

## SWIFT OPTICAL INSTRUMENTS, INC. LIMITED LIFETIME WARRANTY

The Swift Optical Instruments, Inc. Limited Lifetime Warranty assures that the microscope is guaranteed against defects in material and workmanship for the life of the product. Electrical components are covered for five years; camera and video components are covered for one year after purchase. Normal wear, routine maintenance, light bulbs or damage resulting from repair by unauthorized parties, accident, alteration, shipping, misuse or abuse is not covered. Warranty service is provided by Swift Optical Instruments, Inc.'s authorized technicians. Determination of warranty is at the technician's discretion.

Defective products covered by the warranty will be repaired free of charge when they are returned, postpaid, to:

Swift Optical Instruments, Inc.  
Attn: Warranty Repair  
11113 Landmark 35 Drive  
San Antonio, TX 78233

For all warranty repairs or service requests, please call our Repair Department at (877) 967-9438 before anything is shipped. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

\*For customers living outside the United States, Swift Optical Instruments, Inc. will provide standard warranty service. However, inbound & outbound shipping cost is the responsibility of the consumer.

Swift Optical Instruments, Inc.  
(877) 967-9438  
[www.swiftoptical.com](http://www.swiftoptical.com)



## SWIFT M6000 SERIES

The Swift M6000 series is designed for high school, advanced placement studies, and situations that demand a rugged and reliable microscope. Built with optical quality and "student-proof" features, the M6000 includes corded, variable LED illumination, and a coaxial focusing system. The M6001CL features a monocular head, reversed nosepiece, wide field 10XD eyepiece, 4x, 10X, and 40XR (sealed) achromat objectives, a built-in 0.65 condenser with iris diaphragm, and cord hangers. In addition to these features, the M6003CL-4 includes a sealed 100XR objective, 1.25 spiral mount condenser with iris and built-in mechanical stage. M6000DGL models incorporate a digital camera in the monocular head which allows users to capture still images and video clips or to use for presentation purposes.



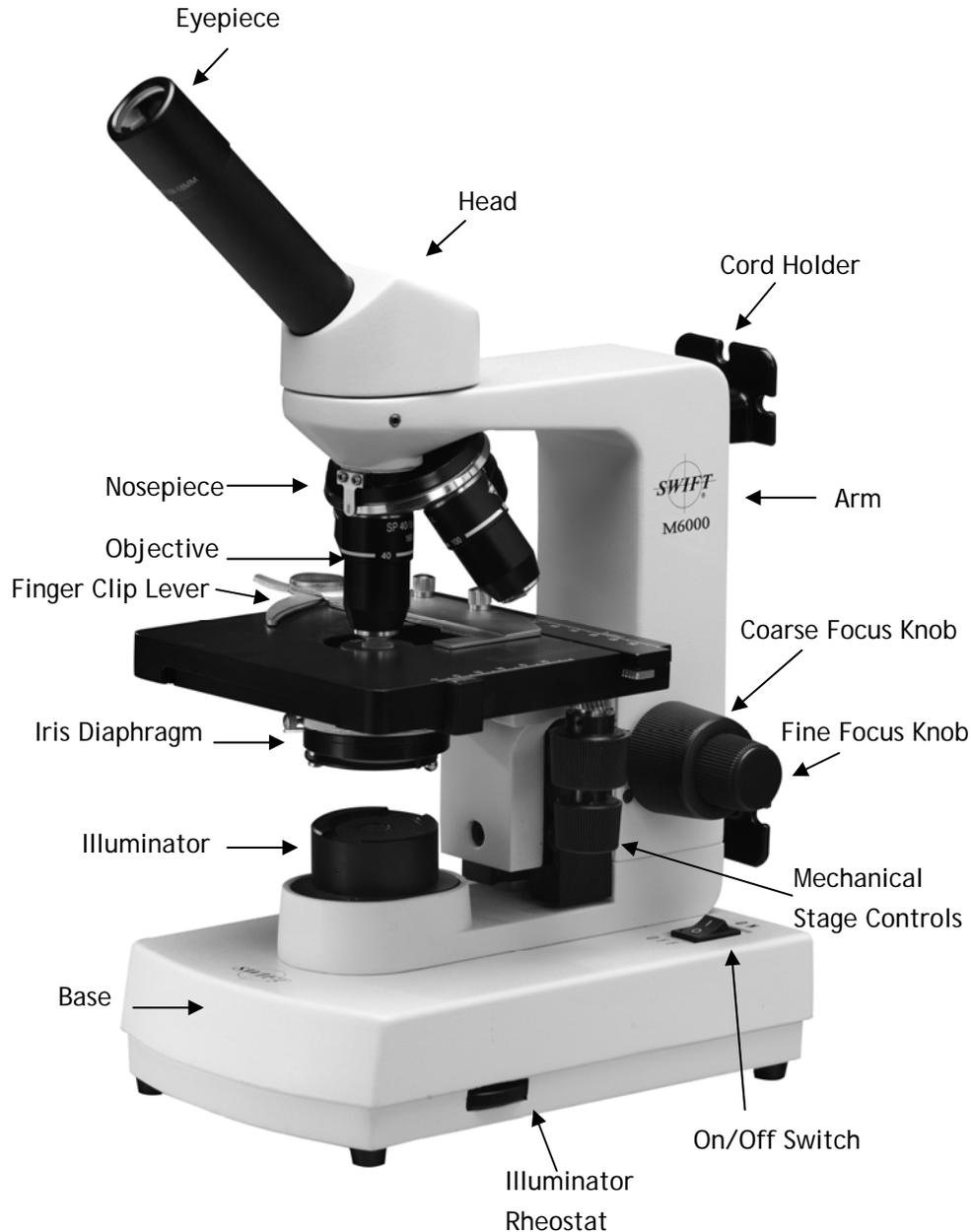
To Order Parts:  
[www.Swift-MicroscopeWorld.com](http://www.Swift-MicroscopeWorld.com)  
800-942-0528 Toll Free  
760-438-0528 International  
[info@swift-microscopeworld.com](mailto:info@swift-microscopeworld.com)

## LED REPLACEMENT

The Swift M6000CL base is equipped with a 3.4 volt, .06 watt illumination system. The LED for this illumination system has approximately 50,000 hours of service. **The time may vary depending on use and intensity. To prolong the life of the LED, you should always turn off the unit when not in use.**

When purchasing a replacement LED, it is important that you use only the Swift approved LED (Swift # MA2215). This LED has been tested and approved for life span, color temperature and brightness.

To replace an LED, you must first make sure the microscope is unplugged. Raise the stage to its highest point to attain clearance for the removal of the illuminator housing. Use the 0.9mm allen wrench (included with the microscope) to loosen the 2 set screws that secure the black illuminator housing to the base of the microscope. Remove the illuminator housing to expose the LED. Remove the LED by pulling it straight up. To install the new LED, align the 2 metal socket pins with the 2 holes at the bottom of the new LED and gently push the LED onto the socket. Re-install the illuminator housing and tighten the set screws to hold the housing in place.



(M6003CL pictured)

maintenance, but certain components should be cleaned frequently to ensure ease of viewing. The power switch should also be turned off or unplugged when the microscope is not in use.

**CLEANING** - The front lens of the objectives (particularly the 40XRD and 100XRD) should be cleaned after use. First brush with a soft, camel hair brush or blow off with clean, oil-free air to remove dust particles. Then wipe gently with a soft lens tissue, moistened with optical cleaner (eyeglass or camera lens) or clean water. Immediately dry with a clean lens paper.

**CAUTION** - Objectives should never be disassembled by the user. If repairs or internal cleaning should be necessary, this should only be done by qualified, authorized microscope technician.

The eyepiece(s) may be cleaned in the same manner as the objectives, except in most cases optical cleaner will not be required. In most instances breathing on the eyepiece to moisten the lens and wiping dry with a clean lens tissue is sufficient to clean the surface. Lenses should never be wiped while dry as this will surely scratch or otherwise mar the surface of the glass.

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.

Periodically, the microscope should be disassembled, cleaned and lubricated. This should only be done by a qualified, authorized microscope technician.

**DUST COVER AND STORAGE** - All microscopes should be protected from dust by a dust cover when in storage or not in use. A dust cover is the most cost-effective microscope insurance you can buy. Ensure that the storage space is tall enough to allow the microscope to be placed into the cabinet or onto a shelf without making undue contact with the eyepieces. Never store microscopes in cabinets containing chemicals, which may corrode your microscope. Also, be sure that the objectives are placed in the lowest possible position and the rotating head is turned inward and not protruding from the base. Microscopes with mechanical stages should be adjusted toward the center of the stage to prevent the moveable arms of the mechanical stage from being damaged during storage in the cabinet.

## COMPONENTS OF THE MICROSCOPE

**ARM** - the vertical column (attached to the base) which supports the stage and contains the coarse and fine adjusting knobs and focus mechanism.

**BASE** - the platform of the instrument to which the arm is attached. The base stands on rubber feet and contains the illuminator assembly.

**COARSE FOCUS** - the larger, outer knob of the focus control which facilitates rapid and heavy movement of the focusing mechanism. In order to prevent gear damage, the focus control is equipped with an upper limit stop that protects the high magnification objectives and slides. The system is also furnished with a tension control to prevent "stage drift".

**COAXIAL CONTROLS** - the focusing control mechanism moves the stage up and down to bring the specimen into focus. A coaxial focus control combines the coarse and fine focus mechanisms into one control with inner and outer knobs, which are located on both sides of the arm. This coaxial focus control incorporates a clutch mechanism which allows for slippage at the extreme ends of the focus range to prevent damage to the gears.

**CONDENSER** - the function of the condenser is to provide full illumination to the specimen plane and to enhance the resolution and contrast of the specimen being viewed.

**EYEPIECES** - the upper optical element that further magnifies the primary image of the specimen and brings the light rays into focus at the eyepoint.

**FINE FOCUS** - the smaller inner knobs of the coaxial control which allows for slow and subtle focusing movement to bring the specimen into sharp focus.

**HEAD** - the upper portion of the microscope which contains the refracting prisms and the eyepiece tubes which hold the eyepieces. Note that the head rotates, allowing operation from the front or back.

**ILLUMINATOR** - the M600CL illuminator uses a 3.4V, 0.06W LED as the light source (LED replacement part # MA2215).

**IRIS DIAPHRAGM** - The iris diaphragm is a round device that is mounted below the condenser. It has multiple leaves similar to a camera shutter. By moving the control lever from side-to-side, the opening in the diaphragm increases or decreases, allowing the user to control the contrast of the specimen. If the image is "washed out" the iris diaphragm is opened too wide. If the image is too dark the iris is not open wide enough.

**MECHANICAL STAGE** - an alternative to stage clips is a mechanical stage. A mechanical stage holds the slide in place and allows the user to move the slide along the x and / or y axis through manipulation of the two mechanical stage control knobs.

**NOSEPIECE** - the revolving turret that holds the objective lenses. Changes in magnification are accomplished by rotating different powered objective lenses into the optical path. The nosepiece must "click" into place for the objectives to be in proper alignment.

**OBJECTIVES** - the optical systems which magnify the primary image of the instrument. Magnifications are usually 4X, 10X, 40X and 100X.

**STAGE** - the table of the microscope where the slide is placed for viewing. This component moves upward and downward when the focusing knobs are turned.

**STAGE CLIPS** - a pair of flexible metal clips attached by spring screws that hold the slide in position on the stage.

## OTHER IMPORTANT TERMINOLOGY

**"COATED" LENS** - in attempting to transmit light through glass, much of the light is lost through reflection. Coating a lens increases the light transmission by reducing or eliminating reflection, thus allowing more light to pass through.

**COMPOUND MICROSCOPE** - a microscope having a primary magnifier (the objective) and a second (the eyepiece) to both conduct light, amplify magnification and convert the image into a field of view easily seen by the human eye.

**COVER GLASS** - thin glass cut in circles, rectangles or squares, for covering the specimen, usually a thickness of 0.15 to 0.17mm. The

Limited Lifetime Warranty will be null and void if the mechanical or optical components are disassembled by a non-Swift dealer.

### A. PROBLEM - No Image

#### CORRECTION -

1. Is the objective fully rotated into position (until it clicks into place)?
2. Is the specimen in the focal path (centered in the opening in the stage above the condenser)?
3. Is the iris diaphragm completely closed?

### B. PROBLEM - No Illumination

#### CORRECTION -

1. Is the power plug connected to an active A.C. outlet?
2. Is the illuminator intensity control turned all the way down?
3. Replace the LED
4. Is the power switch working properly?

### C. PROBLEM - Image appears "washed out" or weak.

#### CORRECTION -

1. Slowly close the iris diaphragm.
2. Objective lens is dirty. See "Care and Cleaning" section.
3. Eyepiece is dirty. See "Care and Cleaning" section.

### D. PROBLEM - Dust or hairs seem to be moving in the image.

**CORRECTION** - The diaphragm is not open wide enough. Open the iris diaphragm to increase the size of the opening allowing for additional illumination.

### E. PROBLEM - Focusing knobs turn with difficulty.

**CORRECTION** - The microscope should be disassembled, cleaned and re-lubricated by a qualified, authorized technician.

## CARE AND CLEANING

The M6000 Series microscope is designed to function with minimal

## DIGITAL PHOTOGRAPHY

The M6000DGL Series of microscopes feature a built-in 1280 X 1024 pixel digital camera to capture still images or video clips onto a computer. In order to use the camera, the software must first be installed on a computer. Instructions on how to install and use the software is included on the software CD that was packaged with the M6000DGL Series microscope.

## PARTS AND ACCESSORIES

### EYEPIECE REPLACEMENTS

MA10511S	W10XD, 18mm Eyepiece with pointmaster
MA10512	W10XD, 18mm Eyepiece
MA10513	W10XD, 18mm Eyepiece with pointer

### OBJECTIVE REPLACEMENTS

MA10071	4XD achromat
MA10072	10XD achromat
MA10073S	40XRD achromat
MA10074	100XRD achromat
MA10081	4XD semi-plan
MA10082	10XD semi-plan
MA10083	40XRD semi-plan
MA10084	100XRD semi-plan

### MISC. ACCESSORIES

MA268	Stage clips
MA12005	Mechanical stage (high drive)
MA12006	Mechanical stage (low drive)
MA533	Dustcover
MA2215	LED 3.4V, .06W
MA14283	Cord holders

## COMMON PROBLEMS IN MICROSCOPY

If you have a problem, you may be able to correct it yourself. Here are a few common problems and easy solutions you may want to try before calling for service.

**CAUTION** - Never disassemble mechanical or optical components. This servicing should only be done by an authorized Swift technician. The

majority of specimens should be protected by a cover glass, and must be covered when using 40XRD or 100XRD objectives.

**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.

**DIN** - (Deutsche Industrial Norman) A German standard for the manufacturing of microscope lenses. DIN is not a quality standard but one of commonality.

**EYE POINT or EYE RELIEF** - the distance from the eyepiece lens to your eye where a full field of view can be seen.

**FIELD OF VIEW** - 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.

**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.

**NUMERICAL APERTURE (NA)** - a measure of an objective's light gathering capabilities. The concept may be compared to the F-value in photographic lenses. Generally speaking, N.A. values of less than 1.00 are "Dry" objectives. Values of 1.00 or greater require oil as a medium. Please note that condensers are part of the optical system and are also assigned an N.A. value. That value must be at least as high as that of the highest objective used.

**PARFOCAL** - a term applied to objectives and eyepieces when practically no change in focus is needed when changing objectives. The objectives on your Swift M6000 microscope are parfocalized at the factory so that only a slight adjustment of the fine focus knob is needed to maintain focus when switching magnification.

**RESOLUTION or RESOLVING POWER** - the ability of a lens to define the details of the specimen at a maximum magnification. This is governed by the NA (Numerical Aperture) of the lens. For example, a 40X objective with NA 0.65 has a maximum resolving power of 650X, equal to 1000 times the NA. This rule of  $NA \times 1000$  is true of all achromatic objectives.

**WORKING DISTANCE** - the distance from the lens of the objective to the cover slip on the slide, when the specimen is in focus.

## USING YOUR SWIFT M6000 SERIES MICROSCOPE

Once you have learned the terminology and purpose of each component of the microscope, use of the microscope is simple and enjoyable. By following these easy steps, you will be able to begin studying the specimen quickly and easily.

1. Place a slide on the stage and secure it in place using the spring loaded stage clips. If the microscope is equipped with a mechanical stage, open the specimen holder of the mechanical stage by pressing the finger clip lever. Carefully place the slide against the stationary side and back edge of the mechanical stage and release the finger clip lever.
2. Align the specimen under the objective lens. If the microscope has a mechanical stage, use the adjustment knobs to center the specimen into the optical path. The knobs allow for the up/down and left /right movement of the slide.
3. After securing and moving the slide into position, turn the power switch on. Rotate the nosepiece to place the lowest power objective (4XD) into position over the specimen. Be sure the objective "clicks" into position. The iris diaphragm should be adjusted at this time to about a ¼ inch (5 mm) open.
4. While viewing through the eyepiece, rotate the coarse focus knob slowly and carefully to bring the specimen into focus. The specimen may require some centering in the field of view at this time. By using the fine focusing knob, slowly and carefully refine the focus to clearly observe the fine details of the specimen. Now you can turn the nosepiece to the higher magnification objectives. The objectives are parfocalized so that once the 4x objective is focused, only a slight turn of the fine focus is required in changing to higher power objectives.
5. Please note that smaller apertures of the diaphragm increase contrast in the image while large apertures decrease the contrast.

(The diaphragm is not intended for controlling the brightness of the illumination). A good procedure to follow in selecting the proper

opening is to start with the largest and reduce it until the fine detail of the specimen is in exact focus. Using an inappropriate aperture results in a "washing out" of the image. Care must be exercised not to reduce the aperture too much to gain high contrast, as then the fine structure in the image of the specimen will be destroyed. Reducing the aperture *does* increase contrast and depth of focus, but it also reduces resolution and causes diffraction. The aperture for the 10X objective will not be the same as for the 40XRD objective, since the angle of the required light is determined by the numerical aperture (N.A.) of the objective, the proper aperture of the diaphragm must be selected. This can be easily achieved after minimal experience with the microscope.

## OIL IMMERSION (Only for M6003CL models)

It is desirable to use immersion oil with the 100XRD objective. Using oil slightly increases the resolution and brightness of the image being viewed through the microscope. Drop a tiny amount of oil onto the slide prior to focusing with the 100XRD objective (between the slide and the objective tip). It is essential to thoroughly clean the objective tip after use. Please contact Swift Optical or your authorized Swift dealer for the appropriate immersion oil to use.

**IMPORTANT:** The working distance of the 40XRD and 100XRD objectives to the slide surface is very close and although the 40XRD objective on the M6000 Series is sealed to prevent immersion oil contamination, it is a good practice to avoid dragging the 40XRD objective through an oiled slide.

