USE AND CARE OF SWIFT M1000D SERIES

MEDICAL-BIOLOGICAL MICROSCOPE

SWIFT®

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When Quodmaster Phase Sets are added to these models a screw (stop) located on the vertical face of the substage condenser bracket must be backed out slightly (2 turns) to allow maximum upward travel of the substage to properly position Phase Condenser.

SWIFT QUODMASTER PHASE MICROSCOPY

The Quodmaster Phase Contrast Set includes the following: 4xD Achromatic (scanning lens) 10xD & 40xD phase objectives. Substage, mount centerable, N.A. 1.15 condenser. Five aperture rotatable disc containing one phase annulus common to both 10xD & 40xRD phase objectives. One darkfield stop common to 4xD 10xD Phase and 40xRD Phase objectives. One diffusion filter and one open aperture in addition to an iris diaphragm for brightfield use at all magnifications.

Note: A 100xRD objective is congruent with the iris diaphragm for brightfield oil immersion microscopy.

The SWIFT Quodmaster 100 is the same as above with the addition of a 100xRD Phase annulus in the disc and a 100xRD Phase objective affording phase technique with 10xD, 40xRD, & 100xD Objectives; darkfield technique with 4xD, 10xD, 40xRD objectives; brightfield with 4xD, 10xD, 40xRD including 100xRD oil immersion.

CARE OF YOUR SWIFT M1000D SERIES MICROSCOPES

Your SWIFT M1000D Series microscope is a precision instrument and requires only routine maintenance. With ordinary care, the microscopes will last a lifetime. Microscopes like other precision instruments should be cleaned after each use, which prevents dust and other forms of contaminents from drying on exposed surfaces.

Eyepiece and objective lenses should never be wiped while dry. Particles of dust should be removed using a soft camels hair brush or air. Lens paper folded several times and moistened with an approved lens cleaner such as Xylol or Xylene should be used to clean glass surfaces. Lenses should never be disassembled except by qualified, authorized technicians.

The painted metal surfaces of your SWIFT M1000D Series microscopes are finished with a formula of epoxy-ester-resin, and are resistant to staining or dulling from most reagents found in classrooms or laboratories. The finish should be wiped off periodically with a soft, moistened piece of flannel or chamois.

Periodic servicing is recommended. This should be done only by qualified technicians since general servicing includes disassembly, cleaning and relubrication. Also, at this time all parts are tightened

and inspected for wear. Periods of maintenance will vary depending on the hours of use of the microscope each day. Some schools will find servicing every three years adequate, while others will require more frequent attention.

SWIFT M1000D Series microscopes operate best when lubricated only with lubricants recommended by SWIFT. Depending on the climate, moisture will evaporate from lubricants over a period of time, usually about three years. At that time, the lubricant no longer performs its function and should be removed and replaced to ensure ease of operation in the movement of parts on their bearing surfaces.

Your SWIFT M1000D Series microscope is covered by the most liberal warranty available, which is printed within all SWIFT brochures and is backed by a fully stocked and manned plant in Tokyo, Japan and San Jose, California, U.S.A., as well as service dealers in most states and many countries of the world.

INSTRUCTIONS FOR REPLACING BULB (LAMP) M1000D SERIES MICROSCOPE BASES

M1001D/M1001DM

1. Remove Eyepieces
2. Turn microscope stand on its back (back of arm on bench)
3. Remove four screws securing bottom cover plate (316A)
4. Remove cover plate exposing lamp (bulb) – – replace lamp and re-assemble

M1002D/M1002DM/M1004D/M1005D

1. Loosen or back off set screw (4S10) on side of variable intensity control knob – – remove knob – – (Use 2mm Allen wrench)
2. Using same wrench loosen set screw (4S10) on side of base – –
3. Lift up the entire insert assembly (1022) – – exposing lmap (bulb) – – replace lamp and re-assemble.

Inquiries regarding the SWIFT M1000D Series or other SWIFT products should be directed to your authorized SWIFT dealer, or:

SWIFT INSTRUMENTS, INC.
Scientific Instrument Division
SanJose, California 95106

the more commonly used, Cargille Immersion Oil, onto the cover glass. The controls are then manipulated to immerse the front lens of the objective into the oil. This forms an air tight connection through which the specimen may be viewed without interference from the atmosphere. Care must be taken not to come into direct contact between the lens of the objective and the cover glass since this may scratch or otherwise mar the viewing area of the lens itself.

Oil immersion objectives should be cleaned immediately after each use since the oil will dry after a time and prevent satisfactory viewing thereafter.

PROCEDURE FOR ADJUSTING THE SWIFT CO-INCIDENT FOCUS BINOCULAR BODY

1. Adjust interpupillary distance for comfortable viewing. (One field of view).

When your particular interpupillary distance is found note the interpupillary scale reading. (Between eyepiece tubes).

2. Set this reading to each individual eyepiece. (By turning Calibrated Diopter Rings).

3. Focus sharply. If there is a difference in vision (Acuity) between eyes, focus sharply to one eye then adjust opposite Diopter Ring for acuity.

The microscope will now be adjusted to your particular vision requirements and parfocal at all powers.

PHASE CONTRAST WITH THE SWIFT M1000D SERIES MICROSCOPE

The phase contrast microscope reveals fine detail in transparent objects which possess very little contrast. Unstained living organisms and cells can be studied without danger of artifacts produced by killing, fixing or staining reagents. Before the advent of phase contrast such specimens could only be examined in transmitted light by closing down the substage condenser diaphragm to a small aperture. The narrow cone of illumination produced diffraction with destruction of detail.

SWIFT SYSTEM OF QUODLIBET PHASE CONTRAST MICROSCOPY

The Quodlibet system of phase offers phase contrast techniques in a simple form, yet with phase contrasted results comparable to instruments costing many times more.

The SWIFT Quodmaster Phase unit may be ordered as a complete microscope or added to your M1000D Series microscope.

used to complete the focusing of the specimen to produce the sharpest image.

4. The iris diaphragm is not intended to control the brightness of the illumination but induces contrast into the specimen by diffracting light rays. Focusing of the specimen should be done with the iris diaphragm opened to its largest aperture. If additional contrast is required to permit accurate viewing of the specimen, the diaphragm should be slowly closed until the details of the specimen are sharply defined. Care should be taken not to use an aperture too small to gain high contrast, as then 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 10xD (N.A. 0.25) objective will not be the same as for the 40xD (N.A. 0.65), since the angle of light required is determined by the numerical aperture of the objective. Proper adjustment of the diaphragm aperture is easily determined after a little experience with the microscope.

The rule governing condenser numerical apertures is: the numerical aperture of the condenser must be equal to or greater than the numerical aperture of the highest powered objective. In this instance, the 100xD oil immersion objective has an N.A. of 1.25. Thus, the Abbe condenser (N.A. 1.25) is required to utilize the full resolving power of the objective. The iris diaphragm provides a continuously variable increase or reduction of the diameter of the cone of light from the illuminator. Proper focusing of the N.A. 1.25 condenser is important and is accomplished as follows:

1. Raise the condenser to its upper limits of focus. The iris diaphragm should be fully opened.

2. Focus the specimen with the 10xD Objective. (The diameter of the cone of light should fill the back lens of the objective. This utilizes the full resolving power of the objective. However, most specimens react better to a cone of light approximately 3/4 the diameter of the back lens of the objective).

3. Remove the eyepiece and view the cone of light visible on the back lens of the objective.

4. Lower the condenser to achieve a cone of light approximately 3/4 the diameter of the lens.

5. Replace the eyepiece and view the specimen.

6. If additional contrast is required to permit study of the specimen, the iris diaphragm may be closed slightly.

7. It is necessary to exclude air from the space between the cover glass over the specimen and the front lens of the 100xD objective. This is accomplished by placing a drop of cedarwood oil, or

or no movement at all of the fine focus control is required when a change is made from high to lower powers.

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.

$$\text{Resolving power} = \frac{\lambda}{\text{N.A.}} \quad \text{when} \quad \frac{\lambda}{\text{N.A.}} \quad \begin{matrix} = \text{wave length of} \\ \text{light being used.} \\ = \text{numerical aperture.} \end{matrix}$$

Widefield Eyepiece: is generally an ocular with an achromatic doublet for an eyelens and with the plano 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 assured.

Working Distance, Free: the distance between the front lens of the objective and the cover glass when the lens is focused on the specimen.

Coarse Focus: this is the large knob found on each side of the microscope and is used for rapid movement of the stage to bring the specimen near to focus.

Fine Focus: the smaller knobs within the larger coarse focus knobs. Fine focus controls are used to precisely focus the specimen to produce the sharpest image.

Tension Control: This is the large thin knurled wheel knob between the coarse focus knob and side of arm – slight turning clockwise or counter clockwise will increase or decrease focus tension and or sensitivity.

Focusing Stop Lever: Moving this lever to locking position will allow user to lower stage and return stage to approximate same focal plane.

USING YOUR SWIFT M1000D SERIES MICROSCOPE

Most models of M1000D Series microscopes will be equipped with widefield 10x eyepieces, objectives 4xD, 10xD, 40xRD, 100xRD and N.A. 1.25 condenser with iris diaphragm and swing out filter holder.

These models are used as follows:

1. Secure the slide to the stage with spring fingers.
2. Revolve the nosepiece to position the lowest power objective.
3. View through the eyepiece and use the coarse focus control to bring the specimen nearly into focus. The fine focus control is now

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.

Numerical Aperture (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 of the objective and the cover glass on the slide. Numerical apertures of all SWIFT objectives are of research quality.

Condenser: a lens or system of lenses to collect light rays and converge them to a focus. Condensers are available for the M1000D Series as follows – N.A. 1.25 Abbe Condenser with iris diaphragm and swing out filter carrier. Condensers available for the Quodlibet System of Phase Microscopy (instantly convertible to dark or brightfield) are as follows: MA403D N.A. 1.15 Condenser with 5 aperture disc and phase annulus compatible to and including Phase 10xD and Phase 40xD Objectives. MA404D same as MA403D with addition of Phase 100xD 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 this is a necessity when using the 40x and 100x 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 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 specimen 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 M1001D Series microscope are parfocalized at the factory so that only a slight movement

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Your SWIFT M1000D Series microscope 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 in the hands of both student and professional users. It is designed to withstand the rigors of daily use with only normal care.

Unpacking: Your SWIFT M1000D Series microscope arrived packed in either a fitted cabinet or molded styrofoam container. The objectives may be in sealed plastic vials and care should be taken not to drop them or allow your fingers to contact the lenses. Install the objectives in a clockwise direction from the lowest to the highest power.

Familiarize yourself with the components of the microscope.

Arm:	The frame that supports all components above the base.
Body:	The unit comprising the inclined eyetubes and prisms which control the path of light to the eyepiece.
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 components that further magnify the primary image and brings the light rays to a focus at the eyepoint.
Condenser:	The optical lens built below the center of the stage.
Stage:	The table of the microscope on which the specimen is placed.
Base:	The component which supports the entire instrument. This component includes an illuminator which directs light through the condenser to the specimen.

Important terminology common to the science of microscopy:

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.

Angular Aperture: the angle (or cone) of light rays capable of entering the front lens of the objective from a point in the object. By

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