LED-Panel V5

User Manual

May 10, 2022

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 a digital imaging device.

Exact 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 that can be controlled from a computer. Use a standard USB port to select the different operation modes of the LED-Panel. Shutter and shooting time lag can be activated by adjusting the LED frequency, 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 that move simultaneously can also be selected through the command-line interface. Via USB, each mode can be triggered individually, and the LED sequence's direction can be changed.

IMPORTANT INFORMATION

Read the manual carefully before using this device.

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

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

1.1 Intended use

LED-Panel V5 is designed to perform timing measurements on digital cameras. Measurements according to ISO 15739 are possible with LED-Panel V5.

- Only suitable for indoor use.
- Place your system in a dry and constant tempered environment without light interference.
- 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 of < 0.06%.
- An accuracy of better than one millisecond enables extremely precise measurements.
- A software-based analysis is included in the LED-Panel software.

1.2 Foreseeable misuse

1.2.1 Older LED-Panel versions

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

1.3 General safety information

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

1.4 Eye safety

If you use the LED-Panel infrared version, please wear the supplied safety goggles 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 V5
- 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 LED-Panel V5. Connect the power supply to electricity. Switch on LED-Panel V5 by setting the power switch to “I.” The power switch is located beside the power supply.

3.2 Hardware description

LED-Panel V5 front and side

Operating element front:

- LED array
- Display
- Trigger button
- Mode button

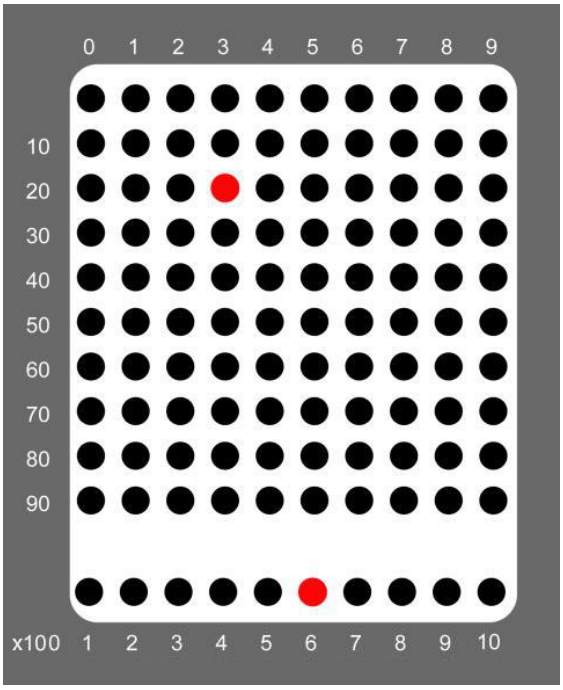
Operating elements side:

- Rotary knob for changing the frequency and dimming of the LED array and the display
- 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 (past version: 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 separated into 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 consists of ten LEDs and is switched forward after all 100 LEDs have passed. Thus, the device can represent cycles of up to 1000 LEDs.

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



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

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 V5 can be operated manually or via software (USB interface). Please refer to chapter 3.3 for information about control software.

3.2.1 Trigger mode

The LED-Panel V5 can be operated manually 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

A remote release is connected to the LED-Panel for the external operating mode. 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).

The period between two triggered events can be calculated if a remote release is connected to the STOP TRIGGER input. 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 the CAMERA TRIGGER remains pressed when stopped. Pressing the CAMERA TRIGGER again resets the LED-Panel.

3.2.2 Setting mode and time

Mode	Response time	Exposure time	Frame rate	Rolling 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 / manual mode	20 µs – 9.9 s 50 kHz - 0.101 Hz	1/50000 – 10 s 50 kHz - 0.1 Hz	Frame rate 1 Hz - 200 Hz	20 µs – 9.9 s 50 kHz - 0.101 Hz

Overview of selectable modes, their descriptions, and times

3.2.2.1 Setting the mode

Press the MODE button (mode is indicated in the display) to set a mode.

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 display's "Set direction" is shown. Change the direction by turning the rotary knob. There are eight directions for the response 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 the LEDs start from the left top edge of the LED matrix and run to the right top edge. It then jumps to the left of the second top line, runs from left to right, and continues 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 and LED-array brightness

The brightness of the display can be modified by using the rotary knob. Press and hold the rotary knob until the message "Set brightness" and "LED xx LCD xx" are shown on the device display. Turn the rotary knob to change the LED array light intensity. To set the display's brightness, push the rotary knob again and turn it to change.

4 MEASUREMENT METHODS

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

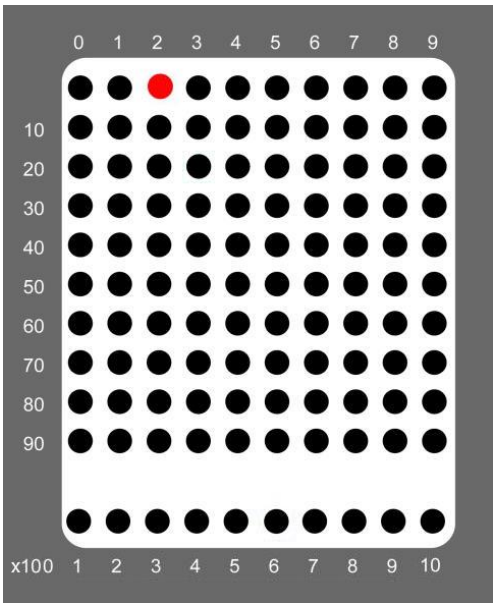


Figure 2

Due to the two buttons having different release points, a time lag can occur between starting the LED-Panel and releasing the camera. We offer an optional device that is guaranteed to push both buttons (microswitch and camera release button) in less than 5 ms. 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 microswitch is connected. Two pictures are taken, and the shutter lag is calculated.

- It is described in Shutter lag without autofocus time. The shutter lag without autofocus time is calculated.
- The camera focus is set to infinity, and afterward, a picture of the LED-Panel is taken with the microswitch's help. After the time for the autofocus and shutter lag has passed, the camera takes a

picture of the running LED-Panel. The time passed since the microswitch (and 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 t

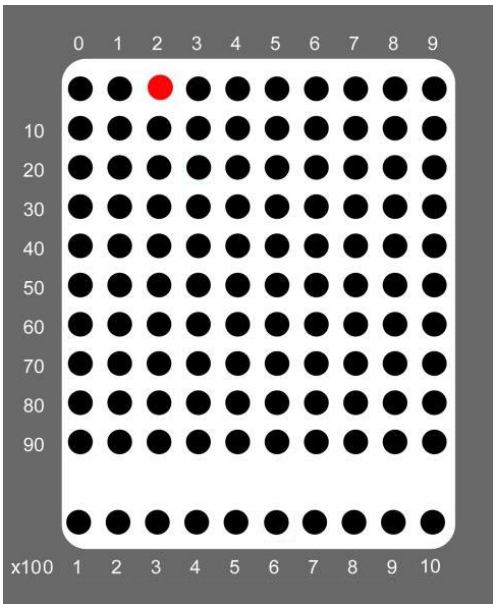


Figure 4

Shutter lag without autofocus time

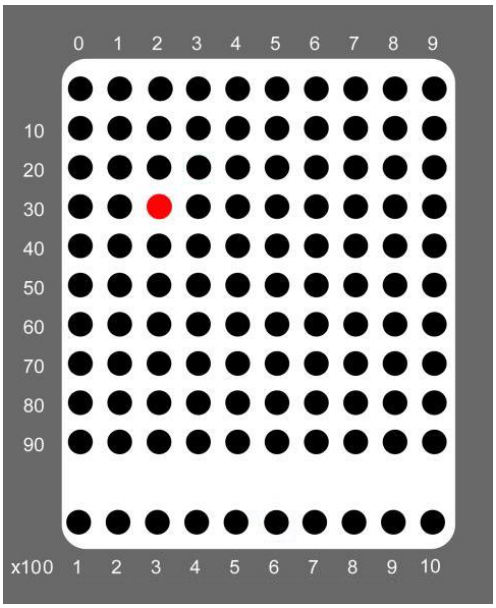


Figure 3

Shutter lag with autofocus time

Example

LED-Panel settings:

Operating mode TRIGGER EXT

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

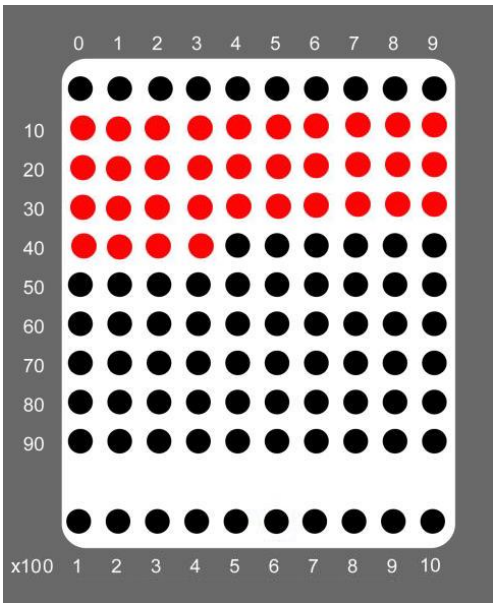
Shutter lag without autofocus time: LED No. 2 lights up → 0.2 s

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 setting the LED-Panel to CONTINUOUS trigger mode and adjusting the time, 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 now be counterbalanced with the rotary knob until the lower row of LEDs stops blinking on the camera display. The LED-Panel has now matched the frame rate of the camera. The manual frequency scan should be started at the lowest level because the frame rate frequency harmonics also cause the LEDs to stop blinking.

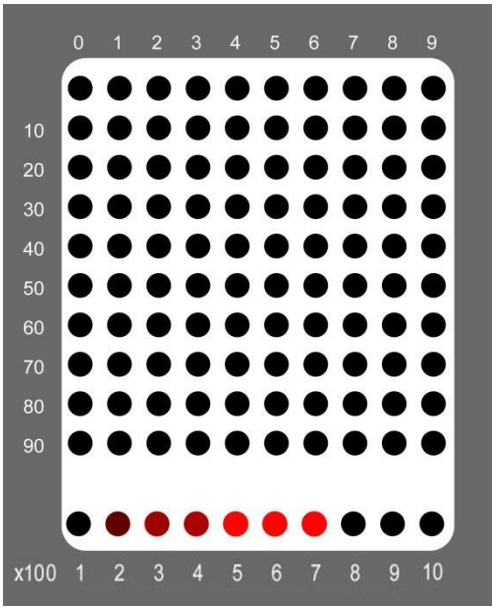


Figure 6

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

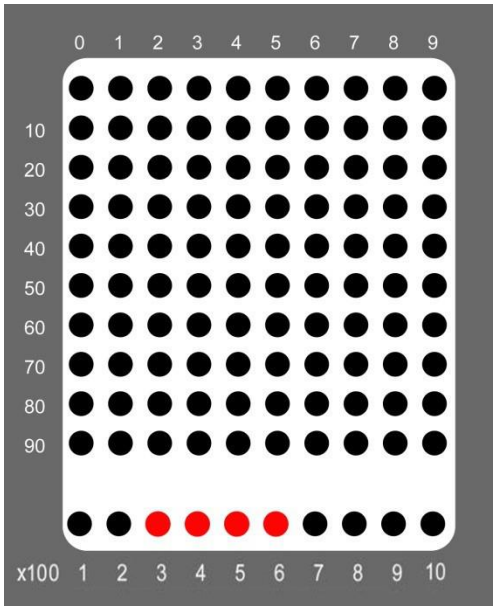


Figure 5

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 CONTINOUS operating mode, and the time must be defined. Afterward, pictures of the LED-Panel are taken in multi-shot mode. The speed of multi-shot mode can be calculated from a distance between the live LEDs in two consecutive images.

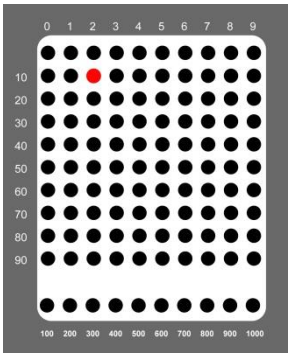


Figure 8

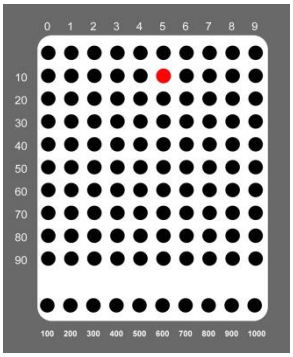


Figure 7

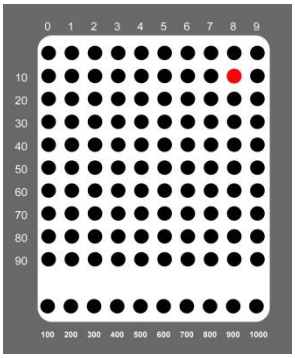


Figure 10

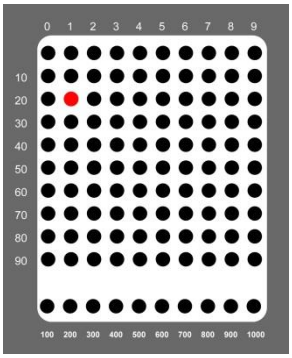


Figure 9

Example

Camera exposure time:

1/250 s

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

Each time the LED has moved three steps forward between the consecutive images. With the LED-Panel's frequency set to 0.1s, the multi-shot mode has a speed of 0.3 s per picture (i.e., 3.3 photos per second).

4.6 Rolling shutter speed

The LED-Panel can be used in CONTINUOUS and TRIGGER EXT operating modes. The LED-Panel is connected to a remote release in TRIGGER EXT operating mode and uses this switch to start. Due to the two buttons having different release points, a time lag can occur between starting the LED-Panel and camera release. We have developed a device that can guarantee pushing both buttons (microswitch and camera release button) in less than five milliseconds. The so-called iQ-Trigger activates the camera release mechanically. The iQ-Trigger is available as a separate product.

All ten rows of LEDs are operated simultaneously in the rolling shutter operating mode, meaning 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. The time can be read from this offset, which is required to read the LED-Panel image.

For this measurement, we recommend framing the field of the LEDs in the image so that they fill the whole image height.

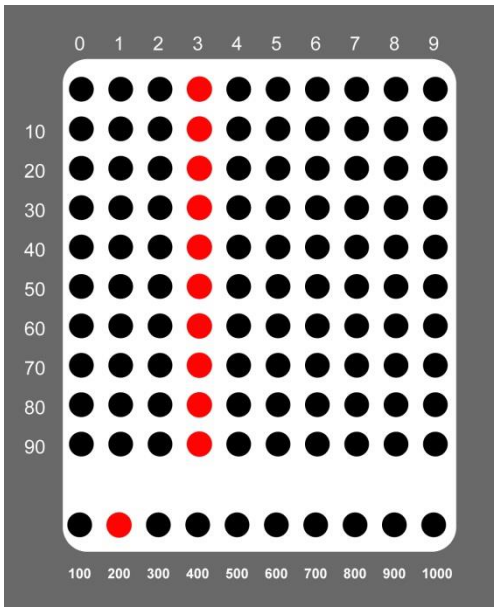


Figure 11

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

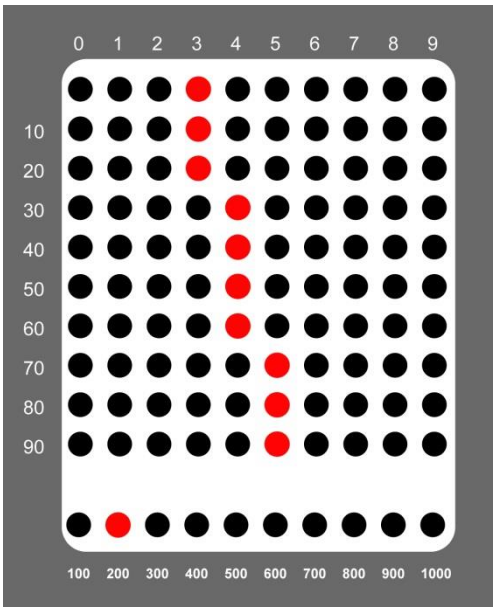


Figure 11a

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

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

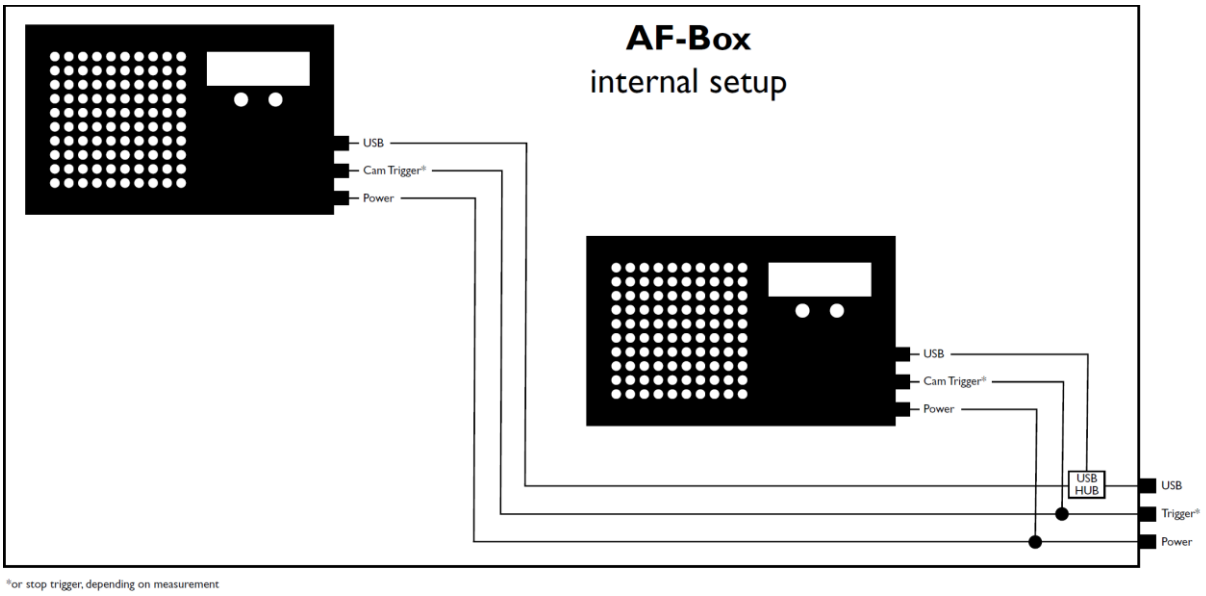


Figure 12: internal wiring

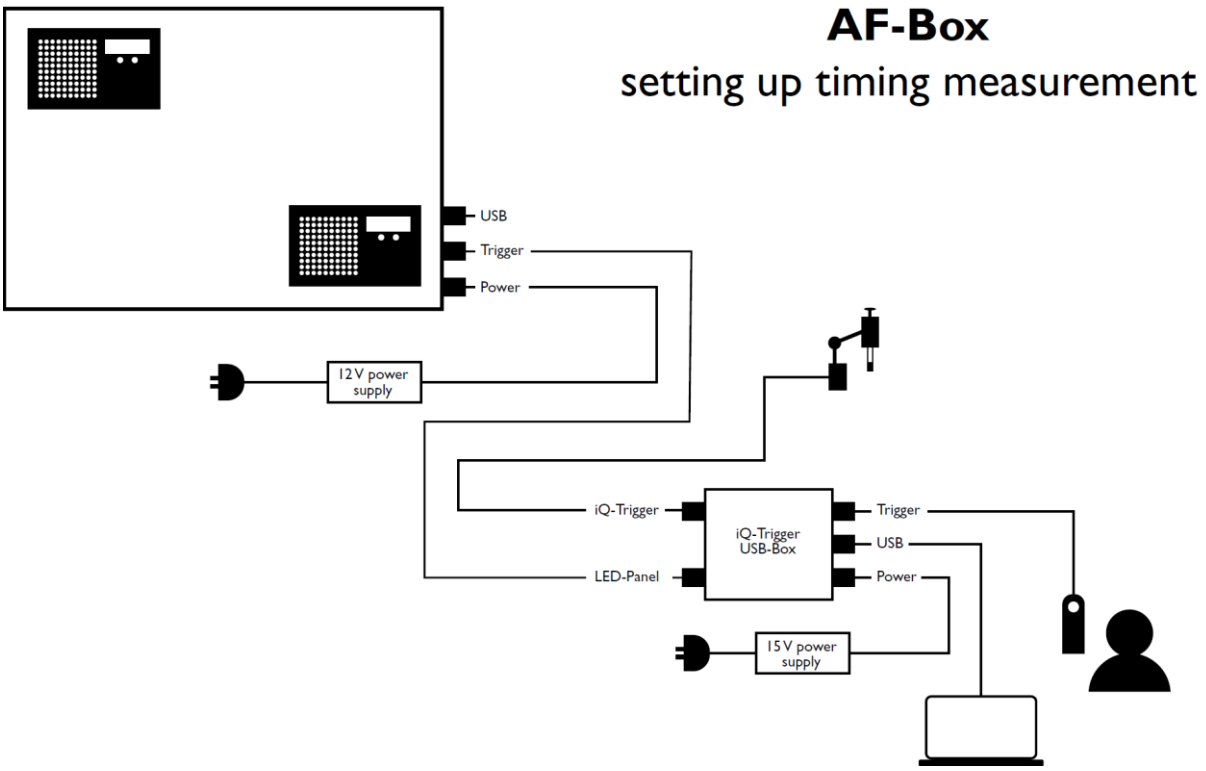


Figure 13: setting up for timing measurement

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 the LED-Panel. Connect the power supply to electricity.

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

5.4 Software activation

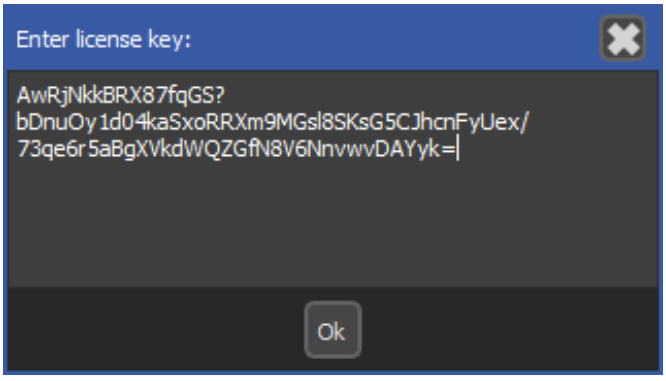


Figure 14

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). To do this, connect your LED-Panel to the computer and enter the license key. The key is in a text file on the USB shipped with the product. After the activation process, 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 V5, LED-Panel V4, and LED-Panel V3
- analyzing images taken from LED-Panel V5 and LED-Panel V4

You can perform many actions using the control software, including setting the desired measurement frequency, choosing between the available LED modes, starting and stopping the LED-Panel, adjusting the LED array, and displaying brightness. You can also release an iQ-Trigger attached to the LED-Panel once or set an interval to release it periodically to take a series of images.

For the analysis of images, 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 standard image file formats like JPEG, PNG, TIFF, and BMP. The analysis results can be saved as plain text (*.txt) and/or XML files for further processing.

Note: Software-based analysis is only available for LED-Panel V5 and LED-Panel V4.

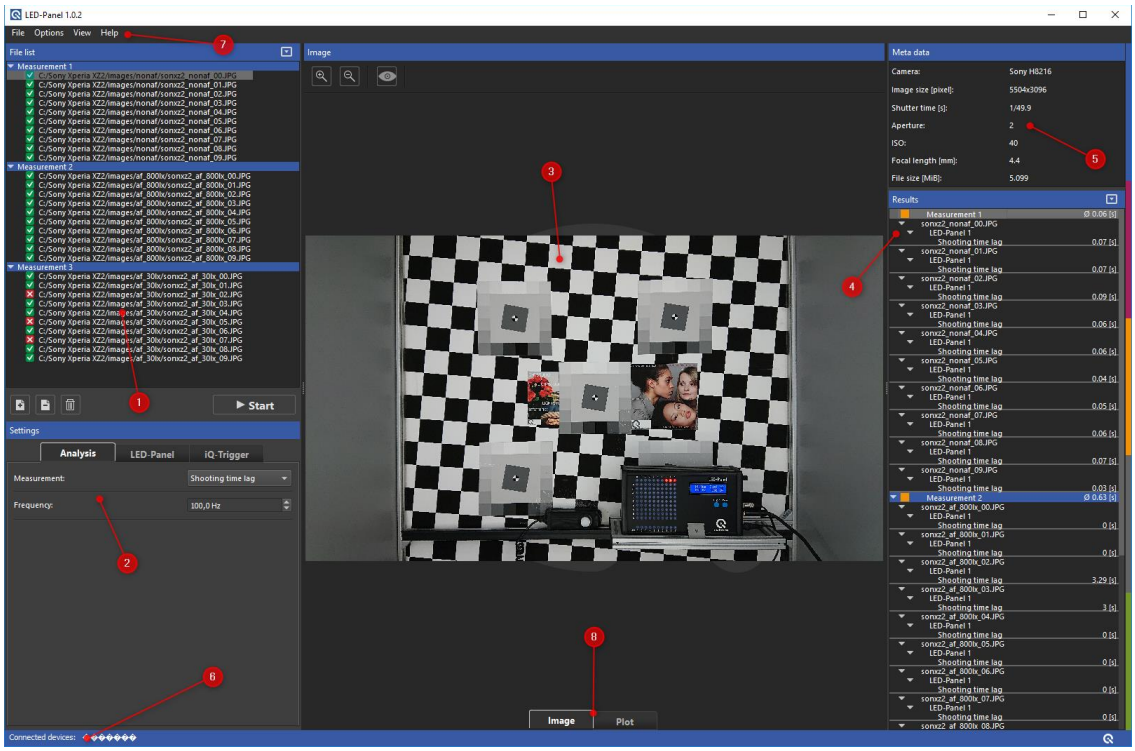


Figure 15

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 metadata view (Figure 15, ④ & ⑤).

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

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

The arrow button in the top right corner will hide or display all files in the list.

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

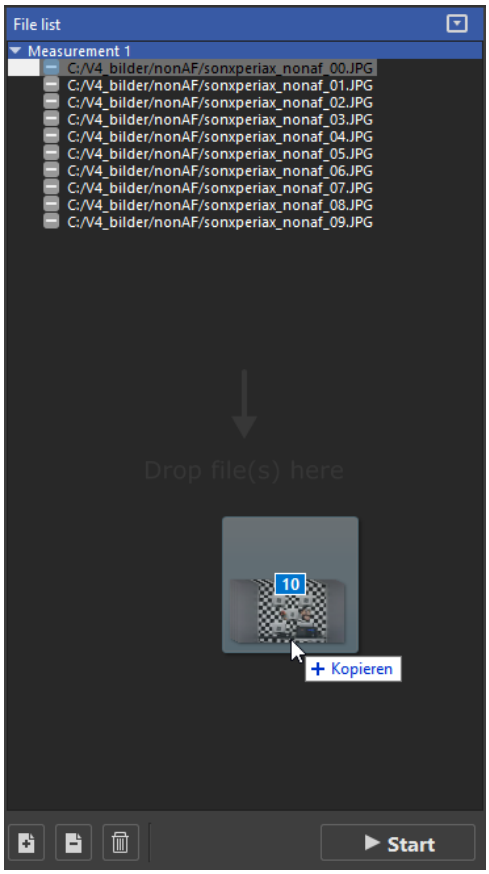


Figure 16

Image not yet processed

Image successfully processed

Detection failed or an error occurred during analysis (a message box will appear 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 tabs (Figure 17).

5.5.2.1 Analysis

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

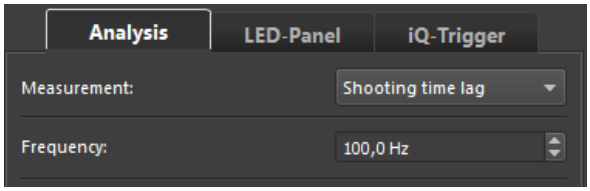


Figure 17

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

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

5.5.2.2 LED-Panel

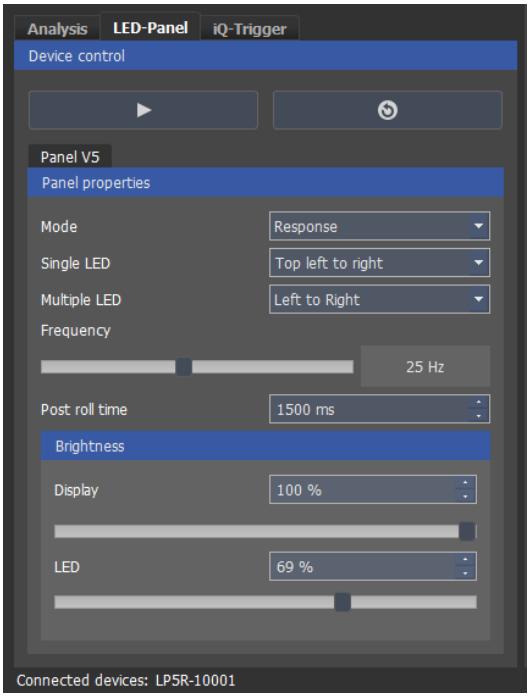


Figure 18

You can control multiple connected LED-Panels in this tab (Figure 18). Version 4 and Version 5 can be controlled simultaneously but will appear under different tabs as they have slightly different features.

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 *Frame rate)*
- *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*. The frequency of V5 can be adjusted up to 50000 Hz compared to a high of 2000 for V4. With the two buttons, you can start, stop, and reset the LED-Panel and set the LED(s) to the starting position.

The slider *LED brightness* and *Display brightness* adjust the LED array and display brightness. This adjustment might be helpful when changing the camera's exposure time for specific testing conditions. For example, if you perform a test under low light conditions and use the automatic exposure mode of your camera. Without dimming the LED array and display of LED-Panel, the bright LED and device display light can influence your camera's exposure.

The *LED* brightness can also be adjusted in V5. This feature is not available for V4.

Note: These settings are applied to all connected LED-Panels; it is impossible to control the devices separately.

5.5.2.3 iQ-Trigger

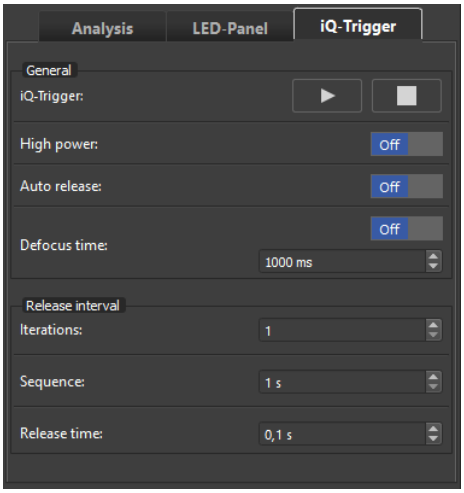


Figure 19

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 that can precisely press a camera's release button (touch screen or hardware button) at set moments.

If the iQ-Trigger is connected to an LED-Panel, it can also be controlled by LED-Panel software. 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).

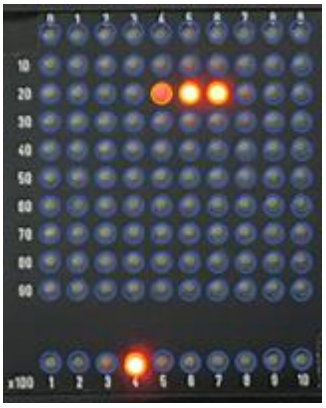


Figure 20

High power:	Increases the thrust of the iQ-Trigger, which is helpful 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 feature can measure negative shutter or shooting release time lag, which is particularly useful for cameras that buffer images 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 between triggering the defocus and start of LED-Panel and iQ-Trigger
Sequence:	Time between iterations
Iterations:	Defining the number of release iterations
Release time:	Determines how long the iQ-Trigger will press the camera release button; the value ranges from 0.1s to 25s

5.5.3 Image view

The image view panel (Figure 15, ③) shows the currently selected image 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

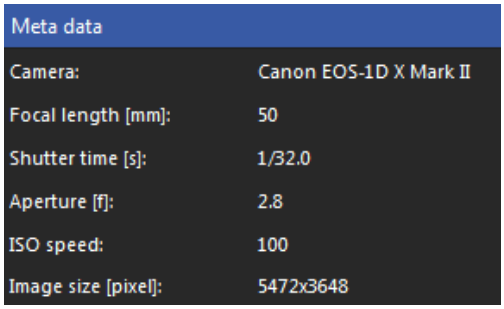


Figure 21

The metadata panel (Figure 21) gives a quick overview of important camera and lens settings such as ISO speed or focal length. The metadata 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 and counted clockwise starting from the top left.

The second column shows the measured time for each LED-Panel and 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.

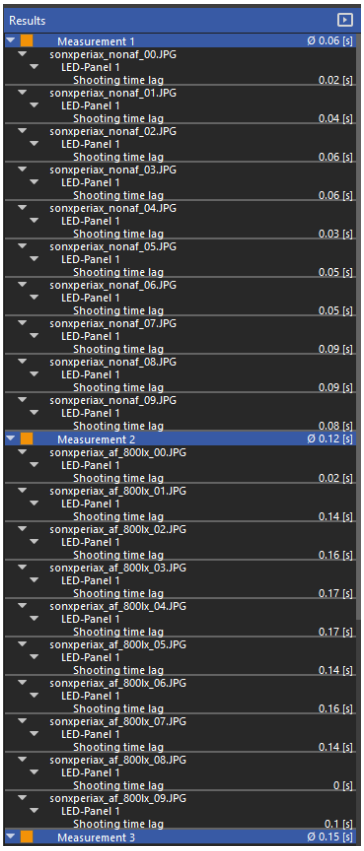


Figure 22

The resulting tree can be collapsed or expanded by clicking the arrow button in the top right corner.

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 the full file path and the 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

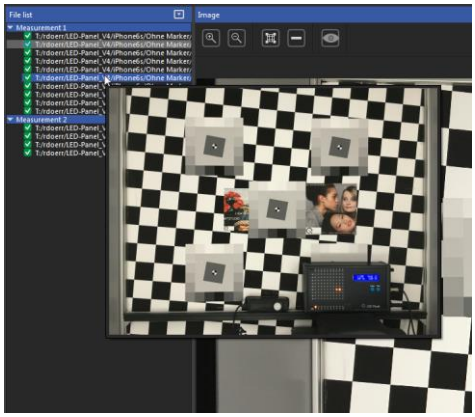


Figure 23

Help

About…: shows general information about the application

5.5.7 Export results

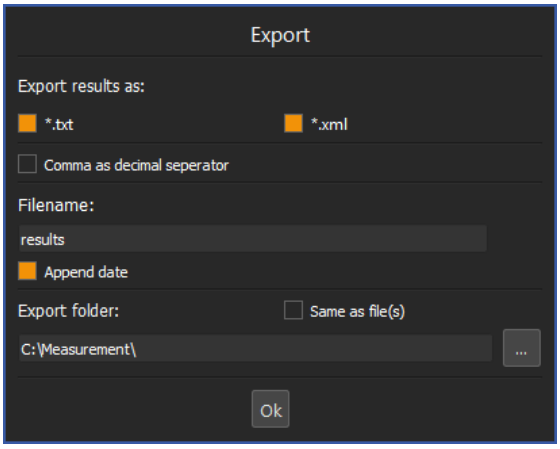


Figure 24

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

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

For each measurement in the file list, a result file will be written to the export folder using the given filename 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 connected LED-Panel serial number(s). By clicking a serial number, the specific LED-Panel display will start flashing.

5.6 Measurement

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

- Ensure that the images are correctly exposed. Under- or overexposed images may lead to a false-positive detection of LEDs due to noise or other artifacts 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.

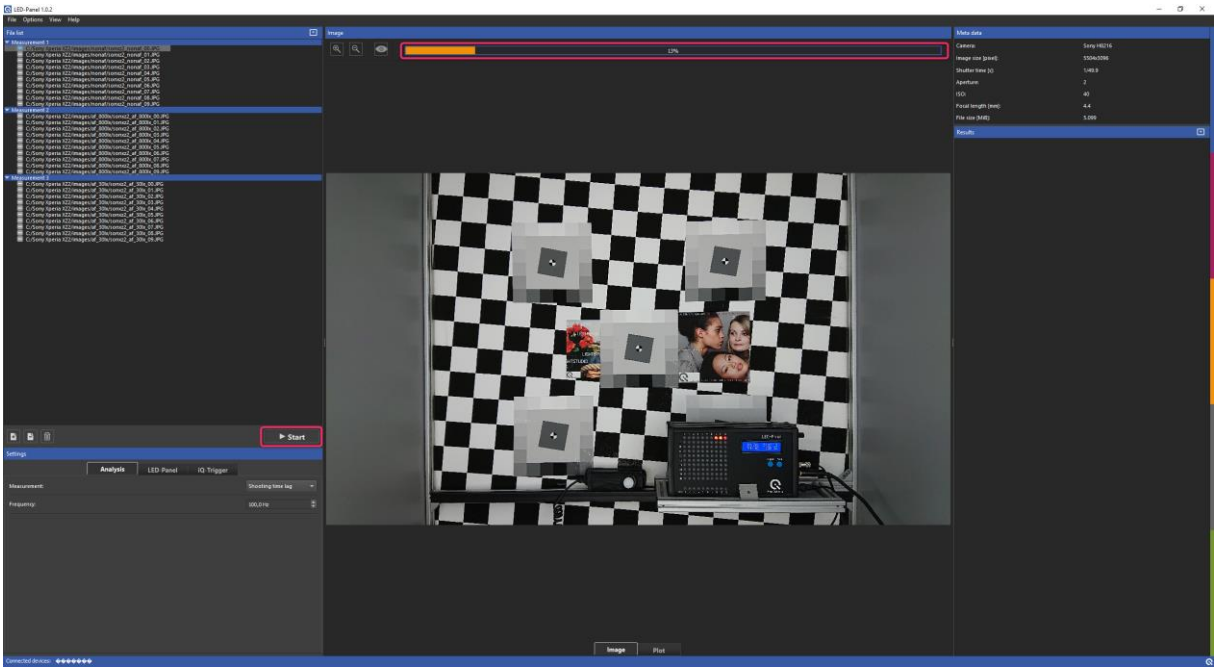


Figure 25

After loading the images into the file list, ensure the settings in the analysis tab match the settings of the LED-Panel in the images. Please click the Start button under the control panel to start the analysis. A progress bar above the image view will display the analysis progress and disappear immediately when the analysis is 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.

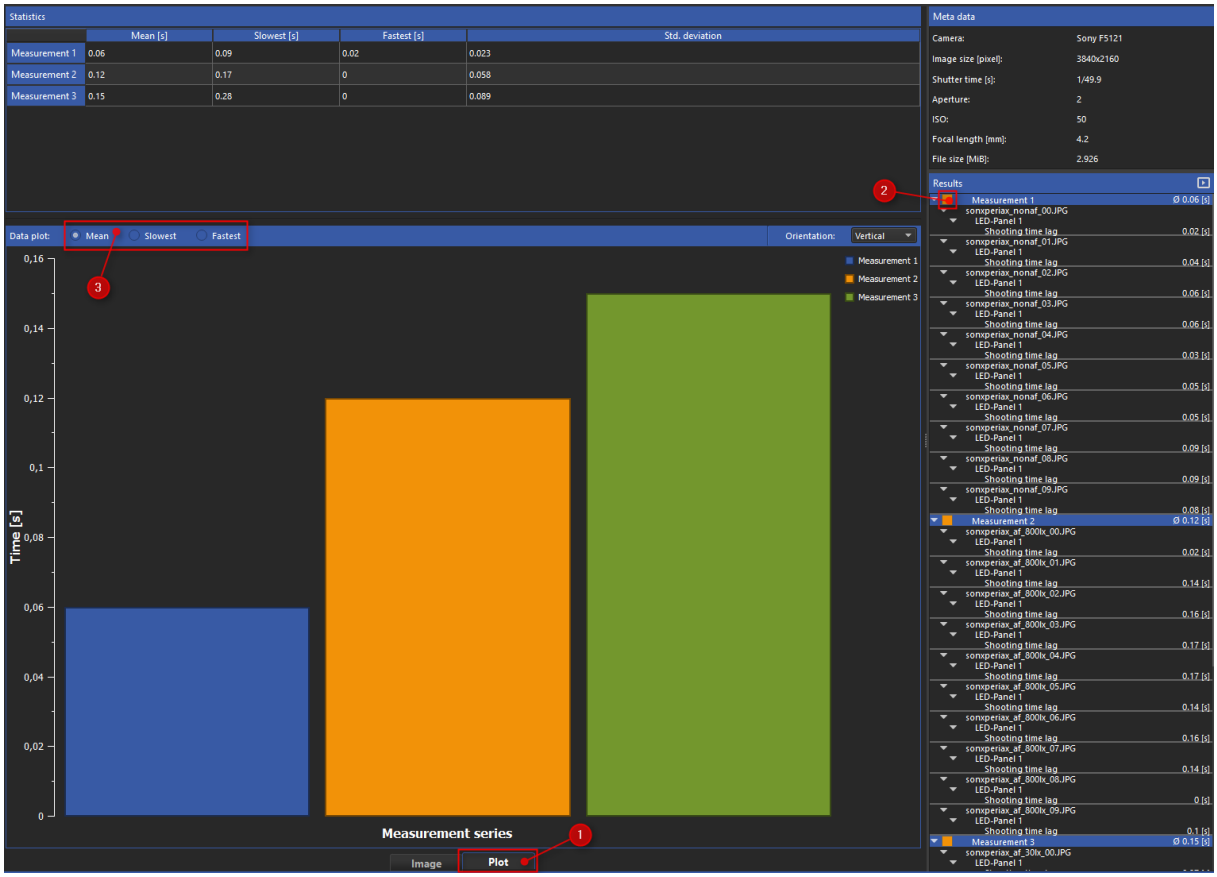


Figure 26

The plot tab ① shows statistics of the different measurements like mean value, fastest time, slowest time, and standard deviation. Additionally, a bar plot visualizes the calculated results. By checking or unchecking the checkbox in the results tree ②, you can display your favored plot ③.

6 VERIFICATION OF ACCURACY

Over time, the accuracy of the quartz oscillator in the LED panel V5 decreases. The accuracy specified in the datasheet is valid for two years but may increase by 2ppm per year.

Image Engineering offers accuracy verification for the V5 LED panel. The crystal oscillator will be tuned if the LED panel is not within specification. The check is recommended every two years but is only necessary if you rely on high accuracy. Please contact support@image-engineering.de if you have any further questions.

7 COMMAND LINE INTERFACE (CLI)

7.1 Introduction

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

These instructions generally apply to LED-Panels V3, V4, and V5, which must be connected to a PC via USB. The commands are command-line based, and the command-line consists of an executable file along with 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 must start with a 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

7.2 Operation functions

7.2.1 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 executing this command, the LED-Panel will change into the exposure time measurement mode.

7.2.2 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 executing this command, the device will return the numerical value of the activated operation mode.

7.2.3 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 executing this command, the LED-Panel will change into the internal (continuous) trigger mode.

7.2.4 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 executing this command, the device will return the numerical value of the activated trigger mode.

7.2.5 Set LEDs switching time

Function

setTime <time>

Description

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

Parameters

Value range LED-Panel V5: from 0.00002-9.9[s]

Value range LED-Panel V4: from 0.0002-9.9[s]

Value precision:	0.00002 - 0.0001	steps of 0.000001[s]
	0.0001 - 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 - 9.9	steps of 0.1[s]

Frame Rate Mode

Value range LED-Panel V5: 1.0 - 200.0[Hz] steps of 0.1[Hz]
Value range LED-Panel V4: 1.0 - 100.0[Hz] steps of 0.1 – 0.2 – 0.5[Hz

7.2.6 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 executing 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.

7.2.7 Start measurement

Function

start

Description

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

7.2.8 Stop measurement

Function

stop

Description

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

7.2.9 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 executing this command, the device will return the value 0 or 1, representing the current measurement state.

7.2.10 Reset measurement

Function

reset

Description

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

7.2.11 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

7.2.12 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

7.2.13 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. The number of switching periods occurred after activating the “Camera Trigger” input.

Return parameters

After executing 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 the two-digit value of the illuminated LED in the 10x10 LED array.

Examples

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

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

7.2.14 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.

7.2.15 Enable / Disable the external input “Camera Trigger”

Function

setCameraTrigger <enable>

Description

With the function “LED-Panel.exe setcamtrigger <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 executing this command, the external input “Camera Trigger” will be disabled

7.2.16 Get the Enabled / Disabled state of the external input “Camera Trigger”

Function

getCameraTrigger

Description

After executing the command “LED-Panel.exe -getCameraTrigger,” the device returns to 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

7.2.17 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 executing this command, the external input “Stop Trigger” will be enabled.

7.2.18 Get the Enabled / Disabled dtate of the external input “Stop Trigger”

Function

getStopTrigger

Description

After executing 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

7.2.19 Set the intensity of the display backlight

Function

setDisplayBrightness <XXX>

Description

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

Parameters

XXX – 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**

7.2.20 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 executing 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%.

7.2.21 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 the 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

7.2.22 Get the direction of the LEDs for “Response Time” and “Exposure Time”

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

7.2.23 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 consists 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

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

7.2.25 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

Please refer to the following table to set the desired switching time between 1/50000s and 10s.

PLEASE NOTE

Parameters 01 to 03 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~~	**21**	1/1600	**41**	1/64	**61**	0.8s
~~**02**~~	~~1/80000~~	**22**	1/1500	**42**	1/60	**62**	1s
~~**03**~~	~~1/64000~~	**23**	1/1300	**43**	1/50	**63**	1.25s
04*	1/50000	**24**	1/1250	**44**	1/40	**64**	1.3s
05*	1/40000	**25**	1/1000	**45**	1/32	**65**	1.5s
06*	1/32000	**26**	1/800	**46**	1/30	**66**	1.6s
07*	1/25000	**27**	1/640	**47**	1/25	**67**	2s
08*	1/20000	**28**	1/600	**48**	1/20	**68**	2.5s
09*	1/16000	**29**	1/500	**49**	1/16	**69**	3s
10*	1/12500	**30**	1/400	**50**	1/15	**70**	3.2s
11*	1/10000	**31**	1/320	**51**	1/13	**71**	4s
12*	1/8000	**32**	1/300	**52**	1/10	**72**	5s
13*	1/6400	**33**	1/250	**53**	1/8	**73**	6s
14*	1/6000	**34**	1/200	**54**	1/6	**74**	6.4s
15	1/5000	**35**	1/160	**55**	1/5	**75**	8s
16	1/4000	**36**	1/150	**56**	1/4	**76**	10s
17	1/3200	**37**	1/130	**57**	0.3s	**77***	1/120
18	1/3000	**38**	1/125	**58**	0.4s		
19	1/2500	**39**	1/100	**59**	0.5s		
20	1/2000	**40**	1/80	**60**	0.6s		

Table 10

* Available for LED-Panel V5 only

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**

7.2.26 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 executing the command "LED-Panel.exe -getTime, "the device will return a one- or two-digit value XX of the switching time, where XX is the value of the switching time from Table 3.

For instance:

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

7.2.27 Trigger iQ-Trigger (LED-Panel V5 and V4 only)

Function

setTrigger

Description

If an 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 100 ms 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

7.2.28 Trigger iQ-Defocus (LED-Panel V5 and V4 only)

Function

setDefocus

Description

If an iQ-Defocus is connected to the LED-Panel, it can be triggered by using "**LED-Panel -setDefocus <mode> -setDefocus <duration>.**"

For the parameters, please see the iQ-Defocus user manual.

7.2.29 Set auto release (LED-Panel V5 and V4 only)

Function

setAutoRelease

Description

Modern camera systems, especially mobile phones, often take continuous photos in the background to avoid shooting time lag and other convenient features. If the user hits the camera release button, a buffered photo may be shown as the actual photo. However, this photo was taken before the user hit the release button. In 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

7.2.30 Set post roll time (LED-Panel V5 and V4 only)

Function

setPostRollTime

Description

The LED-Panel keeps running for a certain time after triggering the iQ-Trigger using "**LED-Panel -setPostRollTime <duration>**." Value = [0 to 30000ms].

Example:

LED-Panel –setPostRollTime 2000

7.2.31 Set the Intensity of the LED-array (LED-Panel V5 only)

Function

setLedBrightness <XXX>

Description

With the function "**LED-Panel.exe -setLedBrightness <XXX>,**" the brightness of the LED array can be changed from 0 to 100 counts.

Parameters

XXX – LED-array brightness in steps of 1 count; can be set from 0 (OFF) to 100 (fully ON).

Example

To set brightness to 24 counts, call **LED-Panel.exe - setLedBrightness 24**

7.2.32 Get the Intensity of the LED-array (LED-Panel V5 only)

Function

getLedBrightness

Description

With the function "**LED-Panel.exe -getLedBrightness,**" it is possible to read the intensity of the LED array.

Return Parameters

After executing the function "**LED-Panel.exe** -**getLedBrightness,**" the device will return a one-, two- or three-digits value of the LED-array brightness in counts.

For example:

Return value **0** means that the LED array is turned OFF.

Return value **100** indicates that the intensity of the LED array is 100%.

8 DISPOSAL INSTRUCTIONS

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

Contact Image Engineering if assistance for disposal is required.

9 TECHNICAL DATA SHEET

The data sheet is available for download at: https://image-engineering.de/support/downloads.

10 TRADEMARK AND COPYRIGHT

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