Electron
Microscopy
Sciences

INSTRUCTION MANUAL

Inverted Microscope CAT. CP2A1

Model CP2A1

Electron Microscopy Sciences
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Introduction to the Inverted Microscope

The Inverted Microscope introduces a high optical standard on a versatile frame at budget-conscious levels. The long working distance condenser and objectives provide superb resolved images in both phase contrast and bright field techniques. The condenser swings out to accommodate roller bottles or other large cultivation vessels.

The Inverted Microscope provides its user with multiple advantages:

- **Affordability:** The Inverted Microscope delivers exacting performance for research without consuming your budget
- **Versatility:** Trinocular body for image documentation; condenser design for observation of virtually all vessel types; mechanical stage with inserts for well plates and petri dishes; three objectives for phase contrast and bright field
- **Durability:** An all metal frame with an all metal focusing mechanism ensures that the microscope will perform well beyond its warranty

Specifications

Optical body	Seidentopf Trinocular Head, inclined 30°, able to rotate a full 360° with 55mm t 75mm interpapillary adjustment. Left Eye diopter adjustment of -5 to +5. Multiple-coated transmission prism system.
Eyepieces	10X Plan wide field, Focal Length 25mm, Field 20mm. Phase Telescope Eyepiece.
Stage	Mechanical stage: (W x D) (in/cm) 8.25 x 8.875 / 20.95 x 22.54; Right-hand Coaxial dropdown X-Y Control Knobs Four Inserts for: well plates (13 x 8 cm and 8 x 5 cm) petri dish (6.8 cm diam.) and slides (7.5 x 3.5 cm and 7.5 x 2.5 cm).
Focusing mechanism	Brass Gear Train Focusing System; Adjustable Tension Control; Coaxial Coarse with Fine dial markings at 0.002mm increments; Adjustable Up-Stop to protect slides and specimens from damage.
Objective turret	Quintuple ball-bearing turret with positive click stops and smooth operation.
Condensers	Long working distance condenser with phase annuli; working distance 50mm. Rack and Pinion Focusing; easily centered with two adjustment knobs.
Illumination	30 watt, 6 volt Halogen bulb with electronic dimmer. Fuse: ½ Amp. 120 volt and 220 volt Models available.
Finish	Bone colored, baked-on enamel paint with "stipple" finish.
Body dimensions	17" High with 13"(D) X 8"(W) Base.
Body weight	21 lb.
Microscope includes	Dust cover, spare halogen lamp and spare fuse, 10X, 25X, 40X phase annulus.

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Objective Lens Specifications

Magnification	N.A.	Working Distance	Cover Glass	Field of View W/10X E.P.
10X Plan	0.25	8.1mm	----	1.8mm
25X Plan	0.40	4.8mm	1.2mm	0.72mm
40XR Plan	0.60	3.3mm	1.2mm	0.45mm
10X Phase Plan	0.25	8.1mm	1.2mm	1.8mm
25X Phase Plan	0.40	4.8mm	1.2mm	0.72mm
40X Phase Plan	0.60	3.3mm	1.2mm	0.45mm

Set-up Procedure

1. Unpack both Styrofoam boxes, the little box has optics
2. Install optics on frame, including:
    a. Head (biggest piece) Turn upside down and remove dust cap. Head sits on frame where black dust cap is located, so remove it by unscrewing thumbscrew
        i. Angle head slightly to help insert it under flange on frame, secure with thumbscrew
    b. Eyepieces, 2 each 10X
        i. Remove dust caps from head and eyepieces just slide in
    c. Objectives
        i. Remove dust caps from Objective turret on frame (see diagram) and thread 5 of the 6 objectives into the nosepiece
        ii. Generally, they go in order of magnification and most users leave out the 40X phase. (phase objectives say PHP on them and have two color stripes, brightfield objectives say PL and have only one color stripe)
    d. Remaining optical parts in this box will be used later, so keep close by
3. Plug it in and turn it on, ON/off switch on right side, bottom. Adjust dimmer to confirm brightness
4. Check condenser centering
    a. Use the 10X Brightfield objective and focus on a specimen or piece of paper
    b. Close the condenser diaphragm (see diagram) and look down onto top of the condenser. Look where the light is shining down. Is it centered in the middle, approximately?
    c. If not close to center, (may have moved in shipping) move bulb to bring into center

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i. To move the bulb, simply loosen the side thumbscrew to release bulb and move its position while looking down on condenser, then tighten thumbscrew

d. Fine tune centering
   i. Leave diaphragm closed and specimen in focus
   ii. Locate Field Iris diaphragm, under light box, left side, (see diagram)
   iii. Look through eyepieces and see circle of light
   iv. Close Field Iris diaphragm while looking into eyepieces. Circle should now be more defined
   v. Locate Condenser Focusing Knob (see diagram) and turn it while looking through eyepieces to get edge of circle in focus
   vi. If circle not in center of field of view, use Condenser Centering Screws (see diagram) to move circle. Must be looking through eyepiece when turning screws.

5. You are done.
6. If you wish, you can check to see the phase rings are centered.
   a. Find in optics box the 10X phase slider (black metal piece with screws on the end, says 10X) and insert this slider into Phase slider slot on condenser (see diagram) until you hear/feel a soft click
   b. Remove one eye piece and insert the Telescoping eye piece from the optics box
   c. Move 10X PHP, 2 yellow stripes, objective into light path
   d. Look through Telescoping eye piece and turn the top out (while holding its body) while looking through it to focus the rings
   e. Check to see the two rings are centered and overlap. If not, adjust screws on end of slider while looking through telescoping eyepiece. Repeat with other slider and objectives.

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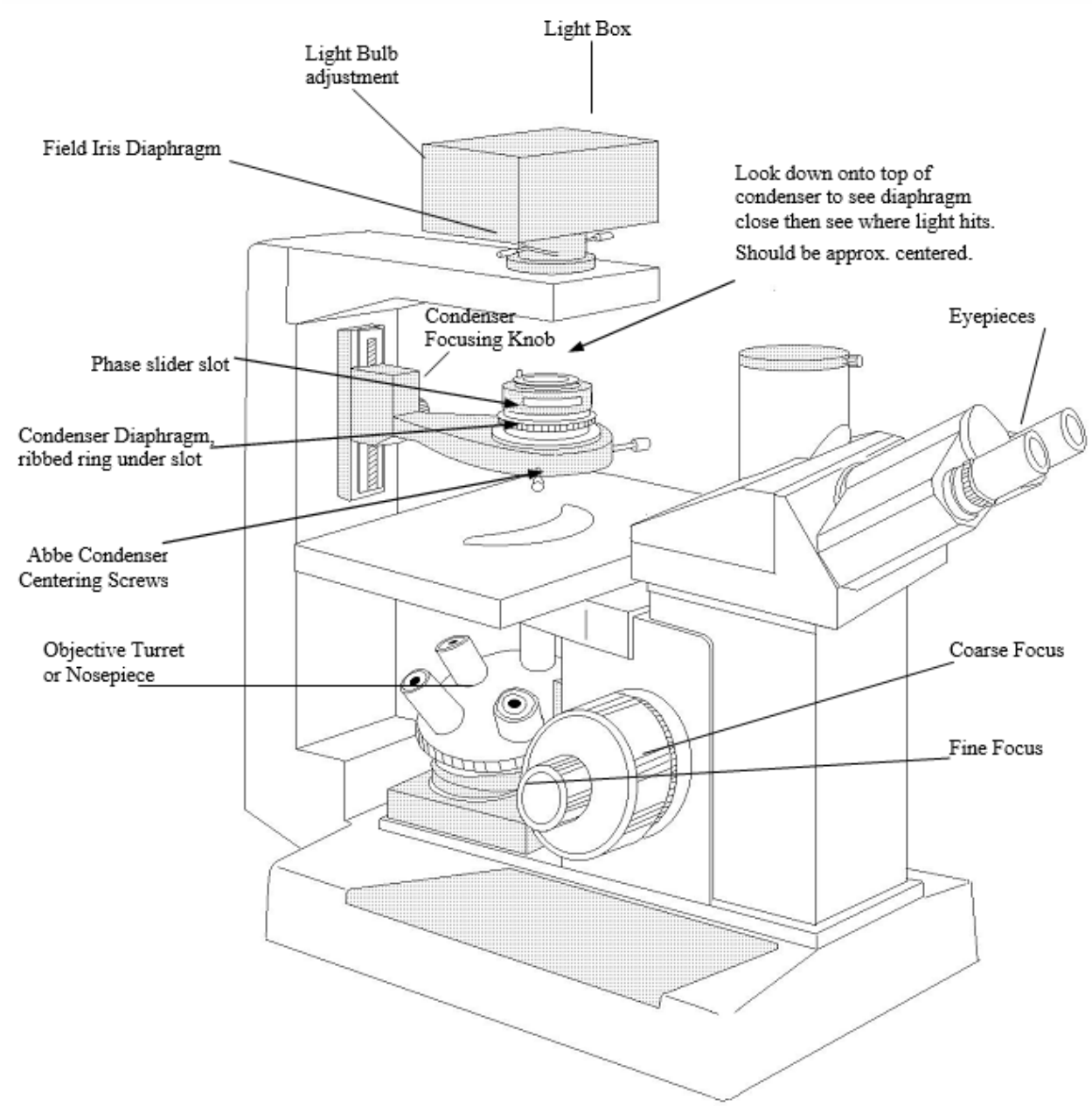
Figure of Inverted Microscope



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Basic Operations

Illumination controls:

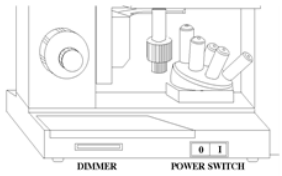
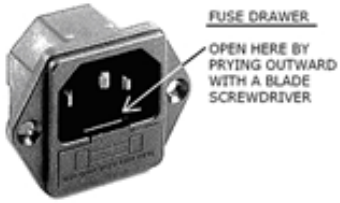


Figure 2

The power switch to the illuminator and the brightness control are located on the right side of the base. Turn on the light with the Power Switch, see Figure 2. If the light does not appear to be ON, check the brightness control to see if it's on a sufficiently high setting. The electrical system is fuse protected and the fuse holder, located in the power cord receptacle at the rear of the microscope, contains a spare fuse. The power cord must be disengaged to access the fuse holder

Interpapillary adjustments:



Proper interpapillary distance, or the distance between eyepieces, is crucial to the user's comfort. Adjusting the interpapillary distance is accomplished through a "folding" action of the Seidentopf design optical body.

Focusing controls:

(A) *Focus Control* - Turning either coarse focus control knobs will raise or lower the objective turret 3.6mm for one complete revolution. Turning either fine focus control knobs one complete revolution will raise or lower the turret 0.3mm. The smallest graduation on the fine focus knob index scale is 2um of vertical.

(B) *Focus Tension Adjustment* - The tension of the coarse focus is adjustable and preset at the factory for ease of use. If you wish to adjust the coarse focus tension, first locate the tension adjustment ring on the left knob between the frame and the knob. Turning the ring toward the rear of the microscope decreases tension, and toward the front of the microscope increases it, preventing drift.

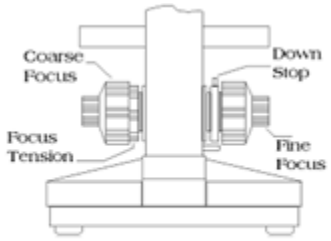


Figure 3

(C) *Focus or Down Stop Control* - Note: This control lever or tab, located on the right side of the frame, between the coarse focus knob and the frame, was pre-set at the factory. It may be necessary to release the stop to observe certain specimens, depending how or where they are positioned on the stage. Simply rotate the lever/tab down toward front of the microscope to the silver bar.

This feature insures that longer (higher magnification) objectives don't contact the

stage or specimen when focusing. Its use protects the objective from damage. To set this control, focus on a specimen with the coarse adjustment, rotate the lever up toward the rear of the microscope to set an upper limit on turret movement. After changing specimens or objectives, focusing is easily accomplished by rotating the coarse adjustment knob to reach the pre-set position, then making fine

adjustments with the fine adjustment knob. This feature does not control fine focus

adjustment, only coarse focus.

Diopter Adjustments:

Note: pre-set at factory at zero. This adjustment, located at the left eyepiece (2)

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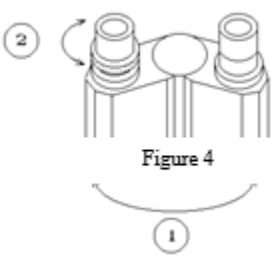
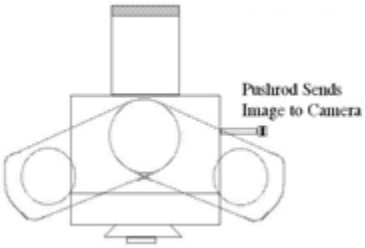


Figure 4

Figure 4, corrects for individual vision. Using the 40X bright field objective, your left eye and bring the specimen into focus. Once the image is well focused, close your right eye and check the focus with your left eye. If the image is out of focus, turn the ring (2) until crisp focus is achieved with your left eye.

This stage can be easily installed or removed by turning (with a coin or screwdriver) the three (3) silver thumb screws located underneath the stage on right hand side. The stage is designed to hold well plates and has two (2) inserts for slides and small well plates or petri dishes.

Trinocular Head:



The push rod on the right side of the Trinocular body controls where the image is sent. When the push rod is in the inward (factory preset) position, 100% of the image light will go to the binocular eyepieces. When the push rod is pulled out away from the frame, 100% of the image light will go to the top (photo) port.

Preparing for Use

Note: When your new microscope was shipped from the factory, the following features were pre-set: lamp centering, condenser centering, and phase annulus centering. This section describes how to check these elements or adjust in the event they became out of center during shipment. Centering these elements is key to proper microscope operation. Adjustments to the light condensing system are crucial for proper illumination and performance.

Lamp centering:

1. Refer to Figure 1. First, be certain the swing out condenser arm is positioned as far to the left as possible and the condenser arm is lowered to the bottom of its travel by turning the condenser vertical control knob counter clockwise. Turn on illumination and adjust to full brightness.
2. Place lens paper or other thin paper on top of the Abbe condenser. This will allow you to see the lamp filament on the paper after you close the field iris diaphragm (located on the left side of the lamp housing).
3. Move the field iris diaphragm lever to the rear of the microscope, then move the lamp focusing control (located on the right side of the lamp housing) until you see a sharp image of the filament. Note: You can also see the lamp filament without using paper by closing the condenser diaphragm and looking down into the condenser.

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4. If the filament image is not centered in the middle of the condenser, loosen the lamp set screw and move the bulb socket with the lamp centering knob to center. Retighten the setscrew.
5. Adjust the lamp focusing control to take the focus of the filament image slightly out of the focal plane. Reopen both the field iris diaphragm and condenser diaphragm.

Kohler Illumination Adjustment/Condenser Centering

1. There are three basic adjustments to be made: centering, vertical focusing, and aperture adjustment.
2. Place a prepared specimen slide on the stage and focus using the 10X Brightfield objective, yellow stripe.
3. While looking into the microscope, close the field iris diaphragm on the lamp housing, see Figure 1, until the iris leaves are visible in the field. Closing the iris in this manner reduces the field so that a small white circle is visible within a black field, as in Figure 6 (A).

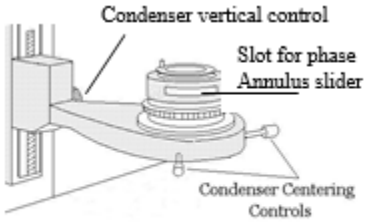

Figure 5

4. Using the condenser vertical control, see Figure 5, move the condenser assembly up and down until the image of the field iris diaphragm is as crisp as possible. The condenser should be near the top of the track.
5. This white circle is the light that is passing through the iris, and it should be centered in the black field, as in Figure 6 (B). If it is not centered, use the centering knobs, see Figure 5, in tandem, slightly turning first one then the other, while observing movement of the small white circle. You can fine-tune centering by opening the iris diaphragm until the white circle almost fills the entire field, as in Figure 6 (C), then slightly readjust to center if necessary. Once the condenser is centered and its height adjusted for optimum performance as described above, subsequent adjustment should not be necessary. The instrument's design requires the condenser be at optimal height and centered for effective phase contrast use.

Figure 6

Note: This microscope features a swing out condenser to accommodate large vessels. When you swing out the condenser you should move it up to allow for maximum space above the stage.

Aligning the Phase Annulus Rings

Phase contrast is a system that involves a pair of light-baffling annular rings. Precise alignment of these rings is necessary to achieve proper phase contrast. Having centered the condenser assembly as describe above, now you must center the phase annulus slider ring for each objective you wish to use. There are two (2) sliders, rectangular black pieces with 10X written on one and 25X/40X on the other

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1. First use the 10X Brightfield objective, one yellow stripe, to focus on a specimen. Then rotate the 10x phase contrast objective, two yellow stripes, into the light path, and install the 10x annulus slider into the condenser slot, See Figure 5. The slider enters on the right side of the condenser with the 10X writing up, and clicks into position when fully inserted, with the silver screws extending on the right and the empty hole visible on the left side of the condenser.
2. Remove one eyepiece and replace it with the phase centering telescope.
3. Looking through the phase centering telescope, turn the uppermost piece of the telescope while holding onto the middle of it, until the image is in focus.
4. The image seen through the telescope should look similar to Figure 7 A. What you are seeing are the phase annulus rings superimposed on one another. While continuing to look through the telescope, turn slightly, first one then the other, each of the slider centering screws, located on the right side of the 10X annulus slider, until the two phase rings are concentric, as in Figure 7B. Now, alignment of this objective is complete. Continue, using the same procedure to center the other two phase contrast objectives. No subsequent adjustment of the phase plates should be required.
5. Remove the telescope and replace it with the eyepiece. The phase contrast objectives are now ready for use.

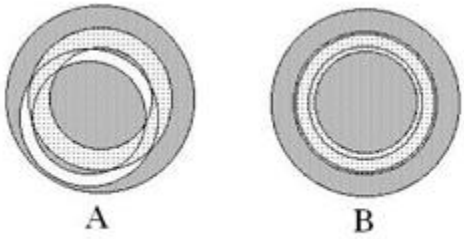

Figure 7

Replacing the Light Bulb

1. Turn off and unplug the microscope.
2. Loosen the lamp set screw, unscrew the lamp centering control lever, and remove the entire lamp socket from the lamp housing.
3. Take care not to touch the lamp with bare fingers, as the lamp may be hot. Remove the lamp by grasping the bulb and pulling it firmly from its fixture. Insert the new lamp, being careful not to touch the glass with your fingers. The

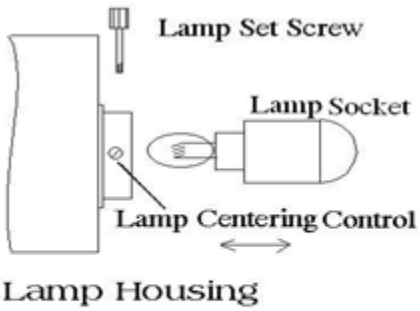

Figure 8

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new lamp should be supplied in a plastic protective envelope. If not, use a tissue or other medium to grasp the bulb to prevent contamination from your hand reducing the bulb's intensity and life.

4. Reinsert the lamp socket into the lamp housing and retighten the setscrew. Make certain the new lamp is placed squarely in the socket to insure that it will center properly in the field of view. You may need to re-center the lamp as previously described.

Preventative Maintenance

Cleaning Frame and Stage: Disconnect the plug from mains socket before cleaning. Clean the frame and stage with a soft cloth moistened with a mild detergent solution. Be sure the instrument is dry before using.

Cleaning Optical Parts: Microscope eyepieces and objectives are coated. They should not be wiped while dry as dirt or dust may scratch the coating. It is best to remove parts from the frame prior to cleaning. Always blow loose dust away first. Apply an optical lens cleaner to a cotton swab to minimize wetting, then wipe the surface clean with a good quality lens tissue. Solvents such as Xylene should NOT be used as a cleaner.

Cleaning 100x Oil Immersion Lens: The immersion oil should be removed from the lens at the end of each workday using cotton swabs or lens tissue moistened with a lens cleaner or a small amount of alcohol.

DO NOT DISASSEMBLE OBJECTIVE LENSES.

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