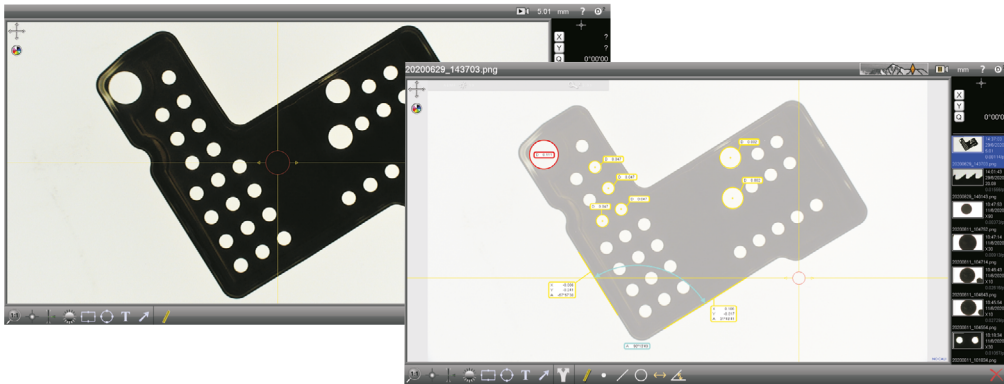# Vision
ENGINEERING

Dimension Two

Annotation and precision measurement software
with EVO Cam II camera control

NAVIGATION INSTRUCTIONS

The symbols in the left-hand margin of each page of the manual will enable you to carry out the following functions:

The buttons in text below do not function. They are for illustrative purposes only.

Contents Click on this button to display the Contents page.

◀ Back one page.

▶ Forward one page.

◀ Back button.

▶ Forward button.

🖨 Click this button to print some or all of the document (specific pages can be chosen).

Exit Click this button to exit the user guide.

! Press the Esc key to display normal Acrobat© Controls.

CONTENTS

Introduction

General

The DimensionTwo™ software is designed to provide users of Vision Engineering's digital inspection systems with more extensive capabilities including EVO Cam II control and high measurement accuracy. In addition to image capture, image annotation tools and on-screen measurement, DimensionTwo provides control of the EVO Cam II camera settings, lighting and zoom settings, an active crosshair (with edge detection) and extended calibration features, such as field of view correction and edge bias, which improve measurement accuracy.

Main features

Image Capture
Capture an image with one click of the mouse, or touch of the screen.

Annotation of captured images
Text, arrows and shapes can be added. A range of powerful constructions are available including creating intersecting lines e.g. for bolt circles etc.

Font size adjustment and a palette of colours are available so that maximum contrast can be obtained between the captured image and the annotation.

Measurement
On-screen measurement can be utilised on any captured image with a choice of circles, lines, points, angles and distances. Measurements include; nearest point separation, centre-to-centre separation, furthest point separation.

Pre-set factory calibration at a range of magnifications offers convenience, simplicity and high accuracy as they incorporate Field of View (FOV) correction, parcentricity correction and edge bias Correction. Users can also perform their own calibrations; either the standard pixel calibration using a calibration mask (provided) or a more accurate calibration, which takes into account FOV, parcentricity and edge bias corrections specific to the individual camera/sensor and lens being used. A calibration grid is provided which can be used for FOV calibrations for a broad range of magnifications.

Touch-screen capability
Simply touch the screen to capture an image, annotate it or measure it. With the usual swipe, pinch and touch of the fingers, the touch-screen facility minimises the use of the mouse making the image capture process even easier.

Opacity change
DimensionTwo allows for the captured image to be modified with a change in opacity from 0 to 100%.

1. Initial set-up

1.1 System requirements

The following are the minimum system requirements that will enable DimensionTwo™ to run efficiently:

- **Operating system**   64-bit. Microsoft Windows 8.1 or 10
- **CPU type**   Intel Core i5, with CPU clock of 2.5 GHz
- **Display card**   Dedicated video graphics card, capable of 1600x1200 with live video streaming, or Intel HD4000 "on-board" video graphics card
- **Display resolution**   1600x1200
- **Memory**   8GB
- **Disk space**   200GB hard drive - for installation, plus data and image/video storage
- **USB**   USB2.0 ports (x2) and one USB3.0 port for connection with Evo Cam II
- **Adobe® Flash®**   Adobe® Flash® Player v15
- **Other**   Windows-compatible mouse and keyboard

1.2 Software installation

ℹ️ **EVO Cam II firmware REV:1.0.0.40:02.00.9:01.06 or higher is required to establish successful communication between DimensionTwo and the EVO Cam II hardware.**

❗ **First plug the security dongle into a USB port and wait until the 'Device driver software installed successfully' message is displayed before continuing. This may take a couple of minutes.**

ℹ️ **Ensure all previous versions of the software have been uninstalled before proceeding with the software installation.**

▶ Insert the USB-stick supplied into a USB port on the PC.

▶ Navigate to the USB's content and double click on the setup.exe file.

▶ The DimensionTwo installation screen will be displayed (see *Figure 1* overleaf):

Figure 1: DimensionTwo installation screen
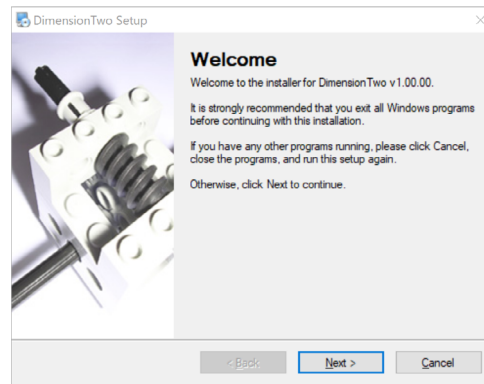
▶ Click on **Next>**.

▶ Follow the on-screen instructions (including the validation of any operating system notifications) until the software is fully installed.

For communication to EVO Cam II (and with the USB3 cable connecting EVO Cam II to the PC) the following is required to complete the installation:

1. Navigate to the DimensionTwo directory (C:\Program Files (x86)\DimensionTwo) and open the sub-directory: 'D2 Configuration Files'. Double-click on the file: 'Transfer D2 Configuration Files.bat'. This will transfer the pre-set files (magnification settings and calibrations) to the Metlogix/Settings folder where they can be read by DimensionTwo.

2. Navigate to the MetlogixD2.ini file in the Metlogix/Settings folder and manually enter the COM port number in place of the X (the ; semicolon should also be deleted):

   [EvoCam]
   ;Port=X

   DimensionTwo will then 'know' through which port communication to and from EVO Cam II will be. (To identify the COM port number, go to the Windows Device Manager and select 'Ports').

3. Select EVO Cam2 as the camera source (see section 2.3 on).

DimensionTwo also supports an 'emulation', or demo, mode where no license key is required. This can be used to perform basic software functions in an 'offline' mode.

The first time the software is used the 'Super Admin' user can set the supervisor's password and up to 5 users' access rights and password (see section 4.6). If the system is only to be used by one person or if all users are to have equal rights, the security settings do not need to be changed.

2. Getting started

This section will describe the following:

- Starting DimensionTwo (see below)
- Language selection (*page 12*)
- Video source setup (*page 13*)

2.1 Starting DimensionTwo

Double click on the DimensionTwo icon D^2 on your PC's desktop. If no security settings have been changed, the Home screen will be displayed (*Figure 2*).

Figure 2: Home screen
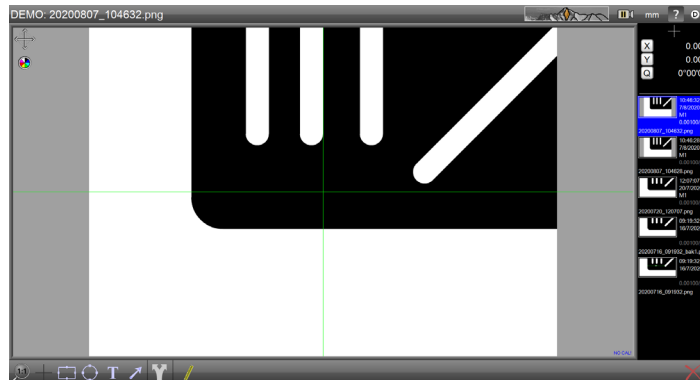
If users have been assigned passwords, the Login screen will be displayed (see *Figure 3* overleaf)

Figure 3: Login screen

To login, proceed as follows:

▶ If necessary, click on the required language.

▶ Select the appropriate user button.

▶ Using the on-screen keyboard key in your password and click **Done**. The Home screen will now be displayed.

ℹ **If you click on Exit, DimensionTwo will be closed.**

2.2 Language selection

If necessary, select your preferred language as follows:

▶ Click on the DimensionTwo logo ❶ to reveal the drop down menu (*Figure 4*).

▶ Click on the **Settings** button ❷. The Settings screen will be displayed (*Figure 5*).

Figure 4: Settings button
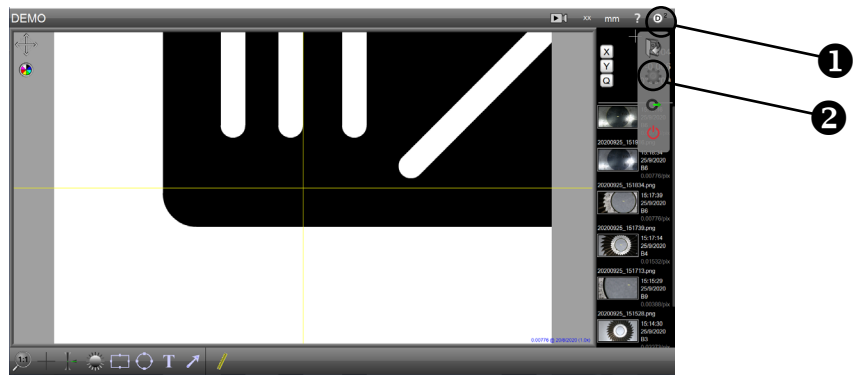
Figure 5: Settings screen
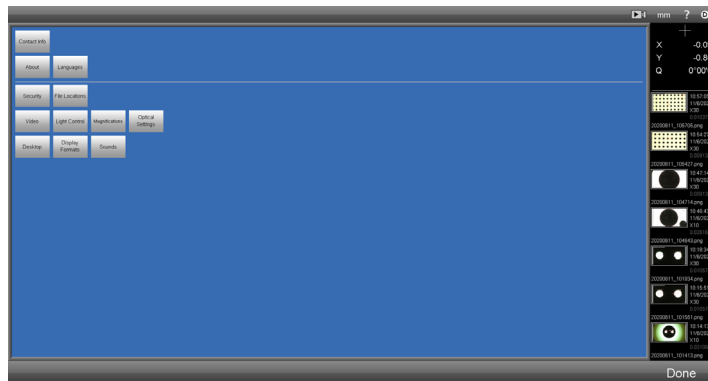
▶ Click the **Languages** button, click the required language from the list and click **Done** to return to the Settings screen.

▶ Click **Done** again to return to the Home screen.

2.3 Video source setup

If the default graphic is displayed in the capture area of the screen, proceed as follows to select the required video source:

▶ From the Home screen (*Figure 6*), click on the DimensionTwo logo ❶ and then click on the Settings button ❷ from the drop down menu. The Settings menu will be displayed (*Figure 7*).

Figure 6: Settings button
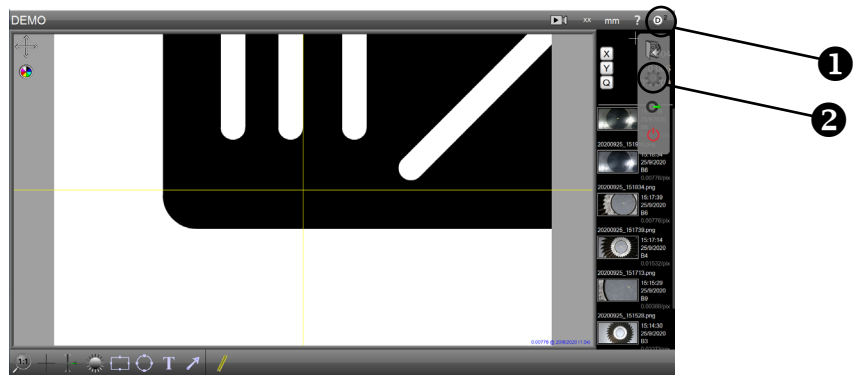
Figure 7: Settings menu
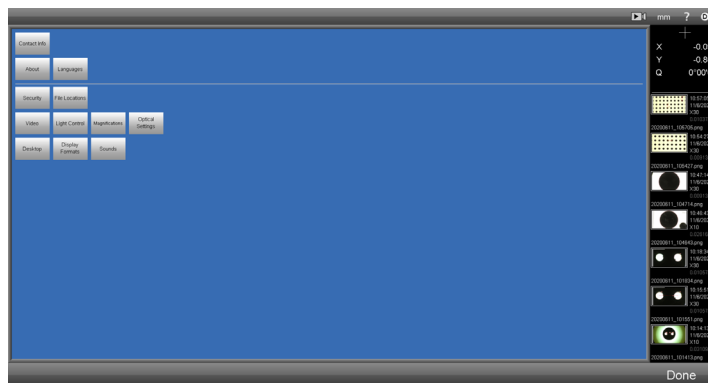
▶ Click the **Video** button. The Video setup screen will be displayed (*Figure 8*).

Figure 8: Video setup screen

The Image source has 3 drop down options:

▶ Bitmap: this is the emulation mode.

▶ uEye: select this when using Mantis Elite Cam HD or Lynx EVO Smart Cam / Smart Cam5.

▶ Direct Show: select this when using other cameras. For EVO Cam II select 'EVOCam2' from the list in the **Camera Choice** dropdown menu, as seen below.

ℹ **As described on** *page 9***, the MetlogixD2.ini file should include [EVO Cam] and the COM port that is being used to connect it.**

ℹ **The DimensionTwo license key must be detected at startup to successfully configure any camera device.**

▶ When the selection is complete, click **Done** to return to the Settings menu and again to return to the Home screen.

ℹ **Before changes to the video settings can take effect, the software must be restarted.**

▶ The 'Config file' options (1 to 5) allow different camera settings to be saved. This functionality can be used with Mantis Elite Cam HD or Lynx EVO and is discussed further in section 5.

3. Operation

i **To view this manual whilst DimensionTwo is running, hold down the Alt key and press the Tab key to toggle between the two.**

This section will describe the following functions:

- Screen areas (*page 16*)
- Still capture (*page 17*)
- Handling captured images (*page 20*)
- Using the crosshair and active crosshair (*page 21*)
- Changing the display units (*page 23*)
- Controlling the image magnification (*page 19*)
- Add annotation (*page 26*)
- Measurement (*page 31*)
- Image control (*page 38*)
- Output options (*page 39*)

3.1 Screen areas

The Home screen consists of the following areas:

- ❶ Status bar
- ❷ Image area
- ❸ Displayed image magnification
- ❹ Active crosshair selector
- ❺ Auto focus
- ❻ Camera control settings
- ❼ Annotation controls
- ❽ Output options
- ❾ Measurement icon (selecting this brings up the measurement tools to the right)
- ❿ Measurement display area
- ⓫ Image list

Figure 9: Screen areas
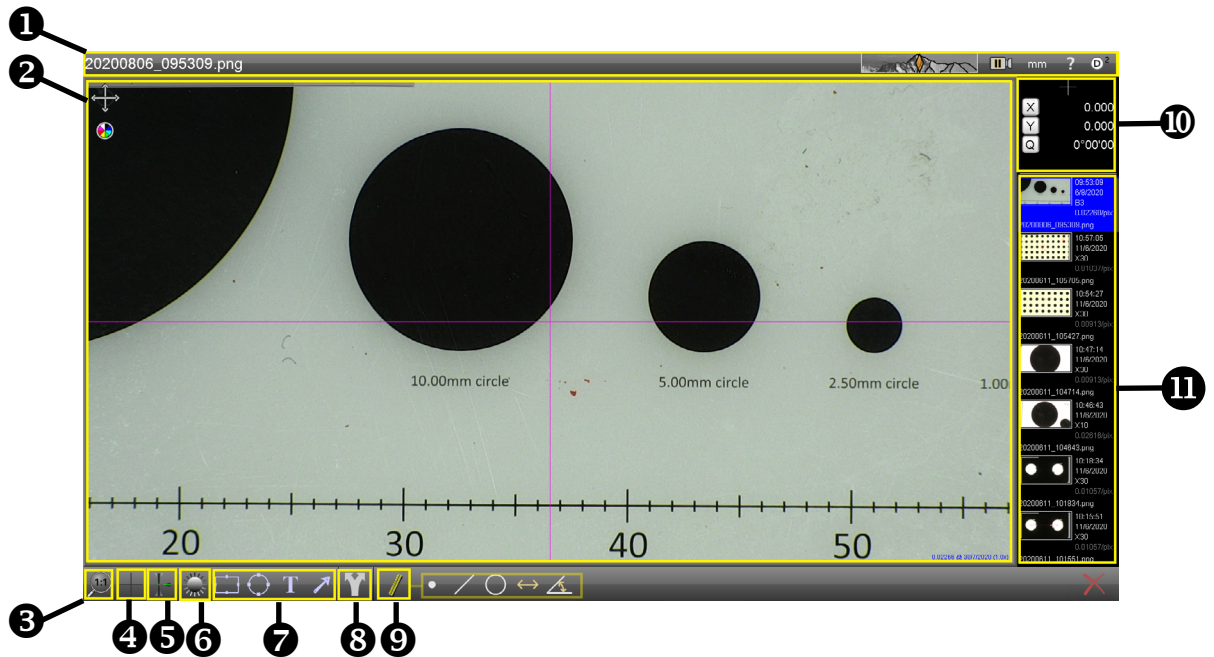
3.2 Camera settings control (with EVO Cam II)

Selecting the 'Sun' icon brings up two tiers of camera control settings.

3.2.1 Lighting controls

The upper tier is for the camera lighting control; there are 3 slider controls: the integrated overhead LED, the substage light (optional) and an external light source connected to the EVO Cam II.

Figure 10: Lighting control panel
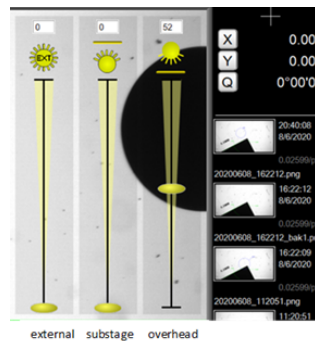
The sliders can be positioned from 0-100, mapping into the supported range of light output in the EVO Cam II. Each slider can be adjusted either by using the mouse to move the slider or by entering a numeric value (0-100) into the field above the slider and pressing Enter.

Each slider can be enabled or disabled in the 'Light Control' setup screen in the Settings menu as shown in the screenshot below.

Figure 11: Light control set-up screen

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3.2.2 Brightness, Gain and Iris controls

The lower tier of the camera control setting is for the Brightness, Gain and Iris control. Each can be positioned either by using the mouse to adjust the slider or by entering a numeric value (0-100) in the field above the slider and pressing Enter.

Figure 12: Brightness, Gain and Iris control panel

a) Manual mode   *b) Auto mode*
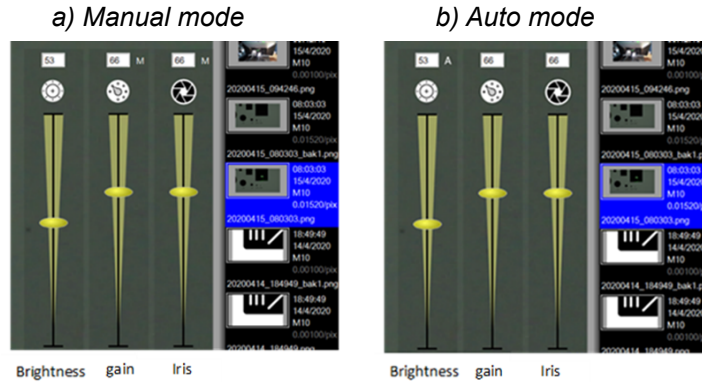
Manual and Auto Exposure Modes: The EVO Cam II camera can be in one of two exposure control modes, effecting the shutter speed of the frames viewed on DimensionTwo; Manual(M) or Auto(A). The adjustment of Brightness, Gain, and Iris levels will put the EVO Cam II camera into one or other of these modes automatically. The mode currently set will be indicated with a small "A" for Auto, or a small "M" for Manual mode, as seen in the two screenshots above.

> **i** **Adjustment of the Gain or Iris will automatically enable Manual Exposure Mode. Adjustment of Brightness will automatically enable Auto Exposure Mode as shown in the screenshots above.**

As described in the previous section, each slider can be enabled or disabled in the 'Light Control' setup screen in the Settings menu as shown in *Figure 11*.

3.3 Auto Focus

Auto Focus is enabled and disabled using the Auto Focus icon located in the bottom left toolbar, as seen in the screenshots below. When enabled, the EVO Cam II will actively attempt to achieve focus for any image presented to the camera. When disabled, the system will effectively be in Manual Focus Mode.

Auto Focus disabled (Manual Focus)   Auto Focus enabled

i **Auto Focus mode cannot be used when performing measurements. If Auto Focus is enabled when attempting to enter the Measurement mode, a message will be displayed instructing the user to disable Auto Focus.**

3.4 Controlling the displayed image magnification

To change the magnification of the image displayed in the Image area, proceed as follows:

▶ Click on the 🔍 icon at the bottom left corner of the screen. A selection of icons will be displayed as follows:

Figure 13: Displayed image options

Displays the entire image — Displays the full width of the image

Displays the image at full size — Drag over area to magnify

Zoom in — Zoom out
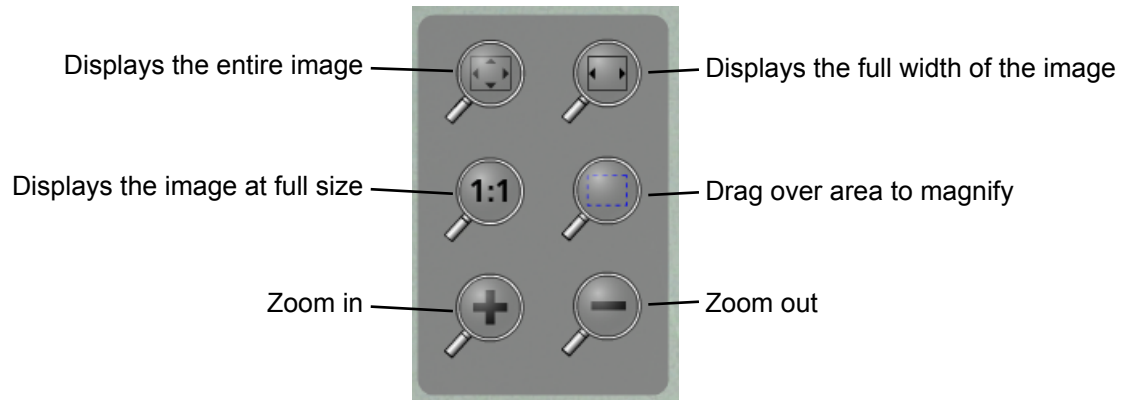
i **When the 🔍 icon is selected, the full width of the image will be displayed but this may cause some of its height to be cropped.**

i **The scrolling wheel on a compatible mouse can be used to zoom in and out.**

i **To pan the image in the Image area, hold down the right mouse button and drag it as required.**

3.5 Still capture

To capture a still from the image being displayed in the Image area, proceed as follows:

▶ Use the controls on the video source to obtain the desire image.

▶ Click on the ▶◁ icon in the Status bar. The icon will now be displayed as ❚❚◁ and a still image will be displayed at the top of the Image list. It will be highlighted blue to indicate it is currently being displayed in the image area and its filename will be displayed at the left-hand end of the status bar.

ℹ **The default filename allocated to a still image is created from the date and time it was captured.**

▶ Click on the ❚❚◁ icon, to return to displaying live video in the image area.

ℹ **If an annotation or dimension is added to an image whilst in the video mode, a still capture will be taken automatically.**

3.6 Handling captured images

Captured images can be renamed to aid identification, or deleted when they are no longer required, as follows:

3.6.1 Renaming a captured image

▶ Click on the image in the Image list which is to be renamed (scroll through the list if necessary). It will be highlighted blue and its current filename will be displayed at the left-hand end of the status bar.

▶ Click on the filename. It will be highlighted in green.

▶ Either type in the filename required, or click on the name again to edit the existing filename.

▶ When the filename has been changed, click **Done**.

3.6.2 Deleting a captured image

▶ Click on the image in the Image list which is to be deleted (scroll through the list if necessary). It will be highlighted blue and its current filename will be displayed at the left-hand end of the status bar.

▶ Click on the ✕ icon at the bottom right of the screen. The delete prompt will appear.

▶ Click **Yes** to delete or **No** to abort deletion.

ℹ **If all the images in the Image list are deleted, the Image area will display the video source or the bitmap image according to the Image source and Camera choice settings.**

3.7 Crosshair and active crosshair

3.7.1 Moving the crosshair

▶ To move the crosshair in the XY plane, ensure the ⤡ icon is displayed in the top left of the Image area. If the ↻ icon is displayed, click on it.

▶ Click and drag the mouse cursor on the Image area to move the crosshair. The movement will be reflected by the X and Y values in the Measurement display area.

▶ To zero the new position of the crosshair, click the **X** and/or **Y** buttons in the Measurement display area.

3.7.2 Rotating the crosshair

▶ To rotate the crosshair, ensure the ↻ icon is displayed in the top left of the Image area. If the ⤡ icon is displayed, click on it.

▶ Click and drag the mouse cursor on the Image area to rotate the crosshair. The movement will be reflected by the Q value in the Measurement display area.

▶ To zero the new angle of the crosshair, click the **Q** button in the Measurement display area.

3.7.3 Changing the colour of the crosshair

▶ With nothing selected in the Image area, click on the ⬤ icon in the top left of the Image area to change the colour of the crosshair. They will change in the following order:

Dark blue
Yellow
Light blue
Magenta
Black
White
Green (default)

3.7.4 Resetting the crosshair position

To restore the crosshair to its default position (i.e. the centre of the image area with zero rotation), click and hold the left mouse key over the ⤡ or ↻ icon for approximately 3 seconds.

3.7.5 Active crosshair

DimesionTwo includes a Video Edge Detection (VED) probe option, or Active Crosshair, which automatically finds the best point of the edge to take a measurement from. The Active Crosshair is selected by clicking the probe icon found in the bottom left toolbar. The selected probe will be indicated by the probe icon as shown in the figures below.

Active Crosshair Selected   Simple Crosshair Selected

A single edge position, detected within the Region of Interest (ROI) of the Active Crosshair, will be displayed as a small green "ringlet". This edge position is determined by a "Strongest Edge" algorithm that is executed against all pixels located within the ROI of the probe. This is the position that will be used when entering a point into a measurement (see *Figure 14* below).

Figure 14: The active crosshair
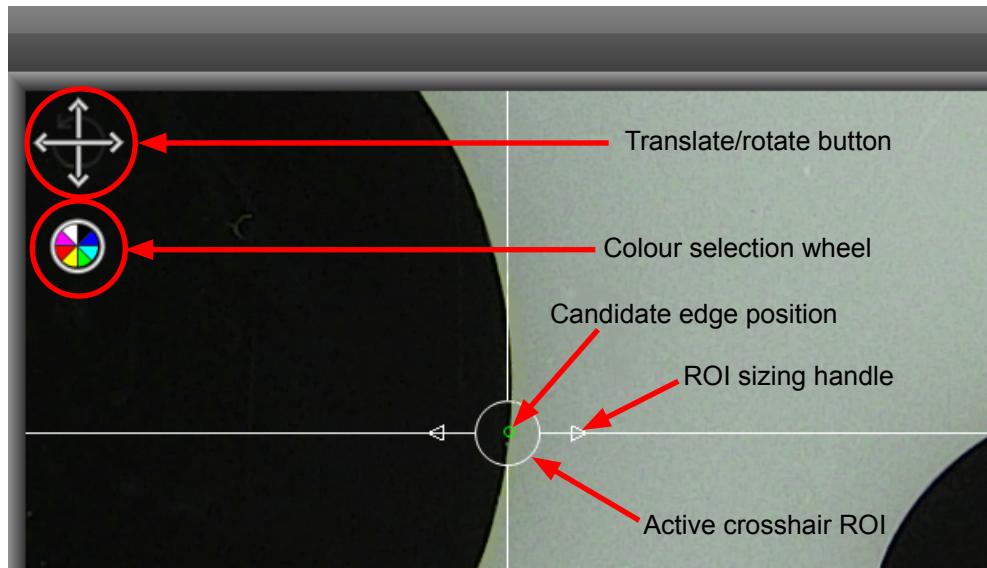
The size of the ROI for the Active Crosshair can be increased or decreased using the sizing handles located on opposite sides of the Active Crosshair ROI diameter. Click and drag to resize the ROI.

Both the Active and Simple Crosshairs can be moved or rotated over the image. The Translate/rotate button in the top left corner of the live video Image is used to switch between these modes. The colour of the crosshair can also be changed using the Colour Selection Wheel button found directly below the Translate/rotate button.

3.8 Magnification settings (with EVO Cam II)

3.8.1 Selecting pre-set magnification (and calibration) settings

The magnification (or zoom) setting on EVO Cam II can be changed via the DimensionTwo main display by selecting one of the pre-set magnification settings. A mouse-click on the file name in the top right of the screen will bring up a drop-down menu below it showing the other magnification settings in the same group (e.g. B1 to B10 in the example below). The required file (magnification) can be selected by a mouse-click, and the camera will respond accordingly.

Figure 15: Top right of the screen enlarged to show the magnification settings drop-down menu
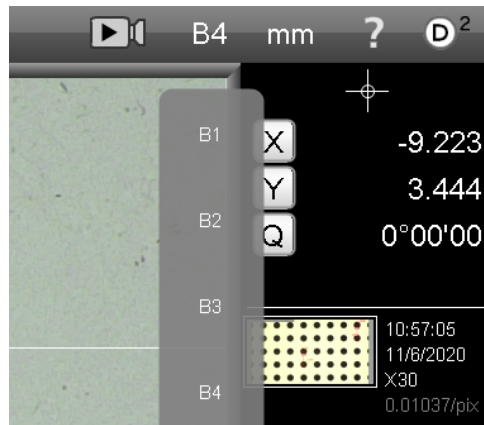
There are 10 factory pre-set magnification settings for each EVO Cam II lens. This means 10 files in each of 7 groups (7 lenses). As an example, the table below shows the zoom lens position for each pre-set magnification/calibration file for the x0.62 lens. The full set (for all lenses) is tabulated in Appendix 2 on *page 51*.

Table 1:The pre-set zoom lens positions for the 0.62x lens.

x0.62	File name	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
	Magnification (approx)*	2.60x	5x	10x	15x	20x	30x	40x	50x	60x	78.12x
	Zoom Lens Position	0	5330	9532	11357	12481	13942	14934	15607	16019	16384

The approximate magnification at each position is also shown (for a 24" Monitor with the screen display set at 1:1).

To access magnification settings in a different group (e.g. when changing lenses) hold down on the left mouse key when clicking on the file name to bring up the drop-down menu of groups (*Figure 16*). Alternatively, all files in all groups can be accessed via Magnifications in the Settings window (*Figure 17*): use mouse-clicks to change the calibration file displayed in the top right hand corner of the screen.

Figure 16: Top right of the screen enlarged to show the pre-set groups in the drop-down menu
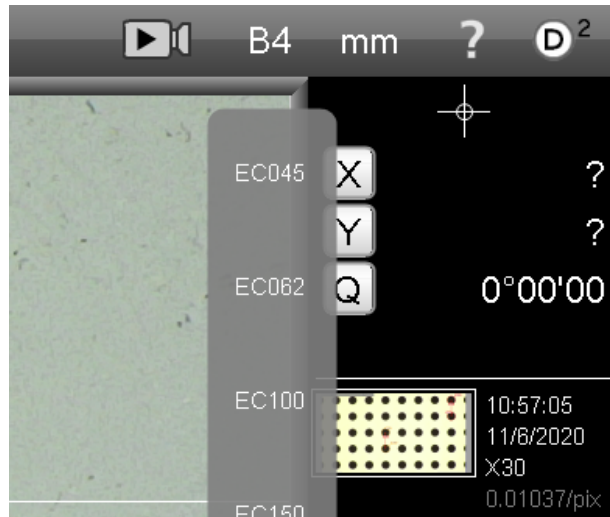
Each magnification setting file also holds the factory-set pixel calibration, and FOV calibration for that zoom lens position. So selecting a file (from the group corresponding to the fitted lens) will also allow accurate measurements at that setting to be made without the need for user calibration (see Section 3.10 on *page 31*).

3.8.2 Magnification files and displayed magnification

Pre-set magnification files for the 0.62x lens (see Table 1 on *page 23*) are named B1, B2, B3 etc. The corresponding (actual) magnification will depend on the size of the monitor being used and the 'displayed image magnification' setting in DimensionTwo (see Section 3.4 on *page 19*).

In order to display the true magnification, measure the size of the displayed image (diagonal) on the monitor, and enter this value in the EVO Cam II firmware settings for screen size. The correct magnification will then be displayed in the EVO Cam II firmware's on-screen display ribbon.

3.8.3 Creating magnification settings

i **To avoid overwriting factory pre-set magnifications/calibrations, it is recommended that different file names and groups names are used.**

▶ Go to **Magnifications** in the **Settings** menu

▶ Select **New**

▶ Enter a Group name (e.g. the lens name, or user name, or the date) in the **Group name** box and a file name in the **Name** box (e.g. '20x' to indicate the magnification). Then click the green 'tick' in the bottom right of the screen to exit the Magnifications window.

Figure 17: Magnifications window

▶ Repeat steps 2 and 3 (above) to add further file names / magnification settings.

▶ When ready, click **Done** to exit the Settings window and return to the display screen. The file name is displayed now in the top right of the screen next to the ▶ ◖ icon.

For EVOCam II, entering the correct zoom index position in the magnification file will enable the camera to go to the correct magnification when the file is selected. To do this:

▶ Select the required file name (magnification setting) using the drop-down menu box in the top right of the screen either on the main display or in the Settings/Magnificaitons window.

▶ On EVO Cam II, the focus setting needs to be set to manual focus (MF) mode and the focus set to infinity with the subject in sharp focus. If it is not in focus, go to a high magnification and manually focus using the camera column height adjustment dials.

▶ Use the EVO Cam II firmware controls to set the required magnification.

i **Rather than use the 'zoom in' an 'zoom out' controls on the EVO Cam II control panel, it may be easier to use 'set zoom limits' function in the firmware because this will ensure that the camera can be set to the discrete magnification of interest (e.g. exactly 10x rather than 9.92x or 10.06x etc.)**

▶ Mouse-click in the **Zoom lens position** window and then mouse-click on the **Use Current** button on the right hand side of the screen. The Zoom lens position box should now be populated with a 4 or 5 digit number.

▶ Select **Done** to exit the Magnifications window, and select **Done** again to return to the display screen.

When this file is selected, the camera zoom will now go to the required magnification. It is also possible to save a calibration to this file. The procedure for this is described in Appendix 3 on *page 52*.

3.9 Adding annotations

i | **If, after adding annotation to an image, another image is selected from the Image list, the annotation on the original image cannot be edited or deleted. However, new annotation can be added and edited.**

Annotations in the form of rectangles, circles, text and arrows can be added to an image as follows:

3.9.1 Adding shapes

▶ Select the ▭ or ◯ icon as required and click and drag the cursor in the Image area from where the shape should start until the required area is covered.

i | **If the image being displayed was direct from the video source a still capture will be taken automatically and an image will be added to the top of the image list highlighted in blue.**

i | **Whilst the shape is being drawn, the Measurement display area will display the position of the centre of the shape relative to the zeroed position of the crosshair (X and Y), and the width (W) and height (H) for rectangles and the diameter (D) for circles.**

i | **In order that correct measurements are displayed, the correct calibration file must be set (see page *page 24*). Note that if no calibration file is set, the displayed measurements will not be correct.**

▶ When the shape is completed (the mouse button released), the icon will no longer be highlighted and the position of the crosshair will be displayed.

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3.9.2 Editing shapes

▶ Click on the border of an existing shape. It will now be displayed as shown below.

Figure 18: Shape editing

Not selected   Selected

Not selected   Selected
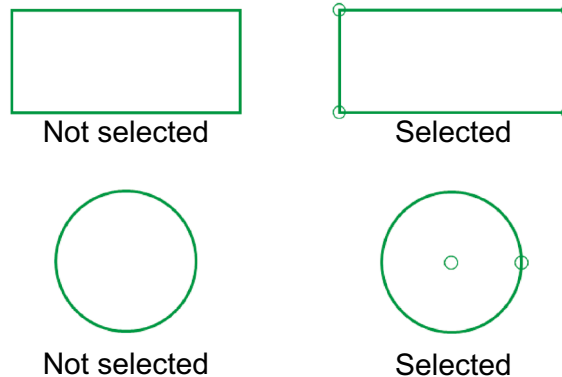
▶ To move a rectangle, select it and then click and drag it from one of its sides to the required position.

▶ To move a circle, select it and then click and drag from the circle at its centre to the required position.

▶ To re-size a rectangle, click and drag any of the circles in its corners until it is the required size.

i   **The aspect ratio of a rectangle can also be changed when it is re-sized.**

▶ To re-size a circle, click and drag the circle at its edge until it is the required size.

▶ To change the colour of a shape, select it and then click on the ⦿ icon in the top left of the Image area. The shape will change colour in the following order:

Dark blue
Yellow
Light blue
Magenta
Black
White
Green (default)

▶ To delete a shape, select it and click the ╳ icon at the bottom right of the screen.

3.9.3 Adding text

i **When text is added to an image, it will be in the form of an arrow attached to a text box.**

▶ To add text to an image, click the **T** icon and then click and drag from where the point of the arrow is required. Release the mouse when the text box is in the required position.

i **Whilst the text box is being drawn, the Measurement display area will display the position of the centre of the box relative to the zeroed position of the crosshair (X and Y), and the width (W) and height (H) of the box.**

▶ To add text, click the text box to select it (*Figure 19*).

Figure 19: Text box selection

Not selected   Selected
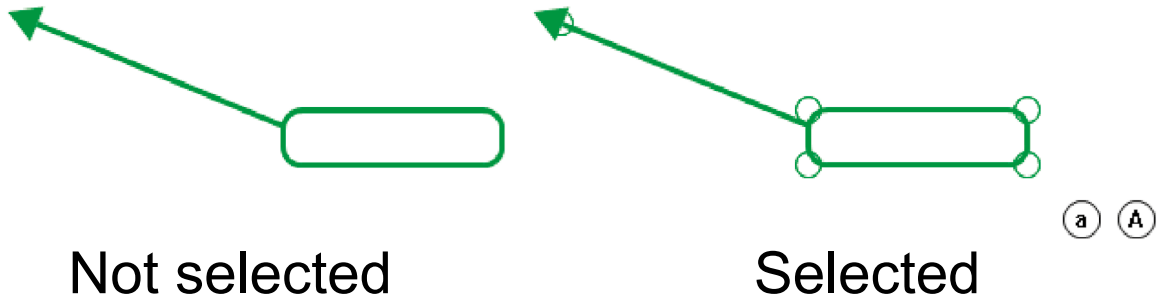
▶ Key in the required text and click the (a) icon to make the text smaller or the (A) icon to make it bigger.

3.9.4 Editing text

▶ To re-size the text box, select it and then click and drag on one of the corner circles until it is the required size and in required position (the call-out arrow head will remain in the same position).

▶ To move the position of the call-out arrow head, select it and then click and drag the arrow head circle until it is in the required position.

▶ To edit the text in a text box, select it. The text cursor, although not shown, is always at the end of the text. Use the Backspace key to delete text or key in text to add it to the end of existing text.

▶ To change the colour of a text box, select it and then click on the ⬤ icon in the top left of the Image area. The shape will change colour in the following order:

Dark blue
Yellow
Light blue
Magenta
Black
White
Green (default)

▶ To delete a text box, select it and then click the ✕ icon at the bottom right of the screen.

3.9.5 Adding annotation arrows

▶ To add an arrow, click the ↗ icon and click and drag the cursor from where the arrow head is required.

▶ Release the cursor when the length and position is as required.

3.9.6 Editing arrows

▶ To edit an arrow, click on it to select it (*Figure 20*).

Figure 20: Arrow selection
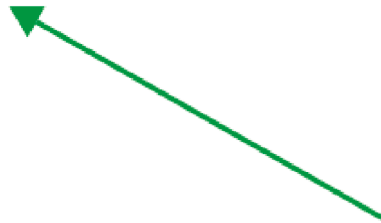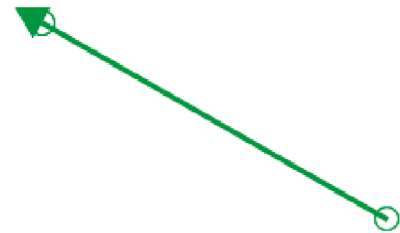
Not selected   Selected

▶ To move the position of the arrow head, select it and then click and drag the arrow head circle until it is in the required position.

▶ To move the position of the arrow tail, select it and then click and drag the arrow tail circle until it is in the required position.

▶ To delete an arrow, select it and then click the ✕ icon at the bottom right of the screen.

3.10 Measurement

3.10.1 Pre-conditions for measurements

Three conditions are required before initiating the measurement mode when using DimensionTwo with EVO Cam II.

▶ Auto Focus must be disabled. If it is enabled, a message will be displayed notifying the operator of this requirement.

▶ The system must be positioned at a calibrated/configured magnification position. Typically this will be one of the pre-set magnification settings discussed in Section 3.8.1 on *page 23*. This can be determined by looking at the top right toolbar to ensure a defined magnification position is selected. If it is not, an XX label will be displayed. **It is important to ensure also that the file selected is one of the group of pre-sets for the lens that is fitted (see** Appendix 2 on *page 51***).**

i **When entering measurement mode, if the system is not at a defined magnification, DimensionTwo will attempt to automatically reposition the magnification to the nearest defined position.**

▶ The Manual Focus setting on the EVO Cam II needs to be set to infinity with the subject in sharp focus. If it is not in focus, go to a high magnification and manually focus using the camera column height adjustment dials.

▶ If the measurement mode is selected when the EVO Cam II focus is not set at infinity, the "System Re-focus Routine" (SRR) will be automatically triggered: this will guide the user through the procedure to ensure that both the camera focus and the manual focus are at the correct settings. This procedure is described in Appendix 1 on *page 50*.

3.10.2 Measurement functions

The measurement functions are as follows:

- **Point**   This displays the X Y coordinates of a point relative to the current crosshair zero position.
- **Line**   This displays the best fit line through up to 9 selected points.
- **Circle**   This measures the diameter of a circle derived from 3 or more points
- **Length**   The measure the distance between 2 points or features
- **Angle**   This measures the angle between two existing lines, or derived from 4 or more points

Points are entered by moving the crosshair to the desired position (using the left mouse button) and then either pressing the right mouse button (while keeping the left button held down) or using the left mouse button to click in the Points Entry box (top right of screen).

Further details for each measurement function are given in the following pages.

3.10.3 Changing the display units
There are two possible unit buttons that can be displayed in the status bar:

- Inch/mm
- DD(decimal degrees)/DMS(degrees,minutes,seconds)

To set these buttons to appear, see Section 4.9.3 on .

▶ Click on these buttons to alternate between the units as required.

3.10.4 Displaying the measurement toolbar

▶ Click the   icon to display the measurement icons.

3.10.5 Resolution and precision

The terms resolution and precision have totally different meanings in the context of this dimensioning system and should not be confused with each other.

Resolution
The term resolution refers to the accuracy of the equipment generating the video image in the Image area. The higher the precision of the equipment, the more accurate the image supplied to the Image area.

Precision
The term precision is directly related to the operators ability to place points on the image accurately. The more precise the operator is about placing points on the image, the more accurate the readings will be.

3.10.6 Point

▶ Click the icon. The Point position box will be displayed in the Measurement display area (*Figure 21*).

Figure 21: Point position box
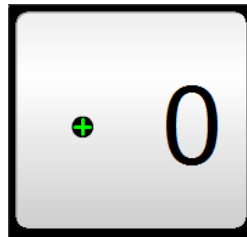
▶ Position the crosshair at the point position is to be measured and click in the Points Entry box. The counter will display 1.

i **Up to 9 points can be placed and the resulting point will be an average of those points.**

▶ Click ✕ to delete the each point and make another one or click ✓ to accept.

▶ When accepted, a box displaying the XY coordinates relative to the crosshair current zero position will be displayed.

▶ To delete the measurement box, select it and click ✕.

3.10.7 Line

▶ Click the [icon] icon. The Line box will be displayed in the Measurement display area (*Figure 22*).

Figure 22: Line box
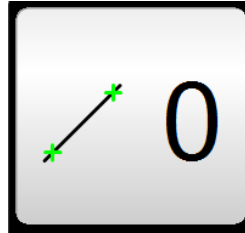
▶ Position the crosshair at the first point in the required line and click in the Points entry box. The counter will display 1.

▶ Position the crosshair at the second point in the required line and click in the Points Entry box. The counter will display 2.

i **There is no limit to the number of points that can be placed and the resulting line will be an average of those points. The angle of the line to the horizontal and the X and Y coordinates of the midpoint of the line are displayed.**

▶ Click [✗] to delete either point and make another one or click [✓] to accept the position of both points.

▶ To delete the line, select it and click [✗] .

3.10.8 Circle

▶ Click the ⬤ icon. The Circle box will be displayed in the Measurement display area (*Figure 23*).

Figure 23: Circle *box*

▶ Position the crosshair at the first point in the required circle and click in the Points entry box. The counter will display 1.

▶ Position the crosshair at the second point in the required circle and click in the Points Entry box. The counter will display 2.

▶ Repeat this for a third time.

ℹ There is no limit to the number of points that can be placed and the resulting circle will be an average of those points.

▶ Click ✗ to delete each point and make more or click ✓ to accept the position of all the points.

▶ When accepted, the diameter of a circle passing through the average position of all points will be displayed.

▶ To measure the radius of an arc, click the ▽ icon (which appears at the base of the screen after ✓ has been clicked) .

▶ To delete the circle, select it and click ✗ .

3.10.9 Length

▶ Click the ⟷ icon. The Length box will be displayed in the Measurement display area (*Figure 24*).

Figure 24: Length box
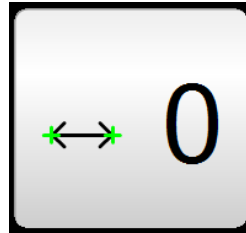
▶ Position the crosshair at the first point in the required length and click in the Points entry box. The counter will display 1.

▶ Position the crosshair at the second point in the required length and click in the Points Entry box. The counter will display 2.

▶ Click ✕ to delete each point and make another one or click ✓ to accept the position of both points.

▶ When accepted, the length of the line will be displayed.

▶ If measuring between circles or a line and a circle, click the ⬤ Icon (which appears at the base of the screen after ✓ has been clicked) for alternative distances

▶ To delete the length, select it and click ✕ .

3.10.10 Angle

▶ Click the ⬚ icon. The Angle box will be displayed in the Measurement display area (*Figure 25*).
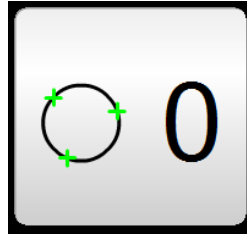
Figure 25: Angle box
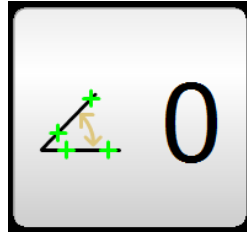
▶ Position the crosshair at the first point in the first line of the angle and click in the Points entry box. The counter will display 1.

▶ Position the crosshair at the second point in the first line and click in the Points Entry box. The counter will display 2. Up to 5 points can be entered on the first line

▶ Repeat the above 2 steps for the second line (the remaining points up to a total of 9 can be entered here).

i **There is no limit to the number of points that can be placed and the resulting lines will be an average of those points.**

▶ Click ✗ to delete any of the points and make another one or click ✓ to accept the position of all the points.

▶ When accepted, the angle between the 2 lines will be displayed.

▶ To display alternative possible angles, click the ⬚ icon (which appears at the base of the screen after ✓ has been clicked) .

▶ To delete the angle, select it and click ✗ .

3.11 Image/annotation contrast control

When an image has had annotations and/or dimensions added, the emphasis of image to additions can be altered so that the image is stronger than the annotations/dimensions or vice-versa.

This is achieved by the Opacity control ❶ in the Status bar (shown in *Figure 26* in the neutral position).

Figure 26: Opacity control
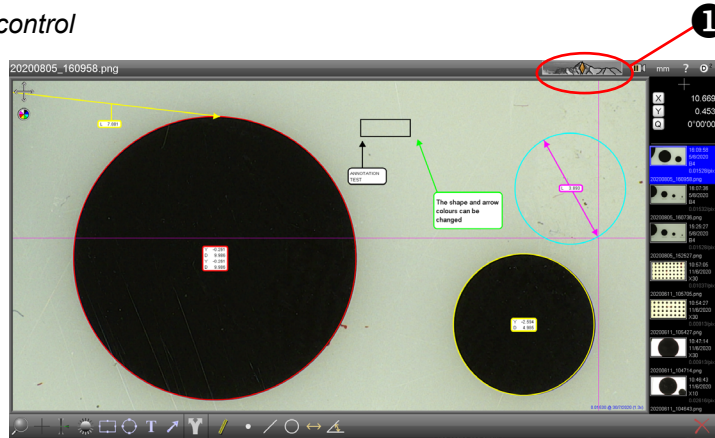
▶ Click and drag the orange slider to the left and the image is more prominent. Slide it to the right and the annotations/dimensions are more prominent (*Figure 27*).

Figure 27: Image control. Either the image or the annotations can be partially or wholly faded out.
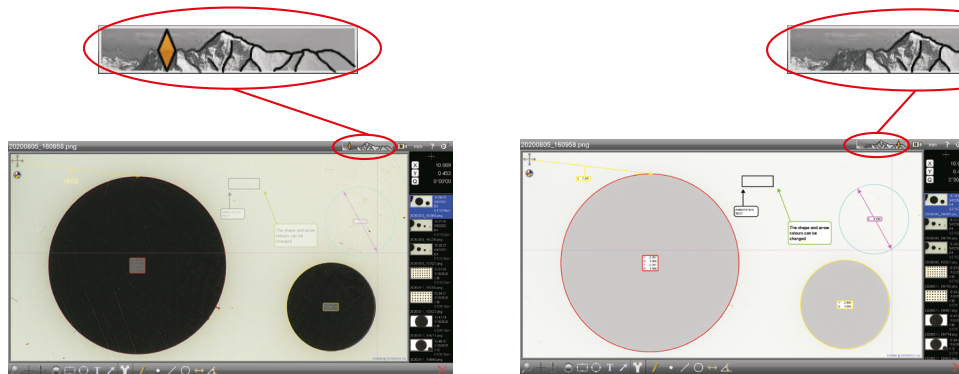
3.12 Output options

▶ Click on the [icon] icon to output the image currently displayed in the Image area in the following ways:

- [printer icon] **Print**   This will print immediately to the default printer

- [save icon] **Save to file** This will open the **Save file** dialogue box. Edit the filename (if required) and navigate to the required location (if required). Select Bitmap, JPG or PNG file type as required and click **Save**.

- [email icon] **Email**   This will open a new email with the file attached.

3.13 Calibration by the user

DimensionTwo provides factory pre-set calibrations for different magnifications. The calibration procedure includes: *field of view (FOV) correction, parcentricity correction* and *edge bias correction* and the pre-sets can be used to perform measurements over a range of magnifications and covering the whole displayed area.

Users can also use DimensionTwo to do their own calibration. This may be because a specific magnification is required that is not one of the pre-sets, or to further improve accuracy. Two levels of calibration by the user are possible:

- 'Pixel' calibration. This is the calibration method offered on DimensionOne and it is the most common calibration method used on digital inspection microscopes (including Vision Engineering's Mantis Elite Cam HD and Lynx EVO Smart Cam 5 systems). It can provide a measurement accuracy of 0.1% but, without the corrections listed above, it will be less accurate at low magnification towards the edges of the display due to lens effects.

  See Appendix 3.1 on *page 52* for the Pixel calibration procedure.

- Full calibration with corrections for FOV, parcentricity and edge bias. This is the method used for the factory pre-set calibrations. Some improvement over the factory calibration may be possible as, unlike the factory pre-sets, a full calibration carried out by the user will be specific to the user's EVO Cam II camera sensor and lens.

  See Appendix 3.2 on *page 53* for the full calibration procedure.

4. Settings

This section describes how to setup the software to meet a user's or a system's individual requirements, and covers the following:

- Accessing the settings menu (*page 41*)
- Software version information (*page 42*)
- Read/Write settings (*page 42*)
- Backup/Restore (*page 42*)
- Set language (*page 42*)
- Security (*page 43*)
- File locations (*page 45*)
- Video settings (*page 45*)
- Magnification settings (see section 3.8.3 on *page 25*)
- Desktop settings (*page 46*)
- Display formats (*page 48*)
- Sounds (*page 48*)
- Using custom settings files with Mantis Elite Cam HD and Lynx EVO Smart Cam (*page 49*)

4.1 Accessing the settings menu

To access the settings menu, proceed as follows:

▶ Click on the DimensionTwo logo ❶ to reveal the drop down menu (*Figure 28*).

▶ Click on the **Settings** button ❷. The Settings menu will be displayed (*Figure 29*).

Figure 28: Selecting the settings screen
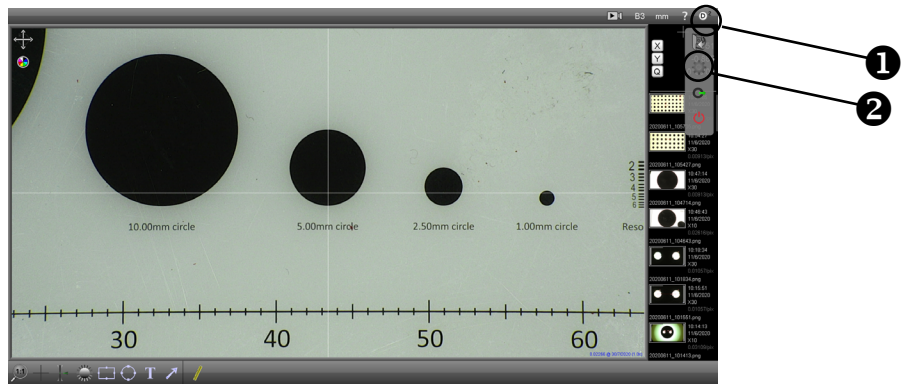
Figure 29: Settings screen
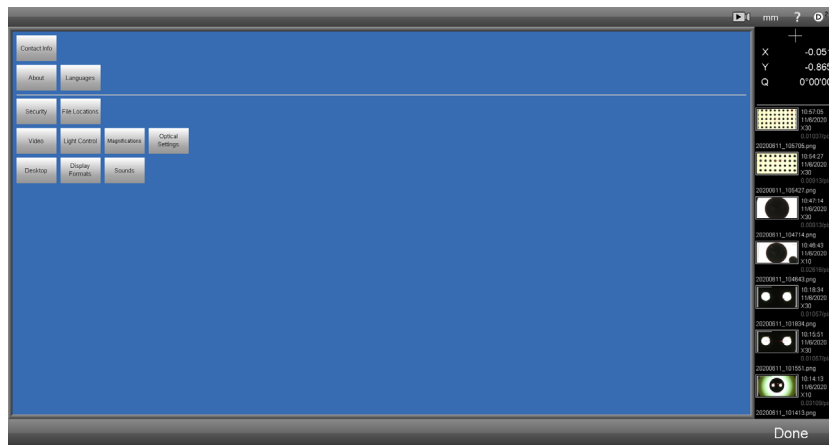
4.2 Software version

To access the information regarding the software, select **About** from the Settings menu.

4.3 Read/Write settings

i **These settings are not functional.**

4.4 Backup and restore

The settings (e.g. camera settings, magnification/calibration file being used) for the current user can be backed up and subsequently restored if necessary as follows:

i **It is always advisable to backup information to an external source. This can be achieved by setting the backup file location accordingly (***page 44***).**

▶ Ensure the user is correctly logged on.

▶ From the Settings menu, click **About**.

▶ To backup the current user's settings, click **Backup now**.

▶ To restore a backed up settings file, click **Restore backup** and select the relevant backup file.

▶ When complete, click **Done** to return to the Settings menu.

4.5 Set language

To set the language used by DimensionTwo, proceed as follows:

▶ From the Settings menu, click the **Languages** button.

▶ Click the required language from the list and click **Done** to return to the Settings menu.

4.6 Security

i **The first time the software is used, the security function will enable the Super Admin user to set the supervisor's password and up to 5 users' access rights and password. If the system is only ever going to be used by one person or all the users are to have equal rights, the security settings do not have to be changed.**

4.6.1 Initial security setup

This function enables the Super Admin to set the access rights for a supervisor and up to 5 users as follows:

▶ From the Settings menu, click the **Security** button. The Super Admin security screen will be displayed (*Figure 30*).

Figure 30: Super Admin security screen

▶ Click in the password field and click on the numbers and symbols now displayed at the base of the screen to enter the required Super Admin password.

▶ If required, enter the number of days the password will be valid for in the field below.

▶ Unless the DimensionTwo should always start with Super Admin logged in, set the **Automatically login as this user** field to No.

▶ The table below outlines the access rights of the supervisor and up to 5 users.

▶ Click on the drop down list to the right of the screen to select supervisor and the required users in turn.

▶ When the supervisor or a user is displayed in the drop down field, their displayed name, password information, account status, login status and access rights can be adjusted.

▶ When all required users' information has been adjusted, click **Done** to return to the settings menu.

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4.6.2 General security setup

Anyone that has been granted access to the security setup screen by the Super Admin can access this screen and make changes as follows:

▶ From the Settings menu, click the **Security** button. The security screen will be displayed.

▶ When the supervisor or a user is displayed in the drop down field to the right of the screen, their displayed name, password information, account status, login status and the following access rights can be adjusted:

- Language settings
- Video settings
- Display formats
- File locations
- Security settings
- Sounds settings
- Desktop settings
- Backup/restore settings

▶ When all required users' information has been adjusted, click **Done** to return to the settings menu.

4.7 File locations

Although DimensionTwo has predetermined folder locations for various file types, the user can select a different folder location for the following file types:

- Backups
- Exports
- Images

To select a folder for any of the above file types, proceed as follows:

▶ From the Settings menu, click the **File locations** button.

▶ Click on the required file type and navigate to the required folder.

▶ Click **OK** to make the change. The folder location will be displayed in the Location column.

▶ Click **Done** to return to the Settings menu.

4.8 Video settings

To access the video settings, proceed as follows:

▶ From the Settings menu, click the **Video** button.

▶ Make any changes necessary and click **Done** to return to the Settings menu.

4.8.1 Pixel resolution

! **This setting has been calculated from the latest calibration (***page 38***), DO NOT CHANGE.**

4.8.2 Line thickness for overlays

This value changes the thickness of the lines displayed for annotations and dimensioning.

4.8.3 Image source

Select between **Bitmap** (to display the default graphic in the image area), **Direct Show** (to enable Windows™ to display compatible video in the image area) or **uEye** (to display the image with settings taken from **uEye software**) from the drop down list. See *Section 5*.

The DimensionTwo software will have to be restarted for a change to this field to take effect.

4.8.4 Camera choice

Select the required camera from the drop down list.

The DimensionTwo software will have to be restarted for a change to this field to take effect.

4.8.5 Video source properties

Click this button to access the selected camera's video properties.

The DimensionTwo software will have to be restarted for a change to this field to take effect.

4.9 Desktop

To access the application settings, proceed as follows:

▶ From the Settings menu, click the **Desktop** button.

▶ Make any changes necessary and click **Done** to return to the Settings menu.

4.9.1 Lock window layout

If the window layout is locked, none of the screen area sizes can be changed.

4.9.2 Display inch/mm button

Alter this field to if you wish to display this button in the Status bar, in a pop-up menu at the base of the screen, or not at all.

4.9.3 Display dms/dd button

Alter this field to if you wish to display this button in the Status bar, in a pop-up menu at the base of the screen, or not at all.

4.9.4 Display keyboard button

The keyboard button is only used to call up a keyboard on a tablet computer.

Alter this field to if you wish to display this button in the Status bar, in a pop-up menu at the base of the screen, or not at all.

4.9.5 Shutdown computer on exit

If this field is set to Yes, the computer will shut down automatically when the DimensionTwo is closed.

4.9.6 Display at full screen size

If the field is set to Yes, the DimensionTwo software will display full screen with no minimise window or close controls.

4.9.7 Restore defaults at launch

If this field is set to Yes, all the settings that have been changed will be reset to the default state (see also Section 4.4).

4.9.8 Crosshair to click

With this option set to Off, the crosshair will perform as described on . When set to On, the crosshair centre will move to wherever the left mouse button is clicked (not suitable for touch-screen use).

4.10 Display formats

To access the Display format settings, proceed as follows:

▶ From the Settings menu, click the **Display formats** button.

▶ Make any changes necessary and click **Done** to return to the Settings menu.

4.10.1 Resolution settings

Set all the resolution settings to be realistic according to the quality of the equipment and magnification used.

4.10.2 Current inch/mm flag

Set this to be the preferred setting for this button.

4.10.3 Current dms/dd

Set this to be the preferred setting for this button. dms = degrees/minutes/seconds, dd = decimal degrees.

4.10.4 Use comma for decimal point

Set this to Yes or No as required.

4.10.5 Date format

Set this field to display the date in either DD/MM/YY or MM/DD/YY format.

4.11 Sounds

To access the Sounds settings, proceed as follows:

▶ From the Settings menu, click the **Sounds** button.

▶ Click in the Enabled column against the sound status to be changed and click **Done** to return to the Settings menu.

5. Using custom settings files with Mantis Elite Cam HD and Lynx EVO Smart Cam

▶ Install uEye Cockpit software (supplied with Vision Engineering Mantis Elite Cam HD and Vision Engineering Lynx EVO Smart Cam).

▶ Open uEye Cockpit software and adjust settings to create the optimal image for your subject.

▶ From the **File/Save Parameters/To file** option, save the Save the settings to ...Metlogix/Settings folder.

i **The file name MUST be saved as one of five file names to correspond to the 5 'Config file' settings that can be found in the Settings Menu, in the Video sub-menu.**

File name	'Config file' setting in DimensionTwo
DimensionTwo-1.ini	1
DimensionTwo-2.ini	2
DimensionTwo-3.ini	3
DimensionTwo-4.ini	4
DimensionTwo-5.ini	5

▶ Once the parameters are set the file can be modified in uEye Cockpit and recalled in DimensionTwo.

Appendix 1 - System re-focus routine (SRR)

When the SRR is initiated the following dialog will be displayed.

> The system is not currently at a calibrated magnification position. Press OK to proceed to the high magnification position.
>
> | OK | Cancel |
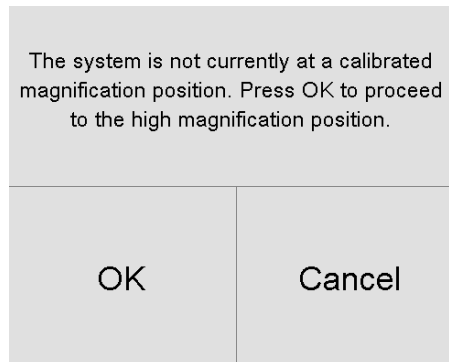
Pressing "Cancel" will close the dialog with no further changes to the operating state of D2. Select this if you want to address the re-focus issue yourself by a) setting the EVO Cam II to manual focus (MF) and setting the focus at 'infinity', and then b) ensuring that the subject is in sharp focus (at a high magnification) by *using the camera column height adjustment dials.*

Pressing "OK" will advance the system through the SRR. The SSR will cause the system to automatically optimise the camera's internal focus position and also to set the optical magnification to the highest configured position.

Once at the high magnification position, the operator will be prompted to manually put the surface of the target measurement subject into focus. **This focus adjustment should be performed using the camera column height adjustment knobs.**

Once in focus, click anywhere on the screen to return the system to the previous magnification position.

If that position was previously a calibrated/configured magnification position, the system will return directly to that position. If the previous position was 'un-configured' (i.e. showing an XX label at the magnification setting) then the system will return to the nearest calibrated/configured magnification.

Following successful completion of the "SRR" sequence the system will be in measurement mode.

Appendix 2 - Pre-set magnification/calibration files

There are 10 pre-set magnification settings for each lens (or group). The file names are tabulated below. The approximate magnifications at each setting are also indicated; these are based on the displayed screen size when using a 24" monitor and the 1:1 screen display option. The 'zoom lens position' at each setting is also shown in this table.

i **Each of these files also holds the factory-set calibration for that magnification/zoom lens position setting.**

x0.45	File name	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
	Magnification (approx)*	1.89x	3.5x	5x	10x	15x	20x	30x	40x	50x	56.7x
	Zoom Lens Position	0	4942	7405	11002	12609	13642	15042	15845	16238	16384
x0.62	File name	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
	Magnification (approx)*	2.60x	5x	10x	15x	20x	30x	40x	50x	60x	78.12x
	Zoom Lens Position	0	5330	9532	11357	12481	13942	14934	15607	16019	16384
x1.0	File name	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
	Magnification (approx)*	10x	12x	15x	20x	30x	40xx	60xx	80x	100x	126x
	Zoom Lens Position	6745	7934	9135	10540	12212	13267	14691	15587	16077	16384
x1.5	File name	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
	Magnification (approx)*	10x	15x	20x	30x	50x	75x	100x	125x	150x	189x
	Zoom Lens Position	3402	6745	8549	10540	12609	14060	14830	15406	16077	16384
x2.0	File name	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
	Magnification (approx)*	15x	20x	30x	50x	75x	100x	125x	150x	200x	252x
	Zoom Lens Position	4552	6745	9032	11503	13038	14060	14830	15406	16077	16384
4D	File name	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
	Magnification (approx)*	2x	3x	5x	10x	15x	20x	25x	30x	35x	42.84
	Zoom Lens Position	2320	6045	9032	12142	13616	14625	15346	15829	16125	16384
5D	File name	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10
	Magnification (approx)*	2x	3x	5x	10x	15x	20x	30x	40x	50x	52.92
	Zoom Lens Position	775	4059	7877	11288	12856	13886	15261	15988	16323	16384

* Approximate magnifications for a 24" Monitor using the DimensionTwo 1:1 displayed screen magnification setting.

Appendix 3 - Calibration procedures

i Before starting any calibration, a file for each magnification/calibration setting required should be created. See Section 3.8.3 on . To avoid overwriting the factory pre-sets, it is recommended not to use the same file names (A1 through to G10) or group names.

A3.1. Pixel Calibration

▶ 1. When used with EVO Cam II, the Auto Focus must be disabled. If it is enabled, a message will be displayed notifying the operator.

▶ 2. The Manual Focus setting on the EVO Cam II needs to be set to infinity with the subject in sharp focus. If it is not in focus, go to a high magnification and manually focus using the camera column height adjustment dials then return to the required magnification by selecting the required magnification setting.
Alternatively, if the measurement mode is selected when the EVO Cam II focus is not set at infinity, the **System Re-focus Routine** (SRR) will be automatically triggered: this will guide the user through the procedure to ensure that both the camera focus and the manual focus are at the correct settings. This procedure is described in Appendix 1.

▶ 3. Ensure that the 'enable FOV' button in Settings/Video is unchecked.

▶ 4. Place a calibration card (Figure A1 below) or a circular subject of known diameter, under the lens of the video source. A calibration slide is supplied with the DimensionTwo software.

▶ 5. Use the circle measurement tool (Section 3.10.8 on) to measure the diameter.
In order to increase the accuracy and repeatability of the calibration, measurements should be performed with the Active Crosshair (Section 3.7.5 on). There is no limit to the number of points that can be selected around the circle perimeter. On completion, click on the green tick in the bottom right of the screen.

▶ 6. The results will appear in the Measurement display area (top right of screen). Click and hold the left mouse button over this area until the calibration box is displayed (see Figure A2 below).
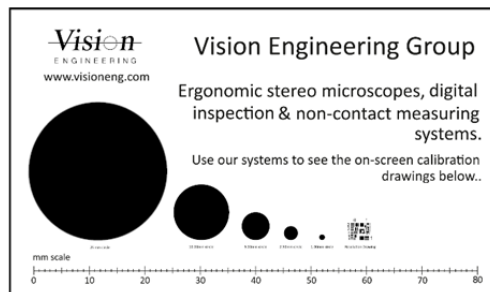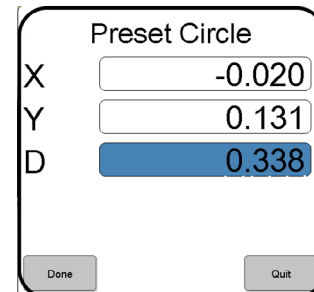
Figure A1 – Calibration card   *Figure A2 - Circle calibration box*

▶ 7. Click in the D (diameter) field and enter the relevant known value of the circle diameter measured and click **Done** to complete the pixel calibration.

▶ 8. Check the calibration accuracy by making a measurement of the calibration circle. Be prepared to repeat the calibration procedure (steps 5 to 7) if necessary.

i **This may be necessary when performing the calibration at a magnification setting for the first time. This is because the pixel calibration is a correction to whatever the current calibration size is, so if the initial value is not close, the pixel calibration will need to be repeated to improve the calibration. Typically, a first calibration may accurate to ~0.5% and the repeat calibration accurate to 0.1% or less.**

▶ 9. Repeat the calibration procedure at all required magnification settings. On completion it is recommended that the software is backed up to ensure that the calibration information is saved; go to the Settings menu, open the **About** window, select **Backup Now** in the bottom left of the screen.

A3.2. Full Calibration

Listed below is recommended order for performing a full calibration which includes the various calibration corrections.

- A. Pixel Calibration
- B. Field of View Correction.
- C. Parcentricity Correction.
- D. Edge Bias Correction.

i **If calibration corrections are to be performed at more than one magnification, it is important to start at the highest magnification and work down.**

A. Pixel Calibration

This is described in the previous section (see Appendix A3.1 on *page 52*)

B. Field of View Correction

Field of view (FOV) correction will require a calibration grid and is performed at each optical magnification setting to correct for the effects of spherical lens aberration on measurements. The FOV calibration is accessed using the **FOV Cal** button located in the **Video** setup screen.

▶ 1. Click on the 🔍 to set the displayed image magnification to 'Displays the entire image'.

i **If the displayed image magnification is incorrect, DimensionTwo will show an error message and prompt you to do this at when 'Teach' is pressed (see point 5 below).**

2. Select the desired magnification setting (file) to be calibrated using the file selector on the main screen or in the top right corner of the Video setup screen (as shown Figure A3 below). If more than one magnification is to be calibrated, start with the highest magnification.

3. In Settings/Video screen, define a filename in the 'FOV corrections file name' window (as shown Figure A3 below). This is for storage of the FOV correction file at the selected magnification. Once generated, FOV calibration files will be stored in the Metlogix/Settings directory.

Figure A3 – Video screen (in Settings)

4. Next, place the calibration grid in the field of view and, if required, use the manual height adjustment to focus the image. ***A calibration grid is supplied with DimensionTwo.*** Make a note of the number of full circles (columns and rows) in the displayed image.

5. Press the **FOV Cal** button and specify the grid parameters for the calibration grid being used; the X and Y Spacing, and the 'calibration circle diameter'. Then enter the 'X dot count' (number of columns) and the 'Y dot count' (number of rows) in the displayed image. Then press the **Teach** button to start the calibration.

Figure A4 – FOV Cal screen
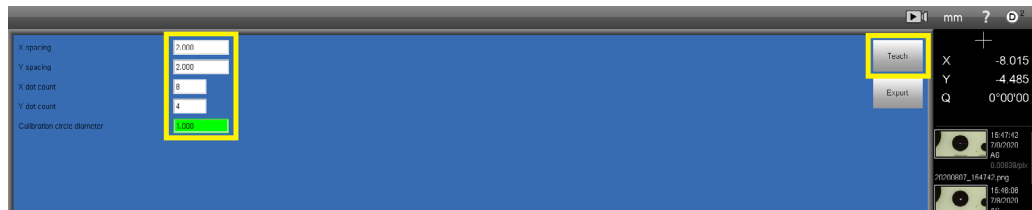
▶ 6. The displayed image of the calibration grid will now be overlaid with a grid of green crosshairs corresponding to the number of columns and rows entered (see Figure A5 below). Align the calibration grid so that the crosshairs are positioned over the associated calibration circles (align those in the centre as centrally as possible).

Figure A5 – Calibration grid with green crosshairs overlaid
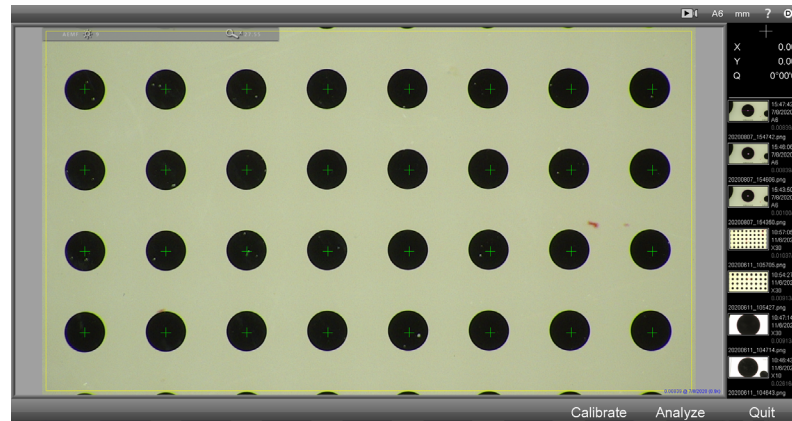
▶ 7. Press the **Analyze** button to assess the level of FOV error in the current image. This error will be displayed as error whiskers. These whiskers will depict the direction and magnitude of error at each calibration position (see Figure A6 below).

*Figure A6 – Calibration grid information after selecting **Analyze***
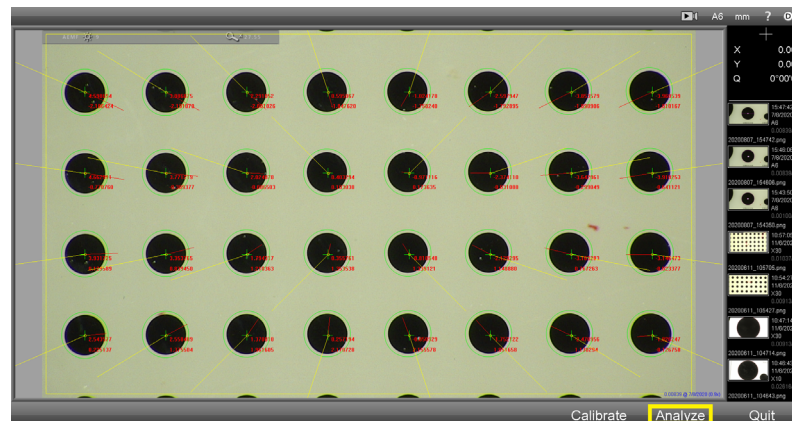
▶ 8. Press the **Calibrate** button to execute the FOV calibration. If successful, the system will return to the FOV calibration screen and a message will be displayed indicating successful calibration (as shown in Figure A7 below). Similarly, if the calibration fails, this will also be indicated. If the calibration fails: ensure the calibration crosshair intersections are completely within the calibration circles, ensure that all calibration circles are entirely within the drawn yellow box, ensure that all the circles show good contrast (adjust lighting if necessary).

Figure A7 – Successful FOV calibration

▮ **The FOV calibration can be disabled and enabled in the Settings/Video screen. Switching it off or on will enable/disable it for all magnification settings. Once FOV calibration is complete, FOV should always be enabled when measuring at this setting. This is because the FOV 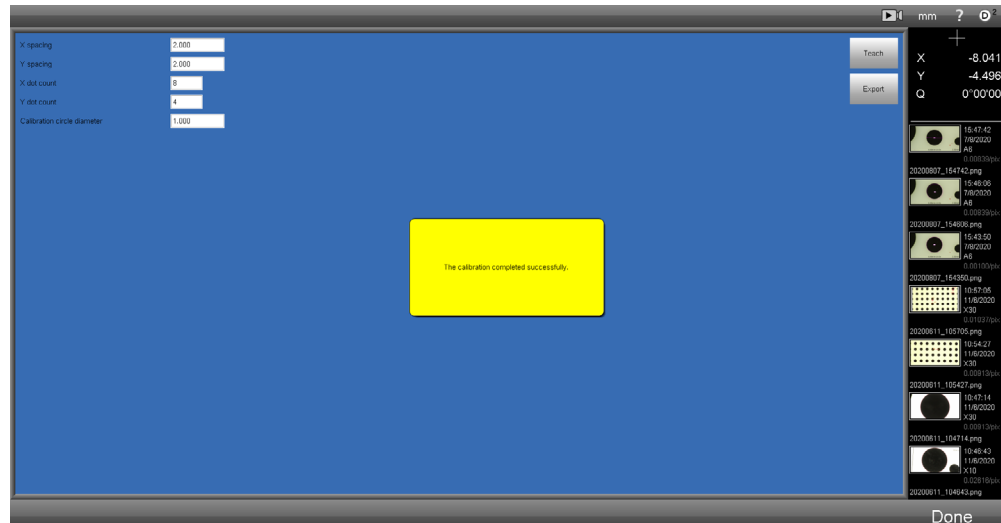calibration routine modifies the measured pixel calibration values (to and an average value for the screen as a whole) and so these values may no longer be optimal for non-FOV measurements.**

C. Parcentricity Correction

Parcentricity correction may be required if some X, Y offset exists between the centre positions of each magnification, as you move through the configured zoom levels of the system. Parecentricity correction, when used, is always performed across all defined magnifications of the system. The parcentricity correction mechanism is accessed within the **Optical Settings** setup screen.

▮ **This setup screen will only be available when more than one magnification has been defined for the system.**

Follow the steps below to perform the parcentricity correction routine;

▶ 1. Access the **Optical Settings** screen and press the **Start Cal.** button to begin the circle feature collection phase of the routine.

i **If parcentricity offset values already appear in the system, the *Clear Cal* button should be used to set all offsets back to zero before proceeding with the calibration.**

Figure A8 – Optical Settings screen
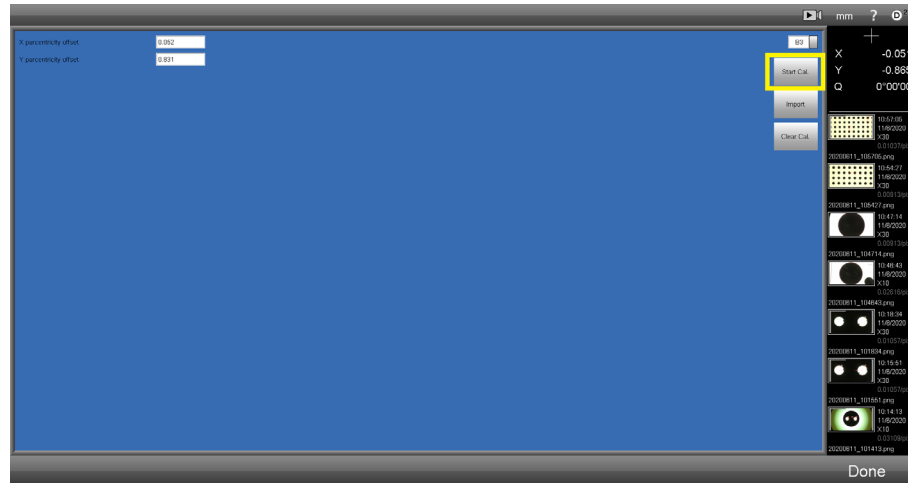
▶ 2. Select the highest magnification defined in the system and place a circle feature (e.g. use a calibration card) in the centre of the field of view.

i **It is very important that the circle feature is not moved, remaining in the same position throughout the measurement process at each magnification.**

▶ 3. As described in Appendix 3.1. Pixel Calibration on *page 52*, use the Active Crosshair to measure the circle feature at the centre of the FOV. Select the green tick on the bottom right of the screen to complete.

▶ 4. Repeat this process at the next magnification down, measuring this same circle. Continue this same sequence until this same circle feature has been measured at each defined magnification in the system.

▶ 5. Once all circle features have been measured, return to the **Optical Settings** screen and press the **Import** button. A message will be displayed indicating successful import of the calibration circles, as seen below. This will apply the calculated X and Y offsets to each magnification, with the high magnification position being the reference magnification position (X=0, Y=0 Offset).

Figure A9 – Successful parcentricity correction

The calibration features were successfully imported.

ℹ **The current offset values at each magnification setting can be viewed by toggling the current magnification in the top right corner (red band in the figure above). The current offsets will be displayed in the X and Y parcentricity offset fields (green band in the figure above).**

D. Edge Bias Correction

Having completed the calibrations and corrections up to this point, users may find that there is a small positive or negative bias in measurements. For example, when making repeat measurements of a calibration circle, the measured value is found to be consistently lower (or higher) than the calibration value and that this 'bias' is present at all magnification settings. This small pixel error is caused by optical anomalies inherent in the optical system. The procedure to correct for it is straightforward.

The Edge Bias correction is an estimate of the bias (in the units of the measurement) and will be applied to all defined magnifications in the system. Follow the steps below to apply Edge Bias correction:

1. Determine the required amount of Edge Bias correction by measuring a variety of calibrated artifacts across a range of magnifications. In the example below, 2.5mm and 5.0mm diameter calibration circles were measured at different magnification settings.

Magnification setting	Measured diameter (mm)	Difference from calibration circle diameter (mm)	Suggested Edge Bias correction
B9	2.490	0.010	
B8	2.494	0.006	
B7	2.497	0.003	-0.002 (for each edge)
B6	2.497	0.003	
B5	4.996	0.004	
B4	4.996	0.004	

2. Enter the Edge Bias correction value into the **Edge Bias** settings field in the **Video** screen (see figure A10). In the example above, an additional value of 0.004mm would improve all of the measurements. There are two edges in the measurement, hence the magnitude of the Edge Bias correction is 0.002.

Figure A10 – The Edge Bias window on the Video screen
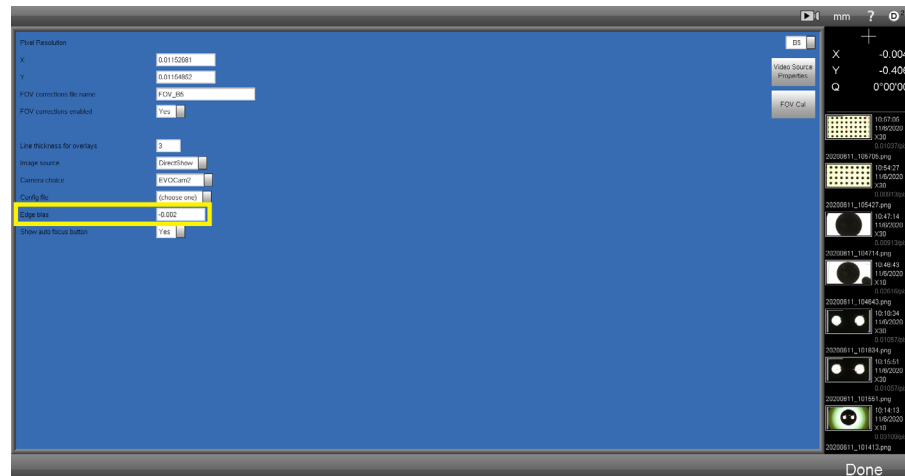
The sign of the applied Edge Bias correction is important. **The value will be applied in the direction of the material (dark pixels). So for a dark calibration circle, entering a positive value will *shorten* the diameter. Hence, in the example above a negative value should be entered i.e. -0.002.**

The following scenarios are based on the measurement of a calibrated circle to determine the Edge Bias correction:

- If the subject is a "boss" feature, and the measurement needs to be made larger, a negative Edge Bias value should be entered. To make the "boss" feature smaller, a positive Edge Bias value should be entered.
- If the subject is a "bore" feature, and the measurement needs to be made larger, a positive Edge Bias value should be entered. To make the "bore feature smaller, a negative Edge Bias value should be entered

▶ 3. Once the Edge Bias correction value has been entered. Repeat measurements of the calibrated artefact(s) to check that the accuracy has been improved i.e. that the correct magnitude and sign has been applied for this correction.

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