

# User instructions

## Metallurgical microscope

### KERN OKN-1, OKO-1

OKN 175, OKN 177  
OKO 176, OKO 178

Version 1.0  
01/2015







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Version 1.0 01/2015

## User instructions

## Metallurgical microscope

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# **1 Before use**

## **1.1 General notes**

You must open the packaging carefully, to make sure that none of the accessories in the packaging fall on the floor and get broken.

In general, microscopes should always be handled carefully because they are sensitive precision instruments. When using or transporting the microscope it is particularly important to avoid abrupt movements, as this may damage the optical components.

You should also avoid getting dirt or finger prints on the lens surface, because in most cases this will reduce image clarity.

To maintain the performance of the microscope, it must never be disassembled. So components such as lenses and other optical elements should be left as they were before use. Also the electrical parts on the rear and base of the device must not be tampered with, as in this area there is an additional risk of triggering an electric shock.

## **1.2 Notes on the electrical system**

Before connecting to a mains power supply, you must make sure that you are using the correct input voltage. The information to select the correct mains cable is located on the device, on the rear of the product directly above the connection socket. You must comply with this information. If you do not comply with these specifications, then fires or other damage to the device could occur.

The main switch must also be switched off before the mains cable is connected. In this way you will avoid triggering an electric shock.

If you are using an extension cable, then the mains cable you use must be earthed.

If the original fuse should blow, it must only be replaced by an appropriate fuse. Suitable replacement fuses are included with the delivery.

When carrying out any procedures whereby you come into contact with the electrical system of the device, such as, for example, changing the bulb or fuse, only carry out these procedures when the power is disconnected.

Under no circumstances should you touch the integrated halogen bulbs either during operation or directly after use. These bulbs produce significant heat and therefore there is a risk that the user could be severely burnt. So before handling the bulbs, you must check that they have cooled down.

The microscope housing, on the other hand, is constructed so that no significant heat radiation emanates from the device and that there is absolutely no risk of the user burning themselves from the housing outer surfaces.

### **1.3 Storage**

You should ensure that the device is not exposed to direct sunlight, temperatures which are too high or too low, vibrations, dust or a high level of humidity.

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

The device should always be located on a rigid, smooth, horizontal surface.

When the microscope is not being used, you should cover it with the enclosed dust protective cover. When doing this, the power supply is stopped by switching off at the main switch and unplugging the mains cable. If the eyepieces are being stored separately, the protective caps must be fitted to the tube connectors. In most cases, if dust and dirt gets inside the optical unit of a microscope this can cause irreversible errors or damage.

The best way to store accessories which consist of optical elements, such as, for example, eyepieces and objectives, is in a dry box with desiccant.

## 1.4 Maintenance and cleaning

In any event, the device must be kept clean and dusted regularly.

If any moisture should occur, before you wipe down the device you must ensure that the mains power is switched off.

When glass components become dirty, the best way to clean them is to wipe them gently with a lint-free cloth.

To wipe oil stains or finger prints off the lens surface, moisten the lint free cloth with a mixture of ether and alcohol (70 / 30 ratio) and use this to clean the lens.

You must be careful when handling ether and alcohol, as these are highly flammable substances. You must therefore keep it away from naked flames and electrical devices which can be switched on and off, and only use it in well-ventilated rooms.

However organic solutions of this type should not be used to clean other components of the device. This could lead to damage to the paint finish. To do this, it is sufficient to use a neutral cleaning product.

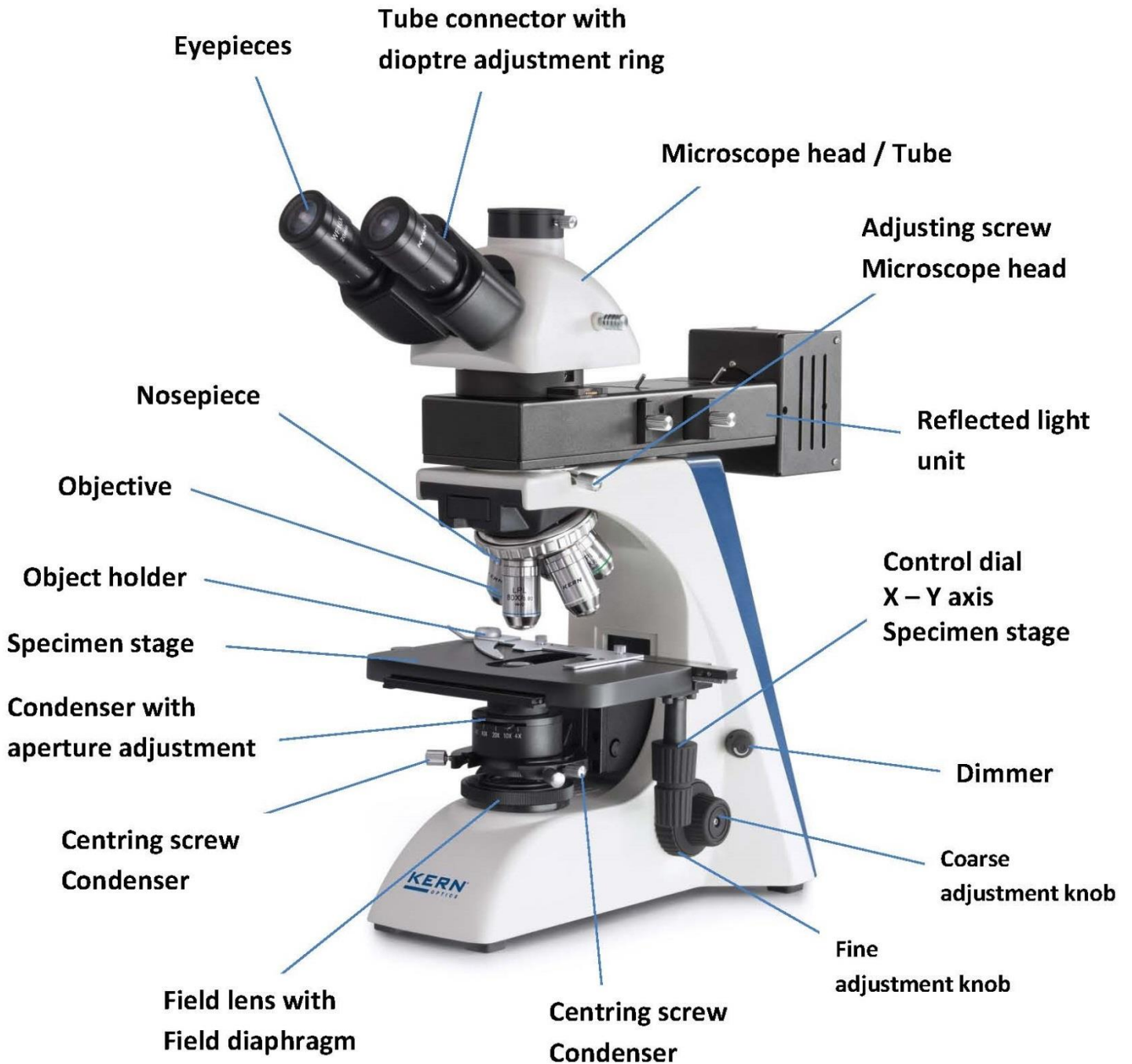
You could also use the following cleaning products to clean the optical components:

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

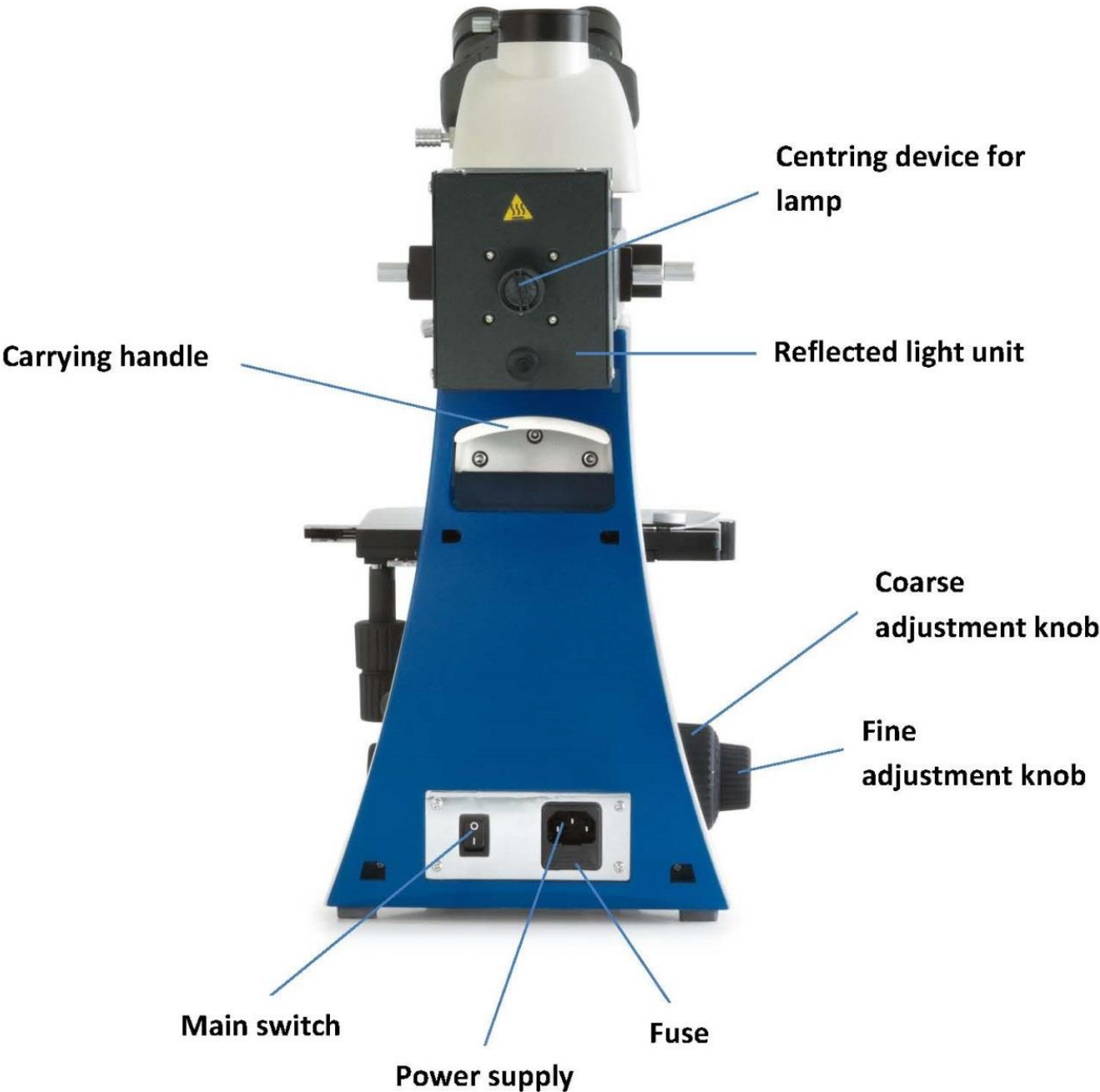
When handled correctly and checked regularly, the microscope should give many years of efficient service.

Should repairs still be necessary, please contact your KERN dealer or our Technical Department.

## 2 Nomenclature

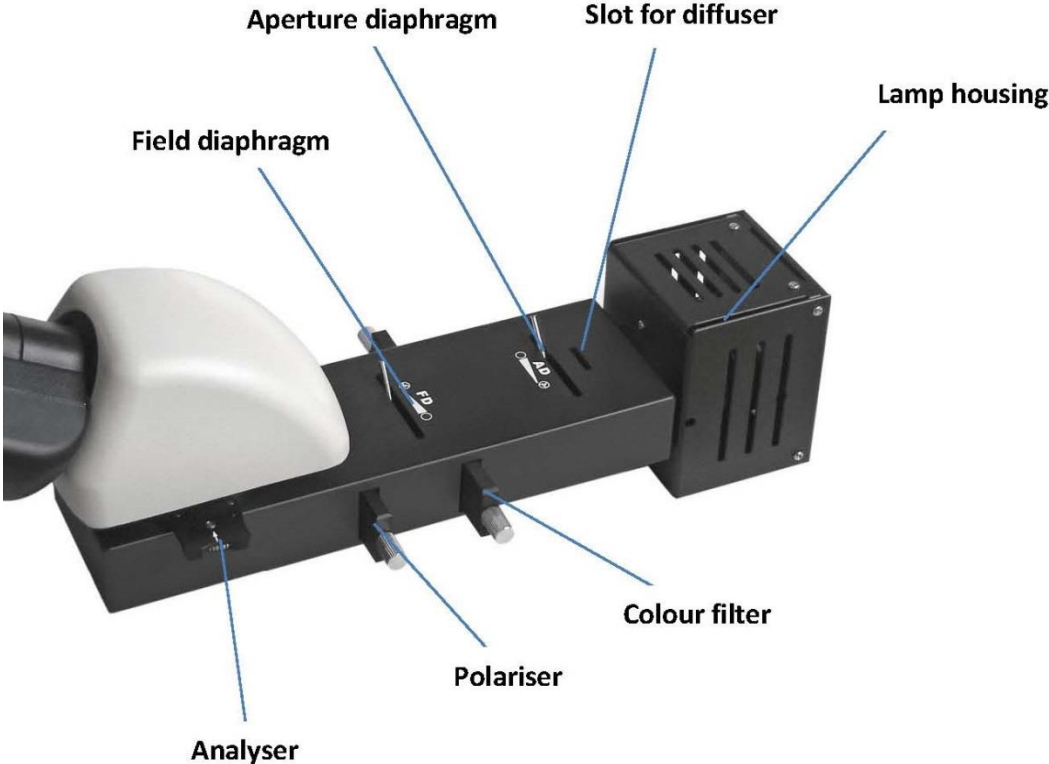


**Rear view**





# Reflected light unit



# Power supply unit for reflected light unit



### 3 Technical data / Features

Model	Standard configuration		
	Optical system	Tube	Illumination
KERN			
OKN 175	Infinity	Binocular	12V / 50W Halogen (reflecting)
OKO 176	Infinity	Binocular	12V / 50W Halogen (reflecting) + 6V / 20W (transmitting)
OKN 177	Infinity	Binocular	12V / 100W Halogen (reflecting)
OKO 178	Infinity	Binocular	12V / 100W Halogen (reflecting) + 6V / 20W (transmitting)

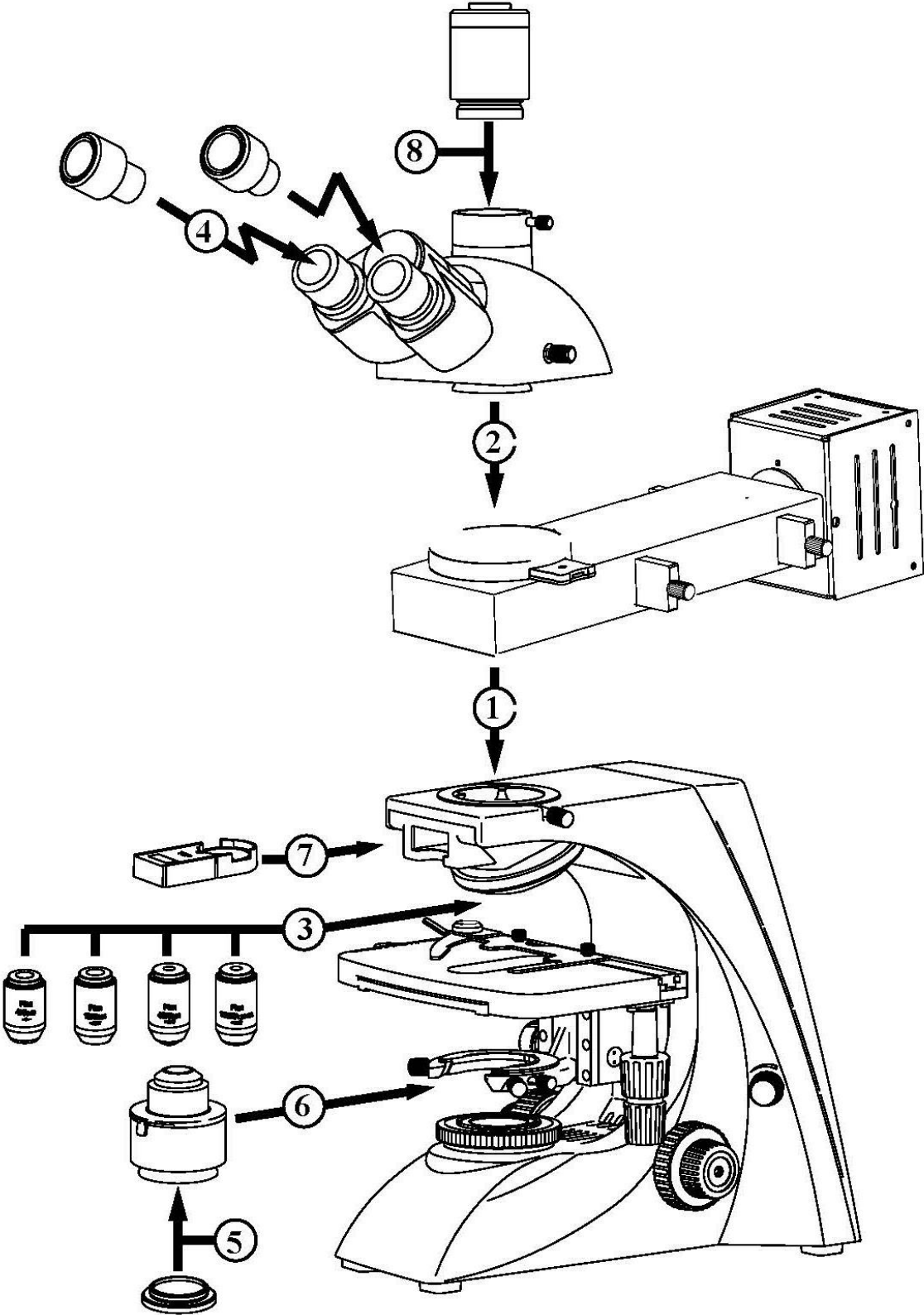
<b>Eyepieces:</b>	WF 10x / Ø 18 mm
<b>Objectives OKN-1:</b>	5x / 10x / 20x LWD / 40x LWD
<b>Objectives OKO-1:</b>	5x / 10x / 100x / 20x LWD / 40x LWD
<b>Product dimension:</b> <i>OKN 175, OKO 176</i>	490x200x460 mm
<b>Product dimension:</b> <i>OKN 177, OKO 178</i>	550x200x460 mm
<b>Packing dimensions:</b> <i>OKN 175, OKO 176</i>	750x360x450 mm
<b>Packing dimensions:</b> <i>OKN 177, OKO 178</i>	990x360x450 mm
<b>Net weight:</b> <i>OKN 175, OKO 176</i>	13 kg
<b>Net weight:</b> <i>OKN 177, OKO 178</i>	14,5 kg
<b>Gross weight:</b> <i>OKN 175, OKO 176</i>	17 kg
<b>Gross weight:</b> <i>OKN 177, OKO 178</i>	21 kg
<b>Input voltage:</b>	AC 100-240V, 50-60Hz
<b>Output voltage:</b>	DC 1,2-6V
<b>Fuse:</b>	2A 5x20mm

Model outfit		Model KERN				Order number
		OKN 175	OKO 176	OKN 177	OKO 178	
Eyepieces	WF 10x / Ø 18 mm	●●	●●	●●	●●	OBB-A1347
	WF 10x / Ø 18 mm (reticule 0,1 mm) (adjustable)	●	●	●	●	OBB-A1350
	WF 5x / Ø 20 mm	○○	○○	○○	○○	OBB-A1355
	WF12,5x / Ø 14 mm	○○	○○	○○	○○	OBB-A1353
Infinity Plan objectives (no cover glass)	5x / 0,11 W.D. 6,73 mm	●	●	●	●	OBB-A1268
	10x / 0,25 W.D. 4,19 mm	●	●	●	●	OBB-A1244
	20x / 0,40 (spring) W.D. 2,14 mm	○	○	○	○	OBB-A1251
	40x / 0,65 (spring) W.D. 0,45 mm	○	○	○	○	OBB-A1258
	100x / 1,25 (oil) (spring) W.D. 0,12 mm	○	●	○	●	OBB-A1241
Infinity Plan objectives Infinity (no cover glass) for long working distance	20x / 0,40 (spring) W.D. 8,35 mm	●	●	●	●	OBB-A1252
	40x / 0,65 (spring) W.D. 3,90 mm	●	●	●	●	OBB-A1259
	50x / 0,70 (spring) W.D. 1,95 mm	○	○	○	○	OBB-A1266
	80x / 0,80 (spring) W.D. 0,85 mm	○	○	○	○	OBB-A1271
Binocular tube	<ul style="list-style-type: none"> <li>Siedentopf, 30°inclined, 360° rotatable</li> <li>Interpupillary distance: 50 – 75 mm</li> <li>With diopter adjustment (both-sided)</li> </ul>	●	●	●	●	OBB-A1125
Trinocular tube	<ul style="list-style-type: none"> <li>Siedentopf, 30°inclined, 360° rotatable</li> <li>Interpupillary distance: 50 – 75mm</li> <li>Light distribution: 100:0</li> <li>With diopter adjustment (both-sided)</li> </ul>	○	○	○	○	OBB-A1344
Nosepiece	Quintuple	●	●	●	●	
Mechanical stage for reflection	<ul style="list-style-type: none"> <li>Stage size: WxD 200x140 mm</li> <li>Travel: 78x55 mm</li> <li>Stage fast lowering unit</li> <li>Stage Up-Down moving range: max. 50 mm</li> </ul>	●		●		
Mechanical stage for transmission	<ul style="list-style-type: none"> <li>Stage size: WxD 190x140 mm</li> <li>Travel: 78x55 mm</li> <li>Coaxial coarse and fine focusing knobs</li> </ul>		●		●	
Stage plate	Plate for sample placement	●	●	●	●	
Glass plate	Glass plate		○		○	OBB-A1378
Clip	Clip		●		●	OBB-A1134
Stage micrometer	Specimen slide with scale reticule 0,01 mm	○	○	○	○	OBB-A1224
Polarising unit	Polarising / Analyser slide	●	●	●	●	OBB-A1287
Condenser	Abbe N.A. 1,25 (aperture diaphragm)		●		●	OBB-A1380
Illumination	6V / 20W Halogen (transmitting)		●		●	OBB-A1204
	12V / 50W Halogen (reflecting)	●	●			OBB-A1207
	12V / 100W Halogen (reflecting)			●	●	OBB-A1376
Field diaphragm	Field diaphragm		●		●	
Filter	Blue	○	●	○	●	OBB-A1176
	Green	○	○	○	○	OBB-A1192
	Yellow	○	○	○	○	OBB-A1202
C-Mount	1x	○	○	○	○	OBB-A1361
	0,57x (focus adjustable)	○	○	○	○	OBB-A1136

● = Standard configuration

○ = Option

4 Assembly



## **4.1 Reflected light unit**

At first you have to unite the lamp housing and the reflected light unit on their connection points. After that the connection has to be fixated by an Allen screw, which is attached to the right-hand side of the connection point of the lamp housing. Now the slides for analyser, polariser and colour filter can be attached to the appropriate slots (see page 8).

Afterwards in order to install the reflected light unit to the microscope, you must loosen the fixing screw on the tube connection point and remove the black protective cover.

You can then insert the round dovetail bracket on the light unit into the round dovetail bracket on the housing and fix it with the fixing screw. When doing this, you should always make sure that you do not touch the lenses with your bare fingers and that no dust enters the apertures.

Finally you must establish the electrical connection between power supply unit and reflected light unit. The plug of the connection cable, attached to the rear of the light unit has to be installed to the socket on the rear of the power supply unit. Please do also use the screw lock on the plug.

## **4.2 Microscope head**

First you must loosen the fixing screw on the tube connection point of the reflected light unit and remove the black protective cover.

You can then insert the round dovetail bracket on the head into the round dovetail bracket on the reflected light unit and fix it with the fixing screw. When doing this, you should always make sure that you do not touch the lenses with your bare fingers and that no dust enters the apertures.

## **4.3 Objectives**

The specimen stage must be in its lowest position so that the objectives can be screwed into the nosepiece. You can then screw the objectives into the nosepiece so that when you turn the nosepiece in a clockwise direction, the objective with the next strongest magnification appears. You must make sure that you do not touch the lenses with your bare fingers and that no dust enters the apertures. For objectives which are marked "OIL", you must use an immersion oil with the lowest level of inherent fluorescence.

#### **4.4 Eyepieces**

You must always use eyepieces with the same magnification for both eyes. These are simply placed onto the tube connectors, once you have first removed the plastic protective caps. There is no way of fixing them. You should always make sure that you do not touch the lenses with your bare fingers and that no dust enters the apertures.

#### **4.5 Colour filter**

OKO-1

A blue colour filter is already an integral part of the condenser. It is screwed onto the underside using a ring bracket. It can be removed at any time. In order to use suitable filters without this holder ring, these can simply be placed in the ring bracket of the field lens.

#### **4.6 Condenser**

OKO-1

We recommend that you use the course adjustment knob to bring the specimen stage to its uppermost position. Use the focus dial of the condenser to move the condenser holder to the central position. In this way the condenser can be fitted at the right place in the condenser holder and fixed with the adjusting screw. When doing this, you should be able to read the scale from the front. You should avoid touching the optical lenses with bare fingers.

***For points 7 (Polarisation unit) and 8 (Camera connection), please see Chapter 8 Use of optional accessories.***

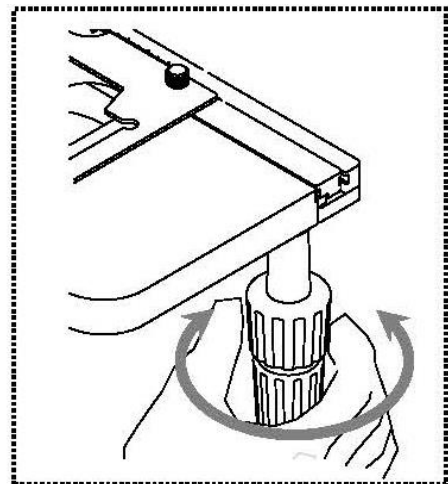
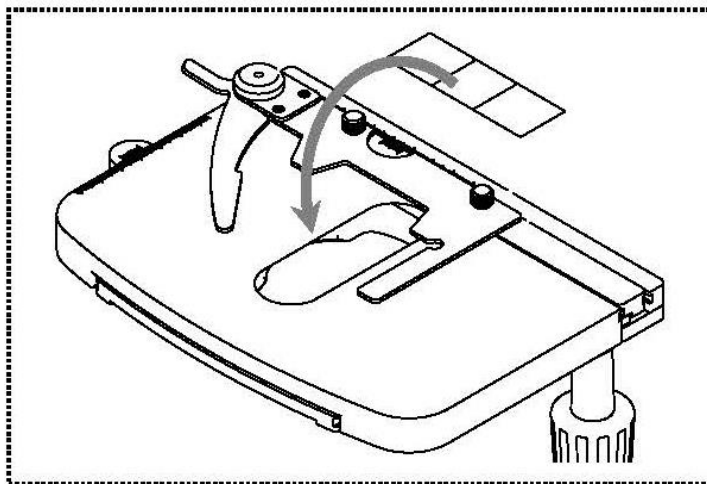
## 5 Operation

### 5.1 Getting started

The very first step is to establish a power connection using the mains plug. You should first adjust the **dimmer** to a **low level**, so that when you look through the eyepiece for the first time, your eyes are not immediately subject to a high level of light. You can now switch on the **lighting** using the **main switch**.

The next step is to **place an object holder** with the sample on the angle table. To do this, the cover glass (if used) must be facing upwards. For the models of the series OKO-1 you can fix the object holder to the table using the slide holder (see *illustration on the left*). You can position a total of two object holders at the same time.

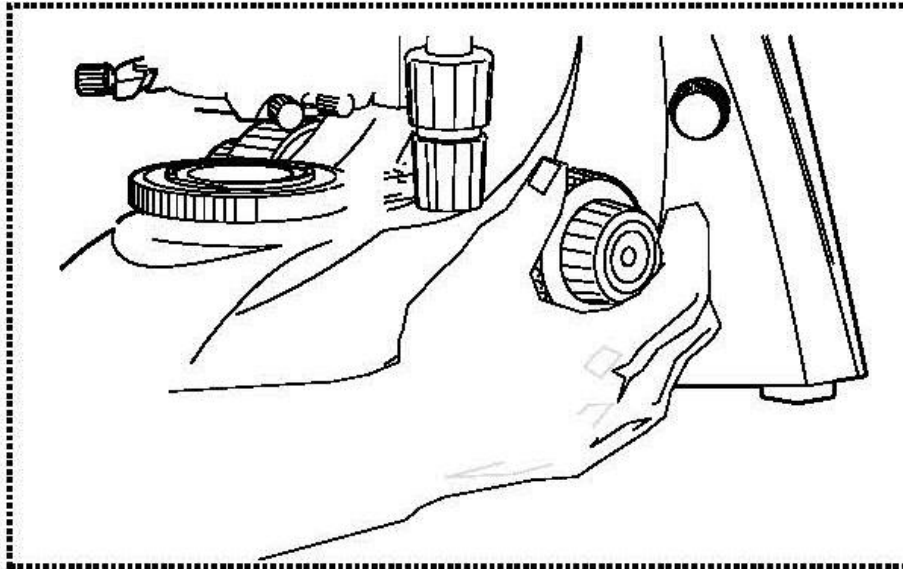
To move the sample into the beam path, you must use the adjustment wheels on the right of the angle table (see *illustration on the right*).



## 5.2 (Pre-) focussing

When you are observing an object, you must have the correct distance to the objective to achieve a sharp image.

In order to find this distance at the beginning (without other default settings of the microscope) place the objective with the lowest magnification in the beam path, look through the right eyepiece with the right eye and turn it slowly using the coarse adjustment knob (*see illustration*).



The simplest way of doing this would be to first raise the specimen stage (using the coarse adjustment knob) until it is just under the objective and then lower it slowly. As soon as an image is recognisable (no matter how sharp), then you should only adjust the focus using the fine adjustment knob.

### Adjusting the torque of the coarse and fine adjustment knob

Next to the left adjustment wheel for the coarse and fine adjustment knob there is a ring which you can use to alter the torque of these wheels. Turning it in a clockwise direction reduces the torque and turning it in an anti-clockwise direction increases it. On one hand, this function can help to make it easier to adjust the focus and on the other hand it can prevent the specimen stage from slipping down unintentionally.

### Important:

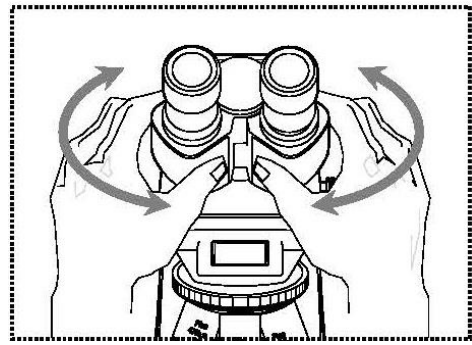
In order to avoid damaging to the focussing system, the left and right adjustment wheels for the coarse and fine adjustment knob must never be rotated at the same time in opposite directions.



### 5.3 Adjusting the interpupillary distance

With binocular viewing, the interpupillary distance must be adjusted accurately for each user, in order to achieve a clear image of the object.

While you are looking through the eyepieces, use your hands to hold the righthand and lefthand tube housing firmly. By pulling them apart or pushing them together, you can either increase or reduce the interpupillary distance (*see illustration*). As soon as the field of views of the lefthand and righthand eyepieces completely overlap each other, i.e. they combine to form a circular image, then the interpupillary distance is set correctly.

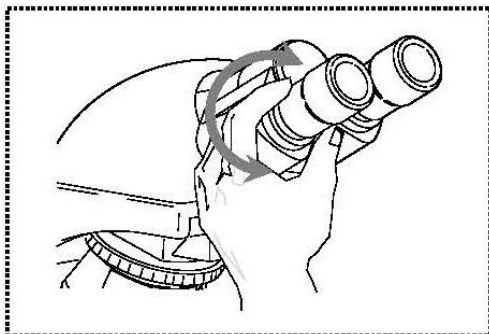


### 5.4 Dioptre adjustment

The eye strengths of each eye of the microscope user can often be slightly different, which in daily life has no consequences. But when using a microscope this can cause problems in achieving precise focussing.

You can use a mechanism on both tube connectors (dioptre adjustment rings) to compensate for this as follows.

1. Put the right dioptre adjustment ring to position 0.
2. Look through the right eyepiece with the right eye and bring the object into focus by using the coarse and fine adjustment knob.
3. Then look through the left eyepiece with the left eye and use the lefthand dioptre adjustment ring to focus the image.  
To do this, you just need to turn the ring in both directions (*see illustration*), to find out where the image is at its most focussed.

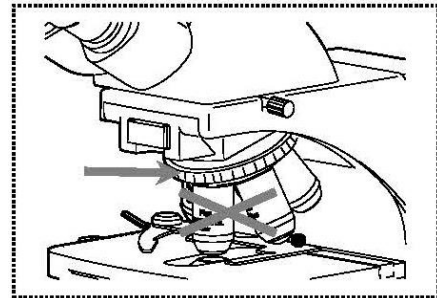


## 5.5 Adjusting the magnification

After prefocussing has been carried out using the objective with the lowest magnification (see section 5.2), you can then adjust the overall magnification using the nosepiece, as necessary. By turning the nosepiece you can bring any one of the four other objectives into the beam path.

When adjusting the nosepiece, you must take the following points into account:

- The required objective must be properly locked in place at all times.
- The nosepiece should not be rotated by holding individual objectives, you should use the silver ring above the objectives (see illustration).



- When rotating the nosepiece you must always make sure that the objective which is about to be positioned in the beam path does not touch the object holder. This can lead to significant damage to the objective lens. We recommend that you always check from the side to make sure that there is sufficient leeway. If this should not be the case, the specimen stage must be lowered accordingly.

If you have focussed the object to be observed for a specific magnification, then if you select the objective with the next greatest magnification, then the object will be slightly out of focus. Use the fine adjustment knob to make a slight adjustment and restore the focus.

## 5.6 Using eye cups

The eye cups supplied with the microscope can basically be used at all times, as they screen out intrusive light, which is reflected from light sources from the environment onto the eyepiece, and the result is better image quality.

But primarily, if eyepieces with a high eye point (particularly suitable for those who wear glasses) are used, then it may also be useful for users who don't wear glasses, to fit the eye cups to the eyepieces.

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

When fitting the eye cups, make sure that the dioptre setting is not moved. We would therefore advise that you hold the dioptre compensation ring on an eyepiece with one hand while you fit the eye cup with the other.

Before using the microscope, users who wear glasses must remove the eye cups, which you may find on High Eye Point eyepieces.

As the eye cups are made of rubber, you must be aware that when you are using them, they can become slightly dirty through grease residues. In order to maintain hygiene, we would therefore recommend that you clean the eye cups regularly (e.g. with a damp cloth).



Eye cups



High Eye Point eyepiece  
(identified by the glasses symbol)

## 5.7 Using oil immersion objectives

The 100x objectives of the OKO-1 and OKN-1 series are objectives which can be used with oil immersion (they are always marked with the word "OIL"). Using these generates a particularly high resolution for microscopic images.

To use oil immersion correctly, please follow these steps.

1. Put a drop of oil on the cover glass (with standard thickness of 0.17 mm) of the object slide.
2. Lower the specimen stage and position the 100x objective in the beam path.
3. Bring the specimen stage or object slide to the objective very slowly until there is slight contact.
4. Observe the object.

The object slide and objective must not be pressed against each other. The oil constitutes the contact layer.

If the contact is made too jerky, there is a chance that existing air bubbles in the oil cannot escape. This would have a negative impact on image clarity.

After use or before changing the slide, any components which have been in contact with the oil must be cleaned thoroughly. *See also 1.4 Maintenance and cleaning.*

## 5.8 Adjusting the Koehler illumination for transmitted light

### OKO-1

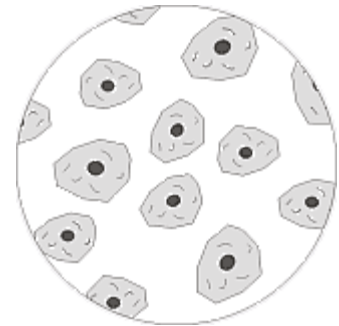
To make sure that perfect image results are achieved during microscopic observation, it is important that the direction of light of the microscope is optimised. If, as with the devices in the KERN OKO-1 series, the lighting can be set in accordance with Koehler, the result is homogenous illumination of the slide and avoidance of disruptive stray light.

The necessary control elements for this are:

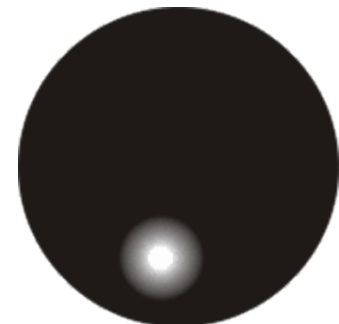
- Height-adjustable and centre-adjustable condenser with aperture diaphragm
- Field diaphragm

When adjusting the Koehler lighting for the first time, you must first select the lowest possible objective magnification, so that you can carry out the following steps.

1. Use the condenser focus wheel to position the condenser directly below the specimen stage. Switch on the lighting and use the coarse and fine adjustment knob to bring the slide with the cover glass positioned facing upwards into focus.



2. Close the field diaphragm completely using its adjusting ring. When you look in the microscope a blurred image appears in the aperture. If the microscopic image is completely dark, the image for the field diaphragm is outside the field of view and must be brought into the field of view using the centring screws on the condenser.



3. Adjust the height of the condenser until the image from the field diaphragm appears clearly in the field of view. For some microscopes there is a risk that you will lift the condenser up so high that it collides with the object holder. Therefore care is needed when doing this.



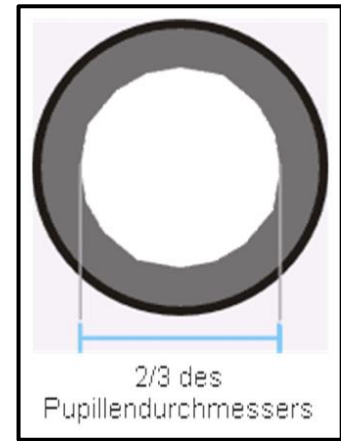
4. Use the centring screws of the condenser holder to bring the image from the field diaphragm into the centre of the field of view.



5. Open the field diaphragm until it just disappears out of the field of view.  
If necessary, simply re-centre using the centring screws on the condenser holder.



6. Use the aperture diaphragm of the condenser to find the very best compromise between contrast and resolution for the microscopic image. The scale divisions on the condenser can be used as a guideline. Select in accordance with the objective being used.



The view in the tube without the eyepiece should look something like the illustration on the right.

The diameter of the aperture diaphragm which is then visible should make up approximately 2/3 of the pupil diameter.

If the eyepiece should be removed, for checking, then please make sure that no dirt or dust falls into the tube.

7. It is possible to alter the brightness of the bulb using the **dimmer**. The brightness is always controlled by the bulb brightness and not by the aperture diaphragm.
8. Possibly there is the need of re-adjusting the focus and x-y axis.
9. Observe the object.

If another magnification is selected afterwards, then the Koehler illumination does not have to be reset from scratch, only the aperture diaphragm and field diaphragm need to be adjusted as required.

As a result you can always check whether the condenser needs to be re-centred.

## **5.9 Adjusting the illumination for incident light**

OKN-1, OKO-1

Just like the components of the transmitted illumination those ones of the incident illumination can be adjusted according to the application requirements as well.

The following components are provided on this occasion:

### **Field diaphragm and aperture diaphragm**

Both of the diaphragms have the same functions like described for the adjustment of the transmitted light (see *section 5.8*). To open and close these diaphragms you have to operate the levers located at the top of the reflected light unit.

### **Colour filter**

The colour filter slide has two round apertures. One of them is with an integrated blue filter, the other one is empty. This slide is marked with the number “2” and therefore it has to be attached to the slot marked with the number “2” as well. If necessary, one of the two apertures has to be snapped into the beam path.

### **Polarising unit (Analyser / Polariser)**

In order to bring the analyser into the beam path you must attach the analyser slide to the slot located on the side underneath the microscope head, so that the integrated wheel facing out. With the wheel you can control the required alignment of the analyser. If the analyser is not needed, it has, contrary to the other slides, to be removed completely from the device.

The polariser slide has two round apertures. One of them is with an integrated polariser, the other one is empty. This slide is marked with the number “1” and therefore it has to be attached to the slot marked with the number “1” as well. If necessary, one of the two apertures has to be snapped into the beam path.

### **Diffuser**

Directly behind the aperture diaphragm there is a slot for the diffuser. It is integrated in a round aperture of a little black slide. That slide can be attached in order to equally disperse the light of the halogen lamp.



## Centring of the lamp

When using the reflected light unit for a long time, the lamp holder possibly moves out of its centre due to the heat development. In this case the illumination is no longer efficiently adjusted. This circumstance can be identified by the user when the background brightness of the field of view has an uneven distribution.

This malposition can be corrected by performing the following method.

1. Make sure, that the lamp housing has cooled down.
2. Switch on the reflected light unit.
3. Choose the objective with the lowest magnification for the beam path.
4. Remove all the (filter) slides from the beam path.
5. If there is one, remove the object (slide) from the stage.
6. Remove one of the eyepieces from the tube.
7. While watching through the tube connector, close the aperture diaphragm of the reflected light unit, so that its border can be seen clearly.
8. The decentred image of the lamp filament can now be seen as well.
9. Loosen the rotary knob on the rear of the lamp housing, so that you can move it together with the attached lamp holder.
10. Look through the tube connector and move the rotary knob in order to bring the image of the lamp filament back to the centre of the opening of the aperture diaphragm.
11. Fixate the rotary knob again.

## 6 Changing the bulb

### 6.1 Transmitted light

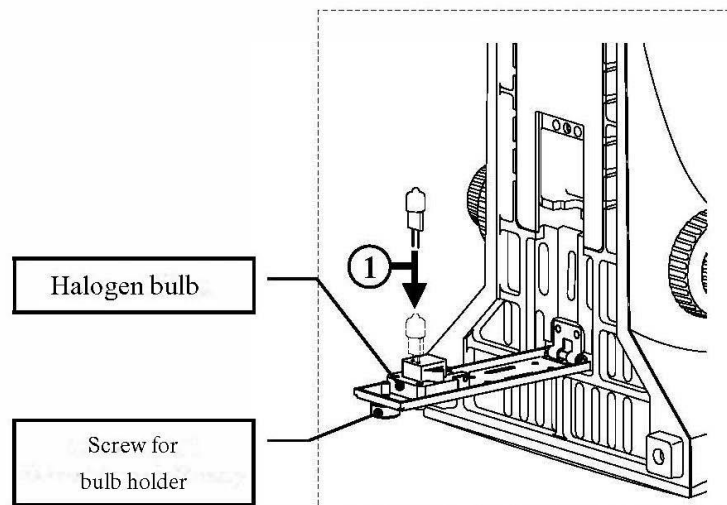
OKO-1

You must not attempt to change the bulb immediately after the microscope has been used, as the bulb will still be hot and so there is a risk that the user could be burnt. Before changing the bulb the device must be switched off and unplugged.

To change the bulb, tip the device carefully to the back or side. When doing this, please make sure that all microscope components are firmly fixed. The bulb holder is on the underside of the device. It can be opened by undoing the screws on the holder (see *illustration*). We recommend that here you should also test again, to check that heat is no longer being produced. The defective bulb can be pulled out of the socket and be replaced with a new one. After the bulb holder has been replaced in the underside of the device and the screws replaced, the bulb replacement procedure is complete.

#### Important:

When fitting the new bulb into the socket, it must only be handled with sterile gloves or using the bulb packaging film. Grease and dust residue can have a negative effect on the light quality and service life.



## **6.2 Reflected light**

OKO-1, OKN-1

You must not attempt to change the bulb immediately after the microscope has been used, as the bulb will still be hot and so there is a risk that the user could be burnt. Before changing the bulb the device must be switched off and unplugged.

All 8 screws on the rear edges of the lamp housing have to be removed.

Thus the holder of the halogen lamp can be separated from the rest of the housing.

The defective bulb can be pulled out of the socket and be replaced with a new one.

Finally the lamp housing is screwed together again.

## **7 Changing the fuse**

### **7.1 Transmitted light**

OKO-1

The fuse housing is on the rear of the microscope below the mains power supply socket. With the device switched off and unplugged, you can pull out the housing. When doing this, it is helpful to use a screwdriver or similar tool. The defective fuse can be removed from its housing and be replaced with a new one.

After that, you just need to insert the fuse housing back into the insertion point below the mains power supply socket.

### **7.2 Reflected light**

OKO-1, OKN-1

The fuse housing is on the rear of the power supply unit of the reflected light unit. With the device switched off and unplugged, you can pull out the housing. The defective fuse can be removed from its housing and be replaced with a new one. After that, you just need to insert the fuse housing back into the insertion point below the mains power supply socket.

## 8 Using optional accessories

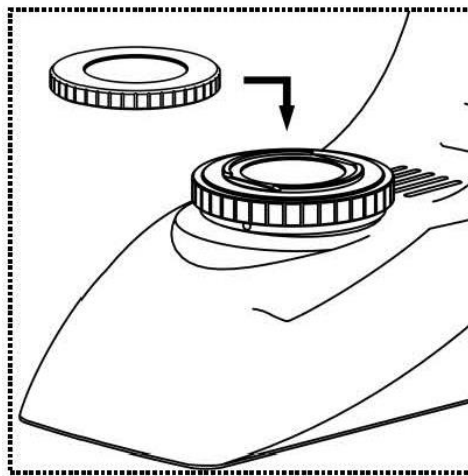
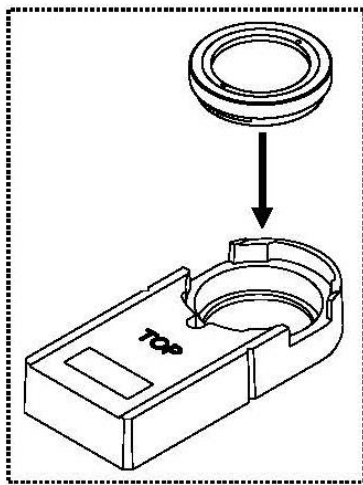
### 8.1 Polarisation unit (Transmitted light)

OKO-1

The polarisation unit consists of a polariser and an analyser.

Both consist of a round glass plate with an external holder ring. To mount the analyser there is a slider with a socket fitted on the front of the microscope directly below the nosepiece (see *illustration on page 10*), where you can simply insert the analyser (see *left illustration*).

The polariser on the other hand is only placed on the ring holder of the field lens (see *right illustration*).



There are two points to take into account when subsequently using the polarisation unit:

- The aperture setting of the condenser must be in position **PH**.
- For its starting position, the polariser must be turned to the position in which you can see the highest level of darkness in the field of view (without object slide).

## 8.2 Camera connection (only for trinocular version)

Due to the trinocular tube, which can be optionally fitted for the OKN-1 and OKO-1 series, it is possible to connect microscope cameras to the device, in order to digitally record images or sequences of images of an object being observed.

After the plastic cover has been removed from the camera adapter connector on the top of the microscope head, then a suitable adapter must be fitted.

In general there are two C-mount adapters available for this (1x and 0.57x magnification, see *Chapter 3 Features*). After fitting one of these adapters it can be fixed with the fixing screw. A camera which has a C-mount thread is then screwed on top of the adapter.

We recommend that you first adjust the field of view using the eyepieces on the device for the existing requirements, and then carry out the observation using the microscope camera (i.e. using the PC screen which is connected).

To do this, the trinocular toggle rod on the righthand side of the microscope head must be pulled out. The light from the microscope lighting is deflected so that it is completely in the beam path for the camera, which causes a dark field of view in the eyepieces. This means that it is not possible to simultaneously observe by the eyepieces and PC screen.

For C-mount adapters, which have their own integrated magnification, the image which is shown on the camera connected to the device can often have a different level of focus compared with the image on the eyepiece.

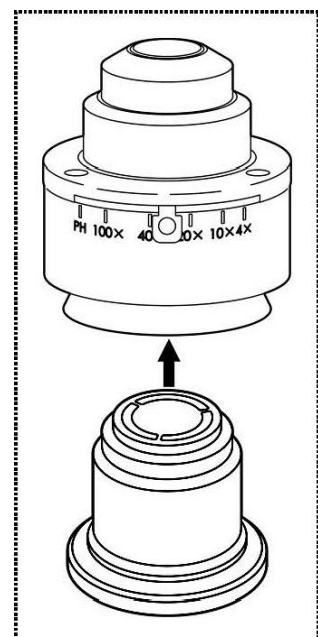
In order to be able to bring both images into focus, the focus can be adjusted by those adapters.

## 8.3 Dark field units (Transmitted light)

### OKO-1

There are two different ways to carry out dark field applications.

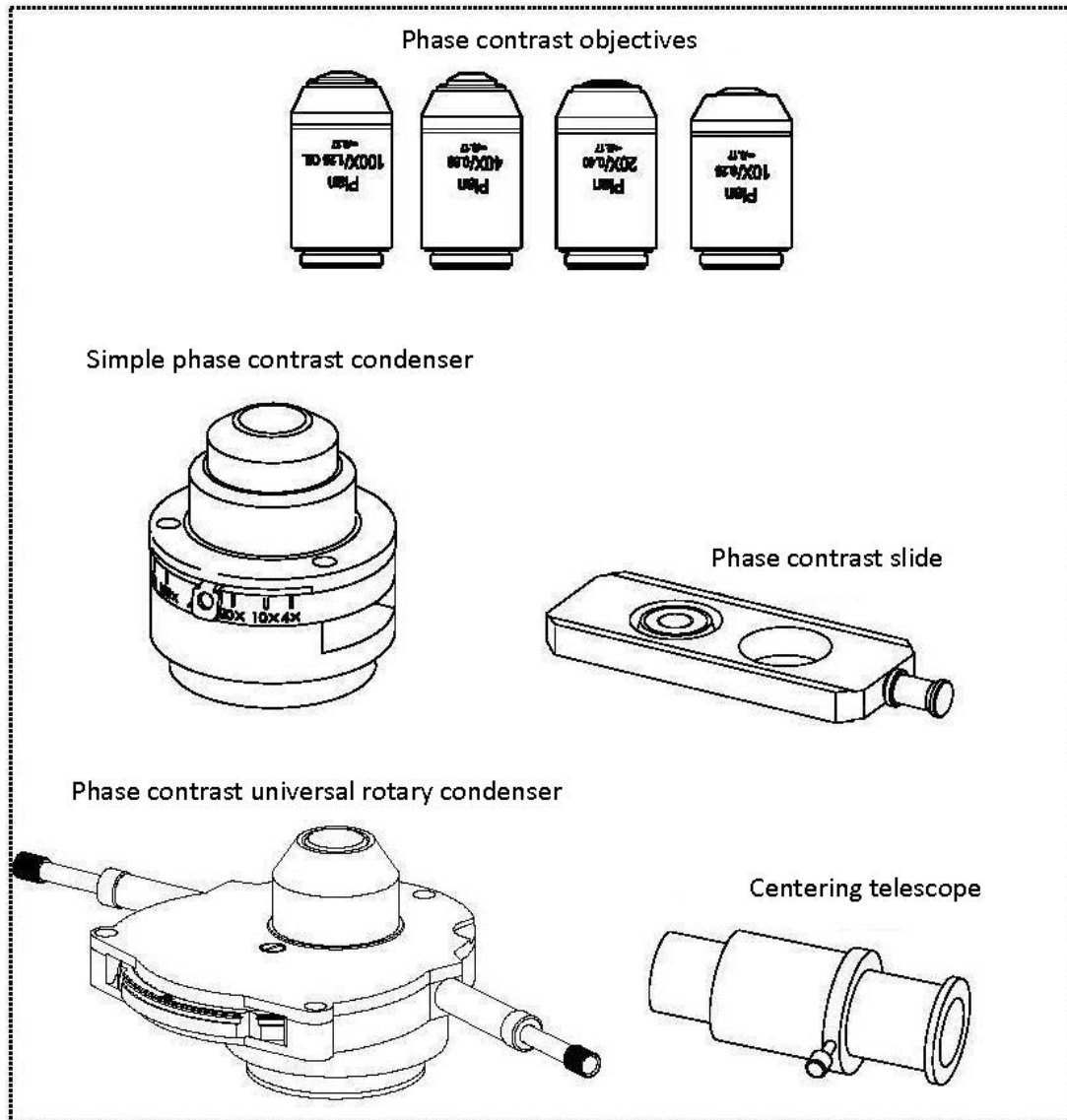
1. A dark field attachment with an integrated black disk can be screwed into the standard condenser of the microscope from below (see *right illustration*). To do this, the condenser must first be removed from the holder. As well as the blue filter on its underside.
2. A special dark field condenser can be used in place of the standard condenser. This as a cardioid construction and also meets the requirements of professional application fields, in contrast to the dark field attachment.



## 8.4 Phase-contrast units (Transmitted light)

### OKO-1

Fundamentally there are two different ways for you to conduct the phase-contrast procedure. A simple method and a more comprehensive method.



#### 1. Simple phase-contrast unit

This consists of a simple PH condenser, a PH objective with a specific magnification (10x, 20x, 40x or 100x), a PH slider, which is adapted to the lens being used, a centring telescope and two green filters.

To use this, you need to replace the standard condenser of the microscope with the PH condenser. One of the objectives in the nosepiece is also replaced with the PH objective and this is positioned in the beam path.

With the surface marked "TOP" facing up, the PH slider is pushed upwards into the insertion point on the PH condenser until it clicks into the first position. At this first position, the phase ring of the PH slider is in the beam path. If the aperture setting on the PH condenser is set to "PH", then the phase-contrast application can begin. In order to return to the bright field application, you must push the PH slider further to the second click position. At this point there is no PH ring as in position 1; the beam can pass without being affected by the PH slider.

The PH objective has a PH ring in its lens system, just like the PH slider. Due to their size on one hand and their positioning on the other, these two rings must be aligned to one another in the beam path. The position of the ring in the objective cannot be altered, that of the ring in the slider however can be. Although it has been pre-centred, it may still be necessary that after a certain period of use it will need to be re-centred using the three Allen bolts on the side of the slider and the centring telescope. *For further information on adjusting the PH rings, please see section 8.4, Point 2 - End.*

Depending on the preferences of the user, using a green filter can produce a more effective and pleasant image. To achieve this, the green filter must be screwed onto the underside of the PH condenser.

## 2. Comprehensive phase-contrast unit

This consists of a PH universal rotary condenser, four PH objectives (10x, 20x, 40x and 100x), a centring telescope, two centring turnscrews and a green filter.

To use this, you need to replace the standard condenser of the microscope with the PH universal rotary condenser. The required objectives are also screwed into the nosepiece and one of these is positioned in the beam path. The two centring turnscrews can be fitted to the relevant points on the sides of the condenser using the screw connection on their spring retainer.

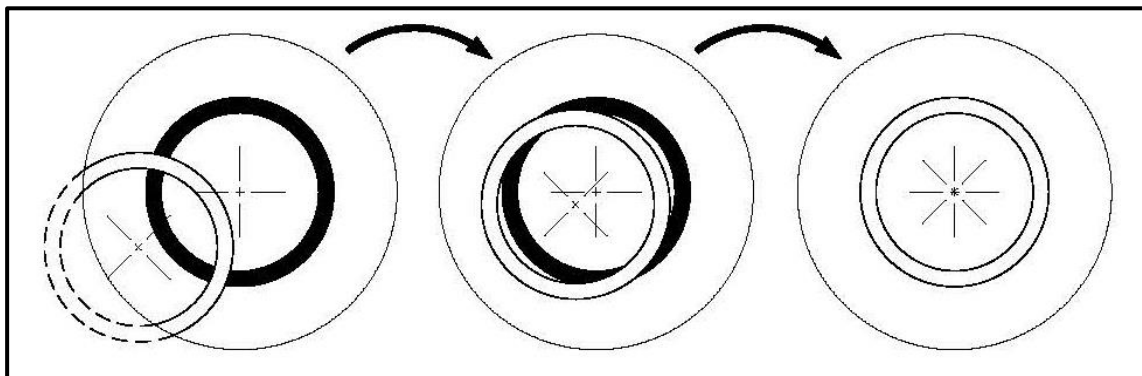
The condenser has a hub with six positioning options. Four of these are fitted with a phase ring, which matches only one specific objective magnification. When doing this you must note the marking on the rotary knob at the relevant position. The other two positions are intended for bright field applications.

A PH objective has a PH ring in its lens system, just like the individual positions of the PH universal rotary condenser. Due to their size on one hand and their positioning on the other, the two related rings must be aligned to one another in the beam path. The position of the ring in the objectives cannot be altered, that of the rings in the condenser disc however can be.

The adjustment for this is carried out as follows.

- a. First adjust the microscope using bright field mode.
- b. Move the hub to the required PH position (e.g. "10x").
- c. Open the aperture diaphragm on the condenser to its maximum (slider to the left).
- d. Bring the relevant PH objective (e.g. 10x) into the beam path.
- e. Place the centring telescope onto one of the two tube connectors, in place of a standard eyepiece.
- f. Undo the fixing screw of the centring telescope and pull out (move) the front part of the telescope, so that you can focus both phase rings in the field of view. You can also use the focus wheel of the condenser holder when doing this. Then retighten the screws.

In the field of view you will now see the image of a white (condenser) and a black (objective) ring. The black one is central and the white one possible is pushed to one side (*see left illustration*).



- g. Now press the turnscrews fitted on the side of the condenser towards the centre until they grip the screws. Then by turning the screws and at the same time watching the rings through the centring telescope, move the white ring to the centre (*see central illustration*).
- h. As soon as both the rings overlap each other (*see right illustration*) the adjustment is successfully completed and can also be carried out for the pairs of rings of the other magnifications.
- i. After the adjustment, the centring telescope must be replaced by the standard eyepiece, so that you are able to observe the object on the angle table in phase contrast mode.

Depending on the preferences of the user, using a green filter can produce a more effective and pleasant image. To achieve this, the green filter must be screwed onto the underside of the PH condenser.



## 9 Trouble shooting

Problem	Possible causes
The bulb does not light	The mains plug is not correctly plugged in
	There is no power at the socket
	Defective bulb
	Defective fuse
The bulb blows immediately	The specified bulb or fuse has not been used
The field of view is dark	The aperture diaphragm and/or field diaphragm are not opened wide enough
	The selector switch for the beam path is set to "Camera"
	The condenser is not correctly centred
You cannot adjust the brightness	The brightness control has been set incorrectly
	The condenser has not been correctly centred
	The condenser is too low
The field of view is dark or is not correctly illuminated	The objective is not positioned correctly on the beam path
	The selector switch for the beam path is between two settings
	The nosepiece is not correctly fitted
	The condenser is not correctly fitted
	An objective is being used which doesn't match the lighting area of the condenser
	The condenser has not been correctly centred
	The field diaphragm is closed too tightly
	The bulb is not correctly fitted
The field of view of one eye does not match that of the other eye	The interpupillary distance is not correctly adjusted
	Dioptre setting has not been carried out correctly
	Different eyepieces are used for the righthand and lefthand side
	The eyes are not used to using a microscope

<b>Problem</b>	<b>Possible causes</b>
Blurred details Bad image Bad contrast Vignetted field of view	The aperture diaphragm is not opened wide enough
	The condenser is too low
	The objective does not belong to this microscope
	The front lens of the objective is dirty
	An immersion object has been used without immersion oil
	The immersion oil contains air bubbles
	The condenser is not correctly centred
	The recommended immersion oil has not been used
Dirt or dust in the field of view	Dirt / dust on the objective
	Dirt /dust on the front lens of the condenser
	Dirt / dust on the eyepieces
One side of the image is blurred	Dirt / dust on the front lens of the condenser
	Dirt / dust on the object
	The stage was not correctly fitted
	The objective is not positioned correctly on the beam path
The image flickers	The nosepiece is not correctly fitted
	The objective is not positioned correctly on the beam path
	The condenser has not been correctly centred
The coarse adjustment knob is difficult to turn	The rotational resistance brake is too tight
	The angle table is blocked by a solid body
The stage moves down on its own The fine adjustment knob moves on its own	The rotational resistance brake is not tight enough
When you move the table, the image becomes blurred	The stage was not correctly fitted

## 10 Service

If, after studying the user manual, you still have questions about commissioning or using the microscope, or if unforeseen problems should arise, please get in touch with your dealer. The device may only be opened by trained service engineers who have been authorised by KERN.

## 11 Disposal

The packaging is made of environmentally-friendly materials, which you can dispose of at your local recycling centre. Disposal of the storage box and device must be carried out by the operator in accordance with all national or regional laws in force in the location of use.

## 12 Further information

The illustrations may differ slightly from the product.

The descriptions and illustrations in this user manual are **subject to change without notice. Further developments** on the device may lead to these changes.



All language versions contain a non-binding translation.  
The original German document is the binding version.