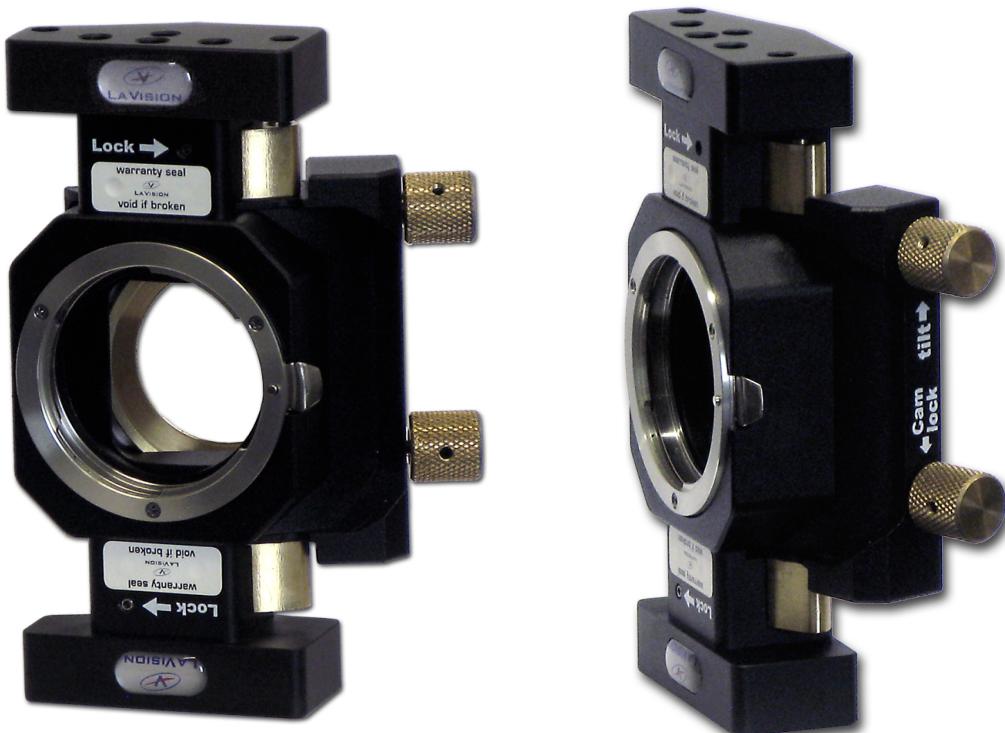


Product Manual

Scheimpflug Mount Version 3

Item Number(s): 1108176



Product Manual for **DaVis 10**

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Product specifications and manual contents are subject to change without notification.

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.

2 Introduction

In 1904 Theodor Scheimpflug, an Austrian Army Officer, patented several cameras for correcting the undesired distortion in photographs taken from balloons when the camera viewing direction was not perpendicular to the ground. The problem of the oblique viewing direction is the limited depth of field which can be accommodated by additionally tilting the image plane in respect to the orientation of the camera lens and light sheet according to Fig. 2.1.

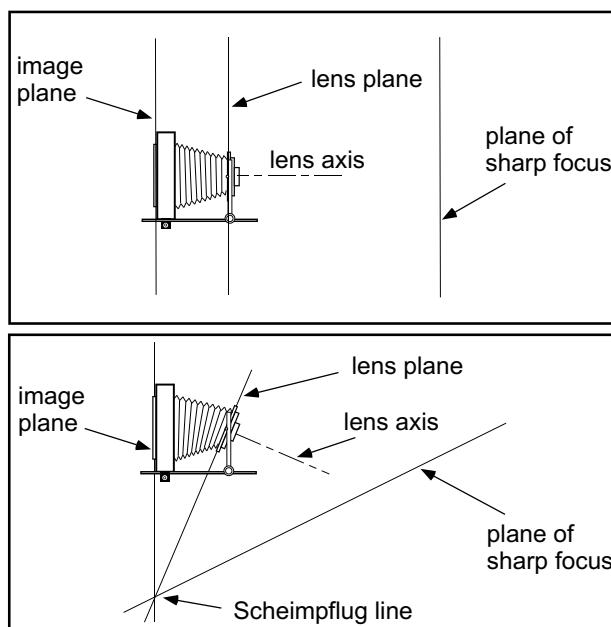


Figure 2.1: Scheimpflug criterion.

According to the Scheimpflug criterion the image plane, the lens plane and the object plane for each cameras has to intersect in a common line, the so called Scheimpflug line. Unfortunately this arrangement has the side effect of introducing a strong perspective distortion. The factor of magnification is no longer constant across the complete field of view and needs additional calibration. Packing list, delivered items:

- This manual
- Scheimpflug unit with M42 adapter installed
- C-mount adapter

3 Scheimpflug Mount

3.1 Installation

The **LaVision** Scheimpflug unit consists of the housing and contains a tilt mechanism and a 360° rotation mechanism. Several mounts for different cameras are provided.

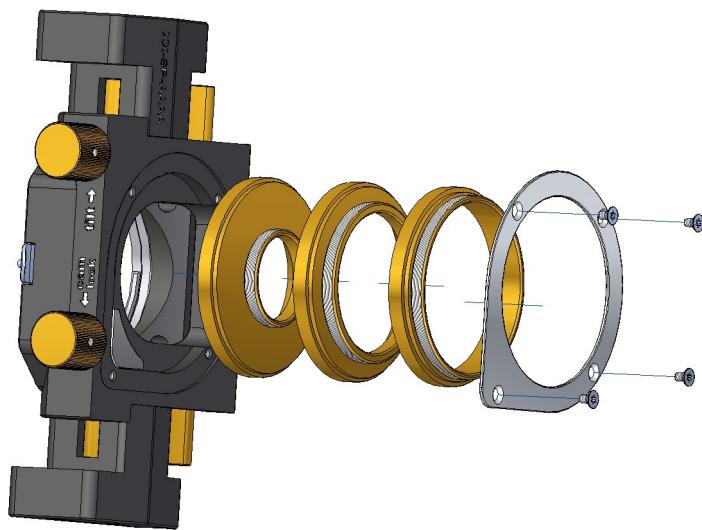


Figure 3.1: Brass adapters for different camera types.

1. C-mount, included
2. M42-mount (for e.g. Imager Pro X, Imager Intense cameras), included
3. M48-mount (for Imager Pro LX cameras), optional

To exchange to another brass adapter for a different camera type loosen the 4 allen screws at the Scheimpflug. Apply the suitable camera adapter and fasten the 4 screws again (see fig. 3.1). Mount the Scheimpflug unit on the camera by using the brass mount's thread. Depending on the camera type which is used the knobs at the side have to be removed.

3.2 Adjustment of the Scheimpflug angle

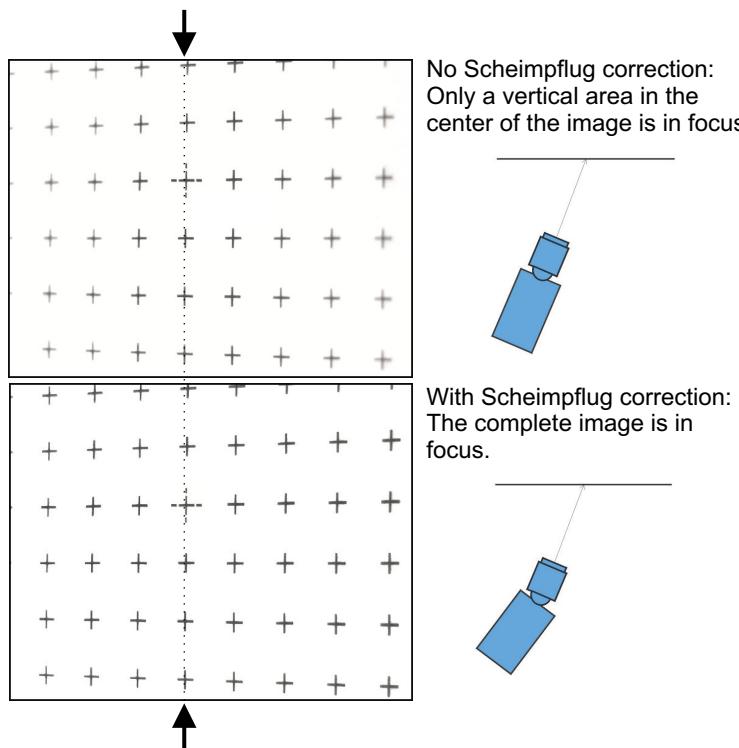


Figure 3.2: Adjustment of Scheimpflug angle.

The adjustment of the Scheimpflug adapter can be done empirically. Arrange a calibration plate in the light sheet position and select a large aperture of the camera lens (i.e. small #f-number). The large aperture will reduce the depth of field and makes the alignment more sensitive. Focus the camera lens in the middle of the area of interest. Since the Scheimpflug mount is not properly aligned only a narrow vertical band will imaged focused. Tilting the Scheimpflug mount to the direction according to the Scheimpflug criterion will result in a wider focused range. Proceed in tilting the adapter as long as the focused area is increasing. Maybe refocusing and adjustment of the camera viewing direction becomes necessary. Stop the procedure as soon as the complete area of interest is focused and select a suitable aperture for image acquisition. A reduction of the aperture will even increase the focused area as the depth of field increases.

References

Prasad AK, Jensen K (1995) "Scheimpflug stereocamera for particle image velocimetry to liquid flows", Appl. Optics, 34, pp . 7092-7099.

3.3 Operation

LaVision's Scheimpflug is designed to work with any camera lens which has a Nikon f-mount Bayonet connection. The camera can have either a standard C-mount thread or a M42 thread in front of the image sensor as long as these treads keep the standard C-Mount back focal length of 17.6 mm. The Scheimpflug angle is changed by tilting the camera's CCD plane with respect to the lens plane. The Scheimpflug axis is thus always positioned inside the image plane. A free choice of the orientation of this axis in the image plane is given by rotating the Scheimpflug unit with respect to the camera.

The free choice of the Scheimpflug axis (or Scheimpflug angle) is necessary for oblique camera viewing directions, when cameras are positioned anywhere in space but not only horizontally (classical stereo set up) separated.



Figure 3.3: Adjustment knobs and (tilt) lock screws.

Tilt: Turn this knob to adjust the Scheimpflug angle

Cam lock: Unlock this knob to rotate the Scheimpflug with respect to the camera. After adjustment lock this knob to avoid unwanted rotation. If the knobs are removed please use suitable allen keys.

(Tilt) Lock: Unlock the Scheimpflug unit by unbolting the 2 grub screws labeled with "lock" before tilting the Scheimpflug unit. If the Scheimpflug is used in horizontal orientation it is not necessary to fasten the lock at all. Only if vibrations are expected at least one grub screw should be tightened after the Scheimpflug angle's adjustment to avoid movement. Never change the Scheimpflug angle with the lock screw fastened! The adjustment mechanism would be destroyed!

3.4 Mounting

For cameras up to 2 kg weight the assembly consisting of camera and Scheimpflug can be mounted at the Scheimpflug on a tripod (1/4-20 UNC thread) or on LaVision's optical profile systems (M6 threads). Please consider the drawing of the base plate, Fig. 4.2 in Chapter 4, for details.

Cameras which can be mounted this way (via the Scheimpflug) are the camera families E-lite, Imager Pro (X, LX, Plus), Imager (Intense, compact).

Note: Almost all High speed cameras are too heavy, e.g. HighSpeedStar family, Phantom series. In this case the assembly must be mounted at the camera.

If the camera-Scheimpflug assembly (only for cameras up to 2 kg) is mounted at the Scheimpflug's base plate, the lens will keep in position during adjustment of the Scheimpflug angle. The visible field of view will not change, only the image sensor will be tilted. The camera can be turned around its optical axis by dismantling the **Cam lock** knob. This way, the orientation of the sensor format can be adjusted to the field of view. The orientation of the Scheimpflug angle with respect to the measurement area is defined by the mounting and can be changed e.g. by tilting the tripod head (if one is used for mounting). The same camera-Scheimpflug assembly can also be mounted at the camera base plate.

In this case the orientation of the Scheimpflug angle can be adjusted by turning the Scheimpflug unit around the optical axis of the camera (loosening the **Cam lock** knob). In this configuration the lens will move during the Scheimpflug angle adjustment and the visible field of view changes.

For suitable mounts please contact LaVision.

The lens tilting is possible only to one side from 0° until about 20°. If a tilting to the other side is wanted the unit has to be mounted upside down. If the Scheimpflug unit is mounted on a suitable tripod or profile system (and not the camera) the Scheimpflug has to be mounted vice versa.

By using the Scheimpflug unit in connection with larger cameras e.g. high speed cameras or cameras without distant flanges it is necessary to remove the brazen knobs for "cam lock" and "tilt" on the side to avoid collisions between the Scheimpflug unit and camera housings.

For tilting and locking the camera rotation use a suitable 1.5mm allen key.

3.4 Mounting

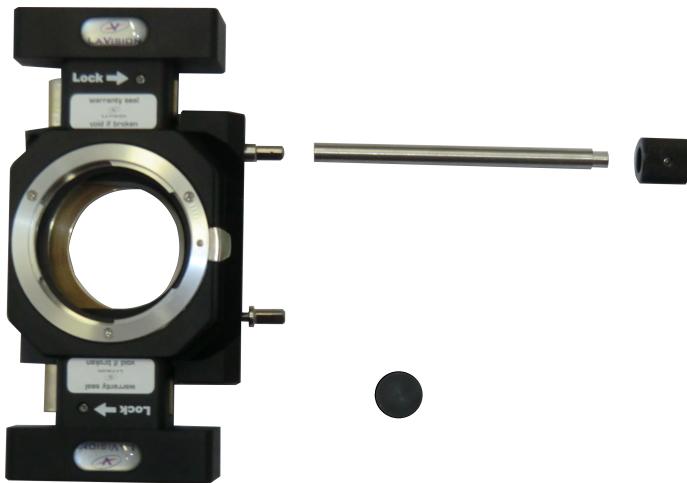


Figure 3.4: Using the Scheimpflug unit without brazen knobs.

For a safe mounting of the Scheimpflug V3 on a Manfrotto 3D Super Pro head is a special adapter available. It can be mounted instead of the standard accessory plate.

For mounting the adapter on the Scheimpflug two M6x35 and one 1/4"-UNC x 3/4" screws are needed (included). Suitable allen keys are 3/16" and 5 mm (not included).



Figure 3.5: Adapter plate.

4 Dimensions

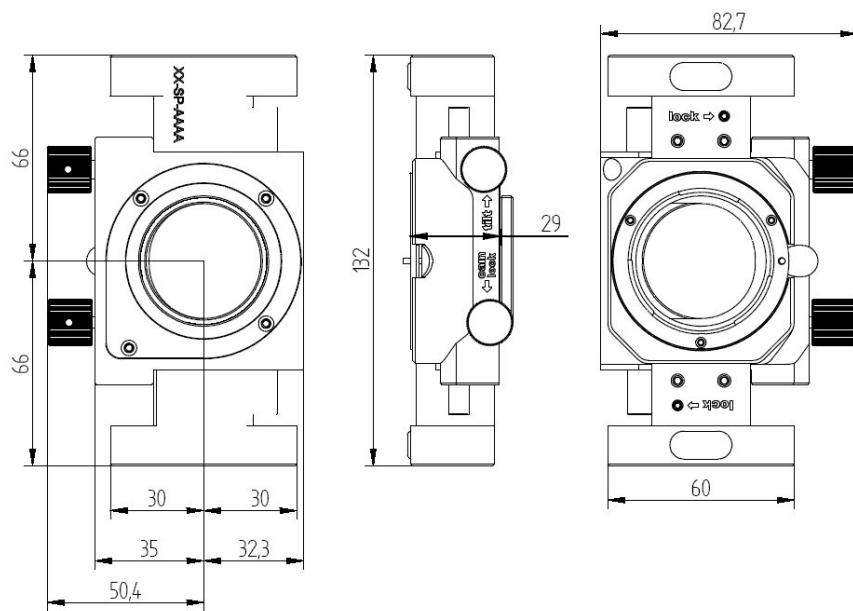


Figure 4.1: Dimensions.

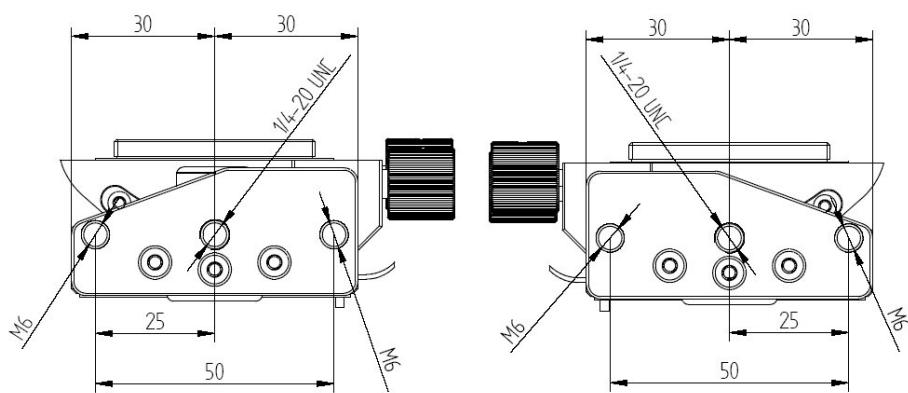


Figure 4.2: Base plate layout.

5 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.
- The number of the used dongle (if available).
- Article number (if available).
- Serial number (if available).
- A short description of the problem.

5.1 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.
- **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.



LAVISION
FOCUS ON IMAGING

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