MEDMONT DV2000

DIAGNOSTIC VIDEO IMAGING

USER MANUAL

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1. Introduction

The Medmont DV2000 provides an integrated solution for capturing and manipulating digital video images from a range of clinical instruments.

The DV2000 Software is a part of Medmont Studio, an integrated clinical environment. Medmont Studio is an extensible software framework that allows different medical instruments to be fully integrated into a single working environment. For hardware requirements see the Medmont Studio manual.

See the Medmont Studio documentation for help on installing and using the Medmont Studio environment.

2. Warranty

The DV2000 software has been designed with all due care and subjected to stringent testing before leaving our factory. The Medmont DV2000 Diagnostic Video software is guaranteed for 12 months from the date of purchase as evidenced by the invoice. During this warranty period Medmont or an authorised agent will replace or upgrade the software free of charge. Such fixes do not extend the warranty period. The warranty does not cover defects due to incorrect handling, installation or set up, non-compliance with the requirements for computer hardware and associated mains powered equipment as specified in the User Manual, unauthorised modifications, loss of the license, loss of income, or service and repair costs for components and associated equipment.

3. Important Facts

This manual does not provide guidance on interpretation of clinical results. The clinician must ensure that he or she has received appropriate medical training in such interpretation. For this reason Medmont cannot be held responsible for misdiagnosis of results.

License

The DV2000 software requires a DV2000 license to be installed in Medmont Studio (see the Medmont Studio manual).

Symbols and Labels

Warning - In event of user error or equipment fault condition there may be a serious risk to health or life of patients or operator, or product damage or loss may occur.

Precaution.

Attention, consult accompanying documents.

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Compliance with the EC Directive 93/42 EEC for medical devices.

Optional Accessories

The following items are optional accessories for the DV2000 software.

Footswitch.

S-Video frame capture card (Leutron).

RGB frame capture card (Flashbus MV Pro).

4. Installation

Medmont staff, or their authorised representatives, will normally install the DV2000 hardware and software. These instructions provide guidelines on the installation process when this is not the case (if for instance you decide to install the DV2000 on another PC). Only a qualified PC technician should perform the hardware and software installation.

There are three basic tasks associated with installing the DV2000:

1. Installing the DV2000 Software.
2. Installing the video capture card.
3. Connecting the video camera and capture switch.

The DV2000 software can be installed without a video capture card to allow review of DV2000 Images. Facilities also exist to allow video capture from TWAIN and DirectShow sources.

Software Installation

The DV2000 software is a component of the Medmont Studio software package. A single CD is supplied with installation software for all Medmont Studio components.

- Select the DV2000 component when asked which components to install.
- Select the appropriate capture card to install its drivers.

See the Medmont Studio documentation for more details on installation.

Video Capture Card Installation

The DV2000 Software supports three video capture boards: Leutron Pic Port, Flashbus, and Picolo.

Installing the Capture Card

To prevent electro-static damage that can occur when handling electronic equipment, use a ground strap or similar device when performing this installation.

1. Turn off the computer.
2. Turn off all accessories (printer, modem, monitor etc) connected to the computer.

3. Unplug the computer and all accessories.
4. Remove the cover from the computer. Refer to your computer user manual for instructions.
5. Select an unused PCI slot and remove the cover, retaining the screw that held the cover in place.
6. Discharge any static build-up on your body by touching the metal case of the computer.
7. Remove the capture card from its anti-static box touching the edges of the card only.
8. Carefully insert the capture card into the PCI expansion slot, gently pressing down until the board is firmly seated.

Do not force the board into place. If you encounter resistance when inserting the board, remove it and try again. Do not move the board from side to side during installation as this may damage the PCI bus connector.

9. Secure the board in place using the screw removed from the cover in step 5.
10. Replace the cover on the computer.
11. Reconnect power and accessories.

Running the Software

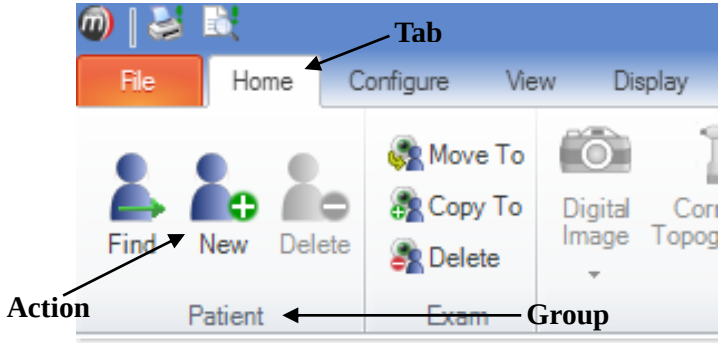
Select the Medmont Studio icon from the **Start > Program Files > Medmont** menu or double-click the desktop icon. A banner with the Medmont Studio logo is displayed while the software loads.

Verify that the DV2000 component has been installed by selecting the **Help** button in the top right corner of Medmont Studio, then selecting **About Medmont Studio 6** from the drop down menu. This displays a dialog that lists the installed components.

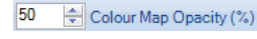
Software Conventions

The term **Application Button** refers to the circular button in the top left of the menu bar. This button can have different icons but is always in the same position on the ribbon bar. When navigating the application button menu we use the following format: **Application Button > Import**.

When referring to menu selection, the terminology **Home > Patient > New** means click on the **Home** ribbon bar tab, then look for the **Patient** group on the ribbon bar and click on the **New** icon. This format conforms to the **Tab > Group > Action** system for identifying menu items in a ribbon bar menu system.



Some keyboard shortcuts can be used when setting spin-box controls like the one shown here. Use the numeric keys for direct entry, up/down arrows for small steps, PgUp/PgDn keys for large steps, and the Home/End keys to move to the opposite end of the currently selected number.



5. Defining and Editing Image Sources

The image camera produces a video format signal that requires conversion to a digital form before it can be captured by the DV2000 software. A plug-in board that accepts S-video, Firewire, or High Speed USB, depending on the camera, typically provides this conversion.

During installation a default video source is created, and the settings for the source are configured, including the displayed name and input type (eg PAL S-Video / Composite, etc). If you have multiple capture boards or use a single board for multiple instruments (eg S-Video input for Slit Lamp and Composite Video for Retinal Camera), then these additional capture sources can also be configured at this time.

The default image source does not define any automatic Capture/Import or Print image operation. You can change this behaviour by defining your own image source as described in this section.

On the **Configure** tab, click **Image Sources** to display the Image Sources dialog (See Figure 1).

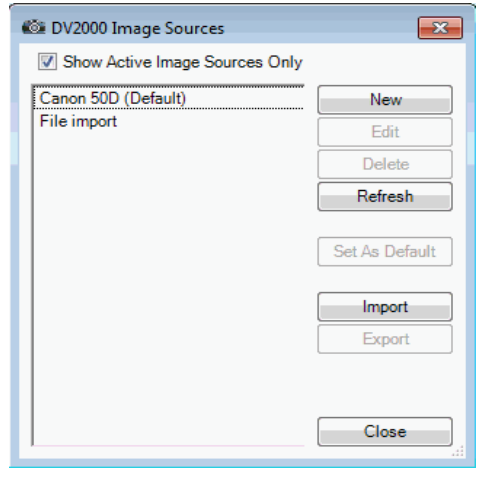


Figure 1. Defining / Editing DV2000 Image Sources.

Adding a New Image Source

To add a new image source, click on the ***New*** button to display the Edit Image Source dialog (See Figure 2). The available options may vary according to the type of installed Video capture card.

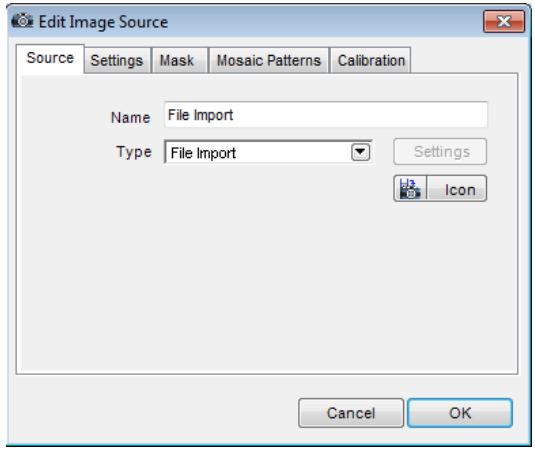


Figure 2. Editing the File Import image source.

Select the image source from those available in the **Type** drop-down box as shown in Figure 3. Give the source an appropriate name (this name will be displayed in the Capture Window title bar).

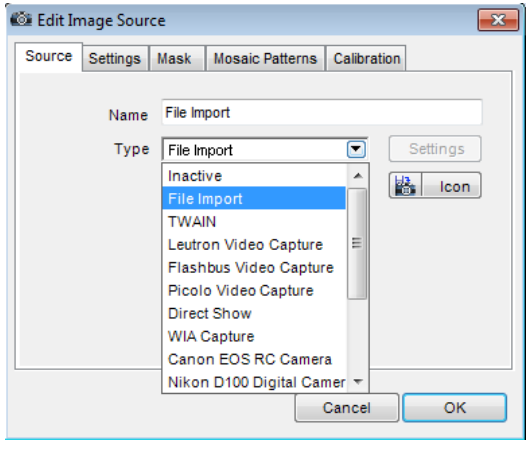


Figure 3. Edit Image Source dialog.

Click the ***Settings*** button to make any source changes (see Figure 4). Select the video standard and format of the video camera. The video source formats available are:

File import
TWAIN
Leutron Video Capture
Flashbus Video Capture
Picolo Video Capture
DirectShow

If you are unsure of the correct standard and format, plug in the video camera, turn it on, and use the ***Auto Detect*** option to select these parameters automatically. Modify the fields as required and click ***OK***.

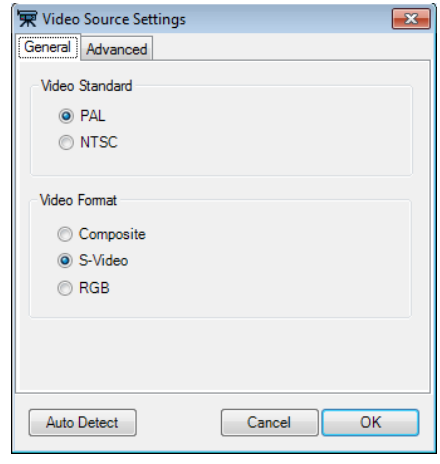


Figure 4. Video Source standard settings dialog.

Change the image save format to suit your practice preference.

Creating and Importing Image Masks

When capturing retinal images, all image data around the retina itself (the black border around the retinal image) is irrelevant and can be discarded. If left as a part of the image, printed retinal images will include this large black area, wasting ink and producing paper curl on some printers.

An Image Mask is a template that discards image data which falls within a specified area, allowing only data that falls within the transparent area of the mask (shown as white) to pass through. The **Mask** tab within the **Edit Image Source** dialog is shown below in Figure 5:

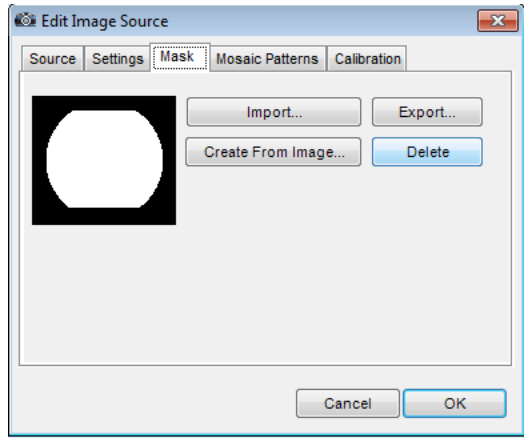


Figure 5. The **Mask** tab.

There are two methods by which you can select an Image Mask from the **Mask** tab within the **Edit Image Source** dialog;

1. You can import a pre-existing Image Mask by clicking on the 'Import' button, shown above. To import an Image Mask that has already been created in Medmont Studio (or in other image processing software), click 'Import'. Select the file and click 'Open'.

2. You can also automatically generate an Image Mask based on any existing image. To do this, click 'Create From Image'. After selecting the desired image, click 'Open', this tool will automatically determine the mask area based on the contrast and brightness values of the image itself and create an accurate mask area. Follow these steps to create your own image mask using this tool:

    - Open the Medmont DV2000 Digital Imaging software by clicking **Home > New Exam > Digital Image** and selecting your image source from the list.
    - Place a clean, white piece of paper immediately in front of the lens of your retinal camera and capture an image.
    - After capturing the image, save it to a Patient, close the DV2000 window and find the captured image in the tree view of Medmont Studio.
    - With the exam selected, click **Edit > File > Export**. Give the file a name and save it to your desktop.
    - Click **Configure > DV2000 > Image Sources**. Choose the appropriate image source for your retinal camera and click

Edit. In the Image Mask section, click on the **Create from Image** button and locate the file on your desktop, then click **Open** with the file selected.

- Medmont Studio will quickly analyse the image and create an image mask, giving a preview of the resulting mask (shown above). This mask will be applied to all image captures that use that image source.

DV2000 Calibrations

A calibration is defined for each image source. By default all measurements are in pixels. The calibration settings can be accessed from the Settings tab of the Edit Image Source screen (see Figure 6) which provides a conversion between pixels and real world measurements. This is particularly useful when doing comparison of images taken over time or with different capture sources.

The **Scaling Factor** is the value that multiplies all measurements on the image to convert them from screen pixel values to real world values. The scaling factor can be used to either magnify (>1) or reduce (< 1) the screen pixel values. For instance, you may want to measure distances in millimetres (mm) instead of pixels. Depending upon how your camera is set-up, work out a scaling factor and enter it here. All images now captured from this image source will give you measurements in mm.

Disclaimer: Medmont Pty Ltd is not responsible for inaccurate measurements due to an incorrect scaling factor. Please ensure that your measurements are precise and that the calibration values have been entered correctly.

By default the origin of the captured image is at the centre of the image. You can change this origin by specifying a new **Origin** pixel in X and Y values.

Editing an Existing Image Source

To edit an existing image source, click on the **Edit** button to display the same Edit Image Source dialog (see Figure 6). Note that now the Calibration settings are fixed (greyed). You cannot change these settings from their initial values, as it would mean an incorrect calibration would apply to images previously captured with this source.

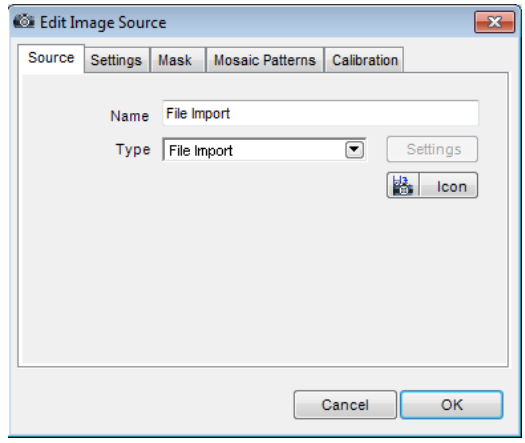


Figure 6. Edit Image Source dialog for existing source.

Select the image source from the **Type** drop-down box (see Figure 6). Click the **Settings** tab to make any changes. Modify the fields as required and click **OK**. To delete an Image Source, select its name and click the **Delete** button.

Once you have created an image source, you can capture or import images to include in an exam. Note that the image source applies to all the images for that exam. If necessary, you can change the image source assigned to a particular exam by displaying the details view for the exam (see Figure 24)

CAUTION

Be very careful when changing the image source. An exam is derived from a particular image source, and changing it will affect all subsequent image measurements.

Customising Image Source Icons

You can now change DV2000 Image Source icons, allowing you to clearly define and distinguish between exams taken with different image sources when working with multiple cameras and other sources. Customised icons will appear in the tree pane in Medmont Studio, as seen in Figure 7:

Figure 7. Customised Image Source Icon

Click **Configure > DV2000 > Image Sources** to define an icon. Select the image source you want to customise and click **Edit**. This will display the **Edit Image Sources** dialog (Figure 8).

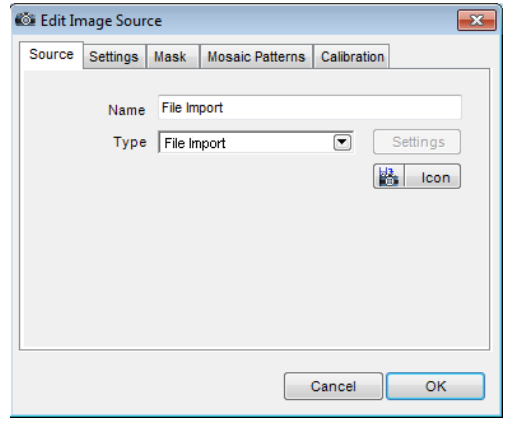


Figure 8. Edit Image Source dialog

Under the **Source** tab, click the **Icon** button. From the resulting dialog, locate and select your desired icon file, which must be in 16-bit .ico format, then click **Open**. After clicking **OK** in the **Edit Image Source** screen, this will apply the new icon to all existing and future exams that use that image source.

Adding Image Source Icons to the Toolbar

Each Active Image Source may be quickly accessed from the ribbon bar by expanding the **Home > New Exam > Digital Image** list (see Figure 9).

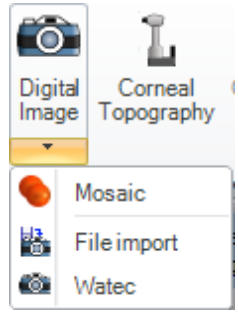


Figure 9. Image source list

Click an item from the list to automatically launch an exam using that image source.

Advanced Source Setup

The advanced setup is only required in special circumstances, for example if you are setting up multiple capture cards or using the DV2000 to capture images from certain retinal cameras.

Setting up Multiple Leutron Capture Cards

From the Image Source dialog (see Figure 1), click on **New** and choose Leutron. Specify the parameters as described in *Adding a New Image Source* on page 8.

Click on **Settings** and the **Advanced** tab to display the Video Source Settings dialog (see Figure 10).

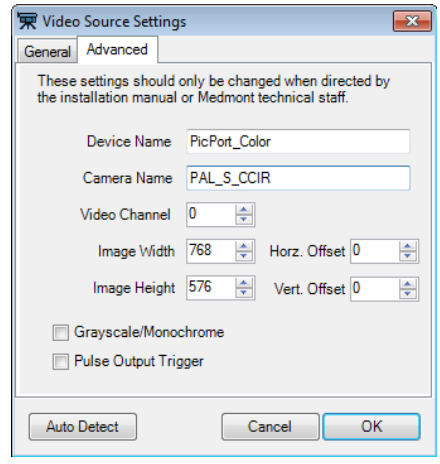


Figure 10. Video Source Settings dialog.

In the device name text box, type PicPort_Color_0. Leave the camera name blank. We recommend not adjusting other parameters as they default to best resolution. Setup the other card, following the same steps, but this time give it a device name PicPort_Color_1. More cards can be added in the same way by incrementing the last digit in the device name.

6. Capturing Images and Video

Opening the capture window

To open the DV2000 capture screen, ensure that you have an image source installed in the **Image Sources** menu (see 'Defining and Editing Image Sources' on page 7), click on a patient, then click on **Home > New Exam > Digital Image** and select the desired image source from the list.

The DV2000 Image Capture screen is shown in Figure 11:

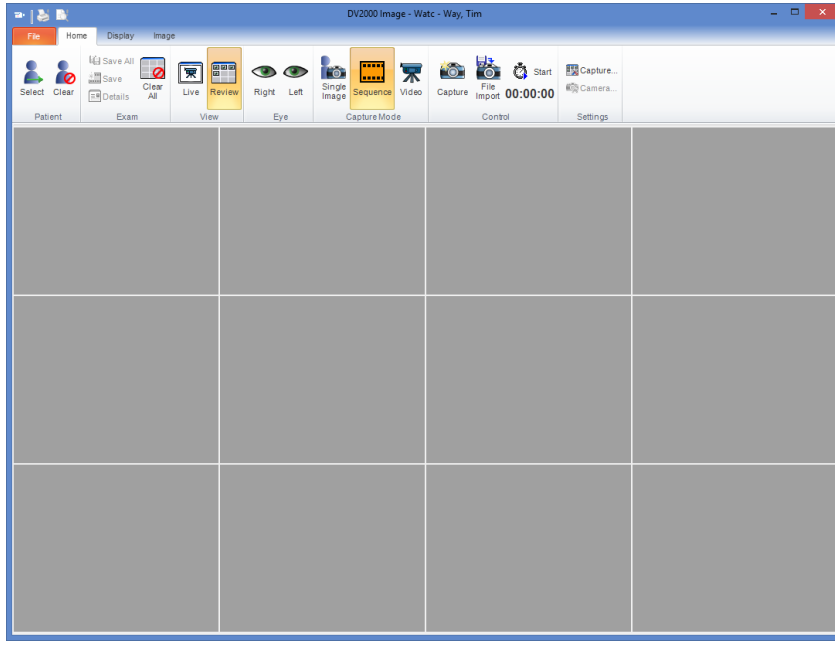


Figure 11. DV2000 Image Capture.

If the installed capture source supports live video capabilities, then the capture screen will also show live video as shown in Figure 12:

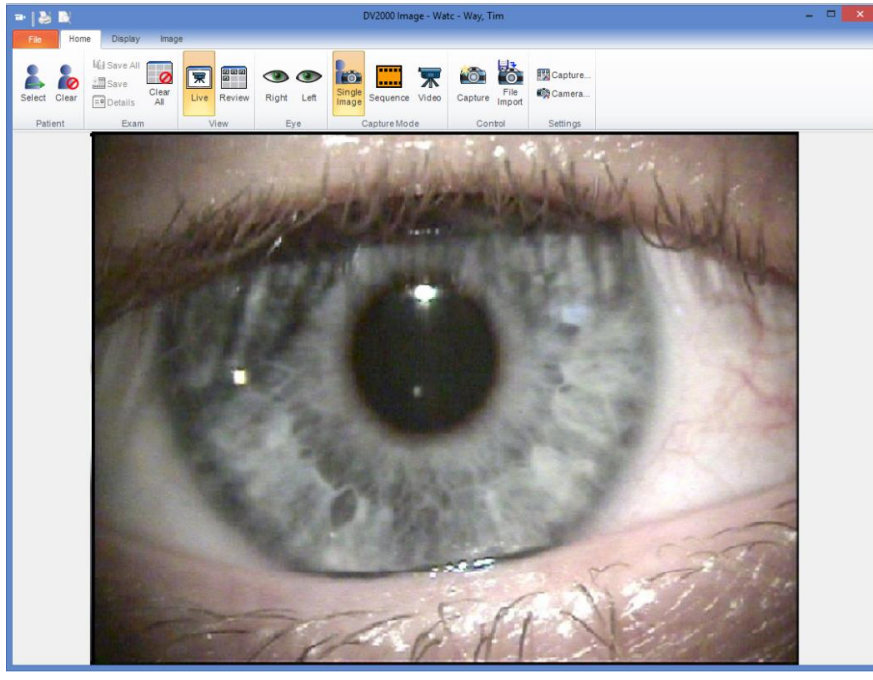
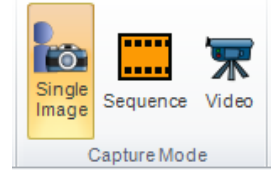


Figure 12. DV2000 Live Video Preview

Once the capture screen is open, select the eye to be examined (by default, the right eye) before continuing any further.

There are three capture options available; **Single Image**, **Sequence** and **Video.** The capture options can be selected by using these buttons within the DV200 Image capture window:



Capturing a Single Image

If you want to capture separate, individual images as separate exams, select **Home > Capture Mode > Single Image** capture mode.

Capture an image by selecting **Home > Control** > **Capture**. Immediately after capture you will be shown a full screen view of the image for review. This is useful for determining if the image is of an acceptable quality or whether another image is required.

The maximised view will look like Figure 13:

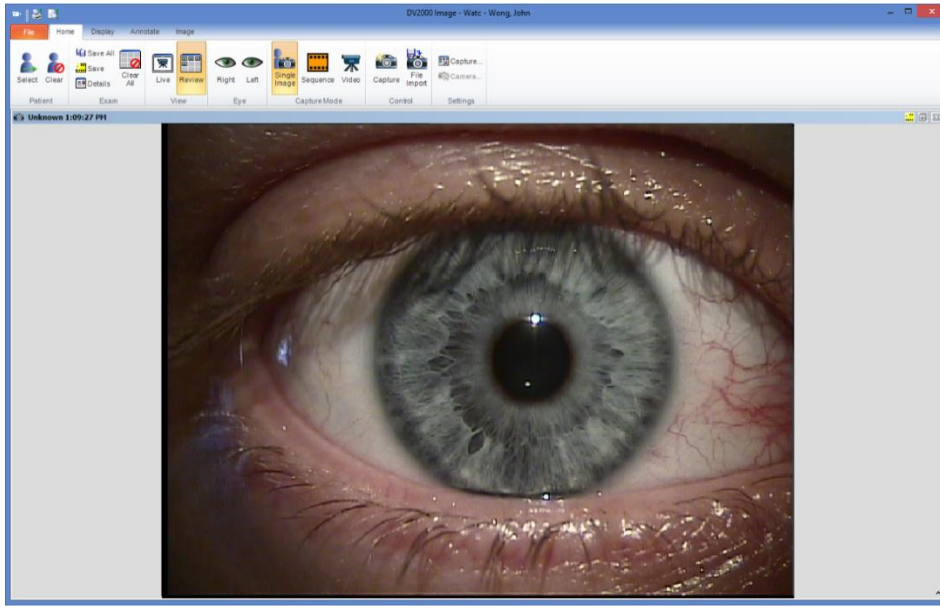


Figure 13. Maximised View

After a short time, which, by default is five seconds and can be changed within the image capture settings (see *Image Capture Settings*, page 19), the image will reduce back to a thumbnail, ready for another capture (see Figure 14).

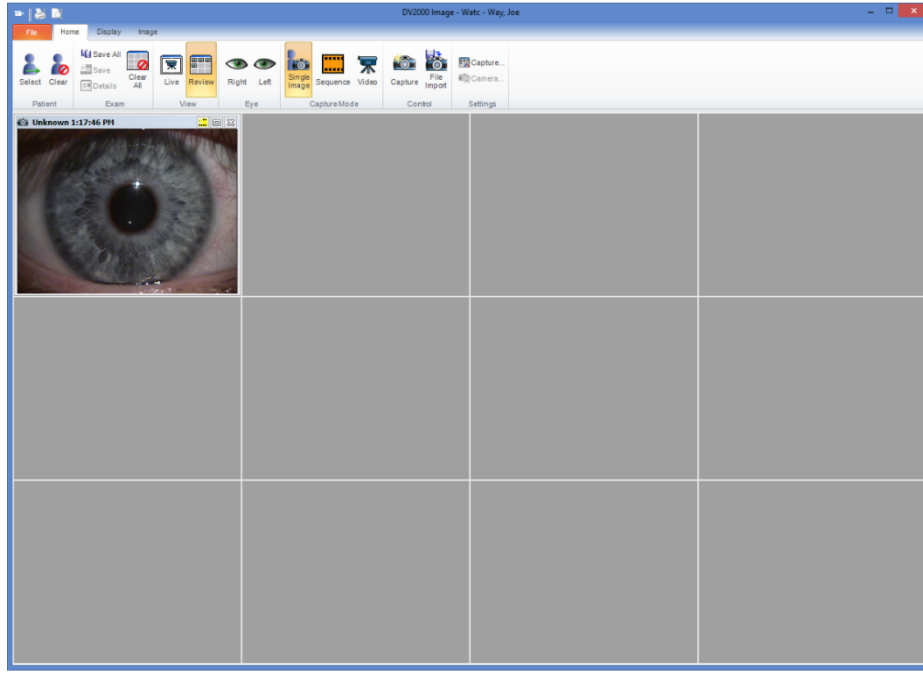


Figure 14. Thumbnail View

Image Capture Settings

To change the image review time (how long the captured image is maximized before reverting to a thumbnail), click the **Home** > **Settings** > **Capture** button and adjust the review time in seconds in the Review Time box (see Figure 15):

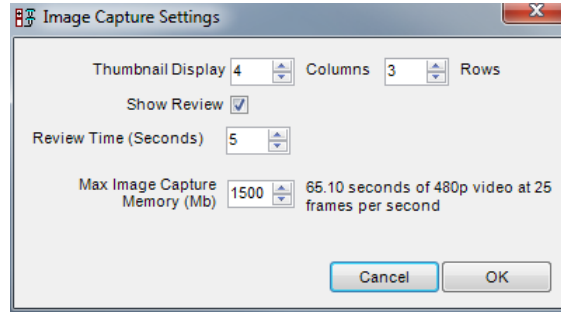


Figure 15. Image Capture Settings

If you do not want to be shown a full screen review of the recently captured image, the option can be disabled by un-ticking the **Show Review** box.

The number of rows and columns displayed in thumbnail review mode can be changed using the columns and rows boxes.

The total number of images and amount of video that can be captured and previewed within the capture window is limited by the amount of available memory allocated. You can limit the amount of memory that the capture window is allocated using the **Max Image Capture Memory** box. If this value is exceeded then video capture will stop and no more images will be able to be captured until some or all of the preview images have been cleared. Note that increasing the allocated image capture memory from the default value may result in the application running out of memory for other operations meaning that you are unable to save images you have captured.

Capturing from a File Source

It is possible to import an image from an existing image file by clicking the **File Import** button. Refer to page 65 for details on importing a valid image file as an exam.

Capturing an Image Sequence

If you want to capture a timed sequence of images, choose the **Image Sequence** option from the capture mode section. These images will be saved as a single exam with each captured image saved as a separated frame within the exam. The exam can then be played back frame by frame or as video.

Click the capture button (or use the external capture switch for your device) to capture and add a new frame to the exam. The sequence timer is started automatically when the first frame is captured. If required you can start the sequence timer before capturing any images by clicking the **Start** button in the Control ribbon. Click the **Stop** button to start capturing a new sequence exam. The next image captured will be added to a new exam.

Capturing Video

If you want to capture live video and have a compatible camera connected, instead of individual images or a sequence of images, choose the **Video** capture mode.

Capturing images from a video source may require a video capture card to be installed (see *Video Capture Card Installation* on page 4).

Some cameras will enable you to view a live video feed during image capture. If you have one of these cameras, this option will be available in the main capture window.

This view can be used for patient positioning and capture timing. To switch back to the thumbnail view, click on **Home** > **Review** button in the main window.

Align the camera and click the **Record** button or press the external capture switch to begin recording video. Once the recording is complete, the review window will be displayed, allowing you to playback the captured recording.

Video Camera Settings

Click on the **Home** > **Settings** > **Camera** (see Figure 16) button to change the camera settings. This option will only be available if the image source is supports video preview. Adjust the Brightness, Contrast, Saturation and Hue as required.

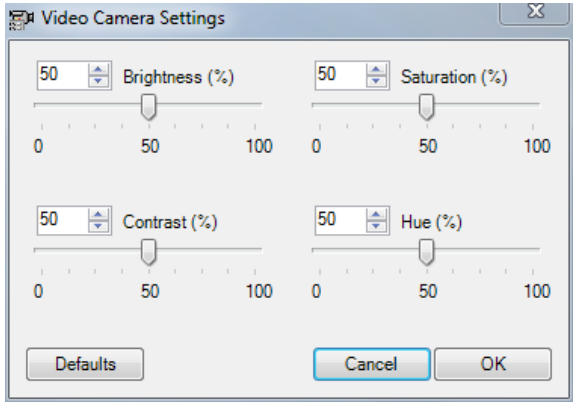


Figure 16. Video Camera Settings

7. Image Review

Once an image has been captured and the review time has expired, the image will automatically revert back to a thumbnail view. The image can be maximised into its own window and minimised again using the maximise / minimise controls (see Figure 17):

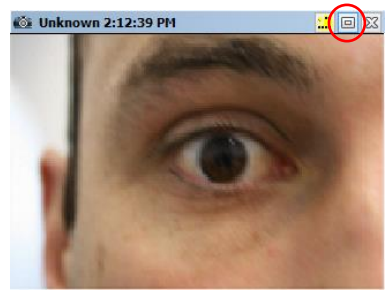


Figure 17. Thumbnail maximise/minimise button

Optionally, you may click on the Close button (✕) to discard that image.

When maximised, details can be added to an exam. Select **Home > Exam > Details** to bring up this option (see Figure 18).

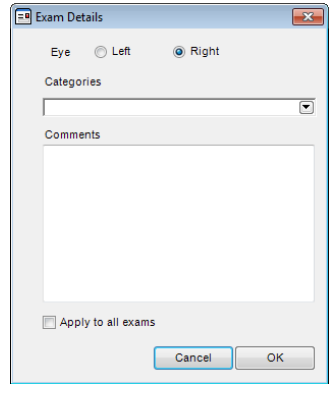


Figure 18. Exam Details

Select left or right radio button to change the tested Eye. If you have defined a set of *categories*, you can select those that apply to this exam from the **Categories** drop-down box. Categories allow sophisticated searching of the patient database and can be customised to suit specific clinical requirements. Refer to the Medmont Studio manual for additional information. Enter any text **Comments** as required and if these details need to be added to all captured images, check the **Apply to all exams** box before saving.

Annotate the image

The clinician is also able to **Annotate** or add **Attributes** the picture in a maximised view. Select the **Edit** tab to add annotations or attributes to the picture.

Once added, the Annotations can be toggled on and off by selecting the Display tab, then un-ticking the box next to Annotations. The Attributes panel can also be turned off by un-ticking the box next to Attributes Panel. Refer to **Adding Annotations** on page 52 for more information.

Image Processing

There are image processing options within the Image tab. Image processing can be done from within the capture screen, even when a captured image is in its minimised thumbnail state. For information on how to use these features, refer to **Image Processing** on page 40.

Selecting and Deselecting a Patient

A patient can be selected from the DV2000 Capture Window while capturing images. If a patient is currently selected then his or her name is displayed in the title bar of the window. The patient does not need to be selected before capturing images, however images cannot be saved unless a patient is selected.

Click the **Select** icon to display the Find Patient dialog shown in Figure 19. You can select a patient that already exists in the database or create a patient (see the Medmont Studio manual). You can scroll and select a patient from the list, or enter their details in one of the text boxes and initiate a search by clicking the *Search* button. Select the patient and click ***OK*** or just double click the name. You can now save images.

You can select the **Clear** icon to disconnect the currently referenced patient from the exam.

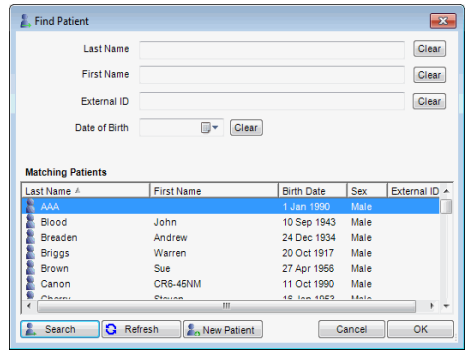


Figure 19. Select a Patient dialog.

Saving Exams

To save an image or video, click the **Save** icon within the thumbnail view of the image or video. You can also select **Save** from within the Home tab to save the single, selected exam or select **Save All** to save all exams.

If a patient is not selected, then the user will need to select a patient or create a new patient to save the exam against. In case a patient is not selected and the clinician attempts to save an exam, the find patient dialog box will show. A patient will then need to be selected before moving on.

8. Capturing and Registering Mosaic Images

Medmont DV2000 software has a new Mosaic Image Wizard. This feature allows you to create a mosaic image of the retina, giving far more visual information than a single image could provide. An example of a completed mosaic image is shown in Figure 20.

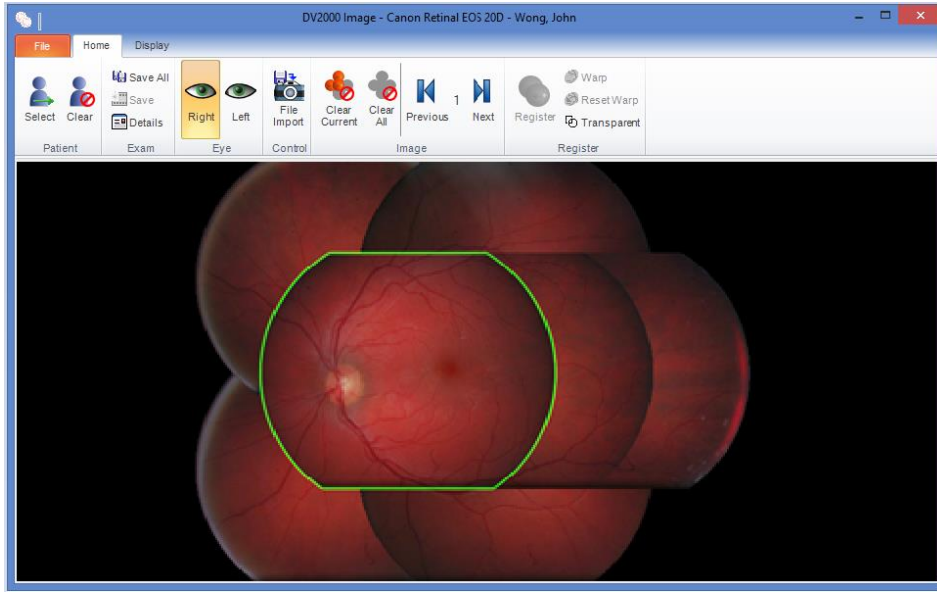


Figure 20. Mosaic image capture screen.

To set up this feature, import the appropriate Image Source. A plastic template with fixation targets and an image source is available upon request.

To install the Image Source, from the Main Application window, select **Configure > Image Sources > Import**. Locate the Image Source file and click **Open**. This will import all camera configuration and pattern data required to use Mosaic Image Capture.

After importing the file, click the icon from within Medmont Studio. This will display the **Pattern Selection** screen (see Figure 21):

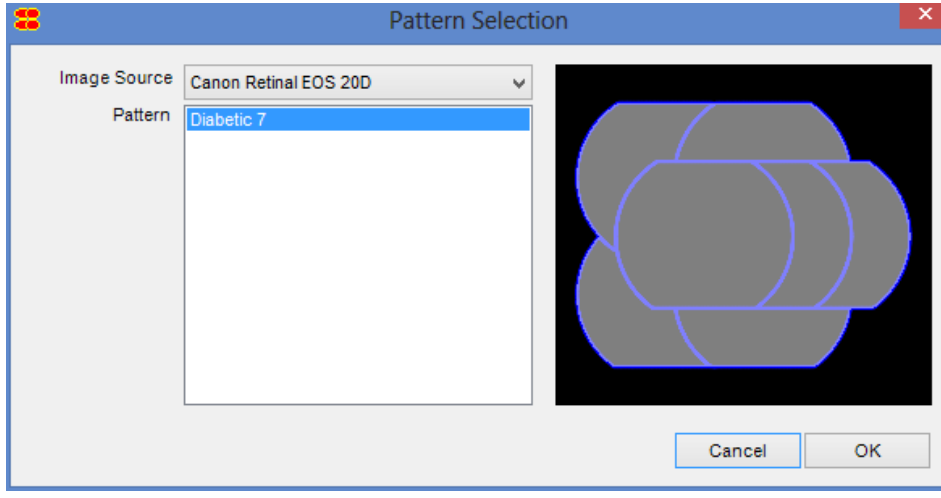


Figure 21. Pattern Selection screen for capturing Mosaic images.

In this screen, you must select the image source you just imported from the **Image Source** drop down box (if not already visible as in Figure 21). The pattern appropriate for your setup will be displayed in the preview window to the right.

Click **OK** to continue to the Mosaic Capture Screen.

Mosaic Capture Screen

The Mosaic Capture Screen will now be displayed:

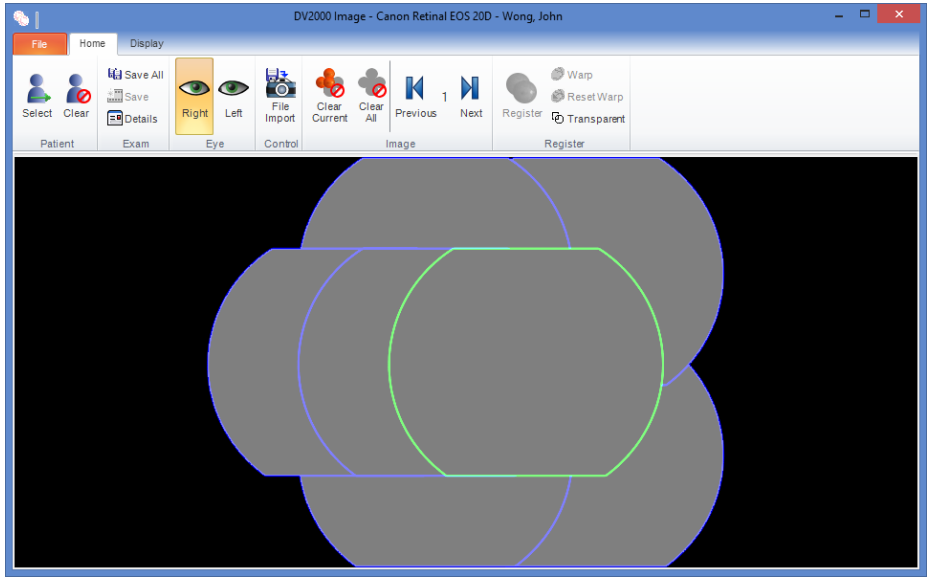


Figure 22. Mosaic Capture Screen

When capturing images, the pattern will progress through a logical image order mimicking the order of the fixation template. Image one will be automatically selected & highlighted in green (visible in Figure 22) when you enter the mosaic capture screen.

The layout and order of the images will vary depending on your pattern and the eye being examined. As you take consecutive images, the software will automatically progress through all layers one at a time, highlighting the current image with a green border, until you have a complete mosaic image.

You can replace one of the captured images by clicking on the image or using the navigation buttons to move to the frame you want to replace, then capture a new image to take its place. You will be presented with the following dialog on capturing a new image (see Figure 23):

Figure 23. Selecting image position

These options function in the following way:

- The first option simply replaces the previous image for that location with the newly captured image.
- The second option allows you to choose a different position for the captured image.
- The third option discards the captured image. Click ok after making your selection.

To clear a single image from the mosaic pattern, select it and click **Clear Current.** To clear all images in the mosaic pattern, click **Clear All**.

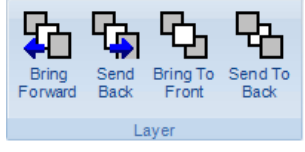
Auto Register

After capturing a full set of images, the **Auto Register** button will become available. Pressing this button will prompt the software to find common features between the captured images and arrange and align them, finishing the mosaic image.

You can also freely arrange images by clicking and dragging them.

Options

The following toolbar icons are available at the top of the Mosaic Capture screen:



From left to right, these icons perform the following tasks:

Moves the selected image down one level in the stack

Moves the selected image up one level in the stack

 Moves the selected image all the way to the top of the stack

 Moves the selected image all the way to the bottom of the stack

9. Viewing DV2000 Images

Select a DV2000 image to view by clicking on the items in the Medmont Studio Explorer pane. To select multiple images hold down the control key while clicking on multiple items.

The View pane will now display the selected images(s). How the images are displayed depends on the current View mode.

Setting the Image View Mode

The View Mode controls how the selected DV2000 Images are displayed. Select the View mode from the ***View*** menu or toolbar. The modes are described below.

Details View

 The details button displays textual information about a single selected DV2000 Image and allows it to be changed (see Figure 24) *Editing Image Details* on page 71).

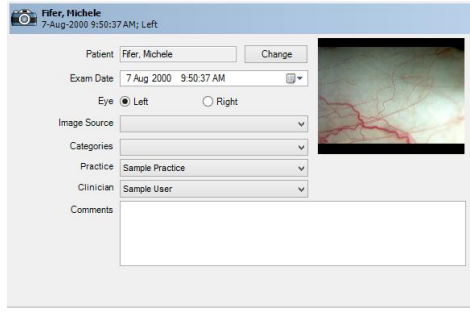


Figure 24. Details View.

Image View

 The image view button displays up to four selected DV2000 images and allows you to zoom, pan and manipulate the image(s) (see Figure 25).

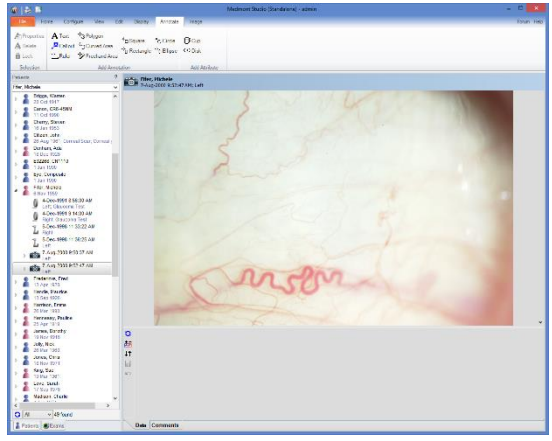


Figure 25. Captured Image View.

You can also display Attributes in this view (see Figure 26):

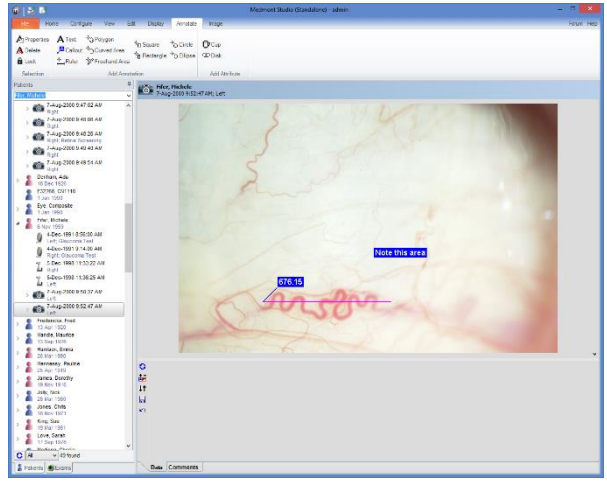


Figure 26. Captured Image View with Attributes.

Thumbnail View

 The thumbnail view button displays up to sixteen thumbnail images related to the selected item (see Figure 27):

 ***Patient*** the thumbnail view displays the exam images for that patient.

 ***Sequence*** the thumbnail view displays the images that make up the sequence.

 ***Image*** or  ***Sequence Image*** the thumbnail view displays the versions of the image.

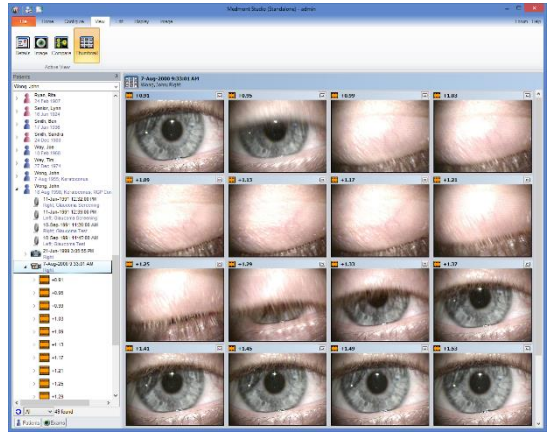


Figure 27. Thumbnail View of a Sequence.

Compare View

Selecting two DV2000 exams in the patient tree and clicking the  button displays a comparison view of the two images, using the arithmetic difference between them to highlight areas of change over time (see Figure 28).

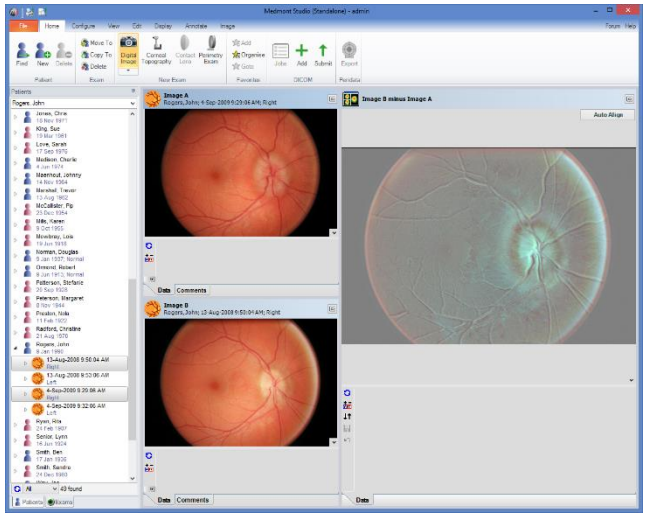


Figure 28. DV2000 Compare View

Upon clicking the Auto Align button, the software will identify common features between the images and superimpose them one on top of the other, correctly aligned.

You can apply an offset or align the images manually by clicking and dragging on the composite image. This allows you to move the free image (the first image selected from patient tree) to the desired position over the fixed image (the second image selected).

A Medmont Studio Feature Pack license is required for Compare View.

Stereo Viewing

It is now possible to enable Stereo Viewing in DV2000, allowing you to view captured images as a stereo pair using one of the following methods:

- Anaglyphic (red/blue) colour separation (works on a standard CRT or LCD monitor and requires red/blue anaglyphic flippers).
- Stereo Interlaced Monitor with polarising goggles.
- NVidia Stereo Driver (requires compatible NVidia graphics card) with shutter glasses. Medmont recommends the use of wireless shutter goggles as other models may not conform to the safety standards for medical electrical systems.

- Side By Side separation (requires commercially available side-by-side stereo viewers).

NOTE: Shutter glasses require a very high refresh rate and therefore cannot be used with LCD monitors.

To set up this feature, select an existing DV2000 exam from the tree pane in Medmont Studio, click the **Display > Stereo > Setup** (see Figure 29).

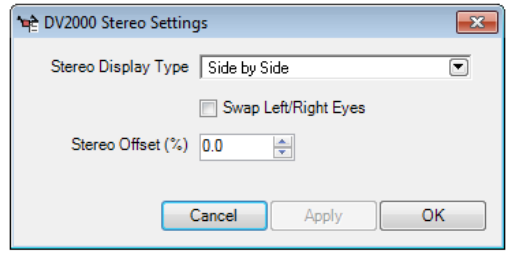


Figure 29. Settings for Stereo Viewing

Select your desired viewing method and click **OK** (configuration of Stereo Offset can be done later from the Stereo Viewer).

To view images in stereo, select two exams from the tree pane in Medmont Studio by holding the **Ctrl** key while clicking them consecutively (these images must have been captured as a proper stereo pair). With the exams selected, choose the **Display** tab, then select **Viewer** from the **Stereo** group. This will launch the stereo viewer, which is a full screen display of both images displayed together using the selected stereo viewing method. An example of an Anaglyphic stereo image can be seen in Figure 30:

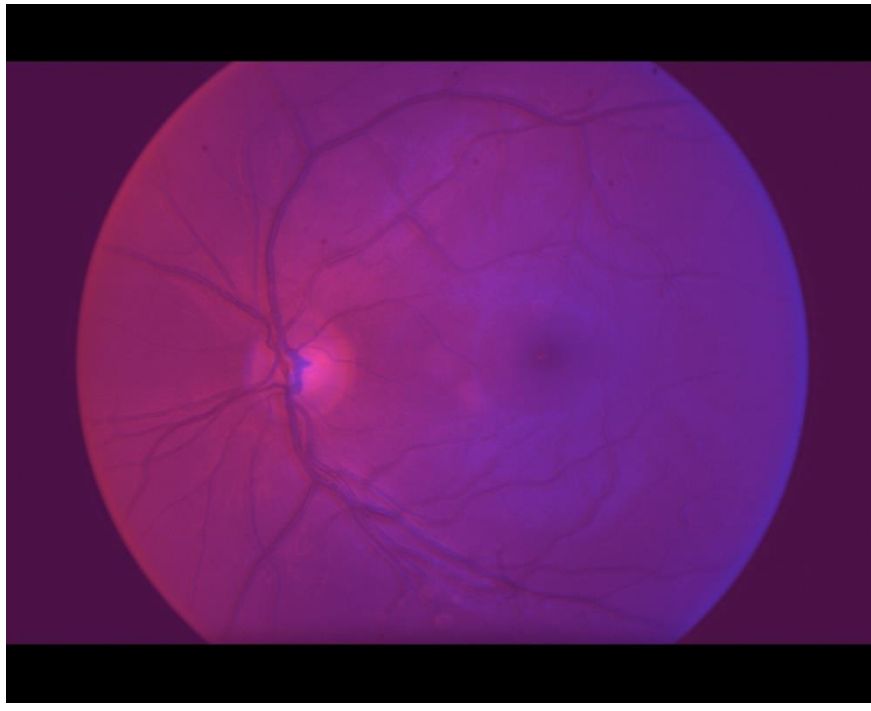


Figure 30. Example stereo image in Anaglyphic view

To find the optimal setting for your viewing method, try using the '+' and '-' keys on your numeric keypad to increase and decrease the stereo offset respectively (this works the same way as setting the stereo offset % manually from within the Image Settings screen; the Image Settings screen will be updated as you make changes using the keys).

You can also press the 'S' key on your keyboard to swap the left and right images if required. In addition to these options, some experimentation with viewer position may also be required to achieve a stereo effect.

The Zoom cursor is automatically activated when you enter the Stereo Viewer and works as normal (see Medmont Studio manual for more info).

To reset the Stereo Viewer, right-click anywhere on the screen and choose **Reset View**. This right-click menu also provides access to the Pan cursor mode, which is useful for navigating a zoomed image.

A list of the all keyboard controls for the Stereo Viewer is available below:

'I' key	Zoom In
'O' key	Zoom Out
Arrow Keys	Pan
'S' key	Swap Eyes
'+' key	Increase Stereo Separation
'-' key	Decrease Stereo Separation
'Esc' key	Exit

Zooming and Panning

Using the Menus to Zoom and Pan

You can zoom and pan the currently displayed Patient Exam images by selecting the **Display** tab, then clicking either **Zoom** or **Pan**. This works on all displayed images at once.

Using the Keyboard to Pan and Zoom

The keyboard can be a convenient means for zooming and panning. Ctrl-I zooms in, Ctrl-O zooms out. Using the arrow keys, Ctrl-left pans left, Ctrl-right pans right, Ctrl-up pans up and Ctrl-down pans down.

Using the Mouse to Pan and Zoom

You can also use the mouse to pan or zoom within a single image. Select the Pan, Zoom or Select option from the **Display** tab or by clicking with the right mouse button over the image. The shape of the cursor changes to reflect the current cursor mode.

In **Pan** mode, click on the image and drag it in the direction you wish to move the image. The image will continue to move in that direction while the mouse button is down or until a boundary is reached. The speed and direction of movement is proportional to the distance of the current cursor position from the position where the mouse button was pressed.

In **Zoom** mode, click on the point in the image that you wish to zoom in on. The image will continue to zoom in while the mouse button is held down.

Pressing the **Control Key** (Ctrl) on the keyboard will toggle the zoom mode between In/Out.

Using the Mouse Wheel

If the mouse includes a **wheel**, it can be used to quickly zoom in and out on the selected image.

Zoom Modes

Display tab > Smooth – pixel data is interpolated as you zoom in. This reduces the visual artefact of pixelization when viewing images at high zoom levels.

Display tab > Fast – pixel data is not interpolated. Faster but somewhat distracting at high zoom levels.

When multiple images are displayed, zooming and panning of the images is synchronised. The Capture video and preview windows (see *Capturing an Image Sequence* on page 20) can also be zoomed and panned.

Viewing Sequences and Video

Sequences of images can be viewed either as video or as a set of thumbnail images.

Playing Video

Select the exam in the Explorer Pane.

Click on the icon above the explorer pane to view the image sequence. The Video tab should now be visible. Use the video tab options to play, pause and step through the sequence:

Video > Play - sequentially displays each image in the sequence (starting from the current image) then pauses at the beginning of the sequence.

Video > Continuous Play - sequentially displays each image in the sequence (starting from the current image) in a continuous loop.

Video tab > Pause - pause playing of the sequence.

Video > Start - display the first image in the sequence.

 **Video > Back** - display the previous image in the sequence.

 **Video > Forward** - display the next image in the sequence.

 **Video > End** - display the last image in the sequence.

Video > Frame Rate - a drop down that allows you to select the playback speed for the video.

Note that any image processing operation performed in this mode is performed on all the images in the sequence.

Viewing Thumbnails

Select the exam in the Explorer Pane.

Click the **Thumbnail** icon above the Explorer Pane. The view displays a thumbnail view of each frame in the sequence. Use the ***Expand*** button in the thumbnail title bar to temporarily enlarge a particular thumbnail. The ***Image Menu*** affects the active thumbnail (the image with a different colour title bar).

10. Image Processing

The DV2000 software provides a range of sophisticated image processing tools. Image processing operations can be performed on preview images before saving (see *Saving* on page 25), or on saved images. You can also set a standard operation or a customised operation consisting of a sequence of operations to be automatically applied while capturing or importing an image.

All of the image processing operations can be applied to a sequence of images by selecting the Image View for the sequence.

Image Operations

The following operations are available from the toolbar or the **Image** menu of the Image View, Capture window and Import window:

 **Contrast Stretch –** manually adjust the contrast thresholds and gamma curve for the image (see *Contrast Stretch Dialog* on page 42*)*.

 **Equalise Luminance –** maximise the image contrast in HSL colour space.

 **Equalise RGB –** maximise the image contrast in RGB colour space.

 **Sharpen –** enhance the visibility of edges and lines in the image.

 **Deinterlace –** remove video interlacing artefacts caused by movement in the subject.

 **Emboss** - adds dimension to an image by making it appear as if it were carved as a projection from a flat background, giving it a three-dimensional appearance. All color in the image will be replaced with shades of grey.

 **Flip –** flip the image around the horizontal axis.

 **Mirror –** flip the image around the vertical axis.

 **Rotate –** rotate the image as specified (see *Rotate Dialog* on page 43).

 **Resize –** resize the image as specified (see *Resize Dialog* on page 43).

 **Invert –** produce a negative image.

 **Greyscale –** convert a colour image to greyscale image, not available for greyscale images.

Colorize – convert a greyscale image to 256-colour image.

Filter – remove colour channels except those specified (see *Channel Separate Dialog* on page 44).

Invert Black – invert all the colour values below a threshold value to maximum (white). Can save printer ink while printing (see *Black Invert Operation* on page 45).

Information… – displays information about the currently selected image and its colour depth.

Creating and Editing Custom Operations

On the **Configure > DV2000 > Custom Operations –** create or edit custom operations, these are image operations that you can define (see *Creating Custom Operations* on page 46).

Copy and Paste Operations

The Windows standard data transfer functions allow for exchange of data between various applications via the Windows Clipboard. You can easily copy a DV2000 image from Medmont Studio and then paste it into any imaging software or a word processor, eg PhotoShop or Microsoft Word. The image can then be modified and copied back into Medmont Studio, if required.

Edit > Clipboard > Copy – Windows standard copy function, copies the current image to the clipboard, which can then be pasted into any other windows application.

Edit > Clipboard > Paste – Windows standard paste function, pastes the current image from the clipboard. Only enabled when there is an image available in the clipboard. Allows for pasting images directly from external imaging applications.

See also *Importing and Exporting Images* on page 65.

Contrast Stretch Dialog

The contrast stretch dialog displays a histogram for the image - the number of pixels with a given brightness level for all brightness levels from black on the left to white on the right (see Figure 31).

The vertical red lines on the left and right are the low and high threshold values respectively. Brightness values between these threshold values are stretched between black and white. Values to the right of the high threshold are mapped to white. Values to the left of the low threshold are mapped to black.

The gamma value curve is the diagonal line. This can apply a non-linear stretch to enhance light or dark regions of the image. Gamma values greater than one increase contrast in dark regions. Gamma values less than one increase contrast in light regions.

Use the spin-boxes or click and drag any of the three lines with the mouse to re-map the brightness values in the image to improve the contrast. If the ***Auto Apply*** option is checked then changes are automatically applied to the image as the sliders are moved. For very large images this may slow the rate at which you can move the sliders.

You can also select the colour model. There are three choices:

1. Average RGB.
2. RGB (Red, Green, Blue) model.
3. HSL (Hue, Saturation, Lightness) model.

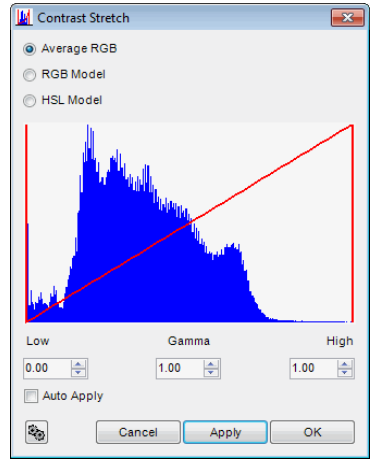


Figure 31. Contrast Stretch dialog.

If you often use the same parameters for the contrast stretching of your images then you can also save this as a custom operation, press the button at the bottom left corner (see *Creating Custom Operations* on page 46).

Rotate Dialog

The rotate dialog allows you to select an angle and direction of rotation to apply to an image (see Figure 32). The angle specified is measured in degrees.

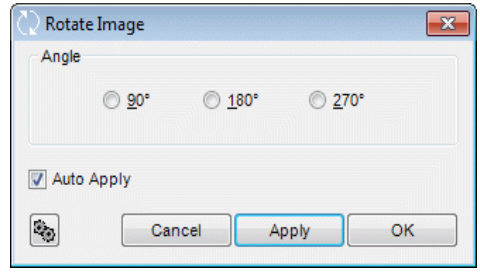


Figure 32. Rotate Dialog

If you repeatedly use the same parameters for rotating your images then you can also save this as a custom operation: Click on the button at the bottom left corner (see *Creating Custom Operations* on page 46).

Resize Dialog

The resize dialog allows you to resize the current image. You can specify the new size either in pixel values or specify a percentage of the original image. If the Maintain Aspect Ratio option is turned off, the image can be stretched whichever way you like. The re-sampling method determines the algorithm used to interpolate pixel values, nearest neighbour is the fastest and cubic is the slowest method (see Figure 33).

> Note that the effect of resizing the image may not be immediately obvious in the View Pane, as the image is always automatically zoomed to fit the window.

You can see the actual size of the image in the image information dialog. On the **Image** tab, click **Information** . A smaller image can substantially reduce the file size when exporting or pasting the image into other applications.

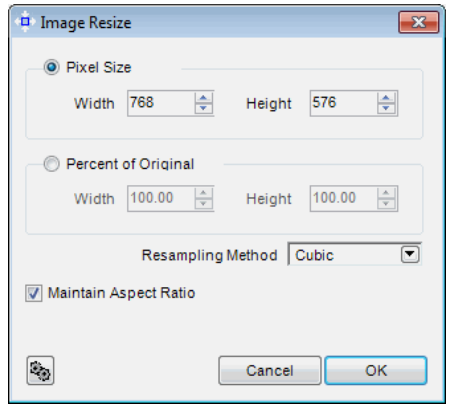


Figure 33. Resize Dialog.

If you repeatedly use the same parameters to resize your images then you can also save this as a custom operation: Click on the button at the bottom left corner (see *Creating Custom Operations* on page 46).

Channel Separate Dialog

The channel separate dialog allows you to extract a single or a combination of colour channels from the current image (see Figure 34).

The screen may be accessed by clicking **Image > Colour > Filter**. Select the channel or channels from the Channel dropdown list. The selection will be the channel(s) that are retained. For example, to create a Red-Free version of a retinal image, select the Green/Blue entry.

The resulting grey-scale image is either the channel remaining when two channels are removed, or the mean of the two remaining channels when one channel is removed.

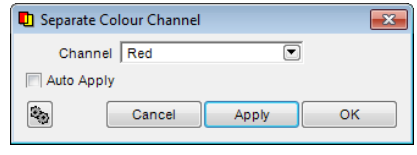


Figure 34. Colour Separate Dialog.

If you often use the same parameters for this operation then you can also save this as a custom operation, click on the button at the bottom left corner (see *Creating Custom Operations* on page 46).

Black Invert Operation

This operation inverts all hue values below the specified threshold, i.e. darker shades to white. You can set this threshold from the Black Invert Dialog (see Figure 35).

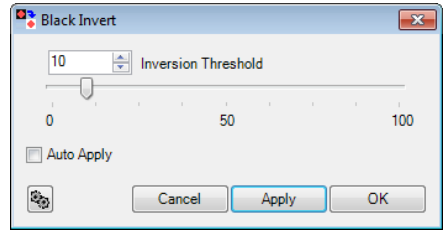
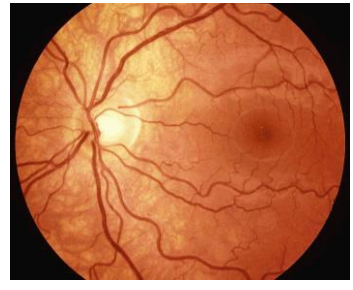


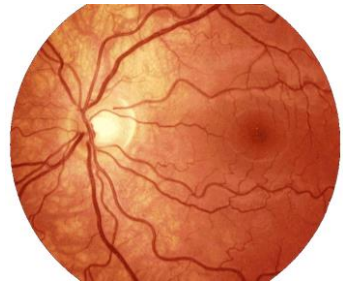
Figure 35. Black Invert Dialog

This operation is especially useful while printing images from retinal cameras, which often have a substantial black border. Applying the operation converts a black border to white. The threshold required to produce optimal results depends on the particular camera.

As an example consider the image below,



This image has solid black boundaries. For this camera, a threshold of 9 was used to remove the black border entirely without affecting the image itself. The following image shows the result.



If you often use the same parameters for this operation then you can also save this as a custom operation, click on the button at the bottom left corner (see *Creating Custom Operations* on page 46). This operation can then be incorporated in a user defined Image Source and automatically applied while printing.

Image Information Dialog

The image information dialog provides information about the currently selected image. This information is useful when exporting or pasting the image to other applications (see Figure 36).

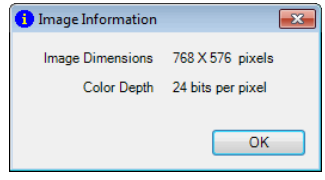


Figure 36. Image Information Dialog.

Creating Custom Operations

Custom Operations provide a powerful mechanism for you to create your own operations to supplement the standard operations. The following sections describe the steps involved in creating custom operations.

Creating Customised Standard Operations

Standard operations which have user defined parameters can be saved as custom operations. This facility is supported by Contrast Stretch, Histogram Equalize (both Luminance and RGB), Black Invert, Resize, Rotate and Colour Separate operations. It reduces to a single mouse click the process of going through a dialog, setting the operation parameters and then applying them to the image.

As an example of the steps required, let us assume that we want to resize a number of images to 50% of their original sizes. We can create a custom operation that allows us to do this with a single click.

To create a custom operation from one of the operations listed above, first select an existing image in the explorer pane. On the **Image** tab, click the icon to display the resize dialog of Figure 33. To set the required parameters, select the percent option and define 50%. Leave the Maintain Aspect Ratio check box ticked.

Click on the button at the bottom left corner to save the current settings as a new custom operation. This displays the Operation Name dialog shown in Figure 37, allowing you to specify a name for the new operation.

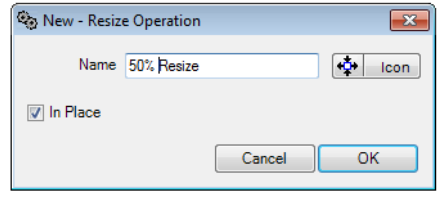


Figure 37. Operation Name Dialog.

Give the operation a sensible name. If a custom operation by the name just typed in already exists then you will be prompted to either overwrite the existing operation or type another name. The operation is assigned a default icon. You can change this icon by pressing the ***Icon*** button.

If the **In Place** check box is ticked, then the operation will process the current image and replace it, losing the original. Un-tick this box to have the operation create a new image.

Click ***OK*** and dismiss the resize dialog. The newly created operation appears on the **Image** tab. From now on you can use this operation as a standard image operation. You can edit this operation at any time from the **Configure tab, Custom Operations** option.

Creating a Sequential Operation

The real power of customised operations comes from Sequential Operations and Multi-Image Operations. A sequential operation effectively combines a set of operations into a single custom operation that successively applies

each operation to the given image. This obviates the necessity to apply a number of operations individually.

To create a new customised sequential operation, click **Configure > DV2000 > Custom Operations.** This displays the Custom Operations dialog shown in Figure 38.

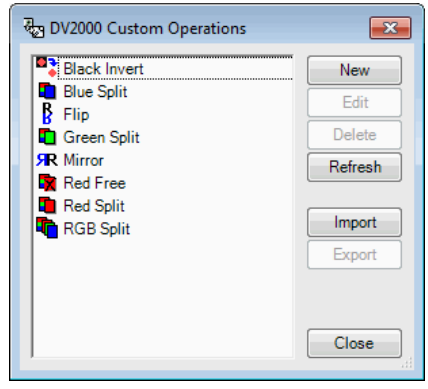


Figure 38. Custom Operations dialog.

Click on the ***New*** button and select Sequential Operation. The Sequential Operation dialog is displayed in Figure 39.

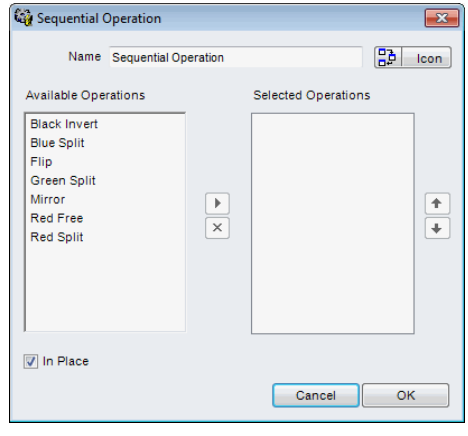


Figure 39. Sequential Operation Dialog.

All existing operations are displayed in the left hand pane. Multi-image operations are not displayed in this pane, as they cannot be included in a sequential operation. The operations for your sequence are displayed in the right pane. To add an operation to your sequence, select the operation in the left pane and click on ▸ to move a copy of the operation to the right pane.

To remove an operation from your sequence select it and click on ×. You can also change the order of the sequence by clicking on the ↑ and ↓ buttons.

If the **In Place** check box is ticked, then the sequential operation will operate on the current image and then replace it, losing the original. Un-tick this box to have the sequential operation create a new image.

Once you are satisfied, give the sequence a name and perhaps select a new icon. Click the ***OK*** button. The new operation now appears in the image toolbar and menu. You can subsequently use it as a single image operation.

Creating a Multi-Image Operation

A Multi-Image Operation is similar to a Sequential Operation in that it also consists of a set of standard operations. But unlike the Sequential Operation, which applies the image operations one after another to the original image, a Multi-Image operation produces a new image version for each operation in the set by applying each operation to the original image. Each of these images appears in the Explorer pane as a new Image Version with the name of the operation.

> Multi-Image operations can only be applied to images that have been saved (i.e. they are not available from the Import and Capture Windows).

To create a new multi-image operation, on the **Configure** tab, click **Custom Operations**. Click the ***New*** button and select Multi-Image Operation to display the Multi-Image Operation dialog (see Figure 40):

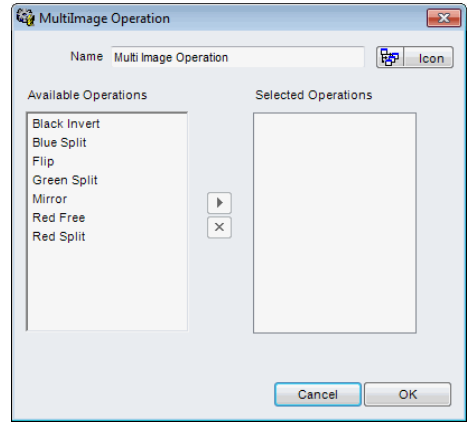


Figure 40. Multi-Image Operation Dialog.

All the existing operations are displayed in the left hand pane. Note that Multi-Image operations cannot contain other Multi-Image operations. The set of operations for the new operation is displayed in the right pane. To add an operation, select it in the left pane and click on to copy it to the right pane. To remove an operation, select it and click on . Once you are satisfied, give the sequence a name and perhaps select a new icon. Click the ***OK*** button.

The new operation now appears in the image toolbar and menu. You can subsequently use it as you would a standard operation.

Modifying Existing Operations

To edit an existing custom operation, on the **Configure** tab, click **Custom Operations**. This displays the Edit Custom Operations dialog shown in Figure 38.

All the customised standard operations, sequential operations and multi image operations are listed in this dialog. From this dialog you can edit, rename, change an icon or delete operations. First select the operation you wish to modify from the list.

Edit

Click on the ***Edit*** button. The dialog that follows will depend upon the type of custom operation you are trying to edit. The process of changing the parameters of these operations is essentially the same as you used to create them (see above).

Rename

Click on the rename button to display the Operation Name dialog (see Figure 37). From here you can change the name of the operation or change the icon. A valid name must be entered.

Delete

To delete an operation, just select it and click on ***Delete***.

Undo Facilities

The DV2000 software supports two levels of undo for image processing operations.

Image tab > Undo All – undo (abandon) all changes since the image or sequence was last saved. Note that this option is not available from Image Import or Image Capture dialogs.

↶ **Image tab > Undo –** undo the last change to the image. Note that this is not available when operating on sequences because of the cost of maintaining multiple versions of a sequence of images.

Image Processing and Image Compression

The DV2000 software allows images to be saved as a JPEG or an uncompressed format. Certain image processing operations (in particular sharpening) can reveal artefacts of the JPEG compression algorithm that are otherwise not visible. In general it is a good idea to perform image processing either before saving the image (in the preview buffer) or on uncompressed images.

Splitting Sequences and Combining Exams

It is possible to combine a set of Exam Images or Image versions into a single sequence. This is particularly useful if you have taken images of a subject over a period of time, and now want to combine and view them played as a sequence.

Select the images that you want to combine and on the **Edit** tab, click **Combine**.

It is also possible to do the reverse. You may want to keep an image from a video sequence as an independent examination or may want to split an entire video sequence into individual exams. Select the image or sequence you want to split and on the **Edit** tab, click **Split**.

Image Versions

The software provides the ability to save multiple versions of an image or an image sequence. This allows you to apply image-processing operations to an image (or edit the image using external software) and save the changes in the database without losing the original image.

Clicking the **Edit** tab, then clicking the **Save** option allows you to save a new version of the currently selected image with a new name. If you specify a name that already exists you will be prompted to overwrite the existing version. If the selected item is a sequence this option saves a new version of each image in the sequence.

The compression algorithm used to save new versions can be changed using the options dialog.

When an Image has multiple versions the version displayed when you select the Image is determined by the **Default Version.** The default version is displayed in the Explorer Pane with a small circle inside. Click the **Edit** tab, then click **Set Default** to set the default version. If the selected item is a sequence this sets the default versions for each frame in the sequence.

Set Default option deletes the selected image version. This tool is different from on the **Home** tab by clicking **Delete** in that if the selected item is a sequence then the version image is deleted from all the frames in the sequence.

Adding Annotations

Graphical annotations can be added to DV2000 Exams using the options on the **Edit** tab.

Annotations are stored with the exam and may be printed, exported, imported and viewed. Note that the bitmap and jpeg export functions export only the image data (i.e. not annotations).

Annotations are automatically saved when they are created and edited. All image versions inherit a common set of annotations that belong to the exam. Annotations created on one image version are automatically displayed on all other versions of the same exam.

Text Annotations

On the **Edit > Text** changes the cursor to allow you to place a text annotation on the image. Simply click at the location that you want the anchor for the annotation to be placed. The Text Annotation dialog shown in Figure 41 is then displayed, allowing you to enter the text to be displayed.

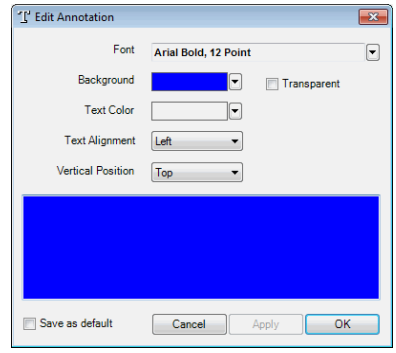


Figure 41. Text Annotation dialog.

Callout Annotations

On the **Edit > Callout** changes the cursor to allow you to place a text callout annotation on the image. This consists of a text label and line pointing to the selected anchor location. A dialog is displayed to allow you to enter the text for the annotation.

Vertical alignment is only available with text annotations. You must enter valid text for callout and text annotations otherwise they will not take effect.

If these are your preferred settings for text and callout annotations, tick the **Save as default** check box. These settings will automatically be applied next time you create a text or callout annotation.

Shape Annotations

The DV2000 allows you to define eight types of shapes on your exam images. These are shown in the Studio User manual and are:

1. Ruler Annotation
2. Circle Annotation
3. Ellipse Annotations
4. Rectangle Annotation
5. Square Annotation
6. Curved Area Annotation
7. Freehand Area Annotation and
8. Polygon Area Annotation

Click on the desired shape tool on the **Edit** tab. Move the mouse to the image pane, the mouse cursor changes to reflect the type of shape being drawn.

The Ruler annotation allows you to draw a straight line between two points and measure the distance between the points. To create a ruler annotation click the mouse at the first point, move to the second point (the tag below the curser shows the measured distance) and click to complete the annotation. The measurement displayed takes into account the scaling factor of the Image Source.

The Circle, Ellipse, Rectangle or Square annotations allow you to create these shapes, as their name implies. To create one of these annotations, click at the point where you want to place the shape and drag the mouse to complete the drawing.

You can create three types of area annotations. To draw a Curved or Polygon area, click on the first point and keep clicking until the last point, then right click to complete the curve. To draw freehand area click on the first point and drag the mouse around the required shape, when finished stop dragging.

Shapes can always be fine-tuned by resizing or moving.

All shape annotations can have callout text attached to them. In addition, Ruler annotation also displays the distance between the two selected points. You have complete control over how the shape annotations are displayed (see *Editing Shape Annotations* on page 54).

Editing Text and Callout Annotations

To edit an existing annotation double click on the annotation and the editor will be displayed allowing you to change the text or attributes. Annotations can be moved by simply dragging them with the mouse.

Editing Shape Annotations

To move or resize a shape annotation, click anywhere on the shape to select it. Hot spot dots are displayed on the shape. Select the desired hot spot and drag with the mouse to move a particular point. To move the whole shape click on the centre cross hair or anywhere on the shape (except a hot spot) and drag the shape with the mouse.

To edit the way a shape annotation is displayed, double click on the annotation or on the **Edit** tab and click **Edit**. This displays the Edit Shape Annotation dialog box shown in Figure 42.

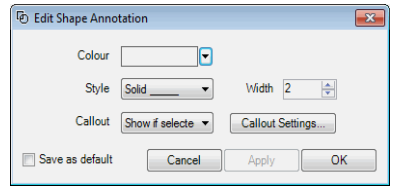


Figure 42. Edit Shape Annotation.

Choose the colour, style and the line width of the annotation.

Click on the **Callout Settings** button to display the text annotation dialog (see Figure 41) and edit the text and display properties.

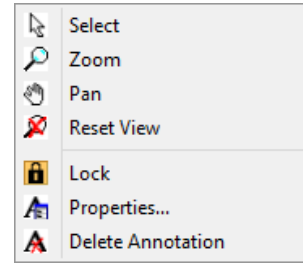
The callout dropdown box allows you to select the option that controls the visibility of callout text of the annotation. You must type a valid callout text before this setting will have any effect.

Locking Annotations

Once an annotation has been created it can be locked, meaning that it cannot be altered or repositioned until it is unlocked. This is to avoid accidently moving or otherwise altering an annotation while left clicking on the exam data to view critical readout data or otherwise navigate around the image data.

Once you have selected the annotation, you can change the status of the locking mechanism in 2 ways:

1. Directly on the annotation itself - Right click to bring up the annotation menu and select **Lock** to toggle the current status of the lock.
2. From the menu – Select **Annotate > Selection > Lock** to toggle the current status of the lock.



The locked status of an annotation is indicated by the presence of a small lock symbol attached to the annotation as shown in Figure 43.

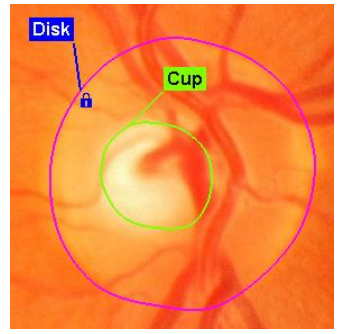


Figure 43 Disk Annotation showing lock symbol.

Deleting Annotations

To delete an annotation, select the annotation, (by clicking once on it) and on the **Edit** tab, click **Delete**, or press the keyboard **Delete** key.

Saving and Abandoning Changes

Changes and additions you make while working with an exam are not permanent. You will notice that as soon as you add annotation, two options will become available on the **Edit** tab. These options are ***Save*** and **Undo** respectively. Use these options to either save the added annotations to the current image or remove the annotations entirely. If you do not use either, the system will display a dialog when you attempt to move away from the edited image asking you whether to save or remove the changes.

11. Attribute Types and Attributes

This feature of the DV2000 software allows you to define special attribute types, which can then be attached to individual exams. Attributes combined with Calibrations (see *DV2000 Calibrations* on page 11) allow you to perform precise measurements on the image. You can use them later for patient prognosis, research purposes or exam cataloguing (using filters).

There are three different kinds of Attribute Types that you can define,

1. Annotation Attribute Type
2. Calculated Attribute Type
3. Entered Attribute Type

Defining and Editing Attribute Types

To define or edit an existing Attribute, on the **Configure** tab, click **Attributes**. This displays the Attributes dialog. Select the DV2000 Exam Type (see Figure 44).

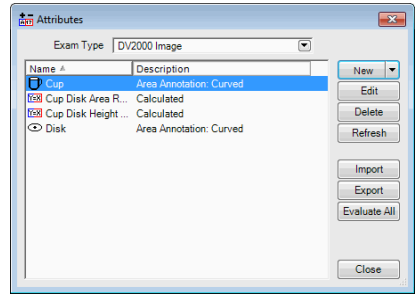


Figure 44. Defining and Editing Attributes.

Click on the ***New*** button to create a new attribute.

Annotation with Attributes

As the name suggests, these are attributes that you actually draw on an image. This annotation can be one of the predefined shapes. Depending upon the shape selected for the attribute type, this attribute can then provide you information about the enclosed portion of the image. DV2000 allows you to select one of the eight types of shapes for Annotation Attribute Type, these are:

1. Ruler - Provides measurement of X and Y coordinates of the starting point, X and Y distances between the start and end points (deltaX and deltaY), and the scaler distance between the two points.
2. Circle - Provides measurement of radius, area and circumference of the circle.
3. Ellipse - Provides measurement of area, circumference and major and minor axes of the ellipse.
4. Rectangle - Provides measurement of area, circumference, height and width of the rectangle.
5. Square - Provides measurement of area, circumference and width of the square.
6. Curved Area - Provides measurement of area, circumference, height and width of the area.
7. Freehand Area - Provides measurement of area, circumference, height and width of the area.
8. Polygon Area - Provides measurement of area, circumference, height and width of the area.

To define an Annotation with Attributes type, click on the ***New*** button. Select Annotation with Attributes and then the shape you require (see Figure 45).

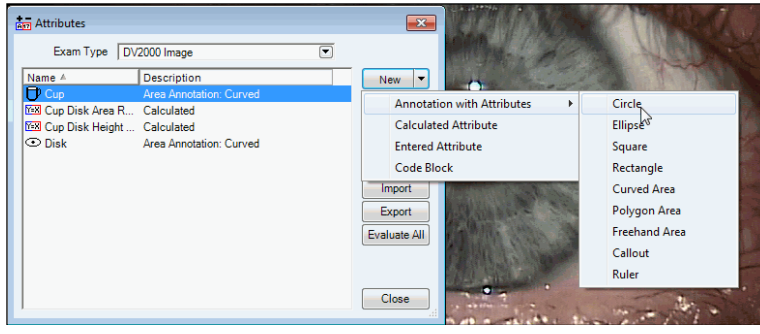


Figure 45. Selecting an Annotation with Attribute type.

Selecting Circle for example displays the New Circle Annotation with Attributes dialog shown in Figure 46.

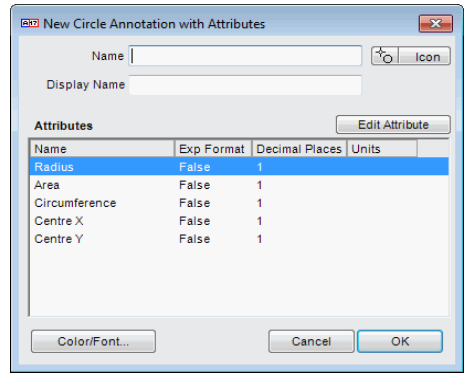


Figure 46. New Circle with Annotation dialog.

Provide a useful name and click on the **Icon** button to select a toolbar icon for this attribute type. You can define the display properties of this Annotation with Attribute type by clicking on the ***Color/Font*** button. This procedure is the same as editing a shape annotation (see *Editing Shape Annotations* on page 54). Click ***OK*** to finish. The new type will now be available on the **Edit** tab within the **Add Attributes** group.

The procedure for editing an Annotation with Attribute type is the same as for defining them. Select the name of the type from the list and click on the ***Edit*** button to display the Edit Annotation with Attribute dialog. For the Circle case we created above you will see the dialog shown in Figure 47.

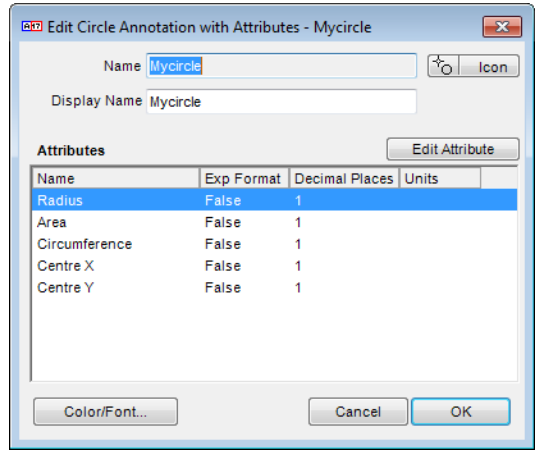


Figure 47. Edit a Circle Annotation with Attribute type.

To Delete an Annotation with Attribute type, select the name of the type from the list and click the ***Delete*** button. Click ***Yes*** at the prompt.

Calculated Attribute Types

Calculated Attribute types are attributes that are automatically calculated for the current image using a mathematical expression. The DV2000 software automatically tries to evaluate their value for every exam. If the expression cannot be evaluated, its name will be italicised and its value blank.

Before you define a Calculated Attribute type, you must already have defined the operands of the expression; you will not be able to build the expression otherwise. To define a Calculated Attribute type, click on the ***New*** button in the Attributes dialog (see Figure 44). This displays the New Calculated Attribute Dialog shown in Figure 48.

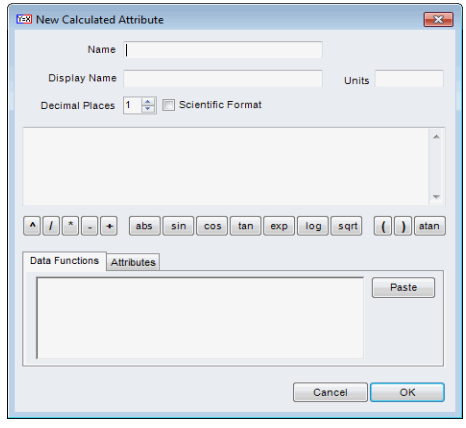


Figure 48. New Calculated Attribute type dialog.

Provide a useful name and build the expression using the expression builder. On the bottom left side list you will find all the user defined Attribute types. The right side list has all the Attributes that can be evaluated for the attribute type selected in the left side list. Select the attribute from the right side list and click on ***Paste***. Click on the operators as required. Complete building your expression. Alternatively, you can type the whole expression directly in the expression box.

Click ***OK*** to finish. Click the ***Arrange*** button at the bottom of the DV2000 Attribute window to add your new Calculated Attribute to the displayed attribute list.

The procedure for editing a Calculated Attribute type is the same as for defining them. Select the name of the type from the list and click the ***Edit*** button to display the Edit Calculated Attribute dialog.

To delete a Calculated Attribute Type, select the name of the type from the list and click on the ***Delete*** button. Click ***Yes*** at the prompt.

Entered Attribute Type

An Entered Attribute is one you assign to an image by specifying a numeric value. The attribute can be either an Integer or a Decimal number. Once defined, Entered Attribute types appear on the **Configure** tab, under **Attribute**.

To define an Entered Attribute Type, click the ***New*** button on the Attributes dialog (see Figure 44). This displays the New Entered Attribute dialog shown in Figure 49.

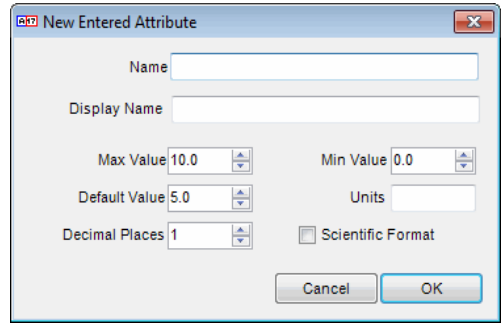


Figure 49. New Entered Attribute type dialog.

Provide a useful name and select the type of data from the drop down list. Define the maximum, minimum, default value and units. Click ***OK*** to finish. Click the ***Arrange*** button at the bottom of the DV2000 Attribute window to add your new Calculated Attribute to the displayed attribute list.

The procedure for editing Entered Attribute types is the same as for defining them. Select the name of the type from the list and click on the ***Edit*** button to display the Edit Entered Attribute dialog.

To delete an Entered Attribute type, select the name of the type from the list and click on the ***Delete*** button. Click ***Yes*** at the prompt.

Displaying Attribute Values

You are now ready to define your attributes, however you should first set the display properties to be able to actually see their values in the View Pane. Click on the Show/Hide button (see Figure 50) at the bottom of the image View Pane and select the **Data** tab.

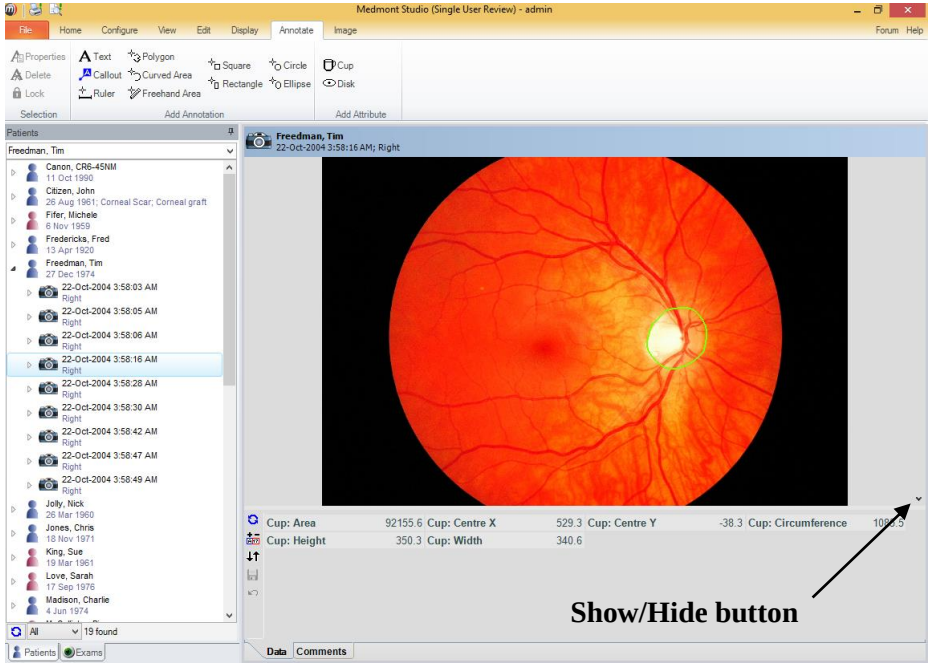


Figure 50. Show hide tab button

Selecting Attribute for Display

Click on the ***Arrange*** button at the bottom of the Attribute window. This displays the Arrange Attribute dialog shown in Figure 51.

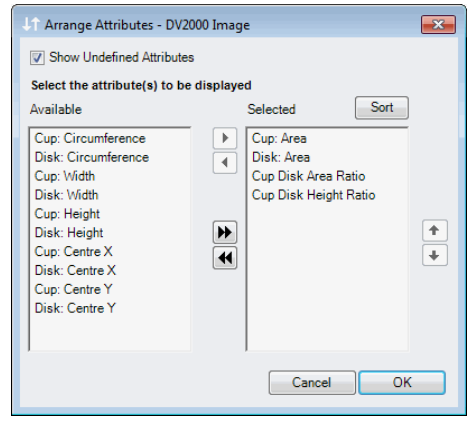


Figure 51. Select Attributes for Display dialog.

In the left side Available list you will find all the attributes that can be displayed. All the attributes currently being displayed are listed in the right side Selected list. Select the attribute(s) you want to display from the left side list and click on ▶ to copy the selection to the Selected list. To remove attributes from the Selected list, select them in the right side list and click on ◀. You can also change the order of attributes as they appear in the attributes window by selecting an individual attribute from the right side list and using the ▲ ▼ Up/Down arrows.

Click the ***Sort*** button to alphabetically sort the right column.

Defining Annotation Attributes

Note that although you may be working with either an exam or an image version while defining attributes, the attributes in reality are applied to exams and not individual image versions.

You can define attributes while Importing/Capturing or from the main Medmont Studio window. The procedures described below apply to all three cases.

Select the image you want to attach attributes to from the explorer pane, and change the view mode to image view (Medmont Studio main window only).

Under the **Tools > Attributes** you will find all the default Annotation and Entered Attribute Types as well as those that you have defined.

You can Define / Edit / Delete the Annotation Attribute types like normal Shape Annotations (see *Shape Annotations* on page 53). The values of the

attributes are automatically updated in the display at the bottom of the view as you draw the shapes.

Once you click on an Annotation with Attributes type, the display of that type turns into a numeric text box with the default value assigned to it. You can then edit the value as you wish in the box. You can also click on the Annotation Attribute to define it. Double clicking on the display deletes the attribute.

Calculated Attributes automatically evaluate the expression as their operands are changed.

12. Importing and Exporting Images

Importing images into existing exams

The DV2000 software provides the ability to export and import DV2000 images to and from Window bitmap (BMP), JPEG or PNG format files for an existing DV2000 exam. This feature allows you to export an image, edit the image using 3rd party image editing software, and store the modified image back into the DV2000 database.

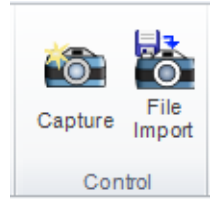
The steps involved are,

- Select the DV2000 Image.
- Click the **Edit** tab and click **Export** to export the image to either a Windows bitmap, JPEG or PNG format file.
- Click the **Edit** tab and click **Import** to import an image from a Windows bitmap, JPEG or PNG format file. If an Exam is selected then a new image is created under the exam. If an Image or Image Version is selected then a new Image Version is created.
- JPEG, BMP or PNG files can also be imported using drag and drop. Select the files or images to import and drag them onto the image area. You can also use the Windows Cut and Paste facilities for image importing from another application.
- Click the **Medmont** application button and click **Export** or **Import** to exchange exam data with other DV2000 users. These options export the Patient data and auxiliary exam data (eg comments, exam type etc) along with the image data.

Importing Images as new DV2000 Exams

The DV2000 software also provides the facility to import external Window bitmap (BMP), JPEG or PNG format images as new exams. This feature allows you to import images, that you may have captured using stand-alone devices e.g. digital camera or a third party software package.

You may either use the File Import option as the default from the DV2000 Image Source (see Figure 3) or, if using a physical capture device expand the menu **Home > Control** and select **File Import**.



You can also use the drag or drop mechanism from any file browser that supports drag and drop e.g. Windows Explorer,

Acquiring Images from TWAIN sources

You can acquire and import DV2000 images from TWAIN compliant sources, eg Digital Cameras or Scanners. You must have already installed the software that came with your device to be able to use this facility.

This option is made available on the **Configure** tab, by clicking **Image Sources**. This brings up the dialog shown in Figure 52.

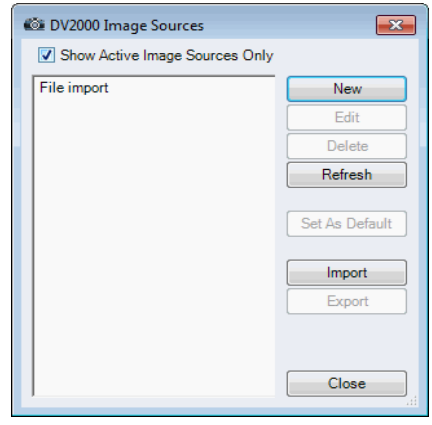


Figure 52. DV2000 Image Sources dialog.

Uncheck the **Show Active Image Sources Only** checkbox to reveal all image sources on your computer. If the TWAIN driver is not visible, click the ***New*** button to display the Edit Image Source dialog. Click on the **Type** drop-down box and select the TWAIN entry as shown in Figure 53.

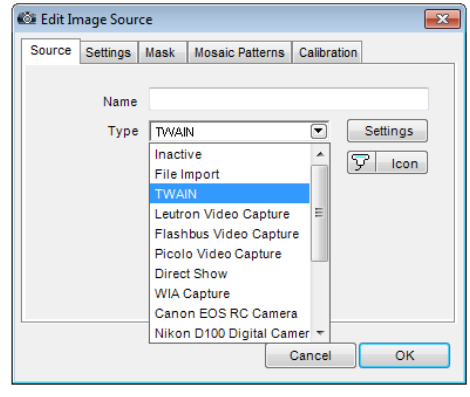


Figure 53. Selecting a TWAIN image source.

Click on the ***Settings*** button to show the Twain Source Settings dialog and then click the ***Select Source*** button. Select your TWAIN source. Give it a name in the Edit Image Source dialog and make any other selections as required. If you like, you can make this the default image source in the DV2000 Image Sources dialog.

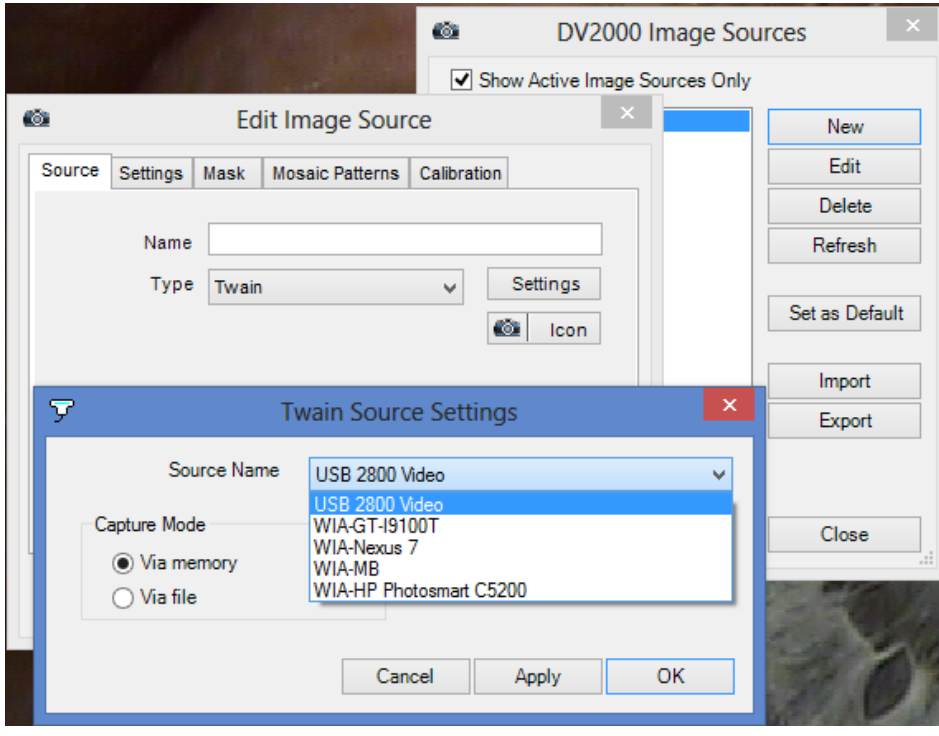


Figure 54. Selecting from the image sources.

In the example shown in Figure 54, the TWAIN source is a Canon scanner. Now when you click on the button the Exam control will run the Canon application. Any images you scan will be directly sent to the DV2000 exam control for subsequent processing.

Acquiring Images from a DirectShow Source

You can acquire and import DV2000 images from DirectShow sources. You must install the DirectShow 9c software before using this facility.

This option is made available on the **Configure** tab, by clicking **Image Sources**. This brings up the dialog shown in Figure 1.

Uncheck the **Show Active Image Sources Only** checkbox to reveal all image sources on your computer. If *Direct Show* is not visible, click the ***New*** button to display the Edit Image Source dialog. Click on the **Type** drop-down box and select the *Direct Show* entry as shown in Figure 55.

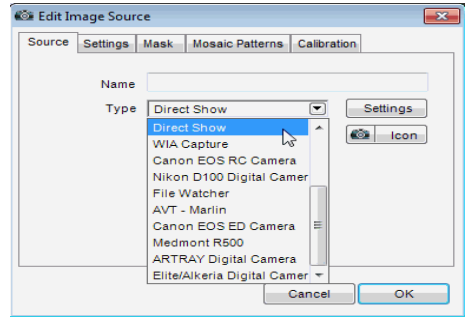


Figure 55. Selecting a Direct Show image source.

13. Printing DV2000 Images

Select the DV2000 Images you wish to print. Select the View Mode (see *Setting the Image View Mode* on page 31).

Click the **Application Button** and click Print adjust titles, margins, etc and print the displayed image, or click the **Application Button** and click **Print Preview** to similarly make adjustments but view the output before printing (see the Medmont Studio manual for more details).

If your system has more than one printer, select the destination from the drop-down **Printer** box (see Figure 56).

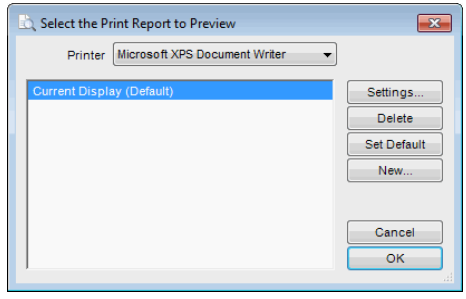


Figure 56. Print Preview selection dialog.

Click the Settings button to see a printer setup dialog where you can set margins, orientation, etc. Click OK to see the print preview.

Figure 57. Print Preview

14. Managing the DV2000 Database

This section describes general housekeeping procedures for managing the DV2000 database.

Editing Image Details

Select the DV2000 Image item in the Explorer Pane and select Details Image View mode (see *Setting the Image View Mode* on page 31). The software displays the Image details (see Figure 58).

Enter or change the details. ***Cancel*** and ***Save*** buttons will appear as soon as any changes are made. Select ***Save*** to keep your changes. The ***Cancel*** button discards any changes.

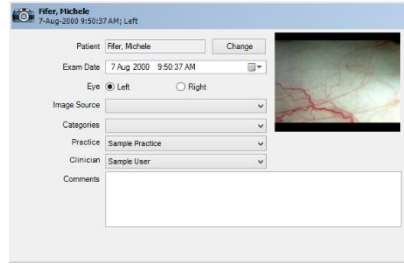


Figure 58. Image Details

Moving an Image to a Different Patient

If you accidentally capture an image against the wrong patient it is possible to move it to the correct patient. Click the ***Change*** button and select the new patient from the Patient selection box. When the changes are saved the DV2000 Image symbol in the Explorer Pane will move under the new Patient (or disappear if the new patient is filtered – see the Medmont Studio manual).

Using Exam Types

Categories are user-defined words or phrases that describe the nature of the examination. Exam categories allow a clinician to locate and compare similar DV2000 images. You can add, delete and change the available exam categories (see the Medmont Studio manual)

Deleting DV2000 Images

Select the Images(s) to be deleted in the Explorer Pane. Click **Home > Exam > Delete**  When prompted confirm the delete operation.

DV2000 Image Filters

DV2000 image filters allow you to restrict the Images that are shown in the Explorer Pane. See the chapter on Filtering in the Medmont Studio manual for further details.

Sorting DV2000 Exams

The DV2000 exams displayed in the Explorer Pane can be sorted by a variety of criteria. See the chapter on Filtering in the Medmont Studio manual for further details.

15. Menu and Icon Reference

DV2000 Explorer Pane Icons

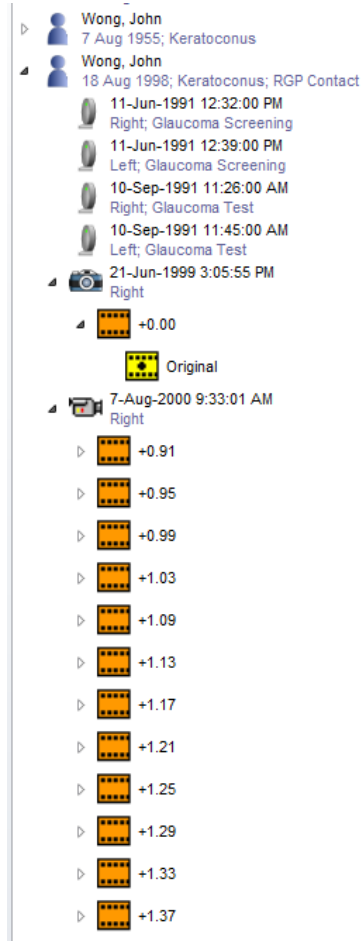


Figure 59. Explorer Pane

The DV2000 software adds the following types of icons to the Medmont Studio Explorer Pane (see Figure 59 above):

Single Image Exam – displayed under Patient icons. Represents a DV2000 Exam where a single image was captured.

Exam Sequence – displayed under Patient icons. Represents a DV2000 Exam where a sequence of images or video sequence was captured.

Image – displayed under exam icons. Represents a single image (or frame).

Version – displayed under Image icons. Represents a version of the image. Multiple versions of the same image can be saved.

Default Version – displayed under Image icons. Represents the version of the image that is displayed when the Image item is selected.

View Items

The DV2000 software adds the following icons above the patient tree when DV2000 Exams are selected.

Details – displays details about the selected exam and allows you to change them (see *Editing Image Details* on page 71).

Image – displays a view of the selected Images and Sequences (see *Setting the Image View Mode* on page 31) and provides image processing and viewing facilities.

Thumbnail – displays a set of thumbnails images that make up a sequence or versions of an image, depending on the selected item.

Compare - a comparison view of the two images, using the arithmetic difference between them to highlight areas of change over time

Home Tab Items

The DV2000 software activates the following icons to the Medmont Studio Home tab:

Digital Image – displays the DV2000 Capture Form to allow you to capture new DV2000 Images (see Capturing an Image Sequence on page 20).

Configure Tab Items

The DV2000 software adds the following items to the existing Medmont Studio Configure tab:

Custom Operations – provides access to the Custom Operations dialog.

Image Sources – provides access to the Images Sources dialog.

Edit Tab Items

The DV2000 software adds an **Edit** tab when an image is selected. Tools enabled on tab depend upon what is selected in the explorer pane. Some options are not available in the Image Import and Capture forms.

Copy – Windows standard copy function, copies the current image to the clipboard, which can then be pasted into any other windows application.

Paste – Windows standard paste function, pastes the current image from the clipboard. Only enabled when there is an image copied to clipboard. Allows for pasting images directly from external imaging applications.

Save– save the current image as a new version.

Set Default – set the version of the image that is displayed when the Image is selected. For Sequences this sets the Default Version for each of the Images in the Sequence.

Delete – delete the version of the image that is selected. For Sequences this deletes the version for each of the Images in the Sequence, there is no need to select the image version for each of the image in the sequence.

Split– splits an image or video sequence into individual exams. This tool is only enabled when an image sequence or one of its children is selected in the explorer pane.

Combine– combines the selected images into a new image sequence. This tool is only available when more than one images are selected.

Import – Import an image from a file source for an exam (see *Exporting and Importing Images* page 65)

Export – Export the currect exam as an image (see *Exporting and Importing Images* page 65)

Register –will prompt the software to find common features between the captured mosaic images, then arrange and align them.

Text – create text annotations.

Callout – create callout annotations; they differ from text annotation in that they have an anchor.

Ruler – create ruler annotations; used to measure distances on the image.

Circle – create circle annotations.

Ellipse – create ellipse annotations.

Rectangle – create rectangle annotations

Square – create square annotations.

Polygon – create polygon area annotations.

Curved – create curved area annotations.

Freehand – create freehand area annotations.

Edit – edit the selected annotation.

Delete – delete the selected annotation.

Save – save the selected annotations.

Undo – undo the most recent annotation.

Cup – define the cup on the currently selected exam.

Disk – define the disk on the currently selected exam.

Display Tab Items

The Display tab is added by the DV2000 software. It is only displayed when a DV2000 exam is selected. Some options are only available when the Image View mode is selected (see *Setting the Image View Mode* on page 31).

 **–** resets the image size to fit the view.

 – zooms in on the displayed view (see *Zooming and Panning* on page 37)

 **–** zooms out on the displayed view (see *Zooming and Panning* on page 37)

Smooth – pixel data is interpolated as you zoom in. This reduces the "square box" visual artefact when viewing images at high zoom levels.

Fast – pixel data is not interpolated. Faster but somewhat distracting at high zoom levels.

 **–** pan to the left of the displayed view (see *Zooming and Panning* on page 37).

 **–** pan to the right of the displayed view (see *Zooming and Panning* on page 37).

 **–** pan to the top of the displayed view (see *Zooming and Panning* on page 37).

 **–** pan to the bottom of the displayed view (see *Zooming and Panning* on page 37).

 **Select –** set the cursor mode of the displayed views to selection using the mouse (see *Zooming and Panning* on page 37).

 **Pan –** set the cursor mode of the displayed views to enable interactive panning using the mouse (see *Zooming and Panning* on page 37).

 **Zoom –** set the cursor mode of the displayed views to enable zoom in/out using the mouse (see *Zooming and Panning* on page 37).

Setup – Configures the currently selected exam for Stereo viewing.

Viewer – Displays the selected exam in full screen Stereo view. Will only become available once the exam has been configured for stereo viewing.

Attributes Panel – Toggles on or off the Attributes Panel underneath the exam image when an exam is being viewed

Annotations – Toggles on or off Annotations that have been added by the user. Can be used to see an exam before and after annotations.

Image Tab Items

The Image tab is added by the DV2000 software. It is only displayed when a DV2000 exam is selected. Some options are only available when the Image View mode is selected (see *Setting the Image View Mode* on page 31).

Contrast Stretch – manually adjust the contrast thresholds and gamma curve for the image.

Equalise Luminance – maximise the contrast in the image while maintaining "true" colours, is disabled for greyscale images.

Equalise RGB – maximise the contrast in the image by processing each colour channel independently. Results in maximum contrast but may introduce "false" colours.

Sharpen – enhance the visibility of edges and lines in the image.

Deinterlace – remove video interlacing artefacts caused by movement in the subject.

Emboss – The operation adds dimension to an image by making it appear as if it were carved as a projection from a flat background, giving it a three-dimensional appearance. All color in the image will be replaced with shades of grey.

Invert – invert the colours/intensities of the image (similar to a photo negative).

Flip – flip the image along horizontal axis.

Mirror – flip the image along vertical axis.

Rotate – rotate the image as specified.

Resize – resize the image as specified.

Greyscale – convert a colour image to greyscale image (not available for greyscale images).

Colourise – convert a greyscale image to 256-colour image (not available for colour images).

Filter – remove the entire colour channels except the ones specified.

Invert Black – invert all the colour values, below the threshold specified, to maximum (white). Saves a lot of ink when printing images with black borders.

Undo – undo the last change to the image.

Undo All – undo (abandon) all changes since the image was last saved.

Image > Information… – displays information about the currently selected image, size and colour depth.

Black Invert – Like the Invert Black function, except the inversion threshold is set to 10 and can only be modified through the Custom Operation on the Configure tab (see *Black Invert Operation* on page 45).

Blue Split – Removes all colour channels except Blue

Green Split – Removes all colour channels except Green

Mirror – flip the image along vertical axis.

Red Free – Removes only the Red colour channel

Red Split – Removes all colour channels except Red

RGB Split – Removes the Red, Green, and Blue colour channels

Video Tab Items

The Video tab is added by the DV2000 software. It is only displayed when a Sequence or Video is selected and Image View mode is active (see *Setting the Image View Mode* on page 31).

Play – sequentially displays each image in the sequence (starting from the current image) then pauses at the beginning of the sequence.

Continuous Play – sequentially displays each image in the sequence (starting from the current image) in a continuous loop.

Pause – pause playing of the sequence.

Start – display the first image in the sequence

Back – display the previous image in the sequence.

Forward – display the next image in the sequence.

End – display the last image in the sequence.

Frame Rate - a dropdown list that selects the playback speed.

16. Compliance

The Medmont Diagnostic Video Imaging software

Model DV2000

Has been produced by

Medmont Pty Ltd
Unit 1, Whitehorse Business Park
170-180 Rooks Road, 3133
Victoria, Australia

It has been classified as a Class 1 Medical Device and is in conformity with the essential requirements and provisions of the European Council Directive 93/42 EEC.

As identification of its conformity, the DV2000 software is labelled with the CE mark as shown below.

CE

17. Representatives

The EU Authorised Representative:

BiB Ophthalmic Instruments
Unit 8, The Orbital Centre, Cockerel Close
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Stevenage, Hertfordshire SG1 2NB
England
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Your Local Medmont Authorised Agent is: