HDR 2.0 User Guide



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Preface

HDR 2.0 is an additional software module for QuickPHOTO programs, that merges series of bracketed images (images with different exposure) of static specimens into so called HDR (High Dynamic Range) images.

Installation

Note

For the successful HDR 2.0 module installation it is necessary to have the *QuickPHOTO CAMERA*, *QuickPHOTO MICRO* or *QuickPHOTO INDUSTRIAL* program in version 3.1 installed on your computer.

Note

In case you do not have the permission to use the HDR 2.0 module contained in your dongle or you are installing the module into a trial version of the one of the above mentioned programs (no dongle is used), the HDR 2.0 module will run in a mode of a demo version. The demo version provides all the functions of a full version, but a watermark will be inserted into the created images. Each time you will run the demo version you will be informed about that fact. If you want to purchase a full version, contact your software supplier.

If you are going to install HDR 2.0 module from a supplied installation disk, insert it into your CD/DVD-ROM drive. An autorun screen will appear. If the autorun screen does not appear, launch the *autorun.exe* file from the installation disk manually. Select *Install HDR* 2.0 option.

If you are going to install HDR 2.0 module from a downloaded installation package, run it and select the destination folder, where the installation files should be extracted. Wait until the installation files will be extracted and an installation wizard will appear.

An installation wizard will appear. Select the desired language and continue by the *Next* button. The wizard will search your computer for installed *QuickPHOTO CAMERA*, *QuickPHOTO MICRO* or *QuickPHOTO INDUSTRIAL* programs. In case there is more then one *QuickPHOTO* version installed on your computer, choose from the displayed list the desired version into which the HDR 2.0 module should be installed and click the *Next* button.

Continue following the on-screen instructions.

Manual Capturing of Images for Merge to an HDR Image

The first step in process of creating an HDR image is capturing of a series of bracketed images (images with different exposure).

Following manual procedure can be used with all supported imaging devices.

Recommended Procedure for Capturing of Series of Bracketed Images

- 1. In the main program open the control panel of your imaging device.
- Put a specimen under a microscope, set an illumination and focus the microscope using the imaging device's live view.
- 3. In the control panel of the imaging device set manual exposure mode.
- 4. Set such exposure time, when the lightest parts of the specimen are well exposed. This will be the darkest image of the bracketed series. Acquire the first image.
- 5. Change the exposure time to approx. double. For example, if the exposure time of the first image was 1/2000 s, set the exposure time of the second image to approx. 1/1000 s. Acquire the second image.
- 6. Repeat the step 5. for acquisition of the rest of the series of bracketed images. Continue capturing images while the contours of the specimen are still visible. Acquire all images from the same series with the same resolution (e.g. 1928 x 1448 pixels).

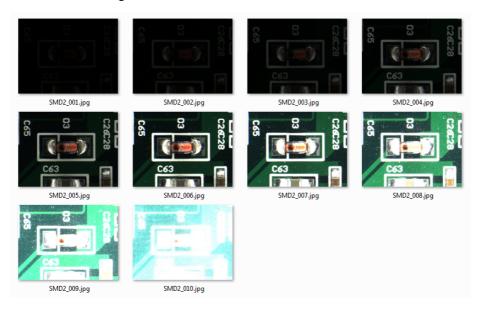
Note

The series of bracketed images may be acquired also starting with the longest exposure time, proceeding towards the shortest one. In such case always shorten the exposure time of each next image to one half of the previously used one.

Note

To achieve best results it is possible to shorten the exposure steps among particular images to 1.6x the value of previously used exposure time, instead of 2.0x.

A series of acquired bracketed images intended for merge to an HDR image can for example look like the following one:



HDR 2.0 Module Launch and Image Source Selection

The HDR 2.0 module is able to process images from three sources:

- 1. Images selected in *Thumbnail Browser*
- 2. Stored images
- 3. Images acquired from an imaging device

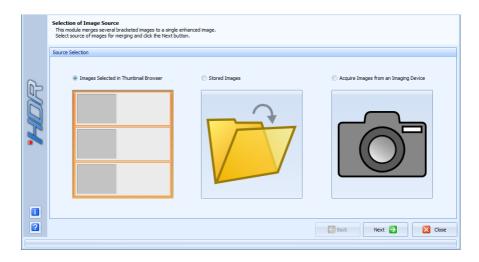
1. Merge of Images Selected in Thumbnail Browser

This option is intended for merge of images opened in the main program.

The procedure of use is following:

- 1. Select the images (intended for merge) opened in the main program by selecting their thumbnails in the *Thumbnail Browser*. The selected images will be indicated by frames. The selection can be performed similarly to the selection of files in Windows[®] Explorer (all images can be selected by [Ctrl+A] key shortcut, the continuous selection can be done while holding the [Shift] key or respectively [Ctrl] key for discontinuous selection).
- 2. Launch the HDR 2.0 module from *Modules* → *HDR 2.0* menu or by clicking the eicon in the tool bar.
- 3. In the opened dialog box select the *Images Selected in Thumbnail Browser* option and click the *Next* button.

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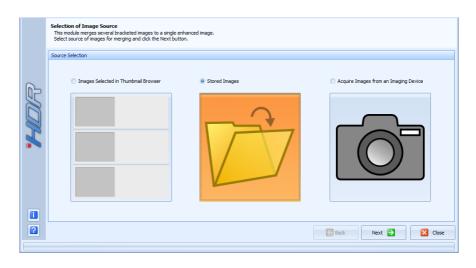
4. A dialog window for merge parameters adjustment and an HDR image creation will appear; for more information see "Merge Parameters Adjustment and HDR Image Creation" on page 19.

2. Merge of Stored Images

This option is intended for merge of bracketed images stored on your hard drive, flash memory drive etc.

The procedure of use is following:

- 1. Launch the HDR 2.0 module from *Modules* → *HDR 2.0* menu or by clicking the eicon in the tool bar.
- 2. In the opened dialog box select the *Stored Images* option and click the *Next* button.



- 3. Use the *Open* dialog to select the images to be merged. Make sure the selection does not contain any unwanted images. Confirm by clicking the *Open* button.
- 4. A dialog window for merge parameters adjustment and an HDR image creation will appear; for more information see "Merge Parameters Adjustment and HDR Image Creation" on page 19.

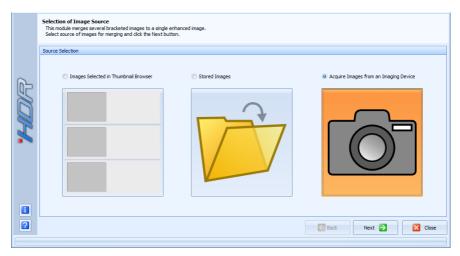
3. Acquisition of Images from an Imaging Device

This option enables, in case of use of one of the supported cameras, automatic acquisition of series of bracketed images intended for merge to an HDR image. The images will be, after acquisition, automatically open in a window, which allows adjustments of merging parameters and creation of an HDR image. This option eliminates the need of manual acquisition of bracketed images as described in previous chapter (see "Manual Capturing of Images for Merge to an HDR Image" on page 9). This option makes creation of HDR images much easier and is very useful especially for routine use.

The procedure of use is following:

1. Launch the HDR 2.0 module from *Modules* → *HDR 2.0* menu or by clicking the eigen in the tool bar

2. In the opened dialog box select the *Acquire Images from an Imaging Device* option and click the *Next* button.

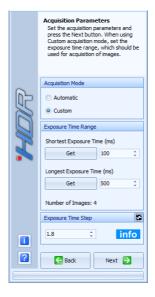


- 3. A control panel of an imaging device will appear together with the *Acquisition Parameters* window of HDR 2.0 module. Adjust the size of imaging device control panel and position of both windows according to your need. Those settings will be remembered for next use.
- 4. Put a specimen under a microscope, set an illumination, focus the microscope using the imaging device's live view and set all required parameters of the imaging device (e.g. image resolution, white balance, shading correction, etc.).
- 5. In the *Acquisition Parameters* window of HDR 2.0 module set the acquisition parameters of series of bracketed images using control elements described below and click the *Next* button. After automatic acquisition of series of bracketed images a dialog window for merge parameters adjustment and an HDR image creation will appear automatically; for more information see "*Merge Parameters Adjustment and HDR Image Creation*" on page 19.

Note

If you are not satisfied with a quality of an HDR image preview, you can return to the previous step by clicking the *Back* button, adjust the parameters and acquire the series of bracketed images again.

Description of Acquisition Parameters Window Control Elements



Acquisition Mode

An *Acquisition Mode* can be selected in the upper part of the window. There are two options available: *Automatic* and *Custom*.

Automatic Acquisition Mode

This is a default option. If it is active, a series of bracketed images will be acquired automatically. There is no need to manually set a range of exposure times for image acquisition - it will be determined automatically. It is recommended to set the automatic exposure mode and adjust it, so that the specimen would be well visible, before proceeding.

Custom Acquisition Mode

This mode is intended for cases, when a full control of range of exposure times for acquisition of bracketed images is needed. In this mode both limits of exposure time range need to be entered to *Shortest Exposure Time (ms)* and *Longest Exposure Time (ms)* fields in the *Exposure Time Range* part. Limits can be entered by typing the values to the empty fields or current value of the exposure time can be read from the imaging device control panel by clicking the corresponding *Get* button.

Custom acquisition mode can be set as follows:

- 1. Set the manual exposure mode in imaging device control panel.
- 2. Set the exposure time to such value, when the lightest parts of the specimen are correctly exposed. In *Acquisition Parameters* window of HDR 2.0 module click the *Get* button in *Shortest Exposure Time (ms)* part. Current exposure time value in ms will be filled to the empty field next to the *Get* button.
- 3. Increase the exposure time to such value, when the live view is lightest as it can be, while the contours of the specimen are still visible. In *Acquisition Parameters* window of HDR 2.0 module click the *Get* button in *Longest Exposure Time (ms)* part. Current exposure time value in ms will be filled to the empty field next to the *Get* button.

Exposure Time Step

This parameter determines a quotient of exposure times for each two subsequent images from a series of bracketed images. If, for example, *Exposure Time Step* is set to value 2.0 and the first image has been acquired with exposure time 0.5 s (500ms), the next image will be acquired with exposure time 500 ms / *Exposure Time Step* value, which is 500 ms / 2.0 = 250 ms and the next image with exposure time 250 ms / 2.0 = 125 ms, and so on.

Default value is 1.8. By selection of lower value an exposure step among particular images from a series of bracketed images can be reduced and in some cases better HDR image quality can be achieved. More images in the series of bracketed images will be acquired.

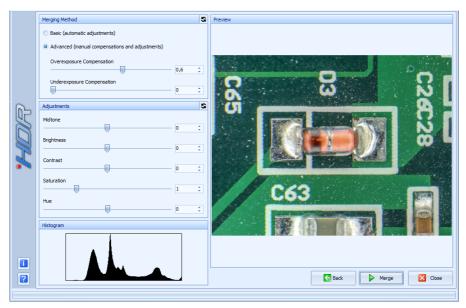
In cases (especially when 32bit operating systems are being used) when a lack of operating memory can occur (see "Memory Requirements - 32bit versus 64bit Operating Systems" on page 29), it might be required to increase the Exposure Time Step value.

Therefore a lower number of images will be acquired in a series of bracketed images, which can lead to decreased quality of the resulting HDR image.

It is recommended to use values in range 1.6 to 2.0.

Merge Parameters Adjustment and HDR Image Creation

After loading of images intended for merge to an HDR image a dialog window for merge parameters adjustment and HDR Image creation will appear:



Description of Control Elements

In Merging Method part, there are two options available:

- Basic (automatic adjustments) this option sets the Midtone, Brightness and Contrast
 sliders in Adjustments part to the values, when overexposed and underexposed areas
 should be optimally compensated. All the automatically set values can be manually
 modified, if needed.
- Advanced (manual compensations and adjustments) this options leaves adjustment of all merging parameters in user's hands. When this option is active, Overexposure

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Compensation and Underexposure compensation sliders become active. Use this option in case, when the Basic (automatic adjustments) option does not provide satisfying results.

- Overexposure Compensation this slider compensates the presence of overexposed areas in the merged HDR image (they will be darken). The higher value is set by the slider, the stronger compensation is applied to the image.
- Underexposure compensation this slider compensates the presence of underexposed areas in the merged HDR image (they will be lighten). The higher value is set by the slider, the stronger compensation is applied to the image.

Default values of *Overexposure Compensation* and *Underexposure compensation* sliders can be restored by clicking the Restore Default Compensations Settings button.

In *Adjustments* part, there are several sliders, which are intended (with use of *Preview* in the right hand part and *Histogram* in the lower part of the dialog window) for fine adjustments of the merged HDR image appearance. If the *Basic (automatic adjustments)* option is active in *Merging Method* part, the values of *Midtone*, *Brightness* and *Contrast* sliders are set automatically (with an option of manual adjustment). If the *Advanced (manual compensations and adjustments)* option is active in *Merging Method* part, all sliders are set to the default values and all adjustment are in the user's hands.

- *Midtone* slider lightens or darkens the merged HDR image, preventing creation of overexposed or underexposed areas.
- The rest of the sliders controls *Brightness*, *Contrast*, *Saturation* and *Hue* of the merged HDR image.

Default values of all sliders in *Adjustments* part can be restored by clicking the Restore Default Adjustments Values button.

Creation of an HDR Image

Click the *Merge* button to initiate the merging process. The merged image will be displayed in the main program window after finishing the process. It will be named *hdr_#####suffix*, where ##### is the serial number assigned to the image by the main program.

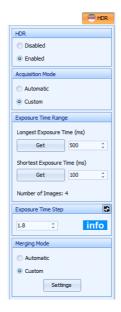
Use of the HDR 2.0 Module with PROMICAM Digital Cameras

When the HDR 2.0 module is used with USB 3.0 or USB 2.0 HDR 2.0 digital cameras, it provides extended functionality, which makes the work easier, and which enables use of the module in conjunction with Deep Focus extended depth of field module see "Creation of Fully Focused HDR Images in Conjunction with Deep Focus Module" on page 25.

After the HDR 2.0 module installation, a new tab called HDR will newly appear in the control panels of USB 3.0 and USB 2.0 PROMICAM digital cameras. This tab contains elements to control the HDR functionality directly from the control panel.

When USB 3.0 or USB 2.0 HDR 2.0 digital cameras are used, it is not necessary to manually launch the HDR 2.0 module in order to acquire HDR images. HDR images can be directly acquired from the control panel of the imaging device. The use of the HDR feature in the control panels of PROMICAM digital cameras is similar to the procedure described earlier; see "Acquisition of Images from an Imaging Device" on page 13. The main difference is, that after acquisition of series of bracketed images a window for merge parameters adjustment and HDR image creation will not appear - an HDR image will be automatically created after clicking the *Capture HDR* button according to the set parameters and automatically displayed in main program window.

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Description of HDR Tab Control Elements

The use of the HDR feature can be *Enabled / Disabled* in the upper part of the tab. In case the HDR feature is enabled, the *Capture* button located in the tool bar above the live view will change to *Capture HDR* button. After clicking the *Capture HDR* button the series of bracketed images will be acquired and the HDR image will be automatically merged according to the set parameters.

There are two options available in the *Acquisition Mode* part: *Automatic* and *Custom*.

Automatic Acquisition Mode

This is a default option. If it is active, a series of bracketed images will be acquired automatically. There is no need to manually set a range of exposure times for image acquisition - it will be determined automatically. It is recommended to set the automatic exposure mode and adjust it, so that the specimen would be well visible, before proceeding.

Custom Acquisition Mode

This mode is intended for cases, when a full control of range of exposure times for acquisition of bracketed images is needed. In this mode both limits of exposure time range need to be entered to *Shortest Exposure Time (ms)* and *Longest Exposure Time (ms)* fields in the *Exposure Time Range* part. Limits can be entered by typing the values to the empty fields or current value of the exposure time can be read by clicking the corresponding *Get* button.

Custom acquisition mode can be set as follows:

- 1. Put a specimen under a microscope, set an illumination, focus the microscope using the imaging device's live view.
- 2. In the imaging device control panel set all required parameters (e.g. image resolution, white balance, shading correction, etc.) and set the manual exposure mode at the *Image* tab.
- 3. Set the exposure time to such value, when the lightest parts of the specimen are correctly exposed. At the *HDR* tab click the *Get* button in the *Shortest Exposure Time* (*ms*) part. Current exposure time value in ms will be filled to the empty field next to the *Get* button.
- 4. Increase the exposure time to such value, when the live view is lightest as it can be, while the contours of the specimen are still visible. At the *HDR* tab click the *Get* button in the *Longest Exposure Time (ms)* part. Current exposure time value in ms will be filled to the empty field next to the *Get* button.

Exposure Time Step

This parameter determines a quotient of exposure times for each two subsequent images from a series of bracketed images. If, for example, *Exposure Time Step* is set to value 2.0 and the first image has been acquired with exposure time 0.5 s (500ms), the next image will be acquired with exposure time 500 ms / *Exposure Time Step* value, which is 500 ms / 2.0 = 250 ms and the next image with exposure time 250 ms / 2.0 = 125 ms, and so on.

Default value is 1.8. By selection of lower value an exposure step among particular images from a series of bracketed images can me reduced and in some cases better HDR image quality can be achieved. More images in the series of bracketed images will be acquired.

In cases (especially when 32bit operating systems are being used) when a lack of operating memory can occur (see "Memory Requirements - 32bit versus 64bit Operating Systems" on page 29), it might be required to increase the Exposure Time Step value. Therefore a lower number of images will be acquired in a series of bracketed images, which can lead to decreased quality of the resulting HDR image.

It is recommended to use values in range 1.6 to 2.0.

Merging Mode

In this part the HDR merging parameters can be adjusted. There are two options available: *Automatic* and *Custom*.

Automatic merging mode - if this option is active, all HDR merging parameters will be set automatically.

Custom merging mode - after activation of this option a Settings button will be enabled. After clicking the Settings button a series of bracketed images will be acquired according to all current settings of the imaging device control panel. Then a Merging Parameters Settings window with a preview of the HDR image will appear. This window looks almost identical to a window for merge parameters adjustment described earlier; see "Merge Parameters Adjustment and HDR Image Creation" on page 19. In displayed window set all required merging parameters and confirm by clicking the OK button. Those settings will be stored and used for all future HDR image acquisitions in the imaging device control panel, until they will be changed or and Automatic mode will be activated.

Note

In case the control panel of USB 3.0 or USB 2.0 PROMICAM digital cameras is launched together with the HDR 2.0 module, as was described earlier; see "Acquisition of Images from an Imaging Device" on page 13, all control elements at the HDR tab will be disabled.

Creation of Fully Focused HDR Images in Conjunction with Deep Focus Module

HDR 2.0 module can be used in conjunction with Deep Focus extended depth of field module for creation of fully focused HDR images from series of partly focused images, so called "slices".

1. Manual Acquisition of HDR Slices Intended for Composition to Fully Focused (EDF) Image by Deep Focus Module

Following procedure can be used for all supported imaging devices:

- 1. Acquire and merge (using the HDR 2.0 module according to the instructions described in the previous chapters of this user guide) particular partly focused HDR images (slices).
- Compose the acquired HDR slices by the Deep Focus module to a fully focused HDR image. Proceed according to the instructions described in the user guide of the Deep Focus module.

2. Automatic Creation of Fully Focused (EDF) HDR Images Using Microscope Focus Motorization

The creation of fully focused (EDF) HDR images can be automated in case of use of USB 3.0 or USB 2.0 PROMICAM digital cameras, Deep Focus module and supported microscope focus motorization.

The procedure of automated creation of fully focused HDR image is similar to procedure of automated creation of standard fully focused image described in the user guide of Deep

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Focus module. Just enable and set the HDR feature in the control panel of USB 3.0 or USB 2.0 PROMICAM digital camera (according to the instructions described earlier; see "Acquisition of Images from an Imaging Device" on page 13) prior to starting the automated acquisition process of the Deep Focus module. After the process begins there will be (using the HDR 2.0 module) acquired a series of partially focused HDR images, which will be subsequently automatically composed to a fully focused HDR image by the Deep Focus module.

Tips for Work with HDR 2.0 Module

Here there are some recommendations for achieving best results with HDR 2.0 module:

- For acquisition of series of bracketed images set the illumination intensity to high value, in order to be able to acquire sufficient number of lighter images, which are key for achieving best results. Do not change the illumination intensity during the acquisition of series of bracketed images.
- Capture the whole series of bracketed images with the same microscope settings. Do not change magnification, focus or illumination conditions and do not move the specimen during the acquisition of the whole series of bracketed images.
- 3. Acquire images of static specimens only.
- 4. In case of merging the images selected in the Thumbnail Browser or stored images, make sure there is no unwanted image in your selection.
- 5. All slices to be merged must have the same resolution (dimensions in pixels e.g. 1928 x 1448).
- 6. If you want to merge higher number of high resolution images, use 64bit operating system with larger RAM (4 GB and more).

Note

The higher the resolution and number of images for merging are, the longer time the merging process takes and more operating memory is needed.

Memory Requirements - 32bit versus 64bit Operating Systems

Merging of series of bracketed images into an HDR image is operating memory-demanding process.

For merging of higher number of high resolution images, it is recommended to use 64bit operating system with larger RAM (4 GB and more). 64bit operating systems allow processing of larger data amounts in the operating memory then the 32bit ones.

Limitations of 32bit Operating Systems

If you use 32bit operating system and merge images with high resolution or higher number of images, you might encounter restriction of maximal number of images, which can be processed. The reason is a limited amount of data, that can be processed in 32bit operating system in operating memory at once by a single application. If that data amount could be exceeded, you will be informed about it by a warning message, when images for merging are being loaded by HDR 2.0 module. If this message appears, it is recommended to lower resolution or the number of images intended for merging. If you decide to continue anyway in merging the originally selected images, the program can become unstable and you could loose all unsaved images.

The following maximal numbers of bracketed images, which can be safely processed in 32bit operating systems, were experimentally found for various resolutions:

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Memory Requirements - 32bit versus 64bit Operating Systems

Resolution of bracketed images in megapixels	Number of images, which can be processed by HDR 2.0 module in 32bit operating systems
3	84
4	56
5	40
6	29
7	23
8	18
9	14
10	11
11	9
12	7
13	6
14	5
15	4
16	3
17	3
18	2

Minimal System Requirements

Minimal Computer Requirements:

- Single-core 2.4 GHz or multi-core processor
- 2 GB RAM
- CD/DVD-ROM drive
- Microsoft[®] Windows[®] Vista[®]/7/8/8.1/10 operating system

Supported QuickPHOTO Program Versions:

- QuickPHOTO CAMERA 3.1
- QuickPHOTO MICRO 3.1
- QuickPHOTO INDUSTRIAL 3.1

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