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INSTRUCTIONS FOR
MODELS 211 & 212 (Corded)
MODELS 211-RLED & 212-RLED (Rechargeable Cordless)
COMPOUND MICROSCOPES

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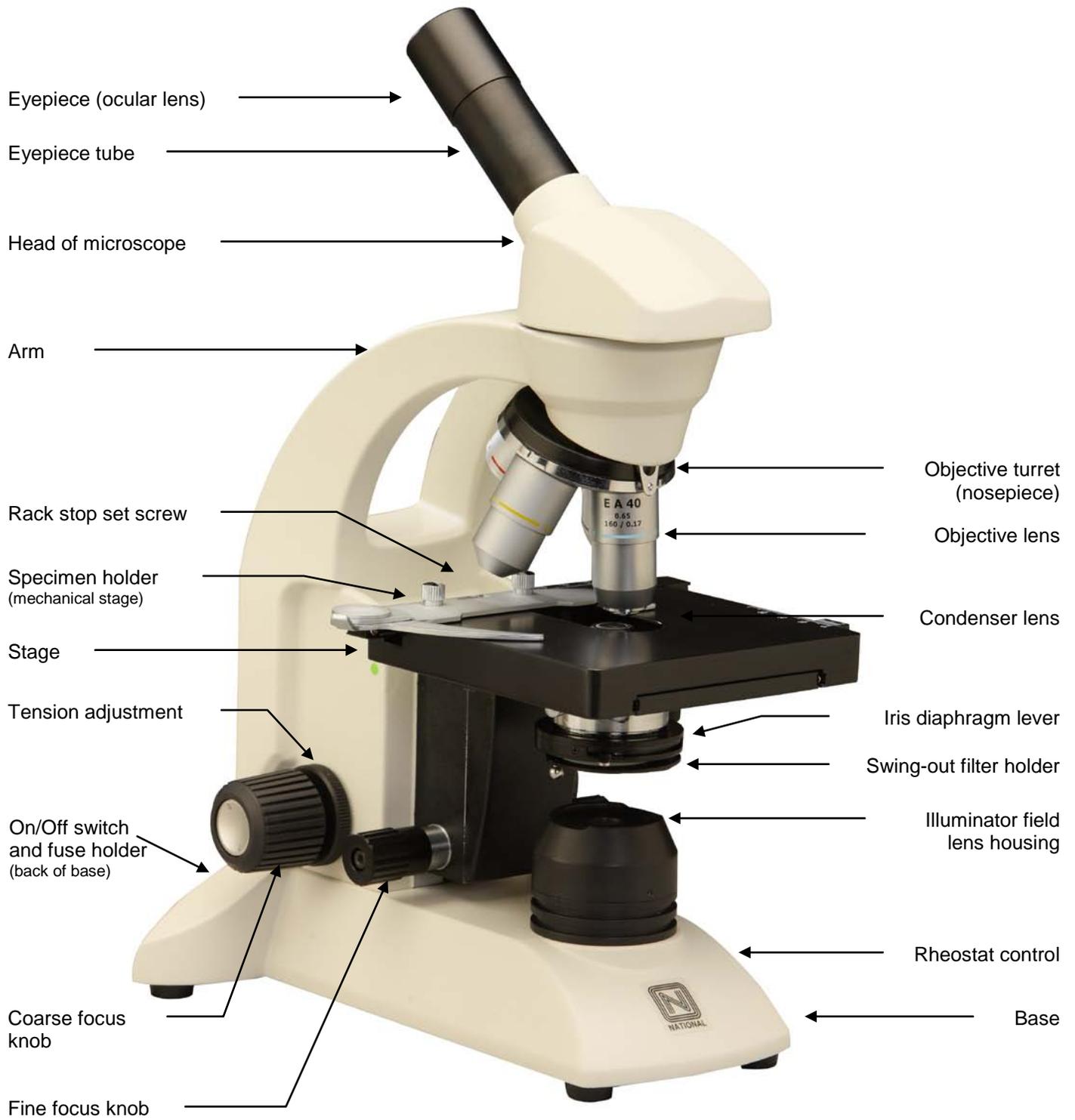
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For optimum viewing satisfaction, follow these simple procedures. Nomenclature used to describe components and controls can be identified by referring to the diagram at left.

UNPACKING

The microscope and accessories have been carefully packed to assure they reach you in the best possible condition. Examine packing material before you discard it. **Retain the styrofoam container in case you need to transport, store or return the microscope for repairs.** Always handle and move microscope by securely holding the arm of microscope. Avoid touching any of the lens surfaces while handling the microscope. Dust, dirt, or fingerprints can damage the delicate lens surfaces or adversely affect image quality.

Model 211/211-RLED: Stand with head, one WF10x eyepiece, 4x, 10x and 40x objectives, condenser, specimen holder, dustcover, 2mm "L" hex wrench (for rack stop adjustment), 0.90mm "L" hex key wrench (for eyepiece socket set screw, tension adjustment collar and for lamp replacement), auto cut-off recharger (RLED only).

Model 212/212-RLED: Stand with head, one WF10x eyepiece, 4x, 10x, 40x and 100x objectives, condenser, specimen holder, dustcover, 2mm "L" hex wrench (for rack stop adjustment), 0.90mm "L" hex key wrench (for eyepiece socket set screw, tension adjustment collar and lamp replacement), auto cut-off recharger (RLED only).

DESCRIPTION OF COMPONENTS

1. **EYEPIECE** (ocular lens) Lens closest to the eye, magnifies the primary image formed by the objective lens. The eyepiece is equipped with a "pointer" that rotates as the eyepiece is turned.
2. **OBJECTIVE TURRET** (nosepiece) Revolving turret which holds objective lenses, permits changes of magnification by rotating different powered objective lenses into optical path.
3. **OBJECTIVE LENS** Lens closest to the object being viewed, forms first magnified image of the specimen.
4. **MECHANICAL STAGE** Permits precise, mechanical manipulation of the specimen slide.
5. **STAGE** Platform of the microscope where the specimen slide is placed.
6. **CONDENSER LENS** 1.25 N.A. Abbe condenser lens positioned under center of stage, condenses light rays from substage illumination and fills the back lens element of objective lens to improve image resolution.
7. **IRIS DIAPHRAGM** Iris opening is controlled by lever, designed to help achieve optimum resolution of the objective lens. Larger apertures used for higher magnifications, and smaller apertures used for lower magnifications. Iris is protected by a frosted glass covering.
8. **FILTER HOLDER** Attached to bottom of iris diaphragm with swing out built in neutral filter. Swing out filter should be removed from optical path when using 40x and 100x objective lens.
9. **SAFETY RACK STOP** When properly adjusted, controls maximum upward travel of stage. Prevents higher power objectives from breaking specimen slides, prevents damage to objective lenses. This stop has been pre-adjusted at the factory.
10. **FOCUSING KNOBS** Coarse focusing knobs (larger knobs) located on each side of arm, raise or lower stage to bring specimen image into focus. Fine focus knobs (smaller knobs) located on each side of arm permit more precise image adjustment.
11. **ILLUMINATION:**

211 and 212: Built-in substage electric LED illuminator provides constant, reliable, pre-focused illumination equal to a 20-watt tungsten bulb.

211-RLED and 212-RLED: Built-in substage electric LED illuminator provides constant, reliable, pre-focusing illumination equal to a 20 watt tungsten bulb. Powered by 3 rechargeable AA nickel metal hydride batteries, no power outlet or electrical cord are needed.

ASSEMBLY

1. Specimen holder:
 - a. Rotate coarse focusing knob to move stage platform to its lowest position.
 - b. Remove two knurled screws from mechanical stage platform.
 - c. Place specimen holder on stage and using the two knurled locking screws, attach specimen holder to mechanical stage

OPERATION

1. Place microscope directly in front of you in a manner which permits you to comfortably look into the eyepiece. Note that the head of microscope rotates 360°, permitting you to operate the microscope from the front or from the back, whichever is most convenient for you. It also permits convenient sharing of microscope by more than one user, by simply rotating head, without needing to move entire microscope. Most users will position the microscope with the arm facing them so that focusing knobs are most convenient to reach.
2. Assure that light is available for illuminating the specimen.

211 and 212 Lighting Operation:

- a. 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.
- b. Push rocker switch located at rear of base to ON position.
- c. In case of equipment malfunction, see troubleshooting procedures located at the back of this manual.

211-RLED and 212-RLED Lighting Operation:

- a. Your microscope has special LED illumination that is powered by 3 rechargeable AA nickel metal hydride batteries (supplied). These batteries may be recharged, as required, using the recharger (supplied). Each set of batteries may be recharged approximately 500 times before replacing, and each charge will provide up to 50 hours of microscope operation. The LED component (bulb) will last for up to 50,000 hours before replacement is required.

WARNING

DO NOT USE regular AA alkaline batteries. Use of other than rechargeable AA nickel metal hydride batteries could result in batteries exploding during recharge. ONLY USE THE SUPPLIED SWITCHING BATTERY RECHARGER WITH AUTOMATIC “TRICKLE CHARGE”.

- b. It is recommended that you charge the batteries before initial use and after prolonged storage as the batteries may have discharged. Plug output cord from battery charger into DC recharging socket located on back of microscope base. Your automatic switching recharger operates on 100 to 240 volts AC 50/60 Hz. Plug recharger into your AC wall outlet. Battery recharger is also equipped with an automatic “trickle charge” feature, the red LED indicator lamp located on recharger will be illuminated when batteries are receiving maximum charge. After batteries are charged, the red LED indicator lamp will turn to green and charger automatically switches to “trickle charge”. The charger can be left plugged in, but for safety reasons it is a good idea to disconnect the charger from the AC wall outlet and the output cord from recharging socket after 12 hours. Batteries and charger may feel warm when charging, and unplugging the recharger is a safety precaution.

Note that your microscope can be used during recharging. **Simply turn “on/off” switch on back of microscope base to “on” position and proceed as follows.**

2. Rotate coarse focus knobs to move stage down (away) from objective lens as far as possible.
3. Position 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.
4. Swing moveable finger on slide holder outward. Place specimen slide (cover slip up) on top of stage surface against fixed side of slide holder. Slowly release moveable finger until it makes contact with specimen slide.
5. Turn rheostat (dimmer) control in direction to reduce illumination brightness to about mid-point. Normally, brightness will need to be reduced as magnification is reduced, and increased as magnification is increased. Experiment with this adjustment until optimum resolution and contrast of specimen is obtained.
6. Locate lever beneath stage that controls the iris diaphragm. Move lever until iris diaphragm is about half open. Normally, aperture of iris should become smaller for lower magnifications and larger for higher magnifications. Experiment with this setting until optimum resolution and contrast of specimen is obtained.
7. While looking through the eyepiece, rotate coarse focusing knobs until specimen comes into focus. If image does not appear in field of view, move specimen slide slightly until image appears in field of view.
8. Adjust fine focus controls until specimen is in sharp focus.

9. Changing magnification.

- a. Magnification is changed by rotating objective turret until a different objective lens is moved into optical path. Always turn turret until you hear the “click”, indicating that lens is properly indexed. Otherwise, you will not be able to see anything when looking through the microscope.

Model 211/211-RLED Objective Specifications

Objective	N.A.	Color Code Ring	Field of View	Working Distance	Magnification with WF10X eyepiece
Din 4X	0.10	Red	4.5mm	18.5mm	40X
Din 10X	0.25	Yellow	1.8mm	6.4mm	100X
Din 40X retractable	0.65	Blue	0.45mm	0.5mm	400X

Model 212/212-RLED Objective Specifications

Objective	N.A.	Color Code Ring	Field of View	Working Distance	Magnification with WF10X eyepiece
Din 4X	0.10	Red	4.5mm	18.5mm	40X
Din 10X	0.25	Yellow	1.8mm	6.4mm	100X
Din 40X retractable	0.65	Blue	0.45mm	0.5mm	400X
Din 100x retractable	1.25	White	0.18mm	0.06mm	1000X

- b. Also note that each objective has a color ring, which permits you to instruct changes in magnification by referring to an easily observed color rather than to a number.
- c. The microscope has been parfocalled at the factory, which allows easy change from one magnification to another, requiring little or no adjustment of the fine focus knobs.
- d. As magnification is increased, the field of view (area of specimen seen through the microscope) will decrease. That is why it is easier to find the specific area of interest on the specimen by starting with the lowest 4x objective lens, before increasing magnification with the higher power objective lens.
- e. NOTE: Care must be taken when rotating the 40x and 100x objective lenses into place. These lenses have a spring retractable mechanism, which retracts slightly into its housing if the front of the lens, strikes the specimen slide. With fine focus adjustment at mid-range, the rack stop has been adjusted at the factory to assure the 40x and 100x lens will clear the thickness of a normal specimen slide and cover slip. However, if the rack stop has been improperly adjusted, or if using a thicker than normal slide or cover slip, moving the 40x and 100x lenses too quickly or carelessly could cause damage to the front lens element or to the slide. Remove swing out filter from optical path when using the 40x and 100x objective lens.
- f. In order to obtain maximum resolution of the 100x oil immersion lens, it is necessary to apply immersion oil between the cover glass of slide and front lens of the objective. Use a very small amount of immersion oil. All air bubbles must be removed from between lens and slide by gently rotating nosepiece back and forth.

When finished viewing, all parts that come in contact with oil must be cleaned. Failure to do so could permanently damage the 100x immersion objective lens.

Do not let the front lens element of the 40x objective lens come into contact with a wet slide surface, as prolonged contact with any moisture could damage the lens. If lens is exposed to moisture, promptly wipe with soft tissue to remove moisture.

MAINTENANCE

WARNING

211/212: For your own safety, turn switch to OFF position and remove electrical plug from power source.

211-RLED/212-RLED: For your own safety, make certain that battery recharger is unplugged and removed from microscope jack before maintaining your microscope.

1. OPTICAL MAINTENANCE

Do not attempt to disassemble any lens components. Consult a microscope service technician when any repairs not covered by instructions are needed.

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.

Do not remove eyepieces or objective lenses to clean. Clean only the outer lens surface. Breath on lens to dampen surface, then wipe with lens paper or tissue or use a cotton swab moistened with distilled water. Wipe lenses with a circular motion, applying as little pressure as possible. Avoid wiping dry lens surface as lenses are scratched easily. If excessive dirt or grease gets on lens surfaces, a small amount of Windex can be used on a cotton swab or lens tissue. To clean objective lenses, do not remove objectives from microscope. Clean front lens element only, following same procedure.

NOTE: Fingerprints or other matter on the front lens element of the objective lens is the single most common reason that you will have difficulty in focusing the microscope. Before having costly servicing done, or before returning to National for "warranty repair", make certain to examine the front lens element with a magnifying glass or eye loupe for the presence of such contaminants. If a microscope is returned to National for warranty repair, and it is determined that such contaminants are the problem, this is not covered under warranty and National will submit a cost estimate for cleaning.

2. MECHANICAL MAINTENANCE

- a. The rack stop screw has been pre-adjusted at the factory and should not require re-adjustment. However, if you do attempt re-adjustment, note the following procedure.

Using a 2mm "L" type hex key wrench, loosen rack stop hex socket set screw by rotating in a counterclockwise direction. With fine focus adjustment at mid-range, focus on a standard slide until sharp image is obtained. Rotate rack stop screw in clockwise direction until tight

- b. Coarse focus tension adjustment prevents the stage from drifting down from its own weight and causing the image to move out of focus. This has been adjusted at the factory, but over the course of time it may loosen and cause the stage of the microscope to slip downward on the focusing block.

The tension adjustment collar is located between arm and coarse focus knob on left side of microscope. With 0.90mm "L" type key wrench, loosen the set screw located in the hole on tension adjustment collar. Turn collar clockwise to tighten tension, counter-clockwise to loosen tension. Use of a wide rubber band will provide a better grip on the tension adjustment collar. After adjusting, tighten the set screw to lock collar in place.

NOTE: It is recommended that you leave the tension as loose as possible for ease of focusing, yet not so loose that it permits the stage of microscope to drift downward from its own weight and cause the microscope to "drift" out of focus.

- c. Metal parts: Use a clean, damp cloth to remove dust or dirt from metal parts, followed by a dry cloth.

3. ELECTRICAL MAINTENANCE

211/212 Maintenance:

- a. Replacing LED element:

An LED "bulb" will last up to 50,000 hours so you don't have to do this exercise very often.

To open the illuminators field lens housing, use 0.9mm "L" type hex key wrench supplied with your microscope. 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.

- b. Replacement of fuse:

The fuse is located at the rear right 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, release pressure on screwdriver to release fuse. Pull cap and fuse out of fuse holder. Insert proper fuse into fuse cap. Insert fuse cap into fuse holder. Using screwdriver, rotate fuse cap assembly in opposite direction of arrow until slot engages, depress fuse cap and rotate ¼ turn to lock into fuse holder.

211-RLED/212-RLED Maintenance: The extent of electrical maintenance, by other than a qualified technician, should be LED replacement, battery recharging and battery replacement. Before maintenance, be sure that recharger is not connected to microscope.

- a. Recharging batteries:

Plug output cord from battery charger into DC recharging socket located on back of microscope base. Your automatic switching recharger operates on 100 to 240 volts AC 50/60 Hz, plug recharger into your AC wall outlet. The red LED indicator lamp located on recharger will be illuminated when batteries are receiving maximum charge. After batteries are charged, the red LED indicator lamp will turn to green and charger automatically switches to "trickle charge". The charger can be left plugged in, but for safety reasons it is a good idea to

disconnect the charger from the AC wall outlet and the output cord from recharging socket after 12 hours. Batteries and charger may feel warm when charging, and unplugging the recharger is a safety precaution.

You may operate the microscope light even while it is being recharged. Simply flip light switch to “on” position and continue using microscope while the recharger is fully engaged.

b. Replacing batteries:

Your microscope includes 3 rechargeable AA nickel metal hydride batteries. These may be recharged up to 500 times, but if you observe that a recharge is providing significantly less than 40 hours of operation. It is probably time to replace to batteries.

IMPORTANT WARNING: DO NOT USE REGULAR ALKALINE BATTERIES IN THIS MICROSCOPE. ANY ATTEMPT TO RECHARGE ALKALINE TYPE BATTERIES COULD RESULT IN BATTERIES EXPLODING.

Gently lay microscope on its side or back. Observe small door in center of microscope bottom base. Loosen slotted screw on door and open. Battery case is mounted on inside of door. Using small Phillips screwdriver, carefully remove Phillips screw that holds battery case together. Slide lid of case straight out to remove and expose batteries. Remove all 3 batteries and replace with new rechargeable AA nickel metal hydride batteries, making certain to insert with correct polarity according to markings on battery holder. Replace lid, close and secure door.

Follow instructions on new battery packaging to determine if they are already charged, or if they should be charged before initial use. If recharging is required, following directions in “3.a” above.

c. Replacing LED element:

An LED “bulb” will last up to 50,000 hours, so you don’t have to do this exercise very often.

To open the illuminators field lens housing, use 0.9mm “L” type hex key wrench supplied with your microscope. 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.

TROUBLESHOOTING

PROBLEM	REASON FOR PROBLEM	SOLUTION
Light fails to operate.	Batteries fully discharged.	Recharge batteries.
	Rheostat control not turned far enough.	Turn rheostat to increase light intensity.
	Light switch in ‘off’ position.	Turn light switch on.
	LED “bulb” burned out.	Replace LED “bulb”.
	Fuse Blown	Replace Fuse
Image does not remain in focus	Stage of microscope drops from its own weight.	Adjust tension control.
Image will not focus	Rack stop not set at proper position.	Adjust rack stop.
	Slide upside down.	Place slide on stage with cover slip up.
	Slide cover slip too thick.	Use 0.17mm thick cover slip (No.1 cover slip)
Poor resolution (image not sharp)	Objective lenses dirty.	Clean objective lenses.
	Eyepiece lens dirty.	Clean eyepiece lenses.
	Too much light.	Adjust diaphragm.
Spots in field of view.	Eyepiece or condenser lens dirty.	Clean lens. ***
	Specimen slide dirty.	Clean slide.
***Spots in field of view can also result from dirt on inside of eyepiece. It is recommended that you have service technician clean inside of lens.		

OPTIONAL ACCESSORIES AND PARTS:

- #610-045R WF10x eyepiece w/reticle, 10mm/100div.
- #615-045 WF15x eyepiece w/pointer
- #760-045 DIN 60xR objective lens, N.A. 0.90
- #800-001 Replacement LED light
- #802-003 Auto cut-off recharger for rechargeable LED microscopes
- #801-160 Replacement fuse, 0.5 amp, time delay
- #951 Dustcover, 16" tall x 13", heavy vinyl with stitched seams.
- #975-001 Carrying case, anodized aluminum, fabric lining, accessory pockets, Velcro straps, keyed lock. Fits all models in series, except dual head models.

LIMITED LIFETIME WARRANTY

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