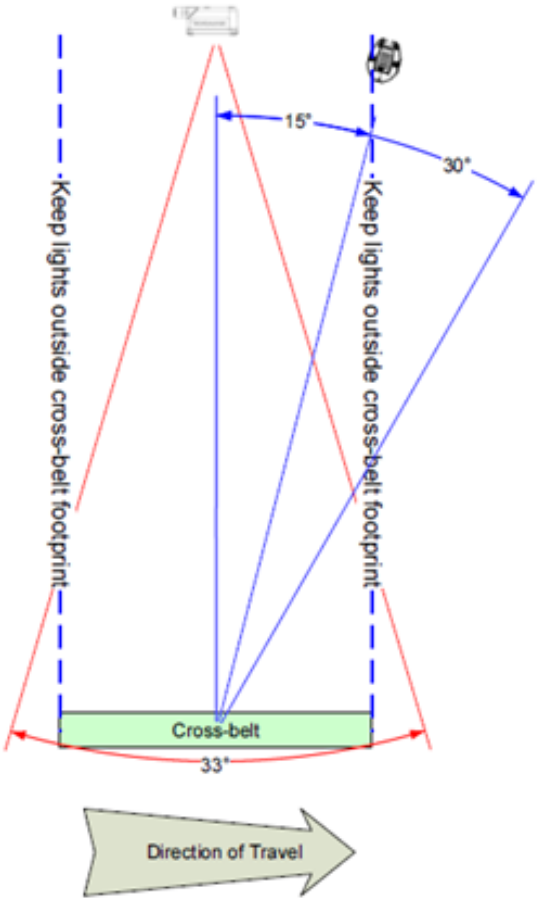
Cross-Belt FOV Image (note seam)

Illuminator Alignment

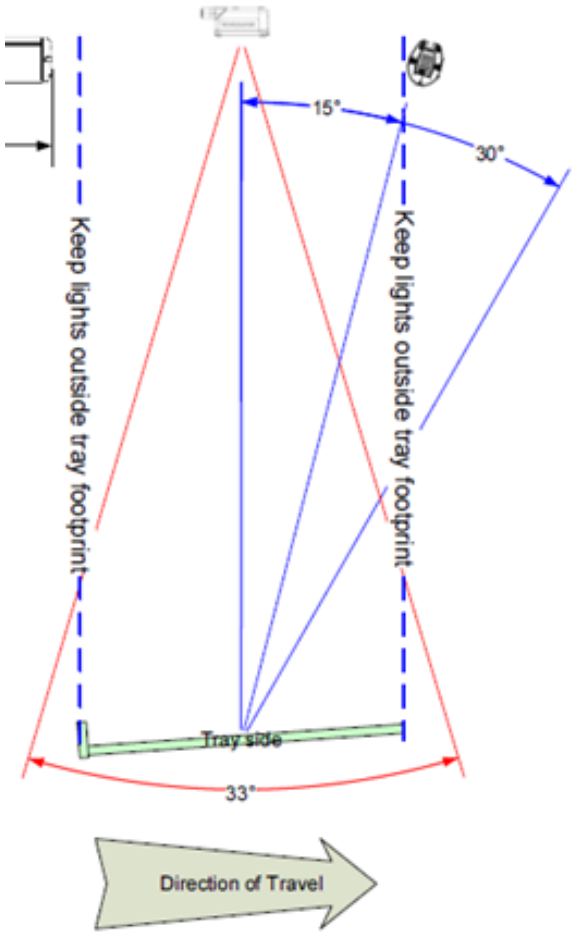
The goal with lighting is to illuminate the Tilt-Tray or Cross-Belt evenly, while minimizing or eliminating “Hot Spots”.

Since the main factor in the presence of “Hot Spots” is the mechanical position of the illuminator, it is recommended that the illuminator be positioned OUTSIDE the vertical footprint of the FOV.

NOTE: In some of the more challenging applications, such as where the Tilt-Tray surface finish is glossy or reflective, the illuminator may have to be positioned at a considerable offset angle from the camera. This may possibly require an angle closer to 60°. See the diagrams below.



Cross-Belt Illuminator alignment

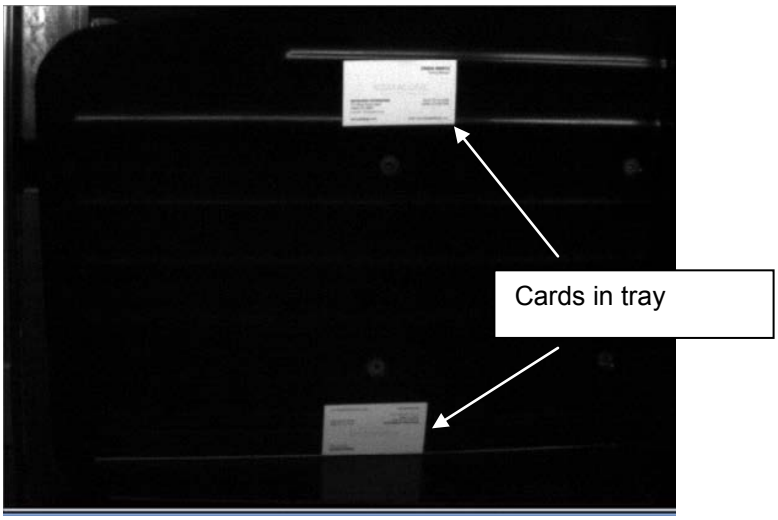


Tilt-Tray Illuminator alignment

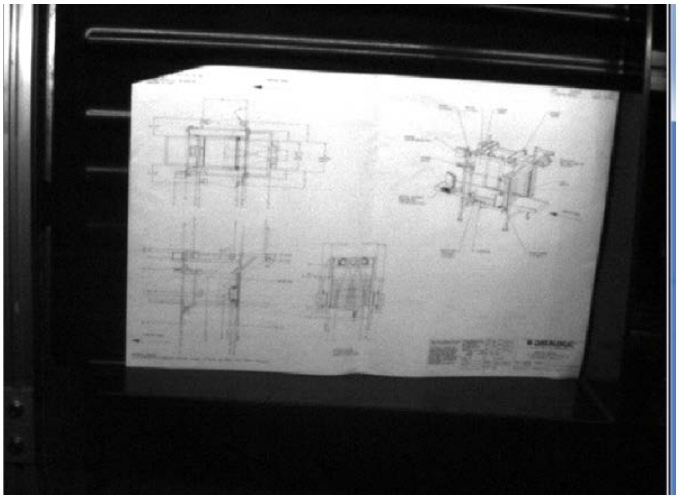
To align the illuminator

1. Start the Object Detector software and connect to the camera.
2. Add (Create) and Load a recipe, then click the Image Setup button.
3. Align the Tilt-Tray within the FOV.
4. Place two readable items on the tray (bar code labels or business cards work well). Place one at each extreme of the camera FOV area.
5. Click the Trigger Image Continuously button.
6. Adjust the angle of the illuminator assembly until the intensity of both labels is as uniform as possible.

Note: Due to the position of the cards or labels in relation to the P14 camera, the intensity of the cards or labels may not be equal.



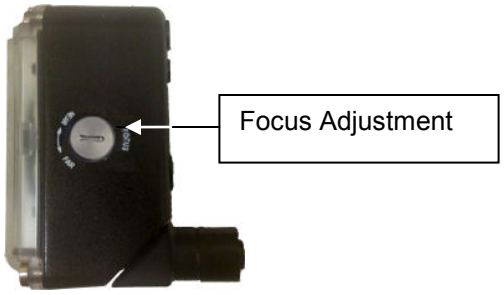
7. You can also place a readable page on the tray to confirm uniform coverage by the illuminator.



P14 Camera Focus

To focus the camera

1. While the camera is Online and capturing images, turn the focus adjustment on the side of the camera.
2. Adjust the focus until the image is in focus in the image window. Turn the focus adjustment clockwise to focus on near objects. Turn it counter-clockwise to focus on objects that are further away. Do not force the focus adjustment.
   Camera focus is not critical since the camera is detecting presence or absence only.



SOFTWARE ADJUSTMENT

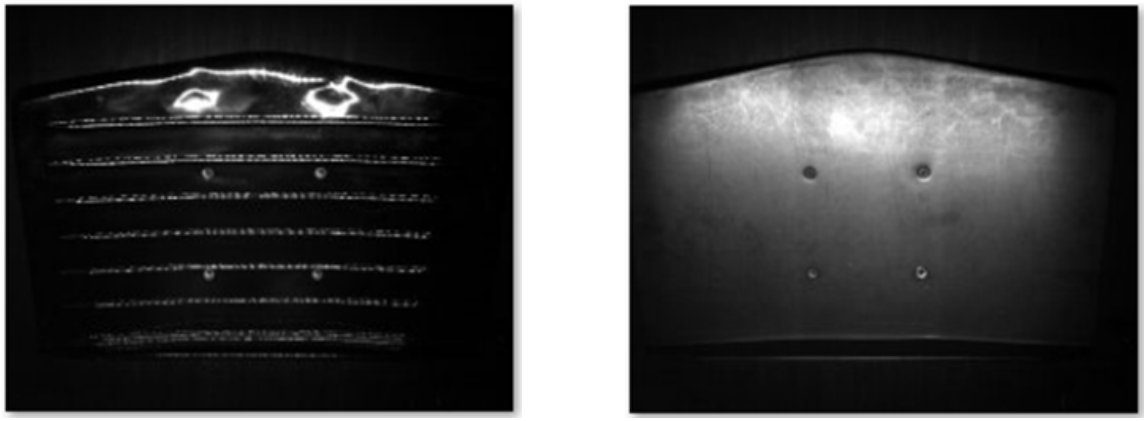
Important Note: The tray surface must be kept clean and free of debris for the Object Detector to function correctly. Bright objects (such as labels and other paper) that are left in the tray can cause false results. Keep the surface clean.

Reducing Hot Spots

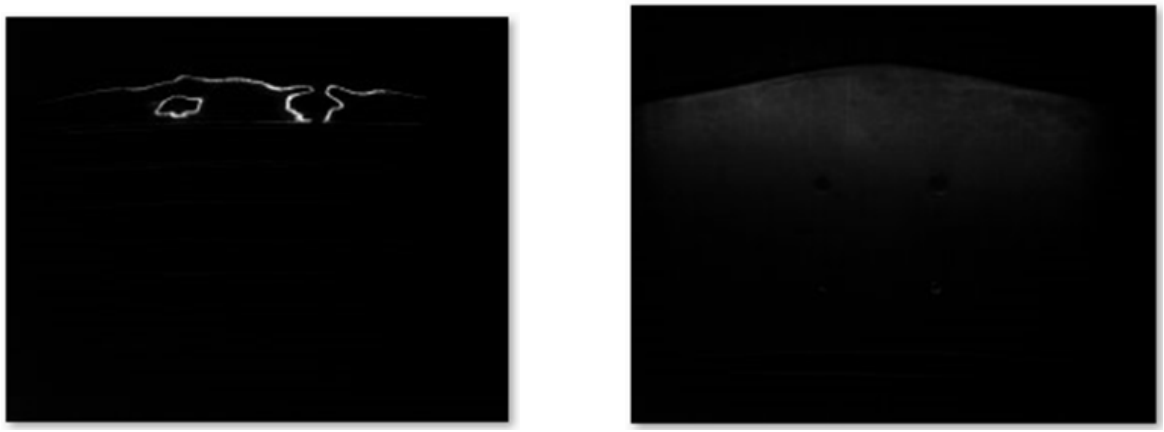
Though the main cause of "Hot Spots" is the mechanical position of the illuminator, minor areas can be eliminated using Object Detector's Noise Reduction function.

To reduce Hot Spots

1. Start the Object Detector software and connect to the camera.
2. Add (Create) and Load a recipe, then click the Image Setup button.
3. Adjust the Shutter to reduce the Hot Spots as seen in the images below.
4. Click the Noise Reduction button.
5. Slowly increase the Number of Iterations slider just until the Hot Spots are reduced further or completely eliminated. Use care with the slider setting. Smaller objects that you want to find can be reduced until they become undetectable.



Images with "Hot Spots"



Images with "Hot Spots" reduced

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