
5

Measuring Images

Visilog allows you to make calibrated geometric measurements, calculate pixel values within a neighbourhood and pixel levels along a line, and extract statistical measurements on an image or area of interest.

About this Chapter

This chapter contains 3 sections, describing:

1. **Calibrating an Image**, how to use default and user-defined calibrations
2. **Taking Geometric Measures**, including distance, area, angles, etc.
3. **Statistical Measurements**, how to obtain statistical measurements along a line, of an image, and of an AOI (Area of Interest) within an image.

Geometric and Statistical Measurements are by nature interactive, as you define the distance area, AOI, etc. Automatic measures, such as the area and perimeter of objects, etc. are carried out using the ANALYSIS Commands

1. Calibrating an Image

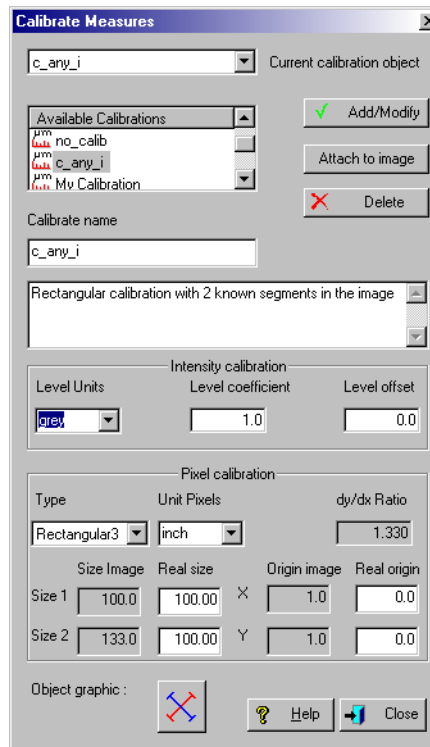


Figure 5-1 Calibration dialog box

Predefined or design your own

By default, all measurements are made in pixels; but by using the CALIBRATE button, you can:

- Apply a predefined scale to the image
- Design your own calibration scale to obtain distance and area measurements in any scale or units, based on a known dimension within an image
- Attach calibrations to an image
- Save calibration definitions for future use.



Select VIEW | MEASURE BAR to display the MEASURE BAR. The CALIBRATION dialog box is displayed when the CALIBRATE button is selected from the MEASURE BAR or by selecting:

TOOLS | CALIBRATE MEASURES ...

Default Calibrations


Default calibrations

By default, the CALIBRATION “no_calib” with a square pixel type and with a scale of 1 pixel to 1 pixel is applied to every image. There is also a default calibration of 1 pixel to 1 pixel for each TYPE. Selecting a calibration from the CURRENT CALIBRATION list applies it as the default to all loaded images except those with attached calibrations. Measurements performed on images with no attached calibration are calculated according to the default calibration.

Note


The CALIBRATION, either default or attached, is taken into account for all analysis operations.

Attaching a Calibration

The  button attaches the current defined calibration to the current image. All subsequent measurements of that image will be calculated according to the attached calibration.

Managing calibrations

When an image is saved to disk, its ATTACHED CALIBRATION (if any) is also saved. When a calibrated image is loaded, a calibration object is created. If a CALIBRATION of the same name already exists, the ATTACHED CALIBRATION will overwrite the existing CALIBRATION.

To check if an image has an ATTACHED CALIBRATION, right-click on the image thumbnail and select PROPERTIES | USER. To remove an attachment, select it from the list of USER PROPERTIES and click the  button.

Existing Calibrations


Calibrations found in TIFF or JPEG images are not loaded if the Tools | SETTINGS | IMPORT IMAGE FORMAT | IGNORE CALIBRATION is selected, because the calibration data set by many sensors is irrelevant for measuring objects in images.

Calibration Quick Steps

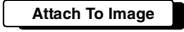
Note

These Quick Steps are intended to serve as a reference. It is strongly recommended that you read this entire Section before calibrating images.


To attach a predefined calibration:

You cannot modify a native Visilog calibration; however, you can modify an existing user-defined calibration. To attach a native Visilog calibration, select it from the list and click the  button.

To attach an existing user-defined calibration:

1. Select the predefined calibration from the AVAILABLE CALIBRATIONS list.
2. Enter the INTENSITY CALIBRATION values, if applicable.
3. Click on the GRAPHIC OBJECT button.
4. Adjust the calibration line(s) in the image.
5. Enter the ACTUAL LENGTH(S) of the line(s) next to the PIXEL LENGTH(S).
6. Click on the  button.

To define a custom calibration:

1. Enter a name for the new calibration in the CALIBRATION NAME field.
2. Enter the INTENSITY CALIBRATION values, if applicable.
3. Select the UNITS OF MEASURE.
4. Click on the MEASUREMENT TYPE button.
5. Select the CALIBRATION TYPE.
6. Select the GRAPHIC OBJECT BUTTON.
7. Adjust the calibration line(s) in the image.
8. Enter the ACTUAL LENGTH(S) of the line(s) next to the PIXEL LENGTH(S).
9. Click on the  button.

Selecting a calibration

At the top left is the AVAILABLE CALIBRATIONS list which presents a scrolled list of predefined calibrations. As you select an existing calibration from the list, its name appears in the CALIBRATE NAME field, and the information describing and defining that scale appears in the rest of the dialog box. The contents of the CALIBRATION dialog box are dependent on which calibration you select.

Add comments

The DESCRIPTION area is an optional field to contains a description or comments regarding the current calibration.

Designing your own

Calibration Types

Visilog offers three possible CALIBRATION TYPES. The best TYPE to use depends on your acquisition device and grabber board as well as on what information is known in the image. The contents of the rest of the dialog box will vary depending on which CALIBRATION TYPE you select. The choices are SQUARE, RECTANGULAR 2, and RECTANGULAR 3.

Square Type

One known measure and X:Y=1:1

Use the SQUARE CALIBRATION TYPE when any one distance in the image is known (for example, a single dimension of an object) and the X:Y ratio is 1. Use this setting for zero-deformation grabbers.



To calibrate a SQUARE type, select SQUARE as the MEASUREMENT TYPE button and then click on the GRAPHIC OBJECT button. Within the image, click-and-drag to resize and reposition the line to define a known element.

Once you have drawn the calibration line in the image, the PIXEL LENGTH (line length in pixels) appears within the CALIBRATE MEASURES dialog box. Enter the known REAL SIZE of the line in the field next to the SIZE IN IMAGE and select the UNITS OF MEASURE (ex. feet, cm, etc.) in the field above.

Rectangular 2 Type

Two known measures at 90°

Use a RECTANGULAR 2 type calibration when you know the length of two dimensions at right angles along the X and Y axes.



To calibrate a RECTANGULAR 2 type, select it as the MEASUREMENT TYPE, and then click on the GRAPHIC OBJECT button. Within the image, click-and-drag to resize and reposition the lines to define known elements. The calibration lines may be manipulated jointly or separately.

Once you have drawn the calibration line in the image, the SIZE IN IMAGE (line lengths in pixels) appear within the CALIBRATE MEASURES dialog box. Enter the known REAL SIZE of the lines in the fields next to the SIZE IN IMAGE and select the UNITS OF MEASURE (ex. feet, cm, etc.) from the list above.

Click the button to save your new calibration definition. The X:Y RATIO is calculated and entered automatically based on the line lengths.

Click the button to attach this calibration to the current image.

Two known measures



Rectangular 3 Type

Use the RECTANGULAR 3 CALIBRATION TYPE when any 2 measurements are known.

To calibrate a RECTANGULAR 3 type, select it as the MEASUREMENT TYPE, and then click on the GRAPHIC OBJECT button. Within the image, click-and-drag as necessary to position and resize the calibration lines. The calibration lines may be manipulated jointly or separately.

Once you have adjusted the calibration lines in the image, the SIZE IN IMAGE (line lengths in pixels) appear within the CALIBRATE dialog box. Enter the known REAL SIZE of the lines in the fields next to the SIZE IN IMAGE and select the UNITS OF MEASURE (ex. feet, cm, etc.) from the list above.

Click the button to save your new calibration definition. The X:Y RATIO is calculated and entered automatically based on the line lengths.

Click the button to attach this calibration to the current image.

X and Y Origins

X and Y Origins

By default, pixel locations are identified by their address along the X and Y axes, starting at 1 from the upper left of the image. The X ORIGIN and Y ORIGIN edit fields allow you to stipulate different starting positions in any units.

Adding, Modifying and Saving a Calibration

When you select the button, any new or modified calibration definition is automatically saved with the other calibration definitions and added to the pick list. Calibrations are saved to disk in the Visilog application data directory, and are loaded at the start of the next session.

To add your own calibration, enter a new name in the CALIBRATION NAME field and adjust the other parameters accordingly, as described above. In defining a new calibration, you can save yourself some effort by first selecting a calibration scale that resembles the one that you want to define, and then just rename it and adjust the necessary parameters.

To modify an existing calibration but keep its original name, edit the information in the dialog box to your satisfaction and select the button to apply your modifications to the current calibration definition. To remove a calibration, use the delete button. Native Visilog calibrations cannot be removed.

2. Taking Geometric Measures

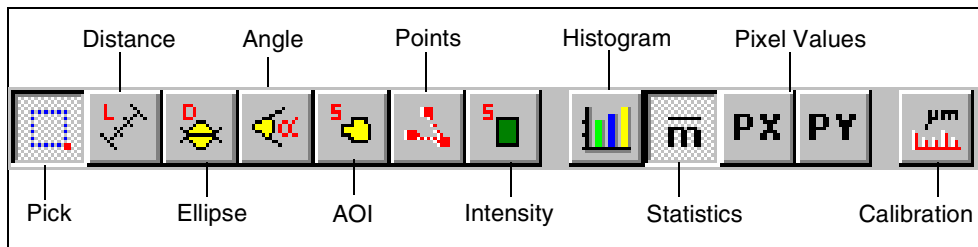


Figure 5-2 Measure tool bar

Select VIEW | MEASURE BAR to display the MEASURE BAR. The MEASURE BAR uses some of the tools from the ANNOTATION BAR.

GEOMETRIC MEASUREMENT capabilities include measuring distances, areas, angles, and point and neighbourhood values.



Measuring an Element

Note Measurements are always scaled according to the proportions of the image, but to make measuring easier, select the CONSTRAIN button before measuring.

Interactive measurement of an element in an image is as easy as selecting the right drawing tool, adjusting the graphic in the image to the same size as the element to be measured, and viewing the results. Brief results are displayed in the VIEWING pad status area, but all results are sent to the RESULT VIEWER window, from where they can be printed and / or saved.

The results are displayed in the scale of the default calibration, or in the scale of an attached calibration, if any. By default all measurements are in pixels and all calculations are based on a square pixel pattern, unless you have attached or set a different calibration as the default, as described in the previous section.

Note Make sure that all parts of the graphic are within the bounds of the current image.

Selecting, Moving and Resizing an Object



Use the PICK tool to select an object and display its handles. An object may be selected also by clicking on any outside edge. Objects may be moved by dragging and resized or re-shaped by dragging on a handle.

Measuring a Line



To measure the distance between two points, click the DISTANCE button. Click-and-drag in the image to resize the line and to position it properly. The distance between the end points of the line drawn in the picture is calculated and the length is shown in the STATUS area and in the RESULT VIEWER.

Measuring a Circle or an Ellipse



To measure a circular area, select the ELLIPSE button. Click-and-drag to describe the radii of an ellipse, or Shift-Click-and drag to describe the radius of a circle. The diameter(s) and area are calculated and displayed. Use the handles to resize as necessary.

Measuring an Angle



To calculate the angle between two lines, select the ANGLE button. Reposition the angle graphic in the image as necessary. The coordinates of the three end points and the resulting angle are displayed in the RESULT VIEWER.

Measuring an Irregular Area



To calculate a polygon, click the POLYGON button, and click-and-drag in the image to describe and calculate the area of an irregular shape. The area of the polygon is displayed in the STATUS BAR and in the RESULT VIEWER. Click-and-drag on any point to resize or reshape the area. Click-and-drag on a side to reposition.

Displaying Point Locations



The POINTS button displays in the RESULT VIEWER the coordinates of all points drawn in the image with the Annotation Bar POINT tool.

Displaying Pixel Values in a Neighborhood



The INTENSITY button displays the address and intensity values of all pixels in a 53-square pixel area. The area is defined in the image as a shaded square, which you can reposition or resize. In resizing, you can change the proportions of the rectangle or make it smaller, but you cannot make it larger.

Deleting Objects



The DELETE ALL button deletes all unmerged graphic objects from the display. The DELETE ALL button is located on the DISPLAY BAR, normally located to the left of the VIEWING pad. To delete an individual object, select it and use the MENU | EDIT | CUT option.

Edit Commands

The EDIT menu commands of CUT, COPY, PASTE, and DELETE can be used with any selected graphic element.

Displaying the Results



By default, the results of all geometric measurements are displayed in the status area, but you can use the RESULT VIEWER button to send the results to the RESULT VIEWER window, from where the results can be printed or saved to a file. How to use the RESULT VIEWER window is explained in *Chapter 7, Viewing Results*.

3. Statistical Measurements

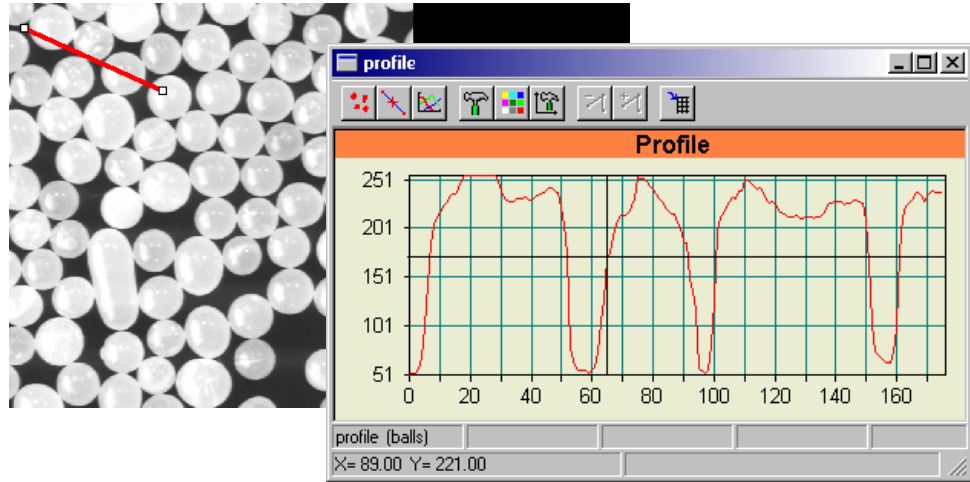


Figure 5-3 Profile of a line in the image “Balls”

Visilog provides three types of statistical measurements:

- Pixel values and statistics along a line or polyline
- Histogram and statistics of an image
- Graph display and statistics of an AOI (Area of Interest).

Lines and Polylines



The PROFILE button in the DISPLAY BAR is only available once you have drawn a line or polyline in the image using the tools in the ANNOTATION BAR. A polyline is a series of connected straight lines connected by nodes that are treated as a single object. Once you select the PROFILE button, the GRAPH of the pixel values is displayed in the GRAPH window of the RESULT VIEWER.

Within the Graph

The grey levels are displayed vertically, and the line length in pixels is on the horizontal axis. As the cursor is moved across the graph, horizontal and vertical lines mark the cursor location, and the X and Y values are displayed in the Graph window status area.

To view a section of the graph in greater detail, click-and-drag the cursor over the area of the graph. Right-click to return to the full display. You can save the graph as a file.

Grey levels are
vertical, Line
Length is
horizontal

To view the actual pixel values and the statistics on the line, select the SPREADSHEET button from within the GRAPH window. Available statistics are: MINIMUM, MAXIMUM, STANDARD DEVIATION and MEAN. If you select the INTERACTION button from within the GRAPH window, a cross is drawn on the polyline at a location corresponding to the position of the cursor in the GRAPH.

The full operation of the GRAPH window and the RESULT VIEWER are explained in *Chapter 7, Viewing Results*.

Histogram and Statistics on an Image



The HISTOGRAM button in the DISPLAY BAR displays a graphic representation of the frequency of intensity levels in the current image. The histogram is displayed through the GRAPH window in the RESULT VIEWER. The Y axis portrays the number of pixels of each value, and the X axis portrays the intensity levels. The statistics are displayed in the STATUS area of the GRAPH window. For a color image, each color is represented by a separate curve in the graph.

As the cursor is moved across the graph, horizontal and vertical lines mark the cursor location, and the X and Y values are displayed in the STATUS area.

To view a section of a graph in greater detail, click-and-drag the cursor over the area of the graph. Right-click to return to the full display.

To view the actual intensity distribution and the statistics on the image, select the SPREADSHEET button from within the GRAPH window. Available statistics are: MINIMUM, MAXIMUM, STANDARD DEVIATION and MEAN.

The full operations of the RESULT VIEWER and the GRAPH are explained in *Chapter 7, Viewing Results*.

Statistical Measurement of an AOI

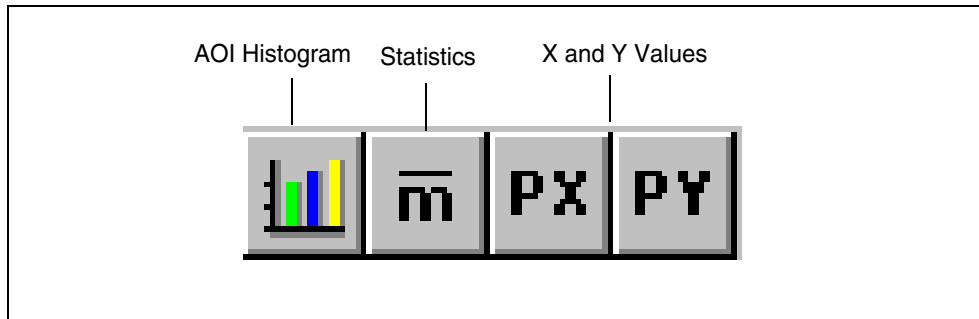


Figure 5-4 AOI Statistics tools

Any shape of AOI

An Area of Interest (AOI) may be either rectangular or irregular in shape. Default statistical analyses include a histogram of grey level distribution, minimum, maximum and mean grey levels and the standard deviation. For a rectangular AOI, you can also display the grey level values along the X or Y axes.

Defining an AOI

To define an AOI, select either the RECTANGLE, POLYGON or FREEHAND POLYGON tool from the ANNOTATION BAR. Click-and-drag to draw the form. Use the PICK tool to move or re-shape the AOI. For information on using the tools in the ANNOTATION BAR, see [Annotating an Image](#) on page 4-2.

Calculating Statistics

The calculated statistics are attached to the AOI. As you move an AOI, all of the attached functions are computed and redisplayed.



The STATISTICS button calculates the Minimum, Maximum and Mean intensity values, the Standard Deviation and the number of pixels for the AOI. The information is displayed in the RESULT VIEWER SPREADSHEET window.

The full operation of the GRAPH and SPREADSHEET windows are explained in [Chapter 7, Viewing Results](#).



AOI Histogram

To calculate and display a histogram of the grey level distribution within an AOI, select the AOI HISTOGRAM button. The histogram is displayed in the GRAPH window of the RESULT VIEWER. The Y axis portrays the number of pixels of each value, and the X axis portrays the intensity levels. The interval range and the number of samplings for the X axis depend on the intensity levels which are present in the AOI.

As the cursor is moved across the graph, a horizontal line marks the cursor location, and the X and Y values are displayed in the GRAPH window STATUS area. Pixel locations are calculated starting from the upper left corner of the AOI.

To view a section of the graph in greater detail, click-and-drag the cursor over the area of the graph. Right-click to return to the full display. From the GRAPH window, the SPREADSHEET button sends the results to the SPREADSHEET window.

The full operation of the GRAPH and SPREADSHEET windows are explained in [Chapter 7, Viewing Results](#).

X-Axis and Y-Axis Grey Levels



The PX or PY buttons respectively calculate the sum of the pixel intensities along the X or Y axes for every value of X or Y of a RECTANGULAR AOI and display the results in the GRAPH window. To view the source data and statistics, click on the SPREADSHEET button in the GRAPH window.

Edit Commands

The EDIT menu commands of CUT, COPY, PASTE, and DELETE can be used with any selected graphic element. Use the CLEAR ALL button to clear all graphic elements from the display. To delete a single object, select it and use the DELETE key.

Saving and Loading AOIs

Use the FILE | SAVE GRAPHIC to preserve an AOI for future use. AOIs that are not saved cease to exist when the current session is ended. The SAVE GRAPHIC option opens a standard SAVE AS dialog box where you can select a directory and name the file.

The FILE | LOAD GRAPHIC option allows you to load a previously defined and saved AOI as a layer over the current image.

The SAVE GRAPHIC command stores the graphical objects, the AOI characteristics, and the measurements to be done, but not the measurements themselves.

Using the RESULT VIEWER FILE | SAVE option, either the GRAPH or the numerical data may be saved to a file.