IFM EFECTOR O2D5XX VISION CAMERA

START-UP GUIDE

START-UP GUIDE CONTENTS

PRODUCT FAMILY AND ACCESSORIES

Connector	Interface	Type of Light	Wide Angle Lens	Standard Lens	Telephoto Lens
8 pole A-coded	Ethernet	RGBW	O2D502	O2D500	O2D504
8 pole A-coded	Ethernet	Infrared	O2D522	O2D520	O2D524
5 pole L-coded	ProfiNet	RGBW	O2D512	O2D510	O2D514
5 pole L-coded	ProfiNet	Infrared	O2D532	O2D530	O2D534
5 pole A-coded	ProfiNet	RGBW	O2D542	O2D540	O2D544
5 pole A-coded	ProfiNet	Infrared	O2D552	O2D550	O2D554

O2D Accessories

Commonly Purchased Accessories

- E2D500 – clam shell mount for camera
- EVC925 – Ethernet RJ45 cable
- E11950 – Power cable
- UOB011 – Power cable with AC plug

WEBSITE – SELECT PRODUCT

ifm O2D5 Cameras Learn More Website

Selecting the right camera for your application

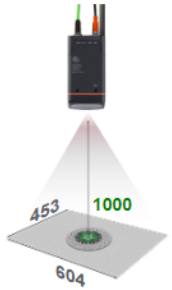
Choose lenstype and operating distance to get field of view size.

Wide angle lens **Standard lens** **Telephoto lens**

Adjust operating distance:

35 mm 5000 mm

Current input: 1000 mm



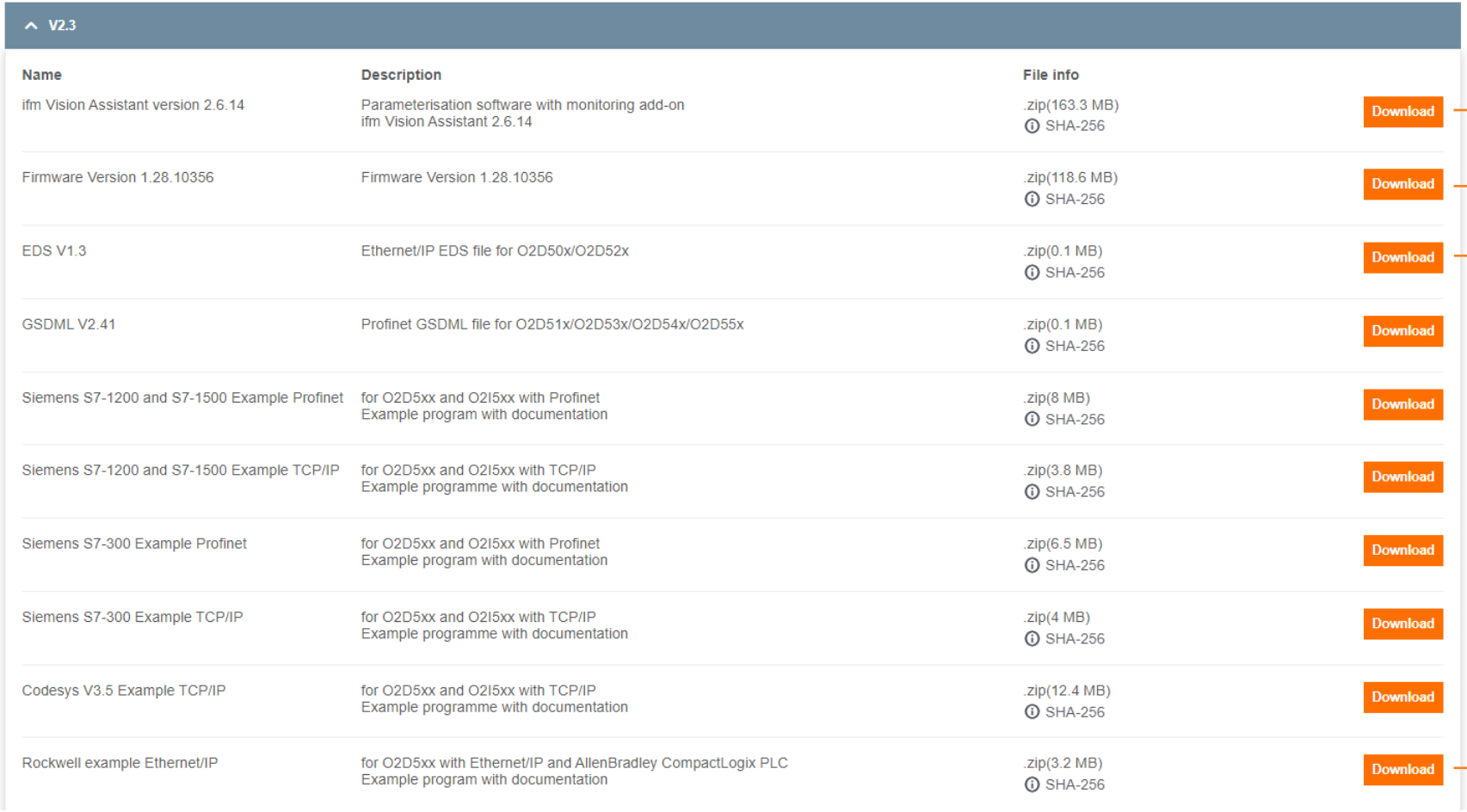
Example graphic shows a brake disc.

Results:			Wide angle lens	Standard lens	Telephoto lens
Operating distance [mm]:			1000	1000	1000
Field of view size [mm]:			604×453	302×227	192×144
Pixel size [mm]:			0.47	0.24	0.15
Connector:	Comm. interface:	Type of light:			
8 pol A-coded	Ethernet	RGB-W	O2D502	O2D500	O2D504
8 pol A-coded	Ethernet	infrared light	O2D522	O2D520	O2D524
5 pol L-coded	ProfiNet	RGB-W	O2D512	O2D510	O2D514
5 pol L-coded	ProfiNet	infrared light	O2D532	O2D530	O2D534
5 pol A-coded	ProfiNet	RGB-W	O2D542	O2D540	O2D544
5 pol A-coded	ProfiNet	infrared light	O2D552	O2D550	O2D554

- Enter mounting distance
- Check which lens version has the field of view needed
- Check resolution of pixel size against what the application requires
- Select the right camera

WEBSITE - DOWNLOADS

Downloads



V2.3

Name	Description	File info	
ifm Vision Assistant version 2.6.14	Parameterisation software with monitoring add-on ifm Vision Assistant 2.6.14	.zip(163.3 MB) SHA-256	Download
Firmware Version 1.28.10356	Firmware Version 1.28.10356	.zip(118.6 MB) SHA-256	Download
EDS V1.3	Ethernet/IP EDS file for O2D50x/O2D52x	.zip(0.1 MB) SHA-256	Download
GSDML V2.41	Profinet GSDML file for O2D51x/O2D53x/O2D54x/O2D55x	.zip(0.1 MB) SHA-256	Download
Siemens S7-1200 and S7-1500 Example Profinet	for O2D5xx and O2I5xx with Profinet Example program with documentation	.zip(8 MB) SHA-256	Download
Siemens S7-1200 and S7-1500 Example TCP/IP	for O2D5xx and O2I5xx with TCP/IP Example programme with documentation	.zip(3.8 MB) SHA-256	Download
Siemens S7-300 Example Profinet	for O2D5xx and O2I5xx with Profinet Example program with documentation	.zip(6.5 MB) SHA-256	Download
Siemens S7-300 Example TCP/IP	for O2D5xx and O2I5xx with TCP/IP Example programme with documentation	.zip(4 MB) SHA-256	Download
Codesys V3.5 Example TCP/IP	for O2D5xx and O2I5xx with TCP/IP Example programme with documentation	.zip(12.4 MB) SHA-256	Download
Rockwell example Ethernet/IP	for O2D5xx with Ethernet/IP and AllenBradley CompactLogix PLC Example program with documentation	.zip(3.2 MB) SHA-256	Download

Software tool for developing the application

Camera firmware update

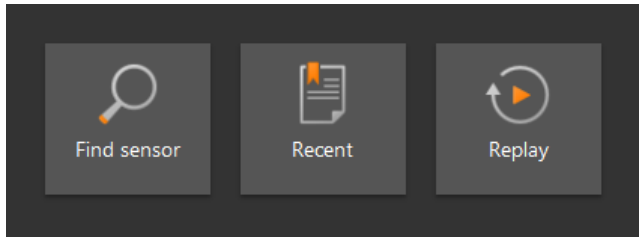
EDS file

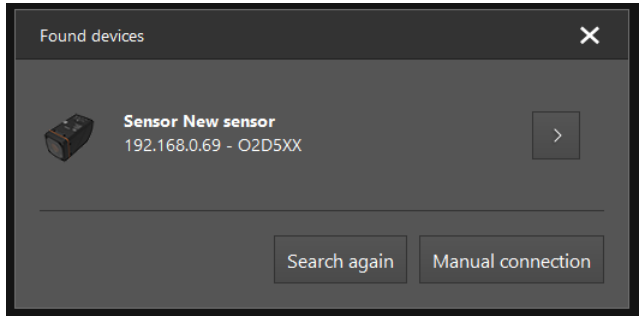
Add-on Instruction

Full Step by step instructions for O2D5 AOI and quick setup guide for Ethernet/IP

CONNECTING TO THE CAMERA

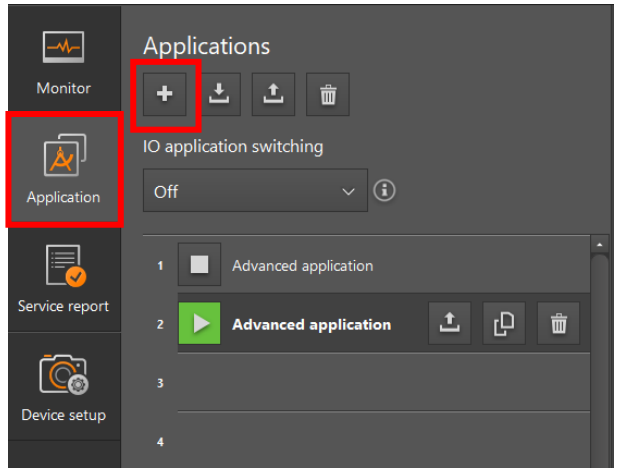
1. Connect power and communications cables
2. Open ifm Vision Assistant Software
3. Click on “Find Sensor”
4. Click on the arrow once the camera is found



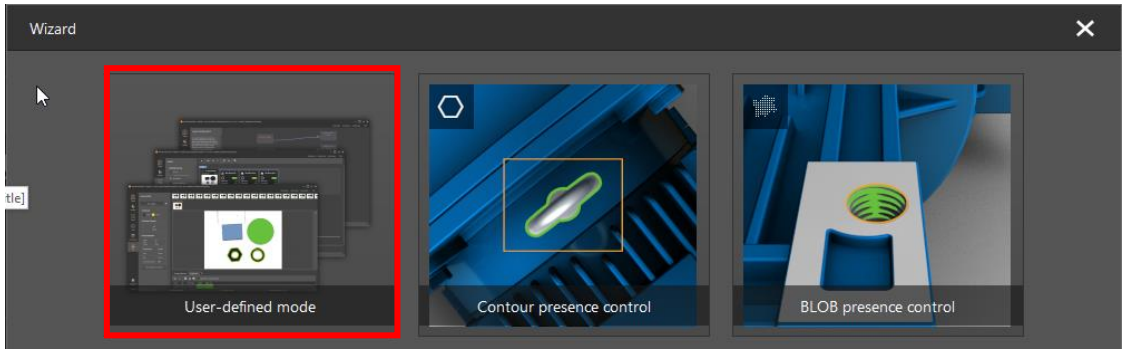


BEGINNING A NEW APPLICATION

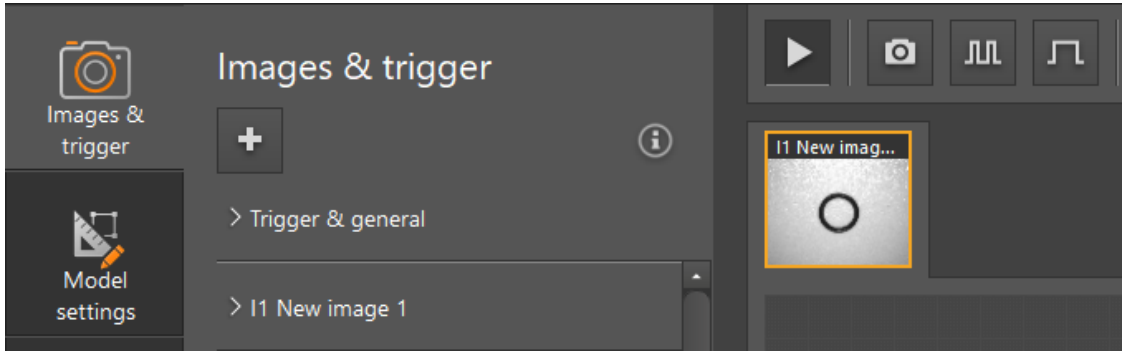
1. Select “Application” on the left-hand navigation tree
2. Click on “+” to create a new application



3. Choose which programming software you want to use
    1. Contour presence control and BLOB presence control use easy to understand step by step instructions. These are popular if you are new to camera applications.
    2. User-defined mode gives you access to all tools that be used to solve your application.



4. Once you select which one you want, the cameras will go through an electromechanical auto-focus routine. If you selected the user-defined mode then the next screen you see will be on the right.



This start-up guide will focus on the User-defined mode

BEGINNING A NEW APPLICATION

A – Set up trigger and create up to 5 images that can be processed every cycle

B – Create new BLOB or contour model. Up to 32 models can be made for one application. 32 total applications can be stored in the camera.

C – Chart showing which models are passing and failing
D – mini PLC with function blocks to do simple math, logic, comparisons

E – View and change ethernet string the camera outputs

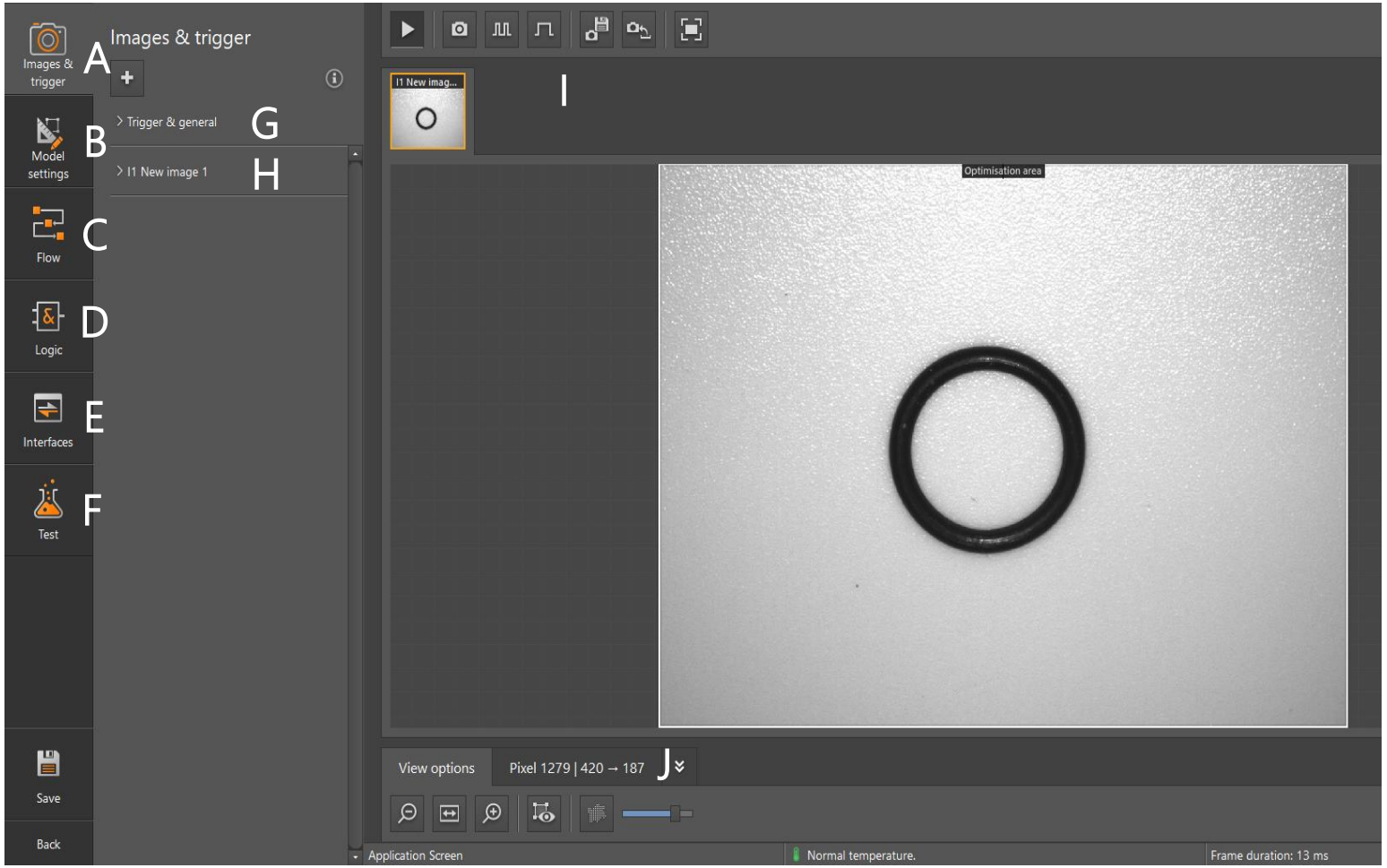
F – Live test of application showing pass/fail results

G – Click to open, set trigger type, focus distance

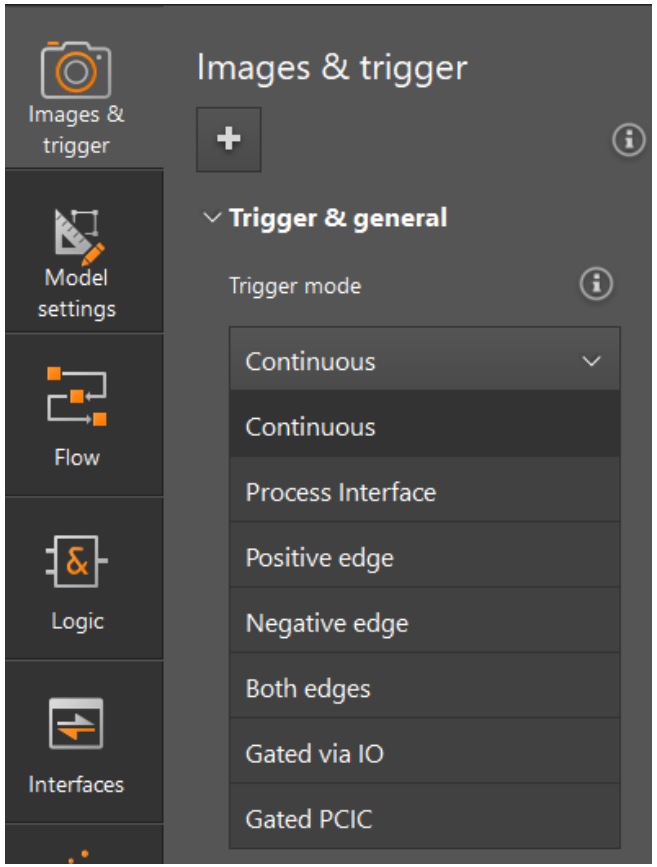
H – Set exposure times, internal/external light, turn ON/OFF internal LED lights, image filters

I – force trigger, save/upload images

J – pixel information as you move your cursor over the image, shows position (X,Y), grayscale value

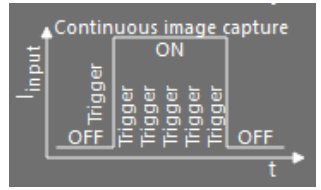


SELECTING THE RIGHT TRIGGER



Continuous

The camera is constantly taking an image to be processed. The maximum achievable frame rate will depend on exposure and evaluation time.

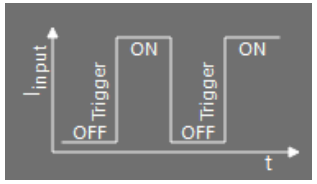


Process Interface

The camera is triggered via a PLC.

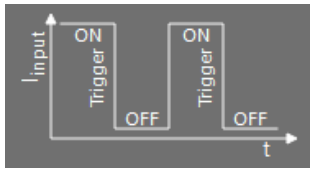
Positive Edge

The camera is triggered by external hardware on the rising edge of the input signal. Typically, the hardware used is a binary sensor.



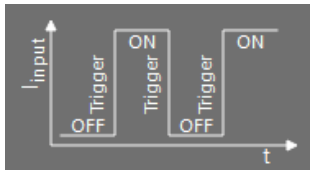
Negative Edge

The camera is triggered by external hardware on the falling edge of the input signal.



Both Edges

The camera is triggered by external hardware on both the rising and falling edge of the input signal.



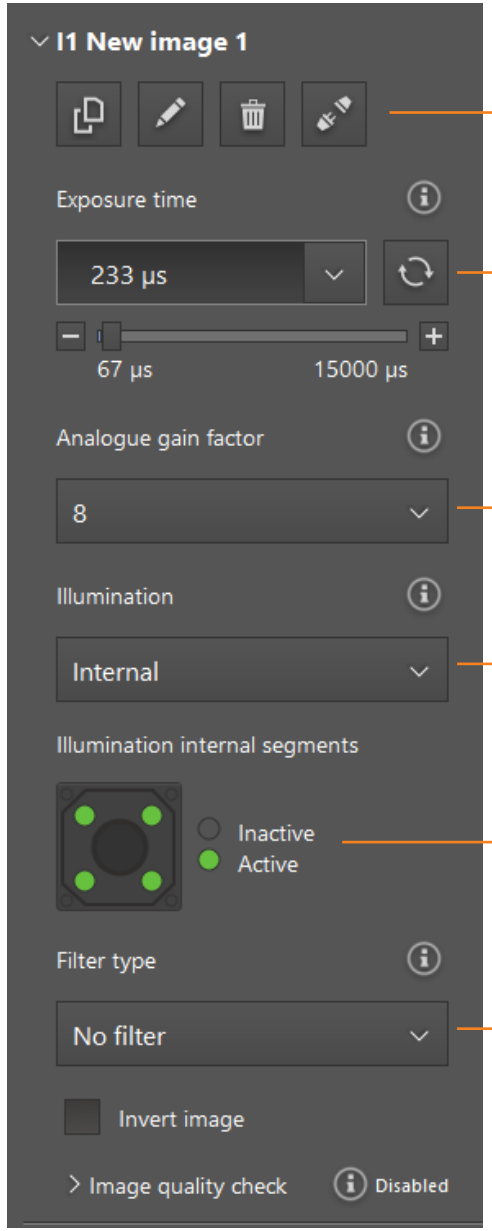
Gated via IO

A positive or negative edge switches the trigger ON and OFF.

Gated via PCIC

A process interface (i.e. PLC) switches the trigger ON and OFF.

CREATING A NEW IMAGE



Create new, name, delete, disable an image

Set the exposure time of the internal LEDs illuminating the part, auto-adjust available, enter number or use the slider bar

Amplify the image
brighter/dimmer

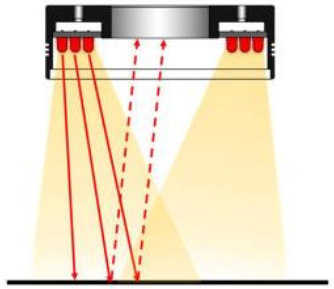
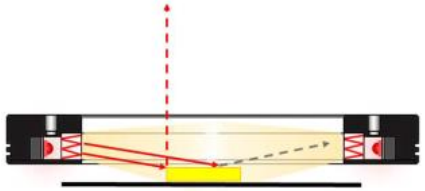
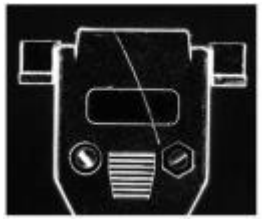
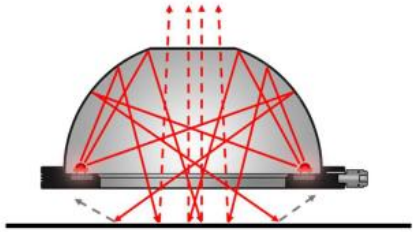
Toggle lights you want to use. Typically, all internal or all external because lights can pulse at different times and leaves a blurred image.

Toggle ON/OFF the internal LEDs you want to be active. Using the top two or bottom two can be helpful to make good contrast on the image, depending on the application. For cameras with color LEDs, white, green, blue and red buttons will appear to toggle through.

Image filters

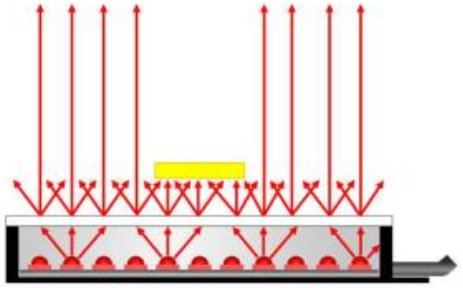
- No filter – deactivated
- Erosion – enlarge dark pixel groups and decrease light pixel gaps
- Dilation – enlarge white pixel groups and decrease dark pixel gaps
- Median – reduces noise pixels

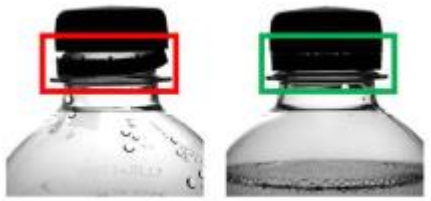
EXTERNAL LIGHTING OVERVIEW

Ring Light	Diagram	Image Example	When to use
			• Check engravings • Illuminate objects far away (~3 feet plus) • Create more homogeneous image due to larger spread of light covering an area
Darkfield Light			
			• Detect scratches or nicks on surfaces
Dome Light			
			• Parts with curved surfaces

EXTERNAL LIGHTING OVERVIEW

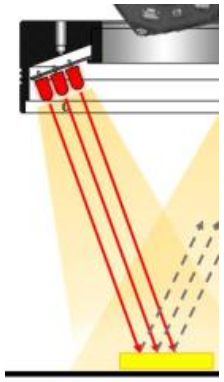
Back Light





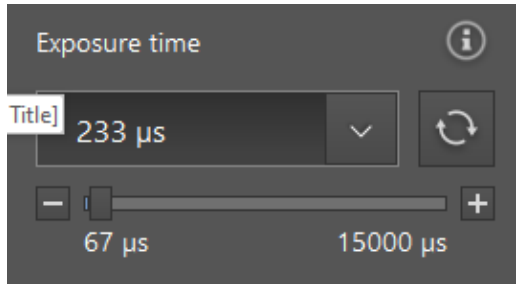
- Analyze transparent vs non-transparent objects

Bar light

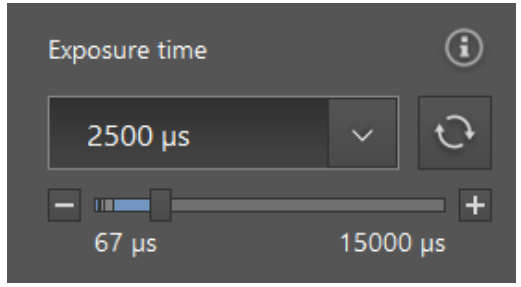


- Large objects you are trying to work on (pallets, cover several square feet)
- Highly powered

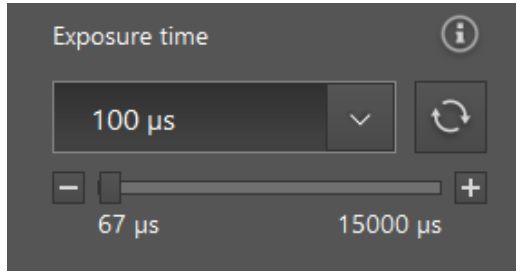
ADJUSTING EXPOSURE TIME TO OPTIMIZE APPLICATION



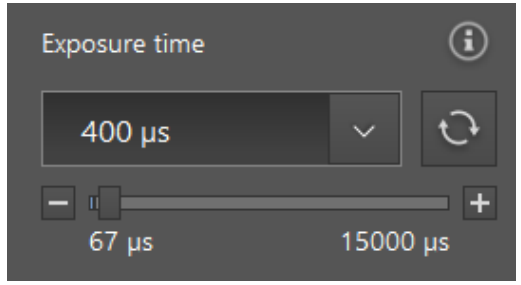
After auto-exposure



High exposure

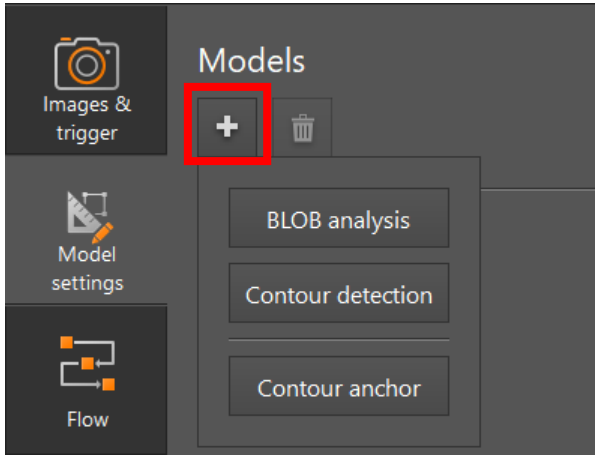


Low exposure



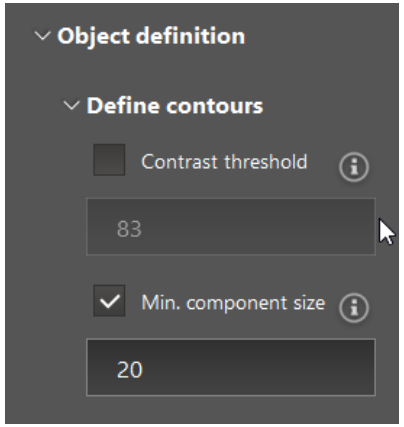
Best for analysis

CREATING A NEW MODEL

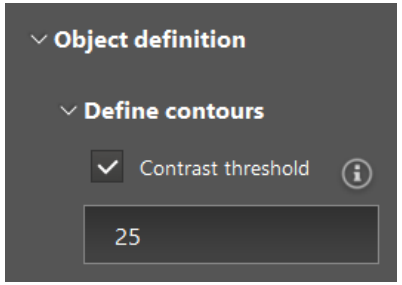


- BLOB analysis – pixel counting algorithm
- Contour detection – pattern matching
- Contour anchor – analyze object no matter the orientation presented to the camera's field of view

Defining your Object Definition Area (Teaching a Good contour)

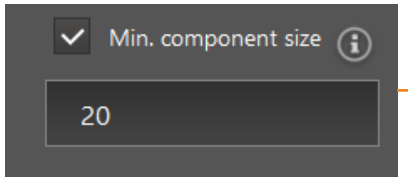


- Automatically, anything inside of the object definition area will be analyzed for contours. The algorithm is finding the edges for when black/white pixels meet.
- Under object definition in the tree on the left is "define contours"
- Automatically a number will appear for contrast threshold. This number represents how strong is the taught contour. An '83' (out of 100) in this example shows a strong contrast, which is easy to see because of the black O-ring and white background.

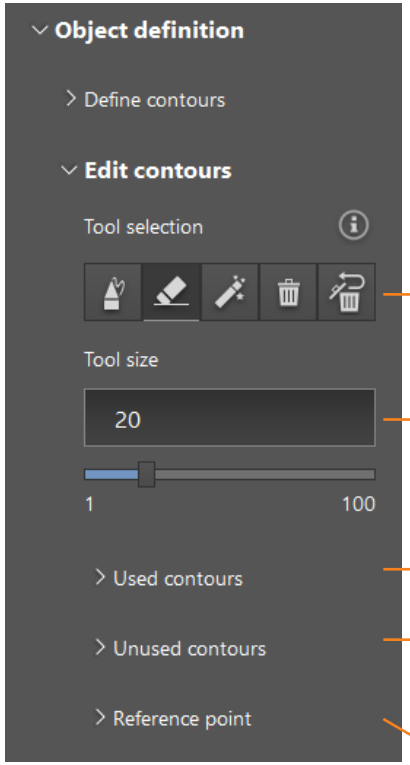


- If we change the contrast threshold to a lower number, the camera will find more contours.

EDITING CONTOUR (OBJECT DEFINITION AREA)



Choose to see contours no smaller than this number. Quick way to cut out contours you do not need.

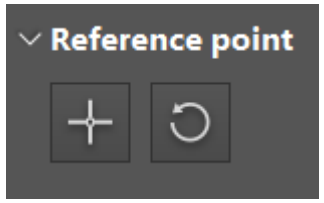


Use various tools to develop your contour. From left to right (draw contours by hand, erase tool, restore, delete continuous contours, restore deleted contours)

Change size of tool you are working with on the image

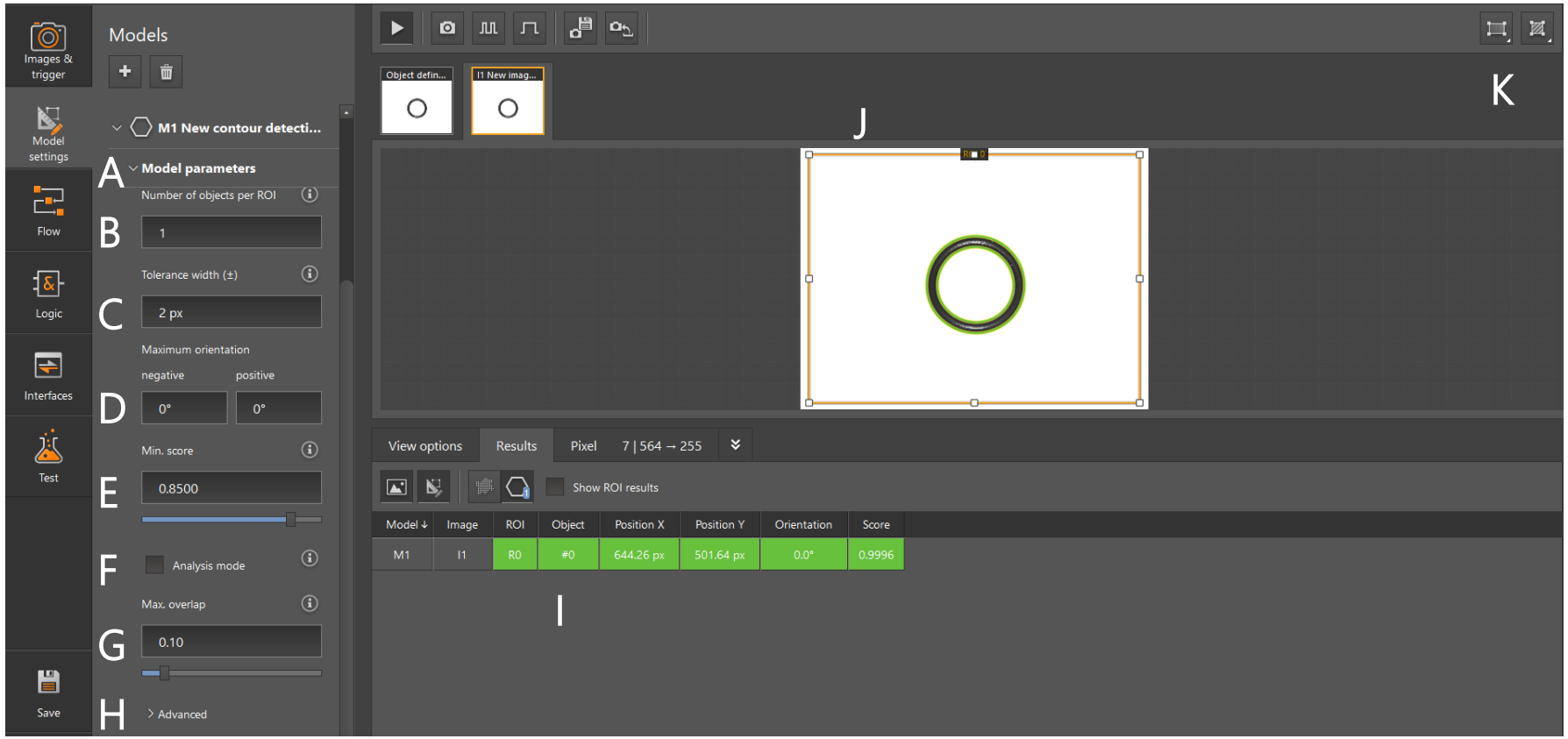
When this is opened you see all contours found with a trash can icon next to it. When you hover over a contour the associated one on the image turns orange.

When open you see all contours you chose not to use.



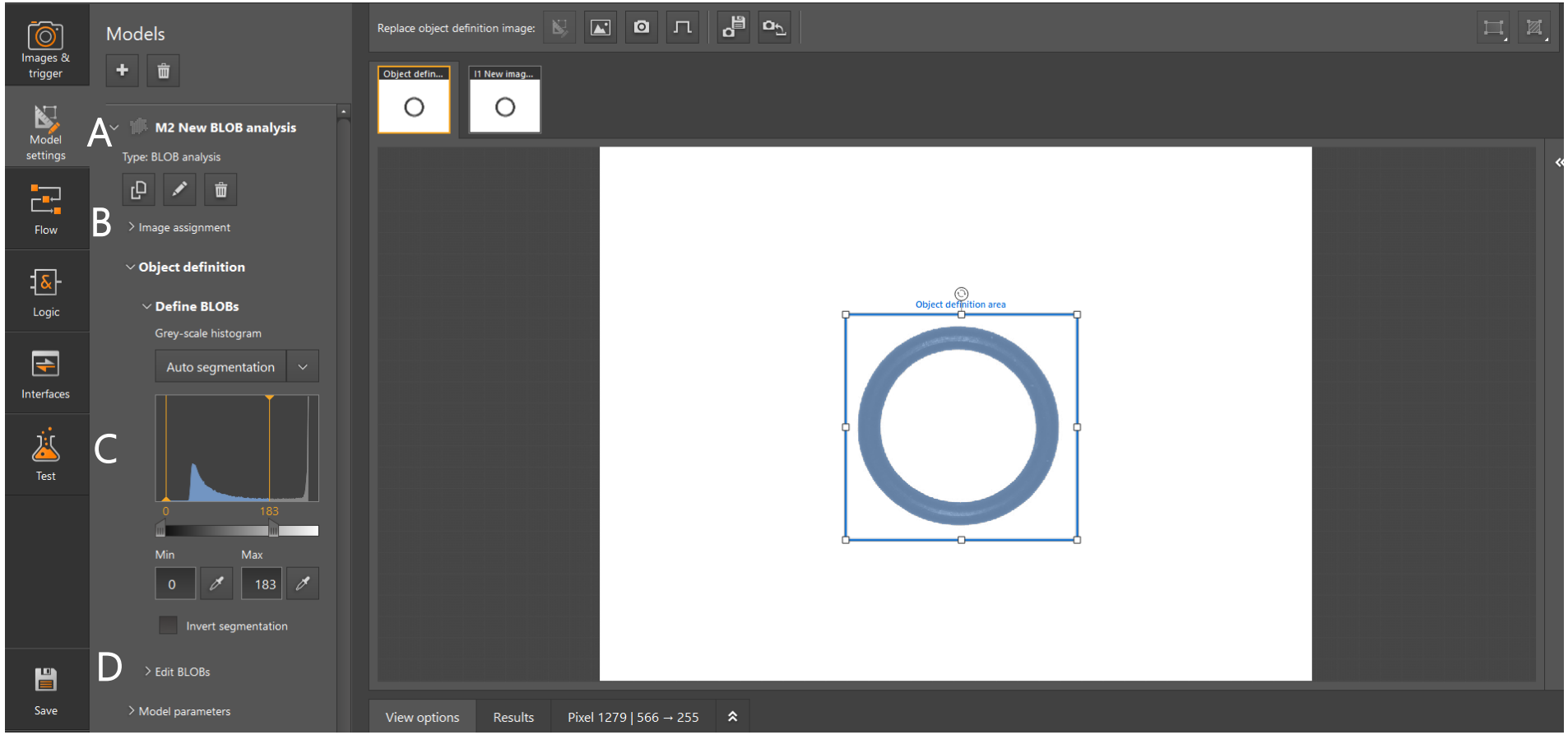
Reference point defaults to the center of the contours found. When you open the tree you see an icon to place the reference point wherever you want. This can be used later in your program. For example, you can create a reference point anywhere on the image and in run-mode you can get the X,Y position of that object in space. Or, create another model, put one reference point on the left edge of the O-ring on one model and on the right edge on the other. Then, measure between the two to give you diameter.

USING CONTOUR MODEL PARAMETERS



A – Develop parameters of the application
B – Number of taught objects you expect to see
C – Increase/decrease contour tolerance
D – Set allowable orientation of the part in a circle
E – Pass/fail score threshold
F – Allows you to see potential taught objects in the ROI. Runs in the background of the camera software.
G – Max amount two objects can intersect
H – Advanced features: time out to stop searching, search acceleration (useful to detect difficult objects, gives up cycle time), alarms around edges of ROI (useful if you want to detect a drifting object)
I – Information about found objects
J – Region of Interest (ROI) – add, draw new shapes
K – Draw ROI arrays, Regions of Disinterest

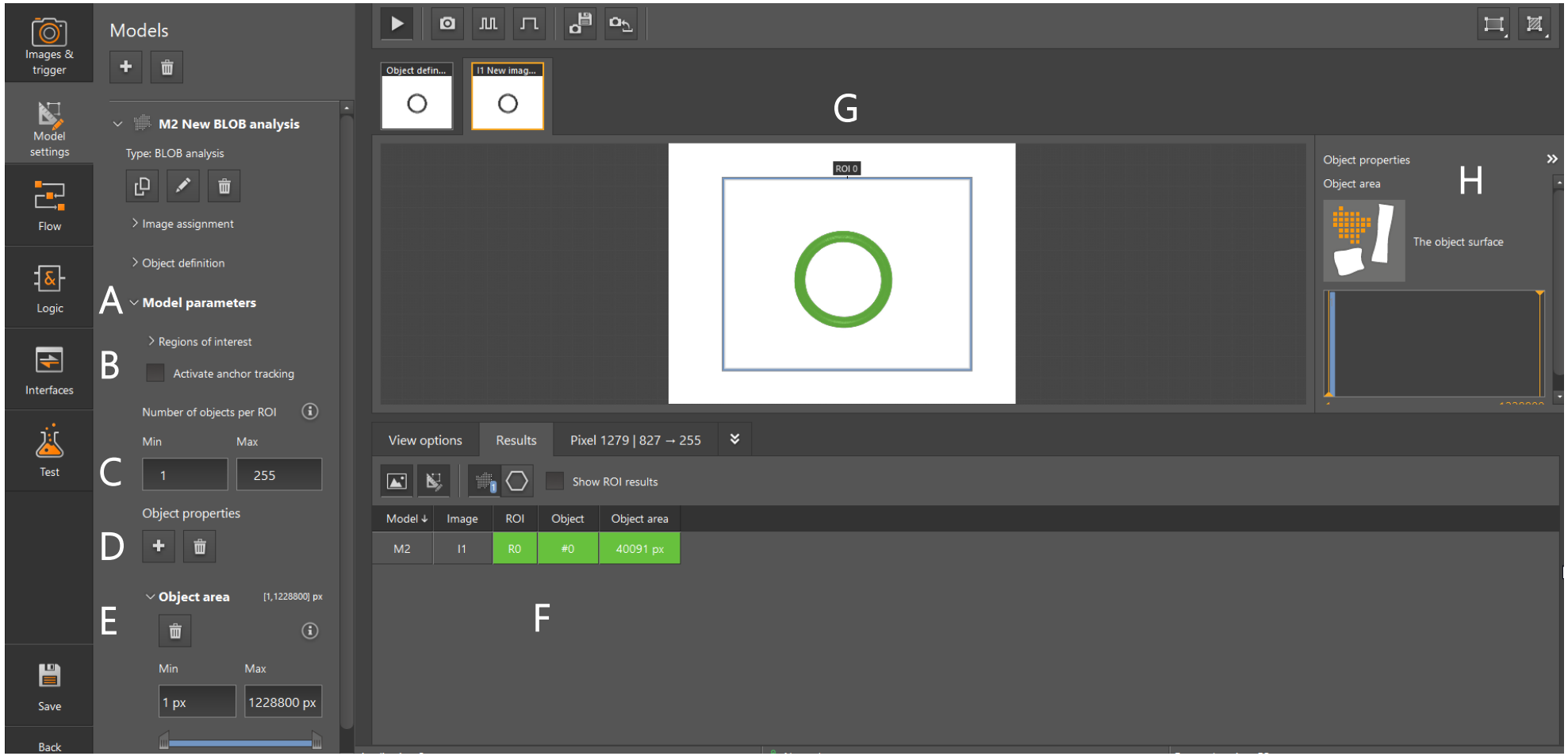
DEFINING BLOB



A – Created new model for BLOB analysis
B – Assign the model to which image taken. In this example, only one image was taken. Any model can be used with up to 5 images.

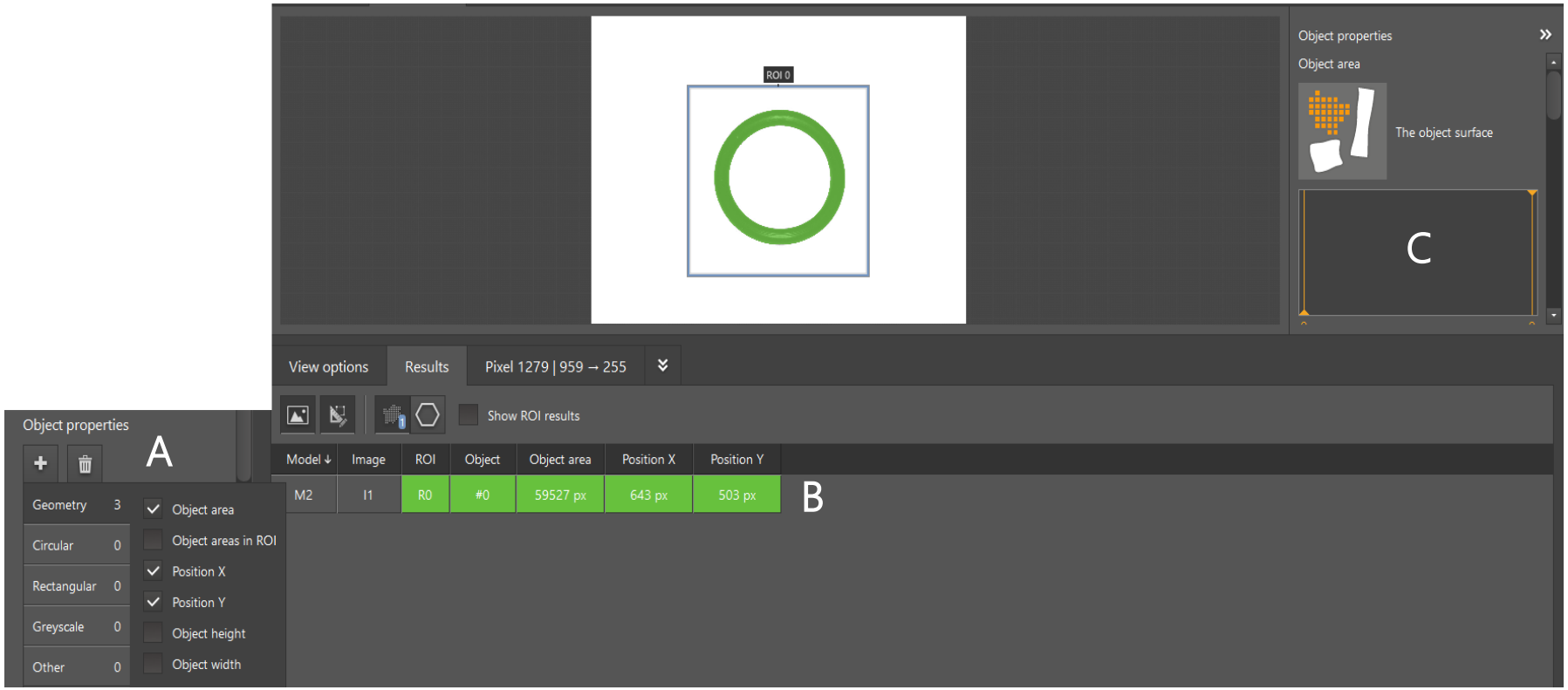
C – Gray-scale histogram, set the color pixels you want to detect
D – Edit options: include/exclude objects within a min and max area, fill holes with size restrictions (if all adjacent pixels are detected then auto detects)

USING BLOB MODEL PARAMETERS



A – Develop parameters for the application
B – Turn ON anchor tracking, new model is created for anchor tracking by teaching a contour
C – Number of objects you expect to see in a ROI
D – Object Properties (see next slide for details)
E – List of different object properties selected, area is default
F – Information on objects found
G – Create ROI's
H – Definition of Object Properties being used

MODEL PARAMETERS – OBJECT PROPERTIES



A – Access to the different object properties. Split in to five categories with parameters that can be added to the output string or used for analysis.

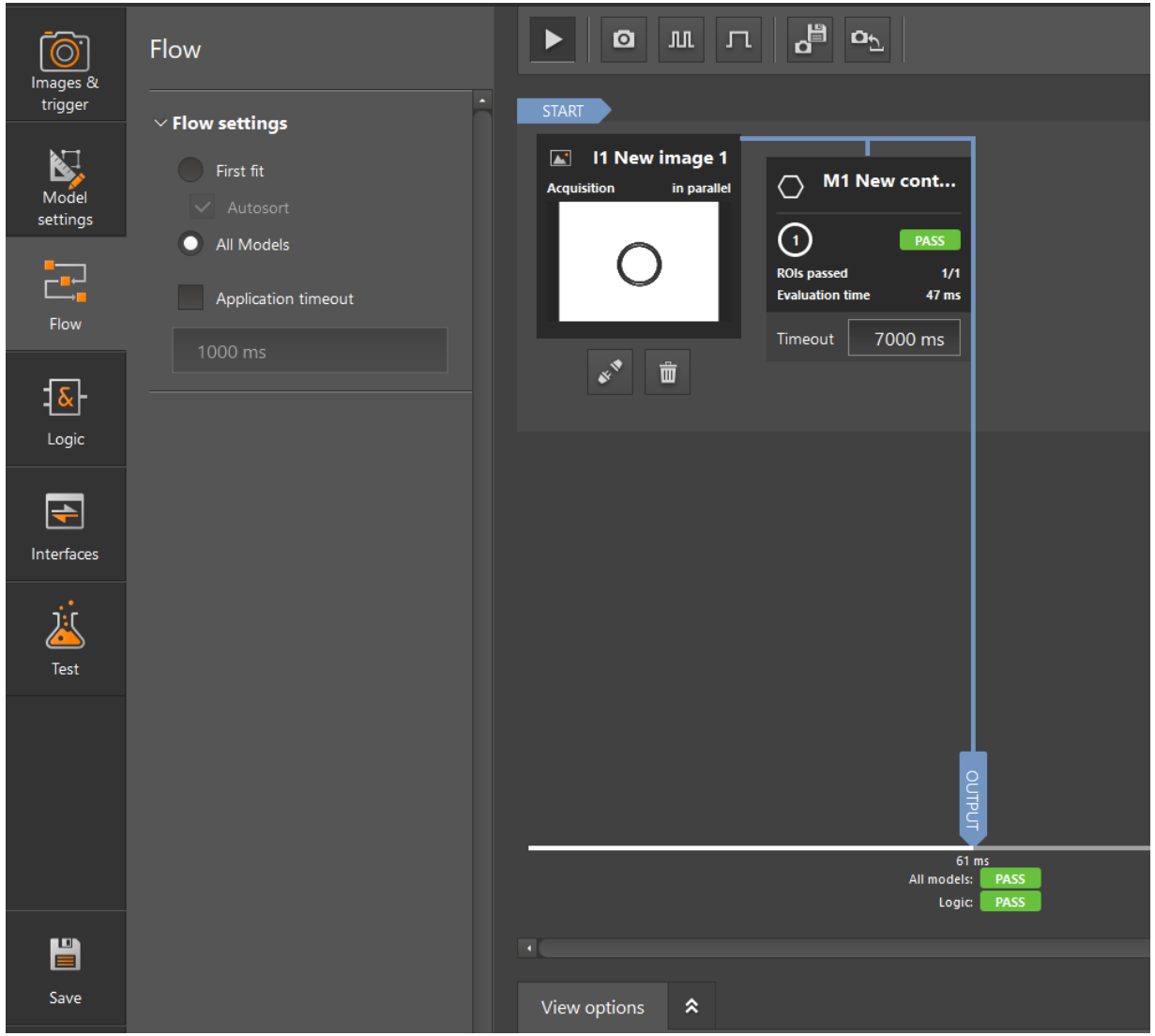
B – Results of the object properties selected.

C – Definition on how each property works.

Helpful properties

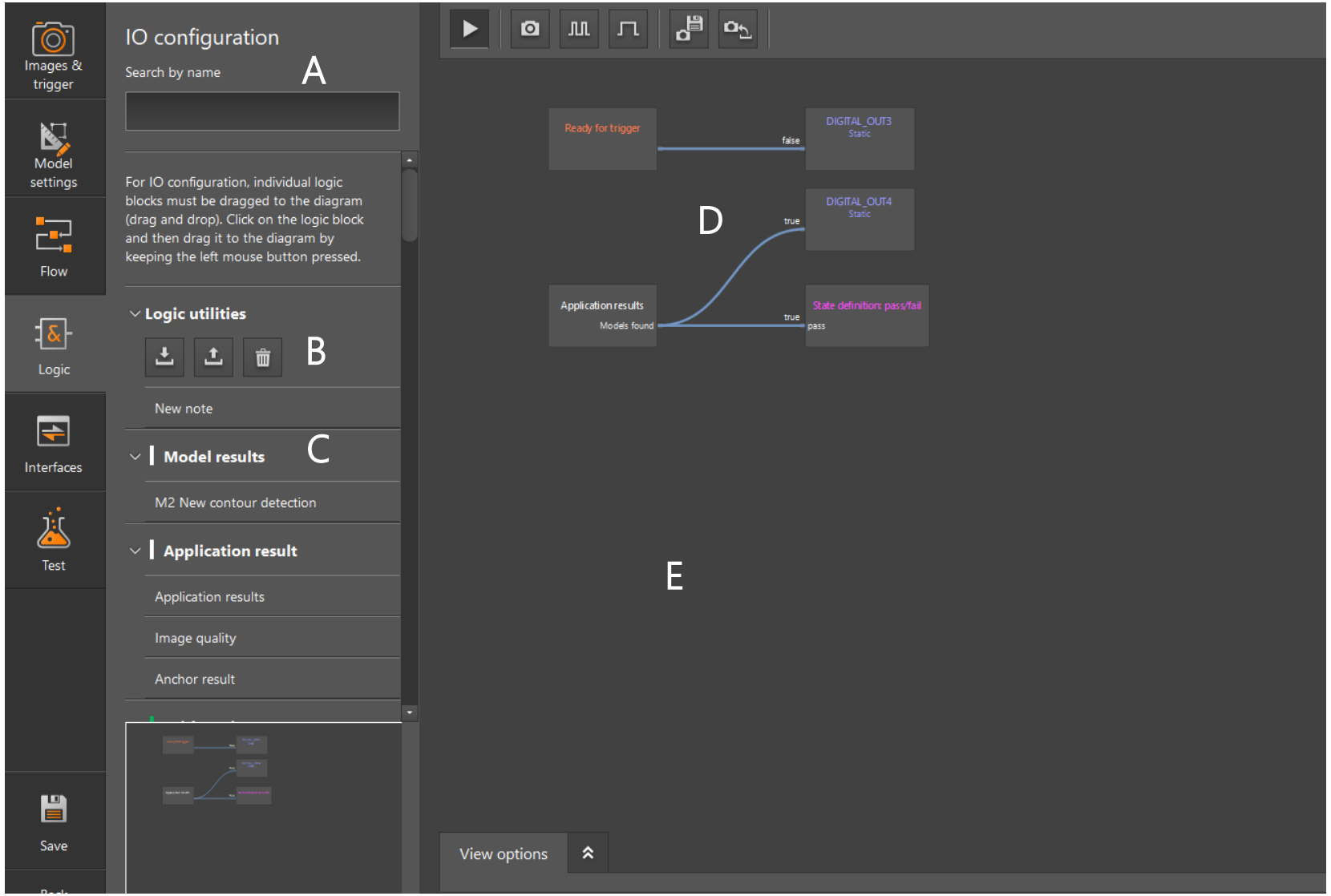
- Position X – center of mass left-right position relative to the camera imager (12 80 x 960 pixels)
- Position Y – center of mass up-down position relative to the imager (use both to detect movement of the object)
- Area – monitor changes in area, create windows for good vs bad
- Grayscale – min, max, average, deviation, useful for cast parts that change color as they harden, paint dry applications

APPLICATION FLOW DIAGRAM



Shows you the flow of the application to a pass/fail result. In this example, one model was created. If more are created this chart would show multiple levels.

LOGIC LAYER



Logic Layer – Drag and drop space to develop your application with logic functions.

A – search bar to find functions

B – Upload and save logic layer file

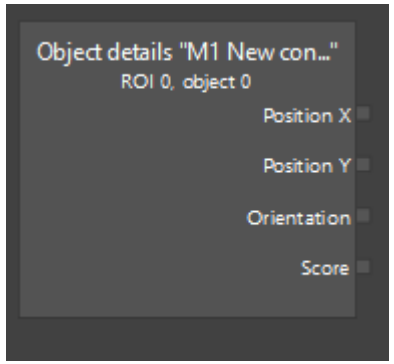
C – List of models created plus logic functions below it

D – Default logic blocks that appear

E – Space to bring in new blocks

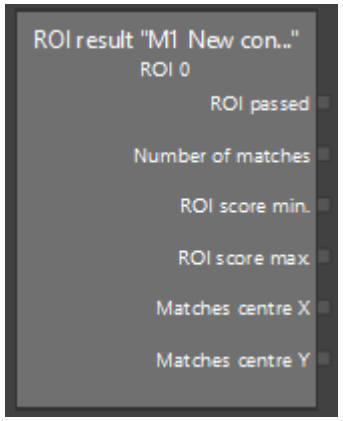
Model Results – Three possibilities

Object Details



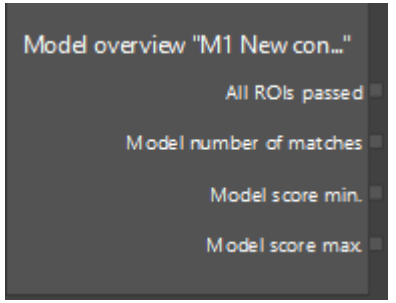
- X position of Object 0 in ROI 0. For more ROI's and Objects more blocks have to be created
- Y position of Object 0 in ROI 0
- Orientation of the part in degrees
- Score versus taught Object Definition

ROI Result



- ROI passed – binary output
- Number of matched objects found in the ROI
- Min ROI score seen
- Max ROI score seen
- X position
- Y position

Model Overview

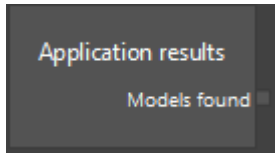


- Binary output for if all ROI's passed analysis. Up to 64 ROI's can be analysis per contour or BLOB model.
- Model number that matched
- Min model score
- Max model score

LOGIC LAYER – LIST OF PARAMETERS AVAILABLE

Application Result

Anchor Result

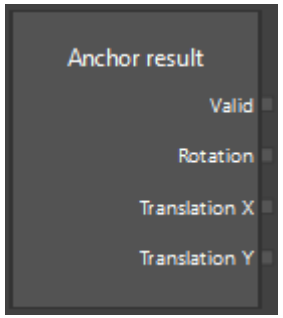


- Taught model from object definition is found in the ROI

Image Quality – Enabled under Images and Trigger

- Sharpness (Warning) – observes how crisp the image is with warning levels
- Brightness (Warning) – observes how bright the image is and can detect brightness drifting for the entire image
- Underexposure (Warning) – dim lighting plus warning in an area
- Overexposure (Warning) – bright lighting plus warning in an area

Anchor Result



- Valid – anchor contour found
- Rotation – orientation in degrees
- Center of contour anchor position X
- Center of contour anchor position Y

LOGIC LAYER – LIST OF PARAMETERS AVAILABLE

Arithmetic

DIFF • Subtract two points • Numerical inputs, outputs	ADD • Add two points • Numerical inputs, numerical outputs	COUNT • Up to 8 number of input signals are added • Bool inputs, numerical outputs	Min/Max Value • Up to 8 inputs can be analyzed and min and max values determined • Numerical input, numerical outputs
Distance between two points • Distance on the output is between objects, position reference points of BLOB and contour models • Numerical inputs, numerical outputs	DIV • Divide two points • Numerical inputs, numerical outputs	MUL • Multiply two points • Numerical inputs, numerical outputs	Fixed Value • Compare analyzed parameters versus a fixed number set by the user • N/A input, numerical output

Digitalization and Logical Functions

Comparator

- If/then statement, a>b or b>a
- Numerical inputs, numerical outputs

AND

- Input signals are compared to each other. "1" = all signals at inputs is 1, "0" = min one signal at inputs is 0
- Bool input, Bool output

OR

- Input signals are compared to each other. "1" = mine one signal on input is 1, "0" all signals on input are 1
- Bool input, Bool output

NOT

- Input signal is inverted
- Bool input, Bool output

Fixed Bool

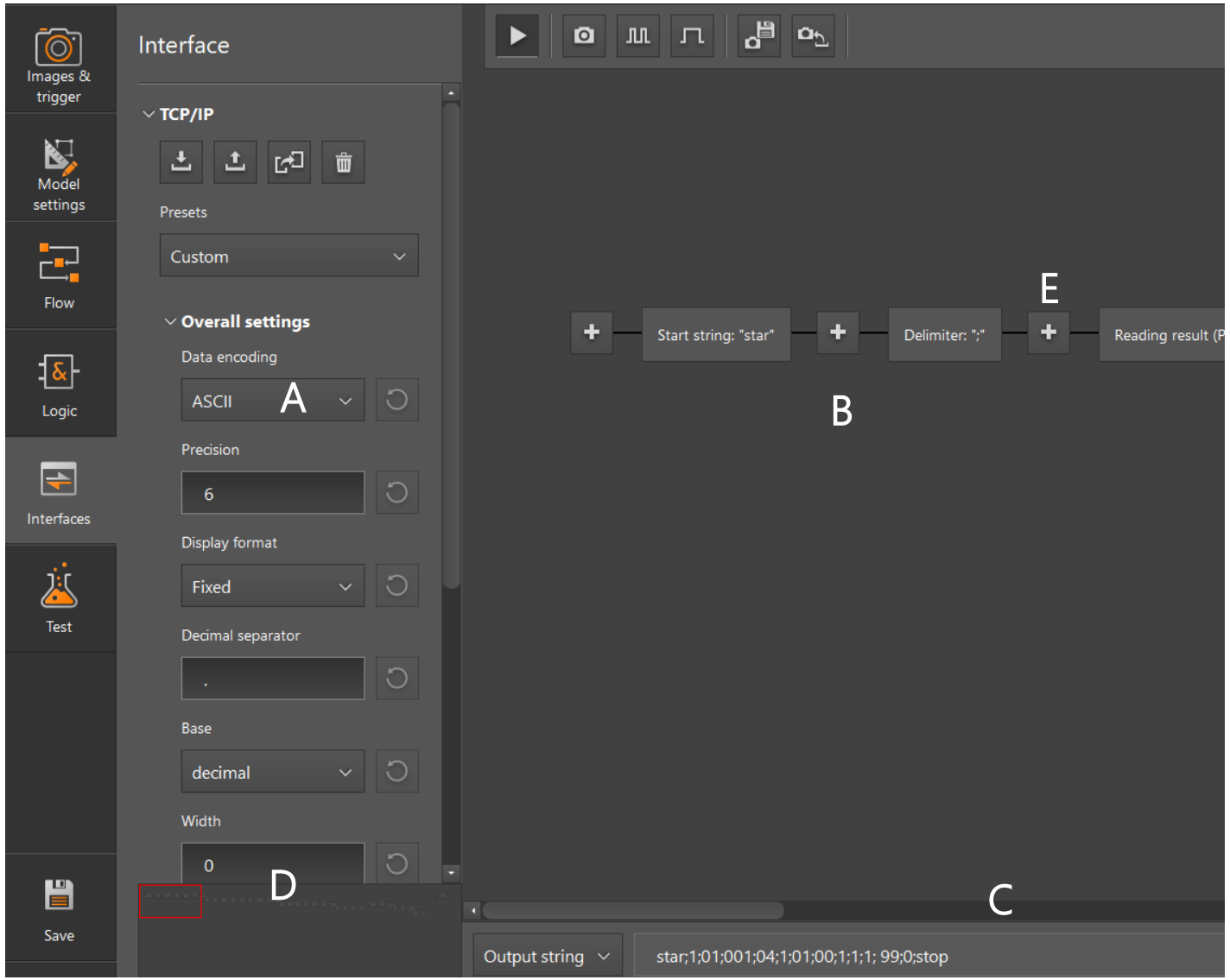
- Fixed true Bool statement
- N/A input, Bool (true) output

Other Functions

Output String – Saves received string, contents are received at PLC via process interface, alphanumeric input
Binary output – Saves received binary data, byte array has max 256 bytes, contents are received at PLC via process interface, byte array input
Digital_OUT 1-5 – toggles if true statements precede it, static = output is switched without limited pulse duration (recommended), pulsed = output is switched with limited pulse duration >= 10 ms
Virtual pins bytes 1-8 – memory areas to transfer data from logic area to interface, 8-bit order, max 64 Bool values

Ready for trigger – output showing device is not processing another image and is ready, Bool
Error – found error, Bool
Image acquisition finished – done processing previous image, Bool
State definition: pass/fail – application pass/fail according to all parameter criteria, Bool

String to Number – converts alphanumeric to numeric, alphanumeric input and numeric output
Number to string – converts numeric data input to alphanumeric output
Binary to string – converts binary input data to alphanumeric output
String to binary – converts alphanumeric input data to binary output
Number to binary – converts numeric data input to binary output
Bool to string – converts Bool input data to alphanumeric output
Bool to binary – converts Bool input data to binary output



A – Presets and overall settings

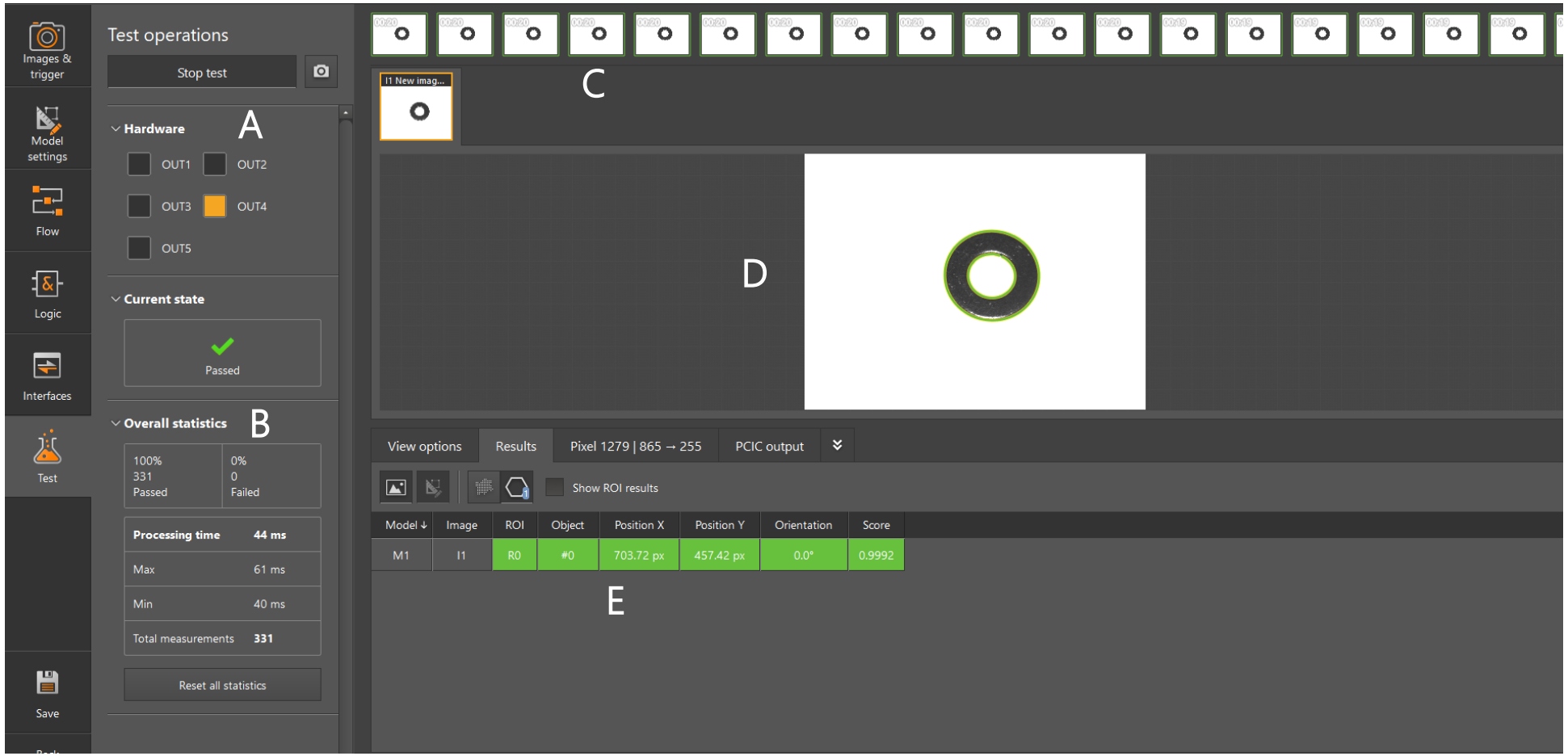
B – Main Area

C – Output string details

D – Overview area

E – Toggle “+” sign to eliminate unwanted information in the output string

TEST



A – hardware output status
B – Statistics of the tests
C – Images being tested in consecutive order
D – Live image
E – Test parameter results

SERVICE REPORT

The service report creates an evaluation of the last 17 passed and failed images with information on the software and hardware devices (34 images total).

Highlights

- Export up to 34 evaluations at a time
- See time and date stamp on all images
- See pass/fail result

External Software Monitoring Tool for troubleshooting available
List Price = $425 USD

E3D310

- View detailed parameter information for images
- Create custom dashboard with live video feed

DEVICE SETUP

General
- Export/import settings
- f/w updates – new f/w found on ifm.com

Network
- DHCP – activate automatic assignment of network settings (default)
- Change IP address
- MAC address

Interfaces
- Set TCP/IP for process interface (PCIC)
- Set fieldbus comms
- External illumination trigger, reserved for OUT5
- IO debouncing for trigger set up

NTP – camera time synched to network time protocol

FTP – sets connection to external server, sends current configs and images to server if certain events occur (see software manual for more info).

RTSP – set up live image feed as a video data stream

Ifm storage device – set up storage device located behind the service lid on the camera housing