Laboratory Microscope H 600

Operating Instructions

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Contents

General Remarks

Congratulations on your decision for a high-quality product of the Helmut Hund GmbH, Wetzlar. Our name represents long-time experience and excellence in the development and production of microscopes and accessories.

Please compare the delivery carefully with the delivery note, the packing note or the invoice. Please keep a copy of these documents together with this manual for future reference regarding additional information, available accessories, or service works. This will give you quick access to the date and the extent of delivery.

Please make sure that no small parts remain in the packing material!

Please be informed that our systems are adjusted and centred in the factory. They are ready-for-use immediately after installation.

Please read this manual carefully before you set the instrument in operation. We recommend that you keep this manual together with the instrument for quick reference.

Whenever the microscope needs to be sent back to the factory, e.g. in case of repairs or for maintenance purposes, please make sure that the instrument is cleaned and disinfected – if necessary.

Cleaning instructions can be found in the respective section of this manual.

Important Information

The laboratory microscope H 600 along with its accessories is an in-vitro diagnostic medical device (IVD) under the terms of the German Medical Product Law (§3 Abs. 4 MPG) when applied for the examination of samples from the human body.

According to the German Medical Device Operator's Ordinance (§2 Abs. 5 MPBetreibV), the user of a medical device has to assure himself of its operability and that it is in good order and condition. Also, the user has to follow the operating instructions and all additional information regarding safety and maintenance.

The supplied microscope configuration contains means that allow the user to align the microscope for Köhler illumination. This manual describes this procedure in detail.

The manufacturer of the IVD is not responsible and not vicariously liable for all information, valuations, diagnoses, etc. resulting from its application.

Symbols used throughout this manual

Special remarks in this manual are indicated by one of the following symbols:

	Safety remark
	Caution! Faulty operation may lead to damage of the microscope and/or its accessories!
	Danger! Hazardous voltages!
	Explaining remark

1. Environmental conditions

The laboratory microscope H 600 is a high-quality optical device that reaches its full performance only in a very clean environment. To avoid excessive contamination, the microscope should be installed in a dust-free room. It should be protected from:

- high relative humidity,
- oil fumes,
- large temperature variations,
- incident light of high intensity.

2. Unpacking and installation

The laboratory microscope H 600 is adjusted in the factory and shipped in a secure packing. Figure 1 shows how the microscope is packed. After having opened the packing, please make sure that the delivery is complete and that no transport damage has occured to the microscope.

In case of complaints, please contact the Helmut Hund GmbH, Wetzlar, Germany, or the supplier immediately.

	Please make sure not to touch any of the optical surfaces during the assembly of the microscope. Fingerprints result in microscopic images of reduced quality. Extreme contaminations may lead to scratches in the optical surfaces when you try to clean them!

	**Operation remark:** **The device may only be set into operation and/or operated by qualified personnel!**

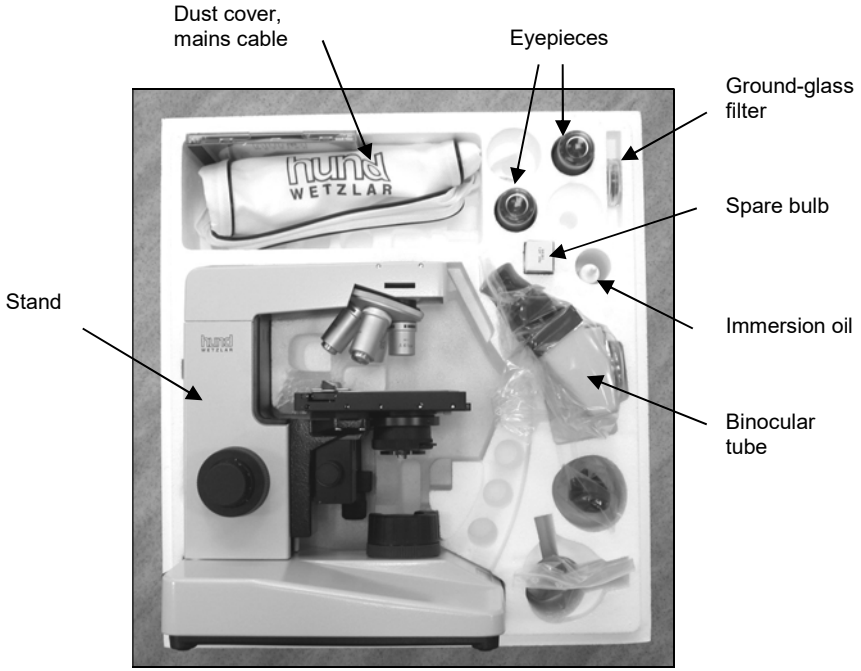


Fig. 1: Laboratory microscope H 600 in its packing.

!	The microscope is shipped with all tools that are necessary for, e. g., mounting the microscope, exchanging the condenser or replacing the halogen lamp. Alternatively, standard tools can be used (screwdrivers, Allen keys).

To assemble the microscope, take it out of its packing and place it on an even, solid and vibration-protected surface.

2.1 Mounting the binocular observation tube

Insert the observation tube into the upper receptacle of the microscope stand (Fig. 2). Turn the eyepieces into the direction of the observer and fix it with the knurled fixing screw.

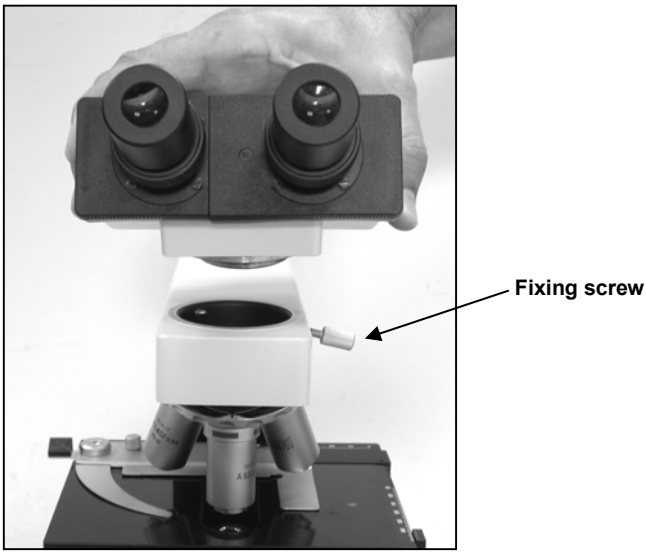


Fig. 2: Mounting the observation tube.

!	Do not cant the observation tube in the receptacle of the microscope stand! This may result in damage to both tube and stand!

Remove the dust covers from the eyepiece tubes and insert the eyepieces.

!	When the fixing screw is unlocked, the observation tube can be rotated 360°. It can be locked in every position. The viewing angle is 30°.

2.2 Adjusting the binocular observation tube

The distance of the eyepiece tubes can be adjusted to the observer's individual interpupillary distance by pulling apart or pushing together the knurled edges of the tube covers. When viewing with both eyes, please make sure that you do not see a double image, only **one** image.

Upon changing the interpupillary distance, the position of the intermediate image in the eyepiece tubes shifts as well. To compensate this, the observation tube carries a scale with values between 55 and 75 which gives the interpupillary distance in mm (Fig. 3). Its value, e. g. 65, must be transferred to the eyepiece tube by adjusting the diopter (Fig. 4).

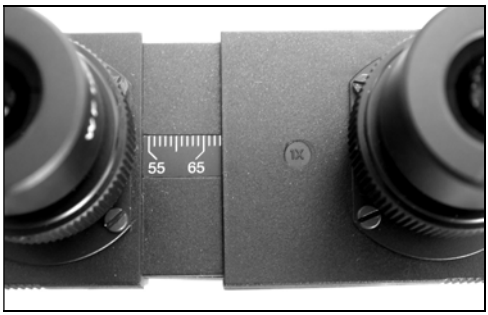


Fig. 3: Scale for adjusting the interpupillary distance.

Fig. 4: Eyepiece scale.

With different acuities of both eyes, the image will generally not be sharp in both eyepiece tubes simultaneously. For an optimal focus adjustment in both eyepieces, focus the specimen by using only the left eyepiece. Then, close your left eye and observe the specimen with the right eye through the right eyepiece. If the image is not in focus, turn the diopter adjustment ring of the right eyepiece tube until it becomes sharp.

The microscope comes with a pair of eyepiece cups to be attached to the eyepieces. (Fig. 5). They reduce disturbing ambient light that may fall into the eyepieces.

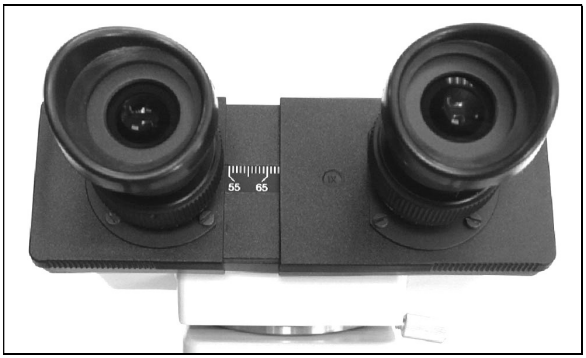


Fig. 5: Attached eyecups.

2.3 Inserting/replacing the condenser

!	New and serviced microscopes have their condensers centered and adjusted in the factory.

Should it be necessary to replace or re-insert a condenser, first move it downwards with the condenser drive knob so that the knurled screw for fixing the condenser can easily be reached. (Fig. 6).

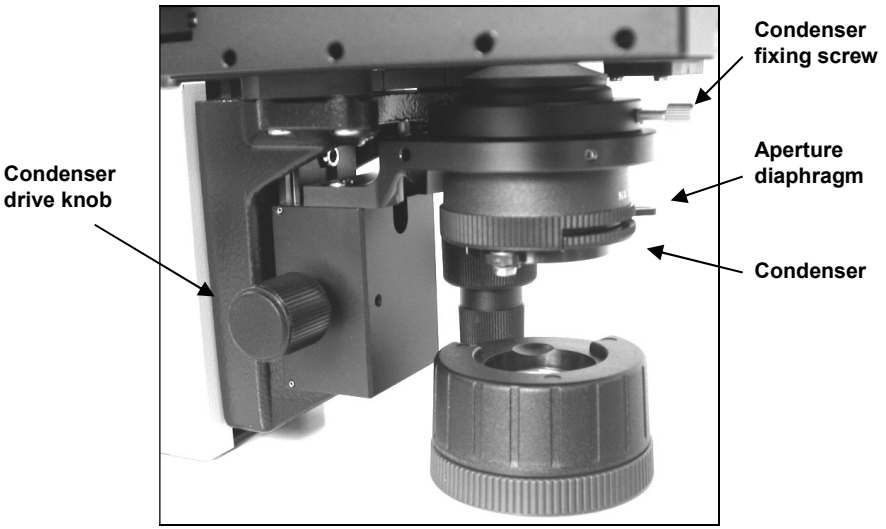


Fig. 6: Condenser and condenser holder.

- Unlock the condenser fixing screw and hold the condenser in place to prevent it from falling down on and possibly damaging the illumination tube.
- Carefully remove the condenser from of its holder. Rotate the condenser slightly while pulling it downwards.
- Carefully insert the replacement condenser into the condenser holder and push it upwards as far as it will go.
- Lock the condenser with the condenser fixing screw.
- Move the condenser upwards again until it reaches its upper stop.
- Open the condenser's aperture diaphragm by moving its lever until it reaches its left stop.

!	Do not cant the condenser when you remove it from or insert it into its holder!

2.4 Electrical connection

Please make sure that the voltage indicated on the label of the microscope or on the external power supply corresponds with the output of the power socket.

	Do not connect microscope or power supply and power socket if both voltages do not correspond! The **mains cable** as well as possible extension cables must be equipped with safety plugs with protective-earth contacts**! The external power supply** comes with adaptors for the most important connector standards.

Only if these conditions are met, insert the mains cable into the corresponding connector on the back side of the stand base and connect it with the power socket (Figs. 7 and 8).

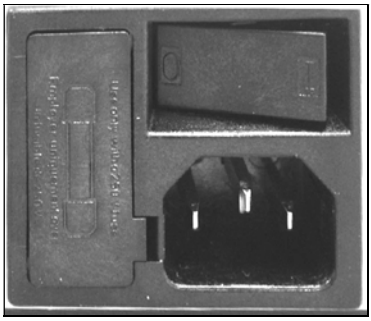


Fig. 7: Mains connector with on/off switch and fuse (left).

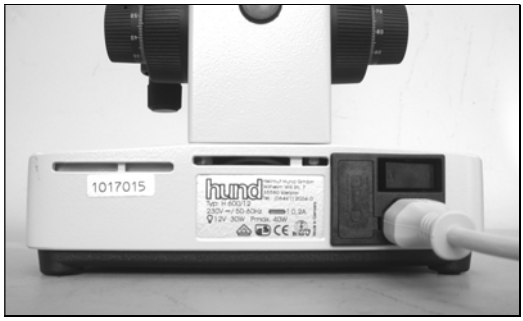
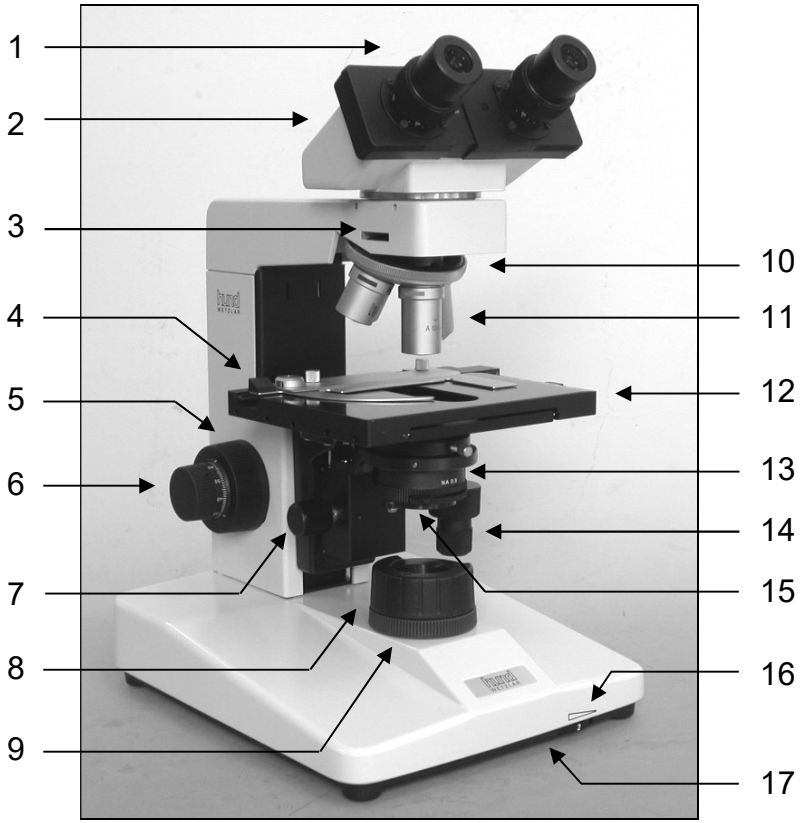


Fig. 8: Plugged mains cable.

3. The laboratory microscope H 600



1	Eyepiece tubes with eyepieces	**10**	Nosepiece
2	Binocular observation tube	**11**	Objective
3	Filter slit	**12**	Microscope stage
4	Specimen holder	**13**	Condenser, aperture diaphragm
5	Focusing drive, coarse	**14**	Stage drive (x/y)
6	Focusing drive, fine	**15**	Filter holder, condenser
7	Condenser drive	**16**	Intensity control
8	Illumination tube	**17**	Access for bulb replacement
9	Adjustment ring field diaphragm		(bottom of stand base)

3.1 Illumination

The laboratory microscope H 600 is available with three transmitted-light sources: The standard source is a halogen lamp 12 V / 30 W. Alternatively, the microscope can be equipped with a 3-W, high-power LED. In both cases, the light source is located in the stand base, directly beneath the illumination tube. Its brightness can be regulated with the adjustment wheel on the front side of the stand base (Fig. 9). The position of the lamp has been adjusted in the factory and does not require any readjustment, even after a lamp change.

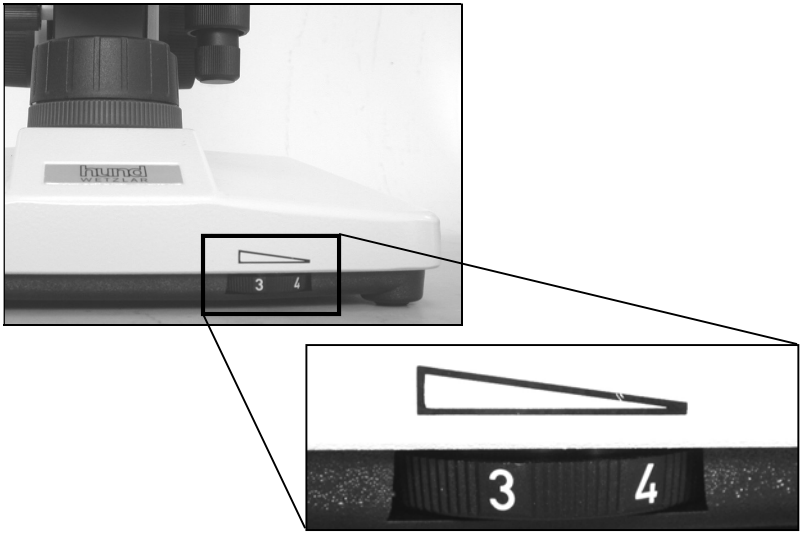


Fig. 9: Brightness control wheel.

If more light intensity is required, e. g. for strongly stained specimens or for darkfield microscopy, a 100 W halogen lamphouse can be employed. The external lamphouse reduces thermal load of the microscope to a minimum (Fig. 10). The brightness of the illumination can be regulated either electronically via the connected power supply, or optically via a variable attenuator (grey filter) between lamphouse and microscope stand.

The light of the 100 W lamphouse is guided from the collector to the illumination tube by means of a light guide (Fig. 11). As this widely blocks the infrared

spectrum of the lamp, the thermal load of the specimen is also minimized. This is a necessity particularly in the observation of native specimens.

!	Adjusting the light intensity with the variable attenuator will not result in changes of the color temperature, in contrast to an electronic adjustment. **In all applications that require intensity variations at constant color temperatures, the potentiometer knob should be set to maximum intensity.** Then, intensity variations should only be carried out with the variable attenuator.

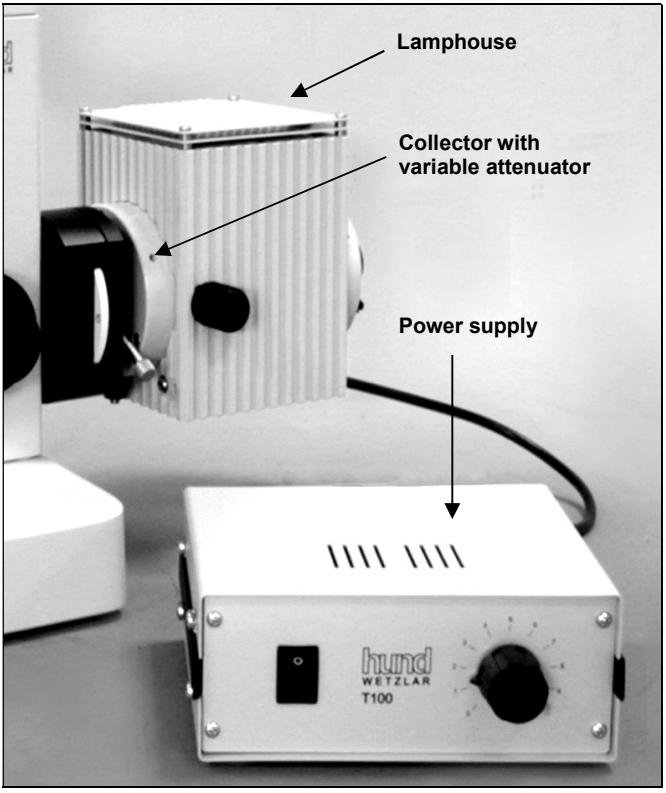


Fig. 10: 100 W halogen illumination with lamphouse, variable attenuator and power supply.

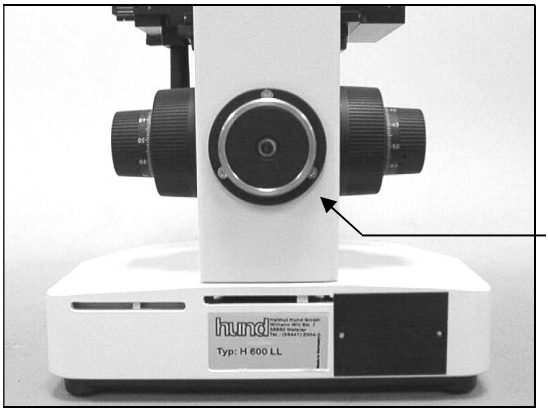


Fig. 11: Back side of microscope stand with light guide connector.

To mount the 100 W halogen illumination, first attach the collector to the dovetail at the back side of the microscope stand (Fig. 12), align and fix it with the knurled screw.

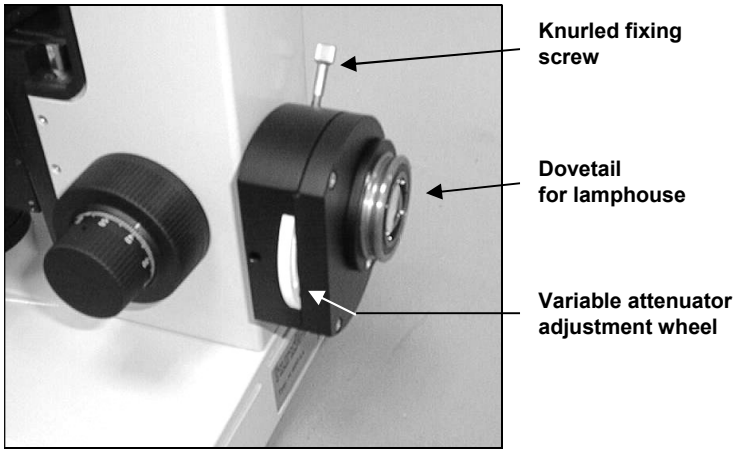


Fig. 12: Mounting the collector.

!	Do not cant the collector when you mount it!

The lamphouse is mounted to the collector's dovetail and also fixed with a knurled screw. Figure 13 shows the correctly mounted illumination unit.

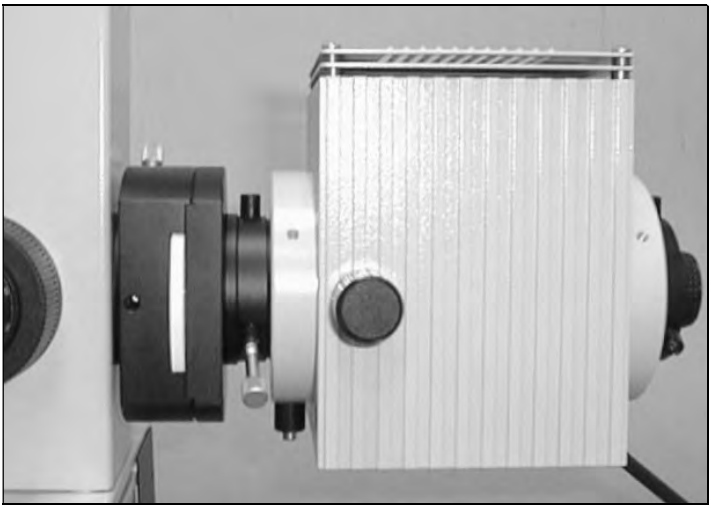


Fig. 13: Correctly mounted collector with lamphouse.

Connect the power supply cable of the lamphouse with the corresponding socket on the back panel of the power supply and the power supply with mains.

The bulb has been centered in the factory. After a bulb change, however, it may be necessary to center and adjust the illumination. Then, proceed as follows:

- Connect the lamphouse with its power supply.
- Connect the power supply with mains.
- **Do not switch the lamp on yet!**
- Loosen the knurled screw and remove lamphouse from the collector.
- Insert the centering keys into the centering screws of the lens at the light exit aperture (Fig. 14).

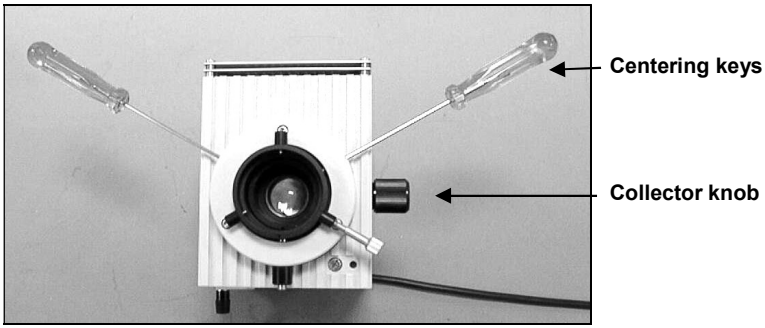


Fig. 14: Centering the light exit aperture lens.

- Center the lens exactly to the center of the light exit aperture (Fig. 15).
- **Switch the lamp on and adjust it for medium brightness.**

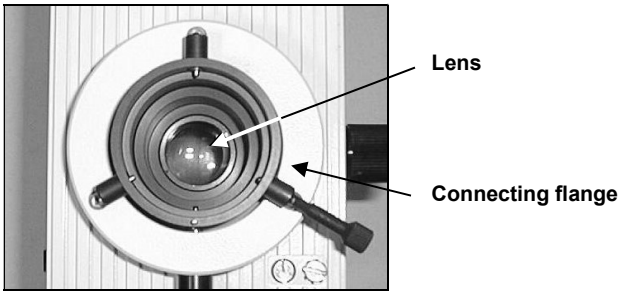


Fig. 15: Centering the lens.

⚠	Although the eyelid closure reflex protects the eye from high light intensities, **avoid to stare directly into the light exit aperture**. When you align the lamp, always hold the aperture **away from you**. **Before you remove the lamp from the microscope, always switch it off and disconnect it from the power supply!**

⚠	**Danger of burns! Do not touch** the lamphouse when it has been in operation for some time!

- Direct the light emission to a uniformly bright projection screen (e. g. to a white wall, ceiling, cabinet door). You should then see two differently large and bright light spots. The larger spot is the direct image of the lamp filament, the second its mirror image generated by the retroreflector in the lamphouse. (Fig. 16).

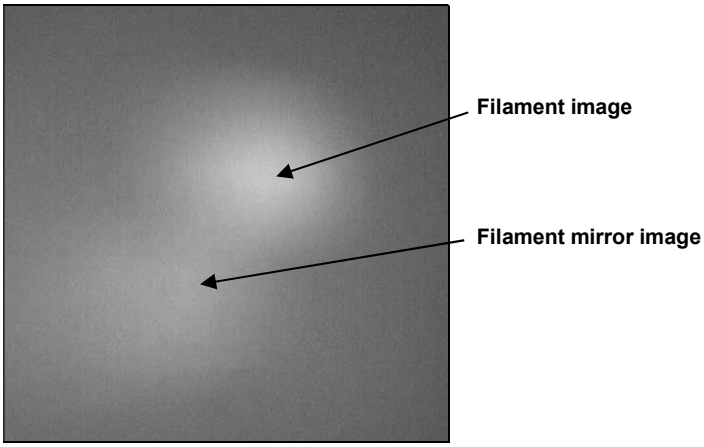


Fig. 16: Visible light spots.

- Focus the filament image (bright spot) with the collector knob (see Fig. 14).
- Focus the mirror image of the filament (darker spot) with the focusing ring on the back of the lamphouse (Fig. 17) until you reach a situation as depicted in Fig. 18.

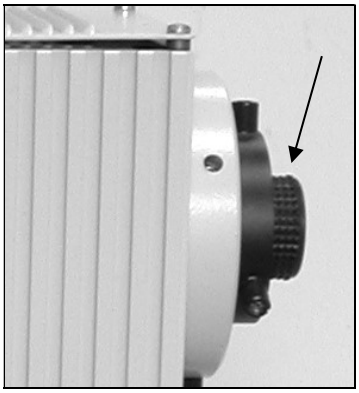


Fig. 17: Focusing ring.

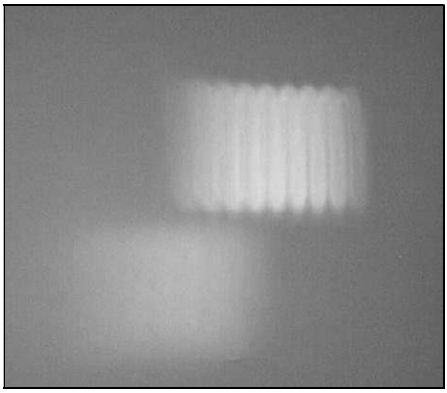


Fig. 18: Same as Fig. 16, in focus.

- Insert the centering keys into the adjustment screws for the lamp reflector on the back of the lamphouse (Fig. 19).

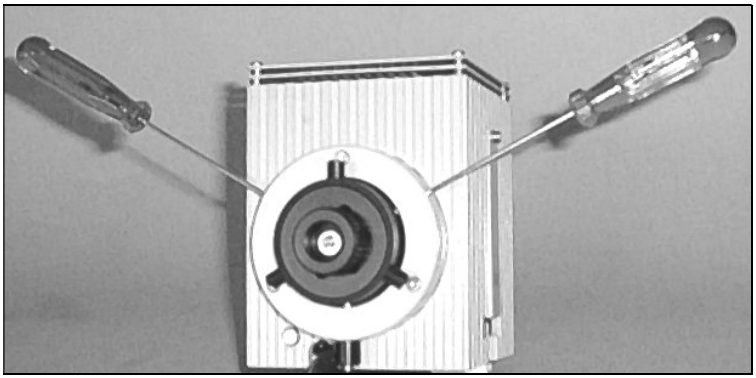


Fig. 19: Centering the reflector.

- Center the mirror image of the filament (darker spot in Fig. 18) with the centering keys to a position adjacent to the direct filament image (Fig. 20).

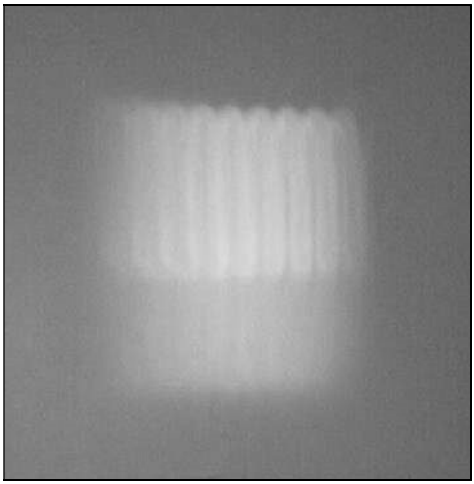


Fig. 20: Image and mirror image of the filament, centered.

!	The centering screws also allow to center the mirror image of the filament onto its direct image. However, this will significantly increase the thermal load of the filament and, thus, shorten the lamp's lifetime.

- Switch the lamp off.
- Disconnect the power supply from mains.
- Attach lamphouse to collector and fix it with the knurled screw.

!	**H 600 stands for mere incident-light microscopes have no transmitted-light illumination.** Here, the corresponding port in the stand base is closed with a protective cap.

3.2 Condensers

Only an appropriate combination of condenser, collector and light source ensures a homogeneous illumination of the specimen. The numerical aperture (NA) of the condenser, along with the NA of the objective, is the decisive parameter for the microscope's resolving power. To this end, the user always has to align the microscope illumination according to **KÖHLER** (see Chap. 5).

The laboratory microscope H 600 can be equipped with brightfield condensers or with combination condensers for brightfield, phase contrast and darkfield microscopy. There is also a dedicated darkfield condenser with high numerical aperture available.

3.2.1 Brightfield condensers

The Hund brightfield condensers NA 0.9 and NA 1.25 (Fig. 21) are equipped with an aperture diaphragm which can easily be operated with a lever pointing towards the user. A filter holder can hold color-glass filters with 32 mm diameter.

Fig. 21: Condenser NA 0.9 with filter holder and aperture diaphragm lever in fully opened position.

!	The brightfield condenser **NA 1.25** can homogeneously illuminate objectives with magnifications of 10x and higher. In combination with an objective 4x, a **ground-glass filter** (Art. No. 018.0125.0) has to be inserted into the filter holder.

To reach its high numerical aperture, the brightfield condenser NA 1.25 must be immersed with oil. Without immersion oil, its numerical aperture is NA 0.9.

Apart from the described condensers, the H 600 can also be equipped with an achromatic brightfield condenser NA 0.9 (Art. No. 018.0326.0).

On how to use the aperture diaphragm, see Chap. 5 ‘Aligning the microscope to Köhler illumination’.

3.2.2 Phase contrast condensers

Phase contrast requires to image an annulus in the front focal plane of the condenser onto the corresponding phase annulus in the rear focal plane of the objective.

The simplest solution is an annular diaphragm in the filter holder of the Hund brightfield condensers NA 0.9 and NA 1.25 (Fig. 22). This diaphragm is built into the condenser and centered in the factory. Phase contrast can be switched on and off by simply swinging the filter holder into our out of the beam path.

!	**Never** remove the annular diaphragm from the filter holder! It can only be reassembled and centered **in the factory**!

!	When observing in phase contrast, the **aperture diaphragm** must **fully be opened**!

Fig. 22: Condenser NA 0.9 with annular diaphragm for phase contrast in filter holder.

With an annular diaphragm mounted in the filter holder, phase contrast can only be realized for one objective magnification, usually for the 40x objective. Should it be necessary to employ several contrasting techniques in one microscope on a regular base, a combination condenser is advisable (Fig. 14). The 'small' combination condenser (Fig. 23) contains a turret with three apertures, the 'large' combination condenser (Fig. 24) a turret with five apertures. One aperture always remains open for brightfield microscopy. The combination condenser is available with NA 0.9 and NA 1.25. Table 1 shows the possible combinations. The turret is marked with colored spots around its perimeter. Their colors indicate the contrasting technique and are identical with the color rings of the corresponding objectives (Tab. 2).

!	To avoid confusions, the position of the annular diaphragm for the **100x phase contrast objective** is marked with a **white ring**! The white spot marks the brightfield position.

The annular diaphragms are centered in the factory and do not require any further adjustment by the user.

Fig. 23: Combination condenser with filter holder and aperture diaphragm lever in fully opened position.

Tab. 1: Combination condensers. D: number of apertures. Ph: phase contrast, DF: darkfield. Numbers in brackets: number of possibel objectives. ●: present. All condensers have one aperture for brightfield microscopy.

NA	D	Possible combinations	Filter holder
0.9	3	Ph (max. 2)	●
0.9	5	Ph (max. 4)	●
1.25	3	Ph (max. 2) or Ph (1) + DF	●
1.25	5	Ph (max. 4) or Ph (max. 3) + DF	●

!	Only the combination condensers NA 0.9 can be operated in combination with a **10x phase contrast objective**! For all other combination condensers, the smallest possible magnification for phase contrast objectives is 20x.

Tab. 2: Color coding of the combination condenser turret, combinations with objectives. BF: brightfield.

Color	Contrasting technique	Objective
white	BF	all
black	DF	all up to 40x
yellow	Ph	Ph 1 10x
green	Ph	Ph 2 20x
blue	Ph	Ph 3 40x
white (ring)	Ph	Ph 4 100x

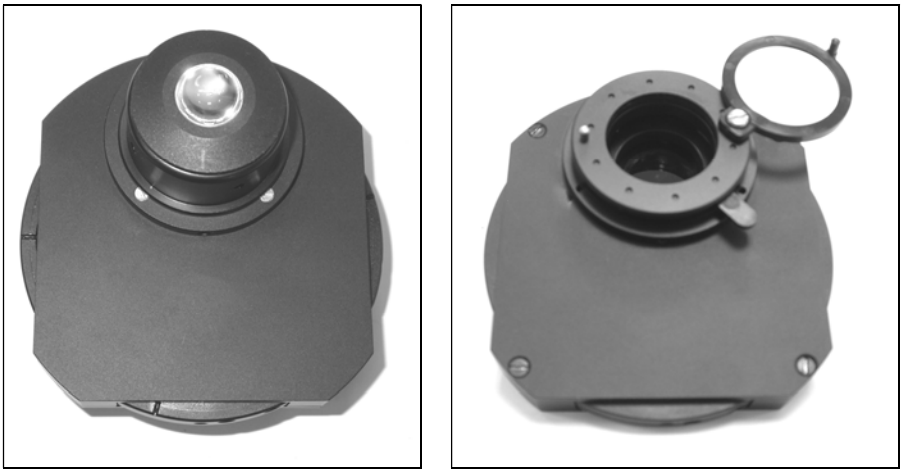


Fig. 24: Large combination condenser. Left: top view, right: bottom view, with filter holder and aperture diaphragm lever in fully opened position.

3.2.3 Darkfield condensers

On principle, darkfield illumination can only be achieved when the condenser aperture is larger than the aperture of the objective that is being used. While this is impossible with Hund condensers with NA 0.9, darkfield illumination is possible, even without immersion oil, for a condenser aperture of NA 1.25, with objectives up to 40x. With the use of immersion oil, however, the quality of the darkfield image increases.

In its simplest design, a darkfield condenser works with an annular diaphragm. Like in the simple phase contrast condenser, the diaphragm is placed in the filter holder of the condenser. It can be swiveled into the beam path whenever darkfield observations are necessary.

Similarly, the darkfield annulus can be placed in the turret of a combination condenser (Tab. 1). Darkfield is activated by rotating the turret until the black spot points towards the user. This also allows darkfield observations for all objectives up to 40x.

!	The large combination condenser NA 1.25 has **no filter holder**! For darkfield microscopy with this condenser aperture, the corresponding annulus must be mounted into the **condenser turret** in the factory. This **reduces** the number of possible **phase contrast objectives**!

For darkfield observations at highest magnifications and with highest numerical apertures, a cardioid-type darkfield condenser with NA 1.4 is available (Fig. 25). This condenser is designed as a mirror system and therefore suitable for darkfield microscopy only. This condenser also has to be immersed with oil.

Fig. 25: Cardioid-type darkfield condenser NA 1.4.

3.3 Microscope stage and specimen holder

To allow for a quick scan across specimen slides, the microscope stage has a coaxial drive on its right side. The total displacement range is 76 mm x 52 mm.

The specimen holder (Fig. 26) holds one standard slide (L x W: 76 mm x 26 mm) firmly on the stage. The holder may be removed by loosening its fixing screws.

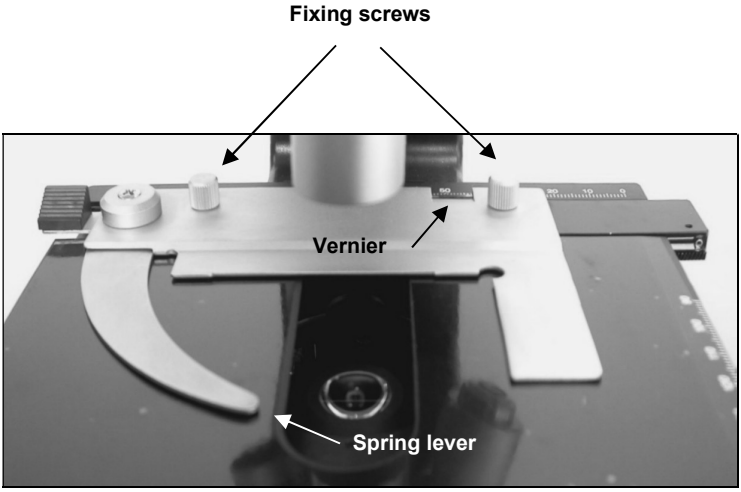


Fig. 26: Specimen holder.

Both axes of the stage are equipped with vernier scales with which interesting specimen details can easily be located (Fig. 27).

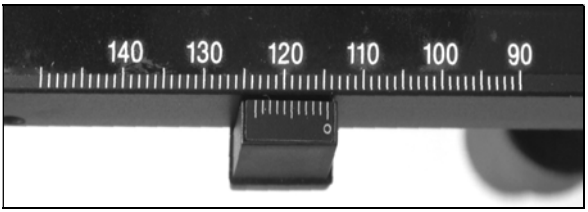


Fig. 27: Stage: vernier scale.

3.4 Coarse and fine focusing drives

The specimen is focused with the coarse and fine focusing drive knobs on either side of the microscope stand (Fig. 28). With the coarse focusing drive, the stage travels over a total vertical range of 22 mm. When using the fine focusing drive, one scale division corresponds to a stage travel of 2 µm (= 0.002 mm).

Fig. 28: Coarse and fine focusing drive (with scale).

The vertical stage travel is mechanically limited to prevent the objectives from being damaged.

!	The coarse focusing drive does not reach a 'hard' stop, but reaches a **safety clutch**. This is indicated by the fine focusing drive knob rotating into the opposite direction of the coarse focusing drive.

3.5 Objectives

The nosepiece of the laboratory microscope H 600 can hold up to five objectives (Fig. 29). Switching between magnifications is simply accomplished by rotating the nosepiece from one click stop to the next.

!	Always rotate the nosepiece until it reaches a defined click stop position. Otherwise, the image field may partly be **shadowed**!

Fig. 29: Nosepiece for up to five objectives.

On principle, all microscope objectives designed for a mechanical tube length of 160 mm are suitable for use with the H 600. Available microscope sets are listed in Tab. 3.

!	All objectives with magnifications of **40x and above** have a small free working distance and are therefore spring-loaded to **protect** the specimen from being damaged.

The objective 100/1.25 Oil must always be immersed with oil to produce a sharp image and to reach its high numerical aperture. Please proceed as follows:

- Move microscope stage downwards with coarse and fine focusing drives;
- Apply one drop of immersion oil (delivered with the microscope) to the specimen's cover slip;
- Move microscope stage upwards with coarse and fine focusing drives;
- Carefully bring the objective in contact with the drop of oil.

!	The moment when the objectives gets in contact with the drop of oil can be observed as a short **'flash of light'**.

!	When you want to reduce the magnification again, please make sure that after having used the 100x objective, do not change to the **40x objective directly**. Due to its small free working distance, the objective may also be immersed with oil and will then deliver a **blurred image**. In that case, please clean the 40x objective immediately.

Apart from the objective sets for 160 mm tube length, there are also two infinity-corrected objective sets available (Tab. 4). They require an additional tube lens to form the intermediate image (Fig. 30).

This tube lens is mounted between observation tube and microscope stand, the mounting steps are the same as for mounting an observation tube (see Chap. 2.1).

!	Please make sure not to cant the mechanical connections when mounting or dismounting observation tube, tube lens and microscope stand!

Tab. 3: Objective sets, tube length 160 mm.

Set	Contrasting technique	Objectives
Achro	HF	4/0.10; 10/0.25; 20/0.40; 40/0.65; 60/0.85; 100/1.25 Oil
Plan	HF	4/0.10; 10/0.25; 20/0.40; 40/0.65; 60/0.85; 100/1.25 Oil
PL Ph	Ph	10/0.25; 20/0.35; 40/0.65; 100/1.25 Oil

Tab. 4: Objective sets, infinity-corrected.

Set	Contrasting technique	Objectives
ICS PL	HF	4/0.10; 10/0.25; 20/0.45; 40/0.65; 100/1.25 Oil
ICS PL Ph	Ph	10/0.25; 20/0.35; 40/0.65; 100/1.25 Oil

Fig. 30: Tube lens for infinity-corrected objectives.

!	Condensers with **NA 1.25** can homogeneously illuminate objectives with magnifications of 10x and higher. In combination with an objective 4x, a **ground-glass filter** (Art. No. 018.0125.0) has to be inserted into the filter holder unless the condenser carries a swing-out lens.

Apart from the objective sets in Tab. 3 and 4, Hund offers some special objectives and objective sets:

- **Objective A Ph 40/0.65**
  Achromat with large free working distance of 0.47 mm, suitable for the use with counting chambers.
- **Objective SPL 100/1.25 – 0.60 with iris diaphragm**
  Oil-immersion objective with adjustable numerical aperture for high-NA darkfield microscopy.
- **Objective FL 50/1.0**
  Fluorite objective with high transmission at small wavelengths and with high NA for hematology and fluorescence microscopy.
- **Objective set for incident-light microscopy**
  Achromats without cover-slip correction:
  EPI A 4/0.13; EPI A 10/0.30; EPI A 20/0.50; EPI A 40/0.60

A summary of the usual objective markings can be found in the Appendix of this manual.

3.6 Filter slide

Directly above the nosepiece, a filter slide (part of the extent of delivery, except for incident-light fluorescence equipments) can be inserted into a slit (Fig. 31). Besides one free aperture, this slide (Fig. 32) contains a green filter (VG 9) and a daylight filter (BG 28). While the green filter yields a more comfortable phase contrast image for some users, the yellow tint of the halogen lamp can be converted to a color temperature close to that of usual daylight with the conversion filter.

Fig. 31: Filter slit in microscope stand.

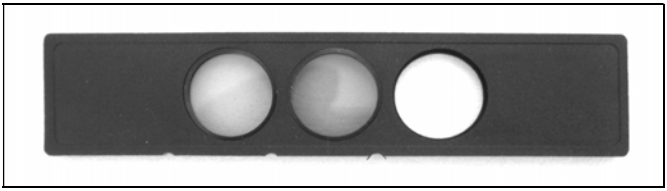


Fig. 32: Filter slide with click stops.

!	When you insert the filter slide, please make sure that the click stops point away from the user and that the smooth surface points upwards.

3.7 Observation tubes

A total of three different observation tubes can be mounted to the laboratory microscope H 600:

3.7.1 Binocular tube H

The binocular tube H (Fig. 5) allows the observation of the microscopic image with both eyes simultaneously. This allows unstressed microscopic work. The tube allows to adjust the interpupillary distance between 55 mm and 75 mm and a diopter adjustment of both eyepiece tubes. This is the standard observation tube for the laboratory microscope H 600.

3.7.2 Trinocular tube 30/70

The trinocular tube 30/70 (Fig. 33) allows the observation of the microscopic image with both eyes and via a connected documentation unit simultaneously. The tube allows to adjust the interpupillary distance between 55 mm and 75 mm and a diopter adjustment of both eyepiece tubes.

The microscopic image is split so as to have 30 % of the overall light intensity in the eyepieces (i. e. 15 % in each eyepiece) and 70 % in the documentation port.

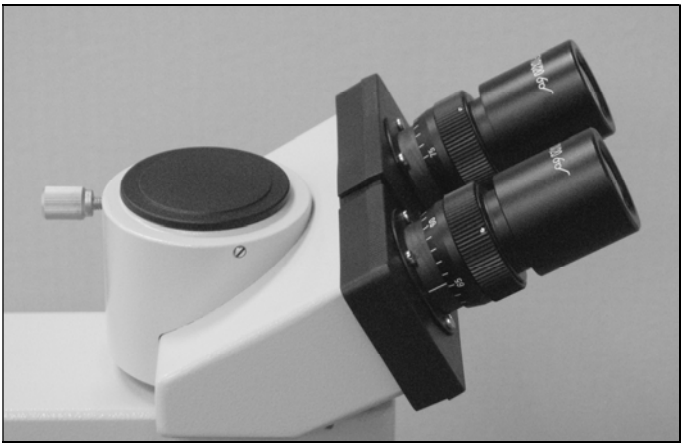


Fig. 33: Trinocular tube 30/70 with dust protection cap.

!	Whenever the documentation port is not in use, please protect it with the **dust protection cap**. Otherwise, its optics may by **stained with dust** or even be **damaged** by parts accidentally dropped into it!

3.7.3 Trinocular tube 100/100

The trinocular tube 100/100 (Fig. 34) allows mechanical switching between eyepieces and documentation port by pulling out or pushing in the lever on its left side. The tube allows to adjust the interpupillary distance between 55 mm and 75 mm and a diopter adjustment of both eyepiece tubes.

When the lever is pulled, 100 % of the light intensity is transferred to the documentation port. If not, it is fully transferred to the eyepieces (i. e. 50 % in each eyepiece).

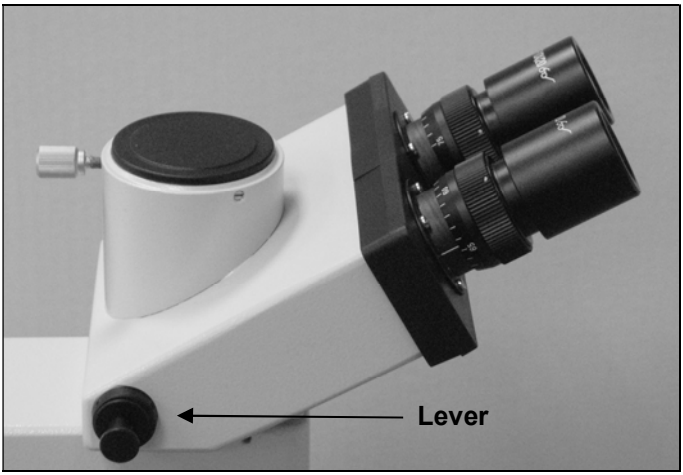


Fig. 34: Trinocular tube 100/100 with dust protection cap.

!	The trinocular tube 100/100 should be preferred in all low-intensity applications such as darkfield or fluorescence microscopy.

!	Whenever the documentation port is not in use, please protect it with the **dust protection cap**. Otherwise, its optics may by **stained with dust** or even be **damaged** by parts accidentally dropped into it!

3.8 Eyepieces

Eyepieces, objectives and the binocular tube form the imaging system of the microscope. By multiplying the magnifications of eyepieces and objectives, one gets the total magnification of the device.

Standard H 600 equipments come with eyepieces WF 10x/18 or WF 10x/20, i. e., with eyepieces with magnifications of 10x and with a field number FN (= diameter of the intermediate image, given in mm) of 18 or 20.

Presently, larger field numbers cannot be achieved. The use of FN 20 eyepieces with the trinocular tube 100/100 will result in a vignetting of the microscopic image!

For larger magnifications, the H 600 can be retrofitted with eyepieces WF 12.5x/18. In combination with an objective 100/1.25 Oil, the maximal useful magnification of 1250x can thus be reached. With eyepieces WF 15x/17, an even larger total magnification can be achieved, but this is already a so-called 'empty' magnification which does not reveal further specimen detail.

The eyepieces WF 10x/18 and WF 12.5x/18 are also available with a pupil distance of 24 mm and are thus suitable for spectacle wearers. All retrofittable eyepieces can be equipped with eyecups that block disturbing ambient light. (Fig. 5).

4. Documentation

The documentation of microscopic images is usually carried out via the documentation port of a trinocular observation tube. There are two alternatives:

4.1 C-mount cameras

The C-mount is a standardized camera mount for which a large variety of cameras is available. In order to connect a camera to the microscope, a C-mount adapter is required which is inserted with its dovetail ring into the documentation port and locked with the fixing screw of the tube (Fig. 35).

Fig. 35: C-Mount adapter (without intermediate optics).

For the laboratory microscope H 600, there are three C-Mount adapters with intermediate magnifications of 0.5x, 1x (i. e. without intermediate optics) and 1.6x.

!	**Rule of thumb for C-Mount adapters:** With chip sizes of ½“, the image section captured by the camera is of about the same size as the image seen in the eyepieces WF 10x/18 when a C-Mount adapter with intermediate optics 0.5x is employed.

The Helmut Hund GmbH offers a line of CCD and CMOS cameras for the described C-Mount adapters. As the camera market is in constant change, information on the currently available cameras are available upon request.

4.2 Single-lens reflex cameras

Apart from C-Mount cameras, single-lens reflex cameras (SLRs) can be attached to the documentation port as well. Here, a phototube with integrated photo eyepiece is required (Fig. 36). At its bottom, it is fixed to the trinocular tube like a C-Mount adapter (see above), at its top, it carries an M42 thread to which an SLR body can be connected via a corresponding T2 adapter.

Fig. 36: Phototube with T2 adapter for single-lens reflex cameras.

On principle, all available SLRs can be attached to the phototube. However, Hund offers only adapters for Canon SLRs in combination with microscope equipments.

The phototube consists of two parts and can thus be adjusted in its height to focus the image on the camera chip. An additional threaded ring secures the phototube against accidental defocusing.

!	If you have received a microscopic equipment with camera and phototube, the tube is already adjusted **in the factory**. Thus, you will receive a sharp image in the eyepieces and in the camera display simultaneously!

If you have received phototube and camera separately, please proceed as follows:

- Mount phototube and camera.
- Place specimen on microscope stage.
- Focus camera image with coarse and fine focusing drives.

!	Many current digital SLRs offer the feature to display the **live image on a PC monitor**. This does not only make it easier to capture an image, but also to focus the microscope. For further technical details on your camera and on the software tools, please consult the camera manual.

- Observe microscopic image through the eyepieces.
- Correct image by using the diopter adjustments.

!	With the different chip sizes of current SLRs, the **image sections** may vary from camera to camera. Due to the large imaging chips, it is generally **smaller** than with C-Mount cameras.

4.3 Camera tube

A simple solution to connect cameras to a microscope with which visual observation is not required is the camera tube (Fig. 37). It substitutes a trinocular tube and is directly inserted into the respective receptacle of the microscope stand. It connects to all documentation units suitable for the trinocular tubes.

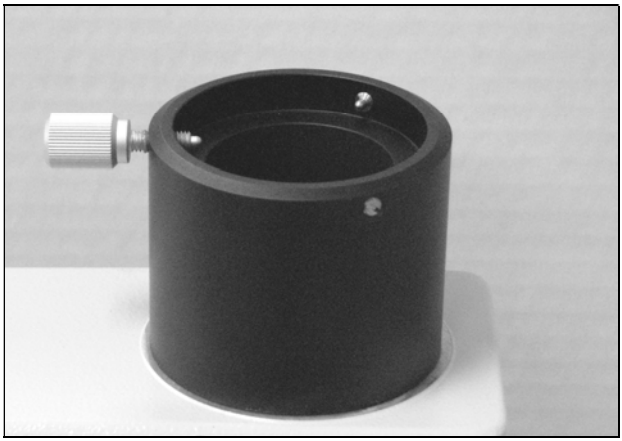


Fig. 37: Camera tube for direct connection between microscope and camera.

5. Adjusting the microscopic image

For a homogeneous illumination of the specimen, it is necessary to align the microscope for Köhler illumination. This is to avoid images of low quality that may, e. g., lead to false diagnoses.

⚠	According to the **German Medical Device Operator's Ordinance** (§2 Abs. 5 MPBetreibV), the user of a medical device has to make sure that it is **operational** and **in proper condition**. Aligning the microscope for **Köhler illumination** guarantees the operability of the microscope.

5.1 Aligning the microscope for Köhler illumination

By aligning the microscope for Köhler illumination, the images become bright and homogeneously illuminated. With the laboratory microscope H 600, the necessary components are:

- condenser drive for condenser height adjustment,
- field diaphragm
- aperture diaphragm.

The purpose of the field diaphragm (Fig. 38) is to protect the specimen from excessive heat. It also blocks all light that does not contribute to the image so that the image contrast is optimized due to minimal light scatter. The field diaphragm should therefore be opened only as far as absolutely necessary.

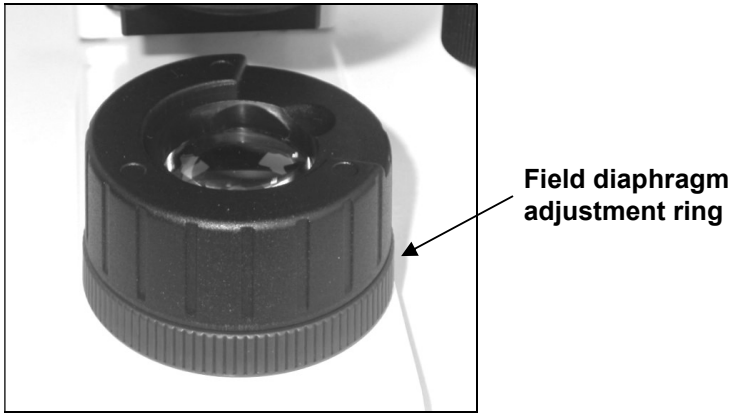


Fig. 38: Illumination tube with field diaphragm.

From the optical point of view, aligning the microscope for Köhler illumination means to image the field diaphragm into the specimen (object) plane. Please proceed as follows:

- Switch the microscope illumination on and adjust it for medium brightness.
- Fully open field diaphragm and aperture diaphragm.
- Place a specimen on the microscope stage and focus it with the coarse and fine focusing drives.
- With the condenser drive, move the condenser upwards until it reaches its upper stop. If you work with a condenser with NA 1.25, it must be immersed with oil to reach this high aperture. To this end, apply a drop of immersion oil to the top lens of the condenser and move it upwards until the drop gets in contact with the specimen.
- Close the field diaphragm by rotating the red adjustment ring.
- With the condenser drive, carefully move the condenser up and down until the image of the field diaphragm becomes as sharply visible as possible **along with the specimen**. Now, the condenser is in its correct position.
- Center the field diaphragm by pressing the red adjustment ring sideways.
- For brightfield investigations, open the field diaphragm far enough so that it is not visible any more. The microscope is now aligned for Köhler illumination.

Figure 39 shows the microscopic images for uncentered, correctly centered and fully aligned field diaphragm, respectively.

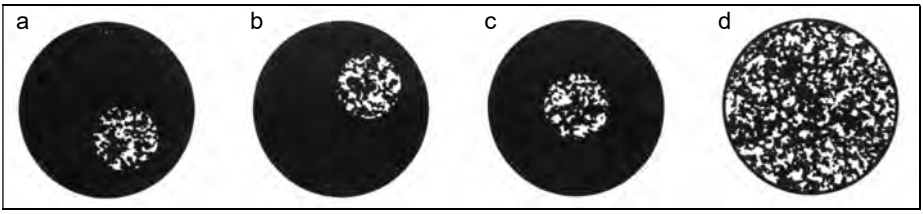


Fig. 39: Microscopic image for uncentered (a, b), correctly centered (c) and fully aligned field diaphragm.

!	On principle, this alignment procedure must be carried out **for each objective separately**.

5.2 Using the aperture diaphragm

The aperture diaphragm is the second diaphragm in the illumination beam path. It is mounted directly underneath the condenser so that the microscope does not produce a sharp image of it (Fig. 40).

The aperture diaphragm determines resolution, depth of field and contrast of the microscopic image. Reducing its aperture results in

- an increase in image contrast,
- an increase in depth of field,
- a decrease in resolution.

Fig. 40: Aperture diaphragm: adjustment lever.

Adjust the aperture diaphragm according to the microscopic image so that you find an acceptable compromise between contrast and resolution.

!	**Rule of thumb:** When you close the aperture diaphragm by about one third, you will observe a significant increase in image contrast.

When you close the aperture diaphragm even further, you will lose resolution due to the resulting reduction in illumination aperture. However, when you observe specimens with poor contrast, the aperture diaphragm must be closed far enough to make these weak structures visible at all.

!	**Important:** As the aperture diaphragm determines contrast, depth of field and resolution, it must **NOT** be used for regulating the **intensity** of the microscope illumination. For this purpose, only use the **brightness control knob**!

5.3 Observing a new specimen

After having aligned the microscope according to Köhler, proceed as follows:

- Switch the microscope illumination on.
- Adjust illumination for medium brightness.
- Fully open the aperture diaphragm.
- Move microscope stage downwards as far as necessary so that a specimen can easily be put into the specimen holder.
- Put specimen into specimen holder.
- Rotate nosepiece until an objective with low magnification is in the beam path.
- Move microscope stage upwards with coarse focusing until fine structures in the specimen become visible.
- Focus specimen with fine focusing drive.
- Switch to other magnifications by rotating the nosepiece.

!	Please make sure that specimens are always put onto the microscope stage with their **cover slips pointing towards the objective (upwards)**! As the optical designs of the objectives include the influences of cover slips, no sharp image will result if the cover slip points downwards. This is particularly so for objective magnifications of **20x and higher**!

5.4 Adjusting the phase contrast image

In a phase contrast microscope, the annular diaphragm in the condenser is imaged onto the phase annulus of the phase contrast objective. The microscope is aligned in the factory so as to reach this condition when the condenser is moved to its upper stop. As a result, objects that would merely be invisible in brightfield observations are displayed dark on an otherwise bright background (positive phase contrast).

!	All our phase contrast microscopes are adjusted for **exact phase contrast in the factory** when the **condenser** is at its **upper stop**. Before starting your microscopic work, please make sure that the condenser is in that position!

For the control of the correct alignment of the microscope, an optional auxiliary microscope can be inserted instead of an eyepiece into one of the eyepiece tubes (Fig. 41). By changing its length, the auxiliary microscope can be focused on the back focal plane of the objective (Fig. 42).

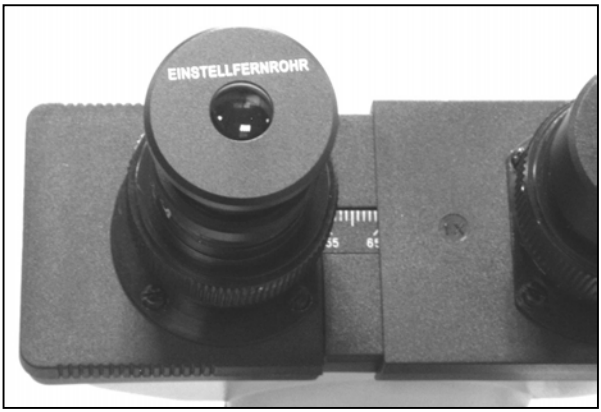


Fig. 41: Auxiliary microscope in eyepiece tube.

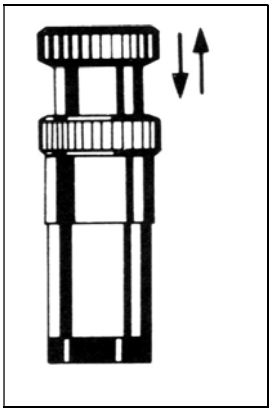


Fig. 42: Focusing the auxiliary microscope.

If the auxiliary microscope is correctly focused, both the pase annulus of the objective and the image of the condenser annulus simultaneously yield a sharp image (Fig. 43). With a correct alignment, both annuli are concentric, and the condenser annulus is visible as a bright ring with narrow dark boundaries (from the phase annulus). The alignment can be optimized by slightly moving the condenser up or down.

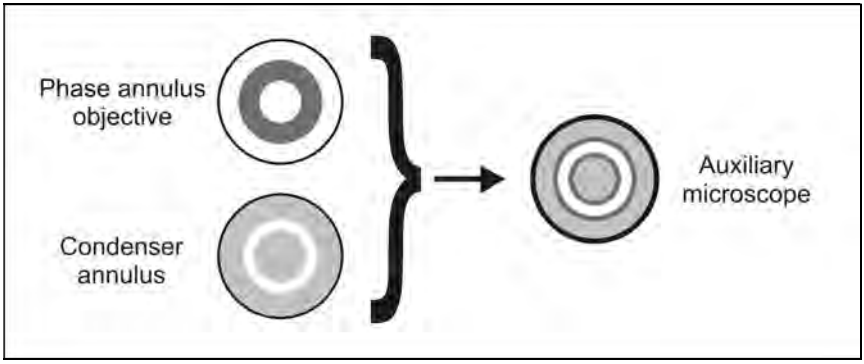


Fig. 43: Auxiliary microscope: Image of condenser annulus and phase annulus.

!	If the alignment of the microscope is **incorrect**, the annuli are **not concentric**. In this case, please contact our **Technical Service** because the phase contrast condensers usually cannot be adjusted by the user.

!	Always make sure that you have chosen the **right combination of objective and condenser annulus** (see above)! With **combination condensers**, the color spot on the condenser turret corresponds to the color ring of the correct phase contrast objective.

5.5 Adjusting the darkfield image

On principle, darkfield illumination can only be achieved when the condenser aperture is larger than the aperture of the objective that is being used. Darkfield illumination can be achieved, even without immersion oil, for condenser apertures of NA 1.25 and higher, with objectives up to 40:1. With the use of immersion oil, however, the quality of the darkfield image increases.

In its simplest design, a darkfield condenser works with an annular diaphragm that is either placed in the filter holder of a brightfield condenser or in the turret of a combination condenser. Due to the low amount of light that passes the diaphragm, a correspondingly high lamp intensity has to be chosen.

For darkfield microscopy at highest apertures, the H 600 can be equipped with a cardioid-type condenser (Fig. 44). Its mirror system with a numerical aperture of 1.4 allows darkfield observations for objective magnifications of up to 100x. Particularly for native-blood investigations according to Enderlein, this condenser is used in combination with a special objective SPL 100/1.25 Oil with iris diaphragm (Fig. 45). This objective allows a matching of the numerical apertures so that an optimal darkfield image results.

Fig. 44: Cardioid-type darkfield condenser NA 1.4.

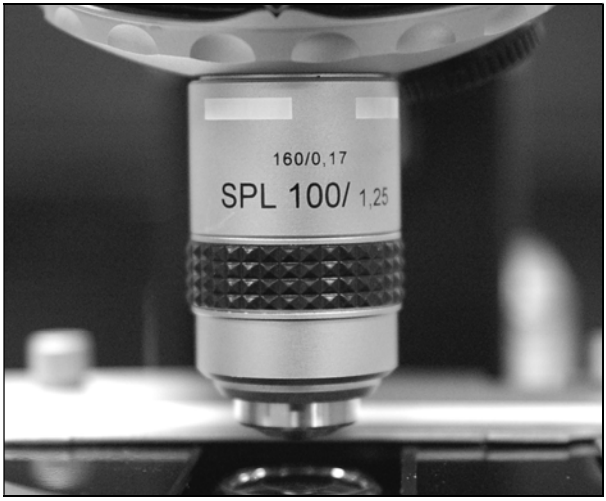


Fig. 45: Objective SPL 100/1.25 Oil with iris diaphragm.

The following instructions explain how to adjust the darkfield image for the microscope H 600 LL HP 100 which is the dedicated microscope for native-blood investigations according to Enderlein. The microscope is equipped with the condenser-objective combination of Figs. 44 and 45, and with one achromatic objective Achro 10/0.25 for centering the condenser. The condenser is centered via the screws shown in Fig. 46:

- Switch illumination on.
- Adjust the illumination to its maximum.
- Fully open the field diaphragm.
- Move condenser with the condenser drive to its upper stop and lower it slightly.
- Rotate objective out of the light path so that the condenser's front lens is freely accessible.
- Apply one drop of immersion oil to the condenser's front lens.

!	Make sure that the drop of oil contains **no air bubbles**. This will deterioriate the quality of the microscopic image! Should this be the case, remove the oil with a soft cloth and try again.

- Place a specimen on the microscopic stage and move it to a position above the condenser.
- Move condenser up until the immersion oil on top of the condenser gets in contact with the microscope slide.

!	Make sure that the immersion oil is uniformly distributed across the whole area of the condenser's front lens.

- Rotate objective Achro 10/0.25 into the light path.
- Focus specimen.

- Move condenser up and down until the image shows a bright spot with well defined edges, surrounded by a dark field.
- Move the bright spot with the condenser's centering screws to the center of the field of view (Figs. 46 and 47).

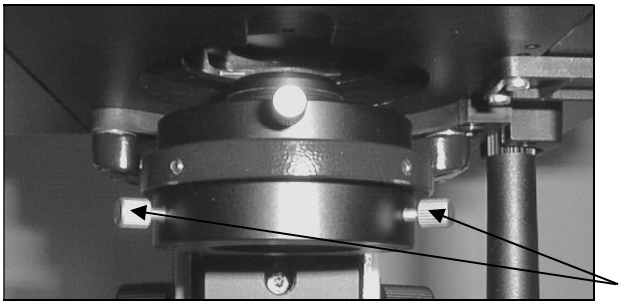


Fig. 46: Condenser holder H 600 LL HP 100 with centering screws.

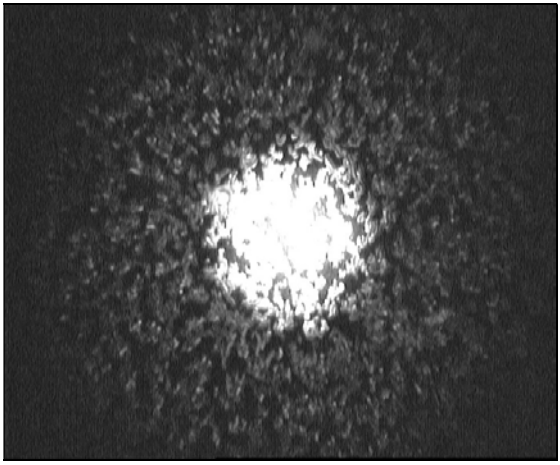


Fig. 47: Darkfield, objective Achro 10/0.25 and condenser NA 1.4. Condenser centered and in correct height.

!

If the condenser is too high or too low, the microscopic image is significantly different from that of Fig. 51:

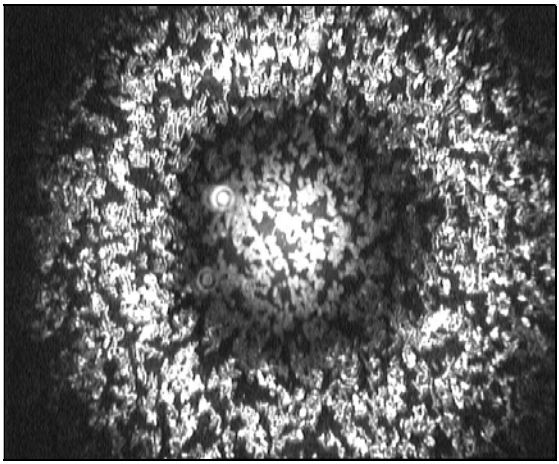


Fig. 48: Condenser too high.

!

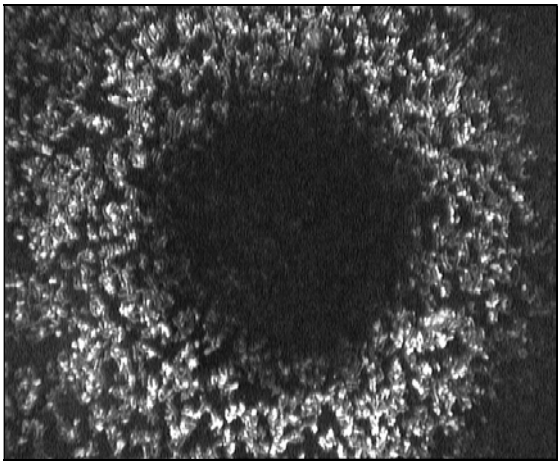


Fig. 49: Condenser too low.

- Rotate objective Achro 10/0.25 out of the light path.
- Apply a drop of immersion oil to the cover slip of the specimen. Make sure that the oil contains no air bubbles (see above).
- Rotate objective SPL 100/1.25 Oil with iris diaphragm into the light path.
- Fully open the objective's iris diaphragm.
- Focus the specimen.
- Close the iris diaphragm until a dark region shows up in the image. Use the centering screws for a fine centering of this dark region.
- Carefully variate the condenser's height until specimen structures show up brightly in front of a dark background.
- Close the objective's iris diaphragm far enough so that the contrast becomes optimal across the complete image.

Figure 50 shows the correctly adjusted darkfield image of a native-blood specimen.

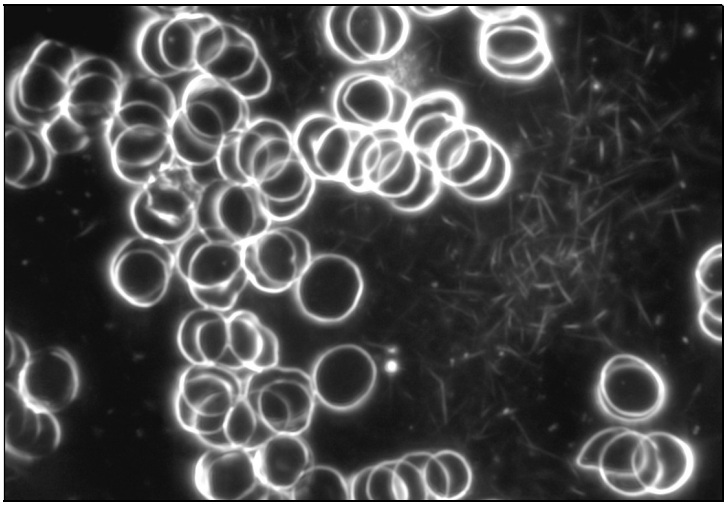


Fig. 50: Native blood, darkfield. Objective: SPL 100/1.25 Oil with iris diaphragm, darkfield condenser NA 1.4.

6. Measuring, counting and pointing

With the laboratory microscope H 600, you can carry out measurement and counting tasks. Necessary accessories are:

- **Measuring or counting eyepiece:**
  A measuring eyepiece (10x or 12.5x) contains a graticule in the intermediate image plane. It is therefore sharply visible along with the microscopic image. Available graticules carry a scale of 10 mm length with 100 divisions and/or crosshairs.

  Counting eyepieces contain graticules with counting patterns. Their sizes and structures depend on their respective applications. One example is the pattern according to Walton and Beckett for counting and measuring asbestos fibers (Fig. 51).

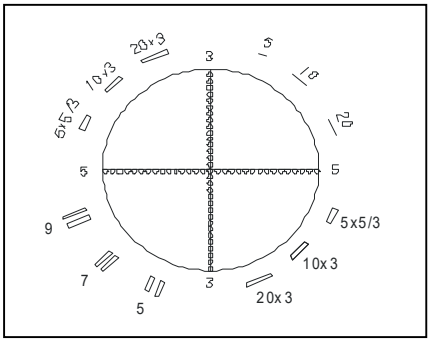


Fig. 51: Walton and Beckett counting pattern for asbestos fibers (schematic).

- **Stage micrometer:**
  For a correct length measurement, the optical system of the microscope must be calibrated. This is usually done with a stage micrometer which also carries a scale of 1 mm or 2 mm length in 100 divisions. The stage micrometer is held on the stage like a specimen and is observed through the eyepieces. Comparing the scales of stage micrometer and eyepiece graticule yield a calibration factor with which 'true' lengths can be calculated.

!	For a correct calibration of the microscope, a stage micrometer with **calibration certificate** is available upon request. Standard stage micrometers, as ordered from the Helmut Hund GmbH, do not come with such a certificate.

- **Microscope camera with measuring software:**
  By the time that this manual was compiled, all microscope cameras distributed by the Helmut Hund GmbH are supplied with a software with which calibration and measuring tasks can be carried out. Here, a stage micrometer is required as well.

Apart from measuring and counting eyepieces, there are also pointer eyepieces. They come with an arrow-shaped pointer in the intermediate image plane with which interesting specimen details can be marked.

!	Please note that only **one** measuring, counting or pointer eyepiece is required. The second eyepiece has to be a **compensation eyepiece** with identical optical design, but without graticule or pointer.

7. Replacing the halogen bulb

7.1 Integrated 3-W LED

Due to their extremely long lifetimes, a replacement of LED modules is not necessary during the lifetime of the microscope.

7.2 Integrated halogen bulb 12 V/30 W

	**Danger! Hazardous voltages!** Before replacing the halogen bulb, **switch off** the microscope and **disconnect** it from the power supply!

	**Danger of burns!** After the illumination is switched off, let the bulb cool down for about 5 minutes before you change it.

- Tilt the microscope carefully backwards.
- Open the lamp holder by turning the locking knob (Fig. 52).

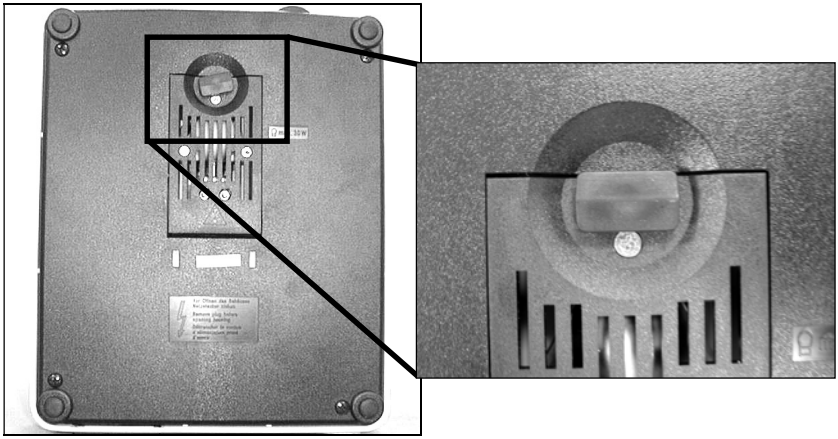


Fig. 52: Bottom of stand base with lamp holder locking knob.

- Open lamp holder (Fig. 53).

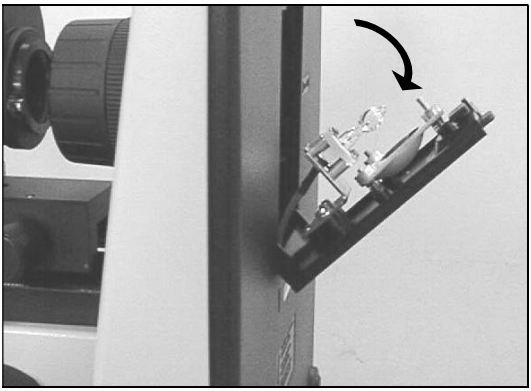


Fig. 53: Opening the lamp holder.

- Pull the old bulb out of its socket.

	Keep the new halogen bulb in its **protection cover** when you insert it. **Do not touch the bulb with bare fingers!**

- Press the new halogen bulb into the socket by exerting only minute pressure. Make sure that lamp sits upright in the socket.
- Remove protective cover.
- Close lamp holder an lock it again with the knob.

	Use only **branded light bulbs**. Otherwise, the illumination of the image may **not** be **homogeneous**!

7.3 Lamphouse with halogen lamp 50 W or 100 W

	**Danger! Hazardous voltages!** Before replacing the halogen bulb, **switch off** the microscope and **disconnect** it from the power supply!

	**Danger of burns!** After the illumination is switched off, let the lamp **cool down for about 5 minutes** before you change it.

- Loosen the knurled screw and remove lamphouse from the collector.
- Loosen the fixing screw of the cover plate and remove it (Fig. 54).
- Loosen the fixing screw of the lamphouse base (Fig. 54) by hand and swing it open as in Fig. 55.

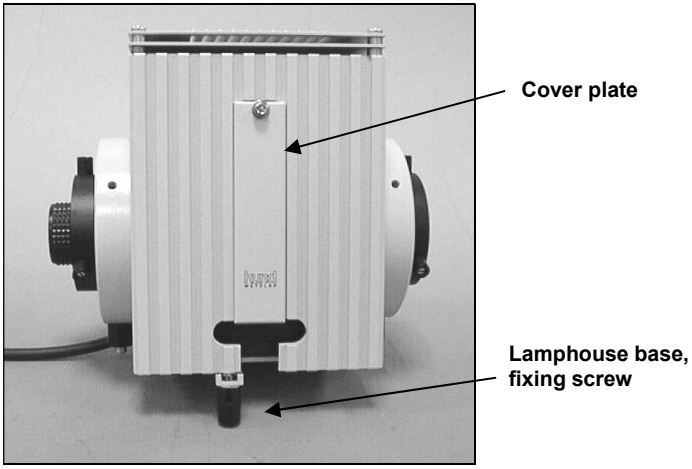


Fig. 54: Halogen lamphouse. Positions of cover plate and fixing screw of the lamphouse base.

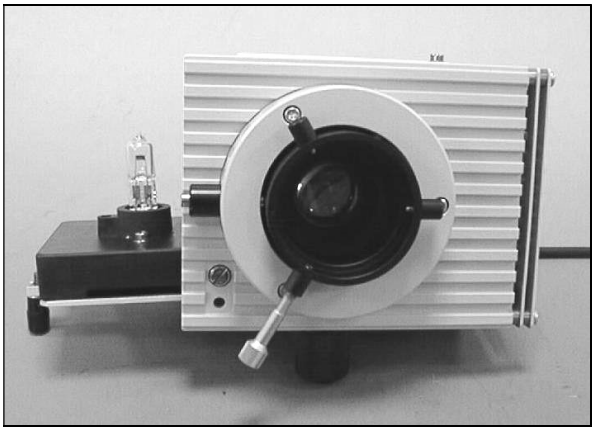


Fig. 55: Lamphouse with swung-out bulb.

- Pull the old bulb out of its socket.

!	Keep new halogen bulb (12 V/50 W: Art. No. 662.96229 or 12 V/100 W: Art No. 662.0005.0) in its **protection cover** when you insert it. **Do not touch the bulb with bare fingers!**

- Press the new halogen bulb into the socket by exerting only minute pressure. Make sure that lamp sits upright in the socket.
- Remove protective cover.
- Close the lamphouse base and fix it with its fixing screw.
- Insert the cover plate and fix it.
- If now the microscopic image is not homogeneously illuminated any more, align the illumination according to the centering and alignment instructions in Chap. 3.1.

!	Use only **branded light bulbs**. Otherwise, the illumination of the image may **not** be **homogeneous**!

8. Replacing the fuses

8.1 Integrated halogen illumination

⚡	**Danger! Hazardous voltages!** Before replacing the fuses, **switch off** the microscope and **disconnect** it from the power supply!

The fuse container is located on the rear side of the stand base, adjacent to the mains connector (Fig. 56).

- Insert a screwdriver into the opening marked in Fig. 56 and pull out the fuse container.

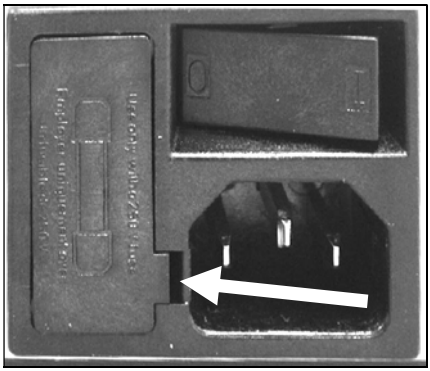


Fig. 56: Fuse container in stand base. Arrow: opening flap.

- Release the fuse holder at the position marked with the arrow in Fig. 57 and pull it out downwards.

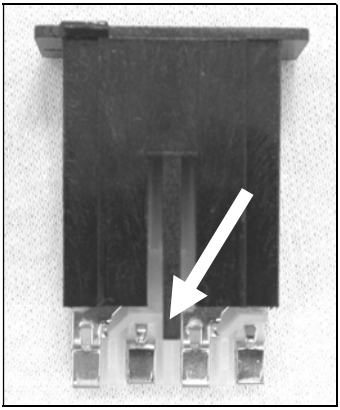


Fig. 57: Fuse container. Arrow: release.

Fig. 58: Fuse holder.

- Replace the fuse(s).
- Assemble the fuse container in reversed order and insert it back into the stand base.

!	Use only replacement fuses **T 0.2 A (mains voltage 230 V)** or **T 0.4 A (mains voltage 115 V)**!

8.2 External halogen lamphouse

⚠	**Danger! Hazardous voltages!** Before replacing the fuses, **switch off** the microscope and **disconnect** it from the power supply!

The fuse holder is located on the rear side of the stand base, directly underneath the mains connector (Fig. 59).

- With a small screwdriver, carefully pull the fuse holder out of the housing.

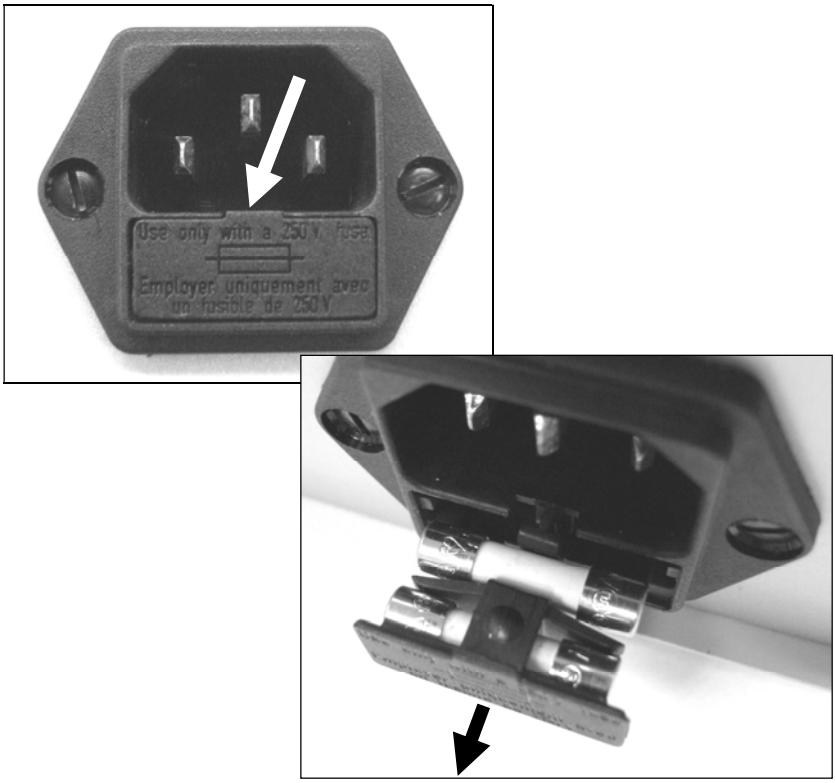


Fig. 59: Fuse holder of halogen power supply. Top: Arrow: release flap, bottom: fuse holder with replacement fuse.

- The rear fuse (the one closer to the housing) is the active fuse, the front fuse is the replacement fuse.
- Replace the fuse(s).

!	**After having replaced the fuse(s)**, it is advisable to insert a functional **replacement fuse** into the fuse holder. Should the active fuse fail, its replacement will then be readily available.

- Push the fuse holder back into the housing.

	Use only replacement fuses **T 0.2 A (mains voltage 230 V)** or **T 0.4 A (mains voltage 115 V)**!

9. How to keep the microscope clean

Please protect your microscope with the provided dust cover after every use. Otherwise, dust may accumulate on all optical surfaces as a result of electrostatic charges and may lead to a deterioration of the microscopic image.

To remove dust from the microscope optics, use oil-free compressed air or a very soft brush. You may also use a blower brush as it is available for cleaning camera lenses.

In case of stronger contaminations, you can clean the optical surfaces with a soft cloth, moistened with pure alcohol. In the same manner, remove immersion oil from objective front lenses, condenser and microscope stage immediately after the end of your work. Finally, clean these surfaces with a dry cloth.

Contaminations of the microscope stand and of all painted surfaces can be removed with a soft cloth, moistened with petroleum ether.

	Please be careful when you clean the microscope with **petroleum ether**! It must **not** get in contact with the **guideways** or the **optical systems**!

	The **microscope head** and the **eyepieces** must **not be disassembled** for cleaning purposes! If you suspect that inner optical surfaces are contaminated or damaged, please contact our **Technical Service Department!**

!	**The Helmut Hund GmbH offers a cleaning set for your microscope (Art. No. 019.9999.132). It contains all necessary components with which the microscope can properly be cleaned.**

Technical data

Supply voltage: (Microscopes with halogen lamps)	230 V AC, 50 … 60 Hz, 115 V AC, 50 … 60 Hz
Supply voltage: (Microscopes with LED illumination)	90 … 264 V AC, 47 … 63 Hz, Output: 18 V DC / 1 A (max.) Polarity:
Device safety:	IEC 1010-1/EN61010-1/VDE 0411, class 1
Temperature range:	5 °C ... 40 °C
Rel. humidity:	max. 80 % up to 31 °C, lin. decreasing, max. 50% at 40°C
Allowable supply voltage fluctuations:	max. ±10 %
Contamination class:	2 acc. to IEC 664
Line transient excess voltage:	Overvoltage excess category II

Safety remarks

The microscope conforms with the safety regulations for electrical measurement, control and laboratory devices and was supplied to the customer in technically flawless condition. To assure proper function of the microscope, the user is obliged to follow the instructions and recommendations contained in this manual.

The microscope must only be employed according to the determination as given in this manual. All maintenance and repair must only be carried out by qualified personnel authorized by the Helmut Hund GmbH or by the manufacturer's Technical Service Department. All spare parts delivered for and accessories to be employed with the microscope must be approved by the Helmut Hund GmbH.

Prior to every use of the microscope, check the mains cable for possible damages. In case of any obvious defect to the cable, it must be replaced immediately.

In case of doubt, please contact our nearest representative or the Helmut Hund GmbH directly.

!	In case of disregard of the safety remarks, proper function and device safety can not be guaranteed any more. Should such disregard lead to any damage of the microscope and its accessories and/or to further damage to property or persons, the Helmut Hund GmbH **cannot be held liable**. **This will also void all warranty claims against the Helmut Hund GmbH, Wetzlar, Germany**!

Device tests

Our microscops are tested to comply with EN 61010-1:

- Protective conductor test, test current 25 A, limit 0.1 Ω;
- High-voltage test, test voltage 1350 V AC;
- Leakage current test, test setup A2, test voltage 230 V AC, limit 0.7 mA at 2 kΩ.

Declaration of Conformity/CE sign

The CE sign confirms that this instrument complies with the EG directive 98/79/EWG (IVDD).

In addition, it complies with the directive 72/23/EWG (low-voltage directive) and the directive 89/336/EWG for electromagnetic compatibility.

This statement becomes void if the device is modified by unauthorized personnel.

Warranty

We grant:

- 20 years of maintenance warranty for all mechanical and optical components;
- 2 years of maintenance warranty for all electronical components and articles of trade;
- or at least the warranty period granted by the manufacturer

Lamps, fuses and consumables are not covered by this warranty.

During the first two years of the warranty period, claims are handled free-of-charge by the factory. The warranty does not include all damages caused by external influences or improper use or handling.

Claims must be reported immediately and in written form not later than 8 days after the receipt of the goods.

Each party will bear 50 % of the freight and handling charges. Please send the goods freight prepaid to Wetzlar and we will ship free to destination.

The Helmut Hund GmbH is certified according to DIN EN ISO 9001:2000, DIN EN ISO 13485:2007, 94/9/EC (ATEX) and DIN EN ISO 14001:2005 and to the European Audit ordinance 1836/93.

Appendix A: Objective markings

Microscope objectives are marked and color-coded according to DIN ISO 8578:2003-08. The most important markings are given in Tab. 5 and Tab. 6.

Tab. 5: Objective markings.

Symbol	Explanation
160	Tube length 160 mm
∞	Infinity-corrected
-	No cover slip correction, e. g. for incident-light microscopy
0.17	Corrected for cover slips of 0.17 mm thickness
Achro/A/AC	Achromat
SPL	Semiplan achromat
Plan/PL	Plan achromat
10/0.25	Magnification/numerical aperture
Oel/Oil	For use with immersion oil
Ph	Phase contrast objective
FL	Fluorit objective, high transmission at short wavelengths

Tab. 6: Color coding. M: magnification

M	**4**	**10**	**20**	**40/50**	**60/80**	**100**
Color ring	Red	Yellow	Green	Bright blue	Dark blue	White

Appendix B: Eyepiece markings

Microscope eyepieces are marked according to DIN ISO 8578:2003-08. The most important markings are given in Tab. 7.

Tab. 7: Eyepiece markings.

Symbol	Explanation
H	Huygens type
P	Plan
WF	Wide-field
10x/18	Magnification/field number
10xB/18	Suitable for spectacle wearers
	Suitable for spectacle wearers

Appendix C: Microscope markings

Hund microscopes and accessories classified as in-vitro diagnostic medical devices are marked according to DIN EN ISO 15223-1 (Tab. 8).

Tab. 8: Label symbols.

Symbol	Explanation
SN	Serial number, followed by a 7-digit number
	In-vitro diagnostic medical device
	Manufacturer: Helmut Hund GmbH, Artur-Herzog-Str. 2, 35580 Wetzlar
CE	CE marking
	Observe the manual!

Waste Disposal Remark

European Union (EU) Waste of Electrical and Electronic Equipment (WEEE) directive

The European Union's WEEE directive requires that products sold into EU countries must have the crossed-out trashbin label on the product (or the package in some cases). As defined by the WEEE directive, this crossed-out trashbin label means that customers and end-users in EU countries should not dispose of electronic and electrical equipment or accessories in household waste. Customers or end-users in EU countries should contact their local equipment supplier representative or service center for information about the waste collection system in their country.

Notes

CE