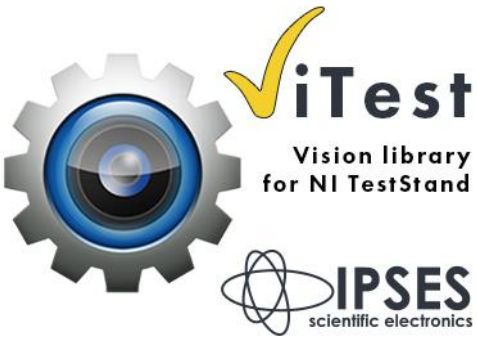
IPSES
scientific electronics

Vision Library
for
National Instruments TestStand™

Rel. 01.05.0000
(Product code: IVL)



CONCEIVING
PLANNING
DEVELOPMENT
IN SCIENTIFIC
ELECTRONICS

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[1] With the exclusion of shipping costs for and from IPSES's laboratories.

This guide describes the functioning of ViTest software Vision Library
Read carefully before using it
It is the responsibility of the technician to undertake all the safety rules provided by law and standard practice during the installation and the use.
For any information which is not contained in this guide, please contact:

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REVISIONS

Manual revision history

Revision/ Date	Description	Author
01.02.0000 March 2015	First version Released	Ricco A. Mancuso C.
01.03.0000 June 2015	Added License Activation Information	Ricco A.
01.04.0000 July 2015	Added IS Frame Grabbers steps description	Bernardin M.
01.04.0001 August, 2016	Added ISO 9001:20015 logo	Bottaccioli M.
01.05.0000 May, 2020	Added installer description. Added FLIR Blackfly GigE Steps description.	Errigo D.

GENERAL FEATURES

ViTest vision library implements a number of features for imaging acquisition, analysis and processing directly usable in National Instruments TestStand.

The library functions are configured as TestStand StepType and included in a specific TypePalette.
Each step has an edit mode by which, in a simple and graphic way, it is possible to configure parameters.

The library already includes a driver for the acquisition and control of the following devices:

- uEye series camera by IDS Gmbh.
- Frame Grabbers by The Imaging Source Europe GmbH
- Blackfly GigE camera by FLIR Systems Inc

This drivers is capable of supporting multiple cameras simultaneously. Anyway, the analysis algorithm is independent by the hardware, so it is possible to manage other kind of industrial cameras. Please contact IPSES for the implementation of your specific camera in the library at support@ipses.com or calling 0039 02 39449519.

The library also contains a number of examples of use.

Installation

Terminate any running software, particularly TestStand. Execute the *IVL_Setup_LV14_TS14_Full_xx.xx.xx.exe* file (where xx.xx.xx is the number of the version), then follow the automatic procedure steps.
At the end of the process, you must restart your PC.
The library will be installed in *C:\IPSES_Lib\ImageLibrary* (it is not possible to change this path).
The installation requires administrator privileges for the user who executes it.

Requirements

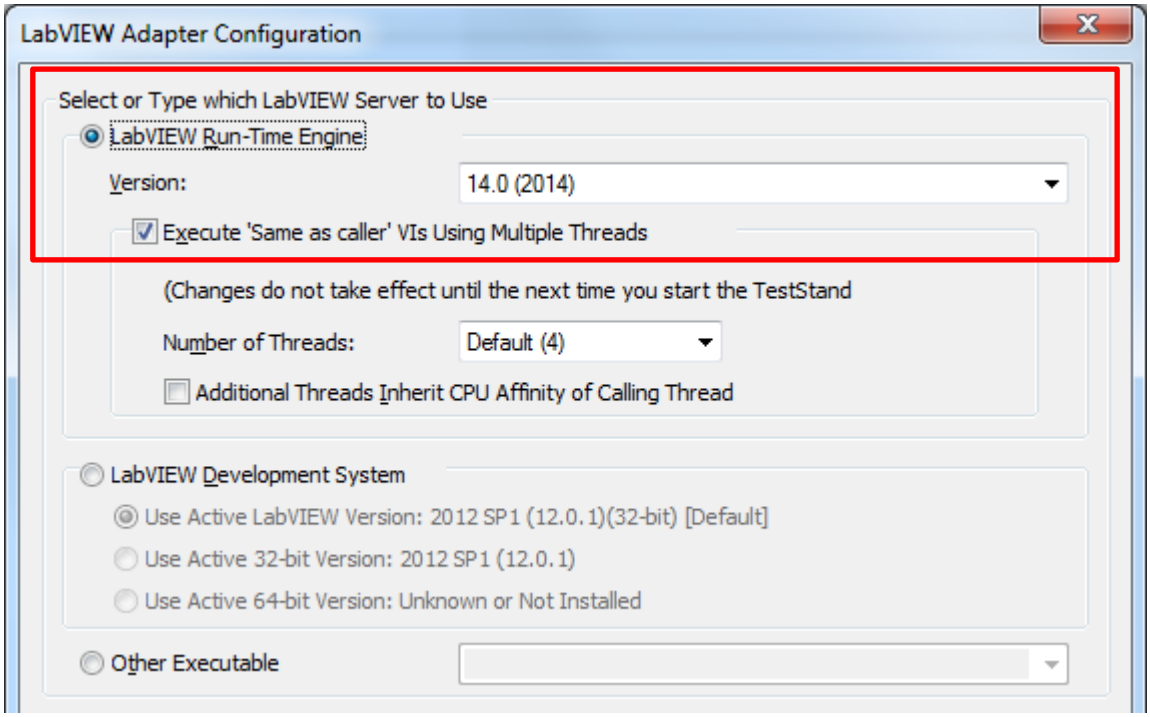
- Operating system Windows 7 32-64bit; Windows 8 and 8.1 32-64 bit; Windows 10 32-64bit
- TestStand 2014 SP1

TestStand configuration

In case you have only the license for NI Vision Run-time, it will be necessary, after installing the library, configure TestStand to use LabVIEW Run-time Engine instead of the Development System.

To perform this configuration, you must:

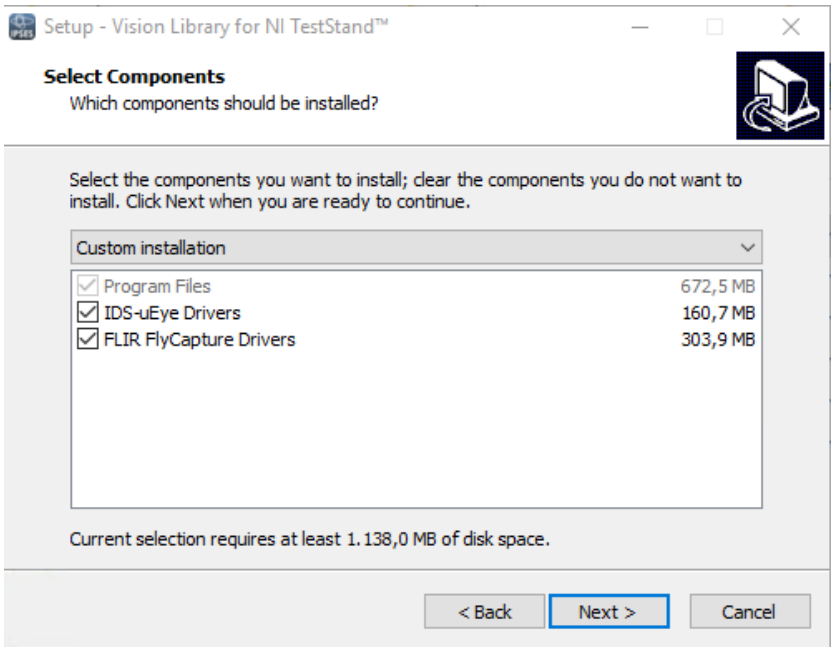
- Access the TestStand Configure - Adapter menu
- Select LabVIEW, then Configure
- Select LabVIEW Run-time Engine 2014 as shown in the picture below



Configuring the LabVIEW adapter of TestStand

In case, however, you have the license for NI Vision Development Module, you can configure the adapter either as described above, so that it will use LabVIEW Run-time, or configure it so to use the Development System, selecting the appropriate voice in LabVIEW Adapter Configuration screen.

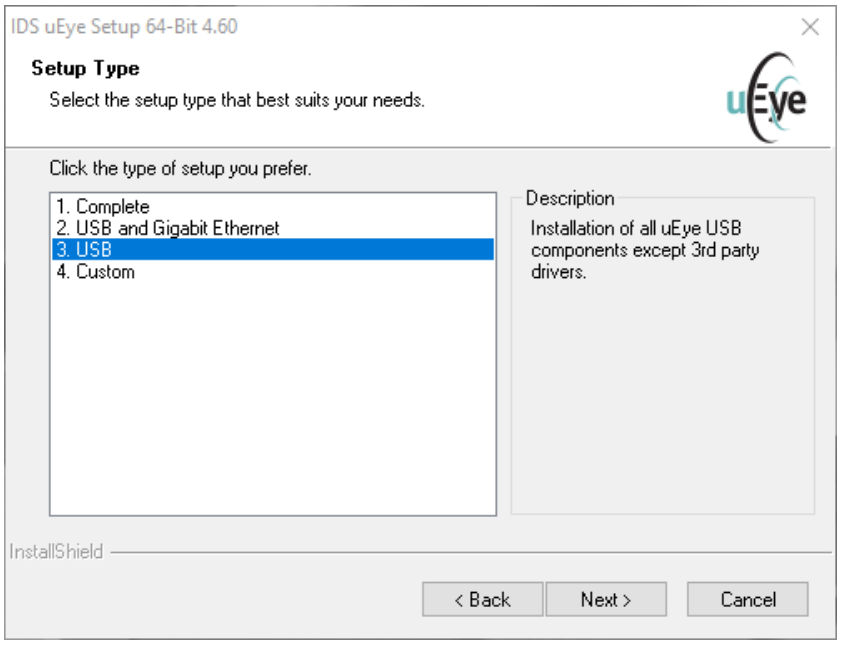
The installer will provide the correct Drivers for the cameras. You can choose what type of driver you are going to install on your system depending on the type of cameras.



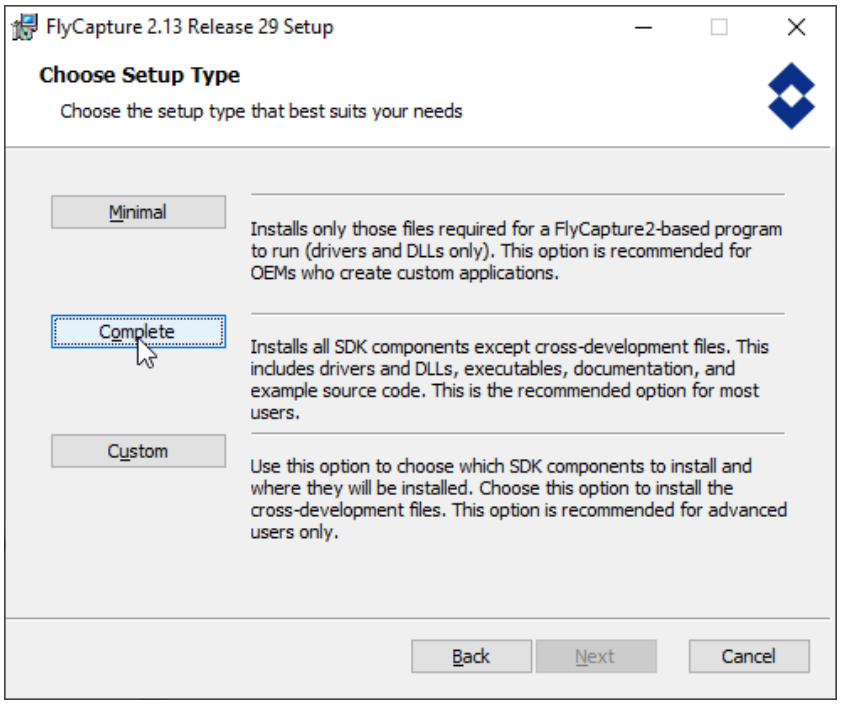
- IDS-uEye Drivers will install drivers for IDS USB cameras.
- FLIR FlyCapture Drivers will install drivers for FLIR blackfly GigE cameras.

The installation will automatically run the installer for the drivers.

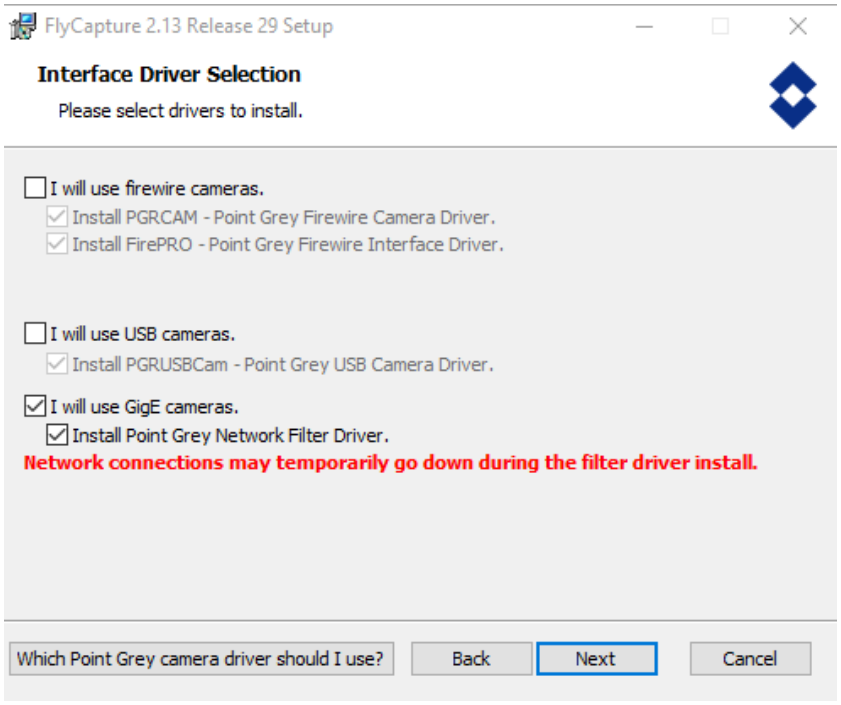
If you select IDS-uEye Drivers, make sure to select USB drivers installation on the page shown below



If you select FLIR FlyCapture Drivers, make sure to select the Complete installation on the page shown below



Than select only the GigE cameras on the Interface Driver Selection



Keep following the installation wizard program and restart the PC at the end.

IDS Camera Driver Configuration

Vision Library ViTest supports different industrial cameras from IDS uEye family. The driver of the library is able to simultaneously manage multiple cameras.
In order to configure the cameras to be used with the library you need to edit the file:

C:\IPSES_Lib\ImageLibrary\config\camera.ini

The following is the content of a camera.ini file that shows the configuration of two cameras:

```
[general]
CameraNumber = 2        Defines the total number of cameras to be managed

[camera_0]              section of the first camera
SN=4002844917           serial number of the first camera
SeqID = 1               sequential number to be associated with camera

[camera_1]              Section of the second camera
SN=4002844918           serial number of the second camera
SeqID = 2               sequential number to be associated with camera
```

The camera Serial Number is a fundamental parameter of the configuration. This number can be found printed on the back of the camera, or read through the software IDS Camera Manager.
It is useful, in case of configuration with more than one camera, set up a Camera Number via IDS Camera Manager for each camera and use the same number in the file camera.ini SeqID parameter in order to have a simple bind to distinguish the different cameras among them.

FLIR Camera Driver Configuration

Vision Library supports FLIR Blackfly GigE cameras. The driver of the library is able to simultaneously manage multiple cameras.
In order to configure the cameras to be used with the library you need to edit the file:

C:\IPSES_Lib\ImageLibrary\config\camera.ini

The following is the content of a camera.ini file that shows the configuration of two cameras:

```
[general]
CameraNumber = 2        Defines the total number of cameras to be managed

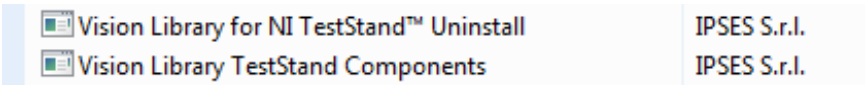
[camera_0]              section of the first camera
SN= 19502432            serial number of the first camera


[camera_1]              Section of the second camera
SN= 19502435            serial number of the second camera
```

The camera Serial Number is a fundamental parameter of the configuration. This number can be found printed on the back of the camera, or read through the software Point Gray FlyCap 2.

Uninstall

To uninstall the product go to Window Control Panel - Programs – Uninstall a Program.
In the installed program list search for Vision Library entries, like image below.



Select the first entry and click to Uninstall, repeat also for the second entry.

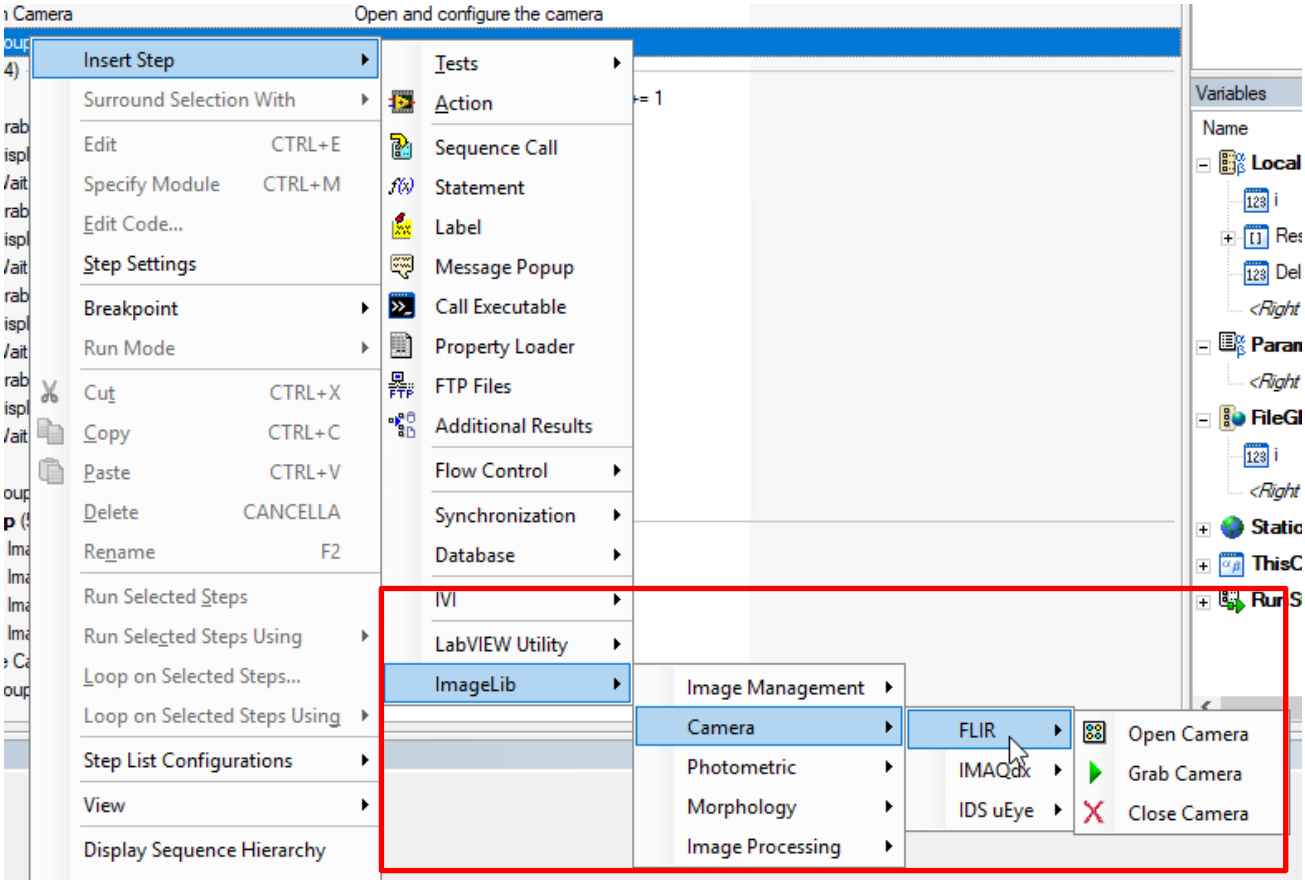
List of functions

The following is the list of library functions divided into categories

- Camera
  - OpenCamera
  - GrabCamera
  - CloseCamera
- Image Management
  - AllocateBuffer
  - DisposeBuffer
  - LoadImage
  - SaveImage
  - DisplayImage
  - HideImage
  - GetImageBuffer
- Image Processing
  - Filter
  - LookupTable
  - RotoTranslation
  - ExtractColorPlane
- Morphology
  - EdgeDetection
  - FindObject
  - PatternMatch
- Photometric
  - EvaluateColor
  - LightMeter

Using the Library

The functions of the Library are accessible directly from the TestStand Insert Step menu and are grouped in the ImageLib sub menu as shown in the figure below.



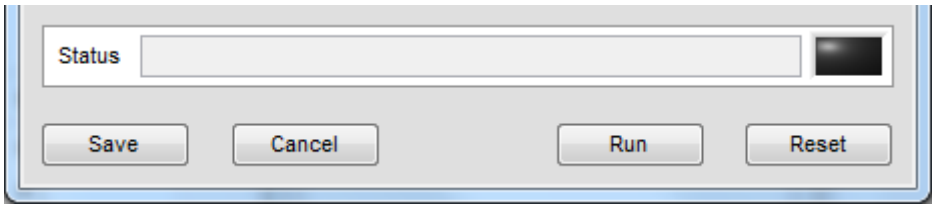
Menu for the inclusion of Step in TestStand sequence

After entering a Step of the Library into a sequence you can then configure the relevant parameters by pressing the Edit button in Step Setting or by pressing CTRL + E: the GUI configuration of Step will appear.

Here below a portion of the Edit panel of one Step parameters is shown. All panels for the Step Edit have common components, namely:

- Save: save configured parameters
- Cancel: cancels the changes and close the Edit panel
- Run: executes the Step
- Reset: resets all parameters of the Edit panel to their default values.

- Status: shows the status of execution of a Step after pressing the Run key, also referring any error that may occur.



Common Features of Step Editing

µEye Camera

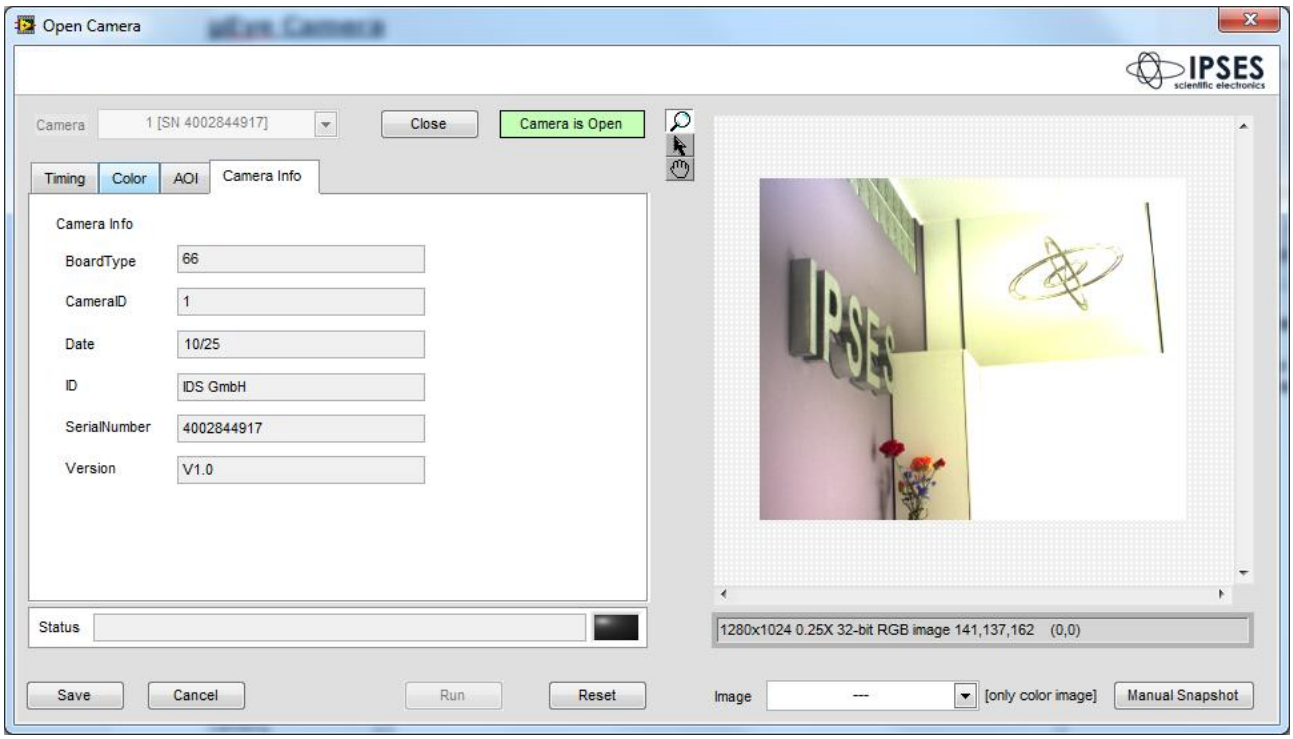
There are three steps in the management of the IDS uEye cameras and are:

- Open
- Grab
- Close

The overall philosophy of using these steps is to run only once, at the beginning of the test sequence, the Open step to open the connection with the camera and configure the relevant parameters. Then you can run as many times as needed the Grab step to acquire an image from the camera and performing step Close at the end of the sequence.

It is suggested that you follow this general scheme of use in order to obtain good performances in terms of execution times of the test sequences. Of course it is possible, in case you need to change some parameters such as acquisition ones, use several times the Open step during the sequence, but this should always be done after performing the Close step, if the connection with the camera is already open. Otherwise Open step will return an error.

Open Camera



This step opens a connection to the IDS uEye cameras specifying different parameters of image acquisition.
You can set exposure time, frame rate and pixel clock, the parameters of manual white balance and the ROI to be applied to the sensor.

The step supports multiple cameras simultaneously. The camera management is assigned to a specific driver that must be configured as described in the "**Configuring IDS Camera Driver**" section.

The step displays in real time the effect of parameter changes by viewing the image acquired from the camera.

Variabile TestStand	Description
Camera_SN	Camera Serial number to open the connection
Image	*Reserved parameter*
Framerate_2_50_fps	Acquisition Frame rate
Exposure_time_0_135_330_ms	Exposure time in ms
Pixelclock_5_49_MHz	Camera Pixelclock (use the IDS camera manager to calculate it)
Color_Gain.Red	Red gain
Color_Gain.Green	Green gain
Color_Gain.Blue	Blu gain
AOI.AOI_Height	ROI heigth
AOI.AOI_Width	ROI width
AOI.AOI_Y_Position	Start Y position on sensor ROI
AOI.AOI_X_Position	Start X position on sensor ROI
Camera_Handler	*Reserved parameter*

TestStand StepType: **ImageLib > uEye Camera > Open Camera**
Test type: **Action**
Result: **Result.Error (container)**

Camera Grab

This step allows you to capture an image from a specific camera. The camera must have been previously connected and configured via the Open Step, otherwise the step will return an error.
Through this step, you can change, for each grab, the exposure time of the camera.

TestStand Variable	Description
Camera_SN	Camera Serial number to open the connection
Image	Image buffer name to copy the image captured by the camera
Exposure_time_0_135_330_ms	Exposure time in ms

TestStand StepType: **ImageLib > uEye Camera > Grab Camera**
Test type: **Action**
Result: **Result.Error (container)**

Close Camera

This step allows you to close the connection with a camera specifying its Serial Number.

TestStand Variable	Description
Camera_SN	Camera Serial number to close the connection

TestStand StepType: **ImageLib > uEye Camera > Close Camera**
Test type: **Action**
Result: **Result.Error (container)**

FLIR Blackfly Camera

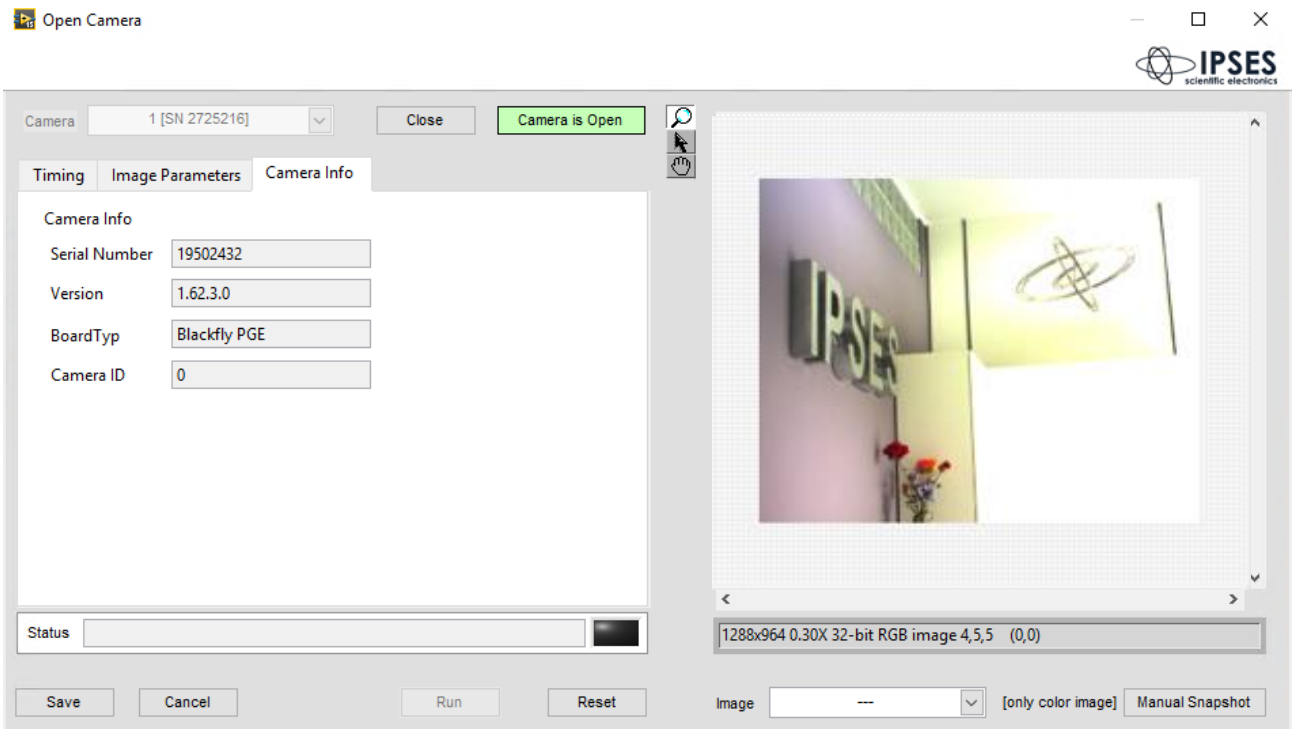
There are three steps in the management of the FLIR blackfly cameras and are:

- Open
- Grab
- Close

The overall philosophy of using these steps is to run only once, at the beginning of the test sequence, the Open step to open the connection with the camera and configure the relevant parameters. Then you can run as many times as needed the Grab step to acquire an image from the camera and performing step Close at the end of the sequence.

It is suggested that you follow this general scheme of use in order to obtain good performances in terms of execution times of the test sequences. Of course it is possible, in case you need to change some parameters such as acquisition ones, use several times the Open step during the sequence, but this should always be done after performing the Close step, if the connection with the camera is already open. Otherwise Open step will return an error.

Open Camera



This step opens a connection to the FLIR blackfly cameras specifying different parameters of image acquisition.

The step supports multiple cameras simultaneously. The camera management is assigned to a specific driver that must be configured as described in the "**Configuring FLIR Camera Driver**" section.

The step displays in real time the effect of parameter changes by viewing the image acquired from the camera.

Variabile TestStand	Description
Camera_SN	Camera Serial number to open the connection

Image	*Reserved parameter*
Exposure	Exposure
Shutter	Shutter time in ms
Framerate	Acquisition Frame rate
ExposureAuto	Enable/disable automatic exposure
ShutterAuto	Enable/disable automatic shutter
FramerateAuto	Enable/disable automatic framerate
Brightness	Brightness of the image
Hue	Hue
Saturation	Saturation
Gamma	Gamma
Gain	Gain
GainAuto	Enable/disable automatic Gain
Camera_Handler	*Reserved parameter*

TestStand StepType: **ImageLib > FLIR Camera > Open Camera**
Test type: **Action**
Result: **Result.Error (container)**

Camera Grab

This step allows you to capture an image from a specific camera. The camera must have been previously connected and configured via the Open Step, otherwise the step will return an error.

TestStand Variable	Description
Camera_SN	Camera Serial number to open the connection
Image	Image buffer name to copy the image captured by the camera

TestStand StepType: **ImageLib > FLIR Camera > Grab Camera**
Test type: **Action**
Result: **Result.Error (container)**

Close Camera

This step allows you to close the connection with a camera specifying its Serial Number.

TestStand Variable	Description
Camera_SN	Camera Serial number to close the connection

TestStand StepType: **ImageLib > FLIR Camera > Close Camera**
Test type: **Action**
Result: **Result.Error (container)**

The Imaging Source Frame Grabbers

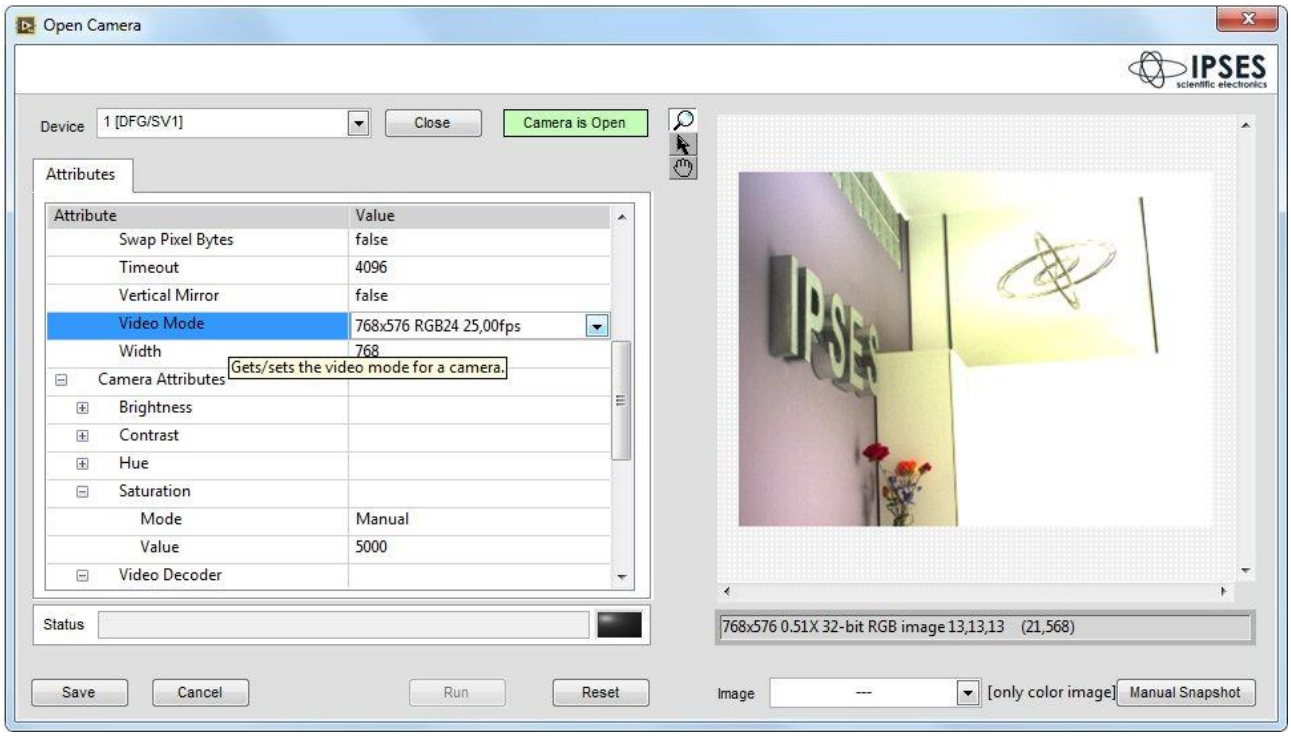
There are three steps in the management of the IS Grabbers and are:

- Open
- Grab
- Close

The overall philosophy of using these steps is to run only once, at the beginning of the test sequence, the Open step to open the connection with the device and configure the relevant parameters. Then you can run as many times as needed the Grab step to acquire an image from the camera and performing step Close at the end of the sequence. Grab step also allow to configure all parameter writable on your device in acquisition mode. This feature give you the ability to run multiple Grab steps with different configuration without the need of run Open and Close steps every time.

It is suggested that you follow this general scheme of use in order to obtain good performances in terms of execution times of the test sequences. Of course it is possible, in case you need to change some parameters such as acquisition ones, use several times the Open step during the sequence, but this should always be done after performing the Close step, if the connection with the camera is already open. Otherwise Open step will return an error.

Open Camera



This step opens a connection to the IS Grabber specifying different parameters of image acquisition.
You can view and set all the parameters available on your device through the list view on the left side of window.

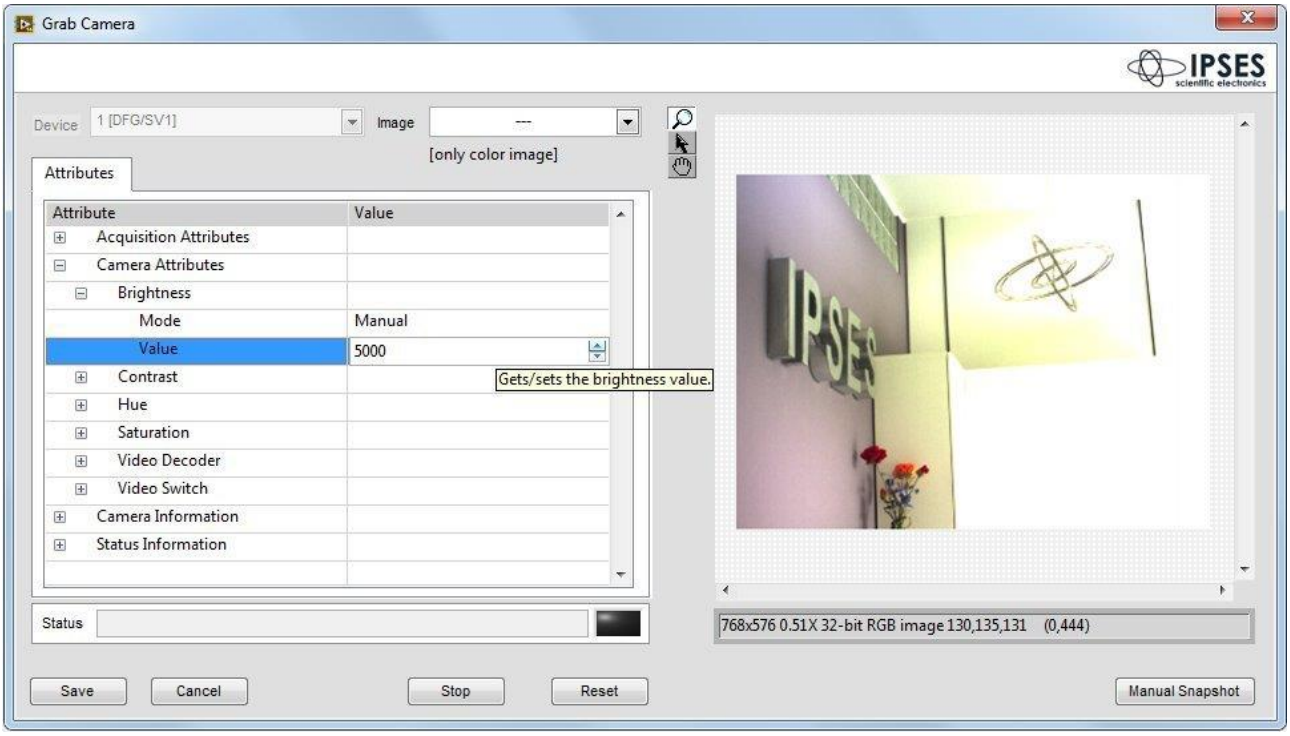
The step supports multiple cameras simultaneously.
The step displays in real time the effect of parameter changes by viewing the image acquired from the camera.

Variabile TestStand	Description

device_session	*Reserved parameter*
device_name	System name of device
device_SN	*Reserved parameter*
image	*Reserved parameter*
camera_configuration	*Reserved parameter*

TestStand StepType: **ImageLib > IS Frame Grabber > Open Camera**
Test type: **Action**
Result: **Result.Error (container)**

Camera Grab



This step allows you to capture an image from a specific device. The device must have been previously connected and configured via the Open Step, otherwise you can't find it in the device selection drop down menu.
Through this step, you can change, for each grab, some parameter writable on your device in acquisition mode.

TestStand Variable	Description
device_session	*Reserved parameter*
device_name	System name of device
device_SN	*Reserved parameter*
image	*Reserved parameter*
camera_configuration	*Reserved parameter*

TestStand StepType: **ImageLib > IS Frame Grabber > Grab Camera**
Test type: **Action**
Result: **Result.Error (container)**

Close Camera

This step allows you to close the connection with a camera specifying its name.

TestStand Variable	Description
device_name	System name of device
device_SN	*Reserved parameter*

TestStand StepType: **ImageLib > IS Frame Grabber > Close Camera**
Test type: **Action**
Result: **Result.Error (container)**

Image Management

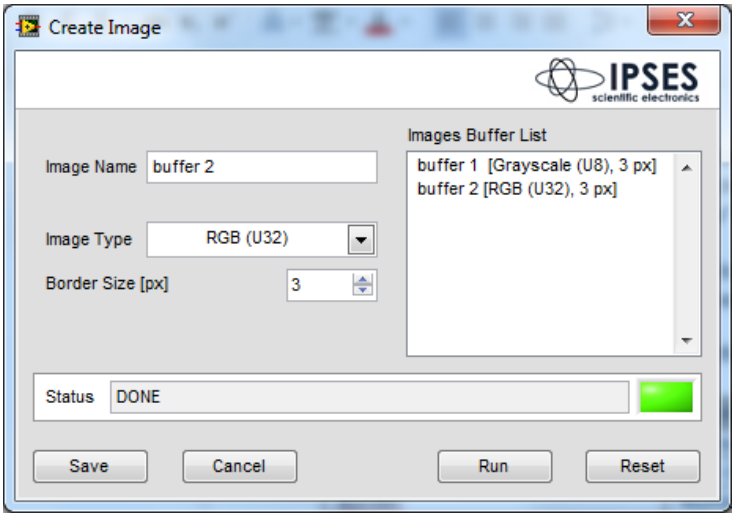
This group of functions is devoted to the management of the image buffer. You can create, destroy, load and save images. Besides, there are steps for displaying images.

Allocate Buffer

This step creates an image buffer.
An image buffer is an area of memory in which the various steps of the library can read or write data representing an image. Each buffer has a unique name, access to a buffer is "by name."

During the creation of a buffer also the type of hosted image (black and white, color, number bit depth) and the number of edge pixels must be defined

The step also reports a list of all the buffers currently in memory.



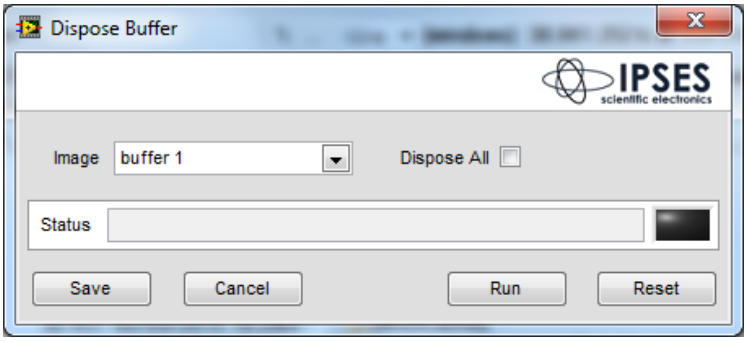
TestStand Variable	Description
Image_Name	Name of the image buffer
Image_Type	Type of image buffer
Border	Number of edge pixels

TestStand StepType: **ImageLib > Image Management > Allocate Buffer**
Test type: **Action**
Result: **Result.Error (container)**

The buffer size is automatically adapted to the size of the image which must contain, then it is not necessary to define in advance the size of the buffer.

Dispose Buffer

This step destroys an image buffer.
Selecting the "Dispose All" flag, the step will destroy all buffers in memory.



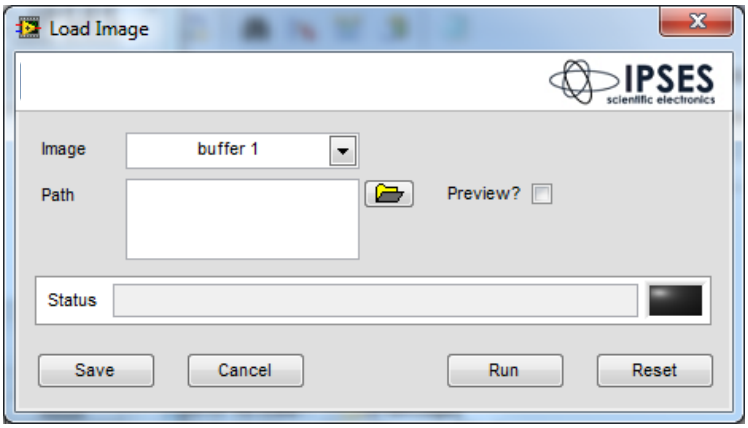
TestStand Variable	Description
Image_Name	Name of the image buffer
Image_Type	*Reserved parameter*
Border	*Reserved parameter*
Dispose All	If enabled, it destroys all buffers in memory

TestStand StepType: **ImageLib > Image Management > Dispose Buffer**
Test type: **Action**
Result: **Result.Error (container)**

Load Image

This step loads an image file by copying its contents into an image buffer.
Selecting the "Preview" option, the step opens a display to show the uploaded image.

The supported file types are BMP, TIFF, JPEG, JPEG2000, PNG, and AIPD. Loaded images will be automatically converted to the format of the used image buffer.



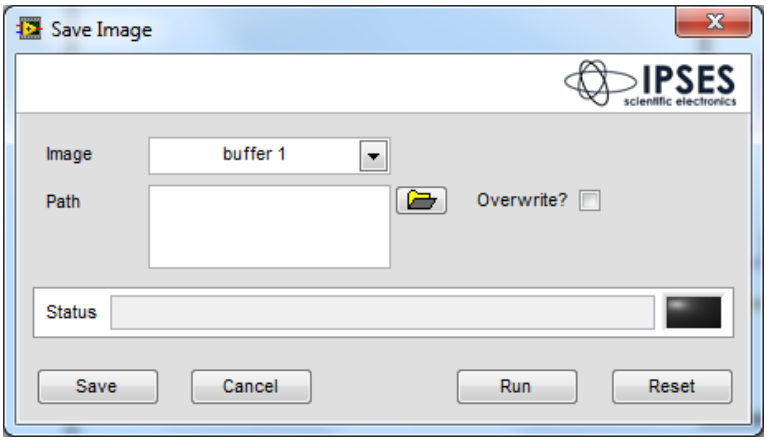
TestStand Variable	Description
Image_Name	Name of the image buffer to upload the image
Path	Disk path of the image file to upload
Overwrite	*Reserved parameter*
Preview	If enabled, it shows a preview of the loaded image (only in edit mode, not during the run of the sequence)

TestStand StepType: **ImageLib > Image Management > Load Image**
Test type: **Action**
Result: **Result.Error (container)**

Save Image

This step saves the contents of an image buffer in a file.

When the option "Overwrite" is enabled, the step will overwrite, without prompting, the file if this already exists. With the option disables, the step will give back an error if you try to write a file that already exists.



The supported file types are BMP, TIFF, JPEG, JPEG2000, PNG, and AIPD. Encoding with which the image is written to a file depends on the extension of the file.

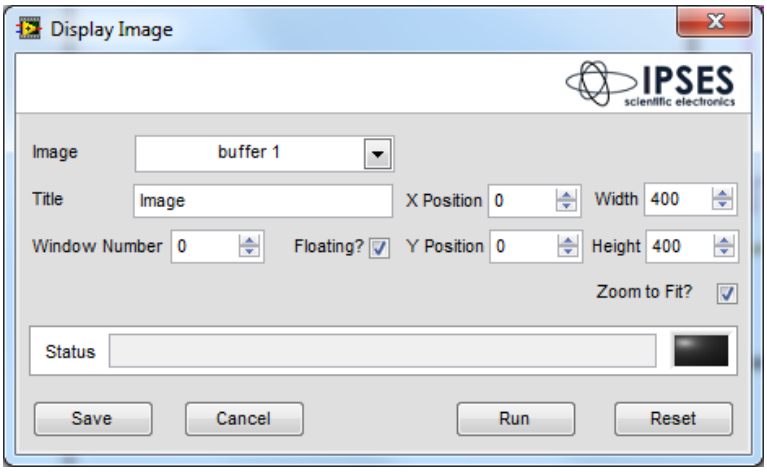
TestStand Variable	Description
Image_Name	Name of the buffer image to be saved
Path	Disk path of the image file to save
Overwrite	If enabled, it enables the overwriting of files
Preview	*Reserved parameter*

TestStand StepType: **ImageLib > Image Management > Save Image**
Test type: **Action**
Result: **Result.Error (container)**

Display Image

This step opens a window displaying images

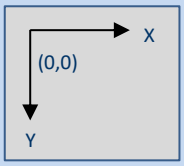
In addition to the buffer of the image you want to display you can decide the title of the window, the position on the monitor, the window size and whether the image should be magnified/scaled to fit the window size. Activating the "floating" option, window will have a title bar, otherwise no.
Window Number defines an ID to be associated with the display window. The usable numbers are from 0 to 14, so they can be displayed up to 15 windows simultaneously.
This ID will be also used in the step for closing the image viewer.



TestStand Variable	Description
Image_Name	Name of the buffer image to be saved
Window_Num	Window ID from 0 to 14
X_Pos	Window X position on monitor
Y_Pos	Window Y position on monitor
Title	Window title
Floating	If enabled, it shows the title bar of the window
Width	Window width
Height	Window height
Zoom_to_fit	Activates the image fit with respect to the window size

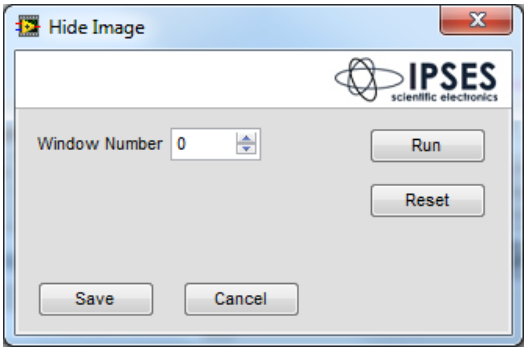
TestStand StepType: **ImageLib > Image Management > Display Image**
Test type: **Action**
Result: **Result.Error (container)**

The coordinate system on which are based the X and Y Position parameters originates in the upper left corner of the monitor, as shown in the figure



Hide Image

This step closes a display window, previously opened by Show Image step, using its Window Number ID.



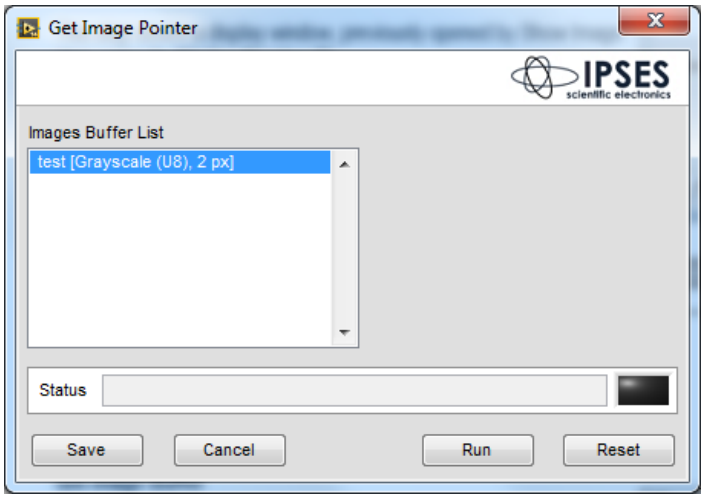
TestStand Variable	Description
Window_Num	Closing Window ID from 0 to 14

TestStand StepType: **ImageLib > Image Management > Hide Image**
Test type: **Action**
Result: **Result.Error (container)**

Get Image Buffer

This step give the access to all the image buffer pointer created with the step “Allocate Buffer”.

This will be useful, for example, to build a custom vision processing step that perform analysis on images owed by the “Vision Library”.



TestStand Variable	Description
Image_Name	Name of the image buffer
Image_Type	*Reserved parameter*
Border	*Reserved parameter*
Dispose All	*Reserved parameter*

TestStand StepType: **ImageLib > Image Management > Get Image Buffer**
Test type: **Action**
Result: **ImageInformation (container), Result.Error (container)**

Image Processing

Filter

This step allows you to apply different filters to improve or extracting features in an image.

The step only supports "grayscale" buffer images (U8, U16, I16, SGL) both incoming and outgoing.

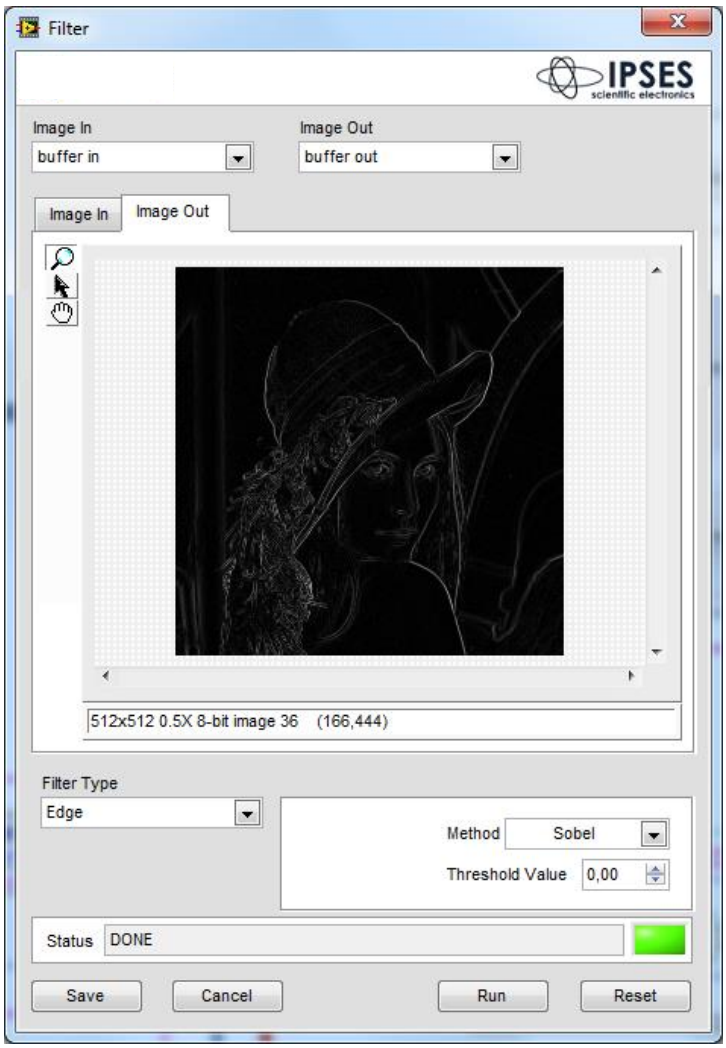
There are three categories of usable filters:

- Low Pass
- Edge
- Kernel

The Low Pass Filters are to be used to mitigate the variations in light intensity in the image. They have a tendency to "soften" the image causing the losing of details and blurring the edges.

The Edge filters are part of the Highpass category. They are used to enhance the variations of light, bring out edges but also any noise from the image content

The kernel filters report different types of filters where you can change the kernel size to accentuate or diminish its effect. A kernel is a small matrix useful for blurring, sharpening, embossing, edge-detection, and more. This is accomplished by means of convolution between a kernel and an image.



For further details on filtering functions and their parameters, please refer to the document:
NI Vision Concept – Spatial Filtering
http://zone.ni.com/reference/en-XX/help/372916P-01/nivisionconcepts/spatial_filtering/

TestStand Variable	Description
Image_Name_IN	Name of the input image buffer to the filter
Image_Name_OUT	Name of the output image buffer to the filter
Filter_Type	Filter type category
X_size	X cell size for the LowPass filter
Y_size	Y cell size for the LowPass filter
__Tollerance	Tolerance percentage of LowPass filter
Threshold_Value	Threshold for the Edge filters
Method	Edge filter method
Kernel_size	Size of Kernel for type Kernel filters
Kernel_family	Filter type for the Kernel category

TestStand StepType: **ImageLib > Image Processing > Filter**
Test type: **Action**
Result: **Result.Error (container)**

Roto Translation

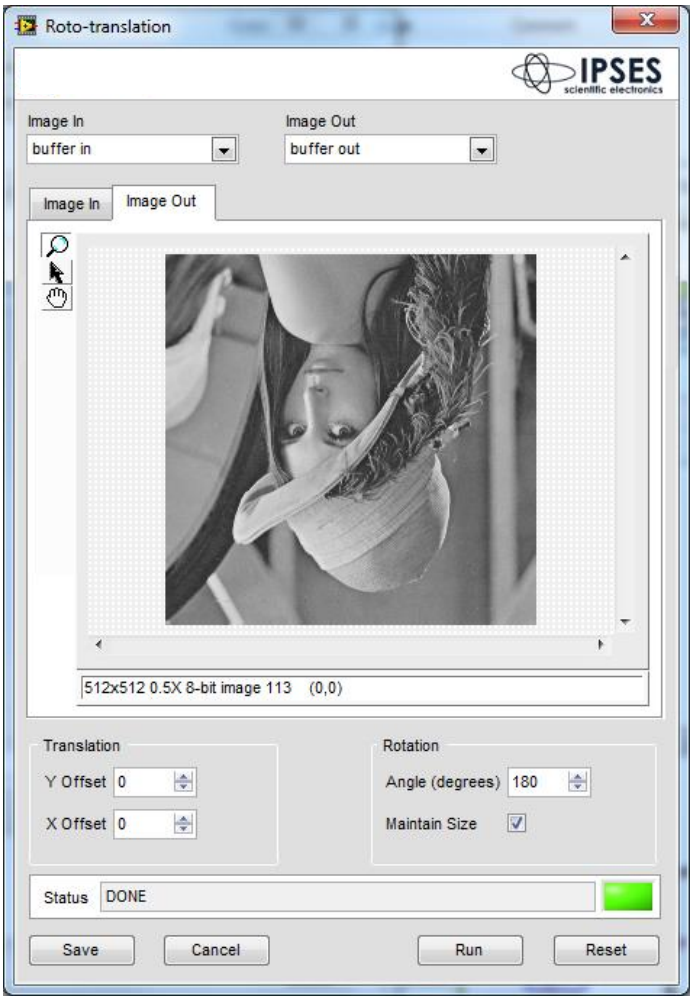
This step allows to perform rotation and translation transformations o of images.

The translation occurs on the plane and is controlled by X Offset and Y Offset parameters. The origin point (X0, Y0) is in the top left of the viewer.
Translating an image its size will remain unchanged, the pixels that result from the translation will have a value of zero (black).

The rotation is controlled by the Angle and Maintain Size parameters.
Rotation is always around the center of the image.
If Maintain Size is enabled the resulting image will be enlarged or reduced in order to fully contain the rotated image. If Maintain Size is disabled the total size of the image will remain unchanged.

In any case the new pixels resulting from the rotation will have a value of zero (black).

The execution order of the transformations performed by the step is: translation, rotation.



TestStand Variable	Description
Image_Name_IN	Buffer name of the input processing image
Image_Name_OUT	Buffer name of the output processing image
X_Offset	X translation offset
Y_Offset	Y translation offset
Angle_degrees_	Rotation angle
Maintain_Size	If enabled, it keeps the image size during rotation

TestStand StepType: **ImageLib > Image Processing > Roto-Translation**
Test type: **Action**
Result: **Result.Error (container)**

Lookup Table

This step allows you to apply a set of lookup tables to the input image.

This step only supports both incoming and outgoing "grayscale" buffer images (U8, U16, I16, SGL)

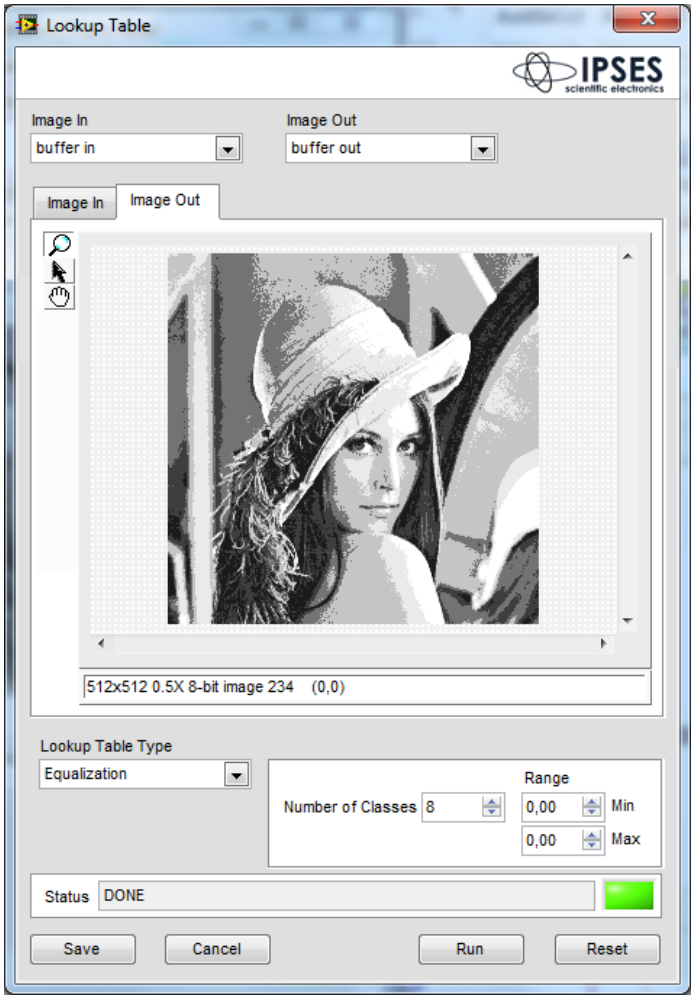
LUT transformations enhance the brightness and contrast of certain areas of the image by changing the dynamics of the intensity

The step supports three LUP categories:

- Mathematical
- BCG
- Equalization

For further details on filtering functions and their parameters, please refer to the document:

NI Vision Concept – Lookup Table
http://zone.ni.com/reference/en-XX/help/372916P-01/nivisionconcepts/lookup_tables/



TestStand Variable	Description
Image_Name_IN	Buffer name of the input processing image
Image_Name_OUT	Buffer name of the output processing image
Lookup_Table_Type	Lookup Table type to be used
Interval_Range_EQ	Value range for the Equalization LUT
Number_of_Classes	Class number of the histogram for the LUT Equalization
BCG_Values.Brightness	Brightness value for the BCG LUT
BCG_Values.Contrast	Contrast value for the BCG LUT
BCG_Values.Gamma	Gamma value for BCG LUT
Range_math.Minimum	Minimum value for the Mathematical LUT range
Range_math.Maximum	Maximum value for the Mathematical LUT range
X_Values	X variable value for Mathematical LUT
Operator	Mathematical LUT type

TestStand StepType: **ImageLib > Image Processing > Lookup Table**
Test type: **Action**
Result: **Result.Error (container)**

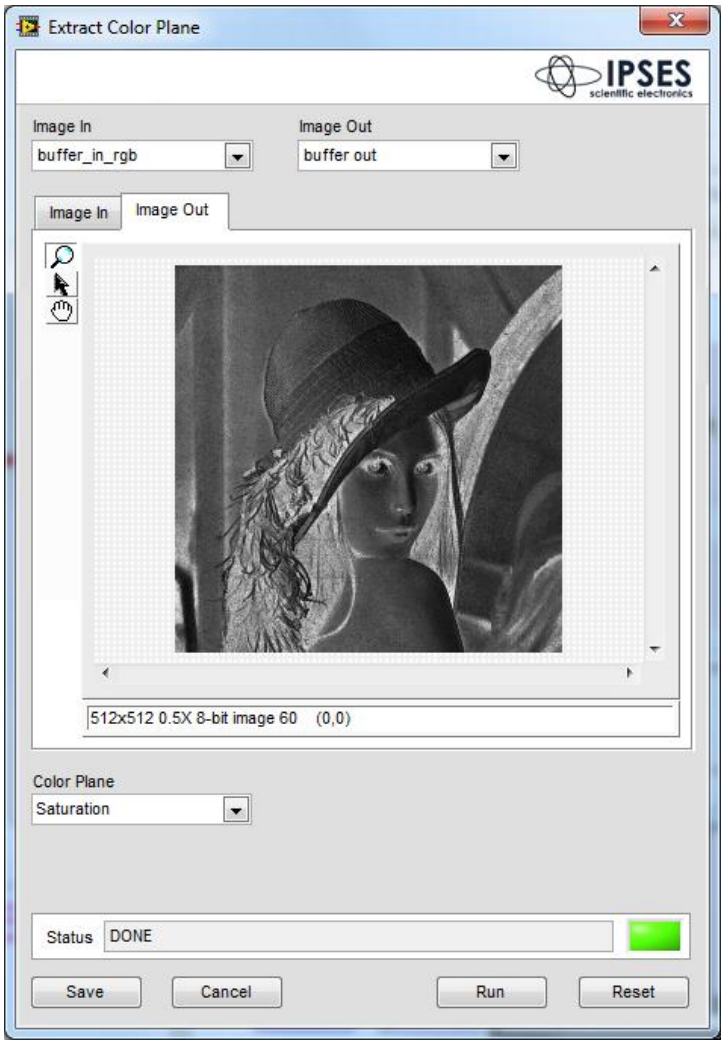
Extract Color Plane

This step allows to extract a color plane from an image

This step only supports buffer color input images (U32, U64) and "grayscale" output images (U8, U16, I16, SGL).

The step can extract from a source color image the following color planes:

- Red
- Green
- Blue
- Hue
- Saturation
- Luminance
- Value
- Intensity

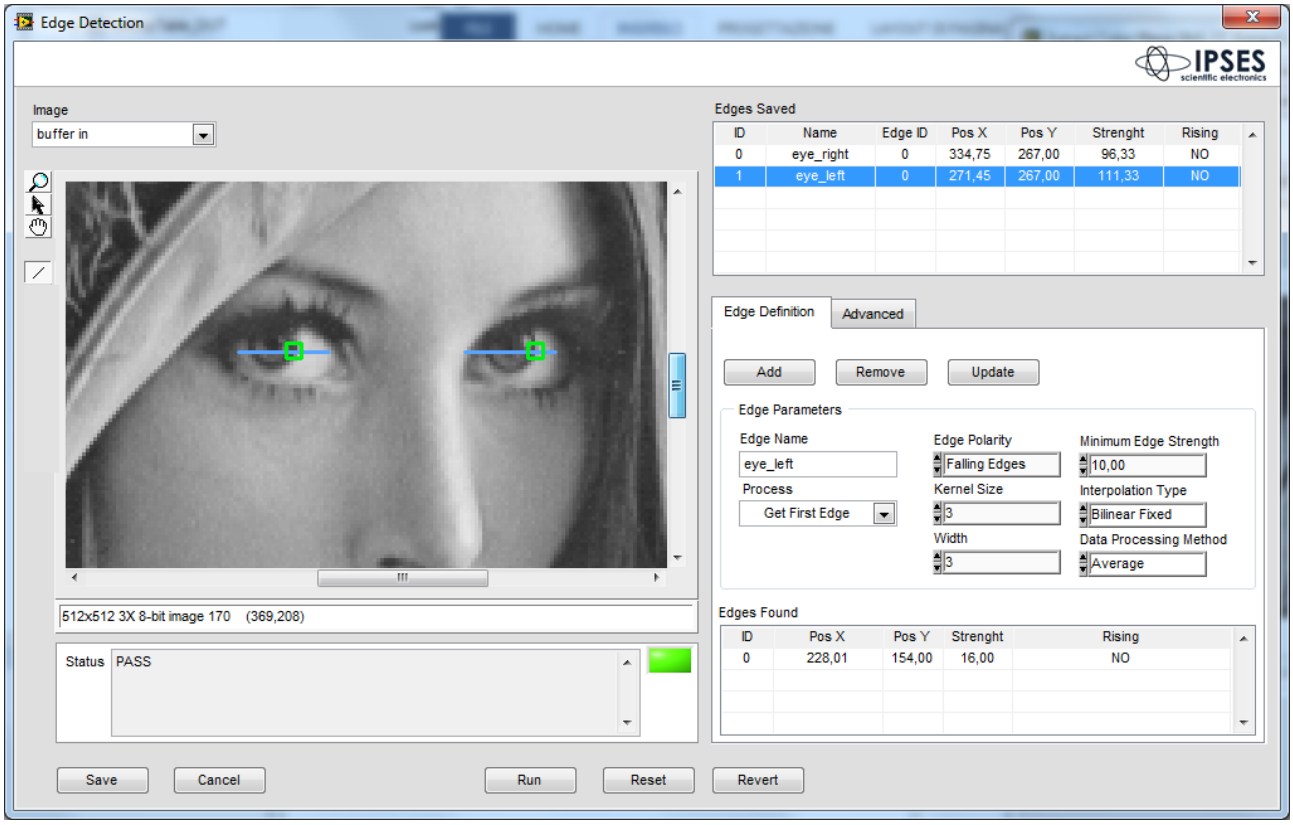


TestStand Variable	Description
Image_Name_IN	Buffer name of the input processing image
Image_Name_OUT	Buffer name of the output processing image
Color_Plane	Color plane type to be extracted

TestStand StepType: **ImageLib > Image Processing > Extract Color Plane**
Test type: **Action**
Result: **Result.Error (container)**

Morphology

Edge Detection



This step allows you to search the edge, i.e. transitions of light intensity in an image.
You can define different linear ROIs along which the edges will be searched
Each ROI may contain different edges, all those found will be saved when you press the Add button. You can then remove the unwanted edges (by the Remove button) or change the search parameters and the position of the ROI. To do this, just make the changes and then press Update.

During the execution of TestStand sequence, the step compares the position and the number of found edges to what is defined during the edit.

The position of the edge is searched for in a neighborhood of 5x5 pixels with respect to the position taught during the editing.

There are different configurations for counting found edges that determines the PASS or FAIL result of the step.
The default configuration requires all edges defined in edit to be found during the execution of the sequence, but different comparison operations can be configured either in range or comparison through the available parameters in the Advanced tab.

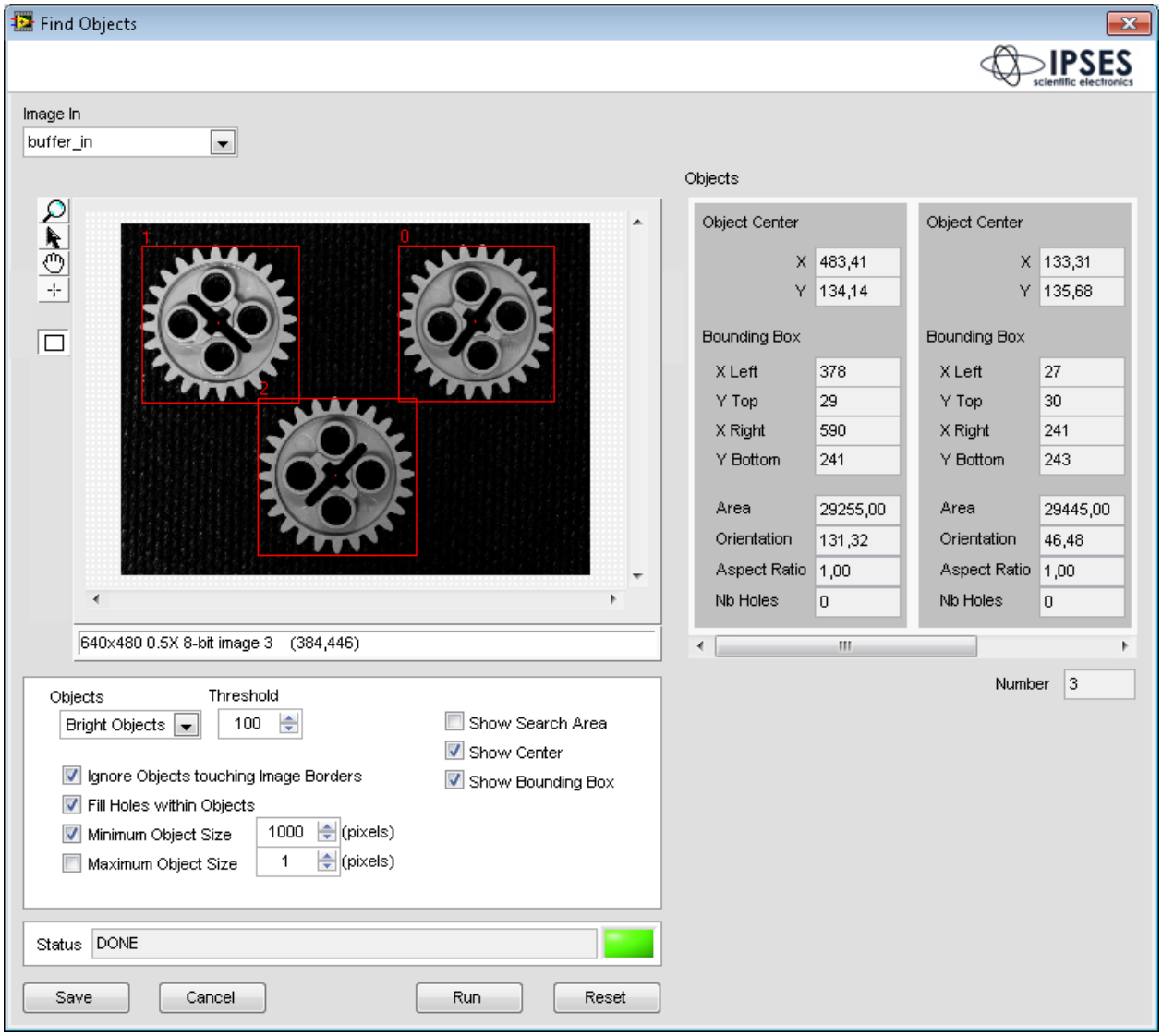
If Fail occurs, the step returns to TestStand, in ReportText variable, the causes of Fail.

The step only supports "grayscale" buffer images (U8, U16, I16, SGL).

TestStand Variable	Description
Image_Name	Name of the input image buffer
Edges_def	Definition ARRAY of all saved edges
Logic.Pass_logic	PASS Logic Type of the step
Pass.Logic_A	Comparison A Variable for the Pass Logic type
Pass.Logic_B	Comparison B Variable for the Pass Logic type

TestStand StepType: **ImageLib > Morphology > Edge Detection**
Test type: **Action**
Result: **Result.Error (container)**

Find Objects



This step allows you to search for objects within a picture.

You can define different search parameters: the threshold of brightness of the object to be searched, if the object is clear or dark (above or below the defined threshold), filter objects above or below a certain threshold area.

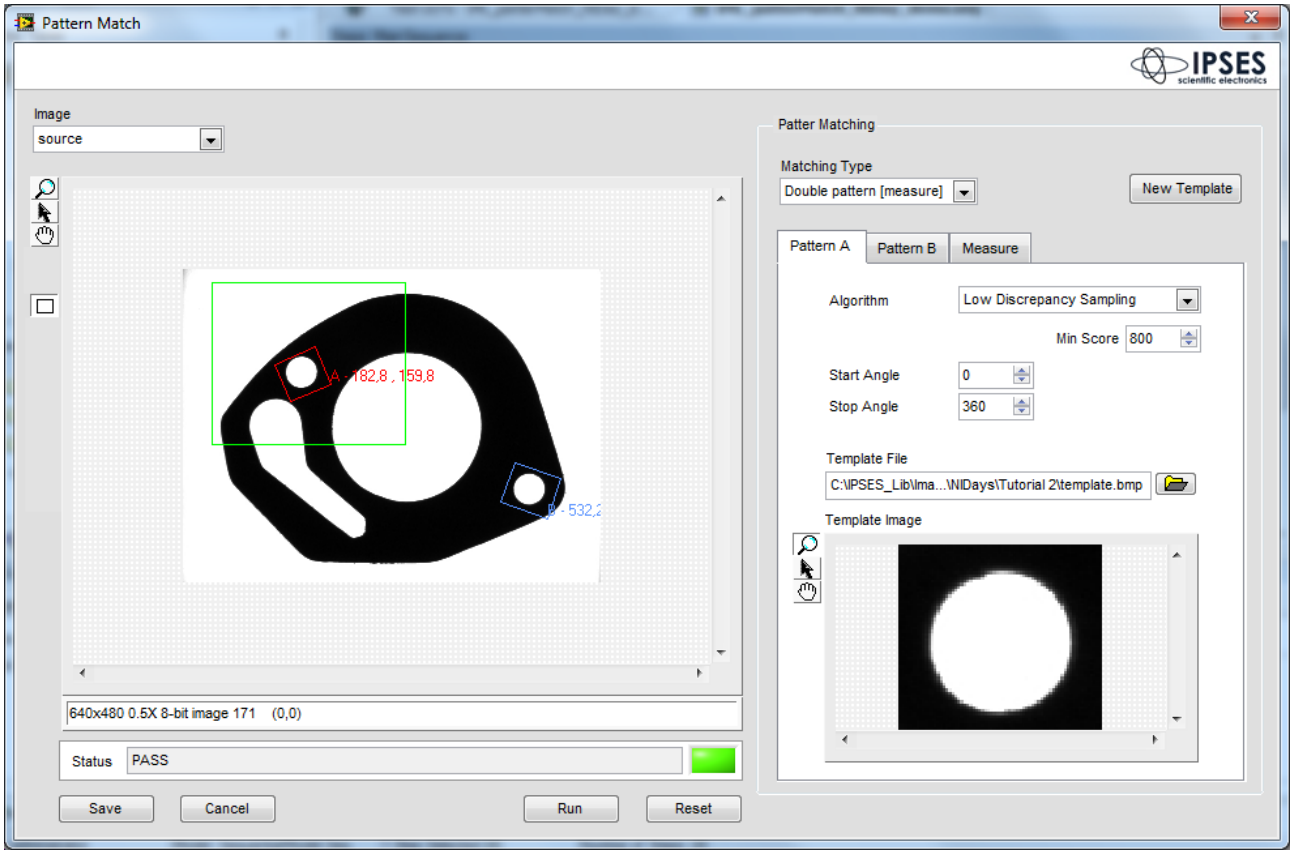
The step returns TestStand an array with all the information of the found items. The information is the X, Y position, the orientation, the rectangle area in which the object is contained, the ratio of height and width and the number of found objects.

The step only supports "grayscale" buffer images (U8, U16, I16, SGL).

TestStand Variable	Description
Image_Name_IN	Name of the input image buffer
Settings.Objects	Defines whether to search objects above or below a threshold
Settings.Threshold	Light threshold
Settings.Reject_Border	If enabled, it discards objects that touch the edge of the image
Settings.Fill_Holes	If enabled, it discards objects inside other objects
Settings.Min_Object_Size	If enabled, it discards objects below a minimum area threshold
Settings.Min_Size	Threshold of the minimum area
Settings.Max_Object_Size	If enabled, it discards objects above a maximum area threshold
Settings.Max_Size	Threshold of the maximum area
Show_Search_Area	If enabled, it shows the search area for objects
Show_Center	If enabled, it shows the center of the object
Show_Bounding_Box	If enabled, it shows the rectangle bounding the object
Number_of_Objects	Number of found objects
Objects_Center	X, Y Central position of the object
Bounding_Box	Left, Top, Right, Bottom Coordinates of the rectangle enclosing the object
Area	Pixel Object Area
Orientation	Rotation angle of the object with respect to the edge image
Aspect_Ratio	Ratio of height and width of the object
Nb_Holes	Number of "holes" (light or dark objects) within an object

TestStand StepType: **ImageLib > Morphology > Edge Detection**
Test type: **Action**
Result: **Result.Error (container), FindObjects_Objects [ARRAY], Number of Objects**

Pattern Match



This step allows you to search for patterns within an image.

There are two types of operation of the step::

- Single Pattern
- Double Pattern

In single pattern mode, a single pattern within the image will be matched and its absolute XY position measures (i.e. absolute and relative measure to the position of the template on the reference image on which it was created), its score, its scale and the rotation angle of the pattern will be reported.
In double pattern mode, two patterns (also different) within the image will be matched. In addition to the measures listed before, it will also be calculated the distance between patterns and the angle formed by the line joining the two patterns compared to the same line calculated on the reference image (the one on which the templates are created)

The templates to search can be created by pressing the "New Template" button.
Each (A and B) pattern will be searched in a different ROI.
For each pattern, it is also possible to define the algorithm and parameters of acceptance.

The user can choose 3 different types of algorithm for search the template into the ROI.

- Low Discrepancy Sampling
- Grayscale Value Pyramid
- Gradients Pyramid

Low Discrepancy Sampling: This algorithm extracts the most significant information to represent an image, like edges and corners. It is useful when the template ha a lot of contrast and details.

Grayscale Value Pyramid: This algorithm uses normalized gray values as features. It is useful when the template does not contain structured information but has intricate textures for dense edges.

Gradients Pyramid: This algorithm uses filtered edge pixels as features. It is mode resistant to occlusion and intensity changes and is often faster because of smaller amount of data. However, the strength and reliability of edges reduces at very low resolutions. This method requires the user to work in higher resolutions ad compared to the Grayscale Value Pyramid method.

For every pattern to search and the algorithm, the Step require an angle search range defined with the Start Angle and Stop Angle. This is used to extract features from the template and for discard result outside the angle range. It is important to reduce this range, if the expected pattern has very little rotation freedom, in order to reduce the elaboration's time and to increase the robustness of the features.

The algorithm tries to find the template image into the ROI in any case and give back as result a score, based to how it is "close" to the template. To filter out false positive results use the Score value. Only matches with a score above the Score value will be accepted.

The step returns Pass to TestStand if all patterns are found (one pattern for single mode, two for double mode), otherwise it will return Fail.

The step only supports "grayscale" buffer images (U8, U16, I16, SGL).

TestStand Variable	Description
Image_Name_IN	Name of the input image buffer
Pattern_match_definitions.ROI	A Pattern search ROI
Pattern_match_definitions.match_Algorithm	A pattern algorithm Search
Pattern_match_definitions.Angle_Range	Search range of rotation of the A pattern
Pattern_match_definitions.Parameters. Minimum_Match_Score	Minimum acceptance score of the A pattern
Pattern_match_definitions.ROI_B	B Pattern search ROI
Pattern_match_definitions.match_Algorithm_B	B pattern algorithm Search
Pattern_match_definitions.Angle_Range_B	Search range of rotation of the B pattern
Pattern_match_definitions.Parameters. Minimum_Match_Score_B	Minimum acceptance score of the B pattern
PatterMatchResultsA.Position__absolute_	XY absolute position of the A pattern
PatterMatchResultsA.Position__relative_	XY relative position of the A pattern (from the position of the pattern on the image sample)
PatterMatchResultsA.Score	A pattern Score
PatterMatchResultsA.Scale	A pattern Scale
PatterMatchResultsA.Angle	A pattern angle
PatterMatchResultsB.Position__absolute_	XY absolute position of the B pattern
PatterMatchResultsB.Position__relative_	XY relative position of the B pattern (from the position of the pattern on the image sample)
PatterMatchResultsB.Score	B pattern Score
PatterMatchResultsB.Scale	B pattern Scale
PatterMatchResultsB.Angle	B pattern angle

PatterMatchABResults.Distance_A_B__absolute__	Distance between the centers of the A and B patterns
PatterMatchABResults.Distance_A_B__relative_	Relative distance (referred to the distance of the pattern on the sample) between the centers of the A and B patterns
PatterMatchABResults.Rotation_angle_line_A_B__deg__	Rotation angle between the line created by the centers of the A and B patterns and the same line on the sample image

TestStand StepType: **ImageLib > Morphology > Pattern Match**
Test type **Test**
Result: **Result.PassFail, PatterMatchResultsA, PatterMatchResultsB, PatterMatchABResults**

Photometric

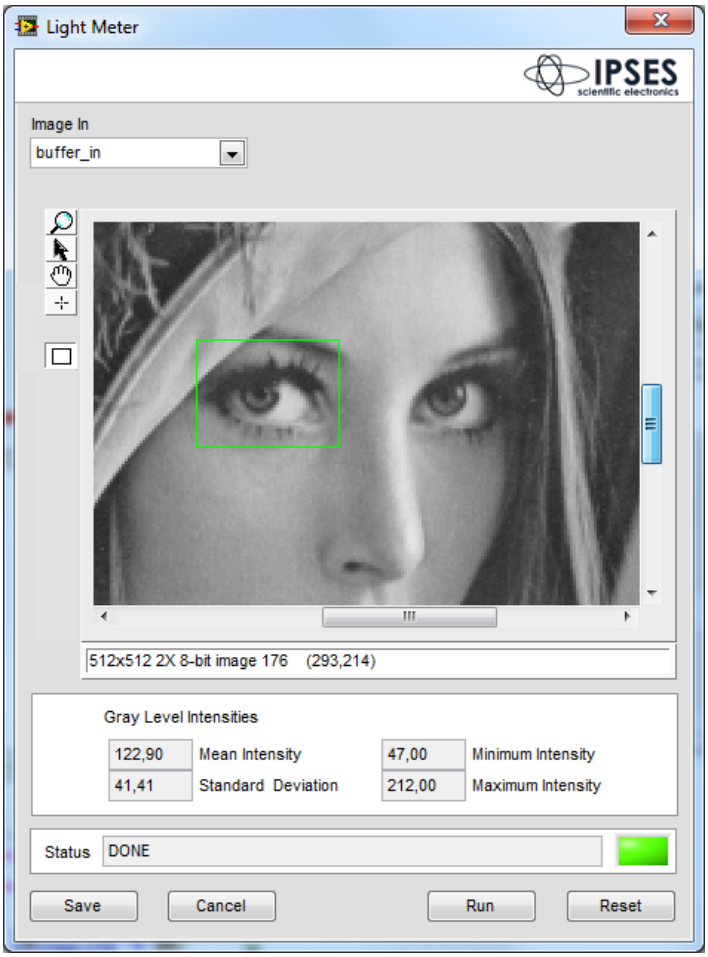
Light Meter

This step allows to perform measurements of the light intensity of an image.

The measures will be carried out within a freely definable rectangular ROI.

Step inside the ROI measure the average intensity, the standard deviation, the minimum and maximum value

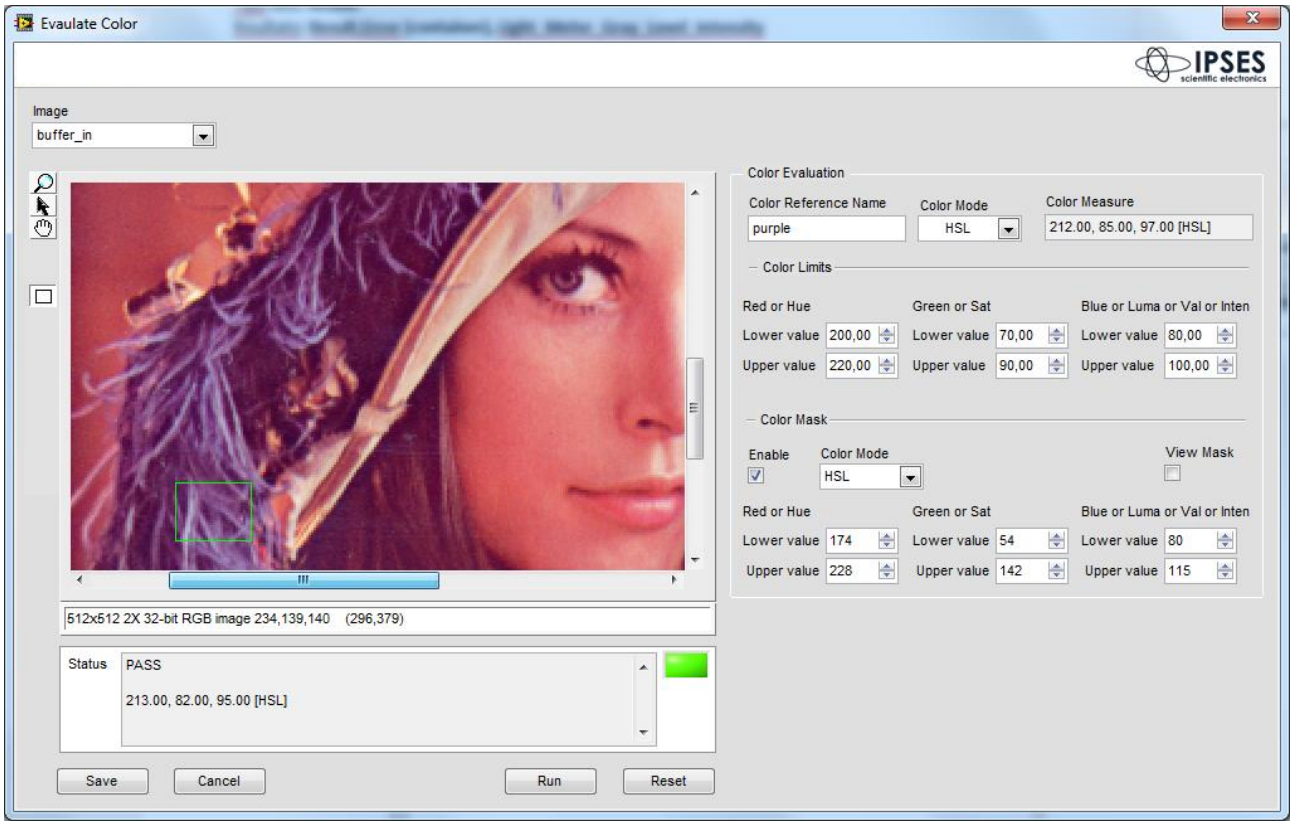
The step only supports "grayscale" buffer images (U8, U16, I16, SGL).



TestStand Variable	Description
Image_Name_IN	Name of the input image buffer
Search_Rect__entire_image_	ROI in which the measurement is performed, if not defined the entire image is measured
Light_Meter_Gray_Level_Intensity.Mean_Intensity	Measurement of average intensity
Light_Meter_Gray_Level_Intensity.Standard__Deviation	Measurement of the standard deviation
Light_Meter_Gray_Level_Intensity.Maximum_Intensity	Measurement of the maximum value
Light_Meter_Gray_Level_Intensity.Minimum_Intensity	Measurement of the minimum value

TestStand StepType: **ImageLib > Photometric > Light Meter**
Test type **Action**
Result: **Result.Error (container), Light_Meter_Gray_Level_Intensity**

Evaluate Color



This step allows you to perform color measurements on an image.

The measures will be carried out within a freely definable rectangular ROI.

The step measures the color in different formats: RGB, HSL, HVS, HIS, CIE L*a*b*, CIE XYZ, Rgl.
it is possible to define a color mask to exclude from the measurement the colors that are not of interest for the test. The mask can be defined in the following formats: RGB, HSL, HVS, HIS.

You can also set limits on the extent of acceptance color. The step will return TestStand Pass if the measurement is within the limits, otherwise fail. In addition to the Pass/ Fail status, the step also shows the values of the measurement made in the TestStand ReportText variable.

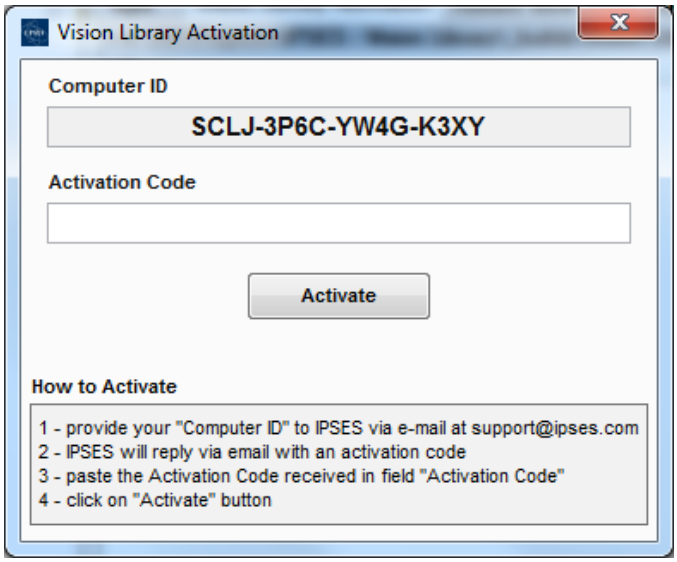
TestStand Variable	Description
Image_Name	Name of the input image buffer
Color.Color_reference_Name	Reference name to be assigned to the measured color
Color.ROI	ROI within which to perform the measurement
Color.Color_Mode	Measurement color type: RGB, HSL, HVS, HIS, CIE L*a*b*, CIE XYZ, RGL.
Color.Color_limits	Acceptance limits of color measuring
Color.Color_Mask.Color_Mode	Type color mask: RGB, HSL, HVS, HIS
Color.Color_Mask.Red_or_Hue	Mask Range

Color.Color_Mask.Green_or_Sat	Mask Range
Color.Color_Mask.Blue_or_Luma_or_Val_or_Inten	Mask Range
Color.Color_Mask.Enable	Enabling color masking

TestStand StepType: **ImageLib > Photometric > Evaluate Color**
Test type: **Test**
Risult: **Result.PassFail**

PRODUCT ACTIVATION

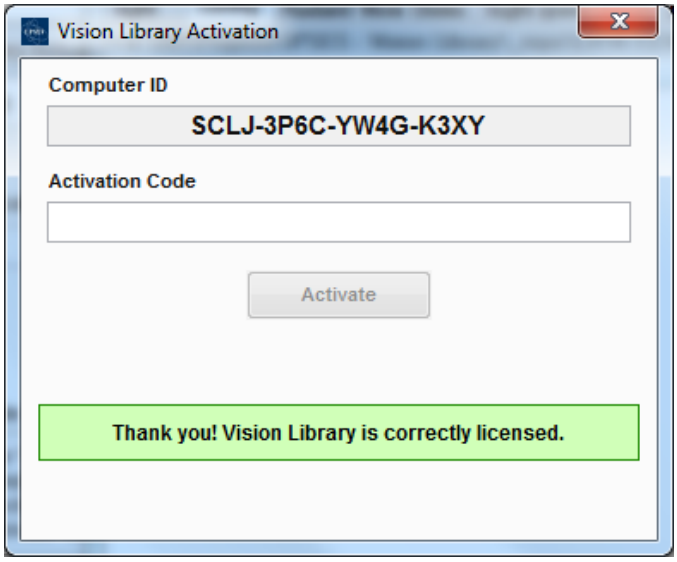
To activate the product you need to use the “Vision Library Activation” wizard and follow the instructions.
The tool is located under *C:\IPSES_Lib\ImageLibrary*.



The steps to activate the product are:

1 - Provide your "Computer ID" to IPSES via e-mail at **support@ipses.com**
2 - IPSES will reply via email with an activation code
3 - Paste the Activation Code received in field "Activation Code"
4 - Click on "Activate" button

At the end of the process you will get a confirmation message.



ERROR CODES

Code	Description
-8001	The Image name is empty
-8002	The camera is already open.
-8003	Image name not found
-8004	Image name not found (GET)
-8008	The Image name already exist but has different settings
-8009	Camera SN not found
-8010	Camera SN invalid
-8011	No Camera selected
-8012	The camera [SN] is closed
-8101	Empty or invalid file path
-8102	Not supported file format
-8201	Select Image In and Image Out
-8202	Edge name already used
-8203	No Edge found in the zone selected
-8204	Edge name empty
-8299	General error message
-8301	Invalid camera handle
-8300	Most of the uEye SDK functions expect the camera handle as the first parameter.
-8302	An IO request from the uEye driver failed. Possibly the versions of the ueye_api.dll (API) and the driver file (ueye_usb.sys or ueye_eth.sys) do not match.
-8303	An attempt to initialize or select the camera failed (no camera connected or initialization error).
-8311	Error opening a Windows registry key
-8312	Error reading settings from the Windows registry
-8315	The driver could not allocate memory.
-8316	The driver could not release the allocated memory.
-8317	Communication with the driver failed because no driver has been loaded.
-8318	The function is not supported yet.
-8332	The function can not be executed in the current camera operating mode (free run, trigger or standby).
-8349	Invalid pointer or invalid memory ID
-8350	File cannot be opened for writing or reading.
-8351	The file cannot be opened.
-8352	The specified file is not a valid bitmap file.
-8353	The bitmap size is not correct (bitmap too large).
-8408	No active image memory available. You must set the memory to active using theis_SetImageMem() function or create a sequence using the is_AddToSequence() function.
-8412	The sequence list is empty and cannot be deleted.
-8413	The image memory is already included in the sequence and cannot be added again.
-8417	The memory could not be locked. The pointer to the buffer is invalid.
-8418	The device ID is invalid. Valid IDs start from 1 for USB cameras, and from 1001 for GigE cameras.
-8419	The board ID is invalid. Valid IDs range from 1 through 255.
-8420	All cameras are in use.
-8422	A timeout occurred. An image capturing process could not be terminated within the allowable period.
-8423	Invalid array
-8425	One of the submitted parameters is outside the valid range or is not supported for this sensor or is not available in this mode.
-8427	No memory could be allocated.
-8429	An internal error has occured.
-8439	The camera is connected to a port which does not support the USB 2.0 high-speed standard.
-8300	Cameras without a memory board cannot be operated on a USB 1.1 port.
-8440	A capturing operation is in progress and must be terminated first.
-8445	The requested image is not available in the camera memory or is no longer valid.
-8448	The function cannot be used because the camera is waiting for a trigger signal.

-8451	A CRC error-correction problem occurred while reading the settings.
-8452	This function has not been enabled yet in this version.
-8453	The camera does not contain any calibration data.
-8454	The system is waiting for the kernel driver to respond.
-8455	The camera model used here does not support this function or setting.
-8456	The function is not possible as trigger is disabled.
-8457	The dialog was canceled without a selection so that no file could be saved.
-8458	An internal structure has an incorrect size.
-8459	The image memory has an inappropriate size to store the image in the desired format.
-8460	This setting is not available for the currently set pixel clock frequency.
-8461	This setting is not available for the currently set exposure time.
-8462	This setting cannot be changed while automatic exposure time control is enabled.
-8463	The BackBuffer surface cannot be created.
-8464	The BackBuffer mix surface cannot be created.
-8465	The BackBuffer overlay memory cannot be locked.
-8466	The BackBuffer overlay memory cannot be created.
-8467	Not supported in BackBuffer Overlay mode.
-8468	Back buffer surface invalid.
-8469	Back buffer surface not found.
-8470	Error releasing the overlay device context.
-8471	The back buffer timer could not be created.
-8472	The back buffer overlay was not enabled.
-8473	Only possible in BackBuffer mode.
-8474	Invalid color format
-8475	Mono binning/mono sub-sampling do not support automatic white balance.
-8476	Invalid I2C device address
-8477	The current image could not be processed.
-8478	Transfer error. Frequent transfer errors can mostly be avoided by reducing the pixel rate.
-8479	Parameter set is not present.
-8480	The camera type defined in the .ini file does not match the current camera model.
-8481	Invalid HIBYTE of host address
-8482	The color mode is not supported in the current display mode.
-8483	No IR filter available
-8484	The camera's starter firmware is not compatible with the driver and needs to be updated.
-8485	The DirectRenderer library could not be found.
-8486	Not enough graphics memory available.
-8487	The image surface or overlay surface could not be created.
-8488	The vertex buffer could not be created.
-8489	The texture could not be created.
-8490	The overlay surface could not be locked.
-8491	The overlay surface could not be unlocked.
-8492	Could not get the device context handle for the overlay.
-8493	Could not release the device context handle for the overlay.
-8494	Function is not supported by the graphics hardware.
-8495	Because of other incompatible settings the function is not possible.
-8496	A device context handle is still open in the application.
-8497	The device is already paired.
-8498	The subnet mask of the camera and PC network card are different.
-8499	The subnet of the camera and PC network card are different.
-8500	The configuration of the IP address is invalid.
-8501	The device is not compatible to the drivers.
-8502	The settings for the image size of the camera are not compatible to the PC network card.
-8503	The configuration of the network card is invalid.
-8504	The configuration of the CPU idle has failed.

-8505	The camera is busy ad cannot transfer the requested image.
-8506	The initialization of the sensor failed.

CONTACTS

IPSES S.r.l. conceives, designs, and markets electronic and scientific instruments. The customized design of our devices allows us to address specific needs for integration into embedded systems. **IPSES** customers enjoy access to a dedicated project engineering team, available as needed.

Our staff consists of highly competent professionals whose experience in the field is extremely strong. Thanks to constant training, process and technical development, **IPSES** is a leading company, combining the dynamism of a young group into the competence and reliability of a qualified staff.

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SUPPORT INFORMATION

The customer can contact the relevant engineer at IPSES S.r.l. directly.

A call can be logged in a variety of ways:

Telephone	:	++39 02 39449519
		++39 02 320629547
Fax	:	++39 02 700403170
Email	:	support@ipses.com

PROBLEM REPORTING

In case you encounter a problem using an IPSES product, we kindly ask you to report it by filling the form in the next page and sending it by fax to +39 02 700403170. The form can also be scanned and sent by e-mail to support@ipses.com . An electronic form is available on our web site (www.ipses.com)

ENGINEERING PROBLEM REPORT

Problem describer

Name		
Company		
Date	Tel.	Fax

IPSES S.r.l.
Via Lazarotto, 10
20031 Cesate (MI)
Italy
Fax ++39 02/700403170
e-mail *support@ipses.com*

Product

Name	Version	Serial No.

Report Type (bug, change request or technical problem)

Major bug	☐	Urgency:	
Minor bug	☐	High	☐
Change request	☐	Medium	☐
Technical problem	☐	Low	☐

Problem Description

Reproduction of Problem

IPSES S.r.l. Action notes

Received by	Date	Report No.	Action

(Product code IVL Rel. 01.05.0000)

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