

# User instructions

## Metallurgical microscope

**KERN**

**OKM-1**

OKM 172, OKM 173

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.

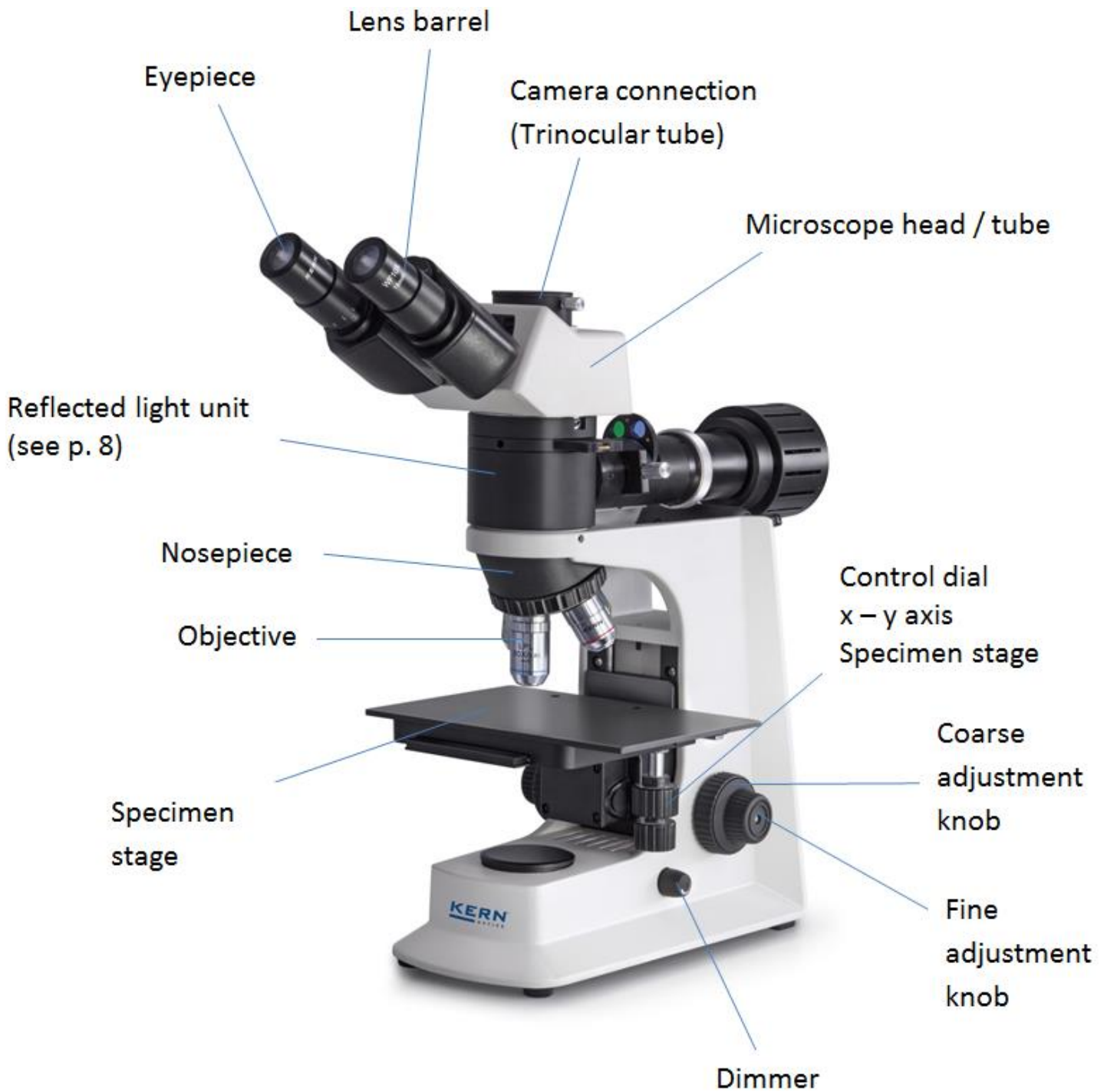
You could also use the following cleaning products to clean the optical components:

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

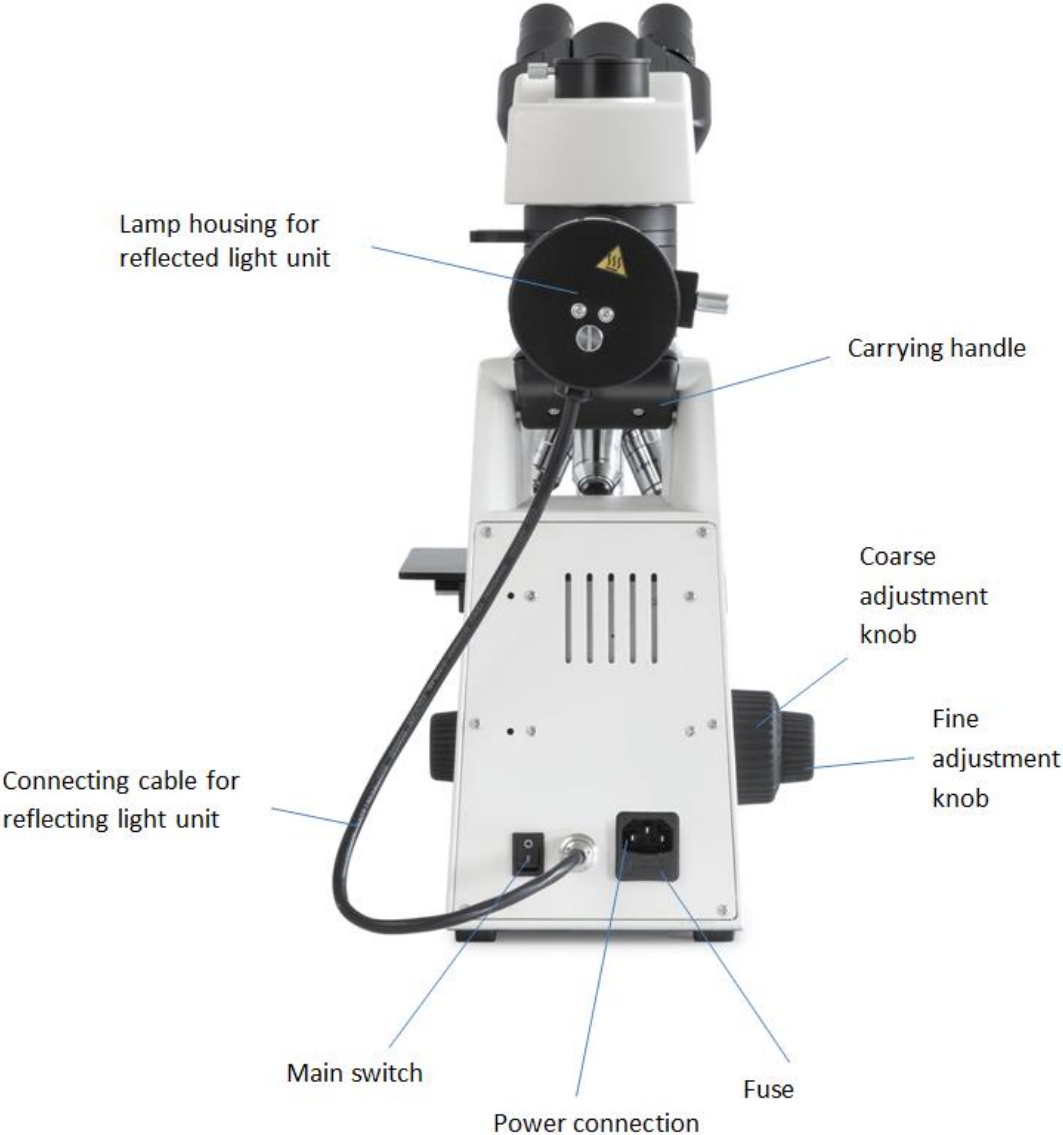
When handled correctly and checked regularly, the microscope should give many years of efficient service.

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

## 2 Nomenclature

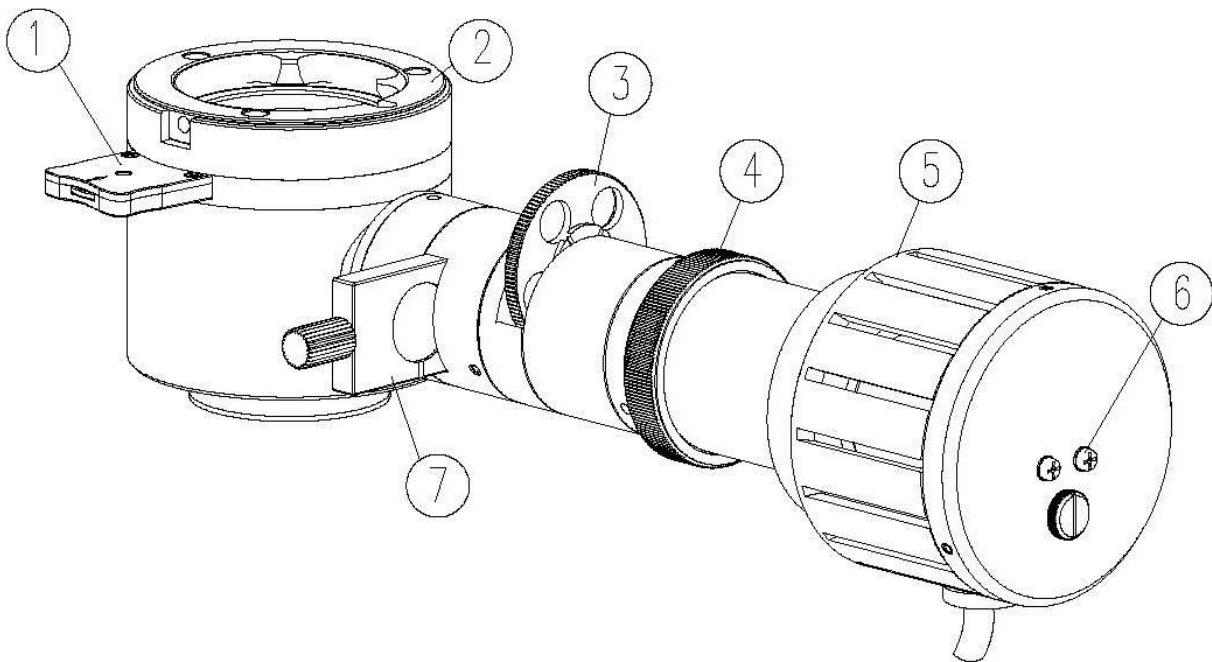


**Rear view**

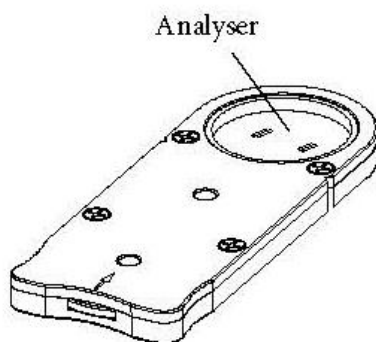




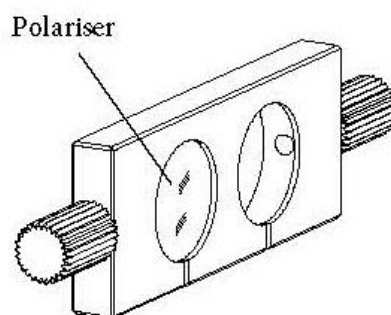
## Reflected light unit



- 1- Analyser
- 2- Connection point (head)
- 3- Filter wheel
- 4- Adjusting ring for aperture diaphragm
- 5- Lamp housing
- 6- Centring screws
- 7- Polariser



Analyser slide



Polariser slide

### 3 Technical data / Features

| Model   | Standard configuration |            |                             |
|---------|------------------------|------------|-----------------------------|
|         | Optical system         | Tube       | Illumination                |
| KERN    |                        |            |                             |
| OKM 172 | Infinity               | Binocular  | 6V / 20W Halogen (Incident) |
| OKM 173 | Infinity               | Trinocular | 6V / 20W Halogen (Incident) |

**Eyepieces:** WF 10x / Ø 18 mm

**Objectives:** 5x / 10x / 20x (LWD) / 40x (LWD)

**Product dimensions:** 440x200x460 mm

**Packaging dimensions:** 555x315x400 mm

**Net weight:** 10,5 kg

**Gross weight:** 8 kg

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

**Output voltage:** DC 1,2-6V

**Fuse:** 2A 5x20mm

| Model outfit  |   | Model KERN |         | Order number | Price<br>excl. of VAT<br>ex works<br>€ |
|---|---|------------|---------|--------------|--|
|   |   | OKM 172    | OKM 173 |              |  |
| Eyepieces   | WF 10x / Ø 18 mm  | ●          | ●       | OBB-A1347    | 55,-                                   |
|   | WF 10x / Ø 18 mm (reticule 0,1 mm) (non-adjustable)   | ●          | ●       | OBB-A1349    | 80,-                                   |
|   | WF 5x / Ø 20 mm   | ○          | ○       | OBB-A1355    | 70,-                                   |
|   | WF 12,5x / Ø 14 mm  | ○          | ○       | OBB-A1353    | 85,-                                   |
|   | WF 16x / Ø 13 mm  | ○          | ○       | OBB-A1354    | 55,-                                   |
| Infinity<br>Plan achromatic<br>objectives<br>(no cover glass)                                 | 5x / 0,11 W.D. 12,10 mm   | ●          | ●       | OBB-A1268    | 110,-                                  |
|   | 10x / 0,25 W.D. 4,75 mm   | ●          | ●       | OBB-A1244    | 190,-                                  |
|   | 20x / 0,40 (spring) W.D. 2,14 mm  | ○          | ○       | OBB-A1251    | 260,-                                  |
|   | 40x / 0,65 (spring) W.D. 0,45 mm  | ○          | ○       | OBB-A1258    | 280,-                                  |
| Infinity<br>Plan achromatic<br>objectives<br>(no cover glass)<br>for long working<br>distance | 20x / 0,40 (spring) W.D. 8,35 mm  | ●          | ●       | OBB-A1252    | 290,-                                  |
|   | 40x / 0,65 (spring) W.D. 3,90 mm  | ●          | ●       | OBB-A1259    | 415,-                                  |
|   | 50x / 0,70 (spring) W.D. 1,95 mm  | ○          | ○       | OBB-A1266    | 460,-                                  |
|   | 80x / 0,80 (spring) W.D. 0,85 mm  | ○          | ○       | OBB-A1271    | 510,-                                  |
| Binocular tube  | · Siedentopf, 30° inclined, 360° rotatable<br>· Interpupillary distance: 50 - 75 mm<br>· With diopter adjustment (one-sided)                                | ●          | ○       | OBB-A1130    | 260,-                                  |
| Trinocular tube   | · Siedentopf, 30° inclined, 360° rotatable<br>· Interpupillary distance: 50 - 75 mm<br>· Light distribution: 80:20<br>· With diopter adjustment (one-sided) | ○          | ●       | OBB-A1346    | 370,-                                  |
| Nosepiece   | Quadplex  | ●          | ●       |              |  |
| Mechanical stage  | · Stage size: WxD 200x140 mm<br>· Travel: 76x52 mm<br>· Coaxial coarse and fine focusing knobs  | ●          | ●       |              |  |
| Illumination  | 6V / 30W Halogen (reflecting)   | ●          | ●       | OBB-A1205    | 30,-                                   |
| Filter unit   | 5-filter unit (Blue, Green, Amber, Grey, Empty)   | ●          | ●       |              |  |
| Polarising unit   | Analyser / Polariser  | ○          | ○       | OBB-A1287    | 265,-                                  |
| C-Mount   | 1x  | ○          | ○       | OBB-A1142    | 115,-                                  |
|   | 0,47x (focus adjustable)  | ○          | ○       | OBB-A1135    | 160,-                                  |

● = Standard configuration

○ = Option

## **4 Assembly**

### **4.1 Reflected light unit**

First 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. The lamp housing should be straightly directed towards the rear (parallel with the microscope housing).

Now you have to attach the plug of the connecting cable to the connection socket on the rear of the microscope (between main switch and power connection).

Finally the analyser and polariser slides can be fitted to the appropriate slots (see *page 8*).

### **4.2 Microscope head**

First you must loosen the fixing screw on the 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 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**

All four objectives are already mounted to the nosepiece. After removing the protective foil they are ready for use. They are ranged in such a way that if you turn the nosepiece clockwise, the objective with the next higher magnification appears. When the objectives need to be dismantled, you should always 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**

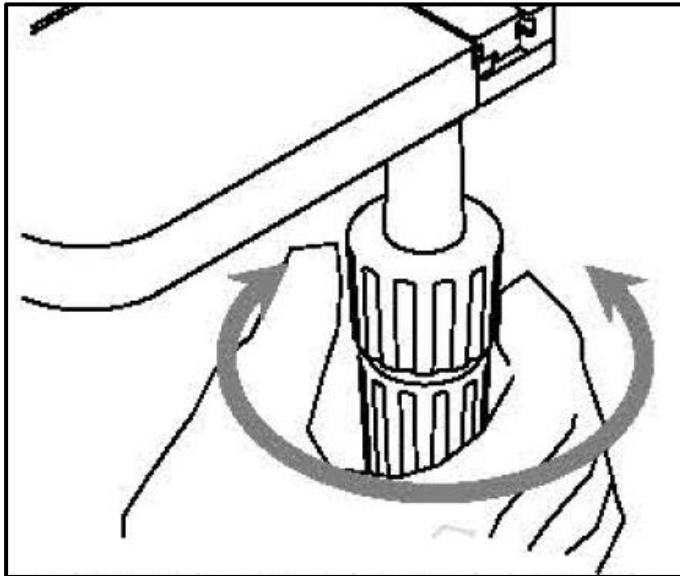
You must always use eyepieces with the same magnification for both eyes. These are simply placed onto the tube connectors, once you have first removed the plastic protective caps. There is no way of fixing them. You should always make sure that you do not touch the lenses with your bare fingers and that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

## 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**.

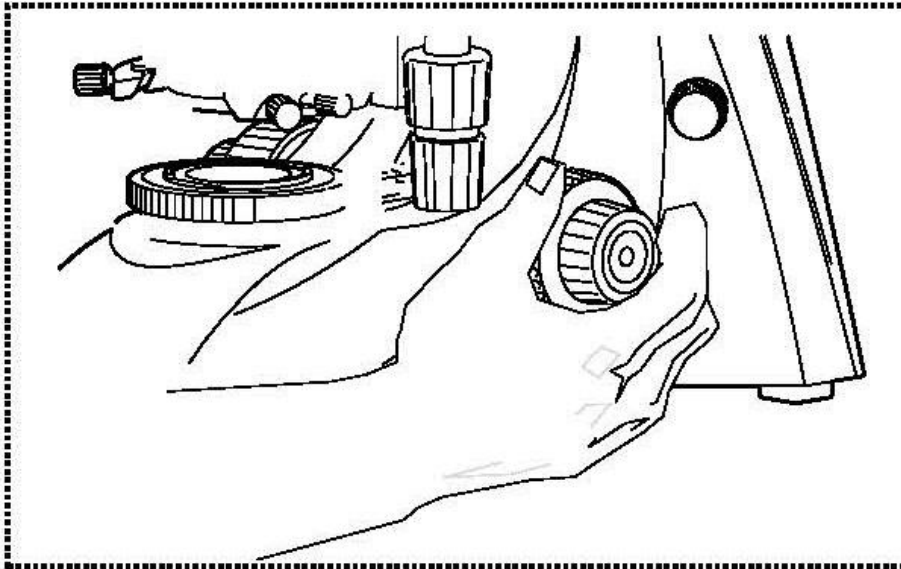
The next step is to **place a sample** on the angle table. To move the sample into the beam path, you must use the adjustment wheels on the right of the angle table (see *illustration*).



## 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.

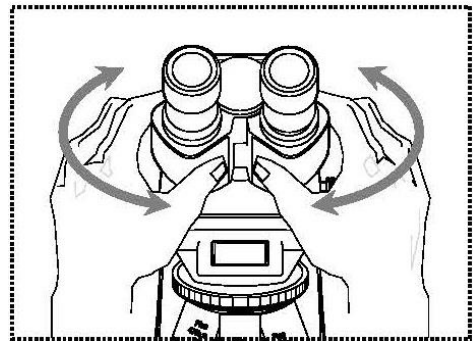
### Important:

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.

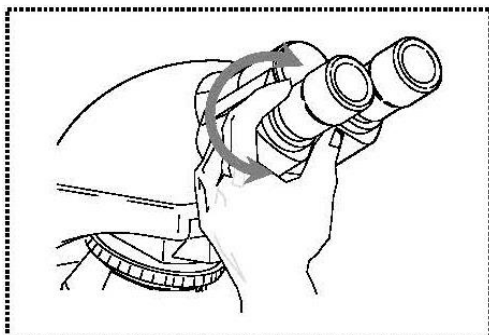


### 5.4 Dioptre adjustment

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 the left tube connector (dioptre adjustment ring) to compensate for this as follows.

1. Look through the right eyepiece with the right eye and bring the object into focus by using the coarse and fine adjustment knob.
2. Then look through the left eyepiece with the left eye and use the 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.

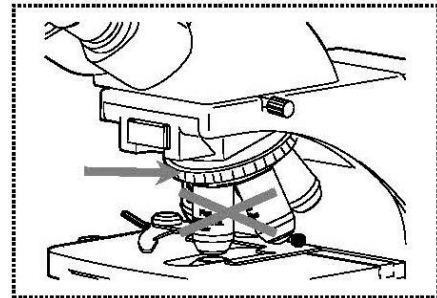


## 5.5 Adjusting the magnification

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 Adjusting the illumination

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.

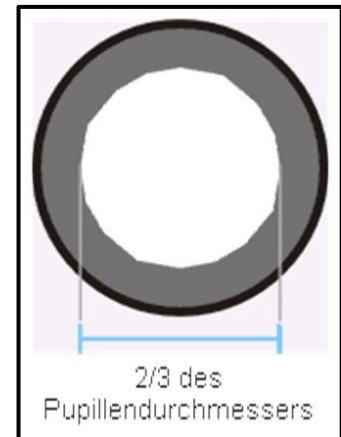
The necessary control elements for this are:

- Aperture diaphragm
- Filter wheel
- Analyser/Polariser

1. Use the **aperture diaphragm** of the condenser to find the very best compromise between contrast and resolution for the microscopic image. Select the right setting 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  $\frac{2}{3}$  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.

The brightness is always controlled by the bulb brightness (dimmer) and not by the aperture diaphragm.

2. With the **filter wheel** (blue, green, yellow, grey, empty) the light colour can be changed in accordance to the application.
3. Especially for metallurgical applications use is made of the **polarising method** to carry out observations in this field. The main components for this are polariser and analyser (see page 8). As soon as the polariser and the analyser are inserted to the beam path, by putting the slides into the slots, the microscope is prepared for the polarising method.  
According to each type of application there must be selected the appropriate position of the wheel on the analyser slide.

Note: When running the reflected light unit for a long time, it is possible that the halogen bulb is moving slightly out of its central position. So the light would be no longer ideally led out of the objectives.

The two centring screws (see page 8) will help to rectify this circumstance.

## 5.7 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)

## 6 Changing the bulb

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. Normally it lasts about 30 minutes until the lamp housing is completely cooled down.

Before changing the bulb the device must be switched off and unplugged.

To change the bulb, firstly you have to dismount the lamp housing of the light unit. Therefore the lower screw on the rear of the housing must be loosened in order to separate the lamp housing from the rest of the light unit (*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 lamp housing has been replaced to the rest of the light unit and the screw 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.



## 7 Changing the fuse

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.

## 8 Using optional accessories

### 8.1 Camera connection

#### OKM 173

Due to the trinocular tube, which is a standard fitting for the OKM 173, 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 0.5x 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).

The tube has a light distribution that guarantees the providing of light for the eyepieces and the camera connection at the same time. This means that it is 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.

## 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<br>Bad image<br>Bad contrast<br>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<br>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.