# User Manual

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nabla III

## *Omegon® ∇-III Nabla III Microscopes*

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# *Omegon® ∇-III Nabla III Microscope*

*Congratulations on purchasing your Omegon ∇-III Nabla III microscope. This device offers you a number of advantages that are not usually common in this price range. Excellent DIN optics, adjustable Köhler LED illumination and high precision mechanics produce outstanding performance. The coaxial adjustment drive of the cross table, together with the focus fine drive that can also be operated with one hand, enables relaxed positioning and focusing of the object. This means you can fully concentrate on observation without taking your hands off the controls.*

## Setup

Place the box with the microscope on a stable surface where it cannot fall down and where you have enough space to set it up. You will need a formula to work with the microscope: total magnification = objective magnification * eyepiece magnification. For example, the combination of the 10x eyepiece with the 4x objective results in a total magnification of 40x.

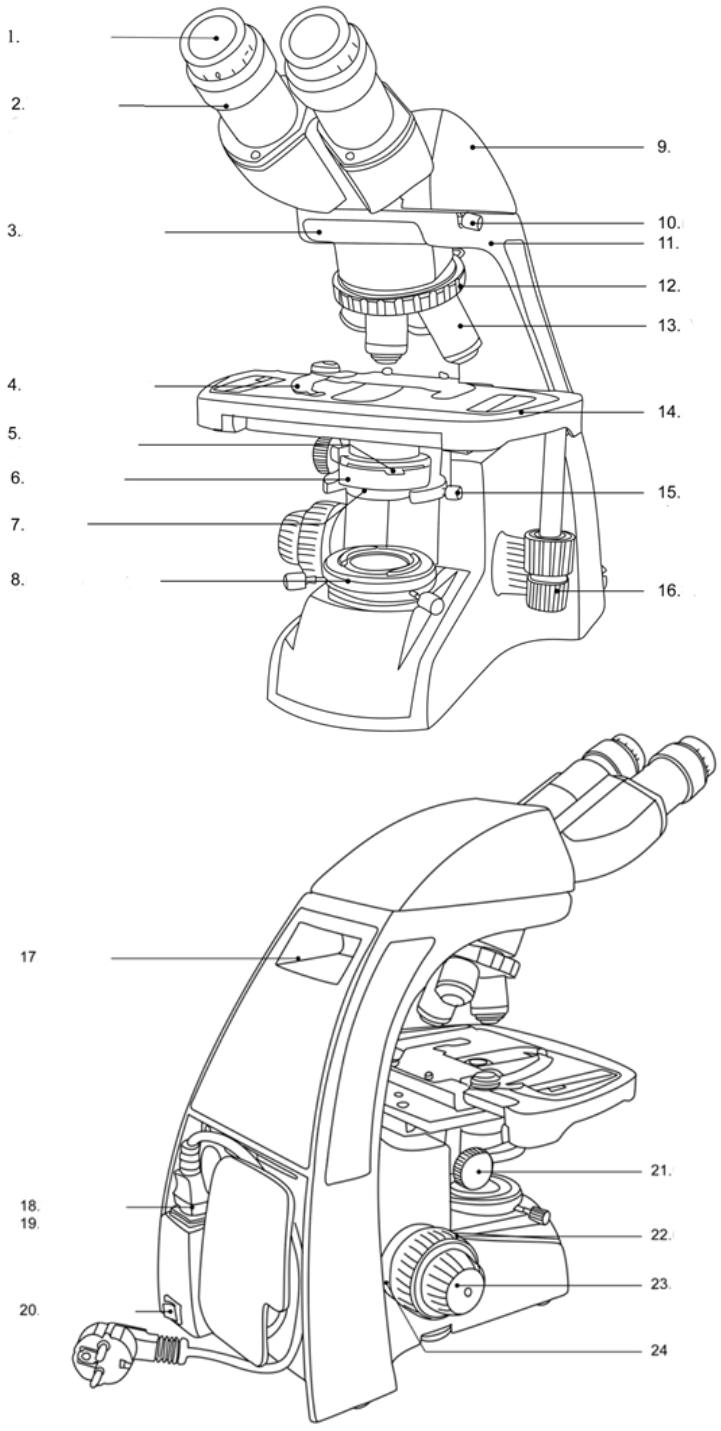
### Attention: Remove shipping locks before use!

To protect the high-precision mechanics during transport, the stage adjustment is blocked by 2-3 locking screws.

To do this, use the Allen key provided.

# Overview

*Omegon ∇-III Nabla III B – Binocular Version*




1. Eyepiece
2. Diopter adjustment
3. Insert bracket
4. Specimen holder
5. Aperture diaphragm lever
6. Condenser
7. Filter
8. Field diaphragm ring
9. Binocular head
10. Binocular head locking screw
11. Body
12. Nosepiece
13. Objective
14. XY Stage
15. Condenser locking screw
16. Coaxial stage controls
17. Handle
18. Power inlet
19. Fuse
20. On/Off Switch
21. Focus adjustment for condensor
22. Coarse focus control
23. Fine focus control
24. Tension adjustment ring

# Features

The Omegon ∇-III Nabla III series biological microscopes are specially designed for teaching in universities and colleges, as well as primary and secondary schools. The ergonomic design makes the operation and use of the instrument more comfortable, and the user does not feel fatigue after long-term use. This product is suitable for teaching in universities and colleges, as well as clinical laboratory tests in hospitals. The microscope is a transmitted light microscope with a compact design and flexibility. Equipped with a 3W LED lamp, field stop, Abbe condensers and other optical components, the standard Köhler illumination system provides uniformly bright and glare-free sample illumination, providing high image quality with brighter and sharper resolutions for photomicrography. The compact body is designed for flexibility and enables various applications such as bright field, dark field and polarization. The trinocular microscope can be equipped with a digital camera and an LCD screen for photo and video documentation and image analysis. The main features of the microscope include:

- Ergonomically designed metal frame for stability and durability
- Carrying handle integrated into the back of the tripod for easy carrying
- Tripod and base made from one piece
- Antifungal treatment that prevents fungal growth
- Cable holder for convenient storage
- Siedentopf eyepiece tubes that do not change length in the tube when the eye relief is adjusted; adjustable eye relief range 48mm – 75mm
- 360° head rotation
- 10x widefield focus eyepieces with high eye relief and 22mm eyepiece field of view, suitable for eyeglass wearers and easy to observe.
- Diopter adjustment on both eyepieces to compensate for ametropia, with diopter scales to make it easier to find the correct setting. Parfocality of focus is ensured by independent diopter adjustment on each eyepiece.
- Optional crosshair eyepiece for measuring purposes; Choice of 0.1 mm/1 cm grid, 0.1 mm/1 cm crosshair or simple crosshair (not included)
- Rotating inverted quadruple objective turret with color-coded, parcentric and parfocal DIN objectives. The turret runs on ball bearings and has internal detent stops so the image remains centered after each magnification change.
- Finite “Plan-ACHROMAT” DIN objectives with magnifications of 4x, 10x, 40x and 100x / oil. Retractable 40XR and 100XR objectives with durable mounts to protect the specimen.
- Convenient low position coaxial coarse and fine adjustment (coarse adjustment on the left side, fine adjustment on both sides) with coarse stroke per rotation of 37.7 mm and fine adjustment 0.1 mm/circle, fine adjustment increments of 1 µm; Focusing range 16 mm; smoothness of coarse focus adjustable
- 21.6 cm x 15 cm built-in double-layer mechanical stage with graphite surface, rounded edges and non-extendable stage and specimen holder; smooth calibrated X/Y movement with 7.5 cm x 5.5 cm transverse movement range

- Built-in Köhler illumination with continuously adjustable LED source with light intensity control. The light path can be further adjusted using the field diaphragm.
- Full Köhler N.A. 1.25 Abbe condensers, the height of which is controlled by a rack and pinion gear that allows focus adjustment of the condenser for correct illumination of the specimen; adjustable diaphragm stop built into the condenser, important for ensuring correct illumination, contrast and depth of field; a graduated scale indicates the approximate setting (size) of the diaphragm stop.
- Trinocular phototube (50% visible, 50% open) on 82929 ∇-III Nabla-III Trino with optional 10 MP digital eyepiece camera and 8-inch LCD camera for capturing images and viewing live video of the sample on a computer or monitor.

# Assembly

Unpack the instrument's outer packing box and take out the inner box. Unpack the inner box to see the instrument and accessories inside. Retain the original packaging for storage of the microscope in longer periods of non-use or for return to the manufacturer. Always keep the microscope in a clean, dry, and dust free environment.

Always use two hands to carry your microscope. Always ensure that all microscope components (eyepieces, cameras, adaptors, stage plates etc.) are secured tightly or otherwise removed before transportation. Never carry the microscope upside down in order to prevent the unit from dropping or the eyepiece components from loosing alignment. Set up the microscope on a stable worktable with solid and smooth tabletop. Do not touch optical surfaces – this will affect image quality.

Remove the microscope base from the shipping box and place it on a firm and stable surface.

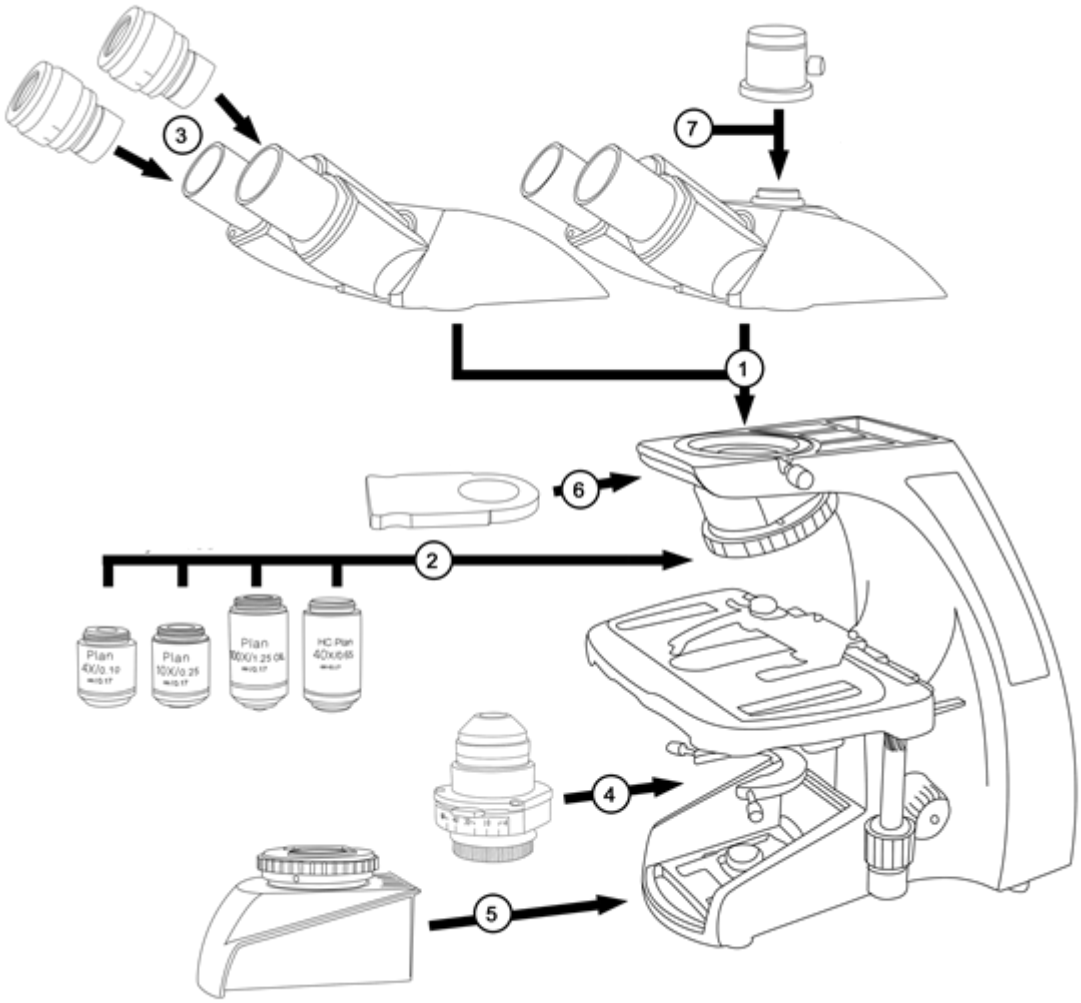
1. Mount the binocular or trinocular head on the stand
2. Remove the supplied objective lenses from the box and screw them one by one into the objective mounts on the nosepiece in the order of increasing power.
3. Then remove the supplied eyepieces from the box and insert them into the eyepiece mounts on the microscope head
4. Mount the condenser / Köhler unit into the holder:

    a. Turn the coarse focus knobs to raise the specimen stage to the top of its range

    b. Turn the condenser focus knob to bring the condenser down to its lowest position

    c. Loosen the condenser clamping screw, put the condenser to the holder, and tighten the condenser clamping screw

    d. Turn the condenser focus screw to raise the condenser to a working position
5. Slide the illumination unit into the microscope base
6. Slide the filter holder into the microscope stand
7. If you are using the trinocular version, screw the CCD adapter onto the photo output of the head



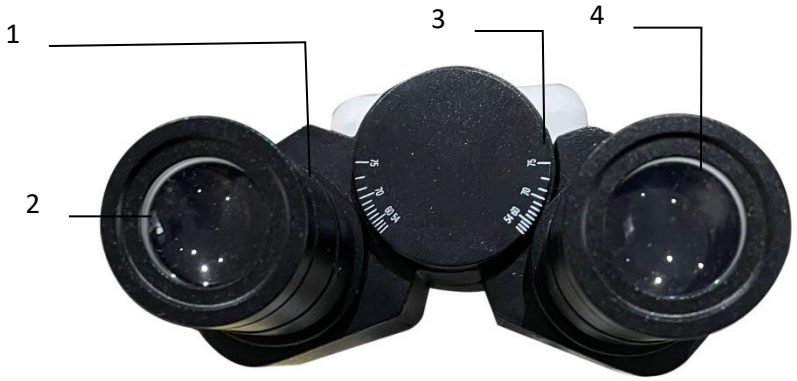
# Calibration

Open the slide holder on the mechanical stage and place a slide with a specimen on the stage. When you release the lever, the slide is clamped onto the stage. Then position the part of the specimen you want to examine more closely under the objective. Turn the nosepiece until the 4x objective is in the microscope's light path and use the coarse focus to move the microscope stage to the highest position under the objective. Turn the Abbe condenser so that the condenser moves to the highest position. Turn the on/off switch on and turn the brightness control to adjust the light intensity for observation through the eyepiece. Turn the coarse focus knob back and forth until an image of the microscopic sample can be observed through the eyepiece. Turn the fine focus knob until the microscopic image observed in the eyepiece is in focus. The microscope is now ready for use.

# Quick start

*1. Using the binocular microscope:*

Rotate the nosepiece to select the objective lens for the desired magnification. Focus your specimen using the coarse and fine focus knobs until the specimen appears sharp in the right eyepiece. After focusing is complete, insert an eyepiece with the same magnification into the left eyepiece tube and then perform the binocular head adjustment (see the structure of a binocular head in the picture below): Hold the left or right part of the binocular head firmly. With both hands, rotate the eyepiece until the interpupillary distance between the two eyepieces matches the interpupillary distance of your eyes (your eyes should be able to observe the image of the microscope at the same time).




(Fig. 2) Binocular head

1. Diopter adjustment for the left eyepiece
2. Left eyepiece
3. Scale for the eye distance
4. Right eyepiece

Rotate the diopter adjustment ring on the left eyepiece tube until the microscopic image observed in the left eyepiece is as sharp as that observed in the right eyepiece. At this point, the binocular adjustment is complete; scales on the dial between the two eyepiece tubes on the binocular head mark the pupil distance. If you already know your own pupil distance, you can set it to a known position and eliminate the step of pupil distance adjustment; the microscope's binocular heads can be rotated 360° to adapt to the operator's operating habits.

Using the coaxial stage adjustment, you can center the desired part of your specimen in the eyepiece.

Rotate the condenser so that it is in the highest position. Operate the condenser aperture diaphragm handle so that both the resolution and contrast of the observed image in the eyepiece meet the requirements. It is recommended to adjust the condenser aperture diaphragm so that the diameter of the image on the rear focal plane of the objective lens is 70–85% of the diameter of the pupil behind the objective lens. You can remove an eyepiece from the microscope and look directly into the eyepiece tube to observe the rear focal plane of the objective and adjust the aperture stop.

Before observing with the 100x oil immersion objective, drop a drop of immersion oil onto the specimen, then move the 100x oil immersion objective into the drop. To remove bubbles in the immersion oil, you can swing the oil immersion objective away and back again with the nosepiece. Then re-center the specimen.

### *2. Using the trinocular microscope:*

Unpacking, installation and calibration of a trinocular microscope are the same as for a binocular microscope. In addition to the binocular attachment, the trinocular variant also has a camera port that allows a camera to be connected at the same time.

# Full Operating Procedure for Brightfield Observations

1) Turn the nosepiece until the 4x objective clicks into place.
2) Use the coarse focus adjustment to move the cross table all the way down.
3) With one hand, swing the slide lock lever to the side and with the other hand place a slide with an object on the cross table. Clamp the slide with the lock - the lock is spring-loaded and clamps automatically when you release it - please release slowly so that the lever does not bang on the glass of the slide.

**Note:**

- Cover Glass: Use cover glasses of 0.17mm thickness in order to allow the objectives exhibit their full performances.

- Specimen Slide: Use specimen slides of 0.9 to 1.4mm thickness. Using thicker specimen slides may result in inaccurate imaging of the field iris diaphragm image on the specimen.

4) Use the coaxial adjustment to move the object into the field of view
5) Switch on the light source and adjust the light intensity control until the proper brightness of the light source is obtained.

**Note:** The coarse adjustment knob tension is preadjusted for easy use. However, if desired, one can change the tension using the tension adjustment ring. Turning the ring clockwise decreases the tension, and vice versa.

6) Adjusting the interpupillary distance, and viewing height

- Swing the eyepiece tubes symmetrically slightly toward or away from one another to adjust the distance between the tubes to your individual interpupillary distance. The adjustment of the interpupillary distance is correct when you see only one round image while looking down the two eyepieces.
- Turn the diopter rings on both eyepieces to set them at the 0 position (match the 0 line with the index line). (This is to prepare for the following procedure.)

**Note:** Interpupillary and diopter adjustment should be done each time the observer is changed since individual eyesight vary. Afterwards, you should focus on the specimen only by adjusting the focusing knobs.

7) Turn the coarse and fine adjustment knobs to bring the specimen into focus.

- Before looking down the eyepieces, turn the coarse adjustment knob and

move the specimen stage up to its highest point. Make sure the slide does not touch the objective.

- Look down the eyepieces, slowly turn the coarse adjustment knob clockwise until the image of the specimen is bright and clear, always moving the slide away from the objective.
- If necessary, use the fine focus knobs to make minor adjustments to bring the specimen into sharp focus.

8) Compensating for ametropia

- Both eyepieces are suitable for spectacle wearers. They also contain focusing rings on both eyepieces for the compensation of defective vision. The provided diopter scale serves to facilitate finding the correct setting.
- Do not look into the eyepiece, and turn the diopter ring counterclockwise until it stops. (in the maximum '+ ' direction).
- Looking through the left eyepiece with your left eye, turn the diopter ring slowly clockwise (in the' -' direction), until the object can be seen clearly by this eye, i.e., bring the specimen into focus.
- Set the diopter for the other eye in the same way.
- Look into both eyepieces. Gently refocus if necessary by turning the focus knobs.

The procedure of adjusting the diopter on reticule eyepiece is slightly different:

- Insert one reticule eyepiece into one of the eyepiece tubes. Only one reticule eyepiece is needed. Make sure the magnification power of both eyepieces and the field of view number are the same. Adjust the interpupillary distance if necessary.
- Use one eye and look through the reticule eyepiece and close the other eye. Stare at the reticule and bring the reticule into sharp focus by turning the diopter ring on the eyepiece. (Place the reticule in the position that's convenient for your observation). When the reticule is in focus, do not move the diopter ring afterwards to keep the reticule in focus.
- Use the same eye to stare at the specimen, turn the focus knob to bring the specimen into sharp focus. Now both reticule and specimen is in focus through that eyepiece.
- Continue looking through the reticule eyepiece, adjust the focus knob and

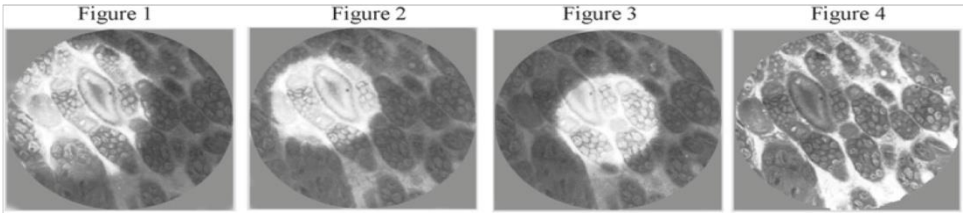
bring the specimen into sharp focus.

- Open your eyes, without looking through the eyepieces, turn the diopter ring of the other non-reticule eyepiece counter clockwise to the end.
- Close the eye on the reticule eyepiece side. Open another eye and look through the non-reticule eyepiece. Turn the diopter ring to bring the specimen into sharp focus.
- Look into both eyepieces. Gently refocus if necessary by turning the focus knobs.

**Note:** The whole point to adjust diopter for reticule eyepiece is to put both reticule and the specimen into focus. To achieve this, you should first adjust the diopter ring to focus reticule, and then adjust the focus knob to focus the specimen through reticule eyepiece. After the reticule side eyepiece is ready, adjust the other side by only turning the diopter ring. Pay attention to which part should be adjusted in each step. This procedure is suitable for both eyepieces are diopter adjustable.

So far, the diopter has been adjusted and should be fixed. Parfocality should have been achieved. No diopter adjustment is needed for later observation when changing to higher power objectives, unless different people use it.

9) Obtaining proper Köhler illumination

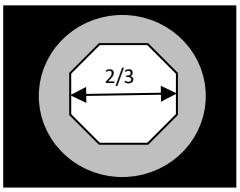



- With the 4X objective engaged and the specimen brought into focus, turn the field iris diaphragm ring clockwise to close the field diaphragm to near its minimum size. The field diaphragm is then visible (even if not in focus) (See Fig. 1 in the picture above).
- Turn the sub-stage condenser focusing knob to adjust the height of the condenser to bring the field iris diaphragm image into focus, i.e., the EDGE of the polygon (i.e. field diaphragm image) should be as clearly in focus as possible. (See Fig. 2 in the picture above)
- Using the sub-stage condenser centering screws to centre the octagon of light, i.e., the field iris diaphragm image is centered in the eyepiece field of view. (See Fig. 3 in the picture above)
- To check centration, open the field iris diaphragm until its image touches the perimeter of the field of view. If the image is not precisely inscribed in the field of view, center again.
- For actual observation, open the field diaphragm until its image is slightly larger than the field of view (i.e., the dark area is just out of view) (See Fig. 4 in the picture above)
- Carefully adjust the sub-stage condenser iris diaphragm, learn to adjust the contrast to optimize your image without introducing artifacts and without losing detail. To adjust the aperture diaphragm, remove one eyepiece from the tube and look through the tube with your naked eye.

**Note:** The aperture iris diaphragm determines the numerical aperture of the illumination system. Appropriate use of the adjustable aperture iris diaphragm (incorporated into the condenser) is most important in securing correct illumination, contrast, and depth of field. Care must be taken to guarantee that the condenser aperture is opened to the correct position with respect to objective numerical aperture. Matching the numerical aperture of the illumination system with that of the objective provides better image resolution and contrast, and also increases the depth of focus.

- Swing lever to adjust the aperture diaphragm to approximately 2/3~4/5 of

the diameter of the exit pupil of the objective.




- Insert the eyepiece back in the tube.

**Note**: Aperture adjustment and proper focusing of the condenser are of critical importance in realizing the full potential of the objective. Condenser height is controlled by a rack and pinion gear system (i.e., the condenser focusing knob) that allows the condenser focus to be adjusted for proper illumination of the specimen. Correct positioning of the condenser with relation to the cone of illumination and focus on the specimen is critical to quantitative microscopy and optimum photomicrography.

**Note:** Since the contrast of microscope specimens is ordinarily low, setting the condenser aperture iris diaphragm to between 70% and 80% of the N.A. of the objective in use is usually recommended. In most applications, this aperture diaphragm setting provides optimum contrast at almost ideal resolution, and is therefore the best compromise for the human eye.

## 10) Engage the objective to be used for observation in the light path, then readjust the focus.

**Note:** Nabla-III series microscopes are parfocaled, so only minor adjustments using FINE FOCUS knobs are needed after engaging higher power objectives.

Because of our built-in stop the 4X and 10X can never come into contact with your microscope slides. The 40XR and 100XR may occasionally touch the micro-slide but because these objectives have retractable resilient mounts your slides will not be damaged

## 11) Re-adjust the field iris diaphragm, the aperture iris diaphragm and the brightness and start observation.

**Note:** Specimen field size and objective aperture change after every objective change. Therefore, the complete procedure of focusing, adjustment of field diaphragm, and adjustment of condenser iris diaphragm, at the same time centering the illumination has to be repeated each time an objective is changed to obtain optimum results.

**Use of the 100XR, Oil Immersion Objective**

- Focus on the specimen by switching the objectives from the lowest power to highest power.
- Before engaging the immersion objective in the light path, place a drop of immersion oil onto the specimen at the area to be observed.
- Turn the revolving nosejpiece to engage the immersion objective, then focus using the fine adjustment knob.
- Make sure the oil is free of bubbles. To remove bubbles, turn the revolving nosepiece to move the oil immersion objective back and forth a few times.
- Immersion oil is used in the contact beneath the underside of the slide and the condenser top lens, and also between the objective and cover slip
- After use, remove oil from the objective front lens by wiping with gauze slightly moistened with an ether (70%)/alcohol (30%) mixture.

# Optional Accessories

*Dark field observation*

Two types of dark field condensors are available, a dry dark field condensor (NA 1.25) and an oil condensor (NA 1.25–1.36).

• Replace the condensor by the dark field condensor if necessary.

• If dark field observation with oil is required, make sure to use the oil between the condensor and the rear part of the object carrier as well as between the front part of the object carrier and the lens (oil). This is the only way we can reach the desired numerical aperture.

- Open the field diaphragm.
- Watch the sample for dark field observation.

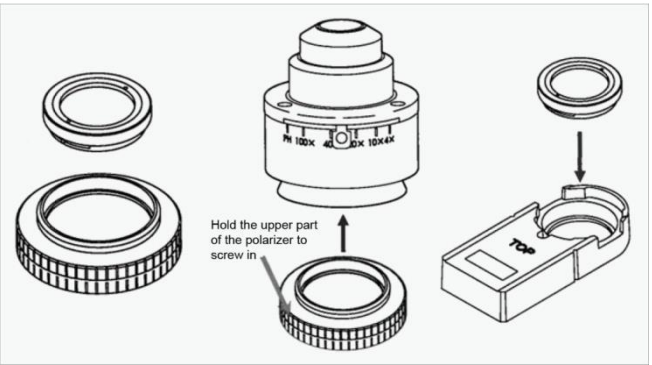
*Observations in polarized light*

A polarization set contains a polarizer and an analyzer.

• Hold down the upper part of the polarizer and screw it into the condensor.

• Pull out the fastening notch, insert the analyzer and insert the notch again.

• Ready to use




**Note**: If the condenser engraving shows a numerical aperture (NA) of 1.0 or higher, the number applies only when oil is applied between the slide glass and the top surface of the condenser. When oil is not present, the NA is about 0.9.

# Storage

- Ensure light intensity switch is turned down to the lowest setting and the switch on the base is turned off.
- Store your microscope with a protective dust cover in a low humidity environment.
- Keep all of your eyepieces, objectives and other accessories in place during storage.

# Maintenance and troubleshooting

Before delivery, the microscope was subjected to testing and inspection. In order to ensure an optimal function and a longer lifespan, disassembly is not permitted under any circumstances. The instrument must be set up in a shady, cool and dry environment without corrosive influences. All lenses must be treated carefully and must not be disassembled or arbitrarily removed. If not used for longer, lens lens, eyepiece and other optical components must be kept in a moisture -tight box; Switch off the on/off switch, pull the mains plug and cover the instrument with a dust protection cover after use. In order to ensure security, the ground connection of the power supply must be in good condition.

In Appendix 1 you will find information about the most common mistakes during use, the causes of errors and the methods for troubleshooting. If the disorders cannot be remedied, please contact the seller.

# Appendix 1: Troubleshooting

| Symptom | Cause of the error | Troubleshooting |
|---|---|---|
| Field of view is not fully visible or uneven brightness in the field of view | The nosepiece is not turned into the correct position. | Rotate the nosepiece until the objective is in the correct position |
| | The field diaphragm is not centered | Center the diaphragm using the adjustment screws at the condenser |
| | There are dust or other contaminants on the surface of the optical parts of the eyepiece or the lens lens | Remove the dust on the optical surfaces with optical lens paper. |
| | The field diaphragm is closed too much | Open the field diaphragm |
| | The aperture diaphragm is not centered | Adjust the aperture diaphragm |
| | The filter was not inserted correctly | Insert the filter correctly |
| The eyes are prone to fatigue during observation. | Inadequate focusing or incorrect eye relief. Due to the low depth of sharpness in the microscopy, different parts of the object or preparation often have to be sharpened separately | Adjust the eye distance so that both eyes can see the preparate at the same time, and adjust the diopter ring so that both eyes see a sharp image |
| Bad resolution, weak object contrast, poorly visible details | The aperture diaphragm was not opened to the correct size | Adjust the apterture diaphragm to the right size |
| | The condensor is not focused correctly | Focus the condensor |
| | The preparate cover glass has the wrong thickness | Use standard cover glasses with 0,17mm thickness |
| | Dirt/dust on the lens | Clean the objective |
| | An oil immersion objective is used without oil | Use immersion oil |
| | The immersion oil has bubbles | Remove the bubbles |
| | Dirt/dust on the preparate or condenser | Remove the dirt |
| It's dirt or dust in the field of vision | Dust/dirt on the light source | Clear thouroghly |
| | Dust/dirt on the condensor | |
| | Dust/dirt on the preparate | |
| | Dust/dirt on the objective | |
| There are diffraction effects in the field of view | The condensor is too low | Adjust the height of the condensor |
| | The aperture diaphragm is closed too far | Open the aperture diaphragm |
| The stage slides down by itself or the focus moves during observation | The friction adjustment for the focus is too loose | Tighten the friction knob |
| The coarse focus adjustment does not extend to the bottom | The holder of the condensor is too low | Adjust the condensor holder at a higher position |
| The field of view one eye does not match the field of view of the other eye | The pupil distance is wrong | Adjust the pupil distance |
| | The diopter adjustment is wrong | Correct your diopter setting |
| | You are not accustomed to microscopic viewing. | Try to observe at low magnification before you increase magnification. Relax your eyes by looking out oft he window to a far away object |

| | | |
|---|---|---|
| The objective bumps into the preparate before it is in focus | The preparate on the stage is upside down | Place the preparate onto the stage in the correct orientation |
| | The cover glass is too thick | Use cover glasses with 0,17mm thickness |
| The light does not turn on | The light bulb is not mounted or defective | Insert a new light bulb |
| | The power cord is not attached | Attach the power chord |

# Appendix 2: Technical Data

| Technical Data | |
|---|---|
| Binocular head | Binocular head, 30°inclined 360° rotatable, eye distance 48mm-75mm |
| Eyepiece | Wide field eyepieces WF10×. Both eyepieces with dioptre adjustments |
| Nosepiece | Nosepiece with ball bearing: 4 positions with factory centered positions for all objectives |
| Objective | Achromatic objectives：4×、10×、40×(S)、100×(S)Oilimmersion<br>Parfokal, centered |
| Stage | Mechanical XY stage<br>Stage size：216mm×150mm<br>Range：55mm×75mm, 0,1mm Vernier scale |
| Condensor | N.A.1.25 Abbe Condensor with diaphragm and filter |
| Focus | Coaxial coarse/fine rack and pinion focuser<br>Vernier of fine focusing scale 0.002mm |
| Illumination | LED3W/4V 220V/110V<br>Adjustable brightness |
| Collector | Fixed field of view, high brightness |
| Optional Accessories | Okulare: WF16×,WF20×, P16×und 1.3 MPixel Camera |
| | Achromatic Objectives: 20×,60×(S) |

Objectives:

| Type | Magnification | Numerical Aperture (N.A.) | Working distance (mm) | Cover glass thickness (mm) |
|---|---|---|---|---|
| Achromatic Objectiv | 4× | 0.1 | 37.5 | 0.17 |
| | 10× | 0.25 | 6.54 | 0.17 |
| | 40×(S) | 0.65 | 0.63 | 0.17 |
| | 100×(S) Oil | 1.25 | 0.195 | 0.17 |