

MEDMONT AUTOMATED PERIMETER



USER MANUAL

Models M700 USB C, M700 USB CR, M730 Focus



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1. Manual Organisation

This manual is divided into four sections:

1. Introduction and Device description,
2. The installation of the software and the perimeter,
3. The set up for and performance of a test, and the saving and reviewing of the results, and
4. A reference section that elaborates on the introduction given in 2.

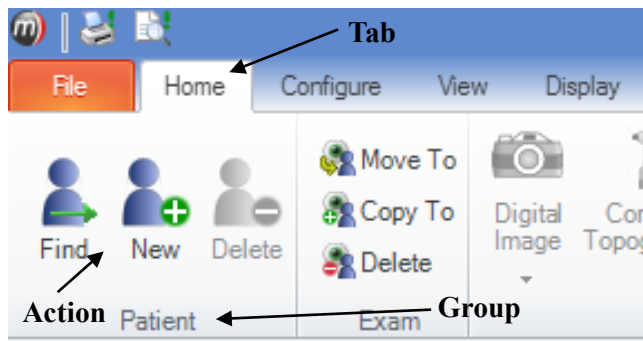
In discussing the normal interaction between the software and those involved in a particular operation, test or test review, the manual uses the term *Clinician* to refer to the person operating the equipment, and *Patient* to refer to the person undergoing the test.

The manual describes the M700 USB and M730 USB Automated Perimeter instrument models and software upgrades of all Automated Perimeters to Studio 5.

Software Conventions



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.



A small glossary is included for terminology that originated with Medmont. It also includes some common terms where they apply to Medmont equipment. It is not a glossary of perimetry. Terms that appear in the glossary are underlined in the text.

2. Introduction

The Automated Perimeter software is designed as a component of Medmont's integrated clinical environment called *Medmont Studio*. Medmont Studio is an extensible software framework that allows the controlling software for different medical instruments to be fully integrated into a single working environment.

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

Variants

The Automated Perimeter may be configured at purchase as a number of optional variants.

- M700 USB C standard model including CCD camera for fixation video monitoring.

- M700 USB CR, additional Red light perimetry @650nm

- M730 Focus Max 30 degree field, incl. stray light shroud

Intended Purpose

The Medmont Automated Perimeter performs rapid and reliable screening and threshold tests of visual fields, while providing comprehensive control over the test and detailed information on its progress.

The clinical applications of visual field testing using the Automated Perimeter can include tests for Glaucoma, Flicker Perimetry, Binocular Testing (including Driving Tests), Neurological Testing, Macula Testing, Peripheral Vision Testing and others.

Easily followed instructions enable a clinician to quickly perform accurate visual field tests, as well as providing the ability to easily design custom fields and tests.

Testing of the visual field is carried out using the technique of static perimetry, with the stimulus targets being a set of rear illumination Light Emitting Diodes (LEDs). In the text the LEDs are referred to as *light points*.

Testing may select from two fields of different coloured stimuli, one green set and one red set (variant R model).

Fixation performance is monitored by the Heijl-Krakau technique, with random stimuli presentations in the blind spot or (optionally) using continuous video tracking of the patient's iris. The patient's fixation performance is continuously displayed to the clinician both statistically and visually.

The Medmont Automated Perimeter shall only be used as described in this manual and only for the intended purpose.

Standard Accessories

Medmont Studio 6 package

Installation instructions

Calibration file on CDR

Power cord

Spare fuses mains power

Spare fuses PCB

Patient switch

Patient switch holder including fasteners

Dust cover

Binocular chinrest

Eye Occluder

Binocular target holder

Mounting screws and washers

USB cable

Patient environment label incl com port insulation plug

Optional accessories

Patient Management Integration Software	Custom
Network licensing	Custom
USB2.0 active extension 5m	PN 1482-242
Medical Isolation transformer 230V 500VA TR2450	PN 0762-279

Spare parts

Patient switch	PN 0472-280
Occluder assembly	PN 0473-379
Occluder with Target Holder	PN 3044-379
M700 PCB USB Microcontroller	model specific
Lens holder head	PN 0360-370
Dust cover	PN 0471-542
Binocular chinrest	PN 1179-319
Fuse, spare T400mA 250V (pkt 10)	PN 1576
Fuse 500mA microfuse	PN 1466-243

3. Warranty

This Medmont Automated Perimeter is manufactured with all due care and subjected to stringent testing before leaving the factory. The instrument is guaranteed for 12 months from the date of delivery. During this warranty period Medmont or an authorised agent will repair or replace all defective parts free of charge. Such repairs do not extend the warranty period. The replaced defective parts become the property of Medmont. The warranty does not cover defects due to incorrect handling, installation or setup, unauthorised modifications, non-compliance with the requirements for computer hardware and associated mains powered equipment as specified in this User Manual, loss of the license, loss of income, or service and repair costs for components and associated equipment. Warranty claims are the responsibility of the agent where the instrument was purchased.

4. 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. Medmont cannot be held responsible for misdiagnosis of results.

Essential Performance

Due to the possible effects of external electromagnetic interferences the essential performances of this instrument are:

- Component failures in the Automated Perimeter unit are not permitted
- Changes in programmable parameters are not permitted
- Reset to factory defaults are not permitted
- Errors of a displayed numerical value sufficiently large to affect diagnosis are not permitted

Classification



Do not use this instrument other than intended and specified. In accordance with IEC 60601-1 clause 5, the M700 (and variants) Automated Perimeter is classified as

Applied parts to patient	Automated Perimeter unit.
--------------------------	---------------------------

Protection against electric shock	Class I
-----------------------------------	---------



Warning: To avoid risk of electric shock, this equipment must only be connected to a supply mains with protective earth

Degree of protection against electric shock	Type B Applied Part Equipment
---	-------------------------------

Protection against harmful ingress of water	Ordinary (no protection) For indoor use only.
---	--

Mode of Operation	Continuous Operation
-------------------	----------------------

Oxygen Rich Environment	This instrument is not
-------------------------	------------------------

	suitable for use in oxygen rich environment
Altitude	<= 4000m

Clinical Results, Accuracy and Age Normals

The Automated Perimeter is delivered to the end user quality tested and calibrated as per specifications. While the device has exceptional long-term stability, it is not the responsibility of Medmont to police the accuracy of the device after delivery. The device is calibrated and referenced against the Medmont Age Normal standard displayed as a dB scale.

Electrical Safety of System



To ensure the safety of the Automated Perimeter system, all associated equipment connected to it must be compliant to EN/IEC60950 and powered by an isolation transformer compliant with medical standard EN/IEC60601-1, UL2601 or CSA22.2#601-1.

Any open communication port on the PC must be covered with provided port covers when the device is used in a patient environment. When networking to another computer, either the use of a network device with electrical separation of I/Os or wireless network may be used. Please contact your distributor, as network performance may be affected.

Radiation

The Automated Perimeter emits radiation in the visual range in the distinct wavelength of 565nm. The levels of intensity of this illumination are below any levels known to be hazardous.

Electromagnetic Interference




Strong electromagnetic interference from unprotected devices or portable and mobile RF communications equipment or mains disturbances (voltage dips, transient surges) or electrostatic discharge may affect the performance or results of the Automated Perimeter. Avoid using the device while such high interference is present. See *Troubleshooting* on page 131 for particular effects and solutions. The device is compliant with medical standard

EN/IEC60601-2.

Guidance and manufacturer's declaration – electromagnetic immunity			
The M700 USB Automated Perimeter is intended for use in the electromagnetic environment specified below. The customer or the user of the M700 USB Automated Perimeter should assure that it is used in such an environment.			
IMMUNITY test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/burst IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	± 2 kV for power supply lines N/A	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1 kV line(s) to line(s) ± 2 kV line(s) to earth	± 1 kV line(s) to line(s) ± 2 kV line(s) to earth	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5 % <i>UT</i> (>95 % dip in <i>UT</i>) for 0,5 cycle 40 % <i>UT</i> (60 % dip in <i>UT</i>) for 5 cycles 70 % <i>UT</i> (30 % dip in <i>UT</i>) for 25 cycles <5 % <i>UT</i> (>95 % dip in <i>UT</i>) for 5 s	<5 % <i>UT</i> (>95 % dip in <i>UT</i>) for 0,5 cycle 40 % <i>UT</i> (60 % dip in <i>UT</i>) for 5 cycles 70 % <i>UT</i> (30 % dip in <i>UT</i>) for 25 cycles <5 % <i>UT</i> (>95 % dip in <i>UT</i>) for 5 s	Mains power quality should be that of a typical commercial or hospital environment. If the user of the M700 USB Automated Perimeter requires continued operation during power mains interruptions, it is recommended that the [ME EQUIPMENT OR ME SYSTEM] be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical

Important Facts

			commercial or hospital environment.
NOTE <i>U_T</i> is the a.c. mains voltage prior to application of the test level.			

Guidance and manufacturer's declaration – electromagnetic immunity			
The M700 USB Automated Perimeter is intended for use in the electromagnetic environment specified below. The customer or the user of the M700 USB Automated Perimeter should assure that it is used in such an environment.			
IMMUNITY test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3V	Portable and mobile RF communications equipment should be used no closer to any part of the M700 USB Automated Perimeter, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.2\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2,5 GHz	3V/m	$d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2,5 GHz where <i>P</i> is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and <i>d</i> is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, ^a should be less than the compliance level in each frequency range. ^b Interference may occur in the vicinity of equipment marked with the following symbol: 
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
^a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the M700 USB Automated Perimeter is used exceeds the applicable RF compliance level above, the M700 USB			

Important Facts

Automated Perimeter should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the M700 USB Automated Perimeter

^b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended separation distances between portable and mobile RF communications equipment and the M700 USB Automated Perimeter

The M700 USB Automated Perimeter is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the M700 USB Automated Perimeter can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the M700 USB Automated Perimeter as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$	80 MHz to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2,5 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Electromagnetic Emissions

This device does not emit harmful or undesired electromagnetic emissions. The device is compliant with medical standard EN/IEC60601-2. **MEDICAL ELECTRICAL EQUIPMENT** needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in the **ACCOMPANYING DOCUMENTS**.

If the M700 USB Automated Perimeter is used in a domestic establishment or connected to the Mains Public Network following warning shall apply:



This equipment/system is intended for use by healthcare professionals only. This equipment/ system may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures, such as re-orienting or relocating the M700 USB Automated Perimeter or shielding the location.



The use of **ACCESSORIES**, transducers and cables other than those specified, with the exception of transducers and cables sold by the **MANUFACTURER** as replacement parts for internal components, may result in increased **EMISSIONS** or decreased **IMMUNITY** of the M700 USB Automated Perimeter.



The M700 USB Automated Perimeter should not be used adjacent to or stacked with other equipment and that if adjacent or stacked use is necessary, the **ME EQUIPMENT** or **ME SYSTEM** should be observed to verify normal operation in the configuration in which it will be used.

Guidance and manufacturer's declaration – electromagnetic emissions

The M700 USB Automated Perimeter is intended for use in the electromagnetic environment specified below. The customer or the user of the Automated Perimeter should assure that it is used in such an environment.

Emissions test	Compliance	Electromagnetic environment – guidance
RF emissions CISPR 11	Group 1	The M700 USB Automated Perimeter uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The M700 USB Automated Perimeter is suitable for use in all establishments other than domestic, and may be used in domestic establishments and
Harmonic emissions	Class A	

Important Facts

IEC 61000-3-2		those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes, provided the following warning is heeded: Warning: This equipment/system is intended for use by healthcare professionals only. This equipment/system may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures, such as re-orienting or relocating the M700 USB Automated Perimeter or shielding the location.
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

Side effects

No undesired side effects to patient or clinician or other persons are known when using this instrument under normal conditions and for the intended purpose.

Instrument Damage



Never operate instrument in a damaged condition. Contact your distributor to seek advice.

Disposal



Some components in the instrument contain lead or polychlorinated biphenyls (PCBs). These substances can be harmful to human health and the environment.

Dispose the instrument and all the electronic accessories only through separate collection and not with normal waste.



For disposal at the end of the product life cycle, please follow national regulations for disposal and recycling.

Symbols and Labels

The following table explains the use of symbols in this manual.



Warning: In the event of user error including use error and unforeseen fault condition there may be a serious risk to health or life of patients or operator, or product damage or loss may occur.



Caution: In the event of user error or unforeseen fault condition, damage to the device or its performance may occur.



Precaution.



Safety related instruction: Refer to instruction manual/booklet.



Alternating current.



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



Type B Equipment (degree of electrical safety).



The date below this symbol shows the year and month of manufacturing.



WEEE mark: Separate collection for electrical and electronic equipment. Device contains dangerous substances; do not dispose with normal waste.



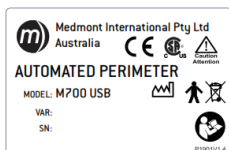
Connector socket for patient switch.



Type B USB connector for USB cable connection to computer.



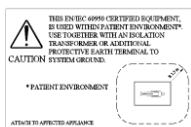
This label is found on the PC port insulation plugs. The plugs are for RS232 and Network ports. These PC ports are to be covered if the PC is used within the patient environment.



Device Label - positioned at the right rear of the instrument.



Fuse Rating label.



Patient environment comprises a 1.5m radius around area in which patient or some other person can touch parts of the medical system intentionally or unintentionally.

Note that the Patient Environment label is supplied as a separate item, and must be fixed to the computer in a visible location.

5. Installation

. The installation instructions and this user manual provide guidelines on the installation process. Medmont or Authorised Distributors can provide this service for a fee. Only a qualified PC technician should perform the hardware and software installation.

There are three basic tasks associated with setting up the instrument:

- Installing the software
- Setting up the perimeter in a suitable environment.
- Connecting the perimeter to the software

The Medmont Studio software can also be installed without a physical perimeter to allow analysis and review of Patient Exams.

PC Requirements

When acquiring a PC for the Medmont Automated Perimeter, please observe the minimum requirements as described in the *Medmont Studio* manual.



Use only a PC and associated equipment that has been safety tested to the Standard EN/IEC60950 (Information Technology Equipment) and the Standards for Electromagnetic Emissions CISPR22/EN55022, and must be powered by an isolation transformer compliant to the medical standard EN/IEC60001-1, UL2601 or CSA22.2#601-1 (see *Optional accessories* on page 5 for products meeting these requirements that are available from Medmont).

Perimeter Environment

The background illumination of the Medmont Automated Perimeter is set at 10 apostilbs or 3.2 cd/m² (except for some driving tests). In order to avoid the possibility of uneven ambient lighting falling on the bowl surface, all overhead lighting should be switched off and testing carried out in a dimly lit or completely darkened environment.

As the Automated Perimeter is a highly precise measuring instrument, it needs to be located in a suitable and clean environment:

Room temperature: +10°C to +40°C

Relative humidity: 10% to 80%

Keep the instrument away from direct sunlight to avoid unnecessary exposure to heat and light.

Software Installation

The Automated Perimeter Software is a component of the Medmont Studio integrated clinical environment. A single Flash Drive is supplied with installation software for all Medmont Studio components. The installation procedure is detailed in the Medmont Studio User manual.

However, if you are installing your Automated Perimeter on a PC for the first time, you will need to tick the checkbox in the software drivers dialog shown in Figure 1 when this is displayed during installation.

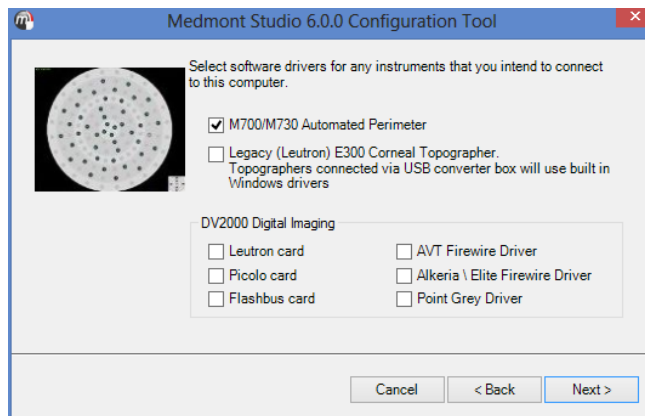


Figure 1. Device driver installation dialog.

See the Medmont Studio documentation for more details on installation.

System Hardware Installation

Medmont Automated Perimeter

The Medmont Automated Perimeter setup consists of three basic components:

- The perimeter unit, which presents the stimuli to the patient.

- A separate Personal Computer, which controls the perimeter and all test functions.
- Isolation transformer, used to provide the extra electrical safety protection for the patient which the PC does not have.

Connect Patient Switch and USB cable into the connector on the lower right-hand side of the perimeter as labelled.

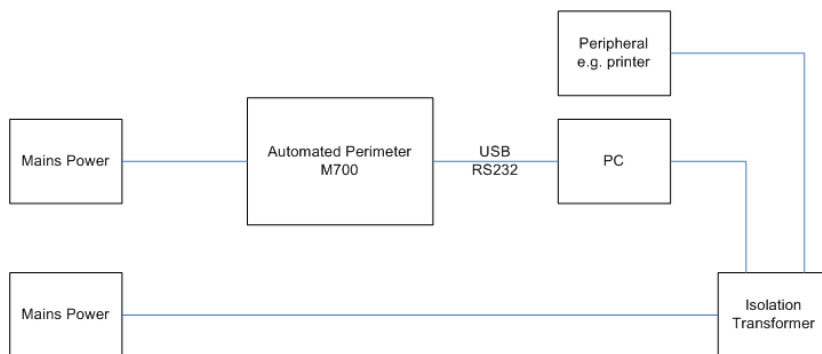


Figure 2. Perimeter power connections.



A hospital grade power cord must be used to achieve reliable grounding.



When setting up the instrument, make sure there is enough space for easy access on the side the power entry module in order to show, the instrument is energised, and to ensure the power lead and switch can be reached easily for disconnecting power.



Connect the power lead to an isolation transformer as shown in Figure 2 only.



Avoid unnecessary power usage by turning off the unit at the end of each day. This will also extend the life of the unit.

USB Interface

The perimeter is fitted with a standard USB 2 interface. Due to the data rates required, you cannot use a USB-1 cable. The terminal is located at the right hand side of the unit. Connect cable to this terminal and any terminal on the rear side of the PC.

M600 Perimeter Upgrades

Older M600 Perimeter devices are no longer supported by Medmont Studio. Databases for these older devices can be upgraded to the latest version of software. Please contact your local distributor for further instructions on this process.

Licensing

Medmont Studio must be licensed. See the Medmont Studio user manual for the necessary steps.

Installing the Perimeter

You must install your particular perimeter with the software before continuing. Double-click the desktop icon or select **Medmont Studio** from the Windows **Start > Programs > Medmont** menu. A banner with the Medmont Studio logo is displayed while the software loads. A full-screen window similar to Figure 3 will appear.

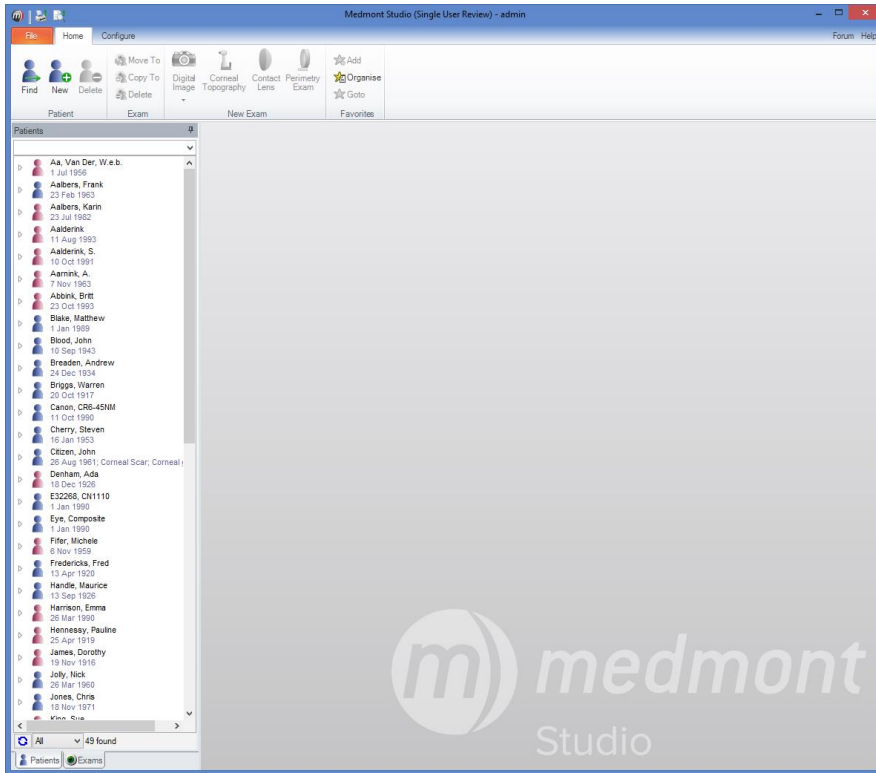


Figure 3. Initial Medmont Studio Window.

To install your instrument, on the **Configure** tab, click **Instrument Setup** within the M700 group. The M700 Instruments dialog shown in Figure 4 will be displayed. Click on the **Import** button to import the calibration file.

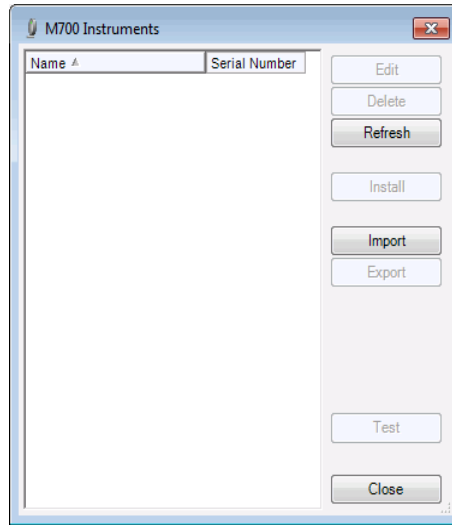


Figure 4. Install a new M700 Instrument dialog.

New systems are supplied with the calibration file on a CD-ROM, while for earlier systems this was supplied on a floppy disk.

- For new systems, navigate to the CD-ROM disk.
- For older systems, navigate to the floppy disk.

You will be presented with a standard Windows file selection dialog listing the calibration file. Ensure the file with the ICF extension is highlighted and click on the **Open** button to load the calibration file.

Medmont Studio will display the perimeter dialog shown in Figure 5. Verify the serial number matches your documentation. By default the perimeter name is the same as the serial number. You can choose to give the instrument a local name at this point. Click the **OK** button.

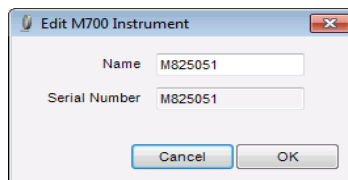



Figure 5. Perimeter Selection.

If you have a number of Perimeters installed on this PC, you will need to select an instrument from the list for every test. You can specify a default

instrument by selecting it in the M700 Instrument dialog and clicking the **Install** button.

Verify that the M700 component has been installed by selecting help icon  located in the top left hand corner of the main Medmont Studio window and select **About Medmont Studio 6**. This displays a dialog that lists, among other things, the installed components.

The *Test* button will be greyed out until a Perimeter is installed. This button is used for regular testing of all light points on the installed Perimeter. Refer to page 128 on testing light points for more information.

PalSet

On starting a test for the first time after installing a perimeter that uses a Belkin video converter for the eye camera, a dialog is presented giving step-by-step instructions on configuring this converter for PAL video operation. This is required as the spatial framing of the camera is performed in PAL mode, and this converter does not provide for software video mode setting. Later perimeters use a different video converter and this setting is automatic.

Clicking the **Run Palset** button will start the PalSet program. If the video system is working it will show the current view from the eye camera. Click the **Devices** menu and it should show *Hi-Speed USB DVD Creator*. Click the **Options** menu, ensure the **Preview** entry is selected, and then select the **Video Capture Filter** option. Click the **Image** tab and ensure the **PAL** radio button is selected. Click **OK** and dismiss PalSet. Click the **OK** button to dismiss the initial instruction dialog

6. Testing a Patient

The following sections describe how to perform a patient examination with the Medmont Automated Perimeter. For those familiar with the instrument, an initial express test is provided in *Express Testing a New Exam* on page 26 to quickly become familiar with the new software.

These sections deal with:

- Preparing and positioning the patient.
- Selecting the test and strategy.
- How the test is monitored while in progress.

The Perimeter Test Control Window

With Medmont Studio running, on the **Home** tab, click **Perimetry Exam** to start the Test Control. Figure 6 shows a typical initial test control window including the video Eye Monitor.

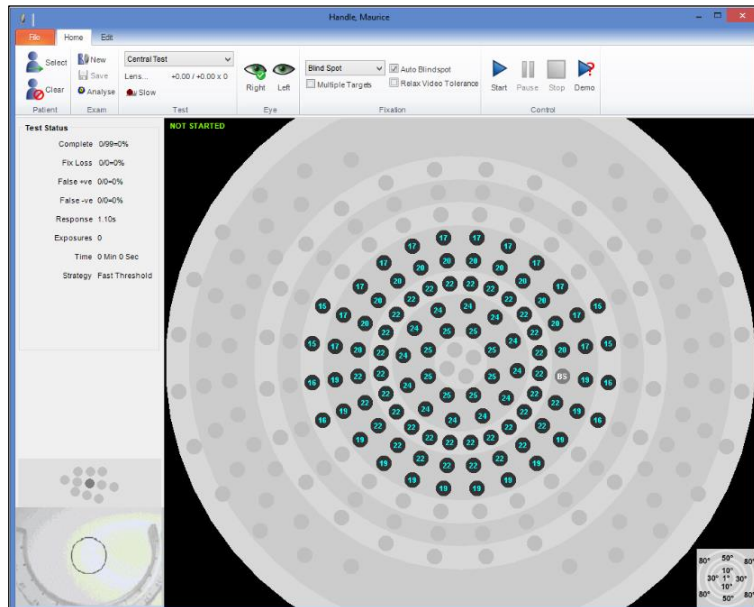


Figure 6. The Test Control screen with Eye Monitor.

The window will appear full screen, overlaying the Medmont Studio window.

Note that if the Test Control window is full screen it will completely hide the Medmont Studio window. However, the Studio window still exists and is completely independent of the Test Control window. However the new Test Control window **is** dependent on Medmont Studio, so closing Medmont Studio will also close the Test Control. You can move between these windows using the Alt-Tab keyboard combination or by selection from the Windows Task Bar.

The window shown in Figure 6 is a representation of the perimeter. It shows the set of light points that make up the test field defined in the selected Template. Each light point in the field is shown as a small black circle containing a blue number. These are the light points **included** in the field. Light points not in the test are shown as light grey. The number in each circle is the starting exposure level in decibels, and is based on either the patient's previous exam or an Age Normal Hill of Vision distribution.

The green light points are arranged in concentric circles with radii of 1°, 3°, 6°, 10°, 15°, 22°, 30°, 40°, 50°, 60°, 70° and 80°. A graphic in the lower right-hand corner provides a key to the ring radii. For perimeters so fitted, the red light points are similarly arranged in concentric circles with radii of 0°, 2°, 4.5°, 8.5°, 12.5°, 18.5° and 26°.

The 1° through 50° rings are referenced to the central Fixation Point, while the 60°, 70° and 80° rings are referenced to the left and right offset fixation points respectively.

Based on the selected eye to test, the current Blind Spot is shown as a grey circle containing the white letters BS.

The controls and text groupings in the left-hand pane provide for the test setup and monitoring, and are described in *Controlling a Test in Progress* on page 37.

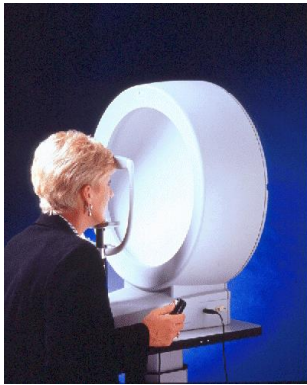
Preparing the Patient

In order to produce good quality and accurate results, some precautions should be followed in positioning the patient correctly. While these are well-known and standard practice for automated perimetry examinations, we here reiterate the most important points as they apply to the Medmont Automated Perimeter. Taking some care in positioning the patient and ensuring he or she is comfortable and aware of what will happen reaps rewards in consistent and valid test results.

The patient needs to understand that the nature of the test is for her to report what she sees peripherally while her gaze remains fixed on the fixation target. Sometimes all that is needed is an explicit instruction to look straight ahead at the fixation target and push the button when a light is seen anywhere on the perimeter.

The clinician may wish to explain that the patient can safely pause the test by holding the button down, and that the test will continue normally when the button is released.

The patient needs to be told that the light point will be a brief flash after which there will be a short pause. She also needs to know that she can respond after the light goes off, so she is not frustrated if she finds it



impossible to respond quickly enough while the light is still on. Thus he or she should respond as quickly as possible, but not too quickly that they respond in error.

The patient should also be told that some points will be very dim and that she should respond if they are seen, but only if she is sure, because at times they will be below her visual threshold, and at other times the perimeter will only pretend to present stimuli.

Ensure the patient is aware that the multiple fixation targets flashing four times will indicate the end of the test.

Especially if the patient has never undergone perimetry before, it is best to test the non-suspect eye first. Otherwise, the convention is to test the right eye first and the Medmont Automated Perimeter respects this convention. The eye not being tested should be covered with the supplied eye patch. If using video fixation monitoring then ensure that the circular head tracking targets on the eye patch (or headband for binocular testing) are correctly positioned and not obscured by the head rest. See *Video Fixation Monitoring* for more information.

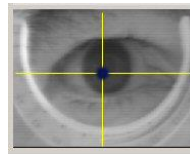
Ensure the eye to be tested is centred squarely in front of the fixation target. Raise or lower the chin rest so the patient's eye is at the height of the marker on the chin-rest frame. Use the chin rest adjustment to get this correct. The face may be turned slightly to the left when testing the right eye, and slightly to the right for the left eye so the nose does not obstruct the nasal periphery of the field.

Similarly, the chin should be positioned so the plane of the face is directed straight ahead or slightly upward (thus putting the eye in slight down-gaze to see the fixation target).

The side turn and upward tilt of the face should be neither exaggerated nor uncomfortable. The only point is that the eye not be in a nasal or up-gaze position where facial structures may shade the peripheral field.

If the patient requires a correcting lens, be sure it is positioned close to the eye and that the holder does not restrict the field of view.

Use the video eye monitor shown here (where fitted) to both position the patient and monitor their fixation throughout the test.





Be sure that the patient is sitting comfortably in the chair and the height of the perimeter and chin rest are correct. If the chair is too far away or the perimeter too low, the patient will be bent uncomfortably forward during the test. Consequently her face may be tilted forward and her eyelids and eyebrows in a position to interfere with the upper visual field.



If the chair is too close or the perimeter too high, the patient may be off balance and continually strain to maintain her position at the perimeter. The instrument may be too close if she feels the need to prop herself up with her arms back or hold onto the instrument to keep from falling backward.

Running the test in demonstration mode for a while as described in *Demonstrating the Test* on page 30, can let the patient see what will happen and to become familiar with using the response button.

Express Testing a New Exam

With Medmont Studio running:

1. Click on the **New Test**  button to start the Test Control. Figure 6 shows the initial test control screen with a right eye Glaucoma test template selected.
2. Select the type of exam (the Template) from the drop down selection box. This will define the Field and Strategy to be used during the test.
3. Click the **Right** or **Left** eye button as required to swap the blind spot and match the eye being tested.
4. When you are ready, click on the **Start**  button.

- The exam will begin. You can pause and stop the exam using the **Pause**  or **Stop**  buttons.

When the test completes you can click on the **Analyse Test**  button to analyse the result.

If a patient or a test belonging to a patient was previously selected in Medmont Studio, then the new patient exam is created for that patient, otherwise the exam is created without reference to a patient.

Note that in the latter case the test initial values will be based on a standard Hill of Vision (see *Statistical Indexes* on page 63), whereas if a patient has been selected then the initial values will be based on their most recent exam. In most cases, using previous values will produce a quicker test.

Note also that without defining a patient, the HoV will be based on the 1-45 year age group, which can bias results for older patients. For all these reasons, Medmont recommend the patient always be defined.

If the wrong patient was selected, you can associate the test with the correct patient by clicking on **Patient > Select** to bring up the **Find Patient** dialog shown in Figure 7. Clicking on **Patient > Clear** disconnects the current test from its currently assigned patient.

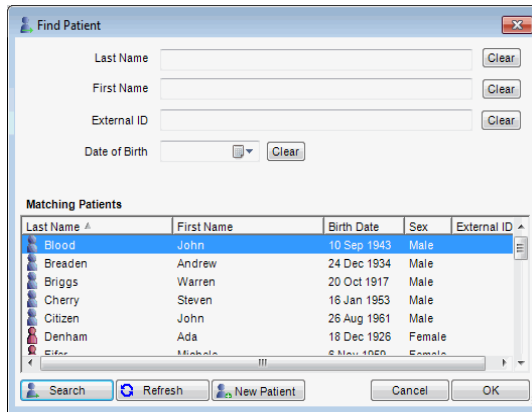


Figure 7. Select Patient window.

Being able to perform an exam or a sequence of exams without previously selecting a patient simplifies performing general screening tests. However, to save an exam result it must be associated with a patient. To check if a patient

has been previously tested, you can browse the patient list in Medmont Studio.

The simplest selection method is to type their family name (or just the first few letters) in the Medmont Studio Explorer pane, then press **Enter**. The first entry that matches the letters entered will be highlighted in the patient explorer window. Select an existing patient by highlighting their name or enter a new one as detailed in the *Adding a New Patient* section of the Medmont Studio User manual.

Starting a New Exam

Here we elaborate on the steps defined in Express Testing a New Exam on page 26.

Again we assume you have started Medmont Studio. To start an exam, on the **Home** tab, click **Perimetry Exam**.

Test Settings


Select the type of exam or template from the drop down selection box (see *Selecting a Test Template* on page 38).

Click the **Eye** button to swap eyes (see *Selecting the Eye* on page 38).


Click the **Lens** button to change the lens to use for testing the patient. If the **Age Based Lens** option is checked then the default lens parameters are calculated automatically based on the patient's current refraction (see *Lens Details* on page 38). If non-zero lens values are specified you will be asked to insert the correct lens in the lens holder before the test begins.

Click the **Multiple Fixation Target** check box to switch between the four-point foveal-loss target and the single point fixation target (on perimeters so fitted).

Click the **Auto Blind Spot** checkbox to switch between automatic and manual blind spot control (see *Blind Spot Fixation Monitor* on page 42).

You can click on the **Slow Response Settings**  button at any time if the patient has trouble responding in time.

Starting the Test

When you and the patient are ready, click on the **Start**  button to begin the exam. You can pause and stop the test from the same menu. The run,

pause and stop functions are also available as toolbar buttons as detailed in the *Express Testing a New Exam* on page 26.

Monitoring the Test

The **Test Status** area groups a number of indicators that monitor the exam (see *The Test Status Group* on page 42).




The Blind Spot Monitor graphic at the lower left indicates the current blind spot as a dark grey spot. The speaker will beep if the patient sees the blind spot. For perimeters so fitted, a small video image from a camera focused directly on the patient's eye is displayed below the blind spot monitor graphic.

During a test the exam state appears as a text message in the top left-hand corner of the perimeter display (i.e. Running, Clinician Pause, Patient Pause, etc). The perimeter display shows light points that are part of this test as black circles with blue numbers. These are the **included** test points and they define a Field. The number is in decibels and denotes the initial exposure level. Test points that are **non-included** are shown in grey.

Changing Test Points during an Exam

You can select any point at any time using the technique described in *Creating a New Template* on page 36. Selecting a point will change its background colour to blue.

The point-based options in the **Test** menu allow any selected point(s) to be added prior to the exam beginning. You can also use selection to add or re-test any point or group of points while the exam is in progress or even after the test has finished. These options are also available on the test toolbar via the icons below. Note that deselecting does not delete a point.

-  Add the currently selected point(s). Use this to add new points that **are not** included in the current field. The point(s) become part of the current field and will be subsequently tested.
-  Re-test the currently selected point(s). Use this to retest points that **are** included in the current field. They will be subsequently retested.
-  Deselect any currently selected point(s). The point and its background will revert to its previous state and colour.

There is no button to delete a point you have added using these methods. However, before the test begins or after it has concluded, if you select the **Edit > Template > Edit** button these points are easily deleted in the Template Editor (see *Modifying Test Parameters* on page 31).

Pausing a Test

Once a test begins, the clinician may pause an exam by clicking the **Pause** button on the toolbar.



As with earlier Medmont perimeter software, the patient can also pause the exam by holding down the patient response button.

Test Point Colours

The colour of the test point text on the perimeter display denotes its current state. Once the test begins, the number in the circle is the last exposed value in decibels. Points eventually Not Seen even at zero decibels (maximum brightness) have the word NO in the circle. The number colours are:


Blue	As yet untested
Red	Exposed but Not Seen
Green	Exposed and Seen
White	Final completed state

Saving the Completed Test

When the exam is stopped or concluded, it can be saved by clicking the **Home > Exam > Save**  button. If the exam was performed without being attached to an existing patient, clicking **Save** will bring up a list (see Figure 7) from which a patient may be selected or a new patient entered. You can continue testing with this or any other field template by clicking on the **Home > New**  button.

Demonstrating the Test

Before starting a test in the normal way, you can run it in demonstration mode. To the patient, this looks just like the real thing. However the results are not being monitored. The clinician sees a dialog saying *Press OK to stop demonstration*, and clicking on the button will conclude the demonstration

and return the test to ready status. Run the test in demonstration mode on the **Home** tab by clicking **Demo** .

When the demonstration stops it will flash the macula targets exactly as will occur at the conclusion of a real test. This is an opportunity to point out to the patient how they will know that the test has ended.

Modifying Test Parameters

A Template defines the Field of light points to be included in the test as well as various settings that make up that particular test. An example template for the Central Test is shown in Figure 8, a view of the Template editor.

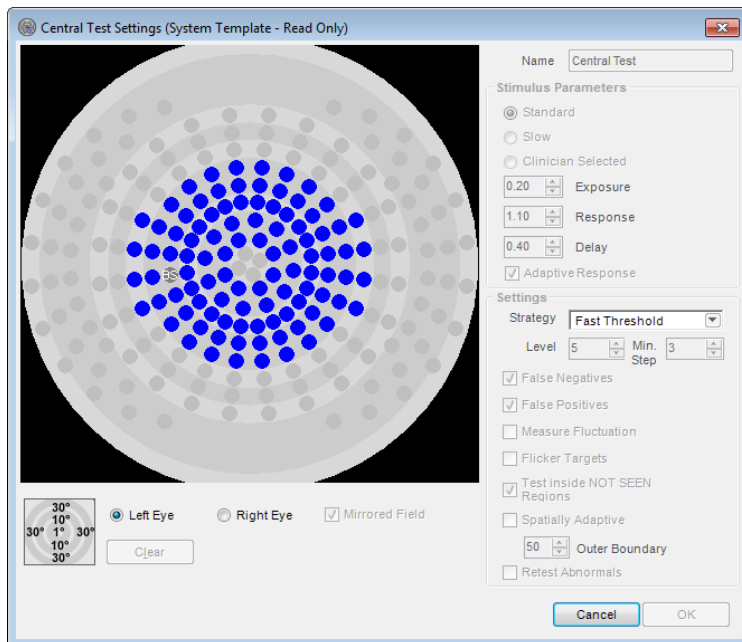


Figure 8. The Template Editor showing the system Central Test template.

You can access the Editor from the Test Control window by clicking the **Edit > Template > Edit** button. You can also review and edit these settings from Medmont Studio on the **Configure** tab with the **Template Setup** option. See *Creating a New Template* on page 36 for how to create a new template. Here we discuss the various settings and the ramifications of any changes.

The Stimulus Parameters Group

The three radio buttons in this group control the light point exposure times. The times are in seconds. The **Standard** and **Slow** buttons select the default times shown below in Table 1, while the **Clinician Selected** button enables the clinician to set other values.

(Seconds)	Exposure	Response	Delay
Standard	0.2	1.1	0.4
Slow	0.2	1.7	0.8

Table 1. Default standard and slow exposure times

Clicking the **User Selected** button enables the three spin boxes. You can either replace the current entry by over-typing, or increment/decrement the values using the spin box arrows. Each exposure time setting affects a different part of a light point exposure sequence.

Exposure This is the time that a light point will be illuminated. It can be the same as or less than the Response time.

Response This is the time in which the patient can respond. It starts at the same time as the Exposure time. It can be the same as or greater than the Exposure time.

Delay This is the time *after* the patient responds *before* the next exposure begins. If the patient does not respond then this time is zero.

If the patient responds before the Response time ends, then the Response time is cut short and the Delay time starts immediately. If the patient does not respond within the Response time, then as soon as this ends the Delay time is skipped and the next Exposure time will start immediately.

The minimum setting for all three delays is 0.1 seconds. If you take the Response time below the Exposure time, then the Exposure time will track the Response time. The same is true for taking the Exposure time above the Response time.

Ticking the *Adaptive Response* checkbox means that as the test progresses the response time will adapt based on how quickly the patient responds to exposures. The exposure time is also adjusted proportionately. The adaptation will not shorten the response time below a minimum of 0.1 seconds. The adaptation is also carefully controlled to ensure any changes to the times are applied gradually.

The Settings Group

The controls in this group provide for selection of the various Strategies available along with a number of monitors and adaptors that can affect both the way the test proceeds and the confidence level of the results. The strategies available and how they work are covered in *The System Test Strategies* starting on page 58.

The following explains each of the functions enabled by the checkboxes in this group.

False Negatives

This is an additional exposure randomly inserted at around every tenth normal exposure, and therefore lengthens the test time somewhat. It selects a random light point from among those that have completed at a level of 9 dB or dimmer, and exposes it at a level 9 dB brighter than its completed level. If the point is **Not Seen**, then the false negative counter is incremented. It is therefore a reliability measure that the patient really did see that light point. The test is normally only enabled for the thresholding strategies.

False Positives

This is an additional pseudo exposure randomly inserted at around every tenth normal exposure, and therefore lengthens the test time somewhat. It uses a normal exposure time slot but does **not** expose any light point. If the patient responds then the false positive counter is incremented. It is therefore a reliability measure that the patient is not just responding to the rhythm of the light point exposures. It is perhaps the most important indicator of test reliability.

Fluctuation Measurement

Fluctuation measurement adds a further level of confidence by re-testing a number of suspect points and recording the variability of these results as a fluctuation measure.

As the test progresses, four spatially dispersed and completed points with the highest defect levels (but not brighter than 3 dB) are chosen for fluctuation testing and are re-tested four times. To ensure four points are chosen the

default threshold defect level is progressively reduced as the test proceeds. When the test concludes, the completed threshold values for these points are examined and their standard deviation (SD) computed.

The average fluctuation value is the mean of these deviations. The severity setting is computed as shown in the table below.

Qualification	Severity
3 or more points with SD > 2.5	***
2 or more points with SD > 2.75	**
1 or more points with SD > 3.05	*

Table 2. Fluctuation severity settings

When Fluctuation measurement has been enabled the test report will include the mean fluctuation (SF) and up to three asterisks to indicate the severity of the variation.

Flicker Targets

A special feature of the Medmont Automated Perimeter is its ability to generate a flickering stimulus. It has been shown that under certain circumstances, evidence of visual field loss can be detected more readily with a flickering stimulus than with a normal static stimulus. In a Flicker Test the stimulus is flashed on and off with equal intervals at a flicker rate that varies with eccentricity.

For this test the patient is required only to respond if the stimulus is perceived to be flickering. If the target is visible but flicker is not apparent then the patient should not respond. To assist the patient in making this discrimination, a high rate of non-flickering targets is presented at the start of the test. If a response is made to these static targets, a false positive error is recorded. The rate of these false positive presentations decreases during the course of the flicker test.

Test Inside NOT SEEN Regions

During a test when the patient still has not seen a light point even when eventually exposed at 0 dB, it is flagged as *Not Seen* (an *Absolute Defect*). When a region of as yet untested points has a contiguous boundary of Not

Seen points it is called a *Not Seen Region*, and will be recognised as such by the software.

When this checkbox is ticked, Not Seen regions have no special treatment and all points will eventually be tested. With this checkbox un-ticked however, as soon as a Not Seen region boundary is complete, all points within that region will automatically be set to Not Seen. It will therefore conclude a test early where Not Seen regions exist with the assumption that points inside these regions are likely to be Not Seen also.

Spatially Adaptive

The Medmont Automated Perimeter allows you to easily create your own templates (see *Creating a New Template* on page 36), and for some applications these may be quite sparse. The system templates Spatially Adaptive, Central 22A and the deprecated Quickscan are examples of sparse fields. The advantage of a sparse field is a large area of the eye can be covered with only a few points, allowing a fast exam. The disadvantage is a defect may be hidden between the tested points and consequently missed. Ticking the Spatially Adaptive checkbox provides a measure of confidence that this will not occur.

Now when a point completes, its value is compared with the age normal value for that patient. If the difference is greater than 6 dB, then the set of this point's neighbours are automatically added to the test field and will be subsequently tested. Thus a suspect isolated point will automatically cause its neighbours to be examined. If these neighbours are also outside the age normal difference, they will be extended in turn. This will continue until either a set of border points are discovered that are within the age normal difference, or either the outer boundary setting (see below) or the edge of the perimeter is encountered.

This functionality also applies to test template boundaries, and a suspect on a boundary will automatically extend the boundary to the perimeter limits.

With this checkbox ticked, and without some limit, a patient with a below age-normal hill of vision would progressively have the field extended until all light points available are included in the test. To prevent this you can specify an outer boundary in degrees using the *Outer Boundary* spin box. With this set, propagation will progress outwards to include this boundary but no further.

Retest Abnormals

A point is considered abnormal if three conditions are satisfied:

1. It deviates by more than 6 dB from the mean of its neighbours.

2. The variation within the neighbourhood is reasonable for this test.
3. There are an adequate number of neighbour points (i.e. the point is not isolated).

Defect points may occur during a test as a result of the patient responding incorrectly. Ticking this checkbox will flag the software to recheck points with an abnormal value that were perhaps the result of the patient's momentary loss of attention or a similar accidental response.

With Retest Abnormals enabled, at the end of the test an additional analysis is performed that examines each point in relation to its neighbourhood. All points found to be significantly different from their neighbours are automatically flagged for retesting. The patient sees no pause, as these points are smoothly re-integrated into the continuing test. The retest is only performed once.

Creating a New Template

A powerful feature of the Medmont Automated Perimeter is the facility to create specialist test fields that address particular patient situations. For example, it is easy to create fields that are specific to just a quadrant or hemi-field. Or you can define quite sparse fields of a few dozen light points that will test very quickly and rely on the Spatially Adaptive monitor (see *Spatially Adaptive* on page 35) to explore into any defect regions.

Begin creating a new template from Medmont Studio. On the **Configure** tab, click **Template Setup** and then click the **New** button. This displays the dialog shown in Figure 9, allowing selection of a base template for subsequent editing. Select a template and click the **OK** button to start the Template Editor.

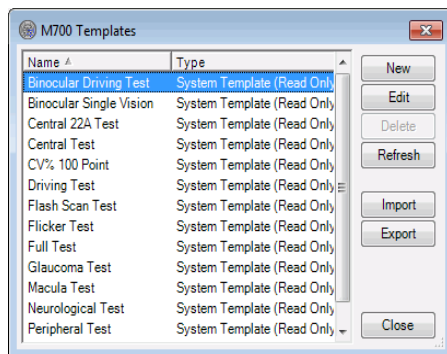


Figure 9. Selecting a base template.

Defining the Field

Figure 8 shows the template editor and a test **Field** for the selected eye. The included light points in the field to be tested are shown as solid blue circles. All other points are grey. By selecting and de-selecting points in this template display, you can create test fields that address specific areas of interest.

You select a point by pointing to it with the cursor and clicking. The point background colour will change to blue. If you hold the mouse button down you can continue to select new points as you move the cursor over unselected points. If you move the cursor to a point you have already selected and click again it will be deselected. Likewise, holding the button down and moving the cursor over previously selected points will deselect those points (including the original points).

If the ***Mirrored Fields*** checkbox is ticked, whatever modifications you make for one eye will automatically be mirrored to the other eye. This will happen whether you review the other eye before exiting or not. If you specifically need different fields for each eye you must ensure this checkbox is unchecked before exiting or moving to the other eye. Only the fields can be different for each eye – the parameters and settings always apply to both eyes.

Pressing the ***Clear*** button will create a perimeter devoid of points to be tested.

Saving a User Template

Once you are happy with the stimulus parameters, strategy settings and light point field, enter a descriptive name and click the ***OK*** button.

Saving a User Template from the Test Window

You may have developed a template while testing a patient and decided it was worth keeping. Before you exit the test screen, click on the **Edit > Template > Save As** button. This displays a dialog that allows you to enter a new template name. Clicking the ***OK*** button will save the current template under that name.

Controlling a Test in Progress

You start a Test by clicking on the **Home** tab within Medmont Studio and clicking ***Perimetry Exam***. Figure 6 shows the initial test screen with a Central Test template selected.

Selecting a Test Template

The drop down text box at the top of the left-hand control pane lists all system and clinician-defined test templates (see *The System Test Templates* on page 51 for a complete discussion of the Medmont supplied test templates). When you select a new test template, the field displayed in the test control window will change to reflect your selection.

Selecting the Eye

Clicking on the *Eye* button swaps to the opposite eye field in the template.

Note that each eye can have different fields in user created fields. All Medmont *system* templates have the same field for both eyes. By default the right eye will be set for a new test. The eye setting will automatically switch to the left eye at the conclusion of the right eye test.

Lens Details

If the **Age Based Lens** option is checked (in the test **Options** menu), then the software will automatically calculate the default lens that should be used for the test based on the patient's current clinical refraction and their age. The age based offset shown in Table 3 is added to the patient's current clinical refraction sphere value.

Age	Sphere
0 - 30	0
31 - 40	1.0
41 - 45	1.5
46 - 50	2.0
51 - 55	2.5
56 - 60	3.0
61+	3.25

Table 3. Age-based Sphere offsets.

For example, when testing a 63-year old with a current refraction sphere value of +0.75 the default lens sphere value will be:

$$+0.75 + 3.25 = 4.0$$

If the **Age Based Lens** option is not checked then, by default, tests are performed with no lens. In either case you can change (or clear) the lens to use for a test by clicking on the **Lens** button.

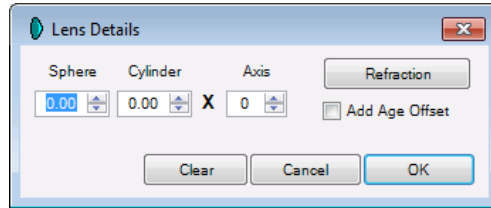


Figure 10. Lens details dialog.

The **Lens Details** dialog, shown in Figure 10, allows you to manually enter the lens parameters to use for the test. Clicking the **Refraction** button sets the default lens parameters for the patient based on their current clinical refraction. If the **Add Age Offset** option is checked then the age based offset from Figure 10 is automatically added to the sphere.

Note that changes made in this dialog apply only to the current test, and do not alter the patient's current clinical refraction.

Setting Prompt to Save

Normally when a test ends there are a number of actions available before the test is saved, including the ability to analyse the result. In a busy practice with many clinicians, the possibility exists that in the subsequent analysis and patient discussion, saving the result may be overlooked.

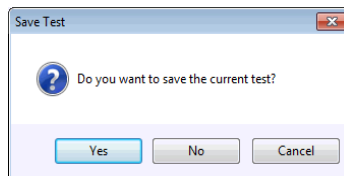




Figure 11. Save test result immediately dialog.

Click the **Edit** tab and checking the option **Prompt to Save** will bring up the Save Result dialog shown in Figure 11 immediately the test ends, making a decision about saving the result necessary before events can continue.

Choosing a Slow Response Setting

Use the **Slow Response**  button at any time to select the *Slow* settings as defined in the Stimulus Parameters group in the Template Editor (see *You can access the Editor* from the Test Control window by clicking the **Edit > Template > Edit** button. You can also review and edit these settings from Medmont Studio on the **Configure** tab with the **Template Setup** option. See *Creating a New Template* on page 36 for how to create a new template. Here we discuss the various settings and the ramifications of any changes.

The Stimulus Parameters Group on page 31). When you press this button the test will start or continue using the slow settings. The button will change from a snail to a rabbit , and if you press the now **Standard** button the test will revert to the standard exposure time settings.

Test Point Colours during Testing

Once the test is running you can monitor the patient's responses from the Test Control window. The colour of the test point text in each of the included points on the field display denotes its current state:

- blue - as yet untested,
- red - exposed but as yet not seen,
- green - exposed and seen,
- white - final completed state.

The grey points are not included and will not be tested. Apart from the blue untested points, which show the *initial* exposure level, the number in the circle is the *last exposed value* in decibels. Points that are eventually exposed at zero decibels and are still Not Seen will have a white NO in their circle.

Monitoring the Test Progress

The perimeter Test Control display shows exactly what is happening on the perimeter itself in real time. The colours and dB values described in the preceding discussion allow you to follow the test as it progresses.

The values that a light point can take and the reasons are dependent on which test strategy is currently being used. For an explanation of how the value of a light point changes as the test progresses, see *The System Test Strategies* starting on page 58.

Test Based on Age Normal HoV

Where there is no previous test of this eye for this patient, the initial values in a light point are based on a standard age normal Hill of Vision (HoV)

(except for the deprecated Screening strategy - see *Screening Strategy* on page 60 for the differences). This same initialisation also applies if the previous test used a Three Zone, Fixed Level, or Age Related strategy.

Note that if no patient has been selected, the HoV is based on a patient in the age group 1 to 45.


Test Based on Previous Exam

When a previous result is used, the initial value of each light point is based on its corresponding value from the previous test. This setting is more likely to be closer to the patient's actual HoV than one that is age based, and will therefore be quicker to threshold, particularly for an abnormal patient. The initial values are the weighted mean of each point and its local neighbours to ensure extreme previous values are not used as starting levels.



Re-Testing Points

The ability to dynamically retest any point in the current field means you can change a field as the exam proceeds to meet any unusual situations or unexpected defects that appear during the test.

During the Exam


For example, if during the exam a particular point has concluded with what you consider a suspect threshold, click on the suspect point to highlight it (its colour will change to blue), and then click on the **Retest**  button. The completed threshold number will change to the last tested value and the point will be retested before the exam concludes.

After the Exam Concludes

You can also retest a point or set of points after the exam has concluded. If you think a region is suspect, highlight the associated points (see *Creating a New Template* on page 36) and then click the **Retest**  button. This creates a temporary field that will be immediately retested when you again press the **Start**  button.

The system automatically detects and retests statistically abnormal points if **Retest Abnormals** is checked in the Template Editor prior to starting the test (see *Retest Abnormals* on page 35).

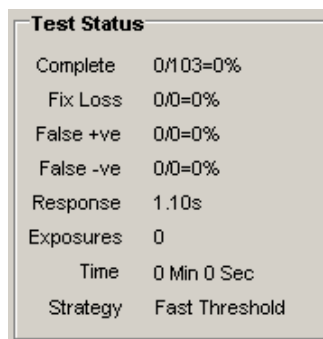
Progressive Analysis

In addition to the Test Control display, you can monitor the test progress using the full graphical facilities of the Analysis view by clicking on the **Analyse Test**  button. This brings up another window with the analysis

view (see *Analysing and Viewing Exam Results* on page 68) showing the current exam field settings. This view is tied to the current test in real time and will dynamically show the test as it proceeds using whichever particular data visualization view you choose to select. You can move the window around and change its size to suit your requirements. The position and settings will be remembered for subsequent use.

The Test Status Group

In the left-hand pane of the Test Control is a group of numeric and statistical monitors called the *Test Status Group* as shown in Figure 12. During a test these monitors are updated after every exposure. Evaluated together they provide an indication of how the test is progressing and whether the patient is responding as expected.



Test Status	
Complete	0/103=0%
Fix Loss	0/0=0%
False +ve	0/0=0%
False -ve	0/0=0%
Response	1.10s
Exposures	0
Time	0 Min 0 Sec
Strategy	Fast Threshold

Figure 12. Test status monitor group.

The following sections explain each monitor, what it is showing, and some suggestions on how it can be interpreted.

Percent Complete Monitor

This shows the percentage of points in the field that have reached their threshold value, measuring progress through the test.

Blind Spot Fixation Monitoring

Blind Spot fixation monitoring checks that a patient is fixated correctly on the central target by periodically exposing a light point, located at the blind spot of the eye being tested, and checking that the patient does not respond. Blind spot fixation monitoring cannot be used for binocular tests.

The blind spot monitors are two groups of eleven light points that are positioned on the perimeter bowl to fully cover all the possible left- and

right-hand blind spots. Early perimeters used five light points. The blind spot light points are always exposed at 0 dB.

A left or right-handed graphic showing the set of blind spot light points that match the current **Eye** setting is displayed at the bottom of the monitor pane. The left-hand version is shown in Figure 13.

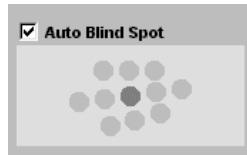


Figure 13. Left-hand blind spot monitor graphic.

The current blind spot point is shown as a darker grey circle. The **Fix Loss** statistic (in the Test Status group) displays the number of times a blind spot light point was seen by the patient as a ratio of the total number of blind spot checks performed , for example:

Fix loss: 2/15=13%

By convention a fixation loss higher than about 20% is considered to indicate low patient (and consequently low test) reliability.

By default the software handles selection of the blind spot light point automatically. However, you can set the light point to use for blind spot monitoring yourself by un-checking the **Auto Blind Spot** checkbox and clicking on the light point with the mouse.

Blind Spot Fixation Monitoring - Automatic Mode

In automatic mode, the blind spot monitor will initially expose the centre light point of this group. You can select a different initial point by un-checking the **Auto-Blind Spot** checkbox, clicking on required blind spot light point, and then checking the box again. If the initial start point is *Not Seen* after two exposures then this light point becomes the blind spot light point in subsequent exposures and the test proceeds immediately. If it *is* seen then its neighbours will be progressively exposed until one is *Not Seen* for two consecutive exposures.

During the search for the blind spot, points will have a red **X** displayed as an indication that they were seen. The blind spot monitor in Figure 14 shows an example of this sequence.

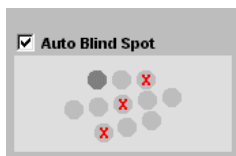


Figure 14. Blind Spot Monitor locating the true blind spot.

When No Blind Spot is Found

If all blind spot light points are seen then the dialog shown in Figure 15 is displayed. Apart from simple lack of patient fixation, this could mean either:

- the wrong eye was selected, or
- the patient positioning was incorrect.

If the wrong eye was selected restart the test with the correct eye, otherwise reposition the patient and, if required, provide additional patient education (see *Preparing the Patient* on page 24).

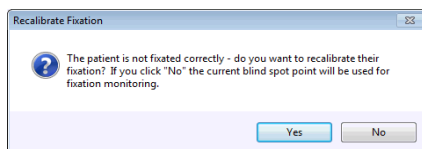


Figure 15. Fixation Lost dialog box.

Automatic Recalibration

If the blind spot is seen during the test, the PC speaker will sound a short beep to alert the clinician (and perhaps the patient) that fixation is not being maintained. If the next exposure of the blind spot is also seen by the patient, the perimeter assumes that the patient has moved and will automatically attempt to locate the new position of the blind spot by testing surrounding light points. If it is unable to locate the new blind spot point automatically, the **Fixation Lost** dialog box shown in Figure 15 is displayed. If you choose to recalibrate, the initial blind spot location procedure described above will start again, beginning with the nominated initial blind spot (by default the centre light point). If you choose not to recalibrate, the test will continue using the last selected blind spot light for blind spot monitoring and will not attempt to recalibrate if patient fixation is lost.

Blind Spot Fixation Monitoring - Manual Mode

In Manual mode, the user takes over complete control of the blind spot. Clicking on any of the eleven points will make that point the current blind

spot. Once the test is running, selecting a new blind spot point this way will schedule its exposure in the next time slot.

Note: No action is taken if the manually selected blind spot point is seen. It is now up to the clinician to move the blind spot to a new position.

The user can map the patient's blind spot by clicking on consecutive points until all have been exposed. The red **X**s assist in this operation and will subsequently define the blind spot boundaries.

Video Fixation Monitoring

Video Fixation Monitoring is an optional, alternative means of monitoring the patient's fixation in which the computer analyses the video of the patient's eye to determine where they are fixating. Video Fixation Monitoring is only available if you have purchased the required Feature Pack license and have a perimeter fitted with the necessary video hardware. Contact your Medmont representative for more information on these requirements.

Positioning the Patient and Calibrating Fixation

Video Fixation Monitoring can be used for both monocular and binocular tests. For monocular testing, a special (supplied) eye patch must be fitted to the patient, which has two small circular tracking targets on the strap. For binocular testing the supplied headband with three small tracking targets must be fitted to the patient.

In either case, you should ensure that the central target is located over the nose and the strap is fitted just above the patient's eyebrow. These targets are used by the perimeter to track and correct for patient head movement, so it is important that they are not obscured by the patient head rest or the lens holder. Note that the actual camera's field of view is larger than that displayed in the video monitor window, so the targets do not necessarily have to be visible in the video monitor window.

When the test begins, the perimeter locates the patient's iris and uses this location as a calibrated reference point for determining if their fixation changes during the test.

Positioning the Patient for Binocular Driving Test

Special consideration must be made for the Binocular Driving Test. For the first half of this test, the patient will be centrally fixated as per normal. As the test progresses, the patient will be prompted to view alternate fixation points; firstly to the right and then to the left, bringing the test to completion.

When prompted for each of these alternate fixation points, advise the patient to turn their head slightly in the direction of the new fixation point rather than moving only their eyes. This will allow for more reliable iris tracking.

Video Fixation Monitoring during the Test

The current calibrated iris location is displayed as a circle outline on the video monitor window. If the perimeter detects that the patient's head has moved (by tracking the circular targets on the eye patch or headband) then it may adjust the calibrated iris location. The centre of the current detected iris location is displayed as a small cross. This cross enables you to verify that Video Fixation Monitoring is correctly tracking the patient's fixation.

Before each test point is exposed, the perimeter checks patient fixation by analysing the live video. If the patient is blinking or has temporarily lost fixation, the perimeter intelligently waits until fixation is regained before exposing the test point. This can greatly improve the reliability of test results by ensuring that tests are only performed when the patient is correctly fixated. Video Fixation Monitoring can also be significantly faster than Blind Spot Fixation Monitoring because it eliminates the 2 to 3 seconds required for each blind spot check.

The **Fix Loss** statistic (in the Test Status group) displays the number of detected fixation losses as a ratio of the total number of fixation checks performed (typically the number of exposures), for example:

Fix loss: $2/15=13\%$

Video Fixation Monitoring Recalibration

If the patient does not fixate correctly within a given period of time, the perimeter will display the current blind spot test point (for monocular exams) to provide a secondary check of fixation. If the patient does not see this stimulus then video fixation monitoring is automatically recalibrated. If the patient sees the blind spot stimulus, or if this process occurs too often during the test, then the **Video Fixation Lost** dialog (Figure 16) is displayed.

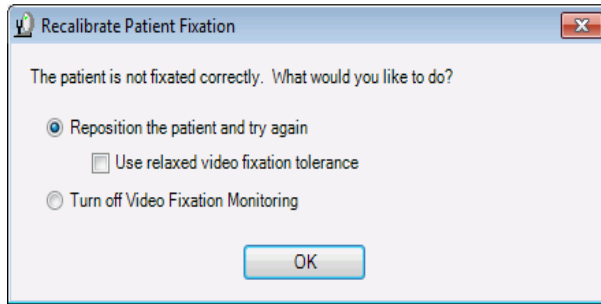


Figure 16. Video Fixation Lost dialog box.

This dialog optionally allows the clinician to relax the tolerance that the perimeter uses when determining whether testing of a point should be deferred until the patient is correctly fixated. This can be useful if the test duration is being unduly prolonged by a patient's inability to fixate. If the fixation tolerance is relaxed then testing is allowed to proceed even if the patient is not fixated (provided the fixation loss is not too large). In this case a fixation loss will be recorded.

Note that you can also use the *Relaxed Video Fixation Tolerance* option in the *Options* menu to set this option prior to (or while running) a test. In this case, the software remembers the setting you have selected and will use the same option for subsequent tests.

The **Video Fixation Lost** dialog also allows the clinician to turn off Video Fixation Monitoring completely and revert to Blind Spot Fixation monitoring.

False Positives Monitor

This monitor performs a pseudo exposure about every tenth normal exposure. It takes a normal exposure time slot and uses the currently set times (see *You can access the Editor* from the Test Control window by clicking the **Edit > Template > Edit** button. You can also review and edit these settings from Medmont Studio on the **Configure** tab with the **Template Setup** option. See *Creating a New Template* on page 36 for how to create a new template. Here we discuss the various settings and the ramifications of any changes.

The Stimulus Parameters Group on page 31) but does **not** turn on any light point. If the patient responds then the false positive counter is incremented. The monitor shows these events as a seen/not-seen ratio and as a percentage, for example:

False +ve: 2/15=13%

False positives usually indicate that the patient is responding to the rhythm of the exposures rather than the actual exposure itself, pressing the button when they expect an exposure has occurred. The patient may also be “trigger happy”, believing he or she must press the button very quickly to get a good score. In this case they should be told that the instrument waits for a time to receive the response after the brief light point exposure, and they should be urged to make slower, more deliberate responses.

By convention, a false positive rate around 20% or higher is considered to indicate low patient reliability and consequently detracts from the reliability of the test result.

False Negatives Monitor

This monitor adds an additional exposure at about every tenth normal exposure. It selects a random light point from among those that have been completed and at a level of 9 dB or dimmer, and exposes it at a level 9 dB brighter. If the point is **Not Seen**, then the false negative counter is incremented. The monitor shows these events as a seen/not-seen ratio and as a percentage, for example:

False -ve: 2/15=13%

In a normal field, a high false negative rate suggests patient inconsistency. Such inconsistency may occur if the patient changes what they consider to be Seen and Not Seen, or if their state of alertness changes, or if they slow down and believe it is too late to respond after the light point has gone off. False negatives also occur as part of the disease state at locations with depressed sensitivity where visibility is highly variable. In such cases, the clinician cannot depend on consistent responses and a high false negative rate results. An effort should be made to distinguish between inconsistency that is part of a disease process and inconsistency as a result of the patient's state of alertness or personality.

By convention, false negatives of around 33% or higher are considered to indicate low patient reliability.

Average response time Monitor

This is the mean value over all exposures during this exam of the elapsed time from the light point being turned on until the patient responds. It is expressed in seconds. This is most useful as a relative measure when compared with a patient's previous exams.

Exposure count Monitor

This is the total number of exposures to date during this exam. When compared with the **Percent Complete** monitor, it gives an indication of the number of exposures required to reach a threshold value for this patient and test strategy.

Test Elapsed Time Monitor

This is the elapsed time in minutes and seconds since the test began.

Strategy

This is the strategy in use for the current template, and is defined by the currently selected template. See *The System Test Strategies* on page 58 for details of the available strategies.

Assigning Sounds to Perimeter Events

Sounds can be associated to different events which occur during a patient examination, for instance when a False Positive response is received. Some events have default sounds already assigned when you install the software. If you would like to assign sounds to unassigned events or change the default sounds then click on the **Configure > Studio > Preferences** dialog. Once open select the *User Settings* tab and click on **Sounds > M700** in the tree list. Once selected the M700 sounds preferences will now be displayed as per Figure 17.

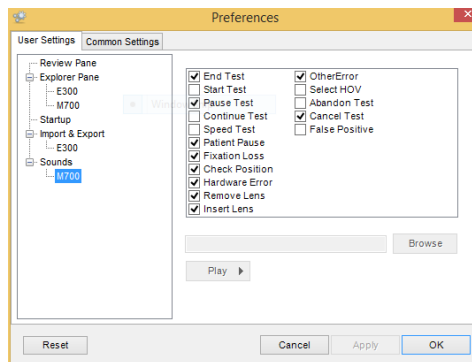


Figure 17 Sound preferences

From the sound preference window you can play any of the assigned sounds by first selecting the sounds event and pressing the **Play** button. If you want to assign a different sound then select the event and press the **Browse** button, only files with a .wav file extension can be assigned. You can disable a sound event by un-ticking the box beside the event. This will maintain the

link to the sound file but not play the sound when the event occurs. Remember to click the **Apply** button after modifying to store the new sound preferences.

7. The System Test Templates

The Automated Perimeter software provides a set of built-in *system* tests. These are shown below in Table 4.

Test Name	Field Extent	Points	M700	M730
Binocular Driving	80°	119	✓	
Binocular Single Vision	Superior 30°, Inferior 40°	21	✓	
Central 22A	22°	45 - 96	✓	✓
Central 22	22°	50	✓	✓
Central	Central 30°	100	✓	✓
CV% 100 Point	80°	100	✓	
Driving	80°/50°	107	✓	
Flicker	15°/22°	74	✓	✓
Full Field	Full 50°	164	✓	
Glaucoma	Central 22°, Nasal step 50°	104	✓	
Macula	Central 10°	48	✓	✓
Neurological	Full 50°	164	✓	
Peripheral	30° to 50°	72	✓	

Quickscan (deprecated)	22°/30°	40	✓	✓
Flash Scan	22°/30°	40	✓	✓
Spatially Adaptive	50°	39 - 168	✓	
CV% 100 Point	60°	100	✓	

Table 4. Medmont Automated Perimeter Built-in System Tests

The following discusses the typical uses of these fields. It is up to the clinician to decide on the most appropriate template for a particular test. In each case if the patient requires a correction lens you will be prompted to insert the lens prior to starting the test, and also to remove it if the field extends past the 30° ring where the lens holder frame could interfere with the patient's vision.

Binocular Single Vision Test

A special feature of the M700 is the facility to test and quantify diplopia or Binocular Single Vision (BSV) defects. The test requires the use of the supplied chin rest adaptor that is placed on top of the standard chin rest and allows the patient's head to be positioned in the middle of the chin rest.

In this test, the stimulus duration is several seconds, much longer than the normal exposure times shown in Table 1. As each stimulus appears at maximum intensity, the patient observes it (while keeping their head stationary) and is asked to decide whether the stimulus appears as a single or double spot. If it appears as a single dot, the patient presses the response button once; if it appears doubled, the patient presses the button twice.

The test rapidly screens a patient's field for the presence of BSV defects and accurately maps the extent of any defect. If the button is pressed once, a dot will appear on the tested cell position. Pressing the button twice will result in a **D** being recorded in that cell position.

If the patient fails to respond at all by the end of the exposure time a **NO**, signifying *no response*, will be displayed. The cell will subsequently be re-tested and if the patient still fails to respond, a NO will be recorded in that cell position.

A pattern of 21 cells is tested, extending 30° superiorly and 40° inferiorly. For each double response recorded, all neighbouring points are also tested to accurately map the extent of the double vision.

Central Test

For normal initial examination purposes, the central 30° field is generally the most appropriate. The Central test provides a rapid means of determining whether any significant field defect is present. If a defect is found, the Fast Threshold test strategy will quantify it by thresholding the defect area.

CV% 100 Point

The CV% 100 Point exam is a Perimetric Residual, three levels strategy exam used to determine the level of blindness in a patient. Using both eyes, the exam tests 100 points through an 80° field. Then a blindness percentage is calculated using the Points Seen and Relative Defect points from the completed 100 point test.

Like the driving test, the patient is first tested in the central 50° area, fixated on the central fixation target. At a specific point during the exam, when most points in the 30° to 50° have been tested, the computer will beep and a message is displayed. The patient's fixation is adjusted to the new fixation target and the clinician selects OK to continue the exam.

The test will continue, testing the temporal field from 50° to 80°. Any of the original points not tested within the 30° to 50° field will also be tested to make the test appear random to the patient. This process will then be repeated on a second fixation target, when prompted by the computer, to complete the exam.

Statistics on the results of the exam can be viewed once the exam has been saved.

Driving Test

The standard full field of the M700 extends to 50° eccentricity, which covers all normal field-testing applications. There is a special Driving Field included as a standard M700 field that extends the measurable field to 80° temporally and 50° nasally by using eccentric (30°) fixation targets.

To carry out this test, select the Driving Test and test the central 50° in the usual way, with the patient fixating on the central fixation target. If a

correction lens has been used, you will be prompted to remove this once the central 30° field has been completed.

When most of the points in the 30° to 50° field have been tested, the computer beeps and the dialog shown below in Figure 18 is displayed.

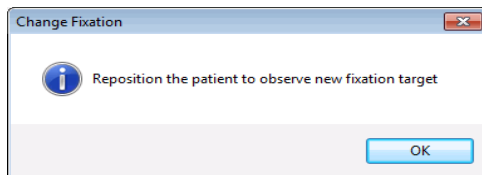


Figure 18. Change fixation dialog for extended fields.

At this point you should ask the patient to look at the eccentric target that is now illuminated, check that the patient is looking at the target, and then click OK.

Continue the test, testing the temporal field from 50° to 80°. During this phase, those points in the original 30° to 50° field that were not already tested are now tested, to ensure that the testing process appears random to the patient.

Binocular Driving Test

This is very similar to the Driving Test (see above) but the patient is tested with both eyes open and they can wear their own prescription lenses where applicable. The blind spot monitoring is disabled and all light points are displayed at a fixed level. The clinician can set the level in the Template Editor (see Figure 8). The three targets are presented in the same way (central, right then left).

Flicker Test

A feature of the Medmont Automated Perimeter is an ability to generate a flickering stimulus. It has been shown that under certain circumstances, evidence of visual field losses can be detected more readily with a flickering stimulus than with a normal static stimulus. In the Flicker Test the stimulus is flashed on and off at equal intervals with a flicker rate that varies with eccentricity. The relationship between flicker rate and frequency is shown below in Table 5.

For this test the patient is required to only respond if the stimulus is perceived to be flickering. If the target is visible but flicker is not apparent

then the patient should not respond. To assist the patient in making this discrimination, a high rate of non-flickering targets is presented at the start of the test. If a response is made to these static targets, a false positive error is recorded. The rate of these false positive presentations decreases during the course of the flicker test.

Eccentricity	Flicker Frequency
1°	18 Hz
3°	18 Hz
6°	16 Hz
10°	12 Hz
15°	12 Hz
22°	9 Hz
>22°	6 Hz

Table 5. Relationship between eccentricity and flicker rate.

The test field used for the Flicker Test extends to 22° eccentricity.

Full Test

This test uses a full field of 50°. It is normally recommended that either a Fast Threshold or 3-Zone test strategy be used with this test to minimise the test duration.

Glaucoma Test

The Glaucoma field is a variant of the central 30° field, and has an extension to 50° on the nasal horizontal meridian. This field could be used to follow progress of a glaucoma field defect, as an alternative to continuing with using the central 30° field.

Macula Test

The Macula field covers the central 10° and has extra test points located at 1° from fixation (on perimeters so fitted).

Neurological Test

An option available on the M700 is a special test designed to quickly evaluate neurological visual fields. Normal full field tests on patients with quadrantal or hemianopic defects will spend a lot of time testing points which the patient cannot see. This significantly extends the test time and creates unnecessary stress for the patient.

This test uses a full 50° field like the Full Test, but with Test Inside Not-Seen Regions turned off (see *Test Inside NOT SEEN Regions* on page 34). The test thus concentrates on the intact part of the field, substantially reducing the total test time.

Peripheral Test

The Peripheral field covers just the 30°–50° ring of the periphery. Note that the statistics associated with HoV Slope may have little validity with this test due to the narrow width of the field.

Quickscan Test (deprecated)

This test is basically a Central 30° with a lower density of points that uses a Screening strategy and requires only about 90 seconds for completion. The Screening strategy does not explore how good a patient's sight may be, but does allow the depth of any defect to be determined. It is not included with the installation but may be loaded from the Templates section on the distribution CD-ROM.

Flash Scan Test

This test is designed for fast screening of patients. It uses the same pattern of points as the Quickscan Test. When combined with the automatic video fixation tracking this test can be performed in less than 60 seconds. This test uses the Age Related screening strategy.

Spatially Adaptive Test

This is a sparsely populated version of a full field (i.e. out to 50°) with the Spatially Adaptive setting on and ready to use (see *Spatially Adaptive* on page 35). It is thus a fast way to test a full field where only large or no defects are expected. The spatially adaptive algorithm will fill in the details

if any defects are found. Note that small defects may be missed with this field.

Central 22A Test

This test is designed for fast screening of patients; consequently it is limited to the central 22° only. The initial test pattern uses a relatively high density of 45 points, including four test points at 1° eccentricity.

It uses the Fast Threshold strategy and the spatially adaptive algorithm and therefore ideally suited where there are only large or no defects expected.

Central 22 Test

This test is similar to the Central 22A Test.

It includes some additional test points at 10° eccentricity, and does not use the spatially adaptive algorithm. It therefore produces more consistent test times and is ideally suited for performing very quick screening tests on patients. It uses the Fast Threshold strategy.

CV% 100 Point Test

This test is a binocular test which tests 100 points. An initial patient Hill of Vision (HOV) is calculated and then remaining points are exposed according to the HOV. The test uses a 3-Zone strategy when exposing remaining points. Points may be seen at the expected HOV level, 0db or not-at-all.

Upon completion of the test, the CV score is calculated based on the number of points seen at the expected HOV level and the number of points seen at 0db.

8. The System Test Strategies

The Automated Perimeter software provides a comprehensive set of test strategies. These are summarised here and elaborated on in subsequent sections.

Fast Threshold	An efficient, modern technique that uses a sophisticated probabilistic algorithm to quickly approach and bracket a patient's threshold.
Threshold	The classic staircase exposure method where the patient's threshold is bracketed in steps the clinician can set.
Screening (deprecated)	Four selected calibration points are accurately thresholded using the Fast Threshold strategy. An initial Hill of Vision (HoV, see <i>Statistical Indexes</i> on page 63) is then computed based on the calibration result. Subsequent exposures only attempt to threshold Not Seen light points.
Three Zone	Points are exposed at a predicted level based on an initial Fast Threshold calibration of four selected points. If the point is seen then it completes. Otherwise its next and final exposure is at 0 dB, and it completes as either Seen or Not Seen.
Fixed level	A go/no-go test where all points are exposed only once at an exposure level the clinician can set. The point completes as either Seen or Not Seen.
Age Related	A strategy with a maximum of two exposures where a fast age related vision profile is the primary concern.

Stimulus Presentation

As described in *You can access the Editor* from the Test Control window by clicking the **Edit > Template > Edit** button. You can also review and edit these settings from Medmont Studio on the **Configure** tab with the **Template Setup** option. See *Creating a New Template* on page 36 for how

to create a new template. Here we discuss the various settings and the ramifications of any changes.

The Stimulus Parameters Group on page 31, you can set the Exposure time, the Response time and the Inter-Test Delay time for any test. In all cases, points are selected at random from the test field.

Fast Threshold Strategy

This algorithm allows very quick thresholding of normal fields without sacrificing any accuracy in defect diagnosis.

An initial set of calibration points is fully thresholded to provide accurate data for the neighbourhood prediction function. The strategy then uses an advanced prediction function to estimate the likely threshold value for a point based on its completed neighbours. It subsequently fits an age and population based probability function to each new light point based on the point's neighbourhood of exposed points. Exposures then use statistical techniques to quickly localise the patient's true threshold level.

Threshold Strategy

In this strategy, in order to locate the threshold of a particular light point, a *staircasing* procedure is followed in varying the cell intensity. The starting level is based on either the patient's previous result or the point's neighbourhood of exposed points.

If there is no response to a particular stimulus, the intensity is increased by twice the minimum step size and re-tested. If there is still no response, the intensity is successively increased in equivalent steps until a response occurs or the maximum level is reached, at which point a not-seen result is recorded.

If there is a response to the initial stimulus, the intensity is decreased in steps of twice the minimum step size until there is no response, at which point a reversal is made in the direction of the intensity steps.

Once a transition occurs at a particular seen/not-seen or not-seen/seen level, the cell intensity is then stepped in minimum increments until a second reversal is indicated. The perimeter confirms the threshold by obtaining two consistent results in a given level range.

This *bracketing* technique for determining a cell threshold results in a very reliable measurement of the visual field threshold.

Screening Strategy (deprecated)

This strategy performs an initial calibration procedure using the Fast Threshold strategy (see *Fast Threshold Strategy* on page 59) during which the thresholds of four preset points are determined. These calibration points are then used to set the screening levels for the subsequent screening test.

A screening strategy will typically underestimate a patient's true field, and so has little clinical use. However it can be used to discover gross defects.

The Screening strategy is deprecated – use the Fast Threshold strategy for new patients.

Three-Zone Strategy

This strategy performs an initial calibration procedure using the Fast Threshold strategy (see *Fast Threshold Strategy* on page 59) during which the thresholds of four preset points are determined. These calibration points are then used to set the initial levels for the subsequent three-zone test.

The seen/not-seen decisions for subsequent light point exposures are:

If the point is Seen	The point is completed.
If the point is Not Seen	The point is completed if the level was at its brightest (ie 0 dB). Otherwise the point's level is set to 0 dB for the next exposure.

Thus points other than the calibration points can be exposed a maximum of twice.

The Map display of a Three-zone strategy uses a different representation of a completed point that reflects the simplified thresholding strategy. Figure 19 shows an example map display for a Three-zone strategy central field test.

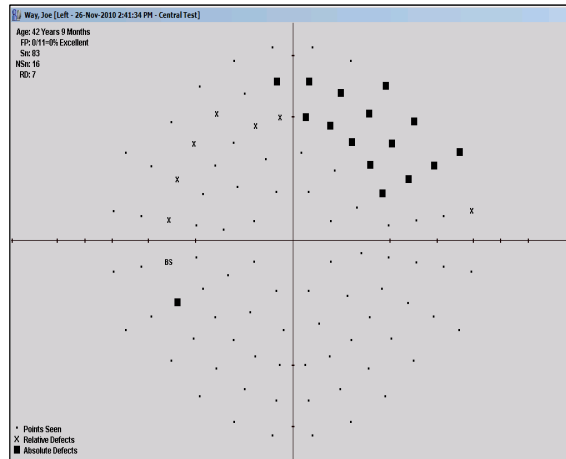


Figure 19. Three-zone strategy map display showing different representation of exposed points.

The figure shows the *Points Seen* graphic as a dot defining a seen point, the *Relative Defect* graphic as an X defining a point seen at 0 dB, and the *Absolute Defect* graphic as a filled box defining a point not seen at all. Note that the map display (see *Numeric Data View* on page 84) contains the most information from this strategy's results.

Fixed Level Strategy

This strategy is essentially a go/no-go test. All points are exposed at a clinician defined level, by default set at 5 dB. The point is completed after this one exposure and flagged as either Seen or Not Seen.

The strategy is thus a very fast test for whether a patient has any serious defects, but where it is not necessary to know whether a defect is absolute or not. The Map display for this strategy is similar to the Three-zone strategy shown in Figure 19 except there are only two states, a dot defining a Seen point, and a filled box defining a point Not Seen. An example using the special Binocular Driving Test field is shown in Figure 20. Note that the map display (see *Numeric Data View* on page 84) contains the most information from this strategy's results.

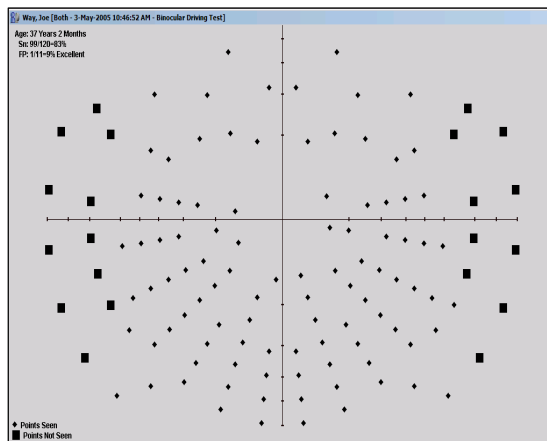


Figure 20. A Fixed Level strategy map display.

Age Related Strategy

This is a two-step strategy where the first exposure is at the 95% confidence level for the patient's age (only 1 in 20 healthy patients will not see this level by chance alone). If this is Not Seen a second exposure at the 99.9% probability is tried (only 1 in 1000 healthy patients will not see this level by chance alone). It provides a fast test where establishing a patient's general vision profile relative to their age is the first requirement. It uses the same display as the three-zone strategy of Figure 19. However in this case the *Points Seen* graphic denotes points seen on the first exposure, the *Relative Defects* graphic denotes points seen on the second exposure, and the *Absolute Defects* graphic denotes points that were not seen at all.

Note that the numeric map display (see *Numeric Data View* on page 84) contains the most information from this strategy's results.

9. Statistical Indexes

The following statistical indexes are calculated for exams and displayed in the Data tab of the Exam view:

Age Normal Hill of Vision

The age normal hill of vision is based on standard age-based population tables interpolated for the Medmont Automated Perimeter. For the green light points, the three age groups are:

1 to 45 years,
46 to 60 years,
61 years and over.

For instruments so fitted, the age groups for the red light points are:

1 to 59 years,
60 to 74 years,
75 years and over.

Patient Based Hill of Vision

Estimating the patient's actual HoV can present a number of problems, particular where there are large defect areas. Simple mean values are often confused by outliers and defect areas, often producing an HoV more depressed than actual.

The Automated Perimeter software uses a robust statistical elimination technique to fit a HoV that estimates the real underlying HoV. This is not a simple curve through the patient's best vision, but a best estimate of the patient's HoV without any defects.

The patient's HoV is expressed as a linear slope parameter of dB/10°, and a dB level at 3° eccentricity. A sample HoV summary display is

Hill of Vision	
Slope	3.5 dB/10°
3° level	25.5 dB

This means that at 3° eccentricity the patient’s mean threshold was 25.5 dB, and it fell away at 3.5 dB for every 10° of eccentricity. Thus at 20° the HoV level would be 19.55 dB.

Overall Defect

Overall Defect or OD is the mean difference between the Age Normal HoV and the mean deviation or Patient Based HoV. This number is negative if the patient’s HoV is less than the Age Normal HoV. See *Patient Based Hill of Vision* and *Age Normal Hill of Vision* on page 63. Up to three asterisks are appended to this number as a severity indication. They are age referenced and the various level boundaries are shown in Table 6.

Age	*	**	***
1-45	-2.6	-3.72	-4.92
46-60	-2.8	-4.05	-6.10
60+	-3.2	-5.95	-8.91

Table 6. The relationship between Overall Defect severity and the number of asterisks.

Pattern Defect

The Pattern Defect or PD statistic is based on spatial correlation, and is a measure of the clustering and depth of defects. It is a scaled mean value of the product of a point’s HoV deviation and that of its neighbours. It qualifies the extent to which deviations are spatially correlated or clustered. For example if deviations from the patient’s HoV are distributed more or less randomly throughout the field, then the PD will be small. As deviations tend to cluster, the index will increase, particularly where both the absolute deviations and clustering are high.

Pattern Defect	Asterisks
≥ 2.8	*
≥ 5.7	**
≥ 8.6	***

Table 7. The relationship between Pattern Defect severity and the number of asterisks.

Like Overall Defect, severity asterisks are also provided for Pattern Defect, and are a measure of the significance of the PD figure. The relationship between the number of asterisks and PD number is shown in Table 7.

Cluster Analysis

The cluster analysis hemi-field comparison facility in the Medmont Automated Perimeter divides the inner perimeter field into nine superior and nine matching inferior hemi-field zones. The outer boundary of the fields is just past the 22° ring. The sector $\pm 30^\circ$ on the blind spot side is excluded.

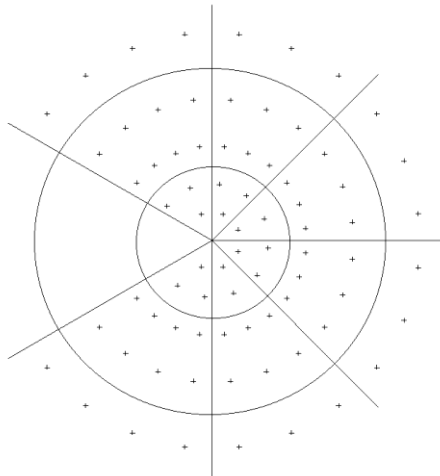


Figure 21. The eighteen hemi-field zones for a left eye field.

The analysis procedure first calculates the mean of the decibel values in a superior zone and compares the result with the corresponding mean in the matching inferior zone. Points with seen values above the Age Normal are replaced by the Age Normal value to prevent points of exceptional vision generating spurious depressions. The difference results are collected for the nine zone pairs. Depending on the magnitude of this adjusted difference, the following messages may be displayed:

No local defects	There is no discernable difference between the superior and inferior zones.
Superior or Inferior Depression	A significant number of superior OR inferior zones are depressed relative to their matching zones.
Superior/Inferior Depression	A significant number of both superior AND inferior zones are depressed.
Inferior Depression/ Superior Defect	A significant number of the inferior zones are depressed, and one or more superior zones have a high difference.
Superior Depression/ Inferior Defect	A significant number of the superior zones are depressed, and one or more inferior zones have a high difference.
Superior or Inferior Defect	One or more superior OR inferior zones have a high difference.
Superior/Inferior Defect	One or more superior AND inferior zones have a high difference.

Note that these results are intended to highlight the *difference* between small, matching opposite superior and inferior zones. If the depression or defect is not hemi-field based, then these statistics will not help. Note also that the outer radial boundary only extends to an eccentricity of 22°. Depressions and defects beyond this limit will not be detected by these statistics.

Seen Points

The Seen Points attribute displays the ratio of the number of points the patient confirmed that they saw, to the number of points that were actually

presented. This attribute is only calculated for Fixed Level and Three-Zone Strategies. For example:

$$\text{Seen Points: } 36/40 = 90\%$$

Not Seen Points

The Not Seen Points attribute displays the ratio of the number of points the patient did not see, to the number of points that were actually presented. This attribute is only calculated for Fixed Level and Three-Zone Strategies. For example:

$$\text{Not Seen Points: } 4/40 = 10\%$$

CV Index

The CV Index (or Perimetric Residual) is a percentage of blindness in a patient. The percentage is calculated by giving a value of 1 to each seen point, .5 to each relative defect point, then adding the resulting values together. This attribute is only calculated for Three-Zone Strategies. See page 57 for information on the CV% 100 Point test

10. Analysing and Viewing Exam Results

The following details the selection of patient exam results and setting the various examination display modes.

Selecting the Exam Results

The first step in viewing exam results is selecting the exam(s) to view. Exams are listed under each patient when the Explorer pane on the left side of the Medmont Studio window is in Tree View mode. Selecting a patient allows you to explore Thumbnail Views (see the Medmont Studio manual) and multiple exam Regression Analysis (see *Regression Analysis* on page 102). Clicking on the small cross in the box beside each patient will expand the exam list for that patient. A section of a typical patient list with a number of visual field exams displayed is shown below in Figure 22. The exams are sorted by date and time.

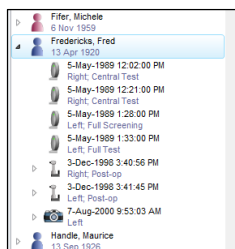


Figure 22. An example patient list showing the left and right eye visual field exam icons for patient Fred Fredericks.

Select exams by clicking on either the exam symbol or the text. To select multiple exams hold down the **Ctrl** key while clicking. You can view up to four exams at a time. The main View window displays the exam result(s). How the exams are displayed depends on the current View mode.

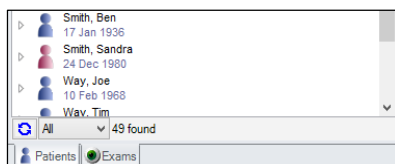


Figure 23. Using the Select M700 Exams tab.

You can examine most visual field exam statistics in a single view by selecting the Exams tab at the bottom of the Explorer pane (see Figure 23) and then expand the explorer pane by clicking and dragging the separator. You can click on the heading for any column to sort the exams by that column. For example, clicking on the Age heading will sort patients by increasing age. Clicking the same heading again will re-sort by decreasing age.

Patient / Exam	Template	Categories	Clinician	Practice	Fixation Losses	False Negatives	False Positives	HoV 3° Level	HoV Slope	Overall Defect	Pattern		
R 6-Sep-1990 11:38:00 AM	Glaucoma Scree...		Sample User, Sa	MEDMONT	020-0%	Excellent							
R 8-Nov-1990 9:00:00 AM	Glaucoma Scree...		Sample User, Sa	MEDMONT	325-12%	Good							
L 8-Nov-1990 9:09:00 AM	Glaucoma Scree...		Sample User, Sa	MEDMONT	1/1-3%	Excellent							
L 4-Mar-1991 2:46:00 PM	Central Screening		Sample User, Sa	MEDMONT	027-0%	Excellent							
R 4-Mar-1991 2:58:00 PM	Central Screening		Sample User, Sa	MEDMONT	018-0%	Excellent							
R 26-Aug-1991 11:28:00 AM	Glaucoma Scree...		Sample User, Sa	MEDMONT	119-5%	Good	014+0%	Excellent					
R 21-Apr-1992 7:14:00 AM	Glaucoma Test		Sample User,	Sample Practice	147-2%	Excellent	214+14%	Good	015+0%	Excellent	23.2	2.9	-3.50*
R 14-Sep-1992 9:34:00 AM	Glaucoma Test		Sample User,	Sample Practice	3/51-4%	Good	014-0%	Excellent	011-40%	Excellent	25.1	3.9	-2.02**
L 3-May-1993 7:58:00 AM	Glaucoma Test		Sample User,	Sample Practice	15/3-20%	Fair	3/14-21%	Good	11/5-7%	Excellent	21.5	2.1	-4.14**

Figure 24. Patient exam statistics view.

The example in Figure 24 shows portion of a display sorted by decreasing test duration. The width of individual columns can be resized by moving the mouse over the column boundary in the header until the cursor changes to two vertical bars, then click and drag the boundary to suit. Selecting a patient will still open a window to the right of this display that shows that exam result field display in the current exam display mode (see *Display Options* on page 87). Figure 25 shows an example with a slice of the main window and a patient selected.

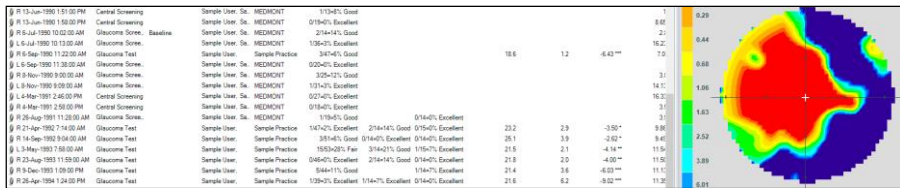
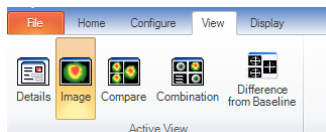


Figure 25. Patient exam statistics and map view.


Setting the Exam View Mode

The View Mode controls how the selected exams are displayed. Select the View mode from the **View** ribbon tab:



The following sections discuss these modes.

Exam Details View and Editor

Clicking on **Details**  from the top of the patient tree displays tabular information about the selected exam and allows the addition or editing of comments (see Figure 26). The summary collects in one place all the details and statistics associated with that exam and includes a thumbnail view of the result field.

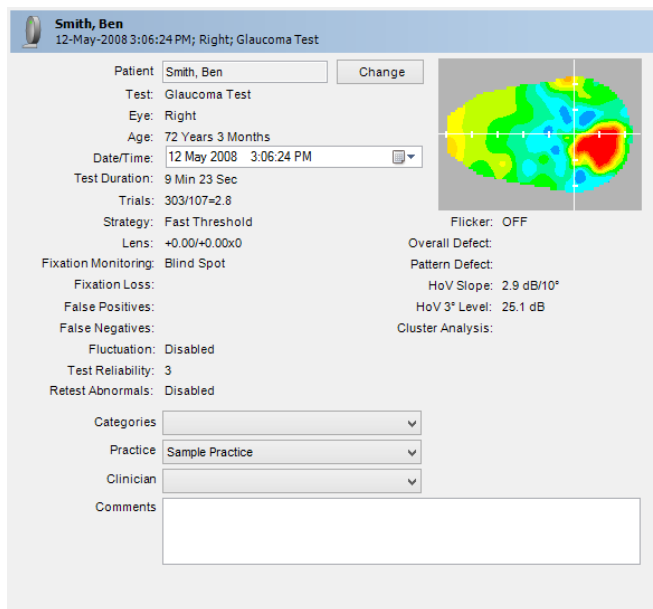


Figure 26. Patient exam details view.

Save and **Cancel** buttons will appear in the bottom right-hand corner if you modify the Categories (see *Medmont Studio User manual*) or add or edit in


the Practice, Clinician, or Comments text box. Clicking on **Save** will add your changes to that particular exam record.

A statistic that only appears on this form is the **Test Reliability** score. This uses a combination of the test's false positives, false negatives and fixation losses to rate the reliability of the test on a score of 0 to 10. This is an excellent first access statistic where scores of about 6 or less should trigger a closer examination of the base test reliability statistics.

Moving an Exam to a Different Patient

If the selected exam was inadvertently assigned to the wrong patient, you can use the drop down box containing the patient's name to move it to its correct place. Click on the **Change** button and then use the **Find Patient** dialog to select the destination patient. Clicking on **OK** will move the exam to the new patient.

Map View

Clicking on **Map**  from the top of the patient tree displays up to four different exams from the same or different patients. Use this View mode to display a full screen colour map image of a single exam or to display images of multiple exams. An example showing four consecutive images for a particular patient is shown below in Figure 27.

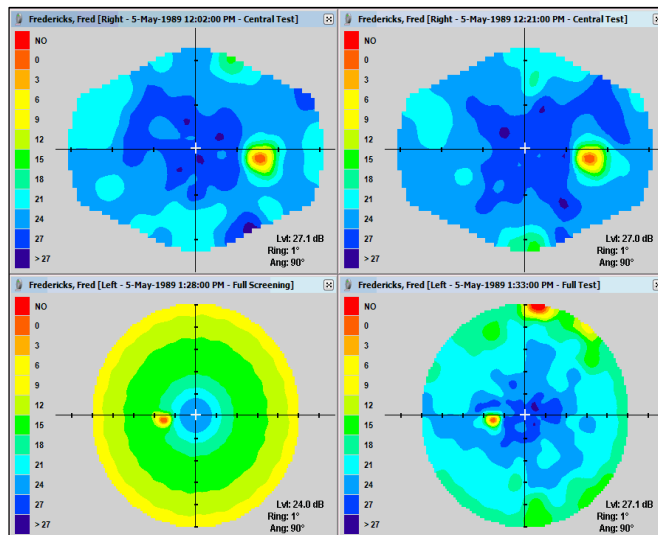



Figure 27. Map view of four consecutive exams.

More often, you would use a single exam map view and the powerful view analysis controls described in *Selecting the Map Type and Data View* on page 73 to examine the results for one particular exam.

Combination View

Clicking on **Combination**  from the top of the patient tree displays four clinician-selected views of the same exam. The Map Type and settings for each image can be controlled independently. Figure 28 is an example where the view is displaying a grey scale threshold level with cross section, an age normal deviation in colour, a patient HoV deviation as a perspective view, and a patient HoV probability as a grey scale with Attributes.

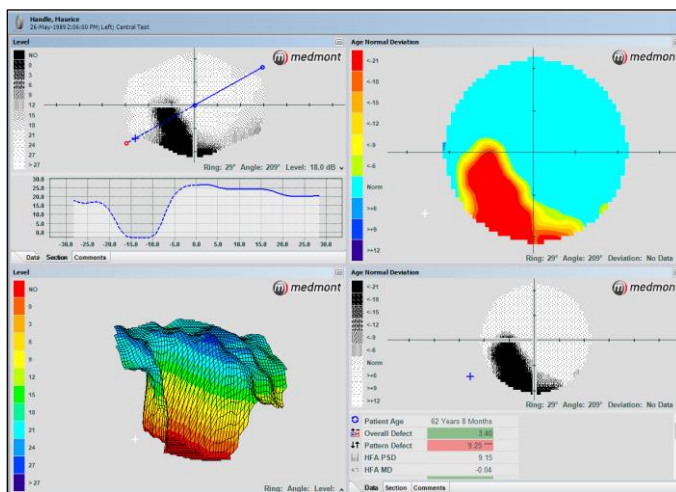



Figure 28. Four different map views of the same exam.

Compare View

Clicking on **Compare**  from the top of the patient tree displays the Level view (see page 79) of two selected exams and the difference between them. This is a powerful tool for monitoring change. You can display the data numerically or in grey scale or colour.

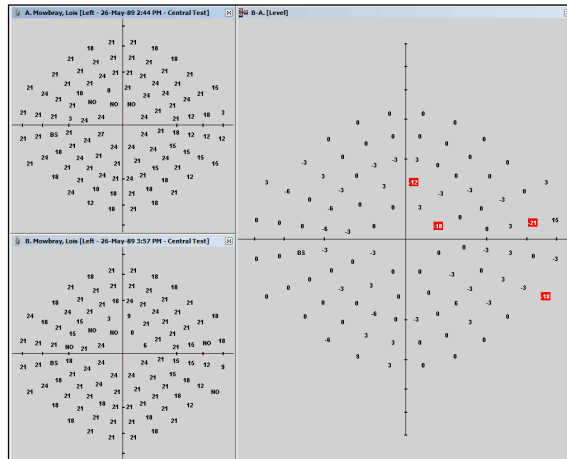


Figure 29. Exam difference display showing decibel levels with points having differences > 6 dB highlighted.

Retinal Overlay View

It is now possible to overlay a captured retinal image over a completed Medmont Automated Perimeter exam. This semi-transparent overlay can act as a visual aid, assisting you in locating and identifying retinal anomalies based on comparison of your field screening results to captured images of that same eye's retina.

A visual field exam with a retinal overlay applied will look like this:

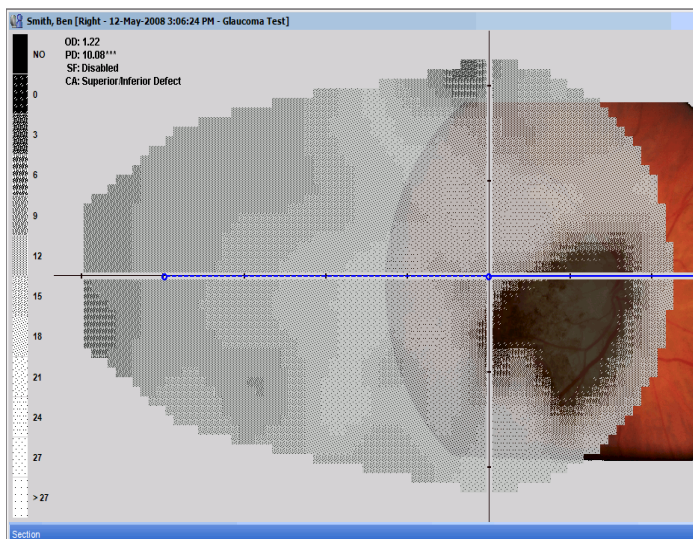



Figure 30. Retinal overlay.

To overlay a retinal image, you must first have a retinal image of the same eye and patient which was captured using Medmont DV2000 Diagnostic Video Imaging software. The optic nerve disc must be defined for the image before attempting overlay.

This is done by selecting the  'Define Disc' icon from the toolbar and drawing a curve around the perimeter of the disc by clicking consecutive points around the disc with your mouse. This will intuitively draw a natural curve. After you have drawn your final point around the circle, right-click your mouse to let the tool automatically join and complete the curve for you based on the points you have defined.

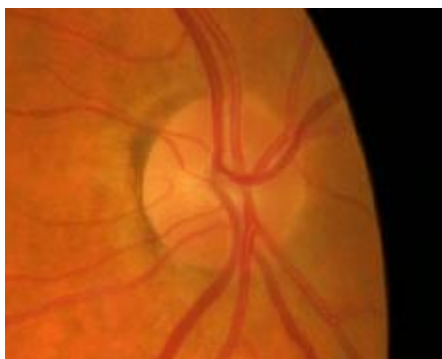


Figure 31. Optic nerve disc before being defined



Figure 32. Optic nerve disc after being defined

The image must be captured using an Image Source which has been calibrated. For details on how to calibrate your Image Source, please refer to the DV2000 User Manual.

To use Retinal Overlay view, simply select your desired visual field exam from the Tree View, hold down the ‘Ctrl’ key on your keyboard and select the corresponding retinal image you wish to overlay. With both exams selected, on the **Display** tab, click **Retinal Overlay > Set Image**. This will automatically superimpose the retinal image over your visual field exam for comparison and review.

Overlay Opacity

The opacity (transparency) of the retinal image overlay can be increased or decreased as desired using the **Retinal Overlay > Opacity** control.

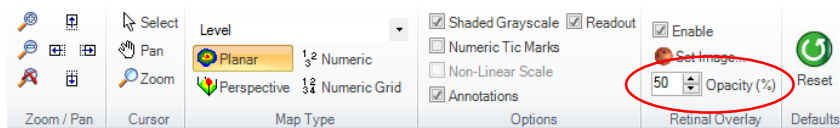


Figure 33. Threshold Exam Settings Dialog

The effect of changing opacity levels can be seen in the following screens:

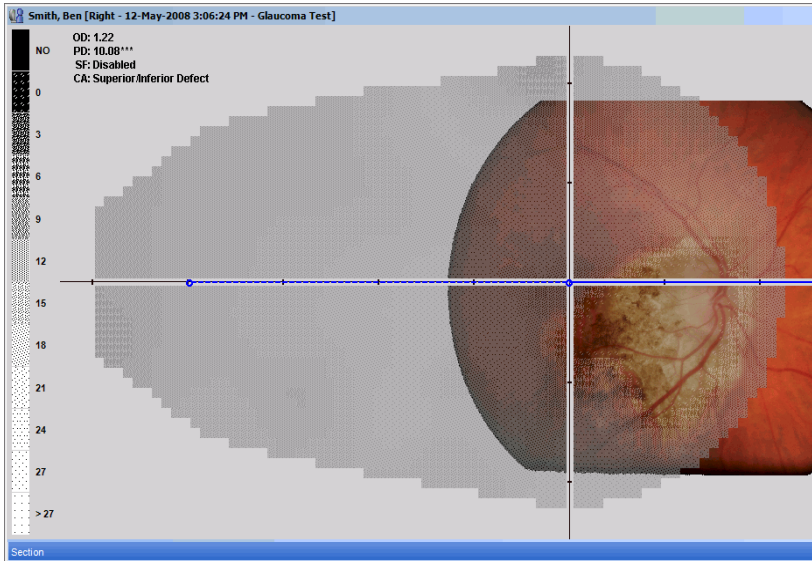


Figure 34. Overlay Opacity 30%

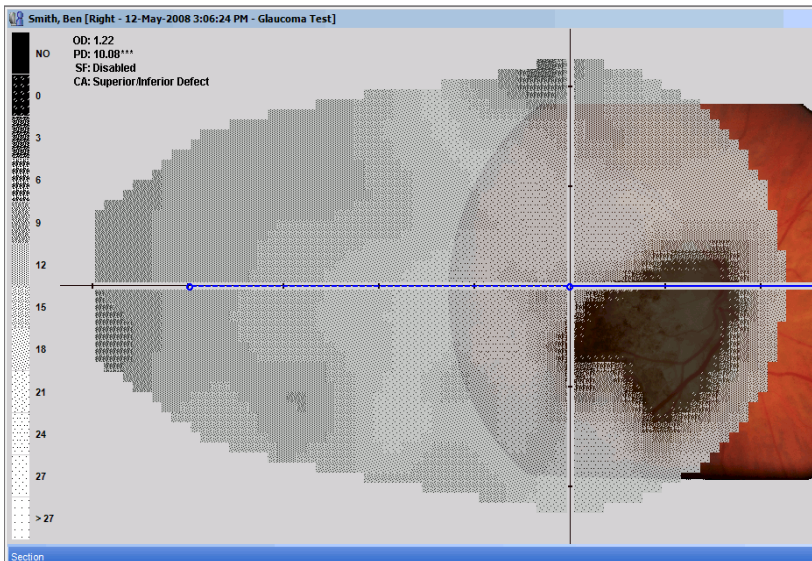



Figure 35. Overlay Opacity 70%

The selected opacity level will be automatically applied to all visual field exams with an overlaid retinal image.

Difference from Baseline View

Clicking on **Difference from Baseline**  icon from the top of the patient tree to display *Difference from baseline* view for the currently selected exam. The view is divided into four sections; baseline exam, current exam, difference from baseline and Pattern Defect. An example is shown in Figure 36.

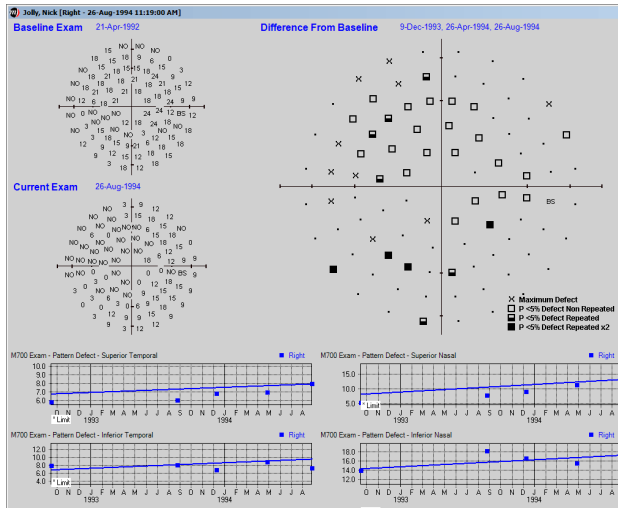


Figure 36 Difference From Baseline View

A baseline exam must be defined before the *Difference from baseline* view can be displayed. If the baseline exam has not yet been created for the patient and eye, a prompt will be displayed as per Figure 37

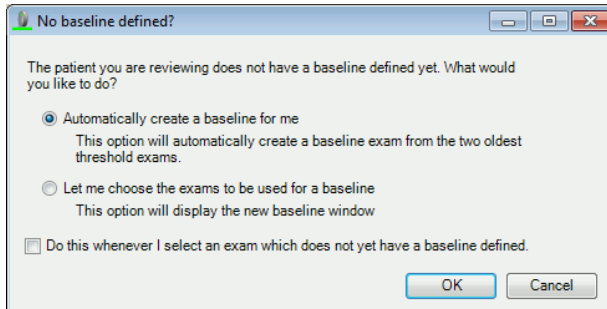


Figure 37 No baseline defined prompt

The prompt allows two options;

1. **Automatically create a baseline exam**; this will automatically create a baseline exam from the two oldest threshold exams.
2. **Manually create a baseline exam**; this will display the Baseline dialog box, allowing the user to select the desired exams from a list of compatible exams, as per Figure 38.

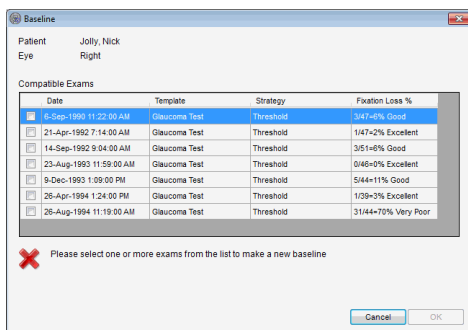


Figure 38 Defining a baseline

The list will be filtered to only display exams which use either the Threshold or Fast Threshold Strategies for the selected patient and the same eye as the currently selected exam. Fixation Loss percentage and the Test Template type will also be shown, to assist the clinician to select the most appropriate exams. Locate the desired exam(s) and then place a tick in the check box next to the exam. When an exam has been checked, the dialog box will provide feedback on the selected exam to let you know if the exam is appropriate for the requirements of the baseline exam. Click **OK** once you have finished.

The *Difference from baseline* view will now contain the baseline exam and the difference exam. The baseline exam will also appear as a separate exam in the patient tree as seen in Figure 39.

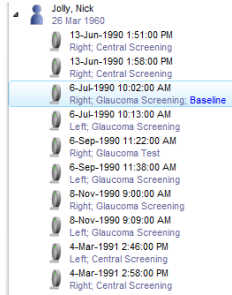
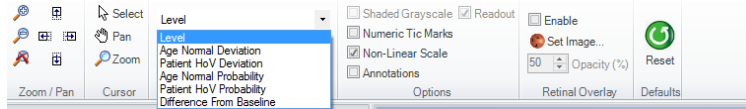


Figure 39 Tree showing a selected baseline exam

The *Difference from baseline* view is described further on page 83.

Selecting the Map Type and Data View

The Map Type controls the type of data displayed for a Patient Exam. You select a map type from the **Display** tab. The drop down selection box allows you to select from a set of available map types.



Map Types

The following details the options available for examining and interpreting patient exam data results.

Level

This displays the raw threshold values in decibels. For a threshold exam, these are the brightness levels in dB the patient can just discern. By default this display uses a non-linear scaling to spread out the high-resolution points in the foveal area. You can remap this display to linear scaling with the **Non Linear Scaling** setting (see *Non-Linear Scal* on page 88). A Level example showing both Linear and Non-Linear scaling of the same exam is shown in Figure 40.

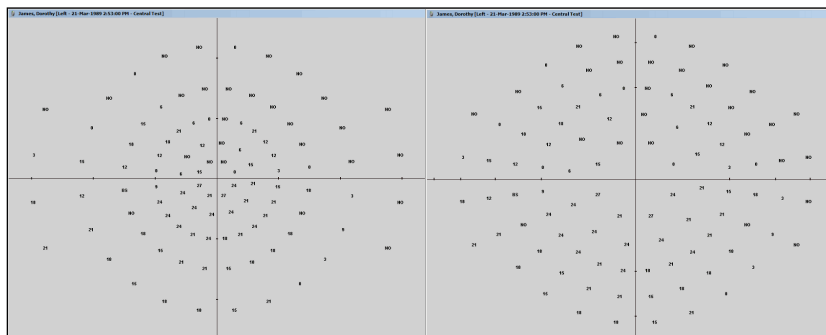


Figure 40. Level visualisation showing Linear scaling on the left and Non-Linear scaling on the right.

Age Normal Deviation

This displays the difference between the patient’s threshold result and the Age Normal Hill of Vision for a person in this age group. An example is shown in Figure 41. A single dot means the point is within ± 6 dB of the age normal. A negative number means the point is below this boundary at that light point position (i.e. the point was seen at more than 6 dB brighter than the age normal). The outer boundary of this plot is at 22° eccentricity. The mean deviation for the entire field is given by the Overall Defect described in *Overall Defect* on page 64.

Note this measure is only available for tests that compute a threshold.

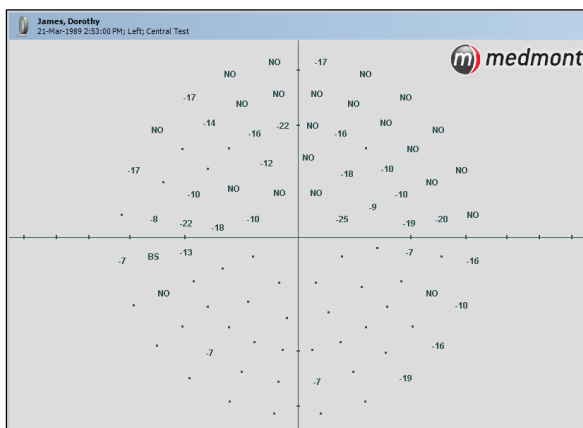


Figure 41. Age Normal visualisation.

Patient HoV Deviation

The patient HoV deviation shows the difference between this patient’s actual HoV and what the patient’s hill of vision would be like without defects (see *Patient Based Hill of Vision* on page 63). An example is shown in Figure 42.

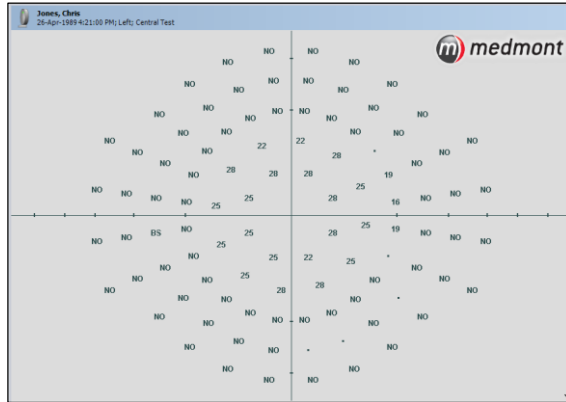


Figure 42. Patient HoV Deviation visualisation.

Values within a defined band of the HoV are displayed as a dot. The band is $\pm 4.5\text{dB}$ out to 15° , and $\pm 6.5\text{dB}$ beyond.

Thus someone with a relatively defect free HoV but simply depressed would display as a field of dots in this view, even though they may show a significant number of negative numbers in an Age Normal Deviation view. The defects shown by this display identify local losses or scotomas, with the effect of any general depression removed.

Points that are Not Seen will be shown as ‘NO’s in this view.

Age Normal Probability

This view compares the patient with a population of similar age. An example is shown in Figure 43. It can be used to determine whether a particular point or set of points are significantly different from the Age Normal, where the number itself, except for very large deviations, cannot give more than an indication that the point may be depressed.



Figure 43. Age Normal Probability visualisation.

It processes the Age Normal Deviation data described in *Age Normal Deviation* on page 80 and presents it as a probability map. Now the differences between the exam result and the Age Normal are presented as symbols, representing the probability levels as one of the graphics shown in Figure 44. The <5% symbol means the value of this point would occur in less than 5% of cases, the <2.5% symbol means the value of this point would occur in less than 2.5% of cases, and so on down to the <0.1% symbol. Another way of looking at the, say, <5% value is that in 20 tests of *normal* eyes, only 1 would show a sensitivity value this low, just by chance. A dot symbol indicates that this particular point can be considered within the normal bounds.

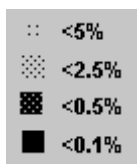


Figure 44. Hill of Vision probability symbols.

Patient HoV Probability

This view can be used to determine whether a particular point or set of points are significantly different from the patient's own HoV, after removing the fact that the HoV itself may be depressed. An example is shown in Figure 45.

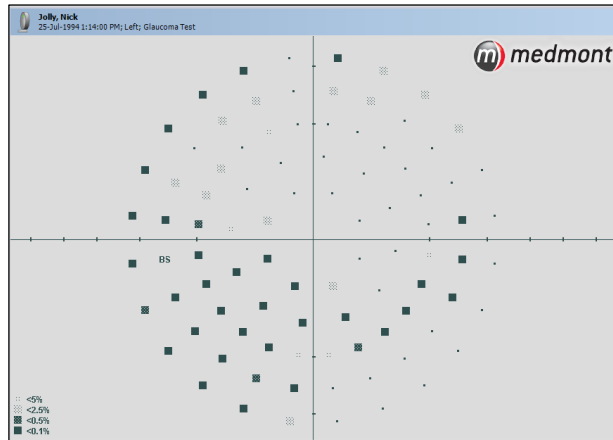


Figure 45. Patient HoV Probability visualisation.

This is similar to the Age Normal Probability (see *Age Normal Probability* on page 81), but measures deviations from the patient's own fitted HoV, so points that show as dots have values that are to be expected for this particular field, even though they may be considerably depressed compared to the age normal. Unexpected point values are represented by the same graphic symbols shown in Figure 44.

Difference from Baseline

The *Difference from baseline* is calculated on a point-by-point basis, assessing the deviation from the corresponding point from the selected baseline. A defect is defined as a deviation from the baseline of $\geq 8.1\text{db}$ for the inner 6° rings, or $\geq 10.4\text{db}$ for the outer rings. Rings beyond 22° are not analysed.

If a point has a greater deviation than the tolerances specified above it will be indicated by an unfilled square (\square). If, on a subsequent follow up exam, the point remains beyond this tolerance, it will be indicated by a half-filled square (\blacksquare). If, on the third follow up exam, the point still remains beyond this tolerance, it will be indicated by a completely filled square (\blacksquare).

If a point is seen in the baseline exam, but not seen in the two most recent follow up exams, it will be indicated by an X symbol. This indicates that the defect is beyond the detectable range.


Pattern defect plots are represented by four charts at the bottom of the exam view and only display points from the baseline to the currently selected exam. For example, the *M700 Exam – Pattern Defect – Superior Temporal*

chart would represent the top left hand zone of *Difference from baseline* view. The two Nasal charts (Superior and Inferior) are associated with the patient's blind spot. If a right eye exam is selected, the Nasal chart will be to the right side of the exam window. If a left eye exam is selected, then the two M700 Nasal charts will be on the left hand side of the exam view.

Data View

The displayed data can be viewed in a number of different ways:


Numeric Data View

Select this button  from the **Display** tab. For the threshold strategies, each point is represented as a number expressed in decibels unless it was Not Seen, in which case it is shown as a NO. For the specialist strategies such as the Three Zone Strategy (see *Three-Zone Strategy* on page 60), a point may not have a numeric representation.


This is the view to use when you want quantitative results from a Threshold strategy exam (not a Screening strategy), as these define the threshold values the patient can only just discern.

By default the light points are displayed as a scaled projection of their spatially correct positions on the perimeter dome. The mapping is a non-linear radius function that expands the high resolution clustering of light points in the foveal area to allow a more even visual display. You can toggle this to a linear scaling as required (see *Non-Linear Scal* on page 88). Only the points that make up the test field are displayed. Figure 40 shows two numeric data views with different scaling.

Numeric Grid Data View


Select this button  on the **Display** tab. This shows the light points re-sampled onto a square grid. If you are used to seeing perimeter data presented this way, it provides an easy entry into using a Medmont perimeter.

Plan View

Select this button  on the **Display** tab. This is a powerful tool for visualising the patterns present in the numeric views. As explained in *Display Options* on page 87, this view can be in colour or shades of grey. Both the colour and grey-scale views are provided with a legend that associates a particular colour or grey-scale with its corresponding level in decibels. You can use the zoom and pan tools described in *Zooming and*

Panning on page 100 to extract more detail, and the cross-section tool described in *Section Tab* on page 91.

Perspective View

Select this button  on the **Display** tab. The view drapes a rectangular grid over the Interpolated Shaded View and provides the dimensions of depth and hidden surface removal as additional visualisation cues. Figure 46 shows an example hill of vision.

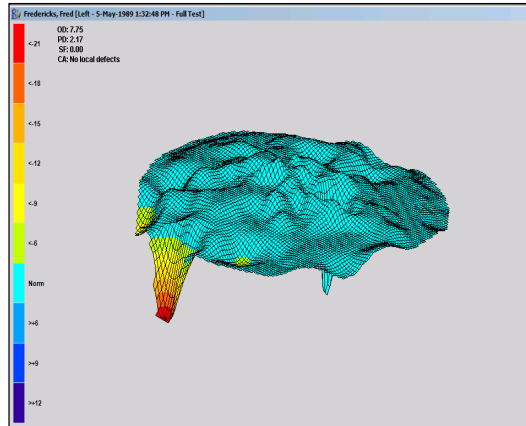



Figure 46. Perspective Hill of Vision view.

You can zoom and pan this view using the tools described in *Zooming and Panning* on page 100, but for the perspective view the mouse driven pan tool provides for considerably more control. To access the mouse tools, place the cursor anywhere in this window and click the right mouse button. This will display a small selection menu beside the cursor. You select items by moving the mouse until the black selection bar is over your selection. For perspective views, click on the hand or Pan entry. The normal arrow cursor should change to a small hand .

Some care is needed in becoming proficient of what we are about to do. Not that you can do any harm, but it is very easy to set the view spinning like a top. The mouse can spin the perspective view about the centre line of both its vertical and horizontal axes. Both axes pass through the centre of the perimeter, with the axes where you would expect them to be in a two dimensional frame (i.e. horizontal and vertical). Hold the mouse steady anywhere in the window and click the left button. The hand cursor will appear to clench. Carefully move the mouse to the right the smallest distance

you can manage. You should see a small arrow appear to the right of the hand and the view should start to slowly rotate about its vertical centre line.

Experiment with moving the mouse very small increments in different directions. With some practise you should be able to position the view so you can look at it from any direction, even underneath. Note that the further you move the mouse away from where you pressed the button, the faster the view will move. You also need to remember approximately where that point was, as you must cross over it to reverse the direction of rotation.

As an example, to re-orient the view so it is level and you are looking horizontally at the plane of the view as shown in Figure 47, we suggest you follow the following procedure. Slowly rotate the view around its vertical axis using only the small left or right arrows until the highest or lowest point of the view plane is at the “front” of the view. Now change to rotating the view about the horizontal axis using only the small top or bottom arrows, and in the direction to bring the plane of the view level with your view as shown in the figure.

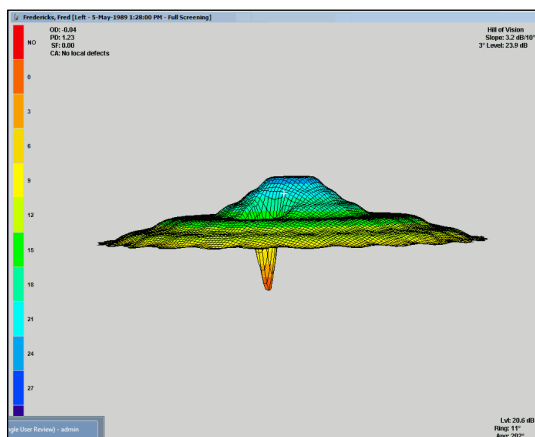


Figure 47. A Perspective view rotated to the horizontal plane.

While managing this view may take a little practise, being able to rock the view from side to side while viewing from a particular aspect can give a very effective illusion of three dimensions. The result can be a better insight into the reasons for the shape, slope and depth of defects in the perceived field.

Display Options

The **Display > Options** tab (see Figure 48) allows you to select options which affect how the data is displayed.

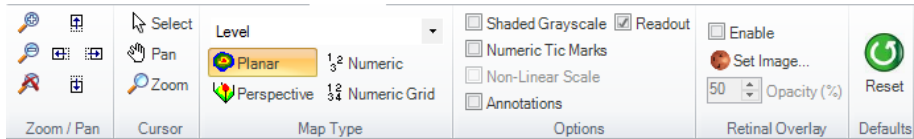


Figure 48. Display Ribbon tab.

Shaded Greyscale

Selecting this option changes the colour display to a grey scale view. Figure 49 shows the effect of this change on Figure 52.

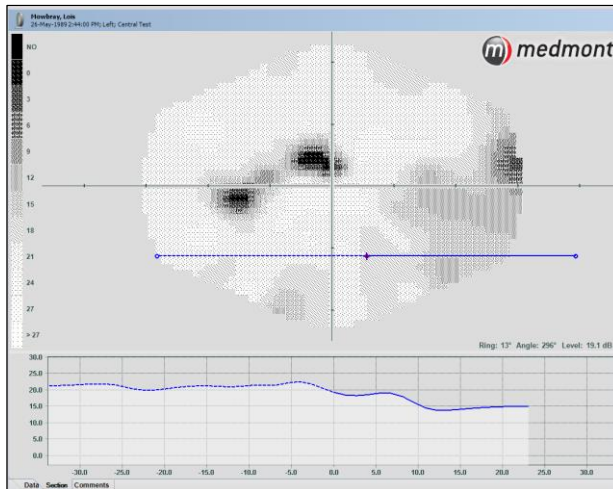


Figure 49. Grey scale view.


This type of grey scale patterning matches the similar view provided in pre-Medmont Studio M700 and M600 software.

Numeric Tick Marks

In all the map views you can choose whether the significant radii in the display have degrees against the tick marks or not. In some map configurations the numeric tick marks can clutter the view, so in all cases, whether they are on or off is optional.

Note that the background of the numbers in the numeric views will override all other graphics to ensure the numbers are always visible. In some views this may mean the numeric tick marks are partially obliterated.

Non-Linear Scale

By default the numeric **Level** display (see *Level* on page 79) uses a non-linear scaling to map points towards the perimeter centre to spread out the high-resolution points in the foveal area. This is also the way the perimeter points are mapped in the **Test Window** perimeter display. Toggling this checkbox or using the  button allows you to see the points with either linear or non-linear mapping.

Annotations

This option allows you to select whether annotations which have been added to the map should be displayed.

Exam Tab Pane

A tabbed pane is located at the bottom of the Exam View to display additional information about the exam. This pane can be expanded by clicking and dragging on the horizontal separator between it and the main view. The pane can also be completely hidden by clicking on the small expand/collapse indicator at the top right of the pane. The content of the tabs is described below:

Data Tab

The data tab (see Figure 50) displays predefined and custom attributes for the exam. By default the attributes displayed include:

Age	Age of the patient when the exam was taken, displayed in Years and Months.
Overall Defect	See <i>Overall Defect</i> on page 64
Pattern Defect	See <i>Pattern Defect</i> on page 64
Fluctuation	Short-term Fluctuation, see <i>Fluctuation Measurement</i> on page 33

Cluster Analysis	See <i>Cluster Analysis</i> on page 65
Seen Points	See <i>Three-Zone Strategy</i> on page 60
Not Seen Points	See <i>Three-Zone Strategy</i> on page 60
Relative Defects	See <i>Three-Zone Strategy</i> on page 60
CV Index	See <i>CV% 100 Point Test</i> on page 57
Fixation Losses	See <i>The Test Status Group</i> on page 42
False Negatives	See <i>The Test Status Group</i> on page 42
False Positives	See <i>The Test Status Group</i> on page 42
IOP	Inter-Ocular Pressure – this is a user entered attribute that you can use to record the patients IOP at the time of the exam.

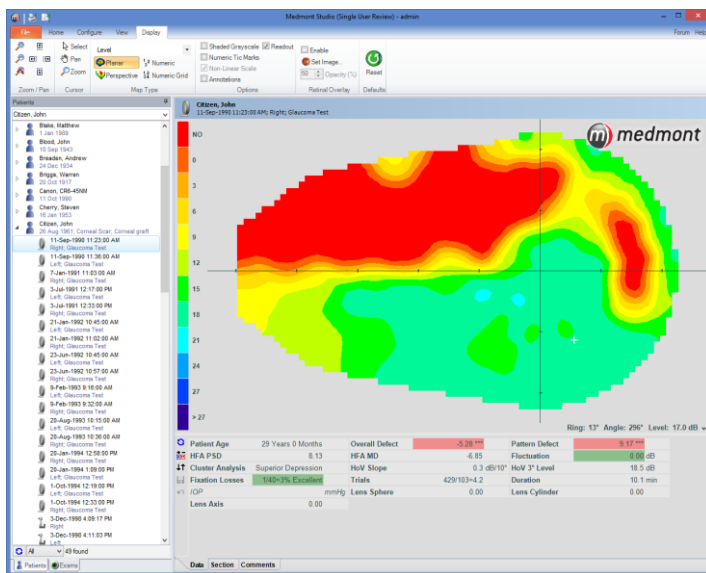



Figure 50. Data Tab

You can select the attributes to be displayed and their order by clicking on the *Arrange user defined attributes* button  (on the left of the tab). This displays the **Arrange Attributes** dialog shown in Figure 51. The **Available** column on the left is the list of available attributes, while the **Selected** column on the right is the list of those attributes selected for display. You can move any or all from one side to the other using the arrow keys in the centre. The single arrows will move a selected attribute from the **Available** list to the **Selected** list, or remove it from the **Selected** list. The double arrows will copy the entire **Available** list to the **Selected** list, or completely clear the **Selected** list.

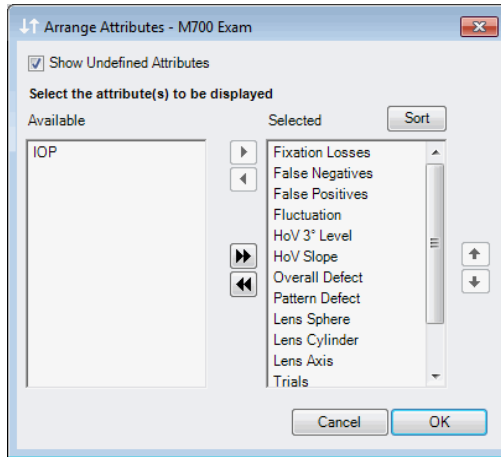


Figure 51. Arrange Attributes dialog

The up and down arrows on the right allow for changing the order in which the selected attributes are displayed. The top item will be the first attribute displayed. Selecting an attribute in the **Selected** list and then clicking on the up arrow will move that attribute towards the top of the list. Clicking on the **Sort** button will sort the column alphabetically.

Some statistics are not applicable to all exam types. There will also be some pre-Medmont Studio exams that will be missing the later statistics. These attributes are normally shown in italics with no value. By un-checking the **Show Undefined Attributes** check box these particular attributes will be automatically removed from the list.

Section Tab

The Section tab shown in Figure 52 can be displayed for any shaded or colour data view (see *Plan View* on page 84). It displays a graph of a 2D slice through the data with eccentricity in degrees for the horizontal axis. When the tab is selected a section line is displayed on the main map view to indicate the location of the slice of data being displayed. You can move this line anywhere over the view to explore a specific cross-section.

Moving the Cross-Section

The section line has three small handles in the middle and at both ends. Use the mouse to click on the centre handle and, still holding the button down, try moving the mouse around. The line maintains its angular orientation but the line centre follows the mouse. You can position the line centre anywhere on the image.

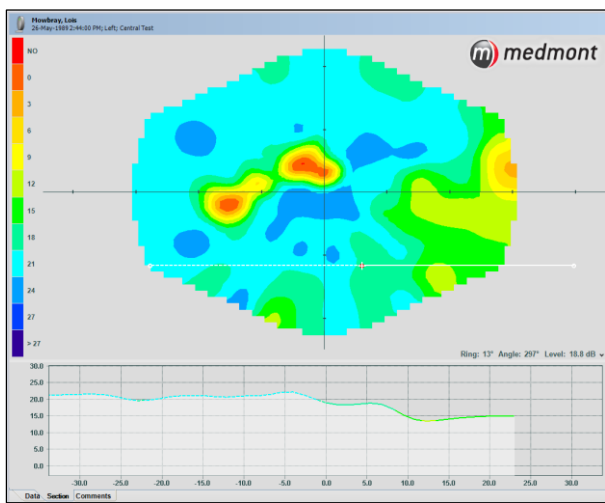


Figure 52. Adding the Section tool.

Now click on the handle at one end of the line. If you hold the button down and move the mouse you rotate the line around its current centre point. Once the mouse has captured the handle and you hold the button down, you can move the mouse anywhere. The section tab updates continuously to reflect the data at the specified location.

Note that the section indicator and the section profile have two halves, with one half solid, the other dashed. This allows you to correlate the cross-section with the location of the indicator on the view as the indicator is rotated.

Comments Tab

This tab allows you to add or edit comments for the exam.

Adding and Editing Attributes

Medmont has already defined an extensive set of attributes. You can define your own statistics that are based on this standard set. We will first examine some of the standard attributes and then proceed to develop some new ones as examples. On the **Configure** tab, click **Attributes** to display the **Attributes** dialog in Figure 53.

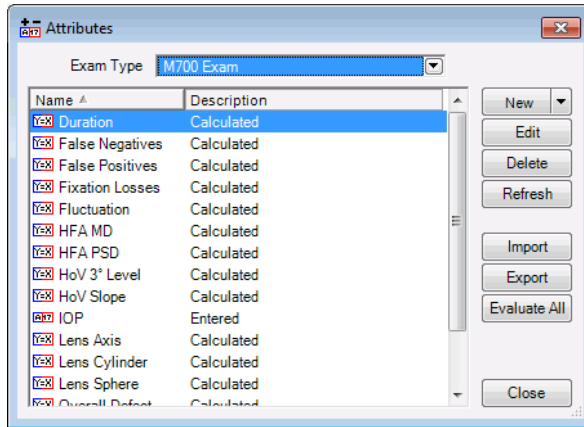


Figure 53. Attributes dialog.

The **Attributes** dialog is shown in Figure 53 and shows the same set of names in the **Name** column as is shown in the **Available** column in Figure 51. The **Description** column shows the derivation of that particular attribute. For example the **HoV_Slope** attribute is calculated from the *GetHOVSlope()* system function. The system functions have direct access to the current exam details.

Editing an Attribute Definition

Some attributes are computed or *derived* from system functions. For example, the *Duration()* system function returns the duration time of the current exam in seconds, although the standard **Duration** attribute is given in minutes. The definition for **Duration** is shown as *Duration()/60*, converting seconds to minutes.

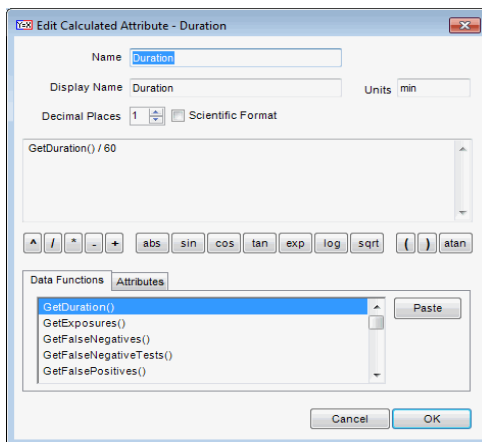


Figure 54. The Edit Calculated Attribute dialog.

To explore how attributes are defined, we will change the **Duration** attribute to display in seconds. First ensure the **Duration** attribute is highlighted in the **Attributes** dialog (Figure 53) and then click on the **Edit** button. This will bring up the **Edit Expression Attribute** dialog shown in Figure 54.

Position the cursor after the text in the Expression edit box and delete the “/ 60” part of the text, leaving just the system duration function *Duration()*. Now the **Duration** attribute is going to return seconds. We need to make the display match this fact so change the “min” text in the **Units** box to “secs”, and change the **Decimal Places** setting from “1” to “0”. Here you can either overtype the existing setting, or use the up/down spin buttons. At this point the expression editor should look like Figure 55.

When you are satisfied with this, click on the **OK** button to copy the new expression to the attributes database. Click on the **Close** button in the **Attributes** dialog, and then force an attribute re-computation by clicking the **Recalculate** button. You should see the **Duration** attribute now display in seconds.

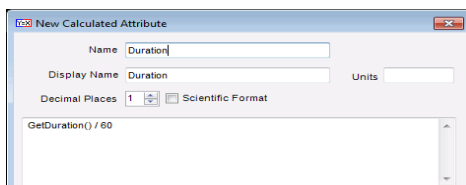


Figure 55. Revised calculation to display Duration in seconds.

This is probably not the way you would want **Duration** to display, so repeat the above procedure and reverse the changes.

Defining a New Attribute

For the next step we will develop a completely new attribute. As an example, say we need the best estimate of a patient's underlying HoV (i.e. disregarding any defects) at 12° eccentricity. There are system functions for the computed patient HoV level and slope, so we can use these to develop an expression for the level at 12°. Remembering that HoV slope is given at the 3° ring, and the slope is in dB/10°, then the required new expression is:

$$\text{HoV_at_10} = \text{HoV_Level} + (0.3 \times \text{HoV_Slope}) - (1.2 \times \text{HoV_Slope})$$

Bring up the **Attribute Expression** editor again from **Tools > Attributes...**, then click on the **New** button. Select **Expression Attribute**. Enter "HoV_at_12" in the **Name** box, select "2" **Decimal Places**, and enter "dB" in the **Units** box.

Note that a name cannot contain spaces. Use the underscore character if spaces would make the name more readable.

To enter the above expression, you can make use of a number of editing shortcuts. The first parameter in the above expression is the HoV level, and this is returned by the *GetHOVLevel()* function. Click on the **Data Functions** tab so you can see the list of functions. Scroll down until you see this function and double-click it. This copies that function into the **Expression** editor window at the current cursor position. Continue entering the above expression, using the same technique to enter the two occurrences of *GetHOVSlope()*. The completed dialog should look like Figure 56.

Click on the **Attribute Expression** dialog **OK** button and then close the **Attributes** dialog. Click on the **Arrange user defined attributes** button (in the **Data** tab at the left) to display the **Arrange Attributes** dialog. Copy the new **HoV_at_12** attribute from the **Available** list to the **Selected** list then click the **Close** button.

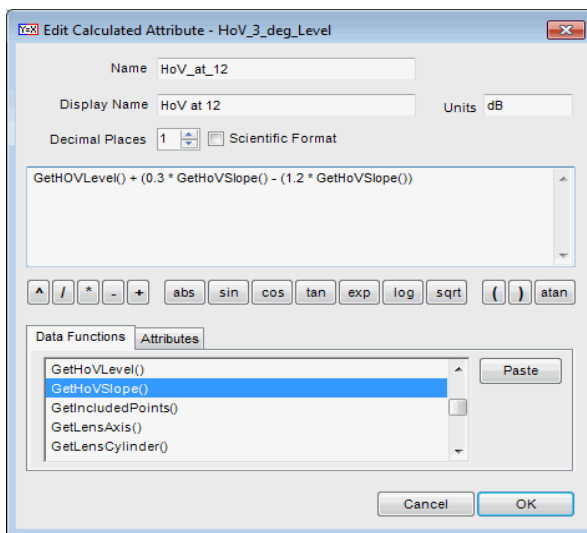


Figure 56. An Expression to evaluate HoV at 12°.

Click on the **Recalculate** button (in the left of the Data tab) to re-evaluate the attributes and you should see the computed value. If you browse to another threshold exam this attribute will be undefined and shown in italics, or not displayed at all (depending on whether the **Show Undefined Attributes** option is selected). This is because the overhead for Medmont Studio to automatically re-evaluate attributes every time would introduce an annoying delay as you browse patient exams. Click the **Recalculate** button to force the attributes to be re-evaluated for the selected exam. If the HoV functions are still undefined the cause will be that the test did not use a Fast or Staircase strategy.

Adding Annotations

Graphical annotations can be added to visual field exams using the options on the **Edit** tab. Annotations are stored with the exam and may be printed, exported, imported and viewed with Medmont Studio Viewer. Display of annotations can be turned off for the current view, by deselecting the **Annotations** option on the **Display** tab.

Annotations can even be added to the comparison view of two exams. In this case the annotation is stored and the next time the same two exams are compared the annotation is displayed. Note that for multiple views, Annotations may need to be enabled in the Settings dialog for the particular view before they are visible.

Text Annotations

The **Text** option on the **Edit** tab changes the cursor to allow you to place a text annotation on the image. Click at the location that you want the anchor for the annotation to be placed. The Text Annotation dialog (see Figure 57) is then displayed, allowing you to enter the text.

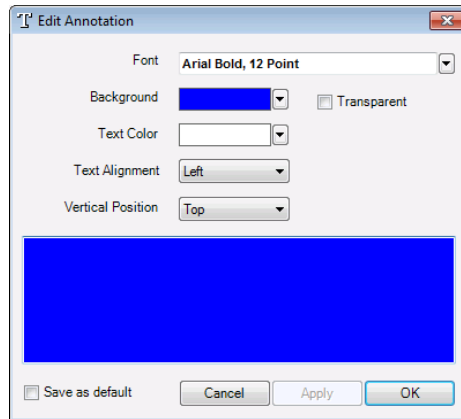


Figure 57. Text Annotation Dialog.

Callout Annotations

The **Callout** option on the **Edit** tab 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. Again a dialog is displayed to allow you to enter the text for the annotation.

Ruler Annotations

The **Ruler** option on the **Edit** tab allows you to make an angular measurement in radians between any two points on the test result.

Shape Annotations

The annotation tools allow you to define seven types of shapes on your exam images; these are shown in the Studio User manual and are:

1. Circle Annotation
2. Ellipse Annotations
3. Rectangle Annotation
4. Square Annotation
5. Curved Area Annotation

6. Freehand Area Annotation and
7. Polygon Area Annotation

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

As their names imply, the Circle, Ellipse, Rectangle and Square annotation tools allow you to create these shapes. To create one, 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 Curved or Polygon areas click on the first point and keep clicking until the second-last last point. Right click to complete the curve. To draw a Freehand area, click on the first point and drag the mouse around the required shape, and stop dragging when you are finished.

Shapes can always be fine-tuned by resizing or moving. To move or resize a shape annotation, click anywhere on the shape to select it. Small, circular hot spots will be displayed on the shape. Click and drag the desired hot spot to move a particular point. To move the whole shape, click and drag from either any point on the shape (except a hotspot), or from the centre cross hair.

Editing 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. Selecting a Text or Callout annotation displays the **Edit Annotations** dialog shown in Figure 57, allowing you to change the text and colours. Selecting a Shape Annotation displays the **Edit Shape Annotation** dialog shown in Figure 58.

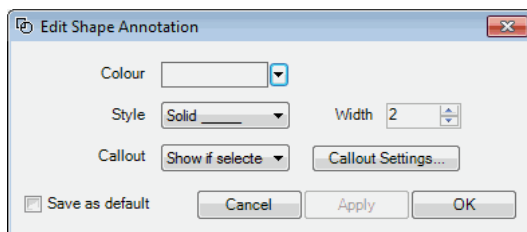


Figure 58. Edit Shape Annotation.

This dialog allows you to choose the colour, style and line width of the shape. You can also add a callout to the shape that allows you to associate text with the shape. The **Callout** box allows you to select the option that controls the visibility of any text associated with the shape. Select the **Show**

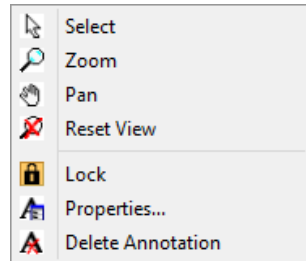
always or *Show if selected* entry to enable the **Callout Settings...** button, and then click on this to display the text annotation dialog (see Figure 57) to edit the text and display properties.


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 accidentally 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 59.

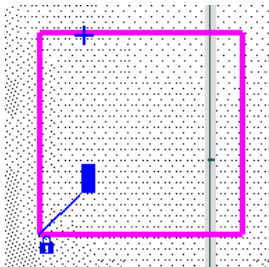




Figure 59 Square Annotation showing the lock symbol.

Deleting Annotations

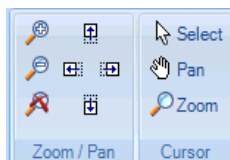
To delete an annotation, select the annotation (by clicking once on it), click on the **Edit** tab and click **Delete**.

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 buttons will become active on the **Edit** tab, **Save**  and **Undo** . Use these buttons or the menu entries to control the saving or not of any current work. If you do not use either, the system will display a dialog when you attempt to move away from the edited image.

Zooming and Panning


You can zoom and pan the currently displayed Patient Exam images from the **Display** tab using the **Zoom** and **Pan** menu items. Use the **Reset** menu item to reset the default image view.




When multiple images are displayed, zooming and panning of the images from this menu entry are synchronised.

Using the Mouse to Pan and Zoom


You can also use the mouse to pan or zoom within a single image. Click with the right mouse button over the image. The shape of the cursor changes to reflect the current cursor mode. You can also change the cursor mode by pressing the spacebar or clicking the right mouse button within the image and select from the popup menu.

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 when 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 left mouse button is held

down. If you hold the ***Ctrl*** key down while clicking then you zoom out instead of in. You can also use the central wheel of a mouse so fitted to control zoom.

11. Regression Analysis

The regression analysis tools allow you to explore the progress of a patient's results over time. Regression views are available when a single Patient is selected in the Medmont Studio explorer pane. This adds a Regression menu and the  regression button above the patient explorer pane. Figure 60 is a full screen shot of Medmont Studio showing the Regression Analysis view for both eye exams for the patient selected. The Regression menu and toolbar allow selection and manipulation of these views.

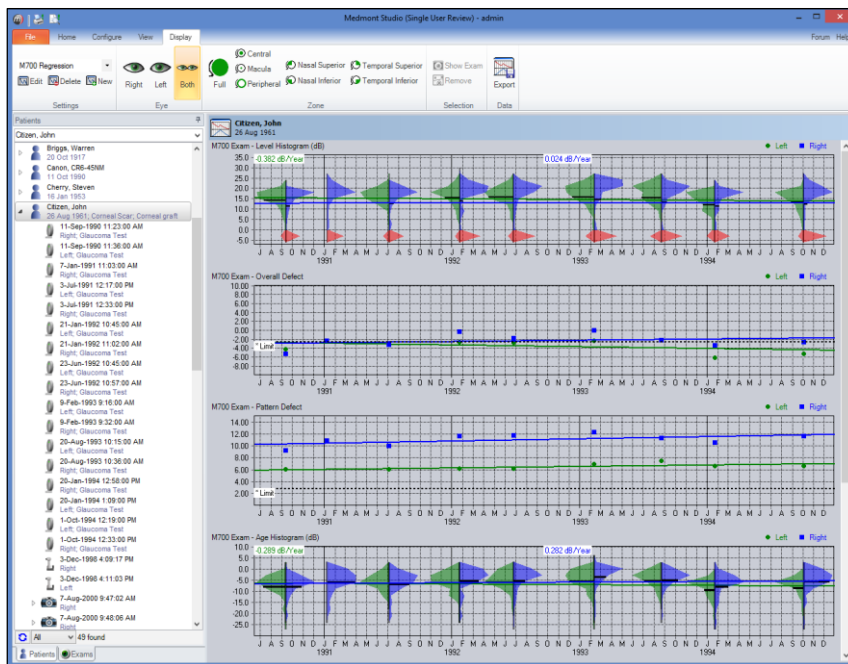





Figure 60. The Regression Analysis view.


The four plots in the Figure show the Exam Levels histogram at the top, then the Overall Defect plot, the Pattern Defect plot, and the Age Histogram at the bottom. Off screen below these will be the HoV Histogram and (Inter Ocular Pressure (IOP) graphic. The latter will only have contents if the values have been added in the Data tab.

By default, all exams for the selected patient for the selected eye are shown at once. The plots are shown even if there is only one exam available. When there is more than one exam a regression line is added with its slope in

dB/year shown in a callout box at the top of the graphic. The Defect graphics will include the one, two or three asterisk limit lines if they are within the vertical axis bounds.

The eye buttons  on the toolbar and in the menu, select which set of exams are displayed. To display the view for both eyes, click **Both**.

You can point the cursor at any histogram or data point and a click will highlight the selected exam in all plots. Clicking the delete button  on the toolbar will remove that exam from all plots. The regression line will be automatically recomputed for the new set of exams. You can restore the original view at any time by clicking on the regression button .

You can bring up a **Map** view for the highlighted exam by clicking on the map view button  or double-clicking the histogram graphic. All the usual map tools are available in this window for reviewing the exam result (see *Map View* on page 71).

Histogram Plots

Histograms can be displayed to show the distribution of test point levels. In this context they show the distribution of values for each exam over time. The values are the Y-axis, and time the X-axis. The histogram is rotated 90° anti-clockwise from a normal representation, so the X-axis does double duty by also representing relative histogram counts.

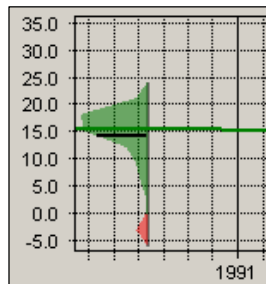


Figure 61. Portion of a Level histogram.

This histogram shown in Figure 61 describes a distribution of exam level values. Level histograms are binned in 3 dB buckets with a Y-axis out to 35 dB. The dark vertical base line defines the range of values encountered. Buckets are joined point-to-point and filled with green colour for the left eye and blue for the right. The transition to zero from the outer boundaries is also joined by straight lines and colour filled. For example, the dimmest value

seen in this example is at 21 dB. The histogram shows the 21 dB bucket level connected to zero at the next dimmest bucket (24 dB). The reason for this is that the exact distribution of points between 21 and 24 is unknown, only that there were some at 21 and none at 24, so a straight line connecting the two is the best estimate possible.

Not Seen values (or absolute defects), when they exist, are shown in red below the 0 dB line at a notional -3 dB value. There are some Not Seen points in this example.

The black horizontal line extending from edge to edge of the histogram is the histogram mean value. Note that on the display, the regression line is drawn after the mean line, so in some cases the latter may not be visible.

The horizontal axis provides yearly major markers and additional monthly minor markers when the history period extends over less than four years. There will always be at least one year marker.

The graphics are translucent, and where two or more histograms overlap, you should still be able to see the overlain graphic. You can use the select capability to highlight them separately for greater visibility.

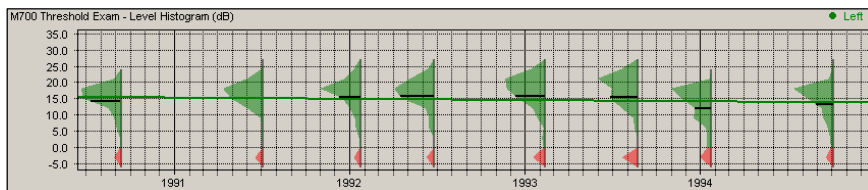


Figure 62. Complete level histogram plot.

The Regression Types

The regression lines are fitted to the mean values for histograms, and to the points themselves for single value statistics. The default least squares method is perhaps the most common regression and is based on minimising the sum of the squares of the differences in the points that make up the sample. This method works well for data that is reasonably distributed and where the data approximates a straight line.

However, least squares is not so effective when the data contains significant outliers, as each point has equal weight and the outliers tend to skew the regression away from its true position. A more robust median regression using M-estimates that minimises the absolute deviation gives outliers less

weight and in general provides a better fit for highly variable data. Median fit is the second regression option (see *Regression Options* on page 106).

Field Subsets



These buttons are added to the toolbar when regressions are selected. They define the zones in the field that will be included in the regression analysis. Clicking one of these buttons will re-graph the data for that data subset. The subset boundaries are defined in Table 8, where the angular coordinate system is anti-clockwise from 3 o'clock (ie 0° is at 3 o'clock, 90° is at 12 o'clock, etc).

Regression Zone	Points Included
Full field	All points in field.
Central zone	Points out to 22°.
Macula zone	Points out to 10°.
Peripheral zone	All radial points between 23° and 50°.
Top left arcuate	All radial points between 9° and 23°, and in the 90° to 180° sector.
Top right arcuate	All radial points between 9° and 23°, and in the 0° to 90° sector.
Bottom right arcuate	All radial points between 9° and 23°, and in the 270° to 360° sector.
Bottom left arcuate	All radial points between 9° and 23°, and in the 180° to 270° sector.

Table 8. Field subset boundary definitions.

Note that some fields have light points that extend asymmetrically past the 22° eccentricity (the glaucoma field for example), and selecting a peripheral zone plot in these cases will not be a peripheral plot but a plot of those points that extend beyond the 22° eccentricity.

Regression Options

On the **Display** tab, click **Edit** will bring up the dialog shown in Figure 63.

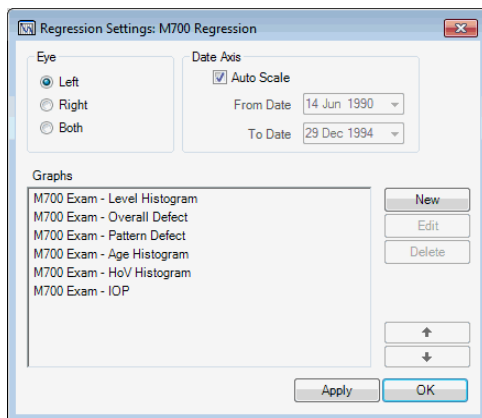


Figure 63. Regression Settings dialog.

This dialog allows you to select from the set of available regressions, preset the eye, and select the time period that the regression covers. By default the latter is all exams for the selected patient. You can also move a selected regression up and down the display using the up and down arrows.

If you select a regression and click on the **Add** or **Edit** button, you will be presented with the Add/Edit Regression Graph dialog shown in Figure 64. It allows you to select/change a regression, define the Y-axis data boundaries, and select the regression type.

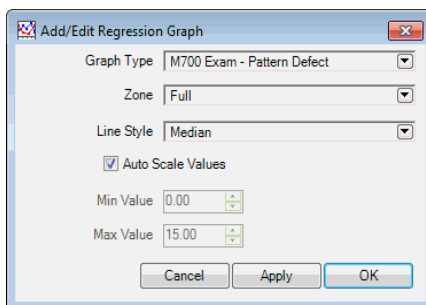


Figure 64. Add/Edit a Regression Graph.

For a histogram regression the **Zone** drop down box (not shown here) allows selection from the list of field subsets (see *Field Subsets* on page 105). The **Line Style** drop down allows selection of the available regression types, either Point to Point, Least Squares, Median Fit, or None (see *The Regression Types* on page 104). The default is **Least Squares**.

12. Printing the Exam Results

There are many options when printing an exam result, although in most cases accepting the defaults will provide a more than adequate result. Before continuing, you should read the *Printing* chapter in the **Medmont Studio** manual. This describes how printer setup is controlled from the **Print Setup** menu from the **Application** Button at the top, and that each view type retains its own settings. This means, for example, that a simple map view could be configured for portrait multi-print, while difference views could be set to landscape.

Here we will move from simple printing using defaults to configuring each print option. The following discussion is considerably simplified if we use a known patient environment. To this end we will refer to and use patients and exams in the sample database provided on the Medmont Studio CD-ROM. If you have not as yet installed this database we recommend you do so now (see *Installing the Demonstration Database* on page 124).

There are two basic ways to print exams.

Map View	Provides either one or six different views of the currently selected exam. The single view will be the current map view and this is most like a standard “What you see...” print, where what you print is what you can currently see. The default <i>Threshold Overview Print</i> automatically formats six different views of the exam per page (three rows by two columns) along with most of the standard statistics and the patient details. Later we will see how you can edit this format to suit your practice.
Multi Print	Provides four views of every exam for the currently selected patient - a complete patient exam history. Prints up to six exams per page (six rows by four columns) and multiple pages if necessary. You can select whether you print left, right, or both eyes.

There is a third option that covers printing Regression Analyses and this will be covered later.

Before beginning, select the sample database. Select patient John Citizen and then the right eye exam for 11-Sep-1990. On the *Display tab*, click on *Numeric*. For this example, also ensure the *Hill of Vision Data, Non-Linear*

Scaling, *Numeric Tick Marks*, *Statistics* and *Attributes* check boxes are ticked.

Printing the Current Display

Click on the **Application** button, then click **Print Preview** to bring up the **Print** dialog. The **Printer** dropdown box will display your current default printer.

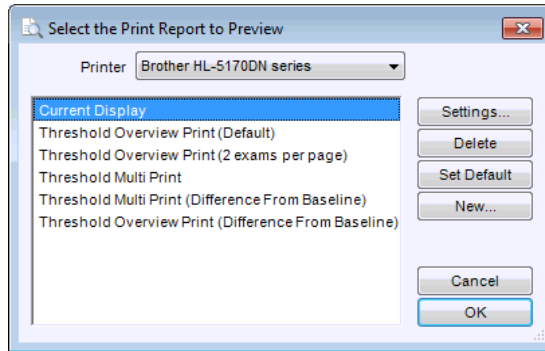



Figure 65. Print setup dialog.

For a start we will explore the **Current Display** option shown in Figure 65, so select this and then click on the **OK** button. This will present a full-screen print preview display similar to Figure 66, essentially a “what you see...” of the Medmont Studio display of this test, but formatted to better suit the printed page. Clicking on the  **Printer** button will print this image.

Export a Print Preview to the Clipboard

In the Preview window, if you click on the **Clipboard** button, the review image is copied to the clipboard as a bitmap, allowing subsequent pasting into any application that allows image cut and paste options (Word, PaintShop, etc).

Export a Print Preview to an Image File

If you click on the **File** button, you can save the printer review image to disk in either *.BMP, *.JPG or *.GIF image formats. This makes for simple communicating of results where the image must be transported electronically, such as by email.

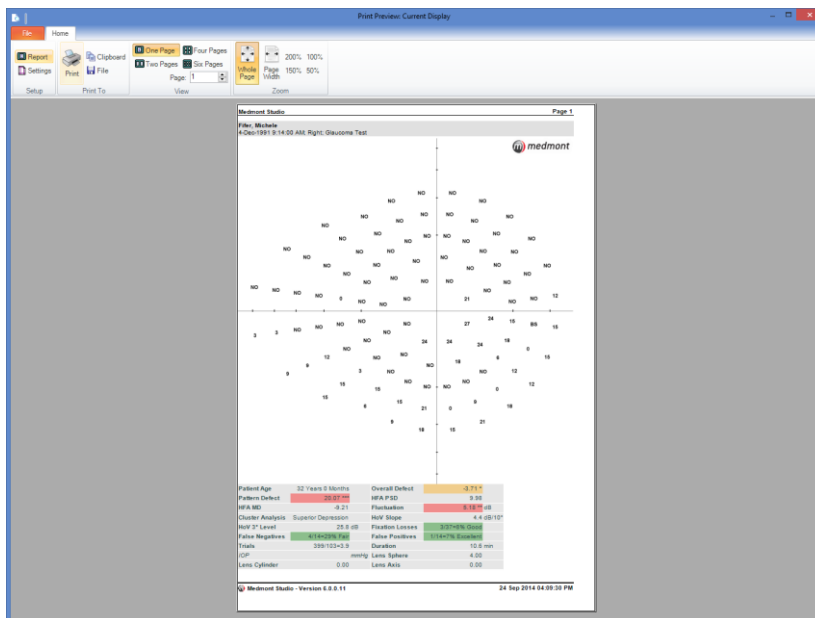


Figure 66. Print preview window for the Current Display option.

Printing Multiple Images

You can print the results for both eyes on the one page. Select both tests in the Explorer pane (hold the Ctrl key down while selecting) then click through to the printer dialog. Click the **Settings** button and set the display to Landscape (see Figure 68). Now when you print the two views will be printed side-by-side, similar to print preview shown in Figure 67.



Figure 67. Printing test results for Both Eyes.

Printer Settings

Clicking on the **Application** button, clicking **Print** and then clicking on the **Settings** button brings up the Print Report Settings dialog shown in Figure 68. This has the familiar controls for setting the destination printer, paper size, units, margins, etc, but in addition has a text box for setting a Print Title. By default this is set to “*Medmont Studio*”. One use for this is to enter your practice name, as the text is remembered between sessions and will therefore be the header on all subsequent printouts.

A further option is the **Greyscale** checkbox beside the printer selector dropdown control. Some black and white printers have difficulty translating colour imagery, and if this is your case, checking this box will ensure that colour images will be translated into greyscale images before being sent to the printer.

Some additional options will appear in this dialog that depend on the currently selected and formatted display.

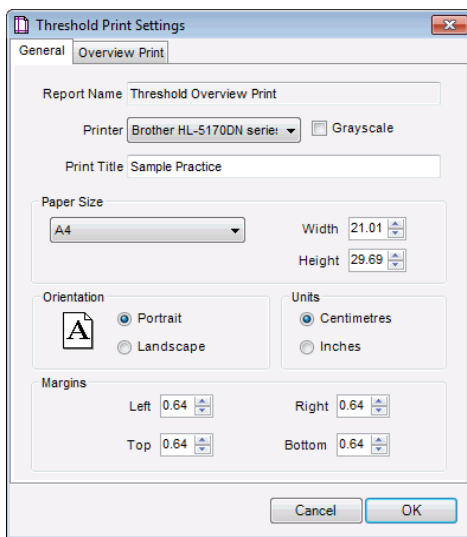


Figure 68. Print Report Settings dialog.

Threshold Overview Print

Click on the **Application** button, then click Print Preview to bring up the Print dialog shown in Figure 65. We will explore the Threshold Overview Print option, so select this and then click on the *OK* button. This presents a full-screen print preview display similar to Figure 70. Click on the Settings... button. For this example, make sure the *Greyscale* checkbox is not ticked, and then click on the *Overview Print* tab. Overview Print Settings

The Overview Print settings dialog is shown in Figure 69. An Overview Print attempts to put as much information on the page as possible. It provides for six graphical views of an exam, plus a full set of statistical summaries, including a selected set of exam attributes. The Overview Print settings dialog gives you considerable control over how this page is displayed.

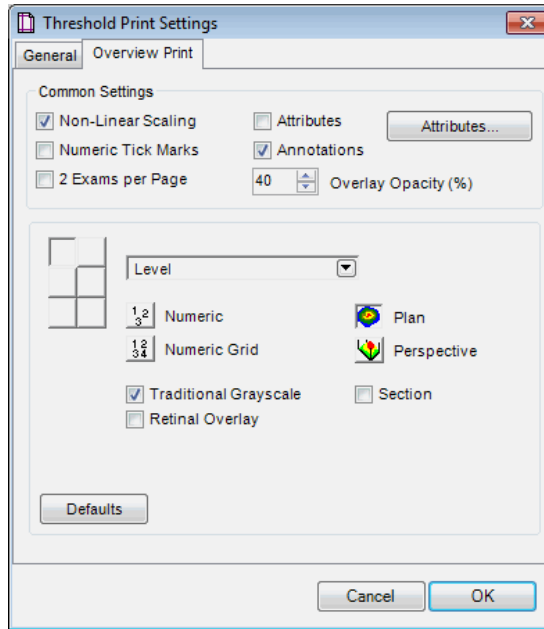


Figure 69. Overview Print settings dialog.

The default display, returned to at any time by clicking on the **Defaults** button, presents six B&W graphical exam images and the standard set of statistical summaries as shown in Figure 70.

Note that if you have ticked *Always display the External ID* on the **Configure** tab from **Preferences**, the external ID will be included in the printout.

The set of six buttons grouped as three rows of two buttons allows for selecting the display parameters for any of the corresponding six graphics. Click on the top-left button. Clear the **Shaded Greyscale** checkbox then click on the **Apply** button. The Preview window will be re-drawn with the top-left graphic now showing a standard colour map display. You might like to explore changing the parameters for the other graphics. Whatever you set up here becomes the default for subsequent Overview prints, so if the standard display does not suit your practice, you can change it here at any time.

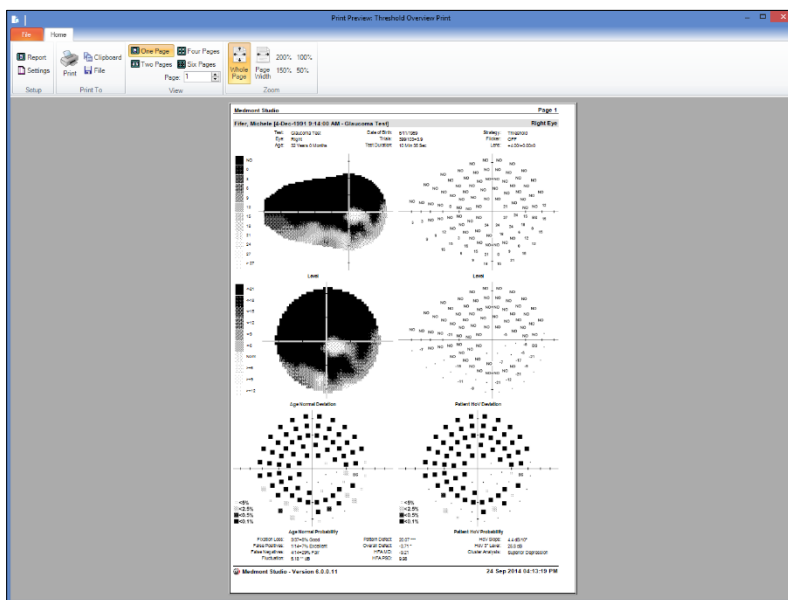


Figure 70. Print preview for an exam Overview Print.

The checkboxes in the Common Settings grouping provide some additional options. Checking the *Non-Linear Scaling* and/or *Numeric Tick Marks* checkboxes will make these changes, but the result can tend to crowd the display somewhat. By default there are no attributes assigned to an Overview Print, so checking the *Attributes* checkbox will make no change until you add some attributes via the *Attribute Options* button. This will display the Threshold Exam Attribute Options dialog (see Figure 51) and allow you to add attributes as required.

The *Retinal Overlay* checkbox will add any registered retinal images to the print preview. Refer to *Retinal Overlay View* on Page 73 for more information on registering and using retinal images with perimeter exams.

The *Overlay Opacity (%)* sets the transparency of the graphic shown in the Plan view when combined with a retinal overlay. If the retinal overlay option is not checked then the opacity has no effect.

M700 Exam Print Report

Click on the **Application** button and click **Print Preview** to bring up the **Print** dialog shown in Figure 65. Select **New**. Select the ***M700 Exam Print Report***. Click on the **OK** button. This presents a full-screen print preview similar that in Figure 71. Print Preview for an M700 Exam Print Report,

Click on the **Settings...** button to open the print report settings dialog. Click on the *Advanced* tab to show additional settings.

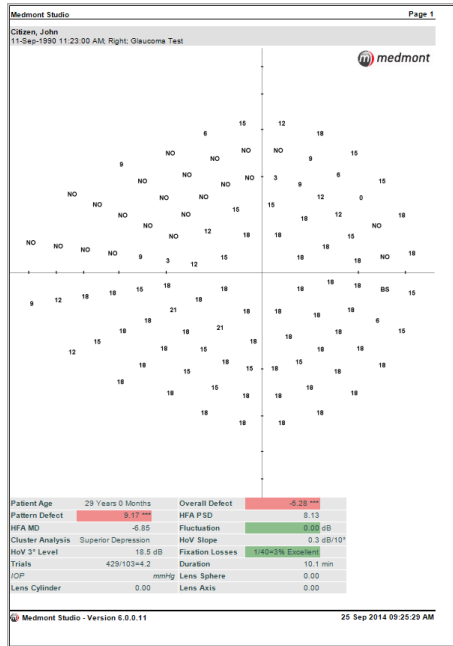


Figure 71. Print Preview for an M700 Exam Print Report

Advanced Print Settings

The advanced M700 Exam Print Report settings are shown in Figure 72. The M700 Exam Print Report is designed to show all of the relevant information about an M700 exam on one page. The attributes that are shown are automatically generated based on the exam strategy used.

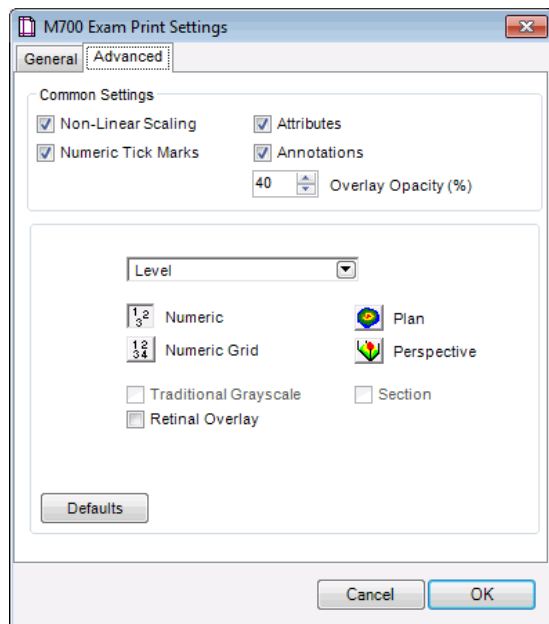


Figure 72. Advanced settings for the M700 Exam Print Report

The default display, returned to at any time by clicking on the **Defaults** button, presents a single graphical exam image and a predetermined set of statistical summaries as shown in Figure 71. Changing any of these settings here will become the default for all future print reports of this type.

The checkboxes in the **Common Settings** grouping provide some additional options. Checking the **Non-Linear Scaling** and/or **Numeric Tick Marks** checkboxes will make these changes, but the result can tend to crowd the display somewhat.

The attributes that are shown are based on the currently selected exam's strategy. These can be turned on and off via the **Attributes** checkbox.

The **Retinal Overlay** checkbox will add any registered retinal images to the print preview. Refer to *Retinal Overlay View* on page 73 for more information on registering and using retinal images with perimeter exams.

The **Overlay Opacity (%)** sets the transparency of the graphic shown in the Plan view when combined with a retinal overlay. If the retinal overlay option is not checked then the opacity has no effect.

Printing the Patient History

You can print a summary of a particular patient’s entire history for the left, right or both eyes, or any selection of exams from within that history. The summary includes four field graphics and a subset of the statistical summaries.

To see the various options available, as an example make sure patient John Citizen is selected, click the button and then select **Print Preview** to bring up the Print Preview dialog. Click on **Threshold Multi Print** selection and then on the **OK** button. When the multi print display appears, select **Settings** to bring up the Threshold Multi Print Settings dialog. Click on the **Multi Print** tab to show the dialog in Figure 73. This is very similar to the Threshold Print Settings dialog in Figure 69 except you can select left, right or both eyes, and there are only four window selection buttons and they are in a horizontal line.

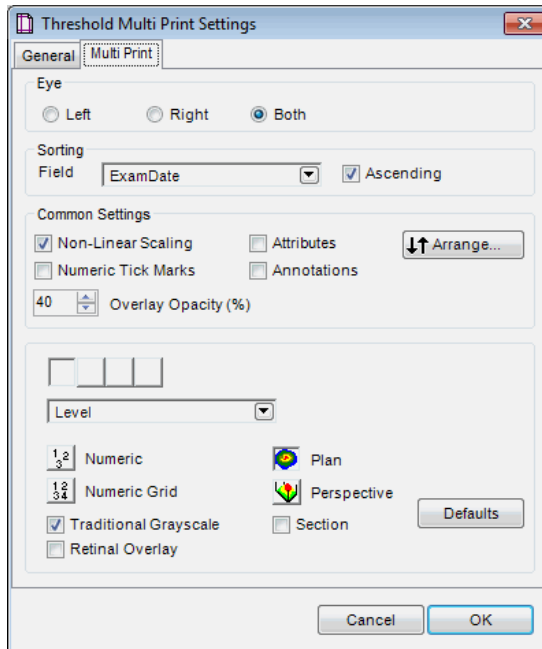


Figure 73 - Threshold Multi-Print options selection dialog.

You can explore the effects of various selections by clicking on each button to make some changes and then clicking on the *Apply* button. If you choose the defaults then you should see a preview screen similar to Figure 74.

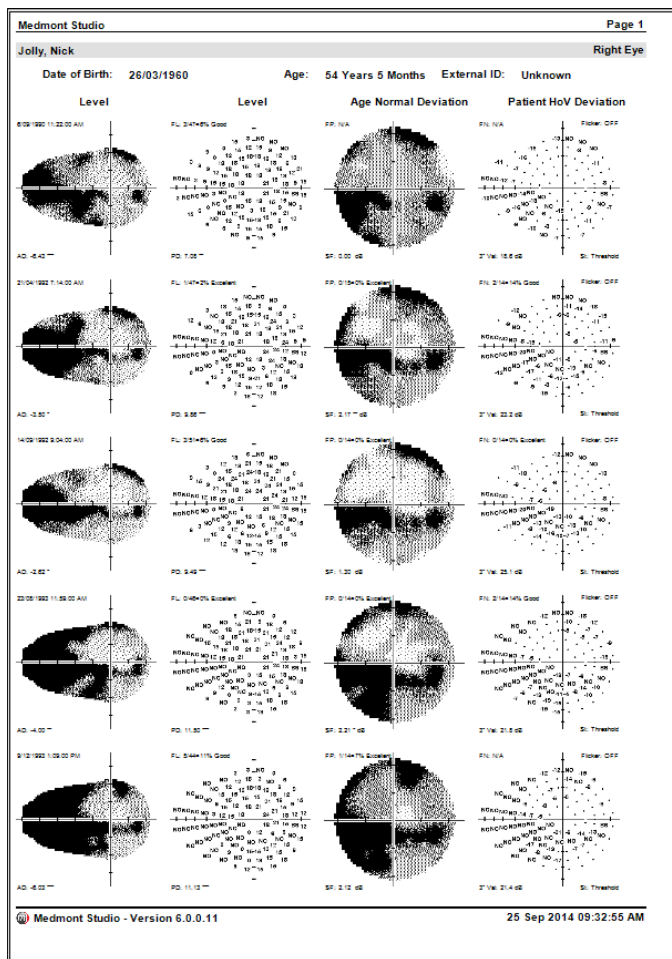


Figure 74. Multi-print print preview screen.

Regression View Printing

Printing a regression result is similar to the previous two, but the selection dialog is rather different. Again select patient John Citizen and click on the Regression button. Click on the **Application** button, then click **Print Preview**, select **M700 Regression Report**, and then click on the **OK** button.

This will bring up the view in Figure 75. Note that you can change these views to a landscape view by selecting **Settings** and clicking the *Landscape* radio button.

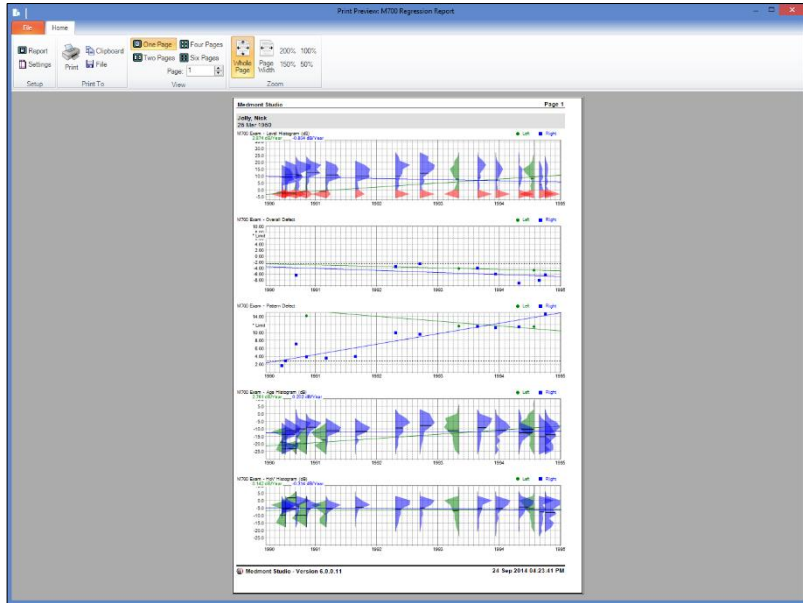


Figure 75. Full screen Regression preview.

13. Exporting the Analysis

There are many situations where the results for a particular patient need to be shared. In your own practice where there may be a number of networked computers, you can easily view exam results from the shared database on any computer with Medmont Studio installed. However, what about the situation where your practice extends to several sites in a city or interstate and a result needs to be sent for a second opinion? Or a patient moves elsewhere and their new clinician asks for their records?

Medmont Studio provides the ability to export a single exam, a set of exams, an entire patient, a number of patients, or the entire patient database.

Selection uses the same technique as patient review – just select the items to export. To export a single exam, highlight it with a click, click the **Application** button and then select **Export**. An Export Selected Items file selection dialog will appear and you can navigate to your destination directory and select an alternate output name to the default.

Do the same to select multiple exams only now hold down the **Ctrl** key while clicking on the required exams. You can hold down the **Ctrl** and **Shift** keys to select the start and finish of a set of contiguous exams. Click on the patient name to export the entire patient's record set. Use the same technique of holding down the **Ctrl** key to select multiple patients for export. Click on the database name to export all patients in that database.

The export formats are various forms of the XML (eXtended Markup Language), a universal markup language for data interchange. However there are various versions that depend somewhat on your local language and whether Unicode characters are used or not. The **Save As Type** drop-down box allows for selection of ASCII (mxf), and Unicode (muf) representations, and compressed ASCII (mcf) and compressed Unicode (mzf) versions respectively.

14. Perimeter Filters

Filters are described in the Medmont Studio User manual. However, here we will setup a couple of simple filters that are perimeter specific.

A filter allows you to search the entire patient database for patients that satisfy specified criteria, defined in terms of the patient's details and/or exams.

For example to sort patients into either male or female groups, click on the filter drop down (or pop up) box at the bottom of the patient pane and select the *Filter* entry (see Figure 76).

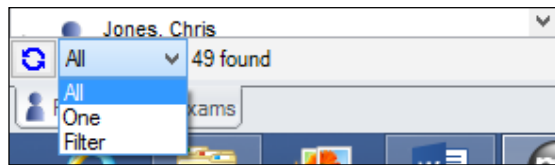


Figure 76. Selecting a filter.

This will display the **Patient Filter** dialog shown in Figure 77. The *Standard* tab is divided into two halves. The top grouping is a number of standard patient parameters, and the bottom grouping is a number of standard practice/exam relationships. For this example we just want to filter the patients to show all females. Click the *Female* radio button in the top grouping, and then click the *Apply* button. Voila! Click on the *OK* button and you can proceed to work with just the female subset of your patients.

We will now explore adding some advanced filters. Note that the filters defined in the *Standard* tab are mutually exclusive with filters defined in the *Advanced* tab – whichever tab is selected will be the filters to apply.

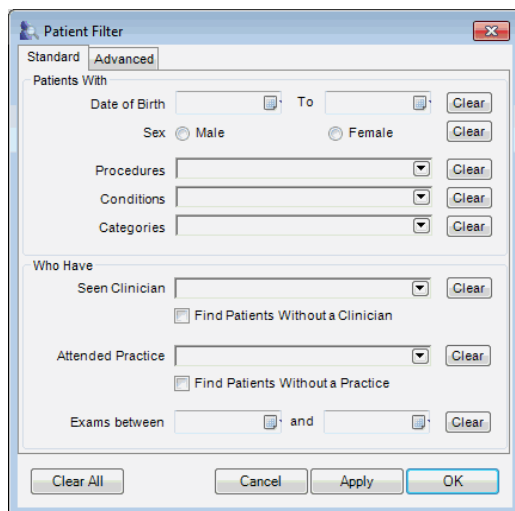


Figure 77. Standard patient filter setup dialog.

Click on the *Advanced* tab in the Patient Filter dialog. Click on the down arrow beside the *New* button and select the **Composite Condition** option. This will bring up the **New Composite Condition** dialog. Ensure the radio button called **Conditions are AND-ed** is checked and click on the *New* button to bring up the **New Simple Condition** dialog shown in Figure 78.

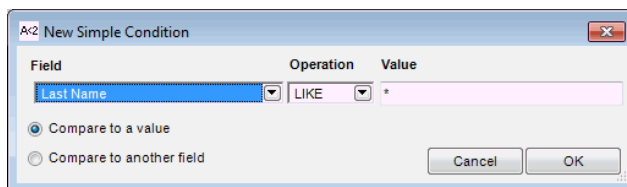


Figure 78. The simple sorting condition dialog.

What we are going to do here is combine a number of simple filter conditions to make a composite condition. The composite condition will be applied to all the selected patients and all of the simple conditions must be true for a particular patient/exam before that patient will be included in the filtered set. The simple conditions to apply are:

- The patient must be Female,
- have a Pattern Defect greater than 12,
- and their age when tested should be less than 40.

If you are using just the demonstration database, this should reduce the patient display to just the one woman - Fifer.

15. Installing the Demonstration Database

The CD-ROM contains a demonstration database that you can use to explore and experiment with the Medmont Automated Perimeter software capabilities.

Use the **Import** feature of Medmont Studio to import the database. Data that is exported from or imported to Medmont Studio is in a specialised XML format (eXtensible Markup Language), a markup language commonly used for data exchange. See the section on **Exporting and Importing Data** in the *Medmont Studio* manual for an explanation of the various format options.

Click the **Application** button, then click **Import** and navigate to the CD-ROM. Move into the **Sample Data** directory and select the file M700SampleData.mcf. Click on **Open** and the database will be imported into Medmont Studio under the User name *Sample User*. You can explore this database and get to know the software without fear of accidentally corrupting or losing an entry, as you can always re-install it at any time from the CD-ROM. If and when you no longer need this you can delete it.

16. Power On Self-Test

When a clinician starts a new exam from Medmont Studio, the software initially requests that the perimeter perform a self-test operation. This quickly scans all perimeter lightpoints and a number of hardware controller parameters. If any of these are outside limits a diagnostic message is displayed.

Initially the perimeter controller just indicates to the perimeter test software that one or more light points are outside the allowable range, and the software will display the message shown in Figure 79.

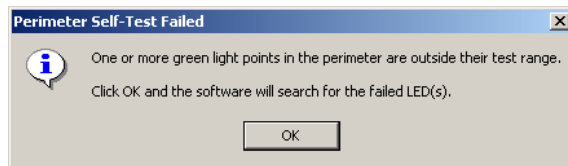


Figure 79. Failed Light point initial error message.

When this occurs, clicking on the OK button initiates an in-depth analysis of the associated light points. This analysis may take several seconds. When it concludes it displays a message similar to Figure 80.

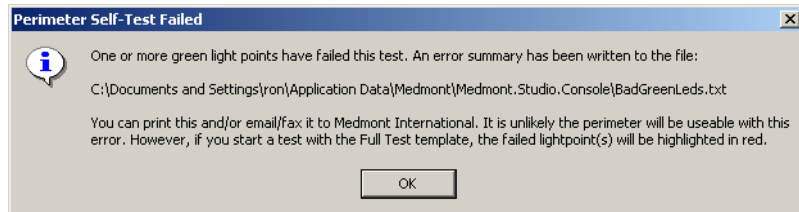


Figure 80. Failed Lightpoint summary message.

The text file named in the message contains a summary of the failed light point(s), and is written to the current user's Application Data folder *Documents and Settings*. Print this file before making a service call to assist Medmont and/or its Distributors in locating the affected light points. Typical contents for this text file where one light point has failed in the green array would be:

```
Bad Green Lightpoint List for Perimeter M233715
Address 0x27   Reading  2.29V
```

17. Glossary

This small glossary is included for terminology that originated with Medmont. It also includes some common terms where they apply to Medmont equipment. It is not a glossary of perimetry. Terms that appear here are underlined in the body of the manual.

Age Normal Hill of Vision

An Age Normal Hill of Vision describes the hill of vision for each of three age groups and is based on standard age-based population tables interpolated for the Medmont Automated Perimeter.

Blind Spot

A stimulus positioned at the patient's blind spot to randomly monitor the patient's fixation during a test using the Heijl-Krakau method.

Field

A field is a collection of stimuli with a pattern devised to test one or more aspects of a patient's vision.

Fixation Point

The fixation target at which the patient must fix their vision.

Offset Fixation Points

These fixation points are offset from the centre of the bowl by 30° and provide for fields that exceed the normal 50° boundaries.

Strategy

A strategy defines a methodology that starts with exposing a stimulus and then using the patient's response to decide on how that light point will be subsequently exposed, if at all.

Template

A template is a file that contains a test field along with additional parameters that define how the field is used in a test.

18. Cleaning, Maintenance and Service



Warning: Do not modify this equipment without authorisation of the manufacturer.

Cleaning



Dust should be removed from the surface of the stimulator bowl with a clean, damp, soft and lint-free cloth using a mild domestic solvent-free cleaner. Do not spray or pour cleaner directly onto surfaces.

All surfaces coming into contact with patients need regular disinfecting. Standard instrument grade disinfectant solutions may be used (e.g. diluted isopropanol). Wipe surfaces with a damp cloth only. Do not use strong oxidising agents or solvents, as they could damage surface coatings. Use soft non-abrasive cloths only.

Maintenance

For Medmont Automated Perimeters equipped with a CCD camera, do not attempt cleaning the lens surface with cloth or any liquid cleaner. Use a soft optics brush with blower or dry cotton swab only.

Multiple LED (Light Emitting Diodes) mounted around the periphery of the stimulator bowl provide the background illumination. Although operated at a low voltage for a long life, they should be periodically checked. If replacement is required please ask your local Medmont distributor for spare parts and replacement instructions.

The vertical chinrest should be lubricated regularly to prevent dust entering the sliding mechanism and to prevent corrosion. Wind up the chinrest to the upper limit. Put a small amount of sewing machine oil onto a lint free cloth. Wipe the steel shaft on the rear side to remove any dust and contamination. A tiny drop of oil may also be applied to the rotating parts and joints of the lens holder mechanism. Wipe off excessive oil immediately. The frequency of the lubrication depends the environment in which the device is kept, but is recommended on a 3-6 monthly interval.

Replacement of fuses



Before replacing any fuses turn off instrument and remove power cord from mains supply and USB cord from instrument.

Only use fuses as specified. Mains fuses are in the power inlet control - open the fuse drawer with a screwdriver blade. Always replace both fuses with labelled rating (see *Specifications* on page 132).

Fuses on the PCB: Pull out damaged fuses from fuse holder on PCB by hand and replace with a new one. Use Schurter type MSF fuse as specified only..

The Automated Perimeter contains no other user serviceable components.

Testing light points

Like with any medical instrument, regular testing of the M700 should be performed by the user to ensure the instrument is functioning correctly. This should include the testing of the perimeter light points using the Perimeter Test Tool.

To start a new test, on the **Configure** tab, click **Instrument Setup**. With the M700 Instrument Setup window open, select the perimeter to be tested and then select the **Test** button to open the Perimeter Test Tool window. If there are multiple perimeters configured be sure to check that the serial number of the selected perimeter matches the serial number found on the perimeter device label being tested. If the perimeter to be tested is not listed, then it is likely the perimeter has not yet been configured. Please refer to page 19 to configure a new perimeter before continuing.

Perimeter Test Tool window will then be displayed.

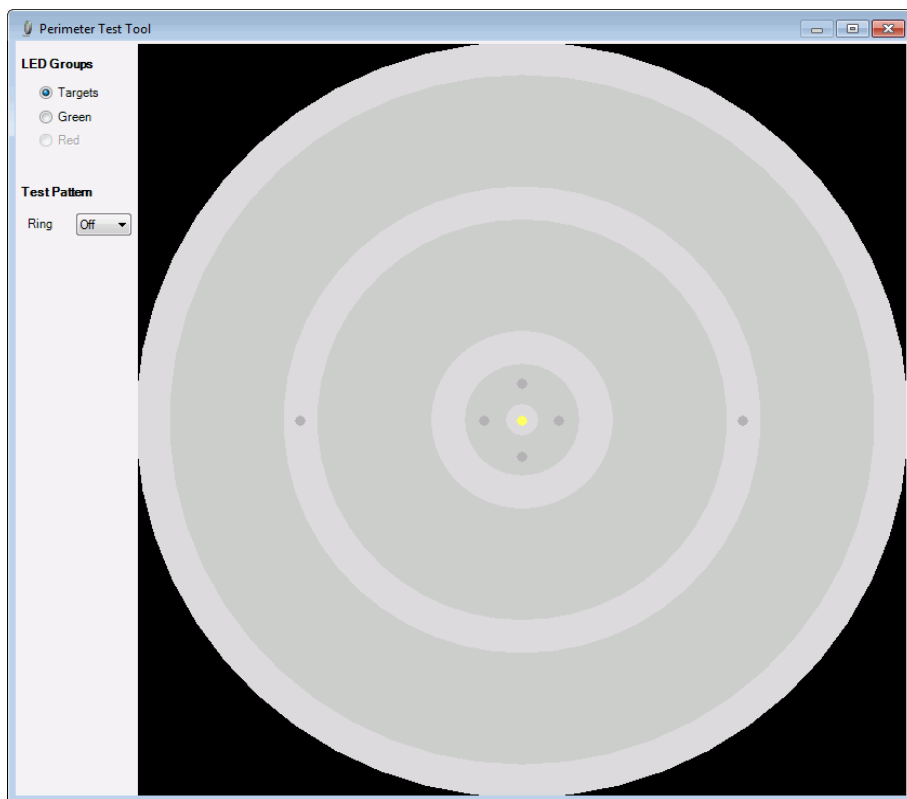


Figure 81. The Perimeter Test Tool – Target LED Group display.

By default, the **Targets** LED Group is selected; this is used for testing the perimeter's various fixation targets. By clicking on a specific target within the Perimeter Test Tool window with your mouse, the fixation light point should then be illuminated on the perimeter.

Selecting the **Green** LED Group will allow all green light points (not including the fixation targets) within the perimeter to be tested. Testing is done by clicking on a single light point within the Perimeter Test Tool or by selecting an option in the **Ring** drop-down box under **Test Pattern**.

When a single light point is selected, the corresponding light point will illuminate on the perimeter. If a ring is selected, the program will illuminate each light point which lies on the selected ring. The practitioner should confirm that the corresponding light point is lit in the perimeter.

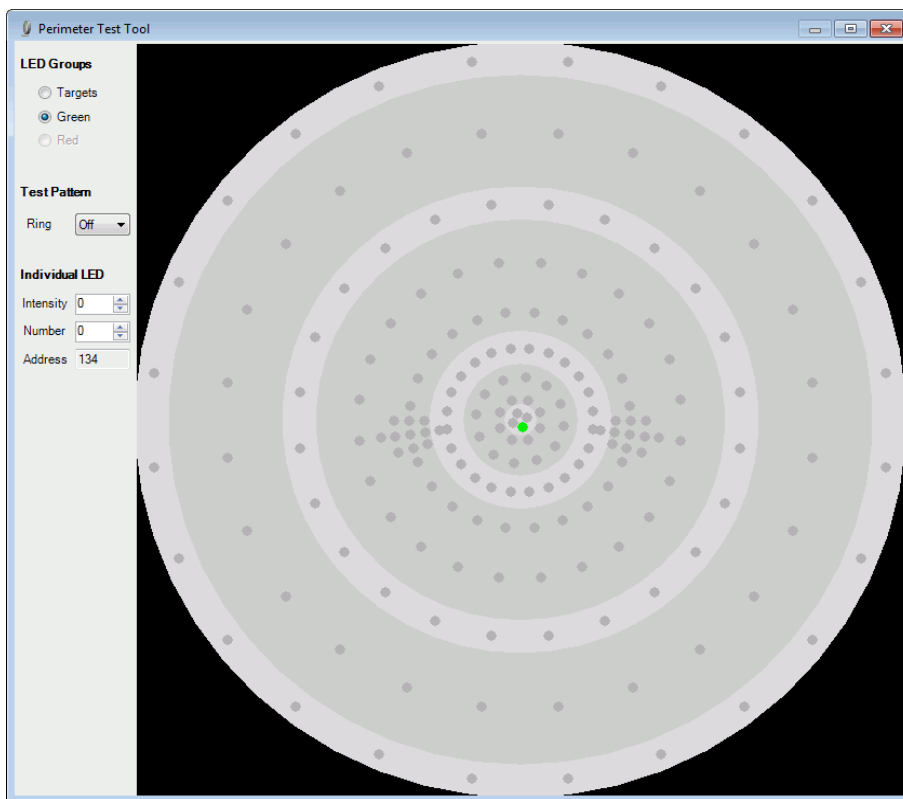


Figure 82. Perimeter Test Tool - Green LED Group display

Perimeters fitted with red light points can also be tested by selecting **RED** under the **LED Groups** option.

At any time the practitioner may adjust the intensity of the illuminated light point by adjusting the Intensity value. The intensity value may be adjusted by pressing the up and down arrows next to the Intensity value field.

The address and number fields are for engineering purposes only and should be noted down in the case of a faulty light point.

Service

For servicing and repair, please contact your local agent to advice on suitable and qualified providers. Medmont will make available on request to the service provider circuit diagrams, components, parts lists and instructions etc. as required.

19. Troubleshooting

This section is a guide for the user to identify, describe and remove certain errors associated with unusual circumstances and/or rare external events. If the actions described do not fix the problem, do not attempt to repair the device yourself or use unqualified personnel. Please call your agent for assistance.



Undesired effects may occur due to unexpected electromagnetic interference like fast transients, electrostatic discharge and voltage dips.

Disturbance	Actions
Loose USB mouse connector.	Unplug and reconnect mouse, or reboot if unsuccessful.
Loose connectors in communication with computer.	Re-connect and restart application or reboot.
Test mode interrupted, changed or unexpected events.	Restart application or reboot if required and retest patient.
Voltage dips in mains may be cause of repeating tests, dimming lights, incorrect communications with PC, inconsistent analysis, or blinking lights.	Restart application and retest patient or reboot if required. Medmont recommend the installation of an Uninterruptible Power Supply (UPS) if unreliable mains power causes problems.

20. Specifications for M700/M730 models

Product Life	Service life 8 years, software support limited (Studio software: current platform only; Operating system: current and previous version)
Simulator Bowl Type	Part hemispherical, radius 300mm, viewing distance 320mm, integrated diffusing surface
Binocular Chin Rest	Supplied
Stimulus Type	Rear illuminated diffuser
Stimulus Source	Pale green LED, wavelength 565nm (optional Red LED, wavelength 626nm)
Stimulus Size	Goldman size III (0.43°) (optional Red 0.72 °)
Stimulus Intensity	16, 3dB ±1dB levels from 0dB (max brightness) to 46dB (min brightness)
Background Illumination German Driving Test	10 asb (3.2cd/m ²), automatic level control 10cd/m ²
Fixation Target	Yellow LED, wavelength 583nm
Fixation Monitor	Heijl-Krakau blindspot method and video fixation tracking. Automatic video fixation loss detection optional.
Time Settings	0.1 – 9.9 seconds adjustable for exposure, response, and inter-exposure delay times.
Test Lens	38mm diameter
PC	See Medmont Studio manual. USB for the bowl interface.
Printer	Bubblejet or Laser, Colour or Monochrome
Operating conditions	+10° to +40°C ambient temperature <= 4000m altitude Maximum 80% relative humidity
Transport/Storage Conditions	-40 to 70°C 10 to 100% relative humidity 500 to 1060 hPa pressure
Compliances	EN/IEC 60601-1 Electrical safety EN/IEC 60601-1-2 Electromagnetic Emissions and Immunity
ISM Classification	Class 1 Type B

Specifications for M700/M730 models

Power requirements	M700 USB C, M700 USB CR, M730 Focus: 100-240VAC 50/60Hz 0.25-0.15A	
	M700 USB	M730 USB
Dimensions	626W x 438D x 713H	500W x 400D x 660H
Weight	16kg	14kg
Fuses	Schurter5x20mm, FST T400mA L 250VAC , p/n 1576, IEC/EN 60127-2/3; UL 248-14; CSAC22.2 no248-14; 35A@250V Microfuse Schurter MSF F500mA 125VAC IEC/EN 60127-3/1; UL 248-14; CSAC22.2 no248-14; 100A@125VAC/DC	

21. Declaration of Conformity

The Medmont Automated Perimeter models M700 USB C, M700 USB CR and M730 Focus have been manufactured by

Medmont International Pty Ltd
Australia

and has been classified as a Class I medical device and is in compliance with the essential requirements and provisions of the European Council Directive 93/42 EEC and is in compliance with the provisions of the RoHS2 Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The instrument complies with the following harmonised standards:

IEC 60601-1 ed. 3 Medical electrical equipment- Part1: General requirements for basic safety and essential performance

IEC 60601-1-2 ed. 3 Medical electrical equipment- Part 1-2: General requirements for basic safety and essential performance- Collateral standard: Electromagnetic compatibility- Requirements and tests.

As identification of its conformity, the Medmont Automated Perimeter is labelled with the CE mark (as shown below) on the instrument label positioned visibly on the main body of the device.



22. Representatives

The EU Authorised Representative:

*BiB Ophthalmic Instruments
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