

## User Guide

# Falcon 3-axis Non Contact Measurement System

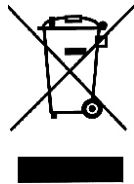


## Falcon 3-axis Non Contact Measurement System

Vision Engineering's Falcon is a compact 3-axis non-contact semi-automated measurement system, designed to give cost-effective accurate results.

The repeatable 5-position zoom optics provide the user with a high resolution clear image of intricate parts. Accurate repeatable results are achieved in X and Y, by the NLEC calibrated stage, and in Z by the unique camera iris control reducing the depth of field, therefore increasing the accuracy, repeatability and reproducibility of Z-axis measurement.

## Health & Safety



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

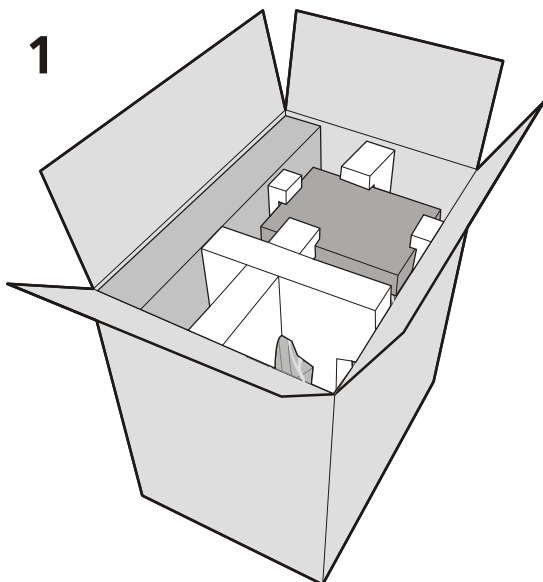
FCC Part 15

EN60950-1:2001

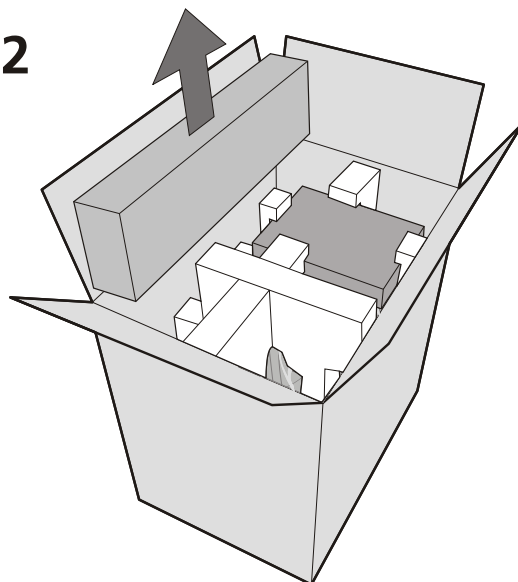
***WARNING: ALL EQUIPMENT PLUGGED INTO THIS UNIT MUST BE APPROVED TO EN60950-1:2001 AND CHECK CURRENT RATING OF OUTPUT SOCKET IF USED.***

# UNPACKING

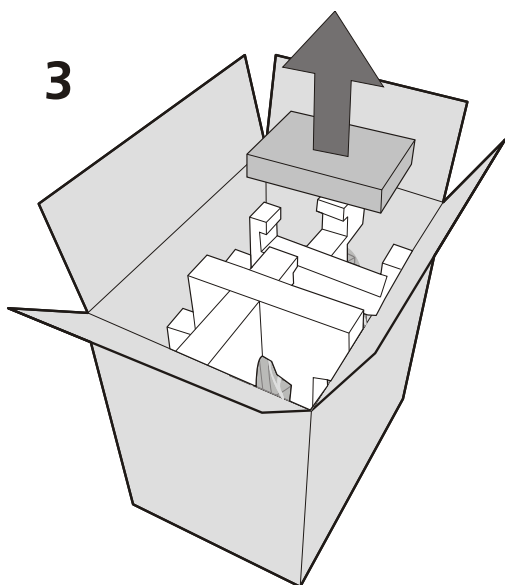
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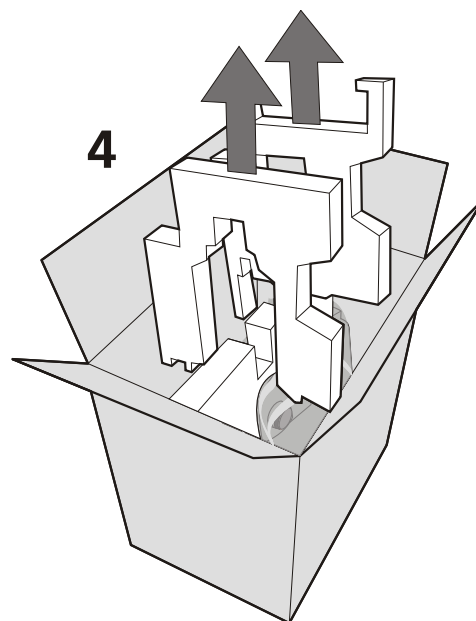
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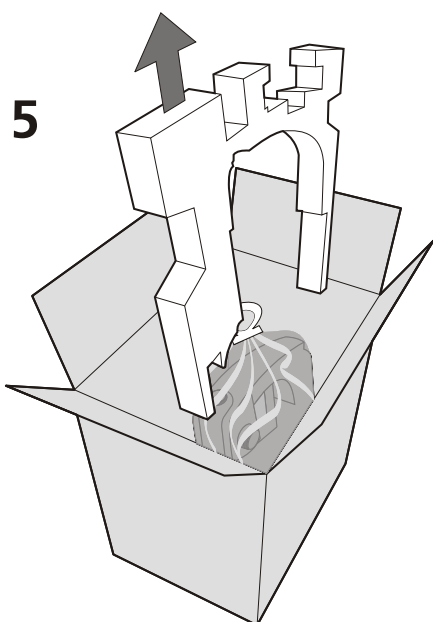
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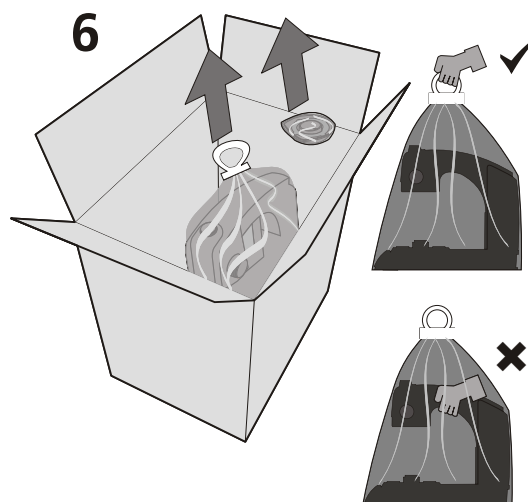
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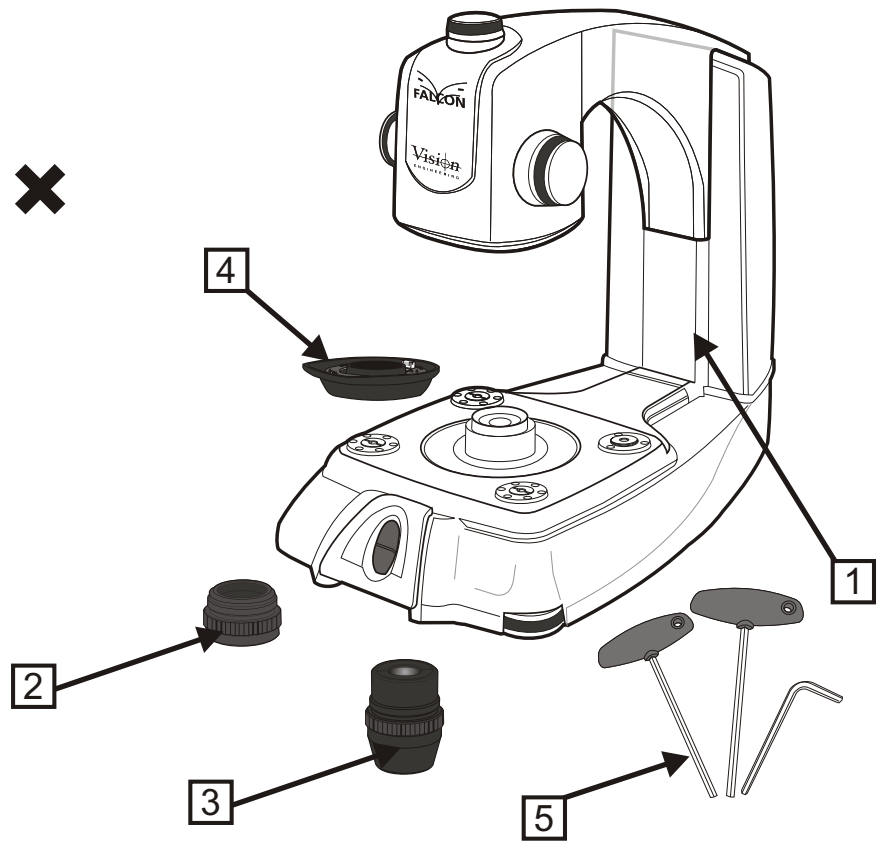
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## Stand & objectives

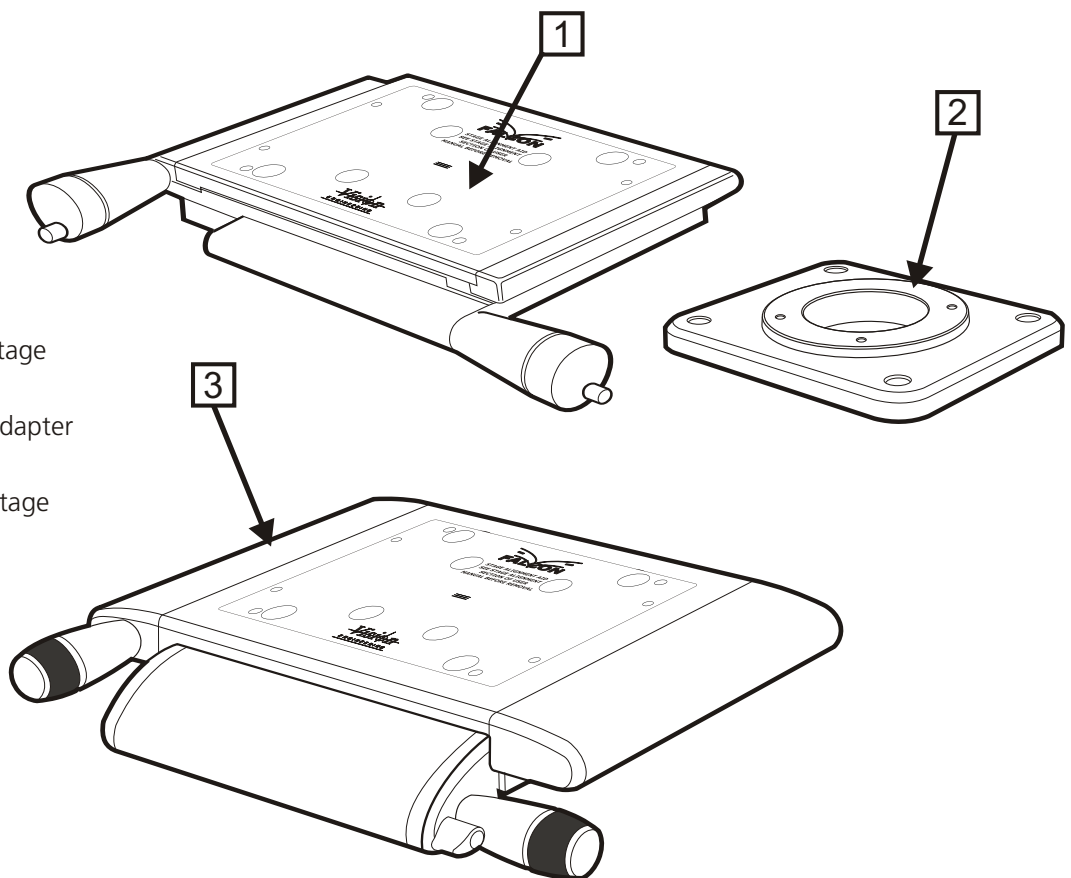


- 1 Stand
- 2 Low Magnification Objective lens
- 3 High Magnification Objective lens
- 4 LED ringlight
- 5 Toolkit



## Stage

- 1 150mm x 100mm stage
- 2 150mm x 100mm adapter
- 3 150mm x 150mm Stage

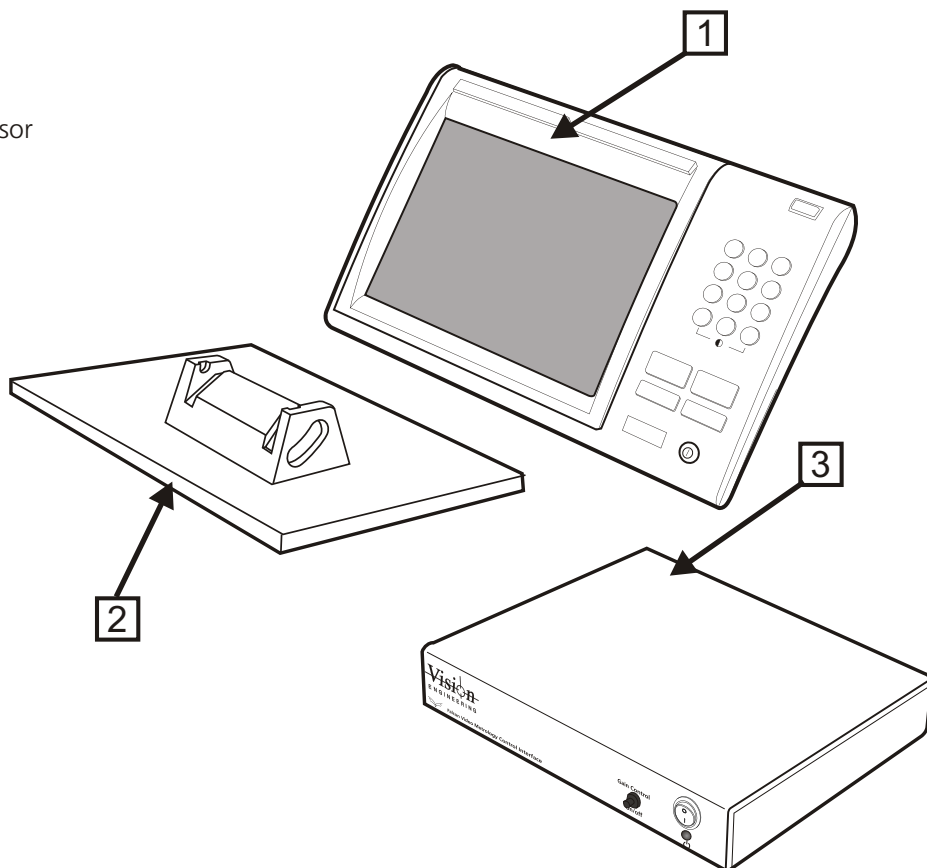


## Microprocessor

1 Quadra-check 300 microprocessor

2 Microprocessor stand

3 Control box





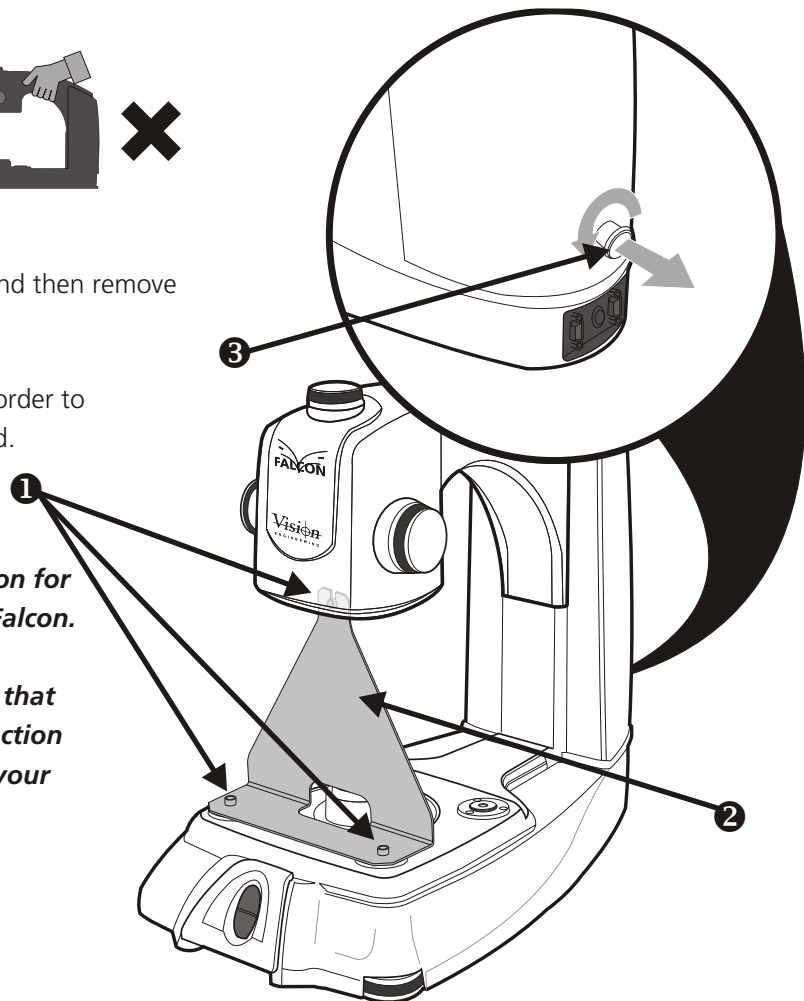
## Removing the transit protection



- ▶ Remove the 3 securing screws **1** and then remove the transit plate **2**.
- ▶ Unscrew the rear transit bolt **3** in order to remove it from the rear of the stand.

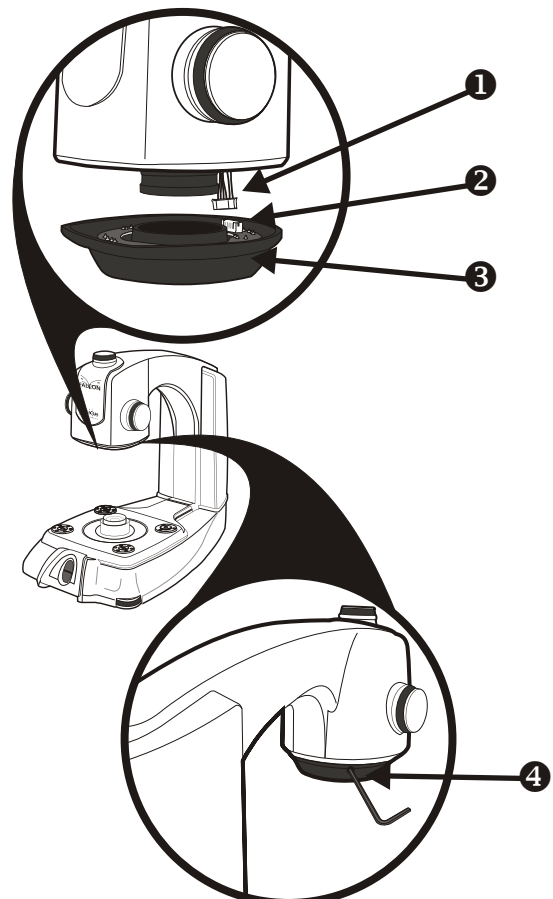
**Note:** *Keep the transit protection for future transport of your Falcon.*

*It is highly recommended that you refit the transit protection whenever you transport your system.*



## Attaching the LED array

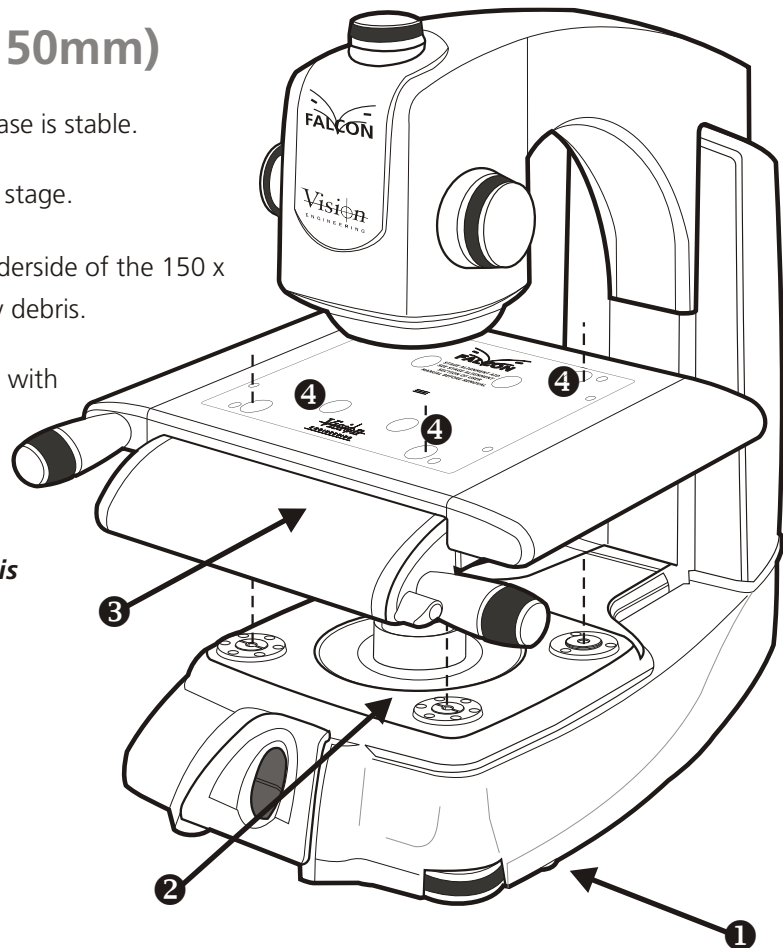
- ▶ Connect the flying lead socket **1** into the fixed plug **2** on the LED array **3**.
- ▶ Carefully position the array and secure it by tightening the single securing screw **4** using the Allen key supplied.



## Stage assembly (150 x 150mm)

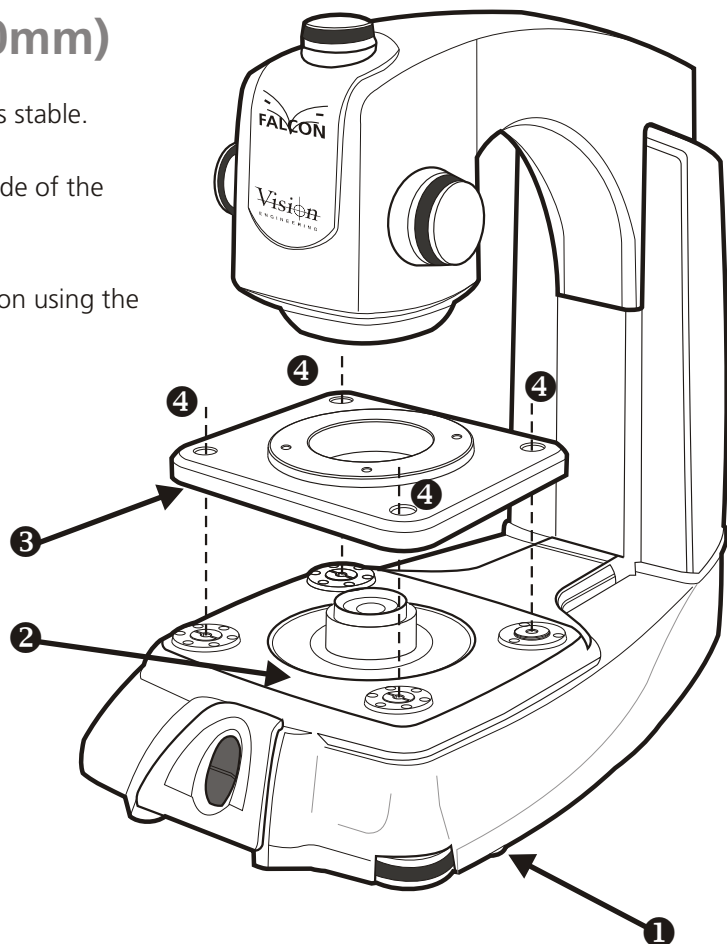
- ▶ Use the stabilising foot ❶ to ensure the base is stable.
- ▶ Remove all red transit protection from the stage.
- ▶ Check the stand base plate ❷ and the underside of the 150 x 150mm stage ❸ are clean and free of any debris.
- ▶ Position the stage and secure it in position with the bolts ❹ and Allen key supplied but **DO NOT** tighten them at this time.

**Note:** *Do not insert the fourth mounting bolt until the system is set up and the stage has been aligned (see page 7).*

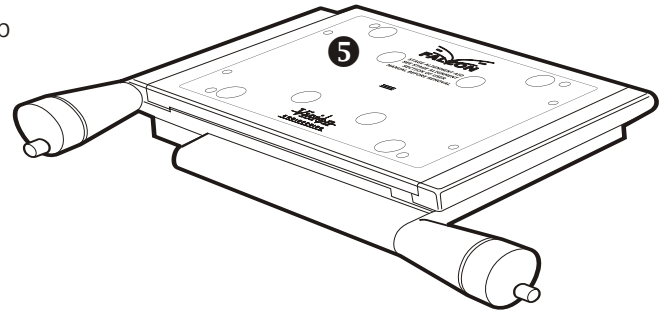


## Stage assembly (150 x 100mm)

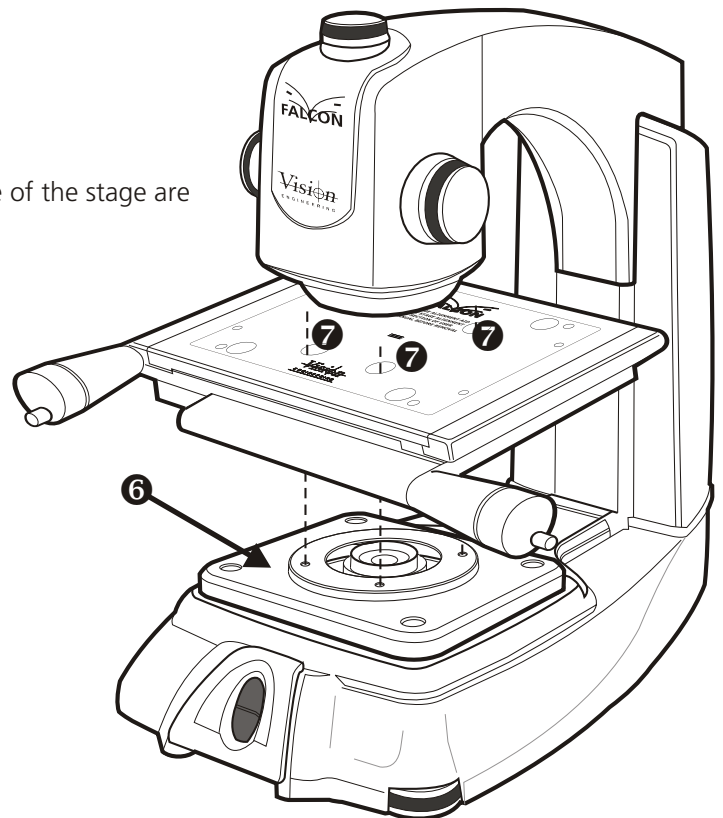
- ▶ Use the stabilising foot ❶ to ensure the base is stable.
- ▶ Check the stand base plate ❷ and the underside of the adapter ❸ are clean and free of any debris.
- ▶ Locate the adapter plate and secure it in position using the bolts ❹ provided.



- ▶ Remove all red transit protection from the stage.
- ▶ Check the adjustable pad ⑤ on the stage is retracted up into the stage bottom plate. The adjustable pad is controlled by the screw in the rear left hole in the aperture under the stage glass.

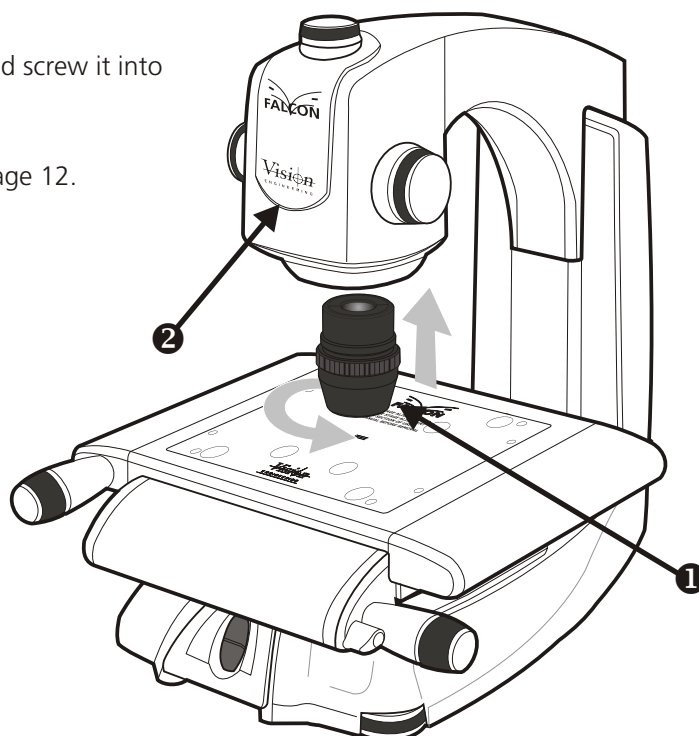


- ▶ Check the top of the adapter ⑥ and the underside of the stage are clean and free of any debris.
- ▶ Place the stage on the adapter and align the three bolt holes ⑦. Screw in the Allen bolts (using the Allen key provided) but **DO NOT** tighten them at this time.



## Objective lens attachment

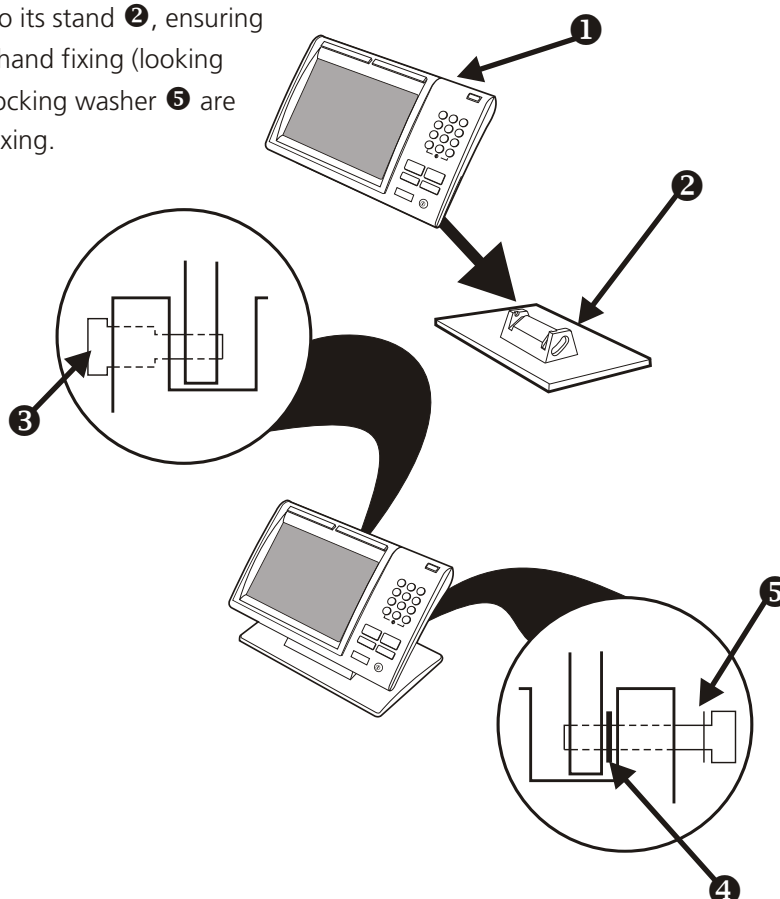
- Place the objective lens ❶ up into the head ❷ and screw it into position.
- For further information, see **Objective lens** on page 12.



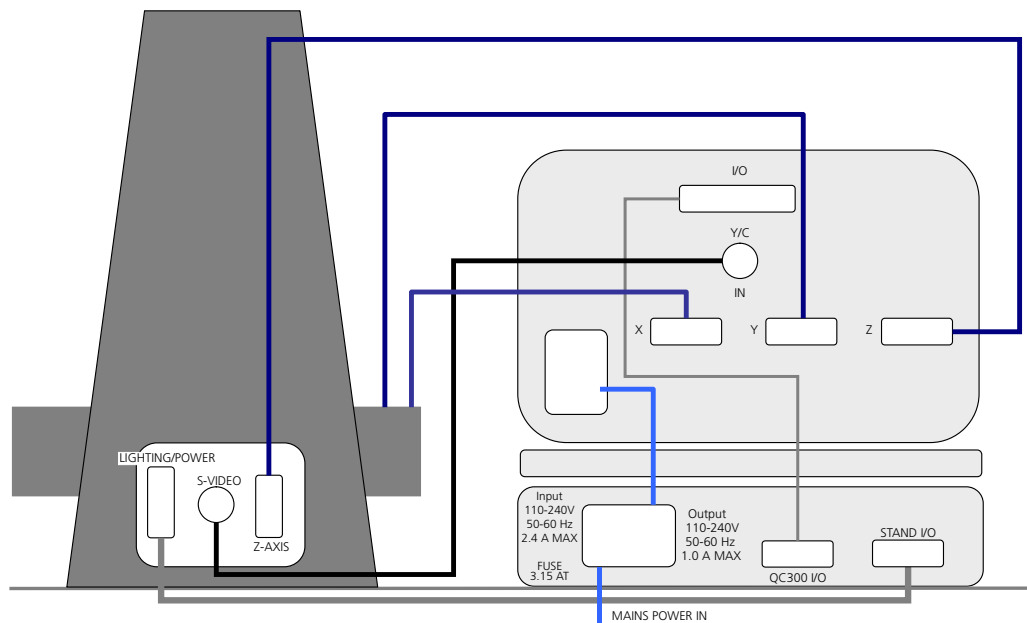
## Microprocessor assembly

- Locate the microprocessor body ❶ on to its stand ❷, ensuring the shoulder bolt ❸ is used on the left-hand fixing (looking from the front) and the spacer ❹ and locking washer ❺ are correctly positioned on the right-hand fixing.

**Note:** *Do NOT overtighten either fixing bolt.*



## Cable connection

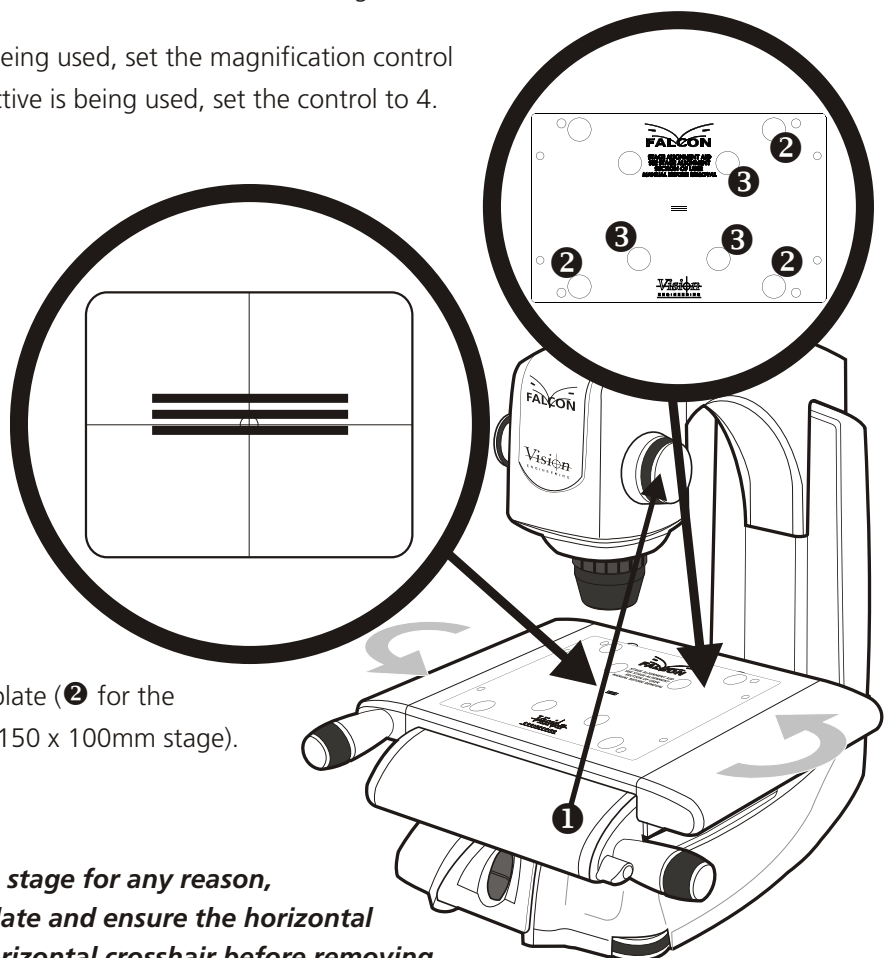


**WARNING:** To comply with safety regulations, easy access to the mains socket must be maintained.

## Stage alignment

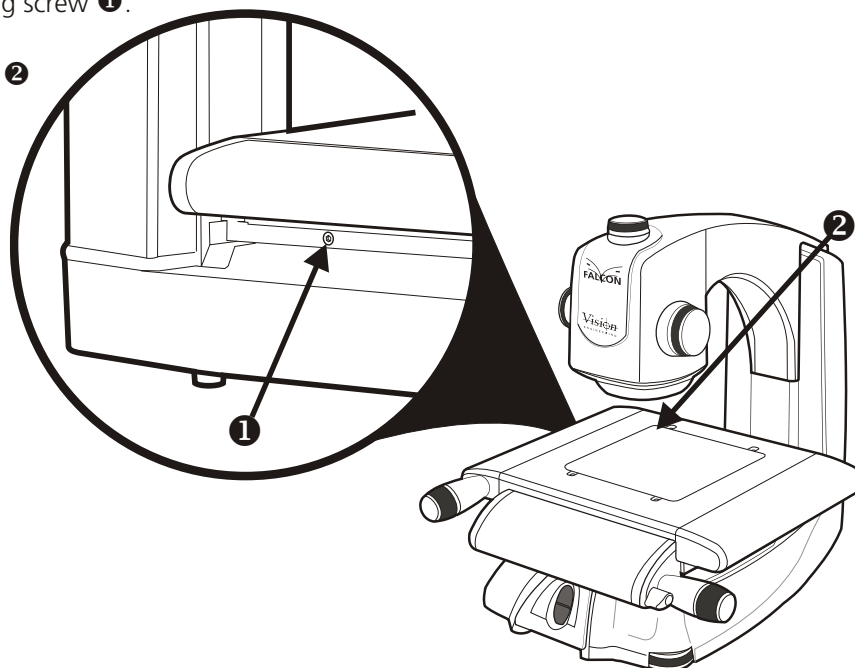
- ▶ Switch on Falcon.
- ▶ Switch on the QC-300 and follow on screen instructions for crossing reference marks.
- ▶ If a high magnification objective is being used, set the magnification control ❶ to 2. If a low magnification objective is being used, set the control to 4.
- ▶ Focus on the three horizontal lines in the centre of the alignment plate attached to the stage.
- ▶ Rotate the stage by hand until the horizontal lines are parallel to the horizontal crosshair on the QC-300.
- ▶ Use the X axis control to check reference lines remain parallel with the crosshair.
- ▶ Use the Allen key supplied to tighten the stage bolts through the appropriate holes in the alignment plate (❷ for the 150 x 150mm stage and ❸ for the 150 x 100mm stage).
- ▶ Remove the alignment plate.

**Note:** *If you need to remove the stage for any reason, re-attach the alignment plate and ensure the horizontal lines are parallel to the horizontal crosshair before removing the stage.*



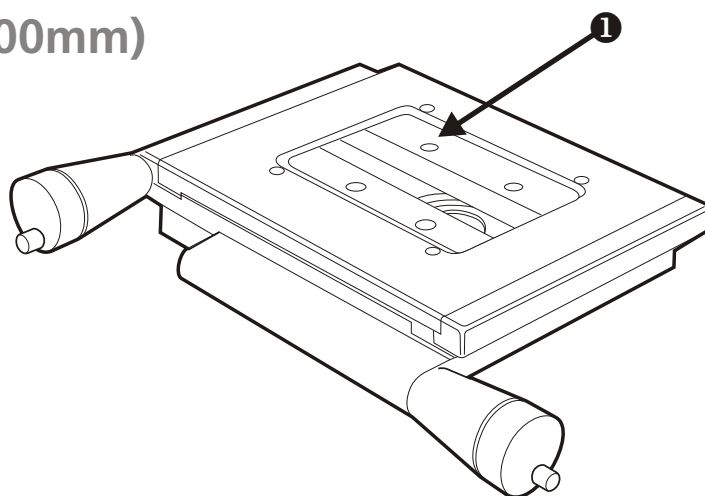
## Securing the stage (150 x 150mm)

- ▶ Loosen the floating stage foot securing screw ❶.
- ▶ Insert and screw in the last stage bolt ❷ and tighten fully.
- ▶ Tighten the floating stage foot securing screw.



## Securing the stage (150 x 100mm)

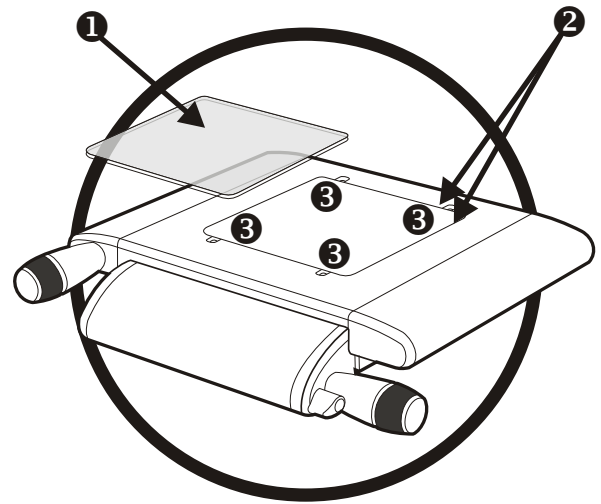
- ▶ Set the adjustable pad ❶ using a flat headed screwdriver. Adjust the screw until it just touches down - DO NOT USE FORCE! If this screw is over tightened, the base plate will distort.



## Fitting the stage glass

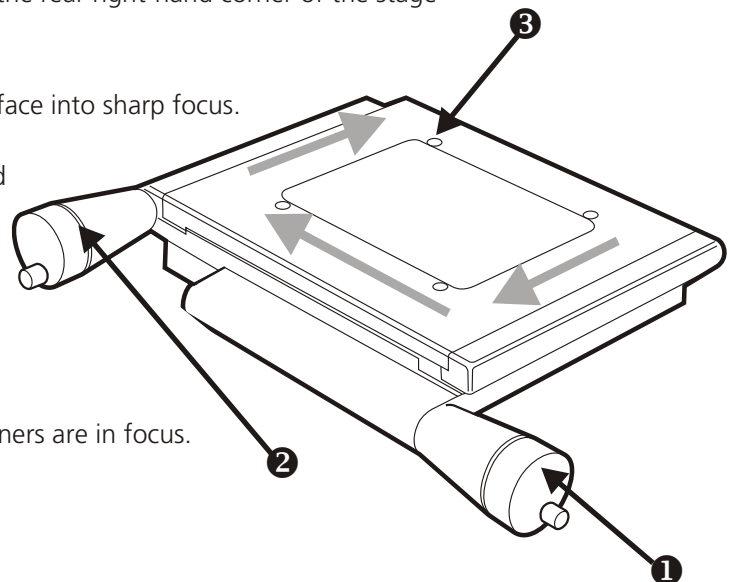
- Fit the stage glass ❶ into its recess, taking care to locate its rear right-hand corner against the location springs ❷ and on to the supports ❸.

**Note:** *The above procedure should be used for both types of stage.*

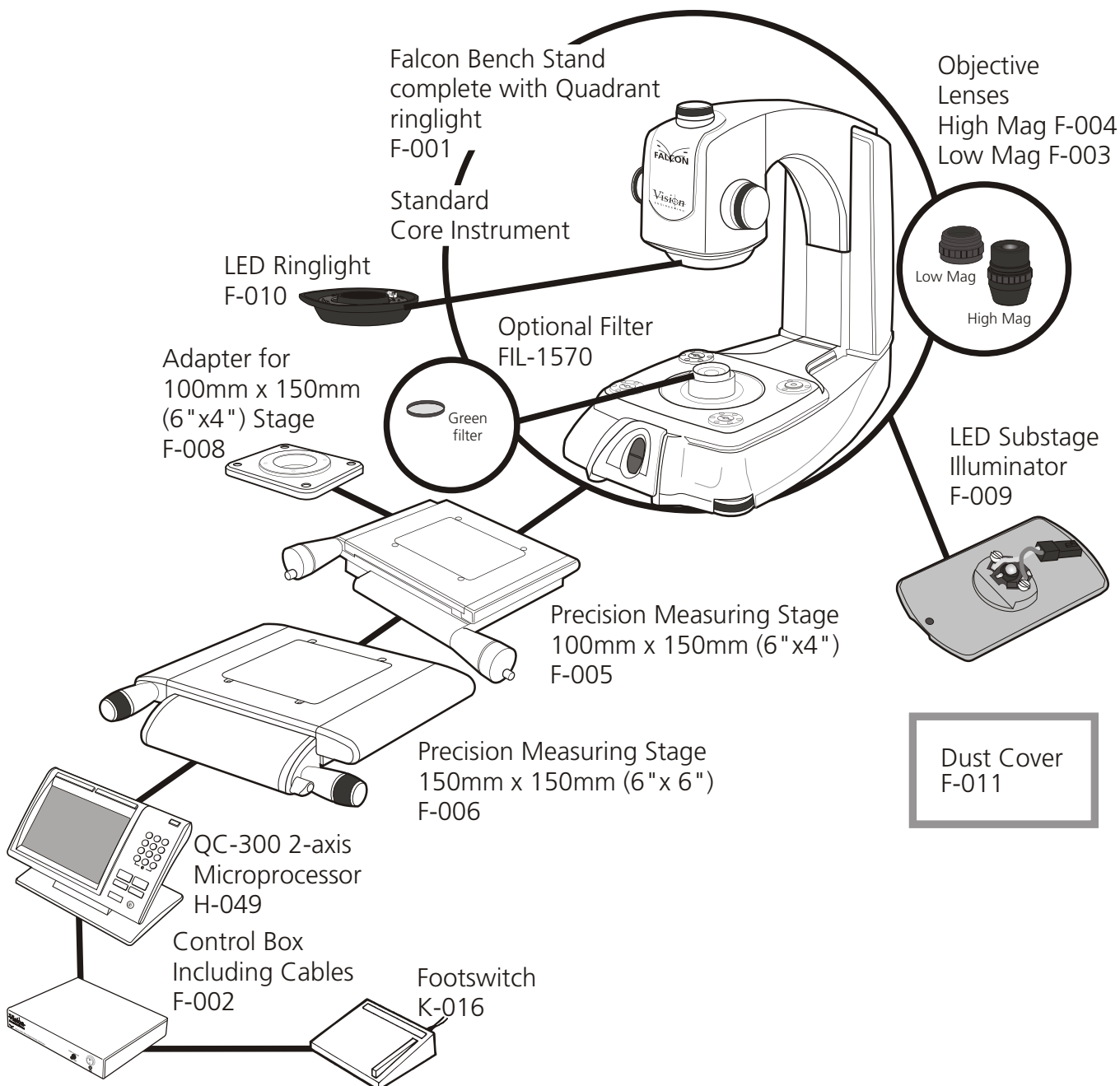


## Stage glass levelling

- Use the X axis ❶ and Y axis ❷ controls to bring the rear right-hand corner of the stage glass (fixed corner) ❸ into view.
- Use the stage focus control to bring the glass surface into sharp focus.
- Use the axis controls to bring the front right-hand corner into view. Use the relevant adjustable glass support to bring the surface of the glass into sharp focus.
- Repeat for the remaining 2 corners.
- Repeat the above steps if necessary until all 4 corners are in focus.



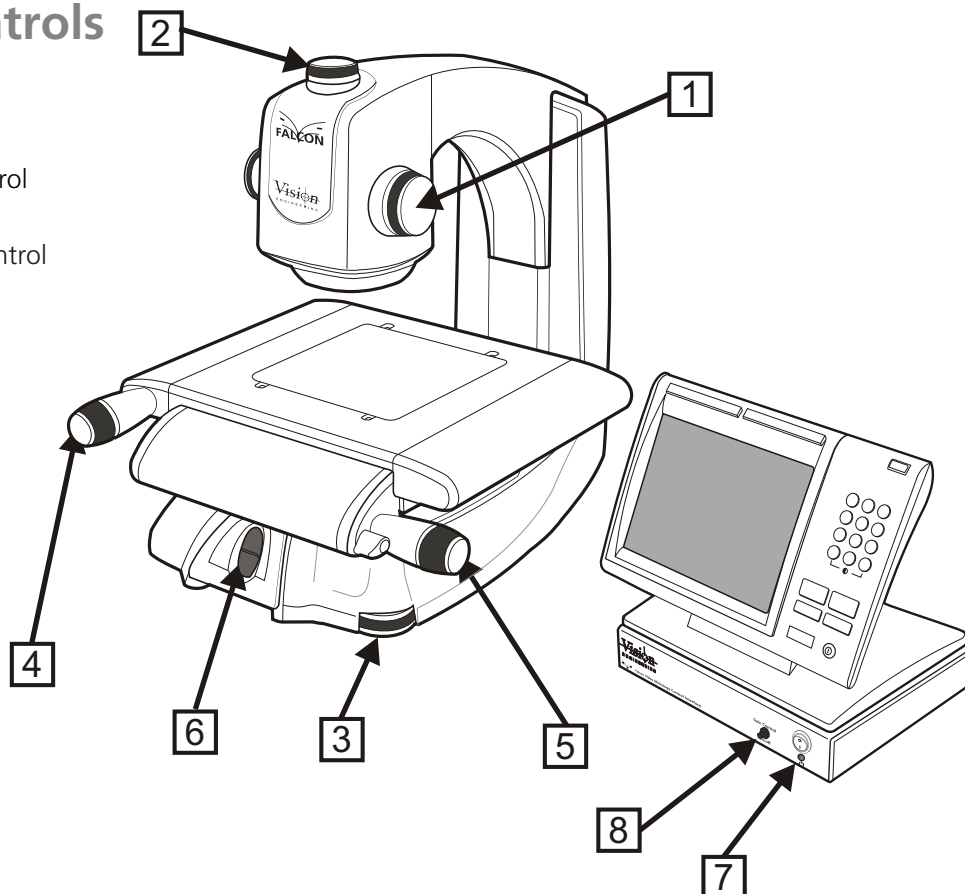
## Falcon family tree





## Main system controls

- 1** Zoom Control
- 2** Surface Illumination Iris Control
- 3** Substage Illumination Iris Control
- 4** Y Axis Control
- 5** X Axis Control
- 6** Fine Z Axis Rocker Control
- 7** On/off switch
- 8** Camera gain control



## Start up

- ▶ Switch on the Falcon, the ringlight power supply and the QC-300.
- ▶ After the start up screen has displayed on the QC-300, follow the on-screen instructions and pass the reference marks in all three axis.
- ▶ Select the Light tab on the screen and adjust the illumination by selecting the icon and adjusting the intensity via the slidebar.
- ▶ Move the zoom to the desired position and focus on the subject by moving the head up or down using the switch at the front of the stand.

To achieve optimum results from your Falcon measuring system, illumination and optics need to be optimised to provide the best possible image. Certain lighting configurations are better for some applications than others.

Substage illumination should be used for profile measurement (optional colour filter available) whilst surface illumination is for subjects with surface features.

Illumination and focus should be adjusted until the image is clear and bright, with good contrast. Maximum contrast improves accuracy and repeatability.

Contact your nearest Vision Engineering branch or Distributor if you require further information.

## Iris controls

The camera and substage are fitted with a 5 position (1-4 and Z) adjustable iris (1 = small, 5 or Z = large), allowing the user to change the aperture of the lens. Changing the position of the controls results in the iris opening and closing. This changes the amount of light passing back through the lens, slightly increasing or decreasing the depth of field, ideal for subjects where greater surface definition is required. Position Z is used for height measurement. The Iris on the substage is used to give sharper edge definition on profiles of 3 dimensional subjects.

## Objective lens

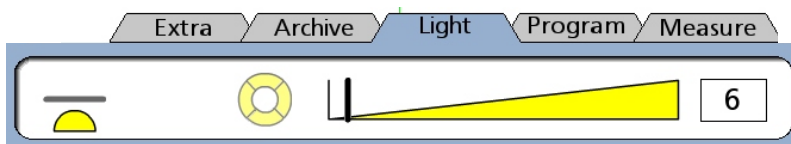
### Magnification table

Part No.	Description	Zoom Ratio	Total System Magnification	Working Distance	Field of View
F-003	Low Magnification Objective	1 - 5x	10x - 50x	91mm	2.7 - 13.5mm
F-004	High Magnification Objective	1 - 5x	20x - 100x	61mm	1.35 - 6.75mm

## Illumination options

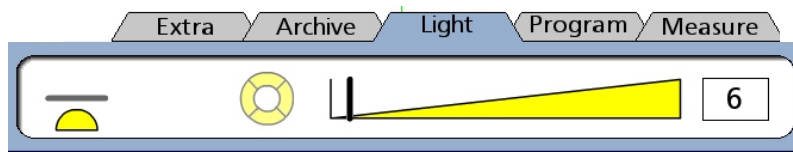
### Substage

- Substage illumination used for the accurate measurement of through holes, profiles and edge features.
- Adjust the intensity firstly by selecting the Substage icon from the Light toolbar, then by moving the marker up or down the slidebar.
- Can be used in conjunction with the surface illumination.



## Ringlight (surface)

- Surface illumination is used for surface features and blind holes etc.
- Adjust the intensity firstly by selecting the Ringlight icon from the Light toolbar, then by moving the marker up or down the sidebar.

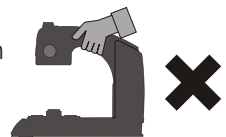


- For difficult to see edges, each quadrant can be switched on (yellow) and off (blank) as required, by selecting the required quadrant ( just touch the screen on the segment required).
- Switching quadrants off can create a shadow, used to increase the contrast of low contrast edges.
- Can be used in conjunction with the surface illumination.

## Best practice

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

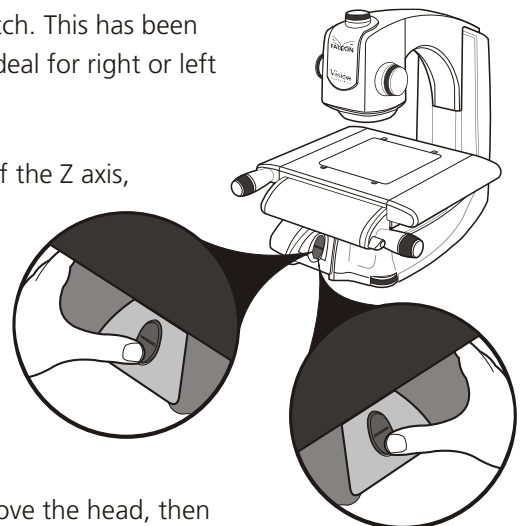
- Do not adjust Magnification.
- Do not adjust camera or substage iris once image has been optimized.
- Do not lean on or shake upper arm of your Falcon product.
- When measuring subjects in the Z axis it is recommended that the approach direction to achieve clear focus is the same for both references.
- When viewing subject to locate measurement feature it is recommended that the Falcon is focussed at max magnification then select lower mag if required.



The Falcon Z axis is controlled by a highly sensitive variable speed switch. This has been incorporated into the instrument in an intuitive ergonomic position, ideal for right or left handed use (see opposite).

Light pressure on the switch will result in extremely fine adjustment of the Z axis, enabling accurate repeatable focussing. As pressure on the switch is increased the focussing adjustment speed will also increase.

Select the correct magnification for the component being measured, based on size of component and field of view (see magnification table on page 12). Ensure that the lens has been calibrated and selected on the QC-300 (see QC-300 user guide for details).



Focus on the subject, using the control at the front of the stand to move the head, then move the zoom control to the desired position.

To achieve the very best from your Falcon 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).

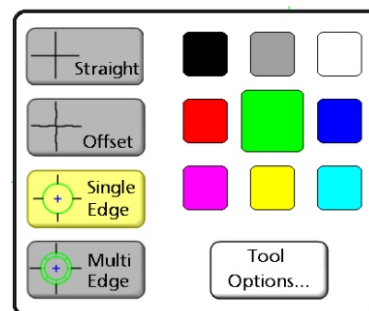
## Camera gain control

Your Falcon System is fitted with camera auto gain control. This can be deactivated by using switch on front of control box. This feature is useful when viewing low contrast parts with high levels of illumination or when taking profile measurements with sub-stage illumination.

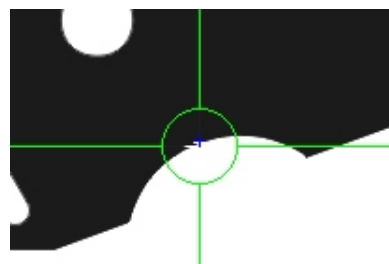
## Taking basic measurements

Measurements can be made using any one of the four capture tools. Touch the screen to display the options.

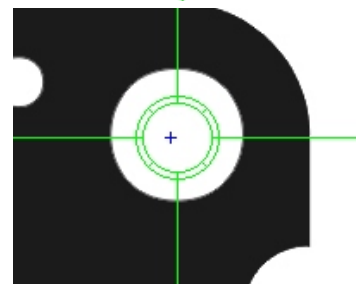
- Straight and Offset crosslines used for manually taking points (not used by Falcon).
- Single Edge tool for capturing single points on a feature.
- Multi Edge tool for capturing multiple points on a feature, either inside or outside the field of view.



Points are captured by aligning the tool over the edge of the feature being measured and pressing enter to register the point. Points can be automatically captured, by leaving the tool stationary over the feature for a preset time (seconds).



The multiedge tool is used to capture multiple points either inside or outside the field of view. For inside the field of view position the tool in the centre of the feature being measured, press enter to fire the points.



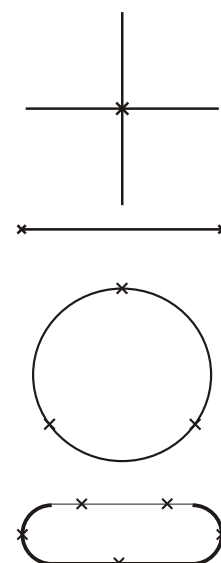
For features outside the field of view, take three points (circle) or 2 points (line) and follow the green arrow to capture the remaining number of points (the number of points can be increased/decreased if required).



## Measuring features

The following geometric features can be measured:

- Point - measured by capturing a single point.
- Line - measured by capturing a minimum of two points.
- Circle - measured by capturing a minimum of three points.
- Slot - measured by capturing five points.



If you wish to measure the form of a feature, it is best to take at least 8 points to achieve a better result.

## Measurement Microprocessor Settings and Advanced Features

Your falcon system has been configured and set up to work with the measurement microprocessor supplied.

Standard factory settings include calibrated magnifications for easy selection and measurement consistency using the Zoom index system.

For information on how to set up and edit the standard features on the microprocessor please refer to the microprocessor user manual.

The user manual also contains information relating to archiving images, writing measurement routines and other advance measurement features that will enhance using the Falcon 3 axis measurement system.

## Getting the most from your Falcon

### Routine maintenance (see page 16)

- The outside of the instrument should be wiped down to remove dirt and dust.
- The instrument and accessories should be checked for loose or damaged components.
- When not in use, protect your Falcon with the dust cover.

### Consumable & replacement parts

Description	Specification	Part Number
Stage glass	150mm x 100mm	K-018
Stage glass	150mm x 150mm	201-B0686
Surface light LED array	20 LEDs, 1,100 lux (filtered)	F-001
Substage LED	330 lux (filtered)	MN-006

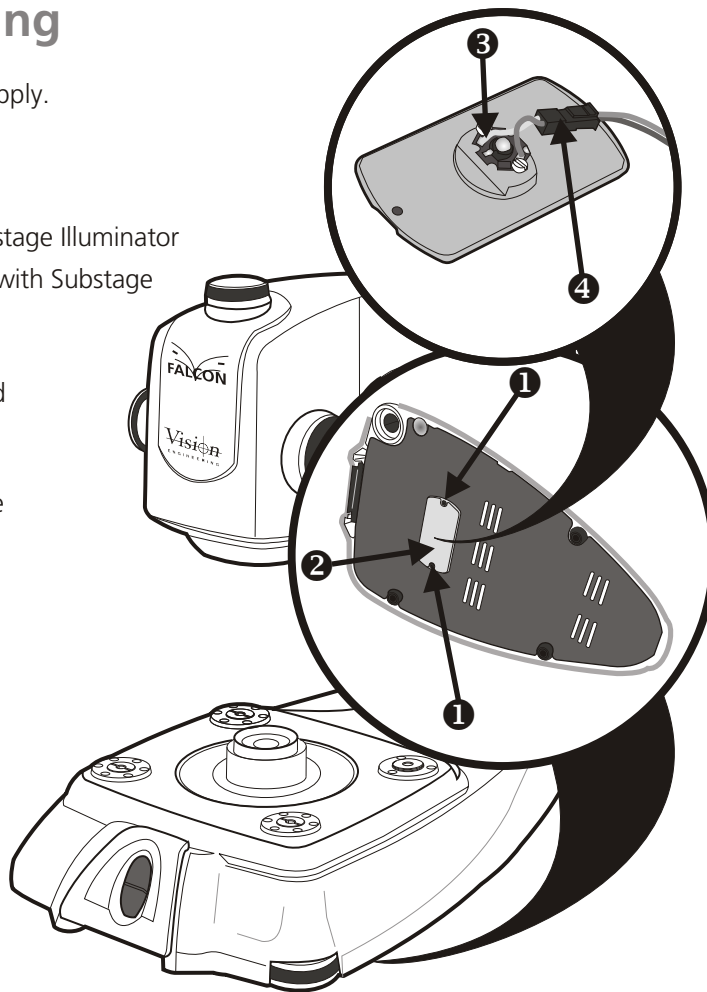
### Environmental considerations

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

- Position the Falcon on a firm, rigid and level table.
- Avoid locating the instrument near to a source of vibration.
- Do not place the instrument close to a radiator or similar heat source.
- Do not place the instrument close to a cold temperature source such as an air conditioning unit.
- Do not position the instrument in direct sunlight, or where bright reflections will prevent a comfortable viewing position.

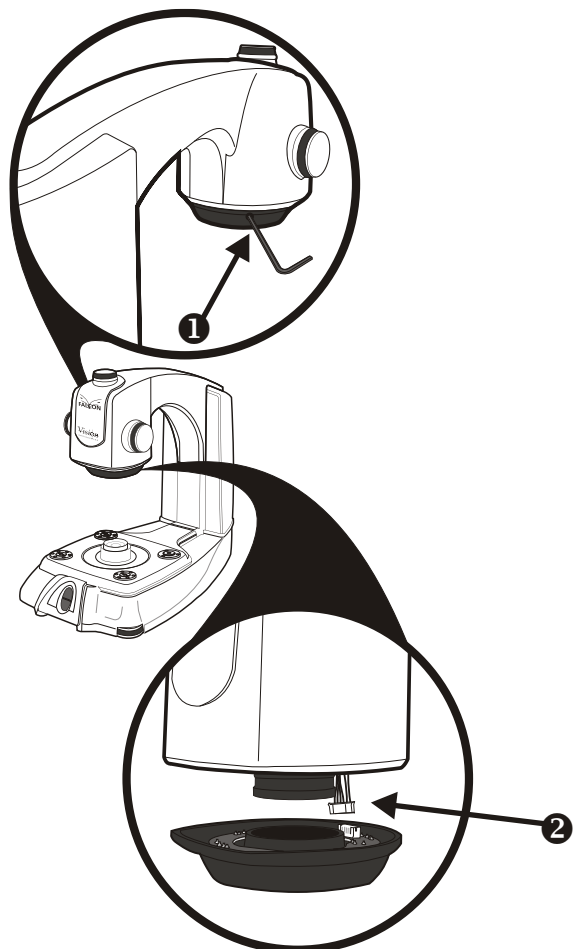
### Substage lamp changing

- ▶ Disconnect the unit from the mains supply.
- ▶ Carefully turn the stand on its side.
- ▶ Remove the two bolts **1** from the Substage Illuminator base plate **2** and remove it, complete with Substage Illuminator unit **3**.
- ▶ Disconnect the inline connector **4** and remove the substage illuminator unit.
- ▶ Fit the new unit by reversing the above procedure.



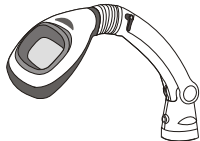
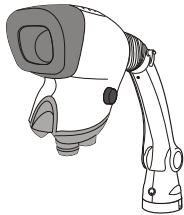

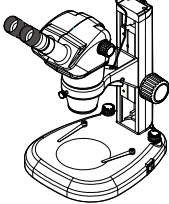

### LED Ringlight replacement

- ▶ Using the Allen key supplied, unscrew the securing screw **1** at the rear of the ringlight assembly.
- ▶ Lower the assembly and disconnect the inline connector **2**.
- ▶ To replace the LED ringlight, reverse the above procedure.






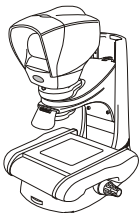
Vision Engineering manufactures a wide range of stereo inspection and non-contact measuring systems. For all product information, please visit our website.

## Stereo inspection systems

Product	Picture	Features	Description
Lentis		<ul style="list-style-type: none"> <li>• 2.5 dioptres.</li> <li>• Multi layered anti reflective coated lens.</li> </ul>	A state of the art bench magnifier for inspection, manipulation and material rework.
Mantis		<ul style="list-style-type: none"> <li>• x4 - x20 Magnification.</li> <li>• Shadow-free LED cold illumination, both surface and substage.</li> <li>• Long working distances, large depth of field.</li> </ul>	The Mantis family is a unique range of optical systems without eyepieces, for intricate tasks requiring superb quality viewing over long periods of use. Available with universal arm or rigid bench stand option.
Alpha		<ul style="list-style-type: none"> <li>• x2.1 – x160 magnification.</li> <li>• Camera option.</li> <li>• Expanded Pupil eyepieces.</li> </ul>	Expanded Pupil eyepiece stereo zoom microscope. Available in boom and bench stand configuration with a wide range of optional accessories (e.g. lighting, cameras)
SX 45		<ul style="list-style-type: none"> <li>• x8 – x50* (6.3:1 zoom ratio) click-stop stereo zoom magnification (x200 max.).</li> <li>• Affordable stereo zoom microscope with first-class performance.</li> <li>• Long-life (up to 6,000 hours), true colour LED illumination.</li> <li>• Wide range of options and configurations.</li> <li>• Extra long working distance (115mm*).</li> </ul>	Designed as an affordable stereo zoom microscope, the SX45 with its long working distance, precision optics and compact design is the perfect solution to many industrial and biological applications. With a wide array of options and accessories, the SX45 allows further tailoring to individual requirements.
Lynx		<ul style="list-style-type: none"> <li>• X2.1 – X120 magnification.</li> <li>• 77mm – 1.75mm field of view.</li> <li>• Camera option.</li> <li>• Eyepieceless viewing system.</li> </ul>	Advanced eyepieceless stereo zoom microscope. Available in boom and rigid stand configuration with a wide range of optional accessories (e.g. lighting, cameras)

\* with standard x1.0 objective

## Non-contact measuring systems

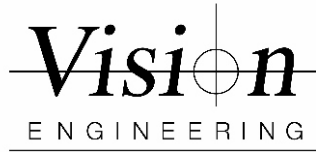
Product	Picture	Features	Description
<b>Kestrel</b>		<ul style="list-style-type: none"> <li>• 150mm x 100mm stage.</li> <li>• QC-200 Microprocessor.</li> <li>• Eyepieceless viewing system.</li> <li>• Video Edge Detection option.</li> </ul>	Entry level, 2-axis measuring system. Ideal for shop floor gauging applications.
<b>Hawk manual</b>		<ul style="list-style-type: none"> <li>• 150mm x 150mm stage.</li> <li>• 2 or 3 axis capability.</li> <li>• Large stage option.</li> <li>• Eyepieceless viewing system.</li> <li>• Video Edge Detection option.</li> </ul>	Advanced manual measuring system, offering increased accuracy and capacity. Operates with QC-200 and QC-300 microprocessors.
<b>Hawk precision</b>		<ul style="list-style-type: none"> <li>• 200mm x 150mm stage.</li> <li>• 2 or 3 axis capability.</li> <li>• Eyepieceless viewing system.</li> <li>• Video Edge Detection option.</li> </ul>	High accuracy measuring system for 2 and 3 axis measurement. Operates with QC-200 and QC-300 microprocessors or QC-5000 PC software.
<b>Hawk automatic</b>		<ul style="list-style-type: none"> <li>• 200mm x 150mm stage.</li> <li>• Video Edge Detection.</li> <li>• Motorised stage movement.</li> <li>• 2 or 3 axis capability.</li> </ul>	Automated measuring system combining optical viewing head with PC based Video Edge Detection. 2 and 3 axis motorised stage movement controlled by QC-5000 PC software.



Falcon Serial Number \_\_\_\_\_

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## **WARRANTY**

This product is warranted to be free from defects in material and workmanship for a period of one year from the date of invoice to the original purchaser.

If during the warranty period the product is found to be defective, it will be repaired or replaced at facilities of Vision Engineering or elsewhere, all at the option of Vision Engineering. However, Vision Engineering reserves the right to refund the purchase price if it is unable to provide replacement, and repair is not commercially practicable or cannot be timely made. Parts not of Vision Engineering manufacture carry only the warranty of their manufacturer. Expendable components such as fuses carry no warranty.

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