

USE AND CARE OF SWIFT SERIES M 950
MICROSCOPE

SWIFT[®]



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**USE AND CARE OF SWIFT SERIES M950
MICROSCOPE**

Edited by
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Your Swift microscope, Series 950, is an instrument of precision, both optically and mechanically, and will last a lifetime with a minimum of maintenance. It is built to the highest and most rigid optical and mechanical standards, and has many built-in features to insure durability and high performance even in the hands of the student. It is designed to withstand the rigors of daily class-room and laboratory use with only normal care.

Unpacking: If your Series 950 microscope is in a cabinet, first lay the cabinet on its side and remove the slot-head bolt on the bottom. This bolt is screwed into the threaded base of the microscope. Open the cabinet and remove the packing, being sure to check the packing for any accessories that may be included. The objectives will be found in their appropriate capsules in the rack, and should be handled carefully to avoid touching the lenses with the fingers. The microscope should be unpacked carefully and the objectives installed in a clockwise direction from lowest power to high.

Familiarize yourself with the components and terminology of the microscope.

- Base - This is the horseshoe shaped part that rests on the table and supports the instrument.
- Stage - The table of the microscope where the slide or specimen is placed.
- Condenser - The optical lens built below the center of the stage.
- Body - The part between the upper optical element and the lower.
- Arm - The frame that supports all components above the base.
- Objective - The optical system which does the initial magnifying to form the primary image.
- Nosepiece - The revolver which carries the objectives.
- Eyepiece - The upper optical component that further magnifies the primary image and brings the light rays to a focus at the eyepoint.

THE COMPONENTS

EYEPIECE—Most models in the 950 series are equipped with the 10x widefield type eyepiece. Because of the extremely wide field of view and a much higher eyepoint than the 10x Huygenian eyepiece, this ocular enables even those with thick eyeglasses to view the specimen with ease. The widefield eyepiece has a built-in pointer, and is designed to accept a variety of measuring and counting accessories. The lenses are highly corrected and coated to reduce glare and reflection.

OBJECTIVES—The objectives are of the research type, with large numerical aperture (N.A.) to permit maximum resolution. All objectives are achromatic, color coded and parfocussed to each other. The 40x (high dry) objective is in a retractable mount to eliminate the possibility of accidental breakage of either the slide or the front lens of the objective. All lenses are hard coated for maximum resolution and produce an excellent flat field.

DISC DIAPHRAGM—The round disc beneath the stage. It has circular openings positioned at various points, and may be rotated to align any one of the apertures with the optical path.

COARSE FOCUS—The body is moved by a diagonally cut rack and pinion. The rack is plated brass and the pinion is of steel and they do not require lubrication.

FINE FOCUS—The fine focus is of the lever type with a micrometer screw. It is operated from either side of the arm. This fine adjustment has an extremely long range of travel for ease of operation.

CONDENSER—The built in condenser has a numerical aperture of 0.65 which is matched to the high dry objective. To insure maximum resolution, the condenser must always have a numerical aperture equal to or greater than the objective in use.

RESOLUTION, OR RESOLVING POWER—This is the ability of an objective to separate two lines without the two lines merging or blurring. Resolving power is computed at 1000 times the numerical aperture (N.A.) of the objective, thus the 40x objective with N.A. 0.65 has a maximum resolving power of 650 times the size of the specimen. If the resolving power of an objective is exceeded, the resulting magnification is termed "empty magnification", which is enlargement without revealing additional features or characteristics of the specimen. A "high dry" objective of less than an N.A. of 0.65 cannot produce an image equal in clarity (definition) and brightness to one of 0.65 N.A.

USING YOUR SWIFT SERIES 950 MICROSCOPE

After securing the slide into position with the stage clips, turn to the lowest power objective. The disc diaphragm should be turned to align the largest opening with the condenser, and the mirror adjusted to direct the light into the optical path.

(NOTE: The use of a mirror to provide illumination is not efficient. Daylight, especially in the classroom, is not easily controlled, therefore the light obtained may vary considerably. On the Series 950, the SWIFT SSL-10 substage illuminator is recommended to provide a constant, even dispersion of light to the optical system.)

While looking in the eyepiece, focus down on the specimen until the image is sharp and clear. The 4x objective has a long working depth, so focus is done with ease at this power. The specimen may be centered to the field at this point, and the nose-piece rotated to the higher magnifying objectives. The objectives are parfocussed so that once the 4x objective is focused, only a slight turn of the fine focus knob is required in changing to the 10x and 40x objective.

Note that should the objective be brought into contact with the slide, no damage will result, since the 40x objective is in a retractable mount. It is impossible for the 4x or 10x objectives to contact the slide.

USE OF THE DIAPHRAGM—The disc diaphragm is not intended to control the brightness of the illumination. The SWIFT SSL-10 is designed for the M950 series, and the intensity of the illumination is computed to be adequate for general use. The purpose of the disc diaphragm is to control the angle of the light rays. Smaller apertures increase contrast and larger ones will decrease the contrast. A good procedure in selecting the proper aperture is to start with the largest, and reduce until the fine details of the specimen are imaged sharply.

Care must be exercised not to reduce the aperture too much to gain high contrast, as then the fine structure of the image will be destroyed. Reducing the aperture does increase contrast and depth of focus, but it also reduces resolution and introduces diffraction. The aperture must be selected for each objective, i.e., the aperture for the 10x (N.A. 0.25) will not be the same for the 40x (N.A. 0.65), since the angle of the light required is determined by the numerical aperture of the objective. Proper selection of the diaphragm aperture is easily determined after a little experience with the microscope.

SWIFT COLOR CONTRAST ACCESSORY—This unit is

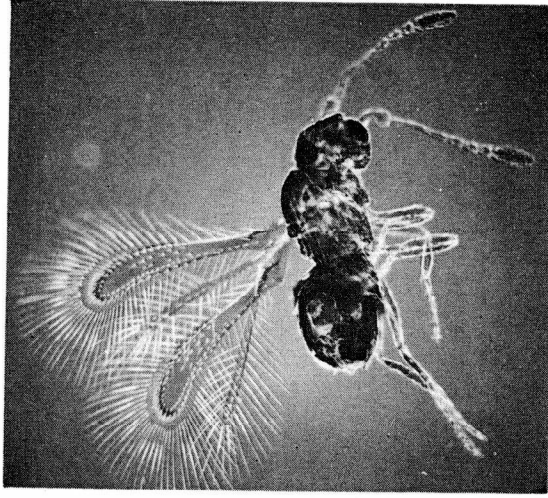
designed to increase contrast in various specimens and permit examination of fine details. Among the many specimens for which this unit is especially recommended are living bacteria, living organisms such as rotifers, protozoa and infusoria, hydrozoa, bryozoa, flatworms and waterfleas. It is extremely effective in viewing living diatoms to show the movement of boat-shaped forms (Navicula). These examples are only a few of the many objects in which study is improved by the SWIFT Color Contrast unit.

The Swift Color Contrast unit is designed to be mounted over the SSL-10 illuminator, and is attached as follows: Loosen the screw that secures the illuminator to the microscope and mount the color contrast unit over it. Tighten the three retaining screws on the color contrast unit to secure it to the illuminator. Now firmly attach the illuminator to the microscope. Center the illumination as follows:

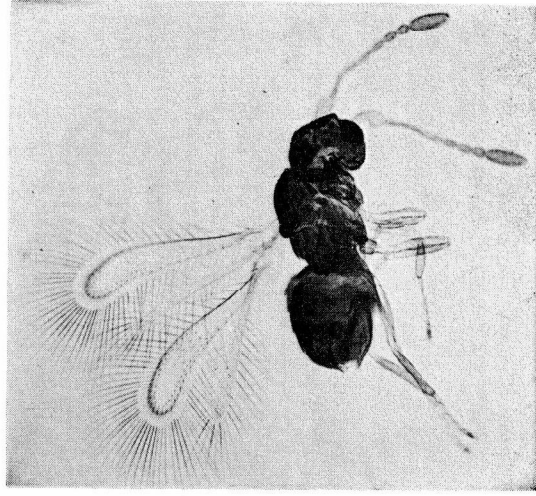
1. Rotate the disc diaphragm so as to place the largest aperture into position.
2. Place a drop of water into a well-slide and cover with a standard cover slide.
3. Use the searching (4x) objective to locate a small, round, flat bubble and focus to a sharp image. You will note the ring visible around the bubble.
4. Manipulate the two control-screws on the Color Contrast accessory until the bright ring is evenly illuminated. The water-mount may now be replaced by the specimen slide to be examined.

This unit is designed to fit without modification Series 950 microscopes beginning with serial number 655001.

If your microscope is of an earlier serial number, it must be modified by removing the disc diaphragm, which is accomplished by unscrewing the center screw that controls the rotation of the diaphragm.



Swift Color Contrast



Brightfield

THE SWIFT SSL-10 ILLUMINATOR FOR SERIES 950 MICROSCOPES

If your microscope is fitted with a mirror in fork mount, the illuminator may be installed to replace this mirror by unscrewing the mounting stud in which the mirror-fork is inserted. This will expose the threaded hole in the microscope stage support, and the illuminator may now be installed.

NOTE: To order Illuminator SSL-10, specify the serial number of the microscope on which the illuminator will be used.

CARE OF THE SWIFT SERIES 950 MICROSCOPE

The Series 950 is designed to require only a minimum of maintenance, and has many features to prevent many of the accidents usually common to the "student" microscope. Loss of stage clips is eliminated, since the clips on the 950 are retained by allen-head set screws, and mirrors and forks are locked in to prevent ordinary removal.

CLEANING: The front lens of the objectives, particularly the high dry 40x, should be cleaned after using by first brushing with a soft camel-hair brush to remove particles of dust, then wiping gently with soft lens tissue moistened (not soaked) with xylol. C.P., and dried with clean lens tissue immediately. The objectives should never be taken apart except by a qualified Swift serviceman. Should dust be observed on the back lens of the objective, an all-rubber ear syringe or enema tube may be utilized to blow the dust out.

The eyepieces may be cleaned in the same manner as the objectives. It is noted that in most cases xylol will not be required.

Breathing on the lens to moisten it, then wiping dry with clean lens tissue will usually be sufficient to clean the surface. The finish of the microscope is hard epoxy and is acid resistant and extremely durable. Clean with a damp cloth and mild detergent.

MECHANICAL: The body should be removed periodically and the slideways lubricated with a thin film of Plastilube, which is the finest lubricant for this purpose.

Should the coarse focus control become too tight or too loose, the set screw in the knobs should be loosened, then the coarse knobs rotated clockwise, one against the other, using two hands. This will increase the tension on the body assembly.

The inclination joint may be tightened by use of the two hex-head nuts visible.

It is recommended that all microscopes be serviced by authorized Swift microscope repairmen or competent servicemen at regular intervals.

The guarantee that accompanies each SWIFT microscope is the most liberal of any manufacturer, and your SWIFT dealer has all the necessary units to insure fast, efficient service.

Swift Instruments Inc. stands ready to assist at any time and welcome any inquiries. Your Series 950 microscope is a highly versatile instrument and many accessories are available to further enhance the use of the microscope.

IMPORTANT MICROSCOPICAL TERMS

COMPOUND MICROSCOPE—A microscope having a primary magnifier (the objective) and a secondary (the eyepiece) to further magnify the image, and bring the light rays to a focal point (the eyes).

ACHROMATIC OBJECTIVE—An optical system corrected for two colors chromatically and one color (yellow-green) spherically.

APERTURE, ANGULAR—The angle (or cone) of light rays capable of entering the front lens of the objective from a point in the object. By increasing the angular aperture of an objective more light rays from the specimen can be taken in by the lens, hence the resolving power is increased.

APERTURE, NUMERICAL (N.A.)—A mathematical formula devised by Ernst Abbe for the direct comparison of dry and all types of immersion objectives for resolving power. Numerical aperture (N.A.) is the sine of half the angular aperture of the objective multiplied by the refractive index of the medium between the front lens and the cover glass. N.A. range of the Series 950 objectives are 0.10 (4x), 0.25 (10x) and 0.65 (40x). These are research type objectives and have a large N.A.

CONDENSER—A lens or system of lenses to collect light rays and converge them to a focus. The series 950 has a condenser built into the stage. The N.A. of the condenser is 0.65, matched to the highest power objective.

COVER GLASS—Thin glass cut in circles, rectangles or squares, for covering the specimen, usually a thickness of 0.17 to 0.18mm. The majority of specimens should be covered by a cover glass, and a necessity for the 40x lens.

DEPTH OF FOCUS—The ability of a lens to furnish a distinct image above and below the focal plane. Depth of focus decreases

with the increase of numerical aperture or with the increase of magnification.

EYEPIECE—The lens system near the eye which magnifies the primary image of the objective so as to form a virtual image 10" away from the eyepiece.

FIELD—The area of the object that is seen when the image is observed. It may range in diameter from several millimeters to less than 0.1mm. Also the size of the diaphragm opening in the eyepiece governs the diameter of the field of view.

FOCAL LENGTH—Parallel rays of light after refraction through a lens will be brought to a focus at the focal point. The distance from the optical center of the lens to the focal point is the focal length or focus.

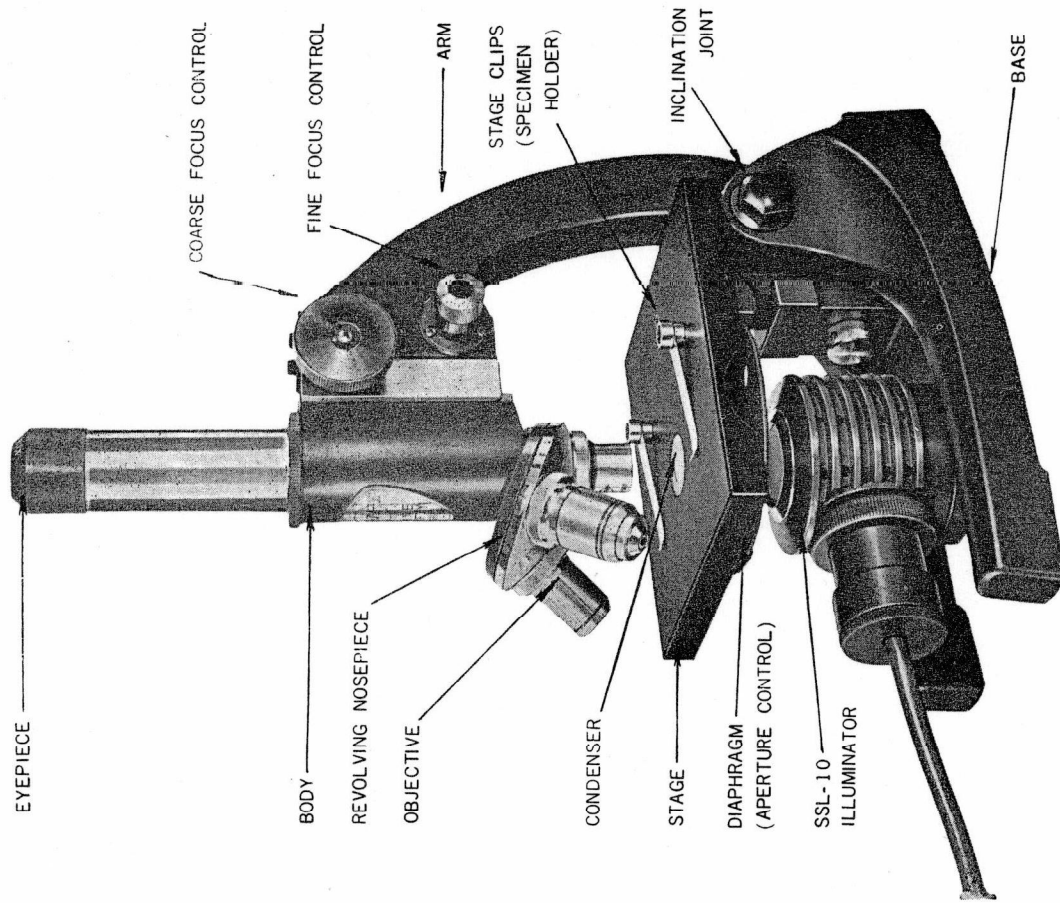
OBJECTIVE—The lens system near the object which forms the primary image.

PARFOCAL—A term applied to objectives and eyepieces when practically no change in focus has to be made when one power is substituted for another. The objectives on your SWIFT Series 950 are parfocalized at the factory so that only a slight turn of the fine adjustment is required when a change is made from low to a higher power.

RESOLVING POWER—The ability of a lens to clearly separate fine detail. Resolving power is directly proportional to the numerical aperture of the objective. Also the shorter the wavelength of the light used, the greater the resolving power of the optical system.

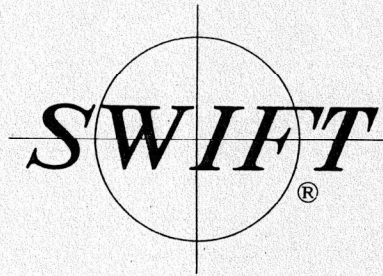
WIDEFIELD EYEPIECE—An ocular with an achromatic doublet for the eyelens and with the plane side of the lower lens nearest the objective. Such a corrected system does not have to be stopped down with a diaphragm, hence a large flat field is insured.

WORKING DISTANCE, FREE—The distance between the front lens of the objective and the cover glass when the lens is focused on the specimen.



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