Vision ENGINEERING

www.visioneng.com

4K MAKROLITE



FM 557119

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User guide

Makrolite 4K digital microscope

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General

Safety

Before using your system for the first time, please read the Health & safety section of the user guide.
Ensure that:

- Your system and accessories are operated, maintained and repaired by authorised and trained personnel only.
- All operators have read, understood and observe the user manual, in particular the safety regulations.

Cleaning

- Disconnect your system from the electrical source before cleaning.
- Do not use any unsuitable cleaning agents, chemicals or techniques for cleaning.
- Never use chemicals to clean coloured surfaces or accessories with rubberised parts.
- Use a specialist lens cloth to clean optical surfaces.

Servicing

Repairs may only be carried out by Vision Engineering-trained service personnel. Only original Vision Engineering spare parts may be used.

Symbols used



Warning!

A potential risk of danger exists. Failure to comply can cause i) a hazard to personnel; ii) instrument malfunction and damage. Please consult the operating instructions provided with the product.



Warning of electrical shock hazard

This symbol indicates the presence of electric shock hazards. Please consult the operating instructions provided with the product.



Important information

This symbol indicates important information. Please carefully follow the instructions or guidelines.

Health & safety



Unauthorised alterations to the instrument or non-compliant use shall invalidate all rights to any warranty claims.

Electrical safety

- Disconnect your system from the electrical source before undertaking any maintenance.



Do not disconnect the power cable when the camera is on, or connect the power cable when the mains supply is on.

- Avoid using any form of liquid near the system.
- Do not operate your system with wet hands.

Illumination safety

- Do not look directly at the illuminated LED's. This may cause damage to the eyesight.

Environmental considerations

- Avoid large temperature fluctuations, direct sunlight and vibrations.
- Ensure electrical components are at least 10cm from walls and combustible materials.
- Position the system on a firm, rigid and level table.
- The equipment should be positioned so that access to the electrical input connector is always available.
- Avoid positioning your system where bright reflections may affect the image.

Operator wellbeing

- The advanced ergonomic design and construction of Vision Engineering products are intended to deliver superior ergonomic performance, reducing the exertion of the user to a minimum. Depending on the duration of uninterrupted work, appropriate measures should be taken to sustain optimal operator performance. This could include: Optimal arrangement of workplace; Variation in task activity; Training of personnel on workplace ergonomics and general health and safety principles.
- It is important to set-up and optimise your working environment correctly in order to obtain maximum benefit from the advanced ergonomic design of your system. For more information visit: www.visioneng.com/ergonomics

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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).

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.





This product conforms to the UKCA and CE marks, demonstrating that it meets the requirements of the applicable directives. Where applicable, other characteristics of the CE directive are implied such as essential health and safety requirements from all the directives that applies to its product, including low voltage directive and the EMC directive.



If the equipment is used in a manner not specified by Vision Engineering Ltd in this user guide, the protection provided by the equipment may be impaired.

CONTENTS

PREFACE

Copyright 3
Disclaimer 3
General 4
- Safety 4
- Cleaning 4
- Servicing 4

Symbols used 4
- **Warning!**
- **Warning of electrical shock hazard**
- **Important information**

Health & safety 4
- Electrical safety 4
- Illumination safety 4
- Environmental considerations 5
- Operator wellbeing 5
- Compliance statements 5

SYSTEM EQUIPMENT

Makrolite 4K core components 8
Required parts ordered separately 8
Additional parts for PC version 8
Optional accessory (for non-PC version) 8

CONFIGURATIONS

Console Configuration 9
PC Configuration 9

COMPONENTS

Makrolite 4K camera 10
Objective lenses 10
Ring-light 11
Stands 12
- Single arm boom stand 12
- Double arm boom stand 13
- Bench stand 13
- Fitting the S417 adaptor 13
- Ergo stand / Multi-axis stand 14
- Fitting the S416 adaptor 14

CONTENTS

SET-UP

Console Configuration 15
Camera connections 15
Console controls 16
Notes on console functions 17
Image capture and video recording (option) 17
PC Configuration with ViPlus 18
Component layout and camera connections 18
ViPlus software overview and camera controls 19
Live image tools *20*
Captured image tools *21*
Calibration & measurement 21
4K Video recording (Blackmagic Media Express utility) 22

SPECIFICATIONS

Camera data 23
Optical data 23
PC requirements 23

APPENDICES

APPENDIX I: 4K capture devices 24
APPENDIX II: ViPlus calibration procedure 25

SERVICE RECORD

27

WARRANTY

28

CONTACTS

29

Makrolite 4K core components:

- Makrolite 4K camera
- 12V power supply
- 2m HDMI cable (4K)
- Ring-light
- Console (keypad)
- 2m Micro-USB cable *(required with PC configuration only).*
- M4 x 10 cap screws - 4pcs (*for attaching camera to the stand)*
- USB Stick (*User Guide & console control sheet*)

Required parts ordered separately:

- Objective lens
- Stand
- Stand adaptor *(if required)*
- 4K monitor

Additional parts for PC version:

- i7 computer
- 4K capture card (Blackmagic Decklink Mini Recorder 4K)
- Software (ViPlus)

Optional accessory (for non-PC version):

- Standalone 4K image and video recorder

Console Configuration

The Makrolite 4K's HDMI port connects directly to a 4K monitor. Full, stand-alone, control is via a console/keypad. Controls include: zoom, autofocus/manual focus, aperture & exposure settings, gain, white balance, objective selection, screen size selection, image flipping, and access to 4 pre-sets buttons whereby all of these settings can be saved/loaded for rapid set-up.

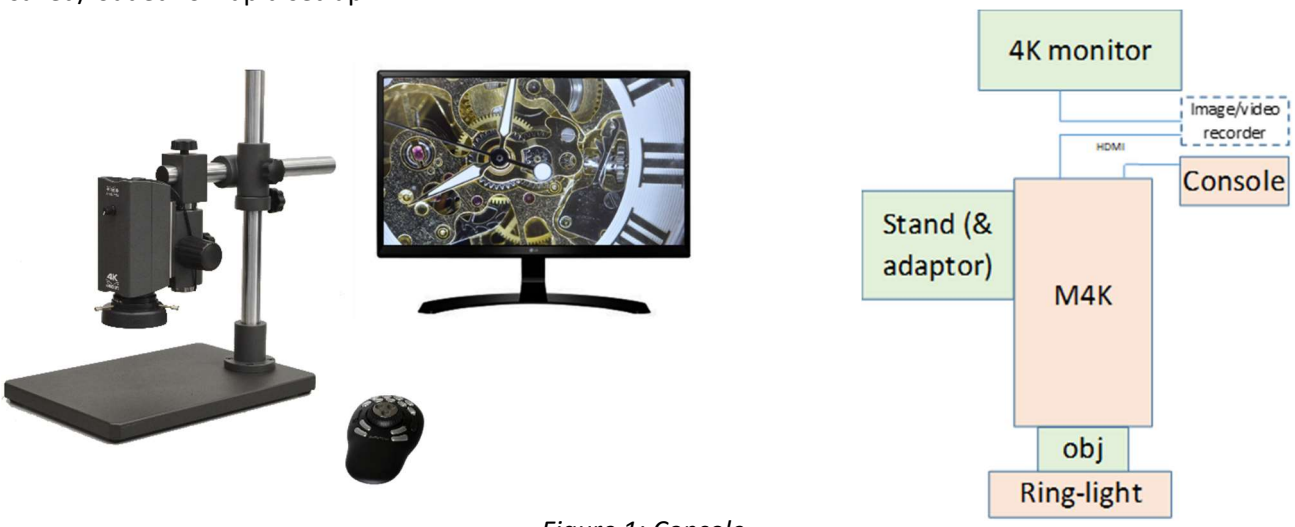


Figure 1: Console

PC Configuration

The PC version extends functionality through the use of Windows software. The key software option is **ViPlus** which provides: full camera control, image capture, measurement, analysis and reporting/tabulation. Saved calibration files store all camera settings (= pre-sets). Video capture is also possible e.g. using the software provided with the capture card (see page 22).

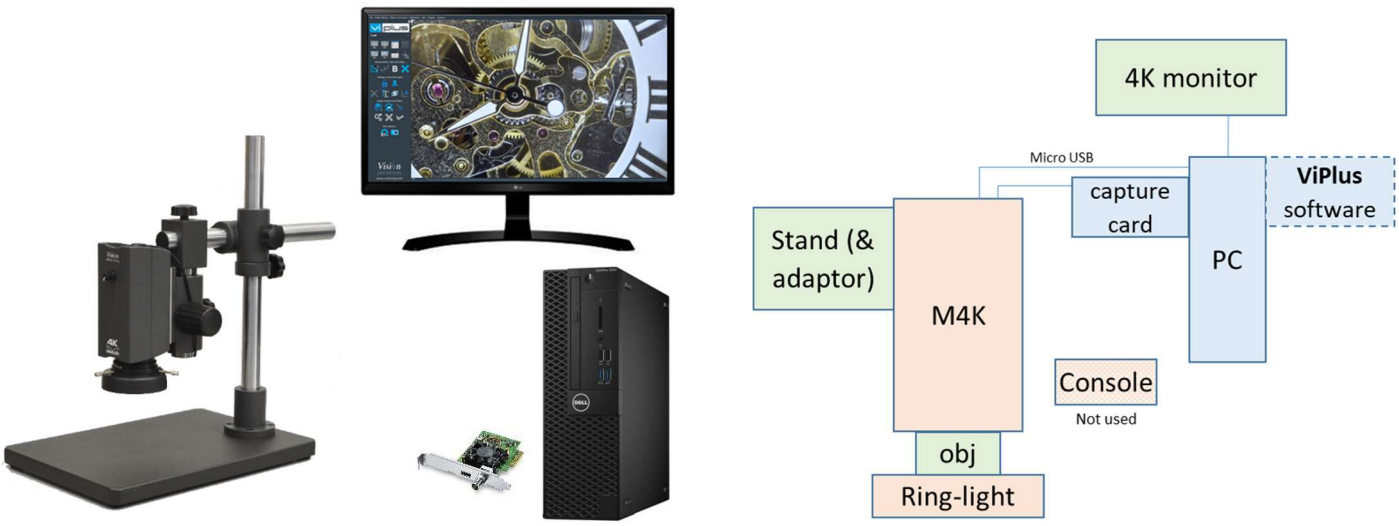


Figure 2: PC configuration

= M4K core components

= optional

= required components

= required for PC version

Makrolite 4K camera

The key parts and connections are shown below.

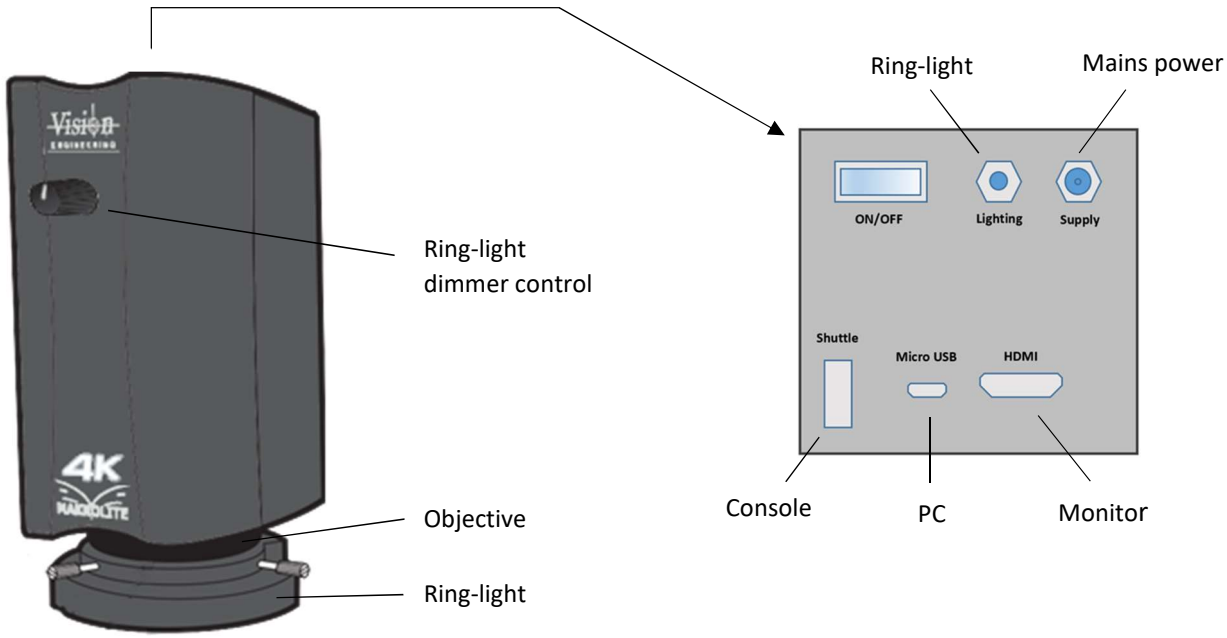


Figure 3: Makrolite 4K and top panel connections

Objective lenses

Fitting the objective. Objectives can be fitted quickly and easily with the quick release mount; first push the objective up and back so that the back of the objective pushes against the mount/holder, then bring the front of the lens up until it clicks into place.

To remove the objective, push it back while bringing the front down.

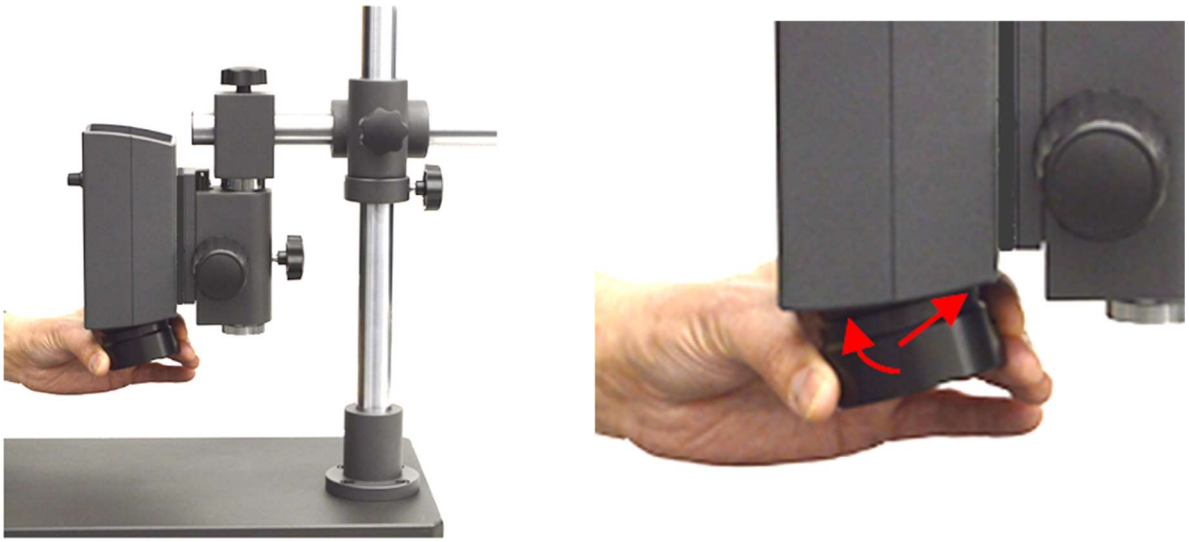


Figure 4a & 4b: Fitting the objective lens

Ring-light

Attaching the ring-light. Slide the ring-light over the camera objective. Secure the three thumb screws. Connect power lead to the 'ring-light' socket on the top panel of the Makrolite 4. Ring-light brightness is controlled using the dimmer control on the front of the Makrolite 4K.

The ring-light may not be required with the bench-stand as this stand includes sub-stage and incident (overhead) lighting.



Figure 5a: Ring-light



Figure 5b: Ring-light fitted to the Makrolite 4K

Stands

Single arm boom stand

The focus control of the stand attaches directly to the interface plate on the back of the Makrolite 4K camera with the 4 screws provided and using the holes indicated in the image (below right)

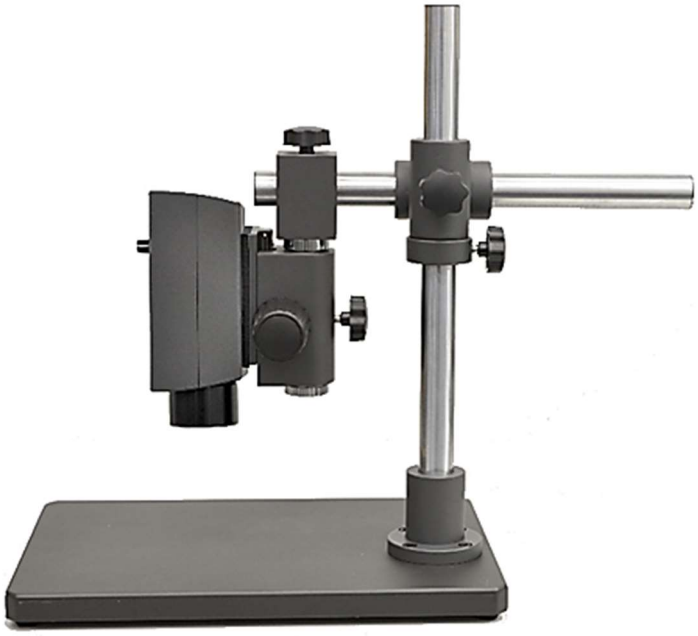


Figure 6: Single arm boom stand (S206)

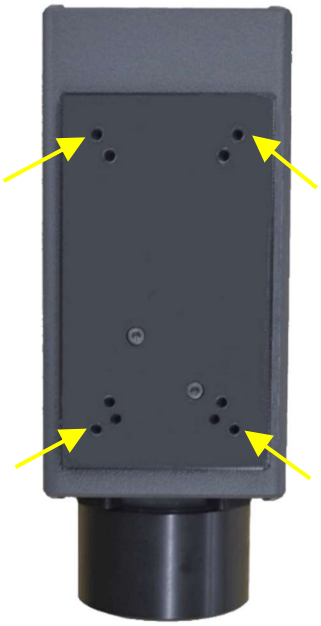


Figure 7: Interface plate screw-holes for S206 stand

The camera is attached by first fixing the two upper screws with a 3mm hex driver. The screw holes are accessed by adjusting the focus control knob (see fig 8a). Once secured, the lower screw holes are accessed by turning the focus control in the opposite direction (see fig 8b).



Figure 8a & 8b: Attaching Makrolite 4K to the S206 stand

With the ring-light attached, the upper few mm of the camera's travel may be restricted by the ring-light cable coming into contact with the focus control block.

Double arm boom stand (with clamp or base)

These stands attach directly to the Makrolite 4K camera in exactly the same way as the single arm stand (see previous page) – no adaptors are required.



Figure 9: Double arm boom stand with clamp (S241)



Figure 10: Double arm boom stand with base (S242)

Bench stand

The S417 adaptor is required to attach the Makrolite 4K camera to the Bench stand.



Figure 11: Bench stand (S203 or S240)



Figure 12: Interface plate screw holes for the S417 adaptor

Note. The microscope support, pictured left supplied with the bench and boom stands are not required with Makrolite 4K. Unscrew the incident light from this support (2 screws) and unscrew this support from the stand (single screw).

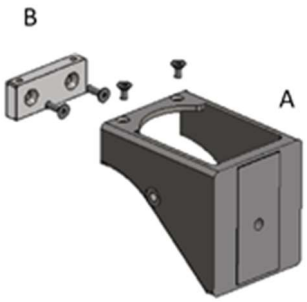


Figure 13: S417 adaptor

Fitting the S417 adaptor

- attach the adaptor bracket (part A in the image above right) to the stand (single screw)
- attach the incident light to the bracket (two screws)
- attach the adaptor plate (part B) to the interface plate on the Makrolite 4K using the two screw holes indicated in the image above
- attach the camera/adaptor plate (B) to the adaptor bracket (A) using the two screws holes indicated above.

Ergo stand / Multi-axis stand (with base or mounted direct to the work bench)

The S416 adaptor is required to attach the Makrolite 4K camera to the Ergo and the Multi-axis stands.

Note the orientation of the adaptor (figure 17) as this is critical.



Figure 14: Ergo stand (EVB010)



Figure 15: Multi-axis stand (EVB021 with EVF111)



Figure 16: Interface plate screw holes for the S416 adaptor

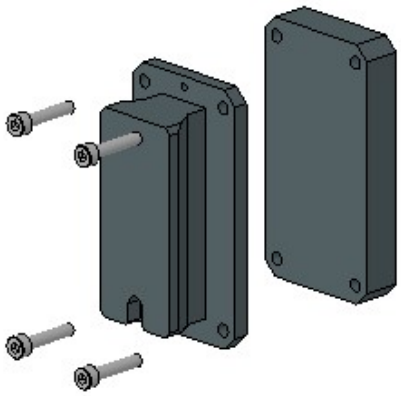


Figure 17: S416 adaptor

Fitting the S416 adaptor

- Use the 4 hex screws to attach the dovetail bracket and spacer to the interface plate of the Makrolite 4K using the screw holes indicated in the image above.
- attach the dovetail to the corresponding bracket on the stand. A 2mm hex key is required to tighten the grub screw on the stand-bracket to ensure the camera is held firmly.

The Ergo stand sub-stage illumination option is not available when used with the Makrolite 4K.

Console Configuration

Camera connections

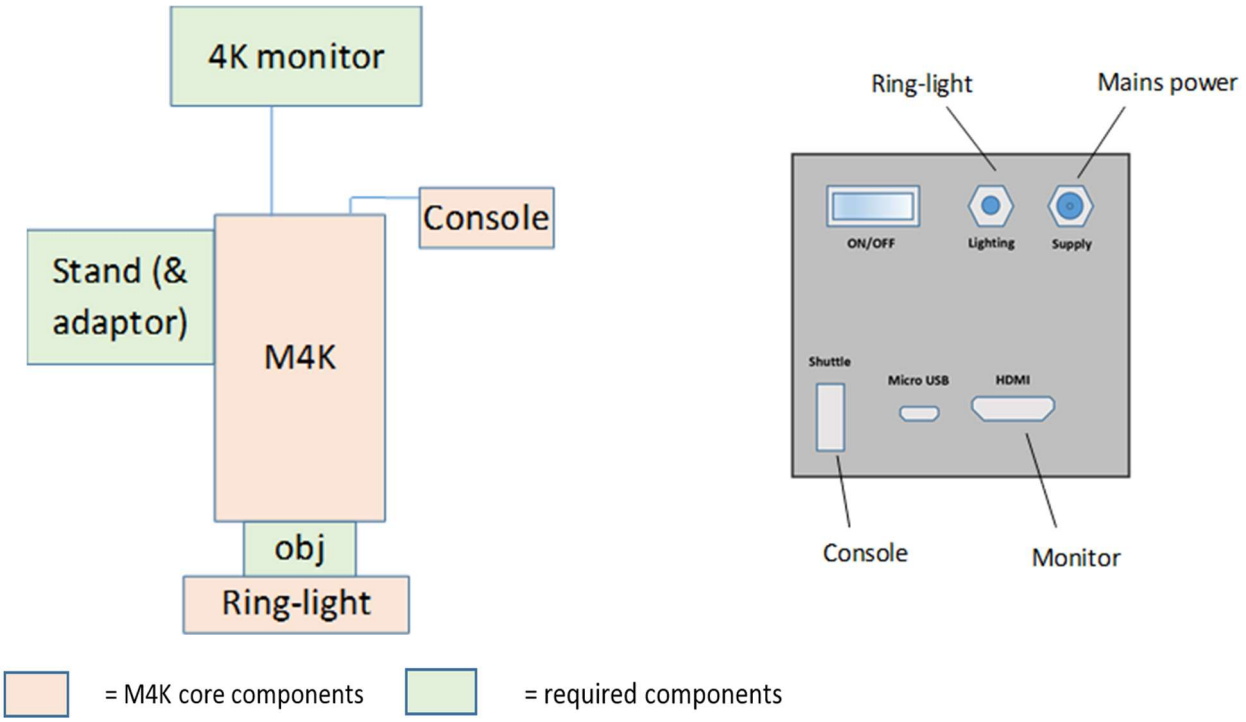


Figure 18: Component layout and Makrolite 4K connections

The console (keypad) connects to the USB port labelled 'Shuttle' on the top panel of the Makrolite 4K. The monitor connects to the HDMI port using the 2m HDMI cable supplied. The Makrolite 4K is powered by the 12V DC supplier supplied. Once connected, switch on the camera and the monitor to complete the camera set up.



Figure 19: Makrolite 4K - console configuration

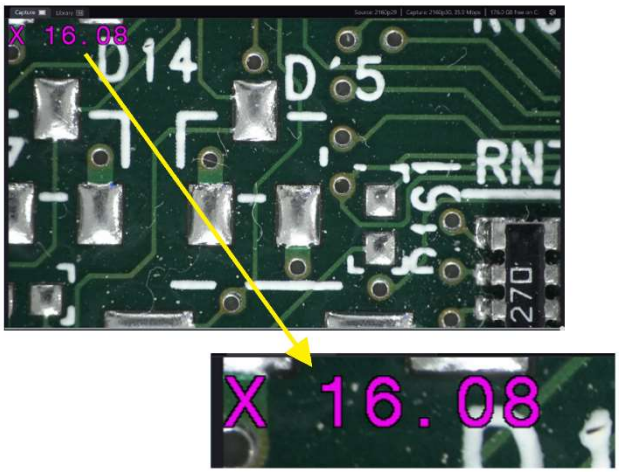


Figure 20: When the console zoom dial is moved the current zoom setting is displayed

When the console is used to change the zoom or any other camera setting, the current setting for that function appears in the on-screen display (as in fig. 20).

Console controls

The console (or keypad) has 15 Buttons. Some have two functions depending on whether the user makes a *short press* or a *long press*. The button functions are shown below.



Button #	Button Name	Short Press	Long Press
1	Mem1	Load set of saved parameters	Save current parameters to Mem1
2	Mem2	Load set of saved parameters	Save current parameters to Mem2
3	Mem3	Load set of saved parameters	Save current parameters to Mem3
4	Mem4	Load set of saved parameters	Save current parameters to Mem4
5	Lens	Select lens type	Switch screen display on/off
6	Mir/Flip	Flip in horizontal direction	Flip in vertical direction
7	Foc/Exp	Switch between manual focus/autofocus	Switch between manual exposure/auto-exposure
8	WB	White balance adjusts automatically in this mode	Adjusts white balance (and retains that setting until changed)
9	Scr. size	Display the current screen size setting	Change the screen size (determines the displayed zoom)
10	Shutter+	Increase exposure time	n/a
11	Gain+	Increase gain	n/a
12	Shutter-	Decrease exposure time	n/a
13	Gain-	Decrease gain	n/a
14	Aperture-	Decrease the aperture	n/a
15	Aperture+	Increase the aperture	n/a
Jog wheel	Manual focus adjustment		
Shuttle	Zoom adjustment (+ small movement to read current zoom)		

Figure 21: Console controls

Notes on console functions:

Buttons 1, 2, 3 & 4 - Pre-sets: each button enables full camera settings to be saved or loaded at the press of a button. Hence, up to four pre-sets can be used. The saveable settings include: zoom position, automatic/manual exposure, gain, iris/aperture, objective lens type, automatic/manual focus, focus setting and screen size.
Button 5 - short press: select lens (to ensure the correct zoom is displayed). Options are: *Sans* (no lens), *0.45x, 0.62x, 1.0x, 1.5*x and *2.0x*.
Button 8 - **Short press**: adjusts the white balance and will automatically re-adjust with different lighting conditions. **Long press:** adjust the white balance and the white balance setting will remain unchanged until button 8 is pressed again. *NOTE: in general, the white balance is set using a white background (e.g. a sheet of paper) in the field of view.*
Button 9 – **long press**: select screen size (to ensure the correct zoom is displayed). Options are *15", 24", 27"* and *28".*
Buttons 10, 11, 12, 13, 14, 15. These camera settings are usable in manual exposure mode only.
Jog. F = 0 corresponds to the longest focal distance setting.
Shuttle. A quick short movement of the dial will display the current zoom position (rather than adjust it).

Image capture and video recording (option)

This option (M4K105) enables 4K image capture and 4K video recording without requiring a PC to be connected to the Makrolite 4K. It is connected by HDMI cables to the Makrolite 4K and to the monitor (see figures below). It is straightforward to use; press one button to capture an image (saving to a USB stick) and another to start/stop video recording. Use either the buttons on the unit or those on the remote controller. The remote controller also enables review, video playback etc.

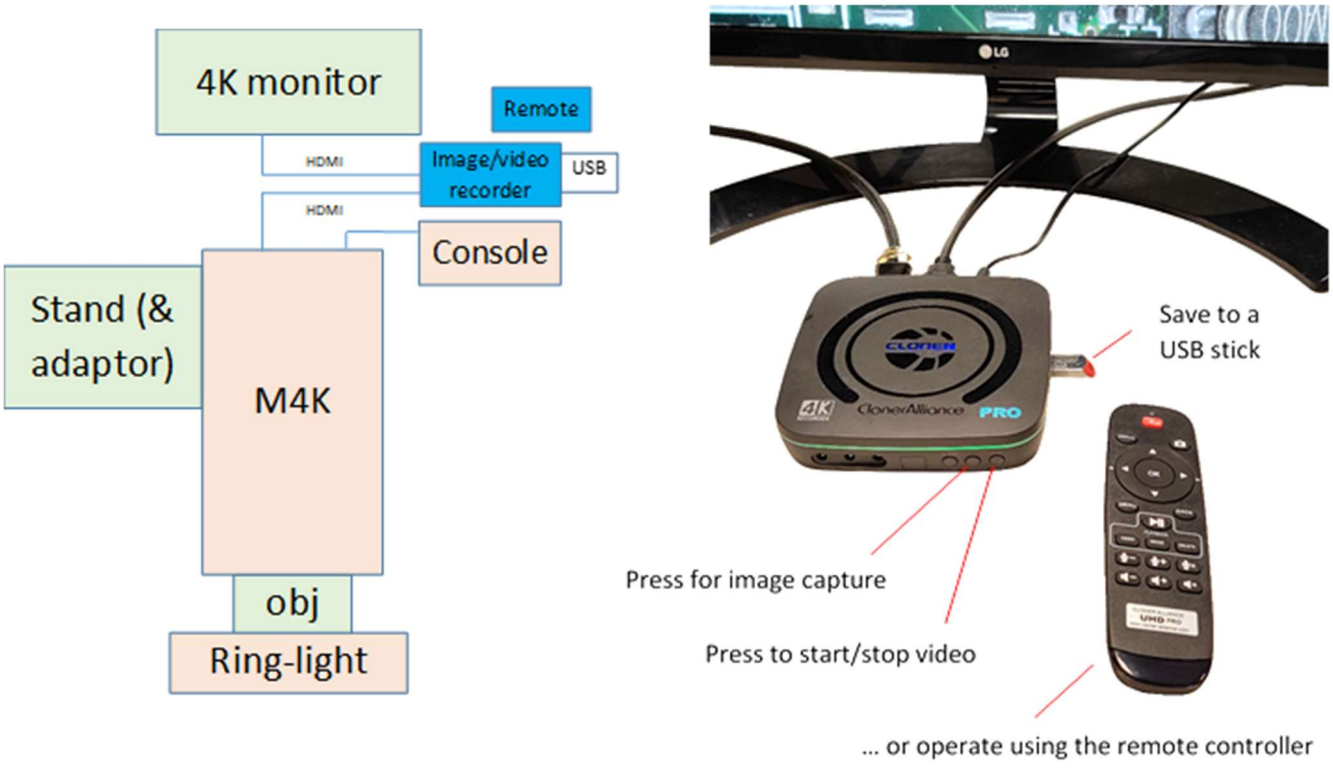


Figure 22: Component layout with the image/video recorder

PC Configuration with ViPlus

In this section it is assumed that the PC meets the requirements (see SPECIFICATIONS) with the recommended 4K capture card (Blackmagic Design – DeckLink Mini Recorder 4K) installed in an expansion slot, and ViPlus software (v.1.03.00 or later) installed. Alternative capture cards/devices are discussed in Appendix I.

Component layout and camera connections

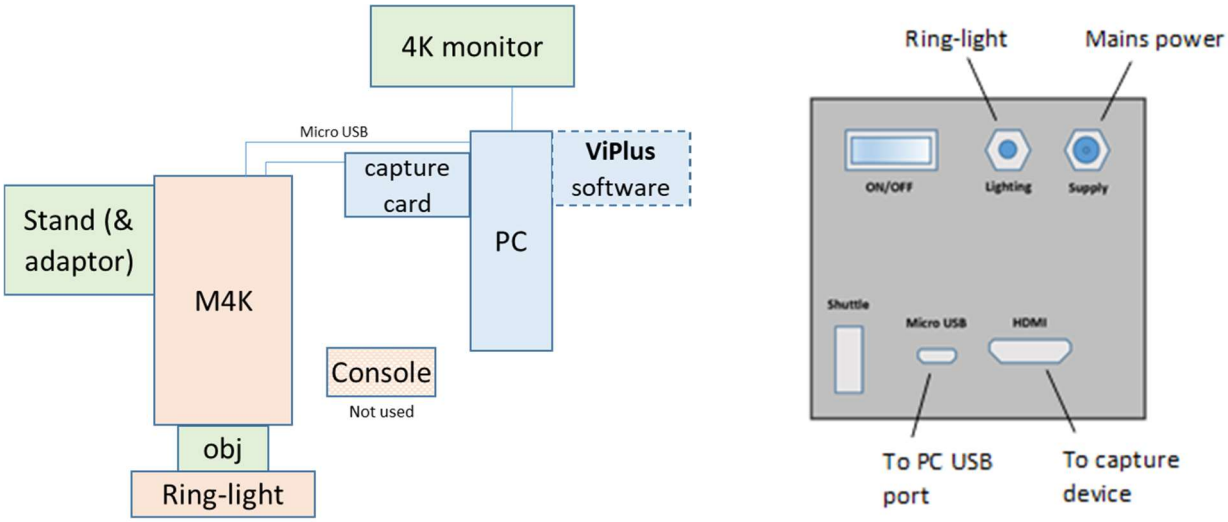


Figure 23: Component layout and Makrolite 4K

The 2m micro USB cable (included) connects between micro-USB port on the top panel of the Makrolite 4K and a USB port on the PC. The HDMI cable (included) connects between the HDMI port on Makrolite 4K and the HDMI-input port of the capture device. The monitor connects to the PC's HDMI or Display port using a suitable high speed cable (this is often supplied with the 4K monitor).

The console cannot be used when the micro-USB cable is connected i.e. when Makrolite 4K is being controlled via the ViPlus software.



Figure 24: Makrolite 4K - PC configuration with ViPlus software.

The 4K capture card fits into an SFF or PCIe expansion slot on the PC.

ViPlus software overview and camera controls

The ViPlus software is a separate Vision Engineering product with its own Installation instructions and user guide. This section provides a short overview of ViPlus' general functionality as well as details on functions that are specific to the Makrolite 4K version.

Several versions of the ViPlus software are included on the USB stick supplied with ViPlus. The version to be installed for use with Makrolite 4K has the filename *Blackmagic – display 4K.*

ViPlus provides control of Makrolite 4K; enabling adjustment of zoom, autofocus and camera settings. It is also used for measurement, annotation, image processing and data reporting.

When the ViPlus software is opened, the user is prompted to select the COM port that the micro-USB cable is connected to. If an incorrect port is selected, video will still be available (when 'play' is selected) but the zoom controls are greyed out (instead of blue) and are not useable. With the correct COM port selected, selecting the 'play' icon in the top left of the screen will bring up the live display.

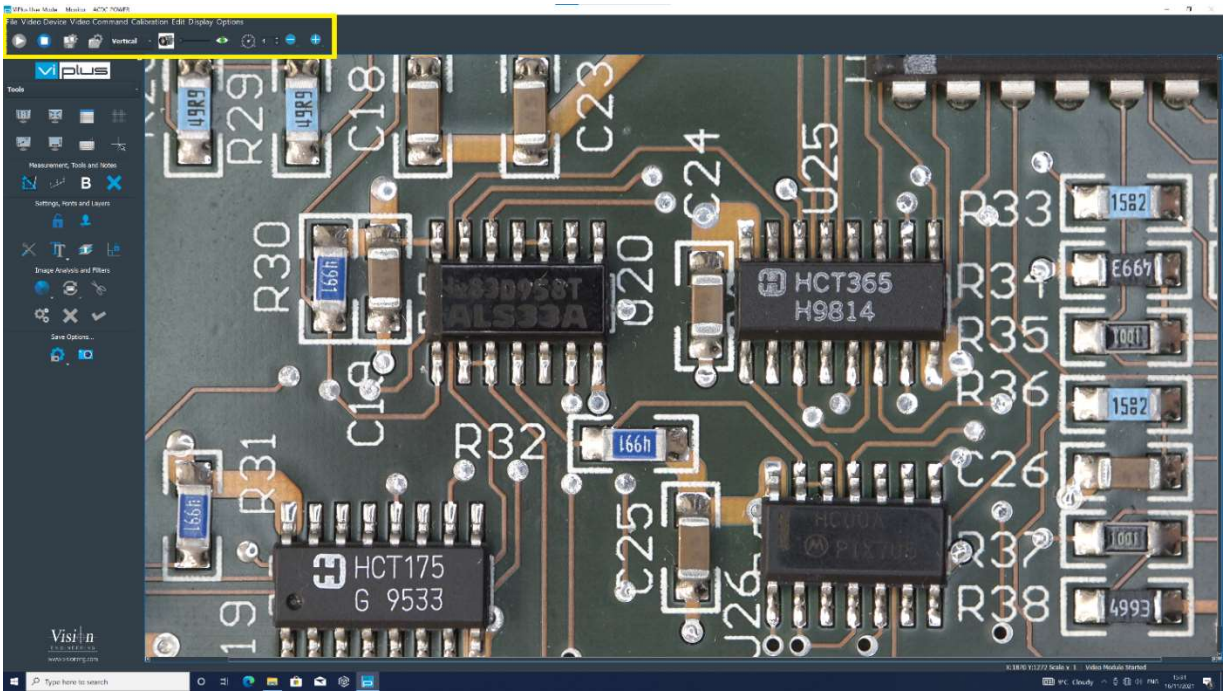


Figure 25: ViPlus display screen (the main control bar at the top is expanded in the next figure).

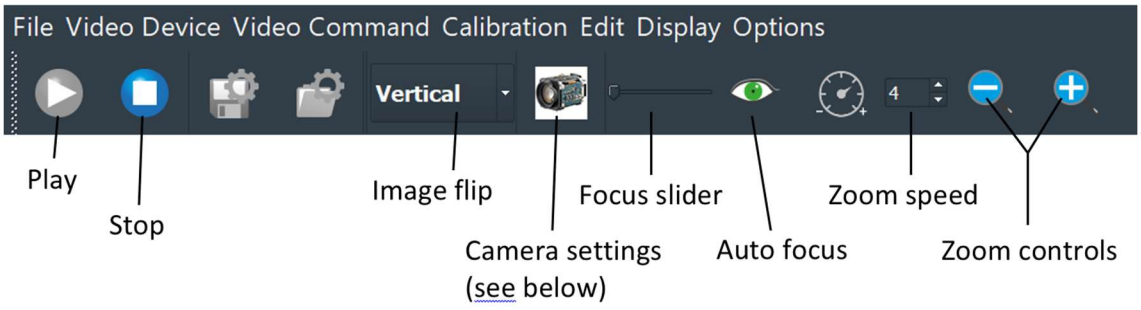


Figure 26: ViPlus camera controls

Live image tools

Selecting 'Video Command' on the main menu allows access to the mirror and flip controls (see image below). This allows the live image to be flipped horizontally or vertically or both. Once set, this orientation will be the default setting.

There is a similar mirror tool on the main menu bar. However, the selections made here do not become the defaults settings.

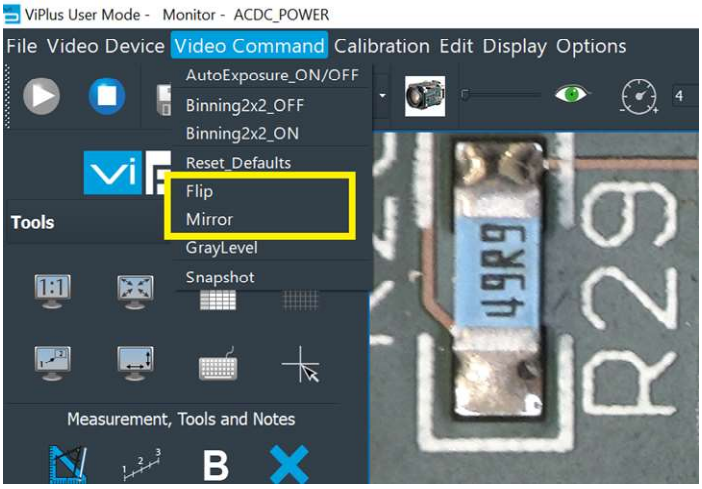


Figure 27: Image 'Flip' and 'Mirror' controls.

Selecting the 'Sony Bloc' camera settings icon opens a window with camera settings that include auto/manual exposure settings (aperture, shutter, gain) white-balance mode and other image display settings.



Figure 28: Sony Bloc camera settings

Captured image tools

As well as control of the Makrolite 4K camera, ViPlus also offers: Image capture (in JPEG, PNG, BMP or TIFF format) annotation tools including markers and measures, measurements tools such as distance, angle, diameter, area, import of CAD files for inspection with CAD juxtaposition, image processing tools such as colour inversion, shape detection, focus stacking (manual acquisition), overlays. It can also be used for generation of reports in Excel and other formats.

The figure below shows where the various tools can be found on the screen menu.

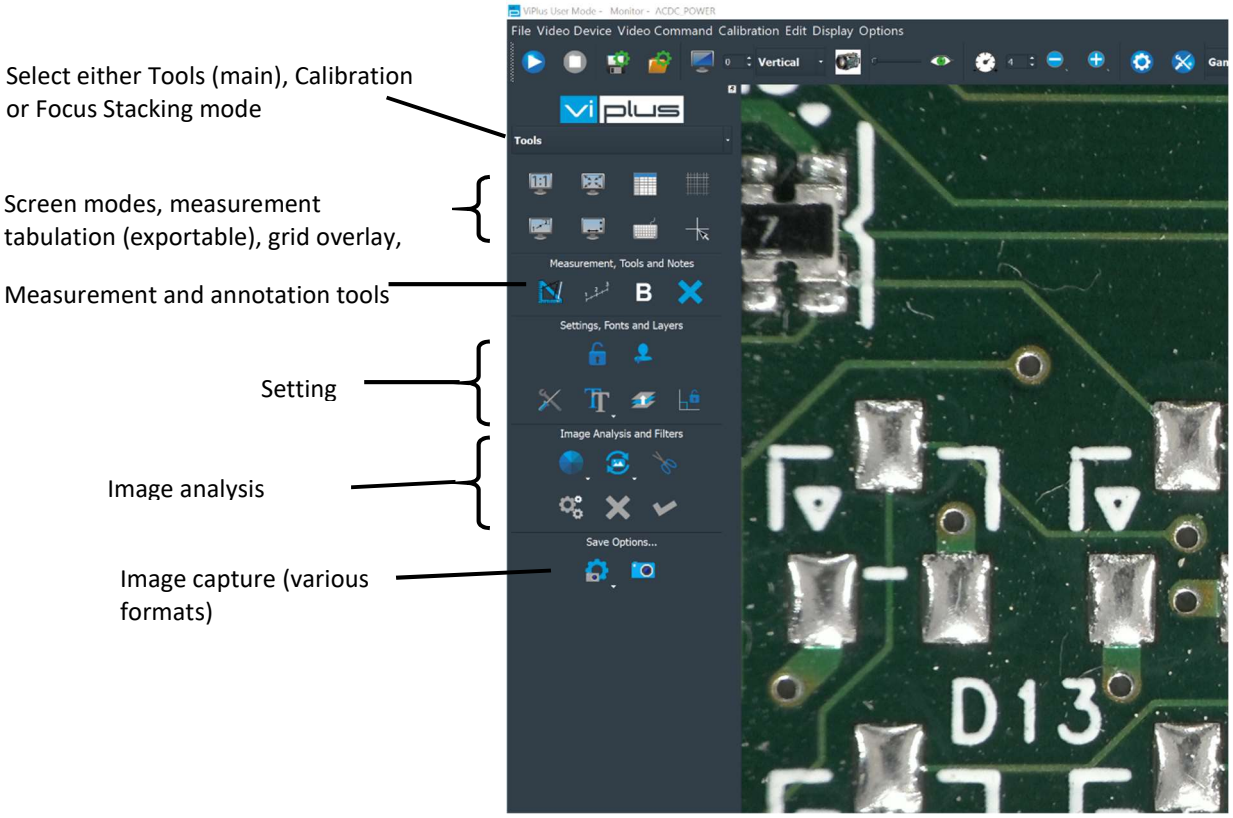


Figure 29. ViPlus tools for captured images

Calibration & measurement

For convenient reference, the ViPlus calibration procedure is given in Appendix II. This information (and much more) is also available in the ViPlus on-line manual. Note that Calibration mode cannot be selected when ViPlus is running in 'Demo' mode; to access Calibration mode, the dongle (security key) needs to be inserted in a USB port and the user needs to be logged in as administrator.

Once a calibration has been saved, opening that calibration file will automatically set the camera settings (including zoom) used for the calibration.

4K Video recording (Blackmagic Media Expess Utility)

Blackmagic capture cards are supplied with a software application for 4K video recording and 4K image capture. This is particularly useful because the Window 10 Camera app will not detect a camera connected via a capture card.

The console (keypad) can be connected and used for camera control. Running the software will bring up the live image. When the console is used to change the zoom etc., the firmware settings will appear in on-screen display (as in the figure below –with text showing the current zoom setting).

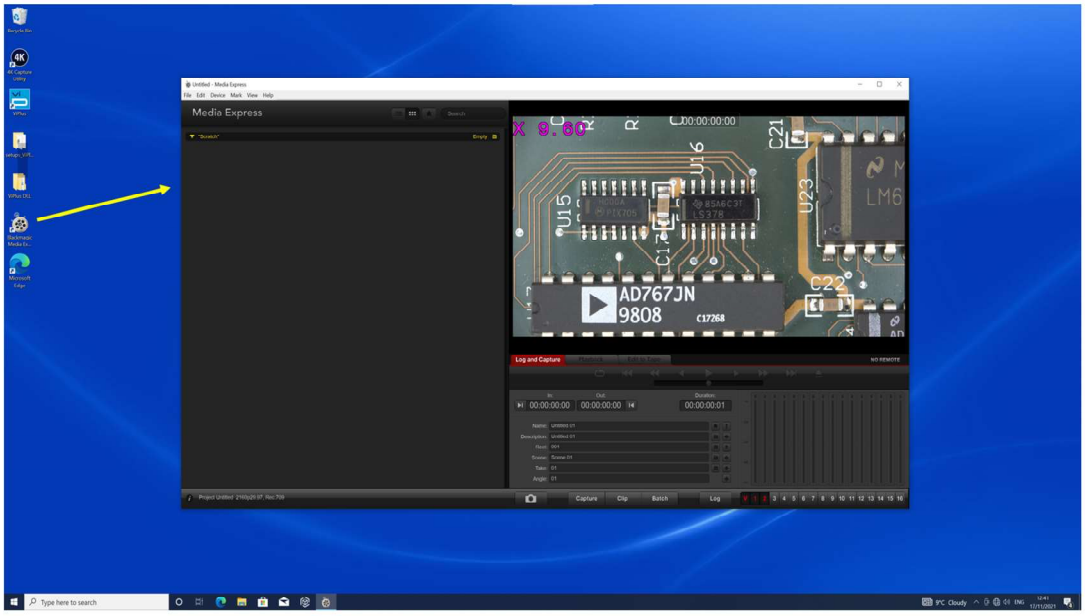


Figure 30: Blackmagic Media Express – display window

4K Image capture and 4K video recording are very straightforward; select either the camera icon or the video 'Capture' button on the lower menu bar (see Fig 31a). Video playback is also straightforward; select the video file from the folder next to the screen, and select the play icon below the screen.

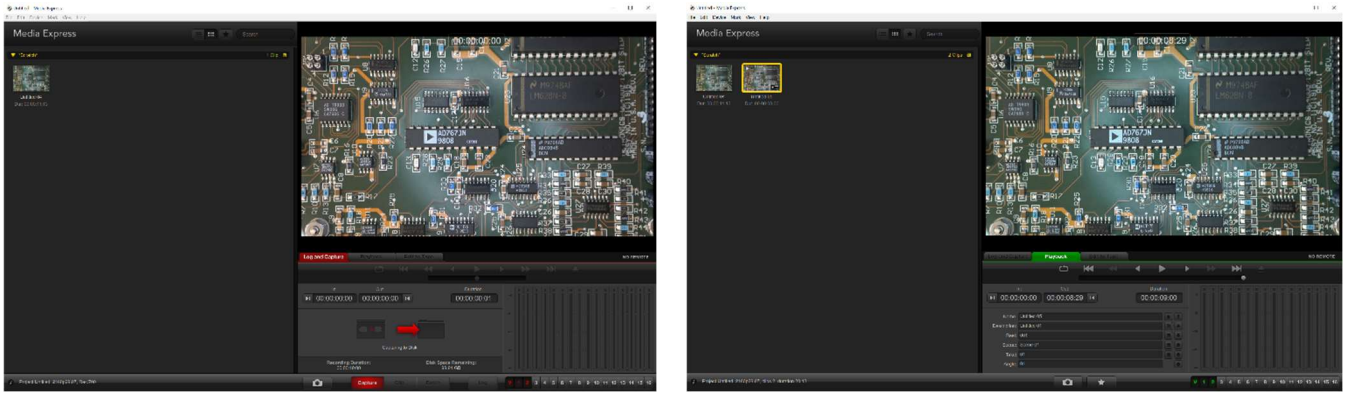


Figure 31a & 31b: Media express screens for recording and playback of 4K

Camera data

Camera data	
Sensor	CMOS 1/2,5” 8.51 mega pixels
Image	Ultra HD 2160p (3840 x 2160)
Focus	Autofocus or manual focus
Camera output	4K 2160p/30fps
Camera output on computer	4K 2160p/30fps on the PCI Express card

Optical data

Objective lens	Part No.	Magnification zoom range* (with digital zoom)	Working distance (mm)	Field of view		
				At Low Zoom	At max. optical zoom	At max digital zoom
0.45x	ECL001	2x – 45x (90x)	170	212mm (3x)	8.8mm	4.4mm
0.62x	ECL002	3x – 57x (114x)	112	201mm (3x)	10.2mm	5.1mm
1.0x	ECL003	5x – 100x (200x)	84	61mm (10x)	6.2mm	3.1mm
1.5x	ECL150	7.5x – 150x (300x)	43	28mm (20x)	4.2mm	2.1mm
2.0x	ECL200	8x – 165x (330x)	29	24mm (20x)	3.2mm	1.6mm

**with a 27” monitor*

PC requirements

PC requirements	
Operating system	Windows 10
Processor	i7 or higher version
Graphics	Graphics card with HDMI 2.0 or higher
Memory	8GB of RAM or more
Requirements for capture card	PCIe or SFF card slot is required for the 4K capture card.

APPENDIX I: 4K capture devices

4K Capture Cards. The recommended capture device is the Blackmagic Design - Decklink Mini Recorder 4K capture card fitted to the PC (via either a PCIe or SFF bracket). The HDMI-in is connected to the HDMI port on Makrolite 4K. Supported capture cards include:

4K Capture Device	Connection	HDMI-out for additional (no lag) connection to a 2nd monitor
Blackmagic Design – DeckLink Mini Recorder 4K*	Supplied with PCIe and SFF brackets	No
Elgato – 4K60 PRO MK.2	Supplied with PCIe and SFF brackets	Yes
Blackmagic Design – Intensity Pro 4K*	PCIe only	Yes

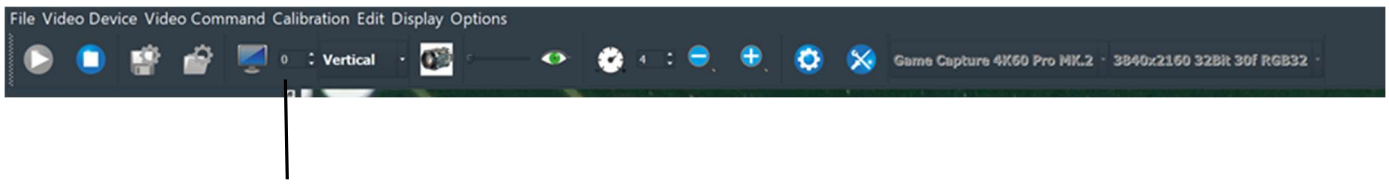
*Use ViPlus version *BlackMagic – display 4K*

USB3 4K capture devices. These devices are not supported. They are an alternative to a capture card and connect between the HDMI of the Makrolite 4K and a USB3 port on the PC. They are convenient because a PCIe or SFF slot is not required and so can be used with any suitable PC/laptop. However, USB3 capture devices are less reliable than capture cards and USB3 performance is likely to be dependent on the PC manufacturer and model. Hence, the use of a USB capture device IS NOT supported by Vision Engineering. The devices below have been tried and used with some success.

4K Capture Device	Connection	HDMI-out for additional (no lag) connection to a 2nd monitor
Elgato – HD60 S+	To USB3	Yes
Elgato – Cam Link 4K	To USB3	No

When connected via one of these USB3 devices, the Makrolite 4K is recognised as a camera by the PC and so the Windows 10 Camera app can be used for live display, image and video capture.

When using with ViPlus it is important to set the fps limit to a number less than 30. The default setting is 0 (= no fps limit) and if left unchanged, the software is likely to crash within a few minutes.



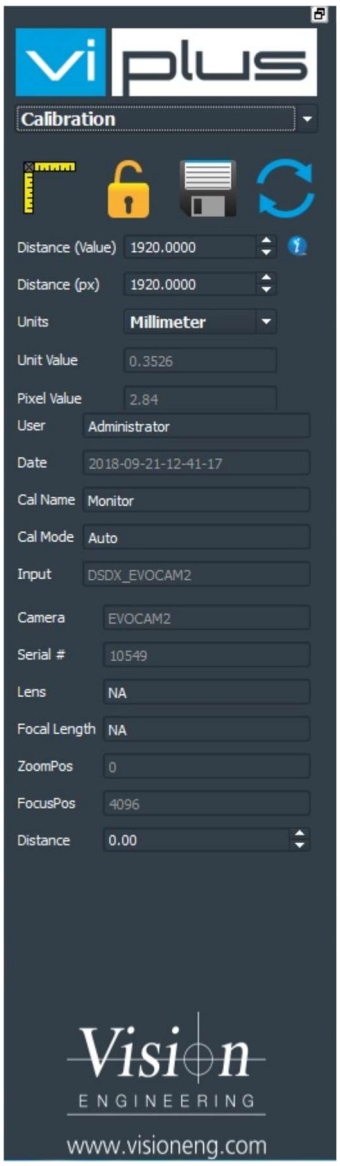
Set the frame rate to a non-zero value below 30.

APPENDIX II: ViPlus calibration procedure

The information in this section can also be found in the ViPlus User guide (in Options/Help).

Calibration settings can only be set or altered by a user logged in as an administrator. The default password is 'admin'

When the Calibration tab is selected, the calibration screen is displayed (see right).



The key calibration controls are shown below:



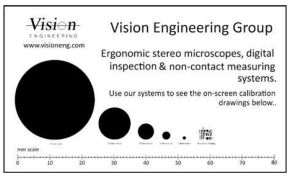
- Auto/Manual calibration (see below)
- Lock/unlock calibration
- Save calibration settings
- Refresh calibration

Calibration procedure

Place the cursor over the icon to display the drop-down option of either 'Auto' or 'Manual' calibration.

Auto

- Place a suitable calibration sheet (e.g. as supplied by Vision Engineering) containing at least one circle of a known dimension.



- Click on the **Auto** option. The system will place a rectangle around the circle. *If the Auto calibration option fails to create a rectangle, an error message will be displayed and a rectangle will be placed in the display as in the Manual option (see below).*
- Enter the required units for the calibration from the units drop down list (see main image right).
- Click the icon to the right of the 'Distance (value)' display
- This will display the distance entry box. Key in the diameter of the calibration circle and click **OK** to confirm or **Cancel** to abort.
- When the required dimension has been set, select the lock function to set the calibration. This locks the camera's zoom and focus controls so as to retain the calibration settings
- To save the calibration, first change the calibration name in the 'Cal Name' field then select the icon.

Manual

- Place a suitable calibration sheet (e.g. as supplied by Vision Engineering) containing at least one circle of a known dimension.
- Click on the **Manual** option. The system will place a rectangle in the display area.

- Drag the rectangle over the calibration circle and use the white point to change the size of the rectangle to fit the outside of the circle.
- Enter the required units for the calibration from the units drop down list (see main image right).
- Click the ¿ icon to the right of the 'Distance (value)' display
- This will display the distance entry box. Key in the diameter of the calibration circle and click **OK** to confirm or **Cancel** to abort.
- When the required dimension has been set, select the lock function to set the calibration. This locks the camera's zoom and focus controls so as to retain the calibration settings
- To save the calibration, first change the calibration name in the 'Cal Name' field then select the icon.

It is important to select the lock function **before** saving the calibration. Failure to do this will result in measurement errors.

System Serial Number: _____

Service Type	Comments	Date of Service	Date of next Service	Company	Signature

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.

This warranty does not cover damage in transit, damage caused by misuse, neglect, or carelessness, or damage resulting from either improper servicing or modification by other than Vision Engineering approved service personnel. Further, this warranty does not cover any routine maintenance work on the product described in the user guide or any minor maintenance work which is reasonably expected to be performed by the purchaser.

No responsibility is assumed for unsatisfactory operating performance due to environmental conditions such as humidity, dust, corrosive chemicals, deposition of oil or other foreign matter, spillage, or other conditions beyond the control of Vision Engineering.

Except as stated herein, Vision Engineering makes no other warranties, express or implied by law, whether for resale, fitness for a particular purpose or otherwise. Further, Vision Engineering shall not under any circumstances be liable for incidental, consequential or other damages.

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