AmScope
The #1 Microscope & Accessories Supplier

T680A SERIES OPERATOR MANUAL

(Please Read This Manual Before Using the Microscope)

T680A Series

Compound Microscope

AmScope
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Before Use

Introduction

Congratulations on the purchase of your new AmScope Microscope! This manual is designed for T680A series microscopes. Though the microscopeâs camera resolution may vary depending on your series model number, the T680A series functions remain the same

Please take a few minutes to familiarize yourself with the features and functions of your new microscope. If you want more information on microscope, parts, and accessories, please visit our website at:

www.AmScope.com

We recommend that you study this manual thoroughly before operating the microscope and that you keep it on hand for future reference. If you have additional questions or need assistance, please send us an email at:

info@AmScope.com

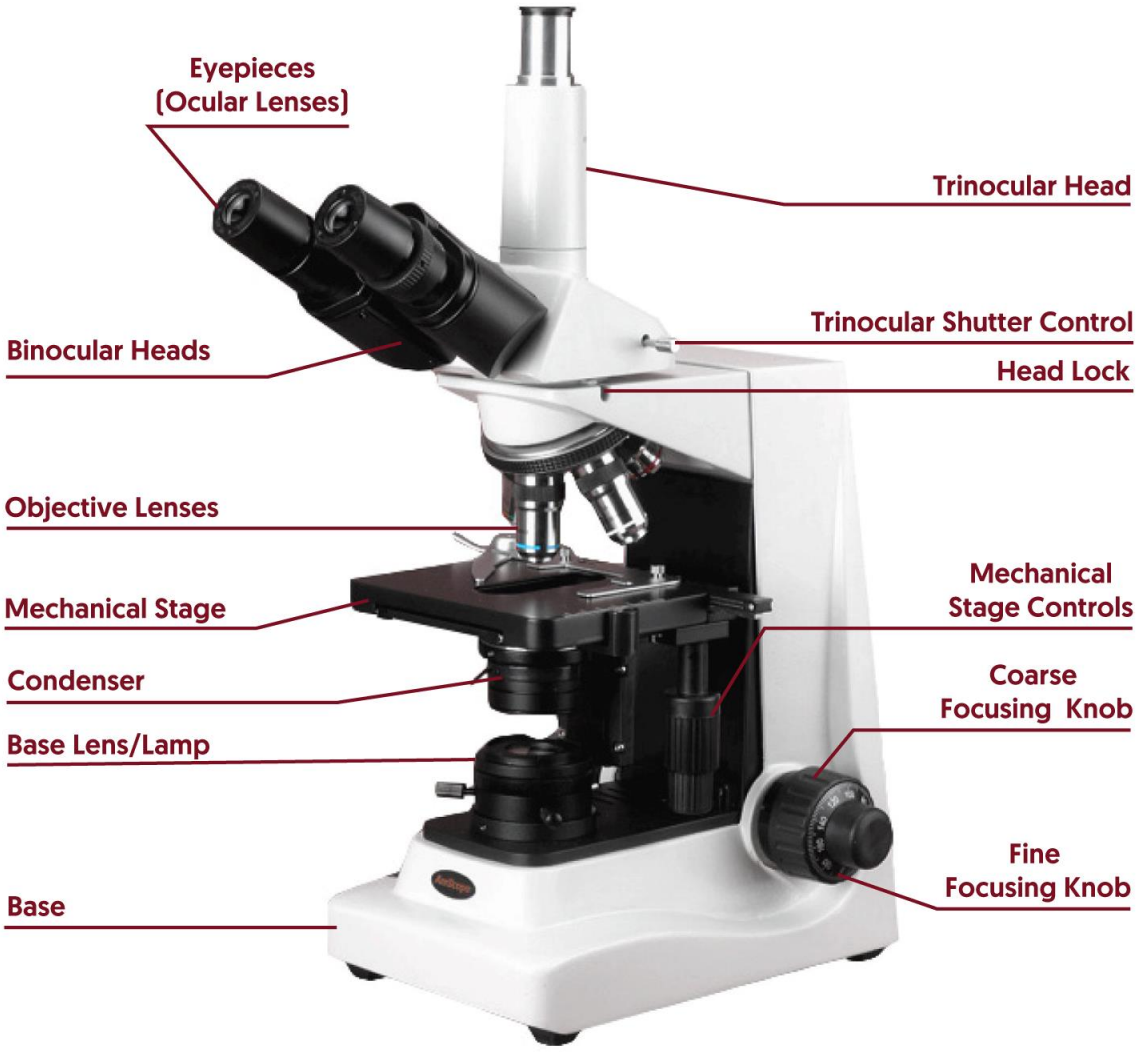
Please include the microscope model number in your email so that we can identify your model and provide immediate help.

Precautions

1. As the microscope is a precision instrument, always handle it with care, avoiding impact or abrupt movement during transportation. Do not shake the package.
2. Do not place the microscope in direct sunlight or in high heat. Keep it indoors in a dry and clean place with temperatures between 32°-100° F (0°-40°C), maximum relative humidity: 85%
3. Avoid touching the lenses on the objective and the eyepiece so that oil and dirt from your fingerprints do not obstruct your view.
4. Before turning the power on, make sure that the power supply voltage is consistent with the voltage of your microscope.

1. Microscope Parts

1.1 Parts Diagram



1.2 Features

This is a brand new professional trinocular compound microscope that offers research grade performance and advanced features. It comes with five high quality objectives (4X, 10X, 20X, 40X, 100X), a Koehler illumination system, a 30 degree inclined 360 degree rotatable compensation-free trinocular head, and 3-D mechanical stage.

It is an ideal instrument for advanced researches. This microscope is made by the same technicians and on the same production line as optical instruments for Leica, Zeiss, Nikon and Olympus.

- An Advanced First-Class High Quality Laboratory Microscope
- Fully Coated Optical System with High Resolution
- Crystal Clear Sharp Images
- 30 Degree Inclined, 360 Degree Swiveling Compensation-free Trinocular Head
- Ten Magnification Levels: 40X-64X-100X-160X-200X-320X-400X-640X-1000X-1600X
- Koehler Illumination System with Field Diaphragm for Lighting Control
- Koehler Condenser with Iris Diaphragm and Swing-Out Filter Holder
- Intensity-Variable Transmitted Halogen Lighting System
- Color Filters Included
- Rack and Pinion Adjustment for Condenser
- Large 3-D Double Layer Mechanical Stage
- Low Position Coaxial Stage Movement Control Knobs
- Dual Side Coaxial Coarse and Fine Focusing Control
- Adjustable Interpupillary Distance
- Adjustable Diopters on Both Oculars
- Durable Cast Alloy Frame & Stand with Stain Resistant Enamel Finish
- Five Achromatic DIN Objectives Included
- Two Sets of Wide Field Eyepiece: Wide Field 10X (18mm Field of View) and P16X
- Quintuple, Reversed, Extra-Large Nosepiece with Wide, Knurled Grip for Easy Operation
- Large Double Layer Mechanical Stage with Stain Resistant Finish
- Upward Stage Stopper to Protect Objectives and Slides
- A Wide Range of Accessories Available Including Phase Contrast and Darkfield Condensers.
- Manufactured Under ISO 9001 Quality Control Standard
- Excellent Five (5) Year Factory Warranty
- Satisfaction Guaranteed or Money Back!

2. Operation

2.1 Unpacking

2.1.1 Unpack the Box

1. Very carefully slide the Styrofoam container out of the cardboard carton.
2. Lay the Styrofoam container on its side. Make sure the side labeled up is up.
3. Remove the tape.
4. Carefully open the Styrofoam container, avoid dropping and damaging the optical items.

2.1.2 Verify Packing List

Check the packing list to ensure that you've received all items:

- One Trinocular Siedentopf Head
- One Microscope Body Frame with Base and Kohler Illumination System
- Four High Quality Objectives: 4X, 10X, 40X and 100X
- One Pair of Widefield WF10X Eyepieces
- One Pair of Widefield P16X Eyepieces
- One Power Cord
- Color Filters
- One Dust Cover
- One Spare Halogen Bulb
- One Spare Fuse
- Immersion Oil
- One 3MP USB2.0 Digital Camera with Reduction Lens (for T680A-3M model only)
- One 5MP USB2.0 Digital Camera with Reduction Lens (for T680A-5M model only)
- One 9MP USB2.0 Digital Camera with Reduction Lens (for T680A-9M model only)
- One USB Cable (for T680A-3M, T680A-5M, T680A-9M models only)
- Two Mounting Adapters for the Camera (for T680A-3M, T680A-5M, T680A-9M models only)
- One CD with Driver, Software and User's Instructions (for T680A-3M, T680A-5M, T680A-9M models only)
- Shipping Weight: 28 lbs

2.2 Assembly

2.2.1 Carefully Remove Microscope from Box

Remove the microscope body from the box and remove the plastic protective covering.

The body of the microscope is composed of the base, the stage, the arm, and the nosepiece.

2.2.2 Install the Microscope Head

Carefully take the microscope head out of the plastic bag, making sure not to touch glass.

Place the bottom side of the microscope head (flat, circular side down) into the circular opening on top of the arm (just above the nosepiece and lock screw).

Tighten the head lock with an Allen key to secure the head in place.

2.2.3 Install the Trinocular Port and C-Mount

Unscrew and remove the photo port cap from the top side of the microscope head.

Screw in the Trinocular port.

If your camera has a c-mount, insert the c-mount adapter onto the Trinocular port. If your camera does not have a c-mount, you can skip this step.

2.2.4 Insert Eyepieces

Remove the eyetube caps.

Place the desired eyepieces into the empty eye/ocular tubes.

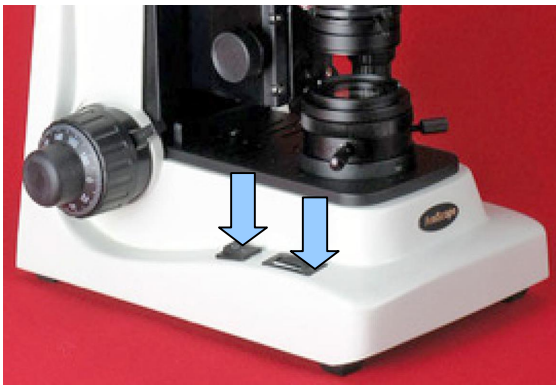
Be sure to avoid touching the lenses.

2.2.5 Insert Objective Lenses

Unpack the objective lenses. Screw the objectives into the microscope nosepiece.

Start with the lowest magnification, and in order of magnification, insert each lens, without touching the glass.

2.2.6 Plug it in, turn it on, and adjust the dimmer if more light is needed.



Plug in the microscope and turn it on.

If no light emerges from the light source, adjust the dimmer knob next to the on/off switch.

2.3 Adjusting the View

2.3.1 Choose forward or reverse viewing

The microscope head rotates to allow for forward or reverse viewing.

There is no difference as far as the optics; it depends on whatôs comfortable. In forward position you are looking over the stage, in reverse position you are looking at the stage.

Once youôve chosen your preferred microscope head position, lock the head-lock screw.

2.3.2 Focus the distance between your eyes.

(The interpupillary distance, the distance between your eye pupils.)

With both eyes open, look into the eyepieces. Adjust the interpupillary distance by holding the eyetubes and rotating the tubes either towards or away from each other until only one circle of light is seen by both eyes.

2.4 Specimen Set Up

2.4.1 Prepare the Specimen

Place the specimen to be studied on a glass slide (or use a prepared slide, purchase separately). Using a cover slip is highly recommended.

2.4.2 Secure the Slide

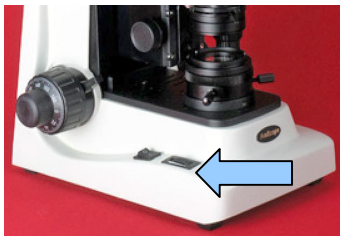
Place the slide on the stage, holding it snugly in place with the metal slide holders (clips) of the mechanical stage.

2.4.3 Center the Specimen

Using the mechanical stage controls, center the slide over the stage opening, lining it up with the light and the objective lens.

The top ring moves the stage forward and backward. The bottom ring moves the stage from left to right

2.4.4 Adjust the dimmer if more light is needed.



To adjust the illumination, slowly turn the dimmer on the right side of the base until the desired intensity of light is achieved.

2.5 Focusing

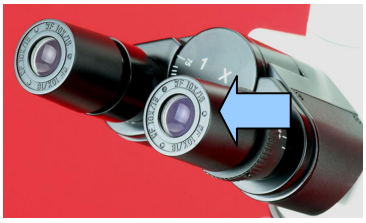
2.5.1 Choose an Objective Lens

Turn the nosepiece to choose an objective. It is easiest to use the lowest magnification first (4X objective) to locate and focus on the specimen. As you move up in magnification you will need to refocus the image a little each time.

2.5.2 Parfocal

Under the diopters on the eyepieces, there are numbered rings. Set these rings to 0 and the image should remain in focus for the entire magnification range. This will enable you to stay more in focus when you add a camera or switch objective lenses.

2.5.3 Focus one eye at time



1. Look with one eye through the eyetube without the diopter.
2. Close your other eye.
3. Focus the image using the coarse focusing knob. Adjust the height of the stage until the sample comes into clear focus.

2.5.4 Focus your other eye

1. Close the first eye. Open the other one.
2. Look with the second eye through the eyepiece with the diopter.
3. Turn the diopter until the image is clear through the side as well.

2.5.5 Re-center Specimen and Re-focus

When you change magnification levels, you may need to re-center the specimen. When you change magnification levels, you will need to re-focus.

2.6 Using the Trinocular Port

The AmScope T680A model is uniquely designed so that you can view the image through the eyepieces and the Trinocular port simultaneously, as well as fine tune the focus of the camera with a C-mount focus adjustment.

You do not need an adapter to attach your AmScope camera to the Trinocular port; however you may need one if you have a non-AmScope camera. Our photo port is a 23mm size.

2.7 Attaching a Camera

Most AmScope cameras come with a reduction lens. Reduction lenses align the magnification of the microscopeôs image with the capacity of the digital cameraôs sensor.

The specimenôs image seen through the magnified objective lens is very large. The reduction lens renders the image in a size compatible with the smaller size of the digital cameraôs sensor.

1. If your camera has a 23mm mounting size, you do not need the C-mount adapter. If installed, remove the C-mount from the top of the Trinocular port by loosening the screw.
2. Place the camera (mounted on a reduction lens) directly into the Trinocular port. It should slide in without issue.
3. Focus through the Trinocular port, by turning the middle portion of the tube.
4. Open up your AmScope Digital Camera Solution software on your computer and let it connect to your microscope.

If your camera needs a C-mount adapter, attach the adapter to your camera and screw the adapter into the Trinocular port. Plug one end of the cord directly into the camera and the USB end into your computer.

2.8 Setting the Stage's Stop-Limit

1. Unlock the stop-limit on the stage.
2. Adjust the stage to the desired maximum height.
3. Lock the stop-limit. This allows you to limit the movement of the stage from the bottom of the range up to the point it is set at.
4. To reset it, unlock the stage and reset the stage to the new height.

If no limit is desired, simply unlock the stop-limit.

2.9 Adjusting Focus Tension

1. To adjust the tension of the focusing knobs, first locate the black ridged tension knob on the inside of the coarse focusing knob.
2. To decrease tension, rotate the adjustment forward, towards the stage (counterclockwise). To increase, rotate away from the stage (clockwise).

Note: If your stage is slipping down after setting the focus, you need to increase the tension.

2.10 Setting the Condenser Lens Adjustment Knob

The condenser adjustment knob raises and lowers the condenserôs distance to the base lens, varying light delivery.

2.11 Adjusting the Iris

By changing the aperture (hole size) of the iris/diaphragm of the condenser, you can adjust the background brightness. Adjust the aperture of the iris diaphragm using the iris adjustment slider located directly under the stage.

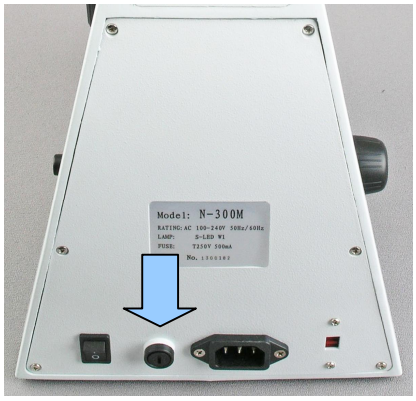
2.12 Changing a Filter (Optional Accessory)

1. At the bottom of the condenser lens, there is a small ring that slides out. Swivel the ring as far out as possible.
2. Insert the preferred colored glass filter.
3. Slide the ring back into place.

Note: The filter holder is placed in from the factory in a manner in which it swings out and hits the arm of the microscope (backwards). If this happens, simply grip the condenser assembly and rotate it. It may take a small amount of force to rotate it, but after doing so, you will be able to swing the filter holder out towards the front of the unit for easier operation.

2.13 Changing the Fuse

The fuse port is on the back of the microscope on the base between the on/off switch and the power inlet.



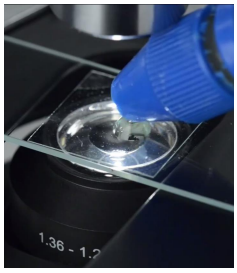
1. Turn off and unplug the microscope.
2. Be sure to remove the eyepieces from the unit before turning the microscope over to prevent them from falling and breaking.
3. Carefully turn the microscope on its side, exposing the base.
4. Using a flat head screwdriver, unscrew the cover and replace the T1A fuse.
5. Screw the fuse cover back in.

2.14 Using Oil Immersion

When using the 100X objective, a drop of immersion oil should be placed between the cover slip and the objective to minimize distortion caused by air.

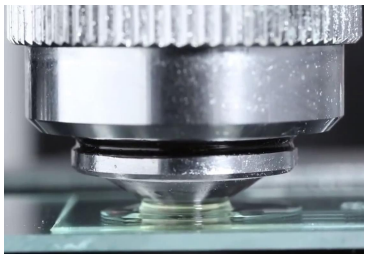
1. Place the slide on the stage and center the specimen.

2. Close the condenserôs aperture iris and ensure that the specimen focused and centered as possible. Increase light intensity once the specimen is clearly illuminated.



3. Move the objectives out of the way to enable access to the slide. Place a drop of immersion oil directly onto the slideôs cover slip, not directly on the specimen; a cover slip MUST be used.

4. Release the stage stop limit.



5. Lower your oil immersion lens (100X objective) into position so that the front lens is immersed in the oil. If your lens is not immersed, use the coarse focusing knobs to adjust the height of the stage to the proper levels. The oil lens should be immersed in oil, but not touching the slide.

6. Adjust the focusing knob, watch for the field of view to come into focus. This is best seen when the iris of the condenser is smaller than the field of the objective. Use the fine focusing knob to make adjustments.

7. Re-engage the stage stop limit.

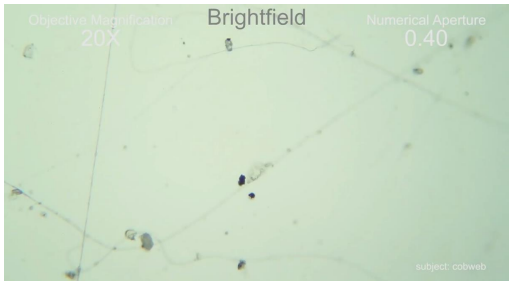
8. When the specimen is in focus, adjust the iris to open just larger than the condenserôs diameter.

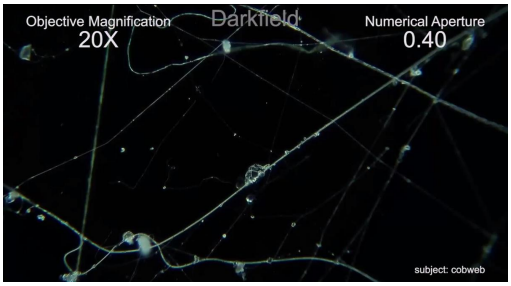
9. After using the oil immersion lens, you will need to clean the lens and specimen before the oil dries.

   Note: Please be careful when using the stage stop limit. The stage limit stop is designed to prevent impact between objective and slide, so when it is off you can damage the microscope or the slide.

2.15 Using Darkfield Condenser Lenses (Optional Accessories)

Darkfield Illumination is a lighting method for increasing contrast. A darkfield condenser lens produces bright images against a dark background for low contrast biological specimens.

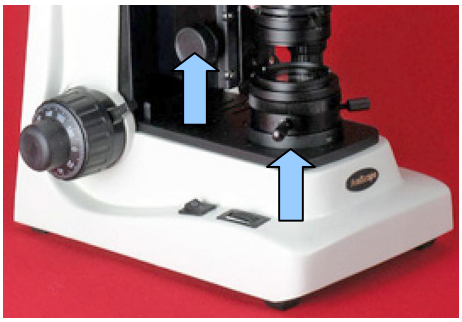




The dry darkfield condenser is for low power magnifications, such as with the 4X, 10X or 40X objective lenses, with numeric apertures of .65 or less.

The oil darkfield condenser is for high power magnifications, the 40X and 100X objective lenses, with numeric apertures of 1.25 or higher.

2.15.1 Installing a Darkfield Condenser Lens



1. Use the condenser lens adjustment knob to lower the condenser so you have easy access to the condenser knob.
2. Loosen the condenser lock screw and replace the condenser lens.
3. Install the darkfield condenser lens and tighten the condenser lock thumb screw on the condenser holder.

When choosing a darkfield condenser, be sure the condenserôs numerical aperture is larger than the numerical aperture of the objective lens.

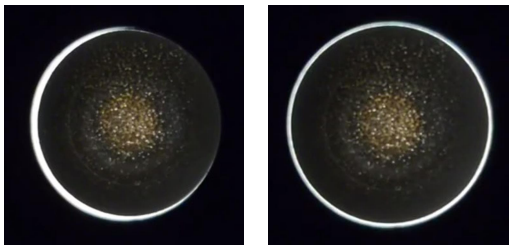
If the objective lens aperture is larger than the aperture of the darkfield condenser, direct light will be transmitted and a darkfield will not be achieved.

2.16 Using a Dry Darkfield Condenser Lens (Optional Accessory)

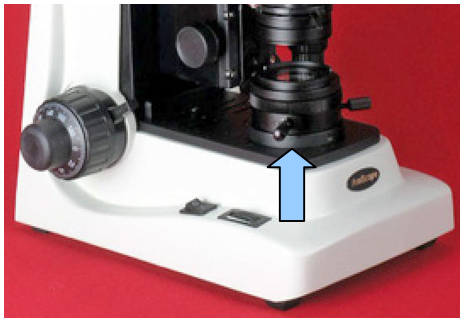
2.16.1 Using the Dry Darkfield Condenser

1. The first step is centering the condenser. Move the 10X objective lens into the light path.

2. Remove an eyepiece and look through the empty eye tube, to see the condenserôs image directly.



3. Use the condenser lens adjustment knob to adjust the height of the condenser until the opaque disc is slightly smaller than the entire image circle, leaving a ring of light.



4. Turn the condenserôs centering screws to move the dark spot to the center.
5. Replace the eyepieces.

6. Raise the condenser to the top of its range, just short of the slide on the stage. The is the optimal position for darkfield viewing, but can be adjusted later, if necessary.
7. Place a slide on the stage and focus. Adjust the height of the stage up or down slightly for optimal viewing, but the condenser lens should be relatively close to the slide.

8. If you are using a variable numerical aperture objective lens, adjust the ring at the bottom to fine tune the darkfield.

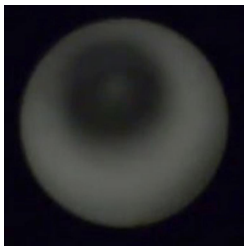
2.17 Using Oil Darkfield Condenser Lens (Optional Accessory)

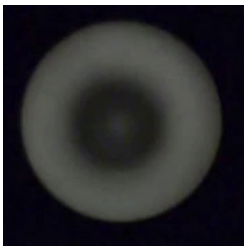
The condenser works with 100X oil objective and low power objectives (4X, 10X, etc) as well. Immersion oil is needed on top of the condenser lens for darkfield observation. Immersion oil is needed between the 100X oil objective and slide.

2.17.1 Using the Oil Darkfield Condenser

1. The first step is centering the condenser. Move the 40X objective lens into the light path.

2. Remove an eyepiece and look through the empty eye tube, to see the condenserûs image directly.





3. Use the condenser lens adjustment knob to adjust the height of the condenser until the opaque disc is slightly smaller than the entire image circle, leaving a ring of light.

Note: The dark spot has a fuzzy edge and will become larger when the condenser gets closers to the objective. The distance between the top of the condenser and the objective is about 8mm, when the dark spot shows in the field of view.

4. Turn the condenserûs centering screws to move the dark spot to the center.

5. Replace the eyepieces.

6. Raise the condenser to the top of its range, just short of the slide on the stage. The is the optimal position for darkfield viewing, but can be adjusted later, if necessary.

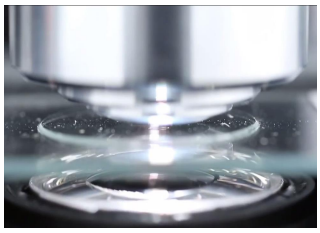
7. Adjust the dimmer so the lamp is at maximum brightness.

8. Place a slide on the stage and focus. Adjust the height of the stage up or down slightly for optimal viewing, but the condenser lens should be relatively close to the slide.

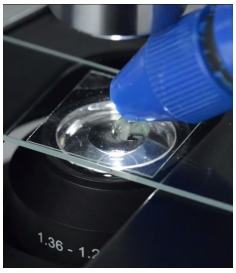
2.17.2 Using Oil Immersion

1. Before you install the oil darkfield condenser lens, apply a drop of immersion oil on the top lens of condenser. If you've already installed it, remove the condenser to apply the drop of oil to the lens, and re-install it. You might need to re-center the condenser.

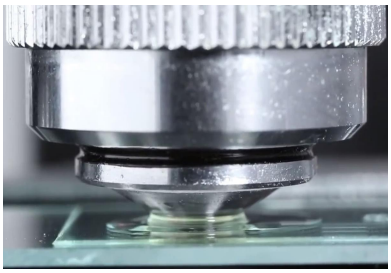
2. Place the slide on the stage.



3. Raise the condenser and let the oil drop contact the underside of the slide. If air bubbles exist in the oil, clean the oil from the condenser lens and bottom of slide and repeat the procedures.

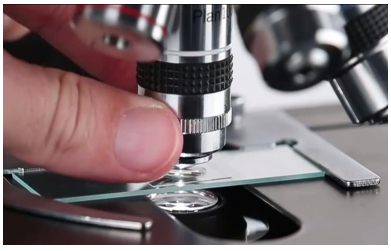


4. Apply a drop of immersion oil to the slide's coverslip.



5. Carefully raise the stage until the oil makes contact with the objective lens.

6. Adjust the iris ring to get proper brightness and contrast of view field.

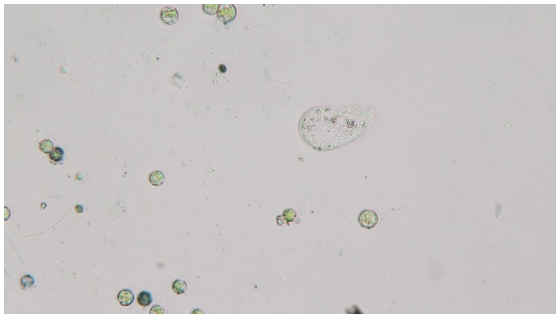


7. If you are using a variable numerical aperture objective lens, adjust the ring at the bottom to fine tune the darkfield.

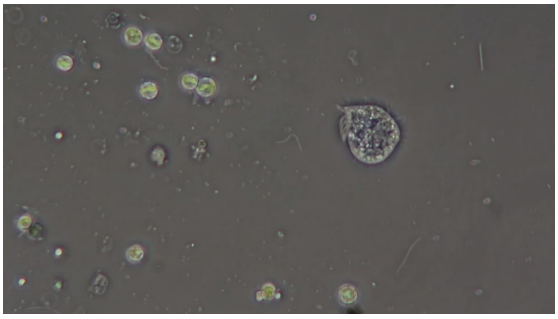
2.17.3 Cleaning the Oil Darkfield Condenser

1. When using oil immersion, once you have finished using the oil darkfield lens, you will need to clean the lens and specimen of the oil before it dries.
2. You can wipe the lens with a soft nonabrasive cloth to remove the oil. If you want to use a cleaner, you can use cigarette lighter fluid to safely remove the oil, as it will break it down. Do not use alcohol based solvents, as they dissolve the cement used to in assembly of the lens (thus breaking your objective).
3. The specimen itself can be discarded, or if desired, you could clean it up and store it for later use. The specimen may also be left with the oil on it, as you will still need to apply more for use later, however it may dry up and cloud your specimen. Cleaning is recommended.

2.18 Using a Phase Contrast Kit (Optional Accessory)

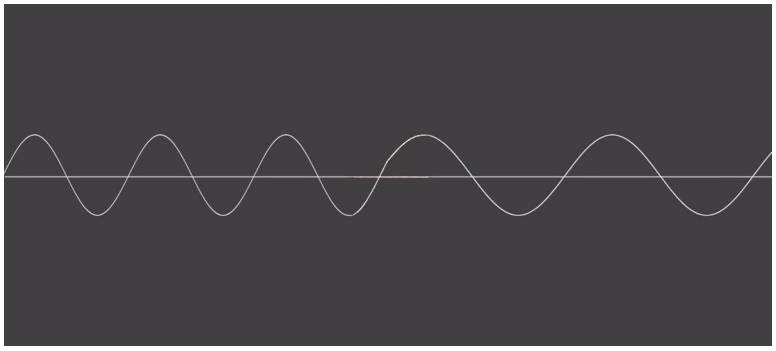


Brightfield

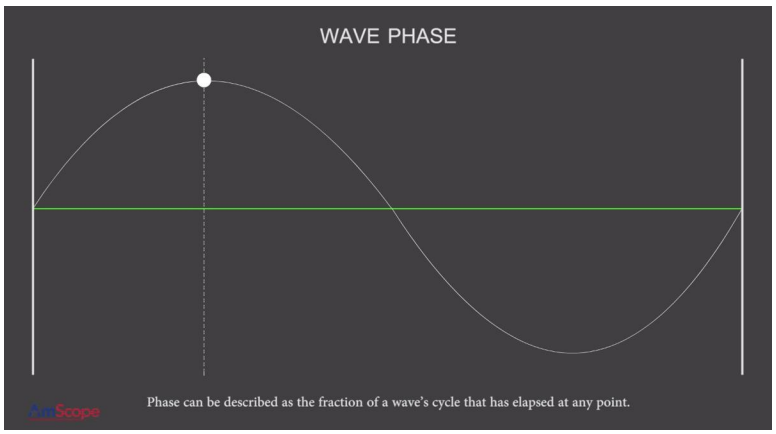


Phase Contrast

Some specimens may offer little in the way of color-variance or opacity and can appear essentially invisible when using basic, transmitted light. Phase-contrast is a technique used in microscopy to enhance the contrast of an image, when observing a specimen which offers little contrast in normal bright-field conditions.

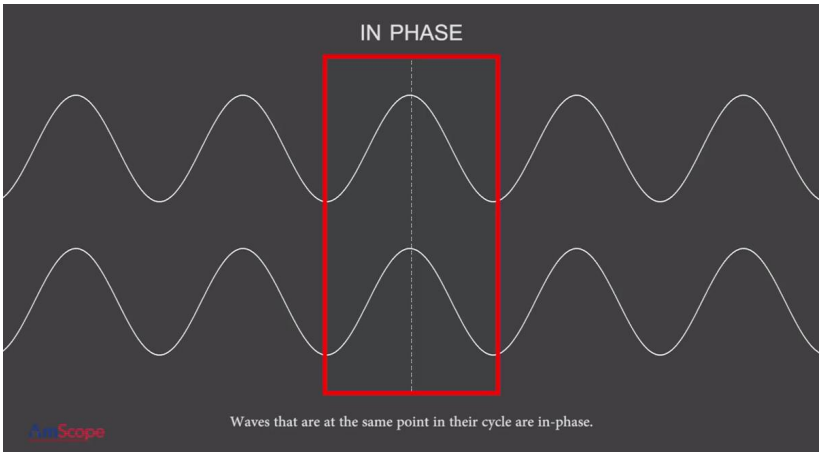


Light waves have several measurable components, the most-common of which are length, frequency and amplitude. While length and frequency translate into the color of light we see, amplitude translates into brightness.

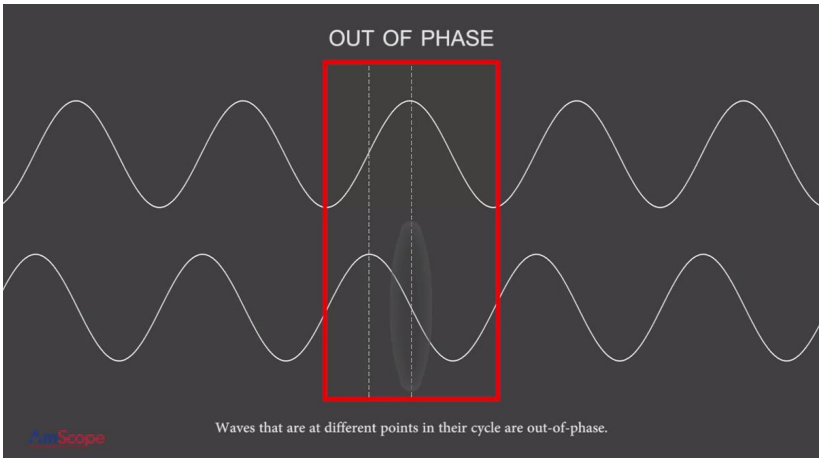


One component that we do not perceive is phase, which can be described as ñhow much of the waveôs cycle has elapsed at a given time.ò

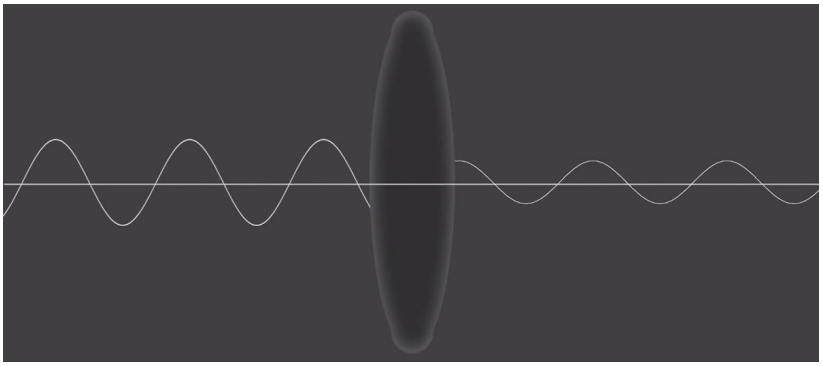
If you imagine light as a small dot (a photon), moving along the cyclical arcs of a light wave, the phase is current position of the photon, relative to the waveôs entire cycle.



As waves of light move through space, if their cycles move in a perfect parallel and are at the same point in their cycles, they are in-phase.



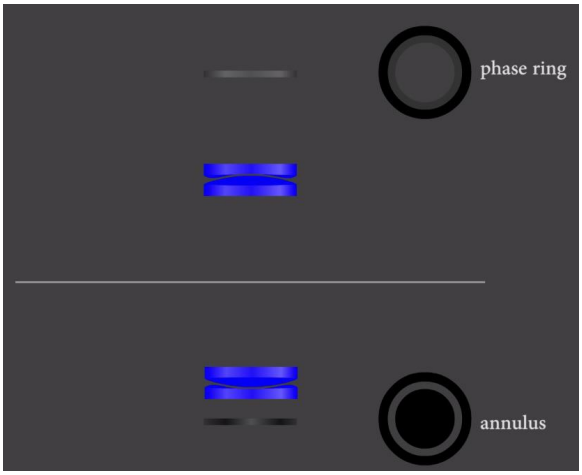
If some of the light waves hit an obstacle and the phases of the waves are altered, so they are no longer in parallel and at the same point in their cycles, they are out-of-phase.



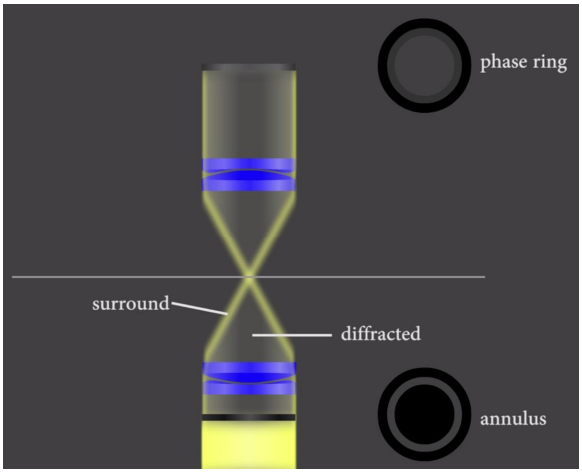
When a light wave passes through any medium, the medium can affect the light waveôs length, amplitude, frequency and phase. There are shifts in phase, due to changes in lightôs speed.

As the speed of light changes when hitting or missing obstacles, like a specimen, the rays are bent, or refracted. The amount of refraction when a light wave hits an obstacle is measured as its refractive index. Itôs this refractive index which creates the variations in phase as light passes through a specimen.

Even though a specimen may appear transparent, as long as its refractive index is different from the baseline index of air, and the specimen has thickness, then there will be changes in phase to any light which passes through the specimen.



A phase contrast system incorporates two components to segregate light, so out-of-phase waves can be realigned. The two components are the annulus in the condenser and the phase ring in the objective lens.

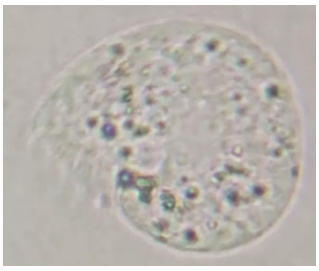


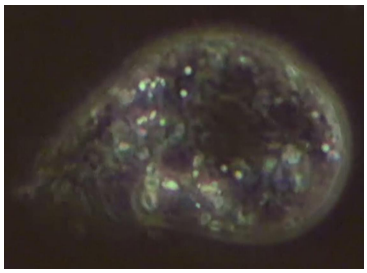
The condenserôs annulus separates light into surround light and diffracted light. Light passing directly through the annulus creates a hollow cone called surround light. This light passes directly through the optical system and is intercepted by the phase ring in the objective lens.

Light diffracted by the edges of the annulus passes more centrally through the specimen in the objective lens.

As the light collectively passes through the objective lens, it is further segregated by the phase ring. The phase ring shifts the phase of the surround light either positively or negatively so the waves are in-phase.

Since human sight is incapable of perceiving light phase, the aim of phase contrast is to translate the disparities in phase into perceivable variations in brightness.





There are several techniques available for increasing the contrast between the specimen and the background, each tailored for a particular purpose. Phase-contrast does so by manipulating the phase of light, and is useful for observing the inner mechanics of cellular structures, especially live cells, without the need for staining.

AmScopeŝ PCS Simple Phase Contrast Kit includes three phase-contrast objective lenses, three phase contrast condenser lenses, and a centering telescope.

AmScopeŝ PCT Turret Phase Contrast Kit includes four phase-contrast objective lenses, a condenser turret, and a centering telescope. The turret has built-in annuli, designed to work with each of the lenses, as well as a brightfield iris.

2.19 Using a Simple Phase Contrast Kit (Optional Accessory)

2.19.1 Unpacking the Simple Phase Contrast Kit

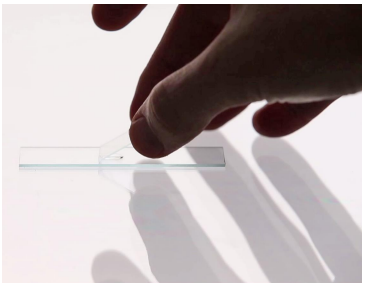
1. Take the aluminum case containing your kit out of the cardboard carton. Remove the tape and open the container carefully so as to avoid dropping and damaging the optical items. You may need to use the key taped onto the box. Check carefully to ensure that all parts and accessories are intact.

   Note: You must match finite tube-length kits to finite tube-length microscopes and infinity-corrected units to infinity-corrected microscopes for optimal results.

2. Check the packing list to ensure that you've received all the items. All units should come with:
   - 10X, 40X, & 100X Phase Contrast Condenser Lenses
   - 10X, 40X, & 100X Phase Contrast Objective Lenses
   - Condenser Assembly
   - Centering Telescope Lens
   - Green filter

2.19.2 Focus the Specimen

1. Once you have installed the phase contrast kit, you will need to calibrate and center the light perfectly for optimal results. You will initially calibrate with the Abbe brightfield condenser.



2. Place a slide on the microscope stage. Make sure the specimen is covered with a cover slip (a good example for a phase contrast specimen is human saliva). Clean any excess material from the slide.
3. Make sure your Abbe brightfield condenser is installed.

4. Focus the specimen using the 10X objective. Adjust the iris ring on the condenser so the light field is just larger than the field of view in the microscope. The condenser itself should be moved to the normal height, which is close to the bottom of the stage of the microscope (the top of the range of the condenser).

2.19.3 Installing a Simple Phase Contrast Condenser

1. Loosen the thumbscrew and remove the existing Abbe brightfield condenser from your microscope.
2. Replace the brightfield objective on nosepiece with the 10X phase contrast objective.

3. Screw the 10X condenser ring plate onto the condenser assembly. Install the ring plate and assembly on the microscopeŝ condenser ring.

4. Change the objective lens to the 10X phase contrast lens. Objective lenses designed for phase contrast will be marked ñPhò, this denotes the objective lens has a built-in phase ring.

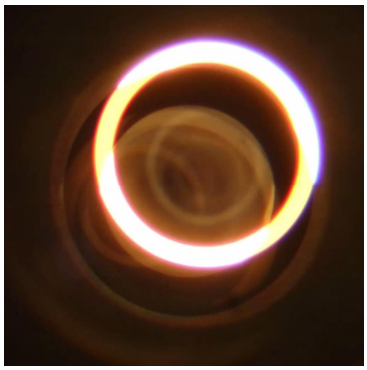
Note: there are 3 phase contrast objectives: 10X, 40X and 100X, and there are 3 condenser ring plates: 10X, 40X and 100X. The corresponding objective and ring plate must work together. For example, the 10X phase contrast objective must work with the 10X condenser ring plate.

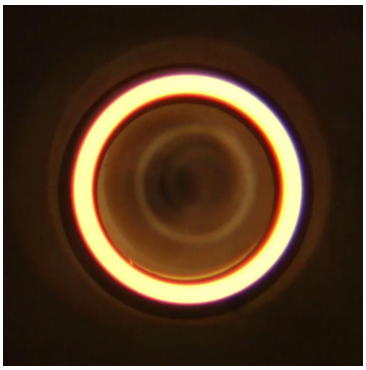
2.19.4 Calibrating the Phase Contrast Objective Lens and Condenser Lens

1. Remove one eyepiece from the microscope eyetube and insert the centering telescope.
2. Turn the microscopeôs light on and look through the telescope lens.
3. While looking through the eyepiece, extend the eyepiece by rotating the top counter clockwise until an image of the objectiveôs phase ring and the condenserôs annulus are clearly in focus. Since they are both part of the same conjugate image plane, they can be simultaneously in focus.

4. If the bright ring is still obscure, raise or lower the condenser by adjusting the condenser focusing knob (or the microscope focusing knob if necessary) until the bright ring is in focus and the dark ring is visible.

5. If the two ring images are not positioned so one is inside the other, adjust the centering screws on the condenser ring plate until the two rings center in parallel.





The annulusôbright ring of light should overlap the dark grey ring, which is the objectiveôs phase ring.

6. Place the green filter in the filter holder or directly onto the center of the base lens of your microscope (where the light emerges from). Remove the green filter if doing darkfield microscopy.

7. Remove the centering telescope and replace the eyepiece.

   Note: Once aligned, repeat the process for each magnification.

2.19.5 Perform the Phase Contrast Observation

After you center the condenser, you can perform the phase contrast observation the same way as a normal brightfield microscope.

Note: When changing to another phase contrast objective and corresponding condenser ring plate, the focusing and centering of bright ring and dark ring should be repeated following the procedures above.

Tips:

1. Make the illumination as bright as possible.
2. The thinner the specimen, the better the image.

2.20 Using a Turret Phase Contrast Kit (Optional Accessory)

2.20.1 Unpacking the Turret Phase Contrast Kit

1. Take the aluminum case containing your kit out of the cardboard carton. Remove the tape and open the container carefully so as to avoid dropping and damaging the optical items. You may need to use the key taped onto the box. Check carefully to ensure that all parts and accessories are intact.

Note: You must match finite tube-length kits to finite tube-length microscopes and infinity-corrected units to infinity-corrected microscopes for optimal results.

2. Check the packing list to ensure that you've received all the items. All units should come with:
   - Turret with 10X, 20X, 40X &100X Phase Contrast Condensers
   - 10X, 20X, 40X & 100X Phase Contrast Objectives
   - Centering Telescope Lens
   - Green filter
   - Small flathead screwdriver

2.20.2 Installing the Turret Phase Contrast Kit

1. Loosen the lock screws and remove the Abbe brightfield condenser from the holder.

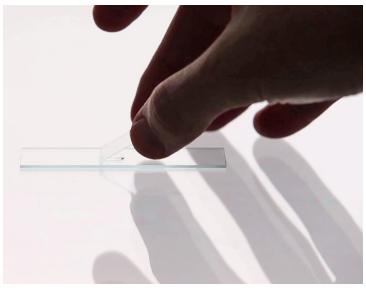
2. Insert the phase contrast condenser turret into the condenser holder and tighten the lock screw with the screw driver. Due to the weight of the turret, itôs best to use the screw driver to securely fasten the turret to the condenser holder.

2.20.3 Focusing the Turret Phase Contrast Kit

1. Rotate the microscopeôs nosepiece to the 10X phase contrast objective lens. Objective lenses designed for phase contrast will be marked ñPhò, this denotes the objective lens has a built-in phase ring.

Note: There are 4 phase contrast objectives: 10X, 20X, 40X and 100X, and there are 5 settings on the condenserôs turret ring: 10, 20, 40, 100 and B. The numbers on the turret ring must always correspond with objectivesô numbers.

For example, when using a 10X phase contrast objective the condenserôs turret ring setting must be 10. The B setting will make the phase contrast condenser work as a conventional brightfield condenser.



2. Place a slide on the microscope stage. Make sure the specimen is covered with a cover slip (a good example for a phase contrast specimen is human saliva). Clean any excess material from the slide.

3. Turn the phase contrast condenserôs turret to the B setting. Focus the specimen. Before aligning the phase contrast lens and condenser, you will need to bring the specimen into focus with the brightfield setting.

4. Once the specimen is in focus with the brightfield setting, rotate the condenserôs turret ring so it is set to 10.

2.20.4 Calibrating the Turret Phase Contrast Objectives and Condenser Lenses

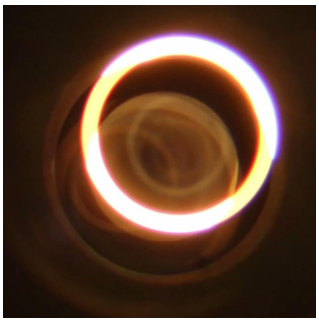
The turret has a built-in annulus for each objective magnification. Once the turret and objective lens are set with matching numbers, they will need to be aligned. You will need to do this again each time you change the objective lens.

Each annulus in the turret is easy to reposition by using a finger.

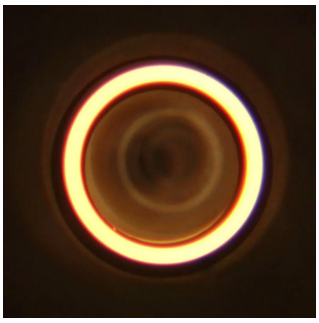
1. Remove one eyepiece from the microscope eyetube and insert the centering telescope.

2. Turn the microscopeôs light on and look through the telescope lens.

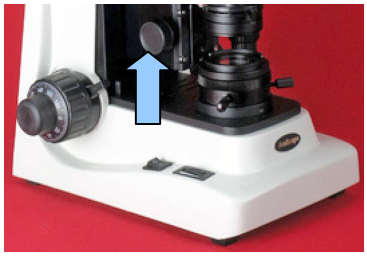
3. While looking through the telescope lens, extend the eyepiece by rotating the top counter clockwise.



4. Keep rotating the telescope lens until an image of the objectiveôs phase ring and the condenserôs annulus are clearly in focus.



5. By slowly moving the annulus on the underside of the turret, now in-line with the condenserôs lens, the annulusôbright ring of light should overlap the dark grey ring, which is the objectiveôs phase ring



6. If the bright ring is still obscure, raise or lower the condenser by adjusting the condenser focusing knob (or the microscope focusing knob if necessary) until the bright ring is in focus and the dark ring is visible.

7. Place the green filter in the filter holder or directly onto the center of the base lens of your microscope (where the light emerges from). Remove the green filter if doing darkfield microscopy.

8. Remove the centering telescope and replace the eyepiece.

   Note: Once aligned, repeat the process for each magnification.

2.20.5 Perform the Phase Contrast Observation

After you center the ring plate, you can perform the phase contrast observation the same way as a normal brightfield microscope.

Note: When changing to another phase contrast objective and corresponding condenser ring plate, the focusing and centering of bright ring and dark ring should be repeated following the procedures above.

Tips:

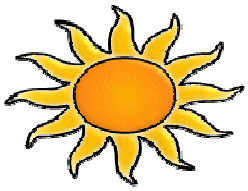
1. Make the illumination as bright as possible.
2. The thinner the specimen, the better the image.

2.21 Microscope Maintenance

2.21.1 Handle with Care

As the microscope and all accessories are precision instruments, always handle them with care, avoiding impact or abrupt movement during transportation. Do not shake the package.

2.21.2 No Sun/Heat



Do not place the microscope and accessories in direct sunlight or in high heat.

Keep the microscope and all accessories indoors in a dry and clean place with temperatures between 32°-100° F (0°-40°C), maximum relative humidity: 85%.

2.21.3 No Dust

Always keep the microscope covered by the dust cover when not in use. The glass will attract dust, obscuring your view. Make sure to keep it in a dry and clean place in order to prevent rust.

2.21.4 Keep Glass Clean

All glass surfaces must always be kept clean.

Oil and dirt from your fingerprints will obstruct your view.

Fine dust on the optical surface should be blown off using a hand blower or gently wiped off with a soft lens tissue.

2.21.5 Use an optical lens cleaner.

Carefully wipe off oil or fingerprints on lens surfaces using a tissue moistened with a small amount of 3:7 alcohol to ether mixture.

2.21.6 Do not use lens cleaner on the non-glass parts of the microscope.

Do not use the optical lens cleaning solution to wipe the surfaces of the other components of the microscope.

All other parts, especially those made of plastic, should be cleaned with a mild detergent.

2.21.7 Do not touch the glass.

Avoid touching the lenses on the objective, the eyepiece and all the accessories with glass lenses.

2.21.8 Do not take apart the microscope.

Do not assemble or disassemble the microscopeûs electrical components yourself.

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2.22 Darkfield Condenser Kit & Phase Contrast Kit Maintenance

2.22.1 Secure Setting

Ensure that the microscope is located on a smooth, level and firm surface.

2.22.2 Do Not Take Apart

Do not attempt to disassemble any components.

2.22.3 Keep Kits Clean

Keep the kits clean; remove dirt and debris regularly. Accumulated dirt on outer surfaces should be cleaned with a damp cloth. More persistent dirt should be removed using a mild soap solution. Do not use organic solvents for cleansing.

2.22.4 Keep Lens Clean

The outer surface of the optics should be inspected and cleaned periodically using an air stream from an air bulb. If dirt remains on the optical surface, use a soft cloth or cotton swab dampened with a lens cleaning solution (available at the camera stores).

All optical lenses should be swabbed using a circular motion. A small amount of absorbent cotton wound on the end of a tapered stick makes a useful tool for cleaning recessed optical surfaces.

Avoid using an excessive amount of solvents as this may cause problems with optical coatings or cemented optics or the flowing solvent may pick up grease making cleaning more difficult.

2.22.5 Cool and Dry Storage

Store the instrument in a cool, dry environment. Put the condenser back in the storage box when not in use.

3. General Specifications

3.1 Features

FEATURE	SPECIFICATION
Optical System	Infinity corrected
Nosepiece	Reversed, ball bearing quintuple
Head	Anti-mould trinocular head, 30-degree inclined
Eyepiece	WF10X & P16X
Achromatic Objectives	4X, 10X, 20X, 40X (spring), 100X (spring, oil)
Focusing	Low position coaxial focus system
Interpupillary Adjustment Range	2-3/16" - 3" (55-75mm)
Mechanical Tube Length	6-5/16" (160mm)
Mechanical Stage	5-1/2"x 6-5/16" (140x160mm)
Stage Traveling Range	2-3/4"x 2-0" (70x50mm)
Focusing Range	1-3/16" (30mm)
Division of Fine Focusing	0.0000787" (0.002mm)
Illumination	Halogen lamp, 6V/20W
Condenser	Koehler, N.A. 1.25, swing with iris diaphragm & filter
Power Supply	110V/220V, CE certified

3.2 Objectives

Type	Model #	Magnification	Numerical Aperture (N.A.) Rating	Medium	Magnification Marks (Color Ring)
DIN Infinity Plan Achromatic Objective with Associated N.A. Ratings (195mm)	A4X	4X	0.10	Air	Red
	A10X	10X	0.25	Air	Yellow
	A20X	20X			
	A40X	40X	0.65	Air	Light Blue
	A60X	60X	0.85	Air	Dark Blue
	A100X	100X	1.25	Cedar Oil	White

3.3 Eyepieces

	Eyepieces					
Magnification	5X	10X	15X	16X	20X	25X
Field of View	ū 18	ū 18	ū 13	ū 15	ū 11	ū 9

3.4 Cameras

MODEL	T680A-3M	T680A-5M	T680A-9M
Sensor	Aptina MT9T001 CMOS (color)	Aptina MT9P001 CMOS (color)	Aptina Special
Sensor Size	1/2ñ(6.55mm(H) x 4.92mm(V), diagonal 8.19mm)	1/2.5" (5.70mm(H) x 4.28mm(V), diagonal 7.13mm)	1/2.4" (5.825mm(H) x 4.369mm(V), diagonal 7.281mm)
Resolution	2048x1536 (approx.3,200,000 pixels)	2592x1944 (approx.5,040,000 pixels)	3488 x 2616 (approx. 9,000,000 pixels)
Reduction Lens	0.5X	0.5X	0.5X
Pixel Size	3.2µm x 3.2µm	3.2µm x 3.2µm	1.67µm x 1.67µm
G Sensitivity	1.0v / lux-sec (550nm)	0.53v / lux-sec (550nm)	0.31v / lux-sec (550nm)
Frame Rate	43fps @680x510, 22fps @1024x768, 8fps @2048x1536	60fps @640x480, 18fps @1280x960, 5fps @2592x1944	27fps @872x654, 8fps @1744x1308, 1.9fps @3488x2616
Exposure	0.128~2000ms, ROI Auto & Manual	0.21~2000ms, ROI Auto & Manual	0.38~2000ms, ROI Auto & Manual

3.5 Darkfield Condensers

SPECIFICATIONS	Dry Darkfield Condenser	Oil Darkfield Condenser
Model	DK-DRY100	DK-OIL100
Numerical Aperture (N.A.) Rating	0.7 ï 0.9	1.36 ï 1.25
Mounting Size (Diameter)	37mm	37mm

3.6 Phase Contrast Kits

SPECIFICATIONS	Simple Phase Contrast Kit	Turret Phase Contrast Kit
Model	PCS	PCT
Phase Contrast Objective	Achromatic 10X/0.25, 160/0.17 with built-in phase plate	Plan phase contrast 10X/0.25, 160/0.17
		Plan phase contrast 20X/0.40, 160/0.17
	Achromatic 40X/0.65, 160/0.17 with built-in phase plate, spring	Plan phase contrast 40X/0.65, 160/0.17
	Achromatic 100X/1.25, 160/0.17 with built-in phase plate, spring, oil	Plan phase contrast 100X/1.25, 160/0.17, Oil
Numerical Aperture (N.A.) Rating	1.25	1.25
Turret Ring Plates	1 For 10X phase contrast objective	10 for 10X phase contrast objective
		20 for 20X phase contrast objective
	1 For 40X phase contrast objective	40 for 40X phase contrast objective
	1 For 100X phase contrast objective	100 for 100X phase contrast objective
Centering Telescope	Focusing adjustable	Focusing adjustable

4. Parameters

4.1 Electrical System

110V/220V, CE certified

4.2 Microscope Parameters

Magnification	10x-2500x
Field of View	ū 0.8mm~ū 4.5mm
Mechanical Tube Length	160mm
Object to Primary Image Distance	195mm
Fine Focusing Sensitivity	0.002mm

4.3 Camera Parameters

- Operating System: Windows XP/Vista/7/8 (32 & 64 bit), Mac OS X, Linux
- PC Requirements: CPU equals to Intel Core2 2.8GHz or higher, USB2.0 port
- Advanced software for Windows:
  - ✓ Offers stitching, EDF, video recording and measurement functions.
  - ✓ Conducts measurements for lengths, angles, arcs, areas and etc.
  - ✓ Gives your computer screens the same field of view as your microscope's eyepiece.
  - ✓ Saves still images in BMP, TIFF, JPG, PICT, PTL or other formats.
  - ✓ Edit and process microscopy images in a manner similar to PhotoShop.
  - ✓ Live video and still image capture can be set in different resolutions simultaneously.
- Life-time free software upgrades.

5. Recommended Accessories

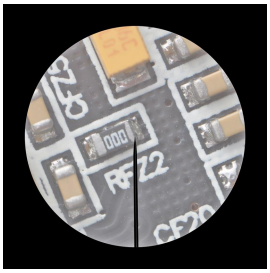
(Purchase separately. Please visit www.amscope.com and search with SKU #, for more information.)

5.1 Eyepieces

5X Eyepieces
SKU: EP5X23

20X Eyepieces
SKU: EP20X23

25X Eyepieces
SKU: EP25X23



10X w/ Pointer
SKU: EP10X23P

10X w/ Reticle
SKU: EP10X23R

5.2 Darkfield Condensers

Dry Darkfield Condenser
SKU: DK-DRY100

Oil Darkfield Condenser
SKU: DK-OIL100

5.3 Objective Lenses

Achromatic

2X
SKU: A2X

5X
SKU: A5X

20X
SKU: A20X

60X
SKU: A60X

Plan Achromatic

Plan 4X
SKU: PA4X

Plan 10X
SKU: PA10X

Plan 40X
SKU: PA40X

Plan 100X
SKU: PA100X

5.4 Phase Contrast Kits

Simple
SKU: PCS

Turret
SKU: PCT

5.5 Cameras and Accessories

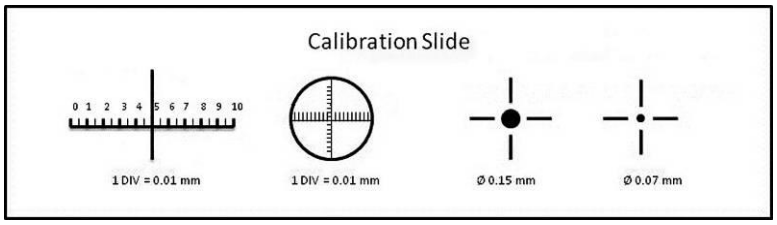
Cameras

To capture images, video, or view live display on a computer (PC/Mac OS X). Real-Time Live Video Microscope Digital Camera, Reduction Lens, High Sensitivity Sensor and Deluxe Calibration Kit.

350K Pixel SKU: MU035	1.3 Mega Pixel SKU: MU130	3 Mega Pixel SKU: MU300	5 Mega Pixel SKU: MU500	8 Mega Pixel SKU: MU800	9 Mega Pixel SKU: MU900	10 Mega Pixel SKU: MU1000

Calibration Micrometer

Calibrate the camera software for on-screen measurements.
SKU: MR400



Charge-Coupled Device Television

CCD Digital (VGA, Trinocular Only)
SKU: CCD-MT
To view live display on a computer monitor (VGA).

CCD TV/Video (Trinocular Only)
SKU: CCD-NP
To view live display on a television (RCA).

1920x1080 Full HD HDMI (Trinocular Only)
SKU: HD1080
To view live display on a computer monitor (VGA).

5.6 Fuses

Fuses For Microscopes
SKU: FS-M
T1AL 220V

5.7 Slides

Prepared

25 Slides
SKU: PS25W

50 Slides
SKU: PS50

100 Slides
SKU: PS100A

200 Slides
SKU: PS200

Blank

50 Blank Slides

SKU: BS-50P-C

100 Blank Slides
SKU: BS-100P-100S-22

144 Blank Slides
SKU: BS-144P-200S-22

300 Blank Slides
SKU: BS-300P-300S

5.8 Cleaners

Sparkle Microscope Optical Lens Cleaner
SKU: CLS

3 in 1 Professional Cleaning Kit for Microscopes, Cameras and Laptops
SKU: CK-I

3 in 1 Cleaning Kit for Microscopes, Cameras and LCD Screens
SKU: CK-II

6. Troubleshooting

6.1 Optical Issues

SYMPTOM	CAUSE	REMEDY
	OPTICAL ISSUES	
One side of the field of view is darker	The nosepiece is misaligned.	Turn the nosepiece until it clicks into place.
	Stains, dust, or dirt has accumulated on the objectives or eyepieces.	Clean all lenses with lens cleaner or a lint free non-abrasive cloth.
Obstructions are observed in the field of view	Stains, dust, or dirt has accumulated on the specimen.	Clean the slide or use a new specimen if sample is destroyed.
	Stains, dust, or dirt has accumulated on the objective, eyepieces, or Barlow lens.	Clean the lens.
Unclear Image	There is no cover slip on the slide.	Add a cover slip. The objectives are designed for use with a 0.17mm cover slip, so it is a requirement to use one for proper images.
	The cover slip is not standard sized.	Replace the cover slip with the appropriate 0.17mm thickness slip.
	The immersion oil has accumulated on the dry objective.	Thoroughly clean the objective lens with lens cleaner or a lint free non-abrasive cloth
	No immersion oil is used with the 100X objective.	Use immersion oil for better clarity and resolution.
	Used wrong oil.	Use standard cedar wood oil.
	The aperture is not open to an appropriate diameter.	Adjust the aperture to have the light just larger than the size of the condenser.
	Stains, dust, or dirt has accumulated on the inlet of the head.	Clean the lens with lens cleaner or a non-abrasive lint free cloth, as well as spray with compressed air.
	The condenser is not in the right position.	Adjust condenser height to the top of the travel range, and then adjust down to focus image.
	Initial focus was at too high a magnification.	Start focusing with the lowest objective and then switch to the higher ones.
	The slide is upside down	The slide thickness at higher magnifications will impact clarity if the slide is upside down.
The color of the image is not accurate	The brightness adjustment knob is not in the right position.	Adjust the brightness knob to a higher or lower setting for color clarity.
	No filter is used or filter is in use.	Remove color filter if natural light is desired, or insert desired filter.

SYMPTOM	CAUSE	REMEDY
OPTICAL ISSUES		
One side of the field of view is dark or the image moves while focusing	The specimen slide is not fixed.	Secure the slide to the stage with clips.
	The nosepiece is not in the right position.	Turn the nosepiece until it clicks into place.
The field of view is not bright enough	The iris diaphragm is too small.	Adjust the iris diaphragm to allow the light to be just larger than the condenser.
	The condenser is not in the right position.	Adjust condenser height to the top of the travel range, and then adjust down to focus image.
	Stains, dust or dirt has accumulated on the condenser, objective, eyepieces, or base lens.	Clean the lens with lens cleaner or a non-abrasive lint free cloth.

6.2 Mechanical Issues

SYMPTOM	CAUSE	REMEDY
MECHANICAL ISSUES		
Unable to move the slide smoothly.	The slide is not secured correctly.	Adjust the slide to use the stage clips and secure the sample.
	The mechanical stage is not properly secured.	Tighten the mechanical stage screws to better secure the stage.
The objective touches the cover slip.	The cover slip is not standard sized.	Replace the cover slip with the appropriate 0.17mm thickness slip.
	The limit-stop is set too high or not engaged.	Be careful to avoid contact between objective and the slide when the limit stop is not engaged (unless using the 100X objective with oil). To re-engage, focus the sample, then lock the limit stop into place to set maximum height at a safe but usable distance.
Focus-knob does not turn.	The tension knob is too tight.	Loosen it by adjusting the tension ring inside the coarse focus knob counterclockwise (close to the arm of the microscope on the left of the microscope).
Stage declines by itself.	The tension knob is too loose.	Tighten it by adjusting the tension ring inside the coarse focus knob clockwise (close to the arm of the microscope on the left of the microscope).
The coarse focusing knob won't raise the stage.	Limit-stop is engaged.	Disengage the limit stop on the left side of the microscope inside the coarse focusing knob.
The fine focusing knob won't raise the stage.	Limit-stop is engaged.	Disengage the limit stop on the left side of the microscope inside the coarse focusing knob.

6.3 Electrical Issues

SYMPTOM	CAUSE	REMEDY
ELECTRICAL ISSUES		
The bulb/light source flickers.	The bulb is close to burning out.	Replace the bulb. This unit uses our BH-6V20W with our 20w unit or our BH-6V30W for the 30W unit.
The microscope does not light up.	The microscope is unplugged.	Insert the plug into the wall socket to achieve electrical illumination.
	The bulb is not inserted correctly.	Check the bulb by unscrewing the base (remove eyepieces first to prevent falling out) door and ensuring that the bulb is inserted.
	The bulb burned out.	Replace the bulb. This unit uses our BH-6V20W with our 20w unit or our BH-6V30W for the 30W unit.
	The fuse burned out.	Replace with fuse on the bottom of the microscope.
The fuse burns out frequently.	The voltage is too high.	Use the correct power supply (110v if 110v unit, 220v if 220v unit), or get a voltage adapter to convert to the proper electrical system.
The bulb burns out frequently.	The voltage is too high.	Use the correct power supply (110v if 110v unit, 220v if 220v unit), or get a voltage adapter to convert to the proper electrical system.
	Used wrong bulb.	Use the correct wattage bulb for the unit. Using a higher wattage than it is rated for can damage your unit (melt components with additional heat), so please be sure to use the correct one. Damage from incorrect usage is not covered under warranty.

7. General Microscopy Guide

Microscopes come in a wide variety of types with many different features. Each AmScope model is designed for specific uses and specific users. This glossary will help illustrate what the variations mean and why they are useful.

Compound and Stereo Microscopes

Using a compound or a stereo microscope depends on the specimen being studied.

Compound microscopes are best for smaller transparent specimens, like slides and biological subjects.
Compound microscopes show a two-dimensional image of the specimen (usually reversed and upside-down)

The common magnification range of our compound microscopes is between 40X-1000X, could be up to 2500X. You need a minimum of 400X to study cell structure.

Stereo microscopes are best for larger specimens you cannot see through.

Stereo microscopes show a 3D image. Three dimensional imaging is perfect for performing dissections, repairing circuit boards, studying fossils and gems or examining any specimen where you want to use your hands.

The magnification range of our stereo microscopes is between 2X to 225X.

Base Lens

Base lenses direct the light source towards the specimen.

Binocular Head-Rotating

A rotating binocular head is designed for maximum flexibility in viewing options.

Binocular microscope heads allow for the easy adjustment of the interpupillary distance (the distance between the eyes), by moving the eyepieces toward or away from each other.

The rotating feature allows for either forward or reverse view, depending on whether you'd rather look at the specimen or over it.

Condenser Lens

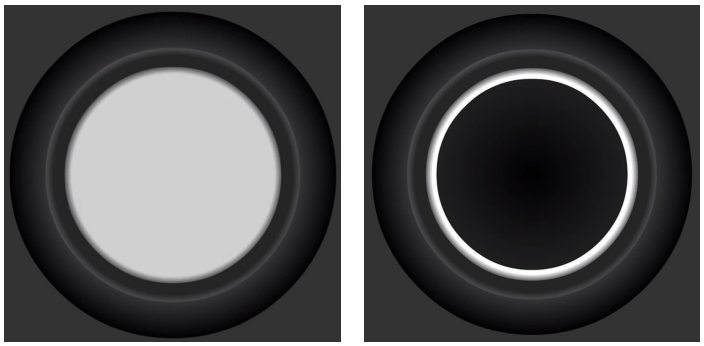
A condenser lens concentrates light on a specimen and increases the resolution. An adjustable iris controls the diameter of the beam of light entering the lens system. Abbe Condenser lenses are specially designed to mount under the stage.

Condenser Lens Adjustment Knob

The Condenser Lens Adjustment Knob changes the distance between the light condenser and the base lens. This allows you to control the concentration of the light hitting your slide.

Darkfield Condenser Lens

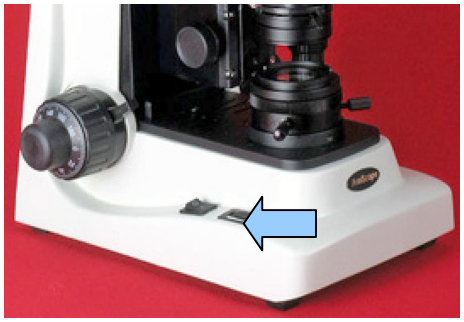
A darkfield condenser lens produces bright images against a dark background for low contrast biological specimens.



Brightfield **Darkfield**

With brightfield lenses, a solid beam of light illuminates the objective lens. Darkfield condenser lenses block the center of the beam of light to produce a hollow cone of light. Light does not enter the objective lens directly. The specimen scatters light, which then enters the objective lens.

Dimmer

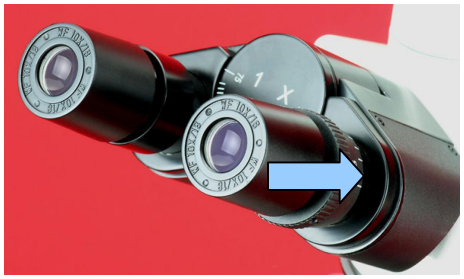


Dimmers control the amount of light escaping from the base lens.

DIN/JIS

DIN is the Deutsches Institut für Normung, the German Institute for Standardization, an international standards organization determining the "standard" for many types of technology. JIS is the Japanese Industrial Standard, specifying the standards used for industrial activities in Japan.

Diopter



Small ring on the eyetube, used to focus ocular lenses (eyepieces).

Eye Guards

Eye Guards fit over the eyepieces, they are for comfort and to protect the glass in the eyepiece.

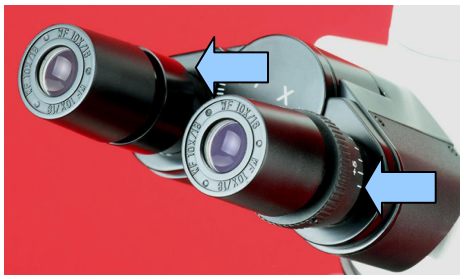
Eyepieces

Eyepieces are also called ocular lenses. Eyepieces come in many magnifications and you replace them by swapping them out of the eyetubes.

The eyepieces magnify the specimen further from the first magnification through the objective lens. Each eyepiece is marked with 2 numbers. The first number is the magnification and the second is the field of view.

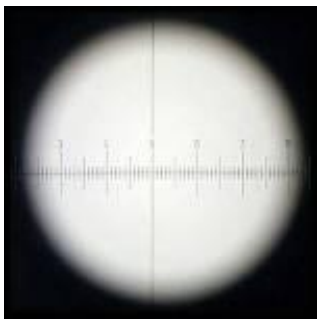
For example, an eyepiece marked WF10/20 has a magnification of 10X and a field of view of 20mm.

Eyetubes

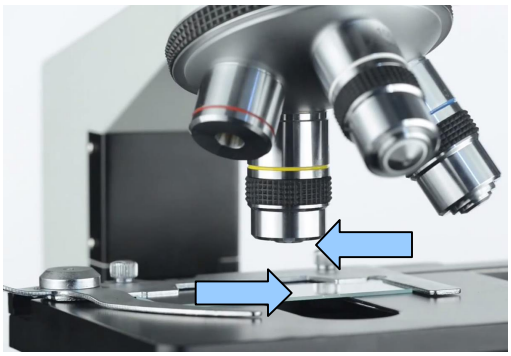


Eyetubes are also called ocular tubes. Eyetubes house the eyepieces and camera adapters. You change eyepeices by removing them from the eyetubes and replacing them with the new ones.

Field of View and Working Distance



Field of view is how much of the specimen you can see through the eyepiece. The linear field of view of the eyepiece is divided by the magnification of the objective. The higher the magnification, the smaller the field of view.



Working distance is the distance between the bottom of objective lens and the stage. You change the working distance when you use the coarse focusing knob.

Together, working distance and field of view determine how much of the specimen you see and how closely.

Focusing Knobs

Coarse Focus: This is the large knob on the side of the microscope that moves the objective lens up and down. It is used in conjunction with the fine focus. Do not use this knob with the 100X objective lens.

Fine Focus: The outer knob, used to fine-tune the focus of a specimen in conjunction with the coarse focus.

Head Types

Monocular

Monocular microscope heads have one eyepiece.

Binocular

Binocular microscope heads have two eyepieces.

Trinocular

Trinocular microscope heads have two eyepieces and a photo port for a camera. This allows you to look at a specimen with a camera without removing an eyepiece.

Multi-head

Multi head microscopes are specially designed for three-person observation. Ideal for teaching and/or training purposes. It has a binocular head and two monocular heads.

Simul-Focal

Simul-Focal heads mitigate the amount of re-focusing needed when you change your view from the eyepieces to the monitor.

Perfect for lectures, teaching demonstrations, clinical examinations and laboratory applications.

Immersion Oil

A special oil used with the 100X objective to concentrate the light and increase the resolution of the image. At high magnifications the field of view is so small that very little light passes. The light refracts, scatters and produces a dark image.

A drop of oil is placed on the slide's cover slip and the objective is lowered until it touches the oil. The oil will match the specimen's light refracting index to the lens, adding more light to the specimen, which improves resolution and clarity.

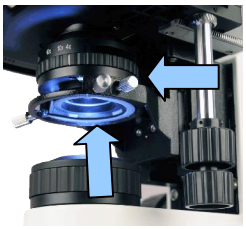
Interpupillary Distance

Interpupillary Distance is the distance between your eyes. AmScope uses 2 types of systems to change interpupillary distance.

Siedentopf heads adjust the interpupillary distance by rotating the eyetubes around a central axis. A Siedentopf head changes the interpupillary distance without changing the tube distance.

Jentsch heads adjust the interpupillary distance by moving the eyetubes closer together or farther apart in a linear fashion. The tube length changes when changing interpupillary distance, so the user compensates by adjusting the focus of the eyepieces to correspond to the new interpupillary distance.

Iris or Diaphragm



The diaphragm or iris is located under the stage and is an apparatus that can be adjusted to vary the intensity, and size, of the cone of light that is projected through the slide.

The iris adjustment slider allows you to adjust the opening of the iris.

Lenses

Microscopes have a two lens system, objective and ocular.

The Objective Lens is the lens closest to the specimen or object.

The Ocular Lens (Eyepiece) is the lens closest to the eye.

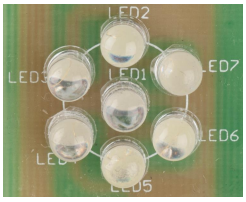
Light Bulbs-Caution

1. Turn off the microscope when not in use to preserve the life of the bulb.
2. Never touch a light bulb directly, especially when itôs turned on.
    a. The light bulbs can get hot enough to burn skin. Wait until the bulb has cooled completely before handling it.
    b. The oil from your skin will create a hot spot on the bulb which will damage the glass, dramatically shortening the life of the bulb.
    c. When changing light bulbs cover skin with cloth or paper to handle the bulb. This will protect both you and the bulb.
3. Hot bulbs will not damage the microscope. AmScopeôs microscopes are designed specifically to handle the heat output of the modelôs bulb.

Lighting-Types

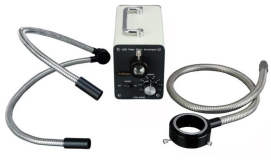
Tungsten
Tungsten light bulbs are the most economical, providing a reliable source of light. They burn hotter than the other bulbs, but are the best option for certain microscopes.

Fluorescent
Fluorescent bulbs burn cooler and brighter than tungsten bulbs. The bulbs are more expensive than tungsten, but
last longer.



LED
LED light bulbs burn the coolest of all the bulbs and last the longest. The bulbs are also the most expensive. Depending on use, LED lights should last about 40,000 hours.

Halogen
Halogen light bulbs produce the most amount of light. The light is very white and concentrated; the bulbs can get very hot and must be cooled regularly. Depending on use, halogen light bulbs can last anywhere from 1 week to 6 months.



Fiber Optic
Fiber optical lighting uses a system of flexible transparent fibers made of plastic or glass. The light is transmitted between the two ends of the fiber, allowing for greater illumination in confined spaces.

Limit Stop Knob

The limit stop is designed to prevent impact between objective and slide. You may loosen the limit-stop knob in order to give yourself the full range of motion for fine tuning the focus when using the 40X and 100X objective lenses.

When the limit stop is off you will be able to damage the microscope or the glass slide. For safety, engage the limit stop once you have it close or in contact with the objective (if using oil contact is required).

Magnification

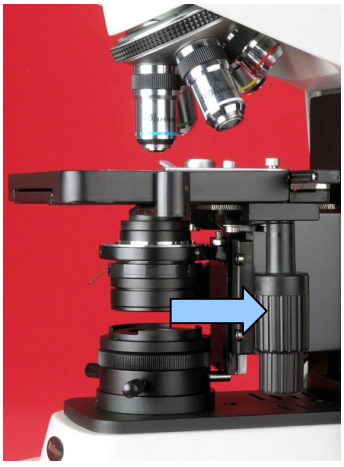
Microscopes have a two lens system. Total Magnification is the power of two lenses multiplied together.

E.g.: (10X Eyepieces) x (4X Objective) = 40X Total Magnification

Mechanical Stage

A Mechanical Stage is a flat mechanism that sits on top of the stage and allows the viewer to move a specimen small distances - a task that is otherwise difficult at higher magnifications. Most mechanical stages are equipped with an X and Y axis so the viewer can see how far the slide has moved.

Mechanical Stage Control



The mechanical stage control moves the stage, mechanically moving the slide along an X and Y axis for optimal positioning.

The top ring moves the stage forward and backward. The bottom ring moves the stage from left to right.

Nosepiece

This circular structure is where the different objective lenses are screwed in. To change the magnification power, rotate the turret.

Numerical Aperture (N.A.)

N.A. is a rating for the resolution of the objective lens. The N.A. rating ranks the objective lensôability to capture light and show fine detail.

Lens with larger numerical apertures capture finer details than lenses with smaller numerical apertures. Generally, lenses with larger numerical apertures create a brighter image, but the depth of field will be shallower.

N.A. Rating	
Objective Lens	Average Numerical Aperture
4X	0.1
10X	0.25
40X	0.65
100X	1.25

Parcentered

When changing objectives, the image of the specimen stays centered. Most compound microscopes are parcentered.

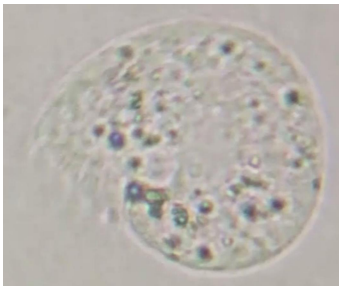
Parfocal

When changing objectives, the image of the specimen stays in focus without needing to adjust the coarse focusing knob. Not all compound microscopes are parfocal.

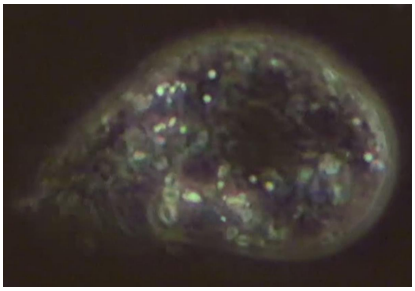
Phase Contrast

Many biological specimens are virtually transparent when viewed with a typical compound microscope. Phase contrast microscopy is a method that collects light from specific incidents (phases) of light only to allow better contrast in viewing transparent specimens.

Phase Contrast improves visibility by manipulating direct and diffracted light to produce greater contrast without losing resolution. The major benefit is the ability to study living cells in their natural state instead of killing them with stain.



Brightfield



Phase Contrast

Phase Contrast Condenser Lenses

A specific condenser with a ring printed on it, used for phase contrast. The magnification of the objective must match the magnification of the condenser. Condensers are used to concentrate the light from a transmitted light on a sample for illumination and viewing.

Phase Contrast Condenser Assembly

For phase contrast kits without a turret, the condenser assembly is the mount for the condenser lenses.

Phase Contrast Objective

A specific objective with a ring printed on it that is used for phase contrast.

The objective is the bottom lens that determines the resolution of the image in the microscope, and is one of the two lenses that compound to make total magnification.

Phase Contrast Turret

The phase contrast condensers are mounted on a rotating turret much like the objectives on a microscope are. The turret also has brightfield and darkfield condensers.

Telescope Lens-Centering

A lens that telescopes in one way or another, used in an eyepiece slot to assist in centering the light in phase contrast microscopy.

Tension Knob

The large, innermost ring on the focusing knob. Adjusts the tension of the focusing knobs.

Trinocular Port

A trinocular microscope has three viewing ports. There are two eyepieces and a third port for photography and video.

The trinocular port is a 23mm adjustable photo port.