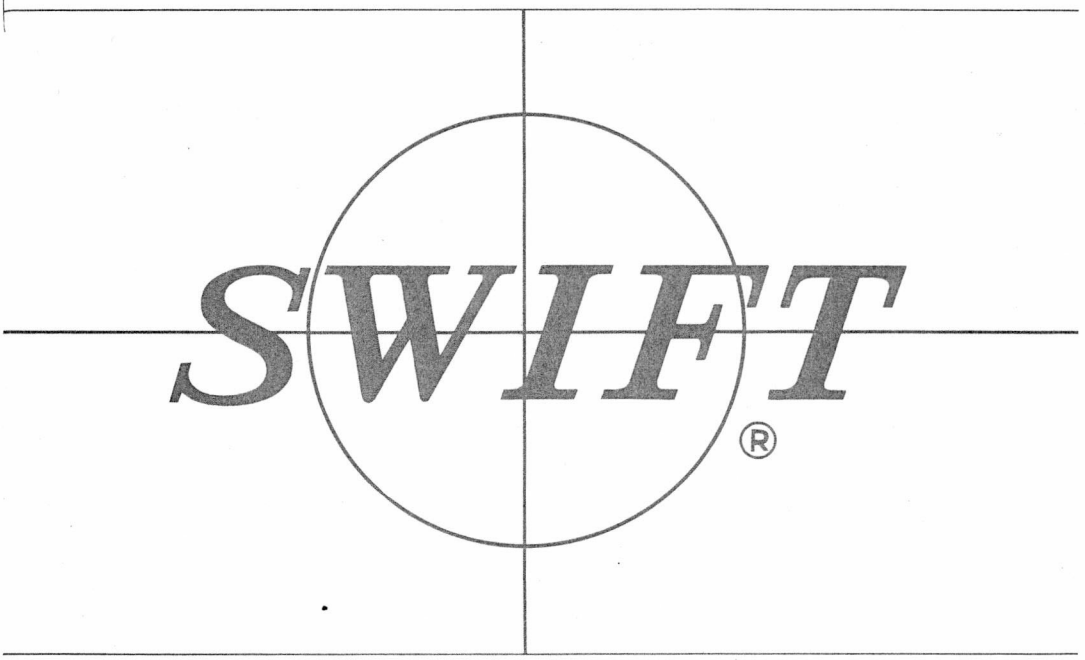
USE AND CARE OF SWIFT SERIES M960

MICROSCOPE



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USE AND CARE OF SWIFT SERIES M960 MICROSCOPE

Your Swift microscope, Series M960, 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 M960 was ordered without cabinet, it will be in a molded styrofoam container. Lay the container on its side, remove the tape from its perimeter and carefully lift the top half of the container. The objectives will be found within individual plastic vials.

Install the objectives into the microscope's revolving nosepiece from the lowest magnification to the highest, in a clockwise direction from the rear.

Familiarize yourself with the components and terminology of the microscope.

Base — This is the rectangular 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 on or 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 M960 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 parfocalized to each other. The 40x (high dry) objective is in a retractable mount to elminate 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 taper-roller type with a micrometer screw. It is operated from either side of the arm. This fine adjustment has an 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 M960 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 M950, 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 nosepiece rotated to the higher magnifying objectives. The objectives are parfocalized 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 M960 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 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 QUODLIBET SYSTEM OF PHASE CONTRAST MICROSCOPY

The Quodlibet system of phase contrast offers techniques in a form simple enough for even the newest science student, yet with phase contrasted results comparable to instruments costing many times more.

The Swift Quodlibet Phase unit may be ordered as a complete microscope or added to your M950 series microscope that is presently equipped with a disc diaphragm.

HOW TO USE YOUR SWIFT QUODLIBET MICROSCOPE

You will note the 10x and 40x objectives are designated " Phase ". This means phase contrast may be achieved with these two objectives, while the 4x objective remains brightfield only.

Look at the disc diaphragm, found attached to the underside of the stage plate. Note the openings (called apertures) in the disc, and the green phase annulus mounted in a green cylindrical mount. Phase contrast is achieved by rotating the disc to position the green annulus under the condensing lens in the stage plate.

With the annulus positioned thus, the 10x and 40x will produce a fine, phase contrast image of the specimen.

Your Swift Quodlibet will also function as a normal, brightfield microscope. Simply rotate the disc diaphragm to any other position, which removes the phase annulus from the path of light, and your 10x and 40x phase objectives will perform as normal brightfield objectives.

Another feature of your Swift Quodlibet is evident when the disc diaphragm is rotated to position the phase annulus under the condensing lens in the stage, and the low power 4x objective is positioned for viewing. In this manner, the specimen is viewed brightly illuminated against a dark background. This is actually low powered darkfield microscopy.

WHAT IS PHASE CONTRAST ?

Phase contrast is literally " optical " staining of the specimen, rather than physical. Phase contrast is achieved by passing light from the illuminator through a phase annulus which is attached to the disc diaphragm of your SWIFT QUODLIBET microscope, which separates the central and outer beams. These light rays consist of undeviated central rays and deviated diffracted rays. The diffracted rays are a quarter wave ($^1/_4\lambda$) behind the central rays. After passing through the phase ring at the back focal plane of the objective the central rays are retarded ($^1/_4\lambda$) and are reduced in intensity. The central rays are now in phase with the diffracted rays. These rays when brought to a focus at the eyepiece produce a well contrasted image of the specimen.

THE SWIFT SSL-10 ILLUMINATOR FOR SERIES M960 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 M960 MICROSCOPE

The Series M960 is designed to require only a minimum of maintenance and has many features to prevent accidents common to the " student " microscope. Loss of stage clips is eliminated since these are secured to the stage by allen socket capscrews. Mirrors and forks are also secured in a similar manner. Gear damage is eliminated by internal devices which prevent the rack and pinion from being disengaged. Overfocusing is prevented by a unique clutch system activated at upper and lower limits of travel. This is a special feature of SWIFT teaching microscopes and is covered under U. S. A patent #3451739.

Tension of the focusing movement is controlled by a tension system found on the pinion metal of the rapid focus control. This is adjusted only by a special tool, Swift Cat. No. MT202. Unauthorized persons are cautioned against tampering with this device.

Cleaning: The front lens of the objectives, particularly the 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, and dried with clean lens paper 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 may be utilized to blow the dust out.

The eyepieces may be cleaned in the same manner as the objectives, except in most cases Xylol will not be required. In most instances breathing on the lens to moisten it, then wiping dry with clean lens tissue will be sufficient to clean the surface.

The finish of the microscope is hard epoxy and is resistant to acids and reagents. Clean this surface with a damp cloth and mild detergent.

Mechanical Parts: Mechanical parts are mostly concealed from the outside. Microscopes should be serviced by a qualified serviceman periodically to remove contaminents from the moving surfaces. These surfaces should then be relubricated using only those lubricants recommended by Swift.

Swift microscopes are covered by the most liberal warranty available and your authorized Swift dealer has all the necessary data to insure fast, efficient service. Swift Instruments, Inc. stands ready to assist you at any time and your inquiries are invited. Your Swift Series M960 microscope is a highly versatile instrument and many accessories are available to further enhance its use.

You will note the exploded view of M960 Series in this manual. Each part is numbered and named on the reverse side. If the occasion should arise where it becomes necessary to order a part, specify the model of your microscope, its serial number, the number of the part and its name. Complete parts are available through authorized Swift dealers or direct from the factory.

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. ranges of the Series M960 objectives are 0.10 (4x), 0.25 (10x) and 0.65 (40x). These are research type objectives and have a larger N. A. than most competitive objectives in the Teaching microscope field.

CONDENSER—A lens or system of lenses to collect light rays and converge them to a focus. The series M960 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 eyepoint.

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 M960 are parfocalized at the factory so that only a slight turn of the fine adjustment is required when a change is made from a lower 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 eye lens 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—The distance between the front lens of the objective and the cover glass when the lens is focused on the specimen.

Inquiries regarding the M960 Series or other Swift products should be directed to your authorized Swift dealer or:

SWIFT INSTRUMENTS, INC.

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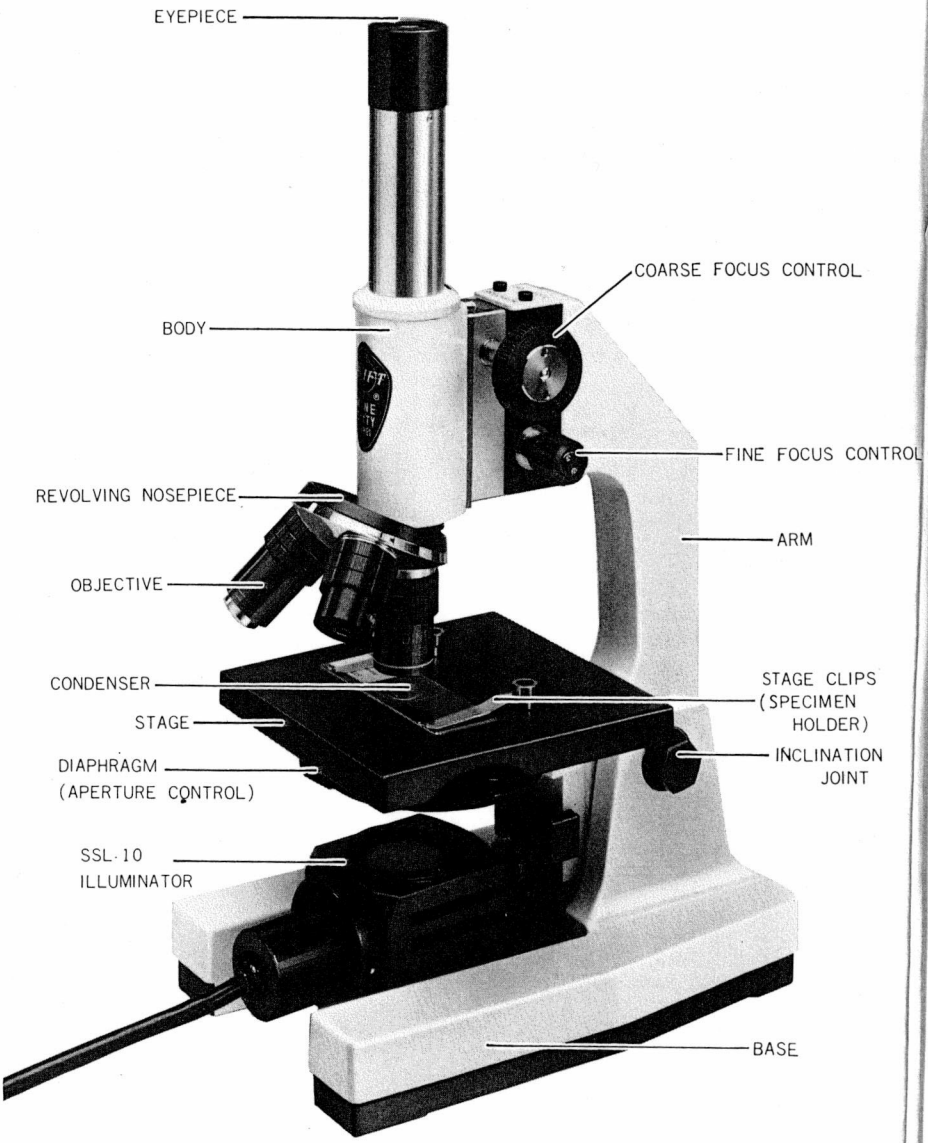
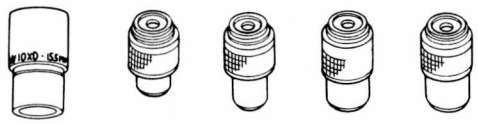
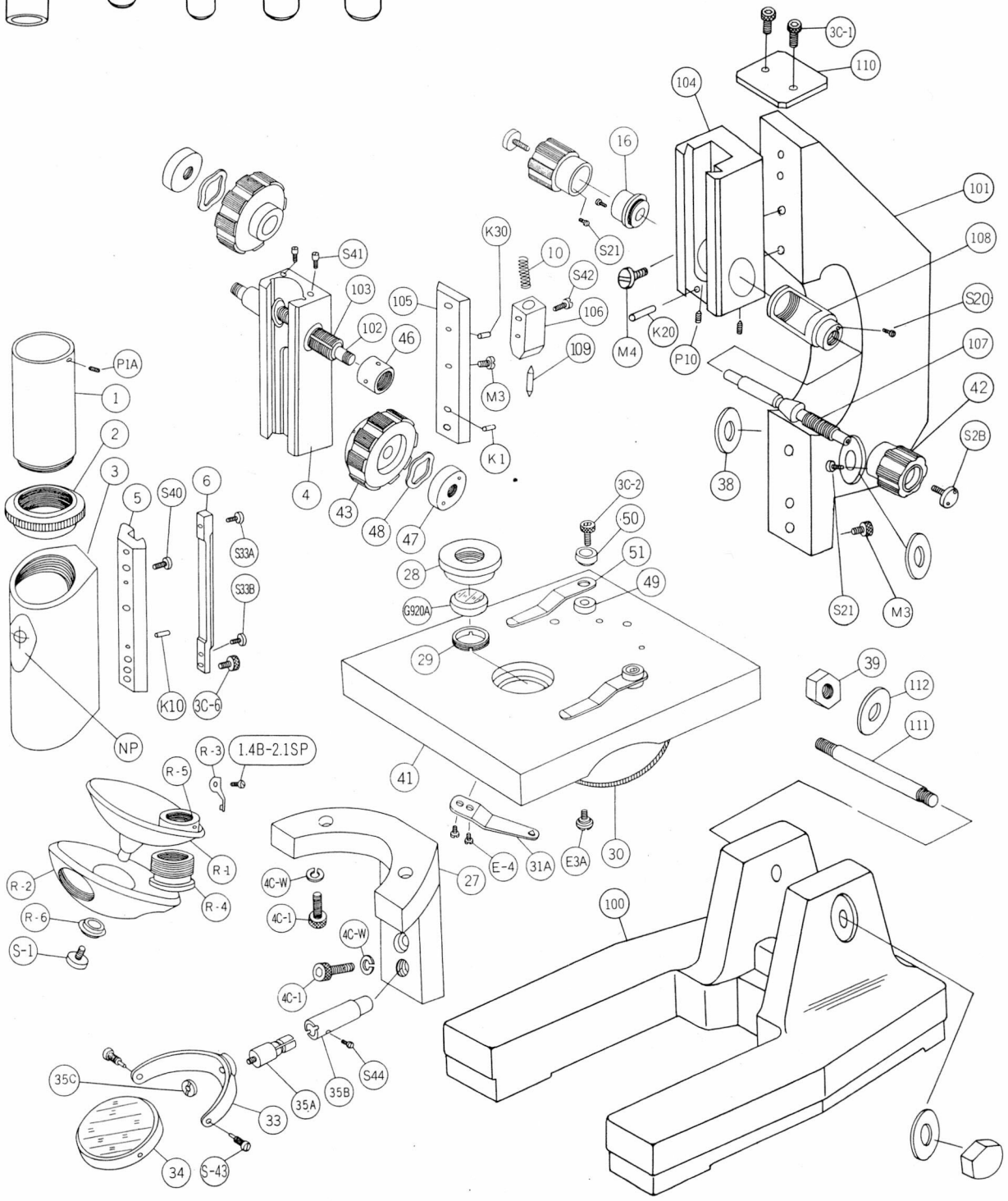
P.O. Box 562 SAN JOSE CAL. 95106


EYEPIECE
COARSE FOCUS CONTROL
BODY
FINE FOCUS CONTROL
REVOLVING NOSEPIECE
ARM
OBJECTIVE
CONDENSER
STAGE CLIPS
(SPECIMEN
HOLDER)
STAGE
INCLINATION
JOINT
DIAPHRAGM
(APERTURE CONTROL)
SSL-10
ILLUMINATOR
BASE

MODEL M960 SERIES

W10×D 4×D 10×D 40×D 100×D





PARTS LIST

Parts Number	Description	Parts Number	Description
1	Eyepiece Tube	46	Metal Ring
2	Flange	43	Coarse Adj. Knob
3	Main Tube	48	Washer
P1A	Screw	47	Nut
NP	Marking Plate	105	Dove Slide
5	Rack guide	K30	Knock Pin
S40	Screw	M3	Screw
6	Rack	K1	Knock Pin
S33A	Screw	109	Pin
S33B	Screw	106	Spring Case
3C-6	Screw	S42	Screw
K10	Knock Pin	10	Fine Adj. spring
1.4B-2.1SP	Screw	S21	Screw
R-3	Spring	16	Fine Adj. Metal
R-5	Connector	M4	Screw
R-1	Upper Revolver	K20	Knock Pin
R-4	Joint Ring	P10	Screw
R-2	Lower Revolver	104	Fine Adj. Block
R-6	Ring	3C-1	Screw
S-1	Screw	110	Cover Plate
4	Fine Adj. Block	101	Arm
S-41	Screw	108	Fine Adj. Case
103	Pinion Metal	S20	Screw
102	Pinion	107	Spindle

PARTS LIST

Parts Number	Description	Parts Number	Description
42	Fine Adj. Knob	41	Stage
S2B	Screw	30	Disc Diaphragm
M3	Screw	E3A	Screw
S21	Screw	31A	Spring
38	Washer	E4	Screw
39	Nut	27	Stage Holder
112	Washer	4C-W	Washer
111	Joint Pin	4C-1	Screw
100	Base	S44	Screw
49	Collar	35B	Bush
50	Collar	35A	Fork
3C-2	Screw	33	Mirror Bow
51	Stage Clip	S43	Screw
28	Condenser Frame	34	Mirror
G920A	Condenser Lens	35C	Nut
29	Retainer Ring		

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