



*"creating affordable innovations  
to care for the world's blind poor"*

## EPIC MICROSCOPE MAINTAINANCE MANUAL

### Guidelines for Maintenance of EPIC II Operating Surgical Microscope



The EPIC Microscope is named for being Economic, Portable, Innovative & Compact. *This microscope is designed for use in rural and field areas where usual operating microscopes are hard to transport. It is lightweight and can run for many hours on a battery, which eliminates the need for an outside power source. There are many features and advantages which are described here or in the operator's manual.*

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# 1 Design Features

The Epic II Operating Surgical Microscope is a robust design and requires minimal maintenance. This manual describes any necessary maintenance for this valuable piece of equipment to function properly and last trouble free for a long time. The following features on this microscope minimize the amount of maintenance required.

- The hard-anodized finish on the parts of the microscope stand reduces wear and excoriation of the metal. This finish also reduces friction between the different parts and joints giving a smoother operation.
- The innovative design with Delrin® inserts used in the joints controls friction and creates smooth tightening of the joints to optimize microscope arm mobility and tension during surgery.
- The robust stand is lightweight, strong, and stable when operating. The three-legged structure of the stand provides stability, without wobble, on an uneven surface.
- The wheels are made of durable plastic that are resistant to wear, roll smoothly, able to lock in place, and are not easily affected by water when cleaning the operating room floor.
- The compact nature of the stand makes it easy to transport. The stand also provides plenty of room for adjustment in the height of the stand to accommodate varying operating bed heights and microscope focal lengths.
- The handles for tightening the joints are adjustable, allowing them to be placed in any position to set the amount of friction and movement of the joint. All the adjustments use either a knob or adjustable handle to provide optimal tension.
- The non-corrosive design provides use of the microscope in high humidity areas without rust forming on the parts. Most of the parts are either aluminum, stainless steel, or coated steel. These materials make the microscope non-corrosive, easy to clean and promote an antimicrobial environment.
- The head of the microscope has adjustment knobs to make operating in different positions easy to do. Knobs covers are available and can be autoclaved, which allows the surgeon to adjust the microscope while scrubbed in an aseptic environment.
- The coated German-made optics of the microscope reduces glare and will provide trouble free use for many years. Most of the optics are accessible for cleaning, as needed.
- The mechanisms of the microscope stand, designed for simple operation, minimal repair, and an easy assembly, make the microscope very attractive for use in the developing world where maintenance resources are limited, and only basic tools are available. For this reason, much of the scope operates manually rather than using electrical motors and relays.
- The electronics of the microscope head runs independently of an external power

source for many hours when using the included lithium ion battery. This is particularly useful in places where electricity is either intermittent or nonexistent in very remote locations. The microscope can also be run directly from a range of DC voltage supplies from 9 to 32 volts without damage to the electronics.

- Most of the electronic parts are modular and easily replaced, if necessary. The lighting is all LED which should provide maintenance free operation for many years. The lighting system, carefully constructed, dissipates the heat from the LEDs to avoid damage to the LEDs.
- The microscope and suitcase together weigh no more than 50 pounds, the current amount allowable for a commercial aircraft check-on. The Pelican™ suitcase with Kaizen foam™ padding is designed to be protective and water resistant. The case also reduces rapid fluctuations in temperature and humidity. The case's secure locks, robust wheels, and comfortable handles all make for easy transportation of the instrument.



## 2 Specifications

Storage and operating temperatures based on LED Drivers.

Storage temperature	35°F (2°C) to 100°F (38°C)
Storage humidity	Below 60%
Operating temperature	40°F (4°C) to 90°F (32°C)
Operating humidity	Less than 70%
Environmental temperature	50°F (10°C) to 100°F (38°C)
Environmental humidity	50% to 70%
Microscope stand construction materials	Non-corrosive materials – primarily aluminum, Delrin® plastic and stainless steel.
Battery weight and dimensions	7.3 x 4.9 x 0.8 in. 1.24 lbs.
Battery type – Li ion	23000mAh or 32000 mAh
Battery voltage output	5V, 9V or 12V DC
Battery charging voltage	12V DC input
Power input to the microscope without the use of the battery	9 to 32 volts DC
Stand-alone weight of the microscope and stand	Approximately 27 lbs.
Weight of the microscope packed in suitcase	50 lbs. maximum

### Microscope optical specifications

Eye pieces	10X
Mag changer powers	4X, 6X, 10X, 16X, 25X
Objective lens	200mm focal length

The Epic II Operating Surgical Microscope is built to last for a lifetime if cared for properly. Pay special attention to these guidelines for maintaining the microscope in its best working condition for the long term.

## 2.1 Environmental Specifications

- a. Maintain in an environment with the least vibration possible
- b. Try to avoid using the microscope in dusty conditions to keep mechanisms and optics working.
- c. **Keep a cover (from top layer of suitcase) over the microscope whenever it is not in use to avoid damage to the lenses from dust.**



## 2.2 Temperature Specifications (see table above)

Avoid sudden changes in temperature. Example: going from air-conditioning to hot outside ambient temperature.

## 2.3 Humidity Specifications (see table above)

- a. Avoid humidity. When transporting the microscope keep it in the original padded case. Leave the water bladder outside of the case if it has had water in it and contains moisture.
- b. Avoid fungus in the optics by maintaining the humidity level less than 60% most of the time, if possible.

## 2.4 Specifications for Storage of Microscope

- Store the microscope in a climate controlled, air-conditioned environment or store in an ambient temperature not more than 100° (38° C) or less than 35° F (2°C).
- Store water bladder outside of case if wet.
- Place the binocular and microscope head inside a plastic bag with a desiccant inside **or** at least place a desiccant inside the microscope case to absorb moisture.



Desiccant packets



## 2.5 Specifications for Transportation of Microscope

- Always transport the microscope in the original case.
- Always transport with fragile labels** and treat it as fragile.
- Do not add additional items to the case when traveling, as this will cause the weight to be above 50 lbs.
- Remove the Lithium ion battery** from the top layer of the case **if traveling by commercial airline** and place in your carry-on.
- For safety, remove the tablet and GoPro or Yi camera from the 4th layer if traveling by airline and place in your carry-on.



### 3 Summary of Warnings for the Microscope

The following warnings are included in **red lettering** throughout the manual.

- a. **Keep a cover over the microscope whenever it is not in use. (2.1)**
- b. **Always transport in original suitcase and with fragile labels. (2.5)**
- c. **Remove Lithium ion battery if traveling by commercial airline. (2.5)**
- d. **Stress to the surgical staff and surgeons the microscope cover. (4.1)**
- e. **Check that the battery charger and power supply is available, plugged in and ready for use BEFORE the surgical day. (4.2)**
- f. **Check the knob for the middle pole slot, that it is aligned and secure. Do not tighten if not aligned properly. (4.2)**
- g. **Do not store wet water bladder in case. (4.2)**
- h. **Do not remove the screws from the bottom pole pegs. (4.5)**
- i. **Do not overtighten any of the handles, knobs or joints. (4.6)**
- j. **Ensure that all the constructed stand parts are engaged fully before tightening any of the knobs or handles on the joints. (4.6)**
- k. **Position the knob so as to fully engage the screw in the center of the keyway then tighten to avoid damage to the keyway. This can cause the two poles to become stuck in place. (4.6)**
- l. **Pay particular attention to tighten the bottom pole knob into the slot on the shaft of the middle pole so that the microscope will not suddenly lower. Make sure the tip of the knob actually aligns with the center of the slot. (4.6)**
- m. **Do not lose the little washer when removing the knob that secures the extension arm to the short top post. The post goes through an aluminum ring where there is a small stainless steel washer. (4.6)**
- n. **Replace the washers and locking nuts from the tilt knob exactly in the same order as removed. (4.6)**
- o. **Fill 4-6 gallons of water in the water bladder and keep in place whenever the microscope is set up. (4.7)**
- p. **There is a risk of the microscope becoming top heavy and tipping over if enough weight is not present – causing irreparable damage. Be ready to steady the scope from falling when the arms are outstretched. Keep flex arm in line with one of the legs to ensure that it is very stable and not to tip over. (4.7)**
- q. **Be careful not to strip the socket corners of set screws. (4.9)**
- r. **Replace the back cover, making sure that none of the wires get into the visual axis of the lenses or are pinched by the back cover itself. (4.9)**
- s. **Find the hex socket screw underneath the lower end of the flex arm (4.11)**
- t. **Do not try to work on the flex arm while it is still under tension. (4.11)**
- u. **Clean the motorized focus in place, the manual focus may be removed to clean. (4.13)**
- v. **Do not get any oil or grease on the lens itself. (4.13)**

- w. Remove the four socket screws that hold the light tube in place with the correct 2.5mm Allen key. Do not remove with a quick twist, but rather with a steady slow torque. (4.15)**
- x. Replace the light tube and tighten the 4 screws that hold the light source in place. Do not over-tighten these. (4.16)**
- y. Discard all used non-functional Lithium ion batteries at a designated recycle center. (5.1)**

## 4 Maintenance Considerations

### 4.1 Overview

In terms of maintenance there is very little that needs to be done to the microscope stand. The following are some details that will be helpful in keeping the microscope and stand maintained or repaired. Any of the parts on the microscope or stand that need to be loosened/removed can be opened by hand with either a metric Allen key set or a Phillips screwdriver. Beyond this, the manufacturer generally should carry out the repairs.

Many of the problems that occur with the microscope are due to humidity and/or dust. Both can be inevitable in a tropical climate where this microscope is often used. It is therefore very important to keep the microscope covered or in its case when it is not in use. A dust cover has been provided with the microscope; alternatively, a large Ziplock plastic bag with desiccant packets may be used. **It is important to stress covering the microscope with the surgical staff and surgeons so that damage does not occur to the working parts of the scope or the lenses.**



### 4.2 Maintenance schedule

The microscope is built for longevity; however, there are some parts that may need adjustment or replacement. Below is a routine maintenance schedule:

Maintenance detail	Frequency	How to check
Check battery level and charge	Night before surgery	Level on battery
<b>Check that the battery charger and power supply is available, plugged in and ready for use</b>	<b>Before each surgical day</b>	<b>Visually and manually</b>
Clean the outer surfaces of the microscope and microscope stand	Before each surgical day	Disinfecting wipes

Check flex arm balance	Before each surgical day	manually
Check all knobs for optimal tightness	Before each surgical day	Visually and manually
<b>Check that knob for middle pole slot is aligned and secure. Do not tighten if not aligned properly</b>	<b>Before each surgical day</b>	<b>Visually and manually</b>
Make sure binocular is aligned properly and mounting screw is tight	Before each surgical day	Visually and manually
Check the clarity and cleanliness of objective lens and binoculars	Before each surgical day	Visually
Check function of bulb and electronic parts	Before each surgical day	Visually and manually
Check that mounting piece for monitor is in place if the system has video	Before each surgical day	Visually and manually
<b>Place dust cover on microscope</b>	<b>after each surgical day</b>	manually
Check that all joints and locking mechanisms on the stand are working properly.	Weekly or whenever set up	Visually and manually
Check that extension arm posts are tight	Weekly or whenever set up	Visually and manually
Check that 3 leg pins are in place and casters are not loose. Check that wheel locking mechanism is working	Weekly or whenever set up	Visually and manually
<b>Check that the water bladder is clean and at least ¾ full (4-6 gallons) of water</b>	Weekly or whenever set up	Visually
Check tension on large knob on side of the microscope and spring washers intact with smooth function	Weekly or whenever set up	Visually and manually
Check all parts of the microscope for wear, wiring problems and broken parts. Replace if necessary.	Every 6 months	Visually and manually
Check that all flex arm screws are in place and tight	Every 6 months	Visually and manually
Check middle pole for burrs and free movement inside bottom pole	Every 6 months	Visually and manually
Check and lubricate all moving parts of the microscope as needed	Every 6 months	Visually and manually
Put together fully, set up and check microscope when not in use.	Every 6 months	Visually and manually
Place microscope parts in designated places in the suitcase with desiccant packets. Close suitcase securely. <b>Do not store wet water bladder in case</b>	Every time microscope is packed for travel or storage	Visually and manually

### 4.3 Tools and supplies needed

<b>Tool</b>	<b>Use</b>
Metric Allen key set	Used for most of the screws on the microscope
Standard Allen key set	3/16 used on leg pegs (rarely)
#2 Phillips screwdriver	Used on back cover of the scope
Flat screwdriver	Occasional use
Small clip ring pliers	Only if flex arm clip rings need to be removed (rarely)
Soldering iron and solder (optional)	Only used in emergency of a wiring solder joint coming loose
Fine flat file	Remove coarse burrs or smooth damaged areas caused by use
Aluminum oxide abrasive pad	Smooth rough metal or Delrin® parts if needed
Cotton buds	Helpful in removing dirt, oil, and debris from parts
Lens paper	To clean the lenses
Cotton cleaning cloth	Used for cleaning
Cotton gloves	Handling lenses
Paper towels	Soak up any excess oil or grease

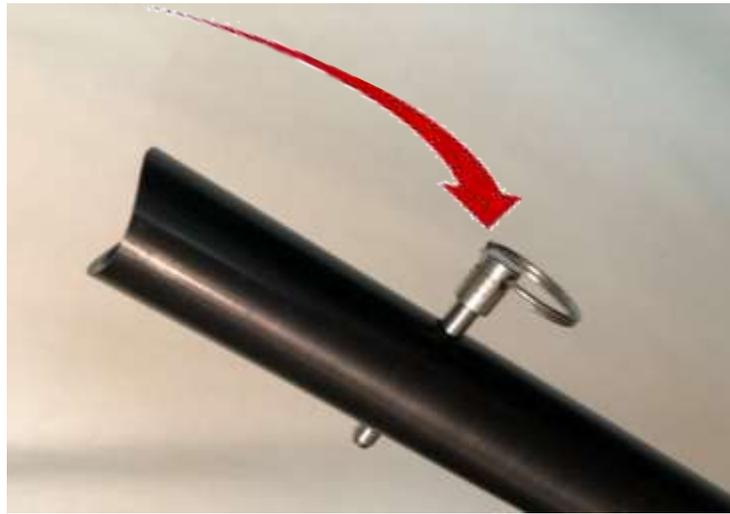
### 4.4 Lubricants and Reagents for Maintenance

	<b>Product</b>	<b>Use with the microscope</b>
tube	White lithium grease	Lubricate metal on metal parts
5%	Vinegar	Clean lenses, especially for fungus growth
Spray bottle	Window cleaner	Clean lenses
mixed	Lens cleaner	60% ethanol and 40% acetone
can	3 in 1 oil	Lubricate hinge pins and other small moving parts
5%	Bleach (sodium hypochlorite)	Use in the water bladder to prevent bacterial or fungal growth
household	Sanitizing wipes	Wipe down microscope for surgery to sanitize
can	Silicon spray	Lubricate Delrin joints
roll	Paper towel	use for cleanup and spills

## 4.5 Microscope Leg Maintenance

There should be no need for any maintenance of the microscope legs or pegs coming out of the bottom pole.

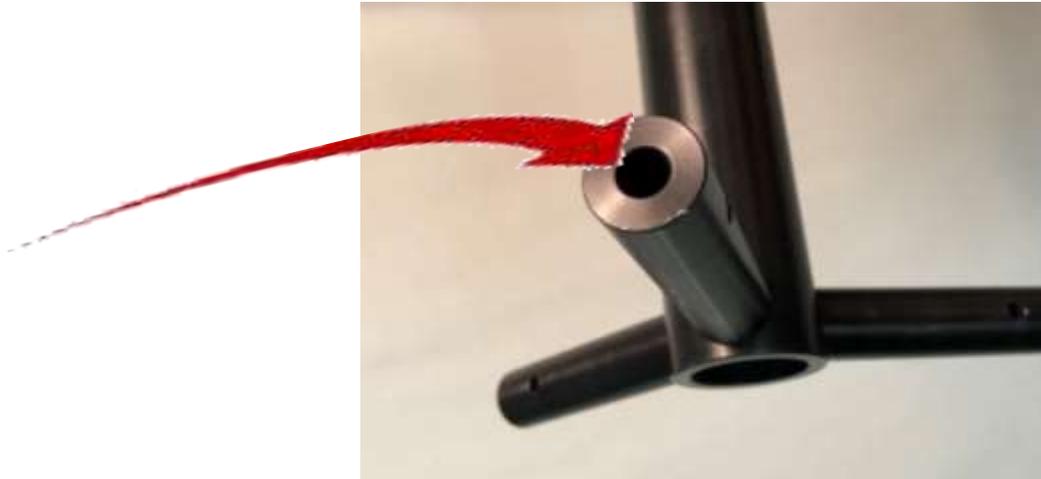
- a. Make sure there are three detent pins and that they are aligning the legs with the leg pegs properly.



- b. If any caster is falling out of a leg, reinsert the post after rotating the Delrin® insert 180 degrees. If this does not work, it may be easier to replace the particular leg and loose caster.



- c. The bottom pole has the pegs that hold the legs on. These are screwed into a stainless steel ring in the bottom of the pole. The screws are very tight to ensure stability and Locktight has been used to keep them from undoing. **It is important not to remove these screws unless absolutely necessary.**



- d. If the legs are loose on the bottom pole, one of the three pegs could be loose. To tighten any of the pegs, use a 3/16 inch Allen key to tighten the loose peg into the stainless steel ring which is inside the bottom of the large pole. This screw is secured with Locktight.

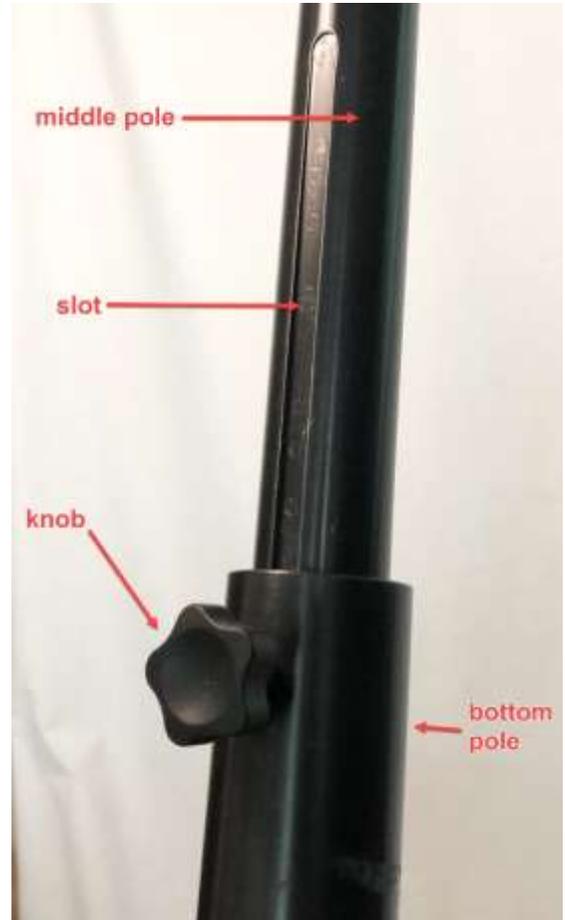


## 4.6 Microscope stand poles

- a. **The joints of the microscope stand should never be over tightened as this can cause damage either to the handle or the stand itself.** Tighten the joints just enough to achieve optimum arm movement for the surgeon.
- b. Each joint is tightened with a metal fitting which compresses either a Delrin® tab or collar. The situations where the joint needs to be tightened to make it completely stationary are: moving the microscope, or if the surgeon wants the joint locked. This can be done by tightening the joint carefully, but firmly, just to the point that it does not move. When the microscope is being used there needs to be some tension on these joints, but the arms should be movable with some friction. This should be adjusted by each surgeon to his/her liking and prior to surgery. With careful adjustment the movement on the arm and microscope head can be smooth and easily moved without drifting during surgery.



- c. Whenever the stand is put together, it is important to make sure that all of the stand parts are fully engaged before tightening any of the knobs or handles on the joints.
- d. The second pole is designed with a keyway slot which is tapered to ensure that when the pole is extended it will not drift downward on its own, and so put the patient at risk. The extension of this pole can be adjusted to a desirable height, depending on the height of the operating table. It is very important that the knob to tighten this pole is fully engaged exactly in the center of this keyway to avoid damage to the keyway, causing the two poles to become stuck in place, otherwise the edge of the keyway will be damaged by over tightening and misalignment. If this happens, the keyway can be cleaned up carefully with a square file and an aluminum oxide pad, as a last resort.



- e. The knob securing the extension arm to the short top post goes through an aluminum ring. If this ring is removed there is a small stainless steel washer in the Delrin® to keep the screw from damaging the Delrin® tab inside. It is easy to lose this little washer when removing these parts.



f. Tilt mechanism knob

On the right side of the microscope body there is a large knob used to adjust the tilt of the microscope head. On the shaft of this mechanism are spring washers and locking nuts to allow the tension of the microscope tilt to be changed. Depending on the surgeon's preference this allows the head of the microscope to tilt easily or to be locked in place. **It is important if this is taken apart that the washers and locking nuts are put back in exactly the same order.**

1. Check the brass washer on either side of the top mount arm where the tilt shaft mechanism goes through.
2. Lightly lubricate the brass washers and ring in the top mount with white lithium grease.
3. Adjust the tension on the tilt mechanism to allow it to move with some resistance by tightening the first lock nut then secure it with the second one.
4. Make sure the spring washers are returned in the same order and orientation as they came from the factory. Each spring washer is cupped. The direction of the cup should alternate on each consecutive washer so that maximum spring effect is made possible. See the diagram for the order of these washers and cap.
5. Replace the large knob and make sure that it can tighten the tilt of the head or loosen it as desired.



## 4.7 Water bladder maintenance

- a. The microscope comes with a plastic water bladder that is designed to be filled and provide balance and weight to the microscope when it is set up for use. The water is removed for traveling to keep the weight of the microscope under 50 lbs.
- b. Put the provided thin metal plate underneath the water bladder before filling it. (located on the inside of the lid of the Pelican case)



- c. Fill the microscope water bladder 3/4 full or 4-6 gallons of water and always keep it in place on the stand whenever the microscope is set up. There is a risk of the microscope becoming top heavy and tipping over if enough weight is not present – causing irreparable damage. Be ready to steady the scope from falling when the arms are outstretched. Keep flex arm in line with one of the legs to ensure that it is very stable and not to tip over.



- d. The water bladder is made of 20 mil plastic which should last for years. However, depending on its care it may need replacement. For extended use of the microscope water bladder, use one ounce (30ml) of household bleach (Clorox) with the water when filling the bladder, to prevent fungal growth.
- e. The water bladder may become discolored or dirty inside after multiple uses, especially in tropical areas depending on the purity of water that has been used. If this occurs, it can easily be cleaned with dishwashing liquid with a brush through the filling port. Using chlorinated tap water or a rinse with 4 ounces of vinegar can help keep the bladder free of fungal growth. All of the inside of the bladder can be accessed for cleaning with a long handled soft bristle brush



#### 4.8 Extension Arm Maintenance

There should be no need for any maintenance of the extension arm. If either of the two posts coming out of the flex arm is loose, tighten it with the appropriate size metric Allen key.



## 4.9 Replacement of LED bulbs

The expected lifetime of the LED bulbs is 100,000 hours so in theory they may never need to be changed. However, in case of a failure of the microscope light to turn on, there could be a failure of the LED bulbs, the wiring, or the LED driver.

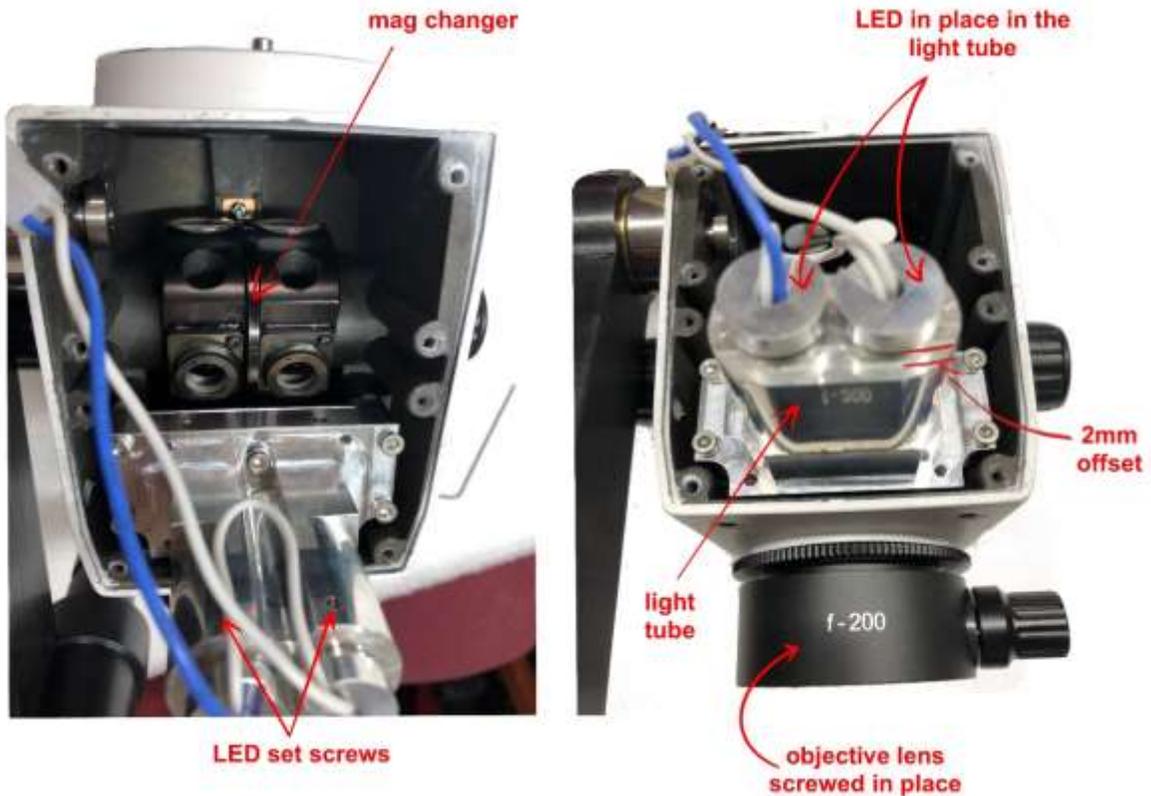
When removing the back of the microscope, check for loose wires that are not inserted totally into the white connector, as a loose wire can cause failure of the light to turn on.

If replacing the LEDs does not solve the problem, then the LED driver chip needs to be checked and replaced if necessary. A replacement LED set and LED driver chip are part of the LED replacement kit. If the light does not turn on after changing both the LED bulbs and chip and the battery LED panel is flashing, then there is an issue or short in the wiring in the microscope back. You can reset the battery simply by pushing the button below this panel.

The instructions for changing the LED bulb are:

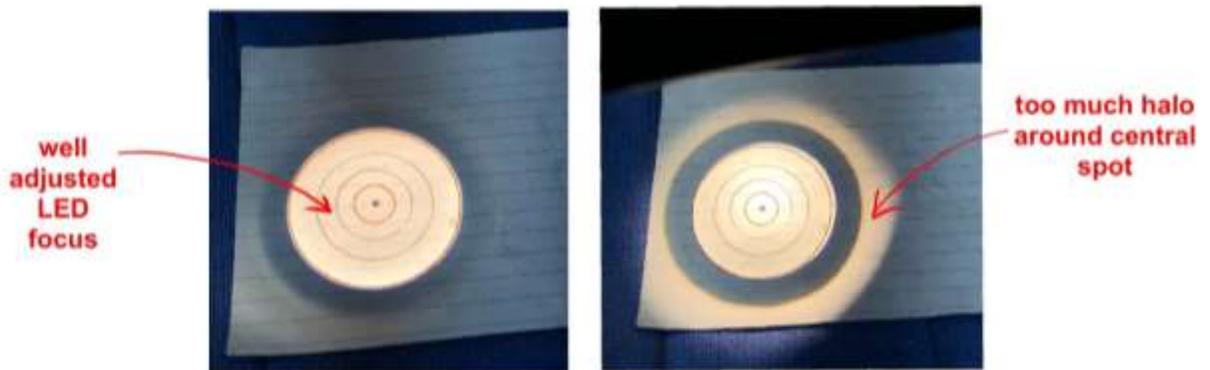
1. Make sure the power is switched off and disconnected from the microscope.
2. Remove the four screws holding the back cover of the microscope with a #2 Phillips screwdriver.
3. Locate the 2 LED mounts (bullets) which are connected with white and blue wire to a white connector.
4. Locate the Allen set screws located just above the LED in the light tube. Use the included 1.5mm Allen key to loosen the 2 LED bullets and remove them. **Be careful not to strip the socket corners of the set screw.**





5. Unplug the connector and remove the LEDs. Note that both LEDs come as a set and so both need to be removed and replaced together.
6. Push the new LEDs all the way into the light tube and then back each LED off the light tube about 2 mm from being completely pushed into the tubes. Some sets come with two rubber O rings on the LED to set this distance. In this case, push them in fully.
7. Before tightening the set screws again reconnect the wires with the white connector
8. Carefully attach the power source to the open back without causing an electrical short.
9. Turn on the light and move the LED bullets slightly in or out to adjust the focus on each LED so that there is not a large halo around the light spot.





10. Tighten the Allen set screws snugly with a 1.5mm Allen key at the right position
11. **It is important when replacing the back cover that none of the wires get into the visual axis of the lenses or are pinched by the back cover itself.**
12. Replace the back cover with the four screws

#### 4.10 Flex Arm Maintenance

Apart from needing a slight adjustment in tension, the flex arm should not need any routine maintenance.

1. If the tension on the flex arm needs to be changed due to upward or downward drift of the arm during surgery, minor adjustments in tension can be made with the small locking handle on the side of the flex arm. For larger adjustments, follow the flex arm tensioning guidelines in section 4.11
2. The 2 small tightening handles can be replaced if they break and these parts are easily ordered.
3. If the flex arm becomes noisy, rough or stiff, follow the lubrication guidelines below.
4. If the flex arm is giving more problems than this, it is recommended that it be sent in for diagnosis and repair.



## 4.11 Flex Arm Tension Adjustment

- a. The tension on the flex arm is factory adjusted to your system, dependent on whether the microscope came with or without a video system.
- b. The tension should be adjusted so that the full range of the flex arm can be used without the microscope head raising or dropping, once it is put in a desired position. It should be easy for the surgeon to move it smoothly to a position in order to focus the microscope and maintain that position.
- c. Whenever a beam splitter, camera or another device is added to or removed from the microscope, it will be necessary to adjust the tension to accommodate the change in weight. This is necessary to keep the microscope balanced so it does not drift from the position to which the surgeon sets it.
- d. When the tension of the flex arm needs to be changed, follow the steps below:



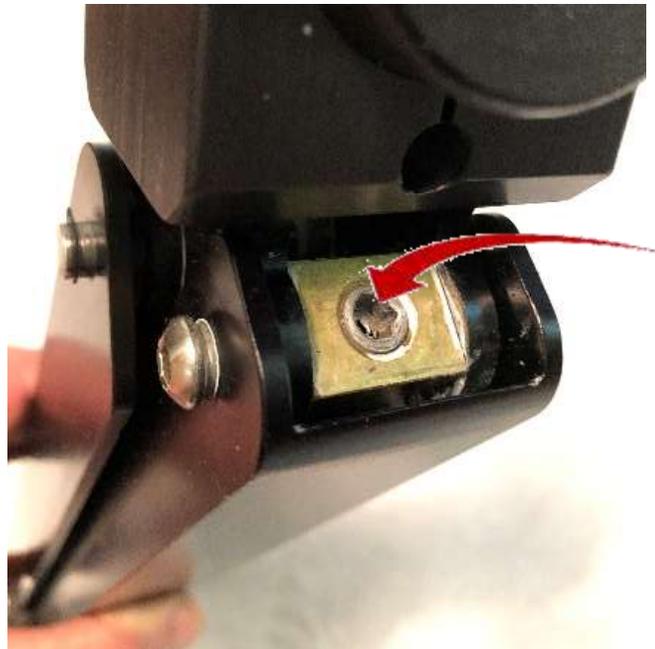
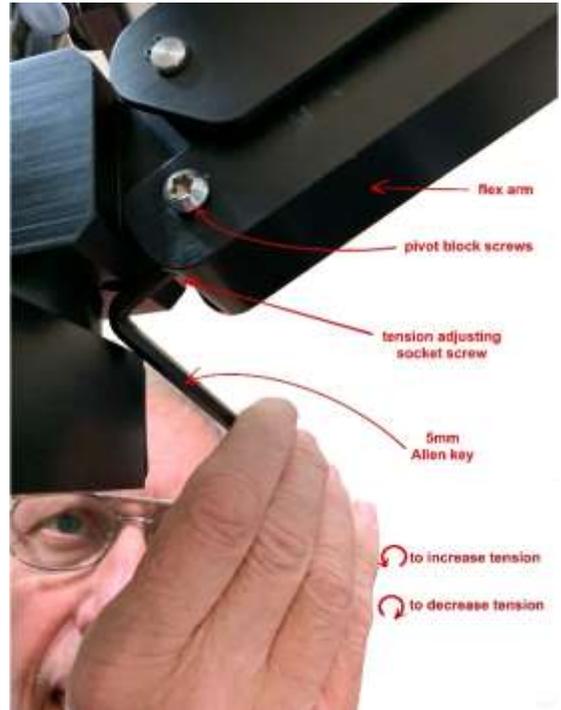
## Steps for flex arm tension adjustment

1. **Find the hex socket screw underneath the lower end of the flex arm:**
2. Use the 5mm Allen wrench included with the scope (layer 4) to adjust the tension.
3. Make sure the Allen key is fully seated into the screw head so that it does not slip out of the socket while turning.
4. Turn the Allen key clockwise or counterclockwise to change the tension.

Turn the Allen screw **Counterclockwise** with the Allen wrench to increase tension to add more weight

Turn the Allen screw **Clockwise** with the Allen wrench to reduce tension to decrease the weight

5. The flex arm tension should be adjusted so that the microscope does not drift upward or downward at any point through the range of travel.
6. Recheck the tension at multiple positions for drift. It should stay wherever it is positioned.
7. If a large adjustment needs to be made to the tension, it may be easier to remove the flex arm from the stand to grossly adjust it first. Make the final adjustment once the flex arm is put back in place.



## 4.12 Lubrication of the flex arm

Lubrication of the flex arm is not needed unless the movement of the flex arm becomes noisy or rough. It is a little bit difficult to remove and reassemble the flex arm and this should only be done after the tension on the arm is removed, by turning the tensioning screw clockwise until it becomes loose. (See section 4.11) **Do not try to work on the flex arm while it is still under tension.** If it becomes necessary to lubricate the arm, follow the steps below:

1. Remove the microscope head and lift the flex arm from off the stand.
2. Take the tension off the spring by turning the tensioning screw clockwise until there's no tension left on the flex arm. (See 4.11 tensioning)
3. Completely remove the locking handle on the side of the flex arm. Note the position of the two washers on the screw end. The Delrin washer should be placed against the casing on re-assembly.
4. Turn the flex arm upside down and remove the two pivot screws with their sleeves from the one end near the bottom block. (use a star bit) This will allow the bottom cover of the flex arm to be swung open. (**do not open or remove the top cover** since there are black washers that will fall out and are challenging to replace.)
5. Lubricate with white lithium grease along the surface of the spring and spring block where it touches the casing or other friction points.
6. Lubricate the spring block, spring, long threaded rod, sliding rod and internal sliding surfaces with white Lithium grease.



7. Remove all excess grease so that none remains on the outside of the flex arm.
8. Lubricate all the small moving joints and pins holding the top and bottom covers with a small amount of 3 in 1 oil. It should not drip. Remove any excess.
9. Replace the cover and put the brass block back in place with the two pivot sleeves and screws. Lubricate these well with white Lithium grease
10. Using the Allen key add tension to the spring by turning it counterclockwise grossly then replace the flex arm on the stand.
11. Make the final adjustments of the tension once the microscope parts have been reassembled on the stand. The flex arm tension should be adjusted. (See steps for flex arm tension adjustment section 4.3)
12. The lubrication of the inside of the flex arm can be done without removing the clip rings on the ends of each pin. If for some reason these clip rings are removed, they need to be replaced with new ones, as they do not function well once they have been removed.

### 4.13 Lens Cleaning

There are multiple lenses in the microscope most of which will stay clean and clear if the dust cover is kept in place when the microscope is not in use.



- a. The most susceptible lens to become dirty is the objective lens, which is on the bottom of the microscope head. During surgery, sometimes, saline irrigation fluid splashes up onto this lens leaving salty deposits. This will eventually obscure the surgeon's view of what he/she is operating on. If the microscope only has a manual focus this lens can be removed and cleaned, **but if it has an motorized focus, it will need to be cleaned in place, as the electrical focus is difficult to remove and replace.**
- b. If a lens is going to be cleaned, it needs to be carefully cleaned with a soft cotton cloth or lens paper.
- c. Be very careful not to touch the lens with fingers as it deposits oil on the lens surface.

- d. Lenses may be cleaned with a mixture of 60% acetone and 40% methyl alcohol. Since the solutions are often not readily available there are similar alternatives. Windex window cleaning solution or vinegar may also be used. It is helpful to use something that dries quickly. A weak solution of only acetone may also be used.
- e. Whenever handling lenses, it is ideal to use cotton gloves to avoid touching the lens with fingers.
- f. Vinegar helps to remove etching caused by fungal growth on lenses if this becomes a problem in a tropical area. If this growth is extensive it may not be able to be totally removed as the lenses do become etched.

#### 4.14 Objective Lens Maintenance

If the objective lens fine focus becomes difficult to turn:

- a. Unscrew the flat head screw in the end of the knob and then use a 1.5mm Allen key to loosen the set screw for the knob and then remove the knob.
- b. Place one drop of 3 in 1 oil onto the shaft where it goes through the housing and attaches to the cam. This cam moves the lens up and down.

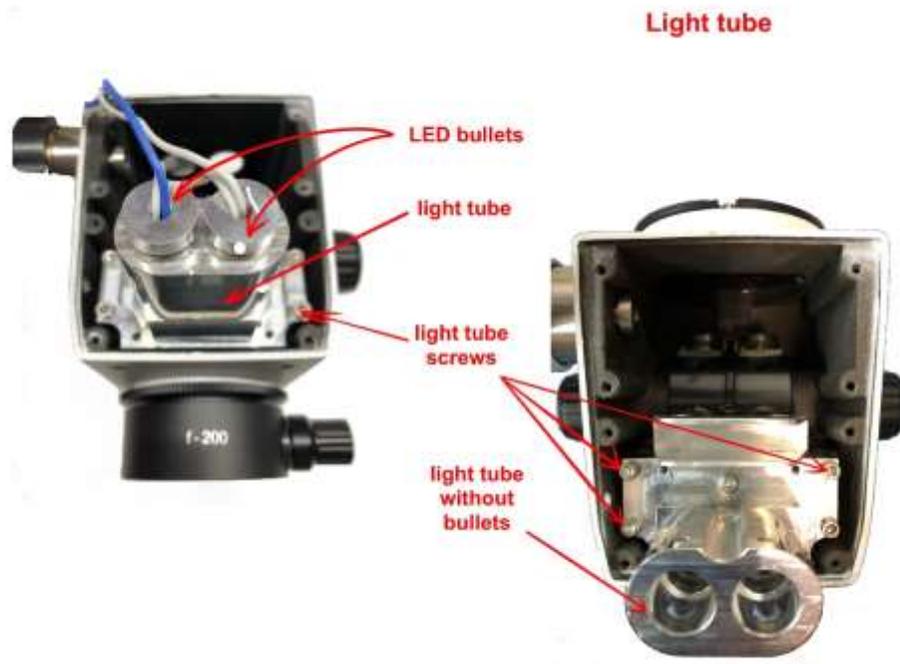


#### Objective lens removed for cleaning



- c. Replace the knob, tightening its set screw and then rotates the lens up and down several times to loosen the lens movement. If it still stiff, repeat the steps above and consider putting a small drop of 3 in 1 oil on the inside of the objective lens holder directly on the outside of the small round cam.
- d. If necessary, a very small amount of white lithium grease can be added to the inside surface of the lens housing with a cotton bud.
- e. **It is important not to get any oil or grease on the lens itself.**

#### 4.15 Light tube



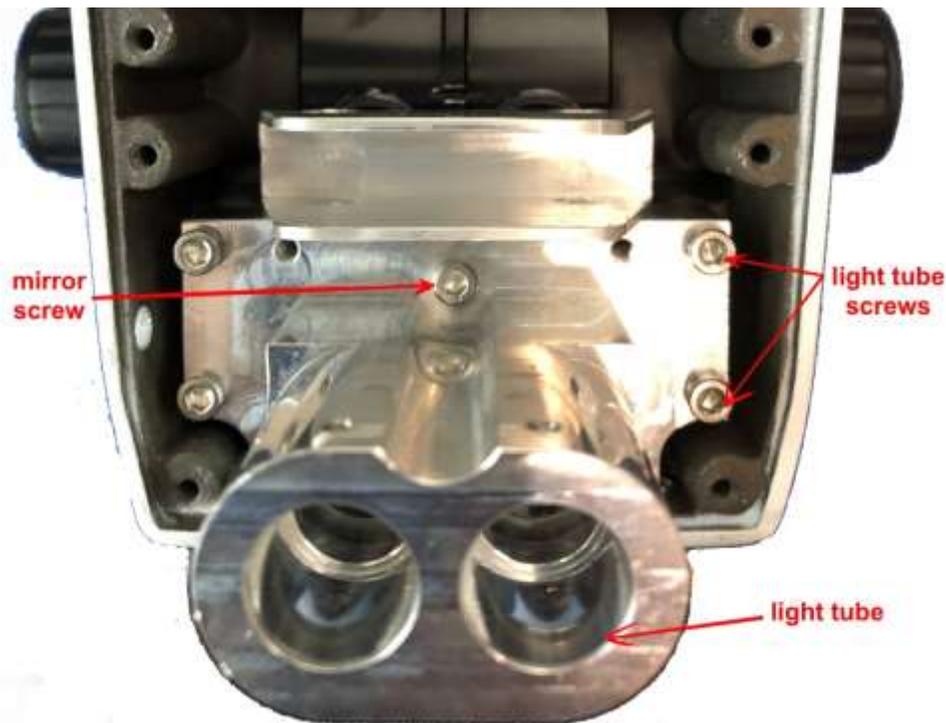
Generally, there is no need to remove the light source tube. If for some reason this needs to be done:

- a. Make sure the power is switched off and disconnected from the microscope.
- b. Remove the four screws holding the back cover of the microscope with a #2 Phillips screwdriver.
- c. The chip and LEDs can now be removed and the electronics accessed on the inside of the back cover.
- d. The LED bullets may be removed if needed – see LED replacement section 5.4
- e. There are four socket screws that hold the light tube in place. **It is very important that these screws are removed with the correct 2.5mm Allen key and they are not removed with a quick twist, but rather with steady slow torque**, as damage to the socket or screw may occur, making removal very difficult or impossible. It is best not to remove the light tube if possible.

- f. There are two set screws that adjust the tilt of the mirror in coordination with the mirror screw. Changing these will adjust the position of the circular beam of light while looking through the binoculars. These are on the bottom edge of the light tube just behind the mirror. Loosen the screw holding the mirror anticlockwise one turn, which will allow the set screws to be moved slightly. If necessary, the mirror screw can be loosened a little more. The light tube should not need adjustment but can be adjusted with the light tube in place.
- g. If the light tube is removed the light source will need to be re-aligned when the light tube is replaced again.

#### 4.16 Alignment of the light tube

- a. Before aligning the light tube to the view through the microscope reconnect the wires with the white connectors.
- b. Replace the light tube and tighten the 4 screws that hold the light source in place, **being very careful not to over tighten these, as damage can occur.**
- c. Carefully attach the power source to the open back without causing an electrical short.

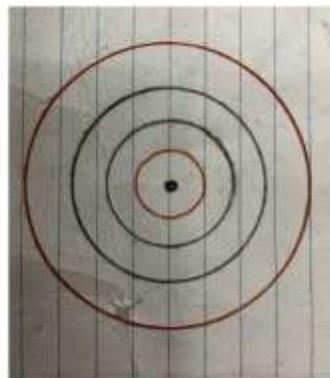


- d. Turn on the light.

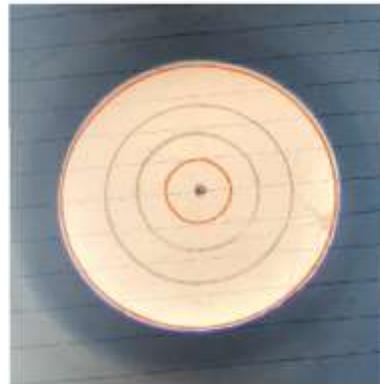


- e. Adjust the light tube mirror to align the light source with the microscope view.
- f. Slightly loosen the single mirror screw that holds the mirror holder to the main light tube on top of the light tube.
- g. Adjust the set screws below the light tube to change the mirror setting. When the alignment is correct Tighten the single screw to secure the mirror position in the place. This can be tedious and requires patience.

**Adjust view to light spot**



**binocular view centered on target**



**light adjusted to center on the target**

## 5 Electrical Components

### 5.1 Lithium ion battery

The 23,000 mAh Lithium ion battery has an estimated life of 2 – 3 years or longer, but at some point will need replacement. The microscope can run on any voltage supply from 9 V – 32 V DC using a 5.5mm X 2.1 or 2.5 mm barrel connector plug. Specifications for alternatives to the battery are discussed in the operating manual.

**Discard all used non-functional Lithium ion batteries at a designated recycle center.**



### 5.2 Alternate Power Supply

The following are the options to power the microscope:

- Lithium ion battery (included)
- The power supply (included)
- Car battery using a battery to microscope conversion cable with alligator clips. (optional)
- Computer or appliance power adapter between 9V to 32V DC– rated for at least 2 amps (not included)



### 5.3 Electronics Description

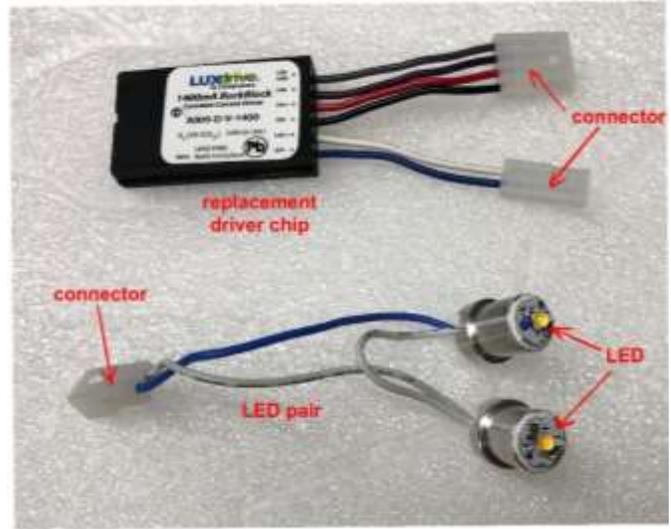
The electronics of the microscope head are fairly simple. The bulk of the electronic management is done by a sealed chip. It has no serviceable parts.

- There are two barrel plugs 5.5 mm X 2.1 or 2.5 mm for inputting power or extending power to another device.
- There is also a USB port, which provides 5V DC voltage for use by the camera.
- There is a rheostat to control the brightness of the light source and a power switch.
- The light source is made up of two LEDs, which are joined together in series and draw about 10 watts. A white connector allows the LEDs to be plugged into the chip.

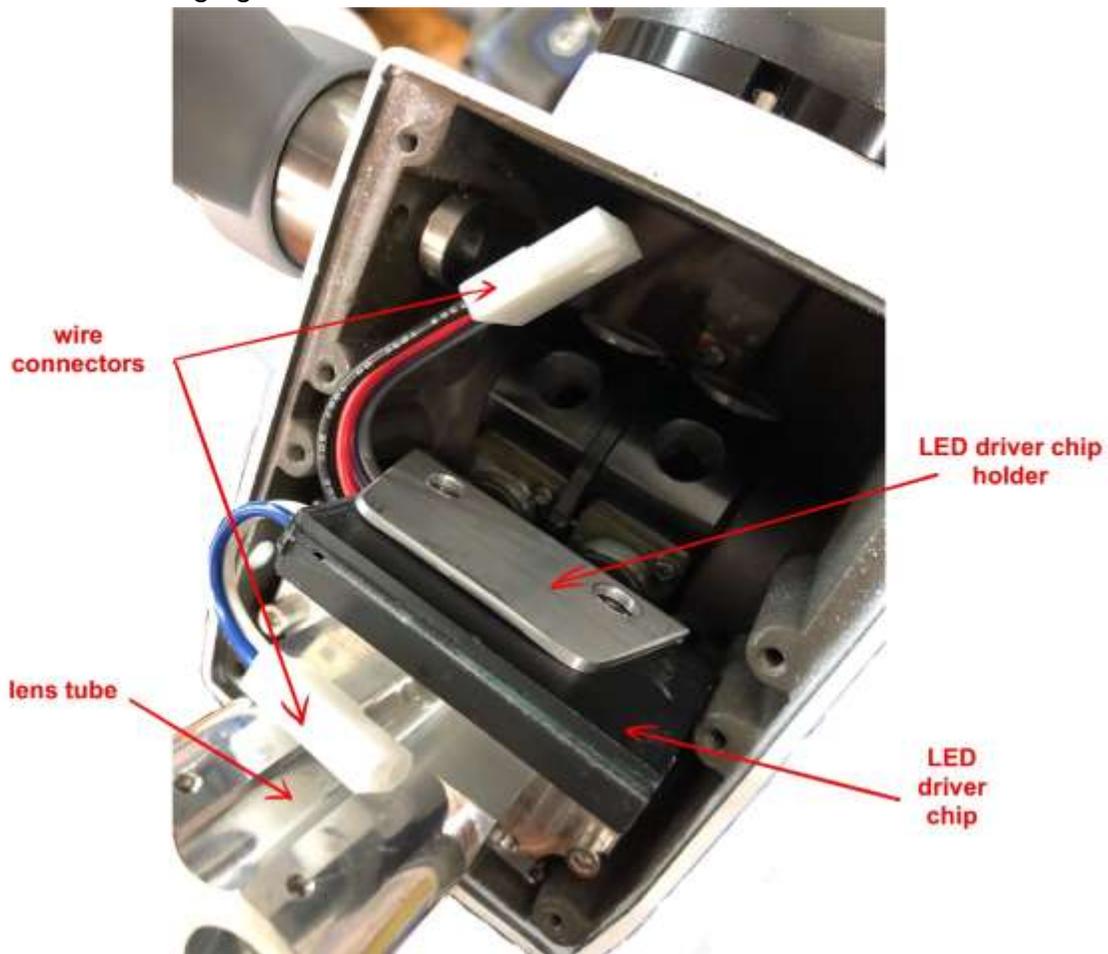
## 5.4 Replacement of electrical parts

### Steps to replace the electrical components

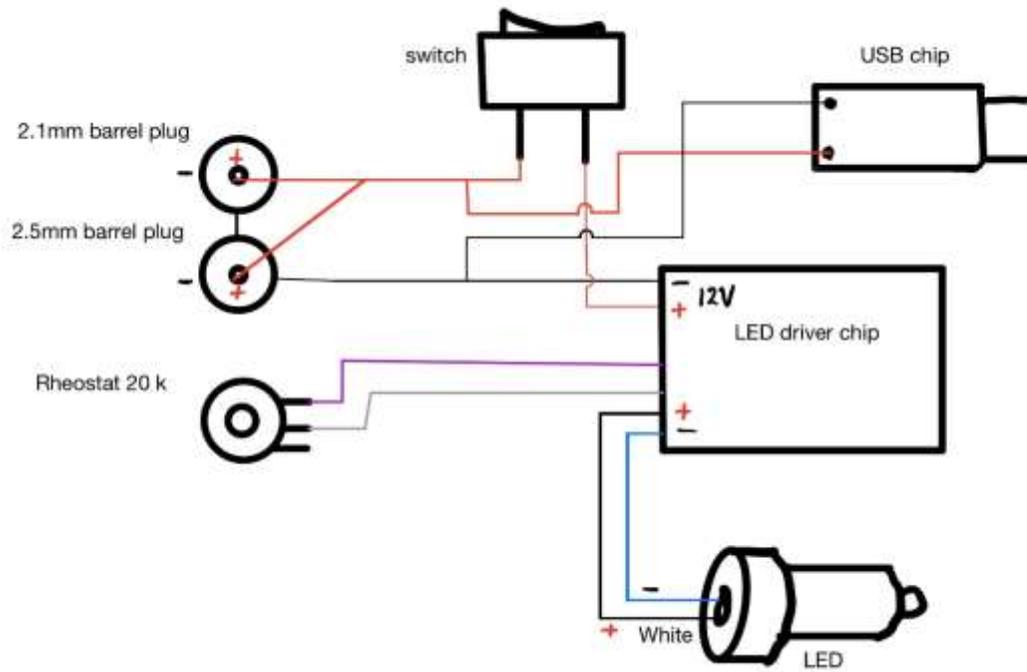
- a. Remove the four screws on the back cover of the microscope with a #2 Phillips screwdriver. All of the components are attached to the back cover of the microscope except for the sealed chip.



- b. Disconnect the two white Molex connectors. (The 4 wire one connects the back to the driver chip and the 2 wire connector connects the driver chip to the LED)
- c. The driver chip is held in a heat-sinking chip holder screwed to the top of the light source.
- d. The LED bulb may be removed and replaced easily by loosening the two set screws that hold the two LED mounts in place and disconnecting the wire connector to them. (See section 4.9)
- e. An electric focus unit may be installed and if so, there will be an extra plug inside the microscope back that provides power to the motorized Z focus unit. This adds to the amount of wiring that is in the microscope head and also makes closing the back a bit more challenging.



## 5.5 Microscope Schematic diagram



## 6 TROUBLE SHOOTING

### 6.1 Troubleshooting of optics

- a. In case of a cloudy view for the surgeon, check the objective lens to see if there are water marks or debris from surgery on it. It should be obvious if it needs cleaning.
- b. Check to see if the cloudy view corresponds to a particular magnification which could imply an issue with the magnification changer lenses.
- c. If the view is completely blocked on one or both eyes, remove the objective lens to see if the shroud on the light system or some other part has come loose and is impeding the optical pathway.
- d. To check the binoculars, remove each eyepiece to look for any clouding of either eyepiece to identify if the issue is within the eyepiece. If the eyepieces are clean, replace them and look through the binoculars by themselves at a distant target. If able to see a distant target clearly in both eyes, the cloudiness is not within the binoculars. The binoculars focus at distance very similar to a regular pair of field binoculars.

### 6.2 Light turns off during surgery

Make sure that the battery is sufficiently charged or that the microscope cord has not become dislodged from the power supply.

### 6.3 No light or light is too dim

Check to see if LED cable plugged in correctly to both battery and microscope

Check to see if Microscope off/on switch is turned on

Check to see if Rheostat is turned up clockwise

Check to see if Battery has charge

Check to see if USB output can charge a phone (means power is getting into the microscope.)

Possible causes:      Bad LEDs (replacement available)  
                                    Bad LED driver chip (replacement available)  
                                    Failed wiring or soldered connection on back (replacement available)

### 6.4 Red reflex is not sufficient

Make sure the objective lens is clear.

Check that the screws in the back of the light source are tight. Do not over tighten the screws.

### 6.5 Out of focus

- Check if both eyepieces are fully pushed in
- Check if both eyepieces are adjusted to 0 diopters
- Check if binocular is seated correctly
- Check if objective lens is smeared or smudged

## 6.6 Cannot see through one or both eye pieces

Remove binocular and see if you can see something at a distance through the binocular. Look down the barrel of the microscope with the binocular removed and see if there is any visible blockage inside. The shroud of the LED mirror could unseat in a rare case

## 6.7 Camera out of focus

If your camera cannot be brought into focus, using the focus ring, ensure there is the proper distance of the camera to the video adapter.  
For the GoPro camera, there must be only one black ring along with the video adapter C mount ring to obtain the correct distance to the sensor.  
For the Yi camera, there must be two rings (one silver and one black) on the Yi camera in addition to the video adapter C mount ring added to attach the camera to the video adapter.

## 6.8 Instability of the stand

Make sure the water bladder is filled at least 3/4 full (4-6 gallons) and that the extension and flex arm are not fully extended.  
The arm works best when there is an angle less than 90 degrees between the extension arm and flex arm.

## 6.9 Movement of the flex arm is not smooth or is too stiff to focus easily

Check the tightness of all the joints, adjust accordingly, and if necessary, change the tension on the flex arm.

## 6.10 The wheels are not turning well

Check that hair and dirt has not accumulated in the wheels and that the locks are unlocked.

## 6.11 Moisture accumulating in the microscope or the case

Remove the water bladder and dry it completely, inside and out. Tighten the lid well before replacing it in the case. If the problem persists, carry the water bladder separately from the case.

## 7 RETURN POLICY

### 7.1 Overview

The EPIC microscope comes with a one year warranty for parts and labor on any defective part. If needing to replace a part, send an email to [support@eyemobil.com](mailto:support@eyemobil.com) with the description of the problem for troubleshooting and solution in the field.

### 7.2 Replacing Parts

The microscope is modular so that any particular part can be easily replaced. If any part needs to be replaced, instructions will be sent whether or not to send the affected part back or if a new part will be sent out and the old one sent in. This may depend on the particular affected part.

Please see Appendix A for the replaceable parts which can be ordered for the EPIC II Microscope.

EPIC I microscopes are powder coated and have slightly different tolerances for the joints. If you have an EPIC I microscope (grey color), then call to verify if these parts are available.

## 8 Resources

### 8.1 Links to video tutorials:

See Youtube channel for the latest tutorials and “how-to use” videos.

<https://www.youtube.com/channel/UCnJgXfimbdtUoPKv0fPs9yQ>

### 8.2 Customer service

Website: [www.eyemobil.com](http://www.eyemobil.com)

Send any inquiries about your microscope to: [service@eyemobil.com](mailto:service@eyemobil.com)

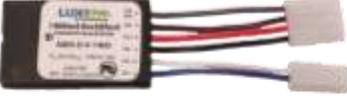
Phone support: 269-340-0823

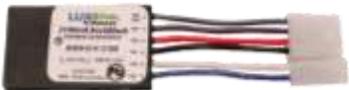
If there is no answer, please leave a message for a return call.



## Appendix A - eyeMobil Part Numbers for Orderable Parts

EPIC II Microscope	Part No	
Microscope head (includes objective lens)	MI-2-001	
10x eyepiece	MI-2-002	
45 fixed binocular	MI-2-003	
0 - 180 inclineable binocular	MI-2-004	

<p>microscope objective lens only - 200mm</p>	<p>MI-2-005</p>	
<p>knob covers - large</p>	<p>MI-2-006</p>	
<p>knob covers - small</p>	<p>MI-2-007</p>	
<p>top mount (assembled)</p>	<p>MI-2-008</p>	
<p>double LED serial system</p>	<p>MI-2-009</p>	
<p>LED 1400 mA chip driver</p>	<p>MI-A-010</p>	

LED 2100 mA chip driver	MI-A-011	
microscope back	MI-2-012	
LED cable	MI-A-013	
microscope dust cover	MI-2-014	

<p>Pelican case M2720</p>	<p>MI-A-015</p>	
<p>Custom Kaizen foam – 45 fixed binocular/scope</p>	<p>MI-2-016</p>	
<p>Custom Kaizen foam – 0/180 inclined/scope</p>	<p>MI-2-017</p>	

Knob cover set (large x 2, small x 4)	MI-2-018	
<b>Video System</b> – complete video assembly with Go Pro camera as addon to microscope	<b>VS-2-CA-GP</b>	
Beam splitter	VS-2-001	
Black video adapter	VS-2-002	

<p>Gopro camera</p>	<p>VS-A-004</p>	
<p>Gopro power cable</p>	<p>VS-A-005</p>	
<p>Gopro micro hdmi to female hdmi adapter</p>	<p>VS-2-006</p>	
<p>Yi camera</p>	<p>VS-A-007</p>	
<p>Yi camera power cable</p>	<p>VS-A-008</p>	

<p>Samsung Galaxy Tab A</p>	<p>VS-A-009</p>	
<p>Samsung Galaxy case</p>	<p>VS-A-010</p>	
<p>HD Video Capture system (wired video capture)</p>	<p>VS-A-011</p>	

Tablet holder	VS-A-012	
1/4-20 male to male adapter	VS-A-013	
1/4" Tripod Ball Head	VS-A-014	
Flex arm	FA-2-CA	
flex arm adjustable lock handle, top	FA-2-001	
flex arm adjustable lock handle, bottom	FA-2-002	

5 mm Allen wrench	FA-A-003	
Extension Arm	EA-2-CA	
Stand, complete assembly	ST-2-CA	
Stand, hand knob	ST-2-001	
Stand, top pole	ST-2-003	
Stand, middle pole	ST-2-004	

Stand, lower pole	ST-2-005	
Stand, leg	ST-2-006	
Stand, leg stainless steel pin	ST-2-007	
Stand, caster	ST-2-008	
Stand, water bladder pan	ST-2-009	

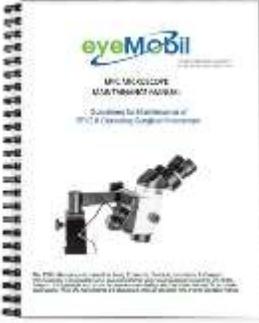
<b>Accessories</b>		
23,000 mAh Battery	AC-A-001	
32,000 mAh Battery	AC-A-002	
Battery charger	AC-A-003	
12V battery LED cable	AC-A-004	

Water bladder	AC-A-005	
Wall mount	AC-2-006	
Table Clamp mount	AC-2-007	
H mount stand	AC-2-008	
Water bladder replacement plates (each 7.4 lbs)	AC-2-009	

<p><b>Surgeon's Stool (w case)</b></p>	<p><b>SS-2-CA</b></p>	
<p>oval back</p>	<p>SS-2-001</p>	
<p>12.5" round seat</p>	<p>SS-2-002</p>	

<p>back rest pole assembly</p>	<p>SS-2-003</p>	
<p>Rod caps</p>	<p>SS-2-004</p>	
<p>stool cylinder with leg attachments and seat attachment</p>	<p>SS-2-005</p>	

stool leg with caster (one)	SS-2-006	
stool leg caster	SS-2-007	
leg stainless steel pin	SS-2-008	
Adjustment screwdriver	SS-2-009	
Surgeon's stool custom case – epic ii	SS-2-010	
Carabiner (to hold cotter pins)	SS-2-011	

<b>Manuals</b>		
EPIC II User Manual	MI-2-UM	
EPIC II Maintainer's Manual	MI-2-MM	
EPIC II Quick Setup Guide	MI-2-QSG	
Stool Quick Setup Guide	SS-2-QSG	
<b>Complete Kits</b>		
EPIC II Microscope (with 45 fixed binocular)	MI-2-CA-45	

<p>EPIC II Microscope (with 0-180 inclined binocular)</p>	<p>MI-2-CA-180</p>	
<p>LED replacement system (including both 1400 mA and 2100 mA LED driver)</p>	<p>MI-2-009, MI-2-010, MI-2-011</p>	
<p>EPIC II Video System with GoPro</p>	<p>VS-2-CA-GP</p>	
<p>EPIC II Video System with Yi Camera</p>	<p>VS-2-CA-YI</p>	

EPIC II Video System (standalone) complete video system that can attach to any Zeiss compatible microscope (beamsplitter, video adapter, Go Pro or Yi camera, Tablet, Tablet holder)

VS-2-SA-GP or VS-2-SA-YI



**Numbering Key = Assembly Code + Version + Model Number**

**Assembly Code**

Stand = SL Flex Arm = FA Surgeon's stool = SS,  
Microscope = MI,  
Video System = VS, Extension Arm = EA,  
Accessories = AC  
Complete assembly=CA Standalone=SA

**Version**

EPIC I = 1, EPIC II = 2, All generations = A

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