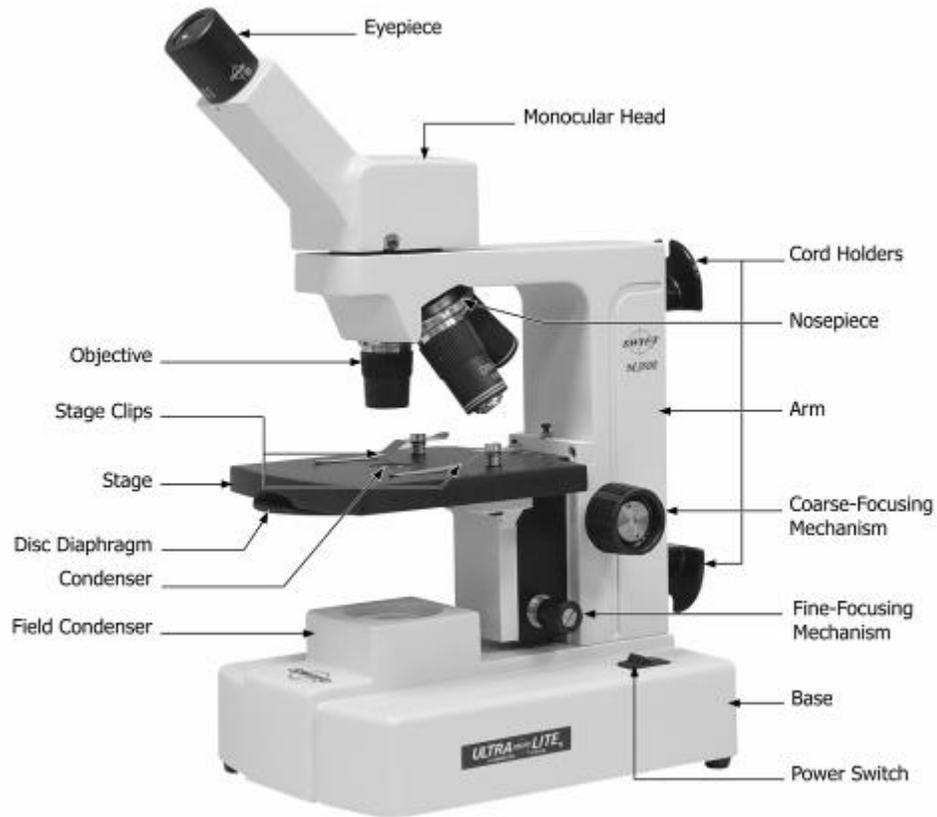


## SWIFT M3500 SERIES MICROSCOPE

The Swift M3500 Series microscope is considered to be the most “Student proof” microscope on the market. It is an instrument of optical and mechanical precision and will perform satisfactorily with minimum maintenance.



## MICROSCOPE COMPONENTS

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

**BASE** - the housing and platform of the instrument to which the arm is attached. The base stands on rubber feet and contains the illuminator assembly. The bulb replacement part number is printed on the underside of the base.

**COARSE FOCUS CONTROL MECHANISM** - this model is a stage focusing model meaning the stage moves up or down by means of a brass rack and steel pinion gear to bring the specimen into focus. The movement is achieved by two large knobs on the sides of the arm. In order to prevent gear damage, the focus control is equipped with a slip clutch that allows slippage at both ends of the focusing range. The system is also furnished with a tension control to prevent "stage drift".

**CONDENSER** - the condenser is mounted in the stage and it is used in conjunction with the iris diaphragm. The function of the condenser is to provide full illumination to the specimen plane and to enhance the resolution and contrast of the object being viewed.

**CORD HOLDERS** - A pair of half-circle brackets installed on the back of the arm which are used to store the electrical cord.

**DISC DIAPHRAGM** - The wheel-shaped disc attached to the underside of the stage. It has circular openings, called apertures, and may be rotated to align any of the apertures with the optical path.

**EYEPIECES** - the upper optical element that further magnifies the primary image of the specimen and brings the light rays in focus at the eyepoint. The eyepiece has a calibrated POINTMASTER® scale for taking measurements.

**FIELD CONDENSER** - A lens located in the light housing which intensifies the light from the illuminator in the base.

**FINE FOCUS CONTROL MECHANISM** - the fine focusing knobs, located on either side of the microscope, in front of and slightly lower than the

coarse focusing knobs, are used for precise focusing adjustments once the specimen has been brought into view with the coarse focus controls

**HEAD** - it is the top portion of the microscope that contains the refracting prisms and the eyepiece tube. The eyepiece is locked onto the eyepiece tube with a set screw. The head rotates allowing operation of the microscope from the front or the back, and allows the microscope to be shared by simply rotating the head.

**IRIS DIAPHRAGM** - a round multi-leaf device mounted below the condenser which is controlled by a lever. It is similar to a camera shutter and controls the amount of light entering the condenser, allowing the user to control contrast. 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, allowing the user to move the slide on any x/y axis through the manipulation of two control knobs or a co-axial control mechanism.

**NOSEPIECE** - the revolving turret that holds the objective lenses, permitting changes in magnification 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 DIN objectives are standard in the industry, with large numerical aperture (N.A.) to permit maximum resolution. All objectives are achromatic, color-coded and parfocaled at a 45mm distance. The 40XRD and the 100XRD are sealed to keep oil residue from seeping into the objective. These two objectives have a spring loaded tip to prevent accidental breakage of either the slide or front lens of the objective if they should come into contact with each other.

<u>Part No.</u>	<u>Mag.</u>	<u>N.A.</u>	<u>Working Distance</u>	<u>Field of View</u>	<u>Color Code</u>
MA10071F	4X	0.10	14.83mm	4.50mm	Red
MA10072	10X	0.25	6.32mm	1.80mm	Yellow
MA10073S	40X	0.65	0.53mm	0.45mm	Blue
MA10074	100X	1.25	0.23mm	0.18mm	White

**POWER SWITCH** - turns the illuminator on and off.

**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.

## IMPORTANT MICROSCOPY TERMS

**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.

**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 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 Normen) An international optical standard for the manufacturing of most quality microscope lenses. Many DIN lenses will be interchangeable from one DIN microscope to another.

**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 converge 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, objectives with 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 has to be made when an objective of one power is substituted for another. The DIN objectives on your Swift M3500 Series Microscope are parfocaled at the factory to a standard 45mm distance, so that only a slight turn of the fine adjustment is required when a change is made from a lower to 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 optical system.

**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 M3500 MICROSCOPE

1. Use the stage clips or slide holder mechanism to secure the slide in place. Be sure the specimen is centered over the opening in the stage.
2. Rotate the nosepiece to place the lowest power (4X) objective over the specimen. Be sure the objective "clicks" into position.

The disc or iris diaphragm should be turned or adjusted to the largest aperture, allowing the built-in substage illuminator to provide a constant, even dispersion of light to the optical system. The disc or iris diaphragm is not intended to control the brightness of the illumination. The purpose of the diaphragm is to match the numerical aperture of the objective. Smaller apertures increase contrast in the image while large apertures decrease the contrast. A good procedure in selecting the proper aperture is to start with the largest and reduce until the fine detail of the specimen is in exact focus.

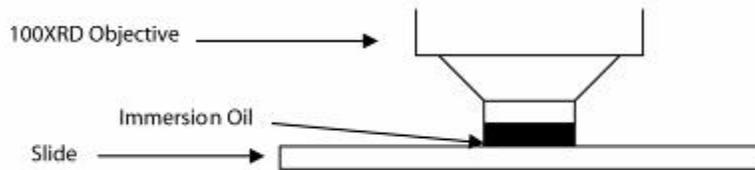
3. While viewing through the eyepiece, rotate the coarse focusing knob to bring the specimen into view. Next, sharpen the focus using the fine focus knob.
4. If the image of the specimen appears pale, the aperture of the diaphragm should be decreased (if the model has a disc diaphragm, rotate the disc to a smaller hole, conversely, if the model has the iris diaphragm, it should be closed slightly). This will increase contrast in the specimen's image. If the specimen appears dark, slightly open the diaphragm.
5. Rotate the nosepiece to the next higher power objective. A slight turn of the fine focusing knob may be required to bring the image of the specimen into sharp focus. Once the specimen is in focus with the highest power objective, it will be in focus with each lower power objective.

### **OIL IMMERSION (Only for models with a 100X objective)**

When light rays from the objective lens to the specimen pass through air, they are distorted slightly, a phenomenon known as refraction. This is usually not a problem at a magnification of 400X or lower. However, at a magnification of 1,000X and above, refraction becomes problematic. This problem is reduced significantly by placing a thin layer of very clear, viscous oil between the slide and tip of the objective lens. The result is a much clearer image at 1,000X because the oil has the same light transmitting properties as glass. Using oil slightly increases the resolution and brightness of the image. Usually a very thin slide (size #1) is used for oil immersion because at this magnification, the working distance is very small and is critical to focusing the specimen. Good quality glass (not plastic) cover slips should be used. If their thickness is over 0.17mm, the objective will not resolve properly, because the specimen cannot be moved close enough to the objective lens to be in focus.

Place a tiny amount of oil (only 1 drop should be sufficient) onto the slide prior to rotating the 100XR objective into position. It is essential to thoroughly clean the objective tip after use to prevent damage and to ensure that an image can be seen clearly the next time the objective is used. Please contact Swift Optical or your authorized Swift dealer for the appropriate immersion oil to use.

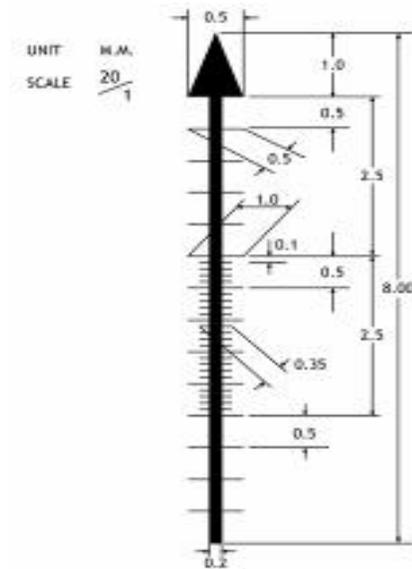
**IMPORTANT:** The working distances of the 40XRD and 100XRD objectives to the slide surface are very small and although the oil immersion objectives are sealed to prevent oil contamination, it is a good practice to avoid dragging these objectives through an oiled slide. The 100XRD oil immersion lens on Swift microscopes has a spring-loaded end to prevent cracking the cover slip upon its initial contact. Once this zone of safety is exceeded by moving the slide further toward the lens, a point can be reached where damage will occur. Always make a practice of frequently checking the position of the lens on the slide. Note that a 100XRD objective requires an iris diaphragm for brightfield oil immersion microscopy.



## HOW TO USE THE POINTMASTER® EYEPIECE RETICLE

Swift's patented POINTMASTER® eyepiece reticle, which is installed in the eyepiece of the M3500 microscope, enables the user to easily measure the size of the specimen.

1. The numbers on the chart indicate the actual size of the POINTMASTER® scale in millimeters. For example, the length is 1.0mm from the top of the arrow to the bottom; the total length of the scale is 8.0mm, etc. The thickness of all the horizontal lines is 0.01mm.
2. To obtain the actual physical size of a specimen, divide the POINTMASTER® scale readings by the magnification of the objective lens that is in use. Divide the readings by 10 if the 10X objective is being used, 40 if the 40XRD objective is in use, or 100 if of 100XRD is in use.



## DIGITAL PHOTOGRAPHY

The M3501CL-DGL and M3503CL-4DGL models feature a built-in 1280 X 1024 pixel digital camera to capture still images or video clips on to a computer. In order to use the camera, the software must first be installed on a computer. The minimum computer requirements to use the camera is having an available USB 2.0 port, Windows XP, Vista or Mac OS X operating system installed on the computer, 512MB of RAM, 1GB free hard drive space and 1Ghz CPU. **Instructions on how to install and use the software is included on the software CD that was packaged with the M3501CL-DGL and M3503CL-4DGL microscopes.**

## PARTS AND ACCESSORIES

### EYEPIECE REPLACEMENTS

MA10510 W10XD, 18mm Eyepiece  
MA10511 W10XD, 18mm Eyepiece with Pointmaster

### OBJECTIVE REPLACEMENTS

MA10071F 4XD Achromat Objective  
MA10072 10XD Achromat Objective  
MA10073S 40XRD Achromat Objective  
MA10074 100XRD Achromat Objective

### MISC. ACCESSORIES

MA268 Stage Clips (pair)  
MA533 Dust Cover  
MA12005 High-drive Mechanical Stage  
MA12006 Low-drive co-axial Mechanical Stage  
MA15383 Cord Holder (pair)  
MA2202F 5W Fluorescent Bulb  
MA2215 .06 W LED replacement lamp

## CARE AND CLEANING

The M3500 Series microscope is designed to function with minimal 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 blown 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.

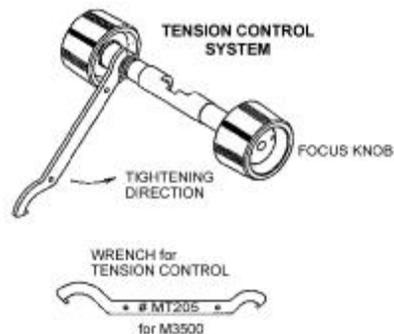
**CAUTION** - Objectives should never be disassembled by the user. If repairs or internal cleaning should be necessary, this should only be done by qualified, authorized microscope technician. The eyepiece(s) may be cleaned in the same manner as the objectives, except in most cases optical cleaner will 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 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.

**TENSION CONTROL OF FOCUSING MOVEMENT** - Tension of the focusing movement is controlled by a tension system found on the pinion metal of the rapid focus control. This can be adjusted by using the Swift part #MT205 wrench.



**BULB REPLACEMENT** - To prolong the life of the bulb you should always turn off the unit when not in use. The replacement bulb part number can be found underneath the microscope on the metal base plate. The M3500DF models use a 5W fluorescent bulb Swift part number MA2202F. The M3500CL models use a .06W LED Swift part number MA2215.

### **MA2202F Fluorescent Bulb**

To replace a bulb, you must first turn the power off and unplug the microscope's electrical cord from the electrical socket and remove any slides on the stage. Carefully turn the microscope on its side, unscrew and open the hinged cover. A cable tie is used to secure the bulb to the bulb socket and must be cut and removed. Make sure the bulb is cool and remove it by carefully pulling the bulb out of its socket. Insert the new bulb by seating the bulb firmly into the socket. The bulb should not need further alignment. Another small cable tie can be used to secure the bulb to the socket if the microscope is going to be moved around often. Close the hinged cover and tighten the screw to hold the hinged cover closed.

### **MA2215 LED**

To replace an LED, you must first turn the power off and unplug the microscope's electrical cord from the electrical socket and remove any slides on the stage. Use the small allen wrench (.09mm) that was included with the microscope to loosen the set screws that hold the black illuminator housing onto the base of the microscope. Remove the illuminator housing to expose the LED. Simply pull the LED straight up to remove it from the light socket. Align the 2 metal socket pins with the holes at the bottom of the new LED and push the LED onto the socket. Re-install the illuminator housing.

## **COMMON PROBLEMS IN MICROSCOPY**

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

#### **CORRECTION -**

1. Is the power plug connected to an active A.C. outlet?
2. Is the on/off power switch working properly?
3. Check the bulb. Try a new bulb if you have one.
4. Check the contact points of the bulb and socket

**B. PROBLEM** - Illumination "hot spots" and uneven brightness in the field of view.

**CORRECTION** -

1. Is the Abbe condenser in the correct position?
2. Are the nosepiece and objective clicked into proper position?

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

**CORRECTION** -

1. Slightly close the diaphragm to a smaller aperture
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 iris diaphragm is not open wide enough. Slowly open the diaphragm to increase the size of the opening allowing for additional illumination.

**E. PROBLEM** - Once the specimen is in focus, it moves out of focus

**CORRECTION** - Gravity is causing the stage to drift downward, causing loss of focus. The focusing tension should be increased to act as a brake to prevent this downward drift. The M3500 Series is outfitted with a tension collar on the focusing shaft to allow tension to be increased or decreased on the Swift slip-clutch system. See page 10.

**F. PROBLEM** - Focusing knobs turn with difficulty.

**CORRECTION** -

1. Loosen the tension collar adjustment. See page 9.
2. The microscope should be disassembled, cleaned and re-lubricated by a qualified, authorized technician.

## 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; 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. • (800) 523-4544 •  
[www.swiftoptical.com](http://www.swiftoptical.com)



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)