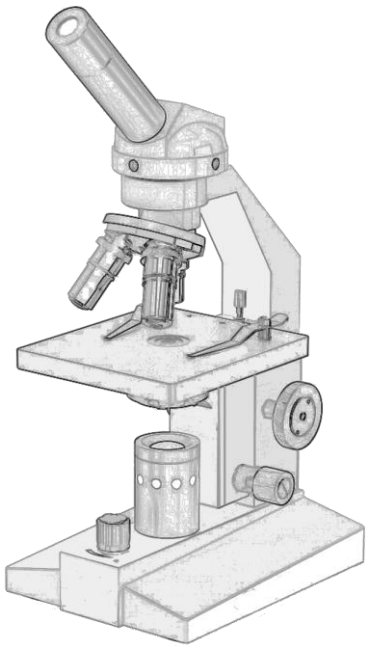
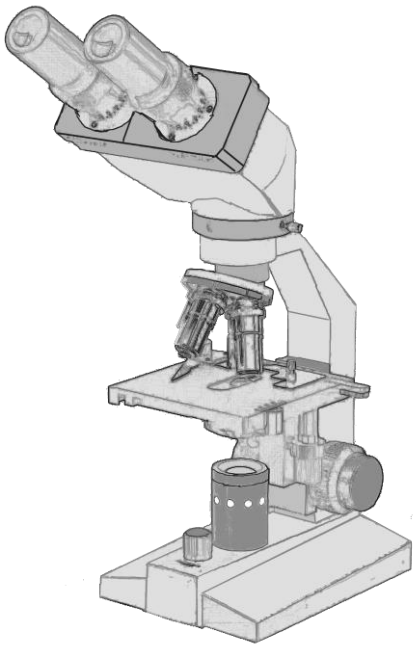
MICROSCOPES:
The Orange & The Purple

Presenter: Harvey Edwards - Principles & Practice

Many schools have the common monocular orange or the binocular purple microscopes. Some work off an AC Adapter, others plug into the wall. Some have batteries, some don't. Some are even white!
This document details a few tricks I've learnt to keep them in top condition



extreme
extremeX
WLMGM04



deluxe
deluxeX
WLMSM03D

This document is not meant to be read!
Rather it is a reference document.
When you have a issue with these microscopes, go to the "WHERE DO I FIND IT?" page,
look up the problem in the list and then go to the referred page.
If unsure of the problem, it may be beneficial to go through the check procedure for the particular model first.

NOTES:

- This document is available as a pdf file upon request.
- All suggestions, corrections and recommendations will be gratefully received by the author.

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WHERE DO I FIND IT?

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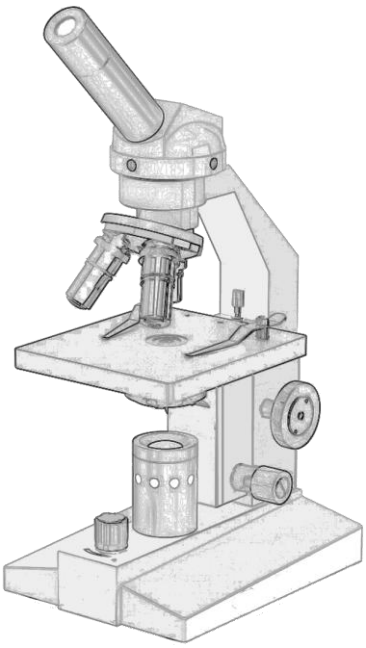
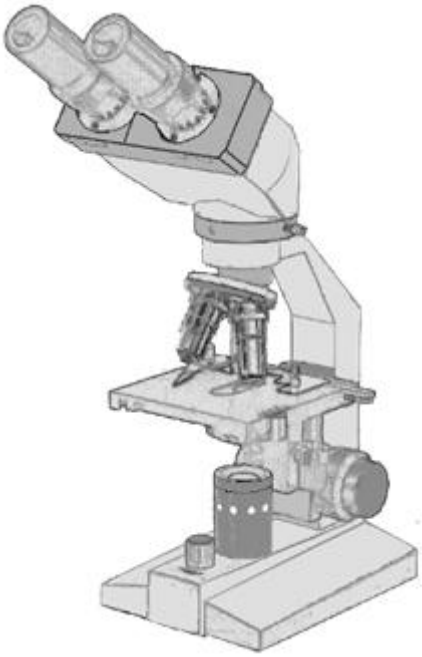
QUICK CHECK - EXTREME/WLMGM04



Start from the bottom up-

- Power cord/AC Adapter safety – feel for nicks & cuts. Inspect where it enters body.
- Plug in and test switch & dimmer, and check illumination led operates
- Battery Charge LED functioning (if fitted).
- Lamphousing, field lens tight?
- Iris moves smoothly and OK?
- Stage movement with coarse and fine focus.
- Stage top movement stop, OK?
- Stage clips movement and pressure onto stage.
- Objectives – not loose?
- Turret rotation and indexing. (Leave x4 objective in position)
- Head & Eyetube – not loose?
- Eyepiece OK. Does it rotate?
- Put minigrid slide on stage and view with x4 objective.
- Check that it can focus. (Stage Stop should allow movement just beyond focus.)

QUICK CHECK – DELUXE/WLMSM03D



Start from the bottom up-

- Power cord/AC Adapter safety – feel for nicks & cuts. Inspect where it enters body
- Plug in and test switch & dimmer, and check illumination led operates
- Battery Charge LED functioning (if fitted).
- Lamphousing, field lens tight?
- Condenser lens movement, OK?
- Iris moves smoothly and OK?
- Stage movement with coarse and fine focus.
- Stage top movement stop, OK?
- Mechanical stage movement and rigidity.
- Slide holder, check fastening to stage, check spring loaded arm & screws.
- Objectives – not loose?
- Turret rotation and indexing. (Leave x4 objective in position)
- Binocular Head & Eyetubes – not loose?
- Eyepieces OK. Do they rotate?
- Put minigrid slide on stage and view with x4 objective.
- Check that it can focus. (Stage Top Limit Adjustment should allow movement just beyond focus.)

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TURRET DETENT STOP SPRING ADJUSTMENT (on all models)

To correct objectives not clicking into position

Example of turret detent stop spring bent out of position, causing the objectives not to 'click' into correct position when the objective turret is rotated.

This problem can easily be corrected;
First check that the spring is being held firmly in place by the two retaining screws. Tighten if loose.
If the spring is firmly held in position, rotate the turret so that the spring is between two of the raised detent sections of the turret. Now insert a round toothpick or shaft of a small jeweller's screwdriver under the spring to deflect it slightly outwards. Then press lightly to bend the spring in towards the turret.
Remove the toothpick/screwdriver and check if the detent stop spring now clicks firmly into each detent as the turret is rotated. If not, repeat this procedure.

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LIGHT FAILURE

The first step is to look at the power connections on the base and identify which type of microscope it is; **'AC' or 'DC' or 'DC HALOGEN'** type?

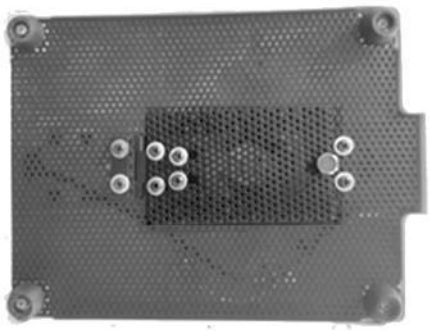
AC TYPE:
This type has a power cable that plugs into the wall power outlet.

DC TYPE:
This type uses an AC adapter power that plugs into the wall power outlet and has a thin cable that plugs into the base.

DC HALOGEN TYPE:
This type uses an AC adapter power that plugs into the wall power outlet BUT is wired into the base.

Having determined the 'type' of microscope – go to the relevant section bellow.

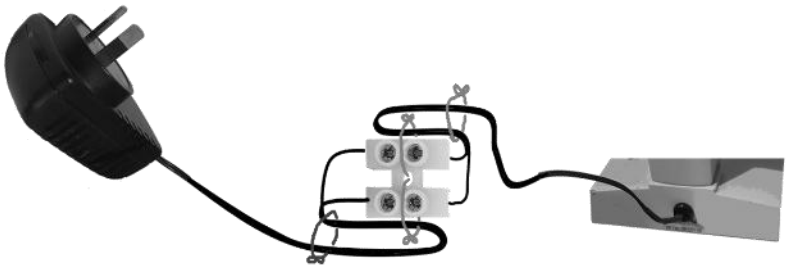
For the **DC HALOGEN TYPE:**



This type uses a 12 volt, 10 watt, Halogen G4 lamp.
To replace the lamp, underneath the base, unscrew the thumbscrew, open the door and pull the old lamp out of the lamp socket. Without touching the lamp glass with bare hands, using gloves or a cloth, fit a new lamp.

If this doesn't fix the issue, then it is likely that there is a broken or damaged cable at the AC adapter.

The simplest solution is to buy a suitable AC Adapter, cut the old one off and wire the new one to the cut cable.



(A somewhat less pretty but effective way to do this, is to use a screw terminal block, some cable ties and wrap the block up in electrical tape to neaten it.)

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For the **DC TYPE:**

KEEP IN MIND THAT ONLY 9 VOLTS EXISTS INSIDE THIS MICROSCOPE SO IT IS INHERENTLY SAFE.

This type uses a quantity of LEDs (often 7 or 12).
Unscrewing, by hand the field lens holder, it can be quickly determined if ALL of the LEDs have failed.
– *this is extremely extremely rare.*

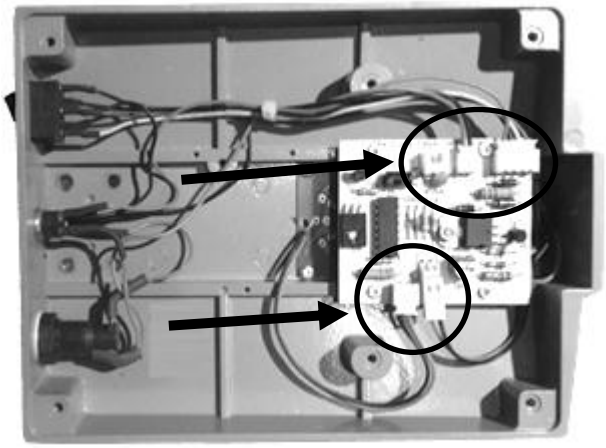
Most common causes of failure are:

Faulty AC Power Adapter; swap it with another from a working microscope to prove.

Broken DC input socket; this requires the replacement of the socket by someone proficient with a solder iron.

Broken Fuseholder; This is unnecessary item on this version, so the wires can be cut off, stripped, and joined together in a terminal block which is then wrapped in electrical tape for insulation.
Of course, a far neater solution is solder in a new fuse holder.

Bad plug connections on or to the PCB; After unscrewing and removing the bottom cover, with the microscope powered and turned on, wriggling the circled plugs will sometimes reveal one that has a broken solder joint or faulty plug.



For the **AC TYPE:**

FULL MAINS POWER (240 VOLTS) EXISTS INSIDE THIS MICROSCOPE SO IT IS ONLY SAFE.WHEN IT IS UNPLUGGED !!

A bit of a diagrammatic explanation of how the illumination in this model works.

The mains power comes in via the fuse then through the ON/OFF switch to the Power Supply. The Illumination LED is powered by that Power Supply. Its brightness is determined by the Dimmer Control which controls the Power Supply. *See also "BATTERY OPERATION".*

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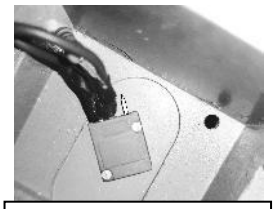
AC TYPE continued.

Before undertaking fault analysis of the Power Supply or LED, the following should be fully checked first.

A. Mains power cable– swap with another from a working microscope
B. Fuse and fuse holder – disconnect the power, check for visual damage, unscrew the fuseholder and check with a multimeter. *(see the "FUSES" attachment)*
   If the fuse keeps blowing then it is most likely the Power supply has failed
C. Plug-in LED – swap with another from a working microscope

NOTE: Replacing the Power supply is a task that is best left to an electronics service technician as it involves mains power wiring.

Most often the lack of illumination is caused by either
LED failure - proven by swapping one from another microscope - just unscrew the black field lens tube below the stage and the LED unplugs.
OR
Failure of the dimmer control



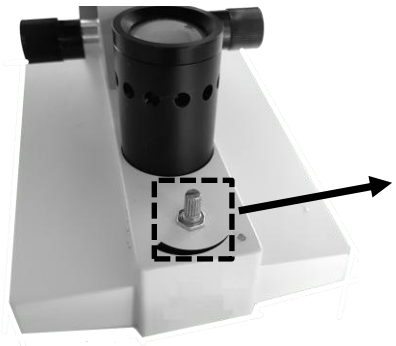
Inside base view of dimmer control

On the AC Type, the dimmer controls are small square units. If it comes loose from the base, it will rotate and break off its fine connections.

"Prevention Is Better Than Cure"
To replace a broken dimmer control (potentiometer) is a fairly complex task requiring good electronics service technician skills. Though currently I make a replacement kit that makes it a little simpler as it doesn't involve any soldering.

SECURING THE DIMMER CONTROL

Pull the knob up and off the dimmer control's shaft.
Check the dimmer is firmly held in place by the nut. No sideways wobble. All nice and secure.
IF NOT:
Whilst holding the split shaft and the threaded bush immediately below it between two fingers, use a small pair of pliers (or a 10mm spanner) ensure the securing nut is tight.
Now add a couple of dobs of nail varnish across the base, nut and threaded bush, be careful not to get it onto the rotating split shaft.



Allow the varnish to dry and then push the control knob back onto the shaft.

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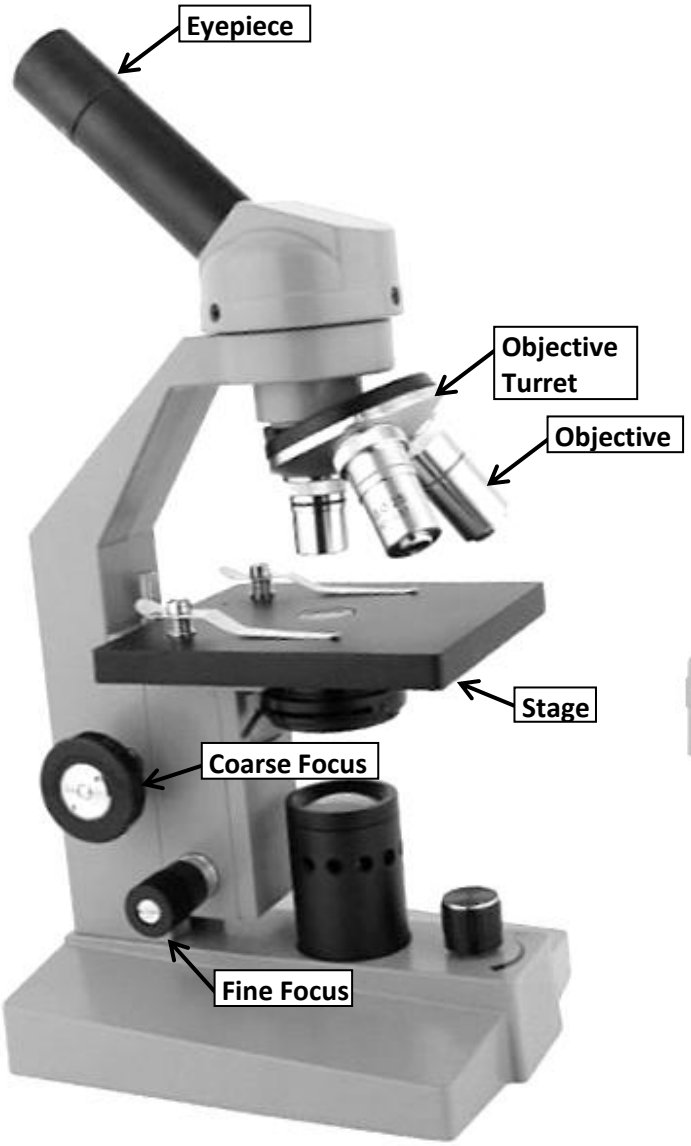
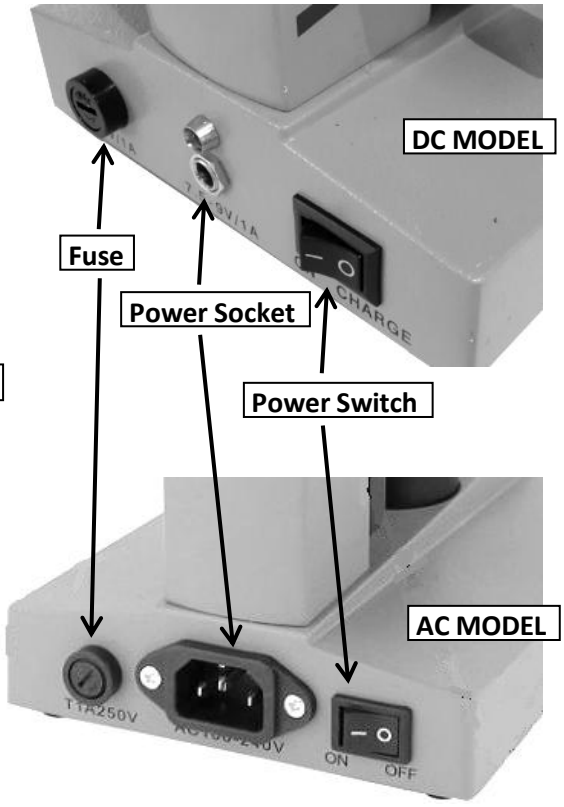
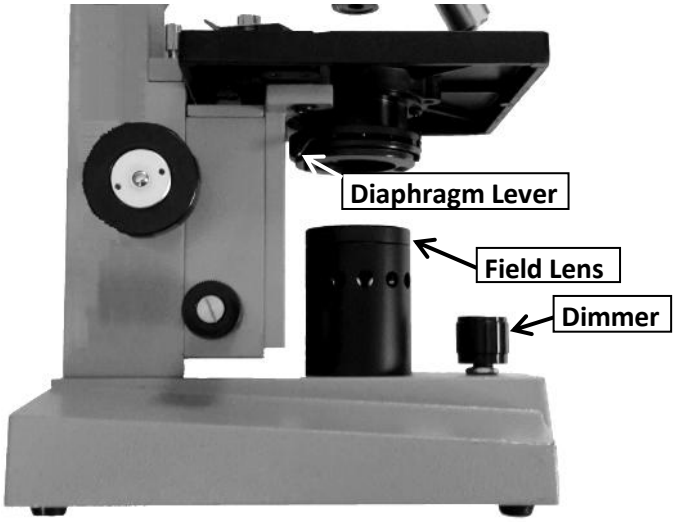
EXTREME (WLMGM04) MICROSCOPE

MICROSCOPE PART IDENTIFICATION







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STAGE SLIPPING (*On an EXTREME (WLMGM04) microscope*.)

Most often a slipping stage on this microscope is caused by incorrect tension setting on the focus control. Remedying this is just a simple operator adjustment.

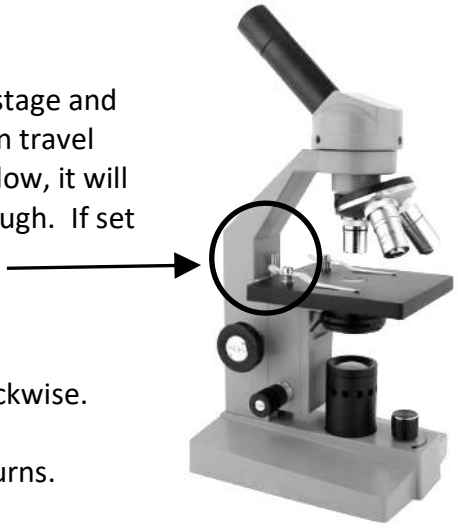
A tension adjusting collar is located on the shaft of the course focus control on one side of the microscope body. This can be turned to increase or decrease the tension on the shaft providing resistance to the stage dropping.

The collar has a few small holes to locate the adjusting spanner that is provided with the microscope.

Tighten only enough to keep the stage from drifting downward.

STAGE STOP – adjustment of top limit of stage travel

(*On an EXTREME (WLMGM04) microscope*.)

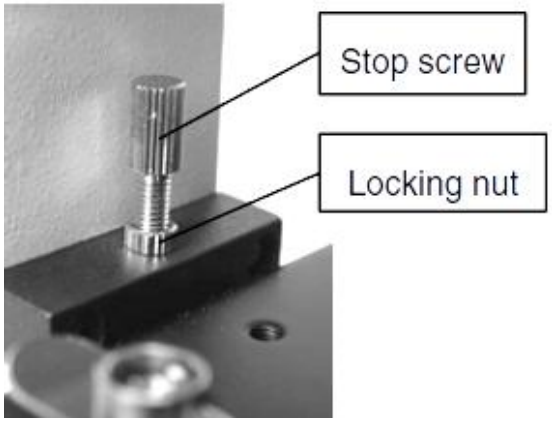


The STAGE STOP screw which is located between the microscope stage and the head support arm sets the top limit of how far up the stage can travel when turning the coarse focus knobs. If this adjustment is set too low, it will not be possible to focus a slide as the stage cannot move high enough. If set too high slide breakage may occur.

It is an easy adjustment to correct this problem.

1. Loosen the round knurled **Locking Nut** by turning it counter-clockwise. You may need to use needle-nose pliers for this.
2. Loosen (by turning anti-clockwise) the **Stop Screw** a couple of turns.
3. Focus on a standard slide until you obtain a sharp image.
4. Tighten the **Stop Screw** by turning it clockwise until it stops, then turn it back ½ turn.
5. Lock into position by tightening the **Locking Nut**.

Note: The higher the stop screw is, the higher the stage will rise.



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ATTACHING A FINE FOCUS KNOB (*On an EXTREME (WLMGM04) microscope*.)

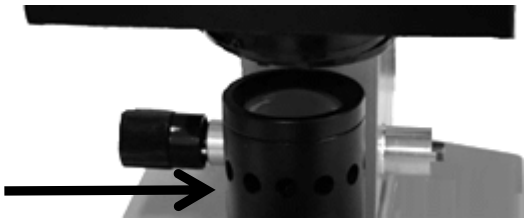
NOTE: There are two models of Fine Focus knob retaining screws;
(they are interchangeable)

The older slotted head style which requires a fine flat blade screwdriver.

The newer Hex Cap head style which requires a 3mm Hex Key.

Procedure

1. Wind the Fine Focus knob that is still attached to the microscope, fully in towards the microscope body.



2. Now turn it back out about 7 turns. This puts the mechanism into its mid position.
3. Fit the missing knob onto the shaft, followed by the spring washer and the retaining screw.

4. Whilst holding this knob, tighten the retaining screw.
5. Turn this knob fully in towards the microscope body until it reaches its end stop. Now tighten the retaining screw just a fractional amount to secure it firmly on the shaft.
6. Now wind Fine Focus knobs so that they are about in the middle of their travel to set the microscope ready for use.

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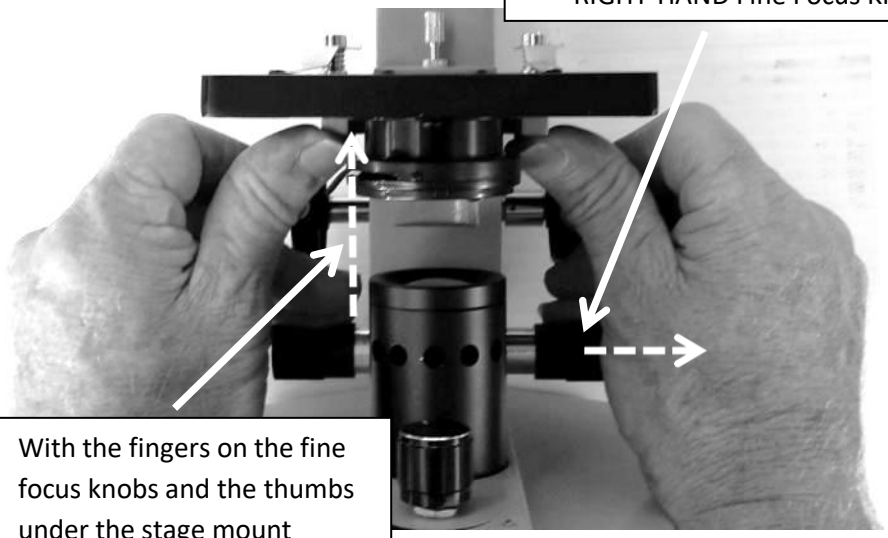
HOW TO TEST THE FINE FOCUS MOVEMENT MECHANISM

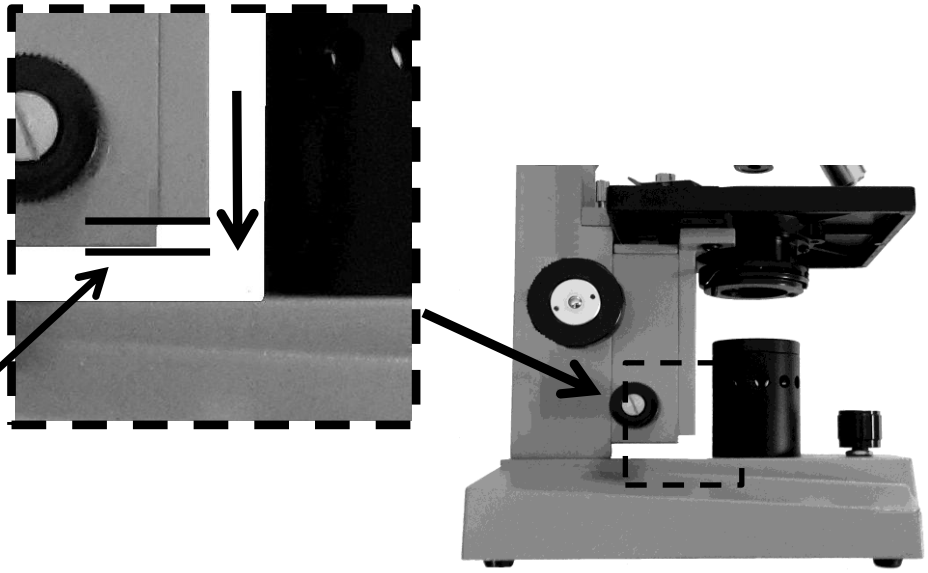
(*On an EXTREME (WLMGM04) microscope*.)

1. With the microscope stage facing you, wind the RIGHT-HAND Fine Focus Knob fully OUT(to the right)



2. With the fingers on the fine focus knobs and the thumbs under the stage mount (as shown), push the stage up.

3. Now let go and watch how long it takes the fine focus mechanism to return to its lowest position.



Perform this test on a microscope, that is working quite satisfactorily and then compare the time taken for the mechanism to return to its lowest position with that of the microscope with the fine focus mechanism problem.

Two things can cause a very slow or non-return to lowest position:

1. Dried or lack of grease on the fine focus dovetail.
2. Failed or weak return spring.

To undertake repairs on the area, it will be necessary to refer to the section on "FOCUS MOVEMENT PROBLEMS major disassembly instructions".

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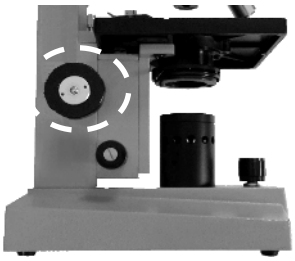
ATTACHING A COARSE FOCUS KNOB (*On an EXTREME (WLMGM04) microscope*.)

This instruction outlines the procedure for refitting a Coarse Focus Knob on this microscope.



The Coarse Focus knob assembly consists of;
a bright chrome circular nut,
a wave spring washer,
the plastic focussing knob
and then under the knob is often one or two washers.
(One of these maybe a thin white plastic washer.)
This is the correct order of assembly.

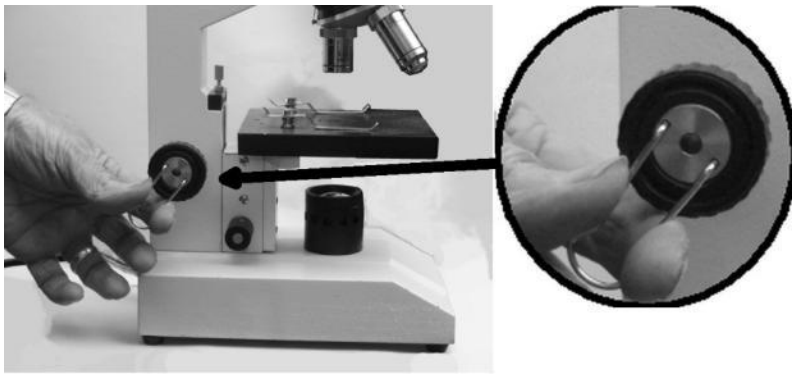
Often it can be worthwhile to wipe down the surfaces of these parts with either Shellite, Ethanol or Metho to remove any grease before reassembly.

Reassembly is simply a process of fitting each part in the correct order on the coarse focus shaft coming out of the body of the microscope.
IMPORTANT: Make sure you put the circular nut on with two small holes in the OUTSIDE.

You will now need to tighten it! But with what and how?
That is what the pair of small holes in the face of the nut are for.

It would be nice if you had a face pin spanner like this: -

Instead make a pair from a 32mm paper foldback clip from the office. Simply pop out the wire 'handles' and twist the two ends 90 degrees as shown.



Now you can insert your new handmade face pin spanner into the holes in the knob retainer and carefully give it a light tighten.

For undoing it can be necessary to hold this 'tool' in a pair of pliers so more leverage can be applied.

For the final tightening of this knob, it will be necessary to hold the knob on the other side still.
It this is difficult; you can use that other knob to wind the stage until it reaches its end stop. Now tighten the nut firmly to secure it on the shaft.

If after reassembly the knob is still slipping, it may be necessary to disassemble again and use fine nose pliers to bend the 'waves' in the wave washer deeper. Over time these washers can begin to flatten and thereby reduce their effectiveness.

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DISASSEMBLY FOR RECTIFYING FOCUS MOVEMENT PROBLEMS

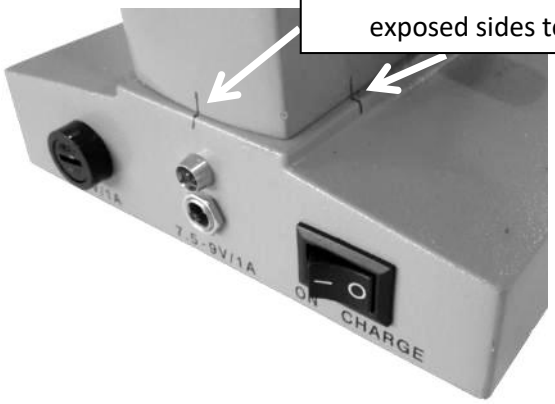
(*On an EXTREME (WLMGM04) microscope*.)

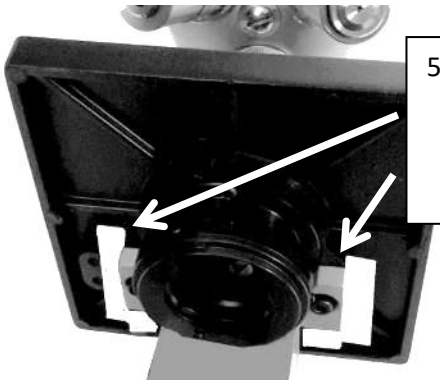
If precautions are not taken there are two important alignments that may be lost in disassembling the microscope;

1. The alignment of the light source as set by the positioning of the arm to the base.
2. The alignment of the stage assembly as set by the stage mount bracket screws.

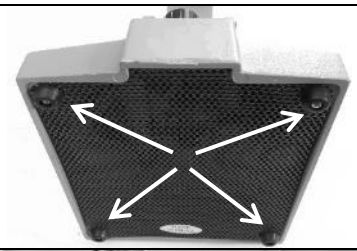
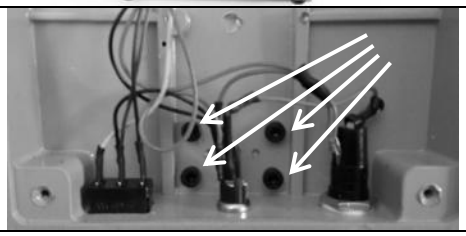
To aid in reassembling these items in the original factory set position, the following steps should be taken.

4. Draw lines across the arm to base joint on all three exposed sides to aid alignment on re-assembly.





5. Attach pieces of masking tape, on the underside of the stage, to define the location of the stage mount bracket. Lines can be added similar to those used on the arm shown above, as a further aid to alignment.

	Undo feet screws to remove base cover.
	Having marked the arm location as described above, undo the arm mount screws and remove the base unit.

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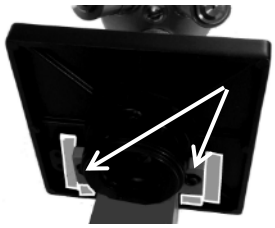
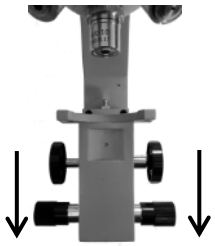
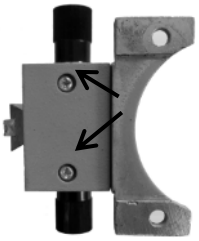
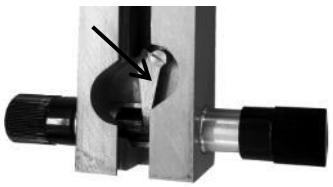
<table>
<tr><td colspan="2">  </td><td>Having marked the location of the stage as described above,
undo the stage mounting screws.

Carefully remove the stage, <u>*ensuring that the location of any metal shims that have been fitted by the factory to level the stage are retained and their position is noted for replacement*</u>.</td></tr>
<tr><td>  </td><td>  </td><td>Wind the coarse focus knob down to remove the fine focus mechanism complete with coarse focus gear rack.

-Inspect the coarse gear rack for wear and check all screws are tight.
-Inspect the coarse focus pinion gear for wear and check its housing is held tightly in the arm.
(i.e. does not have any rotational play)</td></tr>
<tr><td>  </td><td>  </td><td>On the fine focus mechanism, remove 2 screws that retain the top cover plate. Caution; Cover plate is spring loaded. Hold cover in place with fingers, remove cover and remove spring. Do not to allow the spring to escape!

Now the stage mount bracket and fine focus dovetail assembly can be slid up and removed.

-Check all screws on the assembly are tight.
-Check the fine focus drive shaft housing is held tightly and does not have any rotational play.</td></tr>
<tr><td colspan="2">  </td><td>-Check fine focus return spring is at least 30mm long.</td></tr>
<tr><td colspan="2">  </td><td>Inspect the Cam Lever for free movement.
If not moving freely, the retaining screw may require shimming.
If the movement feels ‘gritty’, inspect lever's shape at the shaft end. The point may require polishing to obtain free movement again.
Rectify any problems found.</td></tr>
<tr><td colspan="3">Reassembly is the reverse of the above procedure.
Ensure adequate damping grease is on all sliding surfaces and rack & pinion gears before reassembly.
If necessary follow this procedure;
1. Clean the dovetail and all mating surfaces with alcohol.
2. Lubricate the mating surfaces with damping grease (eg. Losoid 72515 or equivalent).
3. Slide the mechanism up & down at least 10 times.
4. Wipe away any excess grease.</td></tr>
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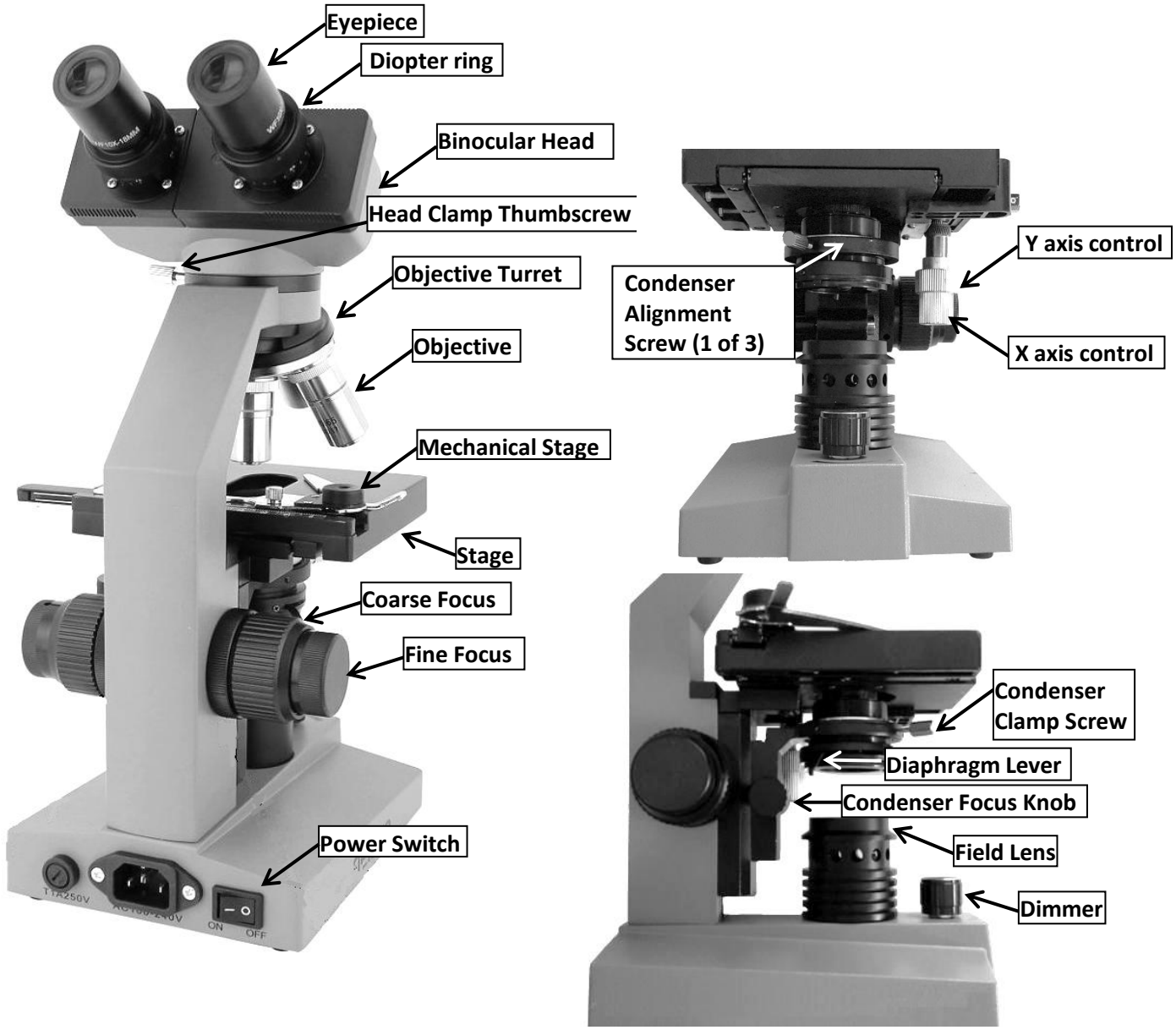
DELUXE (WLMSM03D) MICROSCOPE

MICROSCOPE PART IDENTIFICATION



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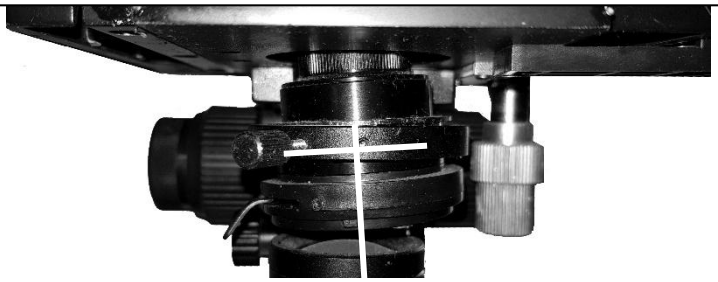
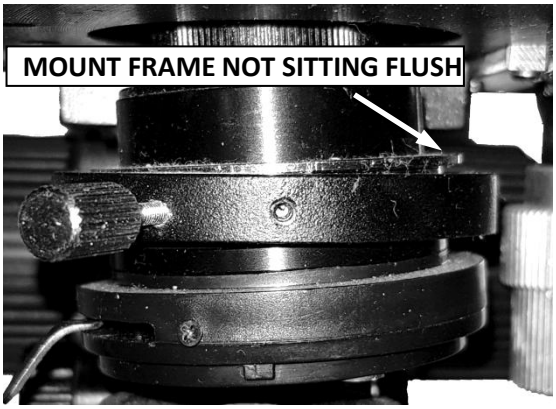
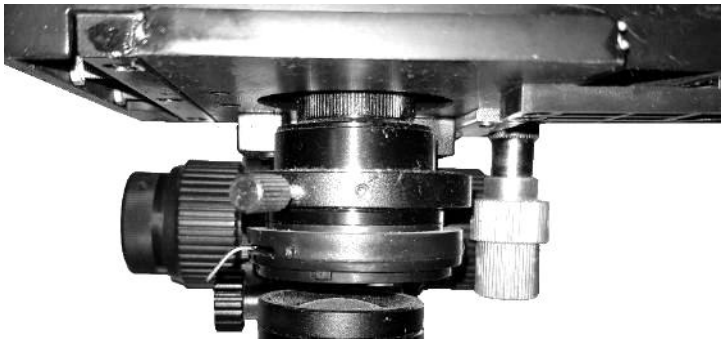
CONDENSER MOUNT FRAME MISALIGNMENT (On a DELUXE/WLMSM03D microscope)

Often checking under the stage, it will be obvious that the condenser lens assembly is not sitting square to the microscope optical axis.

EXAMPLE OF MISALIGNMENT OF THE CONDENSER MOUNT FRAME





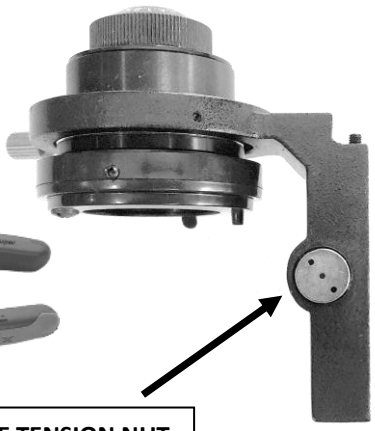


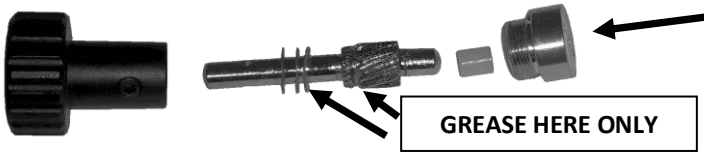
This can be easily corrected by undoing the condenser clamp screw and pushing the mount frame back into position.

CONDENSER HEIGHT TENSION ADJUSTMENT (On a DELUXE(WLMSM03D) microscope)

Often checking under the stage, the knob that adjusts the condenser lens assembly height will have become quite stiff.

The chrome nut is adjusted for correct knob tension.
A simple pin spanner, to adjust the tension, can be made from a paperclip and a pair of pliers.





To remove drive axle, undo and remove both the chrome tension nut and the knob (*requires 1.5mm hex key*) and slide axle out towards tension nut side.

Grease (*petroleum jelly and paraffin oil*) is applied only to the three nylon washers at the knob end of the axle and the pinion gear.

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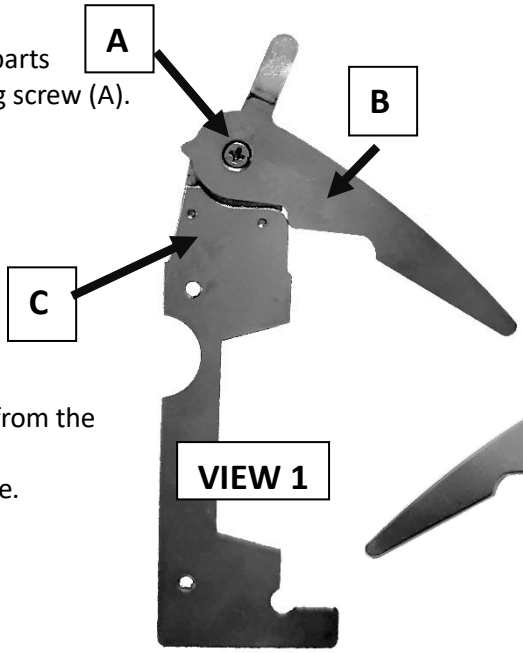
SLIDE HOLDER SERVICE

(On a DELUXE/WLMSM03D microscope)

Remove two thumbscrews retaining slide holder to stage and lift Slide Holder off stage.

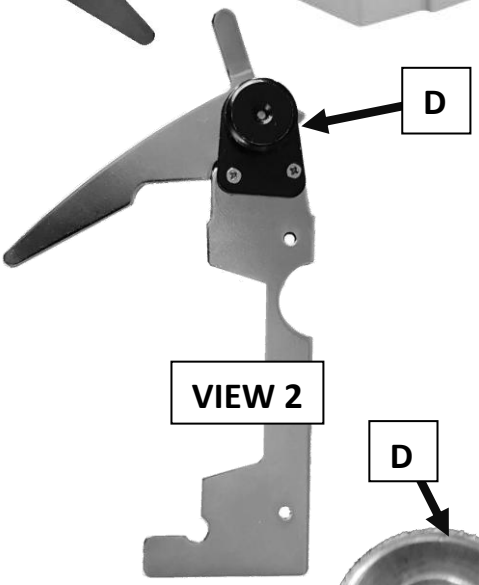
Turn Slide Holder over as shown in VIEW 1.

Firmly holding the component parts together, undo the arm securing screw (A).



VIEW 1

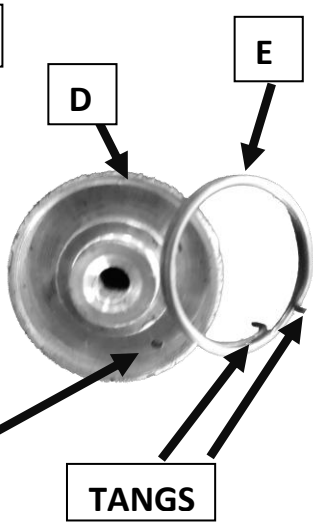
Lift away the Arm (B) and then from the other side, lift away the Cap (D) and the spiral spring fitted inside.



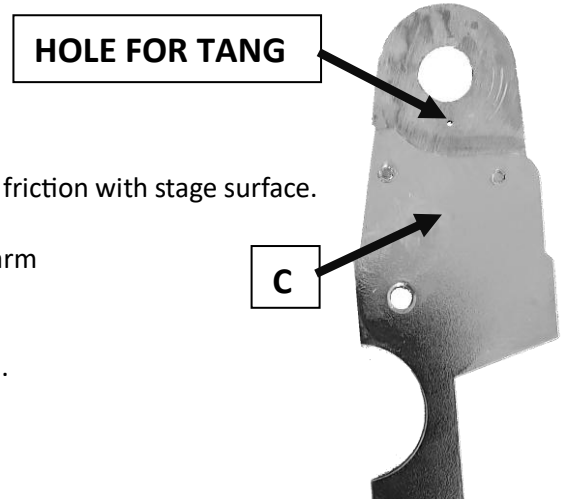
VIEW 2

Assembly procedure

Fit the Spiral Spring (E) into the Cap (D), making sure that the spring tang is inserted into the hole on the Cap (D).
Assemble the Cap (D) with spring onto the Plate (C), ensuring the other spiral spring tang fits into the hole in Plate (C).



Now fit the Arm (B) in place and fit the securing screw (A).
Tighten the screw hand tight and then undo it ¼ of a turn.
Now as viewed from stage side (VIEW 1), rotate the Cap (D) anticlockwise 1/8 of a turn to preload the spiral spring.
Whilst holding Cap (D) in place, tighten screw (A).
Check that the Arm now is spring loaded and operating correctly.



Refit the Slide Holder to the stage with the thumbscrews.

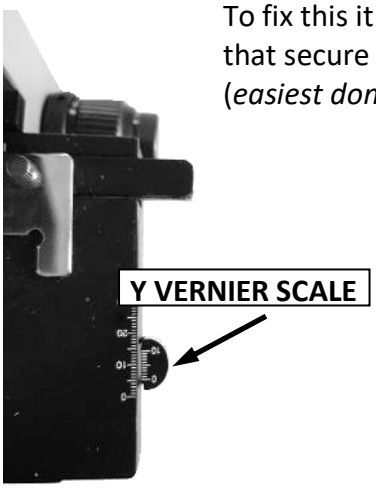
Check that Arm (B) movement is such that it is free from any grating or friction with stage surface.

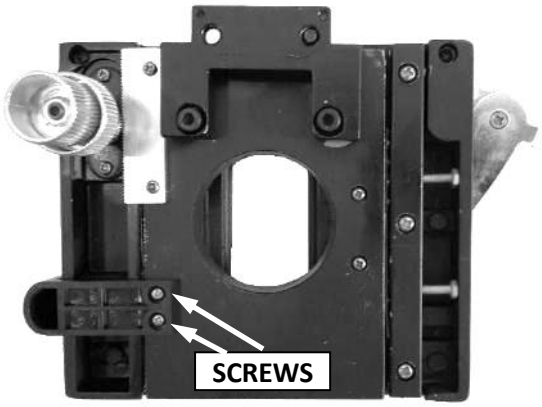
If in doubt measure the gap between the top surface of the stage and arm with a Thickness Gauge. It should be between 0.2 to 0.4mm.
(That's between 1 & 4 sheets of 80 GSM paper)
If not, bend the Arm for adjustment or replace the part with a new one.

Y VERNIER SCALE ON STAGE IS LOOSE (On a DELUXE/WLMSM03D microscope)

The Y vernier scale on the side of the stage often becomes loose.

To fix this it is simply a matter of tightening the two screws that secure it under the stage.
(*easiest done with a stumpy small cross head screwdriver*)





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INNER RING FUNCTIONS

(On a DELUXE/WLMSM03D microscope)

The Stage Top Limit Setting Ring sets the top limit of how far up the stage can travel when turning the focus knobs. If this adjustment is set too low, it will not be possible to focus a slide as the stage cannot move high enough. See the next page for how to adjust this ring.

Most often a slipping stage on this microscope is caused by incorrect setting of the Focus knob Tension Setting Ring. Remedying this is just a simple operator adjustment.

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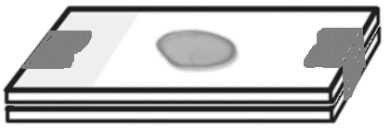
STAGE TOP LIMIT ADJUSTMENT

(On a DELUXE/WLMSM03D microscope)

Tools required: 1.5mm Hex Key, Steel ruler

The upper limit of stage travel, if incorrectly set will often prevent achieving proper focussing (*set too low*) or cause slide breakage (*set too high*).



If focus can't be achieved and it is considered that the Stage Top Limit Adjustment may be set too low, this can be easily checked by taping a sample slide on top of a blank slide and then trying to focus that slide. – be very careful not to break the slide.

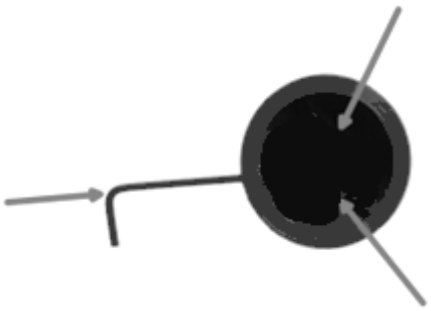
If focus can be achieved under this test, then the Stage Top Limit Adjustment is set too low and should be adjusted as outlined below.

1. Remove binocular head assembly.

2. Place 150mm steel ruler as shown. (*end of ruler on top of chrome slide holder*)

3. Using a 1.5mm hex key release the Stage Top Limit Setting Ring.
(See INNER RING FUNCTIONS figure on previous page)

There are actually 3 grub screws in each ring



Generally, the one that is accessible in the final positioned is tightened but sometimes one of both of the other two are (and they are hard to access)
If so try to locate and undo them one turn too.

4. With the Fine Focus Knob turned fully CLOCKWISE, use the Coarse Focus Knob to set the stage at 68mm position as shown.

5. Turn Stage Top Limit Setting Ring ANTICLOCKWISE until it reaches the internal stop and lock in position with the hex key.

6. Replace the binocular head assembly.

7. Now with a slide with coverslip on the stage and the X100 objective in position, once again release and reset the Stage Top Limit Setting Ring to make a final fine adjustment of the top limit so that the objective is just clear of touching the slide.
(If a slide is unavailable set the top limit for 1.5mm clearance between the stage and the X100 objective lens.)

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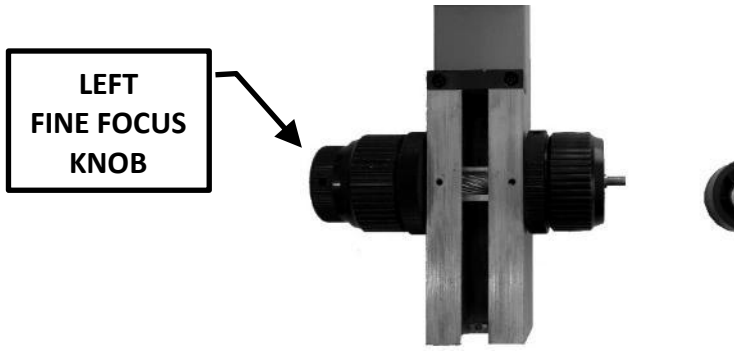
FINE FOCUS KNOB FITTING AND SETUP (On a DELUXE/WLMSM03D microscope)

Tools required: 1.5mm Hex Key, Steel ruler

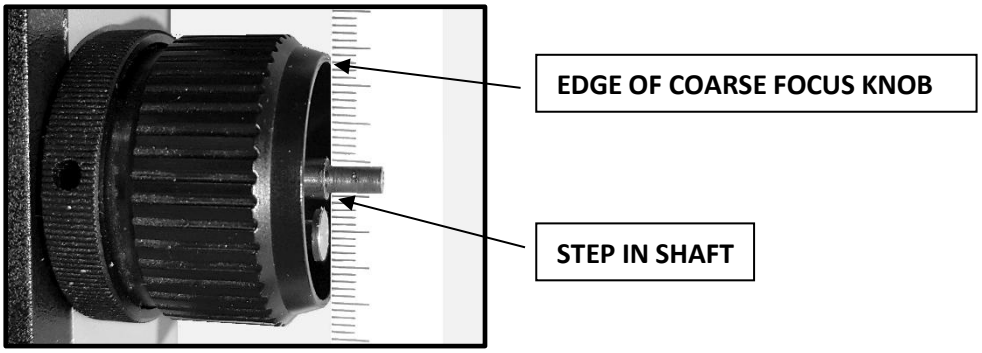


(Stage and Condenser Assembly only omitted for image clarity.)

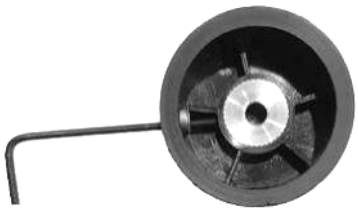
LEFT & **RIGHT** on this page is as viewed from the stage side of the microscope.

On both the Left and Right Fine-Focus Knobs there is a hole provided to access the fastening grub screw.

Without the Right Fine-Focus Knob fitted (it may be necessary to undo its grub screw about 1 turn with 1.5mm Hex Key to remove it), fit Left Fine-Focus Knob and secure the grub screw with 1.5mm Hex Key. Turn the Left Fine-Focus Knob until the edge of the Coarse Focus knob is in line with the step in the adjacent shaft. This is easiest if a steel ruler is placed across the outer edges of the Coarse Focus knob and the Left Fine-Focus Knob is turned until the step in the shaft just touches the ruler.



Take the Right Fine-Focus Knob and insert a 1.5mm Hex Key into the hole provided to access the grub screw. Now whilst looking into the knob's brass insert, adjust the position of the grub screw so it is just below the surface of the inner hole. Leave the hex key in the knob.



Fit the Right Fine-Focus Knob and turn it clockwise until it stops against the stop pillar.
If it doesn't hit the stop pillar turn the Left Fine Focus knob another half turn anti-clockwise and try again.
Now tighten the Right Fine-Focus Knob grub screw.
Ensure the Left Fine-Focus Knob grub screw is also tight

Now turn the Right Fine-Focus Knob anti-clockwise whilst counting the number of turns of its full range between stops. Anywhere between 3 & 4 turns is OK.

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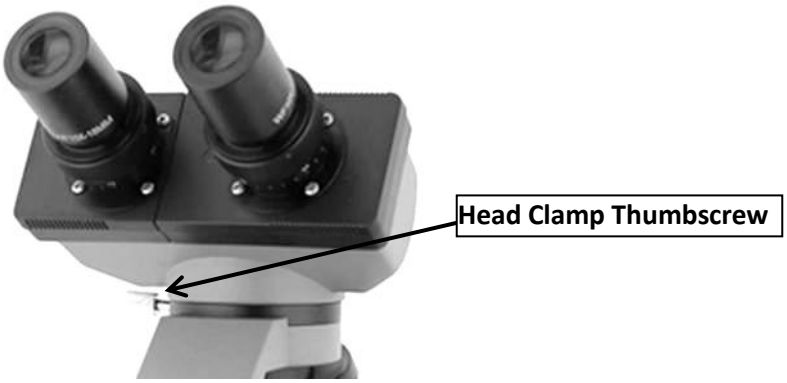
BINOCULAR HEAD ISSUES (On a DELUXE/WLMSM03D microscope)

Binocular head wobbly – simply check that the Head Clamp Thumbscrew isn't loose.

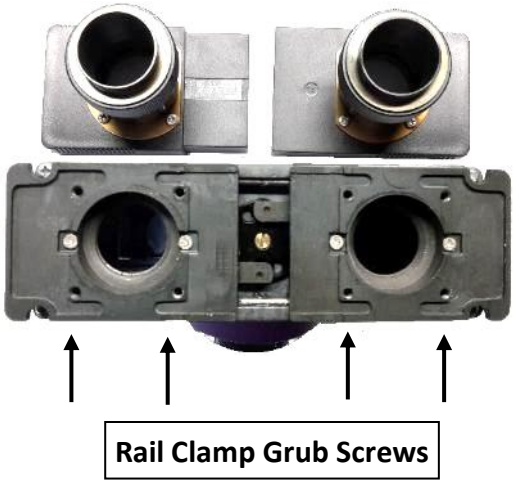


Eyepiece Assembly wobble (up & down)

Test for Eyepiece Assembly wobble by trying to rock the eyepiece mount assemble as shown in the adjacent picture.

If the wobble is excessive, remove the eyepieces. Turn each eyepiece focus ring fully out to make access to the screws easiest.
Undo the 4 screws securing each eyepiece tube and carefully lift off each tube and its black plastic square finger grip.
(*retain any brass shims that may be underneath to align the parts*)

Now check the 4 screws (one in each corner) that secure the assembly to the casting are tight.



If they are tight, then it will be necessary to tighten rail clamp grub screws with a 0.9mm hex key.

Turn in each screw until it just stops and then back out ½ turn.
Test for ease of sliding without being too loose and make fine adjustment of clamping screws
Now reassemble the head, refitting any brass shims that were originally fitted.

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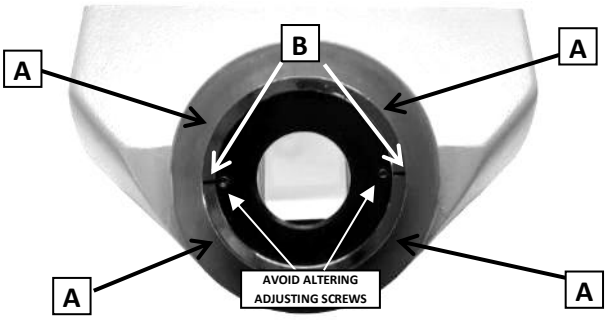
Binocular vision obscured -as seen through both eyepieces

(On a DELUXE/WLMSM03D microscope)
Remove both eyepieces and put aside.
Remove binocular head assembly (loosen thumbscrew and lift out)
Look at bottom of the assembly.



Normally the two prism adjusting grub screws (B) will be in line with the horizontal axis of the head body. Avoid adjusting these grub screws.

If it is not in alignment, undo the 4 clamping grubs screws (A) with a 0.9mm hex key, 1-2 turns to release the black "Prism P1 mounting disk" and rotate it carefully into position and tighten these grub screws.

Look through the binocular head assembly at a distant object to review the alignment and make any further adjustments as necessary.

Binocular vision obscured -as seen through only one eyepiece

(On a DELUXE/WLMSM03D microscope)
It is likely that one prism has become dislodged. This can often be very difficult to rectify.
After dismantling, it may be possible to epoxy the dislodged prism back into its original position

Turn each eyepiece focus ring fully out to make access to the screws easiest.
Undo the 4 screws securing each eyepiece tube and carefully lift off each tube and its black plastic square finger grip. (*retain any brass shims that may be underneath to align the parts*)

Undo the 4 screws (one in each corner) that secure the assembly to the casting.

Lift out the prism assembly and look carefully for a dislodged prism and examine thoroughly for any indication of where it was originally glued in place. If this can be determined, then attempt to glue it back into that original position with a small dob of epoxy glue.

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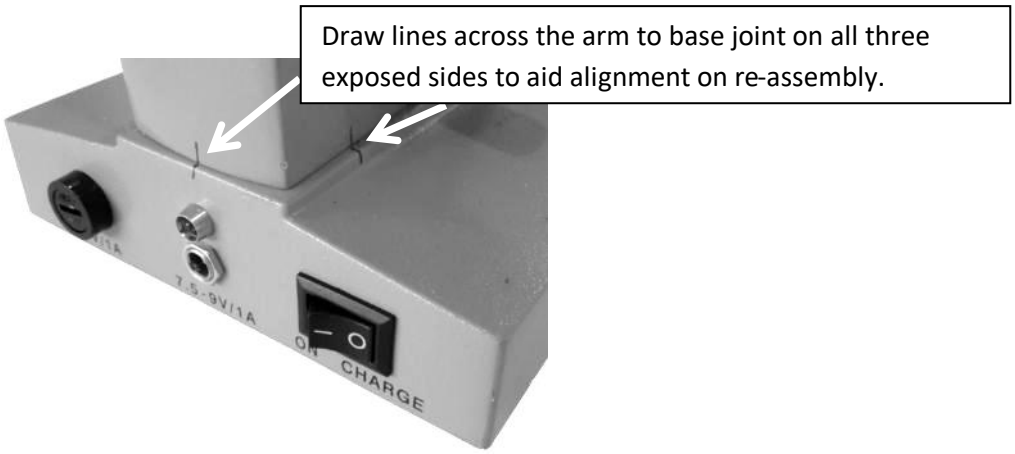
DISASSEMBLY FOR RECTIFYING FOCUS MOVEMENT PROBLEMS

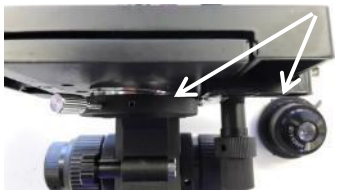
(On a DELUXE/WLMSM03D microscope)

If precautions are not taken alignment of the light source as set by the positioning of the arm to the base may be lost in disassembling the microscope;

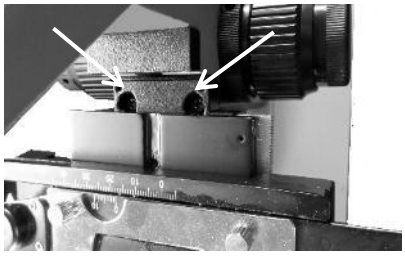
To aid in reassembling these items in the original factory set position the following step should be taken.



REMOVAL OF MAJOR ASSEMBLIES



Wind stage fully up using the focus knobs.
Wind the Substage Condenser Carrier fully up.
Undo condenser retaining thumb screw slightly and remove condenser.



Using mechanical stage position knobs, drive move stage fully out (away from arm) to reveal the two stage mounting screws. Undo both screws and carefully remove the stage.

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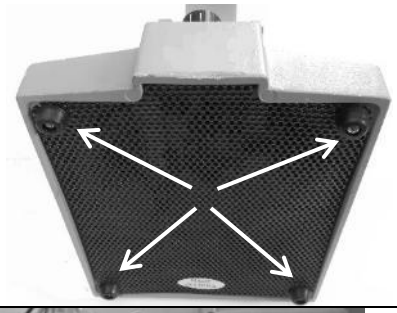
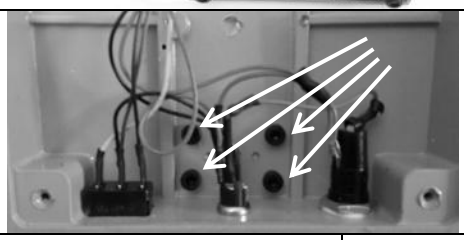
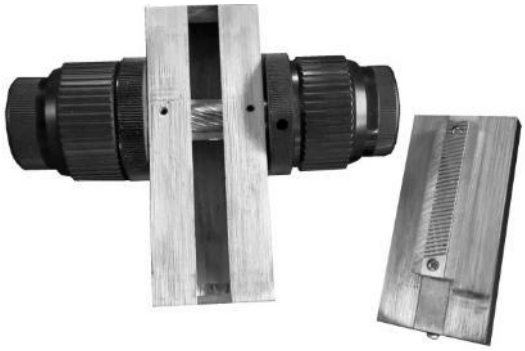
<table>
<tr><td>  </td><td>Undo feet screws to remove base cover.</td></tr>
<tr><td>  </td><td>Having marked the arm location as described above,
undo the arm mount screws and remove the base unit.</td></tr>
<tr><td> 
  </td><td>Wind the Substage Condenser Carrier down to remove it.
-Inspect the gear rack for wear and check all screws are tight.
-Inspect the pinion gear for wear.</td></tr>
<tr><td>  </td><td>Wind the focus knobs to remove the focus rack.
If the focus knob won’t turn far enough, it may be necessary to release the Stage Top Limit Setting Ring using a 1.5 mm hex Key.
-Inspect the gear rack for wear and check all screws are tight.
-Inspect the pinion gear for wear and check its housing is held tightly in the arm.
(i.e. does not have any rotational play)</td></tr>
<tr><td colspan="2">Reassembly is the reverse of the above procedure.
Ensure adequate damping grease is on all sliding surfaces and rack & pinion gears before reassembly.
If necessary follow this procedure;
1. Clean the dovetail and all mating surfaces with alcohol.
2. Lubricate the mating surfaces with damping grease (eg. Losoid 72515 or equivalent).
3. Slide the mechanism up & down at least 10 times.
4. Wipe away any excess grease.</td></tr>
</table>

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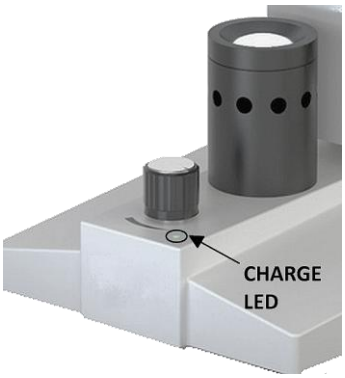
APPENDIX 1 – BATTERY OPERATION

Some models of these microscopes are fitted with internal (NiMH) batteries, as indicated by a small state of charge LED beside the dimmer knob.

> *Before you use the microscope for the first time, you need to charge the batteries fully. Note, it is often necessary to cycle them at least three to five times or more before they will reach peak performance and capacity.*

The operation of the charging system in these microscopes is such that with;
Power Switch set to OFF: NO power enters the microscope and therefore NO battery charging occurs. (Also, the light will be OFF)
Power switch set to ON: the light will turn ON; brilliance being set by the dimmer control position. (It may be best to turn dimmer switch to low whilst charging if not using the microscope.).

If the microscope is plugged into the wall power socket, and the power switch set to ON, not only will the light be on but charging voltage is available for the batteries. If the state of the batteries is such that they need charging, charging current is sent to the batteries and the small led beside the dimmer control will glow **RED**. If the batteries are not in need of charging, no charging current is sent to the batteries and the small led beside the dimmer control will glow **GREEN**. When the batteries are charging that led will start to turn from Red to Green passing through an ORANGE colour as the batteries approach full charge.



From the above you can see in order to charge the batteries the microscope must be plugged into the wall power socket, and the power switch set to ON. Theoretically new fully charged batteries would run the microscope light for 10 hours, but in practice it will be a little less than that.
Of course, as the batteries age, performance will drop.

> *If you never use the microscopes without power, it is probably best simply to remove the batteries all together. All that has to be done is; disconnect the power, remove the microscope base, pull out the batteries and put the base back on. Then you never have to be concerned about the state of battery charge or life ever again.*

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APPENDIX 2 – REMOVAL OF THE BASE FOR ACCESS TO INTERNAL MECHANICS

(On all models)

TOOLS

The following tools are needed for this procedure;

- Screwdrivers, cross (Phillips) head, various sizes
- Hex Key, 3mm
- Fine pointed nose pliers or tweezers to pick up small parts
- Fine permanent marker pen

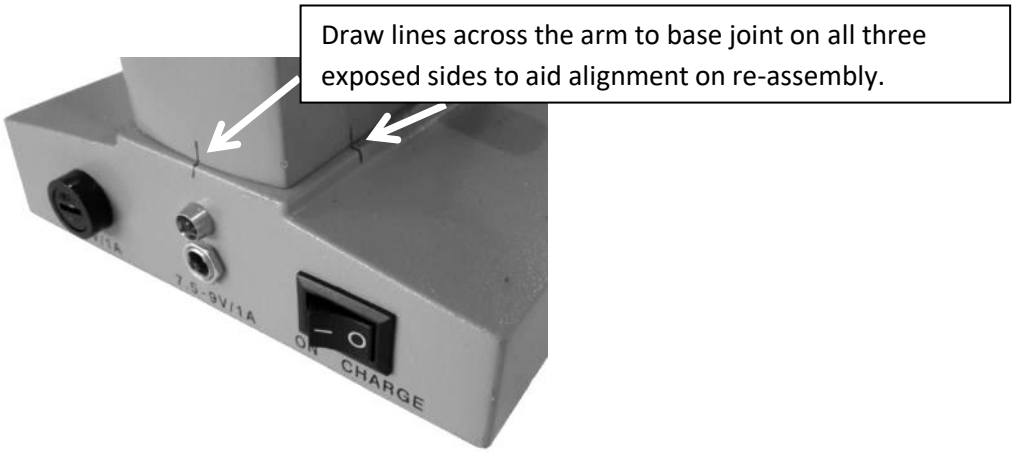
PROCEDURE

Firstly, look at the power connections on the base and identify which type of microscope it is;
'AC' or 'DC'?

DC TYPE

AC TYPE

If the following precaution is not taken, alignment of the light source as set by the positioning of the arm to the base may be lost in disassembling the microscope;
To aid in reassembling these items to the original factory set position, this following step must be taken.

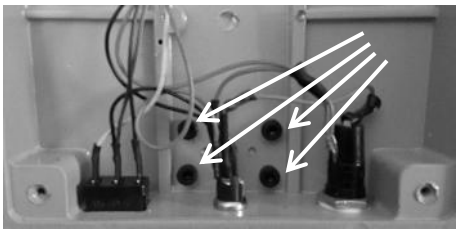
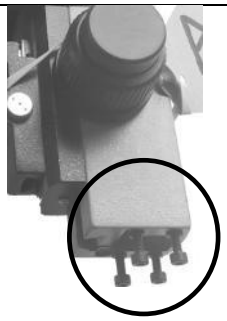


It is recommended that fine permanent marker pen is used for these lines. They can be removed later with a suitable solvent if desired.

Undo feet screws to remove base cover.

This step for AC TYPE ONLY

Undo the two screws securing the black power connector and pull the connector slightly out of the base just enough to make the base to arm screws accessible.

	Undo the arm mount screws and remove the base unit.
	Screw the 4 screws with their spring washers back into the microscope arm for safe keeping.
This step for AC TYPE ONLY Screw the black power connector back into the base.	
Reassembly is the reverse of the above procedure. Please ensure the marks made on the arm and the base assemblies align on final assembly.	

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APPENDIX 3 – FUSES

Reasons why they blow?
-A permanent electrical short circuit
-A momentary short circuit -e.g. Microscope globe filament failure

Always switch off and disconnect the equipment from the power point before removing

Accessing the fuse

Look for screwdriver slot in top or bottom edge to pop out the white fuseholder

Pry open with screwdriver here

May also hold a spare fuse

Unscrew anticlockwise

Common Sizes:
M205 (20mm lg x5mm diam),
3AG (32mm lg x 6.3mm diam - 1 1/4 x 1/4 inch)

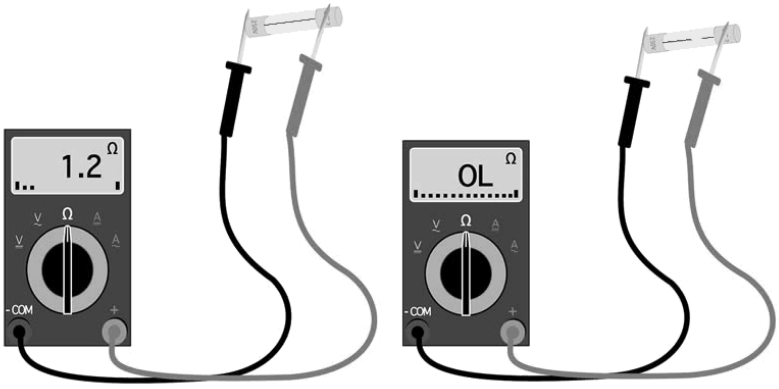
Markings: e.g. T2AL250V

T = Time Delay / **F** = Fast. - no leading letter then it is a "Normal" speed type
2A = 2 Amps (or may be marked **mA** -milliAmp)
L = Low breaking capacity or glass fuse (**H** is High breaking capacity - usually a ceramic package)
250V is the rated voltage of the fuse

So "**F200mA**" would be a 200 milliAmp Fast Acting fuse – *often found in digital multimeters*
And "**T1A**" would be a 1 Amp Time Delay fuse – *often found in microscopes*

Using an Ohmmeter to check

Good fuse: Low ohms typically 0 to 2 ohms
Failed fuse: high ohms – megohms or OL



PRINCIPLES and PRACTICE
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