



National Optical & Scientific Instruments Inc.
6508 Tri-County Parkway
Schertz, Texas 78154
Phone (210) 590-9010 Fax (210) 590-1104

INSTRUCTIONS FOR
MODEL 104-CLED
ELEMENTARY COMPOUND MICROSCOPE

JOIN OUR SOCIAL NETWORK TO WIN!

 Like us on Facebook to enter a drawing for a **FREE** Swift Optical Instruments Lab Manual.*

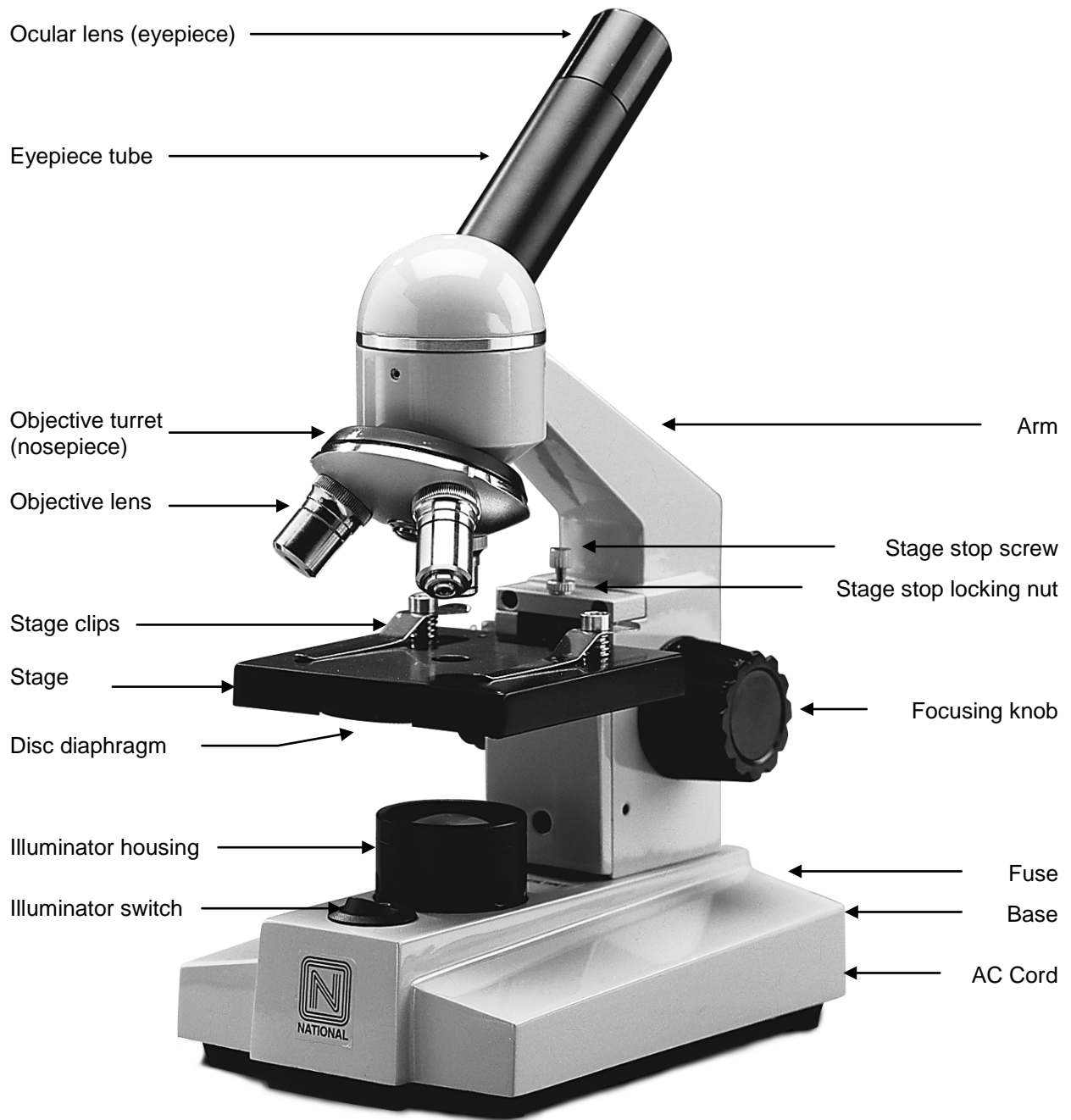
 Follow us on Twitter for a chance to win a **FREE** Motic digital camera.*

 Join our blog to discover what's happening in the science education industry and enter to win a Starbucks gift card.*

 A smart (phone) way to see us on the web.

*Drawings done monthly, winners will be posted on our website.

 **MICROSCOPES & DIGITAL IMAGING PRODUCTS**
Find out more at www.nationaloptical.com



INTRODUCTION

Thank you for your purchase of a National microscope. It is a well-built, precision instrument and 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, it is provided to answer questions, which might arise, and to help you avoid any maintenance expense that may be unnecessary.

Carefully read instructions before operating microscope. Nomenclature used to describe components and controls are identified on opposite page of the manual.

UNPACKING THE MICROSCOPE

Do not discard styrofoam container or packing materials. Save in case instrument needs to be transported or shipped for repairs. Remove microscope, dustcover, 0.90 mm "L" type hex key wrench and warranty card from container. Remove all tape and packing material used to protect microscope during shipment. Make certain lens surfaces do not come in contact with dirt, fingerprints or oil. Damage of lens surfaces occurs when they come in contact with such contaminants, and image quality is reduced.

DESCRIPTION OF COMPONENTS

- A. **OCULAR LENS** (eyepiece): Lens closest to the eye, magnifies the primary image formed by the objective lens. The inclined eyepiece is equipped with a "pointer" that rotates as the eyepiece is rotated.
- B. **OBJECTIVE LENS**: Lens closest to the specimen, forms the first magnified image of the specimen.
- C. **OBJECTIVE TURRET** (nosepiece): Revolving turret designed to hold objective lenses, permits changes of magnification by rotating different powered objective lenses into optical path.
- D. **STAGE CLIPS**: Two locked-on clips hold specimen slide in place on stage.
- E. **STAGE**: Platform of the microscope where the specimen slide is placed. Stage has a built-in condenser lens.
- F. **DISC DIAPHRAGM**: Rotating disc located below stage, with 6 holes of various apertures, designed to help achieve optimum resolution of the objective lens. Smaller apertures used for lower magnifications and larger apertures used for higher magnifications.
- G. **SAFETY STAGE STOP**: When properly adjusted, controls maximum upward travel of stage while focusing, prevents higher power objectives from breaking specimen slides, prevents damage to objective lenses. This safety stage stop has been pre-adjusted at the factory.
- H. **FOCUSING KNOBS**: Focusing knobs located on each side of arm, when turned, raise or lower stage to bring specimen into focus.
- I. **ILLUMINATION**: Built-in substage electric LED illuminator provides constant, pre-focused illumination equal to 20-watt tungsten bulb with 3-wire grounded AC cord.

OPERATION OF MICROSCOPE

- A. Always carry microscope by grasping arm with one hand and placing other hand under base.

- B. Place microscope directly in front of you in a manner which permits you to comfortably look into the eyepiece. Note that the head of the microscope rotates 360°, permitting you to operate the microscope from the front or the back, whichever is most convenient. Most users will position the microscope with the arm facing you so that focusing knobs are most convenient to reach.
- C. First, assure that light is available for illuminating the specimen.
 - 1. Make certain that the main voltage of your microscope corresponds to the voltage of your power outlet, 120V AC. Insert plug into matching voltage output.
 - 2. Flip switch located on base to ON position.
 - 3. In case of equipment malfunction, see Troubleshooting procedures located at the back of this manual.
- D. Rotate focus knobs to move stage down (away) from objectives as far as possible.
- E. Place specimen slide, cover slip facing up, on stage with specimen centered over lens in middle of stage.
- F. Rotate disc diaphragm to position the largest aperture under the hole in center of stage.
- G. Turn the objective turret until the 4x (smallest) objective lens clicks into position in the optical path.

Note that each time you change from one objective lens to another you should turn the turret until you hear the click, which indicates that the lens is properly indexed in the optical path.

- H. While looking through the eyepiece, rotate focusing knobs until specimen comes into focus. If image does not appear in field of view, move specimen slide slightly on stage until image appears in field of view.
- I. Turn the disc diaphragm, observing that different apertures affect the sharpness of the image. Turn diaphragm until sharpest possible image is obtained. When turning the disc diaphragm, you should hear a click as each aperture comes into proper position under the hole in center of stage. If aperture is not properly positioned, you will observe shadows in the field of view when looking through the microscope.
- J. Changing magnification
 - 1. Note that each of the three objectives has a different color ring. This permits the teacher to instruct the class to switch magnifications by referring to the color of the ring.

4x objective – “Red” color ring
 10x objective – “Yellow” color ring
 40x objective – “Blue” color ring

- 2. Total magnification obtained with each objective lens is determined by multiplying the magnification of the eyepiece times the magnification of the objective. Keep in mind that as magnification is increased, field of view (area of the specimen seen when looking through the microscope) decreases. You will find that you use the lower magnifications at most times. Always use the lowest magnification (4x objective) when first focusing on a new specimen slide, as this low magnification provides the biggest field of view, thereby making it easier to find and position the specimen within the field of view.

10x eyepiece x 4x objective = 40 times magnification. (biggest field of view)
 10x eyepiece x 10x objective = 100 times magnification. (smaller field of view)
 10x eyepiece x 40x objective = 400 times magnification (smallest field of view)

3. To change magnification:
 - a. Rotate revolving nosepiece to position 10x objective into optical path. Some slight adjustment of focusing knob may be required.
 - b. Rotate revolving nosepiece to position 40x objective into optical path. Some slight adjustment of focusing knob may be required.

Note: Take care when rotating 40x objective into place. This is the longest lens and has a spring retractable mechanism which retracts slightly into its housing if the front of the lens comes in contact with the specimen slide while focusing the microscope. This prevents damage to the lens or slide.

MAINTENANCE

WARNING: For your own safety, turn switch to OFF position and remove plug from power source before maintaining your microscope. If the power cord is worn, cut or damaged in any way, have it replaced immediately to avoid shock or fire hazard.

A. OPTICAL MAINTENANCE

1. Do not attempt to disassemble any lens components. Consult an expert technical service company when repairs not covered by these instructions are needed.
2. Prior to cleaning any lens surface, brush dirt and lint off lens surface with camel hairbrush or compressed air. Use of air in a can, available at most computer stores, is good source of clean air.
3. Do not remove eyepiece lens or objective lenses from microscope. Clean only the outer lens surface by breathing on lens to dampen surface, then wipe with lens paper or cotton swab. Avoid wiping lens surface while dry, as lenses are scratched very easily.

B. MECHANICAL MAINTENANCE

1. Stage stop adjustment: Stage stop has been pre-adjusted at the factory, and should not require readjustment.
2. Metal parts: Use a clean, damp cloth to remove dust or dirt from metal part followed by a dry cloth.

C. ELECTRICAL MAINTENANCE

1. Replacement of bulb (National #800-001) To open the illuminator field lens housing use 0.90mm "L" type hex key wrench supplied with your microscope to loosen hex screws on lens housing. Remove lens housing to expose LED "bulb". Remove bulb by grasping the plastic base of bulb and gently pulling straight up. Insert new LED "bulb", replace lens housing and tighten hex screw to secure lens housing in place.
2. Replacement of fuse (National #801-160) The fuse is located at right rear side of microscope base. To remove fuse from holder, insert a 6mm screwdriver blade into slot located in rear of fuse holder cap. Slightly depress and rotate screwdriver ¼ turn in direction of arrow to release the fuse. Pull cap and fuse out of fuse holder. Insert proper 0.5 amp fuse into fuse cap. Insert fuse assembly into fuse holder. Using screwdriver rotate fuse cap assembly in opposite direction of arrow until guide slot engages, depress fuse cap and rotate ¼ turn to lock into fuse holder.

TROUBLESHOOTING

PROBLEM	REASON FOR PROBLEM	SOLUTION
Light fails to operate.	Light switch in off position. Fuse blown. LED bulb burned out. Disc diaphragm has not “clicked” into proper position and is blocking light source beneath stage.	Turn light switch on. Replace fuse. Replace LED. Turn disc diaphragm until it “clicks” into position.
Image does not focus	Cover slip on specimen slide too thick. Slide upside down.	Use 0.17mm thick cover slip. (No. 1 cover slip) Place slide on stage with cover slip facing up.
Poor resolution (Image not sharp)	Objective lenses dirty. Eyepiece lens dirty. Too much light.	Clean objective lenses. Clean eyepiece lenses. Adjust disc diaphragm
Spots in field of view.	Eyepiece lens dirty. Specimen slide dirty.	Clean eyepiece lenses. Clean slide.

OPTIONAL ACCESSORIES AND PARTS:

#800-001 Replacement LED light
#801-160 Replacement fuse, 0.5 amps, time delay.

WARRANTY - 5 YEAR LIMITED WARRANTY

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

(11/28/06)