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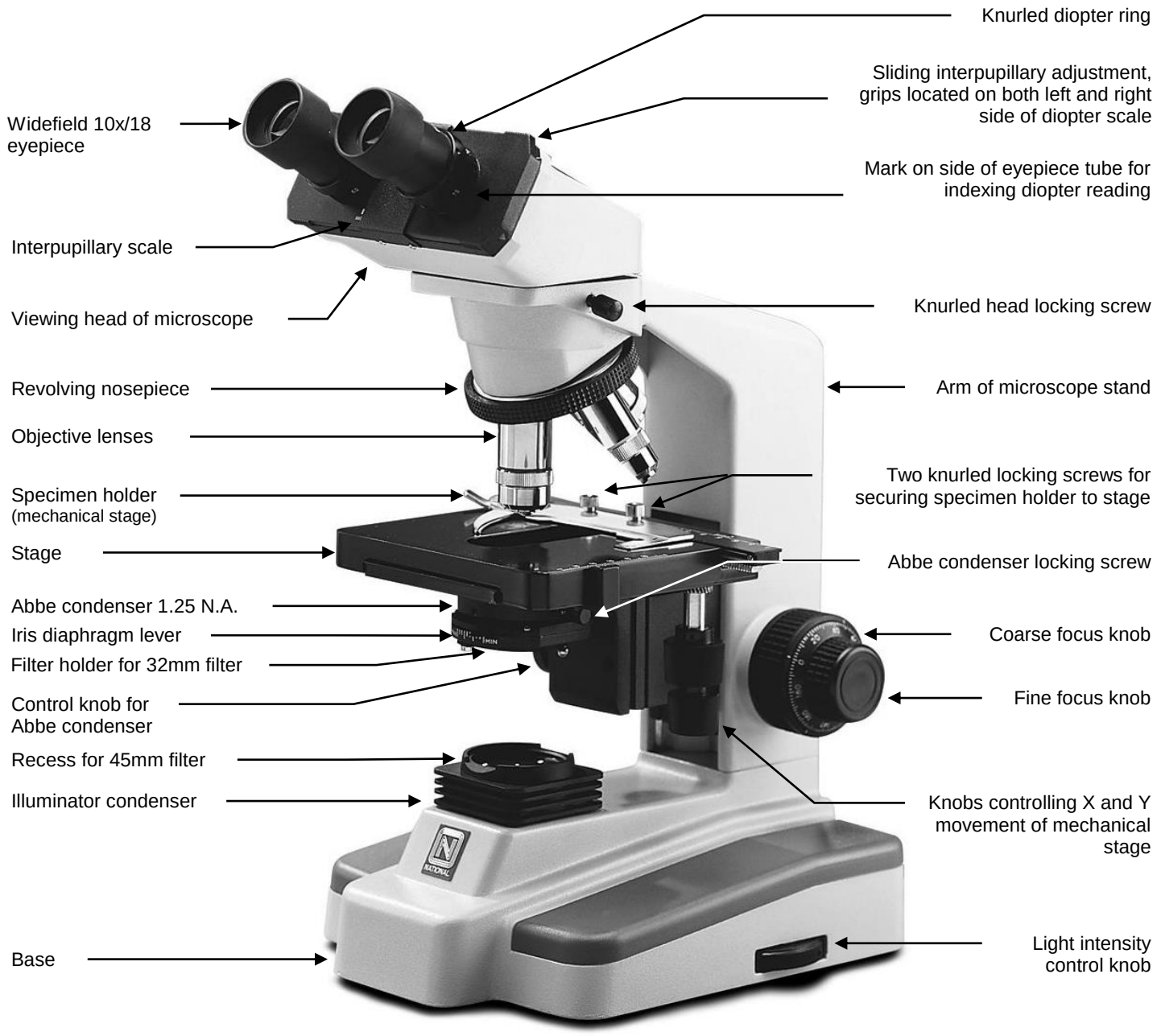
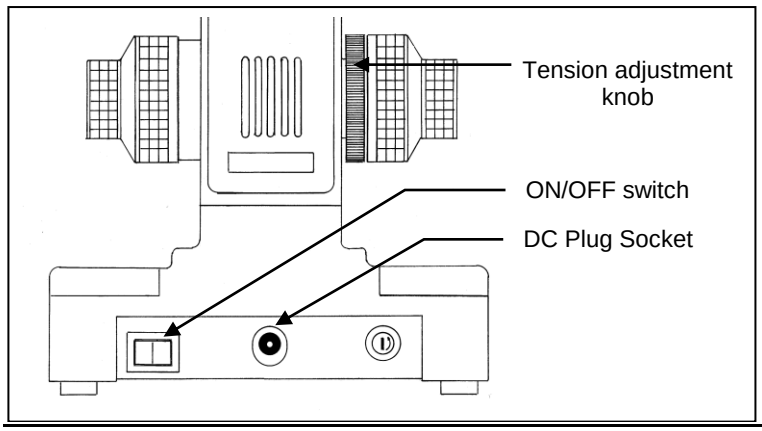
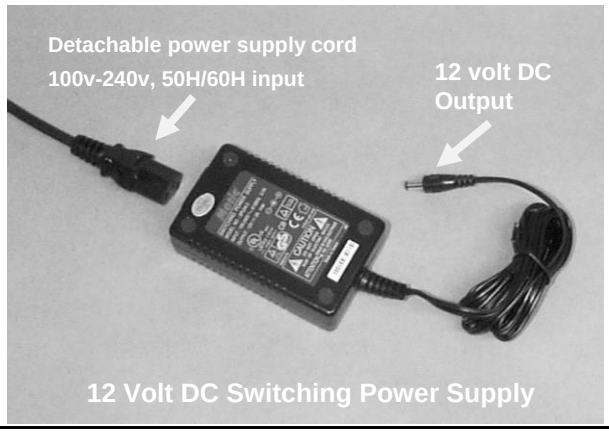
# INSTRUCTIONS FOR

# 160 SERIES

# COMPOUND BIOLOGICAL MICROSCOPES


Knurled diopter ring
Sliding interpupillary adjustment, grips located on both left and right side of diopter scale
Widefield 10x/18 eyepiece
Mark on side of eyepiece tube for indexing diopter reading
Interpupillary scale
Knurled head locking screw
Viewing head of microscope
Revolving nosepiece
Arm of microscope stand
Objective lenses
Two knurled locking screws for securing specimen holder to stage
Specimen holder (mechanical stage)
Stage
Abbe condenser locking screw
Abbe condenser 1.25 N.A.
Iris diaphragm lever
Coarse focus knob
Filter holder for 32mm filter
Fine focus knob
Control knob for Abbe condenser
Recess for 45mm filter
Illuminator condenser
Knobs controlling X and Y movement of mechanical stage
Base
Light intensity control knob


Tension adjustment knob
ON/OFF switch
DC Plug Socket


Detachable power supply cord
100v-240v, 50H/60H input
12 volt DC Output
12 Volt DC Switching Power Supply

## INTRODUCTION

Thank you for your purchase of a National microscope. It is a well built, precision instrument carefully checked to assure that it reaches you in good condition. It is designed for ease of operation and years of carefree use. The information in this manual probably far exceeds what you will need to know in order to operate and maintain your microscope. However, is provided to answer questions which might arise, and to help you avoid any maintenance expense that may be unnecessary.

Your new compound microscope is a high performance microscope with high quality achromatic objective lenses that provide good resolution and optical centering. The microscope is designed with a built-in ball bearing mechanical stage providing a travel range of 75mm x 50mm in the X and Y direction with graduation reading up to 0.1mm for accurate positioning of specimen. Also included is a ball bearing quadruple nosepiece, precision coaxial focusing mechanism, rack and pinion mounted N.A. 1.25 Abbe condenser and built-in 12 volt 20 watt halogen variable light source.

Carefully read these instructions before operating microscope. They will permit you to use your new microscope to its fullest capability. Nomenclature used to describe components and controls is identified by referring to diagram on page 2.

### I. UNPACKING

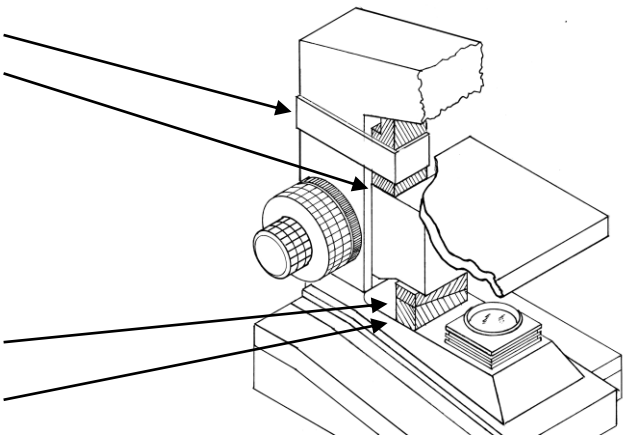
The microscope and accessories have been carefully packed to assure they reach you in the best possible condition. Do not discard the packing container or materials until all components are accounted for. Save the packing container in case the microscope needs transporting to another location or shipped for repairs. Components are packed within the container as indicated below.

| | |
|---|---|
| 160 Monocular: | Head and Stand, one eyepiece, one rubber eyeshield, 32mm blue, yellow and green filters, 45mm neutral filter, dust cover. |
| 161 Dual head: | Head and Stand, vertical viewing eyepiece tube, two eyepieces, two rubber eyeshields, 32mm blue, yellow and green filters, 45mm neutral filter, dust cover, 2mm “L” type key wrench. |
| 162 Binocular head | Head and Stand, two eyepieces, two rubber eyeshields, 32mm blue, yellow and green filters, 45mm neutral filter, dust cover. |
| 163 Trinocular head | Head and Stand, two rubber eyeshields. Vertical viewing eyepiece tube, 32mm blue, yellow and green filters, 45mm neutral filter, dust cover, and Three eyepieces. |

A. Lay container (A) flat and carefully remove microscope head and stand.

**NOTICE**

To protect focus mechanism during shipment, two black plastic wedges (b) and one black plastic block (c) are inserted at strategic points as indicated. These plastic parts **MUST** be removed prior to operating microscope. Failure to do so will result in damage to focusing mechanism and will void your warranty.



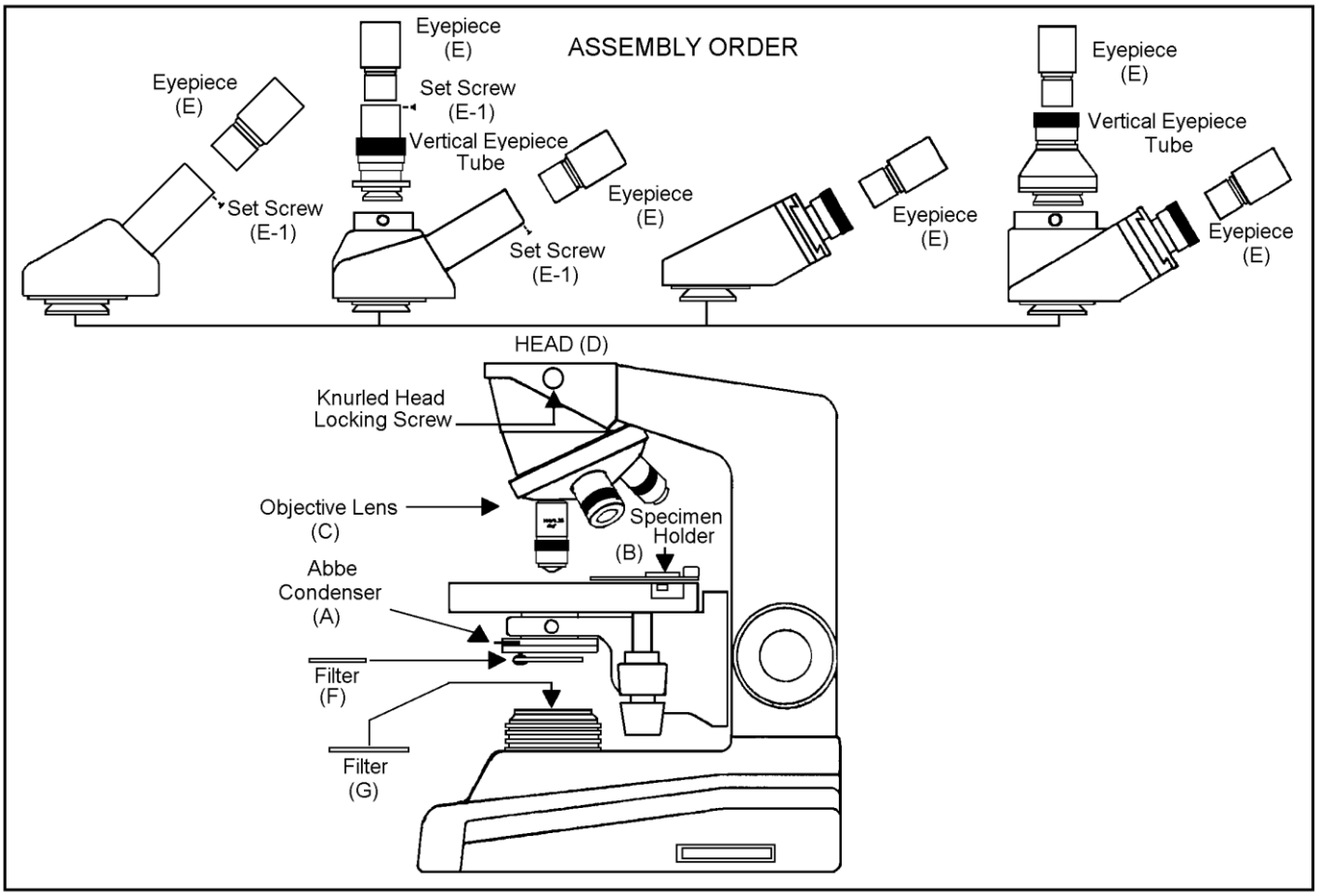

1. Remove two black Velcro straps (a).
2. Remove wedge (b) by pulling apart the two parts of wedge in opposite directions.
3. Lower stage by rotating coarse focus knob, on side of microscope illustrated, in counter-clockwise direction
4. Remove block (c) from stand.
5. These components should be retained with styrofoam container

B. Carefully remove from the stand all tape and packing material used to protect microscope components during shipment.

C. For Models 160, 161 and 162, lay container flat and carefully remove eyepieces, rubber eyeshields, vertical eyepiece tube (model 161 only), filters, and dust cover. For Model 163 trinocular only, lay container flat and carefully remove eyepieces, rubber eyeshields, vertical viewing eyepiece tube, filters, and dust cover.

D. Un-wrap the components, making certain that lens surfaces do not come in contact with dust, dirt, fingerprints. Damage to optical surfaces can result from such contaminants, and reduce image quality.

## II. **ASSEMBLY**




A. Abbe Condenser: Pre-mounted in unit.

B. Specimen holder: Pre-mounted on stage.

C. Objectives: Unless otherwise note, they are pre-mounted on the microscope.

D. Heads: On all series, the head comes pre-mounted to the body of the microscope. Position head so that it faces either forward or backward, whichever suits your preference or needs, and tighten knurled head locking screw.

1. Dual viewing teaching head - Mounting vertical eyepiece tube with diopter to head: Loosen knurled locking screw, remove black dust cap from vertical port. Insert vertical eyepiece tube with diopter into vertical port. Retighten knurled screw to secure vertical eyepiece tube in place.

2. Trinocular head - Mounting vertical eyepiece tube with diopter to head: Loosen knurled locking screw, remove black dust cap from vertical port. Insert vertical eyepiece with diopter into vertical port. Retighten knurled screw to secure vertical eyepiece tube in place.

    a. Trinocular head provided with a three position sliding rod to direct light through microscope. The three position sliding rod (b) allows user to easily direct microscope image into desired path.

1) Rod pushed completely into head; 100% of microscope image is directed to binocular eyepieces.
2) Rod at mid-position (pull or push rod until you feel a gentle click stop), 100% of microscope image is directed to trinocular port.
3) Rod pulled to fully extended position; 30% of image directed to binocular eyepieces, 70% directed to trinocular port.

E. Eyepieces: Remove the dust caps from eyepiece tubes. Avoid touching any lens surface.

Model 160: Using the provided .9mm hex wrench, loosen the eyepiece locking screw E-1. Insert eyepiece into the eyepiece tube. Tighten the eyepiece locking screw.
Model 161: Using the provided .9mm hex wrench, loosen the eyepiece locking screw E-1 on inclined eyepiece tube and vertical eyepiece tube. Insert eyepieces into eyepiece tubes. Tighten the eyepiece locking screws.
Models 162 and 163: Insert eyepieces into the eyepiece tubes.

F. Filter: Swing out filter holder and insert 32mm diameter blue filter.

G. Filter: Insert 45mm neutral filter into the recess located at top of illuminator condenser.

## III. **OPERATION**

A. Illumination.

1. Before operating microscope, **adjust intensity control located on side of base to the minimum position.** This should be done prior to each time light is turned on or off. This will extend bulb life.

2. Insert power plug into 12VDC switching power converter, then insert plug on other end of converter into power jack on back of microscope base. Note that the 12VDC converter will operate on either 120v or 240v current, 50 hertz or 60 hertz, eliminating the need for any other transformer.

3. Push rocker switch at rear of base to ON position.

4. Rotate intensity dial on illuminator base until image is illuminated.

5. Adjust intensity of light to match requirements of objective and specimen slide.

6. In case of equipment malfunction, see “Trouble Shooting” procedures.

B. Interpupillary adjustment of viewing head (Models 162 and 163 only)

1. Look through microscope and adjust distance between the two eyepiece tubes by grasping the sliding mounts to left and right of eyepieces and sliding together or apart.

2. When a full field of view is observed through both tubes, and images blend into one, interpupillary distance is corrected for your eyes. Check the interpupillary scale and note index reading for future reference, in case other users will be changing this adjustment from time to time.

3. Adjust the diopter scales, located on each eyepiece tube, to the same numerical value as indicated on the interpupillary scale. This must be done in order to maintain parfocality of objective lenses. If interpupillary distance is changed, adjust eyepiece diopters accordingly.

C. Focusing the microscope.

1. Position the 4x objective lens into the optical path, making sure that lens is properly indexed in its click-stop position.

2. Place standard specimen slide (cover slip up) on top of stage surface.

   a. Swing moveable finger on slide holder outward. Place specimen slide against fixed side of slide holder. Slowly release moveable finger until it makes contact with specimen slide.

3. Rotate coarse focusing controls until specimen comes into focus.

4. Adjust fine focus controls until specimen is in sharp focus.

5. Adjust diopter for difference in eyesight.

   a. Using right eye, peer into the right eyepiece tube. Adjust sharpness of image by utilizing fine focus controls.

   b. Using left eye, peer into the left eyepiece tube. Adjust sharpness of image by turning diopter adjustment located on left eyepiece tube.

6. Adjusting the aperture (opening) of iris diaphragm.

   Iris diaphragm should not be used to control the brightness of illumination, use light intensity control knob to adjust light level. Iris diaphragms are designed to help achieve high resolution of specimen and provide contrast in the image. Smaller apertures will deliver higher contrast to image. However, closing aperture too much will reduce resolution. Experimentation is the best method of determining the correct opening of diaphragm. Some suggested openings for iris diaphragm are:

| **OBJECTIVE** | **DIAPHRAGM OPENING** |
|---|---|
| 4x | 1/8 open |
| 10x | 1/8 to 1/4 open |
| 40x | 1/4 to 1/2 open |
| 100x | 1/2 to 3/4 open |

7. Changing magnification.

   a. Rotate revolving nosepiece to position 10x objective into optical path.

   b. This microscope has been parfocalized, which allows changes from one objective to another while requiring only a slight adjustment of the fine focus controls.

   c. When changing to the 40x and 100x objective lens, care must be exercised in order to prevent damaging the front lens element and specimen slide.

   d. In order to obtain maximum resolution of the 100x oil immersion lens, it is necessary to apply immersion oil between the coverglass of slide and front lens of the objective.

      1) **Use of a very small amount of immersion oil is required. Only the very tip of the lens should ever come in contact with the immersion oil. Oil should not come in contact with the white sealant ring on the objective. Excess use of immersion oil will ruin your objective and void your warranty.**

      2) All air bubbles must be removed from between lens and slide by rotating nosepiece back and forth.

**Objective Specification Chart**

| Objective | N.A. | Color Code Ring | Field of View | Magnification |
|---|---|---|---|---|
| Din 4X | 0.10 | Red | 4.5mm | 40X |
| Din 10X | 0.25 | Yellow | 1.8mm | 100X |
| Din 40X | 0.65 | Blue | 0.45mm | 400X |
| Din 100X | 1.25 | White | 0.18mm | 1000X |

8. When finished viewing, all parts that come in contact with oil must be cleaned. Failure to do so could permanently damage the 100x oil immersion objective lens. Use of Windex to clean immersion oil off lens surfaces is recommended.

9. Coarse focus tension adjustment.

   a. Tension adjustment knob is located between stand and coarse focus knob of microscope, on the right side.

   b. To tighten tension of coarse focus knobs, turn control in a counter-clockwise direction. It is advisable to leave controls as loose as possible, tightening only enough to keep stage from drifting down and out of focus. To loosen tension, turn control in clockwise direction.

## V. ADAPTING DIGITAL C-MOUNT CAMERA OR SLR CAMERA (to trinocular model only)

A. Trinocular model #163 is equipped with a port (a.) on top of head. By using optional accessory adaptors, either digital c-mount or SLR cameras can be mounted onto the microscope.

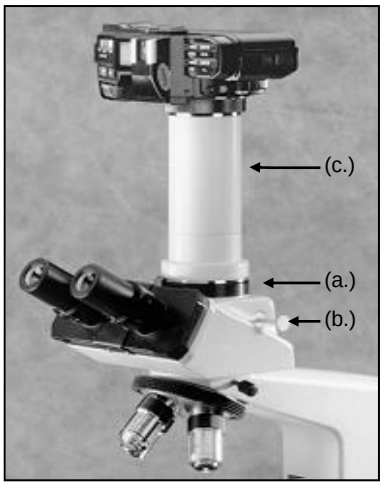
The three-position sliding rod (b.) allows use to easily direct microscope image into desired path.

1) Rod pushed completely into head; 100% of microscope image is directed to binocular eyepieces.

2) Rod at mid-position (pull or push rod until you feel a gentle click stop); 100% of microscope images is directed to trinocular port.

3) Rod pulled to fully extended position; 30% of image is directed to binocular eyepieces, 70% directed to trinocular port.

B. To mount SLR camera, an optional accessory SLR adaptor (c.) is required.




Listed below is the optional accessory SLR adaptor, which includes a 2.5x photo lens which needs to be inserted into the SLR adaptor. A wide range of T-mounts, are available from any camera store.

#930-163 SLR adaptor with 2.5x photo lens (fits Model 163 only)

Remove front lens of SLR camera. Attach appropriate T-mount in place of front camera lens. Screw threaded end of T-mount onto threaded end of SLR adaptor.

Locate knurled screw located on side of trinocular port on microscope. Turn screw counter-clockwise to permit removal of black plastic disk covering trinocular port.

Insert SLR adaptor tube, with camera already mounted to adaptor, into vertical port. If adaptor does not insert easily, further loosen knurled screw at side of port until adaptor tube drops into port and is firmly seated. Retighten knurled screw to secure adaptor and camera in place. Pull sliding rod (b.) until half way extended, to direct 100% of microscope image to trinocular port.

Proceed with operation of camera according to manufacturers directions.

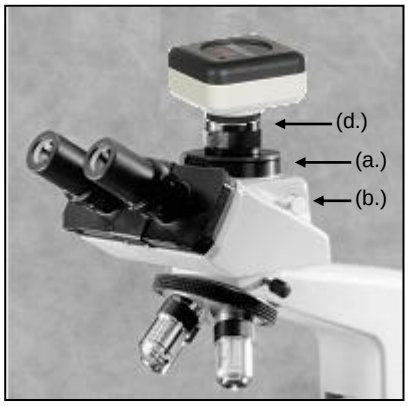
C. To mount a digital c-mount camera, optional accessory #930-005 video adaptor (d.) is required. This adaptor has a 0.5x lens which assures image parfocality when viewed through a video monitor.

Observe that video adaptor has two black knurled rings. If your digital c-mount camera has a 1/2 inch chip, leave both knurled rings in place, thereby creating a “CS” type mount. If your digital c-mount camera has a 1/3

inch chip, remove only the top black knurled ring from c-mount by turning counter-clockwise. The remaining black knurled ring is a “C” type adaptor.

Remove front cap from the digital c-mount camera. Thread front of camera onto threads of video adaptor (d.).

Locate knurled screw located on side of trinocular port (a.) on microscope. Turn screw counter-clockwise to permit removal of black plastic disk covering trinocular port.




Insert video adaptor tube into trinocular port. If adaptor does not insert easily, further loosen knurled screw at side of port until adaptor tube drops into port and is firmly seated. Retighten knurled screw to secure adaptor and camera in place. Pull sliding rod (b.) until half way extended, to direct 100% microscope image to trinocular port. Proceed with operation of digital camera and computer/monitor according to manufacturer’s directions. With the live image on the monitor, slowly rotate the knurled diopter on “C” adapter until image is in focus on monitor. If microscope image does not remain in focus when microscope magnification is changed, recheck digital c-mount camera chip size. Perhaps it will be necessary to either replace or remove the top “CS” adaptor ring in order for the video adaptor to be compatible with the chip size of your digital c-mount camera.

## VI. MAINTENANCE

**WARNING: FOR YOUR SAFETY, TURN SWITCH OFF AND REMOVE PLUG FROM POWER SOURCE OUTLET BEFORE MAINTAINING YOUR MICROSCOPE. TO AVOID SHOCK OR FIRE HAZARD, IF POWER CORD IS WORN, CUT OR DAMAGED IN ANY WAY, HAVE IT REPLACED AT ONCE.**

### A. OPTICAL MAINTENANCE

1. Do not attempt to disassemble any lens component. Consult an expert technical service company when repairs not covered by these instructions are required.

2. Prior to cleaning any lens surface, brush dust or dirt off lens surfaces using a camel hair brush. Or use air to blow dust and lint off surfaces. Use of compressed air in a can, available at any computer supply store, is a good source of clean air.

3. Cleaning eyepiece lenses.

   Do not remove eyepiece from eyepiece tube. Clean only the outer surface. Breathe on lens to dampen surface, then wipe with lens paper. Do not wipe lens surface while dry as lenses are scratched very easily. Wipe a circular motion from center to outer edges.

4. Cleaning objective lenses.

   Do not remove objective lenses from microscope. Clean front lens element only. Using a cotton swab saturated with distilled water, clean front lens surface. Inspect the lens using a magnifying glass to insure that the element is clean. If immersion oil or specimen material of any kind is evident, use a cotton swab dipped in a small amount of Windex to clean all foreign material from objective lens surface. Such material will reduce, or totally block, image quality.

5. Cleaning condenser lens.

   Clean only the top lens surface, visible when looking through hole in top of stage. Use same procedure as used for eyepiece or objective lenses.

6. Illuminator condenser lens.

   Use same procedure as used for eyepiece or objective lenses.

B. ELECTRICAL MAINTENANCE

**WARNING: FOR YOUR SAFETY, TURN SWITCH OFF AND REMOVE PLUG FROM POWER SOURCE OUTLET BEFORE MAINTAINING YOUR MICROSCOPE.**

1. Replacement of lamp.
   a. Carefully lay instrument on its side, taking care to avoid damage to the specimen slide holder located on top of mechanical stage.
   b. Loosen large chrome locking screw located on hinged door of illuminator base.
   c. Swing door open to expose the halogen lamp.
   d. Using a tissue or cloth to gently grasp the halogen bulb, pull straight out of lamp socket.
   e. Your microscope requires a 12 volt, 20 watt halogen bulb, available from the dealer from which you purchased your microscope. This is a common microscope bulb, Osram #64425.
   f. Make certain that new bulb is clean, as fingerprints on bulb can affect light transmission. Grasping bulb gently with a tissue or cloth, insert pins straight into lamp socket.
   g. Carefully clean lamp to assure that it is clean and free of all fingerprints.
   h. Close hinged door and tighten locking screw.

## MODEL 926 PHASE CONTRAST SET

### INTRODUCTION

Phase contrast microscopy provides a means to observe transparent specimens, which are very difficult to observe under bright field illumination. Another advantage of phase microscopy is that it allows the user to observe living specimens that are usually destroyed by staining or fixing reagents. The phase turret control has five positions; one for standard brightfield illumination and four different annuli positions for phase contrast illumination.

### COMPONENTS

Plan 10X Ph/0.25 phase din objective.
Plan 20X Ph/0.40 phase din objective.
Plan 40X Ph/0.65 phase din objective.
Plan 100X Ph/1.25 phase din objective.
Five position 1.25NA Phase turret condenser.
Centering telescoping eyepiece
Green filter, 45mm diameter
Blue filter, 45mm diameter

### ASSEMBLY

A. Install phase turret condenser

1. Rotate coarse focusing knob to move microscope state platform to its highest position.
2. Loosen knurled locking screw located on the side of microscope condenser mounting ring.
3. Insert the phase turret condenser sleeve into condenser mounting ring.
4. Tighten the knurled locking screw to secure phase turret condenser.

B. Install filter

1. Insert filter into filter recess located at top of illuminator lighthouse condenser lens.
   a. Blue filter is utilized for bright field observation.
   b. Green filter is utilized for phase observation.

C. Install objectives

1. Rotate coarse focusing knob to move microscope stage platform to its highest position.
2. Remove objective dust caps from the revolving nosepiece.
3. Screw objective lenses into nosepiece, making certain to mount them in consecutive order, 10x, 20x, 40x, and 100x.

**OPERATION**

A. Rotate condenser focusing control knob to move phase turret condenser to the top of its travel.

B. Rotate phase turret annuli control until the letters BF (brightfield) can be seen at front of phase turret condenser assembly. BF opening must click into locked position to insure proper centering.


C. Rotate revolving nosepiece to position 10X Ph/0.25 phase objective into optical path.

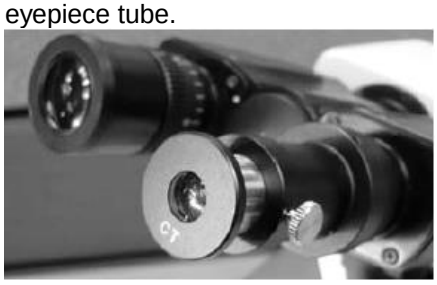
D. Place a standard specimen slide (cover slip up) on top of stage surface.

E. Adjust microscope focus controls until specimen is in sharp focus.

F. Remove specimen slide from stage.

G. Remove eyepiece from eyepiece tube, if binocular version remove one of the two eyepieces.

H. Install centering telescope eyepiece into eyepiece tube.




I. Loosen knurled locking screw located on side of centering telescope eyepiece.

J. Hold knurled locking screw with one hand, grasp very top of centering telescope eyepiece with other hand, peer through eyepiece while sliding sleeve up until the phase ring in the objective is in focus (sleeve is approximately 1" up from knurled locking screw).

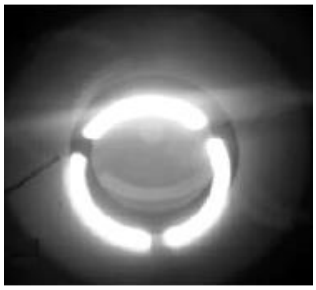
K. Tighten eyepiece knurled locking screw.

L. Rotate the phase turret annuli control until the number 10 can be seen at front of phase turret condenser assembly. Annuli must click into position to assure proper centering.


M. Using condenser focusing control knob, focus the bright annuli ring located in phase turret annulus condenser.

N. Observe the two rings in the field of view.

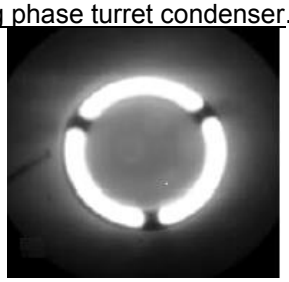
1. The dark larger annulus ring is located in the objective lens
2. The bright smaller annulus is located in the phase turret condenser.



O. Centering of the annuli:

P. Depress the two knurled head centering screws that extend out from each side of phase turret condenser assembly until they engage the hex socket screws of annuli centering mechanism.


Q. While keeping the two centering screws depressed, look through the centering telescope and observe rings located in objective and phase turret condenser. Rotate the centering screws in or out, moving image of the smaller bright annulus ring annuli located in phase turret condenser until it is centered to the larger dark annulus located in the objective. Both rings must be concentric to each other to achieve maximum performance. Make sure that the knurled head centering screws are disengaged from the hex socket screws of annuli centering mechanism and in the “out” position before rotating phase turret condenser.



R. Repeat above steps with the 20x, 40x and 100x phase objectives, making sure to position the corresponding annuli of phase turret condenser to matching objective indexed in optical path. (Plan 10Ph/0.25 matched to the number 10 on rotating phase turret condenser.)

S. It will be necessary to focus the telescoping eyepiece and phase turret condenser with each objective lens.

T. When you have adjusted all 4 annuli to their respective objective lenses remove centering telescope from eyepiece tube and install eyepiece.

1. Microscope is now ready for use.
2. The phase objectives will work well as standard bright field objective lenses. To view in bright field simply position the O position to the front of condenser turret and adjust condenser and iris diaphragm for standard use.

## CLEANING YOUR MICROSCOPE

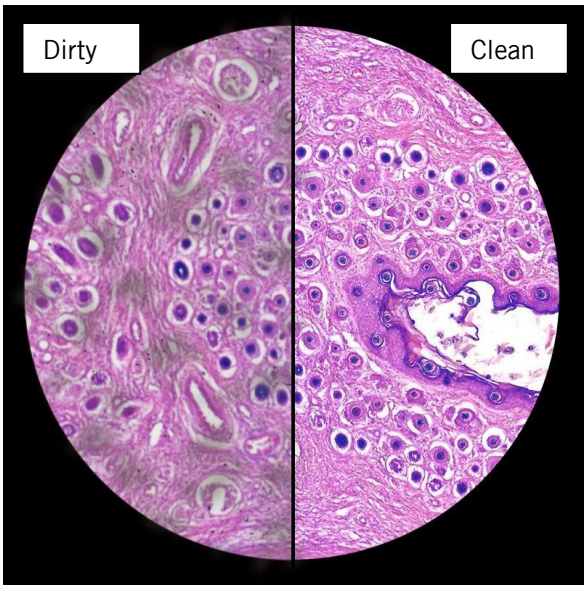
National microscopes are designed to function with minimal maintenance, but certain components should be cleaned frequently to ensure ease of viewing. The power switch should be turned off or the microscope should be unplugged when not in use.

**Do not disassemble your microscope**
Disassembly may significantly affect the performance of the instrument, and may result in electric shock or injury and will void the terms of the warranty.
Never attempt to dismantle any parts other than the ones described below. If you notice any malfunction, contact your nearest National Optical supplier.

**Optics**
Keeping the optics of your microscope clean is essential for obtaining clear images.
Choosing the best cleaning method depends on the nature of the optical surface and type of dirt.

Dirtiness on the image may be caused by the following variables:

- Dirt on the outer or inner eyepiece lens.
- Dirt on the front lens of the objective.
- Dirt on the upper lens of the condenser.
- Dirt on the surface of the sample slide glass.
- Dirt on the upper lens of illuminator.
- Dirt on other optical components of the microscope such as mirrors, lamps, filters, intermediate lenses …
  In the case of microscopes with a camera attached to it:
- Dirt on the camera adapter.
- Dirt on the protection filter of the camera sensor.
  For Eyepieces with reticules:
- Dirt on the outer or inner reticle glass.

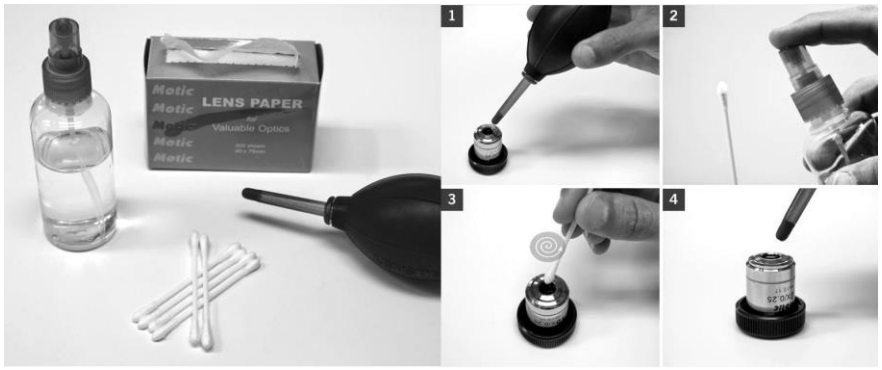



**Objectives** are the optical component of the microscope that require the most maintenance. Because for their actual use, they can get dirty easily.

For objectives that work without oil (dry): The first step is to carefully unscrew the objective from the nosepiece.

In order to make things easier and safer, screw the objective onto one of the objective cases supplied with microscope. By doing it this way, the objective will be in a stable position avoiding possible falls.

**(1)** Proceed by cleaning it using pressurized dry air - or an air gun if available – and, if after this is done we still observe spots of dust or dirt, **(2)** Clean with a cotton swab dampened with a low graduation of alcohol 70% or with a mixture of alcohol and ether (ratio alcohol: 3 to ether: 7). **(3)** With a spiral movement (starting from the center of the lens) we will then clean the surface of the lens. **(4)** Dry its surface by using pressurized dry air and check that the lens is clean either with the help of a magnifying glass or by screwing the lens back on the revolving nosepiece of the microscope.



**For objectives that work with immersion oil** it is essential to clean them after each observation session. To clean use a cleaning cloth for lenses slightly dampened with a low graduation of alcohol. Proceed by cleaning the frontal objective lens (normally 100X-Oil). It is important for those objectives that work at a very close distance to the sample.

**For optical components such as eyepieces, condensers, filters**, etc. we recommend using the same cleaning method. First cleaning it with pressurized dry air, then cleaning it with a cotton swab or a cleaning cloth for lenses (slightly moistened with a low graduation of alcohol) and finally drying it with pressurized dry air. Once the cleaning process is finalized if the image is still not clear, you can either contact us or you can contact your National Optical supplier.

**For users that have a digital camera mounted on the microscope** and whom observe dirt on the digital image, it is important that the first step is to proceed with objectives maintenance, as explained above. If the dirt persist, it must be determined if it is within the microscope or the camera. To check this simply loosen the adapter and rotate the camera. If the dirt rotates while turning it, then it means that it is in the microscope. If it does not rotate, then it is either in the adapter or in the protection filter of the sensor. If the dirt is on the surface lens of the adapter then you can use the same cleaning method that we have explained above, but if the dirt is in the protection filter of the sensor then use pressurized dry air only. If the dirt persist you can either contact us or you can contact your National Optical supplier.

**Mechanics**
The mechanical components of the microscope require less maintenance than the optical components. Our first maintenance advice is to **use the dust cover** provided with the microscope, to avoid the accumulation of dust on the microscope.

**To clean the stand or the specimen holder**, Use a cleaning cloth moistened with soap diluted in distilled water. After this proceed drying the entire surface of the microscope. Take special care with the electrical components of the microscope such as the ON / OFF switch, the dimmer, the lamp holder…
If there are grease stains, use the same cloth moistened with a low graduation of alcohol.

If you face any problems related to the maintenance of your microscope, please contact us. Our technicians will gladly help you solve your maintenance issue/s.

**CLEANING** – The front lens of the objectives (particularly the 100XRD) should be cleaned after use. The lens surface may be gently cleaned with a soft camel hair brush, or blown off with clean, oil-free air to remove dust particles. Then wipe gently with a soft lens tissue, moistened with optical cleaner (eyeglass or camera lens) or clean water. Immediately dry with a clean lens paper.

**CAUTION** - Objectives should never be disassembled by the user. If repairs or internal cleaning should be necessary, this should only be done by qualified, authorized microscope technician. The eyepiece(s) may be cleaned in the same manner as the objectives, except in most cases optical cleaner will not be required. In most instances breathing on the eyepiece to moisten the lens and wiping dry with a clean lens tissue is sufficient to clean the surface. Lenses should never be wiped while dry as this will scratch or otherwise mar the surface of the glass.

The finish of the microscope is hard epoxy and is resistant to acids and reagents. Clean this surface with a damp cloth and mild detergent.

Periodically, the microscope should be disassembled, cleaned and lubricated. This should only be done by a qualified, authorized microscope technician.

**DUST COVER AND STORAGE** – All microscopes should be protected from dust by a dust cover when in storage or not in use. A dust cover is the most cost-effective microscope insurance you can buy. Ensure that the storage space is tall enough to allow the microscope to be placed into the cabinet or onto a shelf without making undue contact with the eyepieces. Never store microscopes in cabinets containing chemicals which may corrode your microscope. Also, be sure that the objectives are placed in the lowest possible position and the rotating head is turned inward and not protruding from the base. Microscopes with mechanical stages should be adjusted toward the center of the stage to prevent the moveable arms of the mechanical stage from being damaged during storage in the cabinet.

## TROUBLESHOOTING

### ELECTRICAL

| PROBLEM | REASON FOR PROBLEM | SOLUTION |
|---|---|---|
| Light fails to operate | Outlet inoperative. | Have qualified service technician repair outlet |
| | AC power cord not connected. | Plug into outlet. |
| | Lamp burned out. | Replace lamp. |
| | Incorrect lamp used improper voltage or base. | Replace with specified lamp. |
| Light burns out too soon | The voltage is too high. | Adjust intensity control to the minimum position before turning the power switch on. |
| Light bulb burns out immediately | Incorrect lamp used. | Use proper lamp (12 volt 20 watt).<br>Plug unit into proper outlet 120v or 220v |
| Light flickers | Lamp not properly inserted into socket. | Properly insert lamp. |
| | Lamp about to burn out. | Replace lamp. |
| | Loose connection at AC outlet. | Have qualified service technician repair outlet. |

### IMAGE QUALITY

| PROBLEM | REASON FOR PROBLEM | SOLUTION |
|---|---|---|
| No image. | Nosepiece not indexed properly. | Move revolving nosepiece until objective lens clicks into position. |
| | Light too bright | Adjust light intensity control to a lower position. |
| Poor resolution.<br>(Image not sharp) | Objective lens dirty. | Clean objective lens. |
| | Eyepiece lens dirty. | Clean eyepiece lens. |
| | Slide upside down. | Turn specimen slide over (cover slip facing up). |
| | Cover slip on specimen slides too thick. | Use 0.17mm thick cover slip. |
| | Too much light. | Adjust light intensity control to a lower position.<br>Iris diaphragm not properly adjusted. |
| | Condenser lens dirty. | Clean condenser lens. |
| | Rack stop not set a proper position. | Adjust rack stop. |
| Spots in field of view. | Eyepiece dirty. | Clean eyepiece lenses. |
| | Specimen slide dirty. | Clean slide. |
| | Condenser lens dirty. | Clean lens of condenser. |
| Uneven illumination of field. | Nosepiece not properly indexed. | Revolve nosepiece into positive index stop. |
| | Diaphragm not properly indexed. | Adjust iris diaphragm to proper level. |

### MECHANICAL PROBLEM

| PROBLEM | REASON FOR PROBLEM | SOLUTION |
|---|---|---|
| Does not stay in focus. | Stage drops down | Adjust tension adjustment knob. |

## OPTIONAL ACCESSORIES AND PARTS:

| | |
|---|---|
| #610-160 | WF10X Eyepiece |
| #610-160R | WF10X eyepiece w/reticle, 10mm/100div. |
| #704-160 | DIN 4X objective lens, 0.10 N.A. |
| #710-160 | DIN 10X objective lens, 0.25 N.A. |
| #740-160 | DIN 40X objective lens, 0.65 N.A. |
| #799-160 | DIN 100X objective lens, 1.25 N.A. |
| #704-160ASC | DIN 4X Super High Contrast objective lens, 0.10 N.A. |
| #710-160ASC | DIN 10X Super High Contrast objective lens, 0.25 N.A. |
| #740-160ASC | DIN 40X Super High Contrast objective lens, 0.65 N.A. |
| #799-160ASC | DIN 100X Super High Contrast objective lens, 1.25 N.A. |
| #704-160P | DIN 4X Plan objective lens, 0.10 N.A. |
| #710-160P | DIN 10X Plan objective lens, 025 N.A. |
| #740-160P | DIN 40X Plan objective lens, 0.65 N.A. |
| #760-160P | DIN 60X Plan objective lens, 0.90 N.A. |
| #799-160P | DIN 100X Plan objective lens, 1.25 N.A. |
| #800-160 | Replacement bulb, 12v 20 watt halogen bi-pin |
| #926 | Phase contrast set: Centering telescope, PLAN/Phase 10x, 20x, 40x, 100xR (oil immersion) objectives, Phase turret condenser assembly including one brightfield position, blue & green filters, storage case |
| #930-005 | Video C-mount adaptor w/0.5x lens (for use with trinocular model only) |
| #930-163 | SLR photo adaptor w/2.5x photo lens (for use with trinocular model only) (T-mount not included) |
| #965-160 | Eyepiece reticle, 10mm/100 div. |
| #975-002 | Carrying case, anodized aluminum, fabric lining, accessory pockets, Velcro straps, keyed lock (Note: Will not accommodate microscope with camera attached) |
| #D-905 | Power Supply Converter (100-240V 47-63 Hz IN 12V, 2AMP OUT) with power cord |

## LIMITED LIFETIME WARRANTY

Please see our website, www.nationaloptical.com, for complete warranty details and exclusions.

(Revised 6/13/2016)