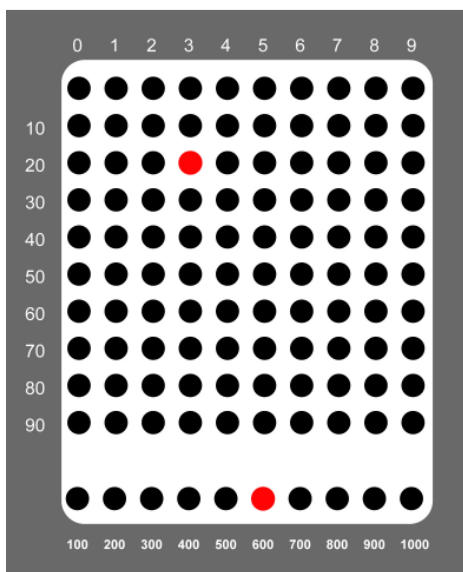# LED-PANEL

The LED-Panel is used for measurement of shutter lag, autofocus times, framerates and the exposure times of digital image capture devices. An accuracy of better than one millisecond and a maximum error of 0.06% enable extremely precise measurements.

Configuration/Operating Mode

A square field of 100 LEDs is connected in ten rows and every row consists of ten LEDs. The LEDs light up one after another with the set speed/frequency. A row beneath the square field, consisting of ten LEDs, is switched forward after all 100 LEDs have passed. Thus time readings for a cycle of up to 1000 LEDs can be read.

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.
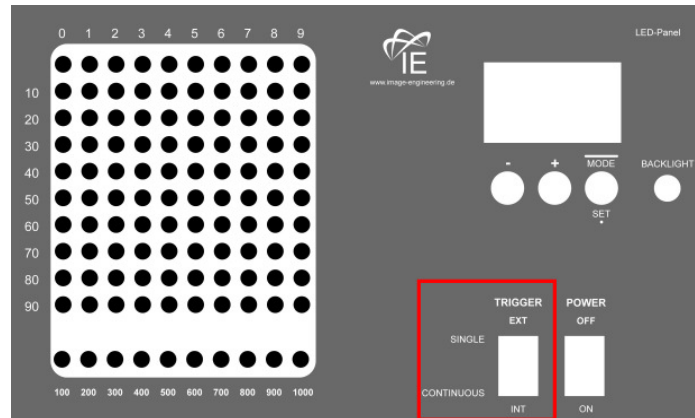
Startup

The LED-Panel is connected with the power plug and switched on.
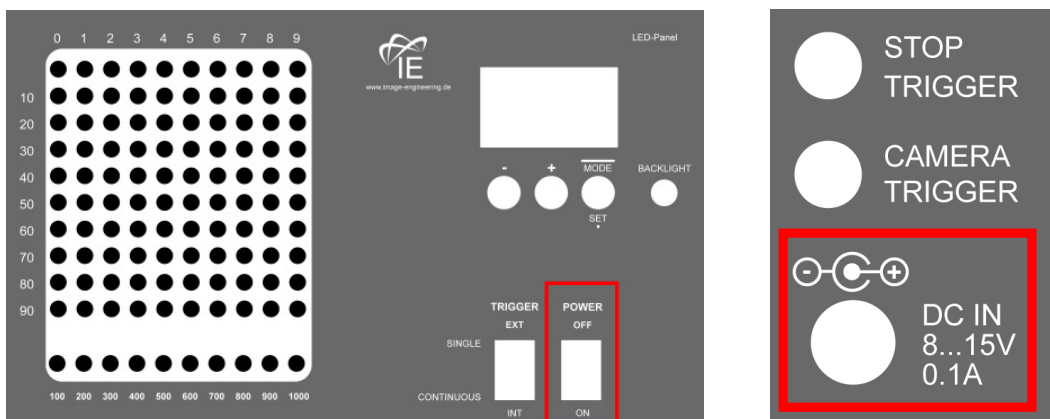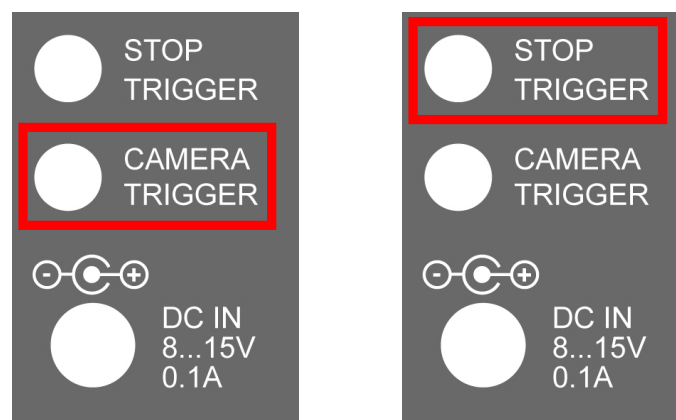
Operating mode

The LED-Panel can be operated by using either using an external (single) or internal (continuous) trigger.

the operating mode must be selected

For the external operating mode a microswitch is connected to the side of the LED-Panel. When connecting to the CAMERA TRIGGER input, the LED-Panel starts by pressing and stops by releasing the microswitch (and retuns to the start position).

If a microswitch 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 (microswitch) and stops by pressing the STOP TRIGGER (microswitch). 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. the CAMERA TRIGGER again resets the LED-Panel.

the microswitch can be connected to several inputs

Setting mode and time

Mode	mode xx.x ms	mode 1/x s	mode Fram.rate
Measurement	response time	exposure time	framerate
Times	1.00 ms - 9.90 s 1.00 kHz - 101 mHz	1/100000 - 10'' 100 kHz - 0.1 Hz	Frm.rate 1 Hz - 50 Hz

overview of selectable modes, their descriptions and times

Setting mode

Prolonged pressing of the **MODE/SET** button (mode is indicated in the display)

Selectable modes: response time [µs/ms/s], exposure time [1/x s], framerate [Hz].

Setting time

• **mode xx.x ms (respone time)**

Position the cursor by pressing the **MODE/SET** button briefly and set the time by using the **+** and **-** buttons. Through the direct use of the **+** and **-** buttons after selecting the mode, the first digit can be set immediately.

• **mode 1/x s (exposure time)**

Set the time by using the **+** and **-** buttons

• **mode Fram.rate (framerate)**

Set the digits which appear before the point by pressing the **+/-** buttons longer and set the digits which appear behind the point by pressing the **+/-** buttons short.

Confirmation

For confirmation, press the **MODE/SET** button briefly ("Ready" is shown in the display).

When in mode µs/ms/s (response time) and 1/x s (exposure time), first put the cursor to the end of the display first by using the MODE/SET button (see "Setting time")
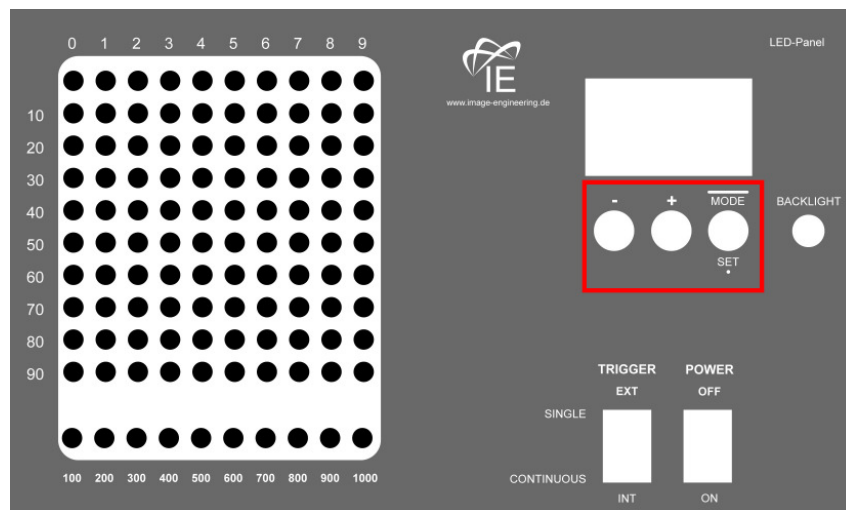
mode and times can be modified by using the MODE/SET buttons

Diplay Brightness

The brightness of the display can be modified by using the "BACKLIGHT" knob.
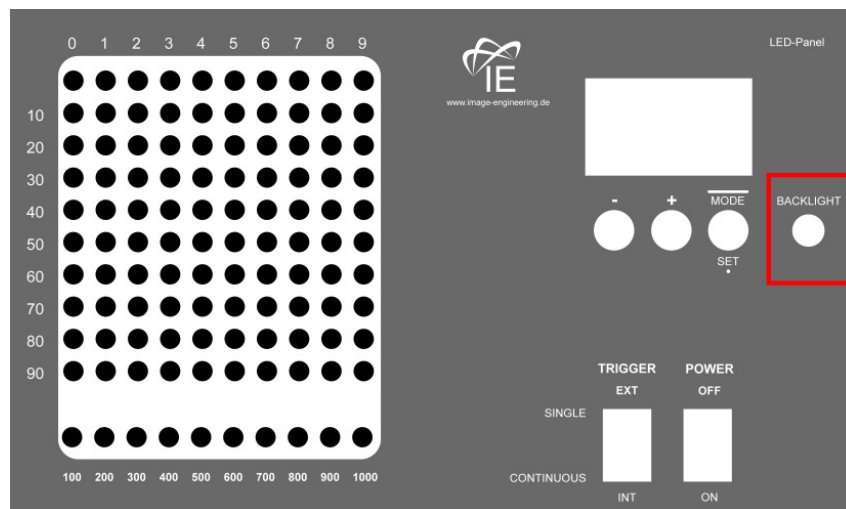
Technical Data for the LED-Panel

| operating mode	external trigger/single , internal trigger/continuous
adjustable times	10 µs to 10 s
maximal reading measurement time	x 1000 of set time
accuracy	<0,06% from 1 ms to 10 s
dimension	215 x 131 x 82 mm
supply voltage	8 - 15 V DC / 100 mA
line voltage for included power suply	90 - 240 V AC 50/60 Hz

MEASURING METHODS

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

   I.   **Shutter lag without autofocus time**
  II.   **Shutter lag with autofocus time**
 III.   **Exposure times**
 IV.   **Video recording rate / Framerate**
  V.   **Speed of multi shot mode**

I. 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 and started with a micro switch. The LED-Panel is connected with a microswitch and is started using this switch. For measuring the shutter lag, the microswitch 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 microswitch was pressed ( ) can be read with the aid of the lighted LED(s) in this picture.

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 (microswitch and camera release button) in less than 5 milliseconds guaranteed. The so-called DIGITUS electrically activates the camera release mechanically. The DIGITUS is available as a separate product.
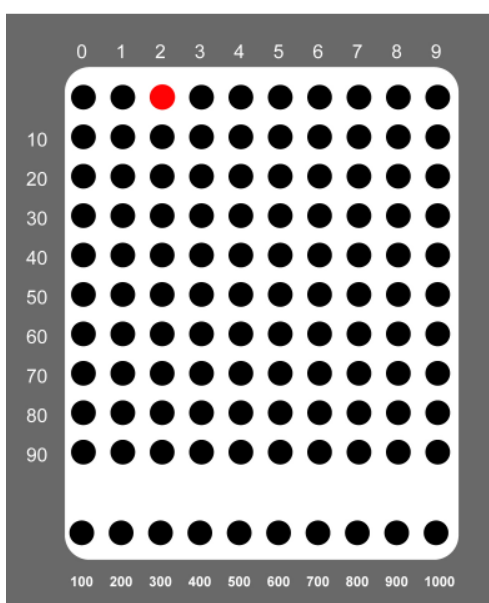
Example
LED-Panel settings:
operating mode TRIGGER EXT
exposure time (1/x s) 1/ 10 sec

LED no. 2 is lit up:
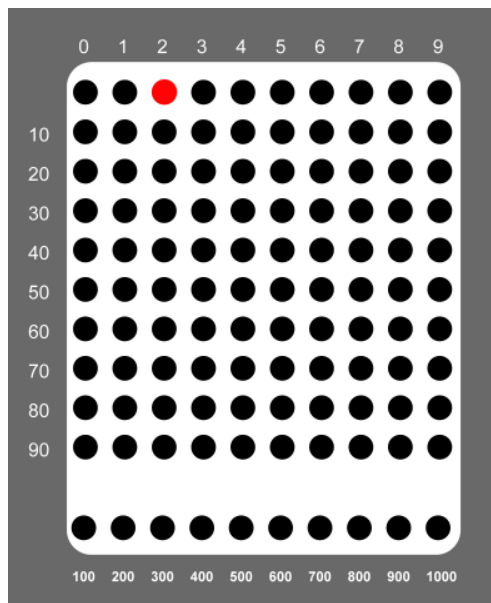Shutter lag is 0.2 seconds

II. Shutter lag with autofocus time

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

1) As described in I. the shutter lag without autofocus time is calculated.

2) The camera is focused to infinity. Afterwards a picture of the LED-Panel is taken taken with the aid of the microswitch. After the time for the automatic focus and shutter lag has passed, the camera takes a picture of the running LED-Panel. The time passed since the microswitch was pressed (and the release button) and automatic focus was completed can be read with the aid of the lit LED(s) in this picture.

The autofocus time can be calculated using the difference between shutter lag with autofocus time (picture 2) and shutter lag without autofocus time (picture 1).

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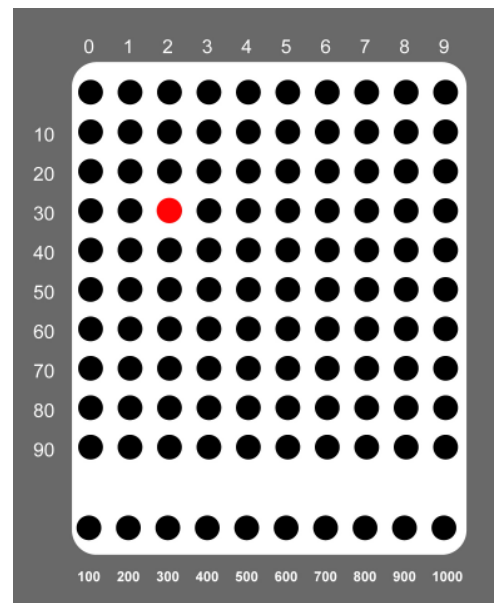
shutter lag without autofocus time   shutter lag with autofocus time

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 seconds

Shutter lag with autofocus time: LED no. 32 lights up → 3.2 seconds

Autofocus time = 3.2 seconds - 0.2 seconds = 3 seconds

III. Exposure Time

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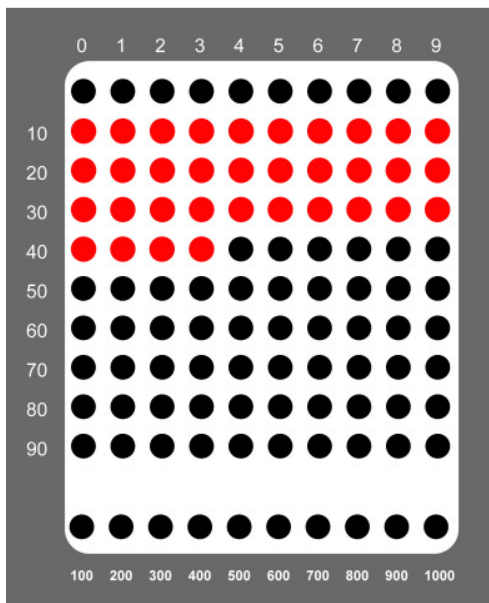

Example

Camera settings: 1/10 second

LED-Panel settings: 3.00 ms / 333 Hz

34 LEDs are lit

IV. Video recording rate / Framerate

This mode enables the frame rate measurement of video recording devices. The LED-Panel is set to frame rate mode ("Fram.rate") and recorded on the camera. The device must be counterbalanced with the buttons **+** and **-** until the lower row of LEDs stop blinking. The frame rate has now been reached. The frequency scan should be started at the lowest level because harmonics of the frame rate frequency also cause the LEDs to stop blinking.
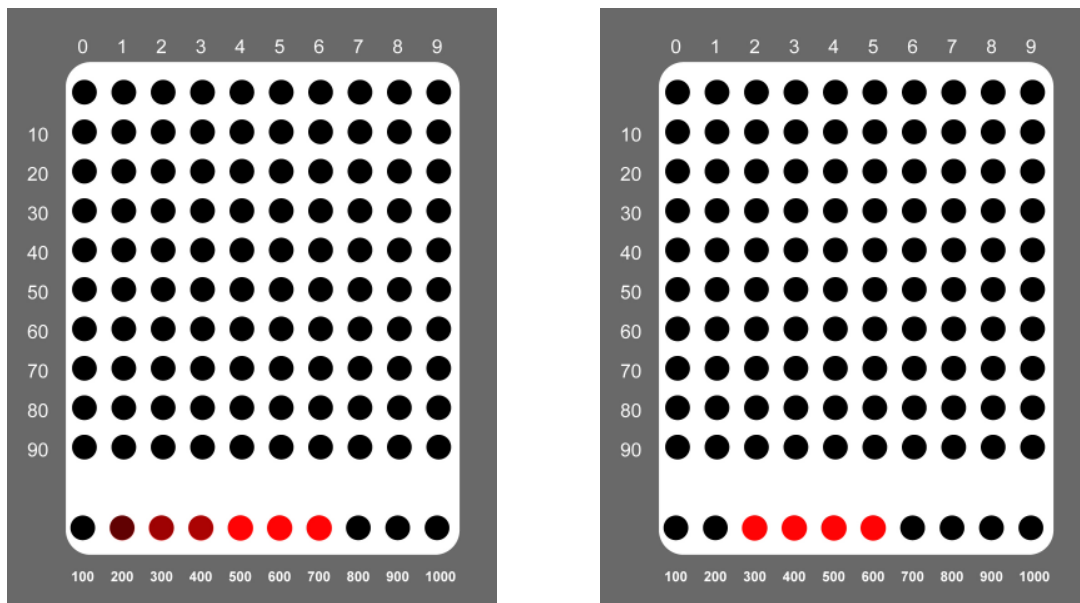
left side: the frequency of the LED-Panel does not conform to the frame rate of the camera (flickering LEDSs)

right side: the frequency of the LED-Panel conforms to the frame rate of the camera (LEDs glow pemanently)

V. Speed of multi shot mode

The speed of the multi shot mode of cameras can 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 adjusted. 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 LEDs in two consecutive pictures.
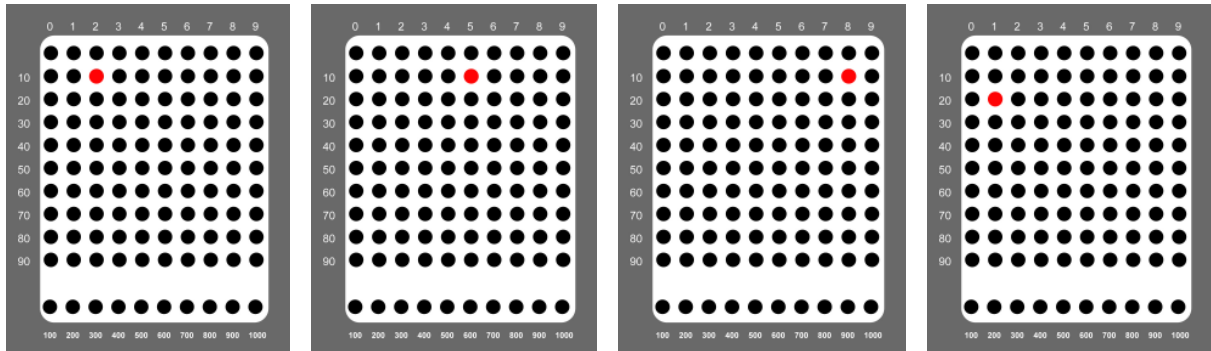
Example

Camera exposure time: 1/250 seconds

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

Between two consecutive pictures a single diode lights up respectively shifted three places. This means a multi shot mode speed of 0.3 seconds per picture (i.e. 3.3 pictures per second).