Vision
ENGINEERING



HAWK

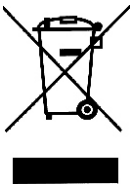
User Guide

Hawk MKII 3-Axis Non-Contact Measurement Systems

HAWK MKII 3-Axis Non-Contact Measurement Systems

Vision Engineering's Hawk family of 3-axis non-contact measuring systems are designed to achieve the highest levels of accuracy and repeatability. With high precision measuring stages, and a range of illumination options to suit all applications.

Health & Safety



RoHS

Vision Engineering and its products conforms to the requirements of the EC Directives on Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS).

EN61326-1:2006
FCC Part 15
EN61010-1:2010

WARNING: ALL EQUIPMENT PLUGGED INTO THIS UNIT MUST BE APPROVED TO EN60950-1:2001 AND CHECK CURRENT RATING OF OUTPUT SOCKET IF USED.

HAWK EQUIPMENT – WARNING

This warning refers to CNC systems

Warning – hazardous moving parts.



To avoid entrapment, keep fingers and other body parts away from moving parts

To stop all CNC movement in an emergency situation move the joystick in **ANY** direction.

This will interrupt the CNC programme and stop any movement.

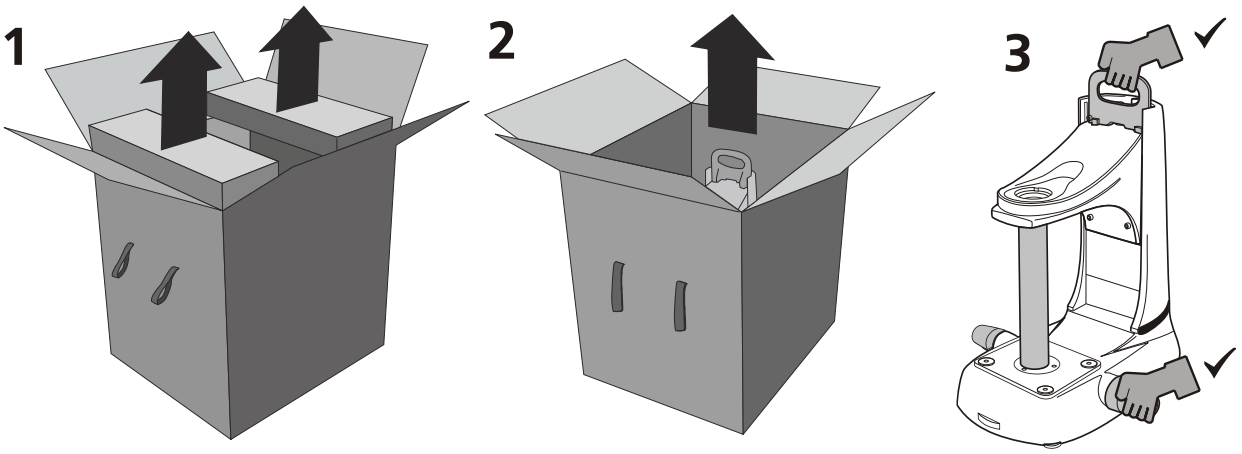
In the case of a system failure or crash, to stop the CNC movement switch the Control Power Supply off or switch off the mains power to the system.



WARNING

DISCONNECT THE MAINS POWER SUPPLY BEFORE PERFORMING ANY MAINTENANCE ROUTINE

Unpacking the Hawk stand (all systems)



Hawk with M3 software manual system

Box 1 Stand
Box 2 Head
Box 3 PSU - Manual and lighting, and cables
Box 4 M3 software pre-installed PC, keyboard and mouse
Box 5 Monitor
Box 6 M3 USB interface box
Box 7 Manual stage (200mm x 150mm)
Box 8 Optional accessories

Hawk with M3-CNC software motorised system

Box 1 Stand
Box 2 Head
Box 3 PSU CNC, and cables
Box 4 Joystick
Box 5 Trackerball
Box 6 M3-CNC software pre-installed PC, keyboard, mouse
Box 7 Monitor
Box 8 M3-CNC USB interface box
Box 9 Motorised stage (200mm x 150mm)
Box 10 Optional accessories

Hawk QC-5000 manual system

Box 1 Stand
Box 2 Head
Box 3 PSU CNC, and cables
Box 4 Joystick
Box 5 Trackerball
Box 6 QC-5000 PC, keyboard and mouse
Box 7 Monitor
Box 8 Manual stage (150mm x 150mm or 200mm x 150mm)
Box 9 Optional accessories

Hawk QC-5000 motorised system

Box 1 Stand
Box 2 Head
Box 3 PSU CNC, and cables
Box 4 Joystick
Box 5 Trackerball
Box 6 QC-5000 PC, keyboard and mouse
Box 7 Monitor
Box 8 Motorised stage (200mm x 150mm)
Box 9 Optional accessories

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Micro 3
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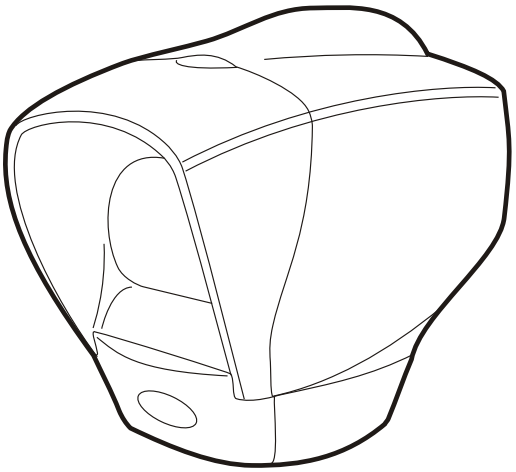
ACCESSORIES & OPTIONS

SERVICE & CALIBRATION RECORD

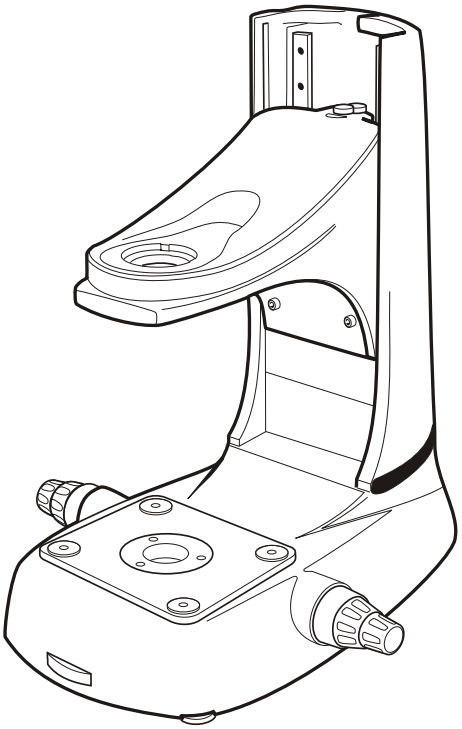
WARRANTY

See packing list to clarify contents of delivery.

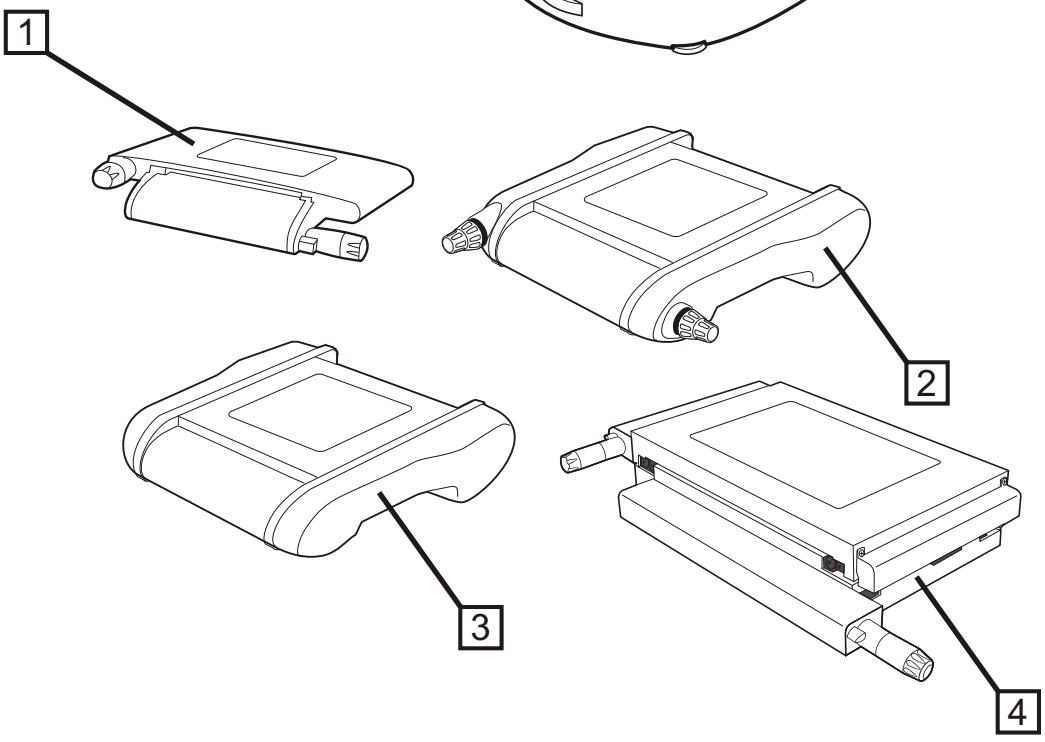
Head pack



Stand pack



Stage pack



1 150mm x 150mm (manual)

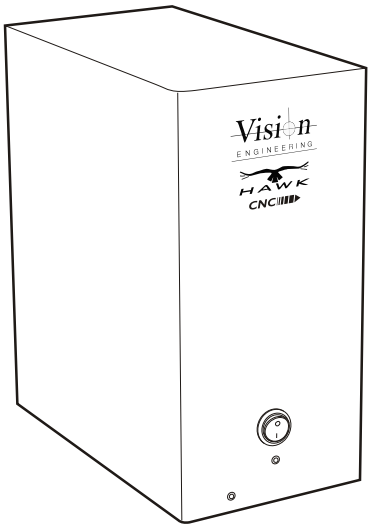
2 200mm x 150mm (manual)

3 200mm x 150mm (motorised)

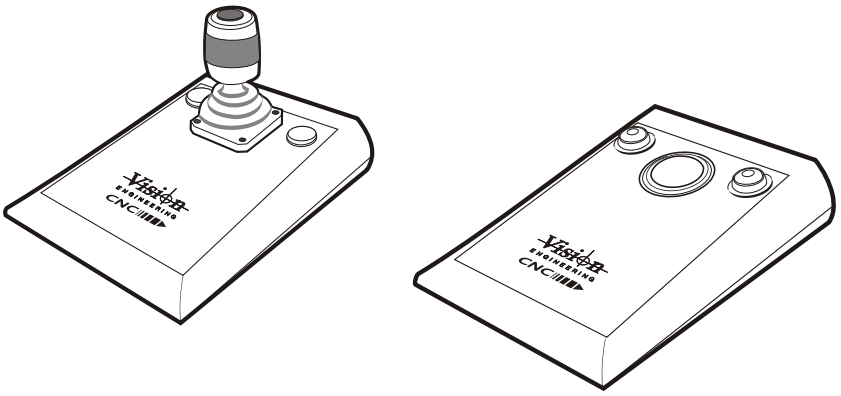
4 250mm X 150mm (manual)

Control units

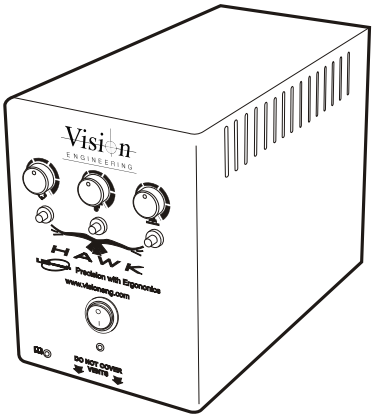
CNC control PSU



Joystick and trackerball



Control PSU manual and lighting control



Accessories

Macro

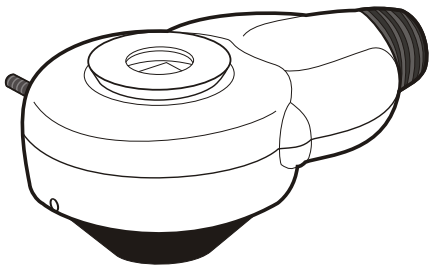


Substage condenser lens

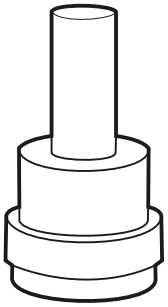
Object lenses

Macro Lens Options
x1
x2
x5
x10

Macro Episcopic
LED illuminator



Micro

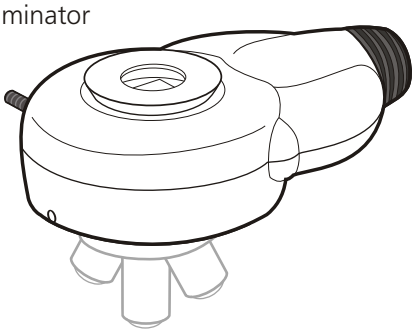


Substage condenser lens

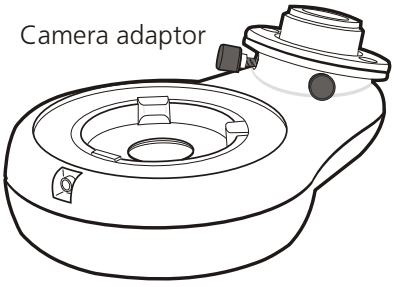
Object lenses

Micro Lens Options		
Micro	Micro LWD	Micro SLWD
x5	x10	x20
x10	x20	x50
x20	x50	
x50	x100	

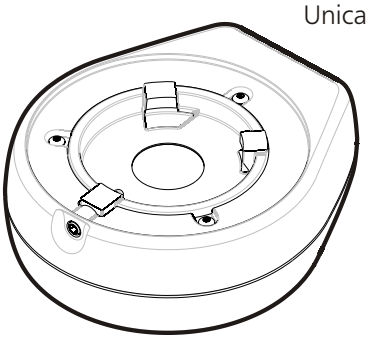
Micro Episcopic
LED illuminator

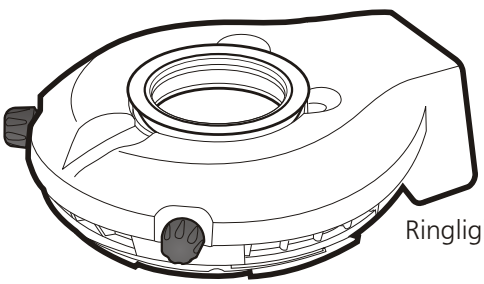


Camera adaptor



Unicam II

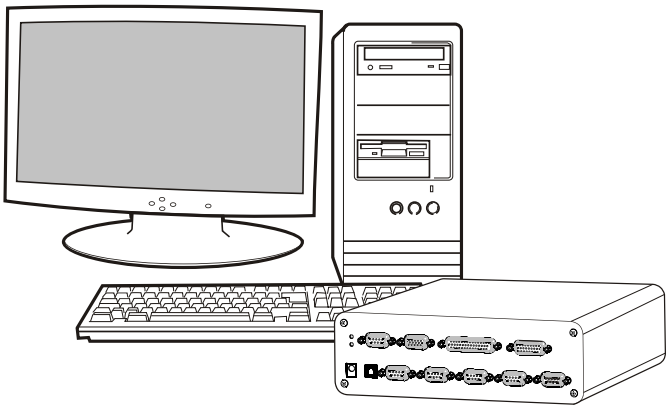




Ringlight illuminator

M3 USB Interface box

M3 USB interface unit



Note: **Please ensure your Windows® operating system is kept up to date through Windows® Update.**

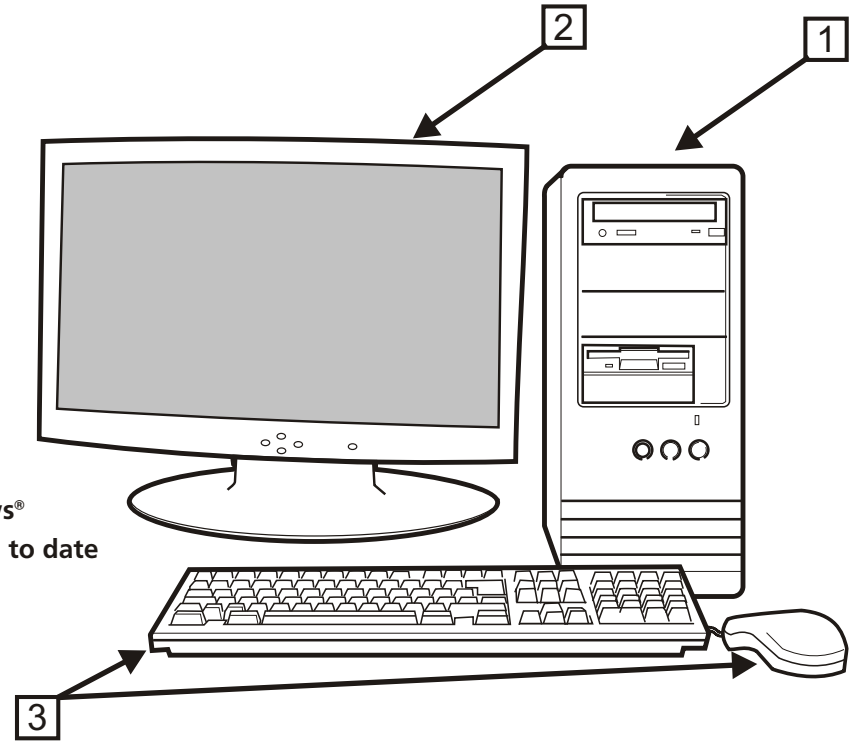
Note: **In applications where the USB signal/power is weak (i.e. with long leads and some laptops) we recommend using a powered hub or repeater cable (available from your local PC retailer).**

QC-5000 PC

1 QC-5000 PC

2 Monitor

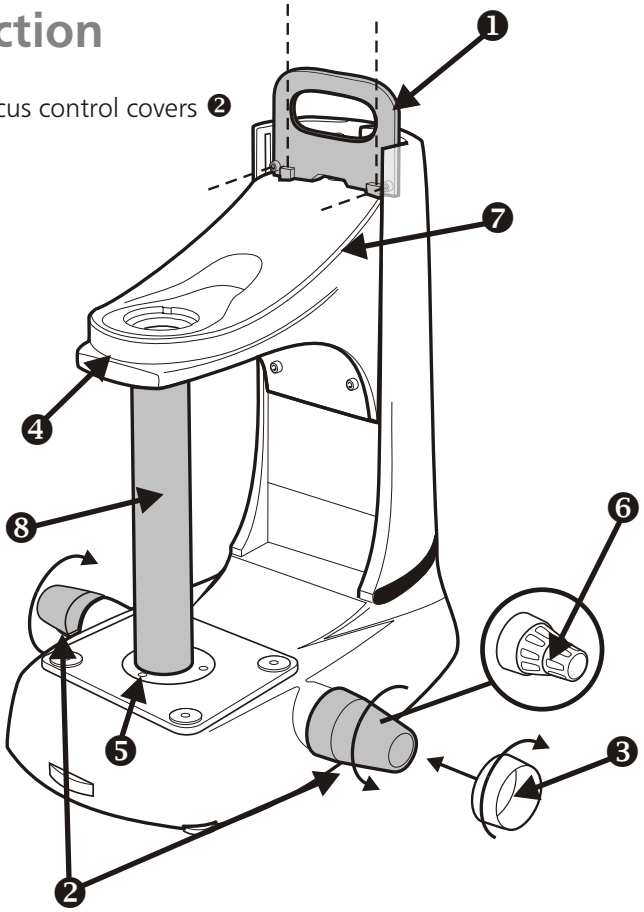
3 Keyboard and mouse



Note: **Please ensure your Windows® operating system is kept up to date through Windows® Update.**

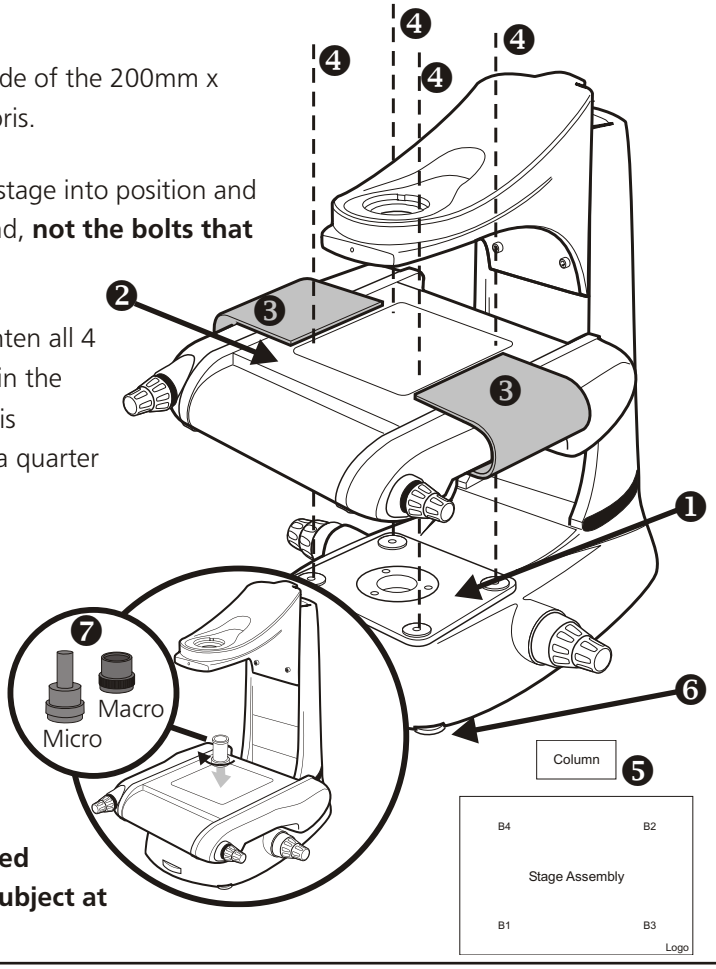
The following paragraphs provide instructions on how to assemble the Hawk Measuring System. In most instances the illustrations are self explanatory; where necessary the illustrations are supported by text.

Removing the transit protection



- Use the red transit handle ❶ and either of the focus control covers ❷ to lift the stand into the required work position.
- Remove the red transit handle and focus control covers. Screw the two focus control collars ❸ (one each side) into position.
- Remove the transit handle by removing the screws that secure it to the stand.
- Loosen screws ❹ and ❺. Use the focus controls ❻ to raise the head platform ❼ until there is sufficient room to remove the transit tube ❽. Unscrew dovetail from item ❽ as required.

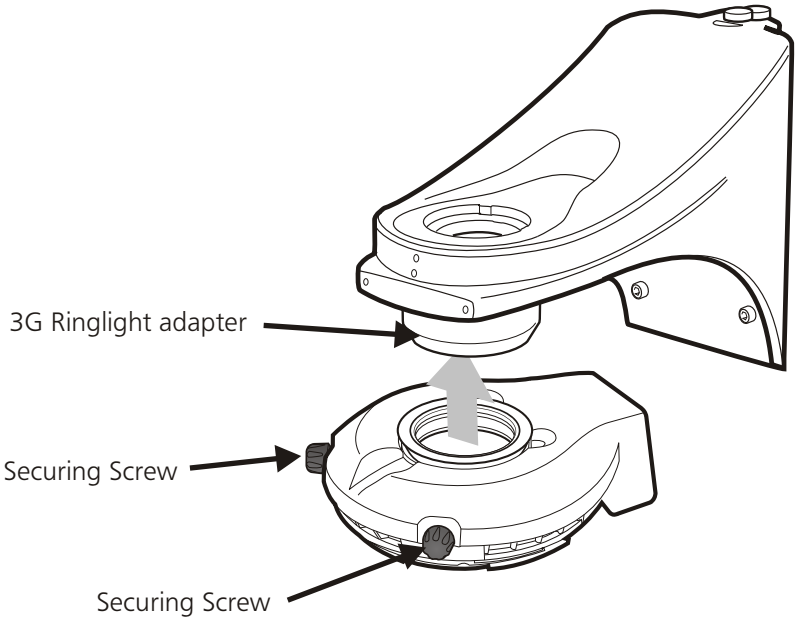
Attaching the stage



- Check the stand base plate ❶ and the underside of the 200mm x 150mm stage ❷ are clean and free of any debris.
- Using the red stage transit handles ❸, lift the stage into position and secure it using the bolts provided with the stand, **not the bolts that secure the stage into the transit box**.
- Use the Allen key supplied to progressively tighten all 4 screws ❹ in the numbered sequence (shown in the diagram ❺ below) to a torque of 2.8Nm. This is approximately equal to bolt touch down, plus a quarter of a turn.
- Remove the stage transit handles.
- Adjust the stabilizing foot ❻ to support the stand base.
- Screw the required condenser lens ❼ through the stage and into the stand.

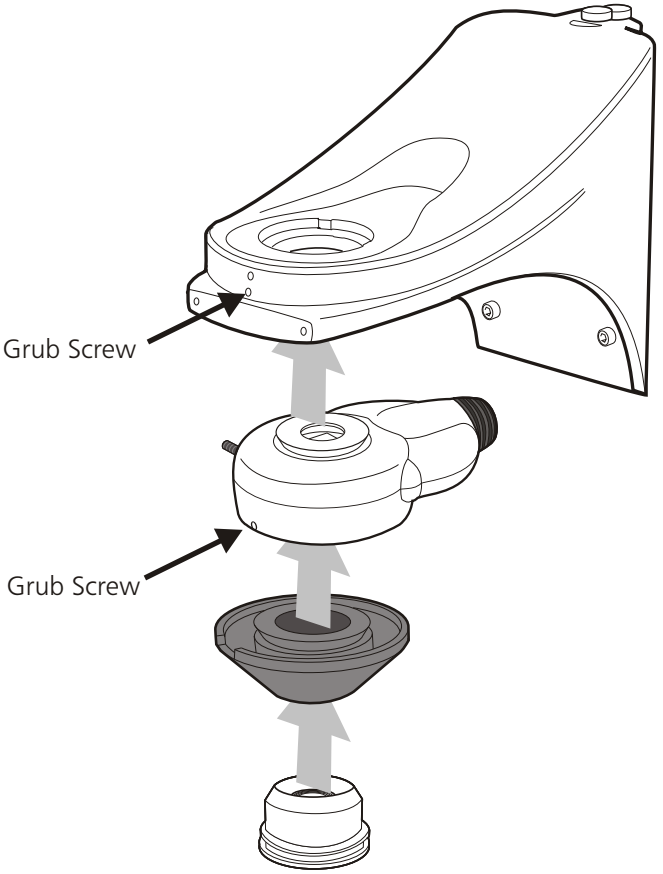
Note: **Micro condensers should only be used with micro lenses when viewing a subject at stage glass level.**

Ringlight attachment

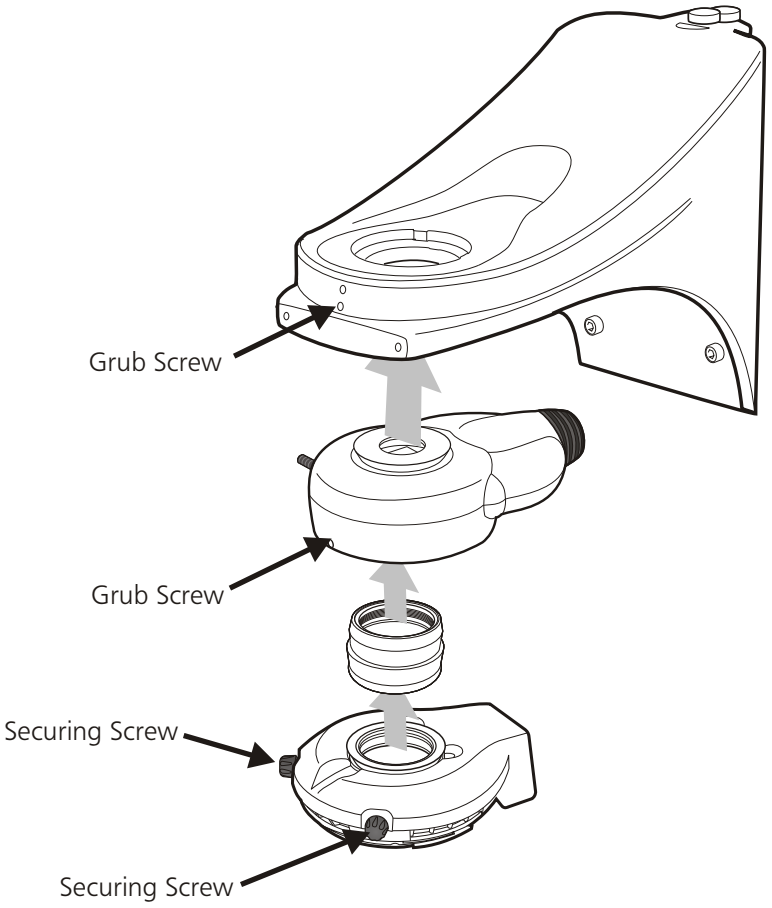


Macro EPI attachment

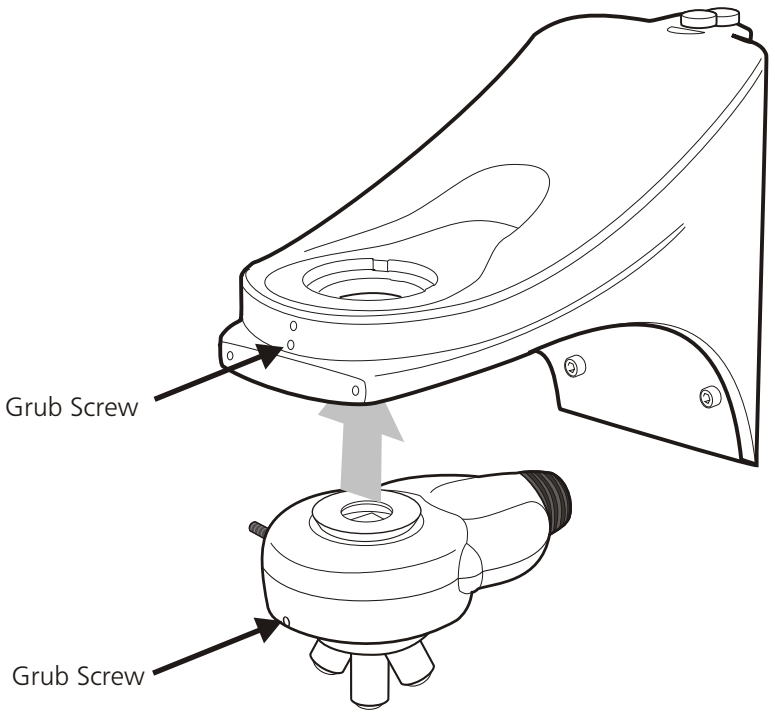
Note: **The same procedure is used to fit either the Macro EPI (illustrated) or the Micro EPI. The Micro EPI cannot have an Objective Holder or Ringlight fitted.**



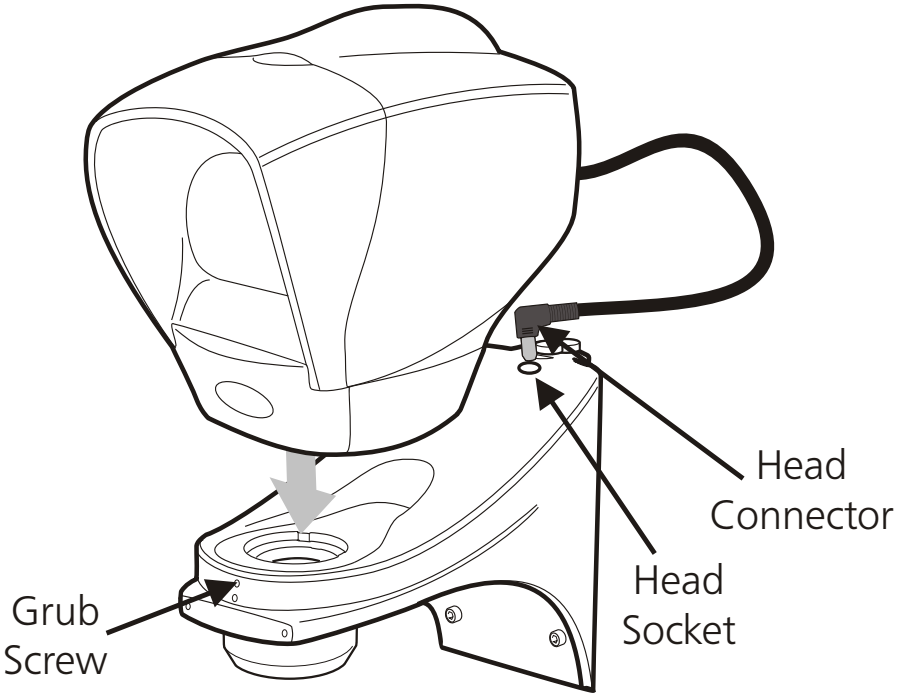
Macro EPI and ringlight attachment



Micro EPI and lens turret attachment

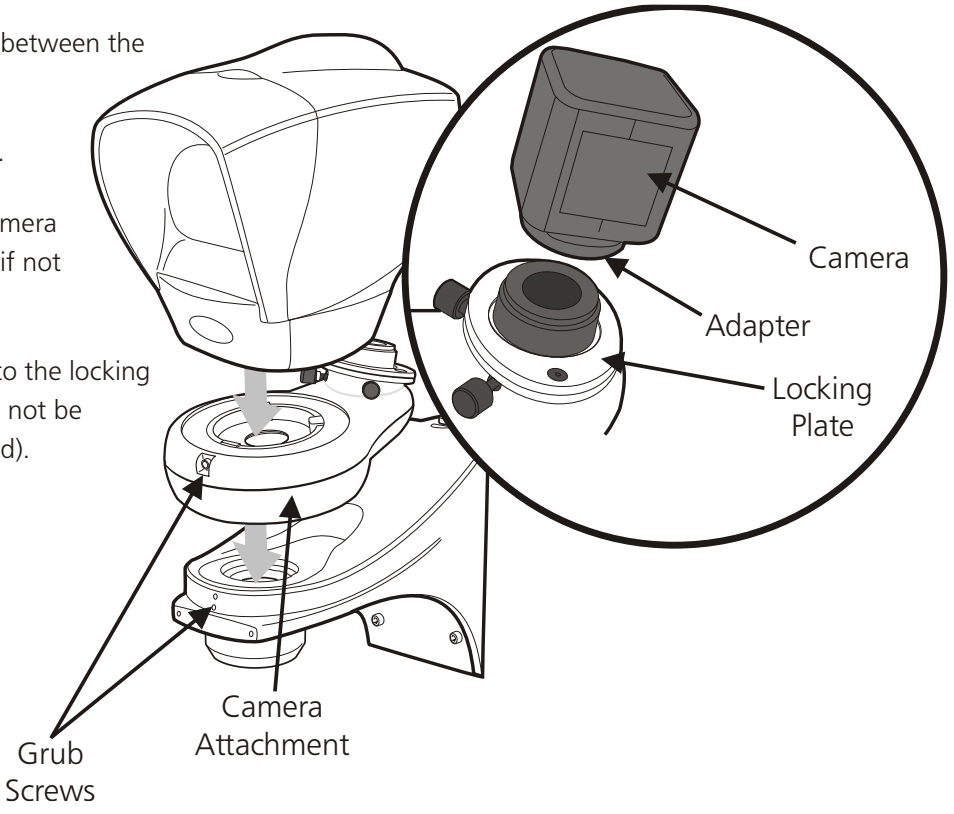


Attaching the head only

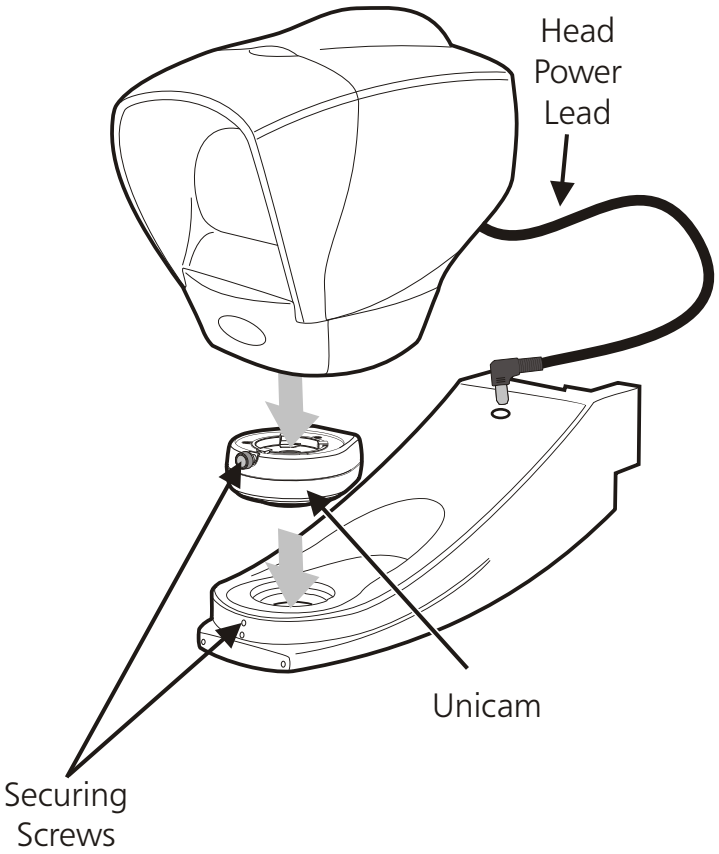


Mounting camera to rear

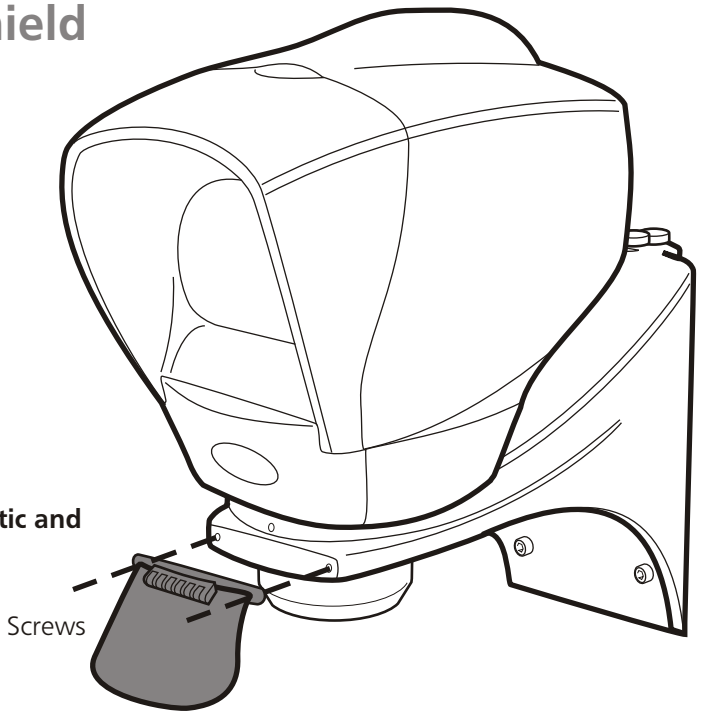
- Position camera attachment between the viewing head and its arm.
- Secure with the grub screws.
- Attach the adapter to the camera and tighten 3 x grub screws if not already fitted.
- Locate camera and adapter to the locking plate (the locking plate must not be overtight, but enough to hold).



Attaching Unicam II



Attaching the anti-glare shield



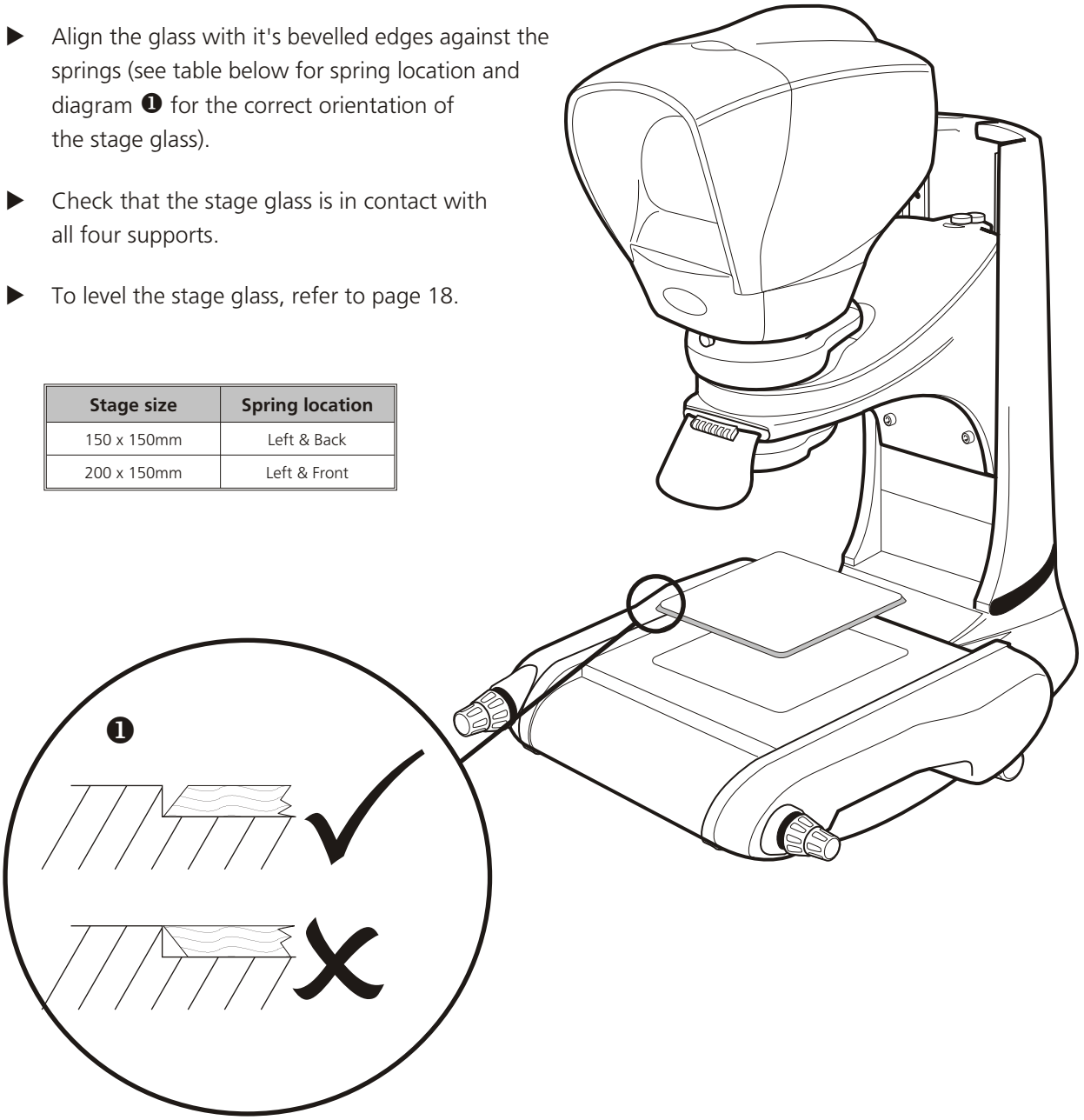
CAUTION: The Anti-Glare Shield is made of plastic and must not be over tightened.

Inserting the stage glass

Note: The stage glass must be handled with care to avoid any fingerprint marks.

- Align the glass with it's bevelled edges against the springs (see table below for spring location and diagram ❶ for the correct orientation of the stage glass).
- Check that the stage glass is in contact with all four supports.
- To level the stage glass, refer to page 18.

Stage size	Spring location
150 x 150mm	Left & Back
200 x 150mm	Left & Front

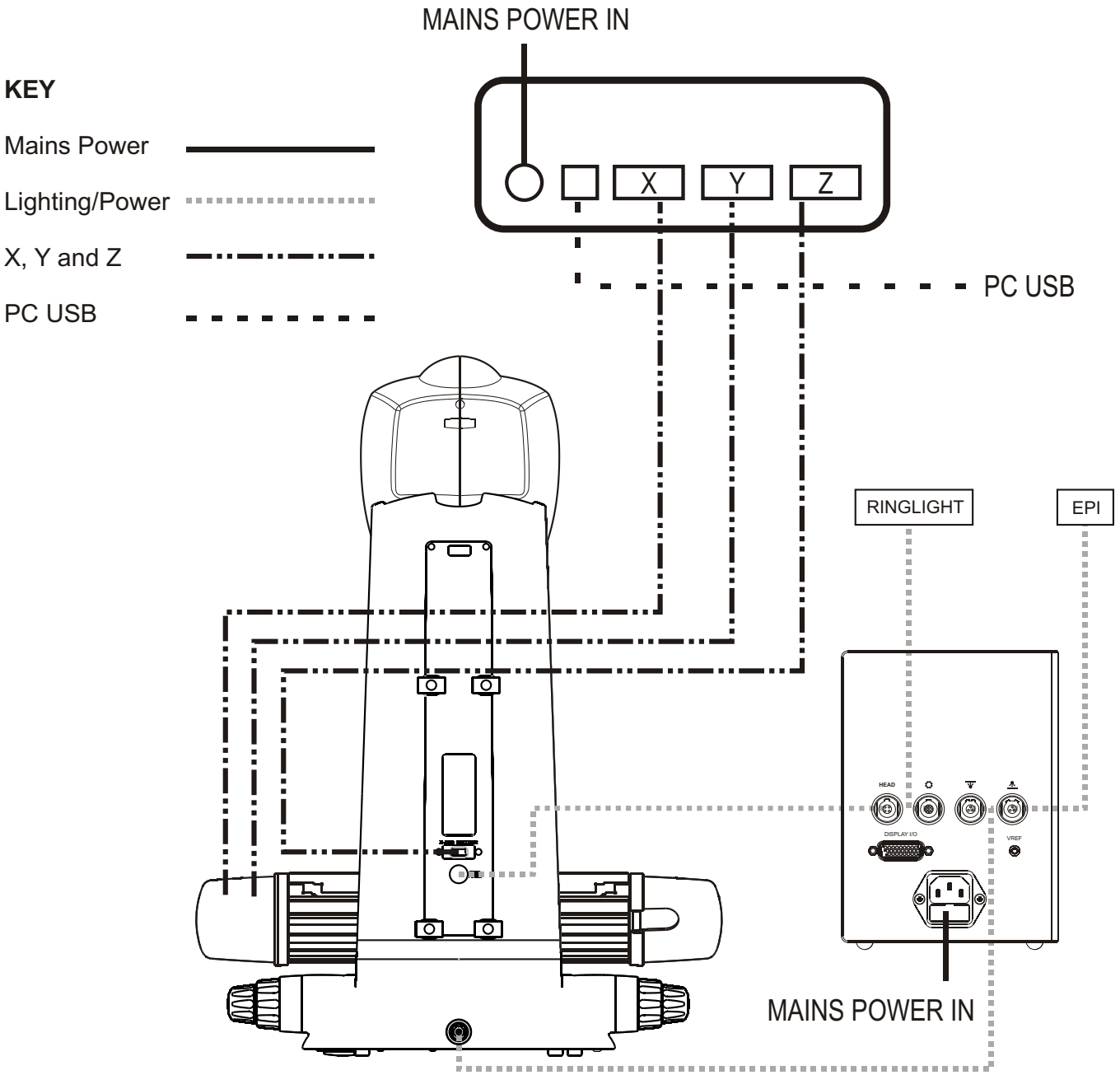


All connectors must be engaged fully and secured with the screws.

Note: **In applications where the USB signal/power is weak (i.e. with long leads and some laptops) we recommend using a powered hub or repeater cable (available from your local PC retailer).**

Note: **Please ensure your Windows® operating system is kept up to date through Windows® Update.**

Cable connection M3-VED (manual systems)



WARNING:To comply with safety regulations, easy access to the mains socket must be maintained.

All connectors must be engaged fully and secured with the screws.

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Cable connection M3-CNC (CNC systems)

KEY

Mains Power

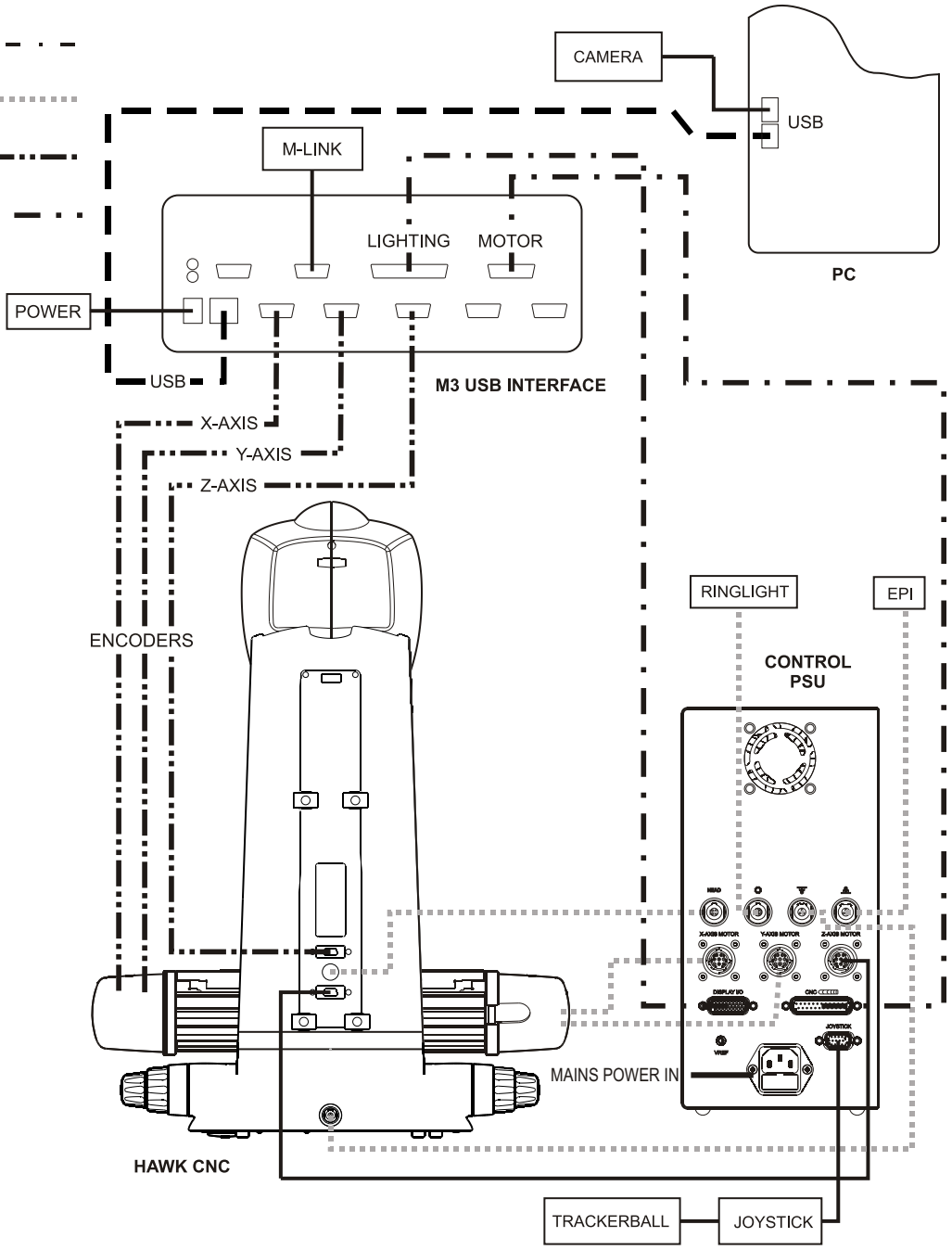
USB

Display

Lighting/Power

X, Y and Z

CNC



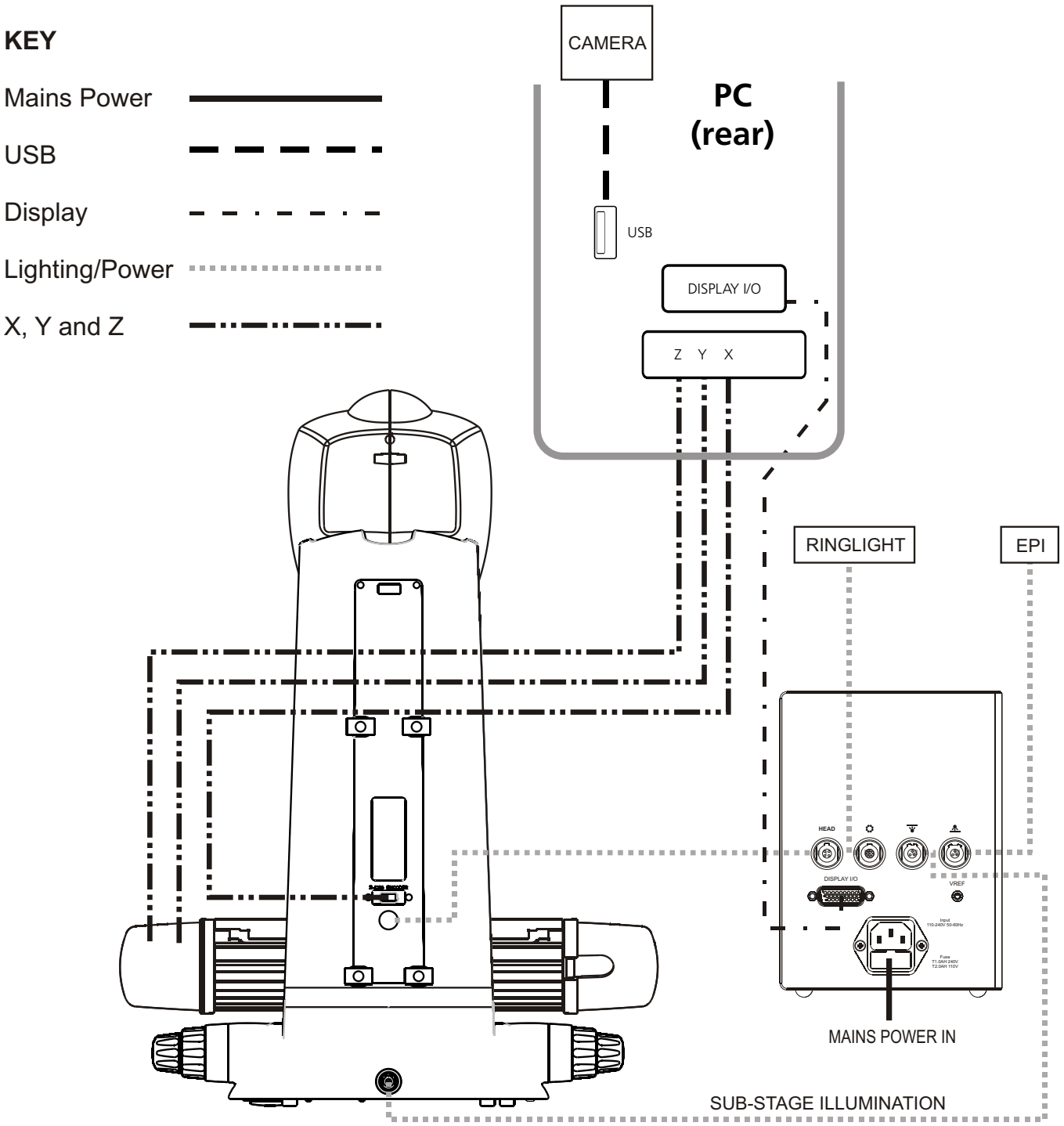
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Note: **Please ensure your Windows® operating system is kept up to date through Windows® Update.**

Cable connection QC-5000 (manual systems)



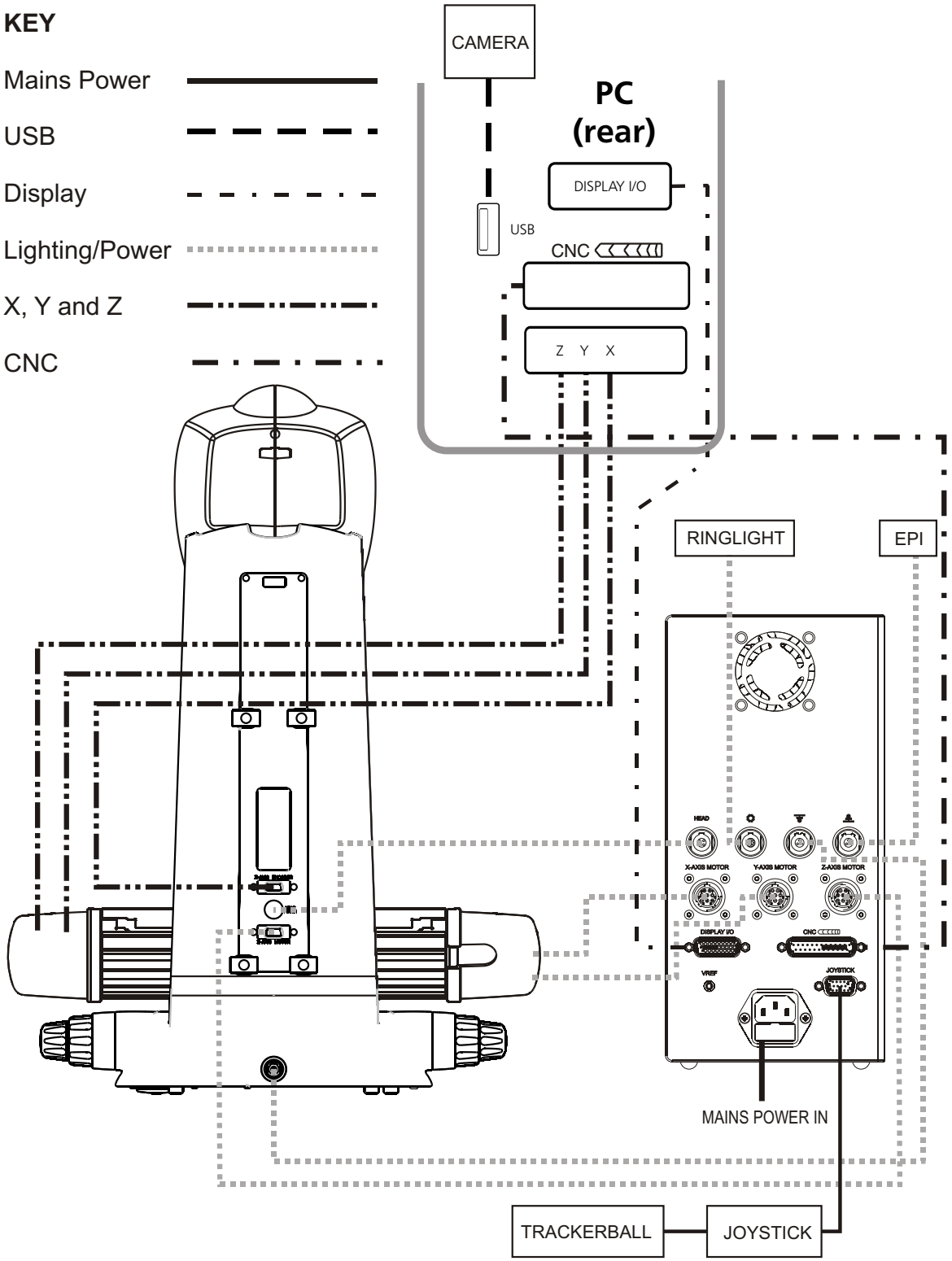
WARNING:To comply with safety regulations, easy access to the mains socket must be maintained.

All connectors must be engaged fully and secured with the screws.

Note: **In applications where the USB signal/power is weak (i.e. with long leads and some laptops) we recommend using a powered hub or repeater cable (available from your local PC retailer).**

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Cable connection QC-5000 (CNC systems)



WARNING:To comply with safety regulations, easy access to the mains socket must be maintained.

WARNING: ENSURE THE RELEVANT START UP AND SHUT DOWN PROCEDURES ARE ALWAYS FOLLOWED TO AVOID DAMAGE TO SYSTEM.

CNC start up procedure (PC / M3)

Before the PC/M3 or Hawk power supply unit is switched on:

- Plug in all the cable connections and accessories to the HAWK microscope system. (see appropriate connection diagrams – pages X, Y, Z).
- Turn on PC, or PC and M3 interface box.
- Turn on the HAWK PSU, **(NEVER disconnect cables while the unit is switched on)**.
- Start up the measurement software.
- The system is now ready for use.

CNC shutdown procedure (PC /M3)

When you are ready to shut down:

- Close down the measurement software.
- Turn off the HAWK PSU.
- Shut down the PC or PC and M3 interface box.
- The System is now off and the cables may be safely disconnected if required.

Manual lighting control PSU start up

Before anything is switched on:

- Plug in all the cable connections and accessories to the HAWK microscope system. (see appropriate connection diagrams – pages X, Y, Z).
- Turn on PC or PC and M3 interface box.
- Turn on the Manual lighting control PSU, **(NEVER disconnect cables while the unit is switched on)**.
- Start up measurement software (if applicable).
- System is now ready for use.

Manual lighting control PSU shutdown

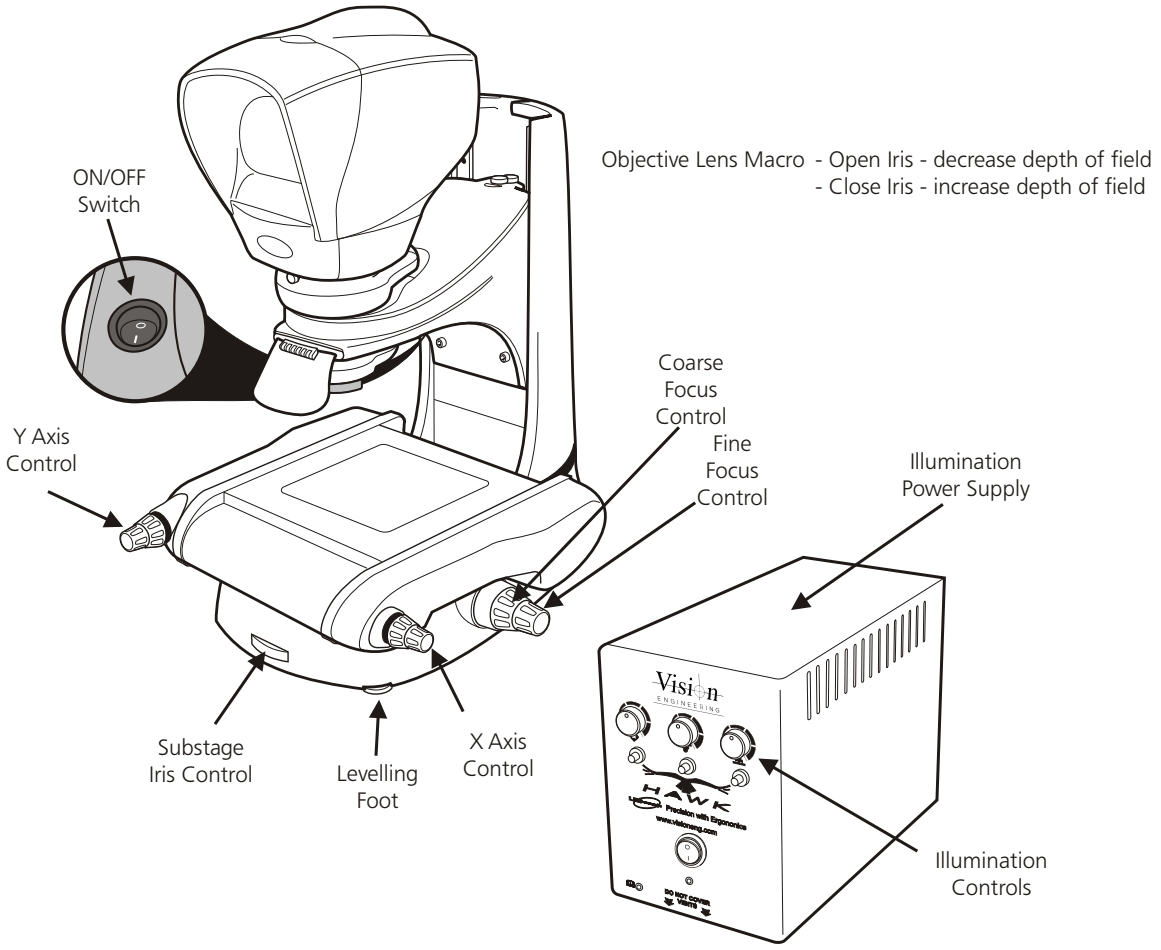
- Close down the measurement software (if applicable).
- Turn off the Hawk PSU.
- Shut down the PC or PC and M3 interface box (if applicable).

The System is now off and the cables may be safely disconnected if required.

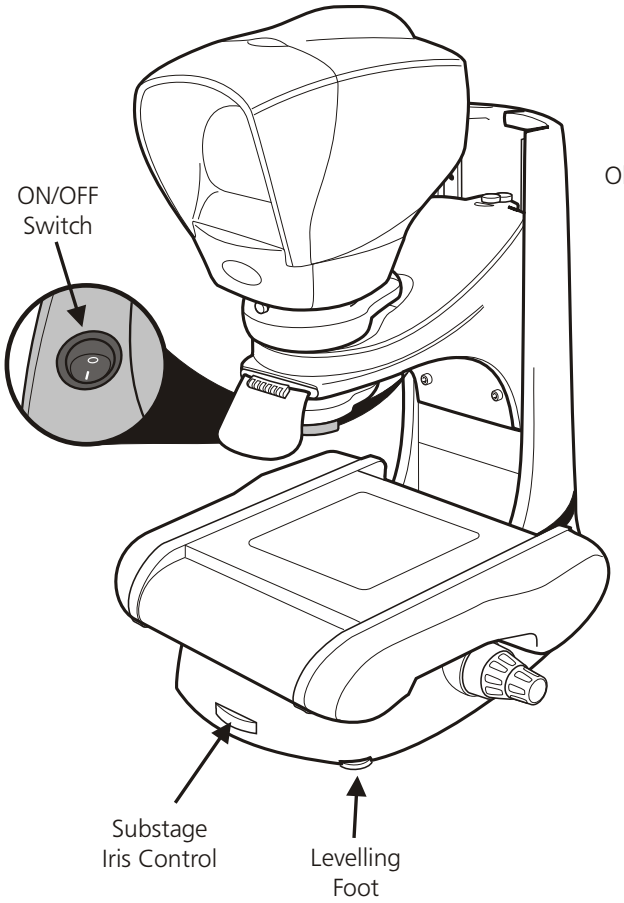
Manual system controls

Turn on the illuminator power supplies and check that the LED at the centre of the head is illuminated.

The manual system controls are identified below.



CNC system controls



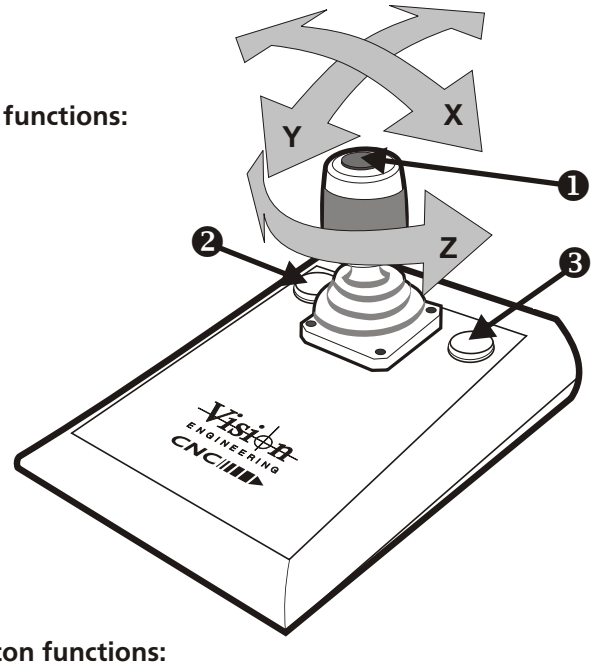
Objective Lens Macro - Open Iris - decrease depth of field
- Close Iris - increase depth of field

Default Joystick button functions:

❶ = Enter

❷ = Speed Toggle

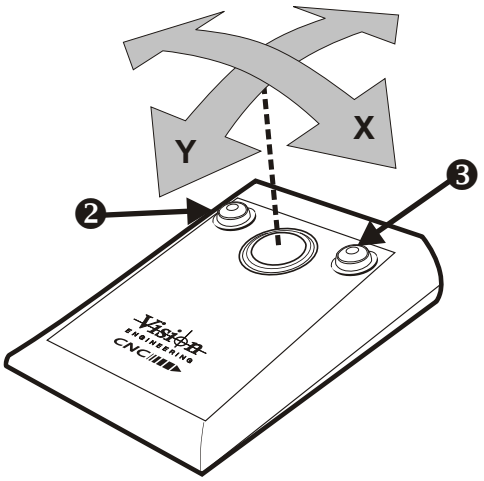
❸ = Finish



Default Trackerball button functions:

❷ = Speed Toggle

❸ = Finish



Align head to stage

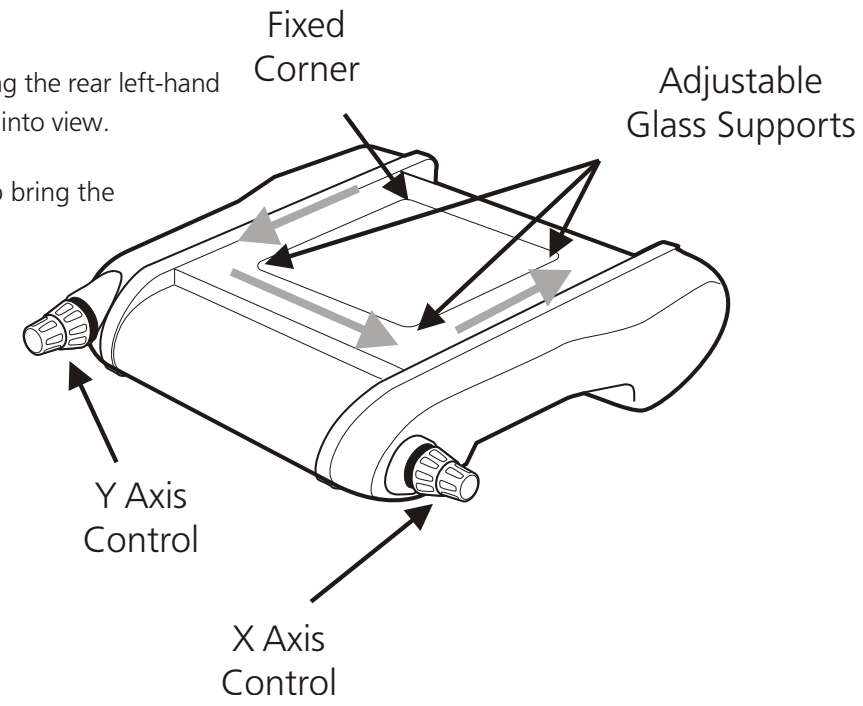
- Ensure that an objective lens is fitted.
- Ensure the head is switched on and then loosen it using an hexagonal/Allen key.
- Align the front edge of the gauge block (or straight edge) with the front edge of the stage glass.
- Rotate the head until the horizontal cross line is parallel with the rear edge of the gauge block (or straight edge).
- Lock the head in position with the hexagonal/Allen key.

Stand levelling

- Adjust the levelling foot until the stand is stable.

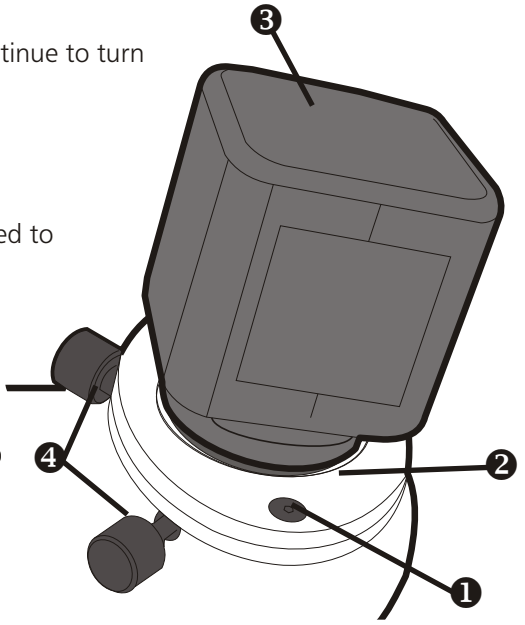
Stage glass levelling

- Adjust the X and Y axis controls to bring the rear left-hand corner of the stage glass (fixed corner) into view.
- Adjust the coarse/fine focus control to bring the glass surface into sharp focus.
- Adjust the X and Y axis controls to bring the front left-hand corner into view.
- Use the relevant adjustable glass support to bring the surface of the glass into sharp focus.
- Repeat the above procedure for the remaining two corners.



Camera Setup

- Loosen hexagonal headed screws ❶ on locking plate ❷ and continue to turn camera ❸ until it is in the correct position.
- Connect the camera to the PC and power supply as required.
- Bring the target/slip into focus within the head, as centrally aligned to crosshair as possible.
- Match the view on the monitor with that in the head - move the camera by using the thumbscrews ❹.
- Tighten the hexagonal headed screws on the locking plate to hol camera in position.



WARNING: ENSURE THE RELEVANT START UP AND SHUT DOWN PROCEDURES ARE ALWAYS FOLLOWED TO AVOID DAMAGE TO SYSTEM (SEE PAGE 15).

To achieve the optimum results from the Hawk Measuring System, the illumination and optics need to be adjusted to provide the best possible image to the operator. Certain lighting options are better for some applications than others.

Illumination and focus should be adjusted until the image is clear and bright, with good contrast. Maximum contrast gives the best image resolution and allows for the highest level of accuracy and repeatability.

Contact the nearest Vision Engineering branch/distributor for further advice.

Objective lens

Iris control

Each Macro objective lens has an adjustable iris which restricts the aperture of the lens. By rotating the control ring on the bottom of the objective lens, the iris opens and closes. Adjusting the objective lens aperture slightly increases or decreases the depth of field. This feature is useful for subjects where greater surface definition is required. The same results can be achieved with a Micro objective lens by adjusting the iris wheel in the Episcopic illuminator.

Closing the Substage Iris improves ability to locate an edge on a cylindrical component/raised profile.

Magnification tables

Macro Lenses					
Part No.	**Objective Lens**	**Total Magnification**	**Working Distance**	**Field of View (diameter)**	**Depth of Field**
H-007	x1	10x	84mm	14.2mm	270µm
H-008	x2	20x	81mm	7.1mm	67µm
H-009	x5	50x	61mm	2.8mm	10µm
H-010	x10	100x	35mm	1.4mm	6µm

Standard Working Distance Micro Lenses					
Part No.	**Objective Lens**	**Total Magnification**	**Working Distance**	**Field of View (diameter)**	**Depth of Field**
H-110	x5	50x	20.0mm	4.4mm	12.22µm
H-100	x10	100x	10.1mm	2.2mm	3.06µm
H-101	x20	200x	3.1mm	1.1mm	1.3µm
H-103	x50	500x	0.66mm	0.44mm	0.3µm

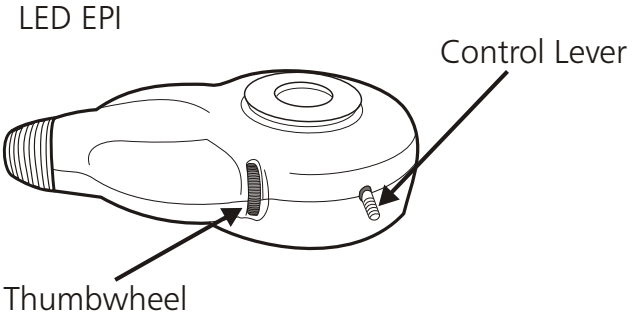
Long Working Distance Micro Lenses					
Part No.	**Objective Lens**	**Total Magnification**	**Working Distance**	**Field of View (diameter)**	**Depth of Field**
H-104	x10	100x	21.0mm	2.2mm	4.4µm
H-105	x20	200x	12.0mm	1.1mm	1.72µm
H-106	x50	500x	10.6mm	0.44mm	1.10µm
H-107	x100	1000x	3.4mm	0.22mm	0.43µm

Super Long Working Distance Micro Lenses					
Part No.	**Objective Lens**	**Total Magnification**	**Working Distance**	**Field of View (diameter)**	**Depth of Field**
H-108	x20	200x	21.0mm	1.1mm	2.24µm
H-109	x50	500x	15.0mm	0.44mm	1.36µm

Episcopic illuminator

The Episcopic illuminator provides through the lens illumination for measuring deep surface features, holes and blind bores. The light follows the optical path through the objective lens. The following adjustment can be made:

- Adjust the surface lighting to suit the component by using the thumbwheel and the beam split mirror.
- Adjust light intensity.
- Adjust the depth of field of the objective lens by rotating the iris control thumbwheel (a smaller iris increases the depth of field).
- To change the image contrast, fully engage the beam split mirror control lever.



Symbols and icons

Key to symbols and icons

The symbols and Icons below are shown where applicable:

 Ringlight

 Sub-stage

 Episcopic illumination

Display I/O Connection to PC or M3 interface box

 Refer to manual

HEAD Viewing Head power

VREF Video reference

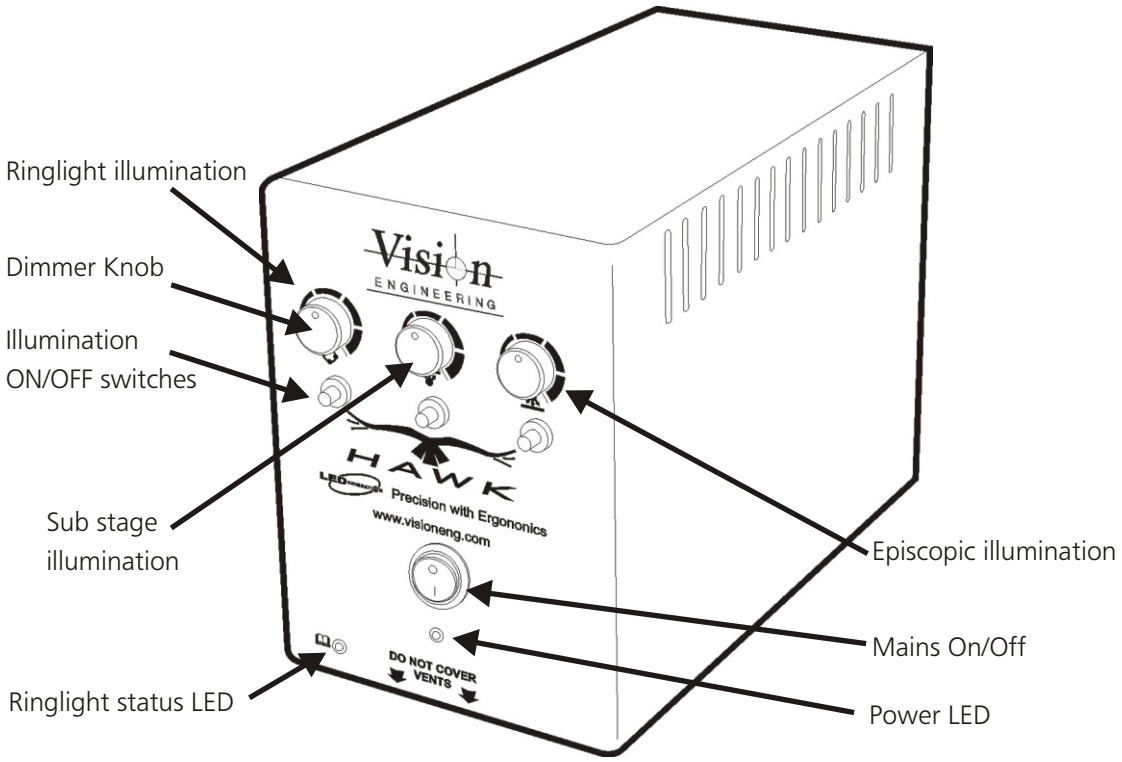
CNC Connection to PC or M3 interface box

JOYSTICK Connection to Joystick controller

X,Y, Z AXIS MOTOR Connection to the HAWK motor connections

Manual and lighting controls

Lighting is controlled by toggle switch and dimmer knob in Manual mode. Note that the manual lighting controls will not operate the lighting if the PC lighting control cable is connected to the 'Display I/O' port at the back of the unit.



Ringlight control

The LED Ringlight, which can be used with Sub-stage illumination, provides above stage illumination and is used for illuminating surface features, blind holes, etc.

- Switch the unit on and adjust intensity as required (QC or PC software).
- The LED illuminator is provided with a temperature protection system to ensure long term LED performance is not compromised by overheating.
- The Ring light status LED ❶ operates as follows:

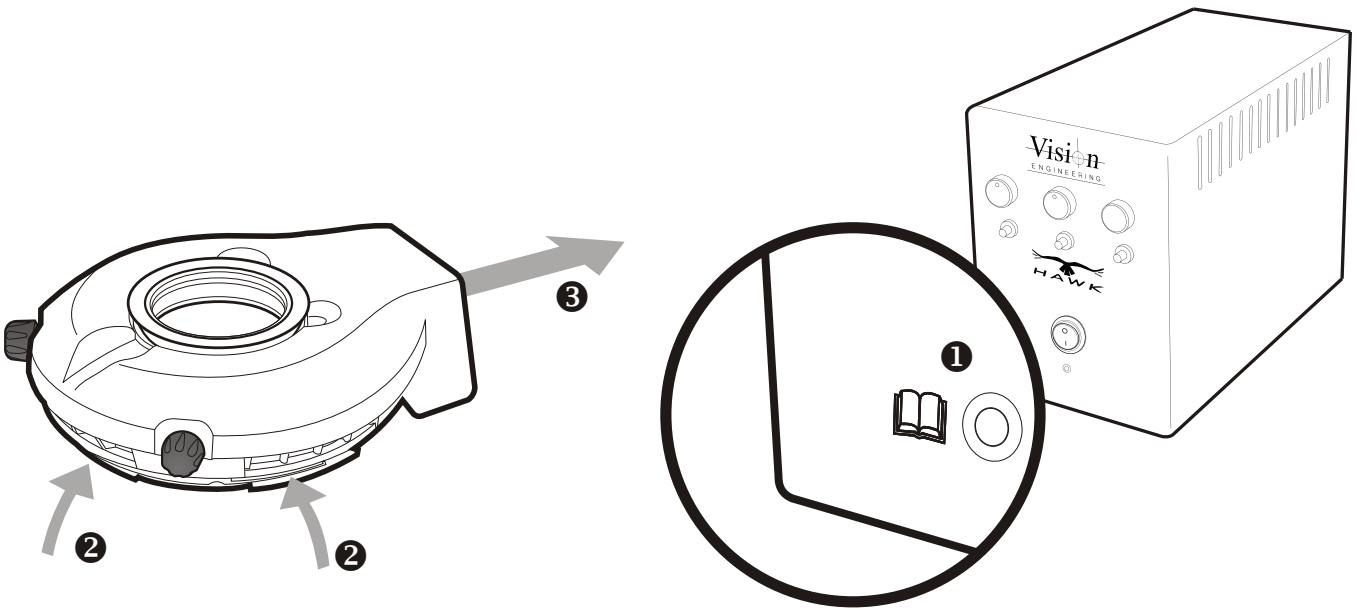
  Solid Green: The controller is fully operational

  Off: The LED Ringlight is not connected

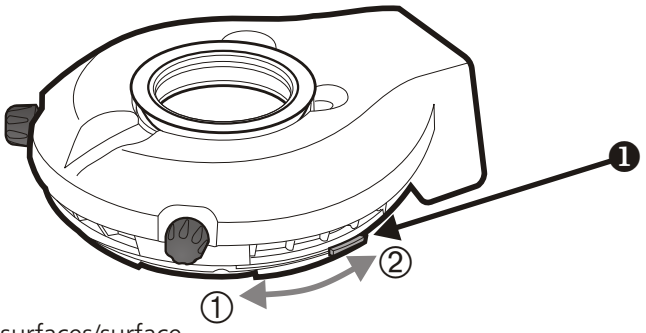
  Flashing Green/Amber: The unit is in thermal protection mode, the LEDs will gradually reduce until the temperature stabilises. Once stabilised the LED will return to green but the maximum brightness level will remain limited, protecting the Ringlight, until the unit is switched off. If the status persists, remove the illuminator and ensure neither the air inlets nor the fan outlet are obstructed. If operating the Ringlight under PC control changing the quadrant status will return the Ringlight to full brightness, ensuring sufficient light under all options.

  Solid Red: The unit is in thermal shutdown mode to protect the life of the LEDs. The LEDs have reached a critical temperature and the controller is unable to stabilise them. The unit will remain in shutdown until a safe temperature is reached, at this point it will return to normal operation (indicated by the status LED being green). If the problem persists allow the Ringlight to cool down, remove the illuminator and ensure neither the air inlets nor the fan outlet are obstructed. If the problem cannot be resolved please contact your nearest representative (see back page).

- In the above **Solid Red** condition, remove the illuminator and ensure neither the air inlet ❷ around the objective, nor the fan outlet ❸ are obstructed.



The Ringlight illuminator is used as follows:



- To illuminate optically difficult surfaces/surface features.
- For use with Macro objective lenses.
- The Ringlight gives a shadow free image.
- Can be used with Episcopic and Substage illumination.

▶ To adjust the light intensity rotate the dial control on the control box (see page 21).

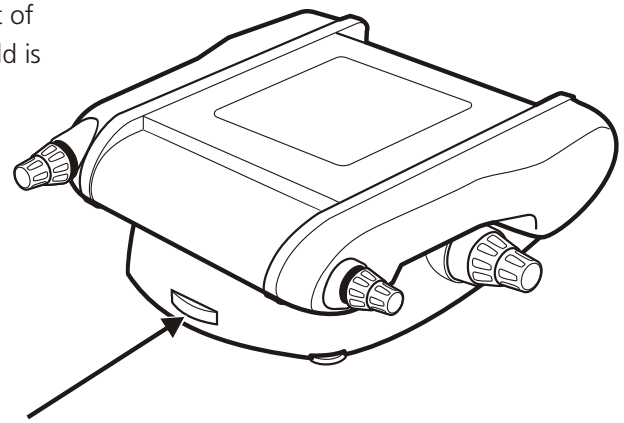
▶ To diffuse the light, move the diffuser control ❶ to position ① for diffused light or to position ② for no diffusion.

Substage

The Substage illumination is used for the accurate measurement of through holes, profiles and edge features etc. The depth of field is adjusted by rotating the thumbwheel on the Hawk base.

The illumination can be used with spotlight, ringlight and EPI illumination systems.

Adjust light intensity by rotating the dial control on the illumination power supply unit.



Best practice

To ensure the most accurate measurements are taken it is recommended that during the measurement process these following guidelines are followed:

- When selecting points on features the point should always be approached in the same fashion, e.g. always work toward a point on the X axis first, moving from left to right and then move towards a point in the Y axis, moving from top to bottom. This procedure will increase repeatability.
- If looking to measure the form of a feature, it is best to take at least eight points to achieve the most repeatable result.
- Ensure fans exhaust areas are not blocked or obstructed.
- Do not lean on or shake the upper arm of your Hawk product.

Note: Contact your local Vision Engineering representative for full details of available training programs.

Note: To achieve the very best from your Hawk non-contact measuring system, you should carry out regular routine maintenance as well as undertaking a schedule of service and calibration (see service and calibration record, at the end of this user guide).

WARNING

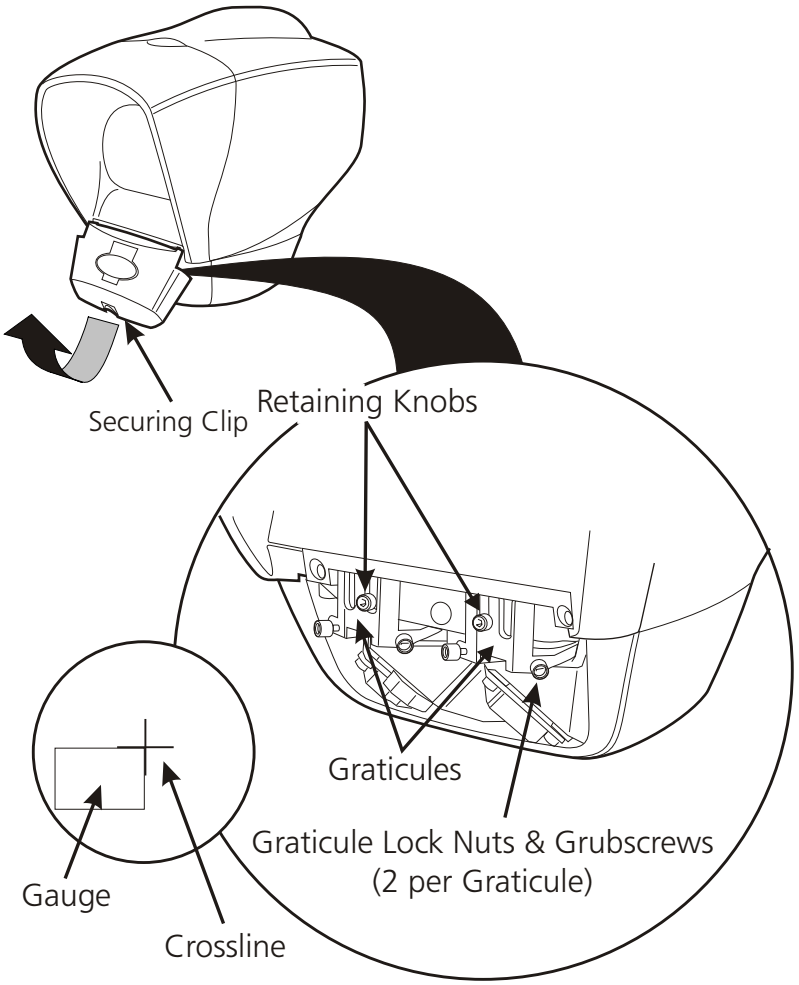
DISCONNECT THE MAINS POWER SUPPLY BEFORE PERFORMING ANY MAINTENANCE ROUTINE

Routine maintenance is important for the longstanding of the Hawk Measuring System. For more complex maintenance contact the local Vision Engineering representative.

Graticule adjustment

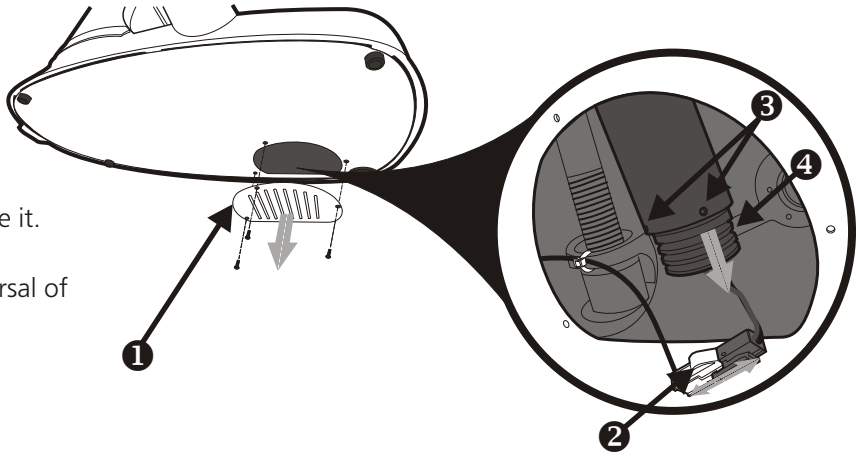
- Undo the securing clip at the base of the front cover and lift the cover off.
- To focus and centralize each graticule, loosen the appropriate retaining knob and move the graticule up or down to focus. Re-tighten the retaining knob.
- To adjust the graticules, place a known 90° gauge (slip gauge or crossline) on the stage and focus the image. Close one eye and locate the crossline on the corner of the gauge by unlocking and adjusting the grubscrews. Once the image is located, lock the grubscrews with the locking nuts.
- Repeat the procedure using the other eye. Make the adjustment so that the graticules overlay each other.

Note: If the image is uncomfortable to the eyes, repeat the above procedure.



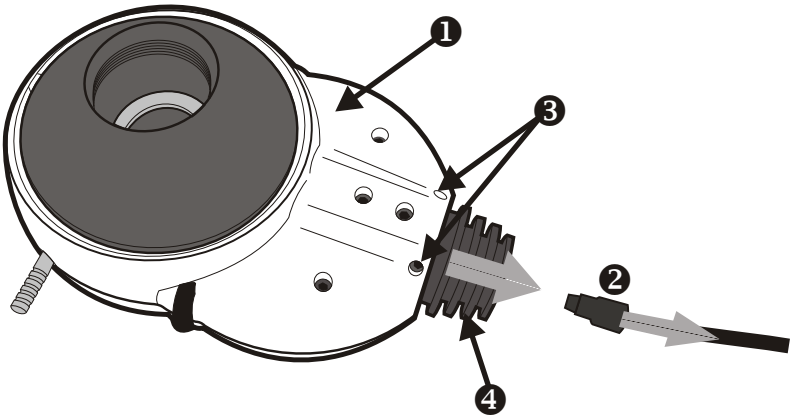
Substage LED replacement

- Take off the substage LED cover plate ❶ by removing its 3 securing screws.
- Pull out and separate the LED connector ❷.
- Loosen the 2 grub screws ❸ that secure the LED assemby ❹ and remove it.
- The replacement procedure is the reversal of the above.



Episcopic LED replacement

- Remove the episcopic assembly ❶ from the Hawk and carefully place it on a workbench as shown.
- Pull its power lead ❷ clear of the socket.
- Loosen the 2 securing screws ❸ and pull the LED assembly ❹ clear of the illuminator.
- The replacement procedure is the reversal of the above.



General care

- Cover the Hawk with a dust cover when not in use.
- Remove dust with a soft brush or cleaning cloth.
- The viewing screen and lenses should be cleaned with a lens cleaning cloth.
- Keep accessories in a dust-free environment when not in use.

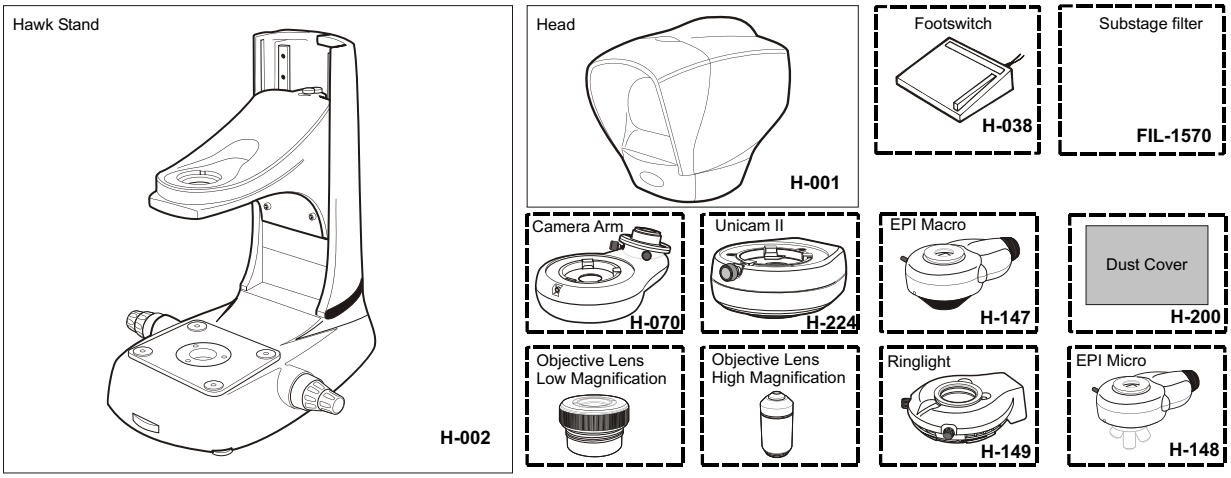
Consumable and replacement parts

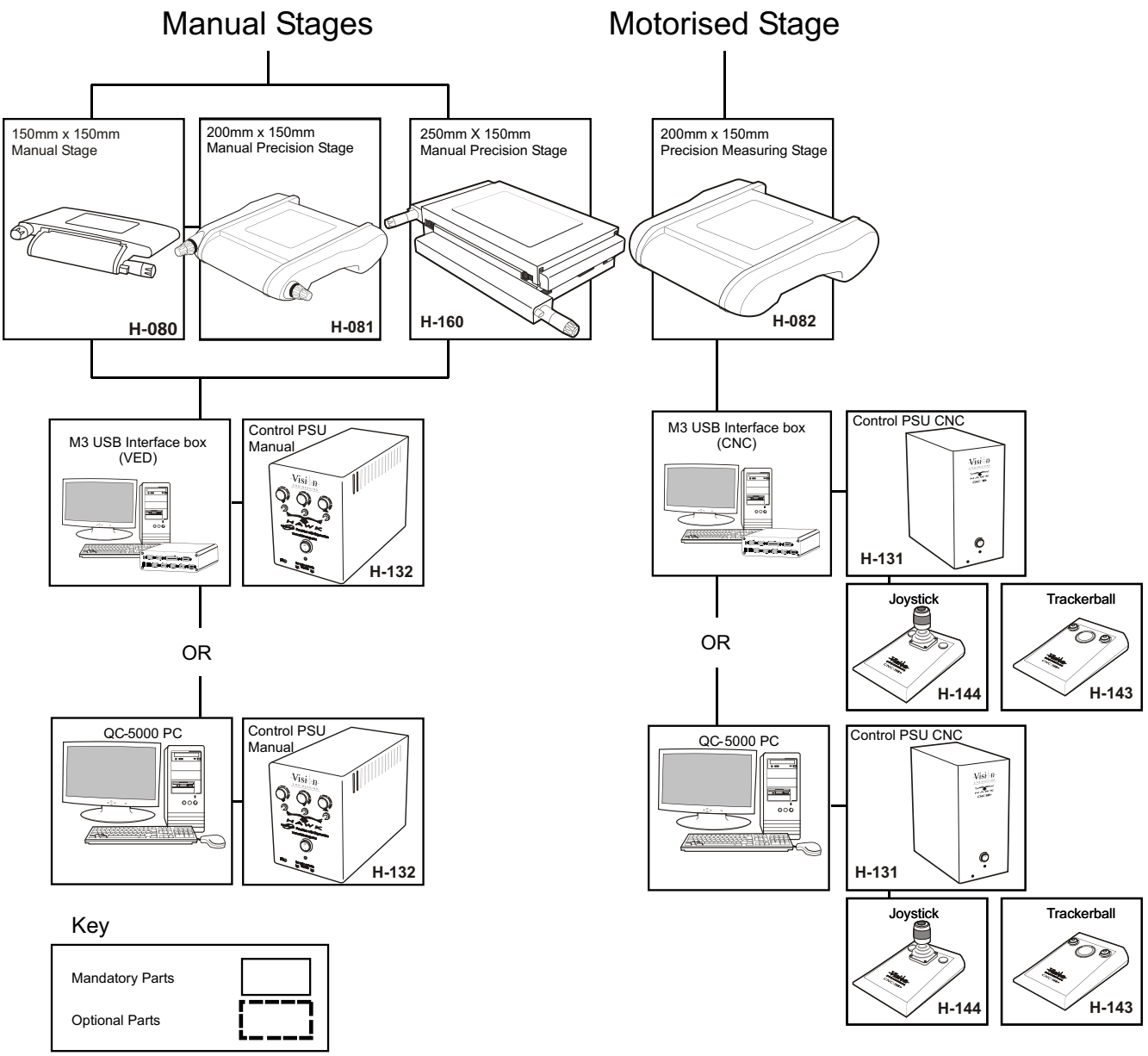
Item	Specification	Quantity in Pack	Part Number
Stage Glass	150x150mm	1	201-B0686
Stage Glass	200x150mm	1	184-B0227
Stage Glass	250x150mm	1	H-161
Anti-Glare shield	Hinged Anti-Glare shield	1	188-A1001/D
Substage Illuminator LED	LED and heat sink assembly	1	2011095
Episcopic Illuminator LED	LED and heat sink assembly	1	2011096
Control PSU CNC	T2.0AH 240V	1	FUS4662
Control PSU CNC	T4.0AH 110V	1	FUS4853
Control PSU Manual	T1.6AH 240V	1	FUS4752
Control PSU Manual	T3.15AH 110V	1	FUS4637
Ringlight LED array	8 point LED	1	FUS4662
Ringlight Fan assembly	Fan	1	2050307

Environmental conditions

Hawk is an accurate, industrial gauging instrument. To achieve the optimum accuracy and repeatability, the following considerations should be taken into account:

- Position the Hawk on a firm, rigid table.
- Do not position the instrument near any source of vibration.
- Ensure that the illuminator power supplies have sufficient ventilation.
- Do not position the instrument close to a radiator or similar heating system.
- Do not position the instrument in direct sunlight, or where bright reflections will prevent a comfortable viewing position.


Hawk Stand
H-002
Head
H-001
Footswitch
H-038
Substage filter
FIL-1570
Camera Arm
H-070
Unicam II
H-224
EPI Macro
H-147
Dust Cover
H-200
Objective Lens
Low Magnification
Objective Lens
High Magnification
Ringlight
H-149
EPI Micro
H-148


Manual Stages
Motorised Stage
150mm x 150mm
Manual Stage
H-080
200mm x 150mm
Manual Precision Stage
H-081
250mm X 150mm
Manual Precision Stage
H-160
200mm x 150mm
Precision Measuring Stage
H-082
M3 USB Interface box
(VED)
Control PSU
Manual
H-132
OR
QC-5000 PC
Control PSU
Manual
H-132
M3 USB Interface box
(CNC)
Control PSU CNC
H-131
Joystick
H-144
Trackerball
H-143
OR
QC-5000 PC
Control PSU CNC
H-131
Joystick
H-144
Trackerball
H-143
Key
Mandatory Parts
Optional Parts

SERVICE & CALIBRATION RECORD

Hawk serial number _____

Stage serial number _____

Service type	Comments	Date of service	Date of next service	Company	Signature