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# Operating instructions
# Polarizing microscope

**KERN** **OPO-1**

OPO 185

Version 1.1
01/2021

EN

# KERN OPO-1

Version 1.1 01/2021

**Operating instructions**
**Polarizing microscope**

Table of Contents

# 1 Before use

## 1.1 General information

The packaging must be opened carefully to prevent the accessories inside from falling to the floor and breaking.

In general, a microscope should always be handled with great care, as it is a sensitive precision instrument. Avoiding abrupt movements during operation or transport is therefore particularly important, especially in order not to endanger the optical components.

Likewise, you should avoid dirt or fingerprints on the lens surfaces, as this will reduce image clarity in most cases.

If the performance of the microscope is to be maintained, it must never be disassembled. Components such as objective lenses and other optical elements should therefore be left as they are found at the start of operation. Also the electrical part at the back and at the bottom of the instrument must not be tampered with without further ado, because here there is the additional danger of triggering an electric shock.

## 1.2 Notes on the electrical system

Before connecting to a power supply, be sure to use the correct input voltage. The power cord selection guide is located on the back of the unit, just above the power jack. Failure to follow these instructions may result in fire or other damage to the unit.

Also, the main power switch should be turned off before connecting the power cord. This will prevent an electric shock from occurring.

If you use an extension cord, the power cord you use must be grounded.

If the original fuse blows, replace it only with a suitable fuse. Suitable replacement fuses are included in the scope of delivery.

All handling of the equipment that involves contact with the electrical system, such as changing lamps or fuses, may only be carried out when the power supply is disconnected.

## 1.3 Storage

Avoid exposing the device to direct sunlight, high or low temperatures, shock, dust and high humidity.

The suitable temperature range is 0 - 40° C and a relative humidity of 85 % should not be exceeded.

The device should always be placed on a firm, smooth and horizontal surface.

When the microscope is not in use, it is best to cover it with the dust cover provided. The power supply should be switched off at the main switch and the power cord removed. When storing the eyepieces separately, it is essential to attach the protective caps to the tube sockets. Dust or dirt inside the optics of a microscope can in many cases cause irreversible malfunctions or damage.

Accessories consisting of optical elements, such as eyepieces and objectives, are preferably stored in a drying box with desiccant.

## 1.4 Maintenance and cleaning

In any case, the device must be kept clean and regularly cleaned of dust.
Before wiping down the unit when wet, make sure that the power is turned off.

Glass components should preferably be wiped lightly with a lint-free cloth when contaminated.

To wipe off oil stains or fingerprints from lens surfaces, the lint-free cloth is moistened with a mixture of ether and alcohol (ratio 70 / 30) and then used for cleaning.

Ether and alcohol must always be handled with care as they are highly flammable substances. Therefore, it is essential to keep them away from open flames and electrical appliances, which are switched on and off, and use only in well-ventilated rooms.

However, organic solutions of this type should not be used to clean other components of the device. This could result in changes to the paintwork. It is sufficient to use a neutral cleaning agent for this purpose.

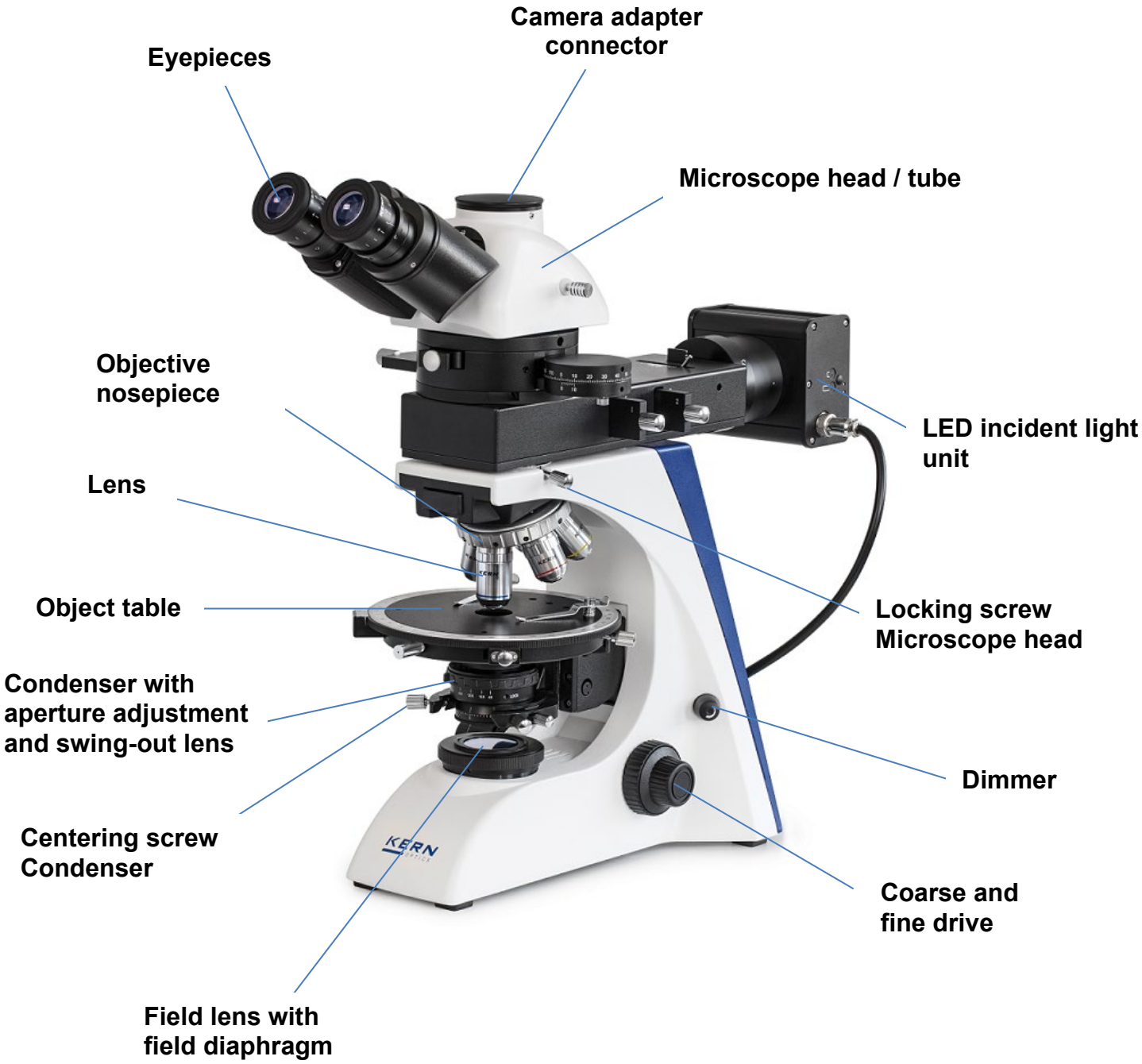
Other cleaning agents for the optical components include:

- Special cleaner for optical lenses
- Special optical cleaning cloths
- Bellows
- Brush

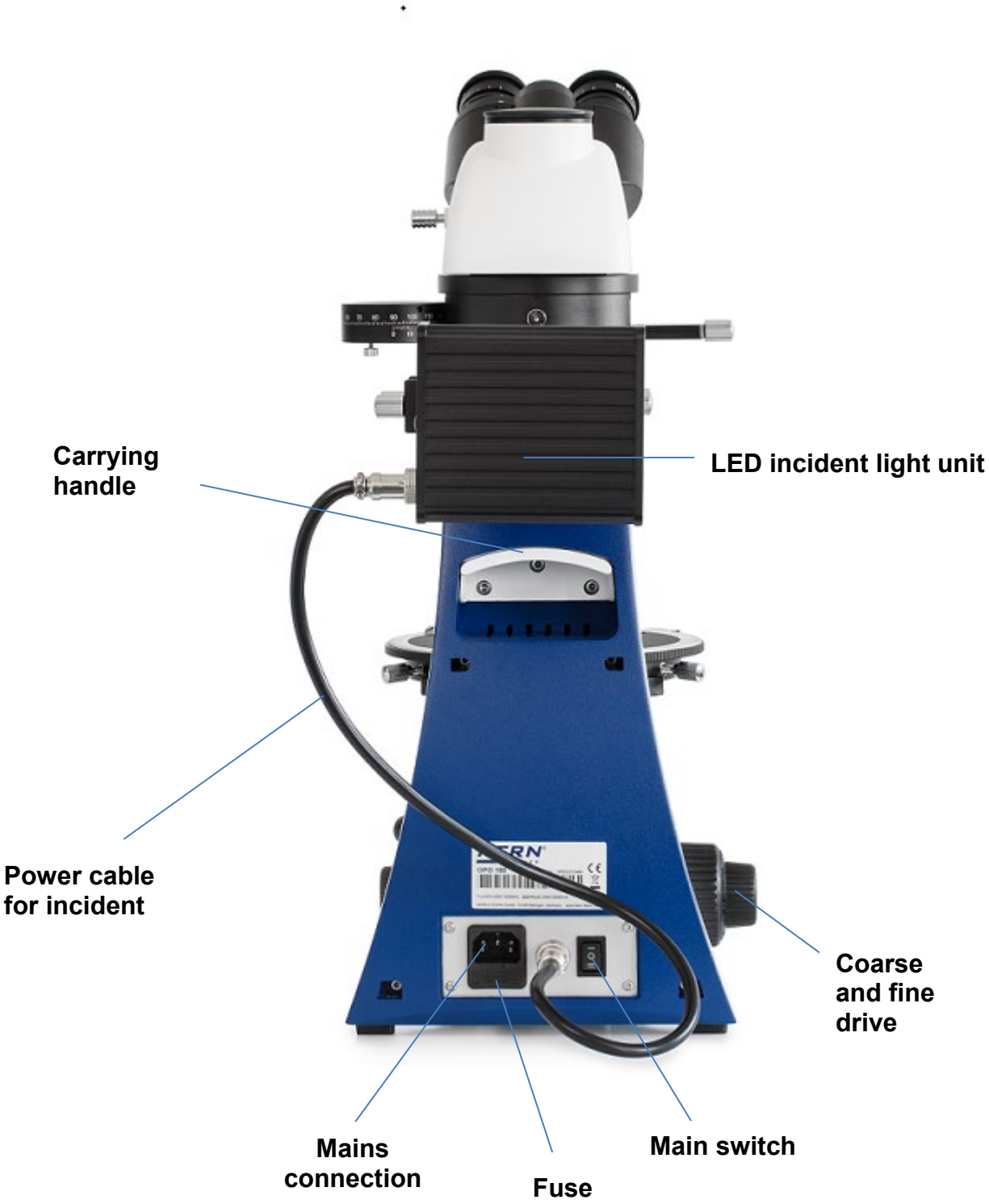
With proper handling and regular inspection, the microscope will operate smoothly for many years.

However, if a repair is necessary, contact your KERN dealer or our Technical Service.

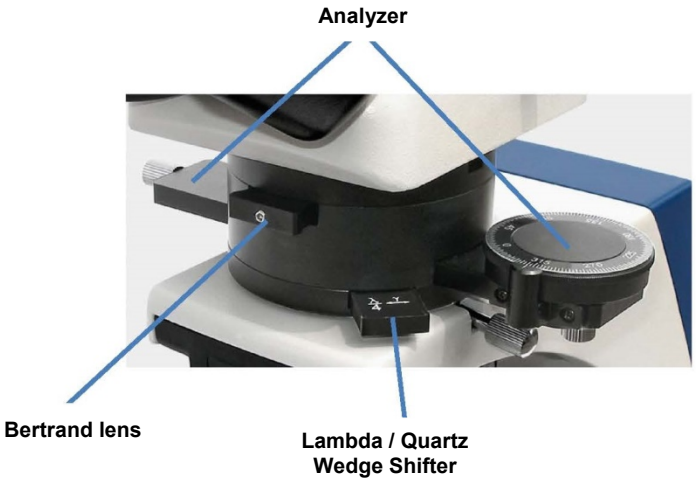
## 2 Nomenclature

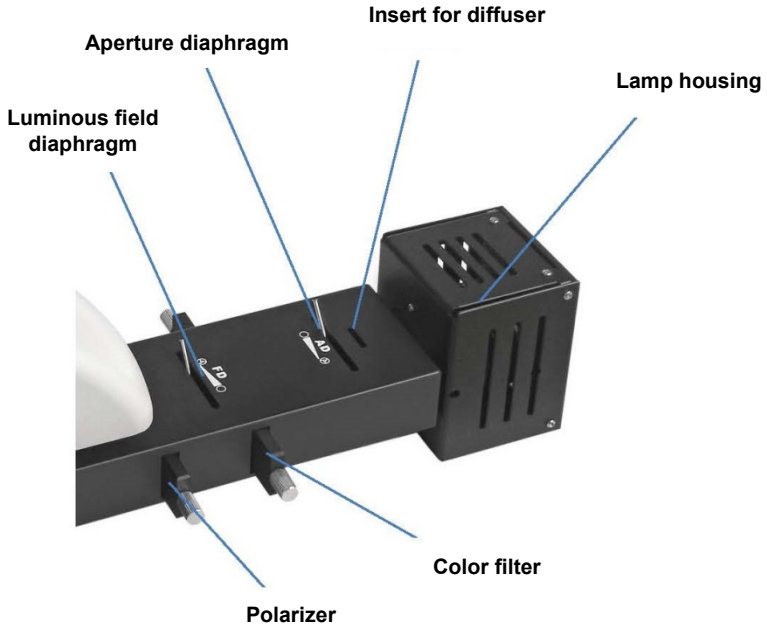


## Rear view


Carrying handle
LED incident light unit
Power cable for incident
Coarse and fine drive
Mains connection
Fuse
Main switch

## Analyzer unit / Reflected light unit



# 3 Technical data / equipment

| Model | Standard configuration | | | | |
|---|---|---|---|---|---|
| KERN | Tube | Eyepiece | Objective quality | Objectives | Illumination |
| OPO 185 | Trinocular | HWF 10×/⌀ 20 mm | Infinity Plan | Non-stress 4×/10×/20×/40×/50× | 5W LED (incident + transmitted) |

**Dimensions Product:** 500x200x500 mm

**Dimensions Packing:** 520x470x430 mm

**Net weight:** 13 kg

**Gross weight:** 16 kg

**Input voltage:** AC 100-240V, 50-60Hz

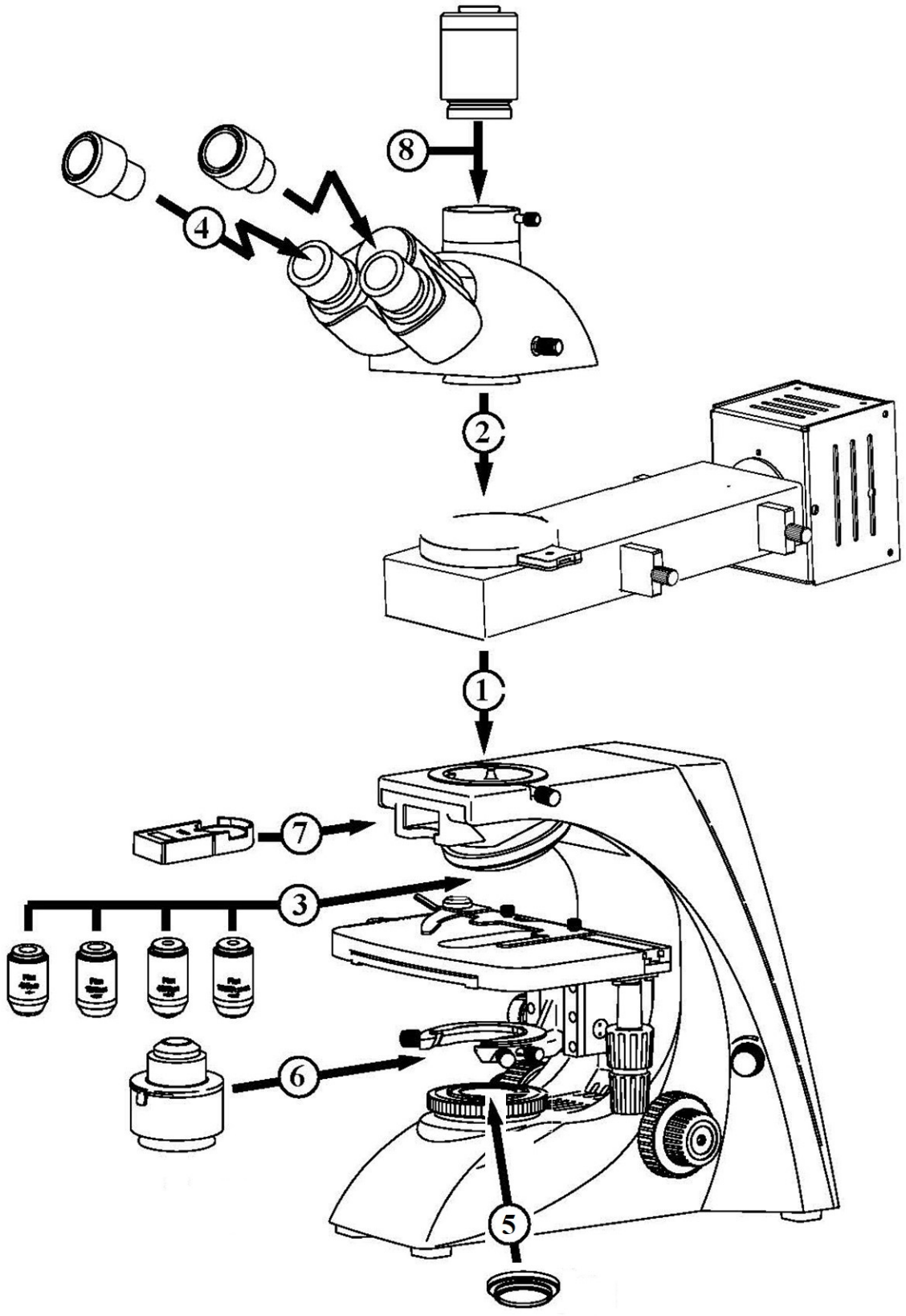
**Output voltage:** DC 1.2-6V

**Fuse:** 2A 5x20mm

| Model outfit | | Model KERN | Order number |
|---|---|---|---|
| | | OPO 185 | |
| **Eyepieces** (23,2 mm) | HWF 10×/20 mm | ✔ | OBB-A1591 |
| | HWF 10×/20 mm (reticule 0,1 mm) (adjustable) | ✔ | OBB-A1592 |
| **Non-stress Infinity Plan objectives** (transmitted) | 4×/0,10 W.D. 12,1 mm | ✔ | OBB-A1294 |
| | 10×/0,25 W.D. 4,64 mm | ✔ | OBB-A1289 |
| | 20×/0,40 (spring-loaded) W.D. 2,41 mm | ✔ | OBB-A1290 |
| | 40×/0,66 (spring-loaded) W.D. 0,65 mm | ✔ | OBB-A1292 |
| **Non-stress Infinity Plan objectives** (incident) for long working distance | 5×/0,13 W.D. 16,04 mm | ○ | OBB-A1593 |
| | 10×/0,25 W.D. 18,48 mm | ○ | OBB-A1594 |
| | 20×/0,40 W.D. 8,35 mm | ○ | OBB-A1291 |
| | 50×/0,70 (spring-loaded) W.D. 1,95 mm | ✔ | OBB-A1295 |
| | 100×/0,85 (dry) (spring-loaded) W.D. 3,00 mm | ○ | OBB-A1595 |
| **Trinocular tube** | · Siedentopf 30° inclined<br>· Interpupillary distance 48 – 76 mm<br>· Light distribution 100:0 | ✔ | |
| **Analyser unit with scale** | 360° rotatable, lockable | ✔ | |
| **Bertrand lens** | Insertable, center-adjustable | ✔ | OBB-A1121 |
| **λ + ¼ λ Slip** | λ Slip and ¼ λ Slip (combination) | ✔ | OBB-A1316 |
| **Quartz wedge** | I – IV Class | ✔ | OBB-A1321 |
| **Revolving round stage** | 360° rotatable, center-adjustable, division 1°, Vernier division 6' | ✔ | |
| **Polarising attached mechanical stage** | Polarising attached mechanical stage | ○ | OBB-A1337 |
| **Swing-out condenser** | N.A. 0,9/0,13 swing-out achromatic condenser (aperture diaphragm) | ✔ | OBB-A1107 |
| **Polarising unit with scale** (transmitted) | 360° rotatable, lockable | ✔ | |
| **Koehler illumination** | 5 W LED spare bulb (transmitted) | ✔ | OBB-A1589 |
| **Illumination polarising unit** | 5 W LED spare bulb (incident) | | |
| **Colour filters** for transmitted illumination | Blue | ✔ | OBB-A1170 |
| | Green | ○ | OBB-A1188 |
| | Yellow | ○ | OBB-A1165 |
| | Grey | ○ | OBB-A1183 |
| **C-Mount** | 1× | ○ | OBB-A1514 |
| | 0,75× | ○ | OBB-A1590 |
| | 0,5× (focus adjustable) | ○ | OBB-A1515 |

✔ = Included with delivery
○ = Option

# 4 Assembly



## 4.1 Analyzer unit (+ reflected light unit)

First, the lamp housing and the incident light unit must be brought together at their connection points. Then the connection is fixed via an Allen screw on the right at the connection point of the lamp housing.
Analyzer, polarizer and color filter slides can now be placed in the appropriate slots (*see page 8*).

To subsequently attach the incident light unit to the microscope, first loosen the fastening screw at the tube connection point and remove the black protective cover.
The round dovetail mount on the incident light unit can now be inserted into the round dovetail mount on the housing and fixed with the fixing screw. Always make sure that the lenses are not touched with bare fingers and that no dust enters the openings.
Finally, the power cable must be used to make the connection between the lamp housing and the connection socket on the back of the microscope.

## 4.2 Microscope head

First loosen the fixing screw at the connection point of the incident light unit and remove the black protective cover.
The round dovetail mount on the head can now be inserted into the round dovetail mount on the incident light unit and fixed with the fixing screw. Always make sure that the lenses are not touched with bare fingers and that no dust enters the openings.

## 4.3 Objective

The stage must be in the lower position so that the objectives can be screwed into the revolving nosepiece. The objectives can now be screwed into the revolving nosepiece in such a way that the objective with the next higher magnification appears when the revolving nosepiece is turned clockwise. Care should be taken not to touch the lenses with bare fingers and not to allow dust to enter the apertures.

### 4.4 Eyepieces

Always use eyepieces with the same magnification for both eyes. These are simply placed on the tube sockets after first removing the protective plastic caps. There is no fixation possibility. You should always make sure that the lenses are not touched with your bare fingers and that no dust enters the openings.

### 4.5 Condenser (Swing-Out) / Transmitted Light Polarizer

The object stage should best be brought into the uppermost position using the coarse drive. With the focus wheel of the condenser one must now bring the condenser carrier into a middle position. This way, the condenser can be inserted into the condenser carrier at the appropriate position and fixed with the locking screw. The scale should be readable from the front. Avoid touching the optical lenses with your bare fingers.
The transmitted-light polarizer (incl. scale) is located on the underside of the condenser. It is fixed to the side of the condenser by means of an Allen screw. When loosening this screw, the polarizer can be turned in both directions.

***For item 6 (camera connection), see Chapter 8 Using Optional Accessories.***

## 5 Operation

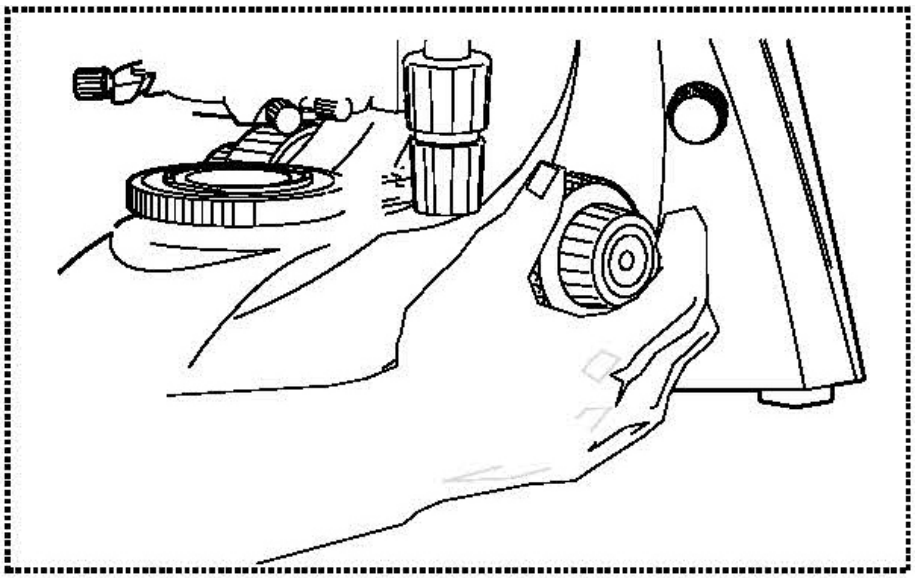
### 5.1 First steps

The first thing to do is to connect the **power supply by means of a mains plug.** The **light intensity control (dimmer)** should first be set to a **low level**, so that the eyes are not immediately exposed to too much light when looking into the eyepieces for the first time. Now the **illumination** can be **switched on** via the **main switch.**

The next step is to **place an object or slide** with specimen on the round turntable. This object must be appropriately prepared so that it is suitable for the use of polarized transmitted and/or reflected light. The slide can be fixed on the stage using the specimen holders. The specimen must be placed so that it lies in the beam path and can be observed.

## 5.2 (Pre-) Focusing

In order for an object to be observed, it must be at the correct distance from the lens so that a sharp image can be obtained.
To find this distance initially (without any other presettings of the microscope), bring the objective with the lowest magnification into the beam path, look with the right eye through the right eyepiece and turn the coarse adjustment knob slowly at first (*see illustration*).



The simplest method for this would be to bring the stage (also using the coarse drive) to just below the lens beforehand and then slowly lower it. As soon as an image (no matter how sharp) can then be seen, the correct sharpness should only be set with the fine drive.

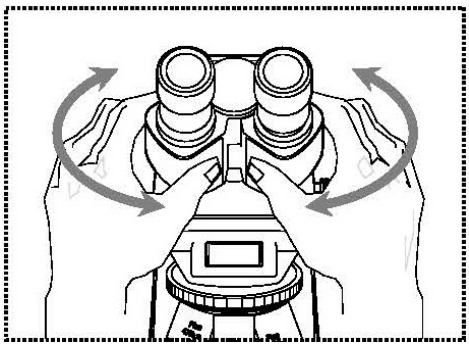
Torque adjustment of coarse and fine drive

Next to the left adjusting wheels of the coarse and fine drive is a ring which can be used to change the torque of these wheels. Turning clockwise decreases the torque and turning counterclockwise increases the torque.
This function can be used to facilitate the focus adjustment on the one hand and to prevent the object stage from sliding down unintentionally on the other hand.

Important

To avoid damage to the focusing system, never turn the left and right dials of the coarse and fine focus knobs in opposite directions at the same time.

## 5.3 Adjusting the eye relief



In binocular viewing, the interpupillary distance must be precisely adjusted for each user to obtain a clear image of the object.
While looking through the eyepieces, hold the left and right tube housings with one hand each. By pulling them apart or pushing them together, the interpupillary distance can be either increased or decreased (*see illustration*). As soon as the field of view of the left eyepiece and the field of view of the right eyepiece overlap completely, or merge into a single circular image, the correct interpupillary distance has been set.

## 5.4 Diopter compensation

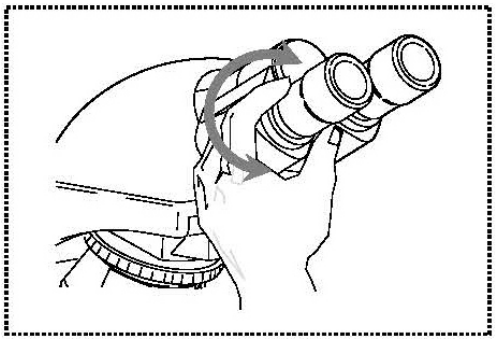
The visual acuity of the eyes of a person using the microscope can very often show minor differences, which are inconsequential in everyday life, but can cause problems with regard to exact focusing when using the microscope.

This difference can be compensated for by a mechanism on the left tube connector (dioptric compensation ring) as follows.

1. Move right diopter adjustment ring to position 0.

2. Look through the right eyepiece with the right eye and focus the image using the coarse and fine focus adjustment knobs.

3. Now look through the left eyepiece with the left eye and focus the image using the left diopter compensation ring.
   To do this, turn the ring in both directions (*see illustration*) to find out at which position the image appears sharpest.

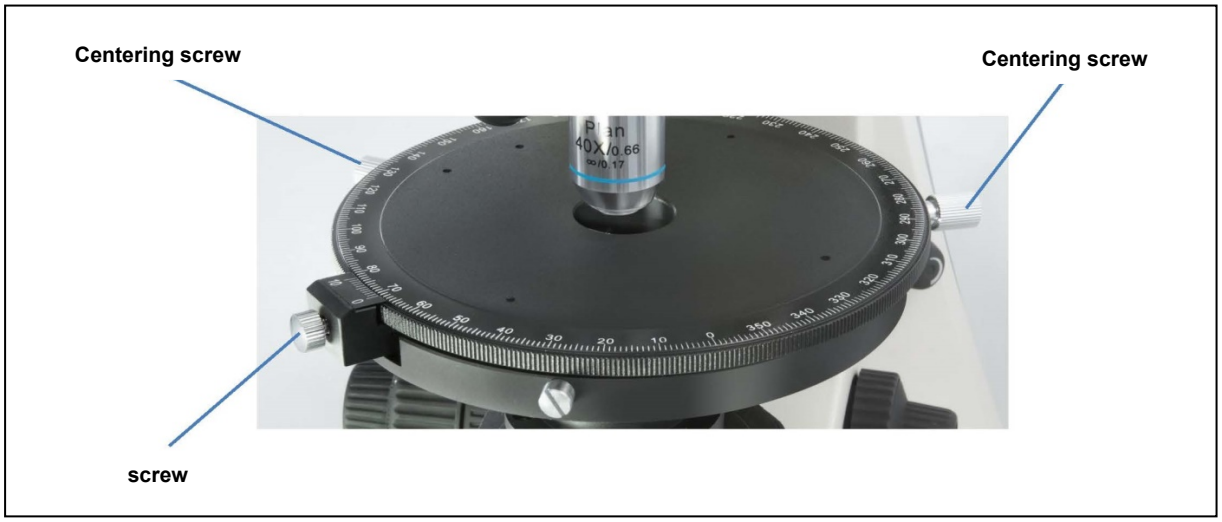


## 5.5 Centering of the microscope stage

In order to analyze certain objects using the polarization method, it is important to be able to rotate the microscope stage. This allows the contrast of the object to be observed as a function of its angular position between the polarizer and the analyzer. For optimal results, the center of the rotation axis of the stage must be aligned with the center of the optical path.

The microscopes of the OPO-1 series are correctly adjusted at the factory. However, it is recommended to check the centering of the microscope stage before first use and regularly thereafter.

In the event of decentering, the following steps must be carried out.



1. 10x Bring the objective into the beam path.

2. Make sure that an eyepiece with scale is in (one of) the tube sockets.
   is appropriate.

3. Place a suitable microscope slide on the stage.
   This should preferably be equipped with a micro reticle.
   *However, it is also possible to use a point-rich object where one of these points is of such a magnitude that it roughly coincides with the center of the eyepiece scale in the field of view of the eyepiece(s).*

4. Position the slide so that when looking through the eyepiece(s), the center of the crosshairs is at the center of the eyepiece scale.

5. Make sure that the fixing screw of the table is loosened so that the table can be turned.
   *If the table cannot be turned or can only be turned with difficulty even though the fixing screw has been loosened, this is an indication that the table is clearly off-centre.*

6. If the table is perfectly centered, observe that during a full rotation of the table, these two centers always remain on top of each other.
   The process would thus be complete.

7. If the stage is not centered, one observes that the center of the crosshairs moves away from the center of the eyepiece scale right at the beginning of the rotation of the stage and does not coincide with it again until after one full rotation.

8. Estimate the center of this circular motion made by the crosshairs and move the slide so that the center of the crosshairs is brought to this estimated center.

9. Operate the two centering screws so that the center of the crosshairs and the center of the eyepiece scale are now aligned again.

10. Repeat steps 6 - 9.

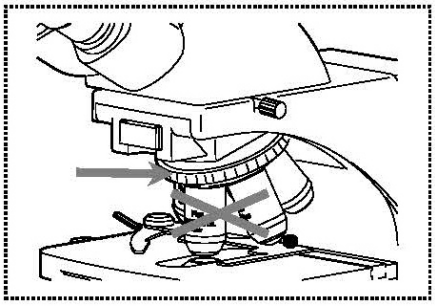
## 5.6 Setting the magnification

After pre-focusing using the objective with the lowest magnification (*see section 5.2*), the total magnification can now be adjusted as required using the revolving nosepiece. By rotating the revolver, any of the four other objectives can be brought into the beam path.

It is essential to observe the following points when adjusting the revolving nosepiece:

- The desired lens must always be properly engaged.

- The turret should not be rotated by holding it by the individual lenses, but by the silver ring above the lenses (*see illustration*).



- When rotating the turret, always make sure that the objective lens that is being brought into the beam path does not come into contact with the specimen slide. This can cause considerable damage to the objective lens.
  It is best to always check from the side whether there is sufficient clearance. If this is not the case, the object table must be lowered accordingly.

If you have focused the object of observation for a certain magnification, the focus can easily get out of focus when selecting the objective with the next higher magnification. In this case, the focus must be restored by slightly adjusting the fine adjustment knob.

## 5.7 Using the eyecups

The eyecups included in the scope of delivery can basically always be used, as they shield disturbing light that is reflected from light sources in the surroundings at the eyepiece, thus resulting in better image quality.

But mainly, if eyepieces with a high viewpoint (especially suitable for eyeglass wearers) are used, then it can be useful for users without glasses to attach the eyecups to the eyepieces.

These special eyepieces are also called High Eye Point eyepieces and can be recognized by a glasses symbol on the side. They are also identified by an additional "H" in the article description (example: HSWF 10x Ø 23 mm).

**With the OPO-1 series, the eyecups are already attached to the eyepiece. To use them, simply unfold the folded rubber parts.**

When unfolding the eyecups, care should be taken not to adjust the diopter setting. Therefore, it is recommended to hold the diopter adjustment ring of an eyepiece with one hand while unfolding the eyecup with the other.

Eyeglass wearers must fold in the eyecups before observing if there are any on the High Eye Point eyepieces.

Since the eyecups are made of rubber, it is important to note that they can easily become contaminated by grease residues during use. To maintain hygiene at all times, it is therefore recommended to clean the eyecups regularly (e.g. with a damp cloth).

Eyecups


High Eye Point Eyepiece
(recognizable by the glasses symbol)

## 5.8 Adjustment of the analyzer unit

In order to be able to use the polarization method in addition to the bright field method, certain components must also be correctly adjusted to each other.

In principle, the correct interaction of polarizer and analyzer must be present for this.
The analyzer is located in one of the two round openings of a special slide, the other opening is empty (glass pane).
This slide is additionally equipped with a rotary wheel (incl. scale) and, in order to use the analyzer, is placed in the slot provided for this purpose (*see page 8, upper illustration*) and then pushed forward to the second locking position.
If the analyzer is no longer to be used, the slide must be pulled out again to the first latching position.

The analyzer unit serves as a counterpart for both the transmitted light polarizer and the reflected light polarizer.

The transmitted light polarizer is located on the underside of the transmitted light condenser and can be rotated if required. The incident light polarizer is located in one of the slots on the incident light unit (*see section 5.10*).

The setting of the analyzer must now be brought to 0° by means of the rotary wheel provided for this purpose. Thus, provided that 0° is also set for the transmitted-light polarizer, the orthogonality between polarizer and analyzer required for common polarization applications is established.
An indication of this orthogonality is the maximum obscuration that can be observed in the field of view.

For the standard polarization procedure, the slider for the Bertrand lens must be in the pulled-out position. It is then brought into the beam path when the interference pattern of a sample is to be observed for conoscopic analyses.

If necessary, the lambda filters included in the standard equipment can also be used. To do this, the corresponding slider must be placed in the slot provided for this purpose (*remove one of the two retaining screws beforehand and reattach it after insertion*).
This slider contains three openings, each of which can be brought into the beam path via a snap-in function. The middle opening does not contain a filter, so the standard polarization method can be used in this position.
The other two apertures each contain a lambda filter (¼ λ and λ). They can be used to adjust the interference colors caused by the polarized light on the sample, as required.

## 5.9 Adjustment of Köhler illumination for transmitted light

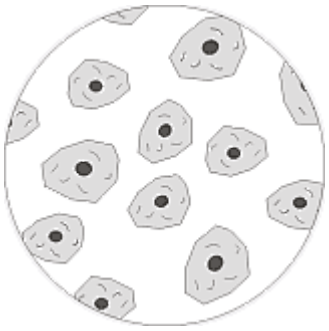
In order to obtain perfect image results during microscopic observation, it is important that the light guidance of the microscope is optimized. If illumination can be adjusted according to Köhler, this results in homogeneous illumination of the specimen and the reduction of disturbing stray light.

Necessary control elements for this are:

- Height adjustable and centerable condenser with aperture diaphragm
- Illuminated field diaphragm

For the first adjustment of Köhler's illumination, the smallest possible objective magnification must first be selected so that the following steps can then be carried out.

1. Move the condenser with the condenser focus wheel to a position directly under the specimen stage. Switch on the illumination and focus the specimen, which is placed with the cover glass facing upwards, using the coarse and fine adjustment knobs.

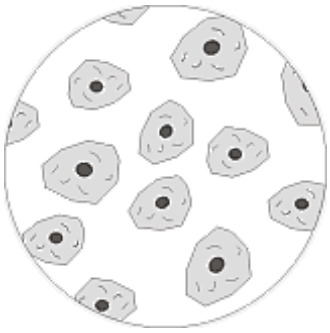


2. Close the field diaphragm completely at its adjustment ring. When looking into the microscope, a blurred image of the aperture appears. If the microscopic image becomes completely dark, the image of the field diaphragm is outside the field of view and must be brought into the field of view by the centering screws of the condenser.

3. Adjust the height of the condenser until the image of the field diaphragm appears sharp in the field of view. With some microscopes, there is a danger of raising the condenser too high and causing a collision with the specimen slide. A little caution is therefore required here.

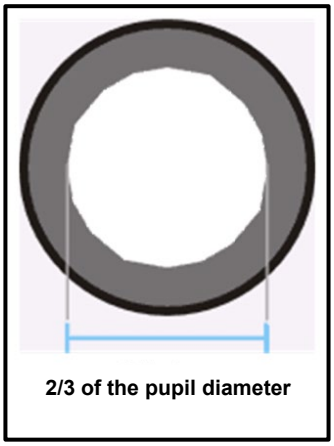
4. Using the centering screws of the condenser carrier, bring the image of the field diaphragm into the center of the field of view.

5. Open the field diaphragm until it just disappears from the field of view.
   If necessary, re-center slightly with the centering screws of the condenser carrier.



6. Use the aperture diaphragm of the condenser to set the optimum compromise between contrast and resolution for the microscopic image. The scale graduation on the condenser is a guide value. Select according to the detented objective.

   The view into the tube, without the eyepiece should look something like the picture on the right.
   The diameter of the then visible aperture diaphragm should be about 2/3 of the pupil diameter.


2/3 of the pupil diameter

   If the eyepiece is to be removed for inspection, please ensure that no dirt or dust can fall into the tube.

7. Possibly change the brightness of the lamp slightly with the **dimmer. The** brightness is always regulated via the lamp brightness and not via the aperture diaphragm.

8. If necessary, readjust the focus and x/y axis.

9. Observe object.

If a different magnification is subsequently selected, the Köhler illumination does not have to be completely reset from the beginning, but only the aperture and field diaphragm adjusted accordingly.
In the course of this, you can also always check whether the condenser needs to be re-centered.

## 5.10 Adjustment of the illumination for incident light

Just like the components of transmitted light illumination, those of reflected light illumination can be adapted to different application requirements.

The following components are available:

### Luminous field diaphragm and aperture diaphragm

The two shutters have the same functions as explained in the transmitted light setting (*see section 5.9*). These shutters are opened and closed using the levers located on the top of the incident light unit.

### Color filter

The color filter slider contains two round openings. One with integrated blue filter and one empty. This slider has the inscription "2" and must therefore be brought into the insertion point also with "2" as the inscription. Depending on the requirements, one of the two openings must be engaged in the beam path.

### Polarization unit (analyzer / polarizer)

In order to bring the analyzer into the beam path, the analyzer slide must be brought into the insertion position at the side below the microscope head so that the integrated rotary wheel points to the right in order to be able to set the desired alignment of the analyzer. If the analyzer is not to be used, it must be moved to the left-hand locking position (slide to the right).

The polarizer slider contains two round openings. One with integrated polarizer and one empty. This slider has the inscription "1" and must therefore be brought into the insertion point also with "1" as the inscription. Depending on the requirements, one of the two openings must be engaged in the beam path.

### Diffuser

Directly behind the lever of the aperture diaphragm is a small insertion point for the diffuser. It is integrated in a round opening of a small black slider. This slider can be inserted to let the light of the LED diffuse evenly.

# 6 Lamp replacement

The devices of the OPO-1 series are equipped with LEDs.
Due to the long service life of LED illumination, regular lamp replacement will not be necessary with these microscopes.
Problems with the lighting would therefore in most cases have defects in the electrical system as the cause. In such a case, our technical service can help.

# 7 Fuse replacement

The fuse housing is located on the rear of the microscope below the power plug connection. When the instrument is switched off and the mains plug is removed, the housing can be pulled out. It is advisable to use a screwdriver or similar to help here. The defective fuse can now be removed from its housing and replaced with a new one. Then reinsert the fuse housing into the insertion point below the mains plug connection.

# 8 Use of optional accessories

In case of using a trinocular tube, it is possible to connect microscope cameras to the instrument in order to digitally document images or sequences of an observation object.

After removing the plastic cover from the camera adapter port on top of the microscope head, a suitable adapter must first be attached to it.
Generally, three C-mount adapters are available for this purpose (1x, 0.5x and 0.75x magnification, *see chapter 3 Equipment*). After attaching one of these adapters, it can be fixed with the locking screw. A camera with a C-mount thread is now screwed onto the top of the adapter.

It is recommended to first adjust the field of view via the eyepieces on the instrument for the existing requirements and then to make the observation via the microscope camera (or via the PC screen connected to it).
The trinocular switch rod on the right side of the microscope head must be pulled out for this purpose. The light of the microscope illumination is thus completely redirected into the beam path for the camera, which causes a dark field of view in the eyepieces. This means that simultaneous observation via eyepieces and PC screen is not possible.

With C-mount adapters that have an integrated lens, the image displayed by a camera attached to the device can often have a different degree of sharpness than the image produced at the eyepiece.
In order to be able to focus both images nevertheless, such adapters are focusable.

# 9 Troubleshooting

| Problem | Possible causes |
|---|---|
| Lamp does not burn | Mains plug not inserted correctly |
| | No power available at the socket |
| | Lamp defective |
| | Fuse defective |
| Field of view is dark | Aperture diaphragm and/or field diaphragm are not open wide enough |
| | The beam path selection slider is set to "Camera". |
| | The condenser is not properly centered |
| Brightness cannot be regulated | The brightness control is set incorrectly |
| | The condenser was not centered correctly |
| | The condenser is lowered too far |
| Field of view is dark or not correct floodlit | The lens was not swiveled in properly |
| | The beam path selector slide is in an intermediate position |
| | The object turret is not mounted correctly |
| | The condenser is not mounted correctly |
| | A lens is used that does not match the illumination range of the condenser. |
| | The condenser was not centered correctly |
| | The light field diaphragm is closed too far |
| | The lamp is not mounted correctly |
| The field of vision of one eye does not match that of the other eye | The interpupillary distance is not adjusted correctly |
| | The diopter adjustment has not been made correctly |
| | Different eyepieces are used on the right and left |
| | The eyes are not used to microscopy |

| Problem | Possible causes |
|---|---|
| Blurred details<br>Bad picture<br>Poor contrast<br>Vignetted field of view | Aperture diaphragm is not open wide enough |
| | Condenser is lowered too far |
| | The objective does not belong to this microscope |
| | The front lens of the lens is dirty |
| | An immersion lens is used without immersion oil |
| | The immersion oil contains air bubbles |
| | The condenser is not centered |
| | The recommended immersion oil is not used |
| | Dirt / dust on the lens |
| | Dirt / dust on the front lens of the condenser |
| Dirt or dust in the field of view | Dirt / dust on the eyepieces |
| | Dirt / dust on the front lens of the Condenser |
| | Dirt / dust on the object |
| One side of the image is blurred | The table was not mounted correctly |
| | The lens is not correctly pivoted to the beam path |
| | The revolving nosepiece is not mounted correctly |
| | The object lies with the upper side down. |
| The picture flickers | The revolving nosepiece is not correct mounted |
| | The lens is not properly mounted on slewed into the beam path |
| | The condenser was not properly centered |
| The coarse drive is difficult to rotate | The rotational resistance brake is too tightened firmly |
| | The table is held by a Solid blocked. |
| The table moves down by itself<br>The fine drive adjusts itself | The rotational resistance brake is too little tightened |
| Touching the table blurs the image | The table was not mounted correctly |

## 10 Service

If despite studying these operating instructions you still have questions about commissioning or operation, or if contrary to expectations a problem should arise, please contact your specialist dealer. The device may only be opened by trained service technicians authorised by KERN.

## 11 Disposal

The packaging is made of environmentally friendly materials that you can dispose of at local recycling points. Disposal of the storage box and device must be carried out by the operator in accordance with the valid national or regional law of the user location.

## 12 Further information

The illustrations may differ slightly from the product.

The descriptions and illustrations in this manual are subject to change without notice. Further developments to the device may entail such changes.

All language versions include a non-binding translation. The original German document is binding.

## Notes