

Product Manual

LED-Flashlight 300

Item Number(s): 1103445, 1103446, 1104338, 1103444



Product Manual for **DaVis 10**

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Note: the latest version of the manual is available in the download area of our website www.lavision.com. Access requires login with a valid user account.

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1 Safety Precautions

Before working with your **LaVision** system, we recommend to read the following safety precautions. Observing these instructions helps to avoid danger, to reduce repair costs and downtimes, and to increase the reliability and life of your **LaVision** system.

1.1 Laser Safety

If a laser¹ is integrated in your system, it is important that every person working with it has fully read and understood these safety precautions **and** the laser manual of the specific laser/LED.

Lasers included in **LaVision** systems may belong to Class 4 laser devices, which are capable of emitting levels of both visible and invisible radiation that can cause damage to the eyes and skin. It is absolutely necessary that protective eyewear with a sufficiently high optical density be worn at any time when operating the laser. The goggles must protect against all wavelengths that can be emitted, including harmonics. See your laser's manual for further details.

Class 4 laser beams are by definition a safety and fire hazard. The use of controls, adjustments or performance of procedures other than those specified in the **LaVision** manual and the laser manual may result in hazardous radiation exposure.

AVOID EYE AND SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION.
FOLLOW THE INSTRUCTIONS YOU CAN FIND IN THE CORRESPONDING LASER
MANUAL FOR PROPER INSTALLATION AND SAFE OPERATION. USE PROTEC-
TIVE EYEWEAR ALL THE TIME WHEN OPERATING THE LASER.



¹In the following, 'laser' means any kind of laser, in particular Nd:YAG and dye lasers as well as Optical Parametric Oscillators at any wavelength and output energy. Also for high-power LEDs precautions should be taken.

Important instructions for safe laser handling:

- Before operating the laser, contact your laser safety officer.
- Read and understand the instruction manual of the particular type of laser. Take special care with respect to laser emission, high voltage and hazardous gases if in use.
- Declare a controlled access area for laser operation. Limit access to trained people. Never operate the laser in a room where laser light can escape through windows or doors. If possible, cover beam paths to avoid obstacles getting into the beam.
- Provide adequate and proper laser safety goggles to **all** persons present who may be exposed to laser light. The selection of the goggles depends on the energy and the wavelength of the laser beam as well as on the operation conditions. Check the laser's manual for a detailed description.
- While working with lasers do not wear reflective jewelry like watches and rings, as these might cause accidental hazardous reflections.
- Avoid looking at the output beam, even diffuse reflections can be dangerous.
- Operate the laser at the lowest beam intensity possible.
- Avoid blocking the output beam or reflections with any part of the body. Use beam dumps to avoid reflections from the target.
- Wear clothes and gloves which cover arms and hands to avoid skin damage when handling in the optical path. Especially UV radiation can cause skin cancer.

1.2 Seizures Warning



WARNING: HEALTH HAZARD! STROBE LIGHTING CAN TRIGGER SEIZURES! Some people (about 1 in 4000) may have seizures or blackouts triggered by flashing lights or patterns. This may occur when viewing stroboscopic lights or objects illuminated by such devices, even if a seizure has never been previously experienced. Anyone who has had a seizure, loss of awareness, or other symptoms linked to an epileptic condition should consult a doctor

1.3 Camera / Image Intensifier Safety

before operating systems which include flashing lights, strobe lights, or a pulsed or modulated laser.

Stop operating the system immediately and consult a doctor if you have one of the following symptoms:

- convulsions, eye or muscle twitching, loss of awareness, altered vision, involuntary movements, disorientation.

To reduce the likelihood of a seizure when operating a system:

- Do not look directly at flashing light sources or on illuminated objects, e.g. into a strobe light or a flashing LED panel.
- Operate the system in a well-lit room.
- Take frequent breaks in normally illuminated areas.

1.3 Camera / Image Intensifier Safety

The camera integrated in your system is based on a CCD (Charge Coupled Device) or CMOS (Complementary Metal-Oxide Semiconductor) sensor with high resolution and high sensitivity. Optionally your system is equipped with a built-in or external image intensifier.

A LASER BEAM FOCUSED ON THE CHIP OR INTENSIFIER, EITHER DIRECTLY OR BY REFLECTION, CAN CAUSE PERMANENT DAMAGE TO THE CHIP OR INTENSIFIER. ANY LASER POWERFUL ENOUGH TO PRODUCE LOCALIZED HEATING AT THE SURFACE OF THE CHIP OR INTENSIFIER WILL CAUSE DAMAGE EVEN WHEN THE CAMERA OR INTENSIFIER POWER IS OFF. A CHIP OR INTENSIFIER DAMAGED BY LASER LIGHT IS NOT COVERED BY ITS WARRANTY.

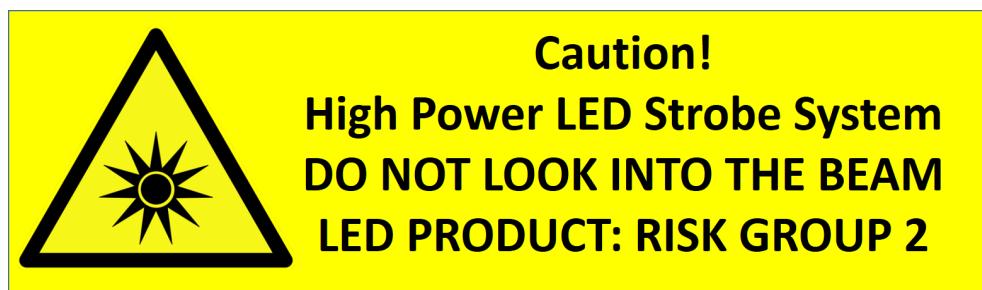


Important instructions for safe camera handling:

- Fully read and understand the instruction manual of the specific type of camera.
- Put the protection cap on the camera lens whenever you do not take images, especially when the laser beam is adjusted. Switching off the camera / image intensifier does not protect the chip from damage by laser light.
- Use full resolution of the sensor and always read out the complete chip to have control of the intensity on all areas of the sensor.

- Make sure that no parts of the image are saturated, i.e. the intensity is below maximum gray level (< 4095 counts for a 12-bit camera, < 65535 counts for a 16 bit camera, ...).
- Start measurements with the lowest laser power and a small aperture of the camera lens.
- Increase laser power step by step and check the intensity on the corresponding image. Make sure that the sensor does not run into saturation.
- Bright parts in the experiment, like reflections on walls or big particles, will limit the maximum laser power. Modify the optical arrangement of your setup in order to remove bright reflections from the camera image.

1.4 High Power LED Safety



LED-Flashlight 300 is a high power, high intensity LED light source. **It can be harmful to the eyes, skin and environment!** Follow this safety rules to avoid damage to eyes, skin or the environment:

- **Read this manual carefully before using *LED-Flashlight 300*.**
- Do not look in the direct or reflected light beam with unprotected eyes!
- Pay special attention to the '**Seizures Warning**' section above as the **LED-Flashlight 300** can be operated at potentially harmful frequencies.
- Do not point the light beam at windows or doors.
- The device shall not be used outdoors! It shall never be pointed at people, animals or vehicles (including cars and aircrafts).

- The radiated light can produce **substantial heat** especially on dark surfaces: Do not point the light beam on dark or flammable objects or chemicals!
- Make sure that the light beam is captured by a suitable beam dump. Suitable here means, that the beam dump can stand the radiation and heat for a long time and that the beam dump is mounted stable.
- Do not expose your skin to the direct or reflected light beam.
- Do not allow untrained or uninformed people or children to use the device.

1.5 International Protection Marking IP

The IP Code, International Protection Marking, IEC standard 60529, classifies and rates the degree of protection provided against intrusion (body parts such as hands and fingers), dust, accidental contact, and water by mechanical casings and electrical enclosures. It is published by the International Electrotechnical Commission (IEC). The equivalent European standard is EN 60529

LED-Flashlight 300 is rated: **IP20**

That is:

- First digit: **Solid particle protection:** 2. Effective against > **12.5 mm**, Fingers or similar objects
- Second digit: **Liquid ingress protection:** 0. Protection against **None**

Note: **LED-Flashlight 300** is not sealed against liquids, especially contact with **Helium filled soap bubbles HFSB** can cause severe damage of the device. Avoid any contact with fluids or soap!



LED-Flashlight 300 water cooled is rated: **IP54**

That is:

- First digit: **Solid particle protection:** 5. Complete touch protection. Protected against dust in harmful quantities (dust-protected)

- Second digit: **Liquid ingress protection:** 4. Protected from splashing water from all sides



Note: The housing of the **LED-Flashlight 300 water cooled** is well suited for the use in harsh environments, where for example liquids or helium filled soap bubbles are used. However, to maintain a long life time of the device, it is recommended to clean the device after use.

Important: The **LED-Flashlight 300 water cooled** is NOT waterproof and is not suitable for complete immersion in liquids!

UW-LED-Flashlight 300 blue is rated: **IP68**

That is:

- First digit: Solid particle protection: 6. Complete touch protection. Protected against dust. (dust-tight)
- Second digit: 8. Protection against permanent immersion



Note: Note: The housing of the **LED-Flashlight 300 water cooled** is well suited for the use in under water applications as well as in harsh and dusty environments. The LED head and support tube can even be permanently immersed in fresh or salt water up to a water depth of 1m. However, to maintain a long life time of the device, it is recommended to check the unit regularly for damage or leaks before use and to clean it after the usage.

2 Introduction

The **LED-Flashlight 300** is a light source specifically designed for **volumetric flow measurements** in air and water. Four versions of the **LED-Flashlight 300** are available:

1. **LED-Flashlight 300 white** (#1103445): warm white colored light, to be used for direct illumination of tracer particles or surfaces
2. **LED-Flashlight 300 blue** (#1103446): blue colored light, to be used for direct illumination of tracer particles or surfaces or with fluorescent colors and filters to avoid stray light and reflections.
3. **LED-Flashlight 300 blue, IP54** (#1104338): blue colored light, to be used for direct illumination of tracer particles or surfaces or with fluorescent colors and filters to avoid stray light and reflections, particularly in harsh or warm environmental areas or when the environment has to stay free from any additional air turbulences.
4. **UW-LED-Flashlight 300 blue** (#1103444): blue colored light, to be used for direct illumination of tracer particles or surfaces or with fluorescent colors and filters to avoid stray light and reflections, particularly in harsh or warm environmental areas or under water.

In the following all four versions are referred to as **LED-Flashlight 300** as the devices are very similar for operation.

For volumetric flow field measurement techniques like **Tomographic PIV** and **Shake-the-Box**, the usual laser illumination can often be replaced by high power LED illumination. The **LED-Flashlight 300** provides an array of 72 high-power LEDs in an area of $300 \times 100 \text{ mm}^2$. The small divergence angle of $\pm 5^\circ$ allows the illumination of measurement volumes with a cross section of about $300 \times 100 \text{ mm}^2$ at 1 m working distance. Optional Fresnel lenses can be used for smaller or larger cross sections. Multiple **LED-Flashlight 300** modules are seamlessly combined to obtain larger cross sections with different aspect ratios, e.g. with three modules a cross section of $300 \times 300 \text{ mm}^2$ or $900 \times 100 \text{ mm}^2$ can be readily obtained.

Light output of **LED-Flashlight 300** is **completely controlled via the trigger line** connected to the 'Ext. Trigger Input' connector on the rear panel of the LED module or on the remote control panel for the IP54 version, respectively. **No USB or network connection is needed** to control the device. Light output follows the input trigger signal (in pulsed overdrive mode up to 10 % duty cycle). So, the two main parameter **pulse rate and the pulse width are entirely controlled by the single trigger signal**.



Note: The **brightness** of **LED-Flashlight 300** is controlled by the **pulse width or illumination time**.

2.1 Features

Compared to low- and especially high-repetition-rate PIV lasers, **LED-Flashlight 300** has important advantages for volumetric illumination:

- It is much more compact, made up only by the LED module itself and a small power supply, allowing easy transportation and mounting, without potential laser misalignment. No maintenance efforts are needed.
- It is safe to operate, requiring no particular laser safety infrastructure and training.
- The incoherent white or blue light ensures high image quality with constant homogeneous particle brightness in time and space without laser speckle effects. Laser illumination often exhibits darker regions due to fringes in the laser beam profile causing less reliable particle tracking.
- The amount of light output is similar to high-repetition-rate laser at a fraction of the cost.

2.2 Applications

The **LED-Flashlight 300** is designed for large measurement volumes in air, e.g. with Helium-filled soap bubbles (HSFB), or in water applications up to cubic meters.

2.3 Operating modes

The **LED-Flashlight 300** supports two operating modes: the pulsed-overdrive mode and the free-trigger mode.

The **pulsed-overdrive mode** is specifically designed for particle based velocity measurements. The LEDs are operated above the nominal LED current to generate short pulses at very high light intensities. Compared to nanosecond laser pulse durations, the length of LED pulses need to be much longer to gather enough light. To protect the LEDs at such high current, the duty cycle is limited to a maximum of 10%. Consequently, for a maximal particle shift of e.g. 10 pixel, a particle image is smeared by 1 pixel at most. 1 pixel smearing has been found to be acceptable for Tomographic PIV and Shake-the-Box analysis.

In the **free-trigger mode** at lower peak power, the **LED-Flashlight 300** can either be used for constant illumination (100% duty cycle), e.g. for experimental adjustment or can be triggered with an arbitrary pulse sequence, e.g. for dual-pulse or multi-pulse illumination.

2.4 Water chiller

To operate the **LED-Flashlight 300, IP54** (#1104338) or **UW-LED-Flashlight 300 blue** (#1103444) a water chiller is required. It has to be ordered separately and can be used for up to four liquid cooled **LED-Flashlight 300** simultaneously.

3 Specifications

- Size: 33,7 x 11,7 x 15,3 cm (#1103445/46)
36,5 x 13,5 x 10 cm (#1104338)
75 x 16 x 16 cm (#1103444)
- Weight: 5.3 kg (LED Module)
1.6 kg (power supply)
19 kg (#1103444)
- LEDs: 72 white high power, high efficiency LEDs
- Opening angle: 10° ($\pm 5^\circ$)
- Working distance: typ. 500 mm - 2000 mm
- Electrical power: avg. 300 W
- Efficiency: 20 % (free-trigger), 10 % (pulsed-overdrive)
- Brightness (white): > 200000 lux (free-trigger, 1 m distance)
> 1000000 lux (pulsed-overdrive, 1 m distance)
- Light pulse rate: 0 - 20 kHz, TTL-triggered
- Duty cycle: 0 % - 100 % (free-trigger)
0 % - 10 % (pulsed-overdrive)
- Max. pulse width: infinite (free-trigger), limited to 10s by **DaVis**
335 μ s (pulsed-overdrive)
- Jitter: < 15 ns
- Mode selection: manual switch or remote (TTL)
- Safety features: temperature control, LED trigger protection
- International Protection Marking IP20 (IEC 60529) (#1103445/46)
IP54 (IEC 60529) (#1104338)
IP68 (IEC 60529) (#1103444)
- Input current (RMS): 3A@115VAC; 1.5A@230VAC max. (#1103445/46)
5.5A@54VDC (#1104338)

For **#1104338 LED-Flashlight 300, IP54** and **#1103444 UW-LED-Flashlight 300** an additional **chiller #1104339** is needed:

- Size: 58 x 29 x 47 cm (L x W x H)
- Weight: 26 kg
- Power supply: AC 1P 220 V
- Frequency: 50 Hz
- Current: 0.25 - 3.9 A
- Nominal cooling CAP: 1.67 kW
- Max pump lift 12 m

4 Content of case and parts

4.1 Content of the LED-Flashlight 300 white / blue / blue, IP54

The content of the shipping case is shown in the following figure:

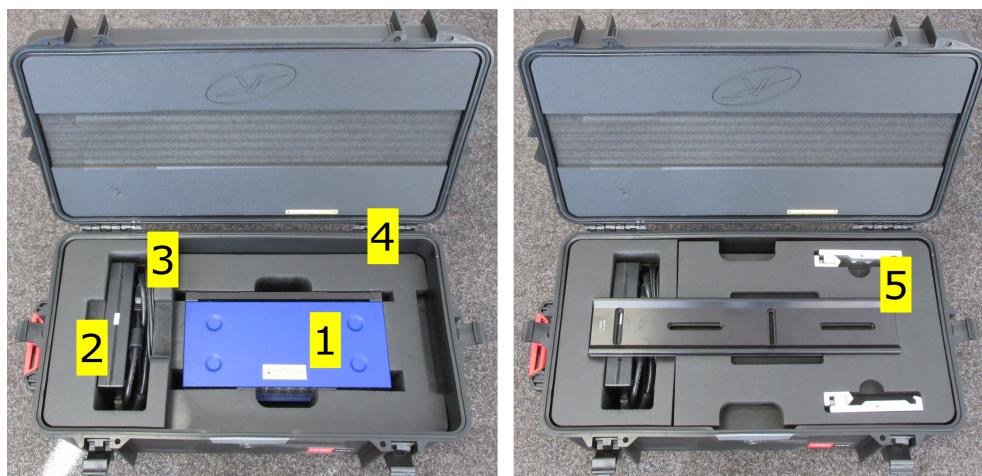


Figure 4.1: The content of the shipping case for **LED-Flashlight 300**

It contains:

1. LED Module (assembled with mounting frame and standing feet)
2. Power supply
3. Mounting parts and cable
4. Manual (behind the foam)
5. Flat rail and rail carrier

Additionally, the water cooled **LED-Flashlight 300, IP54** and **UW-LED-Flashlight 300 blue** version contains the remote control box, a 10 m power cable and water hoses:



Figure 4.2: The remote control box, power cable and water hoses for the **LED-Flashlight 300, IP54** and **UW-LED-Flashlight 300 blue**.

Packaging and exact scope of delivery of the **UW-LED-Flashlight 300 blue** is not shown in this manual.

The (disassembled) unit contains the parts shown in the following figure:

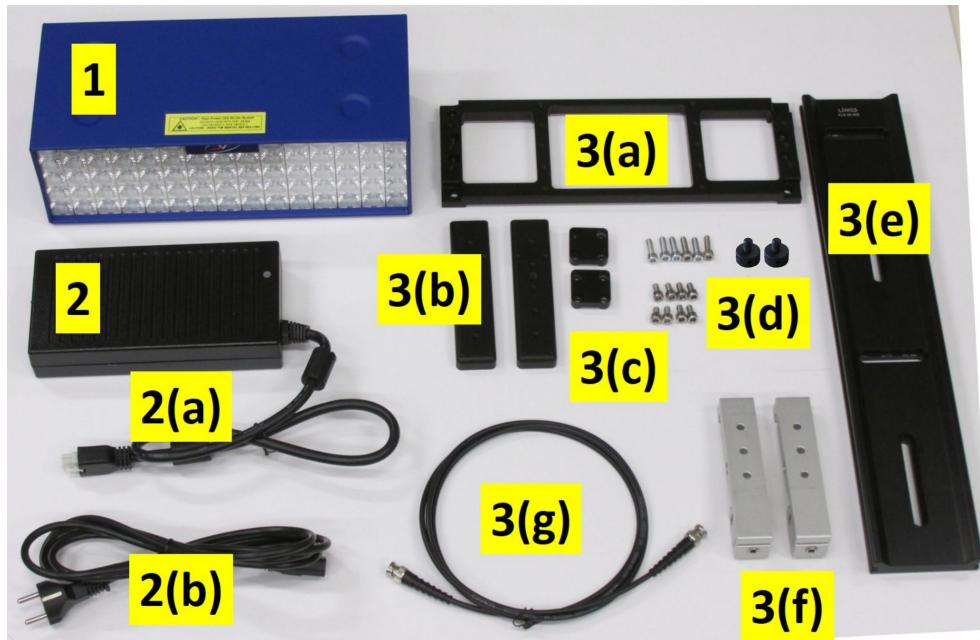


Figure 4.3: All parts of the (disassembled) **LED-Flashlight 300** unit

1. LED Module (disassembled)
2. Power supply
 - (a) Low voltage power connector
 - (b) Country specific socket connector
3. Mounting parts and cable
 - (a) Rear mounting frame
 - (b) Standing feet (2x)
 - (c) Mounting plates (2x)
 - (d) Height adjuster (2x)
 - (e) 500 mm flat rail
 - (f) rail carrier 30 mm (2x)
 - (g) bnc trigger cable, 2m

4.2 Content of the water chiller for #1104338 **LED-Flashlight 300, IP54 and UW-LED-Flashlight 300 blue #1103444**

The water chiller (#1104339) has to be ordered separately. The delivery of the chiller contains:

1. Chiller module
2. 10 cm water hoses with coupling sockets (already assembled to the chiller)
3. Power cord



Figure 4.4: All shipped parts of the water chiller (#1104339)

5 Assembling

5.1 LED-Flashlight 300

LED-Flashlight 300 ships preassembled with standing feet mounted for horizontal positioning:



Figure 5.1: Preassembled **LED-Flashlight 300** unit

If the mounting **frame is not needed**, the mounting frame on the rear side and the standing feet can be **disassembled** and multiple modules can be stacked:



5.1.1 Assemble mounting frame

The mounting parts included in the package allow very flexible mounting of one or more **LED-Flashlight 300** units. To show the principle of the modular mounting system, the assembling of the mounting from a complete disassembled unit is explained in this section.

5.1.1.1 Assemble standing feet

Use 2 x height adjusters and 2 x standing feet base plates:



5.1 LED-Flashlight 300

Screw the two height adjusters into the threads as shown in the following picture:



Use 4 x M6x12 bolts (shorter bolts) to connect 2 x mounting plates to the standing feet base plates:



Note that the feet have some M6 metric threads and one non-metric thread for tripods and gear heads:



5.1.1.2 Assembling for horizontal position

For a horizontal position connect the standing feet to the mounting frame of the LED module with the 4 x M6x20 bolts as shown below:

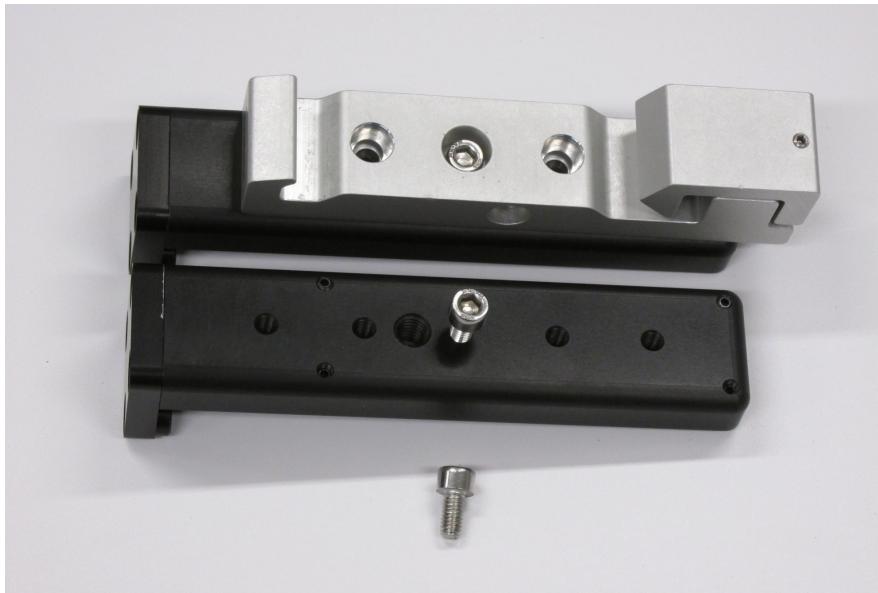


Screw the height adjusters in or out, so that they touch the bottom of the LED module:



To mount the LED module on a rail, use the short M6x12 bolts to fix the rail connectors to the standing feet:

5.1 LED-Flashlight 300



Then mount the module on a rail:



5.1.1.3 Assembling for vertical position

For a vertical position connect the standing feet to the mounting frame of the LED module with the 4 x M6x20 bolts as shown below:



It is also possible to use one central standing foot.

Screw the height adjusters in or out, so that they touch the bottom of the LED module:



Mount the module on a rail as described in ***Assembling for horizontal position:***



5.1.2 Assemble multiple modules

The assembling of multiple modules with connector plates and standing feet is exemplified in the following figures:



5.2 Assembling UW-LED Flashlight 300 blue

UW-LED-Flashlight blue is preassembled and mounted to a joint. It is not possible to connect several UW-LED Flashlight 300 blue at the housing. To use more than one use the joints and position them next to each other.

Positioning the UW-LED Flashlight

A hinge joint allows a flexible positioning of the UW-LED Flashlight in the experimental environment, while the complete aluminum housing is coated for the use in contaminated or salt water. The support tube with two clamps allows a stable mounting of the UW-LED Flashlight.

The complete aluminum housing of the **UW-LED-Flashlight 300** is coated for the use in contaminated or salted water. A hinge joint allows a flexible positioning of the UW-LED Flashlight in the experimental environment. The support tube with two clamps allows a stable mounting of the **UW-LED-flashlight 300**. A lock ring has to be attached at the tube above the upper mounting clamp to prevent the LED from falling down when the axial orientation is adjusted. (figure 5.2). Each mounting clamp has 4 mounting holes. The holes have a vertical distance of 4cm and a horizontally distance of 11,5cm. The support tube has a diameter of 6cm.

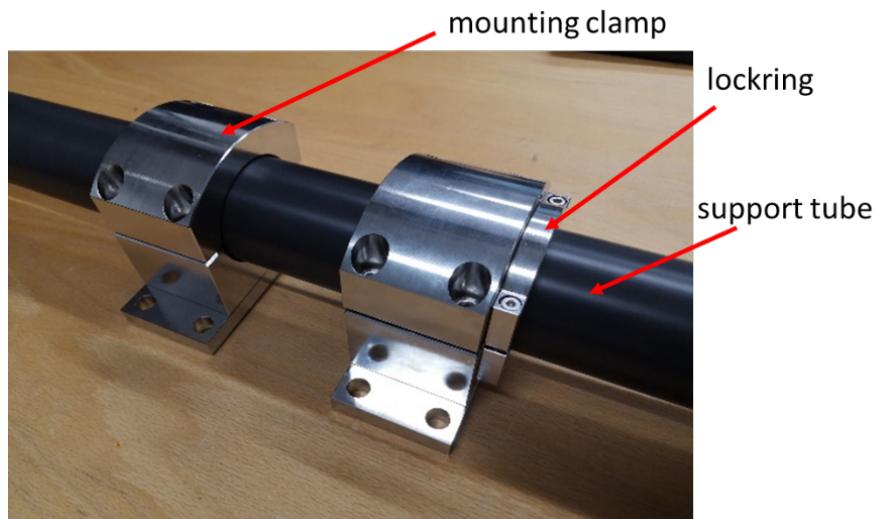


Figure 5.2: Mounting clamps and lock-ring at the support tube

The UW-LED Flashlight can be turned and tilted. To turn the UW-LED Flashlight a 6mm allen key is needed. Slightly unscrew the screw in the marked

5.2 Assembling UW-LED Flashlight 300 blue

area (figure 5.3) and turn the UW-LED Flashlight. The UW-LED Flashlight can be turned 90° in both directions to allow a 180° rotation with the hinge. The 0° position is reached when the marking is in one line with the 24mm screw. The positioning notches above the marking help to define a certain position. Fix the screw when the LED is turned correctly. When the 90° turning is not enough, the UW-LED Flashlight can be turned with the whole support tube in the mounting clamps.

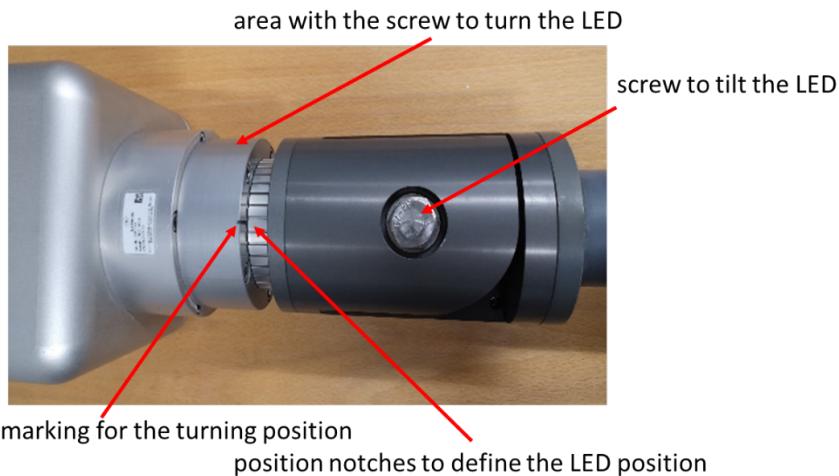


Figure 5.3: UW-LED Flashlight turn and tilt options

To tilt the UW-LED Flashlight a 24mm hexagon socket wrench is required.

Note:

WARNING: Open the 24mm screw only half a turn. If the screw is turned more the LED is not guided anymore and will tilt vertically. When the screw is turned further the connection between the LED and the support tube is removed and the LED will fall down. In this case the LED is only mounted to the cable and tubes, this causes irreparable damage and water can enter the housing.



Open the screw half a turn and tilt the UW-LED Flashlight. The UW-LED Flashlight can be tilted up to 90° in small steps. The steps help to guide the LED. Tighten the screw when the position is correct.

The cooling water hoses and the supply cable are both 8 meters long. Depending on the selected length of the support tube, the free available length of water hoses and supply cable outside is variable. Usually, the maximum support tube length is 2 meters.

6 Rear/Control panel

6.1 Connectors

The following connectors are accessible on the rear/control panel of the LED module (see Fig. 6.1 and 6.2):

1. **Ext. Trigger Input:** TTL input signal, high active (0 V = light off, 5 V = light on). The LED light **output follows the input trigger signal**.
 - In the **Free-Trigger Mode** arbitrary pulses with arbitrary length and repetition rate can be used or even any irregular pulse train. Also CW (constant wave) operation is possible using a constant 5 V signal.
 - In the **Pulsed-Overdrive Mode** the light output follows the input trigger up to a maximum pulse length of 335 µs. Light intensity is about **five times higher** than in the 'Free-Trigger Mode'. The maximum allowed duty cycle is 10%. So e.g. after a trigger signal of 100 µs duration, the next trigger shall not arrive earlier than 900 µs after the **end** of the last trigger. If 10% duty cycle is exceeded, the light output switches off and the red **Over Trigger** light turns on.
2. **Ext. Mode Select:** TTL input signal. The signal can be used to select the operation mode, but only if the operation mode is **set** to **Ext. Mode Select** (using the 'Mode Select' button, indicated by the white 'Ext. Mode Select' LED). In this case, **low** (0 V) (or if no signal is connected) sets the operation mode to 'Free-Trigger Mode' and **high** (5 V) sets the operation mode to 'Pulsed-Overdrive Mode'. The selected mode is indicated by the corresponding status LED: green 'Pulsed-Overdrive Mode' or the blue 'Free-Trigger Mode'.
3. **Trigger Out:** TTL output signal. This output signal represents the **inverted** input trigger signal (low = light on, high = light off) with a delay of about 1 µs.



Figure 6.1: Connectors on the rear panel of the **LED-Flashlight 300** (#1103445, #1103446)



Figure 6.2: Connectors on the control panel of the **LED-Flashlight 300, IP54** (#1104338)

6.1 Connectors

4. **Power connector: Only use the power supply shipped with the device to power the LED module!** Connect the power supply using this connector. To **unplug** the connector, **press the white clip** on top of the connector to release the bracket.

Note: It is recommended to switch the power supply off and wait some seconds until the capacitors have discharged by some amount before disconnecting the power supply. In rare cases disconnecting the active power supply (mainly in case of the water cooled LED version) could lead to electronic damages inside the control panel.

Note: Never interchange the supplied power supplies. An incorrect power supply can lead to malfunction or even damage of the LED. Check each time that the correct power supply is used.



6.2 Status lights

Six status lights are placed on the rear/control panel of the LED module:



1. **Pulsed-Overdrive Mode:** **Green.** Indicates that the device is in the 'Pulsed-Overdrive Mode' mode. This mode can be selected using the 'Mode Select' button or the 'Ext. Mode Select' signal. Blinking indicates that the device is busy switching between modes and does not accept input trigger.
2. **Free-Trigger Mode:** **Blue.** Indicates that the device is in the 'Free-Trigger Mode' mode. This mode can be selected using the 'Mode Select' button or the 'Ext. Mode Select' signal. Blinking indicates that the device is busy switching between modes and does not accept input trigger.
3. **Ext. Mode Select:** **White.** Indicates that the device is in the 'Ext. Mode Select' mode. This mode can be selected using the 'Mode Select' button
4. **Over Trigger:** **Red.** Indicates that the **duty cycle** in the 'Pulsed-Overdrive Mode' is **above 10%** and that **no light is emitted**. Reduce the trigger pulse length or decrease the pulse rate to achieve a duty cycle below or equal to 10%.
5. **High Temperature:** **Yellow.** Indicates that the device is overheating. Reduce the power or increase air circulation to cool down the device.
6. **Over Temperature:** **Red.** Indicates that the device has reached a critical temperature and may damage the LED array. Stop operation immediately and allow the device to cool down.

6.3 Mode select switch

5. **High Temperature: Orange.** Indicates that the device **temperature is too high**. The device is still working, but the lifetime of the LED's may suffer if the device is operated in this condition for a long time. **Reduce the temperature:** reduce the ambient temperature, improve supply of cold air, make sure that the fans are working properly and are not blocked or covered.
6. **Over Temperature: Red.** The temperature is so high that the LED and electronics would be damaged during further operation. The **light output is switched off** until the device cools down. See '**High Temperature: Orange**' (above) for countermeasures!

6.3 Mode select switch

The **Mode Select** button is used to switch between different operation modes manually (yellow rectangles below):



The device has three different operation modes:

1. 'Pulsed-Overdrive Mode'
2. 'Free-Trigger Mode'
3. 'Ext. Mode Select'

Every time the button is pressed, the mode changes. First from left to right: 'Pulsed-Overdrive Mode', 'Free-Trigger Mode', 'Ext. Mode Select'. Then from 'Ext. Mode Select' to 'Pulsed-Overdrive Mode' back again. After pressing the button, the device needs some time for the mode switch. **Blinking** status lights indicate that the **mode switch is in progress**. No light output is generated during the mode switch. When the mode switch is **completed**, the corresponding **status lights shine constantly**.

1. Pulsed-Overdrive Mode:



The mode is active when the **Green** status light is on. Blinking indicates that the device is busy switching to this mode and does not accept input trigger. In the 'Pulsed-Overdrive Mode' the light output follows the input trigger up to a maximum pulse length of 335 µs. Light intensity is about **five times higher** than in the 'Free-Trigger Mode'. The maximum allowed duty cycle is 10%. So e.g. after a trigger signal of 100 µs duration, the next trigger shall not arrive earlier than 900 µs after the **end** of the last trigger. If 10% duty cycle is exceeded, the light output switches off and the red **Over Trigger** light turns on.

2. Free-Trigger Mode:



The mode is active when the **Blue** status light is on. Blinking indicates that the device is busy switching to this mode and does not accept input trigger. In the 'Free-Trigger Mode' arbitrary pulses with arbitrary length and repetition rate can be used or even any irregular pulse train. Also CW (constant wave) operation is possible using a constant (5 V) signal.

3. **Ext. Mode Select:** The mode is active when the white status light is on. When this mode is active, the operation mode is determined by the external TTL signal connected to the '**Ext. Mode Select' bnc connector.**

- A **low** (0 V) signal (or if no signal is connected) sets the operation mode to **Free-Trigger Mode**. This mode is indicated by the simultaneous **blue** and **white** status light:

6.3 Mode select switch



- A **high** signal (5 V) sets the operation mode to **Pulsed-Overdrive Mode**. This mode is indicated by the simultaneous **green** and **white** status light:



7 Operation and connection of the chiller

For the operation of the water cooled **#1104338 LED-Flashlight 200, IP54** and **#1103444 UW-LED-Flashlight 300 blue** an appropriate water cooling device is required. For detailed information about the chiller module also check the original manual from the chiller supplier. One single chiller is able to feed up to four **LED-Flashlight 300, IP54** or **UW-LED-Flashlight 300 blue**. The water distribution for several LEDs can be done using a water distribution kit #1014061, one for each additional LED.

It is recommended to mix the cooling water with some additive to avoid algae formation and corrosion inside the chiller, LED and the water. Approx. 6L of coolant mixture is required to fill the chiller tank. We recommend making a solution of 25% additive with the balance distilled water. A corrosion and biological additive #1013690 has to be ordered separately. Depending on the water quality, the mixture can be used for up to 2 years.

7.1 Parts introduction



Figure 7.1: Parts of the chiller #1104339

7.2 Installation

1. Open the injection port on top of the chiller module to feed the coolant mixture. Do not let the mixture spill over! Make sure that the water does not overflow by observing the water level gauge and adding water slowly.



Note: When switching on the cooling circuit before operating the first time, the water level in the chiller may decrease significantly by distributing the water into the water hoses and the LED devices. Then fill up the water mixture again, so that the level on the water level indicator is in the green range again.

Always check the water level before starting the LED operation.

2. According to the system conditions, connect the water inlet and outlet to the water tubing hoses (see Fig. 7.2) and the water hoses to the LED device (see yellow rectangle in Fig. 7.3).



Figure 7.2: Connecting the water inlet and outlet to the water hoses.

7.2 Installation

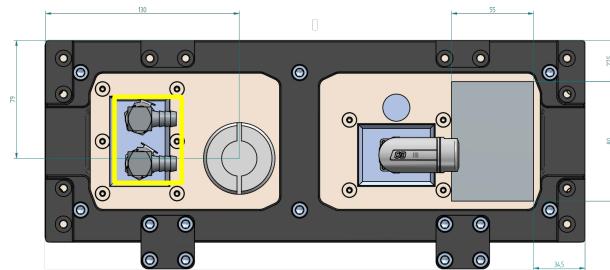


Figure 7.3: The yellow rectangle shows where the water hoses have to be connected to the LED device.

Note: When contacting the water circuit, the direction of the flow must be observed. If the connection is incorrect, the LED reports an error and cannot be activated. Connect “water outlet Chiller” to “water inlet LED” and backwards “water outlet LED” to “water inlet Chiller”.



When using several LEDs the flow direction has to be respected in a similar way.

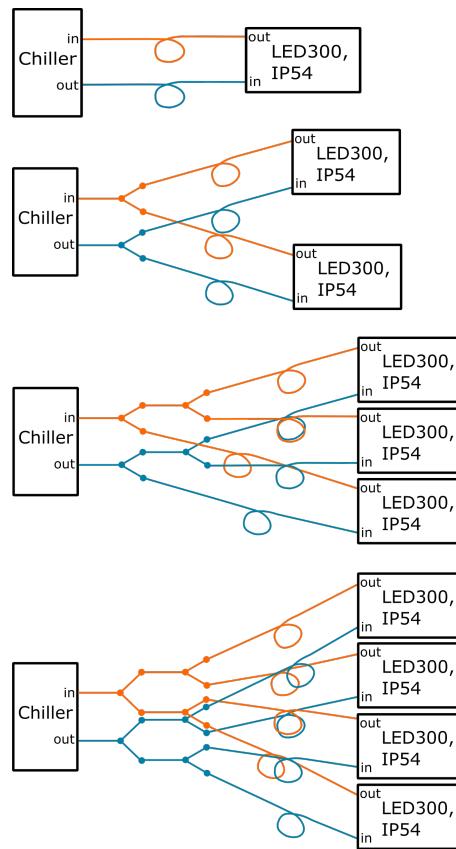


Figure 7.4: Sketches for connecting the chiller with one to four LEDs.

3. Plug in the power connector and turn on the power switch.



Note: *Do not start up without water in the water tank. Switching on the chiller without water inside could destroy the chiller module.*

- After switching on the power button, the circulation pump of the chiller starts working. The first time of operation may cause some bubbles in the pipe leading to a flow alarming occasionally, but running for a few minutes, it will go back to standard operation.
- After the first boot, you must immediately check the fill level gauge and whether the water pipes leak.
- During operation, if the water temperature is below the set value, it is normal that the fans and other components of the machine do not work. The temperature controller will automatically control the working conditions of the internal components based on the set controlling parameters. Depending on the environmental conditions it can take seconds up to hours for the ventilation to start and stop working.
- Normally the user does not need to adjust the parameter of the temperature controller. If this is really necessary, please refer to the user manual of the manufacturer.

7.3 Operation status and parameter adjustment

Under normal circumstances there is no need to adjust the controlling parameters. The device will self-adjust the controlling parameters according to the room temperature. By default the factory setting is set to a water temperature of 25°C.

- Temperature controller panel:



1. Indicators D1, D2 (as shown) of thermostat working state

- D1 ON: thermostat works in intelligent control mode
- D1 OFF: thermostat works in temperature control mode
- D1 FLASHES: thermostat works in parameters setting mode or displays value of room temperature
- D2 ON: chiller works in refrigerating state
- D2 OFF: chiller works in the insulation working state
- D2 FLASHES: chiller works in the energy-saving state

2. Press ▼ button will show the room temperature, 6 seconds later to display the restore defaults. (Meanwhile, D1 is flashing, displaying room temperature.)

3. ▲▼ keys are for adjusting the display status of the controller, parameters selection and adjustment.

4. RST key: enter key.

5. SET key: function setting key.

- Alarm function:

- When alarm occurs, the error code and the temperature will be alternately displayed.

- In alarming state the alarm sound could be suspended by pressing any button, but the alarm display remains until the alarm condition is eliminated.

- E1 Over high room temperature
- E2 Over high water temperature
- E3 Over low water temperature
- E4 Room temperature sensor failure
- E5 Water temperature sensor failure

Table 7.1: Alarm display

- If required, an alarm status of the chiller state can be read out remotely. Please refer to the user manual of the manufacturer for further information.

7.4 Chiller troubleshooting

Please refer to the user manual of the chiller manufacturer if the chiller states some failure condition.

8 Cabling

8.1 LED module



Figure 8.1: Cabling for standard application with **DaVis**: power supply connector connected to the power supply socket, bnc trigger cable connector to 'Ext. Trigger Input' and mode selector cable connected to 'Ext. Mode Select'

In standard applications, **LED-Flashlight 300** is controlled by the Programmable Timing Unit (PTU) from **LaVision** using the **DaVis** software. Illumination time (all **DaVis** versions) and operation mode (**DaVis** 10.0.5 and later) can be set in the *Recording Dialog*.

Note: To control the operation mode remotely from **DaVis** (10.0.5 and later), the operation mode must be set to 'Ext. Mode Select' using the 'Mode Select' button on the rear/control panel (6.3).



For standard operation with **DaVis**, the following cables need to be connected to the LED module:

1. Connect the power supply low voltage plug to the power supply socket of the LED module (rectangular white socket with 2 x 5 pins). Make sure the power supply is switched off before connecting this cable.
First connect the power supply to the LED module, only then connect the power supply to the mains socket. To unplug this cable, press the white clip on top of the plug to release the bracket.



Note: It is recommended to switch the power supply off and wait some seconds until the capacitors have discharged by some amount before disconnecting the power supply. In rare cases disconnecting the active power supply (mainly in case of the water cooled LED version) could lead to electronic damages inside the control panel.

2. Connect a bnc trigger cable to 'Ext. Trigger Input'. By default, this will be connected to the 'Q1' line of the laser connector (see below).
3. **DaVis 10.0.5 and later:** Connect another bnc cable to 'Ext. Mode Select'. By default, this will be connected to the 'L1' line of the laser connector (see below).

8.2 Cabling water cooled **LED-Flashlight 300**

In addition to the cabling described above, for the **LED-Flashlight 300, IP54** and **UW-LED-Flashlight 300 blue** is needed a 10 m power cable (green) to connect the LED with the control box as shown below.



8.2 Cabling water cooled **LED-Flashlight 300**

The remote control box can be attached via the four long holes at the sides (yellow circles in the figure below).



8.3 Programmable Timing Unit (PTU)

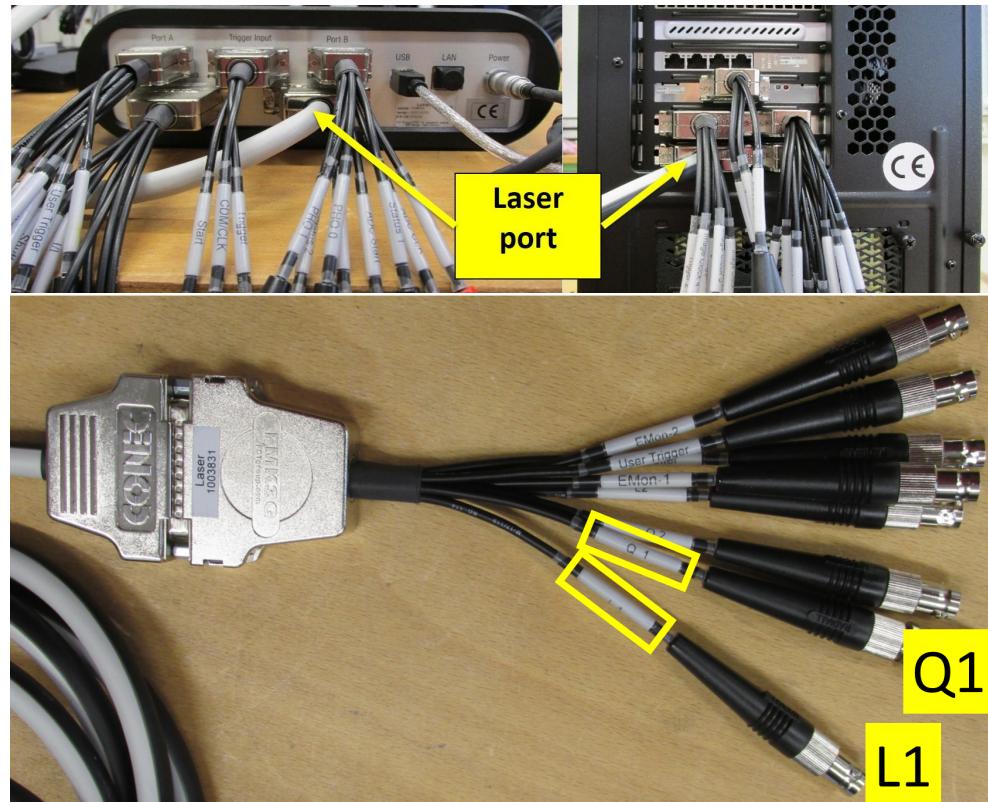


Figure 8.2: External PTU X (top left), internal PTU X (top right): Laser port and extension cable, connector #1003831, extension cable (bottom), connect trigger cable 'Ext. Trigger Input' to **Q1**. Connect the 'Ext. Mode Select' cable to **L1** (only **DaVis 10.0.5** and later)

- Plug the connector **#1003831** to the (gray) **extension cable** (figure 8.2, bottom).
- Connect the **extension cable** to the **laser port of the PTU X**: external (USB) (figure 8.2, top left) or internal (figure 8.2, top right).
- Connect the **Q1** output line from connector #1003831 (figure 8.2, bottom) to the **Ext. Trigger Input** of the **LED-Flashlight 300** (figure 8.1).
- **DaVis 10.0.5** and later: Connect the **L1** output line from connector #1003831 (figure 8.2, bottom) to the **Ext. Mode Select** of the **LED-Flashlight 300** (figure 8.1).

8.4 Schematic

8.4 Schematic

The cabling is shown again schematically in the following figure:

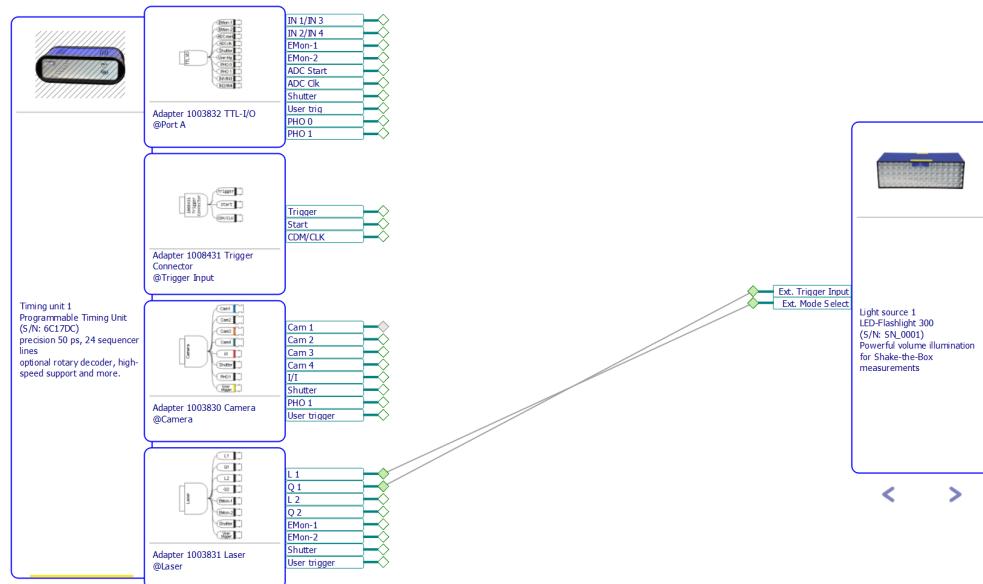


Figure 8.3: Cabling of **PTU X** and **LED-Flashlight 300** for standard applications. Remote mode selection with the 'L1' to 'Ext. Mode Select' connection only works for **DaVis** 10.0.5 and later!

8.5 Connecting multiple devices

In some situations it is useful to use multiple **LED-Flashlight 300** modules, e.g if higher light intensity is needed or a bigger volume needs to be illuminated.

8.5.1 Multiple devices with a single connection

When all modules should work **synchronously**, up to 3 or 4 modules can be connected to 'L1' and 'Q1' with single BNC cables using T-connectors for the different modules (depending on the cable length 3, 4 or even more modules may work on a single connection).

8.5.2 Multiple devices with two connections

When **even more modules** should be used, or if the modules should be triggered with **different timings**, additional modules can be connected to the 'L2' and 'Q2' lines of the laser connector:

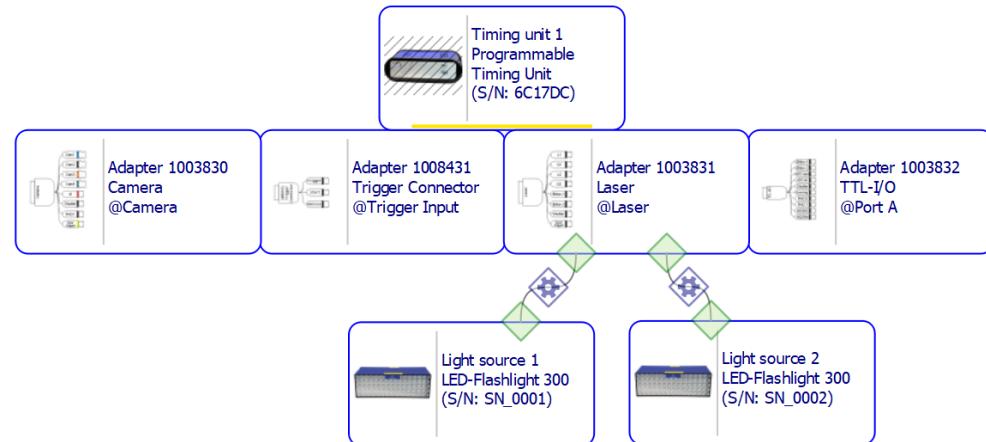


Figure 8.4: Setup for a second (group) of **LED-Flashlight 300** module(s)

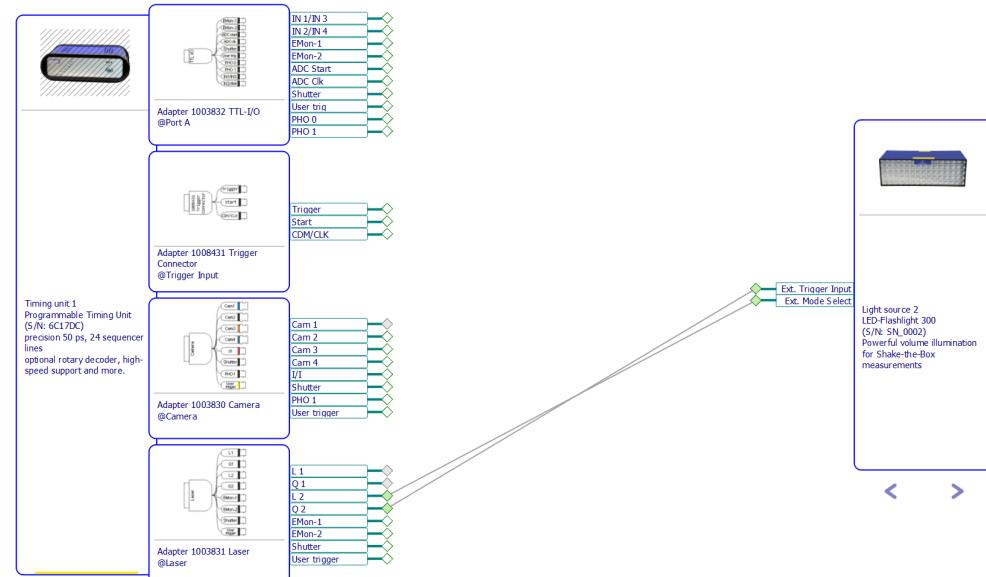


Figure 8.5: Cabling for a second (group) of **LED-Flashlight 300** module(s)

8.5.3 Multiple devices with up to 4 connections

When **even more modules** should be used, or if the modules should be triggered with **different timings**, additional modules can be connected to the 'L2' and 'Q2' lines of the laser connector:

8.5 Connecting multiple devices

using the **generic** laser adapter 1003517. First, remove the laser adapter 1003831 from the hardware setup. Then add the generic adapter (e.g. search for 'generic' in the device list and drag the adapter to the PTU. Then add up to 4 **LED-Flashlight 300** and connect them with the generic

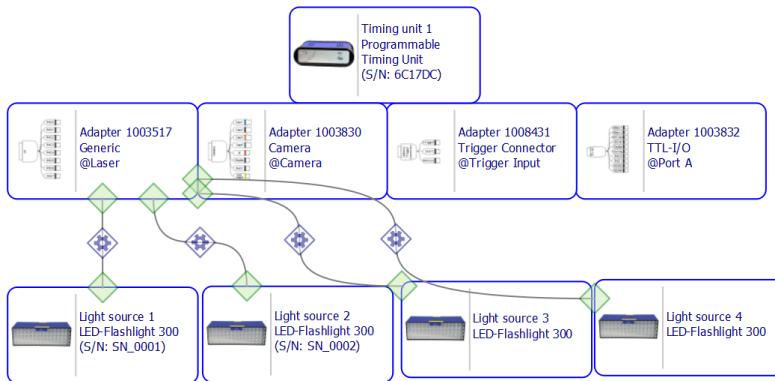


Figure 8.6: Setup for 4 (groups) of **LED-Flashlight 300** module(s) using the 'generic' adapter 1003517

The lines from the LED modules can be configured arbitrarily to the generic adapter. One possible way, e.g. for module 4 is the following:

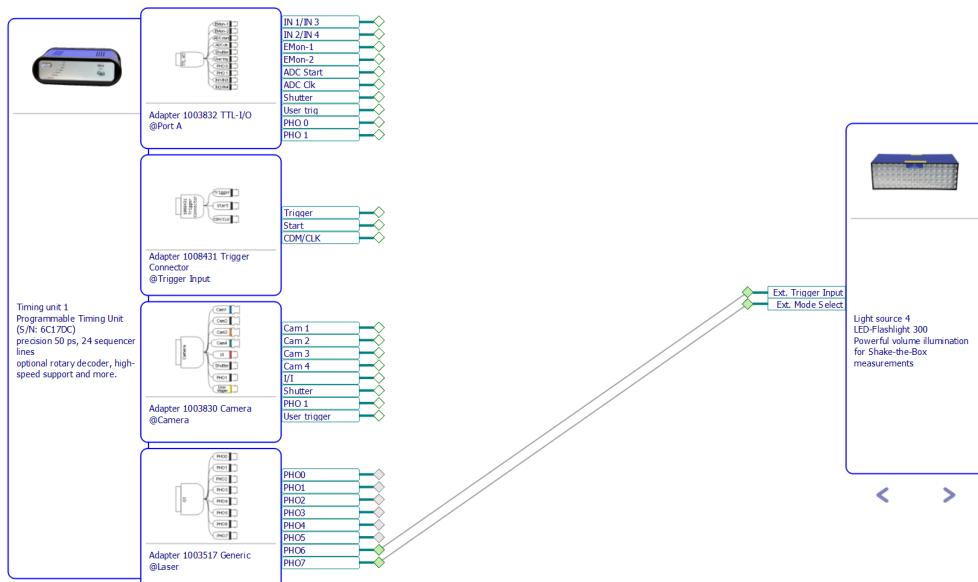


Figure 8.7: Cabling for 4 (groups) of **LED-Flashlight 300** module(s) using the 'generic' adapter 1003517, only module 4 shown here

Note: Make sure that the physical connections fit to the line configuration setup!



8.5.4 Multiple devices with up to 8 connections

It is possible to control up to eight modules independently using the 'generic' adapter 1003517. In this case, the 'Ext. Mode Select' is not connected, the mode must be selected manually using the 'Mode Select' button on the rear/control panel and the corresponding mode must be set in the **DaVis** device settings. Now, up to eight modules (or groups of modules) can be triggered independently, using the 'PHO0' to 'PHO7' lines for the 'Ext. Trigger Input'.

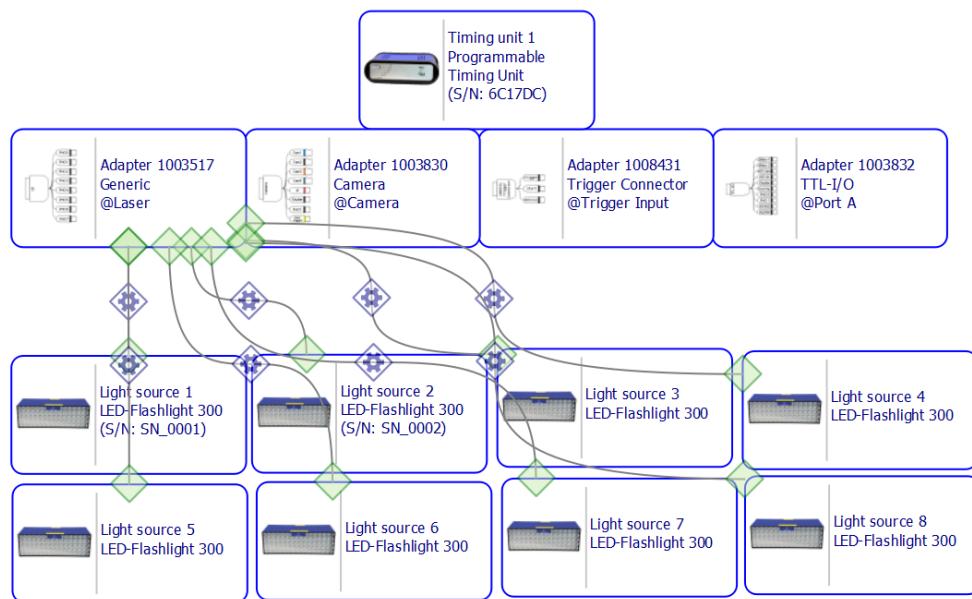


Figure 8.8: Setup for up to 8 (groups) of **LED-Flashlight 300** module(s) using the 'generic' adapter 1003517

8.5 Connecting multiple devices

Now, each module is only connected with a single line, e.g. for module 8:

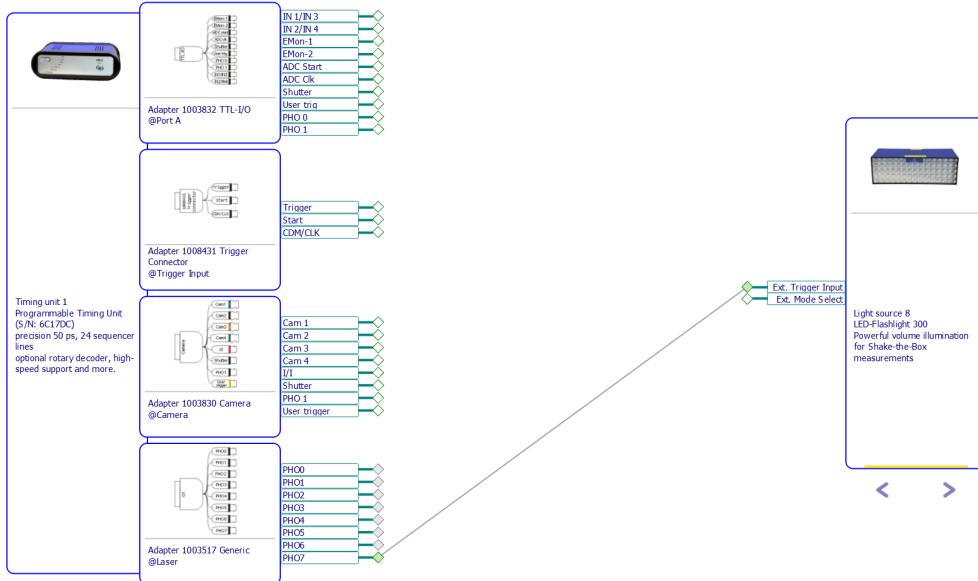


Figure 8.9: Cabling for up to 8 (groups) of **LED-Flashlight 300** module(s) using the 'generic' adapter 1003517, only module 8 shown here

Note: Make sure that the physical connections fit to the line configuration setup and that the correct mode is selected on the rear/control panel of the modules and in the software!



9 Startup

LED-Flashlight 300 can be started, when the power supply is connected to the LED module and the socket. Switch the **power switch on the power supply** on to start the LED. During startup, **all status LED's** on the rear/control panel turn on:



Then, depending on the selected operation mode, the **green** 'Pulsed-Overdrive Mode' or the **blue** 'Free-Trigger Mode' LED start **blinking**, indicating that the selected mode is set up. Finally, the green or blue lights turn on **constantly**, indicating that the device is **ready to accept input trigger** now.

Use the **Mode Select** button repeatedly to switch to the desired operation mode. See section **6.3** for more information on the different operation modes. The selected operation mode is stored and will be active again after a restart of the module.

10 DaVis software settings

Light output of **LED-Flashlight 300** is controlled via the trigger line connected to the 'Ext. Trigger Input' connector on the rear/control panel of the LED module. Light output follows the input trigger signal (in pulsed overdrive mode only up to 10 % duty cycle). So the **pulse rate and the pulse width is controlled by the trigger signal.**

In **DaVis LED-Flashlight 300** is configured as a **gated light source** device. Before use, the gated light source has to be **configured** with correct parameter settings in the **hardware setup** dialog.

The pulse rate or pulse frequency is determined by the recording rate (or trigger rate) in the **recording dialog**. There, also the illumination time (pulse width) is specified.

Note: *The user has to make sure that a duty cycle of **10 % is not exceeded in the 'Pulsed-Overdrive Mode'** by choosing appropriate settings for the recording rate and the illumination time. Otherwise, no light output is generated.*



The setup procedure of **LED-Flashlight 300** is different for different **DaVis** versions:

- **DaVis 8** and the **high-speed recording** of the current **DaVis 10** version (**DaVis 10.0.3**) share the same setup dialogs.
- The low-speed recording of **DaVis 10** has a newer, more modern setup interface. This interface will also be available in a future version of the **DaVis 10 high-speed** recording.
- In **DaVis 10.0.3** and **10.0.4**, the LED is controlled as a **gated light source**
- In **DaVis 10.0.5 and later** the LED is controlled as a dedicated **LED-Flashlight 300** device. This allows remote control of the power mode ('Free Trigger' or 'Pulsed Overdrive'). Moreover, the recording dialog makes sure that 10% duty cycle is not exceeded in the Pulsed Overdrive Mode.

10.1 DaVis 8 and DaVis 10.0.3 - 10.0.5 high-speed

DaVis 10.0.3 - 10.0.5 still uses the same high-speed hardware setup as in **DaVis 8**. This was changed to the new **DaVis 10** drag-and-drop-setup in **DaVis 10.1.0** (and later). **LED-Flashlight 300** is configured as a "gated light source" here.

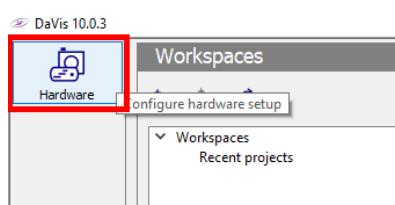
10.1.1 Setup

Enter the hardware **Setup** dialog to configure **LED-Flashlight 300** in **DaVis**:

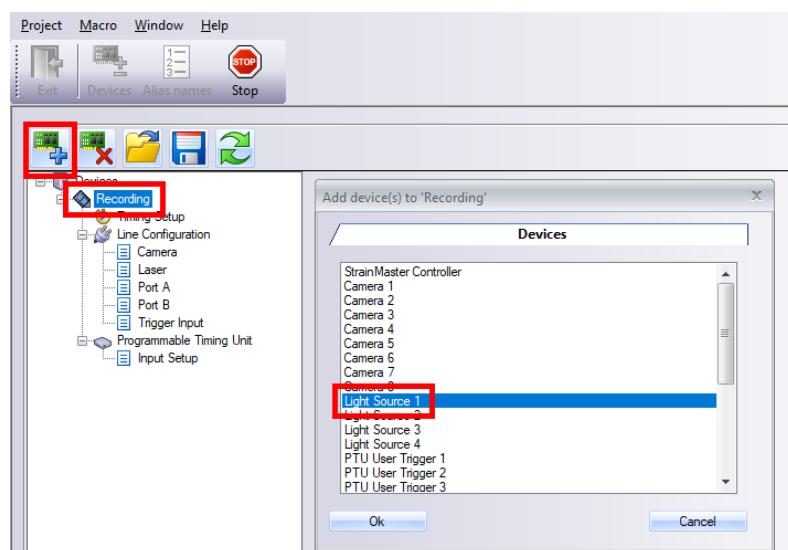
DaVis 8:



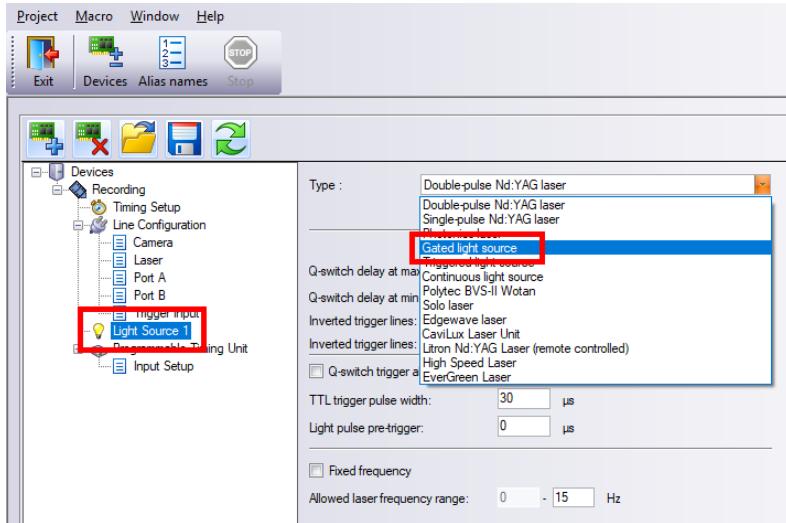
DaVis 10 high-speed:



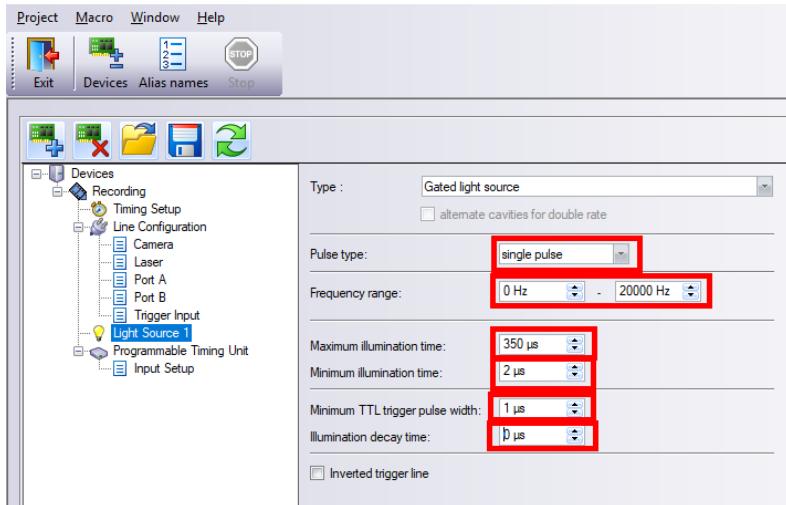
Select the **Recording** entry and use the **Plus** icon to add **Light Source 1** to the device list:



Select **Light Source 1** and choose **Gated light source** from the drop down list:



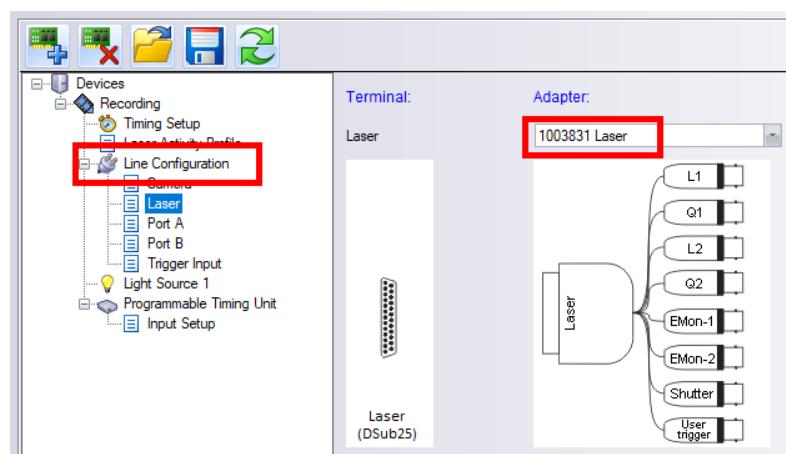
Set the following parameter for **LED-Flashlight 300**:



- Pulse type: single pulse
- Frequency range: 0 Hz to 20000 Hz
- Global warm up: 0 µs **high-speed recording only**
- Fire during record idle: no (do not check the box) **high-speed recording only**
- Maximum illumination time: 335 µs (**Pulsed-Overdrive Mode**). For the '**Free-Trigger Mode**' the highest value that is needed can be set.

- Minimum illumination time: 2 μ s
- Minimum TTL trigger pulse width: 1 μ s
- Illumination decay time: 0 μ s
- Inverted trigger line: no (do not check the box)

Make sure that the number of the laser connector selected in the **Line Configuration:**



is the same as on the connector:



10.1.2 Recording

This section describes the usage of **LED-Flashlight 300** during image recording. It shows how to:

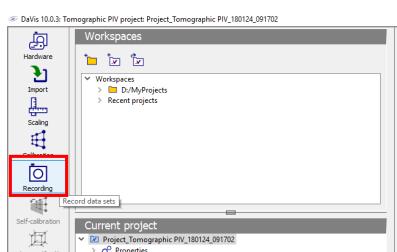
- turn on and off the light for recording
- set up illumination time and pulse rate for the illumination

First, enter the recording dialog by clicking the **Recording** button in the tool bar:

DaVis 8:

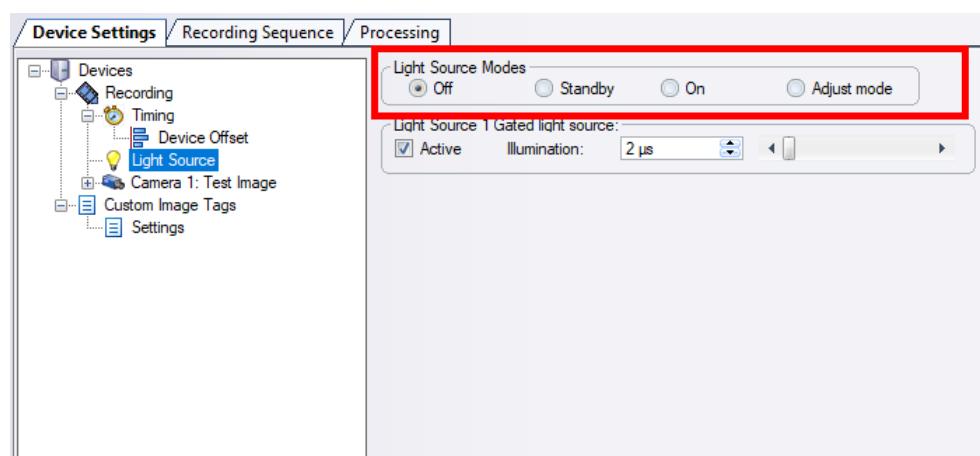


DaVis 10:



Switching light on and off

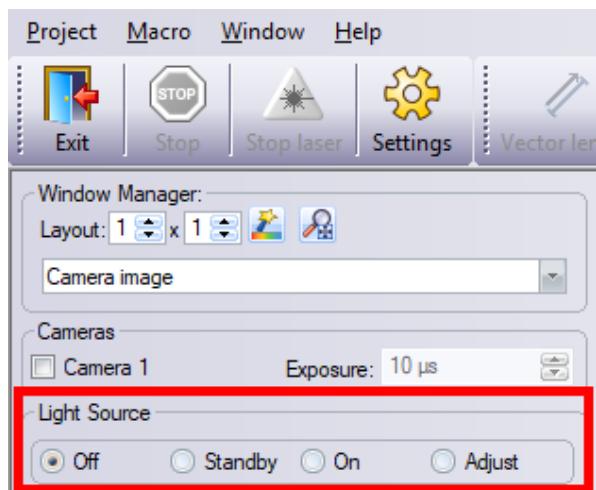
Four different **Light Source Modes** can be selected in the **Light Source** dialog of the **Device Settings**:



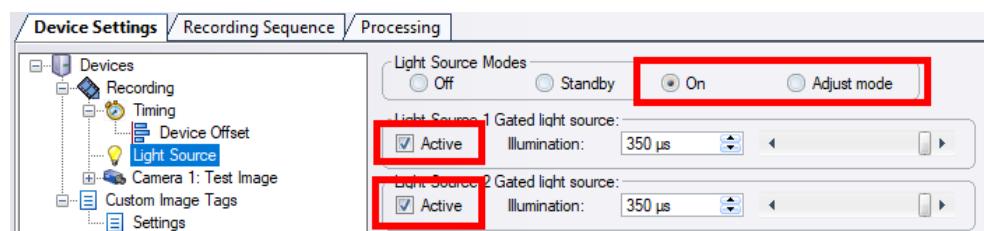
1. **Off:** Light is turned off in idle mode and during recording, no trigger pulses are generated

2. **Standby:** for **LED-Flashlight 300** same as **Off**.
3. **On:** Light is turned on **only during recording** (if the light source is also Active, see below). Trigger signals are generated during recording.
4. **Adjust mode:** Light is turned on **immediately** (if the light source is also Active, see below). Trigger signals are generated immediately.

Depending on the project type, there is also a shortcut dialog for **Light Source Modes** on the left hand side in the recording dialog, where the same modes can be selected:

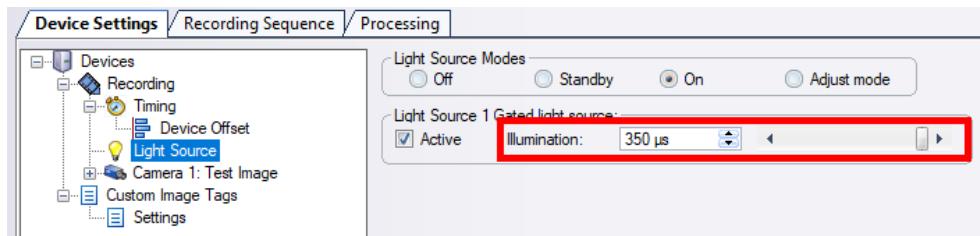


Multiple light sources can be used in a setup. The **Light Source Modes** described above are controlling **all** installed and configured light sources **at the same time**. To get any light output, the individual light sources need be **activated** additionally (e.g. for two light sources):

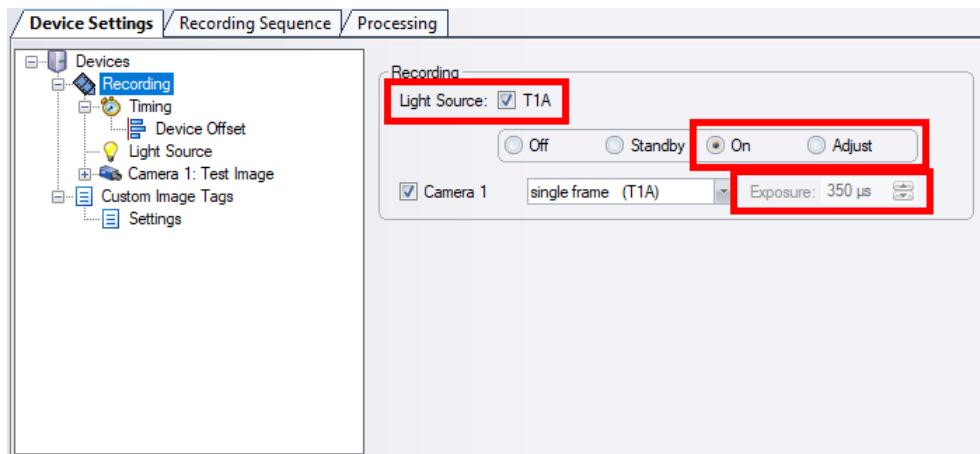


Illumination time

The **brightness** of **LED-Flashlight 300** is controlled by the illumination time: the longer the illumination time, the brighter the light. The **Illumination** time can be set in the **Light Source** dialog of the **Device Settings**:



When the light source is **On** (or in **Adjust** mode) and **Active**, the **Exposure** time of the camera is adjusted internally to fit to the illumination time and can not be set manually:



Note: Remember that there is **no light output** if a duty cycle of **10 % is exceeded** in the '**Pulsed-Overdrive Mode**'. In this mode the illumination time needs to be $\leq 10\%$ of the **recording period** (= 1 / recording rate).

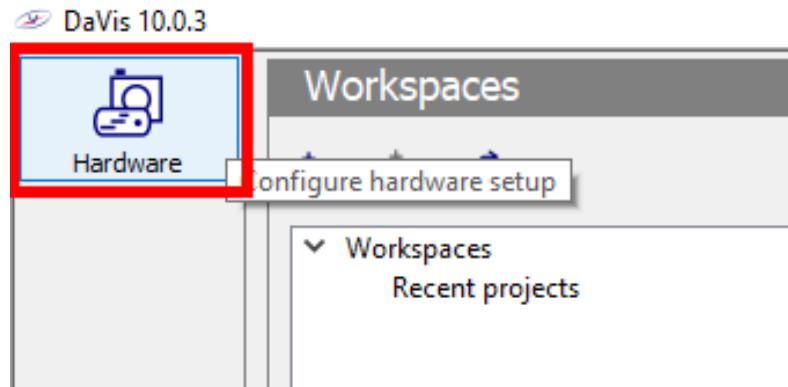


10.2 DaVis 10.0.3 and 10.0.4 low-speed

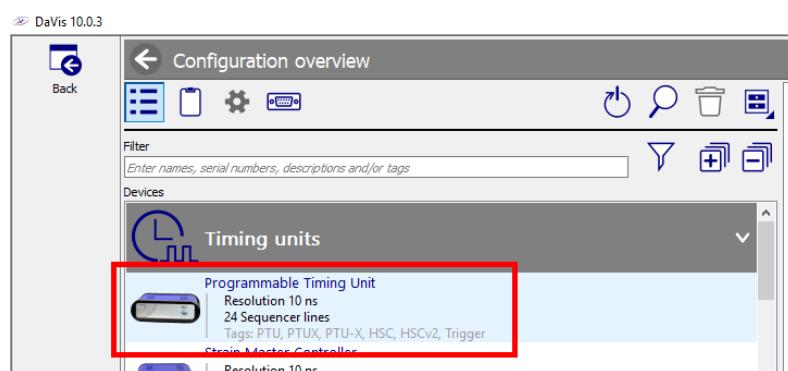
DaVis 10.0.3 and 10.0.4 in the low-speed mode already allow the graphical drag-and-drop setup for hardware components. **LED-Flashlight 300** is still configured as a "gated light source" here.

10.2.1 Setup

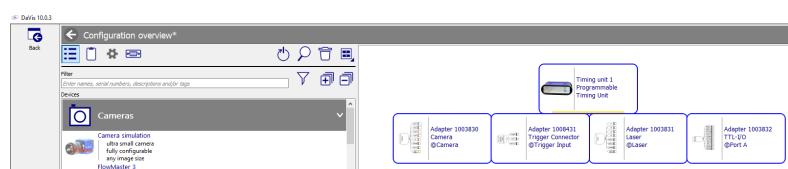
Enter the hardware **Setup** dialog to configure **LED-Flashlight 300** in **DaVis**:



First, add a PTU to the setup (if not already present). Select the PTU from the list of devices:

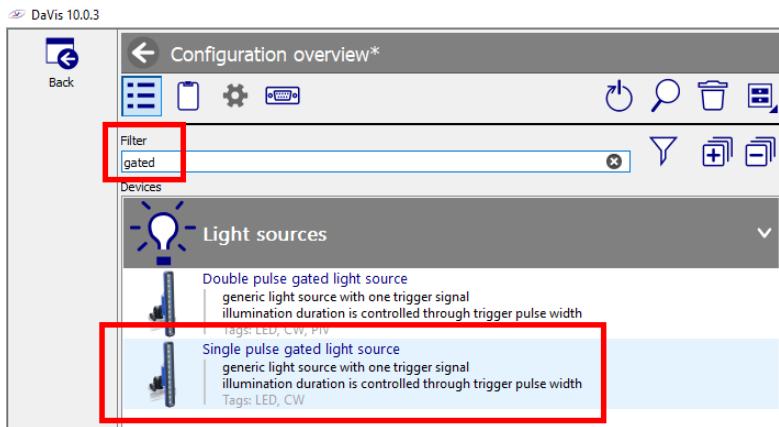


and drag it to the main window (right):

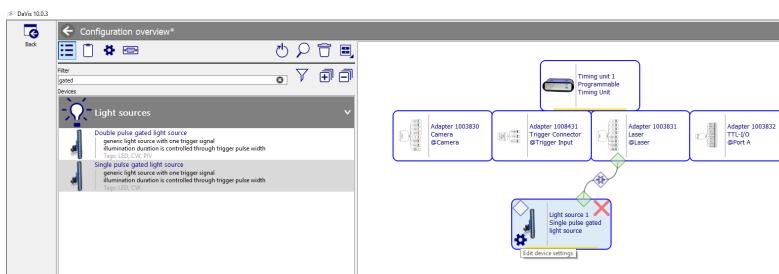


10.2 DaVis 10.0.3 and 10.0.4 low-speed

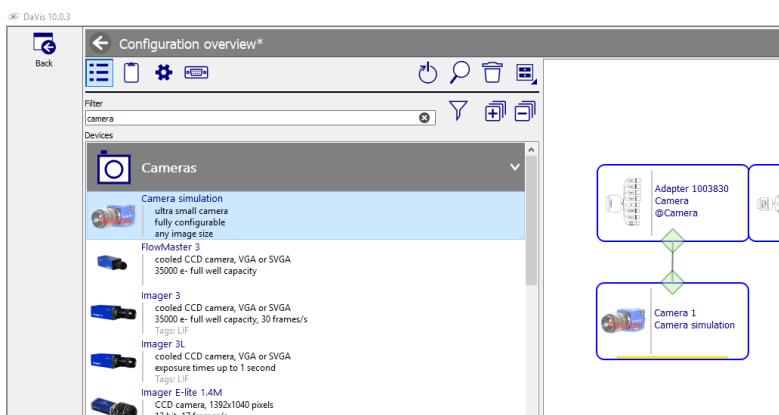
Search for the gated light source in the device list (e.g. by typing "gated" in the **Filter** field):



and drag the **Single pulse gated light source** to the main window (the correct default connections to the PTU are generated automatically):



Add at least one camera from the device list:

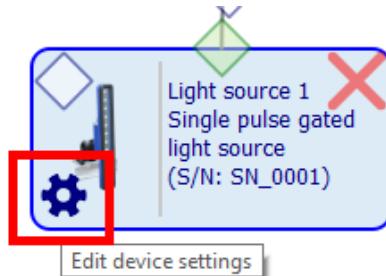


Press the **Initialize** button in the tool bar:

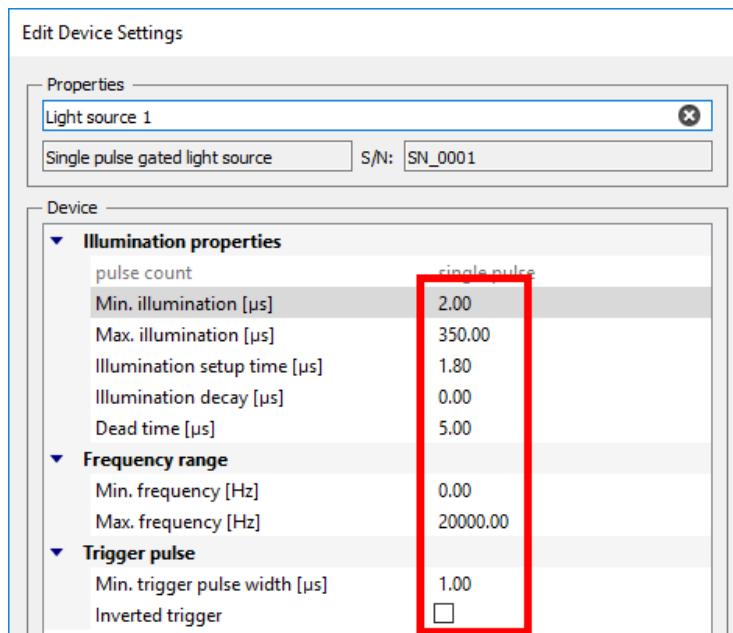


and wait for the initialization to complete.

Now press the 'Edit device settings' button for **Light source 1**:



Set all parameter settings in the upcoming dialog:

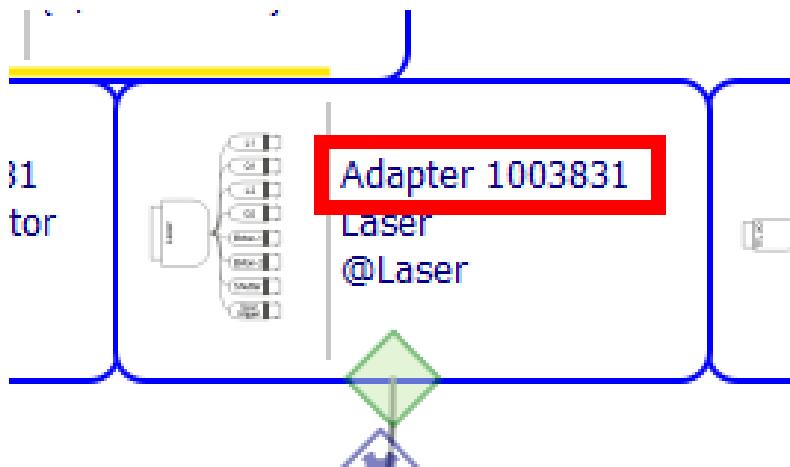


- Minimum illumination time: 2 μs
- Maximum illumination time: 335 μs (**Pulsed-Overdrive Mode**). For the '**Free-Trigger Mode**' the highest value that is needed can be set.
- Illumination setup time: 1.8 μs
- Illumination decay: 0.0 μs
- Dead time: 5 μs
- Minimum frequency: 0 Hz
- Maximum frequency: 20000 Hz
- Minimum trigger pulse width: 1 μs

10.2 DaVis 10.0.3 and 10.0.4 low-speed

- Inverted trigger: no (do not check the box)

Make sure that the **number** of the laser connector **in the software**:



is the **same as on the connector**:

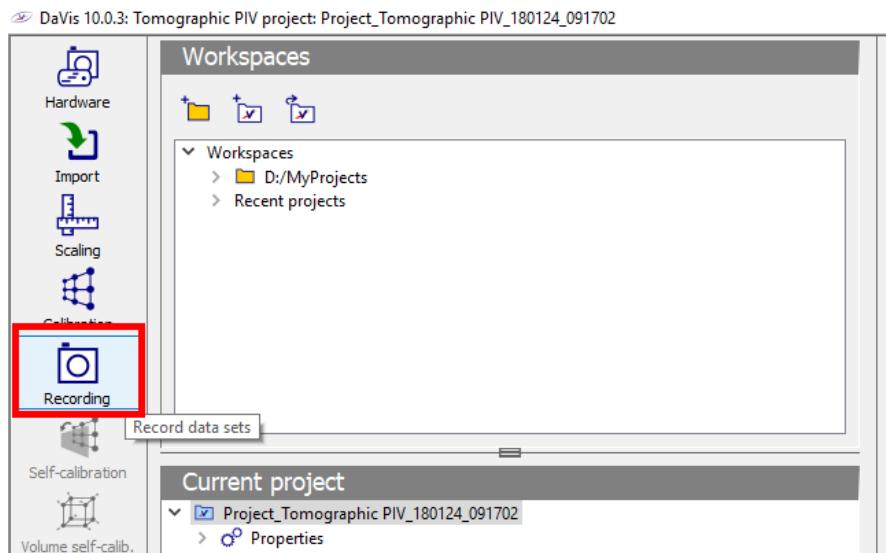


10.2.2 Recording

This section describes the usage of **LED-Flashlight 300** during image recording. It shows how to:

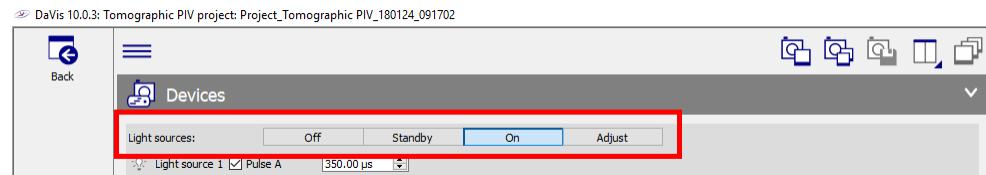
- turn on and off the light for recording
- set up illumination time and pulse rate for the illumination

First, enter the recording dialog by clicking the **Recording** button in the tool bar: **DaVis 10:**



Switching light on and off

Four different **light source modes** can be selected in the **Light sources** dialog of the **Devices** dialog:

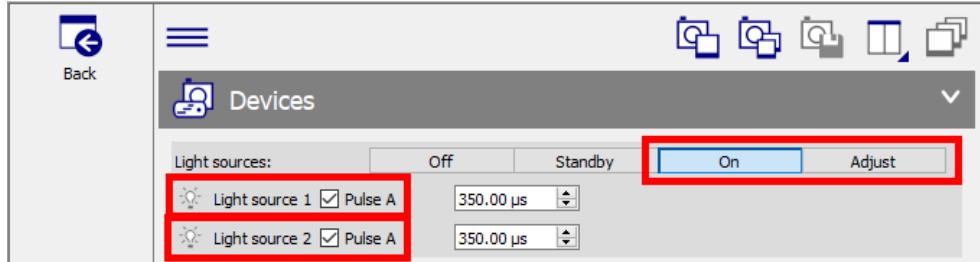


1. **Off:** Light is turned off in idle mode and during recording, no trigger pulses are generated
2. **Standby:** for **LED-Flashlight 300** same as **Off**.
3. **On:** Light is turned on **only during recording** (if the light source is also Active, see below). Trigger signals are generated during recording.
4. **Adjust mode:** Light is turned on **immediately** (if the light source is also Active, see below). Trigger signals are generated immediately.

Multiple light sources can be used in a setup. The **light source modes** described above are controlling **all** installed and configured light sources **at the same time**. To get any light output, the individual light sources need be **activated** additionally (e.g. for two light sources):

10.2 DaVis 10.0.3 and 10.0.4 low-speed

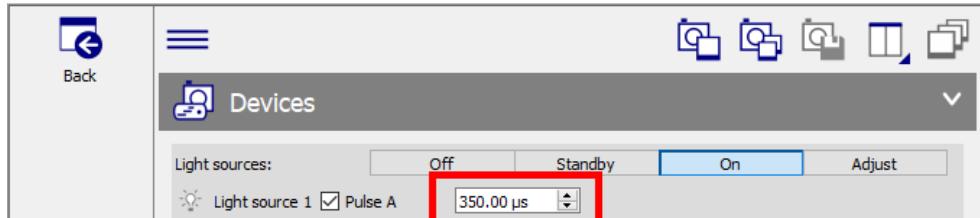
DaVis 10.0.3: Tomographic PIV project: Project_Tomographic PIV_180124_091702



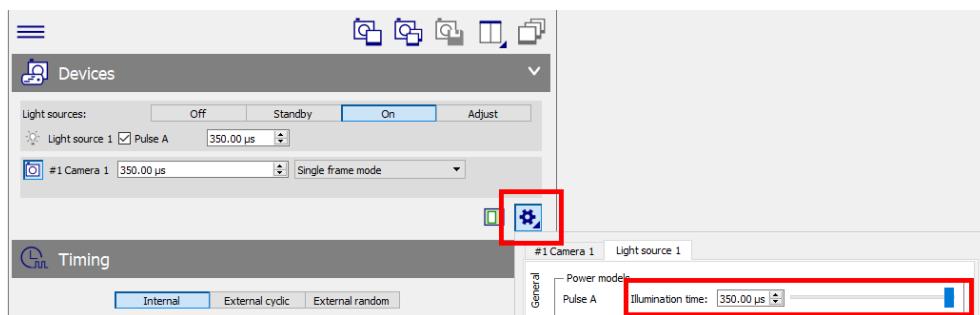
Illumination time

The **brightness** of **LED-Flashlight 300** is controlled by the illumination time: the longer the illumination time, the brighter the light. The **illumination time** can be set in the **Light sources** section of the **Devices** dialog:

DaVis 10.0.3: Tomographic PIV project: Project_Tomographic PIV_180124_091702



or in the devices **Details** dialog:



Note: Remember that there is **no light output** if a duty cycle of **10 % is exceeded** in the '**Pulsed-Overdrive Mode**'. In this mode the illumination time needs to be $\leq 10\%$ of the **recording period** ($= 1 / \text{recording rate}$).

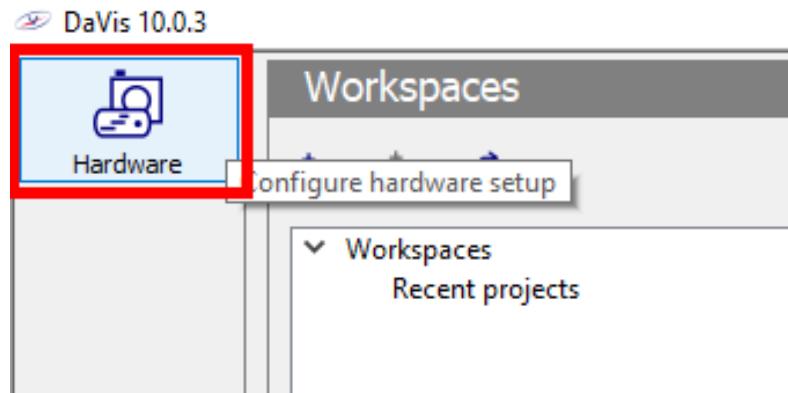


10.3 DaVis 10.0.5 low-speed and 10.1.0 and later (high- and low-speed)

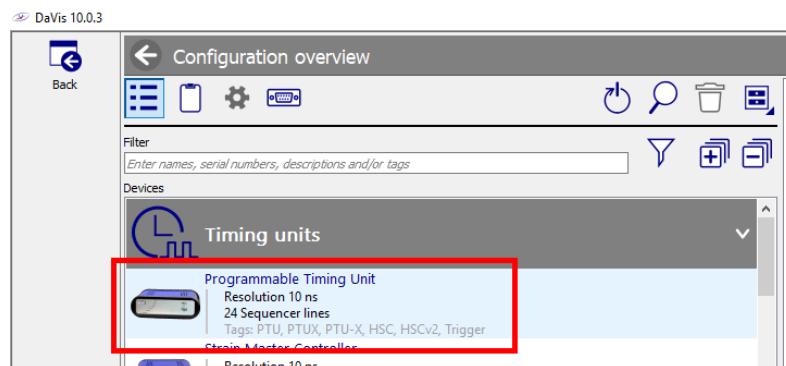
In **DaVis 10.0.5 low-speed and 10.1.0 and later (high- and low-speed)** the LED is controlled as a dedicated **LED-Flashlight 300** device. This allows remote control of the power mode ('Free Trigger' or 'Pulsed Overdrive'). Moreover, the recording dialog makes sure that 10% duty cycle is not exceeded in the Pulsed Overdrive Mode.

10.3.1 Setup

Enter the hardware **Setup** dialog to configure **LED-Flashlight 300** in **DaVis**:

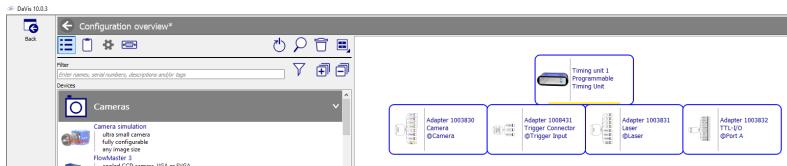


First, add a PTU to the setup (if not already present). Select the PTU from the list of devices:

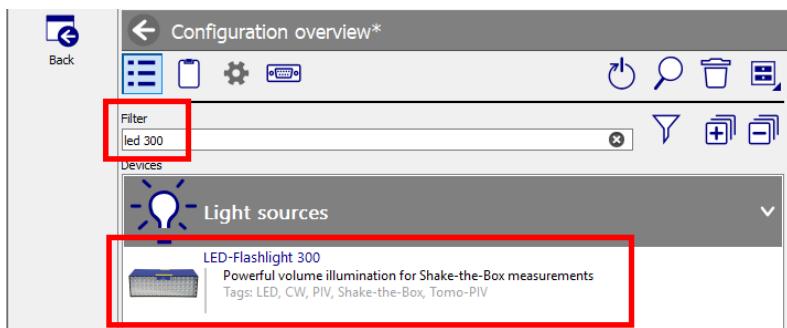


10.3 DaVis 10.0.5 low-speed and 10.1.0 and later (high- and low-speed)

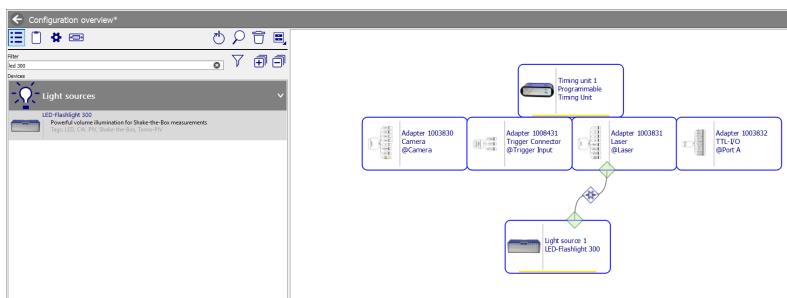
and drag it to the main window (right):



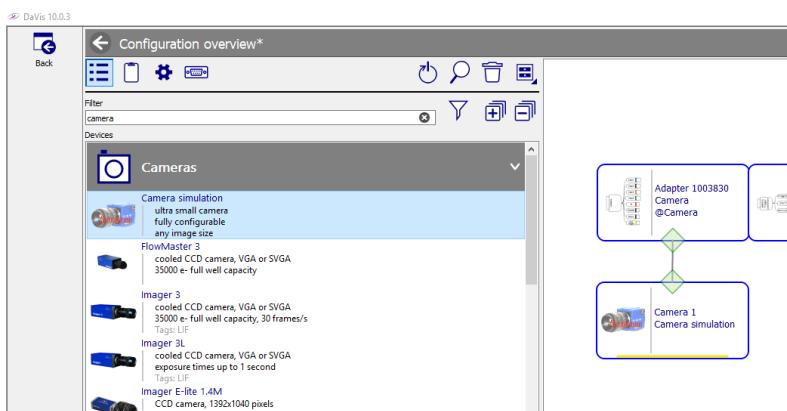
Search for **LED-Flashlight 300** in the device list (e.g. by typing "led 300" in the **Filter** field):



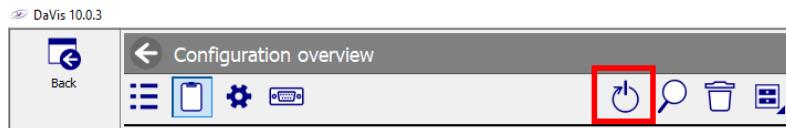
and drag the **LED-Flashlight 300** to the main window (the correct default connections to the PTU are generated automatically):



Add at least one camera from the device list:

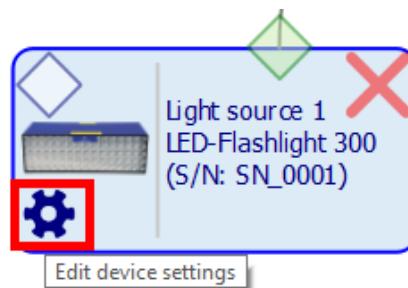


Press the **Initialize** button in the tool bar:

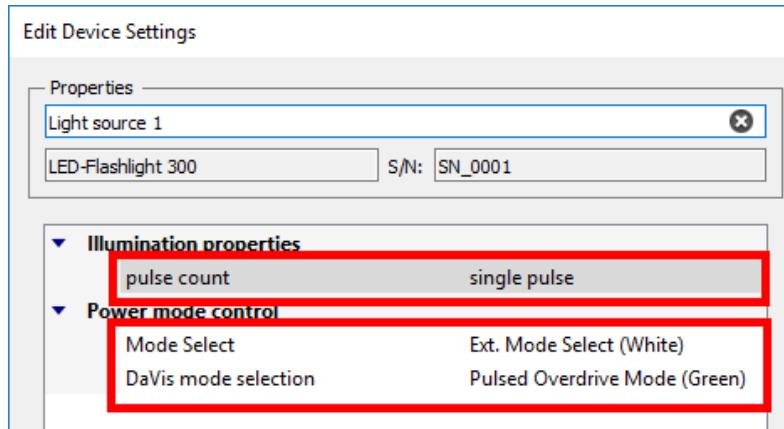


and wait for the initialization to complete.

Now press the 'Edit device settings' button for **LED-Flashlight 300**:



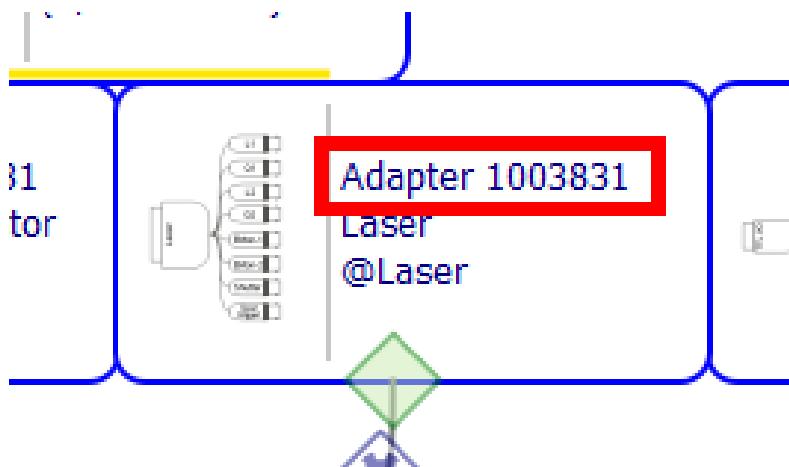
Set all parameter settings in the upcoming dialog according to the desired recording and operation mode:



- **pulse count:** select 'single pulse' or 'double pulse' according to the desired recording mode
- **Mode select:** select the LED pulse mode that is currently active on the LED module (see also 6.3):
 - **Pulsed Overdrive Mode (Green):** use this mode when the 'Ext. Mode Select' cable is not connected and the LED module is in the 'Pulsed Overdrive Mode'. The green LED on the rear/control panel is shining. The mode can not be changed from **DaVis** in the recording dialog, the **Davis mode selection** option (see below) is disabled.

- **Free Trigger Mode (Blue):** use this mode when the 'Ext. Mode Select' cable is not connected and the LED module is in the 'Free Trigger Mode'. The blue LED on the rear/control panel is shining. The mode can not be changed from **DaVis** in the recording dialog, the **DaVis mode selection** option (see below) is disabled.
- **Ext. Mode Select (White):** use this mode, when the 'Ext. Mode Select' cable is connected and the LED module is in the 'Ext. Mode Select' mode. The white LED on the rear/control panel is shining. The power mode can be changed from **DaVis** in the recording dialog, the **DaVis mode selection** option (see below) is available.
- **DaVis mode selection:** This option is only available, if the 'Mode Select' (see above) is set to 'Ext. Mode Select (White)'. With this option, the power mode of the LED module can be switched **remotely** from **Pulsed Overdrive Mode (Green)** to **Free Trigger Mode (Blue)** and back. After changing this option, the LED module needs a few seconds to switch the power mode (LED's on the rear/control panel are flashing), during this time, no light can be emitted. This option can also be changed in the recording dialog.

Make sure that the **number** of the laser connector **in the software**:



is the **same as on the connector:**



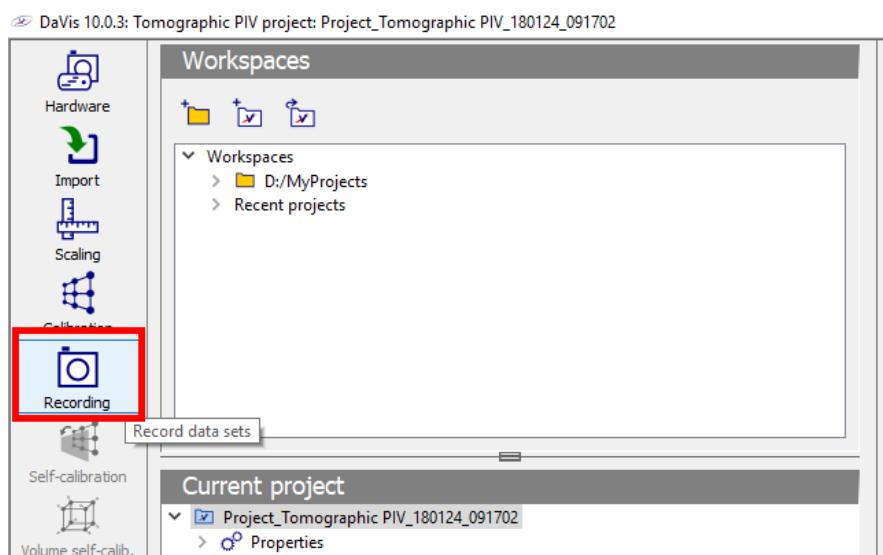
10.3.2 Recording

This section describes the usage of **LED-Flashlight 300** during image recording. It shows how to:

- turn on and off the light for recording
- set up illumination time and pulse rate for the illumination

First, enter the recording dialog by clicking the **Recording** button in the tool bar:

DaVis 10:



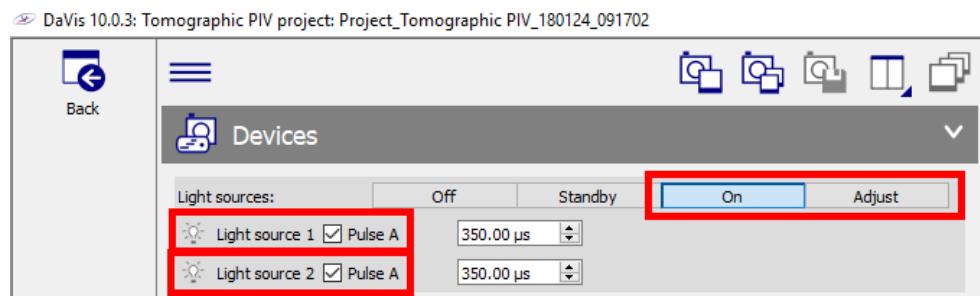
Switching light on and off

Four different **light source modes** can be selected in the **Light sources** dialog of the **Devices** dialog:



1. **Off:** Light is turned off in idle mode and during recording, no trigger pulses are generated
2. **Standby:** for **LED-Flashlight 300** same as **Off**.
3. **On:** Light is turned on **only during recording** (if the light source is also Active, see below). Trigger signals are generated during recording.
4. **Adjust mode:** Light is turned on **immediately** (if the light source is also Active, see below). Trigger signals are generated immediately.

Multiple light sources can be used in a setup. The **light source modes** described above are controlling **all** installed and configured light sources **at the same time**. To get any light output, the individual light sources need be **activated** additionally (e.g. for two light sources):

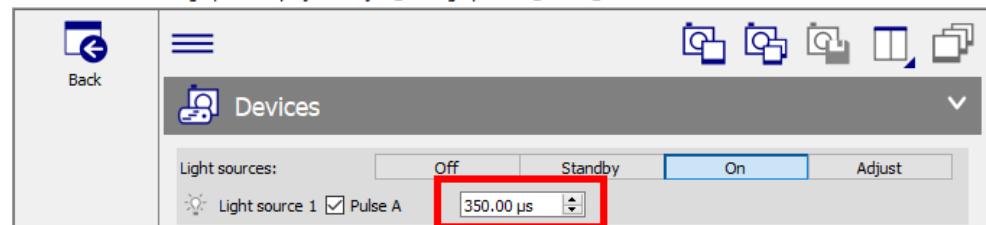


Illumination time

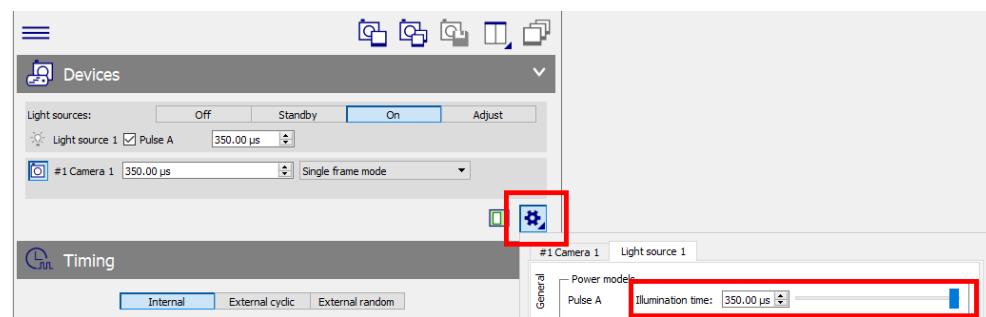
The **brightness** of **LED-Flashlight 300** is controlled by the illumination time: the longer the illumination time, the brighter the light. The **illumination time** can be set in the **Light sources** section of the **Devices** dialog:

Single pulse:

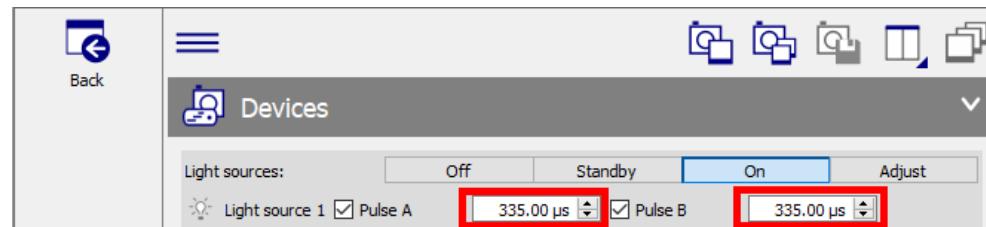
DaVis 10.0.3: Tomographic PIV project: Project_Tomographic PIV_180124_091702



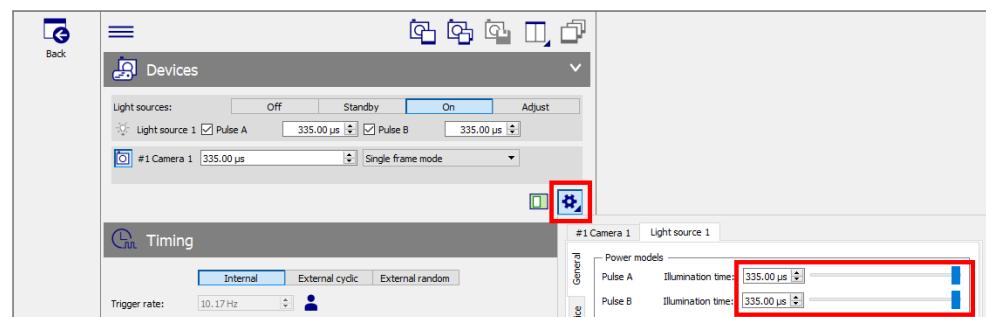
or in the devices **Details** dialog:



Double pulse:

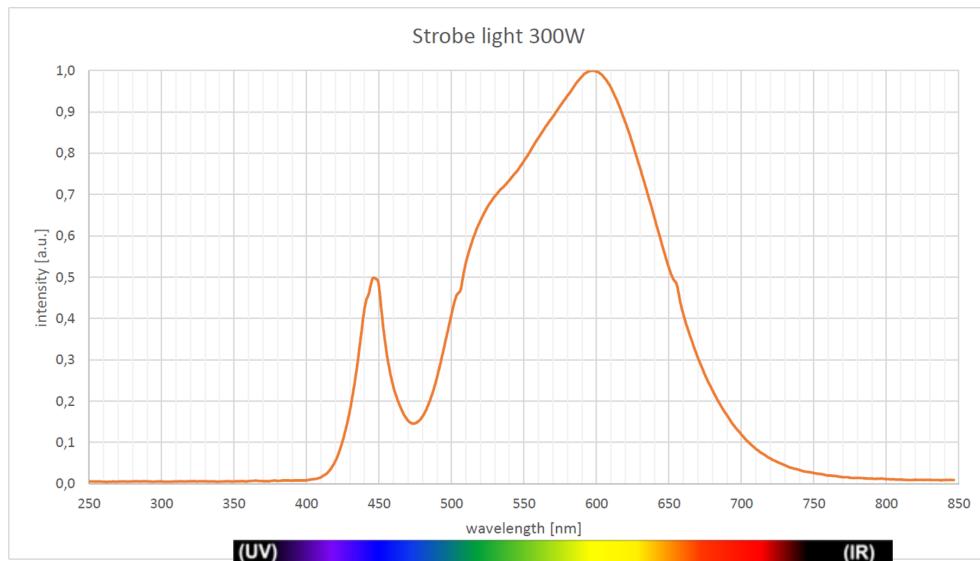


or in the devices **Details** dialog:



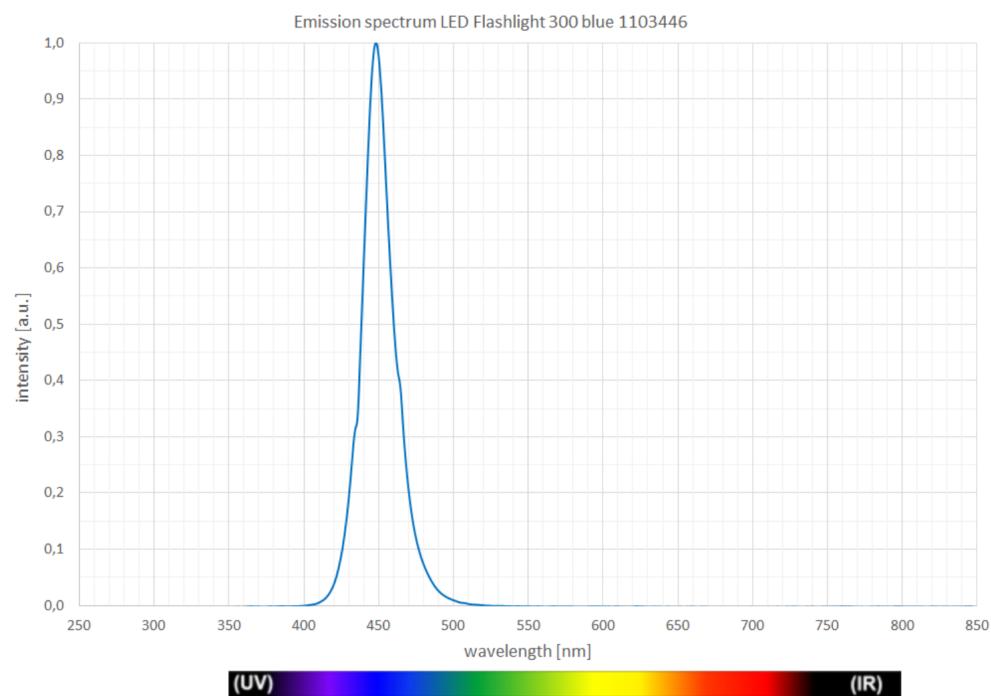
11 Light spectrum

The light intensity spectra of ***LED-Flashlight 300 white and blue*** measured with a spectrometer are displayed in the following figures:



LED-Flashlight 300 white Normalized light intensity (maximum = 1)
depending on light wavelength

LED-Flashlight 300 white has a **warm white** color. There is an intensity peak in the blue (about 445 nm) and the absolute maximum is in the yellow (about 600 nm). There is hardly any intensity in the invisible areas: UV and below, IR and above.



LED-Flashlight 300 blue Normalized light intensity (maximum = 1)
depending on light wavelength

LED-Flashlight 300 blue has a relative narrow band blue color. The peak intensity is at 450 nm, the half maximum width is about 20 nm.

12 Spot Size and Intensity Distribution

The **spot size** and **spot shape** of the LED varies with the distance. Shape and size of the spot have been measured by pointing the LED on a screen and recording the spatial intensity distribution for different distances. The resulting width and height of the spot are measured as the **half maximum width** and displayed in figure 12.1 (red and green curve). It can be seen, that close to the LED (50 cm to 100 cm) width and height are quite different, indicating a more elliptical shape at these distances. Farer away (up to 800 cm) width and height become more similar, the spot becomes nearly circular. Also the peak intensity of the spot is measured for each distance and normalized to the peak intensity at 50 cm distance (figure 12.1 blue curve).

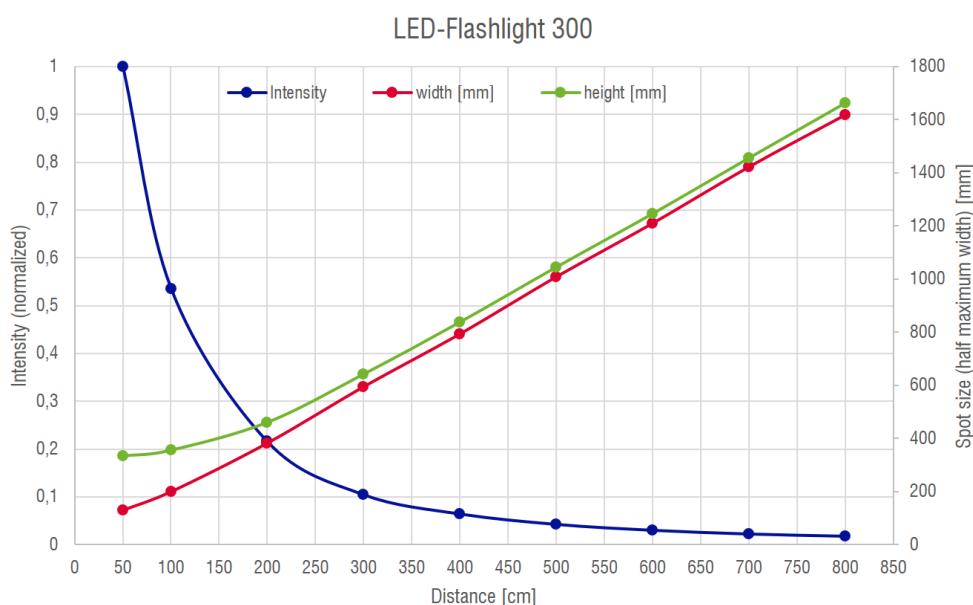


Figure 12.1: Intensity (blue) and spot size (green and red) dependent on LED distance from screen

The following figures display the intensity distribution for different distances from the screen. Displayed is only the **first quadrant**, so that the **center of the light distribution is in the lower left corner**.

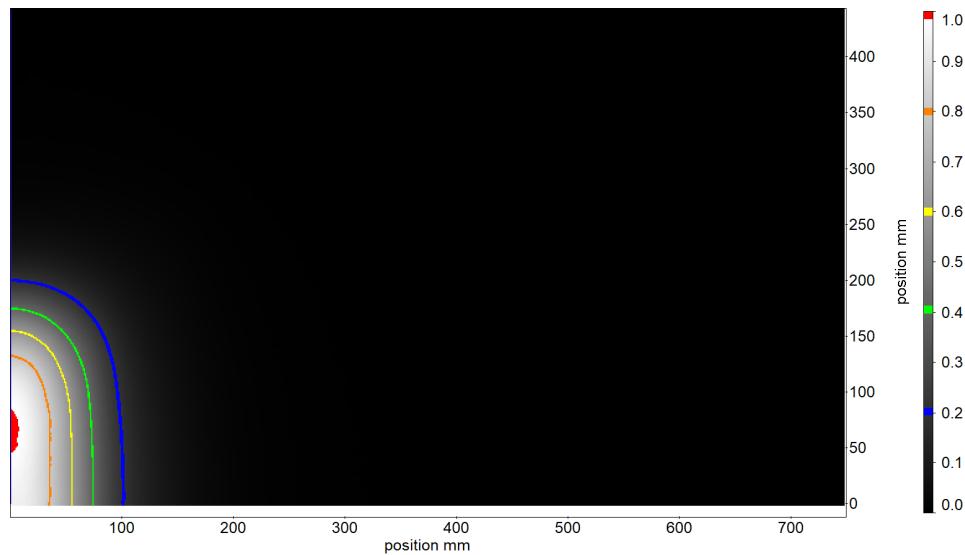


Figure 12.2: Distance of LED from screen: 50 cm

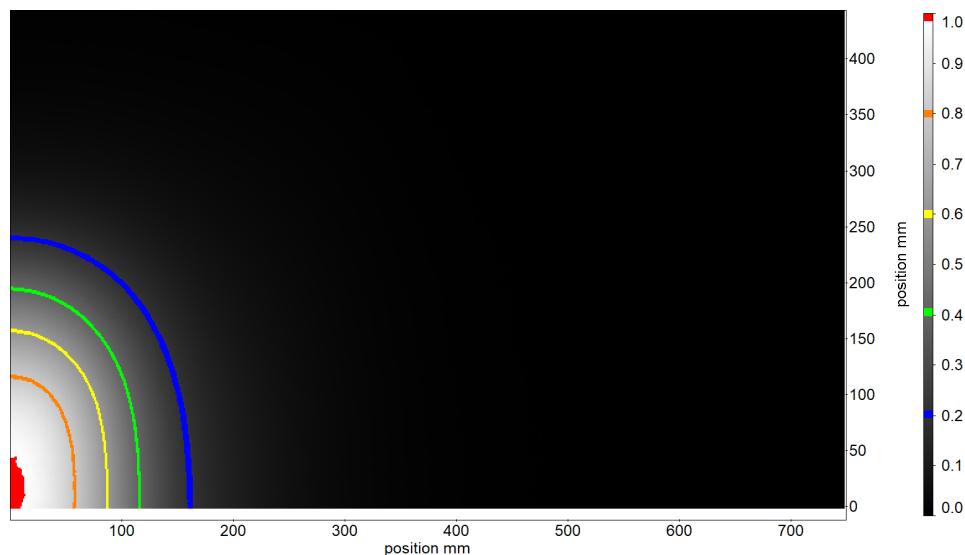


Figure 12.3: Distance of LED from screen: 100 cm

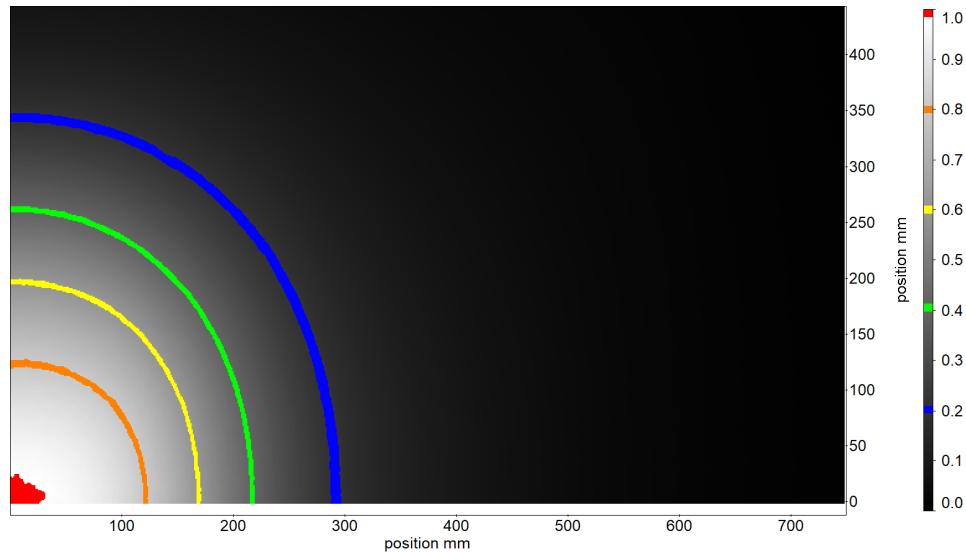


Figure 12.4: Distance of LED from screen: 200 cm

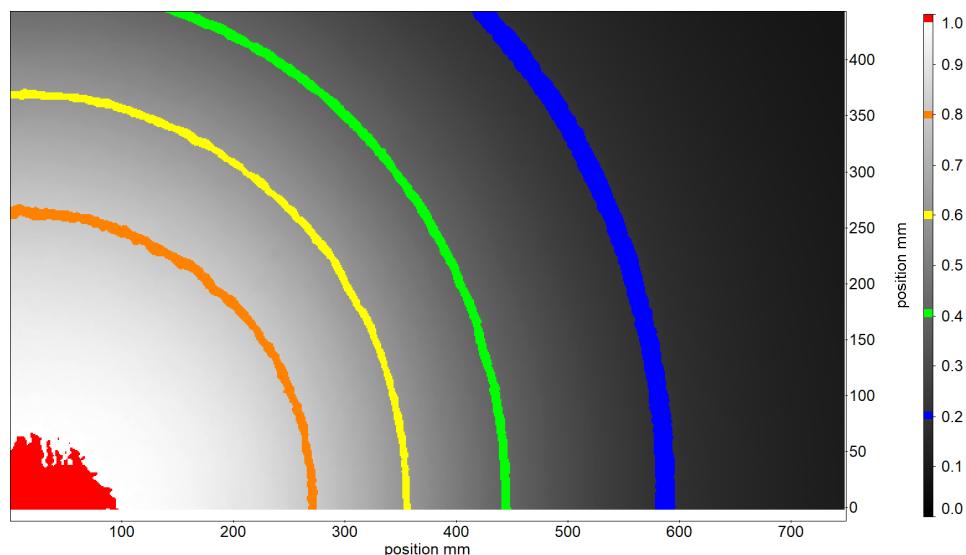


Figure 12.5: Distance of LED from screen: 400 cm

13 Support

If you have a technical problem or a question regarding hardware or software which is not adequately addressed in the documentation, please contact your local representative or **LaVision** service directly.

You can contact service at **LaVision** GmbH by:

e-mail: **service@lavision.de**
phone: **+49 551 9004 229**

Alternatively, you may submit your problem using the **Support Request Form** in the **Support** section of the **LaVision** website www.lavision.com.

In order to speed up your request, please include the following information:

- The order number of your system (see section 13.1).
- The number of the used dongle (see section 13.1).
- A short description of the problem.
- The **LaVision** service file (see section 13.2).
- Some logfiles if you have a reproducible software problem (see section 13.3).
- Information on the Windows operating system and service pack used on the corresponding computer.

13.1 Order and Dongle Number

To be able to find information on the delivered hardware components and customer details in the **LaVision** database, your order number is required. This number can be found in the toolbar menu **Extras – About** or on the original **DaVis** installation medium (see Fig. 13.1).

In the **About DaVis** dialog you find the dongle number and order number information. The **Version ID** is the build number of the **DaVis** version, shown on top of the dialog.

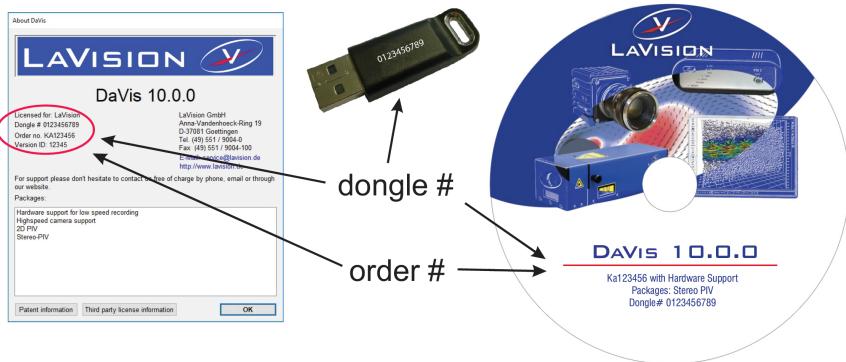


Figure 13.1: Dongle and order no. in **Extras - About** and on the installation DVD.

The dongle number is required to exclude possible license problems. This number is printed on the hardware key as well. The dongle number and the order number can also be found on the original **DaVis** install medium.

Please include the order number and/or the dongle number in your service requests.

13.2 LaVision Service File

In order to be able to reproduce a software problem, it could be essential to know the exact hardware setup and software parameters in **DaVis**. All currently used parameters and all error messages that have been shown since the last **DaVis** start can be extracted using the toolbar menu **Extras - Service - Create service file for LaVision support**.

After you have selected this menu, the system will write all values for the relevant variables into a **LSFX** file. This file will also contain the current settings of the hardware setup, acquisition setup and processing operation lists. The procedure will take some seconds!

The **LSFX** file will be written automatically to a folder selected by the user and the Windows explorer opens at the end with this folder. The name of the file contains the order number and dongle number that is extracted from your software (**#ordernumber_donglenumber.lsfx**). Send the **LSFX** file as attachment to your email together with the description of your problem to service@lavision.de.

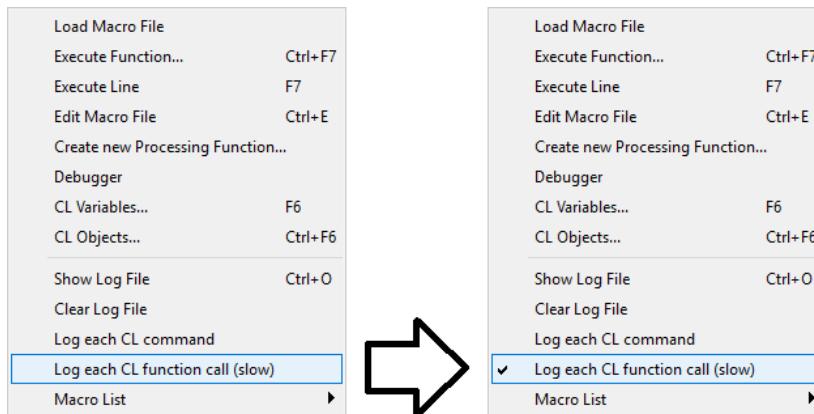
13.3 Log File

During startup of **DaVis**, some log files with names like LOG_<date>_<time>.txt are generated in the **DaVis** subdirectory Users/<name>/log. The name contains date and time of the **DaVis** startup, e.g., LOG_170615_150343.txt.

DaVis holds the last ten log files and removes older ones automatically.

If you have a reproducible software problem in **DaVis**, please send the complete log folder together with your email. These files contain all functions you have called and all error messages that have been displayed after you activated the log. Please proceed as follows:

1. Start **DaVis** and use the toolbar menu **Extras – Macro – Clear Log file**.
2. Enable the **Log each CL function call (slow)** entry in the menu. This feature is active if you see a flag at the left side of the entry. Every time you click on this entry, its status is changed.

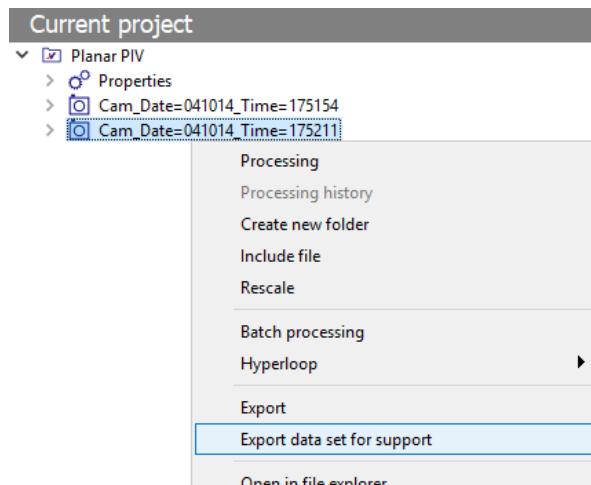


3. Try to reproduce your problem, e.g., until an error message is displayed.
4. A log file has been generated in the **DaVis** main directory. Send this text file attached to your email.
5. Disable mode **Log each CL function call (slow)**. This function is deactivated if you do not see a flag next to the entry.

13.4 Export Data Set for Support

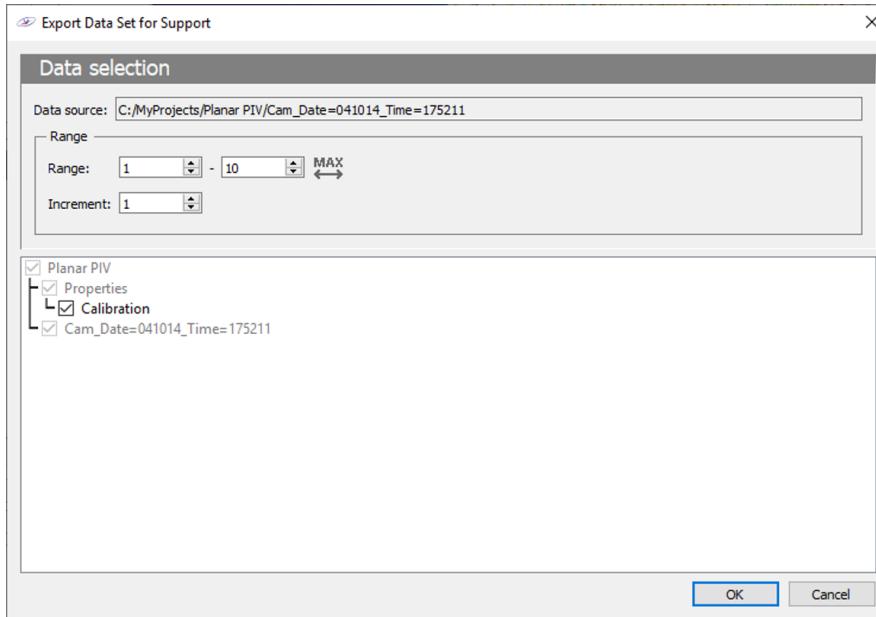
Some problems can only be reproduced using images or data that contain particular information or artifacts. For error analysis, it can be necessary to provide exemplary data that need to be extracted from the corresponding project.

Depending on the project type, the number of cameras used, and the error, it can be necessary to provide the corresponding calibration (spatial, temperature, etc.) and derivative data as well. A convenient way to extract the data from the project is the **Export data set for support** option, which you can select by right-clicking on the corresponding data set in the tree view of the **Project manager**.

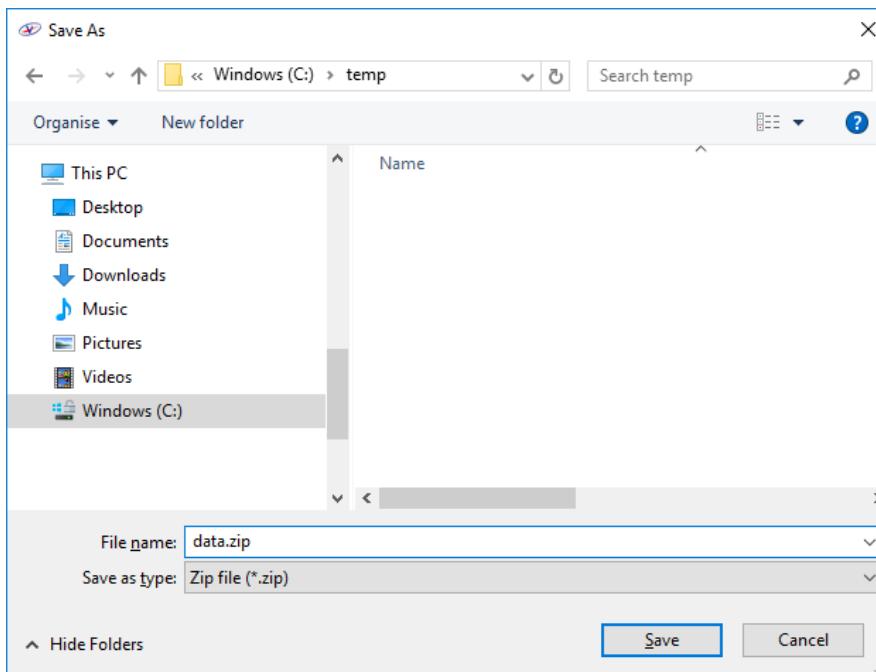


In the **Export data set for support** dialog, specify the range of data which you would like to extract from the data source by entering the range (i.e., first and last image). If a calibration is available in the project, this will be added by default. You have the option to deselect this part if it is not relevant.

13.4 Export Data Set for Support



After clicking the **OK** button, you need to specify location and file name for the zip file that contains the selected data.



DaVis will ask to open the containing folder or to send an email to service@lavision.de.

Note: Files with a size of more than 20 MB should not be sent by email.
LaVision can provide a link for uploading data via file drop. Please contact service@lavision.de for details.

13.5 Shipment of Defective Items

If any item needs to be returned to **LaVision** GmbH for service or repair, please contact the **LaVision** service to obtain a **RMA** (Return Material Authorization) number together with an RMA form. This will list all items with SN and a short description of the problem. Place the RMA form in the box with the item(s) being returned. Return the authorized item(s) according to the shipping instructions.

Shipping instructions:

- Be sure to obtain an RMA number and RMA form.
- Add the signed RMA form to the shipping documents.
- Ship only the items that are authorized.
- Use the original boxes to avoid damages during transportation.
- **Remove cooling water from the laser!**
- **Use antistatic bags for computer boards!**
- Ship returned items to:

LaVision GmbH
Anna-Vandenhoeck-Ring 19
37081 Göttingen
GERMANY

Note: Shipments received by **LaVision** without an RMA number may be refused.



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