LED-Panel V4

User Manual

27. March 2020

Image Engineering GmbH & Co. KG · Im Gleisdreieck 5 · 50169 Kerpen-Horrem · Germany

T +49 2273 99991 - 0 · F +49 2273 99991 -10 · www.image-engineering.com

Content

1 INTRODUCTION

LED-Panel is the ideal measurement device to determine shutter and shooting time lag, autofocus time, burst frame rate, exposure times and the rolling shutter speed of digital imaging devices.

Extremely precise measurements with accuracy better than one millisecond are possible with this device. It meets all the requirements of the ISO 15781 standard, which describes the measurement of shooting time lag, shutter release time lag, shooting rate and start-up time.

The LED-Panel has an interface which can be controlled from a computer. Using a standard USB port, the different operation modes of the LED-Panel can be selected. Shutter and shooting time lag through adjusting the LED frequency can be activated as well as the display refresh mode and the continuous mode for exposure time and frame rate measurements.

Of course the rolling shutter mode with its 10 LED rows moving simultaneously can also be selected through the command line interface. When connected via USB, the maximum speed is already suitable for most applications at 5 kHz (200 µs). If you deactivate the USB connection and control the LED-Panel directly at the front panel, you can go up to 50 kHz operation. Therefore, you have the choice of whether to operate the device in USB or non-USB mode. Via USB each mode can be triggered individually and the direction of the LED sequence can be changed.

IMPORTANT INFORMATION

Read the manual carefully before using the device.

Inappropriate utilization may cause damage to the device, to the DUT (device under test) and/or other components of your setup.

Keep these instructions in a safe place and pass them to any future user.

1.1 Intended use

LED-Panel V4 is designed to perform timing measurements on digital cameras. With iQ-LED-Panel V4 measurements according to ISO 15739 can beperformed.

- Only suitable for indoor use.
- Place your system in a dry and constant tempered environment without any interfering light.
- The optimal ambient temperature range is 22 to 26 degrees Celsius. The maximum ambient temperature range is 18 to 28 degrees Celsius.
- The device has a maximum error < 0.06%.
- An accuracy of better than one millisecond enables extremely precise measurements.
- When controlling LED-Panel over USB interface the maximum speed is limited to 200 µs (5 kHz) due to controller limitations.
- Software based analysis included in LED-Panel software is only available for LED-Panel V4.

1.2 Foreseeable missuse

1.2.1 Older LED-Panel verisons

Most parts of this manual apply to LED-Panel V4. Please contact Image Engineering for the manual for a previous version of LED-Panel.

1.3 General safety information

Do not open the device without any instructions from the Image Engineering support and when connected to the power supply.

1.4 Eye safety

If you use the LED-Panel infrared version please make sure to wear the supplied safety googles according to IEC 62471:2009. **Do not** look directly into the emitted light or look through the optical LED system, this can cause irreversible eye damage.

2 GETTING STARTED

2.1 Scope of delivery

LED-Panel V4, power supply, USB cable, remote control, control software

Optional equipment:

- iQ-Trigger
- iQ-Trigger-T

3 OPERATING INSTRUCTIONS HARDWARE

3.1 Set up hardware

Connect the power cord to the power supply on the side of LED-Panel V4. Connect the power supply to electricity. Switch on LED-Panel V4 by setting the power switch to “I”. The power switch is located beside the power supply.

3.2 Hardware description

LED-Panel V4 front and side

Operating element front:

- LED array
- Display
- Trigger button
- Mode button

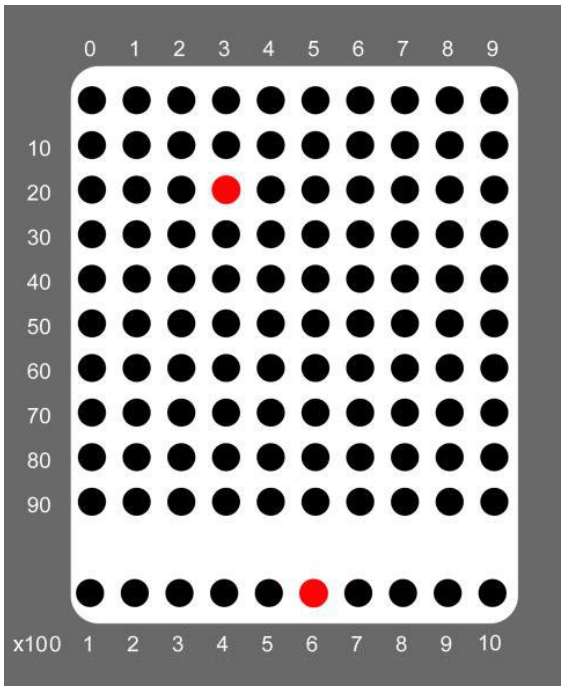
Operating elements side:

- Rotary knob for changing the frequency and dimming the display
- Switch to activate/deactivate USB connection
- USB Mini port (connection to PC)
- Stop trigger (3.5 mm TRS connector, signal input *)
- Camera trigger (3.5 mm TRS connector, signal input *)
- iQ-Trigger (before: Digitus, 6.3 mm TRS connector, signal output *)
- Defocus (6.3 mm TRS connector, signal output *)
- Power switch
- Power connection

The square array of 100 LEDs is segregated in ten rows, each consisting of ten LEDs. The LEDs light up one after another with the set speed/frequency.

The row beneath the square field, also consists of ten LEDs, is switched forward after all 100 LEDs have passed. Thus, cycles of up to 1000 LEDs can be represented by the device.

*For an electrical wiring diagram of these connectors, please see the LED-Panel datasheet.



Square field of 10 x 10 LEDs and the additional row beneath.

In this example the 100 LEDs have already passed through six times, visible on the lighted up LED “600” in the lower row.

The LED-Panel V4 can be operated manually or via software (USB interface). The downside of using USB with the LED-Panel V4 is that due to controller limitations the maximum speed is limited to 200 µs (5 kHz). Therefore the device provides a switch that allows switching the USB connection on and off. Switching the USB off allows controlling the device from the front panel to achieve frequencies up to 50 kHz. Please refer to chapter 3.3 for information about control software.

3.2.1 Trigger mode

The LED-Panel V4 can be operated manually by using either an external (single) or internal (continuous) trigger. The trigger mode can be changed by pressing the button *Trigger*. The trigger is indicated on the LCD-display in the top row:

- Cont: Trigger Continuous
- Sngl: Trigger Single

For the external operating mode a remote release is connected to the LED-Panel. When connecting to the CAMERA TRIGGER input, the LED-Panel starts by pressing and stops by releasing the remote release button (and returns to the start position).

If a remote release is also connected to the STOP TRIGGER input additionally, the period between two triggered events can be calculated. The LED-Panel starts by pressing the CAMERA TRIGGER (remote release) and stops by pressing the STOP TRIGGER (remote release). When stopped, the LED-Panel does not return to the start position – but remains at the LED position lit last. The only prerequisite is that when stopped, the CAMERA TRIGGER remains pressed. Pressing the CAMERA TRIGGER again resets the LED-Panel.

3.2.2 Setting mode and time

Mode	response time	exposure time	frame rate	roll. shutter
Measurement	Response Time	Exposure Time	Frame Rate	Rolling Shutter
LED Movement	Single LED moves across matrix according to set direction	Single LED moves across matrix according to set direction	Bottom row: single LED moves from right to left	Entire row/column moves across matrix according to set direction
Trigger Mode	Single (external)	Continuous (internal)	-	Continuous (internal) Single (external)
Times in USB mode	200 µs - 9 s 5 kHz - 0.111 Hz	1/5000 - 10 s 5 kHz - 0.1 Hz	Frame rate 1 Hz - 100 Hz	200 µs - 9 s 5 kHz - 0.111 Hz
Times in manual mode	20 µs - 9 s 50 kHz - 0.111 Hz	1/50000 – 10 s 50 kHz - 0.1 Hz	Frame rate 1 Hz - 100 Hz	20 µs - 9 s 50 kHz - 0.111 Hz

Overview of selectable modes, their descriptions and times

3.2.2.1 Setting the mode

To set a mode briefly press the *MODE* button (mode is indicated in the display).

Selectable modes: response time [µs/ms/s], exposure time [1/x s], frame rate [Hz], rolling shutter [µs/ms/s].

3.2.2.2 Setting the time

Use the rotary knob to set a time/frequency in the different modes.

3.2.2.3 Setting the LEDs running direction

Figure 1

To set the running direction press and hold the **MODE** button until the message "Set direction" will be shown on the display. Change the direction by turning of the rotary knob. There are eight directions for Response Time and Exposure Time modes and four directions for the Rolling Shutter mode. The running direction is indicated on the right side of the display. For instance the indication “12/34” (Figure 1) means that the LEDs starts from the left top edge of the LED matrix, runs to the right top edge, than jumps to the left of the second top line and runs again from the left to the right and so on to the bottom of the LED matrix. The indication “12/12” means that a column of 10 LEDs starts from the left and runs to the right.

3.2.2.4 Display Brightness

The brightness of the display can be modified by using the rotary knob. Press and hold the rotary knob until the message "Back light" and" XX %"will be shown on the display. Turn the rotary knob to change the back light intensity.

4 MEASUREMENT METHODS

Depending on operating mode, following measurements can be made with the aid of the LED-Panel:

1. **Shutter lag without autofocus time**
2. **Shutter lag with autofocus time**
3. **Exposure times**
4. **Video recording rate / Framerate**
5. **Speed of multi shot mode**
6. **Rolling shutter speed**

4.1 Shutter lag without autofocus time

The LED-Panel is used in TRIGGER EXT operating mode and the time is set. The LED-Panel is connected to and started with a remote release. For measuring the shutter lag, a micro switch button must be connected to the release button on the camera, the camera must be focused and finally both buttons must be pressed. After the shutter lag has passed, the camera takes a picture of the running LED-Panel. The time passed since the micro switch was pressed can be read with the aid of the lighted LED(s) in this picture.

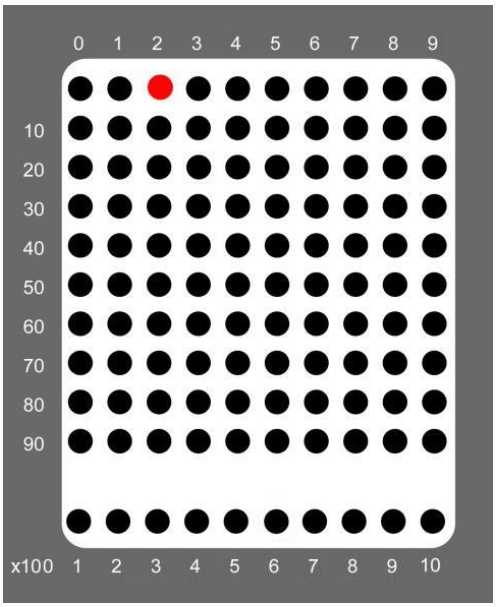


Figure 2

Because the two buttons have a different release point, a time lag can occur between starting the LED-Panel and releasing the camera. We offer an optional device that pushes both buttons (micro switch and camera release button) in less than 5 ms guaranteed. This device – iQ-Trigger - activates the camera release. The iQ-Trigger is available as a separate product and is not included in the scope of delivery of LED-Panel.

Example

LED-Panel settings:

Operating mode TRIGGER EXT

Exposure time (1/x s) 1/10 s

LED No. 2 is lit up (Figure 2):

Shutter lag is 0.2 seconds (2 * 1/10 s)

4.2 Shutter lag with autofocus time

The LED-Panel is used in TRIGGER EXT operating mode and a micro switch is connected. Two pictures are taken and the shutter lag is calculated.

- As described in Shutter lag without autofocus time. The shutter lag without autofocus time is calculated.
- The camera focus is set to infinity. Afterwards a picture of the LED-Panel is taken with the aid of the micro switch. After the time for the auto focus and shutter lag has passed, the camera takes a picture of the running LED-Panel. The time passed since the micro switch (and the release button) was pressed and autofocus was completed can be read with the aid of the lit LEDs in this picture.

The autofocus time can be calculated as the difference between shutter lag with autofocus time (Figure 4) and shutter lag without autofocus time (Figure 3).

Autofocus time = (shutter lag with autofocus time) – (shutter lag without autofocus time)

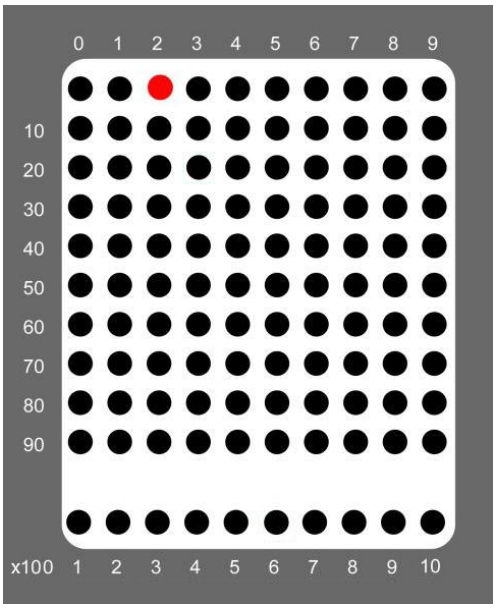


Figure 3

Shutter lag without autofocus time

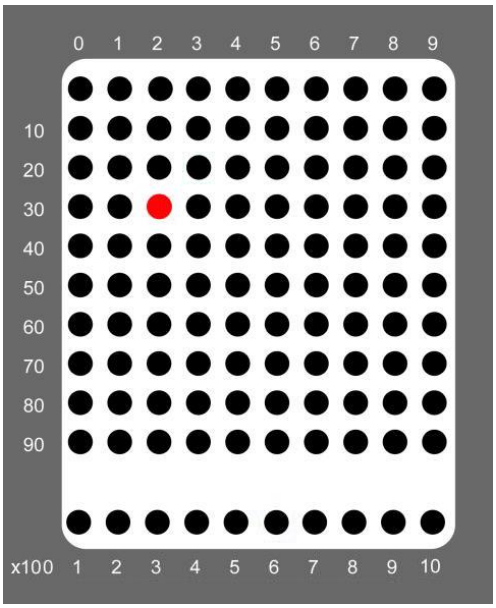


Figure 4

Shutter lag with autofocus time

Example

LED-Panel settings:

Operating mode TRIGGER EXT

Exposure time (1/x s) 1/10 sec

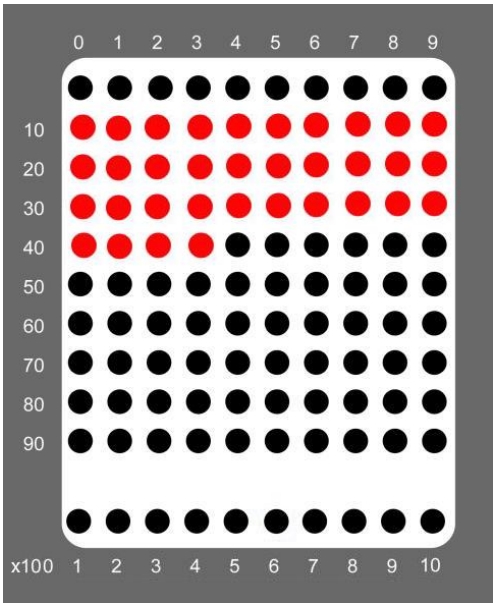
Shutter lag without autofocus time: LED No. 2 lights up → 0.2 s

Shutter lag with autofocus time: LED No. 32 lights up → 3.2 s

Autofocus time = 3.2 s - 0.2 s = 3 s

4.3 Exposure Time

Exposure times of cameras can be measured with the aid of the LED-Panel. When the LED-Panel is set to CONTINUOUS trigger mode and the time is adjusted, a picture of the LED-Panel is taken. The exposure time can be read by analyzing the lit LEDs.



Example

Camera exposure time: 1/10 s

LED-Panel settings: 3.00 ms / 333 Hz

34 LEDs are lit

Exposure time: 34*3.00 ms = 102 ms (~ 1/10 s)

4.4 Video recording rate / Frame rate

This mode makes the frame rate measurement of video recording devices possible. The LED-Panel is set to the frame rate mode “Frame rate” and is being recorded on the camera. The frequency of the LED-Panel must be now counterbalanced with the rotary knob until the lower row of LEDs stops blinking on the camera display. The frame rate of the camera has now been matched by the LED-Panel. The manual frequency scan should be started at the lowest level because harmonics of the frame rate frequency also cause the LEDs to stop blinking.

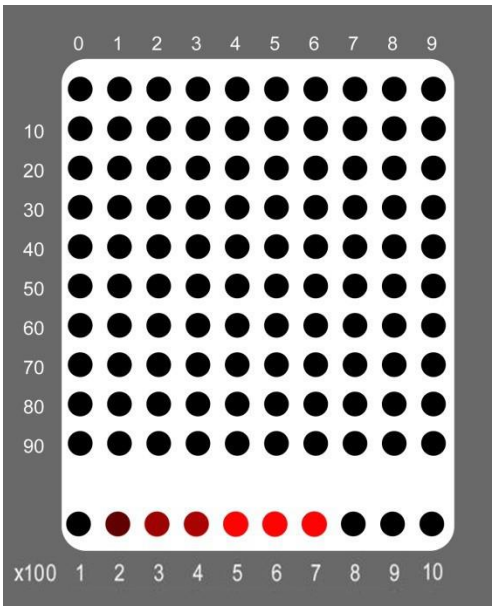


Figure 6

The frequency of the LED-Panel does not match the frame rate of the camera (flickering LEDs)

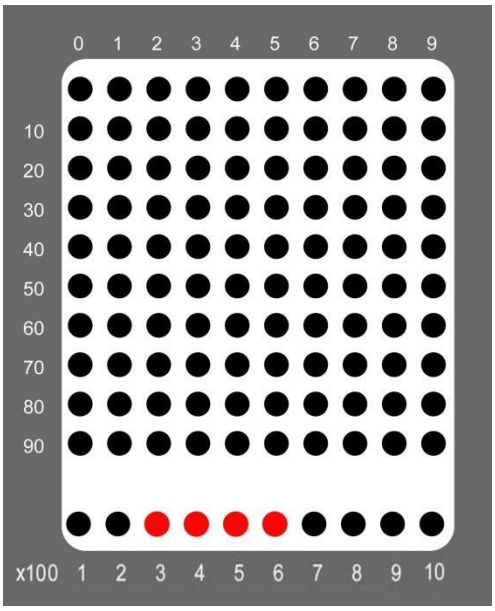


Figure 5

The frequency of the LED-Panel matches the frame rate of the camera (LEDs glow permanently)

4.5 Speed of multi shot mode

The speed of the multi shot mode of cameras can also be measured with the aid of the LED-Panel. The LED-Panel must be set into the operating mode CONTINOUS and the time must be defined. Afterwards pictures of the LED-Panel are taken in the multi shot mode. The speed of multi shot mode can be calculated from the distance between the turned on LEDs in two consecutive pictures.

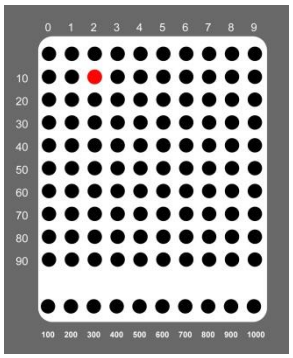


Figure 8

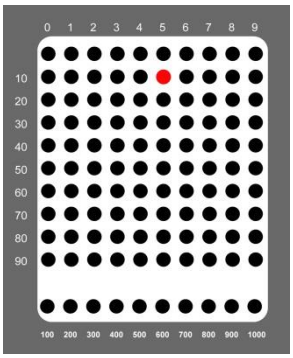


Figure 7

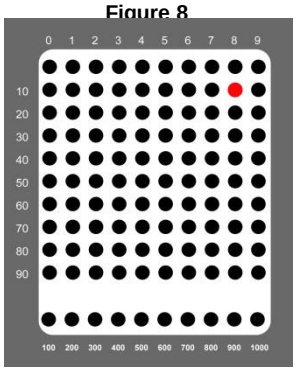


Figure 10

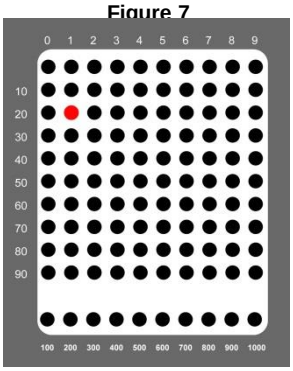


Figure 9

Example

Camera exposure time:

1/250 s

LED-Panel settings: CONTINUOUS, exposure time 1/10 s

Each time the LED has moved three places forwards between the consecutive images. With LED-Panel's frequency set to 0.1s this means the multi shot mode has the speed of 0.3 s per picture (i.e. 3.3 pictures per second).

4.6 Rolling shutter speed

The LED-Panel can be used in both, CONTINUOUS and TRIGGER EXT operating modes. In TRIGGER EXT operating mode the LED-Panel is connected to a remote release and is started using this switch. Because the two buttons have a different release point, a time lag can occur between starting the LED-Panel and camera release. We have developed a device that pushes both buttons (micro switch and camera release button) in less than 5 milliseconds guaranteed. The so-called iQ-Trigger activates the camera release mechanically. The iQ-Trigger is available as a separate product.

In the rolling shutter operating mode all ten rows of LEDs are operated simultaneously. This means that a whole column of LEDs runs across the panel instead of single LEDs. Cameras with a rolling shutter show an offset in the taken picture between the LEDs in the running column. From this offset the time can be read, that is required for reading out the picture of the LED-Panel.

For this measurement we recommend to frame the field of the LEDs in the image in such way that they fill the whole image height.

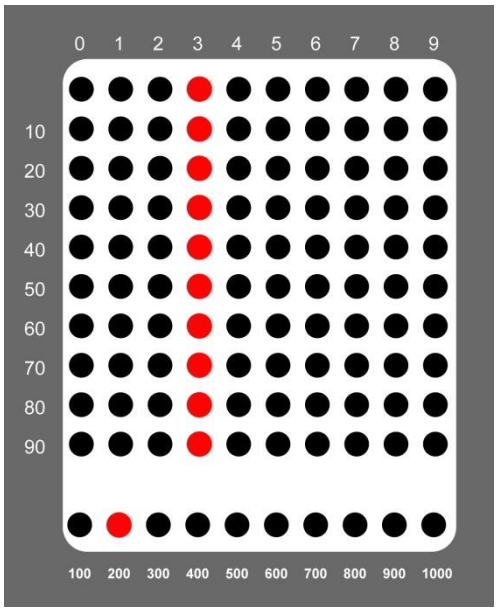


Figure 11

In the rolling shutter mode all ten rows of LEDs are operated simultaneously

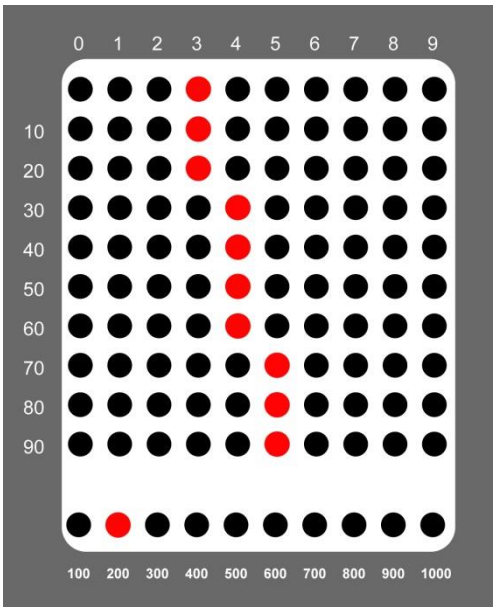


Figure 11a

In case of a rolling shutter effect an off-set of the LED rows is visible.

For software based rolling shutter analysis we recommend two LED-Panels in “Exposure Time” mode, one in the top left corner and one in the bottom right corner. For detailed information on how to set up two LED-Panels with you device under test, please see the following two infographics.

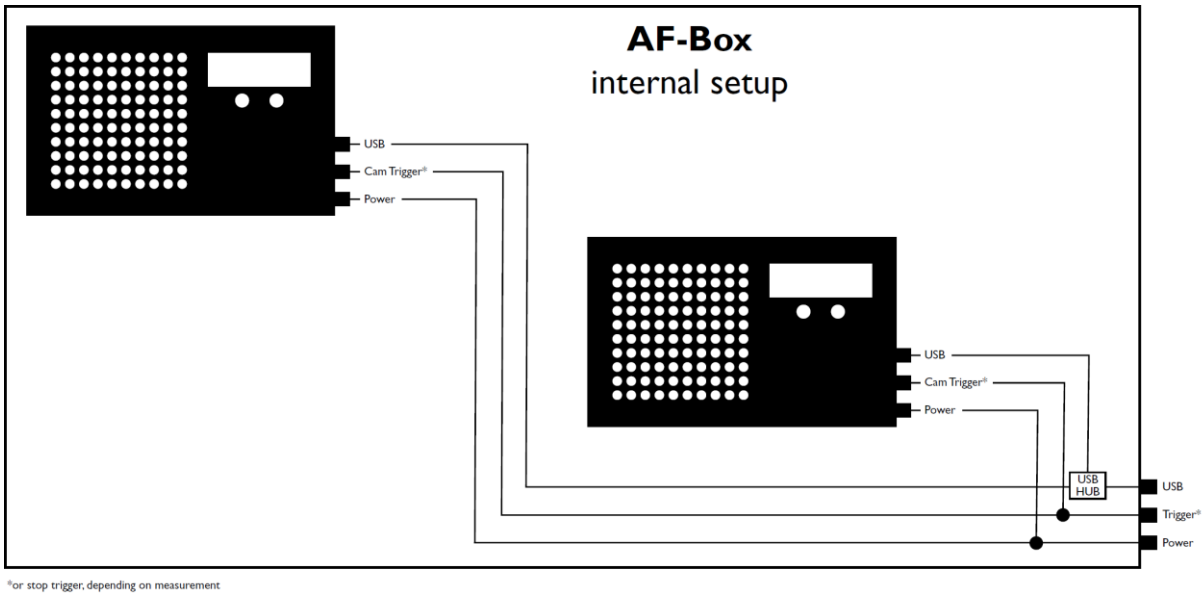


Figure 12: internal wiring

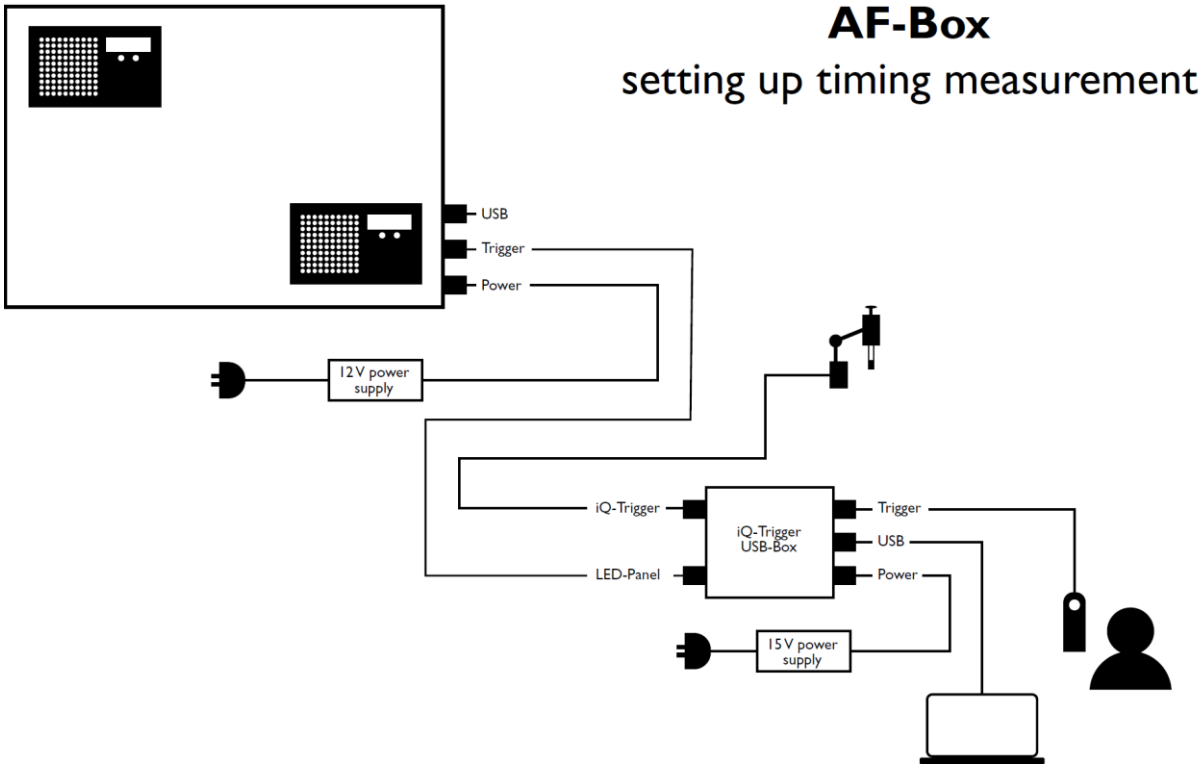


Figure 13: setting up for timing measurement

5 OPERATING INSTRUCTIONS SOFTWARE

5.1 Requirements

- PC with Windows 7 32bit/64bit (or higher) operating system
- One free USB port

5.2 Software installation

Run the installer for your Microsoft Windows operating system. During installation device drivers and additional software will be installed. Along with the LED-Panel software the installation includes:

- Microsoft Visual C++ Redistributable
- Hardware driver

Unless you changed the default installation path, you will find the directory “Image Engineering\LED-Panel <version number>” in your “Program Files” folder after a successful installation. Additionally a directory “Image Engineering\LED-Panel” is created in <root>\Users\<username>\AppData\Roaming (example: C:\Users\John_Doe\AppData\Roaming\Image Engineering) to store application settings.

5.3 Set up hardware and software for software control

Connect the power cord to the power supply on the side of LED-Panel V4. Connect the power supply to electricity.

Connect the USB cable to the LED-Panel V4 and to your PC. Switch on LED-Panel V4 by setting the power switch to “I”. The power switch is located beside the power supply.

5.4 Software activation

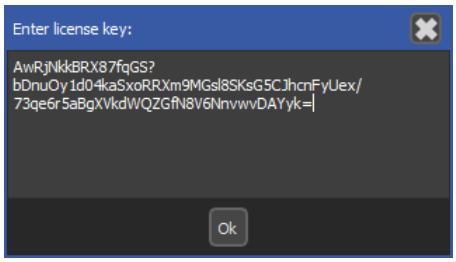


Figure 14

Start the iQ-LED software by clicking the ‘iQ-LED.exe’ or the iQ-LED icon on your desktop.

When you start the LED-Panel software for the first time you will be asked to activate the software (Figure 14). In order to do this connect your LED-Panel V4 to the computer and enter the provided license key. The key is located in a text file on the DVD shipped with the product. After the activation process successfully completed the software starts and a license file will be written to C:\Users\<username>\AppData\Roaming\Image Engineering\LED-Panel\Data\.

NOTE

The LED-Panel hardware must be connected to your computer via USB during the activation process.

5.5 Software description

The LED-Panel software contains two main functions:

- controlling LED-Panel V4 and LED-Panel V3
- analyzing images taken from LED-Panel V4

Using the control software you can set the desired measurement frequency, choose between the available LED modes, start and stop the LED-Panel, adjust display brightness, release an iQ-Trigger attached to the LED-Panel once or set an interval to release it periodically in order to take a series of images.

For the analysis of imgaes the LED-Panel software provides a convenient way to evaluate camera timing, such as shooting release time lag, with the assistance of the LED-Panel device according to ISO 15781. The software supports all common image file formats like JPEG, PNG, TIFF and BMP. The results of the analysis can be saved as plain text (*.txt) and/or XML file for further processing.

Note: Software based analysis is only available for LED-Panel V4

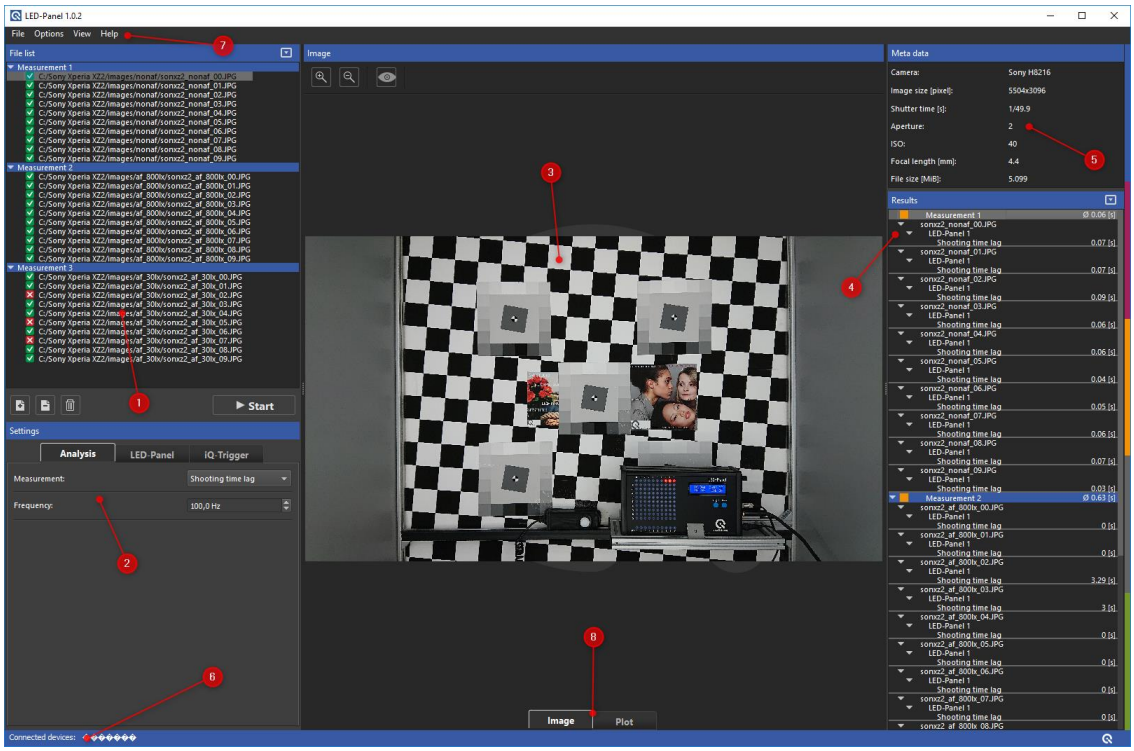


Figure 15

The graphical user interface (GUI) is divided into three major parts (see Figure 15)

- the file list and the setting control panel (Figure 15, ① & ②)
- the image view (Figure 15, ③)
- the results and the meta data view (Figure 15, ④ & ⑤).

Note: After putting the LED-Panel into sleep mode it will shortly wake up after switching off/on the power, after disconnecting of the USB cable or after PC shut down/power up. To wake up from PC use an according command. To wake up manually switch off the LED-Panel, push the MODE button and hold it, then switch on the power.

5.5.1 File list

The file list is located on the top left side of the GUI. Add your images taken from LED-Panel V4 to the list.

The file list can contain different file types such as JPEG, PNG, TIFF and BMP. You can load single images or a whole folder by simply dragging and dropping them onto the file list (Figure 16) or using the file browser by clicking the add-button below the list.

The images are arranged in a “Measurement” tree structure, sorted in ascending order. So each image belongs to a measurement. You can create a new measurement by dropping images on the empty area or by using the plus-button. To add an image to an existing measurement drag and drop it over the file names of the desired measurement or right click on this measurement to open a context menu.

To delete a single file, select it and click the delete-button (Figure 16) or press “Delete” on your keyboard. By clicking the trash-bin-button the entire file list gets cleared.

The arrow button in the top right corner hides or displays all files in the list.

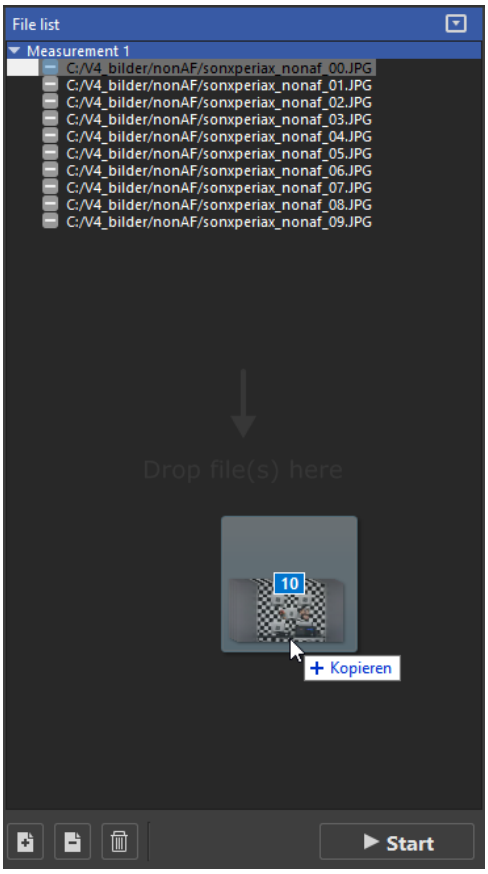


Figure 16

The icon next to the file name indicates the current image status. There are three different states:

Image not yet processed

Image successfully processed

Detection failed or an error occurred during analysis (a message box will show up with further details)

5.5.2 Control panel

The control panel is located on the bottom left side of the GUI. There you select the required settings for your analysis.

The control panel (Figure 15, ②) is divided into three different tabs (Figure 17).

5.5.2.1 Analysis

The “Analysis” tab contains the general settings. “LED-Panel” and “iQ-Trigger” tabs are used to control connected devices.

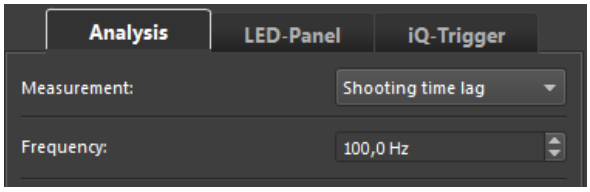


Figure 17

In the “Analysis tab” (Figure 17) you can choose the measurement method and the frequency. The set frequency is used to calculate the time shown by the LED-Panel in your images. For further details on how to measure different camera timings please refer to chapter 5 and ISO 15781.

Note: Ensure that the frequency setting matches the device setting that was used when capturing your images.

5.5.2.2 LED-Panel

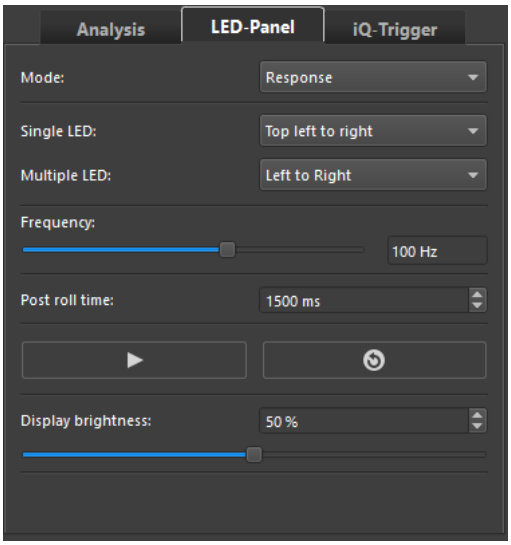


Figure 18

In this tab (Figure 18) you can control multiple connected LED-Panels.

At first choose your desired operating mode. Define the movement direction of the LEDs:

- *Single LED*: the LEDs light up in succession (for modes *Response*, *Exposure time* and *Framerate*
- *Multiple LED*: all LEDs in a row or a column light up simultaneously (for mode *Rolling shutter*)

By moving the slider you can set the device frequency. With the two buttons you can start, stop and reset and the LED-Panel. Reset sets the LED(s) to starting position.

The slider *Display brightness* adjusts the display brightness. This might be helpful to adjust the exposure time of the camera correctly for specific testing conditions. For example if you perform test under low light conditions and use the automatic exposure mode of your camera. Without dimming the display of LED-Panel the bright display light can influence the exposure of your camera.

Note: These settings are applied to all connected LED-Panels; it is not possible to control the devices separately.

5.5.2.3 iQ-Trigger

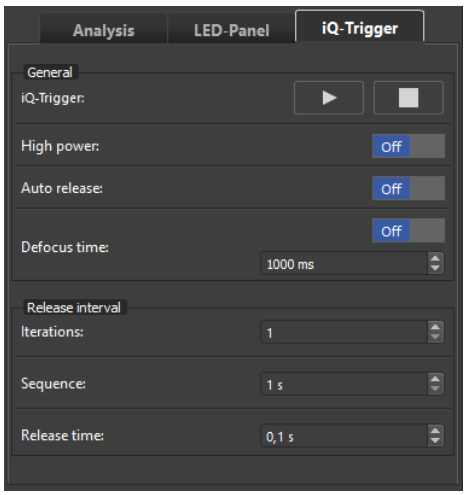


Figure 19

Measuring timing is a critical task in the assessment of imaging devices. The human finger releasing the camera is a source of inaccuracy that should be avoided in a lab environment.

iQ-Trigger is a mechanical finger which can press the release button (touch screen or hardware button) of a camera precisely and at defined moments.

If iQ-Trigger is connected to an LED-Panel it can be controlled by LED-Panel software as well. It is possible to automatically take single images or series by an interval timer (Figure 19). LED-Panel and iQ-Trigger will be synchronized. LED-Panel starts by releasing the iQ-Trigger using the play-button.

For detailed information on setting up the iQTrigger (iQ-Trigger-T) and connecting it with the LED-Panel, please see chapters 3 and 4 (page 7ff) of the iQ-Trigger manual (available in the download section on the iQ-Trigger product page).

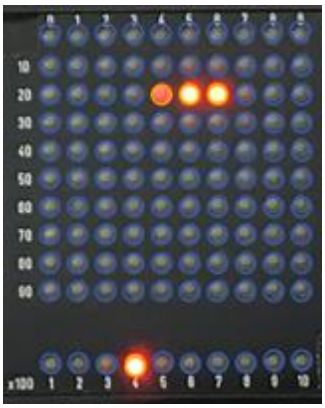


Figure 20

High power: Increases the thrust of the iQ-Trigger which is useful for cameras with a stiff shutter release button

Auto release: LED-Panel will run but iQ-Trigger will be delayed until the 50th LED is reached

This can be used to measure negative shutter or shooting release time lag, which is particularly useful for cameras that buffer images even before the user releases the camera trigger. The difference between it and the actual

glowing LED in the image represents the negative shooting or shutter release time lag.

Defocus time: time period between triggering the defocus and start of LED-Panel and iQ-Trigger

Sequence: time period between iterations

Iterations: defining the amount of release iterations

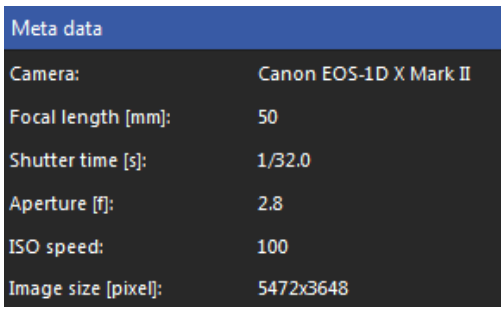
Release time: determines how long the camera release button will be pressed by iQ-Trigger, value ranges from 0.1s to 25s

5.5.3 Image view

The image view panel (Figure 15, ③) shows the image that is currently selected in the file list. With the +🔎-button you can zoom in. The -🔎-button resets the zoom level to fit the view panel.

After a successful analysis you can toggle the highlighting of the detected LEDs in the image with the “eye”-button.

5.5.4 Meta data



Meta data	
Camera:	Canon EOS-1D X Mark II
Focal length [mm]:	50
Shutter time [s]:	1/32.0
Aperture [f]:	2.8
ISO speed:	100
Image size [pixel]:	5472x3648

Figure 21

The meta data panel (Figure 21) gives a quick overview of some important camera and lens settings such as ISO speed or focal length. The meta data of each image will also be written into the results file.

5.5.5 Results

The results panel (Figure 22) shows analysis results as a hierarchical tree with two columns, “Name” and “Time [s]”.

The first column shows the measurements with the assigned images. For each image the detected LED-Panels and measurement types are listed. The number of LED-Panels depends on your setup; they are numbered counted clockwise starting from the top left.

The second column shows the measured time for each LED-Panel as well as an average value for the measurement.

For example, if an image contains four LED-Panels there will be four LED-Panel entries for this particular image with the measured time for each one of them.

By clicking the arrow button in the top right corner the result tree can be collapsed or expanded.

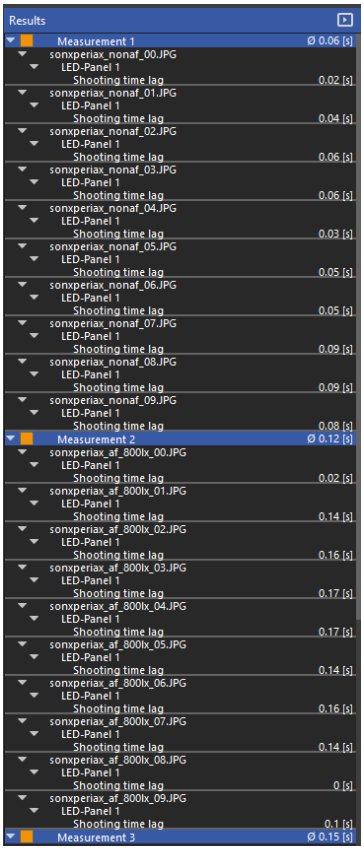


Figure 22

5.5.6 Menu bar

The menu bar (Figure 15, ⑦) provides some quick accessible options.

File

Open: opens the “Open file” dialog
Quit: closes the application

Options

Export: opens the export setting dialog (5.5.7 Export results)

View

Show full file path: toggles between full file path and file name in the file list
Image preview: shows a thumbnail image when the mouse hovers over the file list (Figure 23)
Expand/Collapse: expands or collapses file list and results

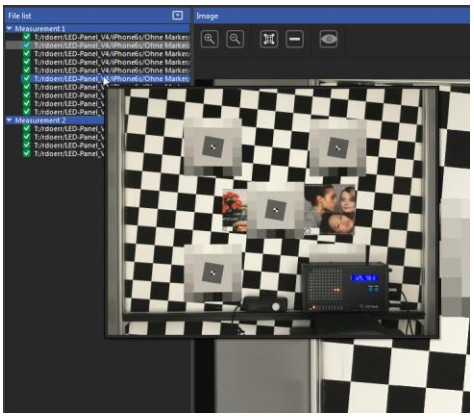


Figure 23

Help

About…: shows general information about the application

5.5.7 Export results

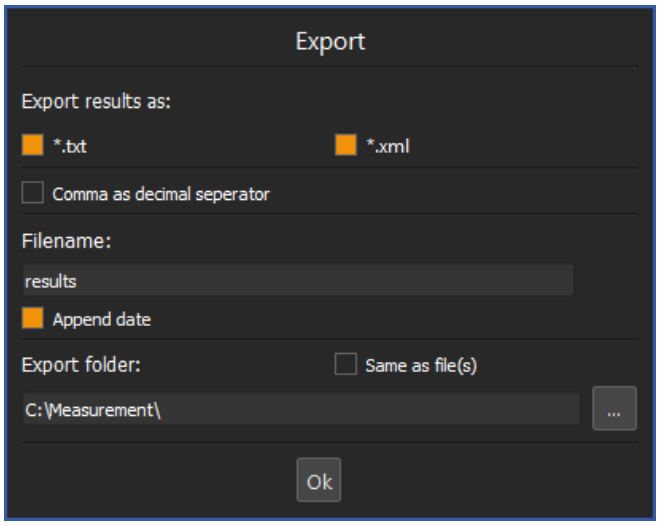


Figure 24

The export dialog lets you configure the file type to be used for the export of results. You can select

- text file (*.txt), formatted for copy-and-paste into a spreadsheet
- XML file (*.xml) for further processing in your workflow or both.

For each measurement in the file list a result file will be written to the export folder using the given file name prefix and the current date as a suffix (fileName_YYYY-MM-DD.ext).

5.5.8 Connected LED-Panel

The status bar (Figure 15, ⑥) at the bottom of the application shows the serial number(s) of the connected LED-Panel. By clicking a serial number the specific LED-Panel display will start flashing.

5.6 Measurement

Prior to analyzing images with the LED-Panel software there are a few things you should keep in mind to ensure proper functioning.

- Make sure that the images are exposed properly. Under- or overexposed images may lead to a false positive detection of LEDs due to noise or other artefacts in the image.
- Align the LED-Panel device properly. Images with rotated or tilted devices may result in a false or failed detection.
- Please ensure that the whole device is visible in the image.

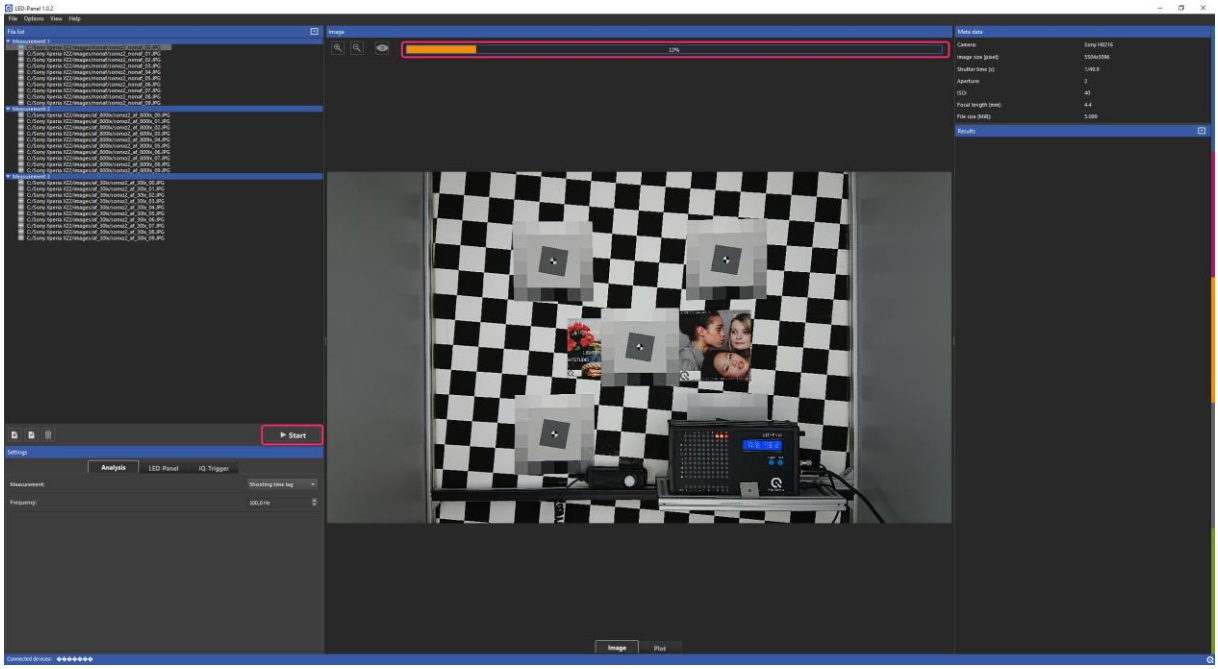


Figure 25

After the images are loaded into the file list make sure that the settings in the analysis tab match the settings of the LED-Panel in the images. To start the analysis, please click the Start button under the control panel. A progress bar above the image view will display the analysis progress. It will disappear immediately when the analysis was finished. Now you can see the detected LEDs in the image view (Figure 15, ③). On the right side the results will appear and they will be written into result files in the selected folder.

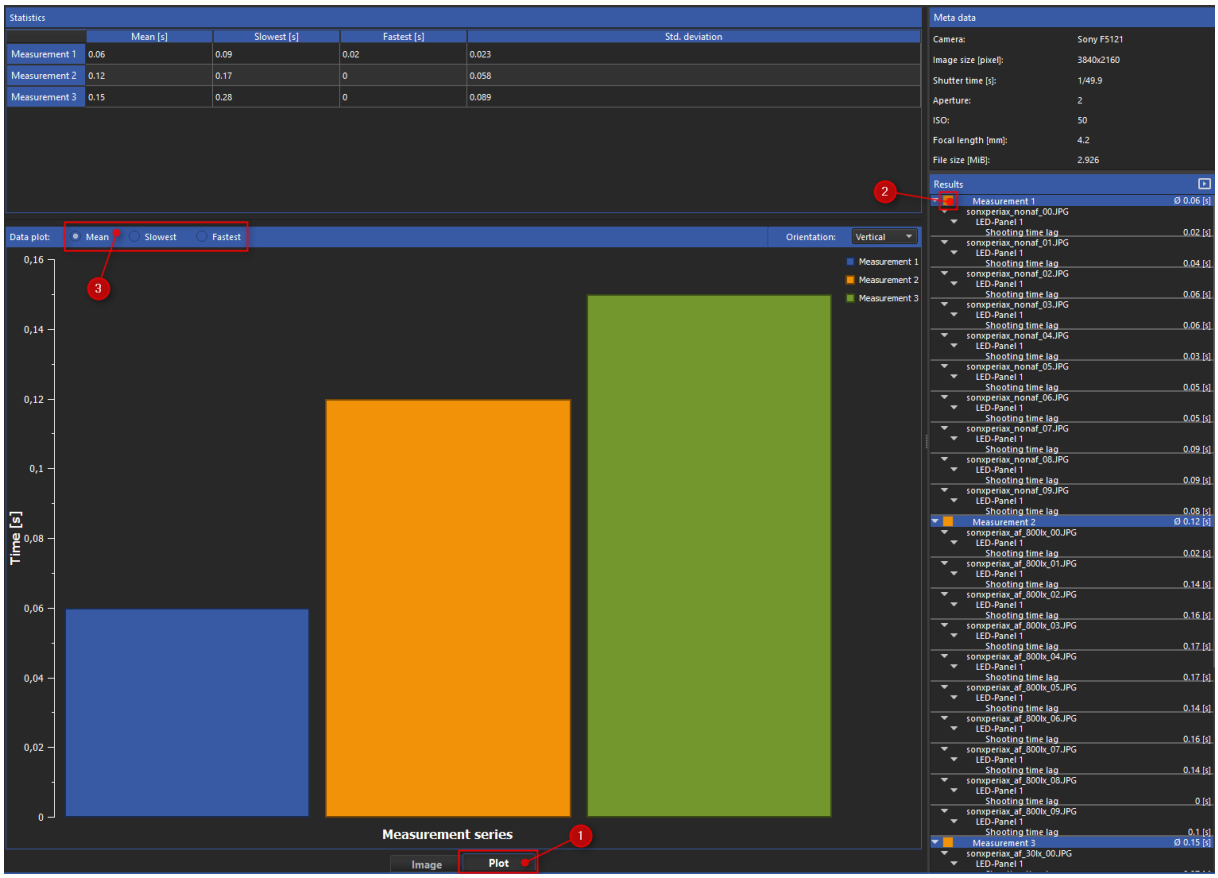


Figure 26

The plot tab ① shows statistics of the different measurements like mean value, fastest time, slowest time and standard deviation. Additionaly a bar plot visualize the calculated results. By check or uncheck the checkbock in the results tree ② you can display your favored plot ③

6 COMMAND LINE INTERFACE (CLI)

6.1 Introduction

This documentation provides help on the implemented command-line functions of the LED-Panel and is intended to assist in scripting of the control software on Microsoft Windows.

These instructions generally apply to LED-Panels V3 and V4, which must be connected to a PC via USB. The commands are command-line based. The command-line consists of an executable file along with the the function and, if applicable, a parameter, all separated by white spaces.

The executable file is always **LED-Panel.exe** and can be used without file extension .exe.

NOTE:

Options are **case sensitive**.

Every option has to start with dash ("-") or double dash ("--").

Example: LED-Panel -start or LED-Panel --start

Usage of option with more than one argument:

LED-Panel -setTrigger <arg1> -setTrigger <arg2>

For more information:

LED-Panel -h or LED-Panel -help

Examples:

LED-Panel.exe -setTrigger Cont

LED-Panel -setTrigger Cont

When using more than one LED-Panel connected to your PC the desired LED-Panel must be set as active.

Examples (addressing an LED-Panel with the serial number LP40001):

LED-Panel.exe –serial LP40001

LED-Panel –serial LP40001

6.2 Operation Functions

6.2.1 Set Operation Mode

Function

setMode <mode>

Description

“LED-Panel.exe -setMode <mode>” sets the operation mode

Parameters

<mode>	**Description**
1	Response time measurement [xx.x µs/ms/s]
2	Exposure time measurement [1/x s]
3	Frame rate measurement [Hz]
4	Rolling shutter mode
5	All LEDs on

Example

LED-Panel.exe -setMode 2

After the execution of this command the LED-Panel will change into the exposure time measurement mode.

6.2.2 Get Operation Mode

Function

getMode

Description

“LED-Panel.exe -getMode” returns the current operation mode.

Return parameters

Return value	Description
1	Response time measurement
2	Exposure time measurement
3	Frame rate measurement
4	Rolling shutter mode
5	All LEDs on

Example

LED-Panel.exe -getMode

After the execution of this command the device will return the numerical value of the activated operation mode.

6.2.3 Set Trigger Mode

Function

setTriggerMode <trigger>

Description

“LED-Panel.exe -setTriggerMode <trigger>” sets the trigger mode

Parameters

<trigger>	Description
1	internal (continuous) trigger
2	external (single) trigger

Example

LED-Panel.exe -setTriggerMode 1

After the execution of this command LED-Panel will change into the internal (continuous) trigger mode.

6.2.4 Get Trigger Mode

Function
getTriggerMode

Description
“LED-Panel.exe -getTriggerMode” returns the current trigger mode

Return parameters

Return value	Description
1	internal (continuous) trigger
2	external (single) trigger

Example

LED-Panel.exe -getTriggerMode

After the execution of the command the device will return the numerical value of the activated trigger mode.

6.2.5 Set LEDs Switching Time

Function
setTime <time>

Description
With the function “LED-Panel.exe -setTime <time>“ it is possible to set switching time (cycle duration) of the LED-Panel.

Parameters
Valid range from 0.0002-9.9[s]
Value precision:

0.0002 - 0.001 steps of 0.00001[s]
0.001 - 0.01 steps of 0.0001[s]
0.01 - 0.1 steps of 0.001[s]
0.1 - 1.0 steps of 0.01[s]
1.0 - 9.0 steps of 0.1[s]

Frame Rate Mode
Value range: 1.0 - 100.0
Value precision:

1.0 - 20.0 steps of 0.1
20.0 - 40.0 steps of 0.2
40.0 - 60.0 steps of 0.5
60.0 - 100.0 steps of 1.0

6.2.6 Get LEDs Switching Time

Function

getTime

Description

With the function “LED-Panel.exe -getTime” it is possible to read the switching time of the device.

Return parameters

After the execution of the command “LED-Panel.exe -getTime” the device will return the cycle duration in seconds or the index of the set time in case of exposure mode.

6.2.7 Start Measurement

Function

start

Description

“LED-Panel.exe -start” starts measurement ignoring the camera trigger input from the camera micro switch.

6.2.8 Stop Measurement

Function

stop

Description

“LED-Panel.exe -stop” stops the measurement without resetting the LEDs.

6.2.9 Get Running State

Function

isRunning

Description

Function “LED-Panel.exe -isRunning” checks if the measurement is currently running.

Return parameters

Return value	Description
0	the device is stopped
1	a measurement is running

Table 1

Example

LED-Panel.exe –isRunning

After the execution of the command the device will return the value 0 or 1 representing the current measurement state.

6.2.10 Reset Measurement

Function

reset

Description

“LED-Panel.exe -reset” clears all the lighting LEDs and prepares the device for a new measurement.

6.2.11 Get Camera Trigger Input State

Function

getCameraTrigger

Description

“LED-Panel.exe -getCameraTrigger” returns the current state of the digital input “Camera Trigger”.

Return parameters

Return value	Description
0	digital input „Camera Trigger“ is not activated
1	digital input „Camera Trigger“ is activated

Table 2

6.2.12 Get Stop Trigger Input State

Function

getStopTrigger

Description

“LED-Panel.exe -getStopTrigger” returns the state of the digital input “Stop Trigger”.

Return parameters

Return value	Description
0	digital input „Stop Trigger“ is not activated
1	digital input „Stop Trigger“ is activated

Table 3

6.2.13 Get the Number of Currently Activated LED

Function

getCurrentLED

Description

With the function “LED-Panel.exe -getCurrentLED” it is possible to read which LED is currently turned on, respectively the number of switching periods occurred after activating the „Camera Trigger“ input.

Return parameters

After the execution of the command “LED-Panel.exe -getCurrentLED” the device will return a two- or three-digits value of the currently switched LED like XYY or YY. Where X is a one-digit value of the lighted LED of the lower LED row and YY is two-digit value of the lighted LED in the 10x10 LED array.

Examples

Return value **65** means that no LEDs are lighted in the lower LED row and the LED number 65 is lighted in the square field. There have been 65 switching periods in total.

Return value **623** means that the LED number 6 is lighted in the lower LED row and the LED number 23 is lighted in the square field. There have been 623 switching periods in total.

6.2.14 Put the LED-Panel in sleep mode, wake from sleep mode

Function

setSleepMode <mode>

Description

“LED-Panel.exe -setSleepMode 1” puts the device in sleep mode.

“LED-Panel.exe -setSleepMode 0” wakes the device from sleep mode.

6.2.15 Enable / Disable the external input “Camera Trigger”

Function

setCameraTrigger <enable>

Description

With the function “LED-Panel.exe setcamtriggeren <enable>” it is possible to activate or deactivate the external (wired) input “Camera Trigger”.

Parameters

<enable>	Description
0	disable the input “Camera Trigger”
1	enable the input “Camera Trigger”

Table 4

Example

LED-Panel.exe -setCameraTrigger 0

After the execution of this command the external input “Camera Trigger” will be disabled

6.2.16 Get the Enabled / Disabled State of the external input “Camera Trigger”

Function
getCameraTrigger

Description
After the execution of the command “LED-Panel.exe -getCameraTrigger” the device returns the current activation state of the external input “Camera Trigger”.

Return parameters

Return value	Description
0	digital input „Camera Trigger“ disabled
1	digital input “Camera Trigger“ enabled

Table 5

6.2.17 Enable / Disable the external input “Stop Trigger”

Function

setStopTrigger <enable>

Description

With the function “LED-Panel.exe -setStopTrigger <enable>” it is possible to activate or deactivate the external (wired) input “Stop Trigger”.

Parameters

<enable>	Description
0	disable the input “Stop Trigger”
1	enable the input “Stop Trigger”

Table 6

Example

LED-Panel.exe -setStopTrigger 1

After the execution of this command the external input “Stop Trigger” will be enabled.

6.2.18 Get the Enabled / Disabled State of the external input “Stop Trigger”

Function
getStopTrigger

Description
After the execution of the command “**LED-Panel.exe -getStopTrigger**” the device returns the current activation state of the external input “Stop Trigger”.

Return values

Return value	Description
0	digital input „Stop Trigger“ disabled
1	digital input „Stop Trigger“ enabled

Table 7

6.2.19 Set the Intensity of the Display Backlight

Function
setDisplayBrightness <XXX>

Description
With the function “**LED-Panel.exe -setDisplayBrightness <XYZ>**” the backlight illumination of the LCD display light can be changed in 1% steps from 0% to 100%.

Parameters
XYZ – backlight intensity in steps of 1%; can be set from 0 (OFF) to 100 (fully ON).

Example

To set intensity to 24 % call **LED-Panel.exe -setDisplayBrightness 24**

6.2.20 Get the Intensity of the Display Back Light

Function

getDisplayBrightness

Description

With the function "**LED-Panel.exe -getDisplayBrightness**" it is possible to read the intensity of the backlight illumination of the LCD display.

Return Parameters

After the execution of the function "**LED-Panel.exe -getDisplayBrightness**" the device will return a one-, two- or three-digits value of the backlight intensity in %.

For instance:

Return value **27** means that the intensity of the backlight is 27%.

Return value **0** means that the backlight is turned OFF.

Return value **100** means that the intensity of the backlight is 100%.

6.2.21 Set the Direction of the LEDs for "Response Time" and "Exposure Time" Modes

Function
setDirectionSingle <X>

Description
"**LED-Panel.exe -setDirectionSingle <X>**" switches the desired moving direction of LEDs. There are eight possible directions.

Parameters

<X>	Description
1	Starting from the top left, run from left to right and to the bottom
2	Starting from the top right, run from right to left and to the bottom
3	Starting from the bottom left, run from left to right and to the top
4	Starting from bottom right, run from right to left and to the top
5	Starting from top left, run from top to bottom and to the right
6	Starting from top right, run from top to bottom and to the left
7	Starting from bottom left, run from bottom to top and to the right
8	Starting from bottom right, run from bottom to top and to the left

Table 8

6.2.22 Get the Direction of the LEDs for “Response Time” and “Exposure Time” Modes

Function
getDirectionSingle

Description
The function “**LED-Panel.exe -getDirectionSingle**” returns the current moving direction of the LEDs in the “Response Time” and “Exposure Time” modes.

Return values
After the execution of this function the device will return a one-digit value of the current LED direction. For the list of the possible return values please refer to the Table 1.

6.2.23 Set the Direction of the LEDs for “Rolling Shutter” Mode

Function
setDirectionMulti <value>

Description
“**LED-Panel.exe -setDirectionMulti <value>**” switches the desired moving direction of the LED columns (each one consisting of ten LEDs).
There are four possible directions.

Parameters

<value>	Description
1	The column moves from left to right
2	The column moves from right to left
3	The column moves from top to bottom
4	The column moves from bottom to top

Table 9

6.2.24 Get the Direction of the LEDs for “Rolling Shutter” Mode

Function
getDirectionMulti

Description
The function “**LED-Panel.exe -getDirectionMulti**” returns the current moving direction of the LED columns (each one consisting of ten LEDs) in “Rolling Shutter” mode.

Return values
After the execution of this function the device will return a one-digit value of the current direction of the LED columns. For the list of the possible return values please refer to the Table 2.

6.2.25 Set LEDs switching time for the "Exposure Time" mode

Function
setTime <XX>

Description
With the function "**LED-Panel.exe -setTime <XX>**" it is possible to set the switching time of the LEDs in the "Exposure Time" mode.

Parameters
To set the desired switching time between 1/5000s and 10s please refer to the following table.

PLEASE NOTE

Parameters 01 to 14 are currently not applicable. They are reserved for future design.

<XX>	switching time [s]	<XX>	switching time [s]	<XX>	switching time [s]	<XX>	switching time [s]
~~**01**~~	~~1/100000~~	**20**	1/2000	**39**	1/100	**58**	0.4s
~~**02**~~	~~1/80000~~	**21**	1/1600	**40**	1/80	**59**	0.5s
~~**03**~~	~~1/64000~~	**22**	1/1500	**41**	1/64	**60**	0.6s
~~**04**~~	~~1/50000~~	**23**	1/1300	**42**	1/60	**61**	0.8s
~~**05**~~	~~1/40000~~	**24**	1/1250	**43**	1/50	**62**	1s
~~**06**~~	~~1/32000~~	**25**	1/1000	**44**	1/40	**63**	1.25s
~~**07**~~	~~1/25000~~	**26**	1/800	**45**	1/32	**64**	1.3s
~~**08**~~	~~1/20000~~	**27**	1/640	**46**	1/30	**65**	1.5s
~~**09**~~	~~1/16000~~	**28**	1/600	**47**	1/25	**66**	1.6s
~~**10**~~	~~1/12500~~	**29**	1/500	**48**	1/20	**67**	2s
~~**11**~~	~~1/10000~~	**30**	1/400	**49**	1/16	**68**	2.5s
~~**12**~~	~~1/8000~~	**31**	1/320	**50**	1/15	**69**	3s
~~**13**~~	~~1/6400~~	**32**	1/300	**51**	1/13	**70**	3.2s
~~**14**~~	~~1/6000~~	**33**	1/250	**52**	1/10	**71**	4s
15	1/5000	**34**	1/200	**53**	1/8	**72**	5s
16	1/4000	**35**	1/160	**54**	1/6	**73**	6s
17	1/3200	**36**	1/150	**55**	1/5	**74**	6.4s
18	1/3000	**37**	1/130	**56**	1/4	**75**	8s
19	1/2500	**38**	1/125	**57**	0.3s	**76**	10s

Table 10

Examples

To set the LED switching time to 1/5000s call **LED-Panel.exe -setTime 15**

To set the LED switching time to 1/125s call **LED-Panel.exe -setTime 38**

6.2.26 Get LEDs Switching Time for the “Exposure Time” Mode

Function

getTime

Description

With the function “**LED-Panel.exe -getTime**“ it is possible to read the LED switching time of the device in the "Exposure Time" mode.

Return parameters

After the execution of the command “LED-Panel.exe -getTime“ the device will return a one- or two-digits value XX of the switching time, where XX is the value of the switching time from the Table 3.

For instance:

Return value **17** means that the switching time is 1/3200s.

6.2.27 Trigger iQ-Trigger (LED-Panel V4 only)

Function

setTrigger

Description

If a iQ-Trigger is connected to the LED-Panel it can be triggered by using „**LED-Panel -setTrigger <mode> -setTrigger <duration>**“

<mode>	Description
0	-
1	Standard mode
2	Power mode

The <duration> can be set in 100ms steps from 0.1s to 25s. The value range is [1..250].

1 = 0.1s, 2 = 0.2s ,10 = 1s

Example:

Trigger the iQ-Trigger in standard mode for 1.5s.

LED-Panel -setTrigger 1 -setTrigger 15

6.2.28 Trigger iQ-Defocus (LED-Panel V4 only)

Function

setDefocus

Description

If a iQ-Defocus is connected to the LED-Panel it can be triggered by using „**LED-Panel -setDefocus <mode> -setDefocus <duration>**“.

For parameters see **Fehler! Verweisquelle konnte nicht gefunden werden. Fehler! Verweisquelle konnte nicht gefunden werden.**.

6.2.29 Set auto release (LED-Panel V4 only)

Function

setAutoRelease

Description

Modern camera systems especially mobile phones often take continously photos in the background to avoid shooting time lag and provide some convenience features. If the user hits the camera release button it can occure that a buffered photo is shown as the actual photo. But this photo was take before the user hit the release button. For this case the auto release function is implemented. If „**LED-Panel -setAutoRelease 1**“ the LED-Panel releases the iQ-Trigger at the 50th LED.

<mode>	Description
0	Off
1	On

6.2.30 Set post roll time (LED-Panel V4 only)

Function

setPostRollTime

Description

The LED-Panel keeps running for a certain time after the iQ-Trigger was triggered by using „**LED-Panel -setPostRollTime <duration>**“. Value [0..30000ms]

Example:

LED-Panel –setPostRollTime 2000

7 ADDITIONAL INFORMATION

7.1 Disposal instructions

After the service life of the LED-Panel, it must be disposed properly. Electrical and electromechanical components are included in the LED-Panel. Observe your national regulations. Make sure that the LED-Panel cannot be used by third parties after disposing of it.

Contact Image Engineering if assistance for disposal is required.

8 TECHNICAL DATA SHEET

See annex for the technical data sheet. It can be downloaded at the website of Image Engineering as well: www.image-engineering.com.

9 TRADEMARK AND COPYRIGHT

9.1 Trademarks

Windows is a registered trademark of Microsoft Corp.

9.2 Software by Third Parties

dcraw (Copyright © 1997-2016 by Dave Coffin): http://www.cybercom.net/~dcoffin/dcraw/

dcraw released under GPLv2+

OpenCV - Open Source Computer Vision Library

OpenCV is released under 3-clause BSD License (http://opencv.org/license.html)

Copyright © 2000-2008, Intel Corporation, all rights reserved.

Copyright © 2009-2010, Willow Garage Inc., all rights reserved.

Third party copyrights are property of their respective owners.

(www.opencv.org)

9.3 Copyright Information

Copyright © Image Engineering GmbH & Co. KG, 2016

THE SOFTWARE FURNISHED UNDER THIS AGREEMENT IS PROVIDED ON AN “AS IS” BASIS, WITHOUT ANY WARRANTIES OR REPRESENTATIONS EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IT IS SOLELY THE RESPONSIBILITY OF THE CONSUMER TO DETERMINE THE SOFTWARE”S SUITABILITY FOR A PARTICULAR PURPOSE OR USE. IMAGE

ENGINEERING GMBH & CO. KG, AND ANYONE ELSE WHO HAS BEEN INVOLVED IN THE CREATION, PRODUCTION, DELIVERY, OR SUPPORT OF THIS SOFTWARE, WILL IN NO EVENT BE LIABLE FOR DIRECT, INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT, ERROR, OR OMISSION IN THE DISKETTE OR SOFTWARE OR FROM ANY OTHER EVENTS, INCLUDING, BUT NOT LIMITED TO, ANY INTERRUPTION OF SERVICE, LOSS OF PROFITS OR GOOD WILL, LEGAL ACTION OR ANY OTHER CONSEQUENTIAL DAMAGES. THE USER ASSUMES ALL RESPONSIBILITY ARISING FROM THE USE OF THIS SOFTWARE, FOR WHICH IMAGE ENGINEERING GMBH & CO. KG SHALL HAVE NO LIABILITY, REGARDLESS OF WHETHER SUCH USE IS LAWFUL OR FORSEEABLE. IMAGE

ENGINEERING GMBH & CO. KG SHALL HAVE NO LIABILITY FOR ANY DATA OR PROGRAMS STORED BY OR USED WITH THIS SOFTWARE, INCLUDING THE COSTS OF RECOVERING SUCH DATA OR PROGRAMS. IMAGE ENGINEERING GMBH & CO. KG RESERVES THE RIGHT TO MAKE CORRECTIONS OR IMPROVEMENTS TO THE INFORMATION PROVIDED AND TO THE RELATED SOFTWARE AT ANY TIME, WITHOUT NOTICE.