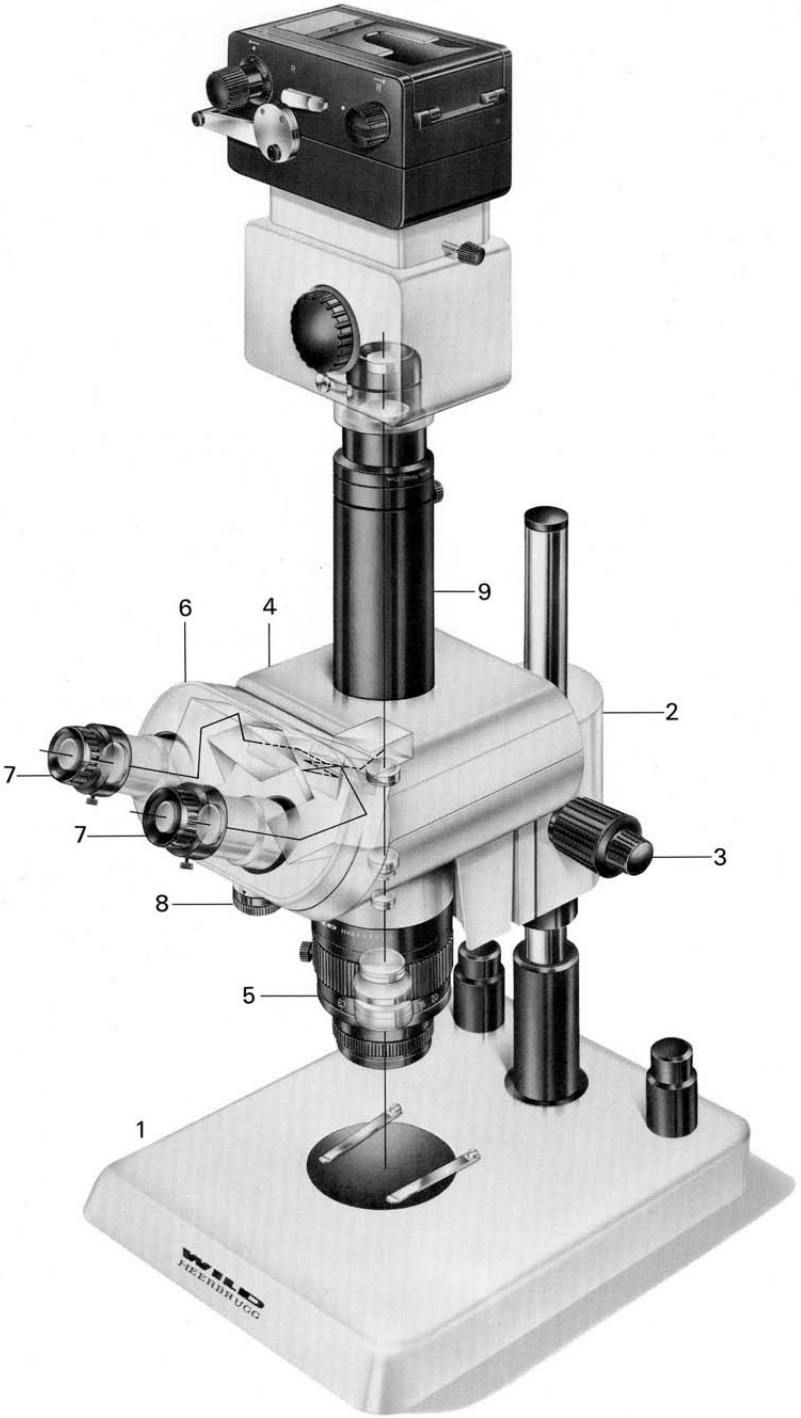
WILD M410/M420

Instructions for use
Mode d'emploi
Bedienungsanleitung
Instrucciones para el uso

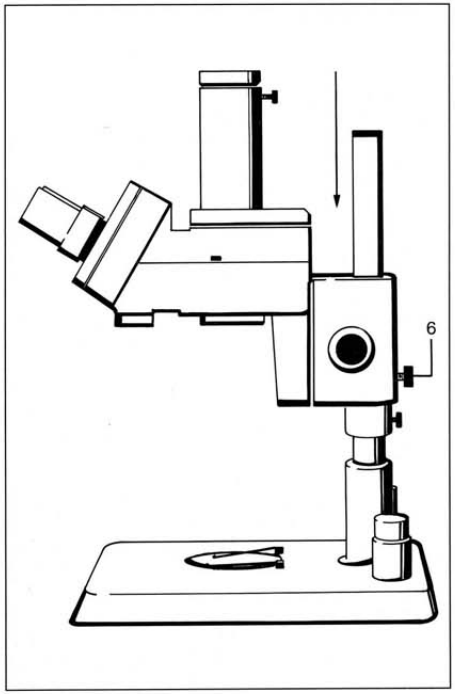
Contents

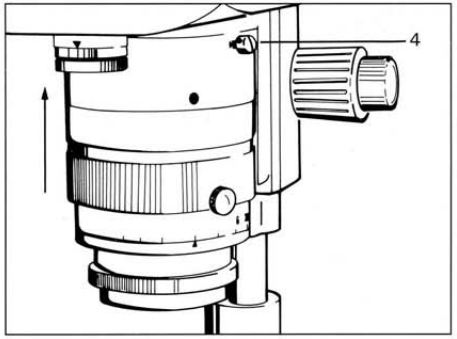


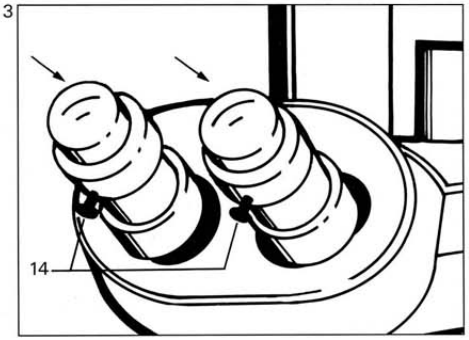
Macroscopes produce an erect, laterally-correct image by means of a central beam path which is then partitioned in the binocular tube for comfortable fatigue-free viewing and for focusing.
In the WILD M410 Makroskop, all of the available light is directed to the binocular observation tube.
In the WILD M420 Makroskop, a fixed beam splitter directs half of the light to the binocular tube and half to the phototube.

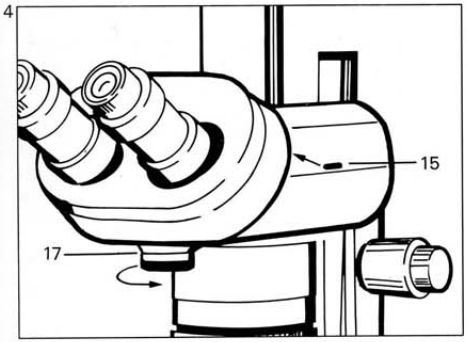
---

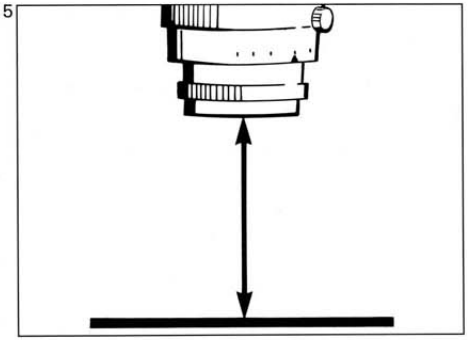
1 Incident- or transmitted-light stand
2 Drive housing for 25 mm or 50 mm diam. columns
3 Coaxial coarse and fine focusing
4 Optics carrier for M410 or M420
5 1:5 Macrozoom or 1:6 Apozoom objective
6 Inclined binocular tube
7 Adjustable wide-field eyepieces or wide-field eyepieces for spectacle wearers
8 Aperture diaphragm
9 Phototube (M420) with selectable eyepiece tube, eyepiece and shutterpiece

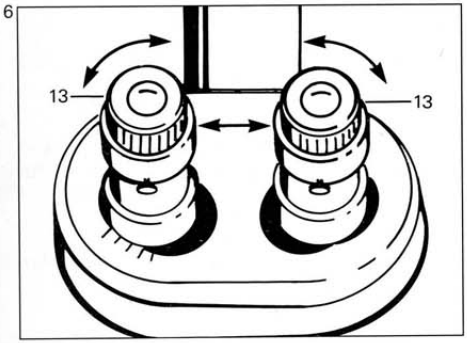


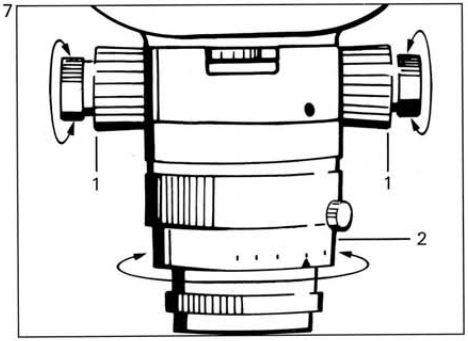












I. Operation

1. Set up the **stand.**
2. Slide the **macroscope** down the column of the stand and secure it with the safety ring and the clamping screw (6).
3. Secure the **zoom objective** using the screw (4).
   Fit an additional objective if required.
4. Fit the **eyepieces** and tighten the screws (14).
5. Turn the knob (17) completely to the right to open the **iris diaphragm.**
6. Move the **dark slide** (15) of the M420 to the left. Before photographing, move it to the right to cut out stray light.
7. Slacken the clamping screw (6).
   Raise or lower the macroscope until the **working distance** of the objective is reached, and align the macroscope to the stand. Secure it with the safety ring and the clamping screw.
8. Arrange the **illuminator.**
   The coaxial incident lamp housing fits above the Makrozoom objective, and the quarter-wave plate on the bayonet mount of the Makrozoom objective or of the additional objectives.
9. Move the eyepiece tubes sideways to set the **interpupillary distance.**
10. Adjust the **dioptric settings** for both eyes by turning the eyelens mounts (13).
11. Select the lowest **magnification** by turning the magnification changer (2).
12. Position an object and **focus** on it with the drive knobs (1).
13. Select the magnification required.

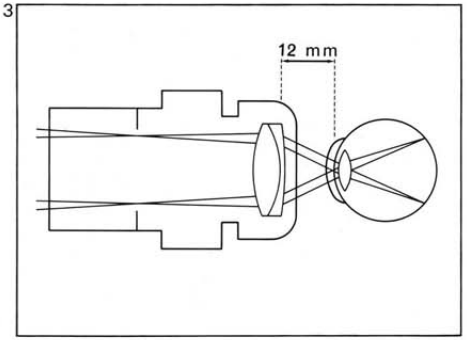
Wild macroscopes are parfocally adjusted.
The image sharpness, once correctly set, remains constant from the lowest magnification to the highest. You can examine your specimen from the overall view right through to the finest detail, without having to refocus.

You can only make full use of this advantage if you take care to set the dioptric setting exactly as described in section 6.

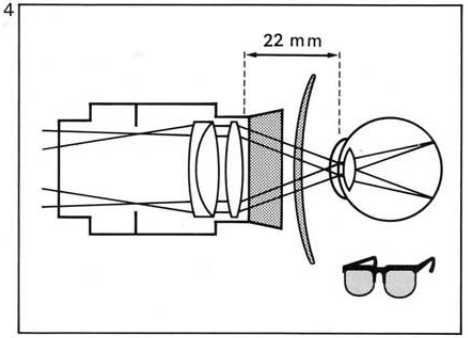
1

2

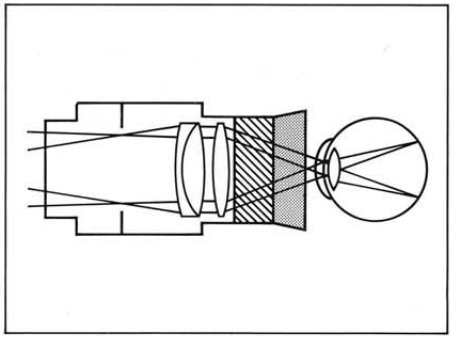
3



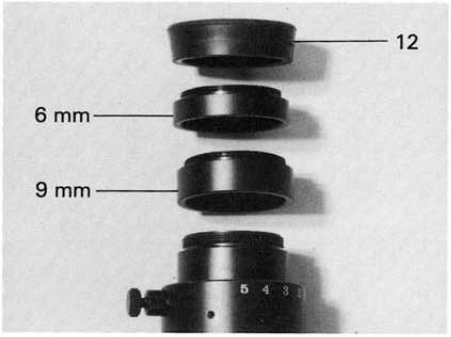
4



5



6



1. Interpupillary distance

Set the individual interpupillary distance (between 55 mm and 75 mm) on the binocular tube by moving the eyepiece tubes sideways. It is shown on the scale on the left (fig. 1).
If it has been correctly set, a single circular field is seen, which results from the fusion of the two separate fields.

1.1 Dark slide

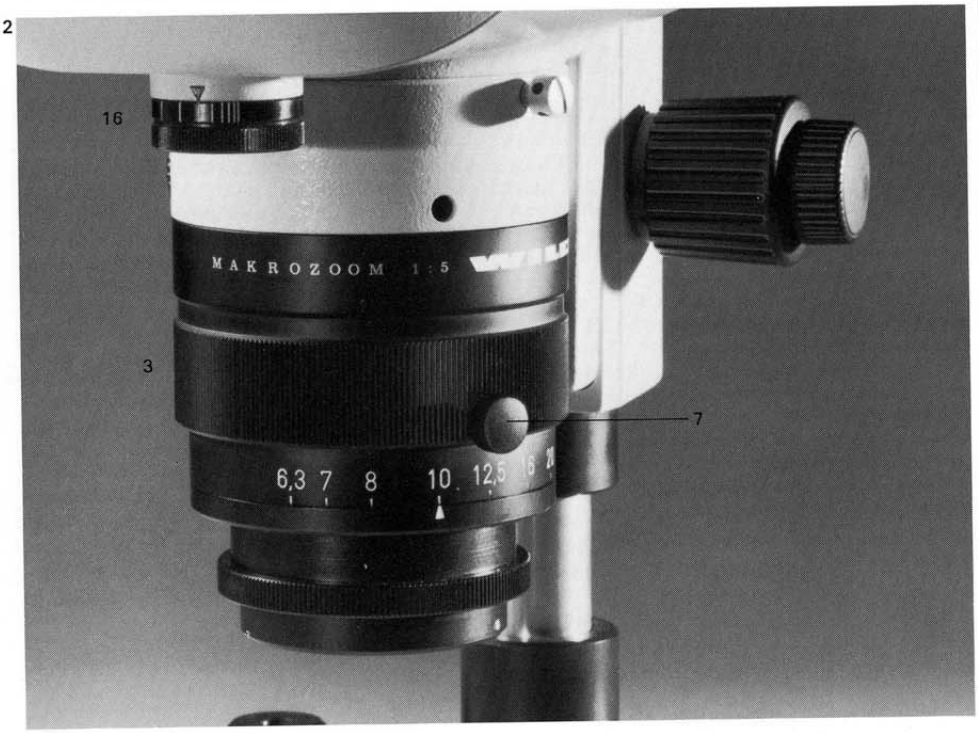
The dark slide prevents stray light from entering the eyepieces during the photographic exposure.
In fig. 2, the dark slide (15) has been pushed to the right and closes off the tubes.

2. Exit pupil position

The correct distance of the eye from the eyepiece is important in the quality of the image. The further the eye is from the correct position, the greater the loss of the peripheral part of the field, i. e. the field diameter is reduced and the marginal areas become dark.
The correct eye-to-eyepiece distance is 12 mm for the adjustable wide-field eyepieces and 22 mm for the eyepieces for spectacle wearers. At the correct position, the exit pupil, all of the ray bundles emerging from the eyepiece are combined.
The exit pupil is located by moving the eye slowly towards the eyepiece until the whole field of view is seen sharply defined.

The 22 mm exit pupil of the eyepiece for spectacle wearers enables **spectacles** to be worn. The flexible **eyecups** (12) prevent scratching of the spectacles. They can be folded back, if the entire exit pupil distance is required.
In order that the eyepiece for spectacle wearers may also be used by **non-spectacle wearers,** spacing rings of 6 mm and 9 mm thickness respectively are available, with which the observer can individually set the required degree of eye contact:

- Screw the required spacing rings into position between the eyecups and the eyepieces (fig. 6).
  The flexible eyecups ensure comfortable working.



3. Focusing

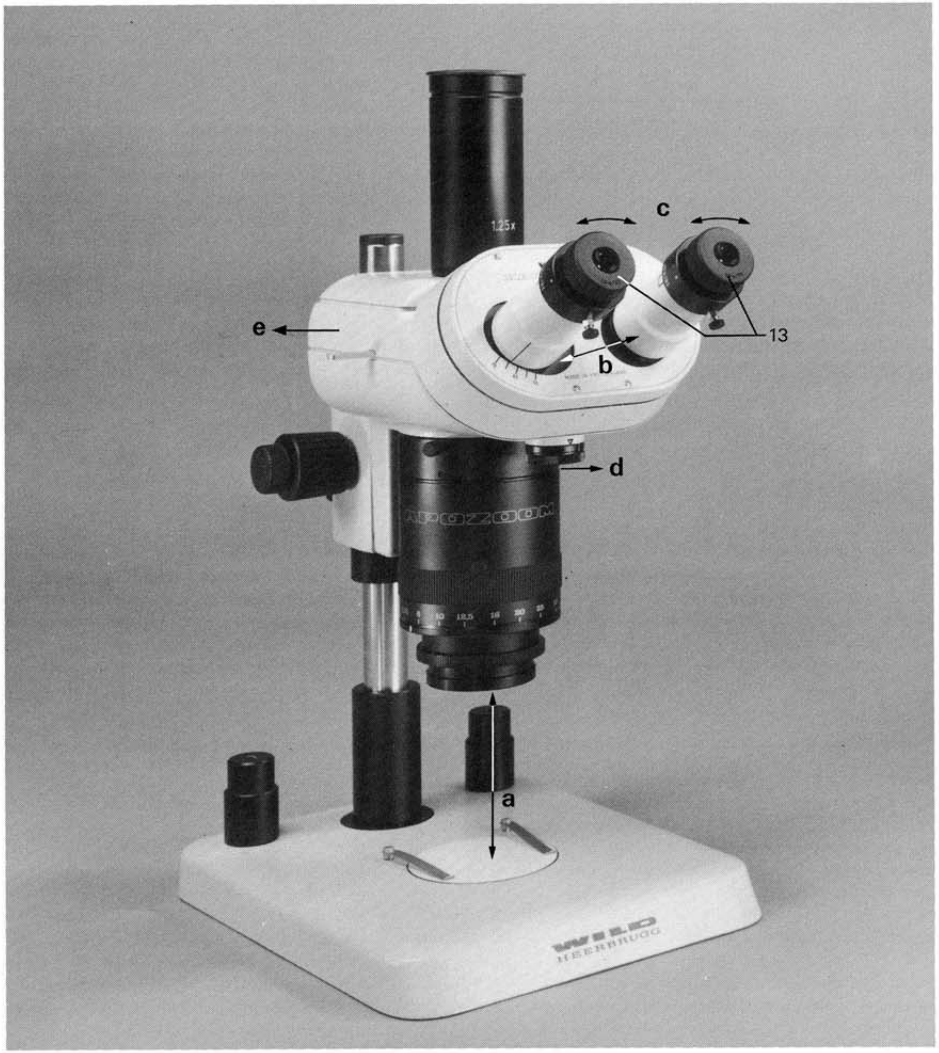
The bilateral coarse and fine focusing knobs (1) ensure comfortable operation.
The superior intermediate optics of the Wild macroscopes cause the image to remain sharp over the whole zoom range, provided that the dioptric settings are correct and that the working distance is not changed. Features nearer to, or farther from, the principal plane of the object can be imaged by refocusing.
The focusing range of 50 mm enables even relatively large objects to be brought into focus without raising the macroscope on the column.

4. Zoom magnification changer

The advanced intermediate optics of the Wild macroscopes enable the zoom position to be set steplessly while the working distance remains constant. By turning the milled ring (3), the distances between the components of the lens combinations are changed, so that the image remains sharp at all zoom positions.
The magnification scale enables the image scale in the film plane to be determined (see section 20). The white index mark denotes the position (in the illustration, for example, it is '10').
The zoom range is limited by end-stops. Any desired zoom position can be secured with screw (7).

5. Aperture diaphragm

The higher the aperture, the better the resolution, but the depth of field decreases with increasing aperture. These factors can be balanced against one another in Wild macroscopes by means of an aperture diaphragm, which enables the depth of field to be increased (see section 20.5).
The diaphragm is operated by a milled knob (16); at the left-hand mark on the scale it is fully open. One interval on the scale represents a doubling or a halving of the diameter of the diaphragm opening.
Partial closure of the diaphragm results in a reduction of the light cone entering the objective and the image brightness is thus reduced. At the central click-stop position of the milled knob, photo-image brightness and exposure time remain constant over the whole zoom range.



6. Dioptric correction

The observer must correct any ametropia on both eyepieces.
The correct diopter settings are essential if parfocality is to be maintained over the whole zoom range.
The dioptric values (+5 to -5) can be read off from the scales on the eyepiece mounts.

a Set the macroscope to the working distance of the objective (see section 20)
b Set the interpupillary distance (see section 1)
c Set the two eyelens mounts to zero
d Open the double-iris diaphragm
e Open the dark slide on the M420.

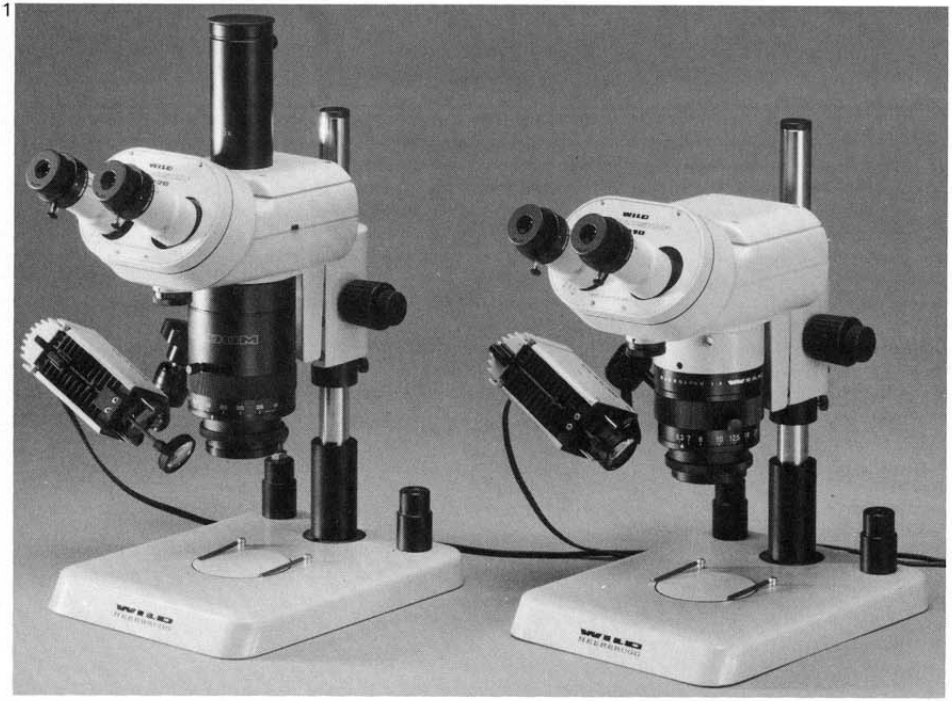
1 Turn to the highest zoom position
- **Focus on a flat test specimen** (e. g. a cross on paper) **with the focusing drive.**

2 Turn to the lowest zoom position
- Turn the eyelens mounts (13) fully out in the '+' direction without looking into the eyepieces.
- **Turn each eyelens mount individually in the '-' direction** until the specimen appears sharp. While doing this, close the other eye.
  The setting can be retained on eyepieces for spectacle wearers.

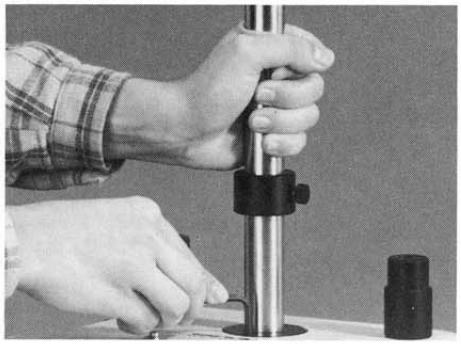
3 Set the magnification changer to the highest position.
- **Inspect the sharpness of focus** and correct it with the focusing drive if necessary.
  The specimen should now remain in focus at all zoom positions without any further refocusing. Otherwise the procedure must be repeated.
  The diopter values set remain the same irrespective of the objective or eyepiece used.

If a **graticule** is used in the eyepiece, it must be in position while the above adjustments are being carried out, because it affects the diopter setting.
The procedure for dioptric correction with the graticule is described in the instructions for the photomicrographic systems and for measuring equipment.

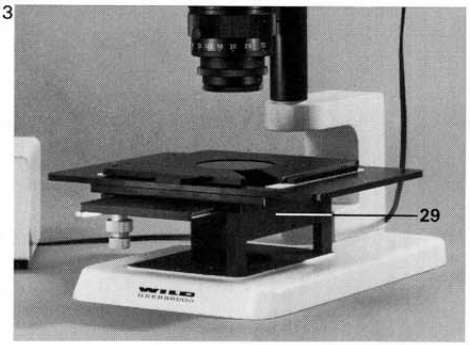
1



2



3



II. Assembly

The Wild M410 (fig. 1, right) and M420 (fig. 1, left) macroscopes are of the same design except that the M420 has a built-in phototube.
The complete outfit consists of an optics carrier with drive housing and inclined binocular tube, a Makrozoom or Apozoom objective, eyepieces, and optional additional objectives. These components are used with the stand and illuminator selected, and with appropriate accessories.

7. Incident-light stands

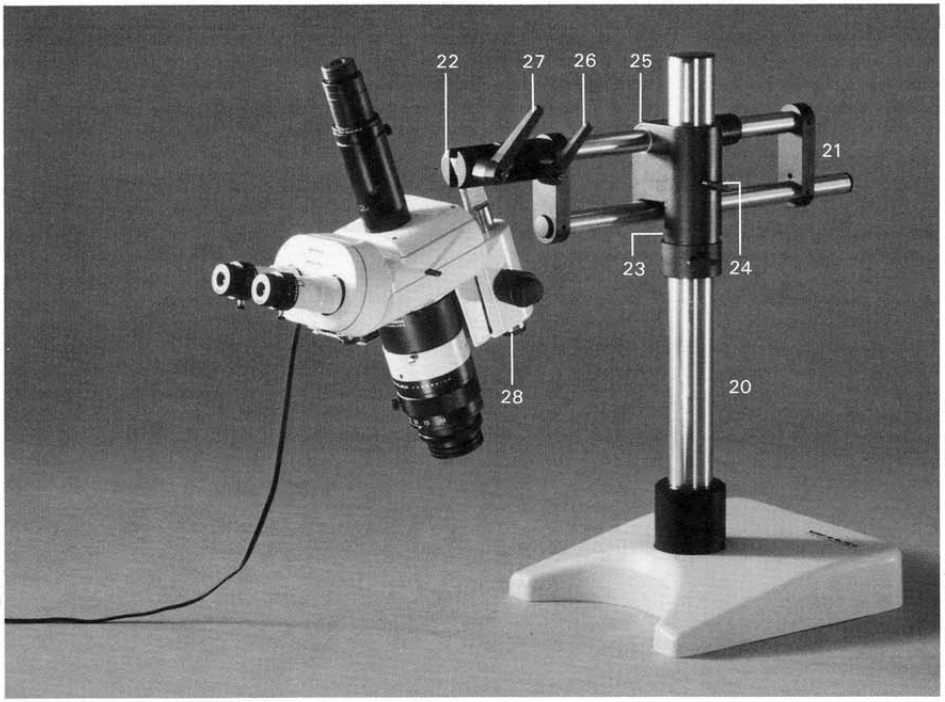
7.1 Rectangular incident-light stand

The rectangular incident-light stand with 350 mm long column, black/white stage plate, and stage clips is the routinely-supplied stand for observations in incident light.
If the baseplate and the column were separated for packing, they must be connected by using the Allen screws and Allen key provided (fig. 2).
Slide the sleeve and the safety ring down the column.
Fit the stage plate and the stage clips.
Add the optics carrier as described in section 9.

7.2 Large incident-light stand

To inspect masks and wafers, **large incident-light stands** are available (fig. 3). Bolt the stage carrier (29) to the baseplate from beneath.
Slide the sleeve and the safety ring down the column.
Wafer slides and turrets, and mask holders, can be supplied to order.
This stand can also be equipped with a ring lamp for observations in transmitted light; a carrier for it is to be placed in the baseplate.

For special applications, **large stands** with an overhang of 140 cm are available.



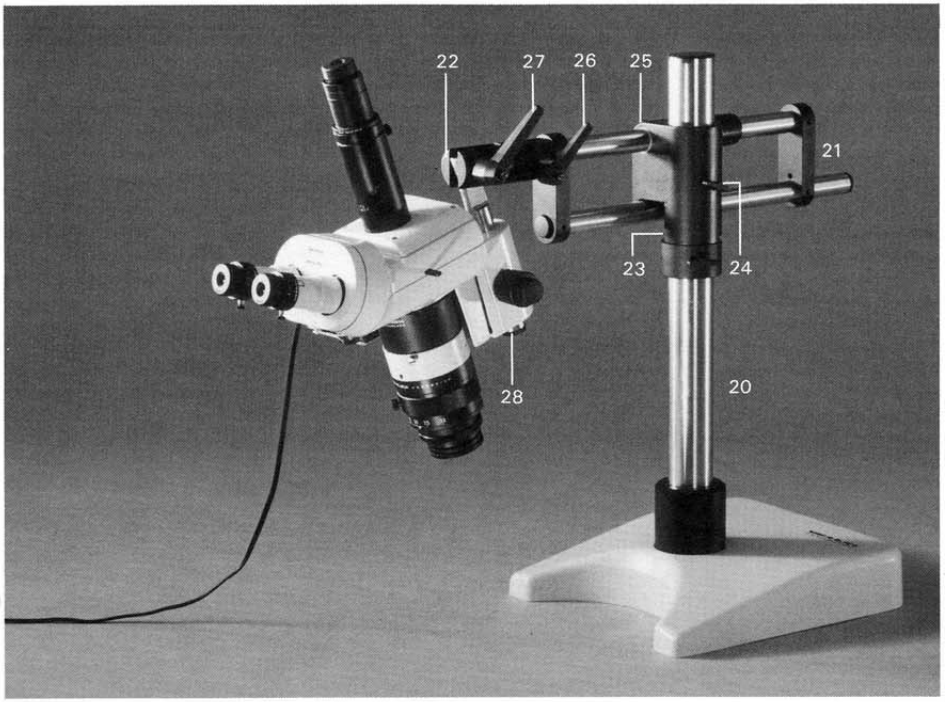
7.3 Swinging-arm and table-clamp stands

These stands consist of a 50 mm diameter post (20), a horizontal arm (21) and a carrier rod (22).

Fitting

- Secure the post of the **swinging-arm stand** to the base by means of the three Allen screws.
- Secure the **table-clamp stand** to a table top 20–50 mm thick by means of the clamp.
- Position the safety ring about 20 cm above the base of the post so that the screw-head (23) faces upwards.
  The screw-head limits the lateral movement of the horizontal arm.
- Slide the horizontal arm down the post and engage the screw-head (23) in the groove.
  Secure the hoizontal arm with the clamping screw (24).
  The overhang of the horizontal arm can be changed by loosening the clamping screw (25).
- Slide the carrier rod over the horizontal arm and secure it with the clamping lever (26).
  The carrier rod can be attached in accordance with the size of the object on either the upper or the lower part of the horizontal arm; the arm and the safety ring can be turned accordingly.
- The clamping lever (27) enables the carrier rod to be fixed at any angle.
  The two levers (26) and (27) can be pulled out along their axes and reset at another position.
- Remove the end-stop (28).
  Mount the macroscope and, where appropriate, the low-voltage lamp with 25 mm adapter, on the carrier rod.
  Replace the end-stop.

The following movements are possible with the swinging-arm and table-clamp stands:
- The horizontal arm can be swung out sideways by up to 30°
- The carrier rod can be tilted and inclined
- The working distance is variable
- The horizontal arm can be extended up to 540 mm.



7.3 Swinging-arm and table-clamp stands

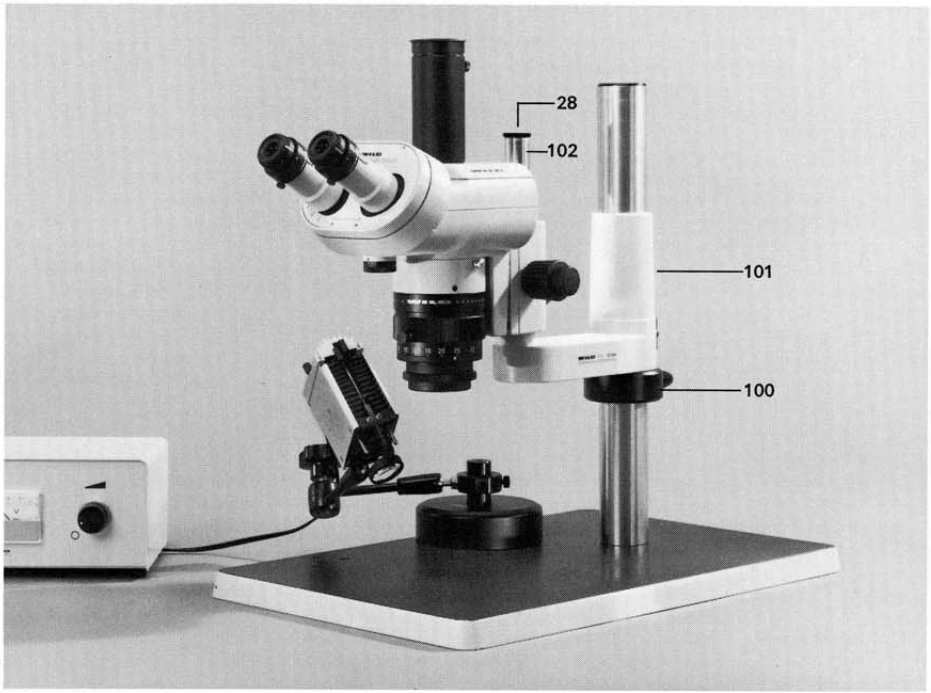
These stands consist of a 50 mm diameter post (20), a horizontal arm (21) and a carrier rod (22).

Fitting

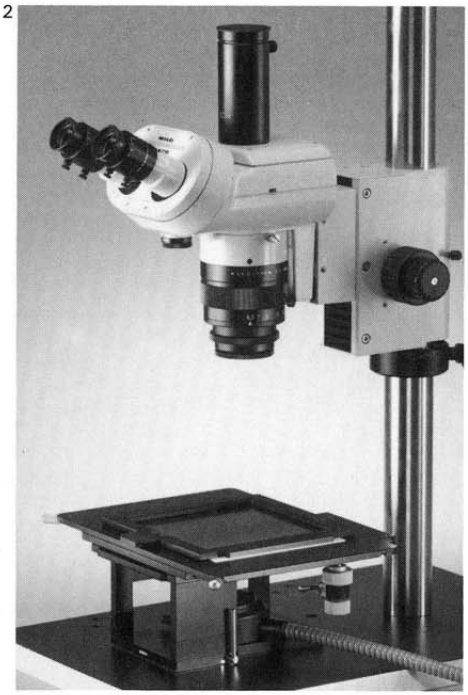
- Secure the post of the **swinging-arm stand** to the base by means of the three Allen screws.
- Secure the **table-clamp stand** to a table top 20–50 mm thick by means of the clamp.
- Position the safety ring about 20 cm above the base of the post so that the screw-head (23) faces upwards.
  The screw-head limits the lateral movement of the horizontal arm.
- Slide the horizontal arm down the post and engage the screw-head (23) in the groove.
  Secure the hoizontal arm with the clamping screw (24).
  The overhang of the horizontal arm can be changed by loosening the clamping screw (25).
- Slide the carrier rod over the horizontal arm and secure it with the clamping lever (26).
  The carrier rod can be attached in accordance with the size of the object on either the upper or the lower part of the horizontal arm; the arm and the safety ring can be turned accordingly.
- The clamping lever (27) enables the carrier rod to be fixed at any angle.
  The two levers (26) and (27) can be pulled out along their axes and reset at another position.
- Remove the end-stop (28).
  Mount the macroscope and, where appropriate, the low-voltage lamp with 25 mm adapter, on the carrier rod.
  Replace the end-stop.

The following movements are possible with the swinging-arm and table-clamp stands:
- The horizontal arm can be swung out sideways by up to 30°
- The carrier rod can be tilted and inclined
- The working distance is variable
- The horizontal arm can be extended up to 540 mm.

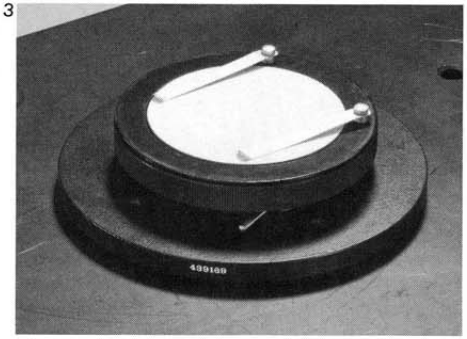
1



2



3



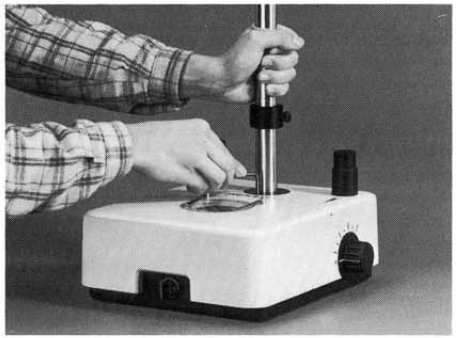
7.4 Universal stand

The universal stand consists of a 52 × 34 cm baseplate and a cylindrical column, 50 mm in diameter and either 450 mm or 800 mm long, which is connected to the centre of the baseplate by screws.
The macroscope can be connected to the 50 mm diameter column by means of a drive housing (fig. 2).
The drive housing for 25 mm diameter columns is attached to the carrier rod (102) of the adapter (101). This carrier rod also accepts low-voltage lamps with a 25 mm diameter adapter.
The safety ring (100) secures the outfit on the column of the stand.
The baseplate serves as a working surface.
The stage carrier with magnetic linkage enables all special stages with 80 mm diameter port to be used (fig. 3).
The stage carrier with magnetic linkage and lift-off device is designed for use with mechanical stages having 4 in × 4 in and 6 in × 6 in travel (fig. 2). Carriers and slides for masks and wafers are available on demand.

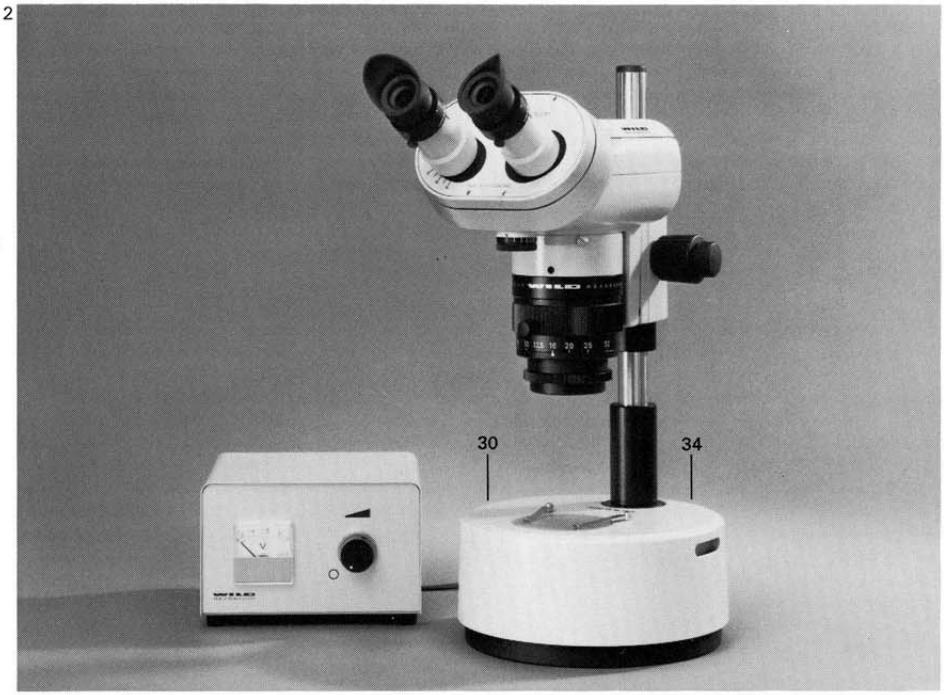
7.5 Combinations

Because the columns of the swinging-arm stand and the universal stand are the same, individual stand combinations can be put together. For example, the swinging-arm can be used on the universal stand, and the adapter with carrier rod 180/25 mm and the drive housing for 50 mm diameter columns can be used on the swinging-arm stand or on the table-clamp stand.

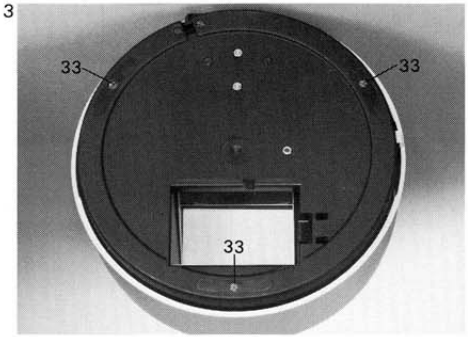
1



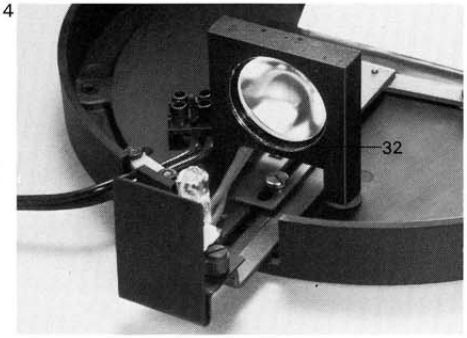
2



3



4



8. Transmitted-light

Each transmitted-light stand consists of a base with illuminator, and a 350 mm long column.
If column and base have been packed separately, connect them with the hollow screws provided (fig. 1).
Add the stage clips and the glass stage plate.
Connect the stand to the regulating transformer.
Slide the sleeve, the safety ring and the macroscope down the column of the stand.

8.1 Transmitted-light stand, bright field, circular

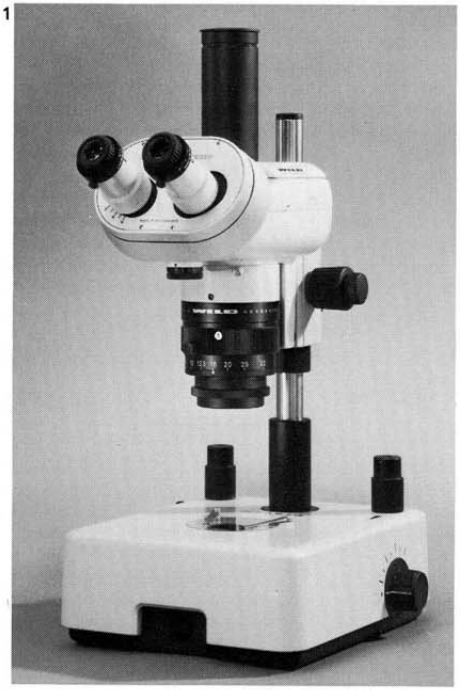
The circular transmitted-light stand is suitable for the examination of transparent object in bright field. For photography, it is recommended that the transmitted-light stand EB or the transmitted-light stand for bright and dark field be chosen.
In the circular transmitted-light stand for bright field, the light from the 6 V/10 W halogen bulb is directed through the specimen and into the objective by means of a deviating mirror, a collector lens, and a condenser lens. The colour temperature is 2700 K.

- Assemble the outfit as described.
- The cable is packed underneath the stand; connect it to the 7 V regulating transformer (see section 13).
- Move the lever (30) to its limit and extract the guide (34) completely.
  Hold the 6 V/10 W halogen bulb with a cloth, insert it, and replace the guide.
  If even more light is required for special applications, a 6 V/20 W halogen bulb can be inserted.

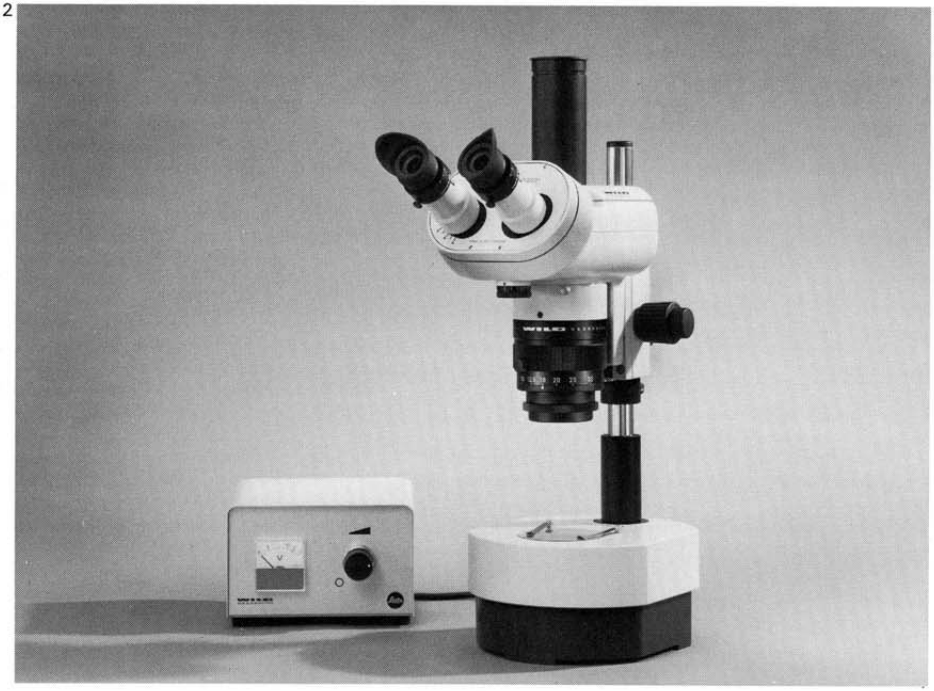
The light spot is focused by displacing the guide with the lever (30) so that each field of view can be optimally illuminated. Since the illumination is very bright, it is however recommended that the entire glass stage plate (diam. 80 mm) be illuminated.
A diffusing filter is present in front of the collector lens. If required, a different 32 mm diam. filter can be fitted instead:

- Pull out the lamp cable.
- Loosen the three screws (33) on the underside of the base and remove the cover plate.
- Remove the spring clip from the filterholder (32).
- Substitute the filter and replace the spring clip.
- Replace the cover plate.

1



2



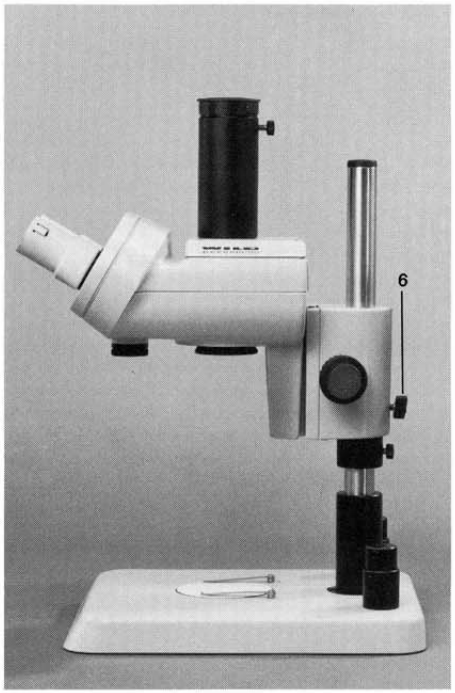
8.2 Transmitted-light stand EB

A complete illumination system including a 6 V/20 W halogen bulb, a regulating transformer and a thermal fuse, is built into the transmitted-light stand EB (fig. 1).
The specially-designed collector system permits optimal use of the light. This stand is particularly useful for **photomicrography in transmitted-light bright field.** The colour temperature is 3200 K.
Further details about the operation of this stand and in particular about the use of the interchangeable collector lenses and the swing-in frosted filter are given in the instruction booklet M2 295.

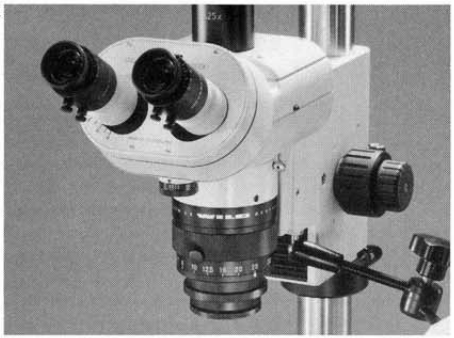
8.3 Transmitted-light stand, bright/dark field

The transmitted-light stand for bright and dark field (fig. 2) enables **observations and photography to be carried out in either bright field or dark field.**
In the dark field technique, no light passes directly through the specimen into the objective. Light reflected at the interfaces of components with differing refractive indices travels into the objective, however, so that a bright image on a dark background is seen and the contrast of weakly-coloured or transparent specimens can be increased.
The built-in 12 V/100 W halogen bulb produces high light intensity at a colour temperature ideal for photomicrography (up to 3400 K).
It is connected to the 12 V regulating transformer, which simultaneously controls the fan.
The changeover from bright to dark field and back is carried out with the lever at the rear of the base.
Further details on the use of this stand are to be found in the instruction booklet M2 280.

1



2



3

4

9. Optics carrier

The optics carrier is routinely supplied with a drive housing for 25 mm columns (fig. 1).

- Slide the safety ring down the column, followed by the whole unit housing. Secure the safety ring. Align the instrument with the stage plate.
- Always secure the safety ring and the wing screw (6) of the drive housing. The sleeve is a precaution against damage from slipping.

The drive housing for 50 mm diameter columns can be used on the universal stand or on the swinging-arm stand (fig. 2).

10. Optical components

10.1 Objectives

Wild macroscopes can be equipped with either a Makrozoom objective or an Apozoom objective. The Makrozoom objective (fig. 4, left) covers a magnification range from 6.3× to 32× and can be combined with a coaxial incident-light housing, a quarter-wave plate and a 0.5×, 1.5× or 2.0× additional objective.

The Apozoom objective (fig. 4, right) has a zoom range from 5.8× to 35×. Because of its superb chromatic correction (for three colours of the spectrum and for all intermediate tones) the Apozoom is the ideal objective for photography and observation under conditions where exceptionally high demand are made regarding contrast, image crispness and resolution. The Apozoom can be equipped with special additional objectives (0.5× and 2.0×).

Insert the objective into the dovetail ring beneath the optics carrier so that the clamping screw (4) is on the right; tighten the latter.

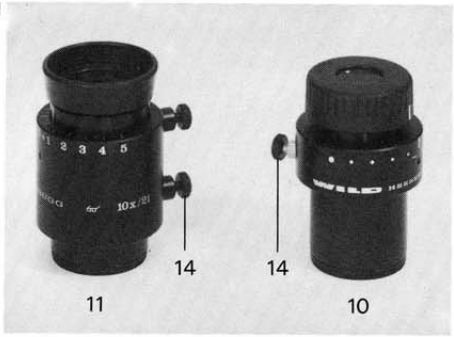
The working distance and the total magnification (see table, section 23) can be altered by adding an additional objective in bayonet mount.

Tighten the additional objective anticlockwise (as viewed from above; fig. 3).

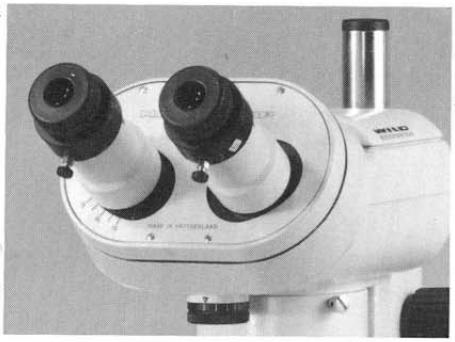
The 0.5× additional objective is mostly used with the swinging-arm stand or with the universal stand.

The 1.5× and 2.0× additional objectives can be used with all stands for incident and transmitted light.

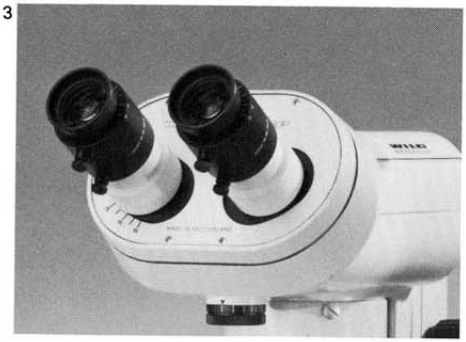
1



2



3



4

10.2 Eyepieces

Wild macroscopes are routinely supplied with two adjustable 10×, 15×, 20× or 32× wide-field eyepieces (10). In addition, wide-field eyepieces for spectacle wearers (11) are available with powers of 10×, 15× and 20×; they can be used with or without spectacles (see section 2).
By changing the eyepieces, the total magnification can be influenced without changing the working distance (cf. table in section 23).
Individual dioptric corrections are accommodated with the adjustable eyelens for each eye (see section 6).

Fitting the eyepieces

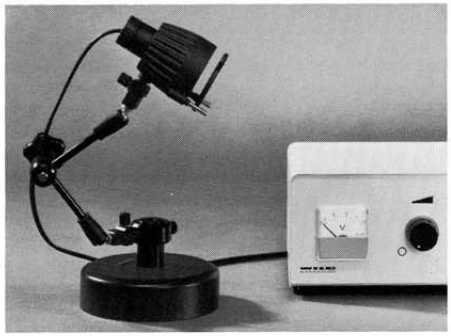
- Remove the dust caps from the tubes.
- Insert the eyepieces. Secure the adjustable one with the clamping screw (14).
- Eyecups can be fitted to the eyepieces. The eyecups of the eyepieces for spectacle wearers are already screwed into position and can be folded back if not required (see section 2).

Graticules in mounts fit into all adjustable eyepieces; they are used for photomicrography and for measuring (fig. 4):
- Unscrew the sleeve (16) from beneath the eyepiece.
- Fit the graticule and replace the sleeve.

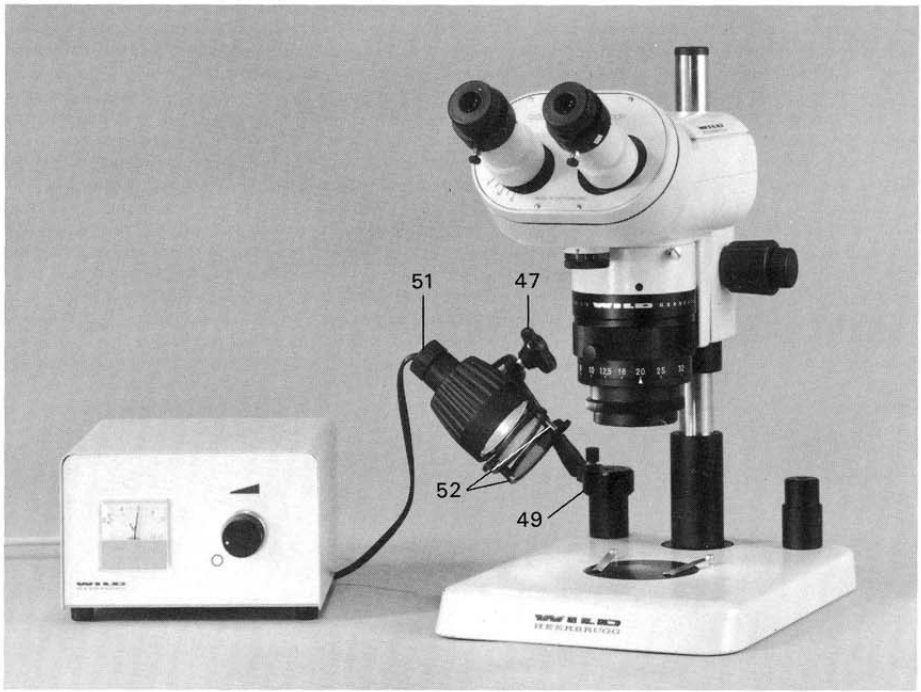
The use of the graticules is described in the appropriate instructions (for MPS systems or for measuring).

Please also observe the notes in section 20 about optics combinations.

1



2



III. Illuminators

11. Incident light

11.1 Low-voltage lamp 6 V/10 W

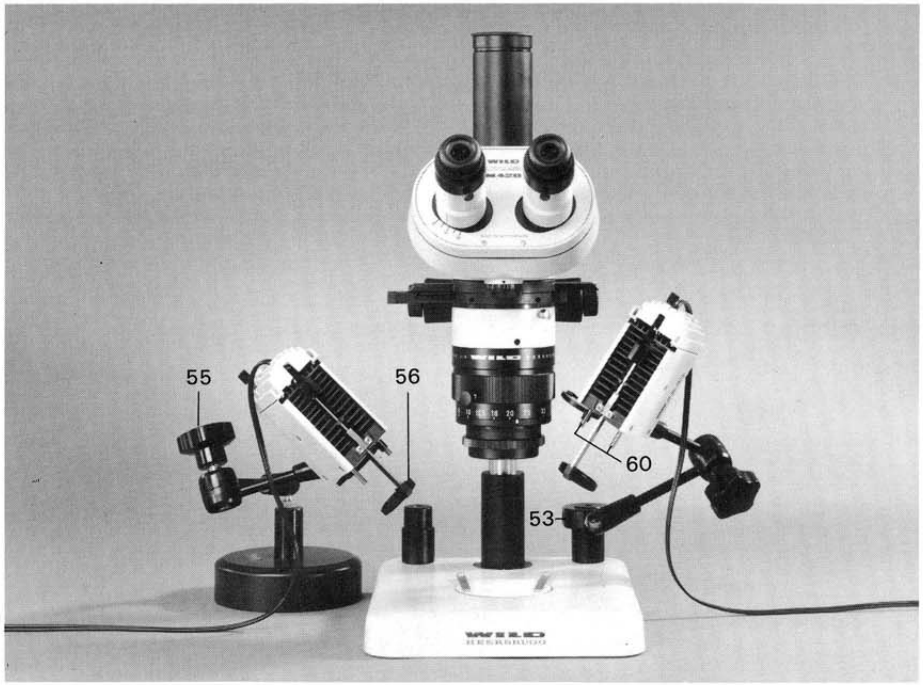
The 6 V/10 W low-voltage lamp is for the inclined incident illumination of spatial objects and is suitable for **observation and photomicrography.** The colour temperature of the halogen bulb is 2700 K.
For shadow-free illumination and for photomicrography, it is recommended that two low-voltage lamps be used; they can both be connected to the same 7 V regulating transformer.
The clampable lampholder can be secured in any position by means of a central clamping knob (47). When loosening this clamping knob, hold the lamp housing.
Because the connectors at the two ends of the arm are identical, the arm can be attached to adapters and to the rotatable coupling of the lamp.
The lampholder can be attached by means of an **adapter diam. 25 mm** to any 25 mm diameter post, e. g. to the column of a stand, to a separate cast base (fig. 1), to the carrier rod of the swinging-arm stand, or to one of the two short posts (fig. 2) on the rectangular stands for incident and transmitted light:

- Connect the adapter (49), the lampholder and the lamp housing.
- Connect the low-voltage lamp to the 7 V regulating transformer (see section 13).
- Hold the lamp housing and slacken the clamping screw (47).
- Align the lamp to the object and retighten the clamping screw.
- By turning the lamp socket (51), focus the light spot aas required.
- Two **filter holders** diam. 50 mm can be connected to each of the two pins on the lamp housing and swung in when needed. It is recommended that a **KG1 heat-absorbing filter** be used to prevent overheating of the specimen.

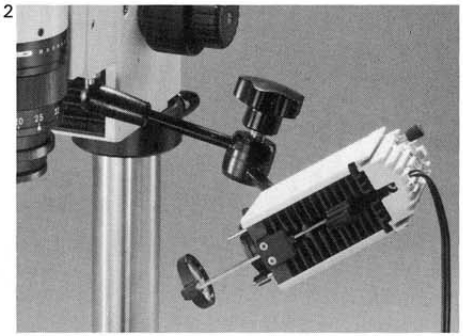
Changing the bulb

Note: Always use a cloth to hold the halogen bulb.
An arrow on the lamp mount and a line on the lamp housing indicate the position at which the two parts can be separated by pulling.
The lamp mount clicks automatically into position again when refitted.

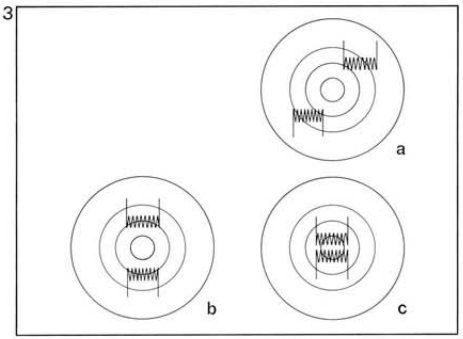
1



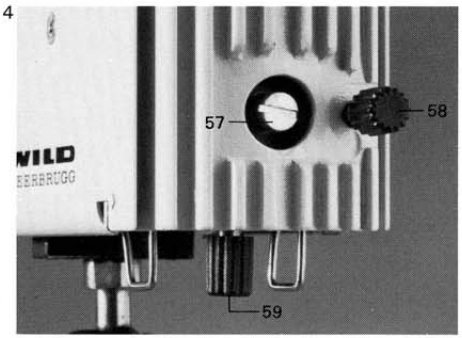
2



3



4



11.2 Low-voltage lamp 6 V/20 W

The 6 V/20 W halogen lamp is a powerful source of uniform illumination at 3200 K and is therefore ideal for photomicrography.
The large lampholder has a thread connector which enables it to be fitted to the cast foot (fig. 1), to the short posts on the rectangular bases of the incident- and transmitted-light stands, and to the drive housing for 50 mm diameter columns (fig. 2). An adapter (53) permits it to be attached to any column of 25 mm diameter.
The articulated lampholder is universally inclinable and can be secured in any position using the single centrally-located clamping knob (55).
Support the lamp housing when loosening the clamping knob.

Fitting the bulb

- Remove the rear part of the lamp housing.
- Hold the 6 V/20 W halogen bulb in a cloth and push it into position. Do not touch the quartz envelope with the fingers.
- Close the housing with the wire clip.

Connect the lamp with the 7 V regulating transformer (see section 13) and switch it on.

Centring the halogen bulb

The centring must be repeated whenever the bulb is changed.

- Pull out the condenser lens (56).
- Cause the light spot to fall vertically on a white paper about 25 mm away.
- Using screw (57), focus the image of the filament and its mirror image(fig. 3a).
- Displace the filament images with the horizontal movement screw (58) so that they are opposite (fig. 3b).
- Using the vertical movement screw (59), bring the two images into contact (fig. 3c).

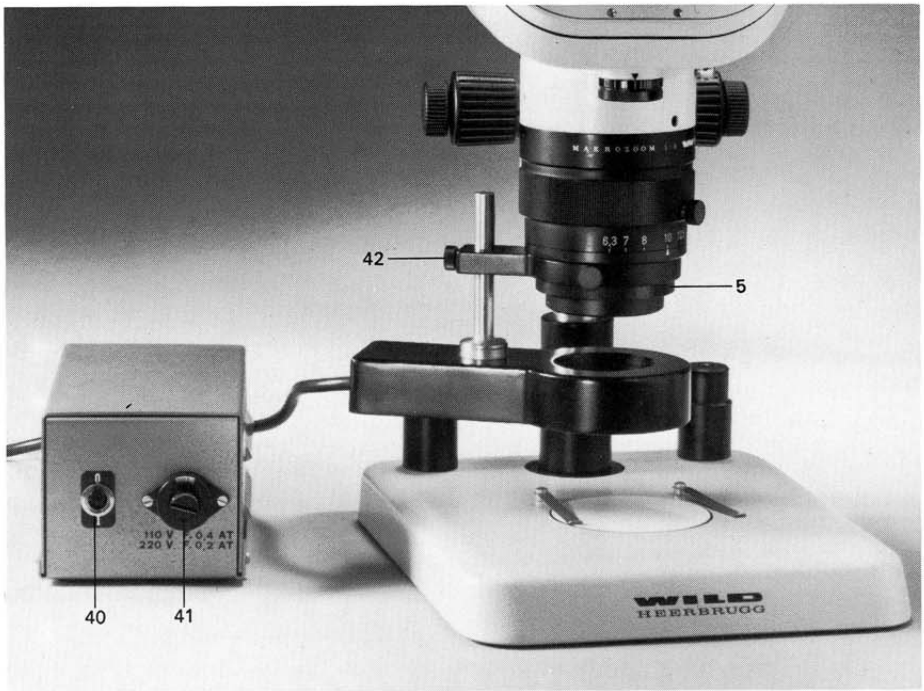
Focusing the light spot

When the condenser lens is fully pulled out, a sharply-defined illuminated field of diameter 16 mm is formed about 75 mm in front of it.
By retracting the lens, the diameter can be increased to about 40 mm without changing the position of the lamp housing. A frequently-used mean position is denoted by a click stop.
Larger illuminated fields can be produced by displacing the lamp housing.

Filters

A heat-absorbing filter is built into the lamp.
A **diffusing filter in swing-out mount** (60) is attachable to one of the rods. A maximum of four 32 mm diameter filters can be used.

1



11.3 Ring illuminator

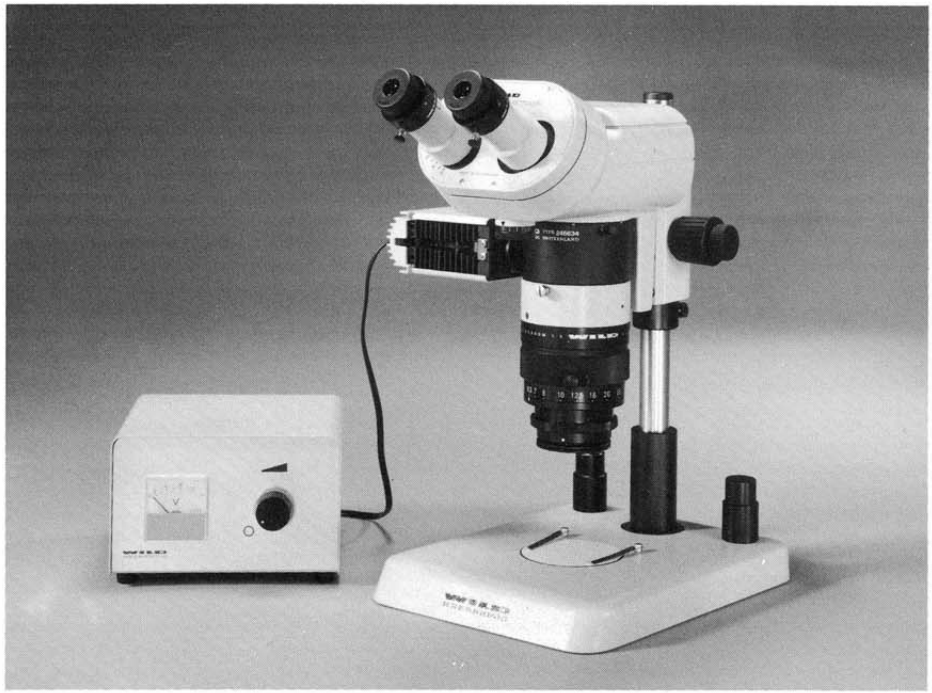
The ring illuminator, which produces light of daylight quality, is used for shadow-free illumination of high-contrast spatial objects. The intensity suffices for magnifications of up to 40×.

Fitting:

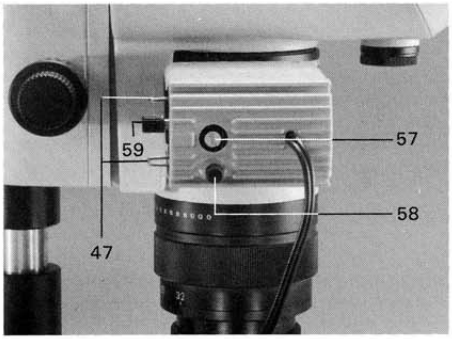
- Unscrew the milled ring (5) from the objective.
- Slide the holder ring over the objective mount.
  Replace the milled ring.
- Using the screw (42), secure the lamp housing at the desired height.
- Set the choke to the **available voltage** as follows:
  Unscrew the fuse holder (41).
  Pull out the cover plate of the voltage selector and replace it so that the appropriate voltage is visible in the cutout:
  110 V position for 100–120 V supply
  220 V position for 200–240 V supply
  Tighten the fuse holder.
- Connect the power cable.
- Switch on the illuminator with the toggle switch (40).

Fuses:
for 110 V: 200 mA, 5×20 mm (370 879)
for 220 V: 500 mA, 5×20 mm (167 650)

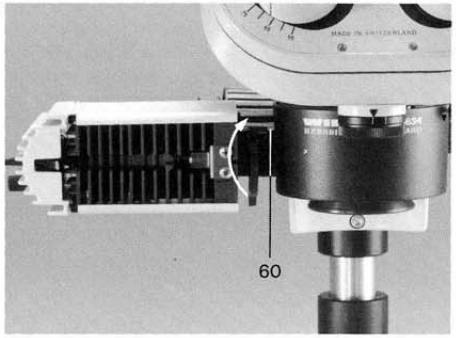
1



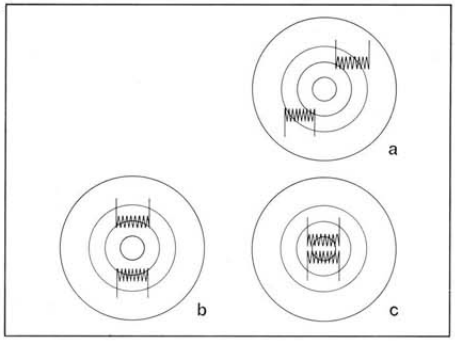
2



3



4



11.4 Coaxial incident illuminator and quarter-wave plate

Coaxial incident light, when directed along the observation path, enables flat and highly-reflecting objects such as integrated circuits and polished metal sections to be examined.
Please ensure that the surface of the object is precisely at right-angles to the axis of the instrument. Tilt will result in a non-uniform image.

Assembly

- Fit the incident light housing between the optics carrier and the **Makrozoom objective** so that the lamp housing points to the left (fig. 1).
  Tighten the clamping screws.
- Secure the quarter-wave plate. The Makrozoom objective and the 1.5× and 2.0× additional objectives have a bayonet mount for the quarter-wave plate.
- A filterholder with 32 mm diameter filter can be attached to the rod (60).
- Connect the lamp housing to the 7 V regulating transformer (see section 13).

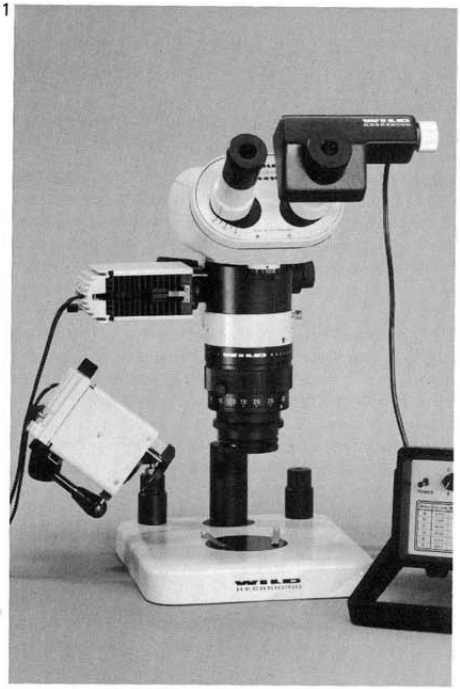
The coaxial incident light housing incorporates polarising filters which eliminate stray light. The degree of extinction is changed by rotating the quarter-wave plate, so that contrasts resulting from the formation of interference colours can also be varied. Because the light is circularly-polarised, no quartz plate is required for photography.

Centring the bulb

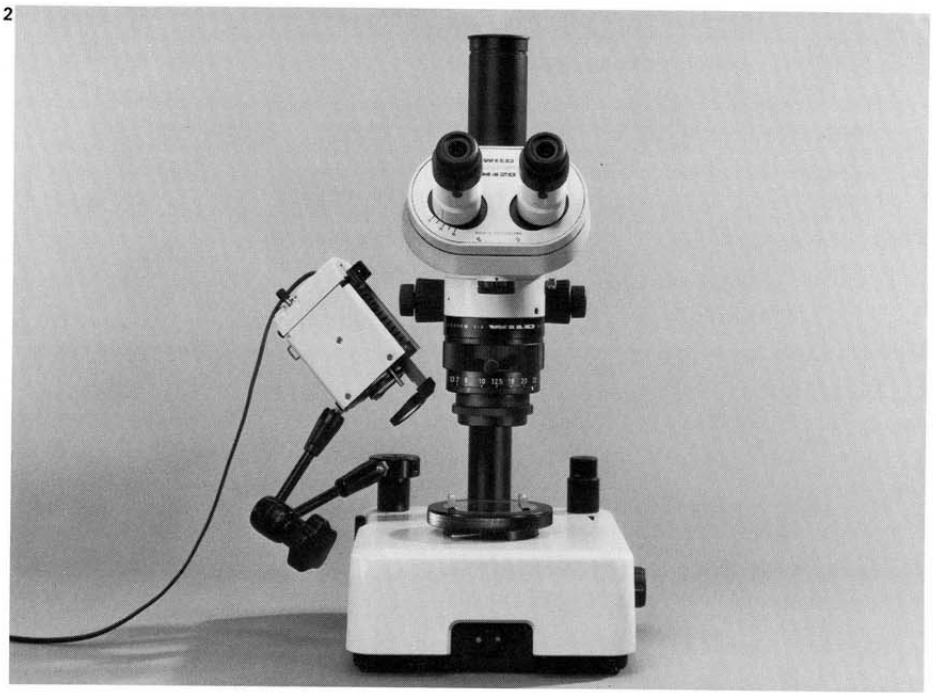
To insert the 6 V/20 W bulb, compress the wire clip (47) and detach the rear part of the housing.
Hold the bulb in a cloth and insert it. Close the housing again.
Whenever the bulb is changed, the lamp must be recentred as follows:

- Remove the Makrozoom objective.
- Swing out the frosted filter of the lamp housing (fig. 3).
- Position a white card about 50 mm below the optics carrier so that the filament and its mirror image are defined in the spot of light.
- Turn the slotted screw (57) until both filament images are as sharp as possible and of the same size (fig. 4a).
- Using the black screws (58 and 59), displace the filament images so that they are opposite to one another and just in contact (figs. 4b and 4c).
- Replace and secure the Makrozoom objective. At the correct working distance there now appears a homogeneous circular spot of light.

1



2



12. Combined illuminators

Numerous objects simultaneously display many of their structures only when they are illuminated by a combination of lighting techniques.

Combined inclined and coaxial incident light (fig. 1) enables objects possessing both flat specular areas and uneven parts, such as hybrid circuits and mechanical components, to be inspected.

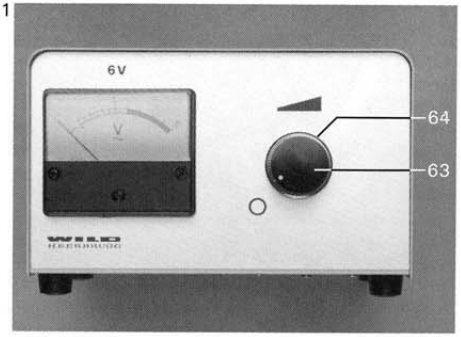
- A 6 V/10 W or 6 V/20 W low-voltage lamp and the 6 V/20 W coaxial illuminator can be connected simultaneously to a 7 V regulating transformer (see section 13) which accepts a maximum loading of 50 W.

The **combination of incident and transmitted light** (fig. 2) is recommended for partly-transparent objects such as fibres, insects, and textiles. The inclined incident light emphasises details and structures of the surface.

- The 7 V regulating transformer for the circular transmitted-light stand will accept a low-voltage lamp in addition.
- For photomicrography, the low-voltage lamps should be connected to a separate transformer, in order that the colour temperature of the halogen lamp remains constant. The same is valid for the combination of the low-voltage lamp with the transmitted-light stand for bright and dark field.

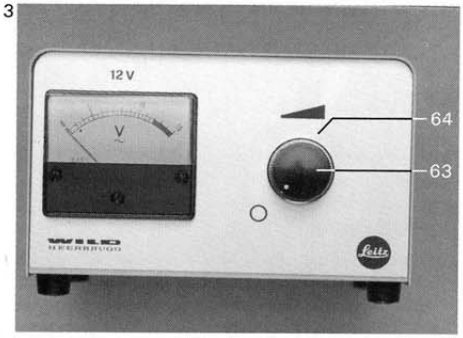
The incorporated regulating transformer of the transmitted-light base EB will power the transmitted-light source and an incident lamp simultaneously.

1

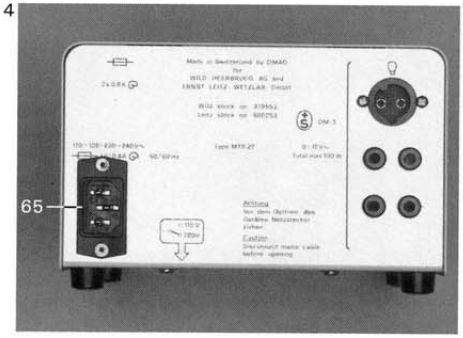


2

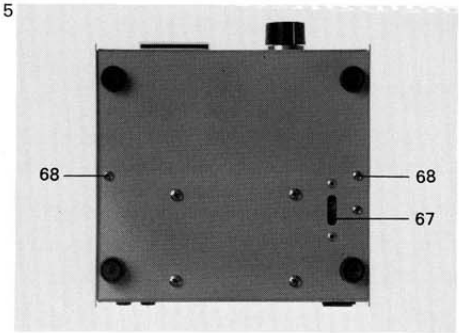
3



4



5



13. Regulating transformer

The 0–7 V/50 VA **regulating transformer** (fig. 1) will accept the 6 V/10 W and 6 V/20 W low-voltage lamps, the circular stand for transmitted light with 6 V/10 W halogen bulb and the coaxial illuminator with 6 V/20 W halogen bulb. A maximum loading of 50 W is to be connected to the two sockets (66) (fig. 2). The 0–12 V/100 VA **regulating transformer** (fig. 3) is used with the transmitted-light stand for bright and dark field with 12 V/100 W halogen bulb and with the coaxial illuminator if a 12 V/20 W halogen bulb is fitted. It has three sockets which accept a maximum combined loading of 100 W (fig. 4).

Operating

- Set the **voltage selector** (67) to the voltage available:
  Position 115 for 100–120 V
  Position 220 for 200–240 V
- Connect the power cable to socket (65) and to the power supply.

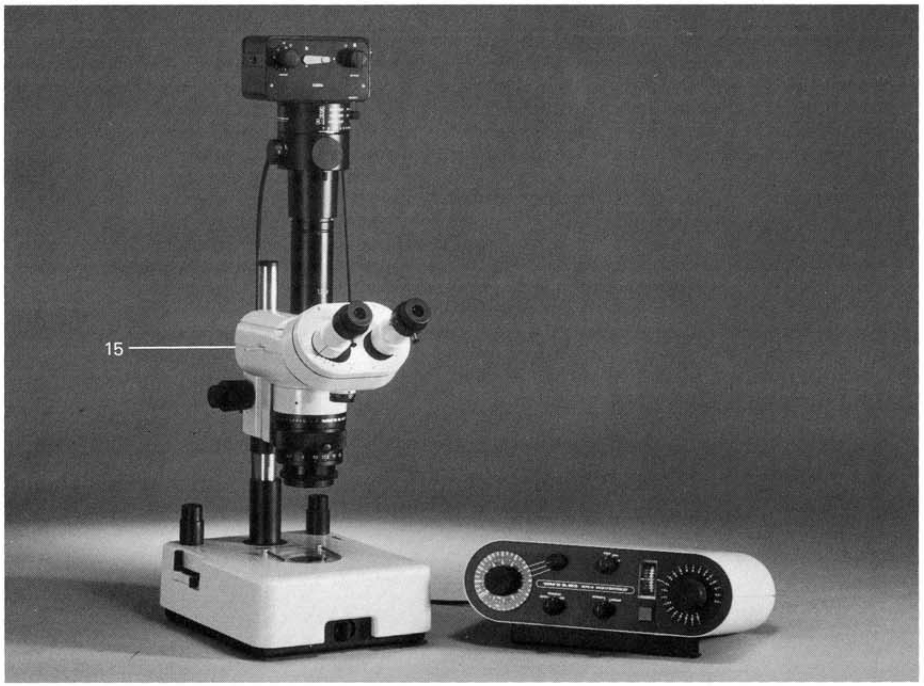
Setting the limiting voltage

- The click stop 6 V or 12 V prevents overloading of the bulb.
- Turn the regulating knob (63) clockwise until it engages.
- Slacken the screw on the metal ring (64).
- Turn the regulating knob back to zero.
- Connect the lamp to the socket (66). Turn the regulating knob until the voltmeter shows 6 V or 12 V, as appropriate.
- Tighten the screw on the metal ring.

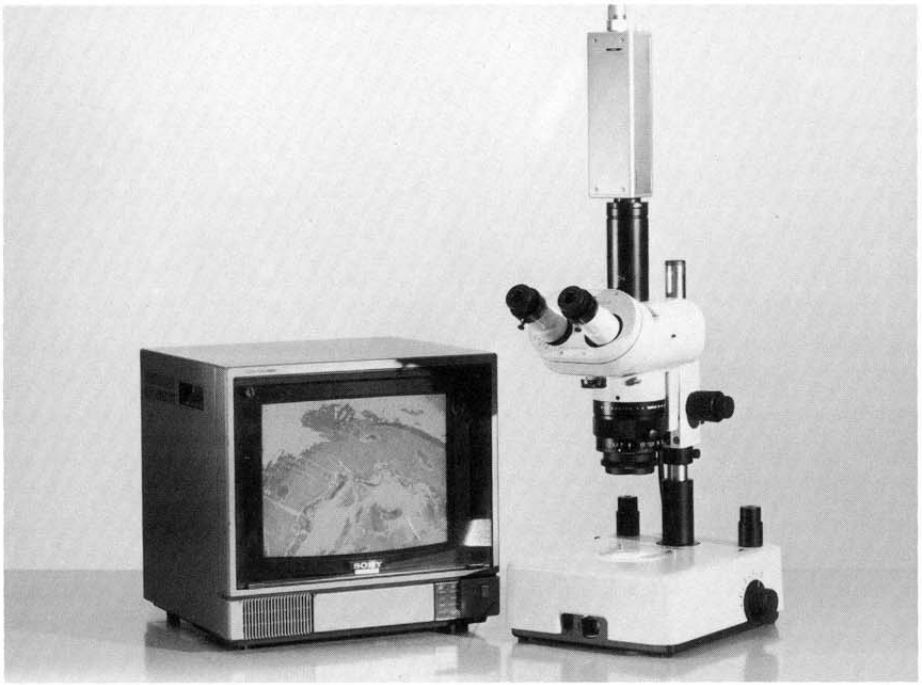
Changing the fuse

- Pull out the power cable.
- Remove the screw (68) from the underside.
- Lift off the housing.
- Replace the defective fuse:
  7 V: 8 A, 5×20 (214 477)
  12 V: 2×800 mA, 5×20 mm (343 950)

1



2



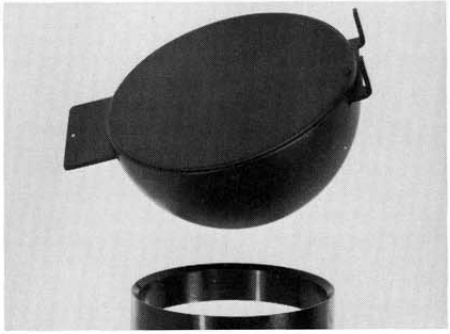
IV. Accessories

14. Photography, cine, TV

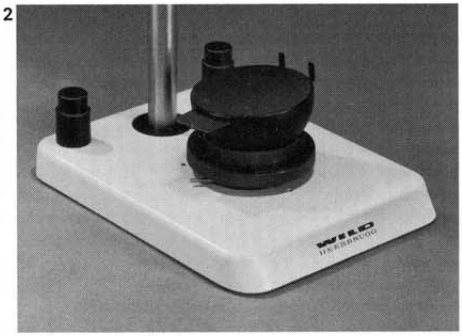
The WILD M420 Makroskop has a built-in phototube with a fixed beam-splitter prism. The latter directs 50% of the light to the binocular for observation, and 50% to the film plane. The instrument accepts the full range of **Wild modular photomicrographic systems** (fig. 1).
A dark slide (15) prevents light from entering the eyepieces during light metering and during the exposure.
The axially-symmetrical beam path results in a well-corrected photographic image. The latter is formed in two stages; the intermediate image is magnified further by a fixed eyepiece placed in an eyepiece tube in the phototube.
The tube factor is 1.25× both for the binocular tube and for the phototube.
The table in section 24 gives the image scales for all film formats.
The fitting of the camera, and its use, are described in the instructions provided with the photomicrographic system.
If photography is carried out with light which is linearly polarised, a **quartz plate** is to be fitted into the optics carrier in order to counteract any disturbance of the normal light partition ratio between the film plane and the sensor (see section 19). If unexpected polarisation colours are then seen down the focusing telescope or during photography, this is a sign that a second quartz plate is present, this one being in the shutterpiece of the camera system. This second plate must be either remounted at 90° to its present position, or removed altogether.

The phototube can also be equipped with a **cine or TV camera.** Two configurations are possible:
- The TV adapter with C-mount is used to project the intermediate image directly into the plane of the film or of the sensor (fig. 2).
- An eyepiece tube, fixed eyepiece and objective f = 50 mm with C-mount are combined to give a higher final image scale by means of two-stage magnification.

1

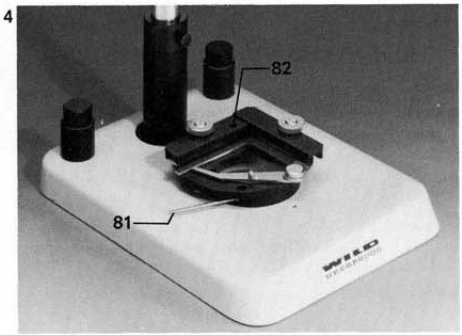


2



3

4



15. Stages

The use of special stages simplifies work. They are attachable to all incident- and transmitted-light stages with 80 mm diameter port, to the transmitted-light stage, and to stage carriers with magnetic linkage.

Fitting

Remove the stage plate and stage clips supplied as standard (fig. 1).
Move the macroscope correspondingly higher on the column and secure it with the wing screw and the safety ring.

15.1 Cup stage

The cup stage (fig. 1) is essential for examining cultures in petri dishes which are held in position by a movable holder.
Insects and plants are secured to the rubber surface with needles.
- Fit the supporting ring.
- Add the cup stage, which can be tilted to any position.

The freedom of movement of the cup stage can be further increased by mounting it on the gliding stage.

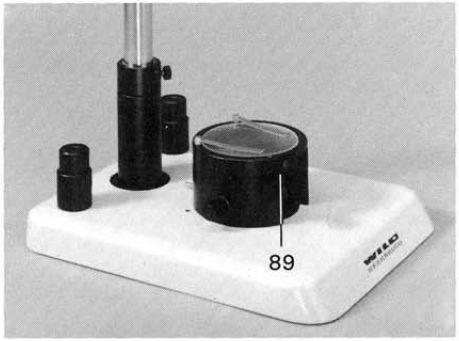
15.2 Gliding stage

The gliding stage (fig. 3) can be quickly moved in any direction and rotated.
- Fit the stage and secure it with the lever (81).
- Fit a glass or black/white stage plate and the two stage clips.

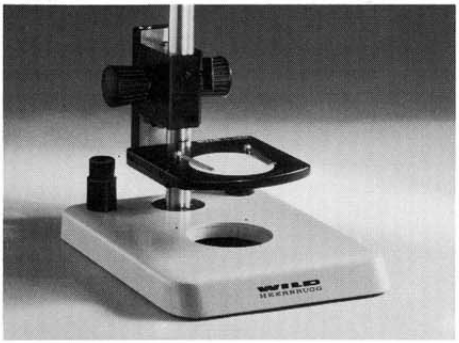
15.3 Stage carrier with mechanical stage

The stage carrier with mechanical stage (fig. 4) facilitates the systematic scanning of specimens.
- Fit the stage carrier and secure it with the lever (81).
- Add the appropriate stage plate (glass or black/white, as appropriate).
- Secure the mechanical stage to the stage carrier with the Allen screw (82). The mechanical stage can also be used on the rotatable Pol. stage.
  The object is secured with the arm and is moved in an x- or a y-direction with the knobs of the mechanical stage (76 mm × 28 mm).

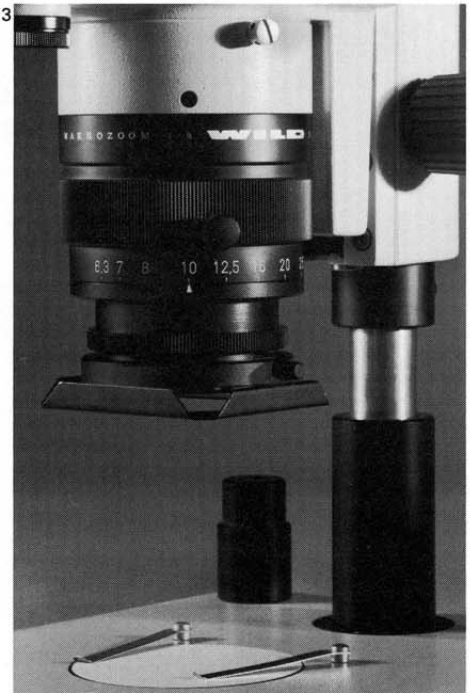
1



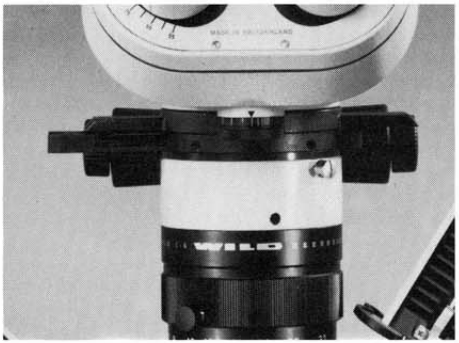
2



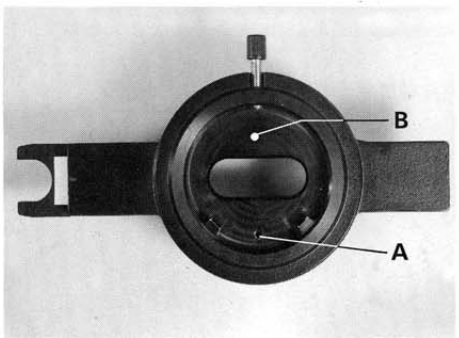
3



4



5



15.4 Transmitted-light stage

Place the transmitted-light stage in the stage cutout (fig. 1).
Fit a glass (or acrylic) stage plate and the two stage clips.
The light source can be daylight or the 6 V/ 10 W low-voltage lamp. The lampholder can be attached to the post (89). Cause the light spot to fall on the tiltable mirror.
Slight deliberate disadjustment of the mirror will produce inclined transmitted illumination, which is very advantageous for observing small translucent objects.

15.5 Hand-focused stage carrier

This stage carrier (fig. 2) enables the object to be brought into focus without changing the height of the tube.
The stage carrier can be mounted on the 25 mm diameter column of the incident- and transmitted-light stands and can be equipped with a glass or black/white stage plate, or with a special stage.
The range of movement is 50 mm.

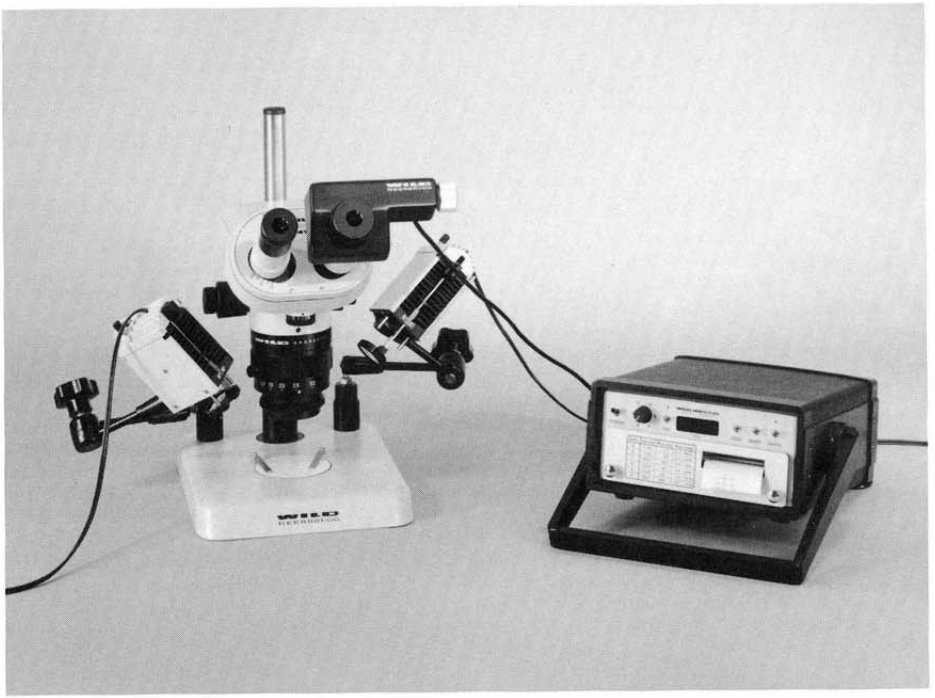
16. Filterholders

A 75 × 75 mm **filterholder,** which accepts colour correction filters, is available for the macroscopes. It fits over the mount of the Makrozoom objective and is secured with a screw (fig. 3).
In addition, a **filter slide housing** will fit between optics carrier and zoom objective (fig. 4). It is recommended that the Apozoom objective be used with the filter-slide housing and not with the filter holder. Remove the locating screw (for stereomicroscopes) from thread A and fit it to thread B.
The filter slide accepts two filters which can be readily changed. Ordinary gelatine filters can be cut into strips to match the filter hole size of 23 mm × 45 mm.

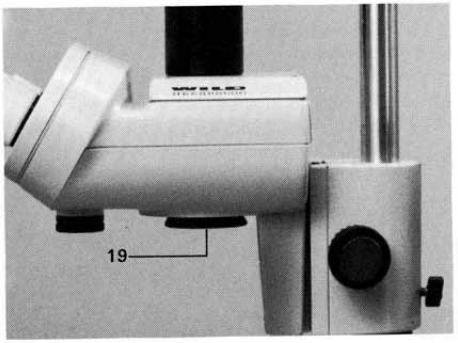
17. Handrests

The individually-adjustable handrests ensure precise and fatigue-free work on the object.
A rubber ring on the base prevents sliding on the table surface. The upper surface of the handrest is insulated with a layer of paint.

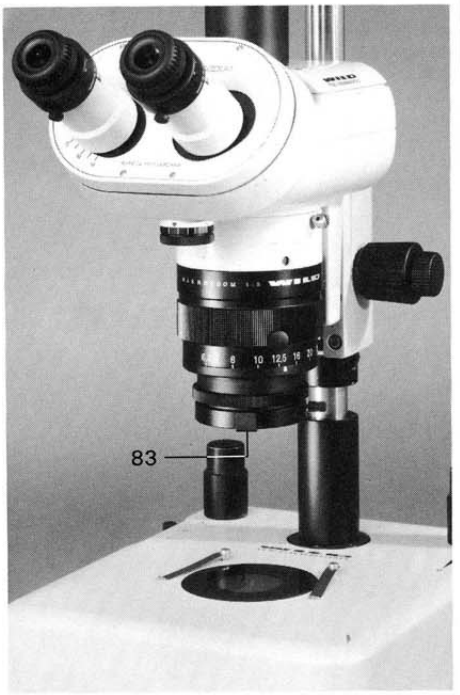
1



2



3



18. Measuring

The vertical beam path of the Wild macroscopes results in an image which is free of distortion.
For **precise measurement work,** adjustable Wild eyepieces can be furnished with a graticule (reticule) in mount (see section 10). The graticules available have various scales or grids, or a crosshair.
Angles can be measured with the **10× widefield goniometer eyepiece,** or with the **rotatable stage** used for polarisation work.
Further details of procedures used for measuring are given in the instruction booklet M2 275.

The **WILD MMS235 Digital Length-Measuring Set** with printer (fig. 1) streamlines and accelerates the action of measuring. The determinations of the calibration values and of the measurement data are microprocessor-controlled. After a single calibration procedure for each magnification, the length of the feature is constantly visible on a digital display. Calculation errors and check measurements are superfluous.
Detailed information is to be found in the instruction booklet M2 270.

19. Polarisation

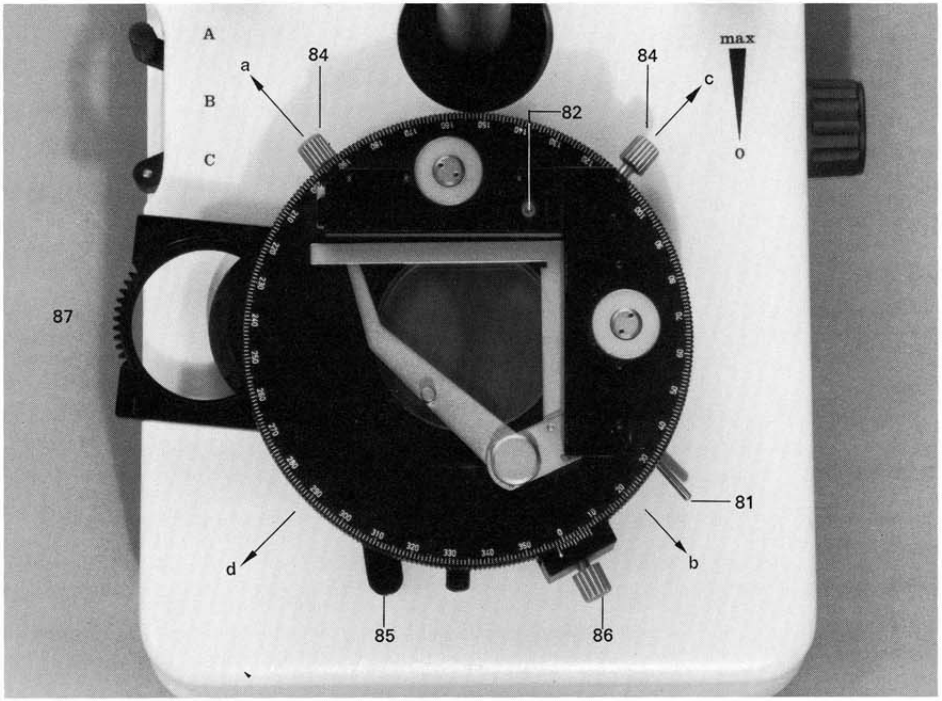
Double-refracting substances, such as many crystals, petrological thin sections and fibres, can be more easily seen and identified in polarised light.
The transmitted-light stands accept either the **polariser on glass stage plate** or the **rotatable Pol. stage.** All polarising sets require an **analyser** in rotatable mount, which is fitted to the objective mount.

The use of polarised light may cause a shift in the partition of the available light between the tubes of the binocular and between the phototube and the sensor of a camera. This can be corrected with a quartz plate (19), which is mounted with two screws beneath the optics carrier.

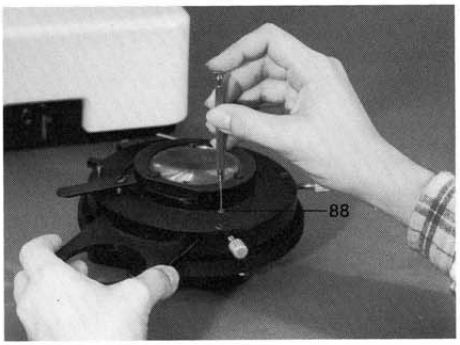
19.1 Polariser on glass stage plate

- Place the polariser on glass on glass stage plate, polariser downwards, in the cutout of the transmitted-light stand (fig. 3)
- Rotate the analyser using the lever (83) so that the field of view without specimen is as dark as possible.
- Place the specimen in position and focus on it.

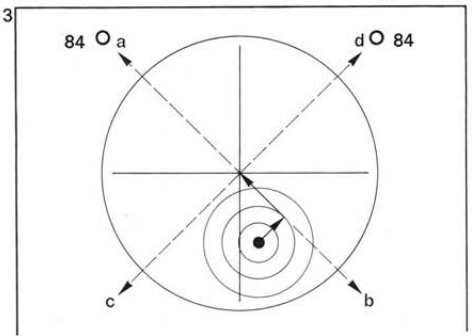
1



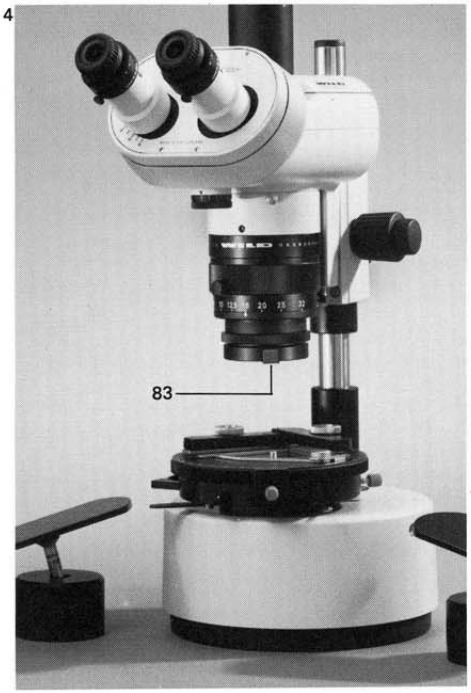
2



3



4



19.2 Rotatable Pol. stage

83 lever for rotatable analyser
84 centring screws
85 lever to swing in polariser
86 screw to secure rotatable stage
87 milled ring to rotate compensator

The rotatable Pol. stage is equipped with a swing-out **polariser.**
If required, a **first-order red compensator** (sensitive-tint plate) and a **mechanical stage** can be added to it. The compensator facilitates the identification of weakly-birefringent specimens.

- To fit the compensator, remove the screw (88) from the underside of the stage.
- Push the compensator in its metal mount fully into the stage.
- Retighten the screw.
- Fit the mechanical stage using the screw (82).
- Remove the glass stage plate and the stage clips from the transmitted-light stand.
- Fit the rotatable Pol. stage so that the two centring screws (84) are symmetrically positioned in relation to the column.
- Secure the stage with the lever (81).
- Switch on the light.
- Swing in the polariser with the lever (85) and pull out the compensator slide.
- Look into the binocular tube and move the lever (83) until the field of view without specimen is dark as possible.
- Secure the specimen with the arm of the mechanical stage and focus on it.

With the help of a crosshair in the eyepiece (see section 10) and of the two centring screws, **centre** the stage as follows:

- The point about which the stage rotates is adjustable and must be brought into coincidence with the axis of the objective, i. e. with the centre of the crosshair.
- Spin the stage in order to establish the point of rotation in the field of view.
- Using the screws (84), displace the point of rotation in the directions ab and cd (fig. 3). Successively repeat this procedure, simultaneously rotating the stage, until the point of rotation coincides with the centre of the crosshair.
- Push in the compensator mount and rotate it until the field of view of appears red.

The rotatable Pol. stage is calibrated and can be used for **angular measurements** (see instruction booklet M2 275).

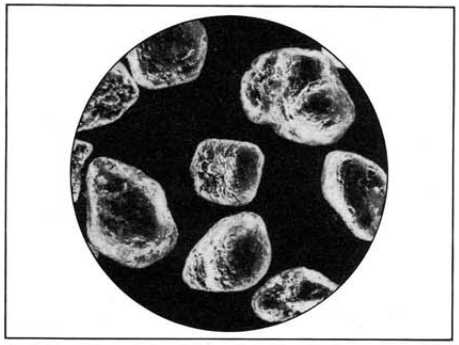
V. Appendix

20. Choosing the optics combination

The choice of optics combination is influenced by the **working distance** required, the **total magnification** obtainable, and the **appropriate field of view.**
Resolution and depth of field are also dependent on the optical components chosen.
The table in section 23 gives field diameters and total magnifications for zoom positions 5.8×, 6.3×, 10×, 20×, 32× and 35× when the various eyepieces (10×, 15×, 20× or 32×) and objectives (0.5×, 1.0×, 1.5× and 2.0×) are used.

20.1 Working distance

The working distance can only be changed by substituting or adding an objective of different focal length. The higher the objective magnification, the shorter the focal length and the working distance, e. g.:
Additional objective 0.5×
with working distance 188 mm or
Additional objective 2.0×
with working distance 39 mm.



20.2 Total magnification

In the visual beam path of the macroscopes, the image is produced in two stages.
First, a magnified intermediate image is produced by the object and the magnification changer together.
In the **second stage,** the intermediate image is further magnified by the eyepiece.
The total magnification is also influenced by the **1.25× tube factor** due to the binocular tube.

Magnification in binocular tube =

$$\frac{\text{zoom position} \times 1.25\times \text{ addl. objective} \times \text{eyepiece}}{10}$$

Example: $\dfrac{6.3 \times 1.25 \times 1.5 \times 20}{10} = 23.6\times$

The magnification range can be extended by using additional objectives. The 0.5× and the 1.5×/2.0× objectives produce lower and higher ranges respectively.
The 10×, 15×, 20× and 32× eyepieces also influence the magnification (see table, section 23).

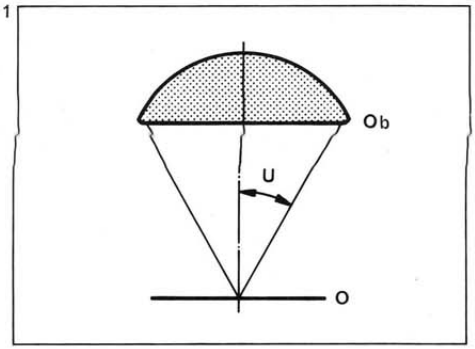
20.3 Field diameter

The field of view is the circular area of the specimen which can be seen down the microscope (fig. 1) and decreases with increasing magnification, e. g. 53.3 mm at 3.9× and 1.6 mm at 160× (see table in section 23).
Thus, low magnifications are used to obtain an overall view, and high magnifications for a detailed examination.
The field diameter is calculated as follows:

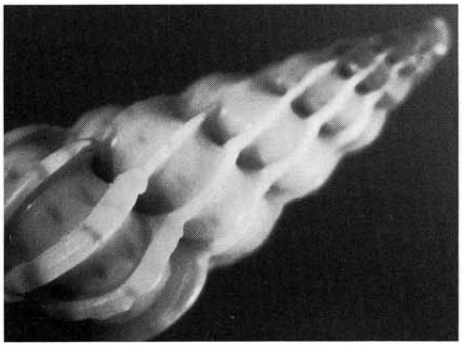
$$\varnothing = \frac{\text{field number} \times 10}{\text{Zoom position} \times 1.25 \times \text{addl. objective}}$$

The field numbers are inscribed on the eyepieces (e. g. 10×/21; field number: 21).

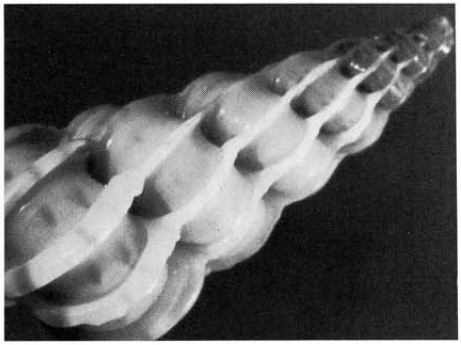
1



2



3



20.4 Resolution

The resolving power of a macroscope is a measure of its **ability to distinguish fine detail,** i. e. to separate two closely-spaced points.

Resolution and contrast depend **on the objective and on the magnification changer position.** Resolution is proportional to the angle of aperture (fig. 1). Powerful objectives of short working distance thus give high resolution, and this increases with the zoom position.

Details not resolved by the objective cannot subsequently be rendered visible by using strong eyepieces.

A given **total magnification** is attainable either by using a weak objective coupled to a strong eyepiece, or vice versa:
e. g. 80× with a 1.0× objective, 20× eyepieces and zoom position 32, or with a 2.0× objective, 10× eyepieces and zoom position 32.
The second combination is preferable if the working distance is unimportant.

An additional eyepiece magnification should be so chosen that all details resolved by the objective are recognisable. No advantage is gained by an excessive secondary magnification, but an inadequate secondary magnification means that the potential of the objective is not being fully exploited.

20.5 Depth of field

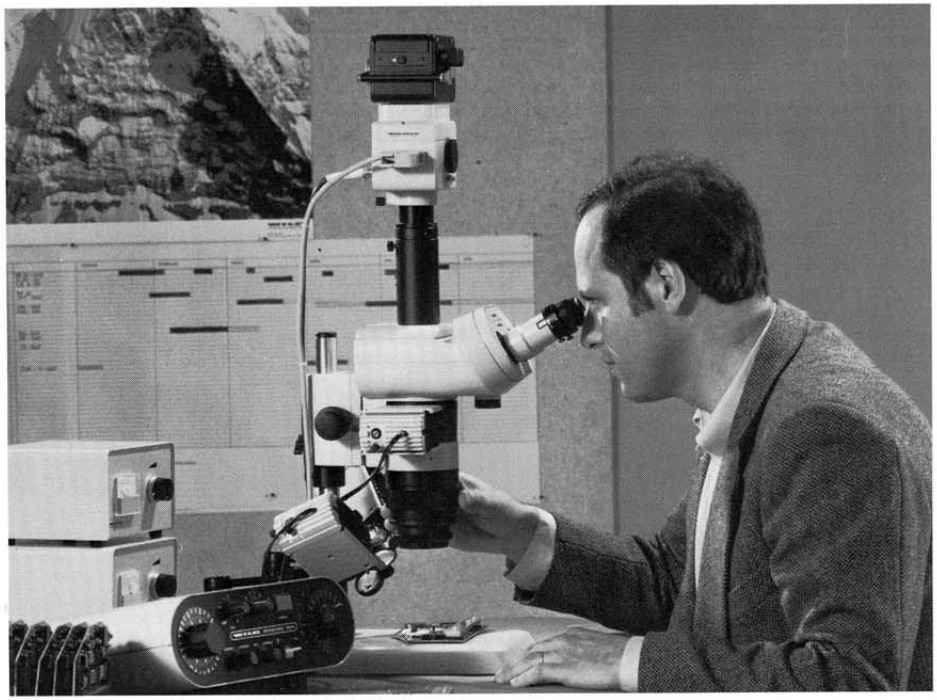
Depth of field depends on the objectives, the eyepieces and the tube factor.

Depth of field decreases with increasing magnification.

These laws are exploited in the Wild macroscopes, which have a built-in aperture diaphragm so that the depth of field may be matched to the topography of the object (see section 5).

For larger objects with coarse structures, the double-iris diaphragm can often be used to improve depth of field at the expense of resolution.

Fig. 2: Double-iris diaphragm open
Fig. 3: Double-iris diaphragm partially closed.



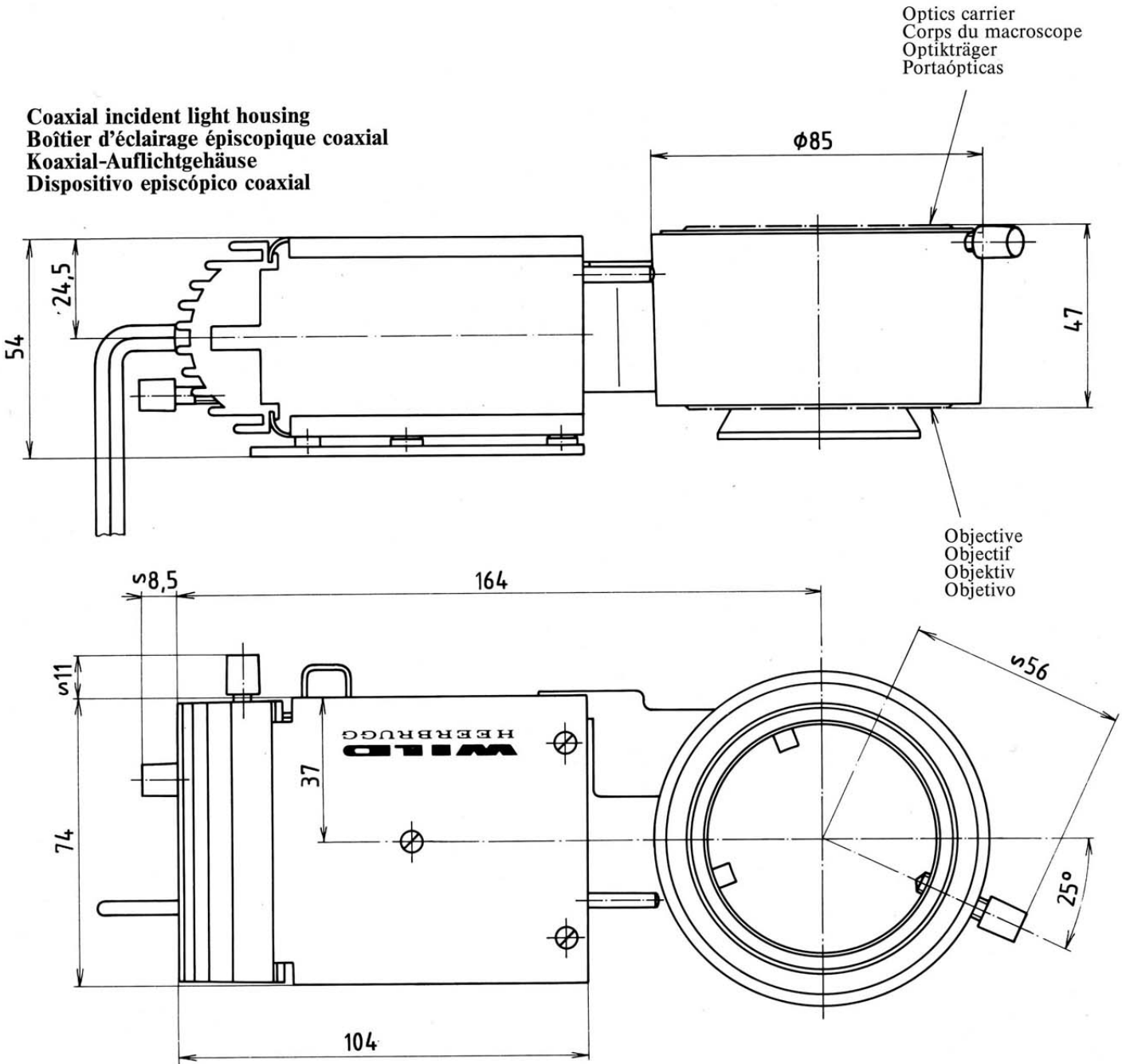
21. Care of the instrument

1. Very high atmospheric humidity must be avoided by working in an air-conditioned room.
2. Do not use substitute plugs.
3. Do not grease or oil any parts.
4. Protect the instrument from dust, damp, fumes, and corrosive substances.
5. Do not store any chemicals in the neighbourhood of the instrument.
6. Use the dust cover during pauses in work.
7. Eyepieces, tubes without eyepieces, and phototubes without camera should always be protected against dust by means of the covers provided.
8. Clean the housing with a soft brush.
9. Optics:
   Dirty eyepieces and objectives have a very bad influence on the image quality. Clean them with a clean soft cloth. Fingerprints and tenacious marks can be removed with a cloth dipped in xylol or ether, but first remove eyecups. Dust is best removed with a pneumatic rubber bulb.
10. If the instrument no longer functions satisfactorily, call in a specialist or your local Wild agent, or contact the factory.

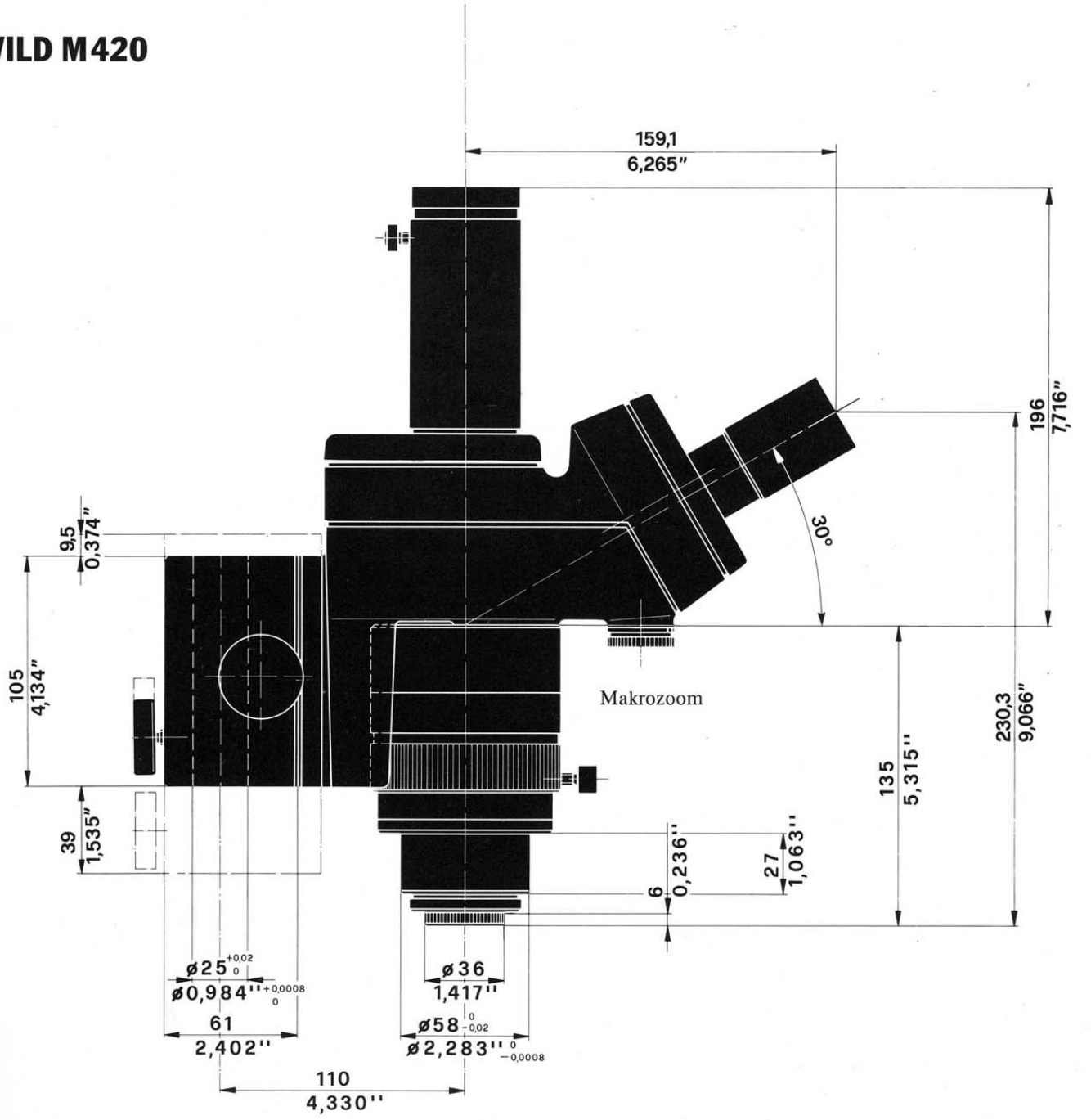
Guarantee

We guarantee the quality of each of our instruments. Our guarantee covers all faults in materials and manufacture. It does not, however, cover damage resulting from careless or improper handling.

Coaxial incident light housing
Boîtier d'éclairage épiscopique coaxial
Koaxial-Auflichtgehäuse
Dispositivo episcópico coaxial



WILD M420



Overall width / Largeur hors tout / Breite über alles / Ancho total 160 mm / 6,229"

23. Optical Data / Données optiques / Optische Daten / Datos ópticos

Eyepiece Oculaire Okular Ocular	Zoom position Position du zoom Zoomstellung Posición del zoom	Makrozoom Apozoom 1.0×		Additional objective / Objectif additionnel / Vorsatzobjektiv / Objetivo adicional					
				0.5×		1.5×		2.0×	
		Working distance Distance de travail Arbeitsabstand Distancia de trabajo 100 mm Makrozoom 102 mm Apozoom		Working distance Distance de travail Arbeitsabstand Distancia de trabajo 192 mm Makrozoom 190 mm Apozoom		Working distance Distance de travail Arbeitsabstand Distancia de trabajo 57 mm Makrozoom		Working distance Distance de travail Arbeitsabstand Distancia de trabajo 39 mm Makrozoom 45 mm Apozoom	
	Makrozoom 6.3×–32× Apozoom 5.8×–35×	Total magnification Grossissement total Total-vergrösserung Aumento total	Field diameter Diamètre du champ visuel Gesichtsfeld-durchmesser Diámetro Campo visual	Total magnification Grossissement total Total-vergrösserung Aumento total	Field diameter Diamètre du champ visuel Gesichtsfeld-durchmesser Diámetro Campo visual	Total magnification Grossissement total Total-vergrösserung Aumento total	Field diameter Diamètre du champ visuel Gesichtsfeld-durchmesser Diámetro Campo visual	Total magnification Grossissement total Total-vergrösserung Aumento total	Field diameter Diamètre du champ visuel Gesichtsfeld-durchmesser Diámetro Campo visual
10×/21 10×/21B	5.8×	7.3×	30 mm	3.6×	58 mm	–	–	14.5×	14.5 mm
	6.3×	7.9×	26.7 mm	3.9×	53.3 mm	11.8×	17.8 mm	15.8×	13.3 mm
	10 ×	12.5×	16.8 mm	6.3×	33.6 mm	18.8×	11.2 mm	25 ×	8.4 mm
	20 ×	25 ×	8.4 mm	12.5×	16.8 mm	37.5×	5.6 mm	50 ×	4.2 mm
	32 ×	40 ×	5.3 mm	20 ×	10.5 mm	60 ×	3.5 mm	80 ×	2.6 mm
	35 ×	43.8×	4.8 mm	22 ×	9.6 mm	–	–	87.5×	2.4 mm
15×/17	5.8×	10.9×	23.4 mm	5.4×	46.8 mm	–	–	21.8×	11.7 mm
	6.3×	11.8×	21.6 mm	5.9×	43.1 mm	17.7×	14.4 mm	23.6×	10.7 mm
	10 ×	18.8×	13.6 mm	9.4×	27.2 mm	28.1×	9.1 mm	37.5×	6.8 mm
	20 ×	37.5×	6.8 mm	18.8×	13.6 mm	56.3×	4.5 mm	75 ×	3.4 mm
	32 ×	60 ×	4.3 mm	30 ×	8.5 mm	90 ×	2.8 mm	120 ×	2.1 mm
	35 ×	65.6×	3.9 mm	32.8×	7.8 mm	–	–	131 ×	1.9 mm
15×/14B	5.8×	10.9×	19.3 mm	5.4×	38.6 mm	–	–	21.8×	9.7 mm
	6.3×	11.8×	17.8 mm	5.9×	35.5 mm	17.7×	11.9 mm	23.6×	8.9 mm
	10 ×	18.8×	11.2 mm	9.4×	22.4 mm	28.1×	7.5 mm	37.5×	5.6 mm
	20 ×	37.5×	5.6 mm	18.8×	11.2 mm	56.3×	3.7 mm	75 ×	2.8 mm
	32 ×	60 ×	3.5 mm	30 ×	6.6 mm	90 ×	2.3 mm	120 ×	1.7 mm
	35 ×	65.6×	3.2 mm	32.8×	6.4 mm	–	–	131 ×	1.6 mm

Eyepiece Oculaire Okular Ocular	Zoom position Position du zoom Zoomstellung Posición del zoom	Makrozoom Apozoom 1.0×		Additional objective / Objectif additionnel / Vorsatzobjektiv / Objetivo adicional					
				0.5×		1.5×		2.0×	
		Working distance Distance de travail Arbeitsabstand Distancia de trabajo 100 mm Makrozoom 102 mm Apozoom		Working distance Distance de travail Arbeitsabstand Distancia de trabajo 192 mm Makrozoom 190 mm Apozoom		Working distance Distance de travail Arbeitsabstand Distancia de trabajo 57 mm Makrozoom		Working distance Distance de travail Arbeitsabstand Distancia de trabajo 39 mm Makrozoom 45 mm Apozoom	
	Makrozoom 6.3×–32× Apozoom 5.8×–35×	Total magnification Grossissement total Total-vergrösserung Aumento total	Field diameter Diamètre du champ visuel Gesichtsfeld-durchmesser Diámetro Campo visual	Total magnification Grossissement total Total-vergrösserung Aumento total	Field diameter Diamètre du champ visuel Gesichtsfeld-durchmesser Diámetro Campo visual	Total magnification Grossissement total Total-vergrösserung Aumento total	Field diameter Diamètre du champ visuel Gesichtsfeld-durchmesser Diámetro Campo visual	Total magnification Grossissement total Total-vergrösserung Aumento total	Field diameter Diamètre du champ visuel Gesichtsfeld-durchmesser Diámetro Campo visual
20×/13	5.8×	14.5×	17.9 mm	7.3×	36 mm	–	–	29 ×	9 mm
	6.3×	15.8×	16.5 mm	7.9×	33 mm	23.6×	11 mm	31.5×	8.2 mm
	10 ×	25 ×	10.4 mm	12.5×	20.8 mm	37.5×	6.9 mm	50 ×	5.2 mm
	20 ×	50 ×	5.2 mm	25 ×	10.4 mm	75 ×	3.5 mm	100 ×	2.6 mm
	32 ×	80 ×	3.3 mm	40 ×	6.5 mm	120 ×	2.2 mm	160 ×	1.6 mm
	35 ×	87.5×	3 mm	43.8×	6 mm	–	–	175 ×	1.5 mm
20×/11B	5.8×	14.5×	15.2 mm	7.25×	30.3 mm	–	–	29 ×	7.6 mm
	6.3×	15.8×	14 mm	7.9×	27.9 mm	23.6×	9.3 mm	31.5×	6.9 mm
	10 ×	25 ×	8.8 mm	12.5×	17.6 mm	37.5×	5.9 mm	50 ×	4.4 mm
	20 ×	50 ×	4.4 mm	25 ×	8.8 mm	75 ×	2.9 mm	100 ×	2.2 mm
	32 ×	80 ×	2.8 mm	40 ×	5.5 mm	120 ×	1.8 mm	160 ×	1.4 mm
	35 ×	87.5×	2.5 mm	43.8×	5 mm	–	–	175 ×	1.3 mm
32×/8	5.8×	23.2×	11 mm	11.6×	22 mm	–	–	46.5×	5.5 mm
	6.3×	25.2×	10.2 mm	12.6×	20.3 mm	37.8×	6.8 mm	50.4×	5.1 mm
	10 ×	40 ×	6.4 mm	20 ×	12.8 mm	60 ×	4.2 mm	80 ×	3.2 mm
	20 ×	80 ×	3.2 mm	40 ×	6.4 mm	120 ×	2.1 mm	160 ×	1.6 mm
	32 ×	128 ×	2 mm	64 ×	4 mm	192 ×	1.3 mm	256 ×	1 mm
	35 ×	140 ×	1.8 mm	70 ×	3.7 mm	–	–	280 ×	0.9 mm

24. Image scales / Echelles de reproduction / Abbildungsmassstäbe / Escalas de reproducción

with 10× eyepiece / avec oculaire photographique 10× / mit Photookular 10× / con ocular fotográfico 10×					
Objective Objectif Objektiv Objetivo	Zoom position Position du zoom Zoom-Stellung Posición del zoom Makrozoom 6.3×–32× Apozoom 5.8×–35×	Image scale 35 mm format (camera factor 0.32×) Châssis petit format 24×36 mm (facteur de chambre 0.32×) Kleinbildkassette 24×36 mm (Kamerafaktor 0.32×) Chasis pequeño formato 24×36 mm (factor de cámara 0.32×)	Field area represented by format limits Champ obtenu avec réticule Mit Strichplatte erfasstes Feld Campo abarcado con retículo mm	0.8× camera back with magazine for 3¼ in×4¼ in Polaroid packfilm Rallonge photographique 0.8× avec châssis Polaroïd 3¼×4¼ in Kameraaufsatz 0.8× mit Polaroidkassette 3¼×4¼ in Suplemento de cámara 0.8× con chasis Polaroid 3¼×4¼ in	1.0× camera back for 3¼ in×4¼ in 9 cm×12 cm, 4 in×5 in magazines Rallonge photographique 1.0× pour châssis 3¼×4¼ in 9×12 cm, 4×5 in Kameraaufsatz 1.0× für Kassetten 3¼×4¼ in 9×12 cm, 4×5 in Suplemento de cámara 1.0× para chasis 3¼×4¼ in 9×12 cm, 4×5 in
Makrozoom 1:5 Apozoom 1:6 1.0×	5.8×	2.3:1	9.7×14.6	5.8:1	7.3:1
	6.3×	2.5:1	9.0×13.8	6.3:1	7.9:1
	10 ×	4.0:1	5.7× 8.7	10.0:1	12.5:1
	20 ×	8.0:1	2.8× 4.3	20.0:1	25.0:1
	32 ×	12.8:1	1.8× 2.7	32.0:1	40.0:1
	35 ×	14.0:1	1.6× 2.4	35.0:1	44.0:1
Additional objective Objectif additionnel Vorsatz-Objektiv Objetivo adicional 0.5×	5.8×	1.2:1	19.7×28	2.9:1	3.6:1
	6.3×	1.3:1	18.0×27.5	3.1:1	4.0:1
	10 ×	2.0:1	11.4×17.4	5.0:1	6.3:1
	20 ×	4.0:1	5.7× 8.7	10.0:1	12.5:1
	32 ×	6.4:1	3.5× 5.4	16.0:1	20.0:1
	35 ×	7.0:1	3.2× 4.8	17.5:1	22.1:1
Additional objective Objectif additionnel Vorsatz-Objektiv Objetivo adicional 1.5×	6.3×	3.8:1	6.0× 9.2	9.4:1	11.9:1
	10 ×	6.0:1	3.8× 5.8	15.0:1	18.8:1
	20 ×	12.0:1	1.9× 2.9	30.0:1	37.5:1
	32 ×	19.2:1	1.2× 1.8	48.0:1	60.0:1
Additional objective Objectif additionnel Vorsatz-Objektiv Objetivo adicional 2.0×	5.8×	4.6:1	4.9× 7.3	11.6:1	14.5:1
	6.3×	5.0:1	4.5× 6.9	12.6:1	15.8:1
	10 ×	8.0:1	2.8× 4.3	20.0:1	25.0:1
	20 ×	16.0:1	1.4× 2.2	40.0:1	50.0:1
	32 ×	25.6:1	0.9× 1.4	64.0:1	80.0:1
	35 ×	28.0:1	0.8× 1.2	70.0:1	87.5:1