Leica DFC Cameras

Image Acquisition

Leica
MICROSYSTEMS

Leica DFC Cameras Image Acquisition

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Symbols

Warning
This symbol denotes information that must be read and observed. Failure to do so may lead to malfunction of, or damage to, the equipment

Useful Information
This symbol indicates additional information or explanation.

Action
This symbol within the text indicates that certain actions must be carried out.

Introduction

Leica DFC Cameras are controlled by Leica DFC Twain camera software. Leica DFC Twain supports image acquisition under Leica LAS, Leica IM and Leica QWin and image editors such as Imaging ®, Photoshop ® and Paint Shop Pro ®.

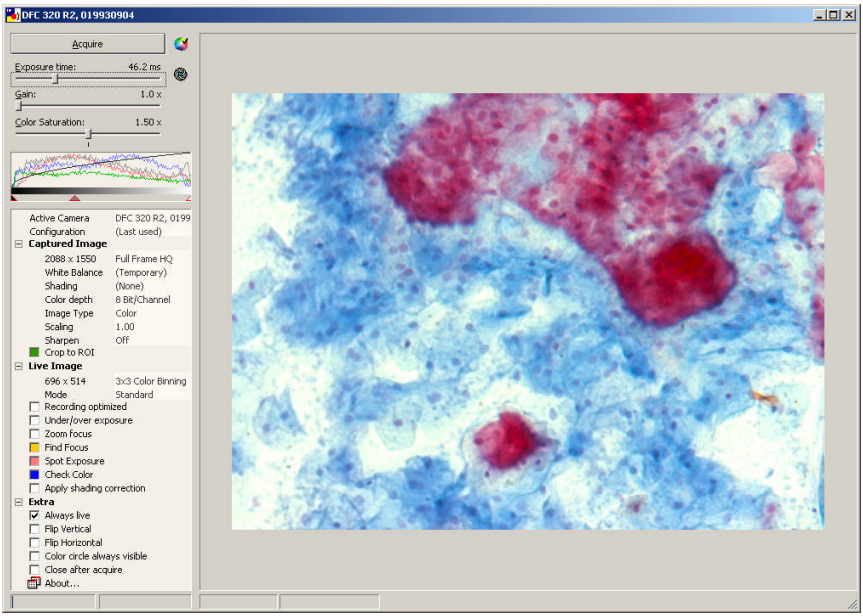
The information provided in this Leica DFC Camera Acquisition Manual is subject to change without notification and does not present Leica Microsystems (Switzerland) Ltd with any binding commitments. The software described here is a licensed product, and may be used only in accordance with the conditions as defined in the license agreement.

Information about DC180 – 480 and DC500 cameras can be found in the Leica DC Manual.

DFC Twain Overall Design

Layout

The Leica DFC Twain user interface looks similar to the screenshot below.



The camera Control Panel is on the left, and the camera Live Image is on the right.

The active camera name appears in the DFC Twain title bar at the top.

The Control Panel handles all the operations of the camera. Some controls are also available within the Live Image area.

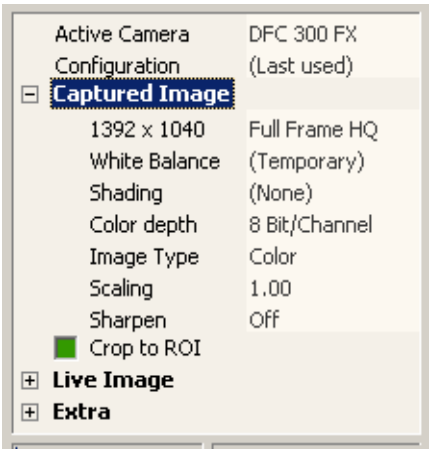
The basic camera functions are contained in the upper section of the control panel. These include controls for exposure, color, contrast and image acquisition. The live image histograms, showing the light intensity across the live image, are also displayed here.

In the lower section of the control panel, detailed parameters of the live and captured images including size, color, cropping, shading, sharpening and focusing can be controlled.

Control Panel Structure

The individual functions of DFC Twain are accessible as branch entries in a tree structure. The main branches (Captured Image, Live Image, Extra) are opened/closed by left-clicking or double-clicking “+” or ”–“.

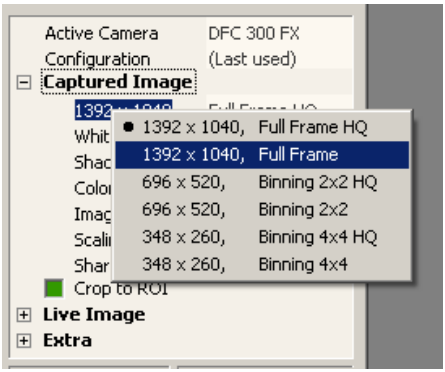
Control Panel branches collapsed



Captured Image branch expanded

Sub-menus

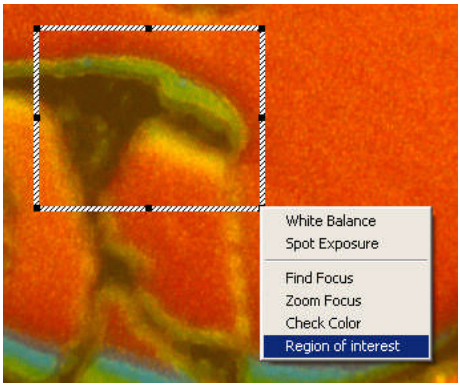
Many controls or status messages contain further sub-menus or settings. These functions are ordinarily hidden and are accessible by right-clicking on the required branch control.



Captured image sub-menu to the resolution size

Live Image Controls

These control elements may be selected from a context menu, after drawing a rectangle within the live image area with the mouse (left-click and drag).

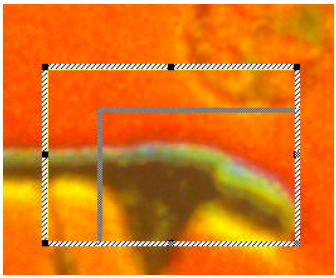


Each function has its own rectangle color and is active until switched off again in the control panel. This means there may be more than one colored rectangle within the live image window.

Rectangle Control

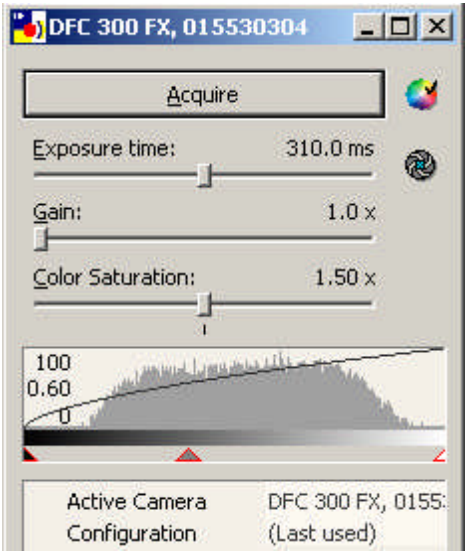
The position and size of these rectangles can be changed at any time:

- Left-click on the colored rectangle to activate it. When active, the rectangle assumes a dotted line.
- Move the rectangle to any position by left-click and dragging the dotted line.
- Resize the rectangle by left-clicking on one of the black square dots around it and dragging.



General Controls

Control Panel



Basic Controls in the upper control panel are:

Acquire button for image acquisition

Auto White Balance button

Exposure time slider

Auto Exposure button

Gain slider

Color Saturation slider (Color cameras)

Pseudo Color slider (Mono cameras)

Histogram Display

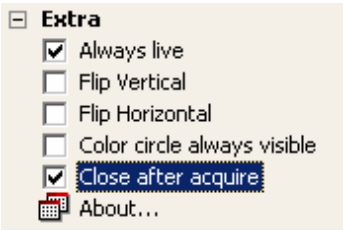
Active Camera menu

Configuration menu

- To acquire an image with the selected settings for your archive or the current application, left-click *Acquire*, or
- press *F3* key.

Depending on the camera type and the settings you have selected, this process may take anything from a few milliseconds to several minutes. Sometimes the image will be exposed several times or each color may be scanned separately. These processes can take a long time to execute, even on fast computers, and if so, will display a progress bar.

If *Close after Acquire* is checked, DFC Twain will close after acquisition, otherwise the system is ready for the next image acquisition.



If *Close after Acquire* is checked, DFC Twain and the camera will take the same time to reinitialize, as if from the start.

You can also make a temporary acquisition by pressing the *F4* key. The acquired image will be located in your local *Temp* folder with a filename *NewImage.bmp*. Each acquired image using this method will be over-written.

Auto White Balance

The White Balance function performs a color correction in the image source in order to display all neutral-colored components of the image (all gray tones, from black to white) without any color bias. Thus, the term

white balance is not strictly correct, neutral balance would be more accurate. However, as the term White Balance is used worldwide, we will also use it here.

To activate Automatic White Balance, click 

The White Balance procedure is one of the most important settings for acquiring a well-rendered color image. It can either be applied to specific detail or region, or to the whole image.

Please note that for brightfield images, color balance is achieved when a daylight filter is in the illumination path.

At camera start-up this function is always off.

See also White Balance in the Captured Image section.

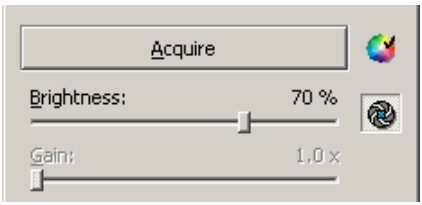
Exposure

Automatic

DFC Twain uses intelligent automated systems to analyze the current light conditions and control exposure time, image grain, contrast and gamma values to optimize the resultant image.

- To activate Automatic Exposure, left-click  .

When automatic exposure is switched on, the *Exposure* slider changes to *Brightness* and the image brightness is displayed as a percentage. This is a target value that the automatic exposure adjustment attempts to achieve.



Automatic exposure remains active until the button is clicked again. At camera start-up this action is always off.

Please note that auto-exposure is not suitable for faint images and is limited to 1 sec.

Manual

Automatic exposure offers the best overall image quality for most acquisition purposes. However, in situations with difficult light conditions, you may wish to adjust the exposure.

Exposure time is applied non-linearly and, depending on the camera model, it is displayed in microseconds, milliseconds or seconds.

DFC290 HD camera only

Connection to HD device
(High definition TV, computer flat-screen or beamer)

Standalone mode

When using the camera in standalone mode always turn on the HD device first, and then power up the computer and/or the camera.

When you turn on the power to the camera, it takes about 2 or 3 seconds to display the live image on the HD device.

Because all the color interpolation is done in the camera, the live image on the HD device is displayed in real-time - there is no time-lag.

If you have attached an HD device to the camera, first check the available and supported resolutions in LAS or DFCTwain.

In LAS or DFCTwain, always start with the lowest resolution first (VGA) and then switch to higher resolutions (HD-ready 720p or Full-HD 1080p).

When an HD device is detected at start-up, the DFC290 HD checks which resolutions are supported on the HD device.

Depending on the brand and model of the HD device, it is possible that not all resolutions of the HD device are supported and available in LAS or DFCTwain.

When an HD device is attached it is recommended to deactivate the *Show All Modes* inside LAS or DFCTwain, and to show only the available and

supported resolutions.

If you select a resolution which is not supported by the HD device, the live image will freeze until you select a valid live image resolution again.

Please note that the DFC290 HD remembers and applies the last used camera settings.

So, for example, to display a flipped image, flip the image while the camera is connected to a PC before closing LAS or DFCTwain.

The camera settings will be remembered until you start LAS or DFCTwain again.

Similarly, to make a while balance, do this while the camera is connected to the PC and before you switch to standalone mode.

Once a correct white balance is set, the camera uses this parameter until you make a new white balance.

The camera does not perform automatic white balance, even if there is a change of the color temperature of the illumination.

Leica strongly recommends using LED illumination for the DFC290 HD which has a stable and constant color temperature at different brightness settings.

Please note that the camera has the capability to do automatic brightness correction in standalone mode, within the range 0.1 ms to 300 ms.

If auto-brightness is set, the camera automatically adjusts the exposure time when the sample brightness changes, eg. when you zoom or change to a different sample.

Remember that you have to set auto-brightness in DFCTwain while the camera is attached to the PC.

If the camera is set to a specific exposure time, the camera will not make any automatic adjustments to the image brightness, even if the illumination or type of sample changes.

When connected to an HD device adjustment of gamma

is limited to five distinct settings between 0.6 and 1.0.

All histogram manipulations (e.g. moving of black point, white point) are done in DFCTwain and are not supported when an HD device is attached.

Once you have set the camera parameters, you can close LAS or DFCTwain on the PC and still see a live image in the HD device.

The live image will continue to be displayed on the HD device, as long as the camera receives power through the FireWire cable.

If you have a laptop kit or the DFC290 HD power kit, you can also disconnect the FireWire cable from the computer.

If you want to have full control of all camera parameters including the histogram, then you must disconnect the HD device, and control the camera in PC mode.

Gain

Increasing Gain is a way of making an image brighter without increasing the exposure or where the amount of light is low. However there may be a degradation of quality at high gain values because there is a greater noise content.

When Automatic Exposure is active Gain is disabled. The default value is 1.0x.

IC 3D camera only

The gain for the IC 3D sensors can be controlled independently or locked together. The default is locked together but this can be changed in the hidden menu in: Extra>>Separate Gain Values.

Color Saturation (Color cameras)

When viewing a sample through an eyepiece and comparing it with the overall color of a live or captured image, you may find that the intensity of color of the

image requires some adjustment.

The color saturation of a whole (color) image may be increased or decreased from the norm using the *Color Saturation* slider.

To adjust towards more artificially vibrant colors move the slider to the right. The maximum value is 3.00x. This is useful when the image may be dull or when separation of the elements of the image is unclear.

To decrease the color intensity, move the slider to the left. The minimum is 0.00x and represents an image without color information - a monochrome image.

This function is only available in color resolution modes. For a monochrome resolution mode or a monochrome camera, the function is not active and the slider is grayed out.

The default value is 1.50x for all Leica DFC color cameras.

Pseudo Color (Mono cameras)

When using a monochrome camera and color filters in a microscope, it is often useful to match the color seen through the eye-piece to the image displayed by the camera.

The image can be adjusted for all colors in the visible spectrum (380 – 780 nm). The minimum possible grey level is black and the maximum possible grey level is the selected color, not white.

To adjust the color, first check the *Pseudo RGB* check box in *Captured Image*. The *Color Saturation* slider changes to a *Pseudo Color* slider.

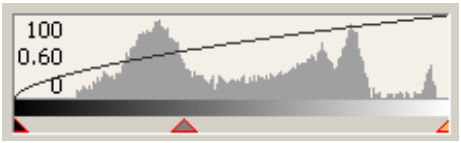
The captured image will be a color image (bitmap).

Histogram

Histogram Display

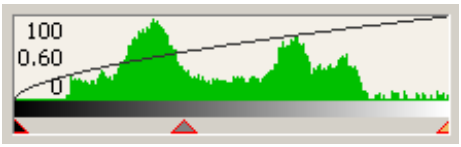
The histogram shows the light distribution in the live image, from the darkest components on the left-hand side to the brightest components on the right-hand side (indicated in a grayscale bar).
A higher peak in the histogram represents more pixels of that tonal density. A well-illuminated image should contain all components from dark to light.

Default luminosity histogram showing values for black/white levels (0,100) and gamma (0.60).

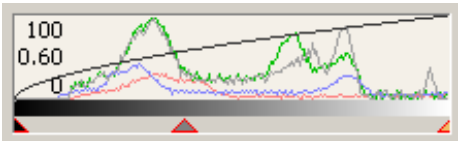


Separate histograms for red, green and blue channels are available.

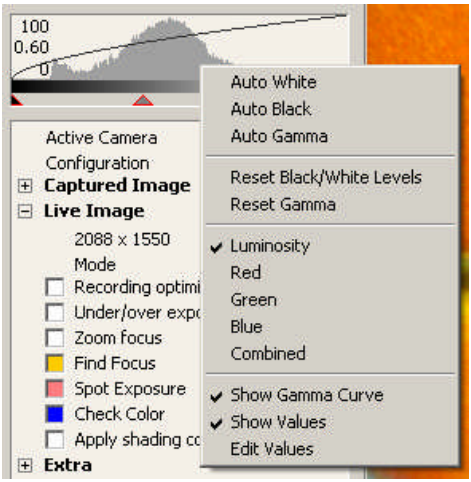
eg, green channel histogram:



Combined histogram showing red, green and blue channels:



How the histogram is displayed, and what contrast values are visible and applied are available by right-clicking in the histogram area. Check/uncheck the required settings.



To select a Histogram type choose *Luminosity*, *Red*, *Green*, *Blue* or *Combined*. The default is *Luminosity*.

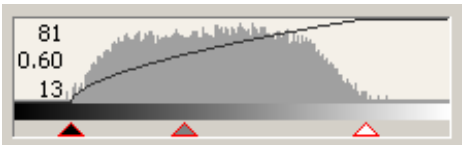
To select automatic contrast functions select *Auto White*, *Auto Black* or *Auto Gamma*. To reset these values choose *Reset Black/White Levels* or *Reset Gamma*, but you must deselect the auto functions first. The default value for Black is 0, White is 100, and Gamma is 0.60.

To display the values for Gamma and Black/White levels choose *Show Values* and to display the Gamma Curve choose *Show Gamma Curve*.

To type manually precise values for all the basic controls choose *Edit Values*.

Image Contrast: Black/ White Levels

To obtain the best image, the contrast indicators (black ▲, left, and white △, right) should be aligned with the limits of the brightness distribution as shown in the example below.



- Right-click in the histogram and check *Auto White* and/or *Auto Black* from the sub-menu.

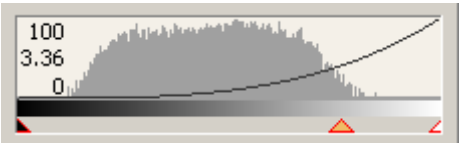
- To revert to manual mode uncheck these auto modes.
- To reset the values – right-click in the histogram and choose *Reset Black/White Levels* from the sub-menu.

Image Contrast: Gamma

The gamma value helps to brighten or darken specific light intensities within an image.

Depending on the acquisition situation, dark areas in images often appear too dark for the human eye. The gamma value is displayed as a number (eg. 3.36, below) in the histogram and also as a black curve (if active).

- Moving the gamma indicator between the two contrast indicators allows selective brightening of these areas.



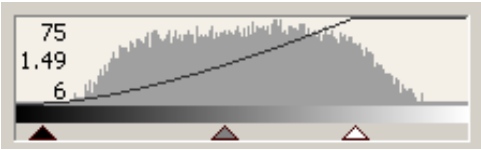
A gamma value of 1.0 is set when the gamma indicator is exactly between the two contrast indicators. Moving it to the left reduces the gamma value and the curve rises at the left end; moving it to the right increases the gamma value and the curve slopes upwards more gradually.

Auto Gamma calculates an optimum gamma value from the composition of the current brightness distribution.

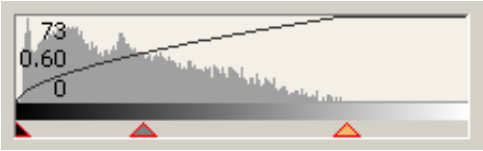
- Right-click in the histogram and choose *Auto Gamma* from the sub-menu.
- To revert to manual mode uncheck *Auto Gamma*.
- To reset, right-click in the histogram and choose *Reset Gamma* from the sub-menu.

Please note that the triangle indicators are grayed out when automatic contrast or gamma are switched on. When the automatic functions are switched off, the triangles are shown red and will respond to mouse

commands.



Automatic functions on: Indicators are positioned automatically



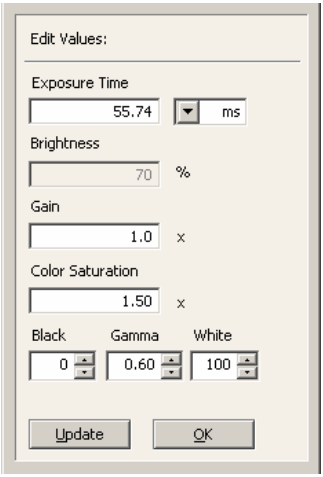
Automatic functions off: Indicators can be moved with mouse

Occasionally, the gamma indicator can sit directly over the black or white level indicators, so that it becomes impossible to separate them. (The black and white levels do not overlap completely)
If this happens click *ctrl + mouse* to grab the gamma indicator and move as before.

You can also select each indicator by pressing the *space bar* once at a time until the indicator you require becomes active and shows as 

Edit Values

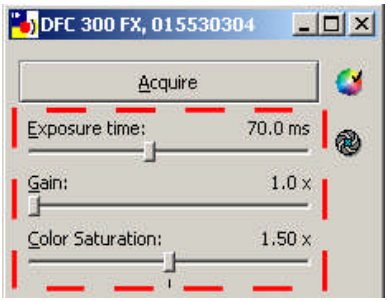
The following panel will allow entries for exposure (or brightness, if auto-exposure is on), gain, color saturation, black / white levels and gamma:



- Click *Update* to apply the values displayed but keep this panel open, or click *OK* to close it.

Be aware that the range of some of these values is not linear and will round up or down in practice.

You can also open this panel by right-clicking in the basic function area of the upper control panel indicated by the red outline below:



Selecting the Active Camera

You can connect as many Leica DFC cameras at the same time as there are FireWire ports in the computer. (Be aware that performance may suffer if you have multiple FireWire peripherals.)

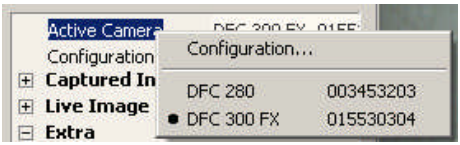
Leica DFC cameras are “Plug and Play” FireWire devices. This means that “Hot Swapping”, connecting and disconnecting while the computer is running, is possible without causing difficulties.

Before disconnecting a camera, some versions of Windows may request that you go through the Safely Remove Hardware Wizard, which you can do via the icon on the Taskbar,

DFC Twain will automatically initialize a newly connected camera and display a live image. If another camera is already connected, the new camera is added to the list but DFC Twain will still display the live image of the current camera.

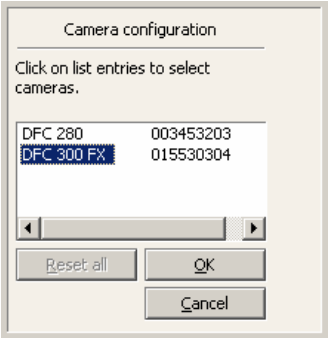
By default, DFC Twain will display a live image of the camera at the top of the list of cameras connected.

- To change the currently active camera, right-click *Active Camera*. Either select a camera in the list (the current camera is denoted by a ●)



or,

- select *Configuration…* and choose a camera from the Camera Configuration panel and click OK.



Leica DFC cameras are identified by their model name and unique serial number, so there is no restriction on connecting several cameras at the same time.

Sensor (IC 3D camera only)

The IC 3D can select one of the two sensors in *Sensor*. This item is only visible when using the IC 3D camera. The default is the left sensor, *L*..

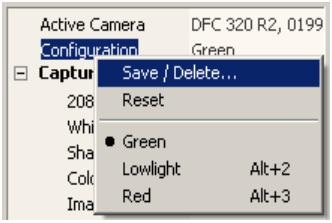
Select *L* for the left sensor and *R* for the right

Managing Configurations

Saving and deleting configurations

Once you have defined the best camera settings for your environment, you can save and retrieve them at any time. This feature is not only useful for different working and lighting conditions, but also creates reproducible user-specific working settings.

- To save the current camera settings, right-click *Configuration* and select the *Save / Delete…*.
- Give a name to the current settings and save.



Saved configurations are entered into a list of settings that can be retrieved at any time, as above. A short-cut to a configuration is denoted by *Alt+1..2..3..* etc.

You can thus activate or deactivate setting combinations for contrast, gamma and exposure, as well as the other current settings.

- To delete, select *Save/Delete…* and delete the named configuration.

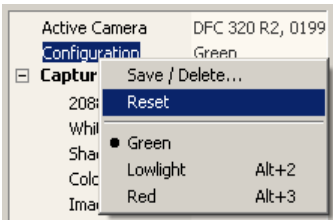
Where there are no saved configurations *(Last used)* will be displayed as the current configuration.

When starting DFC Twain again, the camera will open with the configuration that was used prior to closing and will show *(Last used)*, even though it may be a saved configuration. Select a saved configuration of your choice if in doubt.

Saved configuration files are located in your computer's *Documents and Settings/All Users/Application Data/ Leica DFC280...DFC480* folder. These files are accessible by all camera users.

Reset

To set all the camera control configurations back to default values right-click *Configuration* and select *Reset:*



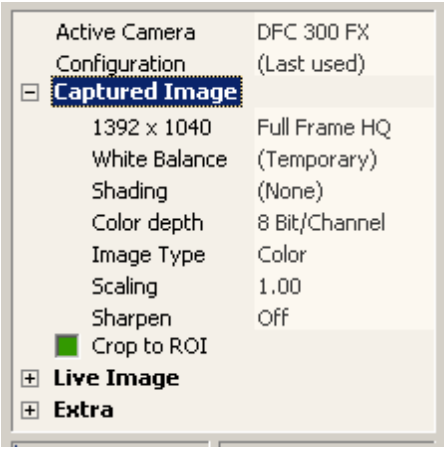
Each configuration is valid for any camera of the same model. This means that you can create a configuration with one Leica DFC280 and load it using another Leica DFC280. However, you cannot load a configuration created on a Leica DFC280 for use with a Leica DFC300FX, for example.

Captured Image Controls

The properties relating to the captured image can be found in this command section.

The live image and captured images are functionally separate and therefore the live image is not always identical to the captured image.

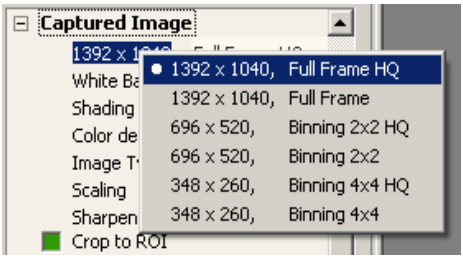
This is useful when a different live image mode offers a faster refresh rate than the captured image mode, or when you always capture in one mode. Also not all functions, eg involving ROI, are available in some modes.



Properties of the captured image

Resolution

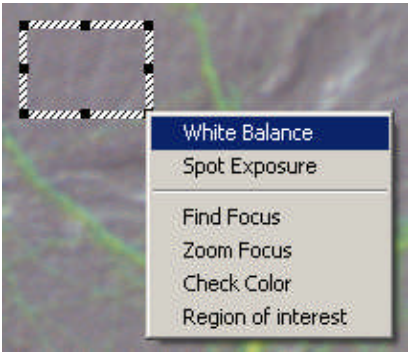
Image resolution modes include the size and whether the image is high quality or binned or a partial image. The number and type of mode available depends on the camera model.



White Balance

Refer also to the previous section on Auto White Balance.

- In order to define the White Balance over a region of interest (ROI), left-click and drag the mouse to draw the area in the live image. Release the mouse and select *White Balance*.



Live image with ROI for white balance

The live image will display the corrected color.

White Balance may also be applied to the whole image. In this case, you do not need to draw an ROI, but only to click on the White Balance icon at the top of the control panel.

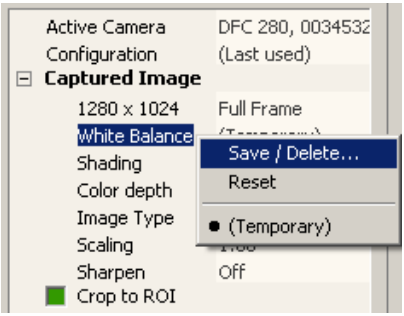
Once you have executed a white balance operation, you can save the settings in order to reactivate them at any time.

- Right-click *Captured Image>>White Balance* for choices.
- Use saved White Balance entries by clicking on the appropriate name.

Save/Delete

Use this to save the current white balance settings under a name for retrieval or deletion at any time.

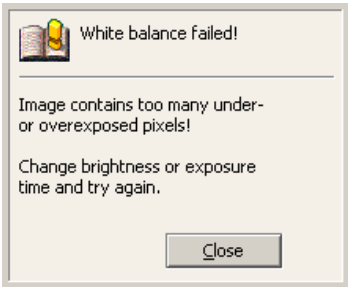
Saved color files are located in your computer's *Documents and Settings/All Users/Application Data/ Leica DFC280...DFC480* folder. These files are accessible by all camera users.



Saving a white balance

White balance is not possible if there are too many under- or over-exposed pixels in the measuring area. A message will inform you if this is the case and the white balance values will be reset. Change the brightness of

the picture or select a different measuring area and repeat the white balance.



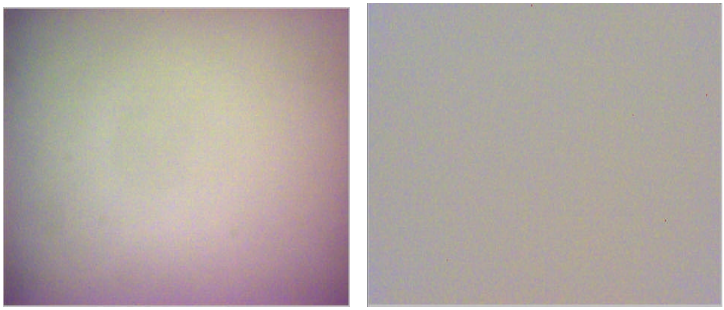
Reset This resets the image source to its default settings.

The reset command may cause the image to suffer a severe color tone shift. If this happens, you should execute another white balance operation.

Shading Correction

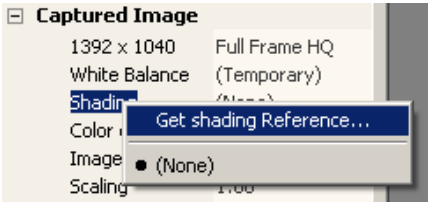
The brightness distribution over the whole image area is seldom homogeneous (because of the lighting, optics, camera adapter, etc.) and Shading Correction corrects this unevenness.

To create a perfectly corrected, homogeneous image, a white image, ie an image of the exposure light only and no subject, is taken as reference and calculated into the live and captured image.

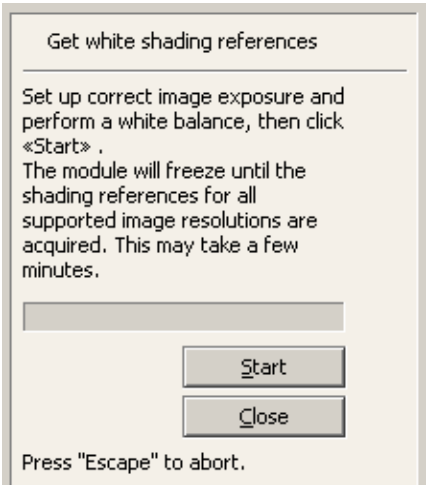


Without shading correction With shading correction

- Select *Get Shading Reference...* and avoid any under or over-exposed areas in the image. Change exposure or illumination brightness if necessary.

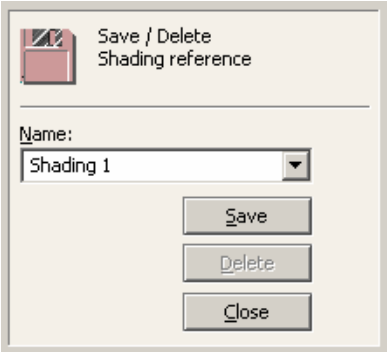


- Press *Start*.



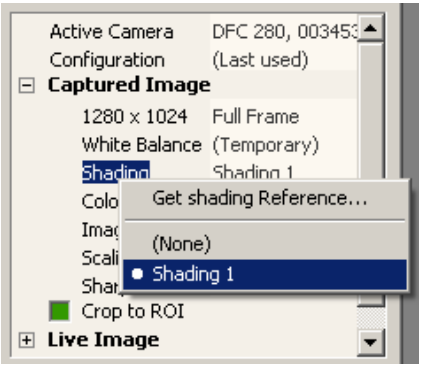
- Follow the onscreen instructions to set the white reference. The window will freeze until shading references for all image resolutions are complete – this may take a few minutes.

If the white shading reference was successful, choose a name for the shading reference, and save it to finish.



Saved shading files are located in your computer's *Documents and Settings/All Users/Application Data/ Leica DFC280...DFC480* folder. These files are accessible by all camera users.

You can now choose and activate the shading correction you have just created from the Shading menu or record further shading references:



Activate shading correction

Image acquisition with shading correction takes a little longer than normal acquisition, as the shading references must be calculated into the final image.

Shading corrections become invalid if you change illumination, objective, zoom position or focus! Once

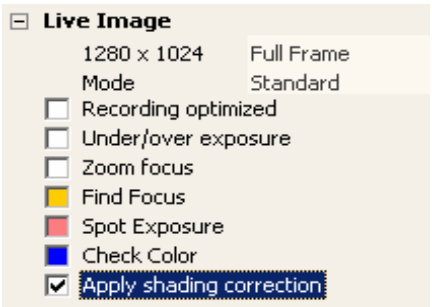
shading is set, you should not change any of these parameters.

Image needs shading correction to correct fall-off at the corners

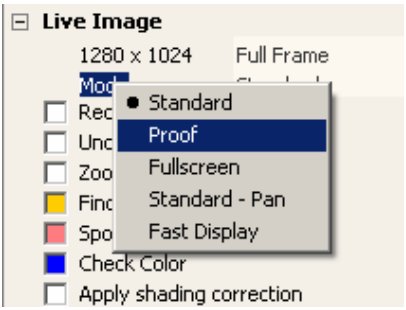
Improved by applying shading correction

You can also apply the shading correction to the live image by:

- Check *Live Image>>Apply Shading Correction*



- or select *Proof* mode in the live image section.

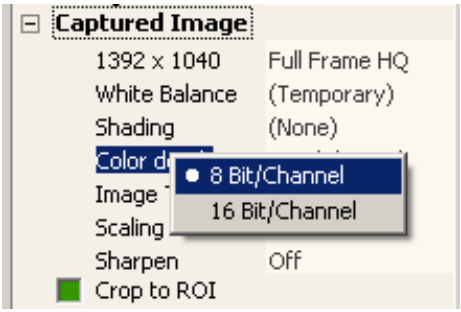


If Proof Mode is activated all image correction and parameters are applied to the live image. This mode is very slow but allows you to check cropping, shading, sharpening etc, as is applied to the captured image.

Color Depth

This option determines the color or “bit” depth quality of images. 16-bit images contain more information than 8-bit images and more accurately represent the original. However they are larger in file size and take longer to process. The visible quality depends on factors such as the image editor software, your monitor and size displayed.

DFC Twain and Leica DFC cameras can acquire images in 8 bits or 16 bits. However, only *HQ* resolution modes allow image acquisition in 16 bits.



Color depth selection

Only a few image file formats such as TIFF, permit storage higher than 8 bits (B/W) or 24 bits (color).

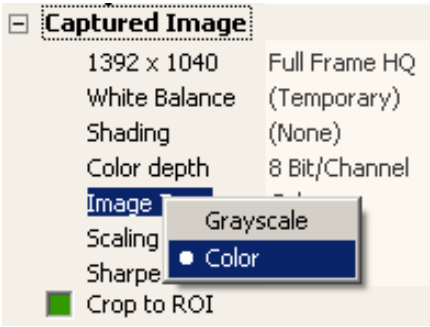
JPEG, (compressed), or BMP, and other file formats do not. Therefore choose a compatible image data format appropriate for you needs or reduce the color depth in the captured image settings.

Few software image editors, such as Photoshop, are able to handle color depths greater than 8 bits. If an image is acquired with a color depth greater than the

image editor allows, an error message may appear, the captured image may be ignored or the software may even crash. DFC Twain does not detect whether or not the image editor can handle higher color depths correctly.

Image Type

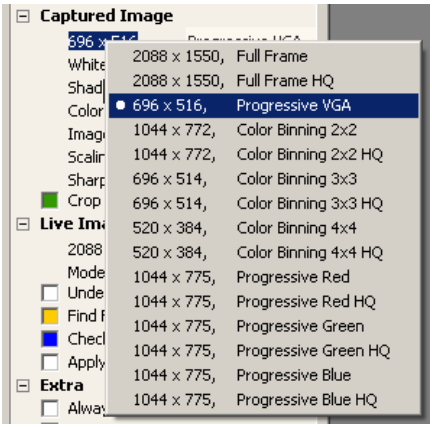
Image Type determines whether the image is acquired as a grayscale (monochrome or B/W) or a color image.



Selection of image type

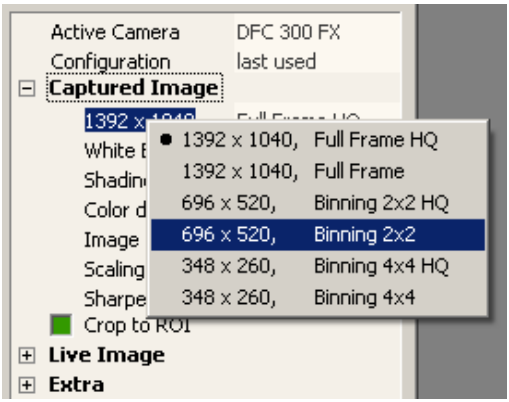
Image Size

Image resolution is the first item in *Captured Image* and the available list depends on the camera model.



Selection of the image resolution

Higher image resolutions require more memory, and therefore recording and processing times are substantially longer.



When selecting an image resolution, some cameras are able to combine several pixels to form a new pixel, thus increasing sensitivity but at a smaller image size. This technique is called binning and in this mode, data transfer is faster. However some color information is lost and the size of the image is limited.

With short exposure times the live image refresh rate can be doubled by activating binning.

Pseudo RGB

(Monochrome cameras only)

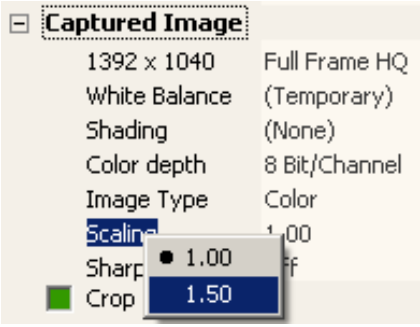
Pseudo RGB allows a monochrome camera to display false color for live and captured images.

Check to activate the *Pseudo Color* slider, and select the color from the spectrum bar.

Scaling

Scaling allows you to scale or enlarge an image, and produce an image optimized for printing or desktop publishing with reduced edge artifacts or “jaggies” (most noticeable on diagonal or curved edges or lines).

Please note that scaling by *1.50* enlarges both the width and the height of an image by 50%. An image size of 4 MB, for example, will become approximately 9 MB! *1.00* represents a 1:1 image with no scaling.

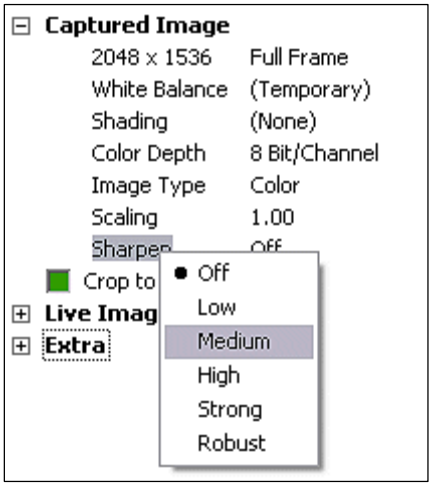


- Select *Scaling* and choose either *1.00* for a normal 1:1 image, or *1.50* for an enlarged image.

Sharpen

Images of certain subjects can appear dull or flat and make focusing difficult. Sharpened pictures can offer crisper focusing and viewing.

Activate Sharpen by right-clicking on *Sharpen* and selecting the appropriate level of sharpness.



The effects of sharpening are not visible in the live image, but only in the captured image.

unsharpened image

the same image with sharpening

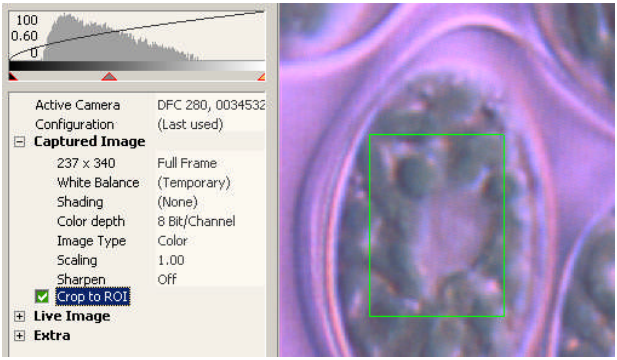
Crop to ROI

If you do not require the whole image, the Crop function allows you to acquire the area of your choice in height and width.

Select ROI

- Activate the *Crop to ROI* by the check-box on the control panel.

The displayed green rectangle on the live image will be the area to be acquired.

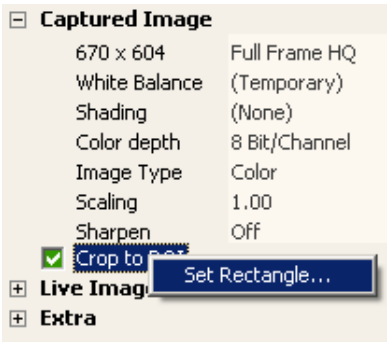


ROI for image acquisition

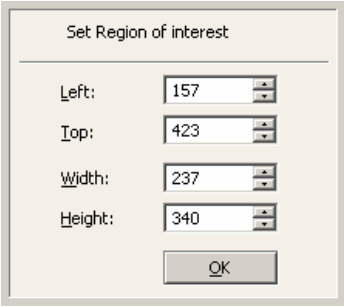
- There are several ways of selecting the size and position of the Crop window:

Manual ROI Setting

- Select Set Rectangle….



- Enter the values for the position (left, top) and size (width, height) in the appropriate fields.

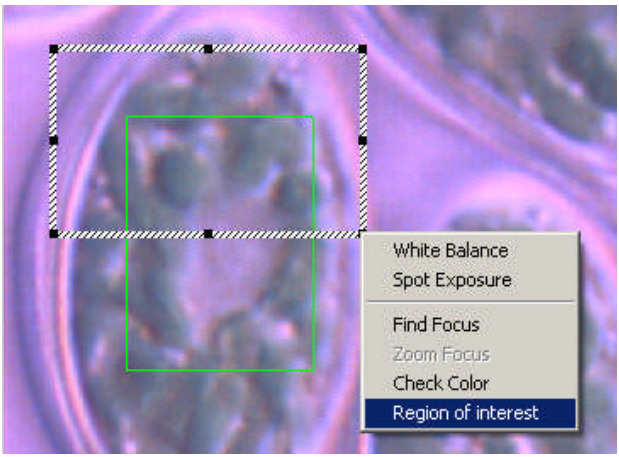


The ROI rectangle is updated automatically on the live image.

Drawing ROI on the Live Image

The Crop area may also be drawn directly on the live image using the mouse.

- Click on the frame of the Crop area - this marks it so that it can be moved, or
- Draw a new rectangle at the position required using the mouse and select *Region of Interest*.



Draw new ROI using mouse on the live image

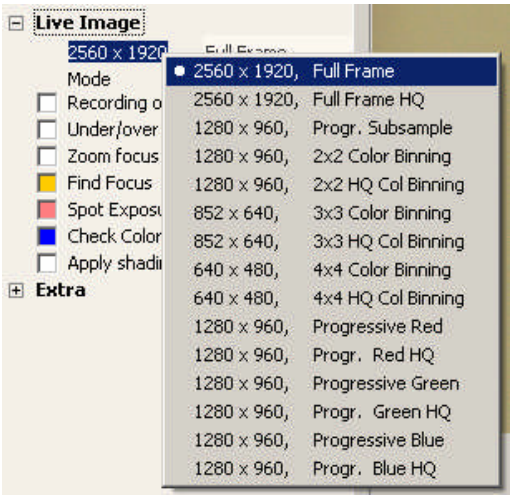
Live Image Controls

The live image shows the image as supplied by the camera. Depending on the camera model, the live image may differ from the subject significantly, for example, if the camera supports various different resolutions. The main task of the live image is a visual check on the image quality, i.e. focusing, framing, etc.

The quality of the live image display is heavily dependent on each camera's specification.

Resolution

As with the Captured Image, Live Image resolution modes include the size and whether the image is high quality, binned or a partial image.



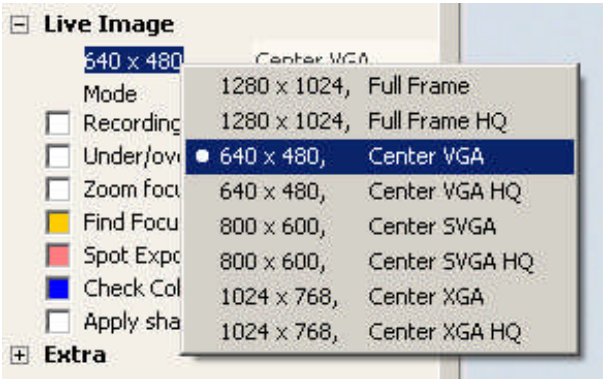
Some resolution modes offer color or monochrome binning, sub-sampling, high/low bit depth and color separation.

Some cameras may offer live image formats that are not available for captured image formats and vice-versa.

On some cameras, the brightness of live image and captured image may appear to be different. In such

cases make sure you select the same image format in live and in capture image, eg. 2x2 binned for live and for captured image.

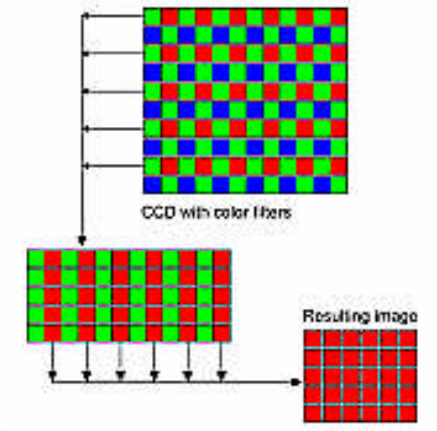
Special Image Formats



Some cameras offer special image formats for live and/or for captured images:

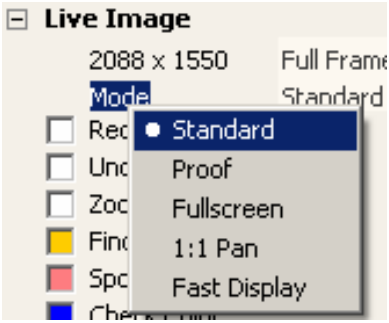
Center Scan Modes: display only the center areas of the image for better focusing.

Progressive Modes: Color Progressive modes (Leica DFC480, 300FX and 320 cameras) display live images without edge artifacts. Mono Progressive modes only display pixels of a certain color, eg *Progressive Red* discards all green and blue pixels and combines the remaining red pixels to form a grayscale image.



Mode

This function lets you select different live viewing modes:



Standard: The default setting which should be used on most occasions. In Standard mode, the live image fits-to-window when the window is resized.

Proof: This mode applies all captured image correction and parameters to the live image. This mode is slow but allows you to check crop, shading, sharpening etc.

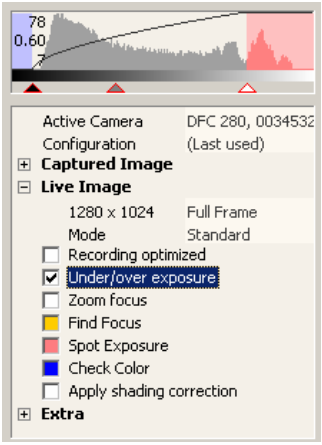
Fullscreen: Displays the live image in fullscreen on the monitor, which can also be activated by pressing the *F5* key. Press *ESC* or *F5* to return to Standard mode.

1:1- Pan: The live image displayed at 1:1 is not fit-to-window. It remains the same resolution selected even when the window is resized. Navigate around the live image using scroll bars, or left-click and drag within the live image window.

Fast Display: For some resolution modes this will offer faster live image refresh rates. However, certain live image features such as zoom & find focus, spot exposure and shading correction, are not available.

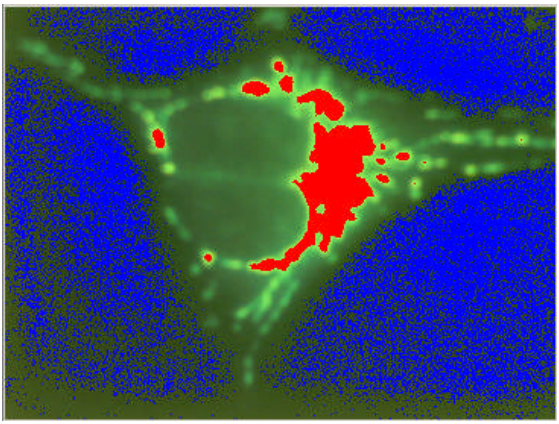
Over / Under Exposure

This function finds areas of the image which are under- or over-exposed. In conjunction with the live histogram, this function assists in adjusting the lighting conditions to the dynamic range for the camera.



- Check/Uncheck *Under/Over exposure*, or
- Right-click *Under/Over exposure* and select *on/off*.

In the histogram, the region beyond the black level appears pale blue, and the region beyond the white level appears pale red.

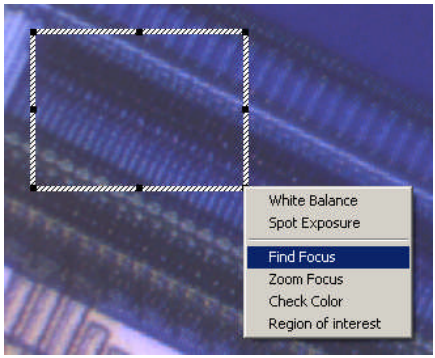


Under-exposed areas of the live image appear blue and over-exposed areas appear red.

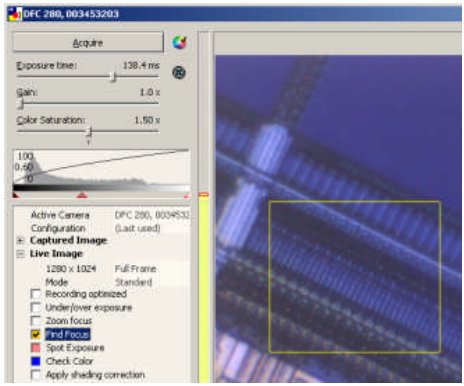
Find Focus

This function helps you find the best focus point in an image, and uses a mouse drawn rectangle within the live image. It is available in all resolution modes.

- Define the position and size of the focus-measuring area, by drawing an ROI and select *Find Focus*.

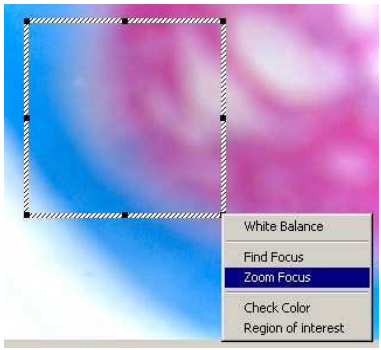


The focus is displayed in the form of a yellow vertical bar -the better the focus within the ROI, the higher the mark in the bar. A maximum level indicator helps you return to an optimum focus previously established.

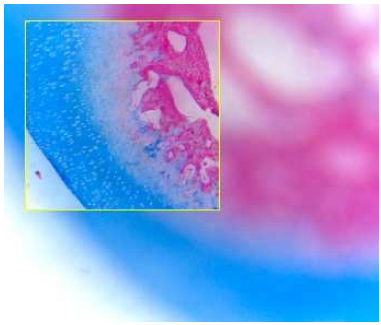


- Check/uncheck *Find Focus* in the Control Panel, or
- set the ROI by right-clicking *Find Focus* and choose *Set Rectangle* – type the values for position and size.

Zoom Focus allows the drawing of an ROI (as described for Find Focus) for fast focusing. The live image will be frozen apart from the area selected for fast focusing. Note that Zoom focus is available only in certain modes.



- Draw a region and select *Zoom Focus*.



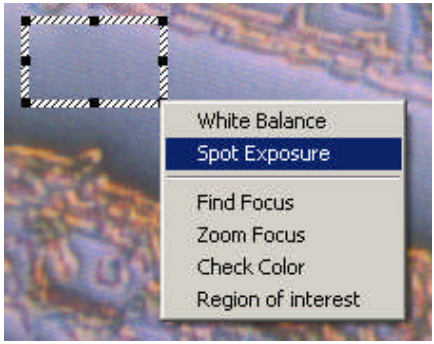
- Set the best focus inside the region
- Uncheck *Zoom Focus* to return to normal viewing,
- or left-click inside the Zoom Focus ROI, or
- right-click *Zoom Focus* and select *on/off*.

Like Find Focus, Zoom Focus will activate a yellow focus bar. Within the ROI, the image is displayed at full resolution, 1:1.

Zoom Focus shares the same ROI as Find Focus, but only one focus function can be active - not both.

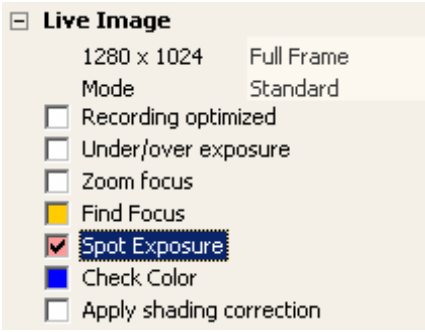
Spot Exposure

This feature allows you to draw a ROI in the live image to set the exposure, and switches on auto-exposure which is now only measured in the defined region.



- Draw a region and select Spot Exposure

Note that if you use Spot Exposure and move the specimen, the exposure may not be appropriate!



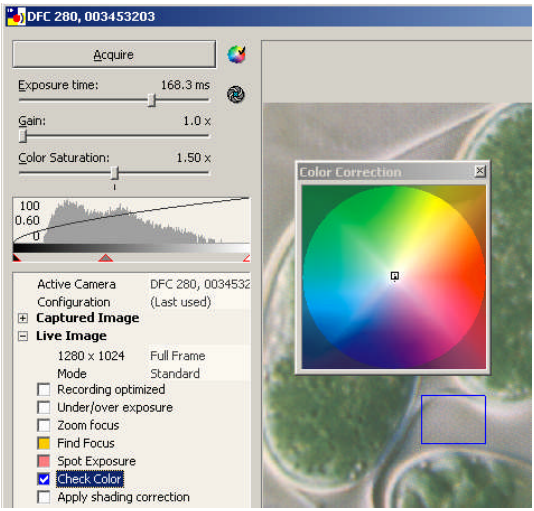
- Check/uncheck *Spot Exposure* to activate (or reselect) or stop , or
- click the *Auto-Exposure* button at the top of the Control Panel , to stop.
- You can set the ROI by right-clicking *Spot Exposure* and selecting *Set Rectangle* – type the values for position and size.

Check Color

This function is used for fine-tuning the overall image color. Depending on the lighting and the camera characteristics, fine correction of the image may be necessary after a white balance in order to compensate for any color shift.

From the control panel:

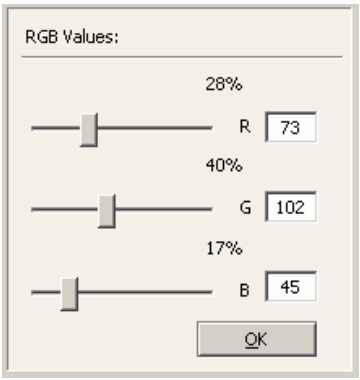
- Check/uncheck *Check Color* to activate the Color Correction Wheel and the measuring rectangle.



Color fine-tuning after white balance

- Inside the Color Wheel, drag the small square to a color value and observe the small dot, which represents the current color within the ROI.

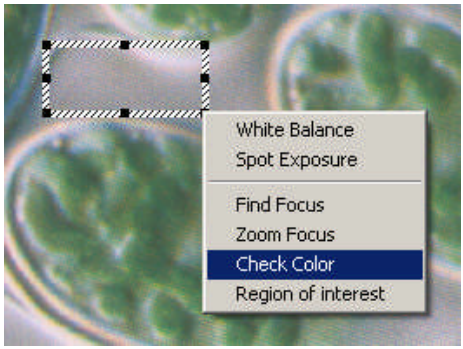
You can also set the separate red, green and blue values by right-clicking *Check Color* and selecting *Set Color Values* which will open the following panel:



The Color Wheel can freely float anywhere in the screen area while DFC Twain is active.

On the Live Image:

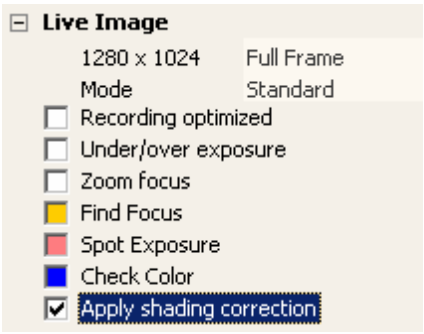
- Adjust the ROI for color fine-tuning by drawing a rectangle in the live image and select *Check Color*.



Measuring area for color fine-tuning

Apply Shading Correction

This function applies any shading definition which is selected in the Captured Image, to the Live Image. This is useful to see if the image is correctly adjusted.



- Check/Uncheck *Apply Shading Correction*, or
- Right-click *Apply Shading Correction* and select *on/off*.

Live Sharpening

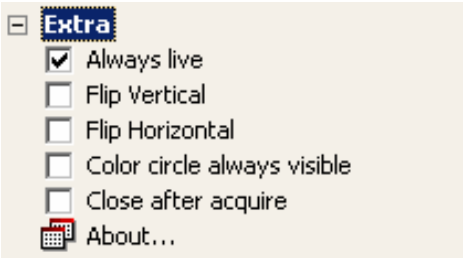
- Check/Uncheck *Live Sharpening* to apply the sharpening value selected in *Sharpen* to the live image

Extra Controls

Functions that support specific camera model properties are listed in the *Extra* branch.

Always live

This function allows you to display the live image even if DFC Twain is running in the background. This may be useful when other software applications need to be running in the foreground on the computer while the live image is still required to be visible. In many cases, this may not be necessary and the live image can be switched off, allowing the main computer resources to be allocated to the software running in the foreground.



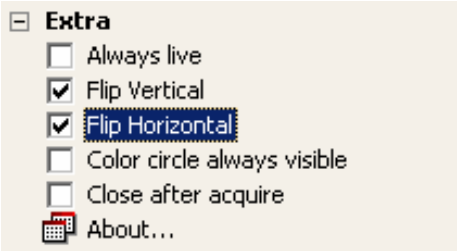
- Activate or deactivate by left-clicking *Always Live*,
- or right-click *Always Live* and select *on/off*.

Flip Horizontal / Flip Vertical

Depending on the installation conditions, it may not be possible to connect the camera to a microscope in a way that results in the correct image orientation. With these two functions, any camera position can be corrected by flipping the image horizontally and/or vertically as required.

- Activate or deactivate by left-clicking the appropriate check box, or

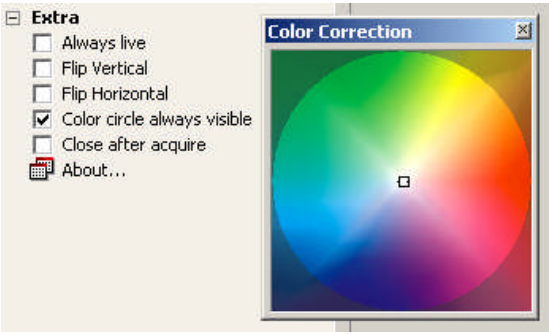
- right-click *Flip Vertical* or *Flip Horizontal* and select *on/off*.



Color Circle Always Visible

This turns the Color Circle or Wheel on or off, depending on how frequently it is required for color correction.

- Left-click *Color Circle Always Visible* to activate or deactivate this function, or
- right-click *Color Circle Always Visible* and select *on/off*.

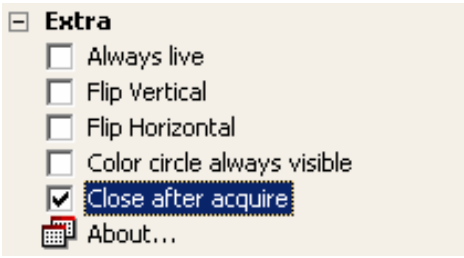


Close after acquire

This function defines whether or not DFC Twain closes automatically after an image is acquired. This may be useful, for example, if you would like to add database information for the image immediately after acquisition.

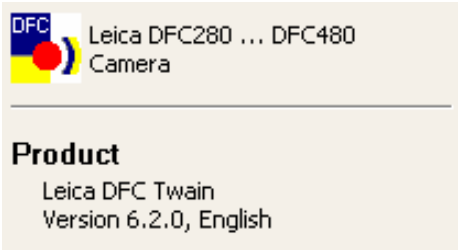
- To activate or deactivate this function left-click the *Close After Acquire* checkbox, or

- right-click *Close After Acquire* and select *on/off*.



About

- Left-click *About...* to display version and language information about DFC Twain.



Hidden Service Controls

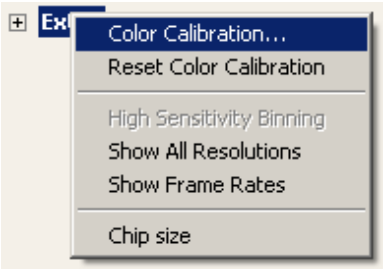
Depending on the camera, seldom-used functions may be available in a hidden menu. They are required for service purposes and contain calibration functions for which special maintenance accessories are needed. They also switch on and off cooling on certain cameras, and allow a shortened list of resolutions for the standard user.

These functions should only be accessible to trained personnel.

- Access to these functions is available by pressing the *CTRL+ SHIFT* keys and simultaneously right-clicking on *Extra*.
- Select from the hidden function menu.

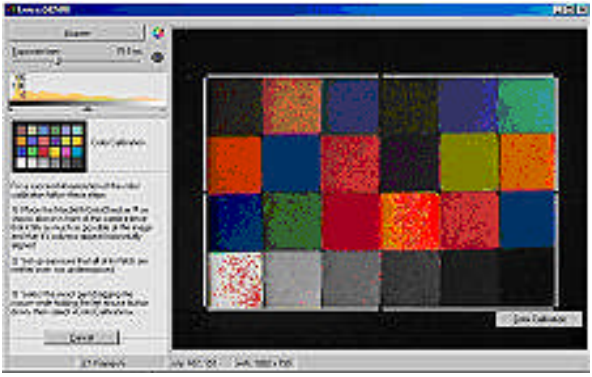
Color Calibration

Color Calibration allows perfect color tuning of your camera by using a Macbeth® ColorChecker as reference.



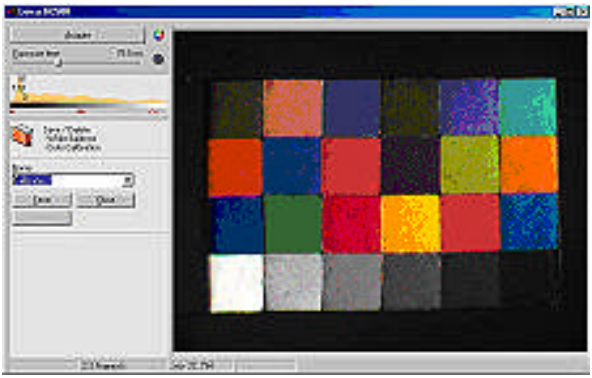
- Select *Color Calibration*

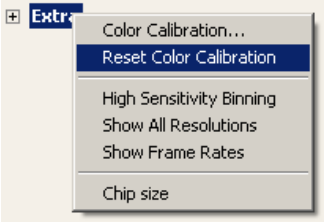
Proceed as follows:



- Place the ColorChecker so that it fills as much of the image as possible. Align the columns vertically and make sure the chart is the correct way round - see the inset diagram  .
- It is important to set the exposure so that no color pads are overexposed, but a manual white balance is not necessary as this is incorporated.
- Left-click and drag to draw the calibration template over the live image. Cover all 24 color fields precisely - if they are not covered, redraw the template - and click *Color Calibration*.

Once the color calibration has completed, name the setting and save it. This setting is now available in the *Captured Image>>White Balance* menu for image acquisition (see White balance).



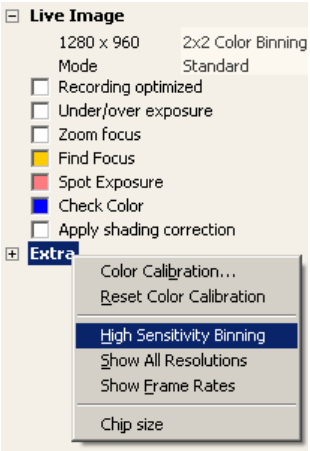


Select *Reset Color Calibration* to revert from a previously created Color Calibration to the camera default calibration.

High Sensitivity Binning

When the image is in a binned mode, the intensity of the binned pixels is added together, hence increasing the apparent sensitivity of the camera. The intensity (brightness) of the image is greater than if binning were not used.

In order to keep the resulting image similar to the original as if it were not binned, we can adjust the brightness with *High Sensitivity Binning* without increasing image noise. This option is available only if the live or captured image is binned.

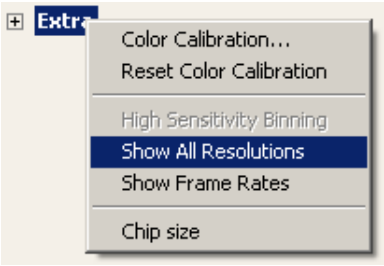


- Check *High Sensitivity Binning* for a brighter image
- Uncheck for a darker (standard) image.

Show All Resolutions

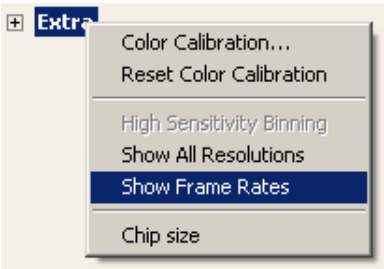
The number of image resolution modes varies with each camera. For each camera, you can select whether to display all modes, e.g. for the advanced user, or a restricted set of modes, e.g. for the standard user.

- Check *Show All Resolutions* to display all modes. Uncheck to display a (shorter) standard list of modes.



Show Frame Rates

The speed at which the live image display is refreshed is hidden by default.



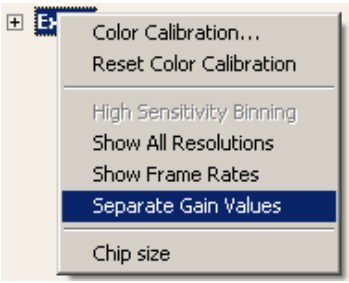
- Check *Show Frame Rates* to display the frames/second.

Crosshair Indicator

- This provides a useful tool to show the vertical and horizontal centre lines of the image.
  Check/Uncheck *Crosshair Indicator* to apply the Crosshair to the live image.

Separate Gain Values (visible with IC 3D camera only)

Gain can be controlled for each of the two sensors in the IC 3D, and by default they are locked together.

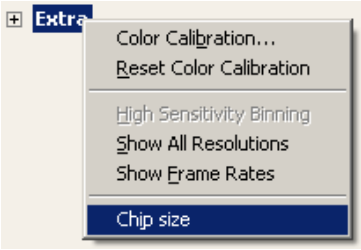


- Check *Separate Gain Values* to adjust the gain for each sensor independently or uncheck to lock them together.

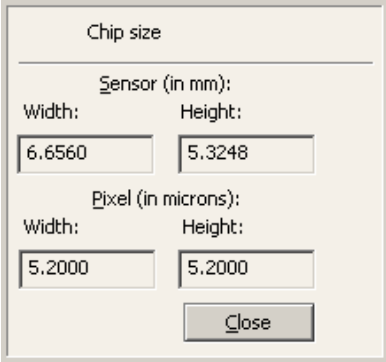
Be aware that if *Separate Gain Values* is checked and the gain values are different, the image will be affected differently when switching from one sensor to the other.

Chip Size

This displays the physical size of the image sensor of the selected camera.
Please note that this is for reference only – DFC Twain does not use this information itself.
However, for applications such as Leica IM, the size of the sensor is required to calculate the calibration of the image in conjunction with the microscope optics data.



- Check *Chip Size* to display chip sensor information.



Cooling

- Check/Uncheck *Cooling* to switch cooling on or off for those cooled cameras which support this feature. Not all cooled cameras support it.

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