PROINSPECT

User Guide

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1. Welcome to PROINSPECT

A single powerful and configurable application The controls of PROINSPECT, developed over years of experience and thousands of installations, enable you to detect anomalies or highlight issues in production processes.

Configurable and scalable in its features, PROINSPECT adapts to multiple fields of application, from checking for defects in the plastics industry to robot guidance, from assembly monitoring to surface inspection, from code reading to presence / absence detection, based on the assertion that: what can be seen can be checked.

PROINSPECT IS THE KEY TO SUCCESS ENABLING YOU TO IMPROVE, MONITOR AND CONTROL PRODUCTION QUALITY.

Its continual evolution and updating has now encompassed artificial intelligence algorithms.

Main features It can manage up to 16 cameras, processing them in parallel and responding robustly and rapidly to the specific characteristics of the application. It saves images of interest and measurement statistics and communicates through various industrial standards with the system's other peripherals. The recipe can be modified without the need to stop the line, delivering intuitive but reliable validation tools.

Visit Univision.

2. Getting started

2.1 Load and Save recipe

2.1.1 Save a Recipe

A recipe can be saved through the menu

File > Save

You can save the recipe while PROINSPECT is in inspection mode.

If you need to save the recipe under a different name

File > Save As...

you must switch PROINSPECT into #SetupMode first.

2.1.2 Load a Recipe

A recipe can be loaded via the menu

File > Open

in this case PROINSPECT must be in #setupmode.

The second way to load a recipe is via the #RecipeSelection panel
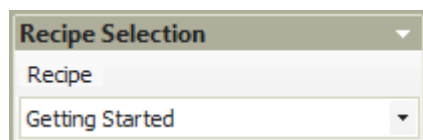
Recipe toolbar

accessible from the toolbar. In this case, if PROINSPECT is in inspection mode, the command will put PROINSPECT in configuration mode before loading the recipe, then, once the recipe is loaded, it will put PROINSPECT again in inspection mode.

2.2 Locate and Inspect

2.2.1 Location Tools

The Location Tools are used to define a feature in the image that provides positional data. The Location Tools create a Fixture, which is used to locate a part in the image quickly and reliably, even if the part being inspected rotates or appears in different locations in the image.

Examine your part and determine which type of feature (or features) meets your application's requirements.

2.2.2 Inspect Tools

Examine your part or object to be inspected and determine which types of features best lend themselves to your application's requirements, and which Inspection Tools best suit themselves to solving your problem.

2.2.3 Fixture

The Location Tools in the Locate Part step create an output known as a Fixture, which acts as a reference point for other vision inspection tools.
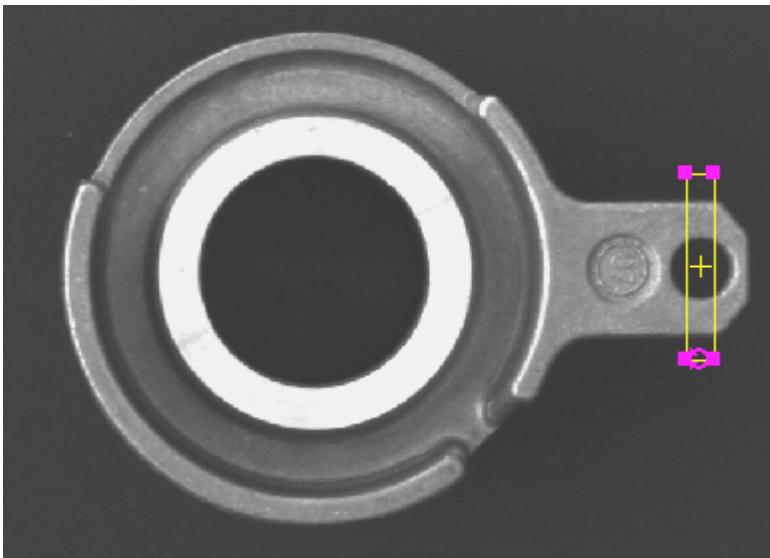
2.2.4 Features

In machine vision, features are referred to as the objects of interest in the image and vision inspections are designed around the types of features found in the image.

Types of features in the Locate Part step include:

EDGES

Linear areas of transition between light and dark pixels. Edges can be things like the ends of parts, pins on a circuit board or threads on a screw. Edges are one of the faster types of features to detect during an inspection, but when used as a Fixture, they should only move in one direction (horizontal or vertical) and be highly contrasted.

Locating an Edge

CIRCLES

Circles are essentially edges, areas defined by a transition between light and dark pixels that defines their geometric shape. Also one of the faster types of features to recognize, as long as they are highly contrasted, however circles do not provide any angular orientation data when used as a Fixture.
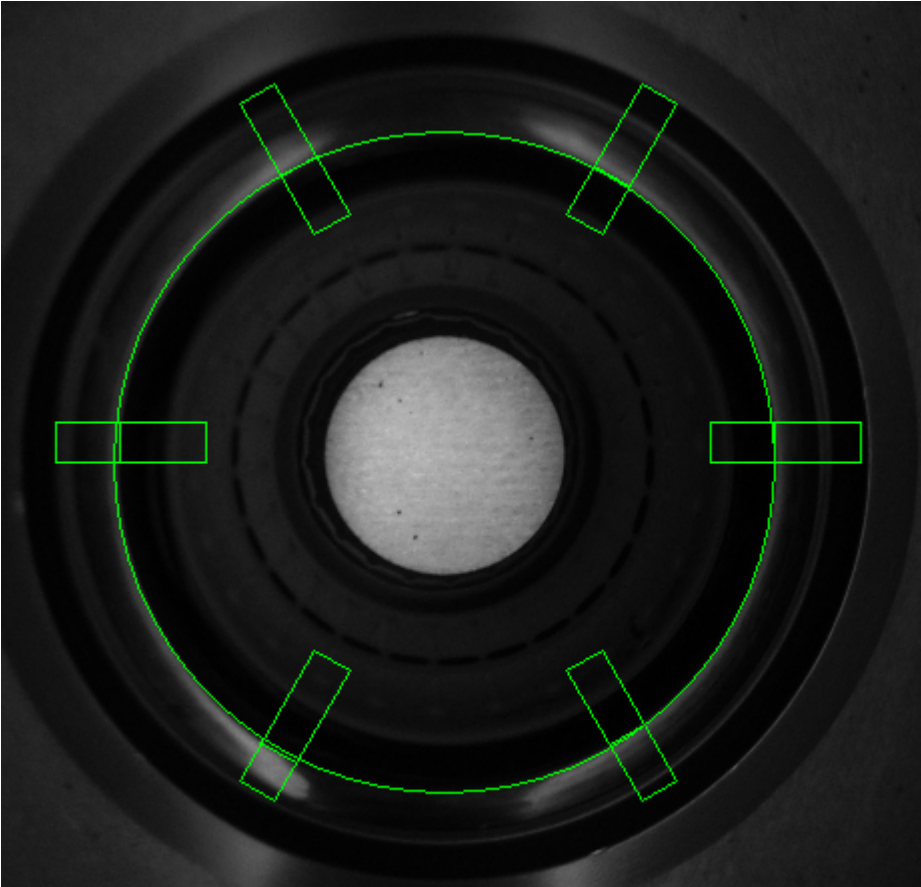
Locating a circle

PATTERNS

A pattern can be anything from a simple group of repeating shapes to complex configurations like logos or labels. The most reliable type of feature to use as a Fixture, patterns allow for the greatest range of positional rotation, movement and scale variations, but generally require the most amount of time to inspect.
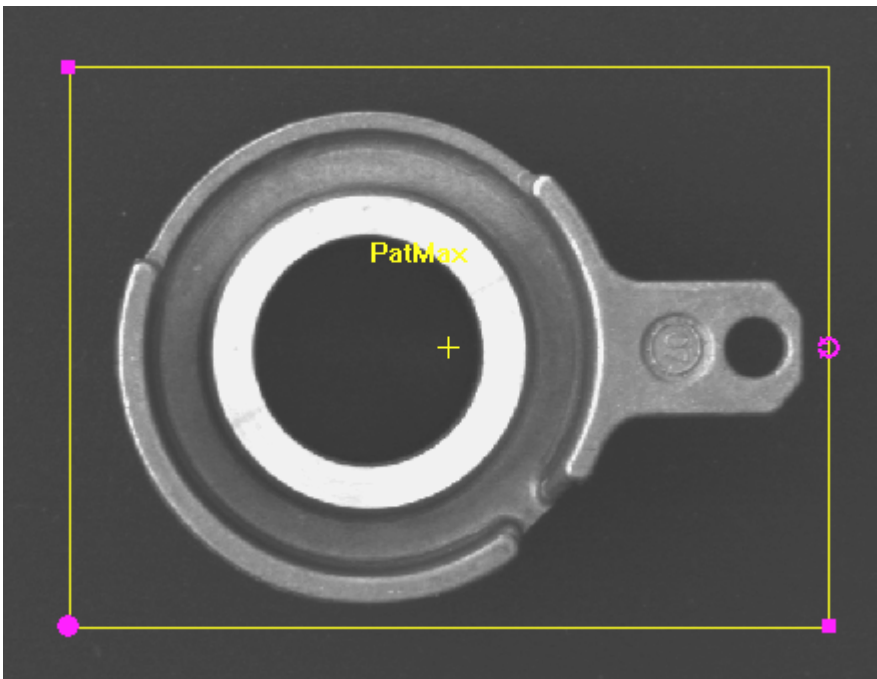
Locating a pattern

In this example a PatMax Patterns Location Tool is used to create a Fixture. The PatMax Patterns Location Tool is used because it can locate complicated patterns while accommodating a wide variety of locations, orientations and scales.

BLOBS

A group of dark or light-colored connected pixels, such as a splotch of white paint on a black background or a black screw on a white conveyor belt. Blobs fall between edges and patterns in terms of their detection speed, and blobs allow for a wider variance of the blob feature's shape and size compared to a pattern, but have limited angular orientation value when used as a Fixture.

2.2.5 Regions

Regions define the area of the image where the Location or Inspection Tool will perform its operation, and are also referred to as the \"Region of Interest.\"

There are several different types of regions used by the Location and Inspection Tools in EasyBuilder, depending upon the type of tool being used. The types of regions used by EasyBuilder are the following:

• Rectangle

• Circle

• Annulus

• Polygon

2.3 Train

Training establishes the region of interest of inspection tools. Furthermore it acquires image templates for tools that require that. Training is needed after a tool has been inserted in the recipe.

Press the Train button. Each View has its own Reference image of the scene that is stored with the recipe and that can be used any time a re-train operation is required. A rectangular shape is shown in the image area. Click near the edges of the rectangle and handles will appear. Drag the corners or use rotational handles to resize the window to enclose the object shape.

The small cross in the center of the rectangle is a special point called origin, this point identifies the object position in the image coordinate system. You can right click to zoom in/out while adjusting regions. Press the Confirm Changes button again to confirm training.
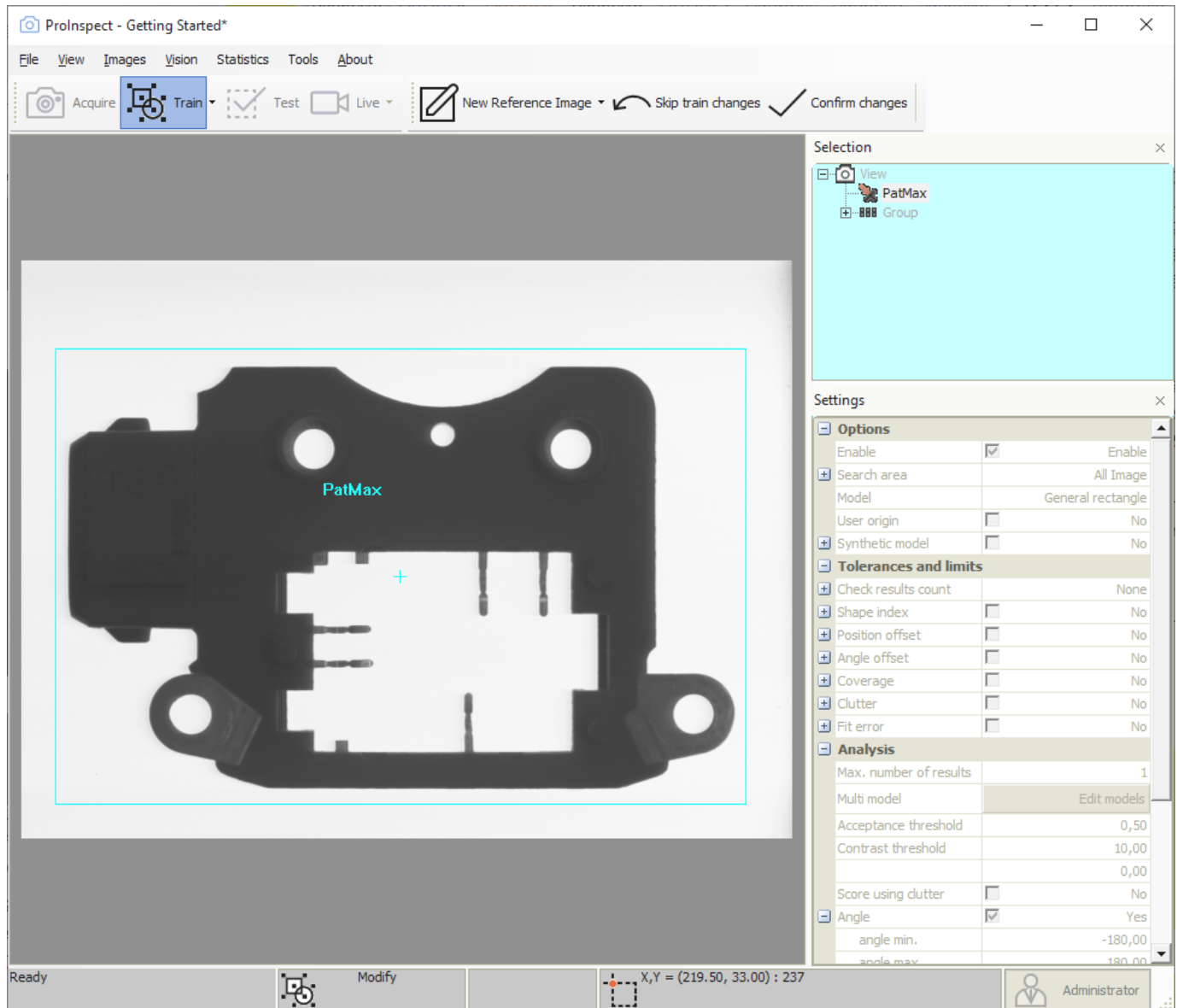
Training is carried out for all the tools of the selected Object.

Train always recalls the "golden image" of the inspected part. The golden image is stored the first time a recipe is trained. It can be changed simply by acquiring or loading a disk image in a train session.

During training you will relocate and resize the windows that appear as color overlay on the image with the mouse pointer. The active window is shown in yellow with pink handles. In order to resize a window you should drag an handle. Drag the yellow lines to relocate.

Once you are satisfied with the windows positions, press again the train button to conclude training.

2.4 Run recipe

2.4.1 Testing the recipe

To test the recipe result you can acquire images from the camera or load images from image files previously saved. After getting a new image click the test button. You will see the graphical result of the inspection and the numerical results of each tool in the Result window.
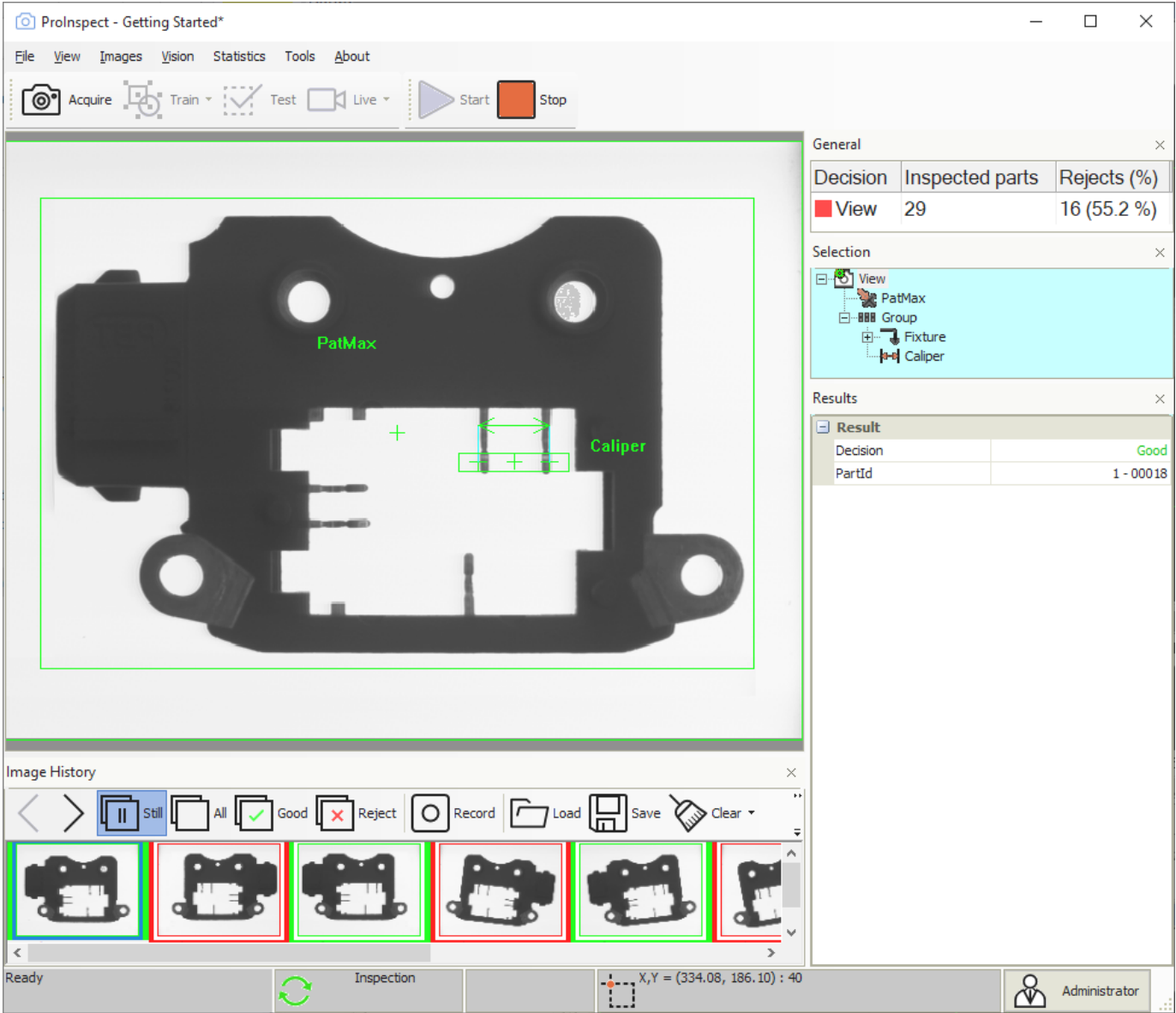
Example of good product 1
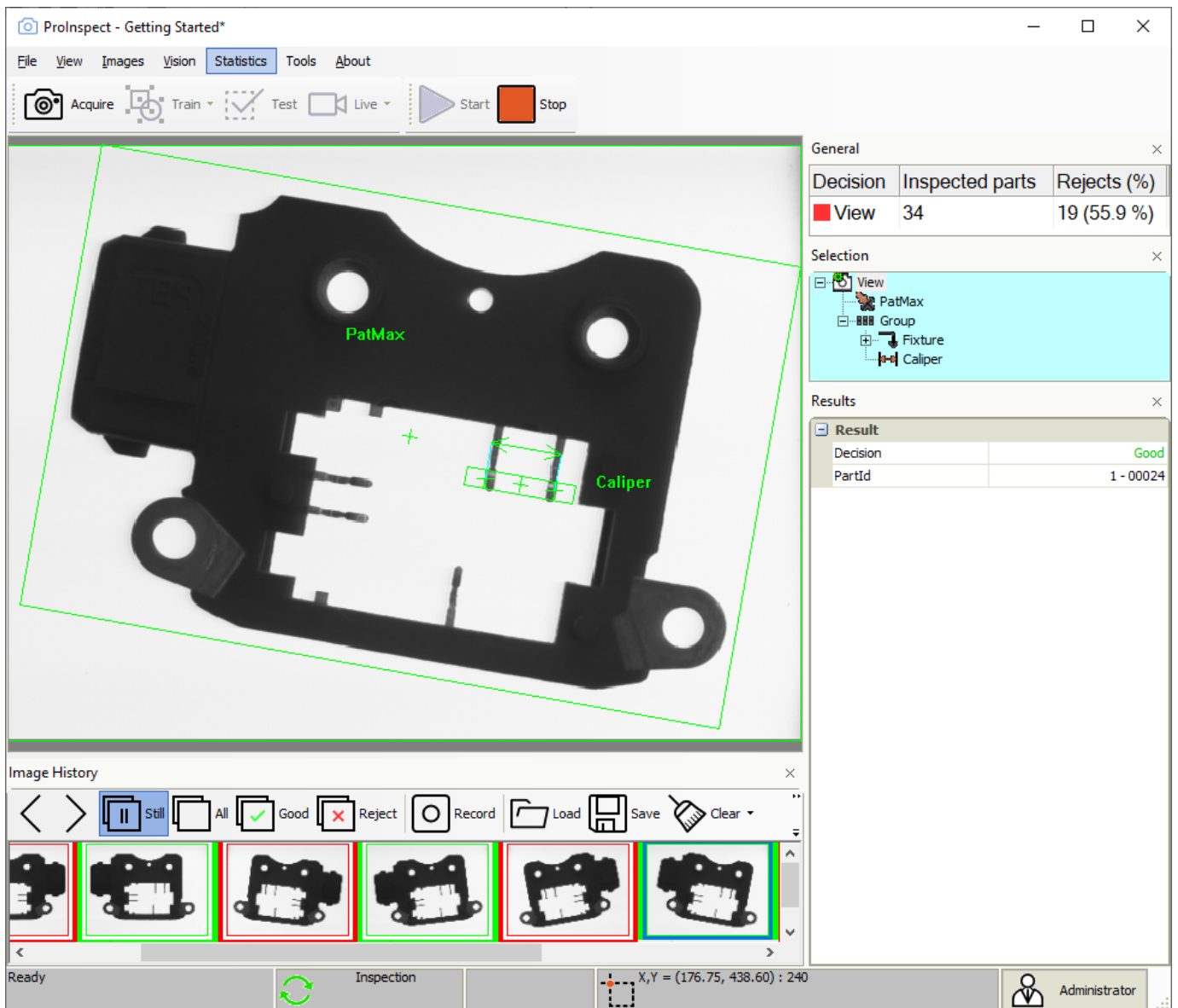
Example of good product 2
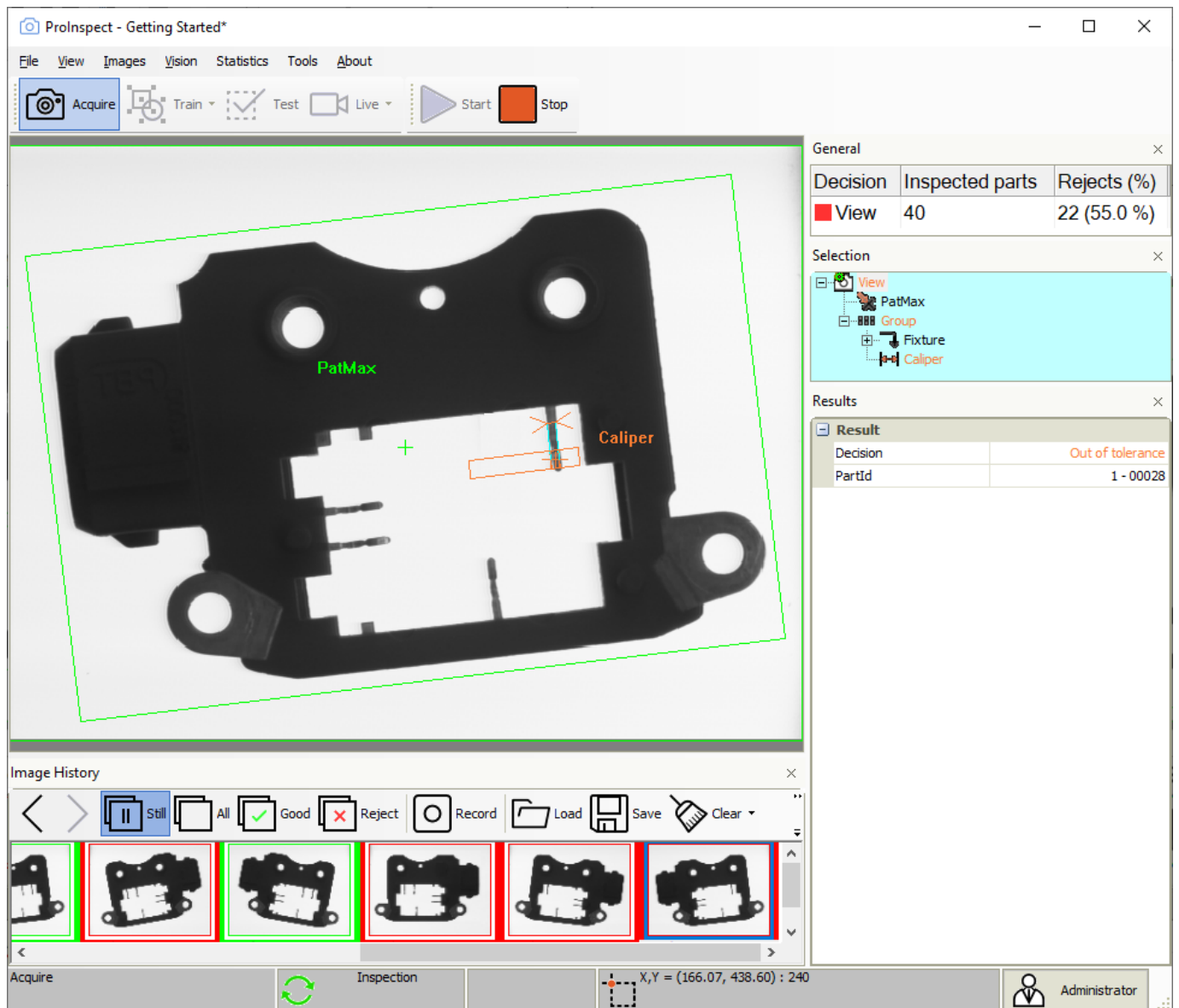
Example of bad product

2.5 Calibration

Calibration is the process with which the system establishes the relationship between the camera space and a known space. Calibrating involves using known data such as the coordinates of a set of points and measuring them in the image space. Because PROINSPECT uses error minimizing resolution techniques, the RMS error (root mean squared error) is provided as estimate of the calibration quality.

In designing the calibration experiment, care should be taken to avoid redundancy in the data that may lead to mathematical problems. A typical situation of redundancy is when the calibration points are aligned.

Physical calibration plate (1cm dot pitch) → **Acquired image of calibration plate** → **Physical location point: (2.91cm, 3.33 cm)**

transformation object

Image coordinate point: (7.6, 8.1)

The transformation object is created by the Calibration tool and is used to convert back and forth between physical and image space.
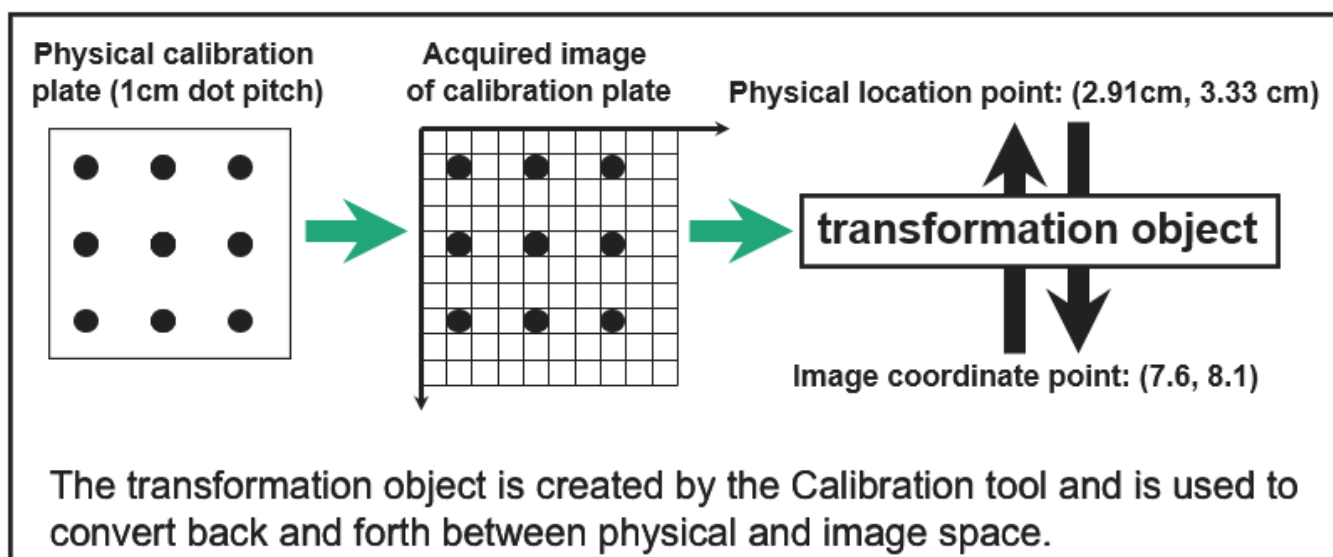
2.6 Input Output

The Inputs/Outputs step is used to define the settings of the discrete input and output lines and I/O modules. You can customize the signal type, select the edge transition and tool results of the signal.

2.6.1 Output results

The result of the inspection is typically a digital True/False signal made available to an external line control or ejection device. Use the Cycle window to set the digital output lines to be used and the timings of the signals.

3. PROINSPECT

3.1 Process

3.1.1 Overview

PROINSPECT can run automatically thanks to a plugin that implements the core of automation: UvpProcessUIS. Here there is the code to drive acquisition, inspections, reports, statistics, output results: all the run-time actions excuted by PROINSPECT. In particular the Process is responsible to create run-time thread for acquisition and inspection, to manage I/O devices for output signals, to implement Sampling actions, to save/report inspection images, to handle run-time settings (Online Setup) etc.

3.1.2 Usage

The main panel to configure PROINSPECT process is the window:

```
Tools > Recipe Options… > Cycle
```

The Cycle panel permits settings of selected View and recipe Object selected. View has different settings from other recipe Objects.

3.1.3 Settings for Views

Cycle	
Mode	Defines what Process has to do with current View in run-time: • None The selected view will not have a runa thread • Queued cycle The selected view is queued in a thread with others view. Its trigger, for run inspection, will be fired after the inspection of another View. First View in a queued set must be triggered. • Stand alone cycle The selected View will run in a separated and owned thread. • Simultaneous queued cycle The selected will run in a single thread but all must be triggered.

Output	
Device	Defines the device for the output result • None No output device • … List of device available.
Mode	Defines how Process has to signal the results • Time delayed pulse Output will be a signal after a set delay. If result is not computed at set time, a reject will be forced. • Step delayed pulse Output will be a signaled on the trigger event of step delayed inspections later. Number of steps is > 1 • No delay Output will be signaled as soon as possible when view inspection ends. **delay** Delay in ms in time delayed pulse **Step delay** Steps in step delayed pulse. **Pulse duration** Duration of output pulse
Data ready	Enables/disables the data ready signal: it is a signal that enables the result signal. Result has a valid value when DataReay is ON. **Line** Line/bit on output device for DataReady **Polarity** Polarity of Data ready status ON: Active high Status is ON when signal is High Active low Status is ON when signal is Low
Result	Enables/disables the result signal. **line** Line/bit on output device for Result **Polarity** Polarity of Result Active high Status is ON when signal is High Active low Status is ON when signal is Low **Mode** Mode of result: Pulse on reject Pulse with the set polarity when the result decision is: reject. Pulse on pass Pulse with the set polarity when the result decision is: pass
Reject code	Reject code is a number used to identify this view result. It is used with processImage result in custom implementations.

Data Device	
Device	Device name

Part Identifier Management	
Part Identifier Device	This section permits to identify selected View with a device that provides PartId tracking. If this kind of device is available you can associate this View to the PartId tracking mechanism setting the proper lines. **Line** Line on partIdDevice where is connected the trigger of the acquisition Fifo of this View **Source** It is the section of the partIdDevice (Input or Output) fo the Line **Output Station** Enables the output station (the output reject line) associated to this View. **Number** Number of the output station (1st , 2nd, … not the line!)

3.1.4 Settings for Objects

Output Object	
Result	Defines which line/bit to use for signaling selected tool **Disable** This item doesn't produce a reject. **View line** Use same line of the owner View. **Separate line** This item will signal a pulse on a different line/bit from View's one. Line Line/bit on output device for Result of this item
Reject code	Reject code is a number used to identify this item result. It is used with ProcessImage result in custom implementations.
Part Identifier management	

Part Identifier management	
Output Station	Enables the output station (the output reject line) associated to this Item. • Disabled Item doesn't take care to the result output • View station Use the same output station of owner View. • Different Station Use a different output station for this Item.

3.1.5 Configuration

Process is provided by the UvpProcessUIS plugin.

3.2 Online Setup

†|†

When PROINSPECT is in Setup mode, you can do actions as acquire images, change the recipe definition, change tool parameters, Train the recipe, define how to communicate with external devices. When PROINSPECT is in #Run mode there are a limited number of possible actions. These actions have an immediate effect on the running inspections: for example, changing a tool parameter, where possible, applies immediately to the next inspections.

Instead, you can use the Online Setup mode to do changes safely, test, and apply to the recipe when validated, without stopping the inspection cycle.

3.2.1 Usage

The Online Setup mode is available only when PROINSPECT is in #Run mode. To enter Online Setup mode, select in the Selection panel the view you want to edit and press the Setup button . The Selection panel will show now only the selected view. This is a partial recipe copy to work with, without affecting the running inspection.

Some panels will continue to show data of the running inspections and others will show data of your changes. Here is some example:

Panel name	Behaviour
Statistics	Run time data
Image history	Run time images
Main display	Setup image
Report	Setup results
Results	Setup results

In this mode, you can do most of the operations you can do when PROINSPECT is in Online Setup mode. You cannot acquire images but you can load images from files or select them from the image history panel.

In this mode you can do all these operations without affecting the running inspection:

- Train the tools
- Change tools parameters
- Test the recipe with different images
- Do the tool statistic sampling
- Validate the changes with the validation tool

When finished, you can apply the changes to the recipe pressing again the Setup button or you can discard the changes using the Setup-Undo Changes button.

Optionally you can edit the entire recipe un-checking the menu option Setup-Selected View.

3.2.2 Configuration

The Online Setup mode is available setting the ApplicationSetupMode in the registry Options\Process key.

Refer to the Options-PartId and UserInterface- UI PartId registry keys for configuration options.

3.3 Validation

3.3.1 Overview

Validation is a procedure available in PROINSPECT that permits to verify a recipe on a known set of test images. It means that you have several images you have already chosen and marked as Good or Reject and your recipe must return the expected result decision. Once PROINSPECT has validated every test image with the expected result the recipe gets the validated status. This status is saved into the recipe. Every modification applied to the recipe gets the recipe to the invalidated status: this because every modified tolerance, every modified model etc. could change the response of the recipe to test samples and needs to be verified. Validation is an action available only in Online Setup mode.

3.3.2 Usage

With PROINSPECT running, enter Online Setup.

Show the Validation window by:

```
View > Other Windows > Validation
```

Validation						✕
Views	Results	Mismatched	Mismatched items	Matched	Matched items	
📷 Camera1	Good validation set: passed	0/10		10/10	[3]: 000_1-00035_Pass_20200710	
	Defective validation set: passed	0/2		2/2	[1]: 000_1-00000_Error_20200710	
📷 Camera2	Good validation set: passed	0/1		1/1	[2]: 000_2-02889_Pass_20200710	
	Defective validation set: failed	1/1	[1]: 000_2-02889_Erro	0/1		

Validation window

The Validation window reports the current validation status of selected View. The first column is green if the View is validated and the result as expected; it is red if View failed validation; it is white is the View is invalidated.

Validate

The command starts the validation process of selected view: PROINSPECT loads all test images, verifies each result decision testing current recipe and updates the proper cell in the Validation report dialog. Validation involves the Good validation set of images where the pass result decision is expected and the Defective validation set of images where the reject result decision is expected. The results if validation is updated in the proper cell and the name of images used to validation as well. Selecting images the inspection results and graphics is shown in Console.

3.3.3 Choosing test images from Image History

The most important and critical action before validating is the choosing of test images. This action can be done using the Image History window. Select the Validation Image set. Now all the command buttons will work on images used for validation.

Load

The command loads and displays into Image History all the images for validation of selected view.

Save

The command saves the selected image in the Validation set folder. You can decide which result decision you expect for images you are saving: the save button has a sub-menu that permits to choose the desired decision:

| As Good | Selected images are being marked as Good. Validation will require a good result decision. | | As Reject | Selected images are being marked as Reject. Validation will require a reject result decision. | | As Is | Selected images are being marked as the current result decision. Validation will require the same result decision as the current images' one. |

Clear

The command removes from the Image History list and/or from the disk (it depends on menu selection) the selected images. This command permits to manage which images to use for validation. Please see Clearing in Image History documentation.

3.3.4 Configuration

Validation operation is available only for enabled users.

Variable	Value	Description
Options\Validation\ValidationEnabled	Permission Levels	Enables validation action

Validation needs UvpValidationUIS plugIn. Please see Plugins.

3.4 Statistics

3.4.1 Statistics

Overview

Each measure or inspection result can be statistically monitored. In the Recipe Options window in the Process Statistic panel, you can select the measures and inspection results to be monitored. In the Statistics menu, you can select a set of panels that summarizes these values in tables. They provide a list of the counters of inspected parts, reject ratio, mean value, standard deviation, and value ranges of a given measure. All measurement values are in metrical units.

Usage

To monitor a value, open the Recipe Options window and select the Process Statistic panel

In the Selection panel, select the tool that has the value you want to monitor. Below the General section, it will appear a list of items with a checkbox; select the value you want to monitor. The selected values will appear in the statistic panels.

TOOL NAME

| Statistic name | Enables or disables the statistic. (default = No) |

You can assign a cavity name to an inspected part checking the statistic of a tool that produces a string result, like Code for the OCR tool.

You can assign a defective class to each measure or inspection result that is statistically monitored.

To assign a defective class, open the Recipe Options window and select the Defective Class panel

You will find all the list of all the inspection results that are statistically monitored. You can assign that inspection result to a defective class, selecting one from the list on the left combo box list

VIEW NAME

| Statistic name | Category name selection (default = None) |

Statistics Panels

Different panels show statistics data in a table for:

Processes, views and tools values Cavity and tools values for each cavity Defective classes and tools values for each defective class

The statistics panels can show several values in the table rows according to the columns available. To select the available columns refer to the UserInterface-UI PartId registry keys.

PROCESSES, VIEWS AND TOOLS VALUES

From the Statistics menu you can open:

the Process panel with the Process menu

that shows the statistics values of all the processes, as the total number of parts and rejects. the Process Statistics panel with the Process Statistics menu

that shows the statistics values of the views and the tools of the selected process in the Process panel, as the total number of parts, rejects, mean and standard deviation. the Statistics Report panel with the Statistics Report menu

that shows in a single panel the statistics values of the views when selected a process or the statistics values of the tools when selected a view in the Process panel, as the total number of parts, rejects, mean and standard deviation. This panel combines the two above panels in a single splitter view panel.

CAVITY AND TOOLS VALUES FOR EACH CAVITY

From the Statistics menu you can open:

the Cavity panel with the Cavity menu

that shows the statistics values of all the cavities, as the total number of parts and rejects. the Cavity Statistics panel with the Cavity Statistics menu

that shows the statistics values of the views and the tools of the selected cavity in the Cavity panel, as the total number of parts, rejects, mean and standard deviation.

DEFECTIVE CLASSES AND TOOLS VALUES FOR EACH DEFECTIVE CLASS

From the Statistics menu you can open:

the Defective Class panel with the Defective Class menu

that shows the statistics values of all the defective classes, as the total number of parts and rejects. the Cavity Statistics panel with the Defective Class Statistics menu

that shows the statistics values of the views and the tools of the selected defective class in the defective class panel, as the total number of parts, rejects, mean and standard deviation.

ADDITIONAL OPERATIONS

From the Statistics menu or the context menu available in the statistics panels can select:

sorting mode visualization mode reset the statistics values export the visualized data in a CSV file

Configuration

The statistics are available adding the UvpPartIdUIS plugin in the registry Plugins key.

Refer to the OptionsPartId and UI PartId registry keys for configuration options.

3.4.2 Run Statistics

Overview

You can see a selection of the measures or inspection results that are statistically monitored in the Run panel. You can open the Run panel from menu:

```
View > Run
```

Settings

To select the measures and inspection results you want to see in the Run panel, open Run panel:

```
Tools > Recipe Options > Run
```

In the Selection panel, select the tool that has the value you want to monitor. In a section with the view name, it will appear a list of items with a checkbox; select the value you want to add to the Run panel.

\<View name\>	
Statistic name	Show or hide the statistic in the Run panel. (default = No)

Run Panel

The Run panel can show the Start and Stop buttons.

Below the buttons, the Run panel shows the selected statistics data in a table.

The Run panel shows several values in the table rows according to the columns available. To select the available columns refer to the UserInterface-UI PartIdRun registry keys.

ADDITIONAL OPERATIONS

From the context menu available in the Run panel you can:

select the sorting mode as the recipe order reset the panel layout reset the statistics values

Configuration

The Run panel is available adding the UvpPartIdRunUIS plugin in the registry Plugins key.

Please refer to

```
Options > PartId
```

and

```
UserInterface > UI PartIdRun
```

registry keys for configuration options. See Registry Keys document.

3.4.3 Statistics Alarms

Overview

You can send alarms to an external device when the reject percentage value of a process reaches an alarm limit. The alarm limit applies to all the processes running. When any process reaches the alarm limit, the alarm is set.

Usage

To set statistics alarms, open the Alarm dialog

```
Tools > Recipe Options > Alarms
```

In the general section, there are limit values for the alarms.

General	
Limit for too many rejects (%)	Reject percentage to activate the alarm (default = 3%)
Min. number of samples	Minimum number of parts when the limit for too many rejects is valid

I/O	
Device	Select the device to use to set the alarm. (default = None)
Alarm for too many reject	Enables or disables the alarm. (default = Yes)
Line	The line to set where the alarm is set

Additional Device Operations

The same device I/O section can be used to:

• Reset the statistics: when the enable statistic reset line is set, the statistics are reset

• Disable the statistics update: when the enable update line is on, the statistics are updated

I/O	
Enable statistic reset	Enables or disables the statistic reset. (default = No)
Line	The line to read to check if the statistic reset is set.
Enable update	Enables or disables the statistic update. (default = No)
Line	The line to read to check if the statistic reset is set

Configuration

The alarm statistics options are available adding the UvpPartIdUIS plugin in the registry Plugins key.

The alarm statistics settings are saved in the ProInspect.cfg file.

3.4.4 Batch

Overview

You can save the production statistics, measurement, and inspection results, for a specific range of time using the batch options. When you open a batch all the production statistics are reset, updated during the production, and saved in a report file when the batch is closed.

Usage

To start a batch, open the batch dialog by menu:

```
Batch > Batch Manager
```

or with the batch manager button in the batch toolbar.

```
View > Toolbars > Batch
```

You can fill the field in the Batch Manager dialog .

Batch Manager

Batch code	Name of the batch; it will be used as the batch report name
Operator	Name of the operator opening the batch (optional)
Parts	Number of batch parts

You can:

- Open a batch with the Open button. The batch manager button in the batch toolbar displays the batch name when a batch is open.
- Modify the opened batch settings with the Modify button
- Close the opened batch with the Close button. Closing the batch saves the batch statistics data in a file with the batch code name.

If you close PROINSPECT when a batch is opened, the batch data is saved and reloaded when reopening PROINSPECT.

You cannot use the same batch name across different recipes.

If you set the batch mode as automatic, the batch manager dialog is opened automatically when you open a recipe.

Open the System Options window and select the Batch panel .

General

Save CSV	Save the batch statistics data in a file with the batch code name when the batch is closed (default = Yes)
Automatic	The batch manager dialog is opened automatically when opening a recipe (default = No)

STATISTICS PANELS WITH BATCH

The statistics panels show statistics data that is:

- Current statistics, if no batch is opened
- Current statistics or batch statistics, if a batch is opened.

RESET STATISTICS

The command resets the current statistics. This will no reset the batch statistics.

BATCH STATISTICS

You can toggle between current statistics and batch statistics with the context menu command.

RUN PANEL WITH BATCH

When a batch is opened, the Run panel shows always the batch selected statistics data in the table and therefore are not reset with the Reset Statistics command.

BATCH ALARMS

A device can set an alarm line when the batch reaches the number of parts set.

Open the System Options window and select the Batch panel .

I/O

Device	Select the device to use to set the alarm. (default = None)
Completion	Enables or disables the alarm. (default = Yes)
Line	The line to set where the alarm is set
Polarity	The polarity of the alarm (default = Active high)

ADDITIONAL OPERATIONS

With the menu command

```
Batch > Save Batch Data
```

you can save anytime the batch statistics data in a file.

Configuration

The statistics are available adding the UvpPartIdBatchUIS plugin in the registry Plugins key.

Refer to the UserInterface-UI PartIdBatch registry keys for configuration options.

3.5 Sharing

3.5.1 Overview

Recipe portions can be shared with other recipes.

Suppose you have a proven recipe in which the parameters have been entered and modified many more to achieve the optimal inspection result. You have to make a new recipe and you realize that some tools should be identical or similar to those of the first recipe. In this case you can export the tools that interest you from the first recipe and import them into the second.

We call this procedure: Import-Export.

Sometimes instead we would like some tools to be shared among multiple recipes. This would allow you to make any changes to the tool in one recipe and automatically find them into all the recipes that share the tool. It is very convenient, for example, when using a calibration tool and wanting to use it for multiple recipes.

We call this process: Sharing.

You can Export-Import or Share entire object, means its training, parameters and model, or its settings parameters only.

3.5.2 Import-Export Objects

Suppose you want to export the MyEdge tool of the MyRecipe_1 recipe in the figure:
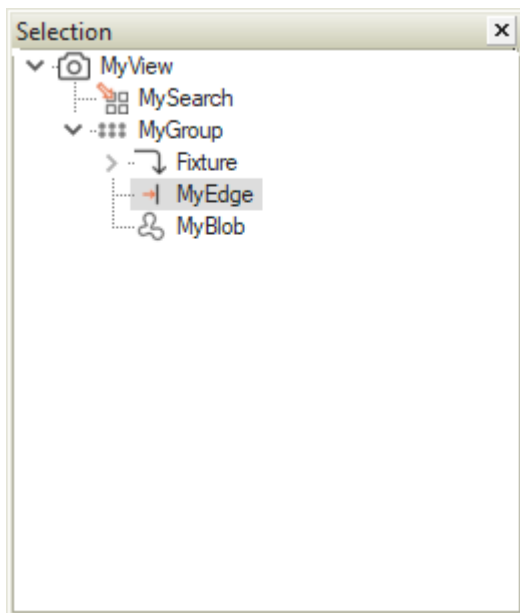
Figura 1

Select MyEdge in the selector window.

In the application menu select:

File>Export>Object...

The Save file window opens.

Select the destination folder and edit the file name.

By default, the name of the object being exported is presented as a file name. However, you can choose a name of your choice.

Save.

The exported object is saved in a file with a .pvx extension.
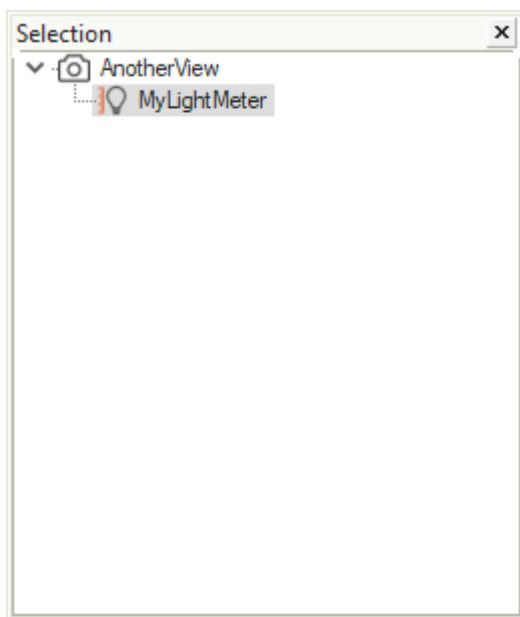
.MyRecipe_2

You now want to import MyEdge object into the MyRecipe_2 recipe

Open the recipe configuration window and create a new object of the same type as MyEdge. The tool that will import the shared file must be the same type, otherwise an exception will be thrown.
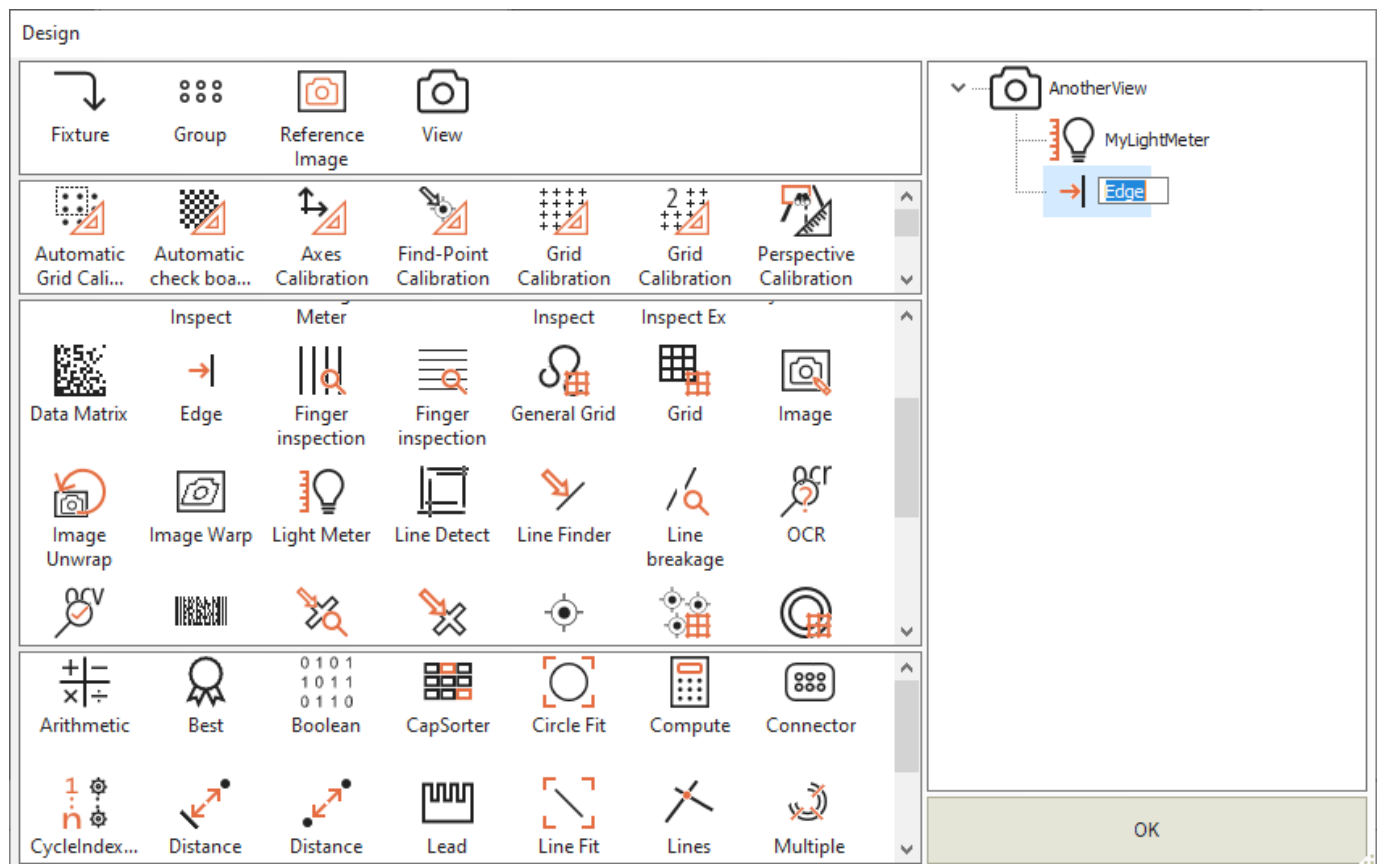
Adding a new Edge tool

It is not necessary to give a name to the created object because, after the import, the name will be changed to the name of the imported object.

Press OK.
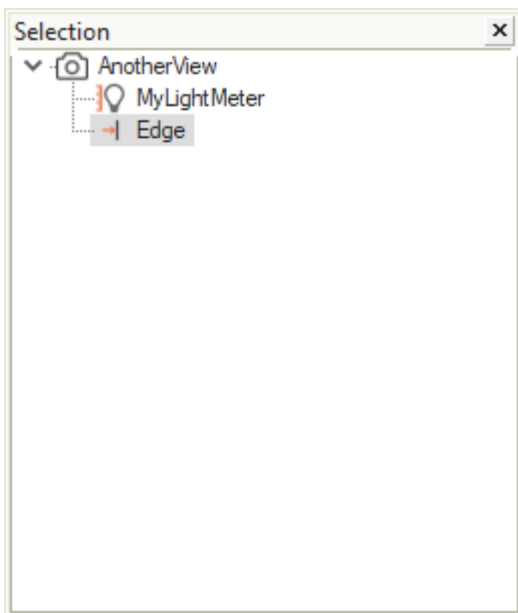
MyRecipe_2 with new Edge

Select the new object and Import the pvx file:

File>Import>Object…

The File open window opens:
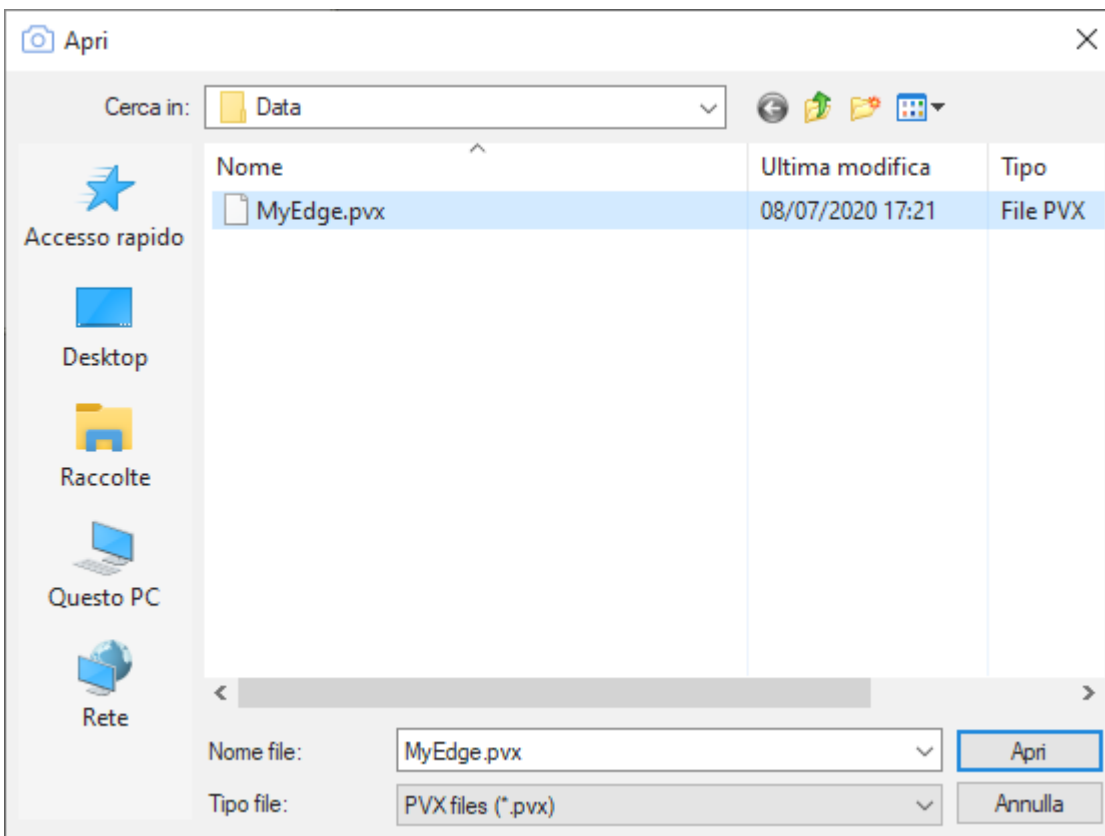
Import MyEdge

Select MyEdge.pvx file.

At this point the Edge object that we had created in MyRecipe_2 has been replaced with an object identical to MyEdge from MyRecipe_2 recipe. The values of the settings parameters of the two MyEdge objects in the two recipes are identical.

3.5.3 Sharing objects

Suppose you want to change a setting value of MyEdge tool of MyRecipe_2 recipe and have the same change in the MyEdge tool of MyRecipe_1 recipe.

The two tools can share the same pvx file.

Open MyRecipe_2 recipe. Select MyEdge tool and open the Settings window.

Open the More... section
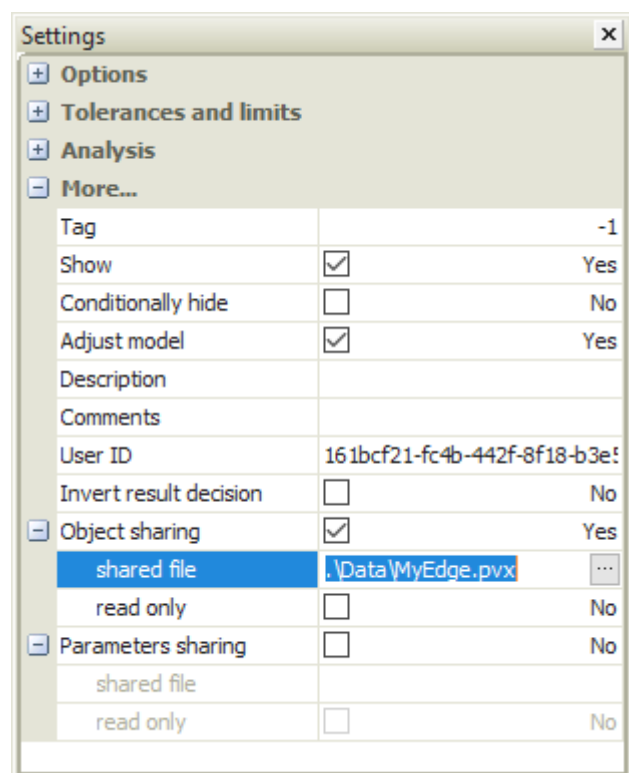
MyEdge settings. Object sharing

Check the Object sharing parameter. The shared file parameter is enabled.

In this field you set the file to be shared. You can proceed in two ways:

Edit the path of the pvx file to be shared. Select the key. The file opening window opens. Select the MyEdge.pvx file.

Since you want to change a value of MyEdge tool and find the change in MyEdge tool of MyRecipe_1 recipe, we do not check the read only parameter.

We proceed to modify the desired settings value. For example position X tolerance.
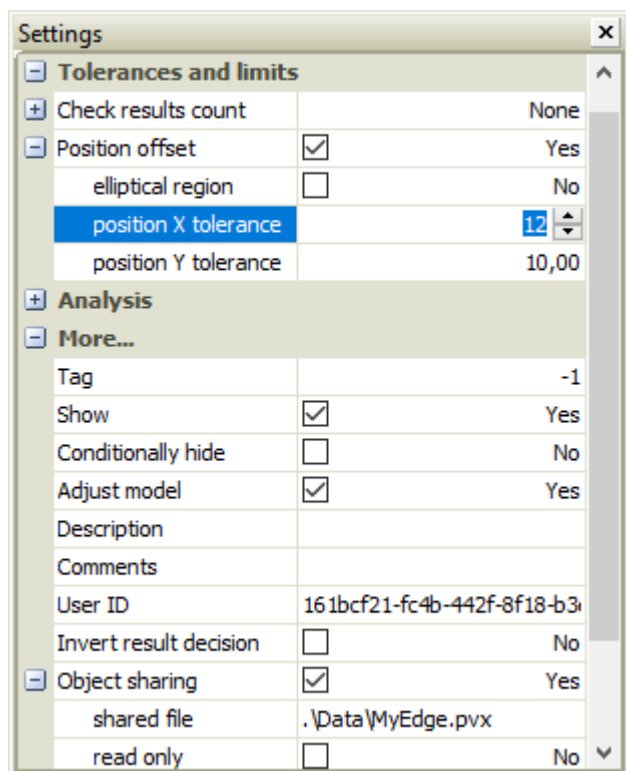
MyEdge settings. Change parameter.

Let's save the recipe.

You will notice that a padlock appears in the recipe selector near the MyEdge tool icon.
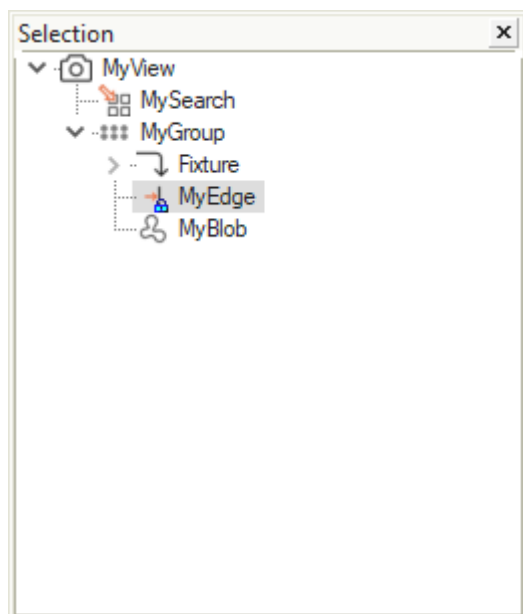
MyEdge with blue padlock

This indicates that that tool is shared on a pvx file.

Open the MyRecipe_1 recipe. Select the MyEdge tool and open the Settings window.

Open the More... section

Check the Object sharing parameter.

Select the MyEdge.pvx file.

At this point the two recipes share the same MyEdge tool. If you change a tool value in one recipe, the change will also apply to the other.

If you want a single recipe to be able to change a shared tool, check the read only parameter into the other recipes.

If you make a change on a shared tool with the read only check, the change will not be saved in the shared file.

3.5.4 Read Only Mode

In this mode all shared recipe files will be read only. This mode is activated by registry variable SharedReadOnly.

In the Settings window the read only parameter will always be checked and disabled.
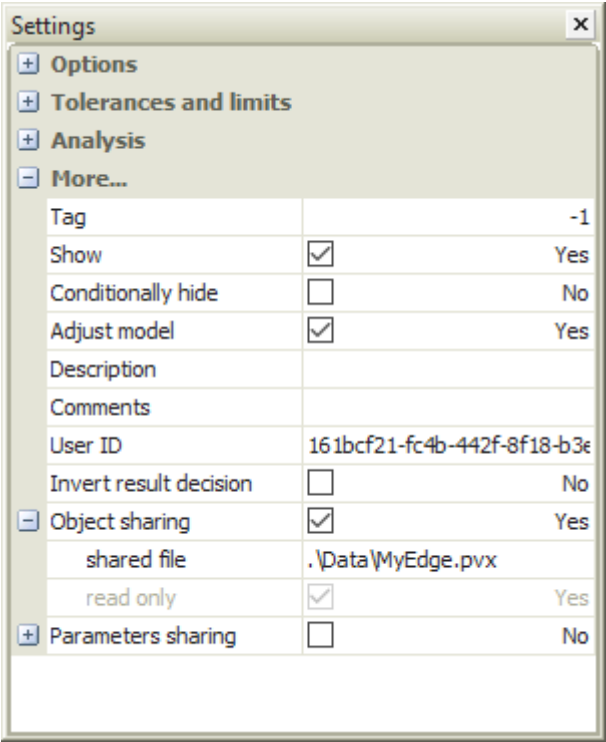
Read only shared file

When saving the recipe, the shared files will not be saved.

However, it may be necessary to edit the shared file. Set the registry parameter ShowSharedFileSave to display the menu item:

```
File > Save Shared Files…
```

The Shared objects window appears:
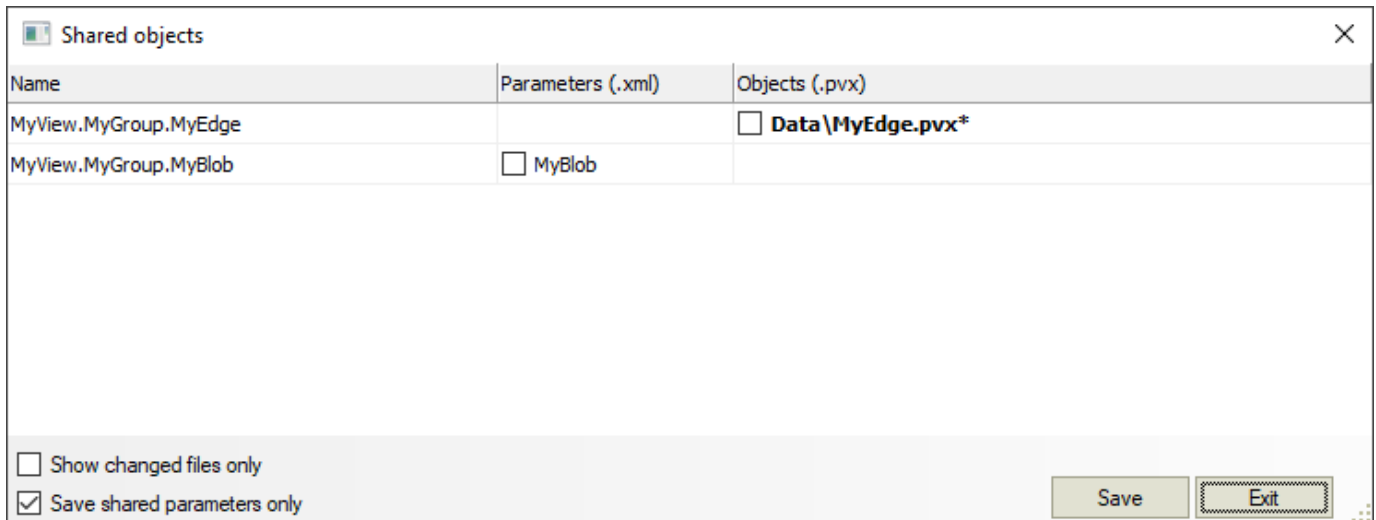
Shared objects window

The shared tools and the corresponding file are listed in this window.

In correspondence of each tool, in the Parameters column (.xml) there is the name of the parameter export file in XML. The name of the PVX object export file is listed in the Objects column (.pvx).

If a shared object has been modified, the corresponding file is shown in bold and marked with a .

If the Show changed files only flag is checked, only the tools that have undergone a change will be listed.

Check the files you wish to save and press Save.

3.5.5 Import-Export Parameters

Settings parameters can be exported and imported by saving them in an XML file

Use the following command:

```
File > Export > Object settings…
```

The save file window opens.

Select the destination folder and edit the file name.

By default, the name of the object being exported is presented as a file name. However, you can choose a name of your choice.

Save.

The exported object is saved in an .xml file. This file can be modified by a common text editor.

To import an xml file use the following command:

```
File > Import > Object settings…
```

In general, the Import-Export procedure on an XML file is the same described for import-export on PVX file.

Please refer to Import-Export Objects for details.

3.5.6 Sharing Parameters

Just like objects, settings parameters only can be shared too.

Please refer to Sharing objects for details.

3.5.7 Multiple tools parameters

Suppose you have an object than contains other tool and you want to export the settings parameters of that object and all the objects it contains.

Referring to the recipe in Figura 11, let's export the MyGroup tool.
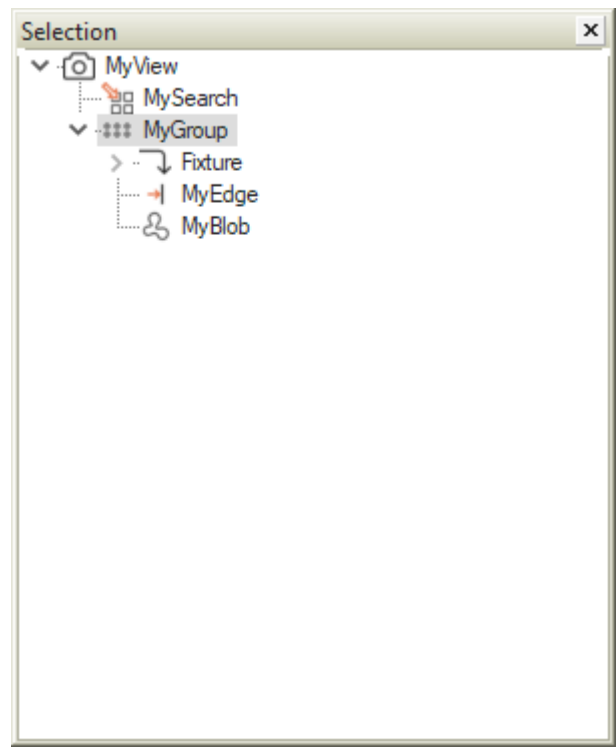
Exporting a Group

You select MyGroup and use the following command:

```
File > Export > Objects settings…
```

An Open folder window will appear.

Select a folder.

If you open the selected folder you will see that four files are created:

MyView.MyGroup.Fixture.xml MyView.MyGroup.MyBlob.xml MyView.MyGroup.MyEdge.xml MyView.MyGroup.xml

One file for the exported object, and one file for each contained tool.

3.5.8 Configuration

Variable	Value	Description
UserInterface\UI SharedItems\ShowSharedFileSave	Permission Levels	To visualize Shared objects window
Options\Settings\SharedReadOnly		0
Paths\SharedData	String	Default path for shared files

3.6 Sampling

3.6.1 Overview

Sampling is a procedure to train some tools statistically. Instead of training models' features from the single reference image, Sampling permits you to use a set of several images to extract information from. Statistical training produces an average image to use as the reference image and a variation image to understand how samples are different from each other. Not all the tools implement the sampling capability. Usually, the set of images is the same for all the tools contained in a View. All tools in a View share the same samples set. If necessary a single tool can have its own sample set.

3.6.2 Usage

There are different ways to run a sampling procedure. However, a condition is required: before starting a sampling, the tools involved must be trained. You can run sampling during normal work of PROINSPECT or in Online Setup mode, you can use current inspected images or use a prior saved set of images. You can add all samples in a single operation or decide which samples to use interactively. You can configure which modes are permitted and which PROINSPECT user can do what enabling by Permission configuration. During the sampling operation, the status bar displays current status:

	Description
	Sampling <n> / <tot>

Sampling has a few settings and these are unique for each View. You can set parameters by window:

```
Tools > Recipe Options > Sample Images
```

3.6.3 Sample Images

Options	
Samples folder	Base folder for saved samples images. To this folder you add the \ and you have the complete specific folder for Current View.

View	
Sample only good parts	Tells the sampling operation to add the current sample only if it has a pass inspection result.
Samples number	Number of images to use for statistical training. When the number is reached the sampling operation ends and the resulting model is updated for all tools involved.
Save images	Tells the sampling operation to save the image of the current sample acquired by PROINSPECT. The image is saved in the View's folder specified as a BMP file.

Sampling with run-time images

A way to run the sampling operation is to process images that PROINSPECT still is acquiring and inspecting, with run-time images. Pressing the Sample button PROINSPECT, after having inspected the last acquired image, pushes it in a pool of images used by the sampling process. The pool is then popped, by a low priority thread, and the sample image is added to the statistical training of the involved tools. Once reached the number of desired samples (samples number) the images are elaborated producing a new model for each enabled tool that will replace the current working one.

Sampling with images from disk

A second way to run the sampling operation is to process images present on the disk into the specified View's folder. This action can be performed PROINSPECT is both in #Run mode and Online Setup mode. As in the sampling with run-time images, PROINSPECT processes all the sample images present in the folder (not only the desired samples number), by a low priority thread, and at the end produces a new model for each enabled tool that will replace the current working one. Sampling from disk permits another feature: the Interactive mode. In this mode images from the disk are loaded one by one and displayed in Console. You can decide what to do with this image:

	Icon	Description
process it		Add sample button
skip it		Skip sample button
end action		Stop Sample button
delete sample from disk		Delete sample button

Sampling with Image History

The sampling operation has a practical user interface integrated with the Image History window. Select the Sample option:

Now all the command buttons will work on images used for statistical training.

	Icon	Description
Load		Loads and displays into Image History all the images of the Sampling folder.
Save		Saves the selected image in the Sapling folder. These images are added to current ones and will be used by Sampling from disk action.
Clear		Removes from the Image History list and/or from the disk (it depends on menu selection) the selected images. This command permits to choose which images to use for statistical training.

3.6.4 Configuration

Sampling operation is available and visible only for enabled users. You can modify behavior by following registry values:

		Description
Options\Process\EnableSamplingInRun	Permission Levels	Enabling functionality
UserInterface\ShowSample	Permission Levels	GUI Visibility

Sampling operation needs the UvpProcessUIS and UvpMainUIS plugIns.

3.7 Console

3.7.1 Overview

The Console is the area of the application in which images can be viewed. Depending on the configuration and on the recipe you can see one or more images.

You can see the images both when the system is running and when it is stopped.

You can see images uploaded from files or acquired images.

Also, the images can be filtered by inspection results.

Load images from files

You can load image files by command:

```
Images > Images > Load…
```

An Open file window opens.

Select the image.

Load images from acquisition system

If the Views of your system are configured with an image acquisition system, you can see the acquired images.

Live

The images are displayed in sequence as they are captured by the acquisition system. This display mode is accessed by menu:

```
Images > Images > Live
```

Or by toolbar button:

```
View > Toolbars > Commands
```

Commands toolbar will open. Press Live button.

Acquire

The image displayed in the Console is the one acquired when managing the Acquire command. This command can be sent from the menu:

```
Images > Images > Acquire
```

Or by toolbar button:

```
View > Toolbars > Commands
```

Commands toolbar will open. Press Acquire button.

Save Images

Image displayed in Console can be saved as an image file by command:

```
Images > Images > Save
```

A Save file window opens. Type the file name and press Save.

Filtering images

While the system is running, images displayed in Console can be filtered by inspection result.

Filters can be selected by toolbar:

```
View > Toolbars > Display mode
```

All

To see all acquired images press button All:

This button has a menu where you can select the images from the Views.

Description	
All views	• Checked You can alternately see images from all Views • Not checked You see images from selected View

Still

The flow of image display can be stopped by pressing the Still button.

Pass

Images can be filtered by displaying only those that have had a good result from the inspection by pressing button Pass.

This button has a menu where you can select the images from the Views.

Description	
All views	• Checked You can alternately see images from all Views • Not checked You see images from selected View
First pass	• Checked Images flow stops at first passed image • Not checked Images flow shows all passed images

Reject

If you only are interested in not passed images, you can filter inspected images by pressing button Reject.

This button has a menu where you can select the images from the Views.

	Description
All views	• Checked You can alternately see images from all Views • Not checked You see images from selected View
First pass	• Checked Images flow stops at first rejected image • Not checked Images flow shows all rejected images

3.7.2 Multiple Consoles

Display mode toolbar will show two more buttons.

Multiview

This button allows you to switch from multiple view to single view and viceversa. Alternatively double click inside the Console window.

When in single view the current View is displayed. When in multiple view, the current view is identified by a frame around its pane.

Each pane can be sized dragging its border.

Default

You can use this button to resize the panes to default size

3.7.3 Zoom and Pan

You can zoom and move the image inside the pane with Console commands. You can access them by menu:

```
View > Console
```

Or by toolbar:

```
View > Toolbars > Console
```

Zoom In

Use this command to enlarge the image.

Zoom Out

Use this commando to make image smaller.

Fit

Use this command to size the image to the pane.

Normal

Use this command to size the image to its normal size.

Pan

Use this command to move the image inside the pan. The cursor changes to a hand-shaped pointer. To get back to normal pointer press Pointer button.

Show graphics

Draws the tools' graphics on the image.

Clears graphics

Clears graphics from the image

3.7.4 View selection

When using multiple console, instead of using the selector, you can select the current image by clicking inside the corresponding pane. A frame around its pane appears.

If the registry variable StatusColorMode is set , the frame is colored as like as the result status of the inspected image:

	Description
Red	Reject
Green	Pass

3.7.5 Display settings

The tools in PROINSPECT can have a graphic interface that reports some result information and permits some diagnostic of results. Each tool has different graphic settings but all can be grouped in families. Select in the selector panel desired tool, then show the window:

```
View > Display Settings
```

Region draw settings section

Tools that implement an image processing.

	Description
Current region	Selects the region of the tool you want set. This feature is available if the tool has more than one region to display. If case you have to select the region.
Region shape	Shows/Hides the graphics of the shape that describes the ROI of the selected tool.
Region center	Shows/Hides the center of the Region.
Region name	Shows/Hides the name of the region. By defaults is the name of the tool (followed by a).
Region mask	Shows/Hides the shapes that mask the ROI of the selected tool.
Region if reject	Shows/Hides the graphics of the shape in case the selected tool has the reject result decision for current inspection even if the Region shape flag is set Hide. This is for showing the ROI where the tool failed.

Model draw setting section

Tools that have a model to look for.

	Description
Model shape	Shows/Hides the graphics of the shape that describes the Model of the selected tool.
Model center	Shows/Hides the center (origin) of the Model of the tool. It may be different from the center of the model shape.
Model name	Shows/Hides the name of the region and its masks. By defaults is the name of the tool. (The masks' name have the name of the tool followed by a #).
Model mask	Shows/Hides the shapes that mask the Model of the selected tool.

Tool draw setting section

Tools that have some own features to display.

	Description
<Own feature n>	Shows/Hides the graphics of this custom feature of the selected tool.
<Own feature m>	Shows/Hides the graphics of this custom feature of the selected tool.

Positions draw setting section

Tools that have one or more Position results.

	Description
Position selection	Selects the position of the tool you want to set. This feature is available if the tool has more than one position result to display.
Target point	Shows/hides the graphics of the shape that displays the point returned as position.
Position name	Shows/hides the name of this position.
Text position	Select where to draw the info of this position:
Coordinates	Shows/hides coordinates (x, y, a) of the selected position.

Measurements draw setting section

Tools that have one or more Measurement results.

	Description
Measurement selection	Selects the measurement of the tool you want to set. This feature is available if the tool has more than one measurement result to display.
Measurement value	Shows/hides the value of this measurement result.
Measurement name	Shows/hides the name of this measurement.
Precision	Sets how many decimal digits for this measurement.
Text position	Select where to draw the info of this measurement:
Quote	Shows/hides graphical position of this measurement.

Value draw setting section

Tools that have one or more Value results.

	Description
Value selection	Selects the value of the tool you want to set. This feature is available if the tool has more than one value result to display.
Value	Shows/hides the value result.
Value name	Shows/hides the name of this value.
Precision	Sets how many decimal digits for this value.
Text position	Select where to draw the info of this value.

3.7.6 Configuration

Multi console is configured by registry. Registry variable EnableSplit must be set.

Let's call each split part as a pane. The division of the console window must be defined by registry variables Rows and Columns.

For each pane, a registry key is created. If for example you set Rows = 1 and Columns = 3, tree registry keys are created: Split00, Split01, Split02.

Each entry has the variables Rows and Columns, so you can recursively split each pane.

Variable	Value	Description
UserInterface\UI Frame\Split\EnableSplit		0
UserInterface\UI Frame\Split\Rows	Positive integer	Number of rows for splitted console
UserInterface\UI Frame\Split\Columns	Positive integer	Number of columns for splitted console
UserInterface\UI Frame\Split\Split	Registry key	One key for each pane
UserInterface\UI Frame\Split \StatusColorMode		0

3.8 Users

3.8.1 Users

Overview

Access to PROINSPECT features is regulated by authorization levels. Each user is assigned a level that allows access to interface elements an features. Each user can define the application layout that will be retrieved when logged in.

There are 4 authorization levels. Here are listed levels from higher to lower:

1	Administrator	Reserved for system installer
2	Super	Assigned to the system manager
3	Leader	Assigned to privileged system operator
4	Operator	Assigned to the machine operator

You can have any number of users with its authorization level.

The Administrator user has access to all PROINSPECT features and has the right to define access permissions for users of other levels.

PROINSPECT can only be closed by authorized users.

Forced user

When closing PROINSPECT the name of the current user is saved. When PROINSPECT restarts the saved current is logged in. If you want a specific user to be logged in when PROINSPECT starts you must enter a valid name in the registry variable ForcedUser.

It is possible to change the current user to the forced user after a time of user inactivity by setting the registry variable ForcedUserIdleTime.

User switching occurs automatically if the current user has an authorization level higher than ForcedUserConfirmationLevel. Otherwise a confirmation window appears
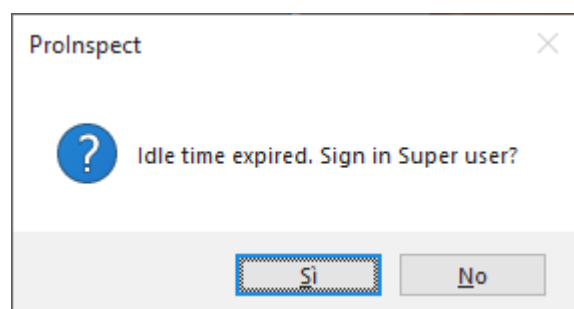
Change user confirmation window

If you want the user change to be notified in the message window and in the logs, the registry variable ForcedUserNotification is set to 1.

Application exit

PROINSPECT can only be closed by authorized users, i.e. with a level equal to or greater than UserCloseMode.

Change user

The change user window is accessed via the Users menu.

```
Tools > Users > Change User…
```

Alternatively, you can access it by pressing the users button in the right corner of the status bar. The current user name is showed in this button.
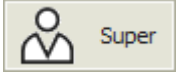
Select the desired user. Enter your password. Press Ok.

Configuration

Users are configured in the registry.

Variable	Value	Description
Users\NumUsers	Positive integer	Number of users
Users\User\Group	1, 2, 3, 4	Authorization level
Users\User\Name	String	User name
Users\User\Password	String	User password
Users\ForcedUser	String	Name of user to load at Startup
Users\ForcedUserIdleTime		0
Users\ForcedUserConfirmationLevel = <1,2,..,N>	Users values	Name of user to load at Startup
Users\ForcedUserNotification = <0,1>	0, 1	Notifies that ForcedUser has been loaded
Users\UserCloseMode	Users values	Enable Exit button

3.8.2 Permission

Overview

It is possible to set the visibility of windows or tool settings parameters according to the current user level.

Per-user permission settings are stored in a database.

Dialogs permission

Each dialog is assigned a minimum user level. The access level that can only be changed by a higher level user. Editing is done through the Access Permissions window.

```
Tools > Users >Access Permissions
```

The Access Permissions dialog has a section named Dialog where the user can change the access level of each window.

Dialog	
Dialog name	Select dialog by name
Access level	Select access level

To change the access level of one dialog, select the dialog name in the Dialog name list. Then select the desired access level in the Access level list.

If a dialog is not enabled for viewing, in addition to not being visible, it will also be removed from the menu.

To apply the changes, you must log in with the changed authorization level.

Settings permission

The tool settings parameters are subject to visibility conditioned by the user's access level.

Each parameter is assigned a level that can only be changed by a higher level user. Editing is done through the Access Permissions window.

The Access Permissions dialog has a section named Items where the user can change the access level of each parameter of each tool. The content of this section changes according to the selected tool.

With the permissions window open, select a tool in the selector. Then click inside the settings window.
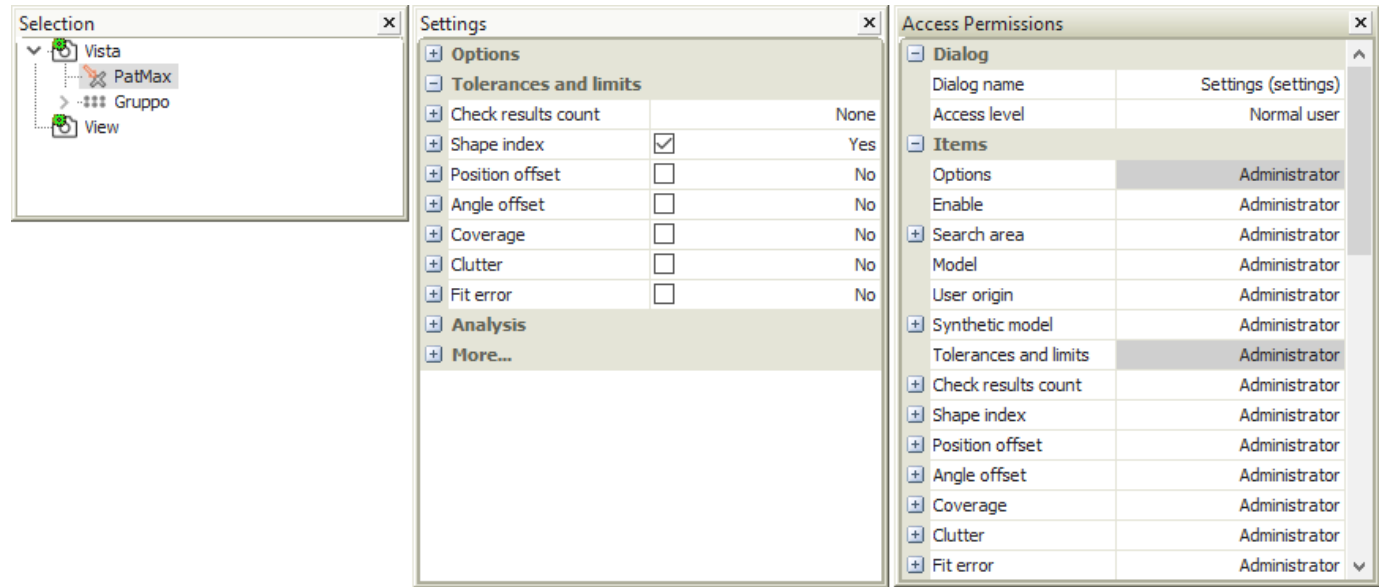
Setting parameters permissions

For each parameter in the settings window there is a parameter in the permissions window with the same name. In correspondence to each parameter it is possible to select the user level.
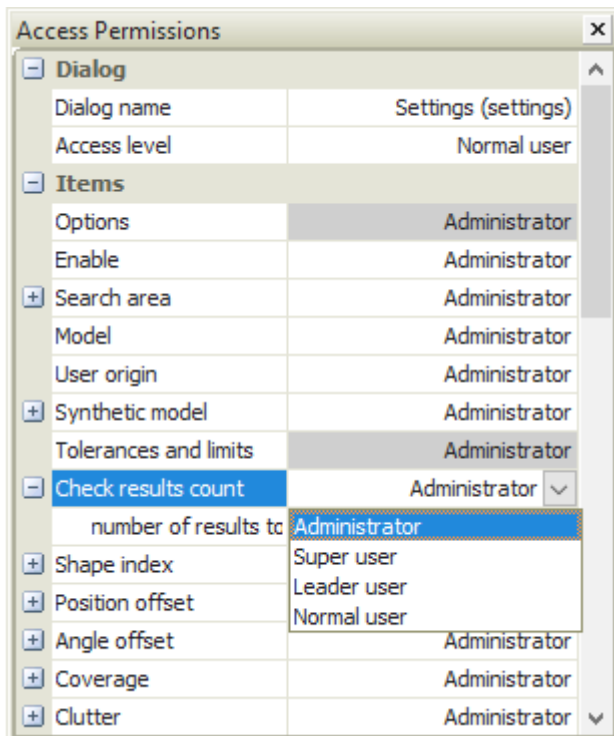
Changing parameter permission

Upon user change, if a settings parameter is not enabled to be visible, it will be removed from the settings dialog.

3.8.3 Permissions update

Overview

The permission settings are saved in a database. It may happen that the DB used is not updated, that is, it does not contain all the items of parameters or windows.

If the DB is not updated, the missing items are displayed in red in the permissions window.
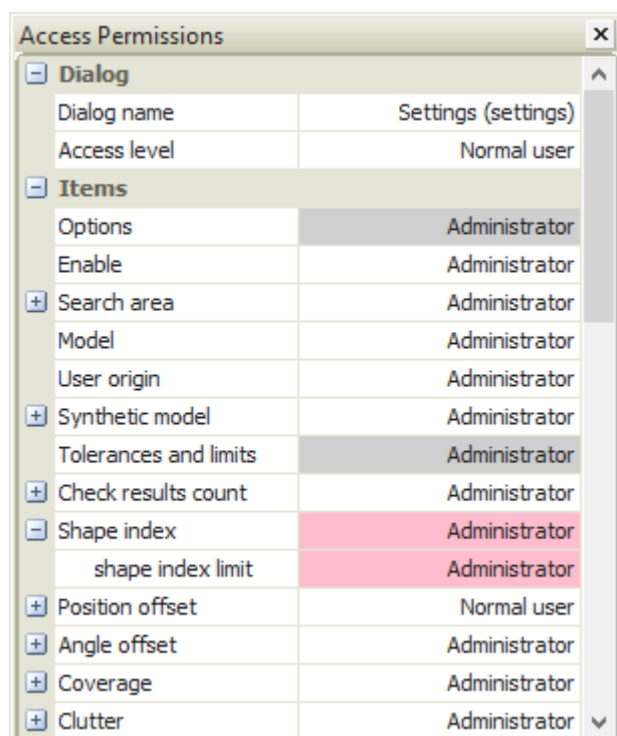
Red parameters are not in database

To update the database, access the Users menu and press the button Update Permissions.

```
Tools > Users > Update Permissions
```

A confirmation window will appear. Press ok to continue.

If the DB file does not exist, the permissions window will appear disabled.

In this case no permit will be applied and all users will see all settings parameters and all dialogs.

The file is supplied together with the PROINSPECT software.

Configuration

Variable	Value	Description
Paths\PermissionsUIS	String	The full path name of the permission file

3.9 Image History

3.9.1 Overview

The ImageHistory is a ProInspect feature that permits to store, in run-time mode, the images used for View inspection. You can decide to store All images, or only the Reject or Good ones (images with an inspection result different from pass, or equal to pass). Selecting an image, ProInspect executes inspection of the current View on it and reports results.

The list (history) of images is a circular queue that you can resize: old images are overwritten by new ones. You can even decide to load archived image files from a storage device. The ImagHistory is useful also for the #Sampling and #Validation actions. ProInspect provides as many ImageHistory as Views of the recipe: selecting the View, automatically the proper History list is updated. Each image of history has a colored mark: color is associated to the #category decision.

The window is accessed via the menu item

```
View > Image History
```
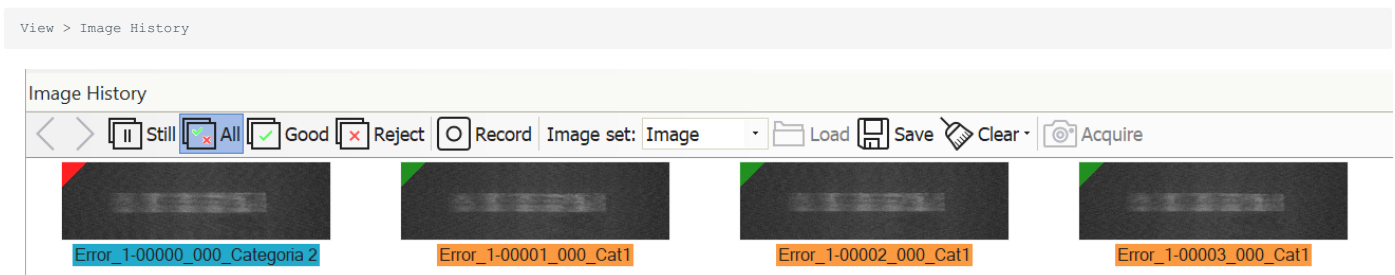

The visibility of the toolbar buttons is bound to:

User access level Current functionality

3.9.2 Image display

The Image Display mode defines which history you want to collect. If you are in Run-mode and History Display mode is in a status different from #Still, you can see the inspected images scrolling in the panel: new ones are added on the right and fill the queue till they replace the oldest. IfWhen the History Display mode is #Still, you can access other operations, like loading new history, storing on disk, execute inspection, delete images, etc. When you select an image from the history image panel, automatically ProInspect switches the History display mode to #Still and executes all tools of the View on the selected image. The History Display status can be automatically updated by the #ForcedDisplayMode: after an interval time of user inactivity, ProInspect switches to this stauts.

Display mode

Still

This status stops the image storing action. ProInspect stops adding run-time images to the history queue. In this display status you can:

Select and run queue images Cancel from the list Save selected images Load a new list

If the system is in Stop and in the register the ForcedDisplayMode variable is set to a valid value, at the end of a time interval set also in the register, the system exits the Stop display mode and enters the mode set again from register. See Forced display.

All

In this status PROINSPECT stores all the run-time images into the queue and marks them with the category color.

Good

In this status PROINSPECT stores only the run-time images with a Pass decision result.

Reject

In this status PROINSPECT stores only the run-time images with a Reject decision result.

Forced display

This feature automatically forces a history display mode after a time of user inactivity. It is a registry configuration.

3.9.3 Save

This command runs the saving action of selected images of the history list on a storage drive.

The path of the folders depends on the modality of the History: Image, Sampling, Validation.

The name of the files can be defined by the registry. TODO : Come?????? fare: #ImageNames

The Save button allows you to save the images displayed in the window.

Saving in Image mode

By pressing Save button, all displayed images will be saved in Images folder.

Images path is:

<Images folder>\<Recipe name>\<View name>

Saving in Sampling mode

To save the images that will be used in the Sampling process, select the Sample item in the Image set combobox.

By pressing Save button, all checked images will be saved in Samples folder.

Images path is:

<Samples folder>\<Recipe name>\<View name>

Saving in Validation mode

To save the images that will be used in the Validation process, select the Validation item in the Image set combobox.

By pressing Save button, all checked images will be saved in Validation folder.

Images path is:

<Validation folder>\<Recipe name>\<View name>

In this modality you are required to select which images you want to save as Good expected and which ones as Reject expected.

The Validation Save button has a sub menu you can use to select the proper option:

	Description
As Good	Regardless the inspection result, the image is saved as a Good image
As Reject	Regardless the inspection result, the image is saved as a Reject image
As Is	The image is saved according to the inspection result

3.9.4 Load

Pressing the button has a different effect depending on the Image set mode.

Upload from Images folder

Pressing the button the file opening window opens showing the contents of the Images folder. You can select the images to be uploaded.
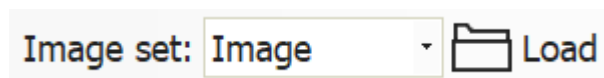
Upload from Sampling folder

The Load button will load all the contents of the Sampling folder.
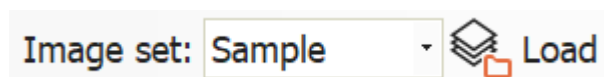
Upload from Validation folder

The Load button will load all the contents of the Validation folder.

3.9.5 Clearing

Cancel from the history list selected images.

The Clear button allows you to delete the images displayed in the window. The button is always enabled regardless of the display mode. The key has a menu in which you can choose the deletion options.

Clearing selected image

Removes from the list the selected images. is the sub-menu All images option is checked all images will be removed.

Clearing all images displayed for the current view

The Clear button will remove from the history list all images of the current View.

Clearing images displayed for all views

The Clear button will remove from the history list all the images of all Views.

Removing images on disk

The Clear button will remove from the history list and from the disk all the images of all the recipe Views.

3.9.6 Compute mode

Usually Image History, when an image is selected in list, executes the tools of the view and shows results. There is a different mode of working for ImageHistory that doesn't force execution: Compute History mode. This setting, visible by registry setting, enables ProInspect to store, run-time, not only the inspected image but also its results. With this variable enabled, you can decide by UI setting the desired behavior. The Selection of images in the ImageHistory in this case simply will show in console the image and the saved results and no execution of tools is performed. You can also decide to save reports and graphics on disk as well as images. In this case, when you load images from disk, automatically PROINSPECT loads also associated reports and graphics. To remind you this modality the ImageHistory panel becomes colored.

3.9.7 Settings

The functions of the Image History window are regulated by parameters that can be set in the window:

```
Tools > Recipe Options > Image History
```

The settings are unique for ach View.

Parameters

General	
Images folder	Destination folder for saved images.
Mode	Graphics and results shown when selecting an image. • Compute results Graphics and results of a new inspection. (Default) • Saved results Graphics and results saved.
Save Graphics and Report to file	Create graphic and reports save files

I/O	
Device	Select the device that provides the input to reset the image counter. • None No device. (Default) • **Reset counter line** Device line to be used for reset. (Default = 1) **Polarity** Line activation status Active high (Default) Active low

<selected view name>	
Max. number of images to save	Maximum number of images to save for this View. (Default = 100)
Save frequency ("All mode")	How often to save images. (default = 1)
Max. number of images to preview	Number of images shown in Image History. (Default = 10)
Circular counter	Circular counter activation. • No Not active. (Default) • Yes Active **Max. value** Length of the circular queue. (Default = 1000) **View position offset** Starting number for this view. (Default = 0)
Selective save	Saving subject to the outcome of the inspection. • No The image is saved when view is reject. (Default) • Yes The image is saved when one of the tools is reject.

\<selected tool name\>	
Take part to save image	This tool contributes to the storing of the image when its result decision is reject. • No Not active. (Default) • Yes Active

3.9.8 Configuration

The features introduced in this paragraph are offered by the plugin UvpMainUIS.

For instructions on how to load this plugin see the section Plugins.

Variable	Value	Description
UserInterface\UI History\ShowRecordButton	Permission Levels	Visibility of Record button
UserInterface\UI History\ShowTestButtons	Permission Levels	Visibility of buttons related to Advanced functionality
UserInterface\UI History\ForcedDisplayPolling	Positive integer	Time in seconds
UserInterface\UI History\ForcedDisplayTime	Positive integer	Elapsed time for user inactivity
UserInterface\UI History\ForcedDisplayMode		-1
Paths\Images	Full path	Images folder
Paths\Samples	Full path	Samples folder
Paths\Validation	Full path	Validation folder
Options\Process\ComputeHistory	Permission Levels	The choice of mode

3.10 Display settings

3.10.1 Overview

The tools in PROINSPECT can have a graphic interface that reports some result information and permits some diagnostic of results. Each tool has different graphic settings but all can be grouped in families. Select in the selector panel desired tool, then show the window:

```
View > Display Settings
```

Region draw settings section

Tools that implement an image processing.

	Description
Current region	Selects the region of the tool you want set. This feature is available if the tool has more than one region to display. If case you have to select the region.
Region shape	Shows/Hides the graphics of the shape that describes the ROI of the selected tool.
Region center	Shows/Hides the center of the Region.
Region name	Shows/Hides the name of the region. By defaults is the name of the tool (followed by a).
Region mask	Shows/Hides the shapes that mask the ROI of the selected tool.
Region if reject	Shows/Hides the graphics of the shape in case the selected tool has the reject result decision for current inspection even if the Region shape flag is set Hide. This is for showing the ROI where the tool failed.

Model draw setting section

Tools that have a model to look for.

	Description
Model shape	Shows/Hides the graphics of the shape that describes the Model of the selected tool.
Model center	Shows/Hides the center (origin) of the Model of the tool. It may be different from the center of the model shape.
Model name	Shows/Hides the name of the region and its masks. By defaults is the name of the tool. (The masks' name have the name of the tool followed by a #).
Model mask	Shows/Hides the shapes that mask the Model of the selected tool.

Tool draw setting section

Tools that have some own features to display.

	Description
<Own feature n>	Shows/Hides the graphics of this custom feature of the selected tool.
<Own feature m>	Shows/Hides the graphics of this custom feature of the selected tool.

Positions draw setting section

Tools that have one or more Position results.

	Description
Position selection	Selects the position of the tool you want to set. This feature is available if the tool has more than one position result to display.
Target point	Shows/hides the graphics of the shape that displays the point returned as position.
Position name	Shows/hides the name of this position.
Text position	Select where to draw the info of this position: • Relative The Text is reported relative to the position of the target point. • Absolute The Text is reported absolute to the origin of the image. • X Relative/absolute X offset. • Y Relative/absolute Y offset
Coordinates	Shows/hides coordinates (x, y, a) of the selected position.

Measurements draw setting section

Tools that have one or more Measurement results.

	Description
Measurement selection	Selects the measurement of the tool you want to set. This feature is available if the tool has more than one measurement result to display.
Measurement value	Shows/hides the value of this measurement result.
Measurement name	Shows/hides the name of this measurement.
Precision	Sets how many decimal digits for this measurement.
Text position	Select where to draw the info of this measurement: • Relative The Text is reported relative to the position of the target point. • Absolute The Text is reported absolute to the origin of the image. • X Relative/absolute X offset. • Y Relative/absolute Y offset. /li>
Quote	Shows/hides graphical position of this measurement. • Location Distance from the measurement of the graphical quote.

Value draw setting section

Tools that have one or more Value results.

	Description
Value selection	Selects the value of the tool you want to set. This feature is available if the tool has more than one value result to display.
Value	Shows/hides the value result.
Value name	Shows/hides the name of this value.
Precision	Sets how many decimal digits for this value.
Text position	Select where to draw the info of this value. • Relative The Text is reported relative to the position of the target point. • Absolute The Text is reported absolute to the origin of the image. • X Relative/absolute X offset. • Y Relative/absolute Y offset.

3.11 Settings

3.11.1 Overview

This dialog can be accessed by menu

```
View > Settings
```

3.11.2 Settings

Settings dialog contains parameters for the selected object.

Parameters can be divided into some main categories.

Options

Set how the tool is constructed (search area, model, ...).

An enable check allows you to logically exclude the tool from the recipe. Not enabled tools are not processed.

Tolerances and Limits

Set constrains on measured values.

Algorithm specific parameters.

More...

Mainly relates to how the object relates to others. All PROINSPECT items have the save more section parameters.

More	
Tag	Generic tag for object identification.
Show	If unchecked, the object is showed for higher user levels only.
Conditionally hide	If checked, the object is hidden if its view has Hide tagged objects checked.
Adjust model	If checked, when the tool is in training mode, its shape can be fitted to the training image by making a run of the tool on the training image.
Description	Text field that user might use to give a brief tool description.
Comments	Text field that user might use to give a brief comments.
User Id	GUID field that user might use to identify the item. User can either edit this field or, by clicking on the button get a proposed GUID.
Invert result decision	If checked the inspection result is inverted: reject becomes good; good becomes reject.
Object sharing	Object can individually be stored on file (pvx) and the same file used to set parameters of another object. **Shared file** Path of the shared pvx file. **Read only** Object will not overwrite the shared file during saving action.
Parameters sharing	Object parameters can be stored on file (xml) and the same file used to set parameters of another object. **Shared file** Path of the shared xml file. **Read only** Object will not overwrite the shared file during saving action.

HIDE OBJECT

Want to share calibration objects over several recipes. We also have a separate calibration recipe where we do the calibration. In the type recipes, made to inspect the parts, it should not be possible to see the calibration object. So we use this option to hide the calibration objects in the type recipes. The calibration objects should only be visible in the calibration recipe. The calibration object will have its Hide object parameter set to true. The calibration view will have its Hide tagged objects parameter set to false and the part inspection view will have its Hide tagged objectsparameter set to true.

3.12 Report

3.12.1 Overview

This window can be accessed by menu

```
View > Report
```

3.12.2 Report

Report dialog shows the results of objects.

For each object the name, the fail/pass status and specific measurements are shown.

3.12.3 Context menu

Display mode can be selected by context menu.

Show mode Direct a sub menu for selecting which item to show. Show multiple results If a tool can have multiple results, each result is shown.

Context menu - Show mode

Item Shows results for selected item only View Shows results for all tools of the view of the selected item All views Shows all items of all views

3.13 Geometry

3.13.1 Overview

Almost all the tools in PROINSPECT have a shape model to define the region of interest (ROI). The shape used to define these ROI can be driven with the tracker tool or directly specifying the features of the shape. All the value settings of this dialog are expressed in image units. There are only some tools that permits a setting in calibrated units. To access the dialog, select in the selector panel the desired tool, then show the Geometry Settings by the menu:

```
View > Geometry.
```

The Tools, that have a model to look for, can provide the #Model geometry settings section.

3.13.2 Origin geometry settings

The Tools that have an origin (usually expressed by a Cartesian axes shape) can provide this section.

Origin

	Description
Name	Displays the name of the origin this section refers to.
Origin X	X coordinate of the origin.
Origin Y	Y coordinate of the origin.
Angle	Angle in degree of the origin.
Width	Length of the X axis.
Height	Length of the Y axis.

3.13.3 Region geometry settings

All Tools that implement an image processing can provide this section. The parameters listed in this section vary depending on the shape .

Rectangle

	Description
Name	Displays the name of the shape this section refers to.
Upper left X	X coordinate of the upper left corner of rectangle.
Upper left Y	Y coordinate of the upper left corner of rectangle.
Width	Width of rectangle.
Height	Height of rectangle.

General Rectangle

	Description
Name	Displays the name of the shape this section refers to.
Calibrated data	Use the input data as calibrated units instead of image units.
Center X	X coordinate of the center of rectangle.
Center Y	Y coordinate of the center of rectangle.
Width	Width of rectangle.
Height	Height of rectangle.
Rotation	Orientation around the center of the rectangle.

Circle

	Description
Name	Displays the name of the shape this section refers to.
Calibrated data	Use the input data as calibrated units instead of image units.
Diameter	Diameter of the circle.
Center X	X coordinate of the center of circle.
Center Y	Y coordinate of the center of circle.

Annulus

	Description
Name	Displays the name of the shape this section refers to.
Center X	X coordinate of the center of circle.
Center Y	Y coordinate of the center of circle.
Inner radius	Internal radius.
Outer radius	External radius.

Annulus Section

	Description
Name	Displays the name of the shape this section refers to.
Center X	X coordinate of the center of circle.
Center Y	Y coordinate of the center of circle.
Inner radius	Internal radius
Outer radius	External radius
Start angle	Start angle of polar section.
End angle	End angle of polar section. If (end – start) equals 360 a full range is adopted.

General Polygon

	Description
Name	Displays the name of the shape this section refers to.
Edit mode	Selects the tracker Edit mode. • Vertex The tracker shows handles at the vertices polygon shape. • New vertices The tracker shows handles at the center of each side of the polygon and permits to fork it adding new vertices. • Rounding The tracker shoes a circular handle at the vertices and in the middle of the polygon shape and permits to round a vertex or arch a side. • Delete vertex The tracker deletes the selected vertex of the current shape.
Drag mode	Selects the tracker Drag mode. • Translate When dragged on a side the tracker translates. • Rotate When dragged on a side the tracker rotates around its center. • Scale When dragged on a side the tracker scale its sizes.
Origin X	X coordinate of the first vertex of the shape.
Origin Y	Y coordinate of the first vertex of the shape.

Thick Cross

	Description
Name	Displays the name of the shape this section refers to.
Calibrated data	Use the input data as calibrated units instead of image units.
Center X	X coordinate of the center of Cross.
Center Y	Y coordinate of the center of Cross.
Rotation	Orientation around the center of the Cross.
Thickness	Thickness of the body of the Cross.
Arm length	Length of each arm of the Cross.

CAD

	Description
Name	Displays the name of the shape this section refers to.
Origin X	X coordinate of the first vertex of the shape.
Origin Y	Y coordinate of the first vertex of the shape.
Angle	Orientation around the center of the bounding box rectangle of the CAD shape.
Width	Width of the boundign box rectangle of the CAD shape.
Height	Height of the boundign box rectangle of the CAD shape.

Circle Finder

It is a circle with several rectangle aligned on its circumference.

	Description
Name	Displays the name of the shape this section refers to.
Diameter	Diameter of the circle.
Center X	X coordinate of the center of circle.
Center Y	Y coordinate of the center of circle.
Start angle	Starting angle of first rectangle (deg).
Angle span	Angle range of all rectangles.
Width	Width of each rectangle.
Height	Height of each rectangle.
Arrange position mode	Position of each rectangle. • Automatic Each rectangle is spaced by an automatically computed angular step. • Free You can locate each rectangle at a desired angle. • Enable edge selection Enables/disables selection of the single rectangle for manual setting by the tracker.

Line Finder

It is a line segment with several rectangle aligned on its perimeter.

	Description
Name	Displays the name of the shape this section refers to.
Diameter	Diameter of the circle.
X point 1	X coordinate of the first point of segment.
Y point 1	Y coordinate of the first point of segment.
X point 2	X coordinate of the second point of segment.
Y point 2	Y coordinate of the second point of segment.
First offset (%)	Percentage of the half-length of the segment to offset the first rectangle.
Second offset (%)	Percentage of the half-length of the segment to offset the last rectangle.
Mirrored by center	Offset are calculated starting from middle point of segment.
Width	Width of each rectangle.
Height	Height of each rectangle.
Arrange position mode	Position of each rectangle. • Automatic Each rectangle is spaced by an automatically computed step. • Free You can locate each rectangle at a desired position on the perimeter. • Enable edge selection Enables/disables selection of the single rectangle for manual setting by the tracker.

Polar Grid

It is a Grid with sectors on a circular polar shape.

	Description
Name	Displays the name of the shape this section refers to.
Center X	X coordinate of the center of circle.
Center Y	Y coordinate of the center of circle.
Inner radius	Internal radius.
Outer radius	External radius.
Start angle	Start angle of polar section.
End angle	End angle of polar section. If (end – start) equal 360 a full range is adopted.
Angular search tol (deg)	How many degrees to enlarge internal sector (it is used for the width of the shape of internal tools).
Radial search tol (pixels)	How many pixels enlarge the internal sector. (it is used for height of the shape of internal tools).

Set of points

	Description
Name	Displays the name of the shape this section refers to.
Origin X	X coordinate of the point.
Origin Y	Y coordinate of the point.
Angle	Orientation of the point.
Options	TODO
Axes size	Size of the Axis identifying the point.

Grid

	Description
Name	Displays the name of the shape this section refers to.
Origin X	X coordinate of the center of the grid.
Origin Y	Y coordinate of the center of the grid.
Width	Width of the grid.
Height	Height of the grid
Rows	Number of rows of the grid.
Columns	Number of columns of the grid.
Gap X	Frame size of each cell in row direction of the grid.
Gap Y	Frame size of each cell in column direction of the grid.

Masks

Several tools provide use of masks to modify the inspection porpoise. When a mask is added to the tool a proper section is displayed in the Geometry setting dialog. In particular, there are the items to define the relationship between the mask and a run-time pre-alignment. The Mask's shape is a General polygon: so this section shows also its settings as well.

	Description
Name	Displays the name of the mask this section refers to.
Fixed position	Tells the tool to not pre-align this mask. The mask is fixed in position as in train-time: it doesn't follow tool's pre-alignment.
Use fixture	Enables/disables the pre-alignment of this fixture with a proper external tool (different from shape owner's tool). You have to select the external tool from the provided list. • \<Fixture tool\> Name of the external tool to use as pre-alignment fixture.
…TODO	General polygon items.

4. Tools

4.1 Basic tools

4.1.1 Basic tools

The basic tools are used to construct the recipe and to define the processing flow.

The recipe consists primarily of views. Each view represents a specific acquisition system. All the tools within the view process the image coming from the corresponding system.

The tools can be grouped using the Group tool .

The positioning of the tools can be conditioned by the result of other tools using the Fixture tool.

4.1.2 Fixture

Overview

The Fixture object is a tool that creates a positional relationship between some independent tools (fixturing tools) and other dependent tools (fixtured tools). In training you can set position of selected tools. At Run-time the Fixture tool computes the rigid transformation that maps all fixturing tools' specification position to the their result position. This transformation is than applied to all fixtured tools that are re-positioned to the new expected position. The operation is name Pre-Alignment.

If the Fixture is applied to the Group, all contained tools inherit the same pre-alignment. If the fixture is applied to a single tool, only the tool gets the pre-alignment.

COMPONENTS

The Fixture tool computes the rigid transformation depending on number of fixturing tools and components selection. If there is only one tool the transformation will use specification and results position and orientation . If there are more tools the transformation will be the best fitting (Least Mean Square) mapping between all specification and results points. You can even select which component to use for transfomation

REFERENCE SYSTEM

Fixture components result can be used to define the origin of a Cartesian reference system.

All the tools fixtured by that Fixture tool will have their coordinates result expressed in the Fixture reference system.

PRESENCE

If a fixture tool fails, i.e. the fixturing tools have the fail result, the fixtured group or tool will not be executed and its result will be set to not Run: you can say that a failure of a fixture is a presence condition for a group or a tool.

MULTIPLE RESULTS

If a fixture has a single fixturing tool with multiple results, and this fixture is applied to a Group, then at run-time the Group and all its owned tools will be cloned and pre-aligned to fixturing tool results.

Settings

Options	
Enable	Enables or disables the fixture. (default = Yes)
Use as client reference system	Fixtured tools will have their results expressed in the Cartesian reference system defined by this fixture. (default = No)
Mode	How the fixture uses its fixturing tools' results. • Normal (default) Rigid transformation computed as best fitting. • Selective Rigid transformation using selected components. **X** Select the tool for the X component. Fixed (default) Gets X component from the parent's fixture. (Fixturing tools #n) Use the selected tool's X component. **Y** Select the tool to be used as component. Fixed (default) Gets X component from the parent's fixture. (Fixturing tools #n) Use the selected tool's Y component. **Angle** Select tool to be used as component. Fixed (default) Gets X component from the parent's fixture. (Fixturing tools #n) Use the selected tool's angle component.

Results

Results	If the fixture is assigned to a tool with multiple results, select the desired result.
Translation X	Component X of the translation vector of the resulting roto-translation used to fixture.
Translation Y	Component Y of the translation vector of the resulting roto-translation used to fixture.
Axis X rotation	Component X of the rotation vector of the resulting roto-translation used to fixture.
Axis Y rotation	Component Y of the rotation vector of the resulting roto-translation used to fixture.
Scale X	Scaling value on the X axes of the resulting roto-translation used to fixture.
Scale Y	Scaling value on the Y axes of the resulting roto-translation used to fixture.

4.1.3 Group

○ ○ ○
○ ○ ○

Overview

A Group is a container of tools. Group shares with contained tools the image to inspect, the calibration to transform results with, the fixture object to pre-align tools with.

CONSTRAINTS

Group can define some constraints that force the specification position of contained tools. Constraint can be:

Concentric

All the group contained tools are forced to have own center to the center of the tool of the fixture (if there are more tools into the fixture the median point is used). To get all contained tools centered you need to train the group.

Pre-aligned

All the group contained tools are forced to have a fixed position relative to the tool of the fixture (if there are more tools into the fixture the median point is used). When the fixturing tool moves (in training mode) all group tools follow the same motion.

None

No constraints.

Settings

Options	
Enable	Enables or disables the group. (default = Yes)
Position constraint	Constraints to be applied to the contained tools. • None (default) No constraint is applied. • Concentric All contained tools are concentric with the center of the fixturing tool. • Pre-aligned All contained tools follow movements of the fixturing tool.
Angle constraint	Only in concentric mode. • None (default) No constraint is applied. • Concentric All contained tools orient according to the fixturing tool orientation.

More	
Tag	Generic label for object custom identification.
Show	Enables or disables visibility of the Group object into the Selection for users not administrator.
Hide object	Enables or disables visibility of the Group object into the Selection for users not administrator conditioned to View Selectively hide objects status.
Description	Text field to give a brief group description.
Comments	Text field to give a brief comments.
User Id	Unique GUID of this item. You can either edit it by clicking on the button.
Enable Conditioned-Run	Enables or disables execution of this Group on View's conditioned run input code.
Conditioned-Run codes	The code of this Group to match for enabling execution.
Invert result decision	Invert inspection result: Group result return fails it all owned items are pass and vice-versa.
Object sharing	Enable or disable saving of the configuration of the Group in a separate binary files that can be shared over several recipes. **Shared file** Path of the file (pvx extension) **Read only** Enables or disables overwriting of the shared file during recipe saving.
Parameters sharing	Enable or disable saving of the settings of the Group in a separate files that can be shared over several recipes. **Shared file** Path of the file (xml extension) **Read only** Enables or disables overwriting of the shared file during recipe saving.
Enable condition XML	Enables or disables a condition defined by a script that permits execution of this Group. The script return true = Group can be executed, or false = Group cannot be run. When the script gives a fail condition Group result is not Run and doesn't contribute to the result of its owner. **condition XML** editor to the Script configuration

Script configuration

This window is accessed by pressing Condition XML button in Group settings window.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<Condition Name="UserConditionName">
    <Define>
        <Operand Name="ToolOperandName">
            <ResultName>ToolX.PositionX</ResultName>
        </Operand>
    </Define>
    <Results>
        <Run Name="RunConditionName">ToolOperandName > 0</Run>
    </Results>
</Condition>
```

Import XML Export XML Verify XML OK Cancel
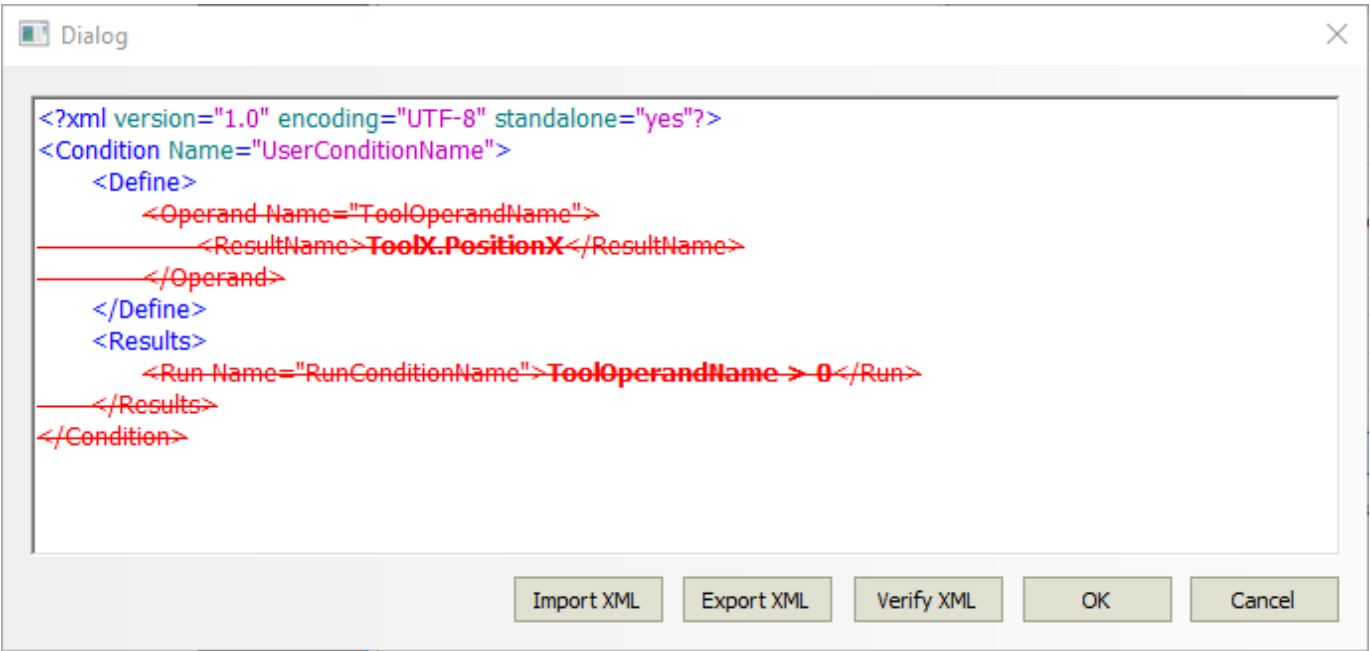
KEYWORDS

Script keywords are described in the following table.

	User can describe the conditioning features of group through an XML language.
Computation Name	Define the user friendly name of this configuration.
Define	Starts the section for operands definitions.
Operand Name	Name of the Operand (position, measure, value, status) used in the computational script. This name is the operand symbol that Group uses in the script formula.
Results	Starts the section for Group computational result definition. The result is a Boolean that enables or disables the execution of the Group. The Script may accept Operands (as described), values, mathematical functions.

IMPORT XML

Import an XML definition for this Group conditional script from a stored file.

EXPORT XML

Export the current XML definition of this Group conditional script to a file.

VERIFY XML

Verify the correctness of Operands and Results. This action is necessary to accept new Group conditional definition.

EXAMPLE

```
<\?xml version="1.0" encoding="UTF-8" standalone="yes"?><br>
<\Condition Name="UserConditionName"><br>
<\Define><br>
<\Operand Name="L1"><br>
<\ResultName>L1.General<\/ResultName><br>
<\/Operand><br>
<\Operand Name="L2"><br>
<\ResultName>L2.General<\/ResultName><br>
<\/Operand><br>
<\/Define><br>
<\Results><br>
<\Run Name="RunConditionName">NOT(L2 OR L1)<\/Run><br>
<\/Results><br>
<\/Condition><br>
```

where:

L1 and L2 are the symbol name of tools in the recipe. The Group condition uses their result (good or fail) to condition its execution. The condition, in this case, is a Boolean expression.

Results

Decision	Pass/Fail decision of the Group. A Group result is pass if all contained items results are passed; it is reject if at least one result is reject.
Processing time	Estimate of processing time

4.1.4 Image unwrap

Overview

The Image Unwrap tool produces, as result, a unwrapped image from an anular region that can be used as reference image for other Groups or tools.

Settings

Options	
Enable	Enables or disables the Image. (default = Yes)
Geometry	Shape that defines region to unwrap.
Inherit golden image	if enabled, the Input reference image for this Image tool is inherited by golden image: when View changes reference image, automatically the input image is updated and, in train, its result image. (default = No)

Analysis	
Overlapping (degs)	defines how many degrees of image to copy at the end of unwrapped image.
Scale X	Scale for unwrapped X dimension.
Scale Y	Scale for unwrapped Y dimension.
Save pre-processing images	Save runtime unwrapped image result.

MORE

Click here to access the More section description.

Images

Reference image	Input reference image.
Preprocessing	Image processed result.

4.1.5 Image Warp

Overview

The Image Warp tool produces, as result, a warped image from multiple camera views and stitches them so that it can be used as reference image for other Groups or tools. Warping is given by a specific calibration that gives the transformation settings.

Settings

Options	
Enable	Enables or disables the Image. (default = Yes)
Geometry	Shape that defines region to unwrap.
Inherit golden image	if enabled, the Input reference image for this Image tool is inherited by golden image: when View changes reference image, automatically the input image is updated and, in train, its result image. (default = No)
All image	Enables or disables region of interest for Image tool

Analysis	
Overlapping (deg)	defines how many pixels of image (width) to copy at the end of warped image.

Warping type	Warping algorithm
	• None
	  No warping
	• Cylindrical
	  Cylindrical calibration
	• Calibration2
	  Calibration of type 2

Pre-Scale	Enables or disables the scale provided by selected fixturing tool.
Save pre-processing images	Save intermediate runtime image result.

MORE

Click here to access the More section description.

Images

Reference image	Input reference image.
Preprocessing	Image processed result.

4.1.6 Reference Image

Overview

The Reference Image is the utility that Groups and Tools can use to work with the Image tool result. If a Group has a reference image all owned tools and groups will execute on the image result of the linked Image tool. If a single tool has a Reference image, it will execute on the image result of the linked Image tool.

4.1.7 View

Overview

The View object is the container of all inspection items that use an image. It is responsible for the acquisition settings and all other processing operations as a global result, output, statistic, image reports, cycle run-time behavior. Every recipe must have at least a View object that defines acquisition, image processing sequence, run cycle mode, input-output interface, statistics report, etc. Several features depend on the View object.

Settings

Options	
Enable	Enables or disables the tool. (default = Yes)
Save golden image	Enables or disables saving of reference image into recipe (default = Yes)
Save measurements calibration image	Enables or disables saving of measurements calibration image into recipe. (default = No)

Camera	
Acquisition module	Acquiring device associated with this view. Every View must have a valid acquisition module to permit run-time processing.
Folder	Folder path containing images for the File virtual acquisition module. Acquisition acts returning a valid picture from a file in the selected folder.
Channel	The physical channel on the selected module.
Description	Description name of module. It needs to match the module name used in the configurazione file.
Contrast	Camera contrast. (default = 0.51; min = 0.00; max = 1.00)
Brightness	Camera brightness. (default = 0.51; min = 0.00; max = 1.00)
Exposure	Exposure time in ms.
Trigger	Sets the trigger mode. • None (default) No trigger is required to start the acquisition. • Fast Acquisition is driven by a hardware signal to the module. • Normal Acquisition is driven by PROINSPECT watching the input line of the selected device. • Manual Acquisition is driven manually by user. • Fast Software Acquisition is driven by PROINSPECT internally on custom events. **Device** Available devices for normal input trigger. **Normal trigger line** Input device line to watch. (default = 1) **Manual trigger mode** Keystroke (default) Trigger is fired by pressing keyboard bar.(default) Elapsed time Periodically cycle time. Trigger is fired after interval elapsed time **Interval** Periodic elapsed time. (default = 500) **Number of acquisition** Number of cycles to do before stopping. Zero equals to infinite. (default = 0)
Trigger polarity	Polarity of acquisition trigger . • Rising edge (default) Acquisition starts on the rising edge of the trigger signal. • Falling edge Acquisition starts on the falling edge of the trigger signal.
Strobe	Enables or disables the strobe output. (default = Yes) **Strobe polarity** Polarity of output strobe signal. **Strobe duration** Strobe duration in ms. **Strobe lines** Active strobe lines.
Light control device	Device selection for output acquisition actions: when acquisition get armed PROINSPECT sets the light control lines to selected polarity status; when acquisition is completed PROINSPECT sets reversal polarity status. **Light control lines** Output lines of device used in acquisition. **Light control polarity** Active status of the light control lines.
Number of lines	Number of lines to acquire. This parameter is meaningful for line scan cameras. (default = 1024)

Camera	
Line exposure	Single line exposure time in ms. This parameter is meaningful for line scan cameras. (default = 0.20)
Line period	Line period in ms, if line trigger is disabled. This parameter is meaningful for line scan cameras. (default = 1.00)
Line trigger	Enables line trigger mode. This parameter is meaningful for line scan cameras. (default = Yes)
Encoder rate	Ratio between camera line triggers and encoder triggers. This parameter is meaningful for line scan cameras. (default = 1.00)
White balance red	Gain of red channel with respect to green. This parameter is meaningful for color cameras. (default = 0.50)
White balance blue	Gain of blue channel with respect to green. This parameter is meaningful for color cameras. (default = 0.50)

More	
Tag	Generic label for object custom identification.
Show	Enables or disables visibility of the View object into the Selection for users not administrator
Description	Text field to give a brief tool description.
Comments	Text field to give a brief comments.
User Id	Unique GUID of this item. You can either edit it by clicking on the button.
Conditioned-Run Device	Input device to limit execution of groups of the view. PROINSPECT watches the selected lines of this device to create conditions that enable the execution of the internal groups. **Lines for Conditioned-Run** Lines to watch **Conditioned-Run polarity** polarity of input lines. Active high (default) Active low **Conditioned-Run mode** I/O device code Internal groups are executed only if their Conditioned-Run code equals the read status of selected input lines. Incremental Conditioned-Run code is automatically incremented. Value is reset on input line active status.
Selectively hide objects	Enables or disables visibility of all view's objects set as conditionally hide for users not administrator.
Invert result decision	Invert inspection result: View result return fails it all owned items are pass and vice-versa.
Object sharing	Enable or disable saving of the configuration of the View in a separate binary files that can be shared over several recipes. **Shared file** Path of the file (pvx extension) **Read only** Enables or disables overwriting of the shared file during recipe saving.
Parameters sharing	Enable or disable saving of the settings of the View in a separate files that can be shared over several recipes. **Shared file** Path of the file (xml extension) **Read only** Enables or disables overwriting of the shared file during recipe saving.

Results

Results	
Decision	Pass/Fail for all the tools in the view. If all tools will pass, the view will pass. A single tool fail will cause the view to fail.
Part Id	Inspection identification.

4.2 Calibration

4.2.1 Calibration

Overview

Calibration is the procedure that allows you to establish a relationship between two coordinate spaces.

A calibration tool creates a calibration object that relate locations in image space to locations in physical space. Some of calibration tools are of type Grid-of-Dots Calibration in which a calibration plate is used. Other calibration tools create transform mapping user defined points.

The transformation object created by the calibration tool is used to convert back and forth between physical and image space.
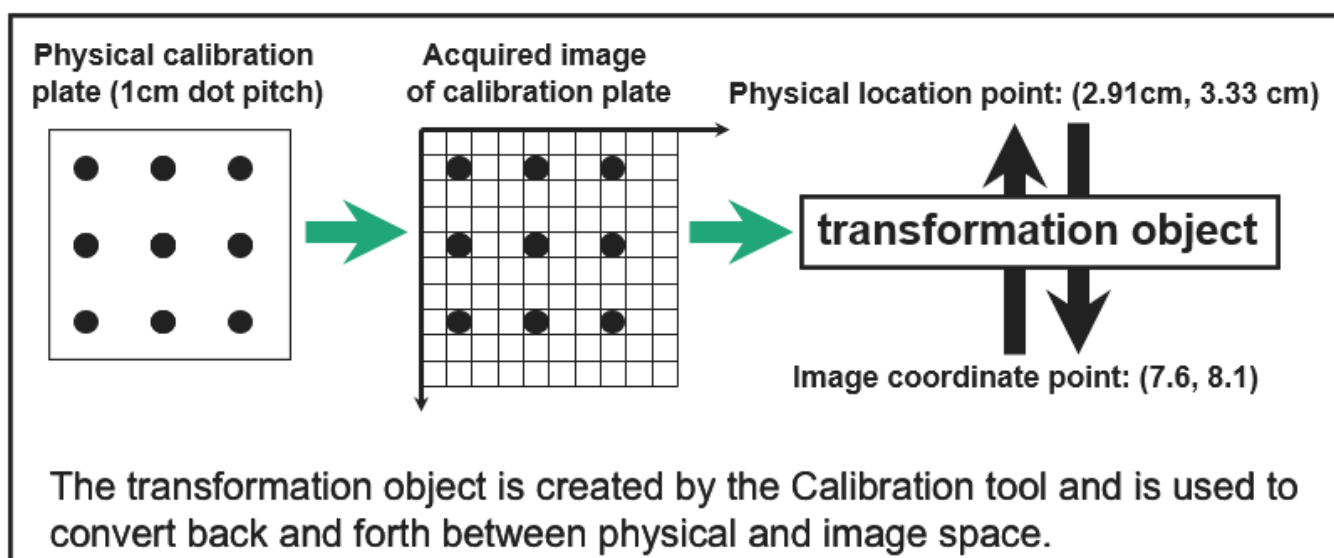
Calibration tool

Usage

There are several calibration tools that you can use in PROINSPECT: - Automatic Check Board Calibration - Automatic Grid Calibration - Axis Calibration - Find Point Calibration - Grid Calibration - Grid Calibration 2 - Point Calibration - Raw Calibration - Z Calibration

Definitions

	Description
Calibration	A procedure to create a transform that establishes the relationship between points in one coordinate space and corresponding points in another coordinate space.
Calibration plate	A precision manufactured flat plate used to calibrate image acquisition systems.
Linear transform	A transform defined by a (2x2) matrix and a (2x1) vector.
Markers	Pair of rectangles in the calibration plate. Point defined by the intersection of the lines drawn through the two rectangles can be used as an anchor point for the physical coordinate system.
Nonlinear transform	A transform created from a set of data points. The transformation varies depending on the data point you transform. It is not consistent over a range of points as is the case of a linear transform.
Physical coordinates	The physical space coordinate system. For example, the coordinate system used to locate points on a calibration plate.
Pitch	The x and y distance between elements in a calibration plate.
Residual error	The difference between the actual grid point locations and the locations predicted by applying the calibrated transformation to the known grid spacing.
Transformation object	An object containing functions that map points in one coordinate system to another coordinate system. For example, a mapping between image space and client coordinate space. The transformation can be linear or nonlinear.

4.2.2 Automatic Check Board Calibration

Overview

Automatic Check Board Calibration is a Grid Calibration 2 tool that constructs a transformation object that relates locations in physical space, as defined by the vertices fo the squares of the calibration plate, to locations in an image. You use the tool by acquiring an image in which the features are at known spacing. You supply the tool with the spacing of the features in physical coordinates and the tool constructs a transformation object that maps points between image coordinates and physical coordinates (also known as client coordinates).

Once you have created such a calibration, you can use it to transform information returned by vision tools into precise physical locations.

Settings

Options	
Enable	Enables or disables the tool. (default = Yes)
Save calibration image	Save image used for calibration. (default = Yes)
Line scan correction	Over different lines or the direction of travel (Y, line 1,2,3..) only a linear correction is calculated (default = No) Along the line, the selected calibration type is used (e.g. polynomial (3))
Camera distance	Distance between image plane and outer lense plane or aperture of the camera.
Perspective correction	Scaling factor that translate points of the Calibration plane to points in the Inspection plane. See Z Calibration. (default = 1.0)
Calibration type	Select the calibration type. Polynomial calibrations are more accurate than linear one and compensate better lens distortion, but requires more points.\\value_table_begin\\
Pitch X	Pitch between the dots in the X axis.
Pitch Y	Pitch between the dots in the Y axis.
Origin X	The coordinate X of the origin bars in the grid, if present.
Origin Y	The coordinate Y of the origin bars in the grid, if present.
Use marker as origin	If the calibration image has origin markers they will be used to set the origin as the intersection of the lines passing from the markers. (default = Yes)

MORE

Click here to access the More section description.

Results

Results	
Decision	Good/Bad decision of the calibration operation.
Scale X	Scaling value in the X axis.
Scale Y	Scaling value in the Y axis.
Axis X rotation	Rotation value in the X axes.
Axis Y rotation	Rotation value in the Y axes.
Mean residual	Mean difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.
Maximum residual	Maximum difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.

4.2.3 Automatic Grid Calibration

Overview

Automatic Grid Calibration is a Grid-of-Dots Calibration tool that constructs a transformation object that relates locations in physical space, as defined by a grid-of-dots calibration plate, to locations in an image. You use the tool by acquiring an image in which the features are at known spacing. You supply the tool with the spacing of the features in physical coordinates and the tool constructs a transformation object that maps points between image coordinates and physical coordinates (also known as client coordinates).

Once you have created such a calibration, you can use it to transform information returned by vision tools into precise physical locations.

Settings

Options	
Enable	Enables or disables the tool. (default = Yes)
Save calibration image	Save image used for calibration. (default = Yes)
Line scan correction	Over different lines or the direction of travel (Y, line 1,2,3..) only a linear correction is calculated (default = No) Along the line, the selected calibration type is used (e.g. polynomial (3))
Camera distance	Distance between image plane and outer lense plane or aperture of the camera.
Perspective correction	Scaling factor that translate points of the Calibration plane to points in the Inspection plane. See Z Calibration. (default = 1.0)
Calibration type	Select the calibration type. Polynomial calibrations are more accurate than linear one and compensate better lens distortion, but requires more points. Linear (default) needs at least a 3x3 grid points. Polynomial (3) needs at least a 6x6 grid points. Polynomial (5) needs at least a 8x8 grid points.
Pitch X	Pitch between the dots in the X axis.
Pitch Y	Pitch between the dots in the Y axis.
Origin X	The coordinate X of the origin bars in the grid, if present.
Origin Y	The coordinate Y of the origin bars in the grid, if present.
Use marker as origin	If the calibration image has origin markers they will be used to set the origin as the intersection of the lines passing from the markers. (default = Yes)

MORE

Click here to access the More section description.

Results

Results	
Decision	Good/Bad decision of the calibration operation.
Scale X	Scaling value in the X axis.
Scale Y	Scaling value in the Y axis.
Axis X rotation	Rotation value in the X axes.
Axis Y rotation	Rotation value in the Y axes.
Mean residual	Mean difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.
Maximum residual	Maximum difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.

4.2.4 Axis Calibration

Overview

This type of calibration allows to define position and orientation of the calibrated axes on the image. Scaling factor on X and Y can be defined also.

Settings

Options	
Enable	Enables or disables the tool. (default = Yes)
Save calibration image	Save image used for calibration. (default = Yes)
Camera distance	Used for Z-calibration: distance from the image plane to the outer lense plane or aperture of the camera (default = 0.0)
Line scan correction	Over different lines or the direction of travel (Y, line 1,2,3..) only a linear correction is calculated (default = No) Along the line, the selected calibration type is used (e.g. polynomial (3))
Perspective correction	Deprecated, now use Z-calibration. Moves points relative to the origin according to this linear factor. (default = 1.0)
X units	Value corresponding to one unit in the X axis. (default = 10.0)
Y units	Value corresponding to one unit the Y axis. (default = 10.0
Origin X	The coordinate X of the origin bars in the grid, if present.
Origin Y	The coordinate Y of the origin bars in the grid, if present.

MORE

Click here to access the More section description.

Results

Results	
Decision	Good/Bad decision of the calibration operation.
Scale X	Scaling value in the X axis.
Scale Y	Scaling value in the Y axis.
Axis X rotation	Rotation value in the X axes.
Axis Y rotation	Rotation value in the Y axes.
Mean residual	Mean difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.
Maximum residual	Maximum difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.

4.2.5 Find Point Calibration

Overview

Find-point calibration uses a small number of points whose coordinates are known in metrical external reference system. The actual number of points is defined in the tool settings. To find these points a search tool like PatMax or Search has to be added (Drag it on the Find-Point-Calibration in the design window). Select the search area for one point and train the search tool.

The World coordinates of each of the calibration point have to be entered in the tool settings. The images coordinates are measured by dragging a set of cursors over the calibration targets (zoom out, if not visible). Select menu Vision Calibration.., Calibration.

During calibration the system shows a set of cursors, one for each calibration point. The cursors can be dragged over the targets, as accurately as possible. The system shows the camera coordinates in the Geometry page.

Settings

Options	
Enable	Enables or disables the tool. (default = Yes)
Execute on run	Enables calibration, when the recipe is executed. Uses patterns, which are found by the connected search tool. Configuration like described in the introduction section above.(default = No)
Save calibration image	Save image used for calibration. (default = Yes)
Camera distance	Used for Z-calibration: distance from the image plane to the outer lense plane or aperture of the camera (defaul = 0.0)
Line scan correction	Over different lines or the direction of travel (Y, line 1,2,3..) only a linear correction is calculated (default = No) Along the line, the selected calibration type is used (e.g. polynomial (3))
Perspective correction	Deprecated, now use Z-calibration. Moves points relative to the origin according to this linear factor. (default = 1.0)
Number of points	Number of point used to calibrate. The minimum number of point depends of the calibration type selected.

Calibration type	Select the calibration type. Polynomial calibrations are more accurate than linear one and compensate better lens distortion, but requires more points.
	• Linear
	  needs at least 3 points.(default)
	• Polynomial (2)
	  needs at least 6 points.
	• Polynomial (3)
	  needs at least 10 points.
	• Polynomial (4)
	  needs at least 15 points.
	• Polynomial (5)
	  needs at least 21 points.

Points	
Point index	Select the point index to set Position X and Position Y coordinates. (default = 1; min = 1; max = Number of points)
Position X	World point coordinate X. (default = 0.00)
Position Y	World point coordinate Y. (default = 0.00)

Results

Results	
Decision	Good/Bad decision of the calibration operation.
Scale X	Scaling value in the X axis.
Scale Y	Scaling value in the Y axis.
Axis X rotation	Rotation value in the X axes.
Axis Y rotation	Rotation value in the Y axes.
Mean residual	Mean difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.
Maximum residual	Maximum difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.

4.2.6 Grid Calibration

Overview

Grid calibration tool (like the automatic grid calibration tool) creates the transformation which relates locations in image space to locations in physical space.

Grid calibration is done by showing a known grid of dots to the system. The system measures the position of each dot and computes the calibration map. A significant advantage of this type of calibration is that the large number of dots enables a better error correction function. With this solution it is possible to significantly reduce errors such as the geometrical optical distortion.

How it works

Calibration requires an image of a calibration plate that provides known physical references:

Must consist of a two-dimensional grid of dots Dost must be circular The dot diameter must be no greater than one-half of the smaller of the x-axis or y-axis dot pitch The diameter of a dot must be at least ten pixels The edge of the calibration plate should be outside the acquired image
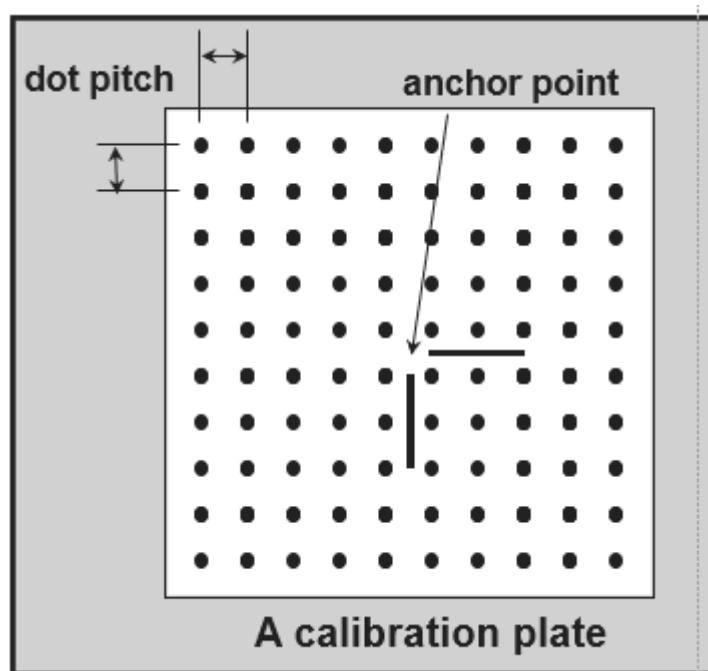
Calibration plate

Calibration tool creates a transformation in which points in the image coordinate system maps to points of the client coordinate system. You can optionally specify a fixed point as the origin point for the client coordinate system.

Calibration determines the precise location of each dot on the calibration plate. The tool then computes the transformation based on the specified x-axis and y-axis dot pitch.

Internal Calibration tool operations:

- Segments the input image of the calibration plate into foreground and background pixels. A soft threshold is used to avoid spatial quantization errors.See Soft threshold

- Determines the centers of mass of each dot.

- If the Calibration tool detects the presence of two rectangles, it computes and stores the location of the anchor point.

- Computes the linear or non-linear transformation — your choice — that best translates physical space into image space.

- Computes the residual error for each point on the grid. Residual error is caused by nonlinear distortion present in the optical system.

After constructing the transformation object, a Calibration tool measures the distance between pixel locations in the image and corresponding locations predicted by the transformation object. If the tool constructed a linear mapping between image and client coordinates, the residual error measures the uncorrected error remaining in your application, both linear and nonlinear. If the tool maps image and client coordinates by using a nonlinear polynomial transformation, the residual error measures how much of the nonlinear distortion is not corrected. If you need higher levels of mapping accuracy you may need to increase the order of the polynomial mapping.

Settings

Options	
Enable	Enables or disables the tool. (default = Yes)
Save calibration image	Save image used for calibration. (default = Yes)
Line scan correction	Over different lines or the direction of travel (Y, line 1,2,3..) only a linear correction is calculated (default = No) Along the line, the selected calibration type is used (e.g. polynomial (3))
Camera distance	Distance between image plane and outer lense plane or aperture of the camera.
Perspective correction	Scaling factor that translate points of the Calibration plane to points in the Inspection plane. See Z Calibration. (default = 1.0)
Calibration type	Select the calibration type. Polynomial calibrations are more accurate than linear one and compensate better lens distortion, but requires more points. Linear (default) needs at least a 3x3 grid points. Polynomial (3) needs at least a 6x6 grid points. Polynomial (5) needs at least a 8x8 grid points.
Pitch X	Pitch between the dots in the X axis.
Pitch Y	Pitch between the dots in the Y axis.
Origin X	The coordinate X of the origin bars in the grid, if present.
Origin Y	The coordinate Y of the origin bars in the grid, if present.
Rows	Grid rows.
Columns	Grid columns.

MORE

Click here to access the More section description.

Results

| Results	
Decision	Good/Bad decision of the calibration operation.
Scale X	Scaling value in the X axis.
Scale Y	Scaling value in the Y axis.
Axis X rotation	Rotation value in the X axes.
Axis Y rotation	Rotation value in the Y axes.
Mean residual	Mean difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.
Maximum residual	Maximum difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.

4.2.7 Grid Calibration 2

Overview

Grid calibration 2 tool creates the transformation which relates locations in image space to locations in physical space.

The tool creates a nonlinear transform that models radial optical distortion and perspective distortion.The

tool has two components: feature extraction and calibration. The feature extractor is specifically designed to extract features in an image of a checkerboard calibration plate. The calibration component can create a calibration transform using the output of the feature extractor.

How it works

Using images of a calibration plate taken from your application is the most common way to create a feature correspondence transform. It is empirical in that it measures the actual environment where your application runs.
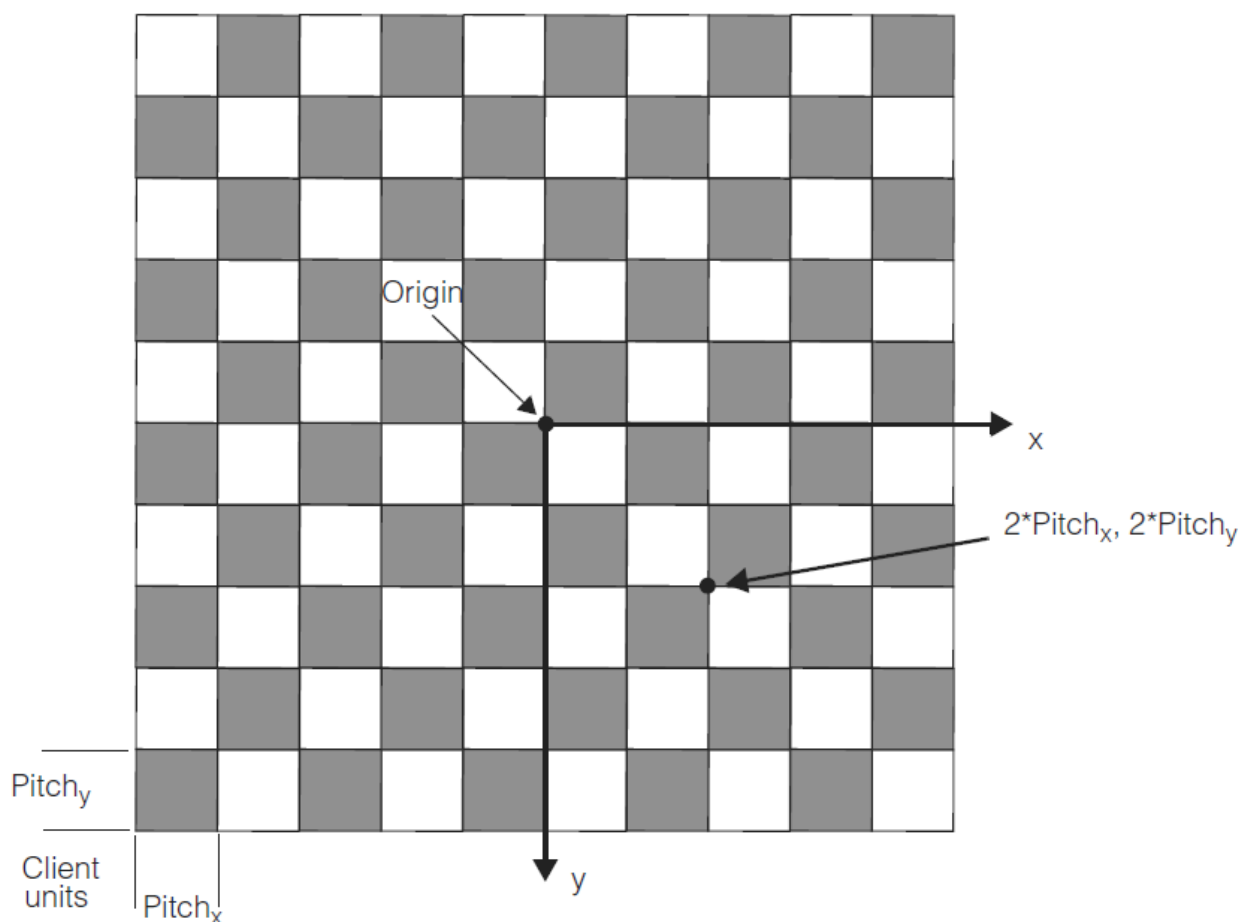
The Tools locates vertices in the image, points where the corners of four checkerboard squares meet. The points found are called vertex features and produces a vector of point pairs where each point pair specifies the location of the source image vertex feature in client coordinates, and the feature location in physical units relative to the checkerboard origin.

Calibration Plate Specifications

1. The calibration plate tiles should be perfectly square. However, the feature extractor that works on the calibration plate image will tolerate tile aspect ratios of from 0.8 to 1.2.

2. The dimensions of the black tiles and the white tiles must be equal.

3. Choose the calibration plate surface material to minimize reflections and non-uniformities. The surface material choice will depend on the camera optics and the surface illumination.

4. Including a registration fiducial in your calibration plate is optional. If you include a fiducial, only use one that conforms to the pattern and dimensions.

5. Calibration plate dimension tolerances must be carefully controlled during the manufacturing process. This is usually more difficult when you make smaller calibration plates. Measure your completed calibration plate carefully to ensure the accuracy of the vertices.

Settings

Options	
Enable	Enables or disables the tool. (default = Yes)
Save calibration image	Save image used for calibration. (default = Yes)
Camera distance	distance from the image plane to the outer lense plane or aperture of the camera
Distortion model	Identifies the lens distortion models used in calibration • Modified SineLaw Projection (default) • SineTanLaw Projection • 3Rad2Tang PolyDistortion • 1Param Radial • No Distortion • 3Param Radial • Line scan
Pitch X	Pitch between the dots in the X axis.
Pitch Y	Pitch between the dots in the Y axis.
Origin X	The coordinate X of the origin bars in the grid, if present.
Origin Y	The coordinate Y of the origin bars in the grid, if present.
Rows	Grid rows.
Columns	Grid columns.
Origin id	The index of vertex used as origin
Corrections	Enables an external corrections to vertices .

MORE

Click here to access the More section description.

Results

| Results	
Decision	Good/Bad decision of the calibration operation
Scale X	Scaling value in the X axis.
Scale Y	Scaling value in the Y axis.
Axis X rotation	Rotation value in the X axes.
Axis Y rotation	Rotation value in the Y axes.
Mean residual	Mean difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.
Maximum residual	Maximum difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.

4.2.8 Point Calibration

Overview

Point calibration uses a small number of points whose coordinates are known in metrical external reference system. The actual number of points is defined in the tool settings.

The World coordinates of each of the calibration point have to be entered in the tool settings.

The images coordinates are measured by dragging a set of cursors over the calibration targets.

During calibration the system shows a set of cursors, one for each calibration point. The cursors can be dragged over the targets, as accurately as possible. The system shows the camera coordinates in the Geometry page.

Settings

Options	
Enable	Enables or disables the tool. (default = Yes)
Save calibration image	Save image used for calibration. (default = Yes)
Camera distance	Used for Z-calibration: distance from the image plane to the outer lense plane or aperture of the camera (defaul = 0.0)
Line scan correction	Over different lines or the direction of travel (Y, line 1,2,3..) only a linear correction is calculated (default = No) Along the line, the selected calibration type is used (e.g. polynomial (3))
Perspective correction	Deprecated, now use Z-calibration. Moves points relative to the origin according to this linear factor. (default = 1.0)
Number of points	Number of point used to calibrate. The minimum number of point depends of the calibration type selected.
Calibration type	Select the calibration type. Polynomial calibrations are more accurate than linear one and compensate better lens distortion, but requires more points. • Linear needs at least 3 points.(default) • Polynomial (2) needs at least 6 points. • Polynomial (3) needs at least 10 points. • Polynomial (4) needs at least 15 points. • Polynomial (5) needs at least 21 points.

Points	
Point index	Select the point index to set Position X and Position Y coordinates. (default = 1; min = 1; max = Number of points)
Position X	World point coordinate X. (default = 0.00)
Position Y	World point coordinate Y. (default = 0.00)

MORE

Click here to access the More section description.

Results

Results	
Decision	Good/Bad decision of the calibration operation.
Scale X	Scaling value in the X axis.
Scale Y	Scaling value in the Y axis.
Axis X rotation	Rotation value in the X axes.
Axis Y rotation	Rotation value in the Y axes.
Mean residual	Mean difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.
Maximum residual	Maximum difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.

4.2.9 Raw Calibration

Overview

Raw Calibration allows to directly insert roto-translation transform parameters to be applied to the reference coordinate system.

Settings

Options	
Enable	Enables or disables the tool. (default = Yes)
Save calibration image	Save image used for calibration. (default = Yes)
Camera distance	Used for Z-calibration: distance from the image plane to the outer lense plane or aperture of the camera (defaul = 0.0)
E11	Upper left value of the transform matrix. (default = 1.0)
E12	Upper right value of the transform matrix. (default = 0.0)
E21	Lower left value of the transform matrix. (default = 0.0)
E22	Lower right value of the transform matrix. (default = 1.0)
Tx	X translation value. (default = 0.0)
Ty	Y translation value. (default = 0.0)

MORE

Click here to access the More section description.

Results

Results	
Decision	Good/Bad decision of the calibration operation.
Scale X	Scaling value in the X axis.
Scale Y	Scaling value in the Y axis.
Axis X rotation	Rotation value in the X axes.
Axis Y rotation	Rotation value in the Y axes.
Mean residual	Mean difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.
Maximum residual	Maximum difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.

4.2.10 Z Calibration

Overview

It may happen that the calibration is carried out on a different plane from that actually used for the inspection. In this case, the transformation of calibration must be corrected in order to compensate for the offset of the inspection plane from the calibration plane.

Assuming that the two planes are coplanar, the measures on the inspection plane are proportional to the measures in calibration plane. The scale factor of this transformation must be supplied by the user or calculated providing the distance of the center of the two planes from the camera.
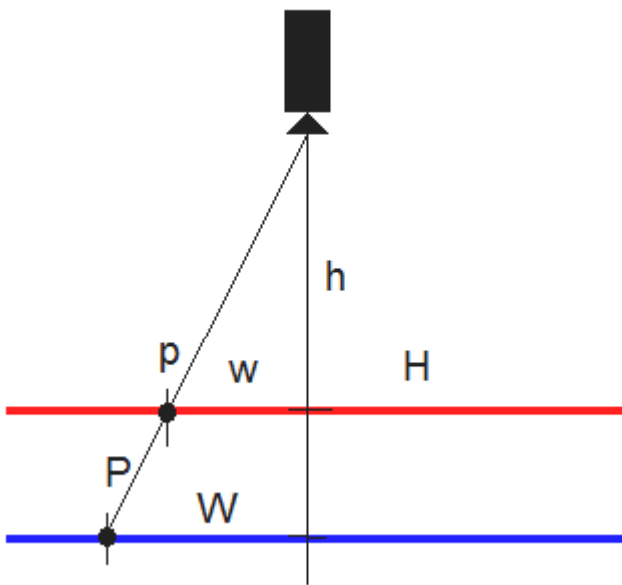
Z Calibration

Assume the situation represented in the figure. The red plane is the Calibration plane and the blue plane is the Inspection plane. Measure W in the Inspection plane is related to measure w in the Calibration plane by the following transform:

```
W = w \ H /h

where

H distance of the Inspection plane from camera
h distance of the Calibration plane from the camera
w distance of a point p in the Calibration plane from the axis passing through the center of the camera
W distance of point P, projection of point p on the inspection plane, from the axis through the center of the camera
```

Z Calibration tool is not a standalone tool but it must be used in pair with another calibration tool. To use Z Calibration tool, at design time, drag it onto the other calibration tool.

Settings

Options	
Enable	Enables or disables the tool. (default = Yes)
Save calibration image	Save image used for calibration. (default = Yes)
Line scan correction	Over different lines or the direction of travel (Y, line 1,2,3..) only a linear correction is calculated. (default = No) Along the line, the selected calibration type is used (e.g. polynomial (3)).
Calibration plane Z offset	Distance between Calibration plane and Inspection plane. (default = 0.0)

MORE

Click here to access the More section description.

Results

| Results	
Decision	Good/Bad decision of the calibration operation.
Scale X	Scaling value in the X axis.
Scale Y	Scaling value in the Y axis.
Axis X rotation	Rotation value in the X axes.
Axis Y rotation	Rotation value in the Y axes.
Mean residual	Mean difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.
Maximum residual	Maximum difference between the theoretical point in the grid with the specified pitch and the calibrated point where the dot center is found.

4.3 Vision Tools

4.3.1 Vision Tools

Overview

Vision tools are usually stand alone tools (means not composite) that perform processing on the assigned image.

A tool must always reside into one view. Usually the image they process is the one associated to the view they belong to.

How it works

SETTINGS

A tool can be personalized setting some parameters. User usually specifies the shape of the ROI (region of interest) inside the image in which to perform the processing. Other parameters are tool specific.

Conditions on results acceptance can be specified , such as range of values that can be taken from the results, number of results,...

TRAIN

Before using a tool it must be trained. The term Training refers to acquisition of parameters values by the tool. This operation may fail, in which case the tool cannot be run.

RUN

After a successful train operation, a tool can be run. Run means processing of the image with the algorithm provided by the tool and the given parameters values.

Run can result into the following values

Good	**Processing was successfully completed and the results satisfy the conditions set by the user.**
Reject	Processing was unsuccessfully completed.
Out of tolerance	Processing was successfully completed but the results do not satisfy the conditions set by the user.
Not run	Processing has not occurred.

4.3.2 Blob

Blob

OVERVIEW

The simplest kinds of images that can be used for machine vision are simple two-dimensional shapes or blobs. Blob analysis is the detection and analysis of two-dimensional shapes within images.

Blob analysis can provide your application with information about the number, location, shape, and orientation of blobs within an image.

Since blob analysis is fundamentally an analysis process of the shape of a closed object, before blob analysis can be performed on an image, the image must be segmented into those pixels that make up the blob being analyzed, and those pixels that are part of the background.

HOW IT WORKS

Hard threshold

The simplest technique for segmenting an image is to pick a threshold pixel value. All pixels with grey-scale values below the threshold are assigned as object pixels, while all pixels with values above the threshold are assigned as background pixels. This technique is called binary thresholding or hard thresholding.

Object pixels are assigned a value of 1 while background pixels are assigned a value of 0.

Soft threshold

Pixels with values above the threshold range are assigned weights of 0 (background), pixels with values below the threshold range are assigned weights of 1 (object), and pixels with values within the threshold range are assigned weights between 0 and 1, typically in a linear manner.

Pre-Processing

Blob tools can be performed also on an processed images: a filter is applied to the blob's image roi before blob analysis.

Blob Inspection

OVERVIEW

Blob inspection is a tool that checks brightness uniformity in a region of interest: it detects and measures the areas of any shape (blobs) corresponding to non uniformities. A point is considered to belong to a blob according to conditions such as its brightness or its contrast with respect to its neighborhood. Blob Inspection can detect bright regions, dark regions or grey regions (regions that are brighter than a threshold thr1 and darker than thr2.

SETTINGS

Options	
Enable	Enable or disable the tool. (default = Yes)
Geometry	Defines tool's region shape. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape. • CAD (Closed ROI) Closed shape imported from a CAD file.
CAD file 1	CAD file name.
Layer nameDisplayed only when CAD (Closed ROI) geometry is selected.	Lists the layer names defined in the selected CAD file. **Connection tolerance** Distance between close segment points to be considered as connected. (default = 0)
User calibrationDisplayed only when CAD (Closed ROI) geometry is selected.	If checked user defines parameters for CAD shapes calibration. Otherwise tool calibration is used. **axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1) **scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1)

Tolerances and limits	
Min. Area	Blobs smaller than value are ignored for the result evaluation.
Blobs number	Enables or disables Blob number limit. **max. Blob number** Maximum number of blobs that can be found. (default = 0) **minor defects** Enable this condition for minor defects evaluation. (default = No)
Single Blob area	Enables or disables Single Blob area limit. **single Blob area limit** Maximum area for a single blob. (default = 100) **minor defects** Enable this condition for minor defects evaluation. (default = No)
Sum of all Blobs area	Enables or disables Sum of all Blobs area. **sum of all Blobs area limit** Maximum value for the sum of the blobs' areas. (default = 500) **minor defects** Enable this condition for minor defects evaluation.(default = No)
Sum of all Blobs area (%)	Enables or disables Sum of all Blobs area as percentage of ROI. **sum of all Blobs area limit (%)** Maximum value (%) for the sum of the blobs' areas. (default = 0) **minor defects** Enable this condition for minor defects evaluation. (default = No)

1

And you can link to it like this:

Go to important point

Analysis	
Threshold mode	Sets threshold's way of working • Standard Threshold is the gray level value. (default = 128 min = 0 max = 255) • Percentage of full range Threshold is the value calculated as percentage of the full histogram of the tool's ROI image. • Percentage of range [min - 255] Threshold is calculated as percentage of the part [min - 255] of the histogram . • Percentage of range [0 - max] Threshold is calculated as percentage of the part [0 - max] of the histogram. • Percentage of range [min - max] Threshold is calculated as percentage of the part [min - max] of the histogram .
Adaptive sensitivity	Threshold is a value that follows the variation of histogram mean between training and inspected ROI image. Threshold is shifted according. (default = no)
Automatic	Threshold is automatically calculated as the optimum value that divides the histogram in two groups such that each group has the minimum with-in group variance. For any given threshold, the within-group variance is defined by the weighted sum of the variances of the two groups.(default = no)
First threshold	Mode standard If polarity is Dark objects, pixels with grey-scale value below the threshold are considered as foreground, while all pixels with value above the threshold are assigned as background pixels. The opposite for White objects. (default = 0
Second threshold [^1]	Mode standard If polarity is Dark objects, pixels with grey-scale value below the threshold are considered as foreground, while all pixels with value above the threshold are assigned as background pixels. The opposite for White objects. (default = 0
SoftnessDisplayed only when threshold mode "Standard" is selected.	In case of large transitions with low slope between the levels of background and blobs the measured area becomes inaccurate. Therefore the width of the transition can be entered. Value are internally weighted and a linear slope is calculated for the transition.
Polarity	Polarity of the object to consider as blob (defects).
Min. area (pixel)	Area must be greater than this limit to be labeled as blob.
Calibrated results	Show results in calibrated units, e.g. mm. (default = no)
Preprocessing	If necessary a # Pre-processing filter can be applied before blob analysis.

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Max. blobs number	Number of blobs found.
Total area (pixel)	Sum of the areas of all found blobs, in pixel.
All Blobs area (%)	Sum of the areas of all found blobs, percentage of ROI area.
Max. area (pixel)	Greatest blob area, in pixel.
Min. area (pixel)	Smallest blob area, in pixel.
Result	Selection of i-th found blob. **Area** Area, in pixel. **Center X** Center of mass X position. **Center Y** Center of mass X position.

IMAGES

Images	
Mask	Mask image to apply. White pixels are care pixels. Black pixels are don't care.
Preprocessing	Image processed through filter (if any) before blob analysis.

CONFIGURATION

This tool is included into the library UvfCvl.

References

1: Displayed only when CAD (Closed ROI) geometry is selected. [5]: Displayed only when threshold mode "Standard" and polarity "Dark and white objects" are selected.

This is another important point.

Blob Measure

OVERVIEW

Blob measure works like the Blob inspect tool but returns several details about each blob found. These details give features of the blob that can be controlled.

SETTINGS

Options	
Enable	Enable or disable the tool. (default = Yes)
User origin	Enable or disable the user defined origin. (default = No)
Geometry	Defines tool's region shape. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape. • CAD (Closed ROI) Closed shape imported from a CAD file.
CAD file	CAD file name.
Layer name	Lists the layer names defined in the selected CAD file. **Connection tolerance** Distance between close segment points to be considered as connected.. (default = 0)
User calibration	If checked user defines parameters for CAD shapes calibration. Otherwise tool calibration is used. **Axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1) **Scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1)

Tolerances and limits	
Check results count	Enables or disables blobs count condition. Condition fails if number of number of blobs in tolerance found don't agree with settings.
Position offset	Enables or disables position tolerance limits. Specification position is the center of mass of the greatest blob found in the reference image . **Elliptical Region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance limits. Specification orientation is the angle of the primary inertia axes of the greatest blob found in the reference image. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Specification mode	In the automatic mode, specification values are automatically set. Otherwise specification values need to bi set.
Area	Enables or disables Blob area limit. **Specification** Expected blob area. (default = 0) **Tolerance+** Positive tolerance. (default = 0) **Tolerance-** Negative tolerance. (default = 0)
Perimeter	Enables or disables Blob perimeter limit. **Specification** Expected blob perimeter. (default = 0) **Tolerance+** Positive tolerance. (default = 0) **Tolerance-** Negative tolerance of the measured perimeter. (default = 0)
Width	Enables or disables Blob width limit. Blob width is the width of bounding box around the principal axes. **Specification** Expected width value. (default = 0) **Tolerance+** Positive tolerance. (default = 0) **Tolerance-** Negative tolerance. (default = 0)
Height	Enables or disables Blob height limit. Blob width is the height of bounding box around the principal axes. **Specification** Expected height value. (default = 0) **Tolerance+** Positive tolerance. (default = 0) **Tolerance-** Negative tolerance. (default = 0)
Holes count	

Tolerances and limits		
		Enables or disables Blob holes count limit.
		Specification
		Expected height value. (default = 0)
		Tolerance+
		Positive tolerance. (default = 0)
		Tolerance-
		Negative tolerance. (default = 0)
Holes max area		Enables or disables Blob holes maximum area limit.
		Specification
		Expected hole area. (default = 0)
		Tolerance+
		Positive tolerance. (default = 0)
		Tolerance-
		Negative tolerance. (default = 0)
Elongation		Enables or disables Blob elongation limit. Elongation is the ratio between inertia principal axes.
		Specification
		Expected elongation. (default = 0)
		Tolerance+
		Positive tolerance. (default = 0)
		Tolerance-
		Negative tolerance. (default = 0)

Analysis	
Max number of results	Number of blob to find.
Adaptive sensitivity	Threshold is a value that follows the variation of histogram mean between training and inspected ROI image. Threshold is shifted according.
Automatic	Threshold is automatically calculated as the optimum value that divides the histogram in two groups such that each group has the minimum with-in group variance. For any given threshold, the within-group variance is defined by the weighted sum of the variances of the two groups
First threshold	Mode standard: If polarity is Dark objects, pixels with grey-scale value below the threshold are considered as foreground, while all pixels with value above the threshold are assigned as background pixels. The opposite for White objects. (default = 0
Second threshold	Mode standard: If polarity is Dark objects, pixels with grey-scale value below the threshold are considered as foreground, while all pixels with value above the threshold are assigned as background pixels. The opposite for White objects. (default = 0
Softness	In case of large transitions with low slope between the levels of background and blobs the measured area becomes inaccurate. Therefore the width of the transition can be entered. Value are internally weighted and a linear slope is calculated for the transition.
Polarity	Polarity of the object to consider as blob (defects).
Min. Area (pixel)	Area must be greater than this limit to be labeled as blob.
Calibrated results	Show results in calibrated units, e.g. mm. (default = no)
Preprocessing	If necessary a # Pre-processing filter can be applied before blob analysis.

More

Click here to access the More section description.

RESULTS

Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Results count	Number of found blobs.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Offset between the tool's specification orientation angle and tool's result orientation angle.
Area	Area of the selected blob, in pixel. **Difference with specification** Difference between result and specified value.
Perimeter	Perimeter of the selected blob, in pixel. **Difference with specification** Difference between result and specified value.
Width	Width of the selected blob, in pixel. **Difference with specification** Difference between result and specified value.
Height	Height of the selected blob, in pixel. **Difference with specification** Difference between result and specified value.
Hole count	Holes count of the selected blob.
Hole max area	Hole maximum area of the selected blob, in pixel. **Difference with specification** Difference between result and specified value.
Elongation	Elongation of the selected blob. **Difference with specification** Difference between result and specified value.

IMAGES

Mask	Mask image to apply. White pixels are care pixels. Black pixels are don't care.
Preprocessing	Image processed through filter (if any) before blob analysis.

CONFIGURATION

This tool is included into the library UvfCvl.

Color Blob Inspection

OVERVIEW

Color Blob inspection is a tool that performs blob analysis on color images. User defines a color representation (RGB or HIS) and which color ranges to accept or refuse. Color Blob tool merges color ranges settings to get a new image for standard blob analysis.

SETTINGS

Options	
Enable	Enable or disable the tool. (default = Yes)
Geometry	Defines tool's region shape. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape. • CAD (Closed ROI) Closed shape imported from a CAD file.
CAD file	CAD file name.
Layer name	Lists the layer names defined in the selected CAD file. **Connection tolerance** Distance between close segment points to be considered as connected.. (default = 0)
User calibration	If checked user defines parameters for CAD shapes calibration. Otherwise tool calibration is used. **Axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1) **Scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1)

Tolerances and limits	
Min. Area	Blobs smaller than value are ignored for the result evaluation.
Blobs number	Enables or disables Blob number limit. **max. Blob number** Maximum number of blobs that can be found. (default = 0) **minor defects** Enable this condition for minor defects evaluation. (default = No)
Single Blob area	Enables or disables Single Blob area limit. **single Blob area limit** Maximum area for a single blob. (default = 100) **minor defects** Enable this condition for minor defects evaluation. (default = No)
Sum of all Blobs area	Enables or disables Sum of all Blobs area. **sum of all Blobs area limit** Maximum value for the sum of the blobs' areas. (default = 500) **minor defects** Enable this condition for minor defects evaluation.(default = No)
Min. Area	Blobs smaller than value are ignored for the result evaluation.

Analysis	
Color space	Reference color space. • HSI (default) Hue-Saturation-Intensity color space. • RGB Red-Green-Blue color space.
Specification mode	Enabling automatic mode, specification values are automatically generated. (default = Automatic)
Hue / Red	Range of validity of Hue/Red value. This color range forces a segmentation of the Hue (HIS) / Red (RGB) image plane. in **Alike** mode (**Unlike**) all pixels out of (into) this range are masked. (default = Yes) **Specification** Nominal value. (default = 0) **Tolerance+** Positive tolerance. (default = 5.00) **Tolerance-** Positive tolerance. (default = 5.00)
Saturation / Green	Range of validity of Saturation/Green value. This color range forces a segmentation of the Saturation (HIS) or Green (RGB) image plane. All pixels out of (into) this range are masked in Alike mode (Unlike mode). (default = No) **Specification** Nominal value. (default = 0) **Tolerance+** Positive tolerance. (default = 5.00) **Tolerance-** Positive tolerance. (default = 5.00)
Intensity / Blue	Range of validity of Intensity/Blue value. This color range forces a segmentation of the Intensity (HIS) or Blue (RGB) image plane. All pixels out of (into) this range are masked in Alike mode (Unlike mode). (default = No) **Specification** Nominal value. (default = 0) **Tolerance+** Positive tolerance. (default = 5.00) **Tolerance-** Positive tolerance. (default = 5.00)
Color Selection	Color selection for binarization. • Alike Pixels with value outside the color ranges are masked. • Unlike Pixels with value inside the color ranges are masked.
Min. Area (pixel)	Area must be greater than this limit to be recognized as blob.

More

Click here to access the More section description.

RESULTS

Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Max. blobs number	Number of blobs found.
Total area (pixel)	Sum of the areas of all found blobs, in pixel.
All Blobs area (%)	Sum of the areas of all found blobs, percentage of ROI area.
Max. area (pixel)	Greatest blob area, in pixel.
Min. area (pixel)	Smallest blob area, in pixel.
Result	Selection of i-th found blob. **Area** Area, in pixel. **Center X** Center of mass X position. **Center Y** Center of mass X position.

IMAGES

Binary	Segmented runtime image.
Hue / Red	Hue/Red plane color before segmentation.
Saturation / Green	Saturation/Green plane color before segmentation.
Intensity / Blue	Intensity/Blue plane color before segmentation.
Mask	Mask image to apply. White pixels are care pixels. Black pixels are don't care.

CONFIGURATION

This tool is included into the library UvfColorToolsStd and UvfColorToolsCvl.

4.3.3 Edges

Edges

OVERVIEW

The Edge tool is the basic method to find image brightness transitions along a given direction. Brightness transitions correspond to physical boundaries of objects in the scene so the Edge is commonly used to locate and measure position of such borders. Brightness transitions have the property of being independent from the actual brightness level of the image so the transition position remains stable even if the global brightness of the scene undergoes significant variations.

Edge tool runs through the tool region in a specific direction to produce a one-dimensional representation of the brightness along it. The position of edges corresponds to the points where brightness changes more quickly. Change can occur as bright to dark or dark to light transition. The Edge tool computes a score for each edge based on the scoring method supplied. It finally selects the edges with the highest score.
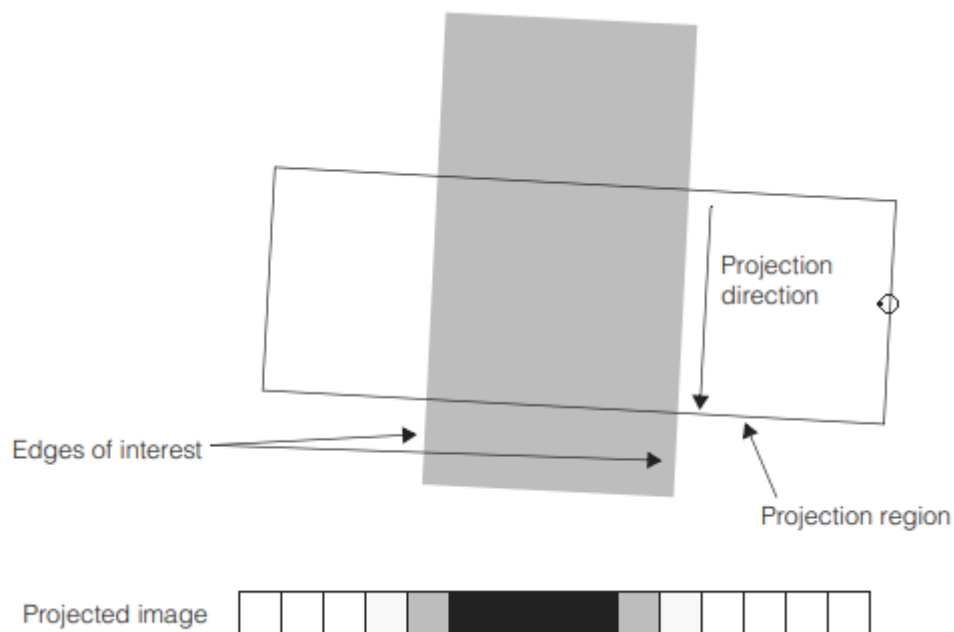
Edge in image

The figure shows how an edge tool works: the Projection region where to look for edges; the Projection operation that sums all the information in the projection region accentuating the strength of edges that lie parallel to the projection rays and reducing the effects of noise; the Projected 1D image that shows the strength of edges; the scan direction for polarity of transitions to the shape handle.

HOW IT WORKS

The edge magnitude and edge angle images are constructed by applying the Sobel edge detection operator to an input image.

Caliper

OVERVIEW

Caliper tool uses the same techniques described for the Edge tool applied to edge pairs. It locates pair of edges instead of a single edge and reports as additional result the distance between them.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Check results count	The expected number of results • None No check. • Expected number Number of results must be equal to Num. of results to find. • Less than Number of results must be less then Num. of results to find. • Greater than Number of results must be greater then Num. of results to find.
Position offset	Enables or disables position tolerance limits. Specification position is the center of the Projection region in the reference image . **Elliptical Region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Size	Enables or disables the size tolerance limit. Sizeis the distance between edge pair. **Specification** Expected size value. (default = 100) **Tolerance+** Positive tolerance. (default = 10) **Tolerance-** Negative tolerance. (default = 10)
Size (md)	Enable this condition for minor defects evaluation.(default = No) **Tolerance+ (%)** Positive tolerance. (default = 10) **Tolerance- (%)** Negative tolerance. (default = 10)

Analysis	
Max number of results	Number of result to find.
Contrast threshold	The contrast above which a transition is considered an edge. (default = 20)
First edge polarity	The expected polarity of the first edge. • Dark to light Transition from darker region to lighter one. • Light to dark Transition from lighter region to darker one. • Don't care (default) Any polarity.
Second edge polarity	The expected polarity of the second edge. • Dark to light Transition from darker region to lighter one. • Light to dark Transition from lighter region to darker one. • Don't care (default) Any polarity.
Filter size	The filter width for edge extraction. (default = 2)
Contrast mode	Contrast is used to score edges. • Disabled No contrast criteria is used. • Stronger contrast (default) Stronger couple of edges get higher scores. • Weaker contrast Weaker couple of edges get higher scores. **Expected contrast** Expected value of contrast: edges with contrast close to this value will get the highest score. (default = 255.00)
Position mode	Position is used to score edges. • Disabled (default) No position criteria is used. • Centered position The center of edge pairs closer to the center of the projection region gets higher scores. • Closer position The center of edge pairs closer to the starting side of the projection region gets higher scores. • Farther position The center of edge pairs further form the starting side of the projection region gets higher scores.
Size mode	Size (distance between the edge pair) is used to score edges. • Disabled (default) No size mode criteria is used. • Expected size Edge pair size closer to expected gets higher scores. • Smaller Edge pair size smaller than expected one gets higher scores. • Larger Edge pair size larger than expected one gets higher scores. **Expected size** Expected edge pair size, in pixel. This value is used for scoring only. (default = 0.00)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
First edge contrast	Contrast of the found first edge.
Second edge contrast	Contrast of the found second edge.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance between specification and result points.
Size	Distance between the edge pairs. **Difference with specification** Difference between the size specified in the Tolerances and limits settings and this measured size.
Score	Score of edge result.

CONFIGURATION

This tool is included into the library UvfCvl.

Circle Finder

OVERVIEW

The Circle finder tool extracts a circular shape within an annular region. A number of Edge tools is automatically placed along radiuses centred on the centre of the annulus. Each Edge provides a result point and a circumference is computed as best fit on them. For reliable error evaluation the gap between the tools should be small. Therefore chose enough edge tools or points in the analysis section.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance. Specification position is the center of interpolated circle. **Elliptical Region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Diameter	Enables or disables the diameter value and tolerances to be used as pass/fail condition. **Diameter mode** Criteria to compute diameter. Interpolated Diameter of best fit circle. Worst Diameter computed using the radius on the worst point. **Specification** Expected diameter value. (default = 100) **Tolerance+** Positive tolerance of the measured diameter. (default = 10) **Tolerance-** Negative tolerance of the measured diameter. (default = 10)
Eccentricity	Enables or disables eccentricity tolerance condition. Eccentricity is defined as difference between maximum diameter and minimum diameter. **limit** Max accepted difference accepted. (default = 0)
Number of missing points	Enables or disables missing point condition. **Max. number of missing points** The number of points that can be missing without a failure condition. (default = 0)
Ignore points	The number of points to discard to have the best fit. The fitting algorithm ignores the points with the worst distance between the tool result point and the fit circle. Then it recomputes the fit circle. **Residual limit for ignoring** The minimum value to consider a point as a candidate for decimation. (default = 0)
Best points	The number of points, with the best score, to use for fitting.
Positive worst error	Enables positive worst point error condition. If the point with the worst error has a residual bigger than the worst point error limit, the condition fails. Positive sign when the point lays outside the fit circle **Worst point error limit** Max accepted distance between any edge and the fitted line. (default = 0)
Negative worst error	Enables positive worst point error condition. If the point with the worst error has a residual bigger than the worst point error limit, the condition fails. Positive sign when the point lays inside the fit circle **Worst point error limit** Max accepted distance between any edge and the fitted line. (default = 0)
Mean error	Enables or disables mean error condition. **Error limit** Max accepted mean error distance. (default = 0)
Local errors	Enable or disable local error condition. Local errors are the errors of points relative to the errors of closest points. The residual error of each point is compared with neighbors (local) to evaluate if they are real defects. If this comparison is bigger than a threshold, the condition fails. **Positive local error** Maximum accepted positive local error . (default = 0) **Negative local error** Maximum accepted negative local error. (default = 0)

Analysis	
Number of points	Number of edge tools to use. (default = 6)
Double edge	Enable or disable double edge searching. If set point used for interpolation will be the center of edge pair(default = No)
Contrast threshold	The contrast above which a transition is considered an edge (default = 20)
First edge polarity	The expected polarity of the edge. Only edges with the specified polarity are considered. • Dark to light Transition from darker region to lighter one. • Light to dark Transition from lighter region to darker one. • Don't care (default) Any polarity.
Filter size (pixel)	The filter width for edge extraction. (default = 2)
Contrast mode	The edge contrast is used to score single edges. • Disabled No contrast criterion is used. • Stronger contrast (default) Stronger edge pairs get higher scores. • Weaker contrast Weaker edge pairs get higher scores. **Expected contrast** Expected transition grey value that get higher score. (default = 255.00)
Position mode	The edge position is used to score single edges. • Disabled (default) No position criteria is used. • Centered position The edge position closer to the center of the projection region gets higher scores. • Closer position The edge position closer to the starting side of the projection region gets higher scores. • Farther position The edge position further form the starting side of the projection region gets higher scores.
Filter for local error (points)	Number of neighbor points used for comparison. (default = 2) **latency** Parameter that identifies neighbors: distance in pixels from current point to define neighbors for comparison. (default = 0) **Overlap for local errors** Overlap ends points for local errors investigation

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the specification X position and result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the specification Y position and result Y position (specification reference system).
Offset length	Distance between specification and result points.
Size	Measured diameter **Difference with specification** Difference between the specification and result diameter.
Max diameter	Diameter of the circle passing through the farthest point.
Min diameter	Diameter of the circle passing through the nearest point.
Eccentricity	Difference between Max diameter and min diameter.
Mean error	Mean distance between the results points and the fitted circle.
Positive worst error (point)	Worst positive distance between the results points and the fitted circle. The number between () indicates the point index the value refers to.
Number of missing points	Number of not found edges.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the specification X position and result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the specification Y position and result Y position (specification reference system).
Offset length	Distance between specification and result points.

CONFIGURATION

This tool is included into the library UvfCvl.

Line Detect

OVERVIEW

Line Detect lets you find linear scratches in the selected search area. It uses basically the Hough algorithm to extract desired linear features.

SETTINGS

Options	
Enable	Enable or disable the tool. (default = Yes)
Geometry	Defines tool's region shape. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape. • CAD (Closed ROI) Closed shape imported from a CAD file.
CAD file	CAD file name.
Layer name	Lists the layer names defined in the selected CAD file. **Connection tolerance** Distance between close segment points to be considered as connected.. (default = 0) **Normalize XY weight** If checked weight is distributed for 50% to X features and for 50% to Y features. If unchecked all features have the same weight. (default = No)
User calibration	If checked user defines parameters for CAD shapes calibration. Otherwise tool calibration is used. **Axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1) **Scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1)

Tolerances and limits	
Number of shapes not matched	Enables or disables check on the number of linear scratches found. (default = Yes) **Max number of shapes** Maximum allowed number. (default = 0)
Length of each shape	Enables or disables check on scratch's length limit. (default = No) **Single shape length limit** Maximum value of shapes' length. (default = 10.00)
Sum of all shapes length	Enables or disables check on the sum of all scratches' length limit. (default = No) **Sum of all shapes length limit** Maximum value of shapes' length sum. (default = 50.00)

Analysis	
Magnitude threshold	Magnitude threshold above which a feature is considered in the Hough space. (default = 20)
Max. num. of lines	Maximum number of scratches to find. (default = 10000)
Minimum length (pixel)	Minimum length (pixels) of valid scratches. (default = 10)
Minimum density	The density is computed as the ratio of the number of contributing featurelets divided by the length. A low density threshold may cause colinear line segments to merge into one longer segment. A high density threshold may break up an otherwise longer line segment into multiple shorter colinear pieces. Very high density threshold may exceed the density of all line segments in the image data, and cause the tool to report no line segment. (default = 0.8)
Diagnostic	Enable extended diagnostic. (default = No)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Num of shapes not matched	Found shapes count.
Sum of shapes length	Sum of shapes length.
Max length	Maximum length of all founded shapes.
Min length	Minimum length of all founded shapes.
Result	Select the index of the line to show information about. **Length** Measured length of the selected shape. **Start point X** X coordinate of the starting point. **Start point Y** Y coordinate of the starting point.

CONFIGURATION

This tool is included into the library UvfCvl.

Line Finder

The Line finder tool lets you extract a line using a set of multiple Edge tools placed perpendicularly along a line. Each Edge tool returns a point and a line is interpolated as best fit on all points found. The result of the Line tool is the center position and the orientation of the line.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance. Specification position is the center segment laying on the interpolated line. **Elliptical Region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Number of missing points	Enables or disables missing point condition. **Max. number of missing points** The number of points that can be missing without a failure condition. (default = 0)
Ignore points	The number of points to discard to have the best fit. The fitting algorithm ignores the points with the worst distance between the tool result point and the fit line. Then it recomputes the fit line. **Residual limit for ignoring** The minimum value to consider a point as a candidate for decimation. (default = 0)
Best points	The number of points, with the best score, to use for fitting.
Positive worst error	Enables positive worst point error condition. If the point with the worst error has a residual bigger than the worst point error limit, the condition fails. Positive sign when the normal to the line passing from this point generates with the oriented line an angle of +90°. Worst point error limitMax accepted distance between any edge and the fitted line. (default = 0)
Negative worst error	Enables negative worst point error condition. If the point with the worst error has a residual bigger than the worst point error limit, the condition fails. Negative sign when the normal to the line passing from this point generates the oriented line an angle of -90°. **Worst point error limit** Max accepted distance between any edge and the fitted line. (default = 0)
Mean error	Enables or disables mean error condition. **Error limit** Max accepted mean error distance. (default = 0)
Local errors	Enable or disable local error condition. Local errors are the errors of points relative to the errors of closest points. The residual error of each point is compared with neighbors (local) to evaluate if they are real defects. If this comparison is bigger than a threshold, the condition fails. **Positive local error** Max accepted positive peak of the error derivative. (default = 0) **Negative local error** Max accepted negative peak of the error derivative. (default = 0)

Analysis	
Number of points	Number of edge tools to use. (default = 4)
Double edge	Enable or disable double edge searching. If set point used for interpolation will be the center of edge pair(default = No)
Contrast threshold	The contrast above which a transition is considered an edge. (default = 20)
First edge polarity	The expected polarity of the edge. Only edges with the specified polarity are considered. • Dark to light Transition from darker region to lighter one. • Light to dark Transition from lighter region to darker one. • Don't care (default) Any polarity.
Filter size (pixel)	The filter width for edge extraction. (default = 4)
Contrast mode	The edge contrast is used to score single edges. • Disabled No contrast criterion is used. • Stronger contrast (default) Stronger edge pairs get higher scores. • Weaker contrast Weaker edge pairs get higher scores. **Expected contrast** Expected transition grey value that get higher score. (default = 255.00)
Position mode	The edge position is used to score single edges. • Disabled (default) No position criteria is used. • Centered position The edge position closer to the center of the projection region gets higher scores. • Closer position The edge position closer to the starting side of the projection region gets higher scores. • Farther position The edge position further form the starting side of the projection region gets higher scores.
Line position mode	Criterion for fitted line positioning. • Centered (default) The line is positioned minimizing the fitting errors. • Worst negative The line is positioned at the worst negative point. • Worst positive The line is positioned at the worst positive point.
Filter for local errors (points)	Filter width **Filter latency (points)** Shift of the values of the filter from its center. (default = 255.00)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system). .
Offset length	Distance from the trained tool position.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.
Min. edge contrast (point)	Edge minimum value. The number between () indicates the point index the value refers to.
Max. edge contrast (point)	Edge maximum value. The number between () indicates the point index the value refers to.
Mean error	Mean distance between the edges and the fitted line.
Worst error+ (point)	Worst positive distance between the edges and the fitted line. The number between () indicates the point index the value refers to.
Worst error- (point)	Worst negative distance between the edges and the fitted line. The number between () indicates the point index the value refers to.
Max local error+ (point)	Maximum positive local error. The number between () indicates the point index the value refers to.
Max local error- (point)	Maximum negative local error. The number between () indicates the point index the value refers to.
Number of missing points	Number of not found edges.

CONFIGURATION

This tool is included into the library UvfCvl.

Multiple Polar Caliper

OVERVIEW

The tool applies several Caliper tools along a circular shape tangentially and returns min , max, average and standard deviation of their sizes. User defines the polar region and the first caliper region.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Geometry	Defines tool's region shape. • Polar grid Circular shape.

Tolerances and limits	
Num of sectors	Number of sectors: defines the number of caliper tools to use(default = 1)
Size	Enables or disables check on size of each caliper size. **Specification** Nominal value. (default = 10) **Tolerance+** Positive tolerance value. (default = 10) **Tolerance-** Negative tolerance value. (default = 10)

Analysis	
Contrast threshold	The contrast above which a transition is considered an edge. (default = 20)
First edge polarity	The expected polarity of the first edge. • Dark to light Transition from darker region to lighter one. • Light to dark Transition from lighter region to darker one. • Don't care (default) Any polarity.
Second edge polarity	The expected polarity of the second edge. • Dark to light Transition from darker region to lighter one. • Light to dark Transition from lighter region to darker one. • Don't care (default) Any polarity.
Filter size	The filter width for edge extraction. (default = 2)
Contrast mode	Contrast is used to score edges. • Disabled No contrast criteria is used. • Stronger contrast (default) Stronger couple of edges get higher scores. • Weaker contrast Weaker couple of edges get higher scores. **Expected contrast** Expected value of contrast: edges with contrast close to this value will get the highest score. (default = 255.00)
Position mode	Position is used to score edges. • Disabled (default) No position criteria is used. • Centered position The center of edge pairs closer to the center of the projection region gets higher scores. • Closer position The center of edge pairs closer to the starting side of the projection region gets higher scores. • Farther position The center of edge pairs further form the starting side of the projection region gets higher scores.
Size mode	Size (distance between the edge pair) is used to score edges. • Disabled (default) No size mode criteria is used. • Expected size Edge pair size closer to expected gets higher scores. • Smaller Edge pair size smaller than expected one gets higher scores. • Larger Edge pair size larger than expected one gets higher scores. **Expected size** Expected edge pair size, in pixel. This value is used for scoring only. (default = 0.00)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Num of passed	Number of calipers with good result.
Min E1 contrast (point)	Minimum contrast of the first edge found transitions.
Mean E1 contrast	Average contrast of the first edge found transitions.
Max E1 contrast (point)	Maximum contrast of the first edge found transitions.
Min E2 contrast (point)	Minimum contrast of the second edge found transitions
Mean E2 contrast	Average contrast of the second edge found transitions.
Max E2 contrast (point)	Maximum contrast of the second edge found transitions.
Min size (point)	Minimum measured size.
Mean size	Average measured size.
Max size (point)	Minimum measured size.
Std. Dev. size	Standard deviation of all measured sizes.

CONFIGURATION

This tool is included into the library UvfCTStd and UvfCTCvl.

Rectangle Finder

OVERVIEW

The Rectangle finder tool lets you fit a set of points to a rectangle. It is the container of four Line Finder tools, one for each rectangle side. Found each line, the Rectangle tool computes the four vertexes, the center (as intersection of diagonals), width and height, and side parallelism/ orthogonality.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance. Specification position is the center of rectangle (intersection of diagonals). **Elliptical region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance limits. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Height	Enables or disables the height tolerance limits. **Specification** Expected height. (default = 0.00) **Tolerance+** Positive tolerance. (default = 0.00) **Tolerance-** Negative tolerance. (default = 0.00)
Width	Enables or disables the width tolerance limits. **Specification** Expected width. (default = 0.00) **Tolerance+** Positive tolerance. (default = 0.00) **Tolerance-** Negative tolerance. (default = 0.00)
Diagonal	Enables or disables the diagonal tolerance limits. **Specification** Expected diagonal length. (default = 0.00) **Tolerance+** Positive tolerance. (default = 0.00) **Tolerance-** Negative tolerance. (default = 0.00)
Orthogonality	Enables or disables the orthogonality tolerance limits. **Tolerance+** Positive tolerance. (default = 0.00) **Tolerance-** Negative tolerance. (default = 0.00)

Single Side	
Side	Each side of the rectangle is a LineFinder tool. Each LineFinder has its own settings: both tolerance limits and analysis. The selection of the side shows the desired LineFinder's setting • Top Top side selected. • Right Right side selected. • Bottom Bottom side selected. • Left Left side selected.

Tolerances and Limits

For Tolerances and Limits please reference to selected single side. See Tolerances and limits.

Analysis

For Analysis please reference to selected single side. See Analysis.

More

Click here to access the More section description.

RESULTS

Tool general results

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance from the trained tool position.
Angle	Angle of the tool. Angle of the fit rectangle is the nominal angle + the angle of transformation that fits specification vertexes to result ones. **Angle offset** Angle offset from the specification an result angle.
Width AB	Size of AB side of the rectangle. ABCD are the result vertexes: A is left-top, B is right-top, C is right-bottom, D is left-bottom. **Difference with specification** Difference between results and specification.
Width BC	Size of BC side of the rectangle. ABCD are the result vertexes: A is left-top, B is right-top, C is right-bottom, D is left-bottom. **Difference with specification** Difference between results and specification.
Height BC	Size of BC side of the rectangle. ABCD are the result vertexes: A is left-top, B is right-top, C is right-bottom, D is left-bottom. **Difference with specification** Difference between results and specification.
Width CD	Size of CD side of the rectangle. ABCD are the result vertexes: A is left-top, B is right-top, C is right-bottom, D is left-bottom. **Difference with specification** Difference between results and specification.
Height DA	Size of CD side of the rectangle. ABCD are the result vertexes: A is left-top, B is right-top, C is right-bottom, D is left-bottom. **Difference with specification** Difference between results and specification.
Diagonal AC	Size of AC diagonal of the rectangle **Difference with specification** Difference between results and specification.
Diagonal BD	Size of BD diagonal of the rectangle. ABCD are the result vertexes: A is left-top, B is right-top, C is right-bottom, D is left-bottom. **Difference with specification** Difference between results and specification.
Angle DA^AB	Angle between DA and AB sides of the rectangle **Difference with specification** Difference between results and specification.
Angle AB^BC	Angle between AB and BC sides of the rectangle **Difference with specification** Difference between results and specification.
Angle BC^CD	Angle between BC and CD sides of the rectangle. ABCD are the result vertexes: A is left-top, B is right-top, C is right-bottom, D is left-bottom. **Difference with specification** Difference between results and specification.
Angle CD^DA	

Results	
	Angle between CD and DA sides of the rectangle. ABCD are the result vertexes: A is left-top, B is right-top, C is right-bottom, D is left-bottom.
Difference with specification	
	Difference between results and specification.

Single Side results

Reference to selected single side results. See Line Finder Results.

CONFIGURATION

This tool is included into the library UvfCvl.

4.3.4 Flaw Detection

Flaw Detection

OVERVIEW

Flaw detection tools are a set of tools designed to inspect and detect flaws in a specified area of the image. Some tools chek color, others contours, others surfaces.

HOW IT WORKS

Area of interest is processed using the specific tool's algorithm.

Boundary Inspect

OVERVIEW

Boundary Inspect is a tool that uses a geometric model to inspect the quality of a model in the run-time image.
The geometric boundary inspection proceeds with matching the model boundary with the remaining image contours to produce matched and unmatched model boundary and image contours.

An image contour (partial or whole) is considered to match a model boundary (partial or whole), if the distance between the contour elements (featurelets) and the model boundary is within a distance tolerance range (Min/Max distances and angle tolerances). Unmatched contour are filtered with size criteria (minimum and maximum length).

Boundary tolerances based on boundary distance and orientation may not be sufficient to discover some types of defects on the boundaries such as small protrusions and intrusions (mouse bites and boundary chips). The boundary inspection tool provides a way of detecting these types of anomalies through boundary anomaly analysis (local contour comparison mode), which is performed by comparing the matched model boundaries with the corresponding image contours to detect any local differences in terms of local contour geometry. Any image contour sections that show these differences will be marked as anomalous sections.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Geometry	Defines tool's model shape. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape. • Line seg Line segment. • CAD (Closed ROI) Closed shape imported from a CAD file. • Ellipse arc Ellipses arc.
CAD file	CAD file name.
Layer name	Lists the layer names defined in the selected CAD file. **Connection tolerance** Distance between close segment points to be considered as connected.. (default = 0)
User calibration	If checked user defines parameters for CAD shapes calibration. Otherwise tool calibration is used. **Axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1) **Scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1)
Search area tol. X left	Search area is the bounding box of the shape. Search area Tols enlarge size of bounding box moving sides respectively. Move left side. (default = 5)
Search area tol. Y up	Move upper side. (default = 5)
Search area tol. X right	Move right side. (default = 5)
Search area tol. Y down	move bottom side. (default = 5)

Tolerances and limits	
Num of shapes not matched	Enables or disables check on the number of features that doesn't match with model's ones. These features are filtered by Boundary's settings and than checked.(default = Yes) **Max number of shapes** Max number of shapes. (default = 0)
Length of each shape	Enables or disables shapes' length check. (default = No) **Single shape length limit** Max length. (default = 10.00)
Sum of all shapes length	Enables or disables sum of shapes' length check. (default = No) **Sum of all shapes length limit** Max length. (default = 50.00)

Analysis	
Min distance tolerance (pixels)	Negative distance tolerance of a feature from the fitted shape. (default = -10.00)
Max distance tolerance (pixels)	Positive distance tolerance of a feature from the fitted shape. (default = 10.00)
Angle tolerance +/-	Angle tolerance. (default = 20.00)
Unmatched feature min. length (pixels)	Minimum length of a feature (shape). (default = 3.00)
Unmatched feature max. length (pixels)	Maximum length of a feature (shape). (default = 0.00)
Anomaly score	Minimum anomaly score. (default = 0.50)
Anomaly min. area	Minimum area of an anomaly. (default = 0.00)
Anomaly max. length	Consider as anomaly the ones that have size less than this limit. (default = 10.00)
Contrast threshold	Grey Level for features detection. (default = 20.00)
Reverse polarity	Find boundaries with inverse polarity compared to the model polarity. (default = No)
Ignore polarity	Find boundaries of any polarity. (default = No)
Granularity	Granularity is expressed as the radius of interest, in pixels, within which features are detected. (default = 1.00)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Num of shapes not matched	Number of pieces of shapes not matched.
Sum of shapes lenght	Sum of not matched shapes' length.
Max length	Maximum length of matched shapes.
Min length	Minimum length of matched shapes.
Result	Not matched shapes selection.
	Length
	Length of selected shape.
	Start point X
	X coordinate of starting point of the selected shape.
	Start point Y
	Y coordinate of starting point of the selected shape.
Num of anomalies	Number of detected anomalies.
Max score for anomalies	Maximum anomalies' detected score.

CONFIGURATION

This tool is included into the library UvfCvl.

Color Match

OVERVIEW

The color match tool compares a region of color in a run-time image against a set of reference colors, and it generates a set of scores to indicate how closely the area of the run-time image matches each known color. The higher the comparison score, the greater the similarity.

SETTINGS

Options	
Enable	Enable or disable the tool. (default = Yes)
Geometry	Defines tool's region shape. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape. • Affine rectangle Rectangular shape with rounded corners.
Auto calibration	Automatically defines the reference color to match. (default = Yes)

Tolerances and limits	
Shape index	Minimum similarity for an acceptable result. **Shape index limit** Minimum acceptable shape index. (default = 1.0)

More

Click More... to access the More section description.

RESULTS

| Decision | Pass/Fail decision of a tool. | | Score | A value ranging from 0 to 1 indicating the value of color distribution similarity. The highest is the score, the closer is the current color distribution to the one trained. | | Processing time | Tool processing time in msec. |

CONFIGURATION

This tool is included into the library UvfColorToolsStd and UvfColorToolsCvl.

TInspect Color (3P)

OVERVIEW

The purpose of the Template Color Inspection tool is to detect defects on a surface. TColorInspect is a TInspect that works on RGB images or HSI images. So you can select the image planes of a color representation and tune grey TInspect processing.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Geometry	Defines tool model shape. • General rectangle (default) Rectangular shape. • Circle Circular shape. • Annulus Annulus shape. • General polygon General polygon shape.

Tolerances and Limits	
Min. Area	Blobs smaller than value are ignored for the result evaluation.
Blobs number	Enables or disables Blob number limit. **max. Blob number** Maximum number of blobs that can be found. (default = 0) **minor defects** Enable this condition for minor defects evaluation. (default = No)
Single Blob area	Enables or disables Single Blob area limit. **single Blob area limit** Maximum area for a single blob. (default = 100) **minor defects** Enable this condition for minor defects evaluation. (default = No)
Sum of all Blobs area	Enables or disables Sum of all Blobs area. **sum of all Blobs area limit** Maximum value for the sum of the blobs' areas. (default = 500) **minor defects** Enable this condition for minor defects evaluation.(default = No)
Sum of all Blobs area (%)	Enables or disables Sum of all Blobs area as percentage of ROI. **sum of all Blobs area limit (%)** Maximum value (%) for the sum of the blobs' areas. (default = 0) **minor defects** Enable this condition for minor defects evaluation. (default = No)

Analysis	
Color space	Reference color space representation.
Hue / Red	Enable or disable TInspect on Hue / Red color plane. (default = Yes)
	Intensity sensitivity
	This parameter represents an index of the sensitivity of the tool to variations of brightness. The higher the value the smaller will be the intensity difference considered as a defect. Intensity sensitivity modifies the threshold image used to filter runtime image. Its range varies from 0 (low sensitivity) to 99 (high sensitivity). Every value drives a pair of parameters (#Proportional and #Constant) that define how the threshold image is modified. $I(x, y) = \text{Proportional} \setminus \text{SDev} + \text{Constant}$ At every position (x, y) threshold image intensity I is the sum of a constant value and a scaling value of standard deviation of training samples at that point. (default = 25) Proportional Scaling factor for the sensitivity function. (default = 8.0) Constant Offset level for the sensitivity function. (default = 15.5)
	Proportional
	Read only value. Scaling factor for the sensitivity function. (default = 8.0)
	Constant
	Read only value. Offset level for the sensitivity function. (default = 15.5)
	Dimension sensitivity
	This parameter represents an index of the sensitivity of the tool to the area of defects. The higher the value the smaller will be the area of a region considered as a defect. Dimension sensitivity is the minimum area of blob analysis after thresholding. (default = 25) Area min. (pixel) Minimum area that can be considered as a defect. (default = 75)
	Area min. (pixel)
	Read only value. Minimum area that can be considered as a defect. (default = 75)
	Saturation value
	This parameter, available only in HSI color space, masks all pixels in the saturation plane with a higher grey value. (default = 10)
Saturation / Green	Enable or disable TInspect on Saturation/Green color plane. (default = Yes)
	Intensity sensitivity
	see Intensity sensitivity
	Proportional
	Read only value. Scaling factor for the sensitivity function. (default = 8.0)
	Constant
	Read only value. Offset level for the sensitivity function. (default = 15.5)
	Dimension sensitivity
	see Dimension sensitivity
	Area min. (pixel)
	Read only value. Minimum area that can be considered as a defect. (default = 75)
Intensity / Blue	Enable or disable TInspect on Intensity/Blue image plane. (default = Yes)
	Intensity sensitivity
	see Intensity sensitivity
	Proportional
	Read only value. Scaling factor for the sensitivity function. (default = 8.0)
	Constant
	Read only value. Offset level for the sensitivity function. (default = 15.5)
	Dimension sensitivity
	see Dimension sensitivity
	Area min. (pixel)
	Read only value. Minimum area that can be considered as a defect. (default = 75)
Defect mode	
Normalization	Normalization to apply to runtime image before preprocessing.
	• None
	Normalization is not performed.
	• Mean & StDev
	Normalization is applied by mean and standard deviation.
	• Mean
	Normalization is applied by mean.
Sobel image	Sobel Image used to highlight borders and edges of template image.

Analysis	
	• None
	Do not use
	• Add image to samples
	Add this image to threshold image to make tools less sensitive in that regions (around borders or edges).
	Magnitude scaling factor
	Sobel parameter to magnify edges.
	Magnitude threshold
	Threshold for Sobel's edges.
Blank scene	Enable or disable TInspect working mode. If enabled, no template model is required but a uniform image of blank scene grey value. (default = 25)
	blank scene value
	Template image gray value. (default = 128)
Erode difference image	Morphology to apply to difference image. (default = false)
	Filter size
	Size of erosion operator. (default = 1)
Use train image as sample	Includes the train image in the training images set. (default = No)
Use custom samples	Uses a different training images set instead of usual. All tools in a View that needs statistical training use the same set. If this flag is set the tool must be trained alone. default = No)
	Samples folder
	Specifies the folder containing training specific images set to use.

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Max blobs number	Found blobs count.
Total area (pixel)	Sum of the areas of all found blobs, in pixel.
Sum of all Blobs area (%)	Sum of the areas of all found blobs, in %.
Max. area (pixel)	Greatest area of all found blobs, in pixel.
Min. area (pixel)	Smallest area of all found blobs, in pixel.
Result	Select the index of the blob to show information about.
	Area
	Area of the selected blob, in pixel.
	Center X
	Position X of the center of mass of the selected blob.
	Center Y
	Position Y of the center of mass of the selected blob.

IMAGES

Images	
Inspected Hue/Red Saturation/Green Intensity/Blue	Run time Hue/red image
Threshold Hue/Red Saturation/Green Intensity/Blue	Threshold Image result of statistical training. Every pixel value of the image is the threshold of the difference between run-time image and template image. Sensitivity modifies this threshold.
Difference Hue/Red Saturation/Green Intensity/Blue	Difference image between runtime minus template and threshold image.
Model Hue/Red Saturation/Green Intensity/Blue	Template image.
Sobel Hue/Red Saturation/Green Intensity/Blue	Sobel image.
Mask	Mask image: care pixels are white; don't care pixels are black.
Threshold with extra mask	Threshold image with runtime movable masks

CONFIGURATION

This tool is included into the library UvfColorToolsStd and UvfColorToolsCvl.

Contour Inspect

OVERVIEW

The shape of the tool defines a contour where Contour Inspect extracts a set of boundary points and computes the distance between each point and the and the expected shape. Boundary points are extracted by several Edge tools laid orthogonally to the contour.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Geometry	Defines tool's model shape. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape. • Line seg Line segment. • CAD (Closed ROI) Closed shape imported from a CAD file. • Ellipse arc Ellipses arc.
CAD file	CAD file name.
Layer name	Lists the layer names defined in the selected CAD file. **Connection tolerance** Distance between close segment points to be considered as connected.. (default = 0)
User calibration	If checked user defines parameters for CAD shapes calibration. Otherwise tool calibration is used. **Axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1) **Scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1)

Tolerances and limits	
Position offset	Enables or disables position tolerance limits. Specification position is the center of the reference shape in the reference image. Reference shape is the shape originated by nominal shape and the laid on reference points. **Elliptical Region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation offset check. (default = No) **Angle+** Tolerance for positive angles. (default = 360.00) **Angle-** Tolerance for negative angles. (default = 360.00)
Minor defect length	Enables or disables minor defect length check. It is the length of the shape contour that is distant to the reference shape more than minor defect depth (default = Yes) **minor defect depth** Maximum accepted distance between contour and reference shape. (default = 0.00) **Limit** Maximum error accepted. (default = 0.00)
Sum of length of minor defects	Enables or disables sum of length of detected minor defect lengths check. (default = No) LimitMaximum length. (default = 0.00)
Major defect length	Enables or disables major defect length check. It is the length of the shape contour that is distant to the reference shape more than major defect depth (default = Yes) **major defect depth** Maximum accepted distance between contour and reference shape. (default = 0.00) **Limit** Maximum error accepted. (default = 0.00)
Sum of length of major defects	Enables or disables sum of length of detected major defects check. (default = No) **Limit** Maximum length. (default = 0.00)
Worst point error	Enables or disables maximum error between detected points and reference shape. (default = Yes) **Limit** Maximum error. (default = 0.00)
Number of missing points	Enables or disables maximum number of not matched points. (default = Yes) **Max number of missing points** Maximum number. (default = 0)

Analysis	
Error polarity	Select polarity of error respect to the reference shape of the inspected object. • Only positive Outside. • Only negative Inside. • Don't care (default) Inside or outside.
Inspection mode	Select how the reference shape is calculated. It is the contour algorithm refers to decide if a border point accepted or is a defect. • Ideal shape Geometric shape. It is the specification shape mapped by alignment transformation. • LS fitted shape Fitting shape. It is the result of fitting operation of reference points versus specification shape model. • Spline fitted shape (default) A spline. It is the result of the interpolation of reference points on the best spline.
Num. reference points	Number of points used to calculate the reference shape. (default = 15.00)
Num. of points to get average	Number of points to be used in average calculation. (default = 10.00)
Ignore points	The number of points to discard to have the best fit. The fitting algorithm ignores the points with the worst distance to the fitted contour. (default = 0) **Residual limit for ignoring** Ignore points for fitting whose residual goes beyond this value. (default = 0)
Best points	The number of points, with the best score, to use for fitting. (default = 0.0)
Pitch	Distance between Edge tools. (default = 10.00)
Edge search width (pixel)	Edge tools width. (default = 20.00)
Edge search height (pixel)	Edge tools height. (default = 5.00)
Contrast threshold	The contrast, in gray levels, above which a transition is considered an edge. (default = 5.00)
First edge polarity	The expected polarity of the edge. Only edges with the specified polarity are considered. • Dark to light Transition from darker region to lighter one. • Light to dark Transition from lighter region to darker one. • Don't care (default) Any polarity.
Filter size	The filter width for edge extraction. (default = 2)
Contrast mode	The edge contrast is used to score single edges. • Disabled No contrast criterion is used. • Stronger contrast (default) Stronger edge pairs get higher scores. • Weaker contrast Weaker edge pairs get higher scores. **Expected contrast** Expected transition grey value that get higher score. (default = 255.00)
Position mode	The edge position is used to score single edges. • Disabled (default) No position criteria is used.

Analysis

- Centered position

The edge position closer to the center of the projection region gets higher scores.

- Closer position

The edge position closer to the starting side of the projection region gets higher scores.

- Farther position

The edge position further form the starting side of the projection region gets higher scores.

Check background	This value checks if a not found edge tool result is due to an obstruction of the border (eg. transfer belts). If the point is not found and the ROI of this edge tool is the expected background, then this point is missing and valuated, otherwise algorithm assumes this region is obstructed and ignore the result.(default = Yes) **Dark background** Background is dark on foreground is brighter or conversely. (default = No) **Background color limit** Gray value that defines background limit. (default = 128)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system). .
Offset length	Distance from the trained tool position.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.
Min contrast	Minimum founded contrast level.
Worst error	Worst error between the contour point and the result reference shape.
Num. of minor defects	Number of minor defects.
Min length of minor defects	Minimum length of minor defects.
Max length of minor defects	Maximum length of minor defects.
Sum of length of minor defects	Sum of lengths of all found minor defects.
Num of major defects	Number of major defects.
Min length of major defects	Minimum length of major defects.
Max length of major defects	Maximum length of major defects.
Sum of length of major defects	Sum of lengths of major defects.
Number of missing points	Number of points not found.
Number of points	Number of used Edge tools.

CONFIGURATION

This tool is included into the library UvfCTStd and UvfCTCvl.

Contour Inspect Ex

OVERVIEW

Contour Inspect Ex Tool is a different optimized and accurate implementation of Contour Inspect tool. The shape of the tool defines a contour where Contour Inspect Ex extracts a set of boundary points and computes the distance between each point and the and the expected shape. Boundary points are extracted by several Edge tools that, differently from ContourInspect tool, work on a rectified image of the perimeter of shape.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Geometry	Defines tool's model shape. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape. • Line seg Line segment. • CAD (Closed ROI) Closed shape imported from a CAD file. • Ellipse arc Ellipses arc.
CAD file	CAD file name.
Layer name	Lists the layer names defined in the selected CAD file. **Connection tolerance** Distance between close segment points to be considered as connected.. (default = 0)
User calibration	If checked user defines parameters for CAD shapes calibration. Otherwise tool calibration is used. **Axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1) **Scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1)

Tolerances and limits	
Position offset	Enables or disables position tolerance limits. Specification position is the center of the reference shape in the reference image. Reference shape is the shape originated by nominal shape and the laid on reference points. **Elliptical Region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation offset check. (default = No) **Angle+** Tolerance for positive angles. (default = 360.00) **Angle-** Tolerance for negative angles. (default = 360.00)
Worst intrusion depth	Enables or disables worst intrusion depth check. It is the point more distant from the contour and internal to the inspected object. (default = Yes) **worst point error limit** Maximum error accepted. (default = 0.00)
Worst protrusion depth	Enables or disables worst protrusion depth check. It is the point more distant from the contour and external to the inspected object. (default = No) **worst point error limit** Maximum error accepted. (default = 0.00)
Intrusion defect length	Enables or disables intrusion defect length check. It is the length of the shape contour that is distant to the reference shape internal to the object more than Intrusion min. depth(default = Yes) **Limit** Maximum length accepted. (default = 0.00)
Sum of intrusion lengths	Enables or disables sum of intrusion length check. (default = No) **Limit** Maximum error accepted. (default = 0.00)
Intrusion area	Enables or disables intrusion area check. Intrusion area is the area subtended between single intrusion defect and reference shape. (default = Yes) **Limit** Maximum error accepted. (default = 0.00)
Sum of intrusion areas	Enables or disables sum of intrusion areas check. (default = No) **Limit** Maximum error accepted. (default = 0.00)
Protrusion defect length	Enables or disables protrusion defect length check. It is the length of the shape contour that is distant to the reference shape external to the object more than Protrusion min. depth(default = Yes) **Limit** Maximum length accepted. (default = 0.00)
Sum of protrusion lengths	Enables or disables sum of protrusion length check. (default = No) **Limit** Maximum error accepted. (default = 0.00)
Protrusion area	Enables or disables protrusion area check. Protrusion area is the area subtended between single protrusion defect and reference shape. (default = Yes) **Limit** Maximum error accepted. (default = 0.00)
Sum of protrusion areas	Enables or disables sum of protrusion areas check. (default = No) **Limit** Maximum error accepted. (default = 0.00)

Tolerances and limits	
Number of missing points	Enables or disables maximum number of not found points. (default = Yes) **Max number of missing points** Maximum number. (default = 0)

Classification	
Short intrusion length	Classification of intrusion lengths. An intrusion length is short if longer than intrusion defect length limit and shorter than this value. (default = 0)
Short protrusion length	Classification of protrusion lengths. A protrusion length is short if longer than protrusion defect length limit and shorter than this value. (default = 0)
Small intrusion area	Classification of intrusion areas. An intrusion area is small if bigger than intrusion area limit and smaller than this value. (default = 0)
Small protrusion area	Classification of protrusion areas. A protrusion area is small if bigger than protrusion area limit and smaller than this value. (default = 0)
Small intrusion depth	Classification of intrusion depth. An intrusion depth is small if bigger than intrusion min. depth and smaller than this value. (default = 0)
Small protrusion depth	Classification of protrusion depth. A protrusion depth is small if bigger than protrusion min. depth and smaller than this value. (default = 0)

Analysis	
Error polarity	Select polarity of error respect to the reference shape of the inspected object. • Only positive Outside. • Only negative Inside. • Don't care (default) Inside or outside.
Intrusion min. depth	Maximum error accepted inside inspected object.
Protrusion min. depth	Maximum error accepted outside inspected object.
Inspection mode	Select how the reference shape is calculated. It is the contour algorithm refers to decide if a border point accepted or is a defect. • Ideal shape Geometric shape. It is the specification shape mapped by alignment transformation. • LS fitted shape Fitting shape. It is the result of fitting operation of reference points versus specification shape model. • Spline fitted shape (default) A spline. It is the result of the interpolation of reference points on the best spline.
Num. reference points	Number of points used to calculate the reference shape. (default = 15.00)
Num. of points to get average	Number of points to be used in average calculation. (default = 10.00)
Ignore points	The number of points to discard to have the best fit. The fitting algorithm ignores the points with the worst distance to the fitted contour. (default = 0) **Residual limit for ignoring** Ignore points for fitting whose residual goes beyond this value. (default = 0)
Best points	The number of points, with the best score, to use for fitting. (default = 0.0)
Pitch	Distance between Edge tools. (default = 10.00)
Edge search width (pixel)	Edge tools width. (default = 20.00)
Contrast threshold	The contrast, in gray levels, above which a transition is considered an edge. (default = 5.00)
First edge polarity	The expected polarity of the edge. Only edges with the specified polarity are considered. • Dark to light Transition from darker region to lighter one. • Light to dark Transition from lighter region to darker one. • Don't care (default) Any polarity.
Filter size	The filter width for edge extraction. (default = 2)
Contrast mode	The edge contrast is used to score single edges. • Disabled No contrast criterion is used. • Stronger contrast (default) Stronger edge pairs get higher scores. • Weaker contrast Weaker edge pairs get higher scores. **Expected contrast** Expected transition grey value that get higher score. (default = 255.00)
Position mode	The edge position is used to score single edges.

Analysis	
	• Disabled (default)
	No position criteria is used.
	• Centered position
	The edge position closer to the center of the projection region gets higher scores.
	• Closer position
	The edge position closer to the starting side of the projection region gets higher scores.
	• Farther position
	The edge position further form the starting side of the projection region gets higher scores.
Check background	This value checks if a not found edge tool result is due to an obstruction of the border (eg. transfer belts). If the point is not found and the ROI of this edge tool is the expected background, then this point is missing and valuated, otherwise algorithm assumes this region is obstructed and ignore the result.(default = Yes)
	Dark background
	Background is dark on foreground is brighter or conversely. (default = No)
	Background color limit
	Gray value that defines background limit. (default = 128)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system). .
Offset length	Distance from the trained tool position.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.
Min contrast	Minimum founded contrast level.
Worst intrusion depth	Worst error between the contour point and the result reference shape inside inspected object.
Worst protrusion depth	Worst error between the contour point and the result reference shape outside inspected object.
Number of intrusions	Number of segment of contour classified as intrusions.
Min intrusion length	Minimum length of intrusions.
Max intrusion length	Maximum length of intrusions.
Sum of intrusions length	Sum of lengths of all intrusion segments.
Number of protrusion	Number of segment of contour classified as protrusions.
Min protrusion length	Minimum length of protrusions.
Max protrusion length	Maximum length of protrusions.
Sum of protrusions length	Sum of lengths of all protrusion segments.
Number of all intrusion areas	Number of all areas subtended inside the inspected object.
Min intrusion area	Minimum area of intrusions.
Max intrusion area	Maximum area of intrusions.
Sum of intrusions areas	Sum of areas of all intrusions.
Number of all protrusion areas	Number of all areas subtended outside the inspected object.
Min protrusion area	Minimum area of protrusions.
Max protrusion area	Maximum area of protrusions.
Sum of protrusions area	Sum of areas of all protrusions.
Number of missing points	Number of points not found.
Number of points	Number of used Edge tools.

CONFIGURATION

This tool is included into the library UvfCTStd and UvfCTCvl.

Finger Inspect

OVERVIEW

Finger Inspect tool measures along lines the width of continuous objects (like fingers). The tool measures the width with a defined density, up to the pixel size, creating a profile of the width of the inspected object. Cuts, fat and thin fingers can be then detected.

SETTINGS

Options	
Enable	Enable or disable the tool. (default = Yes)
Geometry	Defines tool's model shape. • LineSeg (default) Line segment. • CAD Shape imported from a CAD file.
CAD file	Defines CAD file name. **Layer name** Lists the layer names defined in the selected CAD file. **Scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. **Scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. **Axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Connection tolerance** Distance between close segment points to be considered as connected.

Tolerances and Limits	
Finger mean width	Enables or disables width mean measurement check. (default = No)
	Specification
	Width mean specification for a single finger. (default = 0.0)
	Tolerance-
	Positive tolerance of the measured width. (default = 0.0)
	Tolerance+
	Negative tolerance of the measured width. (default = 0.0)
Finger Std. Dev. width	Enables or disables width standard deviation measurement check. (default = No)
	Single finger limit
	Tolerance of the standard deviation width for a single finger. (default = 0.0)
	Global limit
	Tolerance of the standard deviation width for all fingers. (default = 0.0)
Short interruptions	Enables or disables the defect check. (default = No)
	max. number
	Maximum number of defects accepted. (default = 0.0)
Medium interruptions	Enables or disables the defect check. (default = No)
	max. number
	Maximum number of defects accepted. (default = 0.0)
Long interruptions	Enables or disables the defect check. (default = No)
	max. number
	Maximum number of defects accepted. (default = 0.0)
Thin finger length	Enables or disables the thin finger measurement check (single defect). (default = No)
	Single finger limit
	Maximum thin finger length for a single measure. (default = 0.0); if a finger is thin more than the limit, then is a defect
Short fat sections	Enables or disables the defect check. (default = No)
	max. number
	Maximum number of defects accepted. (default = 0.0)
Medium fat sections	Enables or disables the defect check. (default = No)
	max. number
	Maximum number of defects accepted. (default = 0.0)
Long fat sections	Enables or disables the defect check. (default = No)
	max. number
	Maximum number of defects accepted. (default = 0.0)
Blurred finger length	Enables or disables the blurred finger measurement check (single defect). (default = No)
	Single finger limit
	Maximum thin burred length for a single measure. (default = 0.0); if a finger is blurred more than the limit, then is a defect
Sum of lengths of interruptions	Enables or disables broken finger measurement check. (default = No)
	Single finger limit
	Maximum broken finger length for a single finger. (default = 0.0)
	Global limit
	Maximum broken finger length for all fingers. (default = 0.0)
Sum of lengths of thins	Enables or disables thin finger measurement check. (default = No)
	Single finger limit
	Maximum thin finger length for a single finger. (default = 0.0)
	Global limit
	Maximum thin finger length for all fingers. (default = 0.0)
Sum of lengths of fats	

Tolerances and Limits		
	Enables or disables fat finger measurement check. (default = No)	
	Single finger limit	
	Maximum fat finger length for a single finger. (default = 0.0)	
	Global limit	
	Maximum fat finger length for all fingers. (default = 0.0)	
Sum of lengths of blurreds	Enables or disables blurred finger measurement check. (default = No)	
	Single finger limit	
	Maximum blurred finger length for a single finger. (default = 0.0)	
	Global limit	
	Maximum blurred finger length for all fingers. (default = 0.0)	
Number of missing points	Enables or disables missing points (failed measurements) check. (default = No)	
	Single finger limit	
	Maximum number of missing point for a single finger. (default = 0.0)	
	Global limit	
	Maximum number of missing point for all fingers. (default = 0.0)	

When a single finger point is measured, the measure can be classified as an interruption, thin or fat. Then the tool starts to measure the length of the interruption or the thin or fat section, until the point measurement has the same classification.

A point measurement is considered an interruption if there is no finger to measure.
A point measurement is considered thin, if the finger width is less than Thin finger width limit.
A point measurement is considered fat, if the finger width is greater than Fat finger width limit.

Multiple measurements of the same class make a section; a section can be considered:
- short, if the section is long less than the short limit
- medium, if the section is longer than the short limit but less than the medium limit
- long, if the section is longer than the medium limit

Measurement classification	
Short interruption limit	Limit to classify an interruption as short. (default = 0)
Medium interruption limit	Limit to classify an interruption as medium. (default = 0)
Thin finger width limit	Limit to classify a finger as thin, if less than. (default = 3)
Fat finger width limit	Limit to classify a finger as fat, if more than. (default = 7)
Short fat section limit	Limit to classify an fat section as short. (default = 0)
Medium fat section limit	Limit to classify a fat as medium. (default = 0)

Analysis	
Density	Density of the measurement. (default = 1.00)
Number of measurement points	Number of points to average to get a single point measurement. (default = 1)
Align caliper width (pixels)	Width of the caliper used to align the inspected line. (default = 50)
Caliper height (pixel)	Height of the caliper used to align the inspected line. (default = 5)
Worker caliper width (pixel)	Width of the caliper used to measure the inspected line. (default = 20)
Contrast threshold	The contrast, in gray levels, above which a transition is considered an edge. (default = 5.0)
First edge polarity	The expected polarity of the first edge. Only edges with the specified polarity are evaluated. All edges are evaluated in "Don't care" mode.The scan direction is relevant in defining the edge polarity. Polarity can be set to one of the following values: • Dark to light Transition from dark pixels to lighter ones. • Light to dark Transition from light pixels to darker ones. • Don't care (default) Any transition.
Second edge polarity	The expected polarity of the second edge. Only edges with the specified polarity are evaluated. All edges are evaluated in "Don't care" mode.The scan direction is relevant in defining the edge polarity. Polarity can be set to one of the following values: • Dark to light Transition from dark pixels to lighter ones. • Light to dark Transition from light pixels to darker ones. • Don't care (default) Any transition.
Filter size (pixel)	The filter width for edge extraction. (default = 2)
Max. number of results	Do not change. (default = 1)
Contrast mode	Contrast is used to score edges. • Disabled No contrast criteria is used. • Stronger contrast (default) Stronger couple of edges get higher scores. • Weaker contrast Weaker couple of edges get higher scores. **Expected contrast** Expected value of contrast: edges with contrast close to this value will get the highest score. (default = 255.00)
Position mode	Position is used to score edges. • Disabled (default) No position criteria is used. • Centered position Couple of edges in the center of the search region get higher scores. The score decreases with the distance from the center. • Closer position Couple of edges closer to the starting side of the search region get higher scores. The score decreases with the distance from the left side. • Farther position Couple of edges farther from the starting side of the search region get higher scores. The score increases with the distance from the left side.
Size mode	Size (distance between the pair of edges) is used to score edges.

Analysis	
	• Disabled (default) No size mode criteria is used. • Expected size Highest score is given to the edge pairs whose size is closer to the specified "expected size". • Smaller Highest scores is given to the edge pairs with smaller size. • Larger Highest score is given to the edge pairs with larger size. **Expected size** Expected distance, in pixel, that gets higher score. This value is used for scoring only. (default = 0.00)
Dark finger back ground	Defines is the background is darker then the measured object. (default = Yes)
Background color limit	Defines the background gray level. (default = 128) when there is an interruption, if the gray level is less than this value, then is considered as background.
Mouse bites	Enables small breakage detection (advanced). (default = No)
Local inspection	Enable local inspection (default = Yes) **number of point to average** Number of points used to get the local measurement. (default = 5) **only center value** Enables using only the center as measurement . (default = No) **filter gray value on average** Enable using the number of point to average to get the local gray value for the local inspection (default = Yes) **contrast threshold** minimum contrast threshold to detect a breakage **filter size** The filter width for edge extraction. (default = 2) **second edge threshold (%)** percentage change from the first breakage edge gray value to define end of the breakage

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Finger(s) selection	Select the finger number (id) to see results. Result below are referred to the selected finger • Tools name(default) Results are referred to the all fingers • Single finger - id Results are referred to the finger idfinger idNumber of the finger
Finger result	Pass/Fail decision of the finger.
Number of points	Number of measurements.
Number of missing points	Number of failed measurements.
Min contrast	Minimum contrast measured for the found transitions value edges.
Local inspection min contrast	Minimum contrast measured for the found transitions value edges when using local inspection
Finger mean width	Finger width mean measurement.
Finger Std. Dev. width	Finger width standard deviation measurement.
Finger min width	Finger minimum width measurement.
Finger max width	Finger maximum width measurement.
Num. of interruptions	Number of broken sections found. **short interruptions** Number of short interruptions **medium interruptions** Number of medium interruptions **long interruptions** Number of long interruptions **min. length** Size of the smaller interruption **max. length** Size of the larger interruption **sum of lengths** Total interruptions length
Num. of thin sections	Number of thin sections found. **Min length** Minimum length. **Max length** Maximum length. **Sum of lengths** Sum of all thin sections length.
Num. of fat sections	

Results

Number of fat sections found.

short fat sections
Number of short fat sections

medium fat sections
Number of medium fat sections

long fat sections
Number of long fat sections

Min length
Minimum length.

Max length
Maximum length.

Sum of lengths
Sum of all fat sections length.

Num. of blurred sections	Number of blurred sections found.

Min length
Minimum length.

Max length
Maximum length.

Sum of lengths
Sum of all blurred sections length.

Number of fat sections found.

short fat sections

Line Breakage

OVERVIEW

Tool can classify found interruptions into three groups: short, medium and long. User insert values for classification ranges.

SETTINGS

Options	
Enable	Enable or disable the tool. (default = Yes)
Geometry	Defines tool's region shape. • LineSeg Line segment. • CAD Closed shape imported from a CAD file.
CAD file	CAD file name.
Layer name	Lists the layer names defined in the selected CAD file. **Connection tolerance** Distance between close segment points to be considered as connected.. (default = 0)
User calibration	If checked user defines parameters for CAD shapes calibration. Otherwise tool calibration is used. **Axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1) **Scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1)

Tolerances and limits	
Short interruptions	Enables or disables short interruptions tolerance check. **Max number** Maximum number of allowed short interruptions. (default = 0)
Medium interruptions	Enables or disables medium interruptions tolerance check. **Max number** Maximum number of allowed medium interruptions. (default = 0)
Long interruptions	Enables or disables long interruptions tolerance check. **Max number** Maximum number of allowed long interruptions. (default = 0)
Sum of length of interruptions	Enables or disables tolerance check on the sum of length of all detected interruptions. **Single finger limit** Maximum value for the sum of the blobs' areas. (default = 500) **Global limit** Includes minor defects to evaluation and therefore result.(default = No)
All Blobs area (%)	Enables or disables Sum of all Blobs area as percentage of ROI. **All Blobs area limit** Maximum value for the sum of the blobs' areas. (default = 0) **minor defects** Includes minor defects to evaluation and therefore result.(default = No)

Analysis	
Threshold mode	Sets how the threshold parameters are filled in. • Standard Threshold is represented as grey level value.(default = 128
Adaptive sensitivity	Mean values are calculated for the histograms of the ROI of the training and inspected image. Threshold is shifted according to changes of these values. (default = no)
Automatic	Threshold is automatically calculated by the first derivative of the histogram (ROI) (default = no)
First threshold (mode standard)	Mode standard: If polarity is Dark objects, pixels with grey-scale value below the threshold are considered as defect, while all pixels with value above the threshold are assigned as background pixels. The opposite for White objects (default = 0
Second threshold	Displayed only if threshold mode "Standard" and polarity "dark and white objects" is selected: If polarity is Dark objects, pixels with grey-scale value below the threshold are considered as defect, while all pixels with value above the threshold are assigned as background pixels. The opposite for White objects (default = 0
Softness	In case of large transitions with low slope between the levels of background and blobs the measured area becomes inaccurate. Therefore the width of the transition can be entered. Value are internally weighted and a linear slope is calculated for the transition
Polarity	Polarity of the object to consider as blob (defects).
Min. Area (pixel)	Area must be greater than this limit to be recognized as blob.
Calibrated results	show results in calibrated value, e.g. mm (default = no)
Preprocessing	If necessary a preprocessing filter can be selected, operation or not, as default no filtering is done

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Max. blobs number	Number of blobs found.
Total area (pixel)	Sum of the areas of all found blobs, in pixel.
All Blobs area (%)	Sum of the areas of all found blobs, in %.
Max. area (pixel)	Greatest area of all found blobs, in pixel.
Min. area (pixel)	Smallest area of all found blobs, in pixel.
Result	Select the index of the blob to show information about. **Area** Area of the selected blob, in pixel. **Center X** Position X of the center of mass of the selected blob. **Center Y** Position Y of the center of mass of the selected blob.

PatInspect

OVERVIEW

The purpose of PatInspect is to locate an object using the PatMax algorithm and to detect defects on its surface. PatInspect creates the template image of an object from a set of training images and then compares run-time images of the object against the template image trained statistically. A defect is any region that differs from model more than an expected tolerated variation given by the training images set. A defect can be a dark or bright spot on an object, an incorrectly shaped feature, or the absence of a shape. Basically, PatInspect aligns image, computes difference with threshold image, applies some morphology filtering, and runs blob analysis.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Search area	Selects the area where the tool searches for the model. • All image (default) Search area is all the image. • Centered Search area is positioned to the nominal position of the tool. • Free Search area position is defined by the user. If Search area is Centered the search area will be set as the minimum rectangle enclosing the model plus a surrounding frame: **Frame X (pixel)** Frame width. **Frame Y (pixel)** Frame height.
Model	Defines tool model shape. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape.
User origin	Allows to set the model origin in an arbitrary position, instead of the center of the model area.

Tolerances and limits	
Check results count	Enables or disables results count condition. • None not enabled. • Less than Decision positive if number of found items is less than the defined value. • Greater than Decision positive if number of found items is greater than the defined value. • Expected number Decision positive if number of found items is equal to the defined value. **Number of results to find** User defined value for results count.
Shape index	Conformity limit for acceptable result. **Shape index limit** Minimum acceptable shape index. (default = 1.0)
Position offset	Enables or disables position tolerance. **Elliptical region** Instead of rectangular offset area a elliptical is used **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Min area	Area must be greater than this limit to be recognized as blob. (default = 0)
Blobs number	Enables or disables Blob number limit. **max. Blob number** Maximum number of blobs to be found. (default = 0) **minor defects** Includes minor defects to evaluation and therefore result.(default = No)
Single Blob area	Enables or disables Single Blob area limit. **single blob area limit** Maximum area for a single blob. (default = 100) **minor defects** Includes minor defects to evaluation and therefore result.(default = No)
Sum of all Blobs area	Enables or disables Sum of all Blobs area. **sum of all Blobs area limit** Maximum value for the sum of the blobs' areas. (default = 500) **minor defects** Includes minor defects to evaluation and therefore result.(default = No)
Sum of all Blobs area (%)	Enables or disables Sum of all Blobs area as percentage of ROI. **All Blobs area limit** Maximum value for the sum of the blobs' areas. (default = 0) **minor defects** Includes minor defects to evaluation and therefore result.(default = No)

Analysis	
Acceptance threshold	The acceptance level for the global matching score. Results with scores below this limit are not accepted.
Contrast threshold	Minimum contrast of boundaries used to locate the pattern.
Elasticity	It specifies the degree to which you will allow PatMax to tolerate deformations of the object boundaries. You specify the elasticity value in pixels. (default = 0.00)
Score using clutter	When this option is enabled, the system takes into account the clutter (presence of extra contours in the image that were not present in the model) in computing the global score. (default = Yes)
Angle	Enables or disables angle search range. (default = Yes) **Angle min** Lower limit. (default = -30) **Angle max** Upper limit. (default = 30)
Scale	Enables or disables scale range. (default = No) • None Not enabled. • Simmetric Tolerates scale variations for X and Y directions. • Only X Tolerates scale variations only for X direction. • Only Y Tolerates scale variations only for Y direction. **Min** Lower limit. (default =0) **Max** Upper limit. (default = 0)
Ignore polarity	Tool will ignore the polarity of the features to find in reference to the model. (default = No)
Pattern granularity	PatMax uses large features first to do a pre-localization of the object and then refines the search using fine features. Granularity is expressed as the radius of interest, in pixels, within which features are detected. • Automatic (default) The system perform, at train time, an estimate of the optimal settings for Fine and Coarse granularity. • Manual Fine and coarse granularity are used to train the pattern. **Fine** The smallest granularity used to detect features in the training image or shape description. (default = 1) **Coarse** The largest granularity used to detect features. (default = 4)
Accepted overlap (%)	Percentage overlapping area needed to PatMax before it treats multiple overlapping instances as a single instance.
Angle overlap	Angle within which PatMax treats multiple overlapping instances as a single instance.
Intensity sensitivity	This parameter represents an index of the sensitivity of the tool to variations of brightness. The higher the value the smaller will be the intensity difference considered as a defect. (default = 25) **Proportional** Scaling factor for the sensitivity function. (default = 13.80) **Constant** Offset level for the sensitivity function. (default = 25.60)
Dimension sensitivity	This parameter represents an index of the sensitivity of the tool to the area of defects. The higher the value the smaller will be the area of a region considered as a defect. (default = 25) **Area min. (pixel)** Minimum area that can be considered as a defect. (default = 75)
Sobel image	Enables or disables results count condition.

Analysis	
	• None
	Do not use
	• Add image to samples
	Apply sobel operation on mean image to enlarge template image on edges
	Magnitude scaling factor
	The computed edge magnitude for each pixel is multiplied by magScale before being placed in the edge magnitude image.
	Magnitude threshold
	Only sobel magnitude values greater than this value are taken into account (after having been multiplied by magScale).
Use train image as sample	Includes the train image in the sampling. (default = No)
Use custom samples	Uses saved images for the sampling. (default = No)
	Samples folder
	Specifies the folder containing sample images to use.

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool.
	Offset X
	Offset from the trained tool position in the X axes.
Position Y	Y position coordinates. The position is referred to the origin point of the tool.
	Offset Y
	Offset from the trained tool position in the Y axes.
Offset length	Distance from the trained tool position.
Angle	Angle of the tool.
	Angle offset
	Angle offset from the trained tool angle position.
Score	Match quality index. A value from 0 to 1 indicating the global level of conformity between the model and the pattern found. Refers only to the localization part of the tool.
Max blobs number	Found blobs count.
Total area (pixel)	Sum of the areas of all found blobs, in pixel.
Sum of all Blobs area (%)	Sum of the areas of all found blobs, in %.
Max. area (pixel)	Greatest area of all found blobs, in pixel.
Min. area (pixel)	Smallest area of all found blobs, in pixel.
Result	Select the index of the blob to show information about.
	Area
	Area of the selected blob, in pixel.
	Center X
	Position X of the center of mass of the selected blob.
	Center Y
	Position Y of the center of mass of the selected blob.

IMAGES

Images	
Inspected	Runtime image
Threshold image	Threashold Image result of statistical training. Every pixel value of the image is the threshold of the difference between run-time image and template image. Sensitivity modifies this theshold.
Model features	Show features of the model
Difference	Difference image between runtime minus template and threshold image.
Model	Template image.
Sobel	Sobel image.
Mask	Mask image: care pixles are white; don't care pixels are black.

CONFIGURATION

This tool is included into the library UvfCvl.

IMAGES

Images	

Polar Inspection

OVERVIEW

Polar inspection lets you inspect an annulus region. In Area mode non uniform areas (blobs) are extracted. In Edges mode edges that usually correspond to surface defects of a part are detected. Both modes can be selected separately. PolarInspection tools before performing blob analysis and/or edge checking unwraps the image region of the shape.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Geometry	Defines tool's region shape. • Annulus Annulus shape. • Annulus section Section of an annulus • General thick polygon General polygon shape with significant thickness.

Analysis	
Overlapping (deg)	Size (in degrees) of image. (default = 0)
Scale X	A scaling factor can be applied to the unwrapped region. X direction correspond to the radial direction. (default = 1.00)
Scale Y	A scaling factor can be applied to the unwrapped region. Y direction correspond to the radial direction. (default = 1.00)
Areas mode	Enables or disables error area detection. (default = Yes) **Adaptive sensitivity** Threshold for segmentation is a value that follows the variation of histogram mean between training and inspected ROI image. Threshold is shifted according.(default = No) **Automatic** Threshold is automatically calculated as the optimum value that divides the histogram in two groups such that each group has the minimum with-in group variance. For any given threshold, the within-group variance is defined by the weighted sum of the variances of the two groups.(default = no) **First threshold** Mode standard: If polarity is Dark objects, pixels with grey-scale value below the threshold are considered as foreground, while all pixels with value above the threshold are assigned as background pixels. The opposite for White objects. (default = 0
Preprocessing	If necessary a preprocessing filter can be selected, operation or not, as default no filtering is done • None No preprocessing needed. (default) • Median Difference Median difference filtering preprocess. • XY Median Difference Median difference filtering mainly in X and Y direction. • Sobel Used to improve contrast changes • Average Difference Average difference filtering preprocess.
Edges mode	Enables or disables edge detection. (default = Enable) **Contrast threshold** The contrast, in gray levels, above which a transition is considered an edge. (default = 5.00) **First edge polarity** The expected polarity of the first edge. Dark to light Transition from darker region to lighter one. Light to dark Transition from lighter region to darker one. Don't care (default) Any polarity. **Filter size** The filter width for edge extraction. (default = 2) **Max number of results** Maximum number of edges to be found. **Number of accepted defects** The result will be good if the detected defects count are less than this value. (default = 0)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Blobs number	Found blobs' count.
Total area (pixel)	Sum of the areas of all found blobs, in pixel.
Sum of all Blobs area (%)	Sum of the areas of all found blobs, in %.
Max. area (pixel)	Greatest area of all found blobs, in pixel.
Min. area (pixel)	Smallest area of all found blobs, in pixel.
Result	Select the index of the blob to show information about. **Area** Area of the selected blob, in pixel. **Center X** Position X of the center of mass of the selected blob. **Center Y** Position Y of the center of mass of the selected blob.
Edges number	Found edges count.
Edge	Select the index of the edge to show information about. **Position X** X coordinate of the edge central point. **Position Y** X coordinate of the edge central point. **Edge contrast** Contrast measured for the founded edge transition's value.

IMAGES

Images	
Model	Unwrapped image of reference image used to train the tool.
Last	Run time unwrapped image.

CONFIGURATION

This tool is included into the library UvfCTStd and UvfCTCvl.

Thickness Inspect

OVERVIEW

The tool checks the width of a threaded shaped feature on the image. Typical use is the inspection of a glue thread deposed on a surface to verify its minimum or maximum thickness. Internally many Edge tools (calipers) are used, each representing a measurement point with a result. Parameter slice width in the analysis section defines the distance between these points or measurements (in pixel).

HOW IT WORKS

Several calipers are positioned along the selected shape at a defined distance. At run time, the region of the shape is unwrapped and the Caliper tools work all aligned vertically. Edge points detected and sizes evaluated. For each point the local averaged size is then calculated. Local errors are evaluated as the signed distance of a point from its local average.

A point is critical if its local errors are higher than the defined limits:

• if local error is negative and higher than Limit for smaller size value, it is marked as belonging to a smaller defect

• if local error is positive and higher than Limit for larger size value, it is marked as belonging to a larger defect

Defect length is evaluated as the distance between the first and the last of a group of consecutive critical points.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Geometry	Defines tool's region shape.
	• Annulus
	  Annulus shape.
	• Annulus section
	  Annulus section shape.
	• General thick polygon
	  General polygon shape with a thickness.

Tolerances and limits	
Check size	Select which values are used to check size constraints. • Absolute Size value of each measurement point is used. • Average Local average value of each measurement point is used.
Size	Enables or disables the size tolerance limits. **Specification** Expected size value. (default = 100) **Tolerance+** Positive tolerance. (default = 10) **Tolerance-** Negative tolerance. (default = 10)
Defect length	Enables or disables tolerance limit for defect length. Defect length is the length of sections out of size tolerance. ((default = No) **limit** Minimum defect length. (default = 0.0)
Local errors	Enable or disable local error constraints. (default = No) Local errors are the errors of points relative to the errors of closest points. The size of each point is compared with neighbors (local) to evaluate if they are real defects. If this comparison is bigger than a threshold, the condition fails. **Positive local error** Error over the local mean. (default = 0) **Negative local error** Error under the local mean. (default = 0)

Analysis	
Slice width (pixel)	Sets the distance between the measurement points (calipers) in pixel. (default = 10.0)
Error direction	The contrast, in grey levels, above which a transition is considered an edge. • Don't care Any transition. • Only positive Transition from dark pixels to lighter ones. • Only negative Transition from light pixels to darker ones.
Limit for smaller size	Limit for negative local error for smaller defects classification. (default = 1.0)
Limit for larger size	Limit for positive local error for larger defects classification. (default = 1.0)
Number of points to get average (1/2)	Number of points used to evaluate local average. (default = 0.0)
Contrast threshold	The contrast, in grey levels, above which a transition is considered an edge.
First edge polarity	The expected polarity of the edge. Only edges with the specified polarity are considered. • Dark to light Transition from darker region to lighter one. • Light to dark Transition from lighter region to darker one. • Don't care (default) Any polarity.
Second edge polarity	The expected polarity of the second edge. • Dark to light Transition from darker region to lighter one. • Light to dark Transition from lighter region to darker one. • Don't care (default) Any polarity.
Filter size	The filter width for edge extraction. (default = 2)
Contrast mode	Contrast is used to score edges. • Disabled No contrast criteria is used. • Stronger contrast (default) Stronger couple of edges get higher scores. • Weaker contrast Weaker couple of edges get higher scores. **Expected contrast** Expected value of contrast: edges with contrast close to this value will get the highest score. (default = 255.00)
Position mode	Position is used to score edges. • Disabled (default) No position criteria is used. • Centered position The center of edge pairs closer to the center of the projection region gets higher scores. • Closer position The center of edge pairs closer to the starting side of the projection region gets higher scores. • Farther position The center of edge pairs further form the starting side of the projection region gets higher scores.
Size mode	Size (distance between the edge pair) is used to score edges. • Disabled (default) No size mode criteria is used.

Analysis

- Expected size

  Edge pair size closer to expected gets higher scores.
- Smaller

  Edge pair size smaller than expected one gets higher scores.
- Larger

  Edge pair size larger than expected one gets higher scores.

Expected size

Expected edge pair size, in pixel. This value is used for scoring only. (default = 0.00)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Points not found	Number of sampling points where the thickness could not be measured.
Min E1 contrast (point)	Minimum contrast value measured for the first edge found transition.
Mean E1 contrast	Average value contrast measured for the first edge found transition.
Max E1 contrast (point)	Maximum value contrast measured for the first edge found transition.
Min E2 contrast (point)	Minimum contrast value measured for the second edge found transition.
Mean E2 contrast	Average value contrast measured for the second edge found transition.
Max E2 contrast (point)	Maximum value contrast measured for the second edge found transition.
Min size (point)	Minimum measured size.
Mean size	Average measured size.
Max size (point)	Minimum measured size.
Std. Dev. size	Standard deviation of all measured size.
Min. length of defect seg.	Minimal length of all defect segments
Max. length of defect seg.	Maximal length of all defect segments
Sum of length of defect seg.	Sum of length of defect segments
Max local error +(point) (le+)	Returns the maximum positive local error and the location point.
Max local error -(point) (le-)	Returns the maximum negative local error and the location point .

IMAGES

Images	
Model	Unwrapped image of reference image used to train the tool.
Last	Run time unwrapped image.

CONFIGURATION

This tool is included into the library UvfCTStd and UvfCTCvl.

Thin Finger Inspect

OVERVIEW

Finger Inspect tool measures along lines the width of continuous objects (like fingers). The tool measures the width with a defined density, up to the pixel size, creating a profile of the width of the inspected object. The tool measures the line width and detects cuts, fat and thin sections.

The with of the line is measured using the gray level intensity of the line. This allows to measure sub-pixel width. The tool must calibrate the line width during training with a reference image.

SETTINGS

Options	
Enable	Enable or disable the tool. (default = Yes)
Geometry	Defines tool's model shape. • LineSeg (default) Line segment. • CAD Shape imported from a CAD file.
CAD file	Defines CAD file name. **Layer name** Lists the layer names defined in the selected CAD file. **Scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. **Scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. **Axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Connection tolerance** Distance between close segment points to be considered as connected.

Tolerances and Limits	
Finger mean width	Enables or disables width mean measurement check. (default = No) **Specification** Width mean specification for a single finger. (default = 0.0) **Tolerance-** Positive tolerance of the measured width. (default = 0.0) **Tolerance+** Negative tolerance of the measured width. (default = 0.0)
Finger Std. Dev. width	Enables or disables width standard deviation measurement check. (default = No) **Single finger limit** Tolerance of the standard deviation width for a single finger. (default = 0.0) **Global limit** Tolerance of the standard deviation width for all fingers. (default = 0.0)
Short interruptions	Enables or disables the defect check. (default = No) **max. number** Maximum number of defects accepted. (default = 0.0)
Medium interruptions	Enables or disables the defect check. (default = No) **max. number** Maximum number of defects accepted. (default = 0.0)
Long interruptions	Enables or disables the defect check. (default = No) **max. number** Maximum number of defects accepted. (default = 0.0)
Thin finger length	Enables or disables the thin finger measurement check (single defect). (default = No) **Single finger limit** Maximum thin finger length for a single measure. (default = 0.0); if a finger is thin more than the limit, then is a defect
Short fat sections	Enables or disables the defect check. (default = No) **max. number** Maximum number of defects accepted. (default = 0.0)
Medium fat sections	Enables or disables the defect check. (default = No) **max. number** Maximum number of defects accepted. (default = 0.0)
Long fat sections	Enables or disables the defect check. (default = No) **max. number** Maximum number of defects accepted. (default = 0.0)
Blurred finger length	Enables or disables the blurred finger measurement check (single defect). (default = No) **Single finger limit** Maximum thin burred length for a single measure. (default = 0.0); if a finger is blurred more than the limit, then is a defect
Sum of lengths of interruptions	Enables or disables broken finger measurement check. (default = No) **Single finger limit** Maximum broken finger length for a single finger. (default = 0.0) **Global limit** Maximum broken finger length for all fingers. (default = 0.0)
Sum of lengths of thins	Enables or disables thin finger measurement check. (default = No) **Single finger limit** Maximum thin finger length for a single finger. (default = 0.0) **Global limit** Maximum thin finger length for all fingers. (default = 0.0)
Sum of lengths of fats	

Tolerances and Limits		
	Enables or disables fat finger measurement check. (default = No)	
	Single finger limit	
	Maximum fat finger length for a single finger. (default = 0.0)	
	Global limit	
	Maximum fat finger length for all fingers. (default = 0.0)	
Sum of lengths of blurreds	Enables or disables blurred finger measurement check. (default = No)	
	Single finger limit	
	Maximum blurred finger length for a single finger. (default = 0.0)	
	Global limit	
	Maximum blurred finger length for all fingers. (default = 0.0)	
Number of missing points	Enables or disables missing points (failed measurements) check. (default = No)	
	Single finger limit	
	Maximum number of missing point for a single finger. (default = 0.0)	
	Global limit	
	Maximum number of missing point for all fingers. (default = 0.0)	

When a single finger point is measured, the measure can be classified as an interruption, thin or fat. Then the tool starts to measure the length of the interruption or the thin or fat section, until the point measurement has the same classification.

A point measurement is considered an interruption if there is no finger to measure.
A point measurement is considered thin, if the finger width is less than Thin finger width limit.
A point measurement is considered fat, if the finger width is greater than Fat finger width limit.

Multiple measurements of the same class make a section; a section can be considered:
- short, if the section is long less than the short limit
- medium, if the section is longer than the short limit but less than the medium limit
- long, if the section is longer than the medium limit

Measurement classification	
Short interruption limit	Limit to classify an interruption as short. (default = 0)
Medium interruption limit	Limit to classify an interruption as medium. (default = 0)
Thin finger width limit	Limit to classify a finger as thin, if less than. (default = 3)
Fat finger width limit	Limit to classify a finger as fat, if more than. (default = 7)
Short fat section limit	Limit to classify an fat section as short. (default = 0)
Medium fat section limit	Limit to classify a fat as medium. (default = 0)

Analysis	
Density	Density of the measurement. (default = 1.00)
Number of measurement points	Number of points to average to get a single point measurement. (default = 1)
Finger search width (pixels)	Width of the caliper used to align the inspected line. (default = 50)
Finger search height (pixel)	Height of the caliper used to align the inspected line. (default = 5)
Finger search gap right (pixel)	Right don't care area for line search. (default = 0)
Finger search gap left (pixel)	Left don't care area for line search. (default = 0)
Dark back gound	Defines is the background is darker then the measured object. (default = Yes)
Background color limit	Defines the background gray level. (default = 128) when there is an interruption, if the gray level is less than this value, then is considered as background.
Mouse bites	Enables small breakage detection (advanced). (default = No)
Local inspection	Enable local inspection (default = Yes) **number of point to average** Number of points used to get the local measurement. (default = 5) **only center value** Enables using only the center as measurement . (default = No) **filter gray value on average** Enable using the number of point to average to get the local gray value for the local inspection (default = Yes) **contrast threshold** minimum contrast threshold to detect a breakage **filter size** The filter width for edge extraction. (default = 2) **second edge threshold (%)** Percentage change from the first breakage edge gray value to define end of the breakage **Measure don't care left** Left don't care area for measurement. (default = 0) **Measure don't care right** Right don't care area for measurement. (default = 0)

You need to provide a reference image with the finger size you want to measure and calibrate providing the right value in units. The tool calculate a linear map (slope and intercept) between the gray level and the size:

```
size = m \ gray\_level + q
```

The calibration can be:

- with absolute values (Slope an Constant)

- local, one value per line or with a global average calibrated value, if there is more than one line

You can adjust the image with a look-up table image before calibrating.

Finger measurement calibration	
Slope (m)	Slope of the line . (default = 1)
Constant (q)	Intercept of the line . (default = 0)
Use local calibration	Enable local calibration (default = No) **update on train** Update the calibration every train operation (default = Yes) **value** The reference value in units (default = 40) **finger average** Use an average for all fingers, when more than one (default = No) **contrast threshold** Minimum contrast threshold to detect a breakage **slope (m)** Calibrated slope **constant (q)** Calibrated intercept
Manual map	Enable manual mapping image grey levels before calibration (default = Yes) **first threshold** Threshold for black levels(default = 10) **second threshold** Threshold for white levels(default = 220)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Finger(s) selection	Select the finger number (id) to see results. Result below are referred to the selected finger • Tools name(default) Results are referred to the all fingers • Single finger - id Results are referred to the finger id finger id Number of the finger
Finger result	Pass/Fail decision of the finger.
Number of points	Number of measurements.
Number of missing points	Number of failed measurements.
Min contrast	Minimum contrast measured for the found transitions value edges.
Local inspection min contrast	Minimum contrast measured for the found transitions value edges when using local inspection
Finger mean width	Finger width mean measurement.
Finger Std. Dev. width	Finger width standard deviation measurement.
Finger min. width	Finger minimum width measurement.
Finger max. width	Finger maximum width measurement.
Num. of interruptions	Number of broken sections found. **short interruptions** Number of short interruptions **medium interruptions** Number of medium interruptions **long interruptions** Number of long interruptions **min. length** Size of the smaller interruption **max. length** Size of the larger interruption **sum of lengths** Total interruptions length
Num. of thin sections	Number of thin sections found. **Min length** Minimum length. **Max length** Maximum length. **Sum of lengths** Sum of all thin sections length.
Num. of fat sections	

Results	
	Number of fat sections found.
	short fat sections
	Number of short fat sections
	medium fat sections
	Number of medium fat sections
	long fat sections
	Number of long fat sections
	Min length
	Minimum length.
	Max length
	Maximum length.
	Sum of lengths
	Sum of all fat sections length.
Num. of blurred sections	Number of blurred sections found.
	Min length
	Minimum length.
	Max length
	Maximum length.
	Sum of lengths
	Sum of all blurred sections length.

Number of fat sections found.

TInspect

OVERVIEW

The purpose of the Template Inspection tool is to detect defects on a surface. TInspect needs to be pre-aligned by other tools providing a Fixture that arranges its run time position. The tool creates the template model image of an object statistically, from a set of training images and then compares run-time images of the object with it. A defect is any region that differs from model more than an expected tolerated variation given by the training images set. A defect can be a dark or bright spot on an object, an incorrectly shaped feature, or the absence of a shape. Basically, TInspect preprocesses image, computes difference with threshold image, applies some morphology filtering, and runs blob analysis.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Geometry	Defines tool model region by contour shape. • General rectangle (default) Rectangular shape. • Circle Circular shape. • Annulus Annulus shape. • General polygon General polygon shape.

Tolerances and limits	
Min. Area	Blobs smaller than value are ignored for the result evaluation.
Blobs number	Enables or disables Blob number limit. **max. Blob number** Maximum number of blobs that can be found. (default = 0) **minor defects** Enable this condition for minor defects evaluation. (default = No)
Single Blob area	Enables or disables Single Blob area limit. **single Blob area limit** Maximum area for a single blob. (default = 100) **minor defects** Enable this condition for minor defects evaluation. (default = No)
Sum of all Blobs area	Enables or disables Sum of all Blobs area. **sum of all Blobs area limit** Maximum value for the sum of the blobs' areas. (default = 500) **minor defects** Enable this condition for minor defects evaluation.(default = No)
Sum of all Blobs area (%)	Enables or disables Sum of all Blobs area as percentage of ROI. **sum of all Blobs area limit (%)** Maximum value (%) for the sum of the blobs' areas. (default = 0) **minor defects** Enable this condition for minor defects evaluation. (default = No)
Model image average	Enable or disable gray model image average tolerance limits. (default = No) **Specification** Nominal value. (default = 100.00) **Tolerance+** Positive tolerance. (default = 10.00) **Tolerance-** Positive tolerance. (default = 10.00)

Analysis	
Intensity sensitivity	This parameter represents an index of the sensitivity of the tool to variations of brightness. The higher the value the smaller will be the intensity difference considered as a defect. Intensity sensitivity modifies the threshold image used to filter runtime image. Its range varies from 0 (low sensitivity) to 99 (high sensitivity). Every value drives a pair of parameters (#Proportional and #Constant) that define how the threshold image is modified. I(x, y) = Proportional \ SDev + Constant At every position (x, y) threshold image intensity I is the sum of a constant value and a scaling value of standard deviation of training samples at that point. (default = 25) **Proportional** Scaling factor for the sensitivity function. (default = 8.0) **Constant** Offset level for the sensitivity function. (default = 15.5)
Dimension sensitivity	This parameter represents an index of the sensitivity of the tool to the area of defects. The higher the value the smaller will be the area of a region considered as a defect. Dimension sensitivity is the minimum area of blob analysis after thresholding. (default = 25) **Area min. (pixel)** Minimum area that can be considered as a defect. (default = 75)
Defect mode	
Normalization	Normalization to apply to runtime image before preprocessing. • None Normalization is not performed. • Mean & StDev Normalization is applied by mean and standard deviation. • Mean Normalization is applied by mean.
Sobel image	Sobel Image used to highlight borders and edges of template image.
Blank scene	Enable or disable TInspect working mode. If enabled, no template model is required but a uniform image of blank scene gray value. (default = 25) **blank scene value** Template image gray value. (default = 128)
Erode difference image	Morfology to apply to difference image. (default = false) **Filter size** Size of erosion operator. (default = 1)
St.Dev threshold	Pixel in the intermediate threshold image with a gray value bigger than this threshold will be mapped to 255. (default = 180)
Use train image as sample	Includes the train image in the training images set. (default = No)
Use custom samples	Uses a different training images set instead of usual. All tools in a View that needs statistical training use the same set. If this flag is set the tool must be trained alone. default = No) **Samples folder** Specifies the folder containing training specific images set to use.

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Max blobs number	Found blobs count.
Total area (pixel)	Sum of the areas of all found blobs, in pixel.
Sum of all Blobs area (%)	Sum of the areas of all found blobs, in %.
Max. area (pixel)	Greatest area of all found blobs, in pixel.
Min. area (pixel)	Smallest area of all found blobs, in pixel.
Result	Select the index of the blob to show information about. **Area** Area of the selected blob, in pixel. **Center X** Position X of the center of mass of the selected blob. **Center Y** Position Y of the center of mass of the selected blob.

IMAGES

Images	
Inspected	Runtime image
Threshold image	Threshold Image result of statistical training. Every pixel value of the image is the threshold of the difference between run-time image and template image. Sensitivity modifies this threshold.
Difference	Difference image between runtime minus template and threshold image.
Model	Template image.
Sobel	Sobel image.
Mask	Mask image: care pixels are white; don't care pixels are black.
Threshold with extra mask	Threshold image with runtime movable masks
St.Dev threshold	Standard deviation Image

CONFIGURATION

This tool is included into the library UvfCvl.

4.3.5 Geometry

Geometry

OVERVIEW

Geometry tools are container tools that calculate geometrical relations using points provided by contained tools. The main operation of Geometry Tools is to compute the best fitting of source points to get a desired shape and evaluating residual error for each point. Residual error is the offset between result point and corresponding ideal one on the fitted shape.

HOW IT WORKS

Drag new tools or link existing ones into the desired Geometric container tool. Train all (container and contained) in order to get specification positions orientations and measurements. Run on valid images.

Circle Fit

OVERVIEW

The CircleFit tool is a Geometric tool. It lets you fit a circle to a set of points by minimizing the sum of the squares of the distances between all the points and the fit circle. The CircleFit tool generates as a result a circle.

The result of the CircleFit tool is the center position of the circle.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance. Specification position is the center of interpolated circle using specification contained tools' positions. **Elliptical region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Diameter	Enables or disables the diameter tolerance limits. **mode** Criteria to compute diameter. Interpolated Diameter of best fit circle. Worst Diameter computed using the radius on the worst point. **specification** Expected diameter value. (default = 100) **tolerance+** Positive tolerance of the measured diameter. (default = 10) **tolerance-** Negative tolerance of the measured diameter. (default = 10)
Eccentricity	Enables or disables eccentricity tolerance condition. Eccentricity is defined as difference between maximum diameter and minimum diameter. **limit** Max accepted difference accepted. (default = 0)
Number of missing points	Enables or disables missing point condition. **Max. number of missing points** The number of points that can be missing without a failure condition. (default = 0)
Ignore points	The number of points to discard to have the best fit. The fitting algorithm ignores the points with the worst distance between the tool result point and the fit circle and recomputes the fit circle. **Residual limit for ignoring** The minimum value to consider a point as a candidate for decimation. (default = 0)
Best points	The number of points, with the best score, to use for fitting.
Positive worst error	Enables positive worst point error condition. If the point with the worst error has a residual bigger than the worst point error limit, the condition fails. Positive sign when the point lays outside the fit circle Worst point error limitMax accepted distance between any edge and the fitted line. (default = 0)
Negative worst error	Enables positive worst point error condition. If the point with the worst error has a residual bigger than the worst point error limit, the condition fails. Positive sign when the point lays inside the fit circle **Worst point error limit** Max accepted distance between any edge and the fitted line. (default = 0)
Mean error	Enables or disables mean error condition. **Error limit** Max accepted mean error distance. (default = 0)
Local errors	

Tolerances and limits	
	Enable or disable local error condition. Local errors are the errors of points relative to the errors of closest points. The residual error of each point is compared with neighbors (local) to evaluate if they are real defects. If this comparison is bigger than a threshold, the condition fails..
	Positive local error
	Maximum accepted positive local error . (default = 0)
	Negative local error
	Maximum accepted negative local error. (default = 0)
	Filter for local errors
	Number of neighbor points used for comparison. (default = 2)
	Filter latency
	Parameter that identifies neighbors: distance in pixels from current point to define neighbors for comparison. (default = 0)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of the tool.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool.
	Offset X
	Offset between the specification X position and result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool.
	Offset Y
	Offset between the specification Y position and result Y position (specification reference system).
Offset length	Distance between specification and result points.
Size	Measured diameter
	Difference with specification
	Difference between the specification and result diameter.
Max diameter	Diameter of the circle passing through the farthest point.
Min diameter	Diameter of the circle passing through the nearest point.
Eccentricity	Difference between Max diameter and min diameter.
Mean error	Mean distance between the results points and the fitted circle.
Positive worst error (point)	Worst positive distance between the results points and the fitted circle. The number between () indicates the point index the value refers to.
Number of missing points	Number of not found points.

Distance Point to Line

OVERVIEW

The Distance Point to Line tool computes the orthogonal distance between an input line tool and an input point tool.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance limits. Specification position is the trained one and it is defined as the middle point between point and its projection on the line. **Elliptical region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance limits. Specification orientation is the trained one and it is defined as the orientation of segment between the point and its projection on the line. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Signed distance	Enables or disables sign on distance result. A signed value tells about the point's position relative to the line (above-under).
Distance	Enables or disables the distance tolerance limits. **Specification** Expected distance value. (default = 100) **Tolerance+** Positive tolerance of the measured distance. (default = 10) **Tolerance-** Negative tolerance of the measured distance. (default = 10)
Distance (md)	Enables or disables the minor defect classification of the distance. Minor defect is a classification of results that are outside of a smaller range of the active tolerance limits. **Tolerance+ (%)** Percentage of positive tolerance of the measured distance. (default = 0) **Tolerance- (%)** Percentage of negative tolerance of the measured distance. (default = 0)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Offset between the tool's specification orientation angle and tool's result orientation angle.
Distance	Measured distance. **Difference with specification** Difference between the specification and result distance.

Distance Point to Point

OVERVIEW

The Distance Point to Point tool computes the distance between two input tools.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance limits. Specification position is the trained one and it is defined as middle point between the two tool points. **Elliptical Region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance limits. Specification orientation is the trained one and it is defined as the orientation of the segment between the two points. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Use first tool angle	Distance between the two points is projected on the first tool's direction (angle). (default = No)
Distance	Enables or disables the distance tolerance limits. SpecificationExpected distance value. (default = 100) Tolerance+Positive tolerance of the measured distance. (default = 10) Tolerance-Negative tolerance of the measured distance. (default = 10)
Delta X	X component of measured distance (calibrated reference system). (default = No) **Specification** Expected value. (default = 10) **Tolerance+** Positive tolerance of the measured delta X. (default = 10) **Tolerance-** Negative tolerance of the measured delta X. (default = 10)
Delta Y	Y component of measured distance (calibrated reference system). (default = No) **Specification** Expected value. (default = 10) **Tolerance+** Positive tolerance of the measured delta Y. (default = 10) **Tolerance-** Negative tolerance of the measured delta Y. (default = 10)
Distance (md)	Enables or disables the minor defect classification of the distance. Minor defect is a classification of results that are outside of a smaller range of the active tolerance limits. **Tolerance+ (%)** Percentage of positive tolerance of the measured distance. (default = 0) **Tolerance- (%)** Percentage of negative tolerance of the measured distance. (default = 0)
Difference of angles	Angle distance: difference (<180°) between the input tools' angles. (default = No) **Specification** Expected difference value. (default = 0) **Tolerance+** Positive tolerance of the measured difference. (default = 0) **Tolerance-** Negative tolerance of the measured difference. (default = 0)

More

Click More... to access the More section description.

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Offset between the tool's specification orientation angle and tool's result orientation angle.
Distance	Measured distance. **Difference with specification** Difference between the specification and result distance.
Delta X	Measured delta X. **Difference with specification** Difference between the specification and result X component.
Delta Y	Measured delta Y. **Difference with specification** Difference between the specification and result Y component.
Difference of angles	Difference between the specification and result orientations.

Line Fit

OVERVIEW

The Line Fit tool is a Geometric tool. It lets you fit a line to a set of points by minimizing the sum of the squares of the distances between all the points and the fit line. The Line Fit tool generates as a result a segment line over the fit line. Extremes of this segment are the closest points on the fit line of the first and last points of the point set provided.

The result of the Line Fit tool is the centre position and the orientation of the segment that limits the line.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance. Specification position is the middle point between the two extremes of the segment on the fit line. **Elliptical region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance limits. Specification orientation is the angle computed starting from the specification contained tools' points. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Number of missing points	Enables or disables missing point condition. **Max. number of missing points** How many point can be missing without set fail condition. (default = 0)
Ignore points	The number of points to discard to have the best fit. The fitting algorithm ignores the points with the worst distance between the tool result point and the fit line.Then it recalculates the fit line. **Residual limit for ignoring** Residual limit for ignoring The minimum value to consider a point as a candidate for decimation. (default = 0).
Best points	The number of points, with the best score, to use for fitting.
Positive worst error	Enables positive worst point error condition. If the point with the worst error has a residual bigger than the worst point error limit, the condition fails. Positive sign when the normal to the line passing from this point generates with the oriented line an angle of +90°. Worst point error limitMax accepted distance between any edge and the fitted line. (default = 0)
Negative worst error	Enables negative worst point error condition. If the point with the worst error has a residual bigger than the worst point error limit, the condition fails. Negative sign when the normal to the line passing from this point generates the oriented line an angle of -90°. **Worst point error limit** Max accepted distance between any edge and the fitted line. (default = 0)
Mean error	Enables or disables mean error condition. **Error limit** Max accepted mean error distance. (default = 0)
Local errors	Enable or disable the local error condition. Local errors are the errors of points relative to the errors of closest points. The residual error of each point is compared with neighbors (local) to evaluate if they are real defects. If this comparison is bigger than a threshold, the condition fails. **Positive local error** Maximum accepted positive local error . (default = 0) **Negative local error** Maximum accepted negative local error. (default = 0) **Filter for local errors** Number of neighbors points used for comparison. (default = 2) **Filter latency** Parameter that identifies neighbors: distance in pixels from current point to define neighbors for comparison. (default = 0)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of the tool.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Offset between the tool's specification orientation angle and tool's result orientation angle.
Mean error	Mean distance between the result points and the fitted line.
Worst error+ (point)	Worst positive distance between the result points and the fitted line. The number between () indicates the point index the value refers to
Worst error- (point)	Worst negative distance between the result points and the fitted line. The number between () indicates the point index the value refers to
Max local error+ (point)	Maximum positive local error. The number between () indicates the point index the value refers to.
Max local error- (point)	Maximum negative local error. The number between () indicates the point index the value refers to.
Number of missing points	Number of result points not found

Lines Intersection

OVERVIEW

The Lines Intersection tool takes two lines as input and returns the intersection point and lines angle difference. The result position is the intersection point of the two lines. The result angle is the bisector of the angle of the two oriented lines.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance. Specification position is the trained one and it is defined as the intersection of nominal lines.
	Elliptical region
	Search area has elliptical region instead of a rectangular one
	Position X tolerance
	Position tolerance in the X axes. (default = 10)
	Position Y tolerance
	Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance.
	Angle+
	Tolerance for positive angles. (default = 360; min = 0; max = 360)
	Angle-
	Tolerance for negative angles. (default = 360; min = 0; max = 360)
Angle between lines	Enables or disables angle span value condition.
	Specification
	Expected angle value. (default = 90)
	Tolerance+
	Positive tolerance of the measured angle. (default = 10)
	Tolerance-
	Negative tolerance of the measured angle. (default = 10)
Distances	Distances between the extrema of the segments that define lines and opposite line. (default = No)
	Specification
	Expected distance value. (default = 0)
	Tolerance+
	Positive tolerance of the measured angle. (default = 10)
	Tolerance-
	Negative tolerance of the measured angle. (default = 10)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X intersection position and tool's result X intersection position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y intersection position and tool's result Y intersection position (specification reference system).
Offset length	Distance from the trained tool position.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.
Min. distance	Minimum distance between the extrema of the segments that define lines and the opposite line. **Difference with specification** Difference between the specification value and the result value.
Max. distance	Maximum distance between the extrema of the segments that define lines and the opposite line. **Difference with specification** Difference between the specification value and the result value.
Angle between lines	Angle between the specified lines. **Difference with specification** Difference between the specification value and the result value.

Point Fit

OVERVIEW

The Point Fit lets you compute a transformation that fits the resulting position of the contained tools to their specification position. The resulting position is the reference point mapped with the result transformation. Tools that specifies positions to be fitted can be either their nominal positions or user specified positions or custom defined id positions. The point fit reference point can be the center of mass of contained points or a user-defined position.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance. Specification position relays on theReference point mode selected. **Elliptical region** se an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables angle tolerance limits. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Number of missing points	Enables or disables missing point condition. **Max. number of missing points** The number of points that can be missing without a failure condition. (default = 0)
Ignore points	The number of points to discard to have the best fit. The fitting algorithm ignores the points with the worst distance between the tool result point and the ideal expected point (nominal point mapped by the fit transformation) and recomputes the transformation **Residual limit for ignoring** The minimum value to consider a point as a candidate for decimation. (default = 0)
Best points	The number of points, with the best score, to use for fitting.
Worst error	Enables or disables worst point error condition. The worst point is the one with the largest distance from the expected ideal point. **Worst point error limit** Max accepted distance between any point and the ideal point. (default = 0)
Mean error	Enables or disables the mean error condition. **Error limit** Max accepted mean error distance. (default = 0)

Analysis	
Points to fit	Select the points to fit. (default = Yes)
	Tool position
	Resulting tools' positions are fitted to their nominal position. (default)
	User points
	Resulting tools' positions are fitted to the user defined positions.
	Tool Search Id point
	Resulting tools' positions are fitted to their Search id positions (if configured).
Reference point	Reference point mode to use as tool position.
	Center of mass
	Center of mass of all contained tools' points. (default)
	Origin
	Reference system origin.
	(Tools #n)
	One of the contained tool's position.
Point selection	Select point to see its specification point. Points values are editable if Points to fit mode is User points.
	(Tools #n)
	Tool.
	X Point
	Specification point X coordinate. (default = 0.00)
	Y Point
	Specification point Y coordinate. (default = 0.00)
	Angle
	Specification point Angle. (default = 0.00)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of the tool.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool.
	Offset X
	Offset between the specification X position and result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool.
	Offset Y
	Offset between the specification Y position and result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the transformation that maps specification points to result points.
	Angle offset
	Angle offset between specification and result angle.
Mean error	Mean residual.
Worst error (point)	Worst distance between result points and ideal points. The number between () indicates the point index the value refers to.
Number of missing points	Number of not found points.

4.3.6 Grids

Grids

Grid tools are a container of tools: at runtime, every contained tool is positioned at a specified position and run it with all the same settings.

HOW IT WORKS

Drag desired tools into the Grid tool. Define how many ROIs you want your tools need to be run. Train each master tool.

This chapter discusses the following

GRID LOCAL TUNING

Local tuning is an operation of adjustment of the expected position of a tool of one cell with respect of the position result of the preceding one.

Figure shows a situation in which some piled pieces are wanted to be inspected. Because they are expected to be of a given size an that they are disposed approached one another, a grid is used.

In the example happens that there are some defective pieces that shift the following pieces from their expected position. It end out that the pieces are searched in a position they are not anymore and the tool would result in a fault, even if the corresponding piece is good.

By checking local tuning, each cell tool position is pre-aligned with the offset resulting from the run of the tool in the preceding position. This way, bad pieces are detected, but their presence does not affect the inspection of succeeding pieces.
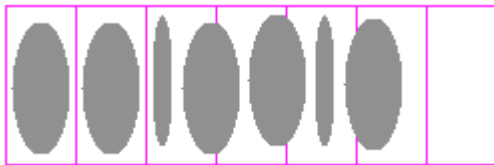
Figure above shows that last piece, without local tuning, would be searched in an area that actually is empty.
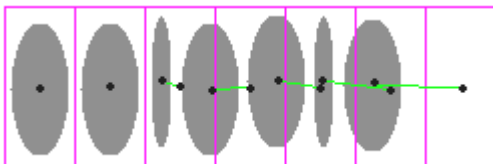
Figure above shows offset that are applied to cell tool position before inspecting them.

General Grid

OVERVIEW

Grid is a tool that automatically executes contained user-selected tools and positions them alongside the perimeter of an arbitrary shape. Every contained tool is run at the same position and orientation relative to the position of starting point of the shape. The perimeter is divided into n-points (number of regions): these points are the reference points of each reiteration.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Position mode	How the grid position is defined.
	Normal (default)
	Position is the position of first contained tool.
	Selective
	Position components can be individually selected between the positions of the contained tools.
	X Select tool to be used as X component.
	• (Tools #n)
	Use the selected tool's X component.
	Y
	Select tool to be used as Y component.
	• (Tools #n)
	Use the selected tool's Y component.
	Angle
	Select tool to be used as Angle component.
	• (Tools #n)
	Use the selected tool's Angle component.
Local tuning	Tool expected position in an iteration is adjusted with the result found in the preceding cell. It is a recursive pre-alignment(default = No)
Geometry	Defines tool's region shape.
	• Circle
	Circular shape.
	• General rectangle (default)
	Rectangular shape.
	• Annulus
	Annulus shape.
	• General polygon
	General polygon shape.
	• LineSeg
	Segment shape.
	• Ellipse arc
	Ellipse arc shape.

Tolerances and limits	
Check results count	Enables or disables results count condition. Condition fails if number of good results don't agree with settings.
	None
	Disabled
	Expected number
	The expected number of good results
	Less than
	Less than number of good results
	Greater than
	More than number of good results
	Number of results to find
	Enter number of good results. (default = 1)

Analysis	
Points	Number iterative regions. (default = 1)

More

Click More... to access the More section description.

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Results count	Number of found results.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the specification X position and result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the specification Y position and result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.

Configuration

This tool is included into the library UvfStdTools.

Points Grid

OVERVIEW

Points Grid is a tool that allows distributing contained tools in N user-defined positions. The user defines the N positions with X, Y and Angle, and the Points Grid tool executes the only instance of each contained tool in those positions.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Position mode	How the grid position is defined. **Normal** (default) Position is the position of first contained tool **Selective** Position components can be individually selected between the positions of the contained tools. **X** Select tool to be used as X component. • (Tools #n) Use the selected tool's X component. **Y** Select tool to be used as Y component. • (Tools #n) Use the selected tool's Y component. **Angle** Select tool to be used as Angle component. • (Tools #n) Use the selected tool's Angle component.
Local tuning	Tool expected position in an iteration is adjusted with the result found in the preceding point. It is a recursive pre-alignment(default = No)

Tolerances and limits	
Check results count	Enables or disables results count condition. Condition fails if number of good results don't agree with settings. • None Disabled • Expected number The expected number of good results • Less than Less than number of good results • Greater than More than number of good results • Number of results to find Enter number of good results. (default = 1)

Analysis	
Points	Number iterative regions. (default = 1)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Results count	Number of found results.
Processing time	Tool processing time in msec.
Result	Result selection index, if there are multiple results.
Decision	Pass/Fail decision of a single result
Position X	Pass/Fail decision of a tool, including multiple results if any.
Position Y	Number of found results.
Offset length	Tool processing time in msec.
Angle	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the specification X position and result X position (specification reference system).

Configuration

This tool is included into the library UvfStdTools.

Polar Grid

OVERVIEW

Polar Grid is a tool that automatically executes contained user-selected tools and positions them alongside the perimeter of an polar region. Every contained tool is run at the same position and orientation relative to the position of starting point of the shape. The polar region is divided into n-sectors (number of regions): the centers of these points are the reference points of each reiteration.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Position mode	How the grid position is defined. **Normal** (default) Position is the position of first contained tool. **Selective** Position components can be individually selected between the positions of the contained tools. **X** Select tool to be used as X component. • (Tools #n) Use the selected tool's X component. **Y** Select tool to be used as Y component. • (Tools #n) Use the selected tool's Y component. **Angle** Select tool to be used as Angle component. • (Tools #n) Use the selected tool's Angle component.
Local tuning	Tool expected position in an iteration is adjusted with the result found in the preceding point. It is a recursive pre-alignment(default = No)

Tolerances and limits	
Check results count	Enables or disables results count condition. Condition fails if number of good results don't agree with settings. • None Disabled • Expected number The expected number of good results • Less than Less than number of good results • Greater than More than number of good results • Number of results to find Enter number of good results. (default = 1)

Analysis	
Sectors	Number sectors the polar region is split to.(default = 1)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Results count	Number of found results.
Processing time	Tool processing time in msec.
Result	Result selection index, if there are multiple results.
Decision	Pass/Fail decision of a single result
Position X	Pass/Fail decision of a tool, including multiple results if any.
Position Y	Number of found results.
Offset length	Tool processing time in msec.
Angle	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the specification X position and result X position (specification reference system).

Configuration

This tool is included into the library UvfStdTools.

4.3.7 Histogram

Histogram

OVERVIEW

Histogram tools processes images analyzing their histogram.

HOW IT WORKS

Define region where computes histogram and run the tool. Histogram tools provides several statistics metrics about histogram.

Color Light Meter

OVERVIEW

Color Light Meter calculates histogram of planes of color images and provides Hue/Saturation/Intensity (HSI Color Space) or Red/Green/Blue (RGB Color Space) statistics of the its region image area.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Geometry	Defines tool's region shape. At the moment the only available shape is Rectangle.

Tolerances and limits	
Specification mode	Enabling automatic mode, specification values are automatically generated. (default = Automatic)
Mean H/R	Enable or disable histogram mean, of Hue/Red plane color, limits checks. (default = No) **Specification** Nominal Hue/Red value. (default = 100.00) **Tolerance+** Positive tolerance. (default = 10.00) **Tolerance-** Positive tolerance. (default = 10.00)
Dev. Std H/R	Enable or disable histogram standard deviation, of Hue/Red plane color, limits checks. (default = No) **Specification** Nominal Hue/Red standard deviation value. (default = 1.00) **Tolerance+** Positive tolerance. (default = 1.00) **Tolerance-** Positive tolerance. (default = 1.00)
Mean S/G	Enable or disable histogram mean, of Saturation/Green plane color, limits checks. (default = No) **Specification** Nominal Saturation/Green value. (default = 100.00) **Tolerance+** Positive tolerance. (default = 10.00) **Tolerance-** Positive tolerance. (default = 10.00)
Dev. Std S/G	Enable or disable histogram standard deviation, of Saturation/Green plane color, limits checks. (default = No) **Specification** Nominal Saturation/Green standard deviation value. (default = 1.00) **Tolerance+** Positive tolerance. (default = 1.00) **Tolerance-** Positive tolerance. (default = 1.00)
Mean I/B	Enable or disable histogram mean, of Intensity/Blue plane color, limits checks. . (default = No) **Specification** Nominal Intensity/Blue value. (default = 100.00) **Tolerance+** Positive tolerance. (default = 10.00) **Tolerance-** Positive tolerance. (default = 10.00)
Dev. Std I/B	Enable or disable histogram standard deviation, of Intensity/Blue plane color, limits checks (default = No) **Specification** Nominal Intensity/Blue standard deviation value. (default = 1.00) **Tolerance+** Positive tolerance. (default = 1.00) **Tolerance-** Positive tolerance. (default = 1.00)

Analysis	
Color space	Reference color space.

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Mean H/R	Hue/Red mean value.
Dev. Std. H/R	Hue/Red standard deviation value.
Mean S/G	Saturation/Mean value.
Dev. Std. S/G	Saturation/Mean standard deviation value.
Mean I/B	Intensity/Blue mean value.
Dev. Std. I/B	Intensity/Blue standard deviation value.

CONFIGURATION

This tool is included into the library UvfColorToolsStd and UvfColorToolsCvl.

Light Meter

OVERVIEW

Light Meter lets you calculate gray level distribution and statistics of the selected image area. It is based on the histogram of the image it processes.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Geometry	Defines tool's region shape. Pixels outside of the shape region are treated as dont' care pixels **Circle** Circular shape. **General rectangle (default)** Rectangular shape. **Annulus** Annulus shape. **General polygon** General polygon shape. **Affine rectangle** Rectangular shape with rounded corners.

SETTINGS

Options	

Tolerances and limits	
Specification mode	Enabling automatic mode, specification values are automatically generated. (default = Automatic)
Mean	Enable or disable histogram mean limits check. (default = No) **Specification** Nominal value. (default = 100.00) **Tolerance+** Positive tolerance. (default = 10.00) **Tolerance-** Positive tolerance. (default = 10.00)
Standard deviation	Enable or disable histogram standard deviation limits check. (default = No) **Specification** Nominal value. (default = 1.00) **Tolerance+** Positive tolerance. (default = 1.00) **Tolerance-** Positive tolerance. (default = 1.00)
Variance	Enable or disable histogram variance limits check. (default = No) **Specification** Nominal value. (default = 1.00) **Tolerance+** Positive tolerance. (default = 1.00) **Tolerance-** Positive tolerance. (default = 1.00)
Left tail	Enable or disable histogram left tail limits check. (default = No) **Percentage** Percentage value that define the left tail. (default = 0) **Specification** Nominal value. (default = 0) **Tolerance+** Positive tolerance. (default = 5) **Tolerance-** Positive tolerance. (default = 5)
Right tail	Enable or disable histogram right tail limits check. (default = No) **Percentage** Percentage value that defines right tail. (default = 0) **Specification** Nominal value. (default = 0) **Tolerance+** Positive tolerance. (default = 5) **Tolerance-** Positive tolerance. (default = 5)
Mode	Enable or disable histogram mode limits check. (default = No) **Specification** Nominal value. (default = 128.00) **Tolerance+** Positive tolerance. (default = 10.00) **Tolerance-** Positive tolerance. (default = 10.00)
Median	

Tolerances and limits	
	Enable or disable histogram median limits check. (default = No)
	Specification
	Nominal value. (default = 128.00)
	Tolerance+
	Positive tolerance. (default = 10.00)
	Tolerance-
	Positive tolerance. (default = 10.00)
Minimum value	Enable or disable minimum gray value limits check. (default = No)
	Specification
	Nominal value. (default = 0.00)
	Tolerance+
	Positive tolerance. (default = 5.00)
	Tolerance-
	Positive tolerance. (default = 5.00)
Maximum value	Enable or disable maximum gray value limits check. (default = No)
	Specification
	Nominal value. (default = 255.00)
	Tolerance+
	Positive tolerance. (default = 5.00)
	Tolerance-
	Positive tolerance. (default = 5.00)
Dark value	Range of validity of darker peak of the histogram. (default = No)
	Specification
	Nominal value. (default = 0)
	Tolerance+
	Positive tolerance. (default = 5.00)
	Tolerance-
	Positive tolerance. (default = 5.00)
Bright value	Range of validity of brighter peak of the histogram.. (default = No)
	Specification
	Nominal value. (default = 0.00)
	Tolerance+
	Positive tolerance. (default = 5.00)
	Tolerance-
	Positive tolerance. (default = 5.00)
Distance peak to peak	Range of validity of the distance between the darker histogram peak and the brighter histogram peak. (default = No)
	Specification
	Nominal value. (default = 0)
	Tolerance+
	Positive tolerance. (default = 5.00)
	Tolerance-
	Positive tolerance. (default = 5.00)

Analysis	
Partial range	Only a range of values of the histogram are taken into account. (default = No)
	Min value
	Lower end of the range of values. (default = 0)
	Max value
	Upper end of the range of values. (default = 255)

More

Click More... to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Mean	Mean value.
Standard deviation	Standard deviation value.
Variance	Variance value.
Left tail	Left tail value.
Right tail	Right tail value.
Mode	Mode value.
Median	Median value.
Minimum value	Minimum value.
Maximum value	Maximum value.
Dark value	Value of the darker peak of the resulting histogram.
Bright value	Value of the brighter peak of the resulting histogram.
Distance peak to peak	Distance between first and last peak of the histogram.

CONFIGURATION

This tool is included into the library UvfStdTools.

Statistic color

OVERVIEW

Statistic color calculates histogram of planes of color images and provides Hue/Saturation/Intensity (HSI Color Space) or Red/Green/Blue (RGB Color Space) statistics of the its region image area. It is a different and optimized implementation of the Color Light Meter tool.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Geometry	Defines tool's region shape. At the moment the only available shape is Rectangle.

Tolerances and limits	
Specification mode	Enabling automatic mode, specification values are automatically generated. (default = Automatic)
Mean Hue/Red	Enable or disable histogram mean, of Hue/Red plane color, limits checks. (default = No) **Specification** Nominal Hue/Red value. (default = 100.00) **Tolerance+** Positive tolerance. (default = 10.00) **Tolerance-** Positive tolerance. (default = 10.00)
Dev. Std Hue/Rrd	Enable or disable histogram standard deviation, of Hue/Red plane color, limits checks. (default = No) **Specification** Nominal Hue/Red standard deviation value. (default = 1.00) **Tolerance+** Positive tolerance. (default = 1.00) **Tolerance-** Positive tolerance. (default = 1.00)
Mean Saturation/Green	Enable or disable histogram mean, of Saturation/Green plane color, limits checks. (default = No) **Specification** Nominal Saturation/Green value. (default = 100.00) **Tolerance+** Positive tolerance. (default = 10.00) **Tolerance-** Positive tolerance. (default = 10.00)
Dev. Std Saturation/Green	Enable or disable histogram standard deviation, of Saturation/Green plane color, limits checks. (default = No) **Specification** Nominal Saturation/Green standard deviation value. (default = 1.00) **Tolerance+** Positive tolerance. (default = 1.00) **Tolerance-** Positive tolerance. (default = 1.00)
Mean Intensity/Blue	Enable or disable histogram mean, of Intensity/Blue plane color, limits checks. . (default = No) **Specification** Nominal Intensity/Blue value. (default = 100.00) **Tolerance+** Positive tolerance. (default = 10.00) **Tolerance-** Positive tolerance. (default = 10.00)
Dev. Std Intensity/Blue	Enable or disable histogram standard deviation, of Intensity/Blue plane color, limits checks (default = No) **Specification** Nominal Intensity/Blue standard deviation value. (default = 1.00) **Tolerance+** Positive tolerance. (default = 1.00) **Tolerance-** Positive tolerance. (default = 1.00)

Analysis	
Color space	Reference color space.

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Mean H/R	Hue/Red mean value.
Dev. Std. H/R	Hue/Red standard deviation value.
Mean S/G	Saturation/Mean value.
Dev. Std. S/G	Saturation/Mean standard deviation value.
Mean I/B	Intensity/Blue mean value.
Dev. Std. I/B	Intensity/Blue standard deviation value.

CONFIGURATION

This tool is included into the library UvfColorToolsStd and UvfColorToolsCvl.

4.3.8 Identification

Identification

OVERVIEW

Identification tools locate and decode one or more symbols in an input image. The symbols within the input image can be of different symbologies and can also be arbitrarily positioned and oriented.

HOW IT WORKS

Symbol identification is computed according to the tool's type and parameters.

Bar Code

OVERVIEW

The Barcode tool decodes 1D symbol codes: Code 39, Code 128, UPC/EAN, Code 93, Codabar, Interleaved 2 of 5, PharmaCode, Postal, RSS, PDF417. In addition to decoding symbols, the ID tool can also compute and report standard measures of symbol quality.

Images that you supply to the ID tool must meet the following requirements to qualify for the easy-to-read category:

• All symbols must be greater than 50 pixels in length, while the maximum width of any module, where a module is the narrowest element of the symbol (either a spaceor a bar), cannot exceed 10 pixels.

• For linear symbologies (where modules have different widths but uniform heights), a module must be at least 1.6 pixels wide and 50 pixels high. For postal codes (where the modules are of uniform width but varying height), a module must be at least 2.5 pixels in width.

• A quiet zone (an area on either end of a symbol with no marks) of at least the minimum size specified in the print specification for the barcode must be present.

• The contrast between modules and background must be at least 32 grey levels.

• The pixel aspect ratio can be no greater than 1.35 to 1.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance limits. Specification point is the center of the rectangular region where to look for code. **Elliptical Region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance limits. Specification orientation is the orientation of the rectangular region where to look for code. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Value	Enables or disables checking of read code. **read code** desired code to match.
Word errors	Enables or disables tolerance limit on decoding. Word errors are the number of erroneous data words encountered while decoding the symbol. (default = No) **number** limit.
Bit errors	Enables or disables tolerance limit on decoding. Bit errors are the number of erroneous bits encountered while decoding the symbol. (default = No) **number** limit.

Analysis	
Symbology	Code format to use in decoding process. • Code39 Code 39 (also called USS Code 39 or Code three of nine) is a widely-used symbology developed for use in non-retail environments, and can encode both letters,digits, and special characters such as " % " and " / ". Asymbol using Code 39 symbology encodes each character using 5 bars and 4 spaces for a total of 9 elements, and 3 out of the 9 elements are always wide. The symbol can include a checksum character for error detection. • UPC/EAN UPC is a fixed-length, numeric-only symbology which can be scanned bidirectionally. The size for a UPC symbol can vary to accommodate various printing processes, but the code works best when the height of the symbol exceeds its width. European companies use the generally equivalent European Article Numbering (EAN) system. • Code 128 Code 128 is a very high-density alphanumeric symbology which can be scanned bidirectionally. The symbology can encode the entire 128 ASCII character set plus four non-data characters. A symbol using Code 128 symbology encodes each character using 11 black or white modules, and each symbol includes a checksum character • Interleaved 2 of 5 Popular in warehouse applications, Interleaved 2 of 5 (also called I-2/5 or ITF) is a variable-length, numeric-only code. A symbol using Interleaved 2 of 5 symbology encodes 2 characters in a unit of 5 bars and spaces, where the even position character is encoded into bars while the odd position character is encoded into spaces. The Interleaved 2 of 5 symbology can only encode data with an even number length. The symbol can include a checksum character for error detection. • 4 State 4-State is an alphanumeric symbology adopted by the Australian Post. A barcode using the 4-State symbology encodes each character using 4 different types of bars, each of which has a distinct name and value. A 4-State barcode can be generated in one of three different structures of 37 bars (standard), 52 bars, or 67 bars. The ID tool supports the Australian, UPU, Japan Post and USPS versions of the 4-state symbology. • POSTNET The Postal Numeric Encoding Technique (POSTNET) barcode was nvented by the US Postal Office to encode ZIP Code information. A barcode using the POSTNET symbology encodes each numeric character using a combination of 5 bars, either short or long. A POSTNET barcode can contain a 5-digit ZIP Code, a 5-digit ZIP + 4 Code, or an 11-digit delivery point code. The symbol always includes a checksum character. • RSS Reduced Space Symbology (RSS) was developed as a family of seven linear symbologies to provide users with features that address specific space limitation and application needs. RSS is designed to allow encoding of up to 74 characters of data. RSS allows greater capacity for encoding and capturing data such as product supplier, expanded product identification, price per pound, extended price, product weight, and so on. The ID tool supports a variety of RSS types. • Code 93 Code 93 is an alphanumeric code similar to Code 39 and can encode 48 different characters. Code 93 is more compact than Code 39, but is not as widely used. • Codabar Developed in the early 1970s, Codabar is designed to be accurately read even when printed on dot-matrix printers for multi-part forms such as FedEx Airbills and blood bank forms. Although newer symbologies hold more information in a smaller space, Codabar has a large installed base in libraries. • PharmaCode Also known as Pharmaceutical Binary Code, Pharmacode is used in the pharmaceutical industry as a packing control system. It is designed to be readable despite printing errors. • PDF417 PDF417 is a stacked linear bar code symbol used in a variety of applications, including transport, identification cards, and inventory management.
Mirrored	Flag indicates whether the image is mirrored..

More

Click here to access the More section description.

RESULTS

Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Symbology	Symbology decoded
Read code	Decoded string code.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Offset between the tool's specification orientation angle and tool's result orientation angle.
Word errors	Number of word errors
Bit errors	Number of bit errors

CONFIGURATION

This tool is included into the library UvfIdToolsStd and UvfIdToolsCvl

Data Matrix

OVERVIEW

The Data Matrix locates 2D Data Matrix symbols in an image and returns the string encoded by the symbol. It first builds a model of a typical symbol. Then, using the model and several values that control how to apply it.

SETTINGS

Options	
Enable	Enable or disable the tool. (default = Yes)
Search area	Select the area where search for a model. • All Image (default) Search area agrees with overall image area. • Centered Search area is the model area enlarged by a symmetric frame. • Free Search area is defined by the user. **Frame X** Frame width. (default = 20) **Frame Y** Frame height. (default = 20)
User origin	Allows to set the model origin in an arbitrary position, instead of the center of the model area. It is the point returned by the tool.
Runtime learning	Sets autolearning. Run-time tools try to learn feature of the code to read: learning a 2D symbol means set parameters of DataMatrix format to create a model to use for decoding.

Tolerances and limits	
Shape index	Conformity limit for acceptable result. **Shape index limit** Minimum acceptable shape index. (default = 1.0)
Position offset	Enables or disables position tolerance. (default = No) **Elliptical region** Position tolerance positive angles. (default = 360) **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables angle tolerance. (default = No) **Angle+** Position tolerance positive angles. (default = 360) **Angle-** Position tolerance negative. (default = 360)
Value	Enables or disables checking of read code. (default = No) **Code** desired code to match.
Word errors	Enables or disables tolerance limit on decoding. Word errors are the number of erroneous data words encountered while decoding the symbol. (default = No) **Number** limit. (default = 0)
Bit errors	Enables or disables tolerance limit on decoding. Bit errors are the number of erroneous bits . (default = No) **Number** Bit errors limit. (default = 0)

Analysis	
AIM Compliance	AIM compliance flag, which indicates whether the Data Matrix symbol is AIM compliant or not. (default = Yes)
Auto learn	Enables or disables automatic set of DataMatrix model settings. (default = Yes) **Rows** Rows of the grid Data Matrix symbols. **Columns** Columns of the grid Data Matrix symbols. **Polarity** Polarity of the symbol. Dark to light (default) Transition from dark pixels to lighter ones. Light to dark Transition from light pixels to darker ones. Don't care Any transition. **ECC** The Symbol tool supports two Error Checking and Correction (ECC) methods: convolutional coding (for ECC 50, 80, 100, and 140) and Reed-Solomon encoding (for ECC 200). A higher ECC level allows data recovery despite an increasing amount of damaged or unreadable symbol area, but also reduces the amount of data that a symbol can represent. ECC0 ECC050 ECC080 ECC100 ECC140 ECC200 (default)
Mirror image	Mirror flag, which indicates whether the image of the symbol is mirrored or not. (default = No)
Score	A score used by the DataMatrix tool to determine symbol quality. (default = 0.50)
Confusion	A score that defines success when using the model to search for the finder pattern. A match scoring above this threshold automatically succeeds. (default = 0.70)
Contrast	The contrast threshold is the minimum contrast that a run-time image may have and still be considered a symbol. This threshold is a fraction of the contrast of the symbol model. (default = 0.50)
Aspect	The aspect ratio is the expected ratio of pixel width to pixel height. You should use the default value except with unusual cameras or single-field acquires. (default = 1.00)
Scale range	To compensate for differences in size between the model and the image, the DataMatrix tool can apply a scaling factor to the model before comparing it to the image. (default = 0.00)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Code	Decoded string.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset from the trained tool position in the X axes.
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset from the trained tool position in the Y axes.
Offset length	Distance from the trained tool position.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.
Scale X	Detected X scale value.
Score	The result score, a number between 0.0 and 1.0, where 1.0 indicates a perfect correlation between the symbol and the model. If the score is 0.0 during the search phase, the tool does not perform the decoding step and sets angle, scale and aspect to their nominal values.
Aspect	The aspect ratio of the symbol that was found with respect to the client coordinate space.
Word errors	The number of erroneous data words encountered while decoding the symbol.
Bit errors	The number of erroneous bits encountered while decoding the symbol.

CONFIGURATION

This tool is included into the library UvfIdToolsStd and UvfIdToolsCvl.

PDF417

OVERVIEW

The PDF417 barcode tool decodes PDF417 stacked barcodes. PDF417 is a multirow, variable-length 2D symbology that offers high data capacity and error correction capability.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Value	Enable or disable code text verification. (default = No)
	Specification
	Nominal code text.
Shape index	Conformity limit for acceptable result.
	Shape index limit
	Minimum acceptable shape index. (default = 1.0)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Read code	Decoded string.
Score	A result value that indicates the success or failure of the read operation. Any score greater than or equal to the acceptance threshold indicates success, and any score less than the threshold indicates failure.

CONFIGURATION

This tool is included into the library UvfIdToolsStd and UvfIdToolsCvl.

QRCode

OVERVIEW

The QRCode locates 2D Quick Response Code in an image and returns the string encoded by the symbol. QRCode is a two-dimensional matrix symbology having finder patterns on three of its corners. There are three versions of QR Code symbols:

- Model 1: original version

- Model 2: enhanced version

- Micro QR

It first builds a model of a typical symbol. Then, using the model and several values that control how to apply it.

SETTINGS

Options	
Enable	Enable or disable the tool. (default = Yes)
Search area	Select the area where search for a model. • All Image (default) Search area agrees with overall image area. • Centered Search area is the model area enlarged by a symmetric frame. • Free Search area is defined by the user. **Frame X** Frame width. (default = 20) **Frame Y** Frame height. (default = 20)
User origin	Allows to set the model origin in an arbitrary position, instead of the center of the model area. It is the point returned by the tool.
Runtime learning	Sets autolearning. Run-time tools try to learn feature of the code to read: learning a 2D symbol means set parameters of QRCode format to create a model to use for decoding.

Tolerances and limits	
Shape index	Conformity limit for acceptable result. **Shape index limit** Minimum acceptable shape index. (default = 1.0)
Position offset	Enables or disables position tolerance. (default = No) **Elliptical region** Position tolerance positive angles. (default = 360) **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables angle tolerance. (default = No) **Angle+** Position tolerance positive angles. (default = 360) **Angle-** Position tolerance negative. (default = 360)
Value	Enables or disables checking of read code. (default = No) **Code** desired code to match.
Word errors	Enables or disables tolerance limit on decoding. Word errors are the number of erroneous data words encountered while decoding the symbol. (default = No) **Number** limit. (default = 0)
Bit errors	Enables or disables tolerance limit on decoding. Bit errors are the number of erroneous bits . (default = No) **Number** Bit errors limit. (default = 0)

Analysis	
Auto learn	Enables or disables automatic set of QRCode model settings. (default = Yes) **Size** QR Code model type and grid size. [21, 49] for QRModel1. [21, 49] for QRModel2. [11, 17] for MicroQR. **Columns** Columns of the grid Data Matrix symbols. **Polarity** Polarity of the symbol. Dark to light (default) Transition from dark pixels to lighter ones. Light to dark Transition from light pixels to darker ones. Don't care Any transition. **QRModel** QR Model format to use Unknown Model not recognized. Model1 QRCode Model1. Model2 QRCode Model2. MicroQR QRCode micro format.
Mirror image	Mirror flag, which indicates whether the image of the symbol is mirrored or not. (default = No)
Score	A score used by the DataMatrix tool to determine symbol quality. (default = 0.50)
Confusion	A score that defines success when using the model to search for the finder pattern. A match scoring above this threshold automatically succeeds. (default = 0.70)
Contrast	The contrast threshold is the minimum contrast that a run-time image may have and still be considered a symbol. This threshold is a fraction of the contrast of the symbol model. (default = 0.50)
Aspect	The aspect ratio is the expected ratio of pixel width to pixel height. You should use the default value except with unusual cameras or single-field acquires. (default = 1.00)
Scale range	To compensate for differences in size between the model and the image, the DataMatrix tool can apply a scaling factor to the model before comparing it to the image. (default = 0.00)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Code	Decoded string.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset from the trained tool position in the X axes.
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset from the trained tool position in the Y axes.
Offset length	Distance from the trained tool position.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.
Scale X	Detected X scale value.
Score	The result score, a number between 0.0 and 1.0, where 1.0 indicates a perfect correlation between the symbol and the model. If the score is 0.0 during the search phase, the tool does not perform the decoding step and sets angle, scale and aspect to their nominal values.
Aspect	The aspect ratio of the symbol that was found with respect to the client coordinate space.
Word errors	The number of erroneous data words encountered while decoding the symbol.
Bit errors	The number of erroneous bits encountered while decoding the symbol.

CONFIGURATION

This tool is included into the library UvfIdToolsStd and UvfIdToolsCvl.

4.3.9 Mathematics

Mathematics

OVERVIEW

Mathematic tools are container tools that perform simple mathematical operations on the results of the contained tools.

HOW IT WORKS

Drag tools with desired result type (position, measure, value) into the Mathematic tool, train and run.

Arithmetic

$$\begin{array}{c|c} + & - \\ \hline \times & \div \end{array}$$

OVERVIEW

Arithmetic tool performs arithmetical operations on tools results. Its execution consists in getting position, size, value results of each contained tool and computing its result applying selected arithmetical operation. Available tolerances for Arithmetic tool depend on available result type of contained tools.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance limits. Specification position is the trained one and it is defined as middle point between the two tool points.
	Elliptical Region
	Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle.
	Position X tolerance
	Position tolerance in the X axes. (default = 10)
	Position Y tolerance
	Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance limits. Specification orientation is the trained one and it is defined as the orientation of the segment between the two points.
	Angle+
	Tolerance for positive angles. (default = 360; min = 0; max = 360)
	Angle-
	Tolerance for negative angles. (default = 360; min = 0; max = 360)
Size	Enables or disables the distance tolerance limits.
	Specification
	Expected size value. (default = 100)
	Tolerance+
	Positive tolerance of the measured size. (default = 10)
	Tolerance-
	Negative tolerance of the measured size. (default = 10)
Value	Enables or disables the value tolerance limit.
	Specification
	Expected value. (default = 100)
	Tolerance+
	Positive tolerance of the measured value. (default = 10)
	Tolerance-
	Negative tolerance of the measured value. (default = 10)

Analysis	
Operation	Operation to be applied.
	• Sum (default)
	Sum of all included tool's results.
	• Subtract
	Subtracts results' values of second, third,... tools to the first tool's values' result.
	• Minimum
	Minimum result values.
	• Maximum
	Minimum result values.
	• Average
	Average values.
	• Multiply
	Multiply values
	• Range
	Range between values.

More

Click here to access the More section description.

RESULTS

	Description
Decision	Pass/Fail decision of the tool.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the specification X position and result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the specification Y position and result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.
Size	Size. **Difference with specification** Difference between result and specification size.
Value	Result of the arithmetic operations. **Difference with specification** Difference between result and specification value.

Configuration

This tool is included into the library UvfStdTools.

Best

OVERVIEW

Best tool evaluates the best result between the results of the defined tools. The best means according to the selected criterion. For tools that provide more than one result, only the first one is used for criterion decision

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance limits. Specification position is the trained one and it is defined as middle point between the two tool points. **Elliptical Region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance limits. Specification orientation is the trained one and it is defined as the orientation of the segment between the two points. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Size	Enables or disables the distance tolerance limits. **Specification** Expected size value. (default = 100) **Tolerance+** Positive tolerance of the measured size. (default = 10) **Tolerance-** Negative tolerance of the measured size. (default = 10)
Value	Enables or disables the value tolerance limit. **Specification** Expected value. (default = 100) **Tolerance+** Positive tolerance of the measured value. (default = 10) **Tolerance-** Negative tolerance of the measured value. (default = 10)

Analysis	
Criteria	Criterion of evaluation. • Major (default) Major is the best. • Minor Minor is the best.
Criteria value	Tools results used to select the best value. • X (default) X position coordinates. • Y Y position coordinates. • Angle Orientation. • Measurement Measure. • Value Value.
Run mode	Criterion of evaluation. • Normal (default) Calculates the best result between all the defined tools. • Stop at 1st pass Best result is the one related to the first tool with pass decision. Other tools are not run and evaluated.

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of the tool.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the specification X position and result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the specification Y position and result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.
Size	Best's Size. **Difference with specification** Difference between result and specification size.
Value	Best's Value. **Difference with specification** Difference between result and specification value.

Configuration

This tool is included into the library UvfStdTools.

Boolean

```
0 1 0 1
1 0 1 1
0 1 1 0
```

OVERVIEW

Boolean tool is a tool that can either own other tools or performs operations on linked tools. This tool performs logical Boolean operations on the results of the contained tools. A Pass result is associated with 1 (or TRUE); a Fail result is associated with 0 (or FALSE).

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Analysis	
Boolean operation	Boolean operations selection. • AND Logical AND. (Default) • OR Logical OR. • NAND Logical NAND. • NOR Logical NOR. • XOR Logical XOR. • NXOR Logical NXOR. • NOT Logical NOT.

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of the tool.
Processing time	Tool processing time in msec.

CONFIGURATION

This tool is included into the library UvfStdTools.

4.3.10 Miscellaneous

Miscellaneous

OVERVIEW

They use various tools often custom tools implemented for testing or particular scenes.

HOW IT WORKS

Miscellaneous tools are processed according to the tool's type and parameters.

CAD

OVERVIEW

CAD tool is a container of tools that can be initialized by a DXF file. Cad file will be constructed so to contain information on which tool to create, and their associated shapes. Cad file will have several layer whose name will be a formatted string that follows the mentioned below rules.

LAYERS NAMES

Name	Value	Purpose
TOOL	Valid tool name ()	Create the tool
NAME	Any	Name of the tool
LINK	Any NAME previously assigned to other tools; use '+' if more	Linked tools
TAG	Number	Tag id
FIX	Any NAME previously assigned to other tools; use '+' if more	Fixture tools
SID	Number	Search Id
PID	Number	Point Id
XML	File name	XML with parameters
Name	Value	Purpose
ORIGIN	Any NAME previously assigned to other tools (only PatMax)	Assign this origin to the tool NAME

Names are separated with '&'
A value is separated from its name with '#'
Additional values are separated with '+'
Examples:
TOOL1#PatMax&NAME#MyPatMax&LINK#TAG#0
TOOL2#LineFinder&NAME#MyLine1&LINK#TAG#0&FIX#MyPatMax

TOOL3#LineFinder&NAME#MyLine1&LINK#TAG#0&FIX#MyPatMax
TOOL4#LineIntersection&NAME#MyLineIntersection&LINK#MyLine1+MyLine2#TAG#0&FIX#&SID#1&PID#1

\Valid tool names

Search, BlobInspect, BlobMeasure, PatMax, PatInspect, Edge, Caliper, CircleFinder, LineFinder, TInspect, RectFinder, Sharpness, DistancePointToPoint, DistancePointToLine, LightMeterStd, LineIntersection, LineFit, PointFit, RectFit, Boolean operator, Arithmetic, Point, Best, Grid, GridPolar, GridPoints, SyntheticXML, SyntheticDXF, LineInspect, LineBreakage

PATMAX

When drawing a line in Y direction only (as the dotted line), from the bottom to the top, the white (+) is on the right of the line and the black (-) is on the left of the line

EDGE

Use a Polyline. Vertex 1 is the starting point: place as in the picture to find a light to dark transition in X direction

LINEFINDER

When drawing a line in Y direction only, from the bottom to the top, the white (+) is on the right of the line and the black (-) is on the left of the line

When there are tools with a valid SearchId , the tool searches for the tools positions. Then compares the found positions to the expected positions, as defined in the dxf drawing, and calculates the mean and worst errors.

The tool position is defined as the origin (0, 0) mapped with the transformation that best fits the found to the expected positions.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
CAD file	Insert file name to initialize the tool with a CAD file.

Tolerances and limits	
Mean error	Enables or disables tolerance check on mean error for tool fixture. **Error limit** Max accepted mean error distance. (default = 0)
Worst error	Enables or disables tolerance check on worst error for fixture tool. Worst point is the one with the largest distance from the fitted point. **Worst point error limit** Max accepted distance between any point and the fitted point. (default = 0)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool.
Position Y	Y position coordinates. The position is referred to the origin point of the tool.
Offset length	Distance from the trained tool position.
Angle	Angle of the tool.

Compute

OVERVIEW

Compute tool is an utility tools that permits to manage results from other tools. You can implement yourself the behaviour of the tool editing a script: this script tells the Compute tools which data collect and how to use them. The Compute tool can have a position (defined by the script), a measure (defined by the script) and a value (defined by the script).

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance limits. Specification position is defined by the script.
	Elliptical Region
	Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle.
	Position X tolerance
	Position tolerance in the X axes. (default = 10)
	Position Y tolerance
	Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance limits. Specification orientation is defined by the script.
	Angle+
	Tolerance for positive angles. (default = 360; min = 0; max = 360)
	Angle-
	Tolerance for negative angles. (default = 360; min = 0; max = 360)
Size	Enables or disables the size tolerance limit. Sizeis defined by the script.
	Specification
	Expected size value. (default = 100)
	Tolerance+
	Positive tolerance. (default = 10)
	Tolerance-
	Negative tolerance. (default = 10)
Value	Enable or disable a value tolerance limit. Value is defined by the script.
	Specification
	Specification value. (default = 0)
	Tolerance+
	Upper tolerance accepted. (default = 0)
	Tolerance-
	Down tolerance accepted. (default = 0)

Analysis	
Config XML	Press this button to show Compute tool XML Configuration dialog.

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	Distance between specification and result points.
Position Y	Distance between the edge pairs. **Difference with specification** Difference between the size specified in the Tolerances and limits settings and this measured size.
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Offset between the tool's specification orientation angle and tool's result orientation angle.
Size	Size result. **Difference with specification** Difference between the size specified in the Tolerances and limits settings and this measured size.
Value	Value result. **Difference with specification** offset from specification value.

CONFIGURATION

This tool is included into the library UvfStdTools.

Compute tool XML Configuration

OVERVIEW

This window is accessed by pressing Config XML button in Compute settings window

CONFIGURATION

Editor

		User can describe the features of compute tool through a XML language.
	Computation Name	Define the user frendly name of this configuration.
	Define	Starts the section for operands definitions.
	Operand Name	Name of the Operand (position, measure, value, status) used in the computational script. This name is operand symbol ComputeTool uses in the script formula.
	Result Name	Description of operand. This is the data source associated with its Operand name. Usually you get desired value by .
	ResultNum	Get as named operand 1st result of the i-th child of the named tool.
	Results	Starts the section for Compute tool results definitions. Every result (General, Position, Value...) is the result of a computational script. Script may accept Operands (as described), values, mathematical functions.
	General	Definition of result status General (pass == 0, reject != 0). This value is the result of the script execution.
	PositionX, PositionY, PositionA	Definition of result position (X, Y, Angle) of the Compute tool. These values are the results of the scripts execution.
	Measure	Definition of result Measure of the Compute tool. This value is the result of the script execution.
	Value	Definition of result Value of the Compute tool. This value is the result of the script execution.

Import XML

Import a XML definition for this ComputTool from a stored file.

Export XML

Export current XML definition of this ComputTool to a file.

Verify XML

Verify correctness of Operands and Results. This action is neccessary to accept new ComputeTool definition.

Example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<Computation Name="Hole">
<Define>
<Operand Name="PosX">
<ResultName>Locate Holes.PositionX</ResultName>
</Operand>
<Operand Name="PosY">
<ResultName>Locate Holes.PositionY</ResultName>
</Operand>
<Operand Name="PosA">
<ResultName>Locate Holes.PositionA</ResultName>
</Operand>
<Operand Name="Bot">
<ResultName>Bottom.Value.0</ResultName>
</Operand>
<Operand Name="Top">
<ResultName>Top.Value.0</ResultName>
</Operand>
</Define>
<Results>
<PositionX Name="Pos">PosX-200</PositionX>
<PositionY Name="Pos">PosY</PositionY>
<PositionA Name="Pos">PosA</PositionA>
<Value Name="Val0">(Top-Bot)\0.022</Value>
```

```
</Results>
</Computation>
```

where:

Locate Holes is the name of tool in the recipe the Compute tool uses position x, y and angle. Compute X position result will have an offset of 200 from original result.

Compute tool value is the computed result from two operands (the first value of the result of the recipe tools **Bot** and **Top** and a simple value 0.02.

```
</Results>
</Computation>
```

Connector

OVERVIEW

Connector is a tool for inspection of pins of connectors. A connector is seen as a set of several rows of pins. Every row has a unique pin model, and each pin has a defined position inside the row and relative to all other pins of other rows. The Connector tool is designed to have a data-driven description and configuration. Connector result is an evaluation of pins positions' and pins' model quality.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Reference point X	X position of the whole connector (calibrated unites). (default = 0.00)
Reference point y	Y position of the whole connector (calibrated unites). (default = 0.00)
Rows angle	Angle/direction of all member rows (calbrated degrees). (default = 0.00)
Rows number	Number of rows that compose the connector. (default = 1)
True position	If "true" each pin offset is computed from nominal expected position. Otherwise nominal position is corrected (mapped) by fitting current transformation result. (default = Yes)
User row reference origin	Enable user to graphically set the position of first pin of each row. Otherwise position is driven by row data. (default = No)
Global Position tols	Enable or disable same tolerances for each pin result position. (default = Yes)
Position offset	Enables or disables pin position tolerance (if Global Position tols is enabled). **Elliptical region** Instead of rectangular offset area a elliptical is used. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)

Row Section	
Row	Selection of connector rows
Reference point y	Y position of the first pin of this row, relative to connector reference point (calibrated unites). (default = 0.00)
Pitch	Distance between two pins (calibrated unites). (default = 100)
Number of Pins	Number of pins in this row. (default = 2)
First pin id	Identifier of row first pin. (default = 1)
Default pin name	Enable or disable default naming of pins. By default pin name originates from its identifier (id). (default = Yes)
Pin selection	Selector of i-th pin.
Frame X (pixel)	Search area frame in horizontal direction around the pin model area. (default = 20)
Frame Y (pixel)	Search area frame in vertical direction around the pin model area. (default = 20)
Position offset	Enables or disables position tolerances to be used as pass/fail condition. These settings are available only if Connector Global position tols is false **Elliptical region** Instead of rectangular offset area a elliptical is used. **Position X tolerance** Position tolerance in the calibrated X axes. (default = 10) **Position Y tolerance** Position tolerance in the calibrated Y axes. (default = 10)
Line scan correction	Enables calibration correction for images acquired with line scan cameras. (default = No)
Calibration plane Z offset	Offset of calibration plane of this pins row. It is the z-calibration offset setting specific for this row. (default = 0,00)
Model	Model used to look for pins into this row • Search Use Search algorithm. • PatMax Use PatMax algorithm. • RSI Search Use RSI Search algorithm.
Multimodel	Enables and trains different pin models for row. This button shows multimodel parameters settings.
Geometry	Defines shape of the pin model. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape.
Score	The acceptance level for the global searching score. Results with scores below this limit are not accepted. (default = 0.30)
Contrast ratio	Enables or disables contrast ratio condition. Available only if Model is of type Search or RSI Search **Tolerance -** Negative tolerance. **Tolerance +** Positive tolerance.
Contrast threshold	Minimum contrast of boundaries used to locate the pattern. Available only if Model is of type PatMax(default = 10)
Elasticity	

Row Section	
	It specifies the degree to which you will allow PatMax to tolerate deformations of the object boundaries. You specify the elasticity value in pixels. (default = 0.00)
Angle	Enables or disables angle search range. (default = No)
	Angle min
	Lower limit. (default = -180)
	Angle max
	Upper limit. (default = 180)
Pattern granularity	PatMax uses large features first to do a pre-localization of the object and then refines the search using fine features. Granularity is expressed as the radius of interest, in pixels, within which features are detected.
	• Automatic (default)
	The system perform, at train time, an estimate of the optimal settings for Fine and Coarse granularity.
	• Manual
	Fine and coarse granularity are used to train the pattern.
	Fine
	The smallest granularity used to detect features in the training image or shape description. (default = 1)
	Coarse
	The largest granularity used to detect features. (default = 4)

Tolerances and limits	
Position offset	Enables or disables position tolerance of the complete connector. Position is computed as best fit of all pins position result
	Elliptical region
	Instead of rectangular offset area a elliptical is used.
	Position X tolerance
	Position tolerance in the X direction. (default = 10)
	Position Y tolerance
	Position tolerance in the Y direction. (default = 10)
Angle offset	Enables or disables orientation tolerance.
	Angle+
	Tolerance for positive angles. (default = 360; min = 0; max = 360)
	Angle-
	Tolerance for negative angles. (default = 360; min = 0; max = 360)
Ignore points	Number of pins to ignore in computing connector position. (default = No)
	Residual limit for ignoring
	The minimum value to consider a point as a candidate for decimation. (default = 0.00
Positive worst error	Enables positive worst point error condition; worst point is the one with the largest distance from the expected pin position. Expected pin position is the nominal pin position moved by the fitting transformation result.
	Worst point error limit
	Max accepted distance between any point and the expected fitted one. (default = 0)
Mean error	Average of distances between result pins positions and expected fitted ones
	Error limit
	Max accepted mean distance. (default = 0)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.
Mean error	Average of distances between result pins positions and expected fitted ones.
Worst error+ (point) (we +)	Worst pin distance and the index of the pin that produced it.
Number of missing points	Number of pins not found.
Worst score (pin)	Worst result score ant the index of the pin that produced it.
Max X pin offset (pin)	Maximum distance from result and expected one, in X direction.
Max Y pin offset (pin)	Maximum distance from result and expected one, in Y direction.
Max length pin offset (pin)	Maximum distance from result and expected one.
Pin ID	Pin selection. **Row** Row owner. **Scale X** Calibration X scale used. **Scale Y** Calibration Y scale used. **Fitting result** Fitting result decision for this pin. **Residual** Residual of fitting computation: distance from result position and expected one. **Offset X** Offset from the expected pin position in the X direction. **Offset Y** Offset from the expected pin position in the Y direction. **Offset length** Offset from the expected pin position. **Score** Result score of pattern matching. **Contrast ratio** Result contrast ratio od search. Available ony if model is of type Search **Angle** Result angle of pattern matching. Available ony if model is of type PatMax.

CONFIGURATION

This tool is included into the library UvfCTStd and UvfCTCvl.

Cycle Index

OVERVIEW

CycleIndex is a simple tool that produces a code for current inspection. With default implementation it uses the View's conditioned run code acquired. This code is than transformed as a string code that is the own tool result.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Value	Enables or disables check on current value (code) of the tool. (default = Yes)
	Specification
	expected code
	tolerance -
	negative tolerance. (default = 10)
	tolerance +
	positive tolerance. (default = 10)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Value	current value.
	difference with specification
	Offset.

CONFIGURATION

This tool is included into the library CycleIndexTool

Cycle Index specs

OVERVIEW

CycleIndex Specs is a simple tool that produces a code for current inspection and adapts specific nominal values and tolerances to check. With the default implementation, it uses the View's conditioned run code acquired, transforms this code into an index, load from a file the specification and tolerance values for this index, and uses these new settings for current inspection. Inspection consists in running specification checking of the results of an external tool CycleIndexSpecs tool accepts as a link.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Index	Enables or disables check on current index (code) of the inspection. (default = Yes) **Specification** expected code **tolerance -** negative tolerance. (default = 10) **tolerance +** positive tolerance. (default = 10)
Spcifications	Enables or disables check on linked tool specification. Specification and tolerances reported are current index's values. (default = Yes) **Specification** value at current index read from external file. **tolerance -** negative tolerance at current index read from external file. (default = 10) **tolerance +** positive tolerance at current index read from external file. (default = 10)

Analysis	
Specification file	Path of external file containing specifications and tolerances for each index. The file as the following format: ;index spec tol- tol+ example: 1 1.1 1.2 1.3 2 2.1 2.2 2.3
Result Id	It is the index of result of the linked tool. As tools can have several measurements or values into a single inspection result, this parameter select proper one. If the linked tool is a toolMeasure, the result iddrives the measure results. if the linked tool is a toolValue, the result Id drives the value results.
Test index	the index to use for manual testing of recipe.
View specifications	command to display external file with the index specifications.

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Index	current index.
Specification	result value checked.

CONFIGURATION

This tool is included into the library CycleIndexSpecs.

DMCTCompare

OVERVIEW

The DMCTCompare tool allows to reference one (1) Data Matrix tool and several text (OCV or the future OCR) tools. In the settings it allows to specify a format string which combines single characters of the results of the text tools, given constant characters and wildcards into one string which must match the result of the Data matrix tool.

Formatted string bust be constructed with has the following rules (BNF):

```
<format string>::={<component>}
<component>::=<tool>|<tool characters>|<wildcard>|<alphanumeric>
<tool>::='%',<tool position>,'%'
<tool position>::=<number>
<number>::=digit, { digit }
<digit>::="0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"
<tool characters>::='%',<tool position>,':',{<character position>},'%'
<character position>::=<number>, ','
<wildcard>::='?'
<alphanumeric>::=?all visible characters?
```

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Value	Enables or disables value.
	Specification
	Formatted string.

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in milliseconds.
Data Matrix code	Mata matrix read code.
Compare Code	Result code
Components	Select code component.
	Code
	Component code.

Configuration

This tool is included into the library DMCTCompare.

Lead Inspection

OVERVIEW

Lead inspection is a tool that automatically creates N instances of the owned tool (selected by the user), and positions them on a user defined line at regular steps. Usually this tool is used to inspect the position of leads of basic electronic components. Lead Inspection arrange expected position

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Position offset	Enables or disables position tolerance. **Elliptical region** Instead of rectangular offset area a elliptical is used. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Pitch	Enables or disables pitch evaluation. (default = No) **Specification** Pitch nominal value. (default = 100) **Tolerance+** Positive tolerance on Pitch value. (default = 100) **Tolerance-** Negative tolerance on Pitch value. (default = 100)
Pitch mean	Enables or disables pitch mean evaluation. (default = No) **Tolerance+** Positive tolerance on Pitch mean value. (default = 0) **Tolerance-** Negative tolerance on Pitch mean value. (default = 0)
Standard deviation	Enables or disables standard deviation evaluation. (default = No) **Specification** Standard deviation nominal value. (default = 0) **Tolerance+** Positive tolerance on standard deviation value. (default = 0) **Tolerance-** Negative tolerance on standard deviation value. (default = 0)
Ignore points	Enables or disables missing point condition. Points with a larger distance than the limit below are ignored. **Residual limit for ignoring** How many point can be missing without set fail condition. (default = 0)
Best points	The fitting algorithm use only the points with best score.
Positive worst error	Enables positive worst point error condition; worst point is the one with the largest distance from the interpolated line. After the line has been fitted it is shifted in to the positive worst point **Worst point error limit** Max accepted distance between any edge and the fitted line. (default = 0)
Negative worst error	Enables worst point error condition; worst point is the one with the largest distance from the interpolated line. After the line has been fitted it is shifted in to the negative worst point **Worst point error limit** Max accepted distance between any edge and the fitted line. (default = 0)
Mean error	Enables or disables mean error condition. **Error limit** Max accepted mean error distance. (default = 0)

Analysis	
Number of points	Number of tools to use. (default = 4)
Oriented pitch	If checked pitch is calculated as the distance between two consecutive tools. If not checked pitch is the distance between the projected position of two consecutive tools on the fitting line. (default = Yes)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of the tool.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset from the trained tool position in the X axes.
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset from the trained tool position in the Y axes.
Offset length	Distance from the trained tool position.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.
Pitch mean	Average of all detected pitch values.
Standard deviation	Standard deviation of all detected pitch values.
Pitch min	Minimum detected pitch value.
Pitch max	Maximum detected pitch value.
Max pin offset X	Maximum measured X tool offset (Pin ID).
Max pin offset Y	Maximum measured Y tool offset (Pin ID).
Max pin offset A	Maximum measured angle tool offset (Pin ID).
Min pin score	Minimum measured score.
Mean error	Mean error of each tool position.
Worst error+ (point)	Worst positive error of each tool position. The number between () indicates the point index the value refers to.
Worst error- (point)	Worst negative error of each tool position. The number between () indicates the point index the value refers to.
Number of missing points	Number of not found tools results.

CONFIGURATION

This tool is included into the library UvfCTStd.

Point

OVERVIEW

Point tool defines a point on the image. The point will be fixed with respect to it's group fixture. Angle is the same as owner group.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Geometry	Defines tool's region shape.
	• Circle
	   Circular shape.
	• General rectangle (default)
	   Rectangular shape.
	• Annulus
	   Annulus shape.
	• General polygon
	   General polygon shape.
	• CAD (Closed ROI)
	   Closed shape imported from a CAD file.

CAD file 1	CAD file name.
Layer nameDisplayed only when CAD (Closed ROI) geometry is selected.	Lists the layer names defined in the selected CAD file. **Connection tolerance** Distance between close segment points to be considered as connected. (default = 0)
User calibrationDisplayed only when CAD (Closed ROI) geometry is selected.	If checked user defines parameters for CAD shapes calibration. Otherwise tool calibration is used. **axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1) **scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1)

Tolerances and limits	
Position offset	Enables or disables position tolerance. **Elliptical region** Instead of rectangular offset area a elliptical is used. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.

CONFIGURATION

This tool is included into the library UvfStdTools.

References

1: Displayed only when CAD (Closed ROI) geometry is selected.

Scrap maker

OVERVIEW

ScrapMaker is a diagnostic tool that produces rejects (scrap) periodically over a counter. It has testing purposes.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Analysis

TODO

Tolerances and limits	
Value	Enables or disables check on ScrapMaker counter . (default = Yes)
	tolerance +
	positive tolerance. When counter reaches this limit the tool forces a reject and reset the counter.(default = 10)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Value	current value.
	difference with specification
	Offset.

CONFIGURATION

This tool is included into the library ScrapMaker.

Sharpness

OVERVIEW

The Image Sharpness tool computes a measure of the relative sharpness of an input image. The primary purpose of this tool is to automate focusing a camera lens on a scene. You acquire an image and run the tool to obtain a sharpness score. By iteratively refocusing, scoring, and comparing the sharpness scores you can maximize the score which is the best camera focus condition.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Shape index	Enables or disables RMS error condition. (default = No) **Shape index limit** Fitting error threshold. (default = 1000)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Score	A value ranging from 0 to 1000 indicating the global value of sharpness. The highest the score, the better is the sharpness. **Difference with specification** Difference between the actual value and the specified value for Shape index.

CONFIGURATION

This tool is included into the library UvfStd.

SCTSConnector

Super Connector (SCTSConnector) tool is a container of Connector tools. It calculates the transform that fits the contained Connectors to their specification positions. The result is the Super Connector is the point resulting from the application of the found fit transform to its tool reference point.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Super Connector ref. point X	Reference point X. (default = 0.00)
Super Connector ref. point Y	Reference point Y. (default = 0.00)
Super Connector angle	Reference angle. (default = 0.00)

Connector	
Connector	Connector selection to set their position parameters. • (Connector #n)
Position	Choose how to consider the connector position. • Absolute Use absolute connector position. (default) • Relative Use offset relative to Super Connector reference point.
Offset X	Relative offset X. (default = 0.00)
Offset Y	Relative offset Y. (default = 0.00)
Offset Angle	Relative Angle. (default = 0.00)

Tolerances and limits	
Position offset	Enables or disables position tolerance. **Elliptical region** Search area has elliptical region instead of a rectangular one. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Ignore points	Enables or disables missing point condition. Points with a larger distance than the limit below are ignored. **Residual limit for ignoring** How many point can be missing without set fail condition. (default = 0)
Best points	The fitting algorithm use only the points with best score.
Positive worst error	Enables positive worst point error condition; worst point is the one with the largest distance from the fitted points. **Worst point error limit** Max accepted distance between any point and the fitted point. (default = 0)
Mean error	Enables or disables mean error condition. **Error limit** Max accepted mean error distance. (default = 0)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset from the trained tool position in the X axes.
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset from the trained tool position in the Y axes.
Offset length	Distance from the trained tool position.
Angle	Angle of the tool. **Angle offset** Angle offset from the trained tool angle position.
Mean error	Mean distance between the points and the fitted points.
Worst error+ (point)	Worst positive distance between the points and the fitted points. The number between () indicates the point index the value refers to.

CONFIGURATION

This tool is included into the library SuperConnector.

XML

OVERVIEW

XML tool is a container of tools that can be exported on a XML file. Settings of all contained tools are exported to the XML file. XML tool can be exported by menu:

```
File > Import and Export > Export XML tool
```

The xml file resulting from the Export XML tool operation can be imported into another XML tool by menu:

```
File > Import and Export > Import XML tool
```

The operation of importing a previously exported xml file will result in initializing the XML tool with all the tools saved in the xml file.

When there are tools with a valid SearchId , the tool searches for the tools positions. Then compares the found positions to the expected positions, as defined in the nominal search position, and calculates the mean and worst errors.

The tool position is defined as the origin (0, 0) mapped with the transformation that best fits the found to the expected positions.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
XML file	Insert file name to initialize the tool with a XML file.

Tolerances and limits	
Mean error	Enables or disables tolerance check on mean error for tool fixture. **Error limit** Max accepted mean error distance. (default = 0)
Worst error	Enables or disables tolerance check on worst error for fixture tool. Worst point is the one with the largest distance from the fitted point. **Worst point error limit** Max accepted distance between any point and the fitted point. (default = 0)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool.
Position Y	Y position coordinates. The position is referred to the origin point of the tool.
Offset length	Distance from the trained tool position.
Angle	Angle of the tool.

4.3.11 OCR and OCV

OCR and OCV

OVERVIEW

The OCR tool performs optical character recognition (OCR), a process for reading character strings.

The OCV tool performs optical character verification (OCV), a process for verifying that each character in a text area is the expected character in the expected location.

OCR

The OCR tool performs optical character recognition (OCR), a process for recognizing characters. In order to accommodate the wide variation in the appearances of characters in different applications, the OCR API is split into three separate vision tools:

- Character segmentation takes an image as input and produces a set of segmented character images.
- Classification takes the segmented character images and determines what character each corresponds to.
- Fielding takes the entire result string from the classifier and checks to see whether the string matches what the user expected as a good result.

The OCR Tool tries to read a paragraph: a string or a set of strings containing characters using the same font. For each line the ROI (region of interest) has to be set. Increase parameter number of regions for several lines. The ROI is specified as an affine rectangle that specifies the approximate location, angle, and skew of the line of text. The ROI must be entirely contained within the input image. The x axis of the affine rectangle should be parallel to the baseline of the text, and the y axis should be parallel to the vertical strokes of the characters. The ROI is expected to contain only the one line of text to be read and some surrounding background and should be larger than the line of text by at least half a character width on all sides if possible.

The OCR Classifier takes a rectified image of a character and returns the best matching character, the score of that best matching character, and the confidence of that best matching character. The OCR Classifier can be incrementally trained with additional training images at any time. The OCR Classifier determines not only the classification (character code/instance) of the run-time rectified image, but it also reports the score of that classification and the confidence of that classification. The score is an indication of the closeness of the match to the training instances. The confidence is computed as the difference between the score of the classification and the score of the next-highest classification.

The OCR Dictionary Fielding tool provides functionality to verify and correct strings read by the OCR Classifier. There are two secondary usages:

- OCR result verification: in this usage, you try to determine whether the OCR result is correct or not by comparing it against acceptable results specified via fielding.
- OCR result correction: in this usage, the raw OCR result string is not among the acceptable results. The user tries to find an acceptable string allowed by the field that is closest to raw OCR result string.

The OCR Dictionary Fielding tool also allows for the possibility of multiple candidates for each character in the input string.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)

Tolerances and limits	
Validate paragraph	Enables or disables paragraphs validation. (default = No) **Accept null paragraphs** Accept empty paragraphs. (default = No) **Wildcard** Enter wildcard characters. These are used as wildcards or "don't care" characters, when the paragraph is validated. **Valid codes** Enter valid codes for validation, separated by "," (comma).
Shape index	Enables shape index limit. (default = No) **shape index limit** Classification score. (default = 1.0)

Analysis	
Number of regions	Paragraph to be searched can be distributed into different image regions. (default = 1)
Font	Select font. It is the font used by the OCR Tool to look for matching (classification) of characters. These fonts are available and exportable into external files. Fonts are shared into PROINSPECT and each time they are modified (a new character model is added) all OCR Tools into the recipe gets updated.
Learn Font	This button opens Learn font dialog.

Segmentation	
Text colour	Set the polarity of the characters. • Automatic (default) Polarity is automatically determined. Automatic polarity detection might fail for very noisy backgrounds. • Dark on light background Dark characters on light background. Polarity specification decreases execution time. • Light on dark background Light characters on dark background. Polarity specification decreases execution time.
Angular range	half of the angle search range. The line angle search range is centered on the xRotation of the affine rectangle used as the ROI for the segmenter. In other words, the full search range is [xRotation - angleHalfRange, xRotation + angleHalfRange]. Increasing angleHalfRange increases the segmenter's run time. Setting angleHalfRange to 0 effectively disables angle search. (default = 0.00)
Skew range	half of the skew search range. The line skew search range is centered on the skew of the affine rectangle used as the ROI for the segmenter. In other words, the full search range is [skew - skewHalfRange, skew + skewHalfRange]. Increasing skewHalfRange increases the segmenter's run time. skewHalfRange to 0 effectively disables skew search. (default = 0.00)
Filter strokes	whether to remove from the normalized image everything that does not appear to have the same stroke width as the rest of the image. This can be useful if, for example, characters appear to be connected to each other by thin noise streaks. However, using the stroke width filter might incorrectly remove real characters if the widths are inconsistent. (default = Yes)
Grey level foreground modifier	a modifier in the range [0, 1] that is used to compute the binarization threshold, in the normalized image, that binarizes between foreground and background. (default = 0.5)
Ignore border fragments	whether to completely ignore any fragments that touch any border of the ROI. Ignoring such fragments can be useful for excluding non-text features such as the edges of labels that might be included within the ROI. (default = Yes)
Contrast threshold	he minimum amount of contrast (in normalized image greylevels) that a fragment must have, relative to the binarization threshold, in order to be considered for possible inclusion in a character. Any character fragment with a contrast lower than this value is completely ignored for all further processing, as though that fragment had never been detected. (default = 30.0)
Fragment max distance to main line	maximum distance a fragment can have outside the main line of characters as percentage of estimated line height. Fragments that overlap the mainline by at least 50% get included regardless of the value of this parameter. (default = 0.0)
Min. fragment (pixel)	the minimum number of foreground (i.e. text) pixels that a character fragment must have in order to be considered for possible inclusion in a character. A character fragment is a blob in the binarized image. Character fragments that contain fewer foreground pixels than this value are completely ignored for all further processing, as though that fragment had never been detected. (default = 15)
Fragments merge mode	Smode used to determine whether to merge two fragments into one character during the Group stage. • Horizontal overlap (default) Character fragments must overlap horizontally by at least one pixel to be merged. The amount of overlap required is specified by Min. overlap • Min space between characters Character fragments with a horizontal gap between them may be merged to form characters, where any two fragments with a gap less than Min space between characters (pixel) will be merged. • Min and max space between characters Character fragments with a horizontal gap between them may be merged to form characters, with the decision to merge two fragments based on both Min. space between characters (pixel) and Max. space between characters (pixel).
Min overlap	the minimum fraction by which two character fragments must overlap each other in the x-direction for the two fragments to be considered part of the same character. (default = 0.00; min = 0.00; max = 1.00)
Min. space between characters (pixel)	the minimum gap size, in pixels, that can occur between two characters. If the gap between two fragments is smaller than this, then they must be considered to be part of the same character, unless the combined character would be too wide . The gap is measured from the right edge of the mark rectangle of one character to the left edge of the mark rectangle of the next character. (default = 1)
Max. space between characters (pixel)	the maximum gap size, in pixels, that can occur within a single character, even for damaged characters. Any gap larger than this value is always interpreted as a break between two separate characters, whereas gaps less than or equal to this value may be interpreted either as a break between two separate characters or as a gap within a single character. (default = 0.00)

Segmentation	
Min number of pixels per characters	the minimum number of foreground (text) pixels that a character must have in order to be reported. Stage. (default = 30.0)
Min character width (pixel)	the minimum width of a character's mark rectangle, in pixels, that a character must have to be reported. (default = 3.0)
Use max character width	Set whether to use Max character width (pixel) to split wide characters. (default = No) **Max character width (pixel)** Sets the maximum allowable width of a character's mark rectangle in pixels. A character wider than this value is split into pieces that are not too wide. (default = 100.0)
Min character height (pixel)	Sets the minimum height of a character's mark rectangle, in pixels, that a character must have to be reported. (default = 3.0)
Use max character height	Sets whether to use Max character height (pixel) to limit the maximum height of a character and/or the line of characters. (default = No) **Max character height (pixel)** Sets the maximum allowable height of a character's mark rectangle, in pixels. This value is used in two ways. First, this value is used when finding the line as a whole; for example, to reject vertically adjacent noise and/or other lines of vertically adjacent characters. Second, an individual character whose height exceeds this value will be trimmed to meet this height. Stage. (default = 100.0)
Use min aspect	Sets whether to use Min aspect to split wide characters. (default = Yes) **Min aspect** Sets the minimum allowable aspect of a character, where the aspect is defined as the height of the entire line of characters divided by the width of the character's mark rectangle. A character whose aspect is smaller than this value (that is, whose width is too large) is split into pieces that are not too wide. (default = 0.8)
Insert spaces	Sets the insert mode, which specifies how to handle insertion of space characters into gaps between other characters. • None (default) Never insert a space character, no matter how large an intercharacter gap is. • Single Insert at most one space character per intercharacter gap, no matter how large the gap is. • Multiple Insert a number of space characters (zero or more) per intercharacter gap based on how large the gap is. **Space score mode** Sets the score mode, which specifies how to handle scoring of space characters. ONE Space characters always get a score of 1.0. Clutter (default) The score of a space character is based on the fraction of pixels that are background. A space character that consists entirely of background receives a score of 1.0. **Min space width** Sets the minimum width of a space character, in pixels. (default = 10.0) **Max space width** Sets the maximum width of a space character, in pixels. (default = 100.0)
Min pitch	Sets the minimum pitch, in pixels, that can occur between two characters. If the pitch between two fragments is smaller than this, then they must be considered to be part of the same character, unless the combined character would be too wide (as specified by Max character width (pixel)and/or Min aspect). (default = 0.0)

Classification	
Accept threshold	Minimum score for a character in order to be classified. (default = 0.50)
Confidence threshold	Minimum confidence value. Confidence is the difference between score values of the best and 2nd best match. (default = 0.00)
Use filter for scale X	Enable filter for X scale. X scale filter range is used for skipping candidate classes/instances whose rectified training image's x-size (that is, width) is beyond the range specified here. (default = Yes) **Limit down** Lower limit value for scaling. (default = 0.67) **Limit up** Upper limit value for scaling. (default value = 1.50)
Use filter for scale Y	Enable filter for Y scale. Y-scale filter range is used for skipping candidate classes/instances whose rectified training image's y-size (that is, height) is beyond the range specified here. (default = Yes) **Limit down** Lower limit value for scaling. (default = 0.67) **Limit up** Upper limit value for scaling. (default value = 1.50)

Fielding	
Max number of positions	Must fit to number of classified or positions, otherwise fielding results are not displayed. (default = 3.0)
Position	Select position to specifying the acceptable choices for a character in this position. **Number** Characters 0 through 9. (default = No) **Alfa-uppercase** Characters A through Z. (default = No) **Alfa-lowercase** Characters a through z. (default = No) **Space** The space character (UTF-32 character code 0x20). (default = No) **Any non space** Any character not in the Cognex-reserved UTF-32 code ranges except the space character whose UTF-32 character code is 0x20. This does include other white spaces, for example, character codes 0x09 through 0x0D. (default = Yes) **Additional characters** Characters that can be assumed.

More

Click here to access the More section description.

LEARN FONT

This dialog is accessed pressing button

```
Analisys > Learn font.
```

Consoles

This dialog has two image consoles.

- Image console Image confined within the tool search area is displayed. Fonts console For each character the associated image is displayed.

- Image console displays rectangles associated to each character after the classification process. These rectangles can be selected to identify the currently selected character of the dialog.

Selection of a rectangle allows to make some operations of association of the represented image to a character of the font. If one rectangle is identified by a "?" (question mark) means that the corresponding image is not associated to any character of the font we are going to learn. Else, if the rectangle is marked with a character means that an association exists.

Fonts console displays areas of the image associated to some characters. Many areas can be associated to the same character.

Edit single character

Font characters can be individually edited by two groups of controls:

• Read character

• Font character

To add a character select one of the proposed rectangle in Image console; type the character in Read character > Name and press Read character > Add button.

Once a character has been added, it will be displayed in the Fonts console. If a read character was associated to a font character, the font character information are displayed. If a character is associated to more than one Font character, the instance index is displayed.

Edit multiple characters

Font characters can be multiply edited.

• Characters Editable text in which to type the associated character for each rectangle in the Image console.

• Unknown character Type a character that will identify a symbol not recognized as one of the current font alphabet.

• Select all Pressing this button all rectangles in the Image console are used to associate characters

• Deselect If some rectangles have to be deselected, press this button and then click on the rectangle to deselect.

• Add Enter add mode. After pressing, select in Image console the rectangles to add and then press it again.

• Delete Enter delete mode. After pressing, select in Fonts console the characters to delete and then press it again.

• Cancel Exit Add or Delete mode without changes.

Archive

A learned font can be serialized to be used for another OCR tool.

• New Create a new font.

• Save Opens a Save file dialog and the user will be asked to enter the name of the file .ocr to save the font in.

• Load Opens a File open dialog to select a file .ocr that stores the wished font.

• Font name Name of the current font.

RESULTS

Results	
Decision	• Good Pass/Fail decision. • Out of tolerance OCR was successfully executed but some validation condition failed. • Reject OCR execution failed.
Processing time	Tool processing time in msec.
Code	Result code.
Score	Tool score.
Fielding computed	Tells whether the fielding operation was successfully executed.
Fielding code	Code after fielding process.
Status	This is the lowest status grade among all position status.
Fielding position	Fielded position selection. **Character** Fielded character. **Status** Fielded position status.
Classification computed	Tells whether the classification operation was successfully executed.
Code classified	Code after classification process.
Classified position	Classified position selection. **Character** Classified character. **Status** Classified position status. Read Classified with good confidence. Confused Classified with poor confidence. Failed Failed to classify. **Instance** What instance the classified character is associated to. **Score** Classification result score **Confidence** The confidence score is the difference between primary character score and confusion character score. **Confusion type** Reason that leads to the confused status. No confusion Good Score too low Confidence score is less than confidence threshold Failed classification validation Failed **Confused character** Highest scoring alternative character.

CONFIGURATION

This tool is included into the library UvfCvlOCR.

OCV

OCV

OVERVIEW

The OCV tool performs optical character verification (OCV), a process for verifying that each character in a text area is the expected character in the expected location.

SETTINGS

Options	
Enable	Enable or disable the tool. (default = Yes)

Tolerances and limits	
Value	If this value is not set, result always good. (default = Yes) **Specification** Set line of characters to verify. This string will be used for train process too. (default = "ABC")
Numbers	Enable or disable numbers. (default = Yes) **available numbers** Type available numbers. (default = "0123456789")
Uppercases	Enable or disable uppercase. (default = Yes) **available uppercases** Type available uppercase characters. (default = "ABCDEFGHIJKLMNOPQRSTUVWXYZ")
Lowercases	Enable or disable lowercases. (default = Yes) **available lowercases** Type available lowercase characters. (default = "abcdefghijklmnopqrstuvwxyz")
Other characters	Enable or disable other characters. (default = Yes) **other characters** Type characters.
Wildcards	Formatted string that specify if in the recognized text some characters have to assume a specific value. Sintax in BNF form is the following: ::={:{};} ::=[0-9]+ ::=[A-Za-z0-9]\ If is empty means that the applied rule for the corresponding is the same as the previous one.
Shape index limit	Enable shape index limit. Matching score is evaluated for each character. The decision is taken by comparing the lowest score value of all accepted characters to this limit. (default = Yes) **shape index limit** (default = 1.0)

Analysis	
Font filename	Path of Font file containing the font to be used in verification process.
Font name	Font file usually contains different fonts. All available fonts will be listed. Select the desired one. • -Not selected- No font is selected. (default) • Available font
Edge polarity	Text polarity. • Dark to light Dark text on light background. (default) • Light to dark Light text on dark background
Acceptance threshold	Sets the threshold used to locate character shapes in the run-time image. (default value = 0.6)
Contrast threshold	Gets the amount of contrast (in run-time image grey levels) that a result must have to be accepted. (default = 10.0)
Uncertainty X (pixel)	Sets the uncertainty of the starting pose in the x dimensions, in client coordinates. (default = 7.0)
Uncertainty Y (pixel)	Sets the uncertainty of the starting pose in the y dimensions, in client coordinates. (default = 7.0)
Angle	The search will be performed in the given angular range. Otherwise, it will use the single nominal value. (default = Yes)
Scale	The search will be performed for the given scale range. Otherwise, it will use the single nominal value. • None No scale in applied. (default) • Symmetric Uniform scale for X and Y. • Only X Scale for X. • Only Y Scale for Y.

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool.
Processing time	Tool processing time in msec.
Read code	Display read code. Not matching characters are displayed as "\".
Score	Lowest score (matching) value for all recognized characters. Characters are "recognized" when the score value is greater then acceptance threshold. Not recognized characters do not change the score value.

CONFIGURATION

This tool is included into the library UvfIdToolsStd and UvfIdToolsCvl.

4.3.12 Pattern Match

Pattern Match

OVERVIEW

The purpose of Pattern Match tools is to find patterns in run-time images and return position, a score of likeliness. Searching is performed in a user defined region. All these tools have a model or more than one model to search in images.

HOW IT WORKS

You first define a shape that includes the model you want to search in images. All regions outside the model shape will have don't care pixels, i.e. pixels that don't have weight on the matching process. Then you train the model (or more models) in the reference image. If the operation successes, you are ready to run the tool on run-time images.

Multimodel

OVERVIEW

This dialog is accessed by Search and PatMax settings dialog Analysis > Multi model > Edit model.

MULTIMODEL

Consoles

Search and PatMax tools can have different models to work to, and the tool result is done by the model that gives the best result.

Multimodel dialog has two image consoles:

- Image console Shows the image the model is extracted from.

- Models console Shows all defined models. Current model can be selected in this console.

The first time this dialog is entered, the default model is shown in both consoles. If other models will be added, their search area and model area will be displayed in the image console, whereas the model image will be displayed in the models console.

Each console has a text field in its lower part that displays the coordinate of the mouse pointer when the mouse enters the console area.

Reference image

Reference image is the image the model is extracted from.

- Reference image name This text field shows the path of the image the currently selected model is extracted from. Each model has its own reference image.

- Load ref. Displays an Open File dialog to select the current model's reference image. This button is active when the current model is in Edit mode.

- Cur. image Selects the current image as the current model's reference image. Always enabled.

Edit

Edit commands are to modify, add and delete models.

- Edit Pressing this button current model can be edited. In the Image console its search area and model area can be modified. Its reference image can be changed. To exit edit mode and confirm changes press this button again.

- Add mode A new model is created.

- Delete model Currently selected model is removed.

- Cancel Exits the edit mode skipping changes.

- Lock User can to change current model search area and/or model position leaving the model's image unchanged

Archive

Model can be archived and used to initialize other models.

- Load Shows an Open file dialog to select a .mod file that will initializes current model.

- Save Open a Save file dialog to save the current model to a .mod file.

PatMax

OVERVIEW

The purpose of PatMax is to locate and measure the conformity of a previously trained set of object's contours, called object's features. The search operation measures how much the features extracted on the current image match with the previously trained model.

PatMax locates the object position in the current image by finding the contours in the image to which the model is most similar.

PatMax offers three key distinctive features:

- High-speed location of objects whose appearance is rotated, scaled, and/or stretched

- Location technology that is based on object shape, not on grey-scale values

- Very high accuracy

PatMax differs from other pattern-location technologies in that it is not based on pixel grid representations that cannot be efficiently and accurately rotated or scaled. Instead, PatMax uses a geometrical feature-based representation that can be transformed quickly and accurately for pattern matching.

SETTINGS

Options	
Enable	Enable or disable the tool. (default = Yes)
Search area	Select the area where search for a model. • All Image (default) Search area agrees with overall image area. • Centered Search area is the model area enlarged by a symmetrical frame. • Free Search area is defined by the user. **Frame X** Frame width. (default = 20) **Frame Y** Frame height. (default = 20)
Model	Defines tool's model shape. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape. • CAD (Closed ROI) Closed shape imported from a CAD file.
User origin	Allows to set the model origin in an arbitrary position, instead of the center of the model area
CAD file	CAD file name.
Layer name	Lists the layer names defined in the selected CAD file. **Connection tolerance** Distance between close segment points to be considered as connected.. (default = 0) **Normalize XY weight** If checked weight is distributed for 50% to X features and for 50% to Y features. If unchecked all features have the same weight. (default = No)
User calibration	If checked user defines parameters for CAD shapes calibration. Otherwise tool calibration is used. **Axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1) **Scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1)
Synthetic model	Model is created using a synthetic image shapes instead of using the reference image. **Model polarity** Polarity of the shapes represented in the synthetic model • White on black background (default) White foreground (pixels within the shape) on black background. • Black on white background Black foreground (pixels within the shape) on white background.

Options

Model frame X (pixel)

symmetrical X frame to add to the width of the model shape.

Model frame Y (pixel)

symmetrical Y frame to add to the height of the model shape.

Tolerances and limits	
Check results count	The expected number of results • None No check. • Expected number Number of results must be equal to Num. of results to find. • Less than Number of results must be less then Num. of results to find. • Greater than Number of results must be greater then Num. of results to find.
Shape index	Conformity limit for acceptable result. **Shape index limit** Minimum acceptable shape index. (default = 1.0)
Position offset	Enables or disables position tolerance. **Elliptical Region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Coverage	Enables or disables the coverage tolerance limit. The coverage score is a measure of the extent to which all parts of the trained pattern are also present in the run-time image. The coverage score is computed by determining the proportion of the trained pattern that is found in the run-time image. If all of the trained pattern is also present in the run-time image, the coverage score is 1.0. Lower coverage scores indicate that less of the pattern is present. **Coverage limit** Minimum acceptable value. (default = 1.0)
Clutter	Enables or disables the clutter tolerance limit. The clutter score is a measure of the extent to which the found object contains features that are not present in the trained pattern. The clutter score is the proportion of extraneous features present in the found object relative to the number of features in the trained pattern. A clutter score of 0.0 indicates that the found instance contains no extraneous features. A clutter score of 1.0 indicates that for every feature in the trained pattern there is an additional extraneous feature in the found pattern instance. The clutter score can exceed 1.0. **Clutter limit** Minimum acceptable value. (default = 0.0)
Fit error	Enables or disables the fit error tolerance limit. The fit error is a measure of the variance between the shape of the trained pattern and the shape of the pattern instance found in the run-time image. The fit error is computed by taking the square root of the sum of the weighted average distances between each boundary point in the pattern and the corresponding boundary point in the pattern instance in the run-time image. If the pattern instance in the run-time image is a perfect fit for the trained pattern, the fit error is 0.0. You can use the fit error to assess the degree to which the shape of a pattern instance matches the shape of the trained pattern **Fit error limit** Maximum acceptable fit error. (default = 0.0)

Analysis	
Max. number of results	Number of model instances to find. (default = 1)
Multimodel	This button shows Multimodel parameters settings.
Acceptance threshold	The acceptance level for the global matching score. Results with scores below this limit are not accepted. (default = 0.50)
Contrast threshold	Minimum contrast of boundaries used to locate the pattern. (default = 10)
Elasticity	It specifies the degree to which you will allow PatMax to tolerate deformations of the object boundaries. You specify the elasticity value in pixels. You should keep the following points in mind when specifying a nonzero elasticity value: • Specifying a nonzero elasticity value does not affect PatMax's execution speed. • Increasing the elasticity value does not decrease PatMax's accuracy. However, location information returned about additional object instances that are found as a result of increasing the elasticity value can be less accurate. • If the elasticity value is too low, you will see low scores and your application may fail to find patterns in the run-time image and/or the positions will be incorrect or unstable. • If the elasticity value is too high, PatMax may match false instances and may return inaccurate or unstable results. (default = 0.00)
Score using clutter	When this option is enabled, the system takes into account the clutter (presence of extra contours in the image that were not present in the model) in computing the global score. (default = No)
Angle	Enables or disables angle search range. (default = No) **Angle min** Lower limit. (default = -180) **Angle max** Upper limit. (default = 180)
Scale	Enables or disables scale range. (default = No) **Min** Lower limit in %. (default = 50) **Max** Upper limit in %. (default = 200)
Ignore polarity	You can specify whether to ignore the polarity of contours. Each of the boundary points that describes a pattern feature has a polarity. The polarity of a boundary point indicates whether the boundary can be characterized as light-to-dark or dark-to-light. You can configure PatMax to find only objects in which every boundary point has the same polarity as the trained pattern, or you can configure PatMax to find objects with mismatched polarity.
Pattern granularity	PatMax uses large features first to do a pre-localization of the object and then refines the search using fine features. Granularity is expressed as the radius of interest, in pixels, within which features are detected. • Automatic (default) The system perform, at train time, an estimate of the optimal settings for Fine and Coarse granularity. • Manual You define fine and coarse granularity to use to train the pattern and to run. **Fine** The smallest granularity used to detect features in the training image or shape description. (default = 1) **Coarse** The largest granularity used to detect features. (default = 4)
Accepted overlap (%)	Percentage overlapping area needed to PatMax before it considers multiple overlapping instances as a single instance. (default = 0.00)
Angle overlap	Angle within which PatMax treats multiple overlapping instances as a single instance. (default = 360)
Timeout (s)	Maximum amount of time allowed to the PatMax algorithm to process the image. A fail result will be set if this time expires. (default = 8)
Algorithm	Used algorithm. • PatMax (default) Full PatMax.

Analysis	
	• PatQuick A quicker version of the PatMax algorithm. PatQuick provides the basic PatMax results but lacks separate measurements of clutter, coverage and fit error. PatQuick may yield a lower localization accuracy. • PatFlex An algorithm that can tolerate and report information about a high degree of nonlinear deformation like spherical or cylindrical distortion, surface flex distortion. • PatPers An algorithm that can tolerate and report information about a high degree of nonlinear deformation like planar perspective.
High sensitivity	High sensitivity is designed to improve PatMax performance for noisy images and/or patterns with extremely low contrast. PatMax will run slower in high sensitivity mode than in standard sensitivity mode. (default = No) **Sensitivity parameter** When set to 1.0 PatMax uses minimum noise rejection. when set to 10.0 PatMax uses maximum noise rejection. Usually the default value 2.0 produces optimal results. This is an advanced parameter and should usually be left set to its default value. (default = 2; min = 0; max = 10)
Manual edge threshold	Enables or disables manual edge threshold. If set to true, tells PatMax to ignore the automatic edge detection threshold computed at train time and to use the user supplied edge threshold. **edge threshold** threshold to use instead of automatically computed at train time. (default = 5)
Deformation rate	expected deformation rate in PatFlex. Higher values increase the time of the alignment, and may result in spurious matches due to the large amount of freedom that the tool has to deform parts of the training image to fit the run-time image.
Flex elasticity	PatFlex flex pattern elasticity in pixels. (default = -1)
Limited deformation	whether or not deformation is known to be minor, in PatFlex. If the runtime image is sufficiently undeformed (e.g. undeformed enough that the PatMax algorithm can still find it, even though PatMax's answer might not be completely accurate), then setting this flag to true may result in accurately modeled deformation at much higher speeds

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Offset between the tool's specification orientation angle and tool's result orientation angle.
Scale X	Scale value in the X axes.
Scale Y	Scale value in the Y axes.
Score	Match quality index. A value from 0 to 1 indicating the global level of conformity between the model and the pattern found.
Clutter	The clutter score: it is a measure of the extent to which the found object contains features that are not present in the trained pattern.
Coverage	The coverage score: it is a measure of the extent to which all parts of the trained pattern are also present in the run-time image.
Fit error	Measure of the variance between the shape of the trained pattern and the shape of the pattern instance found in the run-time image.

IMAGES

Images	
Model	Image of the trained model .
Mask	Mask image to apply. White pixels are care pixels. Black pixels are don't care.
Model featrures	Image of the trained model with the coarse features (cyan color) and fine features (blue color)

CONFIGURATION

This tool is included into the library UvfCvl.

Polar Finder

OVERVIEW

Polar Finder lets you search inside an annulus region. A tool must be associated to the Polar Finder and it will be executed in the region defined by the annulus. For example, it is possible to associate a PatMax, Search or Caliper tool and get the result of the tool applied to a region obtained unwrapping the annulus. Polar Finder unwrap the image region within the polar shape and run contained tool into this unwrapped image. It returns, in particular, the angle where the contained tool finds its own model or edge.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Geometry	Defines tool region shape. • Polar grid Annulus shape.

Tolerances and limits	
Overlapping (degree)	Defines an overlapping region made of pixels taken from the beginning and the end of the unwrapped image. (default = 0)
Scale X	X scale factor for scaling the unwrapped image. (default = 1.00)
Scale Y	Y scale factor for scaling the unwrapped image. (default = 1.00)
Angle offset	Enables or disables orientation tolerance. (default = No) **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle where the contained tool finds its result. **Angle offset** Angle offset from the trained tool angle position.

IMAGES

Images	
Model	unwrapped image of the polar shape reference image region.
Mask	run-time unwrapped image.

CONFIGURATION

This tool is included into the library UvfCTStd and UvfCTCvl.

IMAGES

Images	

RSI Search

OVERVIEW

The RSI Search tool is a specialized search tool that combines features of both PatMax and Search. Like those tools, RSI Search lets you train a model of the image features that you are looking for, then find instances of the trained features in a run-time image.

For most applications that require the ability to find scaled and rotated feature instances, PatMax will be faster and more accurate than RSI Search. But in a number of cases, RSI Search can solve applications that PatMax cannot:

• When using color images

• When the run-time images exhibit shear with respect to the trained model

• When using small models or model images (PatMax may be unable to train patterns from small images because they don't contain enough features)

• When run-time images contain significant texture (PatMax may run slowly if images have too many features)

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Search area	Select the area where search for a model. • All Image (default) Search area agrees with overall image area. • Centered Search area is the model area enlarged by a symmetrical frame. • Free Search area is defined by the user. **Frame X** Frame width. (default = 20) **Frame Y** Frame height. (default = 20)
Model	Defines tool's model shape. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape.
User origin	Allows to set the model origin in an arbitrary position, instead of the center of the model area.
Synthetic model	Model is created using a synthetic image shapes instead of using the reference image. **Model polarity** Polarity of the shapes represented in the synthetic model White on black background (default) White foreground (pixels within the shape) on black background. Black on white background Black foreground (pixels within the shape) on white background. **Model frame X (pixel)** symmetrical X frame to add to the width of the model shape. **Model frame Y (pixel)** symmetrical Y frame to add to the height of the model shape.

Tolerances and limits	
Check results count	The expected number of results • None No check. • Expected number Number of results must be equal to Num. of results to find. • Less than Number of results must be less then Num. of results to find. • Greater than Number of results must be greater then Num. of results to find.
Shape index	Enables or disables conformity limit condition. **Shape index limit** Minimum acceptable shape index. (default = 1.0)
Position offset	Enables or disables position tolerance. **Elliptical Region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes.(default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Angle offset	Enables or disables orientation tolerance. **Angle+** Tolerance for positive angles. (default = 360; min = 0; max = 360) **Angle-** Tolerance for negative angles. (default = 360; min = 0; max = 360)
Relative Contrast	Relative contrast is defined as the scale factor of the standard deviation of the runtime grey levels as compared to the standard deviation of the training time grey levels. **Tolerance-** Lower limit for relative contrast.. (default = 0.00; min = 0.00; max = 1.00) **Tolerance+** Upper limit for relative contrast. (default = 0.00; min = 0.00; max = FLT_MAX)
Relative Brightness	Relative brightness is defined as the scale factor of the mean of the runtime grey levels as compared to the mean of the training time grey levels. **Tolerance-** Lower limit for relative brightness.. (default = 0.00; min = 0.00; max = 1.00) **Tolerance+** Upper limit for relative brightness. (default = 0.00; min = 0.00; max = FLT_MAX)
Shear	Shear angle of the located model in the client coordinate system of the runtime image. **Tolerance-** Lower limit for shear angle. (default = 0; min = -180; max = 180 **Tolerance+** Upper limit for shear angle. (default = 0; min = -180; max = 180)

Analysis	
Max. number of results	Number of model instances to find. (default = 1)
Acceptance threshold	The acceptance level for the global searching score. Results with scores below this limit are not accepted. (default = 0.30)
Confusion	The confusion threshold is the score above which any match is guaranteed to be an instance of the model; all matches with scores greater than or equal to the confusion threshold are considered to be valid. The Search tool uses the confusion threshold to speed the search process. If you are searching for a single instance of the model in an image, as soon as Search tool finds an instance with a score above the confusion threshold, it stops searching and returns the location of the match. If CNLSearch does not find a match with a score above the confusion threshold, it locates all the matches with scores above the acceptance threshold and returns the location of the match with the highest score. (default = 1.0)
Angle	Enables or disables angle search range. (default = No) **Angle min** Lower limit. (default = -180) **Angle max** Upper limit. (default = 180)
Scale	Enables or disables scale range. (default = No) • None • Simmetric • Only X • Only Y • Shear **Min** Lower limit in %. (default = 50) **Max** Upper limit in %. (default = 200)
Ignore polarity	You can specify whether to ignore the polarity of contours. A white square on black background will be found also if it becomes a black one on white background.
Pattern granularity	RSI Search uses large features first to do a pre-localization of the object and then refines the search using fine features. Granularity is expressed as the radius of interest, in pixels, within which features are detected. • Automatic (default) The system perform, at train time, an estimate of the optimal settings for Fine and Coarse granularity. • Manual You define fine and coarse granularity to use to train the pattern and to run. **Fine** The smallest granularity used to detect features in the training image or shape description. (default = 1) **Coarse** The largest granularity used to detect features. (default = 4)
Operation Mode	This enumeration defines constants that specify when the template images are generated. • Generate templates Templates are generated at training time, • Run-time models Templates are generated at run time.
Model compression	This enumeration defines constants that specify what type of compression to apply to the trained model. (default = None) • None Do not compress the trained model. • Lossy Compress the trained model using a lossy compression method. This method produces the fastest search, but may miss some model instances.

Analysis	
	• Lossyless Compress the trained model using a lossless compression method. This method may result in a faster search than using eCompressionNone, but without the risk of failing to find some instances.
Accepted overlap (%)	Percentage overlapping area needed to PatMax before it considers multiple overlapping instances as a single instance. (default = 0.00)
Angle overlap	Angle within which PatMax treats multiple overlapping instances as a single instance. (default = 360)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance between specification and result points.
Angle	Angle of the tool. **Angle offset** Offset between the tool's specification orientation angle and tool's result orientation angle.
Scale X	Scale value in the X axes.
Scale Y	Scale value in the Y axes.
Score	Match quality index. A value from 0 to 1 indicating the global level of conformity between the model and the pattern found.
Relative Contrast	Scale factor of the standard deviation of the runtime grey levels as compared to the standard deviation of the training time grey levels.
Relative Brightess	Scale factor of the mean of the runtime grey levels as compared to the mean of the training time grey levels.
Shear	Shear angle of the located model in the client coordinate system of the runtime image.

IMAGES

Images	
Model	Image of the trained model .
Mask	Mask image to apply. White pixels are care pixels. Black pixels are don't care.

CONFIGURATION

This tool is included into the library UvfCvl.

Search

OVERVIEW

The purpose of Search is to locate and measure the quality of one (or more) previously trained model.

The search operation measures how a part in an image matches a previously trained model of that part. The pattern to be searched is the distribution of its grey levels. Search locates the part finding the area of the image most similar to the trained model.

The score indicates how close a match exists between the trained image and the image whose location was returned. Scores ranges from 0.0, indicating no similarity between the model and the feature, to 1.0, indicating a perfect match. Trained image and inspected one should not be rotated to each other and of same scale.

SETTINGS

Options	
Enable	Enables or disables the tool. (default = Yes)
Search area	Select the area where search for a model. • All Image (default) Search area agrees with overall image area. • Centered Search area is the model area enlarged by a symmetrical frame. • Free Search area is defined by the user. **Frame X** Frame width. (default = 20) **Frame Y** Frame height. (default = 20)
Model	Defines tool's model shape. • Circle Circular shape. • General rectangle (default) Rectangular shape. • Annulus Annulus shape. • General polygon General polygon shape. • CAD (Closed ROI) Closed shape imported from a CAD file.
CAD file	CAD file name.
Layer name	Lists the layer names defined in the selected CAD file. **Connection tolerance** Distance between close segment points to be considered as connected.. (default = 0) **Normalize XY weight** If checked weight is distributed for 50% to X features and for 50% to Y features. If unchecked all features have the same weight. (default = No)
User calibration	If checked user defines parameters for CAD shapes calibration. Otherwise tool calibration is used. **Axes X rotation** Rotation in the X axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Axes Y rotation** Rotation in the Y axes to be applied to the CAD shape. (default = 0; min = -360; max = 360) **Scale X** Scale variation in the X axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1) **Scale Y** Scale variation in the Y axes to be applied to the CAD shape. You express scale value as a multiplier value. (default = 1)
User origin	Allows to set the model origin in an arbitrary position, instead of the center of the model area.
Synthetic model	Model is created using a synthetic image shapes instead of using the reference image. **Model polarity** Polarity of the shapes represented in the synthetic model • White on black background (default) White foreground (pixels within the shape) on black background. • Black on white background Black foreground (pixels within the shape) on white background.

Options

Model frame X (pixel)
symmetrical X frame to add to the width of the model shape.
Model frame Y (pixel)
symmetrical Y frame to add to the height of the model shape.

Tolerances and limits	
Check results count	The expected number of results • None No check. • Expected number Number of results must be equal to Num. of results to find. • Less than Number of results must be less then Num. of results to find. • Greater than Number of results must be greater then Num. of results to find.
Shape index	Conformity limit for acceptable result. **Shape index limit** Minimum acceptable shape index. (default = 1.0)
Position offset	Enables or disables position tolerance. **Elliptical Region** Use an elliptical region area instead of a rectangular one. Position XY tolerances are the semi-axes the ellipse or the semi-size of rectangle. **Position X tolerance** Position tolerance in the X axes. (default = 10) **Position Y tolerance** Position tolerance in the Y axes. (default = 10)
Contrast ratio	Enables or disables contrast ratio condition. **Tolerance -** Negative tolerance. **Tolerance +** Positive tolerance.

Analysis	
Max. number of results	Number of model instances to find. (default = 1)
Multimodel	This button shows Multimodel parameters settings.
Acceptance threshold	The acceptance level for the global searching score. Results with scores below this limit are not accepted. (default = 0.30)
Confusion	The confusion threshold is the score above which any match is guaranteed to be an instance of the model; all matches with scores greater than or equal to the confusion threshold are considered to be valid. The Search tool uses the confusion threshold to speed the search process. If you are searching for a single instance of the model in an image, as soon as Search tool finds an instance with a score above the confusion threshold, it stops searching and returns the location of the match. If CNLSearch does not find a match with a score above the confusion threshold, it locates all the matches with scores above the acceptance threshold and returns the location of the match with the highest score. (default = 1.0)

More

Click here to access the More section description.

RESULTS

Results	
Decision	Pass/Fail decision of a tool, including multiple results if any.
Processing time	Tool processing time in msec.
Position X	X position coordinates. The position is referred to the origin point of the tool. **Offset X** Offset between the tool's specification X position and tool's result X position (specification reference system).
Position Y	Y position coordinates. The position is referred to the origin point of the tool. **Offset Y** Offset between the tool's specification Y position and tool's result Y position (specification reference system).
Offset length	Distance between specification and result points.
Score	A value from 0 to 1 indicating the global level of conformity between the model and the pattern found.
Contrast ratio	A measure of the contrast of the pattern in relation to the model. 1.0 indicates a contrast equal to the trained pattern. Higher or lower values indicate higher or lower contrast.

IMAGES

Images	
Model	Image of the trained model .
Mask	Mask image to apply. White pixels are care pixels. Black pixels are don't care.

CONFIGURATION

This tool is included into the library UvfCvl.

5. Communication

5.1 Communication

The Communication step is used to define inspection results for open data access and exchange (OPC) and communicate data to and from other devices, such as a robot or Programmable Logic Controller (PLC)/Motion Controller (MC).

5.2 PROINSPECT OPC-UA Server

5.2.1 Overview

PROINSPECT OPC-UA Server is an application, apart from PROINSPECT, that allows to publish data via the OPC-UA standard.

The Server and PROINSPECT communicate with each other through a message queuing service based on Microsoft Queue (MSMQ).

The data that can be published includes:

- Status and diagnostic data related with PROINSPECT system.
- Statistical data related with the running inspection recipe.

Status and diagnostic data are not modifiable by the user and includes:

- Machine Name: unique identifier of the machine.
- Actual Recipe: current running recipe.
- Statistics Reset: an input variable used to reset statistical data stored in the Server.
- Watchdog: a value incremented for each message sent to indicate system activity.

Statistical data can be configured by mapping one or more Statistics, previously configured in PROINSPECT, to user-defined OPC-UA variables.

Each PROINSPECT statistic value is indeed converted into a set of OPC-UA variables related with the statistic itself:

- CP
- CPK
- Max
- Mean
- Min
- Nominal
- Standard Deviation
- Sum
- Sum Square
- Tolerance Min
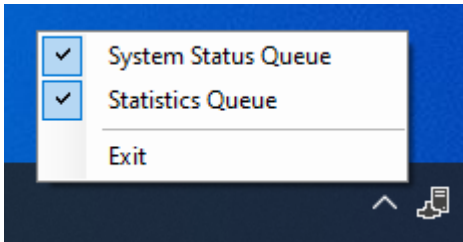- Tolerance Max
- Total Inspected
- Total Rejected

5.2.2 Usage

PROINSPECT OPC-UA Server runs as a background application and its icon is visible in the Windows tray icon area.
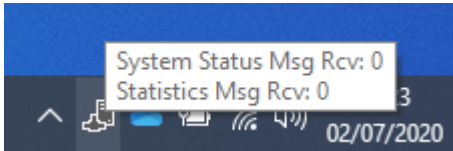

OPC-UA Server icon

The data fetched from each queue can be disabled or enabled independently through the contextual menu of the application.
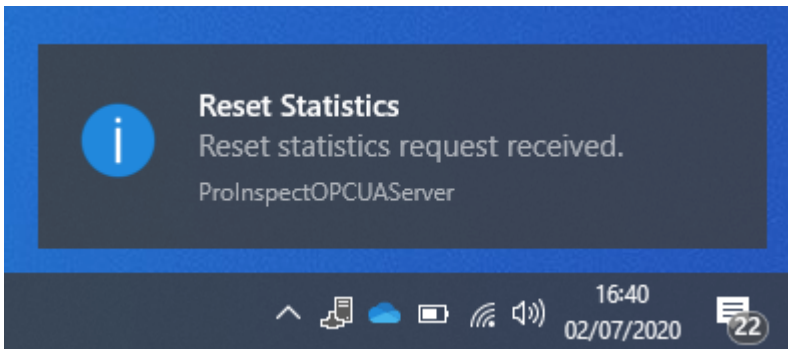
OPC-UA Server options

The number of messages fetched from each queue can be monitored by moving the mouse over the application icon.

OPC-UA Server queue status

The Server warns the user in case of particular events or anomalous conditions.

OPC-UA Server notifications

5.2.3 Configuration

There are three main components that must be installed and configured to run PROINSPECT OPC-UA Server:

• Microsoft Queue Service (MSMQ) Server

• PROINSPECT UvpQueueUIS plugin

• PROINSPECT OPC-UA Server application

Microsoft Queue Service (MSMQ) Server

To install Microsoft Queue Service (MSMQ) Server open:

```
Control Panel > Programs and functionalities > Turn Windows features on or off > Microsoft Message Queue (MSMQ) Server > Microsoft Message Queue (MSMQ) Server Core
```
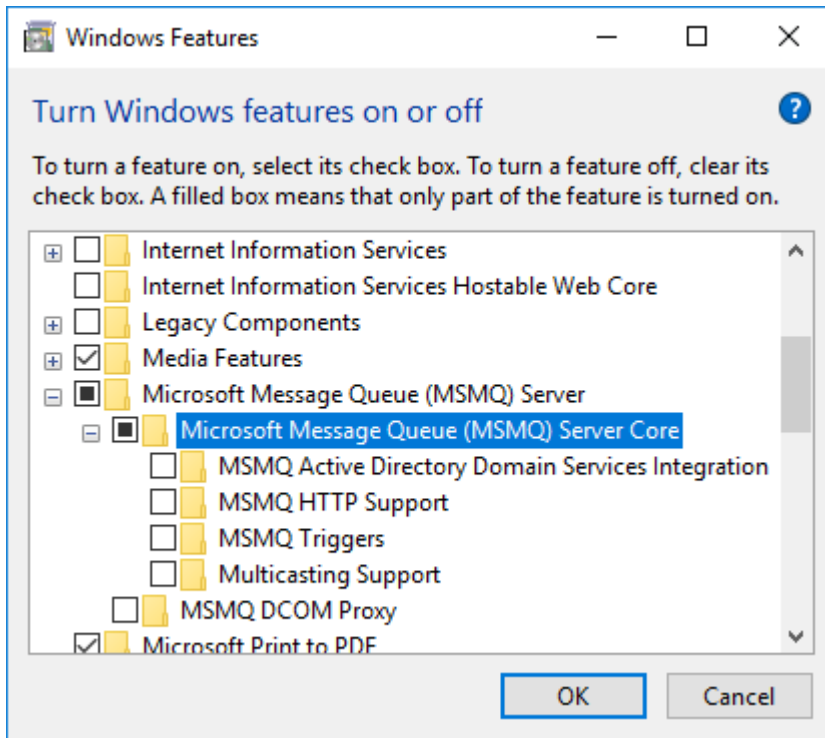
Microsoft Message Queue (MSMQ) Server installation

Microsoft Message Queue (MSMQ) Server has a default storage limit of 100 MB. Once the limit is reached new messages will be discarded. Note that this limit is global for all the queues present on the system. To change this limit open:

```
Computer Management > Services and Applications > Message Queuing > Properties.
```
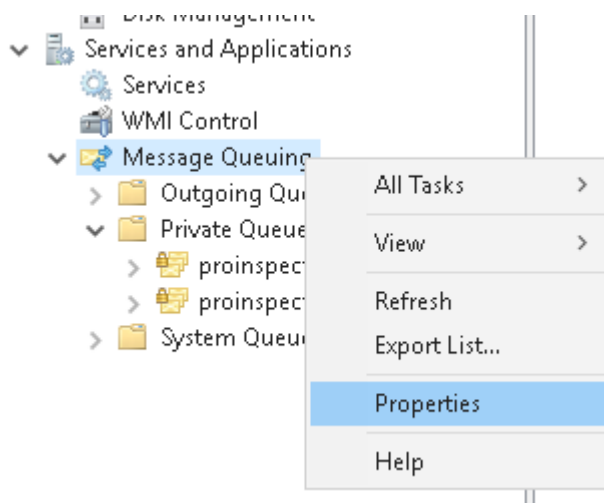

Message Queuing Properties

Define the limit message storage (KB).
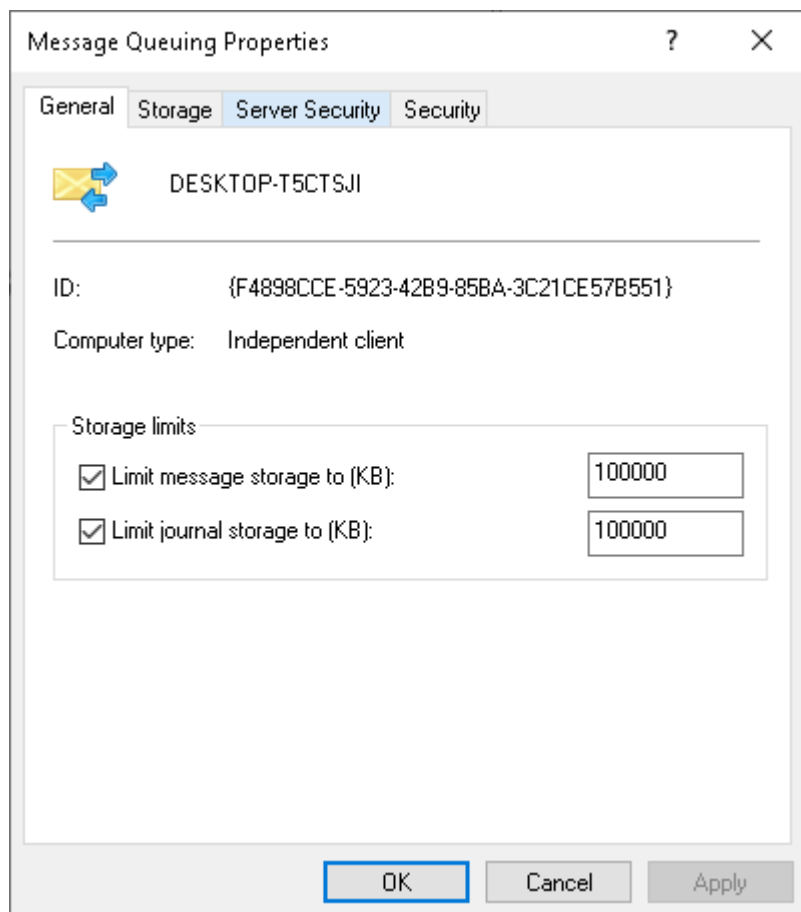
MSMQ Limit message storage configuration

PROINSPECT UvpQueueUIS plugin

Add UvpQueueUIS plugin's configuration.

```
UvpQueueUIS configuration is stored in Options > Queue.
```

Setting	Default value	Description
StatsQueueEnable	1	Enable (1) or disable (0) Statistics queue
StatsQueueName	PROINSPECT Statistics Sessions	Statistics queue name
SystemStatusQueueEnable	1	Enable (1) or disable (0) System Status queue
SystemStatusQueueName	PROINSPECT System Status	System Status queue name
SystemStatusQueueUpdateTime	1	Interval (in seconds) to send each system status message

Table 1. UvpQueueUIS configuration

PROINSPECT OPC-UA Server application

Run OPCUAServer_[version].exe to install the application.
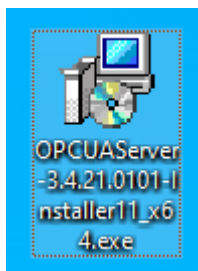
PROINSPECT OPC-UA Server installer

Once the Server is installed there are two configuration files that must be edited:

• OPC-UA Server configuration file

• Statistics mapping file

Open with a text editor OPCUAServer.exe.config. The file is stored into the installation folder.

Setting	Default value	Description
SystemStatusQueueName	PROINSPECT System Status	System Status queue name. Must match UvpQueueUIS SystemStatusQueueName registry key
StatisticsQueueName	PROINSPECT Statistics Sessions	Statistics queue name. Must match UvpQueueUIS StatsQueueName registry key
OPCMappingFile	.\Data\mapping.ini	Variables mapping file
StatisticsQueueFetchTime	5000	Interval (in msec) to fetch data from the Statistics queue
SystemStatusQueueFetchTime	5000	Interval (in msec) to fetch data from the System Status queue

Table 2 PROINSPECT OPC-UA Server configuration

Statistics mapping file contains the list of the published OPC-UA variables and the mapping with the statistic from the recipe. By default, the file is stored into Data sub-folder.

Each variable must be defined after section [Process] as follow:

OPC Variable = PROINSPECT Statistic Name

Example:

[Process]	
LID.Position	Lid Position
LID.TE	Lid Te
LID.Short Shot	Lid Short Shot
LID.Flashes	Lid Flashes

6. Appendix

6.1 Bar code reader

6.1.1 Overview

PROINSPECT supports the use of barcode readers to perform the recipe change.

There are two modes of operation of PROINSPECT:

- Recipe
- Station

Depending on the mode, a recipe or station will be loaded when a barcode is selected.

For setting the mode see #ModalitàStazione.
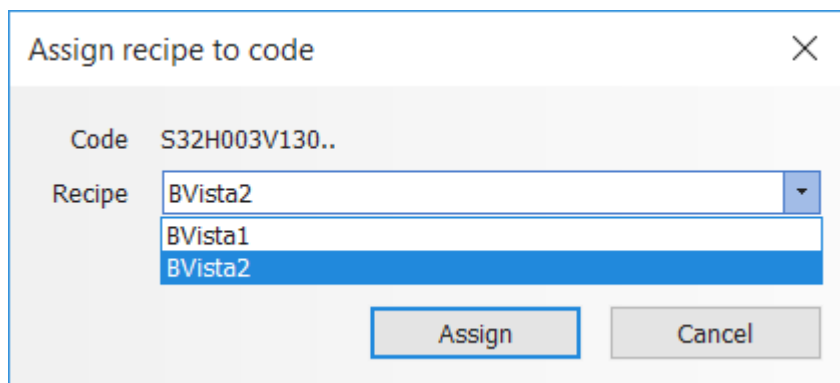
6.1.2 Assign recipe to a code

Access the menu dialog

```
Dataman > Assign…
```

Recipe Mode

In recipe mode the window presents the list of available recipes. The recipes are those present in the configured Data folder.

If you want to change the recipe immediately, check the Change recipe on exit flag.

Press the Assign button to associate current read code to the selected recipe.

Station mode

In station mode the window presents the list of available stations and for each station the list of available recipes.

The stations are the list of folders found in the configure Data folder.

In the Station selector you choose the station. In the Recipe selection you assign the recipe file to the selected station.

The recipe selection presents the list of recipes for the selected station.

Select the recipe.

If you want to change the recipe immediately, check the Change recipe on exit flag.

6.1.3 Change recipe

The dialog is accessed from the menu

```
Dataman > Change
```
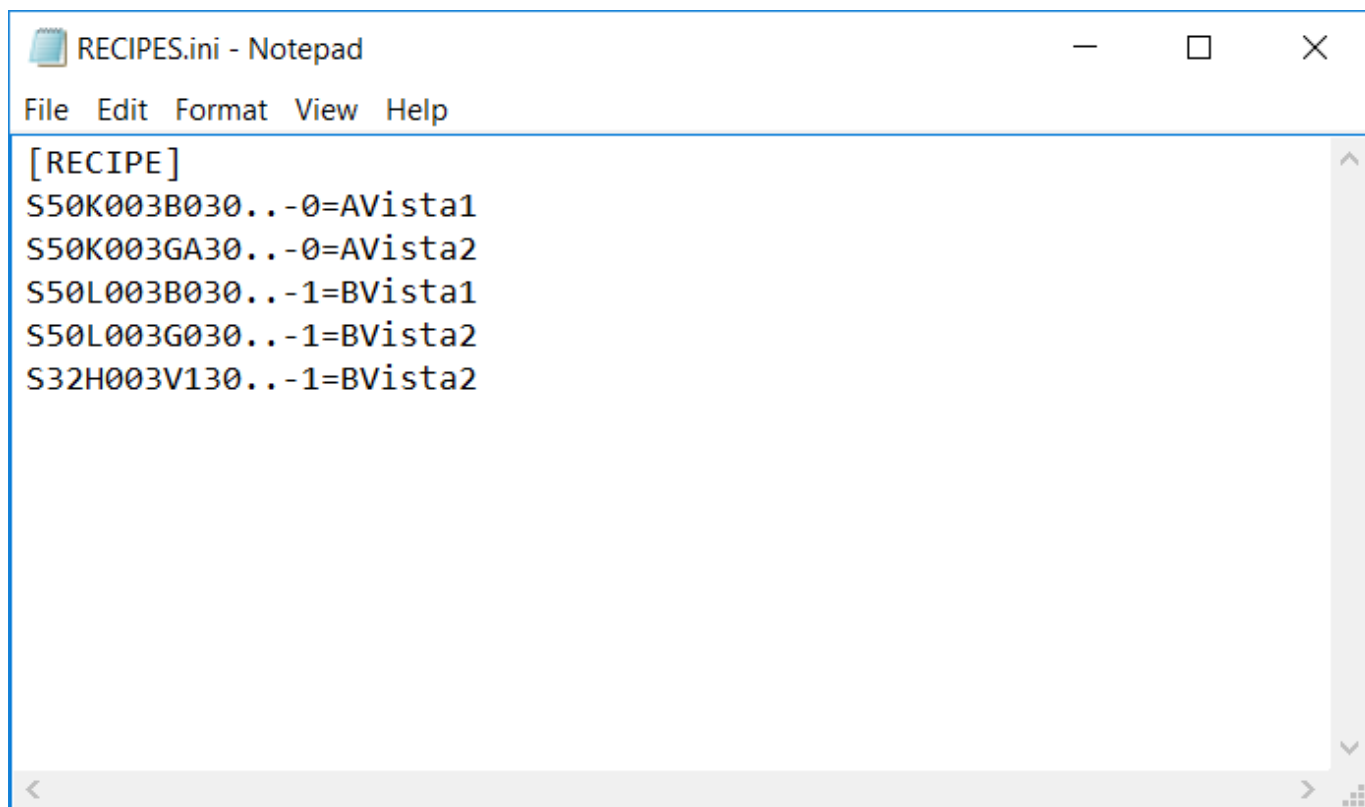

Press Change recipe button to load the assigned recipe.

6.1.4 Recipe List

This window shows the contents of the RECIPES.ini file which contains the association CODE/RECIPE or CODE-STATION / RECIPE. Path and name of this file is configured in the registry variable.

The file must exist.

```
RECIPES.ini - Notepad

File  Edit  Format  View  Help

[RECIPE]
S50K003B030..-0=AVista1
S50K003GA30..-0=AVista2
S50L003B030..-1=BVista1
S50L003G030..-1=BVista2
S32H003V130..-1=BVista2
```

Recipe mode

Each line in the file corresponds to an association formatted in the following way:

```
<code>=<recipe name>
```

Station mode

Each line in the file corresponds to an association formatted in the following way:

```
<code>-<station index>=<recipe name>
```

6.1.5 Configuration

The barcode reader functionality is contained in the PROINSPECT CPDatamanAdapterUIS plugin.

Load this plugin as usual. See CPDatamanAdapterUIS .

Variable	Value	Description
CustomPlugIns\CPDatamanAdapter\Adapter0\Parser\Terminator		0x0a (LF)
UserInterface\UI CPDatamanAdapters\ShowRecipeAssign	Permission Levels	Visibility of Recipe Assign window
UserInterface\UI CPDatamanAdapters\ShowRecipeSelection	Permission Levels	The visibility of Change Recipe window
UserInterface\UI CPDatamanAdapters\ShowRecipeList		The visibility of Recipe List file button
CustomPlugins\CPDatamanAdapter\RecipeCodesFile		Path and name of RECIPES.ini file

6.2 VC200

6.2.1 Vision Controller VC200

Overview

VC200 is a fixed logic controller used to synchronize PROINSPECT software environment to physical actuators used in automation project.

VC200 includes five different area of interest:

1. General I/O with PCL input and output

2. Four "Trigger – Strobe" camera sections

3. Dedicated power supply for special devices such as solenoids or valves

4. Four encoder quadrature input devices

5. Communication interface by a peer to peer Ethernet link.

VC200 is not a standalone product, but it must be used as a supervisor extension of RTVC100Service.
RTVC100Service is installed on PC side and by ethernet port it is connected to VC200 external device

Usage

VC200 is used to track each inspected part in a sequence of acquisitions and responsible of act some handling devices. Tracking is made possible by use of encoder or timing delay in order to fire trigger at right moment under camera places. Common area of interest is tracking inspected parts on linear belt or rounding table. Part is detected by an optical or electronic sensor: it triggers VC200 input line and displaces new events during the time or space distance requested. Camera pictures are usually triggered by hardware signal from Trigger-Strobe camera section. Each photo taken is now ready to be marked by id part code and it can be easily collected to be inspected. At the end of acquire and inspection phase VC200 acts as a standard PLC in order to notify by I/O or devices result of part inspection.

VC200 supports at maximum of four independent tracking processes ruled by the four encoders on board.

Multiple VC200 can be used at the same time. Each device has to be connected to a dedicate peer to peer ethernet port. VC100Service is able to serve a maximum number of four instances.

Configuration

Software to be installed:

1. RTVC100ServerService (one service per VC200 linked)

2. CPRTVC100UIS plugin extension, no registry configuration required

3. UvcIOPartIdSMemDevice - I/O device
   (multiple config. required in case of more than one VC200 device)

4. VC200 firmware 1.5 or compatible VC100 firmware Ed 3.4

   (VC200 has to be setup according to number of services)

6.2.2 CPRTVC100

Overview

CPRTVC100 plugin is used as front end for RTVC100ServerService.
No extra registry configuration is required for single VC100 or VC200 device

This is composed by five report panels:

1. I/O Report

2. Part-ID Report

3. Log

4. Diagnostic

5. Run

and one general setting:

1. VC100 general settings

IO Report Usage:

RTVC100 I/O Report		Status	CntOn	CntOff	TsOn	TsOff	EncOn	EncOff	PartId
Update	In[1]	true	56	55	875836	870987	0	0	"0"
Reset ☐ Absolute	In[2]	false	0	0	0	0	0	0	"0"
In: 0000000000000001	In[3]	false	0	0	0	0	0	0	"0"
Out: 0000000000000000	In[4]	false	0	0	0	0	0	0	"0"
Enc1: 21898900	In[5]	false	0	0	0	0	0	0	"0"
Enc2: 875956	In[6]	false	0	0	0	0	0	0	"0"
Enc3: 0	In[7]	false	0	0	0	0	0	0	"0"
Enc4: 0									

Update is available in order to refresh data from device. This panel cannot be auto updated.

Each row depicts state of input or output line, time and encoder position if enabled.
Line is tagged by PartId code only if executed by scheduler or engaged as First Station.

PartID Report

RTVC100 PartId Report		Status	MSName	PartId	Votes	Size	Triggers	Results	Result due	Reject	Pass	Check station	CheckRej
Update	[0]	"FAIL"	"2.StateAcquireAndInspect…	"101000b"	"0/6 <invalid>"	202.0	1035.0		0.0				
Clear							2245.0						
Process 01 ▼							3480.0						
☐ Encoder							4725.0						
	[1]	"GOOD"	"3.StateResults"	"101000a"	"6/6 <0000>"	201.0	1035.0	1045.0	9500.0				
							2245.0	2257.0					
RTVC100-0 ▼							3480.0	3481.0					

Update is available in order to refresh data from device. This panel cannot be auto updated.
Device and Process can be selected using combo box on left panel side.

This table is used to extract item information during tracking station process.
Major information is time based because of execution time inspection check.

Log Report

Update is available in order to refresh data from device. This panel cannot be auto updated.

Device can be selected using combo box on left panel side.

This report is used to display log info from service. Panel can export event list to cvs file format.

Diagnostic Report

	name	last [msec]	[num] min, mean, max	Insp. last[msec]	Insp. ([num] min, mean, max)	Result last	Result ([num] min, mean, max)	last [enc]	[num] min, mean, max
Process 1	Pulse	204.00	[59] 199.00, 201.80, 207.00					0.00	[0] 0.00, 0.00, 0.00
	Cycle			5047.00	[57] 5030.00, 5053.51, 5093.00			0.00	[0] 0.00, 0.00, 0.00
View 1	Camera Trg O5	1035.00	[59] 1035.00, 1035.00, 1035.00	11.00	[59] 7.00, 11.20, 66.00	1046.00	[59] 1042.00, 1046.20, 1101.00		
View 2	Camera Trg O6	2245.00	[59] 2245.00, 2245.00, 2245.00	15.00	[59] 11.00, 14.83, 42.00	2260.00	[59] 2256.00, 2259.83, 2287.00		
View 3	Camera Trg O7	3480.00	[59] 3480.00, 3480.00, 3480.00	2.00	[59] 0.00, 2.32, 5.00	3482.00	[59] 3480.00, 3482.32, 3485.00		
View 4	Camera Trg O8	4725.00	[59] 4725.00, 4725.00, 4725.00	3.00	[59] 0.00, 1.24, 3.00	4728.00	[59] 4725.00, 4726.24, 4728.00		
View 5	Camera Trg O9	5945.00	[59] 5945.00, 5945.00, 5945.00	3.00	[59] 2.00, 3.58, 7.00	5948.00	[59] 5947.00, 5948.58, 5952.00		
View 6	Camera Trg O9	5945.00	[59] 5945.00, 5945.00, 5945.00	1.00	[59] 0.00, 1.85, 4.00	5946.00	[59] 5945.00, 5946.85, 5949.00		
	WakeUp					9500.00	[59] 9500.00, 9500.00, 9500.00		

This panel is auto updated.

This report is used to display statistics info from service.

Each row depicts relative signal execution in time (min, mean, max) according to last samples collected. Max number of samples is limited to 1024.

Here is a list of major point of reference:

Process	First Station pulse duration on and cycle time.	Pulse duration range tests trigger sensor accuracy. Cycle time is used to check max elapsed time for vision inspection.
View	Camera trigger position, inspection time, "setResult" time position.	Max inspection time value should be less than min Cycle time. Result position must be less than WakeUp time position
WakeUp	First station relative wakeup execution.	This position has to balance inspection time and camera execution. Wakeup must be prior each handling event.
Reject	First station relative handling execution.	Manual tuning is need to verify handling execution
Check station	Time delay from Input check line signal.	Check station should be inside Pulse duration signal range. Check presence is made by a single point of detection.

Run Report

RTVC100 Run			×
Process 1	Total	58	
	Reject O15	1 (1.72 %)	
	Reject O14	0 (0.00 %)	
	Reject O16	0 (0.00 %)	

This panel is auto updated.

This report is used to display line counting info per process.

Settings

Process 1		
Trigger offset (I1)		0
Timing mode		Clock
Trigger Mode		Leading edge
Camera trigger position (O5)		1,035
Camera trigger position (O6)		2,245
Camera trigger position (O7)		3,480
Camera trigger position (O8)		4,725
Camera trigger position (O9)		5,945
Result due position (CB1)		9,500
Enable ejection	☑	Yes
Reject position (O15)		14,265
Reject position (O14)		12,485
Reject position (O16)		16,000
Pass position (O13)		10,595
Reject station priority		3,2,1
Enable check	☐	No
Check station position (I2) (CB2)		11,800
Check station position (I3) (CB3)		13,643
Check station position (I4) (CB4)		15,486
Check station alarm position (O10)		12,800
Check station alarm position (O11)		14,600
Check station alarm position (O12)		16,500
General		
Save		rtvc100processserver0.ini*
Check configuration		Ok
Flush/Update channel		
Log mode		Errors
Log max queue length		200

Settings can be changed online from this interface.
When configuration meets your needed, you can save it into configuration file pressing Save button.

A Check configuration is made every time you change a time/encoder parameter.

This settings panel is designed only for advanced administrator users.

6.2.3 RTVC100ProcessServerService

Overview

RTVC100ProcessServerService is PC base service for VC100 or VC200 tracking device.

Multiple service instances can be used on single PC in order to arrange max four process per device.

RTVC100ProcessServerService installer is able to deploy all files needed also for multiple VC200 connected devices.

Usage

Service is responsible to serve process queue of events. These events are described as Station.

This is a list of Station events to be served:

1. First Station is responsible to acquire digital signal from external device. Rising edge and falling edge signal record the state of timing and encoding position.

2. Acquire and Inspect Station is a sort of multiple digital output sync trigger to camera devices.
   In different places are served all firing triggers to take picture of parts.

3. Wakeup Station is time critical event invoke by a callback when process has to take handling decision.

4. Handling Stations are multiple point of interest. Wakeup moment will take a single decision from this list. Usually good or multiple point of rejection can handle part out of their process.

5. Check Stations are available to verify right placement of items during their route.

SETTINGS

Service must be manually configured editing RTVC100ProcessServer0 file.

This file is subdivided into sections. A part from a General one, each section describes a fully Process.

[GENERAL]			
VC100IP	10.0.10.202	10.0.1.202	IP device
AlarmLines	0	1,…n	Output alarm lines
AlarmValues	0	0: OFF 1: ON	Output state due to alarm condition
Variable	Default	Range	Description

[PROCESS]			
FirstStationLine	1		Input Line - First Station
clockSel	0	0: timer 1: encoder1 2: encoder2	
InputsNormalPolarity	1	1: off2: on	
InputWakeUpResultLine	1		Callback Line – Wakeup Station
OutputTriggerLines	13,14,15,16		Camera Port or general Output Line
NumOfTLCPerTriggerLines	1,1,1,1		Num of cameras per trigger signal
InputEndOfPartIdLine	10		Callback Line – End of tracking Station
OutputDataReadyLine	2		(optional) Output Line delayed First Station
OutputRejectLines	9,10,11,12		Handling reject Stations
OutputRejectLinesPriority	3,2,1,4		Handling priority (less is more)
OutputPassLines	5		Handling good Station
InputCheckLines	2,3		Check Stations
OutputCheckLines	6,7		Output Alarm Line for each Check Station
Variable	Default	Range	Description

<XX> = 1..4

[OUTPUT]			
PositionOffset	1063	tick	Relative delay position from First Station
PulseDuration	5	msec	Relative pulse duration
Variable	Default	Range	Description

Enter one section for each line used in Process section

[CALLBACK]			
PositionOffset	500	tick	Relative delay position from First Station
Variable	Default	Range	Description

Enter one section for each line used in Process section