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INSTRUCTIONS FOR
MODELS 130, 131, 132, 138 & 139
COMPOUND MICROSCOPES

NOTE: These models share common features, nomenclature and method of operation. The only difference are...

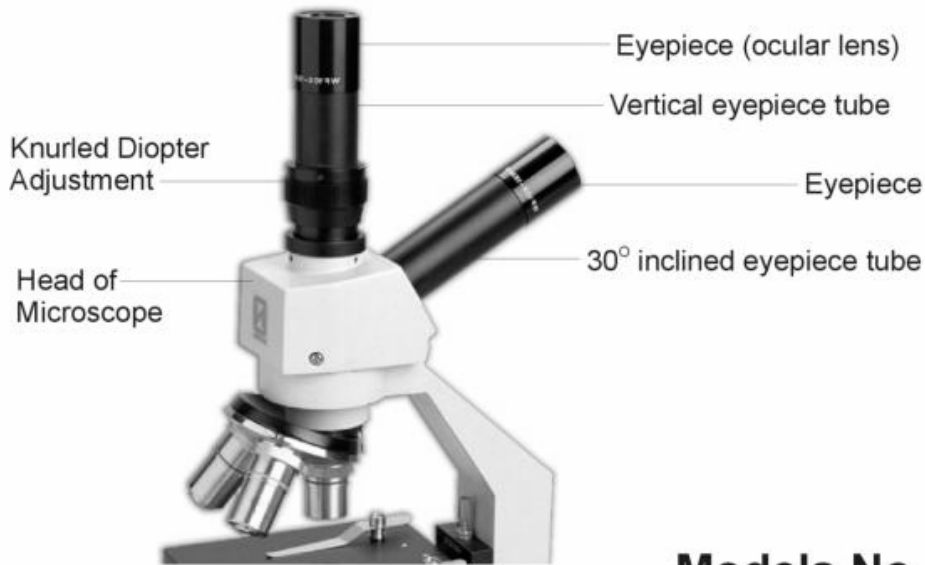
Model 130 features mirror for reflected illumination from natural or other light source.

Models 131 & 132 feature electric illumination from a tungsten bulb.

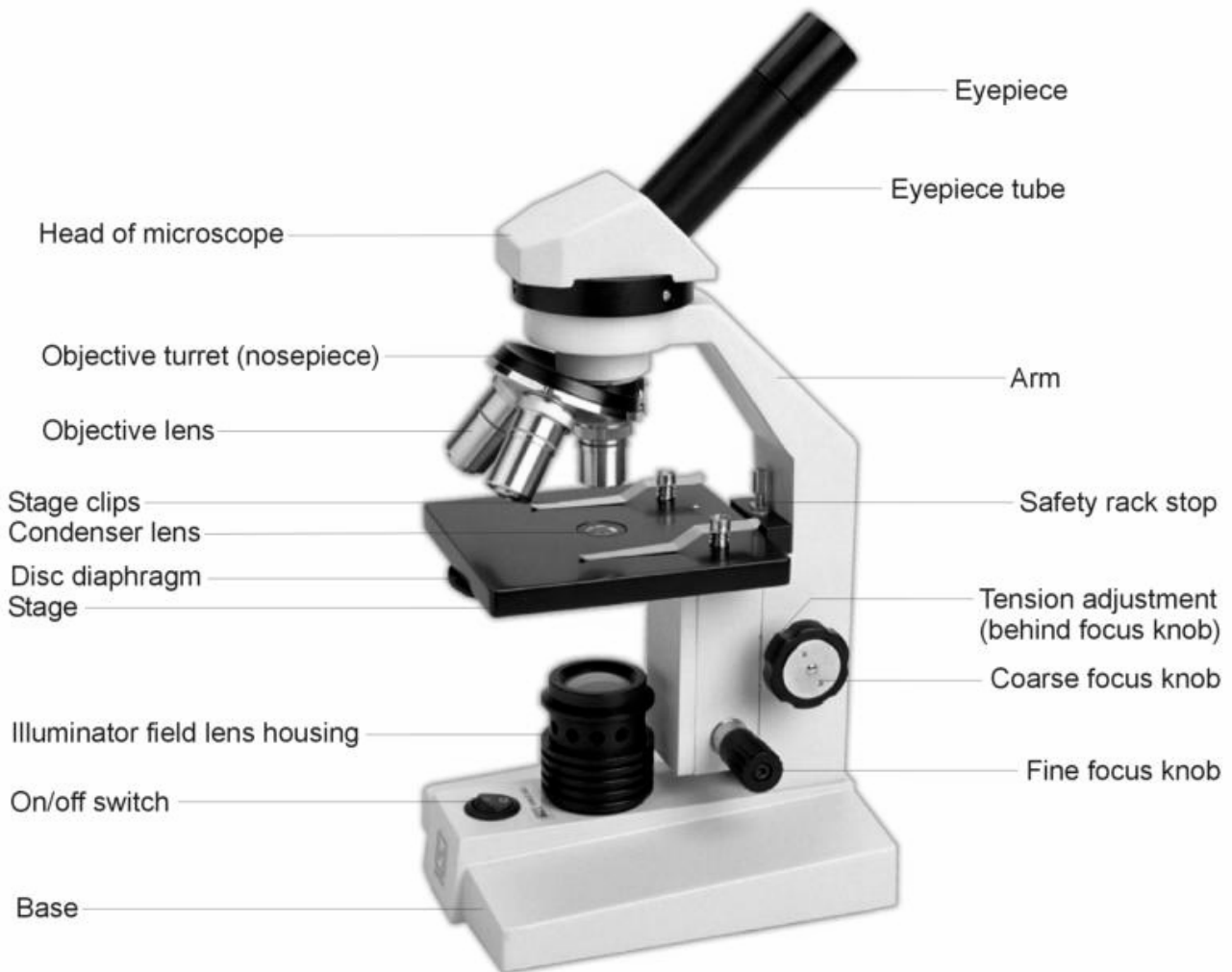
Models 138 & 139 feature electric illumination from a fluorescent bulb.

Models 132 & 139 have both 30° inclined and vertical eyepiece tubes, each supplied with WF10x eyepiece.

Models No. 132 & 139 Dual Head Microscopes



Models No. 130, 131 & 138 Monocular Head Microscopes



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

1. Carefully remove microscope, dustcover and warranty card. 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.
2. Examine packing material before you discard it. Retain the styrofoam container in case you need to transport, store, or return the microscope for service. If it becomes necessary to ship the microscope for any reason, pack it in the styrofoam container, and then pack the styrofoam in another corrugated shipping container for optimum protection. Use of the styrofoam alone will not provide adequate protection in transit, and will void your warranty.

DESCRIPTION OF COMPONENTS

1. **EYEPIECE** (ocular lens) Lens closest to the eye, magnifies the primary image formed by the objective lens. Dual head models 132 and 139 feature both an inclined eyepiece (for primary viewing) and a vertical eyepiece for second viewer or for mounting a camera. The inclined eyepiece is equipped with a "pointer" that rotates as the eyepiece is turned.
2. **DIOPTER ADJUSTMENT** (on models 132 and 139 only) Permits focusing adjustment of image for any difference in vision between primary and secondary viewers.
3. **OBJECTIVE TURRET** (nosepiece) Revolving turret which holds objective lenses, permits changes of magnification by rotating different powered objective lenses into optical path.
4. **OBJECTIVE LENS** Lens closest to the object being viewed, forms first magnified image of the specimen.
5. **STAGE CLIPS** Two locked-on clips hold specimen slide in place on stage. Note: Your microscope is already drilled and tapped to accept an optional mechanical stage. Mechanical stage replaces stage clips and permits precise, mechanical manipulation of the specimen slide.
6. **STAGE** Platform of the microscope where the specimen slide is placed.
7. **CONDENSER LENS** An 0.65 N.A. condenser lens, fixed in center of stage, condenses light rays from substage illumination and fills the back lens element of objective lens to improve image resolution.
8. **DISC DIAPHRAGM** Rotating disc located below stage, with holes of various apertures, designed to help achieve optimum resolution of the objective lens. Larger apertures used for higher magnifications, and smaller apertures used for lower magnifications.
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 just below coarse focusing knobs) permit more precise image adjustment.
11. **ILLUMINATION** Depending on model purchased, microscope is equipped with either a substage plano-concave mirror or built-in electrical illumination.
 - a. Mirror provides illumination of specimen by reflecting light from an artificial source or natural sunlight.
 - b. Built-in substage electric illuminator provides constant, reliable, pre-focusing illumination.

Observe that the main voltage of your microscope is labeled on the back of the base. Make certain that the main voltage of your microscope corresponds to the voltage of your power outlet, either 120v or 220v.

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.
 - a. For mirror models, assure that there is a good nearby source of overhead light, tabletop lamp or reasonably bright natural light. Position the plano (flat) side of mirror upward. Looking through the microscope eyepiece, tilt mirror (mirror tilts on either of two axis) until light appears to fill the entire field of view.
 - b. For electric illuminator models, **make certain that the main voltage of your microscope corresponds to the voltage of your power outlet, either 120v or 220v.** Insert microscope plug into matched voltage outlet. Flip switch located on base to “ON” position. In case of equipment malfunction, see “troubleshooting procedure” located at back of this manual.
3. Rotate coarse focus knobs to move stage down (away) from objective lens as far as possible.
4. Place specimen slide, cover slip facing up, on stage with specimen centered over condenser lens in middle of stage.
5. Rotate disc diaphragm until largest aperture is positioned beneath condenser in center of stage.
6. 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.
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. Turn the disc diaphragm, observing that different apertures affect the sharpness of the image. Turn diaphragm until sharpest possible image is obtained. Note that when turning the disc diaphragm, you should hear a “click” as each aperture comes into proper position under the condenser lens. If aperture is not properly positioned, you will observe shadows in the field of view when looking through the microscope.
10. Changing magnification
 - a. Magnification is changed by rotating objective turret until 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.
 - b. Standard lenses provided with your microscope are a widefield 10x eyepiece (two eyepieces supplied with models 132 and 139). 4x, 10x, and 40x objectives. The 40x objective lens has a special spring retractable mechanism which retracts slightly if front of lens comes in contact with the specimen slide. See chart below for specifications on objectives.

Objective Specification Chart

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

- c. 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.
- d. The microscope has been parfocussed at the factory, which allows easy change from one magnification to another, requiring little or no adjustment of the fine focus knobs.
- e. 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 10x or 40x objective lens.
- f. NOTE: Care must be taken when rotating the 40x objective into place. This lens has 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 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 lens too quickly or carelessly could cause damage to the front lens element or to the slide.
- g. Do not let the front lens element 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.

11. Diopter adjustment for models 132 and 139 dual head.

These dual head models have a 30° inclined eyepiece to provide comfortable viewing for the primary viewer. They also have a vertical eyepiece so that a second viewer can observe the image simultaneously. The primary viewer will have focused the microscope using the coarse and fine focus knobs. To compensate for differences in vision between primary and second viewer, second viewer may have to adjust image in vertical eyepiece by turning the knurled diopter adjustment.

12. Camera adaptation for models 132 and 139.

Specific instructions for adapting a video camera to your microscope are not included in this manual, as the electronic equipment used will vary. Please consult the dealer from whom you purchased the microscope.

A video camera can be mounted on the vertical eyepiece tube, using a simple adaptor available through your dealer.

Note that when using a video camera with the microscope, focusing of the image is accomplished by turning the microscope focusing knobs while observing the image on the TV monitor screen. Under these circumstances, the image observed through the inclined eyepiece will not be in focus.

Generally, there are two types of adaptors used to fit the microscope to a camera. One requires removal of the eyepiece from the vertical eyepiece tube so that the adaptor can be inserted into the tube in place of the eyepiece. The inside diameter of the eyepiece tube is 23.18mm. To remove eyepiece, observe that between the lower edge of the eyepiece and the knurled diopter ring there is one small screw that prevents the eyepiece from being removed. Using a very small screwdriver, loosen this screw just enough to permit removal of eyepiece from tube. Do not remove the three small setscrews on the knurled diopter ring.

The second type of adaptor sometimes used is one that fits over the eyepiece. This type does not require removal of the eyepiece. The outside diameter of the eyepiece is 27.95mm.

MAINTENANCE

WARNING: For your own safety, turn switch off 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.

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 xylene or 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.

Loosen round knurled locking nut by turning counter-clockwise. Then loosen stop screw. With fine focus adjustment at mid-range, focus on standard slide until sharp image is obtained. Rotate rack stop screw in clockwise direction until tight. Lock into position with the locking nut. A needle nose pliers might be needed to loosen the round locking nut.

- 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 a small jewelers screwdriver, loosen the set screw located in only one of the four holes on tension adjustment collar. Turn collar clockwise to tighten tension, counter-clockwise to loosen tension. Use of a wide rubberband 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

The extent of electrical maintenance, by other than a qualified technician, should be bulb replacement. **BE CERTAIN TO TURN SWITCHES OFF AND REMOVE PLUG FROM POWER SOURCE OUTLET BEFORE CHANGING BULBS.**

- a. Changing bulb on Models 131 and 132

Make sure that illuminator field lens housing and lamp are cool before attempting to remove. Remove illuminator field lens housing by rotating in a counter-clockwise direction. This housing is secured tightly, to prevent easy removal by students, so a very firm grip and some strength will be required.

Note that lamp does not screw out. Remove lamp by depressing lamp slightly and rotate in a counter-clockwise direction until it pops up slightly. Replace with a 110v 20 watt lamp with double contact, medium bayonet base. This is a standard, commonly used replacement bulb. National #800-102. Carefully wipe lamp to insure it is clean and free of all fingerprints. Replace field lens housing assembly.

b. Changing bulb on Models 138 and 139 (fluorescent bulb)

Gently lay microscope on side. Using a screwdriver, remove screw in center of each rubber foot on bottom of base. Remove metal cover plate to expose bulb. Bulb is held in place by spring pressure clips and is removed by gently pulling bulb straight out from socket. Replace with new bulb. National #800-138. Replace metal cover plate and rubber feet.

TROUBLESHOOTING

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.
Image does not remain in focus	Stage of microscope drops from its own weight.	Adjust tension control.
	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 disc 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
- #910 Graduated mechanical stage, top mounted adjustment knobs
- #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.
- #975-002 Carrying case, anodized aluminum, fabric lining, accessory pockets, Velcro straps, keyed lock. Fits dual head models.
- #975-138 Carrying case, heavy plastic w/foam liner. Fits all models in series, except dual head models.

LIMITED LIFETIME WARRANTY

National warrants this microscope to be free from defects in material and workmanship under normal use and service for the life of the instrument. The warranty does not cover damage resulting from abuse or misuse, repairs or alterations performed by other than authorized repair technicians, or damage occurring in transit. The warranty does not cover bulbs, batteries, fuses, cords, or add-on accessories such as mechanical specimen holders that are not built into the microscope stage as an integral part of original manufacture. Warranty does not cover lenses that have become inoperable due to excessive dirtiness as a result of misuse or lack of normal maintenance.

Any cameras and software supplied with this microscope are warranted from date of purchase as follows: Cameras, 1-year limited warranty. Software, 90-day limited warranty.

Other than set forth above, National hereby disclaims all warranties, express or implied, of fitness for a particular purpose.

While it is not necessary to register your purchase of a microscope, any camera or software must be registered by completing and mailing the warranty registration card enclosed with such product.

For warranty service, instrument should be well packed to avoid damage in transit, accompanied by a description of the difficulty and return instructions, and shipped postage prepaid to National at the address below. National will repair or replace at no charge and return postage prepaid. If failure was caused by misuse, alterations, accident or abnormal conditions of operation, an estimate for repairs will be submitted for approval prior to work being performed.

This warranty gives you specific legal rights, and you may also have other rights that vary from state to state. If you have questions concerning this product or warranty, contact the dealer from which it was purchased. You may also contact National at the following address and ask for warranty assistance.