

D.) Store your microscope in a clean, dry place and keep it covered with the supplied plastic cover when the instrument is not in use.

2. Optical Parts

Cleanliness of all optical components of the microscope is important for good optical performance. If any optical surface becomes badly coated with dust or dirt, all such loose dust or dirt should be blown off with a syringe or dusted with a camel's hair brush before attempting to wipe the surface clean.

Optical surfaces should be cleaned with a lint-free, soft, linen cloth, lens paper or a cotton swab just moistened with distilled water. Always promptly wipe the surface dry, using a circular motion, before allowing it to air dry.

Glass surfaces should never be touched with the fingers because they will leave a greasy smear and, frequently, corrosive perspiration. Do not clean optical parts unnecessarily. If the specimen image appears to have deteriorated and lacks definition —

A.) Blurred specks appearing in the field of view are generally caused by dust, lint or smears contaminating the eyepiece or specimen cover glass. If the specks move upon rotation of the eyepiece, clean the topmost lens of the eyepiece. If the specks move upon the slight displacement of the specimen slide, clean the cover glass.

B.) Check the quality of the specimen preparation by using a better area of the slide or insert a slide of known results; or turn the nosepiece turret to another objective.

If image quality is improved by turning nosepiece, cleaning of the bottom-most lens of the objective is indicated.

No part of the microscope is quite so vulnerable to lack of complete cleanness as the front lens of the objective. Whenever lack of contrast, cloudiness, or poor definition is encountered, carefully check the condition of the front lens with a magnifier. The 10X wide field eyepiece, reversed, is an excellent magnifier for this purpose.

The 4X and 10X objectives with fairly large front lenses can be cleaned with a cloth or lens tissue wrapped around the finger and moistened with distilled water. The 45X and 100X oil immersion objectives require a little more care. The surface of these front lenses can be readily cleaned with a cotton swab or with a toothpick covered with cotton at the tip. Moisten the cotton with water and squeeze almost dry. Wipe the front lens lightly without applying any undue force or scrubbing action. Check with magnifier after cleaning.

Objective and eyepieces are carefully aligned at the factory and must not be taken apart. Entrust this type of work only to authorized Cambridge Instruments dealers or our factory Technical Services Dept.

The Mirror, In-base Illuminator and Condenser are not very sensitive to the presence of dirt. It makes sense, nevertheless, that good housekeeping be exercised on these parts and that they be kept reasonably clean by following the above cleaning methods.

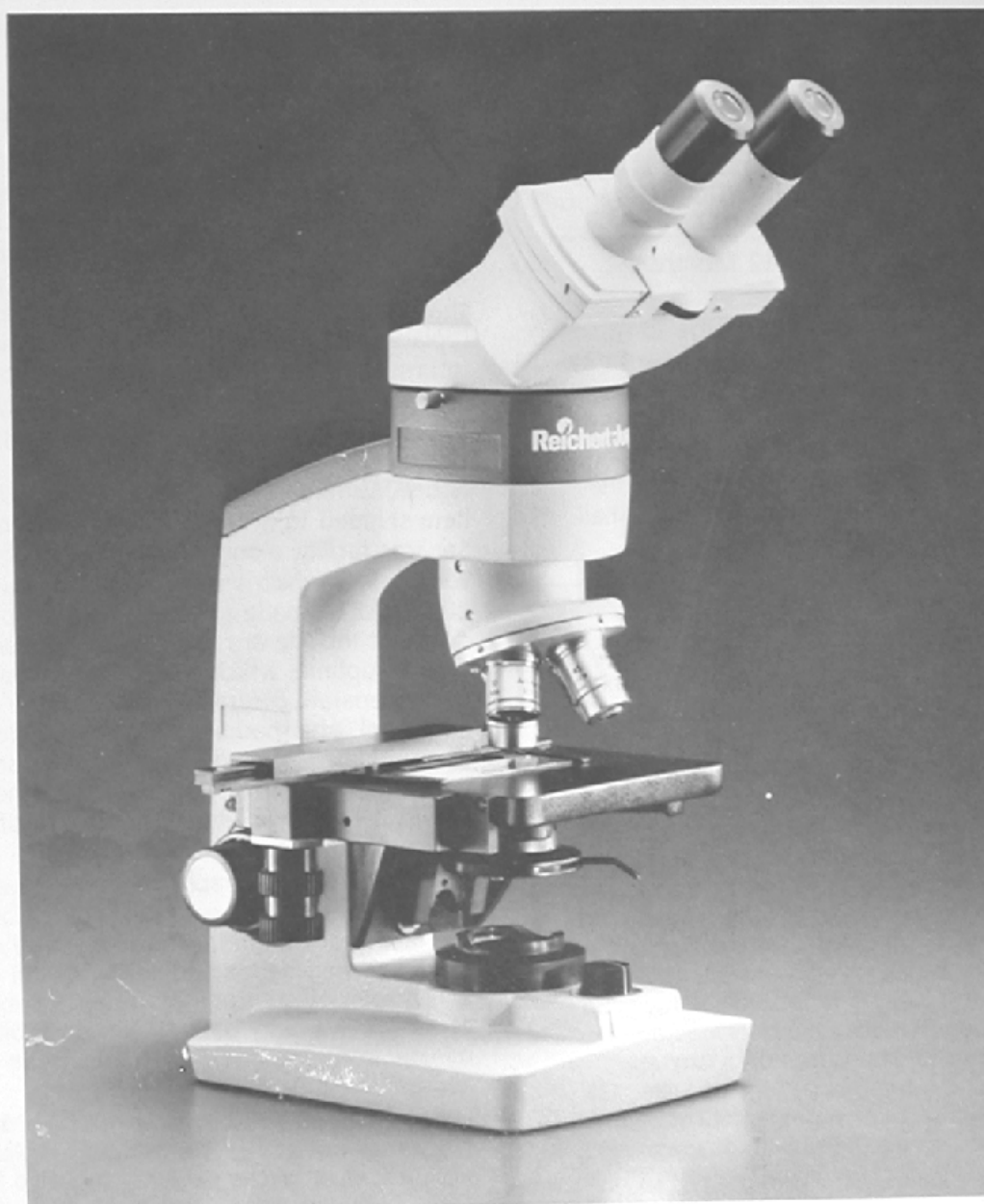
To further your knowledge of optics and the mechanics of the microscope, Cambridge Instruments also offers "The Glossary of Optical Terms" which is available upon request.

Cambridge Instruments

REFERENCE MANUAL

SERIES ONE-FIFTY

Standard Laboratory Microscopes



OPTICAL SYSTEMS DIVISION

WARRANTY FOR SERIES ONE-FIFTY MICROSCOPE

SCOPE AND DURATION OF WARRANTY

Seller warrants to Buyer that the Cambridge Instruments product to be delivered hereunder will (i) be free from defects in material, manufacturing workmanship, and title, and (ii) conform to Seller's applicable product descriptions and specifications, if any, contained in or attached to Seller's quotation. If no product descriptions are contained in or attached to the quotation, Seller's applicable product descriptions and specifications in effect on the date of shipment shall apply. The criteria for all testing shall be Seller's applicable product specifications utilizing factory-specified calibration and test procedures and instruments.

All product warranties, except the warranty of title, and all remedies for warranty failures are limited in time as shown in the table below.

PRODUCT WARRANTED	DURATION OF WARRANTY PERIOD
Series One-Fifty Standard Laboratory Microscope	12 Months

Any product or part furnished without charge to Buyer during the warranty period to correct a warranty failure shall be warranted to the extent of the unexpired term of the warranty applicable to the repaired or replaced item.

The warranty period shall commence on the date the product is sold to the Buyer. The warranty period shall be 12 months from the date of purchase.

WARRANTY EXCLUSIONS

Except as set forth in any applicable indemnity, the foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, express, implied or statutory. NO IMPLIED STATUTORY WARRANTY OF MERCHANTABILITY OF FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY. Warranty coverage does not include consumable supplies such as lamps, bulbs, charts or cards. Warranty coverage does not include any defect or performance deficiency (including failure to conform to product descriptions or specifications) which results, in whole or in part from (1) negligent storage or handling of the product by the Buyer, its employees, agents or contractors, (2) failure of Buyer to prepare or maintain the site or provide power requirements or operating environmental conditions in compliance with any applicable instructions or recommendations of Seller, (3) adverse power conditions or environmental conditions such as erratic power, voltage spikes, RF or magnetic interference, HVAC failure or other causes beyond the reasonable control of the Seller, (4) absence of any product, component, or accessory recommended by Seller but omitted or removed at Buyer's direction, (5) any design, specification, or instruction furnished by Buyer,

its employees, agents or contractors, (6) any alteration of the product by persons other than Seller, (7) combining Seller's product with any product furnished by others where such combination causes failure of or degradation to performance of Seller's product, (8) combining incompatible products of Seller, (9) improper maintenance of the product, or failure to comply with any applicable instructions or recommendations of Seller, or (10) acts of God, acts of civil or military authority, fires, floods, strikes or other labor disturbances, war, riot or other causes beyond the reasonable control of the Seller. Seller does not warrant products of others which are not included in Seller's published product catalog.

BUYER'S REMEDIES

If Seller determines that any product fails to meet any warranty during the applicable warranty period, Seller shall correct any such failure by either, at its option, repairing, adjusting, or replacing without charge to Buyer any defective or nonconforming product. Seller shall have the option to either furnish new or exchange replacement parts or assemblies provided the Buyer return the product to one of the Cambridge Instruments Inc. Service Centers. Warranty service during the applicable warranty period will be performed without charge to Buyer during Seller's normal business hours. Warranty service will be provided by having the item shipped to a Cambridge Instruments Inc. Technical Services facility, along with a copy of the original invoice under which the item was purchased. While every effort will be made to render services promptly, this does not include any guarantees of specific response time or uptime, which may be available for purchase under separate contract. Subject to the availability of personnel, after-hours service is available upon request at an additional charge. The remedies set forth herein are conditioned upon Buyer promptly notifying Seller within the applicable warranty period of any defect or nonconformance.

The preceding paragraphs set forth Buyer's exclusive remedies and Seller's sole liability for claims based on the failure of the products to meet any warranty, tort (including negligence and strict liability) or otherwise, and however instituted, and upon the expiration of the applicable warranty period, all such liabilities shall terminate. In no event shall Seller be liable for special or consequential damages.

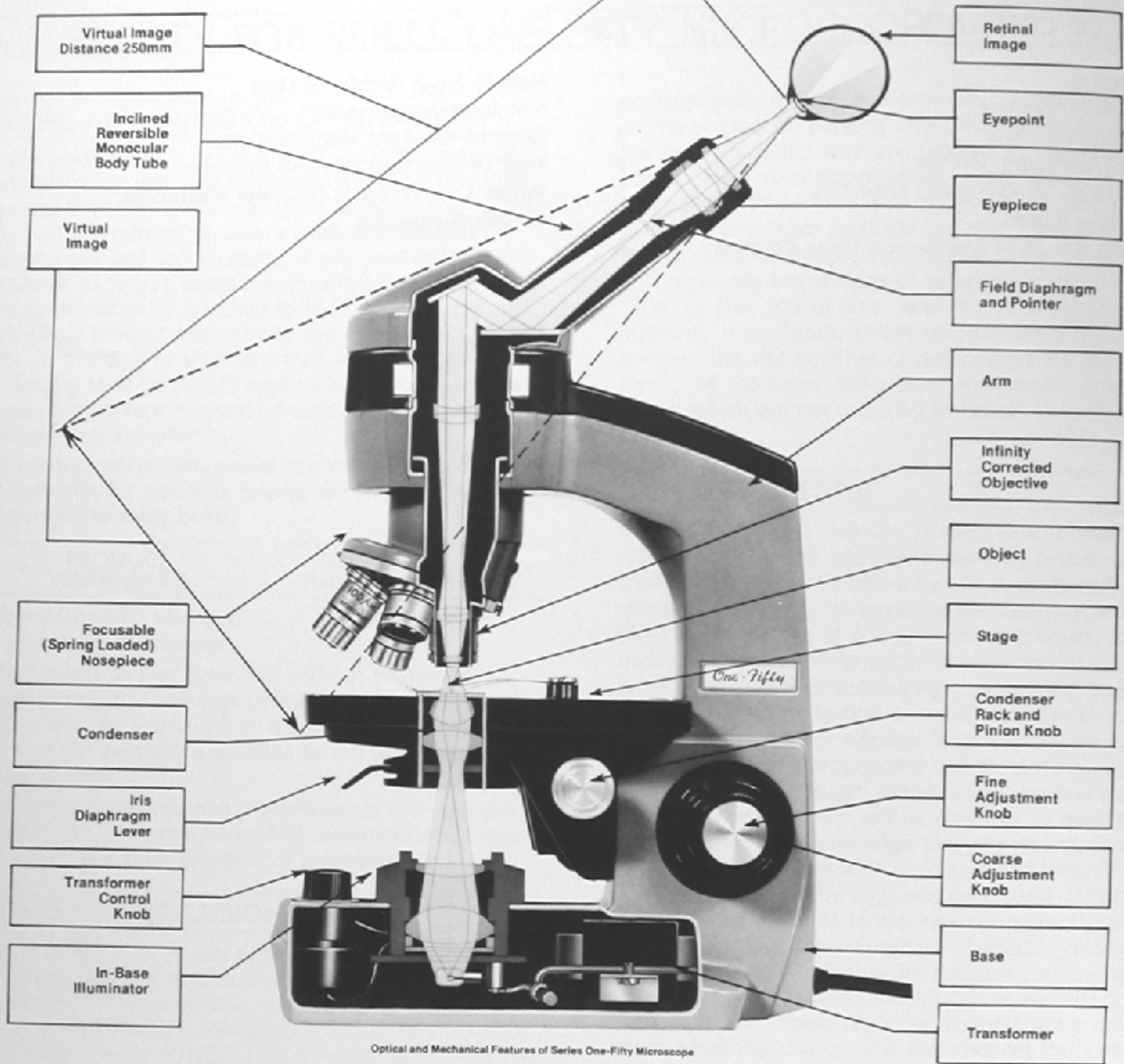
For products installed outside the U.S., the above warranty shall not apply. The warranty applicable to such products shall be the warranty provided by the respective Cambridge Instruments Inc. selling organization in such countries.

Optical and Mechanical Features of
THE MICROSCOPE

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Optical and Mechanical Features of THE MICROSCOPE



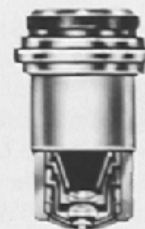
Cross section of scanning objective, 4X.



Cross section of low power objective, 10X.



Cross section of "high dry" objective, 45X.



Cross section of oil immersion objective, 100X.

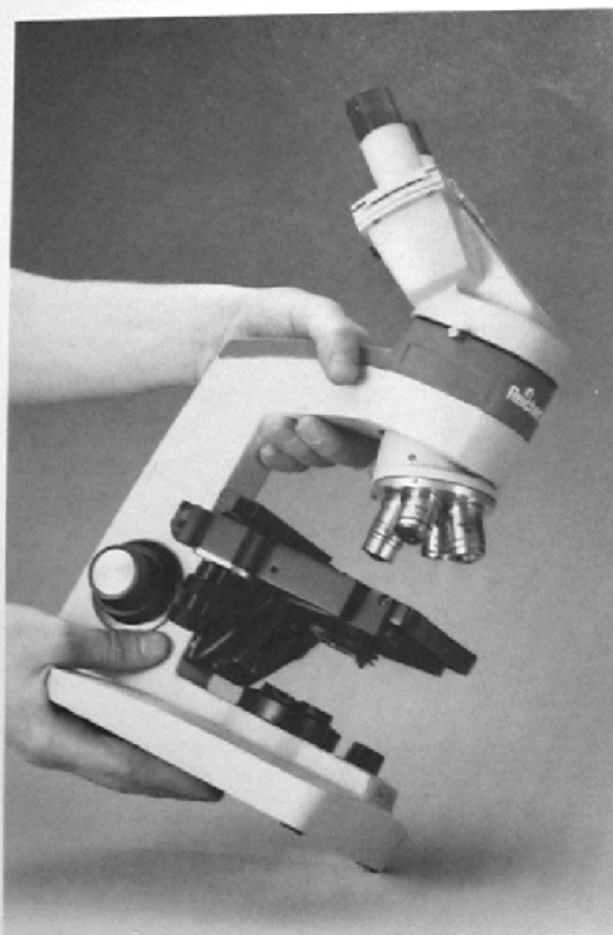


SERIES ONE-FIFTY MICROSCOPE

INTRODUCTION

You now possess one of the finest and most precise scientific instruments available on the market today.

You will enjoy the simplified operation of a superior standard laboratory microscope featuring an exclusive, infinity corrected system. With the advanced optics of your Series One-Fifty microscope, you'll find your field of view larger . . . enjoy sharp, crisp focus . . . enhance your technique and accomplishment. With proper care, your Series One-Fifty microscope assures you years of satisfying, trouble-free service.



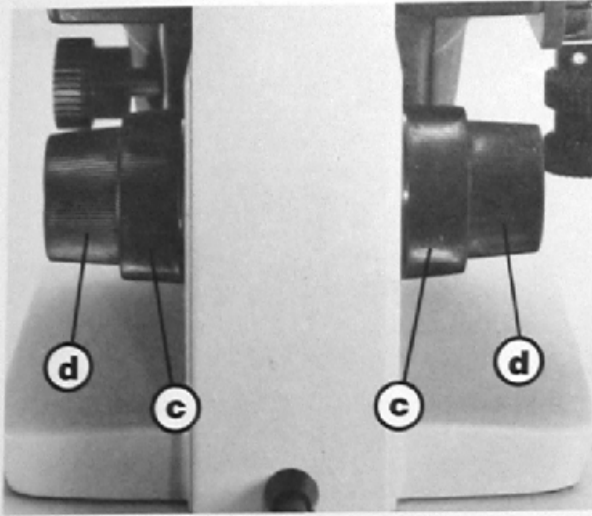
PRELIMINARY PROCEDURE

1) Remove the microscope from its shipping carton by grasping the arm of the instrument; support beneath the base with the other hand. Whenever the position of the microscope is changed, always carry in the illustrated manner.

2) Place the microscope on a firm table or bench. Select a chair, or adjust stool height, so that the user will be comfortable in near-erect posture when viewing through the inclined eyepiece.

3) Your series One-Fifty model is equipped with an In-Base illuminator and many users prefer to reverse the body of the microscope for easier access to slides, objectives, or iris diaphragm lever.

To position the instrument so the back arm is away from the user and the stage is positioned forward, loosen the knurled screw securing the microscope body. The microscope body can then be rotated 180°. The new Series 150 Microscope is designed so the body may rotate freely 360°. When the desired position is reached, tighten the knurled screw.



7) Rotate the coarse adjustment knob (c) to lower the nosepiece until the positive stop is reached. View through the eyepiece(s) and, without disturbing the coarse adjustment setting, slowly rotate a fine adjustment knob (d) in the appropriate direction until specimen detail is in sharpest possible focus. (If using a separate illuminator, adjust mirror tilt as required.)

If your Series One-Fifty Microscope has a binocular body, use the thumb wheel (g) to adjust the interpupillary distance. The left eyepiece tube is focusable to compensate for refraction differences of the eyes.

The correct procedure is to bring the specimen into sharpest possible focus with a fine adjustment knob using the right eyepiece only, while covering the left eyepiece. To focus for the left eye, first turn the knurled ring on the left eyetube fully counterclockwise. While viewing the specimen with the left eye only turn the knurled collar clockwise until the specimen is in sharp focus. **DO NOT** adjust fine adjustment knob during this procedure.



8) Remove an eyepiece to view the back aperture of the objective. Close the condenser iris diaphragm . . . then re-open until the leaves "just" disappear from view to obtain the full resolving power of the microscope. The condenser iris diaphragm may be closed slightly to enhance contrast.

9) Once specimen detail is in sharp focus using the 10X objective, it is then possible to rotate the nosepiece to other objectives without changing the position of the coarse adjustment knob. Very little refocusing with the fine adjustment is required since the Series One-Fifty microscope objectives are parfocal.

You should remember, however, that the iris diaphragm setting must be changed, whenever a different objective is used. As magnification increases, the condenser iris diaphragm is opened as required.

CORRECT DIAPHRAGM SETTINGS

With experience, correct setting of the iris diaphragm can be made from the appearance of the specimen image. Many users fully open the iris diaphragm and then close down until desired specimen contrast is achieved without loss of detail or resolution.

Since numerical apertures of objectives vary directly with the initial magnifications of objectives, it is necessary to change the substage diaphragm setting whenever the nosepiece is rotated to another objective. The greater the initial magnification of the objective . . . the larger its numerical aperture . . . consequently, the wider the cone of light you'll have to present to the specimen and objective by properly opening the substage diaphragm.

To theoretically derive the full resolving power of a given objective, the back lens of the objective must be completely and evenly illuminated. This can be checked by removing the eyepiece and peering into the eyetube to see whether the above conditions are satisfied; if not, the iris diaphragm opening must be changed to meet the required conditions.

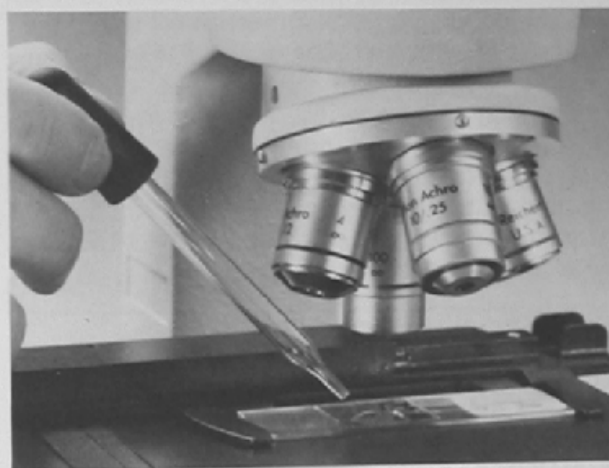
In general practice, however, the substage aperture diaphragm is very rarely set to fill the full numerical aperture of the objective, but rather is acceptably adjusted so that approximately 3/4 of the back lens of the objective is filled with light. Experience and actual experiment will be your best guide and you will soon find it unnecessary to remove the eyepiece for such settings . . . you'll automatically set the iris diaphragm apertures, as demanded by specific specimens, according to the best possible contrast attainable.

UNSTAINED AND LIVING SPECIMENS, because of their low contrast characteristics, can usually be viewed more effectively by setting the diaphragm at or near minimum opening. Reducing the diaphragm setting increases definition, contrast and depth of focus at the sacrifice of resolution and introduces diffraction. Do not, however, close it to such an extent as to introduce undesirable diffraction or distortion of specimen detail . . . select the best compromise by trial and error.

OPERATING PROCEDURE FOR USE OF 100X OIL IMMERSION OBJECTIVE

Use of the 100X oil immersion objective is best accomplished . . . without danger of damaging specimen slide and objective . . . by utilizing the full value of the protective **AUTOFOCUS** stop feature. Proceed in the following manner:

- 1) Focus onto the specimen progressively with the 10X and 45X objective following steps in "Operating Procedure".
- 2) Fully raise the nosepiece by means of a **COARSE** adjustment knob without disturbing the position of the fine adjustment knob.
- 3) Place a small drop of non-drying Crown or Cargille's immersion oil (mineral oil or other substitutes should not be used) in the center of the circle of light formed on the specimen slide.



- 4) Turn the nosepiece to the "red" coded, 100X objective.
- 5) Grasp a coarse adjustment knob and rotate it to its original stop position.
- 6) Bring the specimen into sharp focus with fine adjustment knob.

NOTE: In following the above procedure, remember the advisability and necessity of opening the condenser iris diaphragm.

MICROSCOPE BODIES AND THEIR SCREWS ARE NOT NECESSARILY INTERCHANGEABLE

On some of the older 150 microscopes, binocular and monocular bodies are interchangeable. Rotating bodies (#86 Monocular and #87 Binocular) can be interchanged and #76 Monocular and #77 can be interchanged. However, Series 70 bodies cannot be exchanged with Series 80's.

If Series 70 bodies are interchanged, different screws are required:

#76 Monocular body — X32570-22 screws (2)

#77 Binocular body — X32571-22 screws (2)

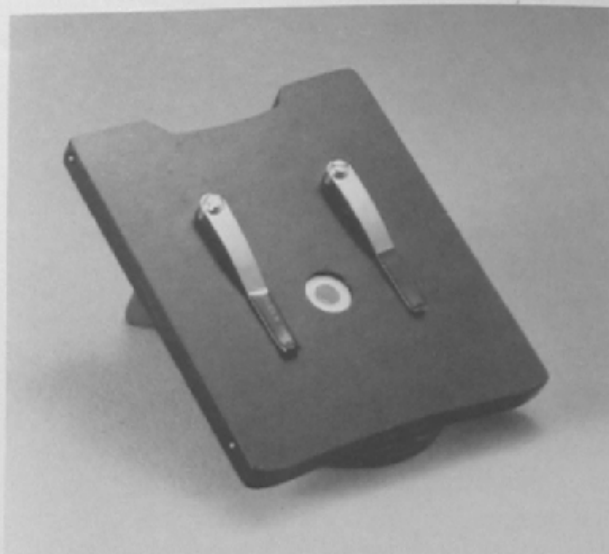
NOTE: Current 150's are available with only the #87 binocular body.

ATTACHING NO. 1534 MECHANICAL STAGE CONTROLS TO NO. 1586 SIMPLE STAGE

To convert the #1586 Stage to a mechanical stage, the #1534 is attached with two screws. The #1534 Mechanical Stage Attachment is held to very close tolerances in manufacture to insure proper fit to the stage. North-south, east-west motion should be smooth and easy, entirely free of any feeling of binding or friction drag against top of stage plate. The #1586 Simple Stage as pictured, is pre-drilled to accept the #1534 Mechanical Stage controls.

HOW TO RESET AUTOFOCUS STOP

AUTOFOCUS, originally developed by Cambridge Instruments, is a quick focus-finder built into the coarse adjustment assembly. An outstanding convenience feature, AUTOFOCUS eliminates lost time in "searching" for correct focus with the coarse adjustment. Together with the spring loaded nosepiece, it eliminates slide breakage and objective damage.

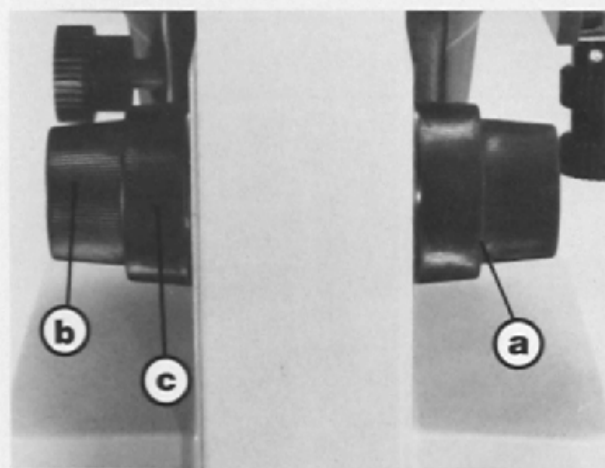


CATALOG NO. 1587A MECHANICAL STAGE CONSISTS OF NO. 1586 SIMPLE STAGE AND NO. 1534 MECHANICAL STAGE ATTACHMENT.



AUTOFOCUS stop is variable to accommodate thick chambers such as hemacytometers but does not require adjustment for slides which vary in thickness as much as $\pm 0.5\text{mm}$ from normal 1.25mm slide thickness. To vary or reset the **AUTOFOCUS** for thicker slides or chambers, or to reset at original position, follow these steps:

- 1) Use 10X objective.
- 2) Loosen Allen screw on coarse adjustment knob (a) with "L" shaped $3/32"$ Allen wrench . . . **DO NOT UNDER ANY CIRCUMSTANCES DISTURB OTHER ALLEN SCREWS.** An instructor should be present to make certain that latter rule is not violated.
- 3) Set fine adjustment (b) at mid-excursion by positioning the fine adjustment at three revolutions from the bottom stop of its range.



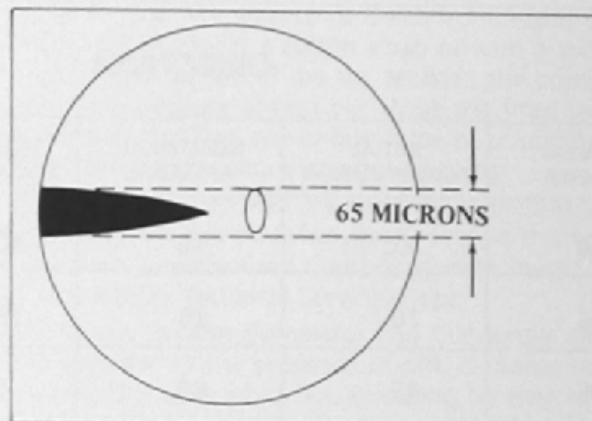
- 4) Place the specimen slide on the stage . . . orient directly above center of condenser.
- 5) Bring specimen detail in sharp focus by carefully rotating coarse adjustment knob (c) without changing setting of fine adjustment knob (b) established in step 3.
- 6) Now, rotate coarse adjustment knob (a) in the direction illustrated until you reach a positive stop . . . hold the knob in this position . . . and tighten Allen screw (a) securely.

SIMPLE MEASUREMENTS WITH SERIES ONE-FIFTY

10X WIDE FIELD EYEPIECE includes a pointer which also may be used to conveniently determine approximate lateral dimensions of a specimen or specimen detail at the object plane. When the eyepiece is used with a 4X, 10X, 45X, or 100X objective, the base portion of the pointer represents approximately 160, 65, 15, and 7 microns respectively.

$$(1 \text{ micron} = .001 \text{ millimeter} = \frac{1}{25,400} \text{ inch})$$

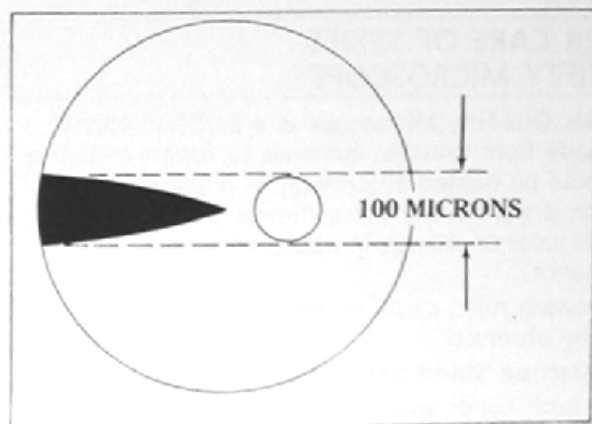
EXAMPLE: Specimen viewed under 10X eyepiece and 10X objective has a length of approximately 65 microns.



10X WIDE FIELD EYEPIECE WITH 10X OBJECTIVE

10X HUYGENIAN EYEPIECE also contains a pointer which may be used to determine approximate lateral dimensions of a specimen at the object plane. When the eyepiece is used with a 4X, 10X, 45X, or 100X objective, the base portion of the pointer represents approximately 250, 100, 25, 10 microns respectively.

EXAMPLE: Spherical specimen viewed under 10X eyepiece and 10X objective has diameter of approximately 100 microns.



10X HUYGENIAN EYEPIECE WITH 10X OBJECTIVE

IMPORTANT: When using a binocular Series One-Fifty microscope, it is recommended that the eyepiece with pointer be used in the right, fixed tube of the microscope body.

TABLE OF RESULTANT MAGNIFICATIONS, FIELD OF VIEW AND WORKING DISTANCES						
OBJECTIVES					EYEPIECE	
					#138 WIDE FIELD 10X	
CATALOG NUMBER	INITIAL MAGNIFICATION	NUMERICAL APERTURE	EQUIVALENT FOCAL LENGTH	WORKING DISTANCE	RESULTANT MAGNIFICATION	FIELD OF VIEW
130	4X	.10	40mm	17.5mm	40X	4.2mm
1026	10	.25	18	9.1	100	1.9
1116	45	.66	4	.7	450	.41
1079	100	1.25	1.8	.10	1000	.18

PROPER CARE OF SERIES ONE-FIFTY MICROSCOPE

The Series One-Fifty Microscope is a precision instrument made from valuable materials by expert craftsmen and should be treated accordingly. If properly used and cared for, it will literally last a lifetime without appreciable wear or change in appearance and performance.

The following rules, cautions and maintenance hints should be observed:

1. Microscope Stand and Mechanical Parts

A.) Use both hands when carrying the instrument. One, firmly grasping the arm of the microscope; the other, beneath the base. Avoid sudden jars.

B.) The finish is tough and durable . . . resists chipping, staining and corrosive action of common laboratory chemicals. Clean with very mild soap or detergent solution when required. Other metal surfaces may be similarly cleaned. Dampen, do not soak, your lint-free

cloth for this purpose. Finally, wipe off thoroughly and buff with dry lint-free cloth.

C.) The bothersome chore of cleaning and relubricating moving parts is effectively minimized in the Series One-Fifty Microscope. All moving parts are protected within the microscope stand and lubricated with a long lasting special purpose lubricant. Disassembly of parts and replacement of these lubricants is rarely if ever necessary under normal laboratory working conditions.